

Data Sheet

MH-Series XTERNAL MOUNT Magnetostrictive Linear Position Sensors

- Easy field installation and replacement of electronics module
- Stroke lengths up to 2500 mm
- High reliability due to EMC, shock & vibration resistance
- CANbus, voltage and current output



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.

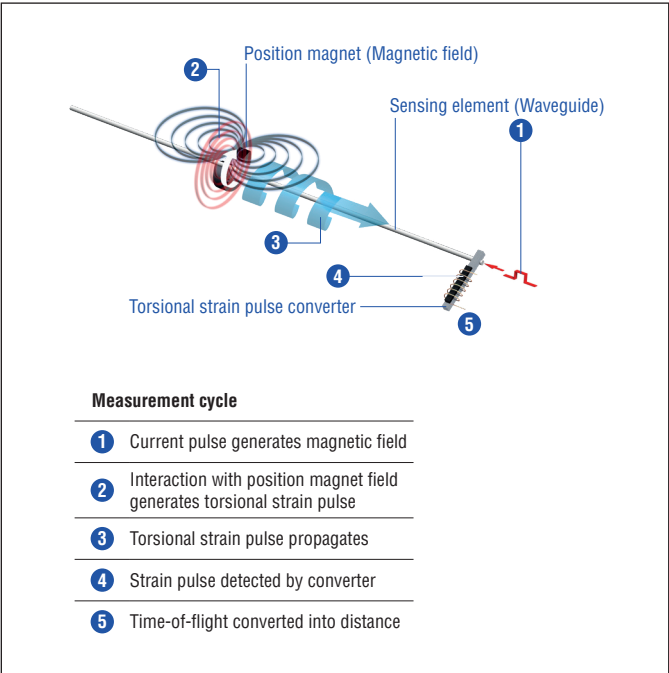


Fig. 1: Time-of-flight based magnetostrictive position sensing principle

XTERNAL MOUNT POSITION SENSOR

The Temposonics XTERNAL MOUNT (XM) position sensor is the first magnetostrictive position sensor for mobile hydraulic cylinders with a replaceable electronic module that automatically pairs with the existing sensing element inside of the cylinder. Take your spare XM electronic module and connect it to any XM sensing element for the two parts to pair themselves and you are back up and running with minimal downtime. There is no searching for paperwork or reading codes from inside of the cylinder.

The XTERNAL MOUNT is intended for harsh applications where electronics circuits have short life spans and the requirement for field replacement is a must. One screw and one connector can quickly change the electronic module that is mounted on the side of the cylinder.



Fig. 2: Typical applications

TECHNICAL DATA ANALOG

Output	
Voltage	0.15...4.9 VDC/0.25...4.75 VDC/0.5...4.5 VDC
Current	4...20 mA
Measured value	Position
Measurement parameters	
Stroke length	50...2500 mm for 7 mm pipe 50...1000 mm for 5 mm pipe
Resolution	±0.1 mm
Power up time	200 ms (typical)
Repeatability	±0.1 mm
Linearity	0050...0250 mm ≤ ±0.2 mm 0255...2000 mm ±0.04 % (F.S.) 2005...2500 mm ≤ ±0.8 mm
Internal sample rate	2 ms
Setpoint tolerance	≤ 1 mm
Operating conditions	
Operating temperature electronics	-40...+105 °C
Humidity	90 % relative humidity, no condensation, EN 60068-2-30
Ingress protection – Electronics module	IP69K EN60529 (when properly mounted)
Shock test	100 g (11 ms) single shock per axis, IEC 60068-2-27 50 g (11 ms) at 1000 shocks per axis, IEC 60068-2-29
Vibration test	Operational sine vibration test IEC 60068-2-6: 20 g (20...2000 Hz) with 7 mm pipe 15 g (20...2000 Hz) with 5 mm pipe Survival random vibration test IEC 60068-2-64: 15 g RMS (20...2000 Hz) 72 h per axis with 7 mm pipe and 5 mm pipe
EMC	Compliant with: ISO 13766-1:2018 Earth-moving and building construction machinery ISO 16750-2:2012 Road vehicles
EMI	200 V/m (200...1000 MHz), ISO 11452-2: 2019 200 mA (20...400 MHz), ISO 11452-4: 2020
Operating pressure ratings	
Pressure (according to DIN EN ISO 19879)*	
PN (nominal operating)	350 bar with 7 mm pipe 300 bar with 5 mm pipe
Pmax (max. overload)	450 bar with 7 mm pipe 350 bar with 5 mm pipe
Pstatic (proof pressure)	625 bar with 7 mm pipe 400 bar with 5 mm pipe
Design/Material	
Sensor electronics module	Zinc Alloy ZP5 (ZnAl4Cu1)
Sensor rod	Stainless steel 1.4306 (AISI 304L)
Sealing	O-rings: H-NBR 70

