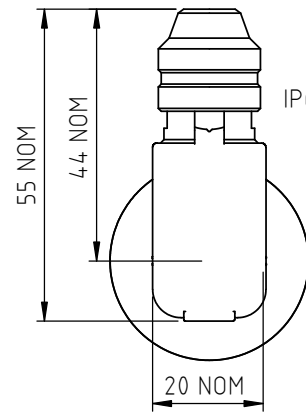
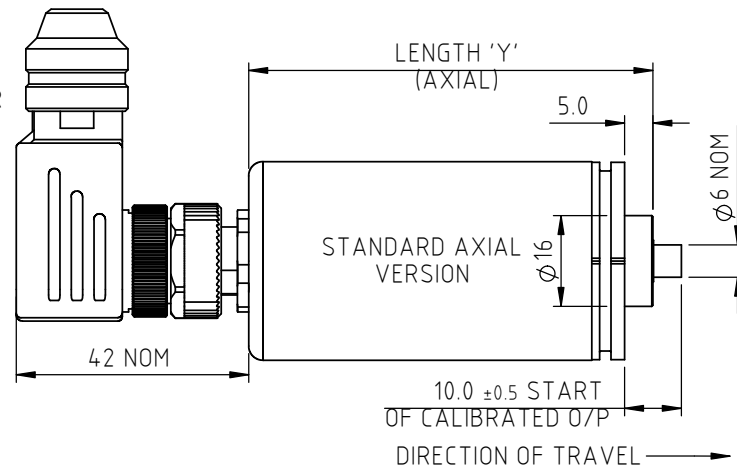


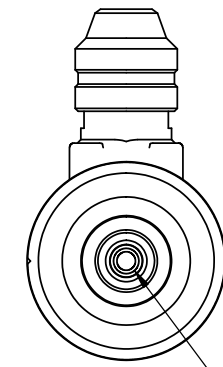
AXIAL IP67 SHORT CABLE GLAND (CODE 'Mxx, MQxx')



AXIAL IP67 M12 CONNECTOR IEC 61076-2-101 (CODE 'J')



STANDARD AXIAL VERSION



TAPPED M4 X 0.7 7 DEEP

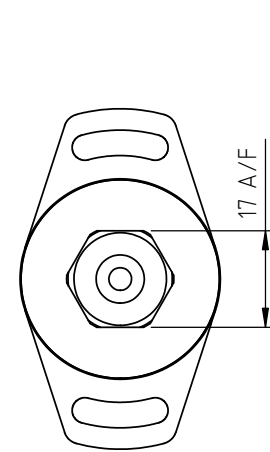
ELECTRICAL OPTIONS/ SPECIFICATIONS

OUTPUT	SUPPLY (NOM.)		
'A' 0.5 - 4.5V RATIOMETRIC	5V		
SUPPLY CURRENT 12mA TYP. 20mA MAX.			
CONNECTIONS;	CABLE 3-CORE	CABLE 5-CORE	CONNECTOR
+Ve	RED	RED	:1
+ SENSE (5-WIRE ONLY)	-	ORANGE	:1
0V	BLACK	BLACK	:3
- SENSE (5-WIRE ONLY)	-	GREY	:3
OUTPUT	WHITE	WHITE	:2
BODY	SCREEN	SCREEN	:4

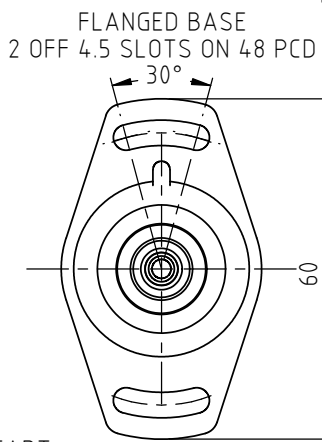
CABLE: 0.2mm<sup>2</sup>, O/A SCREEN, PUR JACKET O/D; 3-CORE: Ø4.6mm, 5-CORE: Ø4.6mm, SUPPLIED WITH 50cm OR REQUIRED LENGTH IN cm. e.g. 'L50/LQ50' (3/5-CORE) CONNECTORS; MAXIMUM CONDUCTOR CROSS SECTION 0.75mm<sup>2</sup>

RANGE OF DISPLACEMENT FROM 0-2mm TO 0-50mm IN INCREMENTS OF 1mm e.g.36.  
BODY MATERIAL:- STAINLESS STEEL.  
FLANGE BASE MATERIAL:- STAINLESS STEEL (CODE 'N')

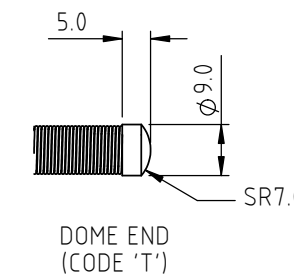
FURTHER OPTIONS:  
SINGLE PAIR OF BODY CLAMPS (CODE 'P')  
SPRUNG PLUNGER, TO EXTENDED POSITION (CODE 'R')  
DOME END (CODE 'T') IN CONJUNCTION WITH SPRUNG PLUNGER (CODE 'R')  
PLUNGER FREE (CODE 'V') NOT AVAILABLE WITH SPRUNG OPTION  
MAGNETIC TIP (CODE 'WA')



