

## TQ 402 & TQ 412 / EA 402 / IQS 452

### Proximity System : TQ 402 & TQ 412 Proximity Transducers EA 402 Extension Cable IQS 452 Signal Conditioner

#### FEATURES

- Non-contacting measurement system based on eddy current principle
- Certified for use in potentially explosive atmospheres
- TQ 402 conforms to API 670 recommendations
- 5 m and 10 m systems
- Temperature compensated system
- Voltage or current output with protection against short circuits

#### CHARACTERISTICS

- Measuring range:  
2 mm or 4 mm
- Transducer temperature range:  
-40°C to +180°C
- Sensitivity:  
4 mV/μm or 8 mV/μm  
1.25 μA/μm or 2.5 μA/μm
- Frequency response:  
DC to 20 kHz (-3 dB)



## DESCRIPTION

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This proximity system allows contactless measurement of the relative displacement of moving machine elements. It is 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.

The system is based around a TQ 402 or TQ 412 non-contacting transducer and its matching IQS 452 signal conditioner. Together, these form a calibrated proximity system in which each component is interchangeable. The system outputs a voltage or current proportional to the distance between the transducer tip and the target (e.g. machine shaft).

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

The transducer body is available with metric or English thread. The TQ 412 version is intended for reverse-mount applications. The TQ 402/412 has an integral coaxial cable, terminated with an AMP-type connector. Various cable lengths (integral and extension) may be ordered.

The IQS 452 signal conditioner contains an HF 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 TQ 402/412 transducer can be matched with a single EA 402 extension cable. Optional junction boxes and housings offer mechanical protection of the integral and extension cable connectors.

The proximity system is powered by associated processor modules or a rack power supply.

## SPECIFICATIONS

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### Overall Proximity System

#### OPERATION

Sensitivity

- *Using IQS 452 Version 0XX* : 4 mV/ $\mu$ m (100 mV/mil)
- *Using IQS 452 Version 1XX* : 1.25  $\mu$ A/ $\mu$ m (31.2  $\mu$ A/mil)
- *Using IQS 452 Version 2XX* : 8 mV/ $\mu$ m (200 mV/mil)
- *Using IQS 452 Version 3XX* : 2.5  $\mu$ A/ $\mu$ m (62.5  $\mu$ A/mil)

Linear measuring range (typical)

- *Using IQS 452 Version 2XX or IQS 452 Version 3XX* : 0.15 - 2.15 mm, corresponding to  
-1.6 V to -17.6 V output using IQS 452 Version 2XX  
15.5 mA to 20.5 mA output using IQS 452 Version 3XX
- *Using IQS 452 Version 0XX or IQS 452 Version 1XX* : 0.3 - 4.3 mm, corresponding to  
-1.6 V to -17.6 V output using IQS 452 Version 0XX  
15.5 mA to 20.5 mA output using IQS 452 Version 1XX

Linearity : See system performance curves

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

Interchangeability of elements : All components in system are interchangeable

## SPECIFICATIONS *(Continued)*

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### ENVIRONMENTAL

Use in explosive atmospheres

- *EC type examination certificate* : LCIE 02 ATEX 6086 X II 2 G (Zones 1, 2) EEx ib IIC T6 to T3



For specific parameters of the mode of protection concerned and special conditions for safe use, please refer to the "EC type examination certificate" that is available from Vibro-Meter SA on demand.

- *CSA standard* : Certificate 1514309 (LR 62075-5),  
Class I, Divisions 1 and 2, Groups A, B, C and D Ex ia

