

WH-L100 User Manual

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Contents

WH-L100 User Manual	1
Features	4
1.Get Start	5
1.1.Product introduction	5
1.2.Basic parameters	5
1.3.Dimension	5
2.Configure module by AT command	6
2.1.System command	6
2.1.1.Query firmware version AT+VER	6
2.1.2.Restart module AT+Z	6
2.1.3.Restore default settings AT+Z=1	6
2.1.4.Enable/disable echo function AT+ECHO	7
2.1.5.Set idle time before entering sleep mode AT+SLEEP	7
2.2.Application command	7
2.2.1.Query transmit buffer AT+TBS?	7
2.2.2.Transmit data AT+TX	7
2.2.3.Query receive buffer AT+RBS?	8
2.2.4.Receive data AT+RX	8
2.2.5.Query ADR status AT+ADR?	8
2.2.6.Set ADR status AT+ADR	8
2.2.7.Query SF(spreading factor) value AT+SF?	9
2.2.8.Set SF(spreading factor) value AT+SF	9
2.2.9.Set accessing network mode AT+NET	9
2.2.10.Join network AT+JN	9
2.2.11.Query network status AT+NS	10
2.3.Basic parameters command	10
2.3.1.Query DEVEUI AT+DEUI?	10
2.3.2.Set DEVEUI AT+DEUI	10
2.3.3.Query APPEUI AT+AEUI?	10
2.3.4.Set APPEUI AT+AEUI	10
2.3.5.Query APPKEY AT+AK?	11
2.3.6.Set APPKEY AT+AK	11
2.3.7.Query NwksSkey AT+NSK?	11
2.3.8.Set NwksSkey AT+NSK	11
2.3.9.Query APPSkey AT+ASK?	12
2.3.10.Set APPSkey AT+ASK	12
2.3.11.Query DEVAddr AT+DADDR?	12
2.3.12.Set DEVAddr AT+DADDR	12
2.3.13.Query delay time of receiving window AT+REX?	12
2.3.14.Set delay time of receiving window AT+REX	13
2.3.15.Query delay time of joining network receiving window AT+JREX?	13
2.3.16.Set delay time of joining network receiving window AT+JREX	13

2.3.17.Query frequency of the second receiving window AT+RX2F?	13
2.3.18.Set frequency of the second receiving window AT+RX2F	14
2.3.19.Query transmitting frequency band AT+RF?	14
3.Working process.....	15
3.1.Access network in the first time	15
3.2.Access network again	15
3.3.Transmit data	15
3.4.Receive data	15
4.Contact Us.....	16
5.Disclaimer	16
6.Update History	16

Features

- Adopt standard LoRaWAN protocol
- 4500 meters transmission distance
- -130dBm receiving sensitivity
- Sleep mode current 2uA
- Internally installed watchdog
- Small size: 36.0 x 21.0 x 2.8mm, SMT encapsulation

1. Get Start

If user has any question, please submit it back to customer center: <https://h.usriot.com>.

1.1. Product introduction

WH-L100 is LoRa module which supports standard LoRaWAN protocol and working frequency band of WH-L100: -L: 433Mhz or 470Mhz; -H: 868Mhz or 915Mhz. WH-L100 has concentrated power density and powerful anti-interference. LoRa direct sequence spread spectrum technology can also bring further communication distance.

Module can work in 1.8V~3.6V and sleep mode current is only 2uA which can be applied in ultra-low power consumption application scenarios.

