Triaxial Inclinometer with Gyro

±180⁰ Pitch/Roll Angle
Pitch Angle Rate Acceleration
SAE J1939, Analog Output or RS-232 Options
2 M12 Connectors, IP67
with Electronic Assistant

P/N: AX06070X

An internal gyroscope minimizes the influence of dynamic linear acceleration on slope sensor readings.

Features:

- Reliable, real-time, accurate and stable slope angle data
- MEMS-based accelerometer measures angle with respect to gravity
- MEMS gyroscope measures angular rate around the axis
- Measures pitch and roll inclination angles in a full ±180 degree orientation range
- Outputs accelerations in 3 orthogonal directions
- Provides an angular rate of rotation of the pitch angle
- Output: SAE J1939
- Automatic baud rate detection (suitable for 250 kbps, 500 kbps and 1 Mbps networks)
- 12V, 24Vdc nominal power supply
- Aluminum enclosure, 2 round 5-pin A-coded M12 connectors, gasket, encapsulation
- IP67 protection
- CE mark pending
- 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
- Robotics position sensing
- Navigation system component

Ordering Part Numbers:

Inclinometers:
AX060700 – Triaxial Inclinometer, CAN (SAE J1939)

Accessories:
Electronic Assistant over CAN (SAE J1939): **P/N: AX070502**

Description:

The Triaxial Inclinometer measures pitch and roll inclination angles in a full ±180 degree orientation range. Pitch angle is compensated by a gyroscope to minimize the influence of dynamic linear accelerations. The unit can also output gravity angle and unit accelerations in three orthogonal directions as well as an angular rate of rotation around the pitch angle.

The angles are measured by a set of MEMS sensors, which senses acceleration caused by the gravity force in three orthogonal directions. The output signals from the MEMS sensors are normalized and processed by a microcontroller.

Inclinometer model options include: CAN networking via SAE J1939. Automatic baud rate detection permits networking with buses operating at different speeds. Refer to the block diagram below.

The inclinometer is IP67 rated and is packaged in a cast Aluminum housing. A dual 5-pin M12 connector configuration allows for networking the sensor in a machine control system. Other configurations are available on request.

The inclinometer transmits angular and angular rate data over the CAN bus using a standard J1939 protocol. The unit's default configuration can be changed using the PC-based Axiomatic Electronic Assistant software.

Block Diagram
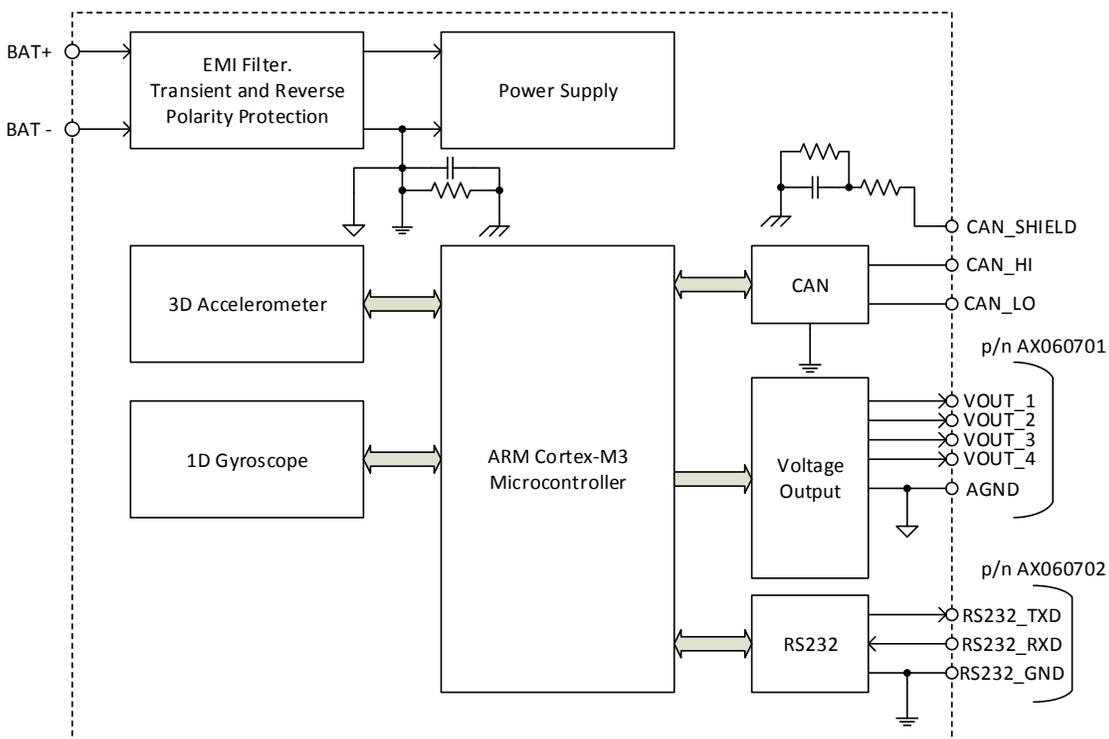
Unit Orientation
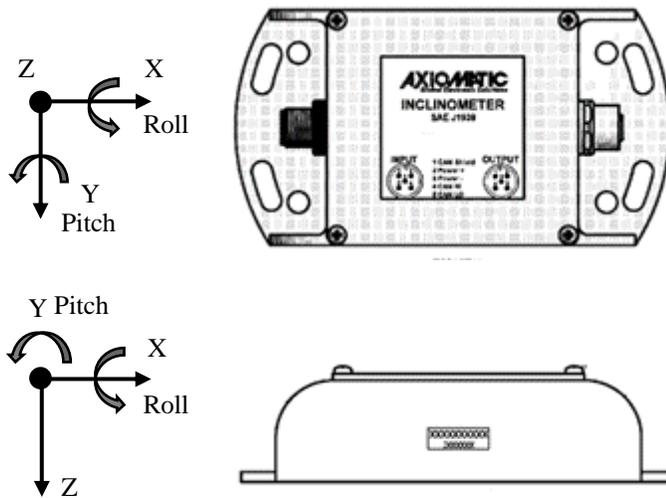
Technical Specifications:

