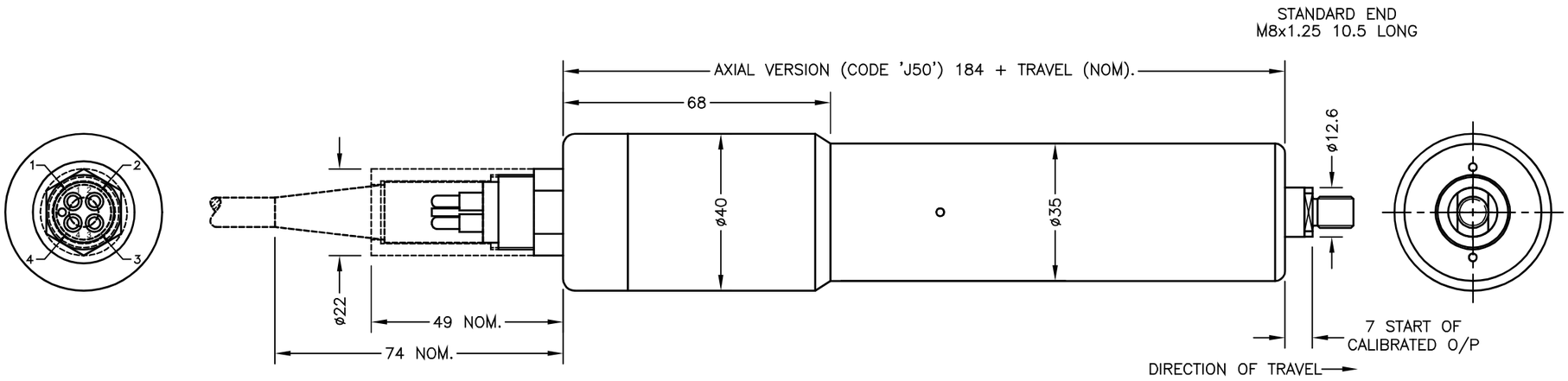
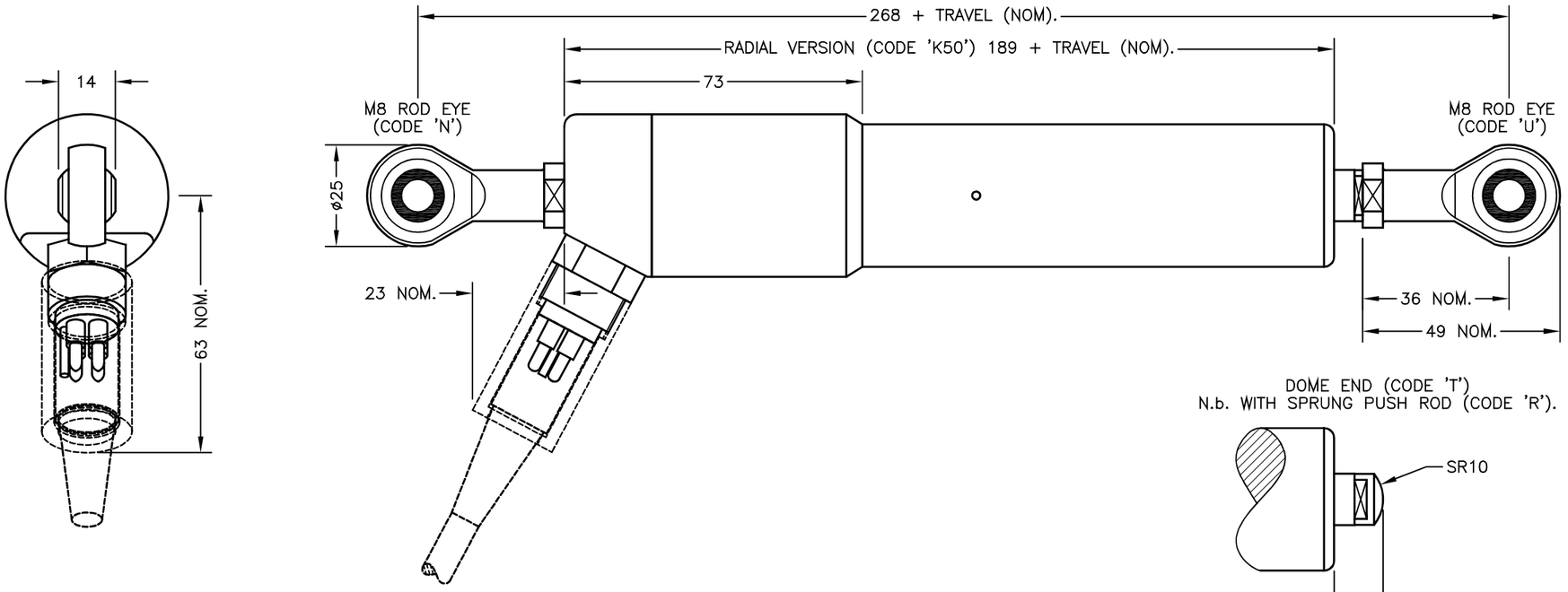
N.b. ROD–EYE ORIENTATION NOT GUARANTEED.
CONNECTORS; MICRO MINI WETMATE, 4–POLE.
BULKHEAD; MCBH–4–MP–SS, STAINLESS STEEL/MOLDED NEOPRENE, SEALING; 340 BAR OPEN FACE, 600 BAR MATED.
IN–LINE; MCIL–4–FS, MOLDED NEOPRENE WITH CABLE. LOCKING SLEEVE; MCDLS–F, DELRIN.





