

# LIPS<sup>®</sup> X125 350 BAR SUBMERSIBLE STAND-ALONE LINEAR POSITION SENSOR

## INTRINSICALLY SAFE FOR HAZARDOUS GAS/VAPOUR ATMOSPHERES

- **Intrinsically safe for Gas to: Ex II 1G**
- **Travel set to customer's requirement**
- **Compact and self-contained**
- **High durability and reliability**
- **High accuracy and stability**
- **Sealing to IP68 350 Bar**



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

Our X125 LIPS<sup>®</sup> (Linear Inductive Position Sensor) incorporates electronics system EX07 which is ATEX / IECEx approved for use in potentially explosive **gas/vapour** atmospheres.

The X125 is designed to provide feedback for arduous underwater applications, such as ROVs, where hazardous surface conditions may exist. It remains an affordable, durable, high-accuracy position. The unit is highly compact and space-efficient, being responsive along almost its entire length. Like all Positek<sup>®</sup> sensors, the X125 provides a linear output proportional to displacement. Each sensor is supplied with the output calibrated to the travel required by the customer, from 5 to 800mm and with full EMC protection built in.

The sensor is very robust, the body and push rod being made of stainless steel for long service life and environmental resistance. Overall performance, repeatability and stability are outstanding over a wide temperature range. The sensor is easy to install with mounting options including M8 rod eye bearings and body clamps. The push rod can be supplied free or captive, with male M8 thread, an M8 rod eye, or dome end, Captive push rods can be sprung loaded, in either direction, on sensors up to 300 mm of travel. The X125 also offers a range of mechanical options, environmental sealing is to IP68 350 Bar.

### SPECIFICATION

<b>Dimensions</b>	
Body diameter	40 mm electronics and 35 mm
Body length (Axial version)	measurement length + 184 mm
Body length (Radial version)	measurement length + 189 mm
Push rod extension	measurement length + 7 mm, OD 12.6 mm
For full mechanical details see drawing X125-11	
<b>Power Supply</b>	+5V dc nom. ± 0.5V, 10mA typ 20mA max
<b>Output Signal</b>	0.5-4.5V dc ratiometric, Load: 5kΩ min.
<b>Independent Linearity</b>	≤ ± 0.25% FSO @ 20°C - up to 450 mm
	≤ ± 0.5% FSO @ 20°C - over 450 mm
	≤ ± 0.1% FSO @ 20°C* available upon request.

\*Sensors with calibrated displacement of between 10 and 400 mm.

<b>Temperature Coefficients</b>	< ± 0.01%/°C Gain & < ± 0.01%FS/°C Offset
<b>Frequency Response</b>	> 10 kHz (-3dB)
<b>Resolution</b>	Infinite
<b>Noise</b>	< 0.02% FSO
<b>Intrinsic Safety</b>	Ex II 1G Ex ia IIC T4 Ga (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%

<b>Sensor Input Parameters</b>	Ui: 11.4V, Ii: 0.20A, Pi: 0.51W.
(without cable)	Ci: 1.16µF, Li: 50µH
(with cable)	Ci: 1.36µF, Li: 860µH with 1km max. cable

<b>Environmental Temperature Limits (Non Icing)</b>	
Operating	-4 to +50°C
Storage	-4 to +50°C
<b>Sealing</b>	IP68 350 Bar
<b>EMC Performance</b>	EN 61000-6-2, EN 61000-6-3
<b>Vibration</b>	IEC 68-2-6: 10 g
<b>Shock</b>	IEC 68-2-29: 40 g
<b>MTBF</b>	350,000 hrs 40°C Gf

<b>Drawing List</b>	
X125-11	Sensor Outline
Drawings, in AutoCAD <sup>®</sup> dwg or dxf 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.**

# LIPS<sup>®</sup> X125 350 BAR SUBMERSIBLE STAND-ALONE LINEAR POSITION SENSOR

## INTRINSICALLY SAFE FOR HAZARDOUS GAS/VAPOUR 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."

ATEX / IECEx approved to;  
 Ex II 1G  
 Ex ia IIC T4 Ga (Ta = -40°C to +80°C)

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

Protection class ia, denotes intrinsically safe for all zones Apparatus group IIC: suitable for IIA to IIC explosive gas. Temperature class T4: maximum surface temperature under fault conditions 135°C. Ambient temperature range extended to -40°C to +80°C.

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

### Safety Parameters:-

Ui: 11.4V, Ii: 0.20A, Pi: 0.51W  
 Ci = 1.36µF\*      Li = 860µH\* (with cable)  
 Ci = 1.16µF      Li = 50µH (without cable)

\*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.

### TABLE OF OPTIONS

**MEASUREMENT RANGE:** Factory-set to any length from 5 to 800 mm in increments of 1mm.

#### ELECTRICAL INTERFACE OPTIONS

The Positek<sup>®</sup> X005 Galvanic Isolation 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

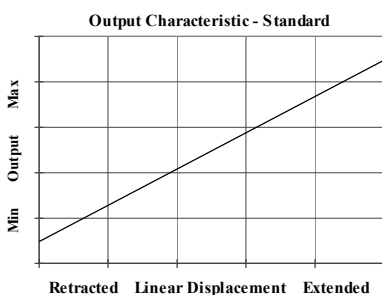
Wet mate 4 pin MC BH-4-M (axial or radial)  
 Supplied with a connector and 0.5 m, 4x0.5mm<sup>2</sup> cable assembly as standard.  
 Mating connector with longer lengths available.

We recommend all customers refer to the 3 or 5-Wire Mode Connection page.

#### MOUNTING OPTIONS

M8 rod eye bearing ( radial versions), Body Tube Clamp/s (axial or radial versions).

**PUSH ROD OPTIONS** – standard retained with M8x1.25 male thread, M8 rod eye bearing, Dome end, Sprung loaded (retraction or extension) 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.

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 situations where large cross-section cables are not practical; for example copper prices and ease of installation.

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.

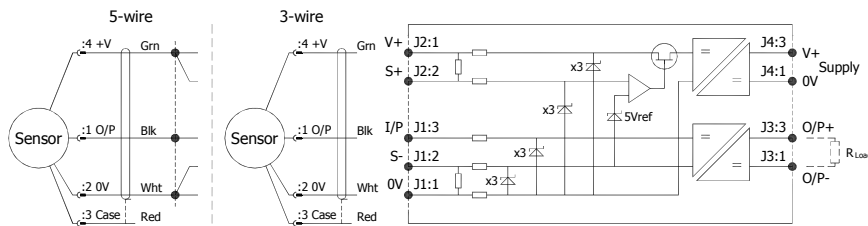
**Three wire mode** connections are common and are suitable in most cases with short or moderate cable runs. Applications that do not require a high degree of accuracy but have cable runs, say in excess of 20m, volts drop can be reduced by introducing a terminal box close to the sensor and using a larger cross-section cable for a majority of the cable run. Sensors are supplied calibrated via a wet mate connector and cable assembly 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 300m of 0.5 mm<sup>2</sup> cable, longer lengths will require larger conductors.

**For this reason Positek® recommends five wire connections for cable lengths exceeding 20 metres in 0.5 mm<sup>2</sup> cable to preserve the full accuracy of the sensor.**

Positek® submersible sensors are supplied with a wet mate connector and four core 0.5 mm<sup>2</sup> cable assembly as standard.

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.

The galvanic isolation amplifier is available as;

- G005-\*\*\* for 'G' prefix sensors
- X005-\*\*\* for '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.