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.

Power Supply Input

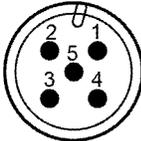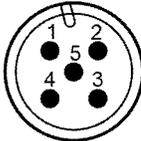| Power Supply Input	12V, 24V nominal (9…36 VDC power supply range) Suitable for engine cranking, jump start and load dump conditions found in mobile equipment.
Supply Current	45 mA maximum at 24Vdc 85 mA maximum at 12Vdc
Protection	Reverse polarity and transient protection is provided.

Angular Measurements

Measurement Range	±180º Pitch & Roll 0…180º Gravity
Resolution	±0.35º Maximum *(All angles, except angle listed below.)* 0.1º *(Pitch angle with gyro compensation)* Effective resolution (3.46* NoiseRMS) at cut-off frequency, Fc=5Hz
Initial Accuracy	±1º Maximum
Temperature Drift	±1.5ºC Maximum, over the full temperature range -40…85ºC
Nonlinearity	±0.7% Maximum
Cross-Axis Sensitivity	±2.5% Maximum
Cut-off frequency, Fc	User configurable 1…50 Hz (5 Hz default)
Settling Time	$\leq$0.2 s Typical at default Fc. From 0 to 95% of the static output value.

Single Gyroscope - Angular Rate Measurements

Measurement Range	±100º/s Pitch
Resolution	±0.11º/s Effective Resolution (3.46*NoiseRMS). Maximum at cut-off frequency, Fc=5Hz
Offset Error	±2.5º/s Maximum, at 25ºC
Offset Temperature Drift	±0.06º/s Maximum, over the full temperature range -40…85ºC
Sensitivity Error	±2% Maximum, over the full temperature range -40…85ºC
Nonlinearity	±0.5º/s Maximum, over the full temperature range -40…85ºC
Cross-Axis Sensitivity	±1.7% Maximum
Cut-off frequency, Fc	User configurable 1…50 Hz (5 Hz default)

| CAN Parameters	
CAN	1 or 2 CAN ports depending on model SAE J1939 (CANopen® is available on request.) For data transmission and for access to the configuration of the inclinometer. By default, the inclinometer transmits angular and angular rate information on the CAN network in PGN 61459, Slope Sensor Information. User configurable PGNs are also available on request.
Baud Rate	Automatic Baud Rate Detection. Refer to user manual. 250 kbit/s, 500 kbit/s and 1 Mbit/s is supported.
Protection	Short circuit to ground
	Connection to the power supply (24V maximum)
ISO 11898	120 Ohm terminated twisted pair, baud rate up to 1MBit/s. Termination resistor is not installed. A mating plug with CAN termination, P/N: AX070114, can be ordered for applications requiring a termination of the CAN network.

