



SAFETY TORQUE SENSORS

CUSTOM TORQUE SENSOR FOR INTEGRATED AND IMPROVED FUNCTIONAL SAFETY IN COLLABORATIVE ROBOTS

High Functional Safety

TE Connectivity's (TE) safety torque sensor has been designed to meet functional safety requirements up to ISO13849 Category 4 PL e thanks to two electrically segregated channels with no common cause failure. In addition, high overload capability helps prevent device failure.

Low Susceptibility to Cross Loads

Our safety torque sensor has been primarily designed for collaborative robot applications and to be assembled on Harmonic Drive gear boxes that result in highly complex stress state. The sensor design is then optimized to reduce axial, radial load and tilting moment susceptibility providing increased accuracy.

Customizable Mechanical Interface

Systems like robots require highly integrated components and our safety torque sensor is available with customized mechanical interfaces. The basic concept of the sensor is always the same (low profile sensor with overall height lower than 20mm) but it can be easily adapted in terms of size and sensing range to meet customer application requirements. If needed, the sensor can be used as a sealing wall to seal a gear box.

Digital I²C Electrical Interface

The standard electrical interface is an I²C serial digital interface with 400kHz communication rate allowing ease of integration. Other electrical interfaces may be designed to fit with customer requirements.

Innovative Microfused Technology

Microfused technology eliminates age-sensitive organic epoxies used in traditional load cell designs, thus providing excellent long-term span and zero stability because potential problems with resin ageing are avoided.

Strain gages are bonded to the mechanical part using innovative Microfused technology from TE. This technology is based on micromachining silicon piezo-resistive strain gages and fusing them in a high-temperature glass-bonding process to a high-performance stainless-steel substrate. This very mature and reliable process has delivered millions of force sensors, which are well proven.

APPLICATIONS

- Collaborative robot joints for functional safety
- Low profile sensor for integration in various industrial systems requiring safe torque control

SPECIFICATIONS

Torque range	From 20Nm to 500Nm (14.7 ft-lbf to 369 ft-lbf)
Dimension	Outer diameter: from 65mm (2.56in) minimum to 140mm (5.51in) typically (smallest diameters are limited by torque transmission capabilities). Overall height: 20mm (0.79in) typ.
Materials	High strength stainless steel (17-4PH) or Titanium (Ti-6Al-4V) housing and FR4 PCB.
Mass	Depending on interface requirements and material, typical value for 100 Nm (73.7 ft-lbf) range is less than 200 gr (0.4 lb).
Overload	±300% of nominal torque range.
Structural torque	±500% of nominal torque range.
Stiffness	25 000 Nm/rad (18 400 F ft-lbf/rad) minimum
Non-Linearity	±0.25%FS maximum.
Hysteresis	±0.25%FS maximum.
Resolution	0.025%FS maximum.
Temperature	0°C to +85°C compensated range. -40°C to +105°C operating range.
Overall accuracy	±1.5%FS typ. including Non-linearity, Hysteresis, Span setting and Thermal drifts. (Sensor may also be provided with uncompensated span and thermal drifts, in this case temperature output is provided in addition to torque output and calibration data are available through an internal EEPROM).
Channel difference	±2%FS typ. including Non-linearity, Hysteresis, Span setting and thermal drifts. (Sensor may also be provided with uncompensated span and thermal drifts, in this case temperature output is provided in addition to torque output and calibration data are available through an internal EEPROM).
Cross loads susceptibility	100N (22.5 lbf) axial load: ±0.2%FS typ. 100N (22.5 lbf) Radial load: ±0.2%FS typ. 1%FS tilting moment: ±0.2%FS typ.
Power supply	5 Vdc ± 0.15 Vdc typ.
Current consumption	< 10 mA per channel.
Electrical interface	I ² C or SPI serial digital interface.

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Digital output	16 Bit output register.
Bandwidth	1000 Hz minimum.
Communication rate	I ² C: 400 kHz maximum / SPI: 20 MHz maximum.
Environmental spec. capability	Vibration, shock, temperature, humidity acc. to EN 60068. EMC (ESD, radiated field immunity, surge immunity) acc. to EN 61000-4.

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