

# Temposonics®

Magnetostrictive, Absolute, Non-contact  
Linear-Position Sensors

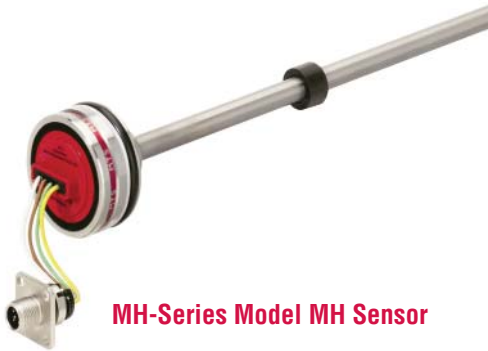


## MH-Series Mobile Hydraulic in-Cylinder Sensor

Model MH CANopen, CAN J1939 Output

### Data Sheet

Document Part Number  
551027 Revision C



MH-Series Model MH Sensor



Cylinder Application Example

#### FEATURES

- Linear, Absolute Measurement in Hydraulic Cylinders
- Non-Contact Sensing Technology
- Superior Accuracy,  $< \pm 0.04\%$  F.S.
- Hysteresis  $< \pm 0.1$  mm
- Repeatability,  $< \pm 0.005\%$  F.S.
- Compact Design for Embedded Cylinder Applications
- Direct CANopen or J1939 Output:  
Displacement and Velocity
- Stroke length: 50 mm (2 in.) to 2500 mm (98 in.)
- Voltage input: 12/24 Vdc
- Shock Rating: 100 g (single hit) / IEC 68-2-27
- Vibration Rating 25 g / 10-2000 Hz/IEC 68-2-6
- 200 V/m EMI Immunity

#### BENEFITS

- Rugged Mobile Sensor
- Direct CANopen or CAN J1939

#### APPLICATIONS

- Continuous Operation In Harsh Mobile Conditions
- High Pressure Conditions
- For Welded and Tie-rod Cylinder Applications

#### TYPICAL INDUSTRIES

- Construction
- Agriculture
- Off-highway Machinery

#### Product overview

The MH-Series Model MH sensor is designed with the “mobile” world in mind. The Model MH sensor is validated in the field by customers worldwide. Performance is second-to-none with high EMI resistance of 200 V/m. Ruggedness is “designed in”; 100 g shock and 25 g vibration rating. The model MH CAN sensor can be fully sealed and embedded in a cylinder to ensure a long operating life. Direct connection to the Temposonics® M12x1 connector system and other proven mobile connectors are available.

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. Go to <http://www.mtssensors.com> for the latest support documentation and related media.

## MH-Series Rod-Style Sensor - CANopen, CAN J1939

### Output Product Overview and Specifications

#### Product specifications

Parameters	Specifications
<b>OUTPUT</b>	
<b>Measured variable:</b>	Linear Position and velocity measurement
<b>Outputs:</b>	Direct CANopen or CAN J1939
<b>Resolution:</b>	<b>Range:</b> 50 to 500 mm 750 mm 1,000 mm 1,250 mm 1,750 mm <b>Resolution:</b> $\pm 0.10$ mm $\pm 0.10$ mm $\pm 0.10$ mm $\pm 0.10$ mm $\pm 0.10$ mm
<b>Stroke length:</b>	50 mm to 2500 mm (2 in. to 98 in.) Measured in 5 mm (0.20 in.) increments
<b>Linearity uncorrected:</b>	< $\pm 0.04\%$ full stroke (minimum $\pm 0.100$ mm 0.003 in.) < $\pm 0.08\%$ full stroke (for short damping zone)
<b>Repeatability:</b>	< $\pm 0.005\%$ of full stroke
<b>Hysteresis:</b>	$\pm 0.1$ mm (0.003 in.)
<b>Operating voltage:</b>	12/24 Vdc (8-32 Vdc)
<b>Power drain:</b>	< 1.5 W
<b>ELECTRONICS</b>	
<b>Electrical isolation:</b>	500 Vdc (DC ground to machine ground)
<b>Polarity protection:</b>	Up to -36 Vdc
<b>Overvoltage protection:</b>	Up to 36 Vdc

