



POSIROT® / PRDS

Digital Magnetic Angle Sensors

Instruction Manual



Please read carefully before installation and operation!

POSIROT® – PRDS

Instruction Manual

Contents



Contents	Safety instructions	3
	Intended use	4
	Unintended use	4
	Description	5
	Mounting	5
	Placement and alignment of the position magnet	5
	Reference position	6
	Torque for the mounting screws	6
	Electrical installation	7
	Outline drawings	8
	Fixing of the PRAS27 with a shield plate	18
	Specification of the outputs	19
	RS422	19
	HTL	20
	SSI	21
	CANopen	22
	CAN SAE J1939	26
	Accessories	31
	Accessory cables	38
	Position magnets	40
	Assembly of the magnets	43
	Mounting plates	44
	Coupling MK4	46
	Service, calibration, disposal	47
	Reliability Characteristics	48
	Declaration of conformity	49

POSIROT® – PRDS

Instruction Manual

Safety instructions



Safety instructions

If total failure or malfunction of the sensor can cause danger or injury to the operator or damage to the machinery or equipment it is recommended that additional safety measures should be incorporated into the system.

Any alteration, reconstruction or extension of the sensor is not allowed.

Sensor must be operated only within values specified in the datasheet.

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

Do not connect / disconnect the sensor under tension.

Disregard of this advice can lead to malfunctions, damage to property or personal injury and releases the manufacturer from product liability.

Explanation of used safety signs and signal words



WARNING, Risk of Injury:

Indicates a potentially hazardous situation, which, if not avoided, could 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.

POSIROT® – PRDS

Instruction Manual

Intended use



Intended use

The angle sensor was intended for angular position measurement, when properly mounted and used in the specified ambient atmospheric and technical conditions for which the sensor is designated.

Unintended use

The unintended use is when the sensor is used outside its specified technical and ambient atmospheric conditions or when incorrectly mounted.

Maintenance and service

- In order to avoid risk of injury and improper handling the customer is not allowed to repair the sensor. No warranty or liability will be granted for opened sensors.
- Damaged sensors must be shut down immediately and sent to the factory for repair.

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 dependance of operating conditions.

The following maintenance steps are recommended:

	Integrity of housing, connector, cable	Mounting elements	Visual check of shaft sealing
PRDS2	X	X	
PRDS3	X	X	X
PRDS5	X	X	
PRDS5-V	X	X	X
PRMAG20		X	
PRMAG21		X	
PRMAG22		X	
PRMAG5Z		X	
Measures	Damaged parts: Put sensor out of service and replace damaged parts resp. send sensor to ASM for repair	Loose mounting parts: Screw tight mounting parts with recommended torque, if applicable use bolt adhesive	Damaged shaft sealing: Put sensor out of service and send it to ASM for repair

Deinstallation

Disconnect electrical connections. Loosen fixing screws.

Disposal

Disposal according to applicable government regulations.

POSIROT® – PRDS

Instruction Manual

Description / Mounting



Description

The angle sensors PRDS 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 incremental output. Resolutions up to 1024 pulses per revolution are available.

Mounting



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 PRDS sensors of the POSIROT® product family. Therefore the angle sensors should be mounted solely with nonmagnetic / non magnetisable shims and screws.

The angle sensors PRDS2, PRDS3 and PRDS5 are equipped with an integrated magnetic shield which minimizes the sensitivity against external magnetic fields.

Optional shield plates are available for the angle sensor PRDS27. They can decrease the effect of residual magnetizing in case the sensor has to be mounted on a ferromagnetic material (see page 18). It is however not possible to exclude the effect of lateral external magnetic fields.



NOTICE

Mechanical information PRDS1, PRDS2, PRDS3, PRDS5

- Prevent the sensor shaft from binding.
- Use shaft couplings resp. torque arms (e.g. flexible ones) to avoid misalignment errors.



NOTICE

Mechanical information PRDS27

- Mount the sensor on a flat surface.
- Do not deform the sensor housing!

Placement and alignment of the position magnet



POSIROT® – PRDS

Instruction Manual

Mounting



Mounting (continuation)

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 / $\bar{Z}$ will be activated.

Reference position SSI output

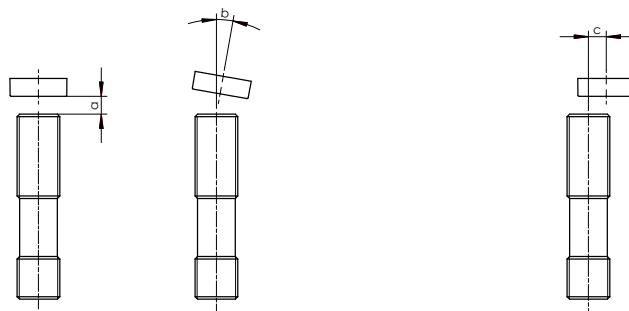
The zero point of the characteristic is given when markings on magnet and housing match.

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.

Measuring error by misalignment of the position magnet

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
PRDS1	PRMAG20	0 ... 4,5	0 ... 5	0,15	0,4	0,8	2,2	5,0	–
	PRMAG21	0 ... 2,0	0 ... 5	0,2	0,4	1,0	3,8	10	–
	PRMAG22	0 ... 7,5	0 ... 5	0,1	0,4	1,0	2,2	4,5	8,0
PRDS2	PRMAG20	0 ... 4	0 ... 5	0,15	0,4	0,8	2,2	5,0	–
	PRMAG21	0 ... 1,5	0 ... 5	0,2	0,4	1,0	3,8	10	–
	PRMAG22	0 ... 7	0 ... 5	0,1	0,4	1,0	2,2	4,5	8,0
PRDS5	PRMAG5-Z	0 ... 5,5	0 ... 5	0,1	0,2	0,6	1,5	4,5	8,5
	PRMAG20	0 ... 3,5	0 ... 5	0,15	0,4	0,8	2,2	5,0	–
	PRMAG21	0 ... 1	0 ... 5	0,2	0,4	1,0	3,8	10	–
	PRMAG22	0 ... 6,5	0 ... 5	0,1	0,4	1,0	2,2	4,5	8,0
PRDS27	PRMAG20	0 ... 4,5	0 ... 5	0,15	0,4	0,8	2,2	5,0	–
	PRMAG22	0 ... 7,5	0 ... 5	0,0	0,0	0,7	1,5	3,8	7,0



POSIROT® – PRDS

Instruction Manual

Electrical installation



Torque for fixing screws

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

Torque	Mounting method	Material	Torque [Nm]
	Nuts M12x1 (PRDS1)	–	2.5
	M2,5 screws for mounting brackets (PRDS2, PRDS3)	–	0.8
	M3 screws for mounting flange (PRDS3)	–	1.2
	M4 screws (PRDS27)	–	1
	M8 screws (PRDS5)	–	<10

Electrical installation



NOTICE

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.

Do not strain the connection cable.

A separate cord grip is recommended.

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

Rotational speed limit by resolution and maximum pulse frequency	Resolution [periods per turn]	Rotational speed for maximum pulse frequency [rpm]	
		50 kHz	200 kHz
	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

