POSIROT® / PRAS
Analog Magnetic Angle Sensors

Instruction Manual

Please read carefully before installation and operation!

Contents

Safety instructions

Do not use POSIROT® position sensors in safety critical applications where malfunction or total failure of the sensor may cause danger for man or machine.

For safety related applications additional mechanisms (devices) are necessary to maintain safety and to avoid damage.

Disregard of this advice releases the manufacturer from product liability.

The sensor must be operated only within values specified in the catalog or datasheet.

Connection to power supply must be performed in accordance with safety instructions for electrical facilities and performed only by trained staff.

Description

The angle sensors PRAS of the POSIROT® product family perform touchless or shaft based angle measurement. A position magnet rotates in front of the sensing area of the sensor head. The angular position is converted into a standardized high resolution voltage or current output. Measuring ranges 15° to 360° having rising or falling characteristic are available.

Mounting

Placement and alignment of the position magnet

CAUTION

For non-contact sensor models air gap and alignment of sensor and position magnet has to be observed. The linearity will degrade in case of misalignment.

Adjacent magnetic fields or ferromagnetic materials can influence the measurement results of the PRAS sensors of the POSIROT® product family. Therefore the angle sensors should be mounted solely with nonmagnetic / non magnetisable shields and screws.

The angle sensors PRAS2, PRAS3 and PRAS5 are equipped with an integrated magnetic shield which minimizes the sensitivity against external magnetic fields.

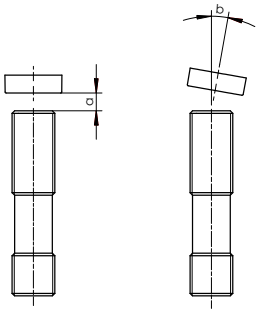
Optional shield plates are available for the angle sensors PRAS20, PRAS21 and PRAS27. They can reduce the effect of residual magnetizing in case the sensor has to be mounted on a ferromagnetic material (see page 8).

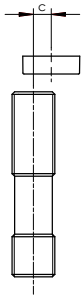
It is however not possible to exclude the effect of lateral external magnetic fields.

Mounting (continued)

Measuring error by misalignment of the position magnet

Sensor	Position magnet	Air gap [mm]	Paral-lelism [°]	Error by axial misalignment [°]					
				0,2 mm	0,5 mm	1 mm	2 mm	3 mm	4 mm
PRAS1	**PRMAG20**	0 ... 6,5	0 ... 5	0,15	0,4	0,8	2,2	5,0	–
	PRMAG21	0 ... 4	0 ... 5	0,2	0,4	1,0	3,8	10	–
	PRMAG22	0 ... 9,5	0 ... 5	0,1	0,4	1,0	2,2	4,5	8,0
PRAS2	**PRMAG20**	0 ... 6	0 ... 5	0,15	0,4	0,8	2,2	5,0	–
	PRMAG21	0 ... 3,5	0 ... 5	0,2	0,4	1,0	3,8	10	–
	PRMAG22	0 ... 9,0	0 ... 5	0,1	0,4	1,0	2,2	4,5	8,0
PRAS5	**PRMAG5-Z**	0 ... 7,5	0 ... 5	0,1	0,2	0,6	1,5	4,5	8,5
	PRMAG20	0 ... 5,5	0 ... 5	0,15	0,4	0,8	2,2	5,0	–
	PRMAG21	0 ... 3	0 ... 5	0,2	0,4	1,0	3,8	10	–
	PRMAG22	0 ... 8,5	0 ... 5	0,1	0,4	1,0	2,2	4,5	8,0
PRAS20	**PRMAG20**	0 ... 7	0 ... 5	0,1	0,3	0,7	2,0	4,6	–
	PRMAG21	0 ... 2	0 ... 5	0,15	0,3	0,9	3,6	9,6	–
	PRMAG22	0 ... 10	0 ... 5	0,0	0,0	0,7	1,5	3,8	7,0
PRAS21	**PRMAG20**	0 ... 7,0	0 ... 5	0,1	0,3	0,7	2,0	4,6	–
	PRMAG21	0 ... 2	0 ... 5	0,15	0,3	0,9	3,6	9,6	–
	PRMAG22	0 ... 10	0 ... 5	0,0	0,0	0,7	1,5	3,8	7,0
PRAS27	**PRMAG20**	0 ... 7,5	0 ... 5	0,1	0,3	0,7	2,0	4,6	–
	PRMAG21	0 ... 2,5	0 ... 5	0,15	0,3	0,9	3,6	9,6	–
	PRMAG22	0 ... 10,5	0 ... 5	0,0	0,0	0,7	1,5	3,8	7,0



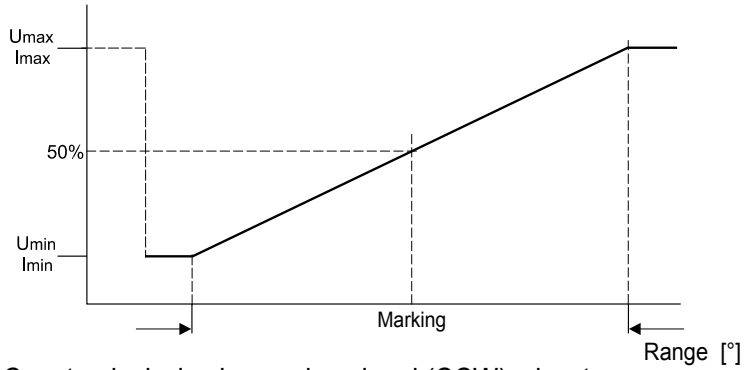


Mounting
(continued)

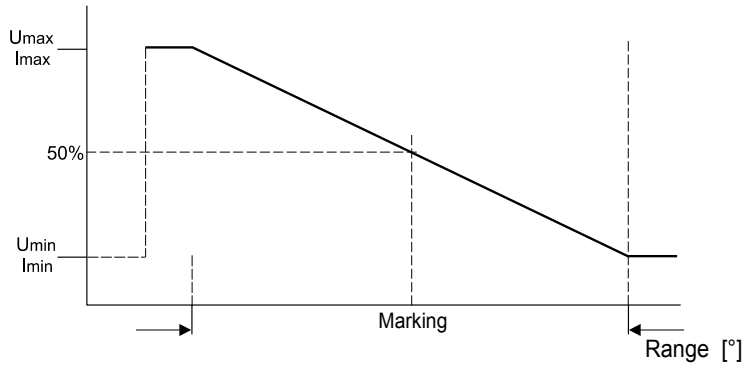
Reference position

For ease of mounting there are reference markings at housing, position magnet and near the shaft. If both markings match output will be on the 50% of full scale.

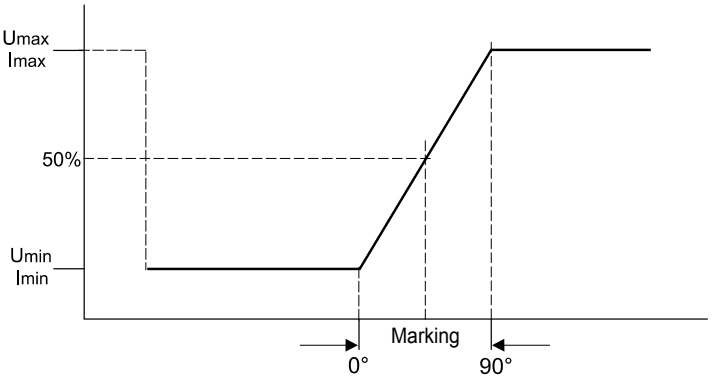
Clockwise increasing signal (CW), view to sensor measuring area/shaft



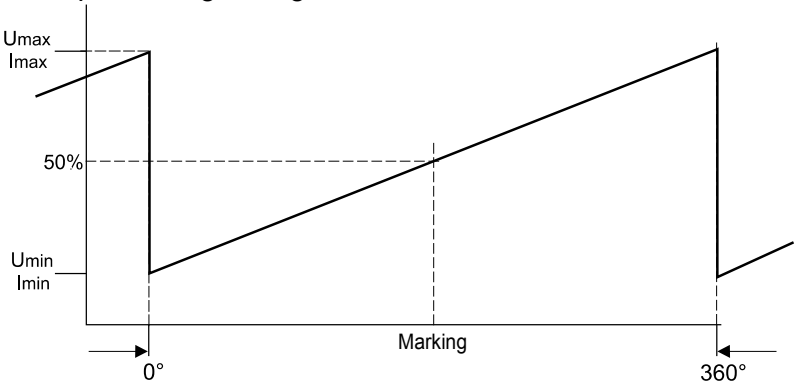
Counterclockwise increasing signal (CCW), view to sensor measuring area/shaft



Example for angle range 90°



Example for angle range 360°



Mounting (continued)

Output	Value range	50% value of output signal
U2	0.5 ... 10 V	5.25 V
U6	0.5 ... 4.5 V	2.5 V
I1	4 ... 20 mA	12 mA

Torque for fixing screws

Torque

Mounting method	Material	Torque [Nm]
Nuts M12x1 (PRAS1)	–	2.5
M2,5 screws for mounting brackets (PRAS2, PRAS3)	–	0.8
M3 screws for mounting flange (PRAS3)	–	1.2
M3 screws with washer (PRAS21)	A4 Aluminium Brass Plastic	<0.8 – – –
M4 screws with washer (PRAS20)	A4 Aluminium Brass Plastic	<1.8 – – –
M4 screws (PRAS24, PRAS27)	–	1

Electrical installation

Supply voltage, current consumption, wiring
For wiring of connector or cable outlet as well as supply voltage and current consumption refer to chapter „Specification of the outputs“ at the end of this manual.
Cable screen has to be connected to protective earth.

