LW001-BG Datasheet EN V1.3

Version	Description	Editor	Date
1.0	initial version create	iris	2019-05-23
1.1	1.change battery level from percentage to normal or low battery indicate in upload data 2.cancel the low battery indicate light	iris	2019-07-22
1.2	add appendix table	iris	2019-10-07
1.3	firmware update to V1.1.3: fix the bug of automatic reboot and update the format of the second payload	iris	2019-10-15

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1 Product Introduction

LW001-BG is a wireless smart and ultra-low power consumption LoRaWAN GPS Tracker. Which is based on standard LoRaWAN protocol that is suitable for long distance transmission,and built-in GPS & 9-Axis motion tracking sensor. It support ABP and OTAA two different network access mode, and easy to configure and update firmware by Mokolora APP.
Ideal to optimize logistic process,asset management, warehouse and inventory scenarios, outdoor tracking, theft protection and much more. In a definable interval, LW001-BG automatically reports its longitude,latitude,speed,battery level and so on.Moko also could provide customized service to suit your application scenarios.

2 Application

- Prefect for professional asset management tracking and location
- Smart animal farming
- Logistica and supply chain management
- Smart cities
- Safety of people and objects
- Smart factory

3 Product Feature

- Based on LoRaWAN™ Protocol
- Support GPS positioning with accuracy within 2.5m CEP
- Built-in 9-Axis motion tracking sensor, support moving object detection
- Support for configuring ABP and OTAA modes with MokoLora APP
- Firmware update Over The Air (OTA)
- Support a wide range frequency CN470MHZ EU868MHZ AU915MHZ US915MHZ AS923MHZ
- 4000mAh non-chargeable battery
- Ultra Low Power，Max. 5-year operating time (Data are reported twice a day)
- Low battery indicator

4 Technical Parameter

4.1 Wireless Parameter

Type	Parameters
Protocal	LoRaWAN
LoRa Data Rate	292bps~5.4kbps
LoRa Frequency	CN470/EU868/AU915/US915/AS923/IN865/KR920/EU433/CN470/C
Max Transmitted Power	19dbm
Sensitivity	-142.5dBm@SF12 300bps

4.2 Hardware Specification

Type	Parameters
MCU	NRF52832-QFAA
Memory	Flash 512KB,RAM 64KB
Power Supply	4000mAh non-chargeable battery
Operating time	max.5 years @upload data twice per day
Sleep Mode Current	<=20uA
Operating Current	Max 150mA@19dBm
LoRa Communication Distance	>=1500m in wide-open area
Positioning Mode	GPS, accuracy 2.5m CEP
Motion Tracking	built in 9 axis accelerometer MPU-9250

