

DATA SHEET

vibro-meter®

TQ423, EA403 and IQS450 proximity measurement system



KEY FEATURES AND BENEFITS

- From the vibro-meter® product line
- Non-contact measurement system based on eddy-current principle
- Ex certified versions for use in hazardous areas (potentially explosive atmospheres)
- TQ423 withstands up to 100 bar
- 5 and 10 m systems
- Temperature-compensated design
- Voltage or current output with protection against short circuits
- Frequency response: DC to 20 kHz (-3 dB)
- Measurement range: 12 mm
- Temperature range: -25 to +140 °C

APPLICATIONS

- Shaft relative vibration and gap/position measurement chains for machinery protection and/or condition monitoring
- Ideal for use with VM600^{Mk2}/VM600 and VibroSmart® machinery monitoring systems
- High-pressure applications

DESCRIPTION

The TQ423, EA403 and IQS450 form a proximity measurement system from Meggitt's vibro-meter® product line. This proximity measurement system allows contactless measurement of the relative displacement of moving machine elements.

TQ4xx-based proximity measurement systems are particularly suitable 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.



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DESCRIPTION (continued)

The system is based around a TQ423 non-contact sensor and an IQS450 signal conditioner. Together, these form a calibrated proximity measurement system in which each component is interchangeable. The system outputs a voltage or a current proportional to the distance between the transducer tip and the target, such as a machine shaft.

The TQ423 is specially designed for high-pressure applications, with the transducer tip withstanding pressures of up to 100 bar. This makes them particularly suitable for measuring relative displacement or vibration on submerged pumps and various types of hydraulic turbines (for example, Kaplan and Francis). This transducer is also suitable for use when the region of the output of the transducer is cluttered.

The active part of the transducer is a coil of wire that is moulded inside the tip of the device, made of PEEK (polyetheretherketone). The transducer body is made of stainless steel. The target material must, in all cases, be metallic.

The transducer body is available only with metric thread. The TQ423 has an integral coaxial cable, terminated with a self-locking miniature coaxial

connector. Various cable lengths (integral and extension) can be ordered.

The IQS450 signal conditioner contains a high-frequency modulator/demodulator that supplies a driving signal to the transducer. This generates the necessary electromagnetic field used to measure the gap. The conditioner circuitry is made of high-quality components and is mounted in an aluminium extrusion.

The TQ423 transducer can be matched with a single EA403 extension cable to effectively lengthen the front-end. Optional housings, junction boxes and interconnection protectors are available for the mechanical and environmental protection of the connection between the integral and extension cables.

TQ4xx-based proximity measurement systems can be powered by associated machinery monitoring systems such as VM600^{Mk2}/VM600 modules (cards) or VibroSmart[®] modules, or by another power supply.

For specific applications, contact your local Meggitt representative.

SPECIFICATIONS

Overall proximity measurement system

Operation

Sensitivity

- Ordering option B31 : 1.33 mV/ μ m (34 mV/mil)
- Ordering option B32 : 0.417 μ A/ μ m (10.6 μ A/mil)

Linear measurement range (typical)

- Ordering option B31 : 0.15 to 12.15 mm, corresponding to a -1.6 to -17.6 V output
- Ordering option B32 : 0.15 to 12.15 mm, corresponding to a -15.5 to -20.5 mA output

Linearity : See **Performance curves on page 5**

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

Interchangeability of elements : All components in system are interchangeable

SPECIFICATIONS *(continued)*

Environmental

Potentially explosive atmospheres

Available in Ex approved versions for use in hazardous locations

| Type of protection Ex i: intrinsic safety (ordering option A2) | | |
|---|-----------------------------------|--|
| Europe | EC type examination certificate | LCIE 11 ATEX 3091 X II 1G (Zones 0, 1, 2) Ex ia IIC T6...T3 Ga |
| International | IECEX certificate of conformity | IECEX LCI 11.0061X Ex ia IIC T6...T3 Ga |
| North America | cCSAus certificate of compliance | cCSAus 1514309 Class I, Divisions 1 and 2, Groups A, B, C, D Ex ia |
| South Korea | KGS certificate of conformity | KGS 15-GA4BO-0664X Ex ia IIC T6 to T3 |
| Russian Federation | EAЭC RU certificate of conformity | EAЭC RU C-CH.AΔ07.B.03003/21 0Ex ia IIC T6...T3 Ga X |

| Type of protection Ex nA: non-sparking (ordering option A3) | | |
|--|--|--|
| Europe | Voluntary type examination certificate | LCIE 11 ATEX 1010 X II 3G (Zone 2) Ex nA II T6...T3 Gc |
| International | IECEX certificate of conformity | IECEX LCI 11.0063X Ex nA II T6...T3 Gc |
| North America | cCSAus certificate of compliance | cCSAus 1514309 Class I, Division 2, Groups A, B, C, D |
| Russian Federation | EAЭC RU certificate of conformity** | EAЭC RU C-CH.AΔ07.B.03003/21 2Ex nA II T6...T3 Gc X |

