LW007-PIR
Product Specification

Version 1.0

MOKO TECHNOLOGY LTD.
www.mokosmart.com

CONTENT

1 Introduction 3
2 Application Scenarios 3
3 Product Appearance 5
3.1 Appearance 5
3.2 Dimensions 5
3.3 LED Patterns 5
4 Product Specifications 5
5 User Guidance 6
5.1 How to install LW007-PIR 6
5.2 How to power on/off LW007-PIR 7
5.3 How to disassemble LW007-PIR 7
5.4 How to make device working quickly 7
5.5 How to configure device parameters 8
6 Main Functions 9
6.1 LoRaWAN capabilities 9
6.1.1 LoRa uplink transmission strategy 9
6.1.2 Confirmed message retransmission mechanism 9
6.1.3 LinkCheck function 9
6.1.4 DeviceTime function 9
6.2 Occupancy detection 9
6.3 Door/Window status detection 10
6.4 Temperature and humidity monitoring 10
6.5 Heartbeat mechanism 11
6.6 Battery performance 11
6.6.1 Low battery alert 11
6.7 On/OFF 12
6.8 Restore to factory setting 12
6.9 Time synchronization 12
6.10 Bluetooth configuration tool 12
7 Uplink Payload 12
7.1 Heartbeat payload 13
7.2 Information payload 13
7.3 Shut Down payload 14
8 Maintenance instruction 15
9 Revision History 15
Appendix 1 Broadcast Contents 16

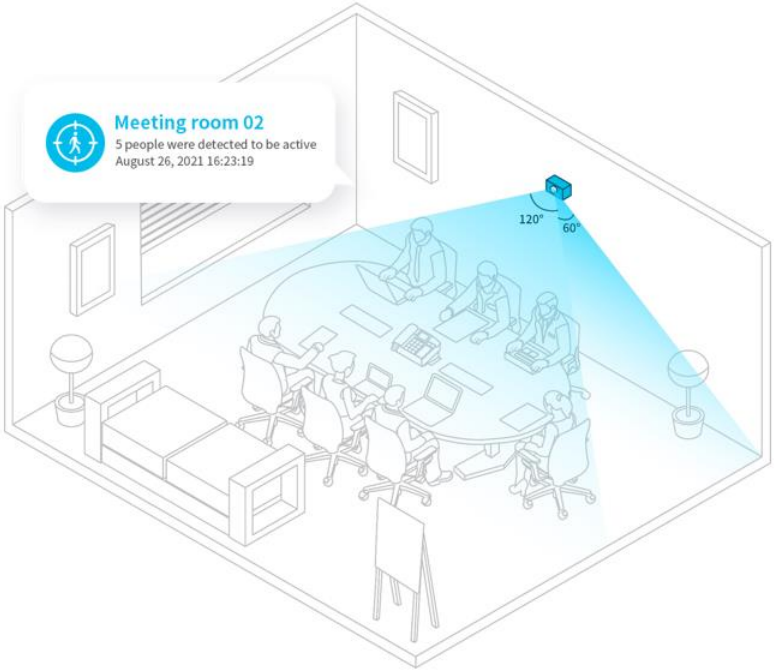
1 Introduction

The LW007-PIR is a passive infrared-based LoRaWAN PIR sensor used to detect motion or occupancy. It can detect whether there is movement within the detection range and send this status change via LoRaWAN network.

In addition, it also supports door/window status detection and environment temperature and humidity monitoring functions, making it can be widely used in office, housing, industrial building and other scenarios.

