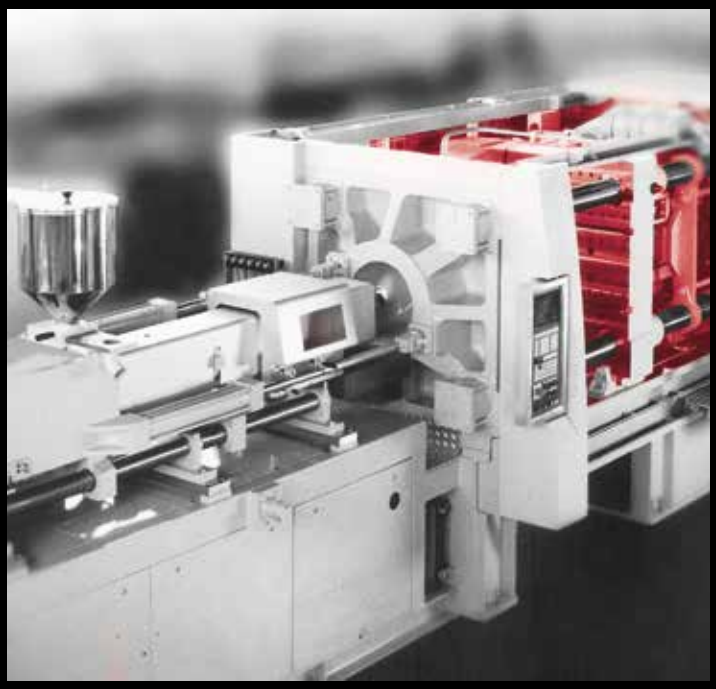
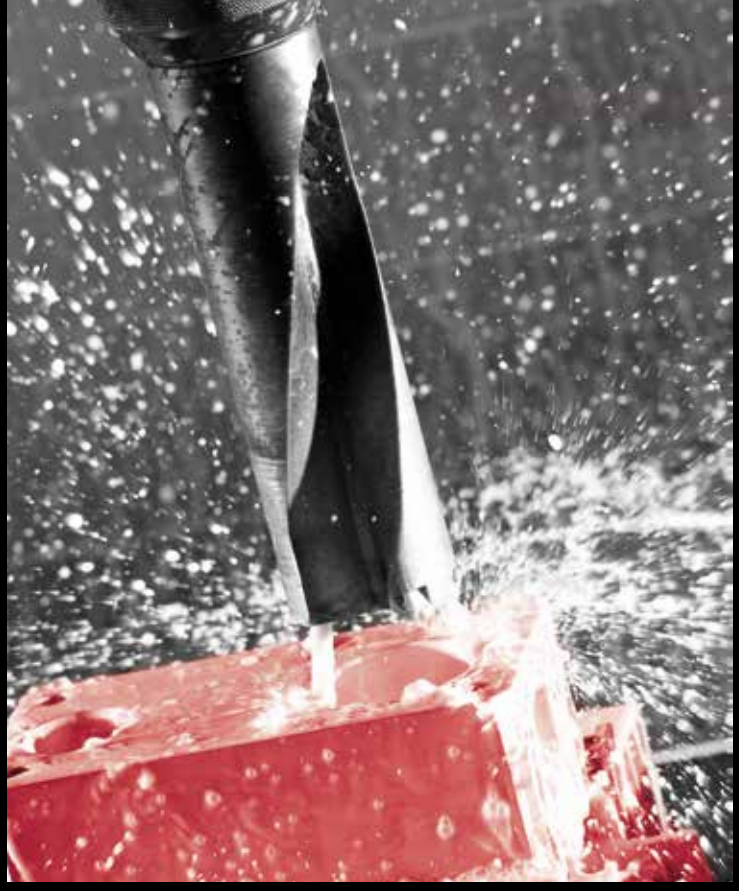
MTS SENSORS

TEMPOSONICS® POSITION SENSORS FOR INDUSTRIAL APPLICATIONS

PRODUCT SELECTOR GUIDE





MEETING THE CHALLENGES **OF INDUSTRIAL APPLICATIONS**

Metal Working • Wood Processing • Testing Machines • Drive Technology • Machine Tools • Packaging & Printing Machineries • Paper & Glass Processing • Food & Beverage Plants • Plastics & Rubber Processing • Textiles Production • Renewable Energy • Power Generation

MTS Sensors also offers solutions for Mobile Hydraulics (off-highway vehicles) and Liquid Level applications

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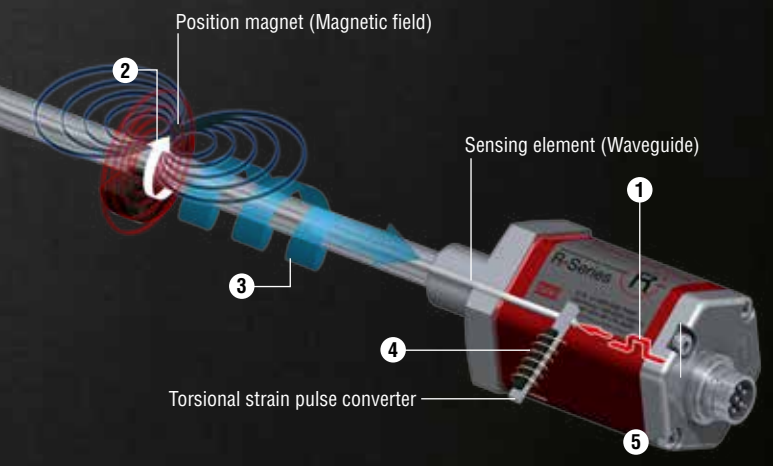
COMPANY

MTS Sensors is recognized as an industry leader in sensing technologies and solutions that enable feedback control for automation and safety applications.