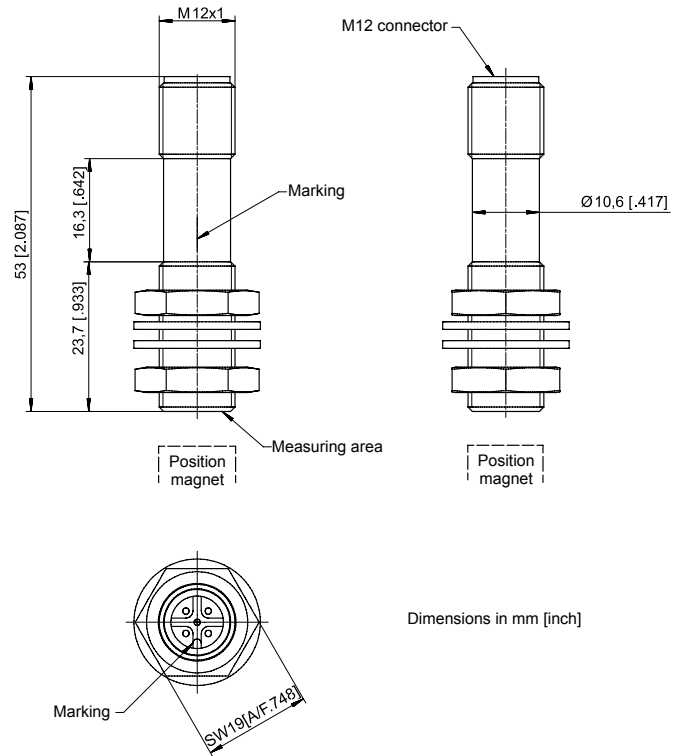
POSIROT® – PRDS

Instruction Manual

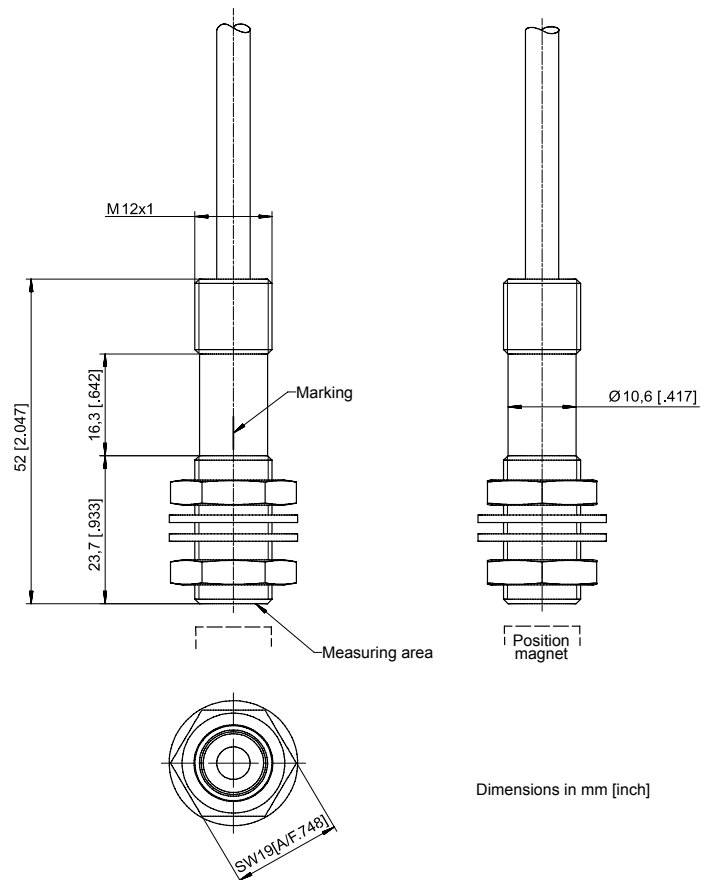
Outline drawings



Outline drawing PRDS1 Connector version



Outline drawing PRDS1 Cable version



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

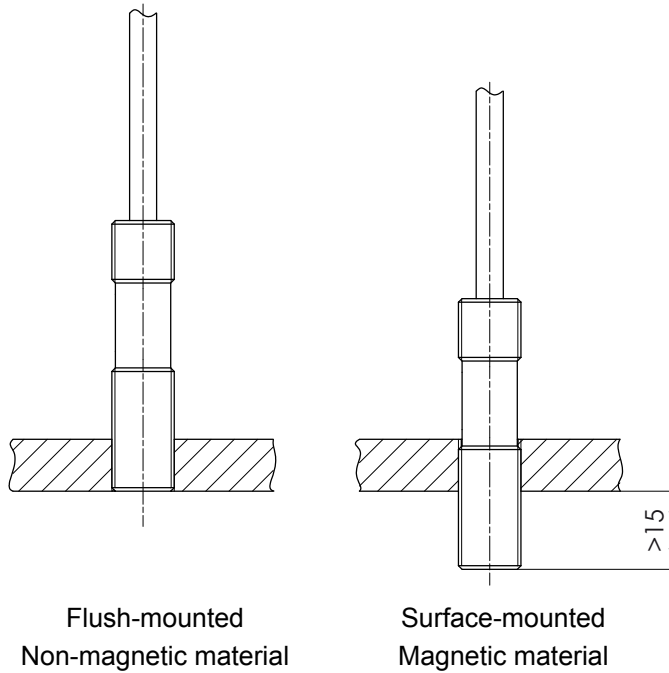
POSIROT® – PRDS

Instruction Manual

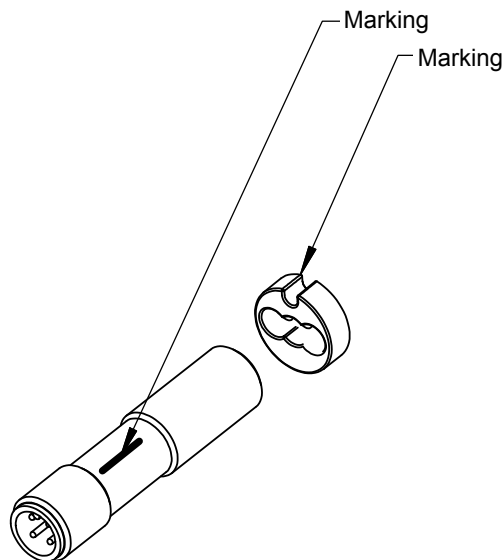
Outline drawings



Mounting PRDS1

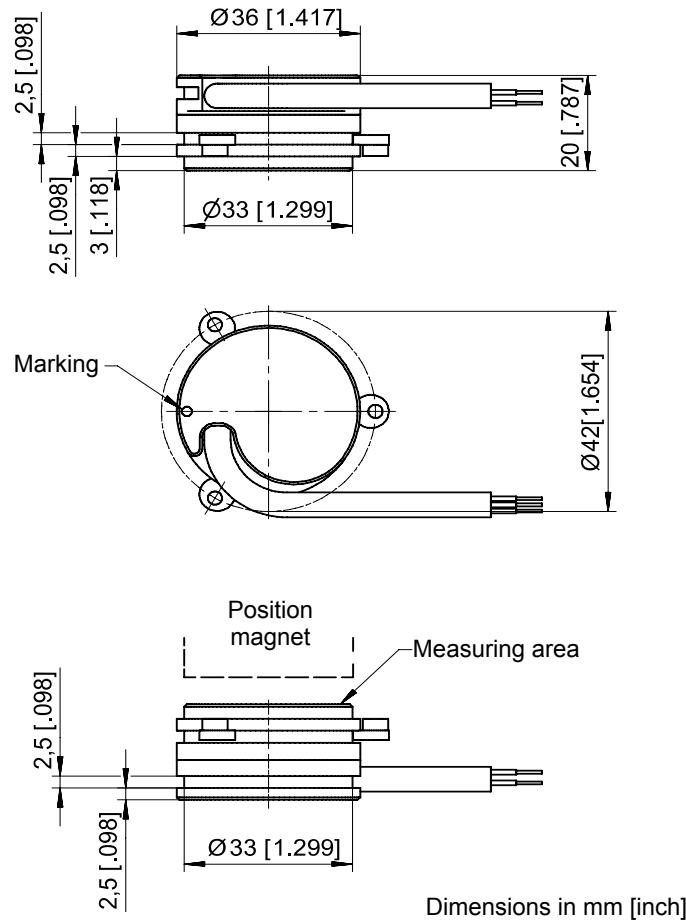


Reference position



A zero impuls Z , $\bar{Z}$ (see pages 19/20) is generated at the reference position.

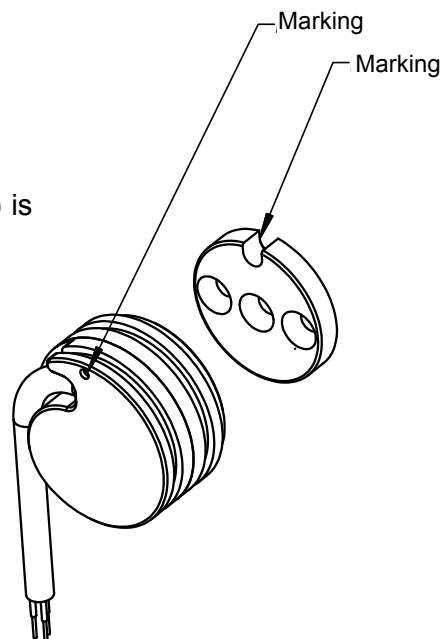
Outline drawing PRDS2 Cable version



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

Reference position

A zero impuls Z , $\bar{Z}$ (see pages 19/20) is generated at the reference position.



POSIROT® – PRDS

Instruction Manual

Outline drawings

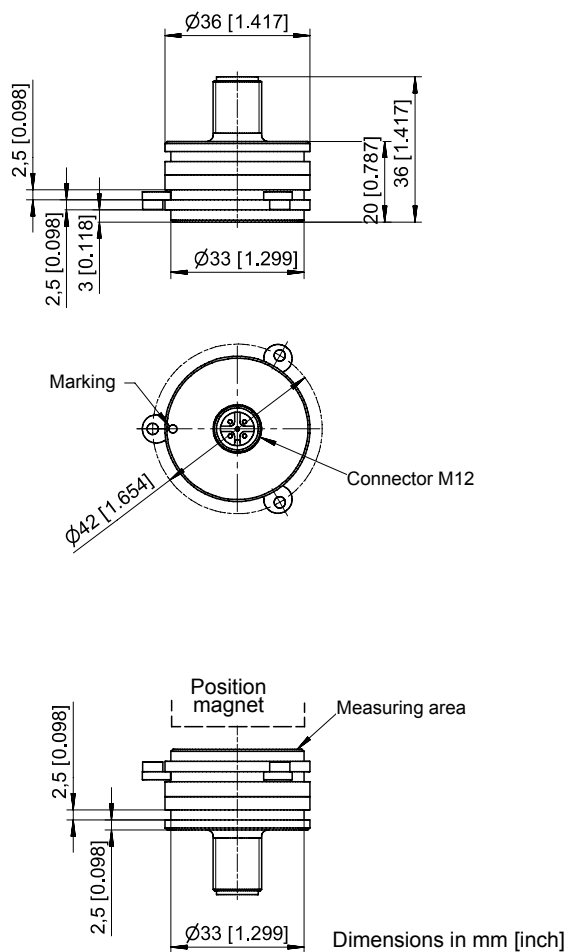


Outline drawing

PRDS2

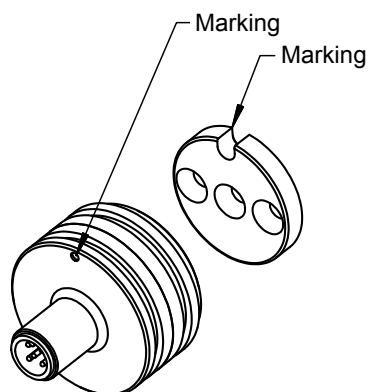
Connector version

M12 axial



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

Reference position



A zero impuls Z, $\bar{Z}$ (see pages 19/20) is generated at the reference position.

POSIROT® – PRDS

Instruction Manual

Outline drawings

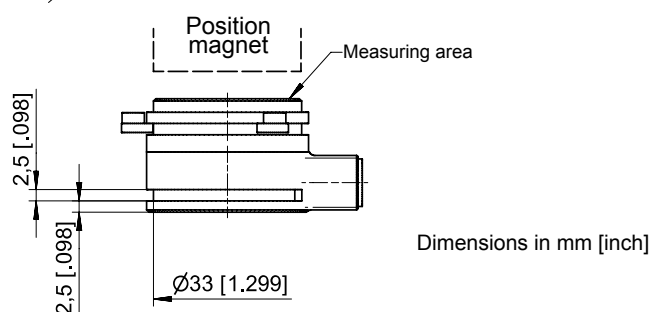
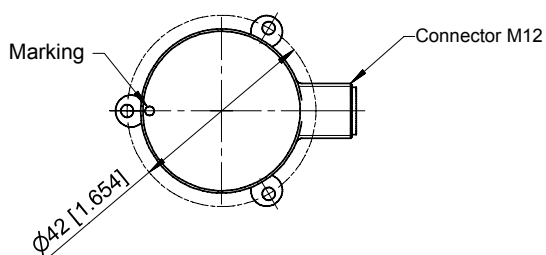
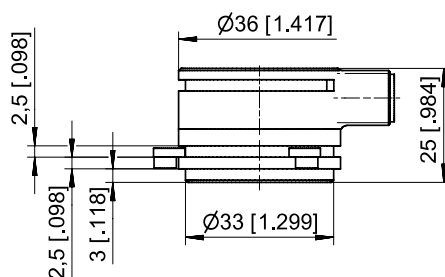


Outline drawing

PRDS2

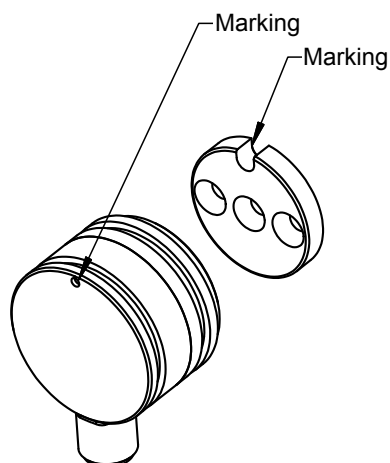
Connector version

M12 radial



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

Reference position



A zero impuls Z, $\bar{Z}$ (see pages 19/20) is generated at the reference position.

POSIROT® – PRDS

Instruction Manual

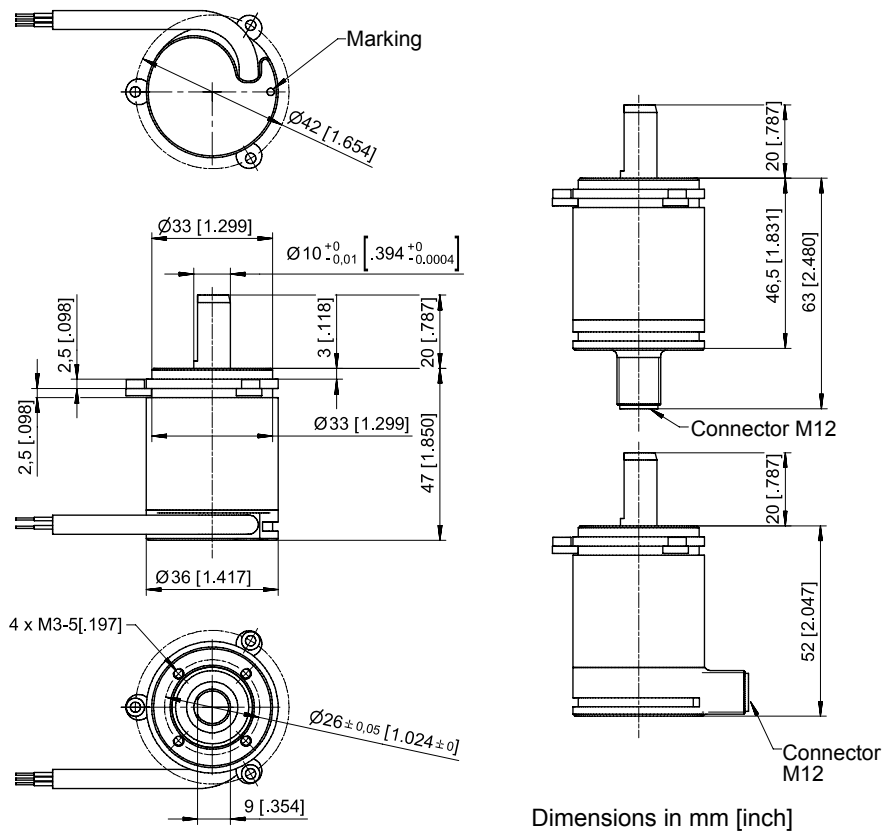
Outline drawings



Outline drawing

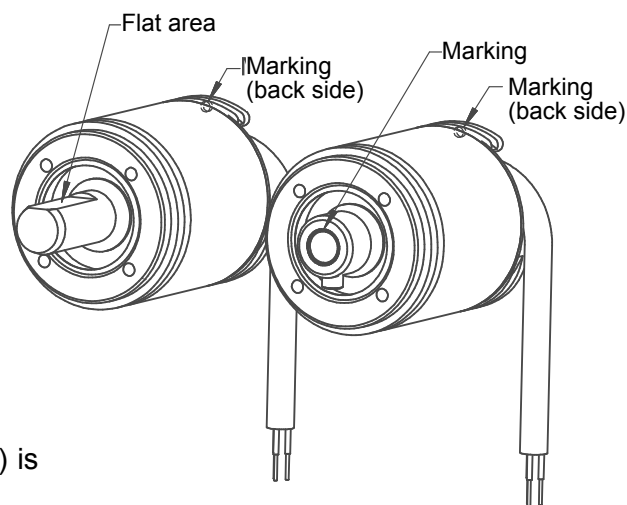
PRDS3

Shaft



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

Reference position



A zero impuls Z, $\bar{Z}$ (see pages 19/20) is generated at the reference position.

