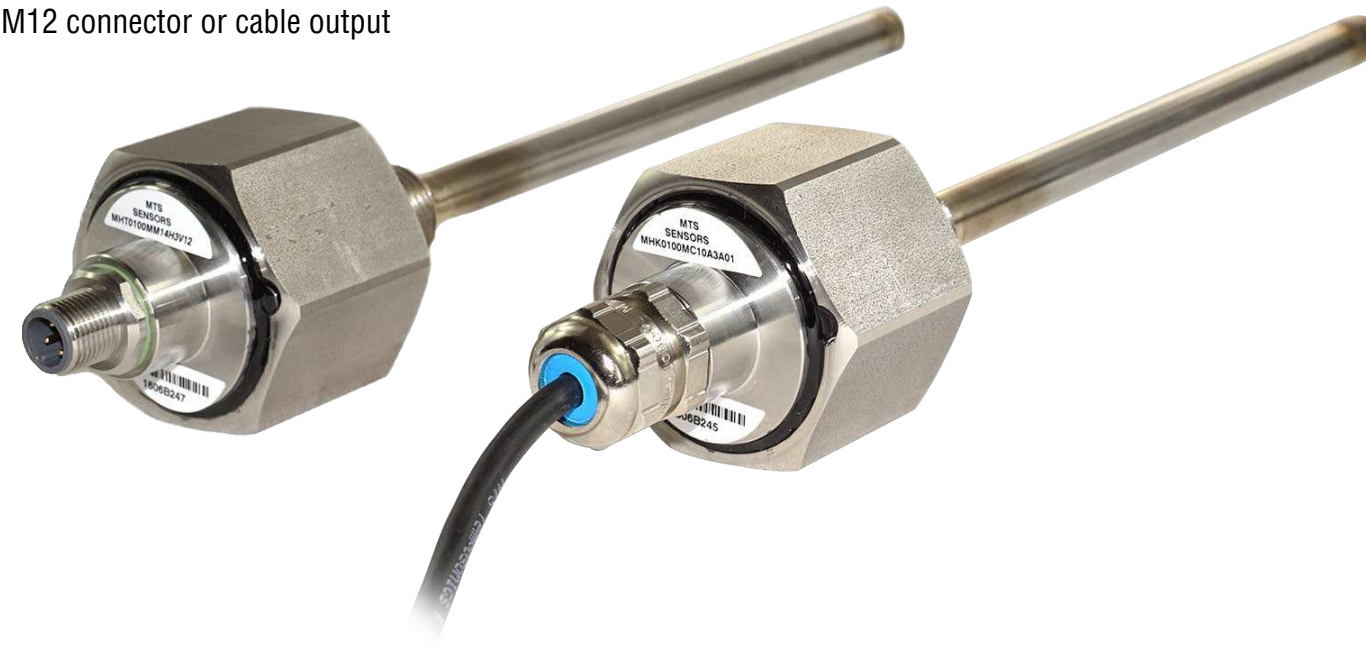
MTS SENSORS

Temposonics®

Magnetostrictive Linear Position Sensors

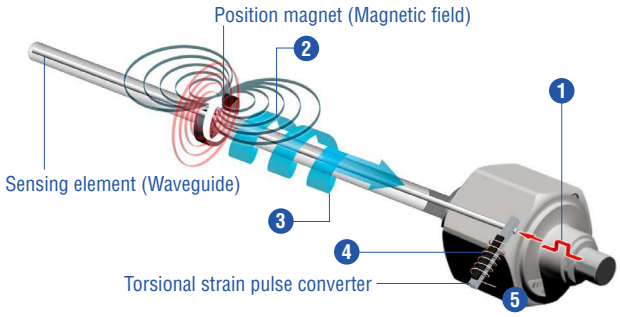
MH-Series MH Threaded Analog
Data Sheet

– Stroke length up to 2500 mm
– With M18×1.5 thread
– Sensor rod with Ø 7 mm or Ø 10 mm
– Rugged to withstand off-highway shock and vibration
– M12 connector or cable output



MEASURING TECHNOLOGY

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.