4.3 Operating Environment

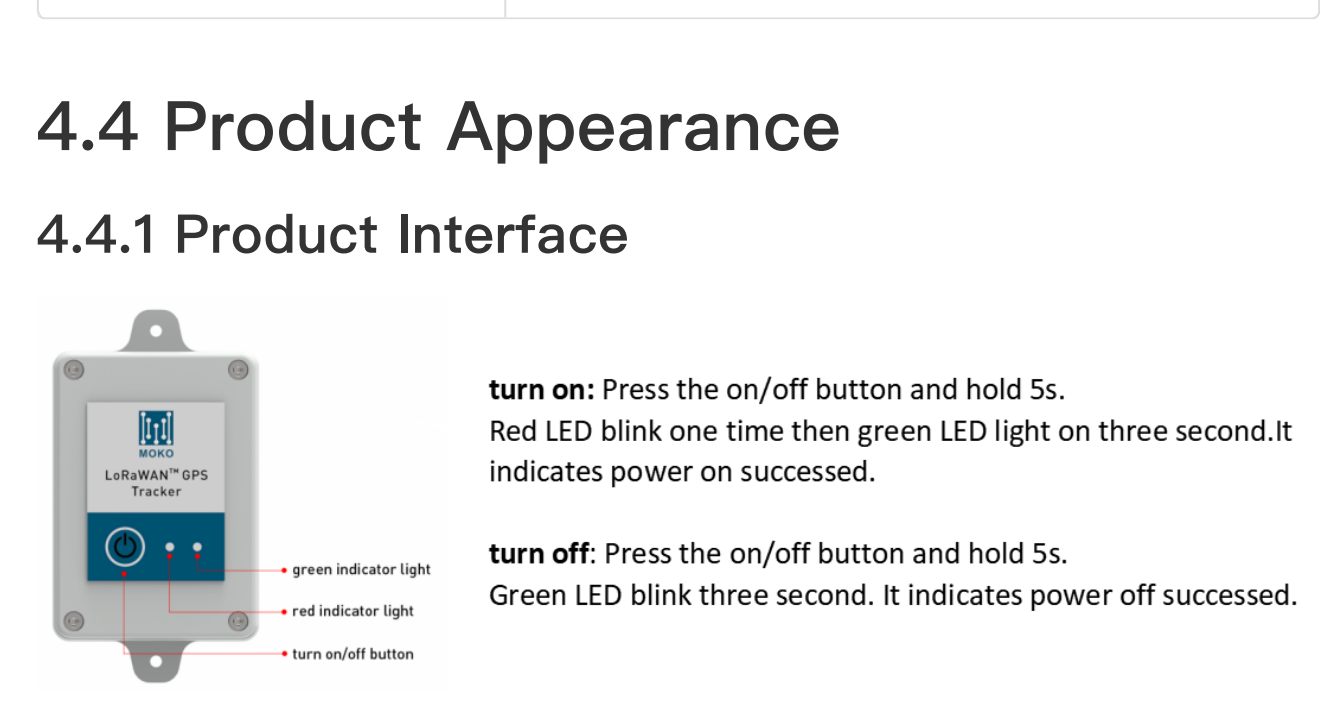
Type	Parameters
Operating Temperature	-40~+70℃
Operating Humidity	10%~90%

