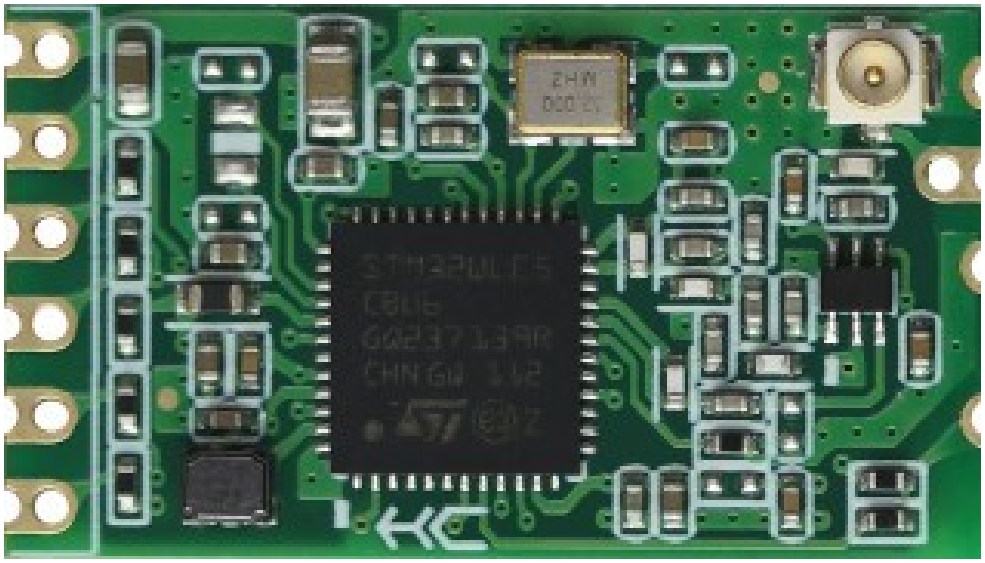
HC-15 Wireless Serial Communication Module User Manual **V1.1**



Product Applications

Wireless sensors, residential and commercial building security Robot Wireless Control Industrial Remote Control, Telemetry, and Automation Data Collection Container Information Management POS Systems Gas Meter Data Wireless Collection Vehicle Keyless Entry System PC Wireless Networking …

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Version Information

HC-15V1.1

Release Date

March 28, 2025

Change Log

1. Added reset module AT+RESET command (March 28, 2025)
2. Added the command SHOWSQ to query or set whether to display signal strength (March 28, 2025)
3. Added the OP command for setting the operating mode (March 28, 2025)
4. Added ECO power-saving mode extension feature with the ECOEX command (March 28, 2025)
5. Added SLTIME command to set the time required for the work mode (send wake-up code, power-saving sleep) (March 28, 2025

   28)
6. Added Sleep Mode SLEEP Command (March 28, 2025)
7. Added DP command for data format settings (March 28, 2025)
8. Added the ADDR command to simultaneously set send and receive addresses (March 28, 2025)
9. Added commands to set send, receive, and listen broadcast addresses (March 28, 2025)
10. Added CRYP command to enable custom encryption functionality (March 28, 2025)
11. Added CRYPKEY command for the encryption key (March 28, 2025)
12. Added CRYPLEVEL command for encryption level (March 28, 2025)
13. Added CRYPKEYREAD command to display the last four characters of the password (March 28, 2025)
14. Added voltage detection below set value prompt command VLTD (March 28, 2025)
15. Added the FWUP command for false wake-up alerts (March 28, 2025)
16. Added the HINT command to display an operation completion prompt (March 28, 2025)
17. Added chip voltage query command VOLTAGE (March 28, 2025)
18. Added chip temperature query command TEMPERATURE (March 28, 2025)
19. Added hardware-based factory reset functionality (March 28, 2025)

Product Features

LoRa technology for long-range wireless transmission (up to 3,500 meters in open areas at S1 data rate) Operating frequency range: 415.09–449.86 MHz (50 communication channels)

Built-in MCU, communicates with external devices via serial port, supports multiple serial port baud rates from 1200 to 115200. More suitable for battery-powered products. For example, with a 2500mAh battery:

Scenario 1: Transmit only, 3μA sleep mode, wakes up and transmits once when triggered, battery life up to five years. Scenario 2: ECO semi-sleep mode reception, average current 1mA in default mode, battery life two to three months.

Scenario 3: Using the AT+SLEEP and AT+OP commands, the device enters a 3μA sleep mode every 5 minutes, then enters ECO mode to receive for half a minute, with the battery lasting two to three years.

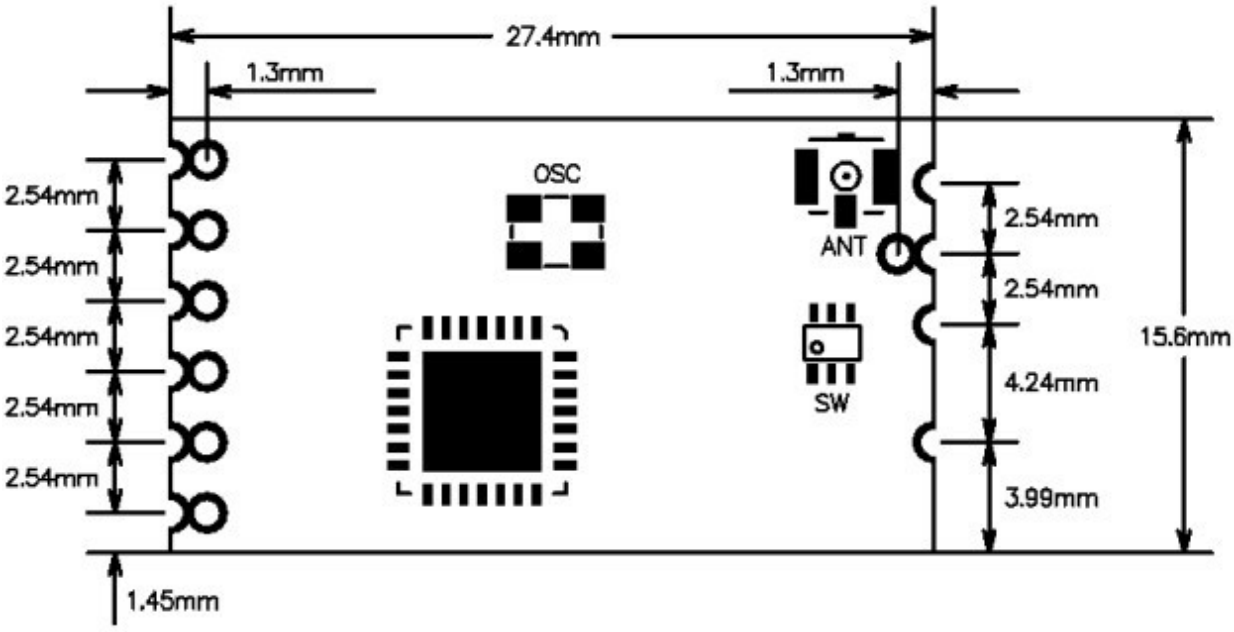
Product Introduction

The HC-15 wireless serial communication module is the next-generation LORA wireless data transmission module. The wireless operating frequency band is 433MHz, supporting up to 50 communication channels. The module's maximum transmission power is 130mW (22dBm), utilizing advanced LoRa technology. Under S1 wireless rate conditions, the reception sensitivity reaches -140dBm, with an open-field communication range of 3,500 meters.

