

Inclinometer**SAE J1939, 1 Deutsch IPD DT15-4P Connector
with Electronic Assistant®****P/N: AX06040X****Features:**

- 1 or 2 axis inclination or slope sensors
- 2 axis (-80°...80°), functional up to $\pm 90^\circ$
- 1 axis, vertically positioned (-180° ... 180° or 0...360°)
- High resolution and accuracy
- SAE J1939 (CANopen® models are also available)
- 12V, 24VDC nominal
- Aluminum enclosure, 1 DT15-4P connector, gasket, encapsulation
- IP67 protection
- Configurable using the **Electronic Assistant®**

**Applications:**

- Industrial Automation, Cranes, Hoists, Utility Vehicles, Off-highway, Ag, and Forestry Equipment

Ordering Part Numbers:**Inclinometers:****AX060400** – Inclinometer, SAE J1939, 1 Deutsch IPD DT15-4P Connector**AX060401** – Inclinometer, SAE J1939, Internal CAN Termination, 1 DT15-4P Connector
(For a model with 2 5-pin M12 Connectors, refer to TDAX06020X.)**Accessories:****Electronic Assistant®** over CAN (SAE J1939 only): **P/N: AX070502****PL-DT06-4S** - A mating plug kit, Axiomatic P/N: PL-DT06-4S is available.
Mating cables are not supplied.**Documentation:**

User Manual UMAX06020X-40X.

CANopen® models with the DT15-4P connector are also available. Refer to TDAX06045X.

AX060450 – Inclinometer, CANopen®, 1 Deutsch IPD DT15-4P Connector**AX060451** – Inclinometer, CANopen®, Internal CAN Termination, 1 DT15-4P Connector

Description: The inclinometer is designed to accurately measure inclination angles in two directions X and Y in the range of $\pm 80^\circ$. It is functional up to $\pm 90^\circ$. If vertically installed, it can measure an inclination angle in one sensing direction in the $\pm 180^\circ$ (0-360°) range.

The angles are measured by a two-axis MEMS sensor, which senses acceleration caused by the gravity force in two orthogonal directions. The output signals from the MEMS sensor are normalized and processed by a microcontroller. The resolved angles can be then sent to the SAE J1939 or CANopen® fieldbus.

Due to a powerful microcontroller, the inclinometer can perform pre-processing of the angular information according to the users' needs. Its internal architecture is user-programmable and allows users to define their own custom functionality using a set of predefined internal functional blocks. All application programming is performed through SAE J1939 CAN interface by the PC-based Axiomatic Electronic Assistant® software.

The inclinometer is IP67 rated and is packaged in a cast Aluminum housing with 1 Deutsch IPD p/n DT15-4P connector.

Dual Axis Functionality

There are two identical functional blocks: Sensor X and Sensor Y presenting angular data from two orthogonal sensing directions X and Y of the inclinometer sensor.

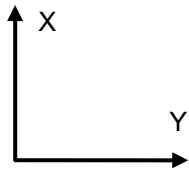


Figure 1.0 Sensing Direction Vectors

The inclinometer measures angles between the sensing directions and the ground plane. Normally, the sensor is mounted horizontally, with the sensing direction vectors being in parallel with the ground plane.

When a sensing direction vector points up, out of the ground plane, the inclination angle is considered to be positive, and when the sensing direction vector points down, into the ground plane, it is negative.

