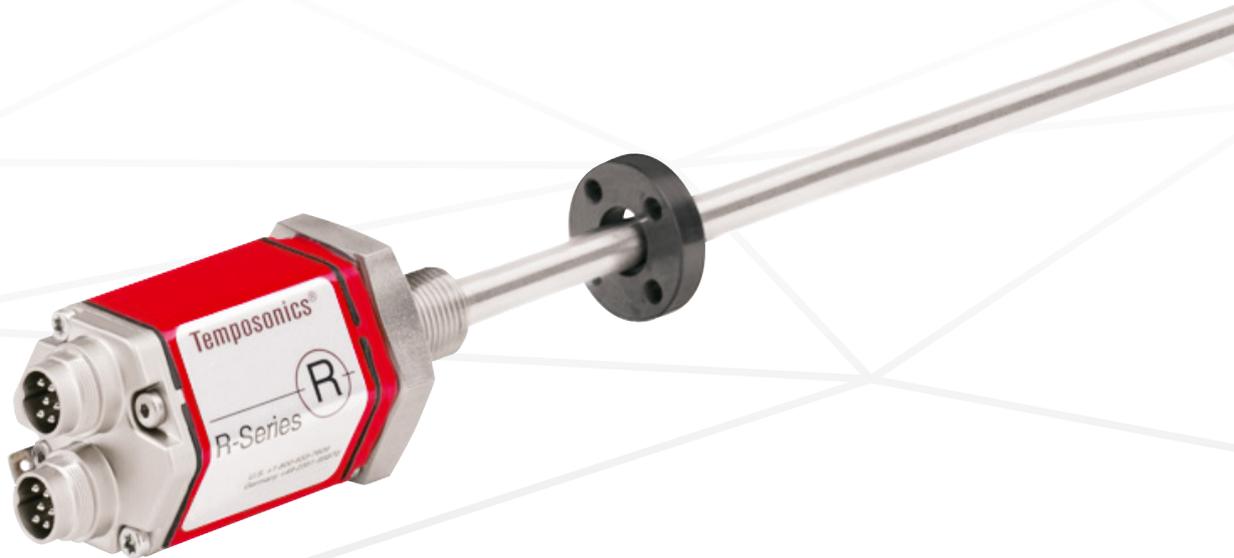


## Data Sheet

# R-Series – RH CANbus

## Magnetostrictive Linear Position Sensors

- Suitable for hydraulic cylinder integration
- Rugged industrial sensor
- Diagnostics LEDs



## 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.

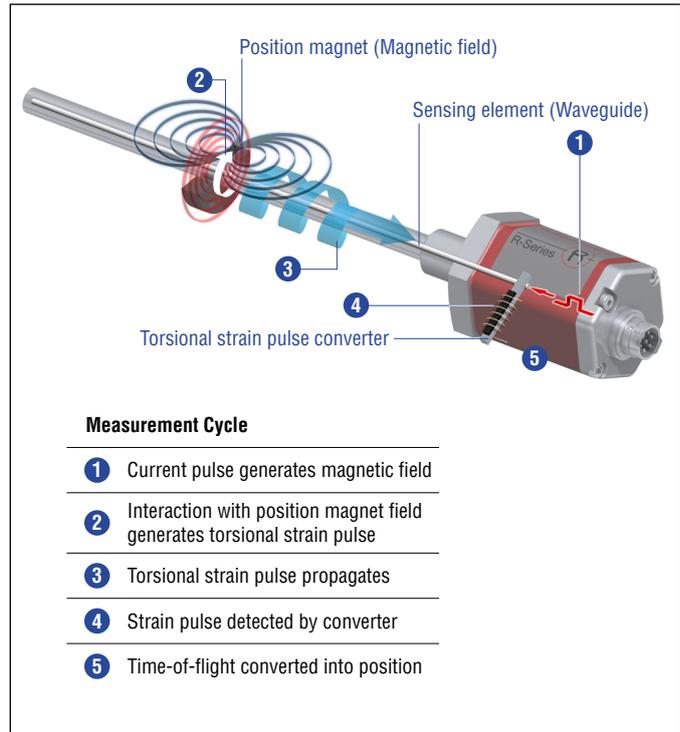


Fig. 1: Time-of-flight based magnetostrictive position sensing principle

## RH SENSOR CANbus

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 sensing element with the built-in waveguide.

Temposonics® RH is a robust, high-performance rod-style sensor for installation into a hydraulic cylinder. The sensor is suitable for long-term operation under harsh industrial environments such as steel industry.

Temposonics position sensors fulfill - as slave devices - all requirements of the CAN-Bus (ISO 11898). The sensors electronics convert the position measurements into bus oriented outputs and transfer these data directly to the control unit. The bus interface is appropriate for serial data transfer of 1 Mbit/s maximum. Sensor integrated software supports the profiles CANopen and CANbasic for a comprehensive customized configuration of the sensor-bus system.