MTS Sensors, a division of MTS Systems Corporation (NASDAQ:MTSC), serves its global customers with a focus on superior regional support. Today, MTS has over 2400 employees worldwide – 400 of whom are employed by MTS Sensors at its four sites: USA (Cary, N.C.), Germany (Lüdenscheid), Japan (Tokyo) and China (Shanghai).

Through its research, development and production of advanced sensing devices, MTS Sensors creates solutions that serve industrial manufacturing, off-highway equipment, liquid level measurement sectors, as well as many other applications and markets. With a diverse and constantly expanding product portfolio, the company is continually working with customers to improve performance and reduce downtime in their operations.



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

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.

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.

SUPERIOR PERFORMANCE

Have a challenging application?
Need reliable performance combined with resistance to high temperature, dirt and vibration?

Extreme demands require extraordinary solutions. MTS Sensors responds to this with an extensive range of measuring stroke options, simultaneous measurement of multiple magnets, smart electronic designs with built-in diagnostics, innovative housing concepts and a wide variety of controller interfaces. Our Temposonics® magnetostrictive technology is maximized with powerful electronics and double-shielded construction that assures immunity against interference. The robust designs guarantee maximum reliability, high-precision position measurements and long term operation in the harshest environments.

Success where others fail.

20 METERS POSITIONS AND MORE

COMPACT SOLUTIONS

Need a reliable sensing solution designed for limited space or difficult access?

In line with your application requirements, MTS Sensors delivers solutions which fit your exact needs in terms of design and performance – from ultra-low profiles and detached electronics to compact hazardous area approved housings. In food & beverage, plastics, textiles and other industries, Temposonics® technology guarantees maximum productivity.

Always the smartest solution.


Temposonics
E-Series
E

MAXIMUM SAFETY

Have an explosive environment or a dangerous area?

Temposonics® sensors from MTS Sensors are the first choice when it comes to meeting safety and hazardous area standards – including SIL 2, ATEX and IECEx Zone 0 / 1 and Zone 21. Optimized for safe use in settings where there is potential for exposure to flames and caustic substances, as well as the possibility of explosive atmospheres, our sensors are highly suited to implementation in chemical plants, offshore oil / gas rigs and other applications of this kind.

Maximum safety for machines and their operators.

INNOVATIVE TECHNOLOGY

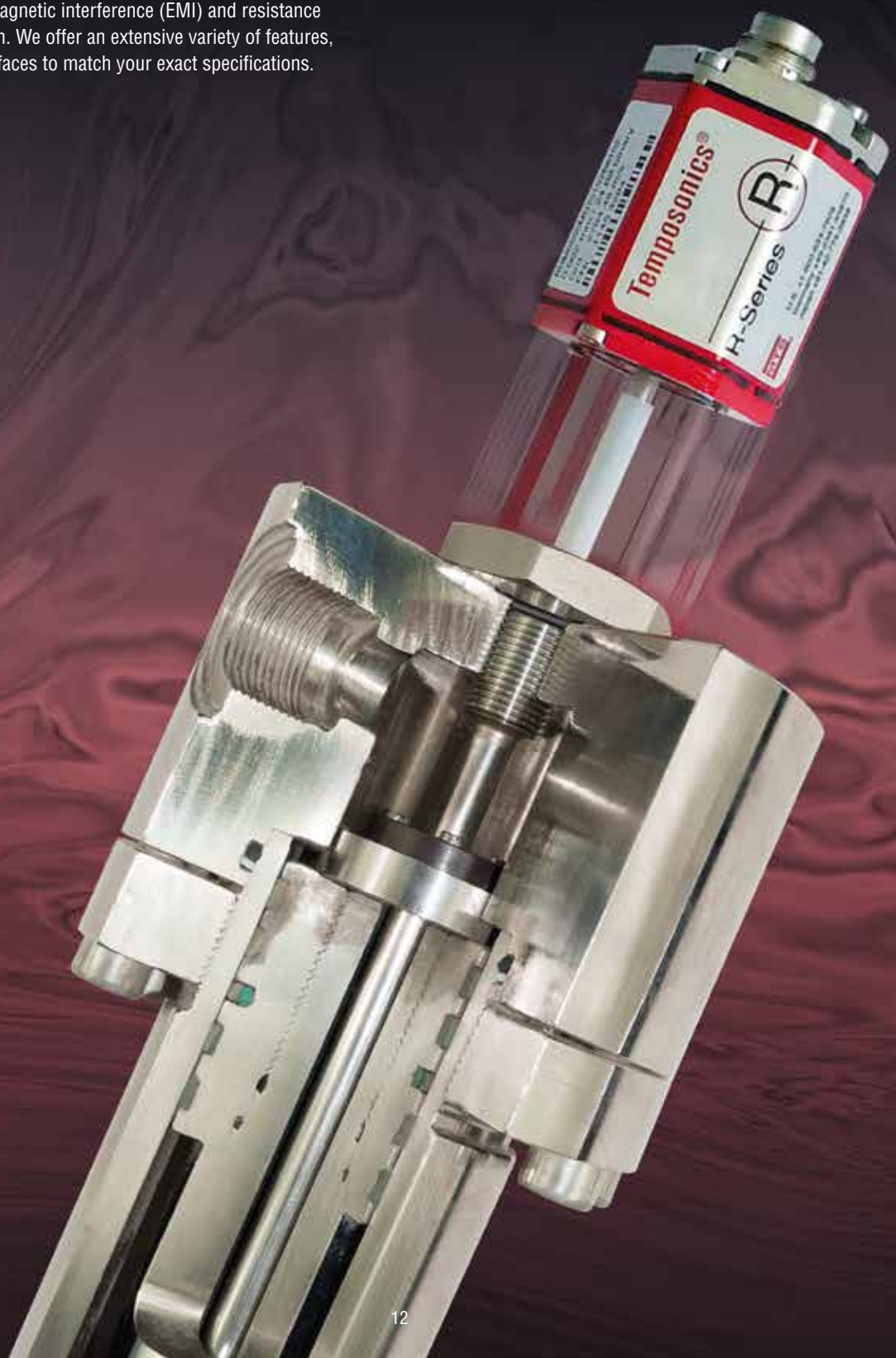
Our mission at MTS Sensors is to provide outstanding quality and application knowledge. We focus on understanding your requirements so you can attain the highest levels of productivity and that success is assured. Our resources are dedicated to the continual development of new products and delivering unparalleled application-oriented solutions to market with speed and agility. It is no coincidence that the engineering team at MTS Sensors is the largest professional team within our organization.