### 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 (min. Ø 50 mm / 1 cm thick)

### TOTAL SYSTEM LENGTH (TSL)

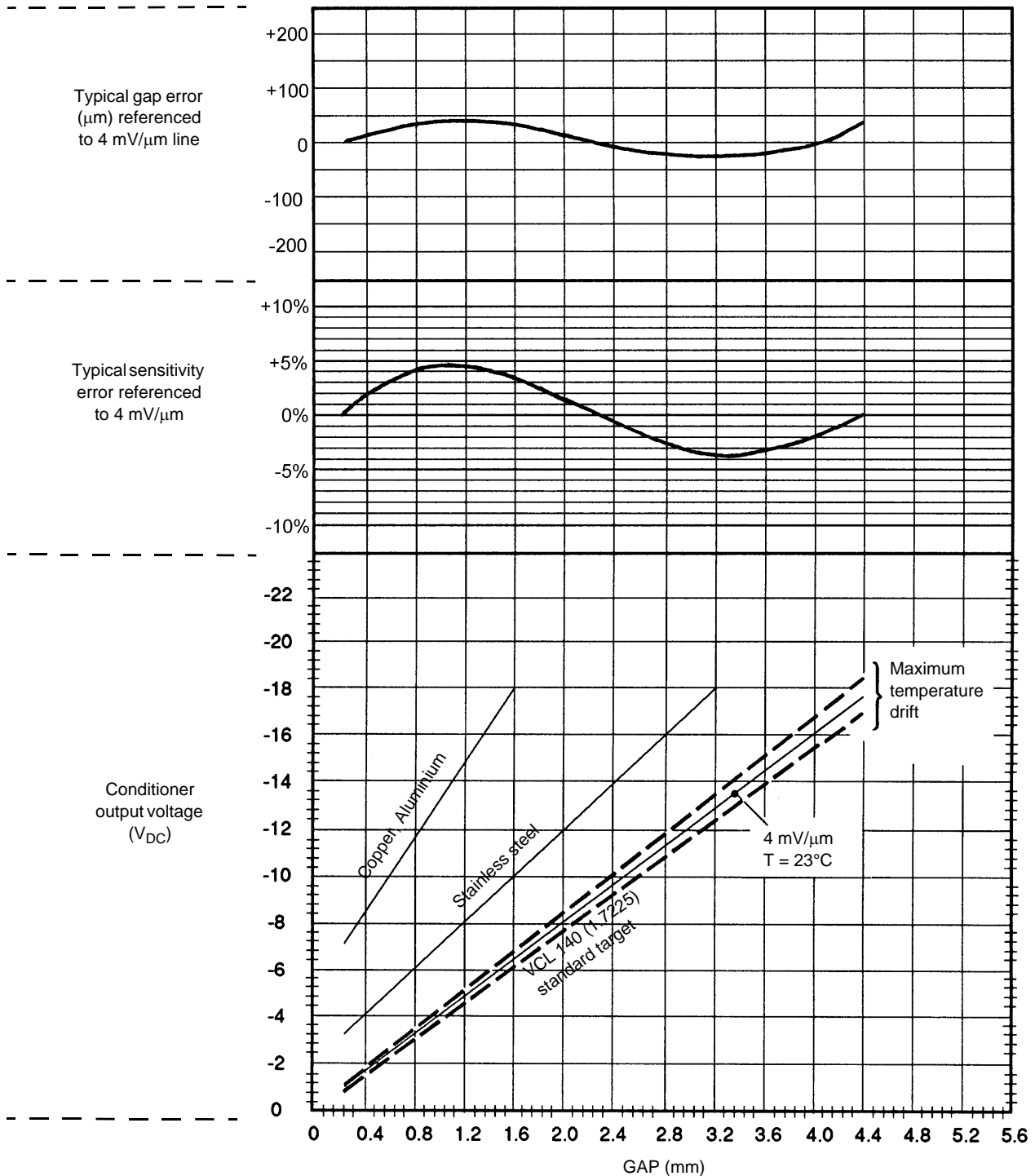
Due to the characteristics of the coaxial cable, an "electrical trimming" of the nominal length of the integral and extension cables is necessary to optimize the system performance and the transducer interchangeability.