FLANGE AXIAL VERSION (CODE 'N')

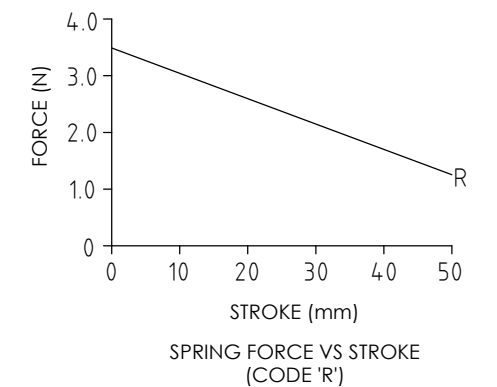


FLANGED BASE 2 OFF 4.5 SLOTS ON 48 PCD

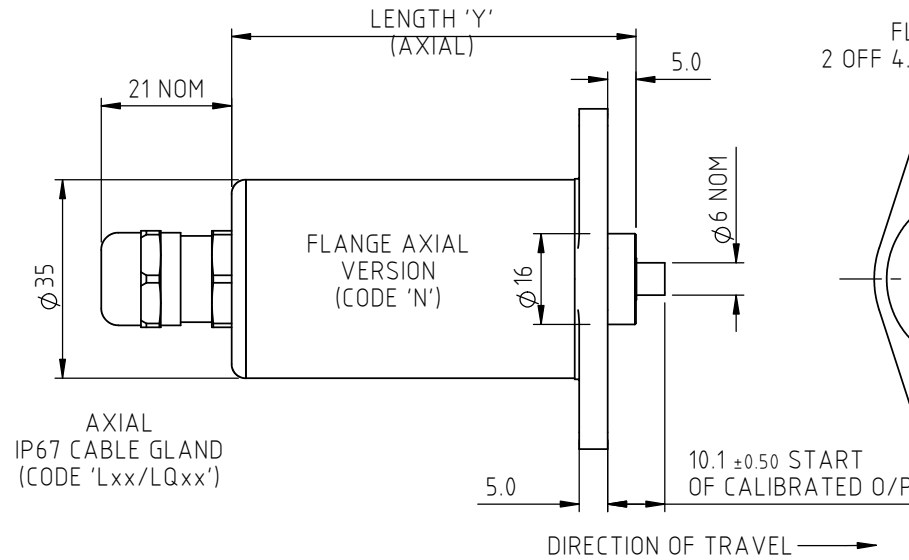


SR7.0

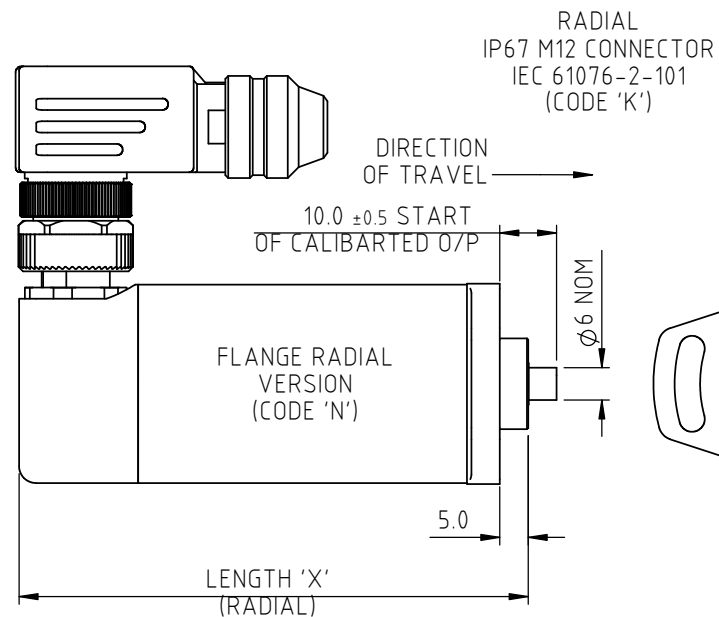
MAGNETIC TIP (CODE 'WA')



AXIAL IP67 CABLE GLAND (CODE 'Lxx/LQxx')