Fig. 2: Typical application: Steel industry

## TECHNICAL DATA

Output								
Interface	CAN fieldbus system according to ISO 11898							
Data protocol	CANopen: CIA standard DS301 V3.0/Encoder profile DS 406 V3.1; CANbasic: CAN 2.0 A							
Baud rate	Transfer rate	1000 kBit/s	800 kBit/s	500 kBit/s	250 kBit/s	125 kBit/s	50 kBit/s	20 kBit/s
	Cable length	< 25 m	< 50 m	< 100 m	< 250 m	< 500 m	< 1000 m	< 2500 m
Measured value	Position, velocity/option: Simultaneous multi-position and multi-velocity measurements up to 20 magnets							
Measurement parameters								
Resolution	Protocol	CANopen			CANbasic			
	Position	5 µm	2 µm	5 µm	2 µm			
	Velocity	0.5 mm/s	0.2 mm/s	1.0 mm/s	0.1 mm/s			
Cycle time	Stroke length	< 2400 mm	< 4800 mm	< 7620 mm				
	Cycle time	1.0 ms	2.0 ms	4.0 ms				
	0.5 ms to 1200 mm additional for CANbasic							
Linearity deviation <sup>1</sup>	< ±0.01 % F.S. (minimum ±40 µm)							
	Option internal linearization (Applies for the first magnet for multi-position measurement)							
	Stroke length	< 300 mm	< 600 mm	< 1200 mm				
	Tolerance	max. ±25 µm	max. ±30 µm	max. ±50 µm				
Repeatability	< ±0.001 % F.S. (Minimum ±2.5 µm) typical							
Hysteresis	< 4 µm typical							
Temperature coefficient	< 15 ppm/K typical							
Operating conditions								
Operating temperature	-40...+75 °C (-40...+167 °F)							
Humidity	90 % relative humidity, no condensation							
Ingress protection	IP67 (connectors correctly fitted)/IP68 with cable outlet							
Shock test	100 g (single shock), IEC standard 60068-2-27							
Vibration test	15 g/10...2000 Hz, IEC standard 60068-2-6 (excluding resonant frequencies)							
EMC test	Electromagnetic emission according to EN 61000-6-3							
	Electromagnetic immunity according to EN 61000-6-2							
	The sensor meets the requirements of the EC directives and is marked with <b>CE</b>							
Operating pressure	350 bar (5,076 psi)/700 bar (10,153 psi) peak (at 10 × 1 min) for sensor rod/RH5-J: 800 bar (11,600 psi)							
Magnet movement velocity	Any							
Design / Material								
Sensor electronics housing	Aluminum (painted), zinc die cast							
Flange	Stainless steel 1.4305 (AISI 303)							
Sensor rod	Stainless steel 1.4306 (AISI 304L)/RH-J: Stainless steel 1.4301 (AISI 304)							
Stroke length	25...7620 mm (1...300 in.)							
Mechanical mounting								
Mounting position	Any							
Mounting instruction	Please consult the technical drawings on <a href="#">page 4</a> and <a href="#">5</a>							
Electrical connection								
Connection type	1 × M12 female connector (5 pin), 1 × M12 male connector (5 pin), 1 × M12 male connector (4 pin) or 1 × M16 female connector (6 pin) or 2 × M16 female connectors (6 pin) or 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.							
Power consumption	90 mA typical							
Dielectric strength	500 VDC (DC ground to machine ground)							
Polarity protection	Up to -36 VDC							
Overvoltage protection	Up to 36 VDC							