Measurement Cycle

1	Current pulse generates magnetic field
2	Interaction with position magnet field generates torsional strain pulse
3	Torsional strain pulse propagates
4	Strain pulse detected by converter
5	Time-of-flight converted into position

Fig. 1: Time-of-flight based magnetostrictive position sensing principle

MH THREADED SENSOR

The Temposonics® MH-Series sensors are specifically designed for direct stroke measurement in hydraulic cylinders. The MH Threaded sensor extends the rugged design of the Temposonics® MH Series sensors to external threaded installations. A MTS M12 connector system ensures protection to IP69K. The inherent absolute capabilities ensure that the MH Threaded sensor is always ready. With two connections styles, the responsive magnetostrictive linear position sensors can be integrated into most installations.
Temposonics® MH Threaded sensors can be used in applications where access is available from the outside of the cylinder. Example applications include lift and tilt cylinders, hydraulic jacks, and hydraulic steering systems in agricultural and construction machinery.

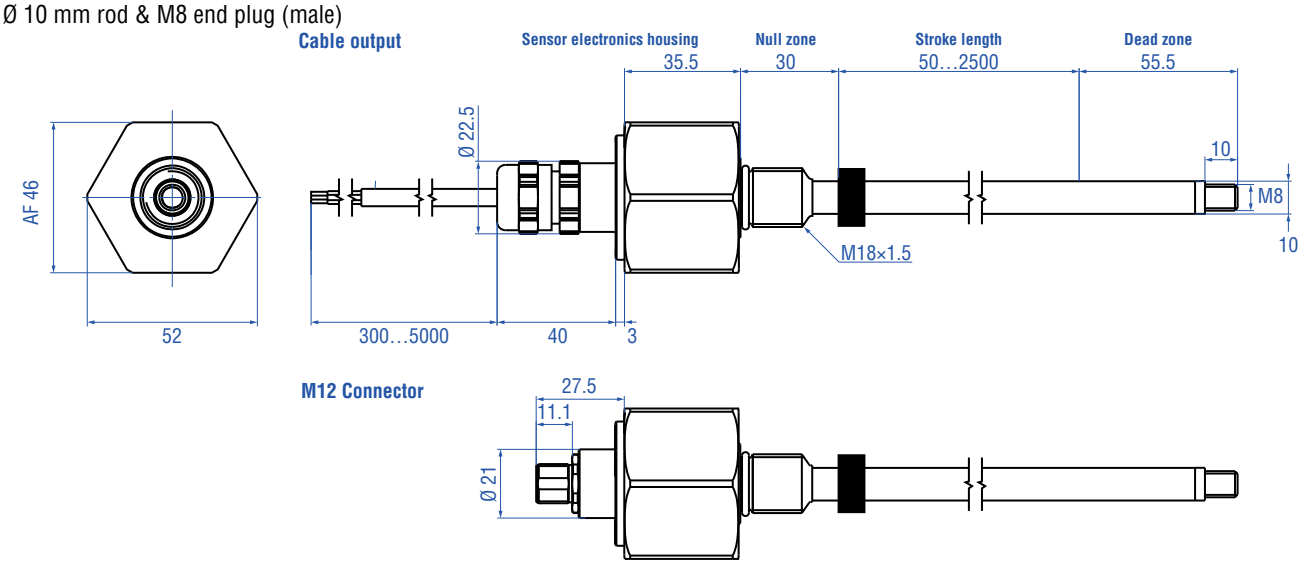
Fig. 2: Typical application: Agricultural sprayer