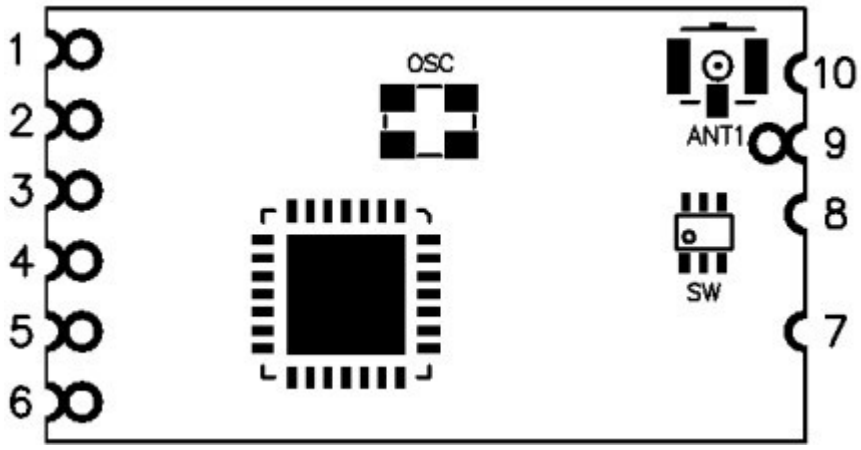
The module is packaged in a surface-mount package, enabling surface-mount soldering. Its dimensions are 27.4mm × 15.6mm × 4mm (including the antenna cap, excluding the spring antenna) making it highly convenient for integration into customer application systems. The module features a PCB antenna connector ANT1, allowing users to connect an external antenna using a coaxial cable and the 433MHz frequency band. The module also includes an antenna soldering pad ANT2 for users to solder a spring antenna. Users can select one of the two antenna options based on their requirements (only one antenna can be selected at a time; both cannot be used simultaneously)

The module incorporates a LoRa SOC, eliminating the need for additional programming. Users can simply transmit and receive serial data in various transparent modes, ensuring convenient operation.

Product Dimensions



Pin Definition



The HC-15 module can be surface-mounted or soldered to 2.54mm pitch header pins, which can be directly inserted into the user's PCB. The module has 10 pins and one RF antenna connector ANT1, with the following definitions:

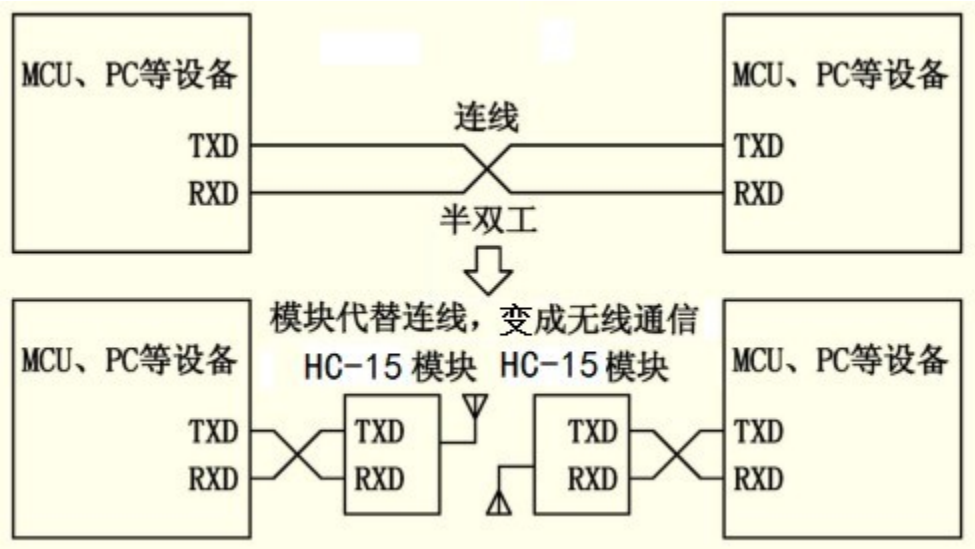
Pin	Definition	I/O Direction	Description
	VCC		Power supply input, DC 3.0–3.6 V, requires a load capacity of at least 300 mA
2	GND		Common Ground
3	RXD	Serial port input	URAT input port, internally connected to a 200 Ω resistor, is the same as VCC
4	TXD	Serial output	URAT output port, internally connected to a 200 Ω resistor, high-level voltage is the same as VCC
5	KEY	Input, internally pulled up	Parameter setting control pin, internally connected to a 1 kΩ resistor, low level active
6	STA	Output	High-level voltage接近VCC voltage, internally connected in series with a 200 Ω resistor, can be connected to an MCU input pin or an external LED (this pin serves as a busy indicator output, normally outputting a high level; when the module is busy, it outputs a low level. Do not send data to the module's serial port RXD pin while the module is busy. In low-power applications, this pin outputs a high level during module sleep mode. After waking up, it first outputs a low level for 200 ms before switching to high level, which can be used to wake up the user device. Additionally, after the module is reset to factory settings, the STA pin level will change 3 times (pulse width 200mS) before finally outputting a high level.
7	AUX	Input, internally pulled up	Wake-up control pin, internally connected to a 1K Ω resistor. After entering sleep mode, a low level wakes up the module, and a high level continues sleep. Additionally, the AUX pin can also be used to switch the operating mode.
8	GND		Common ground
9	ANT	RF Input/Output	433MHz antenna pin, spring antenna solder holes
10	GND		Common Ground

Pins 1 and 9 each have two solder pads. The outer half-hole solder pads are used for surface mount soldering. Pins 1–6 use the inner round hole solder pads for soldering 2.54mm pitch header pins, which can be directly inserted into the user's PCB header; Pin 9 uses the inner solder pad for module surface mount soldering, allowing for hand soldering of spring antennas.