Parameters	Specifications
<b>ENVIRONMENTAL</b>	
<b>Operating conditions:</b>	<b>Operating:</b> -40 °C (-40 °F) to +105 °C (221 °F) <b>Storage:</b> -30 °C (-22 °F) to +105 °C (221 °F) 90% relative humidity, no condensation
<b>EMC test:</b>	200 V/m: ISO 11452-5 ISO 14982 - Agriculture and forest machinery
<b>Shock rating:</b>	100 g (single hit)/IEC standard 68-2-27 (survivability) 25 g / 10 to 2000 Hz /IEC standard 68-2-6
<b>Vibration rating:</b>	<b>Sensor rod, 10 mm (0.39 in.):</b> 25 g <b>Sensor rod, 7 mm (0.27 in.):</b> 15 g
<b>WIRING</b>	
<b>Connection type:</b>	One 5-wire with the M12 x 1 connector and flange (provides IP69K environmental protection when installed in a cylinder).
<b>ROD STYLE SENSOR (Model MH)</b>	
<b>Material:</b>	<b>Sensor rod:</b> Stainless steel 1.4306 / AISI 304L <b>Housing:</b> Stainless steel 1.4305 / AISI 303 <b>Mechanical assembly:</b> Flange housing 48 mm (1.89 in.) dia., O-ring 40.87 x 3.53 mm NBR 80, backup ring 42.6 x 48 x 1.4 PTFE
<b>Sealing:</b>	IP67 (IP69k when installed inside a cylinder with M12 x 1 in. connection type)
<b>Pressure rating:</b>	<b>Sensor rod, 10 mm (0.39 in.):</b> Operating, 350 bar (5076 psi) Peak, 530 bar (7687 psi)  <b>Sensor rod, 7 mm (0.27 in.):</b> Operating, 300 bar (4350 psi) Peak, 400 bar (5800 psi)
<b>Magnet type:</b>	Ring magnet (see standard magnet selections)

## Output options

The MH-Series Model MH position CAN sensor provides direct CANopen and CAN J1939 outputs.

## Model MH sensor dimension references

**Model MH, rod-style Redundant Sensor** Drawing is for reference only, contact applications engineering for tolerance specific information.