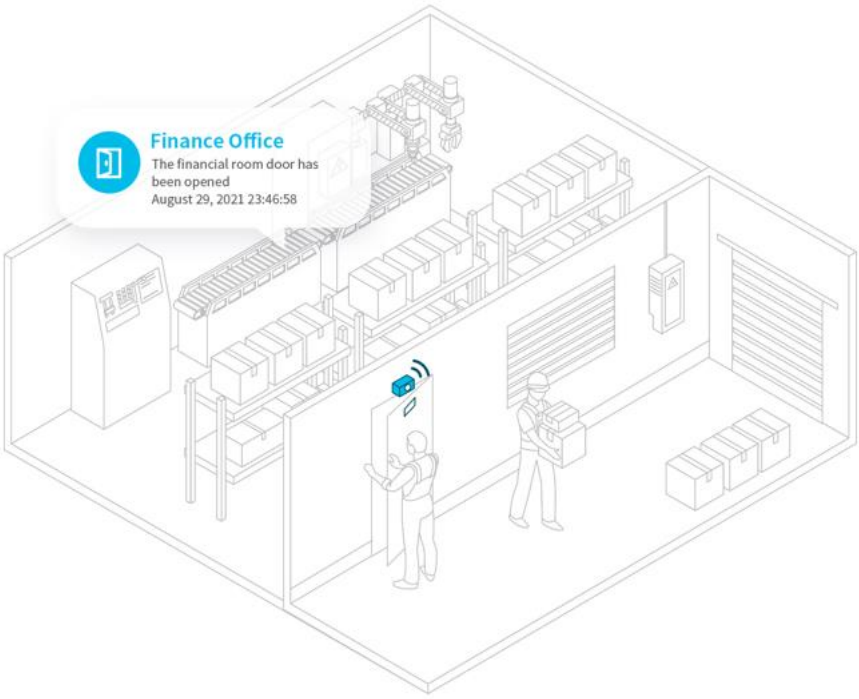
2 Application Scenarios

Scenario 1: Smart Office
Through the LW007-PIR, user can detect the occupancy of a conference room or other purpose-built space, so that space resources can be arranged in a rational manner. At the same time, the LW007-PIR can also be used to monitor the current ambient temperature and humidity.



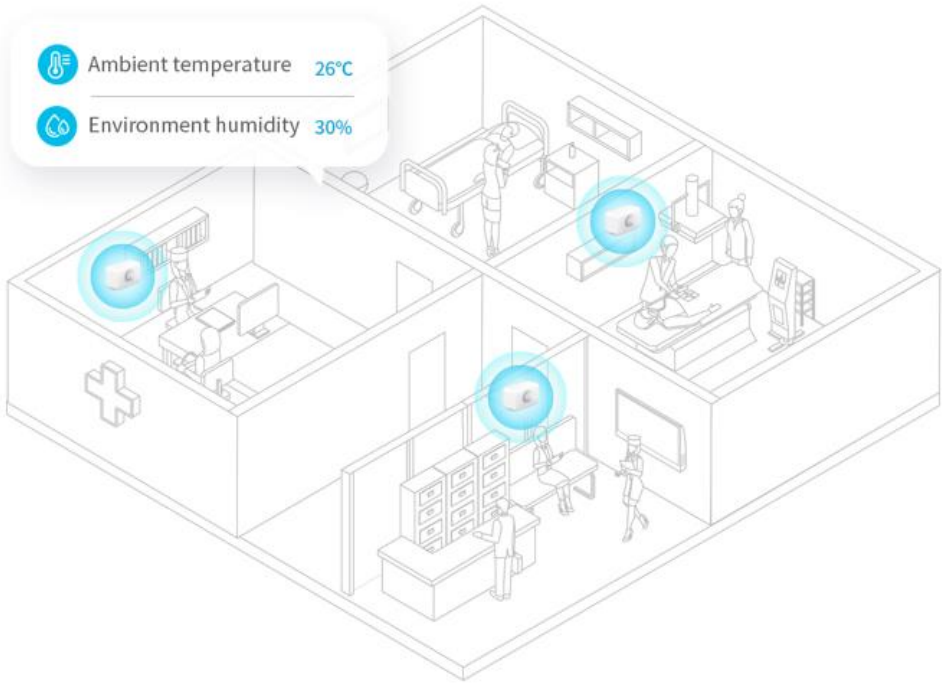
Scenario 2: Intelligent Factory

Users can use the LW007-PIR to detect whether someone is on inspection or duty at the corresponding location at the corresponding time to ensure the safety of assets and equipment and production. The device will report the notification to the server, according to which the user can judge the duty situation and the inspection situation and make the corresponding management scheduling.



