

# LPMS-AL2 Series Hardware Manual ver. 1.0



LPMS-CANAL2



LPMS-RS232AL2



LPMS-TTLAL2



LPMS-USBAL2

## Revision History

<b>Date</b>	<b>Revision</b>	<b>Changes</b>
2020-03-18	1.0	- Initial release - Combine LPMS-CANAL2, LPMS-RS232AL2, LPMS-TTLAL2 and LPMS-USBAL2 hardware information into this LPMS-AL2 series hardware manual

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## I. Introduction

Welcome to the LP-RESEARCH Motion Sensor LPMS-AL2 series hardware manual. In this documentation we will explain the hardware information of LPMS-AL2 series sensors, which includes the following sensor part numbers.

- LPMS-CANAL2
- LPMS-RS232AL2
- LPMS-TTLAL2
- LPMS-USBAL2

We have put a lot of effort into making the LPMS-AL2 series a great product, but we are always eager to improve and work on new developments. If you have any further questions or comments regarding this documentation, please feel free to contact us anytime.

For more information on the LPMS-AL2 or other product series, please refer to related user manuals, available from the LP-RESEARCH website at the following address: <http://www.lp-research.com>.



## II. Device Specification

Table 2-1. Overall specification

Parameters	LPMS-CANAL2	LPMS-RS232AL2	LPMS-TTLAL2	LPMS-USBAL2
<b>Output range of Euler angle</b>	Roll : $\pm 90^\circ$ ; pitch : $\pm 180^\circ$ ; Yaw : $\pm 180^\circ$			
<b>Bandwidth</b>	400Hz			
<b>Resolution</b>	0.01°			
<b>Accuracy</b>	<0.5° (Static), <2° RMS (Dynamic)			
<b>Max. instant impact (0.1 ms)</b>	10,000 g			
<b>Output data type</b>	Raw data/Euler/Quaternion/Linear acceleration/Air pressure/Altitude/Temperature			
<b>Internal sampling rate</b>	400 Hz			
<b>Communication interface</b>	CAN Bus	RS232	TTL(UART)	USB
<b>Max. baudrate</b>	1M bps	921600 bps	921600 bps	921600 bps
<b>Communication protocol</b>	LPCAN / CANOpen	LPBUS	LPBUS	LPBUS
<b>Size</b>	50x42x25 mm (latest version) 48x40x25 mm (old version)			40x34x17 mm
<b>Weight</b>	71 g (latest version) 48 g (old version)			36 g
<b>Max. data update rate</b>	400Hz			
<b>Power consumption</b>	< 182 mW@3.3V			
<b>Power supply</b>	5V~15V DC			5V
<b>Working temperature</b>	-40~+80 °C			
<b>Connector</b>	M12			Micro USB
<b>Waterproof level</b>	IP67			-



Table 2-2. Accelerometer specification

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

Table 2-3. Gyroscope specification

Parameters	Typical Value	Unit
Measurement range	$\pm 125/\pm 245/\pm 500/\pm 1000/\pm 2000$	dps
Sensitivity	4.375/8.75/17.50/35/70	mdps/LSB
Angular rate sensitivity change vs. temperature	$\pm 1.5$	%
Angular rate typical zero-rate level	$\pm 10$	dps
Angular rate typical zero-rate level change vs. temperature	$\pm 0.05$	dps/°C
Rate noise density	7	mdps/ $\sqrt{\text{Hz}}$
Angular random walk	9	degree/hour

Table 2-4. Magnetometer specification

Parameters	Typical Value	Unit
Measurement range	$\pm 4/\pm 8/\pm 12/\pm 16$	gauss
Sensitivity	6842/3421/2281/1711	LSB/gauss



<b>Zero-gauss level</b>	$\pm 1$		gauss
<b>RMS noise (Ultra-high-performance mode)</b>	X axis	3.2	mgauss
	Y axis	3.2	mgauss
	Z axis	4.1	mgauss
<b>Non-linearity</b>	$\pm 0.12$		%FS

Table 2-5. Pressure and humidity sensor specification

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

Table 2-6. Relation between RS232/TTL/USB baudrate and max. update rate

<b>Baudrate (bps)</b>	<b>Max. Update Rate (Hz)</b>
<b>19200</b>	10
<b>57600</b>	50
<b>115200</b>	100
<b>921600</b>	400



Table 2-7. Relation between CAN Bus baudrate and max. update rate

<b>Baudrate (kbps)</b>	<b>CANOpen Protocol Max. Update Rate (Hz)</b>	<b>LPCAN Protocol Max. Update Rate (Hz)</b>
<b>125</b>	200	100
<b>250</b>	400	200
<b>500</b>	400	400
<b>1000</b>	400	400