POSIROT® – PRDS

Instruction Manual

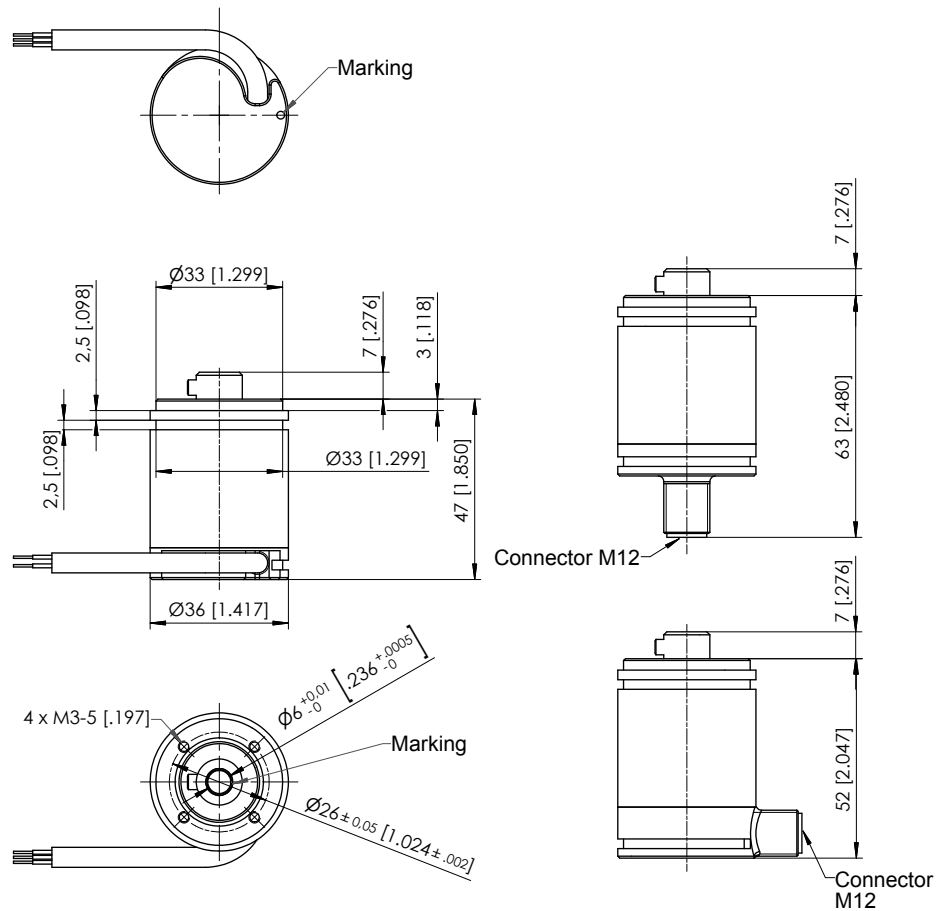
Outline drawings



Outline drawing

PRDS3

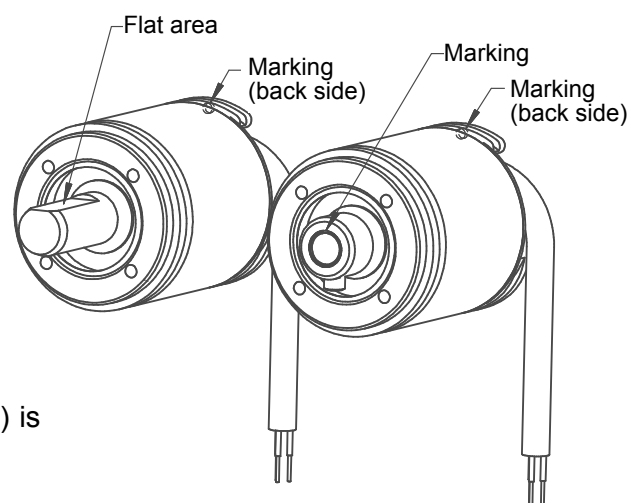
Hollow shaft



Dimensions in mm [inch]

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

Reference position



A zero impuls Z, $\bar{Z}$ (see pages 19/20) is generated at the reference position.

POSIROT® – PRDS

Instruction Manual

Outline drawings

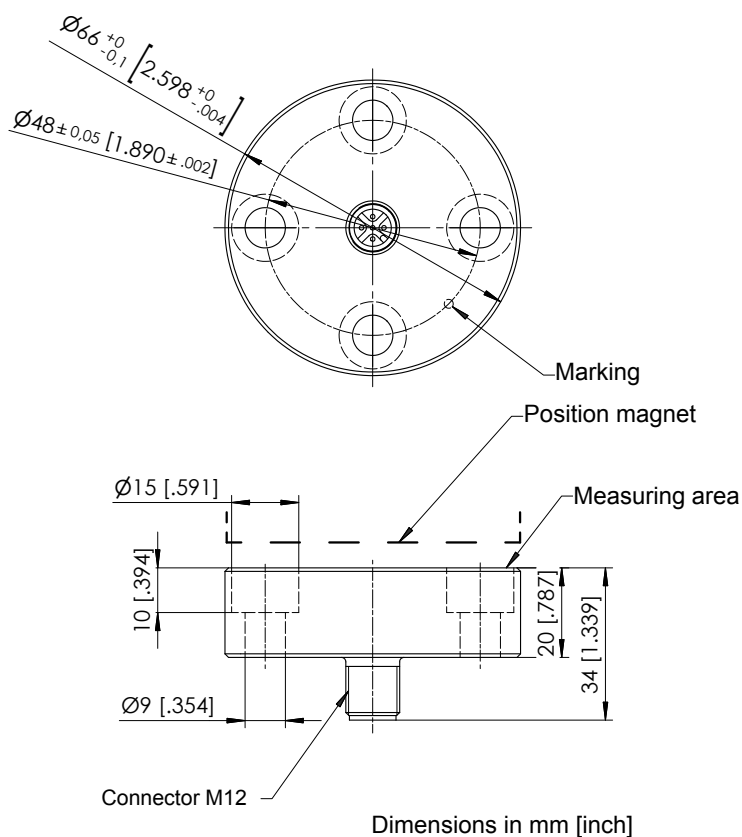


Outline drawing

PRDS5

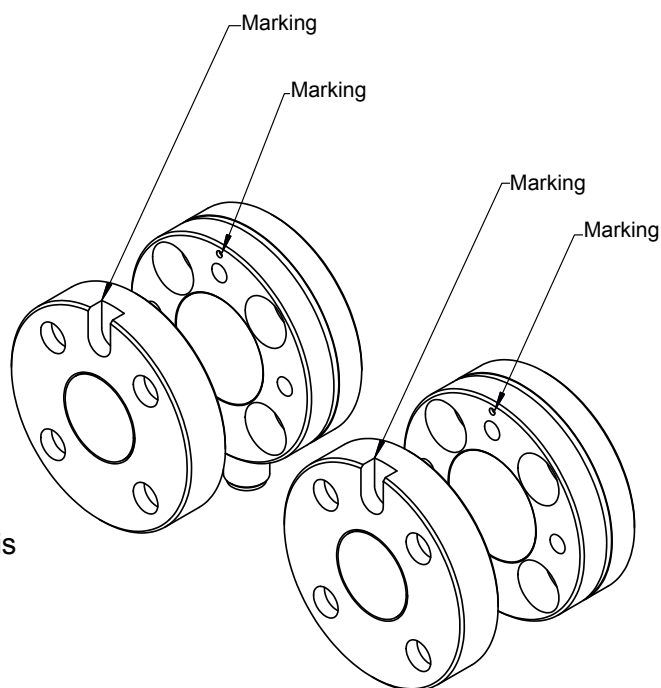
Connector M12

axial



Dimensions informative only.
For guaranteed dimensions consult factory.

Reference position



A zero impuls Z, $\bar{Z}$ (see pages 19/20) is generated at the reference position.

POSIROT® – PRDS

Instruction Manual

Outline drawings

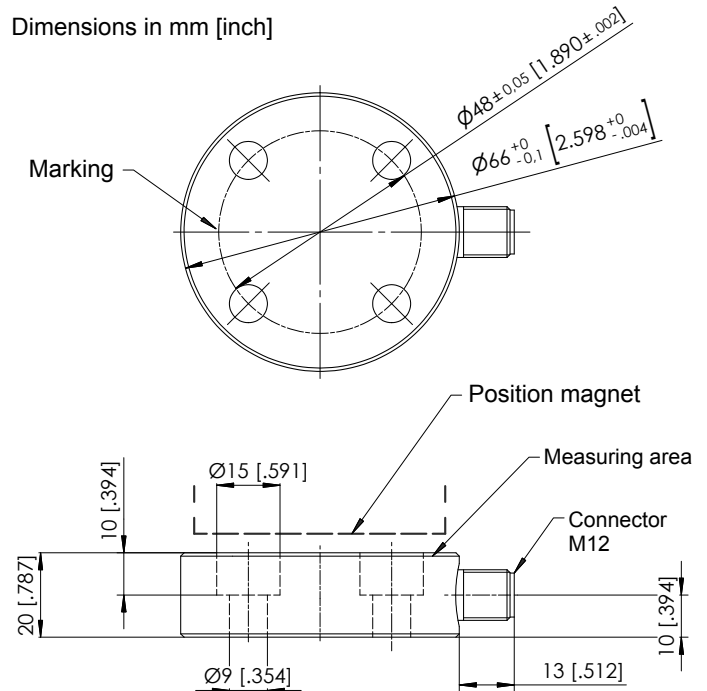


Outline drawing

PRDS5

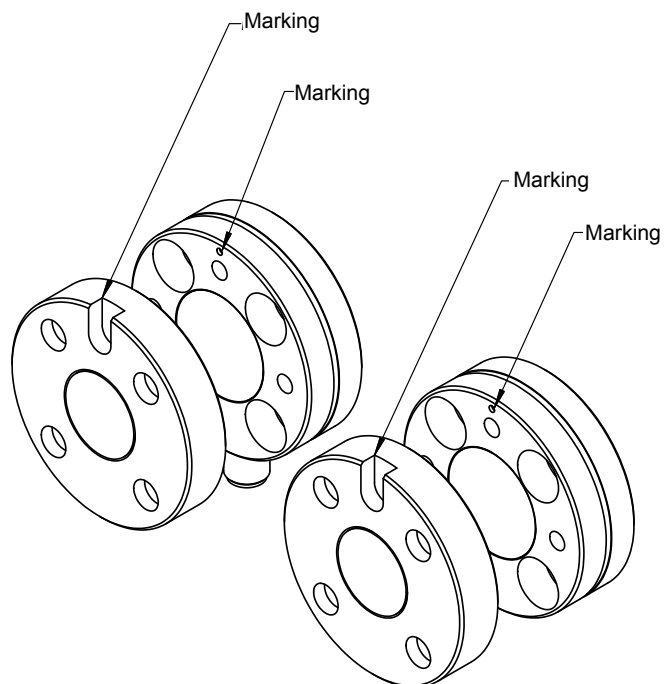
Connector M12

radial



Dimensions informative only.
For guaranteed dimensions consult factory.

Reference position



A zero impuls Z, $\bar{Z}$ (see pages 19/20) is generated at the reference position.

