Motion Sensor (PIR)

Reference Manual

TBMS100-915
TBMS100-868

Model Name: TBMS100

Table of Contents

1. Description 1
2. Specifications 2
2.1 Mechanical 2
2.1.1 Sensor 2
2.2 Environmental 2
2.3 Radio 2
2.4 Certifications and Conformity 3
2.5 Power 2
2.6 User Interface 2
2.7 Additional Features 3
3. Operation 4
3.1 Transport Mode 4
3.2 Default Operation 4
4. Messages 5
4.1 Status 5
4.1.1 Triggers 5
4.1.2 Payload 5
4.1.2 Payload (continue) 6
5. Battery 7
5.1 Replacement 7
5.2 Cautions 7
6. Label format information 8
6.1 Round label 8
6.1.1 All QR code 8
6.1.2 JoinEUI 8
6.1.3 DevEUI 8
6.1.4 Model number 8
6.1.5 Factory check code 9
6.1.6 Model Name 9
6.2 PE Bag & Back Label Label Barcode 9
7. Important Product & Safety Instructions 10
8. Warnings 11
9. Notices 12
10. Cautions 12
11. Regulatory 13
11.1 Federal Communication Commission Interference Statement 13
11.2 Industry Canada statement: 14
Appendix. Configuration Downlink Command 15
Appx. 1 Payload 15
Appx. 2 Configuration Command 16
Appx. 2.1 Payload 16
Appx. 2.1 Payload (continue) 17
Appx. 2.2 Command Description 18
Appx. 3 Response Content 18
Appx. 4 Frame Count 0 Content 19

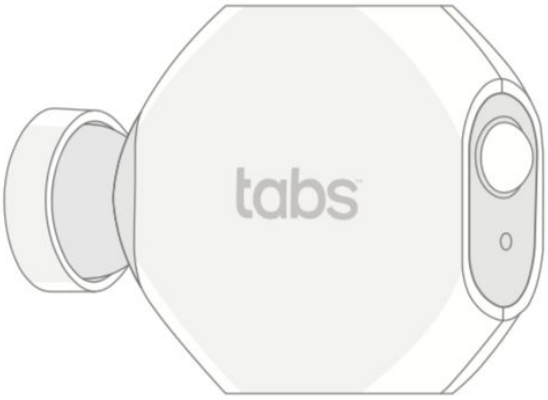
1. Description

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 the active electronics to measure movement and transmit any changes to a LoRaWAN network.

2. Specifications

2.1 Mechanical



2.1.1 Sensor

Length x Width x Height	50mm x 20mm x 50mm without wall mount
Weight	30g without battery 40g with battery
Sensor	• Dual Passive Infrared detectors • Fresnel Lens with 123° horizontal & 93° vertical view

2.2 Environmental

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

2.3 Radio

Frequency	• 863–870MHz for EU • 902–928MHz for North America
Tx Power	US: +19dBm EU: +17dBm
Rx Sensitivity	-135dBm
Antenna Gain	-2dBi Peak, -5dBi Avg

2.4 Certifications and Conformity

FCC ID: 2AMUGTBSP100
IC: 22980-TBSP100
CE
ROHS REACH

2.5 Power

Source	3.6V 1⁄2 AA Li-SOCl2 1200mAh battery
Maximum Voltage	3.6V
Minimum Voltage	3.1V
Current	135mA maximum/ 100uA minimum

2.6 User Interface

LEDs	One blue LED

2.7 Additional Features

PCB Temperature
Battery Monitoring

3. Operation

3.1 Transport Mode

Sensors are shipped with a plastic battery insulating pull tab that must be removed before the operation.

3.2 Default Operation

While in default operation, the device will immediately send a status change message once there is a transition from vacant to occupied state or vice-versa. Additionally, the device will send a status message every 10 minutes while in the occupied state and every 1 hour while in the vacant state.

4. Messages

LoRaWAN Packets for this device use port 102.

