

Temposonics®

Magnetostrictive Linear Position Sensors

TH Analog Data Sheet

- ATEX & IECEx certified
- Continuous operation under harsh industrial conditions
- Flameproof / Increased safety



MEASURING TECHNOLOGY

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

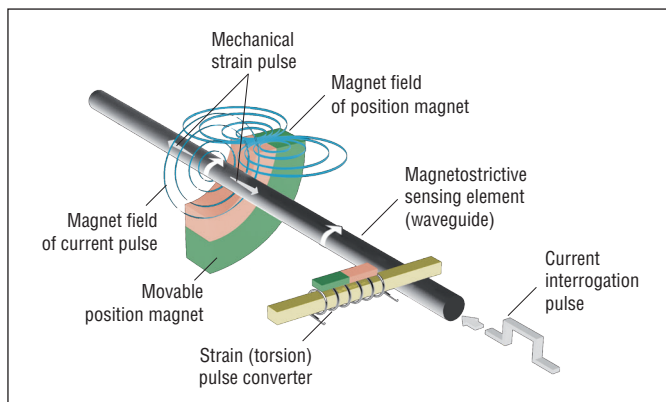


Fig. 1: Time-based magnetostrictive position sensing principle

TH SENSOR

The TH sensor is extremely robust and ideal for continuous operation under harsh industrial conditions. T-Series sensors are ATEX and IECEx certified for hazardous areas in zone 0/1, zone 1, zone 2, zone 21 and zone 22 (flameproof/increased safety).

The T-Series is offered in a standard 10 mm (0.39 in.) rod in lengths from 25...7600 mm (1...300 in.). The sensor rod is capable of withstanding high pressures such as those found in hydraulic cylinders. Furthermore the sensor is also suitable for petro chemical plants and caustic environments. The sensor head contains the active signal conditioning and a complete integrated electronics interface.

Certification

Version D

Flameproof housing with flameproof connection chamber:

IBExU 14 ATEX 1232X

IECEx IBE 14.0062X

Ex II 1/2G	Ex db IIC T4 Ga/Gb
Ex II 1G/2D	Ex tb IIIC T130°C Ga/Db

Version E

Flameproof housing with increased safety connection chamber:

IBExU 14 ATEX 1232X

IECEx IBE 14.0062X

Ex II 1/2G	Ex db e IIC T4 Ga/Gb
Ex II 1G/2D	Ex tb IIIC T130°C Ga/Db

Version N

No hazardous rating:

IP66, IP67, IP68, IP69K, NEMA 4X

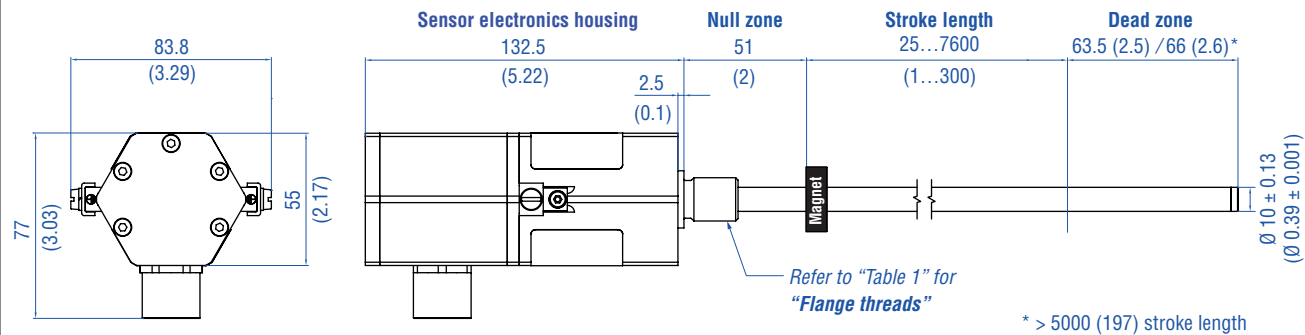
TECHNICAL DATA

Output	
Current	4(0)...20 mA, 20...4(0) mA (minimum/maximum load 0/500 Ω)
Measured value	Position
Measurement parameters	
Resolution	16 bit; 0.0015 % (minimum 1 µm)
Cycle time	0.5 ms up to 1200 mm, 1.0 ms up to 2400 mm, 2.0 ms up to 4800 mm, 5.0 ms up to 7600 mm stroke length
Linearity ¹	< ±0.01 % F.S. (minimum ±50 µm)
Repeatability	< ±0.001 % F.S. (minimum ±2.5 µm)
Hysteresis	< 4 µm
Temperature coefficient	< 30 ppm / °C
Operating conditions	
Operating temperature	–40...+75 °C (–40...+167 °F)
Humidity	90 % rel. humidity, no condensation
Ingress protection	Version D and E: IP66/IP67 Version N: IP66, IP67, IP68, IP69K, NEMA 4X, depending on cable gland
Shock test	100 g (single hit) / IEC standard 60068-2-27
Vibration test	15 g / 10...2000 Hz, excluding resonate frequencies, IEC standard 60068-2-6
EMC test	Electromagnetic emission according to IEC/EN 55011 +A1 Class B Electromagnetic immunity according to IEC/EN 61000-6-2
Magnet movement velocity	Any
Design/Material	
Sensor electronics housing	1.4305 (AISI 303) option 1.4404 (AISI 316L)
Sensor rod	1.4306 (AISI 304L) option 1.4404 (AISI 316L)
Stroke length	25...7600 mm (1...300 in.)
Operating pressure	350 bar static (5000 psi static)
Mechanical mounting	
Mounting position	Any orientation
Mounting instruction	Please consult the technical drawings and the operation manual (document number: 551513)
Electrical connection	
Connection type	T-Series terminal
Operating voltage	+24 VDC (–15 / +20 %)
Ripple	≤ 0.28 Vpp
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