DOME END (CODE 'T')
N.b. WITH SPRUNG PUSH ROD (CODE 'R').

ELECTRICAL OPTIONS/ SPECIFICATIONS

OUTPUT	SUPPLY
0.5 TO 4.5V RATIOMETRIC	5V

SUPPLY CURRENT 12mA TYP. 20mA MAX.

MATING CONNECTOR (CODE 'J50' OR 'K50') SUPPLIED WITH 50cm MOULDED CABLE AS STANDARD.
4–CORE SCREENED: 0.5mm^2, ø7.5mm MAX. JACKET AND CORE INSULATION: EPDM.

CONNECTIONS:–

1	BLACK	OUTPUT
2	WHITE	0V
3	RED	BODY
4	GREEN	+Ve
	SCREEN	NOT CONNECTED TO SENSOR

RANGE OF DISPLACEMENT FROM 0–5mm TO 0–800mm e.g.76mm, IN INCREMENTS OF 1mm.

BODY MATERIAL: STAINLESS STEEL 316.

FURTHER OPTIONS:

SINGLE PAIR OF BODY CLAMPS 'P'
TWO PAIRS OF BODY CLAMPS 'P2'

SPRING RETURN PUSH–ROD, TRAVEL ≤300mm
RETURN TO EXTENDED POSITION (CODE R)
RETURN TO RETRACTED POSITION (CODE S)

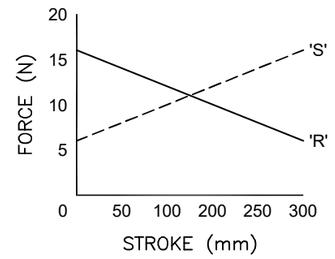
PUSH–ROD FREE (CODE 'V') – NOT AVAILABLE WITH SPRUNG OPTIONS.

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!



SPRING FORCE v STROKE
(OPTION 'R' OR 'S')

MAXIMUM WORKING DEPTH: 3500 METRES 350 BAR. WHERE THE FREE END OF THE CABLE IS TO BE TERMINATED IN A SUBMERGED POSITION, ADEQUATE SEALING MUST BE PROVIDED TO PROTECT CONNECTIONS.

THE PUSH–ROD RETRACTS A FURTHER 4mm NOM. FROM START OF CALIBRATED TRAVEL. STANDARD VERSIONS THE PUSH–ROD EXTENDS A FURTHER 8mm NOM. FROM END OF CALIBRATED TRAVEL, FOR SPRUNG VERSIONS: 'R': 1mm, 'S': 2mm.
'V' CODED PUSH–ROD WILL DEPART SENSOR BODY.

A	FIRST ISSUE	RDS
B	OMITTED OPTIONS ADDED.	PDM
C	"7 START OF..." WAS "7.00 START OF...".	PDM
D	MALE M8 WAS FEMALE RAN1180	RDS
E	CABLE COLOURS CORECTED - RAN1190	PDM
F	3500 METERS WAS 3482 RAN1145	RDS
G	RANGE NOTE AMENDED ~ RAN1200	PDM