Scenario 3: Environmental Monitoring

LW007-PIR can realize temperature and humidity monitoring of the environment, and when the temperature (humidity) changes too fast or the temperature (humidity) exceeds the set threshold, alarm information will be issued to realize intelligent monitoring of the environment. It can be mainly applied to computer room/library storage room/document room/hospital ward and other scenarios.

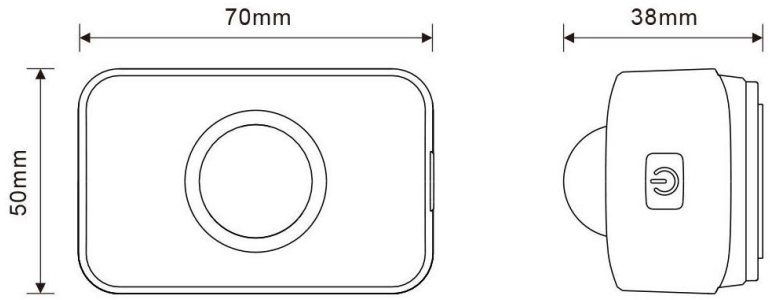


3 Product Appearance

3.1 Appearance

Note: *the environment and orientation of the device can influence the radio performance. For optimum results keep the zone around the antenna area clear from any conducting material or magnetic fields.*

3.2 Dimensions



3.3 LED Patterns

Action	LED Patterns
Turn on	Solid Red and keep 1s
Turn off	Red LED blink 1s
Low battery reminder	Red LED blink once every 10s
Restore to factory setting	Red LED blink 5s

4 Product Specifications

Categories	Parameter	Value
LoRa Wireless Specification	LoRa Protocol	LoRaWAN V1.0.3
	Lora Frequency	EU868/AU915/US915/AS923/IN865/KR920/EU433/CN470/CN779/RU864
	Tx Power	Max 103.77 dBuV/m

	Sensitivity	-137dBm@SF12 300bps
	LoRa Communication Distance	Up to 7 km (in urban open space)
PIR Performance	PIR Detection Range	Max. 8M
	PIR Detection Angle	Horizontal 120°, vertical 60°
T&H Performance	Temperature Measure Accuracy	±0.3℃(0℃-60℃); ±0.5℃(-20℃-0℃); ±1℃(-30℃- -20℃)
	Humidity Measure Accuracy	±3% RH (10% RH - 90% RH); ±4.5% RH - ±3% RH (0% RH - 10% RH); ±3% RH - ±3.8% RH (90% RH - 95% RH)
Door/Window Detection Performance	Detection distance	20 mm
	Recommended installation gap	<10 mm
BLE Wireless Specification	Bluetooth® (BLE)	4.0
	TX Power	Max 0.08dBm
	BLE Communication Distance	Up to 50m in free space
Physical Specification	Dimension	70mm*50mm*38mm
	Shell Material	ABS+PC
	Color	White
Power Consumption	Power Supply	2*AA ER14505 5200mAh Replaceable battery
	Operating Current	<120mA
Application Specification	Operating Temperature	-30 ~ +60℃
	Operating Humidity	0%-95% （No condensation）
	Installation Ways	Double-sided tape/Screws
	Certification	CE FCC certification in process

5 User Guidance

5.1 How to install LW007-PIR

Multiple installation options of LW007-PIR like hanging with screws or double-sided sticker can be selected.

① Double-sided tape

② Bracket

5.2 How to power on/off LW007-PIR

Press and hold the power button for 3 seconds

5.3 How to disassemble LW007-PIR

After removing the mounting back plate, open the battery compartment cover to quickly replace the battery

5.4 How to make device working quickly

Step1: Check the device information
User can get device information according to the label on the boxes, as following picture:

Step2: Confirm the LoRaWAN network (Such as TTN, Senet, LoRIOT, Chirpstack) server to be used.