TSL for a 5 m chain : 4.4 m minimum

TSL for a 10 m chain : 8.8 m minimum

SPECIFICATIONS (Continued)

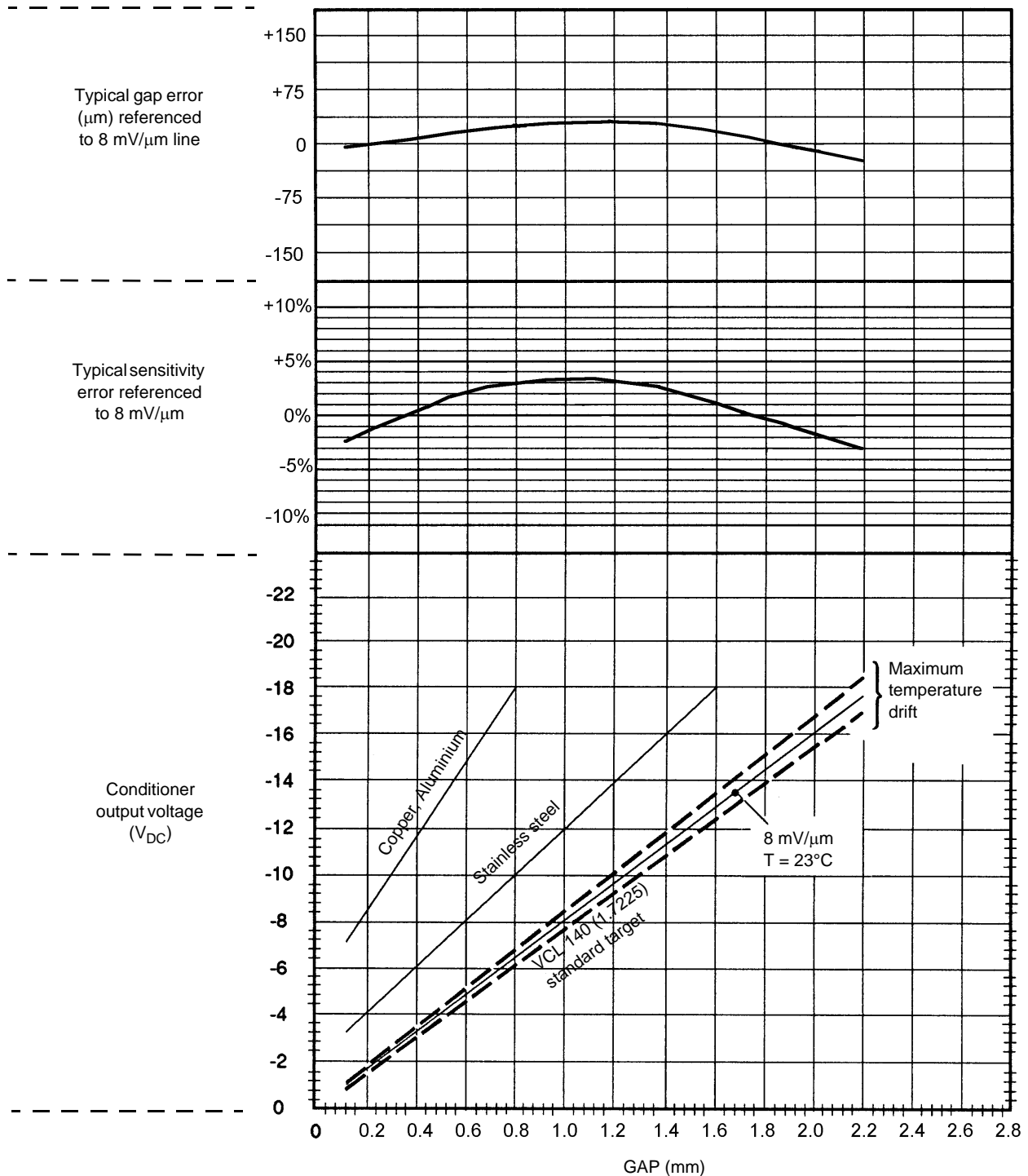
Performance Curves for TQ 402 / 412 Transducer with IQS 452 Version 0XX or Version 1XX Conditioner



