LW004-PB
Product Specification

CONTENT

1 Product Introduction

LW004-PB is LoRaWAN based panic button with positioning function, with a compact and smart outlook, and easy to use. It integrates BLE and GPS that is specially designed for indoor and outdoor positioning of object or person.

The product is mainly applicable to construction site safety management, school safety, nursing home management and other personnel safety management application scenarios.

2 Application Scenarios

Scenario 1: Industrial construction worker safety

The site construction environment is complex and more prone to safety accidents. With LW004-PB, workers can send SOS alarm message and their location located in time when they encounter danger to protect their safety and reduce the loss of safety accidents.
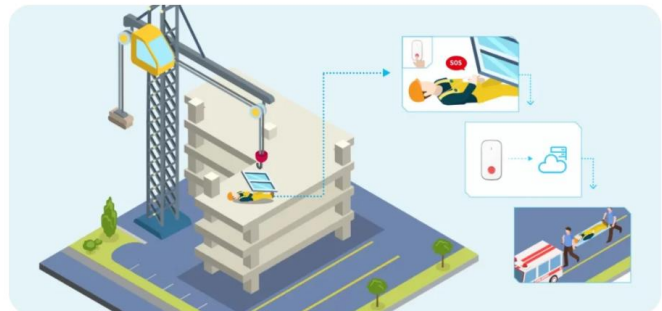
Scenario 2: Hotel staff management

Hotel management will encounter all kinds of unexpected situations, when encountering urgent needs and other emergencies, staff can promptly trigger the LW004-PB worn on the body, never to send a notification, timely handling of abnormal situations. At the same time, it can also be used for indoor positioning through Bluetooth technology to obtain the location information of the emergency situation in time.

Scenario 3: Nursing home management

The elderly wear LW004-PB for indoor and outdoor activities. If they encounter an emergency, LW004-PB will keep sending alarm messages with location information after the SOS button is pressed.

In addition, if an elderly person encounters an unexpected situation and is unable to move for a long time, the device will automatically keep sending alarm messages with location information.

3 Product Guidance

3.1 Appearance

1 LED
2 Function Button
3 Power Button

4 Lanyard Holes
5 TYPE-C
6 Antenna area (inside)
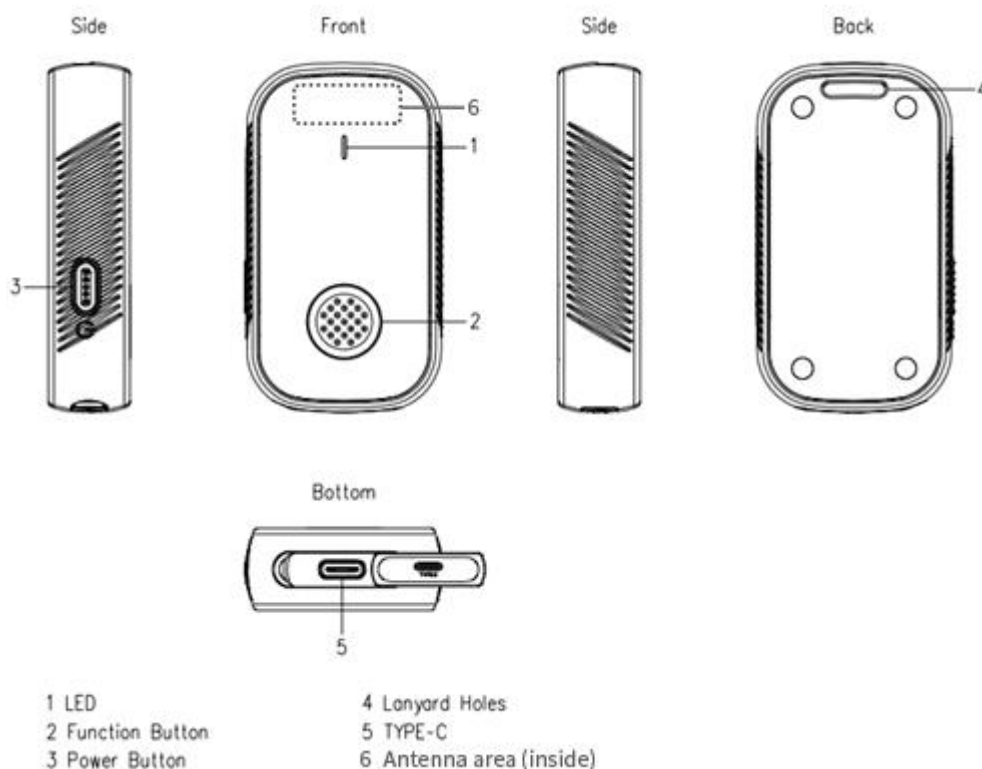
Note: *the environment and orientation of the device can influence the radio performance. For optimum results keep the zone around the antenna area clear from any conducting material or magnetic fields.*

