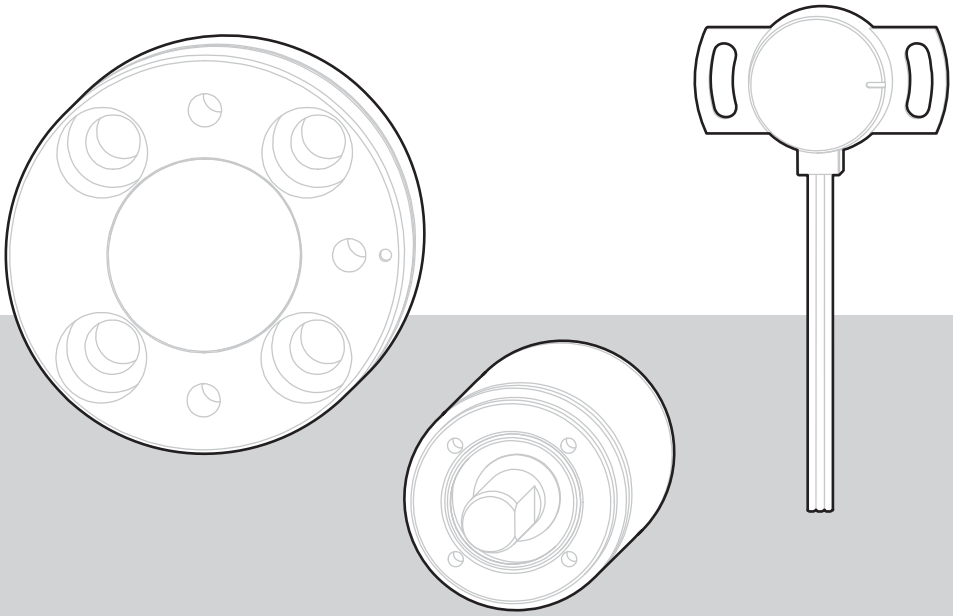
ASM®
perfect in sensors.

posirot® PRAS/PRDS

Magnetic Angle Sensors
Magnetic Incremental Encoders

Installation and operation manual **EN**



Please read carefully before installation and operation!

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Germany

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1 Safety instructions

1.1 Signal words and symbols



WARNING, Risk of Injury:
Indicates a potentially hazardous situation, which, if not avoided, can result in serious injury or property damage.

⚠ DANGER

WARNING, Risk of Personal Injury or Death:
Indicates a situation that can result in serious personal injury or death if not properly avoided.

⚠ WARNING

WARNING, Risk of Personal Injury or Death:
Indicates a situation that can result in moderate personal injury or death if not properly avoided.

⚠ CAUTION

WARNING, Risk of Personal Injury:
Indicates a situation that can result in minor personal injury if not properly avoided.

NOTICE

WARNING, Risk of Property Damage:
Indicates a situation that can result in minor to major property damage if not properly avoided.

Product liability

- Disregarding the following instructions may result in malfunction, damage to property and personal injury and releases the manufacturer from product liability.

Safety regulations

- National safety regulations must be observed!

1.2 General safety instructions

⚠ WARNING

Danger of injury to the operator or damage to the property

- Connection to power supply must be performed in accordance with safety instructions for electrical facilities and performed only by qualified personnel.
- Any alteration, reconstruction or extension of the sensor is not allowed!
- The sensor must be operated only within values specified in the datasheet.
- The danger of personal injury and danger of property damage due to a malfunction of the sensor in machines or systems must be excluded by additional safety measures.
- In safety-relevant applications, additional facilities must be provided for maintaining safety and preventing damage.
- Check whether the protection class of the sensor is suitable for the application.

1.3 Intended use

The angle sensor is intended for angular position measurement. For determining measuring range, environmental compatibility and connection data of the sensor, please note the data sheet. Use the sensor as intended by operating within its specified technical data and ambient conditions.

The installation and operating instructions supplied with the unit must be respected. All maintenance and service work must be carried out. The data sheet of the respective sensor is part of this instruction manual. If not yet available, it may be requested by stating the respective model number.

The sensor must not be improperly mounted, operated or serviced. In addition, operation of the sensor in faulty condition is prohibited.

The sensors listed in the installation and operating instructions must not be operated in potentially explosive environments. Sensors intended for this environment (posirot® EX) are described in their respective manuals.

2 Transport and storage

Observe storage and transport temperatures according to the temperatures specified in the data sheet.

Max. rel. humidity 60%, dew condensation must be prevented at all times.

The device must be secured against slipping and tipping during transport.

Shipment damage

Check sensor immediately for shipment damage. In case of any damage or equipment not operating appropriately, please contact your supplier.

Shipment content

- Sensor
- Installation and operation manual

Description of the PRAS sensors

The angle sensors PRAS of the posirot® product family perform non-contact 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.

Description of the PRDS sensors

The angle sensors PRDS of the posirot® product family perform non-contact or shaft-based angle measurement. A position magnet rotates in front of the sensing area of the sensor head.

The sensor detects the angular position of the position magnet and outputs an absolute digital position value (CANopen, SAE J1939, SSI) or generates an incremental output signal (resolutions of up to 1024 pulses per revolution are available).

Rotational speed limit by resolution and maximum pulse frequency – PRDS sensors

Resolution (periods per turn)	**Rotational speed [rpm]**	
	50 kHz maximum pulse frequency	**200 kHz maximum pulse frequency**
1024	1500	6000
512	3000	10000 *)
256	6000	10000 *)
128	10000 *)	10000 *)
64	10000 *)	10000 *)
32	10000 *)	10000 *)
16	10000 *)	10000 *)

*) Speed limited by mechanical restrictions of the rotating magnet.

3 Installation and initial operation

3.1 Mechanical installation

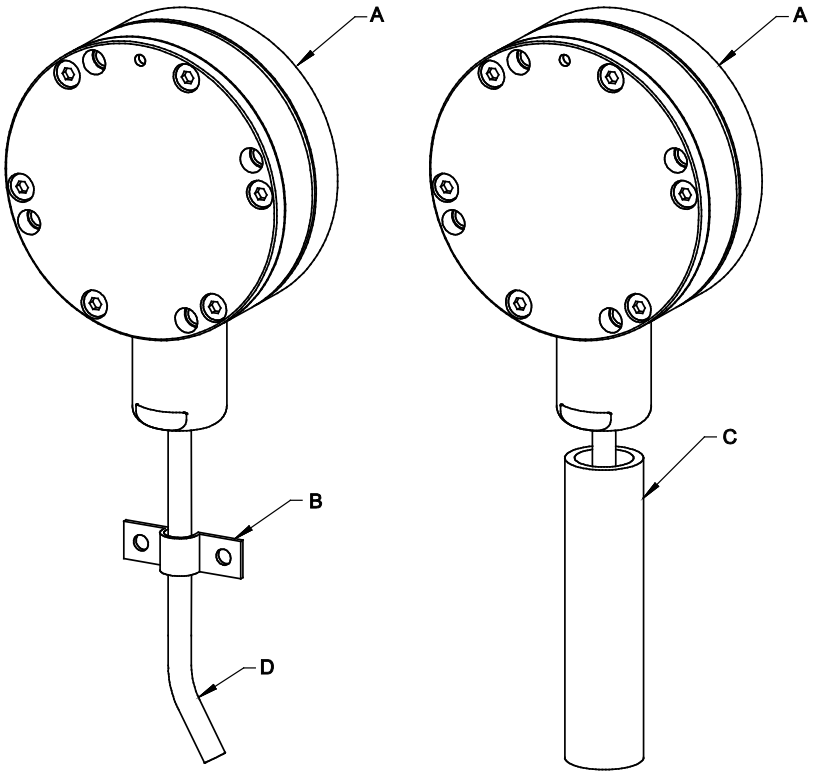
- Do not deform the sensor housing!
- For sensors with shaft use flexible coupling or torque arms to avoid misalignment errors ((see page 17) „Couplings“).

NOTICE

PRAS4: Risk of damage to the sensor due to corrosion

- Mount the sensor on a flat surface
- Avoid or seal gaps of <0.5mm while mounting the sensor
- Use sea-waterproof material
- Take suitable precautions against fouling
- Remove the contamination in case of fouling; define suitable maintenance intervals.