The operating current of the module in receive mode is approximately 10 mA, and in transmit mode, it is approximately 125 mA. Operating voltage: DC 3.0–3.6V (do not connect directly to a 5V power supply, as this will cause overvoltage damage to the module) The power supply must have a load capacity of at least 300mA, and a capacitor of at least 47 μF must be connected in parallel near the module's power pins (recommended: 100 μF or 220 μF capacitor)

Wireless serial port transparent transmission

Working Principle Overview



As shown in the figure above, the HC-15 module replaces the physical connection required for half-duplex communication. The device on the left sends serial data to the module. When the module's RXD port receives the serial data, it automatically transmits the data via radio waves. The module on the right automatically receives the data and restores the original serial data sent by the left device via the TXD port. The process is the same from right to left. The modules can only operate in half-duplex mode and cannot transmit and receive data simultaneously.

The module supports 8 wireless data rates, and different rates cannot transmit data to each other. The default rate is S3. S1 is the lowest rate, at which the module has the highest reception sensitivity and the longest communication distance. As the rate increases, the reception sensitivity decreases, and the communication distance becomes shorter. Users can select the optimal rate based on actual conditions.

Modules are typically used in pairs to transmit data to each other in half-duplex mode. When in use, there is a limit on the number of bytes that can be sent continuously to the module's serial port in a single packet. The default maximum packet size is 1000 bytes, and any data exceeding this limit will be lost. Additionally, due to environmental interference and other factors, some bytes may be lost during the transmission of large amounts of data in a single continuous send. Therefore, the host computer should have acknowledgment and retransmission mechanisms to prevent data loss.

Module Parameter Settings AT Commands

AT commands are used to set module parameters and switch module functions. After setting, the module must exit the configuration mode for the changes to take effect. Additionally, parameter and function modifications are not lost upon power loss.

(1) Entering Command Mode

First method: During normal operation (already powered on), set pin 5 "KEY" to a low level.

Second method: Power off, then set pin 5 "KEY" to a low level before powering on again.

Both methods allow the module to enter AT command mode. Releasing the "KEY" pin (not connected to a low voltage) exits command mode. After exiting command mode, if module functions have been modified, the module will switch to the corresponding functional state.

The second method enters command mode using the serial port format fixed at 9600, N, 1.

Note: After exiting command mode, the module is in reset state. Wait at least 200 ms before attempting to enter command mode again; otherwise, the module may enter command mode using the second method! After receiving data, the module must wait 200 ms before entering command mode. The module must also wait 200 ms after power-on before entering command mode.

(2) Command Description

① Test Communication

Command	Response	Description
AT	**OK**	**AT** command test

Example:

Check if the module has entered AT mode

Send to the module: **AT**

Module response: **OK**

② Restore factory default settings

Command	Response	Description
AT+DEFAULT	**OK+DEFAULT**	Restores all parameters, including the serial port baud rate, to their factory default values.

Example:

Send to the module: AT+DEFAULT

Module response: **OK+DEFAULT**

Note

After the module is restored to factory default settings, it will reboot, and the **STA** pin level will change three times (pulse **width 200 ms**) followed by

it will output a high level.

③ Command to query or change the serial port baud rate

Command	Response	Description
AT+B?	**OK+B:xxxx**	Query baud rate

AT+Bxxxx	OK+B:xxxx	Set baud rate Default: 9600

Command to change the serial port baud rate. The baud rate can be set to **1200 bps**, **2400 bps**, **4800 bps**, **9600 bps**, **19200 bps**, **38400 bps**, **57600 bps**, or **115200 bps**. The factory default is **9600 bps**.

Example:

Set the module serial port baud **rate to 19200 bps**. Send the command "AT+B19200" to the module. The module will respond with "OK+B:19200".

④ Command to query or change the serial port parity bit

Command	Response	Description
AT+PARITYBIT?	OK+PARITYBIT?	Queries the parity bit of the module's serial port
AT+PARITYBITx		Set the parity bit of the module's serial port **0:** No parity (default) **1:** Odd parity **2:** Even parity

Example:

Query:

Send command AT+PARITYBIT?

Return command OK+PARITYBIT0

Set:

Send command AT+PARITYBIT1

Return command OK + PARITYBIT1

⑤ Query or change serial port stop bit command

Command	Response	Description
AT+STOPBIT?	OK+STOPBIT?	Query the stop bit of the module's serial port
AT+STOPBITx		Set the stop bit of the module serial port **1: 1** bit (default) 2**: 1.5** 3**: 2**

Example:

Query:

Send command AT+STOPBIT?

Return command OK+STOPBIT1

Setup:

Send command AT+STOPBIT3

Return command OK+STOPBIT3

⑥ **Reset module**

Command	Response	Description
AT+RESET	OK+RESET	Reset the module

Example:

Send to the module: AT+RESET

Module response: OK+RESET

Note

Using this command will immediately reset the module. It will take 200ms for the module to return to AT mode. Any unsaved parameters will be lost.

⑦ **Query or change the module's wireless transmission channel**

Command	Response	Description
AT+C?	**OK+C:xxx**	Query the wireless channel of the **LoRa** module
AT+Cxxx		Set the wireless channel of the **LoRa** module Wireless frequency modification range: **001~050** Default: **028** (**434.00 MHz**)

Example:

Query wireless channel

Send to the module: **AT+C?**

Module response: **OK+C:xx**

Set wireless channel

Send to module: AT+C028

Module response: **OK+C:28**

Appendix: Correspondence between wireless channels and frequencies

Channel Channel	Frequency (MHz)	Signal Channel	Frequency (MHz)	Signal Channel	Frequency (MHz)	Signal Channel	Frequency (MHz)	Letter Dao	Frequency (MHz)
1	415.09	11	422.41	21	429.73	31	435.83	41	442.54
2	415.70	12	423.63	22	430.34	32	436.44	42	443.15
3	416.31	13	424.24	23	430.95	33	437.05	43	443.76
4	416.92	14	424.85	24	431.56	34	437.66	44	444.37
5	417.53	15	425.46	25	432.17	35	438.27	45	445.59
6	418.14	16	426.07	26	432.78	36	438.88	46	446.20
7	419.36	17	426.68	27	433.39	37	440.10	47	446.81
8	420.58	18	427.29	28	434.00	38	440.71	48	447.42
9	421.19	19	427.90	29	434.61	39	441.32	49	448.64
10	421.80	20	429.12	30	435.22	40	441.93	50	449.86

⑧ Query or change the wireless speed of the module

Command	Response	Description
AT+S?	**OK+S:x**	Query the wireless speed of the **Lora** module
AT+Sx		Set the wireless data rate of the **Lora** module Wireless data rate modification range**: 1**–**8**, default: **3**

Example:

Query wireless speed

Send to the module: **AT+S?**

Module response: **OK+S:x**

Set the wireless speed

Send to the module: AT+S1

Module response: **OK+S:1**

The module supports 8 wireless speeds. Different speeds cannot transmit data to each other. S1 is the lowest speed, offering the slowest communication speed, highest wireless reception sensitivity, and longest communication distance. Higher speeds result in shorter communication distances. Users can select the optimal speed based on actual conditions.

