

mm E103 Short Stroke Linear Position Sensor

FEATURES

- Intrinsically safe for Gas and Dust to: Ex II 1GD
- Non-contacting inductive technology to eliminate wear
- Travel set to customer's requirement
- Short body length
- Accurate, stable, durable and reliable
- Sealing to IP67





Our intrinsically safe E103 LIPS® (Linear Inductive Position Sensor) incorporates electronics system EX07 which is ATEX / IECEx approved for use in potentially explosive gas / vapour and dust atmospheres. The E103 is designed for a wide range of industrial applications and is ideal for OEMs seeking good sensor performance in situations where a shortbodied 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 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, the stainless steel mounting flange has two 4.5mm by 30 degree wide slots on a 48mm pitch.

The plunger can be supplied free or captive, with female M4 thread, or spring-loaded with a ball end. The E103 also offers a range of mechanical options, environmental sealing is to IP67.

SPECIFICATION

Dimensions Body diameter Body Length:	35 mm Dependant on calibrated travel
Calibrated Travel 2 mm to 10 mm 11 mm to 20 mm 21 mm to 30 mm 31 mm to 50 mm Plunger For full mechanical details see	81.3 mm 91.3 mm 101.3 mm 121.3 mm Ø 6mm drawing E1 03-11
Power Supply	+ 5V dc nom. ± 0.5V, 10mA typ 20mA max
Output Signal	0.5-4.5V dc ratiometric, Load: 5k $m \Omega$ min.
Independent Linearity	\leq ± 0.25% FSO @ 20°C \leq ± 0.1% FSO @ 20°C available upon request
Sensors with calibrated travel of 10	
lemperature coerricients	< ± 0.01%/°C Gain & < ± 0.01%FS/°C Offset
Frequency Response	> 10 kHz (-3dB)
Resolution	Infinite
Noise	< 0.02% FSO
Intrinsic Safety	Ex 1GD Ex ia C T4 Ga (Ta= -40°C to 80°C) Ex ia IC T135°C Da (Ta= -40°C to 80°C)
Approval only applies to the specifie conditions in the range 0.80 to 1.10	d ambient temperature range and atmospheric Bar, oxygen ≤ 21%
Sensor Input Parameters (connector option/s) (cable option/s)	Ui: 11.4 V, Ii: 0.20A, Pi: 0.51W. Ci: 1.16 µF, Li: 50µH Ci: 1.36µF, Li: 860µH with 1km max. cable
Env ironm en tal Temperature Operating Storage	Lim its -40°C to + 80°C -40°C to + 12 5°C
Sealing	IP67
EMC Performance	EN 61000-6-2, EN 61000-6-3
Vibration	IEC 68-2-6: 10 g
MTRF	350 000 brs 40°C Gf
Drawing List E103-11 Drawings, in AutoCAD® dwg or dx	Sensor Outline f 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.



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".

ATEX / IECEx approved to; Ex II 1GD Ex ia IIC T4 Ga (Ta= -40°C to 80°C) Ex ia IIIC T135°C Da (Ta= -40°C to 80°C)

the sensor as belonging to; Group II: suitable for all areas except mining, Category 1 GD: can be used in areas with continuous, long or frequent periods of exposure to hazardous gas (Zones 2 to 0) and dust (Zone 20).

Gas: Protection class ia, denotes intrinsically safe for all zones Apparatus group IIC: suitable for IIA, IIB and IIC explosive gases. Temperature class T4: maximum sensor surface temperature under fault conditions 135°C.

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 the intrinsically safe sensors be used in conjunction with a galvanic barrier to meet the requirements of the product certification. The X005 Galvanic Isolation Amplifier is purpose made for IS sensors making it the perfect choice. Refer to the X005 datasheet for product specification and output configuration options.

Safety Parameters:

Ui: 11.4V,	li: 0.20A,	Pi: 0.51W
Ci = 1.36µF*	Li = 860µH* (cat	ole option/s)
Ci = 1.16µF	Li = 50µH (conne	ctor option/s)
*Figures for 1km cable	where: Ci = 200pF/m	& Li = 810nH/m

Sensors can be installed with a maximum of 1000m of cable.