Proximity transducer: TQ 402 / TQ 412  
 Signal conditioner: IQS 452 Version 0XX or IQS 452 Version 1XX  
 Standard target material: VCL 140 (1.7225)  
 Equivalent materials: A 37.11 (1.0065), AFNOR 40 CD4, AISI 4137

## SPECIFICATIONS (Continued)

### Performance Curves for TQ 402 / 412 Transducer with IQS 452 Version 2XX or Version 3XX Conditioner



Proximity transducer: TQ 402 / TQ 412  
 Signal conditioner: IQS 452 Version 2XX or IQS 452 Version 3XX  
 Standard target material: VCL 140 (1.7225)  
 Equivalent materials: A 37.11 (1.0065), AFNOR 40 CD4, AISI 4137

**SPECIFICATIONS** (Continued)

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## TQ 402 / TQ 412 Proximity Transducer

### GENERAL

Transducer input requirements : High-frequency power source via matching conditioner type IQS 452

### ENVIRONMENTAL

Temperature ranges

• *Transducer* : -40°C to +180°C with drift < 5% (operation)  
+180°C to +220°C with drift > 5% (short-term survival)

• *Cable* : -100°C to +200°C

• *Connector* : -65°C to +85°C

• *Heat shrinkable sleeve*  
(modified Polyolefin) : -55°C to +135°C

Protection class (according to IEC 529 and DIN 40050) : The tip of the transducer is rated IP 67  
The connection between the transducer body and its integral cable is rated IP 64

Transducer construction : Wire coil Ø 8 mm, Torlon (polyamide-imide) tip, encapsulated in stainless steel body (AISI 316L) with high-temperature epoxy glue

Integral cable : FEP covered 70 Ω coaxial cable, Ø 3.6 mm

• *Option* : BOA stainless steel armour sheathing  
Note : The BOA sheathing is not leaktight and the heat-shrinkable sleeve is splashproof only

Connector : Miniature coaxial male connector type AMP 1-330 723-0  
NB : This should be hand-tightened only when connecting

## IQS 452 Signal Conditioner

### OUTPUT CHARACTERISTICS

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

## SPECIFICATIONS *(Continued)*

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Output inductance : 100  $\mu$ H

### SUPPLY

Voltage : -20 V to -32 V  
Current :  $13 \pm 1$  mA (25 mA max.)  
Supply input capacitance : 1 nF  
Supply input inductance : 100  $\mu$ H

### ENVIRONMENTAL CHARACTERISTICS

(According to DIN 40040)