Product Specification

Type	Parameters
Dimension	108.6 x 60 x 33.2mm
IP Rating	IP65

4.4 Product Appearance

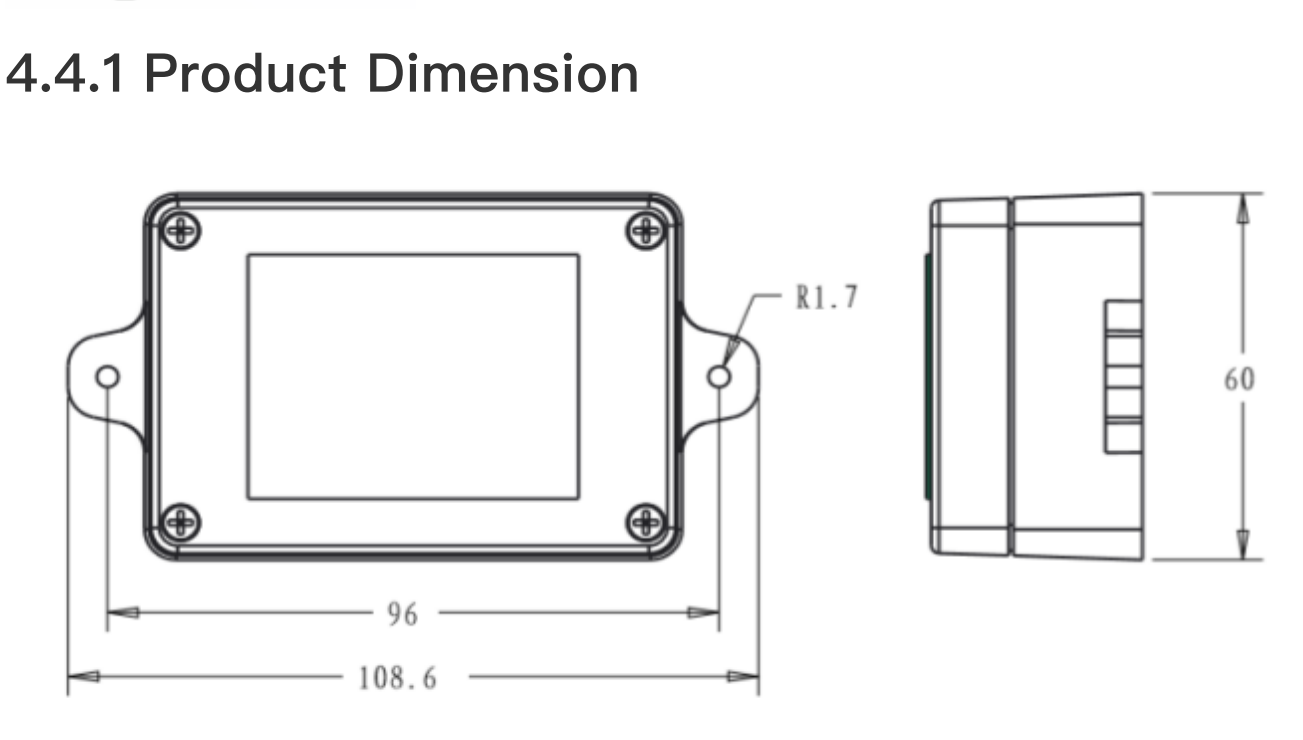
4.4.1 Product Interface



turn on: Press the on/off button and hold 5s.
Red LED blink one time then green LED light on three second.It indicates power on successed.

turn off: Press the on/off button and hold 5s.
Green LED blink three second. It indicates power off successed.

4.4.1 Product Dimension

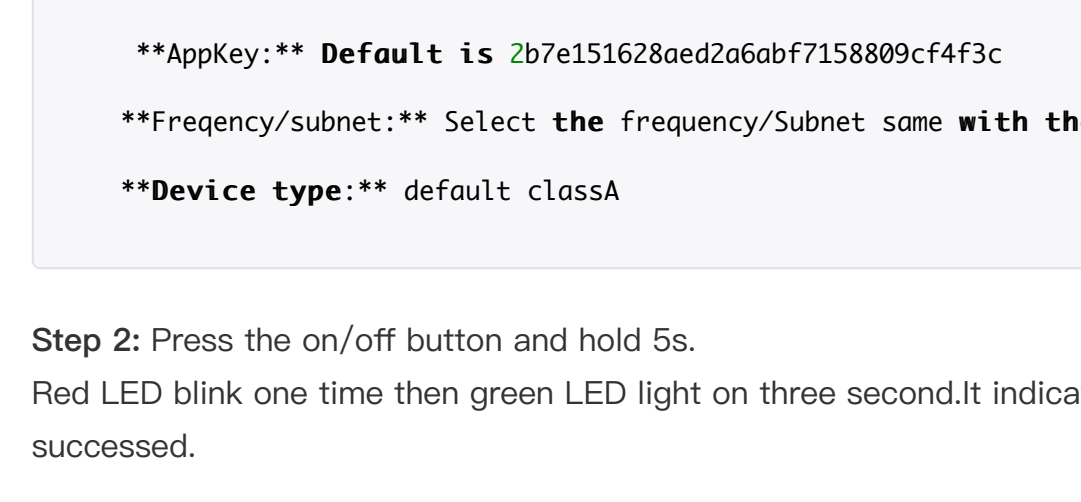


5. Operation Instruction

Lw001-BG has been pre-installed with firmware. The default configuration mode of the device is LoRaWAN OTAA and the device type is Class A. Under the default configuration, user can use the OTAA key that we provide with product add the device to the LoRaWAN server, the device will automatically connect to the network after the device turn on.
Please use MokoLora APP when the user needs to change the OTAA key and other configuration parameters, or change the access network mode to ABP mode. The detail instrution please read the MokoLora APP user manual.

5.1 Quick access network guide

We will based on an 8-channel LoRaWAN gateway and web-base LoRaWAN server to introduce the access network process in below passage.
Before entering the network, the LoRaWAN gateway needs connect to the Internet and configured with the LoRaWAN server. And please makesure gateway frequency same with the device frequency. Here is the simple LoRaWAN network structure.



