POSICHRON®

Magnetostrictive Position Sensors

Installation and operation manual

Please read carefully before installation and operation!

Contents

Safety instructions

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

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

Disregard of this advice releases the manufacturer from product liability.

DANGER

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

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

WARNING

Insulation testing, welding and painting by electrostatic painting system may cause damage to a POSICHRON position sensor embedded within an equipment (cylinder, working machine etc). Disconnect the sensor unit in case of such treatment and plug in a protective shorting plug to ground all pins to cable shield. Refer to acessories for protective shorting plug.

CAUTION

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

Protect the sensor against all strong electric or magnetic fields.

Do not expose the sensor or the position magnets to shocks or any kind of impacts.

The flat profile PCFP must be mounted with unmagnetic screws.

Position magnets must be mounted always with unmagnetic screws.

Description

The purpose of position sensors is to transform position of a linear and guided movement into an electrical signal. Specifications of measuring range, environment, handling and connections as specified in the catalog, must be followed.
The catalog is part of this instruction manual. If the catalog is not available it may be requested by stating the respective model number.

POSICHRON® is an absolute, contact-free and wear-free position measuring system. It is extremely rugged making it suitable even for applications where other measuring principles would fail. The availability of various constructions – rod, square profile and ultra-flat profile – means that the system can be adapted to suit all kinds of installation conditions.

The POSICHRON® linear measuring system consists of a magnetostrictive wave guide and a movable magnet for determining position. The measuring principle of POSICHRON® position sensors is based on two physical effects: the Wiedemann effect and the Villari effect.

To create the Wiedemann effect, a current impulse is sent through the POSICHRON® positional sensor's wave guide. This current impulse generates a circular magnetic field which propagates at the speed of light around the wave guide. If this circular magnetic field makes contact with the magnetic field of the position magnet which is moved lengthways, a torsional mechanical-elastic density wave is triggered at the overlap area of the two magnetic fields as a result of magnetostriction. This wave propagates in the wave guide at approx. 2800 m/s.

The sensor head of the POSICHRON® position sensor contains a detector which detects the arrival of this wave. The magneto-elastic Villari effect is used as the method of detection. The position between the detector coil and the magnet which can be moved lengthways along the POSICHRON® sensor is determined by measuring the time difference between the electrical induction current impulse and the voltage pulse generated via the Villari effect in the detector coil (time-of-flight principle).

This time difference can be converted using various well-known methods into analog or digital output signals. The time-of-flight signals can however also be evaluated directly by commonly-available interface modules or counter and time-measuring devices.

	Measurement rate	Measurement range
Measurement rate depending on the measurement range	1 ms	100 ... 500 mm
	2 ms	500 ... 2000 mm
	5 ms	2000 ... 4000 mm
	10 ms	>4000 mm

Remarks on environmental materials

In order to ensure a perfect magnetic signal of the position magnet all interferences caused by magnetic and/or magnetizable materials have to be avoided.
In principle it is absolutely recommended to use not magnetizable materials for the environment of the sensor. Likewise only not magnetizable screws should be used for the attachment of the position magnet.

Magnetic or magnetizable materials in the environment of the sensor can affect the signal of the position magnet in such a manner that the specified limit values are not kept. In addition it is possible that mismeasurements are caused by magnetic or magnetizable materials.

If the use of magnetizable material (rel. permeability μr >> 1) is inevitable, the sensor must be protected by suitable methods against magnetic fields (**H ≥ 400 A/m**). Pay attention to a sufficient distance of the sensor and the magnet to external magnetic fields with field strengths of **H ≥ 400 A/m**! The magnetic flux density of the environment may not exceed the value of **B = 0.5 mT** at the position of the magnet and the sensor rod. Magnetic and/or magnetizable materials should be absolutely avoided.

Materials with μr > 1 are acceptable if **Br ≤ 0.5 mT** resp. **Hc ≤ 500 A/m** at the same time, higher values than indicated can lead to failure of the position measurement.

To avoid a local increase of the field strength, additionally all edges near the sensor rod and the position magnet must be provided with a chamfer (**1 x 45°**).

Handling of the position magnets

Notes about the handling of the position magnets PCMAG

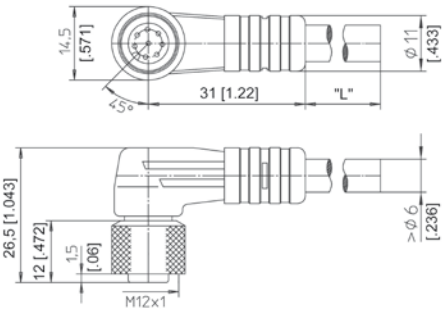
Regardless of the robust design the improper handling of the position magnets can cause reduction in signal quality, in extreme cases signal loss. Therefore a careful handling of the position magnets during installation and operation is recommended.

- **The storage and operation temperature of the position magnet must not exceed 100 °C.**
- **Extremly mechanical shock (drop) must be avoided.**
- **Do not expose the magnet to strong external magnetic fields (Hmax. < 140 kA/m, ~1,8 kOe).**

Note: When using multiple magnets the distance between two magnets must be min. 70 mm to identify the single magnets definitely.

Connector cable for POSICHRON® position sensors
8 pin M12

The 8-lead shielded 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. Wire: cross sectional area 0.25 mm².



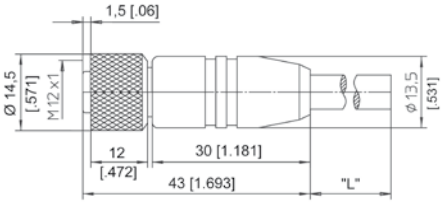
Order code:

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

Length in m

Connector cable for POSICHRON® position sensors
8 pin M12

The 8-lead shielded 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. Wire: cross sectional area 0.25 mm².



Order code:

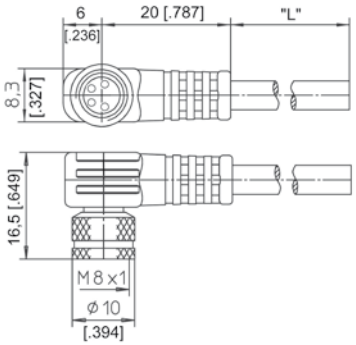
	KAB - XM - M12/8F/G - LITZE
IP69K:	**KAB - XM - M12/8F/G/69K - LITZE**

Length in m

Connector cable wiring - M12, 8 pin	**Connector pin / cable color**							
	1	2	3	4	5	6	7	8
	White	Brown	Green	Yellow	Grey	Pink	Blue	Red

Connector cable for POSICHRON® position sensors
4 pin M8

The 4-lead shielded cable is supplied with a mating 4-pin 90° M8 connector at one end and 4 wires at the other end. Available lengths are 2, 5 and 10 m. Wire: cross sectional area 0.14 mm².



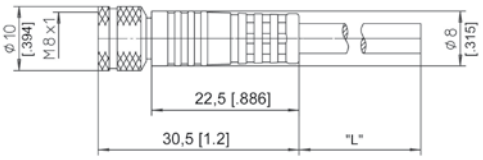
Order code:

	KAB - XM - M8/4F/W - LITZE
IP69K:	**KAB - XM - M8/4F/W/69K - LITZE**

Length in m

Connector cable for POSICHRON® position sensors
4 pin M8

The 4-lead shielded cable is supplied with a mating 4-pin M8 connector at one end and 4 wires at the other end. Available lengths are 2, 5 and 10 m. Wire: cross sectional area 0.14 mm².



Order code:

	KAB - XM - M8/4F/G - LITZE
IP69K:	**KAB - XM - M8/4F/G/69K - LITZE**

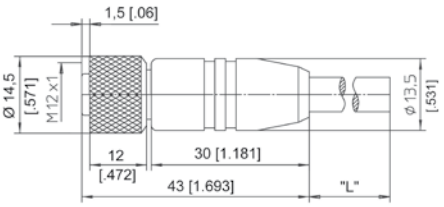
Length in m

Connector cable wiring - M8, 4 pin	Connector pin / cable color			
	1	2	3	4
	Brown	White	Blue	Black

Connector cable wiring - M12, 4 pin	Connector pin / cable color			
	1	2	3	4
	Brown	White	Blue	Black

Connector/bus cable for POSICHRON® position 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 0.3 m, 2 m, 5 m and 10 m.



Order code:

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

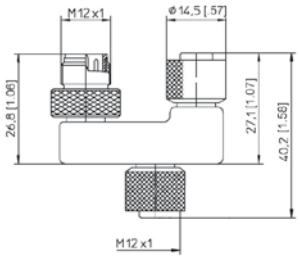
IP69K: **KAB - XM - M12/5F/G/69K - M12/5M/G/69K - CAN**

Length in m

T-piece for bus cable
5 pin M12
CAN bus

Order code:

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

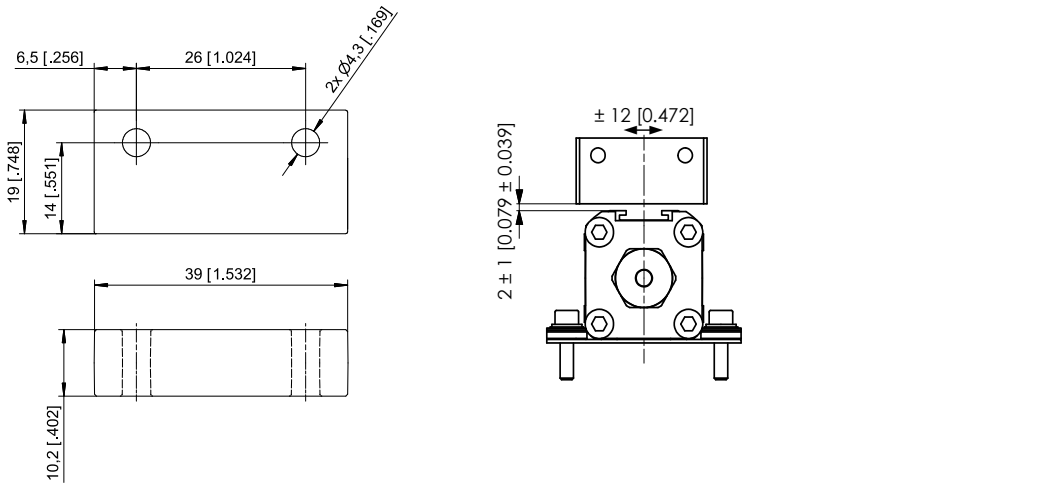


Terminating resistance
5 pin M12
CAN bus

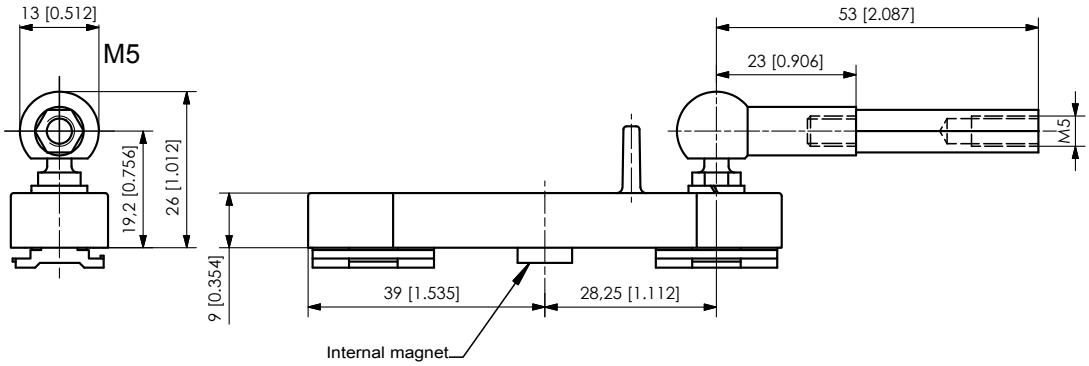
Order code:

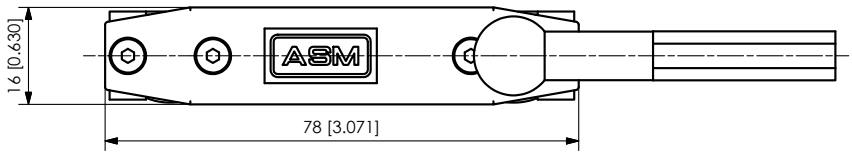
KAB - RTERM - M12/5M/G - CAN

PCMAG5
Standard magnet

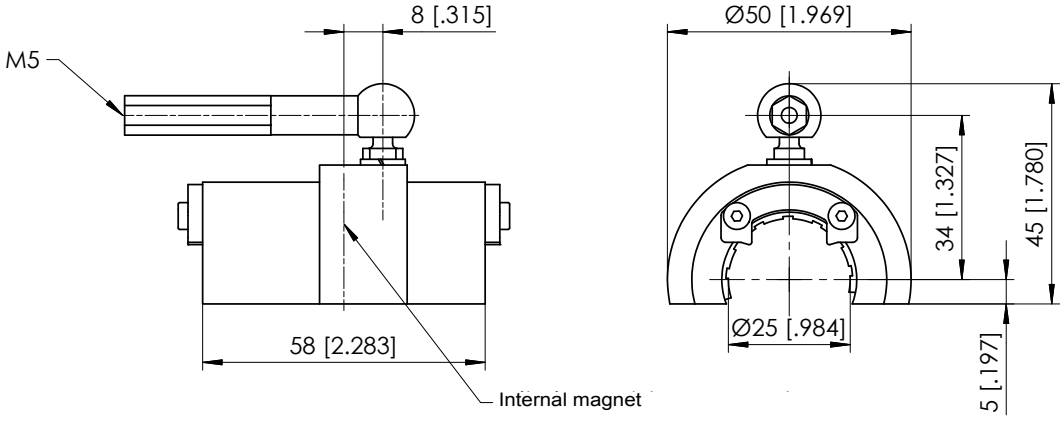


PCMAG3
Guided magnet slider for PCQA with internal position magnet





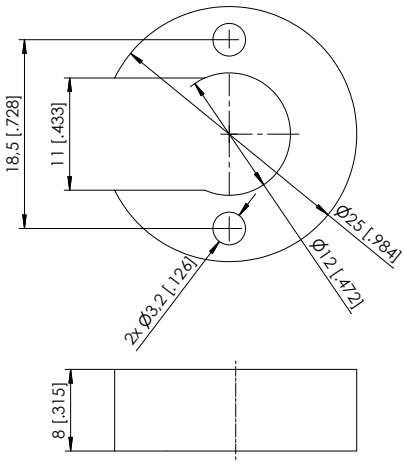
PCRPMAG6
Guided magnet slider for PCRP21 with internal position magnet



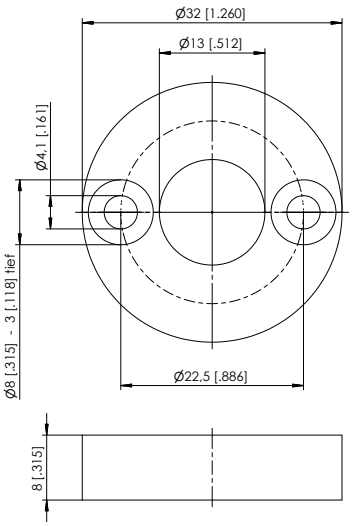
Dimensions in mm [inch]

Dimensions informative only.
For guaranteed dimensions consult factory.

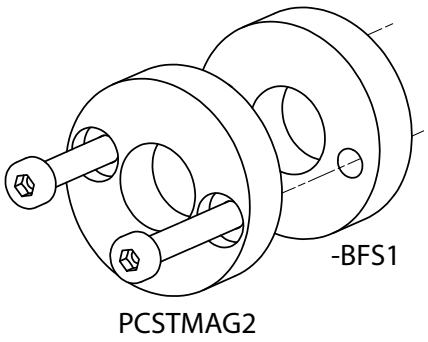
PCSTMAG1



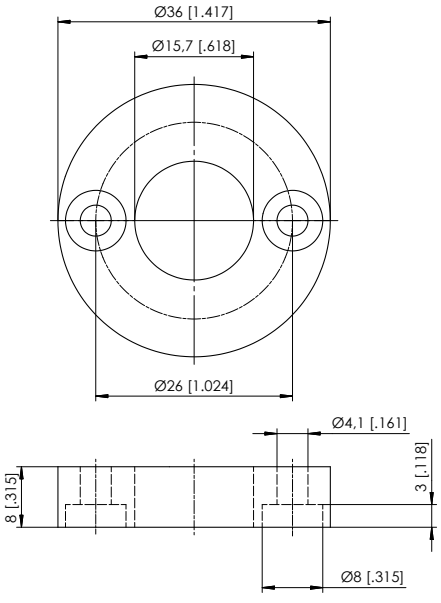
PCSTMAG2
(standard)



PCSTMAG2-BFS1



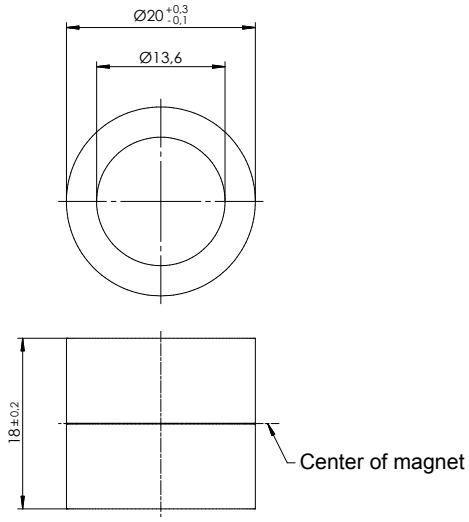
PCSTMAG5



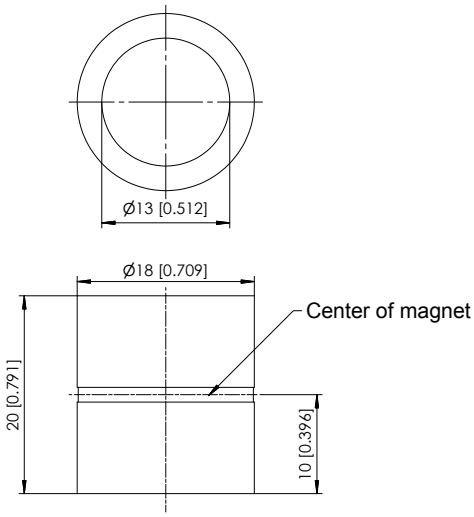
Dimensions in mm [inch]

Dimensions informative only.
For guaranteed dimensions consult factory.

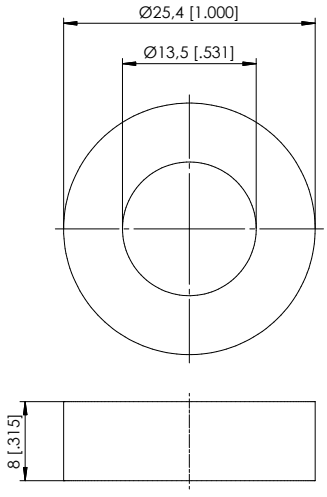
PCSTMAG2-MH1



PCSTMAG2-MH2



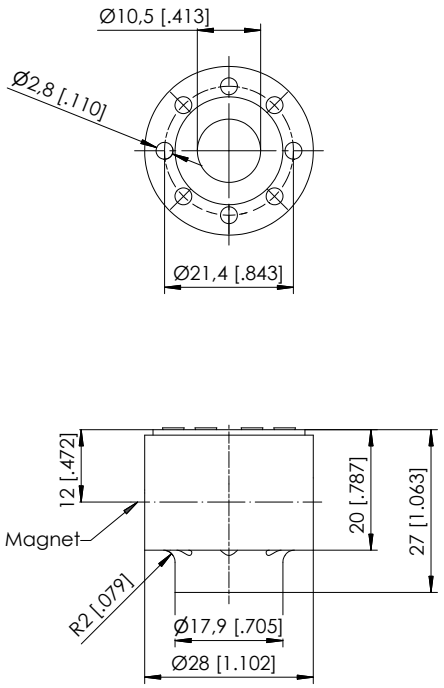
PCSTMAG2-MH3



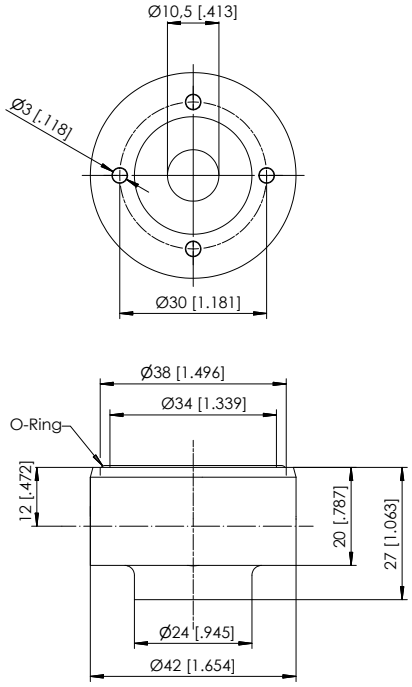
Dimensions in mm [inch]

Dimensions informative only.
For guaranteed dimensions consult factory.

PCSTMAG2-G1



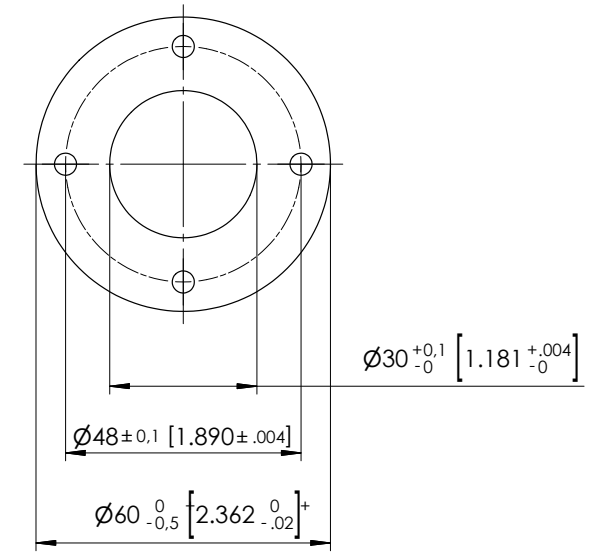
PCSTMAG2-G2

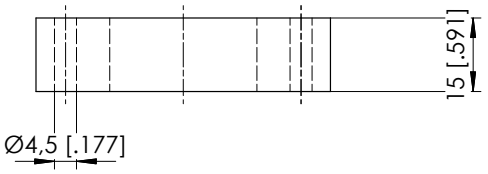


Dimensions in mm [inch]

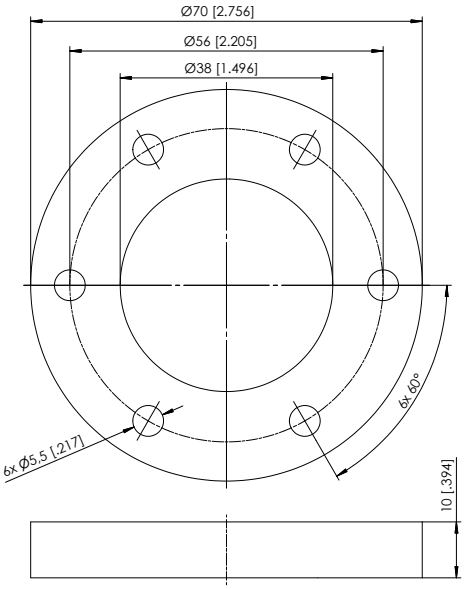
Dimensions informative only.
For guaranteed dimensions consult factory.

