

# Temposonics®

Magnetostrictive Linear Position Sensors

## ET Analog Data Sheet

- High operating temperature
- Compact sensor housing
- ATEX / IECEx / CEC / NEC certified



## 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.

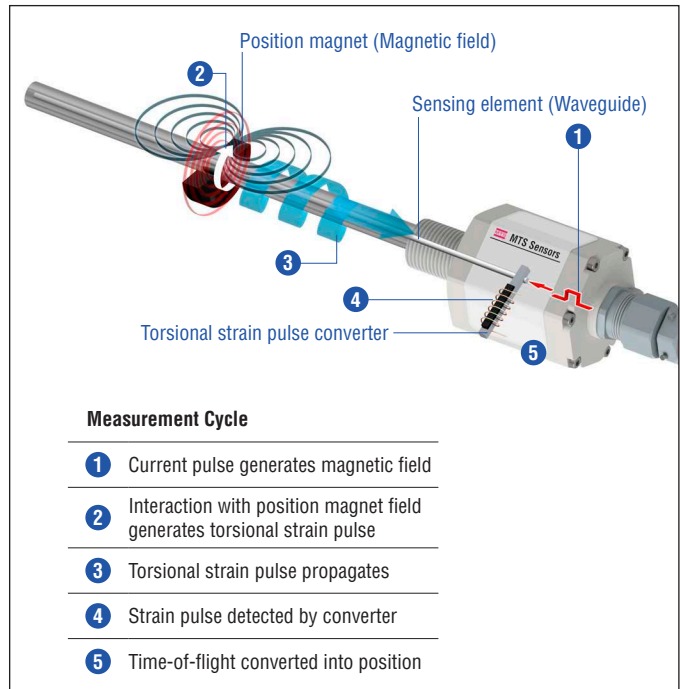


Fig. 1: Time-of-flight based magnetostrictive position sensing principle

## ET SENSOR

Robust, non-contact and wear free, the Temposonics® linear position sensors provide best durability and accurate position measurement solutions in harsh industrial environments. The position measurement accuracy is tightly controlled by the quality of the waveguide which is manufactured by MTS Sensors. The position magnet is mounted on the moving machine part and travels contactlessly over the sensor rod with the built-in waveguide.

### ET sensor specifications:

- High operating temperature up to +85 °C (+185 °F)
- Compact sensor housing
- ATEX / IECEx / CEC / NEC certified
- Set points are programmable

### Certification

⊗ II 3G Ex nC IIC T4 Gc  
 ⊗ II 3D Ex tc IIIC T130 °C Dc IP66 / IP68  
 Class I/II/III Div 2 T4 ABCDFG  
 Class I Zone 2 T4 IIC  
 Zone 22 AEx tc T4 IIIC Dc  
 -40 °C ≤ Ta ≤ 85 °C, Type: 4X

Fig. 2: Certification of Temposonics® ET (version A and E)



