MerryIoT Motion Detection

Reference Manual

MS10-915

MS10-868

Model Name: MS10

BQW_02_0033.006

Table of Content

1. Description

The Motion Sensor utilizes LoRaWAN connectivity to communicate the presence or not of a person. The intended use is to place the sensor with a good view of a room to determine if there is motion in the room or not.

The sensor is composed of a Passive Infrared Detector and Fresnel Lens. The main body contains active electronics to measure movement and transmit any changes to a LoRaWAN network. There are also vibration and tilt detection in case of tampering.

Once the event is detected, the sensor will send an uplink.

2. Specifications

2.1 Mechanical

2.1.1 Sensor

Length x Width x Height	25mm x 70mm x 70mm
Weight	62g without battery 96g with battery
Sensor	• Dual Passive Infrared detectors • Fresnel Lens with 123° horizontal & 93° vertical view • Tamper detection • Temperature/Humidity • Maxima detection range 7M

2.2 Environmental

Temperature	0°C to +50°C
IP Rating	IP 40 equivalent

2.3 Power

Source	1.5 V AA Alkaline x 2 pcs, 2700 mAh
Max. System Voltage	3.0 V
Min. System Voltage	2.4 V
Max. Current	120 mA
Min. Current	30 µA (Sleeping mode)

2.4 Radio

Frequency	Either 863-870 MHz for the EU model and 902-928 MHz for North America
Rx Sensitivity (Conducted)	-137 dBm
Antenna Gain(LoRa)	0.41 dBi (Peak)
Antenna Gain(BLE)	2.24 dBi (Peak)

2.5 User Interface

LEDs	One blue LED
Motion	One Motion Sensor
Button	Test Button

2.6 Certifications and Conformity

FCC	2AAS9MS10
CE	Certified.
IC	29296-MS10

2.7 Additional Features

Battery Monitoring
Tamper detection
Environment temperature

3. Operation

3.1 Installation Mode

- Users need to press the button for over 5 seconds to activate the operation into installation mode. When the Sensor tries to join the network, it will keep blinking for 3 seconds.
- Once the sensor joins the network, the LED will keep on for 3 seconds and send an uplink.
- Users can press the button for over 5 seconds to try to join the network again.
- The device will send uplink three times with the FW version when the device joined successfully.

3.2 Default Operation

- While in default operation the device will immediately send a message any time a control signal is transmitted.
  - Free to Occupied
  - Tamper detected
  - Button pressed
  - Keepalive message
- Users can press the button to send a test message to the network.
- The device will send a status message every 10 minutes while in the occupied state and every 1 hour while in the vacant state.
- While in default mode the device will flash the LED 3 times within 100ms only when the user presses the test button.

4. Messages

LoRaWAN Packets for this device use port 122.

4.1 Status

4.1.1 Triggers

Motion Sensor Triggers:

(1) While in free mode, send a message every 60 minutes;

(2) When the status changes from free mode to occupied mode, send a message immediately;

(3) While the occupied state continues, send a message every 10 minutes;

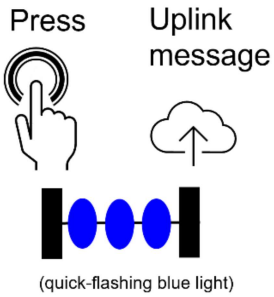
(4) When the device isn't triggered by the occupied state again within 5 minutes from the last message, the status changes from occupied to free mode and sends a message.

Tamper Trigger:

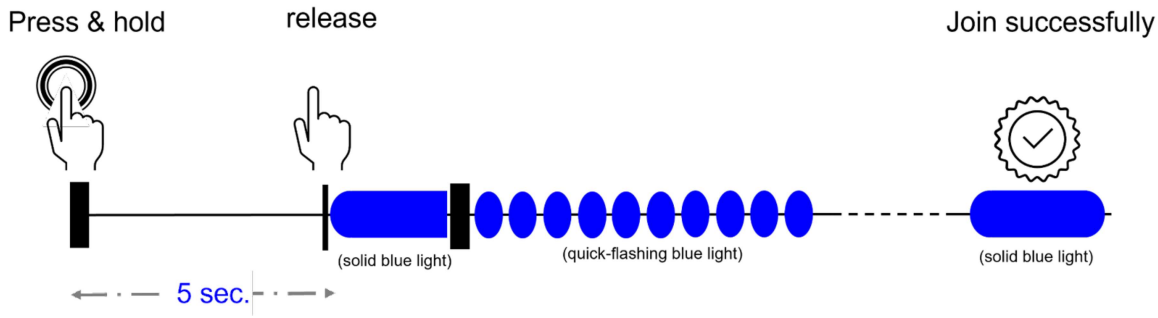
Immediately send a message

Button Pressed Trigger:

