

Installation Manual

Temposonics® MH / MS / MT Magnetostrictive Linear Position Sensors

**Document Part No.
551289 Revision C**



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Contents

| | |
|--|----|
| 1. Safety and operation instructions | 3 |
| 2. Product description and technology | 4 |
| 3. Space requirements - conditions, design | |
| 3.1 Dimensions, tolerances..... | 5 |
| 3.2 Chamfered edge for insertion..... | 6 |
| 3.3 Piston rod bore and depth..... | 6 |
| 3.4 CAD-data, download..... | 6 |
| 3.5 Installing the magnet..... | 7 |
| 3.5.1 Magnet with 2 distant washers..... | 7 |
| 3.5.2 Magnet with 1 distant washer..... | 7 |
| 3.5.3 Installing the magnet..... | 8 |
| 3.6 Safety screw to DIN 913..... | 8 |
| 3.7 Supporting long sensor pipes, sagging..... | 9 |
| 4. Mounting | |
| 4.1 Positioning of O- and backup rings..... | 10 |
| 4.2 Load-bearings geometries of sensor housing..... | 10 |
| 4.3 Mounting in the cylinder..... | 11 |
| 4.4 Handling connection cables during mounting..... | 13 |
| 4.5 Mounting sensors using a Temposonics® M12 connector system..... | 14 |
| 4.6 Mounting in the cylinder..... | 14 |
| 4.7 Mounting sensors with cable or single conductor connection..... | 16 |
| 4.7.1 Mounting sensors with cable connection and cable gland..... | 16 |
| 4.7.2 Mounting sensors with single conductor and third-party connector..... | 16 |
| 5. Cylinder handling after sensor installation | |
| 5.1 Washing and drying cylinders with installed sensors..... | 17 |
| 5.1.1 Sensors with Temposonics® M12 connector system..... | 17 |
| 5.1.2 Sensors with connecting cable..... | 17 |
| 5.1.3 Sensors with third-party connectors..... | 17 |
| 5.2 Painting of cylinders..... | 18 |
| 5.2.1 Electrostatic painting..... | 18 |
| 5.2.2 Cylinders with integrated sensors and Temposonics® M12 connector system..... | 19 |
| 5.2.3 Cylinders with integrated sensors and connecting cables or third-party connectors..... | 19 |
| 6. Transport, intermediate storage | |
| 6.1 Mounting/dismounting cylinders on mobile hydraulics machines..... | 20 |
| 6.2 Electrical and electrostatic effects..... | 20 |
| 6.3 Electrostatic effects..... | 21 |
| 7. Drawings | |
| 7.1 Dimensions of Temposonics® MH sensor | |
| - with M12 connector system..... | 22 |
| - with single wires..... | 23 |
| - with cable..... | 24 |
| - with cable (till 03.2011)..... | 25 |
| 7.2 Dimensions of Temposonics® MS sensor | |
| - with M12 connector system..... | 26 |
| - with single wires..... | 27 |
| - with cable..... | 28 |
| 7.3 Dimensions of Temposonics® MT sensor | |
| - with M12 connector system..... | 29 |
| - with single wires..... | 30 |
| - with cable..... | 31 |
| 7.4 Dimensions of sensor magnets (position transducer) | 32 |
| 7.5 Mounting sensors using Temposonics® M12 connector system (flange)..... | 33 |
| 7.6 Dimensions of turned parts made of M12 round material..... | 34 |

1. Safety operating instructions

Before starting the sensors operation, please, read this documentation carefully and follow the safety instructions.

This technical documentation provides information on the mechanical installation of Temposonics® sensors by qualified personnel* or trained service technicians who are familiar with sensor projecting and handling.

Intended use



Temposonics® sensors are built according to actual electrical engineering standards. They are state-of-the-art and meet the EMC-requirements for interference emission and immunity for vehicles and mobile machines. Nevertheless, using the sensors can result in hazards for the user or third parties, or cause damage of the sensor and other equipment.

The sensors are intended for measuring tasks in the field of mobile hydraulics. They are considered as accessories and must be connected to suitable evaluation electronics, e.g. a PLC, IPC, indicator or another type of electronic control unit.

As a prerequisite to ensure perfect and safe sensor operation, correct transport, storage, mounting, commissioning and careful operation are mandatory. The sensors may be used only in safe condition. To maintain this condition and ensure safe operation, installation, connection and service work may be performed only by qualified and authorized personnel.

Information related to danger

Information related to danger is intended for your personal safety and for the safety of the described product or connected equipment against damage.

Installation and operation

If failure or functional disorder of the sensors cause danger for persons or imply a hazard of damage to operating facilities, additional safety measures such as plausibility checks, limit switches, EMERGENCY OFF systems, protective devices, etc. must be provided to prevent it. In the event of trouble, shut down the sensor and protect it against unauthorized operation.

To maintain the sensor operability, it is indispensable to observe the following information:

- Protect the sensor against mechanical damage during installation and operation.
- Don't open or dismantle the sensor.
- Connect the sensor carefully and make sure that the polarity of connections, the operating voltage as well as the shape and duration of control pulses are correct.
- Use only approved power supply units.
- Observing the permissible sensor limit values for operating voltage and environmental conditions etc. as specified in the product documentation is indispensable.
- Check and document the function of the position sensor regularly.
- Before activating the equipment, make sure that nobody's safety is impaired by starting machines.

Repairs

Repairs on the sensor may only be performed by Temposonics or a body that has been explicitly authorized by Temposonics.

Warranty

The Temposonics warranty period for the sensors and the accessories included in the scope of supplies in the event of material defects and faults occurred although the intended use has been observed is 12 months from the reception of products.

The Temposonics liability is limited to repair or replacement for every defective component of the unit. Warranty for defects due to incorrect use or excessive strain of the product as well as for wear parts is excluded. Temposonics rejects any liability for consequences or side effects in case of violation of the warranty provisions**, independent of whether warranty has been assured or expected. This is also applicable in the event of an error or negligence committed by the company. Temposonics explicitly refrains from making any additional warranty promises. Representatives, agents, dealers and members of the personnel are not authorized to increase or change the warranty conditions.

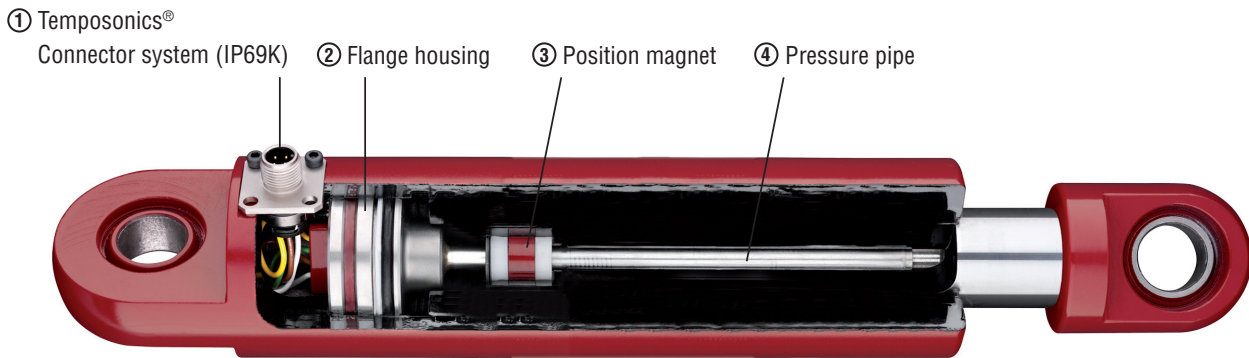
* Qualified personnel means persons who are

- familiar with the projection of safety concepts for automation equipment.
- competent in the field of EMC.
- have been trained adequately for commissioning and service work
- familiarized with the operation of the equipment and know the information required for perfect operation given in the product documentation.

** see Temposonics sales and supply conditions, e.g. available for download from www.temposonics.com

2. Product description and technology

Temposonics® sensors can be used in versatile mobile machines without any restriction and replace contact-based linear sensors like potentiometers. Highly dynamic systems are controlled safely by means of Temposonics® sensors, thus enhancing the productivity, availability and quality of the working process of the machine. Insensitive to vibration, shocks, dust and weathering influence and electro-magnetic disturbances. Temposonics® MH Series sensors are successfully used in front axle and articulated frame steering cylinders, hydraulic jacks and in steering systems for hydraulic units on agricultural and construction machinery.



Simple Mechanics

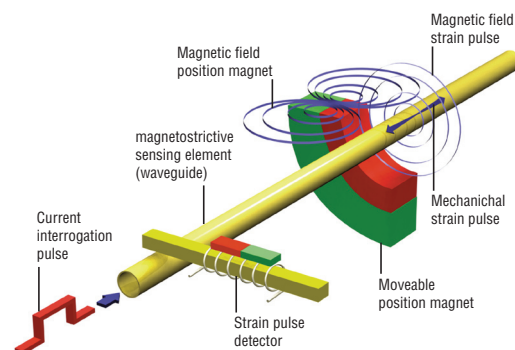
The extremely robust sensor consists of the following main parts:

- ① The innovative connector system which is easy to install in a few seconds, any soldering or crimping needless, dust-and waterproof up to IP69K.
- ② The flange housing with built-in electronics and signal converter.
- ③ The position magnet as only moving part, which is assembled into the piston bottom. This permanent magnet travels wear-free and contactless along the pressure pipe and measures the actual position.
- ④ The pressure pipe placed within the drilled piston rod contains the protected magnetostrictive sensing element.

Magnetostriction

Temposonics® linear sensors are based on the magnetostrictive technology. By measuring the actual position with a non-contact position magnet the sensor operates 100% wear-free. The absolute operating principle enables reliable readings without any reference point or recalibration. A mechanical strain pulse is triggered by the travelling position magnet. The runtime of this ultrasonic wave is measured precisely and compiled into standard electronic output signals.

Measuring principle



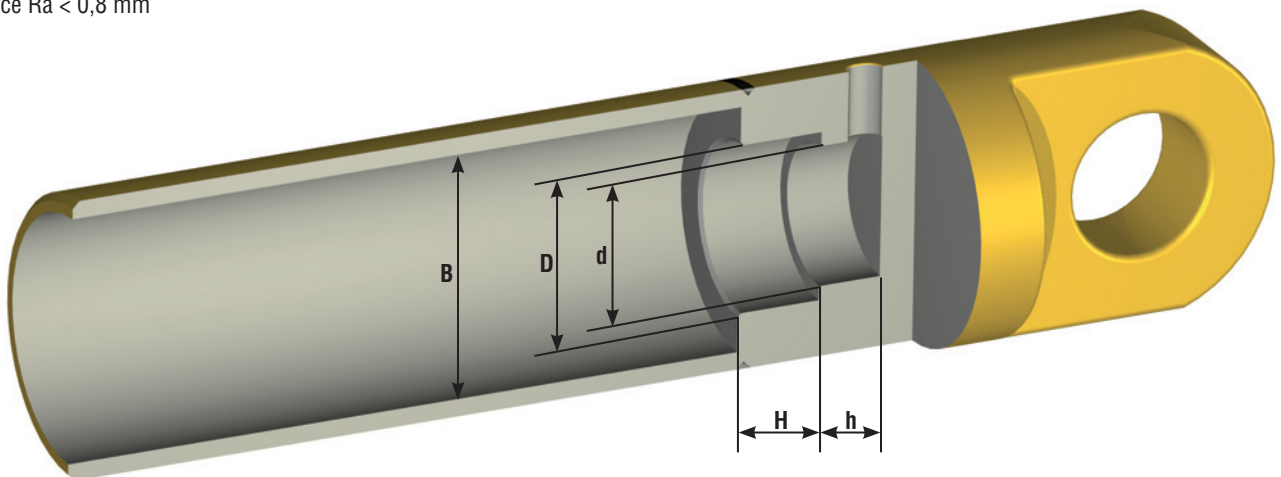
- Due to small dimensions MH sensors require only little space
- Suitable for operating pressures up to 350 bar
- Unaffected by surrounding media such as ageing or foaming oil
- Insensitive to shock and vibration
- Designed for all current supply voltages (12/24 VDC)
- Temposonics® sensors offer all common used output signals:
 - Analog: VDC/mA
 - PWM
 - Bus protocols: CANopen, SAE J1939

3. Space requirements - conditions, design

3.1 Dimensions, tolerances

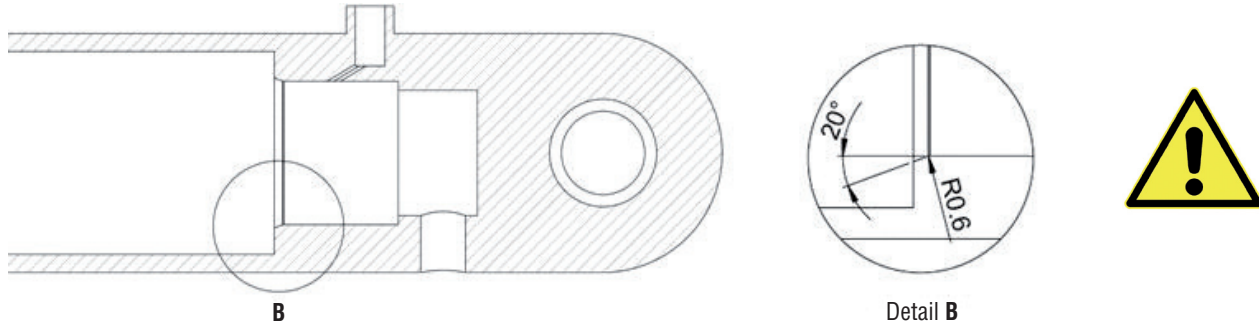
| Type | B Ø cylinder | Installation, housing | | Installation space | |
|------|-----------------|-----------------------------|-------------------------|----------------------|------------------------------------|
| | | D Ø min. | H Depth | d Ø min. | h Depth |
| MS | 32 mm | 28H7 screwed 28G7 welded | 26.8 mm ^{+0.2} | 23.5 mm | < 25 mm |
| MH | 52 mm | 48H8 screwed 48G7 welded | 21.2 mm ^{+0.2} | > 32.5 mm < 40 mm | > 18 mm (cable) > 15 mm (core)) |
| MT | 52 mm | 48H8 screwed 48G7 welded | 39.9 mm ^{+0.2} | 37 mm | > 22 mm |