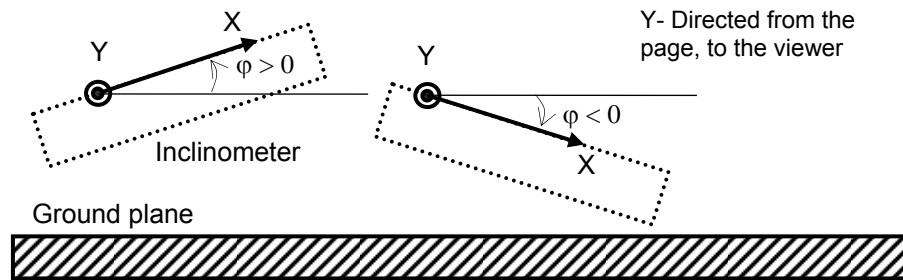
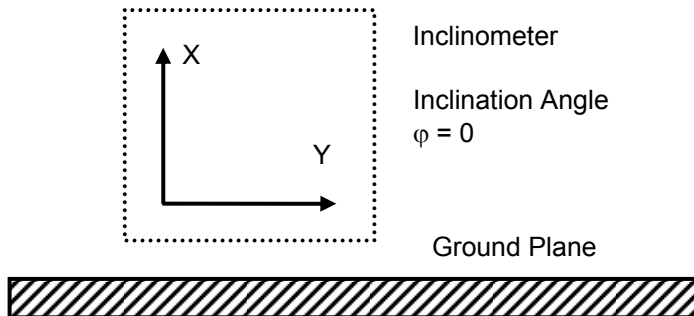


Figure 2: Dual Axis Functionality with the Inclinometer mounted horizontally – Sensor X and Sensor Y Functional Blocks

Single Axis Functionality

The single axis functionality is provided by the vertically mounted sensor functional block. It is available only when the inclinometer is mounted vertically, orthogonally to the ground plane. In this position, if kept vertically, the inclinometer can measure an inclination angle in one direction in the whole $\pm 180^\circ$ degree range.

The sensing direction of the vertically mounted sensor is the same as the Y sensing direction of the regularly (horizontally) mounted sensor. When the X sensing direction points up and the Y sensing direction points to the right, and is in parallel with the ground plane, the inclination angle is zero.



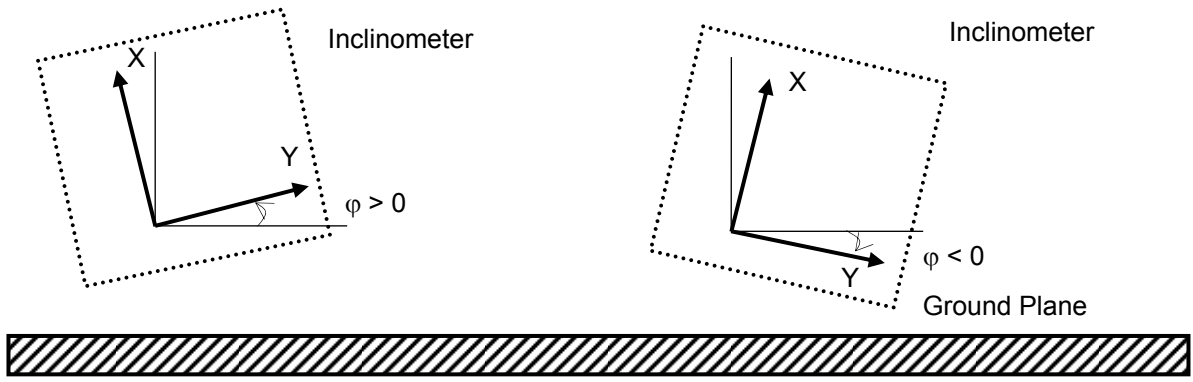


Figure 3: Single Axis Functionality with the Inclinometer mounted vertically – Vertically mounted sensor functional block - The counterclockwise rotation of the sensor produces positive angles and the clockwise, correspondingly, negative.

Using the Electronic Assistant®, the inclinometer can be reprogrammed. The inclinometer consists of a set of internal functional blocks, which can be individually programmed and arbitrarily connected together to achieve the required system functionality, see Figure 4.

