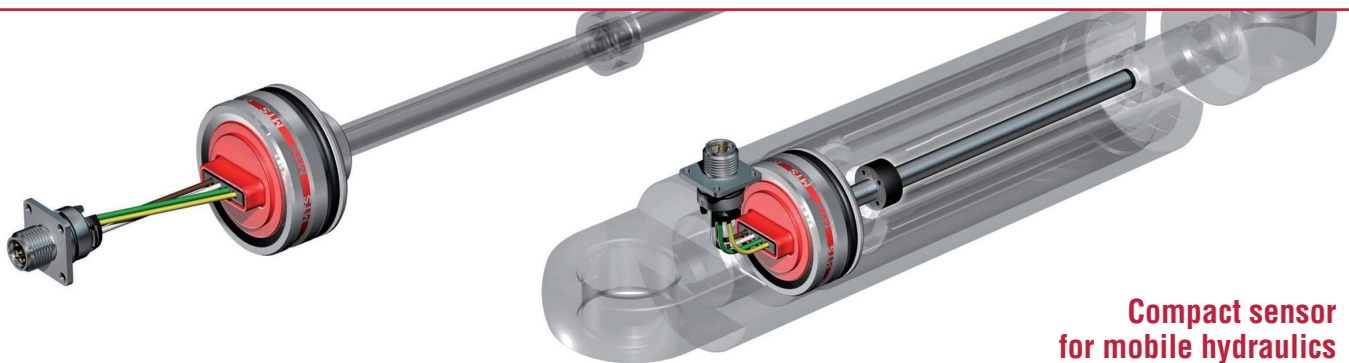


MH Series

Temposonics® MH Analog/Digital

Document Part Number
551308 Revision B

Technical Data/Description



**Compact sensor
for mobile hydraulics**



Designed for the mobile world

MH sensors are designed for mobile machines and intended for IN cylinder use. They are validated in the field by worldwide OEM's and replace linear potentiometers and inductive sensors.

Performance:

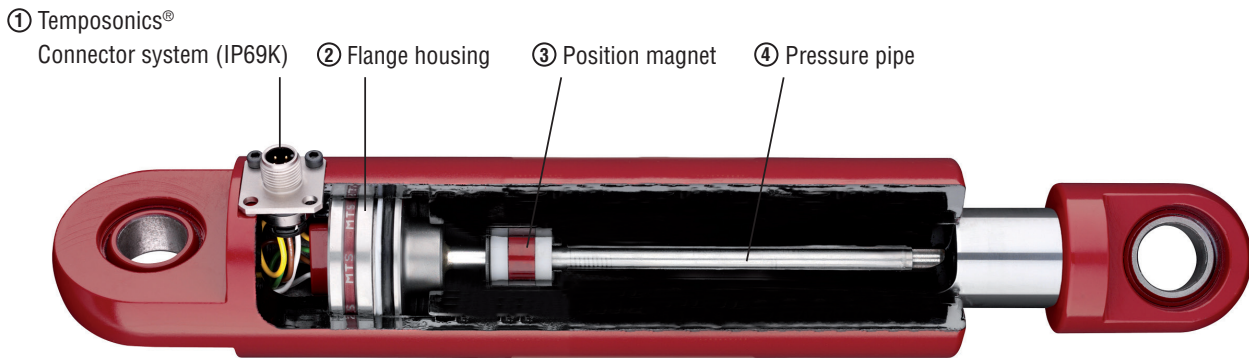
- Linearity ≤ 0.04 % F.S.
- Resolution typ. ± 0.1 mm
- EMI up to 200 V/m
- High vibration and shock load resistance is second to none



All specifications are subject to change. Contact MTS for specifications and engineering drawings that are critical to your application. Drawings contained in this document are for reference only. Please visit www.mtssensor.com for the actual support documentation- related to your selected model.