Cable characteristics must not exceed:

Capacitance: 200 pF/m for max. total of: 200 nF. **Inductance:** 810 nH/m for max. total of: 810 µH

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

ATEX / IECEx approved sensors suitable for gas (X series) and mining (M series) applications, are also available.

TABLE OF OPTIONS

CALIBRATED TRAVEL: Factory set to any length from 0-2mm to 0-50mm (e.g. 36mm).

ELECTRICAL IN TERFACE OPTIONS

The Positek $^{\otimes}$ $X005\,$ Galvanic I solation Amplifier is available with the following output options;

 Standard:
 0.5 - 9.5V or 4 - 20mA.

 Reverse:
 9.5 - 0.5V or 20 - 4mA.

CONNECTOR/CABLE OPTIONS

Connector - Binder 713 series IP67 Cable[†] with Pg 9 gland or short gland IP67

[†]Three core (black jacket) or five core (blue jacket) cable options available. Cable length >5 0 cm – please specify length in cm up to 15000 cm max. We recommend all customers refer to the 3 or 5-Wire Mode Connection page.

 $\mbox{PUSH ROD OPTIO NS}$ – standard retained with M4x0.7 female thread Sprung loaded (spring supplied loose), Dome end (sprung loaded) or Free.





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 Intrinsically 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[†] depends on conductors resistivity, which changes with temperature, cross sectional area[‡] 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 0.75mm², 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 10 m, volts drop can 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 15 Ω per conductor with a current flow of 15 mA, which is more than adequate for 15 0m of 0.25 mm² cable, longer lengths will require larger conductors.

For this reason recomm ends five wire connections for cable lengths exceeding 10 metres in 0.25 mm² cable to preserve the full accuracy of the sensor.

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



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 \pm 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.

Sensors are supplied with three core 0.25 mm^2 cable as standard, however five core 0.25 mm^2 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

 $\frac{1}{2}$ R = pL/A p is the resistivity of the conductor (Ω m) L is the length of conductor (m) A is the conductor cross-sectional area (m²).

[‡]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.





Code **Z000**

Z650

Z999

HOW TO ORDER

	а	b	с	d	е	f		g	h	j	k
E103 .	Displacement	А	Y	Connections	Ν	Opti	on	Option	Option	Option	Z-code
a Displa Displaceme	cement (mm) ent in mm	e.g. 0 -	22 mm		Value 22		k Ca	Z-code libration	to suit X	005 - De	fault nt Lineari
b Outpu	t						10n	nm & 50m	m only!		
Sup V₅ (t	ply V dc tolerance)		Output		Code		Co spe	nnector cifies conn	with cab ector with 1	e option 'J' 00cm of cab	or `JQ' with le.
+5V (4.5 - 5	i.5V)	0.5 - 4.5	5V (ratiometric wit	th supply)	Α						
c Calibra	ation Adjustm	ents			Code						
Sealed					Y						
d Conne	ctions Cable [*] or (Connector			Code						
Connector		IP67 M1	2 IEC 60947-	5-2	J	1					
Cable Glan	nd	IP67 M1	2 - 3-core cab	ble	Lxx						
Cable Glan	nd	IP67 M1	2 - 5-core cab	ble	LQxx						
Cable Glan	nd	IP67 Sh	ort - 3-core ca	ble	Мхх						
Cable Glan	nd	IP67 Sh	ort - 5-core ca	ble	MQxx						
*Supplied with specifies cable	1 50 cm as standard, 9 gland with 20 metr	specify reques of cable.	uired cable length s Nb: restricted cabl	specified in cm. e.g. e pull strength.	L2000						
e Housi r	ng				Code						
Flange Mo	unt				N						
f Body F	ittings				Code						
None - def	ault				blank						
Body Clam	ıps - 1 pair				Ρ						
g Sprun g	g Plunger				Code						
None - def	ault				blank						
Spring Exte	end	Captive	plunger only.		R						
h Plunge	er Fittings				Code						
None - def	ault	Female	Thread M4x0.	7x7 deep	blank	1					
Dome end		Require	d for option `R		т						
j Plunge	er Options				Code						
Captive - c	lefault	Plunger	is retained		blank	1					
Non-captiv	/e	Plunger	can depart bo	ody	v						

All Intrinsically Safe (IS) sensors must have a Z-code suffix. IS sensors must be used in conjunction with a Galvanic Isolation Amplifier - See X005 for Output options.

