



**BROWAN**



# Object Locator

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Reference Manual

TBOL100-915  
TBOL100-868

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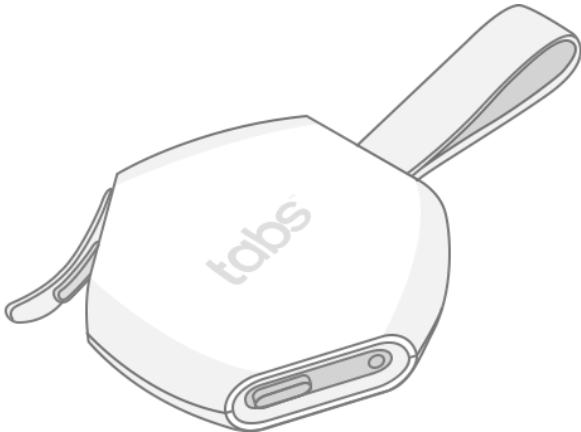
## 1. Description

The Object Locator utilizes LoRaWAN connectivity to communicate the location of the device. The intended use is to attach the sensor to a object like a backpack or purse to be able to remotely know its location.

The sensor is composed of a GNSS receive, a push button, an LED indicator, and a USB-C connector. The device contains a LiPo battery that can be recharged through the USB-C connector.

## 2. Specifications

### 2.1 Mechanical



#### 2.1.1 Sensor

Length x Width x Height	50mm x 13mm x 50mm
Weight	28g
Sensor	<ul style="list-style-type: none"><li>• GNSS</li><li>• 3D MEMs accelerometer</li><li>• Push Button</li></ul>

### 2.2 Environmental

Temperature	0°C to +50°C
IP Rating	IP 64 equivalent

### 2.3 Radio

Frequency	<ul style="list-style-type: none"><li>• 863–870MHz for EU</li><li>• 902–928MHz for North America</li></ul>
Tx Power	+19dBm conducted
Rx Sensitivity	-140dBm conducted
Antenna Gain	-5dBi Peak, -8dBi Avg

### 2.4 Certifications and Conformity

FCC ID: 2AMUGTBOL100

IC: 22980-TBOL100

CE

ROHS REACH

### 2.5 Power

Source	4.2V LiPo 540mAh battery
Maximum Voltage	4.2V
Minimum Voltage	3.6V
Current	TBD

### 2.6 User Interface

LEDs	One green LED
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### 2.7 Additional Features

PCB Temperature	NTC 100k ohm
Battery Monitoring	Resistor divider

## 3. Operation

### 3.1 Transport Mode

The sensor is hibernating without functionality to prevent radio transmissions and to minimize battery usage. To enter flight mode from default mode, the user shall press and hold any button for at least 10 seconds. Upon release of the button, flight mode is activated and the green LED shall flash rapidly for a duration of 3 seconds as an indication to the user.

To exit flight mode, the user shall press and hold any button for at least 10 seconds. Upon release of the button, flight mode is deactivated and default mode entered. As an indication to the user, the green LED shall light up for a duration of 3 seconds.

### 3.2 Default Mode

This mode is active when the device is in normal operating mode.

Whenever device motion is detected after a period of rest, the green LED shall flash 3 times within 500ms.

After a button is pressed, the green LED shall turn on for at most 50ms, after which an uplink transmission is scheduled. After the uplink transmission is complete – but before any down-link windows are opened – the green LED shall turn on for 500ms.

When a command to actuate the vibrator is received, all LEDs shall flash rapidly for the duration of the buzz. A buzz shall last 5 seconds with the buzzer activated for one (1) second followed by a one (1) second idle period, resulting in 3 vibrations and 2 idle periods.

### 3.3 Charging Indication

These indications do not constitute an operating mode by themselves, but may be active whenever there are no other ongoing indications as defined by the flight and default operating modes. When the device is connected to a powered charger, and the battery is charging, the green LED shall be on continuously. If the battery is fully charged while a powered charger is connected, the green LED shall fade-in and out from 0% to 50% brightness at a rate of 12 cycles per minute.

# 4. Messages

LoRaWAN Packets for this device use port 136.

## 4.1 Status

### 4.1.1 Triggers

Packet Triggers:

1. The sensor will update status every 120 minute if the sensor is in stationary mode.
2. The sensor will update status every 30 seconds if the sensor is in moving mode.
3. Press button to trigger event.

\*Note: The sensor will uplink immediately if it changes status from stationary mode to moving mode.

