



LW009-SM PRO

User Guide

Version 1.1

MOKO TECHNOLOGY LTD.

www.mokosmart.com

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1 Product Introduction

1.1 Overview

LW009-SM PRO Wireless Surface-Mounting Vehicle Detector is a parking space status sensor that supports LoRaWAN long-distance wireless standard.

It integrates microwave radar and geomagnetic detection technology. It adopts advanced signal detection algorithm to accurately realize the functions of parking space occupancy detection and parking time statistics.

1.2 Key Feature

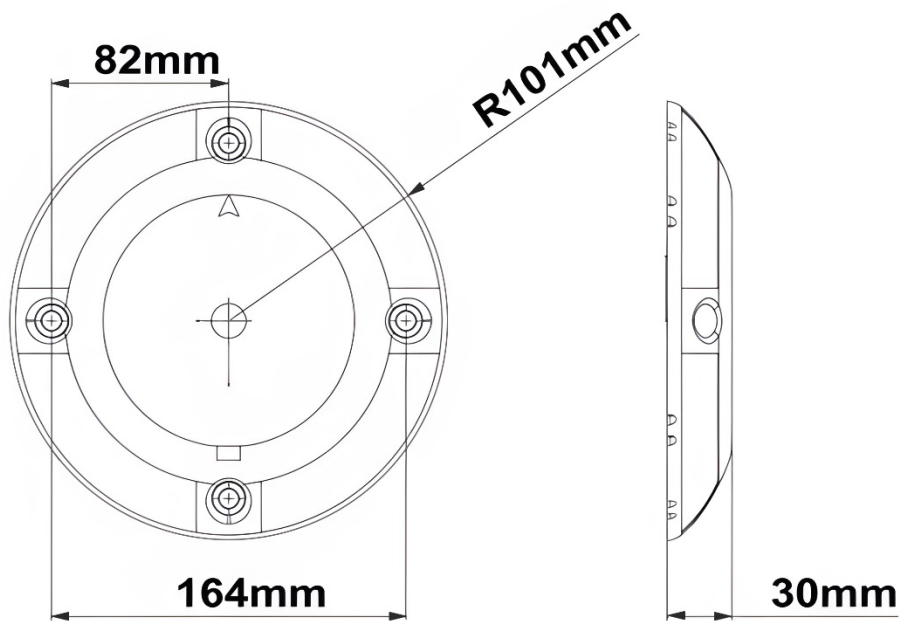
- Compact size, easy to install
- Long wireless transmission distance
- Transmission parameters can be set optional via Bluetooth
- Low power consumption, long battery life
- High detection precision, adjustable detection threshold
- Build-in intelligent procession, Automatic drift compensation, stable and reliable performance
- Build-in Temperature sensor to measure if the road is frozen
- Optional - Reflective warning stickers to increase the visibility of the sensor to avoid any inattention accident happen

2 Product specification

2.1 Appearance



2.2 Dimensions



3 Installation

3.1 Installation Preparation

1. Please try to install the device on the daytime and finish the installation as soon as possible.

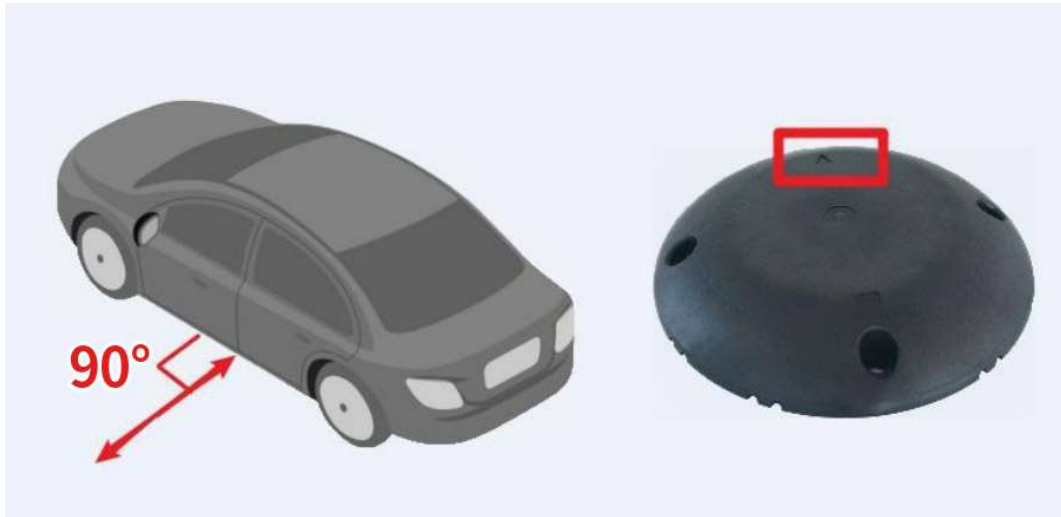
2. Please pay attention to road safety and wear reflective clothes for safety.

