TURCK

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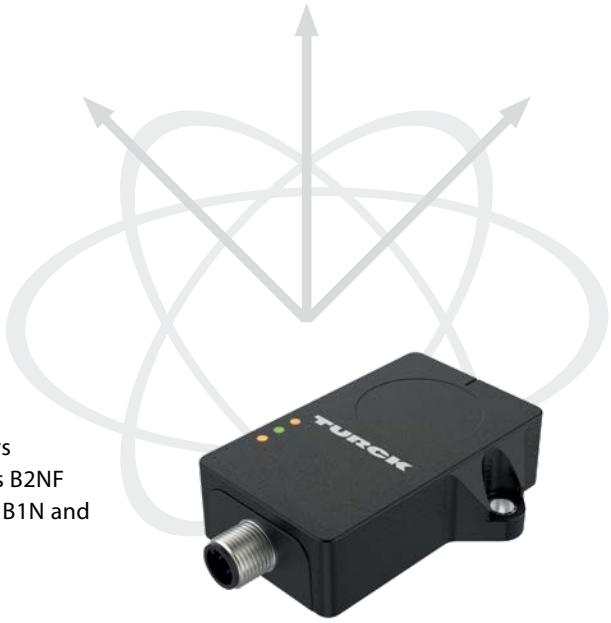
B1N(F)-QR20 | B2N(F)-QR20
Static and Dynamic Inclinometers





Products are linked with further information.

Inclinometers — MEMS and Gyroscope Combined



With its new generation of inclinometers, Turck has combined the MEMS acceleration measurement method with gyroscope technology, so that shocks and vibrations can be suppressed much more effectively than with conventional signal filtering. In this way, the B1NF and B2NF single- and two-axis inclinometers achieve state-of-the-art dynamics, allowing them to be used even in very fast control loops on moving or vibrating machines.

The devices are suitable, for positioning and compensation applications or for dancer arm control in the textile, printing or packaging industry as well as for tilt angle monitoring on construction vehicles, harvesters, excavators, cranes, etc. Turck offers the single-axis B1NF and dual-axis B2NF for dynamic applications, and the B1N and B2N for static applications.

Product highlights

- Combined MEMS and gyroscope sensor signal for highly dynamic detection
- Easy installation and commissioning thanks to the LED spirit level function
- Shock-proof up to 200 g
- Fast IO-Link COM3 interface, current or voltage output, CANopen interface or PNP/NPN switching output
- Thanks to the use of translucent plastics for the LED display, there is no need for LED lenses that are susceptible to water ingress
- High temperature range of -40…85 °C
- High Protection degree IP68/IP69K
- Protection against salt spray and rapid temperature change
- Connector, M12 × 1

The extremely robust IP68/69K sensors output their signals either via a CANopen interface, analog outputs, two switching outputs or IO-Link COM3, the latest and fastest version of the digital interface. IO-Link also allows convenient adaptation to the required application. Plus, additional information such as the operating hours of the sensor or its ambient temperature can be queried for condition monitoring applications.

The spirit level function facilitates the installation of the devices. For this, an LED uses a flashing frequency to indicate when the sensor is positioned horizontally. The use of translucent plastics for the LED display eliminates LED lenses as a potential weak point in the housing.

The versions with a CANopen interface and analog output feature special protection that is particularly beneficial in mobile power supply networks with alternators. Energy-intensive voltage spikes in the power supply network often pose a major challenge in such applications. In such cases, the devices are equipped with protective circuits that ensure the continuous, reliable operation of the sensors even under demanding environmental conditions. This ensures smooth operation starting at a supply voltage of 8V.

- Increased interference immunity: 100V/m acc. to ISO 11452-2, 200mA acc. to ISO 11452-4
- Protection against conducted interference acc. to ISO 7637-2, Severity Level 4, as well as load dump protection acc. to ISO 16750-2 for 12V/24V systems
- E1 type approval by the Federal Motor Transport Authority
- Supply voltage from 8…36 VDC



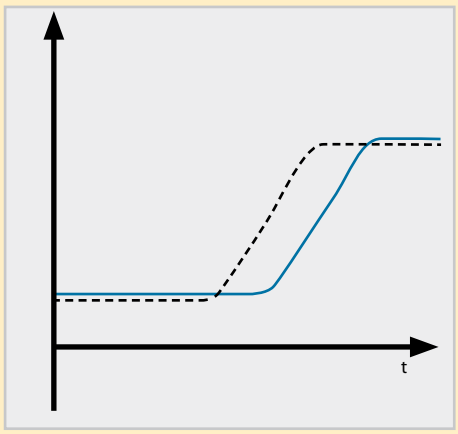
Innovative measuring principle
The inclinometers combine acceleration measurement with gyroscope technology. This means that the impact of interfering accelerations can be effectively suppressed, so that the sensor outputs a precise, fast and robust signal even in dynamic applications.



