DATA SHEET

vibro-meter®

TQ902 / TQ912, EA902 and IQS900 proximity measurement chain



TQ902 (standard mount) and IQS900

KEY FEATURES AND BENEFITS

- From the vibro-meter® product line
- Non-contact measurement based on eddy-current principle
- Available in standard versions and Ex versions certified for use in hazardous areas (potentially explosive atmospheres)
- Conforms to API 670 5th edition
- 1, 5 and 10 m chains
- Temperature-compensated design
- Voltage output or current output with protection against short circuits
- Current-signal transmission over distances up to 1 km
- Frequency response: DC to 20 kHz (−3 dB)
- Linear measurement range: 2 or 4 mm
- Temperature range (sensor): −40 to 180 °C

KEY FEATURES AND FEATURES *(continued)*

- Optional diagnostic circuitry detects sensor, cabling and/or signal conditioner problems
- Suitable for use in functional safety contexts: SIL 2 in accordance with IEC 61508 and PL c Cat 1 in accordance with ISO 13849
- IQS900: Removable screw-terminal connectors and DIN-rail mounting

APPLICATIONS

- Shaft relative vibration and gap/position measurement chains for machinery protection and/or condition monitoring
- Ideal for use with VM600 and/or VibroSmart® machinery monitoring systems
- API 670 applications
- Safety-related applications
- Speed (tachometer) sensor/measurement chain for overspeed detection system (ODS) applications

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DESCRIPTION

Introduction

The TQ902/TQ912, EA902 and IQS900 form proximity measurement chains, from Meggitt's vibro-meter® product line.

TQ9xx-based proximity measurement chains allow contactless measurement of the relative displacement of moving machine elements, and provide an output signal proportional to the distance between the sensor tip and the target. Accordingly, these measurement chains are ideally suited for measuring the relative vibration and axial position of rotating machine shafts, such as those found in steam, gas and hydraulic turbines, as well as in alternators, turbo-compressors and pumps.

A TQ9xx-based proximity measurement chain consists of a TQ9xx proximity sensor, an optional EA90x extension cable and an IQS900 signal conditioner, configured for a particular industrial application. The EA90x extension cable is used to effectively lengthen the front-end, as required. Together, these form a calibrated proximity measurement chain in which each component is interchangeable.

The IQS900 signal conditioner is a versatile and configurable device that performs all required signal processing and generates the output signal (current or voltage) for input to a machinery monitoring system such as a VM600 or VibroSmart®. In addition, the IQS900 supports optional diagnostic circuitry (that is, built-in self-test (BIST)) that automatically detects and remotely indicates problems with a measurement chain.

TQ902/TQ912 sensors and cabling

The active part of a TQ9xx proximity sensor is a coil of wire that is moulded inside the tip of the device, made of PPS (polyphenylene sulfide), a high-performance, high-temperature engineering thermoplastic. The sensor body is made of stainless steel. The target material must, in all cases, be metallic.

The TQ902 and TQ912 proximity sensors are essentially the same except that the TQ902 is for standard-mount and the TQ912 is for reverse-mount applications. Both sensor bodies are available with metric or imperial threads and have an integral coaxial cable terminated with a self-locking miniature coaxial connector.
A TQ9xx sensor's integral cable and the EA90x extension cables are available in various lengths, which can be combined to obtain a particular total system length (TSL) for an application.

Optional interconnection protectors (IP172), junction boxes (JB118) and other housings are available for the mechanical and environmental protection of the connection between a TQ9xx sensor's integral cable and an EA90x extension cable.

IQS900 signal conditioner

The IQS900 signal conditioner contains a high-frequency modulator/demodulator that supplies a driving signal to a TQ9xx sensor. This generates an electromagnetic field in the tip of the senor, which generates eddy-currents in the metallic target. When the target moves, the eddy-currents change, which causes a change in the electrical characteristics of the TQ9xx that the signal conditioner converts into a signal that is proportional to the distance to the target.

The IQS900's output is an analogue signal consisting of a dynamic component (AC) that corresponds to the measured vibration (displacement) and a quasi-static component (DC) that corresponds to the measured gap. The output can be configured as a current or a voltage signal, suitable for transmission to a monitoring system via current (2-wire) or voltage (3-wire) transmission cables, respectively.

For an IQS900 signal conditioner with optional diagnostics, the quasi-static DC component also functions as a diagnostic indicator. That is, the IQS900's diagnostic circuitry continuously checks the integrity of the measurement chain and will drive the measurement/diagnostic component (DC) outside of its normal operating range to indicate a problem with the sensor, the cabling and/or the signal conditioner itself.

For test purposes, the IQS900 includes a "raw" voltage output signal and a test input signal that allow the measurement chain/system operation to be tested in situ, thereby simplifying commissioning and troubleshooting.

DESCRIPTION *(continued)*

Application information

An IQS900 signal conditioner with diagnostics automatically and remotely indicates the health/status of a TQ9xx-based measurement chain so you always know when measurements can be trusted. This helps to ensure that machinery is operated safely and reliably, extending its life and reducing costs.

