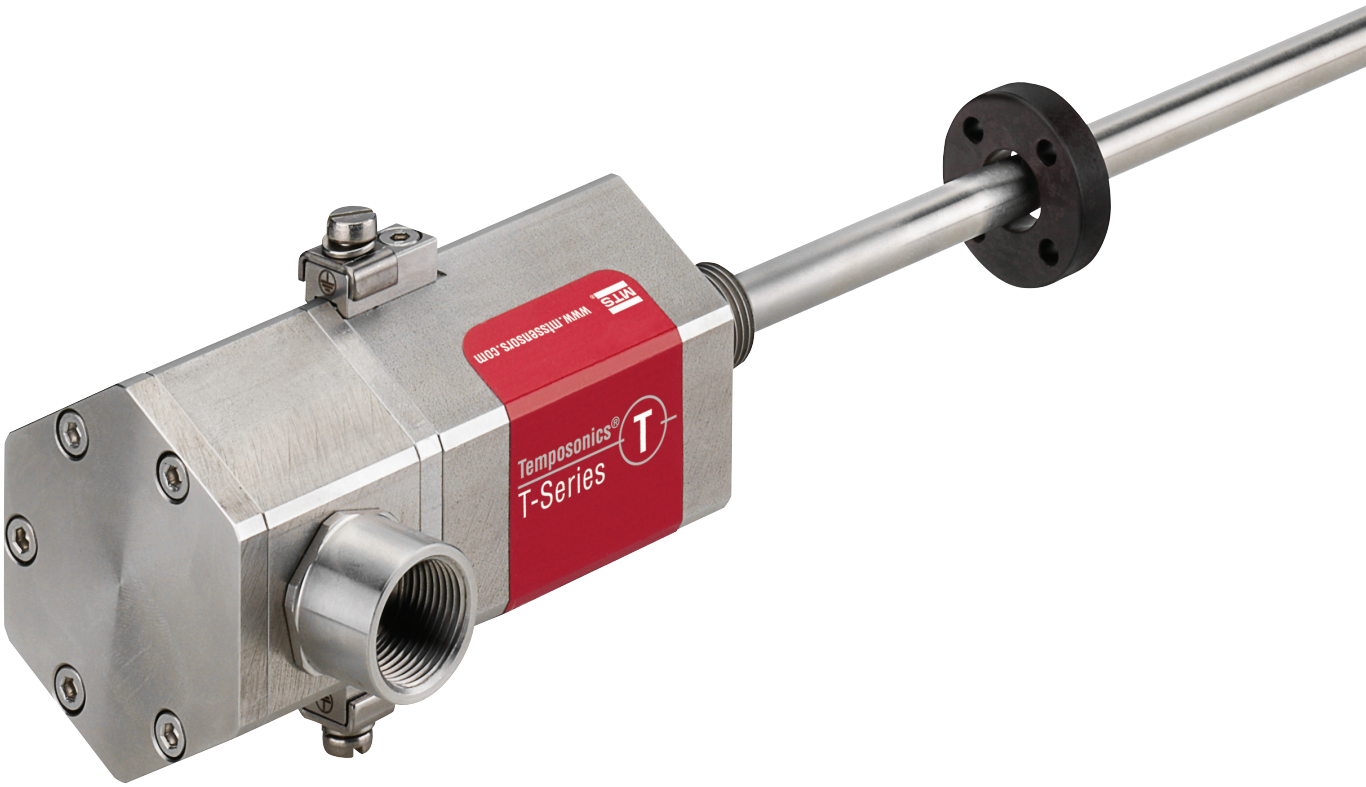
MTS SENSORS

Temposonics®

Magnetostrictive Linear Position Sensors

TH Analog ATEX / IECEx / CEC / NEC Certified, Safety SIL 2 Capable

Operation Manual



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1. Introduction

1.1 Purpose and use of this manual

Before starting the operation of Temposonics® position sensors, read this documentation thoroughly and follow the safety information. For further details on SIL 2 refer to MTS Sensors SIL 2 safety manual (part number: 551504).
Keep the manual for future reference!

The content of this technical documentation and of its various appendixes is intended to provide information on mounting, installation and commissioning by qualified automation personnel [1] or instructed service technicians who are familiar with the project planning and dealing with Temposonics® sensors.

1.2 Used symbols and warnings

Warnings are intended for your personal safety and for avoidance of damage to the described product or connected devices. In this documentation, safety information and warnings to avoid dangers that might affect the life and health of operating or service personnel or cause material damage are highlighted by the preceding pictogram, which is defined below.

Symbol	Meaning
NOTICE	This symbol is used to point to situations that may lead to material damage, but not to personal injury.

2. Safety instructions

2.1 Intended use

This product must be used only for the applications defined under item 1 to item 5 and only in conjunction with the third-party devices and components recommended or approved by MTS Sensors. As a prerequisite of proper and safe operation, the product requires correct transport, storage, mounting and commissioning and must be operated with utmost care.

1. The sensor systems of all Temposonics® series are intended exclusively for measurement tasks encountered in industrial, commercial and laboratory applications. The sensors are considered as system accessories and must be connected to suitable evaluation electronics, e.g. a PLC, IPC, indicator or other electronic control unit.
2. The position sensors must be used only in technically safe condition. To maintain this condition and to ensure safe operation, installation, connection and service, work should only be performed by qualified technical personnel, according to IEC 60079-14, TRBS 1203, Canadian Electrical Code (CEC) and National Electrical Code (NEC) and local regulations.
3. The sensor's surface temperature class is T4.

1/ The term qualified technical personnel characterizes persons who:
– are familiar with the safety concepts of automation technology applicable to the particular project,
– are competent in the field of electromagnetic compatibility (EMC),
– have received adequate training for commissioning and service operations
– are familiar with the operation of the device and know the information required for correct operation provided in the product documentation.

4. The EU-Type Examination Certificates and Certificates of Compliance have to be taken into account including any special condition defined therein.
5. The position sensor may be used in ATEX / IECEx and CEC / NEC Classes, Zones and Divisions according to section 8 respectively section 9. Any use of this product outside of these approved areas will void the warranty and all manufacturer's product responsibilities and liabilities. For non-hazardous areas MTS Sensors recommends to use the version N (not approved).

Zone Concept			
Ex-Atmosphere	**Zone**	**Category**	**Explosion group**
Gas-Ex	In the baffle between Zone 0		Up to IIC (at the rod)
Gas-Ex	Zone 1	2G	IIA, IIB, IIC
Gas-Ex	Zone 2	3G	IIA, IIB, IIC
Dust-Ex	Zone 21	2D	IIIA, IIIB, IIIC
Dust-Ex	Zone 22	3D	IIIA, IIIB, IIIC
Gas-Ex	In the baffle between Zone 0 and		Up to IIC (at the rod)
	Zone 1 or Zone 2		Up to IIC (at the connection chamber)
Gas-Ex	In the baffle between Zone 0 and		Up to IIC (at the rod)
Dust-Ex	Zone 21 or Zone 22		Up to IIIC (at the connection chamber)

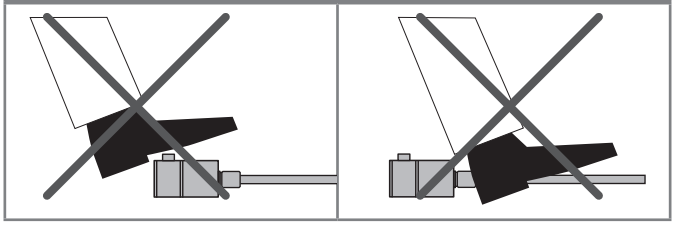
Class and Division Concept			
Ex-Atmosphere	**Class**	**Division**	**Group**
Gas-Ex	Class I	Div. 1	A*, B, C, D
Gas-Ex	Class I	Div. 2	A, B, C, D
Dust-Ex	Class II/III	Div. 1	E, F, G
Dust-Ex	Class II/III	Div. 2	E, F, G

*Cl. I Div. 1 Gr. A not valid for Canada

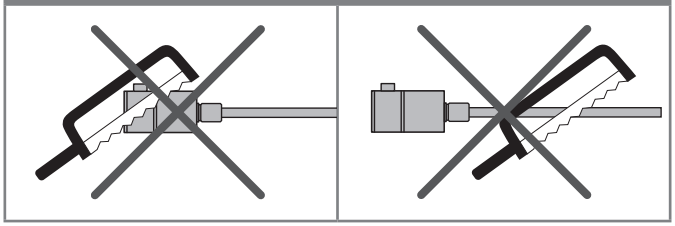
2.2 Forseeable misuse

Forseeable misuse	Consequence
Lead compensating currents through the enclosure	The sensor will be damaged
Use sensor without external fuse in Zone 0 or as SIL 2 version (in Zone 0, Zone 1 / 21)	The sensor might overheat
Use a fuse with more than 125 mA	The sensor might overheat
Wrong sensor connection	The sensor will not work properly or will be destroyed
Operate the sensor out off the operating temperature	No signal output The sensor can be damaged
Power supply is out of the defined range	Signal output is wrong / no signal output / the sensor will be damaged
Position measurement is influenced by an external magnetic field	Signal output is wrong
Cables are damaged	Short circuit – the sensor can be destroyed / sensor does not respond
Spacers are missing / are installed in a wrong order	Error in position measurement
Wrong connection of ground / shield	Signal output is disturbed The electronics can be damaged
Use of a magnet that is not certified by MTS Sensors	Error in position measurement

Do not step on the sensor.
→ The sensor might be damaged.



Do not reprocess the sensor subsequently.
→ The sensor might be damaged.



2.3 Installation, commissioning and operation

If sensor failure or a malfunction create danger of injury to people or of damage to operating equipment, additional safety measures such as plausibility checks, limit switches, EMERGENCY STOP systems, protective devices etc. must be performed. In the event of trouble, shut down the sensor and protect it against accidental operation.
To maintain the sensor operability, it is mandatory to follow the instructions given below.

Safety instructions for commissioning

1. Follow the specifications given in the technical data.
2. Ensure that equipment and associated components used in a hazardous environment are selected and installed in compliance with regulations governing the geographical location and facility. Only install equipment that complies with the types of protection relevant to the applicable Classes, Zones, Divisions and Groups.
3. In explosive atmospheres use only such auxiliary components that meet all requirements of the local and national standards.
4. The potential equalisation of the system has to be established according to the regulations of erection applicable in the respective country of use (VDE 0100, part 540; IEC 364-5-54).
5. Sensors from MTS Sensors are approved only for the intended use in industrial environments (see section 2.1). Contact the manufacturer for advice if aggressive substances are present in the sensor environment.
6. Measures for lightning protection have to be taken by the user.
7. The customer is responsible for the mechanical protection of the sensor.
8. The sensor may be used only for fixed installations with permanently wired cables. The user shall ensure that cables and cable glands correspond to the risk assessment of the hazardous application as well as to thermic, chemical and mechanical environmental conditions. The user is also responsible for the required strain relief. When selecting the sealing, the maximum thermal load of the cables must be taken into account.
9. The user is responsible for meeting all safety conditions as outlined by:
   - Installation instructions
   - Local prevailing standards and regulations
   - Safety manual (document part no. 551504) for SIL 2 capable sensor version

How to ensure safe commissioning

1. Protect the sensor against mechanical damage during installation and operation.
2. Do not use damaged products and secure them against unintentional commissioning. Mark damaged products as being defective.
3. Switch off the supply voltage prior to disconnecting or connecting the connectors.
4. Connect the sensor very carefully and pay attention to the polarity of connections, power supply as well as to the shape and duration of control pulses.
5. Cable entry temperature and branching point temperature may reach 104 °C and 116 °C respectively. Select suitable cable and entry device.
6. For field wiring, use cables suitable for the service temperature range of –40 °C to +116°C.

7. Do not open when energized. Open the sensor only as shown in fig. 6 on page 12.
8. A seal shall be installed within 18“ of the enclosure (for NEC / CEC only).
9. Use only approved power supplies of Category II according to IEC 61010-1.
10. Ensure that the specified permissible limit values of the sensor for operating voltage, environmental conditions, etc. are met.
11. Make sure that:
    – the sensor and associated components were installed according to the instructions
    – the sensor enclosure is clean
    – all screws (only those of quality 6.8, A2-50 or A4-50 are allowed) are tightened according to specified fastening torque in Fig. 6
    – the cable glands certified according to the required hazardous area classification and IP protection are tightened according to the manufactures specifications
    – surfaces limiting the joint shall not be worked or painted subsequently (flameproof enclosure)
    – surfaces limiting the joint have not been provided with a seal (flameproof enclosure)
    – the magnet does not rub against the rod. This could cause damage to the magnet and the sensor rod. If there is contact between the moving magnet including the magnet holder and the sensor rod, make sure that the maximal speed of the moving magnet is less or equal 1 m/s.
12. Ground the sensor via one of the two ground lugs. Both the sensor and the moving magnet including magnet holder must be connected to protective ground (PE) to avoid electrostatic discharge (ESD).
13. Before applying power, ensure that nobody’s safety is jeopardized by starting machines.
14. Check the function of the sensor regularly and provide documentation of the checks (see 6.2 Maintenance).

2.4 Safety instructions for use in explosion-hazardous areas

The sensor has been designed for operation inside explosion-hazarded areas. It has been tested and left the factory in a condition in which it is safe to operate. Relevant regulations and European standards as well as Canadian and North American standards have been observed. According to ATEX, IECEx, CEC and NEC marking, the sensor is approved only for operation in defined hazardous areas (see 2.1 Intended use). The SIL 2 version cannot be adjusted by the customer.

When do you need an external fuse?

Zone / Div.	T-Series standard sensor	T-Series SIL 2 sensor
Zone 0 (rod only)	External fuse required	External fuse required
Zone 1 / 21	No additional fuse	External fuse required
Zone 2 / 22	No additional fuse	No additional fuse
Div. 1	External fuse recommended	External fuse recommended

How to install a T-Series SIL 2 sensor in Zone 0 or a T-Series standard sensor in Zone 0 according to ATEX / IECEx and CEC / NEC guidelines

1. Install an external fuse in compliance with IEC 127 outside the Ex-atmosphere. Connect it upstream to the equipment. Current: 125 mA
2. Install the sensor housing in Zone 1, Zone 2, Zone 21 or Zone 22. Only the rod section (for version D, G and E) can extend into Zone 0 .
3. Follow the safety regulations detailed in IEC/EN 60079-26, ANSI/ISA 60079-26 (12.00.03) and ANSI/ISA/IEC/EN 60079-10-1 to ensure isolation between Zone 0 and Zone 1.
4. When installing the T sensor type TH in the boundary wall for Zone 0, the corresponding requirements in ANSI/ISA/IEC/EN 60079-26 and ANSI/ISA/IEC/EN 60079-10-1 have to be noticed. Thereby the screw-in thread is to be sealed gas tightly (IP67) according to ANSI/ISA/IEC/EN 60079-26 and ANSI/ISA/IEC/EN 60079-10-1.

2.5 Warranty [2]

MTS Sensors grants a warranty period for the Temposonics® position sensors and supplied accessories relating to material defects and faults that occur despite correct use in accordance with the intended application[2]. The MTS Sensors obligation is limited to repair or replacement of any defective part of the unit. No warranty can be provided for defects that are due to improper use or above average stress of the product, as well as for wear parts. Under no circumstances will MTS Sensors accept liability in the event of violations against the warranty rules, even if these have been assured or expected. Nor will MTS Sensors accept liability in the event of fault or negligence of the company.
MTS Sensors explicitly excludes any further warranties. Neither the company’s representatives, agents, dealers nor employees are authorized to increase or change the scope of warranty.

2.6 Return

For diagnostic purposes, the sensor can be returned to the nearest MTS Sensors facility. Any shipment cost is the responsibility of the sender [2]. For a corresponding form, see section 12. Appendix.

2/ See also applicable MTS Sensors sales and supply conditions, e.g. under www.mtssensors.com

3. Identification

3.1 Order code Temposonics® TH

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
T	H										1			N			
a		b	c					d			e	f	g	h	i		

a	Sensor model
T	H	Rod

b	Design
Enclosure Type 3: Model TH rod-style sensor with housing material 1.4305 (AISI 303) and rod material 1.4306 (AISI 304L)	
M	Threaded flange with flat-face (M18×1.5-6g)
N	Threaded flange with raised-face (M18×1.5-6g)
S	Threaded flange with flat-face (¾"-16 UNF-3A)
T	Threaded flange with raised-face (¾"-16 UNF-3A)
Enclosure Type 3X: Model TH rod-style sensor with housing material 1.4404 (AISI 316L) and rod material 1.4404 (AISI 316L)	
F	Threaded flange with flat-face (¾"-16 UNF-3A)
G	Threaded flange with raised-face (¾"-16 UNF-3A)
W	Threaded flange with flat-face (M18×1.5-6g)

c	Stroke length
	SIL 2
X X X X M	0025…1500 mm
X X X . X U	001.0…060.0 in.
	Standard
X X X X M	0025…7620 mm
X X X . X U	001.0…300.0 in.