3.2 LED Patterns and Button

Items	Indicator	Operation	Remark
Turn ON	Solid blue and keep 3S	Press and hold the power button for 3 seconds till the LED indicate blue and release. The LED will indicate blue for 3 seconds to show the LW004-PB is turned on.	
Turn OFF	Red LED Blink 3S	Press and hold the power button for 3 seconds till the red indicator flashes quickly and release. The indicator will flash red for 3	

		seconds to show the LW004-PB is turned off.	
Join LoRa Network	Solid green and keep 3S	If the device had never Joined any network, after turning on, the device automatically sends join request	It will send join request automatic after power on the device or click save button on lora setting interface
Login in	Green LED Blink 1S	Connect to the device via APP successfully	
Login out	Red LED Blink 1S	APP disconnect to the device	When the device in alarm status the indicator may be not visible
Trigger Alarm	Yellow LED Blink		Either enters the alarm mode or send alarm message to server, there will also have vibration reminder
Exit Alarm	Alarm indicator LED turn off	Press alarm button and hold on 5~15S or send downlink command to exit alarm	
Firmware Upgrade	Green LED Blink during the upgrade	Firmware upgrade via OTA in DFU mode	
	Solid Blue and keep 3S after upgrade successfully		
	Solid Red and keep 3S after upgrade failed		
Charging	Blue LED blink	Plug in type-c charger	
Full Charged	Solid blue	Plug in type-c charger	
Low Battery Reminder	Red LED blink	Battery level is lower than set value	
Status indicators	Solid Green and keep one second means that the device is on. Otherwise, the device is off.	Single click the power button	
Factory Reset	Solid green and keep 3S, then device restart	When the device is off, press and hold the power button for	

and green LED Blink 3S	10s till the LED indicate solid green 3s and release button.	

3.3 Product Specifications

Categories	Parameter	Value
LoRa Wireless Specification	LoRa Protocol	LoRaWAN V1.0.3
	Lora Frequency	US915/AU915/AS923/EU868/IN865 /EU868/RU864/KR920/CN470
	Tx Power	Max 20dBm
	Sensitivity	-140dBm@SF12 300bps
	LoRa Communication Distance	Up to 7 km (in urban open space)
BLE Wireless Specification	Bluetooth® (BLE)	V4.2
	BLE Communication Distance	Up to 50m in free space
Hardware Specification	GPS Positioning Accuracy	2.5m CEP
RFID Specification	RFID sensing distance	Card reader sensing distance 12mm
		Mobile phone sensing distance 4mm
Physical Parameter	Dimension	73mm×40mm×17mm (±2mm)
	Net Weight	48 g（±2g）
	Shell Material	ABS/PC+TPU （TPU is used for button and frame）
Power supply	Changer Port	Type C
	Changer Time	2.5 hours@5V/1A

Specification	Battery characteristics	540mA rechargeable battery
Power Consumption	Operating Current	< 120mA
	Sleep Current	< 13uA
Application Parameter	Operating Temperature	-20~60℃
	Charging Temperature	0-45℃
	IP Rating	IP66
	Certificate	CE, FCC

4 User Guidance

4.1 How to Power On/OFF LW004-PB

Press and hold the power button for 3 seconds.

If LED indicator blue for 3 seconds, it means that the LW004-PB is turned on.

If LED indicator flash red for 3 seconds, it means that the LW004-PB is turned off.
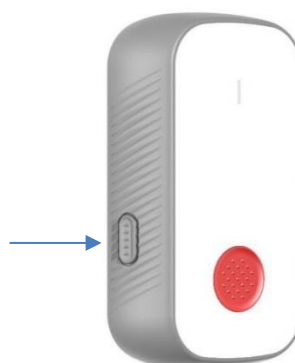
4.2 How to make device working quickly

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

Model:LW004-PB
Region:US915
MAC:C2A8283F69C7
DEVEUI:C2A828FFFF3F69C7

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 6 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 Main Functions

5.1 Multiple Working Mode

5.1.1 Overview

LW004-PB supports four different working modes: *Standby Mode*, *Timing Mode*, *Periodic Mode* and *Motion Mode*.

LW004-PB can only be in one mode at the same time, and the user can use the mobile app or LoRa downlink command to switch the working mode.

No matter what mode the device is, *Heartbeat Payload* will be sent according to heartbeat report interval (The heartbeat report interval can be set by user via MKLoR APP).

If another uplink payload is sent during the heartbeat report interval, the heartbeat report interval will be recalculated with the uplink time point of that payload.

Along to the main working mode, LW004-PB can perform extra operations known as *Auxiliary Operations*.

5.1.2 Standby Mode

In *Standby Mode*, the device will only report *Heartbeat Payload* according to heartbeat report interval and won't send the *Location Payload* which includes LW004-PB's positions.