Temperature range

- *Operation* : -30°C to +70°C
- *Storage* : -40°C to +80°C

Humidity

- *Operation and storage* : Max. 95% non condensing

Vibration

- *Operation and storage* : 2 g peak between 10 Hz and 500 Hz

Protection class : IP 40

### PHYSICAL CHARACTERISTICS

Construction material : Injection moulded aluminium

### ELECTRICAL CONNECTIONS

Input : Stainless steel coaxial female socket

Output and power : Screw terminal strip

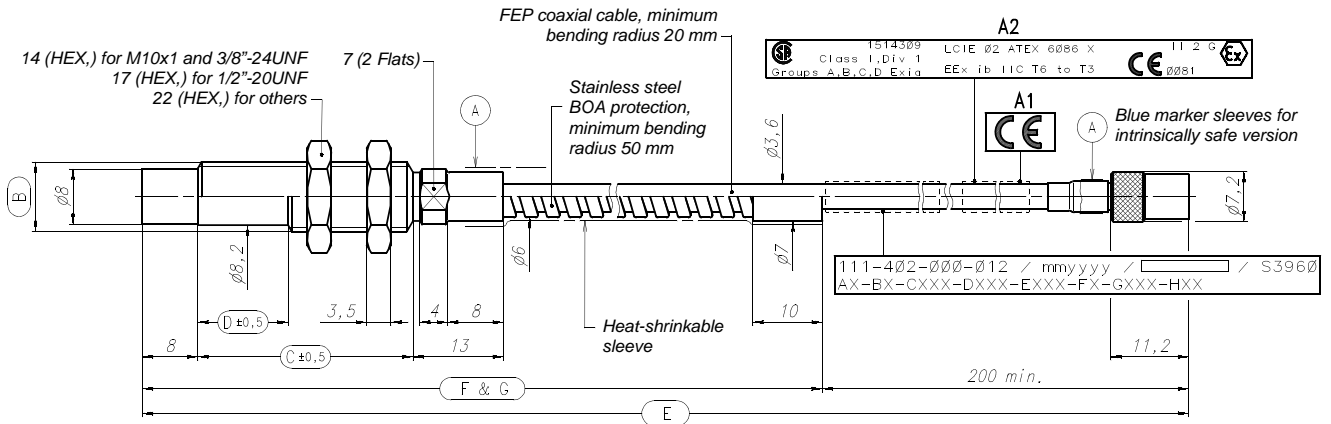
### WEIGHT

Standard version : Approx. 140 g

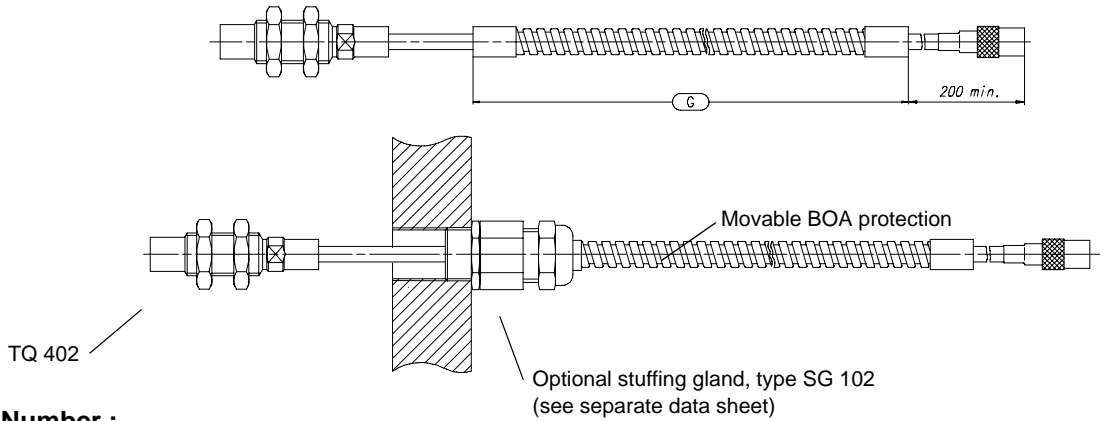
Exi version : Approx. 220 g

DIMENSIONS AND ORDERING INFORMATION

TQ 402 Proximity Transducer



Movable BOA for TQ 402



Ordering Number :

111 - 402 - 000 - [A] [B] [C] [D] [E] [F] [G] [H]

Environment (A)	
Standard	1
Explosive	2

Body Thread (B)	
M10x1	1
M14x1.5	2
M16x1.5	3
3/8"-24UNF	6
5/8"-18UNF	7
1/2"-20UNF	8

Body Length (C)	
Each 1 mm, from 20 to 250 mm	
Min. 20 mm	020
Max. 250 mm	250

Unthreaded Length (D)	
Each 1 mm, from 0 to 230 mm	
Min. 0 mm	000
Max. 230 mm	230

Integral Cable (E)	
0.5 m length	005
1 m length	010
1.5 m length	015
2 m length	020
5 m length	050
10 m length	100

Total System Length (H)	
05	5 m length
10	10 m length

BOA Length (G)	
Each 0.1 m, from 0 to 10.0 m	
000	None
001	Min. 0.1 m
100	Max. 10.0 m

Cable Protection (F)	
0	None
1	BOA
2	BOA + sleeve
3	Movable BOA
4	Movable BOA + sleeve