Standard stroke length (mm)*

Stroke length	Ordering steps
25 … 500 mm	5 mm
500 … 750 mm	10 mm
750…1000 mm	25 mm
1000…2500 mm	50 mm
2500…5000 mm	100 mm
5000…7620 mm	250 mm

Standard stroke length (in.)*

Stroke length	Ordering steps
1 … 20 in.	0.2 in.
20 … 30 in.	0.4 in.
30 … 40 in.	1.0 in.
40…100 in.	2.0 in.
100…200 in.	4.0 in.
200…300 in.	10.0 in.

d	Connection type
C 0 1	Side connection with thread ½"-14 NPT (All versions)
C 1 0	Top connection with thread ½"-14 NPT (All versions)
M 0 1	Side connection with thread M16×1.5-6H (Version E & N)
M 1 0	Top connection with thread M16×1.5-6H (Version E & N)
N 0 1	Side connection with thread M20×1.5-6H (All versions)
N 1 0	Top connection with thread M20×1.5-6H (All versions)
N F 1	Side connection with thread M20×1.5-6H (Version E & N) **Note: Not available for SIL 2 version!**

e	Operating voltage
1	+24 VDC (–15 / +20 %)

f	Version (see “Technical data” for further information)
D	Ex db and Ex tb (AF55)
E	Ex db eb and Ex tb (AF55) US & CA approvals: Ex nA /NI (for Zone 2 and 22) **(Note: Available for SIL 2 version only)**
G	Ex db and Ex tb (AF60) US & CA approvals: Explosionproof (XP) **(Note: Group A is not available for Canada)**
N	Not approved

g See next page.

*/ Non Standard stroke lengths are available; must be encoded in 5 mm / 0.1 in. increments

g	Functional safety type
N	Not approved
S	SIL 2 (with certificate and manual)

h	Additional option type
N	None

i	Output		
1 output with 1 magnet Output 1 (position magnet 1) (Available outputs for SIL 2: A01 and A11)			
A	0	1	4…20 mA
A	1	1	20…4 mA
A	2	1	0…20 mA
A	3	1	20…0 mA
2 outputs with 1 magnet Output 1 (position magnet 1) + output 2 (position magnet 1) Notice: Not available for SIL 2 version!			
A	0	3	4…20 mA 20…4 mA
2 outputs with 2 magnets Output 1 (position magnet 1) + output 2 (position magnet 2) Notice: Not available for SIL 2 version!			
A	0	2	4…20 mA 4…20 mA
A	1	2	20…4 mA 20…4 mA
A	2	2	0…20 mA 0…20 mA
A	3	2	20…0 mA 20…0 mA

3.2 Nameplate (example)

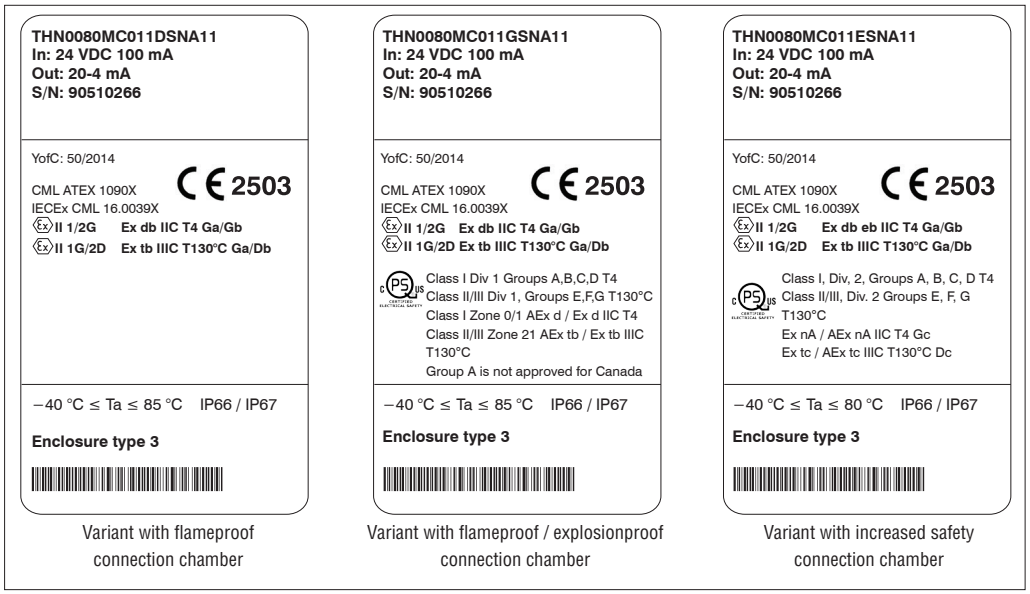


Fig. 1: Label SIL 2 version

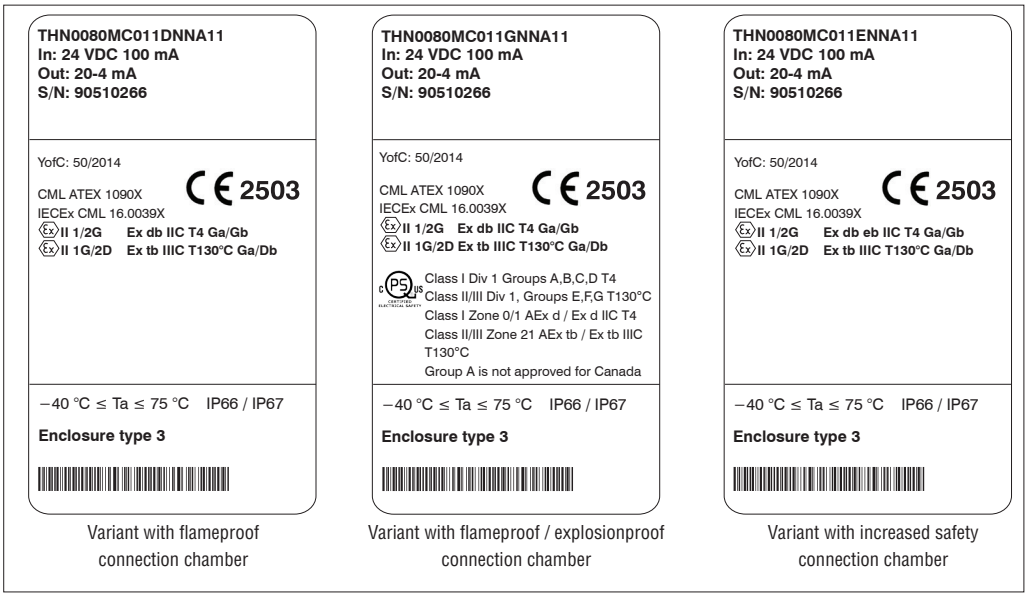


Fig. 2: Label standard version

3.3 Approvals

See chapter 8. on page 31 and chapter 9. on page 33.

3.4 Scope of delivery

Sensor. Accessories (see page 23 f.) have to be ordered separately.

4. Product description and commissioning

4.1 Functionality and system design

Product designation

- Position sensor Temposonics® T-Series

Construction series

- Temposonics® TH (rod)
- Stroke length SIL 2 version: 25…1500 mm (1…60 in.)
- Stroke length standard version: 25…7620 mm (1…300 in.)
- Output signal: Analog

Application

The Temposonics® sensor is used for measurement and conversion of the length (position) variable in the fields of automated system and mechanical engineering. The T-Series sensors are designed for installation in a raised or flat-face flanged hydraulic cylinder, for use as an open-air position sensor or as a liquid level float with the addition of a float.

Principle of operation and system construction

For position measurement, the absolute, linear Temposonics® position sensors make use of the properties offered by the specially designed magnetostrictive waveguide. Inside the sensor a torsional strain pulse is induced in the waveguide by momentary interaction of two magnetic fields. The interaction between these two magnetic fields produces a strain pulse, which is detected by the converter at the sensor electronics housing. One field is produced by a moving position magnet, which travels along the sensor rod with the waveguide inside. The other field is generated by a current pulse applied to the waveguide. The position of the moving magnet is determined precisely by measuring the time-of-flight between the application of the current pulse and the arrival of the strain pulse at the sensor electronics housing. The result is a reliable position measurement with high accuracy and repeatability.

T-Series models

The T-Series is available in four variations, three of which are hazardous classifications:

- Flameproof housing with flameproof connection chamber (version D)
- Flameproof (explosionproof) housing with flameproof (explosionproof) connection chamber (version G)
- Flameproof housing with increased safety connection chamber (version E)
- Non-hazardous (version N)

All of these variations are available in two types of hardware / software, SIL 2 compliant and standard, both in 4…20 mA and 20…4 mA output. The sensor assembly is offered in 1.4305 (AISI 303) stainless steel and in 1.4404 (AISI 316L). Associated with hazardous rating the sensor meets IP66 / IP67. For non-hazardous environments the sensor meets IP66, IP67, IP68, IP69K and NEMA 4X.

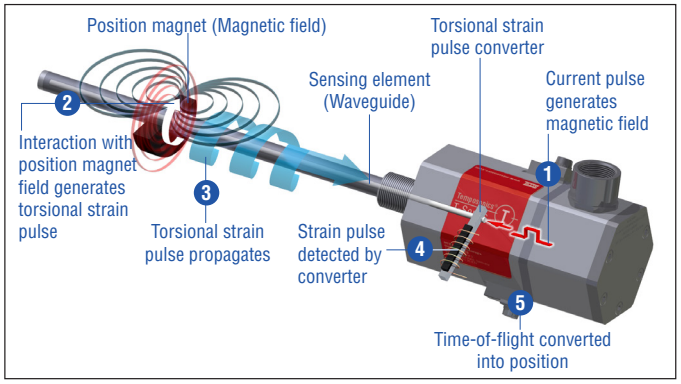
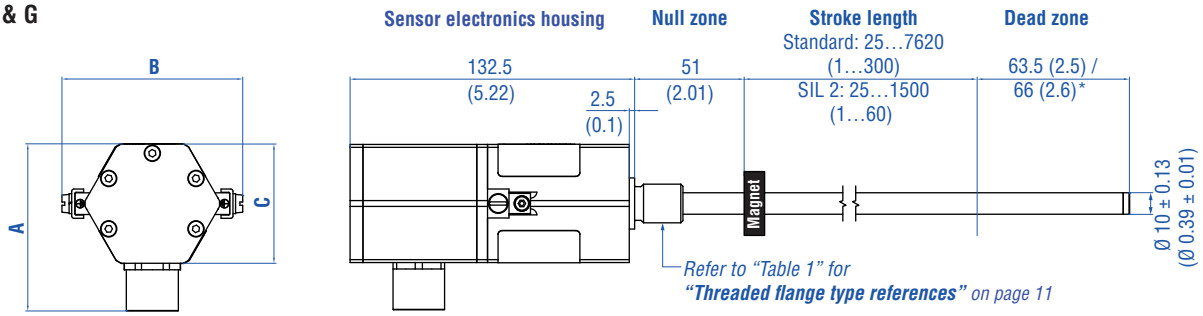


Fig. 3: Time-of-flight based magnetostrictive position sensing principle

4.2 Styles and installation

Threaded flange with raised-face

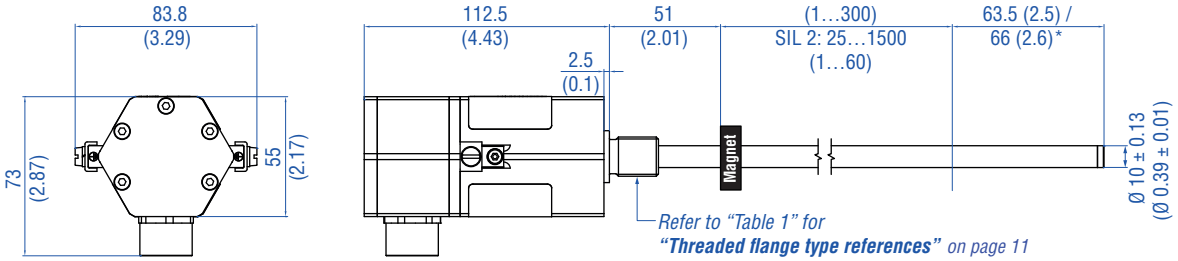
Version D & G



* Stroke length > 5000 mm (196.85 in.)

	Version D	Version G
A	77 (3.03)	82 (3.23)
B	83.8 (3.29)	89.2 (3.51)
C	55 (2.17)	60 (2.36)

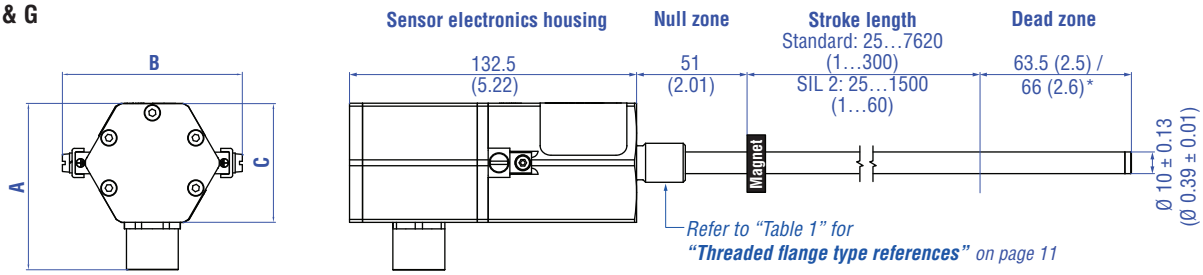
Version E & N



* Stroke length > 5000 mm (196.85 in.)

Threaded flange with flat-face

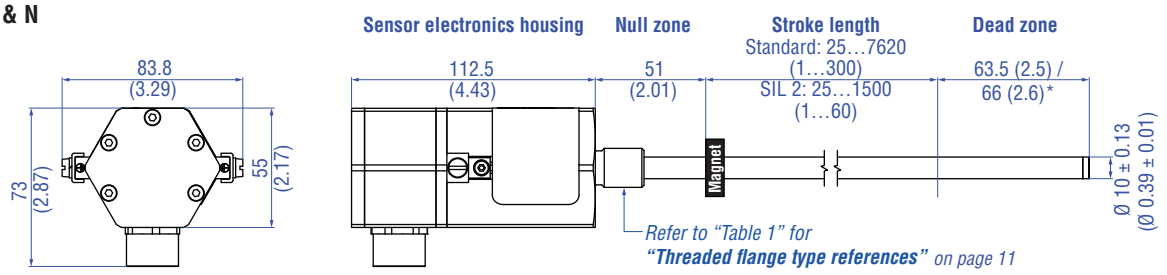
Version D & G



* Stroke length > 5000 mm (196.85 in.)

	Version D	Version G
A	77 (3.03)	82 (3.23)
B	83.8 (3.29)	89.2 (3.51)
C	55 (2.17)	60 (2.36)

Version E & N

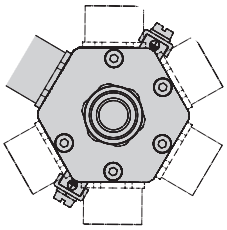


* Stroke length > 5000 mm (196.85 in.)