PCSTMAG7





PCSTMAG4



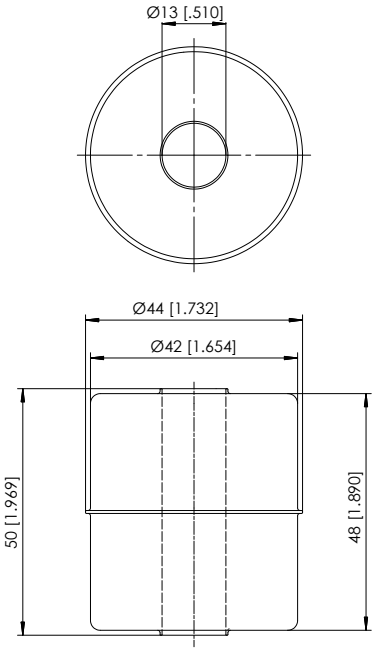
Dimensions in mm [inch]

Dimensions informative only.
For guaranteed dimensions consult factory.

PCSTMAG3

(float, continuous pressure up to 9 bar, for media with a specific gravity of ≥0,75 g/cm³)

Material: 1.4404

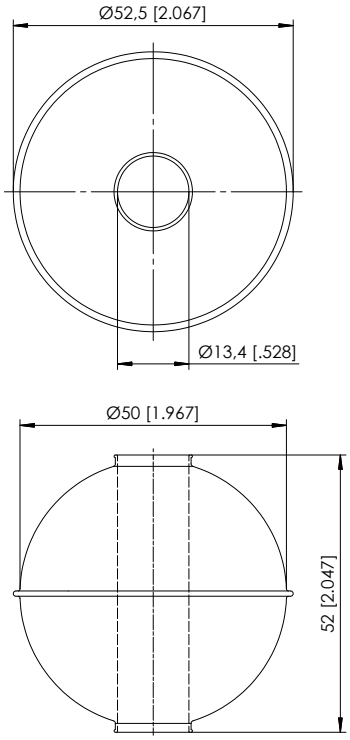


Note: Dependent on the design the available measurement range is reduced of 25 mm on both ends!

PCSTMAG6

(float, continuous pressure up to 30 bar, for media with a specific gravity of ≥0,7 g/cm³)

Material: 1.4571



Note: Dependent on the design the available measurement range is reduced of 25 mm on both ends!

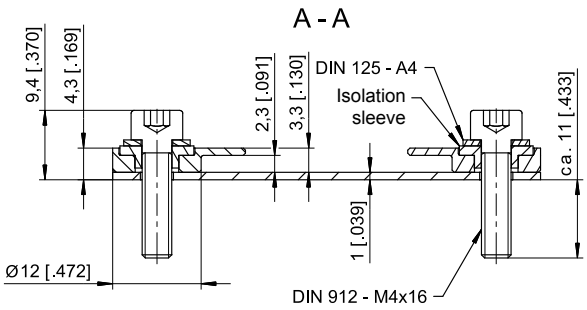
Dimensions in mm [inch]

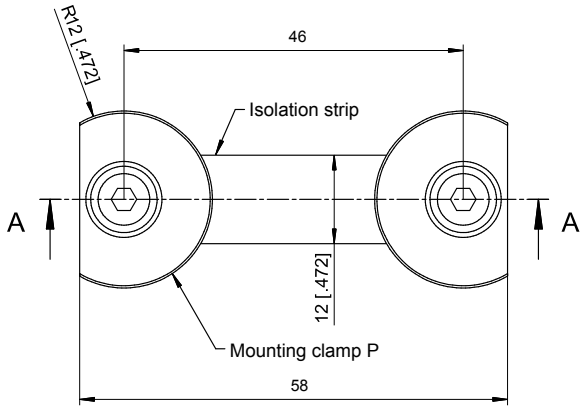
Dimensions informative only.
For guaranteed dimensions consult factory.

Mounting PCQA

The sensor must be mounted with minimum two mounting sets PCQA-BFS1. For longer profiles one ore more additional mounting sets are necessary in the middle of the profile.

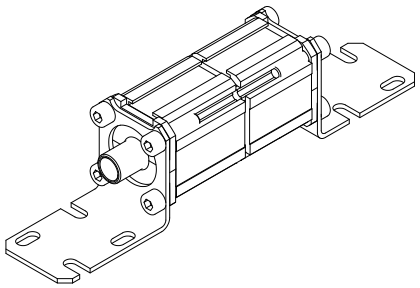
Mounting set PCQA-BFS1 with mounting clamps

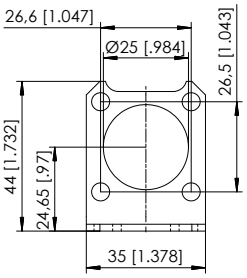


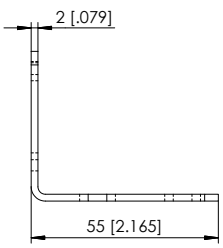


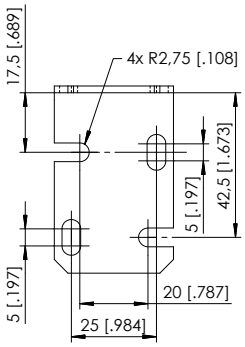
Option -BFW Mounting brackets for PCQA22 and PCQA24

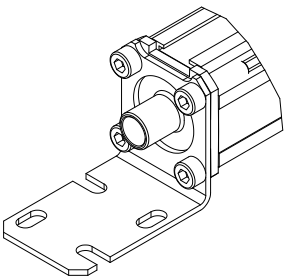
Note: The option -BFW can only be ordered with a new sensor, not separately!











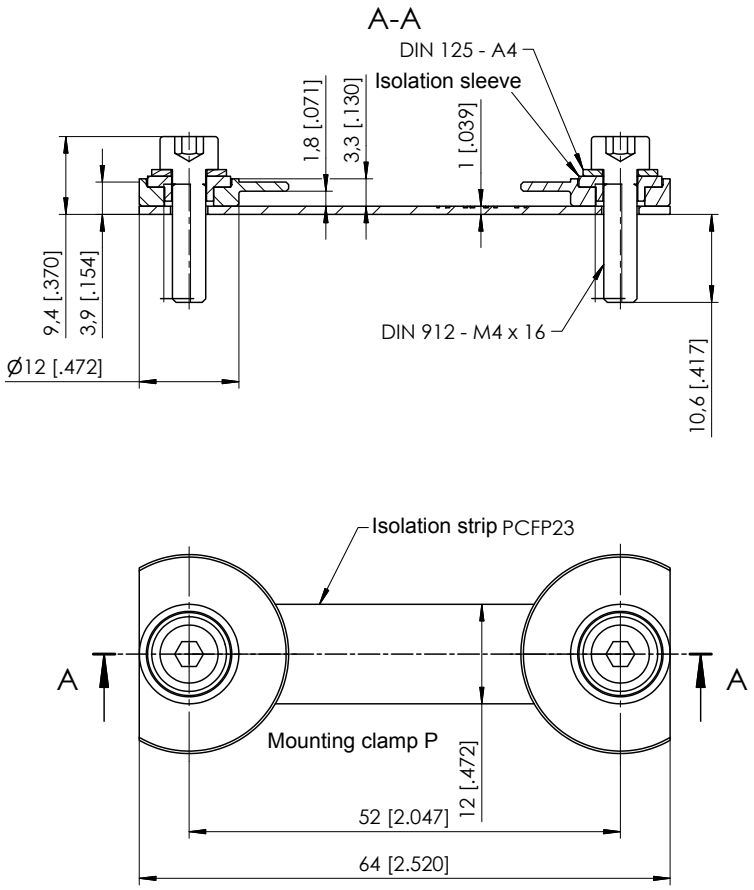
Dimensions in mm [inch]

Dimensions informative only.
For guaranteed dimensions consult factory.

Mounting PCFP

The sensor must be mounted with minimum two mounting sets PCFPxx-BFS1. For longer profiles one ore more additional mounting sets are necessary in the middle of the profile.

Mounting set PCFP23-BFS1 and PCFP24-BFS1 with mounting clamps



Dimensions in mm [inch]

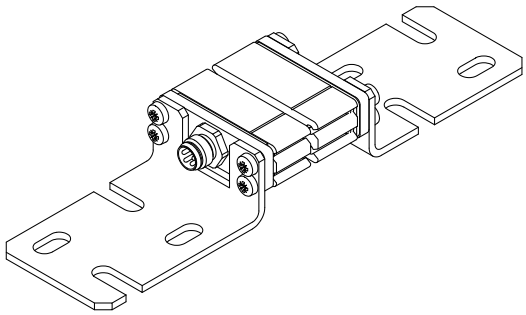
Dimensions informative only.
For guaranteed dimensions consult factory.

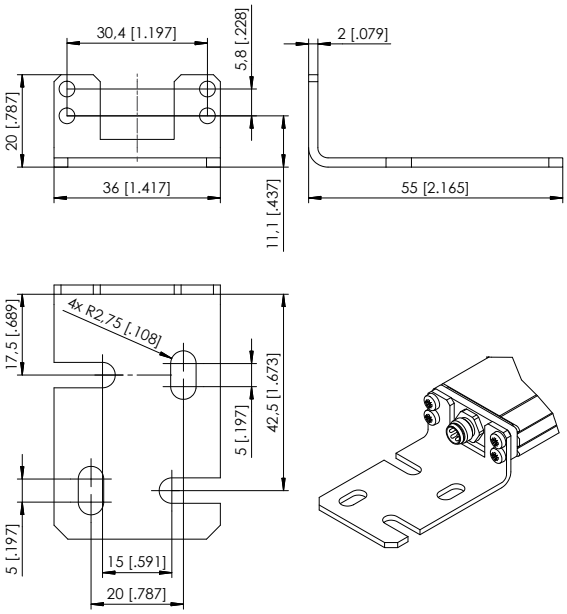
	POSICHRON model	Dim. B [mm]	Dim. C [mm]
Dimensions for BFS1	PCFP23	52	64
	PCFP24	59	71

Option -BFW Mounting brackets

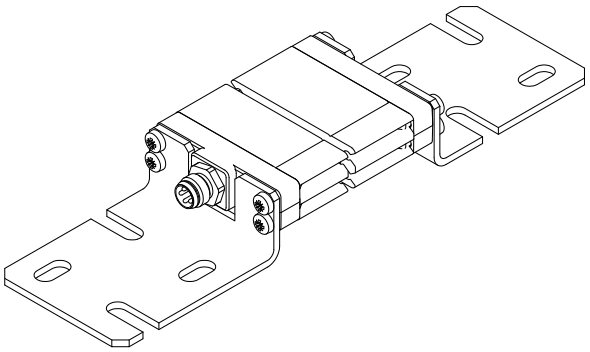
Note: The option -BFW can only be ordered with a new sensor, not separately!