Step3: Register LoRaWAN gateway on LoRaWAN network server. If the gateway model is MKGW2-LW which is from moko, pls refer to *MOKO LoRaWAN Gateway MKGW2-LW Configuration Guide*.

Step4: Register the device on LoRaWAN network server (OTAA mode).

The region/subject and DEVEUI can be get on Step1.

The default AppEUI is 70 B3 D5 3A F0 20 08 09, the default AppKey is 2B 7E 15 16 28 AE D2 A6 AB F7 15 88 09 CF 4F 3C.

Note: *When you use the US915 or AU915 band, the default FSB of the device is FSB2 (CH:8~15).*

Step5: Join in LoRaWAN network server.

Please reboot the device, then device will send join request to LoRaWAN server automatically, then you can check the uplink payload on LoRaWAN server.

Step6: Uplink payload parse.

Option 1: You can refer to *chapter 7 Uplink Payload*, here is the description of the payload parsing rules and samples parsing.

Option 2: MOKOSMART can provide payload decoder code based on some common LoRaWAN network servers.

5.5 How to configure device parameters

Users can use the MKLoRa App to configure device parameters and OTA upgrades.

For more configuration details, please refer to document - *LW007-PIR APP Guide*.

6 Main Functions

6.1 LoRaWAN capabilities

The uplink payloads of LW007-PIR will be transmitted via LoRa and LW007-PIR is based on the standard LoRaWAN protocol V1.0.3.

LW007-PIR is compatible with mainstream gateways and mainstream servers (TTN, SENET, LORA IOT, etc.) in the market.

6.1.1 LoRa uplink transmission strategy

Considering the load balance of the gateway, the battery power consumption and the reliability of the messages, the LW007-PIR is equipped with a LoRa uplink mechanism for users to choose, so that users can select a suitable sending strategy according to different application scenarios.

6.1.2 Confirmed message retransmission mechanism

Because the application scenario of this product requires high success in data transmission, the uplink payload is transmitted by default via confirmed message. When the device transmits data via confirmation message, if the data is not successfully reported, it can be retransmitted through the protocol layer, and the number of retransmissions can be set.

6.1.3 LinkCheck function

LW007-PIR supports the LinkCheck feature, which can check the LoRaWAN network connection status.

The user can set the LinkCheck interval via MKLoRa or LoRaWAN downlink command.

The LW007-PIR will check its network status periodically at this interval. If network check fails, network check process will be initiated again every 10s, if the network detection fails three times in a row, the device will rejoin the LoRaWAN network.

6.1.4 DeviceTime function

LW007-PIR supports the DeviceTime feature, which enables users to periodically time their devices to avoid time offset.

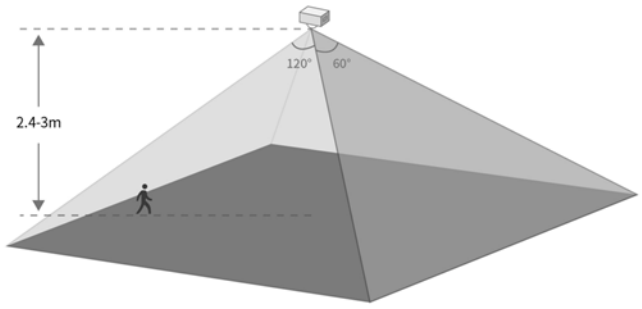
The Time Sync Interval of the MKLoRa APP is the Device Time MAC Command interval.

6.2 Occupancy detection

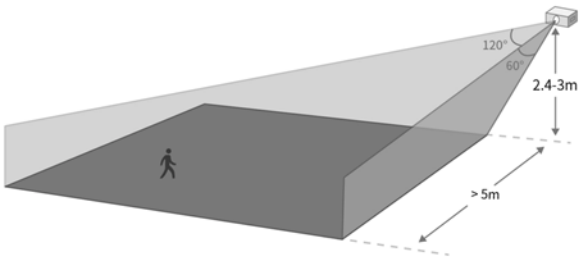
With the built-in PIR sensor and Fresnel lens, the occupancy and movement behavior of the monitoring area can be monitored.