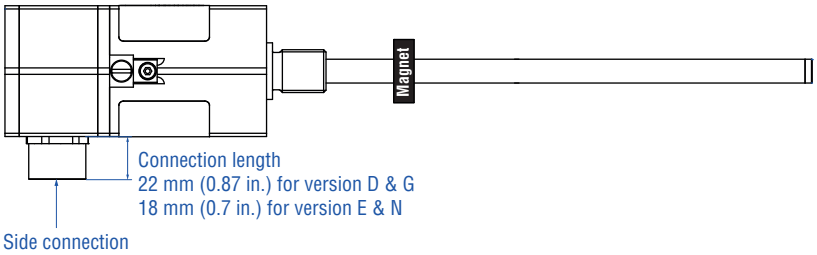
Controlling design dimensions are in millimeters and measurements in ( ) are in inches
Unless otherwise stated, apply to the general tolerances according to DIN ISO 2768-m

Fig. 4: Temposonics® TH with ring magnet

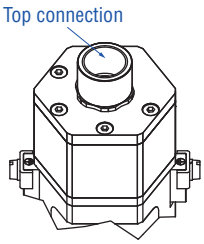
Side connection C01 / N01 / NF1 (with adapter) / M01 (without adapter)

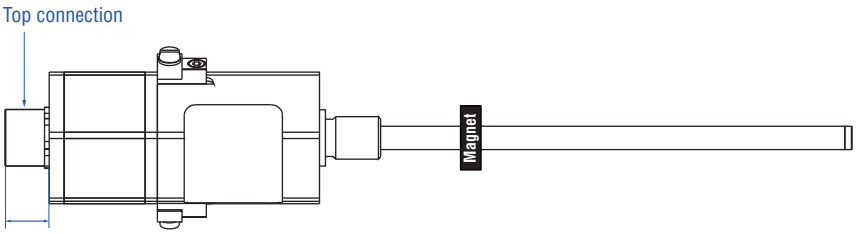


C01 / N01:
Connector on 6 different positions at 60° each
NF1:
Connector on 4 different positions at 60° each



Top connection C10 / N10 (with adapter) / M10 (without adapter)





Controlling design dimensions are in millimeters and measurements in ( ) are in inches
Unless otherwise stated, apply to the general tolerances according to DIN ISO 2768-m

Fig. 5: Temposonics® TH connection options

Threaded flange type	Description	Threaded flange
F	Threaded flange with flat-face 1.4404 (AISI 316L)	¾"-16 UNF-3A
G	Threaded flange with raised-face 1.4404 (AISI 316L)	¾"-16 UNF-3A
M	Threaded flange with flat-face 1.4305 (AISI 303)	M18×1.5-6g
N	Threaded flange with raised-face 1.4305 (AISI 303)	M18×1.5-6g
S	Threaded flange with flat-face 1.4305 (AISI 303)	¾"-16 UNF-3A
T	Threaded flange with raised-face 1.4305 (AISI 303)	¾"-16 UNF-3A
W	Threaded flange with flat-face 1.4404 (AISI 316L)	M18×1.5-6g

Table 1: Model TH rod-style threaded flange type references

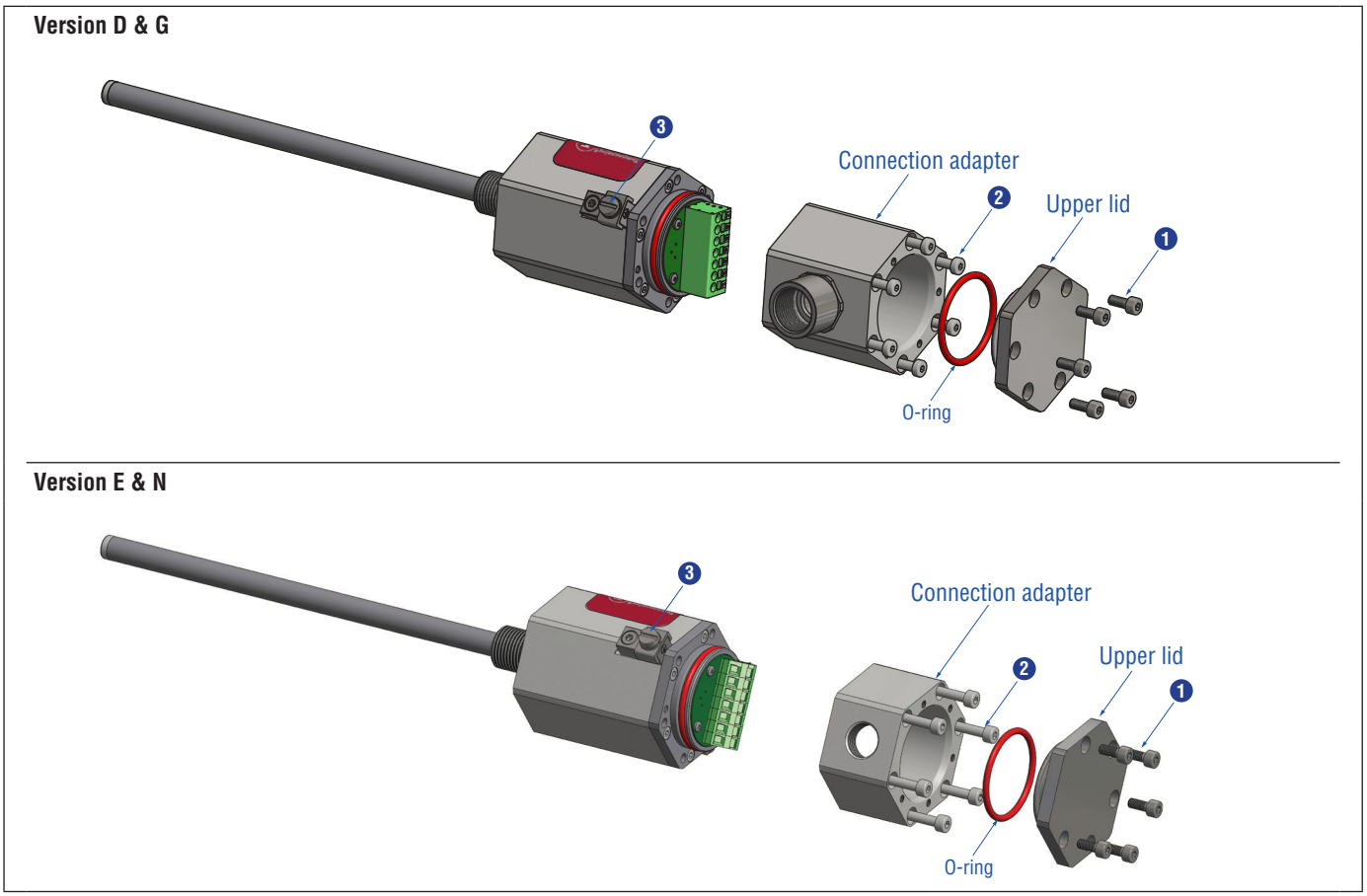


Fig. 6: Temposonics® TH exploded view drawing

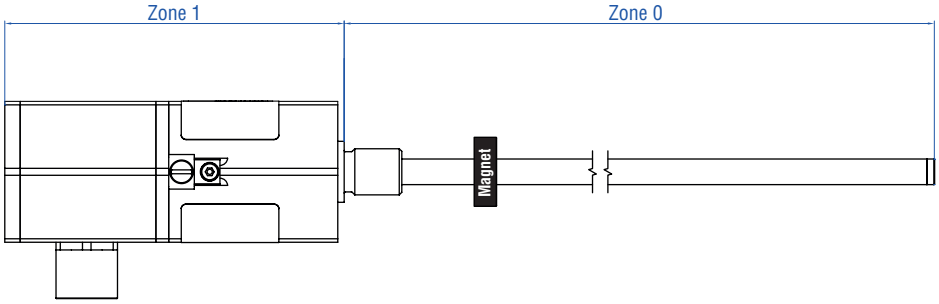
Part	Fastening torque
1 Screw M4×10	1.2 Nm
2 Screw M4×40	1.2 Nm
3 Earthing connection: M5×8 for mounting	2.5 Nm

NOTICE

Connect cable to sensor
See page 20 ff. for more details.

Change orientation of cable bushing (C01, M01, N01, NF1)
Loosen the five hexagonal screws M4 (AF 3) and remove the upper lid (fig. 6). Then loosen the six hexagonal screws M4 (AF 3) of the connection adapter (fig. 6). Change the orientation of the connector on six different positions at 60° each. Note the example on pages 20 ff..

Version D & G –
Flameproof (explosionproof) housing with flameproof (explosionproof) connection chamber ATEX / IECEx / CEC/ NEC
Ex db / Ex tb / AEx d / AEx tb



Version E –
Flameproof housing with increased safety connection chamber ATEX / IECEx
Ex db eb / Ex tb

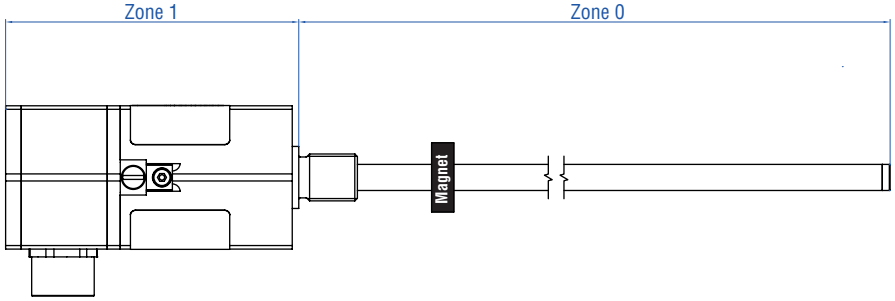


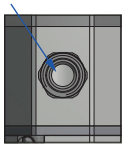
Fig. 7: Temposonics® TH Zone classification

NOTICE

Seal sensor according to ingress protection IP67 between Zone 0 and Zone 1.

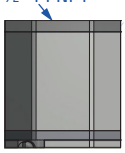
Connection options for version D & G

C01
½"-14 NPT



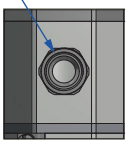
C01 = Side connection
with thread ½"-14 NPT

C10
½"-14 NPT



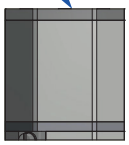
C10 = Top connection
with thread ½"-14 NPT

N01
M20×1.5-6H



N01 = Side connection
with thread M20×1.5-6H

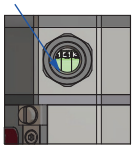
N10
M20×1.5-6H



N10 = Top connection
with thread M20×1.5-6H

Connection options for version E & N

C01
½"-14 NPT

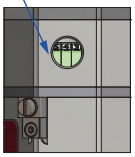


C01 = Side connection
with thread ½"-14 NPT

C10
½"-14 NPT

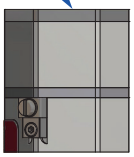
C10 = Top connection
with thread ½"-14 NPT

M01
M16×1.5-6H



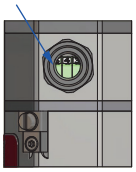
M01 = Side connection
with thread M16×1.5-6H

M10
M16×1.5-6H



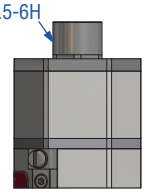
M10 = Top connection
with thread M16×1.5-6H

N01
M20×1.5-6H



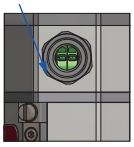
N01 = Side connection
with thread M20×1.5-6H

N10
M20×1.5-6H



N10 = Top connection
with thread M20×1.5-6H

NF1
M20×1.5-6H



NF1 = Side connection
with thread M20×1.5-6H
Not available for SIL 2 version!

Fig. 8: Connection options

Fig. 9: SIL 2 identification

Active measuring range

The technical data of each sensor is checked and documented. The active stroke length (useful electrical stroke), including its start and end position, is adjusted during final inspection and testing (see dimension drawing).

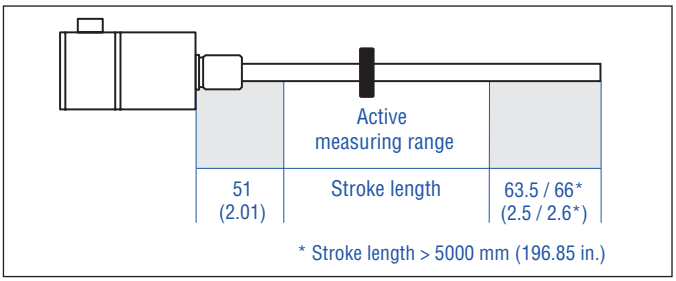


Fig. 10: Active measuring range

NOTICE

On all sensors, the areas left and right of the active measuring range are provided for mounting and damping of the measuring signal. They should not be used for measurement, but nevertheless the active measuring range can be exceeded.

Mechanical zero

To ensure that the entire measuring range can be used electrically, the position magnet must be mounted mechanically as follows:

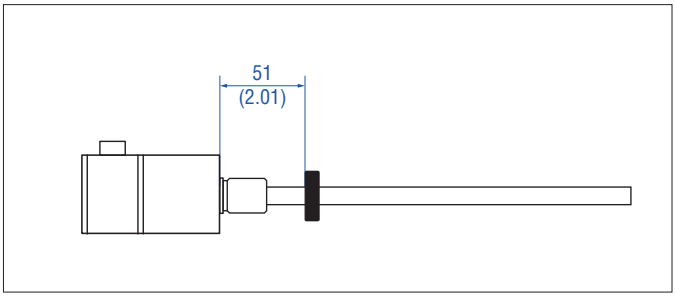


Fig. 11: Temposonics® TH with ring magnet

Installing the rod sensor in a fluid cylinder

Mounted on the face of the piston, the ring magnet travels over the rod without touching it and indicates the exact position through the rod wall – independent of the hydraulic fluid.

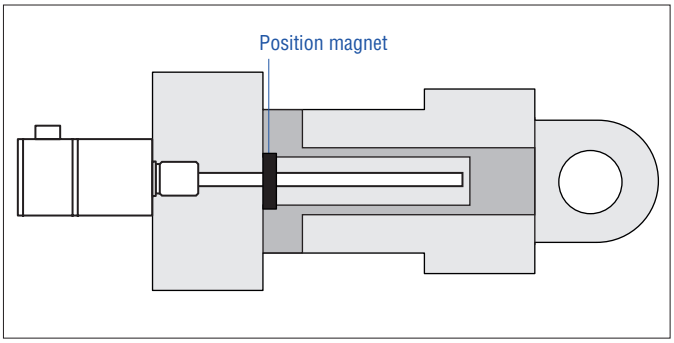


Fig. 12: The sensor rod with the sensing element immerges into the cylinder

Controlling design dimensions are in millimeters and measurements in ( ) are in inches

Mount the sensor via flange thread or a hex nut. For proper function non-magnetic material should be used for mounting support. When using magnetic material the dimensions of Fig. 13 must be observed.

A. If the position magnet aligns with the drilled piston rod

B. If the position magnet is set further into the drilled piston rod install another non-magnetic spacer above the magnet.

When horizontally mounted, longer sensors (from 1 m (3 ft)) should be installed with intermediate mechanical supports.

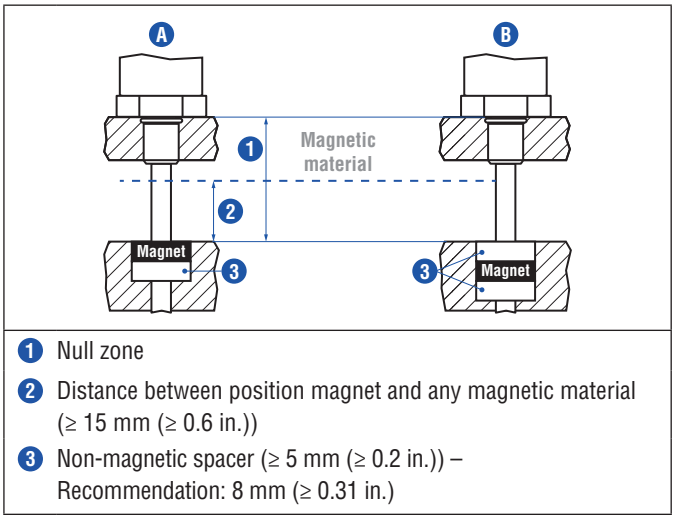


Fig. 13: Installation with magnetic material

Sealing the hydraulics

There are two ways to seal the flange contact surface (fig. 14):

1. A sealing by using an O-ring (e.g. 22.4 × 2.65 mm (0.88 × 0.1 in.)) in a cylinder bottom groove.
2. A sealing via an 15.3 × 2.2 mm (0.6 × 0.09 in.) O-ring in the flange undercut on the flat-faced or raised-face flanges. In this case, a screw hole based on ISO 6149-1 (fig. 15 page 16) must be provided. See ISO 6149-1 for further information.

- Mount the hexagonal housing with a fastening torque of 50 Nm near the thread.
- Seat the flange contact surface completely on the cylinder mounting surface.
- The cylinder manufacturer determines the pressure-resistant gasket (copper gasket, O-ring, etc.).
- The position magnet should not grind on the sensor rod.
- The piston rod drilling (min. Ø 13 mm (0.51 in.)) depends on the pressure and piston speed.
- Protect the sensor rod from abrasion wear using suitable constructive measures.

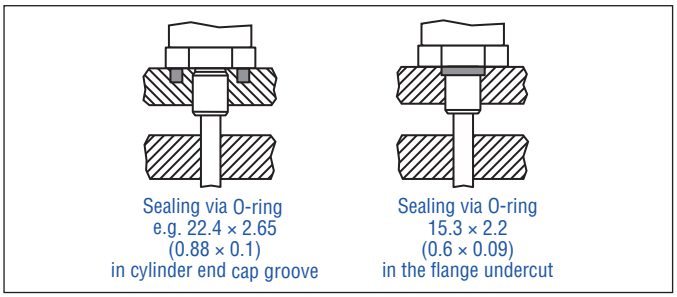
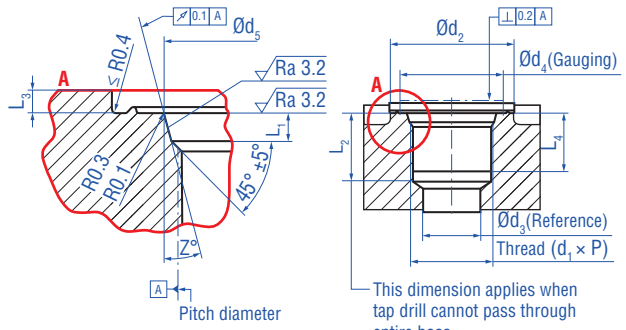


Fig. 14: Way of sealing

Thread (d_1×P)	d_2	d_3	d_4	d_5 +0.1 0	L_1 +0.4 0	L_2	L_3	L_4	Z° ±1°
M18×1.5-6g	65	13	24.5	19.8	2.4	28.5	2	26	15°



Controlling design dimensions are in millimeters

Fig. 15: Notice for threaded flange M18×1.5-6g based on DIN ISO 6149-1

Mounting the ring magnet

Install the magnet using material with non-magnetic properties for entrainment device, screws, spacers etc..