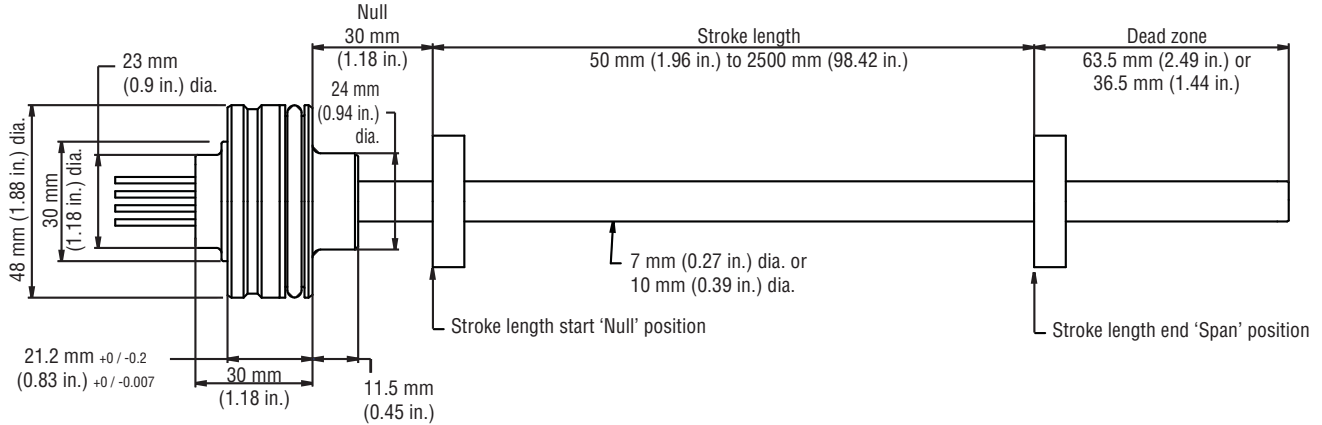


Figure 1. MH-Series Model MH rod-style sensor dimension reference

## Standard magnet selections (Model MH)

### SELECTION OF POSITION MAGNETS (MAGNET AND MAGNET SPACER MUST BE ORDERED SEPARATELY)

A choice of three magnets are available with the Model MH rod-style sensor. Magnets must be ordered separately with Model MH position sensors. The standard ring magnet (part number 201542-2) is suitable for most applications.

#### STANDARD RING MAGNET Part number 201542-2



**Material:** Ferrite PA  
**I.D.:** 13.5 mm (0.53 in.)  
**O.D.:** 33 mm (1.3 in.)  
**Thickness:** 8 mm (0.3 in.)  
**Operating temperature:**  
- 40 °C (-40 °F) to  
- 105 °C to (221 °F)

#### MAGNET SPACER Part number 400633 (used with magnet part no.: 201542-2)



**Material:** Non-ferrous  
*Used with ring magnet (part no.: 201542-2)*  
**I.D.:** 14 mm (0.56 in.)  
**O.D.:** 32 mm (1.25 in.)  
**Thickness:** 3.2 mm (0.125 in.)

#### RING MAGNET Part number 400533



**Material:** Ferrite PA  
**I.D.:** 13.5 mm (0.53 in.)  
**O.D.:** 25.4 mm (1 in.)  
**Thickness:** 8 mm (0.3 in.)  
**Operating temperature:**  
- 40 °C (-40 °F) to  
- 105 °C to (221 °F)

#### RING MAGNET Part number 401032



**Material:** Ferrite PA  
**I.D.:** 13.5 mm (0.53 in.)  
**O.D.:** 17 mm (0.68 in.)  
**Thickness:** 8 mm (0.31 in.)  
**Operating temperature:**  
- 40 °C (-40 °F) to  
- 105 °C to (221 °F)

## Model MH Rod-Style Sensor - CANopen, CAN J1939 Output Installation

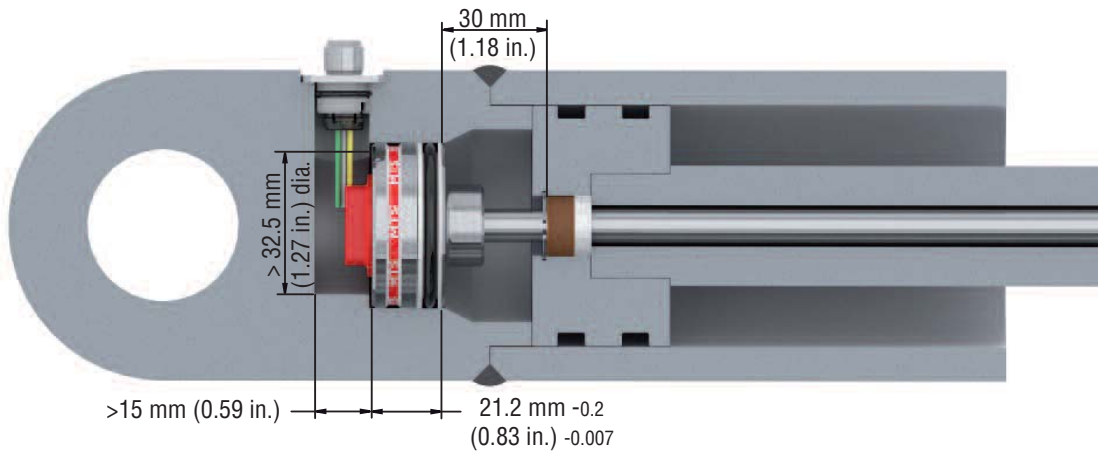
### Model MH sensor installation references

The robust Temposonics Model MH sensor's new stainless-steel position sensor is designed for direct stroke measurement in mobile hydraulic cylinders. The Temposonics Model MH sensor can be installed from the head side or the rod side of the cylinder depending on the cylinder design.