Step 1: Add device to LoRaWAN server
The default access network mode of the device is OTAA. Add the OTAA device to the server. Fill in the information according to the OTAA key (DevEUI, AppEUI, AppKey) provided by our company or read the device data by APP:

```
**Device name:** Default device name LW001_BG_xxxx, which can be changed by the user.

**DevEUI:** Please refer to the information provided by our company. Each device have a different DevEUI and it is unique in the server.

**AppEUI:** Default is 526973696e674846

 **AppKey:** Default is 2b7e151628aed2a6abf7158809cf4f3c

**Freqency/subnet:** Select the frequency/Subnet same with the device.

**Device type:** default classA
```

Step 2: Press the on/off button and hold 5s.
Red LED blink one time then green LED light on three second.It indicates power on successed.

Step 3: The device will automatically connect to LoRaWAN server after the device turn on. When device connect to LoRaWAN server successed, it will start uploading data to the server. The default data upload interval on the device is 10 minutes.

5.2 Uplink Payload instruction

Each complete uplink payload data consists of two hexadecimal data packets, and the length of each data packet is 10 bytes.
Function description: the first data packet contains data total packet number, current packet, latitude and longitude. The second data packet contains the current packet, current battery level, speed, X-axis direction, and Y-axis direction.

5.2.1 First data packet

Type	Byte	Value	Description
total packets	01	0x02	the total packets of uplink data, all the complete data packet are 2
current packet	02	0x01	the number of current packet
latitude	03-06	0x00000000-0xFFFFFFFF	Latitude is represented by the 4-byte float of the IEEE 754 standard, and the byte order is low byte first. The format is ddmm.mmmm when the float converted to decimal data keep four decimal places. Convert to decimal data is positive, representing north latitude (N). otherwise, it means southern latitude (S)
longitude	07-10	0x00000000-0xFFFFFFFF	Longitude is represented by the 4-byte float of the IEEE 754 standard, and the byte order is low byte first. The format is dddmm.mmmm when the float converted to decimal data keep four decimal places. converted to decimal positive, to represent the east longitude (E); otherwise, it means western longitude (W)

```
example : 02 01 56 F8 0B 45 F4 29 32 46
```

Byte	01	02	03-06	07-10
example data	02	01	56 F8 0B 45	F4 29 32 46
example description	the total data packet is 2	this is the first data packet	convert to decimal data and keep 4 decimal place is 2239.5210, it means north latitude 22 degree 39 minutes and 31.26 (0.5210x60) second	convert to decimal data and keep 4 decimal place is 11402.4883, it means east longitude 114 degree 02 minutes and 29.298 (0.4889x60) second

5.2.2 Second data packet

Type	Byte	Value	Description
total packets	01	0x02	the total packets of uplink data, all the complete data packet are 2
current packet	02	0x02	the number of current packet
battery level	03	0x00, 0X01	the current battery level,00 indicate normal battery,01 indicate low battery
speed	04-07	0x000000-0xFFFFFF	speed is represented by the 4-byte float of the IEEE 754 standard, and the byte order is low byte first. when the float converted to decimal data keep four decimal places
X-axis	08-09	0x0000-0xFFFF	X-axis direction of 9 axis sensor , byte order is low byte first. After convert to decimal data need divide by 100
Y-axis	10-11	0x0000-0xFFFF	Y-axis direction of 9 axis sensor , byte order is low byte first.After convert to decimal data need divide by 100

```
example: 02 02 00 F6 28 DC 3E 1C 46 31 01
```

byte	01	02	03	04-07	08-09
example data	02	02	00	F6 28 DC 3E	1C 46
example desription	This is the second data packet	This is the second data packet	current battery level is normal	convert to decimal data and keep four deciaml places is 0.4300,it means speed 0.43knots. convert to km/h : 0.43x1.852= 0.796km/h	convert to intege is 17948, it means the direction of X-axis of 9-axis sensor is 179.48(17948/10 degree

5.3 Configuration parameter changes and firmware upgrades

If user need change the device settings or upgrade firmare,this can be done through the MokoLora APP. The detail operations can refer to below APP user manual.
http://doc.mokotechnology.com/index.php?s=/2&page_id=12

After changed the device settings needs add the device in the server, and please fill in the device information as modified. Detail operation please refer to 5.1
If user change the LoraWAN mode to ABP, then need add ABP device in server, and other information should keep the same as in APP.