- Max. allowable surface pressure: 40 N/mm²
- Fastening torque for M4 screws: 1 Nm; use washers, if necessary

Mounting for liquid level measurement

A “stop collar” is ordered separately with a float, based on the material under measurement specific gravity. The stop collar is designed to keep the float out of the dead zone. The placement of the stop collar is dependent on the float and placement of the magnet. If your application requires measuring to the bottom of your vessel, ask MTS Sensors about our low liftoff float option which can measure less than 25 mm (1 in.) of liquid.

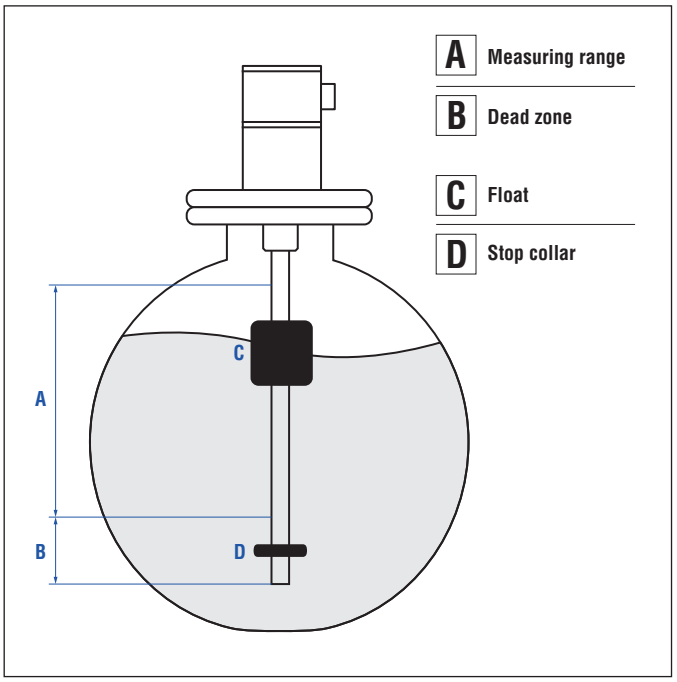


Fig. 16: Liquid level measurement

Controlling design dimensions are in millimeters and measurements in ( ) are in inches

4.3 Electrical connection

Placement of installation and cabling is vital to proper performance of the sensor's electromagnetic compatibility (EMC). Hence correct installation of this active electronic system and the EMC of the entire system must be ensured by using shielded cables and grounding. Overvoltages or faulty connections can damage the electronics despite protection against wrong polarity.

NOTICE

Never connect / disconnect the sensor when voltage is applied.

Instruction for connection

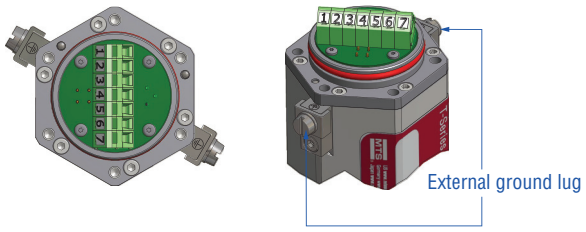
- Remove the cover plate as shown in fig. 6 on page 12 to connect the cables to the sensor.
- If you use a cable / cable gland use low-resistance twisted pair and shielded cables and connect the shield to ground externally via the controller equipment.
- Control and signal leads should be kept separate from other power cables and away from motor cables, frequency inverters, valve cables, switching relays, etc.
- Install a conductor of 4 mm² cross section to one of the two external ground lugs.
- Keep all non-shielded leads as short as possible.
- Keep the ground connections short and with a large cross section and avoid ground loops.
- Use only stabilized power supplies and make sure that the specified connecting values are met.

NOTICE

The contactable cross section is 0.2…2.5 mm² and 0.2…1.5 mm².
Only 1 wire per clamping point is allowed.

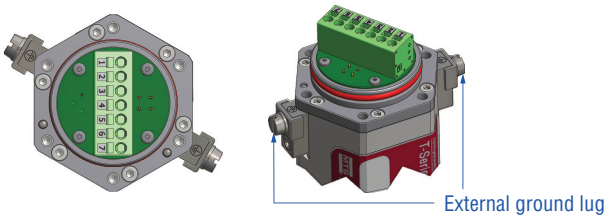
Connector wiring for SIL 2 sensor

Connect the sensor directly to the control system, indicator or other evaluating systems as follows:



Pin number	Description
1	Output
2	DC Ground
3	Not connected
4	Not connected
5	+24 VDC (–15 / +20 %)
6	DC Ground (0 V)
7	PE – Protective Earth Ground

Fig. 17: Model TH (version E & N) rod-style sensor wiring diagram SIL 2 (1.5 mm² conductor) Suitable for connection type: C01, C10, M01, M10, N01, N10

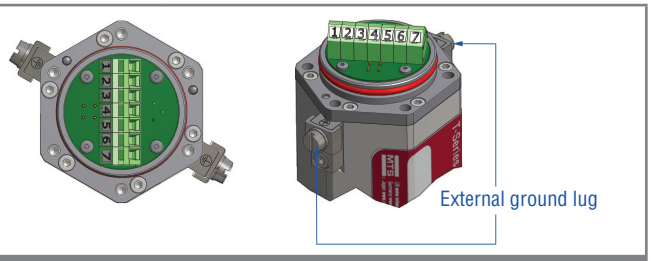


Pin number	Description
1	Output
2	DC Ground
3	Not connected
4	Not connected
5	+24 VDC (–15 / +20 %)
6	DC Ground (0 V)
7	PE – Protective Earth Ground

Fig. 18: Model TH (version D & G) rod-style sensor wiring diagram SIL 2 (2.5 mm² conductor) Suitable for connection type: C01, C10, N01, N10

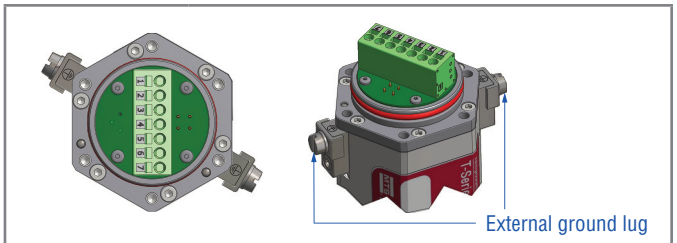
Connector wiring for standard sensor

Connect the sensor directly to the control system, indicator or other evaluating systems as follows:



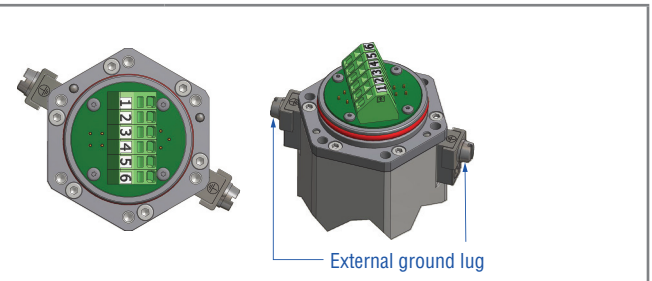
Pin number	Description
1	Output 1
2	DC Ground
3	Output 2
4	DC Ground
5	+24 VDC (–15 / +20 %)
6	DC Ground (0 V)
7	PE – Protective Earth Ground

Fig. 19: Model TH (version E & N) rod-style sensor wiring diagram standard (1.5 mm² conductor) Suitable for connection types: C01, C10, M01, M10, N01, N10



Pin number	Description
1	Output 1
2	DC Ground
3	Output 2
4	DC Ground
5	+24 VDC (–15 / +20 %)
6	DC Ground (0 V)
7	PE – Protective Earth Ground

Fig. 21: Model TH (version D & G) rod-style sensor wiring diagram standard (2.5 mm² conductor) Suitable for connection types: C01, C10, N01, N10



Pin number	Description
1	Output 1
2	DC Ground
3	Output 2
4	+24 VDC (–15 / +20 %)
5	DC Ground (0 V)
6	PE – Protective Earth Ground

Fig. 20: Model TH (version E & N) rod-style sensor wiring diagram standard (2.5 mm² conductor) Suitable for connection type: NF1

NOTICE

Connect output 1 to load of 500 Ω if you use output A03 with output 2 only.

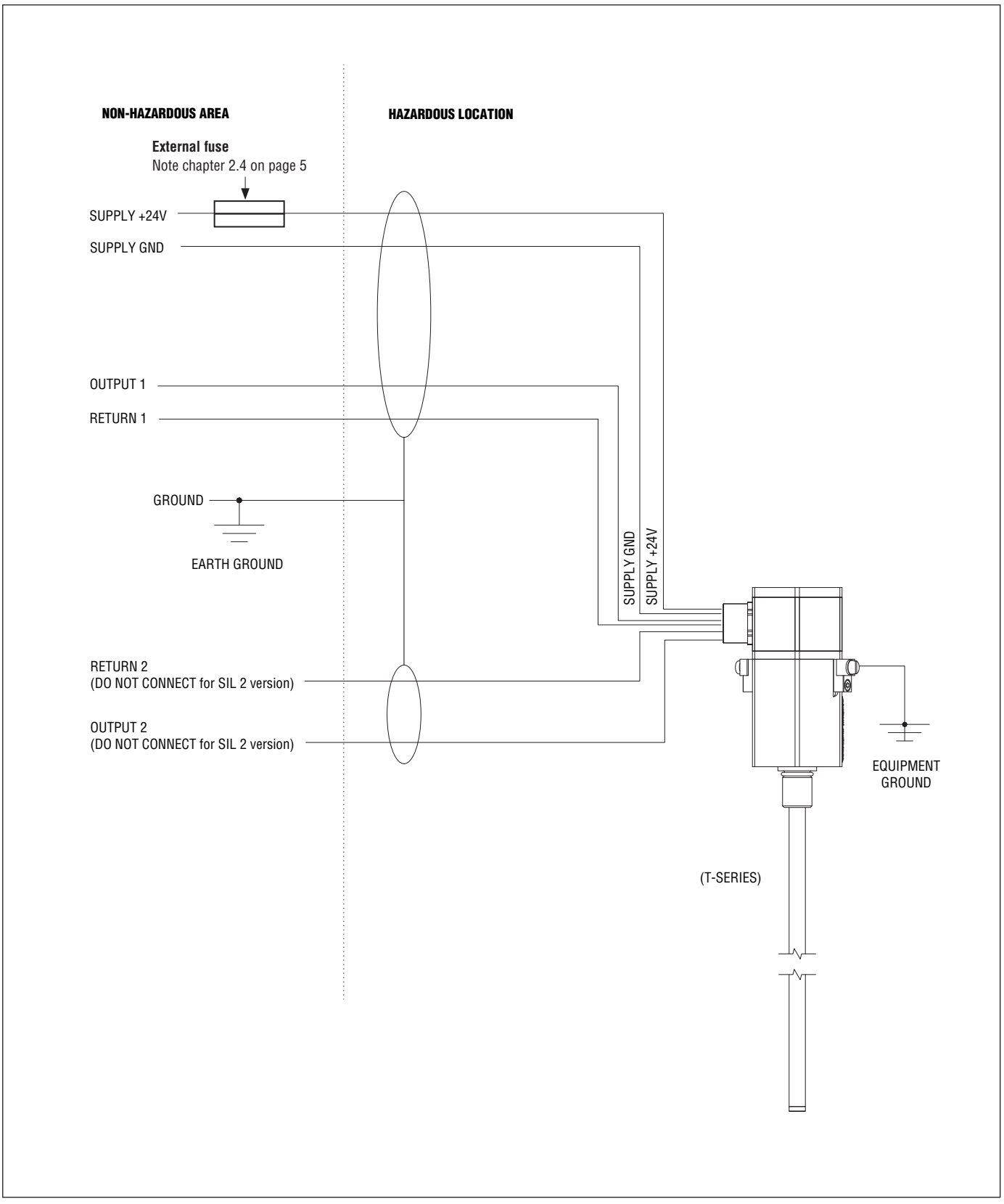


Fig. 22: Installation wiring diagram

Cable connection (SIL 2 example)

Recommended tools

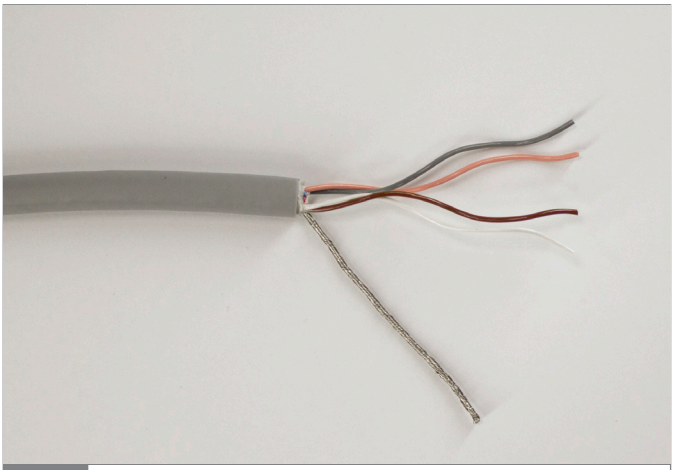
Electric torque screwdriver
3 mm (0.12 in.),
fastening torque 1.2 Nm

Torque wrench
torque depending on cable gland

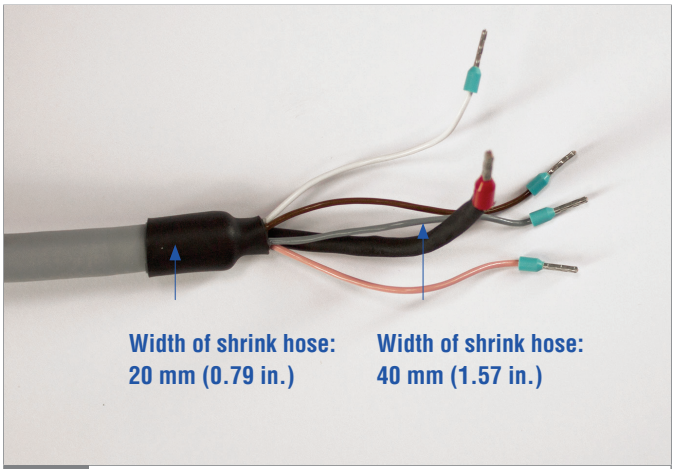
Slotted screwdriver
2.0 × 40 mm (0.08 × 1.57 in.)

Crimping tool
for ferrules with max. 2.5 mm²

Step 1: Preparing of cable



1 Strip the cable for 60 mm (2.36 in.).



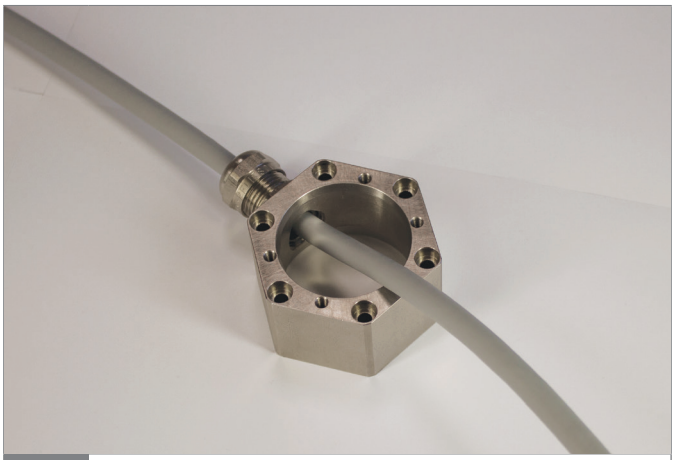
2 Install the shrink hose and the ferrules (max. 1.5 mm² or max. 2.5 mm² depending on connection).

The following two options present how to connect the cable to the T-Series sensor:

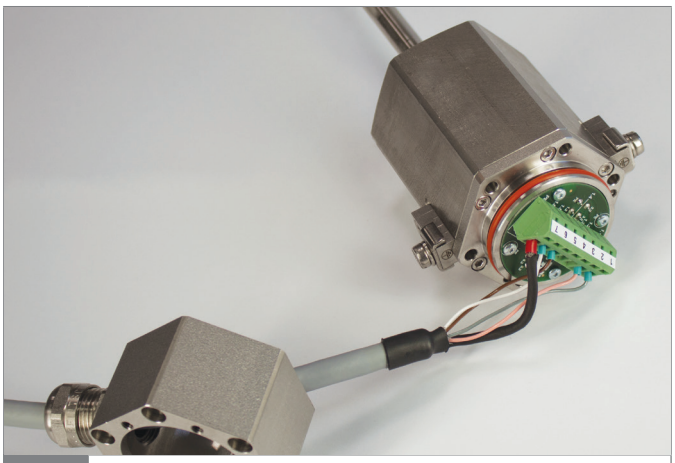
Option 1: Cable connection via disassembly of connection adapter (see page 21)
Option 2: Cable connection without disassembly of connection adapter (see page 22)

Step 2: Cable connection (Option 1: Disassembly of connection adapter)

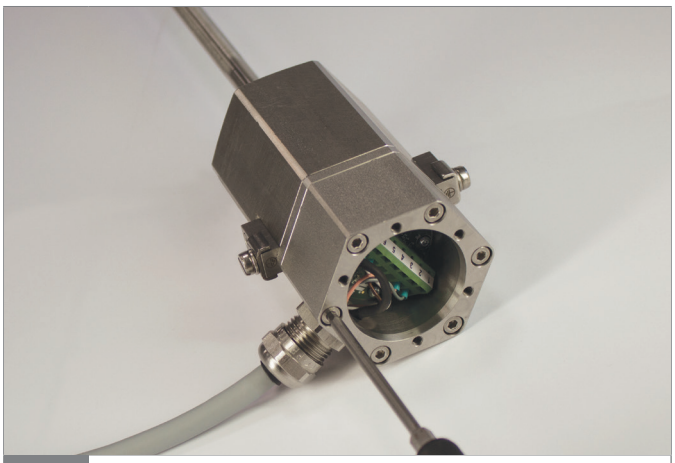
1 Loosen the five M4×10 screws (AF 3).