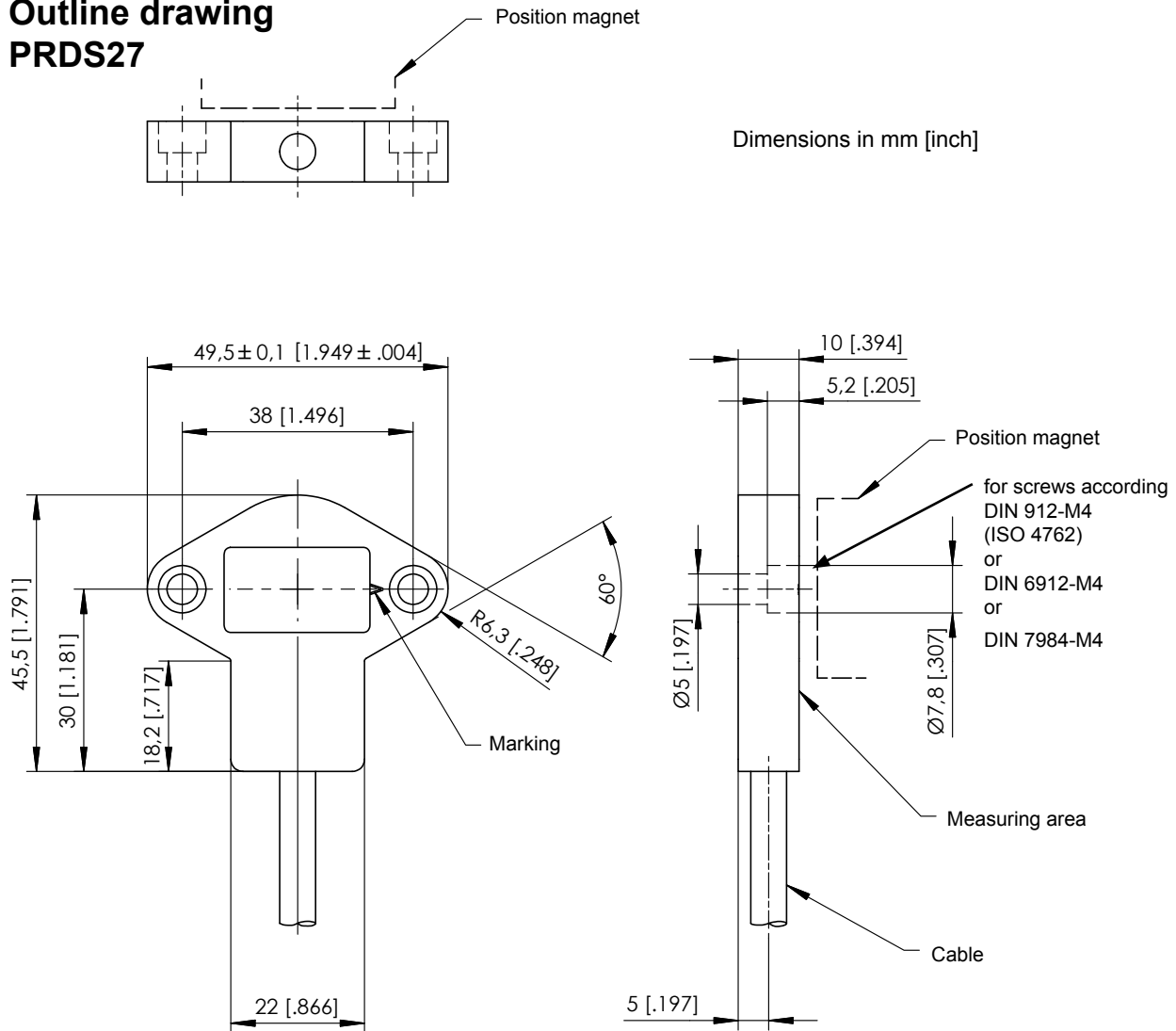
POSIROT® – PRDS

Instruction Manual

Outline drawings



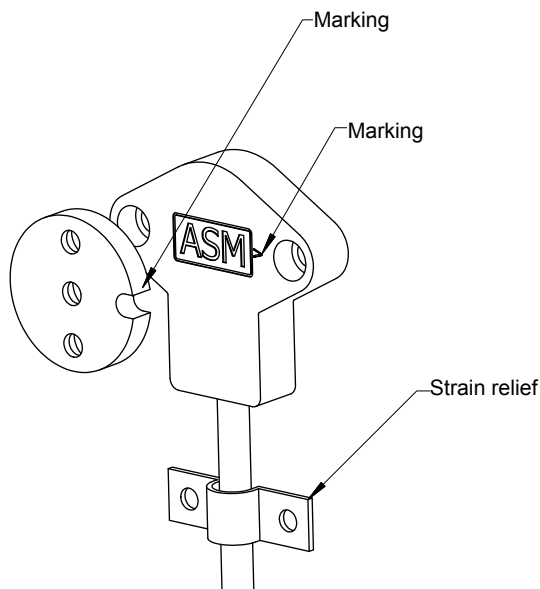
Outline drawing PRDS27



For all sensors with cable:

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

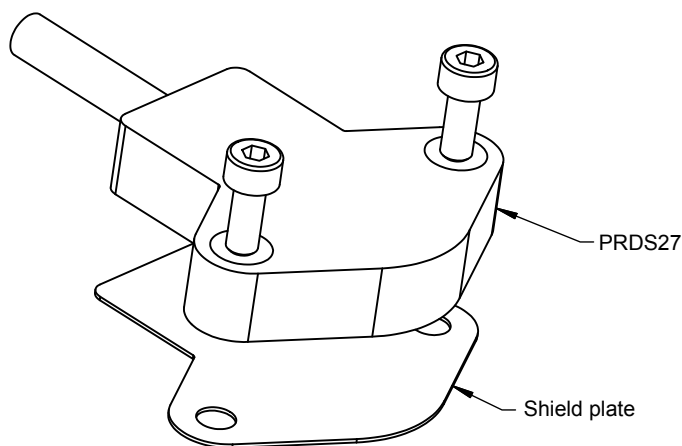
Reference position PRDS27



A zero impuls Z , $\bar{Z}$ (see pages 19/20) is generated at the reference position.

Fixing of the PRDS27 with a shield plate (optional)

PRDS27



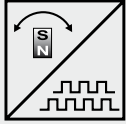
POSIROT® – PRDS

Instruction Manual

Output RS422

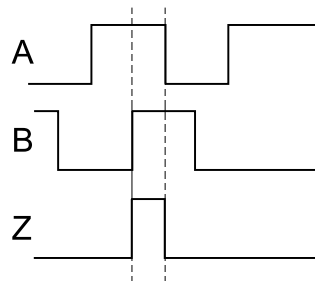
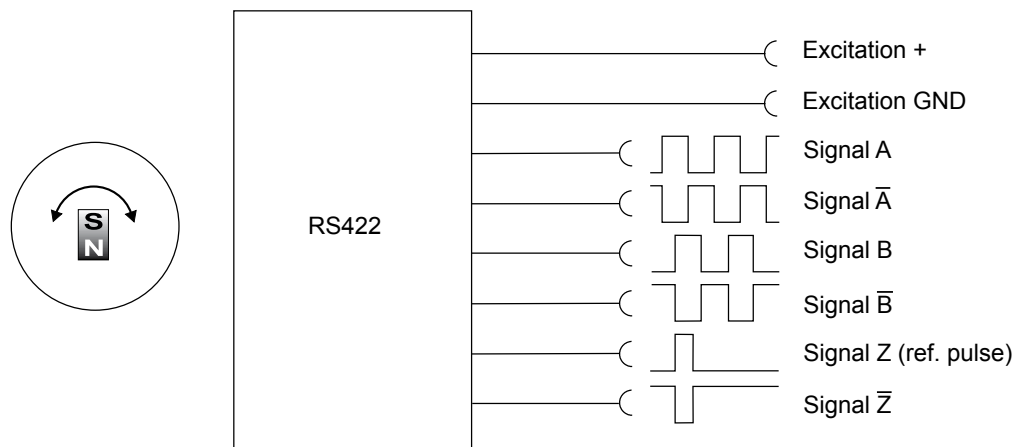


RS422 Incremental



Interface	RS422
Excitation voltage	5 V $\pm 10\%$ (RS5V); 12...36 V (RS24V)
Excitation current	100 mA max., depending on the load
Pulse frequency	50, 200, 800 kHz
Output signals	A, $\bar{A}$, B, $\bar{B}$, Z, $\bar{Z}$ Push-Pull
Output current	60 mA max.
Stability (temperature)	$\pm 50 \times 10^{-6} / ^\circ\text{C}$ f.s. (typ.)
Operating temperature	-40 ... +85 $^\circ\text{C}$
Protection	Short circuit
EMC	EN 61326-1:2013

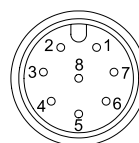
Output signals



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

The subsequent counting device must
be able to process the specified maxi-
mum pulse frequency of the sensor.

Signal wiring	Signal	Plug connection	Cable connection
	Excitation +	1	white
	GND	2	brown
	A	4	yellow
	$\bar{A}$	6	pink
	B	3	green
	$\bar{B}$	5	grey
	Z	7	blue
	$\bar{Z}$	8	red



View to sensor
connector

M12A8 / M12R8

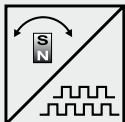
POSIROT® – PRDS

Instruction Manual

Output HTL

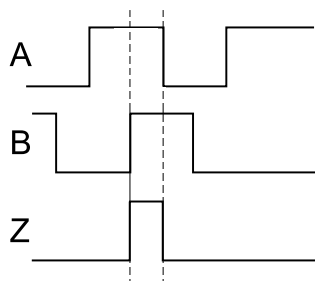
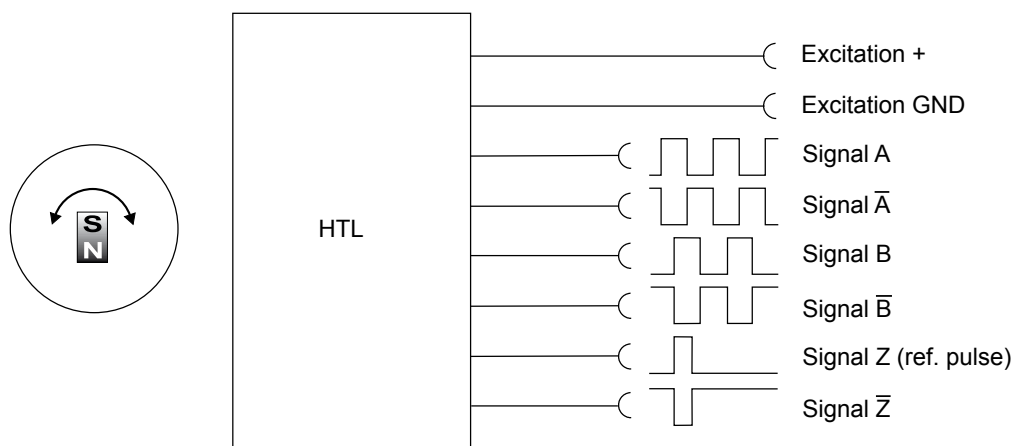


HTL Incremental



Interface	HTL
Excitation voltage	12...36 V
Excitation current	100 mA max., depending on the load
Pulse frequency	50, 200, 800 kHz
Output signals	A, $\bar{A}$, B, $\bar{B}$, Z, $\bar{Z}$ Push-Pull
Output current	50 mA max.
Stability (temperature)	$\pm 50 \times 10^{-6}$ / °C f.s. (typ.)
Operating temperature	-40 ... +85 °C
Protection	Short circuit
EMC	EN 61326-1:2013

Output signals

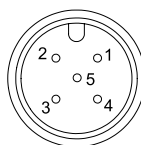


Pulse sequence for clockwise rotation
CW in view of shaft or active front of
sensor.

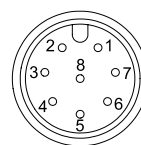
The subsequent counting device must
be able to process the specified maxi-
mum pulse frequency of the sensor.

Signal wiring	Signal	Plug connection M12A5 / M12R5	Plug connection M12A8 / M12R8	Cable connection
	Excitation +	1	1	white
	GND	3	2	brown
	A	2	4	yellow
	$\bar{A}$		6	pink
	B	4	3	green
	$\bar{B}$		5	grey
	Z	5	7	blue
	$\bar{Z}$		8	red

View to sensor
connector



M12A5 / M12R5



M12A8 / M12R8

POSIROT® – PRDS

Instruction Manual

Output SSI



SSI

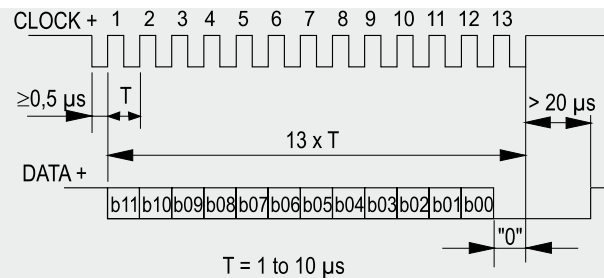
Synchronous serial



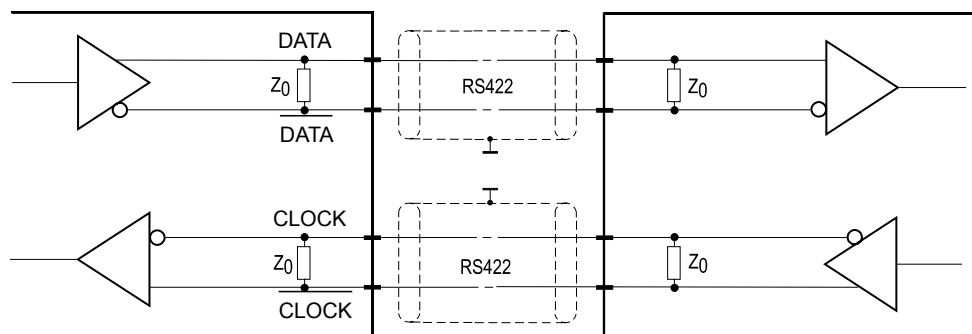
Interface	EIA RS-422
Excitation voltage	5 V $\pm 10\%$ (SSI5V); 12...36 V (SSI24V)
Excitation current	100 mA max. without load
Clock frequency	100 kHz ... 1 MHz
Code	Single step Gray code 12 Bit
Resolution	12 Bit
Delay between pulse trains	20 μ s min.
Stability (temperature)	$\pm 50 \times 10^{-6}$ / $^{\circ}\text{C}$ f.s. (typ.)
Operating temperature	-40 ... +85 $^{\circ}\text{C}$
Protection	Short circuit
EMC	EN 61326-1:2013

Data format

(Train of 13 pulses)



Recommended processing input circuit



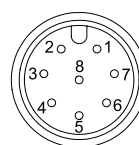
Cable length	Baud rate
50 m	100-1000 kHz
100 m	100-300 kHz

Note:

Extension of the cable length will reduce the maximum transmission rate. The signals CLOCK /CLOCK and DATA/DATA must be connected in a twisted pair cable, shielded per pair and common.