CE

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A	24/09/15		CHECKED BY	X ±0.4
B	08/01/16		RDS	X.X ±0.2
C	21/10/16			X.XX ±0.1
D	25/4/17			DIMS mm
E	14/06/17	DESCRIPTION		
F	15/06/17	INTRINSICALLY SAFE 350 BAR SUBMERSIBLE STAND-ALONE LINEAR POSITION SENSOR		
G	12/09/17			
SCALE 12.5mm		DRAWING NUMBER G125-11	REV G	
			SHEET 1 OF 1	

POSITEK LIMITED

LIPS® G125 350 BAR SUBMERSIBLE 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**
- **Travel set to customer's requirement**
- **Compact and self-contained**
- **High durability and reliability**
- **High accuracy and stability**
- **Sealing to IP68 350Bar**

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 G125 LIPS® (Linear Inductive Position Sensor) incorporates electronics system EX06 which is CSA approved for use in potentially explosive **gas/vapour** atmospheres.

The G125 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® sensors, the G125 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 300mm of travel. The G125 also offers a range of mechanical options, environmental sealing is to IP68 350 Bar.

SPECIFICATION

Dimensions	
Body diameter	40 mm electronics & 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 G125-11	
Power Supply	+5V dc nom. ± 0.5V, 10mA typ 20mA max
Output Signal	0.5-4.5V dc ratiometric, Load: 5kΩ min.
Independent Linearity	≤ ± 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.	
Temperature Coefficients	< ± 0.01%/°C Gain &
	< ± 0.01%FS/°C Offset
Frequency Response	> 10 kHz (-3dB)
Resolution	Infinite
Noise	< 0.02% FSO
Intrinsic Safety	Class I, Zone 0
	Ex ia IIC T4 (Ta = -40°C to +80°C)
	AEx ia IIC T4 (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.
(without cable)	Ci: 1.16µF, Li: 50µH
(with cable)	Ci: 1.36µF, Li: 710µH with 1km max. cable
Environmental Temperature Limits (Non Icing)	
Operating	-4°C to +50°C
Storage	-4°C to +50°C
Sealing	IP68 350Bar
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	
G125-11	Sensor Outline
Drawings, in AutoCAD® 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.

For further information please contact:
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G125-17f

LIPS® G125 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.”

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

*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.

TABLE OF OPTIONS

MEASUREMENT RANGE: Factory set to any length from 0-5mm to 0-800mm (e.g. 254mm)

ELECTRICAL INTERFACE OPTIONS

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.

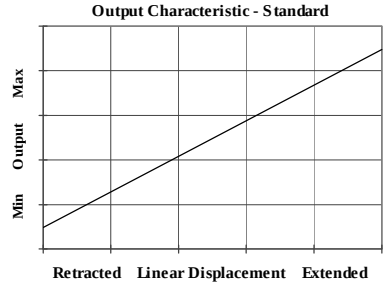
CONNECTOR Wet mate 4 pin MC BH-4-M (axial or radial)
Supplied with a connector and 0.5 m, 4x0.5mm^2 cable assembly as standard.
Mating connector with longer lengths available.

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.



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G125-17f

POSITEK LIMITED

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[†] 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 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.

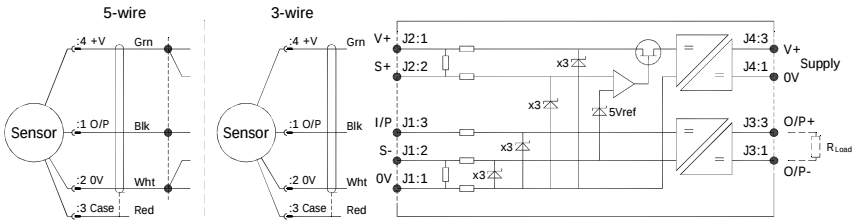
Three wire mode connections are common and are suitable in most cases with short or moderate cable runs. Applications that do not require a high degree of accuracy but have cable runs, say in excess of 20m, volts drop can reduced by introducing a terminal box close to the sensor and using a larger cross-section 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 mm² cable, longer lengths will require larger conductors.

For this reason Positek® recommends five wire connections for cable lengths exceeding 20 metres in 0.5 mm² cable to preserve the full accuracy of the sensor.

Positek® submersible sensors are supplied with a wet mate connector and four core 0.5 mm² 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 (mm²)	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

[†] R = ρL/A ρ is the resistivity of the conductor (Ωm) L is the length of conductor (m) A is the conductor cross-sectional area (m²).
[‡] It is presumed that **d**irect **c**urrent flow is uniform across the cross-section of the wire, the galvanic isolation amplifier and sensor are a dc system.

