



Temposonics

AN AMPHENOL COMPANY

Data Sheet

ET Analog

Magnetostrictive Linear Position Sensors

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



MEASURING TECHNOLOGY

The absolute, linear position sensors provided by Temposonics rely on the company's proprietary 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.

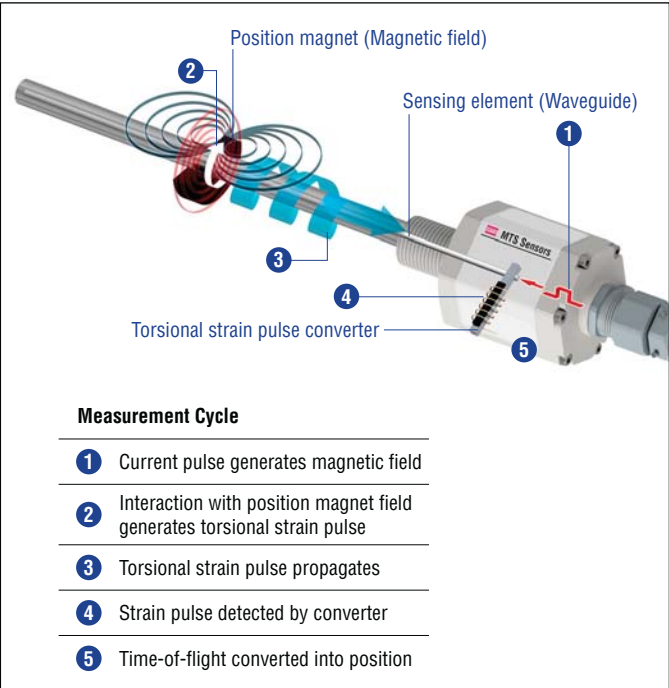


Fig. 1: Time-of-flight based magnetostrictive position sensing principle

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 Temposonics. The position magnet is mounted on the moving machine part and travels contactlessly over the sensor rod/sensor profile 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/Ex tD A22 IP66/IP68 T130°C 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

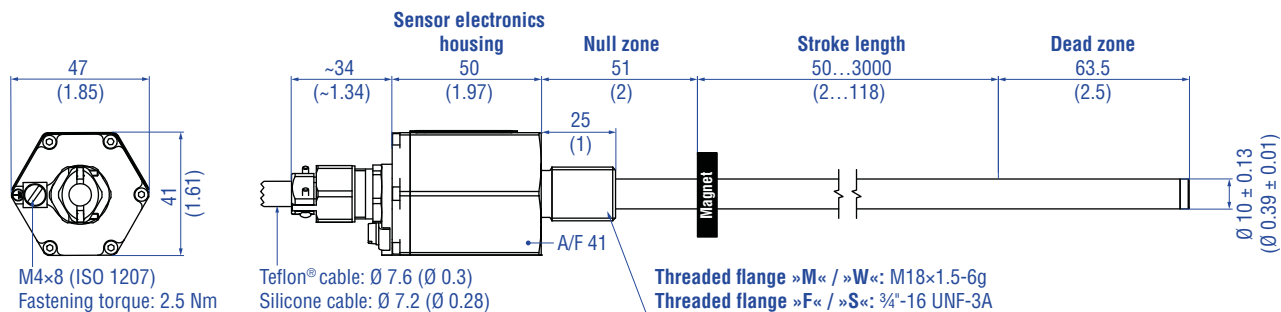
Output				
Voltage	0...10 VDC and/or 10...0 VDC (minimum load controller: > 5 kΩ)			
Current	4(0)...20 mA and/or 20...4(0) mA (minimum/maximum load: 0/500 Ω)			
Measured value	Position			
Measurement parameters				
Resolution	16 bit (minimum 1 μm depending on stroke length) ¹			
Cycle time	Stroke length	≤ 1200 mm	≤ 2400 mm	≤ 3000 mm
	Cycle time	0.5 ms	1.0 ms	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); option: −40...+75 °C (−40...+167 °C)			
Humidity	90 % relative humidity, no condensation			
Ingress protection	With Teflon® cable (part no. 530 112): IP66 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	20 g/10...2000 Hz, IEC standard 60068-2-6 (excluding resonant frequencies)			
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 (rod version only)	Up to 350 bar (5076 psi)			
Magnet movement velocity ³	Any			
Design / Material				
Sensor electronics housing/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)			
Sensor profile	Aluminium			
Stroke length	50...3000 mm (1.97...118.11 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 %); UL recognition requires an approved power supply with energy limitation (UL 61010-1), or Class 2 rating according to the National Electrical Code (USA)/ Canadian Electrical Code.			
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