Signal wiring	Signal name	Connector pin no.	Cable output color
	Excitation +	1	white
	Excitation GND	2	brown
	CLOCK	3	green
	CLOCK	4	yellow
	DATA	5	grey
	DATA	6	pink

Connection



M12A8 / M12R8

View to sensor connector

POSIROT® – PRDS

Instruction Manual

Output CANopen



Description

Magnetic angle sensor with CANopen interface according to CiA 406.

Interface CANOP 	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 pins
	Integrated bus terminating resistor	No
	Bus, galvanic isolated	No
Specifications	Excitation voltage	11 ... 36 V DC
	Excitation current	15 mA typical at 24 V DC 30 mA typical at 12 V DC, 100 mA max.
	Resolution	0.05° max.
	Linearity	1° (0.25° as option)
	Measuring rate	1 kHz (asynchronous)
	Stability (temperature)	$\pm 50 \times 10^{-6}$ / °C f.s.
	Repeatability	1 LSB
	Operating temperature	-40 ... +105 °C
	Protection	Reverse polarity, short circuit
	Dielectric strength	1 kV (V AC, 50 Hz, 1 min.)
	EMC Automation	EN 61326-1:2013

Setup



WARNING



NOTICE

Warning notice

- 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!
- Change parameters only when machine is in a safe condition!

Before connecting the sensor to the CAN-Bus the devices have to be checked for correct bitrate and unique node-IDs. Both parameters are configurable by Layer-Setting-Service (LSS) or by Service Data Object (SDO). After power-on the sensor will enter pre-operational state and send a boot-up message being ready for configuration by Service Data Objects. Parameters configured by the user can be stored nonvolatile by SAVE command. On receiving „NMT-Node-Start“ the sensor transits to operational state and starts process data transmission. When „Auto-Start“ is configured the sensor will automatically transit to operational after boot-up without a need for the Node-Start message.

Node monitoring is supported by Node Guarding and Heartbeat protocol. Node Guarding implements cyclic querying of the node status by the NMT-Master within the guard time window. The Heartbeat protocol provides automatic transmission of the node status (heartbeat message) by the slave within producer heartbeat time window.

Following the CAN example protocols included in this manual the sensor may be used without CANopen master device.

POSIROT® – PRDS

CANopen Output Specification



Service Data Object (SDO) COB-Id

Service data objects (SDO) provide a peer to peer communication between master and slave. The communication object identifier (COB) of the SDO is defined by the Node-Id.

SDO	COB-Id	Default COB-Id
Master to Slave	600h + Node-Id	67Fh
Slave to Master	580h + Node-Id	5FFh

Process Data Object (TPDO)

Real time data transfer is provided by Process Data Objects (PDO). The PDO mapping is fixed. The PDO COB-Id is by default setting derived from the Node-Id (Predefined Connection Set) but may be changed to application specific values by PDO COB-Id 1800-1, 1801-1, DLC defines the length of the data field.

COB-Id	DLC	Data Frame
180h + Node-Id	length	Byte0 Data Frame max 8 Byte Byte7

Transmission behaviour of TPDO-1, -2, -4 is configurable by Communication Parameter PDO COB-Id 1800, 1801, ... sub-indices -1, -2, -3 and -5.

Transmission type example for TPDO-1	COB-Id 1800-1	Transmission Type 1800-2	Inhibit Time 1800-3	Event Timer [ms] 1800-5
Cyclic Asynchronous		FEh	1 .. 07FFFh	1 .. 07FFFh
Change of State		FEh	1 .. 07FFFh	0
Synchronous		N = 1 .. 240		-
TPDO Disable	80 00 xx xx	-		-
TPDO Enable	00 00 xx xx			

Transmission type «cyclic asynchronous» triggers TPDO-transmission periodically with a time period defined by the event timer.

Transmission type «change of state» will be enabled If the event timer is set to «0». This will trigger TPDO-transmission on change of the position value where «Inhibit time» defines a minimum time delay between consecutive TPDOs.

In «synch mode» a TPDO is transmitted on reception of a number of one or multiple SYNC commands.

Enable or disable a TPDO by setting Bit 31 of the COB-Id '0' resp. '1' (Default: «0» Enabled).

POSIROT® – PRDS

CANopen Output Specification



Object Dictionary Communication Profile CiA 301

Object	Index [hex]	Sub-index	Access	Type	Default	Value Range / Note
Device type	1000	0	ro	U32	0A0196h	encoder profile ,406‘
Error register	1001	0	ro	U8	0	
COB-ID-Sync	1005	0	rw	U32	80	
Manufacturer device name	1008	0	ro	String	-	
Manufacturer hardware version	1009	0	ro	String	-	
Manufacturer software version	100A	0	ro	String	-	
Guard time	100C	0	rw	U16	0	0 .. 7FFFh
Life time factor	100D	0	rw	U8	0	0 .. FFh
Save Settings	1010	1	w	U32	-	„save“ (65766173h)
Load Manufacturer Settings	1011	1	w	U32	-	„load“ (64616F6Ch)*
COB-ID-EMCY	1014	0	ro	U32	FFh	NodeID+80h
Producer heartbeat time	1017	0	rw	U16	0	0 .. 7FFFh
Identity Object VendorID	1018	1	ro	U32	252h	
Identity Object Product Code		2	ro	U32	-	
Identity Object Revision number		3	ro	U32	-	
Identity Object Serial number		4	ro	U32	-	
COB-ID Server->Client	1200	1	ro	U32	67Fh	- SOD
COBID Client-> Sever		2	ro	U32	5FFh	- SDO
PDO1 COB-ID	1800	1	rw	U32	1FFh	181h .. 1FFh
PDO1 Transmission-Type		2	rw	U8	FEh	0 .. FFh
PDO1 Inhibit time		3	rw	U16	0	0 .. 7FFFh
PDO1 Event timer		5	rw	U16	64h	0 .. 7FFFh
PDO2 COB-ID	1801	1	rw	U32	2FFh	281h .. 2FFh
PDO2 Transmission-Type		2	rw	U8	1	0 .. FFh
PDO2 Inhibit time		3	rw	U16	0	0 .. 7FFFh
PDO2 Event timer		5	rw	U16	0	0 .. 7FFFh
PDO4 COB-ID	1803	1	rw	U32	4FFh	481h .. 4FFh
PDO4 Transmission-Type		2	rw	U8	FEh	0 .. FFh
PDO4 Inhibit time		3	rw	U16	0	0 .. 7FFFh
PDO4 Event timer		5	rw	U16	0	0 .. 7FFFh

*) Reset into default settings except Bitrate and Node ID.

POSIROT® – PRDS

Instruction Manual

Output CANopen



Object	Index [hex]	Sub- index	Access	Type	Default	Value Range / Note
TPDO1-Mapped Object1	1A00	1	ro	U32	60040020h	
TPDO2-Mapped Object1	1A01	1	ro	U32	60040020h	
TPDO4-Mapped Object1	1A03	1	ro	U32	63000108h	
NMT-Startup	1F80	0	rw	U32	0	0, 8

POSIROT® – PRDS

Instruction Manual

Output CANopen



Device Profile CiA 406

Object	Index [hex]	Sub-index	Access	Type	Default	Value Range / Note
Manufacturer specific						
Node-ID	2000		rw		127	1...127
Bitrate	2010		rw		4	0..4, 6
Error	2030		ro			
Hysteresis	2040		rw			
Number of Positions	2080		rw		1	1..4
User Offset	2100		rw		0	0... 0FFFFh
Filter	2102		rw		0	1...255
Angle Encoder CiA406						
Operating Parameters	6000	0	rw		0	
Measuring Units per Rev.	6001	0	rw		16383	
Preset Value	6003	0	rw		0	
Position Value	6004	0	ro			
Cyclic Timer	6200	0	rw		100	
Profile and SW Version	6507	0	ro			
Serial Number	650B	0	ro			
CAM CiA406						
Cam state register	6300	1...4	ro			
Cam enable register	6301	1...4	rw		0	
Cam polarity register	6302	1...4	rw		0	
Cam 1-8 low limit	6310... 6317	1...4	rw		0	
Cam 1-8 high limit	6320... 6327	1...4	rw		0	
Cam 1-8 hysteresis	6330... 6337	1...4	rw		0	

Operating Parameters Bit Code

15	...	...	...	4	3	2	1	0
						sfc		cs
MSB								LSB

cs = 0 Code sequence CW
cs = 1 Code sequence CCW
sfc = 0 Scaling function disabled
sfc = 1 Scaling function enabled

POSIROT® – PRDS

Instruction Manual

CANopen Output Specification



Process Data Object (TPDO) Mapping

TPDO	COB-Id	DLC	Data Frame							
			Byte0							Byte7
TPDO-01	180h +Node-Id	4	4 Byte Position Data							
			(LSB)	...	...	(MSB)				
TPDO-02	280h +Node-Id	4	4 Byte Position Data							
			(LSB)	...	...	(MSB)				
TPDO-04	480h +Node-Id	1	CAM State							

CAM State Data Format

8 Bit CAM State Register							
b7	b6	b5	b4	b3	b2	b1	b0
CAM 8	CAM 7	CAM 6	CAM 5	CAM 4	CAM 3	CAM 2	CAM 1

TPDO Default Settings

TPDO	Default COB-Id	Default Transmission Type
TPDO-01: Position Data, 4 Byte	1FFh	Event Timer 100ms (FE, TI=0)
TPDO-02: Position Data, 4 Byte	2FFh	Sync Mode
TPDO-04: CAM Status, 1 Byte	4FFh	Change of State Mode

Bit rates	Index	Bit rate
	0	1 MBit/s
	1	800 kBit/s
	2	500 kBit/s
	3	250 kBit/s
	4	125 kBit/s
	5	reserved
	6	50 kBit/s

POSIROT® – PRDS

Instruction Manual

CANopen Output Specification



Examples

Example protocols are prepared using the IXXAT USB-to-CAN PC-Interface with CAN-Monitor „miniMon“ (IXXAT Automation GmbH, D-88250 Weingarten). These examples enable the user to configure and to run the CANopen slaves from a host PC without using a CANopen master ECU. The miniMon-screen has the configuration and status window at left side, a receive message window and a transmit message window below.

Configuration Exemple 1 - screenshot

The screenshot displays the MiniMon V3 by IXXAT software interface. The left sidebar shows the 'IXXAT Interfaces' section with 'USB-to-CAN compact' and 'CAN A: SJA 1000' selected. Below this, a status list includes 'Controller initialized', 'Low speed transceiver', 'Transmit pending', 'Data overrun', 'Error warning level', and 'Bus off'. The baudrate is set to 125 kbit/s, and the busload percentage is shown as 0%.

The main window contains two tables. The top table, 'Time / 10 mSec', shows received messages with columns for Time, Identifier, Format, Flags, and Data. The bottom table, 'Tx', shows transmitted messages with columns for Tx, Identifier, Ext., Rtr, and Data.

Time / 10 mSec	Identifier	Format	Flags	Data
00:00:40.59	77F Std			00
00:00:43.22	67F Std		Self	2F 00 20 00 7E
00:00:43.22	5FF Std			60 00 20 00 00 00 00 00
00:00:43.89	67F Std		Self	2F 10 20 00 00
00:00:43.89	5FF Std			60 10 20 00 00 00 00 00
00:00:45.53	67F Std		Self	23 10 10 01 73 61 76 65
00:00:45.56	5FF Std			60 10 10 01 00 00 00 00

Tx	Identifier	Ext.	Rtr	Data
	1CEAFFFD	☒	☐	FC 01 00 00 00
	67F	☐	☒	23 10 10 01 73 61 76 65
	67F	☐	☐	2F 00 20 00 7E
	67F	☐	☐	2F 10 20 00 00
	67F	☐	☐	23 10 10 01 6C 6F 61 64

The status bar at the bottom indicates 'Ready' and 'Msg: 7'.

POSIROT® – PRDS

Instruction Manual

CANopen Output Specification



Configuration Example 1 - detailed explanation

The example shows the Sensor responding on POWER ON with the Boot-Up message. By SDO message the node-Id and the bit rate will be changed to 7Eh and 1000kbit/s. Finally the host sends an SDO „SAVE“ to store the configuration nonvolatile.