TECHNICAL DATA

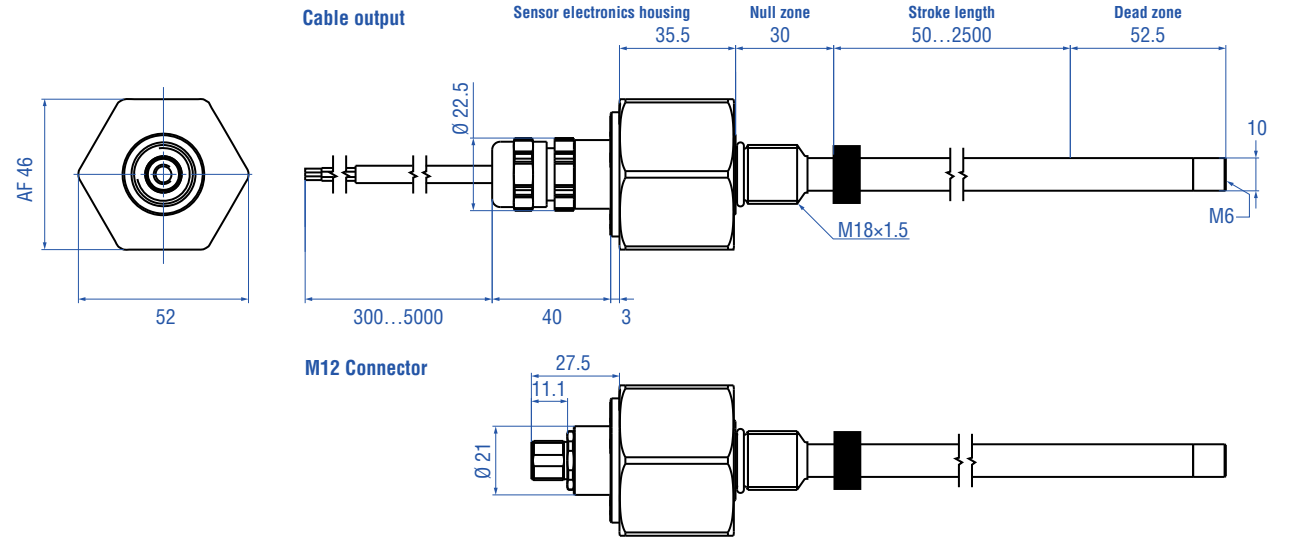
Output		
Current	4…20 mA	
Voltage	0.25…4.75 VDC; 0.5…4.5 VDC	
Measured value	Position	
Signal characteristic	Analog output restricted by noise and ADC	
Measurement parameters		
Resolution	Typ. 0.1 mm	
Internal sample rate	2 ms	
Linearity	0050…0250 mm ≤ ±0.1 mm 0255…2000 mm ±0.04 % (F.S.) 2005…2500 mm ≤ ±0.8 mm	
Hysteresis	±0.1 mm	
Setpoint tolerance	< 1 mm	
Operating conditions		
Mounting position	Any	
Operating temperature	–40…+85 °C	
Storage temperature	–25…+65 °C	
Humidity	EN60068-2-30, 90 % rel. humidity, no condensation	
Ingress protection – M12 connector	IP69K with M12 connector and mating plug	
Ingress protection – Cable output	IP69K	
Shock test	IEC 60068-2-27, 100 g (6 ms) single shock, 50 g (11 ms) at 1000 shocks per axis	
Vibration test	Vibrations: IEC 60068-2-64, 15 g (r.m.s.) Ø 7 mm rod (10…2000 Hz) - resonance frequencies excluded 20 g (r.m.s.) Ø 10 mm rod (10…2000 Hz) - resonance frequencies excluded	
EMC test	2009/64/EG Road vehicles 2009/19/EG Agricultural and Forest machines ISO 14982 Emissions/Immunity ISO 7637-1/2 Transient Impulses ISO / TR 10605 Electrostatic Discharge (E.S.D.)	
Pressure impulse test according DIN EN ISO 19879	Ø 7 mm rod	Ø 10 mm rod
Operation pressure (P_N)	300 bar	350 bar
Operation pressure (P_{max})	400 bar	450 bar
Operation pressure (P_{static})	525 bar	625 bar
Design/Material		
Sensor electronics housing	Stainless steel 1.4305 (AISI 303)	
Sensor rod	Ø 7 mm: Stainless steel 1.4301 (AISI 304) / Ø 10 mm: Stainless steel 1.4306 (AISI 304L)	
Stroke length	50…2500 mm	
Sealing	O-ring 15.4 × 2.1, NBR 90 black	
Electrical connection		
Connection type	M12 connector or cable output	
Operating voltage	+12/24 VDC (8…32 VDC)	
Current consumption	12 VDC: typ. < 100 mA; 24 VDC: typ. < 50 mA	
Load (output VDC)	$R_L \geq 10$ kΩ	
Loud (output mA)	12 VDC: $R_L \leq 250$ Ω; 24 VDC: $R_L \leq 500$ Ω	
Inrush current	12 VDC: max. 2.5 A/2 ms; 24 VDC: max. 4.5 A/2 ms	
Supply voltage ripple	< 1 % $_{PP}$	
Power drain	< 1 W	
Over voltage protection (VDC-GND)	Up to +36 VDC	
Polarity protection (GND-VDC)	Up to –36 VDC	
Electric strength	500 VDC (DC GND to chassis GND)	