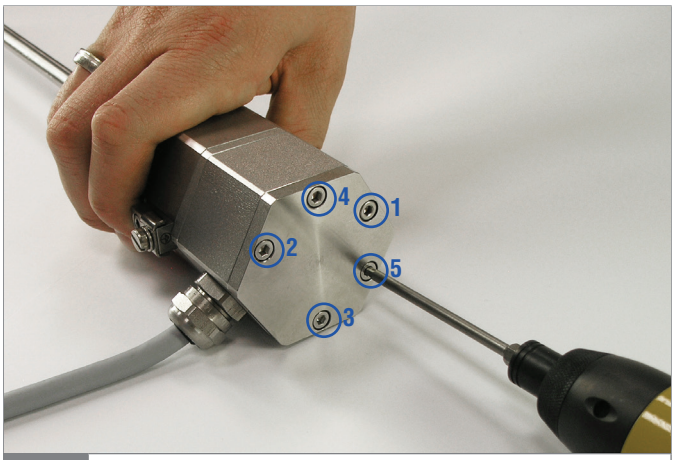
2 Mount the cable gland at the connection adapter. Note the instructions given by the manufacturer of the cable gland.



3 Connect the cable to the sensor.
Note the connection wiring on page 17 f.



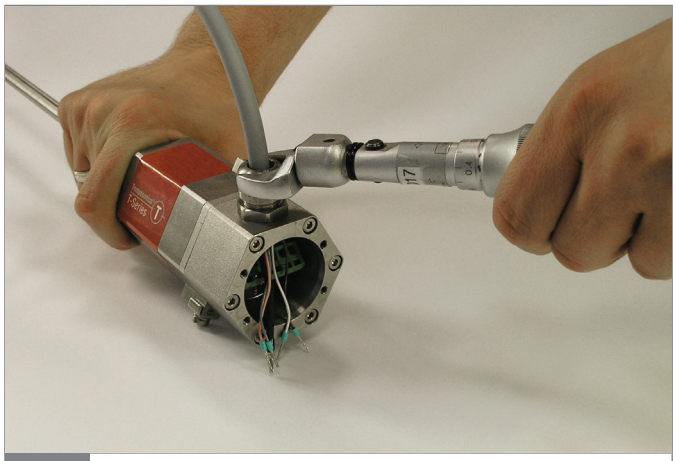
4 Tighten the screws of the connection adapter with a fastening torque of 1.2 Nm. Inspect surfaces and O-ring for damage. Wipe surfaces clean and apply O-ring lube.



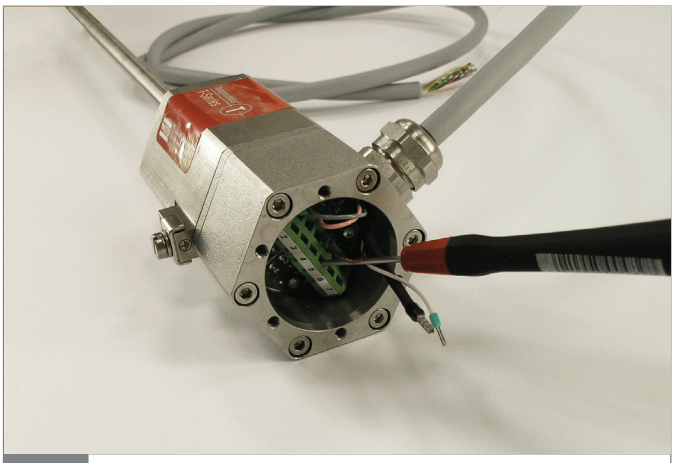
5 Tighten the screws of the upper lid crosswise with a fastening torque of 1.2 Nm (see figure for right sequence). Inspect surfaces and O-ring for damage. Wipe surfaces clean and apply O-ring lube. Check the position of O-ring between upper lid and connection adapter.

Step 2: Cable connection (Option 2: Without disassembly of connection adapter)

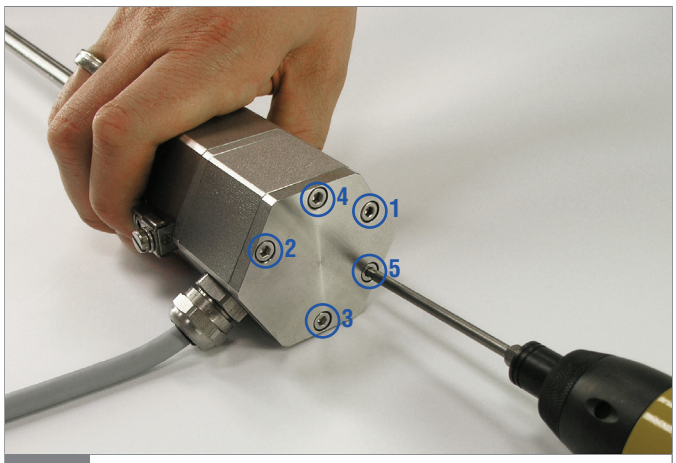
1 Loosen the five M4×10 screws (SW 3).



2 Mount the cable and cable gland. Note the instructions given by the manufacturer of the cable gland.



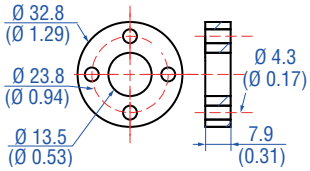
3 Connect the cable to the sensor.
Note the connection wiring on page 17 f.



4 Tighten the screws of the upper lid crosswise with a fastening torque of 1.2 Nm (see figure for right sequence). Inspect surfaces and O-ring for damage. Wipe surfaces clean and apply O-ring lube. Check the position of O-ring between upper lid and connection adapter.

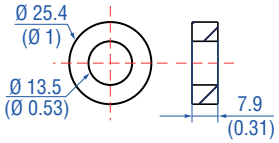
4.4 Frequently ordered accessories – Additional options available in our Accessories Guide 551444

Position magnets



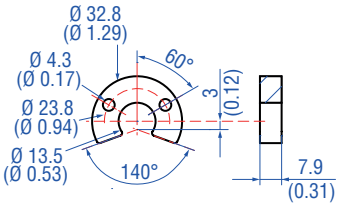
Standard ring magnet
Part no. 201 542-2

Material: PA ferrite GF20
Weight: Ca. 14 g
Operating temperature:
–40…+105 °C (–40…+221 °F)
Surface pressure: Max. 40 N/mm²
Fastening torque for M4 screws: 1 Nm



Ring magnet OD25,4
Part no. 400 533

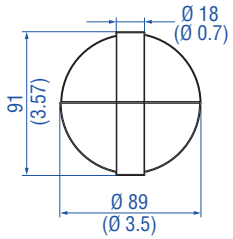
Material: PA ferrite
Weight: Ca. 10 g
Operating temperature:
–40…+105 °C (–40…+221 °F)
Surface pressure: Max. 40 N/mm²



U-magnet OD33
Part no. 251 416-2

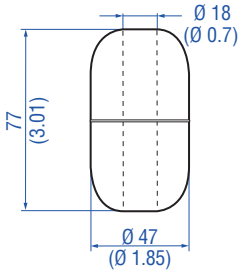
Material: PA ferrite GF20
Weight: Ca. 11 g
Operating temperature:
–40…+105 °C (–40…+221 °F)
Surface pressure: Max. 40 N/mm²
Fastening torque for M4 screws: 1 Nm

Magnet floats [3]



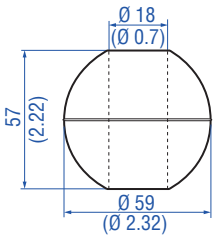
Magnet float
Part no. 251 469-2

Pressure: 29.3 bar (425 psi)
Operating temperature:
–40…+125 °C (–40…+257 °F)
Magnet offset: No
Specific gravity: 0.45
Material: Stainless steel
Weight offset: Yes



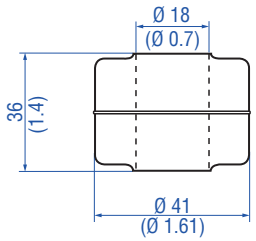
Magnet float
Part no. 251 981-2

Pressure: 29.3 bar (425 psi)
Operating temperature:
–40…+125 °C (–40…+257 °F)
Magnet offset: No
Specific gravity: 0.67
Material: Stainless steel
Weight offset: Yes



Magnet float
Part no. 251 387-2

Pressure: 22.4 bar (325 psi)
Operating temperature:
–40…+125 °C (–40…+257 °F)
Magnet offset: No
Specific gravity: 0.48
Material: Stainless steel
Weight offset: Yes



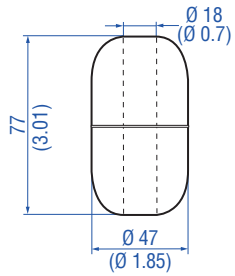
Magnet float
Part no. 200 938-2

Pressure: 8.6 bar (125 psi)
Operating temperature:
–40…+125 °C (–40…+257 °F)
Magnet offset: No
Specific gravity: 0.74
Material: Stainless steel
Weight offset: Yes

Controlling design dimensions are in millimeters and measurements in ( ) are in inches

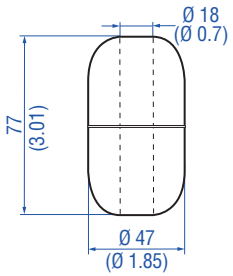
3/ – Be sure that the float specific gravity is at least 0.05 less than that of the measured liquid as a safety margin at ambient temperature.
– For interface measurement: A minimum of 0.05 specific gravity differential is required between the upper and lower liquids.
– When the magnet is not shown, the magnet is positioned at the center line of float.
– An offset weight is installed in the float to bias or tilt the float installed on the sensor tube. So the float remains in contact with the sensor tube at all times and guarantees permanent potential equalization of the float. The offset is required for installations that must conform to hazardous location standards.

Magnet floats [4]



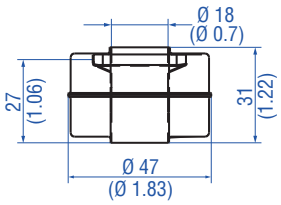
Magnet float
Part no. 251 982-2

Pressure: 29.3 bar (425 psi)
Operating temperature:
–40…+125 °C (–40…+257 °F)
Magnet offset: No
Specific gravity: 0.93
Material: Stainless steel
Weight offset: Yes



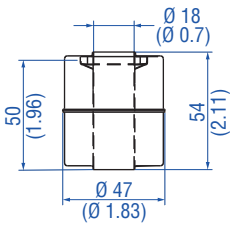
Magnet float
Part no. 251 983-2

Pressure: 29.3 bar (425 psi)
Operating temperature:
–40…+125 °C (–40…+257 °F)
Magnet offset: No
Specific gravity: 1.06
Material: Stainless steel
Weight offset: Yes



Magnet float [5]
Part no. 201 606-2

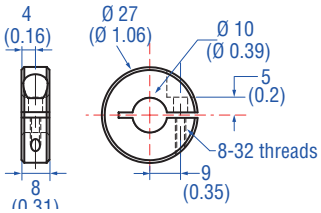
Pressure: 4 bar (60 psi)
Operating temperature:
–40…+125 °C (–40…+257 °F)
Magnet offset: Yes
Specific gravity: 0.93
Material: Stainless steel
Weight offset: Yes



Magnet float [5]
Part no. 201 605-2

Pressure: 4 bar (60 psi)
Operating temperature:
–40…+125 °C (–40…+257 °F)
Magnet offset: Yes
Specific gravity: 0.6
Material: Stainless steel
Weight offset: Yes

Collar



Collar
Part no. 560 777

Material:
Stainless steel 1.4301 (AISI 304)
Weight: Ca. 30 g

Hex key $^{7}/_{64}$" required

Programming tools

Analog hand programmer
Part no. 253 124

Easy teach-in-setups of stroke length and direction on desired zero / span positions. For the first output.

Programming kit
Part no. EU: 253 134-1
Part no. US: 253 309-1

Kit includes:
Interface converter box, power supply, cable
Software is available at:
www.mtssensors.com

Analog cabinet programmer
Part no. 253 408

Features snap-in mounting on standard 35 mm DIN rail. This programmer can be permanently mounted in a control cabinet and includes a program / run switch. For the first output.

Manuals & Software available at:
www.mtssensors.com

Controlling design dimensions are in millimeters and measurements in ( ) are in inches

4/ – Be sure that the float specific gravity is at least 0.05 less than that of the measured liquid as a safety margin at ambient temperature.
– For interface measurement: A minimum of 0.05 specific gravity differential is required between the upper and lower liquids.
– When the magnet is not shown, the magnet is positioned at the center line of float.
– An offset weight is installed in the float to bias or tilt the float installed on the sensor tube. So the float remains in contact with the sensor tube at all times and guarantees permanent potential equalization of the float. The offset is required for installations that must conform to hazardous location standards.
5/ Standard float that can be expedited.

5. Operation

5.1 Getting started

The sensor is factory-set to its order sizes and adjusted, i.e. the required output signal corresponds exactly to the selected stroke length.

Example: Output 4...20 mA = 0...100 % stroke length

NOTICE If necessary, the TH analog standard sensors can be re-adjusted using the service tools described below. To install the connection cable, the sensor's upper lid needs to be removed as shown in fig. 6 on page 12. It is not possible to configure the T-Series SIL 2 sensors.

NOTICE

Observe during commissioning

1. Before switching on for the first time, check carefully to ensure the sensor has been connected correctly.
2. Ensure that the sensor control system cannot react in an uncontrolled way when switching on.
3. Ensure that the sensor is ready and in operation mode after switching on.
4. Check the preset span start and end values of the measuring range (see section 4.2 Styles and installation) and correct them via the customer's control system, if necessary or via the MTS Sensors service tools. The operation of the service tools is described in detail on the following pages.

5.2 Programming and configuration

MTS Sensors service tools

Temposonics® sensors can be adapted to modified measurement tasks very easily from outside via the connecting leads – without opening the sensor. Various MTS Sensors sensor control units from the list of accessories (see page 24) are available for this purpose.

NOTICE The analog hand programmer and the programming kit are not approved for use in a hazardous environment.

NOTICE The T-Series (only standard version) can be configured with the programming tools listed below. The T-Series SIL 2 rated sensor is not a field programmable device. All sensor parameters are factory-set and not adjustable by the end user.

Analog hand programmer, part no. 253 124

Connect the hand programmer directly to the sensor. When measuring with one magnet it is possible to change the start and end positions as well as the measuring direction via simple teach-in process. After that, the changed parameters are stored in the sensor. Move the magnet to the desired null and span positions (minimum distance between setpoints: 25 mm (1 in.)) and push the corresponding 0 % respectively 100 % buttons on the programmer. The individual steps are explained in the following section.

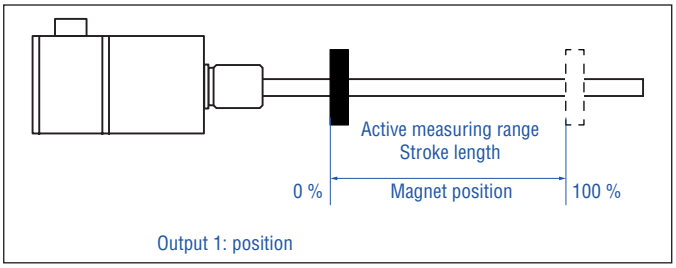


Fig. 23: Active measuring range

☐ **Step 1: Connect hand programmer**
☐ Step 2: Adjust measuring range

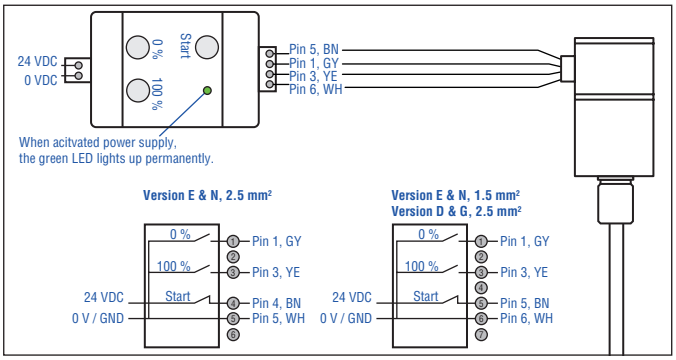


Fig. 24: Connect hand programmer (see connection wiring fig. 19 / fig. 20 / fig. 21 on page 18)

☑ Step 1: Connect hand programmer
☐ **Step 2: Adjust measuring range**

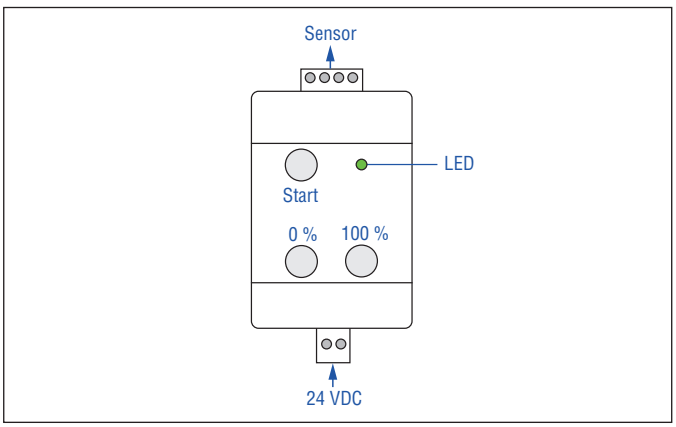


Fig. 25: Adjust measuring range

1. Activate the programming mode:
   - Press "Start" button and "100 %" button simultaneously
   - Release "Start" button and also "100 %" button after > 1 sec.

