

## Triaxial Inclinometer

SAE J1939

3 Analog Outputs

2 M12 Connector(s), IP67  
with Electronic Assistant®

P/N: AX061000

### Features:

- Reliable, real-time, accurate and stable slope angle data
- MEMS-based accelerometer measures angle with respect to gravity
- Measures pitch and roll inclination angles in a full  $\pm 180$  degree orientation range
- Outputs gravity angle and accelerations in 3 orthogonal directions
- 3 analog output signals (+/-10V, 0-10V, +5V, 0-5V, 4-20 mA, 0-24 mA or 0-20 mA)
- SAE J1939
- 12V, 24Vdc nominal power supply
- Aluminum enclosure, 2 round 5-pin A-coded M12 connectors, gasket
- IP67 protection
- Configurable using the **Electronic Assistant®**



### Applications:

- Level, tilt, pitch and acceleration monitoring in agricultural, off-highway and mining equipment
- Platform levelling and stabilization in industrial machines
- Navigation system component

**General Description:** The unit measures pitch and roll inclination angles in a full  $\pm 180$  degree orientation range. The unit can also output: gravity angle and unit accelerations in three orthogonal directions. The inclinometer transmits angular data over CAN bus using a standard J1939 protocol. The angular data is also output on three independently configured universal voltage/current signal outputs. The unit original configuration can be changed using Axiomatic Electronic Assistant® PC-based configuration tool.

### Ordering Part Numbers:

#### Inclinometers:

**AX061000** – Triaxial Inclinometer, CAN (SAE J1939), 3 Analog Outputs, 2 M12 Connectors

#### Accessories:

**AX070502** - Electronic Assistant®

## Technical Specifications:

### Static Parameters

Parameter	Value	Remarks
Measurement Range	$\pm 180^\circ$ – Pitch & Roll 0...180° – Gravity	+/- 90° Default for Pitch & Roll
Resolution	0.06°	Effective Resolution (3.46*NoiseRMS). Maximum at cut-off frequency, Fc=5Hz
Initial Accuracy	$\pm 2^\circ$	Maximum, at 25°C
Temperature Drift	$\pm 3^\circ$	Maximum, in the full temperature range: - 40...85°C
Nonlinearity	$\pm 0.1\%$	Maximum, at 25°C
Cross-Axis Sensitivity	$\pm 1\%$	Maximum, at 25°C

### Dynamic Parameters

Parameter	Value	Remarks
Cut-off frequency, Fc	1...50 Hz, 5 Hz default	User selectable
Settling time	$\leq 0.2s$	Typical at default Fc. From 0 to 95% of the static output value.

### Inputs

Parameter	Value	Remarks
Supply Voltage	9...36 VDC	12V, 24V – nominal
Supply Current <sup>1</sup>	TBA mA TBA mA TBA mA TBA mA	Maximum at 24V, Outputs in V mode Maximum at 24V, Outputs in mA mode Maximum at 12V, Outputs in V mode Maximum at 12V, Outputs in mA mode
Protection	Reverse polarity, Transients <sup>2</sup>	

<sup>1</sup> CAN bus is connected.

<sup>2</sup> Withstands 80 VDC @25°C for 2minutes for jump start conditions

### CAN Output

Parameter	Value	Remarks
Number of ports	1 CAN Port	To output data and change the internal configuration of the inclinometer.
Communication standards	SAE J1939  ISO 11898  Bosch CAN protocol specification 2.0, Part A, B.	Full support for a J1939 ECU is provided. By default, the inclinometer transmits angular information on the CAN network in PGN 61459, Slope Sensor Information. User configurable PGNs are also available.  120Ohm terminated twisted pair, baud rate up to 1MBit/s (250 kbit/s is used for SAE J1939 models). Termination resistor is not installed.  For the internal CAN controller.
Protection	Short circuit to ground  Connection to the power supply	Only for 12V systems, 24V max