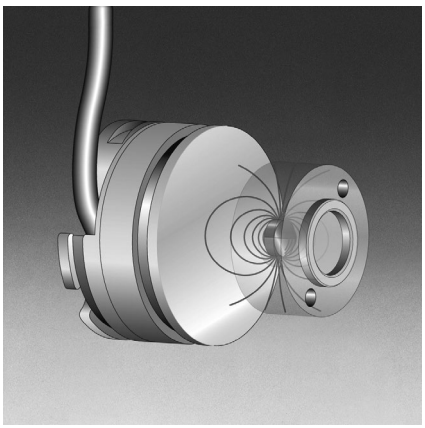
Installation of the sensor supply cable (underwater housing)



A – PTAM4
B – Strain relief with a separate cord grip
C – Mechanical protection
D – R>30 min. bending radius with fixed cable
R>30 min. bending radius with free cable

Placement and alignment of the position magnet





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 and PRDS sensors of the posi**rot**® product family. Therefore, the angle sensors and position magnets should be mounted solely with non-magnetic screws and washers.

The angle sensors PRAS2/PRDS2, PRAS3/PRDS3, PRAS4, PRAS5/PRDS5,PRAS6/PRDS6 and PRAS7/PRDS7 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, PRAS26, PRAS27/PRDS27 and PRAS29/PRDS29. They can reduce the effect of residual magnetizing in case the sensor has to be mounted on a ferromagnetic material.
It is however not possible to exclude the effect of lateral external magnetic fields.

Reference position incremental output

For ease of mounting there are reference markings at housing, position magnet or shaft. If both markings match, the reference output Z / $\overline{Z}$ will be activated.

Reference position SSI output

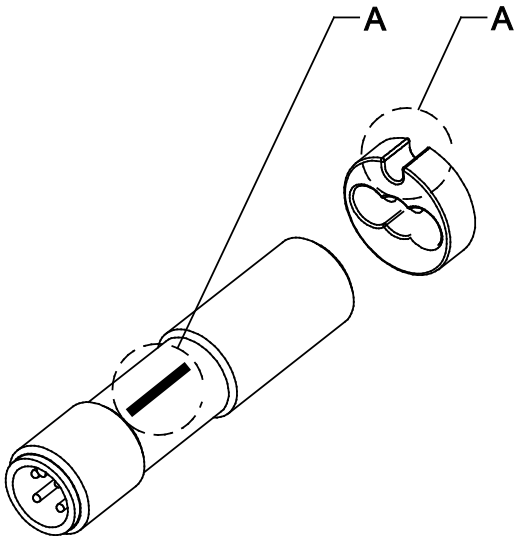
The zero point of the characteristic is given when markings on magnet and housing match.

Reference position CAN output (CANopen, J1939)

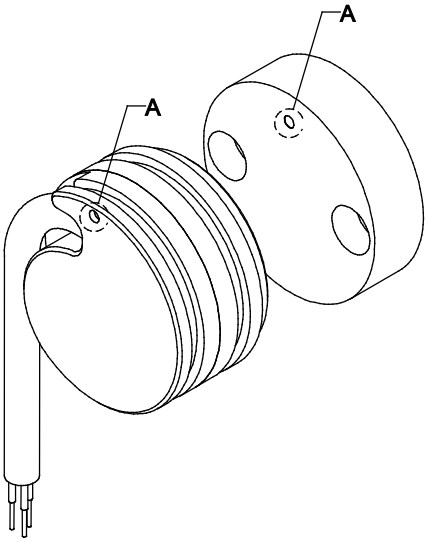
The average value of the characteristic is given when markings on magnet and housing match. The characteristic can be defined by configuration via CAN bus.

Reference position of the posirot® angle sensors

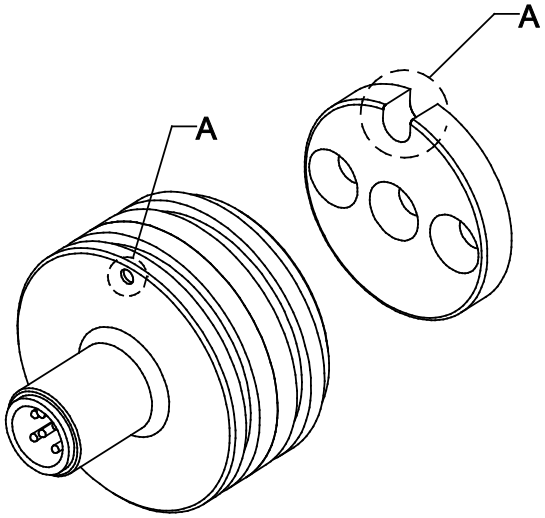
PRAS1 / PRDS1



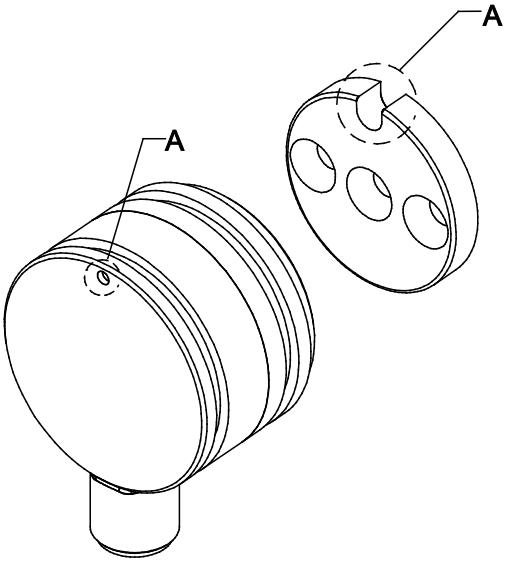
PRAS2 / PRDS2 Cable version



PRAS2 / PRDS2 Connector version
M12 axial

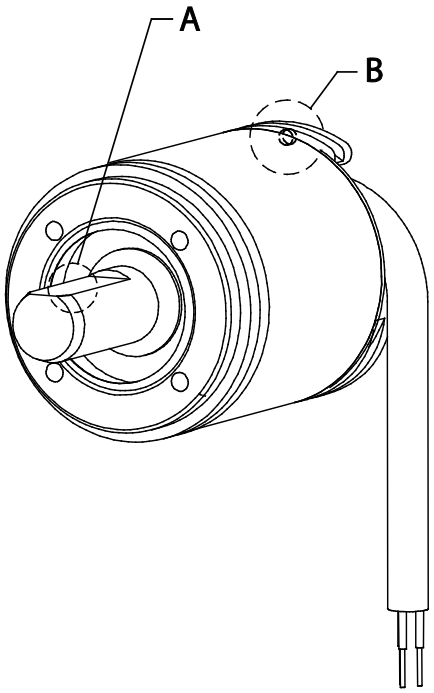


PRAS2 / PRDS2 Connector version
M12 radial



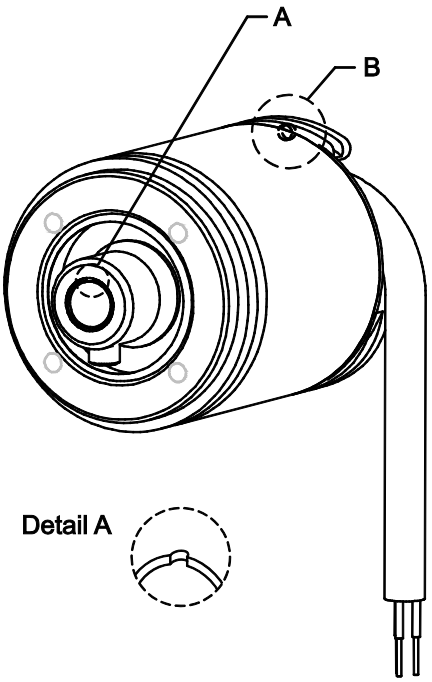
PRDS2: a zero impulse Z, $\overline{Z}$ is generated at the reference position.