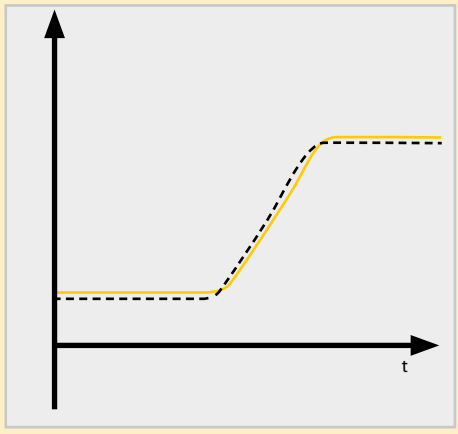
Maintenance-free operation
Robust and sealed housings with protection class IP68/IP69K and a high shock resistance of 200 g as well as a wide temperature range of -40 °C…+85 °C allow maintenance-free operation even in demanding environments

A comparison of static and dynamic sensors

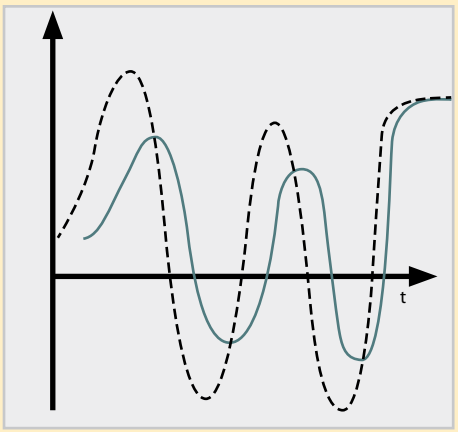
Acceleration measuring cell (static)

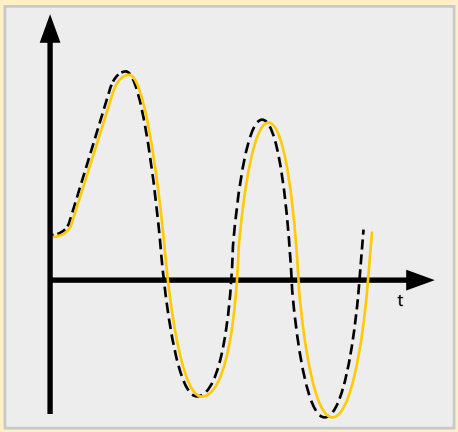


Sensor fusion (dynamic)



- Actual movement
- Inclination angle derived from acceleration measurement: The filter suppresses interference but delays the output signal
- Inclination angle derived from a fusion of gyroscope and acceleration measurements: fast response and precise angle outputs





- Actual movement
- Angle of inclination for fast movements from acceleration measurement: filter suppresses interference, but delays the output signal
- Inclination angle for fast movements by fusion of gyroscope signal and acceleration measurement: fast response and precise angle output



Easy commissioning
The spirit level makes it easier to install the devices. An LED indicates when the sensor is level by changing its flashing frequency.



Wide range of output variants
In addition to the classic design with analog output, sensors with PNP/NPN switching outputs as well as with IO-Link or CANopen interfaces complete the product portfolio. This also includes devices for use in zones 2 or 22.

Extensive parameterization options

The TAS (TURCK Automation Suite) service tool offers extensive parameterization options. Settings such as filter parameters and the start and end points of the inclination angle measurement can be specified. In addition, the sensor's zero point can be adjusted using the installation orientation. Use either TAS or EasyTeach—simply bridge between Pin 1 and Pin 5. This significantly simplifies commissioning.

Innovative operating principle

A major advantage of inclinometers is their ease of use and fast commissioning. Using inclinometers gives a large degree of freedom in the design, which makes them extremely attractive. The sensors do not require a separate positioning element, and the mechanical coupling usually required for rotary encoders from the rotating machine part to the encoder shaft is no longer necessary. This minimizes sources of error, which also benefits system availability

Inclinometers usually use acceleration measuring cells to calculate the inclination angle. Earth gravity is used as a reference. When the sensor is tilted, it detects a change in acceleration, which serves as a measure for the tilt angle calculation.