Fig. 3: Typical application: Metal processing

## TECHNICAL DATA

Output	
Voltage	0...10 VDC and / or 10...0 VDC (minimum load controller: > 5 kΩ)
Current	4(0)...20 mA and / or 20...4(0) mA (minimum / maximum load: 0 / 500 Ω)
Measured value	Position
Measurement parameters	
Resolution	16 bit (minimum 1 μm depending on stroke length) <sup>1</sup>
Cycle time	Stroke length 50...1200 mm: 0.5 ms Stroke length 1201...2400 mm: 1.0 ms Stroke length 2401...3000 mm: 2.0 ms
Linearity <sup>2</sup>	≤ ±0.02 % F.S. (minimum ±60 μm)
Repeatability	≤ ±0.005 % F.S. (minimum ±20 μm) typical
Operating conditions	
Operating temperature	-40...+85 °C (-40...+185 °F)
Humidity	90 % relative humidity, no condensation
Ingress protection	Version A and E with Teflon® cable (part no. 530 112): IP66 Version A, E and N with silicone cable (part no. 530 113): IP68 (2 bar (29 psi) @ 30 min)
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)
EMC test	Electromagnetic emission according to EN 61000-6-4 Electromagnetic immunity according to EN 61000-6-2 The sensor meets the requirements of the EU directives and is marked with <b>CE</b>
Operating pressure	Up to 350 bar (5076 psi)
Magnet movement velocity <sup>3</sup>	Any
Design / Material	
Sensor electronics housing	Stainless steel 1.4305 (AISI 303); option: Stainless steel 1.4404 (AISI 316L)
Flange	Stainless steel 1.4305 (AISI 303); option: Stainless steel 1.4404 (AISI 316L)
Sensor rod	Stainless steel 1.4306 (AISI 304L); option: Stainless steel 1.4404 (AISI 316L)
Stroke length	50...3000 mm (1...118 in.)
Mechanical mounting	
Mounting position	Any
Mounting instruction	Please consult the technical drawings and the operation manual (document number: <a href="#">551890</a> )
Electrical connection	
Connection type	Cable outlet
Operating voltage	+24 VDC (-15 / +20 %)
Ripple	≤ 0.28 V <sub>pp</sub>
Current consumption	100 mA typical, dependent on stroke length
Dielectric strength	700 VDC (DC ground to machine ground)
Polarity protection	Up to -30 VDC
Overvoltage protection	Up to 36 VDC

1/ The internal digital value is transferred via a 16-bit D/A converter into a proportional, analog current or voltage signal

2/ With position magnet # 251 416-2

3/ If there is contact between the moving magnet including the magnet holder and the sensor rod, make sure that the maximal speed of the moving magnet is ≤ 1 m/s (ATEX requirement due to ESD [Electro Static Discharge])

