

# Temposonics®

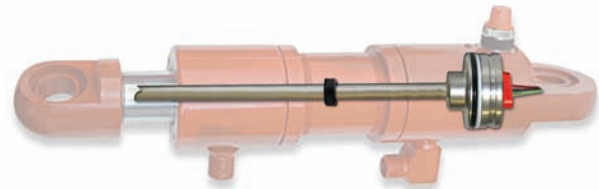
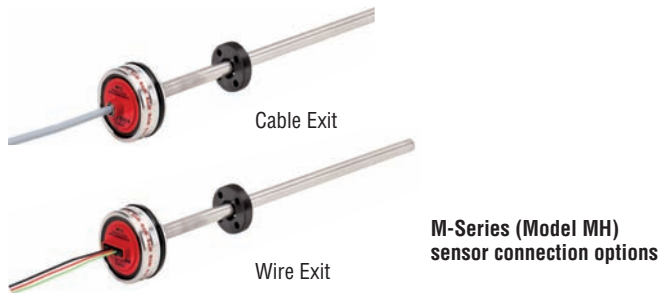
## Magnetostrictive Linear-Position Sensors



M-Series Mobile Equipment Sensor  
Model MH  
Analog Output

550824 I

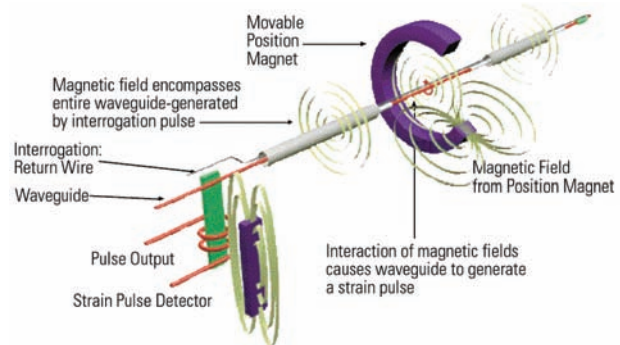
### Product Specification



M-Series (Model MH) with analog output (sensor cylinder application example)

### Features

- Linear, Absolute Position Sensors
- Non-contact Sensor Technology
- Superior Accuracy: Linearity < +/- 0.04% F.S.
- Repeatability: < ± 0.005% F.S.
- Compact Design for Embedded Cylinder Applications
- No External Electronics
- Analog Output: 0.25 - 4.75 Vdc, 4-20 mA
- Sensor Stroke Length: 50 mm (1.97 in.) - 2500 mm (98.43 in.)
- Power Supply: 12/24 Vdc
- Shock Rating: 100 g (single hit) / IEC 68-2-27
- Vibration Rating: 25 g / 10-2000 Hz / IEC 68-2-6



### Product overview

Today's buyers are more concerned with greater productivity, lower overall operating costs and cost of ownership. Temposonics M-Series Mobile Equipment sensors help lower overall costs by increasing safety and versatility, increasing reliability and reducing service costs. Temposonics Mobile Equipment sensors are designed specifically for position sensing applications in rugged environments typically encountered by construction, agriculture and other off-highway machinery. All Temposonics Mobile Equipment sensors utilize magnetostrictive technology.

The M-Series, Model MH sensor with analog output, is one of the latest compact stainless-steel position sensors specifically designed for use in welded and tie-rod style cylinders, or any space limited cylinder application. The M-Series Model MH sensor is an ideal choice for a wide range of standard hydraulic cylinders with diameters of 50 mm (1.97 in.) or larger.

The extremely rugged model MH sensor consists of the following main components:

1. The sensor head; A robust housing with built-in electronics.
2. The pressure-proof sensor pipe; The sensor pipe houses and protects the internal sensing element.
3. The position magnet; The magnet is mounted on the piston, during operation it travels along the stationary sensor tube. This sensor system is "non-contact" by design.

### Benefits of magnetostrictive sensing

Temposonics linear-position sensors use the time based magnetostrictive position sensing principle developed by MTS. Within the sensing element, a sonic strain pulse is induced in a specially designed magnetostrictive waveguide by the momentary interaction of two magnetic fields. One field comes from a movable permanent magnet that passes along the outside of the sensor. The other field comes from an "interrogation" current pulse applied along the waveguide. The resulting strain pulse travels at ultrasonic speed along the waveguide and is detected at the head of the sensing element.

The position of the magnet is determined with high precision and speed by accurately measuring the elapsed time between the application of the interrogation pulse and the arrival of the resulting strain pulse with a high-speed counter. Elapsed time is used to determine the permanent magnet position which provides an absolute position reading that never requires recalibration or re-homing after a power loss. Non-contact sensing eliminates wear, and guarantees the best durability and output repeatability.

