

Temposonics®

Magnetostrictive Linear Position Sensors



Sensor with Ex approval

**TH Analog ATEX / IECEx / CEC / NEC / KCs / EAC Ex certified /
Japanese approval / Safety SIL 2 capable**

Operation Manual

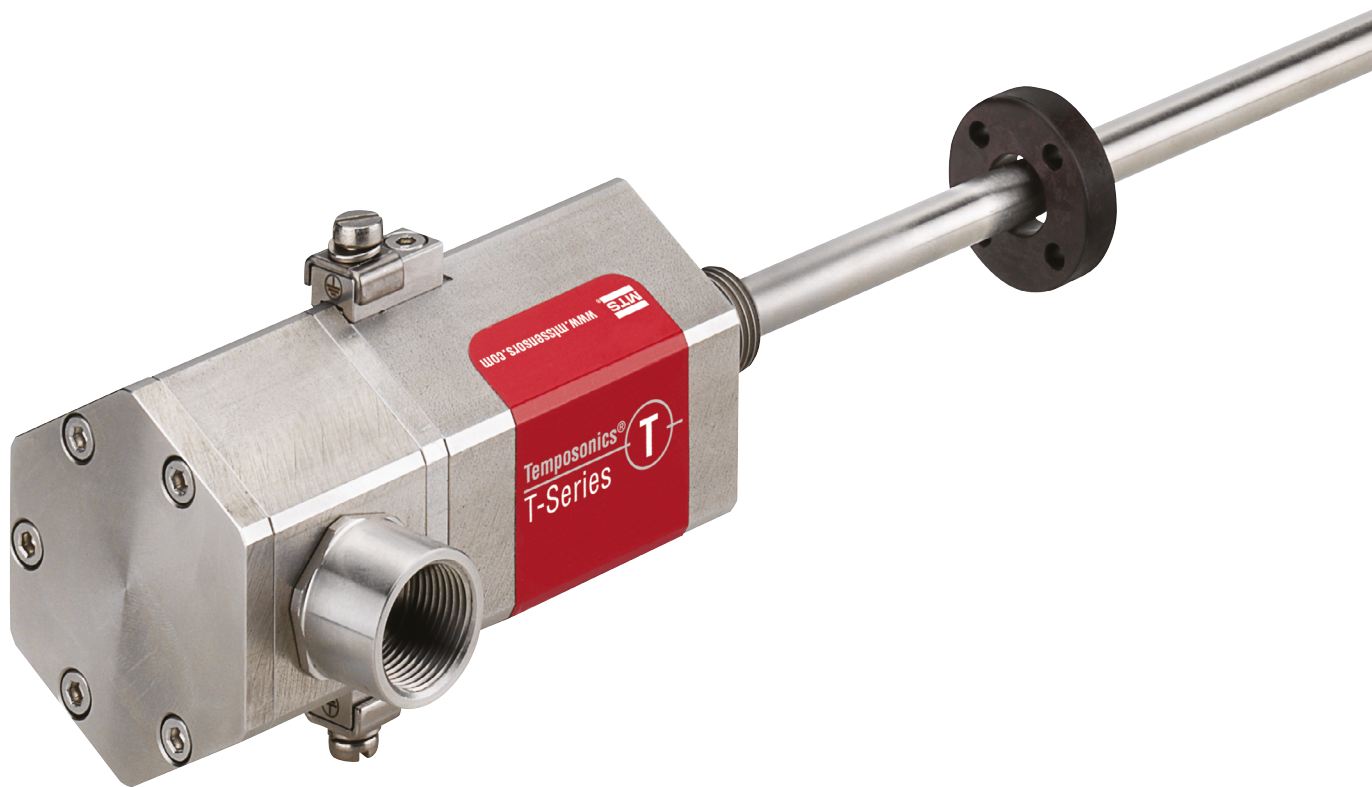


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1. Introduction

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 appendix 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 pictogram 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 4 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 sensor's surface temperature class is T4.
3. The EU-Type Examination Certificates and Certificates of Compliance have to be taken into account including any special condition defined therein.

^{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)

4. The position sensor may be used in zones (ATEX, IECEx) and Classes, Zones and Divisions (CEC, NEC) according to chapter 8. 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		
Gas-Ex	In the baffle between Zone 0 and		Up to IIC (at the rod)
	Zone 21 or Zone 22		

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

- 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

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)	In case of failure, the sensor might overheat
Use a fuse with more than 125 mA	In case of failure, the sensor might overheat
Wrong sensor connection	The sensor will not work properly or will be destroyed
Operate the sensor out of the operating temperature range	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

2.3 Installation, commissioning and operation

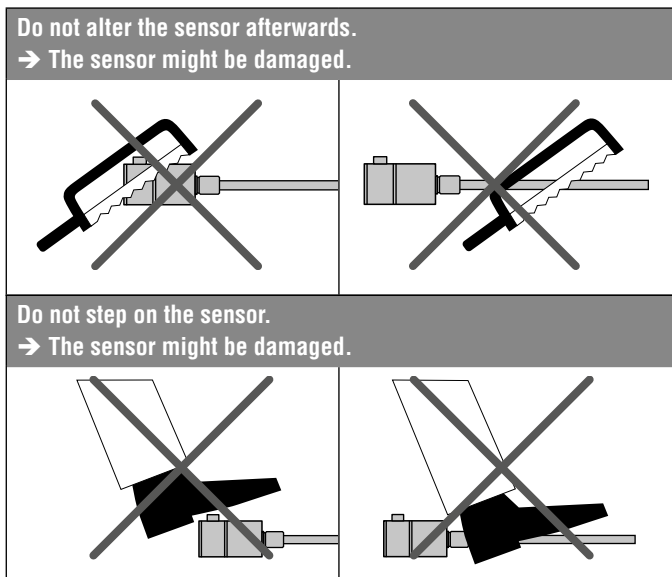
The position sensors must be used only in technically safe condition. To maintain this condition and to ensure safe operation, installation, connection, cable installation and service, work may be performed only by qualified technical personnel, according to IEC 60079-14, TRBS 1203, Canadian Electrical Code (CEC) and National Electrical Code (NEC) and local regulations.

If danger of injury to persons or of damage to operating equipment is caused by sensor failure or malfunction, additional safety measures such as plausibility checks, limit switches, EMERGENCY STOP systems, protective devices etc. are required. In the event of trouble, shut down the sensor and protect it against accidental operation.

Safety instructions for commissioning

To maintain the sensor's operability, it is mandatory to follow the instructions given below.

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 chapter "2.1 Intended use" on page 3). 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 user 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
10. Any parts of the equipment which got stuck (e.g. by frost or corrosion) may not be removed by force if potentially explosive atmosphere is present.
11. The surface temperatures of equipment parts must be kept clearly below the ignition temperature of the foreseeable air/dust mixtures in order to prevent the ignition of suspended dust.



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. Prevent electrostatic charges.
4. Do not use the sensor in cathodic systems for corrosion protection. Do not allow parasitic currents on the sensor housing.
5. Switch off the supply voltage prior to disconnecting or connecting the connectors.
6. 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.
7. Cable entry temperature and branching point temperature may reach 104 °C (219 °F) and 116 °C (241 °F) respectively. Select suitable cable and entry device.
8. For field wiring, use cables suitable for the service temperature range of -40 °C (-40 °F) to +116 °C (241 °F).
9. Do not open when energized. Open the sensor only as shown in Fig. 7 on page 13.
10. A seal shall be installed within 18" of the enclosure (for NEC / CEC only).
11. Use only approved power supplies of Category II according to IEC 61010-1.
12. Ensure that the specified permissible limit values of the sensor for operating voltage, environmental conditions, etc. are met.
13. 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. 7
 - the cable glands certified according to the required hazardous area classification and IP protection are tightened according to the manufacture's specifications
 - surfaces limiting the joint shall not be machined or painted subsequently (flameproof enclosure)
 - surfaces limiting the joint have not been provided with a seal (flameproof enclosure)
 - the magnet does not grind on 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 maximum speed of the moving magnet is less or equal 1 m/s.
14. 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).
15. Before applying power, ensure that nobody's safety is jeopardized by starting machines.
16. Check the function of the sensor regularly and provide documentation of the checks (see chapter "6.2 Maintenance" on page 37).

2.4 Safety instructions for use in explosion-hazardous areas

The sensor has been designed for operation inside explosion-hazardous areas. It has been tested and left the factory in a condition in which it is safe to operate. Relevant regulations and standards have been observed. According to the marking (ATEX, IECEx, CEC, NEC, KCs, EAC Ex, Japanese approval) the sensor is approved only for operation in defined hazardous areas (see chapter "2.1 Intended use" on page 3). 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 sensor in Zone 0 according to the guidelines (ATEX, IECEx, CEC, NEC, KCs, EAC Ex, Japanese approval)

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), ANSI/ISA/IEC/EN 60079-10-1 and JNIOH-TR-46-2 to ensure isolation between Zone 0 and Zone 1.
4. When installing the TH sensor 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 air tightly (IP67) according to ANSI/ISA/IEC/EN 60079-26 and ANSI/ISA/IEC/EN 60079-10-1.

2.5 Warranty

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 offense against the warranty rules, no matter if these have been assured or expected, even in case 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.

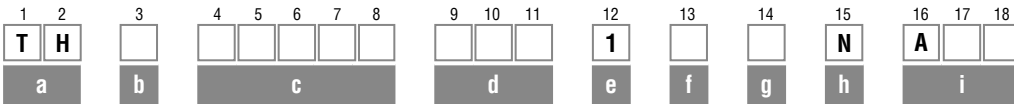
2.6 Return

For diagnostic purposes, the sensor can be returned to MTS Sensors. Any shipment cost is the responsibility of the sender ². For a corresponding form, see chapter "11. Appendix" on page 47.

^{2/} See also applicable MTS Sensors terms of sales and delivery on:
www.mtssensors.com

3. Identification

3.1 Order code of Temposonics® TH



a	Sensor model
T H	Rod

b	Design
Enclosure Type 3: TH rod sensor with housing material stainless steel 1.4305 (AISI 303) and rod material stainless steel 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: TH rod sensor with housing material stainless steel 1.4404 (AISI 316L) and rod material stainless steel 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
X X X X M	0025...1500 mm (SIL 2)
Standard stroke length (mm)	
25 ... 500 mm	5 mm
500 ... 750 mm	10 mm
750...1000 mm	25 mm
1000...1500 mm	50 mm
X X X X U	001.0...060.0 in. (SIL 2)
Standard stroke length (in.)	
1 ...20 in.	0.2 in.
20 ...30 in.	0.4 in.
30 ...40 in.	1.0 in.
40 ...60 in.	2.0 in.
Non standard stroke lengths are available; must be encoded in 5 mm / 0.1 in. increments	

c	Stroke length (continued)
X X X X M	0025...7620 mm (standard)
Standard stroke length (mm)	
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
X X X X U	001.0...300.0 in. (standard)
Standard stroke length (in.)	
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.
Non standard stroke lengths are available; must be encoded in 5 mm / 0.1 in. increments	

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 See next page

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

f Version (see chapter 8 for further information)	
D	Ex db and Ex tb (A/F 55)
E	Ex db eb and Ex tb (A/F 55) <u>US & CA approval:</u> Ex nA /NI (for Zone 2 and 22) (Note: US & CA approval is only available for SIL 2 version)
G	Ex db and Ex tb (A/F 60) <u>US & CA approvals:</u> Explosionproof (XP) (Note: Group A is not available for Canada)
N	Not approved

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 position magnet	
Output 1 (position magnet 1)	
Notice: For SIL 2 only outputs A01 and A11 are available!	
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 position 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 position 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

NOTICE
 Use magnets of the same type (e.g. 2 ring magnets with part no. 201 542-2) for multi-position measurement.

3.2 Nameplate

<p>THN0080MC011DSNA11 In: 24 VDC 100 mA YofC: 26/2018 Out: 20-4 mA Enclosure type 3 S/N: 18260255</p>  <p>CML 16 ATEX 1090X IECEx CML 16.0039X CE 2503 Ⓜ II 1/2G Ex db IIC T4 Ga/Gb Ⓜ II 1G/2D Ex tb IIIC T130°C Ga/Db 18-KA4BO-0247X 18-KA4BO-0248X</p> <p>-40°C ≤ Ta ≤ 85°C IP66/IP67</p> <p>Датчик серии Т ОС ВО ЗАО ТИБР №ТC RU C-DE.ГБ08.В.01976 Ga/Gb Ex db IIC T4 X Da/Db Ex tb IIIC T130°C X</p>  <p>Variant with flameproof connection chamber Version D</p>	<p>THN0080MC011ESNA11 In: 24 VDC 100 mA YofC: 26/2018 Out: 20-4 mA Enclosure type 3 S/N: 18260255</p>  <p>CML 16 ATEX 1090X IECEx CML 16.0039X CE 2503 Ⓜ II 1/2G Ex db eb IIC T4 Ga/Gb Ⓜ II 1G/2D Ex tb IIIC T130°C Ga/Db 18-KA4BO-0249X 18-KA4BO-0250X</p> <p>Class I, Div. 2, Groups A, B, C, D T4 Class II/III, Div. 2, Groups E, F, G T130°C Ex nA/AEx nA IIC T4 Gc Ex tc/AEx tc IIIC T130°C Dc</p> <p>-40°C ≤ Ta ≤ 80°C IP66/IP67</p> <p>Датчик серии Т ОС ВО ЗАО ТИБР №ТC RU C-DE.ГБ08.В.01976 Ga/Gb Ex db eb IIC T4 X Da/Db Ex tb IIIC T130°C X</p>  <p>Variant with increased safety connection chamber Version E</p>	<p>THN0080MC011GSNA11 In: 24 VDC 100 mA YofC: 26/2018 Out: 20-4 mA Enclosure type 3 S/N: 18260255</p>  <p>CML 16 ATEX 1090X IECEx CML 16.0039X CE 2503 Ⓜ II 1/2G Ex db IIC T4 Ga/Gb Ⓜ II 1G/2D Ex tb IIIC T130°C Ga/Db 18-KA4BO-0247X 18-KA4BO-0248X</p> <p>Class I, Div. 1, Groups A, B, C, D T4 Class II/III, Div. 1, Groups E, F, G T130°C Class I, Zone 0/1 AEx d / Ex d IIC T4 Class II/III, Zone 21 AEx tb / Ex tb IIIC T130°C Group A is not approved for Canada</p> <p>-40°C ≤ Ta ≤ 85°C IP66/IP67</p> <p>Датчик серии Т ОС ВО ЗАО ТИБР №ТC RU C-DE.ГБ08.В.01976 Ga/Gb Ex db IIC T4 X Da/Db Ex tb IIIC T130°C X</p>  <p>Variant with flameproof / explosionproof connection chamber Version G</p>
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Fig. 1: Example of a nameplate of a TH sensor (SIL 2 version)