Caution: Observe different color code for pre-assembled accessory cables - refer to accessories pages.

The protection class of sensors with connector output is valid only if the electrical plug is connected!

Caution: Do not twist the M12 connector insert.

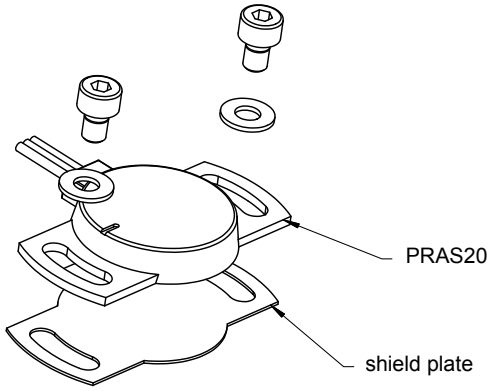
Cable outputs must be installed in such a way that no moisture can get into the cable.
Crossing the dew point must be avoided.

A separate cord grip is recommended.

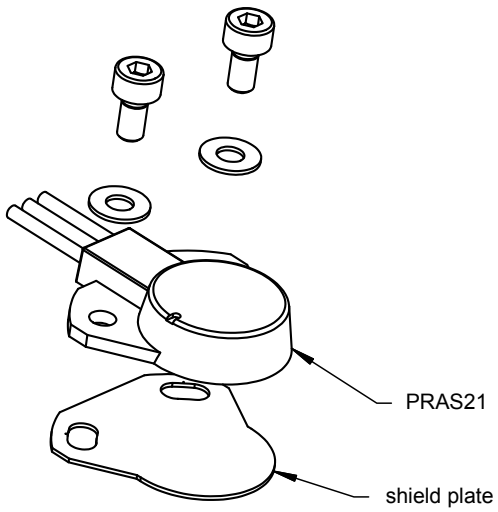
Mounting
(continued)

Sensor fixing with a shield plate (optional)

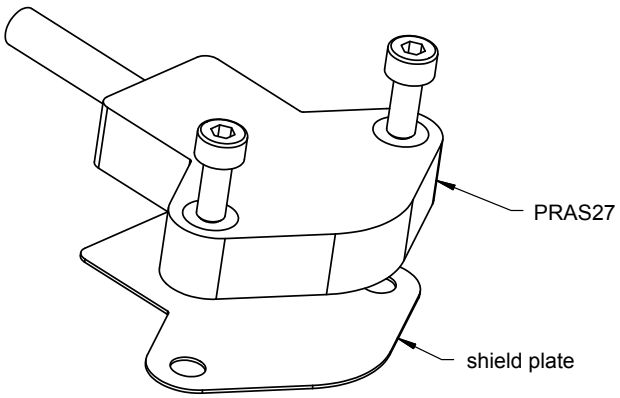
PRAS20



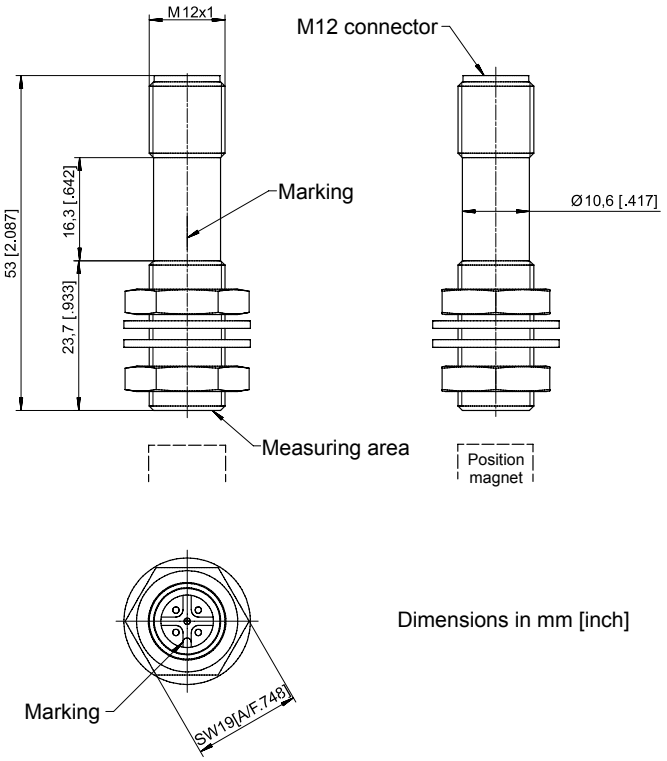
PRAS21



PRAS27

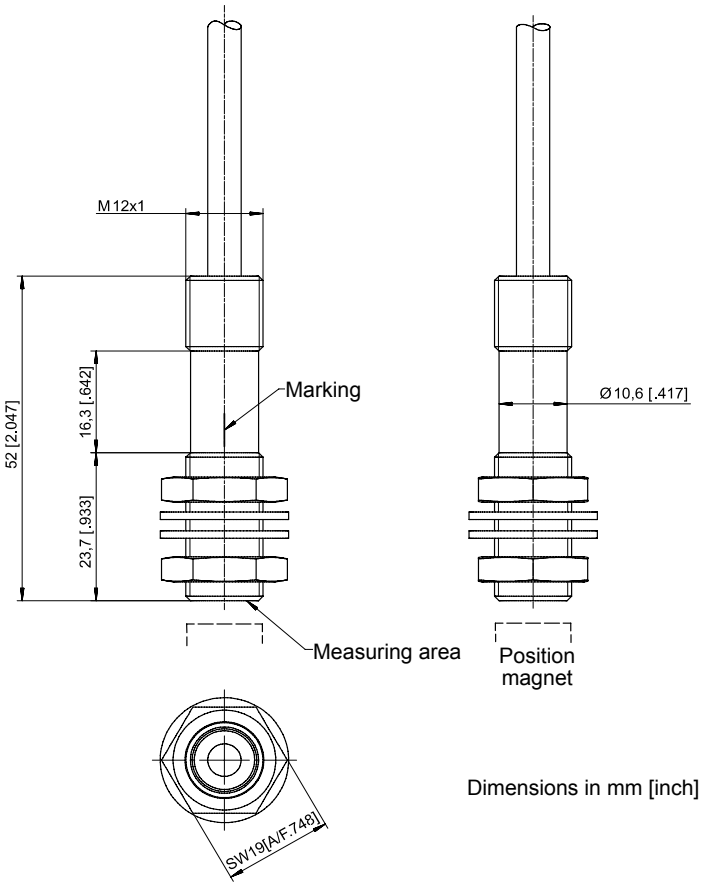


Outline drawing PRAS1
Connector version



Dimensions in mm [inch]

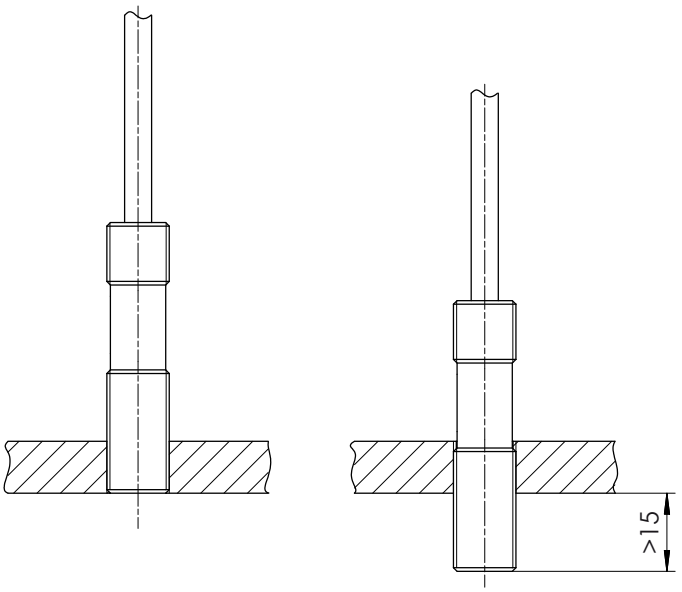
Outline drawing PRAS1
Cable version



Dimensions in mm [inch]

Weight without cable 20 g approx.
Dimensions informative only.
For guaranteed dimensions consult factory.