## TECHNICAL DRAWING

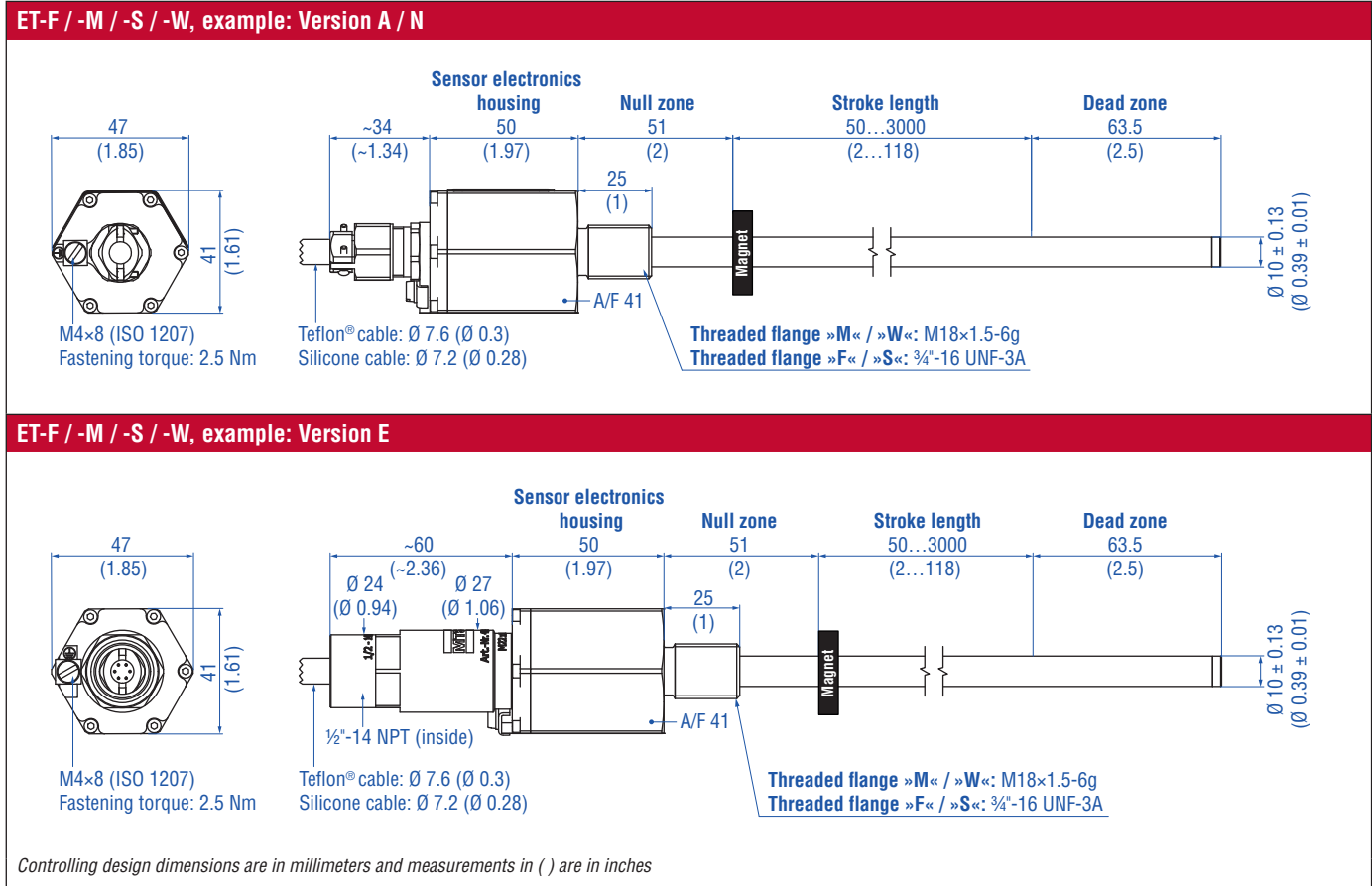


Fig. 4: Temposonics® ET with ring magnet

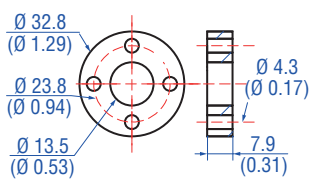
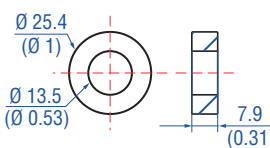
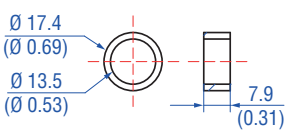
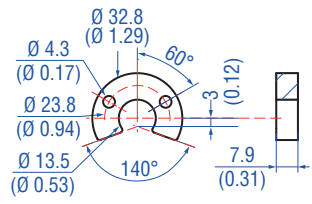
## CONNECTOR WIRING

TXX / VXX			
Signal + power supply			
Cable	Color	Voltage	Current
	GY	Output 1: 0...10 VDC or 10...0 VDC	Output 1: 4(0)...20 mA or 20... 4(0) mA
	PK	DC Ground for output 1	DC Ground for output 1
	YE	Output 2: 0...10 VDC or 10...0 VDC	Output 2: 4(0)...20 mA or 20... 4(0) mA
	GN	DC Ground for output 2	DC Ground for output 2
	BN	+24 VDC (-15 / +20 %)	+24 VDC (-15 / +20 %)
	WH	DC Ground (0 V)	DC Ground (0 V)

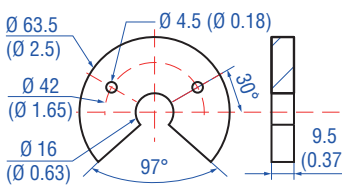
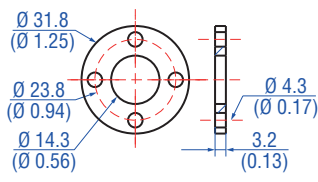
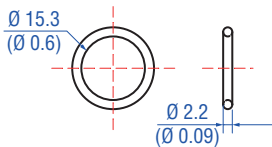
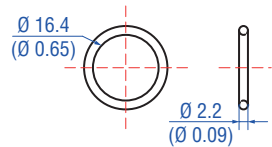
Fig. 5: Connector wiring TXX / VXX