*Not engraved/marked on the products.

**Not engraved/marked on all products.

-  **For specific parameters of the mode of protection concerned and special conditions for safe use, refer to the Ex certificates that are available from Meggitt SA.**
-  **When using protection mode “Ex nA” (non-sparking), the user must ensure that the signal conditioner is installed in an industrial housing or enclosure that ensures a protection rating of at least IP54 (or equivalent).**
-  **For the most recent information on the Ex certifications that are applicable to this product, refer to the Ex product register (PL-1511) document that is available from Meggitt SA.**

SPECIFICATIONS *(continued)*

Approvals

| | |
|--|---|
| Conformity | : CE marking, European Union (EU) declaration of conformity. EAC marking, Eurasian Customs Union (EACU) certificate/ declaration of conformity. |
| Electromagnetic compatibility | : EN 61000-6-2:2005. EN 61000-6-4:2007 + A1:2011. TR CU 020/2011. |
| Electrical safety | : EN 61010-1:2010 |
| Environmental management | : RoHS compliant (2011/65/EU) |
| Hazardous areas | : Ex approved versions (see Potentially explosive atmospheres on page 3) |
| Russian federal agency for technical regulation and metrology (Rosstandart) | : Pattern approval certificate No 60859-15 |

System calibration

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

Note: If special calibration is required, please define the alloy precisely or supply a sample of alloy (minimum: Ø60 mm / 1 cm thick) according to Meggitt SA drawing number PZ 7009/1.

Total system length

The total system length (TSL) is the sum of the length of the TQ4xx transducer's integral cable and the length of the EA40x extension cable. The supported TSLs can be obtained from different combinations of cables.

Total system lengths

| | |
|--------|--|
| • 5 m | : 1.0 m integral cable + 4.0 m extension cable. 5.0 m integral cable with no extension cable. |
| • 10 m | : 1.0 m integral cable + 9.0 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 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 length trimming