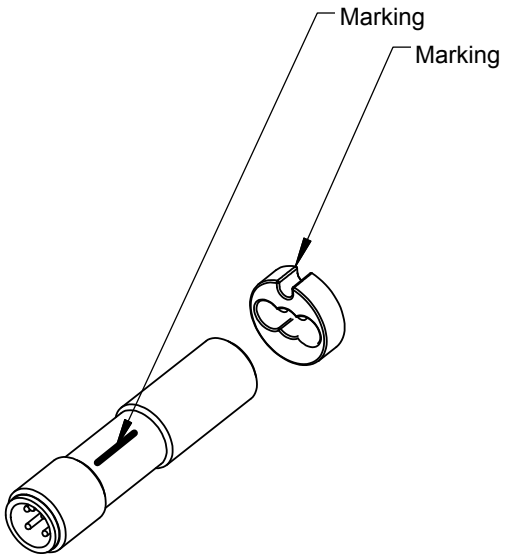
Mounting PRAS1



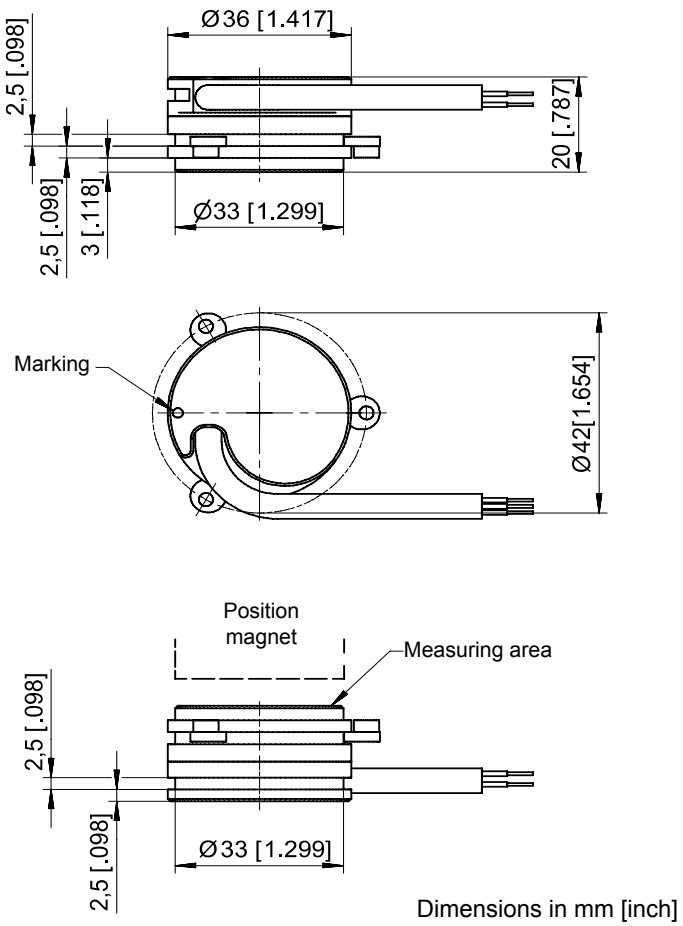
Flush-mounted
Non-magnetic material

In case of
magnetic material

Reference position

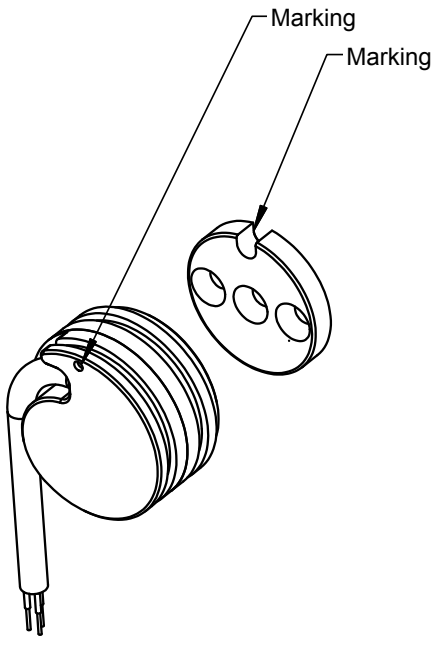


Outline drawing
PRAS2
Cable version



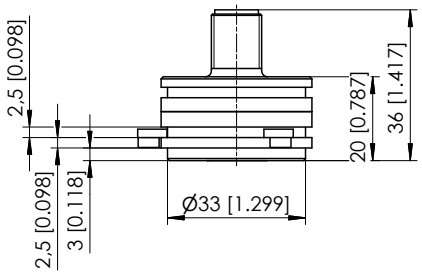
Dimensions in mm [inch]

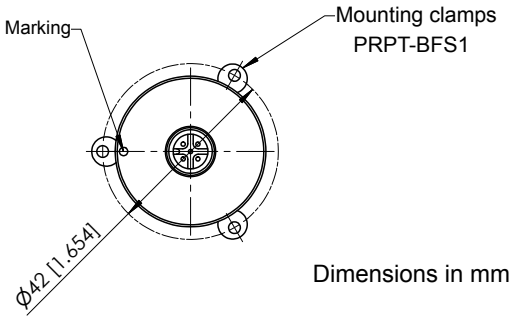
Weight without cable 40 g approx.
Dimensions informative only.
For guaranteed dimensions consult factory.



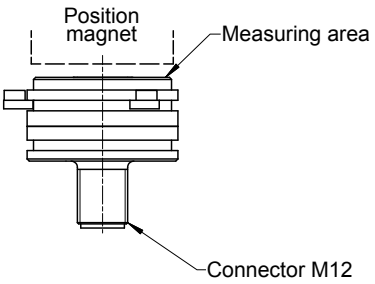
Outline drawing PRAS2

Connector version
M12 axial



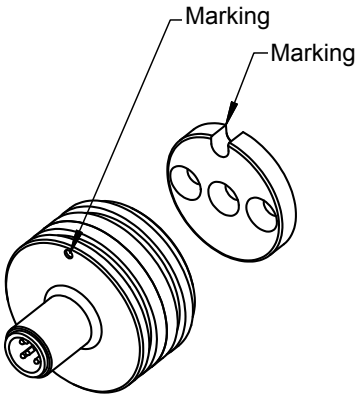


Dimensions in mm [inch]



Weight without cable 50 g approx.
Dimensions informative only.
For guaranteed dimensions consult factory.

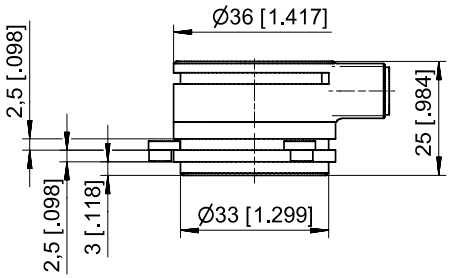
Reference position

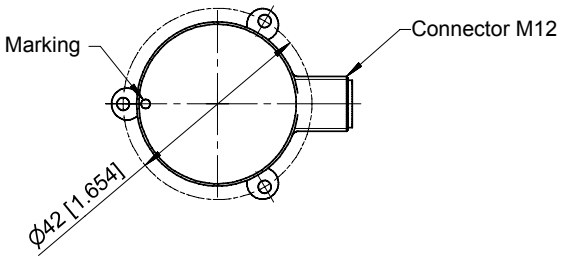


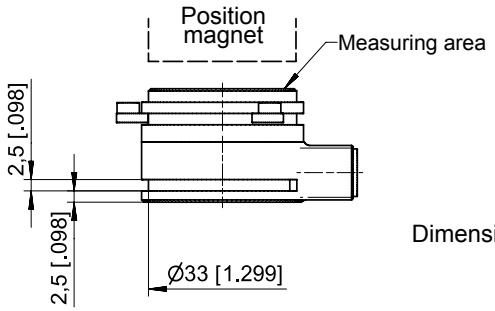
Also for connector version

Outline drawing PRAS2

Connector version
M12 radial



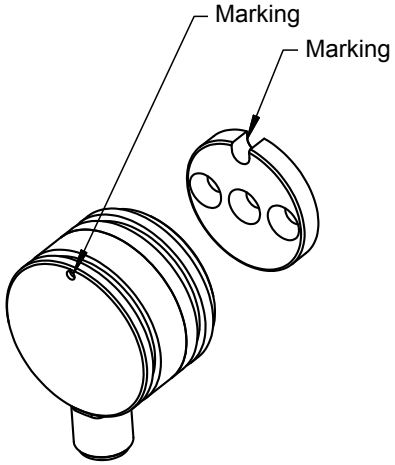




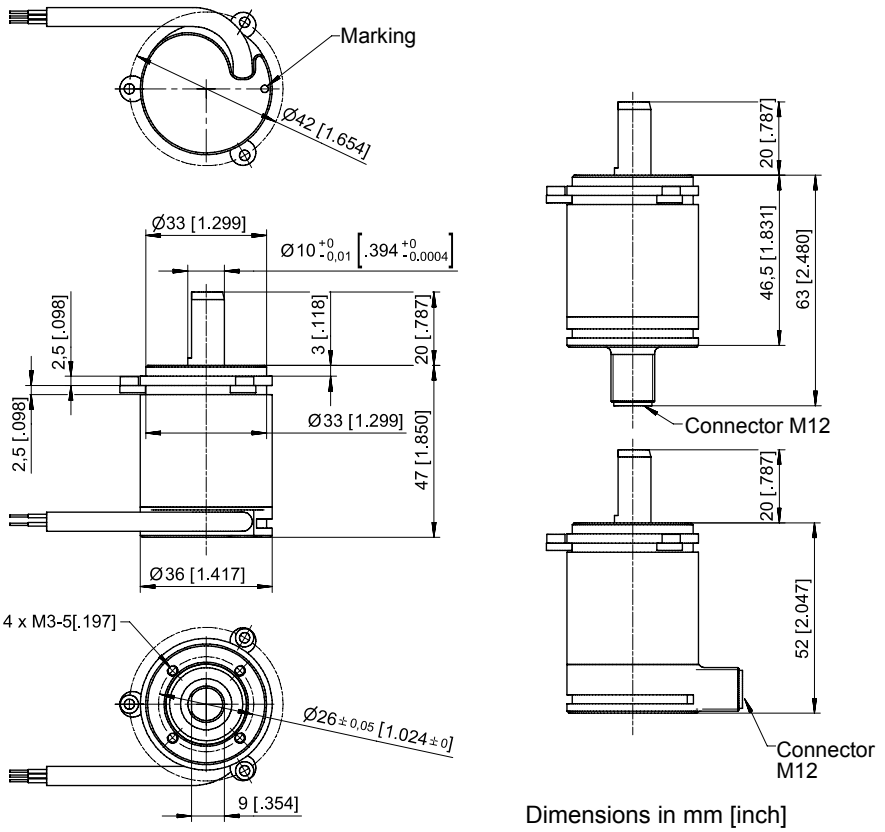
Dimensions in mm [inch]

Weight without cable 50 g approx.
Dimensions informative only.
For guaranteed dimensions consult factory.

