

Temposonics®

Magnetostrictive, Absolute, Non-contact
Linear-Position Sensors



MH-Series Mobile Hydraulic In-Cylinder Sensor Model MH CAN Safety (SIL 2) Data Sheet



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 CAN Safety Output:
Displacement + 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
- SIL2 Safety Integrity Level
- CAN Safety (SIL 2) Output

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 specifically for mobile hydraulic applications. The MH has proven worldwide performance in a great variety of rugged machines. The MH is designed for durability with shock rating of 100g, vibration rating of 25g, EMI resistance of 200 V/m, and is fully sealed and embedded in hydraulic cylinders. MH CAN Safety sensor design and signal output provides full assurance and durability of the SIL(2) rating.

The Safety Integrity Level (SIL) is a system used to define the safety level of a device [SIL 1 - SIL 4]. The SIL rating is determined based on a number of quantitative and qualitative factors such as development process and safety life cycle management. It is a measurement of performance and potential risk of failure based on the IEC 61508 standard.

The SIL(2) Safe failure fraction (SFF) determines the failure-safety of the system. CAN Safety reaches a level of 95% with a hardware fault to ground of 0. The SIL(2) Probability for Failure per Hour (PFH) is $\geq 10^{-7}$ to $< 10^{-6}$ as defined for high demand or continuous modes of operation.

The MH sensor provides absolute position feedback using Temposonics non-contacting technology. This ensures high performance, long operating life, and superior value when implemented in rugged mobile applications.

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MH-Series Model MH CAN Safety (SIL 2) Sensor Product Specifications and Output

Product specifications

Parameters	Specifications
INPUT/OUTPUT	
Measured variable:	Linear position and velocity
Output:	Direct CAN Safety acc. CiA DS-304
Resolution:	Position: ± 0.10 mm Velocity: 1 mm/s
Stroke length:	50 mm to 2500 mm (2 in. to 98 in.) Measured in 5 mm (0.20 in.) increments
Linearity uncorrected:	50 to 250 mm ≤± 0.1 mm 255 to 2000 mm < ± 0.04% full stroke (minimum ± 0.100 mm 0.003 in.) < ± 0.08% full stroke (for short damping zone) 500 mm ≤± 0.2 mm 750 mm ≤± 0.3 mm 1250 mm ≤± 0.5 mm 2005 to 2500 mm ≤± 0.8 mm
Hysteresis:	± 0.1 mm (0.003 in.)
Operating voltage:	12/24 Vdc (8-32 Vdc) Voltage supply ripple: <1 % p-p
Power drain:	< 1.5 W
ELECTRONICS	
Electrical isolation:	500 Vdc (DC ground to machine ground)
Polarity protection:	Up to -36 Vdc
Overvoltage protection:	Up to 36 Vdc

Parameters	Specifications
ENVIRONMENTAL	
Operating conditions:	Operating: any orientation, -40 °C (-40 °F) to +105 °C (221 °F) Storage: -30 °C (-22 °F) to +105 °C (221 °F) 90% relative humidity, no condensation
EMC test:	200 V/m ISO 11452-5 ISO 14982: Agriculture and forest machinery IEC 61000-6-1/2 - CE
Shock rating:	100 g (single hit)/IEC standard 68-2-27 (survivability)
Vibration rating:	25 g / 10 to 2000 Hz /IEC standard 68-2-6 Sensor rod, 10 mm (0.39 in.): 25 g Sensor rod, 7 mm (0.30 in.): 15 g
WIRING	
Connection type:	One 5-pin with the M12x1 connector and flange (provides IP69K environmental protection when installed in a cylinder).
ROD STYLE SENSOR (Model MH)	
Material:	Sensor rod: Stainless steel 1.4306 / AISI 304L Housing: Stainless steel 1.4305 / AISI 303 Mechanical assembly: 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
Sealing:	IP67 (IP69k when installed inside a cylinder with M12 x 1 in. connection type)
Pressure rating:	Sensor rod, 10 mm (0.39 in.): Operating, 350 bar (5076 psi) Peak, 450 bar (6615 psi) Sensor rod, 7 mm (0.30 in.): Operating, 300 bar (4350 psi) Peak, 400 bar (5800 psi) Pressure pulse test acc.: DIN EN ISO 19879
Magnet type:	Ring magnet (see standard magnet selections)

Output options

The MH-Series Model MH position CAN Safety sensor provides direct CANopen Safety output.

