

TIPS[®] S623 LARGE ANGLE SUBMERSIBLE TILT SENSOR

High-resolution tilt feedback for industrial and scientific applications

- **Non-contacting inductive technology to eliminate wear**
- **Angle 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[®] has the expertise to supply a sensor to suit a wide variety of applications.

Our S623 TIPS[®] (Tilt Inductive Position Sensor) is an affordable, durable, high-accuracy tilt sensor designed to provide feedback for arduous underwater applications such as ROVs. The S623, like all Positek[®] sensors, is supplied with the output calibrated to the angle required by the customer, between 15 and 160 degrees and with full EMC protection built in. The sensor provides a linear output proportional with the rotation of the sensor. There is a machined registration mark to identify the calibrated mid point.

Overall performance, repeatability and stability are outstanding over a wide temperature range. Electrical connections to the sensor are made via a wet mate connector.

The sensor has a rugged 316 stainless steel body and mounting flange. The flange has two 5.5mm holes on a 54mm pitch to simplify mounting. The S623 offers a range of electrical options. Environmental sealing is to IP68 350 Bar.

SPECIFICATION

Dimensions	
Body diameter	40 mm, Flange 69mm
Body Length (to seal face)	81 mm
	For full mechanical details see drawing S623-11
Independent Linearity/Hysteresis	
(combined error)	< ± 0.25° - up to 100°
Temperature coefficients	< ± 0.01%/°C Gain & < ± 0.01%FS/°C Offset
Response Time	250 mS @ 20°C typ.
Resolution	Infinite
Damping Ratio	0.2 : 1 (0.6 nom. @ 25°C)
Noise	< 0.02% FSO
Environmental Temperature Limits	
Operating	-4°C to +50°C all output options
Storage	-4°C to +50°C
Sealing	IP68 350 Bar
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	
S623-11	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.



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High-resolution tilt feedback for industrial and scientific applications

How Positek’s PIPS[®] technology eliminates wear for longer life

Positek’s **PIPS[®]** technology (Positek Inductive Position Sensor) is a major advance in displacement sensor design. PIPS[®]-based displacement transducers have the simplicity of a potentiometer with the life of an LVDT/RVDT.

PIPS[®] technology combines the best in fundamental inductive principles with advanced micro-electronic integrated circuit technology. A PIPS[®] sensor, based on simple inductive coils using Positek’s ASIC control technology, directly measures absolute position giving a DC analogue output signal. Because there is no contact between moving electrical components, reliability is high and wear is eliminated for an exceptionally long life.

PIPS[®] overcomes the drawbacks of LVDT technology – bulky coils, poor length-to-stroke ratio and the need for special magnetic materials. It requires no separate signal conditioning.

Our LIPS[®] range are linear sensors, while RIPS[®] are rotary units and TIPS[®] are for detecting tilt position. Ask us for a full technical explanation of PIPS[®] technology.

We also offer a range of ATEX-qualified intrinsically-safe sensors.

TABLE OF OPTIONS

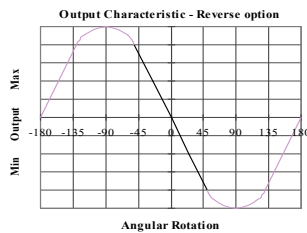
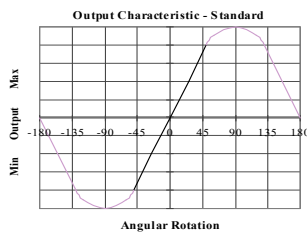
CALIBRATED TRAVEL: Factory-set to any angle from $\pm 7.5^\circ$ to $\pm 80^\circ$ in increments of 1° .

ELECTRICAL INTERFACE OPTIONS

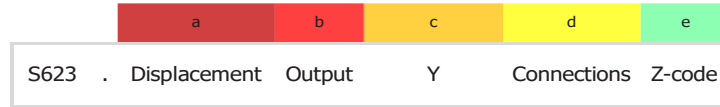
OUTPUT SIGNAL	SUPPLY INPUT	OUTPUT LOAD
Standard: 0.5-4.5V dc ratiometric	+5V dc nom. \pm 0.5V.	5k Ω min.
Buffered: 0.5-4.5V dc	+24V dc nom. + 9-28V.	5k Ω min.
\pm 5V dc	\pm 15V dc nom. \pm 9-28V.	5k Ω min.
0.5-9.5V dc	+24V dc nom. + 13-28V.	5k Ω min.
\pm 10V dc	\pm 15 V dc nom. \pm 13.5-28V.	5k Ω min.
Supply Current	10mA typical, 20mA maximum.	
4-20mA (2 wire)	+24 V dc nom. + 18-28V.	300 Ω @ 24V.
(3 wire sink)	+24 V dc nom. + 13-28V.	950 Ω @ 24V.
(3 wire source)	+24 V dc nom. + 13-28V.	300 Ω max.