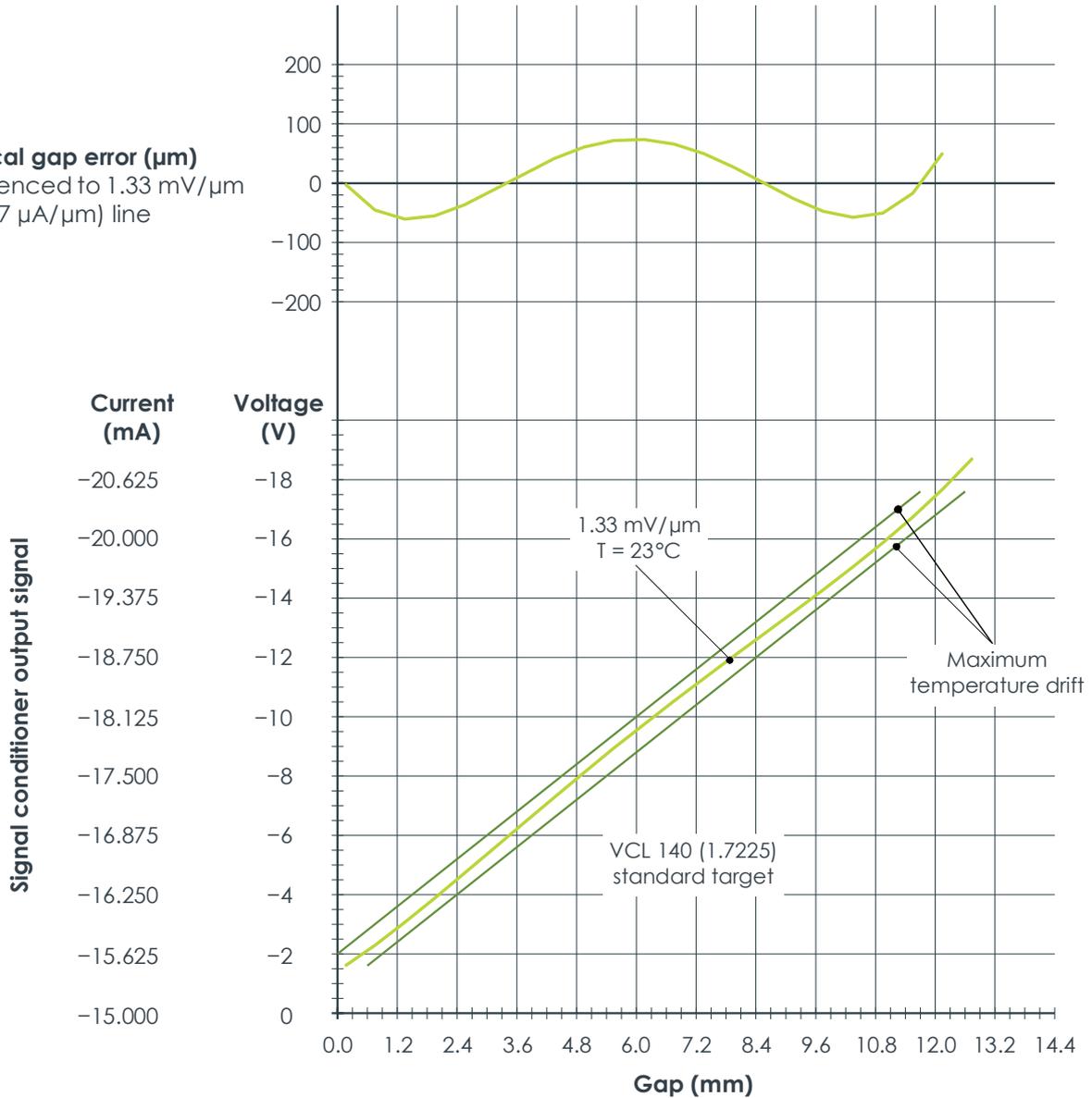
Due to the characteristics of the coaxial cable, an "electrical trimming" of the nominal length of extension cables is necessary to optimize the system performance and the transducer interchangeability.

| | |
|----------------------------------|-----------------|
| TSL for a 5 m measurement chain | : 4.4 m minimum |
| TSL for a 10 m measurement chain | : 8.8 m minimum |

SPECIFICATIONS (continued)

Performance curves for TQ423 with IQS450

Typical gap error (μm)
referenced to 1.33 mV/ μm
(0.417 $\mu\text{A}/\mu\text{m}$) line



Proximity transducer: TQ423
Signal conditioner: IQS450
Standard target material: VCL 140 (1.7225)
Equivalent materials: A 37.11 (1.0065), AFNOR 40 CD4, AISI 4140

SPECIFICATIONS *(continued)*

TQ423 proximity transducer and EA403 extension cable

General

Transducer input requirements : High-frequency power source from an IQS450 signal conditioner

Environmental

Temperature ranges

- Transducer : -25 to +140°C with drift <5%
- Transducer and cable : **-40 to +195°C if used in an Ex Zone**
- Cable and connector : -40 to +200°C

Maximum pressures

- Transducer tip : 100 bar
- Transducer/cable assembly : 10 bar (with flexible hose option).
1 bar (without flexible hose option).

Protection rating (according to IEC 60529) : The head of the proximity transducer (transducer 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

Transducer construction : Wire coil Ø18 mm, PEEK (polyetheretherketone) tip, encapsulated in stainless steel body (1.4435) with high-temperature epoxy glue

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) : The stainless steel hose of the TQ423 provides additional mechanical protection and is leak-tight. The stainless steel hose of the EA403 provides additional mechanical protection but is not leak-tight.
- FEP sheath (extruded fluorinated ethylene propylene) : The FEP sheath of the EA403 provides resistance to almost all chemicals and low permeability to liquids, gases and moisture. It is also flexible, low friction and mechanically tough.

SPECIFICATIONS *(continued)*

IQS450 signal conditioner

Output

Voltage output, 3-wire configuration

- Voltage at min. gap : -1.6 V
- Voltage at max. gap : -17.6 V
- Dynamic range : 16 V
- Output impedance : 500 Ω
- Short-circuit current : 45 mA

Current output, 2-wire configuration

- Current at min. gap : -15.5 mA
- Current at max. gap : -20.5 mA
- Dynamic range : 5 mA

Output capacitance : 1 nF

Output inductance : 100 μH

Supply

Voltage output, 3-wire configuration

- Voltage : -20 to -32 V*
- Current : -13 mA ± 1 mA (-25 mA max.)