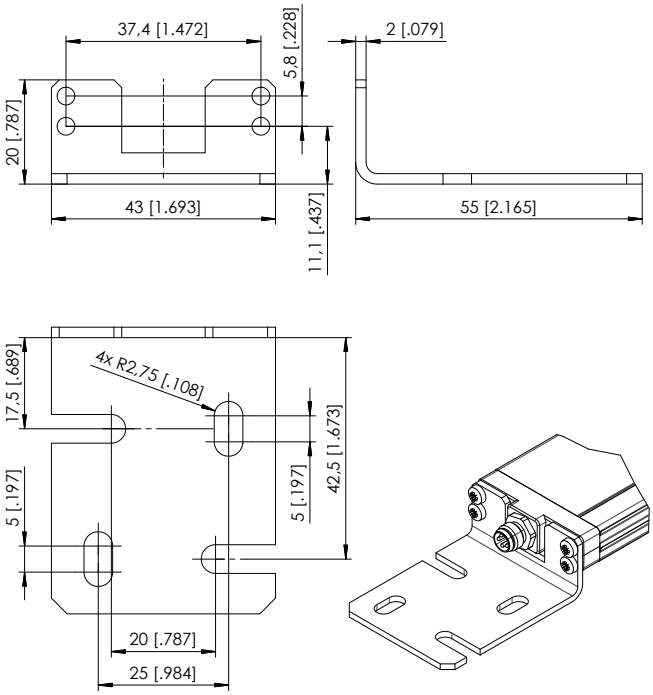
For PCFP23





For PCFP24

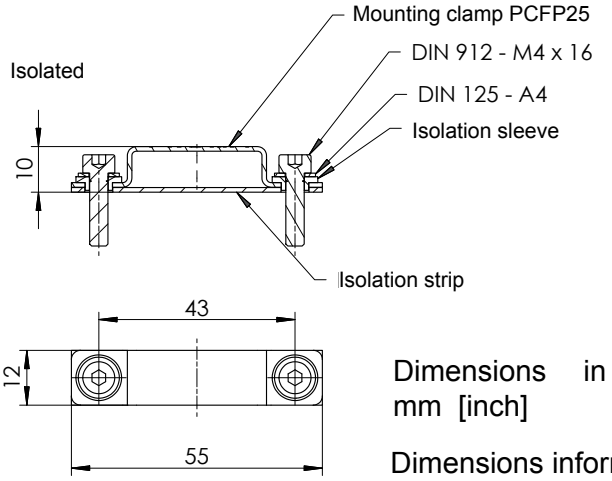


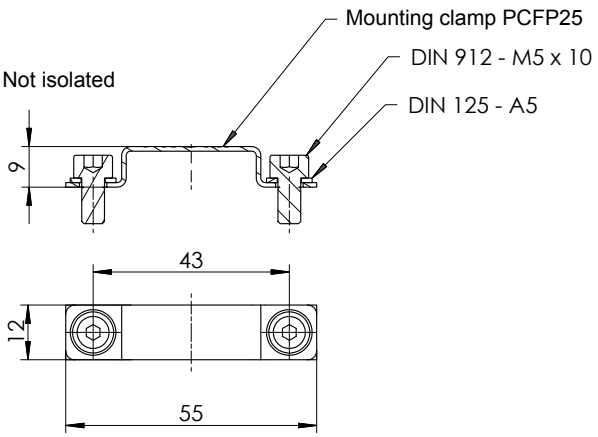


Dimensions in mm [inch]

Dimensions informative only.
For guaranteed dimensions consult factory.

Mounting set PCFP25-BFS1





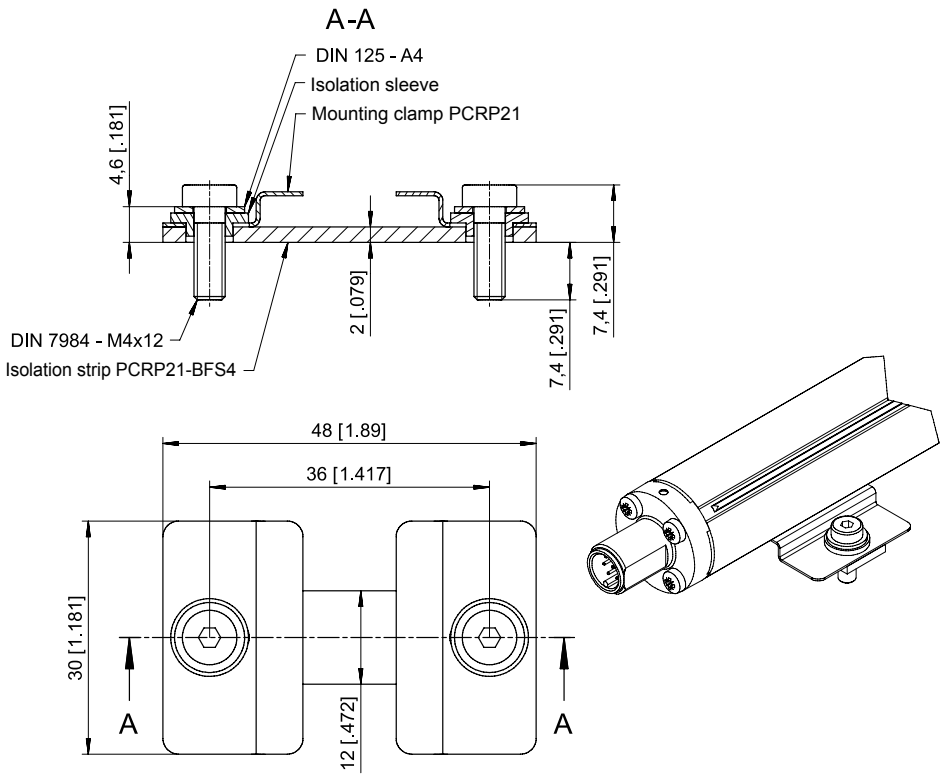
Dimensions in mm [inch]

Dimensions informative only.
For guaranteed dimensions consult factory.

Mounting PCRP21

The sensor must be mounted with minimum two mounting sets PCRP21-BFS4. For longer profiles one ore more additional mounting sets are necessary in the middle of the profile.

Mounting set PCRP21-BFS4 with mounting clamps

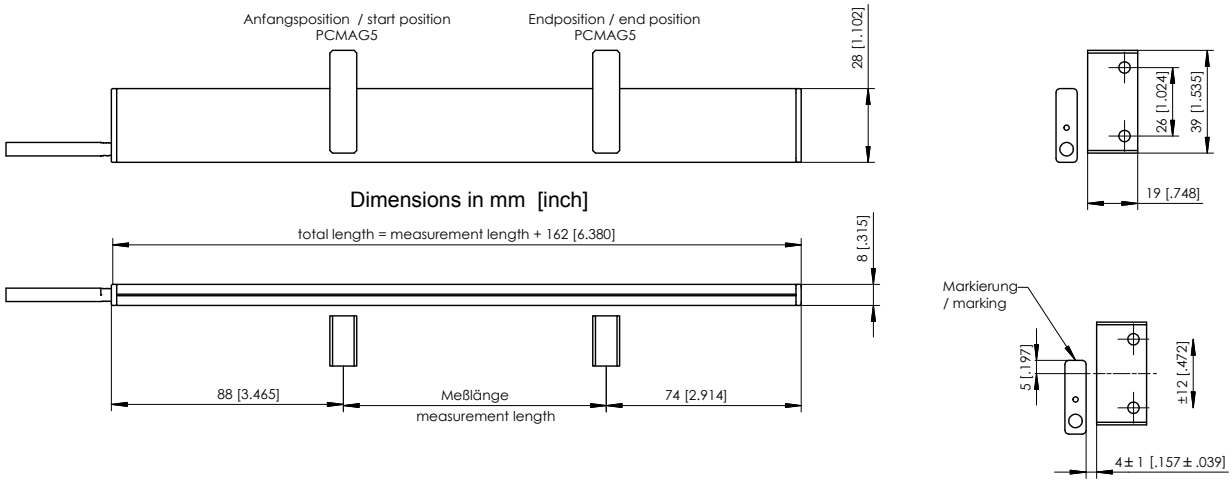


Mounting PCRP32

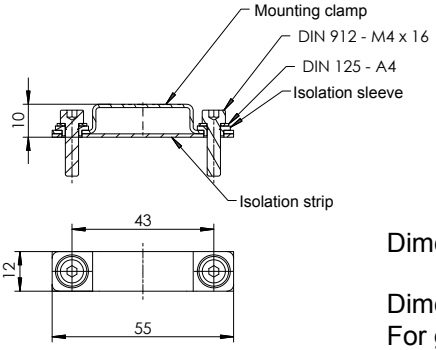
The sensor must be mounted in such a position that the magnet is located above the arrow label on the sensor housing!

Mounting PCFP25

The position sensor must be mounted with min. two mounting sets PCFP25-BFS1 (accessories). For longer profiles one or more additional mounting sets are necessary in the middle of the profile.



Mounting set with mounting clamps

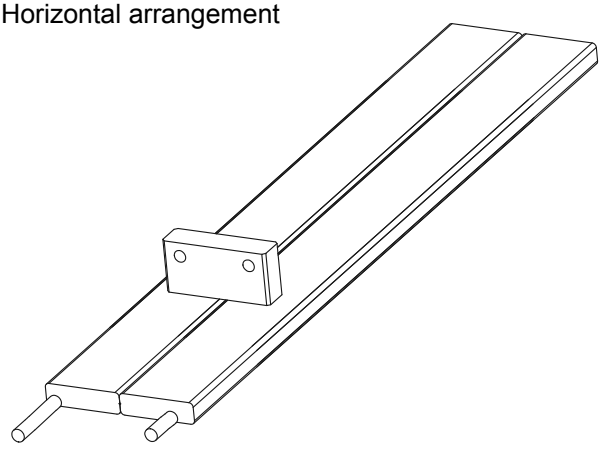


Dimensions in mm [inch]

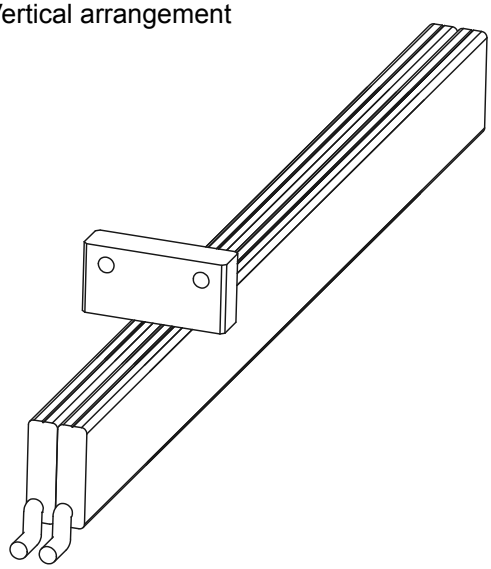
Dimensions informative only.
For guaranteed dimensions consult factory.