Appendix:

Wireless speed rates corresponding to reception sensitivity and serial communication speed (serial port baud **rate is 9600**; other baud rates require user testing)

Wireless speed	Receiver Sensitivity (Reference value)	Serial communication speed (Time from when the data is sent from the transmitter to when it is received by the receiver)
1	**-140 dBm** Reference communication distance **3500** meters	Sending 1 byte takes approximately **2.**5 seconds to receive the information; sending 10 bytes takes **approximately 3.**2 seconds to receive the information; sending 20 bytes takes **approximately 3.9** seconds to receive the information; sending 40 bytes takes approximately **5.2** seconds to receive the information. Sending more than 40 bytes will be received in packets (maximum 40 bytes per packet) with the **first** packet received after **5.2** seconds, and subsequent packets received with delays based on the number of bytes per packet (maximum 40 bytes per packet, with a delay of **4.**9 seconds)
2	**-137 dBm** Reference communication distance: **3000** meters	Send 1 byte, receive the response **approximately 1.**35 seconds later; send 10 bytes, receive the response **approximately 1.7** seconds later; **send** 20 bytes, receive the response **approximately 2.05** seconds later; send 40 bytes, receive the response **approximately 2.9** seconds later. Sending **more** than 40 bytes will be received in packets (**maximum** 40 bytes per packet) The **first** packet is received after **2.9** seconds, with subsequent packets received based on the number of bytes in each packet. (**maximum** 40 bytes per packet, **2.**7 seconds)
3	**-134 dBm** Reference communication distance: **2500** meters	Sending 1 byte results in reception of the message approximately **0.**75 seconds later; sending 10 bytes results in reception **approximately 0.9**5 seconds later; sending 40 bytes results in reception **approximately 1.5** seconds later; sending 80 bytes results in reception approximately **2.35** seconds later. Sending **more** than 80 bytes will be received in packets (**maximum 8**0 bytes per packet) with the **first** packet received after **2.35** seconds, and subsequent packets delayed based on the number of bytes in each packet. (maximum 80 bytes per packet, **2.**1 seconds)

4	-131.5 dBm Reference communication distance: 2000 meters	Sending 1 byte, information is received approximately 0.45 seconds later; sending 10 bytes, information is received approximately 0.55 seconds later; sending 40 bytes, information is received approximately 0.9 seconds later; sending 80 bytes information is received approximately 1.25 seconds later. Sending more than 80 bytes will be received in packets (maximum 80 bytes per packet) with the first packet received after 1.25 seconds, and subsequent packets delayed based on the number of bytes in each packet. (maximum 80 bytes per packet, 1.0 second delay)
5	-129 dBm Reference communication distance: 1500 meters	Sending 1 byte takes approximately 0.3 seconds to receive the information; sending 10 bytes takes approximately 0.37 seconds to receive the information; sending 80 bytes takes approximately 0.8 seconds to receive the information; sending 160 bytes takes approximately 1.25 seconds to receive the information. Sending more than 160 bytes will be received in packets (maximum 160 bytes per packet) with the first packet received after 1.25 seconds, and subsequent packets received based on the number of bytes per packet. (maximum 160 bytes per 0.9 seconds)
6	-126.5 dBm Reference communication distance: 1000 meters	Sending 1 byte results in reception approximately 0.23 seconds later; sending 10 bytes results in reception approximately 0.27 seconds later; sending 80 bytes results in reception approximately 0.55 seconds later; sending 160 bytes results in reception approximately 0.85 seconds later. Sending more than 160 bytes will be received in packets (maximum 160 bytes per packet) with the first packet received after 0.85 seconds, and subsequent packets received based on the number of bytes in each packet. (maximum 160 bytes per 0.5 seconds)
7	-124 dBm Reference communication distance: 800 meters	Sending 1 byte results in reception of the message approximately 0.2 seconds later; sending 10 bytes results in reception approximately 0.22 seconds later; sending 160 bytes results in reception approximately 0.63 seconds later; sending 250 bytes results in reception approximately 0.87 seconds later. Sending more than 250 bytes will be received in packets (maximum 250 bytes per packet) with the first packet received after 0.87 seconds, and subsequent packets received based on the number of bytes per packet. (maximum 250 bytes per packet, 0.42 seconds)
8	-121 dBm Reference communication distance: 600 meters	Send 1 byte, receive the message approximately 0.17 seconds later; send 10 bytes, receive the message approximately 0.2 seconds later; send 160 bytes, receive the message approximately 0.5 seconds later; send 250 bytes, receive the message approximately 0.6 seconds later. Sending more than 250 bytes will be received in packets (maximum 250 bytes per packet) with the first packet received after 0.6 seconds, and subsequent packets delayed based on the number of bytes in each packet. (maximum 250 bytes per packet, 0.3 seconds)

⑨ Example of basic parameters

Command	Description
AT+RX	Return the current module's serial port baud rate, wireless channel, wireless data rate, wireless transmission power, and other information in sequence.

for the module:

Send to the module: AT+RX

Module end response: OK+B:9600
OK+C:28 OK+S:3
OK+P:22 dBm

⑩ Query module firmware version information

Command	Response	Description
AT+V **Example:**	**www.hc01.com HC-15V1.1 2025.03.28**	Return the official website URL and firmware version number

Send to the module: **AT+V**

Module response: **www.hc01.com HC-15V1.1 2025.03.28**

⑪ Query or change the module's wireless transmission power

Command	Response	Description
AT+P?	**OK+P:X**	Query transmission power
AT+PX	**OK+P:X**	Set transmit power Setting range: **-6 to 22 dBm** Default: **22 dBm**

The factory default setting is 22 dBm, which provides the maximum transmission power and the longest communication range. Setting the transmission power to -6 dBm results in the minimum transmission power and the shortest communication range.

Example:

Query wireless frequency

Send module command ''AT+ P?''

Module response ''OK+P22dBm'' Set wireless frequency

Send module command “AT+P-5”

Module response “OK+P：-5dBm”

⑫ Query or set whether to display signal strength

Command	Response	Description
AT+SHOWSQ?	Show SNR and RSSI [0:DISABLED 1:Enabled]	Display help information
AT+SHOWSQ=?	OK+SHOWSQ=X	Query whether to display signal strength
AT+SHOWSQ=X **Example:**		Set whether to display signal strength 0: Disable (default) 1: Enable

Query:

Send to the module: AT+SHOWSQ=?

Module response: OK+SHOWSQ=0

Set:

Send to module: AT+SHOWSQ=1

Module response: OK+SHOWSQ=1

Note:

After enabling the display signal strength feature,when data is received,the signal-to-noise ratio (SNR) and signal strength (RSSI) of the received data will be displayed in the format: "SNR= X RSSI= X", followed by the received data.