* / According to calculations under use of the FKM guideline

Cycles	Sensor pipe
Dynamic pressure: $< 2 \times 10^6$ pressure cycles	350 bar with 7 mm pipe 300 bar with 5 mm pipe
Static pressure: $< 2 \times 10^4$ pressure cycles	450 bar with 7 mm pipe 350 bar with 5 mm pipe
Proof pressure: Maximum 5 minutes testing time for cylinder pressure test	625 bar with 7 mm pipe 400 bar with 5 mm pipe

Technical data continued on next page

Electrical connection	
Connection type	Deutsch style connector (DT/AT 04-4P)
Operating voltage	12/24 VDC nominal (8...32 VDC)
Min load resistance (output VDC)	10 kΩ
Max Inrush current	3.0 A/2 ms (1.5 A/2 ms if supply < 13 V)
Supply voltage ripple	< 1 % _{PP}
Power drain	< 1.5 W
Over voltage protection (GND-VDC)	Up to +36 VDC
Polarity protection (GND-VDC)	Up to -36 VDC
Insulation resistance	R ≥ 10 MΩ @ 60 sec
Electric strength	500 VDC (DC GND to chassis GND)

TECHNICAL DATA CANbus

Output	
Bus-protocol	SAE J1939, CANopen protocol according to CiA DS-301 V4.1, device profile DS-406 V3.1
Measured value	Position and velocity
Measurement parameters	
Stroke length	50...2500 mm for 7 mm pipe 50...1000 mm for 5 mm pipe
Resolution (position)	±0.1 mm
Resolution (velocity)	1 mm/s
Boot up time	400 ms (typical)
Cycle time	Programmable
Linearity	0050...0250 mm ≤ ±0.2 mm 0255...2000 mm ±0.04 % (F.S.) 2005...2500 mm ≤ ±0.8 mm
Internal sample rate	1 ms
Setpoint tolerance	±0.5 mm
Operating conditions	
Operating temperature electronics	-40...+105 °C
Humidity	90 % relative humidity, no condensation, EN 60068-2-30
Ingress protection – Electronics module	IP69K EN60529 (when properly mounted)
Shock test	100 g (11 ms) single shock per axis, IEC 60068-2-27 50 g (11 ms) at 1000 shocks per axis, IEC 60068-2-29
Vibration test	Operational sine vibration test IEC 60068-2-6: 20 g (20...2000 Hz) Survival random vibration test IEC 60068-2-64: 15 g RMS (20...2000 Hz) 12 h per axis
EMC	Compliant with: ISO 13766-1:2018 Earth-moving and building construction machinery ISO 16750-2:2012 Road vehicles
EMI	200 V/m (200...2000 MHz), ISO 11452-2: 2019 200 mA (20...200 MHz), ISO 11452-4: 2011
Operating pressure ratings	
Pressure (according to DIN EN ISO 19879)*	
PN (nominal operating)	350 bar with 7 mm pipe 300 bar with 5 mm pipe
Pmax (max. overload)	450 bar with 7 mm pipe 350 bar with 5 mm pipe
Pstatic (proof pressure)	625 bar with 7 mm pipe 400 bar with 5 mm pipe
Design/Material	
Sensor electronics module	Zinc Alloy ZP5 (ZnAl4Cu1)
Sensor rod	Stainless steel 1.4306 (AISI 304L)
Sealing	O-rings: H-NBR 70

