



**TEMPOSONICS[®] AND HALL EFFECT
POSITION SENSORS FOR MOBILE APPLICATIONS**

PRODUCT SELECTOR GUIDE





MEETING THE CHALLENGES OF MOBILE APPLICATIONS

Agricultural • Construction • Forestry • Mining • Handling & Logistics • Municipal Vehicle

MTS Sensors also offers solutions for Industrial and Liquid Level applications.

TABLE OF CONTENTS

COMPANY **5**

MEASURING TECHNOLOGIES **6**

M12 CONNECTOR SYSTEM **7**

SERIES QUICK GUIDE **9**

MH-SERIES MH **10**

MH-SERIES FMH **11**

MH-SERIES MH SIL 2 **12**

MH-SERIES MT **13**

MH-SERIES MS **14**

MH-SERIES MXR **15**

MH-SERIES MB **16**

HE-SERIES **17**

LOCAL SUPPORT **18**

COMPANY

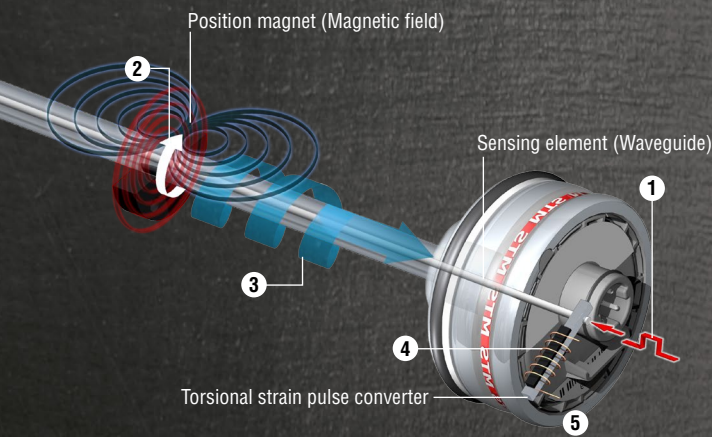
MTS Sensors is recognized as an industry leader in sensing technologies and solutions. These sensors permit high-precision and dynamic position and/or speed measurement in state-of-the-art automation and safety-relevant applications.

With a versatile and ever increasing product portfolio, MTS Sensors cooperates closely with customers, to optimize performance and reduce downtimes. Outstanding quality associated with practical know-how ensures that customers achieve utmost productivity and success. Continuous research, development and production of sensor systems constantly enable new solutions for measuring tasks in the industrial, mobile hydraulics as well as process technology fields to be created.

MTS Sensors, a division of MTS Systems Corporation (NASDAQ:MTSC), serves its global customers with a focus on superior regional support.



MEASURING TECHNOLOGIES



Measurement Cycle

- 1 Current pulse generates magnetic field
- 2 Interaction with position magnet field generates torsional strain pulse
- 3 Torsional strain pulse propagates
- 4 Strain pulse detected by converter
- 5 Time-of-flight converted into position

MAGNETOSTRICTION

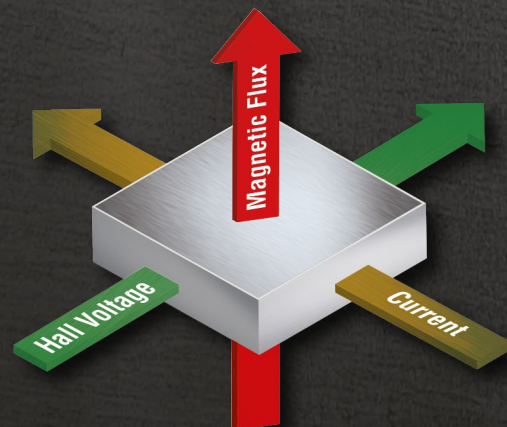
The absolute, linear position sensors provided by MTS Sensors rely on the company's proprietary Temposonics® magnetostrictive technology, which can determine position with a high level of precision and robustness.

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 generated by the sensor element and 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.