#### Installation Notes:

1. Use a non-ferrous circlip to fix the magnet.
2. The piston rod bore is dependent on hydraulic pressure and piston velocity. Minimum drilling for a (10 mm rod) should be 13.5 mm.
3. There should be no less than 3 mm clearance between the end of the sensor rod and the bottom of the rod bore at full retraction.

**Model MH, rod-style sensor mechanical installation** Drawing is for reference only, contact applications engineering for tolerance specific information.

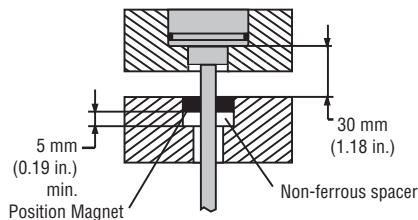


**Figure 2.** MH-Series Model MH rod-style sensor mechanical installation example

**Model MH, rod-style sensor installation** Drawings are for reference only, contact applications engineering for tolerance specific information.

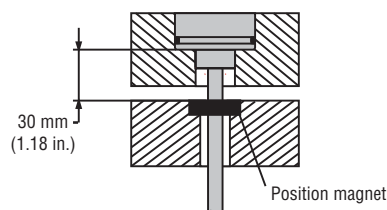
Installation methods are possible in magnetic and non-magnetic applications (shown in *Figures 3 and 4*) and are entirely dependent on the cylinder design. While the most common method of installation is from the rod side of the cylinder, installation from the head side of the cylinder is also possible. In both installation methods, the sensor seals the cylinder by using an O-Ring and backup ring which is installed on the sensor housing.

#### Magnetic material installation reference



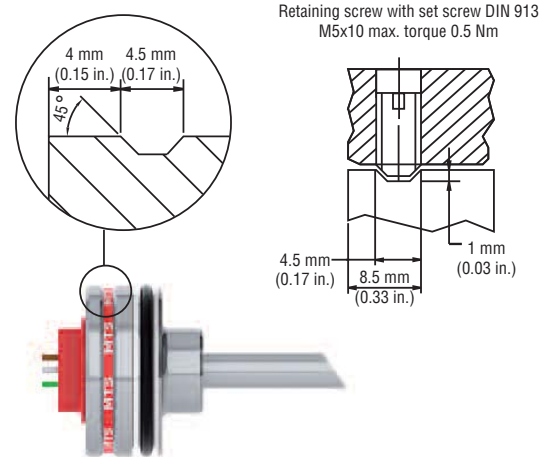
**Figure 3.** Model MH installation in magnetic material using a non-ferrous magnet spacer.

#### Non-magnetic material installation reference



**Figure 4.** Model MH installation in non-magnetic material (without a non-ferrous magnet spacer).

#### Set screw detail



## Connections and wiring

### CONNECTION TYPE

The Temposonics® M12 connector system (shown in *Figures 7, 8, 9 and 10*), meets the most stringent protection requirements important for the difficult environmental conditions of mobile hydraulics applications. Protection type IP69K makes the robust metal housing not only completely dust and waterproof, even the harshest cleaning measures cannot damage the sensor.

**Model MH, rod-style sensor connector and pin assignments** Drawings are for reference only, contact applications engineering for tolerance specific information.