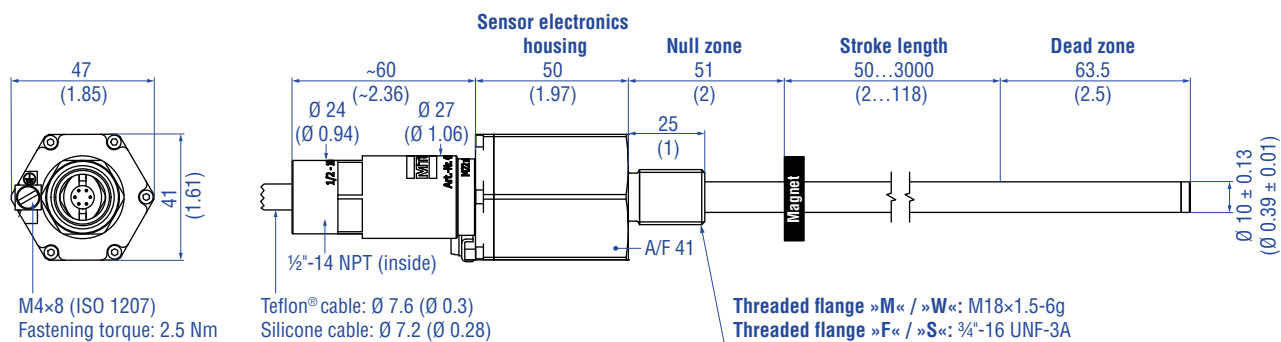
2/ With position magnet # 251 416-2

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

ET-F / -M / -S / -W, example: Version A / N



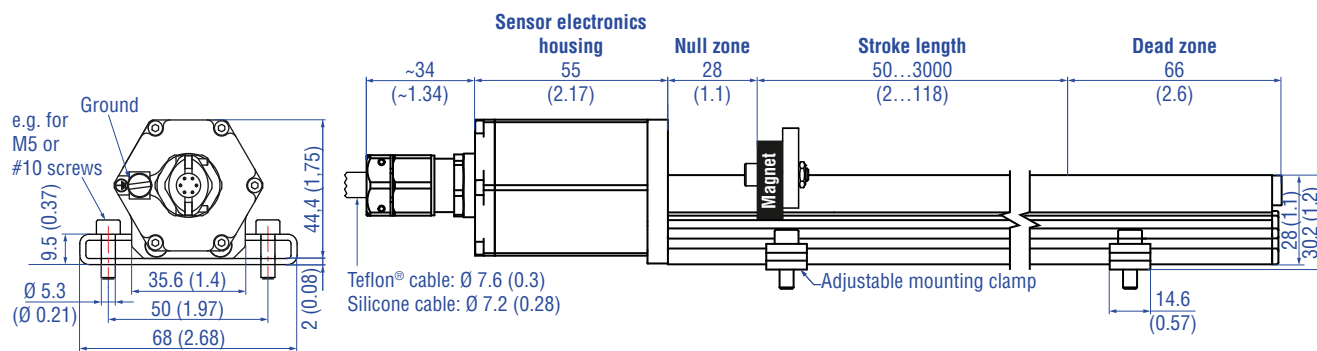
ET-F / -M / -S / -W, example: Version E



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

Fig. 4: Temposonics® ET with ring magnet

ET-P, example: Version A / N



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

Fig. 5: Temposonics® ET-P with U-magnet

CONNECTOR WIRING

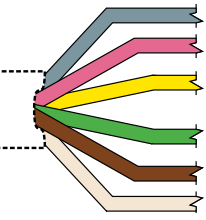
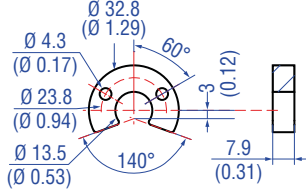
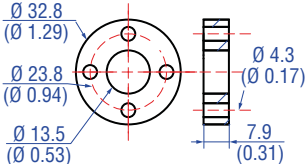
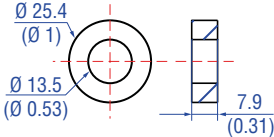
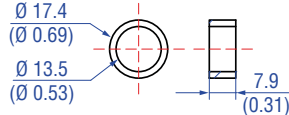
TXX / VXX			
Signal + power supply			
Cable	Color	Voltage	Current
	GY	Output 1: 0...10 VDC or 10...0 VDC	Output 1: 4(0)...20 mA or 20... 4(0) mA
	PK	DC Ground for output 1	DC Ground for output 1
	YE	Output 2: 0...10 VDC or 10...0 VDC	Output 2: 4(0)...20 mA or 20... 4(0) mA
	GN	DC Ground for output 2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