The Temposonics® technology, based on magnetostriction, does not rely on moving parts and is not exposed to mechanical stress. Therefore, the sensors exhibit considerably longer lifespans and much higher reliability when compared to other technologies, even in harsh working conditions. Furthermore, since the output from sensors with Temposonics® technology corresponds to an absolute position, rather than a relative value, it is not required to recalibrate sensors.

HALL EFFECT

MTS Sensors' linear position sensors utilizing Hall Effect technology are able to determine position with a high level of repeatability and robustness. The sensor consists of sensing elements and supporting electronics in a robust sensor rod. The non-contacting position magnet is attached to the object in motion for the given application. The magnetic field, of the position magnet, perpendicular to the sensing elements creates a measurable (Hall) voltage which is proportional to the strength of the magnetic field. The Hall voltage is then converted into a linear position measurement. Since the output of the sensor corresponds to an absolute position, rather than a relative value, recalibration is not required.



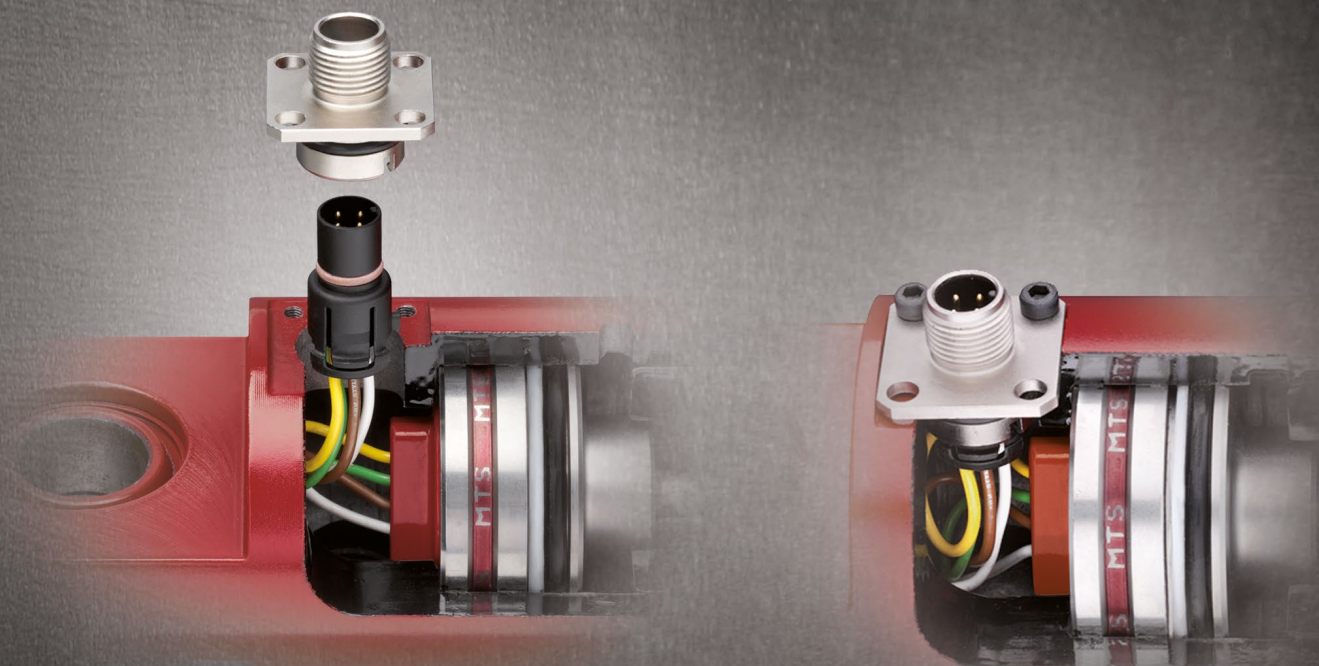
M12 CONNECTOR SYSTEM

The MTS Connector System M12 meets the highest protection requirements according to DIN EN 60529 - important for a harsh environment in mobile hydraulic applications. With protection type IP69K, the robust metal housing is not only absolutely dustproof, but penetration of water inside the cylinder is also prevented. It is able to withstand even extremely hard cleaning conditions using high-pressure equipment.

