

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.

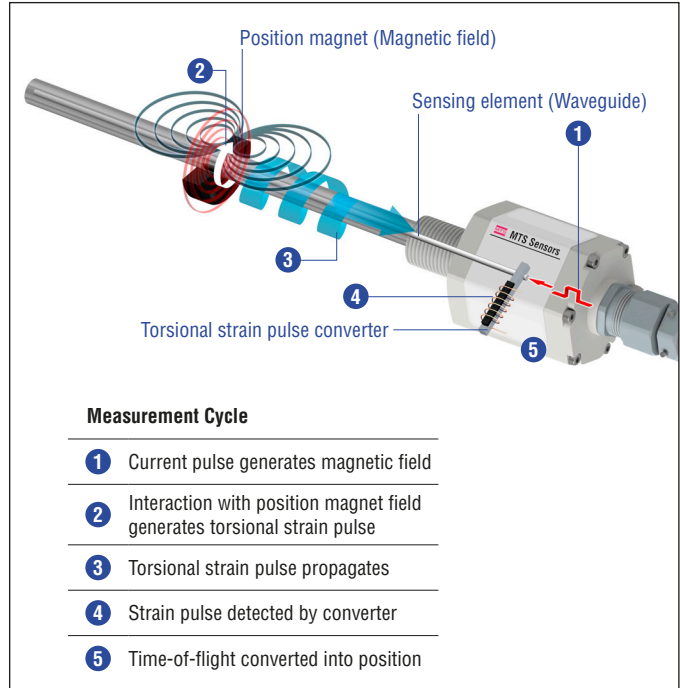


Fig. 1: Time-of-flight based magnetostrictive position sensing principle

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) ¹
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 ²	≤ ±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 CE
Operating pressure	Up to 350 bar (5076 psi)
Magnet movement velocity ³	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: 551890)
Electrical connection	
Connection type	Cable outlet
Operating voltage	+24 VDC (-15 / +20 %)
Ripple	≤ 0.28 V _{pp}
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