Pioneers and Innovators.

IN-CYLINDER APPLICATIONS

The rod style sensor models from MTS Sensors are designed for direct stroke measurement inside prepared hydraulic or pneumatic cylinders. High performance, durability and value have made our Temposonics® sensors the standard for in-cylinder applications in the fluid power industry.

In addition, these sensors feature high degrees of linearity, immunity to electromagnetic interference (EMI) and resistance to shock and vibration. We offer an extensive variety of features, dimensions and interfaces to match your exact specifications.



MODULAR DESIGN

At the head of our sensors, a threaded flange and O-ring allow the device to be mounted and sealed into a port opening in the cylinder end cap. Alternatively, some sensor designs enable direct embedding of the complete sensor (including the supporting electronics) inside the cylinder. Here the sensor's pressure-resistant rod fits into a bore that is drilled through the center of the piston head and rod assembly. The position magnet is mounted on the top of the piston head or installed in a shallow counter-bore within the piston head.

Modular, environmentally friendly design
The modular design of the R-Series and G-Series devices allows for easy replacement of the sensing element and electronics without breaking the cylinder's high pressure seal. This not only prevents leaks from the cylinder port, but also significantly reduces maintenance costs and downtime. Temposonics® technology is mounted inside cylinders across a broad range of industry sectors – from steel rollers to wood plants, from food processing to renewable energy.

SERIES QUICK GUIDE

	A	E	G	GB	R	T
FEATURES						
Velocity measurement	●				●	
Multi-position measurement		●	●		●	●
Sensor parameters programmable	●		●	●	●	●
Diagnostic LEDs			●		●	
Redundant version			●		●	
OUTPUT						
Analog – Current		●	●	●	●	●
Analog – Voltage		●	●	●	●	
Start / Stop		●	●			
PWM			●			
SSI	●	●		●	●	
Profibus					●	
CANbus		●			●	
DeviceNet					●	
EtherCAT®					●	
EtherNet / IP™					●	
Powerlink					●	
Profinet					●	
Incremental analog (sin / cos)	●					
Incremental digital (A / B quadrature channels)	●					
MINIMUM STROKE LENGTH						
25 mm (1 in.)	●			●	●	●
50 mm (2 in.)		●	●			
MAXIMUM STROKE LENGTH						
1500 mm (60 in.)		ER				TH (SIL 2)
2000 mm (80 in.)	AP					
2540 mm (100 in.)		EH, EE	GTE			
2900 mm (114 in.)			GT			
3000 mm (118 in.)		EP,EL,EP2,ET				
3250 mm (128 in.)				GB		
5080 mm (200 in.)			GP		RP, RD4	
7620 mm (300 in.)			GH		RH, RS	TH
20000 mm (787 in.)					RF	

CERTIFICATES

	CE	UL/cUL	GOST	SIL 2	ATEX	IECEx
A-SERIES						
AP	●					
E-SERIES						
EH	●	●				
ET	●				●	
EP	●	●				
EL	●	●				
EP2		●				
ER	●	●				
EE	●					
G-SERIES						
GH	●	●			●	
GP	●	●			●	
GT2 / GT3	●					
GTE	●				●	●
GB-SERIES						
GB	●					
R-SERIES						
RH	●	●	●		●	
RP	●	●	●		●	
RF	●		●			
RD4			●			
RT4						
RS	●		●			
T-SERIES						
TH	●				●	●
TH (SIL 2)	●			●	●	●

YOUR CHALLENGE
OUR SOLUTION

A-SERIES
(Linear Encoder)

The Temposonics® A-Series "Duo" linear encoder is specially designed for the position control in electric and linear motors. It includes both an incremental interface and an absolute Synchronous Serial Interface (SSI) output in a single sensor housing. The incremental interface (either 1 V_{PP} sin / cos or A / B quadrature channels) provides position feedback for the motor, while the SSI output delievers absolute linear position of the sensor.

In those applications where magnetostriction can meet accuracy requirements, the added ruggedness and reliability of the A-Series products will help machine builders design systems that require less maintenance and can operate in more demanding environments.