If location information is needed in *Standby Mode*, user can use *Downlink for Position* (one of *Auxiliary Operations*) to get the *location payload*.

In additional, the user can also enable other auxiliary operations to achieve the corresponding functions. (Refer to *5.2 Auxiliary Operations*)

5.1.3 Timing Mode

In *Timing Mode*, LW004-PB will report *Location Payload* at the time point configured in advance. Each LW004-PB can set up to 10 reporting time points.

We divided the day into 96 time points, each 15 minutes apart, with the first time point being 00:00. Each LW004-PB can set up to 10 reporting time points.

User can select different *Positioning Strategies* for *Timing Mode* to obtain location information according to different application scenarios.

User also can use *Downlink for Position* (one of *Auxiliary Operations*) to get the extra *location payload*.

In additional, the user can also enable other auxiliary operations to achieve the corresponding functions. (Refer to 5.2 *Auxiliary Operations*)

5.1.4 Periodic Mode

In *Periodic Mode*, LW004-PB will report its positions periodically. The report interval can be set by user.

User can select different *Positioning Strategies* for *Periodic Mode* to obtain location information according to different application scenarios.

User also can use *Downlink for Position* (one of *Auxiliary Operations*) to get the extra *location payload*.

In additional, the user can also enable other auxiliary operations to achieve the corresponding functions. (Refer to 5.2 *Auxiliary Operations*)

5.1.5 Motion Mode

When the LW004-PB is in motion mode, it can monitor the whole process of the LW004-PB from stationary to motion and from motion to stationary through the built-in 3-axis accelerometer sensor.

The whole motion process can be divided into four parts: *Start of movement, In movement, End of movement, Stationary.*

5.1.5.1 Start of Movement

LW004-PB detects whether the device is moving by 3-axis accelerometer sensor, and if the preset moving judgment condition (*Motion Threshold* & *Motion Duration*) is reached, the device is considered to start moving and start positioning.

When the positioning process is finished, LW004-PB will send *Location Payload*. User can choose to send this payload repeatedly. The number of repetitions can be set by user.

User can select different *Positioning Strategies* for *start of movement* to obtain location information according to different application scenarios.

Note: User can choose whether to report Location Payload or not at start of movement.

5.1.5.2 In Movement

After *start of movement*, LW004-PB will be *in movement* state.

LW004-PB will send *Location Payload* periodically during the movement.

User can select different *Positioning Strategies* during the movement to obtain location information according to different application scenarios.

Note: User can choose whether to report Location Payload or not during the movement.

5.1.5.3 End of Movement

The LW004-PB detects whether the device is still moving by 3-axis accelerometer sensor.

If the device never reaches the moving judgment condition (*Motion Threshold* & *Motion Duration*) within N seconds, the device is considered to have stopped moving and started positioning immediately.

When the positioning process is finished, LW004-PB will send *Location Payload*.

LW004-PB can report multiple different *Location Payloads*, the number of *Location Payloads* and the interval between *Location Payloads* can be set by user.

User can select different *Positioning Strategies* for *End of movement* to obtain location

information according to different application scenarios.

Note: User can choose whether to report Location Payload or not at End of movement.

5.1.5.4 Stationary

After the last *Location Payload* of *End of movement* was sent, the device will come into *Stationary* state.

When the device is in *Stationary state*. The device will only report *Heartbeat Payload* according to heartbeat report interval and won't send the *Location Payload.*

5.1.5.5 Motion Mode Event Message

Event messages are notifications sent by LW004-PB to inform the server about a specific event when the device is in *Motion Mode*.

There are three types of event message notifications that can be activated:

Event message at *start of movement*: *Event Message Payload* will be sent when the preset moving trigger condition (*Motion Threshold* & *Motion Duration*) is reached.

Event message *During the movement*: When the device is *in movement*, *Event Message Payload* will be sent whenever the device starts positioning.

Event message at *End of movement*: *Event Message Payload* will be sent when the device come into *End of movement* state.

Note: All the above three events can be set individually to send or not to send event messages.

5.2 Auxiliary Operations

5.2.1 Overview

Whatever the working mode, the LW004-PB supports *Auxiliary Operations*, which can be:
➢ Alarm Function
➢ Downlink for Position
➢ Man Down Detection

Note: Priority Description (Alarm function >Man Down Detection> Downlink for Position).

5.2.2 Alarm Function

LW004-PB supports two alarm types: One is *Alert alarm*, another one is *SOS alarm*.

Users can choose the alarm type according to the actual application scenario, but the device can

only choose one alarm type at the same time.

Alert alarm: When users encounter general emergencies or need to make special notifications, the alarm is triggered by pressing the emergency button, which sends the positioning data to the server once and notifies the background to arrange personnel to deal with it in time, then device will exit alarm state automatically.