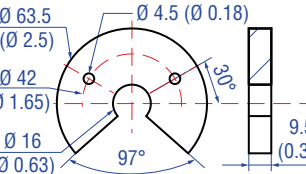
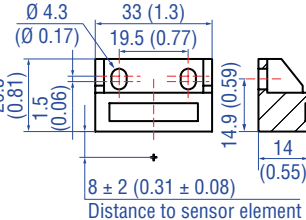
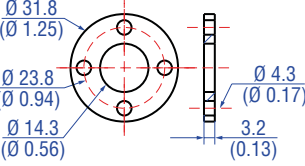
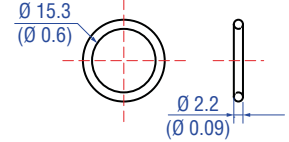
Fig. 6: Connector wiring TXX / VXX

FREQUENTLY ORDERED ACCESSORIES FOR ET-F/-W/-M/-S – Additional options available in our [Accessories Guide](#) 551444

Position magnets

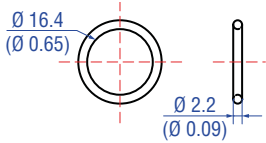
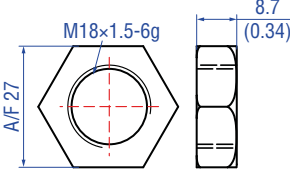
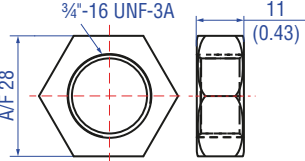
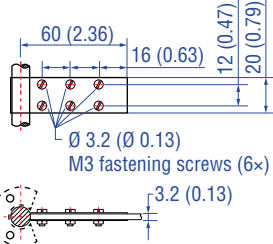
			
U-magnet OD33 Part no. 251 416-2	Ring magnet OD33 Part no. 201 542-2	Ring magnet OD25.4 Part no. 400 533	Ring magnet OD17.4 Part no. 401 032
<p>Material: PA ferrite GF20 Weight: Approx. 11 g Surface pressure: Max. 40 N/mm² Fastening torque for M4 screws: 1 Nm Operating temperature: -40...+105 °C (-40...+221 °F)</p>	<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>Material: PA ferrite Weight: Approx. 10 g Surface pressure: Max. 40 N/mm² Operating temperature: -40...+105 °C (-40...+221 °F)</p>	<p>Material: PA neobond Weight: Approx. 5 g Surface pressure: Max. 20 N/mm² Operating temperature: -40...+105 °C (-40...+221 °F)</p>

Position magnets

			
U-magnet OD63.5 Part no. 201 553	Block magnet L Part no. 403 448	Magnet spacer Part no. 400 633	O-ring for threaded flange M18×1.5-6g Part no. 401 133
<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>Material: Plastic carrier with hard ferrite magnet Weight: Approx. 20 g Fastening torque for M4 screws: 1 Nm Operating temperature: -40...+75 °C (-40...+167 °F)</p> <p>This magnet may influence the sensor performance specifications for some</p>	<p>Material: Aluminum Weight: Approx. 5 g Surface pressure: Max. 20 N/mm² Fastening torque for M4 screws: 1 Nm</p>	<p>Material: Fluoroelastomer Durometer: 75 ± 5 Shore A Operating temperature: -40...+204 °C (-40...+400 °F)</p>

O-ring

Mounting accessories

			
O-ring for threaded flange 3/4"-16 UNF-3A Part no. 560 315	Hex jam nut M18×1.5-6g Part no. 500 018	Hex jam nut 3/4"-16 UNF-3A Part no. 500 015	Fixing clip Part no. 561 481
<p>Material: Fluoroelastomer Durometer: 75 ± 5 Shore A Operating temperature: -40...+204 °C (-40...+400 °F)</p>	<p>Material: Steel, zinc plated</p>	<p>Material: Steel, zinc plated</p>	<p>Application: Used to secure sensor rods (Ø 10 mm (Ø 0.39 in.)) when using an U-magnet or block magnet Material: Brass, non-magnetic</p>