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ISO 9001 UKAS MANAGEMENT SYSTEMS

256053

CE

Intrinsically Safe - Gas/Vapour Atmospheres

LIPS® SERIES G125 350 Bar Submersible Stand-Alone Linear Position Sensor

		a		b		c	d	e	f	g	h
G125	.	Displacement		A		Connections	Option	Option	Option	Option	Z-code

a **Displacement** (mm)		**Value**
Displacement in mm	e.g. 0 - 254 mm	**254**

b **Output**		
Supply V dc V_s (tolerance)	**Output**	**Code**
+5V (4.5 - 5.5V)	0.5 - 4.5V (ratiometric with supply)	**A**
±15V nom. (±9 - 28V)	±5V	**B**
+24V nom. (13 - 28V)	0.5 - 9.5V	**C**
±15V nom. (±13.5 - 28V)	±10V	**D**
+24V nom. (18 - 28V)	4 - 20mA 2 wire	**E**
+24V nom. (13 - 28V)	4 - 20mA 3 wire Sink	**F**
+24V nom. (9 - 28V)	0.5 - 4.5V	**G**
+24V nom. (13 - 28V)	4 - 20mA 3 wire Source	**H**

c **Connections**		**Code**
Connector - Axial	IP68 350 Bar Wet mate 4 pin MC BH-4-M plus pre-wired mating connector	**J50**
Connector - Radial		**K50**

d **Body Fittings**		**Code**
None - default		blank
M8 Rod-eye Bearing	Radial body style only	**N**
Body Clamps - 1 pair		**P**
Body Clamps - 2 pairs		**P2**

e **Sprung Push Rod**		**Code**
None - default		blank
Spring Extend	Up to 300mm displacement. Captive push rod only.	**R**
Spring Retract		**S**

f **Push Rod Fittings**		**Code**
None - default	Male Thread M8x1.25x10.5 long	blank
Dome end	Required for option 'R'	**T**
M8 Rod-eye Bearing		**U**

g Push Rod Options		**Code**
Captive - default	Push rod is retained	blank
Non-captive	Push rod can depart body	**V**

h **Z-code**	**Code**
Calibration to suit G005 - Default	**Z000**
≤± 0.1% @20°C Independent Linearity displacement between 10mm & 400mm only!	**Z650**

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.

Generic Installation Information

G SERIES SENSORS

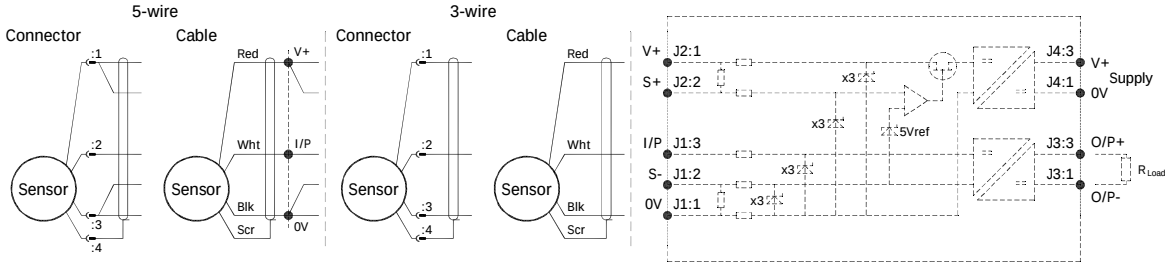
INTRINSICALLY SAFE FOR HAZARDOUS GAS/VAPOUR ATMOSPHERES

CSA Qualified Intrinsically Safe Device Certificate number 13.2588225			Class I, Zone 0 Ex ia IIC T4 (Ta = -40°C to +80°C AEx ia IIC T4 / Ex ia IIC T4(Ta = -40°C to +80°C
Electronics Option	**Output Description:**	**Supply Voltage:** V_s (tolerance)	**Load resistance:**
A	0.5 - 4.5V (ratiometric with supply)	+5V (4.5 - 5.5V)	5kΩ min

Connector Pin Layout:

DIN 43650 C

IEC 60947-5-2



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 = 11.4V **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

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/m for max. total of: 660 µH

Use:

The sensor is designed to measure Linear or rotary 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.

WARNING: Substitution of components may impair intrinsic safety
AVERTISSEMENT: La substitution de composants peut altérer la sécurité intrinsèque

Maintenance:

No maintenance is required.