<p>THN0080MC011DNNA11 In: 24 VDC 100 mA YofC: 26/2018 Out: 20-4 mA Enclosure type 3 S/N: 18260255</p>  <p>CML 16 ATEX 1090X IECEx CML 16.0039X CE 2503 Ⓜ II 1/2G Ex db IIC T4 Ga/Gb Ⓜ II 1G/2D Ex tb IIIC T130°C Ga/Db 18-KA4BO-0247X 18-KA4BO-0248X</p> <p>-40°C ≤ Ta ≤ 75°C IP66/IP67</p> <p>Датчик серии Т ОС ВО ЗАО ТИБР №ТC RU C-DE.ГБ08.В.01976 Ga/Gb Ex db IIC T4 X Da/Db Ex tb IIIC T130°C X</p>  <p>Variant with flameproof connection chamber Version D</p>	<p>THN0080MC011ENNA11 In: 24 VDC 100 mA YofC: 26/2018 Out: 20-4 mA Enclosure type 3 S/N: 18260255</p>  <p>CML 16 ATEX 1090X IECEx CML 16.0039X CE 2503 Ⓜ II 1/2G Ex db eb IIC T4 Ga/Gb Ⓜ II 1G/2D Ex tb IIIC T130°C Ga/Db 18-KA4BO-0249X 18-KA4BO-0250X</p> <p>-40°C ≤ Ta ≤ 75°C IP66/IP67</p> <p>Датчик серии Т ОС ВО ЗАО ТИБР №ТC RU C-DE.ГБ08.В.01976 Ga/Gb Ex db eb IIC T4 X Da/Db Ex tb IIIC T130°C X</p>  <p>Variant with increased safety connection chamber Version E</p>	<p>THN0080MC011GNNA11 In: 24 VDC 100 mA YofC: 26/2018 Out: 20-4 mA Enclosure type 3 S/N: 18260255</p>  <p>CML 16 ATEX 1090X IECEx CML 16.0039X CE 2503 Ⓜ II 1/2G Ex db IIC T4 Ga/Gb Ⓜ II 1G/2D Ex tb IIIC T130°C Ga/Db 18-KA4BO-0247X 18-KA4BO-0248X</p> <p>Class I, Div. 1, Groups A, B, C, D T4 Class II/III, Div. 1, Groups E, F, G T130°C Class I, Zone 0/1 AEx d / Ex d IIC T4 Class II/III, Zone 21 AEx tb / Ex tb IIIC T130°C Group A is not approved for Canada</p> <p>-40°C ≤ Ta ≤ 75°C IP66/IP67</p> <p>Датчик серии Т ОС ВО ЗАО ТИБР №ТC RU C-DE.ГБ08.В.01976 Ga/Gb Ex db IIC T4 X Da/Db Ex tb IIIC T130°C X</p>  <p>Variant with flameproof / explosionproof connection chamber Version G</p>
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Fig. 2: Example of a nameplate of a TH sensor (standard version)

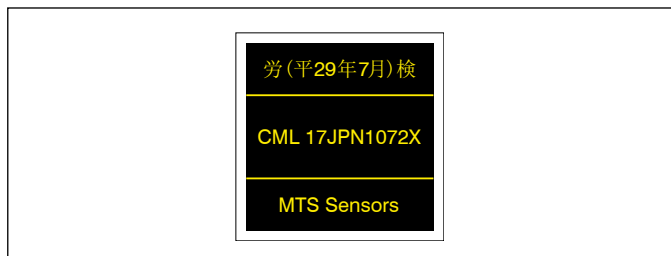


Fig. 3: Label for Japanese approval

3.3 Approvals

See chapter “8. Technical data” on page 38 ff..

NOTICE

For a detailed overview of the certifications, see www.mtssensors.com

3.4 Scope of delivery

TH (rod sensor):

- Sensor

4. Product description and commissioning

4.1 Functionality and system design

Product designation

- Position sensor Temposonics® T-Series

Sensor model

- Temposonics® TH (rod sensor)

Stroke length

- 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

Temposonics® position sensors are used for measurement and conversion of the length (position) variable in the fields of automated systems 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 sensor with the addition of a float.

Principle of operation and system construction

The absolute, linear position sensors provided by MTS Sensors rely on the company's proprietary Temposonics® magnetostrictive technology, which can determine position with a high level of precision and robustness.

Each Temposonics® position sensor consists of a ferromagnetic waveguide, a position magnet, a strain pulse converter and supporting electronics. The magnet, connected to the object in motion in the application, generates a magnetic field at its location on the waveguide. A short current pulse is applied to the waveguide. This creates a momentary radial magnetic field and torsional strain on the waveguide. The momentary interaction of the magnetic fields releases a torsional strain pulse that propagates the length of the waveguide. When the ultrasonic wave reaches the end of the waveguide it is converted into an electrical signal. Since the speed of the ultrasonic wave in the waveguide is precisely known, the time required to receive the return signal can be converted into a linear position measurement with both high accuracy and repeatability.

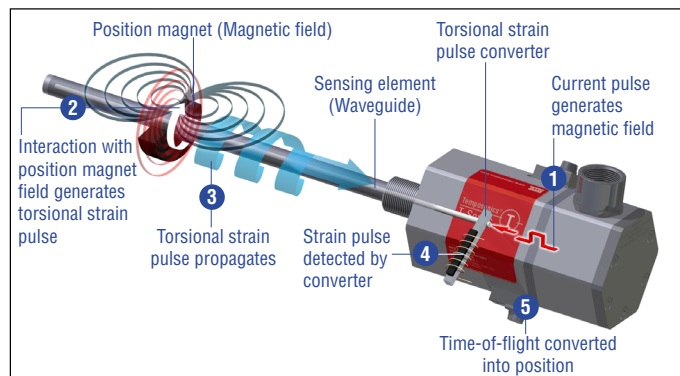


Fig. 4: Time-of-flight based magnetostrictive position sensing principle

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.

4.2 Styles and installation of Temposonics® TH

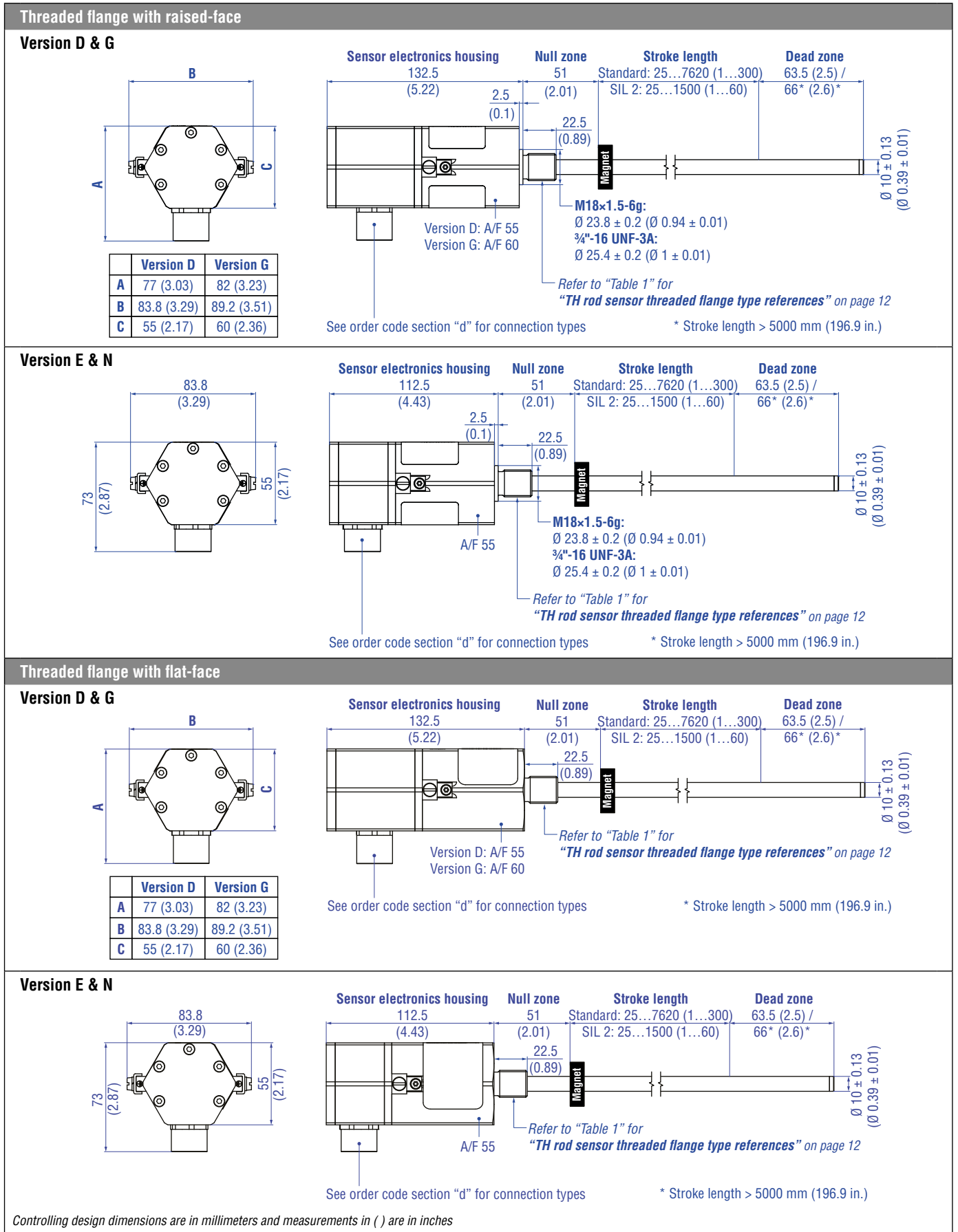


Fig. 5: Temposonics® TH with ring magnet

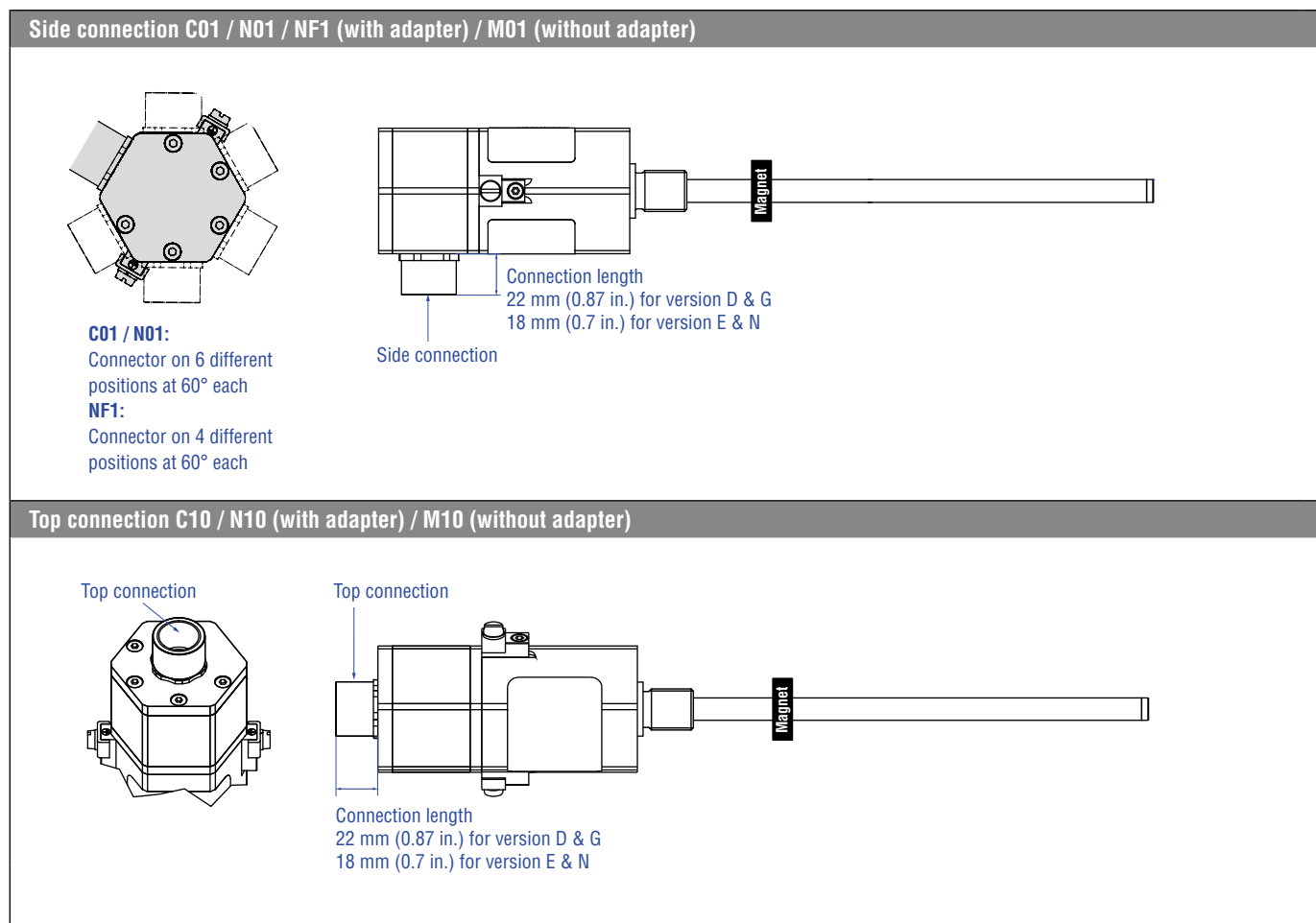


Fig. 6: Temposonics® TH connection options

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

Table 1: TH rod sensor threaded flange type references

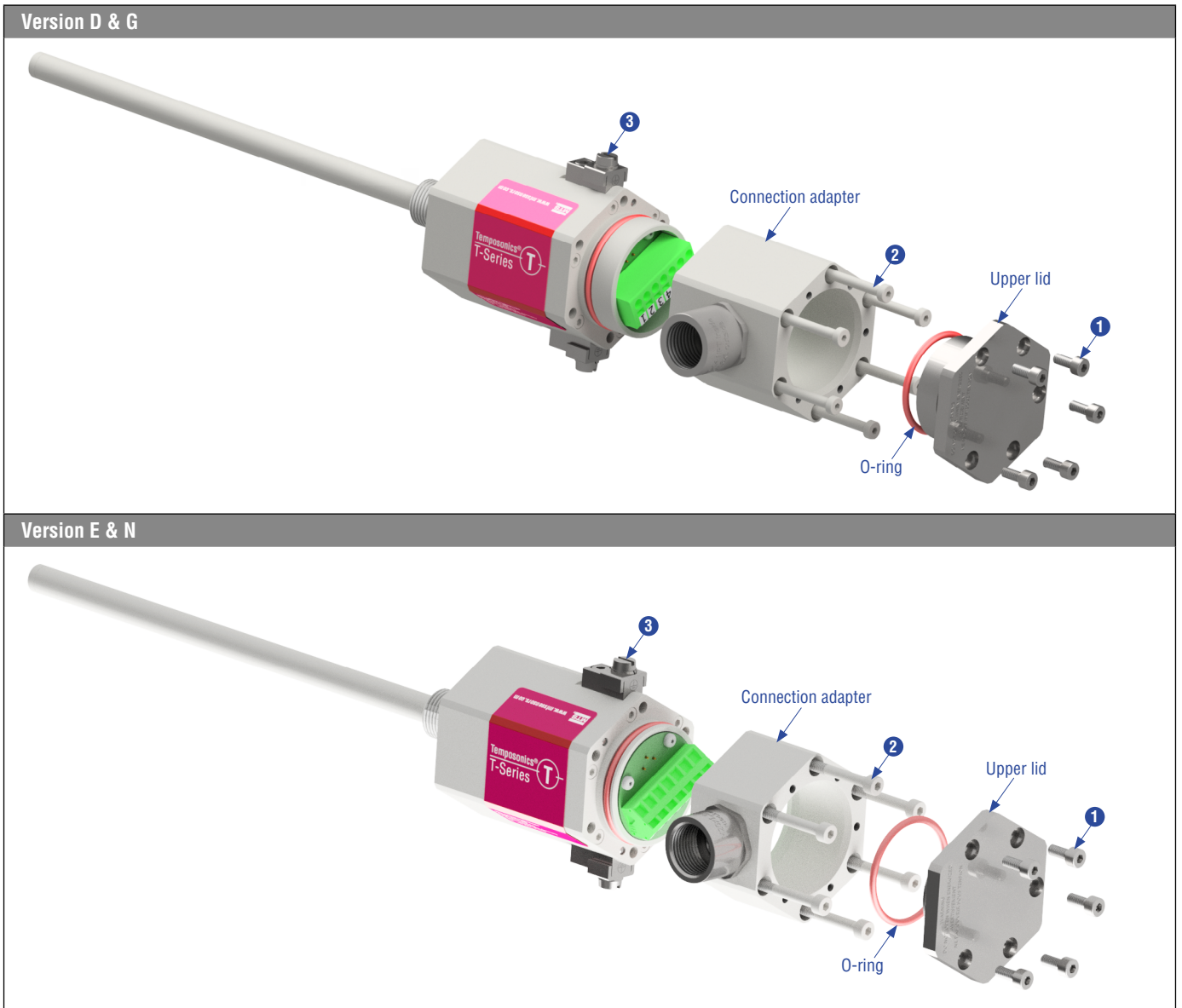


Fig. 7: Temposonics® TH exploded view drawing

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 22 ff. for more details.

