

## TIPS® P603 LARGE ANGLE 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 IP67**



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 P603 TIPS® (Tilt Inductive Position Sensor) is an affordable, durable, high-accuracy tilt sensor designed for industrial and scientific feedback applications. The P603, 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.

It is particularly suitable for OEMs seeking good sensor performance for arduous applications such as industrial machinery where cost is important.

Overall performance, repeatability and stability are outstanding over a wide temperature range. Electrical connections to the sensor are made via an industrial standard 4-pin M12 connector, with limited rotational capability to facilitate cable routing.

The sensor has a rugged stainless steel body and anodised aluminium mounting flange. The flange has two 4.5mm by 30 degree wide slots on a 48mm pitch to simplify mounting and position adjustment. The P603 offers a range of electrical options. Environmental sealing is to IP67.

### SPECIFICATION

<b>Dimensions</b>	
Body diameter	35 mm, Flange 60mm
Body Length (to seal face)	44 mm standard, 50 mm buffered
For full mechanical details see drawing P603-11	
<b>Independent Linearity/Hysteresis</b>	
(combined error)	< ± 0.25° - up to 100°
<b>Temperature coefficients</b>	
	< ± 0.01%/°C Gain &
	< ± 0.01%FS/°C Offset
<b>Response Time</b>	250 mS @ 20°C typ.
<b>Resolution</b>	Infinite
<b>Damping Ratio</b>	0.2 : 1 (0.6 nom. @ 25°C)
<b>Noise</b>	< 0.02% FSO
<b>Environmental Temperature Limits</b>	
Operating	-20°C to +85°C all output options
Storage	-40°C to +125°C
<b>Sealing</b>	IP67
<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>	
P603-11	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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### 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

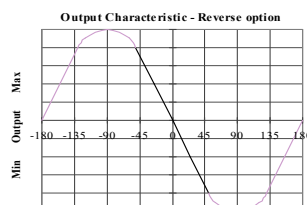
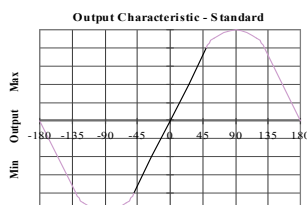
**CALIBRATED TRAVEL:** Factory-set to any angle from  $\pm 7.5^\circ$  to  $\pm 80^\circ$  in increments of  $1^\circ$ .

#### ELECTRICAL INTERFACE OPTIONS

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

#### CONNECTOR

Connector - Hirschmann ELWIK 4102 IP67



## TIPS® SERIES P603 Large Angle Tilt Sensor

a	b	c	d	e
P603	Displacement	Output	Y	J
				Z-code

a Displacement (degrees)		Value
Displacement in degrees	e.g. 0 - 54 degrees	<b>54</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>
±15V nom. (±9 - 28V)	±5V	<b>B</b>
+24V nom. (13 - 28V)	0.5 - 9.5V	<b>C</b>
±15V nom. (±13.5 - 28V)	±10V	<b>D</b>
+24V nom. (18 - 28V)	4 - 20mA 2 wire	<b>E</b>
+24V nom. (13 - 28V)	4 - 20mA 3 wire Sink	<b>F</b>
+24V nom. (9 - 28V)	0.5 - 4.5V	<b>G</b>
+24V nom. (13 - 28V)	4 - 20mA 3 wire Source	<b>H</b>
c Calibration Adjustments		Code
Sealed		<b>Y</b>
d Connections		Code
Connector	IP67 M12 IEC 60947-5-2	<b>J</b>
e Z-code		Code
Connector with cable option 'J' with length required in cm i.e. J500 specifies connector with 500cm of cable.		<b>Z999</b>

## Installation Information

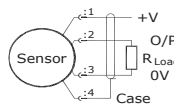
### TIPS® P603 LARGE ANGLE TILT SENSOR

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

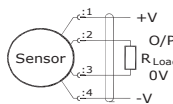
Connector Pin Layout:  
IEC 60947-5-2



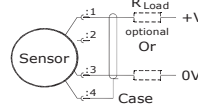
'A', 'C', 'G' & 'H'



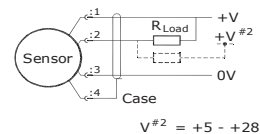
'B' & 'D'



'E'



'F'



**Mechanical Mounting:** Flange mounted, flange slots are 4.5mm by 30 degrees wide on a 48mm pitch. The mid point of the calibrated range is set with the flange slots in the vertical plane, mechanical mid point adjustment is achieved by rotating the sensor in the flange slots.

**Note:** the sensor should be mounted on a vertical face.

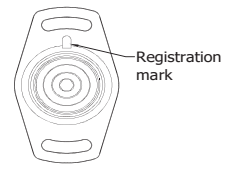
**Output Characteristic:** The sensor has full rotational freedom and two sectors, 180° apart, over which linear response can be achieved. At the mid point of the calibrated range the output signal will be half full scale deflection, and the mounting flanges will be vertical. In the calibrated range 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°.