Redundant version

Horizontal arrangement

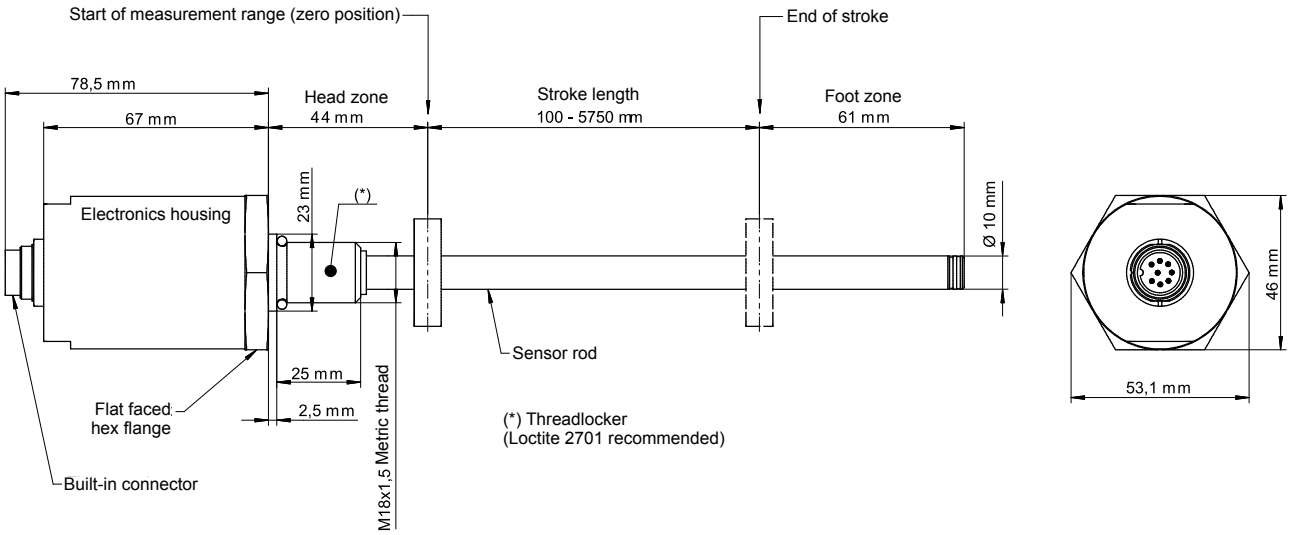


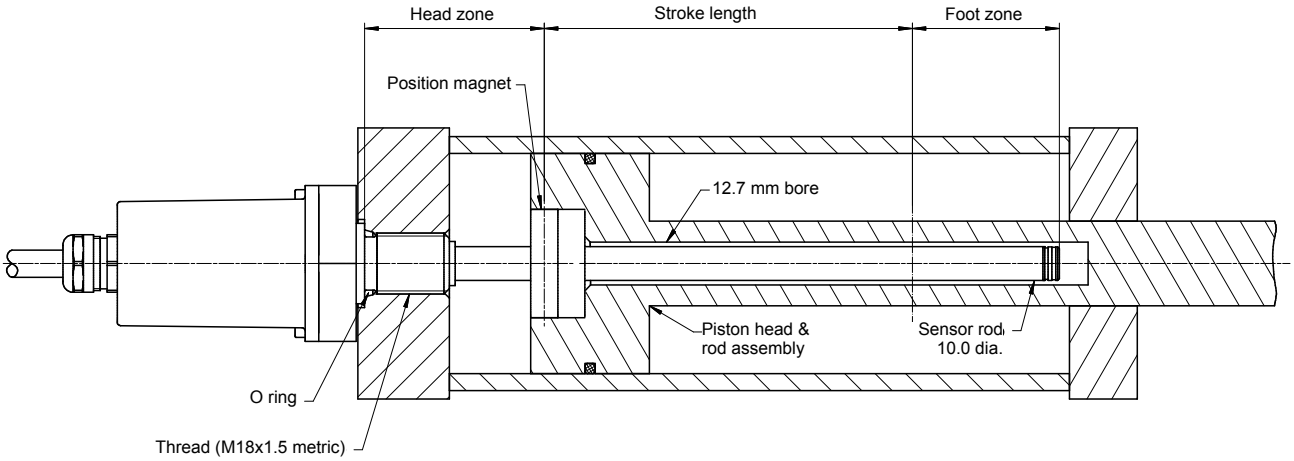
Vertical arrangement



Mounting PCSTxx

The PCSTxx will be mounted via screw-thread M18 or ¾ inch.
The PCSTxx-M18 resp. PCSTxx-Z3/4 will be mounted via the flange thread (M18 x 1,5 bzw. ¾ inch-16UNF). The mounting face of the sensor head must fit plane to the surface of the hydraulic cylinder. To avoid any damage use a fitting nut for the flange thread. Tighten the sensor, a torque of 50 Nm must not be exceeded. Apply threadlocker to the the thread before mounting (recommended: LOCTITE 2701).



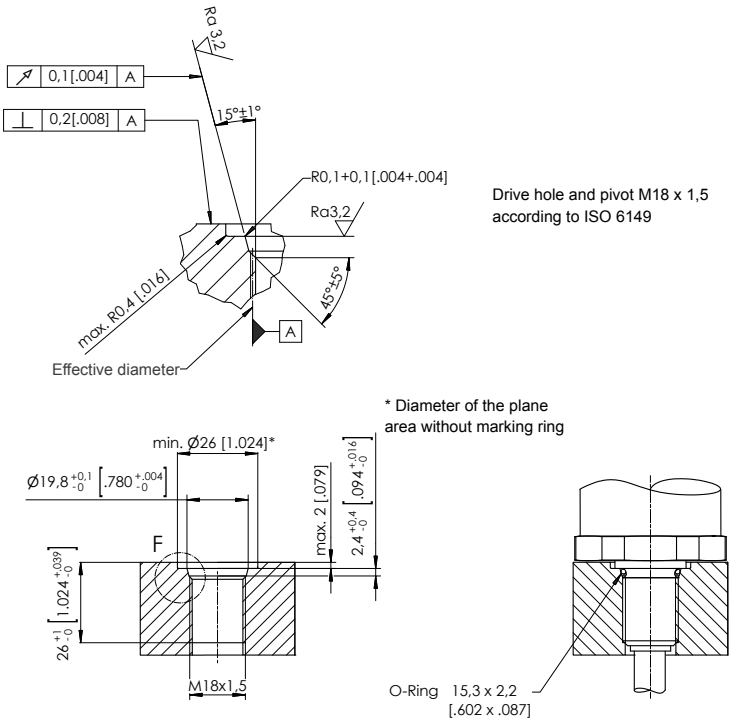


Dimensions in mm [inch]

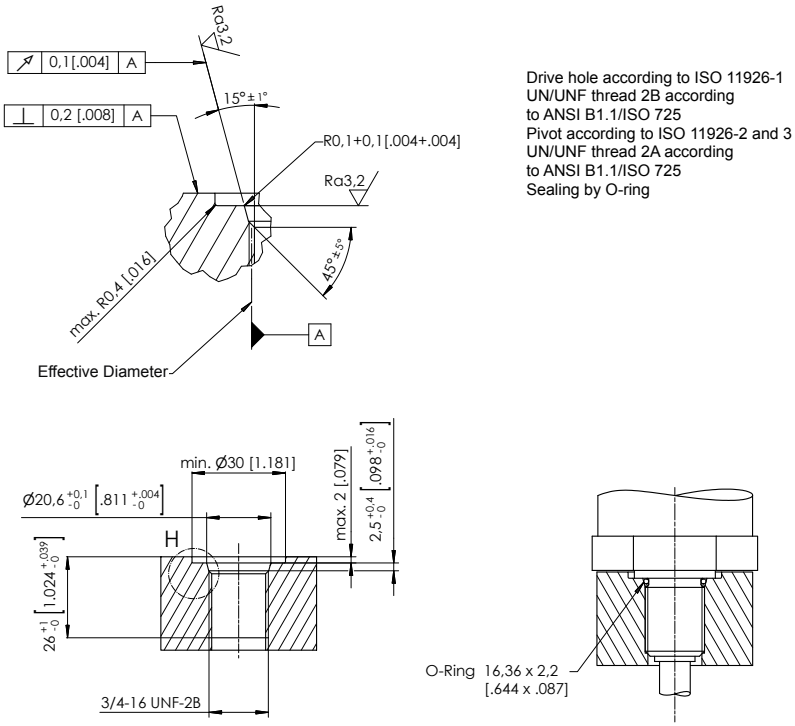
Dimensions informative only.
For guaranteed dimensions consult factory.

Mounting PCSTxx
(continuation)