Reference position



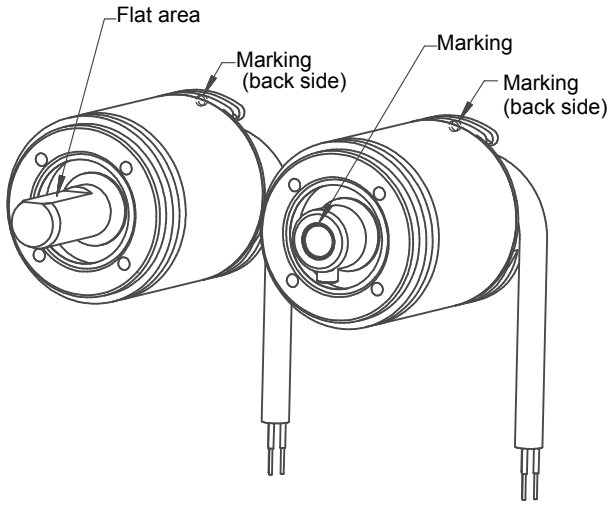
Outline drawing
PRAS3
Shaft



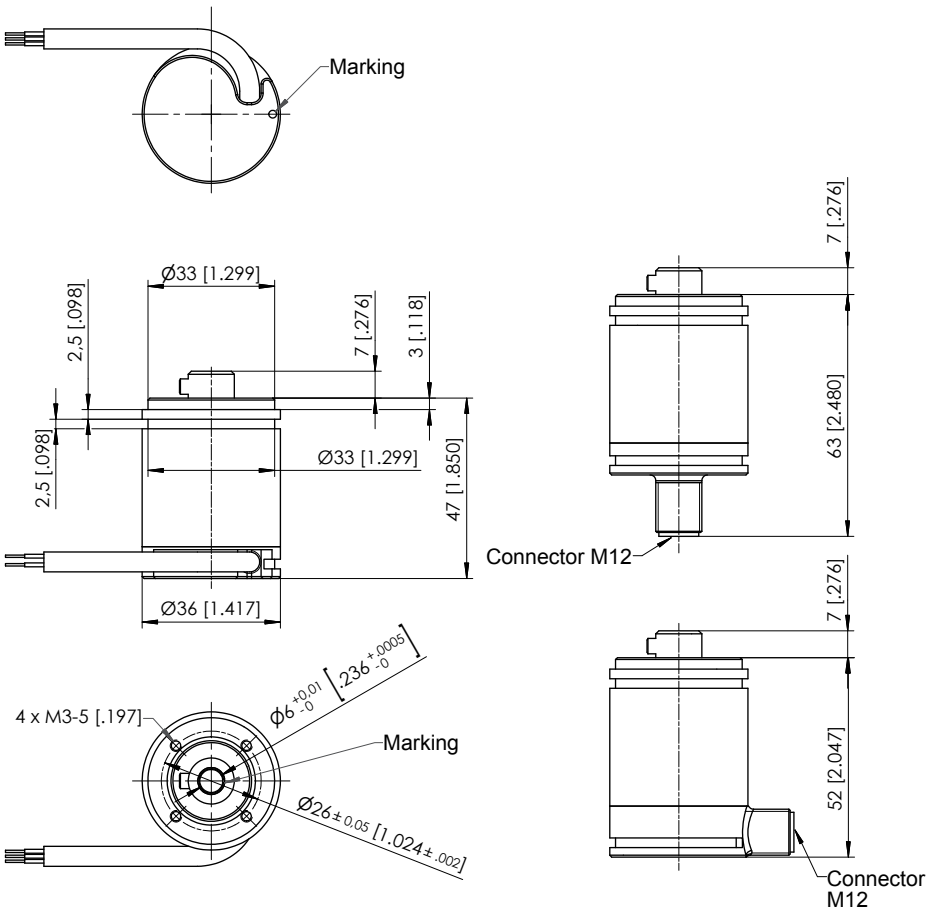
Dimensions in mm [inch]

Weight without cable 250 g approx.
Dimensions informative only.
For guaranteed dimensions consult factory.

Reference position



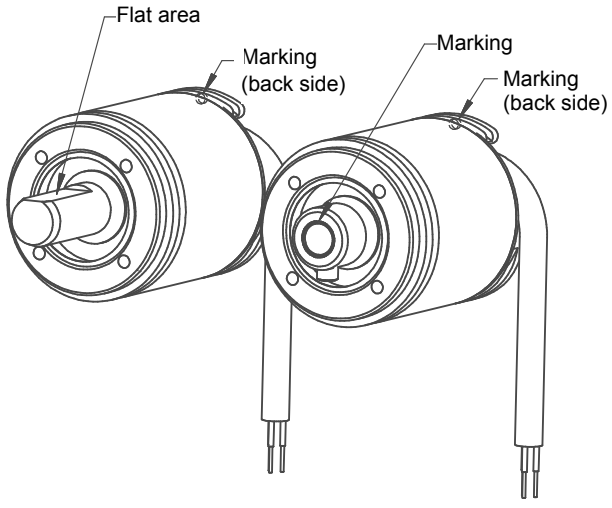
Outline drawing
PRAS3
Hollow shaft



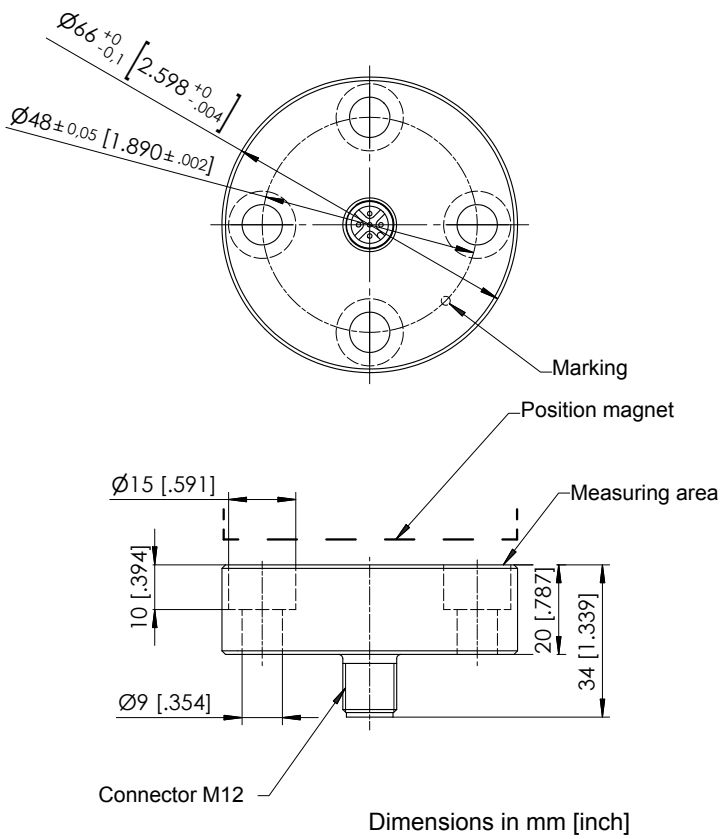
Dimensions in mm [inch]

Weight without cable 250 g approx.
Dimensions informative only.
For guaranteed dimensions consult factory.

