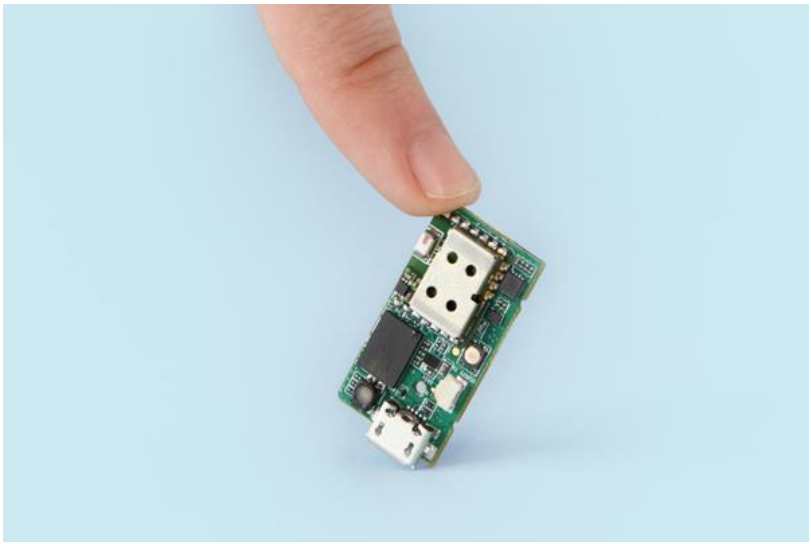
LPMS-B2 Series
Hardware Manual ver. 1.0



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Version History

Date	Revision	Changes
2020-03-10	1.0	- Initial release. - Contents extracted from quick start guide.

Table of Contents

1. Introduction

Welcome to the LP-RESEARCH Motion Sensor LPMS-B2 Series hardware manual.

In this documentation we will primarily introduce the hardware specifications of LPMS-B2 Series sensors. If you have any further questions or comments regarding this documentation please feel free to contact us anytime.

For more information on the LPMS-B2 or other product series, please refer to related datasheets and user manuals, available from the LP-RESEARCH website at the following address: http://www.lp-research.com.

Table 1-1. LPMS-B2 Series part number information

Part Number	Bluetooth Classic 2.0	Bluetooth Low Energy 4.1	Enclosure Case	Embedded Battery
LPMS-B2	✓	✓	✓	✓
LPMS-B2 OEM	✓	✓	×	×

