



Temposonics

AN AMPHENOL COMPANY

SENSOR SELECTOR GUIDE

Magnetostrictive Linear and Hall Effect Position Sensors

Mobile Hydraulics

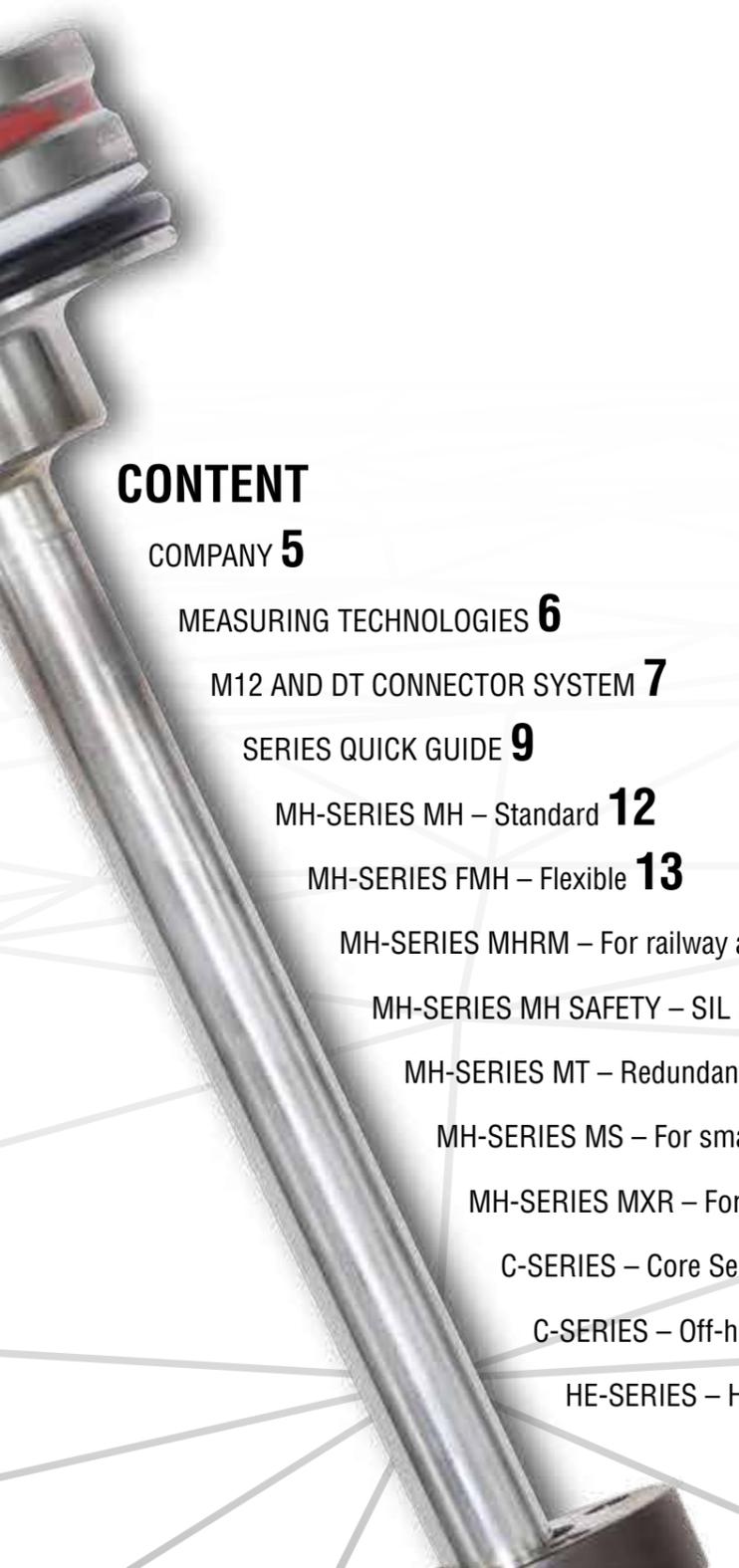




MEETING THE CHALLENGES OF MOBILE HYDRAULICS APPLICATIONS

Agricultural • Construction • Forestry • Mining • Handling & Logistics • Municipal Vehicle • Railway Vehicle • Marine & Offshore Applications

Temposonics also offers solutions for industrial and liquid level applications.