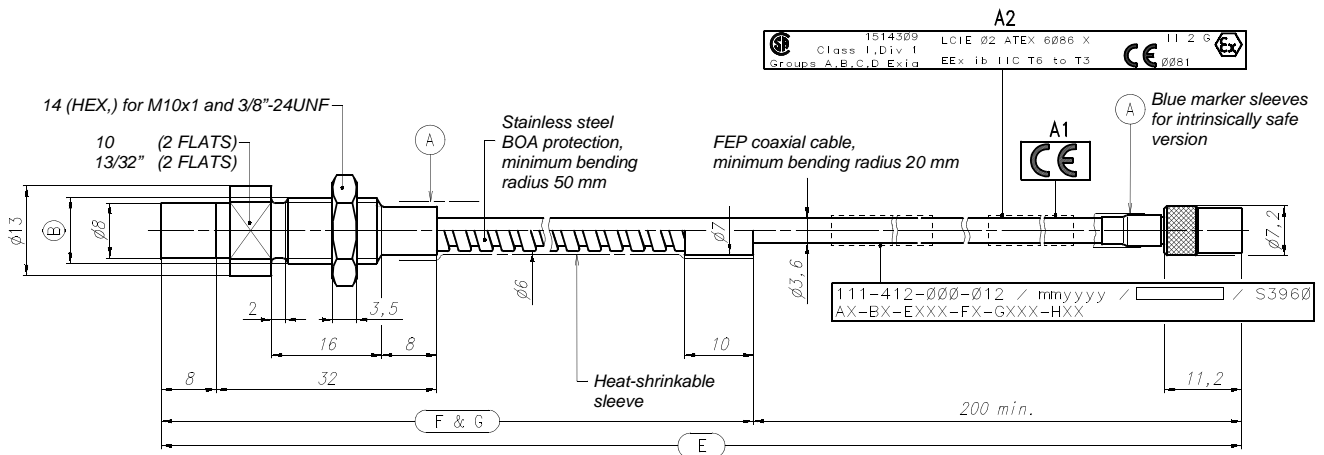
Notes :

- (1) All dimensions are in mm.
- (2) The total system length (dimension "H") is the sum of the lengths of the integral cable and the extension cable.
- (3) For details on cable length tolerances, please refer to the section "Total System Length (TSL)" on page 3.

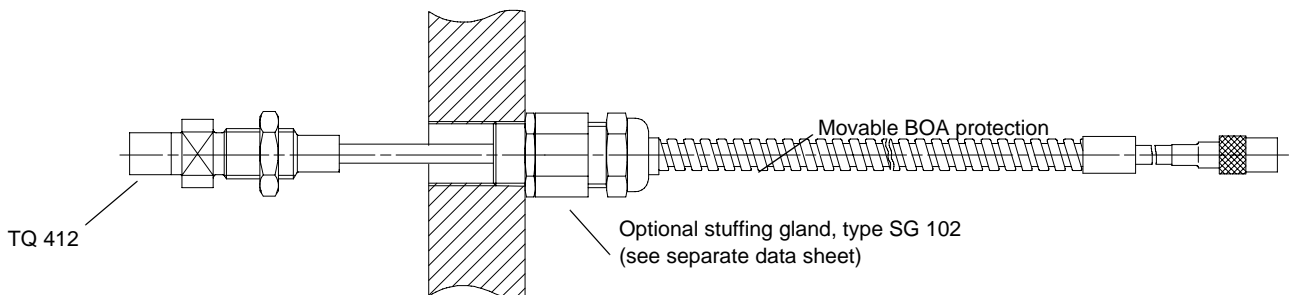
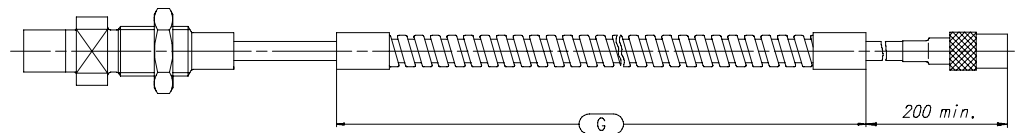