Click-on mounting without the need of any tools saves valuable mounting time and increases the safety of the sensor installation. The sensor is installed in the hydraulic cylinder and connected electrically within seconds. Time-consuming connection of the cable conductors, polarity errors or "dry" solder joints are a matter of the past!

The connector system is prefabricated and delivered in conjunction with the position sensor, i.e. its contact carrier is already connected to the sensor conductors. When mounting, the contact carrier is taken out of the cylinder through a bore hole, and the flanged housing can be clicked in position easily from outside. During installation of the cylinder unit into the mobile machine, the sensor can be connected at 8 different angles using a universal M12 connector.

The minimized installation height of the connector system ensures successful cylinder mounting even under limited space conditions.





SERIES QUICK GUIDE

	MH	FMH	MT	MS	MXR	MB	HE
TECHNOLOGY							
Magnetostrictive Technology	•	•	•	•	•	•	
Hall Effect Technology							•
OUTPUT							
Analog	•	•	•	•	•	•	•
CANbus	•	•		•	•		
FEATURES							
Position Measurement	•	•	•	•	•	•	•
Velocity Measurement	•			•	•		
M12 Connector	•	•	•	•	•	•	•
Ingress Protection IP69K	•	•	•	•	•	•	•
Embedded Installation	•		•	•			•
Threaded Version	•	•				•	•
External Mounting					•		
Ø 7 mm Pressure Pipe	•			•			
Ø 8 mm Pressure Pipe						•	
Ø 10 mm Pressure Pipe	•		•				•
Ø 12.7 mm Pressure Pipe		•					
SIL 2	•						
Redundancy			•				
5 VDC Operating Voltage					•		•
12 VDC Operating Voltage	•	•	•	•	•	•	•
24 VDC Operating Voltage	•	•	•	•	•		•
STROKE LENGTH							
100...500 mm					•	*	•
50...2500 mm	•	•	•	•			
2520...5000 mm	•	•					

MTS Sensors offers full application support. From design to production and logistics excellence. Contact us for free support.

* specific stroke lengths, see page 16



MH-SERIES MH

The Temposonics® MH-Series sensors are specifically designed for direct stroke measurement in hydraulic cylinders. MH-Series sensors can be fully sealed and embedded in a cylinder while providing excellent protection against the environment and EMI and ensures a long operating life. The MH-Series sensors can be installed from the head side or the rod side of the cylinder depending on the cylinder design. The MH sensor is also available as an external threaded installation. A Temposonics® M12 connector system ensures protection to IP69K. Various signal outputs (analog, digital) are available.

Output (resolution)

Analog	Voltage / Current (50...2500 mm: typ. ± 0.1 mm 2520...3500 mm: ≤ 0.5 mm 3520...5000 mm: ≤ 1.0 mm)
Digital	CANopen & SAE J1939 (Position: 0.1 mm; Velocity: 1 mm/s)

Operating conditions

Temperature	-40...+105 °C (-40...+221 °F)
Shock test	IEC 60068-2-27 50...2500 mm: 100 g (6 ms) single shock 50 g (11 ms) at 1000 shocks per axis 2520...5000 mm: 50 g (6 ms) single shock 15 g (11 ms) at 1000 shocks per axis
Vibration test	IEC 60068-2-64 50...2500 mm: 20 g (r.m.s.) (10...2000 Hz) – resonance frequencies excluded 2520...5000 mm: 5 g (r.m.s.) (10...2000 Hz) – resonance frequencies excluded
EMC	*

