



# **E-LEAN RACE STD DATASHEET**

6 DOF Smart Inertial  
Measurement Unit for race  
and custom applications

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Issue 1.1



## 1 GENERAL DESCRIPTION

E-LEAN RACE STD is a full inertial measuring unit with 6 degrees of freedom and equipped with a 16bit Microcontroller with digital signal processing unit.

E-LEAN RACE STD also makes internal estimation of the lean angle and pitch angle of the vehicle, if properly fed with vehicle speed.

E-LEAN RACE STD is connected to the vehicle CAN BUS where it receives the vehicle speed and it transmits the accelerations signals  $A_x$ - $A_y$ - $A_z$ , the angular rate signals  $W_x$ - $W_y$ - $W_z$ , the estimation of the vehicle attitude and the diagnosis status of the hardware.

The attitude estimation is based on the most accurate state of the art algorithms of signal filtering and processing.

## 2 E-LEAN APPLICATIONS

E -LEAN RACE STD may be used both in two-wheeled and four wheeled vehicle applications which benefit from attitude and inertial measurements knowledge.

The main application for E-LEAN RACE STD is telemetry.

On request, E-LEAN RACE STD can be used for custom applications, including:

- ✓ Slide Out/Lowside identification (motorcycles)
- ✓ Rollover identification (cars)
- ✓ Traction Control and Braking Control
- ✓ Suspension Control and Stability Control
- ✓ Adaptive lighting
- ✓ Airbag-triggering
- ✓ Energy management and range prediction in electric vehicles

### 3 KEY FEATURES

Key Features of E-LEAN
<b>The 6DOF and the algorithm allow orientation installation flexibility<sup>1</sup></b>
<b>Compact dimension and weight</b>
<b>Automotive Compliant (regulation UN/ECE R10)</b>
<b>Robust to vehicle vibrations up to 10g RMS, over the standard engine frequencies</b>
<b>The 16g accelerometer scale makes it suitable to suspension (active or semi-active) control</b>
<b>Fault Diagnosis and Recovery (signal coherence, over-temperature)</b>
<b>Temperature compensation</b>
<b>Rigid plastic housing including mounting damping supports</b>

### 4 TECHNICAL DATA

Technical Data	
<b>Supply Voltage</b>	Nominal: 12V Range: 8V..18V
<b>Supply Current</b>	34mA @ 12V
<b>Protection Class</b>	IP 67
<b>Operating Temperature Range</b>	-10°C ... +70°C
<b>Storage Temperature Range</b>	-40°C ... +85°C
<b>Acceleration Range</b>	Up to ±16g
<b>Angular rate Range</b>	Up to ±250 deg/sec
<b>Native resolution</b>	Accelerations: 16 bit Angular rates: 16 bit
<b>Bandwidth (-3dB cut-off)</b>	Roll rate: 7Hz Accelerations: 7Hz Angular Rates: 7Hz  Customization available upon request
<b>Weight</b>	35g

<sup>1</sup> See Section STANDARD MOUNTING ORIENTATION for more details on positioning.

## 5 CAN INTERFACE

CAN INTERFACE	
<b>Refresh rate</b>	10ms
<b>Baudrate</b>	1 Mbaud (customizable)
<b>Identifier Length</b>	11 bit
<b>OUPUT Identifier</b>	Customizable
<b>OUPUT information</b>	Attitude angles (motorcycle applications) 3 axis accelerations 3 axis ang. Rates Fault status
<b>INPUT Identifier</b>	Customizable
<b>INPUT Information</b>	Vehicle Speed <sup>2</sup>
<b>Terminating Resistance</b>	120 Ohm
<b>Impedance to VDD and GND</b>	4.7 kOhm

## 6 PINOUT

Pinout – Connector JAE MX44	
PIN No	Name
1	CAN-High
2	GND
3	Vbatt
4	CAN-Low

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<sup>2</sup> Vehicle speed is mandatory for providing attitude angles in motorcycle applications.