Output (resolution)	
SSI	1 µm
Incremental analog (sin / cos)	20 µm (signal period)
Incremental digital (A / B quadrature channels)	1 µm (signal period)

Operating conditions	
Temperature	–40…+85 °C (–40…+185 °F)
Shock test	100 g (single shock), IEC standard 60068-2-27
Vibration test	15 g / 20…2000 Hz IEC standard 60068-2-6 (resonance frequencies excluded)

Design	
Stroke length	25…2000 mm (1…80 in.)

Accuracy	
Linearity	< ±0.01 % F.S.

Electrical connection	
Operating voltage	+24 VDC (–15 / +20 %)

AP Sensor
with absolute and incremental signals

More information available at:
www.mtssensors.com

E-SERIES
(EH, ET, EP, EL, EP2, ER, EE)

The Temposonics® E-Series are very compact sensor models suitable for situations where space-constrained mounting is a critical factor. MTS Sensors offers different designs to meet the needs of various industrial applications.

This series comprise three rod models for in-cylinder integration: EH, ET (ATEX-certified), EE (embedded in cylinder).
In addition there are three profile models, which features a slim housing: EP, EL and EP2. On the EP2 sensor, the position magnet can travel along the entire fl at housing profile.

Finally there is the ER sensor. This has an aluminum cylinder with a guided driving rod which contains both the sensor element and the electronics. The position is detected via the solid extractable driving rod. Typical applications for E-Series sensors are plastics processing, food & beverage processing, control systems and packaging.

Output (resolution)

	EH	ET	EP / EL	EP2	ER	EE
Current	Infinite	–	Infinite	Analog	Infinite	Infinite
Voltage	Infinite	–	Infinite	Analog	Infinite	–
Start / Stop	*	*	*	*	*	–
SSI	20 µm	–	20 µm	–	20 µm	–
CANopen	10 µm	–	10 µm	–	–	–

Operating conditions

Temperature	EH / EP / EL / EP2 / ER:	–40… +75 °C (–40…+167 °F)
	ET:	–40…+105 °C (–40…+221 °F)
	EE:	–40… +85 °C (–40…+185 °F)
Shock test	100 g (single shock), IEC standard 60068-2-27	
Vibration test	EH / ET / EL / EE / ET:	15 g / 10…2000 Hz
	EP2:	8 g / 10…2000 Hz
	ER:	5 g / 10…2000 Hz
	IEC standard 60068-2-6 (resonance frequencies excluded)	

Design

Stroke length	EH / EE:	50…2540 mm (2…100 in.)
	ET / EP / EL / EP2 :	50…3000 mm (2…118 in.)
	ER:	50…1500 mm (2… 60 in.)

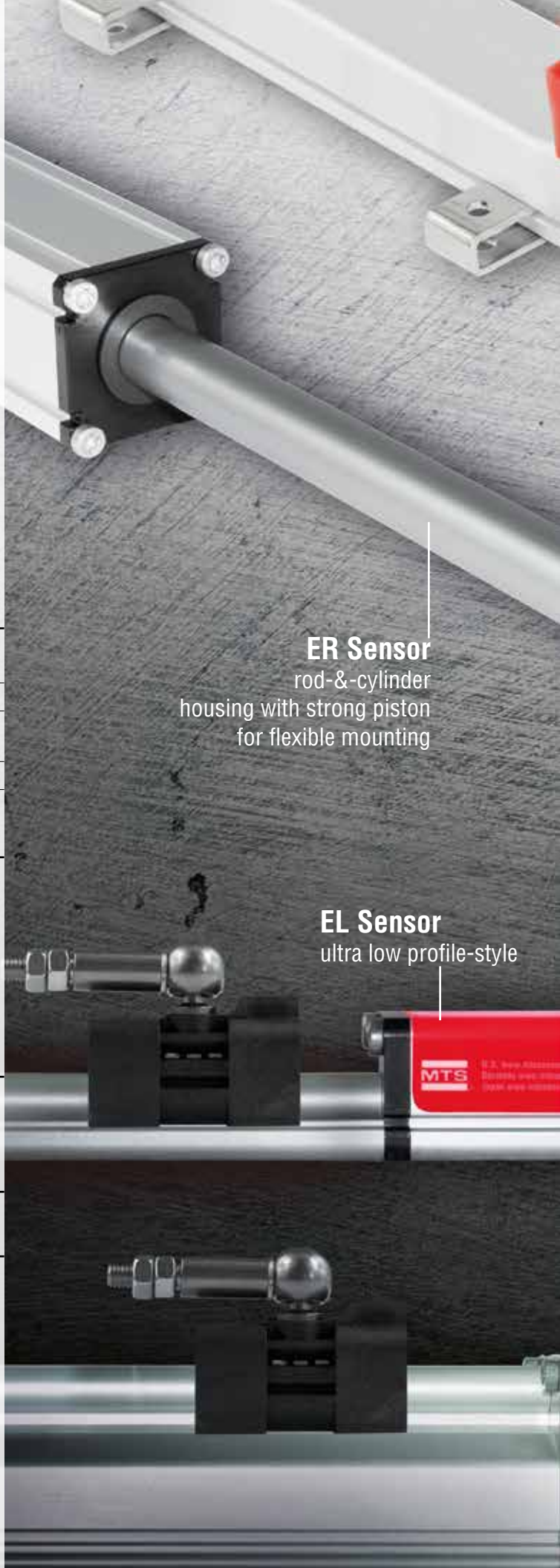
Accuracy

Linearity	< ±0.02 % F.S.