* / According to calculations under use of the FKM guideline

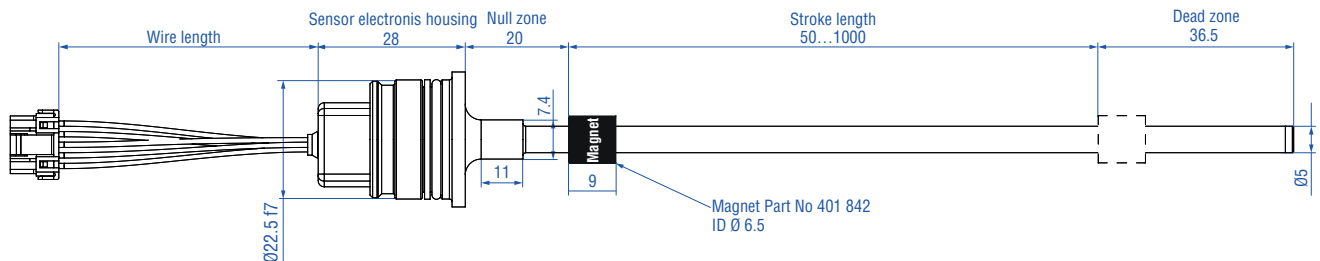
Cycles	Sensor pipe
Dynamic pressure: < 2 × 10 ⁶ pressure cycles	350 bar with 7 mm pipe 300 bar with 5 mm pipe
Static pressure: < 2 × 10 ⁴ pressure cycles	450 bar with 7 mm pipe 350 bar with 5 mm pipe
Proof pressure: Maximum 5 minutes testing time for cylinder pressure test	625 bar with 7 mm pipe 400 bar with 5 mm pipe

Technical data continued on next page

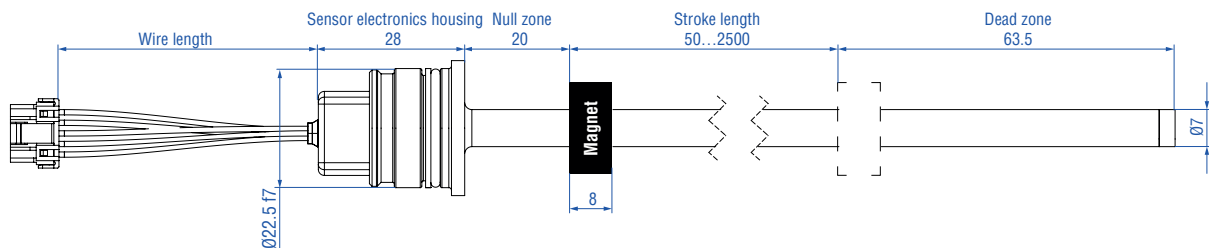
Electrical connection	
Connection type	Deutsch style connector (DT/AT 04-4P)
Operating voltage	12/24 VDC nominal (8...32 VDC)
Max Inrush current	3.5 A/2 ms (2.0 A/2 ms if supply < 13 V)
Supply voltage ripple	< 1 % _{PP}
Power drain	< 1.5 W
Over voltage protection (GND-VDC)	Up to + 36 VDC
Polarity protection (GND-VDC)	Up to – 36 VDC
Insulation resistance	R ≥ 10 MΩ @ 60 sec
Electric strength	500 VDC (DC GND to chassis GND)