PRAS3/PRDS3 Shaft



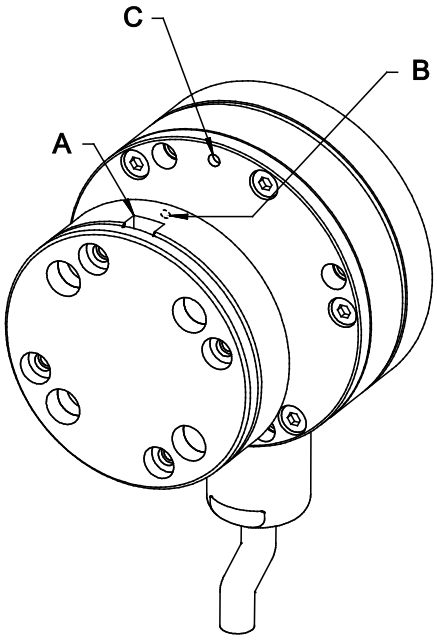
A – Marking
B – Marking (back side)

PRAS3/PRDS3 Hollow shaft



Allowable shaft load PRAS3/PRDS3
100 N radial, 100 N axial

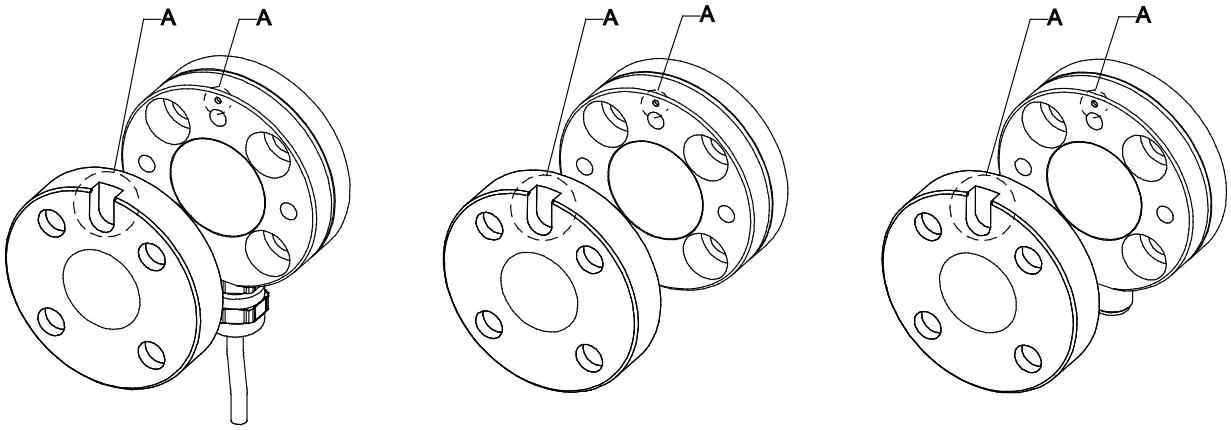
PRAS4



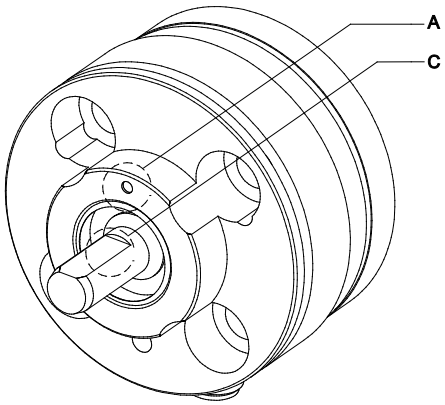
A, C – Marking
B – Marking (back side)

PRAS5/PRDS5-K

Cable version, Connector version M12 axial/radial



PRDS5-V Shaft



Allowable shaft load PRDS5-V:

100 N radial, 100 N axial

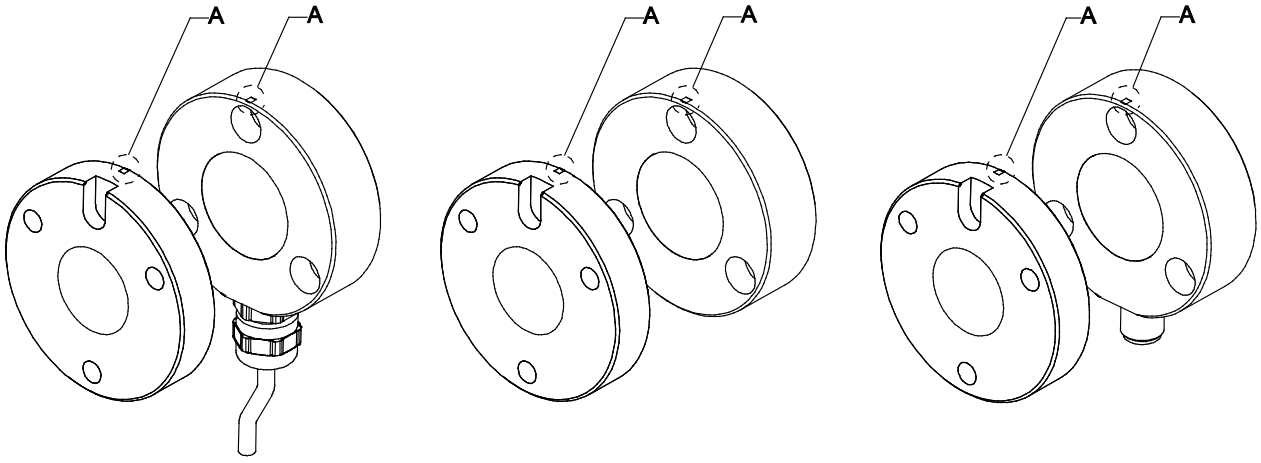
PRDS5, PRDS5-V: a zero impulse Z, $\overline{Z}$ is generated at the reference position.

A – Marking

C – Flat area

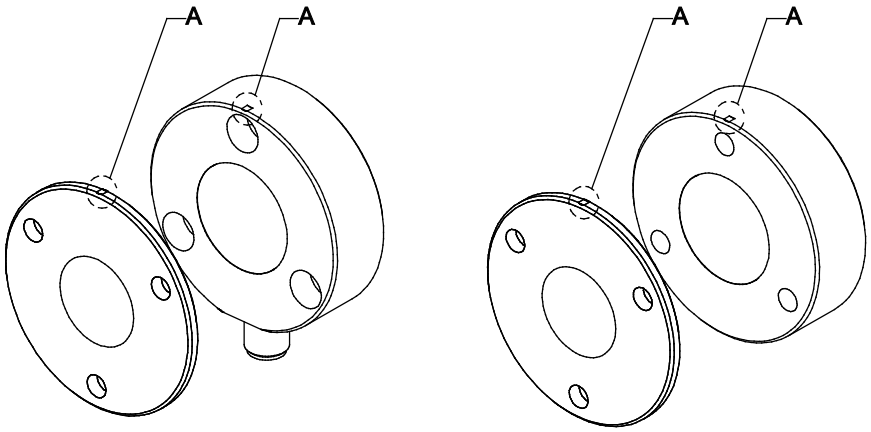
PRAS6/PRDS6

Cable version, Connector version M12 axial/radial



PRAS7/PRDS7

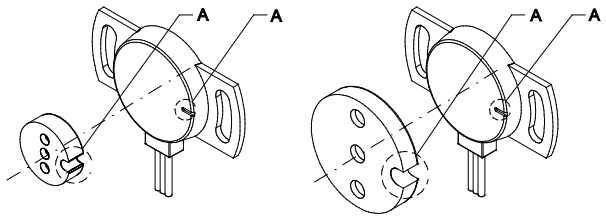
Connector version M12 axial/radial



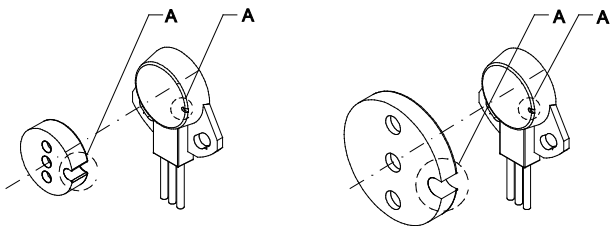
A – Marking

PRDS6, PRDS7: a zero impulse Z, $\overline{Z}$ is generated at the reference position.