Design

Stroke length	50...5000 mm
---------------	--------------

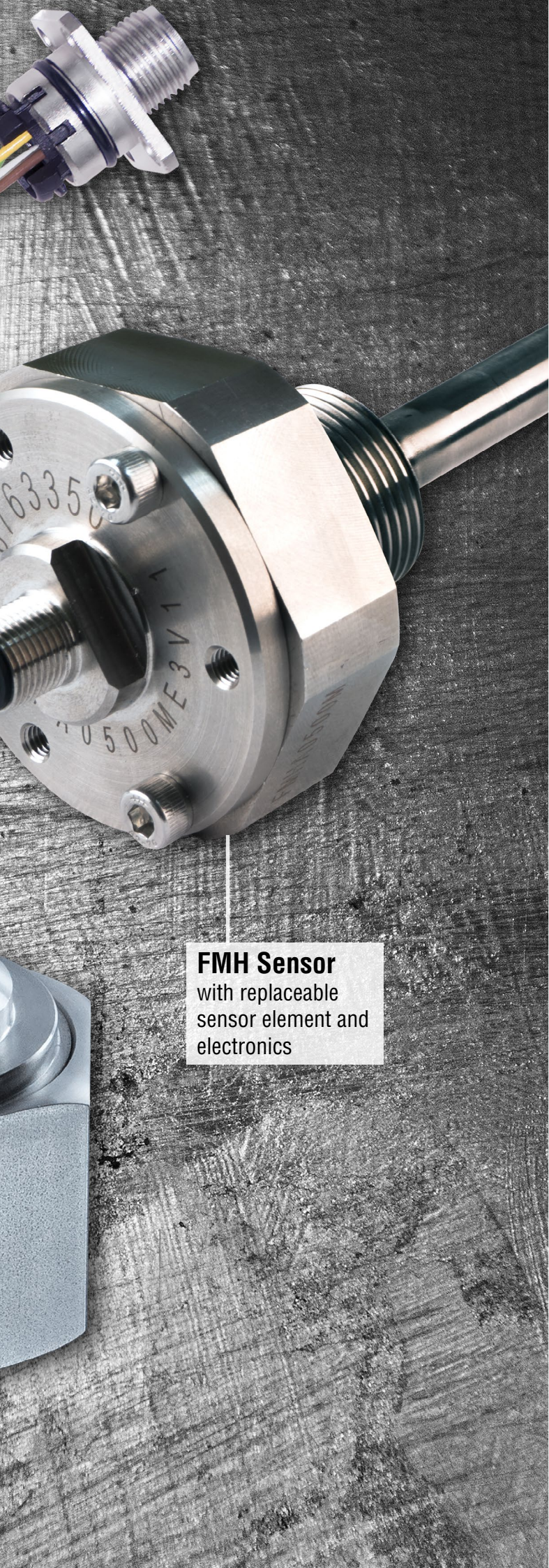
Electrical connection

Operating voltage	+12 / 24 VDC (-15 / +20 %)
-------------------	----------------------------

MH Sensor
with stroke
lengths up
to 5000 mm

MH Threaded
for external
threaded
installation

* Please refer to the data sheets available at:
www.mtssensors.com



FMH Sensor
with replaceable
sensor element and
electronics

MH-SERIES Flexible MH (FMH)

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.

Output (resolution)

Analog	Voltage / Current (± 0.2 mm)
Digital	CANopen & SAE J1939 (± 0.2 mm)

Operating conditions

Temperature	$-40 \dots +105$ °C ($-40 \dots +221$ °F)
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	*

Design

Stroke length	50...5000 mm
---------------	--------------

Electrical connection

Operating voltage	+12 / 24 VDC ($-15 / +20$ %)
-------------------	-------------------------------

* Please refer to the data sheets available at:
www.mtsensors.com

MH-SERIES MH SIL 2

The Temposonics® MH SIL 2 sensors are specifically designed for direct stroke measurement in hydraulic cylinders. The MH-Series sensors can be fully sealed and embedded in a cylinder which provides excellent protection against the environment and EMI and ensures a long operating life. The MH-Series sensors can be installed from the head side or the rod side of the cylinder depending on the cylinder design. A MTS M12 connector system ensures protection to IP69K. The MH Safety models are SIL (Safety Integrity Level) certified according to IEC 61508, they have a Performance Level (PL) in accordance with ISO 13849-1 and meet the EN 954-1 standard.