Reference position



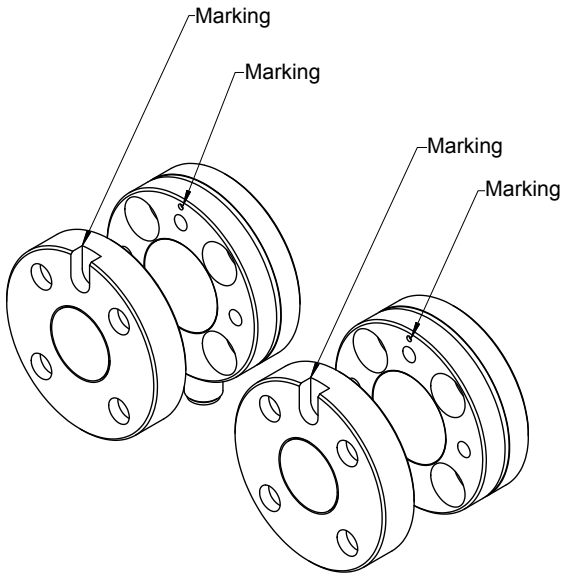
Outline drawing
PRAS5
Connector M12
axial



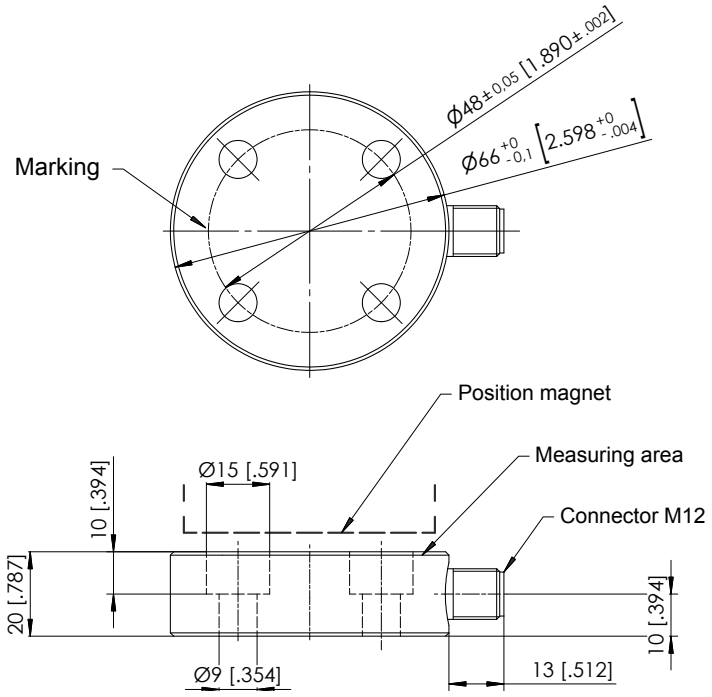
Dimensions in mm [inch]

Dimensions informative only.
For guaranteed dimensions consult factory.

Reference position



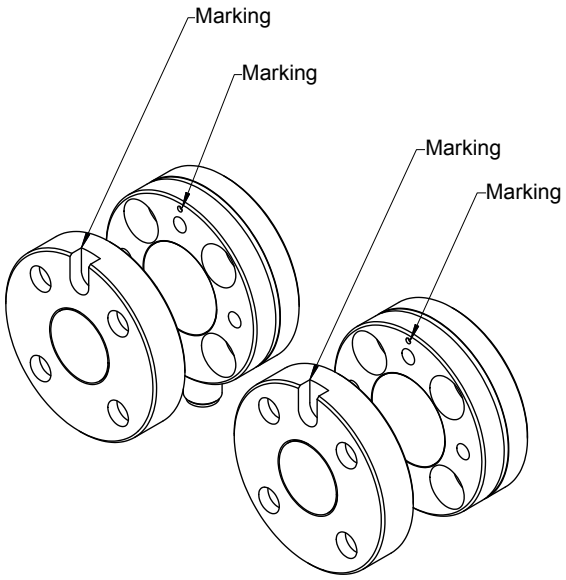
Outline drawing
PRAS5
Connector M12
radial



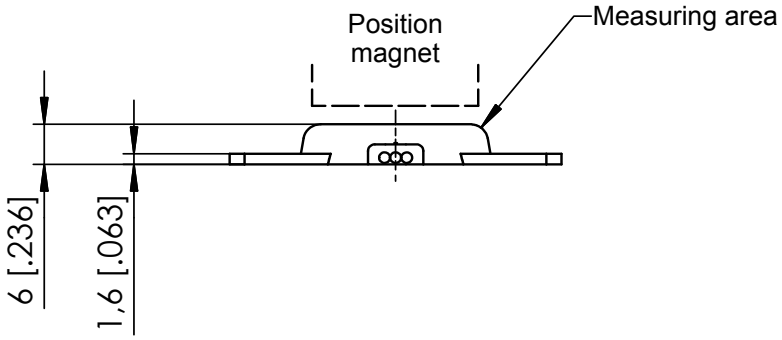
Dimensions in mm [inch]

Dimensions informative only.
For guaranteed dimensions consult factory.

Reference position

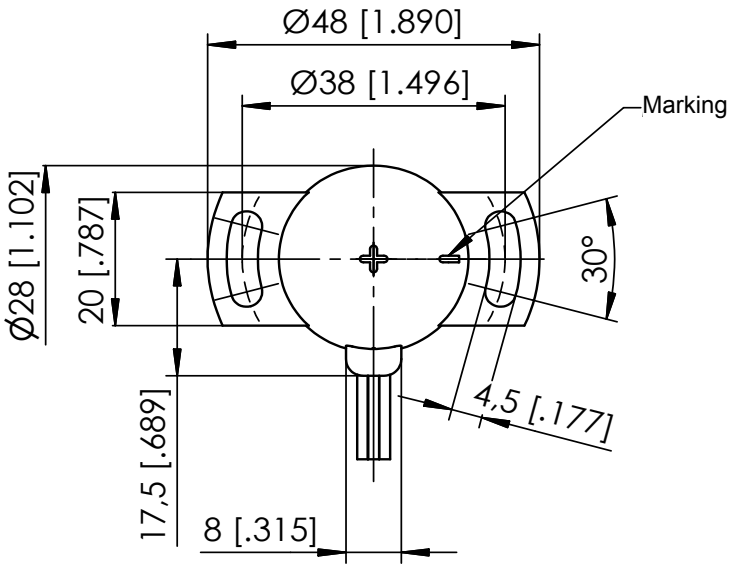


Outline drawing PRAS20

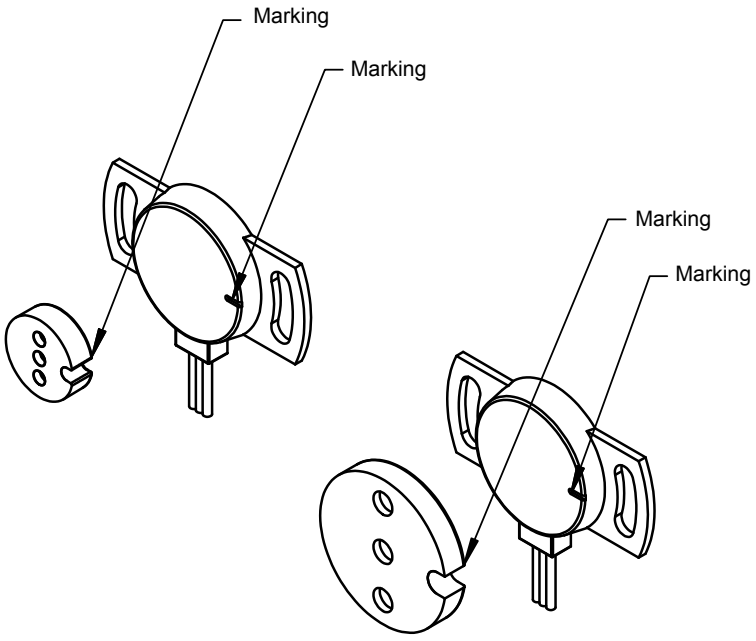


Dimensions in mm [inch]

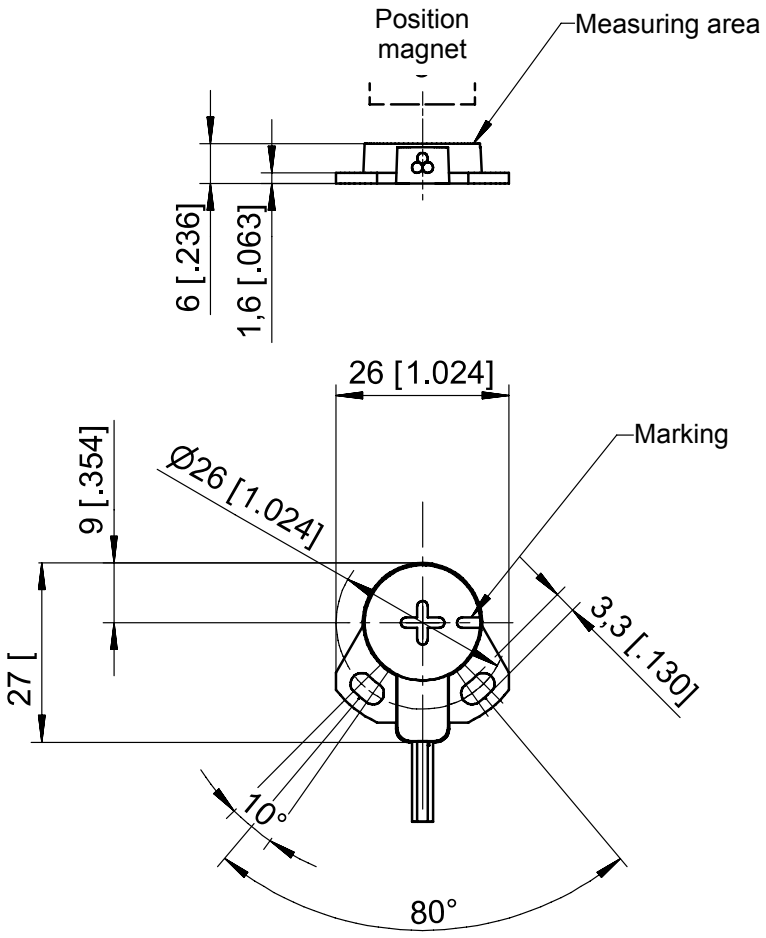
Dimensions informative only.
For guaranteed dimensions consult factory.