2. Set start point (0 % output) = 4 mA / 0 mA:
   - Set the magnet on start position
   - Press the "0 %" button shortly

3. Set end point (100 % output) = 20 mA:
   - Set the magnet on end position
   - Press the "100 %" button shortly

4. Establish normal function (operation mode):
   - Press "Start" button

Analog cabinet programmer, part no. 253 408

The built-in programming unit is installed firmly in the control cabinet. It can be used to change the stroke length and the measuring direction and save the new values in the sensor using a simple teach-in process. For this, take the position magnet to the required start and end points and press the “0 %” or the “100 %” button to set the positions. The smallest adjustable measuring range, i.e. the minimum distance between the new setpoints, can be 25 mm (1 in.).

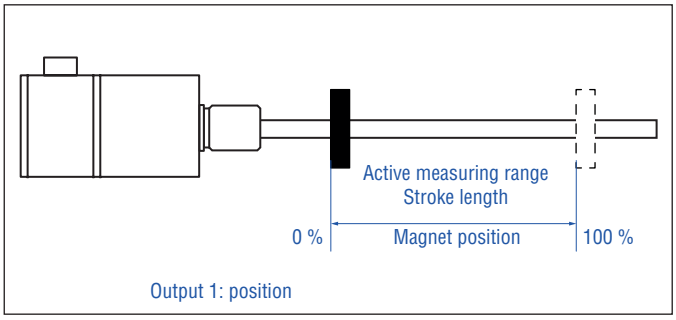


Fig. 27: Active measuring range

☐ **Step 1: Install cabinet programmer**
☐ Step 2: Connect cabinet programmer

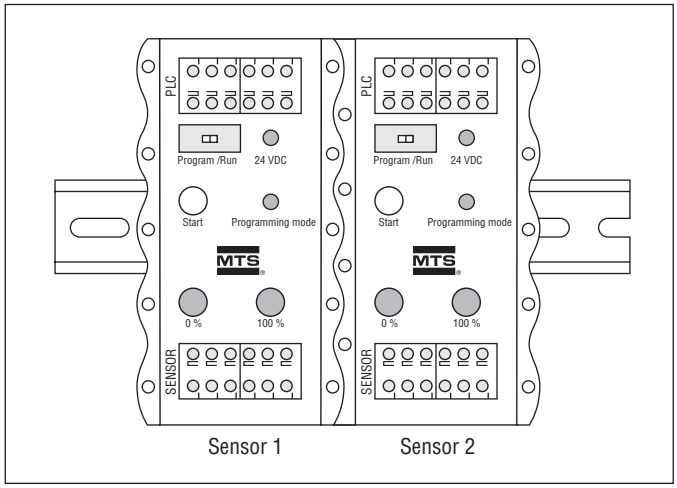
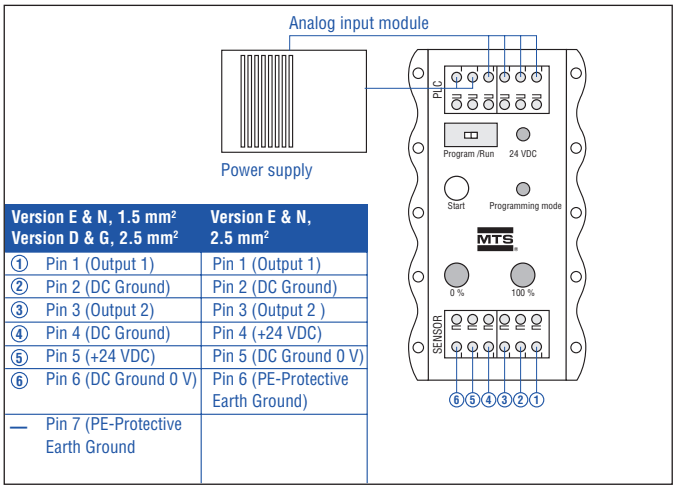


Fig. 26: Dimensions: 10 × 55 × 31 mm (0.39 × 2.17 × 1.22 in.); material: aluminum, side caps PA 6.6 FR; connection type: spring terminals, max. 1,5 mm ²; ingress protection: IP20

The programmer electronics housing is designed for mounting on standard 35 mm rails (DIN EN 60715 / 50022). It is suitable for connection between sensor and controller in a cabinet. The programming mode can be activated without any service tool at any time.

☑ Step 1: Install cabinet programmer
☐ **Step 2: Connect cabinet programmer**



Version E & N, 1.5 mm² Version D & G, 2.5 mm²	Version E & N, 2.5 mm²
① Pin 1 (Output 1)	Pin 1 (Output 1)
② Pin 2 (DC Ground)	Pin 2 (DC Ground)
③ Pin 3 (Output 2)	Pin 3 (Output 2)
④ Pin 4 (DC Ground)	Pin 4 (+24 VDC)
⑤ Pin 5 (+24 VDC)	Pin 5 (DC Ground 0 V)
⑥ Pin 6 (DC Ground 0 V)	Pin 6 (PE-Protective Earth Ground)
— Pin 7 (PE-Protective Earth Ground	

Fig. 28: Connect cabinet programmer (see connection wiring fig. 19 / fig. 20 / fig. 21 on page 18)

<u>Adjust measuring range</u>

Normal function (run mode):
Sliding switch on “Run” (now all sensor leads are connected with the control unit). Green LED “24 VDC” shows normal function.

Activate programming mode:
Sliding switch on “Program”. Press “Start” button and “100 %” button simultaneously.
Release “Start” button and also “100 %” button after > 1 sec.
Green “Programming mode” LED on cabinet programmer flashes (programming mode reached).

Set start point (0 % output) = 4 mA / 0 mA:
Set the magnet to start position. Press “0 %” button quickly.

Set end point (100 % output) = 20 mA:
Set the magnet to end position. Press “100 %” button quickly.

Back to normal function:
Press “Start” button quickly. LED “Programming mode” stops flashing.
Slide switch to “Run”.

Programming kit, part no. 253 134-1 (EU) / 253 309-1 (US)
The PC programmer, a hardware converter, can be used for customized sensor settings. Parameters of the sensor can be changed within the active stroke via a Windows computer and analog configurator by MTS Sensors. Depending on the sensor design, the tool allows the menu-driven change of:

- Start- / end-position of magnet
  (minimum distance between new setpoints: 25 mm (1 in.))
- Output assignment to the measured values
- Output signal with errors (e.g. no magnet)

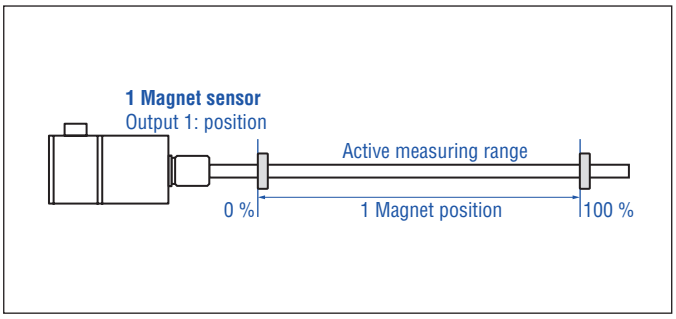


Fig. 30: Active measuring range

☐ **Step 1: Connect PC programmer**
☐ Step 2: Install software
☐ Step 3: Start program

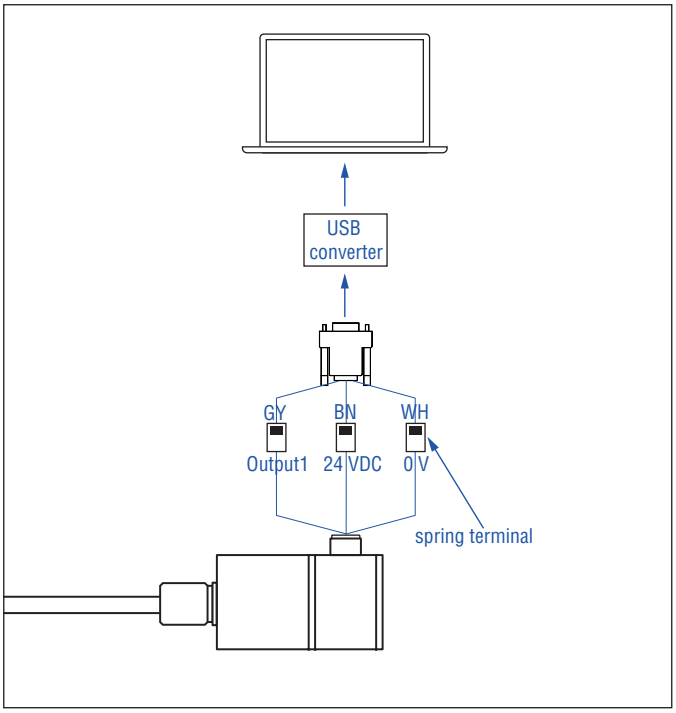


Fig. 29: Connect programmer (with spring terminal)

- Connect the programmer with the sensor via the corresponding cable.
- Connect the programmer via USB port with the computer.
- Connect the power supply via jack on the side. The external contact of the connector is 0 V (ground).

☑ Step 1: Connect PC programmer
☐ **Step 2: Install software**
☐ Step 3: Start program

Download current software version from www.mtssensors.com. Copy AnalogConfigurator.exe to your computer and start the program. The program now displays a list of available COMs. Normally, the COM port with the lowest number (e.g. COM1) should be selected. If a connection fails, it could be a missing driver. In this case, download and install the USB serial converter driver from www.mtssensors.com.

☑ Step 1: Connect PC programmer
☑ Step 2: Install software
☐ **Step 3: Start program**

After starting the analog configurator, the relevant user interface of the connected sensor with its adjustable parameters will open (fig. 31 on page 28). The following example illustrates the configuration of a sensor with two magnets.

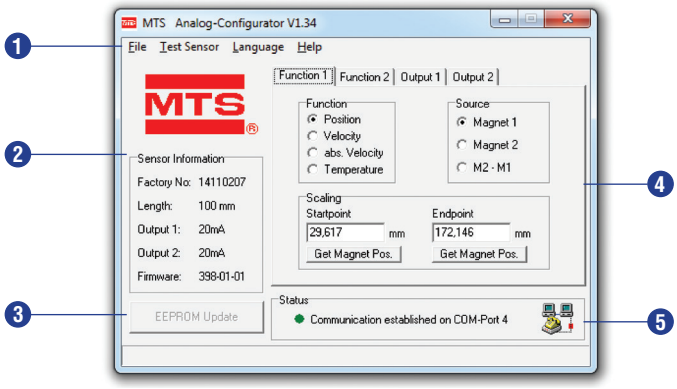


Fig. 31: Example of windows user interface

1. In the **File** menu, the sensor configuration can be saved on hard disk, printed out or loaded into the sensor [6]. Moreover, this menu permits returning to the factory setting.
2. The frame **Sensor Information** contains the invariable sensor parameters, which are read in automatically when connecting the sensor.
3. Any changes which were made are shown with dark background. By clicking on **EEPROM update**, the altered parameters are sent to the sensor and stored permanently. Subsequently, the stored values are displayed again with a white background.
4. The control tabs of mainframe permit allocation of functions to the sensor outputs. Via **Function** the type of measurement is selectable. The measuring range of the functions will be determined in **Scaling**.
5. **Status** indicates that the sensor is connected successfully.

Tabs control frame

6. Via tab **Function 1** you can determine the type of measurement and the **source**. In fig. 32 position measurement with **Magnet 1** is selected. Under **Scaling** you can specify the start- and endpoint of the position measurement.
7. Via tab **Output 1** the analog output signal is assigned to a function, **Function 1** or **Function 2**.
8. If **Position** is selected as type of measurement the actual magnet position can be stored via buttons **Get Magnet Pos.** (Note: On sensors with 2 magnets, value storage always relates to the first magnet only).

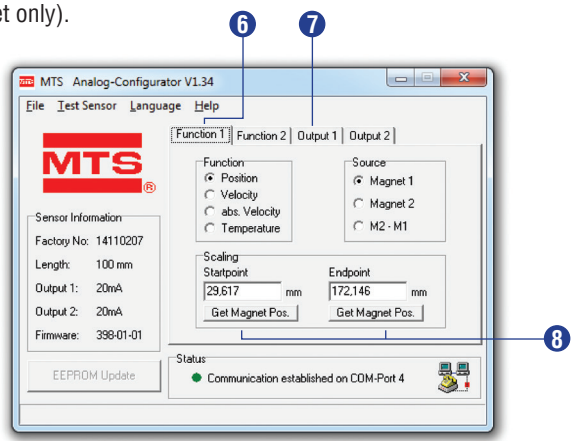


Fig. 32: Example of tab controls

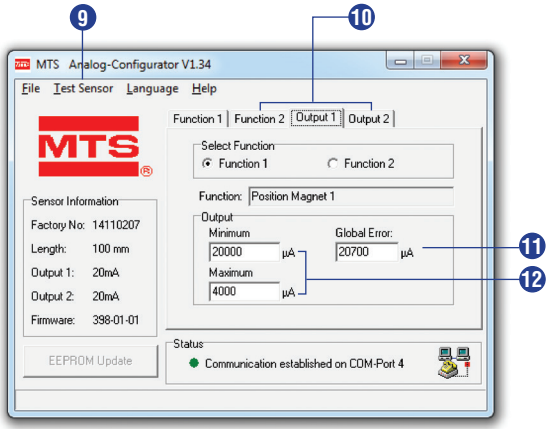


Fig. 33: Example of tab controls

9. Menu **Test Sensor** provides a data display (fig. 34), which shows the absolute positions of the position magnets. Compared with the sensor measuring rate, serial data transmission between sensor and PC is relatively slow, i.e. not every actually measured value can be displayed. For this reason, only every 50th measurement value appears in the diagram.
10. Index cards **Function 2**, **Output 2** and the functional reference to the 2nd magnet in field **Source** (fig. 32), are provided only for sensors with two analog outputs.
11. Unless a position magnet is provided, or if it is in the sensor dead zone, i.e. out of measuring range, **Global Error** is output. The error value can be adjusted within –0.7…20.7 mA.
12. Thereby, field **Output Minimum** indicates the current value which should be output at the starting point of the selected function. The output value pertaining to the end point must be specified in field **Output Maximum** (fig. 33).

Data display

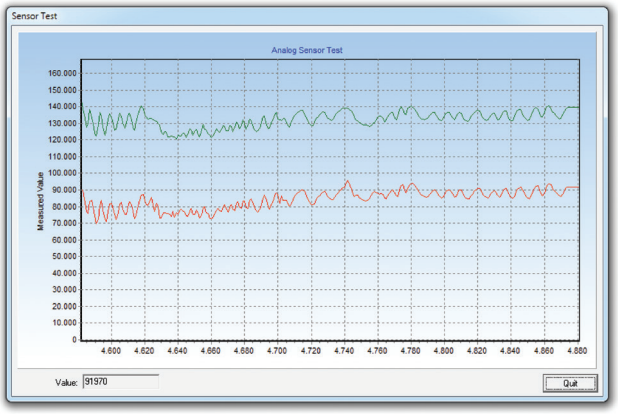


Fig. 34: Sensor Test diagram of analog sensor with 2 position magnets

6/ Only sensor configurations with the same serial number permitted

Setting examples for hand programmer or cabinet programmer
The sensor measurement range can be positioned with the tools as previously described any time.