## M-Series Model MH Analog Sensor product specifications and dimensions

### Temposonics Model MH high-pressure compact sensor

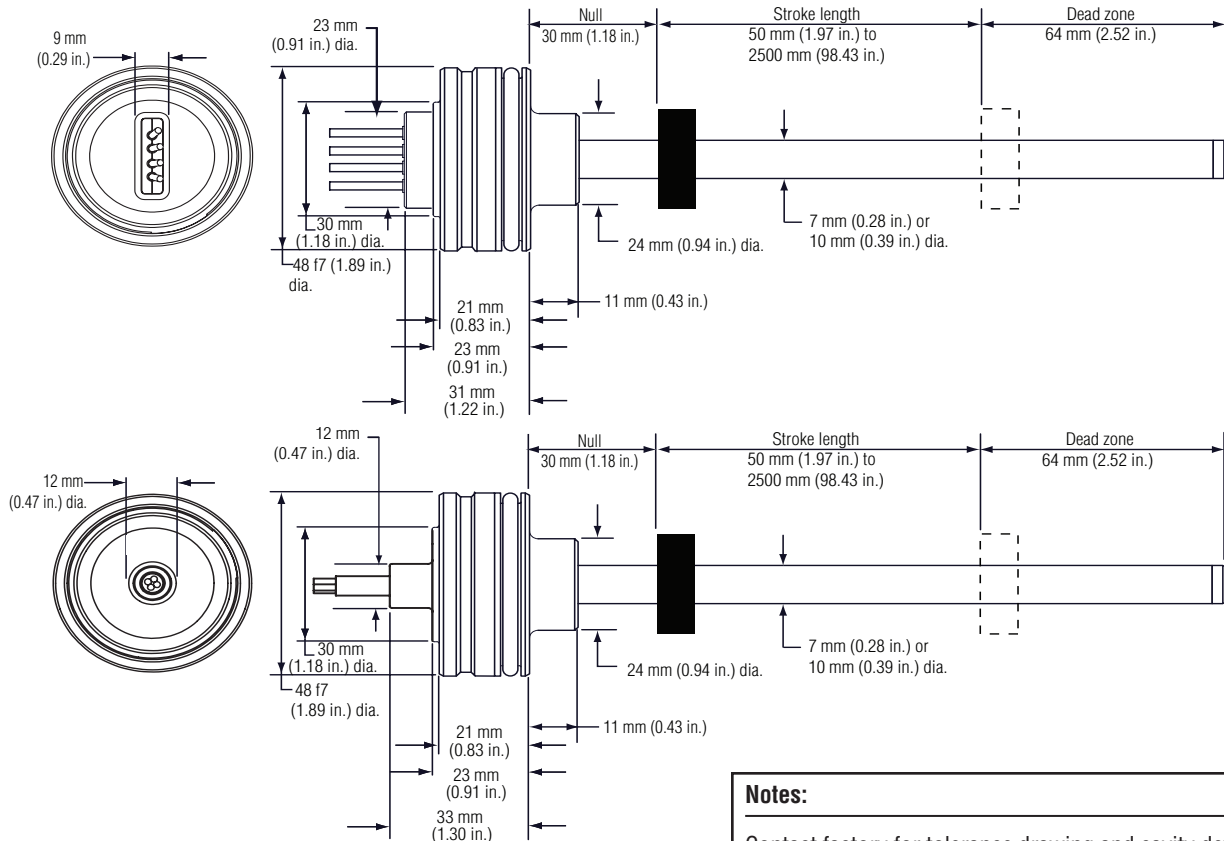
M-Series sensors were designed with the “mobile” world in mind, and have been validated in the field by customers worldwide. Performance is second-to-none; high accuracy, repeatability, 200 V/m EMI, and position output.

Ruggedness is “designed in”; 100 g shock and 25 g vibration rating. Cable and wire options are sized for direct connection to industry proven connectors. The model MH sensor is fully sealed and when embedded in a cylinder provides a long operating life.

| Parameters                     | Specifications  |
|--------------------------------|---|
| <b>Measured variations:</b>    | Displacement  |
| <b>Resolution:</b>             | 0.1 mm  |
| <b>Linearity, uncorrected:</b> | $\pm 0.04\%$ F.S. minimum $\pm 0.100$ mm (0.003 in.)  |
| <b>Repeatability:</b>          | $\pm 0.005\%$ F.S.  |
| <b>Update frequency:</b>       | > 488 Hz  |
| <b>Ripple:</b>                 | < 0.05% F.S.  |
| <b>Stroke length:</b>          | 50 mm - 2500 mm (1.97 - 98.43 in.)<br>in 5 mm (0.19 in.) increments   |
| <b>Outputs:</b>                | Analog: 0.25 - 4.75 Vdc, 4 - 20 mA, output rable factory programmable through entire stroke, fully reversible |
| <b>Operating temperature:</b>  | -40 °C (-40 °F) to 105 °C (221 °F) (sensor)   |
| <b>Dew point, humidity:</b>    | 90% rel. humidity, no condensation  |
| <b>Sealing:</b>                | IP 67 (individual wires); IP 67 (cable exit)  |

