MH-Series Flexible MH
Data Sheet

- Linear, absolute measurement
- Easy in-field installation and replacement
- Stroke lengths from 500…5000 mm
- Resolution: ±0.2 mm
- Analog and CANbus output options
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.

FLEXIBLE MH SENSOR

Designed for use with hydraulic cylinders in mobile applications, the externally threaded Flexible MH sensor features an innovative two-part design. This design allows users to separate the flexible sensing element and electronics from the housing without opening the hydraulic system.

While it is manageable to install and remove hydraulic cylinder sensors at a manufacturing facility, it can be extremely challenging in the field. Trained service technicians can remove and replace the internal components with just 200 mm of clearance regardless of stroke length and without breaking the hydraulic seal. This serviceability means decreased downtime and disruption, providing increased productivity. Replacement units ship as coiled rings to ease handling and reduce shipping costs.
### TECHNICAL DATA ANALOG

#### Input
- Measured value: Position
- Stroke range: 500…5000 mm (in 20 mm steps)

#### Output
- Signal characteristic: 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: ±0.2 mm
- Sample rate: 2 ms

#### Accuracy
- Linearity: ±0.04 % (F.S.)
- Repeatability: ±0.005 % (F.S.)
- Hysteresis: ±0.2 mm

#### Operating conditions
- Mounting position: Any
- Operating temperature: −40…+105 °C
- Humidity: 90 % rel. humidity, no condensation
- Ingress protection: IP67 / IP69K with appropriate mating connection

#### Pressure
- Nominal operating pressure (P<sub>n</sub>): 350 bar
- Max. overload pressure in cylinder (P<sub>max</sub>): 450 bar
- Max. static proof pressure in cylinder (P<sub>proof</sub>): 625 bar

#### Environmental testing
- Shock test: IEC 60068-2-27, 100 g (6 ms) single shock, 50 g (11 ms) at 1000 shocks per axis
- Vibration test: IEC 60068-2-64, 2 g (5…2000 Hz)
- EMC test & evaluation: ISO16750-2:2010
- ISO 14982:2009 - Agricultural and forestry machinery
- ISO 13766:2006 - Earth-moving machinery
- EN 13309:2010 - Construction machinery
- RF immunity: to 200 V/m per ISO 11452-2/-4

#### Materials and dimensions
- Sensor rod with flange: Stainless steel 1.4306 (AISI 304L)
- Sensor electronics housing: Stainless steel 1.4305 (AISI 303)

#### Electrical installation
- Connector: M12 male plug
- Supply voltage: 12 VDC (tolerance range 8…32 VDC) / 24 VDC (tolerance range 8…32 VDC)
- Current consumption: Typ. ≤ 100 mA / Typ. ≤ 50 mA
- Load (output VDC): R<sub>L</sub> ≥ 10 kΩ / R<sub>L</sub> ≥ 10 kΩ
- Load current (output VDC): Typ. 1 mA
- Load (output mA): R<sub>L</sub> ≤ 250 Ω / R<sub>L</sub> ≤ 500 Ω
- Inrush current: Max. 2.5 A/2 ms / Max. 4.5 A/2 ms
- Supply voltage ripple: < 1 % pp
- Power drain: < 1 W
- Over voltage protection (GND-VDC): Up to +36 VDC
- Polarity protection (GND-VDC): Up to −36 VDC
- Insulation Resistance: R ≥ 10 MO @ 60 sec
- Electric strength: 500 VDC (DC GND to chassis GND)
**Tempsonics® MH-Series Flexible MH**

**Data Sheet**

## TECHNICAL DATA DIGITAL

### Input
- **Measured value**: Position
- **Stroke range**: 500…5000 mm (in 20 mm steps)

### Output
- **Signal characteristic**: Analog output restricted by noise or A/D converter of control unit
- **Interface**: CANopen / SAE J1939
- **Resolution**: ±0.2 mm
- **Sample rate**: CANopen: 1 ms; SAE J1939: 20 ms

### Accuracy
- **Linearity**: ±0.04 % (F.S.)
- **Repeatability**: ±0.005 % (F.S.)
- **Hysteresis**: ±0.2 mm

### Operating conditions
- **Mounting position**: Any
- **Operating temperature**: −40…+105 °C
- **Humidity**: 90 % rel. humidity, no condensation
- **Ingress protection**: IP67 / IP69K with appropriate mating connection

