

## Data Sheet

# E-Series ET Analog

## Magnetostrictive Linear Position Sensors

- High operating temperature
- Compact sensor housing
- ATEX/UK Ex/IECEX/CEC/NEC/CCC 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 a 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 beginning 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.

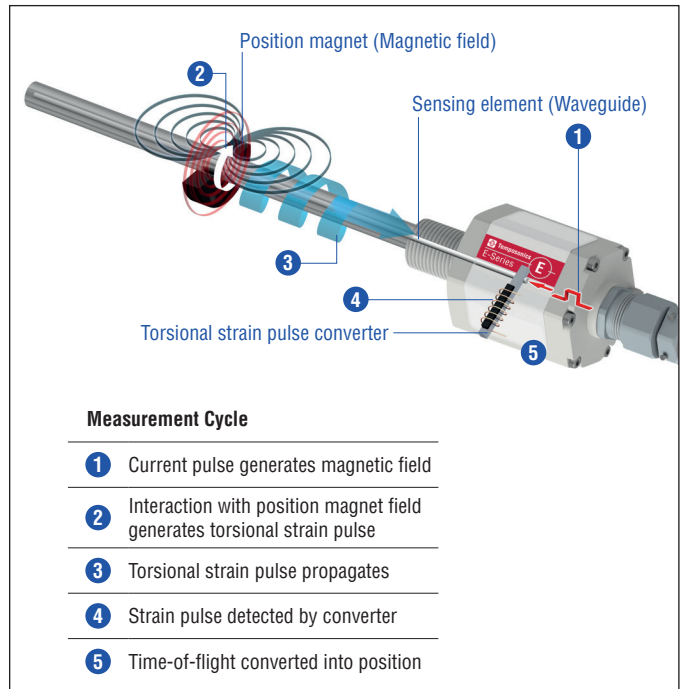


Fig. 1: Time-of-flight based magnetostrictive position sensing principle

## 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/UK Ex/IECEX/CEC/NEC/CCC certified
- Set points are programmable

Certification
⊕ II 3G Ex nC IIC T4 Gc
⊕ II 3D Ex tc IIIC T130 °C Dc
⊕ Class I/II/III Div 2 T4 ABCDFG
⊕ Class I Zone 2 T4 IIC Zone 22 AEx tc T4 IIIC Dc Ex tc IIIC T130 °C Dc IP66/IP68
⊕ Ex nC IIC T4 Gc
⊕ Ex tD A22 IP66/IP68 T130 °C -40 °C ≤ Ta ≤ 85 °C; Type: 4X; IP66/IP68

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	≤ 1200 mm	≤ 2400 mm
	Cycle time	0.5 ms	1.0 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); option: -40...+75 °C (-40...+167 °C)		
Humidity	90 % relative humidity, no condensation		
Ingress protection	With FEP 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	Rod: 20 g/10...2000 Hz, IEC standard 60068-2-6 (excluding resonant frequencies) Profile: 15 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 ET sensors fulfill the requirements of the EMC directives 2014/30/EU, UKSI 2016 No. 1091 and TR CU 020/2011		
Operating pressure (rod version only)	Up to 350 bar (5076 psi)		
Magnet movement velocity <sup>3</sup>	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	Aluminum		
RoHS compliance	The used materials are compliant with the requirements of EU directive 2011/65/EU and EU regulation 2015/863 as well as UKSI 2012 No. 3032		
Stroke length	50...3000 mm (2...118 in.)		
Mechanical mounting			
Mounting position	Any		
Mounting instruction	Please consult the technical drawings <a href="#">on page 4</a> 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/sensor profile, make sure that the maximal speed of the moving magnet is ≤ 1 m/s (Ex requirement due to ESD [Electro Static Discharge])