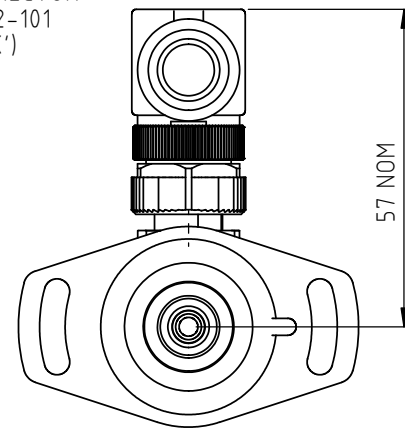


DIRECTION OF TRAVEL

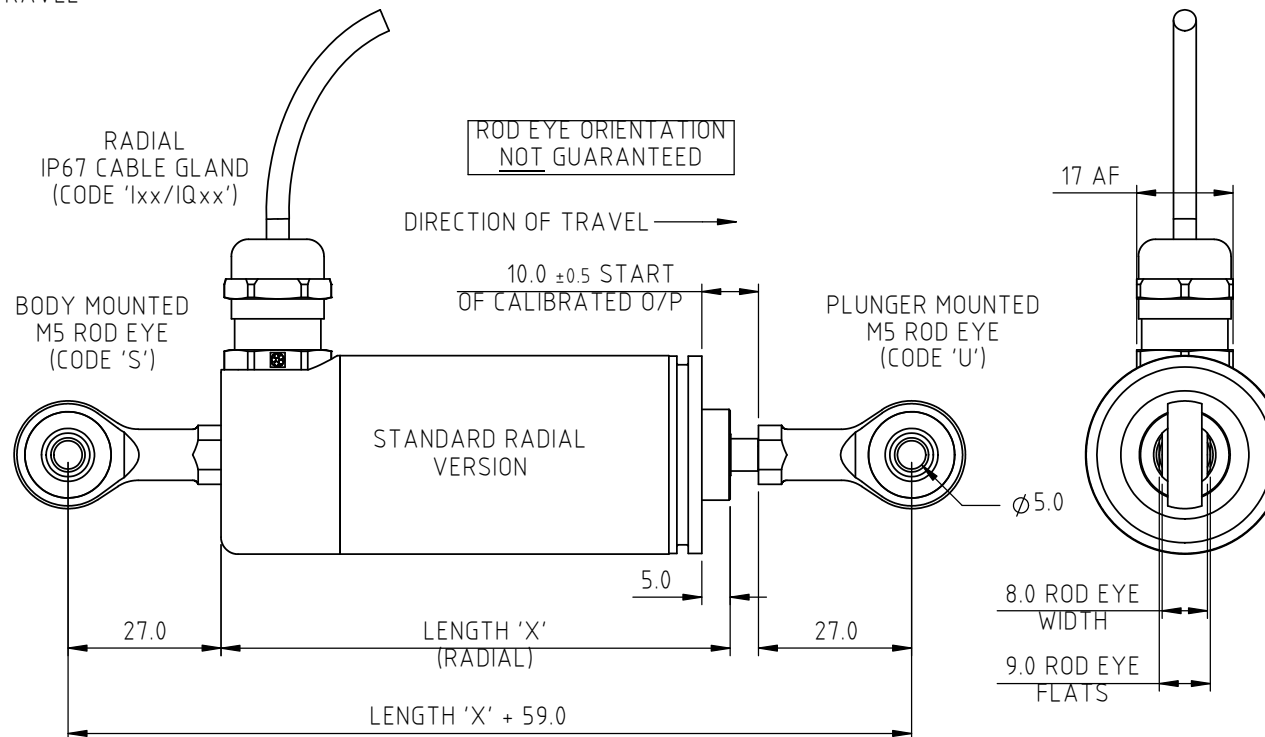


FLANGE RADIAL VERSION (CODE 'N')

LENGTH 'X' (RADIAL)



RADIAL IP67 M12 CONNECTOR IEC 61076-2-101 (CODE 'K')



BODY MOUNTED M5 ROD EYE (CODE 'S')

STANDARD RADIAL VERSION

PLUNGER MOUNTED M5 ROD EYE (CODE 'U')

LENGTH 'X' (RADIAL)

LENGTH 'X' + 59.0

ROD EYE ORIENTATION NOT GUARANTEED

DIRECTION OF TRAVEL

10.0 ± 0.5 START OF CALIBRATED O/P

8.0 ROD EYE WIDTH

9.0 ROD EYE FLATS

NOTE:- READ INSTALLATION SHEET H000-19 FOR FULL INSTRUCTIONS FOR USE.

**CSA APPROVED TO**  
**Class I Zone 0**  
**Ex/AEx ia IIC T4 (Ta= -40 to 80°C)**  
**AEx ia D IIIC T93°C (Ta= -40 to 80°C)**  
**Ui 11.4V, Ii 0.2A, Pi 0.51W**

APPROVED FOR USE IN CONJUNCTION WITH A GALVANICALLY ISOLATED BARRIER.

NOTE: APPROVAL ONLY APPLIES AT NORMAL ATMOSPHERIC PRESSURE!

DRAWINGS NOT TO BE CHANGED WITHOUT REFERENCE TO THE CHANGE PROCEDURE.  
CHANGES TO PARTS USED IN INTRINSICALLY SAFE PRODUCT MUST BE APPROVED BY THE AUTHORISED PERSON.  
THIS IS AN UNCONTROLLED PRINT AND WILL NOT BE UPDATED.