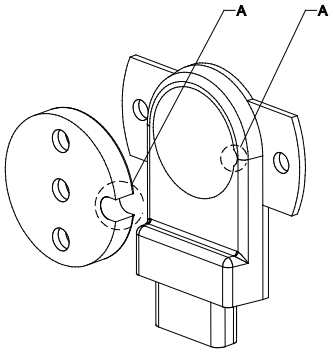
PRAS20



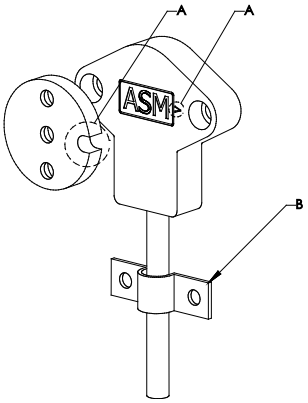
PRAS21



PRAS26



PRAS27/PRDS27, PRAS29/PRDS29

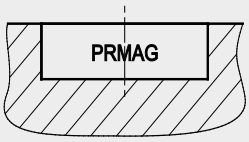
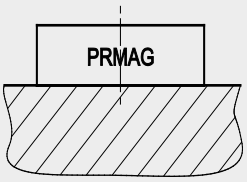


Assembly of the position magnets

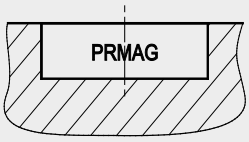
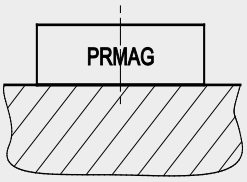
NOTICE

- 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 angle sensors.

Mounting on non-magnetic material

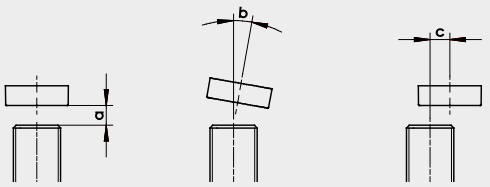
	flush-mounted 	surface-mounted 
PRMAG2 PRMAG2-Z	●	●
PRMAG5-Z PRMAG6-Z PRMAG7-Z	●	●
PRMAG20 PRMAG21 PRMAG22	●	●
PRMAG-M10	●	●

Mounting on magnetic material

	flush-mounted 	surface-mounted 
PRMAG2 PRMAG2-Z	●	●
PRMAG5-Z PRMAG6-Z PRMAG7-Z	●	●
PRMAG20 PRMAG21 PRMAG22	-	●
PRMAG-M10	-	●

● : mounting admissible

Measuring error by misalignment of the position magnet



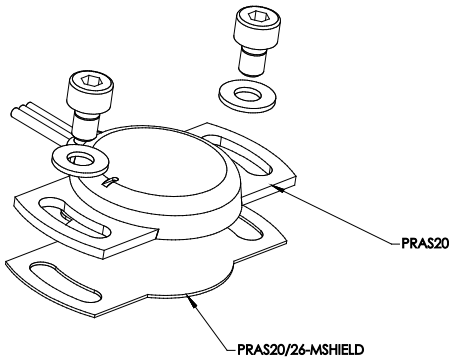
Air gap (a)
Parallelism (b)
Axial misalignment (c)

Sensor	Position magnet	Air gap [mm]	Parallelism [°]	Error by axial misalignment [°]					
				0.2 mm	0.5 mm	1 mm	2 mm	3 mm	4 mm
PRAS20 PRAS21 PRAS26	PRMAG20	0 ... 7	0 ... 5	0.1	0.3	0.7	2	4.6	–
	PRMAG21	0 ... 2	0 ... 5	0.15	0.3	0.9	3.6	9.6	–
	PRMAG22	0 ... 10	0 ... 5	0	0	0.7	1.5	3.8	7
	PRMAG-M10	0 ... 3	0 ... 5	0.1	0.1	0.5	2	7	–
PRAS27 PRDS27 PRAS29 PRDS29	PRMAG20	0 ... 7.5	0 ... 5	0.1	0.3	0.7	2	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	0.7	1.5	3.8	7
	PRMAG-M10	0 ... 3.5	0 ... 5	0.1	0.1	0.5	2	7	–
PRAS1 PRDS1	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	3.8	10	–
	PRMAG22	0 ... 9.5	0 ... 5	0.1	0.4	1	2.2	4.5	8
	PRMAG-M10	0 ... 5	0 ... 5	0.1	0.1	0.5	2.0	7	–
PRAS2 PRDS2	PRMAG2-Z-VA	0 ... 9	0 ... 5	0.1	0.2	0.6	1.5	4.5	8.5
	PRMAG20	0 ... 6	0 ... 5	0.15	0.4	0.8	2.2	5	–
	PRMAG21	0 ... 3.5	0 ... 5	0.2	0.4	1	3.8	10	–
	PRMAG22	0 ... 9	0 ... 5	0.1	0.4	1	2.2	4.5	8.0
PRAS4	PRMAG5-Z-VA-WP	0 ... 6.5	0 ... 5	0.1	0.2	0.6	1.5	4.5	8.5
PRAS5 PRAS6 PRAS7 PRDS5 PRDS6 PRDS7	PRMAG2-Z-(VA)	0 ... 8.5	0 ... 5	0.1	0.2	0.6	1.5	4.5	8.5
	PRMAG5-Z-(VA)	0 ... 7.5	0 ... 5	0.1	0.2	0.6	1.5	4.5	8.5
	PRMAG6-Z-(VA)	0 ... 7.5	0 ... 5	0.1	0.2	0.6	1.5	4.5	8.5
	PRMAG7-Z-VA	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	–
	PRMAG21	0 ... 3	0 ... 5	0.2	0.4	1	3.8	10	–
	PRMAG22	0 ... 8.5	0 ... 5	0.1	0.4	1	2.2	4.5	8

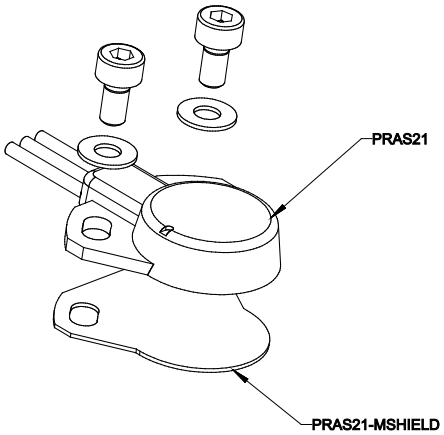
Sensor fixing with a shield plate (optional)

An optional shield plate is available for the angle sensors PRAS20, PRAS21, PRAS26, PRAS27/PRDS27 and PRAS29/PRDS29. It can reduce the effect of residual magnetizing in case the sensor has to be mounted on a ferromagnetic material.

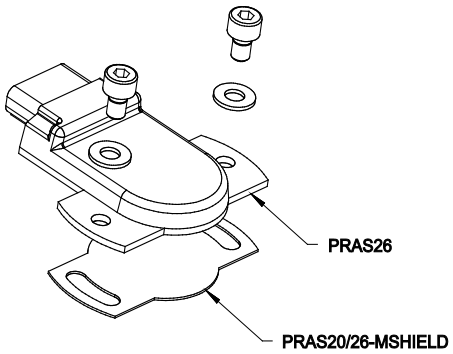
PRAS20



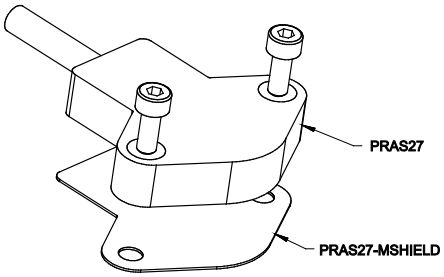
PRAS21



PRAS26



PRAS27/ PRDS27
PRAS29/ PRDS29

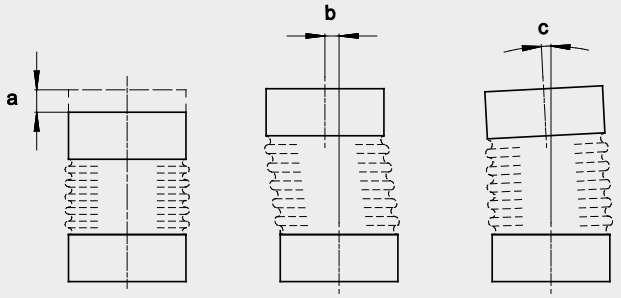
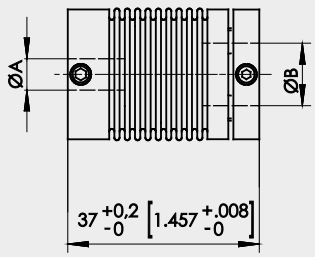


Torque for fixing screws

The specified torques and mounting methods are general recommendations and can differ according to application and operating conditions.