Equally important, TQ9xx-based measurement chains using an IQS900 with diagnostics are SIL 2 "by design" so they bring enhanced reliability and significant risk reduction, making them suitable for use in safety-related applications (functional safety contexts).

Further, TQ9xx-based measurement chains are form, fit and functionally equivalent replacements that match or better the outstanding performance of TQ4xx-based measurement chains. Each component is interchangeable, so existing TQ4xx-based proximity measurement chains can be quickly and easily replaced or upgraded. For example, an IQS900 signal conditioner without diagnostics is a direct replacement for an IQS45x in most TQ4xx-based measurement chains.

Note: A TQ9xx-based measurement chain using an IQS900 configured with a current output and a GSI127 galvanic separation unit, allows transmission over distances up to 1 km – longer than any other solution.

For specific applications, contact your local Meggitt representative.

SPECIFICATIONS

Overall proximity measurement chain

Operation

Sensitivity

- Ordering option code B21 : 8 mV/µm (203.2 mV/mil)
- Ordering option code B22 : 2.5 µA/µm (63.5 µA/mil)
- Ordering option code B23 : 4 mV/µm (101.6 mV/mil)
- Ordering option code B24 : 1.25 µA/µm (31.75 µA/mil)

Linear measurement range (typical)

- Ordering option code B21 : 0.15 to 2.15 mm, corresponding to a −1.6 to −17.6 V output
- Ordering option code B22 : 0.15 to 2.15 mm, corresponding to a −15.5 to −20.5 mA output
- Ordering option code B23 : 0.3 to 4.3 mm, corresponding to a −1.6 to −17.6 V output
- Ordering option code B24 : 0.3 to 4.3 mm, corresponding to a −15.5 to −20.5 mA output

Linearity : See **Performance curves on page 6 and on page 7**

Frequency response : DC to 20 kHz (−3 dB)

Interchangeability of elements : All components in chain are interchangeable

SPECIFICATIONS *(continued)*

System (chain) calibration

Calibration temperature	: +23°C ±5°C
Target material	: VCL 140 steel (1.7225)

Note: For applications using a non-standard or special target material, performance curves can be generated and supplied. Contact Meggitt SA for further information.

Total system (chain) length

The total system length (TSL) is the sum of the length of the TQ9xx sensor's integral cable and the length of the EA90x extension cable. For TQ902/TQ912, EA902 and IQS900 proximity measurement chains, the supported TSLs are obtained from the following different combinations of cables.

Total system (chain) lengths

- 1 m : 1.0 m integral cable with no extension cable
- 5 m : 0.5 m integral cable + 4.5 m extension cable.
  1.0 m integral cable + 4.0 m extension cable.
  1.5 m integral cable + 3.5 m extension cable.
  2.0 m integral cable + 3.0 m extension cable.
  5.0 m integral cable with no extension cable.
- 10 m : 0.5 m integral cable + 9.5 m extension cable.
  1.0 m integral cable + 9.0 m extension cable.
  1.5 m integral cable + 8.5 m extension cable.
  2.0 m integral cable + 8.0 m extension cable.
  5.0 m integral cable + 5.0 m extension cable.
  10.0 m integral cable with no extension cable.

Note: The combination of cables selected for a particular total system (chain) length depends on the application. For example, to obtain the optimum location for the separation between the integral and extension cables or to eliminate the requirement for an extension cable.

Total system (chain) length trimming

Due to the characteristics of the coaxial cable, an "electrical trimming" of the nominal length of extension cables is necessary to optimize the system performance and the sensor interchangeability.

TSL for a 1 m measurement chain	: 0.9 m min.
TSL for a 5 m measurement chain	: 4.4 m min.
TSL for a 10 m measurement chain	: 8.8 m min.

In-situ test support

Raw output	: The raw output (RAW/COM) provides a "raw" voltage output signal that corresponds to the internal signals of the IQS900 signal conditioner, even if the IQS900 is configured with a current output. This allows the measurement chain/system operation from sensor to signal conditioner to be easily verified in situ.
Test input	: The test input (TEST/COM) allows a voltage input signal to be injected at the input to the IQS900 signal conditioner in order to test the IQS900 itself and/or cabling to the monitoring system. This allows the measurement chain/system operation from signal conditioner to monitoring system to be easily verified in situ.