REV	CHANGE HISTORY	DR'WN	DATE	CHK'D
H	MAGTIP,RODEYES RAN1311/12.AMEND MARKINGS RAN1425	ASC	31/05/2023	ASC

NOTE: SENSORS WITH TRAVEL UP TO 50mm ARE MADE IN STANDARD LENGTHS

BODY LENGTH (mm)			
TRAVEL (mm)		'Y' AXIAL	'X' RADIAL
CALIBRATED	MECHANICAL		
0-2 TO 0-10	10	81.3	99.8
0-11 TO 0-20	20	91.3	109.8
0-21 TO 0-30	30	101.3	119.8
0-31 TO 0-50	50	121.3	139.8

THE PLUNGER RETRACTS 5mm FROM START OF CALIBRATED TRAVEL (2mm FOR SPRUNG VERSIONS) AND EXTENDS 9.5mm\* BEYOND END OF MECHANICAL TRAVEL. \*DOES NOT INCLUDE DIFFERENCE BETWEEN CALIBRATED AND MECHANICAL TRAVEL. DIMENSIONS ARE NOMINAL. 'V' CODED PLUNGER WILL DEPART SENSOR BODY.



APPROVED BY	REV		X	±0.4
RDM	H		X.X	±0.2
			X.XX	±0.1
			DIMS mm	
DESCRIPTION				
H103 INTRINSICALLY SAFE SHORT STROKE LINEAR SENSOR				
SCALE	3:4	DRAWING NUMBER		
A3		H103-11		
				SHEET 1 OF 1



# H103 SHORT STROKE LINEAR POSITION SENSOR

## INTRINSICALLY SAFE FOR HAZARDOUS DUST ATMOSPHERES

- **Intrinsically safe for Gas and Dust to:**  
**Class I, Zone 0 Ex ia / AEx ia**  
**Zone 20 Ex ia / AEx ia**  
**Class I, Division 1; Class II, Division 1;**  
**Class III, Division 1**
- **Non-contacting inductive technology to eliminate wear**
- **Travel set to customer's requirement**
- **Short body length**
- **Accurate, stable, durable and reliable**
- **Sealing to IP67**

As a leading designer and manufacturer of linear, rotary, tilt and intrinsically safe position sensors, Positek® has the expertise to supply a sensor to suit a wide variety of applications.

Our intrinsically safe H103 incorporates electronics system EX08 which is CSA approved for use in potentially explosive **gas/vapour and dust** atmospheres. The H103 is designed for a wide range of industrial applications and is ideal for OEMs seeking good sensor performance in situations where a short-bodied sensor is required for operation in hazardous areas. The unit is compact and space-efficient, being responsive along almost its entire length, and like all Positek® sensors provides a linear output proportional to travel. Each unit is supplied with the output calibrated to the travel required by the customer, from 2 to 50mm and with full EMC protection built in. Overall performance, repeatability and stability are outstanding over a wide temperature range. The sensor has a rugged stainless steel body and plunger. It is easy to install and set up, mounting options include; flange, M5 rod eye bearings and body clamps. The plunger can be supplied free or captive, with a female M4 thread, an M5 rod eye, magnetic tip, or spring-loaded with a dome end. The H103 also offers a range of mechanical options, environmental sealing is to IP67.



### SPECIFICATION

#### Dimensions

Body diameter	35 mm	
Body Length	Dependant on calibrated travel	
Calibrated Travel	Axial	Radial
2 mm to 10 mm	81.3 mm	99.8mm
11 mm to 20 mm	91.3 mm	109.8mm
21 mm to 30 mm	101.3 mm	119.8mm
31 mm to 50 mm	121.3 mm	139.8mm

Plunger Ø 6mm

For full mechanical details see drawing H103-11

#### Independent Linearity

≤ ± 0.25% FSO @ 20°C

#### Temperature Coefficients

< ± 0.01%/°C Gain &

< ± 0.01%FS/°C Offset

> 10 kHz (-3dB)

Resolution Infinite

Noise < 0.02% FSO

#### Intrinsic Safety

Class I, Zone 0  
 Ex ia IIC T4 Ga AEx ia IIC T4 Ga  
 Class I, Zone 20  
 Ex ia IIIC T135°C Da AEx ia IIIC T135°C Da  
 Class I, Division 1, Groups A, B, C, D; T4  
 Class II, Division 1, Groups E, F, G, T135°C  
 Class III Division 1;  
 (Ta = -40°C to +80°C)

Approval only applies to the specified ambient temperature range and atmospheric conditions in the range 0.80 to 1.10 Bar, oxygen ≤ 21%

Sensor Input Parameters Ui: 11.4V, Ii: 0.20A, Pi: 0.51W.