TECHNICAL DRAWING

Form Factor G
Ø 10 mm rod & M8 end plug (male)



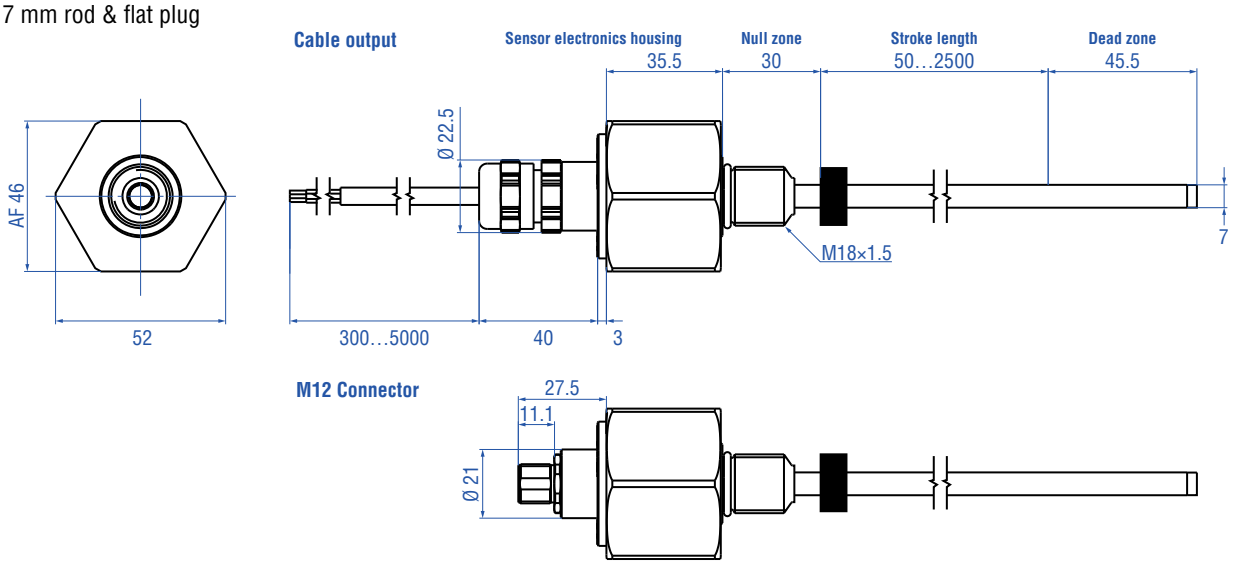
Form Factor K
Ø 10 mm rod & M6 end plug (female)