## TECHNICAL DRAWING

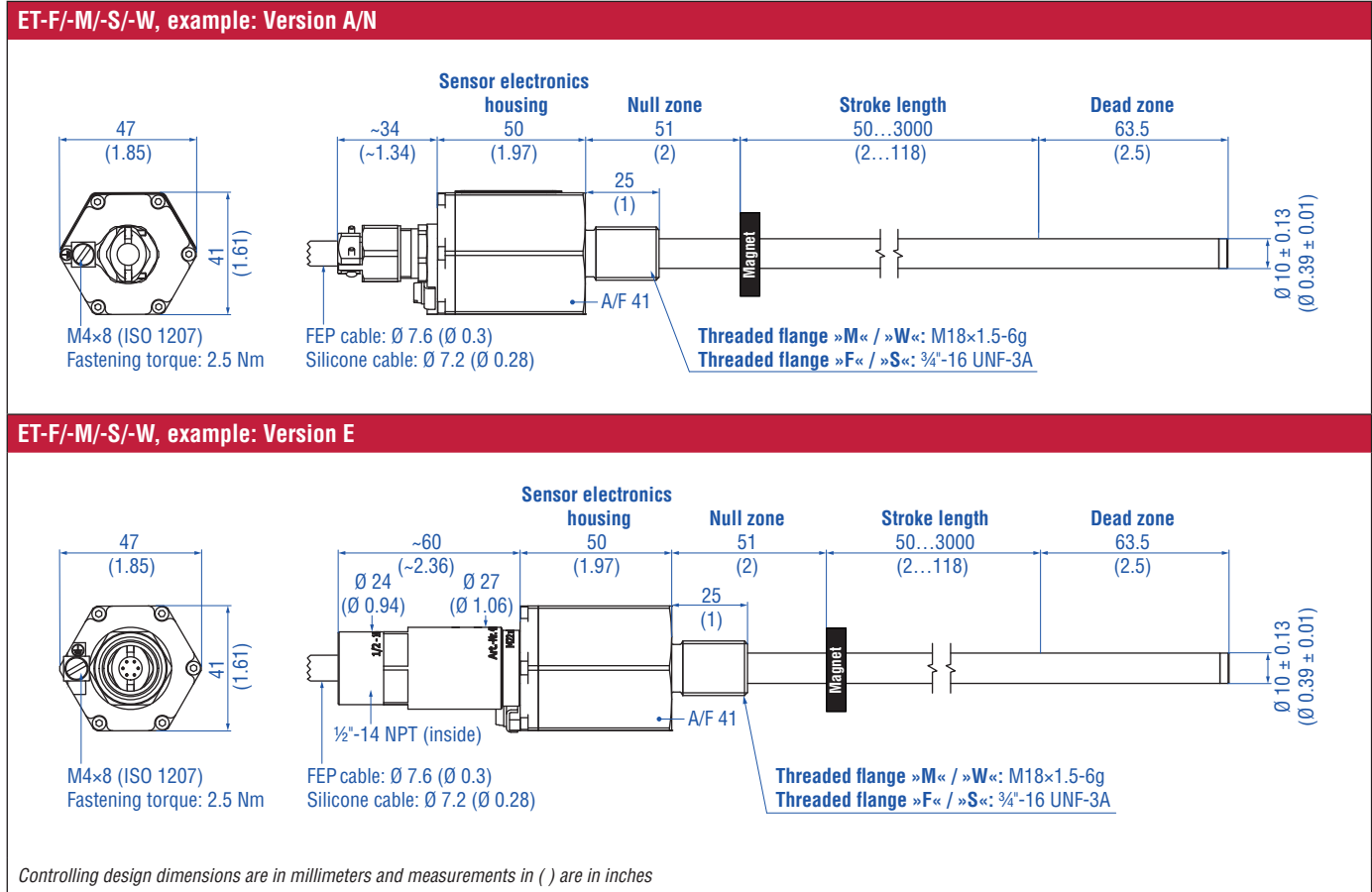


Fig. 4: Temposonics® ET with ring magnet

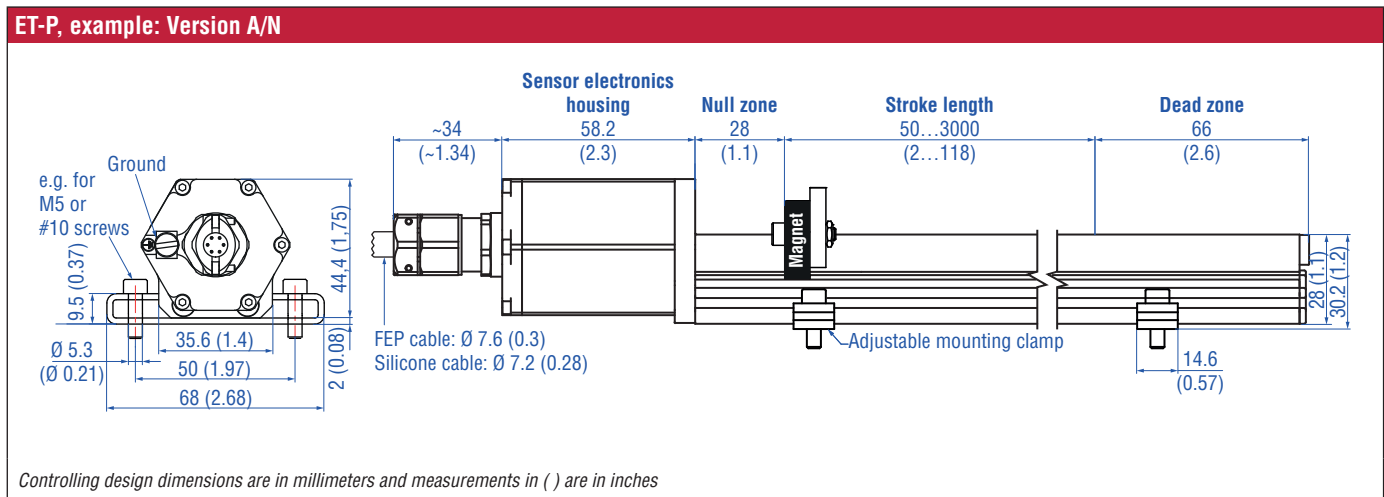


Fig. 5: Temposonics® ET-P with U-magnet

## CONNECTOR WIRING

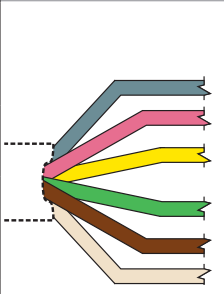
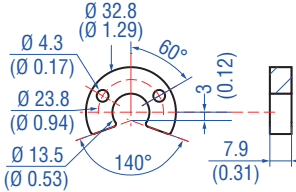
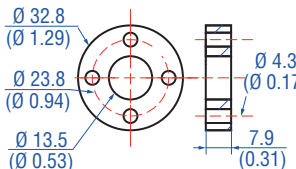
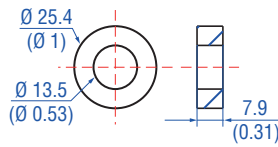
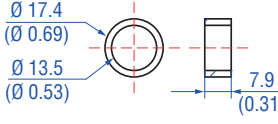
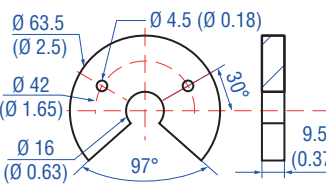
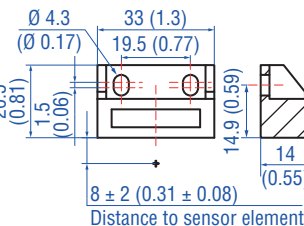
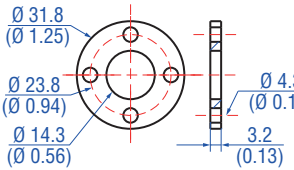
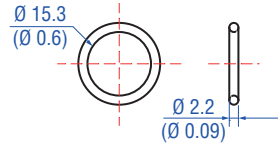
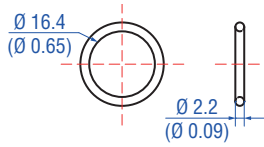
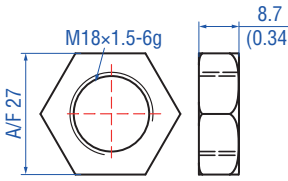
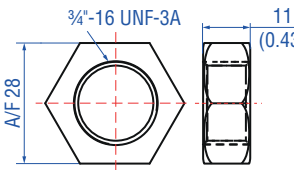
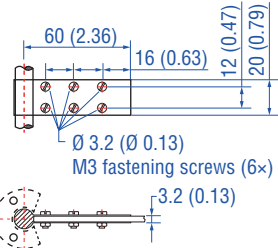
TXX/VXX			
Signal + power supply			
Cable	Color	Voltage	Current
	GY	Output 1: 0...10 VDC or 10...0 VDC	Output 1: 4(0)...20 mA or 20... 4(0) mA
	PK	DC Ground for output 1	DC Ground for output 1
	YE	Output 2: 0...10 VDC or 10...0 VDC	Output 2: 4(0)...20 mA or 20... 4(0) mA
	GN	DC Ground for output 2	DC 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 Catalog](#)  551444