CONNECTOR

Wet mate 4 pin MC BH-4-M (axial or radial).
Supplied with a connector and 0.5 m, 4x0.5mm²
cable assembly as standard.
Mating connector with longer lengths available.



TIPS® SERIES S623 Large Angle Submersible Tilt Sensor



a Displacement (degrees)		Value
Displacement in degrees	e.g. 0 - 54 degrees	54
b Output		Code
Supply V dc Vs (tolerance)	Output	
+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 Calibration Adjustments		Code
Sealed		Y
d Connections		Code
Connector - Axial	IP68 350 Bar Wet mate 4 pin MC	J50
Connector - Radial	BH-4-M plus pre-wired mating connector	K50

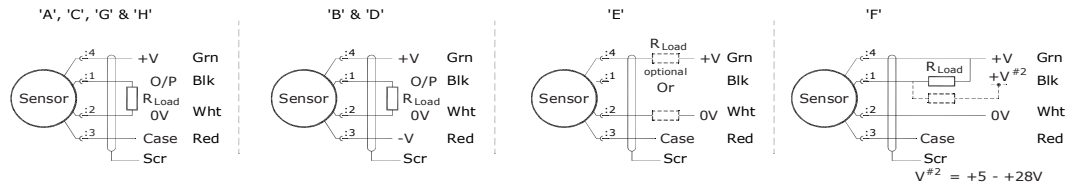


Installation Information

TIPS[®] S623 LARGE ANGLE SUBMERSIBLE TILT SENSOR

Output Option	Output Description:	Supply Voltage: V_s (tolerance)	Load resistance: (include leads for 4 to 20mA O/Ps)
A	0.5 - 4.5V (ratiometric with supply)	+5V (4.5 - 5.5V)	$\geq 5k\Omega$
B	$\pm 5V$	$\pm 15V$ nom. (± 9 - 28V)	$\geq 5k\Omega$
C	0.5 - 9.5V	+24V nom. (13 - 28V)	$\geq 5k\Omega$
D	$\pm 10V$	$\pm 15V$ nom. (± 13.5 - 28V)	$\geq 5k\Omega$
E	4 - 20mA 2 wire Current Loop	+24V nom. (18 - 28V)	≈ 0 - 300 Ω max. @24V ~ 1.2 to 6V across 300 Ω { R_L max. = $(V_s - 18) / 20^{-3}$ }
F	4 - 20mA 3 wire Sink	+24V nom. (13 - 28V)	≈ 0 - 950 Ω max. @24V ~ 3.8 to 19V across 950 Ω { R_L max. = $(V_s - 5) / 20^{-3}$ }
G	0.5 - 4.5V	+24V nom. (9 - 28V)	$\geq 5k\Omega$
H	4 - 20mA 3 wire Source	+24V nom. (13 - 28V)	≈ 0 - 300 Ω max. ~ 1.2 to 6V across 300 Ω

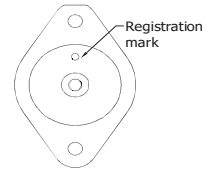
Connector Pin Layout:
MC BH 4 M (face view)



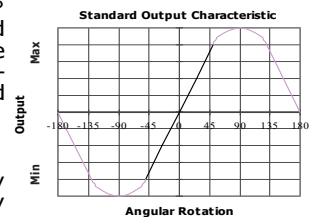
Mechanical Mounting: Flange mounted, flange holes are 5.5mm diameter on a 54mm pitch. As shipped, the sensor calibrated mid-point will be obtained with the flange in the vertical plane, as shown. Mechanical adjustment of the mid point can be achieved by loosening two M4 grub screws in the edge of the flange and rotating the sensor body. **Note:** the sensor should be mounted on a vertical face.

N.b. cable free end must be appropriately terminated to prevent water ingress into the cable. **See page 2 for connector handling instructions.**
The sensor is sealed to IP68 350 Bar.