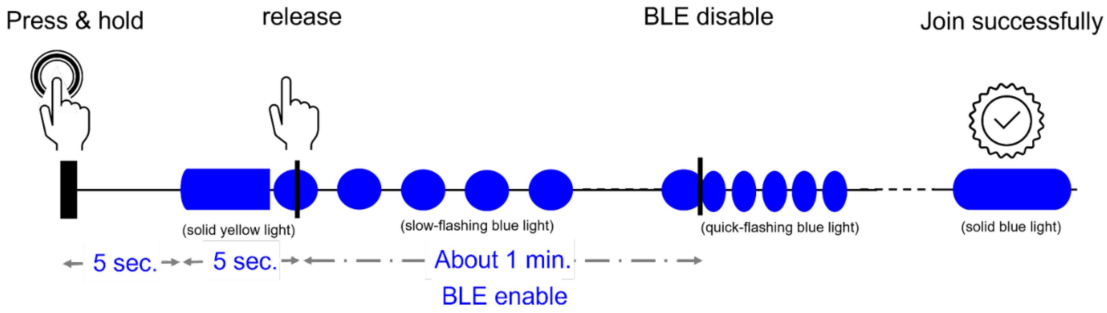
- A single press-send uplink message



- **Long press more than 5s-Rejoin trigger:**



- **Long press more than 10s-BLE DFU Mode:**



Press and hold the button for over 10 seconds until the BLUE LED starts blinking. when the BLUE LED starts blinking (like a breathing light), the DFU mode is enabled. Users can upgrade the device FW via BLE.

4.1.2 Payload

Port	122
Payload Length	10 bytes

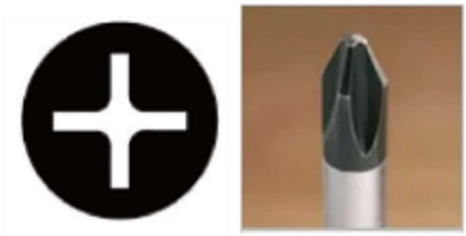
Bytes	0	1	2	3	4	5	6	7	8	9
Field	Status	Battery	Temp		RH	Time		Count		

Status	**Sensor's status** Bit [0] 1 – occupied, 0 – free Bit [1] 1 – Button pressed, 0 - Button released Bit [2] 1 – Tamper detected, 0 - No tamper detected Bits [7:3] RFU
Battery	**Battery level** Bits [3:0] unsigned value v, range 0 – 15; battery voltage in V = (21 + v) ÷ 10. Bits [7:4] RFU
Temp	**Environment Temperature** Bits [15:0] Signed value x, little-endian format. Temperature measurement range : -40.0 ~ 125.0 °C Ex. Positive number: EF01 => 01EF = 495, Temp = 495 ÷ 10 = 49.5 °C Negative number: F0FF => FFF0 = 65520 +(-65535) -1 =-16 Temp = -16 ÷ 10 = -1.6 °C
RH	**Relative humidity as measured by a digital sensor** Bits [6:0] unsigned value in %, range 0-100. Bit [7] RFU
Time	**Time elapsed since the last event-triggered** Bits [15:0] unsigned value in minutes, range 0 – 65,535. *Note little-endian format.
Count	**Total count of event-triggered** Bits [23:0] unsigned value, range 0 – 16,777,215. *Note: little-endian format. Note: This value is not stored persistently on the device and may reset whenever the device is power-cycled or rebooted.

