Temposonics®

Magnetostrictive Linear Position Sensors

MH-Series Flexible MH
Data Sheet

– Linear, absolute measurement
– Easy in-field installation and replacement
– Stroke lengths from 500…5000 mm
– Resolution: ±0.2 mm
– Analog and CANbus output options

MEASURING TECHNOLOGY

The absolute, linear position sensors provided by Temposonics 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.
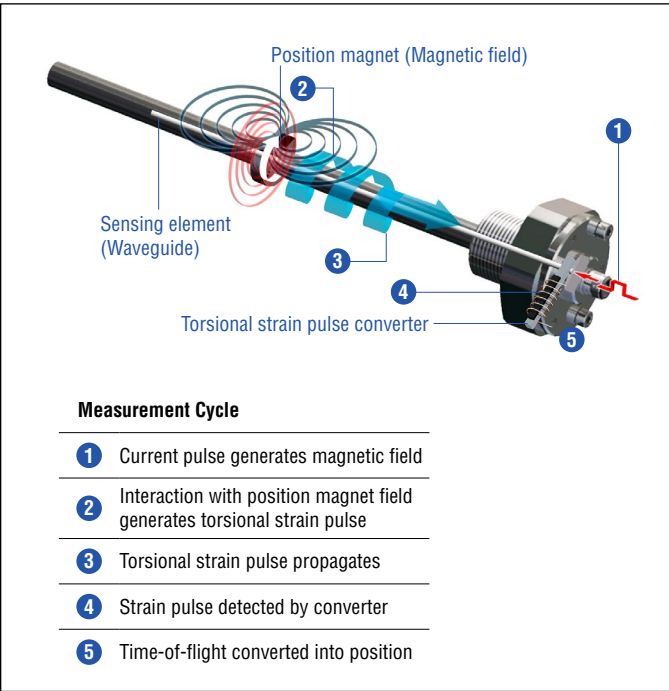

Position magnet (Magnetic field)

Sensing element
(Waveguide)

Torsional strain pulse converter

Measurement Cycle

1	Current pulse generates magnetic field
2	Interaction with position magnet field generates torsional strain pulse
3	Torsional strain pulse propagates
4	Strain pulse detected by converter
5	Time-of-flight converted into position

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

FLEXIBLE MH SENSOR

Designed for use with hydraulic cylinders in mobile applications, the externally threaded Flexible MH sensor features an innovative two-part design. This design allows users to separate the flexible sensing element and electronics from the housing without opening the hydraulic system.