1. Product description and technology

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



Simple Mechanics

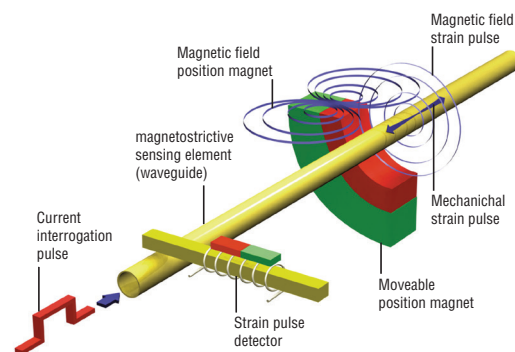
The extremely robust sensor consists of the following main parts:

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

Magnetostriction

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

tt principle

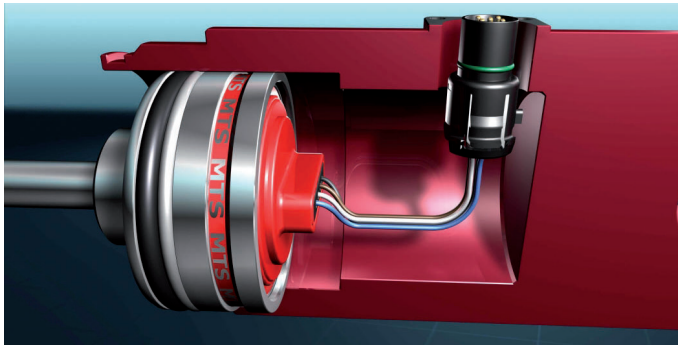


- Due to small dimensions MH sensors require only little space
- Suitable for operating pressures up to 350 bar
- Unaffected by surrounding media such as ageing or foaming oil
- Insensitive to shock and vibration
- Designed for all current supply voltages (12/24 VDC)
- Temposonics® sensors offer all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

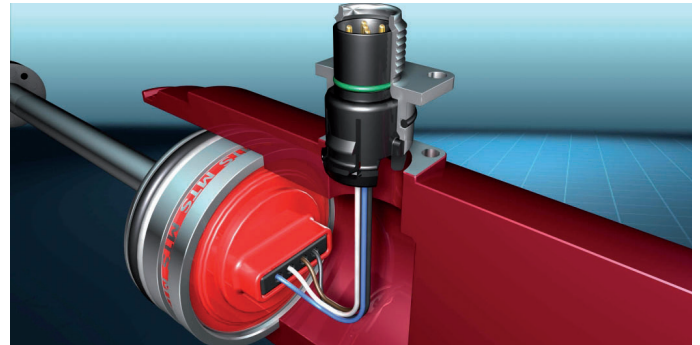
2. Temposonics® connector system M12

MTS presents the innovative connector system for Temposonics® MH-Series

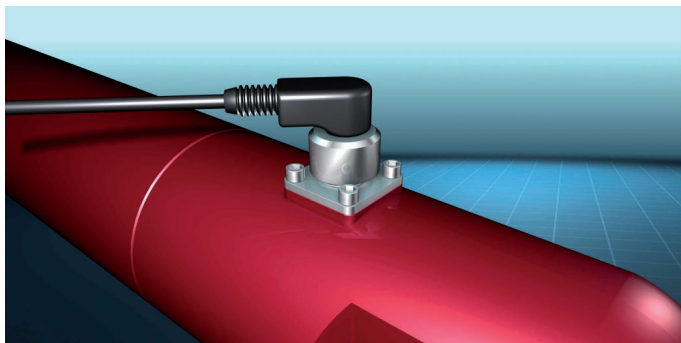
The Temposonics® Connector System meets the highest protection requirements important for a harsh environment in mobile hydraulic applications. Protection type IP69k performs water and dust proof. In addition it is even resistive against high pressure water cleaning.



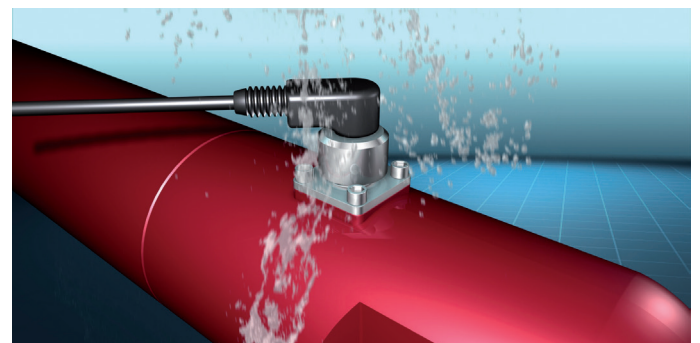
- ① The MH sensor is delivered by MTS together with the new connector system:
The connector insert carrier is already connected to the sensor conductors, i.e. no soldering, any colour or connection mistake.