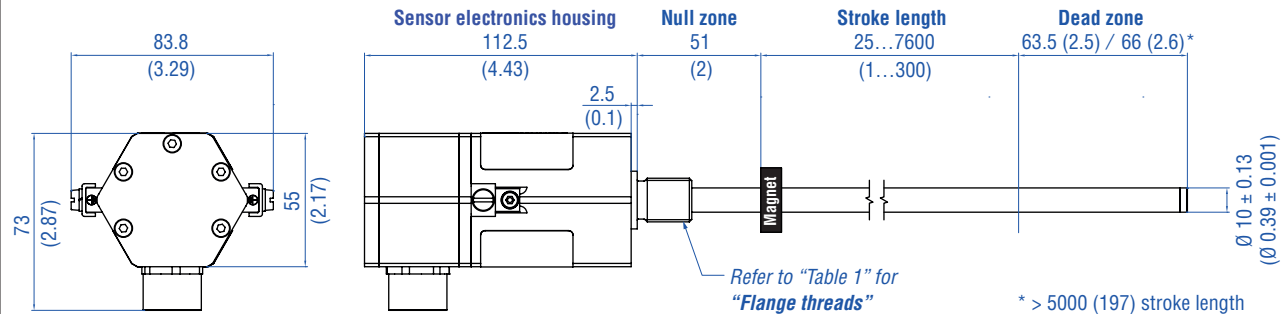
TECHNICAL DRAWINGS

With raised-face flange

Version D

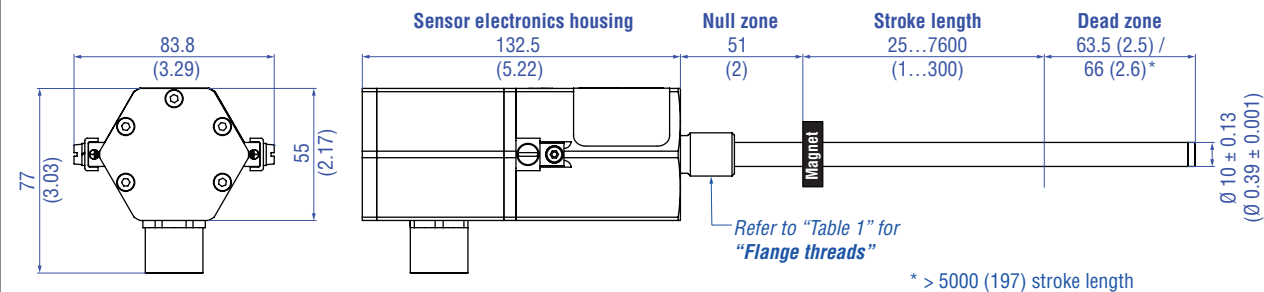


Version E & N

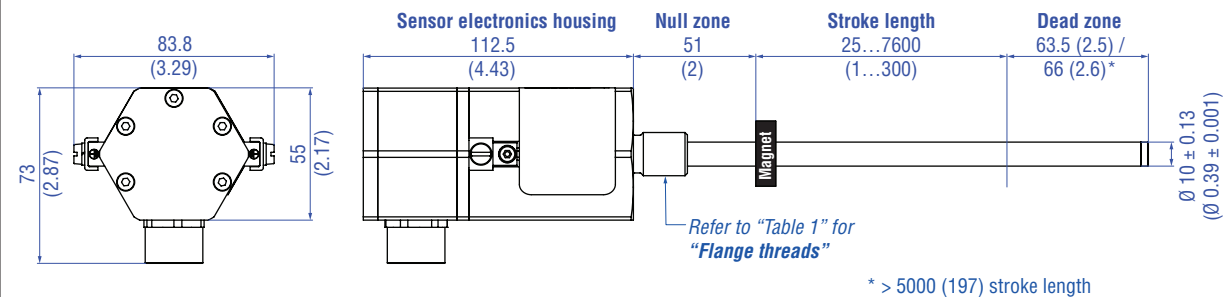


With flat-faced flange

Version D



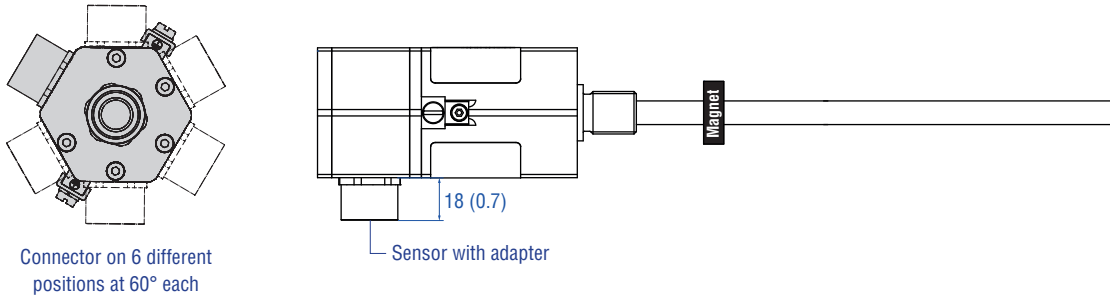
Version E & N



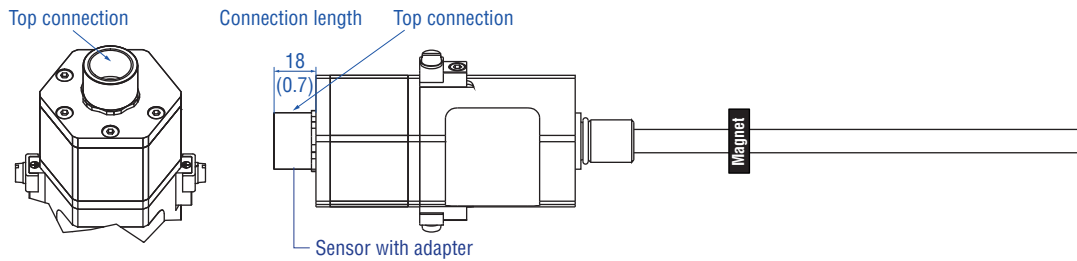
Controlling design dimensions are in millimeters and measurements in () are in inches
 Unless otherwise stated, apply to the general tolerances according to DIN ISO 2768-m

CONNECTION OPTIONS

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



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



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

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

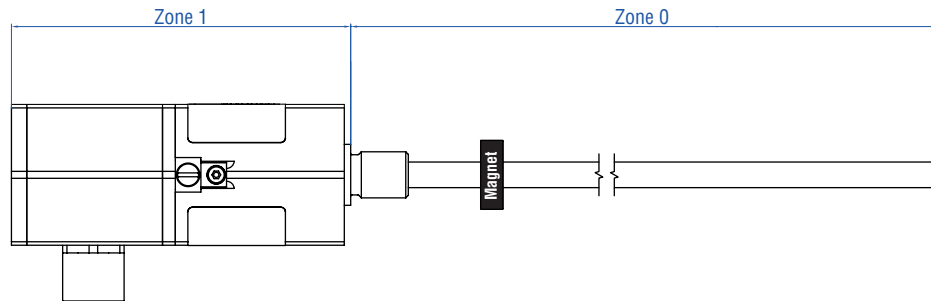
Table 1: Model TH flange type references