Model	Mounting method	Material	Torque [Nm]
PRAS1, PRDS1	Nuts M12x1	–	2.5
PRAS21	Screws M3 with washer	A4 Aluminium Brass Plastic	<0.8 – – –
PRAS20/PRAS20R	Screws M4 with washer	A4 Aluminium Brass Plastic	<1.8 – – –
PRAS27, PRDS27 **PRAS29, PRDS29**	Screws M4	–	1
PRAS26	Screws M4 with washer	A2	<1.8
PRAS2, PRDS2	Screws M2.5 for mounting brackets	–	0.8
PRAS3, PRDS3	Screws M3 for mounting flange	–	1.2
PRAS4	Screws M6	A2	<4
PRAS5, PRDS5	Screws M8	Steel	<10
PRAS6, PRDS6	Screws M6	Steel	<6
PRAS7, PRDS7	Screws M6	Steel	<6

Couplings

Model MK4	Rated torque	2 Nm	
	Total length (inserted)	37 mm	
			
	Axial misalignment (a)	< 0.7 mm	
	Lateral misalignment (b)	< 0.25 mm	
	Angular misalignment (c)	< 2°	
	 Dimensions in mm [inch]		
	Order code	A	B
	MK4-37-6-6	Ø6H7 [.236 +.0005]	Ø6H7 [.236 +.0005]
	MK4-37-6-10	Ø6H7 [.236 +.0005]	Ø10H7 [.394 +.0006]
	MK4-37-6-12	Ø6H7 [.236 +.0005]	Ø12H7 [.472 +.0007]

3.2 Electrical connection

NOTICE

Damage or destruction of the sensor due to excessive operating voltage or mounting error

- The applied operating voltage must not exceed the value specified in the data sheet.
- Operate the sensor only within the limits specified in the data sheet.
- Connection to the power supply only by qualified personnel and in accordance with the applicable safety regulations for electrical equipment.
- Do not connect or disconnect the sensor under voltage!

Corrosion in the sensor due to moisture penetration

- Use the sensor only according to protection class.
- The mating connector should have the same protection class as the sensor, otherwise the lower protection class of the mating connector is valid.
- Avoid crossing the dew point.
- Cable outputs must be installed in such a way that no moisture can get into the cable.
- The protection class of sensors with connector output is valid only if the electrical plug is connected!

Damage of the sensor cable due to mechanical stress

- Do not twist the M12 connector inserts.
- It is important that the knurled nuts on the connectors are tightened to the correct torque for each different size of the connector:
  - M12-ASM connectors / couplings: 1.0 Nm
  - connectors / couplings of other manufacturers: according to manufacturer instruction.
  - Use a torque wrench.
- Do not strain the connection cable.
- A separate strain relief is recommended.

Damage to the sensor via water ingress through the junction box due to corrosion resulting from water penetration (PRAS4)

- The connecting cable must be routed to the terminal box via a pressure-tight cable gland.

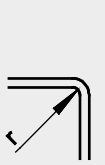
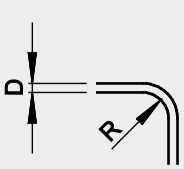
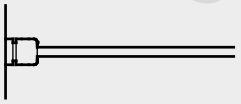
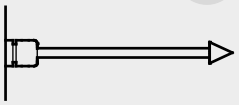
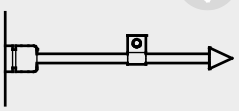
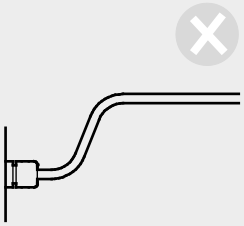
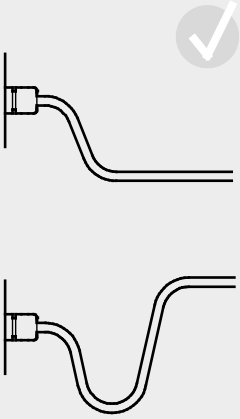
Connector Pin assignment

According to the definitions of the output types contained in the appendix. Observe different color code for pre-assembled accessory cables. See catalog information for accessories.

Supply voltage

See specification in the data sheet of the sensor. The maximum operating voltage must not be exceeded.

Installation of the sensor supply cable

	incorrect	correct
Admissible bending radius of the cable must be observed: R ~ 5 x D R ~ 10 x D (underwater cable)		
Length compensation for the cable must be observed		
A separate cord grip for cable strain relief is recommended		
Observe cable routing in case of splashing water, water condensation and humidity		

Electromagnetic Compatibility (EMC)

Electromagnetic compatibility of posirot® magnetic angle sensors is influenced by the sensor wiring.

NOTICE

Possible malfunction of the sensor when used in systems with highly interference-prone components such as frequency inverters

Recommended wiring:

- Use single shielded sensor cable with twisted pair conductors for power supply and signal output.
- Connect the cable shield to ground on one side of the control cabinet. Connect the shield connection over a large area using cable clamps before or at the cable entry into the control cabinet. When preassembled cables are delivered, the screen is not connected to the housing on the sensor side.
- Do not install sensor cables close to power conductors such as motor or contactor control cables (use separate cable ducts for signal and power cables).
- Install the cables in metal cable ducts which are connected to ground.

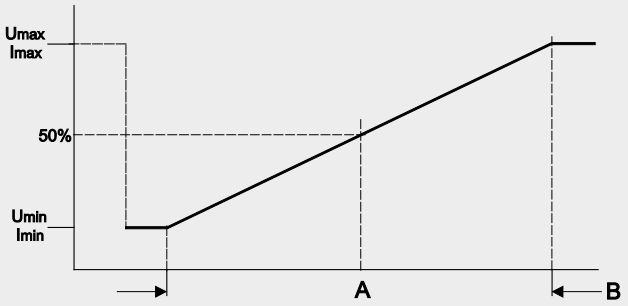
3.3 Operating temperature

posirot® PRAS20/PRAS20R	-40 ... +85°C
posirot® PRAS21	-40 ... +85°C
posirot® PRAS26	-40 ... +85°C
posirot® PRAS27/PRDS27	-40 ... +85°C
posirot® PRAS29/PRDS29	-40 ... +85°C
posirot® PRAS1/PRDS1	-40 ... +85°C
posirot® PRAS2/PRDS2	-40 ... +85°C
posirot® PRAS3/PRDS3	-40 ... +85°C
posirot® PRAS4	-20 ... +85°C (up to +30°C in sea water)
posirot® PRAS5/PRDS5	-40 ... +85°C
posirot® PRAS6/PRDS6	-40 ... +85°C
posirot® PRAS7/PRDS7	-40 ... +85°C

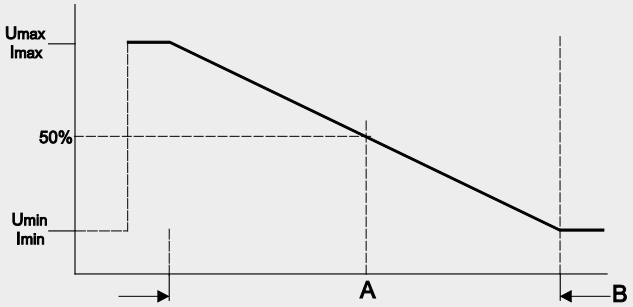
3.4 Characteristics for magnetic angle sensors

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.

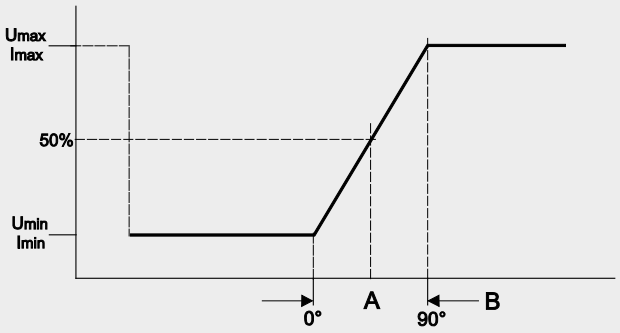
Output signal
(CW increasing*)



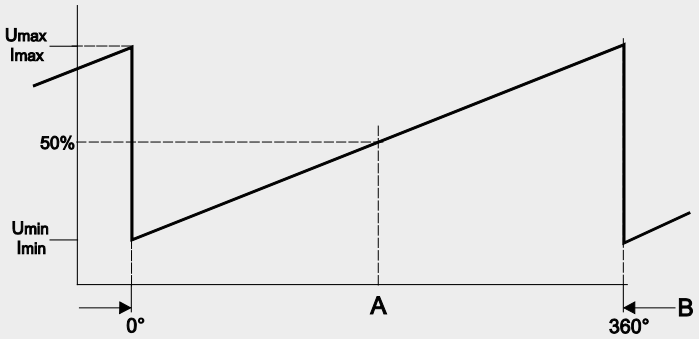
Output signal
(CCW increasing*)