INSTALLATION INFORMATION

For certificate number and safety parameters information for product marked EX04, see next page.

ATEX/IECEx Qualified to Intrinsic Safety Standard Certificate numbers SIRA 13 ATEX2371X IECEx SIR 13.0154X			Ex II 1GD Ex ia IIC T4 Ga (Ta = -40°C to +80°C) Ex ia IIIC T135°C Da (Ta = -40°C to +80°C)	
Electronics Version	Output Description:	Supply Voltage: V _s (tolerance)	Load resistance:	
EX 07	0.5 - 4.5V (ratiometric with supply) [Output code 'A']	+ 5V (4.5 - 5.5V)	5kΩ min	



Putting Into Service: 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:-

Ui = 11.4VCi = 1.36µF* Ci = 1.16µF

Pi = 0.51W

li = 0.20A ('Lxx', 'LQxx', 'Mxx', or 'MQxx' options) *Figures for 1km cable Li = 860µH* ('J' option) $Li = 50 \mu \dot{H}$

The sensor is certified to be used with up to **10 00m** of cable, cable characteristics must not exceed:-Capacitance: ≤ 200 pF/m for max. total of: 200 nF Inductance: ≤ 810 nH/m for max. total of: 810 μH

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

The performance of the sensor may be affected by voltage drops associated with long cable lengths; For cable lengths exceeding 10 metres a five wire connection is recommended to eliminate errors introduced by cable resistance and associated temperature coefficients.

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

Warning - The M12 IEC 60947 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!

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.

Use: The sensor is designed to measure linear displacement and provide an analogue output signal.

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

Maintenance: No maintenance is required. Any cleaning must be done with a damp cloth.

Mechanical Mounting: Via the two slots in the flange, the slots are 4.5 mm by 30 degrees wide on a 48 mm pitch.

Output Characteristic: Plunger extended 10 mm^{*} from mounting face at start of normal travel. *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.







INSTALLATION INFORMATION

For certificate number and safety parameters information for product marked EX07, see previous page.

ATEX Qualified to Intrinsic Safety Standard Certificate numbers SIRA 00ATEX2076X			Ex 1GD EEx ia / C T4 (Ta = -40°C to + 80°C) Ex ia D 20 T135 °C (Ta = -40°C to + 80°C)		
Electronics Version	Output Description:	Supply Voltage: V _s (tolerance)	Load resistance:		
EX 04	0.5 - 4.5V (ratiometric with supply) [Output code 'A']	+ 5V (4.5 - 5.5V)	5kΩ min		

The barrier parameters must not exceed:-

Ui = 11.4V	li= 0.20A	Pi = 0.51W			
Ci = 1.36µ F*	Li= 710µ H*	('Lxx' option) *Figures for 1 km cable			
Ci = 1.16 µF	Li= 50 µH	('J' option)			

The sensor is certified to be used with up to 1000m of cable, cable characteristics must not exceed:-

Capacitance:	≤ 200 pF/m	for max.	total of:	200 nF
Inductance:	≦ 660 nH <i>/</i> m	for max.	total of:	660 µH

With the exception of the certificate number and safety parameters above, all other notes regarding Putting Into Service, Use, Assembly and Dismantling etc. on previous page apply to sensors marked EX04 or EX07.

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The information provided herein is to the best of our knowledge true and accurate, it is provided for guidance only. All specifications are subject to change without prior notification. Althen – Your expert partner in Sensors & Controls | althensensors.com

Althen stands for pioneering measurement and custom sensor solutions. In addition we offer services such as calibration, design & engineering, training and renting of measurement equipment.

Germany/Austria/Switzerland info@althen.de **Benelux** sales@althen.nl **France** info@althensensors.fr Sweden info@althensensors.se USA/Canada info@althensensors.com Other countries info@althensensors.com





ELECTRICAL OPTIONS / SPECIFICATIONS

