

NOTE. ROD-EYE ORIENTATION NOT GUARANTEED

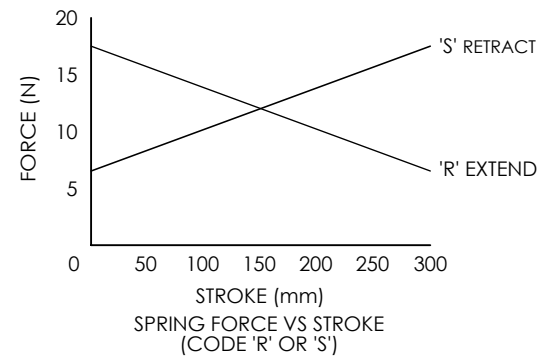
ELECTRICAL OPTIONS/ SPECIFICATIONS  
OUTPUT  
'A' 0.5 - 4.5V RATIOMETRIC  
SUPPLY CURRENT 12mA TYP. 20mA MAX.  
SUPPLY (NOM)  
5V

CONNECTIONS:	CABLE	CONNECTOR
+Ve	3-CORE RED	5-CORE RED :1
+SENSE (5-WIRE ONLY)	-	ORANGE :1
0V	BLACK	BLACK :3
-SENSE (5-WIRE ONLY)	-	GRAY :3
OUTPUT	WHITE	BLUE :2
BODY	SCREEN	SCREEN :4

CABLE; 0.2mm², O/A SCREEN, PUR JACKET, SUPPLIED WITH 50cm OR REQUIRED LENGTH IN cm (15000cm MAX).  
STANDARD 3-CORE: BLACK Ø4mm JACKET e.g. L50  
OPTIONAL 5-CORE: BLUE Ø4.6mm JACKET e.g. LQ50  
CONNECTORS; MAXIMUM CONDUCTOR CROSS SECTION 0.75mm²

RANGE OF DISPLACEMENT FROM 0-5mm TO 0-800mm e.g. 76.  
BODY MATERIAL:- STAINLESS STEEL.  
FURTHER OPTIONS:  
BODY CLAMP CODE 'P'  
TWO BODY CLAMPS CODE 'P2'  
CLAMP CONSISTS OF 2 PARTS AND REQUIRES 2 M6x55 (MIN.) CAP HEAD SCREWS.

SPRUNG PUSH-ROD, ≤300mm:  
EXTENDED POSITION CODE 'R'. RETRACTED POSITION CODE 'S'  
PUSH-ROD FREE CODE 'V' - NOT AVAILABLE WITH CODES 'R' OR 'S'  
CALIBRATION ADJUSTMENTS NOT AVAILABLE ON RADIAL VERSIONS  
CODES 'Ixx' OR 'K'.



NOTE:- READ INSTALLATION SHEET G000-19 FOR FULL INSTRUCTIONS FOR USE.

**CSA APPROVED TO**  
**Class I Zone 0**  
**Ex/AEx ia IIC T4 (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
G	RAN1311 CODE 'WA' ADDED	ASC	01/06/2023	ASC

GAIN AND OFFSET ADJUSTMENTS  
SEALED (CODE 'Y')

THE PUSH-ROD RETRACTS 4mm NOM. BACK FROM THE START OF CALIBRATED TRAVEL. THE PUSH-ROD EXTENDS 8mm\* NOM. BEYOND THE END OF CALIBRATED TRAVEL. \*SPRUNG OPTIONS:- CODE 'R': 1mm, CODE 'S': 2mm. CODE 'V': PUSH-ROD NOT RETAINED.

APPROVED BY RDM	REV G		X ±0.4 X.X ±0.2 X.XX ±0.1 DIMS mm
DESCRIPTION G101 INTRINSICALLY SAFE STAND ALONE LINEAR POSITION SENSOR			
SCALE A3	DRAWING NUMBER G101-11		

SHEET 1 OF 1



# G101 STAND-ALONE LINEAR POSITION SENSOR

## INTRINSICALLY SAFE FOR HAZARDOUS GAS/VAPOUR ATMOSPHERES

- **Intrinsically safe for Gas to:**  
**Class I, Zone 0 Ex ia / AEx ia**
- **Non-contacting inductive technology to eliminate wear**
- **Travel set to customer's requirement**
- **High durability and reliability**
- **High accuracy and stability**
- **Sealing to IP65/IP67 as required**



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 G101 incorporates electronics system EX06 which is CSA approved for use in potentially explosive **gas/vapour** atmospheres. The G101 is designed for industrial and scientific feedback applications and is ideal for OEMs seeking good sensor performance for arduous applications in hazardous areas. The unit is highly compact and space-efficient, being responsive along almost its entire length.