Current output, 2-wire configuration

- Voltage : -20 to -32 V*
- Current : -15.5 to -20.5 mA

Supply input capacitance : 1 nF

Supply input inductance : 100 μH

Environmental

Temperature ranges

- Operating : -35 to +85°C*
- Storage : -40 to +85°C

Humidity : 95% max. non-condensing.
100% condensing (not submerged).

Protection rating : IP40
(according to IEC 60529)

Vibration : 2 g peak between 10 and 55 Hz
(according to IEC 60068-2-26)

Shock acceleration : 15 g peak (half sine-wave, 11 ms duration)
(according to IEC 60068-2-27)

Physical characteristics

Construction material : Injection-moulded aluminium

Mounting : Two or four M4 screws

Dimensions : See **Mechanical drawings and ordering information on page 11**

*See **Thermal considerations on page 8.**

SPECIFICATIONS *(continued)*

Electrical connections

- Input : Self-locking miniature coaxial connector (female).
Note: When connecting, this should be hand-tightened, until locked.
- Output and power supply : Three screw terminals – wire section 2.5 mm² max.

Weight

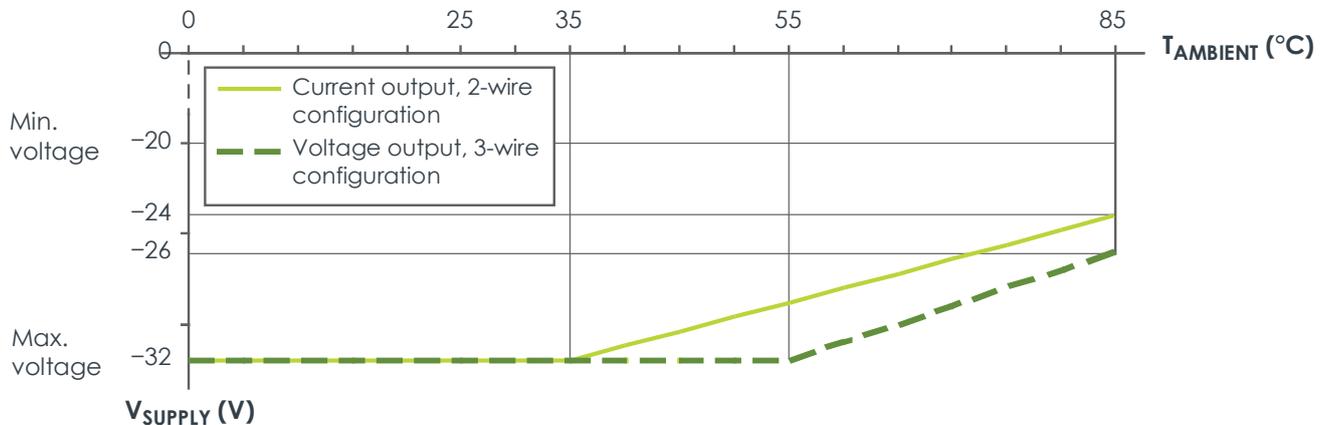
- Standard version : 140 g approx.
Ex version : 220 g approx.

Signal conditioner with MA130 mounting adaptor (ordering option I1)

- Universal DIN rail holder type : TSH 35
DIN rail type : TH 35-7.5 and TH 35-15
(according to EN 50022 / IEC 60715)
Dimensions : See **Accessories on page 12**