1.2. Basic parameters

Parameter	Description
Power supply	Single power supply: 1.8V~3.6V
Protocol	LoRaWAN
Frequency band	L: 433/470Mhz; H: 868Mhz/915Mhz
Transmitting power	20dBm(About 100mW)
Working temperature	-30°C~+80°C
Storage temperature	-45°C~+90°C
Data interface	Serial port with baud rate 115200
Antenna interface	Bonding pad
Dimension	36.0mm*21.0mm*2.8mm

Figure 1 Basic parameters

1.3. Dimension

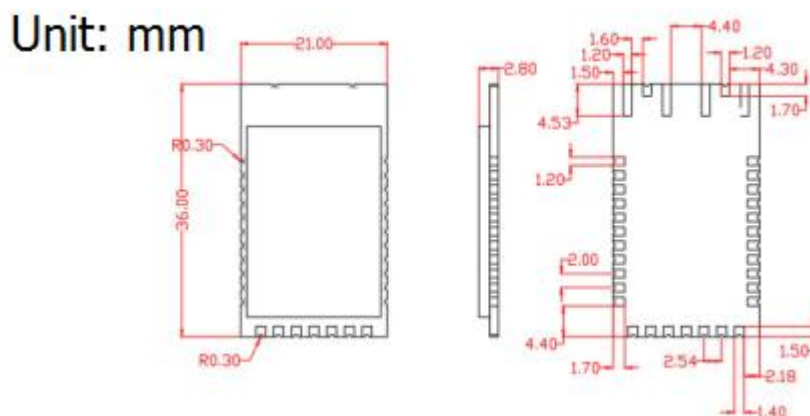


Figure 2 Dimension

2. Configure module by AT command

Serial port parameters as follow: baud rate 115200, 8 bits data bits, no parity, 1 bit stop bits. Command should end with carriage return and line feed and user can refer to

<https://www.usriot.com/support/faq/enter-serial-command-mode.html> to enter AT command mode and send AT command. Serial port will transmit and receive error code and OK in ASCII format, and will transmit and receive data or parameters in HEX format.

Return code as follows:

Return code	Description
OK	Normal response
ER00	Syntax error
ER01	Parameter error
ER02	Reject to enter sleep mode
ER03	Module is not in network
ER04	Transmitting is busy
ER05	Receive buffer has no data
ER06	Error in Flash piece
ER07	Transmit data unsuccessfully
ER08	Reject configuration
ER09	Reject query

2.1. System command

2.1.1. Query firmware version AT+VER

Command	Response	Description
AT+VER	Example: +VER:L100-L_G470_V1.0.0_V1.0	Version
	ER00	Syntax error

L100-L: Hardware model; G470: LoRaWan series, 470Mhz frequency band; V1.0.0: Software version; V1.0: Hardware version.

2.1.2. Restart module AT+Z

Command	Response	Description
AT+Z	OK	Successful command execution
	ER00	Syntax error

2.1.3. Restore default settings AT+Z=1

Command	Response	Description
AT+Z=1	OK	Successful command execution
	ER00	Syntax error

2.1.4.Enable/disable echo function AT+ECHO

Command	Response	Description
AT+ECHO=<switch>	OK	Successful command execution
	ER00	Syntax error

<switch>: Status of echo function. 0: Disable function; 1: Enable function; 2: Disable CN470 uplink and downlink in same frequency;(only work in CN470 frequency band) 3: Enable CN470 uplink and downlink in same frequency.(only work in CN470 frequency band)

Note: Please be cautious to configure <switch> to 2 and 3. This must be according with gateway, otherwise it may lead to module can't receive data.

Example: Enable echo function: AT+ECHO=1

2.1.5.Set idle time before entering sleep mode AT+SLEEP

Command	Response	Description
AT+SLEEP=<time>	OK	Successful command execution
	ER00	Syntax error

<time>: Idle time before entering sleep mode.(Default is 20 seconds and range from 3 seconds to 60 seconds)

Example: Set idle time to 30 seconds: AT+SLEEP=30

2.2.Application command

2.2.1.Query transmit buffer AT+TBS?

Command	Response	Description
AT+TBS?	OK	Transmitting is free
	ER00	Syntax error
	ER04	Transmitting is busy

This command is to query status of module transmit buffer and module response time should less than 100ms.

2.2.2.Transmit data AT+TX

Command	Response	Description
AT+TX=<p>+<m>+<n>+<L> +<d>	OK	Transmitting data successfully
	ER00	Syntax error
	ER01	Parameter error
	ER03	Module is not in network
	ER04	Transmitting is busy
	ER07	Transmit data unsuccessfully

➤ <p>: Port number.