**FREQUENTLY ORDERED ACCESSORIES** – Additional options available in our [Accessories Guide](#)  [551444](#)

**Position magnets**

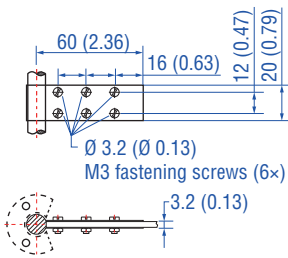
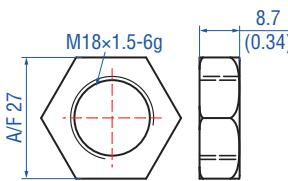
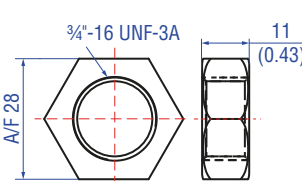
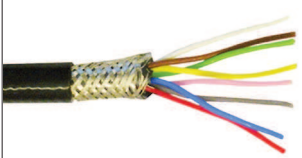
			
<p><b>Ring magnet OD33</b> Part no. 201 542-2</p>	<p><b>Ring magnet OD25.4</b> Part no. 400 533</p>	<p><b>Ring magnet OD17.4</b> Part no. 401 032</p>	<p><b>U-magnet OD33</b> Part no. 251 416-2</p>
<p>Material: PA ferrite GF20 Weight: Approx. 14 g Surface pressure: Max. 40 N/mm<sup>2</sup> Fastening torque for M4 screws: 1 Nm Operating temperature: -40...+105 °C (-40...+221 °F)</p>	<p>Material: PA ferrite Weight: Approx. 10 g Surface pressure: Max. 40 N/mm<sup>2</sup> Operating temperature: -40...+105 °C (-40...+221 °F)</p>	<p>Material: PA neobind Weight: Approx. 5 g Surface pressure: Max. 20 N/mm<sup>2</sup> Operating temperature: -40...+105 °C (-40...+221 °F)</p>	<p>Material: PA ferrite GF20 Weight: Approx. 11 g Surface pressure: Max. 40 N/mm<sup>2</sup> Fastening torque for M4 screws: 1 Nm Operating temperature: -40...+105 °C (-40...+221 °F)</p>





**Position magnet      Magnet spacer      Optional installation hardware**

			
<p><b>U-magnet OD63.5</b> Part no. 201 553</p>	<p><b>Magnet spacer</b> Part no. 400 633</p>	<p><b>O-ring for threaded flange M18x1.5-6g</b> Part no. 401 133</p>	<p><b>O-ring for threaded flange 3/4"-16 UNF-3A</b> Part no. 560 315</p>
<p>Material: PA 66-GF30, magnets compound-filled Weight: Approx. 26 g Surface pressure: 20 N/mm<sup>2</sup> Fastening torque for M4 screws: 1 Nm Operating temperature: -40...+75 °C (-40...+167 °F)</p>	<p>Material: Aluminum Weight: Approx. 5 g Surface pressure: Max. 20 N/mm<sup>2</sup> Fastening torque for M4 screws: 1 Nm</p>	<p>Material: Fluoroelastomer 75 ± 5 durometer Operating temperature: -40...+204 °C (-40...+400 °F)</p>	<p>Material: Fluoroelastomer 75 ± 5 durometer Operating temperature: -40...+204 °C (-40...+400 °F)</p>

**Manuals, Software & 3D Models available at:**  
[www.mtssensors.com](http://www.mtssensors.com)

Controlling design dimensions are in millimeters and measurements in ( ) are in inches