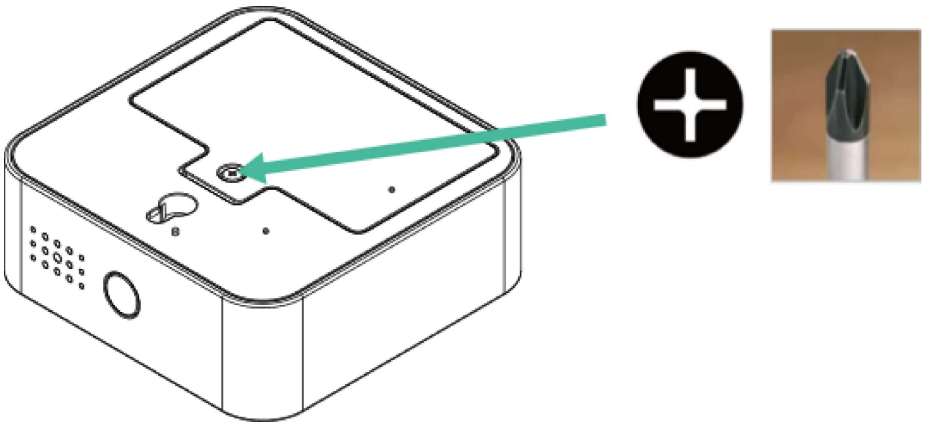
5. Battery

5.1 Replacement

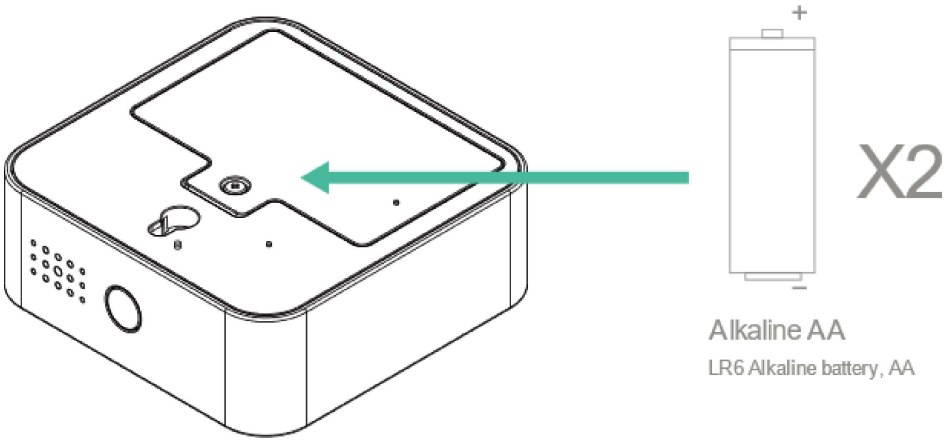
1 **Tools: Cross-type screwdriver x 1(PH0)**



2 **Remove the battery cover of the sensor with a cross-type screwdriver (PH0 size).**



3 **Replace the battery with new ones (Alkaline Battery, "LR6", AA size x 2 pcs).**
*Caution: Using batteries other than the ones provided may result in loss of performance and battery life, and also damage to the device. Dispose of properly, observing environmental protection rules. Mixing of cells can result in battery leakage and sub-optimal device performance.



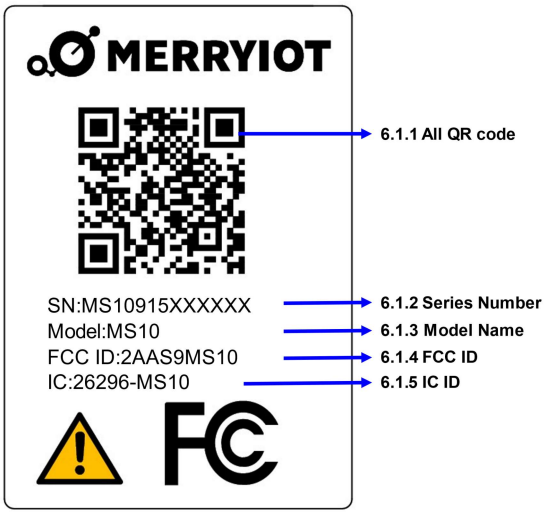
4 **Re-assemble the battery cover.**

5.2 Cautions

CAUTION: Disposal of a battery (or battery pack) into a fire or a hot oven, or mechanically crushing or cutting of a battery (or battery pack) can result in an EXPLOSION!
Leaving a battery (or battery pack) in an extremely high temperature surrounding environment can result in an EXPLOSION or leakage of flammable liquid or gas.
A battery (or battery pack) subjected to extremely low air pressure may also result in an EXPLOSION or leakage of flammable liquid or gas.
Discard used batteries according to the manufacturer's instructions.
CAUTION: The unit is provided with a battery-powered circuit.
There is a danger of explosion if the battery is incorrectly replaced.
Replace only with the same or equivalent type recommended by the manufacturer.
Discard used batteries according to the manufacturer’s instructions.
Risk of Explosion if Battery is replaced by an Incorrect Type. Dispose of Used Batteries according to the Instructions.