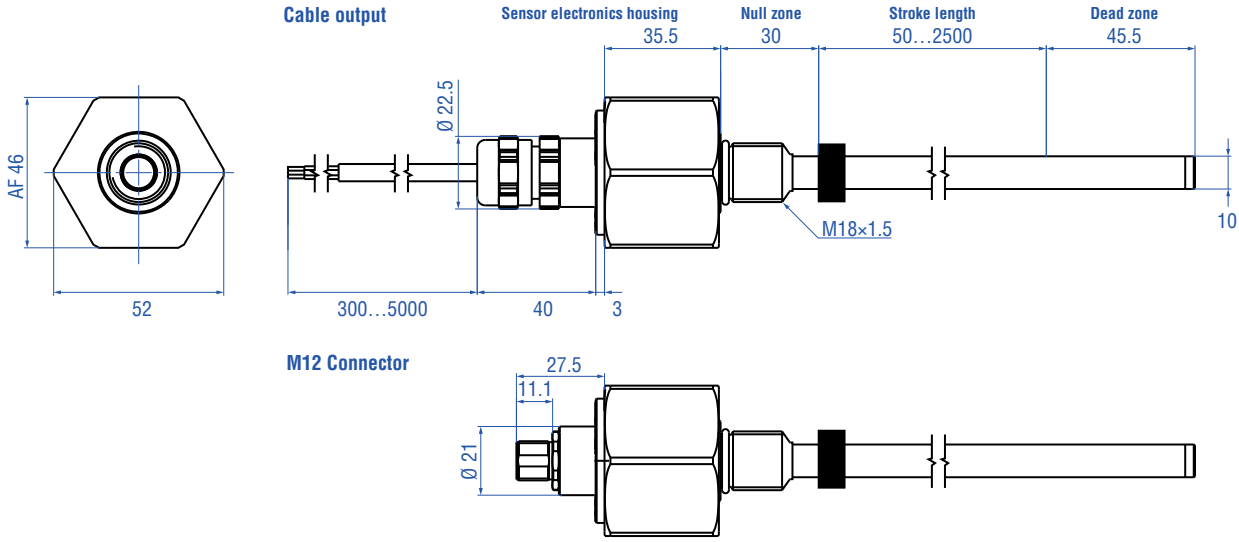
Controlling design dimensions are in millimeters
Unless otherwise stated, apply to the general tolerances according to DIN ISO 2768-m

TECHNICAL DRAWING

Form Factor P
Ø 7 mm rod & flat plug



Form Factor T
Ø 10 mm rod & flat plug



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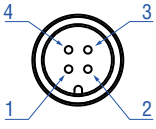
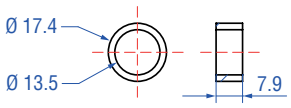
CONNECTOR WIRING



M12 connector				Cable output	
Pin	E	G	H	Color	
1	not connected	VDC	VDC	**BN**	VDC
2	VDC	not connected	SIG	**WH**	GND
3	GND	GND	GND	**GN**	SIG
4	SIG	SIG	not connected	–	–

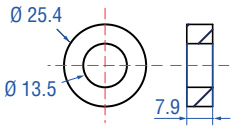
FREQUENTLY ORDERED ACCESSORIES

Position magnets



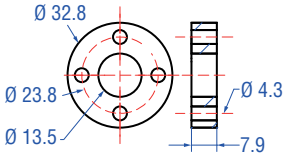
Ring magnet
Part no. 401 032

Material: PA neobind
Weight: Ca. 5 g
Operating temperature: –40…+100 °C
Surface pressure: Max. 20 N/mm²



Ring magnet
Part no. 400 533

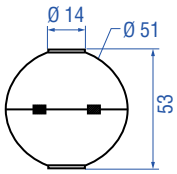
Material: PA ferrite
Weight: Ca. 10 g
Operating temperature: –40…+100 °C
Surface pressure: Max. 40 N/mm²



Ring magnet
Part no. 201 542-2

Material: PA ferrite GF20
Weight: Ca. 14 g
Operating temperature: –40…+100 °C
Surface pressure: Max. 40 N/mm²
Fastening torque for M4 screws: 1 Nm