Change orientation of cable bushing (C01, M01, N01, NF1)

Loosen the five hexagonal screws M4 (A/F 3) and remove the upper lid (Fig. 7). Then loosen the six hexagonal screws M4 (A/F 3) of the connection adapter (Fig. 7). Change the orientation of the connector on six different positions at 60° each. Note the example on page 22 ff..

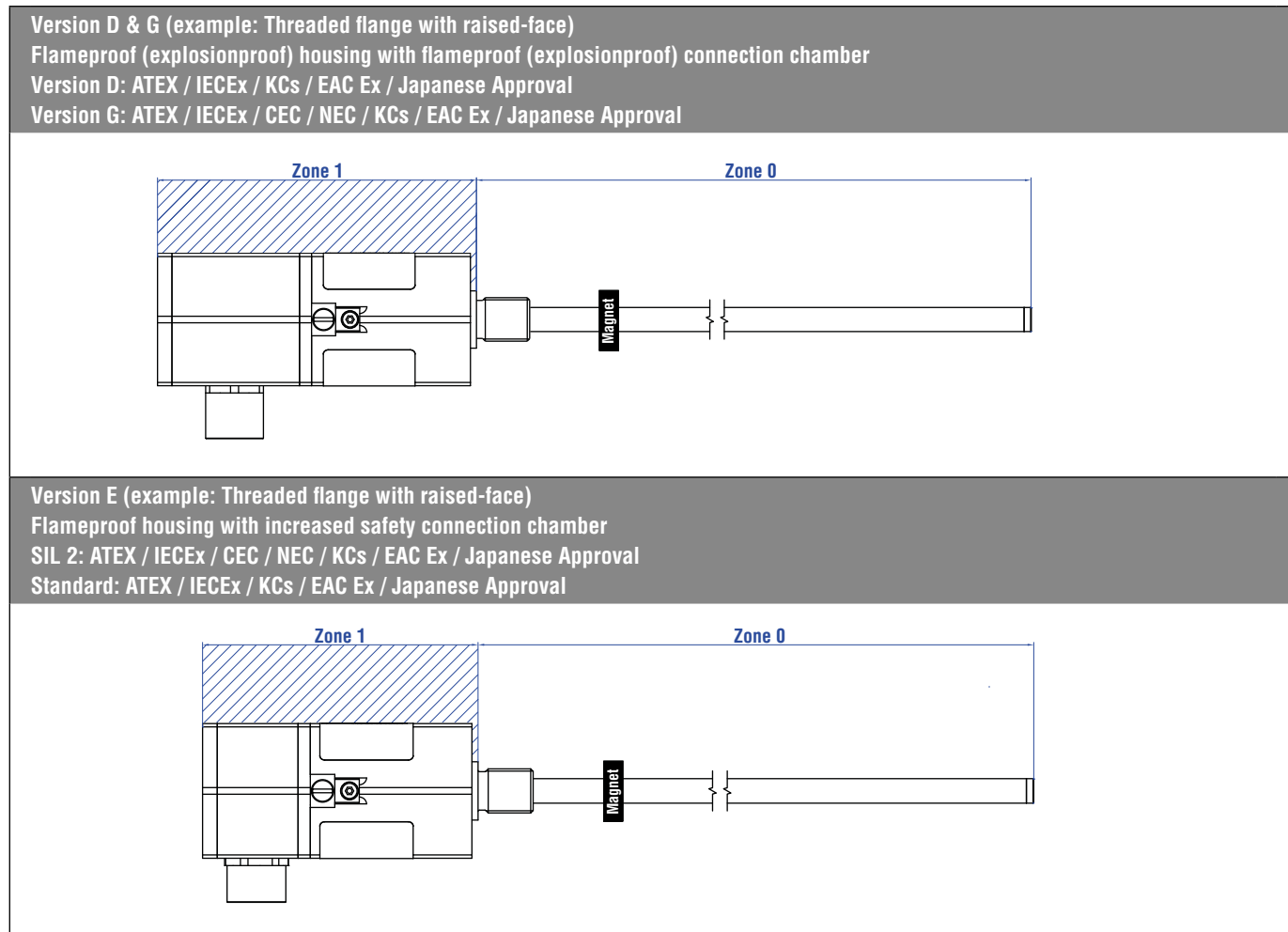


Fig. 8: Temposonics® TH Zone classification

NOTICE

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

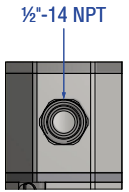
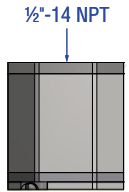
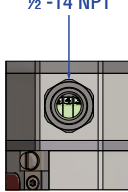
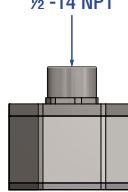
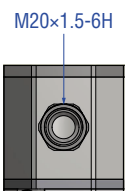
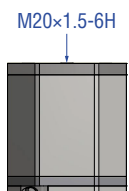
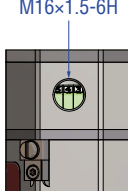
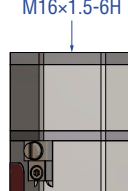
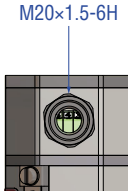
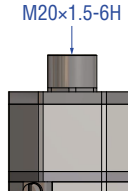
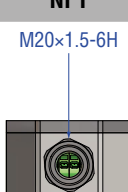
Connection options for version D & G		Connection options for version E & N	
C01	C10	C01	C10
 <p>Side connection with thread ½"-14 NPT</p>	 <p>Top connection with thread ½"-14 NPT</p>	 <p>Side connection with thread ½"-14 NPT</p>	 <p>Top connection with thread ½"-14 NPT</p>
N01	N10	M01	M10
 <p>Side connection with thread M20×1.5-6H</p>	 <p>Top connection with thread M20×1.5-6H</p>	 <p>Side connection with thread M16×1.5-6H</p>	 <p>Top connection with thread M16×1.5-6H</p>
		N01	N10
		 <p>Side connection with thread M20×1.5-6H</p>	 <p>Top connection with thread M20×1.5-6H</p>
		NF1	
		 <p>Side connection with thread M20×1.5-6H</p>	<p>Notice: Not available for SIL 2 version!</p>

Fig. 9: Connection options



Fig. 10: SIL 2 identification

Installation of TH with threaded flange

Fix the sensor rod via threaded flange M18×1.5-6g or ¾"-16 UNF-3A.

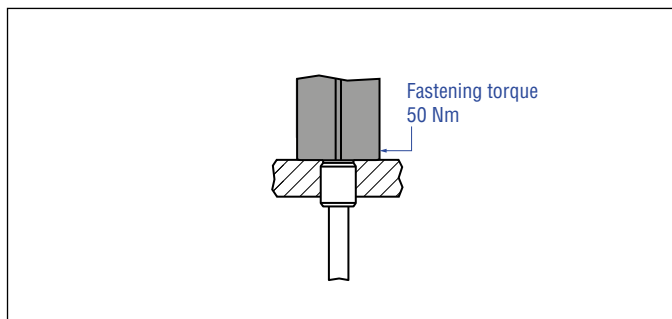


Fig. 11: Mounting example of threaded flange

Installation of a rod-style sensor in a fluid cylinder

The rod-style version has been developed for direct stroke measurement in a fluid cylinder. Mount the sensor via threaded flange or a hex nut.

- Mounted on the face of the piston, the position magnet travels over the rod without touching it and indicates the exact position through the rod wall – independent of the hydraulic fluid.
- The pressure resistant sensor rod is installed into a bore in the piston rod.

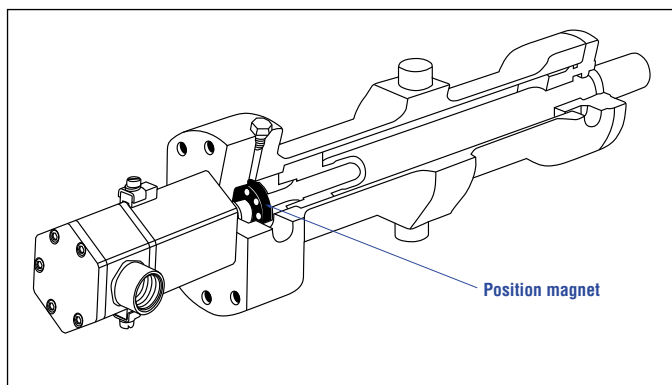


Fig. 12: Sensor in cylinder

Hydraulics sealing for threaded flange with raised-face

Seal the flange contact surface by using an O-ring in the undercut (Fig. 13):

For threaded flange (¾"-16 UNF-3A) »G« / »T«:

O-ring 16.4 × 2.2 mm (0.65 × 0.09 in.) (part no. 560 315)

For threaded flange (M18×1.5-6g) »N«:

O-ring 15.3 × 2.2 mm (0.60 × 0.09 in.) (part no. 401 133)

In the case of threaded flange M18×1.5-6g provide a screw hole based on ISO 6149-1 (Fig. 15). See ISO 6149-1 for further information.

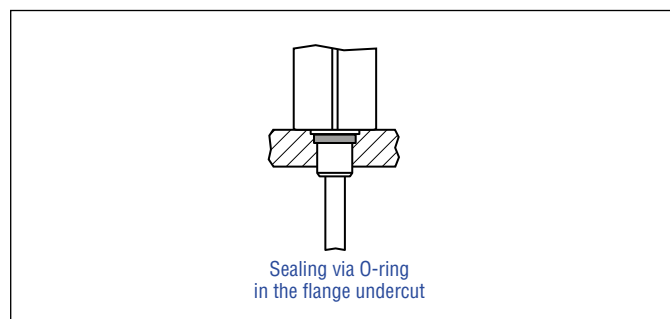


Fig. 13: Possibility of sealing for threaded flange with raised-face

Hydraulics sealing for threaded flange with flat-face

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.), 25.07 × 2.62 mm (0.99 × 0.1 in.)) in a cylinder end cap groove.
2. A sealing by using an O-ring in the undercut.

For threaded flange (¾"-16 UNF-3A) »F« / »S«:

O-ring 16.4 × 2.2 mm (0.65 × 0.09 in.) (part no. 560 315)

For threaded flange (M18×1.5-6g) »M« / »W«:

O-ring 15.3 × 2.2 mm (0.60 × 0.09 in.) (part no. 401 133)

In the case of threaded flange M18×1.5-6g provide a screw hole based on ISO 6149-1 (Fig. 15). See ISO 6149-1 for further information.

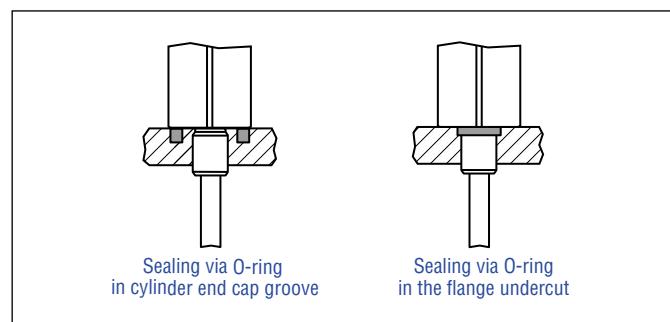


Fig. 14: Possibilities of sealing for threaded flange with flat-face

- Note the fastening torque of 50 Nm.
- 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 (TH-F / -G / -M / -N / -S / -T / -W: ≥ Ø 13 mm (≥ Ø 0.51 in.)) depends on the pressure and piston speed.
- Adhere to the information relating to operating pressure.
- Protect the sensor rod against wear.

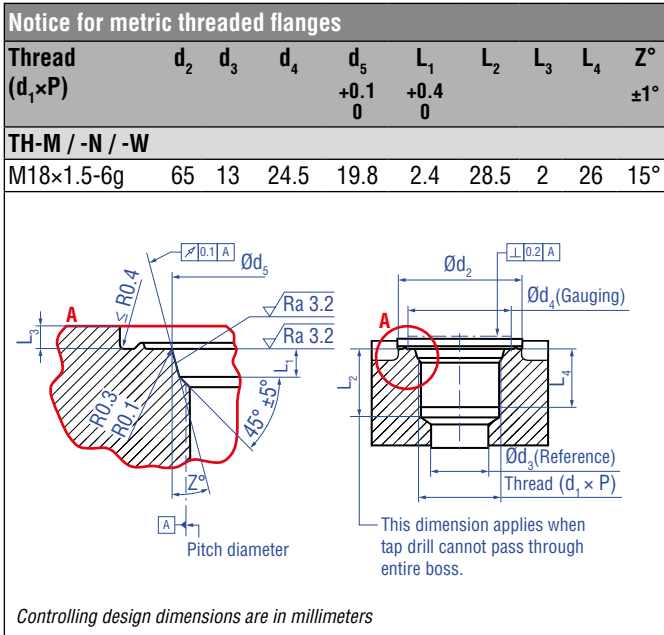


Fig. 15: Notice for metric threaded flange M18×1.5-6g based on DIN ISO 6149-1

4.3 Magnet installation

Typical use of magnets




Magnet	Benefits
 Ring magnets	<ul style="list-style-type: none"> Rotationally symmetrical magnetic field
 U-magnets	<ul style="list-style-type: none"> Height tolerances can be compensated, because the magnet can be lifted off
 Floats	<ul style="list-style-type: none"> For liquid level measurement

Fig. 16: Typical use of magnets

Mounting ring magnets & U-magnets

Install the magnet using non-magnetic material for mounting device, screws, spacers etc.. The magnet must not grind on the sensor rod. Alignment errors are compensated via the air gap.

- Permissible surface pressure: Max. 40 N/mm²
- Fastening torque for M4 screws: 1 Nm; use washers, if necessary
- Minimum distance between position magnet and any magnetic material has to be 15 mm (0.6 in.) (Fig. 18).
- If no other option exists and magnetic material is used, observe the specified dimensions (Fig. 18).

NOTICE

Mount ring magnets and U-magnets concentrically. The maximum permissible air gap must not be exceeded (Fig. 17). Take care to mount the primary sensor axis in parallel to the magnet path in order to avoid damage to the carriage, magnet and sensor rod.