6. Troubleshooting

6.1 The device can't connect to the LoRaWAN network

- Please check the if the device turn on successed.
- Please check if the frequency of the LoraWAN gateway is same as device.

6.2 APP can't connect to the device

- Please check if the device turn on successed.
- Please check if the system software of the phone meet requiremnts. Android system require above vereion 4.4. IOS system need above version 9.0.
- Please check if your phone bluetooth is open.

For more issues please connect our relevant staff.

7 Order Information

Product code	Frequency
LW001-BG-EU868	EU868
LW001-BG-US915	US915
LW001-BG-AU915	AU915
LW001-BG-IN865	IN865
LW001-BG-KR920	KR920
LW001-BG-AS923	AS923
LW001-BG-EU433	EU433
LW001-BG-CN470	CN470
LW001-BG-CN779	CN779

8 Appendix Table

8.1 Default Uplink Channels

Band/CH	0	1	2	3~95	Default Data Rate
EU868	868.1 DR0~DR5	868.3 DR0~DR5	868.5 DR0~DR5	-	0
US915	902.3 DR0~DR3	902.5 DR0~DR3	902.7 DR0~DR3	0~63 902.3 + ch x 0.2 DR0~DR3 64~71 903.0 + (ch-64)x 1.6 DR4	0
US915HYBRID	902.3 DR0~DR3	902.5 DR0~DR3	902.7 DR0~DR3	0~7 902.3 + ch x 0.2 DR0~DR3 64 903.0 + (ch-64)x 1.6 DR4	0
CN779	779.5 DR0~DR5	779.7 DR0~DR5	779.9 DR0~DR5	-	0
EU433	433.175 DR0~DR5	433.375 DR0~DR5	433.575 DR0~DR5	-	0
AU915	915.2 DR0~DR3	915.4 DR0~DR3	915.6 DR0~DR3	0~63 915.2 + ch x 0.2 DR0~DR5 64~71 915.9 + (ch-64) x 1.6 DR6	0
AU915OLD	915.2 DR0~DR3	915.4 DR0~DR3	915.6 DR0~DR3	0~63 915.2 + ch x 0.2 DR0~DR3 64~71 915.9 + (ch-64) x 1.6 DR4	0
CN470	470.3 DR0~DR5	470.5 DR0~DR5	470.7 DR0~DR5	200KHz channel space up to 95	0
AS923	923.2 DR0~DR5	923.4 DR0~DR5	-	-	2
KR920	922.1 DR0~DR5	922.3 DR0~DR5	922.5 DR0~DR5	-	0
IN865	865.0625 DR0~DR5	865.4025 DR0~DR5	865.985 DR0~DR5	-	0
CN470PREQUEL	471.5 DR0~DR5	471.7 DR0~DR5	471.9 DR0~DR5	200KHz channel space up to 7	0
STE920	922.0 DR0~DR5	922.2 DR0~DR5	922.4 DR0~DR5	200KHz channel space up to 7	0

```
Notes:

1. LW001-BG support all of the uplink channels of different band in the table. But in our default settings of the max channel is CH0~7 when the band channel numbers is more than 8, you can configure the DR and CH parameter through APP  according your actual demand band.

       Examples: US915 support max 72 channels. 64 channels numbered 0 to 63 utilizing LoRa 125 kHz BW varying from DR0 to DR3, using coding rate 4/5, starting at 902.3 MHz and incrementing linearly by 200 kHz to 914.9 MHz.

       8 channels numbered 64 to 71 utilizing LoRa 500 kHz BW at DR4 starting at 903.0 MHz and incrementing linearly by 1.6 MHz to 914.2 MHz


 2.The band range not list in the table but belong to LoRaWAN standard channel plan can be customised.
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