When the space occupation status changes, the device will report *Information Payload* to the server.
At the same time, if the space occupancy status is continuously occupied, the device will report *Information Payload* to the server regularly to notify the occupancy status.

PIR detection range description：



Ceiling installation type

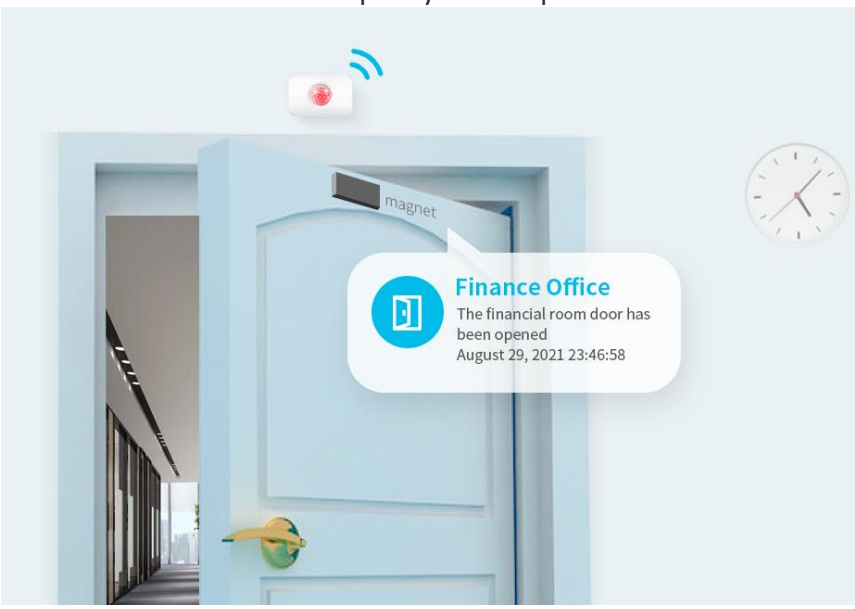


Wall installation type

6.3 Door/Window status detection

LW007-PIR can be mounted on any doors/windows to detect an opening or closing event. When these events occur, LW007 will report *Information Payload* to sever thus enabling security monitoring of the space.

This function can be used in conjunction with the occupancy detection function, making the results of occupancy detection more accurate and reliable. When someone opens a room door and enters, both the door detection status and the occupancy status change, allowing the user to determine the current occupancy of the space.



Note: *When using the PIR function in conjunction with window status detection, ensure that no curtains, screens or other objects obstruct the PIR detection area.*

6.4 Temperature and humidity monitoring

LW007-PIR Built-in high-precision sensors and exterior ventilation holes design, can quickly and accurately sense temperature and humidity changes.

The product can set temperature threshold alarm, temperature over limit alarm, humidity

threshold alarm, humidity over limit alarm and other functions, which can realize timely alert and notification of abnormal temperature and humidity in the monitoring area, so that customers can deal with abnormal situations quickly.

6.5 Heartbeat mechanism

The device will report *Heartbeat Payload* at regular intervals.

If another Payload is uploaded during the heartbeat interval, the heartbeat upload interval will be refreshed.

Users can set different heartbeat reporting intervals according to the actual application scenario to ensure network stability.

6.6 Battery performance

The LW007-PIR is equipped with 2*AA non-rechargeable battery (ER14505).

According to the operating voltage requirement of each component, the total actual power available is about 4000mAh.

Based on this actual power capacity, the endurance of the device is about 5 years under typical scenarios (Each day: Trigger PIR detection 20 times, Trigger door detection 20 times, uplink 40 information payloads by SF10)

When the battery runs out, user can replace the battery with the same type and size.

6.6.1 Low battery alert

When LW007-PIR's battery level is low, its LED indicator will flash red every 10s and it will report *Heartbeat Payload* to the server as a prompt immediately.