The G101, 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, any stroke from 0-5mm to 0-800mm 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 M5 rod eye bearings and body clamps. The push rod can be supplied free or captive with female M5 thread, an M5 rod eye, dome end or magnetic tip. 1/4" Rod eye option available. Captive push rods can be sprung loaded, in either direction, on sensors up to 300mm of travel. The G101 also offers a wide range of mechanical options, environmental sealing is to IP65 or IP67, depending on selected cable or connector options.

### SPECIFICATION

#### Dimensions

Body diameter	35 mm
Body length (Axial version)	calibrated travel + 163 mm
Body length (Radial version)	calibrated travel + 186 mm
Push rod extension	calibrated travel + 9 mm, OD 9.5 mm

*For full mechanical details see drawing G101-11*

#### Power Supply

#### Output Signal

#### Independent Linearity

	+5V dc nom. $\pm 0.5V$ , 10mA typ 20mA max
	0.5-4.5V dc ratiometric, Load: 5k $\Omega$ min.
	$\leq \pm 0.25\%$ FSO @ 20°C - up to 450 mm
	$\leq \pm 0.5\%$ FSO @ 20°C - over 450 mm
	$\leq \pm 0.1\%$ FSO @ 20°C* available upon request.

\*Sensors with calibrated travel from 10 mm up to 400 mm.

#### Temperature Coefficients

	$< \pm 0.01\%/^{\circ}C$ Gain &
	$< \pm 0.01\%FS/^{\circ}C$ Offset

$> 10$  kHz (-3dB)

#### Frequency Response

#### Resolution

#### Noise

#### Intrinsic Safety

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

#### Sensor Input Parameters

(connector option/s)

(cable option/s)

#### Environmental Temperature Limits

Operating

Storage

#### Sealing

#### EMC Performance

#### Vibration

#### Shock

#### MTBF

#### Drawing List

G101-11

Drawings, in AutoCAD® dwg or dxf format, available on request.

Sensor Outline

**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.**



# G101 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."

CSA approved to;

Class I, Zone 0

Ex ia IIC T4 (Ta = -40°C to +80°C)

AEx ia IIC T4 (Ta = -40°C to +80°C)

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

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.

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.

### Safety Parameters:-

Ui: 11.4V, Ii: 0.20A, Pi: 0.51W

Ci = 1.36µF\* Li = 710µH\* (cable option/s)

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

\*Figures for 1km cable where: Ci = 200pF/m & Li = 660nH/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: ≤ 660 nH/m for max. total of: 660 µH

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 dust (H series, USA only) applications, are also available from Positek.

## TABLE OF OPTIONS

**CALIBRATED TRAVEL:** Factory set to any length from 0-5mm to 0-800mm (e.g. 254mm)

### ELECTRICAL INTERFACE OPTIONS

Axial sensors supplied with access to output 'zero' and 'span' calibration adjustments as standard. No access option available.

The Positek® **G005** 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/CABLE OPTIONS

Connector - Hirschmann GD series Axial, IP65

Connector - Hirschmann ELWIK 4102 Radial, IP67

Cable<sup>†</sup> with M12 gland or short gland Axial, IP67

Cable<sup>†</sup> with Pg 9 gland Radial, IP67

<sup>†</sup>Three core (black jacket) or five core (blue jacket) cable options available. Cable length >50 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.

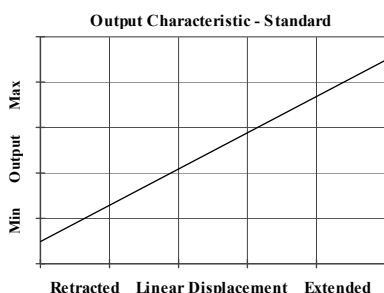
### MOUNTING OPTIONS

M5 rod eye bearing ( radial versions), Body Tube Clamp/s (axial or radial versions). 1/4" Rod eye option available.