Example angular range 90°

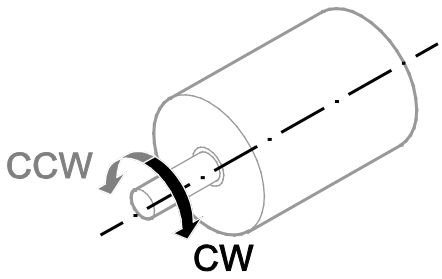


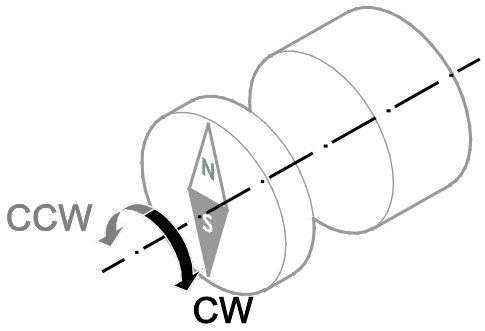
Example angular range 360°



A – Marking
B – Measurement range [°]

*: Rotation direction of the sensor axis / of the position magnet with a view to the sensor





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
U8	0.5 ... 4.5 V	2.5 V
I1	4 ... 20 mA	12 mA

4 Maintenance and disposal

4.1 Maintenance and service

NOTICE

Opening all the posirot® sensors will cause damage and void the warranty

- Do not open the sensor.
- We strongly advise against repair attempts. Any repairs not carried out by ASM will invalidate the warranty. Damaged sensors must be shut down immediately, please contact ASM.

Maintenance interval

Proper maintenance comprises the visual examination of parts (e.g. integrity of housing, connectors and cables). Maintenance intervals depend on the specific application and should be defined by the user in dependence of operating conditions.

Check sensor regularly for possible damage. The following maintenance steps are recommended:

Inspection of …	Measures
Integrity of housing	Remove sensor from service and send it to ASM for repair
Integrity of cables, connectors	Damaged parts: remove sensor from service and replace damaged parts resp. send sensor to ASM for repair
Mounting elements	Loose mounting parts: mounting elements must be tightened with recommended torque. Provide screw locks if necessary
Visual check of shaft sealing	Damaged shaft sealing: Remove sensor from service and send it to ASM for repair

Calibration

The recommended calibration interval is 1 year.

Test protocol and traceable calibration certificate (ISO9001 / ISO10012) is available on request.

4.2 Disposal

Disposal according to applicable government regulations.

5 Output specification

5.1 Analog output

U2 Voltage output 0.5 ... 10 V 	Excitation voltage	18 … 36 V DC
	Excitation current	typical 10 mA max. 15 mA
	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. (typical for 90° … 360°) ±100 x 10^{-6} / °C f.s. (typical for <90°)
	Protection	Reverse polarity, short circuit
	Operating temperature	-40 … +85 °C
	EMC	DIN EN 61326-1:2013

U2B Voltage output 0.5 ... 10 V 	Excitation voltage	11.5 … 27 V DC
	Excitation current	typical 12 mA max. 16 mA
	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. (typical for 90° … 360°) ±100 x 10^{-6} / °C f.s. (typical for <90°)
	Protection	Reverse polarity, short circuit
	Operating temperature	-40 … +85 °C
	EMC	DIN EN 61326-1:2013

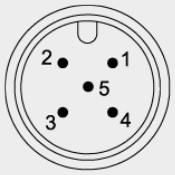
U6 Voltage output 10 … 90 % ratiometric 	Excitation voltage	5 V DC ±10 %
	Excitation current	typical 8 mA max. 12 mA
	Output voltage	10 … 90 % of the excitation voltage
	Output current	2 mA max.
	Measuring rate	1 kHz standard
	Stability (temperature)	±50 x 10^{-6} / °C f.s. (typical for 90° … 360°) ±100 x 10^{-6} / °C f.s. (typical for <90°)
	Protection	Reverse polarity, short circuit
	Operating temperature	-40 … +85 °C
	EMC	DIN EN 61326-1:2013

U8 Voltage output 0.5 … 4.5 V 	Excitation voltage	11 … 36 V DC
	Excitation current	typical 10 mA max. 20 mA
	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. (typical for 90° … 360°) ±100 x 10^{-6} / °C f.s. (typical for <90°)
	Protection	Reverse polarity, short circuit
	Operating temperature	-40 … +85 °C
	EMC	DIN EN 61326-1:2013

I1 Current output 4 … 20 mA, 3 wires 	Excitation voltage	18 … 36 V DC
	Excitation current	typical 30 mA max. 35 mA
	Load R_L	500 Ω max.
	Output current	4 … 20 mA
	Measuring rate	1 kHz standard
	Stability (temperature)	±50 x 10^{-6} / °C f.s. (typical for 90° … 360°) ±100 x 10^{-6} / °C f.s. (typical for <90°)
	Protection	Reverse polarity, short circuit
	Operating temperature	-40 … +85 °C
	EMC	DIN EN 61326-1:2013

I1B Current output 4 … 20 mA, 3 wires 	Excitation voltage	10 … 27 V DC
	Excitation current	typical 32 mA max. 36 mA
	Load R_L	250 Ω max.
	Output current	4 … 20 mA
	Measuring rate	1 kHz standard
	Stability (temperature)	±50 x 10^{-6} / °C f.s. (typical for 90° … 360°) ±100 x 10^{-6} / °C f.s. (typical for <90°)
	Protection	Reverse polarity, short circuit
	Operating temperature	-40 … +85 °C
	EMC	DIN EN 61326-1:2013

Analog output, 1 channel
(connector and cable output, except seawater resistant submarine cable)

Signal wiring	**Output signals**	**Connector pin no.**	**Cable color**
Connector M12, 5 pin  View to the sensor connector	Excitation +	1	brown
	Signal	2	white
	GND	3	blue
	Do not connect!	4	black
	Do not connect!	5	grey

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

Analog output (cable output, seawater resistant submarine cable)

Signal wiring	Output signals	Cable color
	Excitation +	white
	Signal	green
	GND	brown
	Do not connect!	grey
	Do not connect!	-

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

Analog output, redundant

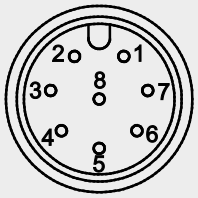
U2R Voltage output 0.5 ... 10 V 	Excitation voltage	18 … 36 V DC
	Excitation current	typical 10 mA max. 15 mA per channel
	Output voltage	0.5 ... 10 V DC
	Output current	2 mA max.
	Measuring rate	1 kHz Standard
	Stability (temperature)	±50 x 10^{-6} / °C f.s. (typical for 90° … 360°) ±100 x 10^{-6} / °C f.s. (typical for <90°)
	Protection	Reverse polarity, short circuit
	Operating temperature	-40 … +85 °C
	EMC	DIN EN 61326-1:2013

U6R Voltage output 10 … 90 % ratiometric 	Excitation voltage	5 V DC ±10 %
	Excitation current	typical 8 mA max. 12 mA per channel
	Output voltage	10 … 90 % of the excitation voltage
	Output current	2 mA max.
	Measuring rate	1 kHz standard
	Stability (temperature)	±50 x 10^{-6} / °C f.s. (typical for 90° … 360°) ±100 x 10^{-6} / °C f.s. (typical for <90°)
	Protection	Reverse polarity, short circuit
	Operating temperature	-40 … +85 °C
	EMC	EN 61326-1:2013

U8R Voltage output 0.5 … 4.5 V 	Excitation voltage	11 … 36 V DC
	Excitation current	typical 10 mA max. 20 mA per channel
	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. (typical for 90° … 360°) ±100 x 10^{-6} / °C f.s. (typical for <90°)
	Protection	Reverse polarity, short circuit
	Operating temperature	-40 … +85 °C
	EMC	DIN EN 61326-1:2013