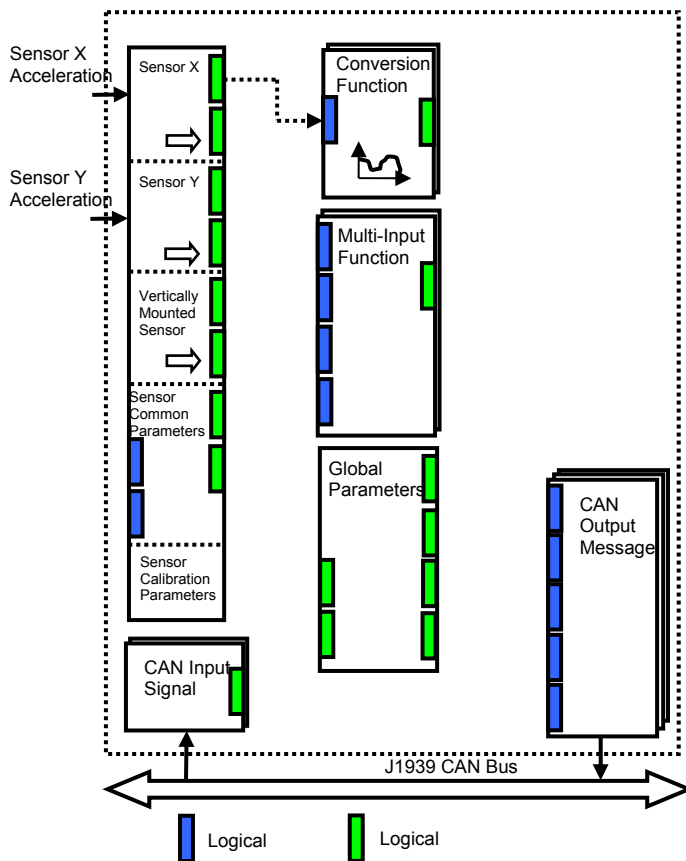


Figure 4 - Inclinometer Internal Structure

Technical Specifications:

Input

Power Supply Input	12V, 24V nominal (9...43 VDC power supply range)
Supply Current	40 mA at 12 V Typical; 22 mA at 24 V Typical
Protection	Reverse polarity and transient protection is provided.

Outputs

Operation Modes	Dual Axis or Single Axis
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Single Axis – Angle Range	Single Axis: -180°...180° (0...360°)	Vertical position of the inclinometer should be maintained within the maximum displacement angle (+/- 20° by default)
Single Axis – Measurement Range	Single Axis: -180°...180° (0...360°)	
Resolution	±0.05° Maximum	
Initial Accuracy	±0.25° Maximum, at 25°C	
Repeatability	±0.05° Maximum	
Nonlinearity	±0.1° Typical	

Dual Axis – Angle Range	Dual Axis: -80°...80°	Functional up to ±90°
Dual Axis Measurement Range	Low-angle range -30°...30°	High-angle range -80°...-30° 30°...80°
Resolution	±0.05° Maximum	±0.2° Maximum
Initial Accuracy	±0.25° Typical at 25°C	±0.5° Maximum, at 25°C
Repeatability	±0.05° Maximum	±0.2° Maximum
Temperature Drift	±0.0015%/ °C Typical, at 0° over the full temperature range -40...85°C	-
Nonlinearity	±0.1° Typical	±0.25° Maximum
Cross-Axis Sensitivity	0.5% Typical	

Cut-off frequency, Fc	5 Hz (default) 1...20 Hz (User configurable)
Settling Time	0.3 sec. Typical at Fc ≥ 5Hz from 0 to 95% of the static output value

CAN	1 CAN port, SAE J1939
Protection	Short circuit to ground Connection to the power supply (24V maximum)
Network Termination	According to the SAE J1939 standard, it is necessary to terminate the network with external termination resistors. The resistors are 120 Ohm, 0.25W minimum, metal film or similar type. They should be placed between CAN_H and CAN_L terminals at both ends of the network (not provided). For the AX060401 part number there is an integrated 120Ω, 1%, 1W resistor is built into the unit. It is meant for use at the end of a CAN network.