- ② The connector insert is taken out of the cylinder through a bore hole. The flange can easily be clicked in position from outside.



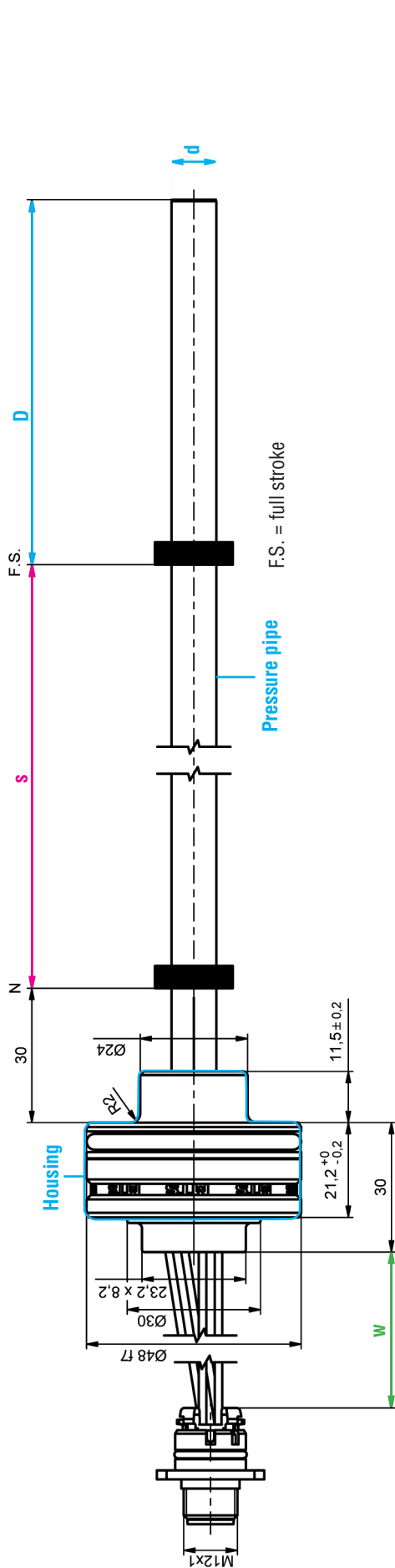
- ③ Four standard screws must be tightened to mount the connector system on the cylinder. In case of using angled type connectors the connector insert can be rotated inside the flange in 45° steps.



- ④ With a corresponding mating plug the connector system fulfills an IP rating of IP69K.

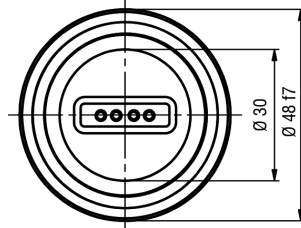
- Absolutely easy and safe installation.
- No brazing or crimping of connecting leads is required.

3. Dimensions

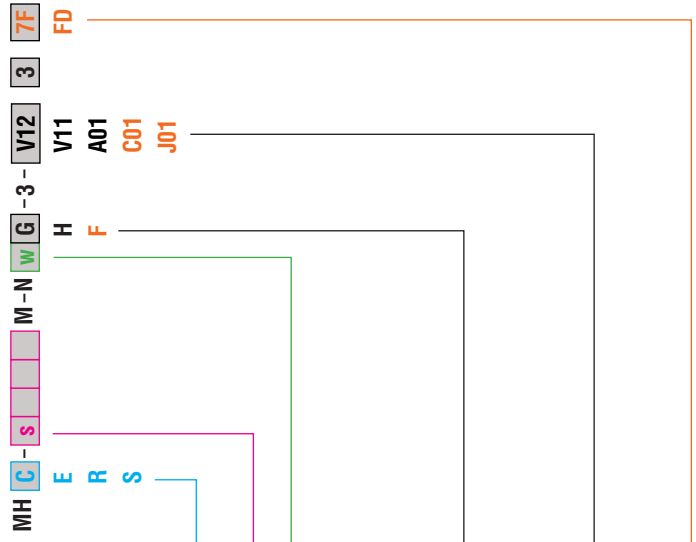


Model no.