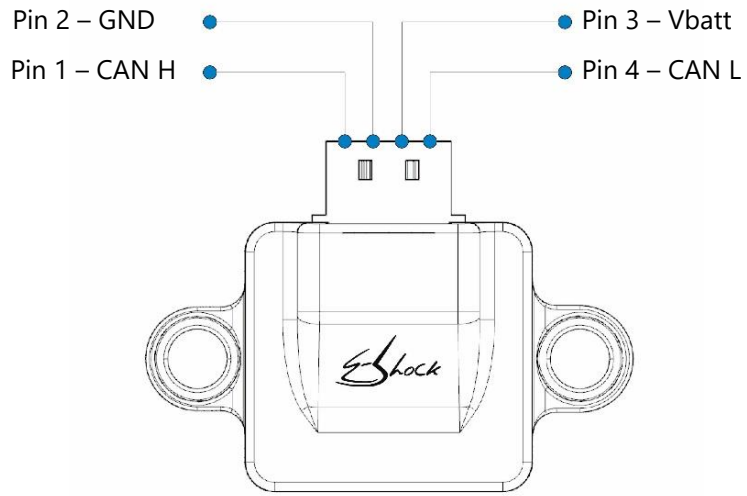


Fig. 1 Pinout illustration

## 7 DIMENSIONS

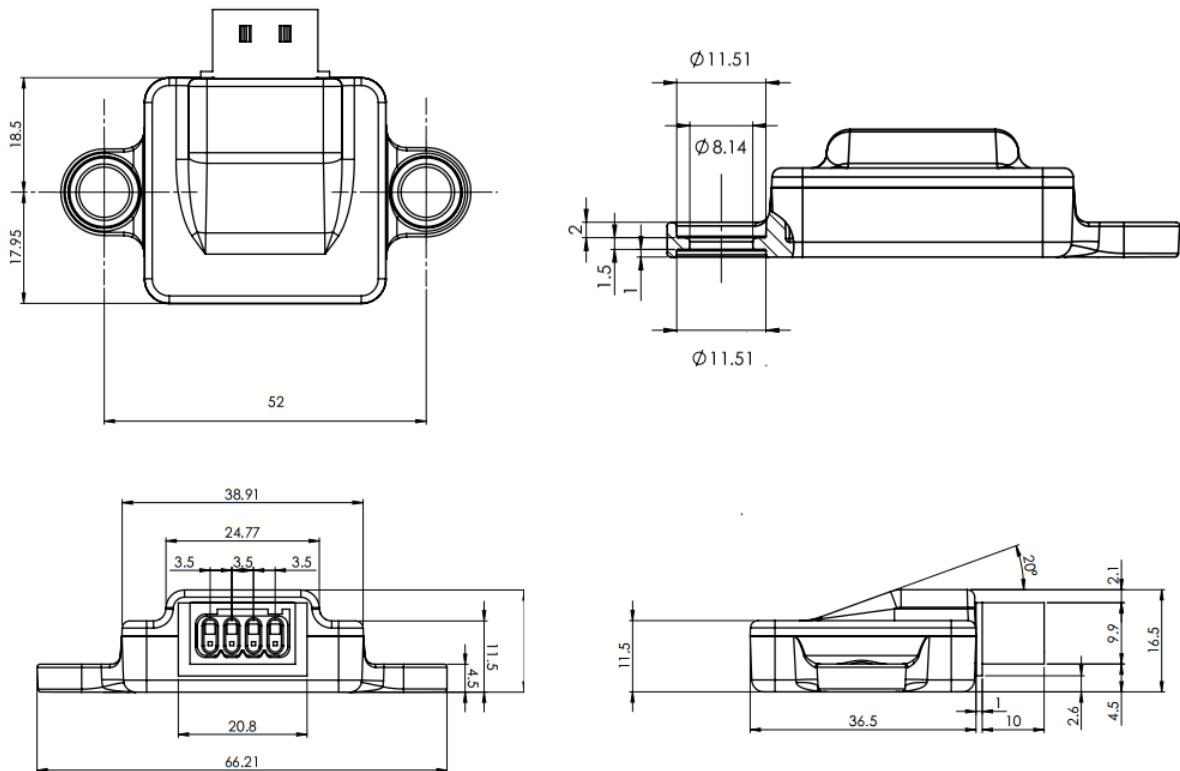


Fig. 2 Dimensions in millimeters

## 8 STANDARD MOUNTING ORIENTATION

E-LEAN RACE STD standard mounting orientation is illustrated in Fig. 3.

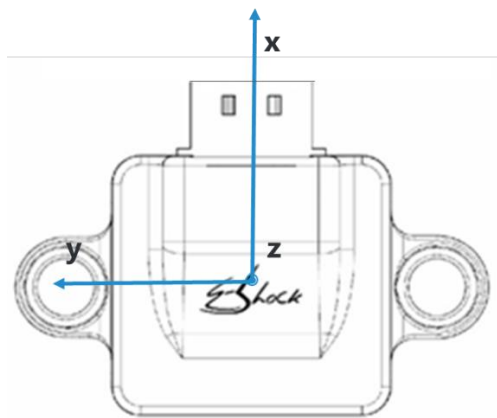
X, Y and Z represents longitudinal, lateral and vertical axis of the vehicle respectively, according to right-handed orientation tern.

Sensor mounting orientation is represented in the image below.

The connector output side has to be oriented to the forward longitudinal direction of movement of the vehicle.

For standard installation, the face of the device with **E-shock** logo must look upward.

To compensate installation tolerances up to  $\pm 45$  degrees with respect to nominal orientation, a zeroing procedure is recommended in order to get best performance from the device.



**Fig. 3 Standard mounting position**

Installation orientation can be customized upon request. Please refer to instruction manual provided with the prototype for correct installation.

Wrong installation or missing zeroing of the device may impact on correct functioning of roll and pitch angle estimations, when available.

## 9 DISCLAIMER

The prototype delivered is an experimental version of the attitude sensor for lean angle estimation "E-LEAN".

E-LEAN RACE STD has been tested and validated in heavy duty conditions, on several motorbikes and tracks using proper technical instrumentations.

This electronic device is an object whose concept design is preliminary, it has custom and limited functionalities that could shape the final prototype.

The methodology and the production process employed to do this kind of sensor prototype are potentially different from those that could be used for the final and definitive production.

The prototype must be used only for racing applications and for the customer to verify its functional requirements.

The prototype does not have all the characteristics of completeness, robustness and scalability of a finished "automotive" product and it is not possible to force it to an intensive use.

The possible use of this prototype for experimental and / or demonstration purpose cannot and must not be confused with the marketing of a finished product.

E-Shock S.r.l. is not liable in any way and it will not provide any warranty against defects, it will not correct any malfunctions, even partial, resulting from a massive use and / or misuse of this prototype in any way.

The specification in this document can be changed to E-Shock decision. E-Shock assumes no responsibility for any claims or damages arising out of the use of this document, or from the use of modules based on this document, including claims or damages based on infringement of patents, copyrights or other intellectual property rights.

## 10 CONTACTS

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