Output (resolution)

Analog	Voltage / Current (typ. ±0.1 mm)
Digital	CANopen Safety protocol according CiA DS-301 V4.1 (Position: 0.1 mm; Velocity: 1 mm/s)

Operating conditions

Temperature	-40...+105 °C (-40...+221 °F)
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 20 g (r.m.s.) (10...2000 Hz) – resonance frequencies excluded
EMC	*

Design

Stroke length	50...2500 mm
---------------	--------------

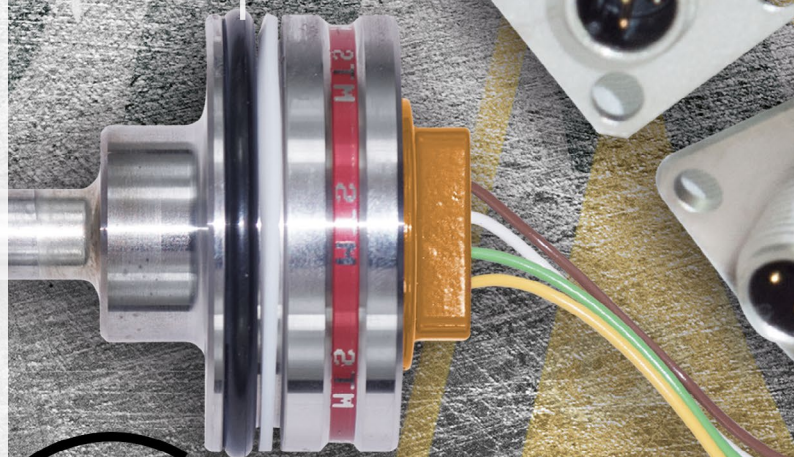
Electrical connection

Operating voltage	+12 / 24 VDC (-15 / +20 %)
-------------------	----------------------------