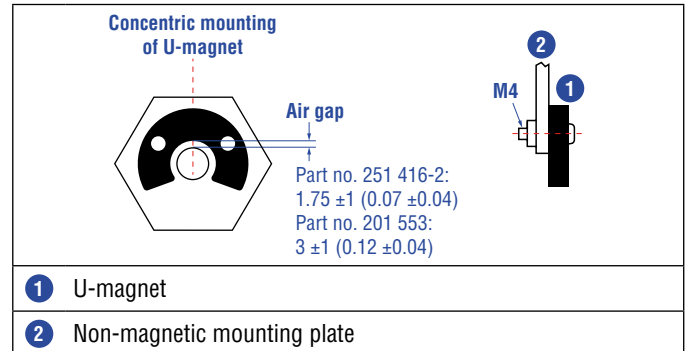


Fig. 17: Mounting of U-magnet (part no. 251 416-2 or part no. 201 553)

Magnet mounting with magnetic material

When using magnetic material the dimensions of Fig. 18 must be observed.

- If the position magnet aligns with the drilled piston rod
- If the position magnet is set further into the drilled piston rod, install another non-magnetic spacer (e.g. part no. 400 633) above the magnet.

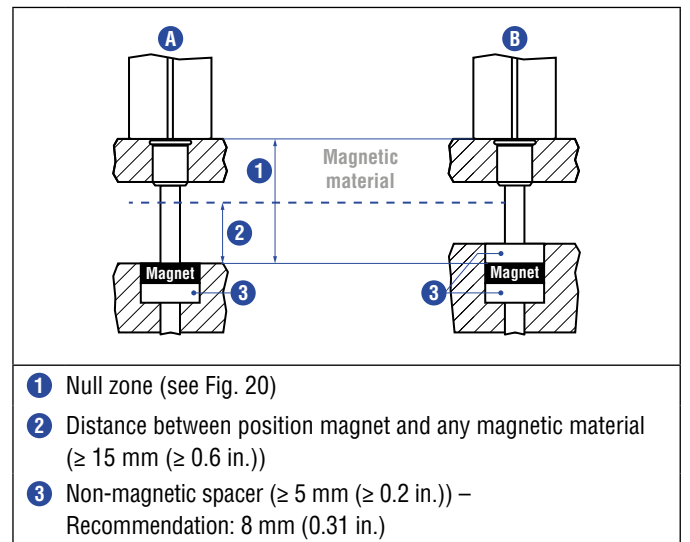


Fig. 18: Installation with magnetic material

Sensors with stroke lengths ≥ 1 meter (3.3 ft.)

Support horizontally installed sensors with a stroke length from 1 meter (3.3 ft.) mechanically at the rod end. Without the use of a support, rod and position magnet may be damaged. A false measurement result is also possible. Longer rods require evenly distributed mechanical support over the entire length (e.g. part no. 561 481). Use an U-magnet (Fig. 19) for measurement.

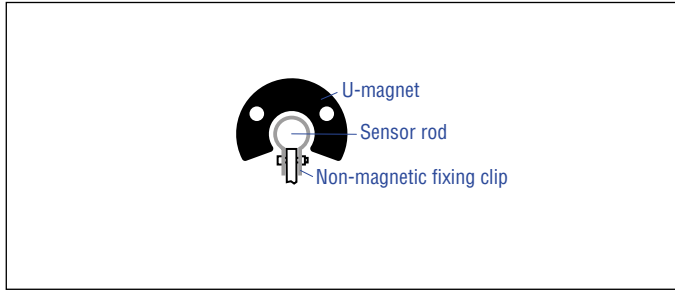


Fig. 19: Example of sensor support (part no. 561 481)

Start and end positions of the position magnets

Consider the start and end positions of the position magnets during the installation. To ensure that the entire stroke length is electrically usable, the position magnet must be mechanically mounted as follows.

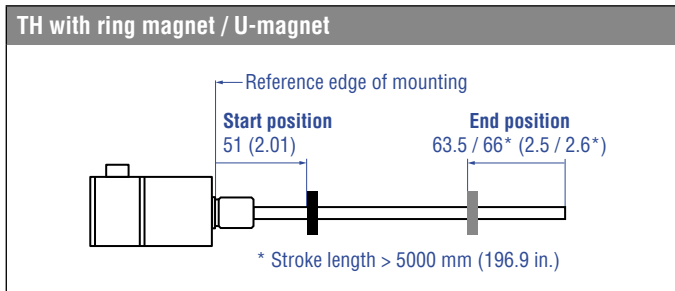


Fig. 20: Start and end positions of magnets

NOTICE
 On all sensors, the areas left and right of the active stroke length are provided for null and dead zone. These zones should not be used for measurement, however the active stroke length can be exceeded.

Multi-position measurement

The minimum distance between the magnets is 75 mm (3 in.).

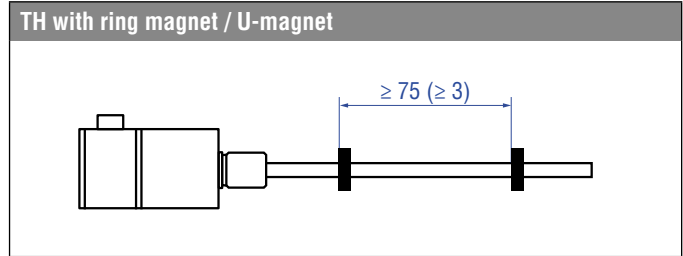


Fig. 21: Minimum distance for multi-position measurement

NOTICE
 For multi-position measurement, use magnets of the same type e.g. 2 x U-magnet (part no. 251 416-2). The minimum allowed distance between the magnets (i.e. front face of one to the front face of the next one) is 75 mm (3 in.). Contact MTS Sensors if you need a magnet distance < 75 mm (3 in.).

Mounting floats

A stop collar is ordered separately with a float. The stop collar consists of material, which is below the specific gravity of the fluid. It 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 within the float. If your application requires measuring to the bottom of your vessel, ask MTS Sensors about our low lift-off float option.

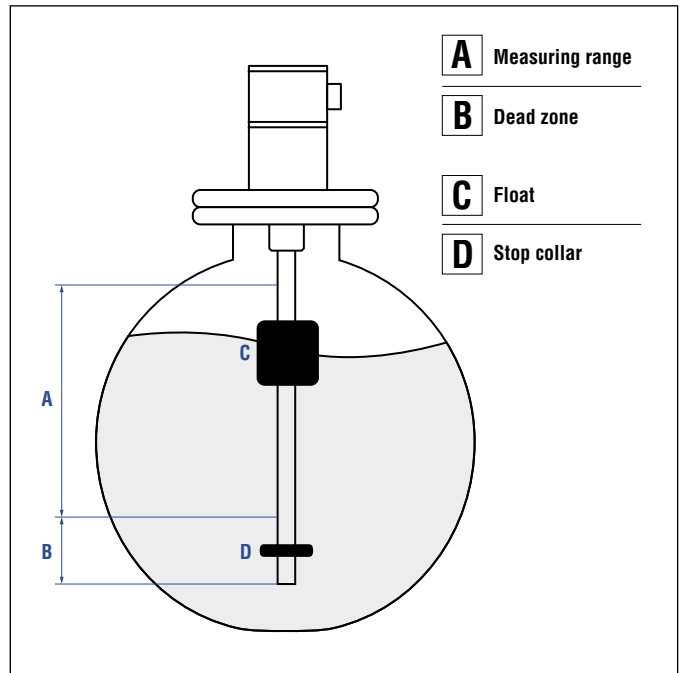


Fig. 22: Liquid level measurement

4.4 Electrical connection

Placement of installation and cabling have decisive influence on 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 sensor electronics – despite protection – against wrong polarity.

NOTICE

1. Do not mount the sensors in the area of strong magnetic or electric noise fields.
2. Never connect / disconnect the sensor when voltage is applied.

Instruction for connection

- Remove the cover plate as shown in Fig. 7 on page 13 to connect the cables to the sensor.
- If you use a cable / cable gland use low-resistance twisted pair and shielded cables. Connect the shield to ground externally via the controller equipment.
- Keep control and signal leads separate from power cables and sufficiently far away from motor cables, frequency inverters, valve cables, 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 as short as possible with a large cross section. Avoid ground loops.
- Use only stabilized power supplies in compliance with the specified electrical ratings.

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!

Grounding of rod sensors

Connect the sensor electronics housing to machine ground. Ground sensor type TH via one of the two ground lugs as shown in Fig. 23. Refer also to the information given in chapter "2.3 Installation, commissioning and operation" on page 4.

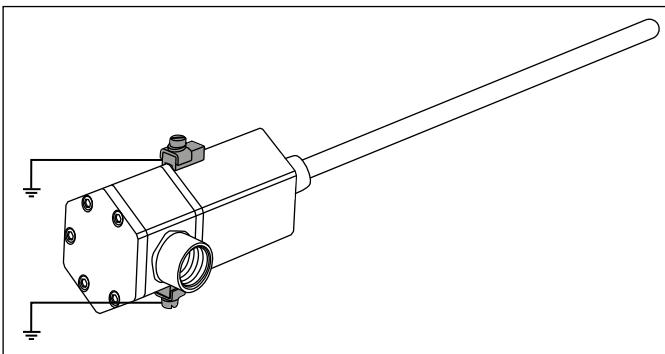


Fig. 23: Grounding via ground lug

Connector wiring for SIL 2 sensor

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

Version E & N suitable for connection types: C01, C10, M01, M10, N01, N10		
Signal + power supply		
Terminal	Pin	Function
	1	Output
	2	Signal Ground
	3	Not connected
	4	Not connected
	5	+24 VDC (-15 / +20 %)
	6	DC Ground (0 V)
	7	Cable shield

Fig. 24: TH (version E & N) wiring diagram SIL 2 (1.5 mm² conductor)

Version D & G suitable for connection types: C01, C10, N01, N10		
Signal + power supply		
Terminal	Pin	Function
	1	Output
	2	Signal Ground
	3	Not connected
	4	Not connected
	5	+24 VDC (-15 / +20 %)
	6	DC Ground (0 V)
	7	Cable shield

Fig. 25: TH (version D & G) wiring diagram SIL 2 (2.5 mm² conductor)

Connector wiring for standard sensor

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

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

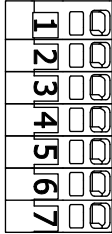
Version E & N suitable for connection types: C01, C10, M01, M10, N01, N10		
Signal + power supply		
Terminal	Pin	Function
	1	Output 1
	2	Signal Ground
	3	Output 2
	4	Signal Ground
	5	+24 VDC (-15 / +20 %)
	6	DC Ground (0 V)
	7	Cable shield

Fig. 26: TH (version E & N) wiring diagram standard (1.5 mm² conductor)

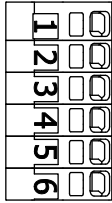
Version E & N suitable for connection type: NF1		
Signal + power supply		
Terminal	Pin	Function
	1	Output 1
	2	Signal Ground
	3	Output 2
	4	+24 VDC (-15 / +20 %)
	5	DC Ground (0 V)
	6	Cable shield

Fig. 27: TH (version E & N) wiring diagram standard (2.5 mm² conductor)

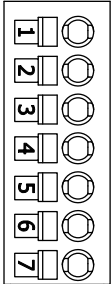
Version D & G suitable for connection types: C01, C10, N01, N10		
Signal + power supply		
Terminal	Pin	Function
	1	Output 1
	2	Signal Ground
	3	Output 2
	4	Signal Ground
	5	+24 VDC (-15 / +20 %)
	6	DC Ground (0 V)
	7	Cable shield

Fig. 28: TH (version D & G) wiring diagram standard (2.5 mm² conductor)