TECHNICAL DRAWING

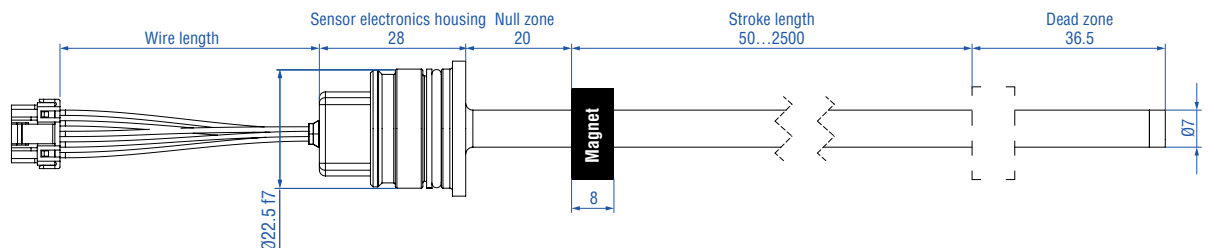
XM-HB – Ø 5 mm pressure pipe dead zone: 36.5 mm stroke length: 50...1000 mm (flat endplug)



XM-HD – Ø 7 mm pressure pipe dead zone: 63.5 mm stroke length: 50...2500 mm (flat endplug)



XM-HF – Ø 7 mm pressure pipe dead zone: 36.5 mm stroke length: 50...2500 mm (flat endplug)