**PUSH ROD OPTIONS** – Retained<sup>†</sup> or Free with M5x0.8 female thread, M5 rod eye bearing or Magnetic tip, Spring loaded - retract or extend, Dome end<sup>#</sup>.

<sup>†</sup> standard, retained with female thread.

<sup>#</sup> with spring extend.



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# 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® 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<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.

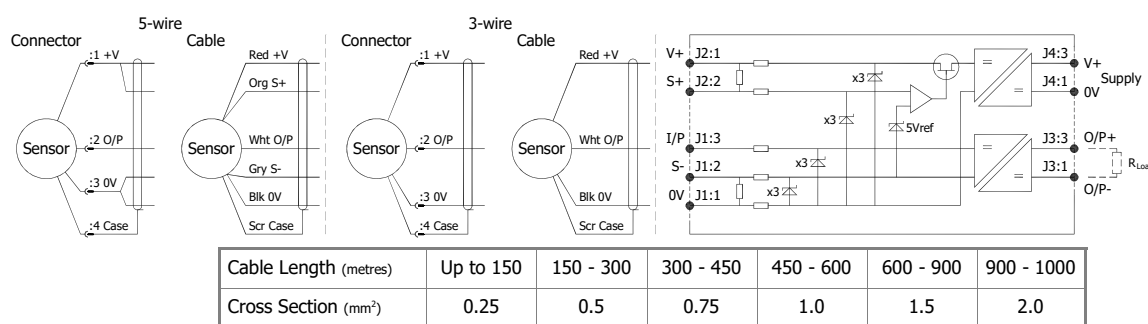
This is important because the effects of volts drop can significantly alter the perceived accuracy of the sensor which is ratiometric i.e. the output signal is directly affected by the voltage across the sensor. Changes in temperature will also be seen as gain variation in the sensor output.

**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.



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 (Ωm)  $L$  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.

# Intrinsically Safe - Gas/Vapour Atmospheres

## G101 Stand-Alone Linear Position Sensor

a	b	c	d	e	f	g	h	j	k
G101	Displacement	A	Adjustments	Connections	Option	Option	Option	Option	Z-code

a Displacement (mm)		Value
Displacement in mm	e.g. 0 - 254 mm	<b>254</b>
b Output		
Supply V dc V <sub>s</sub> (tolerance)	Output	Code
+5V (4.5 - 5.5V)	0.5 - 4.5V (ratiometric with supply)	<b>A</b>
c Calibration Adjustments		Code
Accessible - default <sup>†</sup>	<sup>†</sup> Axial body style only. Radial body style sealed by default.	blank
Sealed		<b>Y</b>
d Connections Cable or Connector		Code
Cable Gland - Radial	IP67 metal - 3-core cable	<b>Ixx</b>
	IP67 metal - 5-core cable	<b>IQxx</b>
	IP65 DIN 43650 'C'	<b>J</b>
Connector - Axial	pre-wired - 3-core cable	<b>Jxx</b>
	pre-wired - 5-core cable	<b>JQxx</b>
	IP67 M12 IEC 60176-2-101 nylon	<b>K</b>
Connector - Radial	pre-wired - 3-core cable	<b>Kxx</b>
	pre-wired - 5-core cable	<b>KQxx</b>
	IP67 nylon - 3-core cable	<b>Lxx</b>
Cable Gland - Axial	IP67 nylon- 5-core cable	<b>LQxx</b>
	IP67 Short - 3-core cable	<b>Mxx</b>
Cable Gland <sup>†</sup> - Axial	IP67 Short - 5-core cable	<b>MQxx</b>
Specify required cable length 'xx' in cm. e.g. L2000 specifies cable gland with 20 m of cable, 50 cm supplied as standard. <sup>†</sup> Nb: restricted cable pull strength.		
e Body Fittings		Code
None - default		blank
M5 Rod-eye Bearing	Radial body style only	<b>N</b>
f Body Clamps		Code
Body Clamps - 1 pair		<b>P</b>
Body Clamps - 2 pairs		<b>P2</b>
g Sprung Push Rod		Code
None - default		blank
Spring Extend	Up to 300mm displacement.	<b>R</b>
Spring Retract	Captive push rod only.	<b>S</b>
h Push Rod Fittings		Code
None - default		blank
Dome end	Requires option 'R'	<b>T</b>
M5 Rod-eye Bearing		<b>U</b>
Magnetic Tip		<b>WA</b>
j Push Rod Options		Code
Captive - default		blank
Non-captive		<b>V</b>

