

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 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.

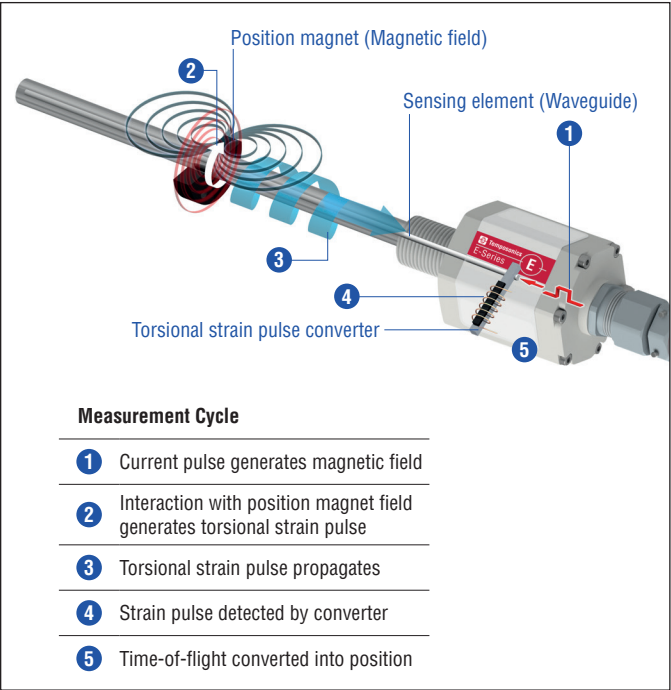


Fig. 1: Time-of-flight based magnetostrictive position sensing principle

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 tc IIIC T130°C Dc -40 °C ≤ Ta ≤ 105 °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) 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 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 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	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 2022 No. 622 with amendments			
Stroke length	50...3000 mm (2...118 in.)			
Mechanical mounting				
Mounting position	Any			
Mounting instruction	Please consult the technical drawings on page 4 and the operation manual (document number: 551890)			
Electrical connection				
Connection type	Cable outlet			
Operating voltage	+24 VDC (−15/+20 %); the ET sensors must be power supplied via an external Class 2 power source in accordance with the UL approval			
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			

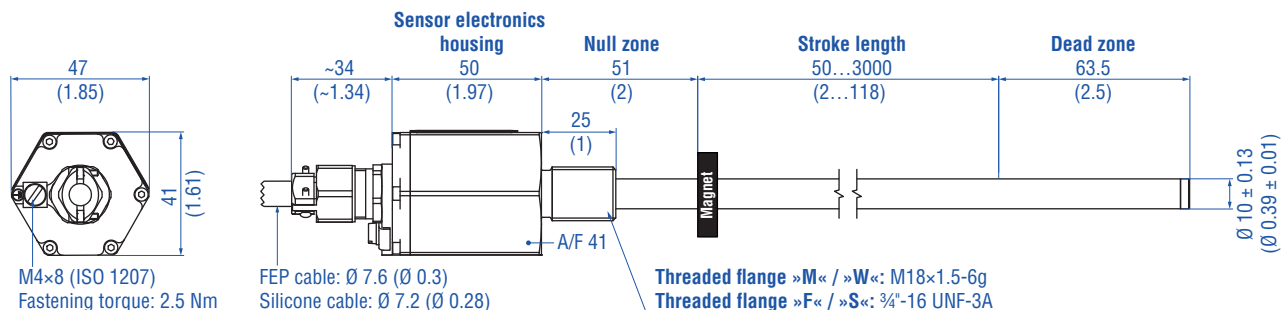
1/ The internal digital value is transferred via a 16-bit D/A converter into a proportional, analog current or voltage signal

2/ With position magnet # 251 416-2

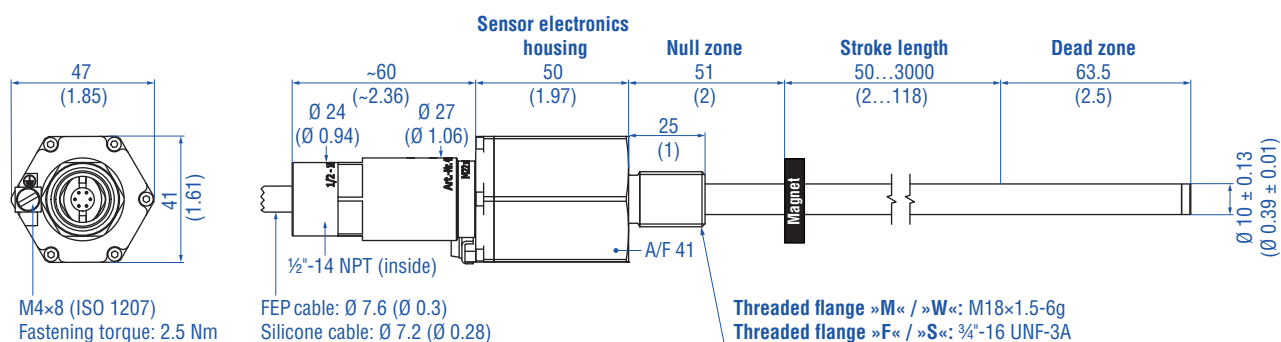
3/ If there is contact between the moving magnet including the magnet holder and the sensor rod/sensor profile, make sure that the maximal speed of the moving magnet is ≤ 1 m/s (Ex requirement due to ESD [Electro Static Discharge])