| Parameters  | Specifications   |
|---|--|
| <b>Rod pressure ratings</b><br><b>10 mm (0.39 in.) rod:</b>                             | 350 bar (5076 psi) operating, 530 bar (7687 psi) peak pressure   |
| <b>7 mm (0.27 in.) rod:</b>   | 300 bar (4351 psi) operating, 450 bar (6526 psi) peak pressure   |
| <b>Electrical connection:</b>   | Individual 4-wire (optional M12 connector) or Pigtailed PUR cable  |
| <b>Voltage input:</b>   | 12/24 Vdc (10 to 32 Vdc)   |
| <b>EMC tests:</b>   | 200V/m:<br>ISO 11452-5<br>ISO 14982, Agriculture and forest machines<br>ISO 7637-0/1/2/3, Road vehicles<br>DIN EN 50121-3-2:5/2001, Railway applications<br>IEC 61000-6-1/2 - CE |
| <b>Shock ratings</b><br><b>10 mm (0.39 in.) rod:</b><br><b>7 mm (0.27 in.) rod:</b>     | 100 g (single hit) /IEC 68-2-27<br>100 g (single hit) /IEC 68-2-27   |
| <b>Vibration ratings</b><br><b>10 mm (0.39 in.) rod:</b><br><b>7 mm (0.27 in.) rod:</b> | 25 g RMS/<br>10 - 2000 Hz/IEC 68-2-6<br>15 g RMS/<br>10 - 2000 Hz/IEC 68-2-8   |
| <b>Current drain:</b>   | 80 mA typical  |
| <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   |
| <b>Sensor material:</b>   | Stainless steel 1.4301/AISI 304  |

### Temposonics Model MH sensor dimensions



#### Notes:

Contact factory for tolerance drawing and cavity detail.

## M-Series Model MH Analog Sensor installation, wiring examples and magnets

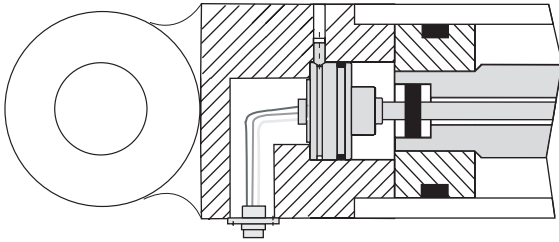
The robust Temposonics Model MH sensor's new stainless-steel position sensor is designed for direct stroke measurement in standard compact hydraulic cylinders. The Temposonics Model MH sensor can be installed from the head side or the rod side of the cylinder depending on the cylinder design.

### Sensor installation

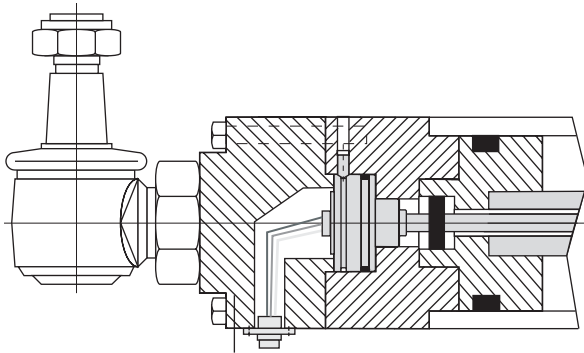
The method of installation is entirely dependent on the cylinder design. While the most common method of installation is from the rod side of the cylinder, installation from the head side of the cylinder is also possible. In both installation methods, the sensor seals the cylinder by using an O-Ring and backup ring which is installed on the sensor housing.

### Temposonics Model MH sensor installation examples

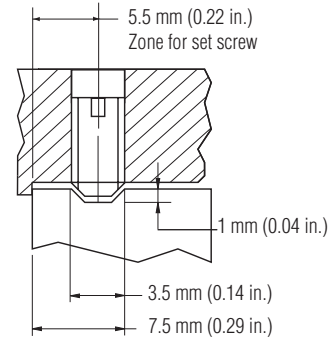
#### Rod-side installation



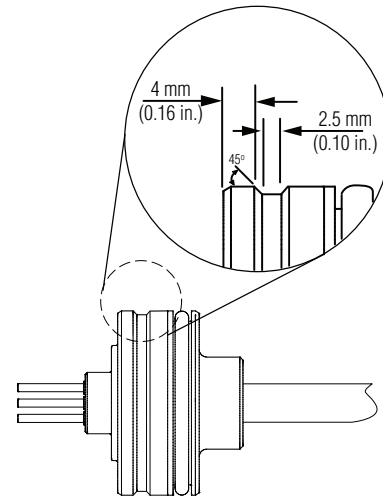
#### Cylinder head, side installation



**Retaining screw with set screw DIN 914  
M5 x 10 maximum torque 0.5 Nm  
(0.369 lbf-ft. / 4.43 lbf-in.) or  
UNF/UNC equivalent**