(connector option/s) Ci: 1.16µF, Li: 50µH

(cable option/s) Ci: 1.36µF, Li: 860µH with 1km max. cable

#### Environmental Temperature Limits

Operating -40°C to +80°C

Storage -40°C to +125°C

#### Sealing

IP67

#### EMC Performance

EN 61000-6-2, EN 61000-6-3

Vibration IEC 68-2-6: 10 g

Shock IEC 68-2-29: 40 g

MTBF 350,000 hrs 40°C Gf

#### Drawing List

H103-11 Sensor Outline

3D models, step or .igs format, available on request.

**Do you need a position sensor made to order to suit a particular installation requirement or specification? We'll be happy to modify any of our designs to suit your needs - please contact us with your requirements.**



For further information please contact:

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H103-17h

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# H103 SHORT STROKE LINEAR POSITION SENSOR

## INTRINSICALLY SAFE FOR HAZARDOUS DUST ATMOSPHERES

Intrinsically safe equipment is defined as "equipment which is incapable of releasing sufficient electrical or thermal energy under normal or abnormal conditions to cause ignition of a specific hazardous atmosphere mixture in its most easily ignited concentration."

CSA approved to;

Class I, Zone 0      Ex ia IIC T4 Ga      AEx ia IIC T4 Ga  
 Class I, Zone 20      Ex ia IIIC T135°C Da      AEx ia IIIC T135°C Da  
 Class I, Division 1, Groups A, B, C, D; T4  
 Class II, Division 1, Groups E, F, G, T135°C;  
 Class III Division 1;  
 (Ta = -40°C to +80°C)

Designates the sensor as belonging to; Class I, Zone 0 / Class I, Zone 20: can be used in areas with continuous, long or frequent periods of exposure to hazardous gas or dust.

Gas:

Protection class ia IIC, denotes intrinsically safe for Zones 0, 1 & 2 and IIA, IIB and IIC explosive gases.  
 Temperature class T4: maximum sensor surface temperature under fault conditions 135°C.

Dust:

Protection class ia IIIC, denotes intrinsically safe for Zones 20 & 21 explosive dust.  
 T135°C: maximum sensor surface temperature under fault conditions 135°C.

Ambient temperature range extended to -40°C to +80°C.

It is imperative Positek® intrinsically safe sensors be used in conjunction with a galvanic barrier to meet the requirements of the product certification. The Positek G005 Galvanic Isolation Amplifier is purpose made for Positek IS sensors making it the perfect choice. Refer to the G005 datasheet for product specification and output configuration options.

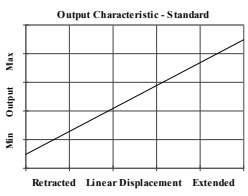
For cable lengths exceeding 10 metres a five wire connection is recommended to eliminate errors introduced by cable resistance and associated temperature coefficients.

CSA approved sensors suitable for gas (G series) applications, are also available from Positek.

H103	a	b	c	d	e	f	g	h	j	k
	Displacement	A	Y	Connections	Option	Option	Option	Option	Option	Z000

a Displacement	Value
Factory set to any length from 0-2 mm to 0-50 mm (e.g. 0-36 mm)	36
b Output	Code
Supply $V_{dc}$ (tolerance)	Output
+5V (4.5 - 5.5V)	0.5 - 4.5V (ratiometric with supply)
Supply Current 10mA typical, 12mA max.	A
c Calibration Adjustments	Code
Sealed	Y
d Connections	Code
Cable gland radial IP67 Pg9, metal, 3-core cable	Ixx
Cable gland radial IP67 Pg9, metal, 5-core cable	IQxx
Connector axial IP67 4 pin M12 IEC 61076-2-101, metal	J
Connector axial IP67 4 pin M12 IEC 61076-2-101, metal, pre-wired 3-core cable	Jxx
Connector axial IP67 4 pin M12 IEC 61076-2-101, metal, pre-wired 5-core cable	JQxx
Connector radial IP67 4 pin M12 IEC 61076-2-101, metal	K
Connector radial IP67 4 pin M12 IEC 61076-2-101, metal, pre-wired 3-core cable	Kxx
Connector radial IP67 4 pin M12 IEC 61076-2-101, metal, pre-wired 5-core cable	KQxx
Cable gland axial IP67 Pg9, metal, 3-core cable	Lxx
Cable gland axial IP67 Pg9, metal, 5-core cable	LQxx