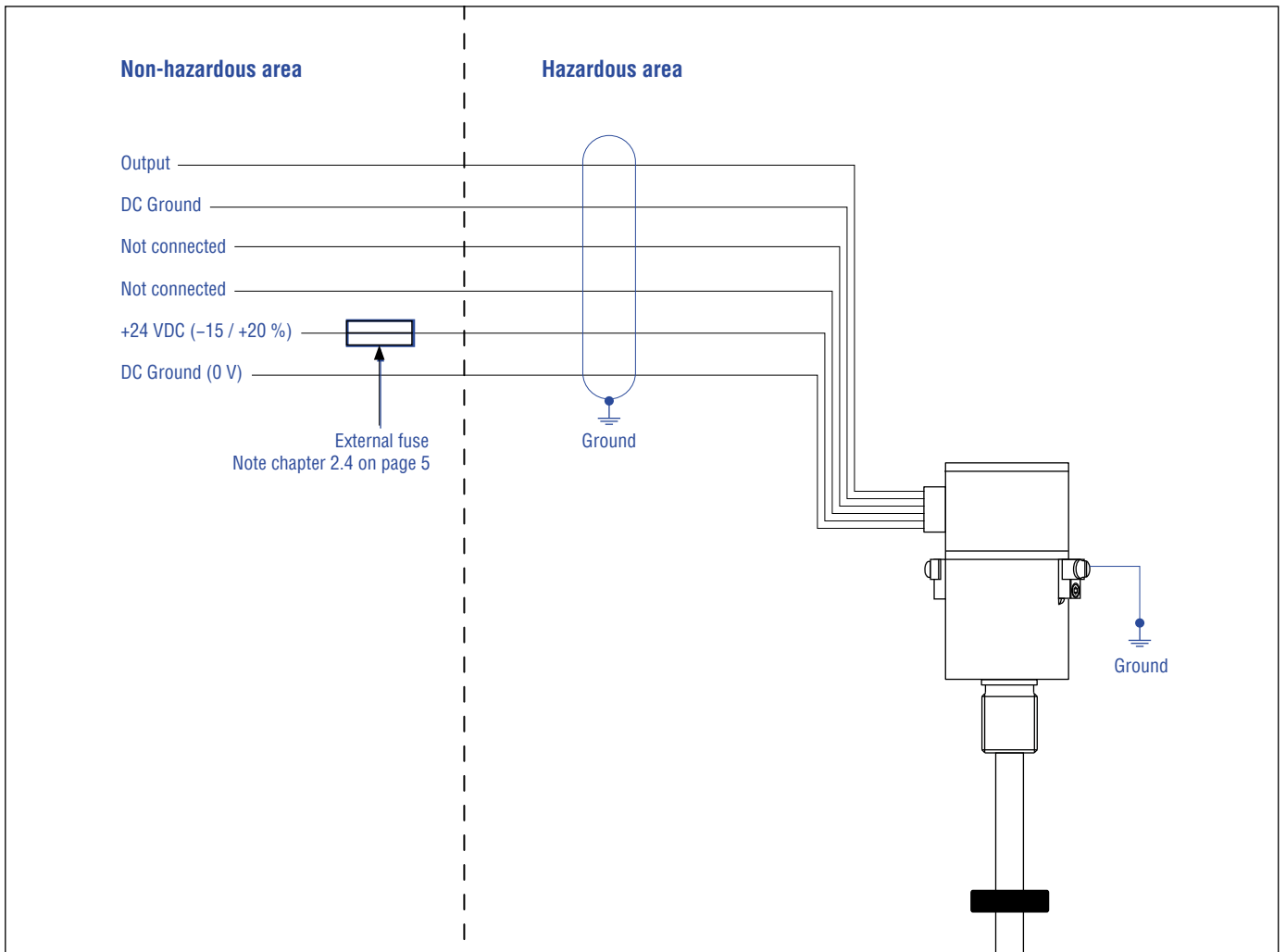




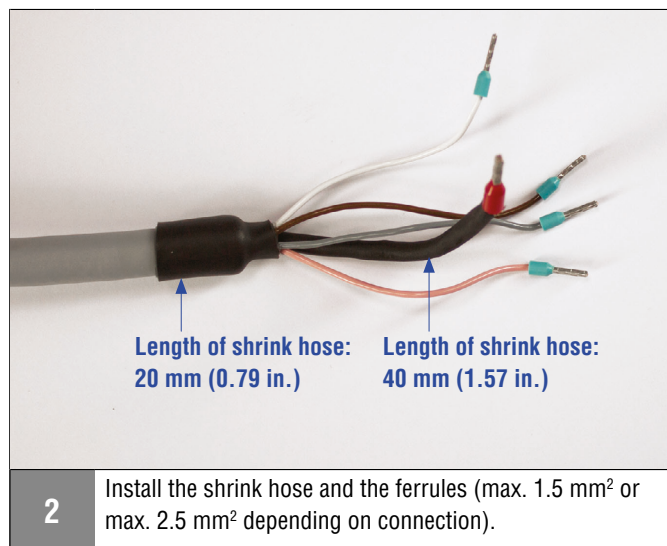
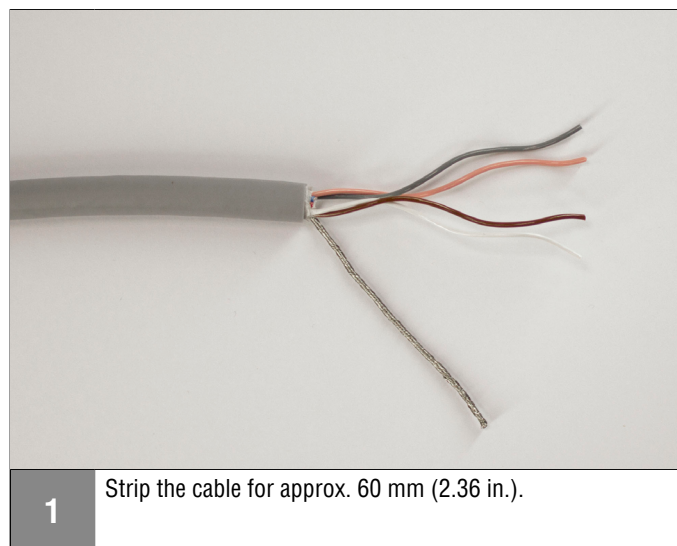


Fig. 29: Installation wiring diagram for side connection and top connection (example: Side connection)

Cable connection (only for versions E and N)

Recommended tools			
			
Electric torque screwdriver	Torque wrench	Slotted screwdriver	Crimping tool
3 mm (0.12 in.), fastening torque 1.2 Nm	Torque depending on cable gland	2.0 × 40 mm (0.08 × 1.57 in.)	For ferrules with max. 2.5 mm ²

Step 1: Preparing of cable



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 23)

Option 2: Cable connection without disassembly of connection adapter (see page 24)

NOTICE

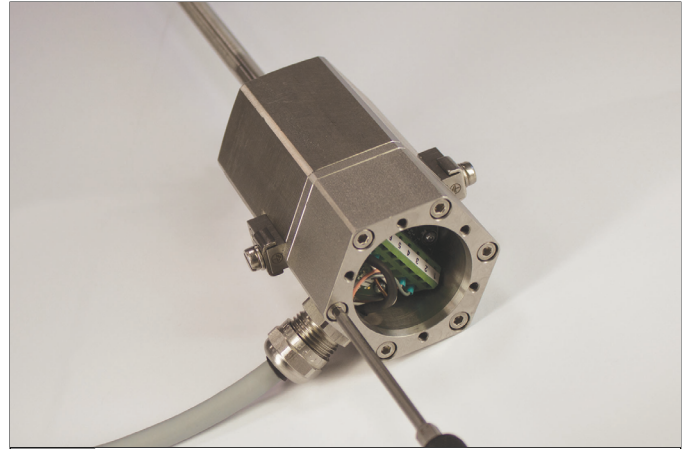
The example “Cable connection” is only valid for versions E and N of the TH sensor. Refer to the corresponding installation requirements and local regulations, if you like to connect a cable to the TH sensor versions D and G.

*The figures are examples.
 Variations are possible, e.g. different cable colors*

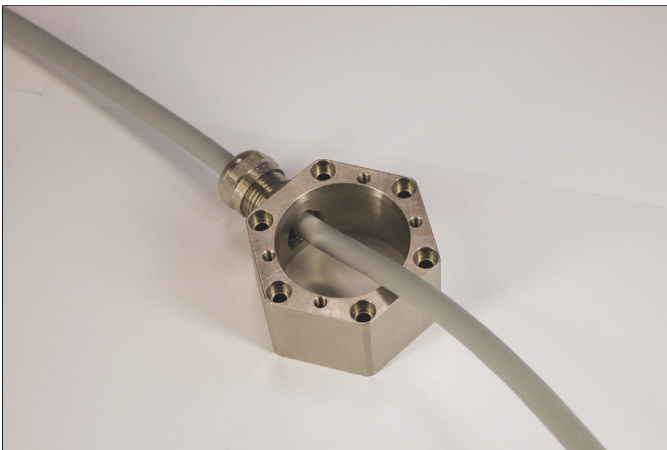
Step 2: Cable connection (Option 1: Disassembly of connection adapter)



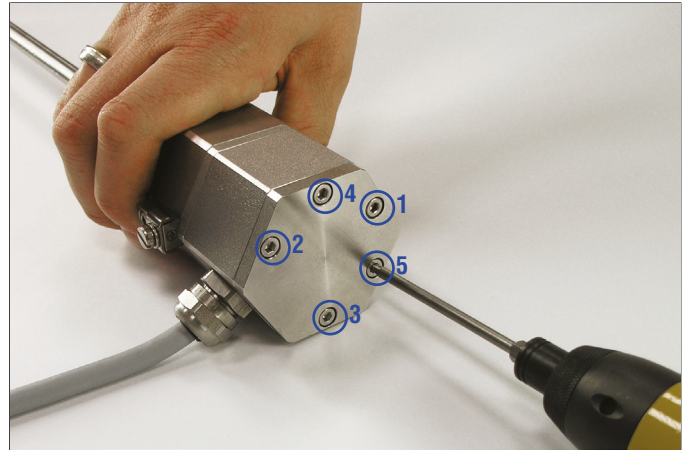
1 Loosen the five M4×10 screws (A/F 3). Remove the upper lid. Loosen the six M4×40 screws (A/F 3) of the connection adapter. Remove the connection adapter. See also Fig. 7.



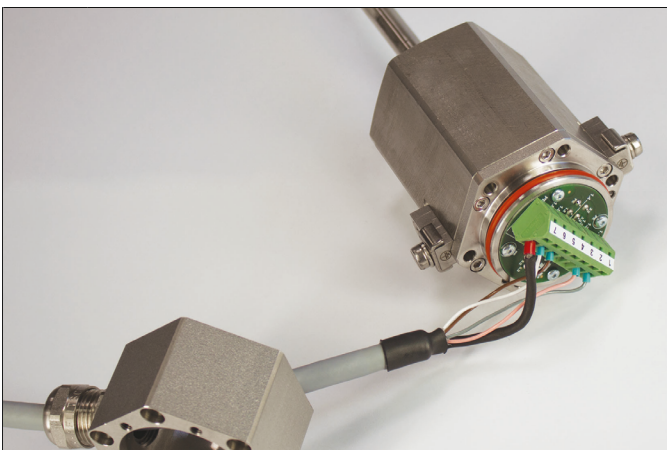
4 Inspect surfaces and O-ring for damage. Wipe surfaces clean and apply O-ring lube. Tighten the screws of the connection adapter with a fastening torque of 1.2 Nm.



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



5 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. Tighten the screws of the upper lid crosswise with a fastening torque of 1.2 Nm (see figure for right sequence).



3 Connect the cable to the sensor. Note the connection wiring on page 19 f..

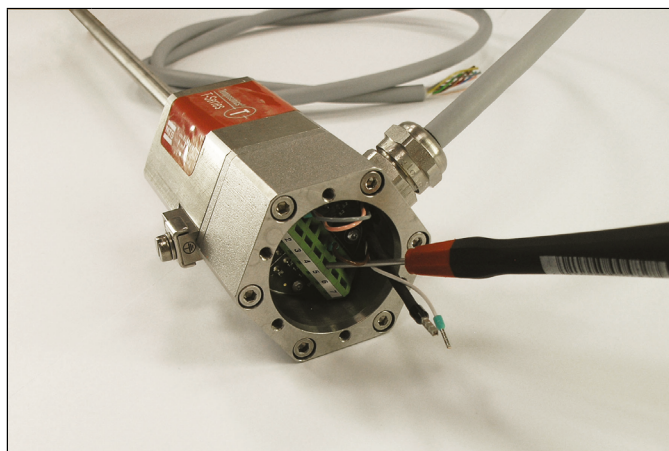
NOTICE
 The example “Cable connection” is only valid for versions E and N of the TH sensor. Refer to the corresponding installation requirements and local regulations, if you like to connect a cable to the TH sensor versions D and G.

*The figures are examples.
 Variations are possible, e.g. different cable colors*

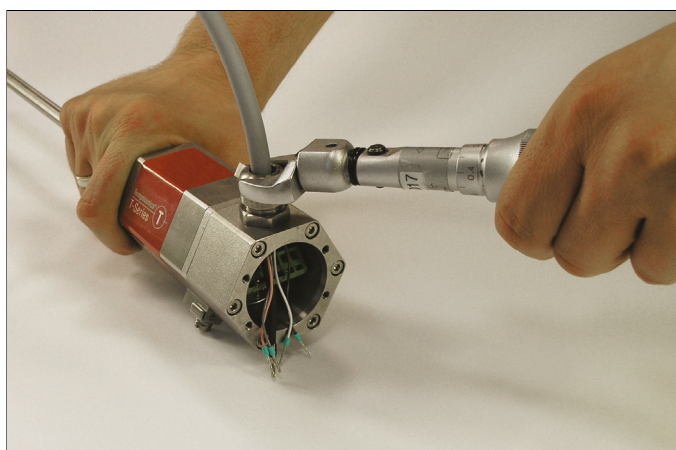
Step 2: Cable connection (Option 2: Without disassembly of connection adapter)



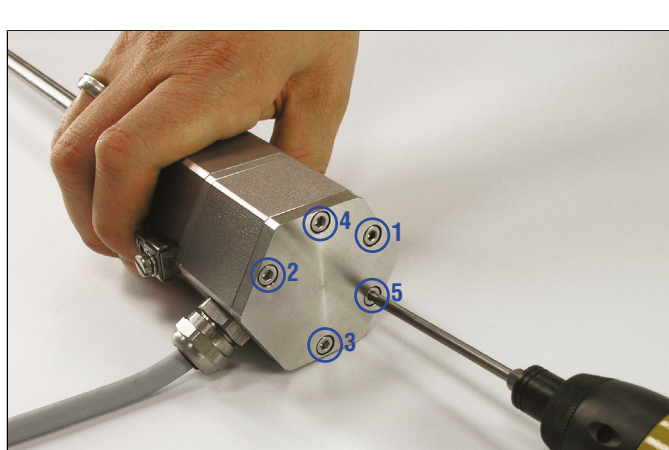
1 Loosen the five M4×10 screws (A/F 3).



3 Connect the cable to the sensor.
Note the connection wiring on page 19 f..



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



4 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. Tighten the screws of the upper lid crosswise with a fastening torque of 1.2 Nm (see figure for right sequence).

NOTICE

The example “Cable connection” is only valid for versions E and N of the TH sensor. Refer to the corresponding installation requirements and local regulations, if you like to connect a cable to the TH sensor versions D and G.

*The figures are examples.
Variations are possible, e.g. different cable colors*

4.5 Frequently ordered accessories for TH standard – Additional options available in our [Accessories Guide](#) **551444**

Position magnets

<p>Ring magnet OD33 Part no. 201 542-2</p> <p>Material: PA ferrite GF20 Weight: Approx. 14 g Surface pressure: Max. 40 N/mm² Fastening torque for M4 screws: 1 Nm Operating temperature: -40...+105 °C (-40...+221 °F)</p>	<p>Ring magnet OD25.4 Part no. 400 533</p> <p>Material: PA ferrite Weight: Approx. 10 g Surface pressure: Max. 40 N/mm² Operating temperature: -40...+105 °C (-40...+221 °F)</p>	<p>U-magnet OD33 Part no. 251 416-2</p> <p>Material: PA ferrite GF20 Weight: Approx. 11 g Surface pressure: Max. 40 N/mm² Fastening torque for M4 screws: 1 Nm Operating temperature: -40...+105 °C (-40...+221 °F)</p>	<p>U-magnet OD63.5 Part no. 201 553</p> <p>Material: PA 66-GF30, magnets compound-filled Weight: Approx. 26 g Surface pressure: 20 N/mm² Fastening torque for M4 screws: 1 Nm Operating temperature: -40...+75 °C (-40...+167 °F)</p>

Magnet spacer

Floats *

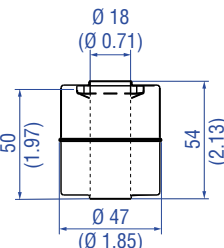
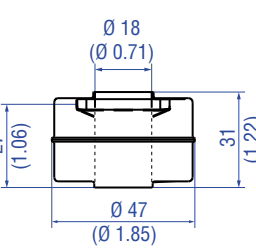
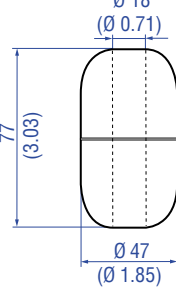
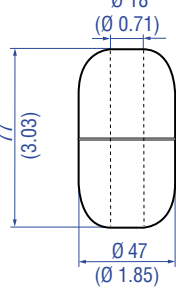
<p>Magnet spacer Part no. 400 633</p> <p>Material: Aluminum Weight: Approx. 5 g Surface pressure: Max. 20 N/mm² Fastening torque for M4 screws: 1 Nm</p>	<p>Float Part no. 251 387-2</p> <p>Material: Stainless steel (AISI 316L) Weight offset: Yes Pressure: 22.4 bar (325 psi) Magnet offset: No Specific gravity: Max. 0.48 Operating temperature: -40...+125 °C (-40...+257 °F)</p>	<p>Float Part no. 200 938-2</p> <p>Material: Stainless steel (AISI 316L) Weight offset: Yes Pressure: 8.6 bar (125 psi) Magnet offset: No Specific gravity: Max. 0.74 Operating temperature: -40...+125 °C (-40...+257 °F)</p>	<p>Float Part no. 251 469-2</p> <p>Material: Stainless steel (AISI 316L) Weight offset: Yes Pressure: 29.3 bar (425 psi) Magnet offset: No Specific gravity: Max. 0.45 Operating temperature: -40...+125 °C (-40...+257 °F)</p>