Optional installation hardware	Cable		
 <p>60 (2.36) 16 (0.63) 12 (0.47) 20 (0.79) Ø 3.2 (Ø 0.13) M3 fastening screws (6×) 3.2 (0.13)</p>	 <p>M18x1.5-6g AF 27 8.7 (0.34)</p>	 <p>¾"-16 UNF-3A AF 28 11 (0.43)</p>	
<p><b>Fixing clip for rod with Ø 10 mm</b> Part no. 561 481</p>	<p><b>Hex jam nut M18x1.5-6g</b> Part no. 500 018</p>	<p><b>Hex jam nut ¾"-16 UNF-3A</b> Part no. 500 015</p>	<p><b>Teflon® cable</b> Part no. 530 112</p>
<p>Application: Used to secure sensor rods (Ø 10 mm (Ø 0.39 in.)) when using an U-magnet Material: Brass, non-magnetic</p>	<p>Material: Steel, zinc, plated</p>	<p>Material: Zinc plated with nylon insert</p>	<p>Name of cable in order code: T Material: Teflon® jacket; black Features: Twisted pair shielded Cable Ø: 7.6 mm (0.3 in.) Dimensions: 4 × 2 × 0.25 mm<sup>2</sup> Bending radius: 8 – 10 × Ø (fixed installation) Operating temperature: –100...+180 °C (–148...+356 °F)</p>

Cable	Programming tools <sup>4</sup>		
			
<p><b>Silicone cable</b> Part no. 530 113</p>	<p><b>Hand programmer for analog output</b> Part no. 253 124</p>	<p><b>Cabinet programmer for analog output</b> Part no. 253 408</p>	<p><b>Programming kit</b> Part no. 254 555</p>
<p>Name of cable in order code: V Material: Silicone jacket; red Features: Twisted pair, shielded Cable Ø: 7.2 mm (0.3 in.) Dimensions: 3 × 2 × 0.25 mm<sup>2</sup> Bending radius: 5 × Ø (fixed installation) Operating temperature: –50...+180 °C (–58...+356 °F)</p>	<p>Easy teach-in-setups of stroke length and direction on desired zero / span positions. For sensors with 1 magnet.</p>	<p>Features snap-in mounting on standard 35 mm DIN rail. This programmer can be permanently mounted in a control cabinet and includes a program / run switch. For sensors with 1 magnet.</p>	<p>Kit includes: Interface converter box, power supply, cable software is available at: <a href="http://www.mtssensors.com">www.mtssensors.com</a></p>

**Manuals, Software & 3D Models available at:**  
[www.mtssensors.com](http://www.mtssensors.com)

Controlling design dimensions are in millimeters and measurements in ( ) are in inches  
4/ The programming tools are not approved for use in hazardous environments

## ORDER CODE

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
E	T										1				
a		b	c					d			e	f	g		

<b>a</b>	<b>Sensor model</b>
E T	Rod

<b>b</b>	<b>Design</b>
ET rod-style sensor with housing and sensor rod material stainless steel 1.4404 (AISI 316L)	
F	Threaded flange ¾"-16 UNF-3A
W	Threaded flange M18×1.5-6g
ET rod-style sensor with housing material stainless steel 1.4305 (AISI 303) and sensor rod material stainless steel 1.4306 (AISI 304L)	
M	Threaded flange M18×1.5-6g
S	Threaded flange ¾"-16 UNF-3A

<b>c</b>	<b>Stroke length</b>
X X X X M	0050...3000 mm
<b>Standard stroke length (mm)*</b>	
	<b>Ordering steps</b>
50 ... 500 mm	5 mm
500 ... 750 mm	10 mm
750...1000 mm	25 mm
1000...2500 mm	50 mm
2500...3000 mm	100 mm
X X X X U	002.0...118.0 in.
<b>Standard stroke length (in.)*</b>	
	<b>Ordering steps</b>
2 ... 20 in.	0.2 in.
20 ... 30 in.	0.5 in.
30 ... 40 in.	1.0 in.
40...100 in.	2.0 in.
100...116 in.	4.0 in.

<b>d</b>	<b>Connection type</b>
T X X	T01...T10 (1...10 m) 5 XX m Teflon® cable (part no. 530 112) T03...T33 (3...33 ft) 5 XX ft Teflon® cable (part no. 530 112)
V X X	V01...V10 (1...10 m) 5 XX m silicone cable (part no. 530 113) V03...V33 (3...33 ft) 5 XX ft silicone cable (part no. 530 113)

\*/ Non standard stroke lengths are available; must be encoded in 5 mm / 0.1 in. increments

5/ Encode in meters if using metric stroke length. Encode in feet if using US customary stroke length