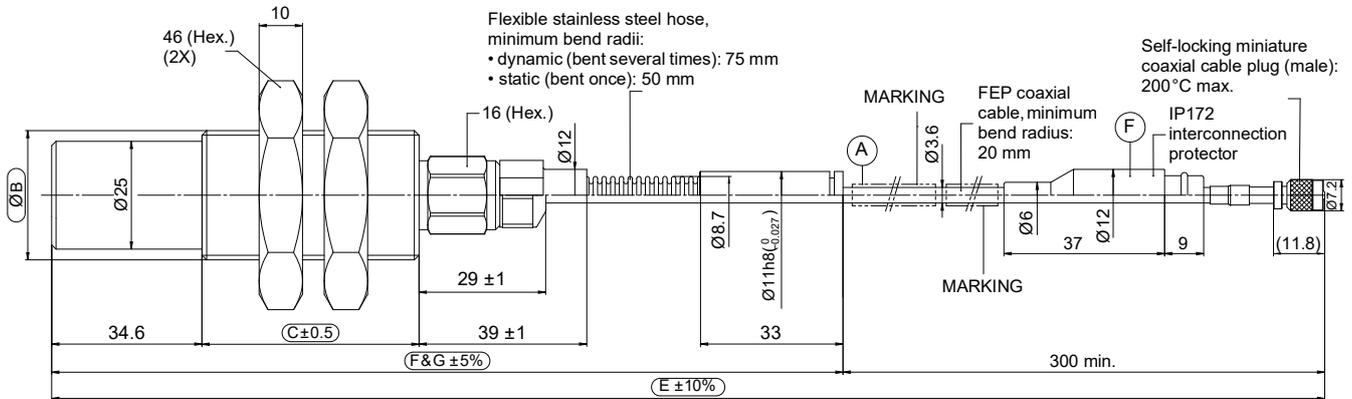
Thermal considerations

The IQS450 signal conditioner will operate at ambient temperatures as high as 85°C, but to do so, it requires derating of the maximum input voltage. The IQS450 must operate between the minimum supply voltage and the maximum supply voltage, as shown on the following graph.



MECHANICAL DRAWINGS AND ORDERING INFORMATION

TQ423 proximity transducer



Ordering number:

111 - 423 - 000 - 013



| Environment (A) | |
|-----------------|---|
| Standard | 1 |
| Explosive Ex i | 2 |
| Explosive Ex nA | 3 |

| Body thread (B) | |
|-----------------|---|
| M30 x 1.5 | 1 |

| Body length (C) | |
|-----------------|-----|
| 50 mm | 050 |
| 86 mm | 086 |
| 120 mm | 120 |
| 150 mm | 150 |
| 180 mm | 180 |

| Integral cable length (E) | |
|---------------------------|-----|
| 1 m | 010 |
| 5 m | 050 |
| 10 m | 100 |

| Optional protection (F) | | |
|-------------------------|-----------|---|
| Cable | Connector | |
| None | None | 0 |
| Flexible hose | None | 1 |
| None | IP172 | 5 |
| Flexible hose | IP172 | 6 |

| Total system length (H) | |
|-------------------------|------|
| See note 1 | |
| 05 | 5 m |
| 10 | 10 m |

| Flexible hose length (G) | |
|--------------------------|-------------------------|
| 000 | None |
| 010 | For 1 m integral cable |
| 050 | For 5 m integral cable |
| 100 | For 10 m integral cable |

Notes

All dimensions are in mm unless otherwise stated.

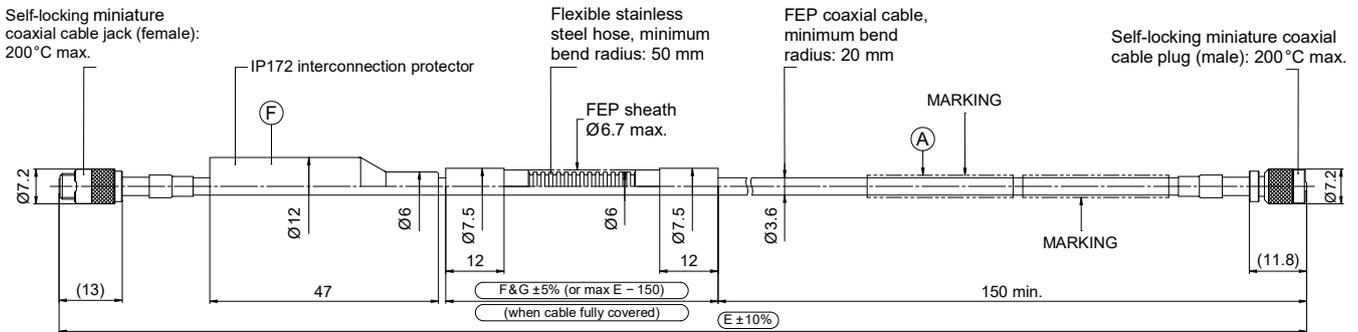
1. The Total system length (H) = TQ423 integral cable length (E) + EA403 extension cable length.

