

Angular Position Technology

Inclinometers

WHAT IS AN INCLINOMETER?

Inclinometers measure angular tilt in reference to gravity. Turck inclinometers contain a MEMS (Micro-Electro-Mechanical System) device that incorporates a microelectromechanical capacitive element into the sensor that utilizes two parallel plate electrodes, one stationary and one attached to a spring-mass system. The suspended electrode is free to move with the change in angle relative to earth's gravity. This results in a measurable change in the capacitance between the two plates that is proportional to the angle of deflection. These signals are conditioned to provide voltage outputs (0.1 to 4.9 VDC) or current outputs (4 to 20 mA).

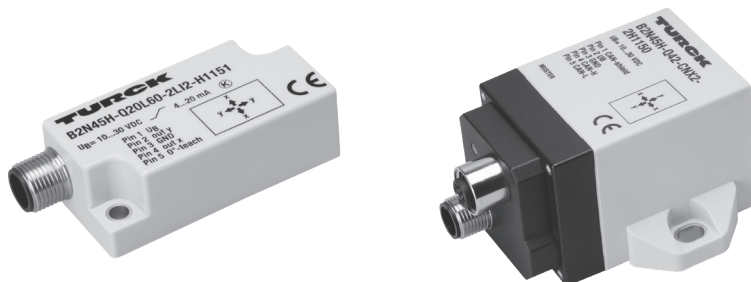
The microprocessor design and the MEMS technology allows for a compact, precise inclinometer in a very robust, industrialized package. The inclinometer carries an IP68 rating for ingress protection, and can operate in temperatures from -30 °C to +70 °C (-22 °F to +158 °F), with the option for -40 °C (-40 °F). These sensors can be mounted up to a maximum of $\pm 85^\circ$ angle for dual axis models and 360° for single axis models.

WHERE CAN I USE AN INCLINOMETER?

Inclinometer sensors may be used in a wide variety of applications to solve unique feedback requirements where the customer needs to level platforms or control tilt angle.

The device's small size lends itself to a multitude of applications, such as:

- Commercial machines: diggers, cranes, rotary tables, bulldozers, road construction machinery
- Dancer arm position for web tension control
- Solar plants: mirror and cell positioning
- Machine control: levers, pedals, flaps, mixing machines, hydraulic jacks
- Vertical and horizontal drills used in tunnel and road construction and immersion equipment
- Offshore plants: platforms, cranes
- HVAC louvers, flood control gates, telescopes
- Conveyors, utility vehicles, agricultural and forestry machinery, cranes and hoisting technology – and more



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Why Choose Turck Inclinometers?

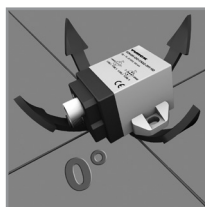
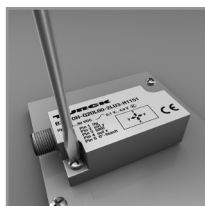
High Accuracy and Repeatability

- $\leq 0.1\%$ repeatable, after a warm-up time of 0.5 hours, ensures consistent outputs.
- Resolution as fine as $\leq 0.04^\circ$ for Dual Axis analog family.
- Resolution as fine as $< 0.01^\circ$ for CANopen Single Axis family.
- Temperature compensated down to -40°C (-40°F) and up to $+70^\circ\text{C}$ ($+158^\circ\text{F}$) on select versions. Temperature coefficients as low as $0.01^\circ/\text{K}$ for analog models or $0.008^\circ/\text{K}$ for CANopen models.



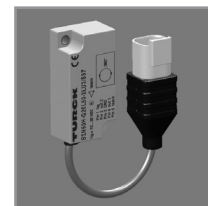
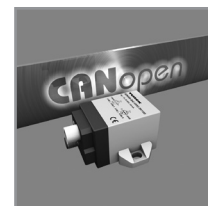
Rugged, Reliable and Compact

- Rated to 55 Hz (1 mm) vibration and 30 g (11 ms) shock for a wide variety of applications.
- Q20L60 analog and set point versions measure 20 mm x 30 mm x 60 mm, making them the most compact IP68/IP69K rated inclinometer on the market.
- Q42 CANopen inclinometer housing measures 42 mm x 42.5 mm x 68 mm, and incorporates bus-in and bus-out M12 Eurofast® connectors for ease of use.
- IP68 rated according to Turck's stringent test protocol:
 - » 24 hours continuous storage at 70°C (158°F)
 - » 24 hours continuous storage at -25°C (-13°F)
 - » 7 days submerged at a depth of 1 meter
 - » 10 thermal shock changes from -25 to $+70^\circ\text{C}$ (-13 to $+158^\circ\text{F}$), 1 hour dwell cycle