Housing	C/E/R	Material
	S	Stainless steel
Pressure pipe	d	10 mm (pn = 350 bar)
Damping	D	36 mm: $s \leq 1200$ mm
		63 mm: $s \leq 2500$ mm
Stroke range	s	50 - 2500 mm
Wire length	w	60 - 240 mm
Null zone	N	30 mm



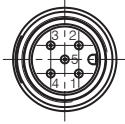
M12 4-pin	G: 1 = 12/24 VDC 3 = GND 4 = Signal
MH Analog	H: 1 = 12/24 VDC 3 = GND 2 = Signal
M12 5-pin	F: 1 = n.c. 2 = 12/24 VDC 3 = GND
MH Digital	4 = CAN HI 5 = CAN LO
MH Analog	A01: 4 - 20 mA
	V11: 0.25 - 4.75 VDC
MH Digital	V12: 0.50 - 4.50 VDC
	C01: CANopen
	J01: SAE J1939
Baudrate	2 500 kbit/sec
Node ID	40 40 hex



All dimensions in mm

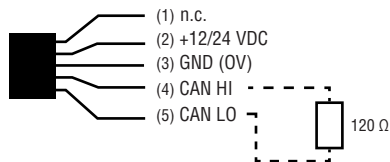
4. Electrical installation

MH Digital (5 pin)

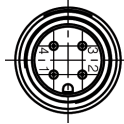


PIN assignment digital 5 pin	
	F
PIN 1	n.c.
PIN 2	VDC
PIN 3	GND
PIN 4	CAN HI
PIN 5	CAN LO

Pin assignment (e.g. N10F)

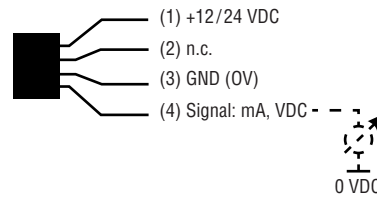


MH Analog (4 pin)

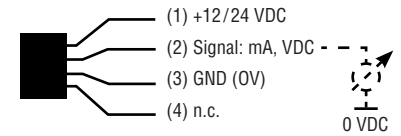


PIN assignment analog 4 pin		
	G	H
PIN 1	VDC	VDC
PIN 2	n.c.	signal
PIN 3	GND	GND
PIN 4	signal	n.c.

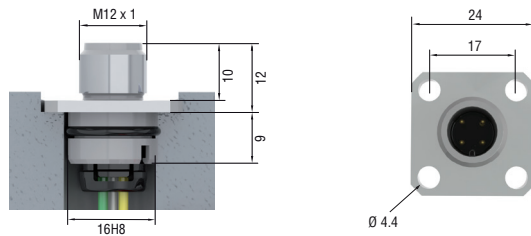
Pin assignment (e.g. N08G)