For information on combining integral and extension cables to obtain a particular total system length, see

Total system length on page 4. For information on cable length tolerances, see **Total system length trimming on page 4.**

MECHANICAL DRAWINGS AND ORDERING INFORMATION (continued)

EA403 extension cable



Ordering number: 913 - 403 - 000 - 013 - **A** - **E** - **F** - **G**

| Environment (A) | |
|-----------------|---|
| Standard | 1 |
| Explosive Ex i | 2 |
| Explosive Ex nA | 3 |

| Extension cable length (E) See note 1 | |
|--|-----|
| 4.0 m ±400 mm | 040 |
| 5.0 m ±500 mm | 050 |
| 9.0 m ±900 mm | 090 |

| Flexible hose length (G) | |
|-----------------------------|------------|
| Each 0.1 m, from 0 to 8.8 m | |
| 000 | None |
| 001 | 0.1 m min. |
| 088 | 8.8 m max. |

| Optional protection (F) See note 2 | | |
|---------------------------------------|-----------|---|
| Cable | Connector | |
| None | None | 0 |
| Flexible hose | None | 1 |
| Flexible hose with FEP sheath | None | 2 |
| None | IP172 | 5 |
| Flexible hose | IP172 | 6 |
| Flexible hose with FEP sheath | IP172 | 7 |

Notes

All dimensions are in mm unless otherwise stated.

1. The total system length = TQ423 integral cable length + EA403 extension cable length (E).

For information on combining integral and extension cables to obtain a particular total system length, see

Total system length on page 4. For information on cable length tolerances, see **Total system length trimming on page 4.**

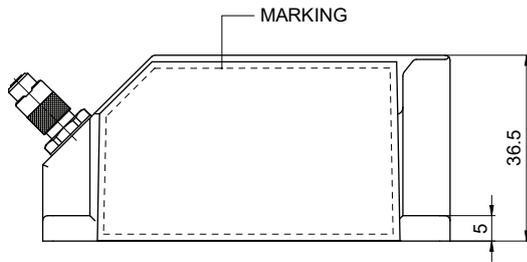
2. When optional protection such as a flexible stainless steel hose with or without an FEP sheath is ordered:

Flexible hose length (G) max. = EA403 extension cable length (E) - 150 mm, for an extension cable that is protected to the maximum extent possible ("cable fully covered").

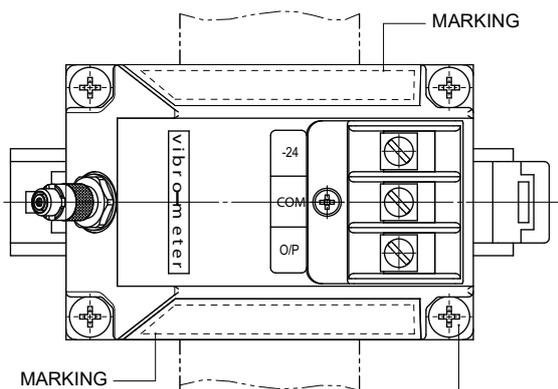
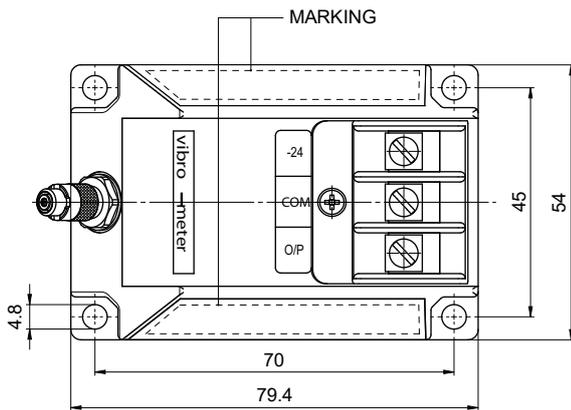
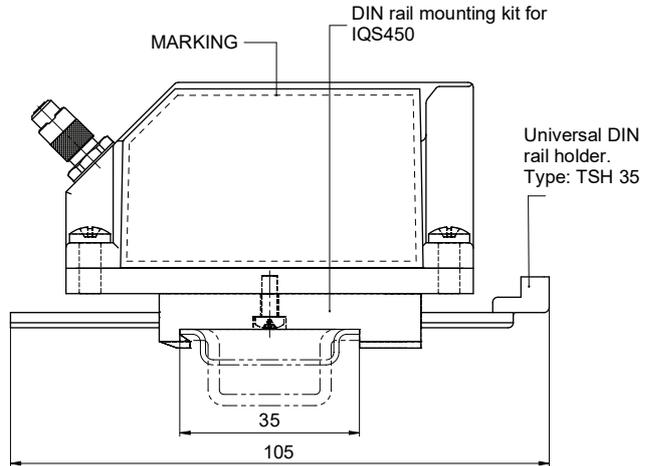
MECHANICAL DRAWINGS AND ORDERING INFORMATION (continued)