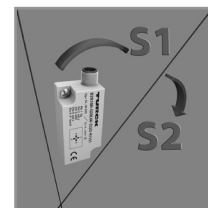
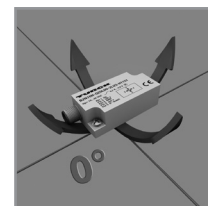
Expanded Line

- Dual axis with analog voltage or current outputs measuring up to -85 to $+85^\circ$.
- Single axis with analog voltage or current outputs measuring from 1 to 360° of travel.
- 360° Single axis with configurable dual PNP set points.
- CANopen interface now available in single axis or dual axis that can be used in a wide variety of industrial and mobile applications.
- Factory default measuring ranges.
- Non-standard measuring ranges available upon request. Contact factory for availability and specifications.
- Prewired connections potted in cable and value add connectivity is available on request. Contact factory for availability and specifications.



Easy to Use

- Zero point offset on the Dual Axis Analog inclinometers can be field adjusted by applying a signal to the teach input pin or by using an optional teach pendant.
- Span of the Single Axis Analog inclinometers can be easily scaled by using the teach input pin to set the span in the field.
- Discrete outputs of the Single Axis Digital inclinometer can be independently set by using the teach input pin or by using an optional teach pendant.
- CANopen inclinometers come with CiA DS-301, profile CiA DSP-410 for ease of configuration.



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Dual Axis with Analog Output

Turck's standard product is a low profile dual axis (X and Y) inclinometer with standard angular ranges of $\pm 10^\circ$, $\pm 45^\circ$, $\pm 60^\circ$ and $\pm 85^\circ$, with additional ranges optional. Each axis has independent outputs. The 5 VDC version is a ratiometric design and the power is limited between 4.75 and 5.25 VDC. This means that the output is proportional to the supply voltage. The 10-30 VDC supply units are regulated and the output is fixed regardless.

- $\pm 10^\circ$, $\pm 45^\circ$, $\pm 60^\circ$, $\pm 85^\circ$
- Current 4-20 mA, 10-30 VDC
- Voltage output 0.1-4.9 V, 10-30 VDC
- Voltage output 0.1-4.9 V @ 5 VDC
- Teachable zero point up to $\pm 15\%$ with teach adapter VB2-SP4
- FM Class I, Div 2 approved when used with Guard-Q20L60 and approved cordset.