Note: Changes of node-Id and bit rate will become effective on next POWER ON sequence. So the SAVE command has to address the old SDO-COB-Id.

screenshot explanation:

Time / 10 mSec	Identifier	Format	Flags	Data
00:00:40.59	<i>Boot-Up message</i>	77F StJ		00
00:00:43.22	<i>Set node Id to 7Eh</i>	67F StJ	Self	2F 00 20 00 7E
00:00:43.22	<i>Response</i>	5FF StJ		60 00 20 00 00 00 00 00
00:00:43.89	<i>Set baud rate to 1000 kbit/s</i>	67F StJ	Self	2F 10 20 00 00
00:00:43.89	<i>Response</i>	5FF StJ		60 10 20 00 00 00 00 00
00:00:45.53	<i>SAVE</i>	67F StJ	Self	23 10 10 01 73 61 76 65
00:00:45.56	<i>Response</i>	5FF StJ		60 10 10 01 00 00 00 00

POSIROT® – PRDS

Instruction Manual

CANopen Output Specification



Configuration Example 2 - detailed explanation

The message window shows the slave responding on POWER ON with the Boot-Up message on new node-id 7Eh. Event timer of PDO1 is changed to 500ms and COB-Id of PDO1 is changed to 1F1h. Finally „Autostart“ is activated (automatic transition to operational) and the configuration stored nonvolatile with „SAVE“. On POWER OFF / POWER ON the slave starts sending PDOs asynchronously with the new COB-Id after the Boot-Up message.

Screenshot explanation:

Time / 10 mSec	Identifier	Format	Flags	Data
00:00:17.36	<i>Boot-Up Message</i>	77E Std		00
00:00:48.90	<i>Set PDO1 Event Timer 500</i>	67E Std	Self	2B 00 18 05 F4 01 00 00
00:00:48.90	<i>Response</i>	5FE Std		60 00 18 05 00 00 00 00
00:01:02.70	<i>Set PDO1 COB-Id to 1F1</i>	67E Std	Self	23 00 18 01 F1 01 00 00
00:01:02.70	<i>Response</i>	5FE Std		60 00 18 01 00 00 00 00
00:01:06.85	<i>Set Autostart</i>	67E Std	Self	23 80 1F 00 08 00 00 00
00:01:06.85	<i>Response</i>	5FE Std		60 80 1F 00 00 00 00 00
00:01:10.90	<i>SAVE</i>	67E Std	Self	23 10 10 01 73 61 76 65
00:01:10.91	<i>Response .. POWER OFF</i>	5FE Std		60 10 10 01 00 00 00 00
00:01:19.92	<i>Boot Up on POWER ON</i>	77E Std		00
00:01:19.92	<i>Cyclic PDO Transfer</i>	1F1 Std		66 1B 00 00
00:01:20.42	<i>on Power On</i>	1F1 Std		67 1B 00 00
00:01:20.92	...	1F1 Std		67 1B 00 00
00:01:21.42	...	1F1 Std		66 1B 00 00
00:01:21.92	...	1F1 Std		67 1B 00 00
00:01:22.42	...	1F1 Std		66 1B 00 00
00:01:22.92	...	1F1 Std		66 1B 00 00
00:01:23.42	...	1F1 Std		68 1B 00 00
00:01:23.92	...	1F1 Std		68 1B 00 00

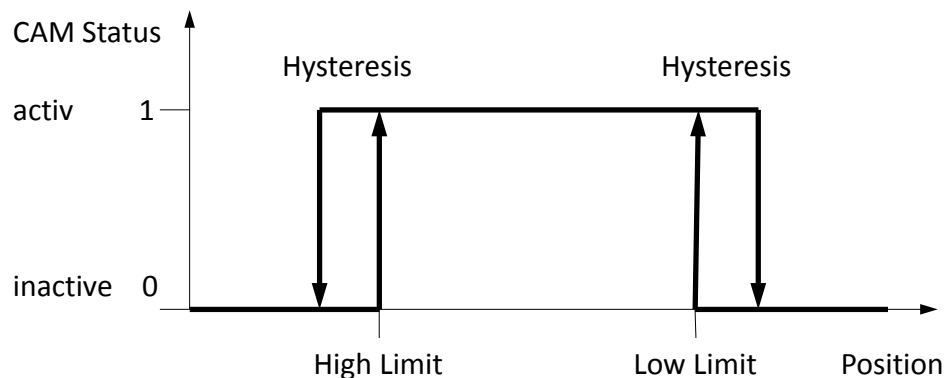
POSIROT® – PRDS

Instruction Manual

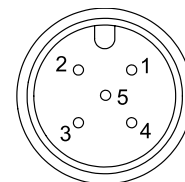
Output CANopen



CAM function

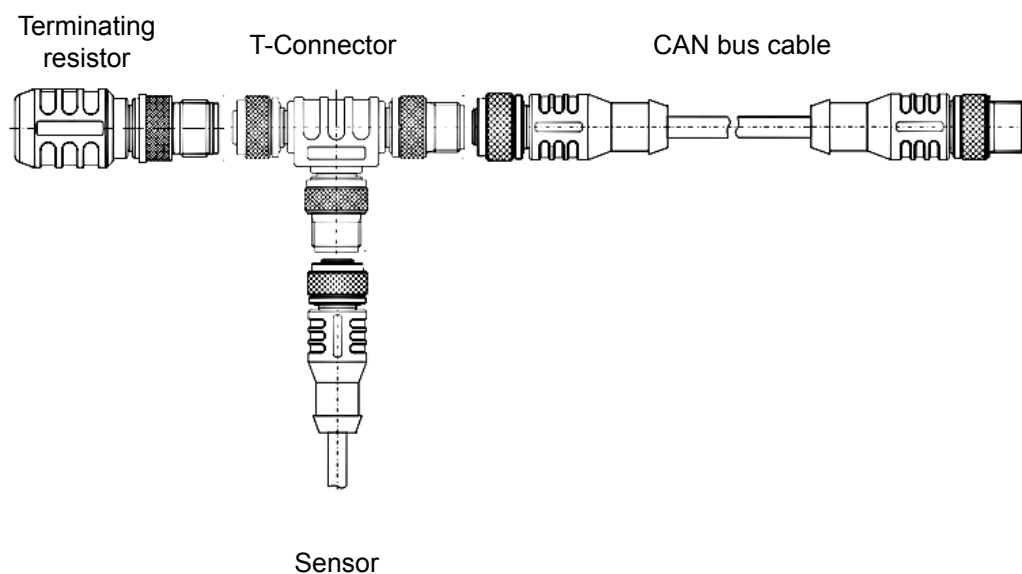


Signal wiring / connection	Signal name	Connector pin	Wire color	View to sensor connector
	Shield	1	Braid	
	Excitation +	2	White	
	GND	3	Brown	
	CAN-H	4	Blue	
	CAN-L	5	Black	



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.



POSIROT® – PRDS

Instruction Manual

Output CAN SAE J1939



Description

Angular encoder according to standard SAE J1939. Customer configuration of operating parameters by Peer-to-Peer. Process data exchange by Broadcast message.

Interface J1939 	CAN specification	ISO 11898, Basic and Full CAN 2.0 B
	Transceiver	24V-compliant, not isolated
	Communication profile	SAE J1939
	Bit rate	250 kBit/s
	Internal termination resistor	No
	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 EFddh	Proprietary-A (PDU1 peer-to-peer) dd Sensor Node ID
	Process data	PGN FFnnh	Proprietary-B (PDU2 broadcast); nn Group Extension (PS) configurable

Specifications	Excitation voltage	8 ... 36 V DC
	Excitation current	15 mA typical at 24 V DC 30 mA typical at 12 V DC, 100 mA max.
	Resolution	0.05° max.
	Linearity	1° (0.25° as option)
	Measuring rate	1 kHz (asynchronous)
	Stability (temperature)	±50 x 10 ⁻⁶ / °C f.s.
	Repeatability	1 LSB
	Operating temperature	-40 ... +85 °C
	Protection	Reverse polarity, short circuit
	Dielectric strength	1 kV (V AC, 50 Hz, 1 min.)
	EMC Automation	EN 61326-1:2013

POSIROT® – PRDS

Instruction Manual

Output CAN SAE J1939



Setup



WARNING



NOTICE

Warning notice

- Changing the parameters can cause a sudden step of the instantaneous value and can result in unexpected machine (re)actions!
- Precautions to prevent danger for man or machine are necessary!
- Execute parametrizing at standstill of the machine only!

Node-ID

The default Node-ID the sensor will claim on power up is user or factory configurable. The user can configure by "Commanded Address" service according to the J1939 standard or by Peer-to-Peer message as described below.

User configuration

User accessible parameters including node-id may be configured by peer-to-peer proprietary A message PGN 0EF00h. The parameters are accessed by byte-index and read/write operations coded in the data frame. The slave will return the data frame including the acknowledge code. Parameter values will be effective immediatly. On execution of "Store Parameters" the configuration is saved nonvolatile.

Peer-to-peer message (PGN 0x00EF00), send/receive format

PGN		8 Byte data frame							
PGN _{HIGH}	PGN _{LOW} (Node-ID)	Index	Rd/Wr	0	Ack	4-Byte Data			

Request: Control Unit → Sensor

→	0EFh	dd	i	0/1	0	0	LSB	..	..	MSB
---	------	----	---	-----	---	---	-----	----	----	-----

Response: Control Unit ← Sensor

←	0EFh	cc	i	0/1	0	a	LSB	..	..	MSB
---	------	----	---	-----	---	---	-----	----	----	-----

a: Acknowledge codes:

0: Acknowledge, 81: Read only parameter, 82: Range overflow,
83: Range underflow, 84: Parameter does not exist

dd: Sensor Node-ID (Default 0F7h, 247d)

cc: Control-Unit Node-ID



Configuration examples

Example: Set Transmit Cycle to 10ms, Index 31, Node-ID 247d (F7h)

	PGN _{HIGH}	PGN _{LOW}	8 Byte data frame							
→	0EFh	F7h	1Fh	01h	00	00	0Ah	00	00	00
←	0EFh	cc	1Fh	01h	00	00	0Ah	00	00	00

Example: Read Transmit Cycle value, Index 31

→	0EFh	F7h	1Fh	00	00	00	00	00	00	00
←	0EFh	cc	1Fh	00	00	00	0Ah	00	00	00

Example: Store Parameters permanently, Index 28

→	0EFh	F7h	1Ch	01h	00	00	65h	76h	61h	73h
←	0EFh	cc	1Ch	01h	00	00	65h	76h	61h	73h

Example: Reload factory defaults, Index 29

→	0EFh	F7h	1Dh	01h	00	00	64h	61h	6Fh	6Ch
←	0EFh	cc	1Dh	01h	00	00	64h	61h	6Fh	6Ch

POSIROT® – PRDS

Instruction Manual

Output CAN SAE J1939



Encoder - Parameters

Parameter	Index [dec]	Default	Range / Selection	Unit	Read / Write
Control					
Node ID	14	247	128 ... 247		r/w ¹⁾
Store parameters	1C	-	"save"		wr ²⁾
Reload factory defaults	1D	-	"load"		wr ²⁾
Communication					
Transmit cycle	1F	100	10...10000	ms	r/w
PGN Group Extension (PS)	20	0	0...255		r/w
Measurement					
Code sequence	46	0	0 CW 1 CCW		r/w
Measuring steps per turn	49	2 ¹⁴	2... 2 ¹⁴	steps	r/w
Preset	4A	0	0... 2 ¹⁴ - 1	steps	r/w ³⁾
Averaging filter	4D	1	1...255		r/w
Identification					
SW Version	C6	-	4 bytes	number	ro
Serial number	C7		4 bytes	number	ro
Identity number	C8	-	21 bit	number	ro

1) Effective on next power-up

2) „save“ MSB...LSB: 73h, 61h, 76h, 65h

„load“ MSB...LSB: 6Ch, 6Fh, 61h, 64h

3) Changing „Measuring Step“ will zero the preset value

The maximum preset value accepted will be equal to the measuring steps per turn actually configured

Process data

Process data are transmitted by broadcast proprietary-B-Message PGN 0x00FFxx where the low byte is configurable.