2. System Overview

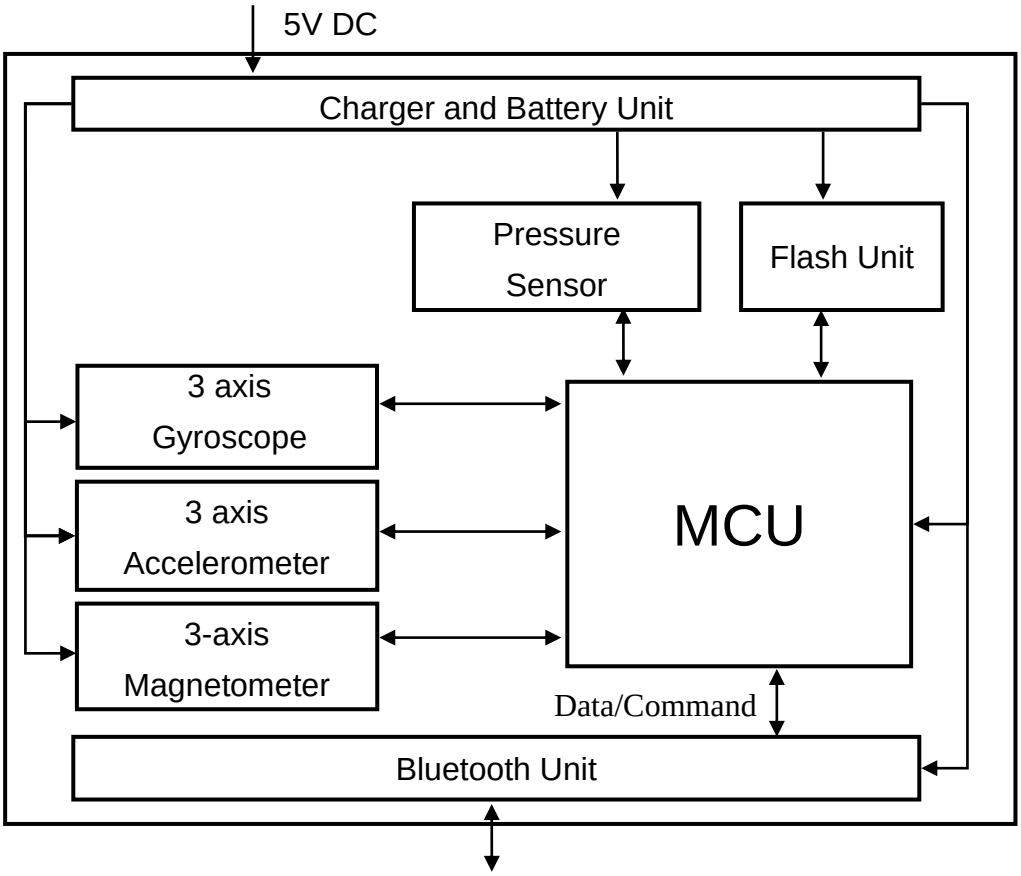

Fig. 2.1. LPMS-B2 series sensor structure

3. Coordinate

The LPMS sensor calculates the orientation difference between a fixed sensor coordinate system **(S)** and a global reference coordinate system **(G)**. Both coordinate systems are defined as right-handed Cartesian coordinate systems. The sensor coordinate system **(S)** is constructed as following images.

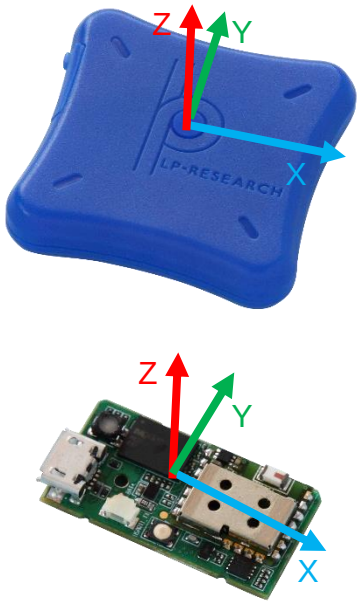

Fig. 3.1. Sensor coordinates of LPMS-B2 and LPMS-B2 OEM

The global reference coordinate system **(G)** can be divided into two different cases. While the orientation calculation is using all acceleration, gyroscope and magnetic data (sensor filter mode set at acc+gyr+mag), **(G)** system is defined as following:

- X positive when pointing to the magnetic north
- Y positive when pointing to the magnetic west
- Z positive when pointing up (gravity points vertically down with -1g)

While the orientation calculation is using only acceleration and gyroscope data (sensor filter mode set at acc+gyr), **(G)** system is defined as following:

- X positive aligned to ground plane horizontal projection of x axis of **(S)** when sensor powered on
- Y positive based on right-handed Cartesian coordinate definition
- Z positive when pointing up (gravity points vertically down with -1g)

4. Specification

Table 4-1. Overall parameters

Parameters	LPMS-B2	LPMS-B2 OEM
Output range of Euler angle	Roll: ±180°; Pitch: ±90°; Yaw: ±180°	
Bandwidth	400Hz	
Resolution	<0.01°	
Accuracy	<0.5° (Static), <2° RMS (Dynamic)	
Max. instant impact (0.1 ms)	10,000g	
Output data type	Raw data/Euler/Quaternion/Linear acceleration/Air pressure/Altitude/Temperature	
Latency	20 ms	
Internal sampling rate	400Hz	
Communication interface	Bluetooth Classic 2.0 (BLE4.1 Optional)	
Max. baudrate	921600 bps	
Communication protocol	LPBUS	
Size	39x39x8 mm	16x31x4 mm
Weight	12 g	2g
Communication distance	<20m	
Max. data update rate	400Hz	
Power consumption	<132mW @ 3.3V	
Power supply	Lithium Battery > 6h (3.7V@230mAh)	3.3-5.5V DC
Working temperature	-20~+60 °C	-40 ~ +80 °C
Connector*	Micro USB, type B	Micro USB, type B; SM02B-SURS-TF;

*LPMS-B2 USB connector is only used for charging, the sensor is powered by the internal embedded lithium battery.

Table 4-2. Accelerometer Specification

Parameters	Typical Value	Unit
Measurement range	±2/±4/±8/±16	g
Sensitivity	0.061/0.122/0.244/0.488	mg/LSB
Linear acceleration sensitivity change vs. temperature	±1	%
Linear acceleration typical zero-g level offset accuracy	±40	mg
Linear acceleration zero-rate change vs. temperature	±0.5	mg/°C
Acceleration noise density	90 (FS= ±2 g ODR = 104 Hz)	μg/√Hz

Table 4-3. Gyroscope Specification

Parameters	Typical Value	Unit
Measurement range	±125/±245/±500/±1000/±2000	dps
Sensitivity	4.375/8.75/17.50/35/70	mdps/LSB
Angular rate sensitivity change vs. temperature	±1.5	%
Angular rate typical zero-rate level	±10	dps
Angular rate typical zero-rate level change vs. temperature	±0.05	dps/°C
Rate noise density	7	mdps/√Hz