Mounting hole M18



Mounting hole ¾ inch

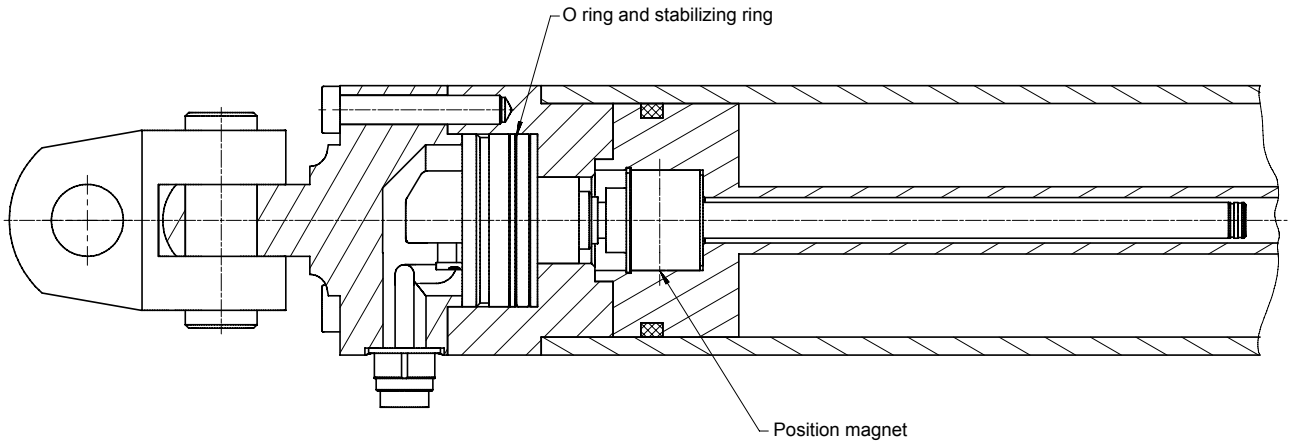


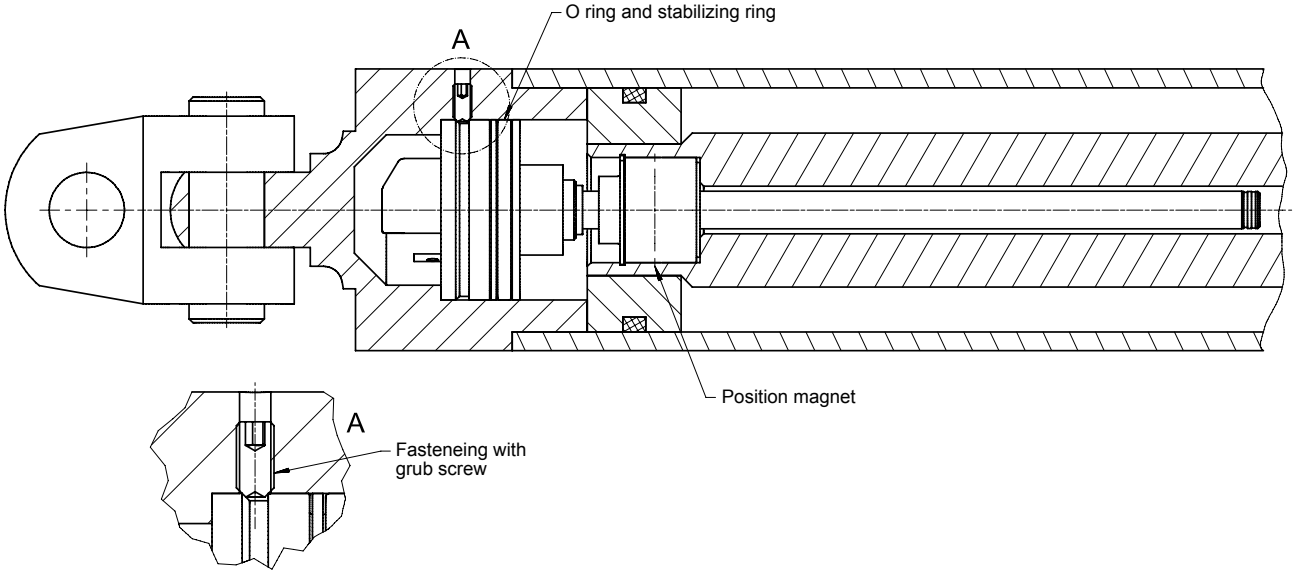
Dimensions in mm [inch]

Dimensions informative only.
For guaranteed dimensions consult factory.

Mounting PCSTxx (continuation)

The application range for the rod-style PCSTxx is wide. For one of them, the use in hydraulicic cylinders, the following mounting notes are helpful. The PCSTxx-SV is the plug-in version and, depending on the design of the hydraulic cylinder, will be fastened with a grub screw. For applications in hydraulic cylinders an additional model is available:





Dimensions in mm [inch]

Dimensions informative only.
For guaranteed dimensions consult factory.

Mounting PCSTxx (continuation)

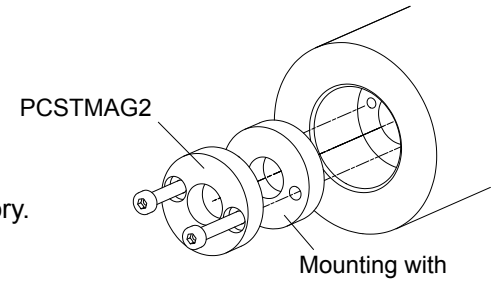
The sensor rod of stainless steel is located within the bore of the piston rod. The size of bore must be selected depending on the pressure and the speed of the piston, however a size of at least 12,7 mm (½ inch). The maximum pressure of **400 bar** must not be exceeded.
At the retraction and the extension of the hydraulic cylinder a capacity of V = l · A (A: sensor cross section = 78,5 mm², l: piston stroke) must be displaced. If the displaced capacity isn´t able to flow into or off fast enough a force has an effect on the sensor rod surface, perhaps the rod may break! In order to keep the effect of the force as small as possible, compensation holes of sufficient cross section must be planned, by those the capacity can flow through without generating unnecessarily high pressure on the sensor rod.

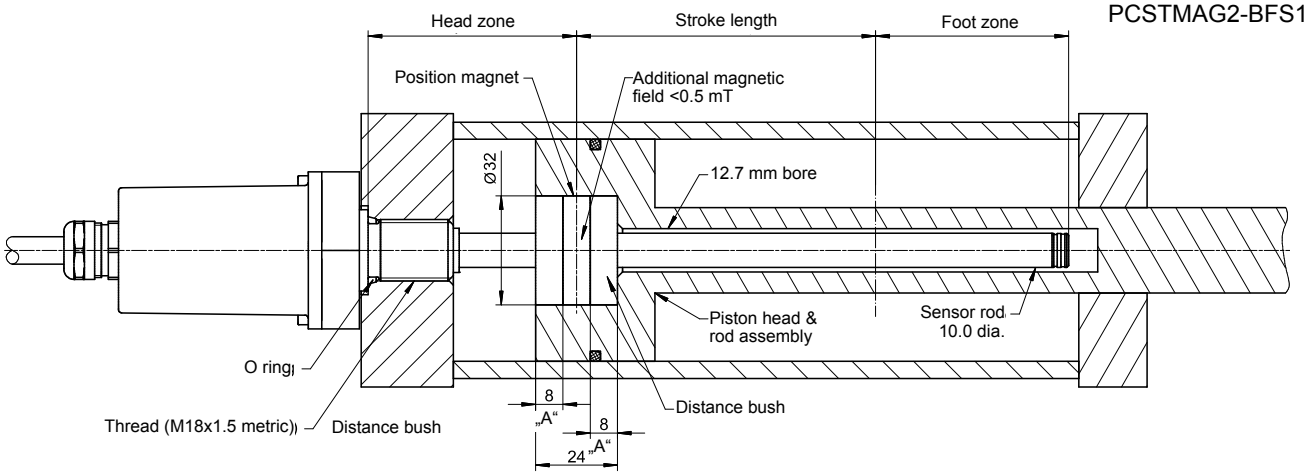
The position magnet as well as the sensor rod must be protected against wear by constructive methods. The position magnet must not drag along the sensor rod (especially when mopunted in a hydraulic cylinder)! As an alternative to PCSTMAG2 a high-tensile and abrasion-poor special magnet is available (PCSTMAG2-G1/G2).
Non-magnetizable screws, distance bushes, circlips etc. must be used for mounting support. Use non-magnetic screws only to fix the position magnet! If a magnetic material is used a minimum distance of 8 mm (dimension “A”) must be observed between the position magnet and the mounting flange resp. the hydraulic piston (see drawing below).
As an option is the distance bush “**PCSTMAG2-BFS1**” available.

Note: The magnetic leakage field of any environment at the position of the magnet must not exceed 0.5 mT.

Dimensions in mm [inch]

Dimensions informative only.
For guaranteed dimensions consult factory.



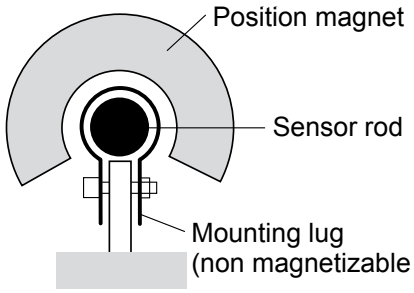


Mounting PCSTxx (continuation)

If mounted in horizontal position, sensors with more than 1000 mm range (length) must be provided with mechanical support at every 1000 mm and use the position magnet PCSTMAG1 (U-shape, see drawing)).

The rod of sensors with more than 1000 mm range and without mechanical support may have a sag or possibly break!

Example: Sensor support

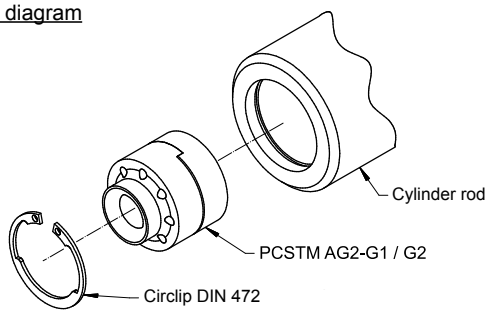


Therefore the sensor rod must not pulled out of the bore of the hydraulic cylinder completely. A minimum length of 50 mm must remain in the piston resp. the piston rod.

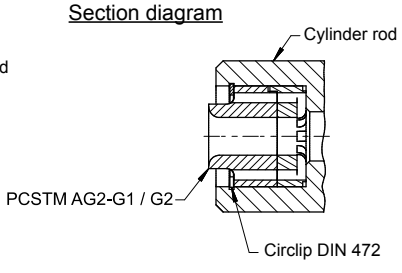
Mounting of PCSTMAG2-G1/G2

Take both parts of the housing out of the bag, put it together and insert it into the designated bore of the cylinder piston. The correct position of the housing is very important (see drawing).
Please check that the four rubber pads are located in the four holes of the part of the housing. The four rubber pads ensure the horizontal compensation. The circlip DIN 472 fixes the housing of PCSTMAG1. Check the that the circlip fits into the groove completely.
Assemble PCSTMAG2-G2 in the same way.

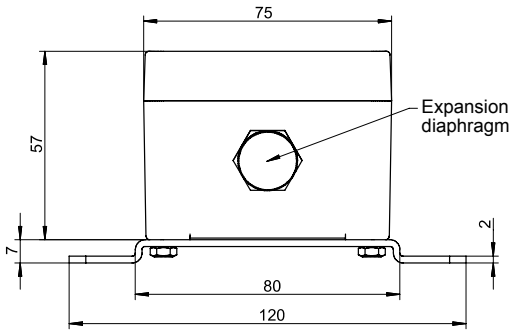
ISO diagram

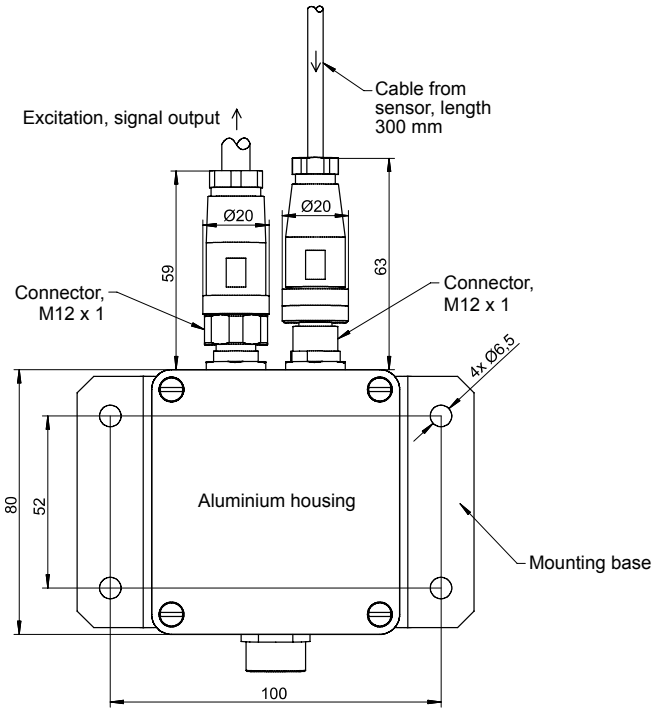


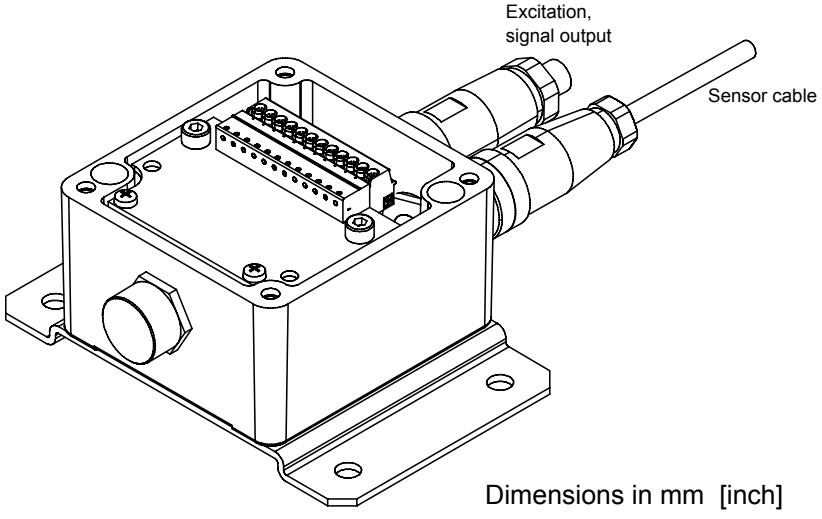
Section diagram



Mounting
PCST26
Separate electronics housing







Dimensions in mm [inch]

Dimensions informative only.
For guaranteed dimensions consult factory.