⑬ Query or set module operating mode

Command	Response		Description
AT+OP?	Operating mode [X[0:GM 1:WOR 2:ECO] Y[0:DISABLED 1-2]]		Display help information
AT+OP=?	OK + OP = X	When Y=0	Query operating mode
	OK + OP = X, Y	When Y > 0	
AT + OP = X	OK + OP = X		Set working mode Parameter details are provided in the mode description below Default: X=0, Y=0
AT+OP=X,Y	OK + OP = X, Y		

Example:

Query:

Send command AT+OP=?

Return command OK+OP=0

Set:

Send command AT+OP=2,2

Return command OK+OP=2,2

Mode description

Parameter X	Parameter Y (AUX pin level)			Description
	Mode	Level	Function	
0 (GM) General Mode	0 (Disabled)	-	-	1. GM and WOR can send data to each other. 2. GM sends data, ECO cannot receive. 3. WOR sends data, and ECO can receive it. 4. In WOR mode, data can be sent continuously, but a wake-up code is sent before the first data packet, occupying some airtime. Subsequent data packets are sent without a wake-up code until all data is transmitted. 5. If only the X parameter is set, the Y parameter is automatically set to 0.
	1 (Mode Switch)	High	GM	
		Low	WOR	
	2 (Sleep Mode)	High	Hibernate	
		Low	Working	
1 (WOR) Wake-up Mode	0 (Disabled)	-	-	
	1 (Mode Switch)	High	WOR	
		Low	GM	
	2 (Sleep Switch)	High	Hibernate	
		Low	Working	

2 (ECO) Power-saving mode	0 (Disabled)	-	-	1. In ECO mode, when data is received and no print output, the AUX pin level is pulled low, and the mode will switch according to the pre-set AUX function. 2. In ECO mode, when data is received and printed, the AUX pin level is pulled low, but the mode will not immediately switch according to the AUX function preset. The mode will switch only after data output and printing are completed. 3. If only the X parameter is set, the Y parameter will automatically be set to 0.
	1 (Mode Switch)	High	ECO	
		Low	GM	
	2 (Mode Switch)	High	ECO	
		Low	WOR	

After setting parameter Y, the corresponding function is achieved by controlling the voltage level of the AUX pin on the control module.

Enable ECO power-saving mode. As the receiver, the module is in sleep mode by default (operating current approximately 3μA) and periodically wakes up (wake-up time varies depending on wireless data rate; refer to the "ECO Mode Data-less Wake-up Interval Table" for details) to receive wireless data. The transmitter must be set to WOR wake-up mode. When sending data, a wake-up code is added. Upon receiving the wake-up code, the receiver enters the receiving state and remains in this state until all data is received, after which it returns to sleep mode. If the transmitter is in GM normal mode, no wake-up code is sent, and modules in ECO power-saving mode will not receive data while in sleep mode.

You can use the AT+OP=2,2 command to set both modules to ECO mode. This allows you to switch between ECO and WOR modes by controlling the level of the AUX pin, enabling half-duplex communication in power-saving mode.

⑭ Query or set ECO mode extended functions

Command	Response		Description
AT+ECOEX?	Eco mode extension [X[0:DISABLED 100-60000ms] Y[0:GM 1:WOR]]		Display help information
AT+ECOEX=?	OK+ECOEX=X	When Y=0	Query the extended functions of ECO mode
	OK + ECOEX = X, Y	When Y > 0	
AT+ECOEX=X	OK + ECOEX = X		Set the extended feature parameter X for ECO mode. The value range is: 0: Disabled 100–60000 (ms) (default: 500 ms) Parameter Y value range: 0: General Mode (GM, default) 1: Wake-up mode (WOR)
AT+ECOEX=X,Y	OK + ECOEX=X,Y		
Query:			

Send command AT+ECOEX= ?

Return command OK+ECOEX=0

Setup:

Send command AT+ECOEX=1000,1

Return command OK+ECOEX=1000,1

Note:

1. The module's extended functionality determines whether, when in ECO mode, the device should automatically switch operating modes after receiving data within a specified time period (X time, default 500ms).
2. When X=0, the ECO extension function is disabled: In ECO mode, after receiving valid data and completing printing, the mode will not automatically switch.
3. When X≠ 0, enable the ECO extension feature:
   a. In ECO mode, when data is received and printing is completed, a timeout period X is set:
      1) During the timeout period, ECO mode is prevented from entering sleep mode. Once the timeout period expires, ECO mode is no longer prevented from entering sleep mode.
      2) Within the timeout period, if data is detected to be sent, the mode is switched according to parameter Y, and then the data is sent. After the data is sent, the mode switches back to ECO mode.
   b. In ECO **mode, the module will only enable serial data reception after data is received and printed**. To send data, it is recommended to wait until the module has completed printing the first packet of data before sending. At this point, the data to be sent will be temporarily stored in the buffer and will be sent after the mode switches to GM or WOR.
4. When both AUX and ECOEX functions are enabled, note the following:
   a. The AUX function takes precedence over the ECOEX function. Therefore, when the AUX pin level is detected as pulled down, data will be sent according to the mode preset by AUX, rather than according to the mode preset by ECOEX.
   b. Switching the AUX pin between high and low does not interrupt the ECOEX timer. Therefore, when switching back from the mode set by AUX to ECO mode, the device will not enter ECO sleep mode before the ECOEX timeout expires.

⑮ Query or set the time for the module to send the wake-up code/power-saving sleep mode

Command	Response	Description
AT+SLTIME?	WOR and ECO time [2-4s]	Display help information
AT+SLTIME=?	AT+SLTIME=X	Query the module's wake-up and power-saving mode times
AT+SLTIME=X		Set the time for module wake-up and power-saving mode Power-saving mode: Sleep time Wake-up mode: Time to send the wake-up code Value range: 2/3/4 seconds (default: 2 seconds)

Example:

Query:

Send command AT+SLTIME=?

Return command OK+SLTIME=2

Set:

Send command OK+SLTIME=4

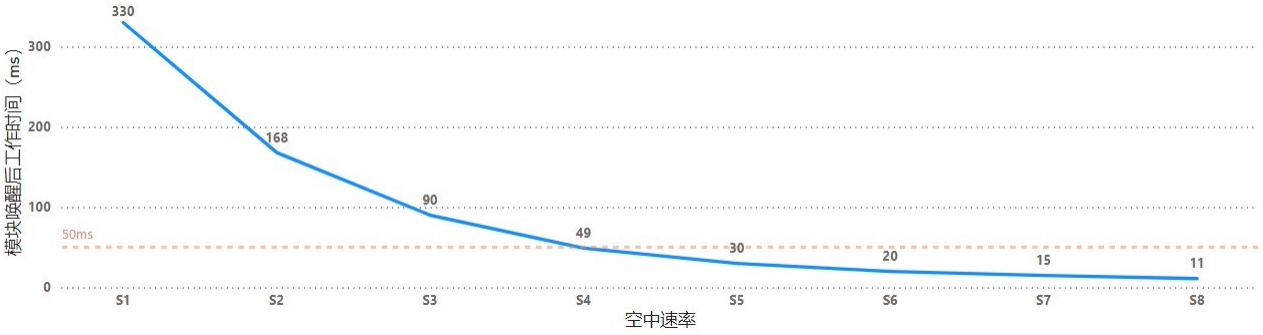
Return command OK + SLTIME = 4

Note:

To ensure that data is received correctly, the parameters of the transmit module in WOR wake-up mode and the receive module in ECO power-saving mode must be set to the same values.