ZONE DIVISION

Version D –

Flameproof housing with flameproof connection chamber ATEX / IECEx

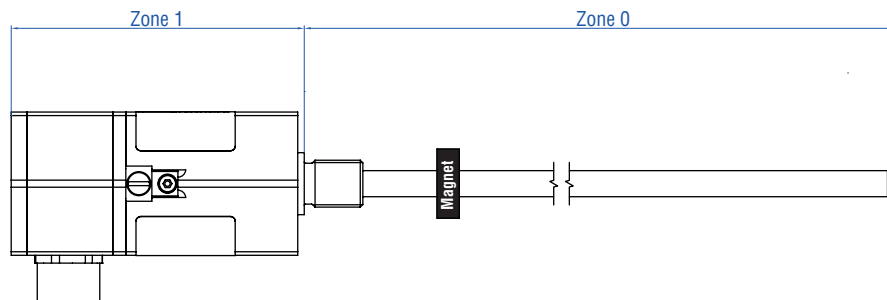
Ex db / Ex tb



Version E –

Flameproof housing with increased safety connection chamber ATEX / IECEx

Ex db e / Ex tb

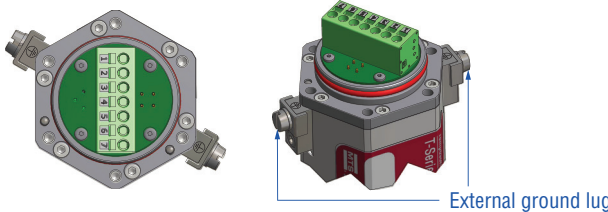


NOTICE

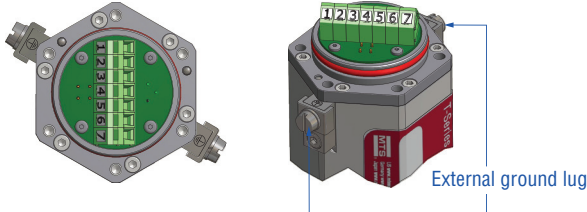
Seal sensor according to ingress protection IP67 between zone 0 and zone 1.

CONNECTOR WIRING

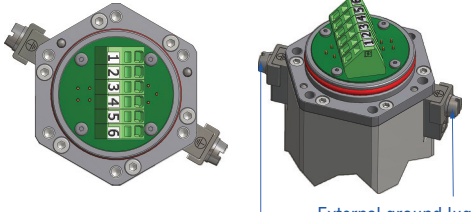
Model TH (version D) rod-style sensor wiring diagram (2.5 mm² conductor)

Suitable for connection types: C01, C10, N01, N10		Pin	Description
		1	Output 1
		2	DC Ground
		3	Output 2
		4	DC Ground
		5	+24 VDC (–15 / +20 %)
		6	DC Ground (0 V)
		7	PE – Protective Earth Ground

Model TH (version E & N) rod-style sensor wiring diagram (1.5 mm² conductor)

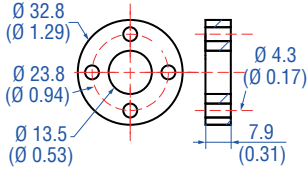
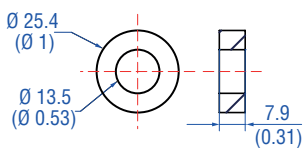
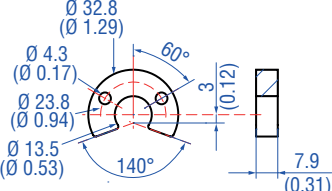
Suitable for connection types: C01, C10, M01, M10, N01, N10		Pin	Description
		1	Output 1
		2	DC Ground
		3	Output 2
		4	DC Ground
		5	+24 VDC (–15 / +20 %)
		6	DC Ground (0 V)
		7	PE – Protective Earth Ground

Model TH (version E & N) rod-style sensor wiring diagram (2.5 mm² conductor)