d Connections continued	Code
Cable gland, short <sup>†</sup> axial IP67, metal, 3-core cable	Mxx
Cable gland, short <sup>†</sup> axial IP67, metal, 5-core cable	MQxx
<small>Specify required cable length 'xx' in cm. e.g. L2000 specifies axial cable gland with 20 m of cable, 50 cm supplied as standard. <b>Note!</b> maximum length supplied 15000cm. <sup>†</sup>Nb: restricted cable pull strength.</small>	
e Housing	Code
Standard default	blank
Flange Mount 2 off 4.5 mm x 30 degree wide slots, 48 mm P.C.D.	N
M5 Rod-eye bearing radial version only	S
f Body Fittings	Code
None default	blank
Body Clamps 1 pair	P
g Sprung Plunger	Code
Not sprung default	blank
Spring extend captive plunger only. Note! Supplied loose without option 'T'	R
h Plunger Fittings	Code
Female thread M4x0.7x7 deep default	blank
Dome end with spring extend option 'R'	T
M5 Rod-eye Bearing	U
Magnetic Tip	WA
j Plunger	Code
Captive plunger is retained - default	blank
Non-captive plunger can depart body	V
k Z-code	Code
Calibration to suit G005 required	Z000
± 0.1% FSO @20°C Independent Linearity 0 - 10 mm min.	Z650
¼" Rod eyes with options 'S' and/or 'U'	Z827



For further information please contact:

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H103-17h



# Three or Five-Wire Mode Connection

## FOR INTRINSICALLY SAFE SENSORS IN HAZARDOUS ATMOSPHERES

The aim of this document is to help readers who do not understand what is meant by three or five wire modes of connection between the galvanic isolation amplifier and sensor, and the factors behind them. It is by no means an in-depth technical analysis of the subject.

Whether opting for a pre-wired Positek® Intrinsicly Safe sensor or one with a connector, choosing the right mode of connection and cable to suit the application requires careful consideration.

Interconnecting cables are not perfect conductors and offer resistance to current flow, the magnitude of resistance<sup>†</sup> depends on conductors resistivity, which changes with temperature, cross sectional area<sup>‡</sup> and length. If the voltage were to be measured at both ends of a length of wire it would be found they are different, this is known as volts drop. Volts drop changes with current flow and can be calculated using Ohm's law, it should be noted that volts drop occurs in both positive and negative conductors. The effects of volts drop can be reduced by increasing the conductors cross sectional area, this does not however eliminate the effects due to temperature variation. There are instances where large cross-section cables are not practical; for example most standard industrial connectors of the type used for sensors have a maximum conductor capacity of 0.75mm<sup>2</sup>, copper prices and ease of installation are other considerations.

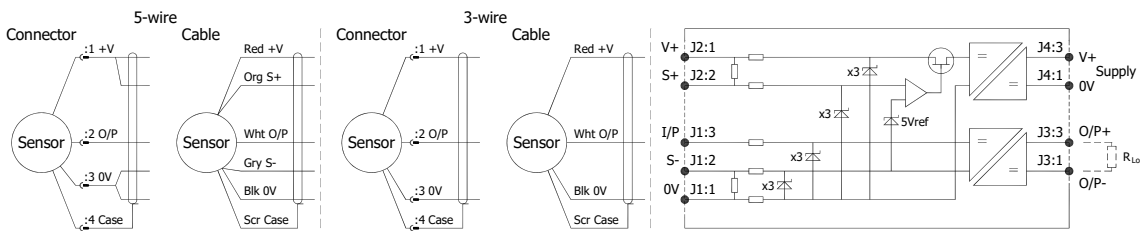
This is important because the effects of volts drop can significantly alter the perceived accuracy of the sensor which is ratiometric i.e. the output signal is directly affected by the voltage across the sensor. Changes in temperature will also be seen as gain variation in the sensor output.

**Three wire mode** connections are common and are suitable in most cases with short or moderate cable runs. Applications that do not require a high degree of accuracy but have cable runs, say in excess of 10m, volts drop can be reduced by introducing a terminal box close to the sensor and using a larger cross-section cable for a majority of the cable run. Sensors supplied with three core cable are calibrated with the cable fitted which largely eliminates errors due to conductor resistance at room temperature however, as mentioned above, small gain errors due to temperature fluctuations should be expected.

**Five wire mode** connections have significant benefits as losses in the positive and negative conductors are compensated for by the galvanic isolation amplifier which can 'sense' the voltage across the sensor and dynamically adjust the output voltage so that the voltage across the sensor is correct. The effects of cable resistance and associated temperature coefficients are eliminated allowing for smaller conductors than a three wire connection for the same cable run. The amplifier can compensate for up to 15Ω per conductor with a current flow of 15mA, which is more than adequate for 150m of 0.25 mm<sup>2</sup> cable, longer lengths will require larger conductors.

**For this reason Positek® recommends five wire connections for cable lengths exceeding 10 metres in 0.25 mm<sup>2</sup> cable to preserve the full accuracy of the sensor.**

See illustrations below for examples of connecting a sensor to the galvanic isolation amplifier.



Cable Length (metres)	Up to 150	150 - 300	300 - 450	450 - 600	600 - 900	900 - 1000
Cross Section (mm <sup>2</sup> )	0.25	0.5	0.75	1.0	1.5	2.0

The table above shows recommended conductor sizes with respect to cable length for both three and five wire connections, based on copper conductors. Three wire connections will introduce a gain reduction of 5% and a ±1% temperature dependence of gain over the range -40°C to +80°C for the cable temperature. (i.e. about -150 ppm/°C for the maximum lengths shown and less pro rata for shorter lengths.)