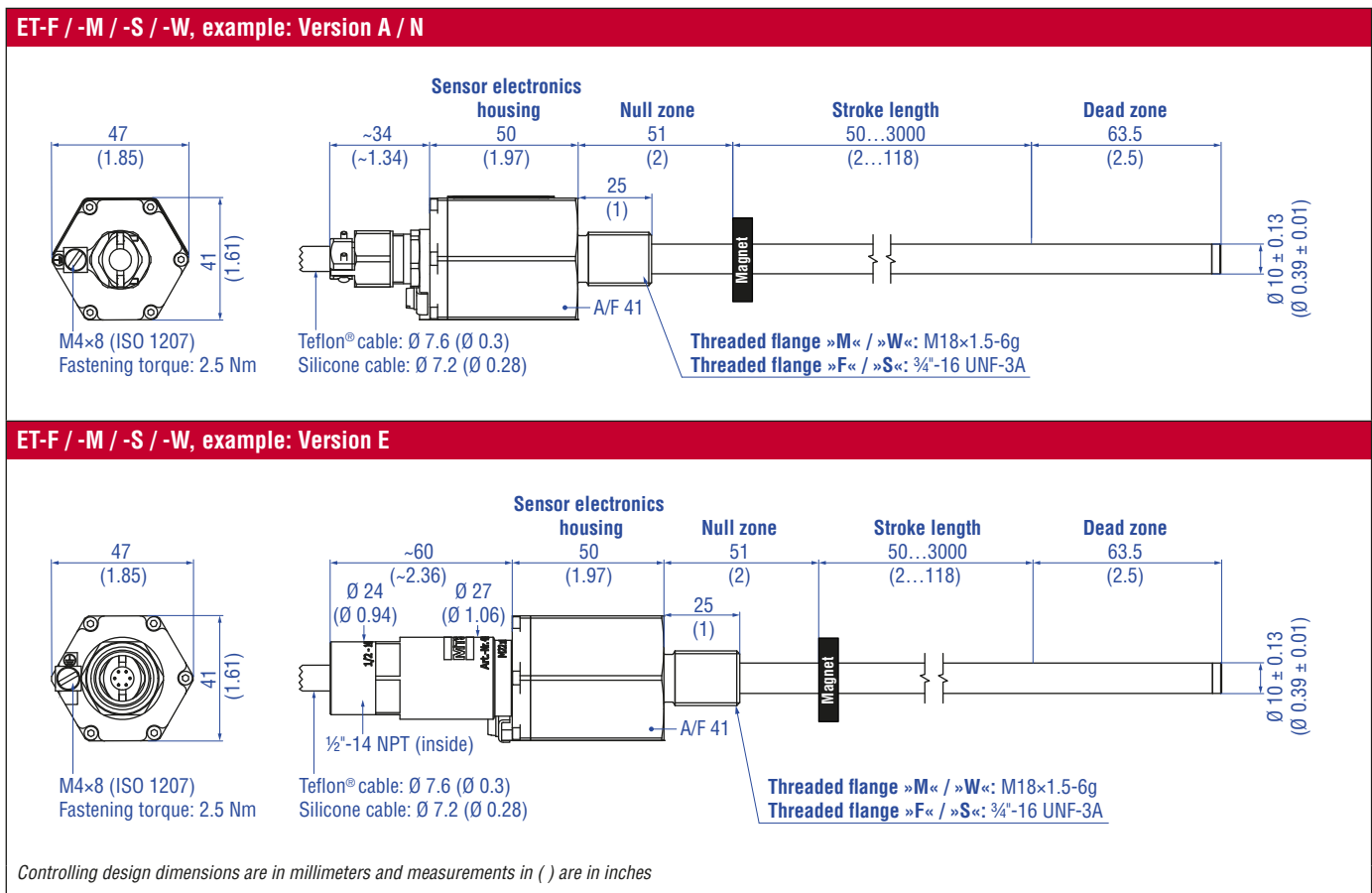


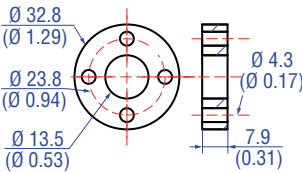
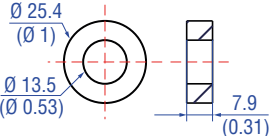
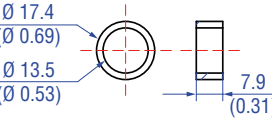
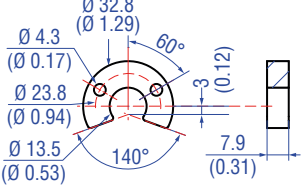
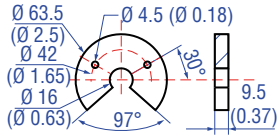
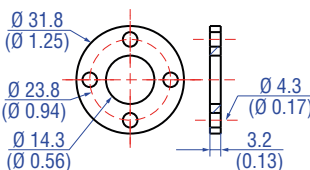
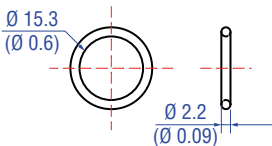
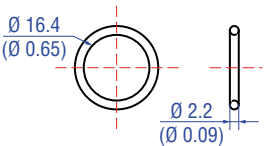
Fig. 4: Temposonics® ET with ring magnet

CONNECTOR WIRING

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

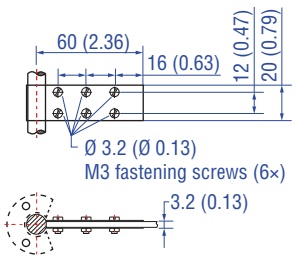
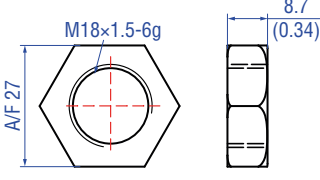
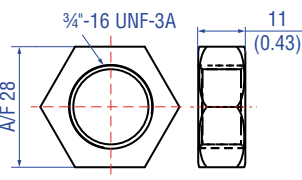
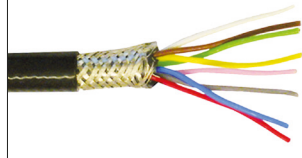
Fig. 5: Connector wiring TXX / VXX