In dynamic applications, other influences often occur in addition to acceleration due to vibrations, shocks or starting and braking moments. Average value filters are usually used, which reduce the influence of noise accelerations, but slow the signal and cannot detect fast movements.

The dynamic inclinometers not only use an acceleration measuring cell for angle determination, but also a gyroscope sensor. An intelligent fusion algorithm based on the acceleration data and the rotation rate values significantly reduces the effects of vibrations or interfering accelerations. This allows the sensor to output a precise, fast and robust signal even in moving, dynamic applications

The QR20 inclinometer family – The right solution for every need

Dynamic sensors
- Fusion of gyroscope data and acceleration
- Analog, CANopen, IO-Link, -parameterizable switching outputs

Static inclinometers
- Analog, CANopen, IO-Link, and -parameterizable switching outputs

Static applications
- 1 switching output with a fixed switching window
- Replaces simple liquid or ball switches



Resilience in mobile networks
The CANopen and analog output versions feature special protection against voltage spikes in vehicle electrical systems with alternators, enable operation in 12-V power supply systems, and have E1 type approval from the Federal Motor Transport Authority.

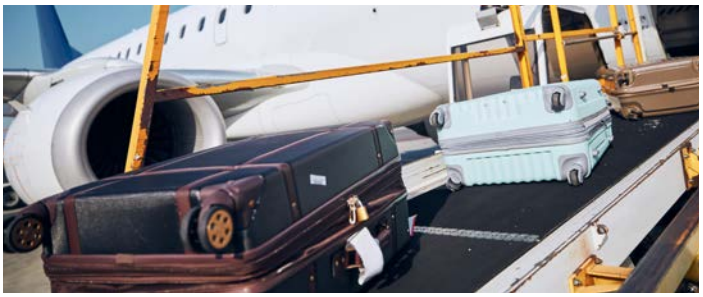


Accessories
For harsh operating environments exposed to impact from falling rocks, the GUARD-QR20 stainless steel protective housing reliably protects the sensor. The MAGKIT-QR20 magnetic mounting kit also allows for tool-free installation.

Application Examples



Tracking solar panels to follow the Sun's position



Baggage conveyor belt positioning in baggage handling



Inclination measurement on the bucket, boom, and undercarriage for optimal control



Perfect alignment of the cab thanks to dynamic inclinometers



End-of-travel detection for roll-off dump trucks



Simple web tension regulation via dancer arm control in paper and textile machines

Data for mobile machines
Dynamic inclinometers with a CANopen interface provide not only the inclination angle but also acceleration and gyroscope readings across three axes. This data supports applications such as collision detection and navigation.

Flexible parameterization
The TAS (TURCK Automation Suite) service tool offers extensive parameterization options: Filter settings as well as the start and end points of the inclination angle measurement can be defined. The sensor's zero-point calibration relative to its mounting position can be performed either via TAS or via EasyTeach.