While it is manageable to install and remove hydraulic cylinder sensors at a manufacturing facility, it can be extremely challenging in the field. Trained service technicians can remove and replace the internal components with just 200 mm of clearance regardless of stroke length and without breaking the hydraulic seal. This serviceability means decreased downtime and disruption, providing increased productivity. Replacement units ship as coiled rings to ease handling and reduce shipping costs.
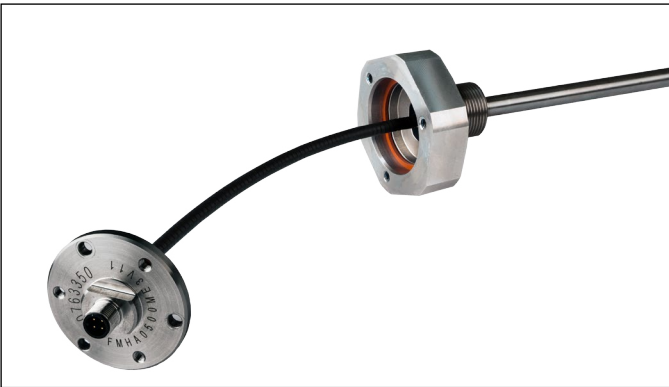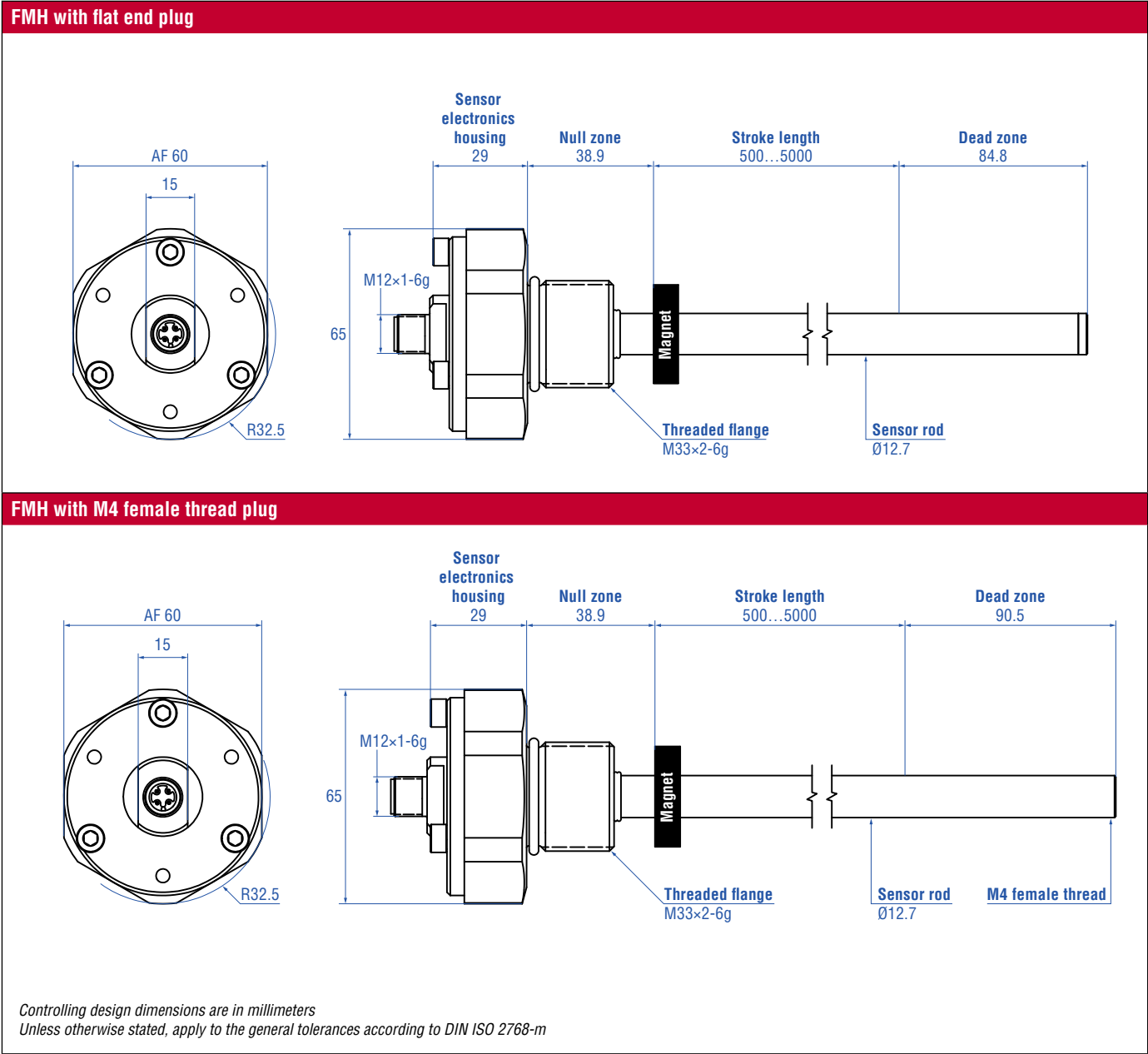

Fig. 2: Two-part housing design

TECHNICAL DATA ANALOG

Input	
Measured value	Position
Stroke range	500…5000 mm (in 20 mm steps)
Output	
Signal characteristic	Analog output restricted by noise or A/D converter of control unit
Voltage	0.25…4.75 VDC / 0.5…4.5 VDC
Current	4…20 mA
Resolution	±0.2 mm
Sample rate	2 ms
Accuracy	
Linearity	±0.04 % (F.S.)
Repeatability	±0.005 % (F.S.)
Hysteresis	±0.2 mm
Operating conditions	
Mounting position	Any
Operating temperature	−40…+105 °C
Humidity	90 % rel. humidity, no condensation
Ingress protection	IP67 / IP69K with appropriate mating connection
Pressure	
Nominal operating pressure (P_N)	350 bar
Max. overload pressure in cylinder (P_{MAX})	450 bar
Max. static proof pressure in cylinder (P_{PROOF})	625 bar
Environmental testing	
Shock test	IEC 60068-2-27, 100 g (6 ms) single shock, 50 g (11 ms) at 1000 shocks per axis
Vibration test	IEC 60068-2-64, 2 g (5…2000 Hz)
EMC test & evaluation	ISO16750-2:2010 ISO 14982:2009 - Agricultural and forestry machinery ISO 13766:2006 - Earth-moving machinery EN 13309:2010 - Construction machinery RF immunity to 200 V/m per ISO 11452-2/-4
Materials and dimensions	
Sensor rod with flange	Stainless steel 1.4306 (AISI 304L)
Sensor electronics housing	Stainless steel 1.4305 (AISI 303)