Reference position



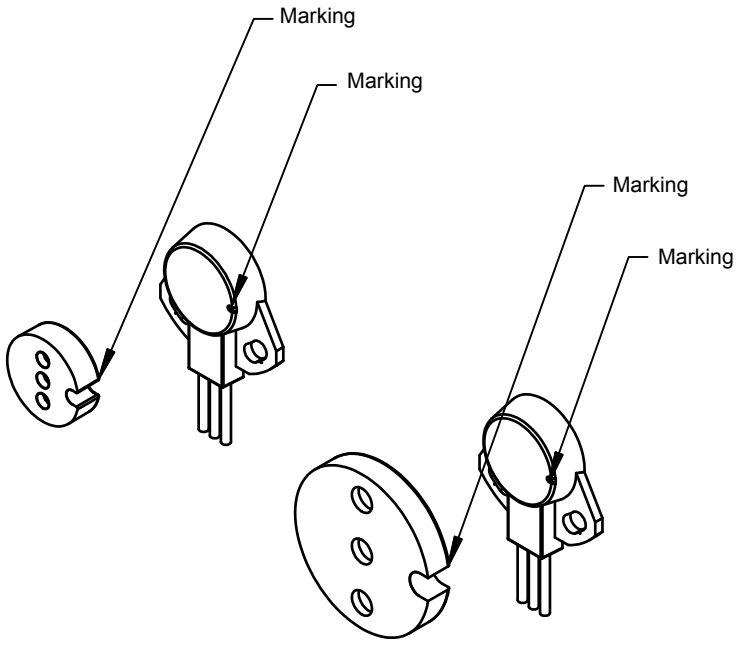
Outline drawing PRAS21



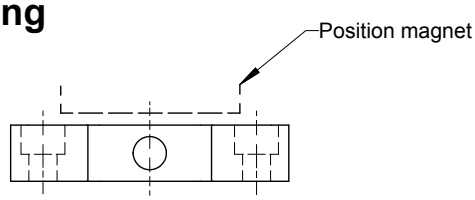
Dimensions in mm [inch]

Dimensions informative only.
For guaranteed dimensions consult factory.

Reference position

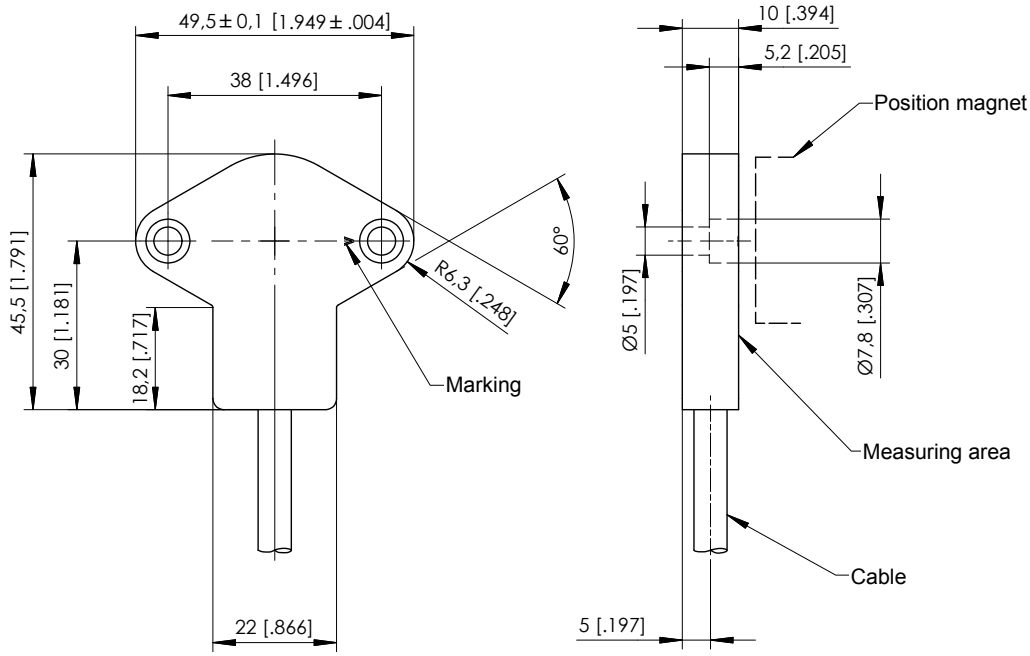


Outline drawing PRAS27

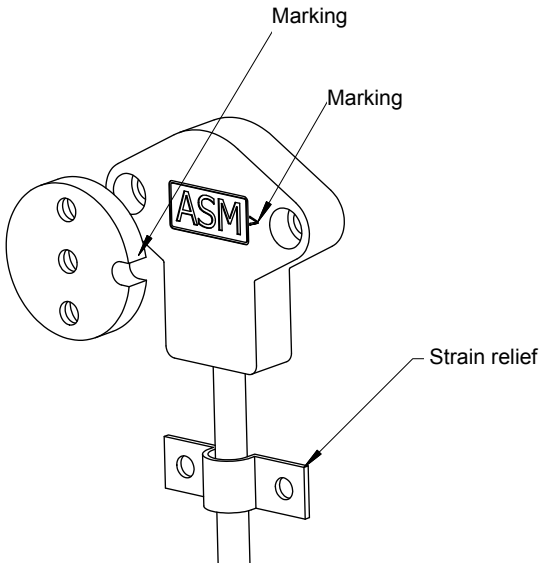


Dimensions in mm [inch]

Dimensions informative only.
For guaranteed dimensions consult factory.

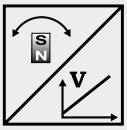
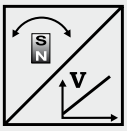
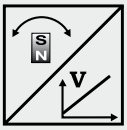
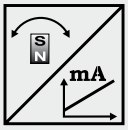


Reference position



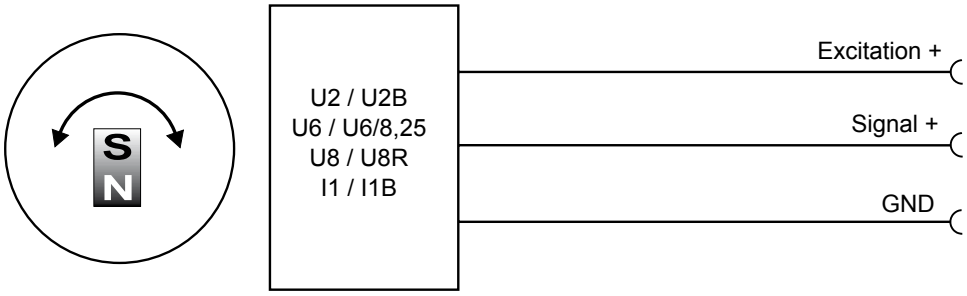
For all sensors with cable:

Cable diameter	Ø 5,2 mm	
Min. bending radius	in motion	not in motion
	10 x Ø, 10 million cycles	5 x Ø

U2; U2B Voltage Output 0.5 ... 10 V 	Excitation voltage	U2: 18 ... 36 V DC; U2B: 11.5 ... 27 V DC
	Excitation current	20 mA max. (10 mA typ.)
	Output voltage	0.5 ... 10 V DC
	Output current	2 mA max.
	Measuring rate	1 kHz standard
	Stability (temperature)	±50 x 10^{-6} / °C f.s. (typ.) for 90°...360° ±100 x 10^{-6} / °C f.s. (typ.) for <90°
	Protection	Reverse polarity, short circuit
	Operating temperature	-40 ... +85 °C (-40 ... +185 °F)
U6 and U6/8,25 Voltage Output 0.5 ... 4.5 V ratiometric 	Excitation voltage	+ 5V DC ±10 %; 8,25 V ±10 %
	Excitation current	40 mA max. (8 mA typ.)
	Output voltage	0.5 ... 4.5 V DC
	Output current	2 mA max.
	Measuring rate	1 kHz standard
	Stability (temperature)	±50 x 10^{-6} / °C f.s. (typ.) for 90°...360° ±100 x 10^{-6} / °C f.s. (typ.) for <90°
	Protection	Reverse polarity, short circuit
	Operating temperature	-40 ... +85 °C (-40 ... +185 °F), option 125°C
U8; U8R Voltage Output 0,5 ... 4,5 V 	Excitation voltage	11 ... 36 V DC
	Excitation current	12 mA, typ. 20 mA max.
	Output voltage	0,5 ... 4,5 V DC
	Output current	2 mA max.
	Measuring rate	1 kHz standard
	Stability (temperature)	±50 x 10^{-6} / °C f.s. (typ.) for 90°...360° ±100 x 10^{-6} / °C f.s. (typ.) for <90°
	Protection	Reverse polarity, short circuit
	Operating temperature	-40 ... +85 °C (-40 ... +185 °F)
I1; I1B Current Output 4 ... 20 mA, 3 wire 	Excitation voltage	I1: 18 ... 36 V DC; I1B: 10 ... 18 V DC
	Excitation current	60 mA max. (30 mA typ.)
	Load resistor	500 Ω max. I1B: 200 Ω max.
	Output current	4 ... 20 mA
	Measuring rate	1 kHz standard
	Stability (temperature)	±50 x 10^{-6} / °C f.s. (typ.) for 90°...360° ±100 x 10^{-6} / °C f.s. (typ.) for <90°
	Protection	Reverse polarity, short circuit
	Operating temperature	-40 ... +85 °C (-40 ... +185 °F)

Other outputs on request.