Float

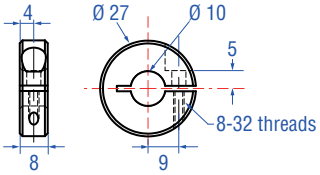


Float
Part no. 561 612

Material: Stainless steel AISI 304
Density: 720 kg/m³
Specific gravity: 0.61 maximum
Max. pressure: 40 bar
Weight: Ca. 42 g
Operation temperature: –40…+125 °C

For sensors with Ø 10 mm rod
For sensors with up to
2000 mm stroke length

Collar



Collar
Part no. 560 777

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

Hex key 7/64" required

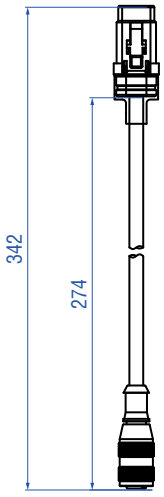
For sensors with Ø 10 mm rod

Test kit

MH test kit (analog)
Part no. 280 618

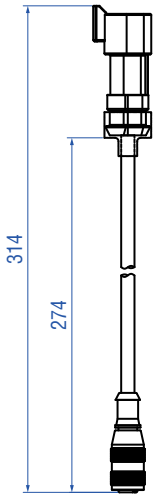
Kit includes:
- 12 VDC battery charger with adapter (EU & UK)
- Cable with M12 connector
- Cable with pigtailed wires
- Carrying case

Cord sets and adapter cables



4 pin M12 to DTM06 connector
Part no. 254 597

M12 connector: Brass/Nickel
DT connector: DTM06 3 pin
Material: PVC Jacket
Cable length: 275 mm
Cable Ø: 5 mm
Operating temperature:
–40…+105 °C



4 pin M12 to DT04 connector
Part no. 254 600

M12 connector: Brass/Nickel
DT connector: DT04 3 pin
Material: PVC Jacket
Cable length: 275 mm
Cable Ø: 5 mm
Operating temperature:
–40…+105 °C

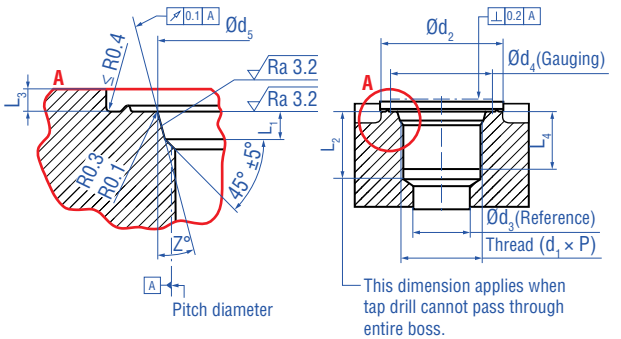
INSTALLATION

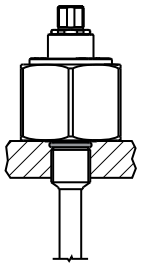
Hydraulics sealing

For sealing the flange contact surface, a sealing via an O-ring 15.3 × 2.2 mm in the undercut is necessary. A screw hole based on ISO 6149-1 must be provided.

Screw hole based on ISO 6149-1

Thread (d_1×P)	d_2	d_3	d_4	d_5	L_1	L_2	L_3	L_4	Z°
M18×1.5	55	13	24.5	19.8	2.4	28.5	2	22	15°





Sealing via O-ring
in the flange undercut

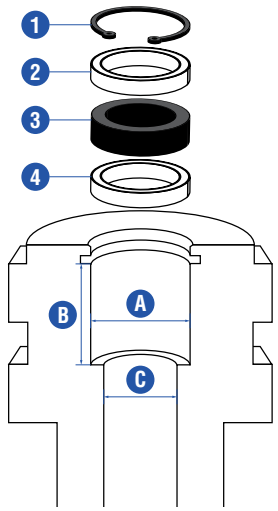
- Note the fastening torque of 50 Nm.
- The flange contact surface must be seated completely on the cylinder mounting surface.
- The cylinder manufacturer determines the pressure-resistant gasket (copper gasket, O-ring, etc.).
- The position magnet should not make contact with the sensor rod.
- The peak pressure should not be exceeded.
- Protect the sensor rod against wear.