Controlling design dimensions are in millimeters

Fig. 3: Temposonics® XTERNAL MOUNT full assembly

TECHNICAL DRAWING

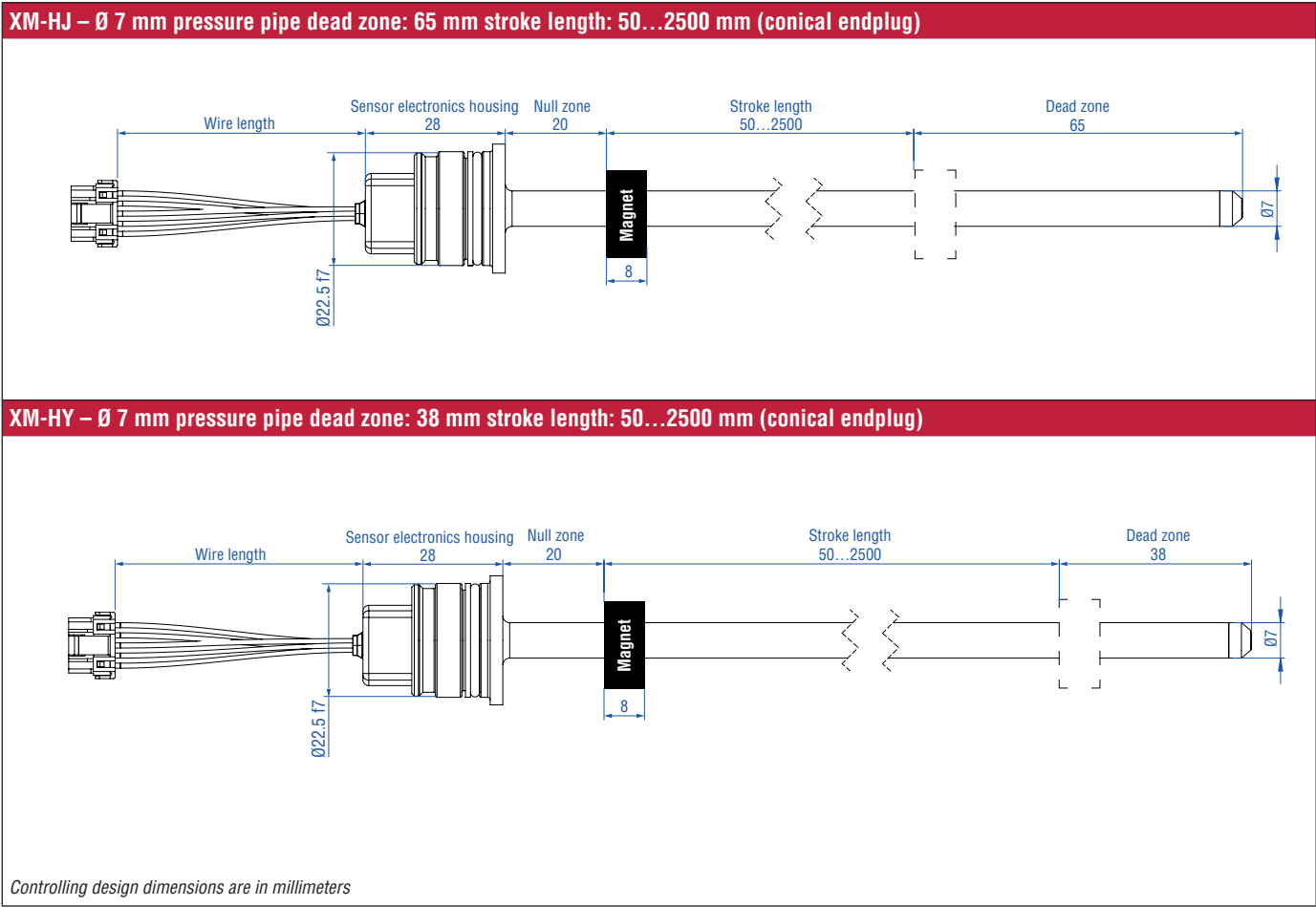


Fig. 4: Temposonics® XTERNAL MOUNT full assembly

TECHNICAL DRAWING

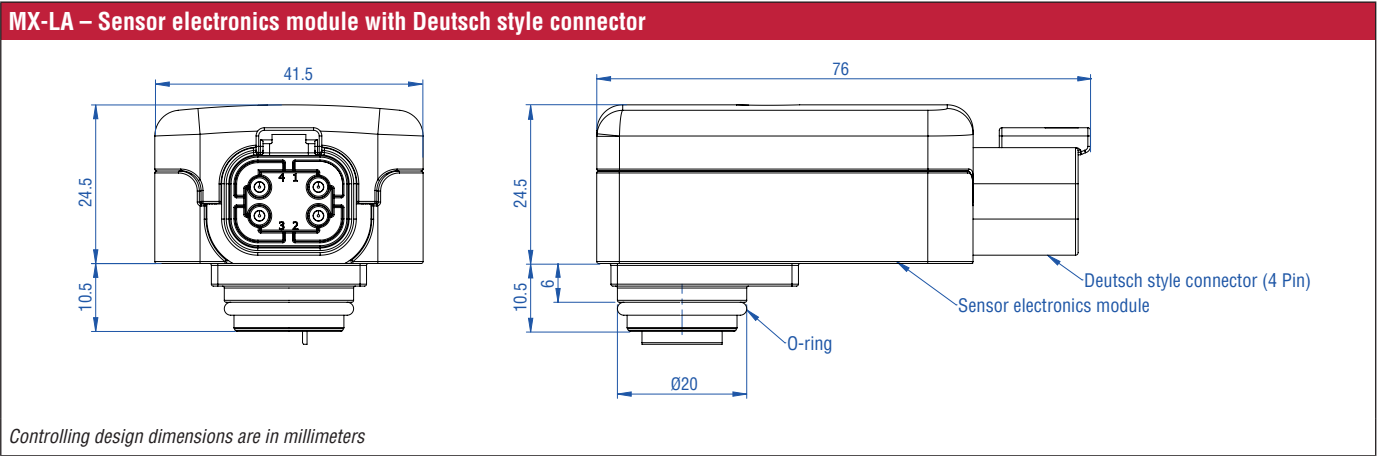


Fig. 5: Temposonics® XTERNAL MOUNT sensor electronics module side view

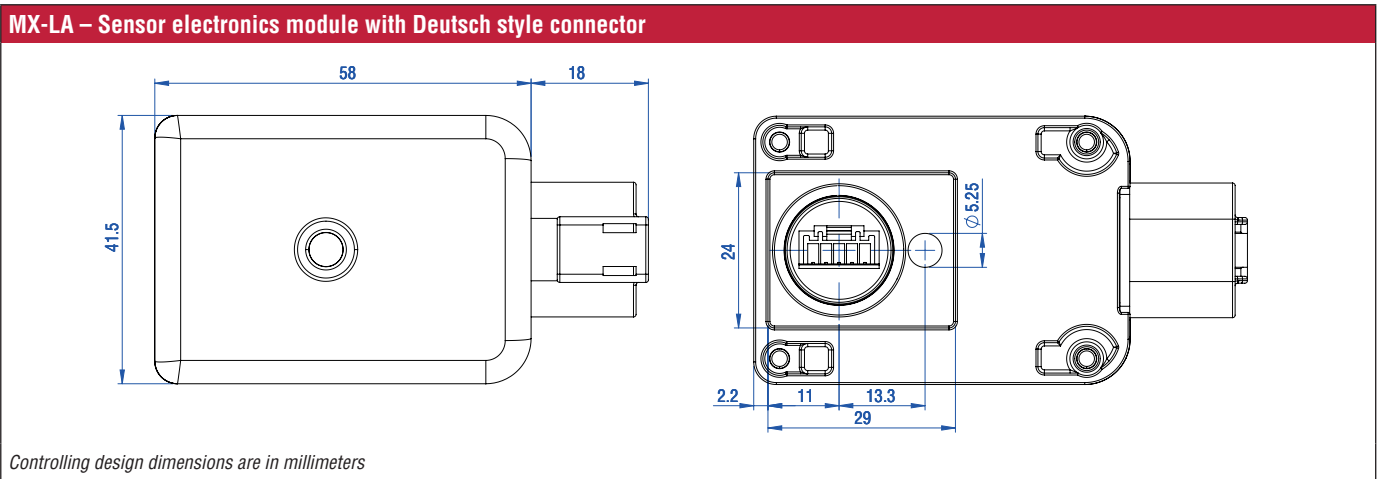


Fig. 6: Temposonics® XTERNAL MOUNT sensor electronics module top and bottom view

CONNECTOR WIRING

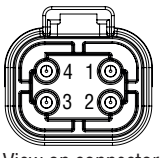
Deutsch style connector (DT/AT 04-4P)			
 View on connector	Analog (G)		CANbus (S)
	Pin	Function	Function
	1	VDC	VDC
	2	not connected	CAN_L
	3	GND	GND
	4	SIG	CAN_H

Fig. 7: Connector wiring

ORDER CODE – FULL ASSEMBLY (ANALOG OUTPUT)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
X	M	H						M	A	G			3			
a		b		c					d		e		f	g		

a	Sensor model
X M	XTERNAL MOUNT

b	Design
Full assembly	
H B	Rod: Ø 5 mm/dead zone: 36.5 mm/stroke length: 50...1000 mm/flat endplug