Electrical connection

Operating voltage	+24 VDC (–15 / +20 %)

* Controller dependent



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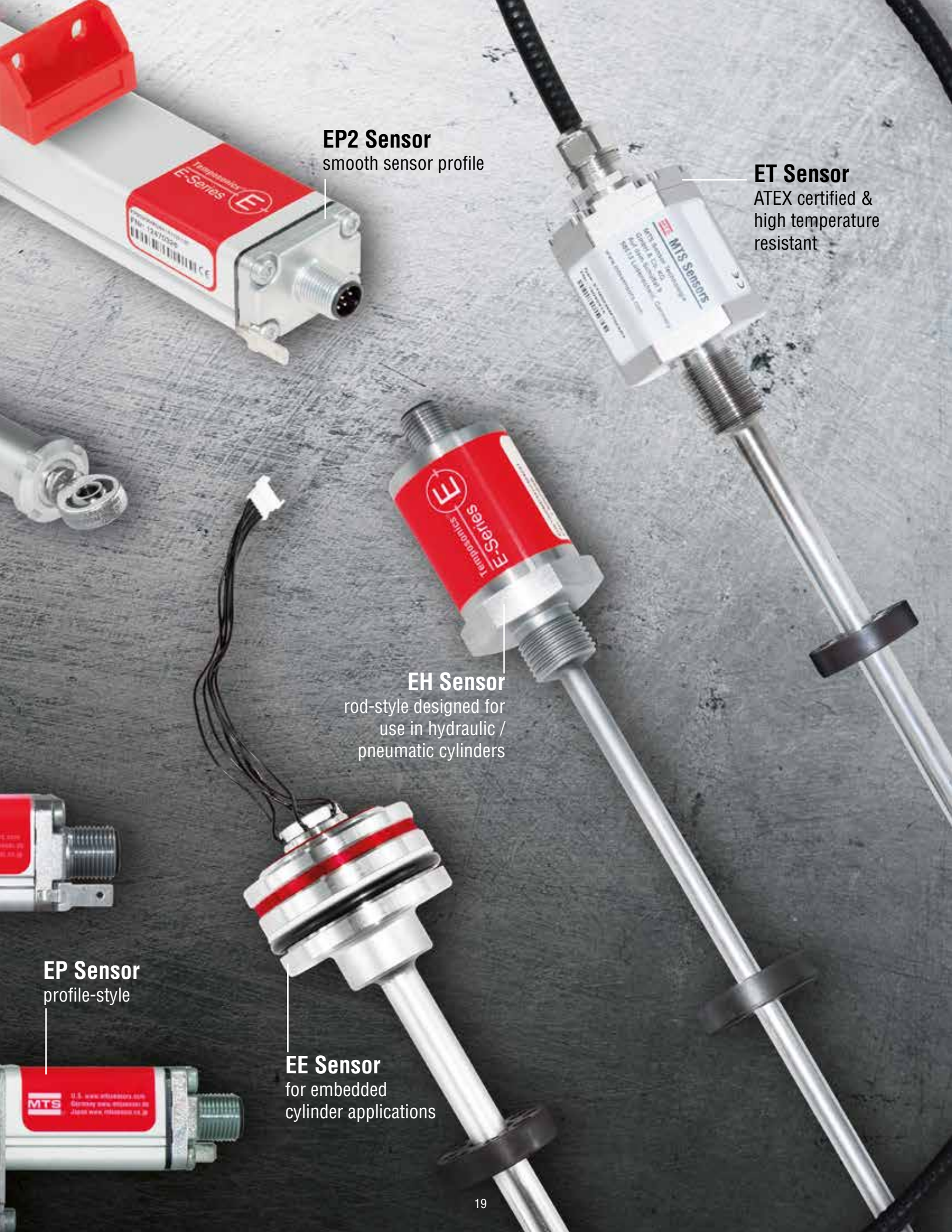

EP2 Sensor
smooth sensor profile
ET Sensor
ATEX certified &
high temperature
resistant
EH Sensor
rod-style designed for
use in hydraulic /
pneumatic cylinders
EP Sensor
profile-style
EE Sensor
for embedded
cylinder applications

G-SERIES
(GH, GP, GT2 / GT3, GTE)

The Temposonics® G-Series provides high durability and accurate position measurement solutions in harsh industrial settings. The sensor element is installed in a pressure-resistant stainless steel rod or aluminum profile. A double-shielded housing protects the electronics and offers excellent EMI immunity.

The GT2 / GT3 and GTE models feature multiple independent measuring systems contained in one compact housing. Each measuring system has its own channel with sensor element, power and evaluation electronics and output signal. The GTE model is embedded in cylinder for added robustness. Example applications include control valves, fluid cylinders, turbine pitch control, ship control systems and floodgates.

Output (resolution)

	GH	GP	GT2 / 3	GTE
Current	Infinite	Infinite	Infinite	Infinite
Voltage	Infinite	Infinite	Infinite	Infinite
Start / Stop	Controller dependent	Controller dependent	–	–
PWM	Controller dependent	Controller dependent	–	–

Operating conditions

Temperature	GH / GP: –40…+80 °C (–40…+176 °F) GT2 / GT3: –40…+75 °C (–40…+167 °F) GTE: –20…+75 °C (–4…+167 °F)
Shock test	100 g (single shock), IEC standard 60068-2-27
Vibration test	GH*: 15 g / 10…2000 Hz GP: 15 g / 10…2000 Hz GT2 / GT3: 5 g / 10…2000 Hz GTE: 10 g / 10…2000 Hz IEC standard 60068-2-6 (resonance frequencies excluded) *Option: High vibration resistant

Design

Stroke length	GH: 50…7620 mm (2…300 in.) GP: 50…5080 mm (2…200 in.) GT2 / GT3: 50…2900 mm (2…114 in.) GTE: 50…2540 mm (2…100 in.)