3. Installation Tool Preparation:

- ✧ Ruler: Measure the installation position
- ✧ Marking pen: mark the installation position
- ✧ Coring bit
- ✧ Blower: blow away the powder

4. Product installation orientation requirements

The direction of the arrow above the device should be at 90 degrees angle to the front of the vehicle, as shown in following figure, both mounting directions are recommended. Geomagnetic The detector must be installed in the required direction, otherwise there may be a possibility of false alarms.



3.2 Installation Steps

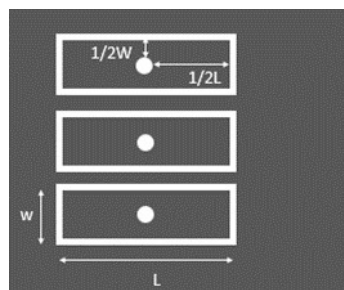
Step 1: Product Check

Take out the product and make sure appearance is not damaged. Check if the label pastes tight on the product and label information (include the DevEUI and other parameters which used to device registration) is clear.

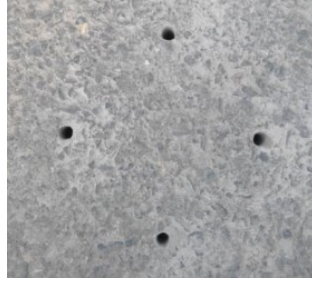


Step 2: Drill Hole

Find and mark the center of the desired detector location.



Drill four holes (Depth: around 60 mm; Diameter: around 8 mm) into the road.



Step 3: Install Expansion Bolts

Install the four expansion bolts separately to the device.



Step 4: Place the Device

Place the LW009-SM PRO face up with the 4 expansion bolts aligned with the 4 mounting holes in Figure 3. Press the 4 expansion bolts into these 4 mounting holes so that the bottom surface of the LW009-SM is tight against the road surface and there is no gap between the underside of the bolt cap and the device, then lock the bolts with an Allen screwdriver.



4 Access to the device

4.1 Power On/Off

- **Power On:** Place the magnet stripe (Put together with mounting screws in the box with the device) in the groove at the top of the device and stay for 3 seconds.



- **Power Off:** There are 2 ways to power off the device.
- ✧ 1. Power off the badge via MKLoRa APP.
 - ✧ 2. Power off the badge via LoRaWAN downlink command.

4.2 Enable Bluetooth Connect Function

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

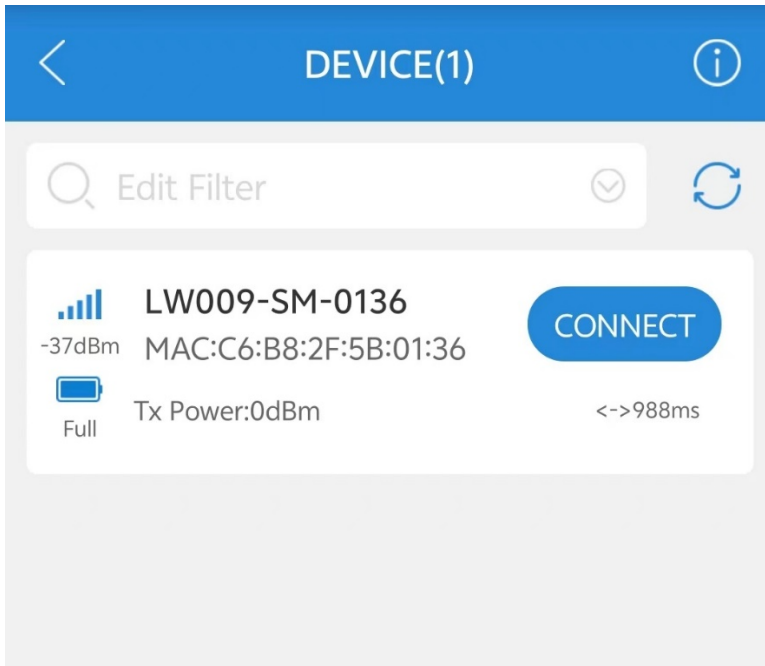
- ✧ Within the first N minutes after the device is turned back on.
- ✧ After the device is turned on, place the magnet stripe (Put together with mounting screws in the box with the device) in the groove at the top of the device and stay for 3 seconds.
- ✧ .LoRaWAN server sends LoRa command to turn on Bluetooth broadcast for N minutes.