I1R Current output 4 … 20 mA, 3 wires 	Excitation voltage	18 … 36 V DC
	Excitation current	typical 30 mA max. 35 mA per channel
	Load R_L	500 Ω max.
	Output current	4 … 20 mA
	Measuring rate	1 kHz standard
	Stability (temperature)	±50 x 10^{-6} / °C f.s. (typical for 90° … 360°) ±100 x 10^{-6} / °C f.s. (typical for <90°)
	Protection	Reverse polarity, short circuit
	Operating temperature	-40 … +85 °C
	EMC	DIN EN 61326-1:2013

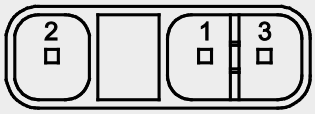
Analog output, 2 channels, redundant (connector and cable output)

Signal wiring **Connector M12, 8 pin**	**Channel**	**Output signals**	**Connector pin no.**	**Cable color**
 View to the sensor connector	1	Excitation +	1	white
		Signal	2	brown
		GND	3	green
		Do not connect!	4	yellow
	2	Excitation +	5	grey
		Signal	6	pink
		GND	7	blue
		Do not connect!	8	red

PRAS20 / PRAS20R / PRAS21

Signal wiring Single wires	Output signals	Cable color
	Excitation +	brown
	Signal	white
	GND	blue

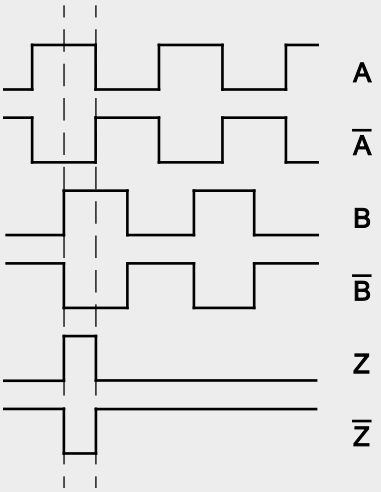
PRAS26

Signal wiring TE3, 3 pin	Output signals	Connector pin no.
 View to the sensor connector	GND	1
	Excitation +	2
	Signal	3

5.2 Incremental output

HT24VF Incremental		
	Interface	HTL
	Excitation voltage	8 ... 36 V DC
	Excitation current	100 mA max., depending on the load
	Max. pulse frequency	500 kHz
	Output signals	A, $\overline{A}$, B, $\overline{B}$, Z, $\overline{Z}$ Push-Pull
	Output current	10 mA max.
	Stability (temperature)	±50 x 10^{-6} / °C f.s. (typical)
	Operating temperature	-40 ... +85 °C
	Protection	Short circuit
	EMC	DIN EN 61326-1:2013

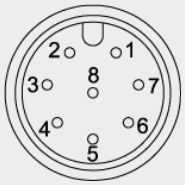
Output signals



Pulse sequence for clockwise rotation CW in view of shaft or active front of sensor.

A zero impulse Z, $\overline{Z}$ is generated at the reference position.

Signal wiring
Connector M12, 8 pin

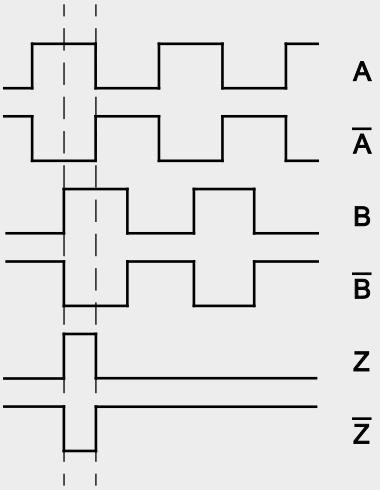


View to the sensor connector

Output signals	**Connector pin no.**	**Cable color**
Excitation +	1	white
Excitation GND	2	brown
A	4	yellow
$\overline{A}$	6	pink
B	3	green
$\overline{B}$	5	grey
Z	7	blue
$\overline{Z}$	8	red

RS5VF /RS24VF Incremental		
	Interface	EIA RS-422
	Excitation voltage	RS5VF: 5 V DC ±10 % RS24VF: 8 ... 36 V DC
	Excitation current	100 mA max., depending on the load
	Max. pulse frequency	500 kHz
	Output signals	A, $\overline{A}$, B, $\overline{B}$, Z, $\overline{Z}$ Push-Pull
	Output current	10 mA max.
	Stability (temperature)	±50 x 10^{-6} / °C f.s. (typical)
	Operating temperature	-40 ... +85 °C
	Protection	Short circuit
	EMC	DIN EN 61326-1:2013

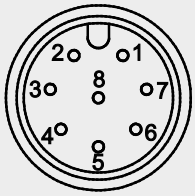
Output signals



Pulse sequence for clockwise rotation CW in view of shaft or active front of sensor.

A zero impulse Z, $\overline{Z}$ is generated at the reference position.

Signal wiring
Connector M12, 8 pin



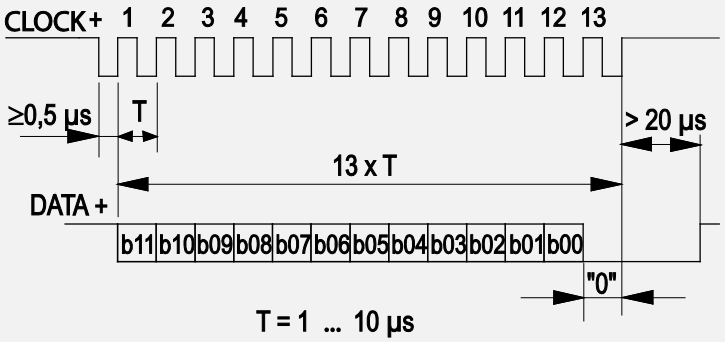
View to the sensor connector

Output signals	**Connector pin no.**	**Cable color**
Excitation +	1	white
Excitation GND	2	brown
A	4	yellow
$\overline{A}$	6	pink
B	3	green
$\overline{B}$	5	grey
Z	7	blue
$\overline{Z}$	8	red

5.3 Digital output

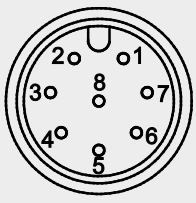
RSSI5V/RSSI24V Synchronous serial SSI	Interface	EIA RS-422
	Excitation voltage	RSSI5V: 5 V DC ±10% RSSI24V: 10 ... 36 V DC
	Excitation current	100 mA max. without load
	Clock frequency	100 kHz ... 500 kHz
	Code	Gray-Code, continuous progression, 12 bit
	Delay between pulse trains	20 µs min.
	Stability (temperature)	±50 x 10^{-6} / °C f.s. (typical)
	Operating temperature	Refer to sensor specifications
	Protection	Short circuit
	EMC	EN 61326-1:2013

Data format
(Train of 13 pulses)



Transmission rate	**Cable length**	**Baud rate**	**Note:**
	50 m	100 - 1000 kHz	Extension of the cable length will reduce the maximum transmission rate. The signals CLOCK /$\overline{\text{CLOCK}}$ and DATA/$\overline{\text{DATA}}$ must be connected in a twisted pair cable, shielded in pairs, the pairs also commonly shielded.
	100 m	100 - 300 kHz	

Signal wiring
Connector M12, 8 pin



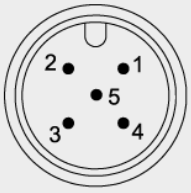
View to the sensor connector

Output signals	**Connector pin no.**	**Cable color**
Excitation +	1	white
Excitation GND	2	brown
CLOCK	3	green
$\overline{\text{CLOCK}}$	4	yellow
DATA	5	grey
$\overline{\text{DATA}}$	6	pink
-	7	blue
-	8	red

CANOP CANopen	CAN Specification	ISO 11898, Basic and Full CAN 2.0 B
	Communication profile	CANopen CiA 301 V 4.02, Slave
	Device profile	Encoder CiA 406 V 3.2
	Configuration services	Layer Setting Service (LSS), CiA Draft Standard 305 (transmission rate, node id)
	Error Control	Node Guarding, Heartbeat, Emergency Message
	Node ID	Default: 127; programmable via LSS or SDO
	PDO	3 TxPDO, 0 RxPDO, static mapping
	PDO Modes	Event-/Time triggered, Remote-request, Sync cyclic/acyclic
	SDO	1 server, 0 Client
	CAM	8 cams
	Certified	Yes
	Transmission rates	50 kBaud to 1 MBaud, default: 125 kBaud; programmable via LSS or SDO
	Bus connection	M12 connector, 5 pin
	Integrated bus terminating resistor	Adjustable by the customer
	Bus, galvanic isolated	No

Specifications	Excitation voltage	8 ... 36 V DC
	Excitation current	20 mA typical at 24 V DC 40 mA typical at 12 V DC, 80 mA max.
	Resolution	0.05° max.
	Stability (temperature)	±50 x 10^{-6}/°C f.s. (typical)
	Repeatability	1 LSB
	Operating temperature	See specification of the respective sensor
	Protection	Reverse polarity, short circuit
	Dielectric strength	1 kV (V AC, 50 Hz, 1 min.)
	EMC	DIN EN 61326-1:2013

Signal wiring
Connector M12, 5 pin



View to the sensor connector

Output signals	Connector pin no.	Cable color
Shield	1	brown
Excitation +	2	white
GND	3	blue
CAN-H	4	black
CAN-L	5	grey

Digital output CANopen (cable output, seawater resistant submarine cable)

Signal wiring	Output signals	Cable color
	$+U_V$ (Excitation voltage)	red
	GND	black
	CAN-H	blue
	CAN-L	white

CANopen – Set up (MCANOP)

WWW.