Position magnets			
			
<p><b>U-magnet OD33</b> Part no. 251 416-2</p>	<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>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>	<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 neobond Weight: Approx. 5 g Surface pressure: Max. 20 N/mm<sup>2</sup> Operating temperature: -40...+105 °C (-40...+221 °F)</p>

Position magnets	Magnet spacer	O-ring	
			
<p><b>U-magnet OD63.5</b> Part no. 201 553</p>	<p><b>Block magnet L</b> Part no. 403 448</p>	<p><b>Magnet spacer</b> Part no. 400 633</p>	<p><b>O-ring for threaded flange</b> M18×1.5-6g Part no. 401 133</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: 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 applications.</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 Durometer: 75 ± 5 Shore A Operating temperature: -40...+204 °C (-40...+400 °F)</p>

O-ring	Mounting accessories		
			
<p><b>O-ring for threaded flange</b> 3/4"-16 UNF-3A Part no. 560 315</p>	<p><b>Hex jam nut M18×1.5-6g</b> Part no. 500 018</p>	<p><b>Hex jam nut 3/4"-16 UNF-3A</b> Part no. 500 015</p>	<p><b>Fixing clip</b> Part no. 561 481</p>
<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>



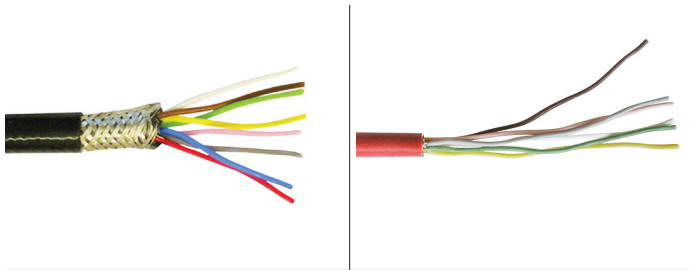
**FREQUENTLY ORDERED ACCESSORIES FOR ET-P** – Additional options available in our [Accessories Catalog](#) 551444

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

Position magnets	Mounting accessories		
<p><b>U-magnet OD33</b> Part no. 251 416-2</p>	<p><b>Block magnet L</b> Part no. 403 448</p>	<p><b>Mounting clamp</b> Part no. 400 802</p>	<p><b>T-nut</b> Part no. 401 602</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>	<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 applications.</p>	<p>Material: Stainless steel (AISI 304)</p>	<p>Fastening torque for M5 screw: 4.5 Nm</p>

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

**Cables**



**FEP cable**  
Part no. 530 112

Material: FEP 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 × 2 × 0.25 mm<sup>2</sup>  
Bending radius: 8 – 10 × D (fixed installation)  
Operating temperature: -100...+180 °C (-148...+356 °F)

**Silicone cable**  
Part no. 530 113

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 × 2 × 0.25 mm<sup>2</sup>  
Bending radius: 5 × D (fixed installation)  
Operating temperature: -50...+180 °C (-58...+356 °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](http://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.

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



## 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		

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

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

<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...118 in.	4.0 in.
Non-standard stroke lengths are available; must be encoded in 5 mm / 0.1 in. increments	

<b>d</b>	<b>Connection type</b>
T X X	T01...T10 (1...10 m) XX m FEP cable (part no. 530 112) T03...T33 (3...33 ft.) XX ft. FEP cable (part no. 530 112)
V X X	V01...V10 (1...10 m) XX m silicone cable (part no. 530 113) V03...V33 (3...33 ft.) XX ft. silicone cable (part no. 530 113)
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/UK Ex/IECEX/CEC/NEC/CCC
E	ATEX/UK Ex/IECEX/CEC/NEC/CCC 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 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 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 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 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 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 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

<b>h</b>	<b>Operating temperature (optional)</b>
L	-40...+75 °C (-40...+167 °C)

**NOTICE**

Use magnets of the same type for multi-position measurement.

**DELIVERY**

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**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

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