Inclinometers – Static applications

ID	Type designation	Measuring range	
Analog			
100053372	B1N360V-QR20-2LU4X3LD-H1151	1-axis, 0 to 360°	Analog output: 0.5…4.5 V; Supply voltage: 8…30 V
100053374	B2N10H-QR20-2LU4X3LD-H1151	2-axis, ±10°	Analog output: 0.5…4.5 V; Supply voltage: 8…30 V
100053375	B2N25H-QR20-2LU4X3LD-H1151	2-axis, ±25°	Analog output: 0.5…4.5 V; Supply voltage: 8…30 V
100053376	B2N45H-QR20-2LU4X3LD-H1151	2-axis, ±45°	Analog output: 0.5…4.5 V; Supply voltage: 8…30 V
100053377	B2N60H-QR20-2LU4X3LD-H1151	2-axis, ±60°	Analog output: 0.5…4.5 V; Supply voltage: 8…30 V
100053378	B2N85H-QR20-2LU4X3LD-H1151	2-axis, ±85°	Analog output: 0.5…4.5 V; Supply voltage: 8…30 V
100055182	B1N360V-QR20-2LUX3LD-H1151	1-axis, 0 to 360°	Analog output: 0…10 V; Supply voltage: 10…30 V
100055195	B2N10H-QR20-2LUX3LD-H1151	2-axis, ±10°	Analog output: 0…10 V; Supply voltage: 10…30 V
100055196	B2N25H-QR20-2LUX3LD-H1151	2-axis, ±25°	Analog output: 0…10 V; Supply voltage: 10…30 V
100055197	B2N45H-QR20-2LUX3LD-H1151	2-axis, ±45°	Analog output: 0…10 V; Supply voltage: 10…30 V
100055198	B2N60H-QR20-2LUX3LD-H1151	2-axis, ±60°	Analog output: 0…10 V; Supply voltage: 10…30 V
100055199	B2N85H-QR20-2LUX3LD-H1151	2-axis, ±85°	Analog output: 0…10 V; Supply voltage: 10…30 V
100051196	B1N360V-QR20-2LI2X3-H1151/3GD	1-axis, 0 to 360°	Analog output: 4…20 mA; Supply voltage: 15…30 V; for zones 2 and 22
100055180	B1N360V-QR20-2LI2X3LD-H1151	1-axis, 0 to 360°	Analog output: 4…20 mA; Supply voltage: 10…30 V
100055184	B2N10H-QR20-2LI2X3LD-H1151	2-axis, ±10°	Analog output: 4…20 mA; Supply voltage: 10…30 V
100055185	B2N25H-QR20-2LI2X3LD-H1151	2-axis, ±25°	Analog output: 4…20 mA; Supply voltage: 10…30 V
100055186	B2N45H-QR20-2LI2X3LD-H1151	2-axis, ±45°	Analog output: 4…20 mA; Supply voltage: 10…30 V
100052452	B2N45H-QR20-2LI2X3-H1151/3GD	2-axis, ±45°	Analog output: 4…20 mA; Supply voltage: 15…30 V; for zones 2 and 22
100055187	B2N60H-QR20-2LI2X3LD-H1151	2-axis, ±60°	Analog output: 4…20 mA; Supply voltage: 10…30 V
100055188	B2N85H-QR20-2LI2X3LD-H1151	2-axis, ±85°	Analog output: 4…20 mA; Supply voltage: 10…30 V
CANopen			
100046427	B1N360V-QR20-CNX4-2H1150	1-axis, 0 to 360°	CANopen; Bus in, Bus out; Supply voltage: 8…36 V
100046429	B2N85H-QR20-CNX4-2H1150	2-axis, ±85°	CANopen; Bus in, Bus out; Supply voltage: 8…36 V
100046441	B1N360V-QR20-CNX4-H1150	1-axis, 0 to 360°	CANopen; Bus in; Supply voltage: 8…36 V
100046443	B2N85H-QR20-CNX4-H1150	2-axis, ±85°	CANopen; bus input; supply voltage: 8…36 V
IO-Link			
100025084	B1N360V-QR20-IOLX3-H1141	1-axis, 0 to 360°	IO-Link; Supply voltage: 18…30 V
100025086	B2N85H-QR20-IOLX3-H1141	2-axis, ±85°	IO-Link; supply voltage: 18…30 V
2 x PNP/NPN switching outputs, parameterizable			
100026933	B1N360V-QR20-2UPN6X3-H1141	1-axis, 0 to 360°	2 freely parameterizable switching windows; supply voltage: 10…30 V
100052453	B1N360V-QR20-2UPN6X3-H1141/3GD	1-axis, 0 to 360°	2 freely parameterizable switching windows; supply voltage: 10…30 V, for zones 2 and 22
100026934	B2N85H-QR20-2UPN6X3-H1141	2-axis, ±85°	2 freely parameterizable switching windows; supply voltage: 10…30 V

Products are linked with further information.