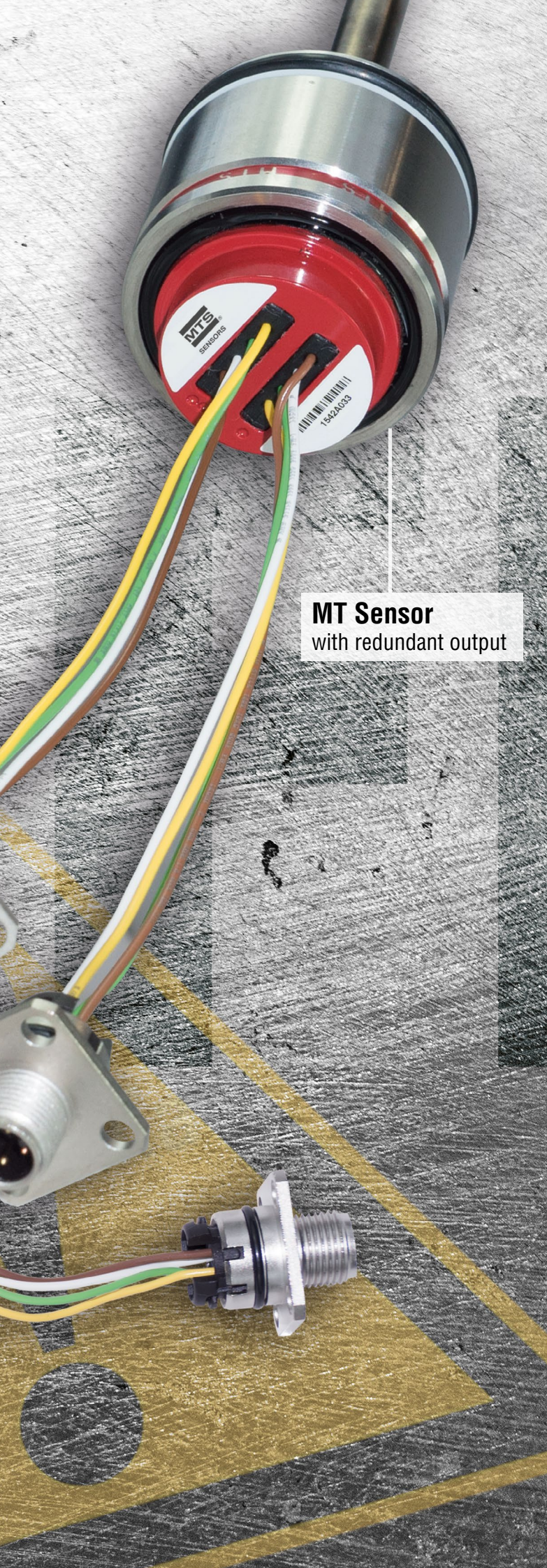
Safety Classification

IEC 61508	SIL2 (Device type B)
ISO 13849	PLd – Cat2

MH SIL 2 Sensor
with analog or digital output



* Please refer to the data sheets available at:
www.mtssensors.com



MT Sensor
with redundant output

MH-SERIES MT

MTS Sensors has developed the redundant position sensor Temposonics® MT to maximize safety and availability of mobile machines. The MT sensor is a redundant sensor with two discrete sensing elements, two discrete electronic boards and two discrete output connections. Both sensing elements are enclosed in a single pressure-resistant stainless steel rod for direct stroke measurement in the hydraulic cylinder, which provides excellent protection against the environment and EMI and ensures a long operating life. Dual MTS Sensors M12 connector systems ensure protection to IP69K.

Output (resolution)

Analog	Voltage / Current (typ. 0.1 mm)
--------	------------------------------------

Operating conditions

Temperature	-40...+105 °C (-40...+221 °F)
Shock test	IEC-60068-2-27 100 g (6 ms) single shock 50 g (11 ms) at 1000 Shocks per axis
Vibration test	IEC 60068-2-6 15 g (r.m.s) (10...2000 Hz)
EMC	*

Design

Stroke length	50...2500 mm
---------------	--------------

Electrical connection

Operating voltage	+12 / 24 VDC (-15 / +20 %)
-------------------	----------------------------

* Please refer to the data sheets available at:
www.mtssensors.com

MH-SERIES MS

The Temposonics® MS sensors are specifically designed for direct stroke measurement in hydraulic cylinders with bore diameters of 28 mm or greater. MS-Series sensors can be fully sealed and embedded in a cylinder which provides excellent protection against the environment and EMI and ensures a long operating life. The MS-Series sensors can be installed from the head side or the rod side of the cylinder depending on the cylinder design. A Temposonics® M12 connector system ensures protection to IP69K. Various signal outputs (analog, digital) are available.

Output (resolution)

Analog	Voltage / Current (Position: typ. 0.1 mm)
Digital	CANopen & SAE J1939 (Position: 0.1 mm; Velocity: 1 mm/s)

Operating conditions

Temperature	-40...+105 °C (-40...+221 °F)
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 15 g (r.m.s.) (10...2000 Hz) – resonance frequencies excluded
EMC	*

Design

Stroke length	Analog: 50...2500 mm Digital: 50...1500 mm
---------------	---

Electrical connection

Operating voltage	+12 / 24 VDC (-15 / +20 %)
-------------------	----------------------------

MS Sensor
for small diameter
installation



* Please refer to the data sheets available at:
www.mtssensors.com



MXR Sensor
for external mounting

MH-SERIES MXR

The MH-Series Model MXR sensor is ideal for retrofitting older equipment or for external mounting. The magnetostrictive sensor includes a stainless steel housing and can be mounted externally alongside a hydraulic cylinder. The MH-Series Model MXR sensor is available in two versions: the MXRC and the MXRS. Although the two versions are similar in both appearance and performance, there are unique features distinguishing the two sensors from one another. The MXRC is available in four discrete stroke lengths up to 250 mm, while the MXRS is available in stroke lengths from 100 to 500 mm (50 mm ordering increments). The MXRC works with a 5 VDC operating voltage, and provides a voltage output that is ratiometric to the operating voltage. The MXRS can work with an operating voltage of either 12 or 24 VDC, and has multiple analog and digital output options available.