Note: *N is the broadcast timeout duration which can be set via MKLoRa APP, 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 APP Configuration Guide

5.1 Connect to APP

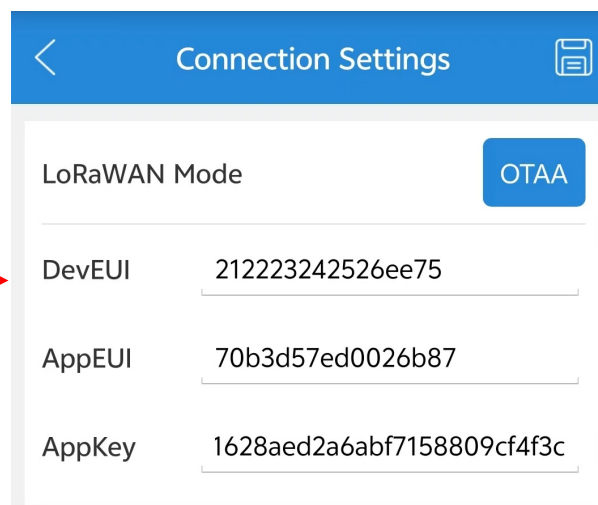
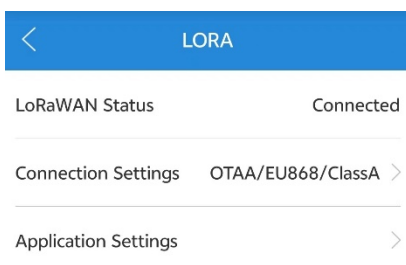
Please download “MKLoRa” APP from app store directly. Please allow Bluetooth to be enabled during the installation process. This APP communicates with the device via Bluetooth, and it only supports above android 4.4 and IOS 9.0 system.



After the device is turned on, the device Bluetooth will start broadcasting. Open the MKLoRa APP and choose LW009, then you can search the LW009-SM PRO device by click the refresh icon. The default broadcast name of the device: LW009-SM -XXXX. Then click “Connect” button, the default login password is Moko4321. The Edit Filter at the top can help user filter the keywords and RSSI. RSSI ranges from -127dBm to 0dBm;

5.2 Configure LW009-SM PRO Parameters

5.2.1 LORA Parameters



Configure/Read the LoRaWAN mode and the key parameters, such as DevEUI, AppEUI and AppKey.



5.2.2 Parking Parameters

In this page, users can set parameters for parking detection.

The screenshot shows the 'Parking' settings page. The top bar is blue with a back arrow on the left and a document icon on the right. Below the bar, the 'Detection Algorithms' section has a blue button labeled 'Joint Detection(Magnetic&Radar)'. The 'Detection Sensitivity' section has a blue button labeled '4'. The 'Parking Detection Cycle' section has a text input '5' followed by 's'. The 'Detection Confirmation Duration' section has a text input '1' followed by 's'. The 'No Parking Calibration' section has a blue button labeled 'Calibra' and a note: '*Please ensure that there is no obstruction above the device and the parking space before 'No Parking Calibration'..'. The 'Bluetooth Beacon Report Switch' section has a blue button labeled 'OFF'. The 'Independent Parking Data Report' section has a blue button labeled 'ON' and a note: '*Beacon data is a separate payload. When 'Bluetooth Beacon Report Switch' is on, did normal parking data need to be reported separately?'. The 'Bluetooth Filter Settings' section has a right arrow. The bottom navigation bar has four icons: LORA, PARKING (selected), GENERAL, and DEVICE.

Detection Algorithms:

Three detection algorithms can be set:
Magnetic sensor only, Radar only, Joint detection (magnetic& radar)

Detection Sensitivity:

The value ranges from 1-7(sensitivity from low to high). The default is 4.