### Pressure
- **Nominal operating pressure (P_n)**: 350 bar
- **Max. overload pressure in cylinder (P_max)**: 450 bar
- **Max. static proof pressure in cylinder (P_proof)**: 625 bar

### Environmental testing
- **Shock test**: IEC 60068-2-27, 100 g (6 ms) single shock, 50 g (11 ms) at 1000 shocks per axis
- **Vibration test**: IEC 60068-2-64, 2 g (5…2000 Hz)
- **EMC test & evaluation**: ISO16750-2:2010
  - ISO 14982:2009 - Agricultural and forestry machinery
  - ISO 13766:2006 - Earth-moving machinery
  - EN 13309:2010 - Construction machinery
  - RF immunity to 200 V/m per ISO 11452-2/-4

### Materials and dimensions
- **Sensor rod with flange**: Stainless steel 1.4306 (AISI 304L)
- **Sensor electronics housing**: Stainless steel 1.4305 (AISI 303)

### Electrical installation
- **Connector**: M12 male plug
- **Supply voltage**: 12 VDC (8…32 VDC) / 24 VDC (8…32 VDC)
- **Current consumption**: Typ. < 100 mA / Typ. < 50 mA
- **Inrush current**: Max. 1.0 A @ 2 ms / Max. 1.5 A @ 2 ms
- **Bus termination (HI-LO)**: 120 Ω
- **Supply voltage ripple**: < 1 % p-p
- **Power drain**: < 1.5 W
- **Over voltage protection (GND-VDC)**: Up to +36 VDC
- **Polarity protection (GND-VDC)**: Up to −36 VDC
- **Insulation Resistance**: R ≥ 10 MΩ @ 60 sec.
- **Electric strength**: 500 VDC (DC GND to chassis GND)
**TECHNICAL DRAWING**

**FMH with flat end plug**

![Diagram of FMH with flat end plug](image)

**FMH with M4 female thread plug**

![Diagram of FMH with M4 female thread plug](image)

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

**CONNECTOR WIRING**

**Analog output**

<table>
<thead>
<tr>
<th>M12 connector</th>
<th>Pin</th>
<th>E</th>
<th>G</th>
<th>H</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>not connected</td>
<td>VDC</td>
<td>VDC</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>VDC</td>
<td>not connected</td>
<td>SIG</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>GND</td>
<td>GND</td>
<td>GND</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>SIG</td>
<td>SIG</td>
<td>not connected</td>
</tr>
</tbody>
</table>

**Digital output**

<table>
<thead>
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<th>M12 connector</th>
<th>Pin</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
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</tr>
<tr>
<td></td>
<td>2</td>
<td>VDC</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>GND</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>CAN_HI</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>CAN_LOW</td>
</tr>
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</table>
FREQUENTLY ORDERED ACCESSORIES