➤ <m>: 00: Don't confirm to send the data packet; 01: Confirm to send the data packet.

- <n>: Retransmission times and take effect in <m>=01.
- <L>: Data packet length.
- <d>: Data packet.

This command is to transmit data and response time of ER00, ER01, ER03, ER04 should less than 100ms. ER07: time delay of transmitting data should less than 20 seconds.

Example: AT+TX=02+01+01+02+3132. Port number is 2, confirm to send the data packet, retransmission times is 1 time, data packet length is 2 and data packet is 12(HEX3132).

2.2.3.Query receive buffer AT+RBS?

Command	Response	Description
AT+RBS?	OK	Receive buffer has data
	ER00	Syntax error
	ER05	Receive buffer has no data

This command is to query status of module receive buffer and module response time should less than 100ms.

2.2.4.Receive data AT+RX

Command	Response	Description
AT+RX	<p> +<L> + <d>	Receive data
	ER00	Syntax error
	ER03	Module is not in network
	ER05	Receive buffer has no data

- <p>: Port number.
- <L>: Data packet length.
- <d>: Data packet.

This command is to receive data and response time of ER00, ER03 should less than 100ms. ER05: time delay of receiving data should less than 20 seconds.

2.2.5.Query ADR status AT+ADR?

Command	Response	Description
AT+ADR?	00	ADR has not been configured
	01	ADR has been configured
	ER00	Syntax error

This command is to query status of module ADR and module response time should less than 100ms.

2.2.6.Set ADR status AT+ADR

Command	Response	Description
AT+ADR=<m>	OK	Configure successfully
	ER00	Syntax error

<m>: 00: reset ADR status; 01: set ADR status.

This command is to configure ADR status and module response time should less than 100ms. Example: set ADR status: AT+ADR=01.

2.2.7. Query SF(spreading factor) value AT+SF?

Command	Response	Description
AT+SF?	<m>	Return SF value
	ER00	Syntax error

This command is to query module SF value and module response time should less than 100ms.

2.2.8. Set SF(spreading factor) value AT+SF

Command	Response	Description
AT+SF=<m>	OK	Configure successfully
	ER00	Syntax error
	ER01	Parameter error

<m>: SF value and range from 7 to 12(7-C in HEX format).

This command is to configure module SF value and module response time should less than 100ms.

Example: set SF value to 10: AT+SF=A.

2.2.9. Set accessing network mode AT+NET

Command	Response	Description
AT+NET=<m>	OK	Configure successfully
	ER00	Syntax error
	ER01	Parameter error
	ER03	Module is not in network

<m>: 00: OTAA mode; 01: ABP mode.

This command is to configure module accessing network mode and activate the network. Module response time of ER00, ER01, ER03 should less than 100ms and time of accessing network successfully should less than 6 seconds.

Example: set module to OTAA mode: AT+NET=00.

2.2.10. Join network AT+JN

Command	Response	Description
AT+JN	OK	Configure successfully
	ER00	Syntax error

Request to access network. This command is configure module network connections after re-powering or restarting(module has activated the network). Module response time of ER00 should less than 100ms.

2.2.11. Query network status AT+NS

Command	Response	Description
AT+NS?	OK	Configure successfully
	ER00	Syntax error
	ER03	Module is not in network

This command is to query module network connections status. Module response time of ER00,ER03 should less than 100ms.

2.3. Basic parameters command

These commands are used to query/set module basic parameters. During normal using procedure, these parameters almost won't change. And these parameters modification will take effect after restarting module.

2.3.1. Query DEVEUI AT+DEUI?

Command	Response	Description
AT+DEUI?	<m>	Return 8 bytes HEX format DEVEUI
	ER00	Syntax error

This command is to query module DEVEUI. Module response time should less than 100ms.