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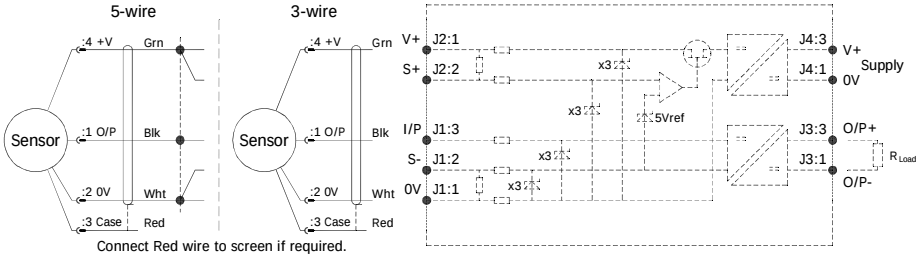
POSITEK LIMITED

Installation Information

LIPS® G125 350 BAR SUBMERSIBLE STAND-ALONE LINEAR POSITION SENSOR INTRINSICALLY SAFE FOR HAZARDOUS GAS/VAPOUR ATMOSPHERES

Connector Pin Layout:
MC BH 4 M (face view)



Connect Red wire to screen if required.

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

The G125 is supplied with a wet-mate MC BH-4-M connector.

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.

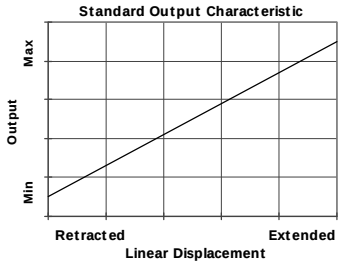
Cable; 50cm of 20AWG 4 core screened cable with moulded MC IL-4-F connector. N.b. Cable free end must be appropriately terminated, including preventing water ingress into the cable. **See page 2 for connector handling instructions.** The sensor is sealed to IP68 350 Bar.

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: Depending on options; Body can be mounted by M8 rod eye or by clamping the sensor body - body clamps are available, if not already ordered. Target by M8x1.25 male thread or M8 rod eye. It is assumed that the sensor and target mounting points share a common earth.

Output Characteristic: Target is extended 7 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:- 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.

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G125-19d

POSITEK LIMITED

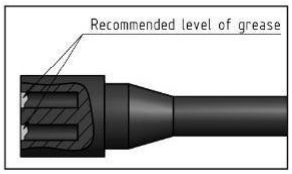
Installation Information

LIPS® G125 350 BAR SUBMERSIBLE STAND-ALONE LINEAR POSITION SENSOR INTRINSICALLY SAFE FOR HAZARDOUS GAS/VAPOUR ATMOSPHERES

Handling

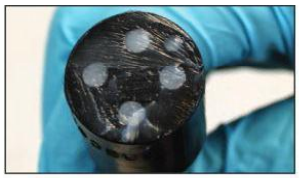
- Always apply grease before mating
- Disconnect by pulling straight, not at an angle
- Do not pull on the cable and avoid sharp bends at cable entry
- When using a bulkhead connector, ensure that there are no angular loads
- Do not over-tighten the bulkhead nuts
- SubConn® connectors should not be exposed to extended periods of heat or direct sunlight. If a connector becomes very dry, it should be soaked in fresh water before use

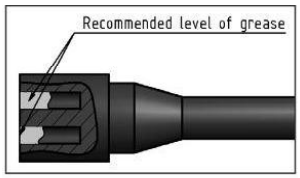
Greasing and mating above water (dry mate)



- Connectors must be greased with Molykote 44 Medium before every mating
- A layer of grease corresponding to minimum 1/10 of socket depth should be applied to the female connector
- The inner edge of all sockets should be completely covered, and a thin transparent layer of grease left visible on the face of the connector
- After greasing, fully mate the male and female connector in order to secure optimal distribution of grease on pins and in sockets
- To confirm that grease has been sufficiently applied, de-mate and check for grease on every male pin. Then re-mate the connector

Greasing and mating under water (wet mate)





- Connectors must be greased with Molykote 44 Medium before every mating
- A layer of grease corresponding to approximately 1/3 of socket depth should be applied to the female connector
- All sockets should be completely sealed, and transparent layer of grease left visible on the face of the connector
- After greasing, fully mate the male and female connector and remove any excess grease from the connector joint

Cleaning

- General cleaning and removal of any accumulated sand or mud on a connector should be performed using spray based contact cleaner (isopropyl alcohol)
- New grease must be applied again prior to mating

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CE

G125-19d