<table>
<thead>
<tr>
<th>Position magnets</th>
<th>Cord sets and adapter cables</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Ring magnet" /></td>
<td><img src="image" alt="Cord set" /></td>
</tr>
<tr>
<td><strong>Ring magnet</strong></td>
<td></td>
</tr>
<tr>
<td>Part no. 402 316</td>
<td>Part no. 254 597</td>
</tr>
<tr>
<td>Material: PA ferrite coated</td>
<td>M12 connector: Brass/Nickel</td>
</tr>
<tr>
<td>Weight: 13 g</td>
<td>DT connector: DTM06 3 pin</td>
</tr>
<tr>
<td>Operating temperature: -40...+100 °C</td>
<td>Cable length: 275 mm</td>
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<tr>
<td>Surface pressure: 20 N/mm²</td>
<td>Cable Ø: 5 mm</td>
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<tr>
<td></td>
<td>Operating temperature: -40...+105 °C</td>
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<table>
<thead>
<tr>
<th>Test kits</th>
<th></th>
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<tr>
<td>![MH test kit (analog)]</td>
<td><img src="image" alt="MH test kit (digital) for US" /></td>
</tr>
<tr>
<td>Part no. 280 618</td>
<td>Part no. 253 879</td>
</tr>
<tr>
<td>Kit includes:</td>
<td>Kit includes:</td>
</tr>
<tr>
<td>• 12 VDC battery charger with</td>
<td>• USB CAN-Mod Kit:</td>
</tr>
<tr>
<td>adapter (EU &amp; UK)</td>
<td>- USB CAN-Modul</td>
</tr>
<tr>
<td>• Cable with M12 connector</td>
<td>- USB CAN-Modul Utility CD</td>
</tr>
<tr>
<td>• Cable with pigtailed wires</td>
<td>(driver &amp; manual)</td>
</tr>
<tr>
<td>• Carrying case</td>
<td>- USB cable</td>
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<tr>
<td></td>
<td>cable with MTS M12 connector and</td>
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<tr>
<td></td>
<td>RS232 connector</td>
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<td>• cable with RS232 connector</td>
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<td>• carrying case</td>
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<td></td>
<td>• 12 VDC power supply</td>
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<tr>
<td>![MH test kit (digital) for</td>
<td><img src="image" alt="MH test kit (digital) for" /></td>
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<tr>
<td>EU / Asia](image)</td>
<td>Part no. 254 267</td>
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<td>Part no. 254 267</td>
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<td>• USB CAN-Modul Kit:</td>
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<td>- USB CAN-Modul Utility CD</td>
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<td>(driver &amp; manual)</td>
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<td>- USB cable</td>
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<td>cable with MTS M12 connector</td>
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<td>and RS232 connector</td>
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<td>• cable with RS232 connector</td>
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<td>• carrying case</td>
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<td></td>
<td>• 12 VDC power supply</td>
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Controlling design dimensions are in millimeters.
## ORDER CODE FMH ANALOG

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<th>11</th>
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<th>14</th>
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<tbody>
<tr>
<td>F</td>
<td>M</td>
<td>H</td>
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</tbody>
</table>

**a** Sensor model
F M H Flexible MH

**b** Design
A M33 thread flange, flat end plug
B M33 thread flange, M4 female plug

**c** Stroke length
X X X X M 0500…5000 mm (20 mm increments)

**d** Pin assignment
M12 connector (VDC - GND - SIG)
E M12 connector with 4 pins (E: 2-3-4)
G M12 connector with 4 pins (G: 1-3-4)
H M12 connector with 4 pins (H: 1-3-2)

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

**f** Output
<table>
<thead>
<tr>
<th>V</th>
<th>1</th>
<th>1</th>
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<tbody>
<tr>
<td></td>
<td>0.25…4.75 VDC</td>
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<td>V</td>
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<td>0.5…4.5 VDC</td>
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<td>V</td>
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<td>4.75…0.25 VDC</td>
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<tr>
<td>V</td>
<td>1</td>
<td>4</td>
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<tr>
<td></td>
<td>4.5…0.5 VDC</td>
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<tr>
<td>A</td>
<td>0</td>
<td>1</td>
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<td></td>
<td>4…20 mA</td>
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<tr>
<td>A</td>
<td>0</td>
<td>4</td>
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<tr>
<td></td>
<td>20…4 mA</td>
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## DELIVERY

- Position sensor, O-ring
- Accessories have to be ordered separately.

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

## NOTICE

If you have questions about the replacement of sensor electronics and sensor element contact the MTS Sensors application team.
ORDER CODE FMH DIGITAL

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a  Sensor model
F M H Flexible MH

b  Design
A  M33 thread flange, flat end plug
B  M33 thread flange, M4 female plug

c  Stroke length
X X X X M 0500…5000 mm (20 mm increments)

d  Pin assignment
M12 connector (VDC - GND - CAN HI - CAN LO)
F  M12 connector with 5 pins (F: 2-3-4-5)

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

f  Output
C 0 1 CANopen
J 0 1 SAE J1939

g  Baud rate setting
CANopen
0  1000 kbit/s
1  800 kbit/s
2  500 kbit/s
3  250 kbit/s (default)
4  125 kbit/s

SAE J1939
3  250 kbit/s (fix setting)

h  Node ID
CANopen
7 F Node ID (hex): 01…7F (default = 7F)
SAE J1939
F D Node ID (hex): 01…FD (default = FD)

DElIVERY

Position sensor, O-ring
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