SOS alarm: When the user encounters an emergency, the alarm is triggered by pressing the emergency button, which continuously sends the positioning data to the server to notify the background to arrange personnel to deal with the emergency in time to ensure the safety and health of the personnel till the alarm state is stopped by button or LoRaWAN downlink command.

Users can choose different ways to trigger the alarm function, such as long press or click the button, detailed setting items can be seen in *LW004-PB APP Guide.*

By default, the user can exit the alarm by pressing and holding the SOS button for 15s (Can be set in range of 5~15s).

5.2.2.1 Alarm Event Message

To let customers clearly know the start time and the end time of the alarm, LW004-PB also support alarm event message function.

When the alarm starts, the event payload will be reported immediately, telling the customer that the alarm has started.

When the alarm ends, the event payload will be reported immediately to tell the customer that the alarm is over.

5.2.3 Downlink for Position

When the Downlink for Position is used, LW004-PB's position can be requested via LoRa downlink command. (*Refer to Document "LW004-PB Downlink Command"*)

User can select different *Positioning Strategies* for **this function** to obtain location information according to different application scenarios.

5.2.4 Man Down Detection

The LW004-PB's built-in three-axis sensor can detect whether the person who wear LW004-PB or is stationary for a long time.

If the preset Man Down detection condition is reached, LW004-PB will report the *Location Payload with a faster reporting frequency* to remind the user to handle the exception.

When the elderly wear LW004-PB during daytime hours, if the elderly encounters an emergency and do not move for a long time, they can use this function to deal with the abnormal situation in time.

5.2.4.1 Man Down Event Message

When the device comes into Man down state, *Event Message Payload* will be reported immediately.

When the device comes exits Man down state, *Event Message Payload* will be reported immediately.

5.3 Positioning Strategies

The device can set the corresponding positioning strategy for device mode and auxiliary operations.

LW004-PB has the following main positioning strategies:
- Only Bluetooth: Only Bluetooth scans are used for position determination.
- Only GPS: Only GPS is used for position determination.
- Bluetooth+GPS: Bluetooth and GPS will be used in positioning, same to V2 version firmware.

5.3.1 GPS Fix

LW004-PB obtains the corresponding location information via satellite to determine the location of the product.

When the device successfully obtains the location information, it will enter the hibernation mode, and the location information will be reported at the reporting time point, and the reporting content will include the successful positioning time point, so that the location trajectory analysis can be performed.

5.3.2 Bluetooth Fix

LW004-PB obtains the broadcast information of surrounding Bluetooth devices through Bluetooth scanning function, and reports the information (MAC address and RSSI) of Bluetooth devices that meet the conditions of Bluetooth filtering to the server through LoRa, and the application server goes to calculate the location, the accuracy of positioning depends on the actual deployment of the customer and the calculation of the location algorithm.

The following BLE Beacon types are supported for scanning：
- iBeacon (Apple)
- Eddystone (Google)
- The Moko-defined beacons
- Unknown (For example, a beacon manufacturer-defined format)

The success of Bluetooth positioning depends on the Bluetooth location scan time and Bluetooth device count threshold. The Bluetooth scan time and Bluetooth device count thresholds can be set by the user via MKLoRa.
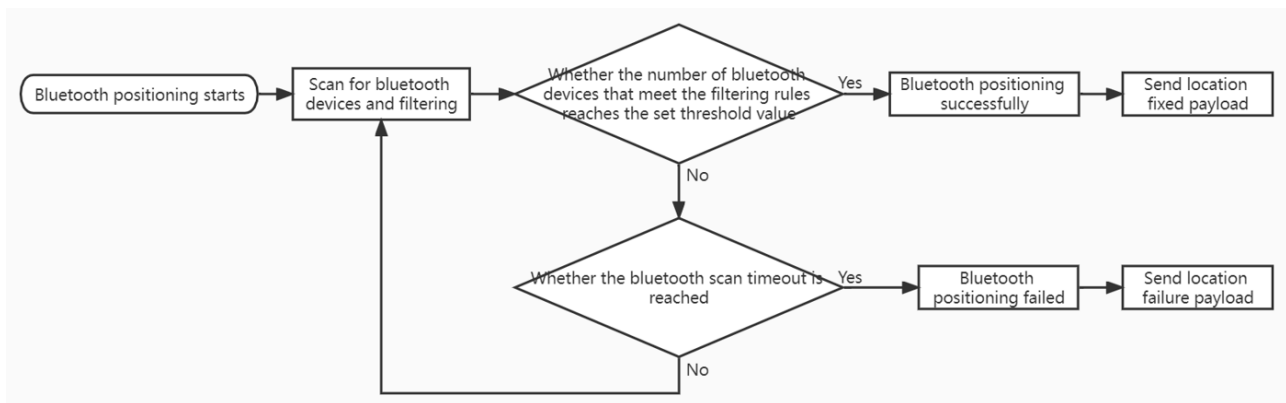
5.3.2.1 Filtering Rules

LW004-PB supports multiple data filtering methods to help you easily obtain target beacon data:

➢ Filter by RSSI, MAC address, advertising name and advertising raw data

➢ Filter out duplicate data: Only one piece of Bluetooth data is reported for beacons with the same MAC address in one Bluetooth fix period.