**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.

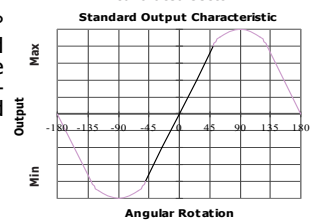
**Repeated rotation of the connector will damage the internal wiring!**

**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.



Direction of increasing output  
in calibrated sector



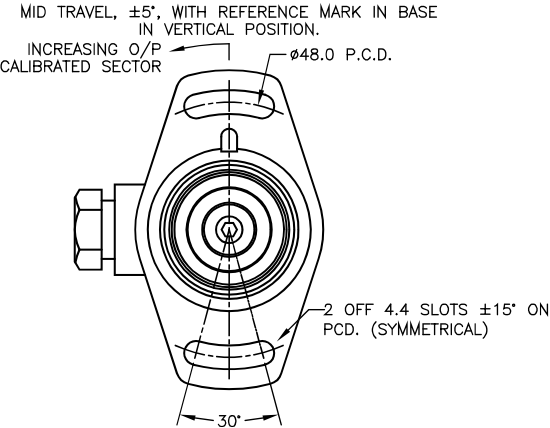
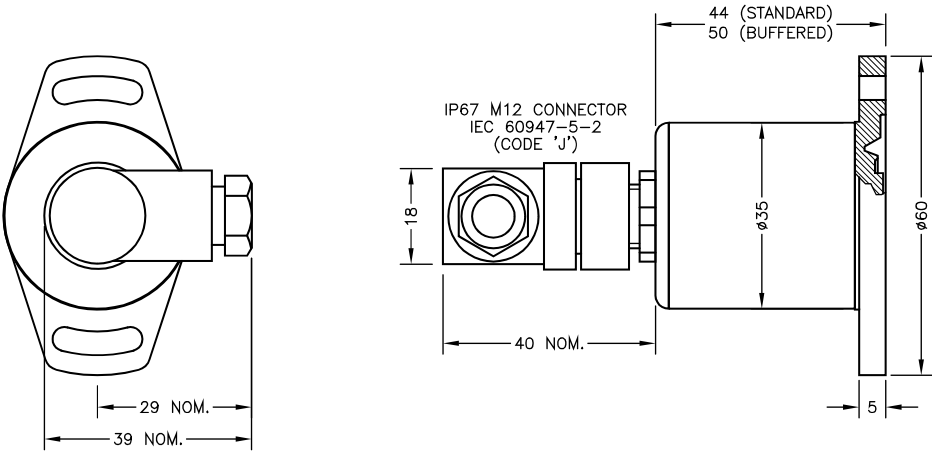
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**CE**  
P603-19m

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N.b. CONNECTOR ORIENTATION NOT GUARANEED.

ELECTRICAL OPTIONS/ SPECIFICATIONS				
OUTPUT		SUPPLY		
OUTPUT OPTION	A	0.5 TO 4.5V RATIOMETRIC	5V	STANDARD
	B	±5V	±15V	
	C	0.5 TO 9.5V	24V	
	D	±10V	±15V	BUFFERED
	G	0.5 TO 4.5V	24V	
	E	SUPPLY CURRENT 12mA TYP. 20mA MAX.		
	F	4 TO 20mA 2-WIRE	24V	
	H	4 TO 20mA 3-WIRE SINK	24V	
		4 TO 20mA 3-WIRE SOURCE	24V	
	SINK VERSION OUTPUT COMPLIANCE 5-28V			
SOURCE VERSION DRIVE 300Q MAX TO 0V				
CONNECTOR (MAXIMUM CONDUCTOR CROSS SECTION 0.75mm <sup>2</sup> )				
		:1	+Ve	
		:3	0V	
		:4	-Ve — OPTIONS: B OR D	
		:2	OUTPUT	
		:4	BODY — OPTIONS: A, C, E-H	
RANGE OF DISPLACEMENT FROM 0-15° TO 0-160° e.g.76°, IN INCREMENTS OF 1°.				
BODY MATERIAL:- STAINLESS STEEL.				
FLANGE BASE MATERIAL:- ALUMINIUM.				



A	FIRST ISSUE	RDS
B	NOTES EXPANDED.	PDM
C	FLANGE TH'KNNESS ADDED.	PDM
D	ADDITIONAL DIMS/VIEWS ADDED.	PDM
E	DISP. 15 TO 160° WAS 20 TO 160° RAN442.	PDM
F	REGISTRATION MARK CORRECTED RAN490.	PDM
G	RANGE NOTE AMENDED ~ RAN1200	PDM



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	27/10/03		CHECKED BY RDS	X	±0.4	
B	19/10/06			X.X	±0.2	
C	05/01/10			X.XX	±0.1	
D	06/07/11	DESCRIPTION				
E	20/11/13	TIPS P603				
F	14/04/14	LARGE ANGLE TILT SENSOR				
G	13/09/17					
SCALE 10mm 		DRAWING NUMBER		P603-11		
				REV	G	
				SHEET 1 OF 1		