For In-Cylinder installation:

- The plunger borehole:
  - Ø 7 mm rod: ≥ Ø 10 mm
  - Ø 10 mm rod: ≥ Ø 13 mm

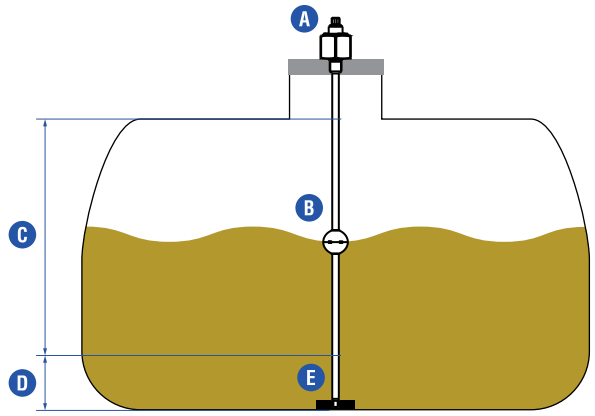
  depends on the pressure and piston speed.
- The bore depth in piston:
  Null zone + Stroke length + Dead zone + > 3 mm

Magnet installation for In-Cylinder applications



1	Circlip		
2	Non-magnetic spacer (≥ 5 mm)		
3	Position magnet		
4	Non-magnetic spacer (≥ 5 mm)		
		Magnet (Part no.)	
	401 032	**400 533**	**201 542-2**
A	> 17.4	> 25.4	> 32.8
B	≥ 18	≥ 18	≥ 13.5
C	**Rod Ø**	**Piston rod drilling**	
	Ø 7	≥ Ø 10	
	Ø 10	≥ Ø 13	

Magnet installation for float applications



A	MH threaded sensor
B	Float
C	Stroke length
D	Dead zone
E	Stop collar

Controlling design dimensions are in millimeters

ORDER CODE

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
M	H						M					3			
a		b	c					d				e	f		

a	Sensor model
M	H	Rod

b	Form factor
G	Threaded port M18×1.5, rod Ø 10 mm, M8 plug (male)
K	Threaded port M18×1.5, rod Ø 10 mm, M6 plug (female)
P	Threaded port M18×1.5, rod Ø 7 mm, flat plug
T	Threaded port M18×1.5, rod Ø 10 mm, flat plug

c	Stroke range (mm)
				0050…2500 mm (in 5 mm steps)

d	Electrical wiring
M12 connector (VDC - GND - SIG)	
M	0	0	E	4 pin (2-3-4)
M	0	0	G	4 pin (1-3-4)
M	0	0	H	4 pin (1-3-2)
Cable output	
C	0	3	A	300 mm pigtailed wire termination
C	0	5	A	500 mm pigtailed wire termination
C	1	0	A	1000 mm pigtailed wire termination
C	2	0	A	2000 mm pigtailed wire termination
C	3	0	A	3000 mm pigtailed wire termination
C	5	0	A	5000 mm pigtailed wire termination

e	Supply voltage
3	+12/24 VDC (8…32 VDC)

f	Output
V	1	1	0.25…4.75 VDC
V	1	2	0.5…4.5 VDC
V	1	3	4.75…0.25 VDC
V	1	4	4.5…0.5 VDC
A	0	1	4…20 mA
A	0	4	20…4 mA

DELIVERY

Position sensor,
O-ring

Accessories have to be ordered separately.

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

MTS®
SENSORS

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LEGAL NOTICES

ISO 9001 CERTIFIED

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