Detailed setup instructions can be found in *LW004-PB APP guide*.

5.4 Bluetooth Broadcast Capabilities

The device can make a Bluetooth broadcast and can be connected in the following three cases.

1. Within the first N minutes after the device is turned back on.

2. Doubel click power button, the device will turn on Bluetooth broadcast for N minutes.

3. LoRaWAN server sends LoRa command to turn on Bluetooth broadcast for N minutes.

Note: N is the broadcast timeout time, the unit is s, can be configured by the user. If the device is successfully connected and then disconnected, the broadcast timeout will be refreshed, and the user can choose to establish Bluetooth connection with the device again within this time.

5.5 LoRaWAN Capabilities

The data of LW004-PB will be transmitted via LoRa and LW004-PB is based on the standard LoRaWAN protocol V1.0.3.

LW004-PB is compatible with mainstream gateways and mainstream servers (TTN, SENET, LORA IOT, etc.) in the market.

5.5.1 Timed Sync Command

DeviceTimeReq MAC Command: LW004-PB 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. (Please refer to *LW004-PB APP Guide*)

5.5.2 Network Check Command

LinkCheckReq MAC Command: LW004-PB supports the LinkCheck feature, which enables users to periodically check the network connection status. The *Network Check Interval* of the MKLoRa APP is the LinkCheck MAC Command interval. (**Please refer to** *LW004-PB APP Guide*)

5.5.3 LoRa Uplink Transmission Strategy

Considering the load balance of the gateway, the battery power consumption and the reliability of the messages, the LW004-PB 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.

5.5.4 Confirmed Message

The product supports confirmed message type for uplink payload. User can select confirmed message type via MKLoRa APP.

If the device doesn't receive a reply from the server for uplink payload, the device will automatically retransmit the uplink payload, the maximum number of retransmissions for uplink payload can be set by the customer via MKLoRa APP.

5.6 3-Axis Accelerometer Capabilities

With the built-in three-axis sensor, the device can achieve *Man Down Detection* and motion detection in *Motion Mode*.

5.7 Battery Performance

The LW004-PB is equipped with 540mAH rechargeable battery.

When LW004-PB's battery level is low, its power indicator will flash every 30s and it will report *Low Power Payload* to the server as a prompt.

Notes: Low battery threshold can be to set 10%,20%,30%,40%,50% or 60%.

5.8 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.

The device can be set so that it cannot be switched off by the power button. In this case, the device can only be switched off by LoRaWAN downlink command or automatically off when it runs out of power.

In additional, LW004-PB supports sending *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 Shut Down Payload.

5.9 Time Synchronization

There are two methods to sync time of LW001-BG PRO.

1. LW004-PB supports the DeviceTimeReq MAC Command, which enables users to periodically time their devices to avoid time offset.

2.When the APP connect with the device successfully, the phone system time will be sync to the device via Bluetooth.

5.10 Device Status Indication

Because of the impact of power consumption, LW004-PB is not designed to have a dedicated indicator to indicate that the device is on.

Therefore, we have designed the device status to be briefly indicated by button triggering.

When the device is on, single click the on/off button twice within 1s, if the LED indicator solid white and keep one second means that the device is on, otherwise the device is off.

5.11 Factory Reset

User can restore the device to factory settings by button operation (Refer to 3.2 LED Patterns and Button) or LoRaWAN downlink command.

5.12 Configuration Tool

The device can use MKLoRa app developed by Moko for quick OTA upgrades and parameter configuration. About the detail of MKLoRa, pls refer to *LW004-PB APP Guide.*

6 Uplink Payload

6.1 Event Message Payload

Event message payload will be sent in Port 1.

Byte 0	Byte 1	Byte 2~5	Byte 6
Battery Level	Time zone	Timestamp	Event Type

Battery Level: Convert to binary.

- ✧ Bit 7 (00 means device isn't in charging; **01** device is in charging)
- ✧ Bit 6 ~ Bit 0 (Convert to decimal, the unit is %. It is the current battery level)

Time zone: It is a signed number, convert to decimal, then then divide by 2, and this is UTC time zone.

Timestamp: Standard UTC time.