Parking Detection Cycle:

The value ranges from 1-60s, the default is 5s(every 5s compare the value with threshold, if value exceeds threshold, start detection confirmation).

Detection Confirmation Duration:

The value ranges from 1-60s, the default is 1s(confirm the parking space status in 1s).

No Parking Calibration:

Click the calibration button to start calibration.

Bluetooth Beacon Report Switch:

Enable/disable Bluetooth beacon report function

Independent Parking data report:

Report parking data and beacon data separately or not.

Bluetooth Filter Settings

Positioning Timeout 5 s

Number Of MAC 1

RSSI Filter (-127dBm~0dBm)

-82dBm

*The device will uplink valid ADV data with RSSI no less than -82dBm.

Filter Relationship ADV Name&Raw Data

Filter by MAC >

Filter by ADV Name >

Filter by Raw Data >

Positioning Timeout:

Bluetooth maximum scan time.

The value ranges from 1-10s, the default is 5s

Number of MAC:

Maximum Bluetooth MAC reported

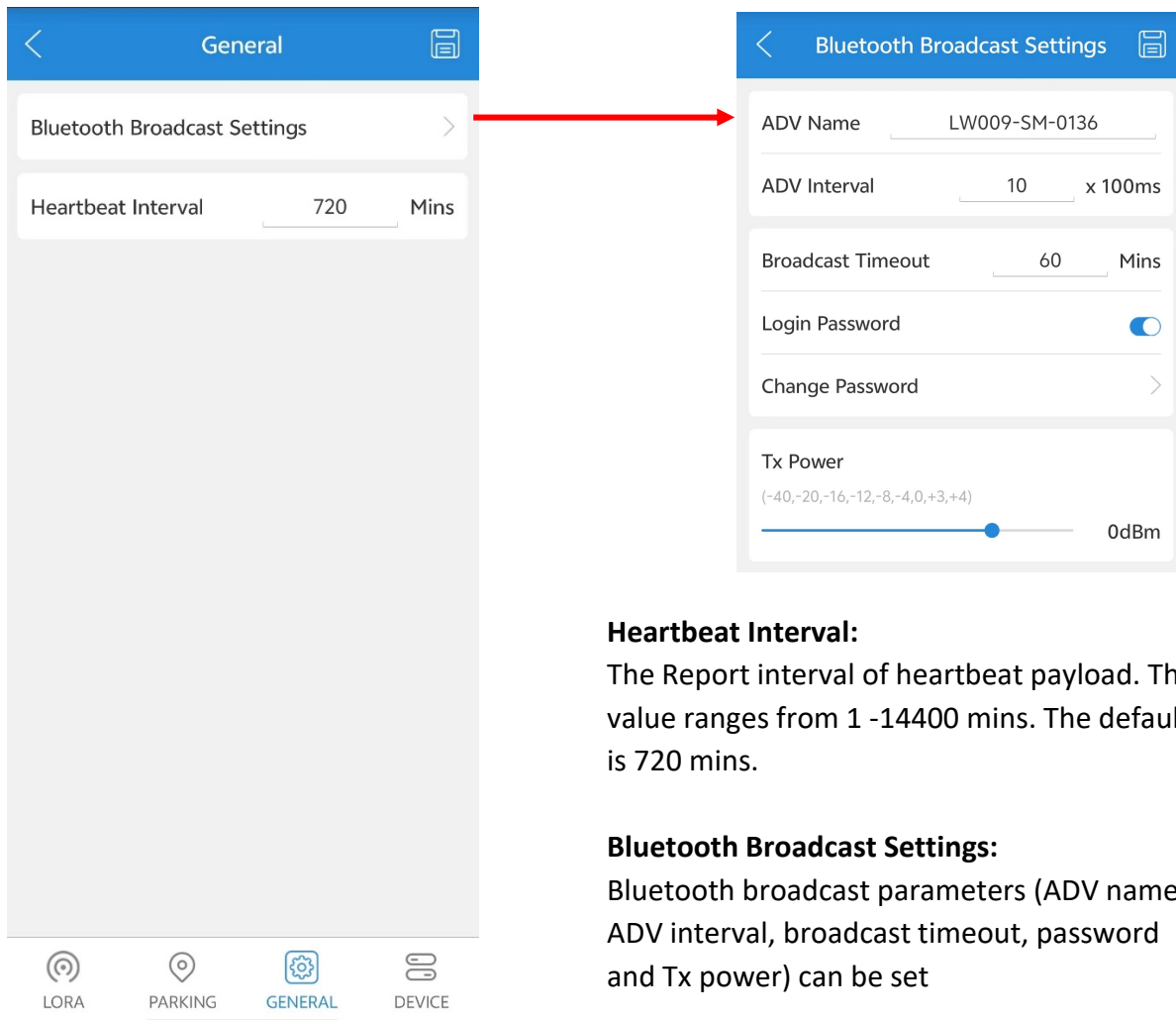
The value ranges from 1-10, the default is 1