TECHNICAL DRAWING

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



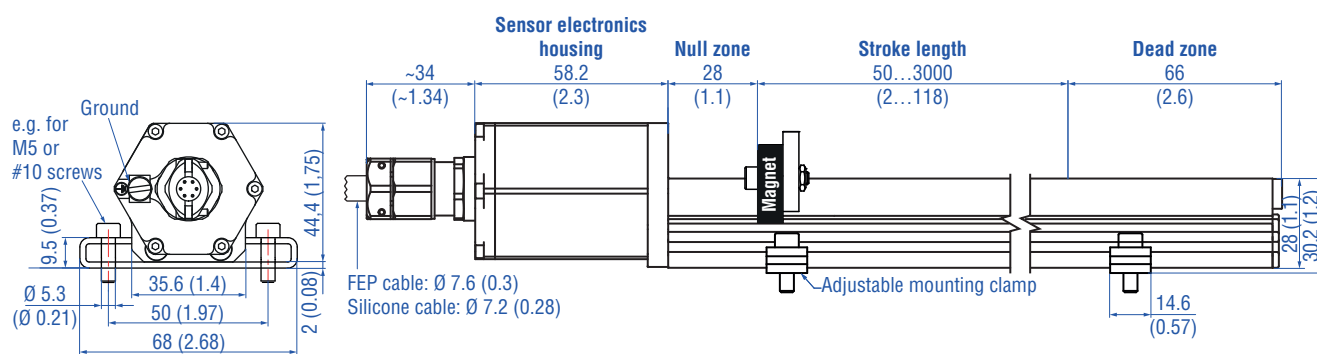
ET-F/-M/-S/-W, example: Version E



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

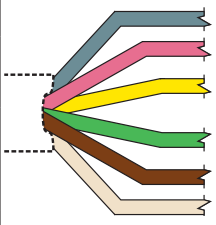
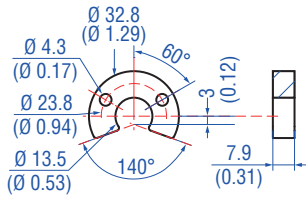
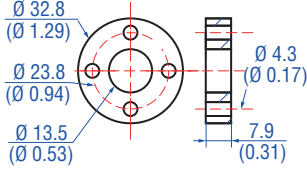
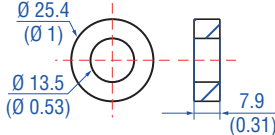
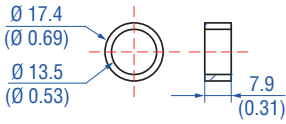
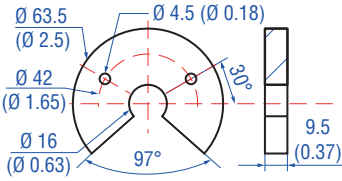
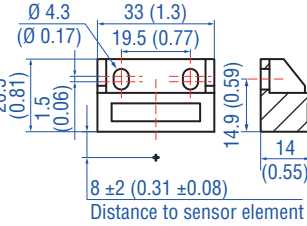
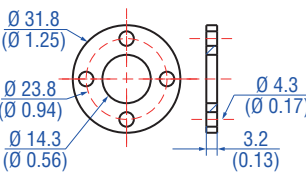
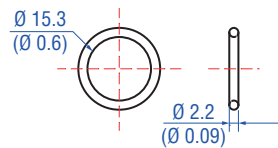
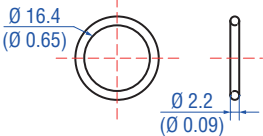
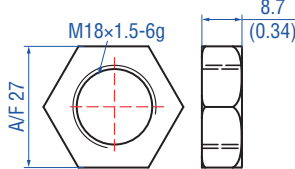
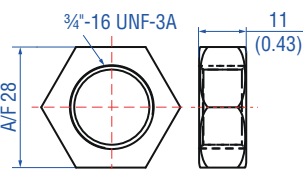
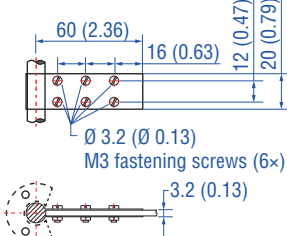
TXX/VXX			
Signal + power supply			
Cable	Color	Voltage	Current
	GY	Output 1: 0...10 VDC or 10...0 VDC	Output 1: 4(0)...20 mA or 20... 4(0) mA
	PK	DC Ground for output 1	DC Ground for output 1
	YE	Output 2: 0...10 VDC or 10...0 VDC	Output 2: 4(0)...20 mA or 20... 4(0) mA
	GN	DC Ground for output 2	DC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