Event Type:

- ✧ 00 means *Start of movement*; 01 means *In movement*; 02 means *End of movement*
- ✧ 03 means start SOS alarm; 04 means SOS alarm exit.
- ✧ 05 means start Alert alarm; 06 means Alert alarm exit.
- ✧ 07 means come into Man Down status; 08 means exit Man Down status.

6.2 Device Information Payload

Device information payload will be sent in Port 2 when device is power on.

Byte 0	Byte 1	Byte 2~4	Byte 5~6	Byte 7
Battery Level	Device Status	FW version	Hardware version	Time zone

Battery Level: Convert to binary.

- ✧ Bit 7 (00 means device isn't in charging; 01 device is in charging)
- ✧ Bit 0 ~ Bit 6 (Convert to decimal, the unit is %. It is the current battery level)

Device Status: Convert to binary.

- ✧ Bit 4~7 (**Current device mode:** Convert to decimal. 1 means standby mode; 2 means timing mode; 3 means periodic mode; 4 means stationary state in motion mode; 5 means start of movement in motion mode; 6 means in movement for motion mode; 7 means end of movement in motion mode)
- ✧ Bit 0~3 (**Current auxiliary operation:** Convert to decimal. 0 means no auxiliary operation; 1 means downlink for position; 2 means Man Down status; 3 means Alert alarm; 4 means SOS alarm)

FW Version: Convert to decimal.
    If Byte 2~4 is 0x 03 02 01, it means the FW version is V3.2.1

Hardware Version: Convert to decimal.
    If Byte 5~6 is 0x 03 02, it means the Hardware version is V3.2

Time zone: It is a signed number, convert to decimal, then then divide by 2, and this is UTC time zone.

6.3 Shut Down Payload

Shut Down payload will be sent in Port 3.

Byte 0	Byte 1	Byte 2	Byte 3~6	Byte 7

Battery Level	Device Status	Time zone	Timestamp	Shut down type

Battery Level: Convert to binary.

  ✧ Bit 7 (00 means device isn't in charging; **01** device is in charging)

  ✧ Bit 0 ~ Bit 6 (Convert to decimal, the unit is %. It is the current battery level)

Device Status: Convert to binary.

  ✧ Bit 4~7 (**Current device mode:** Convert to decimal. 1 means standby mode; 2 means timing mode; 3 means periodic mode; 4 means stationary state in motion mode; 5 means start of movement in motion mode; 6 means in movement for motion mode; 7 means end of movement in motion mode)

  ✧ Bit 0~3 (**Current auxiliary operation:** Convert to decimal. 0 means no auxiliary operation; 1 means downlink for position; 2 means Man Down status; 3 means Alert alarm; 4 means SOS alarm)

Time zone: It is a signed number, convert to decimal, then then divide by 2, and this is UTC time zone.

Timestamp: Standard UTC time.

Shut Down Type: The reason of power off. 00 means Bluetooth command or App; 01 means LoRaWAN Command; 02 means power button; 03 means battery run out.

6.4 Heartbeat Payload

Heartbeat Payload will be sent in Port 4.

Byte 0	Byte 1	Byte 2	Byte 3~6
Battery Level	Device Status	Time zone	Timestamp

Battery Level: Convert to binary.

  ✧ Bit 7 (00 means device isn't in charging; **01** device is in charging)

  ✧ Bit 0 ~ Bit 6 (Convert to decimal, the unit is %. It is the current battery level)

Device Status: Convert to binary.

  ✧ Bit 4~7 (**Current device mode:** Convert to decimal. 1 means standby mode; 2 means timing mode; 3 means periodic mode; 4 means stationary state in motion mode; 5 means start of movement in motion mode; 6 means in movement for motion mode; 7 means end of movement in motion mode)

  ✧ Bit 0~3 (**Current auxiliary operation:** Convert to decimal. 0 means no auxiliary operation; 1 means downlink for position; 2 means Man Down status; 3 means Alert alarm; 4 means SOS alarm)

Time zone: It is a signed number, convert to decimal, then then divide by 2, and this is UTC time zone.

Timestamp: Standard UTC time.

6.5 Low Power Payload

Low power payload will be sent in Port 5.

Byte 0	Byte 1	Byte 2	Byte 3~6	Byte 7
Battery Level	Device Status	Time zone	Timestamp	Low Power Prompt

Battery Level: Convert to binary.

- ✧ Bit 7 (00 means device isn't in charging; 01 device is in charging)
- ✧ Bit 0 ~ Bit 6 (Convert to decimal, the unit is %. It is the current battery level)

Device Status: Convert to binary.

- ✧ Bit 4~7 (**Current device mode:** Convert to decimal. 1 means standby mode; 2 means timing mode; 3 means periodic mode; 4 means stationary state in motion mode; 5 means start of movement in motion mode; 6 means in movement for motion mode; 7 means end of movement in motion mode)
- ✧ Bit 0~3 (**Current auxiliary operation:** Convert to decimal. 0 means no auxiliary operation; 1 means downlink for position; 2 means Man Down status; 3 means Alert alarm; 4 means SOS alarm)

Time zone: It is a signed number, convert to decimal, then then divide by 2, and this is UTC time zone.