Surface Ra < 0,8 mm

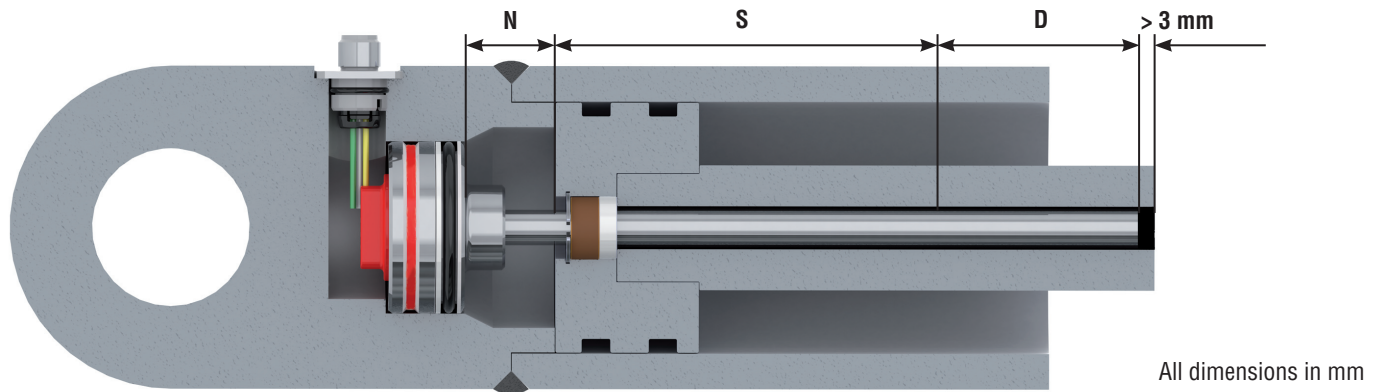


3.2 Chamfered edge for insertion

For correct and easy sensor mounting in the cylinder, a chamfered edge as shown in the drawing is required. To avoid damaging the O-ring during installation, the radius at the transition from borehole to chamfered edge must be R0.6 - R1. Without this radius, there would be a sharp edge, which could damage the O-ring.



3.3 Piston rod bore and depth



| | MH | MS | MT |
|-------------------------|--|-------|-------|
| N = Null zone | 30 mm | 22 mm | 30 mm |
| S = Stroke range | acc. to actual data sheet and selected model no. | | |
| D = Damping | | | |

Declarations in agreement with actual data sheet and selected model no.

The borehole depth is composed of measuring range (S), dampening (D) and a clearance of 3 mm (depth = S + D + 3 mm).

| | ∅ Pressure pipe | ∅ Piston rod |
|-----------|-----------------|-----------------|
| MS | 7 mm | 10 mm |
| MH | 10 mm (7 mm) | 13.5 mm (10 mm) |
| MT | 10 mm | 13.5 mm |

Please pay attention:

- The position magnet shall not touch the pressure pipe.
- Do not exceed operating pressure.

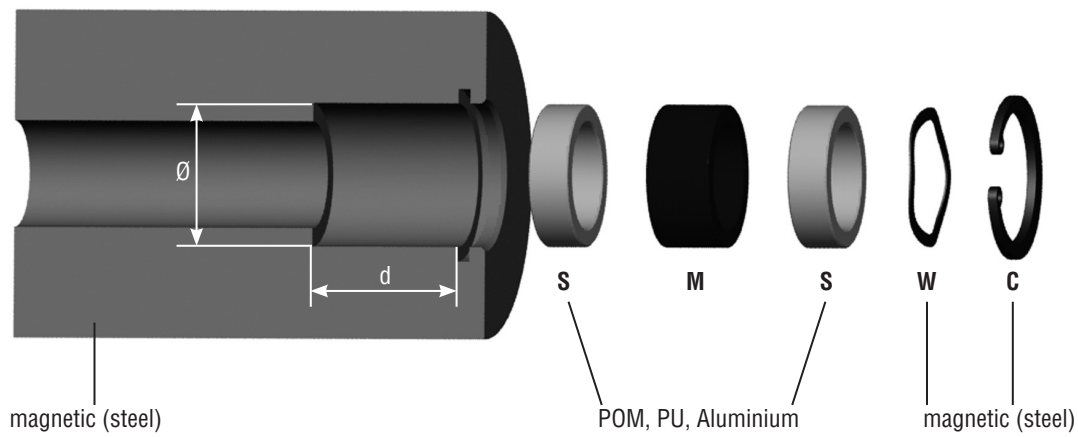
3.4 CAD data, download

CAD models of all Temposonics® MH, MS and MT sensor models are available for download in many commonly used data formats on the Temposonics website (www.temposonics.com). Go to our website, select Europe -> Support -> Login. Send a password request and you will be granted access to the menu for engineering drawings, where you will find the 3-D model configurator for CAD model download.

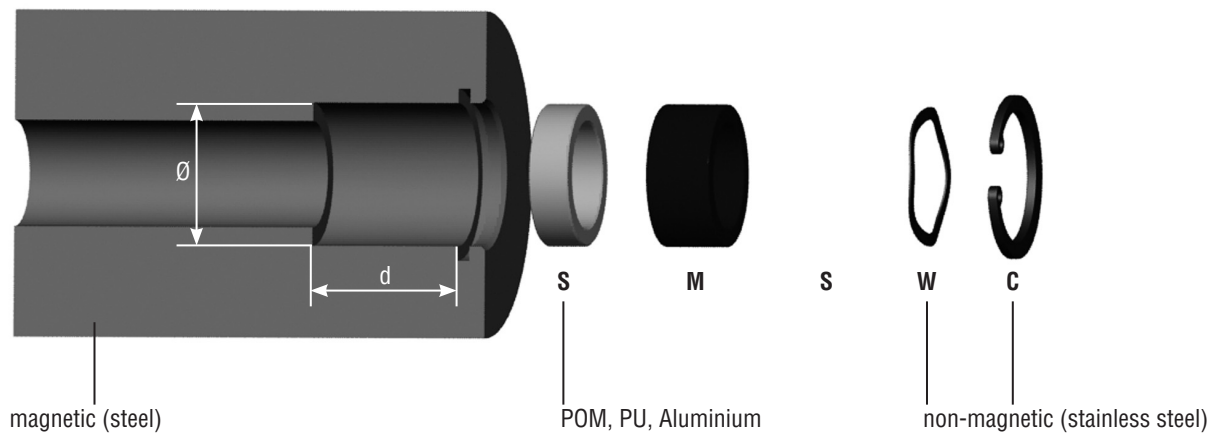
3.5 Installing the magnet

Use only distance washers of non-magnetic materials such as polyamide or aluminum. We recommend securing the magnet by means of a spring washer and a retainer. If these parts are of non-magnetic stainless steel, the second distance washer is not required (see section 3.5.2).

3.5.1 Magnet with 2 distant washers



3.5.2 Magnet with 1 distant washer

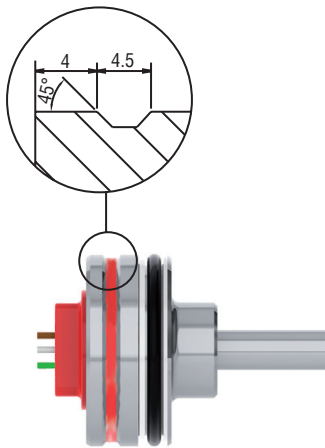


3.5.3 Installing the magnet

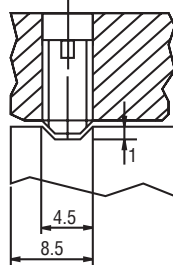
| Description | M Magnet | | |
|-----------------------------------|----------------------------------|----------------------------------|----------------------|
| | 401 032 | 400 533 | 201 542-2 |
| Ø Borehole diameter | 17.5 ^{+0.1} | 25.5 ^{+0.1} | 33 ^{+0.1} |
| d Depth | 13.0 ^{+0.1} | | |
| 1 Distant washer | 18.0 ^{+0.1} | | |
| 2 Distant washers | | | |
| S Distant washer OD x 5 x 13,3 | 17.4 ^{+0.1} | 25.4 ^{+0.1} | 33.0 ^{+0.1} |
| M Magnet | 17.4 x 8 x 13.5 | 25.4 x 8 x 13.5 | 33.0 x 8 x 13.5 |
| W Corrugated washer | OD: 16.5 - 17.4 ID: 13.5 - 14 | OD: 24.5 - 25.4 ID: 13.5 - 14 | 4 x M4 1 Nm |
| C Circlip | DIN 472 - 18 x 1 | 25 x 1 | 4 x M4 1 Nm |

3.6 Safety screw to DIN 913

For MH and MT sensors, an M5x10 set screw to DIN 913 with flat point should be used. This safety screw is only required for blocking the sensor housing in axial direction and needs to butt only against the groove, i.e. the screw may be tightened only with a max. torque of **0.5 Nm** to prevent damaging the sensor. The set screw should be inserted with a resolvable safety adhesive, e.g. **Loctite blue**.



Detail housing

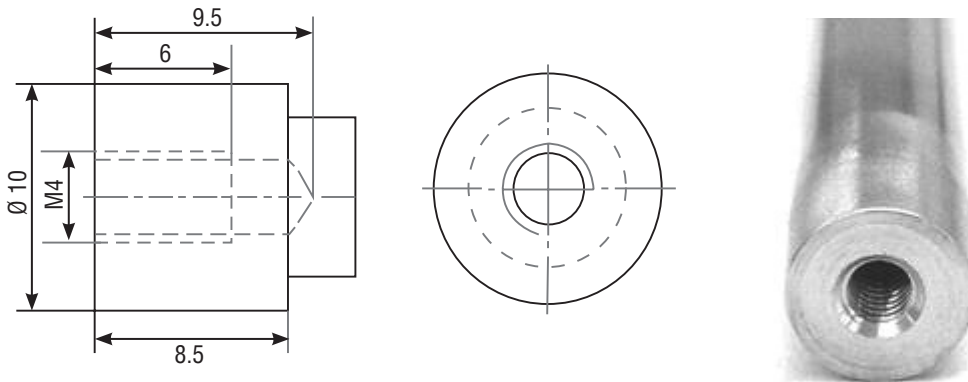


Detail safety screw

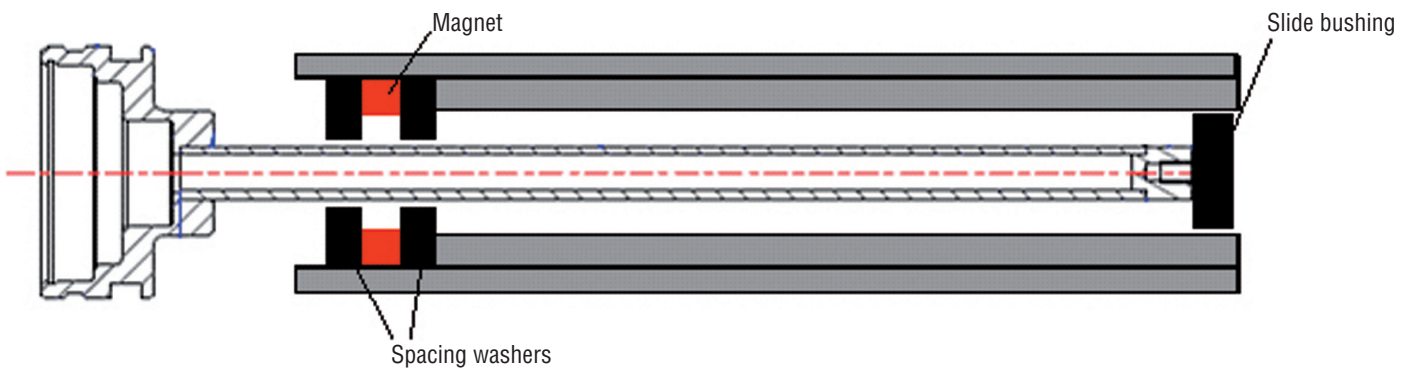
3.7 Supporting long sensor pipes, sagging

From a sensor measuring length of 1500 mm, the weight of the sensor can cause sagging of the sensor rod in horizontal cylinder mounting position. Sagging does not affect the sensor function, since the sensor pipe is damped by the surrounding oil and lubricated when contacting the piston rod. Generally, however, the following measures can be taken with long sensor rods:

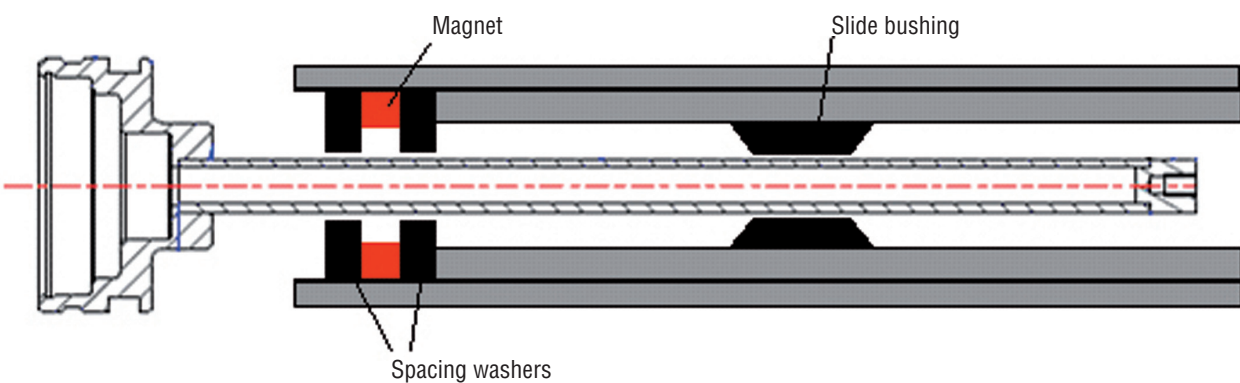
Install a slide bushing at the end of the sensor rod (right figure). The pressure pipe is provided with a threaded port at the end. For assembling and fixing the pressure pipe use corresponding screws. The maximum tightening torque for screws is 2.5 Nm (the screw property class must be taken into account).