H D	Rod: Ø 7 mm/dead zone: 63.5 mm/stroke length: 50...2500 mm/flat endplug
H F	Rod: Ø 7 mm/dead zone: 36.5 mm/stroke length: 50...2500 mm/flat endplug
H J	Rod: Ø 7 mm/dead zone: 65 mm/stroke length: 50...2500 mm/conical endplug
H Y	Rod: Ø 7 mm/dead zone: 38 mm/stroke length: 50...2500 mm/conical endplug

c	Stroke length
X X X X M	0050...2500 mm in 5 mm steps (rod: Ø 7 mm)
X X X X M	0050...1000 mm in 5 mm steps (rod: Ø 5 mm)

d	Electronics module connector
Deutsch style connector (DT/AT 04-4P) (VDC – GND – SIG)	
A G	Connector wiring G: 1-3-4

e	Sensing element wire length
0 5	50 mm (default)
0 8	75 mm
1 0	100 mm
1 5	150 mm

f	Operating voltage
3	12/24 VDC nominal (8...32 VDC)

g	Output
V 1 1	0.25...4.75 VDC
V 1 2	0.5...4.5 VDC
V 1 5	0.15...4.9 VDC
A 0 1	4...20 mA

DELIVERY



- Electronics module with O-ring
- Sensing element assembled in Pressure pipe with O-ring and Backup-ring
- M5x30 mounting screw for Electronics module