Output (resolution)

Analog	Voltage / Current (Position: typ. 0.1 mm)
Digital	CANopen & SAE J1939 (Position: 0.1 mm; Velocity: 1 mm/s)

Operating conditions

Temperature	-40...+105 °C (-40...+221 °F)
Shock test*	IEC 60068-2-27 MXRS: 100 g single shock MXRC: 5 g single shock
Vibration test*	IEC 60068-2-6 MXRS: 15 g (10...2000 Hz) MXRC: 1 g (10...150 Hz)
EMC	**

Design

Stroke length	100...500 mm
---------------	--------------

Electrical connection

Operating voltage	+5 VDC, +12 / 24 VDC (-15 / +20 %)
-------------------	------------------------------------

* The shock and vibration rating is stated for a fully retracted sensor. The rating for full or partially extended sensor depends on the application

** Please refer to the data sheets available at:
www.mtssensors.com

MH-SERIES MB

The Temposonics® MB sensors are designed for threaded port assembly in hydraulic cylinders. The MB sensor works with a 12 VDC operating voltage, and provides a voltage output. A Temposonics® M12 connector system ensures protection to IP69K.

Output (resolution)

Analog	Voltage (infinite)
--------	-----------------------

Operating conditions

Temperature	-40...+75 °C (-40...+167 °F)
Shock test	IEC-60068-2-27 50 g (6 ms) single shock 50 g (11 ms) at 1000 shocks per axis
Vibration test	IEC 60068-2-64 15 g sinus (10...2000 Hz)
EMC	*

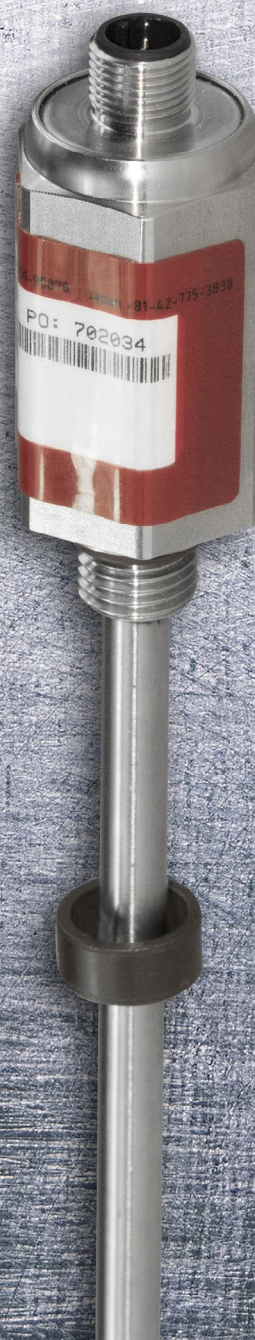
Design

Stroke length	72, 109, 128, 148, 162, 186, 194, 217, 250 mm
---------------	---

Electrical connection

Operating voltage	+12 VDC (±25 %)
-------------------	-----------------

MB Sensor
for threaded port assembly



* Please refer to the data sheets available at:
www.mtssensors.com

HE-SERIES

with Hall effect technology

The HE-Series utilizing Hall effect technology is specifically designed for direct stroke measurement in hydraulic cylinders with bore diameters of 25 mm or greater. With virtually no dead zone, tight pin to pin measurements can be achieved. HE sensors can be fully sealed and embedded in a cylinder which provides excellent protection against the environment and EMI and ensures a long operating life. With six different mounting styles, the HE sensors can be installed externally from the head side or internally from the rod side of the cylinder depending on the cylinder design. A Temposonics® M12 connector system ensures protection to IP69K. Analog signal outputs are available.