Note: See **Connectors on page 10** and refer to the *Proximity measurement chains using TQ9xx proximity sensors installation manual* for further information

SPECIFICATIONS *(continued)*

TQ902 and TQ912 proximity sensors and EA902 extension cable

General

Sensor input requirements	: High-frequency power source from an IQS900 signal conditioner

Environmental

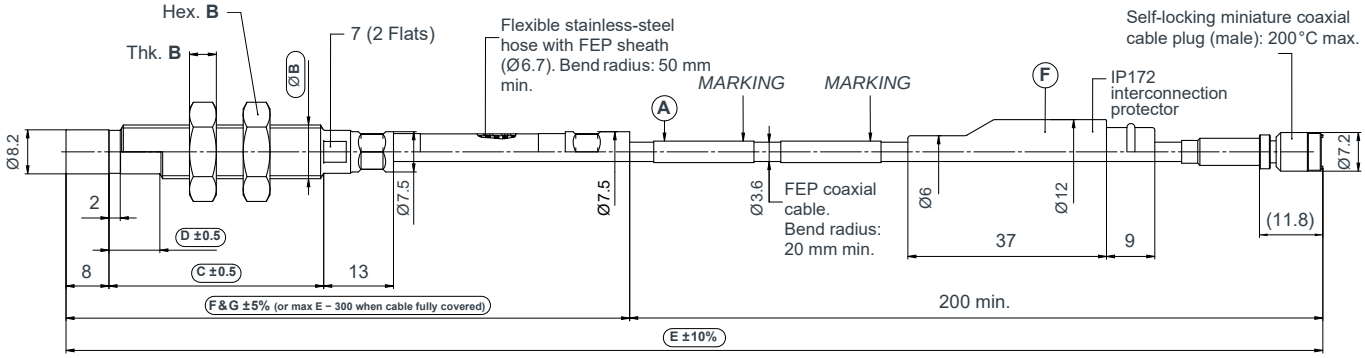
Temperature range	
• Sensor	: −40 to 180°C (−40 to 356°F) operating. 180 to 220°C (356 to 428°F) short-term survival for 2 hours max.
• Sensor and cabling	: **Temperature for use in an Ex Zone: *pending***
• Cabling, connector and optional protection	: −40 to 200°C (−40 to 392°F)
Measurement drift	
• Sensor and cabling with a total system (chain) length of 1, 5 or 10 m	: <5% for −40 to 180°C (−40 to 356°F)
Pressure	
• Sensor	: 6 bar (100 psid) between sensor tip and body
Humidity	
• Sensor and integral cable assembly	: 0 to 95%, non-condensing. 100% max., condensing (not submerged).
Protection rating (according to IEC 60529)	: The head of the sensor (sensor tip and integral cable) is rated IP68
Vibration (according to IEC 60068-2-26)	: 5 g peak between 10 and 500 Hz
Shock acceleration (according to IEC 60068-2-27)	: 15 g peak (half sine-wave, 11 ms duration)

Physical characteristics

Sensor construction	: Wire coil Ø8 mm, PPS (polyphenylene sulfide) high-performance thermoplastic tip, crimped to a stainless-steel body (AISI 316L)
Integral and extension cables	: FEP covered 70 Ω coaxial cable, Ø3.6 mm
Connectors	: Self-locking miniature coaxial connectors. Note: When connecting, these should be hand-tightened until locked.
Optional protection	
• Flexible stainless-steel hose (protection tube) with FEP sheath (extruded fluorinated ethylene propylene)	: The combination of stainless-steel hose with FEP sheath provides sealed (leak-tight) mechanical and electrically insulated protection. Note: The FEP sheath also provides resistance to almost all chemicals and low permeability to liquids, gases and moisture, while being flexible, low friction and mechanically tough.

MECHANICAL DRAWINGS AND ORDERING INFORMATION

TQ902 proximity sensor



Ordering number:

111 - 902 - 000 - 011 - A B C D E F G H

Environment (A)	
Standard	1
Explosive (Ex)	5

Hex.	Thk.	Body thread (B)	
17	5	M10 × 1	1
22	7	M14 × 1.5	2
24	8	M16 × 1.5	3
9/16″	7/32″	3/8″-24UNF	6
15/16″	3/8″	5/8″-18UNF	7
3/4″	5/16″	1/2″-20UNF	8

Body length (C)	
Each 1 mm, from 20 to 250 mm	
20 mm min.	20
250 mm max.	250

Unthreaded length (D)	
Each 1 mm, from 2 to 230 mm	
2 mm min.	2
230 mm max.	230

Integral cable length (E)	
500 mm ±50 mm	500
1000 mm ±100 mm	1000
1500 mm ±150 mm	1500
2000 mm ±200 mm	2000
5000 mm ±500 mm	5000
10000 mm ±1000 mm	10000

Optional protection (F) [1]		
	Cable	Connector
0	None	None
2	Flexible hose with FEP sheath	None
4	Movable flexible hose with FEP sheath	None
5	None	IP172
7	Flexible hose with FEP sheath	IP172
9	Movable flexible hose with FEP sheath	IP172

Flexible hose length (G) [1]	
Each 100 mm, from 0 to 9800 mm. G min. = C + 100 mm.	
0	None
100	100 mm min.
9800	9800 mm max.

Total system length (H)	
01	1 m
05	5 m
10	10 m

Notes
All dimensions are in mm (in) unless otherwise stated.
1. When optional protection such as a flexible stainless-steel hose with FEP sheath is ordered:
   Flexible hose length (G) min. = 100 mm.
   Flexible hose length (G) max. = Integral cable length (E) − 200 mm, for an integral cable that is protected to the maximum extent possible (“cable fully covered”).