### III. Connector Pinout

#### M12-5pos Connector

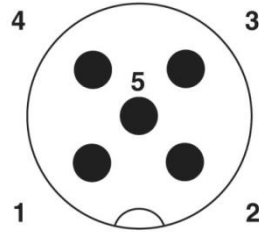


Fig. 3.1. Pin number of LPMS-CANAL2/RS232AL2/TTLAL2

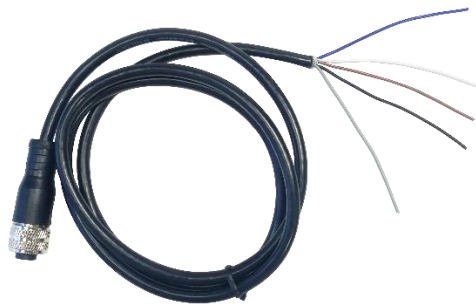


Fig. 3.2. Cable for M12-5pos connector

Table 3-1 Connector signals for LPMS-CANAL2 or LPMS-RS232AL2

Pin no.	Signal	Value	Cable Color	Remark
1	NC		Brown	
2	VDD	+5V~15V DC	White	Power supply
3	GND		Blue	Signal ground
4	TX/CAN+		Black	Data lines
5	RX/CAN-		Grey	

Table 3-2 Connector signals for LPMS-TTLAL2

Pin no.	Signal	Value	Cable Color	Remark
1	NC		Brown	
2	RX		White	Data line
3	VDD	+5V~15V DC	Blue	Power supply
4	GND		Black	Signal ground
5	TX		Grey	Data line

## M12-8pos Connector

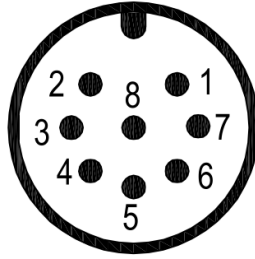


Fig. 3.3. Pin number of LPMS-CANAL2/RS232AL2/TTLAL2



Fig. 3.4. Cables for M12-8pos connector  
(left: cable connections for CAN/RS232/TTL; right: USB connection)

Table 3-3 Connector signals for LPMS-CANAL2/RS232AL2/TTL2

Pin No.	Signal	Value	Cable Color	Remark
1	VDD1	+5V~+15V DC	White	Power supply for CAN, RS232 and TTL
3	TX/CAN+	-	Green	Data lines for CAN, RS232 and TTL
4	RX/CAN-	-	Yellow	
8	VDD2	+5V DC	Red	Power supply for USB
6	D-	-	-	Data lines for USB
7	D+	-	-	
2	GND	-	Brown	Signal ground
5	RES	-	-	reserved

**NOTE: Please do not use USB with other interfaces at the same time.**

## USB Connector

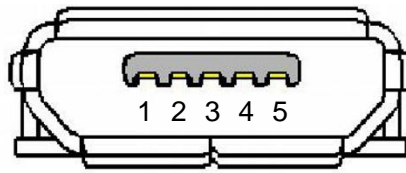


Fig. 3.5. Pin number of LPMS-USBAL2 USB connector

Table 3-4 Connector signals for LPMS-USBAL2

Pin no.	Signal	Value	Remark
1	VBUS	+5V DC	Power line
2	D-		Data line
3	D+		Data line
4	-		None
5	GND		Signal ground

## IV. Mechanical Information

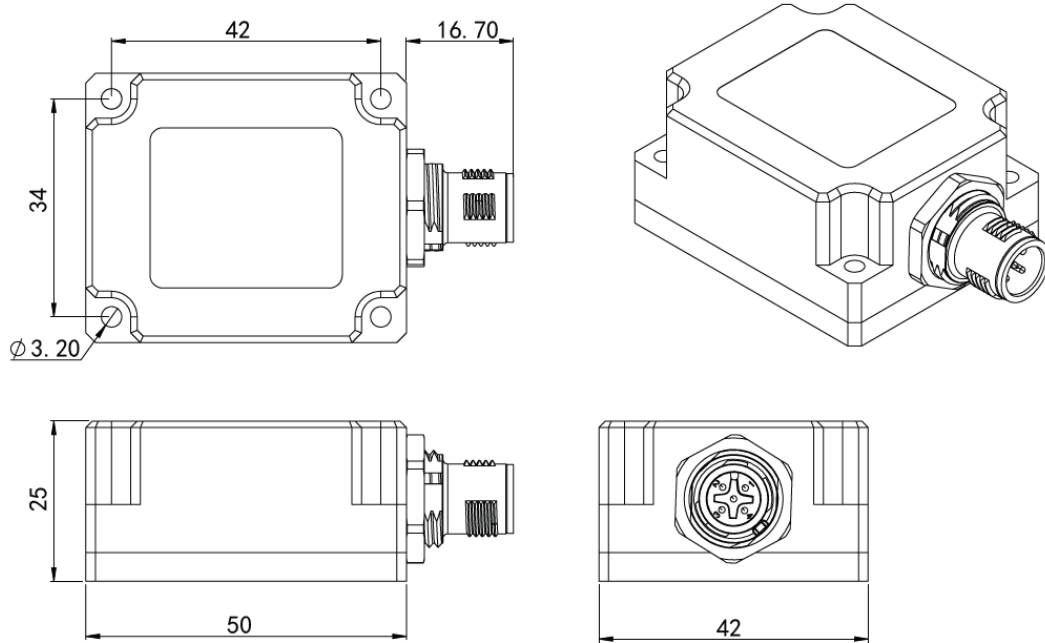


Fig. 4.1. Dimension of LPMS-CANAL2/RS232AL2/TTLAL2 (latest version)