General Specifications

Microprocessor	STM32, 32-bit, 128 KByte flash program memory
Sensor	Dual axis MEMS acceleration sensor
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)
Packaging and Dimensions	Cast Aluminum enclosure with gasket, Encapsulated 1 Deutsch IPD p/n DT15-4P connector 3.34 x 3.14 x 2.18 inches 84.8 x 79.8 x 55.5 mm (L x W x H) (Refer to Figure 5.)
Protection	IP67
Weight	1.25 lbs, 0.58 kg
Vibration	MIL-STD-202G, Test 204D and 214A (Sine and Random) 10 g peak (Sine) 7.86 Grms peak (Random)
Shock	MIL-STD-202G, Test 213B 50g
Approvals	CE marking

Installation	<p>Mounting holes accept #10 or M6 screws. The thickness of the mounting flange is 0.25 inch or 6.35 mm.</p> <p>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.</p>
Electrical Connections Model AX060400	<p>1 Deutsch IPD p/n DT15-4P connector Pin out 1 Power + 2 Power GND 3 CAN_L 4 CAN_H A mating plug kit, Axiomatic P/N: PL-DT06-4S is available.</p>
Electrical Connections Model AX060401	<p>This model includes internal CAN termination. 1 Deutsch IPD p/n DT15-4P connector The pinout is the same as for the model AX060400. A mating plug kit, Axiomatic P/N: PL-DT06-4S is available.</p>

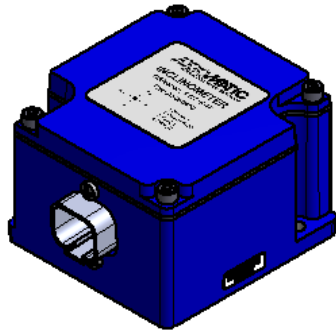
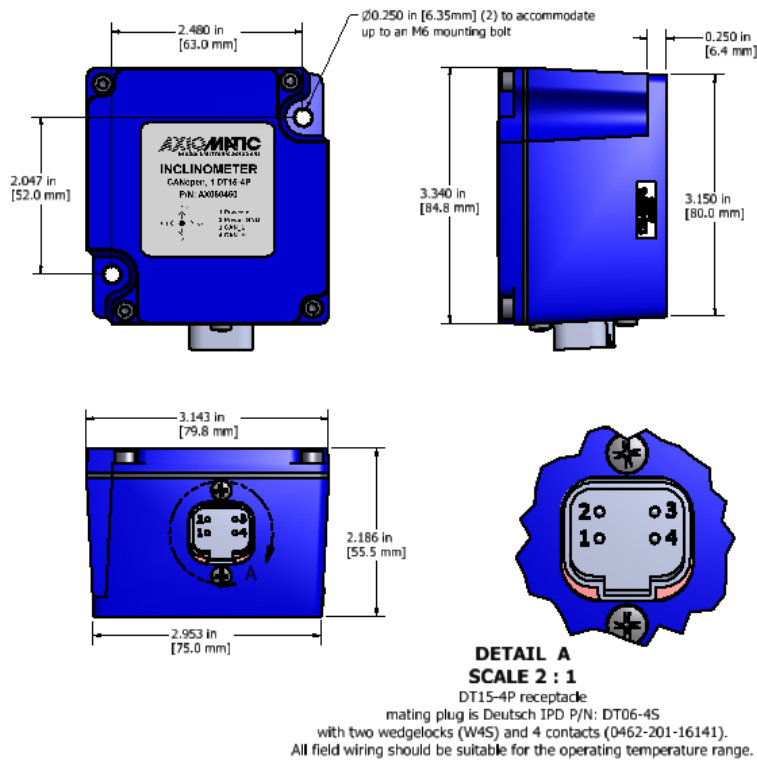


Figure 5 – AX06040X Dimensions

Note: 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.

Form: TDAX06040X-08/21/15