Output Characteristic: The sensor has full rotational freedom and two sectors, 180° apart, over which linear response can be achieved. At the mid point of the calibrated range the output signal will be half full scale deflection, and the mounting flanges will be vertical. In the calibrated range the output increases as the sensor is rotated in an anti-clockwise direction viewed from the flange face - see drawing above. The calibrated output is factory set to be between 15 and 160°.



Direction of increasing output in calibrated sector



Incorrect Connection Protection levels:-

- A **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.
- B & D Supply leads diode protected. Output must not be taken outside $\pm 12V$.
- C & G Supply leads diode protected. Output must not be taken outside 0 to 12V.
- E, F & H Protected against any misconnection within the rated voltage.



Installation Information

TIPS[®] S623 LARGE ANGLE SUBMERSIBLE TILT SENSOR

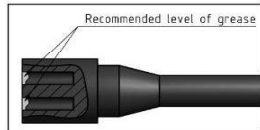
Handling

- 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

Cleaning

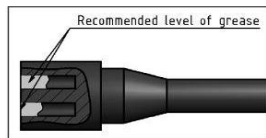
- General cleaning and removal of any accumulated sand or mud on a connector should be performed using spray based contact cleaner (isopropyl alcohol)
- New grease must be applied again prior to mating

Greasing and mating above water (dry mate)



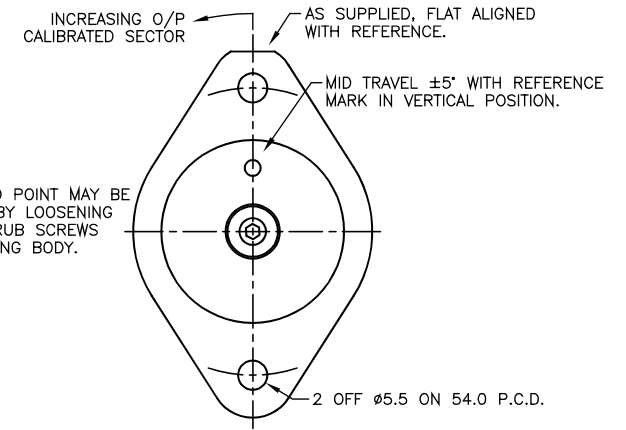
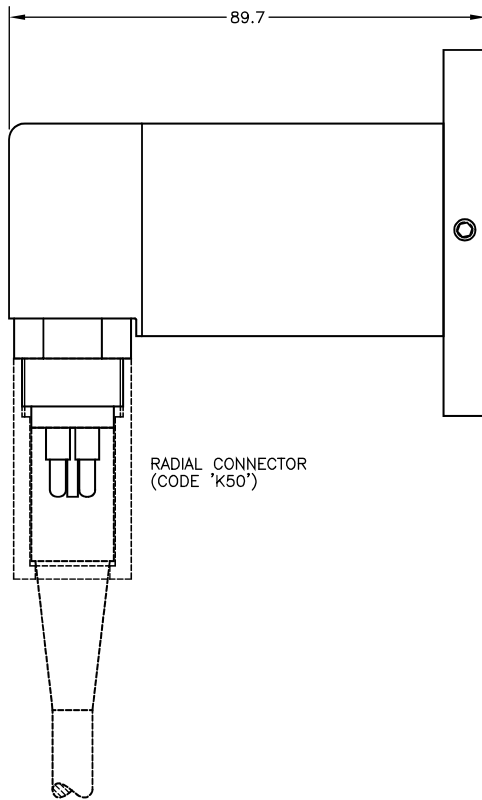
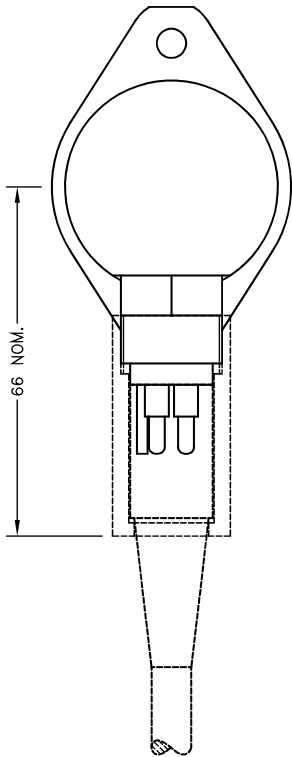
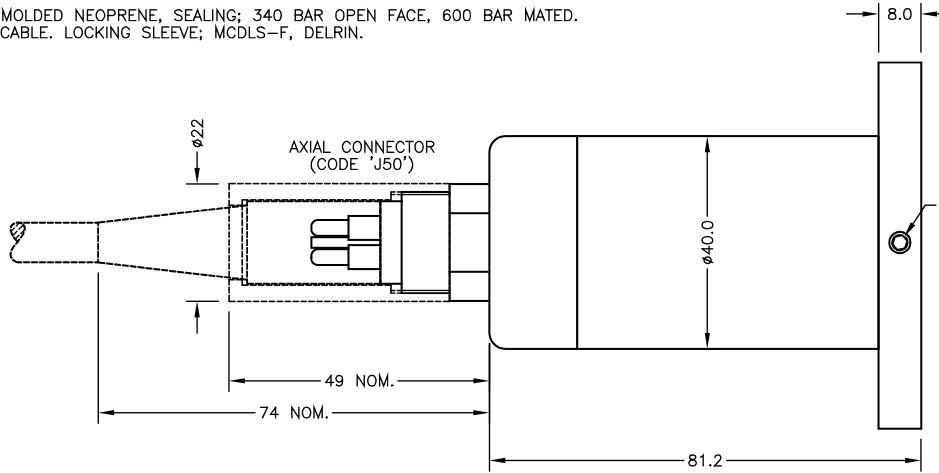
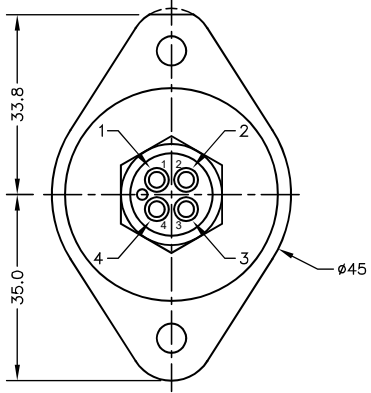
- Connectors must be greased with Molykote 44 Medium before every mating
- A layer of grease corresponding to minimum 1/10 of socket depth should be applied to the female connector
- The inner edge of all sockets should be completely covered, and a thin transparent layer of grease left visible on the 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