Mounting PCST26
Separate electronics

Keep the cable between sensor and electronics housing well separated from power wiring, the minimum distance must be 500 mm.

To achieve a good noise rejection a low-pass filter with a cutoff frequency of 5 kHz is recommended at the input of the subsequent electronics.

To avoid potential compensation currents via the shield it is recommended to connect all facility units (components) with potential compensation lines.

Do only connect sensor and electronics housing with the same serial number!

Do not operate the system before the the sensor and the electronics housing have been connected and screwed together properly.

Do not connect or disconnect the electronics housing while the power is on!

Electromagnetic Compatibility (EMC)

The electromagnetic compatibility depends on wiring practice. Recommended wiring:

- The profile housing sensor models can be mounted isolated using the appropriate mounting sets including an isolation strip.
- Use shielded twisted pair sensor cable.
- Keep sensor signal well separated from power wiring e.g. AC wiring, motor or relay. Use separate conduit or ducts for each.

If application includes highly electromagnetic interference emitting equipment like switch converter drives additional measures are recommended:

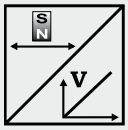
- Use a twisted pair cable, shielded per pair and common.
- Use shielded conduits or ducts connected to ground potential.

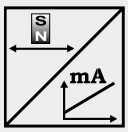
Repair and disposal

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

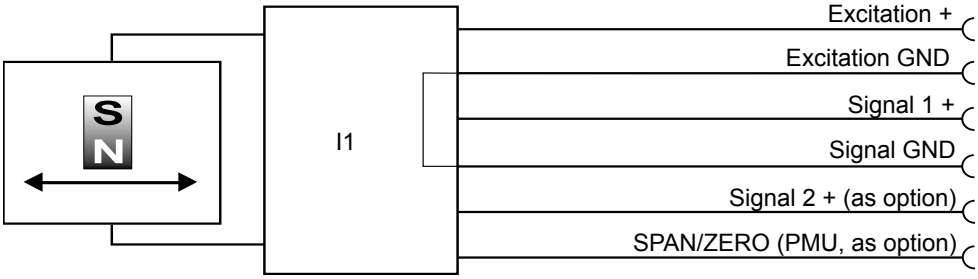
In order to avoid risk of injury and improper handling do not try to repair. No warranty or liability will be granted for opened sensors.

Disposal: Send metal parts for recycling!

Signal conditioner U1, U2, U3, U8 Voltage output 	Excitation voltage	**U1, U2**: 18 ... 36 V DC; **U8, U3**: 10 ... 36 V
	Excitation current	Typ. 23/46 mA at 24/12 V DC, 80 mA max.
	Output voltage	**U1**: 0 ... 10 V; **U2**: 0.5 ... 10 V; **U3**: 0 ... 5 V; **U8**: 0.5 ... 4.5 V
	Output current	2 mA max.
	Resolution	16 bit
	Stability (temperature)	±50 x 10^{-6} / °C f.s.
	Protection	Reverse polarity, short circuit
	Output noise	0.5 mV_{RMS}
	Operating temperature	-40 ... +85 °C
	EMC	EN 61326:2006

Signal conditioner I1 Current output (3 wire) 	Excitation voltage	18 ... 36 V DC f.R<250Ω 10 ... 36 V DC
	Excitation current	Typ. 36/66 mA at 24/12 V DC, 80 mA max.
	Load resistor	350 Ω max.
	Output current	4 ... 20 mA, 30 mA max (at failure)
	Resolution	16 bit
	Stability (temperature)	±50 x 10^{-6} / °C f.s.
	Protection	Reverse polarity, short circuit
	Output noise	0.5 mV_{RMS}
	Operating temperature	-40 ... +85 °C
	EMC	EN 61326:2006

Signal diagram

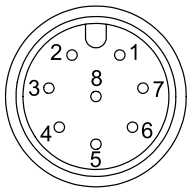


Signal wiring	Output signals I1	Connector pin	Cable output color
	Excitation +	1	white
	Excitation GND	2	brown
	Signal 1 +	3	green
	Signal GND	4	yellow
	Signal 2 + (as option)	5	grey
	SPAN/ZERO (PMU*, as option)	6	pink

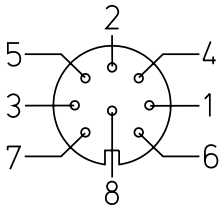
When using multiple magnets the distance between two magnets must be min. 70 mm to identify the single magnets definitely.

Connection
Mating connector

View to sensor connector



CONN-M12-8M

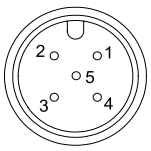


CONN-D8-8M

Output with 4 (5)-pin connector M12

View to sensor connector

CONN-M12-5M

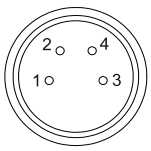


Signal wiring	Output signals	Connector pin
	Excitation +	1
	Signal 1 +	2
	GND	3
	Signal 2 + (option)	4
	PMU optional	5

Output with 4-pin connector M8

View to sensor connector

CONN-M8-4M



Signal wiring	Output signals	Connector pin
	Excitation +	1
	Excitation GND	2
	Signal +	3
	PMU optional	4

Diagnostic signal on error for U2 and I1, U1, U2, U3 and U8

The analog signal output in case of error

In case of error (e.g. magnet missing) the analog output signal will assume a state according to the following options:

Standard (w/o marking) **Alarm_HIGH**	The output voltage resp. the output current is at HIGH level (overrange) ⇨ U_{out}>10.5 V, I_{out}>21 mA
Option /U **Alarm_LOW**	The output voltage resp. the output current is at LOW level (underrange) ⇨ U_{out}<0.25 V, I_{out} 1.5 ... 2 mA
Option /H **Alarm_HOLD**	The output voltage resp. the output current will keep the last valid state

Settling time for analog outputs

Settling time for POSICHRON® sensors with analog outputs: <15 ms / 0 ... 90%

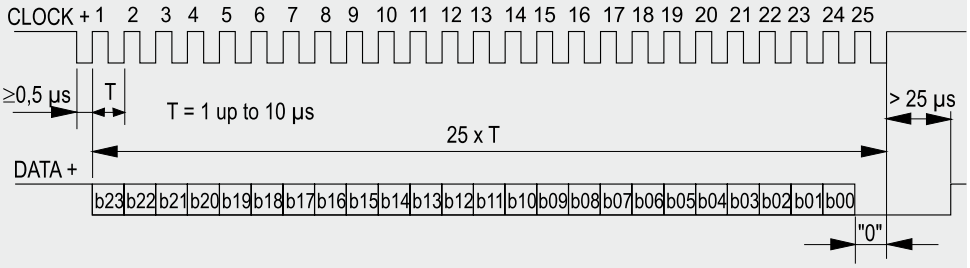
Option - PMU for analog output or I1, U1, U2, U3 and U8

Programming of the start and end value by the customer:

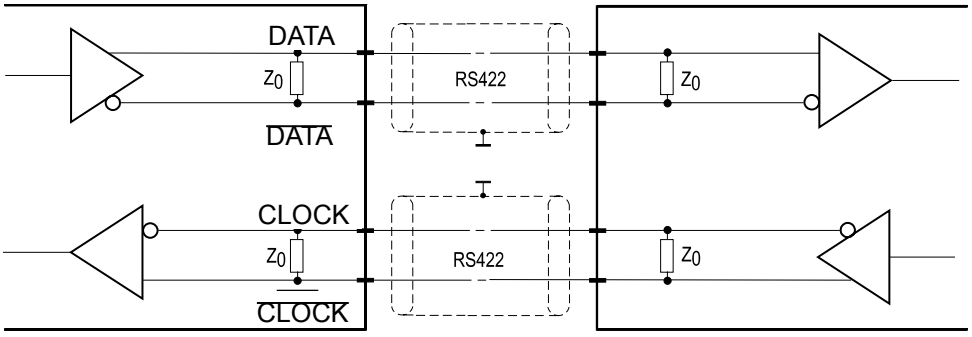
The option PMU allows to program the start value and the end value of the output range by a programming signal SPAN/ZERO available at the connector. This Signal SPAN/ZERO must be connected with GND via a push button, then position magnet of the sensor must be moved to the start resp. end position. Pushing the button between 1 and 4 seconds sets the actual position as start position, pushing the button more than 5 seconds sets the actual position as end position. The values will be stored and are available after switching off the sensor.
To reset the sensor to the factory values the button must be pushed when the sensor is switched on.

Synchronous serial interface SSI	Output	RS422
	Excitation voltage	18 ... 27 V DC, residual ripple 10 mV_{SS}
	Excitation current	Typ. 80 mA, 150 mA max.
	Clock frequency	100 kHz ... 1 MHz
	Code	Gray code, dual code
	Resolution	≥ 5 µm
	Delay between pulse trains	>25 µs
	Filter	Average determination
	Stability (temperature)	±50 x 10^{-6} / °C f.s.
	Operating temperature	-40 ... +85 °C
	EMC	EN 61326:2006

Data format
(Train of 26 pulses)



Signal diagram



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

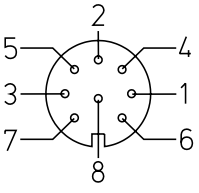
Note:
Extension of the cable length will reduce the maximum transmission rate.
The signals CLOCK/$\overline{\text{CLOCK}}$ and DATA/$\overline{\text{DATA}}$ must be connected in a twisted pair cable, common shielded.

Signal wiring

Signal name	Connector pin	Cable output color
Excitation +	1	white
Excitation GND	2	brown
CLOCK	3	green
$\overline{\text{CLOCK}}$	4	yellow
DATA	5	grey
$\overline{\text{DATA}}$	6	pink

View to sensor connector

CONN-M12-8M



CONN-D8-8M

Error indication:
If the sensor cannot detect a magnet the position value will assume the maximum value (0xFFFFFFF).

Description

CANopen interface with process data for position and cam functions, programmable are preset, resolution, filtering and cam switching points.