Inclinometers – Dynamic applications, fusion of accelerometer and gyroscope data

ID	Type designation	Measuring range	
Analog			
100053373	B1NF360V-QR20-2LU4X3LD-H1151	1-axis, 0 to 360°	Analog output: 0.5…4.5 V; Supply voltage: 8…30 V
100053379	B2NF10H-QR20-2LU4X3LD-H1151	2-axis, ±10°	Analog output: 0.5…4.5 V; Supply voltage: 8…30 V
100053381	B2NF25H-QR20-2LU4X3LD-H1151	2-axis, ±25°	Analog output: 0.5…4.5 V; Supply voltage: 8…30 V
100053401	B2NF45H-QR20-2LU4X3LD-H1151	2-axis, ±45°	Analog output: 0.5…4.5 V; Supply voltage: 8…30 V
100053402	B2NF60H-QR20-2LU4X3LD-H1151	2-axis, ±60°	Analog output: 0.5…4.5 V; Supply voltage: 8…30 V
100053260	B2NF85H-QR20-2LU4X3LD-H1151	2-axis, ±85°	Analog output: 0.5…4.5 V; Supply voltage: 8…30 V
100055183	B1NF360V-QR20-2LUX3LD-H1151	1-axis, 0 to 360°	Analog output: 0…10 V; Supply voltage: 10…30 V
100055205	B2NF10H-QR20-2LUX3LD-H1151	2-axis, ±10°	Analog output: 0…10 V; Supply voltage: 10…30 V
100055206	B2NF25H-QR20-2LUX3LD-H1151	2-axis, ±25°	Analog output: 0…10 V; Supply voltage: 10…30 V
100055207	B2NF45H-QR20-2LUX3LD-H1151	2-axis, ±45°	Analog output: 0…10 V; Supply voltage: 10…30 V
100055208	B2NF60H-QR20-2LUX3LD-H1151	2-axis, ±60°	Analog output: 0…10 V; Supply voltage: 10…30 V
100055209	B2NF85H-QR20-2LUX3LD-H1151	2-axis, ±85°	Analog output: 0…10 V; Supply voltage: 10…30 V
100055181	B1NF360V-QR20-2LI2X3LD-H1151	1-axis, 0 to 360°	Analog output: 4…20 mA; Supply voltage: 10…30 V
100055200	B2NF10H-QR20-2LI2X3LD-H1151	2-axis, ±10°	Analog output: 4…20 mA; Supply voltage: 10…30 V
100055201	B2NF25H-QR20-2LI2X3LD-H1151	2-axis, ±25°	Analog output: 4…20 mA; Supply voltage: 10…30 V
100055202	B2NF45H-QR20-2LI2X3LD-H1151	2-axis, ±45°	Analog output: 4…20 mA; Supply voltage: 10…30 V
100055203	B2NF60H-QR20-2LI2X3LD-H1151	2-axis, ±60°	Analog output: 4…20 mA; Supply voltage: 10…30 V
100055204	B2NF85H-QR20-2LI2X3LD-H1151	2-axis, ±85°	Analog output: 4…20 mA; Supply voltage: 10…30 V
CANopen			
100046428	B1NF360V-QR20-CNX4-2H1150	1-axis, 0 to 360°	CANopen; Bus in, Bus out; Supply voltage: 8…36 V
100046440	B2NF85H-QR20-CNX4-2H1150	2-axis, ±85°	CANopen; Bus in, Bus out; Supply voltage: 8…36 V
100046442	B1NF360V-QR20-CNX4-H1150	1-axis, 0 to 360°	CANopen; Bus in; Supply voltage: 8…36 V
100046444	B2NF85H-QR20-CNX4-H1150	2-axis, ±85°	CANopen; bus input; supply voltage: 8…36 V
IO-Link			
100020900	B1NF360V-QR20-IOLX3-H1141	1-axis, 0 to 360°	IO-Link; Supply voltage: 18…30 V
100020901	B2NF85H-QR20-IOLX3-H1141	2-axis, ±85°	IO-Link; supply voltage: 18…30 V
2 x PNP/NPN switching outputs, parameterizable			
100026931	B1NF360V-QR20-2UPN6X3-H1141	1-axis, 0 to 360°	2 freely parameterizable switching windows; supply voltage: 10…30 V
100026932	B2NF85H-QR20-2UPN6X3-H1141	2-axis, ±85°	2 freely parameterizable switching windows; supply voltage: 10…30 V

Products are linked with further information.

Types and Data

Inclinometers – Static application, 1 PNP switching output

ID	Type designation	Measuring range	
100052883	B1N180V-QR20-UP6-H1141	1-axis, Switching window 0…180°	Supply voltage 10…30 V

Accessories

ID	Type designation	
100027185	GUARD-QR20	Stainless steel protective housing for QR20 inclinometers to protect against mechanical impact
100029224	AP-Q20L60-QR20	Adapter plate for mounting the QR20 housing with mounting holes for the Q20L60 housing
100051844	MAGKIT-QR20	Mounting magnet for installing the QR20 housing; suitable for vibration sensors and inclinometers
6825482	USB-2-IOL-0002	IO-Link master with integrated USB interface for easy parameterization of inclinometers with analog and digital outputs
6625005	RKC5.301T-1.5-RSC4T/TXL320	Adapter cable for connecting the inclinometer with analog outputs to the USB-2-IOL-0002 parameterization unit
6967114	TX1-Q20L60	Teach adapter for easy measurement range parameterization or zero-point setting via Easy Teach

Products are linked with further information.