Spacing washers should be of non-magnetic, sliding material (e.g. polyamide) and dimensioned so that the inside diameter is smaller than the one of the position magnet. A smaller inside diameter prevents the sensor rod from touching the magnet, thus protecting it against wear (see figures).



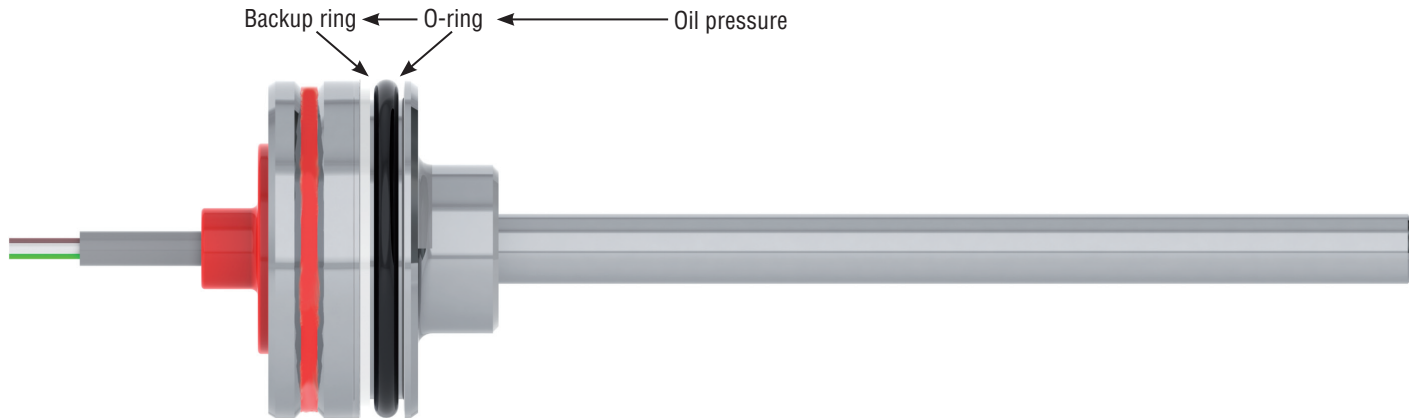
Another possible way to prevent the sensor rod from sagging is using slide bushings of non-magnetic material in the piston rod (see figure).



4. Mounting

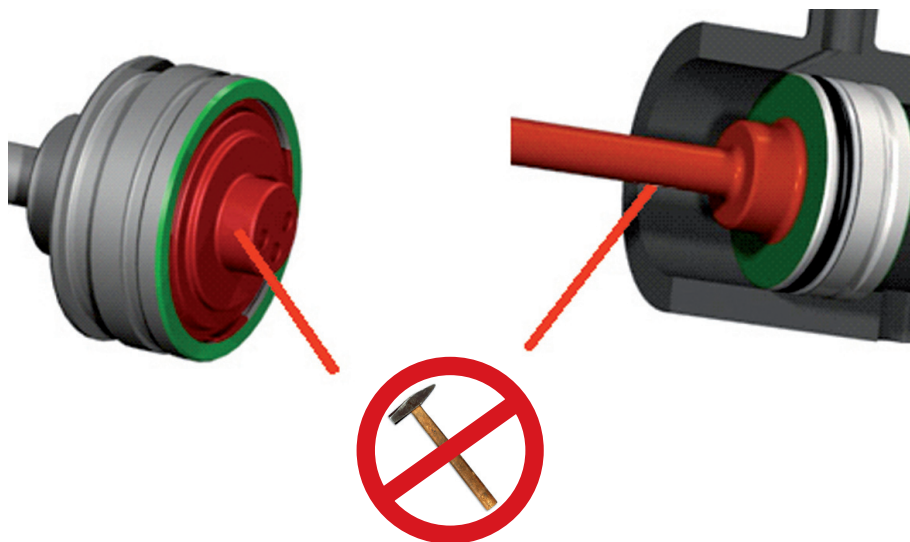
4.1 Positioning of O- and backup rings

O-ring and backup ring have been fitted at the factory as shown in the figure.



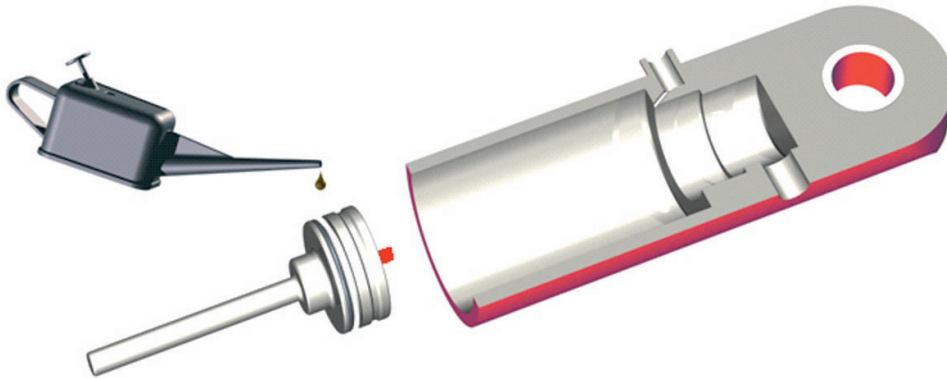
4.2 Load-bearing geometries of sensor housings

Only the surfaces marked in green may be loaded when mounting the sensor in the cylinder.
Surfaces marked in red must not be subjected to any forces or even hammer strokes.

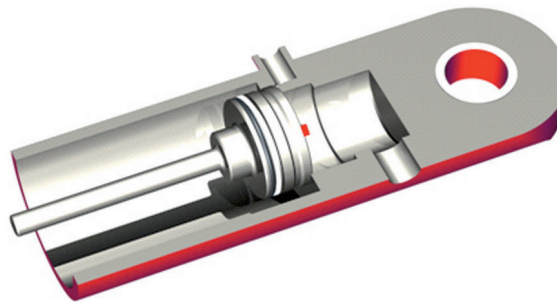


4.3 Mounting in the cylinder

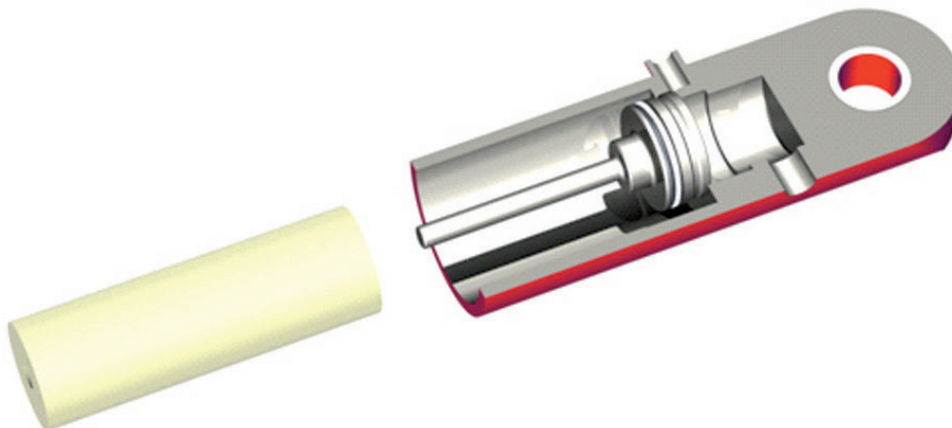
Lubricate O-ring and backup ring before mounting in the cylinder.



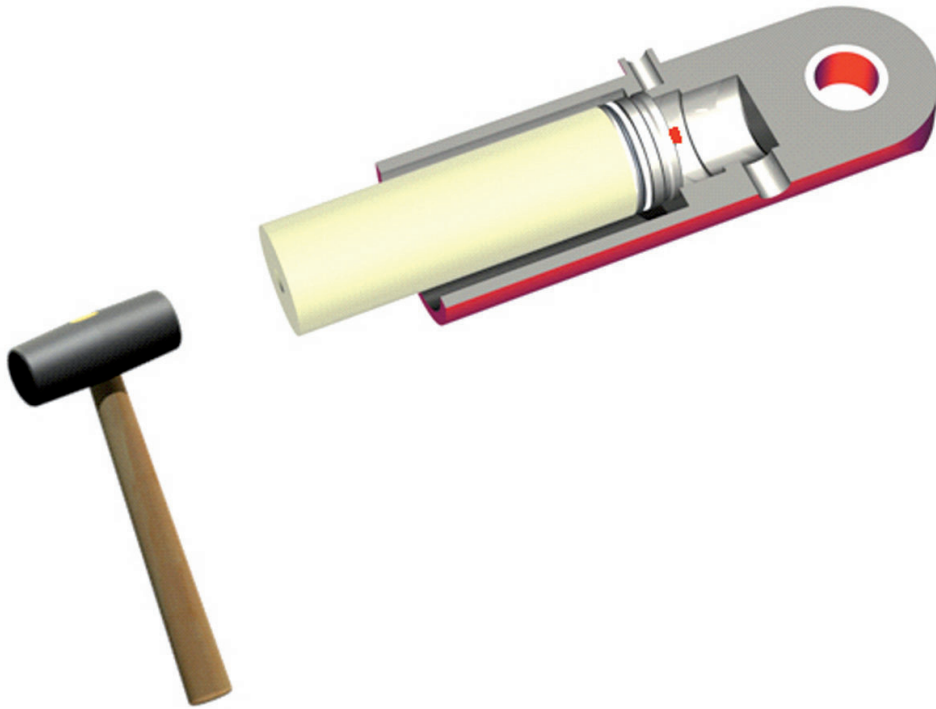
Push the sensor into the seat carefully. **Make sure that conductors or cables are not under strain.**



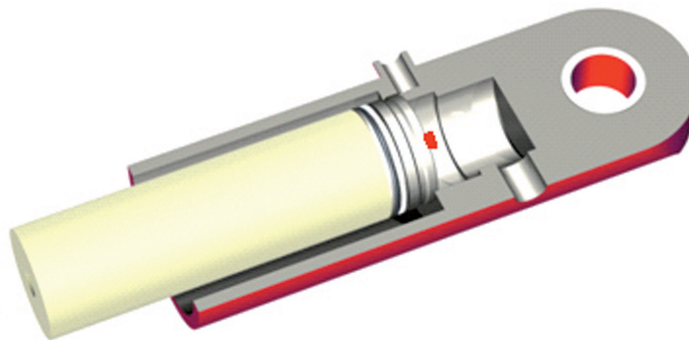
Use an individually prepared bush (e.g. polyamide) to press the sensor into the seat.



If necessary, use only a **rubber mallet** to hammer the sensor in position carefully.

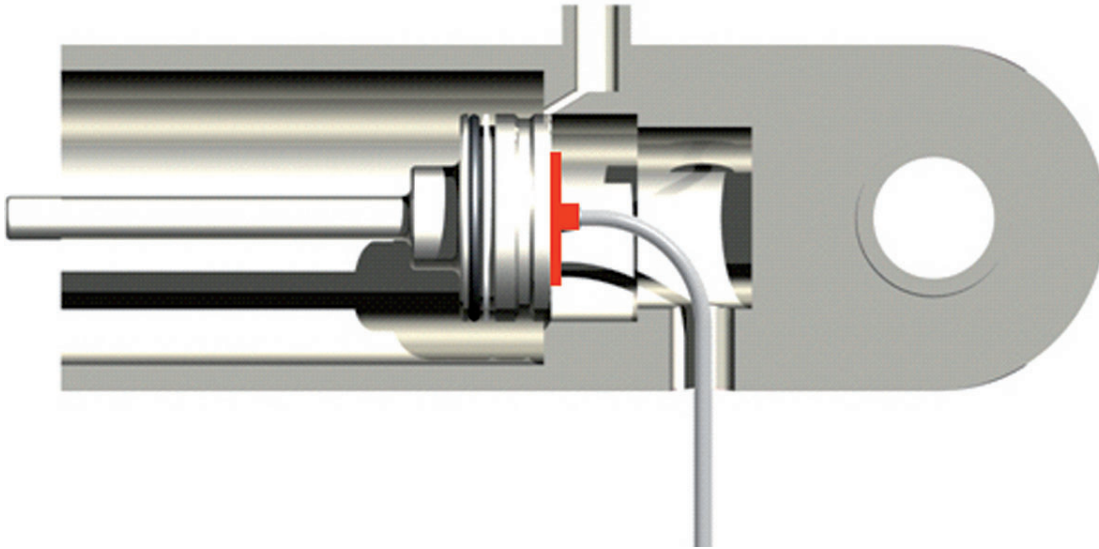


Never use a steel hammer. Don't subject the sensor and the tools to hard strokes during installation.