## Signal Outputs

Parameter <sup>1</sup>	Value	Remarks
Number of Outputs	3	
Output Modes	Voltage or Current	EA configurable
Protection	Short circuit to ground Transients	Any voltage above 12V can cause a permanent device damage if applied continuously.
<b>Voltage Modes</b>		
Voltage Ranges	0...5 V 0...10 V ±5 V ±10 V	
Output Current	≤ 10 mA	Per channel
Output Impedance	0.5 Ohm	Typical
Resolution	0.024%	12 bit
Accuracy	±0.07%	Maximum, in the full temperature range: -40...85°C
Dynamic Performance		
Settling Time	TBA	Typical. 5V step. From 0 to 95% of the static output value.
<b>Current Modes</b>		
Current Ranges	4...20 mA 0...20 mA 0...24 mA	
Load Resistance	≤ 400 Ohm	
Output Impedance	50 MOhm	Typical
Resolution	0.024%	12 bit
Accuracy	±0.25%	Maximum, in the full temperature range: -40...85 °C. 300 Ohm load resistance.
Dynamic Performance		
Settling Time	TBD	Typical. 20mA step. From 0 to 95% of the static output value.

<sup>1</sup> Parameters are for the signal outputs, not for the sensor.

By default, the signal voltage outputs are configured the following way:

Signal Output	Default Assignment	Remarks
VOUT_1	Pitch Angle	Voltage Output. ±10 V Range. -90° → -10 V, 90° → 10 V
VOUT_2	Roll Angle	Voltage Output. ±10 V Range. -90° → -10 V, 90° → 10 V
VOUT_3	Gravity Angle	Voltage Output. ±10 V Range. 0° → -10 V, 180° → 10 V

The default configuration can be changed using EA (Electronic Assistant).

## General Specifications

Parameter	Value
Sensor Type	MEMS
Internal Logic	User Configurable with Electronic Assistant (EA), AX070502
Operating Temperature	-40...+85 °C
Environmental Protection	IP67
Vibration and Shock <sup>1</sup>	<p>The sinusoidal component of the vibration testing was conducted following MIL-STD-202G, method 204D, test condition C (10g peak). A resonant frequency analysis was performed, no resonances were noted.</p> <p>Sweep Characteristic: 10Hz to 2000Hz to 10Hz  Sweep Period: 20 Minutes  Test Duration: 8hrs/axis  Test Intensity: 10g Peak</p> <p>The random component of the vibration testing was conducted meeting or exceeding the requirements of MIL-STD-202G, method 214A, test condition I/B (7.68 Grms):</p> <p>Frequency Range: 5Hz to 2000Hz  Test Duration: 8hrs/axis  Overall Grms: 7.68 Grms</p> <p>The shock component of the vibration testing is based on MIL-STD-202G, method 213B, test condition A. The pulse duration was shortened to 9 ms from the standard 11 ms due to our vibration system limits. Eight pulses per axis were performed instead of six. The test was conducted as follows:</p> <p>Pulse Type: half sine  Pulse Duration: 9 ms  Peak Value: 50 g  Pulses per axis: 8</p>
Enclosure	Metal enclosure, anodized with two 5-pin M12 A-coded round connectors. Refer to dimensional drawing.
Size	Refer to dimensional drawing.
Weight	0.75 lb. (0.34 kg)

<sup>1</sup>MEMS sensor can withstand 20000 g max.