Note: *Low battery threshold can be to set 5% and 10%. User can also choose not to report the Heartbeat Payload when the device's battery level is low.*

6.7 On/OFF

Users can switch the device on and off by press and hold the power button on the side of the device for 3s.

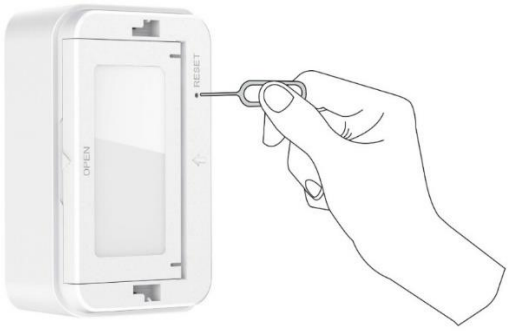
In additional, LW007-PIR supports sending the shutdown payload as a notification alert when the device is turned off. Users can choose to turn off this feature.

Note: *If the battery is suddenly disconnected or pulled out, the device cannot send the Shutdown Payload.*

6.8 Restore to factory setting

There are two ways to restore to factory setting:

1.Through the physical button, Click the reset button on the back of the location device by tools.



2.User can send LoRaWAN downlink commands to make the plug restore to factory setting via LoRaWAN server.

6.9 Time synchronization

There are two methods to sync time of LW007-PIR.

1. LW007-PIR supports the DeviceTimeReq MAC Command, which enables users to periodically time their devices to avoid time offset.

2.When the device is successfully connected to MKLoRa app, the time of host device will be synced to the device immediately.

6.10 Bluetooth configuration tool

The device can use MKLoRa app developed by MOKO for quick OTA upgrades and parameter configuration via Bluetooth connection. About the detail of MKLoRa, pls refer to *LW007-PIR APP Guide*.

7 Uplink Payload

There three different types of uplink Payloads: *Heartbeat Payload*, *Information Payload*, and *Shutdown Payload*.

The different types of Payloads will be uploaded at different ports.

7.1 Heartbeat payload

Heartbeat payload will be sent in Port 5.

Byte 0~4	Byte 5	Byte 6	Byte 7~9	Byte 10
Timestamp	Time zone	Device Status	T&H Data	Low battery status and door/window trigger times

- **Timestamp:** Standard UTC time.
- **Time zone:** It is a signed number, convert to decimal, then then divide by 2, and this is UTC time zone.
- **Device Status:** Convert to binary.
  - Bit 7 & Bit 6 (00 means PIR motion not detected; 01 means PIR motion detected; 11 means that occupancy detection function is disable)
  - Bit 5 & Bit 4 (00 means that door/window is close; 01 means that door/window is open; 11 means that door/window status detection function is disable)
  - Bit 3 & Bit 2 (00 means current environment temperature is lower than minimum temperature alarm threshold value; 01 means current environment temperature is higher than maximum temperature alarm threshold value; 11 means that temperature threshold alarm function is disable)
  - Bit 1 & Bit 0 (00 means current environment humidity is lower than minimum humidity alarm threshold value; 01 means current environment humidity is higher than maximum humidity alarm threshold value; 11 means that humidity threshold alarm function is disable)
- **T&H Data:** Convert three bytes of data to binary, 24 bits in total.
  - Bit 23 ~ Bit 14 (Current temperature: Convert to decimal, the unit is 0.1℃, then plus -30℃; 0b 11 1111 1111 means that temperature monitoring function is disable)
  - Bit 13 ~ Bit 4 (Current humidity: Convert to decimal, the unit is 0.1%; 0b 11 1111 1111 means that humidity monitoring function is disable)
  - Bit 3 & Bit 2 (00 means current environment temperature rises faster than temperature change alarm condition; 01 means current environment temperature drops faster than temperature change alarm condition; 11 means that temperature change alarm function is disable)
  - Bit 1 & Bit 0 (00 means current environment humidity rises faster than humidity change alarm condition; 01 means current environment humidity drops faster than humidity change alarm condition; 11 means that humidity change alarm function is disable)
- **Low battery status and door/window trigger times:** Convert two bytes of data to binary, 16 bits in total.
  - Bit 15 (1 means that battery level is low; 0 means that battery level is normal)
  - Bit 14 ~ Bit 0 (Door/window trigger times: Convert to decimal, unit is times. 32767 times means door/window status detection function is disable)

7.2 Information payload

Information payload will be sent in Port 6.