Accessories (e.g. position magnets) have to be ordered separately

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

ORDER CODE – FULL ASSEMBLY (CANBUS OUTPUT)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
X	M	H						M	A	S			3							
a		b		c					d		e		f	g			h	i		j

a	Sensor model
X M	XTERNAL MOUNT

b	Design
Full assembly	
H B	Rod: Ø 5 mm/dead zone: 36.5 mm/stroke length: 50...1000 mm/flat endplug
H D	Rod: Ø 7 mm/dead zone: 63.5 mm/stroke length: 50...2500 mm/flat endplug
H F	Rod: Ø 7 mm/dead zone: 36.5 mm/stroke length: 50...2500 mm/flat endplug
H J	Rod: Ø 7 mm/dead zone: 65 mm/stroke length: 50...2500 mm/conical endplug
H Y	Rod: Ø 7 mm/dead zone: 38 mm/stroke length: 50...2500 mm/conical endplug

c	Stroke length
X X X X M	0050...2500 mm in 5 mm steps (rod: Ø 7 mm)
X X X X M	0050...1000 mm in 5 mm steps (rod: Ø 5 mm)

d	Electronics module connector
Deutsch style connector (DT/AT 04-4P) (VDC – LO – GND – HI)	
A S	Connector wiring S: 1-2-3-4

e	Sensing element wire length
0 5	50 mm (default)
0 8	75 mm
1 0	100 mm
1 5	150 mm

f	Operating voltage
3	12/24 VDC nominal (8...32 VDC)

g	Output
C 0 1	CANopen
J 0 1	SAE J1939

h	Baud rate
CANopen (C01)	
0	1000 kbit/s
1	800 kbit/s
2	500 kbit/s
3	250 kbit/s
4	125 kbit/s
6	50 kbit/s
7	20 kbit/s
8	10 kbit/s
SAE J1939 (J01)	
2	500 kbit/s
3	250 kbit/s

i	Node ID/Source Address
CANopen (C01)	
	Hex 01...7F
SAE J1939 (J01)	
	Hex 01...FD

j	Cycle time
A	01 msec
B	05 msec
C	10 msec
D	20 msec
E	30 msec
F	40 msec
G	50 msec

DELIVERY



- Electronics module with O-ring
- Sensing element assembled in Pressure pipe with O-ring and Backup-ring
- M5x30 mounting screw for Electronics module

Accessories (e.g. position magnets) have to be ordered separately

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

ORDER CODE – ELECTRONICS MODULE (ANALOG OUTPUT)

1	2	3	4	5	6	7	8	9
X	M	L	A	G	3			
a		b	c		d	e		

a	Sensor model		
X	M	EXTERNAL MOUNT	
b	Design		
Electronics module			
L	Electronics module with Analog output		
c	Electronics module connector		
Deutsch style connector (DT/AT 04-4P) (VDC – GND – SIG)			
A	G	Connector wiring G: 1-3-4	
d	Operating voltage		
3	12/24 VDC nominal (8...32 VDC)		
e	Output		
V	1	1	0.25...4.75 VDC
V	1	2	0.5...4.5 VDC
V	1	5	0.15...4.9 VDC
A	0	1	4...20 mA

DELIVERY

- 
 - Electronics module with O-ring
- Accessories (e.g. position magnets) have to be ordered separately

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www.temposonics.com

ORDER CODE – ELECTRONICS MODULE (CANBUS OUTPUT)

1	2	3	4	5	6	7	8	9	10	11	12	13
X	M	L	A	S	3							
a		b	c		d	e			f	g		h

a	Sensor model
X M	XTERNAL MOUNT

b	Design
	Electronics module
L	Electronics module with CANbus output

c	Electronics module connector
	Deutsch style connector (DT/AT 04-4P) (VDC – LO – GND – HI)
A S	Connector wiring S: 1-2-3-4

d	Operating voltage
3	12/24 VDC nominal (8...32 VDC)

e	Output
C 0 1	CANopen
J 0 1	SAE J1939

f	Baud rate
	CANopen (C01)
0	1000 kbit/s
1	800 kbit/s
2	500 kbit/s
3	250 kbit/s
4	125 kbit/s
6	50 kbit/s
7	20 kbit/s
8	10 kbit/s
	SAE J1939 (J01)
2	500 kbit/s
3	250 kbit/s

g	Node ID/Source Address
	CANopen (C01)
	Hex 01...7F
	SAE J1939 (J01)
	Hex 01...FD

h	Cycle time
A	01 msec
B	05 msec
C	10 msec
D	20 msec
E	30 msec
F	40 msec
G	50 msec