### 4.1.2 Payload

Port	136
Payload length	11 bytes

Byte	1	2	3	4	5	6	7	8	9	10	11
Field	Status	Battery	Temp	Lat			Long				

<b>Status</b>	<b>Sensors status</b>
	Bit[0] 1 - button trigger event, 0 - no button trigger event
	Bit[1] 1 - moving mode, 0 - stationary mode
	Bit[2] RFU
	Bit [3] 1 - no GNSS fix, 0 - GNSS fixed
	Bit [4] 1 - GNSS error, 0 - GNSS OK
	Bit[7:5] RFU
<b>Battery</b>	<b>Battery level</b>
	Bits [3:0] unsigned value v, range 1 – 14; battery voltage in V = (25 + v) ÷ 10.
	Bits [7:4] RFU

<b>Temp</b>	<b>Temperature as measured by on-board NTC</b>	
	Bits [6:0]	unsigned value $\tau$ , range 0 – 127; temperature in °C = $\tau - 32$ .
	Bit [7]	RFU
<b>Lat</b>	<b>Latitude as last reported by GNSS receiver</b>	
	Bits [27:0]	signed value $\phi$ , range -90,000,000 – 90,000,000; WGS84 latitude in ° = $\phi \div 1,000,000$ . *Note: little-endian format.
	Bits [31:28]	RFU
<b>Long</b>	<b>Longitude and position accuracy estimate as last reported by GNSS receiver</b>	
	Bits [28:0]	signed value $\lambda$ , range -179,999,999 – 180,000,000; WGS84 longitude in ° = $\lambda \div 1,000,000$ .
	Bits [31:29]	unsigned value $\alpha$ , range 0-7; position accuracy estimate in m = $2^{\alpha+2}$ (max). The value 7 represents an accuracy estimate of worse than 256m.
	Note: If there is no GNSS fix (see sensor status), the Lat. and Lon. fields contain the last values reported by the GNSS receiver. If there has never been a GNSS fix acquired, the values may both be 0. *Note2: little-endian format.	

## 5. Command

### 5.1 Configuration Command

Port	204
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#### 5.1.1 Payload

Bytes	0	1	2
Field	Cmd	Config	

<b>Cmd</b>	<b>Command</b>	1 byte
	Bit [7:0]	0x00 – Set update event interval when the sensor is moving. default value : 30 sec 0x01 – Set keep alive interval when the sensor is in stationary mode. default value : 7200 sec

		0x02 – Set g-sensor timeout interval when the sensor is moving. default value : 60 sec
<b>Config</b>	<b>Configuration</b> Bits [15:0]	0 or 2 bytes unsigned value in seconds, range 15 – 65,535. *Note: little-endian format.

## 5.2 Command Description

Cmd	Command Description	Config Length
0x00(1byte)	Get Sensor Configuration <b>(Only for unconfirmed downlink)</b>	0 bytes
0x00(1byte)	Set update event interval when the sensor is in moving mode. *Note: little-endian format.	2 bytes
0x01(1byte)	Set keep alive interval when the sensor is in stationary mode. *Note: little-endian format.	2 bytes
0x02(1byte)	Set g-sensor timeout interval when the sensor is in moving mode. *Note: little-endian format.	2 bytes

<b>Payload Content</b>	<p>Command content</p> <p>Ex:</p> <p>001E00    <b>01201C</b>    <b>023C00</b></p> <p>00 1E00 =&gt; Set update event interval when the sensor is in moving mode. : 0x001E -&gt; 30 sec</p> <p><b>01 201C</b> =&gt; Set keep alive interval when the sensor is in stationary mode.</p>
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: 0x1C20 -> 7200 sec  
**02 3C00** => Set g-sensor timeout interval when the sensor is in moving mode.  
: 0x003C -> 60 sec

### 5.3 Response Content (Only for unconfirmed downlink)

Port	204
Payload Length	9 bytes
Payload Content	<p>Response content  Ex:</p> <p><b>001E0001201C023C00</b></p> <p>00 1E00 =&gt; Update event interval when the sensor is in moving mode.  : 0x001E -&gt; 30 (sec)  <b>01 201C</b> =&gt; Keep alive interval when the sensor is in stationary mode.  : 0x1C20 -&gt; 7200 (sec)  <b>02 3C00</b> =&gt; G-sensor timeout interval when the sensor is moving.  : 0x003C -&gt; 60 (sec)</p>

### 5.4 Sensor Vibration Command (Internal command)

Port	136
Payload Length	1 bytes

#### 5.4.1 Payload

Bytes	0
Field	Cmd

Cmd:

0x01 – Trigger sensor vibration.