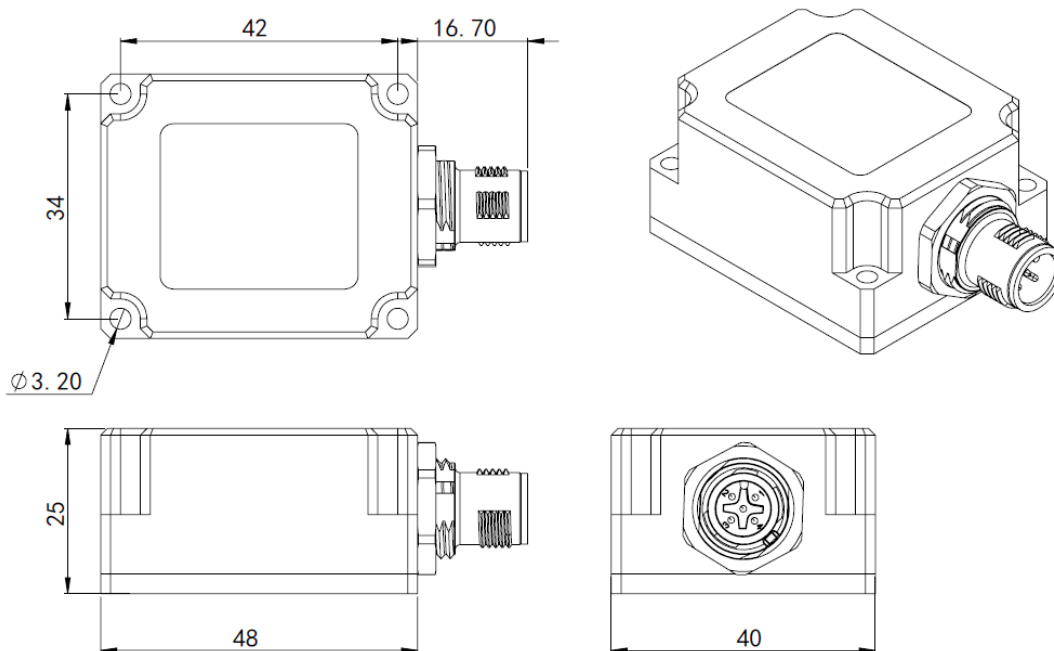


Fig. 4.2. Dimension of LPMS-CANAL2/RS232AL2/TTLAL2 (old version)

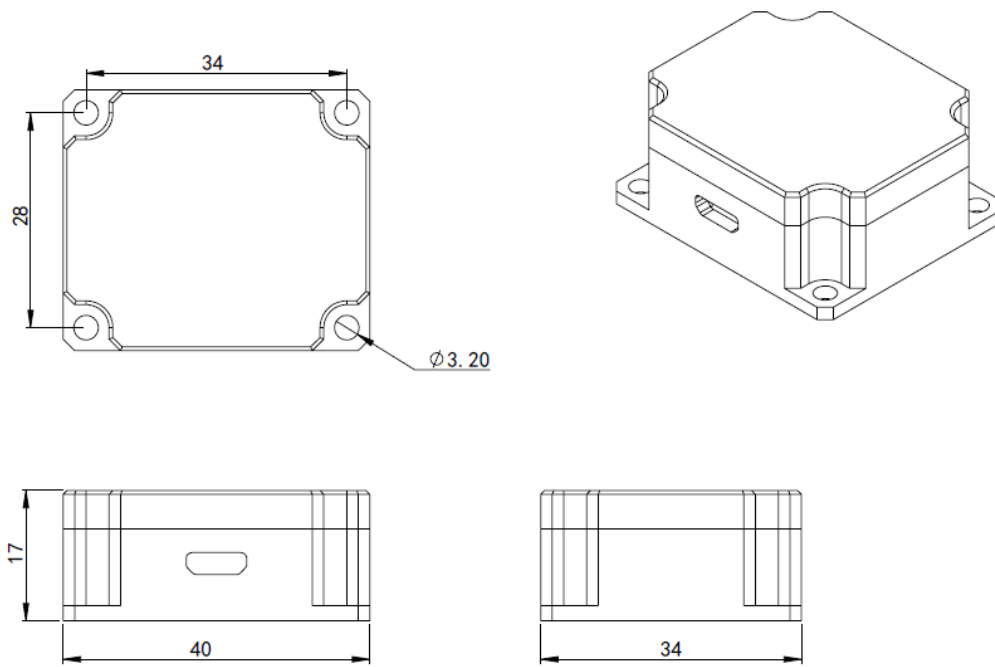


Fig. 4.3. Dimension of LPMS-USBAL2