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 ±85° angle for dual axis models and 360° for single axis models.

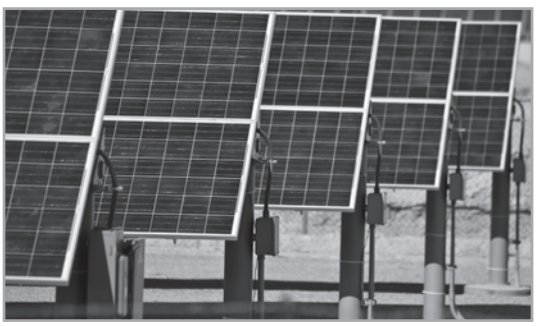


WHERE CAN I USE AN INCLINOMETER?

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









Inclinometers

Why Choose TURCK Inclinometers?

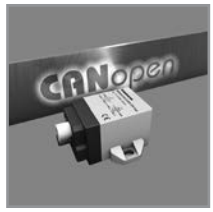
High Accuracy and Repeatability





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

Expanded Line

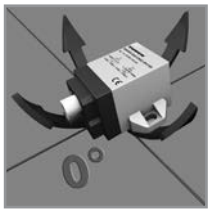




- Dual axis with analog voltage or current outputs measuring up to -85° to 85°.
- Single axis with analog voltage or current outputs measuring from 1 to 360° of travel.
- 360° Single axis with configurable dual PNP set points.
- CANopen interface now available in single axis or dual axis that can be 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

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 +70 °C to -25 °C (+158°F to -13°F), 1 hour dwell cycle

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 pendent.
- 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 ±10°, ±45°, ±60° and ±85°, with additional ranges optional. Each axis has independent outputs. The 5 VDC version is a ratiometric design and the power is limited to 4.75 to 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.

- ±10°, ±45°, ±60°, ±85°
- 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 ±15% with teach adapter VB2-SP4
- FM Class 1, 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	M1534012	±10°	< 0.04°	±0.3°	±5°	≤ ±0.05° K	0.01° /K	≤ 200 Ω	1	1
B2N45H-Q20L60-2LI2-H1151	M1534013	±45°	< 0.1°	±0.5°	±15°	≤ ±0.025° K	0.03° /K	≤ 200 Ω	1	1
B2N60H-Q20L60-2LI2-H1151	M1534014	±60°	< 0.14°	±0.5°	±15°	≤ ±0.025° K	0.03° /K	≤ 200 Ω	1	1
B2N60H-Q20L60-2LI2-H1151/S97	M1534046	±60°	< 0.14°	±0.5°	±15°	≤ ±0.025° K	0.03° /K	≤ 200 Ω	1	1
B2N85H-Q20L60-2LI2-H1151	M1534032	±85°	< 0.14°	±0.5°	±15°	≤ ±0.025° K	0.03° /K	≤ 200 Ω	1	1
Dual Axis – Analog Output, 0.1–4.9 V										
B2N10H-Q20L60-2LU3-H1151	M1534006	±10°	< 0.04°	±0.3°	±5°	≤ ±0.05° K	0.01° /K	≥ 40 kΩ	1	1
B2N45H-Q20L60-2LU3-H1151	M1534007	±45°	< 0.1°	±0.5°	±15°	≤ ±0.025° K	0.03° /K	≥ 40 kΩ	1	1
B2N45H-Q20L60-2LU3-H1151/S97	M1534039	±45°	< 0.1°	±0.5°	±15°	≤ ±0.025° K	0.03° /K	≥ 40 kΩ	1	1
B2N60H-Q20L60-2LU3-H1151	M1534008	±60°	< 0.14°	±0.5°	±15°	≤ ±0.025° K	0.03° /K	≥ 40 kΩ	1	1
B2N60H-Q20L60-2LU3/S97	M1534060	±60°	< 0.14°	±0.5°	±15°	≤ ±0.025° K	0.03° /K	≥ 40 kΩ	1	1
B2N85H-Q20L60-2LU3-H1151	M1534027	±85°	< 0.14°	±0.5°	±15°	≤ ±0.025° K	0.03° /K	≥ 40 kΩ	1	1
B2N85H-Q20L60-2LU3/S97	M1534040	±85°	< 0.14°	±0.5°	±15°	≤ ±0.025° K	0.03° /K	≥ 40 kΩ	1	1
Dual Axis – Analog Output, Ratiometric 0.1-4.9 V @ 5 VDC										
B2N10H-Q20L60-2LU5-H1151	M1534009	±10°	< 0.04°	±0.3°	±5°	≤ ±0.05° K	0.01° /K	≥ 40 kΩ	1	1
B2N45H-Q20L60-2LU5-H1151	M1534010	±45°	< 0.1°	±0.5°	±15°	≤ ±0.025° K	0.03° /K	≥ 40 kΩ	1	1
B2N60H-Q20L60-2LU5-H1151	M1534011	±60°	< 0.14°	±0.5°	±15°	≤ ±0.025° K	0.03° /K	≥ 40 kΩ	1	1
B2N85H-Q20L60-2LU5-H1151	M1534042	±85°	< 0.14°	±0.5°	±15°	≤ ±0.025° K	0.03° /K	≥ 40 kΩ	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:	≤ 0.2% of measuring range |A-B| ≤ 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:	±0.2°(10° or 360°) / ±0.3°(45°) / ±0.4°(60°)
Baud Rate:	10 kBit/s to 1 MBit/s
Interface:	CANopen