RSSI Filter:

LW009-SM PRO will upload the beacon advertising data with RSSI no less than the setting value.

The value ranges from -127~0dBm, the default is -127dBm.

5.2.3 General Parameters

**Heartbeat Interval:**

The Report interval of heartbeat payload. The value ranges from 1 -14400 mins. The default is 720 mins.

Bluetooth Broadcast Settings:

Bluetooth broadcast parameters (ADV name, ADV interval, broadcast timeout, password and Tx power) can be set

5.2.4 Device Parameters

The screenshot shows a mobile application interface titled 'Device Information'. It contains several rows of data: 'Software Version' (nRF52-SDK17.0+1.0.7), 'Firmware Version' (V1.0.1-loraTest) with a blue 'DFU' button next to it, 'Hardware Version' (LW009-SM V1.0), 'Battery Voltage' (3.394V), 'Mac Address' (C6:B8:2F:5B:01:36), 'Product Model' (LW009-SM), and 'Manufacturer' (MOKO TECHNOLOGY LTD.). At the bottom, there is a 'Debugger Mode' section with a right-pointing arrow.

Device Firmware Upgrade (DFU):

To update the firmware via the DFU should use the upgrade package that MOKO provides with ZIP format. If you use an android phone, place the ZIP file of firmware upgrade package into the phone folder, select the upgrade package file from the OTA page of the APP, and click to upgrade.

IOS phones need to share the upgrade package file with MKLoRa via computers and iTunes tools. and then select the upgrade package file from the OTA page of the APP, and click to upgrade.

Debugger Mode:

Click start button to start debugging, around 1 minute later, click stop button to stop debugging, then share the file to moko support engineers.

Note: for more APP configuration details, pls refer to [MKLoRa APP guide](#).

6 Communication Protocol

6.1 Uplink Payload

6.1.1 Heartbeat Payload (Port 1)

Heartbeat Payload will be sent in Port (Fport) 1.

Byte Index	Content	Parse Rule
Byte 0	Battery Level,	0x 00 means Normal; 0x 01 means low power
Byte 1~2	Battery Voltage	Convert to decimal, the unit is mV
Byte 3~6	Report Timestamp	Standard UTC time
Byte 7	Timezone of report timestamp	It is a signed number, convert to decimal, then then divide by 2, and this is UTC time zone
Byte 8	Temperature	Convert to decimal. If the value > 128, then minus 256, the unit is °C
Byte 9	Parking Status	0x 00 means no vehicle; 0x 01 means occupied by vehicle

6.1.2 Parking Information Payload (Port 2)

Parking Information Payload will be sent in Port (Fport) 2.

Byte Index	Content	Parse rule
Byte 0	Battery Level	0x 00 means Normal; 0x 01 means low power
Byte 1~2	Battery Voltage	Convert to decimal, the unit is mV
Byte 3~6	Report Timestamp	Standard UTC time
Byte 7	Timezone of report timestamp	It is a signed number, convert to decimal, then then divide by 2, and this is UTC time zone
Byte 8	Temperature	Convert to decimal. If the value > 128, then minus 256, the unit is °C
Byte 9	Parking Detection mode	0x 00 means Separate Magnetic Sensor 0x 01 means Separate Radar 0x 02 means Magnetic Sensor& Separate Radar
Byte 10	Parking Status	0x 00 means no vehicle; 0x 01 means occupied by vehicle
Byte 11	Report Reason	0x 00 means heartbeat 0x 01 means Parking spaces become empty (From occupied to unoccupied) 0x 02 means Parking spaces was occupied (From unoccupied to occupied) 0x 03 means Strong magnetic disturbance 0x 04 means Low battery alert 0x 05 Magnetic sensor failed
Byte 12~13	Radar Data	/
Byte 14~19	The X/Y/Z value of magnetic sensor	/
Byte 20~23	Timestamp of parking data	Standard UTC time. Timezone is UTC+0 in default

6.1.3 Beacon Payload with Parking Data (Port 3)

Beacon Payload with parking information will be sent in Port (Fport) 3.