Table 4-4. Magnetometer Specification

Parameters	Typical Value		Unit
Measurement range	±4/±8/±12/±16		Gauss
Sensitivity	6842/3421/2281/1711		LSB/gauss
Zero-gauss level	±1 (FS=±4 gauss)		gauss
RMS noise (Ultra-high-performance mode)	X axis	3.2	mgauss
	Y axis	3.2	mgauss
	Z axis	4.1	mgauss
Non-linearity	±0.12		%FS

Table 4-5. Pressure and Humidity Sensor Specification

Parameters	Typical Value	Unit
Pressure measurement range	300~1100	hPa
Temperature coefficient of offset	±1.5	Pa/K
Absolute accuracy pressure	±1.0	hPa
Pressure sensitivity	0.18	Pa
Pressure noise	1.3	Pa
Humidity measurement range	0~100	%RH
Humidity accuracy	±3	%RH
Humidity latency （10~90~10 %RH, 25 °C）	±1	%RH
Humidity sensitivity	0.008	%RH
Humidity noise	0.02	%RH
Humidity stability （10~90 %RH, 25 °C）	0.5	%RH/year

5. Battery Charging

Charging

The LPMS-B2 sensor can be charged through the micro USB port. In case of LPMS-B2 OEM, users have to specify the methods of power supply for their own designs.

The charging voltage for LPMS-B2 is 5V and the required power current is at least 100mA for an efficient charging progress. Depending on the remaining power in the battery, the on-board LED will show different charging status by different colors. Detailed information of the LED status is introduced in the following section.

LED Indication

Table 5-1. LED Status Indication

Work Mode		LED Status	LED Color	Remaining Battery
Normal	Connection off	Blinking light	Blue	>10%
			Red	<10%
	Connection on	Pulsating light	Blue	>10%
			Red	<10%
Charging		Always on	Green	>90%
			Blue	20%~90%
			Red	<20%

6. Mechanical Information

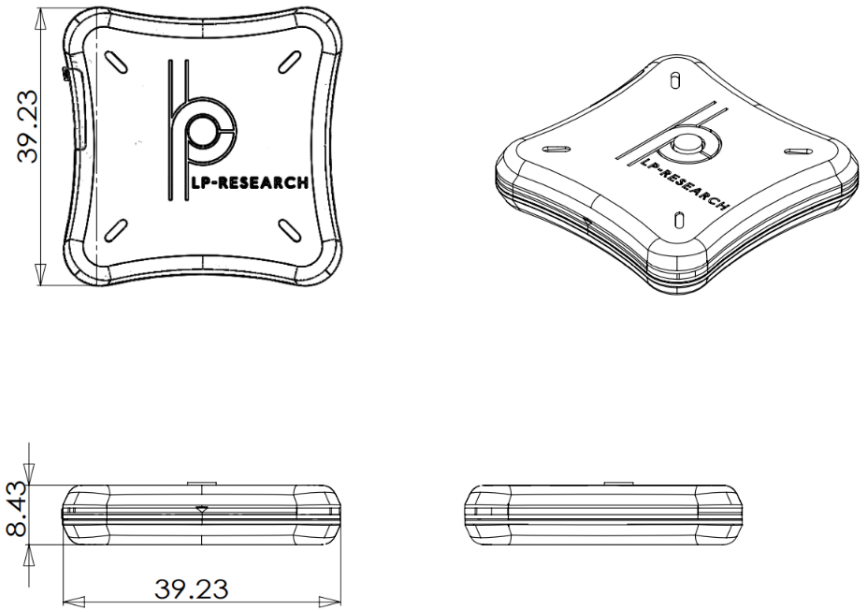

Fig. 6.1. LPMS-B2 Dimension

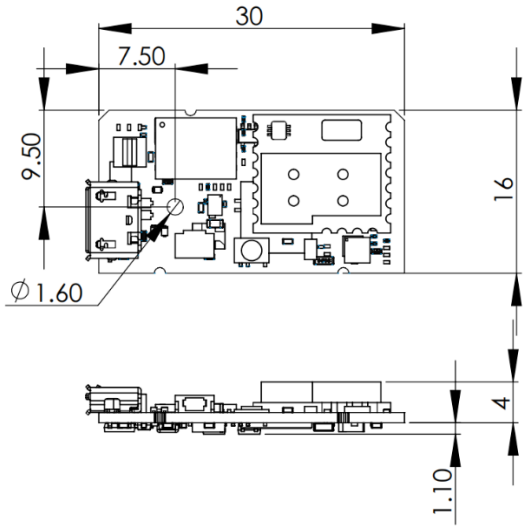

Fig. 6.2. LPMS-B2 OEM Dimension