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COMPANY

Temposonics is recognized as an industry leader in sensing technologies and solutions. These sensors and transmitters permit high-precision and dynamic position and/or speed measurement in state-of-the-art automation and safety-relevant systems. With a versatile and ever-increasing product portfolio and a focus on superior regional support, Temposonics 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.

Temposonics is part of Amphenol Corporation (NYSE: APH). Amphenol is one of the largest manufacturers of interconnect products in the world. The company designs, manufactures and markets electrical, electronic and fiber optic connectors, coaxial and flat-ribbon cable, and interconnect systems. As sensor solutions manufacturer, Temposonics matches the portfolio of the group of companies that are all part of Amphenol, enabling customers to benefit from an extended, complementary product selection.

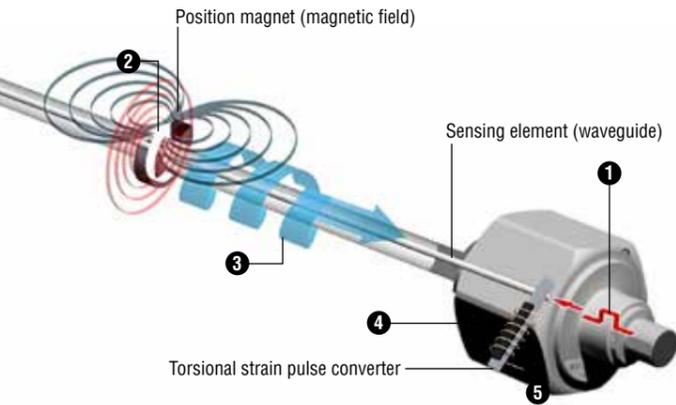
Pioneers and innovators since 1975.

INNOVATIVE TECHNOLOGY

Our mission at Temposonics is to provide outstanding quality and application knowledge. We focus on understanding your challenges and delivering the best sensor solution to let you attain the highest level of productivity. Our resources are dedicated to the continual development of new products and delivering unparalleled application-oriented solutions with agility. It is no coincidence that our R&D is one of the largest team within our organization. .

Trust the experts.

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 Temposonics rely on the company's proprietary magnetostrictive Temposonics® technology, which can determine position with a high level of precision and robustness.

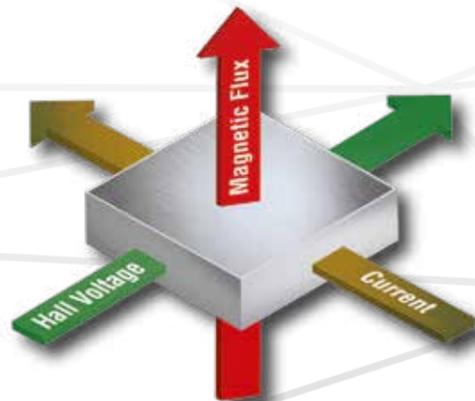
Each position sensor consists of a ferromagnetic waveguide, a position magnet, a strain pulse converter and supporting electronics. The magnet, connected to the object in motion in the application, generates a magnetic field at its location on the waveguide.

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 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 magnetostrictive technology corresponds to an absolute position, rather than a relative value, it is not required to recalibrate sensors.

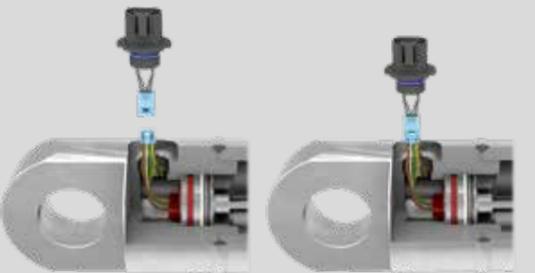
Hall Effect

Temposonics 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 and DT connector system

Temposonics offers OEMs and cylinder manufacturers the most popular connector systems to make connections faster, more reliable and cost-effective.

	M12 connector system	DT connector system
Cylinder Installation		
Ingress Protection IP69K	<ul style="list-style-type: none"> Absolutely tight, meets the requirements of IP67 and IP69K according to DIN EN 60529 Prevents the ingress of liquids and protects against corrosion Suitable for high-pressure cleaners 	
Simple Assembly	<ul style="list-style-type: none"> Insert the sensor into the cylinder Lead the contact carrier out through the hole Connect the threaded flange and the contact carrier with a "click" Press the threaded flange into the bore Screw in the fixing screws DONE! The assembly is completed in a minute 	<ul style="list-style-type: none"> Insert the sensor into the cylinder Lead the intermediate plug out through the hole Connect the DT connector flange with a "click" Press the DT connector flange into the bore hole Press the crown disc for fixing DONE! The assembly is completed in a minute
Delivery	M12 and DT connector systems are ready for connection and are supplied together with the position sensors.	