DELIVERY



- Electronics module with O-ring

Accessories (e.g. position magnets) have to be ordered separately

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

ORDER CODE – SENSING ELEMENT AND PRESSURE PIPE ASSEMBLY (ALL OUTPUTS)

1	2	3	4	5	6	7	8	9	10	11
X	M	S						M		
a		b		c					d	

a	Sensor model									
X	M	XTERNAL MOUNT								

b		Design	
Sensor element and pressure pipe assembly			
S	B	Rod: Ø 5 mm/dead zone: 36.5 mm/stroke length: 50...1000 mm/flat endplug	
S	D	Rod: Ø 7 mm/dead zone: 63.5 mm/stroke length: 50...2500 mm/flat endplug	
S	F	Rod: Ø 7 mm/dead zone: 36.5 mm/stroke length: 50...2500 mm/flat endplug	
S	J	Rod: Ø 7 mm/dead zone: 65 mm/stroke length: 50...2500 mm/conical endplug	
S	Y	Rod: Ø 7 mm/dead zone: 38 mm/stroke length: 50...2500 mm/conical endplug	

c	Stroke length									
X	X	X	X	M	0050...2500 mm in 5 mm steps (Rod: Ø 7mm)					
X	X	X	X	M	0050...1000 mm in 5 mm steps (Rod: Ø 5mm)					

d	Sensing element wire length									
0	5	50 mm (default)								
0	8	75 mm								
1	0	100 mm								
1	5	150 mm								

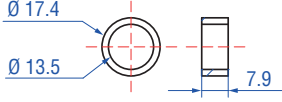
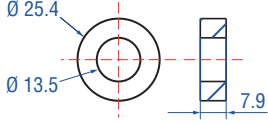
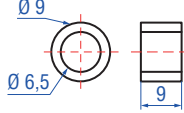
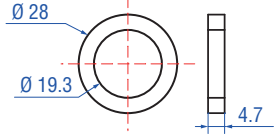
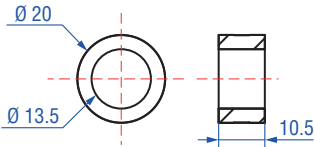
DELIVERY



- Sensing element assembled in Pressure pipe with O-ring and Backup-ring
- Accessories (e.g. position magnets) have to be ordered separately

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

FREQUENTLY ORDERED ACCESSORIES

Position magnets			
			
Ring magnet OD17.4 Part no. 401 032	Ring magnet OD25.4 Part no. 400 533	Ring magnet OD9 Part no. 401 842	Ring magnet OD28 Part no. 400 424
Material: PA neobond Weight: Approx. 5 g Surface pressure: Max. 20 N/mm ² 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...+120 °C (-40...+248 °F)	Material: Strontium ferrite compound nylon 12 Weight: ca. 1 g Operating temperature: -40...+85 °C (-40...+185 °F)	Material: Composite PA ferrite GF20 Weight: Approx. 6 g Surface pressure: Max. 20 N/mm ² Operating temperature: -40...+100 °C (-40...+212 °F)
Position magnet	Test kit		
			
Ring magnet OD20 Part no. 254 012	Test kit Analog Part no. 280 618		
Material: Composite neobond Weight: Approx. 8.5 g Surface pressure: Max. 20 N/mm ² Operating temperature: -40...+75 °C (-40...+167 °F)	Kit includes: 1 × MH-Series Analog / PWM Tester 1 × 12 VDC battery charger with adapter (adapter main plug EU, adapter main plug UK) 1 × cable with M12 connector 1 × cable with pigtailed wires 1 × carrying case		



Temposonics

AN AMPHENOL COMPANY

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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