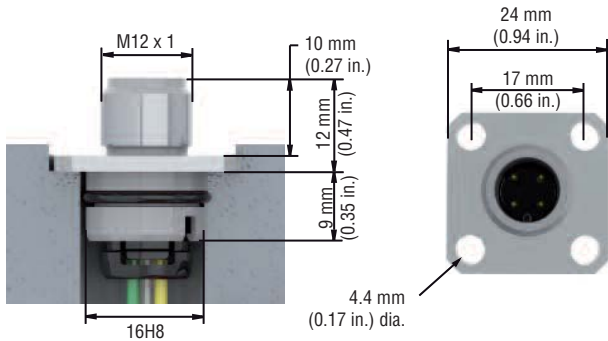


Figure 5. Model MH sensor connection dimensions

### CAN Pin Assignment

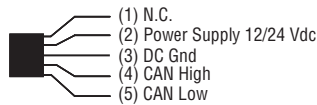


Figure 6. M12 x 1 connector system pin assignments

### MOUNTING THE CONNECTOR SYSTEM TO THE CYLINDER

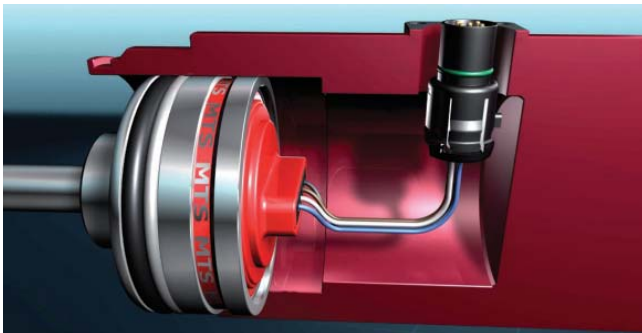


Figure 7. The MH sensor is delivered by MTS together with the new connector system: The connector insert carrier is already connected to the sensor electronics, i.e. no soldering, any color or connection mistake.



Figure 8. The connector insert is taken out of the cylinder through a bore hole. The flange housing can be snapped into position easily from outside.



Figure 9. Four standard screws must be tightened to mount the connector system on the cylinder.

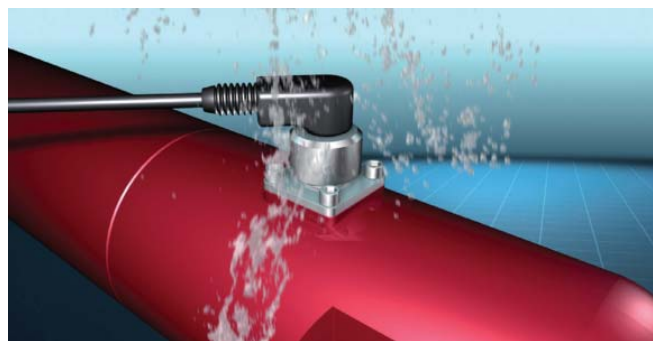
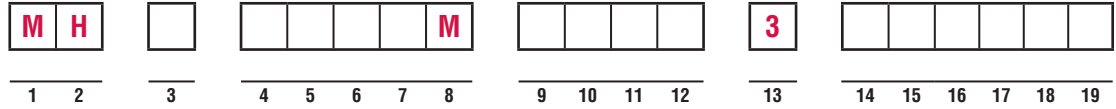


Figure 10. With a corresponding mating molded plug the connector system fulfills a ingress rating of IP69K.

**Model MH Rod-Style Sensor - CANopen, CAN J1939 Output**  
**Ordering Information**

**MH-Series Model MH ordering information**

Use the table below to configure your sensor part number.