6. Label format information

6.1 Device back label



6.1.1 All QR code

URN:LW:D0: 0016160000000001:0016160000XXXXXX:01632002
The total maximum resulting character sentence is 48 alphanumeric characters long.

6.1.1.1 JoinEUI

900MHz: 0016160000000001. (US)
800MHz: 0016160000000002. (EU)
Uses a hexadecimal representation resulting in 16 characters.

6.1.1.2 DevEUI

0016160000XXXXXX.
Uses a hexadecimal representation resulting in 16 characters

6.1.1.3 ProfileID

The profile identifier encodes a Vendor Identifier and a Vendor Profile Identifier as a hexadecimal representation resulting in 8 characters.

6.1.1.3.1 VendorID

0163
VendorID is assigned by the LoRa Alliance.

6.1.1.3.2 VendorProfileID

900MHz: 2002 (US)
800MHz: 3002 (EU)

6.1.2 Serial Number

SN: MS10915XXXXXX
Not included in the QR code.

6.1.3 Model Name

MODEL: MS10.

Fixed code, not including in QR code.

6.1.4 FCC ID

2AAS9MS10

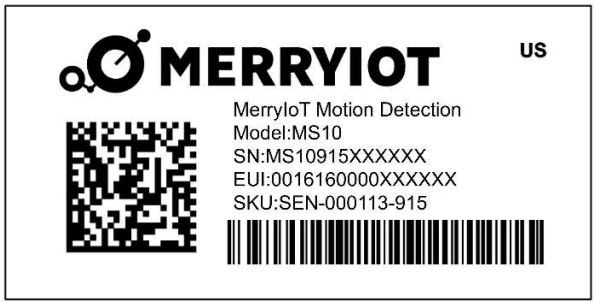
6.1.5 IC ID

26296-MS10

6.1.6 Caution!

For more information, please refer to chapter 5.2. and 10.

6.2 Packaging label



GS1 Data Matrix

- The GS1 Application Identifier (21) indicates that the GS1 Application Identifier data field contains a serial number.
- The GS1 Application Identifier (92) assigned to the company's internal information is DevEUI.

7. Important Product & Safety Instructions

For the most current and more detailed information about Browan features and settings and safety instructions, please download the user manual for the products online at www.browan.com before using any Browan products or services.

Certain sensors contain magnets. **Keep away from ALL Children!** Do not put it in your nose or mouth. Swallowed magnets can stick to intestines causing serious injury or death. Seek immediate medical attention if magnets are swallowed.

These products are not toys and contain small parts that can be dangerous to children under 3 years old. Do not allow children or pets to play with products.

Observe proper precautions when handling batteries. Batteries may leak or explode if improperly handled.

Observe the following precautions to avoid a sensor explosion or fire:

- Do not drop, disassemble, open, crush, bend, deform, puncture, shred, microwave, incinerate, or paint the sensors, Hub, or other hardware.
- Do not insert foreign objects into any opening on the sensors or Hub, such as the USB port.
- Do not use the hardware if it has been damaged—for example, if cracked, punctured, or harmed by water.
- Disassembling or puncturing the battery (whether integrated or removable) can cause an explosion or fire.
- Do not dry the sensors or battery with an external heat source such as a microwave oven or hairdryer.

8. Warnings

- Do not place naked flame sources, such as lighted candles, on or near the equipment.
- The battery shall not be exposed to excessive heat such as sunshine, fire, or the like.
- Do not dismantle, open or shred battery packs or cells.
- Do not expose batteries to heat or fire. Avoid storage in direct sunlight.
- Do not short-circuit the battery. Do not store batteries in a box or drawer where they may short-circuit each other or be short-circuited by other metal objects.
- Do not remove a battery from its original packaging until required for use.
- Do not subject batteries to mechanical shock.
- In the event of a battery leaking, do not allow the liquid to come in contact with the skin or eyes. If contact has been made, wash the affected area with copious amounts of water, and seek medical advice.
- Do not use any charger other than that specifically provided for use with the equipment.
- Observe the plus (+) and minus (-) marks on the battery and equipment and ensure correct use.
- Do not use any which is not designed for use with the product.
- Do not mix cells of different manufacture, capacity, size, or type within a device.
- Keep batteries out of the reach of children.
- Seek medical advice immediately if a battery has been swallowed.
- Always purchase the correct battery for the equipment.
- Keep batteries clean and dry.
- Wipe the battery terminals with a clean dry cloth if they become dirty.