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

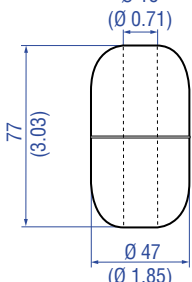
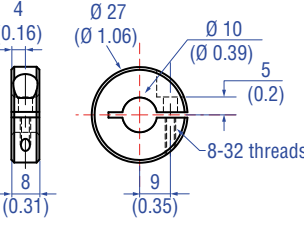
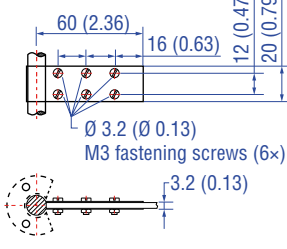
- * / • Be sure that the float specific gravity is at least 0.05 less than that of the measured liquid as a safety margin at ambient temperature
- For interface measurement: A minimum of 0.05 specific gravity differential is required between the upper and lower liquids
- When the magnet is not shown, 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

Floats *

			
<p>Float Part no. 201 605-2</p> <p>Material: Stainless steel 1.4571 (AISI 316 Ti) Weight offset: Yes Pressure: 4 bar (60 psi) Magnet offset: Yes Specific gravity: Max. 0.6 Operating temperature: -40...+125 °C (-40...+257 °F) Standard float that can be expedited</p>	<p>Float Part no. 201 606-2</p> <p>Material: Stainless steel 1.4571 (AISI 316 Ti) Weight offset: Yes Pressure: 4 bar (60 psi) Magnet offset: Yes Specific gravity: 0.93 ± 0.01 Operating temperature: -40...+125 °C (-40...+257 °F) Standard float that can be expedited</p>	<p>Float Part no. 251 982-2</p> <p>Material: Stainless steel (AISI 316L) Weight offset: Yes Pressure: 29.3 bar (425 psi) Magnet offset: No Specific gravity: 0.93 ± 0.01 Operating temperature: -40...+125 °C (-40...+257 °F)</p>	<p>Float Part no. 251 983-2</p> <p>Material: Stainless steel (AISI 316L) Weight offset: Yes Pressure: 29.3 bar (425 psi) Magnet offset: No Specific gravity: 1.06 ± 0.01 Operating temperature: -40...+125 °C (-40...+257 °F)</p>

Float * Stop collar Mounting accessory

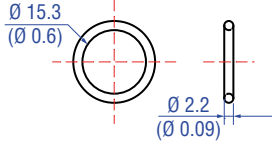
		
<p>Float Part no. 251 981-2</p> <p>Material: Stainless steel (AISI 316L) Weight offset: Yes Pressure: 29.3 bar (425 psi) Magnet offset: No Specific gravity: Max. 0.67 Operating temperature: -40...+125 °C (-40...+257 °F)</p>	<p>Stop collar Part no. 560 777</p> <p>Provides end of stroke stops for float Material: Stainless steel 1.4301 (AISI 304) Weight: Approx. 30 g Hex key 7/64" required</p>	<p>Fixing clip Part no. 561 481</p> <p>Application: Used to secure sensor rods (Ø 10 mm (Ø 0.39 in.)) when using an U-magnet or block magnet Material: Brass, non-magnetic</p>

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

- * / • 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

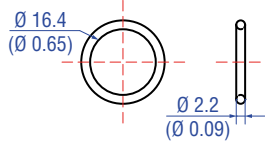
- An offset weight is installed in the float to bias or tilt the float installed on the sensor tube. So the float remains in contact with the sensor tube at all times and guarantees permanent potential equalization of the float. The offset is required for installations that must conform to hazardous location standards

O-rings



**O-ring for threaded flange
 M18x1.5-6g
 Part no. 401 133**

Material: Fluoroelastomer
 Durometer: 75 ± 5 Shore A
 Operating temperature:
 -40...+204 °C (-40...+400 °F)



**O-ring for threaded flange
 3/4"-16 UNF-3A
 Part no. 560 315**

Material: Fluoroelastomer
 Durometer: 75 ± 5 Shore A
 Operating temperature:
 -40...+204 °C (-40...+400 °F)

Programming tools



**Hand programmer for analog output
 Part no. 253 124**

Easy teach-in-setups of stroke length and direction on desired zero / span positions. For sensors with 1 magnet.



**Programming kit
 Part no. 253 134-1**

Kit includes:
 1 × interface converter box,
 1 × power supply
 1 × cable (60 cm) with M16 female connector (6 pin), straight – D-sub female connector (9 pin), straight
 1 × cable (60 cm) with 3 × terminal clamp – D-sub female connector (9 pin), straight
 1 × USB cable

For sensors with 1 or 2 magnets.

Software is available at:
www.mtssensors.com



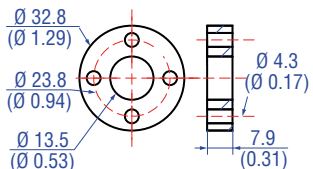
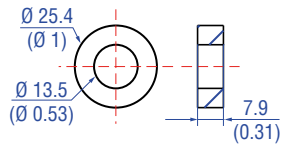
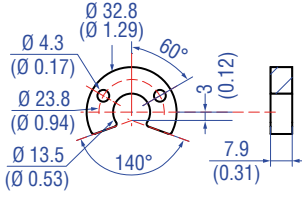
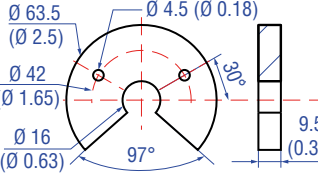
**Cabinet programmer for analog output
 Part no. 253 408**

Features snap-in mounting on standard DIN rail (35 mm). This programmer can be permanently mounted in a control cabinet and includes a program / run switch. For sensors with 1 magnet.

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

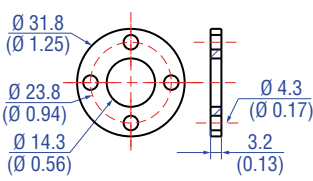
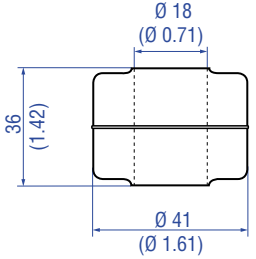
4.6 Frequently ordered accessories for TH SIL 2 – Additional options available in our [Accessories Guide](#)  551444

Position magnets

			
<p>Ring magnet OD33 Part no. 201 542-2</p>	<p>Ring magnet OD25.4 Part no. 400 533</p>	<p>U-magnet OD33 Part no. 251 416-2</p>	<p>U-magnet OD63.5 Part no. 201 553</p>
<p>Material: PA ferrite GF20 Weight: Approx. 14 g Surface pressure: Max. 40 N/mm² Fastening torque for M4 screws: 1 Nm Operating temperature: -40...+105 °C (-40...+221 °F)</p>	<p>Material: PA ferrite Weight: Approx. 10 g Surface pressure: Max. 40 N/mm² Operating temperature: -40...+105 °C (-40...+221 °F)</p>	<p>Material: PA ferrite GF20 Weight: Approx. 11 g Surface pressure: Max. 40 N/mm² Fastening torque for M4 screws: 1 Nm Operating temperature: -40...+105 °C (-40...+221 °F)</p>	<p>Material: PA 66-GF30, magnets compound-filled Weight: Approx. 26 g Surface pressure: 20 N/mm² Fastening torque for M4 screws: 1 Nm Operating temperature: -40...+75 °C (-40...+167 °F)</p>

Magnet spacer

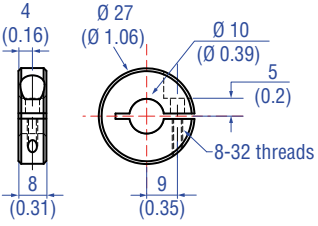
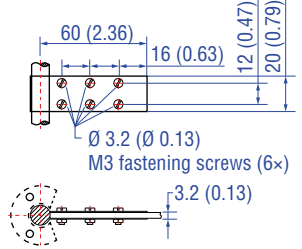
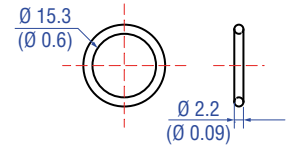
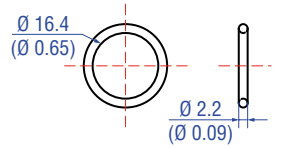
Float *

	
<p>Magnet spacer Part no. 400 633</p>	<p>Float Part no. 200 938-2</p>
<p>Material: Aluminum Weight: Approx. 5 g Surface pressure: Max. 20 N/mm² Fastening torque for M4 screws: 1 Nm</p>	<p>Material: Stainless steel (AISI 316L) Weight offset: Yes Pressure: 8.6 bar (125 psi) Magnet offset: No Specific gravity: Max. 0.74 Operating temperature: -40...+125 °C (-40...+257 °F)</p>

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

- * / 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

Stop collar	Mounting accessory	O-rings	
			
<p>Stop collar Part no. 560 777</p>	<p>Fixing clip Part no. 561 481</p>	<p>O-ring for threaded flange M18x1.5-6g Part no. 401 133</p>	<p>O-ring for threaded flange 3/4"-16 UNF-3A Part no. 560 315</p>
<p>Provides end of stroke stops for float Material: Stainless steel 1.4301 (AISI 304) Weight: Approx. 30 g Hex key 1/64" required</p>	<p>Application: Used to secure sensor rods (Ø 10 mm (Ø 0.39 in.)) when using an U-magnet or block magnet Material: Brass, non-magnetic</p>	<p>Material: Fluoroelastomer Durometer: 75 ± 5 Shore A Operating temperature: -40...+204 °C (-40...+400 °F)</p>	<p>Material: Fluoroelastomer Durometer: 75 ± 5 Shore A Operating temperature: -40...+204 °C (-40...+400 °F)</p>

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

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. 7 on page 13. It is not possible to configure the T-Series SIL 2 sensor.

NOTICE

Observe during commissioning

1. Before switching on for the first time, check carefully to ensure the sensor has been connected correctly.
2. Position the magnet in the measuring range of the sensor during first commissioning and after replacement of the magnet.
3. Ensure that the sensor control system cannot react in an uncontrolled way when switching on.
4. Ensure that the sensor is ready and in operation mode after switching on.
5. Check the pre-set span start and end values of the measuring range (see section 4.2 Styles and installation of Temposonics® TH) 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

Analog interface

The analog sensor can be directly connected to a controller. Its electronics generates a position signal output proportional to the start and end of the active measuring range.

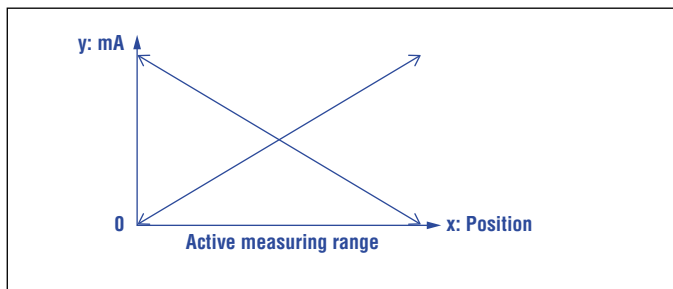


Fig. 30: Analog interface

MTS Sensors programming 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 programming tools from the list of accessories (see page 27) are available for this purpose.

NOTICE The programming tools 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.

5.2.1 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, see also “5.2.4 Setting examples for programming tools” on page 36. 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.

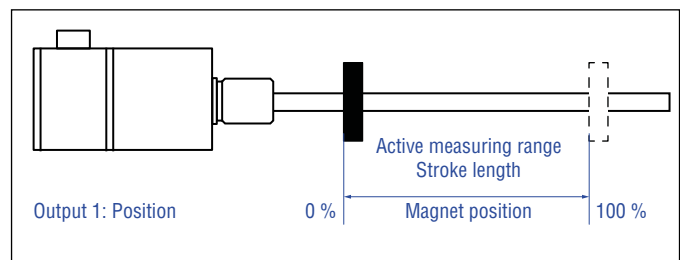


Fig. 31: Active measuring range

□ Step 1: Connect hand programmer

□ Step 2: Adjust measuring range

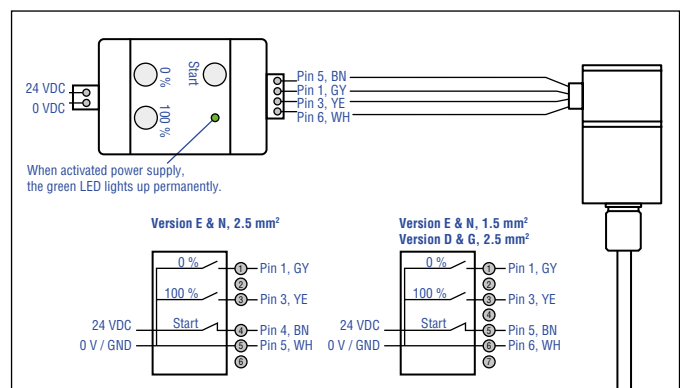


Fig. 32: Connect hand programmer (see connection wiring Fig. 26 / Fig. 27 / Fig. 28 on page 20)

Connect the hand programmer to the power supply and to the sensor according to Fig. 32.

NOTICE
You can only adapt magnet 1 via hand programmer. In order to change the settings of magnet 1 you have to connect both outputs (output 1 and output 2).

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

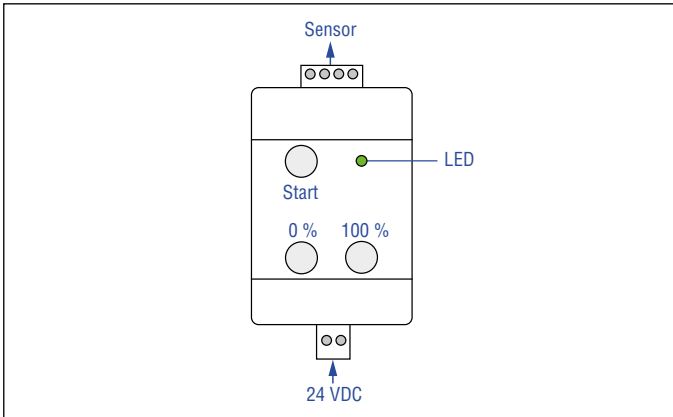


Fig. 33: Adjust measuring range

3. Set end point (100 % output) (Fig. 34):
 - Set the position magnet on end position
 - Press and release the “100 %” button
4. Back to normal function (operation mode):
 - Press “Start” button
 - Connect the sensor to control unit

1. Activate the programming mode:
 - Press “Start” button and “100 %” button simultaneously
 - Release “Start” button first, wait 1 second and release “100 %” button
2. Set start point (0 % output) (Fig. 34):
 - Set the position magnet on start position
 - Press and release the “0 %” button

Output from order code	Output 1		Output 2	
	Start position (0 % output)	End position (100 % output)	Start position (0 % output)	End position (100 % output)
A01	4 mA	20 mA	—	—
A11	20 mA	4 mA	—	—
A21	0 mA	20 mA	—	—
A31	20 mA	0 mA	—	—
A03	4 mA	20 mA	20 mA	4 mA
A02	4 mA	20 mA	4 mA *	20 mA *
A12	20 mA	4 mA	20 mA *	4 mA *
A22	0 mA	20 mA	0 mA *	20 mA *
A32	20 mA	0 mA	20 mA *	0 mA *

* When using the analog hand programmer only the start and end positions of magnet 1 (output 1) are adjusted. The settings of magnet 2 (output 2) are not affected.