Download

- A detailed specification of this interface can be downloaded from the ASM website:

  www.asm-sensor.com/en/downloads.html > Configuration files

⚠ WARNING

Risk of injury by unexpected machine movement

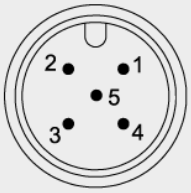
- Change parameters only when machine is in a safe condition!
- Changing parameters may cause unexpected machine movement.
- Changing parameters may influence dependent parameters e.g. changing the resolution may have influence on position of CAM switches.
- Precautions have to be taken to avoid damage to human and machine parts!

CANJ1939 SAE J1939 	CAN Specification	ISO 11898, Basic and Full CAN 2.0 B	
	Transceiver	24V-compliant, not isolated	
	Communication profile	SAE J1939	
	Baud Rate	250 kbit/s	
	Internal termination resistor	adjustable by the customer	
	Address	Default 247d, configurable	

NAME Fields	Arbitrary address capable	1	Yes
	Industry group	0	Global
	Vehicle system	7Fh (127d)	Non specific
	Vehicle system instance	0	
	Function	FFh (255d)	Non specific
	Function instance	0	
	ECU instance	0	
	Manufacturer	145h (325d)	Manufacturer ID
	Identity number	0nnn	Serial number 21 bit

Parameter Group Numbers (PGN)	Configuration data	PGN EF00h	Proprietary-A (PDU1 peer-to-peer)
	Process data	PGN FFnnh	Proprietary-B (PDU2 broadcast); nn Group Extension (PS) configurable

Specifications	Excitation voltage	8 ... 36 V DC
	Excitation current	20 mA typical at 24 V DC 40 mA typical at 12 V DC 80 mA max.
	Measuring rate	1 kHz (asynchronous)
	Stability (temperature)	±50 x 10^{-6}/°C f.s. (typical)
	Repeatability	1 LSB
	Operating temperature	See specification of the respective sensor
	Protection	Reverse polarity, short circuit
	Dielectric strength	1 kV (V AC, 50 Hz, 1 min.)
	EMV	DIN EN 61326-1:2013

Signal wiring Connector M12, 5 pin	Output signals	Connector pin no.	Cable color
 View to the sensor connector	Shield	1	brown
	Excitation +	2	white
	GND	3	blue
	CAN-H	4	black
	CAN-L	5	grey

Digital output CANJ1939 (cable output, seawater resistant submarine cable)

Signal wiring	Output signals	Cable color
	$+U_V$ (Excitation voltage)	red
	GND	black
	CAN-H	blue
	CAN-L	white

SAE J1939 – Set up (MCANJ1939)

WWW.

Download

- A detailed specification of this interface can be downloaded from the ASM website:

  www.asm-sensor.com/en/downloads.html > Configuration files

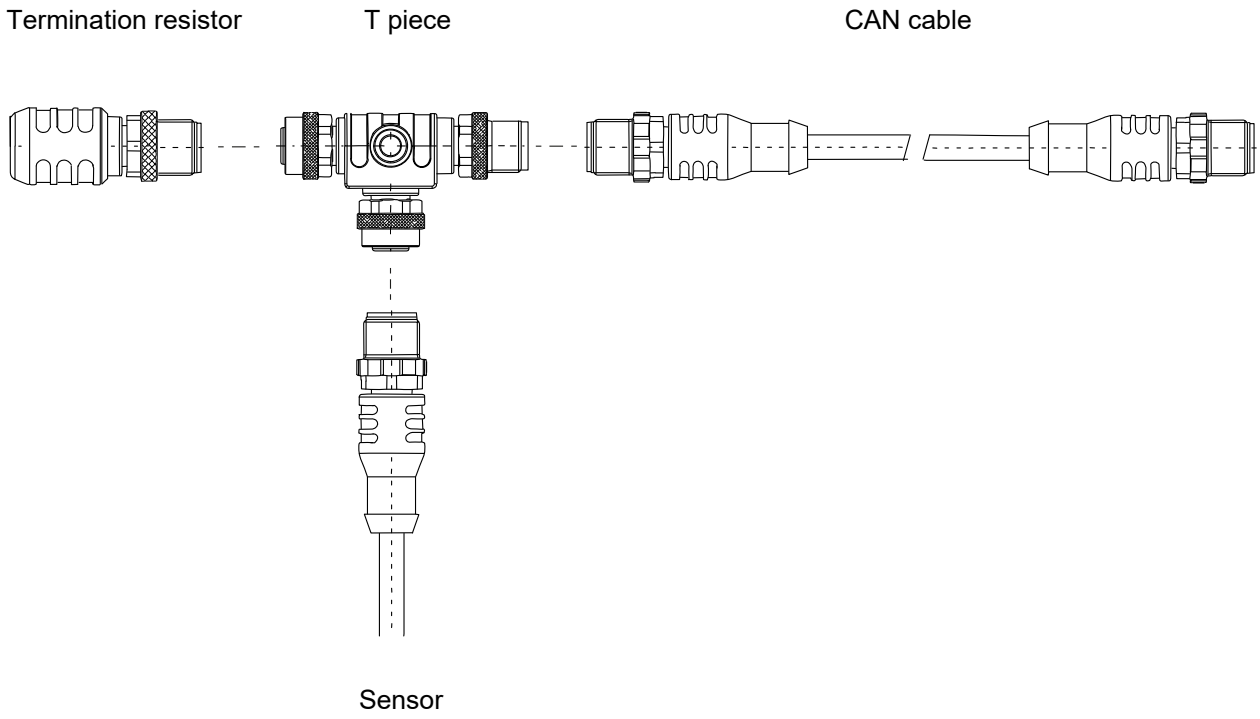
⚠ WARNING

Risk of injury due to unexpected machine movement

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CAN-Bus wiring

Connect the device by a T-connector to the CAN trunk line. Total length of stubs should be minimized. Do not use single stub lines longer than 0.5 m. Connect terminating resistors 120 Ohm at both ends of the trunk line.



Reliability Characteristics

Model	**PRAS1/PRDS1, PRAS20/PRAS20R, PRAS21, PRAS26, PRAS27/PRDS27, PRAS29/PRDS29, PRAS2/PRDS2, PRAS3/PRDS3, PRAS4, PRAS5/PRDS5, PRAS6/PRDS6, PRAS7/PRDS7**	
Output	**U2, U2B, U2R**	Voltage output 0.5 ... 10 V
	U6, U6R, U8, U8R	Voltage output 0.5 ... 4.5 V
	U6/8,25	Voltage output 0.825 ... 7.425 V
	I1, I1B, I1R	Current output 4 ... 20 mA
	RS5V, RS5VF, RS24V, RS24VF	Incremental interface (RS422)
	H24V, HT24VF	Incremental interface (HTL)
	RSSI5V, RSSI24V	Synchronous-serial interface
	CANOP, CANOPR	Digital interface CANopen
	CANJ1939, CANJ1939R	Digital interface SAE J1939
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}	PRAS: 100 x 10^6 revolutions PRDS: 400 x 10^6 revolutions
	Max. revolutions	10.000 1/min
	Allowable shaft load (10 mm solid shaft, 6 mm hollow shaft)	100 N radial, 100 N axial
Standards	Failure rate of electronic components (Siemens)	SN 29500

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