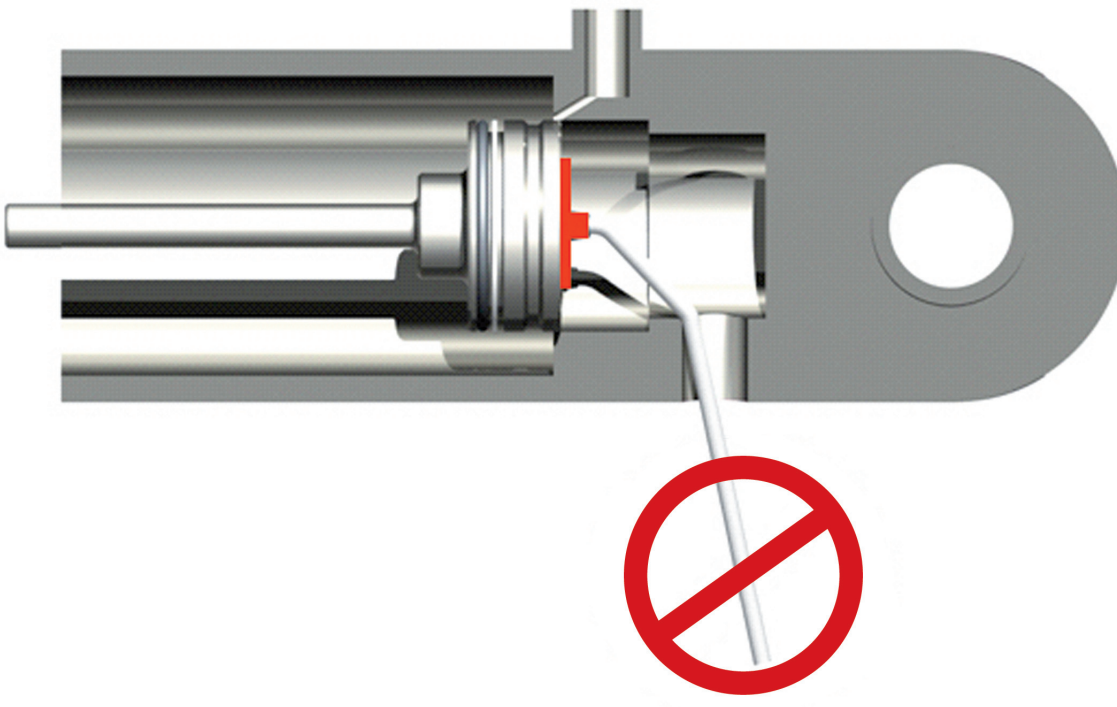


4.4. Handling connecting cables during mounting

When mounting, take the connecting cables through the cylinder wall carefully. **Avoid tensile stress acting on the connecting cable.**



Never expose the connecting cable to tensile stress and protect it against sharp edges, which might damage the insulation of the connecting cables!



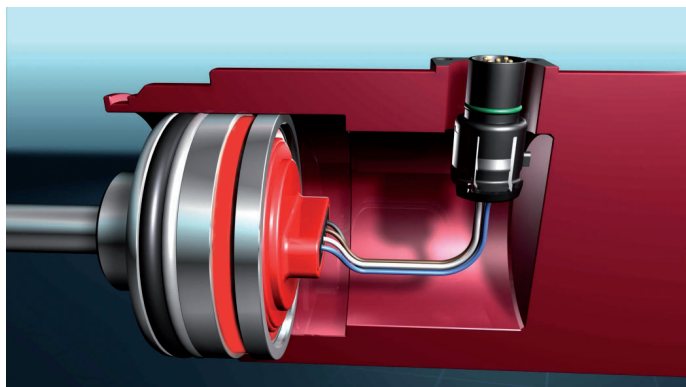
4.5 Mounting sensors using a Temposonics® M12 connector system

The Temposonics® M12 connector system is connected to the sensor and ready for installation. After installation in the cylinder and inserting the mating plug, it meets the high requirements of protection class IP68 and IP69K. Soldering, screwing or crimping is not necessary. The risk of contact faults, corrosion of contacts and faulty connection is also omitted. When you select suitable mating plugs, make sure that these plugs are also protected to IP68 or IP69K, because this protection class can only be ensured if suitable mating plugs are used.

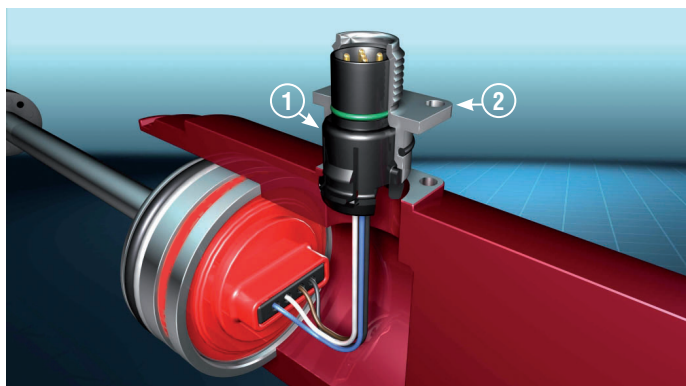
Dimensions (see Annex)

4.6 Mounting in the cylinder

Introduce the contact carrier (black plastic part) through the cylinder wall carefully. Make sure to keep the conductors away from sharp or pointed edges.

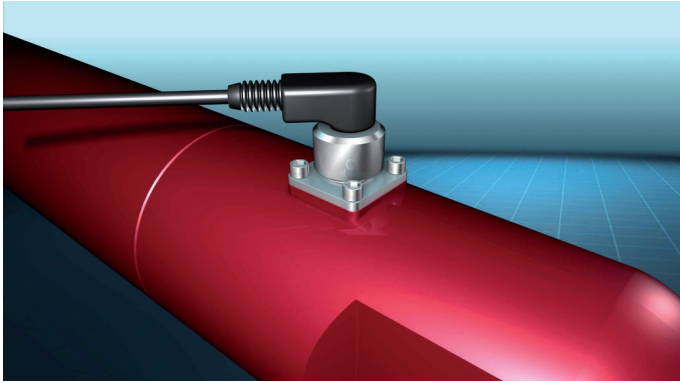


Insert the contact carrier into the flange plate and click it in position. Note the nose of the contact carrier and one of the two apertures of the flange connector, since the contact carrier can be inserted also at an angle of 45°.



- ① Contact support for snapping into 2 staggered positions, at an angle of 45° to the flange plate
- ② Flange plate in 4 positions staggered by 90°, for screw mounting

Apply lubricant for O-rings and press the flange plate into the borehole in the cylinder wall. Fasten the flange plate using screws or rivets according to the list given below. **The dimensions of screws for mounting the flange plate should be selected so that they don't collide with the lock nuts of the connected mating plugs.**



Recommended M4 cylinder head screws with pan head, max. diameter 7mm:

- Hexagon socket head cap screw to DIN 912
- Hexalobular socket cylinder head screw to ISO 14580
- Slotted screw to DIN 84
- Comparable cross-head screw
- Comparable thread-forming screws

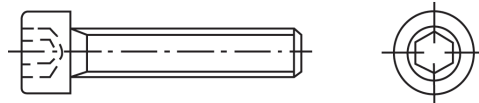
Screws should be inserted using resoluble safety adhesive. Alternatively, mounting can be done using a round head rivet to DIN660.

Non-recommended screws:

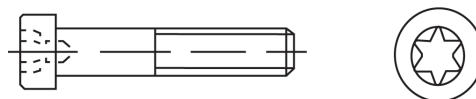
- Hexagon head screws
- Countersunk head screws
- Self-tapping screws

Recommended cylinder head screws:

Hexagon socket head cap srew



Torx screw:



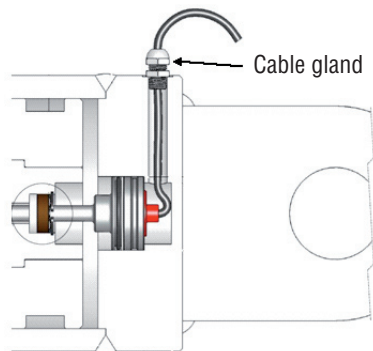
Slotted screw



4.7 Mounting sensors with cable or single conductor connection

Temposonics® sensors are protected according to IP67 (MH) or IP65 (MS, MT). To further minimize the ingress of water into the sensor housing, important aspects should be taken into account when sealing the sensor as well as the cable or conductor connection.

4.7.1 Mounting sensors with cable connection and cable gland



Sensors with cable connection should be mounted using an (ideally metal) IP68 cable entry gland for sealing and strain relief. Make sure that strain relief is provided in the further cable run.

When using **third-party connectors** with Temposonics® sensor cables, the following conditions must be met:

- The connector protection type should be at least IP68.
- The connectors should enclose also the cable sheathing, in order to prevent exposed conductors and to provide strain relief. Otherwise the conductors are not sufficiently protected against external effects.
- Unless the cable sheathing is enclosed by the connector, water running along the cable can enter the cable at the point where the sheathing has been stripped.
- If the cable sheathing is not enclosed by the connector, gasket material should be applied to the point at which the sheathing has been stripped, in order to preclude the ingress of water.
- Make sure that the polarity is correct.
- For connectors with screw terminals, cable end sleeves should be used to avoid short circuiting.
- If connectors are equipped with solder contacts, make sure that the contacts are soldered correctly.
- Crimp contacts on connectors should be gas-tight and pressed only using suitable tools, because this is the pre-requisite for precluding contact defects due to corrosion.
- When mounting connectors, make sure protection against ESD is provided, i.e. workplaces and personnel must be protected against electrostatic charging.
- Cable glands should be protected against damage by surrounding steel profiles (e.g. U-steel)

4.7.2 Mounting sensors with single conductor and third-party connector

When mounting third-party connectors on sensors with single conductors, the following information should be taken into account:

- The connector protection type should be at least IP68. Make sure O-rings are fitted correctly.
- The connector housing should be completely of metal. Plastic connectors can be damaged easily, thus tightness is not ensured.
- Make sure that the polarity is correct.
- For connectors with screw terminals, cable end sleeves should be used, in order to prevent short circuiting and contact corrosion.
- End sleeves should be pressed onto the conductors in a way that all strands are clamped into the sleeve. Protruding strands can cause short circuiting!
- If connectors are provided with solder contacts, ensure that the contacts are soldered correctly and that no strands stand proud.
- Crimp contacts should be gas-tight and pressed only using special crimp tools. This is the pre-requisite to preclude corrosion of contacts.
- Most commercially available connectors are not or not sufficiently protected against the ingress of water running along the cable. For this reason, suitable caps should be fitted to close them after mounting.
- When mounting connectors, make sure protection against ESD is provided, i.e. workplaces and personnel must be protected against electrostatic charging.

5. Cylinder handling after sensor installation

5.1 Washing and drying cylinders with installed sensors

Frequently, hydraulic cylinders are washed or degreased before painting. For this purpose, various chemical and/or thermal methods are used, whereby cleaning agents are sprayed onto the components under high pressure up to 50 bar. During this procedure, the following measures relating to polyurethane (PUR) connecting cables and plug-in connections must be taken.

5.1.1 Sensors with Temposonics® M12 connector system



IP69 K

- When washing at low pressures up to approx. 5 bar, the plastic cap supplied with sensor and connector system is sufficient to protect the M12 connector system (Temposonics material number GZ0605).
- When washing at higher pressures, an M12x1 metal protective device should be used to protect the connector system against the effect of chemicals.
- The actual Temposonics connector system won't be damaged due to its high protection class, however, mating plugs which are connected subsequently might corrode due to the effect of chemicals.
- If temperatures higher than 105° C are used for drying after washing, the connector systems should not be exposed to this temperature during more than about 5 minutes.

5.1.2 Sensors with connecting cable



IP67

- Protect the connecting cables using suitable enclosures (e.g. bags) against the effect of moisture, high pressures and temperatures.
- Normally, cable entry glands meet the requirements of IP 67, however, they are not pressure-tight. For this reason, they must be protected against moisture as well, in order to prevent moisture from accumulating in the connecting compartment of the cylinder.
- Temposonics connecting cables are made of PUR and relatively resistant against a large variety of chemicals and oils. However, exceptions are e.g. carbon tetrachloride, trichloroethylene, perchloroethylene, which can be ingredients of fat solvents and cleaning agents.
- Therefore, make sure that cables are protected adequately, if cleaning agents that can attack PUR are used.
- If temperatures higher than 105° C are used for drying after washing, the connecting cables shouldn't be exposed to this temperature during more than 5 minutes.

5.1.3 Sensors provided with third-party connectors



IP67

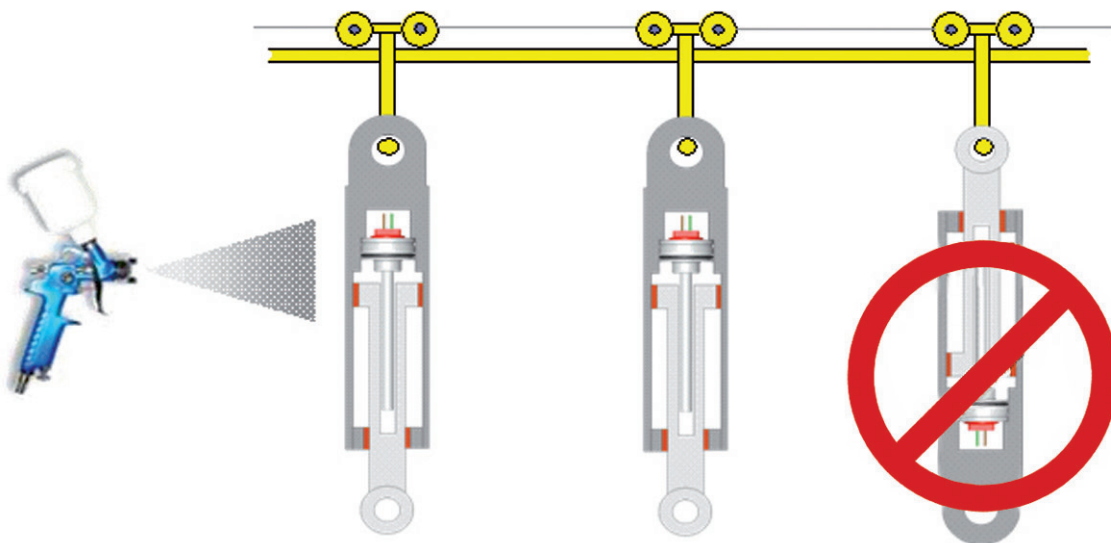
- If third-party connectors are used, a sealed screw cap must be fitted when washing, since third-party connectors normally have only protection class IP67.
- Moreover, check if the housing of the third-party connector is sufficiently tight to resist high pressures when washing. If necessary, measures for protection of the housing should be taken.
- These connectors must be protected against the ingress of moisture as well to prevent moisture from accumulating in the connecting compartment of the cylinder.
- If temperatures higher than 105°C are used for drying after washing, third-party connectors shouldn't be exposed to this temperature during more than 5 minutes either.