Timestamp: Standard UTC time.

Low Power Prompt Percent: When the battery is less than or equal to low power prompt battery percent, the red LED will flash once every 30 seconds. Convert to decimal, the unit is %.

6.6 Location Payload

Depending on whether the positioning process is successful or not, there are two types location payloads: Location Fixed Payload and Location Failure Payload

6.6.1 GPS Location Fixed Payload

GPS Location Fixed Payload of working mode will be sent in Port 6.
GPS Location Fixed Payload of auxiliary operation will be sent in Port 10.

Byte 0	Byte 1~2	Byte 3~6	Byte 7~10
Battery Level	Device Status and age	Longitude	Latitude

Battery Level: Convert to binary.

- ✧ Bit 7 (00 means device isn't in charging; 01 device is in charging)
- ✧ Bit 0 ~ Bit 6 (Convert to decimal, the unit is %. It is the current battery level)

Device Status: Convert to binary.

✧ Bit 13~15 (**Current device mode:** Convert to decimal. 1 means standby mode; 2 means timing mode; 3 means periodic mode; 4 means stationary state in motion mode; 5 means start of movement in motion mode; 6 means in movement for motion mode; 7 means end of movement in motion mode)

✧ Bit 10~12 (**Current auxiliary operation:** Convert to decimal. 0 means no auxiliary operation; 1 means downlink for position; 2 means Man Down status; 3 means Alert alarm; 4 means SOS alarm)

✧ Bit 0~9 (**Age:** Convert to decimal, the unit is S. Time difference between the time of successful GPS positioning and the time of reporting. If the age is 100s, the report timestamp is 10:30:20 am, so the timestamp of successful GPS positioning is 10:28:40 am)

Latitude and Longitude encoder rule: Big-Endian format. It is a singed number.
If the value > 0x80 00 00 00, minus 0x01 00 00 00 00 and convert to decimal, then divide by 10 00 00 00, the unit is degree (°);
If the value<=0x80 00 00 00, convert to decimal and then divide by 10 00 00 00, the unit is degree (°);

6.6.2 GPS Location Failure Payload

GPS Location Failure Payload of working mode will be sent in Port 7.
GPS Location Failure Payload of auxiliary operation will be sent in Port 11.

Byte 0	Byte 1	Byte 2	Byte 3~6
Battery Level	Device Status	Reasons for positioning failure	Location failure data

Battery Level: Convert to binary.

✧ Bit 7 (00 means device isn't in charging; **01** device is in charging)

✧ Bit 0 ~ Bit 6 (Convert to decimal, the unit is %. It is the current battery level)

Device Status: Convert to binary.

✧ Bit 4~7 (**Current device mode:** Convert to decimal. 1 means standby mode; 2 means timing mode; 3 means periodic mode; 4 means stationary state in motion mode; 5 means start of movement in motion mode; 6 means in movement for motion mode; 7 means end of movement in motion mode)

✧ Bit 0~3 (**Current auxiliary operation:** Convert to decimal. 0 means no auxiliary operation; 1 means downlink for position; 2 means Man Down status; 3 means Alert alarm; 4 means SOS alarm)

Reasons for positioning failure:
01 -- Hardware Error
02 -- Interrupted by *Downlink for Position*
03 -- Interrupted by *Man Down Detection*
04 -- Interrupted by *Alarm function*
05 -- GPS positioning timeout (Please increase GPS positioning time via MKLoRa APP)
06 -- GPS positioning time is not enough (The reporting interval is set too short, please increase

report interval via MKLoRa APP)

07 -- GPS positioning timeout of alert alarm (Please increase alert alarm report interval via MKLoRa APP)

08 -- The reporting interval of SOS alarm is set too short (Please increase SOS alarm report interval via MKLoRa APP)

09 -- GPS PDOP Limit (Please increase PDOP via MKLoRa APP)

0A -- Interrupted positioning at *end of movement* (the movement ends too quickly, resulting in not enough time to complete the positioning)

0B -- Interrupted positioning at *start of movement* (the movement restarted too quickly, resulting in not enough time to complete the positioning)

0C -- Other reason

Location Failure Data:

Location Data			
Byte 3	Byte 4	Byte 5	Byte 6
C/N 0	C/N 1	C/N 2	C/N 3

C/N 0: Carrier over noise (dBm) for the strongest signal satellite seen.
C/N 1: Carrier over noise (dBm) for the 2nd strongest signal satellite seen.
C/N 2: Carrier over noise (dBm) for the 3rd strongest signal satellite seen.
C/N 3: Carrier over noise (dBm) for the 4th strongest signal satellite seen.