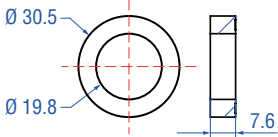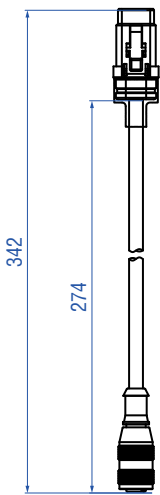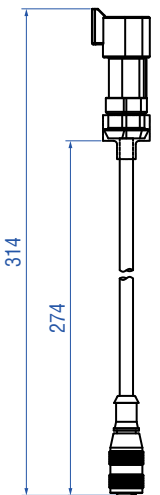| Electrical installation		
Connector	M12 male plug	
Supply voltage	**12 VDC (tolerance range 8…32 VDC)**	**24 VDC (tolerance range 8…32 VDC)**
Current consumption	Typ. $\leq$ 100 mA	Typ. $\leq$ 50 mA
Load (output VDC)	$R_L \geq$ 10 kΩ	$R_L \geq$ 10 kΩ
Load current (output VDC)	Typ. 1 mA	Typ. 1 mA
Loud (output mA)	$R_L \leq$ 250 Ω	$R_L \leq$ 500 Ω
Inrush current	Max. 2.5 A / 2 ms	Max. 4.5 A / 2 ms
Supply voltage ripple	< 1 %$_{PP}$	
Power drain	< 1 W	
Over voltage protection (GND-VDC)	Up to +36 VDC	
Polarity protection (GND-VDC)	Up to −36 VDC	
Insulation Resistance	R $\geq$ 10 MΩ @ 60 sec	
Electric strength	500 VDC (DC GND to chassis GND)	

TECHNICAL DATA DIGITAL

Input	
Measured value	Position
Stroke range	500…5000 mm (in 20 mm steps)
Output	
Signal characteristic	Analog output restricted by noise or A/D converter of control unit
Interface	CANopen / SAE J1939
Resolution	±0.2 mm
Sample rate	CANopen: 1 ms; SAE J1939: 20 ms
Accuracy	
Linearity	±0.04 % (F.S.)
Repeatability	±0.005 % (F.S.)
Hysteresis	±0.2 mm
Operating conditions	
Mounting position	Any
Operating temperature	−40…+105 °C
Humidity	90 % rel. humidity, no condensation
Ingress protection	IP67 / IP69K with appropriate mating connection
Pressure	
Nominal operating pressure (P_N)	350 bar
Max. overload pressure in cylinder (P_{MAX})	450 bar
Max. static proof pressure in cylinder (P_{PROOF})	625 bar
Environmental testing	
Shock test	IEC 60068-2-27, 100 g (6 ms) single shock, 50 g (11 ms) at 1000 shocks per axis
Vibration test	IEC 60068-2-64, 2 g (5…2000 Hz)
EMC test & evaluation	ISO16750-2:2010 ISO 14982:2009 - Agricultural and forestry machinery ISO 13766:2006 - Earth-moving machinery EN 13309:2010 - Construction machinery RF immunity to 200 V/m per ISO 11452-2/-4
Materials and dimensions	
Sensor rod with flange	Stainless steel 1.4306 (AISI 304L)
Sensor electronics housing	Stainless steel 1.4305 (AISI 303)

Electrical installation		
Connector	M12 male plug	
Supply voltage	**12 VDC (8…32 VDC)**	**24 VDC (8…32 VDC)**
Current consumption	Typ. $\leq$ 100 mA	Typ. $\leq$ 50 mA
Inrush current	Max. 1.0 A @ 2 ms	Max. 1.5 A @ 2 ms
Bus termination (HI-LO)	120 Ω	
Supply voltage ripple	< 1 % p-p	
Power drain	< 1.5 W	
Over voltage proctection (GND-VDC)	Up to +36 VDC	
Polarity protection (GND-VDC)	Up to −36 VDC	
Insulation Resistance	R $\geq$ 10 MΩ @ 60 sec.	
Electric strength	500 VDC (DC GND to chassis GND)	

TECHNICAL DRAWING

FMH with flat end plug

Sensor electronics housing 29 · Null zone 38.9 · Stroke length 500…5000 · Dead zone 84.8

AF 60 · 15 · 65 · R32.5 · M12×1-6g

Threaded flange M33×2-6g · Sensor rod Ø12.7 · Magnet

FMH with M4 female thread plug

Sensor electronics housing 29 · Null zone 38.9 · Stroke length 500…5000 · Dead zone 90.5

AF 60 · 15 · 65 · R32.5 · M12×1-6g

Threaded flange M33×2-6g · Sensor rod Ø12.7 · M4 female thread · Magnet

Controlling design dimensions are in millimeters
Unless otherwise stated, apply to the general tolerances according to DIN ISO 2768-m