5.2 Painting cylinders

5.2.1 Electrostatic painting

Sometimes, various dry and wet methods implying the application of paint to the component surface using electrostatic charge to paint cylinders are used. These methods employ very high voltages up to 100 kV, which can damage the electronics of Temposonics® position measuring systems. To prevent this damage, it is mandatory to take the following measures during electrostatic painting.

- Attach the cylinder to the painting frame by the foot side of the cylinder rather than by the piston rod. The reason is that the integrated sealing and slide rings can cause electric isolation between the piston rod and the cylinder/sensor housing, i.e. low-impedance connection between the painting equipment ground and the sensor housing is not ensured.
- Clean the suspension points at the painting system and all connections used for short-circuiting conductors and connection to the painting system ground regularly and remove paint as well as other residues, in order to ensure low-impedance connection.



5.2.2 Cylinders with integrated sensors and Temposonics® M12 connector system

When using dry or powder painting methods for cylinders, powder is applied to the component surface by means of static charge. These methods employ very high voltages that can damage the electronics of Temposonics® position measuring systems integrated in the cylinders. This can be prevented using the following metal protective caps.

The metal protective cap safeguards the contact pins and thus the electronics of the sensor against electrostatic effects (high voltage). It is important to note that:

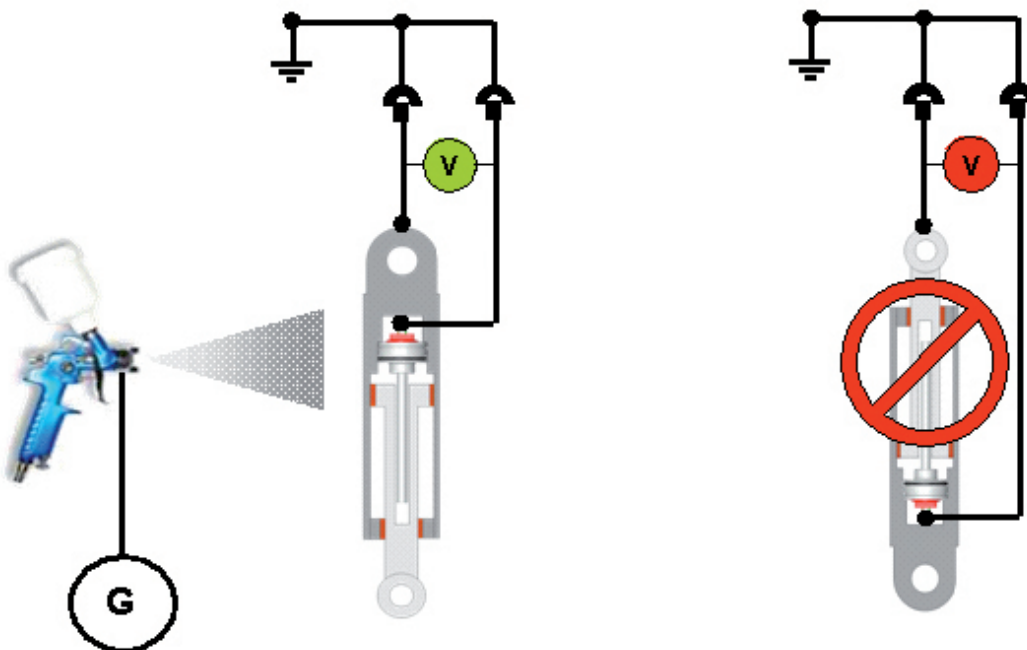
- The material of the protective cap must be permanently electrically conducting.
- The cap must not be of aluminum (aluminum is subject to oxidation and can cause electric isolation).
- The metal protective cap must have an M12x1 thread.
- The cap must be screwed up to the connector flange plate.
- Make sure that no paint particles contaminate the thread or the contact pins.
- The thread of the protective cap must be clean and free from paint particles and other substances at all times.
- The metal protective cap must be tightened only so that it is hand-tight (max 5 Nm).
- Paint particles on the cap outside are uncritical.

Drawing examples for the protective cap are given in the attachment.

5.2.3 Cylinders with integrated sensors and connecting cables or third-party connectors



Electrostatic painting cannot be used for sensors with connecting cables, since the cable cannot be protected safely against the high process voltage. Safe electrostatic painting is ensured only in conjunction with the Temposonics M12 connector system and the brass caps shown in chapter 7.6.



Suspended from the cylinder foot - no potential formation between sensor housing and sensor connections

Suspended from the piston rod – high potential (high voltage) between sensor housing and connecting cable possible

6. Transport, intermediate storage


When transporting the cylinders, make sure that the cables and connectors are not under tensile stress. When handling/storing carelessly, connectors and cables can be squeezed easily between stacked cylinders.

Moreover, it is necessary to encapsulate the connections or exposed cable ends using an antistatic bag. For this, the original bags (Temposonics material number V0108) can be re-used. Furthermore, it is important to re-fit the white dust protective caps (Temposonics material number GZ0605) on the Temposonics IP69K connector system after installation of the connector. The cylinders storage conditions should be as dry as possible.

6.1 Mounting/dismounting cylinders on mobile hydraulics machines

As during transport, connectors, cables and cable ends should be protected sufficiently during mounting and dismounting. Cables and conductors must be neither subjected to load or tensile stress, nor bended. When connecting cables are installed, make sure that the insulation is not damaged by sharp edges.

6.2 Electrical and electrostatic effects

 **Insulation tests**
Part of the tests performed on mobile machines can be insulation tests. These tests are intended to determine the dielectric strength of the cables against the housing (insulation resistance) using high voltages. During these tests, all sensor cables must be disconnected, otherwise stray voltage over the sensor protective circuitry against ground can damage these components and cause sensor failure.

Welding

After installation of the cylinders in machines, welding work on adjacent components may be necessary. If the grounding tong is applied too closely to or even directly on the cylinder, welding currents can be transmitted to the sensor via the cylinder, which can cause melting of the sensor pipe or damage of internal sensor components.

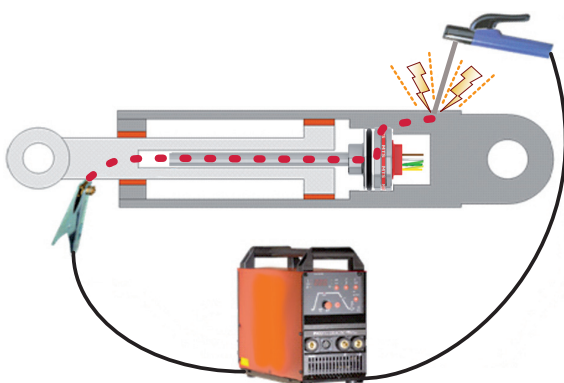
Cylinders mostly consist of two assemblies: the lower part with the cylinder pipe (Figure, shown in dark gray) and the piston with the piston rod (light gray).

These components are isolated electrically from each other by gaskets, bearings and slide rails, i.e. normally, no current flow is possible.

With long sensors, however, the sensor pipe can sag due to its own weight and touch the wall of the piston rod borehole. In this case, there is an electric connection. The entire welding current flows through the sensor pipe and the sensor head and damages the electronics.

Therefore, the instructions given below must be followed:

- Cut or disconnect all sensor connections during welding.
- Never fasten the grounding point at the piston rod or at the cylinder pipe.
- Never weld on a part of the cylinder, if a sensor has been installed.
- Never perform welding work near a cylinder, if a sensor has been installed.
- Due to insulating bearings, plastic slide bearings or grease in the contacts points, electric potentials can build up at every bearing point of machines. Accordingly, similar effects as on hydraulic cylinders.



As a rule:

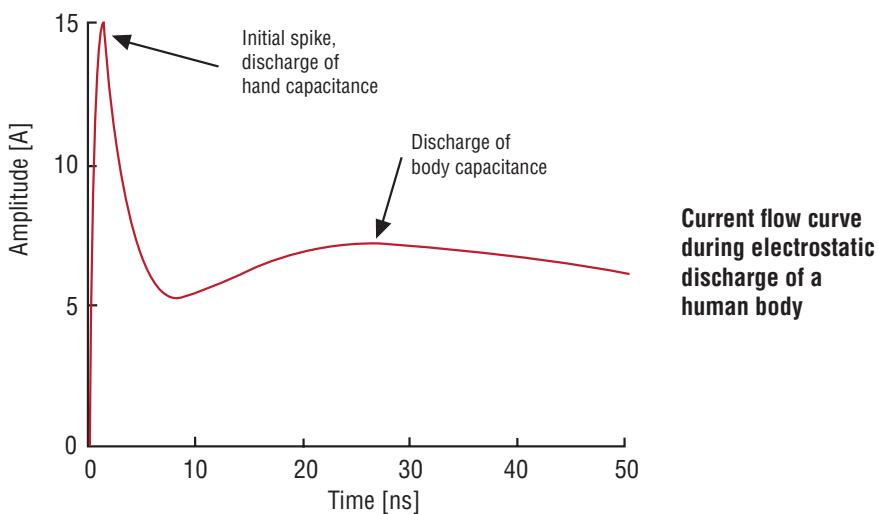
Don't perform welding work on the cylinder!

6.3 Electrostatic effects

Electrostatic charge is caused due to friction and separation of charge. This phenomenon is widely known and can be produced e.g. by carpets or car seats. Mostly, the charge is noticed only in the event of discharge, when the associated „shock“ occurs. The voltages due to electrostatic discharge can have very high values, for example:

Walking over carpet floors up to 30,000 V
 Walking over synthetic floors up to 12,000 V
 Moving at the workplace up to 6,000 V

Not only the high voltages, but especially the sudden discharge and related currents (up to 50 Ampère!) can cause destruction of electrical components. The effects are similar to those occurring due to electrostatic discharge during dry painting (see also chapter 7.1).



To avoid electrostatic discharge, workplaces and persons working with or on electronic components must be earthed.

Suitable protective measures are:

- Persons wear ribbons connected to the grounding point by means of spiral cable around their wrist.
Please, contact us, if you need information on suppliers for suitable protective equipment.
- Work is only performed on diverting material, i.e. charges can be diverted gently (e.g. work plate of wood rubber, ESD foam material).
- Avoid hard discharge. Don't deposit components on metal plates or metal film.
- Don't remove electrostatically sensitive components from the packaging without grounding.
- Caution when cutting adhesive tapes, don't tear to open.

7. Drawings

7.1 Dimensions of Temposonics® MH Sensor with M12 connector (901490)

Please pay attention to actual data sheets!

Model no. MH Digital (5 pin) example

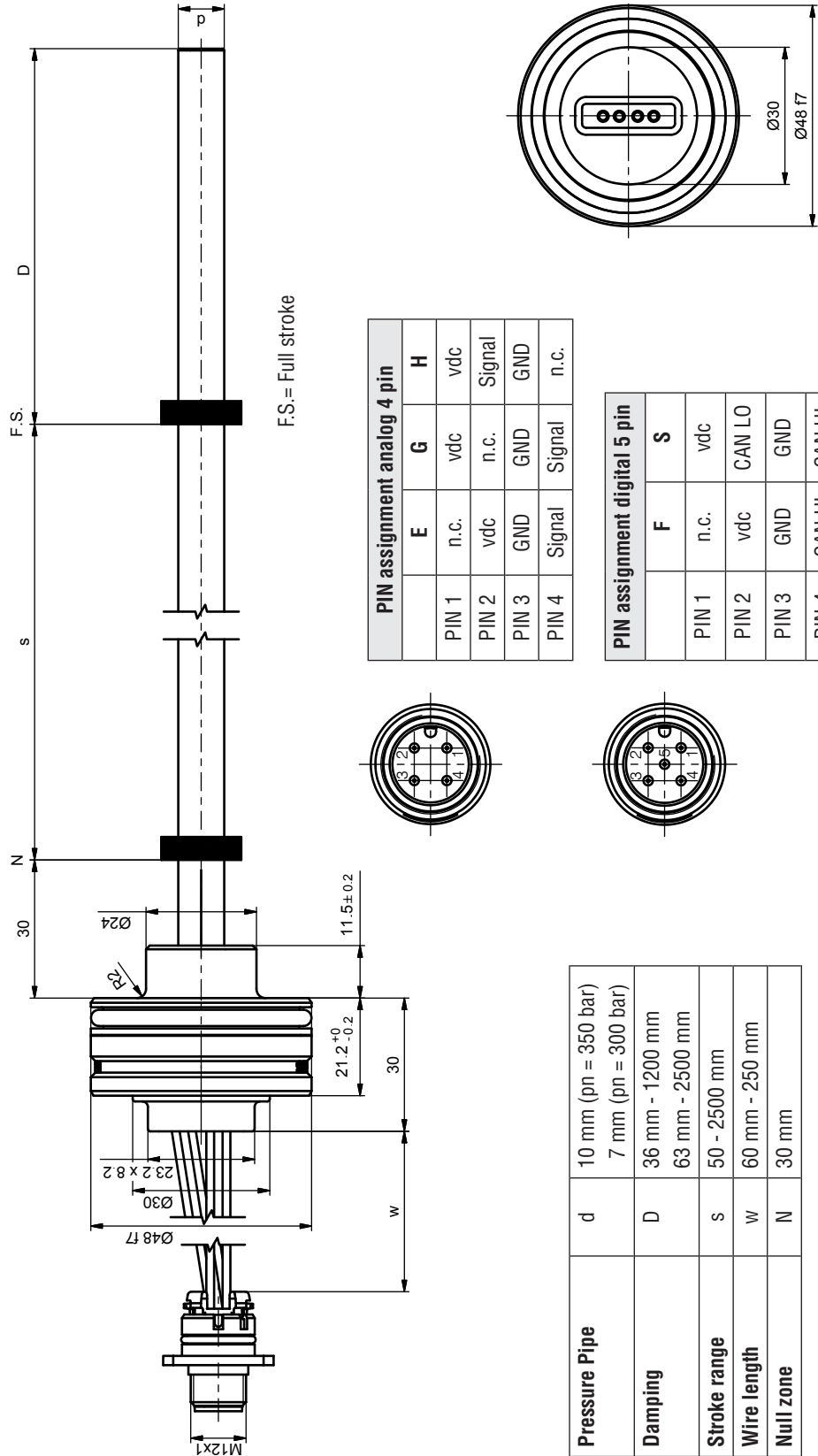
MH **C** - **s** **M-N** **w** **F** - **3** - **C01** - **3** - **7F**
D **E** **F** **R** **S** **J01** **S01** **3** **2** **40**