Byte Index	Content	Parse rule
Byte 0	Battery Level	0x 00 means Normal; 0x 01 means low power
Byte 1~2	Battery Voltage	Convert to decimal, the unit is mV
Byte 3~6	Report Timestamp	Standard UTC time
Byte 7	Timezone of report timestamp	It is a signed number, convert to decimal, then then divide by 2, and this is UTC time zone
Byte 8	Temperature	Convert to decimal. If the value > 128, then minus 256, the unit is °C
Byte 9	Parking Detection mode	0x 00 means Separate Magnetic Sensor 0x 01 means Separate Radar 0x 02 means Magnetic Sensor& Separate Radar
Byte 10	Parking Status	0x 00 means no vehicle; 0x 01 means occupied by vehicle
Byte 11	Report Reason	0x 00 means heartbeat 0x 01 means Parking spaces become empty (From occupied to unoccupied) 0x 02 means Parking spaces was occupied (From unoccupied to occupied) 0x 03 means Strong magnetic disturbance 0x 04 means Magnetic sensor failed 0x 05 means Radar failed
Byte 12~13	Radar Data	/
Byte 14~19	The X/Y/Z value of magnetic sensor	/
Byte 20~23	Timestamp of parking data	Standard UTC time. Timezone is UTC+0 in default
Byte 24	The amount of reported beacons	Convert to decimal, the unit is bytes
Byte 25~30	The MAC address of 1 st beacon	/
Byte 32	The RSSI of 1 st beacon	Convert to decimal, then minus 256, the unit is dBm
Byte 33~36	The scanned timestamp of 1 st beacon	Standard UTC time. Timezone is UTC+0 in default
Byte 37~42	The MAC address of 2 nd beacon	/
Byte 43	The RSSI of 2 nd beacon	Convert to decimal, then minus 256, the unit is dBm

Byte 44~47	The scanned timestamp of 2 nd beacon	Standard UTC time. Timezone is UTC+0 in default
.....		
.....		
.....		

6.1.4 Low-Power Payload (Port 4)

Low-Power Payload will be sent in Port (Fport) 4.

Byte Index	Content	Parse rule
Byte 0	Battery Level	0x 00 means Normal; 0x 01 means low power
Byte 1~2	Battery Voltage	Convert to decimal, the unit is mV
Byte 3~6	Report Timestamp	Standard UTC time
Byte 7	Timezone of report timestamp	It is a signed number, convert to decimal, then then divide by 2, and this is UTC time zone
Byte 8	Temperature	Convert to decimal. If the value > 128, then minus 256, the unit is °C

6.1.5 Shut-Down Payload (Port 5)

Shut-Down Payload will be sent in Port (Fport) 5.

Byte Index	Content	Parse rule
Byte 0	Battery Level	0x 00 means Normal; 0x 01 means low power
Byte 1~2	Battery Voltage	Convert to decimal, the unit is mV
Byte 3~6	Report Timestamp	Standard UTC time
Byte 7	Timezone of report timestamp	It is a signed number, convert to decimal, then then divide by 2, and this is UTC time zone
Byte 8	Temperature	Convert to decimal. If the value > 128, then minus 256, the unit is °C
Byte9	Shut Down Type	0x 00 means Bluetooth command or App; 0x 01 means LoRaWAN Command

6.1.6 Event Payload (Port 6)

Event Payload will be sent in Port (Fport) 6.

Byte Index	Content	Parse rule
Byte 0	Battery Level	0x 00 means Normal; 0x 01 means low power
Byte 1~2	Battery Voltage	Convert to decimal, the unit is mV
Byte 3~6	Report Timestamp	Standard UTC time
Byte 7	Timezone of report timestamp	It is a signed number, convert to decimal, then then divide by 2, and this is UTC time zone
Byte 8	Temperature	Convert to decimal. If the value > 128, then minus 256, the unit is °C
Byte 9	Event Type	0x 00 means Uplink Payload triggered by downlink message

6.1.7 Number of Parking Detection Payload (Port 7)

Event Payload will be sent in Port (Fport) 7.