It should be noted that the maximum cable length, as specified in the sensor certification, takes **precedence** and **must not** be exceeded.

Positek® sensors are supplied with three core 0.25 mm<sup>2</sup> cable as standard, however five core 0.25 mm<sup>2</sup> cable can be supplied on request. The galvanic isolation amplifier is available as;

G005-\*\*\* for 'G' and 'H' prefix sensors  
X005-\*\*\* for 'E', 'M' and 'X' prefix sensors

<sup>†</sup>  $R = \rho L/A$   $\rho$  is the resistivity of the conductor ( $\Omega m$ )  $L$  is the length of conductor (m)  $A$  is the conductor cross-sectional area (m<sup>2</sup>).

<sup>‡</sup> It is presumed that direct current flow is uniform across the cross-section of the wire, the galvanic isolation amplifier and sensor are a dc system.



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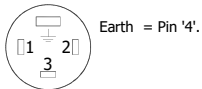
# Generic Installation Information

## H SERIES SENSORS

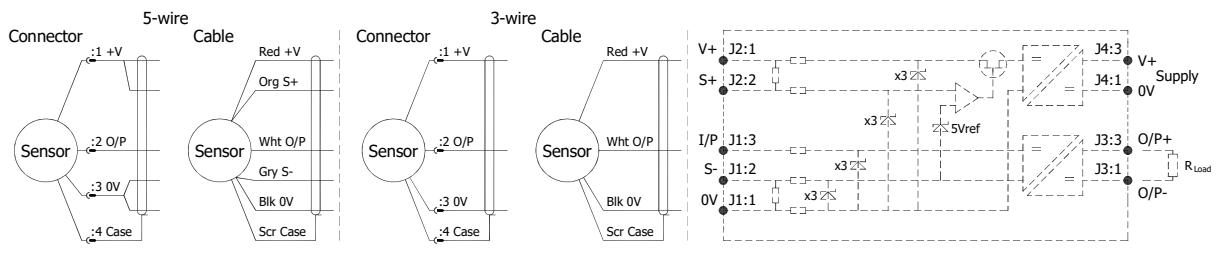
INTRINSICALLY SAFE FOR HAZARDOUS GAS/VAPOUR & DUST ATMOSPHERES

CSA Qualified Intrinsically Safe Device Certificate number 13.2588225		Ex ia IIC T4 Ga Class I, Zone 0, AEx ia IIC T4 Ga Class I, Division 1, Groups A, B, C, D; T4 Ex ia IIIC T135°C Da Zone 20, AEx ia T135°C Da; Class II, Division 1, Groups E, F, G, T135°C; Class III Division 1; (Ta = -40°C to +80°C)	
Electronics Version	Output Description:	Supply Voltage: V <sub>s</sub> (tolerance)	Load resistance:
EX08	0.5 - 4.5V (ratiometric with supply)	+5V (4.5 - 5.5V) 10mA Nom.	5kΩ min

Connector Pin Layout:  
DIN 43650 C



IEC 60947-5-2



### Putting Into Service:

This sensor must only be installed, operated and maintained by competent and suitably trained personnel. The installation and maintenance must be carried out in accordance with all appropriate international, national and local standard codes of practice and site regulations for intrinsically safe apparatus. The use, installation, or maintenance of the sensor, in any other way than intended, may impair its operation or the protection it provides. The sensor must be used with a galvanic isolation barrier designed to supply the sensor with a nominal 5V and to transmit the sensor output to a safe area. The barrier parameters must not exceed:-

$$U_i = 11.4V \quad I_i = 0.20A \quad P_i = 0.51W$$

$$C_i = 1.36\mu F^* \quad L_i = 860\mu H^* \quad (\text{with maximum length integral cable})$$

$$C_i = 1.16\mu F \quad L_i = 50\mu H \quad (\text{without integral cable})$$

\*Figures for 1km cable where:  $C_i = 200\text{pF/m}$  &  $L_i = 810\text{nH/m}$

Cable characteristics must not exceed:-

$$\text{Capacitance: } \leq 200 \text{ pF/m or max. total of: } 200 \text{ nF}$$

$$\text{Inductance: } \leq 810 \text{ nH/m or max. total of: } 810 \mu H$$

Approval only applies to specified ambient temperature range and atmospheric conditions in the range: 0.80 to 1.10 Bar, oxygen  $\leq 21\%$ .

**Markings and safety parameter information for product marked EX06, see annex 1.**

### Environmental Conditions

Pollution degree: 2

Installation category: I

Humidity 80% to temperatures up to 31 °C decreasing linearly to 50% rH at 40 °C; /// max 80% rh, non condensing. The sensor has been assessed for indoor use only. Where used outdoors suitable environmental protection **must** be provided.