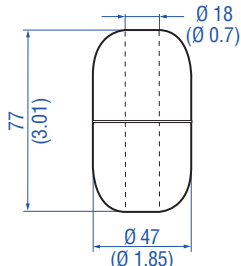
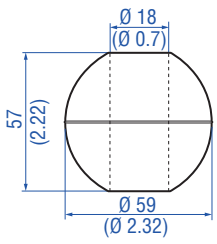
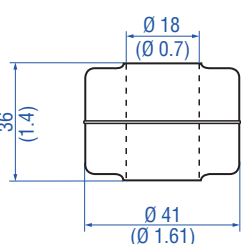
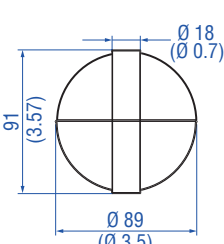
Suitable for connection type: NF1		Pin	Description
		1	Output
		2	DC Ground
		3	Output 2
		4	+24 VDC (–15 / +20 %)
		5	DC Ground (0 V)
		6	PE – Protective Earth Ground

FREQUENTLY ORDERED ACCESSORIES – Additional options available in our [Accessories Guide](#) 551444

Position magnets

		
Standard ring magnet Part no. 201 542-2	Ring magnet OD25,4 Part no. 400 533	U-magnet OD33 Part no. 251 416-2
Material: PA ferrite GF20 Weight: Ca. 14 g Operating temperature: –40...+105 °C (–40...+221 °F) Surface pressure: Max. 40 N/mm² Fastening torque for M4 screws: Max. 1 Nm	Material: PA ferrite Weight: Ca. 10 g Operating temperature: –40...+105 °C (–40...+221 °F) Surface pressure: Max. 40 N/mm²	Material: PA ferrite GF20 Weight: Ca. 11 g Operating temperature: –40...+105 °C (–40...+221 °F) Surface pressure: Max. 40 N/mm² Fastening torque for M4 screws: Max. 1 Nm

Magnet floats²

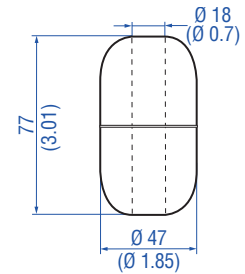
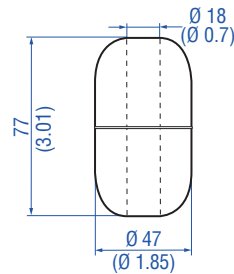
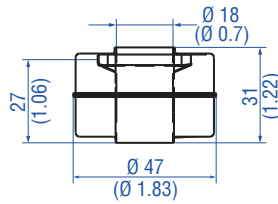
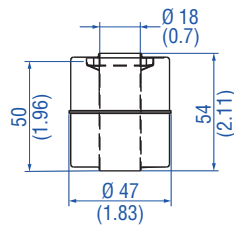
			
Magnet float Part no. 251 981-2	Magnet float Part no. 251 387-2	Magnet float Part no. 200 938-2	Magnet float Part no. 251 469-2
Pressure: 29.3 bar (425 psi) Operating temperature: –40...125 °C (–40...257 °F) Magnet offset: No Specific gravity: 0.67 Material: Stainless steel Weight offset: Yes	Pressure: 22.4 bar (325 psi) Operating temperature: –40...125 °C (–40...257 °F) Magnet offset: No Specific gravity: 0.48 Material: Stainless steel Weight offset: Yes	Pressure: 8.6 bar (125 psi) Operating temperature: –40...125 °C (–40...257 °F) Magnet offset: No Specific gravity: 0.74 Material: Stainless steel Weight offset: Yes	Pressure: 29.3 bar (425 psi) Operating temperature: –40...125 °C (–40...257 °F) Magnet offset: No Specific gravity: 0.45 Material: Stainless steel Weight offset: Yes

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

- 2/ – 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.

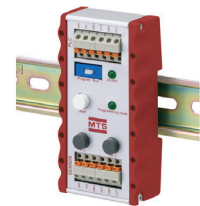
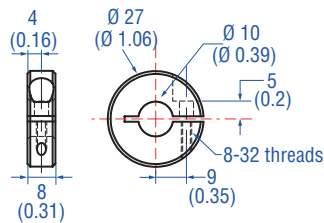
- When the magnet is not shown, the magnet is positioned at the center line of float.
– An offset weight is installed in the float to bias or tilt the float installed on the sensor tube. So the float remains in contact with the sensor tube at all times and guarantees permanent potential equalization of the float. The offset is required for installations that must conform to ATEX standards.