Accuracy

Linearity	< ±0.02 % F.S.

Electrical connection

Operating voltage	+24 VDC (–15 / +20 %)

More information available at:
www.mtssensors.com


GTE Sensor
embedded rod-style with
redundant measurement
GH Sensor
rod-style designed
for use in hydraulic/
pneumatic cylinders
GT2 / GT3 Sensor
rod-style with dual
or triple redundant
measurement
Temposonics®
G-Series

GB-SERIES
(GB)

The Temposonics® GB-Series is designed to be incorporated into hydraulic cylinders, such as those typically used in power generation plants. The flat, compact electronics housing facilitates deployment in restricted spaces.

The operational advantages of these sensors are: high pressure resistance, strong immunity to EMI and ability to operate in temperatures up to +100 °C. GB-Series sensors can be programmed using a hand-programmer unit, through either the USB port or wirelessly via Bluetooth®. Thanks to the Bluetooth® proprieties it is possible to set and monitor parameters remotely – making the operator's life significantly easier!

Output (resolution)	
Current	16 bit
Voltage	16 bit
SSI	5 µm

Operating conditions	
Temperature	–40…+100 °C (–40…+212 °F)
Shock test	100 g (single shock), IEC standard 60068-2-27
Vibration test	15 g / 10…2000 Hz IEC standard 60068-2-6 (resonance frequencies excluded)

Design	
Stroke length	25…3250 mm (1…128 in.)

Accuracy	
Linearity	< ±0.02 % F.S.

Electrical connection	
Operating voltage	+24 VDC (–15 / +20 %)

More information available at:
www.mtssensors.com

GB Sensor
high pressure rod-style
for high operating temperature,
configurable via Bluetooth®

R-SERIES
(RH, RP, RF, RD4, RT4, RS)

The Temposonics® R-Series features the highest performance, accuracy and reliability in magnetostrictive linear position sensors designed for advanced motion control implementations. With a variety of housing styles and electrical interfaces, the R-Series can be integrated into a wide range of applications. They have a modular construction and are extremely robust. Their double-shielded arrangement assures the best immunity against EMI. Whether it is a rod version (RH), profile version (RP), has detached electronics (RD4), built-in redundancy (RT4) or a flexible rod (RF), the R-Series is a highly compelling sensor solution. For extremely harsh environments MTS Sensors offers the RS sensor with IP69K protective housing.

Output (resolution)

	RH	RP	RF	RD4	RT4	RS
Current	16 bit	16 bit	16 bit	16 bit	–	16 bit
Voltage	16 bit	16 bit	16 bit	16 bit	–	16 bit
SSI	0.5 µm	0.5 µm	2 µm	2 µm	1 µm	0.5 µm
Profibus	1 µm	1 µm	1 µm	1 µm	–	1 µm
CANbus	2 µm	2 µm	2 µm	2 µm	–	2 µm
DeviceNet	2 µm	2 µm	2 µm	2 µm	–	–
EtherCAT®	1 µm	1 µm	1 µm	1 µm	–	1 µm
EtherNet/IP™	1 µm	1 µm	1 µm	1 µm	–	–
Powerlink	1 µm	1 µm	1 µm	1 µm	–	–
Profinet	1 µm	1 µm	1 µm	1 µm	–	–

Operating conditions

Temperature	–40…+75 °C (–40…+167 °F)
Shock test	100 g (single shock), IEC standard 60068-2-27
Vibration test	RH / RP*: 15 g / 10…2000 Hz RF: 5 g / 10… 150 Hz RD4 / RT4: 10 g / 10…2000 Hz IEC standard 60068-2-6 (resonance frequencies excluded) *Option: High vibration resistant

Design

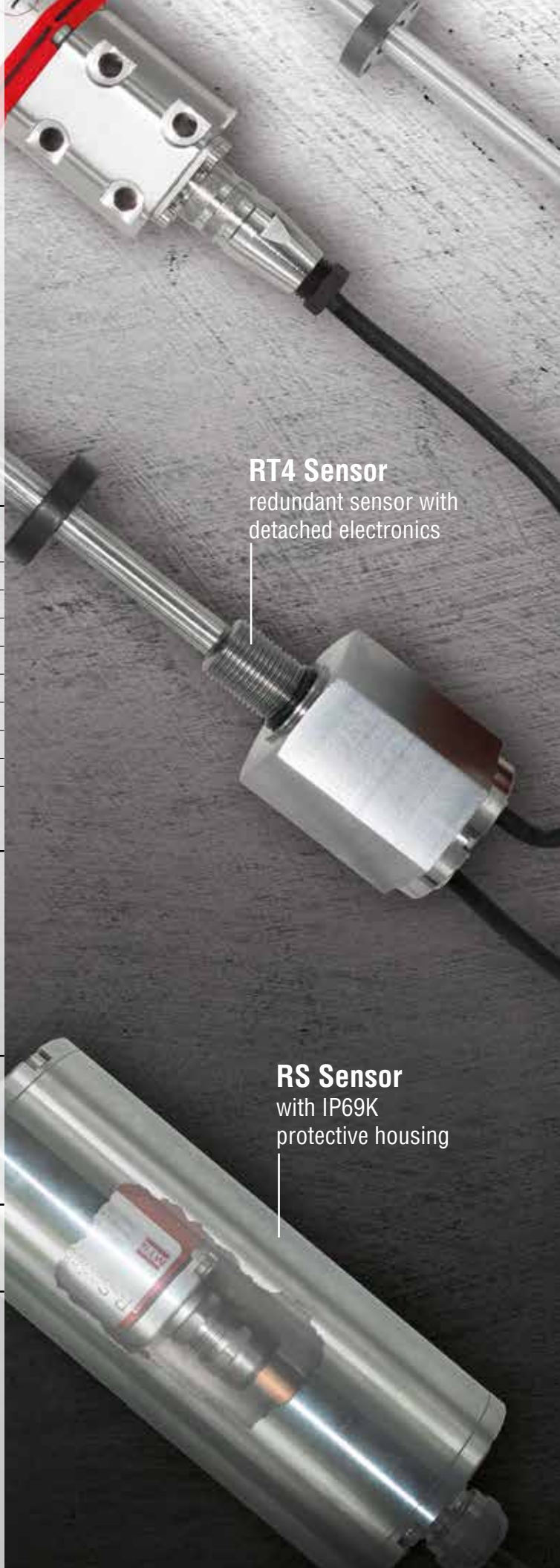
Stroke length	RH: 25… 7620 mm (1…300 in.) RP / RD4: 25… 5080 mm (1…200 in.) RF: 150…20000 mm (6…787 in.) RT4: 25… 2540 mm (1…100 in.) RS: 50… 7620 mm (1…300 in.)