Byte Index	Content	Parse rule
Byte 0	Battery Level	0x 00 means Normal; 0x 01 means low power
Byte 1~2	Battery Voltage	Convert to decimal, the unit is mV
Byte 3~6	Report Timestamp	Standard UTC time
Byte 7	Timezone of report timestamp	It is a signed number, convert to decimal, then then divide by 2, and this is UTC time zone
Byte 8	Temperature	Convert to decimal. If the value > 128, then minus 256, the unit is °C
Byte 9	Number of parking detection	

6.2 Downlink Command

LW009-SM PRO supports to configure the device via downlink commands. Application port is 10 by default

6.2.1 Payload Format

The content of the downlink command consists of two parts: HEAD, Flag, CMD, LEN and DATA

Byte Index	Type	Content	Description
Byte 0	HEAD	0xED	All downlink commands will begin with ED
Byte 1	FLAG	0x00, 0x01, or 0x02	Command type. 0x00: Read device parameters; 0x01: Configure device parameters; 0x02: Data Notification
Byte 2	CMD	0x01 ~ 0xFF	Message ID. Each parameter has a unique ID
Byte 3	LEN	0x00 ~ 0xF0	The length of Command Data 0x00 means the “DATA” part is empty.
Byte 4 – XX	DATA	Maximum 240 bytes	Command Data The Command Data is available only if the instruction type is 0x01. Other instruction types don't have this part.

6.2.2 Common Downlink Command

HEAD	FLAG	CMD	LEN	Description
ED	01	10	0	Turn off the device
	01	11	0	Reboot the device
	01	12	0	Factory reset the device
	00/01	1D	2	Heartbeat interval, parse rule: convert to decimal, the unit is mins
	00/01	1F	1	Bluetooth scan timeout, parse rule: Convert to decimal, the unit is second(range:1-10)
	00/01	20	1	Beacon quantity that can be reported, parse rule: Convert to decimal, the unit is second(range:1-10)
	00/01	40	1	Parking detection mode, 0: only magnetic detection 1: only radar detection 2: magnetic and radar detection
	00/01	41	1	Parking detection interval, parse rule: Convert to decimal, the unit is second(range:1-60)
	00/01	43	6	Parking detection threshold X-axis: the 1st and 2nd byte; Y-axis: the 3rd and 4th byte;

				Z-axis: the 5th and 6th byte. Parse rule: convert to decimal
	00/01	A1	2	Heartbeat payload setting, The 1st byte refers to message type: 00 means Unconfirmed; 01 means Confirmed. The 2nd byte refers to max retransmission times: Convert to decimal, the unit is times.
	00/01	A2	2	Parking Space Payload Settings The 1st byte refers to message type: 00 means Unconfirmed; 01 means Confirmed. The 2nd byte refers to max retransmission times: Convert to decimal, the unit is times.

Example:

1. Turn off the device

ED 01 10 00			
HEAD	FLAG	CMD	LEN
ED	01	10	00

2. Set heartbeat interval as 100s:

ED 01 1D 02 00 64				
HEAD	FLAG	CMD	LEN	DATA
ED	01	1D	02	0064=>100s

3. Set paring detection mode as only magnetic detection

ED 01 40 01 00				
HEAD	FLAG	CMD	LEN	DATA
ED	01	40	01	00=>only magnetic

				detection
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4. Set Parking detection threshold as: x-axis: 900, y-axis: 705, z-axis: 650

ED 01 43 06 03 84 02 C1 02 8A				
HEAD	FLAG	CMD	LEN	DATA
ED	01	43	06	0384=>x-axis:900 02C1=>y-axis:705 028A=>z-axis:650

5. Set heartbeat payload as: unconfirmed type and max 2 retransmission time

ED 01 A1 02 00 02				
HEAD	FLAG	CMD	LEN	DATA
ED	01	A1	02	00=>unconfirmed type 02=>max retransmission time:2

Note: For more downlink command, user can refer to **LW009-SM PRO Downlink Command v1.0**

7 Revision History

Version	Description	Editor	Date
1.0	Initial version	Damon	2024-07-20

1.1	Delete humidity	Damon	2025-6-30
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FCC STATEMENT

1. 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.
 - (2) This device must accept any interference received, including interference that may cause undesired operation.
2. 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.

FCC Radiation Exposure Statement

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator & your body

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