Data field of process data

B7	B6	B5	B4	B3	B2	B1	B0
Error				Position value			
Byte ^{*)}				MSB			LSB

^{*)} Error codes: 0 = no error, 1 = error, internal error

POSIROT® – PRDS

Instruction Manual

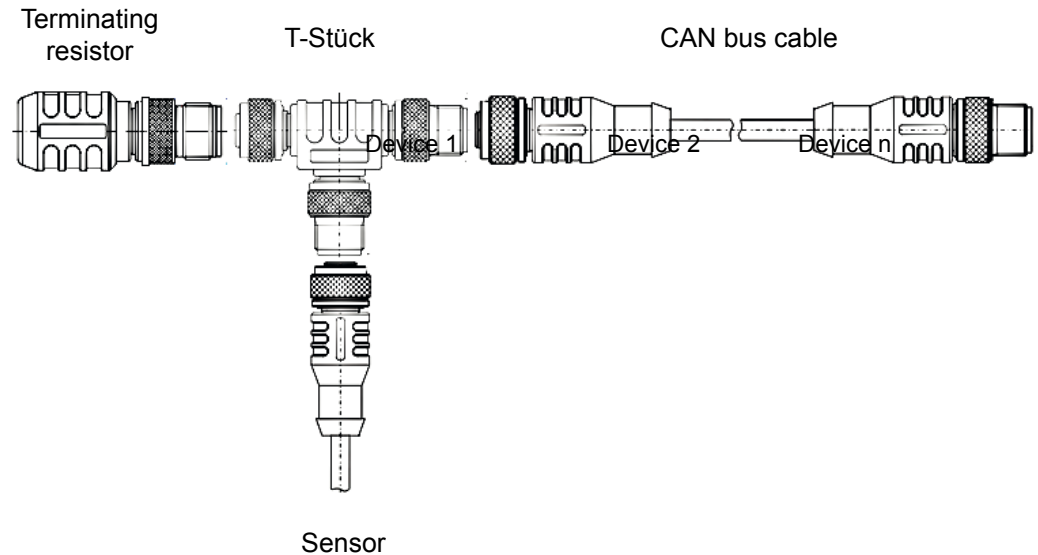
Output CAN SAE J1939



Signal wiring / connection	Signal name	Connector pin	Wire color	View to sensor connector
	Shield	1	Braid	
	Excitation +	2	White	
	GND	3	Brown	
	CAN-H	4	Blue	
	CAN-L	5	Black	

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.



POSIROT® – PRDS

Instruction Manual

Accessories



Accessory Cables

Connector cable for POSIROT®-sensors 8 pins M12

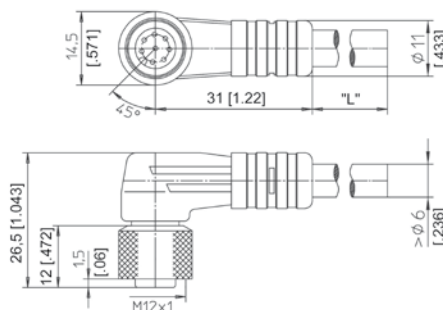
The 8-core screened cable is supplied with a mating 8-pin 90° M12 connector at one end and 8 wires at the other end. Available lengths are 2, 5 and 10 m.

Order code:

KAB - XM - M12/8F/W - LITZE

IP69K: **KAB - XM - M12/8F/W/69K - LITZE**

Length in m



Connector cable for POSIROT®-sensors 8 pins M12

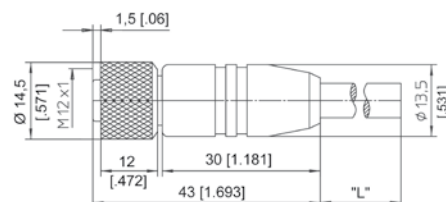
The 8-core screened cable is supplied with a mating 8-pin M12 connector at one end and 8 wires at the other end. Available lengths are 2, 5 and 10 m.

Order code:

KAB - XM - M12/8F/G - LITZE

IP69K: **KAB - XM - M12/8F/G/69K - LITZE**

Length in m



Accessory cable M12, 8 pin

Connector pin / cable color

1	2	3	4	5	6	7	8
White	Brown	Green	Yellow	Grey	Pink	Blue	Red

POSIROT® – PRDS

Instruction Manual

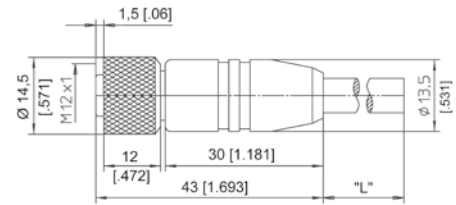
Accessories



Accessory Cables

**Connector/bus cable
for POSIROT®-
sensors**
5 pin M12
CAN bus

The 5-lead shielded cable is supplied with a female 5-pin M12 connector at one end and a male 5-pin M12 connector at the other end. Available lengths are 2, 5 and 10 m.



Order code:

KAB - XM - M12/5F/G - M12/5M/G - CAN

IP69K: KAB - XM - M12/5F/G/69K - M12/5M/G/69K - CAN

Length in m

T-piece for bus cable
5 pin M12
CAN bus

Order code:

KAB - TCONN - M12/5M - 2M12/5F - CAN



**Terminating
resistance**
5 pin M12
CAN bus

Order code:

KAB - RTERM - M12/5M/G - CAN



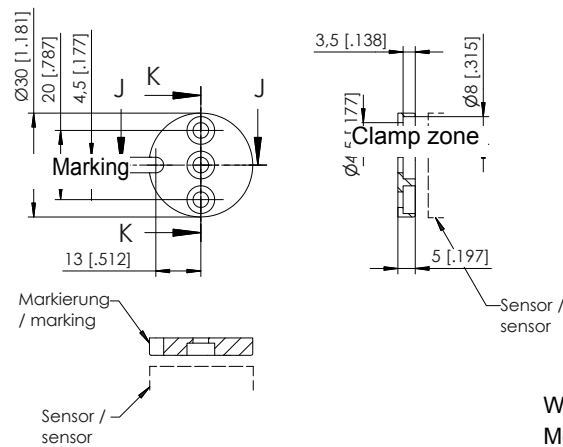
POSIROT® – PRDS

Instruction Manual

Accessories

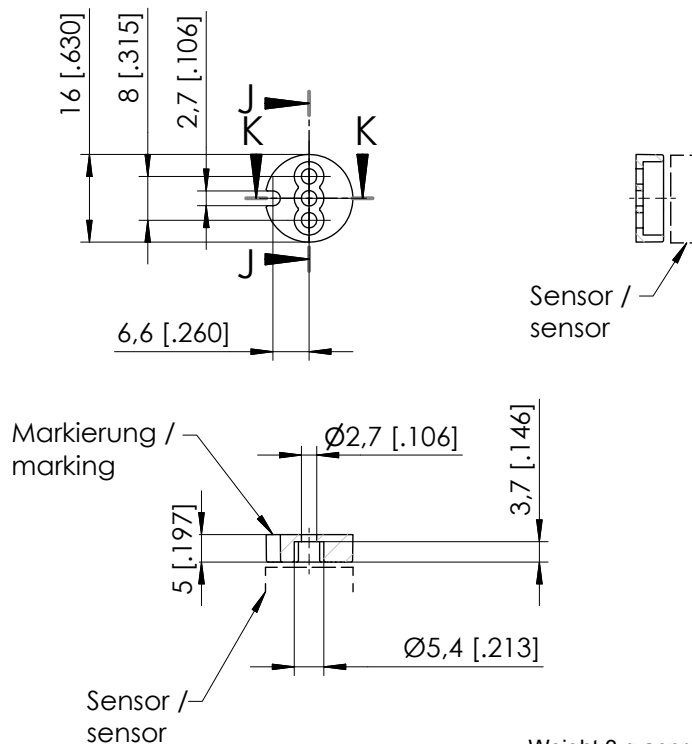


Position magnet PRMAG20



Weight 11 g approx.
Moment of inertia 1.2 kgmm²

Position magnet PRMAG21



Weight 3 g approx.
Moment of inertia 0.1 kgmm²

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

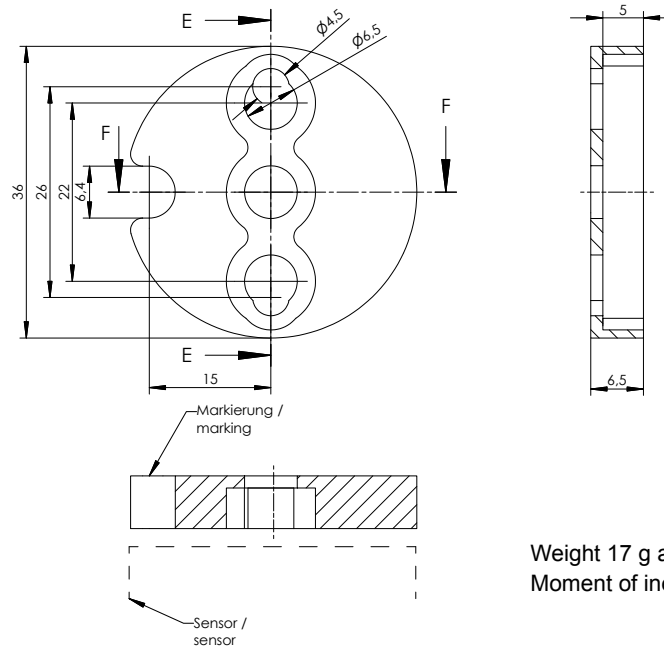
POSIROT® – PRDS

Instruction Manual

Accessories



Position magnet PRMAG22



Weight 17 g approx.
Moment of inertia 3 kgmm²

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

POSIROT® – PRDS

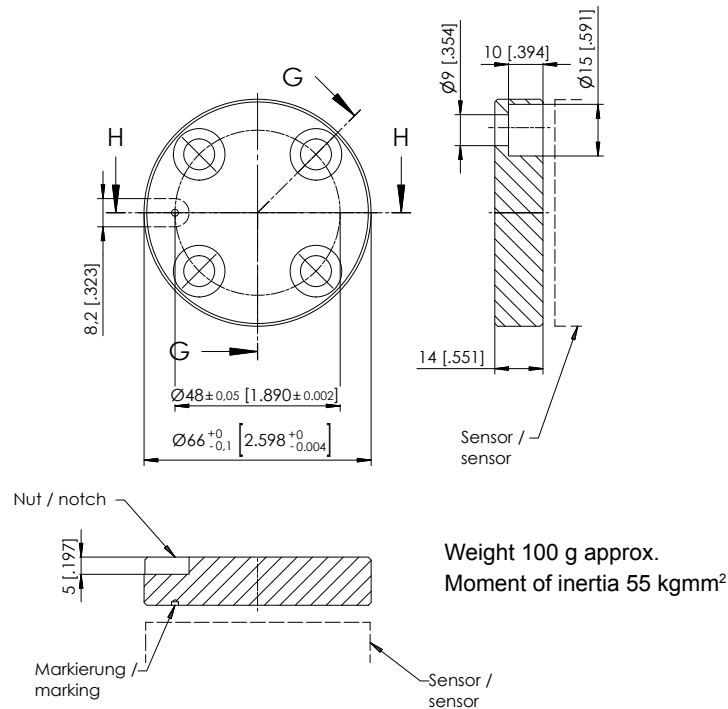
Instruction Manual

Accessories



Position magnet

PRMAG5-Z



Dimensions in mm [inch]

Dimensions informative only.

For guaranteed dimensions consult factory.

Mounting of the magnets	Magnet	Mounting method	Material
	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

POSIROT® – PRDS

Instruction Manual

Accessories

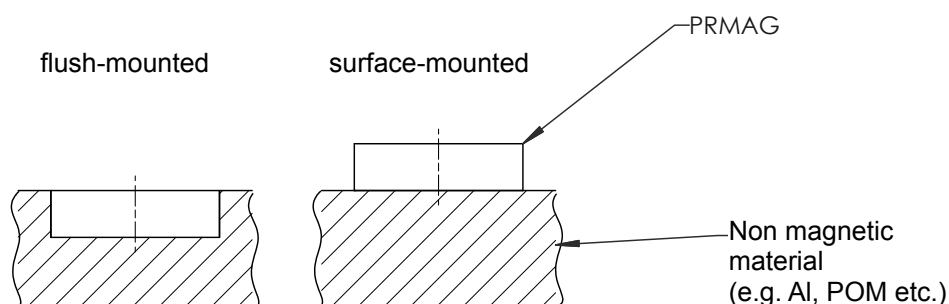


Assembly of the position magnets

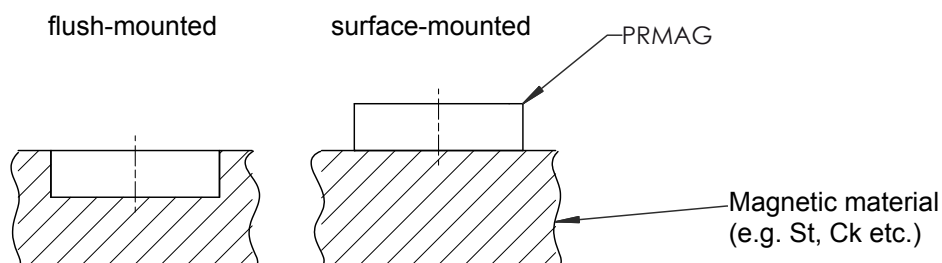


NOTICE

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 PRDS angle sensors.