Part Number	ID Number	Angular Range	Resolution	Absolute Accuracy	Zero Point Calibration	Temperature Drift	Temperature Coefficient	Load Resistance	Dimensional Drawing	Wiring Diagram
Dual Axis – Analog Output, 4-20 mA										
B2N10H-Q20L60-2LI2-H1151	1534012	$\pm 10^\circ$	$< 0.04^\circ$	$\pm 0.3^\circ$	$\pm 5^\circ$	$\leq \pm 0.05^\circ/\text{K}$	$0.01^\circ/\text{K}$	$\leq 200 \Omega$	1	1
B2N45H-Q20L60-2LI2-H1151	1534013	$\pm 45^\circ$	$< 0.1^\circ$	$\pm 0.5^\circ$	$\pm 15^\circ$	$\leq \pm 0.025^\circ/\text{K}$	$0.03^\circ/\text{K}$	$\leq 200 \Omega$	1	1
B2N60H-Q20L60-2LI2-H1151	1534014	$\pm 60^\circ$	$< 0.14^\circ$	$\pm 0.5^\circ$	$\pm 15^\circ$	$\leq \pm 0.025^\circ/\text{K}$	$0.03^\circ/\text{K}$	$\leq 200 \Omega$	1	1
B2N60H-Q20L60-2LI2-H1151/S97	1534046	$\pm 60^\circ$	$< 0.14^\circ$	$\pm 0.5^\circ$	$\pm 15^\circ$	$\leq \pm 0.025^\circ/\text{K}$	$0.03^\circ/\text{K}$	$\leq 200 \Omega$	1	1
B2N85H-Q20L60-2LI2-H1151	1534032	$\pm 85^\circ$	$< 0.14^\circ$	$\pm 0.5^\circ$	$\pm 15^\circ$	$\leq \pm 0.025^\circ/\text{K}$	$0.03^\circ/\text{K}$	$\leq 200 \Omega$	1	1
Dual Axis – Analog Output, 0.1–4.9 V										
B2N10H-Q20L60-2LU3-H1151	1534006	$\pm 10^\circ$	$< 0.04^\circ$	$\pm 0.3^\circ$	$\pm 5^\circ$	$\leq \pm 0.05^\circ/\text{K}$	$0.01^\circ/\text{K}$	$\geq 40 \text{ k}\Omega$	1	1
B2N45H-Q20L60-2LU3-H1151	1534007	$\pm 45^\circ$	$< 0.1^\circ$	$\pm 0.5^\circ$	$\pm 15^\circ$	$\leq \pm 0.025^\circ/\text{K}$	$0.03^\circ/\text{K}$	$\geq 40 \text{ k}\Omega$	1	1
B2N45H-Q20L60-2LU3-H1151/S97	1534039	$\pm 45^\circ$	$< 0.1^\circ$	$\pm 0.5^\circ$	$\pm 15^\circ$	$\leq \pm 0.025^\circ/\text{K}$	$0.03^\circ/\text{K}$	$\geq 40 \text{ k}\Omega$	1	1
B2N60H-Q20L60-2LU3-H1151	1534008	$\pm 60^\circ$	$< 0.14^\circ$	$\pm 0.5^\circ$	$\pm 15^\circ$	$\leq \pm 0.025^\circ/\text{K}$	$0.03^\circ/\text{K}$	$\geq 40 \text{ k}\Omega$	1	1
B2N60H-Q20L60-2LU3/S97	1534060	$\pm 60^\circ$	$< 0.14^\circ$	$\pm 0.5^\circ$	$\pm 15^\circ$	$\leq \pm 0.025^\circ/\text{K}$	$0.03^\circ/\text{K}$	$\geq 40 \text{ k}\Omega$	1	1
B2N85H-Q20L60-2LU3-H1151	1534027	$\pm 85^\circ$	$< 0.14^\circ$	$\pm 0.5^\circ$	$\pm 15^\circ$	$\leq \pm 0.025^\circ/\text{K}$	$0.03^\circ/\text{K}$	$\geq 40 \text{ k}\Omega$	1	1
B2N85H-Q20L60-2LU3/S97	1534040	$\pm 85^\circ$	$< 0.14^\circ$	$\pm 0.5^\circ$	$\pm 15^\circ$	$\leq \pm 0.025^\circ/\text{K}$	$0.03^\circ/\text{K}$	$\geq 40 \text{ k}\Omega$	1	1
Dual Axis – Analog Output, Ratiometric 0.1-4.9 V @ 5 VDC										
B2N10H-Q20L60-2LU5-H1151	1534009	$\pm 10^\circ$	$< 0.04^\circ$	$\pm 0.3^\circ$	$\pm 5^\circ$	$\leq \pm 0.05^\circ/\text{K}$	$0.01^\circ/\text{K}$	$\geq 40 \text{ k}\Omega$	1	1
B2N45H-Q20L60-2LU5-H1151	1534010	$\pm 45^\circ$	$< 0.1^\circ$	$\pm 0.5^\circ$	$\pm 15^\circ$	$\leq \pm 0.025^\circ/\text{K}$	$0.03^\circ/\text{K}$	$\geq 40 \text{ k}\Omega$	1	1
B2N60H-Q20L60-2LU5-H1151	1534011	$\pm 60^\circ$	$< 0.14^\circ$	$\pm 0.5^\circ$	$\pm 15^\circ$	$\leq \pm 0.025^\circ/\text{K}$	$0.03^\circ/\text{K}$	$\geq 40 \text{ k}\Omega$	1	1
B2N85H-Q20L60-2LU5-H1151	1534042	$\pm 85^\circ$	$< 0.14^\circ$	$\pm 0.5^\circ$	$\pm 15^\circ$	$\leq \pm 0.025^\circ/\text{K}$	$0.03^\circ/\text{K}$	$\geq 40 \text{ k}\Omega$	1	1

Technical Specifications – Q20L60:

Voltage:	10-30 VDC / Ratiometric: 4.75-5.25 VDC
Protection:	IP68
Operating temperature:	-30 to +70 °C (-22 to +158 °F)
/S97 Option:	-40 to +70 °C (-40 to +158 °F)
Housing:	Polycarbonate
Shock resistance:	30 g (11 ms)
Vibration:	55 Hz (1 mm)
Repeatability:	$\leq 0.2\%$ of measuring range [A-B] $\leq 0.1\%$ after warm-up time of 0.5 h

Technical Specifications – Q42:

Voltage:	10-30 VDC
Protection:	IP68
Operating temperature:	-40 to +70 °C (-40 to +158 °F)
Housing:	PA12
Shock resistance:	30 g (11 ms)
Vibration:	55 Hz (1 mm)
Max. linear deviation:	$\pm 0.2^\circ$ (10° or 360°) / $\pm 0.3^\circ$ (45°) / $\pm 0.4^\circ$ (60°)
Baud rate:	10 kBit/s to 1 MBit/s
Interface:	CANopen