Module data-less wake-up time in ECO mode

Wireless rate		S1	S2	S3	S4	S5	S6	S7	S8
Wake-up duration (ms)		330	168	90	49	30	20	15	13
3.7V/2500mAh lithium battery theoretical operating days (excluding data reception power consumption and user device power consumption)	SLTIME=2	60	107	185	306	466	635	748	808
	SLTIME=4	108	194	326	528	710	873	980	1067



⑯ Query or set whether the module has entered sleep mode and the sleep cycle

AT+SLEEP?	Sleep Mode[format<X,Y,Z> X[0:DISABLED 1:SLEEP 2:SLEEP+AWAKEN] Y[0-86400s] Z[0-3600s]		Display help information
AT+SLEEP=?	AT+SLEEP=X	When X is equal to 0 or 1	Check if the module has entered sleep mode
	AT+SLEEP=X,Y	When Y is greater than 0	
	AT+SLEEP=X,Y,Z	When both X and Z are greater than 0	
AT+SLEEP=X	OK + SLEEP = X	X and Y values can be omitted to save space Omitted	Set whether the module enters sleep mode X indicates sleep mode, with the following value range: After exiting AT mode: 0: Do not enter sleep mode (default) 1: Enter sleep mode; no reminder after waking up 2: Enter sleep mode, with a reminder upon wake-up Y is the scheduled wake-up time, with the following range: 0, 1–86400 seconds (**0 is off**, default: 0) Z is the time to re-enter sleep mode after waking up, with a valid range: 0, 5–3600 seconds (**is off**, default: 0)
AT+SLEEP=X,Y	AT+SLEEP=X,Y	The Z value can be omitted if not set	
AT+SLEEP=X,Y,Z	AT+SLEEP=X,Y,Z		

User Manual

Example:

Query:

Send command AT+SLEEP=?

Return command OK+SLEEP=0

Set:

Send command AT+SLEEP=2,40

Return command OK+SLEEP=2,40

Note:

1. During sleep mode, the module's current consumption is approximately 3 μA. Parameter X is not saved (reset is lost) and each time the module enters AT mode, it is reset to 0.
2. After entering sleep mode, the STA pin maintains a high-level output. The module can be woken up using the KEY pin or the AUX pin. After waking up, X, Y, and Z all return to their default values.
3. When the module wakes up from sleep mode, the STA pin outputs a low level for 200 ms, followed by a high level, which can be used to wake up the user device. During this 200 ms period, data transmission and reception, as well as entering AT mode, are not permitted.
4. When the parameter Y is set to greater than 1h (3600s), the module is awakened every 1 hour (awakening duration: 8ms), then returns to sleep mode. If the remaining time is less than 1 hour, the module is awakened based on the remaining time. Since the module uses an internal RC oscillator for timing, there will be some time error, with the time error per hour potentially reaching 1–2 minutes.
5. When the timer wake-up function is enabled (Y value is not 0) and the timer sleep function is enabled (Z value is not 0), the module will repeatedly enter sleep mode for Y seconds and then wake up for Z seconds. Lowering the KEY or AUX pin level will disable both the timer wake-up and timer sleep functions. When Y is 0, Y is not displayed and does not take effect, and Z is also not displayed and does not take effect.
6. Enable the reminder function. When the module is about to enter sleep mode, it will display "HINT:SLEEP." After the module is awakened, it will display "HINT:AWAKEND."
7. When the AUX pin is at a low level, using the AT+SLEEP command to enter sleep mode will be blocked, and the serial port will display:

   ERROR:AUX_LOW.

⑰ Query or set the module's data format

Command	Response	Description
AT+DP?	Use address [0:DISABLED 1:ENABLED]	Display help information
AT+DP=?	OK+DP=?	Query the module's data transmission mode
AT+DP=X		Set the data transmission mode for the module 0: Transparent transmission (does not use address code, default) 1: Directed transmission (uses address code)

Example:

Query:

Send command AT+DP=?

Return command OK+DP=0

Set:

Send command AT+DP=1

Return command OK+DP=1

⑱ Query or set the address for module transmission and reception

Command	Response	Description
AT+ADDR?	Transmit and receive address [0000-FFFF]	Display help information
AT+ADDR=?	OK+ADDR=XXXX,YYYY	Query the module's transmit and receive addresses
AT+ADDR=ZZZZ **Example:**		Set the module's transmission and reception addresses XXXX: Transmission address YYYY: Reception address ZZZZ: Sets both the send and receive addresses simultaneously ZZZZ value range: 0000~FFFF (Hexadecimal, case-insensitive) Default: A1B2

Query:

Send command AT+ADDR=?

Return command OK+ADDR= A1B2

Set:

Send command AT+ADDR= 2ABC

Return command OK+ADDR=2ABC

⑲ Query or set the module's transmission address

Command	Response	Description
AT+TXADDR?	Tx address [0000...FFFF]	Display help information
AT+TXADDR=?	OK + TXADDR=XXXX	Query the module's transmission address
AT+TXADDR=XXXX **Example:**		Set the module's transmission address XXXX Value range: 0000~FFFF (Hexadecimal, case-insensitive) Default: A1B2

Query:

Send command AT+TXADDR=?

Return command OK+TXADDR= A1B2

Set:

Send command AT+TXADDR= 2233

Return command OK+TXADDR=2233

⑳ Query or set the module's receiving address

Command	Response	Description
AT+RXADDR?	Rx address [0000...FFFF]	Display help information
AT+RXADDR=?	OK + RXADDR = XXXX	Query the module's receive address
AT+RXADDR=XXXX **Example:**		Set the module's receiving address XXXX Value range: 0000~FFFF (Hexadecimal, case-insensitive) Default: A1B2

Query:

Send command AT+RXADDR=?

Return command OK+RXADDR=A1B2

Setup:

Send command AT+RXADDR=2233

Return command OK + RXADDR = 2233

㉑Query or set whether the module is listening for broadcast addresses

Command	Response	Description
AT+LISTEN?	Enable Address listening [0:DISABLED 1:ENABLED]	Display help information
AT+LISTEN=?	OK+LISTEN=X	Check if the module is enabled for broadcast address listening
AT+LISTEN=X **Example:**		Set whether the module is listening for broadcast addresses 0: Disabled (default) 1: Enable

Query:

Send command AT+LISTEN=?

