

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.

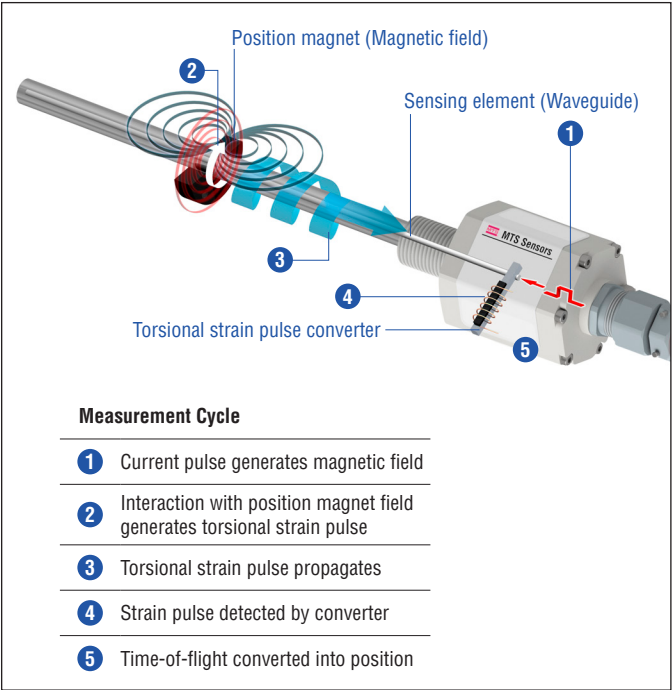


Fig. 1: Time-of-flight based magnetostrictive position sensing principle

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

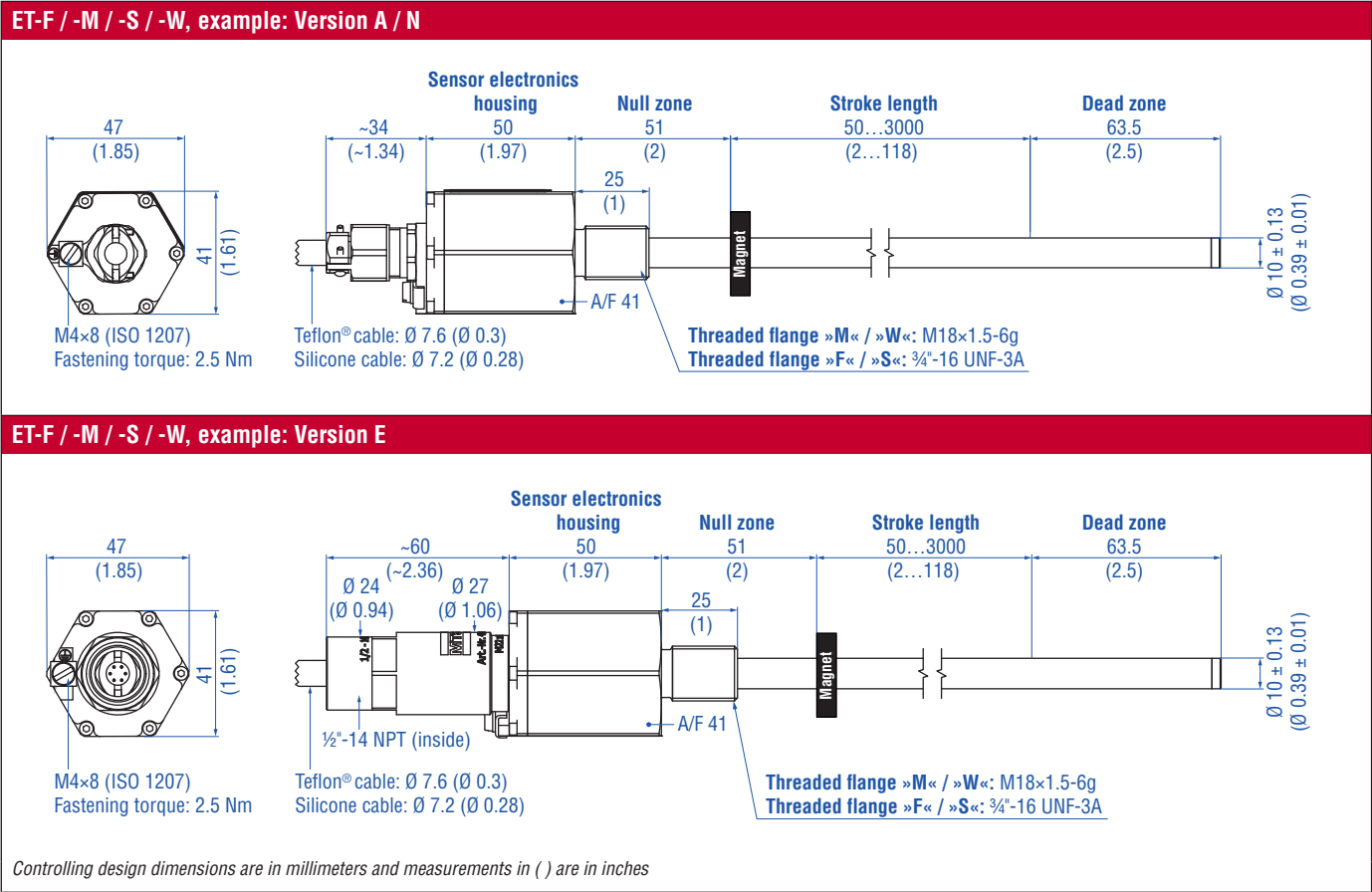


Fig. 4: Temposonics® ET with ring magnet

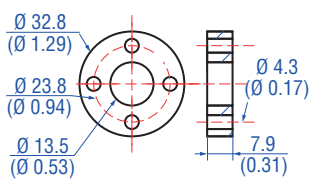
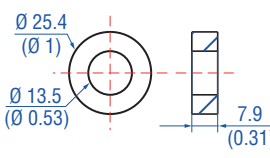
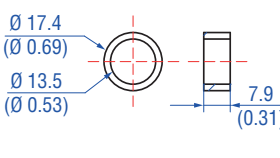
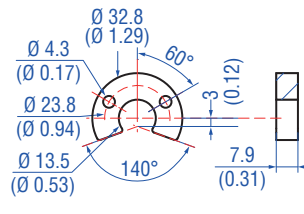
CONNECTOR WIRING

TXX / VXX			
Signal + power supply			
Cable	Color	Voltage	Current
	GY	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

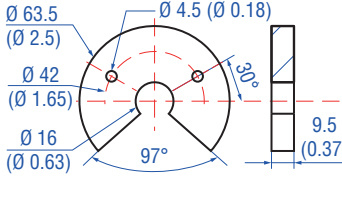
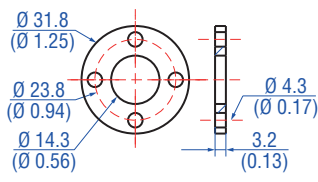
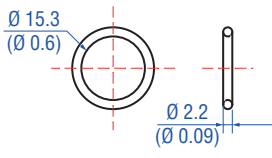
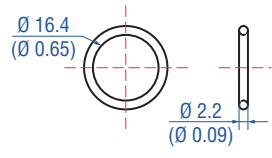
Position magnets

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

Position magnet

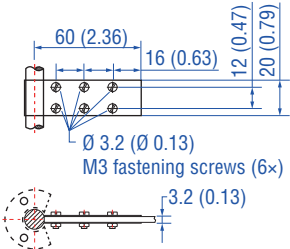
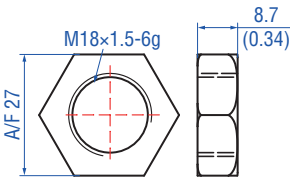
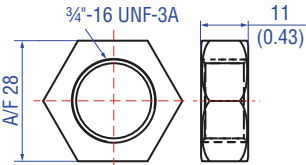
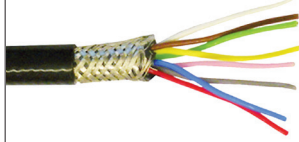
Magnet spacer

Optional installation hardware

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

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 for rod with Ø 10 mm Part no. 561 481 Application: Used to secure sensor rods (Ø 10 mm (Ø 0.39 in.)) when using an U-magnet Material: Brass, non-magnetic	 Hex jam nut M18x1.5-6g Part no. 500 018 Material: Steel, zinc, plated	 Hex jam nut 3/4\"-16 UNF-3A Part no. 500 015 Material: Zinc plated with nylon insert	 Teflon® cable Part no. 530 112 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 mm² 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 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 mm² Bending radius: 5 × Ø (fixed installation) Operating temperature: –50...+180 °C (–58...+356 °F)	 Hand programmer for analog output Part no. 253 124 Easy teach-in-setups of stroke length and direction on desired zero / span positions. For sensors with 1 magnet.	 Cabinet programmer for analog output Part no. 253 408 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.	 Programming kit Part no. 254 555 Kit includes: Interface converter box, power supply, cable software is available at: www.mtssensors.com

Manuals, Software & 3D Models available at:
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								

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 Tempsonics® 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

NOTICE

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

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

NOTICE

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

* / 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

DELIVERY



Sensor

Accessories have to be ordered
separately

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

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

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