4.1 Status

4.1.1 Triggers

Packet Triggers:

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

(2) When the status changes from the 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 didn't trigger by the occupied state again within 5 minutes from the last message, status changes from occupied to free mode and send a message.

4.1.2 Payload

Port	102
Payload Length	8 bytes

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

4.1.2 Payload (continue)

Status	**Sensors status**	
	Bit [0]	1 – occupied, 0 – free
	Bits [7:1]	RFU
Battery	**Battery level**	
	Bits [3:0]	unsigned value v, range 1 – 14; battery voltage in V = (25 + v) ÷ 10. *Note: The initial operation will be in low voltage state, after 10 minutes, it will turn into a steady-state, which is referenceable.
	Bits [7:4]	RFU
Temp	**Temperature as measured by on-board NTC**	
	Bits [6:0]	unsigned value τ, range 0 – 127; temperature in °C = τ - 32.
	Bit [7]	RFU measurement range -32 to 95°C
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

Use ER14250 or equivalent.
Remove the upper cap and replace the battery.

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 that 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.

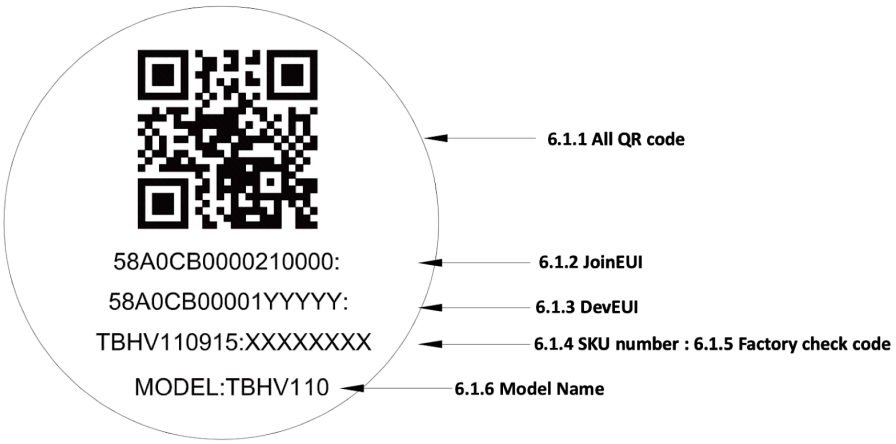
There is a danger of explosion if the battery is incorrectly replaced.

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 Round label



6.1.1 All QR code

URN:LWDP:58A0CB0000210000:58A0CBFFFFFEFFFF:TBMS100915:4D4483B1.

The total maximum resulting character sentence is 72 alphanumeric characters long.

6.1.2 JoinEUI

900MHz: 58A0CB0000210000. (US/AU/AS923/BR)

800MHz: 58A0CB0001500000. (EU/IN/RU)

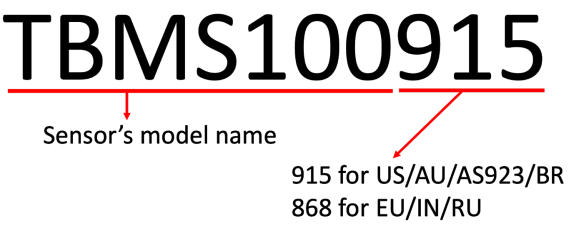
Uses a hexadecimal representation resulting in 16 characters.

6.1.3 DevEUI

58A0CBFFFFFEFFFF.

Uses a hexadecimal representation resulting in 16 characters

6.1.4 Model number



Non-reserved characters(except ":" and space) with a maximum length of 20 characters.

6.1.5 Factory check code

4D4483B1.

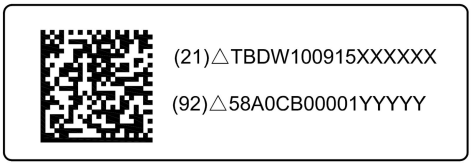
Checksum of the factory production line.

6.1.6 Model Name

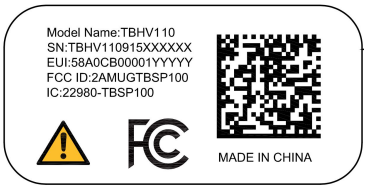
MODEL:TBMS100.