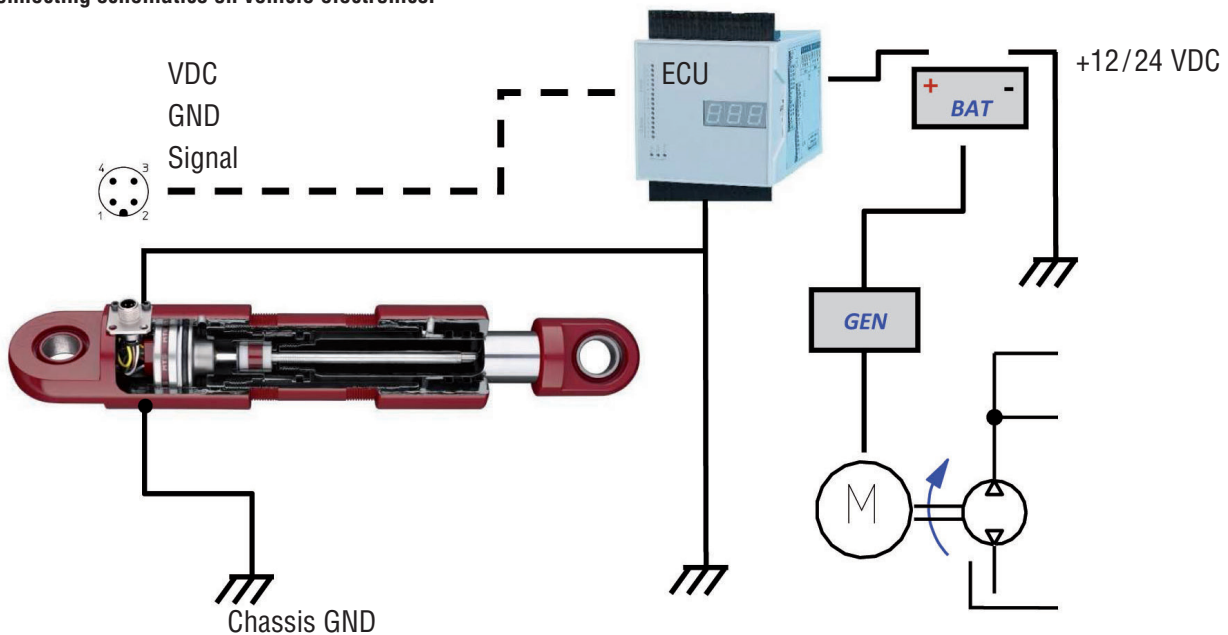
Pin assignment (e.g. N08H)



M12 connector system



Connecting schematics on vehicle electronics:

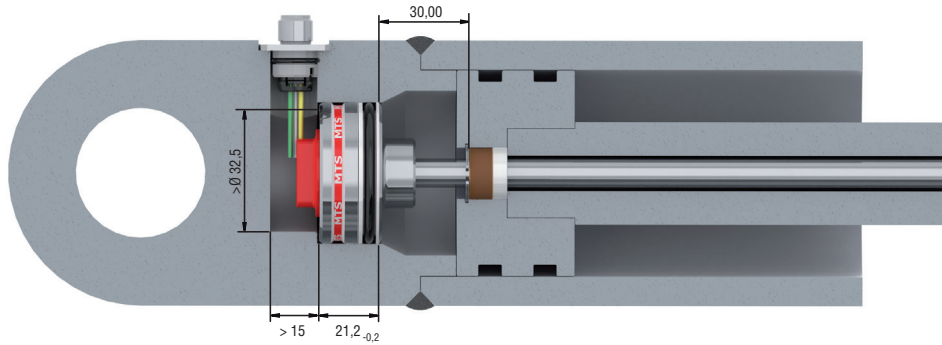


5. In Cylinder assembly

Mechanical installation

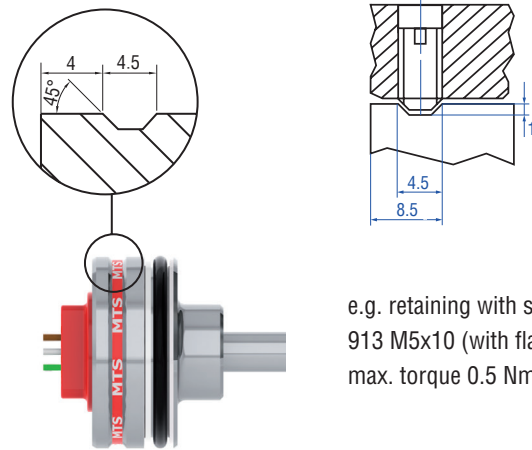
The robust Temposonics® model MH sensor is designed for direct stroke measurement in hydraulic cylinders. The Temposonics® MH sensor can be installed from the head side or the rod side of the cylinder depending on the cylinder design.

Example



Sensor installation

The method of installation is entirely dependent on the cylinder design. While the most common method of installation is from the rod side of the cylinder, an installation from the head side of the cylinder is also possible. In both installation methods, the hermetic sealing of the cylinder is given by an O-ring with additional back up ring.