Fig. 34: Determine start and end position

5.2.2 Analog cabinet programmer, part no. 253 408

Install the built-in programming unit firmly in the control cabinet. It is possible to change the start and end positions as well as the measuring direction via simple teach in process, see also “5.2.4 Setting examples for programming tools” on page 36. After that, the changed parameters are stored in the sensor. Move the position magnet to the desired start or end position and push the corresponding “0 %” or “100 %” button. The minimum distance between the new setpoints is 25 mm (1 in.). The individual steps are explained in the following section.

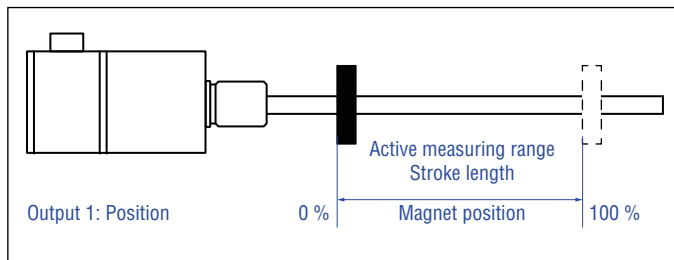


Fig. 35: Active measuring range

- Step 1: Install cabinet programmer**
- Step 2: Connect cabinet programmer
- Step 3: Adjust measuring range

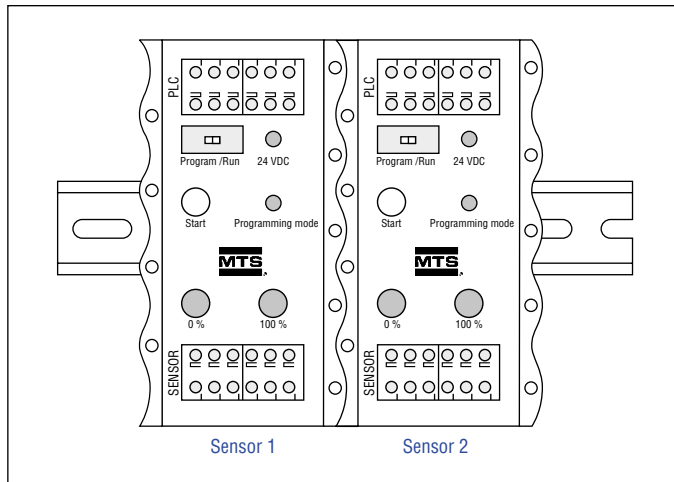


Fig. 36: Dimensions: 10 × 55 × 31 mm (0.39 × 2.17 × 1.22 in.); material: Aluminum, side caps PA 6.6 FR; connection type: Spring terminals, max. 1,5 mm²; ingress protection: IP20

The cabinet programmer is designed for mounting on standard 35 mm (1.38 in.) rails according to DIN EN 60715 / 50022. Install the cabinet programmer between sensor and controller e.g. in a control cabinet. Using the cabinet programmer the sensor can be easily re-programmed as needed with no additional tools.

- Step 1: Install cabinet programmer
- Step 2: Connect cabinet programmer**
- Step 3: Adjust measuring range

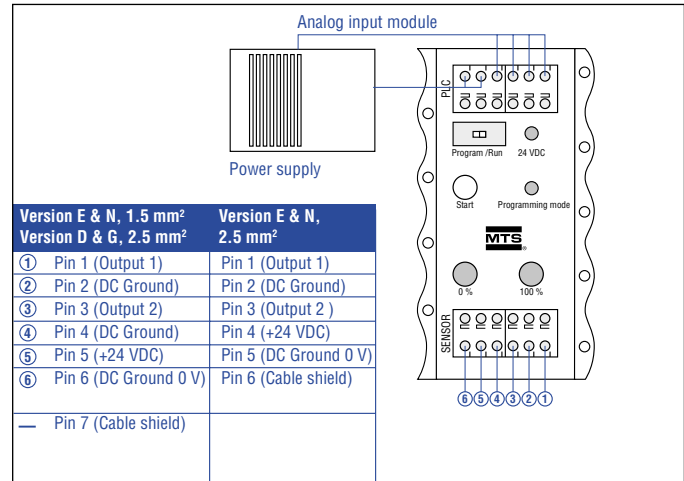


Fig. 37: Connect cabinet programmer (see connection wiring Fig. 26 / Fig. 27 / Fig. 28 on page 20)

Connect the cabinet programmer to the controller, to the power supply and to the sensor according to Fig. 37.

- Step 1: Install cabinet programmer
- Step 2: Connect cabinet programmer
- Step 3: Adjust measuring range**

1. Activate programming mode:
 - Slide switch to “Program”
 - Press “Start” button and “100 %” button simultaneously
 - Release “Start” button first, wait 1 second and release “100 %” button
 - Green “Programming mode” LED on cabinet programmer flashes (programming mode reached)

Point 2 – 4 on the next page

2. Set start position (0 % output) (Fig. 38):

- Set the position magnet to start position
- Press and release the “0 %” button

Output from order code	Output 1		Output 2	
	Start position (0 % output)	End position (100 % output)	Start position (0 % output)	End position (100 % output)
A01	4 mA	20 mA	—	—
A11	20 mA	4 mA	—	—
A21	0 mA	20 mA	—	—
A31	20 mA	0 mA	—	—
A03	4 mA	20 mA	20 mA	4 mA
A02	4 mA	20 mA	4 mA *	20 mA *
A12	20 mA	4 mA	20 mA *	4 mA *
A22	0 mA	20 mA	0 mA *	20 mA *
A32	20 mA	0 mA	20 mA *	0 mA *

* When using the analog hand programmer only the start and end positions of magnet 1 (output 1) are adjusted. The settings of magnet 2 (output 2) are not affected.

Fig. 38: Determine start and end position

3. Set end position (100 % output) (Fig. 38):

- Set the position magnet to end position
- Press and release the “100 %” button

4. Back to normal function (operation mode):

- Press and release the “Start” button
- LED “Programming mode” stops flashing
- Slide switch to “Run”
- Green LED “24 VDC” shows normal function

5.2.3 Programming kit, part no. 253 134-1 (EU) / 253 309-1 (US)

The PC programmer is a hardware converter between sensor and serial PC interface. It can be used for adjusting sensor parameters via computer and the MTS Sensors programming software, see also “5.2.4 Setting examples for programming tools” on page 36. The software for reading and adjusting the sensors requires a Windows computer with a free USB port. You can adjust the following parameters:

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

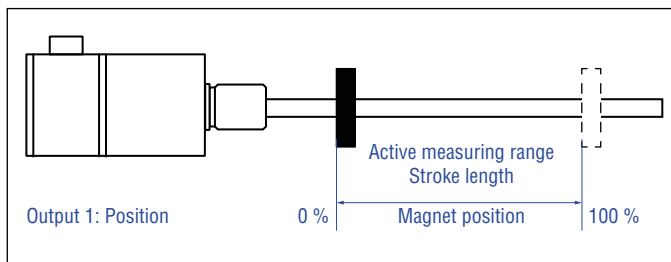


Fig. 39: Active measuring range

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

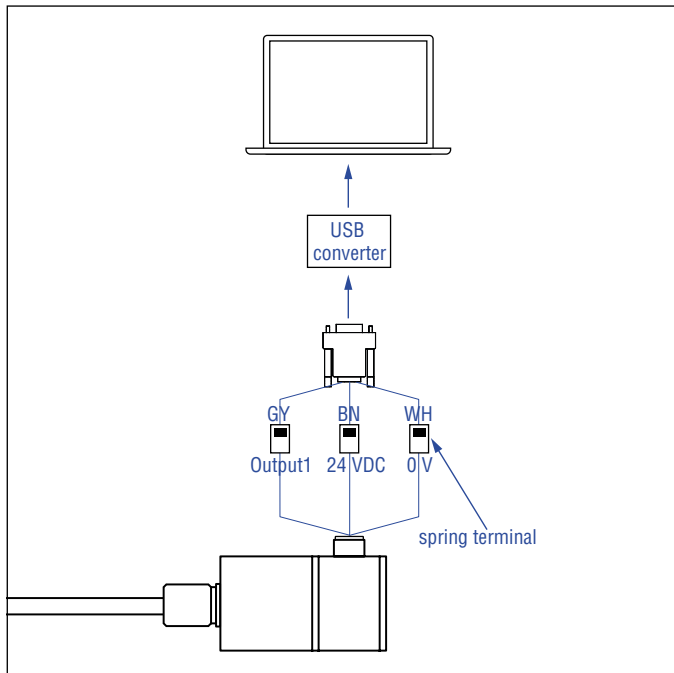


Fig. 40: Connect PC programmer (with spring terminal)

- Connect the PC programmer with the sensor via the corresponding adapter cable
- Connect the PC programmer to a USB port of the computer
- Connect the power supply via connector. The outer contact of the connector is 0 V (ground), the inner contact is 24 VDC

NOTICE

Never connect / disconnect the sensor when voltage is applied!

- 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. A free COM port is selected. The COM port, which was chosen, is displayed in the Device Manager. 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 program, the user interface of the connected sensor with its adjustable parameters will open (Fig. 41). The following example illustrates the configuration of a sensor with two magnets.

MTS TH analog software user interface

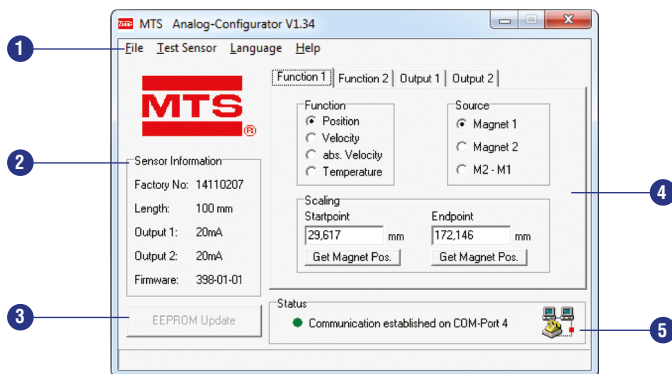


Fig. 41: MTS Analog-Configurator V1.34, Function 1

- 1 In the **File** menu, the sensor configuration can be saved on hard disk, printed out or loaded into the sensor³. 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 the main display section 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. 42 position measurement with **Magnet 1** is selected. Under **Scaling** you can specify the **Startpoint** 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).

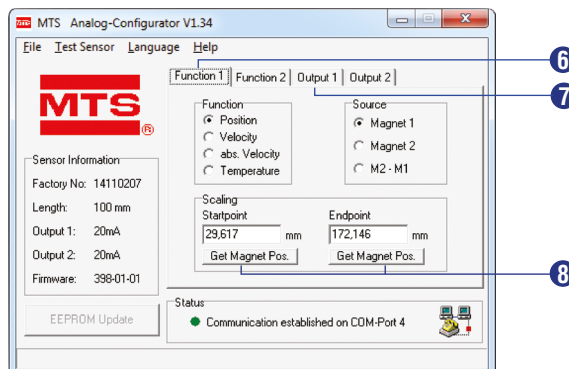


Fig. 42: Example of tab controls

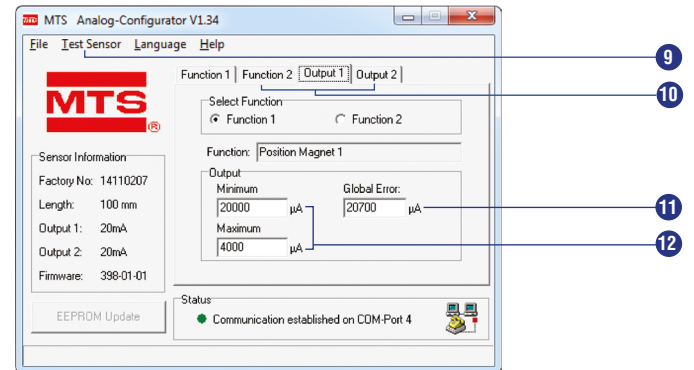


Fig. 43: Example of tab controls

- 9 Menu **Test Sensor** provides a data display (Fig. 44), 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. 42), 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 $-0.7 \dots 20.7$ 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. 43).

Data display

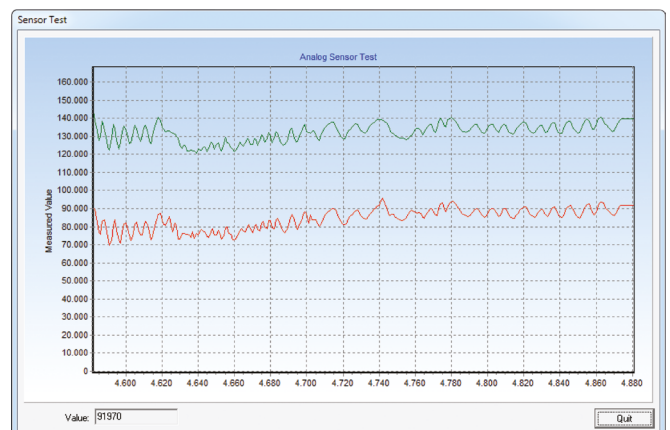


Fig. 44: Sensor Test diagram of analog sensor with 2 position magnets

3/ Only sensor configurations with the same serial number permitted

5.2.4 Setting examples for programming tools

The sensor's measuring range can be repositioned using the tools described above within the active measuring range at any time.

NOTICE

Independent of the measuring direction, the location of the setpoints in the factory settings is always: SP1 (set point 1) at sensor electronics housing and SP2 (set point 2) at rod end (Fig. 45).

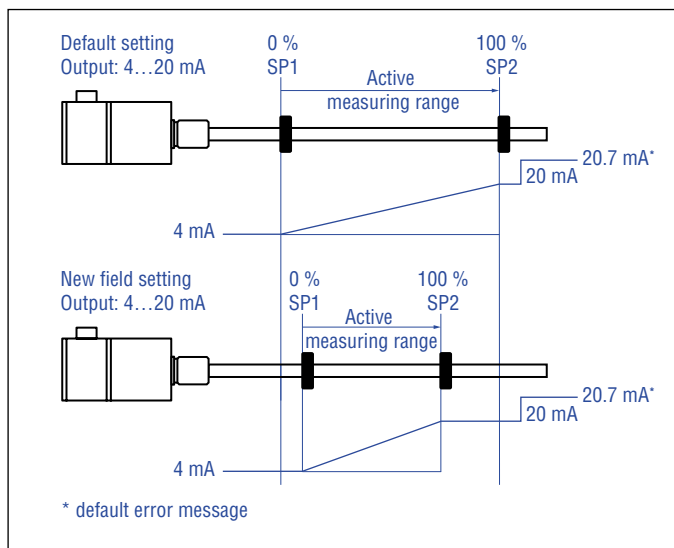


Fig. 45: Set start- and endpoint

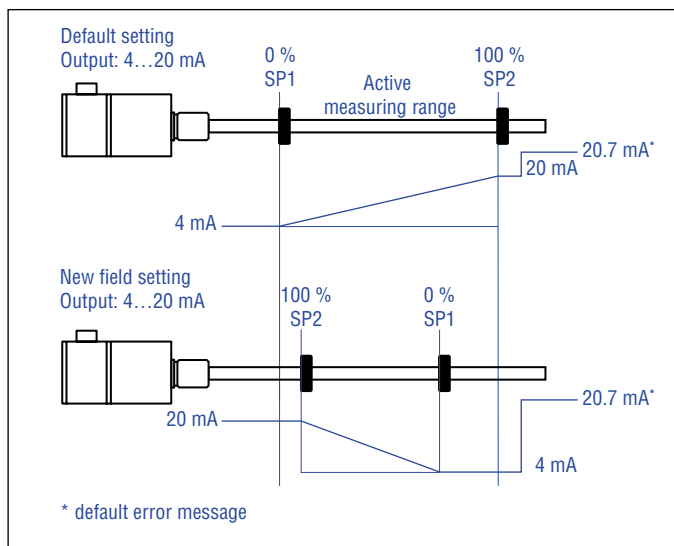


Fig. 46: Start- and endpoint, set the direction

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		

Fig. 47: Schedule of inspection

NOTICE

Perform maintenance work that requires a dismantling of the system only in an Ex-free atmosphere. If this is not possible take protective measures in compliance with local regulations.