Output signals

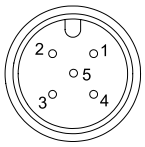


Signal Wiring	Output signals	M12A4/5, M12R4/5 pin no.	Cable output IEC60947-5-2	Cable output DIN47100
	Excitation +	1	brown	white
	Signal	2	white	green
	GND	3	blue	brown
	Do not connect!	4	black	–
	Do not connect!	5		

3-wire current 4...20 mA interface: GND has to be connected!

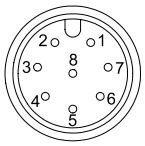
Connection

View to sensor connector



Signal wiring, redundant version with 2 channels and 1 connector	Connector M12 8 pins	Sensor	Signal	Wire color
	1	Sensor 1	Excitation +	white
	2	Sensor 1	Signal	brown
	3	Sensor 1	GDN	green
	4	Sensor 1	Do not connect!	yellow
	5	Sensor 2	Excitation +	grey
	6	Sensor 2	Signal	rosa
	7	Sensor 2	GDN	blue
	8	Sensor 2	Do not connect!	red

Connection



View to sensor connector

Accessory cable M12, 4 pin	Connector pin / wire color			
	1	2	3	4
	brown	white	blue	black

Accessory cable M12, 8 pin	Connector pin / wire color							
	1	2	3	4	5	6	7	8
	white	brown	green	yellow	grey	pink	blue	red

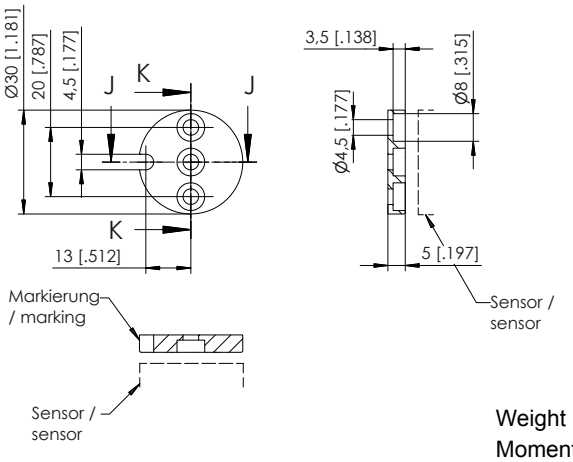
CAUTION

Note:
Sensors with extended temperature range like

PRAS1-KAB-T125
PRAS2-KAB-T125
PRAS3-KAB-T125

are equipped with special cables. These cables cannot pass any traction forces to the sensor.
The customer must ensure an appropriate strain relief or install the cables firmly.

Position magnet PRMAG20

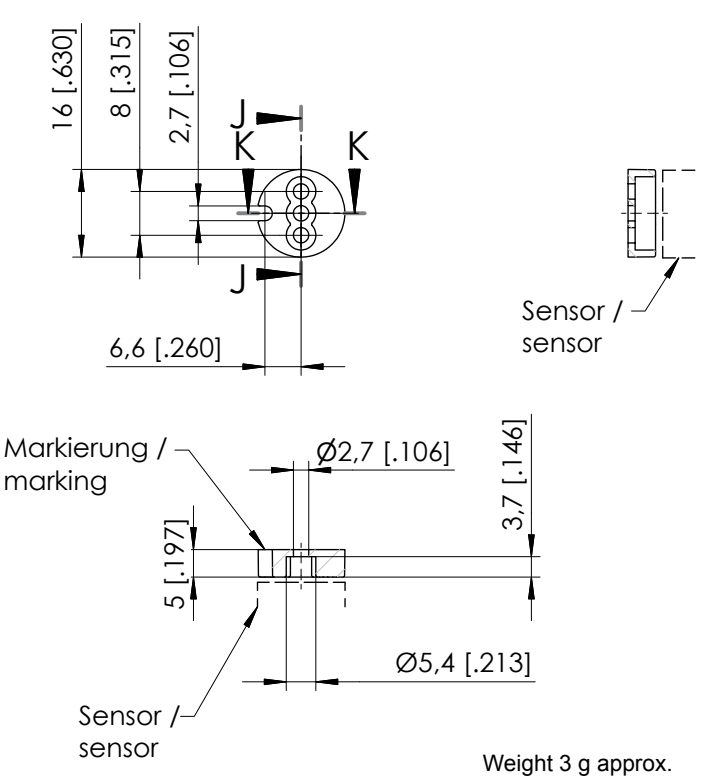


Weight 11 g approx.
Moment of inertia 1.2 kgmm²

Dimensions in mm [inch]

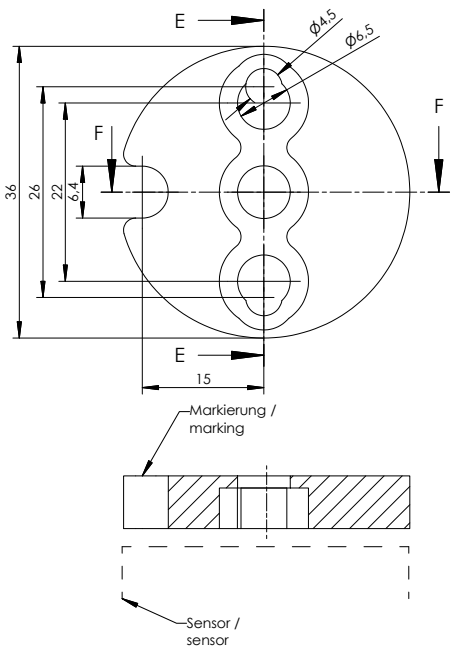
Dimensions informative only.
For guaranteed dimensions consult factory.

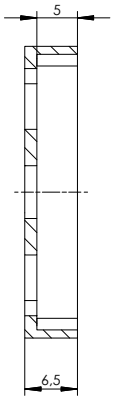
Position magnet PRMAG21



Weight 3 g approx.
Moment of inertia 0.1 kgmm²

Position magnet PRMAG22



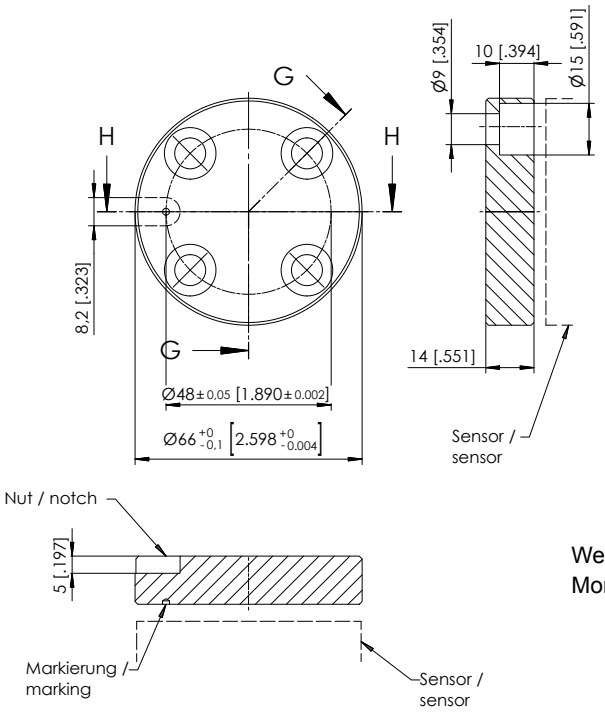


Weight 17 g approx.
Moment of inertia 3 kgmm^2

Dimensions in mm [inch]

Dimensions informative only.
For guaranteed dimensions consult factory.

Position magnet PRMAG5-Z



Weight 100 g approx.
Moment of inertia 55 kgmm²

Dimensions in mm [inch]
Dimensions informative only.
For guaranteed dimensions consult factory.

Fixing of the position magnets

CAUTION

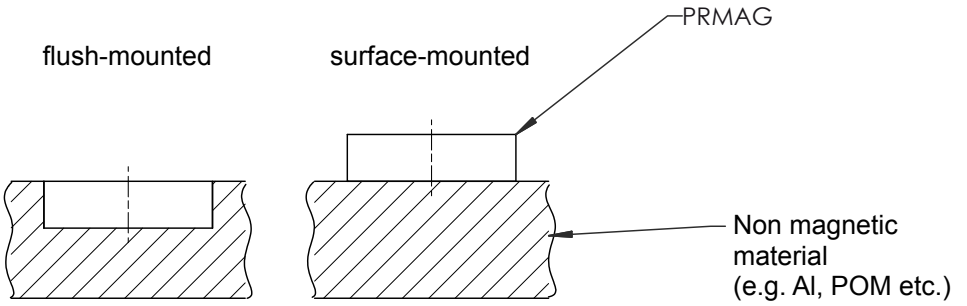
Adjacent magnetic fields or ferromagnetic materials can influence the measurement results of the PRAS sensors of the POSIROT® product family. Therefore the angle sensors should be mounted solely with nonmagnetic / non magnetisable shields and screws

	Magnet	Mounting method	Material
Mounting of the magnets	PRMAG20	Screw(s) M4	A4
	PRMAG21	Screw(s) M2.5	A4
	PRMAG22	Screw(s) M4 or M6	A4
	PRMAG5-Z	Screws M8	A2
	Anti-rotation element	–	A2 or non-magnetic

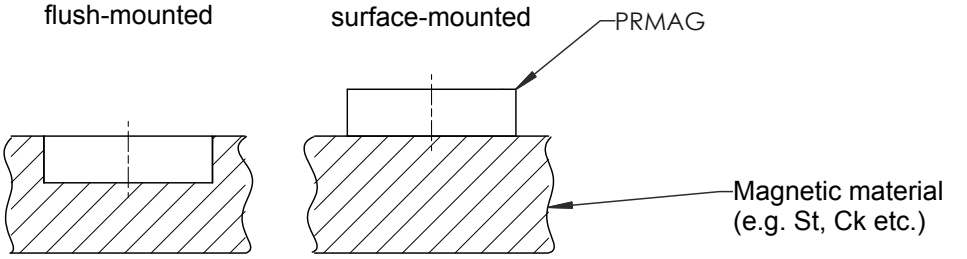
Assembly of the position magnets

CAUTION

Usually it is not admissible to countersink a position magnet into ferromagnetic material, because this would have a negative influence on the performance of the position magnet, and could lead to measurement errors of the PRAS angle sensors.