## DIMENSIONS AND ORDERING INFORMATION (Continued)

### TQ 412 Proximity Transducer



#### Movable BOA for TQ 412



Ordering Number : 111 - 412 - 000 - 01 - **A** - **B** - **E** - **F** - **G** - **H**

Environment (A)	
Standard	1
Explosive	2

Body Thread (B)	
M10x1	1
3/8"-24UNF	6

Total System Length (H)	
05	5 m length
10	10 m length

Integral Cable (E)	
0.5 m length	005
1 m length	010
1.5 m length	015
2 m length	020
5 m length	050
10 m length	100

Cable Protection (F)	
None	0
BOA	1
BOA + sleeve	2
Movable BOA	3
Movable BOA + sleeve	4

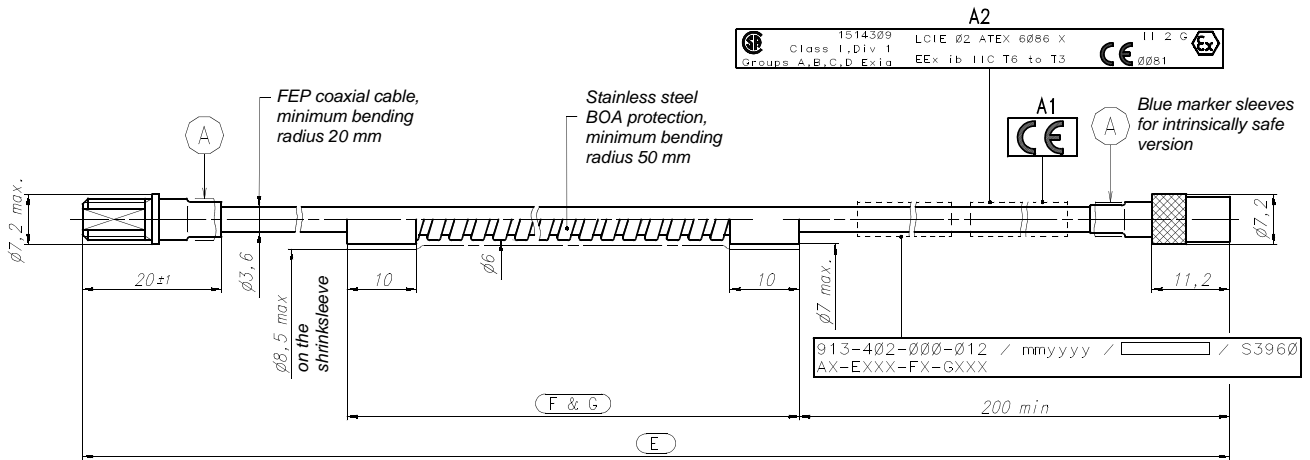
BOA Length (G)	
Each 0.1 m, from 0 to 10.0 m	
000	None
001	Min. 0.1 m
100	Max. 10.0 m

#### Notes :

- (1) All dimensions are in mm.
- (2) The total system length (dimension "H") is the sum of the lengths of the integral cable and the extension cable.
- (3) For details on cable length tolerances, please refer to the section "[Total System Length \(TSL\)](#)" on page 3.

### EA 402 Extension Cable

**DIMENSIONS AND ORDERING INFORMATION** (Continued)



Ordering Number : 913 - 402 - 000 - 01 - **A** - **E** - **F** - **G**

Environment (A)	
Standard	1
Explosive	2

Cable Length (E)		
Ø 3.6	3.0 m	030
	3.5 m	035
	4.0 m	040
	4.5 m	045
	5.0 m	050
	8.0 m	080
	8.5 m	085
	9.0 m	090
9.5 m	095	

Cable Protection (F)	
None	0
BOA	1
BOA + sleeve	2

BOA Length (G)	
000	None
028	2.8 m
033	3.3 m
038	3.8 m
043	4.3 m
048	4.8 m
078	7.8 m
083	8.3 m
088	8.8 m
093	9.3 m