Position magnets			
 U-magnet OD33 Part no. 251 416-2 Material: PA ferrite GF20 Weight: Approx. 11 g Surface pressure: Max. 40 N/mm² Fastening torque for M4 screws: 1 Nm Operating temperature: -40...+120 °C (-40...+248 °F)	 Ring magnet OD33 Part no. 201 542-2 Material: PA ferrite GF20 Weight: Approx. 14 g Surface pressure: Max. 40 N/mm² Fastening torque for M4 screws: 1 Nm Operating temperature: -40...+120 °C (-40...+248 °F)	 Ring magnet OD25.4 Part no. 400 533 Material: PA ferrite Weight: Approx. 10 g Surface pressure: Max. 40 N/mm² Operating temperature: -40...+120 °C (-40...+248 °F)	 Ring magnet OD17.4 Part no. 401 032 Material: PA neobond Weight: Approx. 5 g Surface pressure: Max. 20 N/mm² Operating temperature: -40...+105 °C (-40...+221 °F)
Position magnets		Magnet spacer	O-ring
 U-magnet OD63.5 Part no. 201 553 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)	 Block magnet L Part no. 403 448 Material: Plastic carrier with neodymium 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.	 Magnet spacer Part no. 400 633 Material: Aluminum Weight: Approx. 5 g Surface pressure: Max. 20 N/mm² Fastening torque for M4 screws: 1 Nm	 O-ring for threaded flange M18×1.5-6g Part no. 401 133 Material: Fluoroelastomer Durometer: 75 ± 5 Shore A Operating temperature: -40...+204 °C (-40...+400 °F)
O-ring	Mounting accessories		
 O-ring for threaded flange ¾"-16 UNF-3A Part no. 560 315 Material: Fluoroelastomer Durometer: 75 ± 5 Shore A Operating temperature: -40...+204 °C (-40...+400 °F)	 Hex jam nut M18×1.5-6g Part no. 500 018 Material: Steel, zinc plated	 Hex jam nut ¾"-16 UNF-3A Part no. 500 015 Material: Steel, zinc plated	 Fixing clip Part no. 561 481 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

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

Position magnets

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

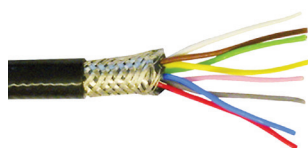
Position magnets

Mounting accessories

U-magnet OD33 Part no. 251 416-2 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...+120 °C (-40...+248 °F)	Block magnet L Part no. 403 448 Material: Plastic carrier with neodymium 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.	Mounting clamp Part no. 400 802 Material: Stainless steel (AISI 304)	T-nut Part no. 401 602 Fastening torque for M5 screw: 4.5 Nm

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

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 aluminum
P	Profile

c	Stroke length
X X X X M	0050...3000 mm
Standard stroke length (mm)	
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.)	
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	

d	Connection type
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.	

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/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).

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 (optional)
L	–40...+75 °C (–40...+167 °C)

NOTICE

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

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

UNITED STATES
Temposonics, LLC
Americas & APAC Region
3001 Sheldon Drive
Cary, N.C. 27513
Phone: +1 919 677-0100
E-mail: info.us@temposonics.com

GERMANY
Temposonics
GmbH & Co. KG
EMEA Region & India
Auf dem Schüffel 9
58513 Lüdenscheid
Phone: +49 2351 9587-0
E-mail: info.de@temposonics.com

ITALY
Branch Office
Phone: +39 030 988 3819
E-mail: info.it@temposonics.com

FRANCE
Branch Office
Phone: +33 6 14 060 728
E-mail: info.fr@temposonics.com

UK
Branch Office
Phone: +44 79 21 83 05 86
E-mail: info.uk@temposonics.com

SCANDINAVIA
Branch Office
Phone: +46 70 29 91 281
E-mail: info.sca@temposonics.com

CHINA
Branch Office
Phone: +86 21 3405 7850
E-mail: info.cn@temposonics.com

JAPAN
Branch Office
Phone: +81 3 6416 1063
E-mail: info.jp@temposonics.com

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