Model no. MH Analog (4 pin) example

MH **C** - **s** **M-N** **w** **E** - **3** - **A01**
D **E** **F** **R** **S** **G** **H** **V11** **V12**

Model no. MH Agri

MH **V** - **s** **M-N** **w** **G** - **2** - **V11**
H **V12**



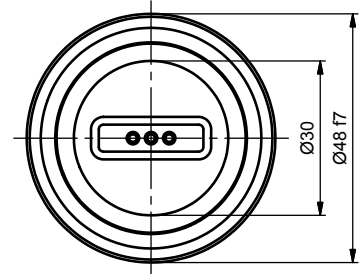
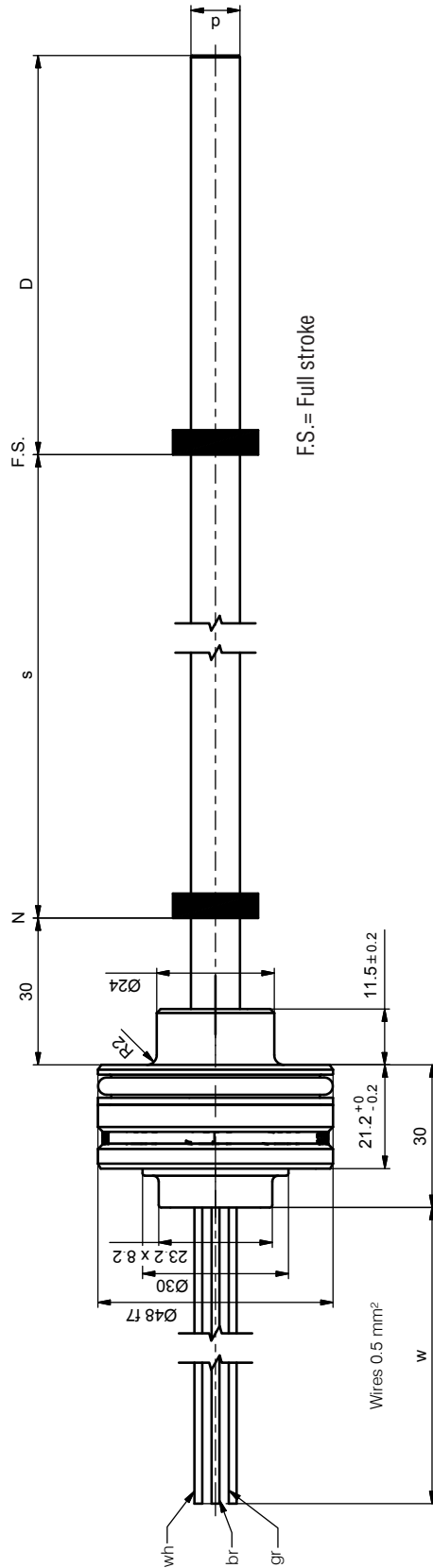
| | | |
|----------------------|---|---|
| Pressure Pipe | d | 10 mm (pn = 350 bar) 7 mm (pn = 300 bar) |
| Damping | D | 36 mm - 1200 mm 63 mm - 2500 mm |
| Stroke range | s | 50 - 2500 mm |
| Wire length | w | 60 mm - 250 mm |
| Null zone | N | 30 mm |

All dimensions in mm

Dimensions of Temposonics® MH Sensor with single wires (901489)

Model no.

MH **C** - **s** **M-N** **w** **A** - **3** - **A01**
D **E** **F** **R** **S**
V11
V12



| Wire assignment | |
|-----------------|--------|
| BN | VDC |
| WH | GND |
| GN | Signal |

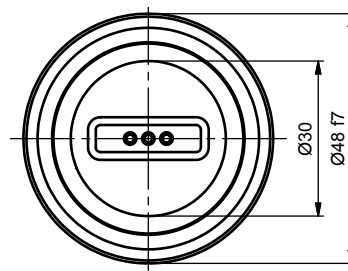
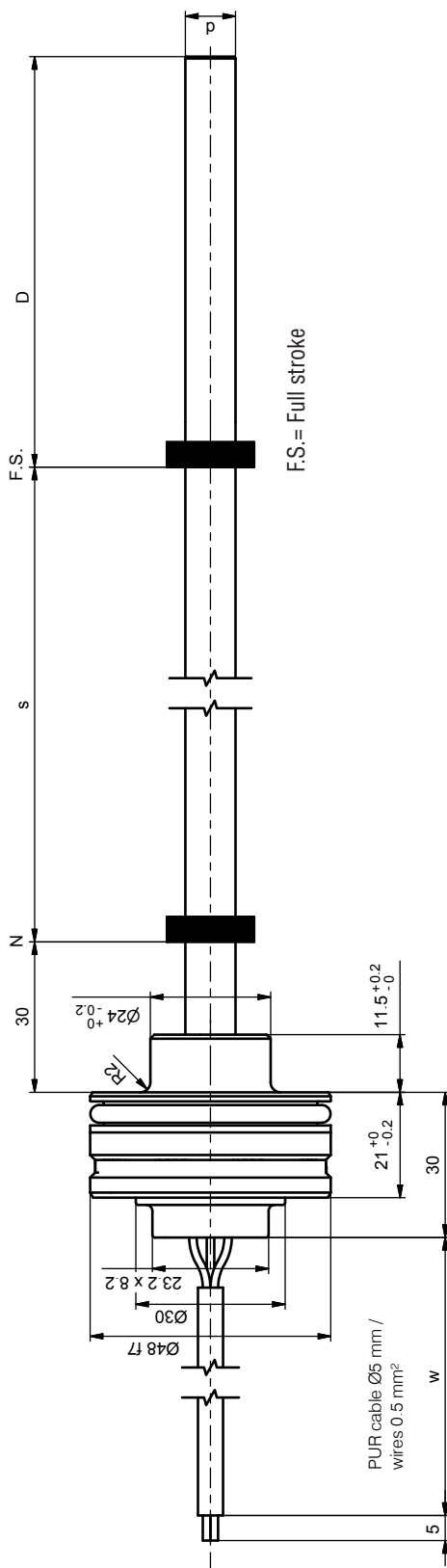
| Pressure Pipe | d | 10 mm (pn = 350 bar) 7 mm (pn = 300 bar) |
|---------------|---|---|
| Damping | D | 36 mm - 1200 mm 63 mm - 2500 mm |
| Stroke range | s | 50 - 2500 mm |
| Wire length | w | 60 mm - 250 mm |
| Null zone | N | 30 mm |

All dimensions in mm

Dimensions of Temposonics® MH Sensor with cable (901500)

Model no. MH **C** - **s** **M-T** **w** **A** - **3** - **A01**
D **E** **F** **R** **S**
V11
V12

Model no. MH Agri MH **V** - **s** **M-T** **w** **A** - **2** - **V11**
V12

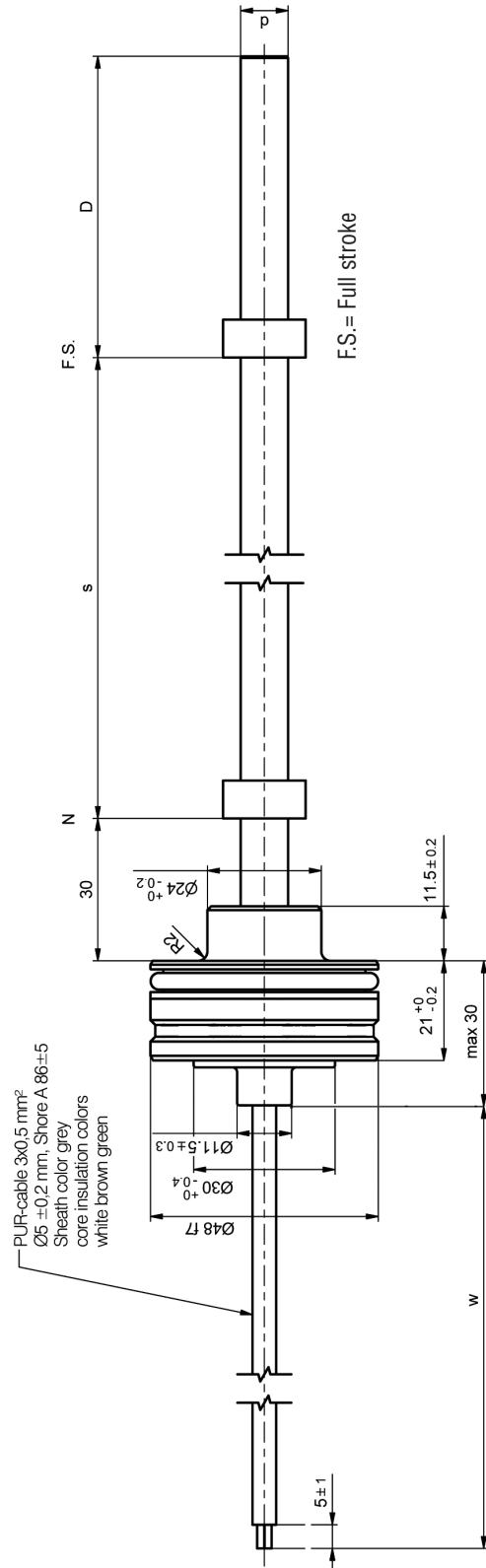


| Wire assignment | |
|-----------------|--------|
| BN | VDC |
| WH | GND |
| GN | Signal |

| | | |
|----------------------|------------------|---|
| Pressure Pipe | d | 10 mm (pn = 350 bar) 7 mm (pn = 300 bar) |
| | Damping | D |
| Stroke range | s | 50 - 2500 mm |
| Wire length | w | 300 mm - 5000 mm |
| | Null zone | N |

All dimensions in mm

Dimensions of Temposonics® MH Sensor with cable (till 03.2011), (901501)



| Wire assignment | |
|-----------------|--------|
| BN | VDC |
| WH | GND |
| GN | Signal |

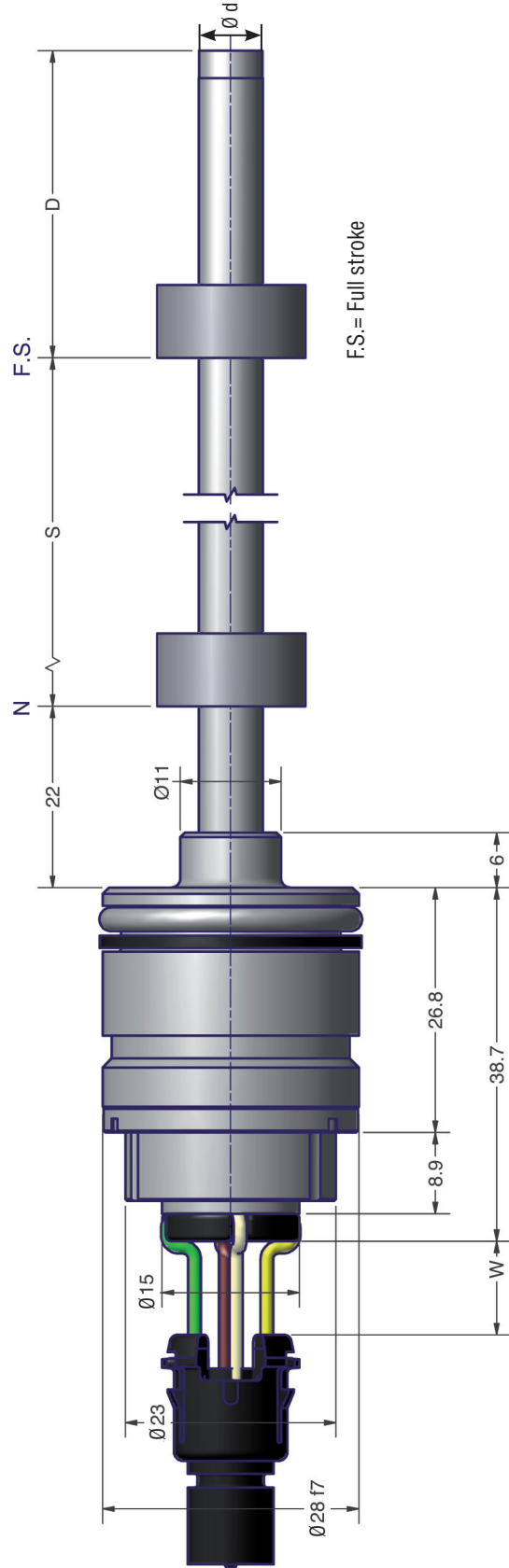
| | | |
|---------------|---|---|
| Pressure Pipe | d | 10 mm (pn = 350 bar) 7 mm (pn = 300 bar) |
| | D | 36 mm - 1200 mm 63 mm - 2500 mm |
| Stroke range | s | 50 - 2500 mm |
| Wire length | w | 300 mm - 5000 mm |
| Null zone | N | 30 mm |

All dimensions in mm

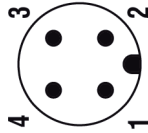
7.2 Dimensions of Temposonics® MS Sensor with M12 connector

Model no.