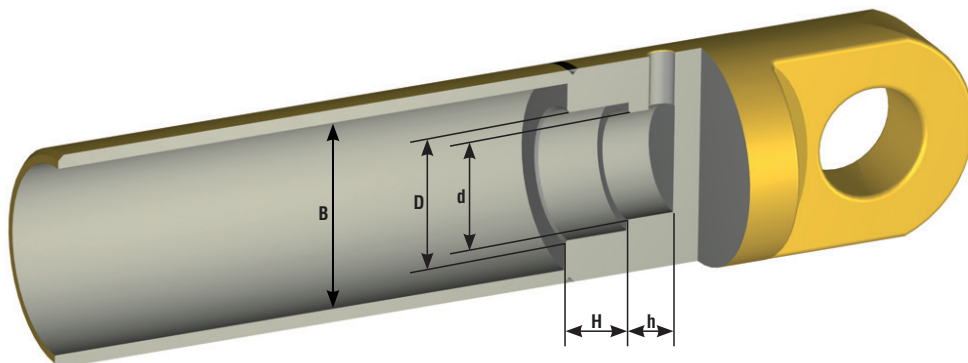


e.g. retaining with set screw DIN 913 M5x10 (with flat point!)
max. torque 0.5 Nm

Please pay attention:

- The position magnet shall not touch the pressure pipe.
- The min. bore diameter in the piston rod is 13.5 mm.
Do not exceed operating pressure.

Flange housing
with O-ring and
back-up ring

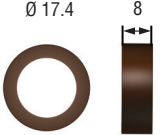

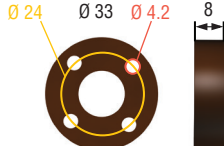


Type	B Ø Cylinder	D Ø min.	H Depth	d Ø min.	h Depth
MH	52	48 48	21,2	> 32,5 < 40	> 15

All dimensions in mm

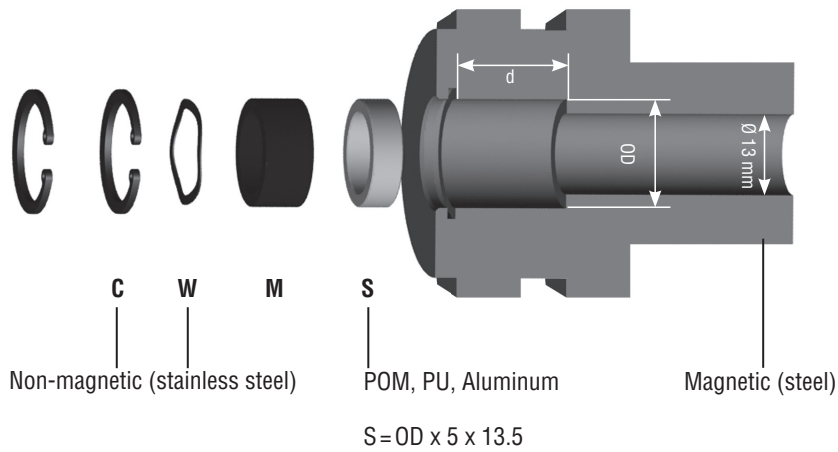
Please pay attention to installation manual!

5.1. Position magnets

 Part no.: 401032	 Part no.: 400533	 Part no.: 201542-2
OD 17.4 mm	OD 25.4 mm	OD 33 mm
ID 13.5 mm	ID 13.5 mm	ID 13.5 mm
Height 8 mm	Height 8 mm	Height 8 mm
P_A* 10 N/mm ²	P_A* 40 N/mm ²	P_A* 40 N/mm ²
		Fastening torque for screws M4: max 1 Nm

*max. mechanical burden, e.g. by circlip, lock washers etc.

5.2. Magnet assembly in piston



	Part no.: 401032	Part no.: 400533	Part no.: 201542-2
OD	17.5 mm	25.5 mm	33.0 mm
d	13.0 mm	13.0 mm	13.0 mm

Please pay attention to installation manual!