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	4 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 kBit to 1 MBit, default: 125 kBit; programmable via LSS or SDO
	Bus connection	M12 connector, 5 pins
	Integrated bus terminating resistor	120Ω
	Bus, galvanic isolated	No

Specifications	Excitation voltage	18 ... 36 V DC
	Excitation current	Typ. 20 mA for 24 V DC, 100 mA max.
	Resolution	50 µm max.
	No. of position magnets	1 ... 4
	Measuring rate	1 kHz max., depending on the mesurement range
	Stability (temperature)	±50 x 10^{-6} / °C f.s.
	Operating temperature	-40 ... +105 °C
	Protection	Reverse polarity, short circuit
	EMC Automation	EN 61326-1:2006-10

When using multiple magnets the distance between two magnets must be min. 70 mm to identify the single magnets definitely.

	Measurement range	**Measurement rate**
Measurement rate depending on the measurement range	100 ... 500 mm	1 ... 1.4 ms
	500 ... 1000 mm	1.4 ... 2.5 ms
	1000 ... 2000 mm	2.5 ... 4.3 ms
	2000 ... 4000 mm	4.3 ... 8.8 ms
	4000 ... 6000 mm	8.8 ms ... 13 ms

Setup

Before connecting to the CAN bus make sure that every node has a different node ID and a common bit rate. If necessary set node ID and bit rate by the Layer-Setting-Service (LSS) as defined in Standard CiA DSP-305.

If LSS is not available node ID and bit rate can be changed by writing the new values to objects 2000 and 2010 via Service Data Object (SDO). New node ID and bit rate become effective not before ”SAVE” and resetting the device.

After power up the slave will send a boot-up message and will be ready for configuration and start of data exchange. On first power-up the default parameters are effective.

Change parameters and operating mode of process data objects after importing the EDS file by the master software. Changed parameters become effective immediately. Parameters will become non-volatile on writing ”SAVE” to object 1010-1.

Note: Setting of some parameters may have influence on the function of other parameters, e.g. changing the resolution may also influence the cam function.

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!

Device profile

Manufacturer-specific	Index	Default	Value range
Node-ID	2000	127	1…127
Bitrate	2010	4	0..7 (s. table below)
Number of Positions	2080	1	1..4
User Offset	2100	0	$0…2^{32}$-1
Reload factory defaults	2101	-	
Filter	2102	0	1...255
Angle encoder CiA406			
Operating Parameters	6000	0	0...7
Total Measuring Range	6002		
Position Step Setting	6005-1	50 µm	
Speed Step Setting	6005-2	1mm/s	
Preset Values	6010-1..4	0	
Position Values	6020-1..4	0	
Speed Values	6030-1..4	0	
Cyclic Timer	6200	100	
Profile and SW Version	6507		
Serial Number	650B		
Offset values	650C-1..4		
Cam function CiA406			
Cam state register	6300-1..4	0	
Cam enable register	6301-1..4	0	
Cam polarity register	6302-1..4	0	
Cam 1-8 low limit	6310-6317-1..4	0	
Cam 1-8 high limit	6320-6327-1..4	0	
Cam 1-8 hysteresis	6330-6337-1..4	0	

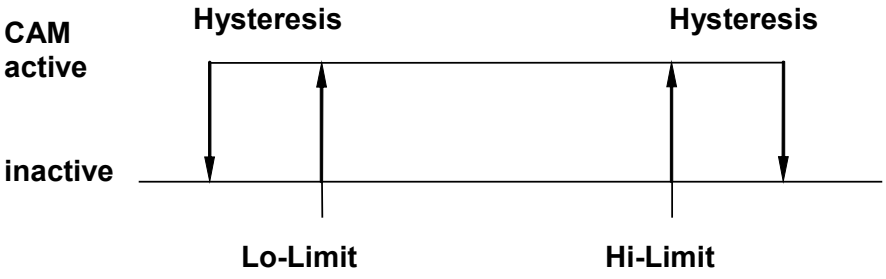
Bit rates	**Index**	**Bit rate**
	0	1 MBit/s
	1	800 kBit/s
	2	500 kBit/s
	3	250 kBit/s
	4	125 kBit/s
	5	reserved
	6	50 kBit/s
	7	20 kBit/s

Process data

PDO	4 Byte LSB..MSB	2 Byte LSB, MSB	1 Byte	1 Byte
TxPDO-1..4	Position	Speed	CAM Status	Error

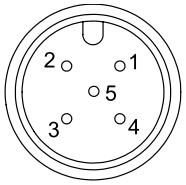
PDO error byte	Error	Meaning
	0	Normal operation
	1 ... n	Malfunction, number of missing position magnets according to index 2080 (number of positions)

CAM function



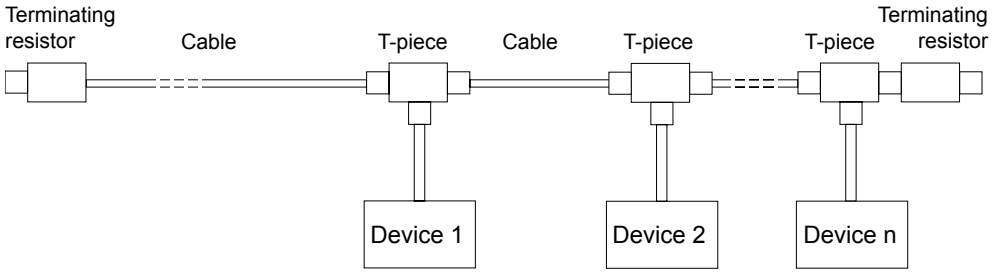
Signal wiring / connection	Signal name	Connector pin	Wire color	Color code 47100
	Screen	1	Braid	Braid
	Excitation +	2	Brown	White
	GND	3	White	Brown
	CAN-H	4	Blue	Green
	CAN-L	5	Black	Yellow

View to sensor connector



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.



POSICHRON®
Output CAN-SAE J1939

Description

Linear encoder according to standard SAE J1939. Configuration of operating parameters by proprietary-A-Message (peer-to-peer connection). Process data exchange by proprietary-B-Message (broadcast).

Interface 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 temination resistor	120 Ω
	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	18 ... 36 V DC
	Excitation current	Typ. 20 mA for 24 V DC, 100 mA max.
	Resolution	50 µm max.
	Measuring rate	1 kHz max., depending on the mesurement range
	Stability (temperature)	±100 x 10^{-6} / °C f.s.
	Operating temperature	-40 ... +85 °C
	Protection	Reverse polarity, short circuit
	EMC	EN61326-1:2006

Signal wiring and connection see previous page.

	Measurement range	**Measurement rate**
Measurement rate depending on the measurement range	100 ... 500 mm	1 ... 1.4 ms
	500 ... 1000 mm	1.4 ... 2.5 ms
	1000 ... 2000 mm	2.5 ... 4.3 ms
	2000 ... 4000 mm	4.3 ... 8.8 ms
	4000 ... 6000 mm	8.8 ms ... 13 ms

Setup procedure

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

W**arning 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!

Configuration examples

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

	PGN_{HIGH}	PGN_{LOW}	8 Byte data frame							
→	0EFh	0F7h	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	0F7h	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	0F7h	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	0F7h	1Dh	01h	00	00	64h	61h	6Fh	6Ch
←	0EFh	cc	1Dh	01h	00	00	64h	61h	6Fh	6Ch

Example: Broadcast (PGN_{LOW} = 0FFh) - Reload factory defaults of all sensors, Index 29

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

Table of configurable bit rates
(see next page, index 21)

Index 21	Bit rate
0	1000 kBit/s
1	800 kBit/s
2	500 kBit/s
3	250 kBit/s
4	125 kBit/s
5	50 kBit/s

Configurable parameters Linear Encoder Parameters - Standard Configuration

Parameter	Index [dec]	Default	Range / Selection	Unit	Read / Write
Control					
Node ID	20	247	128 ... 247		rd/wr [1)]
Baude rate	21	3 (250kB)	0 ... 5		rd/wr [2)]
Termination resistor	22	0	-		rd [2)]
Store parameters	28	-	”save” [3)]		wr
Reload factory defaults	29	-	”load” [3)]		wr [2)]
Communication					
Transmit mode	30	0	0 timer 1 request 2 event		rd/wr
Transmit cycle	31	100	10 ... 65535	ms	rd/wr
PGN Group Extension	32	0	0 ... 255		rd/wr
Event mode hysteresis	38	1000	0 ... 10000	steps	rd/wr
Process data byte order	39	0	0 little / 1 big endian		rd/wr
Measurement					
Code sequence	70	0	0 CW 1 CCW		rd/wr
Number of position magnets	72	1	1 ... 4		rd/wr
Measuring step	73	50	1 ... 1000	µm	rd/wr
Preset	74	0	0 ... 10000	steps	rd/wr
Averaging Filter	77	1	1 ... 255		rd/wr
Identification					
SW Version	198	-	4 bytes	number	rd
Serial number	199	-	4 bytes	number	rd
Identity number	200	-	21 bit	number	rd

2) Change of Node ID by writimg to index 20 is effective immediately and initiates Address Claiming
2) Effective on next power-up
3) „save“ MSB...LSB: 73h, 61h, 76h, 65h
„load“ MSB...LSB: 6Ch, 6Fh, 61h, 64h

Broadcast access by PGN_{LOW} = 0FFh addresses the specified index of all sensors.

Process data

Process data are transmitted by broadcast proprietary-B-Message PGN 0x00FFxx where the low byte is configurable. If the number of position magnets is configured to more than one magnet, position and velocity values are transmitted by a number of successive process data messages.

Byte order of process data message

B7	B6	B5	B4	B3	B2	B1	B0
Error	**M_Index**	**Velocity**		**Position**			
*)	1 ... 4	MSB	LSB	MSB			LSB

*) Error codes: 0 = no error
1,2 ... = error, number of missing magnets
081h, 082h ... = error, number of too many magnets detected

M_Index: Auto incrementing index for subsequent process data management in multimagnet configuration.

Models

PCFP24, PCFP25,
PCST24, PCST25, PCST26, PCST27,
PCRP21, PCRP32,
PCQA22, PCQA24

Outputs

U2	Voltage output	0.5 ... 10 V
U3	Voltage output	0 ... 5 V
U8	Voltage output	0.5 ... 4.5 V
I1	Current output	4 ... 20 mA

Characteristics	Probability of failure	0,6 x 10^{-6}/h
	Life period MTTF	190 years
	Working Life	10 years

Standards

SN29500 Failure rate electronic components (Siemens)

POSICHRON®
Declaration of Conformity

Declaration of Conformity

The position sensor POSICHRON

Manufacturer:	ASM GmbH Am Bleichbach 18-22 85452 Moosinning / Germany
Model:	**PCQA22, PCQA24, PCFP23, PCFP24, PCFP25** **PCRP21, PCRP32, PCST24, PCST25, PCST26, PCST27**
Options:	U1, - U2, - U3, - U8, - I1, - SSI, - CANOP, - CANJ1939

complies with the following standards and directives:

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

Moosinning, 03.12.2012

i.A. Andreas Bolm
Quality Manager

i.A. Peter Wirth
Head of Development

ASM GmbH Automation • Sensorik • Messtechnik
Am Bleichbach 18-22 85452 Moosinning / Germany
Telephone: +49 8123 986-0 Telefax: +49 8123 986-500
Internet: www.asm-sensor.com
E-Mail: info@asm-sensor.de