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Single Axis 360° with Analog Output

When a larger range is required or only one axis is necessary, the single axis 360° inclinometer has an adjustable measuring range and allows for programming a specified span within the 360°. The teach function is simple and can be done in seconds.



- Measuring range is adjustable via teach adapter VB2-SP4
- Current 4-20 mA output
- Voltage 0.1-4.9 V output
- Vertical mount only
- Factory default is 1° to 360°
- FM Class 1, Div 2 approved when used with Guard-Q20L60 and approved cordset.

Single Axis 360° with Two Discrete Switchpoints

This version has dual discrete outputs that are programmable as either normally open or normally closed with an adjustable span within the full angular range 0° to 360°.



- Two switchpoints (PNP, N.O. or N.C.), hysteresis, and span are all adjustable with teach adapter VB2-SP5
- Switch state indication by LEDs
- FM Class 1, Div 2 approved when used with Guard-Q20L60 and approved cordset.

Single and Dual Axis with CANopen Interface

A standard CANopen interface according to CiA DS-301/CiA DSP-410. All measured values and parameters are accessible via the object
directory (OD).



- Transmit data object (TPDO1) with four operating modes
- Service-data object (Standard-SDO)
- Error message via emergency object
- Monitoring functions Heartbeat as well as Nodeguarding/Lifeguarding
- Memory and recovery function of all parameters
- Indication of status and error via two color LED
- Setting of node ID as well as baud rate via object dictionary
- Freely configurable limit frequency (digital filter)
- Configuration of the minimal change of angle for TPDO1 send event
- Optional monitoring of internal device temperature

Part Number	ID Number	Angular Range	Resolution	Absolute Accuracy	Zero Point Calibration	Temperature Drift	Temperature Coefficient	Load Resistance	Dimensional Drawing	Wiring Diagram
Single Axis 360° – Analog Output, Adjustable Measuring Range 4–20 mA										
B1N360V-Q20L60-LI2-H1151	M1534045	360°	< 0.14°	±0.5°	N/A	N/A	0.03° /K	≤ 200 Ω	1	2
Single Axis 360° – Analog Output, Adjustable Measuring Range 0.1–4.9 V										
B1N360V-Q20L60-LU3-H1151	M1534044	360°	< 0.14°	±0.5°	N/A	N/A	0.03° /K	≤ 40 kΩ	1	2
Single Axis 360° – Digital Output, PNP, N.C./N.O. Programmable, Adjustable Switchpoints										
B1N360V-Q20L60-2UP6X3-H1151	M1534051	360°	< 0.14°	±0.5°	N/A	≤ ±0.03° K	0.03° /K	≤ 500 mA	1	3
Single Axis – Analog Output, CANopen Interface										
B1N360V-Q42-CNX2-2H1150	M1534065	360°	< 0.01°	±0.1°	N/A	N/A	0.008° /K	N/A	2	4
Dual Axis – Analog Output, CANopen Interface										
B2N10H-Q42-CNX2-2H1150	M1534061	±10°	≤ 0.05°	±0.1°	N/A	N/A	0.008° /K	N/A	2	4
B2N45H-Q42-CNX2-2H1150	M1534062	±45°	≤ 0.1°	±0.1°	N/A	N/A	0.008° /K	N/A	2	4
B2N60H-Q42-CNX2-2H1150	M1534063	±60°	≤ 0.1°	±0.1°	N/A	N/A	0.008° /K	N/A	2	4