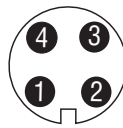


#### Detail flange housing



### Wiring diagram (standard configuration)

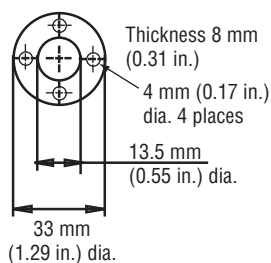
| Wire color | Signal          | M12 Pin position |
|------------|-----------------|------------------|
| Green      | Position output | 4                |
| Brown      | 12/24 Vdc       | 2                |
| White      | DC ground       | 3                |
| Yellow     | N/C             | 1                |



### Position magnets

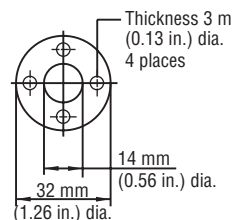
#### Part no. 201542-2

Temperature:  
-40°C (-40 °F) to  
105 °C (221 °F)  
Material: Ferrite PA



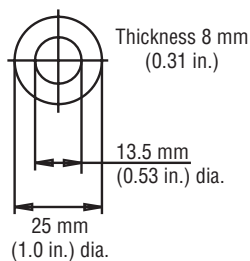
#### Part no. 400633

Magnet spacer  
(use with magnet  
part no. 201542-2)



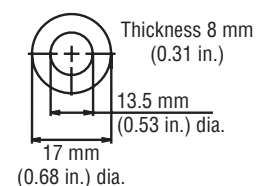
#### Part no. 400533

Temperature:  
-40°C (-40 °F) to  
105 °C (221 °F)  
Material: Ferrite PA



#### Part no. 401032

Temperature:  
-40°C (-40 °F) to  
105 °C (221 °F)  
Material: Ferrite PA



**M-Series Model MH Analog sensor How to order and accessories**

When placing an order, build the desired model number using the model number guide (right). If you have any questions about how to apply a model MH position sensor to your specific application, please contact MTS Applications Engineering.



- SENSOR MODEL** ————
- Hydraulic rod-style
- MH** = 48 mm (1.89 in.) dia. housing
- PRESSURE PIPE** ————
- C** = 10 mm (0.39 in.) diameter
- D** = 7 mm (0.28 in.) diameter
- STROKE LENGTH (order length)** ————
- M** = Millimeters 50 mm to 2500 mm (1.97 in. to 98.43 in.)  
in 5 mm (0.19 in.) increments
- CONNECTION TYPE** ————
- N** ———— = Wire exit:  
Integral "single wires", each conductor is 0.5 mm<sup>2</sup> (20 AWG)  
Wire lengths:  
**10** = 100 mm (3.94 in.) length  
**20** = 200 mm (7.07 in.) length  
**30** = 300 mm (11.81 in.) length  
Wire length: first digit x 100 mm / second digit x 10 mm  
Termination type:  
**A** = Pigtail (stripped conductors)  
(Note: For wire termination, consult factory)  
**E** = M12 integrated connector M12x1 for MH-Analog and MH PWM, A-polarization, 4-pin 4-wires,  
PIN1-N.C. - yellow, PIN2 - supply-brown, PIN3 - ground-white, PIN4 - signal-green.
- Cable exit:**  
**T** ———— = 4 conductor / cable; Integral PUR cable, pigtailed, 4 cables, shielded  
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 m. max.; 0.1 m. increments)  
Termination type:  
**A** = Pigtail (stripped conductors)  
(Note: For wire termination, consult factory)
- INPUT VOLTAGE** ————
- 3** = + 12/24 Vdc
- OUTPUT** ————
- Voltage:  
**V11** = 0.25 to 4.75 Vdc  
**V12** = 0.5 to 4.5 Vdc  
**V13** = 4.75 to 0.25 Vdc  
**V14** = 4.5 to 0.5 Vdc  
Current:  
**A01** = 4 to 20 mA

| Accessories                                       |          |
|---|----------|
| Description                                       | Part no. |
| Ring magnet                                       | 201542-2 |
| Ring magnet                                       | 400533   |
| Ring magnet                                       | 401032   |
| Magnet spacer (use with magnet part no. 201542-2) | 400633   |
| M12 Flange  | 253769   |



**Part Number: 03-08, 04-09, 550824 Revision I**  
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 All Temposonics sensors are covered by US patent number 5,545,984. Additional patents are pending.  
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