Accuracy

Linearity	RH / RP / RS: < ±0.01 % F.S. RF / RD4 / RT4: < ±0.02 % F.S.

Electrical connection

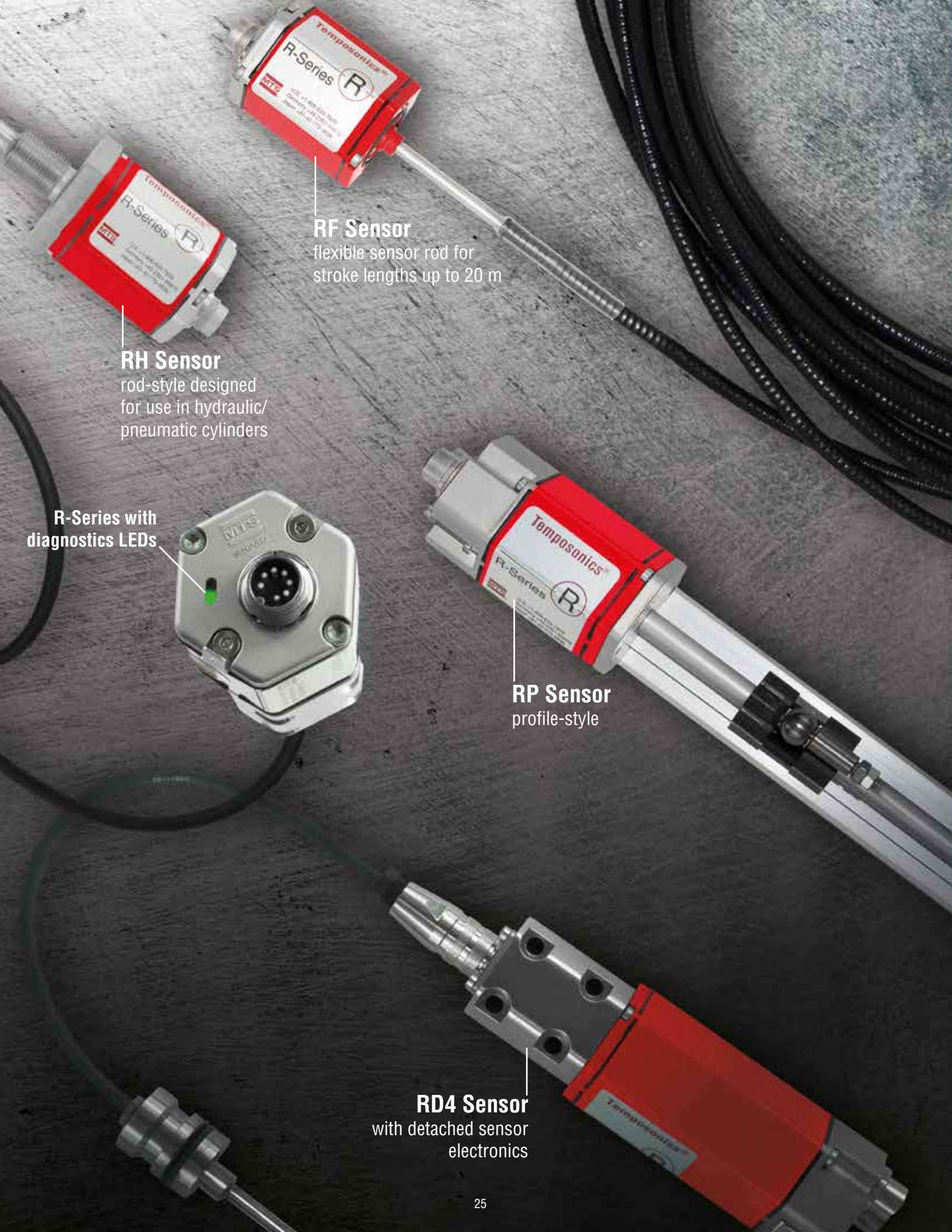
Operating voltage	+24 VDC (–15 / +20 %)