MS **D** - **s** - M - N - **w** - **E** - 3 - **A01**
 F **G** **H** **V11**
 V12



| | | |
|---------------|---|---------------------|
| Pressure Pipe | d | 7 mm (pn = 300 bar) |
| Damping | D | 36 mm - 1200 mm |
| | s | 63 mm - 2500 mm |
| Stroke range | w | 50 - 2500 mm |
| Wire length | N | 60 mm - 250 mm |
| Null zone | N | 22 mm |

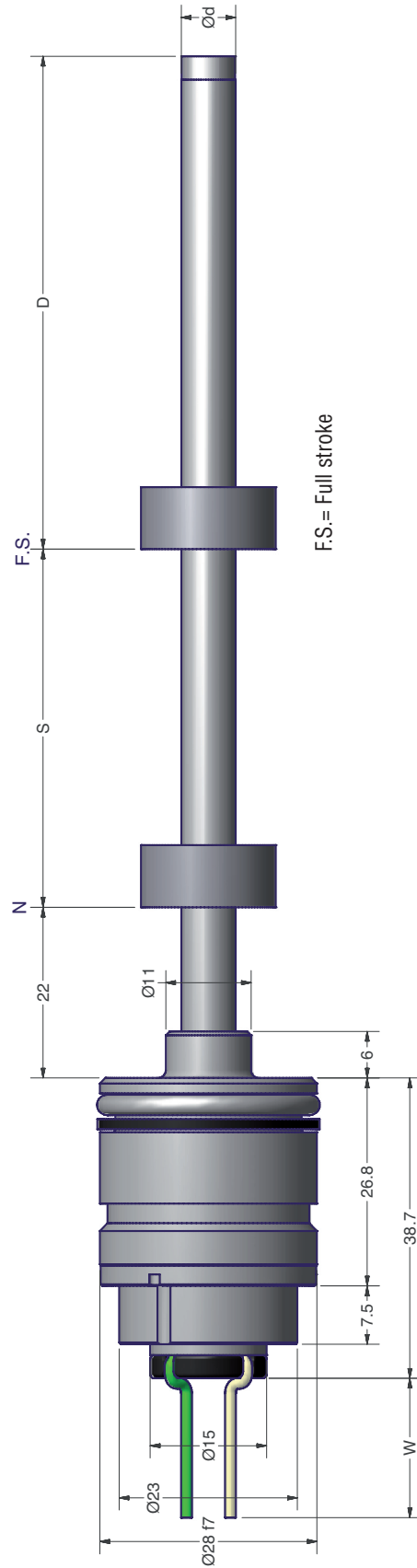


| PIN assignment analog 4 pin | | | |
|-----------------------------|--------|--------|--------|
| | E | G | H |
| PIN 1 | n.c. | vdc | vdc |
| PIN 2 | vdc | n.c. | Signal |
| PIN 3 | GND | GND | GND |
| PIN 4 | Signal | Signal | n.c. |

All dimensions in mm

Dimensions of Temposonics® MS Sensor with single wires

Model no.
MS **D** - **s** - **M** - **N** - **w** - **A** - **3** - **A01**
F **V11**
V12



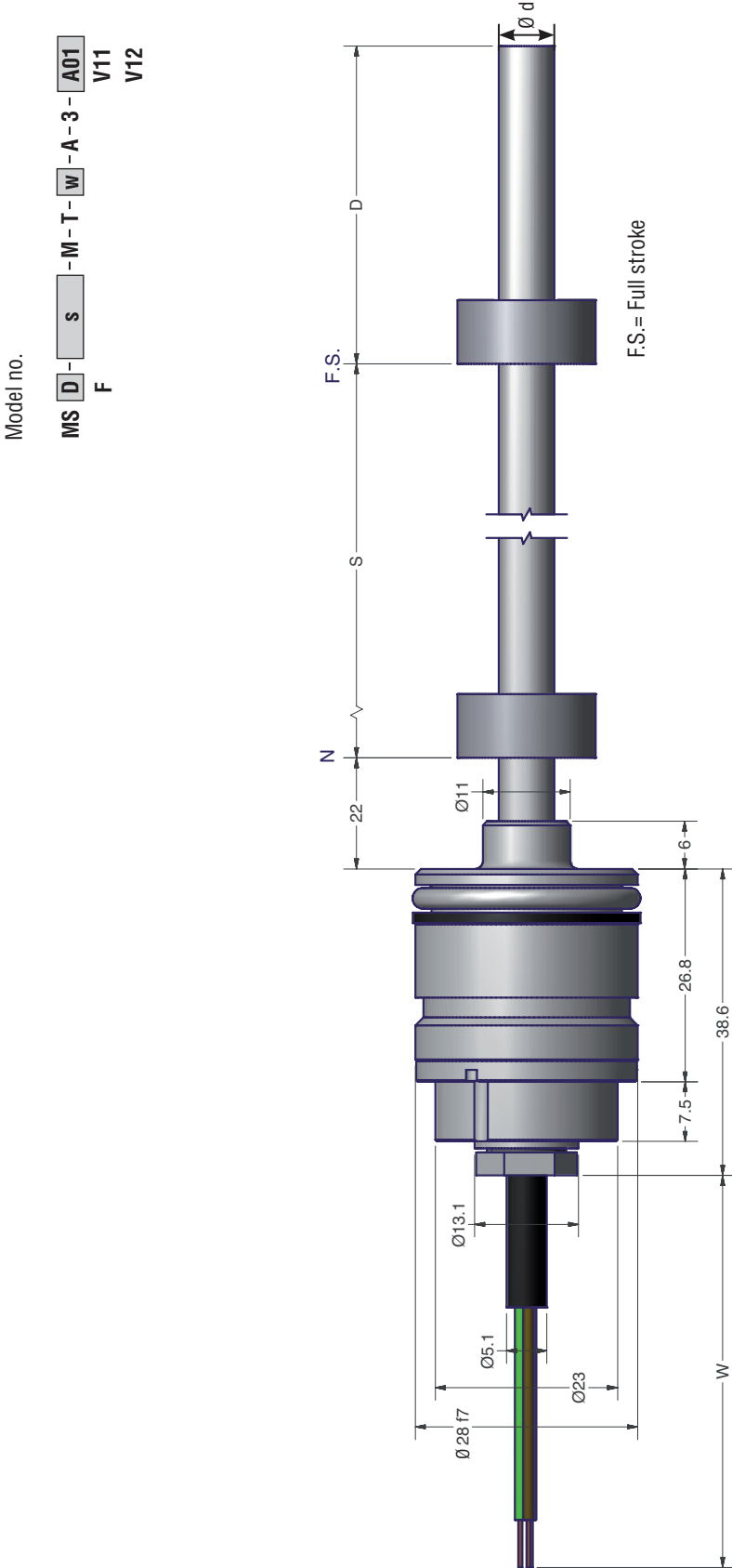
| Wire assignment | |
|-----------------|--------|
| BN | VDC |
| WH | GND |
| GN | Signal |
| YE | n.c. |

4 Wire x 0.25 mm (24 AWG)

| | | |
|---------------|---|---------------------|
| Pressure Pipe | d | 7 mm (pn = 300 bar) |
| Damping | D | 36 mm - 1200 mm |
| | s | 63 mm - 2500 mm |
| Stroke range | s | 50 - 2500 mm |
| Wire length | w | 60 mm - 250 mm |
| Null zone | N | 22 mm |

All dimensions in mm

Dimensions of Temposonics® MS Sensor with cable



| Wire assignment | |
|-----------------|--------|
| BN | VDC |
| WH | GND |
| GN | Signal |

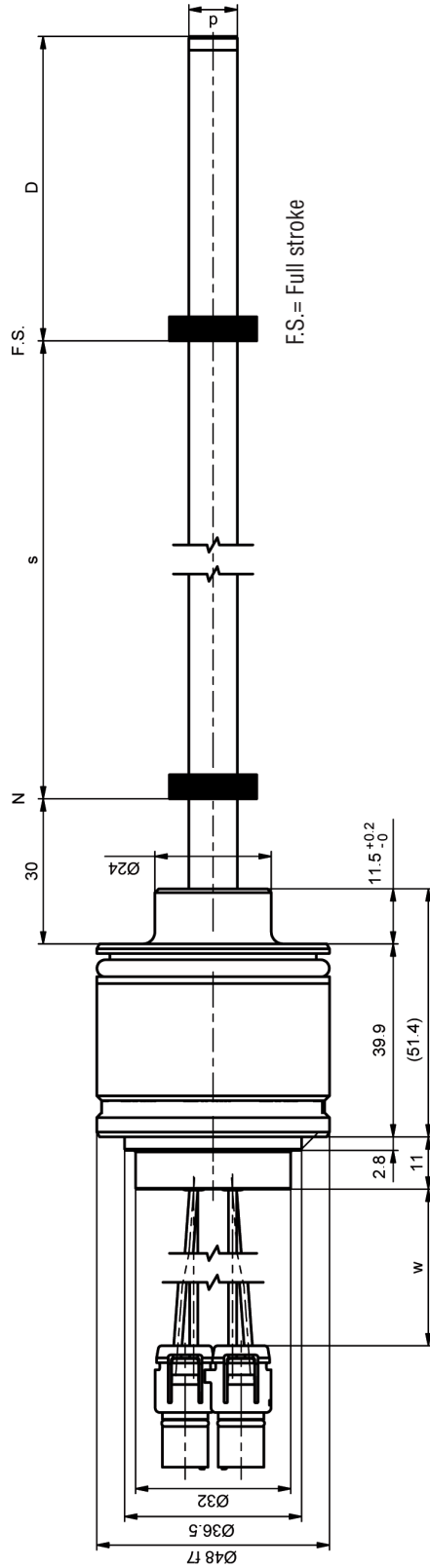
3 Wire x 0.34 mm² (24 AWG)

| | | |
|---------------|-----|-------------------------|
| Pressure Pipe | d | 7 mm ($p_n = 300$ bar) |
| Damping | D | 36 mm - 1200 mm |
| | s | 63 mm - 2500 mm |
| Stroke range | s | 50 - 2500 mm |
| Wire length | w | 300 mm - 5000 mm |
| Null zone | N | 22 mm |

All dimensions in mm

7.3 Dimensions of Temposonics® MT Sensor with M12 connector (901479)

Model no.
MT **C** - **s** **M-N** **w** **R-3** - **A21**
R **V21**
V22



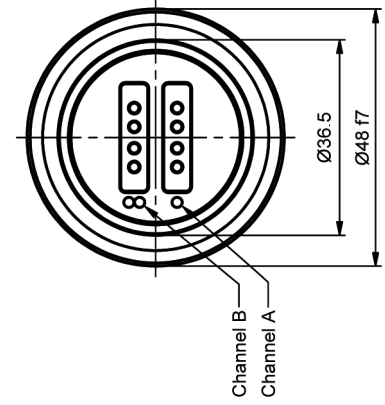
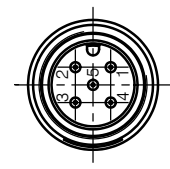
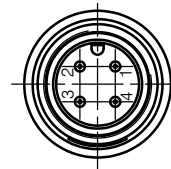
F.S. = Full stroke

Pin assignment channel A (4-pin)

| | |
|-------|--------|
| PIN 1 | VDC |
| PIN 2 | n.c. |
| PIN 3 | GND |
| PIN 4 | Signal |

Pin assignment channel B (5-pin)

| | |
|-------|--------|
| PIN 1 | VDC |
| PIN 2 | Signal |
| PIN 3 | GND |
| PIN 4 | n.c. |
| PIN 5 | n.c. |