QUICK GUIDE

	MH	FMH	MHRM	MT	MS	MXR	C	C	HE
	Standard	Flexible	For Railway Applications	Redundant	For Smaller Bore Cylinders	For External Mounting	C-Series Core Sensor	C-Series Off-Highway	Hall Effect Sensor

TECHNOLOGY									
Magnetostrictive Technology	•	•	•	•	•	•	•	•	•
Hall Effect Technology									•

OUTPUT									
Analog	•	•	•	•	•	•	•	•	•
CANbus	•	•			•	•			

FEATURES									
Position Measurement	•	•	•	•	•	•	•	•	•
Velocity Measurement	•	•			•	•			
M12 Connector (IP69K)	•	•	•	•	•	•	•	•	•
DT Connector (IP67&IP69K)*	•								
Embedded Installation	•		•	•	•				•
Threaded Version	•	•	•				•		•
External Mounting						•			
Ø 4 mm Pressure Pipe								•	
Ø 7 mm Pressure Pipe	•		•		•				
Ø 8 mm Pressure Pipe							•		
Ø 10 mm Pressure Pipe	•		•	•					•
Ø 12.7 mm Pressure Pipe		•							
SIL 2 capable	•								
Redundancy				•					
5 VDC Operating Voltage						•	•		•
12 VDC Operating Voltage	•	•	•	•	•	•	•		•
24 VDC Operating Voltage	•	•	•	•	•	•		•	•

STROKE LENGTH									
100...500 mm						•			•
72...275 mm							**	**	
50...2500 mm	•	•	•	•	•				
2520...5000 mm	•	•							

Temposonics offers full application support – from design to production and logistics excellence. Contact us for free support.

* only for in-cylinder

** specific stroke lengths, see page 20 and 21

SAVE YOUR TIME FOR THE THINGS YOU LOVE.

...trust the experts!

Have you ever thought about how much time you're wasting waiting for adequate support or your order?

Our commitment at Temposonics is to consistently deliver quality products on time to meet your schedules and provide first-class service. Trust in our continuous product development of high-performance position sensors and rely on our highly qualified personnel.

At Temposonics, we live by the promise of unparalleled service that enables us to take all available means to exceed your expectations. Our goal is to support you optimizing your productivity and we love the idea to make you save your valuable time.

Your Temposonics Team



MH-SERIES MH Standard (In-Cylinder & External Threaded)

The Temposonics® MH-Series is specifically designed for direct stroke measurement in hydraulic cylinders. The MH 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. They 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. The user can choose between the M12 and the DT connector system - both meet the requirements of IP67 and IP69K according to DIN EN 60529. Various signal outputs (Analog, CANbus) are available.

MH Sensor
with DT connector system

MH Sensor
with M12 connector system



MH Threaded
for external
threaded installation



FMH Sensor
with replaceable
sensor element and
electronics

Output (resolution)

Analog	Voltage/Current (50...2500 mm: typical ± 0.1 mm 2520...3500 mm: ≤ 0.5 mm 3520...5000 mm: ≤ 1.0 mm)
CANbus	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 20 g (r.m.s.) \varnothing 10 mm pressure pipe (10...2000 Hz) 15 g (r.m.s.) \varnothing 7 mm pressure pipe (10...2000 Hz) – excluding resonant frequencies
EMC	For more information see data sheet

Design

Stroke length	50...5000 mm
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Electrical connection

Operating voltage	+12/24 VDC (8...32 VDC)
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MH-SERIES FMH (Flexible MH) Easy In-Field Serviceability

Designed for use with hydraulic cylinders in mobile applications, the externally threaded Temposonics® FMH sensor features an innovative two-part design. This design allows users to separate flexibly the 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 shipped as coiled rings to ease handling and reduce shipping costs.

Output (resolution)

Analog	Voltage/Current (± 0.2 mm)
CANbus	CANopen/SAE J1939 (± 0.2 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 60068-2-64 2 g (5...2000 Hz)
EMC	For more information see data sheet

Design

Stroke length	CAN: 500...5000 mm Analog: 500...5000 mm
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Electrical connection

Operating voltage	+12/24 VDC (8...32 VDC)
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MH-SERIES MHRM For Railway Applications

The MHRM sensor has been developed especially for railway applications and extends the portfolio of the Temposonics® MH-Series sensors. It is compliant with EN 50121-3-2 and meets the special requirements for shock according to EN 61373 Cat2 (Bogie) and Cat3 (Axle), vibration according to IEC 60068-2-64 Fn Cat3 (Axle) and EMC according to DIN EN 50155.