IQS450 signal conditioner

Signal conditioner only
(ordering option I0)



Signal conditioner
with MA130 mounting adaptor
(ordering option I1)



Note: All dimensions are in mm unless otherwise stated.

Self-tapping cross-head (Phillips) screws:
Type: WN 1411, KA40x10
Mounting torque: 0.6 N•m

Ordering number: 204 - 450 - 000 - 002 - A - B - H - I

| Environment (A) | |
|-----------------|---|
| Standard | 1 |
| Explosive Ex i | 2 |
| Explosive Ex nA | 3 |

| Measurement range | Sensitivity (B) | |
|-------------------|-----------------|----|
| 12 mm | 1.33 mV/μm | 31 |
| | 0.417 μA/μm | 32 |

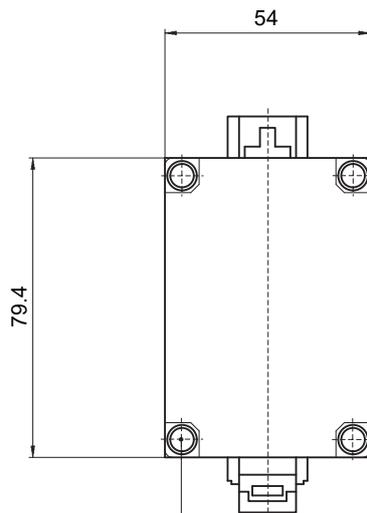
| Installation (I) | |
|------------------|--|
| 0 | Signal conditioner only |
| 1 | Signal conditioner assembled on MA130 mounting adaptor |

| Total system length (H) | |
|-------------------------|------|
| 05 | 5 m |
| 10 | 10 m |

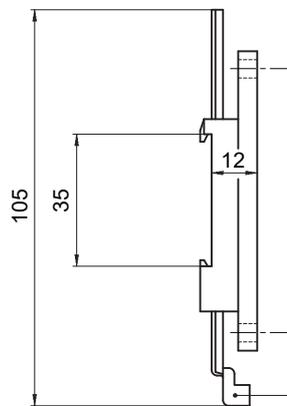
ACCESSORIES

| | | |
|--------|----------------------------|--------------------------------------|
| ABA17x | Industrial housings | : Refer to corresponding data sheets |
| IP172 | Interconnection protection | : Refer to corresponding data sheet |
| JB118 | Junction box | : Refer to corresponding data sheet |
| KS107 | Flexible conduit | : Refer to corresponding data sheet |
| MA130 | Mounting adaptor | : See below |
| SG1xx | Cable feedthroughs | : Refer to corresponding data sheets |

MA130 mounting adaptor (for IQS450)



Holes for self-tapping cross-head (Phillips) screws:
Type: WN 1411, KA40 × 10
Mounting torque: 0.6 N•m
Quantity: 4 screws supplied



Universal DIN rail holder:
Type: TSH 35
Compatibility: TH 35-7.5
and TH 35-35
DIN rails

Note: All dimensions are in mm unless otherwise stated.

Ordering number (PNR): 809-130-000-011

RELATED PRODUCTS

| | | |
|-------------------------------|--|-------------------------------------|
| TQ401, EA401 and IQS450 | Proximity measurement system (2 mm measurement range) | : Refer to corresponding data sheet |
| TQ402/TQ412, EA402 and IQS450 | Proximity measurement system (2 or 4 mm measurement range) | : Refer to corresponding data sheet |
| TQ403, EA403 and IQS450 | Proximity measurement system (12 mm measurement range) | : Refer to corresponding data sheet |
| TQ422/TQ432, EA402 and IQS450 | Proximity measurement system (2 or 4 mm measurement range, high-pressure applications) | : Refer to corresponding data sheet |
| TQ442, EA402 and IQS450 | Proximity measurement system (2 or 4 mm measurement range, right-angle (90°) mount) | : Refer to corresponding data sheet |

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