Return command OK+LISTEN=0

Set:

Send command AT+LISTEN=1

Return command OK+LISTEN=1

Note:

1. The broadcast address is 0XFFFF. After enabling broadcast listening, the module can receive data from the broadcast address. The sender must set the send address to 0XFFFF.
2. If broadcast address listening is enabled, the module can receive data from both the receiving address and the broadcast address, even if they are different.

㉒Query or set whether the module has enabled encryption functionality

Command	Response	Description
AT+CRYP?	Data decryption [0:DISABLED 1:ENABLED]	Display help information
AT+CRYP=?	OK+CRYP=X	Check if the module's encryption function is enabled
AT+CRYP=X		Set whether the module is enabled for encryption 0: Disable (default) 1: Enabled

Example:

Query:

Send command AT+CRYP=?

Return command OK+CRYP=0

Setup:

Send command AT+CRYP=1

Return command OK+CRYP=1

Note:

When custom encryption is enabled, the maximum length of a single data packet sent at wireless speed for S7 and S8 is 224, not 250.

㉓Query or set module keys

Command	Response		Description
AT+CRYPKEY?	CRYP password[format[XX:XX...XX:XX], value[0-F],Length[8-16]]		Display help information
AT+CRYPKEY=?	HINT: CRYPKEY_ UNREADABLE	When CRYPKEYREAD is equal to 0	Query the module's key
	OK + CRYPKEY = ******XX:XX:XX:XX	When CRYPKEYREAD is equal to 1	
AT+CRYPKEY=XX:XX...XX:XX	OK+CRYPKEY=******XX:XX:XX:XX		Set the module's key XX value range: 0~FF (hexadecimal, case-insensitive) XX separated by colons (English); XX Must be at least 8 characters, maximum 16 characters

Example:

Query:

Send command AT+CRYPKEY=?

Return command OK+CRYP= HINT:CRYPKEY_UNREADABLE

Set:

Send command AT+CRYPKEY=23:30:56:AF:EE:CD:0:06

Return command OK+CRYPKEY=23:30:56:AF:EE:CD:00:06

Send command AT+CRYPKEY=23:64:56:AF:EE:CD:B2:C4:0:86:F4:99:14:15:B5:16

Return command OK+CRYPKEY=23:64:56:AF:EE:CD:B2:C4:00:86:F4:99:14:15:B5:16

Note:

Default key: 11:22:33:44:55:66:77:88:99:00:AA:BB:CC:DD:EE:FF

㉔ Query or set the encryption level of the module

Command	Response	Description
AT+CRYPLEVEL?	Data encryption level [1-4]	Display help information
AT+CRYPLEVEL=?	OK+CRYPLEVEL=X	Query the encryption level of the module
AT+CRYPLEVEL=X		Set the encryption level of the module 1: Send 4 bytes of IV 2: Send 8 bytes of IV 3: Send 12 bytes of IV 4: Send 16 bytes of IV (default)

Example:

Query:

Send command AT+CRYPLEVEL=?

Return command OK + CRYPLEVEL=4

Set:

Send command AT+CRYPLEVEL=1

Return command OK+CRYPLEVEL=1

Note:

After enabling encryption, at least four additional bytes of data must be sent compared to when encryption is disabled (when the encryption level is set to 1) When the encryption level is set to 4, an additional 16 bytes of data are sent. The higher the encryption level, the higher the security, but this also increases the length of the data being sent, which can affect the transmission time. Users can decide whether to enable encryption based on their needs.

㉕Query or set whether the last four digits of the key are displayed

Command	Response	Description
AT+CRYPKEYREAD?	Display the last four bytes of CRYPKEY [0: DISABLED, 1: ENABLED] NOTE: Changing from 0 to 1 resets the CRYPKEY	Display help information
AT+CRYPKEYREAD=?	OK+CRYPKEYREAD=X	Check if the module displays the last four digits of the key Display
AT+CRYPKEYREAD=X		Set whether the module displays the last four digits of the key. 0: Disabled (default) 1: Enabled

Example:

Query:

Send command AT+CRYPKEYREAD=?

Return command OK + CRYPKEYREAD=0

Set:

Send command AT+CRYPKEYREAD=1

Return command OK+CRYPKEYREAD=1

Note:

1. For CRYPKEY security, when the parameter is set from 0 to 1, CRYPKEY will be reset to its default value. However, setting the parameter from 1 to 0 will not reset CRYPKEY.
2. When the parameter is set to 0, using the AT+CRYPKEY=? command will display HINT:CRYPKEY_UNREADABLE. When the parameter is set to 1, using the AT+CRYPKEY=? command will display OK+CRYPKEY=******XX:XX:XX:XX.

㉖Query or set whether the module is enabled for a voltage warning below the set value

Command	Response		Description
AT+VLTD?	Voltage detection [format<X,Y.Z> X[0:DISABLED 1:ENABLED] Y[1-3] Z[0-9]]		Display help information
AT+VLTD=?	OK+VLTD=X,Y.Z	Y and Z are separated by a decimal point	Query whether the module has voltage detection enabled
AT+VLTD=X	OK + VLTD = X	The values of Y and Z can be omitted if not set	Set whether the module enables voltage detection prompt X indicates whether voltage detection is enabled, with the following value range: 0: Disabled 1: Enable. The module will trigger a warning when the supply voltage drops below the set voltage. Serial port prompt: HINT:UNDERVOLTAGE

User Manual AT+VLTD=X, Y.Z	OK + VLTD=X,Y.Z	Y and Z are separated by a decimal point	2: Enable sleep mode when the power supply voltage drops below the set voltage Serial port prompt: HINT:UNDERVOLTAGE_SLEEP, Then enter sleep mode (default) Y. Z Value range: 1.8–3.6 V, default: 2.7 V Y represents the integer part of the voltage, with a range of 1 to 3 Z is the decimal part of the voltage, with a range of 0 to 9

Example:

Query:

Send command AT+VLTD=?

Return command OK+VLTD=1,3.0

Set:

Send command AT+VLTD=1,3.1

Return command OK+VLTD=1,3.1

Note:

Check every 10 seconds. When X=1, if the detected module's supply voltage is below Y.Z volts, the serial port will display the prompt "HINT:UNDERVOLTAGE".