Because of its two mounting styles, the sensor is applicable i.a. for inclination controls, in damping units or in rail processing vehicles. All MHRM sensors use the M12 connector system which meets the protection requirements to IP69K.

Output (resolution)

Analog	Voltage/Current (typical ± 0.1 mm)
Linearity	50...250 mm: ≤ 0.1 mm 255...2000 mm: ± 0.04 % (F.S.) 2005...2500 mm: ≤ 0.8 mm
Hysteresis	≤ 0.2 mm

Operating conditions

Temperature	MHRM Embedded: $-40...+105$ °C ($-40...+221$ °F) MHRM Threaded: $-40...+105$ °C ($-40...+221$ °F)
Shock test	EN 61373 Cat2 (Bogie) and Cat3 (Axle)
Vibration test	IEC 60068-2-64 Fn Cat3 (Axle)
EMC	For more information see data sheet

Design

Stroke length	50...2500 mm
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Electrical connection

Operating voltage	+12/24 VDC (8...32 VDC)
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MHRM Embeddable Sensor
for in-cylinder integration

InterConnection Plug
M12 system plug or cable

MHRM Threaded
for external
threaded installation

**DEVELOPED
FOR
RAILWAY APPLICATIONS**

MH-SERIES MH SAFETY SIL 2/PLd

The Temposonics® MH SAFETY 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 Temposonics M12 connector system ensures protection to IP69K. The MH Safety models are designed according to the design principles of the IEC 61508 (Safety Integrity Level 2). They have a Performance Level d (PL) in line with EN ISO 13849-1.

Output (resolution)

Analog	Voltage/Current (typical ±0.1 mm)
CANbus	CANopen Safety protocol according EN 50325-5 (Position: 0.1 mm; Velocity: 1 mm/s)

Operating conditions

Temperature	-40...+100 °C (-40...+212 °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 25 g (sinusoidal) (10...2000 Hz)
EMC	For more information see data sheet

Design

Stroke length	50...2500 mm
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Electrical connection

Operating voltage	+12/24 VDC (8...32 VDC)
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Safety Classification

IEC 61508	SIL 2 (Device type B)
EN ISO 13849-1	PLd / Category 2

Approvals

E1 type-approved

SIL 2
MH SAFETY SENSOR

MH SAFETY Sensor
with Analog or CANbus output



MT Sensor
with redundant output

MH-SERIES MT Redundant

Temposonics has developed the redundant position sensor MT to maximize safety and availability of mobile machines. The MT sensor is a redundant sensor with two discrete sensing elements, electronic boards and 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 Temposonics M12 connector systems ensure protection to IP69K.

Output (resolution)

Analog	Voltage/Current (typical 0.1 mm)
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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 (sinusoidal) (10...2000 Hz)
EMC	For more information see data sheet

Design

Stroke length	50...2500 mm
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Electrical connection

Operating voltage	+12/24 VDC (8...32 VDC)
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MH-SERIES MS For Smaller Bore Cylinders

The Temposonics® MS sensors are specifically designed for direct stroke measurement in hydraulic cylinders with bore diameters of 28 mm or larger. They 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 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, CANbus) are available.

Output (resolution)

Analog	Voltage/Current (Position: Typical 0.1 mm)
CANbus	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)
EMC	For more information see data sheet