j Z-code	Code
Calibration to suit G005 - Default	<b>Z000</b>
Connector IP67 M12 IEC 60176-2-101 must have options 'Y' & 'J'	<b>Z600</b>
Connector IP67 M12 IEC 60176-2-101 must have option 'J'	<b>Z601</b>
≤± 0.1% @20°C Independent Linearity displacement between 10mm & 400mm only!	<b>Z650</b>
1/4 Rod eye options available	<b>Z827</b>

### Note!

All Intrinsically Safe (IS) sensors must have a Z-code suffix.

IS sensors must be used in conjunction with a Galvanic Isolation Amplifier - See G005 for Output options.



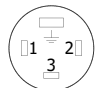
# Installation Information

## G101 STAND-ALONE LINEAR POSITION SENSOR

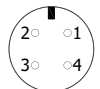
### INTRINSICALLY SAFE FOR HAZARDOUS GAS/VAPOUR ATMOSPHERES

#### Connector Pin Layout:

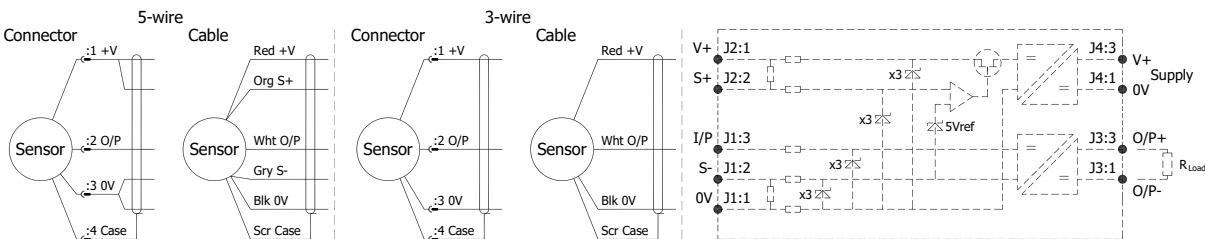
DIN 43650 C



IEC 60947-5-2



Earth = Pin '4'.



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

#### The G101 is available with the following connections:-

IP65	DIN 43650 C Connector	Axial	Option 'J'
IP67	IEC 60947-5-2 Connector	Radial	Option 'K'
IP67	Cable gland with cable	Axial or Radial	Options 'Lxx', 'LQxx', 'Mxx', 'MQxx', 'Ixx' or 'IQxx'

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.

Cable Up to 150m of 0.2 mm<sup>2</sup>, screened, PUR jacket; 3 core cable 4 mm dia. black,  
5 core cable 4.6 mm dia. Blue.

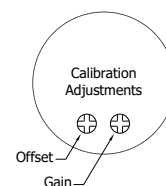
N.b. sensors supplied with cable, the free end must be appropriately terminated.

**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!**

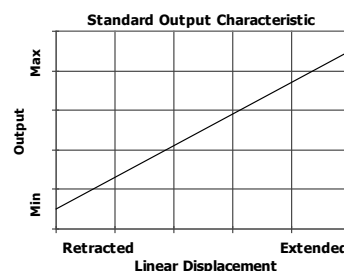
**Gain and Offset Adjustment:** (Where accessible - Typically  $\pm$  10% Min available)

To adjust the gain or offset use a small potentiometer adjuster or screwdriver 2mm across. Do not apply too much force on the potentiometers.



**Mechanical Mounting:** Depending on options; Body can be mounted by M5x0.8 male thread, M5 rod eye (1/4" Rod eye option available) or by clamping the sensor body - body clamps are available, if not already ordered. Target by M5x0.8 female thread, M5 rod eye or magnetic tip. It is assumed that the sensor and target mounting points share a common earth.

**Output Characteristic:** Target is extended 9 mm from end of body at start of normal travel. The output increases as the target extends from the sensor body, the calibrated stroke is between 5 mm and 800 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.