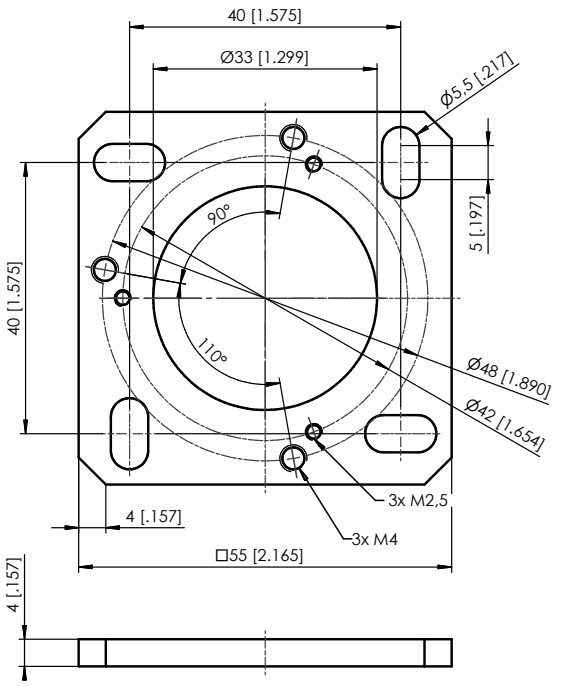


✓	✓	PRMAG5-Z
✓	✓	PRMAG20
✓	✓	PRMAG21/22



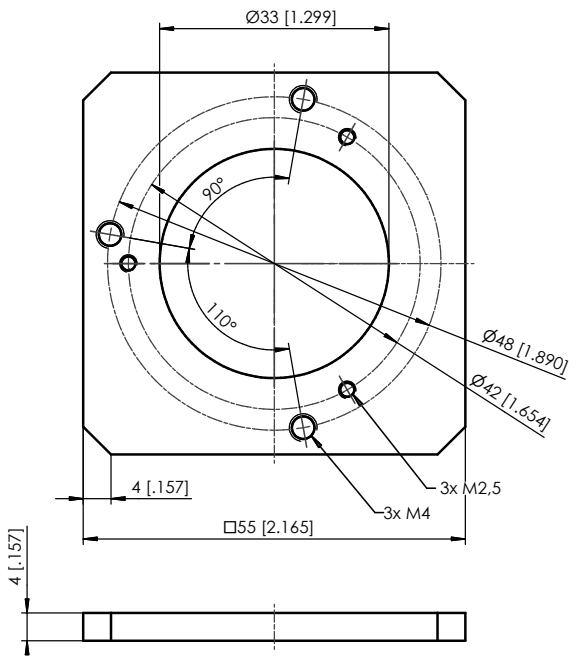
✓	✓	PRMAG5-Z
–	✓	PRMAG20
–	✓	PRMAG21/22

Mounting plate PRPT-BPL1



In combination with the mounting clamps PRPT-BFS1 (3 x M2.5) or in combination with the mounting bracket PRPT-BFS2 (3 x M4).

Mounting plate PRPT-BPL2 (welding assembly)

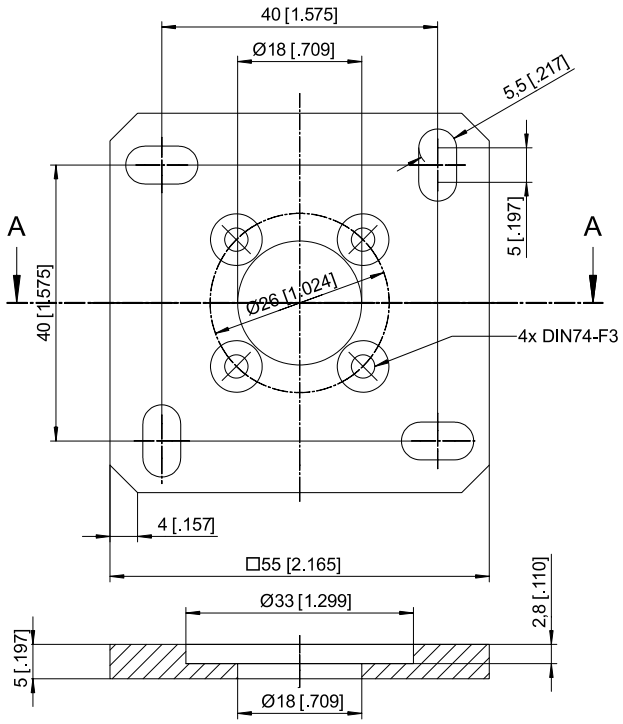


In combination with the mounting clamps PRPT-BFS1 (3 x M2.5) or in combination with the mounting bracket PRPT-BFS2 (3 x M4).

Dimensions in mm [inch]

Dimensions informative only.
For guaranteed dimensions consult factory.

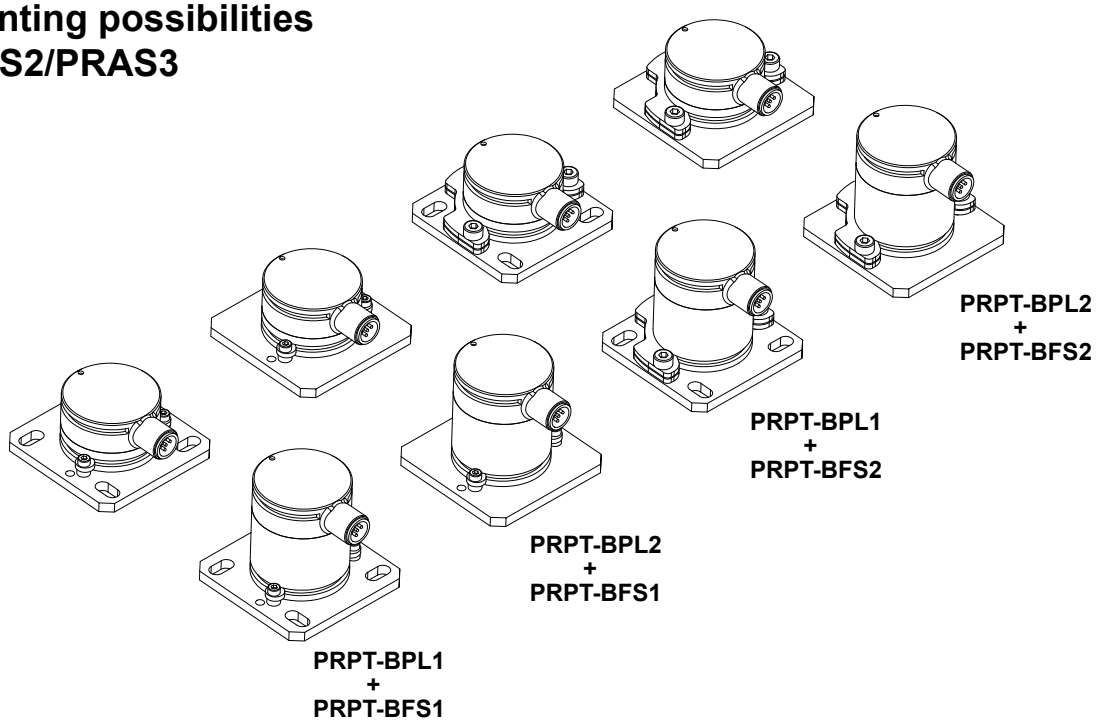
Mounting plate PRPT-BPL3



Dimensions in mm [inch]

Dimensions informative only.
For guaranteed dimensions consult factory.

Mounting possibilities PRAS2/PRAS3



Models

PRAS2(R), PRAS3(R), PRAS5(R)

U2 Voltage output 0.5 ... 10 V
U6 Voltage output 0.5 ... 4.5 V
I1 Current output 4 ... 20 mA

Characteristics	Device type	B
	Probability of failure PFH (λ_{DU})	877 Fit
	Life period $MTTF_d$	130 years
	Working life	10 years
	Mechanical life period L_{10}	400 x 10^6 revolutions

Standards

IEC 61508-1, -2, -6, Functional Safety
ISO 13849-1, Safety of Machines
SN29500 Failure rate electronic components (Siemens)

Declaration of conformity

The angle sensor

Manufacturer:	ASM GmbH Am Bleichbach 18-22 85452 Moosinning / Germany
Model:	**PRAS1, PRAS2, PRAS3, PRAS5,** **PRAS20, PRAS21, PRAS27**

complies with the following standards and directives:

Directives:	2004/108/EG (EMC)
Standards:	EN 61326-1:2006 (EMC)

Moosinning, 20.7.2011

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