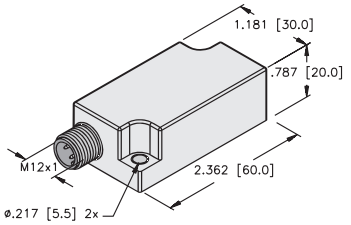
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Angular Position Technology

Dimensional Drawings

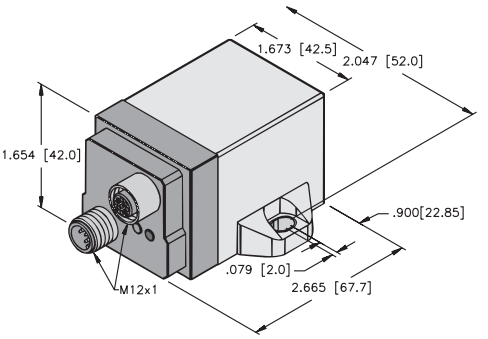
1

Q20L60 Housing



2

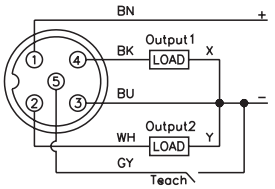
Q42 Housing



Wiring Diagrams

Diagram 1

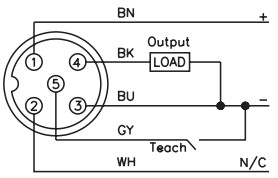
5-pin M12 ***eurofast***® connection



Mating cordset: **RK 4.5T-*/S618**
Teaching adapter: **VB2-SP4**

Diagram 2

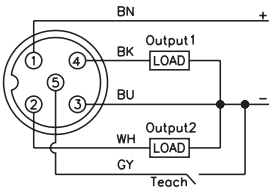
4-pin M12 ***eurofast***® connection



Mating cordset: **RK 4.5T-*/S618**
Teaching adapter: **VB2-SP4**

Diagram 3

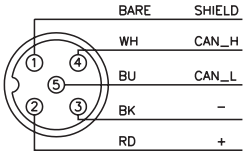
5-pin M12 ***eurofast***® connection



Mating cordset: **RK 4.5T-*/S618**
Teaching adapter: **VB2-SP5**

Diagram 4

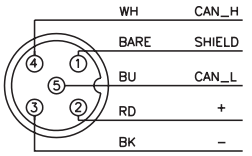
5-pin M12 ***eurofast***® connection



Male

Mating cordset: **RKC 572-*M**

5-pin M12 ***eurofast***® connection



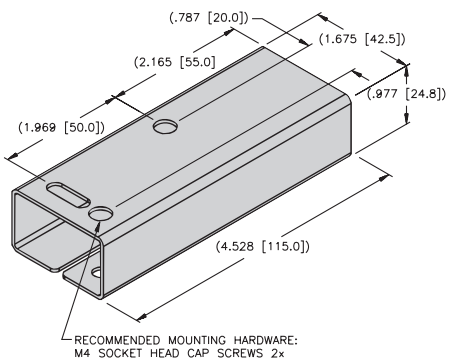
Female

Mating cordset: **RSC 572-*M**

* Length in meters. Standard cable lengths are 2, 5, 10 and 15 meters. Consult factory for other lengths.

Accessories

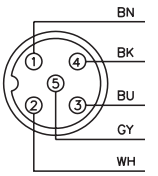
Guard - Q20L60, required for use with an inclinometer to maintain FM approval in a Class 1, Div 2 environment





Wiring Diagram

5-pin M12 ***eurofast***® connection



Mating cordset: **P-RKG 5.64T-1877-***
Recommended mating cordset for use in FM Class 1, Div 2 environment