6.6.3 Bluetooth Location Fixed Payload

Bluetooth Location Fixed Payload of working mode will be sent in Port 8.
Bluetooth Location Fixed Payload of auxiliary operation will be sent in Port 12.

Byte 0	Byte 1	Byte 2~3	Byte 4~XX
Battery Level	Device Status	Age	Bluetooth Data

Battery Level: Convert to binary.

- ✧ Bit 7 (00 means device isn't in charging; 01 device is in charging)
- ✧ Bit 0 ~ Bit 6 (Convert to decimal, the unit is %. It is the current battery level)

Device Status: Convert to binary.

- ✧ Bit 4~7 (**Current device mode:** Convert to decimal. 1 means standby mode; 2 means timing mode; 3 means periodic mode; 4 means stationary state in motion mode; 5 means start of movement in motion mode; 6 means in movement for motion mode; 7 means end of movement in motion mode)
- ✧ Bit 0~3 (**Current auxiliary operation:** Convert to decimal. 0 means no auxiliary operation; 1 means downlink for position; 2 means Man Down status; 3 means Alert alarm; 4 means SOS alarm)

Age: Convert to decimal, the unit is S. Time difference between the time of successful GPS positioning and the time of reporting. If the age is 100s, the report timestamp is 10:30:20 am, so the timestamp of successful GPS positioning is 10:28:40 am

Bluetooth Data:

Location Data					
Byte 4~9	Byte 10	Byte 10~15	Byte 16	……………	……………
MAC address of Bluetooth device 1	RSSI of Bluetooth device 1	MAC address of Bluetooth device 2	RSSI of Bluetooth device 2	……………	……………

The number of reported Bluetooth devices can be set by the customer.
RSSI encoded rule: Convert to decimal, and minus 256, the unit is dBm.

6.6.3 Bluetooth Location Failure Payload

Bluetooth Location Failure Payload of working mode will be sent in Port 9.
Bluetooth Location Failure Payload of auxiliary operation will be sent in Port 13.

Byte 0	Byte 1	Byte 2	Byte 3~XX
Battery Level	Device Status	Reasons for positioning failure	Bluetooth Data

Battery Level: Convert to binary.

- ✧ Bit 7 (00 means device isn't in charging; **01** device is in charging)
- ✧ Bit 0 ~ Bit 6 (Convert to decimal, the unit is %. It is the current battery level)

Device Status: Convert to binary.

- ✧ Bit 4~7 (**Current device mode:** Convert to decimal. 1 means standby mode; 2 means timing mode; 3 means periodic mode; 4 means stationary state in motion mode; 5 means start of movement in motion mode; 6 means in movement for motion mode; 7 means end of movement in motion mode)
- ✧ Bit 0~3 (**Current auxiliary operation:** Convert to decimal. 0 means no auxiliary operation; 1 means downlink for position; 2 means Man Down status; 3 means Alert alarm; 4 means SOS alarm)

Reasons for positioning failure:
01 -- Hardware Error
02 -- Interrupted by *Downlink for Position*
03 -- Interrupted by *Man Down Detection*
04 -- Interrupted by *Alarm function*
05 -- Bluetooth positioning timeout (Please increase positioning time of Bluetooth fix)
06 -- Bluetooth broadcasting in progress (Please reduce the Bluetooth broadcast timeout or avoid Bluetooth positioning when Bluetooth broadcasting in process)
07 -- Interrupted positioning at *end of movement* (the movement ends too quickly, resulting in not enough time to complete the positioning)
08 -- Interrupted positioning at *start of movement* (the movement restarted too quickly, resulting in not enough time to complete the positioning)

Bluetooth Data:

Location Data					
Byte 4~9	Byte 10	Byte 10~15	Byte 16	……………	……………
MAC address of Bluetooth device 1	RSSI of Bluetooth device 1	MAC address of Bluetooth device 2	RSSI of Bluetooth device 2	……………	……………

The information of the scanned Bluetooth devices which meet filter conditions will be reported.

RSSI encoded rule: Convert to decimal, and minus 256, the unit is dBm.

7 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.

8 Revision History

Version	Description	Editor	Date
1.0	Initial version	Iris	2020-08-27
1.1	Format modification, content adjustment	Allen	2020-12-22
1.2	Suitable for firmware version V2.2.3 &HW Version V1.4	Allen	2021-01-28
3.0	Suitable for firmware version V3.0.4 &HW Version V1.4/V1.5/V1.6	Allen	2022-05-10

MOKO TECHNOLOGY LTD.

4F,Buidling2, Guanghui Technology Park,
MinQing Rd, Longhua, Shenzhen, Guangdong, China

Tel:86-755-23573370-829

Support_lora@mokotechnology.com

https://www.mokosmart.com

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