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Model MH sensor dimension references

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

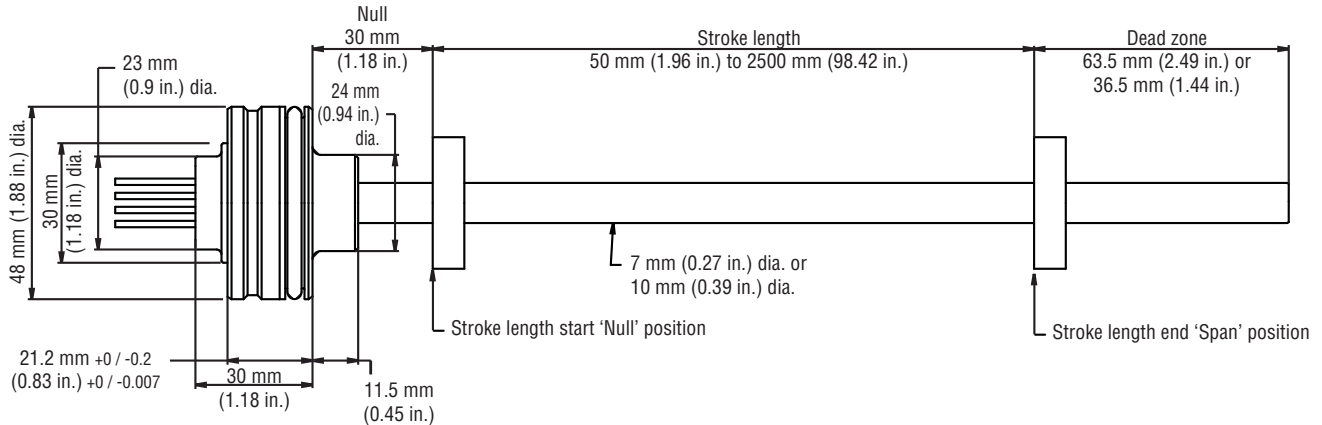


Figure 1. MH-Series Model MH rod-style sensor dimension reference

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)

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MH-Series Model MH CAN Safety (SIL 2) Sensor

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.

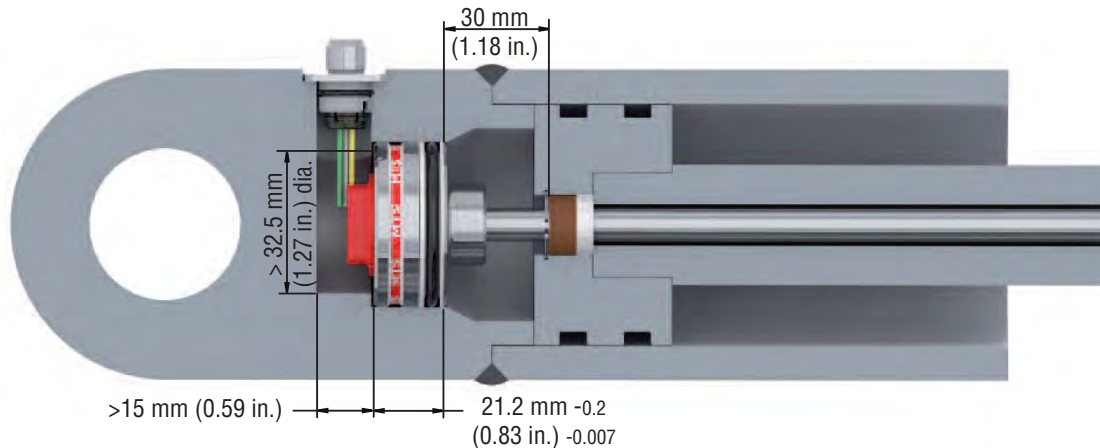


Figure 2. MH-Series Model MH rod-style sensor mechanical installation example

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

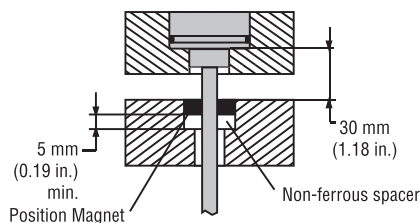


Figure 3. Model MH installation in magnetic material using a non-ferrous magnet spacer.