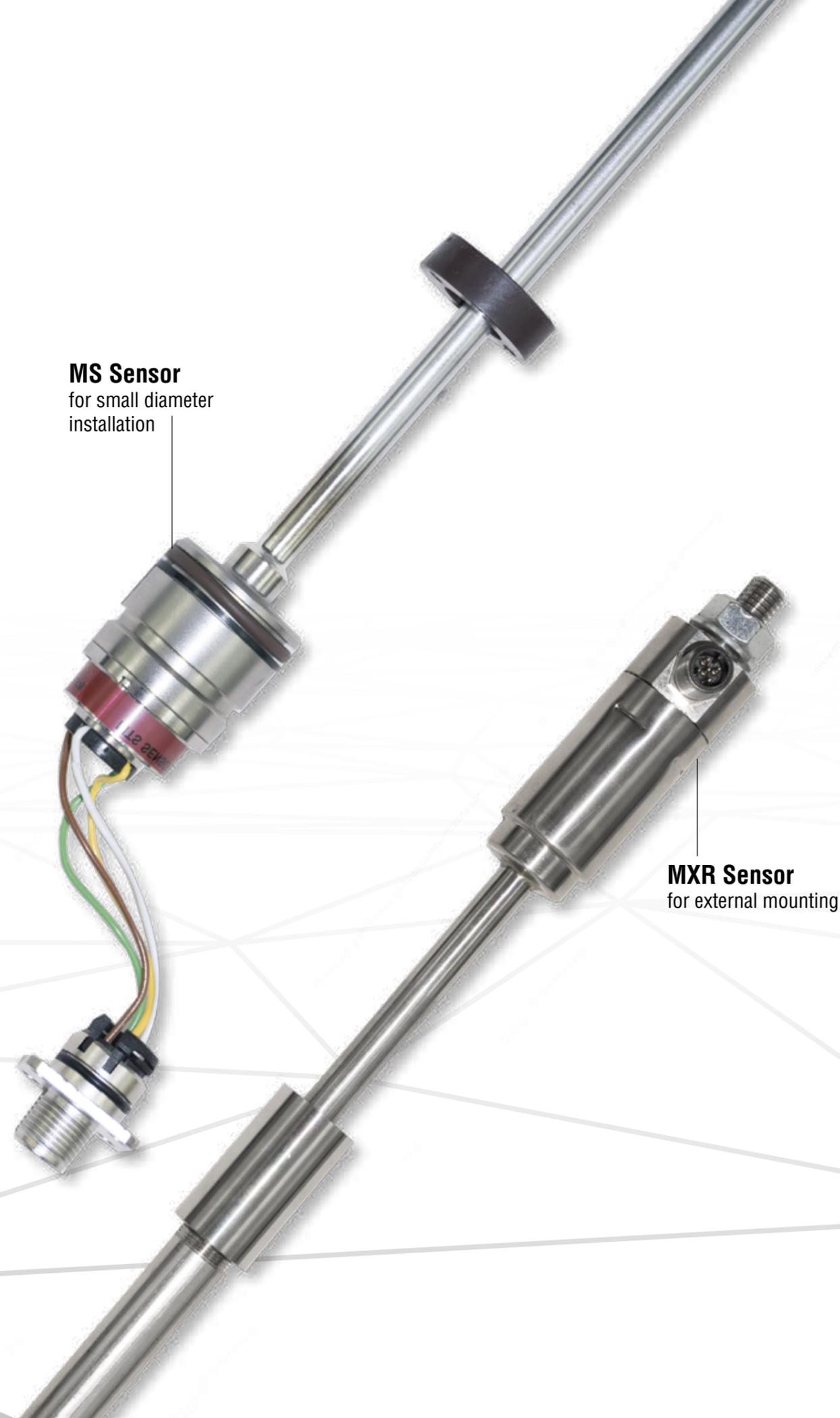
Design

Stroke length	Analog: 50...2500 mm CANbus: 50...1500 mm
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Electrical connection

Operating voltage	+12/24 VDC (8...32 VDC)
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More information available at:
www.temposonics.com



MH-SERIES MXR External Mount

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. 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: Typical 0.1 mm)
CANbus	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	For more information see data sheet

Design

Stroke length	MXRS: 100...500 mm MXRC: 100...250 mm
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Electrical connection

Operating voltage	+12/24 VDC (8...32 VDC)
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* The shock and vibration rating is stated for a fully retracted sensor. The rating for full or partially extended sensor depends on the application

More information available at:
www.temposonics.com

C-SERIES Core Sensor

The Temposonics® C-Series is the smallest sensor series on the market that offers all the advantages of magnetostrictive measurement technology. This makes the C-Series ideal for integration in small applications. The low weight allows installation in small portable OEM products. Due to the contact-free measuring principle, the sensor is completely wear-free and does not have to be readjusted again. In addition, the C-Series is cost-effective and has low energy requirements with an operating supply from 5 VDC or 12 VDC.