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

Position magnets			
			
<p>Ring magnet OD33 Part no. 201 542-2</p> <p>Material: PA ferrite GF20 Weight: Approx. 14 g Surface pressure: Max. 40 N/mm² Fastening torque for M4 screws: 1 Nm Operating temperature: -40...+105 °C (-40...+221 °F)</p>	<p>Ring magnet OD25.4 Part no. 400 533</p> <p>Material: PA ferrite Weight: Approx. 10 g Surface pressure: Max. 40 N/mm² Operating temperature: -40...+105 °C (-40...+221 °F)</p>	<p>Ring magnet OD17.4 Part no. 401 032</p> <p>Material: PA neobind Weight: Approx. 5 g Surface pressure: Max. 20 N/mm² Operating temperature: -40...+105 °C (-40...+221 °F)</p>	<p>U-magnet OD33 Part no. 251 416-2</p> <p>Material: PA ferrite GF20 Weight: Approx. 11 g Surface pressure: Max. 40 N/mm² Fastening torque for M4 screws: 1 Nm Operating temperature: -40...+105 °C (-40...+221 °F)</p>
Position magnet Magnet spacer Optional installation hardware			
			
<p>U-magnet OD63.5 Part no. 201 553</p> <p>Material: PA 66-GF30, Magnets compound-filled Weight: Approx. 26 g Surface pressure: 20 N/mm² Fastening torque for M4 screws: 1 Nm Operating temperature: -40...+75 °C (-40...+167 °F)</p>	<p>Magnet spacer Part no. 400 633</p> <p>Material: Aluminum Weight: Approx. 5 g Surface pressure: 20 N/mm² Fastening torque for M4 screws: 1 Nm</p>	<p>O-ring for flange M18x1.5-6g Part no. 401 133</p> <p>Application: Flange M18x1.5 Material: Fluoroelastomer 75 ± 5 durometer Operating temperature: -40...+204 °C (-40...+400 °F)</p>	<p>O-ring for flange 3/4-16 UNF-3A Part no. 560 315</p> <p>Application: Flange 3/4-16 UNF Material: Fluoroelastomer 75 ± 5 durometer Operating temperature: -40...+204 °C (-40...+400 °F)</p>

Manuals, Software & 3D Models available at:
www.mtssensors.com

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

Optional installation hardware			Cable
			
Fixing clip Part no. 561 481	Hex jam nut M18 Part no. 500 018	Hex jam nut ¾" Part no. 500 015	Teflon® cable Part no. 530 112
Application: Used to secure sensor rods (Ø 10 mm (Ø 0.39 in.)) when using an U-magnet Material: Brass, non-magnetic	Application: M18x1.5 thread Material: Steel, zinc, plated	Application: ¾"-16 UNF thread Material: Zinc plated with nylon insert	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 ² Bending radius: 8 – 10 × Ø (fixed installation) Operating temperature: –100...+180 °C (–148...+356 °F)

Cable	Programming tools ⁴		
			
Silicone cable Part no. 530 113	Analog hand programmer Part no. 253 124	Analog cabinet programmer Part no. 253 408	Programming kit Part no. 254 555
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 ² Bending radius: 5 × Ø (fixed installation) Operating temperature: –50...+180 °C (–58...+356 °F)	Easy teach-in-setups of stroke length and direction on desired zero / span positions. For sensors with 1 magnet.	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.	Kit includes: Interface converter box, power supply, cable Software is available at: www.mtssensors.com

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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		

a	Sensor model	
E	T	Rod

b	Design
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

c	Stroke length				
X	X	X	X	M	0050...3000 mm
Standard stroke length (mm)*		Ordering steps			
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.
Standard stroke length (in.)*		Ordering steps			
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.			

d	Connection type		
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)

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

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

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

DELIVERY



Sensor

Accessories have to be ordered separately

*/ 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

Manuals, Software & 3D Models available at:
www.mtssensors.com

Document Part Number:
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