Byte 0~4	Byte 5	Byte 6	Byte 7~9	Byte 10
Timestamp	Time zone	Device Status	T&H Data	Low battery status and door/window trigger times

- **Timestamp:** Standard UTC time.
- **Time zone:** It is a signed number, convert to decimal, then then divide by 2, and this is UTC time zone.
- **Device Status:** Convert to binary.
  - Bit 7 & Bit 6 (00 means PIR motion not detected; 01 means PIR motion detected; 11 means that occupancy detection function is disable)
  - Bit 5 & Bit 4 (00 means that door/window is close; 01 means that door/window is open; 11 means that door/window status detection function is disable)
  - Bit 3 & Bit 2 (00 means current environment temperature is lower than minimum temperature alarm threshold value; 01 means current environment temperature is higher than maximum temperature alarm threshold value; 11 means that temperature threshold alarm function is disable)
  - Bit 1 & Bit 0 (00 means current environment humidity is lower than minimum humidity alarm threshold value; 01 means current environment humidity is higher than maximum humidity alarm threshold value; 11 means that humidity threshold alarm function is disable)
- **T&H Data:** Convert three bytes of data to binary, 24 bits in total.
  - Bit 23 ~ Bit 14 (Current temperature: Convert to decimal, the unit is 0.1℃, then plus -30℃; -30℃ means that temperature monitoring function is disable)
  - Bit 13 ~ Bit 4 (Current humidity: Convert to decimal, the unit is 0.1%; 0% means that humidity monitoring function is disable)
  - Bit 3 & Bit 2 (00 means current environment temperature rises faster than temperature change alarm condition; 01 means current environment temperature drops faster than temperature change alarm condition; 11 means that temperature change alarm function is disable)
  - Bit 1 & Bit 0 (00 means current environment humidity rises faster than humidity change alarm condition; 01 means current environment humidity drops faster than humidity change alarm condition; 11 means that humidity change alarm function is disable)
- **Low battery status and door/window trigger times:** Convert two bytes of data to binary, 16 bits in total.
  - Bit 15 (1 means that battery level is low; 0 means that battery level is normal)
  - Bit 14 ~ Bit 0 (Door/window trigger times: Convert to decimal, unit is times. 32767 times means door/window status detection function is disable)

7.3 Shut Down payload

Shut Down payload will be sent in Port 7.

Byte 0~4	Byte 5	Byte 6	Byte 7

Timestamp	Time zone	Low battery status	Current battery voltage

- **Timestamp:** Standard UTC time.
- **Time zone:** It is a signed number, convert to decimal, then then divide by 2, and this is UTC time zone.
- **Low battery status:** 00 means that battery level is normal; 01 means that battery is low; FF means that device won't send *Heartbeat Payload* to server when device's battery level is low)
- **Current battery voltage:** Convert to decimal, unit is 0.1V, then plus 2.2V)

8 Maintenance instruction

- Do not use or store the device in dusty or dirty areas.
- Do not use or store the device in extremely hot temperatures. High temperatures may damage the device or battery.
- Do not use or store the device in extremely cold temperatures .when the device warms to its normal temperature, moisture can form inside the device and damage the device or battery.
- Do not drop ,knock, or shake the device. Rough handing would break it.
- Do not use strong chemicals or washing to clean the device.
- Do not paint the device ,paint would cause improper operation
- Do not disassemble the device casually or use the tools for maintenance without permission

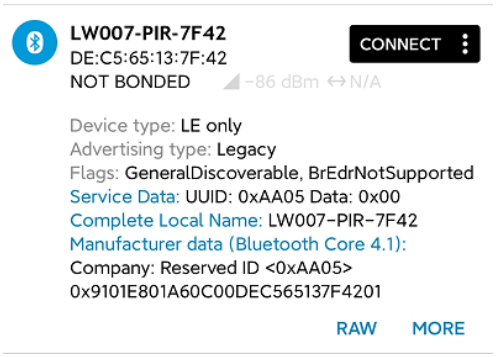
Handle your device, battery and accessories with care. The suggestions above help you keep your device operational.