2.3.2. Set DEVEUI AT+DEUI

Command	Response	Description
AT+DEUI=<m>	OK	Configure successfully
	ER00	Syntax error
	ER01	Parameter error
	ER08	Reject configuration

<m>: 8 bytes HEX format DEVEUI.

This command is to set module DEVEUI. Module response time of ER00, ER01, ER08 should less than 100ms.

Example: AT+DEUI=B3ACA4A430195288.

2.3.3. Query APPEUI AT+AEUI?

Command	Response	Description
AT+AEUI?	<m>	Return 8 bytes HEX format APPEUI
	ER00	Syntax error

This command is to query module APPEUI. Module response time should less than 100ms.

2.3.4. Set APPEUI AT+AEUI

Command	Response	Description
AT+AEUI=<m>	OK	Configure successfully
	ER00	Syntax error
	ER01	Parameter error
	ER08	Reject configuration

<m>: 8 bytes HEX format APPEUI.

This command is to set module APPEUI. Module response time of ER00, ER01, ER08 should less than 100ms.

Example: AT+AEUI=2323232323233452.

2.3.5.Query APPKEY AT+AK?

Command	Response	Description
AT+AK?	<m>	Return 16 bytes HEX format APPKEY
	ER00	Syntax error

This command is to query module APPKEY. Module response time should less than 100ms.

2.3.6.Set APPKEY AT+AK

Command	Response	Description
AT+AK=<m>	OK	Configure successfully
	ER00	Syntax error
	ER01	Parameter error
	ER08	Reject configuration

<m>: 16 bytes HEX format APPKEY.

This command is to set module APPKEY. Module response time of ER00, ER01, ER08 should less than 100ms.

Example: AT+AK=A811E1130060C80B07BC35E9023115C5.

2.3.7.Query NwksSkey AT+NSK?

Command	Response	Description
AT+NSK?	<m>	Return 16 bytes HEX format NwkSkey
	ER00	Syntax error

This command is to query module NwkSkey. Module response time should less than 100ms.

2.3.8.Set NwksSkey AT+NSK

Command	Response	Description
AT+NSK=<m>	OK	Configure successfully
	ER00	Syntax error
	ER01	Parameter error
	ER08	Reject configuration

<m>: 16 bytes HEX format NwkSkey.

This command is to set module NwkSkey. Module response time of ER00, ER01, ER08 should less than 100ms.

Example: AT+NSK=9C7510F9CDA558215944943290ADFF3E.

2.3.9. Query APPSkey AT+ASK?

Command	Response	Description
AT+ASK?	<m>	Return 16 bytes HEX format APPSKey
	ER00	Syntax error

This command is to query module APPSKey. Module response time should less than 100ms.

2.3.10. Set APPSkey AT+ASK

Command	Response	Description
AT+ASK=<m>	OK	Configure successfully
	ER00	Syntax error
	ER01	Parameter error
	ER08	Reject configuration

<m>: 16 bytes HEX format APPSKey.

This command is to set module APPSKey. Module response time of ER00, ER01, ER08 should less than 100ms.

Example: AT+ASK=5F6A868930653B907B7027B8D8AE51CF.

2.3.11. Query DEVAddr AT+DADDR?

Command	Response	Description
AT+DADDR?	<m>	Return 4 bytes HEX format DevAddr
	ER00	Syntax error

This command is to query module DevAddr. Module response time should less than 100ms.

2.3.12. Set DEVAddr AT+DADDR

Command	Response	Description
AT+DADDR=<m>	OK	Configure successfully
	ER00	Syntax error
	ER01	Parameter error
	ER08	Reject configuration

<m>: 4 bytes HEX format DevAddr.

This command is to set module DevAddr. Module response time of ER00, ER01, ER08 should less than 100ms.

Example: AT+DADDR=073BBE88.

2.3.13. Query delay time of receiving window AT+REX?

Command	Response	Description
AT+REX?	<m>+<n>	Return 2 bytes HEX format delay time of rx1 and rx2
	ER00	Syntax error

This command is to query delay time of module's the first and the second receiving windows. Module response time should less than 100ms.