### Special Condition for Safe Use:

The apparatus does not meet the 500 V r.m.s dielectric strength test between circuit and frame, in accordance with clause 6.3.13 of IEC 60079-11:2011. This must be taken into consideration on installation.

When using a Sensor that has an integral cable in a dust application, the free end of the cable shall be appropriately terminated for the zone of use.

Under certain extreme circumstances, the non-metallic and isolated metal parts incorporated in the enclosure of this equipment may generate an ignition-capable level of electrostatic charge. Therefore the equipment shall not be installed in a location where the external conditions are conducive to the build-up of electrostatic charge on such surfaces. This is particularly important if the equipment is installed in a zone 0 location. In addition, the equipment shall only be cleaned with a damp cloth.

P.T.O.



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H000-19d

1 of 2



# Generic Installation Information

## H SERIES SENSORS

INTRINSICALLY SAFE FOR HAZARDOUS GAS/VAPOUR & DUST  
ATMOSPHERES

### Use:

The sensor is designed to measure Linear or rotary displacement and provide a proportional analogue output signal.

### Assembly and Dismantling:

The unit is not to be serviced or dismantled and re-assembled by the user.

WARNING: Substitution of components may impair intrinsic safety

AVERTISSEMENT: La substitution de composants peut altérer la sécurité intrinsèque.

### Maintenance:

Accumulated dust layer must not exceed a depth of 200mm.

### Annex 1 - Markings and Entity Parameters for product with EX06 electronics system.

Class I, Zone 0

Ex ia IIC T4 (Ta= -40 to 80°C)

AEx ia IIC T4 (Ta= -40 to 80°C)

AEx iaD IIIC T93°C (Ta= -40 to 80°C)

**Ui = 11.4V**      **Ii = 0.20A**      **Pi = 0.51W**

**Ci = 1.36µF\***      **Li = 710µH\***      (with maximum length integral cable)

**Ci = 1.16µF**      **Li = 50µH**      (without integral cable)

\*Figures for 1km cable where: Ci = 200pF/m & Li = 660nH/m

Cable characteristics must not exceed:-

Capacitance: ≤ 200 pF/m or max. total of: 200 nF

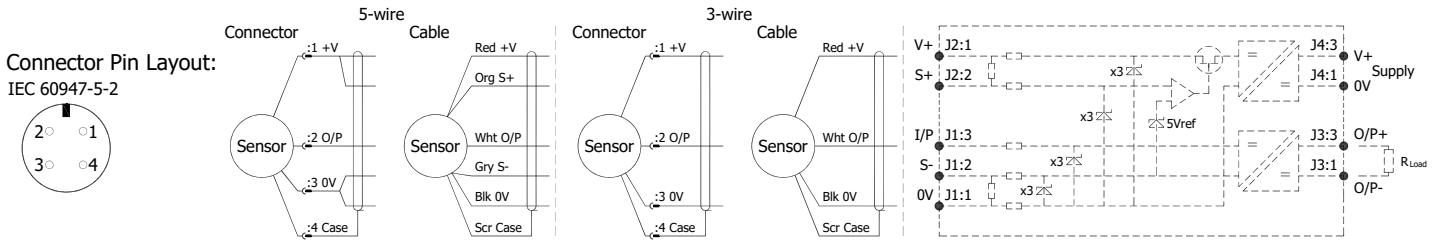
Inductance: ≤ 660 nH/m or max. total of: 660 µH





# Installation Information

## H103 SHORT STROKE LINEAR POSITION SENSOR INTRINSICALLY SAFE FOR HAZARDOUS DUST ATMOSPHERES



N.b. sensors supplied with cable, the free end must be appropriately terminated.

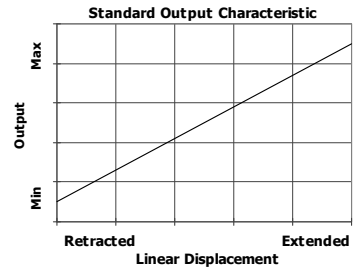
**Warning** - The M12 IEC connector may be rotated for purposes of convenient orientation of the connector and cable, however rotating the connector more than one complete revolution is not recommended. **Repeated rotation of the connector will damage the internal wiring!**

**Mechanical Mounting:** Depending on options, body can be mounted by flange, rod eye bearing or clamping the sensor body - body clamps are available, if not already ordered. Plunger mounted by M4x0.7 female thread, rod-eye bearing or magnetic tip - see drawing H103-11.

**Output Characteristic:** Plunger extended by, at start of normal travel:  
 Standard: 10 mm\* from Ø35 mm face  
 Flange Mount: 10 mm\* from flange face

\*Note: where dome end option is fitted add 5 mm.

The output increases as the plunger extends from the sensor body, the calibrated stroke is between 2 mm and 50 mm.



**Incorrect Connection Protection levels: Not protected** – the sensor is **not** protected against either reverse polarity or over-voltage. The risk of damage should be minimal where the supply current is limited to less than 50mA.