Output (resolution)

Analog	Voltage (infinite)
PWM	Controller dependent

Operating conditions

Temperature	-40...+75 °C (-40...+167 °F)
Shock test	IEC-68-2-27 10 g (11ms) single hit 10 g (11ms) 1000 shocks per axis
Vibration test	IEC 68-2-6 (10...2000 Hz) 10 g (sinusoidal) excluding resonant frequencies
EMC	For more information see data sheet

Design

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

Operating voltage	CS: 5 VDC (tolerance range 4.75...5.5 VDC), CM: 12 VDC (tolerance range 9...15 VDC)
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C-Series
Core Sensor



C-Series
Off-highway

C-SERIES Off-Highway

The Temposonics® C-Series mobile sensor is designed for battery powered off-highway applications found on mobile paving machines, agricultural equipment, watercraft, recreational vehicles, and others. It is ideal for measuring small cylinder strokes that are restricted by size and weight. Due to the contact-free measuring principle, the sensor is completely wear-free and does not have to be readjusted again.

Output (resolution)

Analog	0.3 mm
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Operating conditions

Temperature	-40...+85 °C (-40...+185 °F)
Shock test	Survival test with pressure pipe: IEC 60068-2-27, 100 g (6 ms) single shock per axis; IEC 60068-2-29, 50 g (11 ms) at 1000 shocks per axis
Vibration test	Survival random vibration test with pressure pipe: IEC 60068-2-64 15 g RMS 20...2000 Hz 12 h per axis Operational sine vibration test with pressure pipe: IEC 60068-2-6 (5...2000 Hz) 25 g (10 mm) 6 sweeps per axis
EMC	For more information see data sheet

Design

Stroke length	72, 109, 128, 148, 162, 186, 194, 217, 250, 275 mm
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Electrical connection

Operating voltage	12/24 VDC (8...32 VDC)
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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 larger. 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...+85 °C (-40...+185 °F)
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Shock test	IEC 60068-2-27 50 g/10 ms up to 500 mm sensor length 100 g/6 ms up to 180 mm sensor length
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Vibration test	IEC 60068-2-6 15 g (r.m.s.) (10...2000 Hz) DIN EN 60068-2-64 15 g (r.m.s. random)
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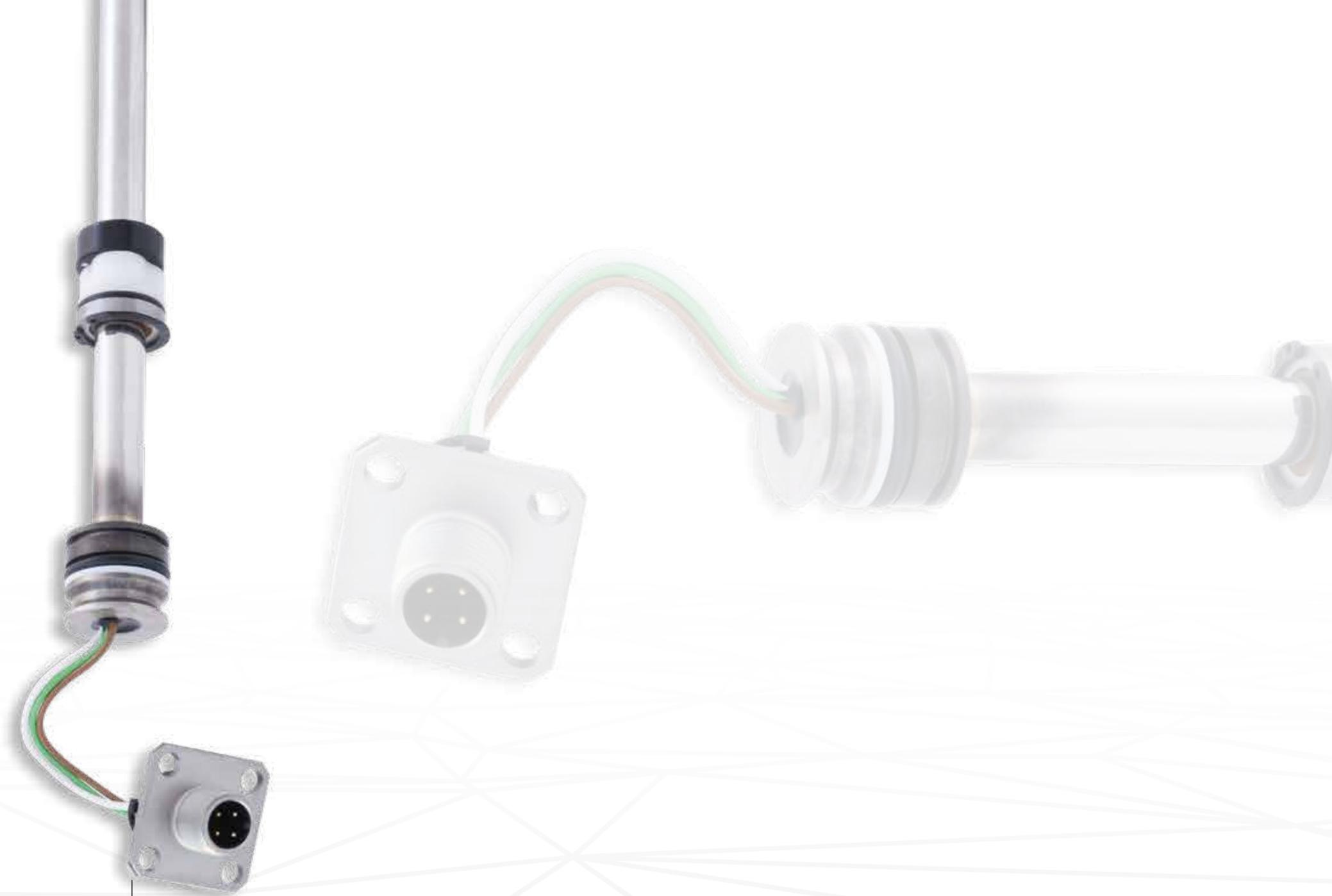
EMC	For more information see data sheet
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Design