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

Position magnets

Magnet slider S, joint at top Part no. 252 182	Magnet slider V, joint at front Part no. 252 184	Magnet slider N, longer ball-joint arm Part no. 252 183	Magnet slider G, backlash free Part no. 253 421
Material: GRP, magnet hard ferrite Weight: Approx. 35 g Operating temperature: -40...+85 °C (-40...+185 °F)	Material: GRP, magnet hard ferrite Weight: Approx. 35 g Operating temperature: -40...+85 °C (-40...+185 °F)	Material: GRP, magnet hard ferrite Weight: Approx. 35 g Operating temperature: -40...+85 °C (-40...+185 °F)	Material: GRP, magnet hard ferrite Weight: Approx. 25 g Operating temperature: -40...+85 °C (-40...+185 °F)

Position magnets

Mounting accessories

U-magnet OD33 Part no. 251 416-2	Block magnet L Part no. 403 448	Mounting clamp Part no. 400 802	T-nut Part no. 401 602
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)	Material: Plastic carrier with hard ferrite magnet Weight: Approx. 20 g Fastening torque for M4 screws: 1 Nm Operating temperature: -40...+75 °C (-40...+167 °F) This magnet may influence the sensor performance specifications for some applications.	Material: Stainless steel (AISI 304)	Fastening torque for M5 screw: 4.5 Nm

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

Cables



Teflon® cable
Part no. 530 112

Name of cable in order code: **T**

Material: Teflon® jacket; black
Features: Twisted pair, shielded, flexible
high thermal resistance, mostly oil &
acid resistant

Cable Ø: 7.6 mm (0.3 in.)

Cross section: $4 \times 2 \times 0.25 \text{ mm}^2$

Bending radius: $8 - 10 \times D$
(fixed installation)

Operating temperature:
 $-100...+180 \text{ }^\circ\text{C}$ ($-148...+356 \text{ }^\circ\text{F}$)



Silicone cable
Part no. 530 113

Name of cable in order code: **V**

Material: Silicone jacket; red
Features: Twisted pair, shielded, highly
flexible, halogen free, high thermal
resistance

Cable Ø: 7.2 mm (0.28 in.)

Cross section: $3 \times 2 \times 0.25 \text{ mm}^2$

Bending radius: $5 \times D$
(fixed installation)

Operating temperature:
 $-50...+180 \text{ }^\circ\text{C}$ ($-58...+356 \text{ }^\circ\text{F}$)

Programming tools (Not approved for use in hazardous environments)



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.



Programming kit
Part no. 254 555

Kit includes:

1 × interface converter box

1 × power supply

1 × cable (60 cm) with M12 female
connector (5 pin), straight – D-sub
female connector (9 pin), straight

1 × cable (60 cm) with M16 female
connector (6 pin), straight – D-sub
female connector (9 pin), straight

1 × cable (60 cm) with 3 × terminal
clamp – D-sub female connector
(9 pin), straight

1 × USB cable

Software is available at:
www.temposonics.com



Cabinet programmer for analog output
Part no. 253 408

Features snap-in mounting on
standard DIN rail (35 mm). This
programmer can be permanently
mounted in a control cabinet and
includes a program/run switch.
For sensors with 1 magnet.

ORDER CODE

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
E	T										1					
a		b	c	d	e	f	g	h								

a	Sensor model
E T	Rod/Profile

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
	ET profile-style sensor with housing material stainless steel 1.4305 (AISI 303) and profile material aluminium
P	Profile

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

d	Connection type
T X X	XX m Teflon® cable (part no. 530 112) T01...T30 (1...30 m/3...99 ft.)* See "Frequently ordered accessories" for cable specifications
V X X	XX m silicone cable (part no. 530 113) V01...V30 (1...30 m/3...99 ft.)* See "Frequently ordered accessories" for cable specifications
*/ Encode in meters if using metric stroke length. Encode in feet if using US customary stroke length	

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

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

h	Operating temperature
L	–40...+75 °C (–40...+167 °F)

DELIVERY



ET-F/-W/-M/-S (rod sensor):

- Sensor

Accessories have to be ordered separately.

ET-P (profile sensor):

- Sensor
- 2 mounting clamps up to 1250 mm (50 in.) stroke length + 1 mounting clamp for each 500 mm (20 in.) additional stroke length

NOTICE

Use magnets of the same type for multi-position measurement, e.g. 2 × U-magnet (part no. 251 416-2).

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

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Document Part Number:
551898 Revision E (EN) 05/2021



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