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 only be performed by MTS Sensors or a repair facility explicitly authorized by MTS Sensors. 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...+200 °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

8.1 Technical data Temposonics® TH SIL 2

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) ⁴
Cycle time	2.0 ms
Linearity deviation ⁵	< ±0.01 % F.S. (minimum ±50 μm)
Repeatability	< ±0.001 % F.S. (minimum ±2.5 μm) typical
Hysteresis	< 4 μm typical
Temperature coefficient	< 30 ppm/K typical

Operating conditions

Operating temperature	Version E: -40...+80 °C (-40...+176 °F) Version D, G: -40...+85 °C (-40...+185 °F)
Humidity	90 % relative humidity, no condensation
Ingress protection	Version D, G, and E: IP66 / IP67 (if properly connected by means that support IP66 / IP67 (pipe, gland, etc.)) 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 (excluding resonant frequencies)
EMC test	Electromagnetic emission according to IEC/EN 61326-1 (Class B) Electromagnetic immunity according to IEC/EN 61326-3-2 (Class B) The sensor meets the requirements of the EU directives and is marked with CE
Operating pressure	350 bar static (5076 psi static)
Magnet movement velocity ⁶	Any

Design / Material

Sensor electronics housing	Stainless steel 1.4305 (AISI 303); option: Stainless steel 1.4404 (AISI 316L)
Flange	See "Table 1: TH rod sensor threaded flange type references" on page 12
Sensor rod	Stainless steel 1.4306 (AISI 304L); option: Stainless steel 1.4404 (AISI 316L)
Stroke length	25...1500 mm (1...60 in.)

Mechanical mounting

Mounting position	Any orientation
Mounting instruction	Please consult the technical drawings on page 11

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

4/ The internal digital value is transferred via a 16 bit D/A converter into a proportional, analog current signal

5/ With position magnet # 201 542-2

6/ If there is contact between the moving magnet (including the magnet holder) and the sensor rod, make sure that the maximum speed of the moving magnet is ≤ 1 m/s (Safety requirement due to ESD [Electro Static Discharge])

Certifications

Certification required	Version E	Version D	Version G	Version N
IECEX / ATEX (IECEX: Global market; ATEX: Europe)	Ex db eb IIC T4 Ga/Gb Ex tb IIIC T130°C Ga/Db Zone 0/1, Zone 21 -40 °C ≤ Ta ≤ 80 °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
EAC Ex (Russian market)	Ga/Gb Ex db eb IIC T4 X Da/Db Ex tb IIIC T130°C X Zone 0/1, Zone 21 -40 °C ≤ Ta ≤ 80 °C	Ga/Gb Ex db IIC T4 X Da/Db Ex tb IIIC T130°C X Zone 0/1, Zone 21 -40 °C ≤ Ta ≤ 85 °C	Ga/Gb Ex db IIC T4 X Da/Db Ex tb IIIC T130°C X Zone 0/1, Zone 21 -40 °C ≤ Ta ≤ 85 °C	No hazardous area approval
KCs (South Korea)	Ex d e IIC T4 Ex tb IIIC T130°C Zone 0/1; Zone 21 -40 °C ≤ Ta ≤ 80 °C	Ex d IIC T4 Ex tb IIIC T130°C Zone 0/1; Zone 21 -40 °C ≤ Ta ≤ 85 °C	Ex d IIC T4 Ex tb IIIC T130°C Zone 0/1, Zone 21 -40 °C ≤ Ta ≤ 85 °C	No hazardous area approval
Japanese approval	Ex d e IIC T4 Ga/Gb Ex t IIIC T130°C Db Zone 0/1, Zone 21 -40 °C ≤ Ta ≤ 80 °C	Ex d IIC T4 Ga/Gb Ex t IIIC T130°C Db Zone 0/1, Zone 21 -40 °C ≤ Ta ≤ 85 °C	Ex d IIC T4 Ga/Gb Ex t IIIC T130°C Db Zone 0/1, Zone 21 -40 °C ≤ Ta ≤ 85 °C	No hazardous area approval

Fig. 48: Certifications TH SIL 2

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 %

Fig. 49: Sensor parameter TH SIL 2

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 %

Fig. 50: Safety values TH SIL 2

8.2 Technical data Temposonics® TH standard

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) ⁷
Cycle time	0.5 ms up to 1200 mm stroke length 1.0 ms up to 2400 mm stroke length 2.0 ms up to 4800 mm stroke length 5.0 ms up to 7620 mm stroke length
Linearity deviation ⁸	< ±0.01 % F.S. (minimum ±50 μm)
Repeatability	< ±0.001 % F.S. (minimum ±2.5 μm) typical
Hysteresis	< 4 μm typical
Temperature coefficient	< 30 ppm/K typical

Operating conditions

Operating temperature	-40...+75 °C (-40...+167 °F)
Humidity	90 % relative humidity, no condensation
Ingress protection	Version D, G, and E: IP66 / IP67 (if properly connected by means that support IP66 / IP67 (pipe, gland, etc.)) 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 (excluding resonant frequencies)
EMC test	Electromagnetic emission according to IEC/EN 55011 +A1 Class B Electromagnetic immunity according to IEC/EN 61000-6-2 The sensor meets the requirements of the EU directives and is marked with CE
Operating pressure	350 bar static (5076 psi static)
Magnet movement velocity ⁹	Any

Design / Material

Sensor electronics housing	Stainless steel 1.4305 (AISI 303); option: Stainless steel 1.4404 (AISI 316L)
Flange	See "Table 1: TH rod sensor threaded flange type references" on page 12
Sensor rod	Stainless steel 1.4306 (AISI 304L); option: Stainless steel 1.4404 (AISI 316L)
Stroke length	25...7620 mm (1...300 in.)

Mechanical mounting

Mounting position	Any orientation
Mounting instruction	Please consult the technical drawings on page 11

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/} The internal digital value is transferred via a 16 bit D/A converter into a proportional, analog current signal

^{8/} With position magnet # 201 542-2

^{9/} If there is contact between the moving magnet (including the magnet holder) and the sensor rod, make sure that the maximum speed of the moving magnet is ≤ 1 m/s (Safety requirement due to ESD [Electro Static Discharge])

Certifications

Certification required	Version E	Version D	Version G	Version N
IECEx / ATEX (IECEx: Global market; ATEX: Europe)	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
EAC Ex (Russian market)	Ga/Gb Ex db eb IIC T4 X Da/Db Ex tb IIIC T130°C X Zone 0/1, Zone 21 -40 °C ≤ Ta ≤ 75 °C	Ga/Gb Ex db IIC T4 X Da/Db Ex tb IIIC T130°C X Zone 0/1, Zone 21 -40 °C ≤ Ta ≤ 75 °C	Ga/Gb Ex db IIC T4 X Da/Db Ex tb IIIC T130°C X Zone 0/1, Zone 21 -40 °C ≤ Ta ≤ 75 °C	No hazardous area approval
KCs (South Korea)	Ex d e IIC T4 Ex tb IIIC T130°C Zone 0/1; Zone 21 -40 °C ≤ Ta ≤ 75 °C	Ex d IIC T4 Ex tb IIIC T130°C Zone 0/1; Zone 21 -40 °C ≤ Ta ≤ 75 °C	Ex d IIC T4 Ex tb IIIC T130°C Zone 0/1; Zone 21 -40 °C ≤ Ta ≤ 75 °C	No hazardous area approval
Japanese approval	Ex d e IIC T4 Ga/Gb Ex t IIIC T130°C Db Zone 0/1, Zone 21 -40 °C ≤ Ta ≤ 75 °C	Ex d IIC T4 Ga/Gb Ex t IIIC T130°C Db Zone 0/1, Zone 21 -40 °C ≤ Ta ≤ 75 °C	Ex d IIC T4 Ga/Gb Ex t IIIC T130°C Db Zone 0/1, Zone 21 -40 °C ≤ Ta ≤ 75 °C	No hazardous area approval

Fig. 51: Certifications TH standard

9. Declaration of conformity of SIL 2 version

EU-Konformitätserklärung
EU-Konformitätserklärung
Déclaration UE de Conformité



MTS Sensor Technologie GmbH & Co. KG

EC15.002I

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-N-Axx
TH-x-xxxxx-xxx-1-G-S-N-Axx
TH-x-xxxxx-xxx-1-E-S-N-Axx

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

2014/30/EU	Electromagnetic Compatibility Elektromagnetische Verträglichkeit Compatibilité électromagnétique
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
2011/65/EU	Restriction of the use of hazardous substances in electrical and electronic equipment Beschränkung der Verwendung gefährlicher Stoffe in Elektro- und Elektronikgeräten Limitation de l'utilisation de substances dangereuses dans les équipements électriques et électroniques

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

**EN 60079-0 :2012+A11 :2013, EN 60079-1 :2014, EN 60079-7 :2015+A1 :2018, EN 60079-26 :2015, EN 60079-31 :2014
EN 61326-1:2013, EN 61326-3-1 :2018, EN 61326-3-2 :2019, EN 61000-6-7 :2015, EN 50581:2012**

EC type examination certificate: **CML 16 ATEX 1090X Issue 1**

EG-Baumusterprüfbescheinigung:

Certificat de l'examen CE:

Issued by / ausgestellt durch / exposé par: **CML B.V.**
Hoogoorddreef 15, 1101BA, Amsterdam, Netherlands

Notified body for quality assurance control: **CML B.V.**
Benannte Stelle für Qualitätsüberwachung: **Hoogoorddreef 15, 1101BA, Amsterdam, Netherlands**
Organisme notifié pour l'assurance qualité:

Ident number / Kennnummer / **2776**

No. d'identification:

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

Luedenscheid, 2019-03-17


Dr.-Ing. Eugen Davidoff
Zulassungsmanager / Approvals Manager



MTS Sensor Technologie GmbH & Co. KG, Auf dem Schüffel 9, D-58513 Lüdenscheid · Tel. +49-2351-9587-0 · Fax +49-2351-56491 ·
info.de@mtssensors.com Amtsgericht Iserlohn HRA 3314 · Persönlich haftende Gesellschafterin: MTS Sensor Technologie und Verwaltungen
GmbH, Amtsgericht Iserlohn HRB 4044 Geschäftsführer: Dr.-Ing. Thomas Grahl, David Thomas Hore · USt-IdNr.: DE 125 802 421 ·
Bankverbindung: HSBC Trinkaus & Burkhardt AG, Düsseldorf Swift-BIC: TUBDDEDD · IBAN: DE96 3003 0880 0013 6170 07

EU-Konformitätserklärung
EU-Konformitätserklärung
Déclaration UE de Conformité



MTS Sensor Technologie GmbH & Co. KG

EC16.008D

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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-N-S-N-Axx

Axx = output type analog current

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

2014/30/EU Electromagnetic Compatibility
Elektromagnetische Verträglichkeit
Compatibilité électromagnétique

2011/65/EU Restriction of the use of hazardous substances in electrical and electronic equipment
Beschränkung der Verwendung gefährlicher Stoffe in Elektro- und Elektronikgeräten
Limitation de l'utilisation de substances dangereuses dans les équipements électriques et électroniques

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

**EN 61326-1 :2013, EN 61326-3-1 :2018, EN 61326-3-2 :2019, EN 61000-6-7 :2015
EN 50581 :2012**

Luedenscheid, 2019-03-17

Dr.-Ing. Eugen Davidoff
Zulassungsmanager / Approvals Manager



10. Declaration of conformity of standard version

EU-Konformitätserklärung
EU-Konformitätserklärung
Déclaration UE de Conformité



MTS Sensor Technologie GmbH & Co. KG

EC15.001J

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Temposonics® TH-x-xxxxx-xxx-1-D-N-N-Axx
TH-x-xxxxx-xxx-1-G-N-N-Axx
TH-x-xxxxx-xxx-1-E-N-N-Axx

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

2014/30/EU	Electromagnetic Compatibility Elektromagnetische Verträglichkeit Compatibilité électromagnétique
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
2011/65/EU	Restriction of the use of hazardous substances in electrical and electronic equipment Beschränkung der Verwendung gefährlicher Stoffe in Elektro- und Elektronikgeräten Limitation de l'utilisation de substances dangereuses dans les équipements électriques et électroniques

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

**EN 60079-0 :2012+A11 :2013, EN 60079-1 :2014, EN 60079-7 :2015+A1 :2018, EN 60079-26 :2015,
EN 60079-31 :2014, EN 61000-6-2:2005, EN 55011 :2009+A1 :2010 Class B, EN 50581:2012**

EC type examination certificate: **CML 16 ATEX 1090X Issue 1**
EG-Baumusterprüfbescheinigung:
Certificat de l'examen CE:

Issued by / ausgestellt durch / exposé par: **CML B.V.
Hoogoorddreef 15, 1101BA, Amsterdam, Netherlands**

Notified body for quality assurance control: **CML B.V.
Benannte Stelle für Qualitätsüberwachung:
Organisme notifié pour l'assurance qualité: Hoogoorddreef 15, 1101BA, Amsterdam, Netherlands**

Ident number / Kennnummer / **2776**
No. d'identification:

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

Luedenscheid, 2019-03-17

Dr.-Ing. Eugen Davidoff
Zulassungsmanager / Approvals Manager



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info.de@mtssensors.com Amtsgericht Iserlohn HRA 3314 · Persönlich haftende Gesellschafterin: MTS Sensor Technologie und Verwaltungs
GmbH, Amtsgericht Iserlohn HRB 4044 Geschäftsführer: Dr.-Ing. Thomas Grahl, David Thomas Hore · USt-IdNr.: DE 125 802 421 ·
Bankverbindung: HSBC Trinkaus & Burkhardt AG, Düsseldorf Swift-BIC: TUBDDEDD · IBAN: DE96 3003 0880 0013 6170 07

EU-Konformitätserklärung
EU-Konformitätserklärung
Déclaration UE de Conformité



MTS Sensor Technologie GmbH & Co. KG

EC16.007C

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-N-N-N-Axx

Axx = output type analog current

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

- | | |
|-------------------|---|
| 2014/30/EU | Electromagnetic Compatibility
Elektromagnetische Verträglichkeit
Compatibilité électromagnétique |
| 2011/65/EU | Restriction of the use of hazardous substances in electrical and electronic equipment
Beschränkung der Verwendung gefährlicher Stoffe in Elektro- und Elektronikgeräten
Limitation de l'utilisation de substances dangereuses dans les équipements électriques et électroniques |

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

EN 61000-6-2:2005, EN 55011 :2009+A1 :2010 Class B, EN 50581:2012

Luedenscheid, 2019-03-17

Dr.-Ing. Eugen Davidoff
Zulassungsmanager / Approvals Manager



11. 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 Sensors order number: _____ Sensor type(s): _____

Serial number(s): _____ Sensor length(s): _____

The sensor has been in contact with the following materials:

Do not 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 _____

GERMANY
MTS Sensor Technologie
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