Output (resolution)

Analog	Voltage / Current (< 0.2 mm)
--------	------------------------------------

Operating conditions


Temperature	$-40 \dots +85$ °C ($-40 \dots +185$ °F)
Shock test	IEC 60068-2-27 < 250 mm stroke length: 25 g single shock > 250 mm stroke length: 20 g single shock
Vibration test	IEC 60068-2-6 15 g (r.m.s.) (10...2000 Hz)
EMC	*

Design

Stroke length	100...500 mm
---------------	--------------

Electrical connection

Operating voltage	+5, +12, +24 VDC
-------------------	------------------



HE Sensor
with Hall effect technology

* Please refer to the data sheets available at:
www.mtssensors.com

LOCAL SUPPORT WORLDWIDE



CUSTOMER SUPPORT

Our customer-focused experts are highly trained in both pre- and post-sales support. They will help you personally with questions about ordering and delivery times.



APPLICATION SUPPORT

A team of highly qualified engineers with extensive practical knowledge is available to help you achieve the optimal solution – whether it is selecting the right sensor for your specific application or troubleshooting an existing installation.



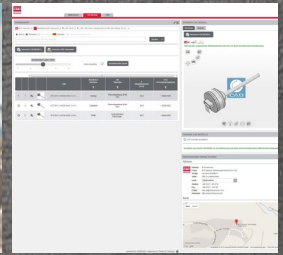
INNOVATION WORKSHOP

MTS Sensors can partner with you to develop joint solutions for meeting the industry's most challenging problems. Our workshops provide a forum for exchanging product and solution roadmaps that drive innovation and development. When we work together on creative solutions, we find that nothing is impossible.



START-UP & ONSITE SERVICE

Our engineers provide exceptional support to guarantee smooth integration and ongoing performance and reliability for your sensor implementation. Local support, along with a network of distributors worldwide, enable onsite visits. Our goal is to increase your productivity and efficiency.



DIGITAL SUPPORT

We continually invest in new solutions and improved product performance. In addition, a wealth of technical documentation, CAD models and software updates are available through our website.

AMERICAS & OCEANIA

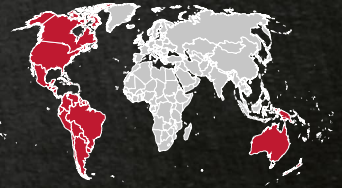
MTS Systems Corporation

Sensor Division

U.S.A.

Tel. +1-919-677-0100

info.us@mtssensors.com



EUROPE, AFRICA & MIDDLE EAST

MTS Sensor Technologie GmbH & Co. KG

Germany

Tel. +49-23 51-95 87 0

info.de@mtssensors.com



MTS Systems SAS

France

Tel. +33-1 58 43 90 28

info.fr@mtssensors.com

MTS Systems Srl. Sensor Division

Italy

Tel. +39-030 988 38 19

info.it@mtssensors.com

ASIA

MTS Sensors Technology Corp.

Japan

Tel. +81-42-775-3838

info.jp@mtssensors.com



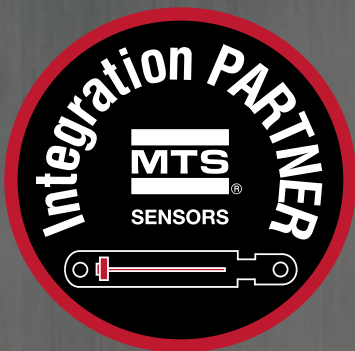
MTS Sensors

China

Tel. +86-21 6485 5800

info.cn@mtssensors.com

www.mtssensors.com



The MTS Integration Partner program brings together the position-sensing technology and expertise of MTS Sensors with hydraulic cylinder manufacturers, and system integrator partners to develop complete system solutions that meet OEM needs.

Strong Partnership. Complete system solutions.

Document Part Number: 605080 Revision C (EN) 11/2016

LEGAL NOTICES MTS, Temposonics and Level Plus are registered trademarks of MTS Systems Corporation in the United States; MTS SENSORS and the MTS SENSORS logo are trademarks of MTS Systems Corporation within the United States. These trademarks may be protected in other countries. All other trademarks are the property of their respective owners. Copyright © 2016 MTS Systems Corporation. No license of any intellectual property rights is granted. MTS reserves the right to change the information within this document, change product designs, or withdraw products from availability for purchase without notice. Typographic and graphics errors or omissions are unintentional and subject to correction. Visit www.mtssensors.com for the latest product information.