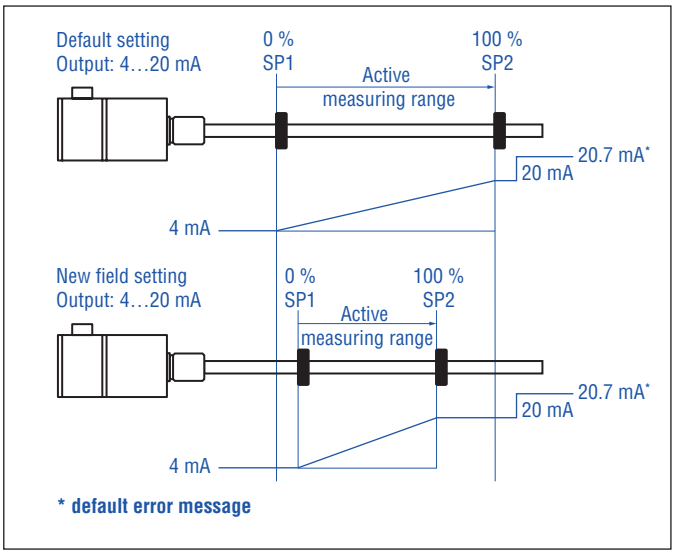


Fig. 35: Set start- and endpoint

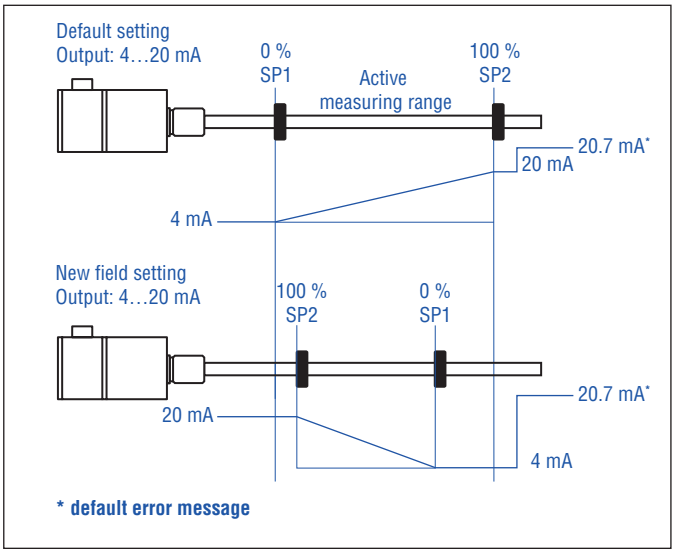


Fig. 36: Start- and endpoint, set the direction

NOTICE

Independent of the measuring direction, the location of the setpoints in the factory settings is always: SP1 at sensor electronics housing and SP2 at rod end (fig. 35). The minimum distance between SP1 and SP2 is 25 mm (1 in.).

6. Maintenance and troubleshooting

6.1 Error conditions, troubleshooting

Error condition	Status
Magnet error	Error value at output **Standard version:** Current output: 20.7 mA (default error message) **SIL 2 version:** Current output: < 3.6 mA (close to 0 mA)

6.2 Maintenance

The required inspections need to be performed by qualified personnel according to IEC 60079-17 / TRBS 1203. These inspections should include at least a visual inspection of the housing, associated electrical equipment entrance points, retention hardware and equipment grounding. Inside the Ex-atmosphere the equipment has to be cleaned regularly. The user determines the intervals for checking according to the environmental conditions present at the place of operation. After maintenance and repair, all protective devices removed for this purpose must be refitted.

Type of inspection	Visual inspection every 3 months	Close inspection every 6 months	Detailed inspection every 12 months
Visual inspection of the sensor for intactness, removal of dust deposits	●		
Check of electrical system for intactness and functionality			●
Check of entire system	User's responsibility		

NOTICE

Perform maintenance work that requires a dismantling of the system only in an Ex-free atmosphere. If this is not possible, however, at least protective measures in compliance with the local regulations should be taken.

Maintenance: defines a combination of any actions carried out to retain an item in, or restore it to, conditions in which it is able to meet the requirements of the relevant specification and perform its required functions.
Inspection: defines an activity with the purpose of checking a product carefully, aiming at a reliable statement of the condition of the product. The inspection is carried out without dismantling, or, if necessary, with partial dismantling, and supplemented by other measures, e.g. measurements.

Visual inspection: Optical inspection of product aims at the recognition of visible defects like missing bolts without using auxiliary equipment and tools.
Close inspection: defines an inspection which encompasses those aspects covered by a visual inspection and, in addition, identifies those defects, such as loose bolts, which will be apparent only by the use of access equipment, for example steps, where necessary, and tools.
Detailed inspection: defines an inspection which encompasses those aspects covered by a close inspection and, in addition, identifies those defects, such as loose terminations, which will only be apparent by opening the enclosure, and / or using, where necessary, tools and test equipment.

6.3 Repair

Repairs of the sensor may be performed only by MTS Sensors or an explicitly authorized body. Repairs of the flameproof joints must be made by the manufacturer in compliance with the constructive specifications. Repairs must not be made on the basis of values specified in tables 1 and 2 of IEC/EN 60079-1.

6.4 List of spare parts

No spare parts are available for this sensor.

6.5 Transport and storage

Note the storage temperature of the sensor, which is from –40…+93 °C (–40…+199.4 °F).

7. Removal from service / dismantling

The product contains electronic components and must be disposed of in accordance with the local regulations.

8. Technical data for SIL 2 sensor

Output	
Current	4…20 mA, 20…4 mA (minimum / maximum load 0 / 500 Ω)
Measured value	Position
Measurement parameters	
Resolution	16 bit; 0.0015 % (minimum 1 µm)
Cycle time	2.0 ms
Linearity [7]	< ±0.01 % F.S. (minimum ±50 µm)
Repeatability	< ±0.001 % F.S. (minimum ±2.5 µm)
Hysteresis	< 4 µm
Temperature coefficient	< 30 ppm/K typical
Operating conditions	
Operating temperature	–40…+85 °C (–40…+185 °F)
Humidity	90 % rel. humidity, no condensation
Ingress protection	Version D, G and E: IP66 / IP67 Version N: IP66, IP67, IP68, IP69K, NEMA 4X, depending on cable gland
Shock test	100 g (single shock) / IEC standard 60068-2-27
Vibration test	15 g / 10…2000 Hz, IEC standard 60068-2-6 (resonance frequencies excluded)
EMC test	Electromagnetic emission according to IEC/EN 61326-1 (Class B) Electromagnetic immunity according to IEC/EN 61326-2-3 (Class B)
Magnet movement velocity	Any
Design and material	
Sensor electronics housing	1.4305 (AISI 303); option: 1.4404 (AISI 316L)
Sensor rod	1.4306 (AISI 304L); option: 1.4404 (AISI 316L)
Stroke length	25…1500 mm (1…60 in.)
Operating pressure	350 bar static (5076 psi static)
Mechanical mounting	
Mounting position	Any orientation
Mounting instruction	Please consult the technical drawings on page 10
Electrical connection	
Connection type	T-Series terminal
Operating voltage	+24 VDC (–15 / +20 %)
Ripple	≤ 0.28 V_{pp}
Current consumption	100 mA typical
Dielectric strength	700 VDC (DC ground to machine ground)
Polarity protection	Up to –30 VDC
Overvoltage protection	Up to 36 VDC

7/ With position magnet # 201 542-2

Certification for SIL 2 sensor

Certification Required	Version E	Version D	Version G	Version N
IECEx / ATEX	Ex db eb IIC T4 Ga/Gb Ex tb IIIC T130°C Ga/Db Zone 0/1, Zone 21 –40 °C ≤ Ta ≤ 85 °C	Ex db IIC T4 Ga/Gb Ex tb IIIC T130°C Ga/Db Zone 0/1, Zone 21 –40 °C ≤ Ta ≤ 85 °C	Ex db IIC T4 Ga/Gb Ex tb IIIC T130°C Ga/Db Zone 0/1, Zone 21 –40 °C ≤ Ta ≤ 85 °C	No hazardous area approval
NEC (USA)	**Non-incendive** Class I Div. 2 Groups A, B, C, D T4 Class II/III Div. 2 Groups E, F, G –40 °C ≤ Ta ≤ 80 °C **Non-sparking** Class I Zone 2 AEx nA IIC T4 Gc Class II/III Zone 22 AEx tc IIIC T130°C Dc –40 °C ≤ Ta ≤ 80 °C	—	**Explosionproof** Class I Div. 1 Groups A, B, C, D T4 Class II/III Div. 1 Groups E, F, G T130°C –40 °C ≤ Ta ≤ 85 °C **Flameproof** Class I Zone 0/1 AEx d IIC T4 Class II/III Zone 21 AEx tb IIIC T130°C –40 °C ≤ Ta ≤ 85 °C	No hazardous area approval
CEC (Canada)	**Non-incendive** Class I Div. 2 Groups A, B, C, D T4 Class II/III Div. 2 Groups E, F, G –40 °C ≤ Ta ≤ 80 °C **Non-sparking** Class I Zone 2 Ex nA IIC T4 Gc Class II/III Zone 22 Ex tc IIIC T130°C Dc –40 °C ≤ Ta ≤ 80 °C	—	**Explosionproof** Class I Div. 1 Groups B, C, D T4 Class II/III Div. 1 Groups E, F, G T130°C –40 °C ≤ Ta ≤ 85 °C **Flameproof** Class I Zone 0/1 Ex d IIC T4 Ga/Gb Class II/III Zone 21 Ex tb IIIC T130°C Db –40 °C ≤ Ta ≤ 85 °C	No hazardous area approval

SIL 2 sensor parameter

T-Series (SIL 2: Analog Safety)	IEC 61508
Safety Level	SIL 2
Device type	B
$MTTF_d$	100 years @ 60 °C 44 years @ 80 °C
PFD_{avg}	3.49E-04 @ 60 °C 9.85E-04 @ 80 °C
Diagnostic Response Time (Fail Detection Time)	25 ms (max) 1 sec for CRC fault detection
% of SIL 2 range for PFD	3.5 % @ 60 °C; 9.9 % @ 80 °C
Hardware Fault Tolerance (HFT)	0
Useful lifetime	50 years @ 60 °C 18 years @ 80 °C
Device @ 1 % accuracy (60 °C / 80 °C / 85 °C)	SFF 93.6 %

Safety values for maximum operating temperature

Device @ 1 % accuracy	λ_{SD}	λ_{SU}	λ_{DD}	λ_{DU}	SFF
T-Series @ 60 °C	0	100	802	62	93.6 %
T-Series @ 80 °C	0	283	2266	175	93.6 %
T-Series @ 85 °C	0	400	3205	248	93.6 %

9. Technical data for standard sensor

Output	
Current	4(0)…20 mA, 20…4(0) mA (minimum / maximum load 0 / 500 Ω)
Measured value	Position
Measurement parameters	
Resolution	16 bit; 0.0015 % (minimum 1 µm)
Cycle time	0.5 ms up to 1200 mm, 1.0 ms up to 2400 mm, 2.0 ms up to 4800 mm, 5.0 ms up to 7620 mm stroke length
Linearity [8]	< ±0.01 % F.S. (minimum ±50 µm)
Repeatability	< ±0.001 % F.S. (minimum ±2.5 µm)
Hysteresis	< 4 µm
Temperature coefficient	< 30 ppm/K typical
Operating conditions	
Operating temperature	–40… +75 °C (–40…+167 °F)
Humidity	90 % rel. humidity, no condensation
Ingress protection	Version D, G and E: IP66 / IP67 Version N: IP66, IP67, IP68, IP69K, NEMA 4X, depending on cable gland
Shock test	100 g (single shock) / IEC standard 60068-2-27
Vibration test	15 g / 10…2000 Hz, IEC standard 60068-2-6 (resonance frequencies excluded)
EMC test	Electromagnetic emission according to IEC/EN 55011 +A1 Class B Electromagnetic immunity according to IEC/EN 61000-6-2
Magnet movement velocity	Any
Design and material	
Sensor electronics housing	1.4305 (AISI 303); option: 1.4404 (AISI 316L)
Sensor rod	1.4306 (AISI 304L); option: 1.4404 (AISI 316L)
Stroke length	25…7620 mm (1…300 in.)
Operating pressure	350 bar static (5076 psi static)
Mechanical mounting	
Mounting position	Any orientation
Mounting instruction	Please consult the technical drawings on page 10
Electrical connection	
Connection type	T-Series terminal
Operating voltage	+24 VDC (–15 / +20 %)
Ripple	≤ 0.28 V_{pp}
Current consumption	100 mA typical
Dielectric strength	700 VDC (DC ground to machine ground)
Polarity protection	Up to –30 VDC
Overvoltage protection	Up to 36 VDC

8/ With position magnet # 201 542-2

Certification for standard sensor

Certification Required	Version E	Version D	Version G	Version N
IECEx / ATEX	Ex db eb IIC T4 Ga/Gb Ex tb IIIC T130°C Ga/Db Zone 0/1, Zone 21 –40 °C ≤ Ta ≤ 75 °C	Ex db IIC T4 Ga/Gb Ex tb IIIC T130°C Ga/Db Zone 0/1, Zone 21 –40 °C ≤ Ta ≤ 75 °C	Ex db IIC T4 Ga/Gb Ex tb IIIC T130°C Ga/Db Zone 0/1, Zone 21 –40 °C ≤ Ta ≤ 75 °C	No hazardous area approval
NEC (USA)	—	—	**Explosionproof** Class I Div. 1 Groups A, B, C, D T4 Class II/III Div. 1 Groups E, F, G T130°C –40 °C ≤ Ta ≤ 75 °C **Flameproof** Class I Zone 0/1 AEx d IIC T4 Class II/III Zone 21 AEx tb IIIC T130°C –40 °C ≤ Ta ≤ 75 °C	No hazardous area approval
CEC (Canada)	—	—	**Explosionproof** Class I Div. 1 Groups B, C, D T4 Class II/III Div. 1 Groups E, F, G T130°C –40 °C ≤ Ta ≤ 75 °C **Flameproof** Class I Zone 0/1 Ex d IIC T4 Ga/Gb Class II/III Zone 21 Ex tb IIIC T130°C Db –40 °C ≤ Ta ≤ 75 °C	No hazardous area approval

EU Declaration of Conformity EC15.001E

EU-Konformitätserklärung

Déclaration UE de Conformité

MTS Sensor Technologie GmbH & Co. KG, Auf dem Schueffel 9, 58513 Luedenscheid, Germany

declares as manufacturer in sole responsibility that the position sensor type
erklärt als Hersteller in alleiniger Verantwortung, dass der Positionssensor Typ
déclare en qualité de fabricant sous sa seule responsabilité que les capteurs position de type

Temposonics **TH-x-xxxxx-xxx-1-D-N-x-xxx**
TH-x-xxxxx-xxx-1-G-N-x-xxx
TH-x-xxxxx-xxx-1-E-N-x-xxx

comply with the regulations of the following European Directives:
den Vorschriften folgender Europäischen Richtlinien entsprechen:
sont conformes aux prescriptions des directives européennes suivantes :

2014/34/EU Equipment and protective systems for use in potentially explosive atmospheres
Geräte und Schutzsysteme zur Verwendung in explosionsgefährdeten Bereichen
Appareils et systèmes de protection à être utilisés en atmosphères explosibles

2014/30/EU Electromagnetic Compatibility
Elektromagnetische Verträglichkeit
Compatibilité électromagnétique

Applied harmonized standards:
Angewandte harmonisierte Normen:
Normes harmonisées appliquées :

EN 60079-0:2012+A11:2013, EN 60079-1:2014, EN 60079-7:2015, EN 60079-26:2015, EN 60079-31:2014, EN 61000-6-2:2005, EN 55011:2009+A1:2010 Class B

EC type examination certificate:
EG-Baumusterprüfbescheinigung: **CML ATEX 1090 X**
Certificat de l'examen CE de type :
issued by / ausgestellt durch / exposé par: **Certification Management Limited**
Ellesmere Port CH65 4LZ, United Kingdom (2503)

Notified body for quality assurance control: **Certification Management Limited**
Benannte Stelle für Qualitätsüberwachung: **Ellesmere Port CH65 4LZ, United Kingdom**
Organisme notifié pour l'assurance qualité :
Ident number / Kennnummer / Numéro d'identification : **2503**

Marking / Kennzeichnung / Marquage : **Ex II 1/2G Ex db IIC T4 Ga/Gb resp.**
Ex II 1/2G Ex db eb IIC T4 Ga/Gb resp.
Ex II 1G/2D Ex tb IIIC T130°C Ga/Db

Luedenscheid, 2016-06-13

MTS Sensor Technologie GmbH & Co. KG

Dr.-Ing. Eugen Davidoff
Approvals Manager
ATEX Representative

EU Declaration of Conformity
EU-Konformitätserklärung
Déclaration UE de Conformité

EC15.002E

MTS Sensor Technologie GmbH & Co. KG, Auf dem Schueffel 9, 58513 Luedenscheid, Germany

declares as manufacturer in sole responsibility that the position sensor type
erklärt als Hersteller in alleiniger Verantwortung, dass der Positionssensor Typ
déclare en qualité de fabricant sous sa seule responsabilité que les capteurs position de type

Temposonics **TH-x-xxxxx-xxx-1-D-S-x-xxx**
TH-x-xxxxx-xxx-1-G-S-x-xxx
TH-x-xxxxx-xxx-1-E-S-x-xxx

comply with the regulations of the following European Directives:
den Vorschriften folgender Europäischen Richtlinien entsprechen:
sont conformes aux prescriptions des directives européennes suivantes :

2014/34/EU Equipment and protective systems for use in potentially explosive atmospheres
Geräte und Schutzsysteme zur Verwendung in explosionsgefährdeten Bereichen
Appareils et systèmes de protection à être utilisés en atmosphères explosibles

2014/30/EU Electromagnetic Compatibility
Elektromagnetische Verträglichkeit
Compatibilité électromagnétique

Applied harmonized standards:
Angewandte harmonisierte Normen:
Normes harmonisées appliquées :

EN 60079-0:2012+A11:2013, EN 60079-1:2014, EN 60079-7:2015, EN 60079-26:2015, EN 60079-31:2014, EN 61326-1:2013, EN 61326-2-3:2013

EC type examination certificate:
EG-Baumusterprüfbescheinigung: **CML ATEX 1090 X**
Certificat de l'examen CE de type :
issued by / ausgestellt durch / exposé par: **Certification Management Limited**
Ellesmere Port CH65 4LZ, United Kingdom (2503)

Notified body for quality assurance control: **Certification Management Limited**
Benannte Stelle für Qualitätsüberwachung: **Ellesmere Port CH65 4LZ, United Kingdom**
Organisme notifié pour l'assurance qualité :
Ident number / Kennnummer / Numéro d'identification : **2503**

Marking / Kennzeichnung / Marquage : **Ⓔx II 1/2G Ex db IIC T4 Ga/Gb resp.**
Ⓔx II 1/2G Ex db e IIC T4 Ga/Gb resp.
Ⓔx II 1G/2D Ex tb IIIC T130°C Ga/Db

Luedenscheid, 2016-06-13

MTS Sensor Technologie GmbH & Co. KG

Dr.-Ing. Eugen Davidoff
Approvals Manager
ATEX Representative

12. Appendix

Safety Declaration

Dear Customer,
If you return one or several sensors for checking or repair, we need you to sign a safety declaration. The purpose of this declaration is to ensure that the returned items do not contain residues of harmful substances and / or that people handling these items will not be in danger.