<b>SENSOR MODEL</b>	_____ =	<b>M H</b>	<b>1-2</b>
<b>MH</b>	= Rod-style with pressure fit flange housing 48 mm (1.88 in.) dia.		
<b>SENSOR STYLES</b>	_____ =		<b>3</b>
<b>C</b>	= Rod-style 10 mm (0.39 in.) dia. damping zone 63.5 mm (2.49 in.)		
<b>D</b>	= Rod-style 7 mm (0.27 in.) dia. damping zone 63.5 mm (2.49 in.)		
<b>E</b>	= Rod-style 10 mm (0.39 in.) dia. reduced damping zone 36.5 mm (1.44 in.)		
<b>F</b>	= Rod-style 7 mm (0.27 in.) dia. reduced damping zone 36.5 mm (1.44 in.)		
<b>STROKE LENGTH (ORDER LENGTH)</b>	_____ =		<b>4-8</b>
<b>M</b>	= Millimeters 50 to 2500 mm (in 5 mm increments)		
<b>CONNECTION TYPE</b>	_____ =		<b>9-12</b>
<b>N</b>	= <b>Wire exit:</b> Integral 'single wires', each conductor: 0.5 mm <sup>2</sup> (20 AWG) <b>Termination type:</b>		
<b>N__A</b>	= Pigtail (stripped conductors) no termination		
<b>N__F</b>	= 5 single wires, M12x1 IP69K, 5 pin (pin assignment 2-3-4-5)		
	<b>Wire length:</b>		
<b>06</b>	= 60 mm (2.36 in.) min. wire length		
<b>25</b>	= 250 mm (9.84 in.) max. wire length		
	<b>Cable exit:</b>		
<b>T</b>	4 conductor/ cable integral PUR cable, pigtailed, 4 cables, shielded. Cable length (first digit x 1m, second digit x 0.1 m).		
<b>10</b>	= 1.0 m length (standard all other lengths require minimum order quantities: 0.5 m min. to 9.9 max.: 0.1 m increments).		
	<b>Termination type:</b>		
<b>A</b>	= Pigtail (stripped conductors) Contact factory for termination		
<b>INPUT VOLTAGE</b>	_____ =	<b>3</b>	<b>13</b>
<b>3</b>	= +12/24 Vdc		
<b>OUTPUT</b>	_____ =		<b>14-19</b>
<b>C01</b>	= CANopen		
<b>J01</b>	= SAE J1939		
	<b>17 digit Baud rate</b>		
<b>0</b>	= 1000 kBit	<b>3</b>	= 250 kBit
<b>1</b>	= 800 kBit	<b>4</b>	= 125 kBit
<b>2</b>	= 500 kBit	<b>5</b>	= Reserved
		<b>6</b>	= 50 kBit
		<b>7</b>	= 20 kBit
		<b>8</b>	= 10 kBit
	<b>18 + 19 digit: Node-ID</b>		
	= CANopen: hex 01 to 7F (default node ID is 7F)		
	= J1939: hex 01 to FD (default node ID is FD)		

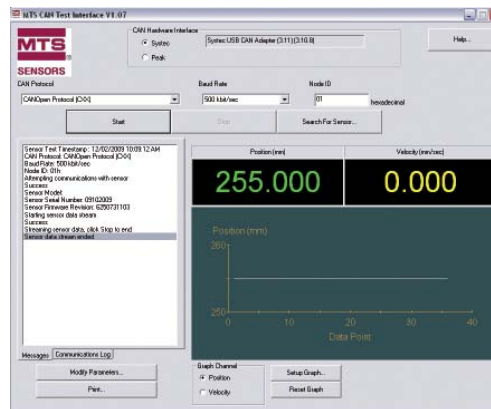
## Magnet selections and optional Test kit

Magnet selections and the MH-Series CAN test kit part no.: 253879, must be ordered separately. Refer to the tables below for ordering information.

Magnet selections	Part no.
Ring magnet, O.D. 17.4 mm (0.68 in.)	401032
Ring magnet, O.D. 25.4 mm (0.99 in.)	400533
Ring magnet, O.D. 33 mm (1.29 in.)	201542-2
Non-ferrous magnet spacer†	400633

† Used with ring magnet part no.: 201542-2

Optional accessory	Part no.
<p>MH-Series CAN test kit</p> <p>The MH-Series CAN Test kit includes:</p> <ul style="list-style-type: none"> <li>MH-Series CANopen / J1939 Test software installation CD</li> <li>USB CAN module kit                             <ul style="list-style-type: none"> <li>USB CAN module</li> <li>USB CAN Module utility CD</li> <li>USB connector cable</li> </ul> </li> <li>12 Vdc battery charger with adapter</li> <li>Cable with M12x1 and RS232 connectors</li> <li>Cable with core cable ends and RS232 connector</li> <li>Carrying case</li> <li>User's guide (PDF format)</li> </ul>	253879



MH-Series CAN test kit software interface



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