Stroke length	100...500 mm
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Electrical connection

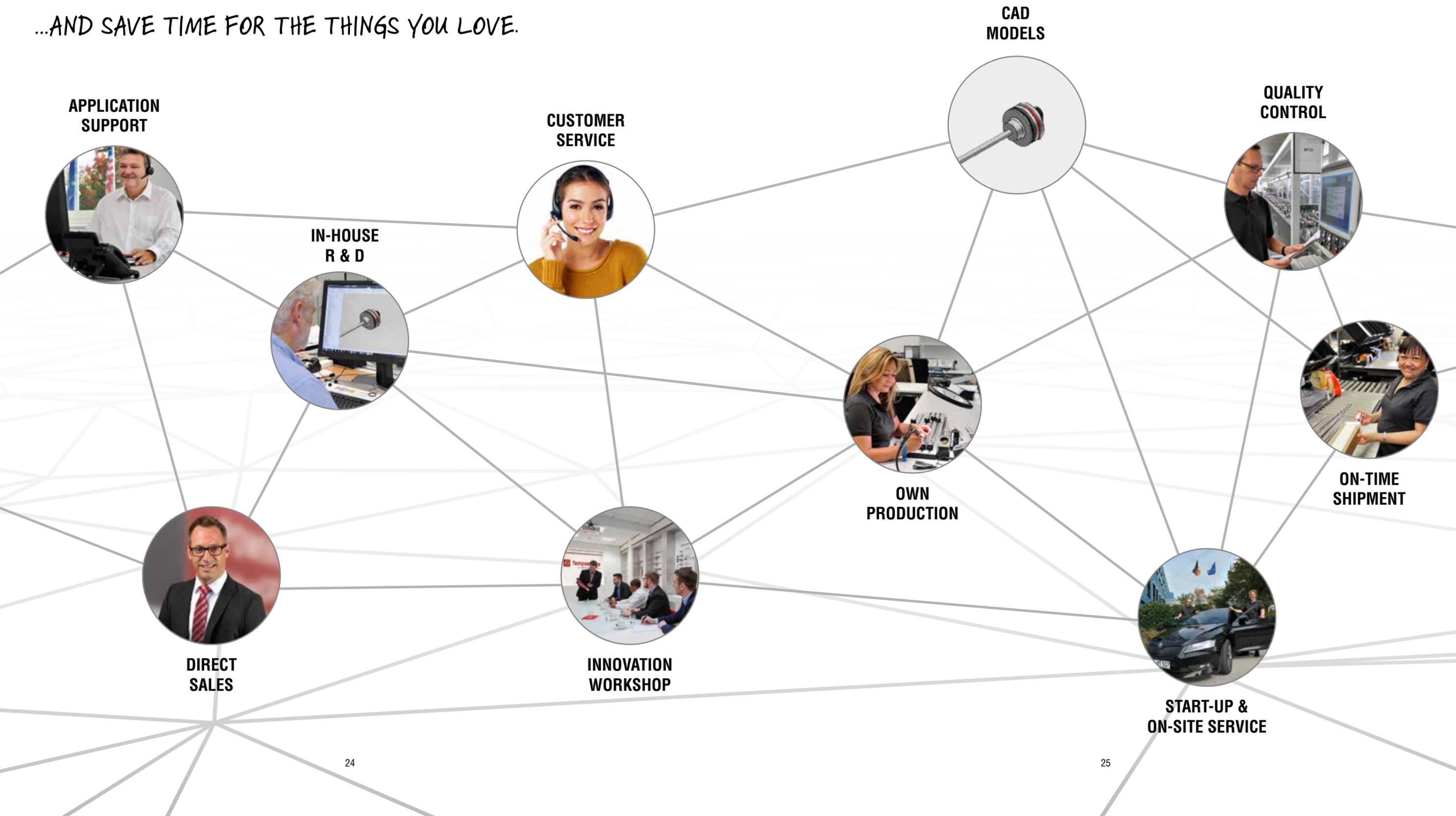
Operating voltage	+5, +12, +24 VDC (4.75...32 VDC)
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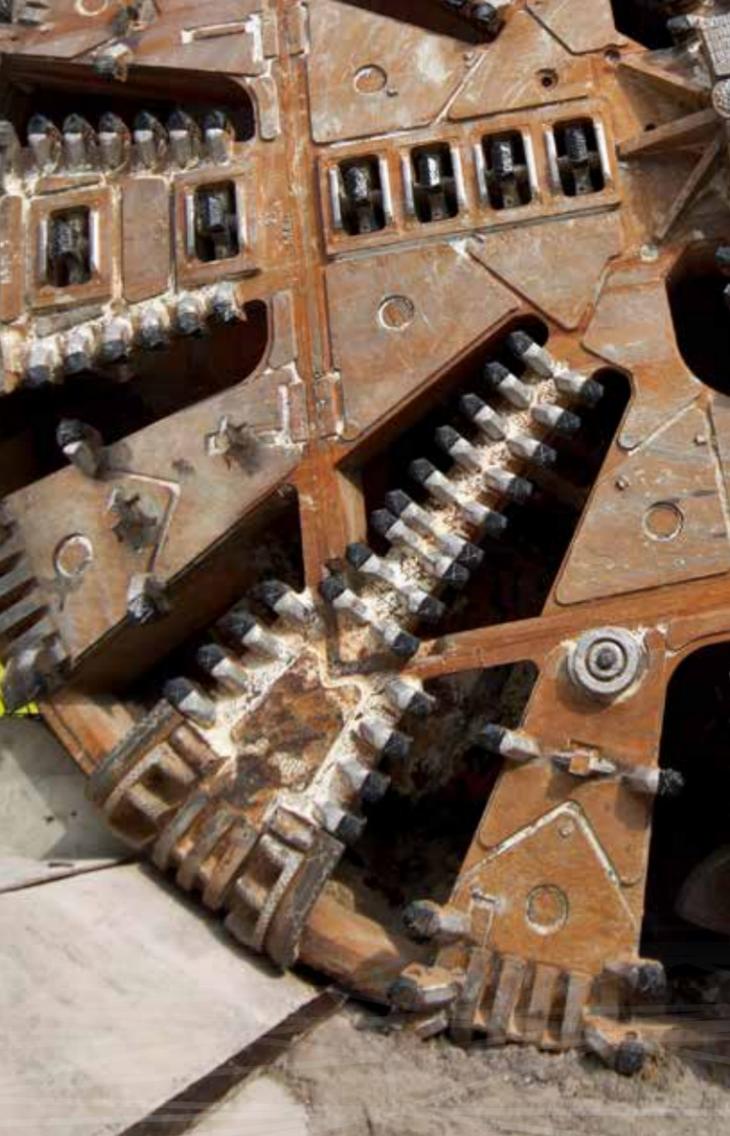


HE Sensor
with Hall Effect technology

TRUST THE EXPERTS

...AND SAVE TIME FOR THE THINGS YOU LOVE.





MEETING THE CHALLENGES OF MOBILE HYDRAULICS APPLICATIONS

The Temposonics® position sensors for mobile machinery are specifically designed for direct stroke measurement either mounted externally or within the hydraulic cylinder. Due to their reliability, these sensors increase the productivity, automate recurring operation sequences and reduce maintenance and downtime. Even in harsh environments under high vibration and high pressure they work reliably and maintenance-free because of its ruggedness.

Temposonics also offers solutions for industrial and liquid level applications.

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