MTS order number: _____ Sensor type(s): _____

Serial number(s): _____ Sensor length: _____

The sensor has been in contact with the following materials:

Don't specify chemical formulas.
Please include safety data sheets of the substances, if applicable.

In the event of suspected penetration of substances into the sensor, consult MTS Sensors to determine measures to be taken before shipment.

Short description of malfunction:

Corporate information

Company:_____

Address: _____

_____

Contact partner

Name: _____

Phone: _____

E-Mail: _____

We hereby certify that the measuring equipment has been cleaned and neutralized. Equipment handling is safe. Personnel exposure to health risks during transport and repair is excluded.

Stamp Signature Date

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MTS®
SENSORS

Document Part Number:
551513 Revision D (EN) 05/2016

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LEGAL NOTICES

ISO 9001 CERTIFIED

Reg.-No. 003095-QM08

SIL 2 Safety Integrity Level IEC 61508

CE

Ex

c PS us CERTIFIED ELECTRICAL SAFETY

EU Type Examination Certificate CML16ATEX1090X Issue 0

1 Equipment intended for use in Potentially Explosive Atmospheres Directive 2014/34/EU

2 Equipment **Position Sensor Temposonics® T-Series TH**

3 Manufacturer **MTS Technologie GmbH & Co. KG** **MTS Systems Corporation, Sensors Division**

4 Address Auf dem Schüffel 9
58513 Lüdenscheid
Germany

3001 Sheldon Drive
Cary
NC 27513
USA

5 The equipment is specified in the description of this certificate and the documents to which it refers.

6 Certification Management Limited, Unit 1 Newport Business Park, New Port Road, Ellesmere Port CH65 4LZ, UK, Notified Body Number 2503, in accordance with Article 17 of Directive 2014/34/EU of the European Parliament and of the Council, dated 26 February 2014, certifies that this equipment has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of equipment intended for use in potentially explosive atmospheres given in Annex II to the Directive.

The examination and test results are recorded in the confidential reports listed in Section 12.

7 If an 'X' suffix appears after the certificate number, it indicates that the equipment is subject to conditions of safe use (affecting correct installation or safe use). These are specified in Section 14.

8 This EU Type Examination certificate relates only to the design and construction of the specified equipment or component. Further requirements of Directive 2014/34/EU Article 13 apply to the manufacture of the equipment or component and are separately certified.

9 Compliance with the Essential Health and Safety Requirements, with the exception of those listed in the confidential report, has been demonstrated through compliance with the following documents:

EN 60079-0:2012 EN 60079-1:2014 EN 60079-7:2015 EN 60079-26:2015

EN 60079-31:2014

10 The equipment shall be marked with the following:

Ⓔx II 1/2 G D or

Ex db IIC T4 Ga/Gb	Ex db eb IIC T4 Ga/Gb	Ex tb IIIC T130°C Ga/Db
Ta = -40°C to +90°C	Ta = -40°C to +90°C	Ta = -40°C to + 90°C

11 Description

The T-Series TH is a magnetostrictive linear position sensor comprising a stainless steel hexagonal cross-sectional enclosure and cylindrical measuring element.
The enclosure comprises two compartments; one containing the electronics and the other containing termination facilities for the connection to external circuits. The compartments are separated by a spigoted bushing with the terminal compartment cover being secured by five M4 socket-head cap screws grade
A4-70. The rear of the electronics contains a threaded boss through which passes the measuring element.
Cable entry is made via either an M16 threaded boss to the side of the terminal compartment, which may optionally be fitted with an M20 or ½" NPT thread adapter, or an M20 or ½" NPT entry in the cover.
A facility for an external earthing or equi-potential bonding conductor is provided on both the terminal and electronics compartment comprising: a ground block; an M4 Screw; an M5 screw; a spring washer; a clamping tab.

12 Certificate history and evaluation reports

Issue	Date	Associated report	Notes
0	26 May 2016	R1188A/00	First issue

Note: Drawings that describe the equipment or component are listed in the Annex.

13 Conditions of manufacture

The following conditions are required of the manufacturing process for compliance with the certification.

13.1 When the Position Sensor Temposonics® T-Series TH utilise increased safety explosion protection, each unit shall be subjected to a dielectric strength test in accordance with EN 60079-7 clause 6.1.

14 Special Conditions for Safe Use (Conditions of Certification)

The following conditions relate to safe installation and/or use of the equipment.

14.1 For repair of the flameproof joints, contact the manufacturer for information on their dimensions. Repairs must not be made on the basis of the values specified in Tables 1 and 2 of EN 60079-1.

14.2 When installing the Position Sensor Temposonics® T-Series TH in the boundary of a zone 0 hazardous area, the corresponding requirements of EN 60079-26 and EN 60079-10-1 must be complied with. At this, the interface must be sufficiently tight (IP66 or IP67) or form a flameproof joint according to IEC 60079-1 (joints specified for a volume ≤ 100 cm^3) between the zone 0 and the less hazardous area. In addition, the Position Sensor Temposonics® T-Series TH must be protected against overheating by means of an upstream fuse of 125 mA.

14.3 The sensor tube must be protected from mechanical damage.

IECEx Certificate of Conformity

INTERNATIONAL ELECTROTECHNICAL COMMISSION
IEC Certification Scheme for Explosive Atmospheres

for rules and details of the IECEx Scheme visit www.iecex.com

Certificate No.:	IECEx CML 16.0039X	Issue No: 0	Certificate history: Issue No. 0 (2016-06-09)
Status:	**Current**	Page 1 of 3	
Date of Issue:	**2016-06-09**		
Applicant:	**MTS Sensor Technologie GmbH & Co KG** Auf dem Schüffel 9 58513 Lüdenscheid **Germany**		
Electrical Apparatus:	**Position Sensor Temposonics® T-Series TH**		
Optional accessory:			
Type of Protection:	**Flameproof enclosure "db"; Increased Safety "eb"; Protection by enclosure "tb"**		
Marking:	Ex db IIC T4 Ga/Gb ; Ex db eb IIC T4 Ga/Gb; Ex tb IIIC T130°C Ga/Db -40 ≤ Ta ≤ +90°C		

Approved for issue on behalf of the IECEx Certification Body: D R Stubbings MIET

Position: Technical Director

Signature:
(for printed version)

Date: 2016-06-09

1. This certificate and schedule may only be reproduced in full.
2. This certificate is not transferable and remains the property of the issuing body.
3. The Status and authenticity of this certificate may be verified by visiting the Official IECEx Website.

Certificate issued by:

Certification Management Limited
Unit 1, Newport Business Park
New Port Road
Ellesmere Port
CH65 4LZ
United Kingdom

IECEx Certificate of Conformity

Certificate No:	IECEx CML 16.0039X	Issue No: 0
Date of Issue:	**2016-06-09**	Page 2 of 3

Manufacturer: **MTS Sensor Technologie GmbH & Co KG**
Auf dem Schüffel 9
58513 Lüdenscheid
Germany

Additional Manufacturing location(s):

MTS Systems Corporation, Sensors Division
3001 Sheldon Drive
Cary
NC 27513
United States of America

This certificate is issued as verification that a sample(s), representative of production, was assessed and tested and found to comply with the IEC Standard list below and that the manufacturer's quality system, relating to the Ex products covered by this certificate, was assessed and found to comply with the IECEx Quality system requirements. This certificate is granted subject to the conditions as set out in IECEx Scheme Rules, IECEx 02 and Operational Documents as amended.

STANDARDS:

The electrical apparatus and any acceptable variations to it specified in the schedule of this certificate and the identified documents, was found to comply with the following standards:

IEC 60079-0 : 2011 Edition:6.0	Explosive atmospheres - Part 0: General requirements
IEC 60079-1 : 2014-06 Edition:7.0	Explosive atmospheres - Part 1: Equipment protection by flameproof enclosures "d"
IEC 60079-26 : 2014-10 Edition:3.0	Explosive atmospheres – Part 26: Equipment with Equipment Protection Level (EPL) Ga
IEC 60079-31 : 2013 Edition:2	Explosive atmospheres - Part 31: Equipment dust ignition protection by enclosure "t"
IEC 60079-7 : 2015 Edition:5.0	Explosive atmospheres – Part 7: Equipment protection by increased safety "e"

*This Certificate **does not** indicate compliance with electrical safety and performance requirements other than those expressly included in the Standards listed above.*

TEST & ASSESSMENT REPORTS:

A sample(s) of the equipment listed has successfully met the examination and test requirements as recorded in

Test Report:

GB/CML/ExTR16.0064/00

Quality Assessment Report:

GB/FME/QAR14.0005/00 GB/CML/QAR16.0004/00

IECEx Certificate of Conformity

Certificate No:	IECEx CML 16.0039X	Issue No: 0
Date of Issue:	2016-06-09	Page 3 of 3

Schedule

EQUIPMENT:

Equipment and systems covered by this certificate are as follows:

The T-Series TH is a magnetostrictive linear position sensor comprising a stainless steel hexagonal cross-sectional enclosure and cylindrical measuring element.

The enclosure comprises two compartments; one containing the electronics and the other containing termination facilities for the connection to external circuits. The compartments are separated by a spigoted bushing with the terminal compartment cover being secured by five M4 socket-head cap screws grade A4-50. The rear of the electronics contains a threaded boss through which passes the measuring element.

Cable entry is made via either an M16 threaded boss to the side of the terminal compartment, which may optionally be fitted with an M20 or ½" NPT thread adapter, or an M20 entry in the cover.

A facility for an external earthing or equi-potential bonding conductor is provided on both the terminal and electronics compartment comprising: a ground block; an M4 Screw; an M5 screw; a spring washer; a clamping tab.

Conditions of manufacture:

1 When the position sensor Temposonics ® T-Series TH utilises increased safety explosion protection, each unit shall be subjected to a dielectric strength test in accordance with IEC 60079-7 clause 6.1.

CONDITIONS OF CERTIFICATION: YES as shown below:

1 For repair of the flameproof joints, contact the manufacturer for information on their dimensions. Repairs must not be made on the basis of the values specified in Tables 1 and 2 of IEC 60079-1.

2 When installing the p osition sensor Temposonics® T-Series TH in the boundary of a zone 0 hazardous area, the corresponding requirements of IEC 60079-26 and IEC 60079-10-1 must be complied with. At this, the interface must be sufficiently tight (IP66 or IP67) or form a flameproof joint according to IEC 60079-1 (joints specified for a volume ≤ 100 cm^3) between the zone 0 and the less hazardous area. In addition, the p osition sensor Temposonics® T-Series TH must be protected against overheating by means of an upstream fuse of 125 mA.

3 The sensor tube must be protected from mechanical damage.

Annex:

IECEx CML 16-0039X Issue 0 Annex.pdf

File
LR1346

CERTIFICATE OF COMPLIANCE
(ISO TYPE 3 CERTIFICATION SYSTEM)

Issued to	MTS Sensor Technologie GmbH & Co. KG
Address	Auf Dem Schüffel 9 Lüdenscheid, Germany D-58513
Project Number	LR1346-1
Product	T-Sensors
Model Number	TH Series (See report LR1346-1 for full model code)

Ratings

Canada	US
Class I, Div, 1, Groups B, C, D Class II, III, Div 1 Groups E, F G Temperature code T4 Enclosure Type 3*	Class I, Div 1 Groups A, B, C, D Class II, III Div 1 Groups E, F G Temperature code T4 Enclosure Type 3*
Ex d IIC T4 Ga/Gb Ex tb IIIC T130°C Db	Class I, Zone 0/1 AEx d IIC T4 Class II/III, Zone 21 AEx tb IIIC T130°C

* Enclosure type marked depends on material selected - Grade 1.4305 is marked Type 3, Grade 1.4404 (316L equivalent) is marked Type 3X.
Ta= -40°C to +90°C.
Voltage: +24 Vdc (-15%/+20 %)
Current: up to 140 mA

Applicable Standards

CSA-C22.2 No.61010-1-12, edition 3 (2012)
CSA C22.2 No. 25-1966
CSA C22.2 No. 30-1986
CSA C22.2 No 94-M91
CSA C22.2 No. 60079-0, edition 3, (2015)
CSA C22.2 No. 60079-1, edition 2, (2011)
CSA C22.2 No. 60079-7, edition 1, (2012)
CSA C22.2 No. 60079-31, Edition 2 (2015)

ANSI/ISA-61010-1 (82.02.01), edition 3 (2012)
FM 3600, 2011
FM 3615, 2006
FM 3616, 2011
NEMA 250 2014
ANSI/ISA 60079-0 (12.00.01) -2009, edition 6
ANSI/ISA 60079-1 (12.22.01) -2009, edition 6
ANSI/ISA 60079-7 (12.16.01) -2008, edition 2
ANSI/ISA 60079-26 (12.00.03) -2011, edition 1
ANSI/ISA 60079-31 – 2015, edition 2

Factory/Manufacturing Location: Same as Applicant

QPS Evaluation Services Inc

Testing, Certification and Field Evaluation Body
Accredited in Canada, the USA, and Internationally

File
LR1346

Statement of Compliance: The product(s) identified in this Certificate and described in the Report covered under the above referenced project number have been investigated and found to be in compliance with the relevant requirements of the above referenced standard(s). As such, they are eligible to bear the QPS Certification Mark shown below, in accordance with the provisions of QPS's Service Agreement.

CERTIFIED
ELECTRICAL SAFETY

Issued By: **Dave Adams, P.Eng.**
Manager, Hazardous Locations Dept. [Ex. Equipment]

Signature:

Date: May 2, 2016

File
LR1346

CERTIFICATE OF COMPLIANCE
(ISO TYPE 3 CERTIFICATION SYSTEM)

Issued to	MTS Sensor Technologie GmbH & Co KG
Address	Auf Dem Schüffel 9 Lüdenscheid Germany D-58513
Project Number	LR1346-2
Product	T-Sensors
Model Number	TH Series

Ratings

Canada	**US**
Class I, Div, 2, Groups A, B, C, D Class II, III, Div 2 Groups E, F G Temperature code T4 Enclosure Type 3*	Class I, Div 2, Groups A, B, C, D Class II, III Div 2 Groups E, F G Temperature code T4 Enclosure Type 3*
Zone 2, Zone 22	Class I, Zone 2, Zone 22

* Enclosure type marked depends on material selected - Grade 1.4305 is marked Type 3, Grade 1.4404 (316L equivalent) is marked Type 3X.

Ta= -40°C to +80°C.

Voltage: +24 Vdc (-15%/+20 %)
Current: up to 110 mA

Applicable Standards

CSA-C22.2 No.61010-1-12, edition 3 (2012)
CSA C22.2 No. 213-2015
CSA C22.2 No 94-M91

ANSI/ISA-61010-1 (82.02.01), edition 3 (2012)
ANSI/ISA 12.12.01 -2015
NEMA 250 2014

Factory/Manufacturing Location: Same as Applicant

File
LR1346

Statement of Compliance: The product(s) identified in this Certificate and described in the Report covered under the above referenced project number have been investigated and found to be in compliance with the relevant requirements of the above referenced standard(s). As such, they are eligible to bear the QPS Certification Mark shown below, in accordance with the provisions of QPS's Service Agreement.

CERTIFIED
ELECTRICAL SAFETY

Issued By: **Dave Adams, P.Eng.**
Manager, Hazardous Locations Dept. [Ex. Equipment]

Signature: 

Date: March 7, 2016