<b>e</b>	<b>Operating voltage</b>
1	+24 VDC (-15 / +20 %)

<b>f</b>	<b>Version (see "Certification of Temposonics® ET (version A and E)" on page 2 for further information)</b>
A	ATEX / IECEx / CEC / NEC
E	ATEX / IECEx / CEC / NEC with ½" NPT adapter
N	Not approved

**NOTICE**  
Version E (section f ) is only available with design »M« and »S« (section b ).

<b>g</b>	<b>Output</b>
<b>Voltage</b>	
<b>1 output with 1 position magnet</b>	
<b>Output 1 (position magnet 1)</b>	
V 0 1	0...10 VDC
V 1 1	10...0 VDC
<b>2 outputs with 1 position magnet</b>	
<b>Output 1 (position magnet 1) + output 2 (position magnet 1)</b>	
V 0 3	0...10 VDC      10...0 VDC
<b>2 outputs with 2 position magnets</b>	
<b>Output 1 (position magnet 1) + output 2 (position magnet 2)</b>	
V 0 2	0...10 VDC      0...10 VDC
V 1 2	10...0 VDC      10...0 VDC
<b>Current</b>	
<b>1 output with 1 position magnet</b>	
<b>Output 1 (position magnet 1)</b>	
A 0 1	4...20 mA
A 1 1	20...4 mA
<b>2 outputs with 1 position magnet</b>	
<b>Output 1 (position magnet 1) + output 2 (position magnet 1)</b>	
A 0 3	4...20 mA      20...4 mA
<b>2 outputs with 2 position magnets</b>	
<b>Output 1 (position magnet 1) + output 2 (position magnet 2)</b>	
A 0 2	4...20 mA      4...20 mA
A 1 2	20...4 mA      20...4 mA

**NOTICE**  
Use magnets of the same type (e.g. 2 ring magnets with part no. 201 542-2 ) for multi-position measurement.

## **DELIVERY**

---



Sensor

Accessories have to be ordered separately

**Manuals, Software & 3D Models available at:  
[www.mtssensors.com](http://www.mtssensors.com)**



**Document Part Number:**  
551898 Revision B (EN) 10/2017

**LOCATIONS**

**USA**  
**MTS Systems Corporation**  
**Sensors Division**  
3001 Sheldon Drive  
Cary, N.C. 27513, USA  
Tel. +1 919 677-0100  
Fax +1 919 677-0200  
info.us@mtssensors.com  
www.mtssensors.com

**JAPAN**  
**MTS Sensors Technology Corp.**  
737 Aihara-machi,  
Machida-shi,  
Tokyo 194-0211, Japan  
Tel. +81 42 775-3838  
Fax +81 42 775-5512  
info.jp@mtssensors.com  
www.mtssensors.com

**FRANCE**  
**MTS Systems SAS**  
Zone EUROPARC Bâtiment EXA 16  
16/18, rue Eugène Dupuis  
94046 Creteil, France  
Tel. +33 1 58 4390-28  
Fax +33 1 58 4390-03  
info.fr@mtssensors.com  
www.mtssensors.com

**GERMANY**  
**MTS Sensor Technologie**  
**GmbH & Co. KG**  
Auf dem Schüffel 9  
58513 Lüdenscheid, Germany  
Tel. +49 2351 9587-0  
Fax +49 2351 56491  
info.de@mtssensors.com  
www.mtssensors.com

**CHINA**  
**MTS Sensors**  
Room 504, Huajing Commercial Center,  
No. 188, North Qinzhou Road  
200233 Shanghai, China  
Tel. +86 21 6485 5800  
Fax +86 21 6495 6329  
info.cn@mtssensors.com  
www.mtssensors.com

**ITALY**  
**MTS Systems Srl**  
**Sensor Division**  
Via Camillo Golgi, 5/7  
25064 Gussago (BS), Italy  
Tel. +39 030 988 3819  
Fax +39 030 982 3359  
info.it@mtssensors.com  
www.mtssensors.com

**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 © 2017 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](http://www.mtssensors.com) for the latest product information.