Non-magnetic material installation reference

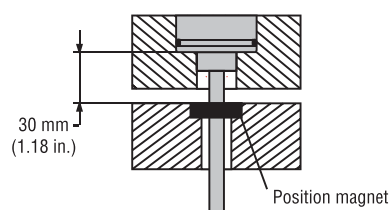
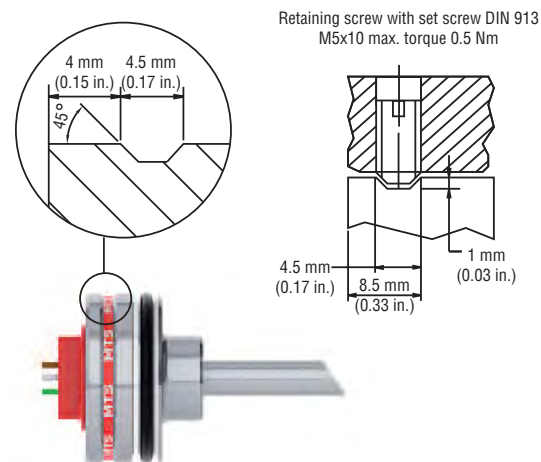


Figure 4. Model MH installation in non-magnetic material (without using a non-ferrous magnet spacer).

Set screw detail



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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.*

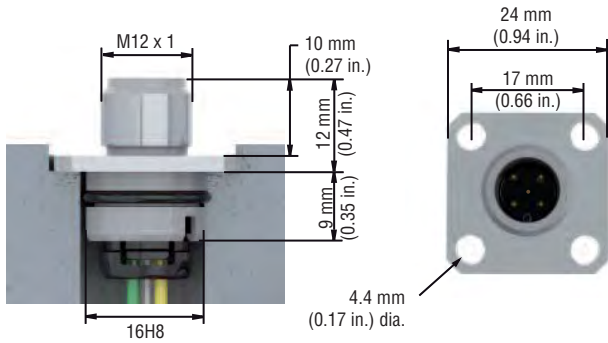


Figure 5. Model MH sensor connection dimensions

CAN Pin Assignment

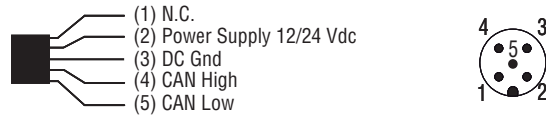


Figure 6. M12 x 1 connector system pin assignments

MOUNTING THE CONNECTOR SYSTEM TO THE CYLINDER

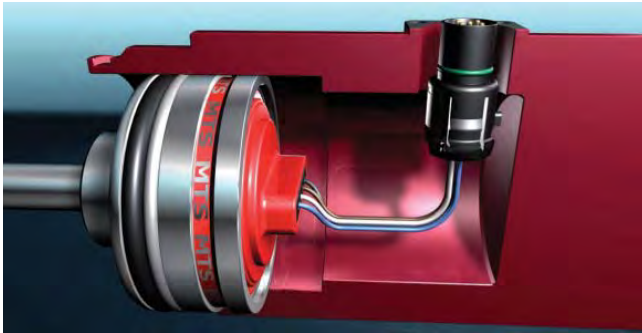


Figure 7. The MH sensor is delivered by MTS together with the new connector system: The connector insert carrier is already connected to the sensor electronics, i.e. no soldering, any color or connection mistake.



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.

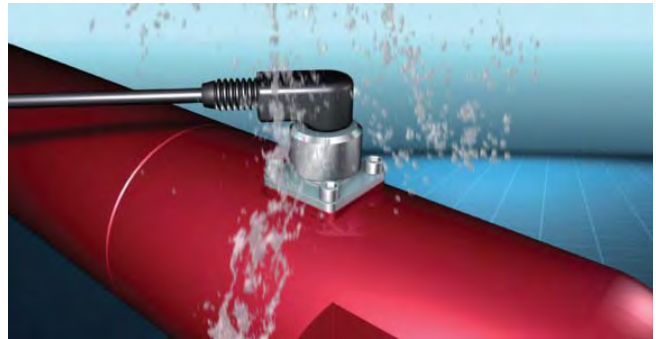


Figure 10. With a corresponding mating molded plug the connector system fulfills a ingress rating of IP69K.