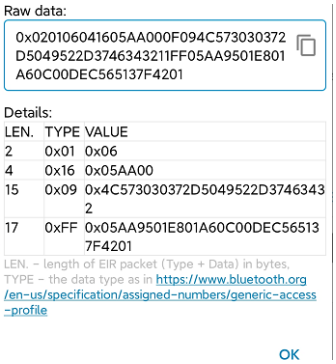
9 Revision History

Version	Description	Editor	Date
1.0	Initial version	Allen	2022-1-20

Appendix 1 Broadcast Contents

The Bluetooth broadcast contents of LW007-PIR are divided into advertising packet and response packet. The following is an example of the broadcast content:





Advertising packet content is as follows:

LEN	TYPE	VALUE
4	0x16	0x 05 AA 00
15	0x09	0x 4C 57 30 30 37 2D 50 49 52 2D 37 46 34 32

- Service UUID: LW005-MP (0x 05 AA)
- Device ADV Name: LW007-PIR-7F42 (0x 4C 57 30 30 37 2D 50 49 52 2D 37 46 34 32) (7F 42 is the last 4 bits of device MAC addresses)

Response packet content is as follows:

LEN	TYPE	VALUE
17	0xFF	0x 05 AA 95 01 E8 01 A6 0C 00 DE C5 65 13 7F 42 01

- Device status: 0x 95 (1001 0101)
  - Bit 7 (1 means that device will send *Heartbeat Payload* to server when device's battery level is low; 0 means that device won't send *Heartbeat Payload* to server when device's battery level is low)
  - Bit 6 (1 means that battery level is low; 0 means that battery level is normal)
  - Bit 5 & Bit 4 (00 means that door/window is close; 01 means that door/window is open; 11 means that door/window status detection function is disable)
  - Bit 3 & Bit 2 (00 means PIR motion not detected; 01 means PIR motion detected; 11 means that occupancy detection function is disable)
  - Bit 1 & Bit 0 (00 means low PIR sensitivity; 01 means medium PIR sensitivity; 11 means high PIR sensitivity)
- Temperature: 18.8℃ (0x 01 E8: Convert to decimal, unit is 0.1℃, then plus -30℃; 0x FF FF means temperature monitoring function is disable)
- Humidity: 42.2& (0x 01 A6: Convert to decimal, unit is 0.1%; 0x FF FF means humidity monitoring function is disable)
- Battery voltage: 3.4V (0x 0C: Convert to decimal, unit is 0.1V, then plus 2.2V)

- Bluetooth Tx power: 0 dBm (0x 00: Convert to decimal, it is a signed number, unit is dBm)
- MAC Address: DE C5 65 13 7F 42 (0x DE C5 65 13 7F 42)
- Login password verification required: YES (0x 01: 01 means Yes, 00 means NO)

FCC Caution:

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.

If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

-- Reorient or relocate the receiving antenna.

-- Increase the separation between the equipment and receiver.

-- Connect the equipment into an outlet on a circuit different
from that to which the receiver is connected.

-- Consult the dealer or an experienced radio/TV technician for help.

To maintain compliance with FCC’s RF Exposure guidelines, this equipment should be installed and operated with minimum distance between 20cm the radiator your body: Use only the supplied antenna.

MOKO TECHNOLOGY LTD.

Factory 201, 107 Pinshun Rd Guixiang community, Guanlan Street, Longhua, Shenzhen, China 518110

Tel:86-755-23573370-829

Support_lora@mokotechnology.com

https://www.mokosmart.com