㉗ Query or set whether the module is enabled for false wake-up prompt

Command	Response		Description
AT+FWUP?	False wake-up prompt [format<X,Y,Z> X[0:DISABLED 1:HINT 2:HINT+SLEEP 3:HINT+SLEEP+AWAKEND] Y[1-99] Z[1-3600]]		Display help information
AT+FWUP=?	AT+FWUP=X,Y,Z		Check if the module has enabled the false wake-up prompt
AT+FWUP=X	OK+FWUP=X	The values for Y and Z can be omitted if not set	Set whether the module is enabled for false wake-up alerts X indicates false wake-up mode, with the following value range: 0: Disabled (default) 1: Prompt 2: Enter sleep mode after prompt 3: Prompt, then enter sleep mode; prompt again after a set time Y is the threshold value, with the following range: 1–99 (default: 30 times) Z is the time for scheduled wake-up, with a range of: 1–3600 seconds (default: 30 seconds)
AT+FWUP=X,Y	OK + FWUP = X,Y	The Z value can be omitted if not set	
AT+FWUP=X,Y,Z **Example:**	OK + FWUP=X,Y,Z		

Query:

Send command AT+FWUP=?

Return command OK+FWUP=0,30,30

Set:

Send command AT+FWUP=3,40,60

Return command OK+FWUP=3,40,60

Note:

1. The prompt message is as follows:

When X is equal to 1	Only a prompt is displayed	HINT:INTERRUPTED
When X is equal to 2	Display the message and enter sleep mode	HINT:INTERRUPTED_ENTER_SLEEP
When X equals 3	Display a prompt before entering sleep mode	HINT:INTERRUPTED_ENTER_SLEEP
	Display a prompt after the sleep mode timer expires	HINT:AWAKEND

2. The value of Y is the threshold for the number of incorrect wake-up attempts. When the number of incorrect wake-up attempts reaches the threshold, the corresponding action will be taken. The following situations will reset the number of incorrect wake-up attempts:
   a. The number of incorrect wake-ups reaches the threshold
   b. The threshold is not reached, but the cumulative wake-up count reaches 100
   c. Entering AT mode
3. When the module enters sleep mode in this manner, it can be awakened using the KEY pin and AUX pin.

㉘Query or set whether the module is enabled for operation prompts

Command	Response		Description
AT+HINT?	Hint[format<X,Y,Z,A> options [0:DISABLED 1:ENABLED]]		Display help information
AT+HINT=?	OK + HINT=X,Y,Z	When A is equal to 0	Check if the module is enabled for operation prompts
	OK + HINT = X, Y, Z, A	When A is equal to 1	
AT + HINT = X	OK + HINT = X		Set whether the module is enabled for operation prompts X-A value range: 0: Disable 1: Enable Default: X, Y, Z, A = 0,0,0,0
AT+HINT=X,Y	OK + HINT = X,Y		
AT+HINT=X,Y,Z	OK + HINT = X, Y, Z		
AT+HINT=X,Y,Z,A	OK+HINT=X,Y,Z,A		

Example:

Query:

Send command AT+HINT=?

Return command OK+HINT=0,0,0

Set:

Send command AT+HINT=1,1,1,0

Return command OK+HINT=1,1,1,0

Description:

X: Enter/exit AT mode complete prompt
Y: Initialization complete prompt Z: Data transmission complete prompt A: System error prompt. Specific details are as follows:

1. When X is 1, enable the AT mode entry/exit completion prompt. The prompt message is as follows:

When entering AT mode is complete		HINT:DONE_ATMODE
When exiting AT mode	No data updated	HINT:DONE_NOCHANGES
	Data updated, but not saved	HINT:DONE_APPLY
	Data updated, saved successfully	HINT:DONE_SAVE
	Data has been updated, but saving failed	HINT:ERROR_SAVE

2. When Y is 1, enable the initialization complete prompt. When initialization is complete, display the prompt "HINT:DONE_INIT".

3. When Z is 1, enable the data transmission complete prompt. When the data transmission is complete, display the prompt "HINT:DONE_TX".

4. When A is 1, enable the system error prompt. The prompt message is as follows:

Watchdog reset	ERROR:RESET_IWDG
Known system error reset (XX: is a hexadecimal number code)	ERROR: RESET_EXX (e.g., ERROR: RESET_EA1)
Other system error reset	ERROR: RESET_SYSTEM

29 Query the voltage of the module chip

Command	Response	Description
AT+VOLTAGE	OK + VOLTAGE=X	Returns the voltage of the module chip

Example:

Query:

Send command AT+VOLTAGE

Return command OK + VOLTAGE = 3.2V

30 Query the temperature of the module chip

Command	Response	Description
AT+TEMPERATURE	OK+TEMPERATURE=X	Returns the temperature of the module chip in degrees Celsius

Example:

Query:

Send command AT+TEMPERATURE

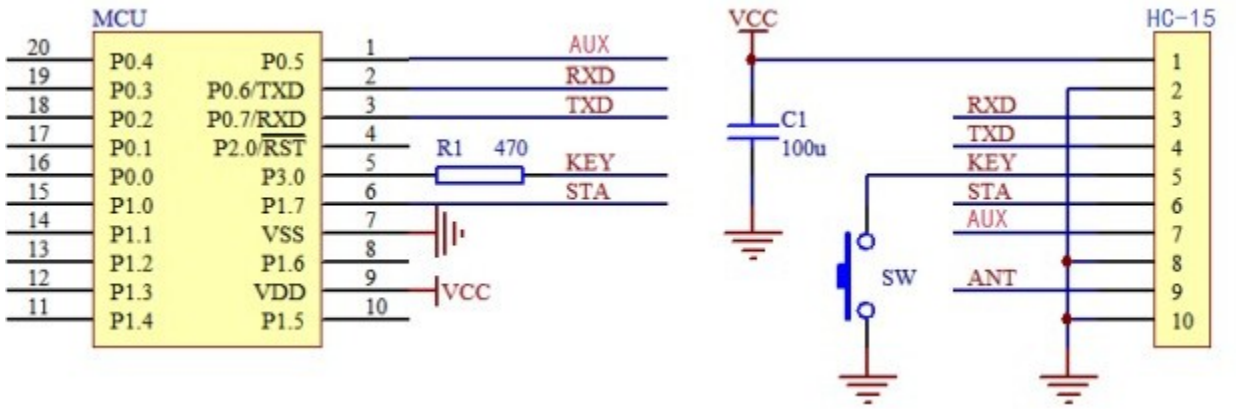
Return command OK+TEMPERATURE=24.0C

Restore factory settings via hardware

The module can be restored to factory settings via hardware. Set the KEY pin to a low level, then quickly pull the AUX pin low five times within 5 seconds. The module will automatically restore factory settings, reboot, and the **STA** pin level will change three times (pulse **width 50 ms**) finally outputting a high level.

Application example and circuit

HC-15 Module Connection to MCU Serial Port



In the MCU, the "KEY" control pin should be set to high-impedance state or high level output under normal conditions; during parameter setup, set it to low level. The "AUX" control pin in the MCU should be set to high-impedance state or high level output under normal conditions; when waking up, the HC-15 module outputs a low level. The "STA" pin in the MCU should be configured as an input pin or left floating and unconnected.