6. MH Analog: Technical data / Model configurator

Input		
Measured variables:	position	
Stroke range:	50 - 2500 mm in 5 mm steps	
Output		
Signal characteristic:	continuously analog output restricted by noise or A/D converter of control unit	
Voltage:	0.25...4.75 VDC / 0.5...4.5 VDC	
Current:	4...20 mA	
Resolution:	typ. ± 0.1 mm	
Power up time:	typ. 250 ms	
Null zone:	30 mm	
Damping:	36 mm: stroke range ≤ 1200 mm 63 mm: stroke range ≤ 2500 mm	
Accuracy		
Linearity:	50...250 mm $\leq \pm 0.1$ mm 255...2000 mm ± 0.04 % full stroke (F.S.) 2005...2500 mm $\leq \pm 0.8$ mm	
Hysteresis:	± 0.1 mm	
Internal sample rate:	2 ms	
Setpoint tolerance:	≤ 1 mm	
Operating conditions		
Fitting position:	any	
Operating temperature electronics:	-40°C...+105°C	
Storage temperature:	-25°C...+65°C	
Fluid temperature:	-30°C...+85°C	
Dew point, humidity:	EN60068-2-30, 90 % rel. humidity, no condensation	
Pressure		
Operating pressure ratings:	Ø 10 mm pressure pipe PN: 350 bar Pmax: 450 bar Pstatic: 625 bar	pressure impulse test acc. DIN EN ISO 19879
IP rating		
M12 connector:	EN60529 (IP69K) plugged	
Sensor housing:	EN60529 (IP67)	
Environmental testing		
Shock:	IEC 60068-2-27, 100 g (11 ms) single shock, 50 g (11 ms) at 1000 shocks per axis	
Vibrations:	IEC 60068-2-64, 20 g (r.m.s.) Ø 10 mm pressure pipe (10...2000 Hz) - resonance frequencies excluded	
EMC:	2009/64/EG Road vehicles (e1 conform) 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.)	
Materials and dimensions		
Pressure Pipe:	stainless steel 1.4306 / AISI 304L	
Housing:	1. stainless steel 1.4305 / AISI 303 2. steel 1.0718 (11SMnPb30) acc. to EN 10087 burnished (black oxide) acc. to DIN 50938 surface treatment to avoid corrosion during storage, handling and installation flange Ø 48 mm	
Sealing:	O-ring 40.87 x 3.53 mm NBR 80, back-up ring 42.6 x 48 x 1.4 PTFE	
Electrical installation		
Connector:	connector system M12x1 with O-ring 7 x 1.35 mm NBR 70 connecting flange brass nickel-plated with O-ring 13 x 1.6 NBR 70	
Supply voltage:	12/24 VDC (tolerance range 8 - 32 VDC)	
Voltage supply ripple:	< 1 % s-s	
Power drain:	< 1 W 12 VDC typ. ≤ 100 mA; 24 VDC typ. ≤ 50 mA	
Electric strength:	500 VDC (DC ground to machine ground) $R \geq 10$ M Ω @ 60 sec.	
Over voltage protection (GND-VDC):	up to +36 VDC	
Polarity protection (GND-VDC):	up to -36 VDC	
Load:	$R_L \geq 10$ k Ω (output VDC) $R_L \leq 500$ Ω (output mA @ 24 VDC) $R_L \leq 250$ Ω (output mA @ 12 VDC)	
Inrush current:	max. 4.5 A/2 ms (24 VDC); max. 2.5 A/2 ms (12 VDC)	

Temposonics® Model configurator

<p>Sensor model MH = flange housing Ø 48 mm</p> <p>Form factor C = stainless steel housing / pressure pipe Ø 10 mm damping 63 mm, stroke < 2500 mm E = stainless steel housing / pressure pipe Ø 10 mm damping 36 mm, stroke < 1200 mm R = stainless steel housing / pressure pipe Ø 10 mm damping 63 mm with threaded female port M4 S = steel housing / pressure pipe Ø 10 mm damping 63 mm, stroke < 2500 mm</p> <p>Stroke length 0050 - 2500 mm in 5 mm steps</p> <p>Connection type Single wires with connector system M12 N __ G = 4 single wires (20 mm increments), M12 IP69K, 4 pin (pin assignment 1-3-4) N06G = 60 mm min. wire length N24G = 240 mm max. wire length N __ H = 4 single wires (20 mm increments), M12 IP69K, 4 pin (pin assignment 1-3-2) N06H = 60 mm min. wire length N24H = 240 mm max. wire length</p> <p>Supply voltage 3 = +12/24 VDC</p> <p>Output V11 = 0.25...4.75 VDC V12 = 0.5...4.5 VDC A01 = 4...20 mA</p>	<p>M H</p>	<p>M</p>	<p>3</p>
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Scope of delivery:

Position sensor, O-Ring, backup-ring
M12 connector system

Please order magnets separately!