✓	✓	PRMAG5-Z
✓	✓	PRMAG20/21/22



✓	✓	PRMAG5-Z
–	✓	PRMAG20/21/22

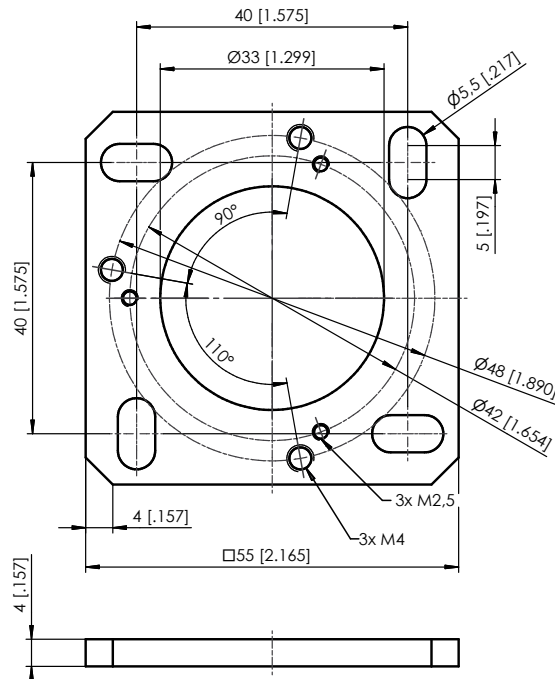
POSIROT® – PRDS

Instruction Manual

Accessories

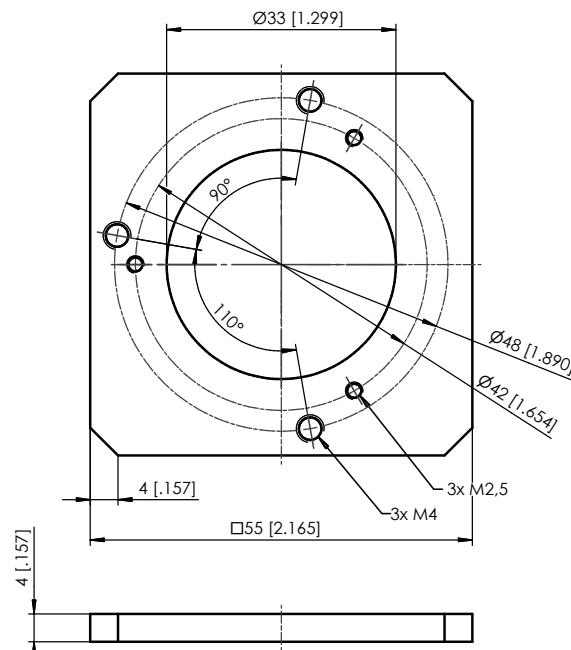


Mounting plate PRPT-BPL1



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.

POSIROT® – PRDS

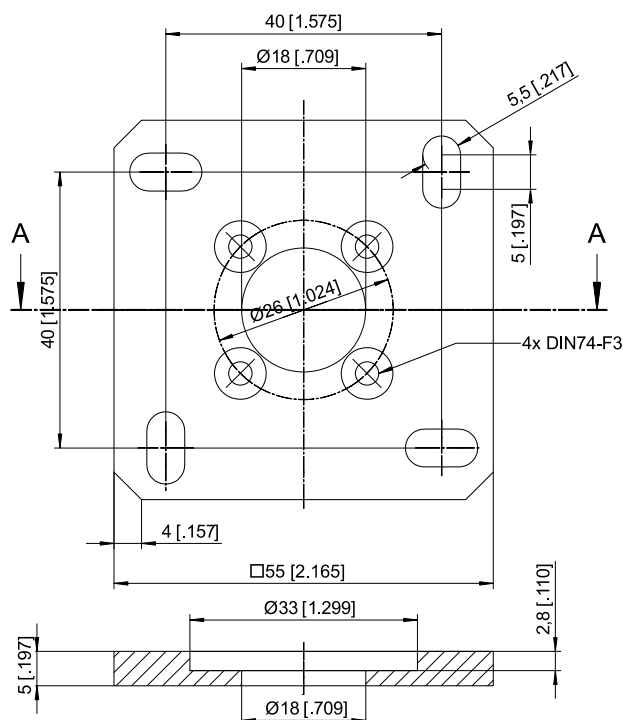
Instruction Manual

Accessories



Mounting plate

PRPT-BPL3

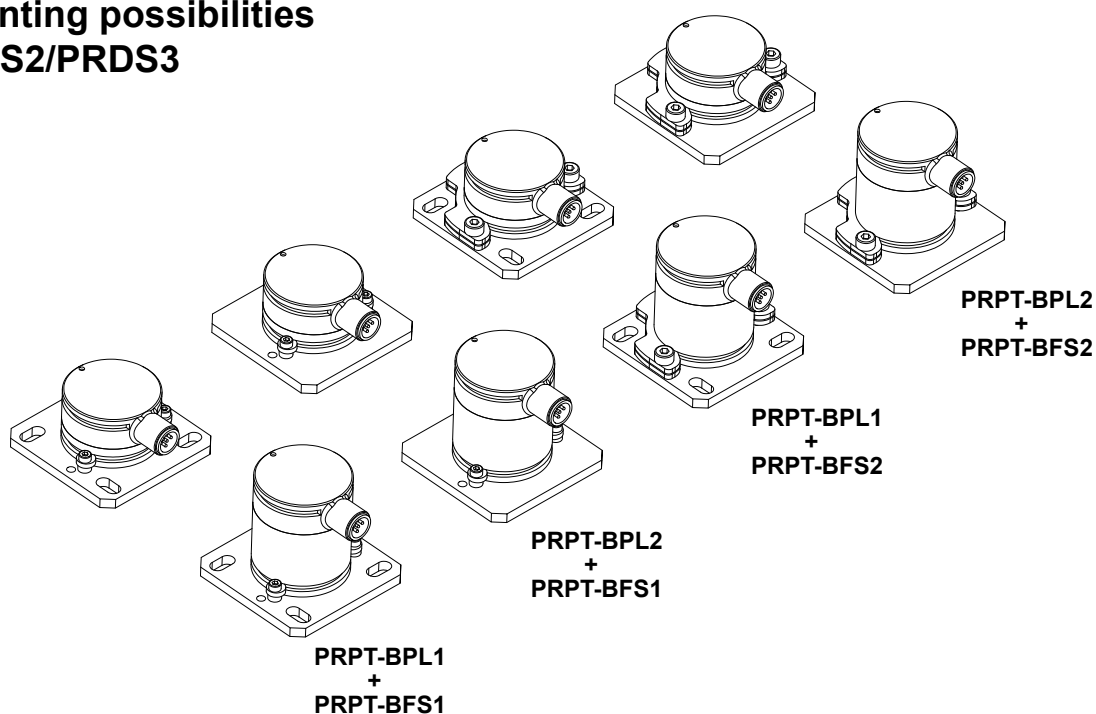


Dimensions in mm [inch]

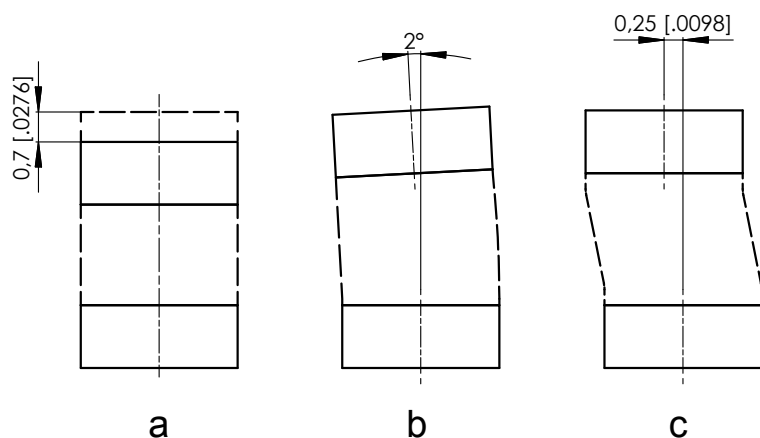
Dimensions informative only.
For guaranteed dimensions consult factory.

Mounting possibilities

PRDS2/PRDS3



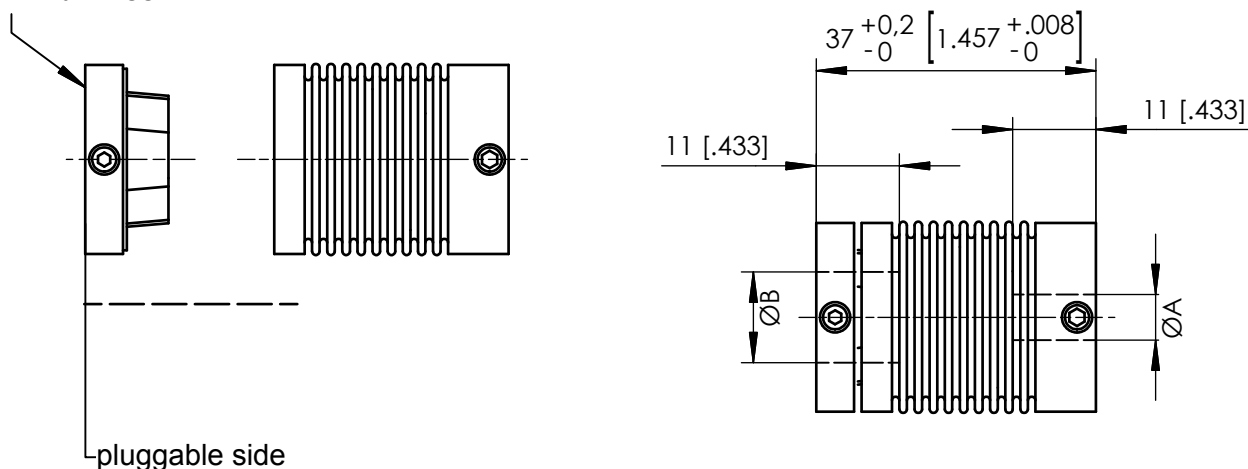
Model MK4	Rated torque	2 Nm
	Total length (inserted)	37 mm
	Axial misalignment (a)	< 0.7 mm
	Angular misalignment (b)	< 2°
	Lateral misalignment (c)	< 0.25 mm

**Maximum
misalignment**

Dimensions in mm [inch]

Order code	A	B
MK4-37-6-6	Ø6 [.236 +.0005]	Ø 6 [.236 +.0005]
MK4-37-6-10	Ø6 [.236 +.0005]	Ø10 [.394 +.0006]
MK4-37-6-12	Ø6 [.236 +.0005]	Ø12 [.472 +.0007]

axially pluggable



Screws (ISO4029)

2 x M4

Torque

2,5 Nm

Dimensions in mm [inch]

POSIROT® – PRDS

Instruction Manual

Service, calibration, disposal



Service

Sensors and accessories have to be repaired and adjusted at ASM in Moosinning.

In order to avoid risk of injury and improper handling the customer is not allowed to repair the sensor. No warranty or liability will be granted for opened sensors.

Damaged sensors must be shut down immediately and sent to the factory for repair.

Calibration

The recommended calibration interval is 1 year.

Test protocol is available on request.

Disposal

Disposal according to applicable government regulations.

POSIROT® – PRDS

Instruction Manual

Reliability Characteristics



Models PRDS1, PRDS2, PRDS3, PRDS5, PRDS27

RS422	Output
HTL	Output
SSI	Output
CAN	Output

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)

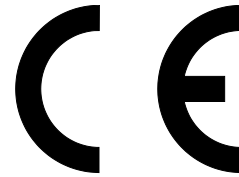
POSIROT® – PRDS

Instruction Manual

Declaration of conformity



Declaration of conformity



The angle sensor

Manufacturer: ASM GmbH
 Am Bleichbach 18-24
 85452 Moosinning / Germany

Model: **PRDS1, PRDS2, PRDS3, PRDS5, PRDS27**

complies with the following standards and directives:

Directives: 2014/30/EU

Standards: EN 61326-1:2013 (EMC)

Moosinning, 22nd February 2016

A handwritten signature in black ink, appearing to be 'P. Wirth'.

i.A. Peter Wirth
Head of Development



ASM GmbH Automation • Sensorik • Messtechnik

Am Bleichbach 18-24

Telephone: +49 8123 986-0

Internet: www.asm-sensor.de

E-Mail: info@asm-sensor.de

85452 Moosinning / Germany

Telefax: +49 8123 986-500

www.asmsensors.com

info@asmsensors.com

