| Vision | 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 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/CN779 |
| Max Transmitted Power | 19dbm |
| Sensitivity | -142.5dBm@SF12 300bps |

## 4.2 Hardware Specification

| Type | Parameters |
|---|---|
| MCU | NRF52832-QFAA |
| Memory | Flash 512KB,RAM 4KB |
| Power Supply | 4000mAh non-chargeable battery |

|Operating time   |max.5 years @upload data twice per day
|Sleep Mode Current   |<=20uA   |
| Operating Current  |Max 150mA@20dBm   |
|LoRa Communication Distance   |>=1500m in urban 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

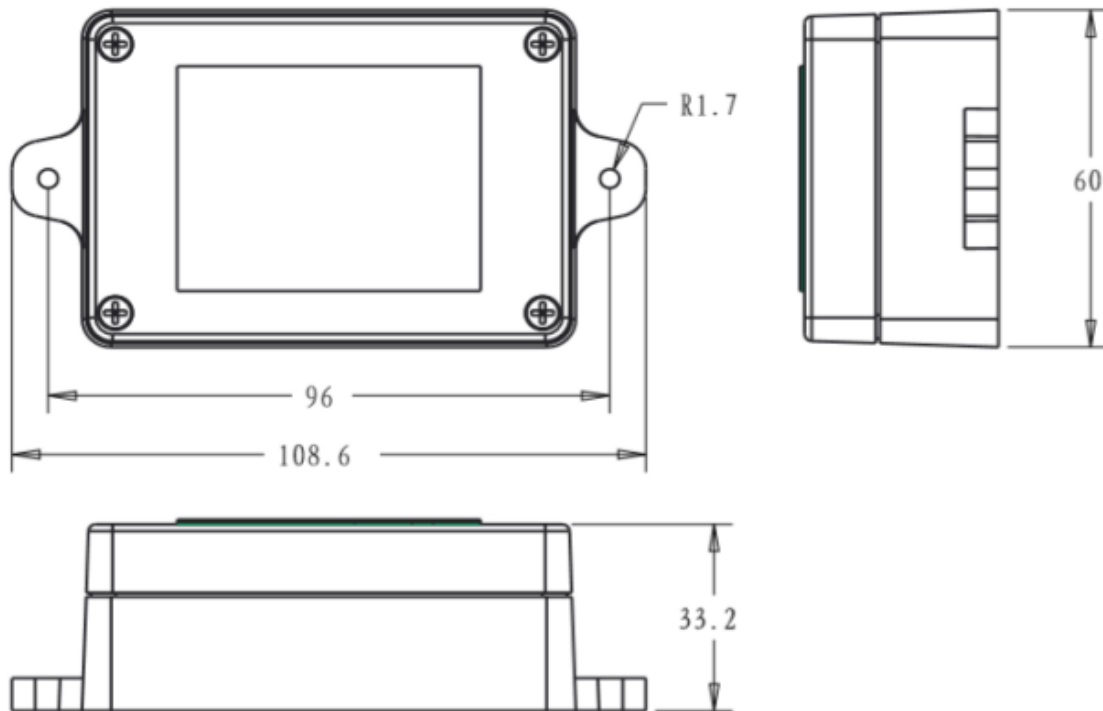## 4.4.1 Product Interface



green indicator light

red indicator light
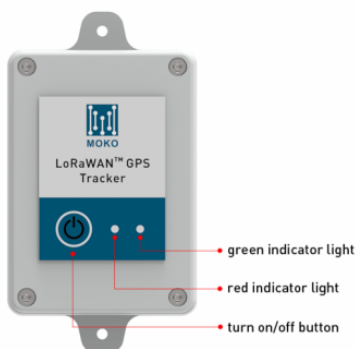
turn on/off button

**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 |
|------|------|-------|-------------|
| current packet | 01 | 0x02 | the number of current packet |
| battery level | 02 | 0x00, 0X01 | the current battery level,00 indicate normal battery,01 indicate low battery,it can only send one or two hundred pieces of data |
| speed | 03-06 | 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 | 07-08 | 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 | 09-10 | 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 00 F6 28 DC 3E 1C 46 31 01
```

| byte | 01 | 02 | 03-06 | 07-08 | 09-10 |
|------|-----|-----|-------|-------|-------|
| example data | 02 | 00 | F6 28 DC 3E | 1C 46 | 31 01 |
| | This is the | current | convert to decimal data and keep four deciaml places is | convert to integer is 17948,  it means the | convert to integer is 305, it means the |

| example byte desription | 01 second data packet | 02 battery level is normal | 03-06 deciaml places is 0,it means speed 0.43knots. convert to km/h : 0.43x1.852= 0.796km/h | 07-08 means the ...tion of X-axis of 9-axis sensor is 179.48(17948/100) degree | 09-10 the ...tion of Y-axis of 9-axis sensor is 3.05 (305/100) 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=/83&page_id=625

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 |

| 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 |