Magnet floats³ **Standard interface floats³**



Magnet float⁴ Part no. 201 605-2	Magnet float⁴ Part no. 201 606-2	Magnet float Part no. 251 982-2	Magnet float Part no. 251 983-2
Pressure: 4 bar (60 psi) Operating temperature: –40...125 °C (–40...257 °F) Magnet offset: Yes Specific gravity: 0.6 Material: Stainless steel Weight offset: Yes	Pressure: 4 bar (60 psi) Operating temperature: –40...125 °C (–40...257 °F) Magnet offset: Yes Specific gravity: 0.93 Material: Stainless steel Weight offset: Yes	Pressure: 29.3 bar (425 psi) Operating temperature: –40...125 °C (–40...257 °F) Magnet offset: No Specific gravity: 0.90...0.96 Material: Stainless steel Weight offset: Yes	Pressure: 29.3 bar (425 psi) Operating temperature: –40...125 °C (–40...257 °F) Magnet offset: No Specific gravity: 1.03...1.10 Material: Stainless steel Weight offset: Yes

Collar **Programming tools**



Collar Part no. 560 777	Analog hand programmer Part no. 253 124	Programming kit Part no. EU: 253 134-1 Part no. US: 253 309-1	Analog cabinet programmer Part no. 253 408
Material: Stainless steel 1.4301(AISI 304) Weight: Ca. 30 g Hex key 7/64 required	Easy teach-in-setups of stroke length and direction on desired zero/span positions. For the first output.	Kit includes: Interface converter box, power supply, cable Software is available at: www.mtssensors.com	Features snap-in mounting on standard 35 mm DIN rail. This programmer can be permanently mounted in a control cabinet and includes a program/run switch. For the first output.

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

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

- An offset weight is installed in the float to bias or tilt the float installed on the sensor tube. So the float remains in contact with the sensor tube at all times and guarantees permanent potential equalization of the float. The offset is required for installations that must conform to ATEX standards.
- 4/** Standard float that can be expedited.

ORDER CODE

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

a	Sensor model
T H	Hydraulic rod style

b	Design
Model TH rod-style sensor with housing 1.4305 (AISI 303) (hydraulic rod style, material 1.4306 (AISI 304L))	
M	Flange with flat-face (M18×1.5–6g)
N	Flange with raised-face (M18×1.5–6g)
S	Flange with flat-face (¾"-16 UNF-3A)
T	Flange with raised-face (¾"-16 UNF-3A)
Model TH rod-style sensor with housing 1.4404 (AISI 316L) (hydraulic rod style, material 1.4404 (AISI 316L))	
F	Flange with flat-face (¾"-16 UNF-3A)
G	Flange with raised-face (¾"-16 UNF-3A)
W	Flange with flat-face (M18×1.5–6g)

c	Stroke length
X X X X M	25...7600 mm
X X X X U	1...300 in.

Standard stroke length (mm)*

Stroke length	Ordering steps
25 ... 500 mm	5 mm
500 ... 750 mm	10 mm
750...1000 mm	25 mm
1000...2500 mm	50 mm
2500...5000 mm	100 mm
5000...7600 mm	250 mm

Standard stroke length (in.)*

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

d	Connection type
C 0 1	Side connection with thread ½" NPT (version D & E & N)
C 1 0	Top connection with thread ½" NPT (version D & E & N)
M 0 1	Side connection with thread M16×1.5 (version E & N)
M 1 0	Top connection with thread M16×1.5 (version E & N)
N 0 1	Side connection with thread M20×1.5 (version D & E & N)
N 1 0	Top connection with thread M20×1.5 (version D & E & N)
N F 1	Side connection with thread M20×1.5 (version E & N)

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

f	Version
D	Ex db and Ex tb
E	Ex db e and Ex tb
N	No hazardous rating

g	Functional safety type
N	Not approved

h	Additional option type
N	None

i	Output
1 output with 1 magnet	
Output 1 (position magnet 1)	
A 0 1	4...20 mA
A 1 1	20...4 mA
A 2 1	0...20 mA
A 3 1	20...0 mA
2 outputs with 1 magnet	
Output 1 (position magnet 1) + output 2 (position magnet 1)	
A 0 3	4...20 mA 20...4 mA
2 outputs with 2 magnets	
Output 1 (position magnet 1) + output 2 (position magnet 2)	
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

DELIVERY



Sensor

Accessories have to be ordered separately

Operation manuals & software are available at:
www.mtssensors.com

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

Document Part Number:
551385 Revision B (EN) 08/2015

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