9. Notices

- Avoid exposing your sensors or batteries to very cold or very hot temperatures. Low or high-temperature conditions may temporarily shorten the battery life or cause the sensors to temporarily stop working.
- Take care in setting up the Hub Gateway and other hardware. Follow all installation instructions in the User Guide. Failure to do so may result in injury.
- Do not install hardware equipment while standing in water or with wet hands. Failure to do so can result in electric shock or death. Use caution when setting up all electronic equipment.
- When charging the sensors, do not handle the sensors with wet hands. Failure to observe this precaution could result in electric shock.
- PROP 65 WARNING: This product contains chemicals known to the State of California to cause cancer and birth defects or other reproductive harm
- Cleaning Browan Products: Use a clean dry cloth or wipe to clean Browan products. Do not use detergent or abrasive materials to clean the Browan products, as this may damage the sensors.

10. Cautions

CAUTION: Disposal of a battery (or battery pack) into a fire or a hot oven, or mechanically crushing or cutting of a battery (or battery pack) can result in an **EXPLOSION!**

Leaving a battery (or battery pack) in an extremely high temperature surrounding environment can result in an **EXPLOSION** or leakage of flammable liquid or gas.

A battery (or battery pack) subjected to extremely low air pressure may also result in an **EXPLOSION** or leakage of flammable liquid or gas.

Discard used batteries according to the manufacturer's instructions.

CAUTION: The unit is provided with a battery-powered circuit.

There is a danger of **EXPLOSION** if the battery is incorrectly replaced.

Replace only with the same or equivalent type recommended by the manufacturer. Discard used batteries according to the manufacturer’s instructions.

Risk of **EXPLOSION** if Battery is replaced by an Incorrect Type. Dispose of Used Batteries According to the Instructions.

11. Regulatory

Hereby, Browan Communications Inc. declares that the radio equipment for Browan products complies with Directive 2014/53/EU.

This device complies with Part 15 of the FCC Rules and RSS Standards of Industry Canada.

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.

This symbol means that according to local laws and regulations your product should be disposed of separately from household waste. When this product reaches its end of life, take it to a collection point designated by local authorities. Some collection points accept products for free. The separate collection and recycling of your product at the time of disposal will help conserve natural resources and ensure that it is recycled in a manner that protects human health and the environment.

11.1 Federal Communication Commission Interference Statement

This equipment has been tested and found to comply with the limits for a Class B digital device, under 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 following 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 of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and the receiver.
- Connect the equipment to 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 Caution: Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

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.

IMPORTANT NOTE:

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 a minimum distance of 20cm between the radiator & your body.

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Country Code selection feature to be disabled for products marketed to the US/CANADA

Operation of this device is restricted to indoor use only.

11.2 Industry Canada statement:

This device contains license-exempt transmitter(s)/receiver(s) that comply with Innovation, Science, and Economic Development Canada's license-exempt RSS(s). Operation is subject to the following two conditions :

(1) This device may not cause interference

(2) This device must accept any interference, including interference that may cause undesired operation of the device

Cet appareil contient des émetteurs / récepteurs exempts de licence qui sont conformes au (x) RSS (s) exemptés de licence d'Innovation, Sciences et Développement économique Canada. L'opération est soumise aux deux conditions suivantes :

(1) Cet appareil ne doit pas causer d'interférences

(2) Cet appareil doit accepter toute interférence, y compris les interférences pouvant provoquer un fonctionnement indésirable de l'appareil

Radiation Exposure Statement:
This equipment complies with Canada's radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with a minimum distance of 20cm between the radiator & your body.

Déclaration d'exposition aux radiations:
Cet équipement est conforme Canada limites d'exposition aux radiations dans un environnement non contrôlé. Cet équipement doit être installé et utilisé à distance minimum de 20cm entre le radiateur et votre corps.