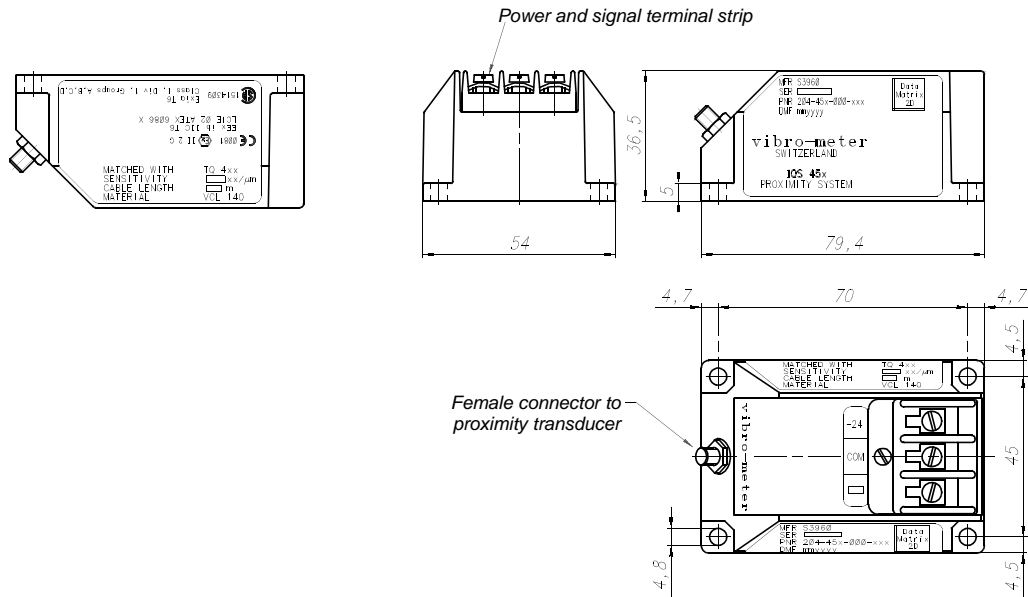
**Note :**

(1) All dimensions are in mm unless otherwise stated.

(2) For details on cable length tolerances, please refer to the section "[Total System Length \(TSL\)](#)" on page 3.

## DIMENSIONS AND ORDERING INFORMATION (Continued)

### IQS 452 Signal Conditioner



To order please specify :

IQS Type	Measuring Range	Mode	Sensitivity	Total System Length	Version	Ordering Number
IQS 452, versions M0XX or M1XX	4 mm	Voltage output, 3-wire configuration	4 mV/ $\mu$ m	5 m	Standard	204-452-000-01
				10 m	Standard	204-452-000-02
				5 m	Exi	204-452-000-03
				10 m	Exi	204-452-000-04
		Current output, 2-wire configuration <sup>1)</sup>	1.25 $\mu$ A/ $\mu$ m	5 m	Standard	204-452-000-11
				10 m	Standard	204-452-000-12
IQS 452, versions M2XX or M3XX	2 mm	Voltage output, 3-wire configuration	8 mV/ $\mu$ m	5 m	Standard	204-452-000-21
				10 m	Standard	204-452-000-22
				5 m	Exi	204-452-000-23
				10 m	Exi	204-452-000-24
		Current output, 2-wire configuration <sup>1)</sup>	2.5 $\mu$ A/ $\mu$ m	5 m	Standard	204-452-000-31
				10 m	Standard	204-452-000-32
				5 m	Exi	204-452-000-33
				10 m	Exi	204-452-000-34

<sup>1)</sup> Current output is used in conjunction with GSI 124 galvanic separation

## ACCESSORIES

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JB 118	Junction box	PA 153	Probe adapter
PA 151	Probe adapter	SG 102	Cable feedthrough
PA 152	Probe adapter		



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