Accessories (selection)	Part no.
OD17,4 Ring magnet	401 032
OD25,4 Ring magnet	400 533
OD33 Ring magnet	201 542-2

MH Testkit 280618

Scope of delivery:

- MH-Series analog / PWM Tester
- 12 VDC battery charger with adapter (adapter main plug EU, adapter main plug UK)
- cable with M12 connector
- cable with pigtailed wires
- carrying case
- CD-Rom with user's guide



8. MH Digital: Technical data/Model configurator

Input		
Measured variables:	position and velocity	
Stroke range (position):	50...2500 mm in 5 mm steps	
Measuring range (velocity):	0...1000 mm/s	
Output		
Signal characteristic:	Bus-protocol: SAE J1939, CANopen protocol acc. CiA DS-301 V4.1, device profile DS-406 V3.1	
Resolution (position):	0.1 mm	
Resolution (velocity):	1 mm/s	
Boot up time:	typ. 400 ms	
Cycle time:	CANopen: 1 ms SAE J1939: 20 ms	
Null zone:	30 mm	
Damping:	36 mm: stroke range \leq 1200 mm 63 mm: stroke range \leq 2500 mm	
Accuracy		
Linearity:	50...250 mm \leq \pm 0.1 mm 255...2000 mm \pm 0.04 % full stroke 2005...2500 mm \leq \pm 0.8 mm	
Hysteresis:	\pm 0.1 mm	
Internal sample rate:	1 ms	
Setpoint tolerance:	\pm 0.2 mm	
Operating conditions		
Fitting position:	any	
Operating temperature electronics:	-40°C...+105°C	
Storage temperature:	-25°C...+65°C	
Fluid temperature:	-30°C...+85°C	
Dew point, humidity:	EN60068-2-30, 90 %rel. humidity, no condensation	
Pressure		
Operating pressure ratings:	Ø 10 mm pressure pipe PN: 350 bar Pmax: 450 bar Pstatic: 625 bar	pressure pulse test acc. DIN EN ISO 19879
IP rating		
M12 connector:	EN60529 (IP69K), plugged	
Sensor housing:	EN60529 (IP67)	
Environmental testing		
Shock:	IEC 60068-2-27, 100 g (11 ms) single shock, 50 g (11 ms) at 1000 shocks per axis	
Vibrations:	IEC 60068-2-64, 20 g (r.m.s.) Ø 10 mm pressure pipe (10...2000 Hz) - resonance frequencies excluded	
EMC:	2009/64/EG Road vehicles (e1 conform) 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.)	
Materials and dimensions		
Pressure Pipe:	stainless steel 1.4306 / AISI 304L (Ø 10 mm / Ø 7 mm)	
Housing:	1. stainless steel 1.4305/AISI 303 2. steel 1.0718 (11SMnPb30) acc. to EN 10087 burnished (black oxide) acc. to DIN 50938 surface treatment to avoid corrosion during storage, handling and installation flange Ø 48 mm	
Sealing:	O-ring 40.87 x 3.53 mm NBR 80, back-up ring 42.6 x 48 x 1.4 PTFE	
Electrical installation		
Connector:	connector system M12x1 with O-ring 7 x 1.35 mm NBR 70 connecting flange brass nickel-plated with O-ring 13 x 1.6 NBR 70	
Supply voltage:	12/24 VDC (tolerance range 8 - 32 VDC)	
Voltage supply ripple:	< 1 % s-s	
Power drain:	< 1.5 W 12 VDC typ. \leq 100 mA; 24 VDC typ. \leq 50 mA	
Electric strength:	500 VDC (DC ground to machine ground)) $R \geq 10 \text{ M}\Omega @ 60 \text{ sec.}$	
Over voltage protection (GND - VDC):	up to +36 VDC	
Polarity protection (GND - VDC):	up to -36 VDC	
Bus termination (HI-LO):	120 Ω	
Inrush current:	1.5 A/2 ms (24 VDC); 1.0 A/2 ms (12 VDC)	

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