12. Configuration Downlink Command

Note: Only for PIR Parameters Settings

Port	102
Payload Length	5 bytes

*Note: Configuration Down-link Command should consider the duty cycle.

12.1 Payload

Bytes	0	1	2	3	4
Field	Cmd	Config			

Cmd	**Command**	
	Bit [7:0]	0x01 – Set configuration, other values – RFU
Config	**PIR Sensor Configuration**	
	Bits [4:0]	RFU
	Bit [5]	0 – use band-pass filter, 1 – use low-pass filter. Default: 0 (use BPF)
	Bits [8:6]	RFU
	Bits [10:9]	unsigned value ω, range 0-3; window time in sec = (ω + 1) × 4. Default: 0 (4 sec)
	Bits [12:11]	unsigned value ρ, range 0-3; pulse counter threshold = ρ + 1. Default: 0 (1 pulse)
	Bits [16:13]	unsigned value β, range 0 – 15; blind time in sec = (β + 1) × 0.5. Default: 15 (8 sec)
	Bits [24:17]	detection threshold, range 0 – 255. Default: 16
	Bits [31:25]	RFU
Payload Content	**Command content**	
	Ex: **01000e02100** **01 00e02100** => PIR parameter: 0x0021e000 Example: =>Room Occupied: 0100e02100 => Desk Occupied:(<=60cm) 0100148101	

12.2 For Sensor Settings

12.2.1 Payload

Port	204

Bytes	0	1~4
Field	Cmd	Config

Cmd	**Command**	1 byte
	Bit [7:0]	0x00 – Set keepalive interval in sec. default value: 3600 sec value range: 15~65535 0x02 – Set occupied interval in sec. default value: 600 sec value range: 0~65535 0x03 – Set free detection time in min. default value: 5 min value range: 0~255 0x04 - Set trigger count in the occupied status. default value: 0 value range: 0~65535 0x05 - Set PIR parameters. default value: please see 12.1 0x06 – Set tamper detection on/off default: enable

Config	**Configuration (**0~4 bytes) See the table as follows:

Cmd	Command Description	Config Length
0x00	Get Sensor Configuration **(Only for unconfirmed downlinks)** *Note: little-endian format.	0 bytes
0x00	Set keepalive interval in sec *Note: little-endian format.	2 bytes
0x02	Occupied interval in sec *Note: little-endian format.	2 bytes
0x03	Free detection time in min	1 byte
0x04	Trigger Count in the occupied status *Note: little-endian format.	2 bytes
0x05	PIR Parameters (see 5.1) *Note: little-endian format.	4 bytes
0x06	Bit[0] = 1: Enable tamper detection, 0: Disable tamper detection Bit[7:1] = RFU	1 byte

12.2.2 Command Description

Payload Content	Command content
	Ex: **00100e || 025802 || 0305 || 040000 || 0500e02100 || 0600** 00 100e => Reporting interval: 0x0e10 -> 3600 sec 02 5802 => Occupied override: 0x0258 -> 600 sec 03 05 => Free detection time: 0x05 -> 5 min 04 0000 => Trigger Count in the occupied status 05 00e02100 => PIR parameter: 0x0021e000 06 00 => Disable tamper detection Example: =>Room Occupied: 0500e02100 => Desk Occupied: 0500148101

12.3 Response Content

(Only for unconfirmed downlinks)

Port	204
Payload Length	18 bytes

Payload Content	**Response content**
	Ex: **00100e 025802 0305 040000 0500e02100 0600** 00 100e => Reporting interval: 0x0e10 -> 3600 sec 02 5802 => Occupied override: 0x0258 -> 600 sec 03 05 => Free detection time: 0x05 -> 5 min 04 0000 => Trigger Count in the occupied status 05 00e02100 => PIR parameter: 0x0021e000 06 00 => Disable tamper detection

12.4 Frame Count 1 Content

Payload Length	9 bytes
Payload Content	Frame count 1 content Ex: **01 02200000 7ff1f102** **01** => Command ID **02200000** => HW ID: 0x00002002 (little-endian format) **7ff1f102** => FW Version: 0x02f1f17f (little-endian format)

13. BLE FOTA Downlink Command

Port	206
Payload Length	3 bytes

13.1 Payload

Bytes	0~2
Payload	0x444655

14. Reboot Downlink Command

Port	206
Payload Length	6 bytes

14.1 Payload

Bytes	0~5
Payload	0x5245424f4f54