2.3.14. Set delay time of receiving window AT+REX

Command	Response	Description
AT+REX=<m>+<n>	OK	Configure successfully
	ER00	Syntax error
	ER01	Parameter error
	ER08	Reject configuration

<m>: 1 bytes HEX format Rex1; <n>: 1 bytes HEX format Rex2.

This command is to set delay time of module's the first and the second receiving windows. Module response time of ER00, ER01, ER08 should less than 100ms.

Example: Configure delay time of the first receiving windows to 2 seconds and delay time of the second receiving windows to 3 seconds: AT+REX=02+03.

2.3.15. Query delay time of joining network receiving window AT+JREX?

Command	Response	Description
AT+JREX?	<m>+<n>	Return 2 bytes HEX format delay time of Joinrx1 and Joinrx2
	ER00	Syntax error

This command is to query delay time of module's the first and the second joining network receiving windows. Module response time should less than 100ms.

2.3.16. Set delay time of joining network receiving window AT+JREX

Command	Response	Description
AT+JREX=<m>+<n>	OK	Configure successfully
	ER00	Syntax error
	ER01	Parameter error
	ER08	Reject configuration

<m>: 1 bytes HEX format JoinRex1; <n>: 1 bytes HEX format JoinRex2.

This command is to set delay time of module's the first and the second joining network receiving windows. Module response time of ER00, ER01, ER08 should less than 100ms.

Example: Configure delay time of the first joining network receiving windows to 5 seconds and delay time of the second joining network receiving windows to 6 seconds: AT+JREX=05+06.

2.3.17. Query frequency of the second receiving window AT+RX2F?

Command	Response	Description
AT+RX2F?	<m>	Return 4 bytes HEX format frequency of the second receiving window. For example, 433.3MHz is 19D3A220 in HEX format.
	ER00	Syntax error

This command is to query frequency of module's the second receiving window. Module response time should less

than 100ms.

2.3.18. Set frequency of the second receiving window AT+RX2F

Command	Response	Description
AT+RX2F=<m>	OK	Configure successfully
	ER00	Syntax error
	ER01	Parameter error
	ER08	Reject configuration

<m>: 4 bytes HEX format. For example, 470.1MHz is 1C052820 in HEX format.

This command is to set frequency of module's the second receiving window. Module response time of ER00, ER01, ER08 should less than 100ms.

Example: Configure frequency of module's the second receiving window to 470100000Hz: AT+RX2F=1C052820.

2.3.19. Query transmitting frequency band AT+RF?

Command	Response	Description
AT+RF?	<m>	Return 2 bytes HEX format frequency band. For example, 470 frequency band is 01D6 in HEX format.
	ER00	Syntax error

This command is to query module's transmitting frequency band. Module response time should less than 100ms.

3.Working process

This chapter introduce the module working process.

Note: In default state, module will enter sleep mode if no operation to module within 20 seconds.

3.1.Access network in the first time

- 1.Ensure parameters and accessing network method to add node in LoRa gateway platform.
- 2.Power or wake up module.
- 3.Query module DevEUI(AT+DEUI?), AppEUI(AT+AEUI?) and enter them into LoRa gateway platform. Then choose frequency band.
- 4.Choose accessing network mode by AT+NET. Module will return 'OK' after accessing network successfully.

3.2.Access network again

If all module's accessing network parameters have been configured, AT+JN can be used to make module join network after restarting module.

3.3.Transmit data

- 1.Module join network.
- 2.Check transmit buffer status by AT+TBS.
- 3.Use AT+TX to send data if transmit buffer is free.

3.4.Receive data

- 1.Module join network.
- 2.Check receive buffer status by AT+RBS.
- 3.Use AT+RX to receive data if receive buffer has data.

4.Contact Us

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6.Update History

2018-03-14 V1.0.0.01 established based on Chinese version V1.0.0.