Fixed code, not including in QR code.

6.2 PE Bag & Back Label Label Barcode



PE Bag Label



Back Label

Definition of Back Label and PE Bag Barcode Label:

GS1 DataMatrix

- 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.

: Caution! For more information please refer to chapter 5.2 and chapter 10.

7. Important Product & Safety Instructions

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

Certain sensors contain magnets. **Keep away from ALL Children!** Do not put in 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 pack 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 Tabs Products: Use a clean dry cloth or wipe to clean Tabs products. Do not use detergent or abrasive materials to clean the Tabs 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 that 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

CE FC	Hereby, Browan Communications Inc. declares that the radio equipment for Tabs products is in compliance 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, 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 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 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:

The product complies with the US portable RF exposure limit set forth for an uncontrolled environment and is safe for intended operation as described in this manual. The further RF exposure reduction can be achieved if the product can be kept as far as possible from the user body or set the device to lower output power if such a function is available.

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

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

The product complies with the Canada portable RF exposure limit set forth for an uncontrolled environment and are safe for intended operation as described in this manual. The further RF exposure reduction can be achieved if the product can be kept as far as possible from the user body or set the device to lower output power if such a function is available.

This equipment should be installed and operated with minimum distance 0cm between the radiator & your body.

Déclaration d'exposition aux radiations :

Le produit est conforme aux limites d'exposition pour les appareils portables RF pour les Etats-Unis et le Canada établies pour un environnement non contrôlé. Le produit est sûr pour un fonctionnement tel que décrit dans ce manuel. La réduction aux expositions RF peut être augmentée si l'appareil peut être conservé aussi loin que possible du corps de l'utilisateur ou que le dispositif est réglé sur la puissance de sortie la plus faible si une telle fonction est disponible.

Cet équipement doit être installé et utilisé avec un minimum de 0 cm de distance entre le radiateur et votre corps.

Appendix. Configuration Downlink Command

(Only For PIR Parameters Settings)

Port	102
Payload Length	5 bytes

*Note: Configuration Down-link Command should take duty cycle into consideration.

Appx. 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

Appx. 2 Configuration Command

(For Sensor Settings)

Port	204

Appx. 2.1 Payload

Bytes	0	1~4
Field	Cmd	Config

Appx. 2.1 Payload (continue)

Cmd	**Command**	1 byte
	Bit [7:0]	0x00 – Set reporting interval in sec.(per unit:5min) 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 4.2.1.

Config

Configuration (0~4 bytes)

See the table as follows:

Cmd	Command Description	Config Length
0x00	Get Sensor Configuration **(Only for unconfirmed downlink)**	0 bytes
0x00	reporting interval in sec *Note: little-endian format. **(Must be lesser than "keep-alive time")**	2 bytes
0x02	Occupied interval in sec *Note: little-endian format. **(Must be lesser than "keep-alive time")**	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 4.2.1) *Note: little-endian format.	4 bytes

Appx. 2.2 Command Description

Payload Content	Command content Ex: 00100e || **025802 || 0305 || 040000 || 0500148101** 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 00148101 => PIR parameter : 0x01811400 **Example:** **=> Desk Occupied:** **0500148101** **=> Room Occupied:** **0500e02100**

Appx. 3 Response Content

(Only for unconfirmed downlink)

Port	204
Payload Length	16 bytes

Payload Content	Response content
	Ex: 00100e**025802030504000005001481 01** 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 00148101 => PIR parameter : 0x01811400

Appx. 4 Frame Count 0 Content

Payload Length	17 bytes
Payload Content	Frame count 0 content Ex: **01** **01** => command ID **06000000** => bootloader version : 0x00000006 (little-endian format) **00060000** => HW ID : 0x00000600 (little-endian format) **7ff1f102** => FW CRC : 0x02f1f17f (little-endian format) **e2d4f6ee** => PubKey ID : 0xeef6d4e2 (little-endian format)