CONNECTOR WIRING

Analog output

M12 connector

Pin	E	G	H
1	not connected	VDC	VDC
2	VDC	not connected	SIG
3	GND	GND	GND
4	SIG	SIG	not connected

Digital output

M12 connector

Pin	F
1	not connected
2	VDC
3	GND
4	CAN_HI
5	CAN_LOW

FREQUENTLY ORDERED ACCESSORIES

Position magnets	Cord sets and adapter cables	

Ring magnet **Part no. 402 316**	**4 pin M12 to DTM06 connector** **Part no. 254 597**	**4 pin M12 to DT04 connector** **Part no. 254 600**
Material: PA ferrite coated Weight: ca. 13 g Operating temperature: -40…+100 °C Surface pressure: 20 N/mm²	M12 connector: Brass/Nickel DT connector: DTM06 3 pin Material: PVC Jacket Cable length: 275 mm Cable Ø: 5 mm Operating temperature: –40…+105 °C	M12 connector: Brass/Nickel DT connector: DT04 3 pin Material: PVC Jacket Cable length: 275 mm Cable Ø: 5 mm Operating temperature: –40…+105 °C

Test kits

MH test kit (analog) **Part no. 280 618**	**MH test kit (digital) for US** **Part no. 253 879**	**MH test kit (digital) for EU / Asia** **Part no. 254 267**

Kit includes:
• 12 VDC battery charger with adapter (EU & UK)
• Cable with M12 connector
• Cable with pigtailed wires
• Carrying case
	• USB CAN-Modul Kit:
	  - USB CAN-Modul
	  - USB CAN-Modul Utility CD (driver & manual)
	• USB cable
	  cable with MTS M12 connector and RS232 connector
	• cable with RS232 connector
	• carrying case
	• 12 VDC power supply
		• USB CAN-Modul Kit:
		  - USB CAN-Modul
		  - USB CAN-Modul Utility CD (driver & manual)
		• USB cable
		  cable with MTS M12 connector and RS232 connector
		• cable with RS232 connector
		• carrying case
		• 12 VDC power supply

Controlling design dimensions are in millimeters

ORDER CODE FMH ANALOG

1	2	3	4	5	6	7	8	9	10	11	12	13	14
F	M	H						M		3			
a			b	c					d	e	f		

a	Sensor model	
F M H	Flexible MH	

b	Design
A	M33 thread flange, flat end plug
B	M33 thread flange, M4 female plug

c	Stroke length
X X X X M	0500…5000 mm (20 mm increments)

d	Pin assignment
M12 connector (VDC - GND - SIG)	
E	M12 connector with 4 pins (E: 2-3-4)
G	M12 connector with 4 pins (G: 1-3-4)
H	M12 connector with 4 pins (H: 1-3-2)

e	Operating voltage
3	+12 / 24 VDC (8…32 VDC)

f	Output
V 1 1	0.25…4.75 VDC
V 1 2	0.5…4.5 VDC
V 1 3	4.75…0.25 VDC
V 1 4	4.5…0.5 VDC
A 0 1	4…20 mA
A 0 4	20…4 mA

DELIVERY

Position sensor,
O-ring

Accessories have to be ordered
separately.

Operation manuals & software are available at:
www.temposonics.com

> **NOTICE**
>
> If you have questions about the replacement of sensor electronics
> and sensor element contact the Temposonics application team.

ORDER CODE FMH DIGITAL

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
F	M	H						M	F	3		0	1			
a			b	c					d	e	f			g	h	

a	Sensor model	
F M H	Flexible MH	

b	Design
A	M33 thread flange, flat end plug
B	M33 thread flange, M4 female plug

c	Stroke length	
X X X X M	0500…5000 mm (20 mm increments)	

d	Pin assignment
M12 connector (VDC - GND - CAN HI - CAN LO)	
F	M12 connector with 5 pins (F: 2-3-4-5)

e	Operating voltage
3	+12 / 24 VDC (8…32 VDC)

f	Output	
C 0 1	CANopen
J 0 1	SAE J1939

g	Baud rate setting
CANopen	
0	1000 kbit/s
1	800 kbit/s
2	500 kbit/s
3	250 kbit/s (default)
4	125 kbit/s
SAE J1939	
3	250 kbit/s (fix setting)

h	Node ID
CANopen	
7 F	Node ID (hex): 01…7F (default = 7F)
SAE J1939	
F D	Node ID (hex): 01…FD (default = FD)

DELIVERY

Position sensor, O-ring

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ISO 9001 CERTIFIED   CERTIFIED ISO 9001   UKCA   CE

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