RT4 Sensor
redundant sensor with detached electronics

RS Sensor
with IP69K protective housing

More information available at:
www.mtssensors.com


Temposonics
R-Series
R
RF Sensor
flexible sensor rod for
stroke lengths up to 20 m
RH Sensor
rod-style designed
for use in hydraulic/
pneumatic cylinders
R-Series with
diagnostics LEDs
MTS
RP Sensor
profile-style
RD4 Sensor
with detached sensor
electronics

T-SERIES
(TH)

The devices in the Temposonics® T-Series are designed for hazardous working environments, where they may have to deal with flames, caustic substances and potentially explosive atmospheres (such as chemical plants, offshore oil / gas rigs, etc.). They are the first linear position sensors in the industry to meet SIL 2 standards.
In addition, they are fully compliant with ATEX and IECEx Zone 0 / 1, Zone 1, Zone 2, Zone 21 and Zone 22 safety certifications covering the protection types “flameproof” and “increased safety”.

Output (resolution)	
Current	16 bit

Operating conditions	
Temperature	Standard: –40…+75 °C (–40…+167 °F) SIL 2: –40…+85 °C (–40…+185 °F)
Shock test	100 g (single shock), IEC standard 60068-2-27
Vibration test	15 g / 10…2000 Hz IEC standard 60068-2-6 (resonance frequencies excluded)

Design	
Stroke length	Standard: 25…7620 mm (1…300 in.) SIL 2: 25…1500 mm (1…60 in.)

Accuracy	
Linearity	< ±0.01 % F.S.

Electrical connection	
Operating voltage	+24 VDC (–15 / +20 %)

TH Sensor
ATEX/IECEx certified & SIL 2 capable
rod-style for maximum safety

More information available at:
www.mtssensors.com

HAZARDOUS AREAS

MTS Sensors responds to the user's need of maximum safety with sensor models specifically designed for applications found in hazardous (increased safety & flameproof) and safety (SIL) regulated environments.

G-Series GH / GP	
Stroke length	50…1650 mm (2…65 in.)
Marking	Ⓔx II 3G Ex nA IIC T4 Gc Ⓔx II 3D Ex tc IIIB T100°C Dc IP65/67
Operating temperature	–20 °C ≤ Ta ≤ 75 °C
IP ingress protection	GH: IP67 / GP: IP65
Outputs	Analog & Start / Stop

G-Series GTE	
Marking	Ⓔx II 3G Ex nA IIC T4 Gc
Operating temperature	–20…+75 °C
IP ingress protection	IP54

SIL 2
Safety Integrity Level
IEC 61508

T-Series TH	
Marking	**Protection type D:** Ⓔx II 1/2G Ex db IIC T4 Ga/Gb Ⓔx II 1G/2D Ex tb IIIC T130°C Ga/Db **Protection type E:** Ⓔx II 1/2G Ex db e IIC T4 Ga/Gb Ⓔx II 1G/2D Ex tb IIIC T130°C Ga/Db
Operating temperature	**Standard version:** –40 °C ≤ Ta ≤ 75 °C **SIL 2 version:** –40 °C ≤ Ta ≤ 85 °C
IP ingress protection	IP66 / IP67

	R-Series RH / RP
Stroke length	50…1650 mm (2…65 in.)
Marking 50…1650 mm (2…65 in.)	Ⓔx II 3G Ex nA IIC T4 Gc Ⓔx II 3D Ex tc IIIB T100°C Dc IP65/67
Operating temperature	–20 °C ≤ Ta ≤ 75 °C
IP ingress protection	RH: IP67 / RP: IP65
Outputs	Analog, CANbus & SSI

	HPH (G- / R-Series)
Marking	Ⓔx II 1/2 G Ex d IIC T5 Gb Ⓔx II 1/2 D Ex tb IIIC T100°C Db Class 1, Devision 1, Groups A, B, C, and D
Operating temperature	–40…+75 °C
IP ingress protection	IP68
Outputs G-Series	Analog, Start/Stop & PWM
Outputs R-Series	Analog, Profibus, CANbus, SSI & DeviceNet

	E-Series ET
Marking	Ⓔx II 3G Ex nC IIC T4 Gc Ⓔx II 3D Ex tc IIIC T130 °C Dc
Operating temperature	–40 °C ≤ Ta ≤ 105 °C
IP ingress protection	IP66 / IP68

More information available at:
www.mtssensors.com

LOCAL SUPPORT WORLDWIDE

CUSTOMER SUPPORT

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

APPLICATION SUPPORT

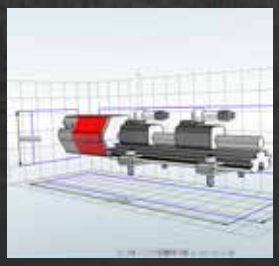
A team of highly qualified engineers with extensive practical knowledge is available to help you achieve the optimal solution – whether it is selecting the right sensor for your specific application or troubleshooting an existing installation.

INNOVATION WORKSHOP

MTS Sensors can partner with you to develop joint projects. 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 & ON SIDE SERVICE

Our engineers provide exceptional support to guarantee smooth integration, ongoing performance and reliability for your sensor implementation. Local support, along with a network of distributors worldwide, enable on-site 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 is available through our website.

AMERICAS & OCEANIA

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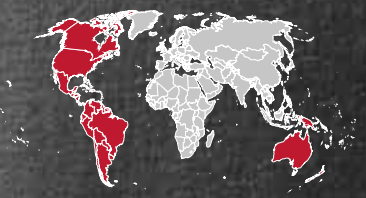

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