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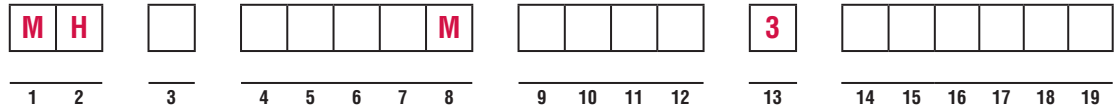
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MH-Series Model MH CAN Safety (SIL 2) Sensor

Ordering Information

MH-Series Model MH ordering information

Use the table below to configure your sensor part number.



SENSOR MODEL _____ = **M H** 1-2

MH = Rod-style with pressure fit flange housing 48 mm (1.88 in.) dia.

SENSOR STYLES _____ = _____ 3

- C** = Rod-style 10 mm (0.39 in.) dia. damping zone 63.5 mm (2.49 in.)
- D** = Rod-style 7 mm (0.27 in.) dia. damping zone 63.5 mm (2.49 in.)
- E** = Rod-style 10 mm (0.39 in.) dia. reduced damping zone 63.5 mm (2.49 in.)
- F** = Rod-style 7 mm (0.27 in.) dia. reduced damping zone 36.5 mm (2.49 in.)

STROKE LENGTH (ORDER LENGTH) _____ = _____ **M** 4-8

----- **M** = Millimeters
50 to 2500 mm (in 5 mm increments)

CONNECTION TYPE _____ = _____ 9-12

- N** _____ = **Wire exit:**
Integral 'single wires', each conductor: 0.5 mm² (20 AWG)
- Termination type:**
- N__A** = no termination
- N__F** = 4 single wires, M12x1 IP69K, 5 pin (pin assignment 2-3-4-5), see fig 6 on page 5.

Wire length:

- 06** = 60 mm (2.36 in.) min. wire length
- 25** = 250 mm (9.84 in.) max. wire length

Cable exit:

- T** _____ 4 conductor/ cable integral PUR cable, pigtailed. Cable length (first digit x 1m, second digit x 0.1 m).
- 10** = 1.0 m length (standard all other lengths require minimum order quantities: 0.5 m min. to 9.9 max.: 0.1 m increments).

Termination type:

- A** = Pigtail (stripped conductors) Contact factory for termination

INPUT VOLTAGE _____ = **3** 13

3 = +12/24 Vdc

OUTPUT _____ = _____ 14-19

S01 = CANopen Safety (SIL2)

17 digit Baud rate

- 0** = 1000 kBit **3** = 250 kBit **6** = 50 kBit
- 1** = 800 kBit **4** = 125 kBit **7** = 20 kBit
- 2** = 500 kBit **5** = Reserved **8** = 10 kBit

18 + 19 digit: Node-ID

= CAN Safety (SIL2): hex 01 to 40 (default Node ID = 40)

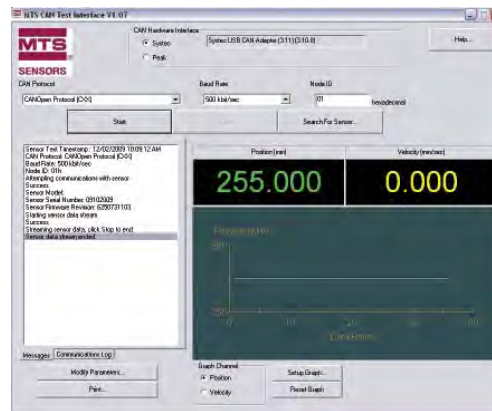
Magnet selections and optional Test kit

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.
MH-Series CAN test kit	253879
<p>The MH-Series CAN Test kit includes:</p> <ul style="list-style-type: none"> MH-Series CANopen / J1939 Test software installation CD USB CAN module kit <ul style="list-style-type: none"> USB CAN module USB CAN Module utility CD USB connector cable 12 Vdc battery charger with adapter Cable with M12x1 and RS232 connectors Cable with core cable ends and RS232 connector Carrying case User's guide (PDF format) 	



MH-Series CAN test kit software interface

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