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.



NOTE: ZERO POINT MAY BE ADJUSTED BY LOOSENING TWO M4 GRUB SCREWS AND ROTATING BODY.

ELECTRICAL OPTIONS/ SPECIFICATIONS

OUTPUT	SUPPLY	
A	0.5 TO 4.5V RATIOMETRIC	5V
B	±5V	±15V
C	0.5 TO 9.5V	24V
D	±10V	±15V
G	0.5 TO 4.5V SUPPLY CURRENT 12mA TYP. 20mA MAX.	24V
E	4 TO 20mA 2-WIRE	24V
F	4 TO 20mA 3-WIRE SINK	24V
H	4 TO 20mA 3-WIRE SOURCE	24V

SINK VERSION OUTPUT COMPLIANCE 5-28V SOURCE VERSION DRIVE 300Ω MAX TO 0V

MATING CONNECTOR (CODE 'J50' OR 'K50') SUPPLIED WITH 50cm MOULDED CABLE AS STANDARD.
4-CORE SCREENED: 0.5mm², 0.75mm MAX. JACKET AND CORE INSULATION: EPDM.

CONNECTIONS:-

- 1 BLACK OUTPUT
- 2 WHITE 0V
- 3 RED BODY (OPTIONS: A, C, E-H) -Ve (OPTIONS: B OR D)
- 4 GREEN +Ve

SCREEN NOT CONNECTED TO SENSOR

RANGE OF DISPLACEMENT FROM 0-15° TO 0-160° e.g. 76°, IN INCREMENTS OF 1°.

BODY MATERIAL: STAINLESS STEEL 316.

A	FIRST ISSUE.	RDS
B	RADIAL CONN ADDED - RAN1129.	PDM
C	CABLE COLOURS CORRECTED - RAN1190	PDM
D	RANGE NOTE AMENDED ~ RAN1200	PDM



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.

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.



A	15/09/15	CHECKED BY RDS	X	±0.4
B	12/12/16		X.X	±0.2
C	14/06/17		X.XX	±0.1
				DIMS mm
D	13/09/17	DESCRIPTION		
				S623 350 BAR SUBMERSIBLE LARGE ANGLE TILT SENSOR
SCALE 10mm				DRAWING NUMBER S623-11 REV D
SHEET 1 OF 1				