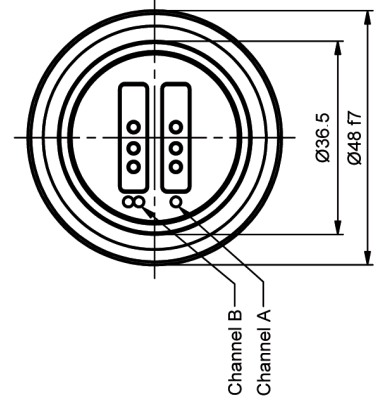
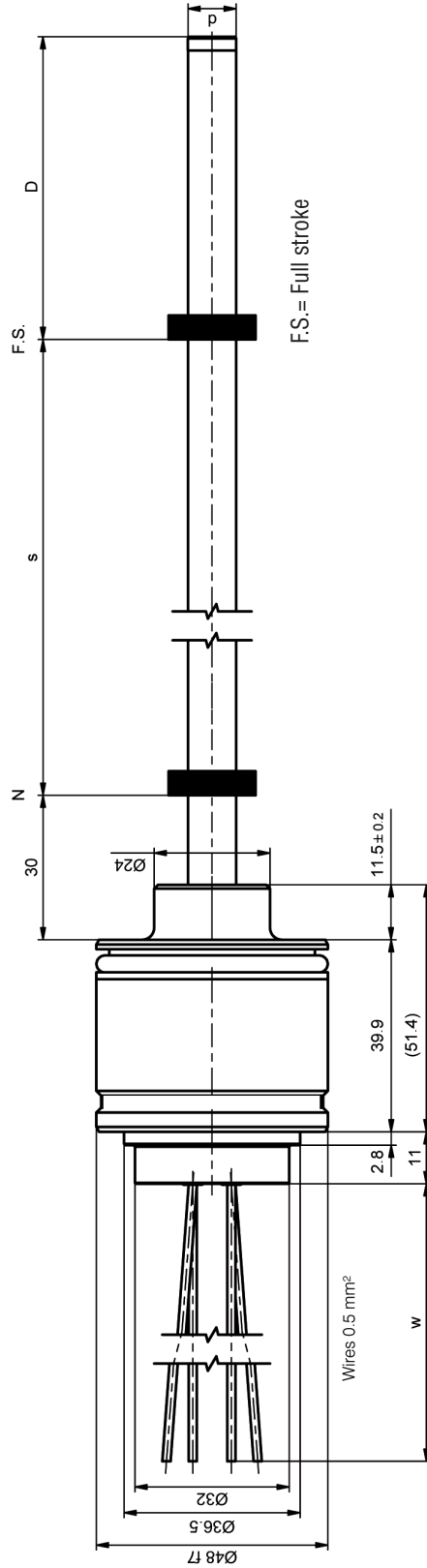


| | | |
|----------------------|---|---|
| Pressure Pipe | d | 10 mm (pn = 350 bar) 7 mm (pn = 300 bar) |
| Damping | D | 36 mm - 1200 mm 63 mm - 2500 mm |
| Stroke range | s | 50 - 2500 mm |
| Wire length | w | 60 mm - 250 mm |
| Null zone | N | 30 mm |

All dimensions in mm

Dimensions of Temposonics® MT Sensor with single wires (901497)

Model no.
 MT **C** - **s** **M-N** **W** **A** - **3** - **A21**
R V21
 V22



| Wire assignment channel A | |
|---------------------------|--------|
| BN | VDC |
| WH | GND |
| GN | Signal |

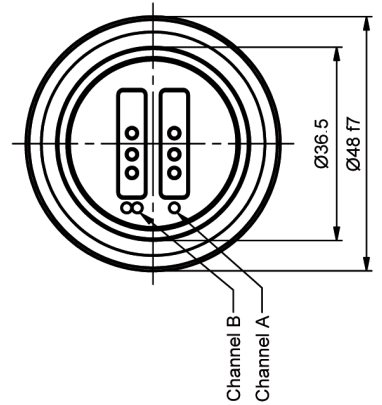
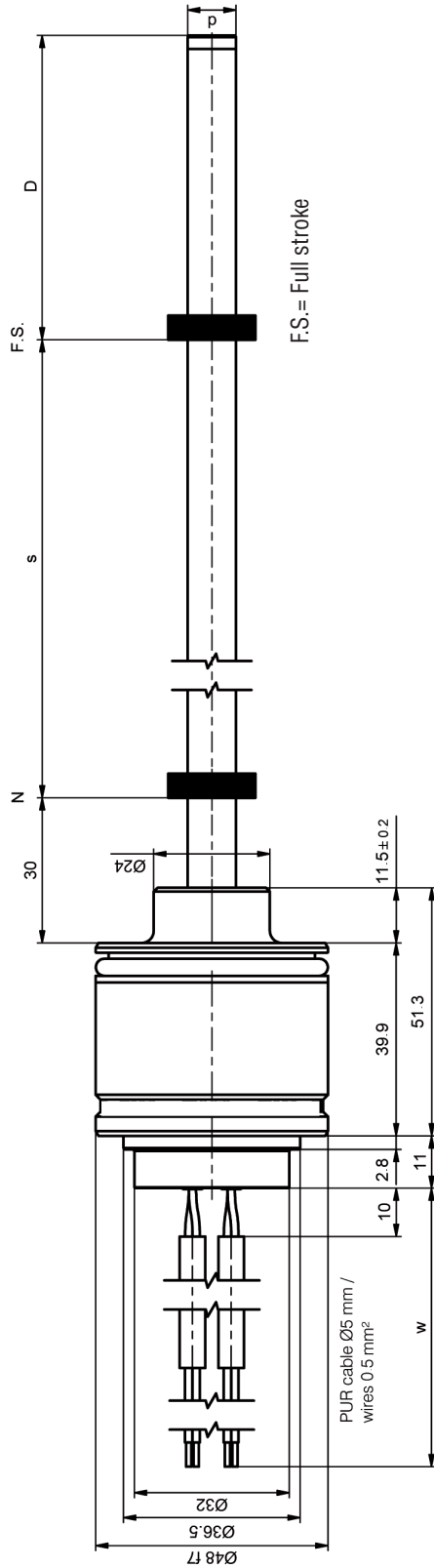
| Wire assignment channel B | |
|---------------------------|--------|
| BN | VDC |
| WH | GND |
| GN | Signal |

| | | |
|----------------------|---|---|
| Pressure Pipe | d | 10 mm (pn = 350 bar) 7 mm (pn = 300 bar) |
| Damping | D | 36 mm - 1200 mm 63 mm - 2500 mm |
| Stroke range | s | 50 - 2500 mm |
| Wire length | w | 60 mm - 250 mm |
| Null zone | N | 30 mm |

All dimensions in mm

Dimensions of Temposonics® MT Sensor with cable (901499)

Model no.
MT **C** - **s** **M-T** **w** **A-3-** **A21**
R **V21**
V22



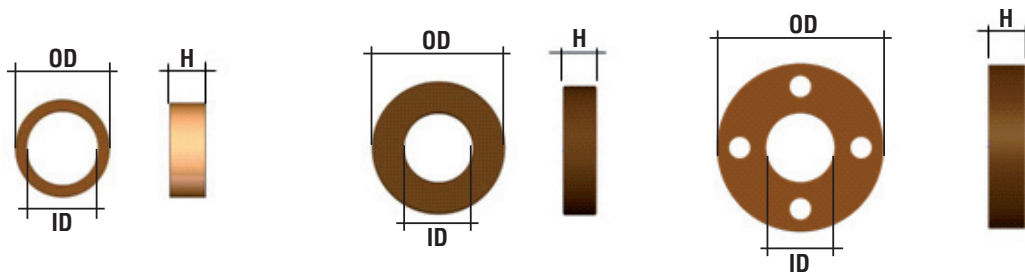
| Wire assignment channel A | |
|---------------------------|--------|
| BN | VDC |
| WH | GND |
| GN | Signal |

| Wire assignment channel B | |
|---------------------------|--------|
| BN | VDC |
| WH | GND |
| GN | Signal |

| | | |
|----------------------|---|---|
| Pressure Pipe | d | 10 mm (pn = 350 bar) 7 mm (pn = 300 bar) |
| Damping | D | 36 mm - 1200 mm 63 mm - 2500 mm |
| Stroke range | s | 50 - 2500 mm |
| Wire length | w | 300 mm - 5000 mm |
| Null zone | N | 30 mm |

All dimensions in mm

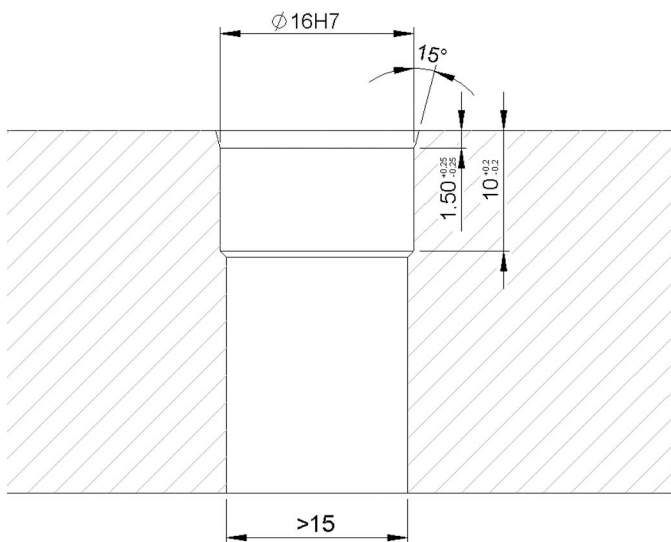
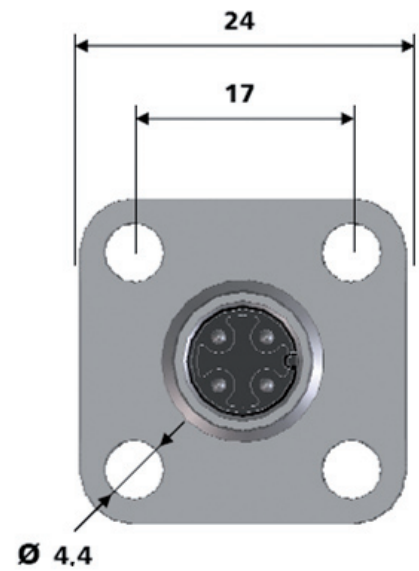
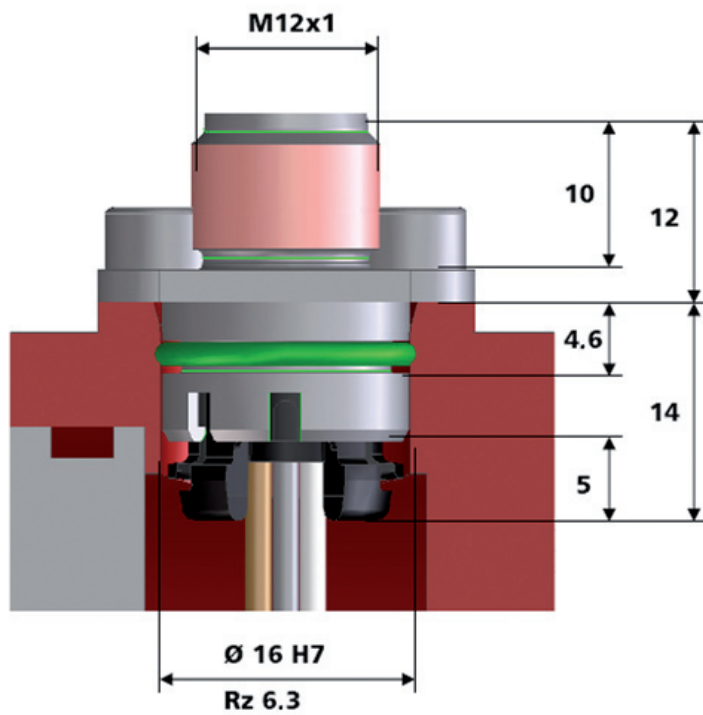
7.4 Dimensions of sensor magnets (position transducers)



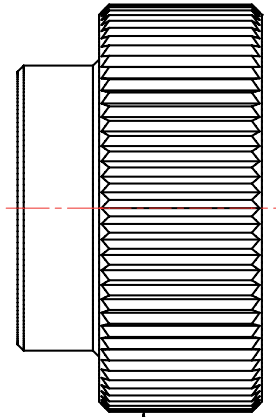
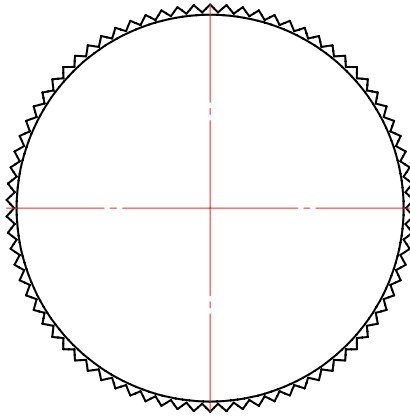
| | Ringmagnet part no. 401032 | Ringmagnet part no. 400533 | Ringmagnet part no. 201542-2 |
|-----------|--|--|---|
| OD | 17.4 mm | 25.4 mm | 33 mm |
| ID | 13.5 mm | 13.5 mm | 13.5 mm |
| H | 8 mm | 8 mm | 8 mm |
| | Max. contact pressure 40 N/mm ² * in axial direction | Max. contact pressure 40 N/mm ² * in axial direction | Max. contact pressure 40 N/mm ² * in axial direction Max. M4 screw tightening torque: max. 1 Nm |

*Max. mechanical load due to e.g. locking or spring washers, etc.

7.5 Mounting sensors using Temposonics® M12 connector system (flange)

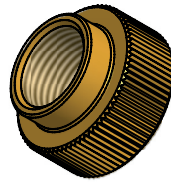
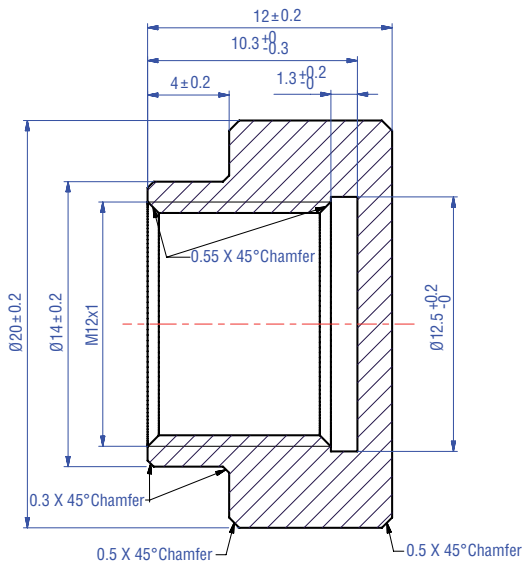


7.6 Dimensions of turned parts made of M12 round material

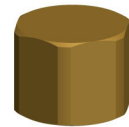
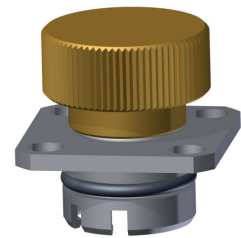


Knurl DIN 82-RAA 0,8

E-E (5:1)



Material:
 Brass or copper





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