Model AX060700: CAN	
CAN	1 CAN port, SAE J1939 There is only one CAN port supported by the unit. Both CAN connectors are physically connected together to facilitate cable routing in the user system.
Electrical Connections Model AX060700	**P/N: AX060700 (CAN SAE J1939)** INPUT CONNECTOR OUTPUT CONNECTOR M12 Male FRONT VIEW M12 female FRONT VIEW 1. CAN SHIELD 1. CAN SHIELD 2. Power + 2. Power + 3. Power - 3. Power - 4. CAN HI 4. CAN HI 5. CAN LO 5. CAN LO

General Specifications

Microprocessor	STM32, 32-bit, 128 Kbyte flash program memory
Sensors	MEMS acceleration and MEMS gyroscope sensors
Control Logic	User programmable functionality using Axiomatic Electronic Assistant
User Interface	Axiomatic Electronic Assistant, P/N: AX070502
Operating Conditions	-40 to 85 °C (-40 to 185 °F)
Enclosure and Dimensions	Cast Aluminum enclosure 2 Round M12 5-pin A-coded integral connectors Encapsulated, Lid Gasket

	Dimensions: 2.90 x 5.35 x 1.42 inches 73.66 x 135.99 x 36.16 mm (L x W x H)
Protection	IP67
CE Compliance	CE marking pending for EMC Directive RoHS compliant
Vibration and Shock	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. Sweep Characteristic: 10Hz to 2000Hz to 10Hz Sweep Period: 20 Minutes Test Duration: 8hrs/axis Test Intensity: 10g Peak 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): Frequency Range: 5Hz to 2000Hz Test Duration: 8hrs/axis Overall Grms: 7.68 Grms 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: Pulse Type: half sine Pulse Duration: 9 ms Peak Value: 50 g Pulses per axis: 8
Weight	0.85 lb, 0.39 kg
Installation	Mounting holes accept #10 or M6 screws. The thickness of the mounting flange is 0.25 inch or 6.35 mm.
	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 grounded on the other end. All chassis grounding should go to a single ground point designated for the machine and all related equipment.

Dimensions
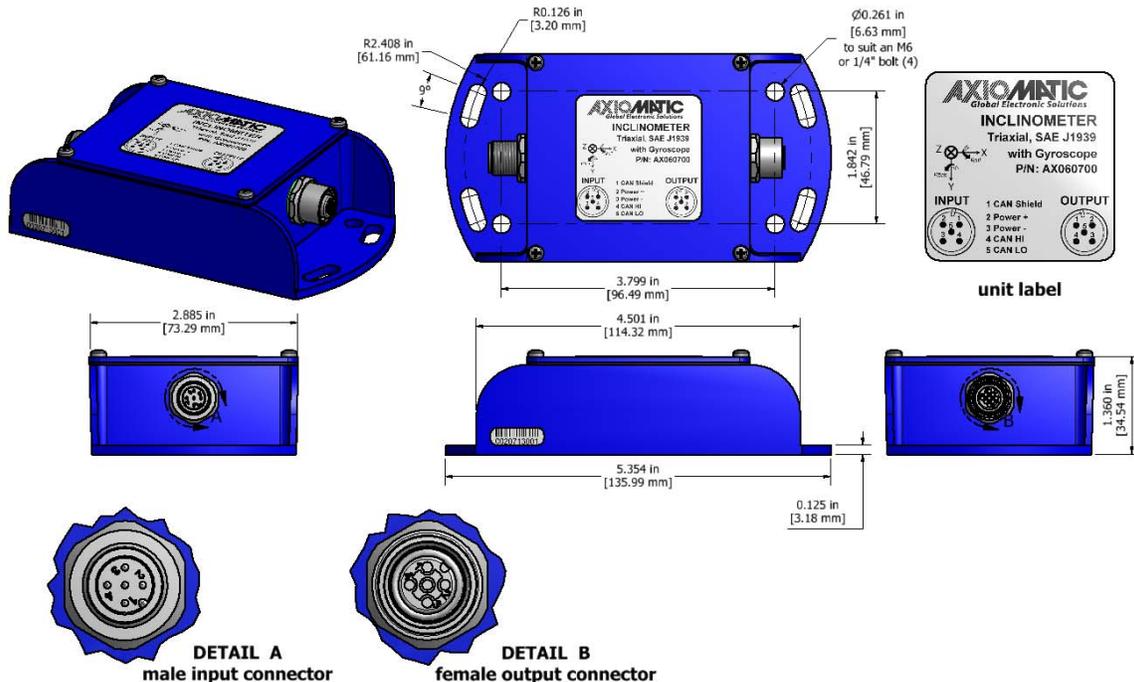
Note: CANopen® is a registered community trademark of CAN in Automation e.V.