# Motion Sensor

Reference Manual

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1. Description

The Tabs 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 mmovement and transmit any changes to a LoRaWAN network.

2. Specifications

2.1 Mechanical
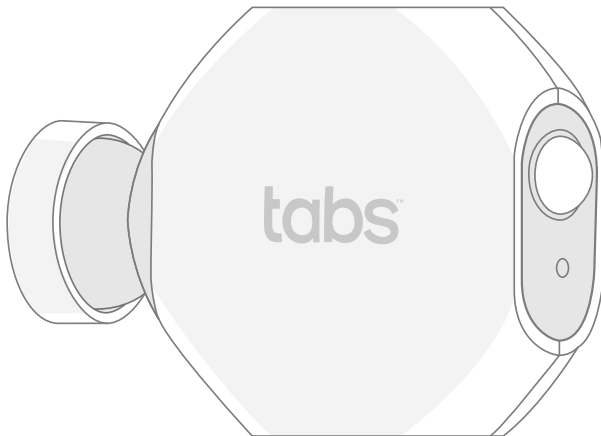
2.1.1 Sensor

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 and Fresnel Lens with 123° horizontal and 93° vertical view

2.2 Environmental

Temperature	-20°C to +50°C
IP Rating	IP 50 equivalent

2.3 Radio

Frequency	Either 863–870MHz for Eu models and 902–928MHz for North America
Tx Power	+19dBm conducted
Rx Sensitivity (Conducted)	-140dBm
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 ½ AA Li-SOCl2 1200mAh battery
Maximum Voltage	3.6V
Minimum Voltage	3.1V
Current	135mA maximum/5uA minimum

2.6 User Interface

LEDs	One blue LED

2.7 Additional Features

PCB Temperature
Battery Monitoring

3. Operation

3.1 Power On Reset

Anytime the device power drops below 2.8V the device will enter a Power
On Reset (POR) when greater than 2.8V is restored. Immediately after the
POR the device will attempt to enter installation mode. After a 30 second
duration the device will move to default operation.

3.2 Transport Mode

They are shipped with a plastic battery isolation tab that must be removed
to enable operation.

3.3 Installation Mode

The device shall enter installation mode after being commanded by the
network and remain in installation mode until commanded by the network.
While in installation mode the device will turn on the LED whenever motion
is detected.

3.4 Default Operation

While in default operation the device will immediately send a message
any time there is a transition from vacant to occupied state or vice-versa.
Additionally, the device will send a 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 Common Fields

Status[7:0]

{Fault3, Fault2, LED1, LED0, Fault1, Fault0, BTN1, BTN0}
- Nominally Fault0 indicates no network time available
- Nominally Fault1 indicates loss of primary sensor function
- Nominally Fault2 indicates loss of secondary sensor function
- Nominally Fault3 indicates loss of network connectivity

Battery[7:0]

LoRaWAN Decode
- 0 => Device is charging or line powered
- 1 to 254 => device level, 1 = minimum and 254 = fully charged
    - Futher encode
        - [7:4] = predicted battery life percentage, 15 = New, 0 = Replace
        - [3:0] = BatteryVoltage — 2.5V, in 0.1V steps, So 3.1V = 6
- 255 => Device could not measure battery — possible Fault

Temperature[6:0]

Unsigned Integer (0 to 127) Temperature = value - 32, measurement range -32 to 95°C

4.1.2 Triggers

Packet Triggers: 60 minute inactivity, Occupancy Detection, Every 10 minute during occupancy, ~~20 minute of vacancy~~
5 minute of vacancy

4.1.3 Payload

Port	102
Payload Length	8 bytes

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

Status	**Sensor status**	
	Bit [0]	1 – occupied, 0 – free
	Bits [7:1]	RFU
Battery	**Battery level**	
	Bits [3:0]	unsigned value ν, range 1 – 14;
		battery voltage in V = $(25 + \nu) \div 10$.
	Bits [7:4]	unsigned value κ, range 0 – 15; remaining battery capacity in % = $100 \times (\kappa \div 15)$.
Temp	**Temperature as measured by on-board NTC**	
	Bits [6:0]	unsigned value τ, range 0 – 127;
		temperature in °C = $\tau - 32$.
	Bit [7]	RFU
Time	**Time elapsed since last event trigger**	
	Bits [15:0]	unsigned value in minutes, range 0 – 65,535.
Count	**Total count of event triggers**	
	Bits [23:0]	unsigned value, range 0 – 16,777,215.
	Note: This value is not stored persistently on the device, and may reset whenever the device is power-cycled or rebooted.	

4.2 Configuration Down-link Command

Port	102
Payload Length	5 bytes

4.2.1 Payload

Byte	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 = $(\omega + 1) \times 4$. Default: 0 (4 sec)
	Bits [12:11]	unsigned value ρ, range 0-3; pulse counter threshold = $\rho + 1$. Default: 0 (1 pulse)
	Bits [16:13]	unsigned value β, range 0 – 15; blind time in sec = $(\beta + 1) \times 0.5$. Default: 15 (8 sec)
	Bits [24:17]	detection threshold, range 0 – 255. Default: 16
	Bits [31:25]	RFU