## Compliance

### Enclosure Protection

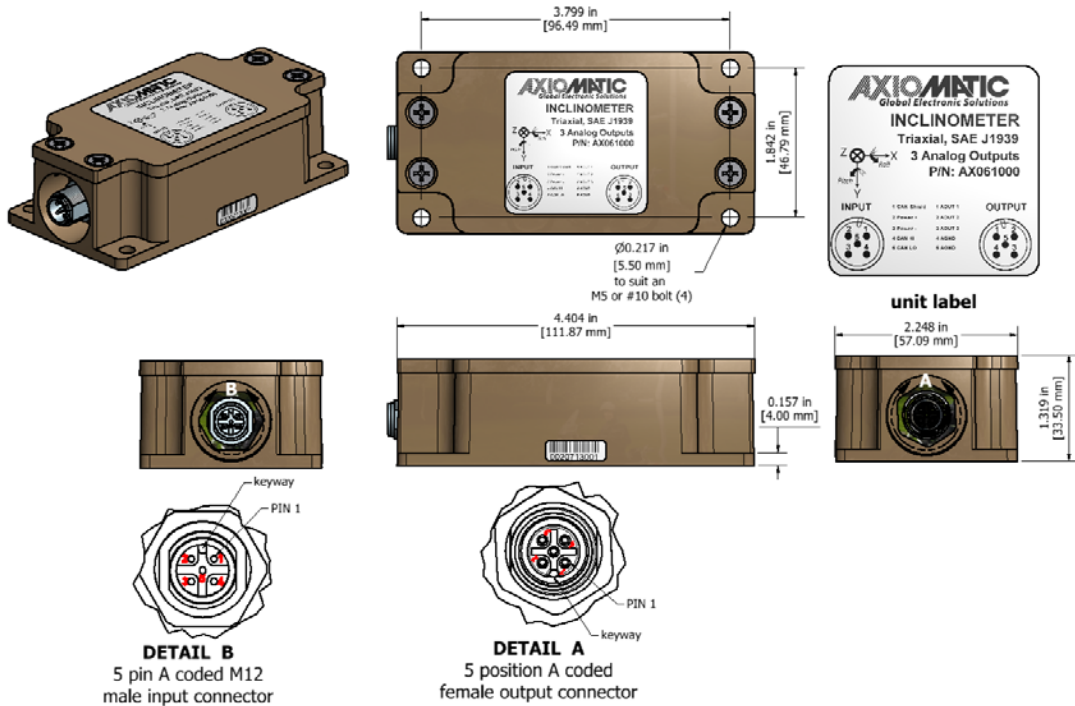
Standard	Description	Conditions
IEC 60529	Degrees of protection provided by enclosures (IP Code).	IP67. Mating connectors compliant with IEC 61076-2-101:2012 should be installed.

Name	Remarks
CE Marking	EMC RoHS

## Installation Instructions:

The CAN wiring is considered intrinsically safe. All field wiring should be suitable for the operating temperature range of the module. CAN wiring may be shielded using a shielded twisted conductor pair and the shield must be connected to the CAN\_SHIELD pin.

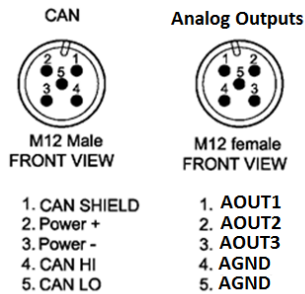
**Dimensions:** The enclosure is cast Aluminum, anodized and includes a gasket and o-rings for sealing.



**Electrical Connections:**

**Model: AX061000**

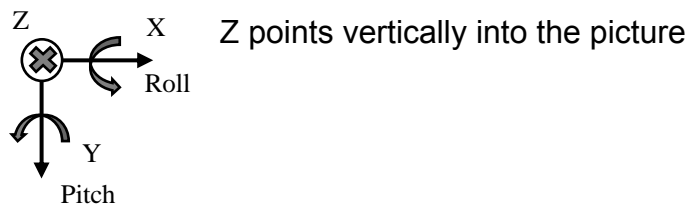
The unit contains two 5-pin M12 A-coded round connectors. Use mating connectors compliant with IEC 61076-2-101:2012.



**Unit Orientation:**

**Model: AX061000**

The unit coordinates, together with the Pitch and Roll directions are shown on the inclinometer label.



Notes: Electronic Assistant® is a registered US trademark of Axiomatic Technologies Corporation. CANopen® is a registered community trade mark of CAN in Automation e.V. Specifications are indicative and subject to change. Actual performance will vary depending on the application and operating conditions. Users should satisfy themselves that the product is suitable for use in the intended application. All our products carry a limited warranty against defects in material and workmanship. Please refer to our Warranty, Application Approvals/Limitations and Return Materials Process as described on [www.axiomatic.com/service.html](http://www.axiomatic.com/service.html).

Form: TDAX061000-09/11/18