1/ With position magnet # 251 416-2

## TECHNICAL DRAWINGS

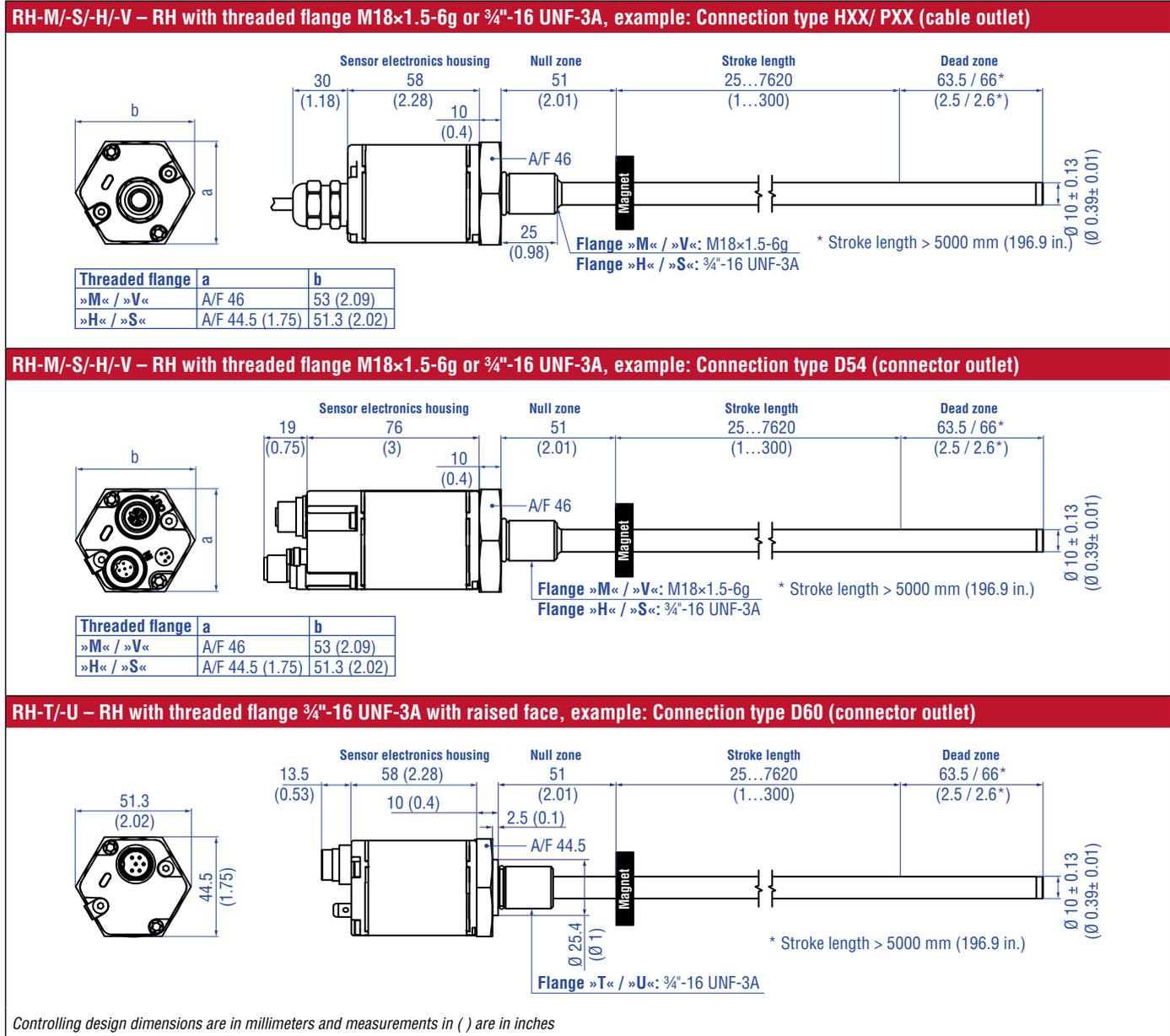
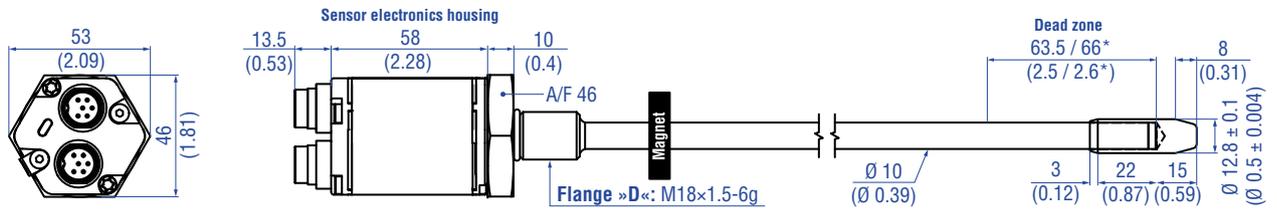
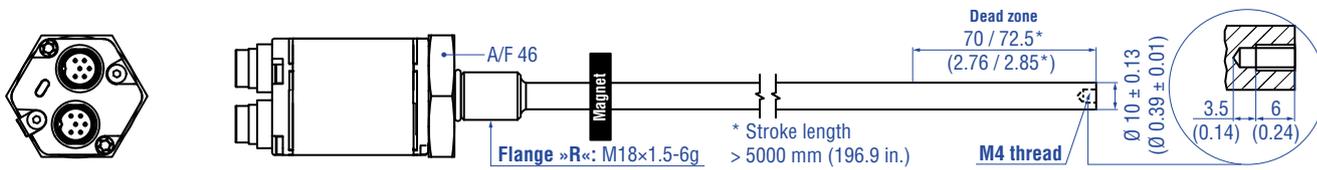


Fig. 3: Temposonics® RH with ring magnet, part 1

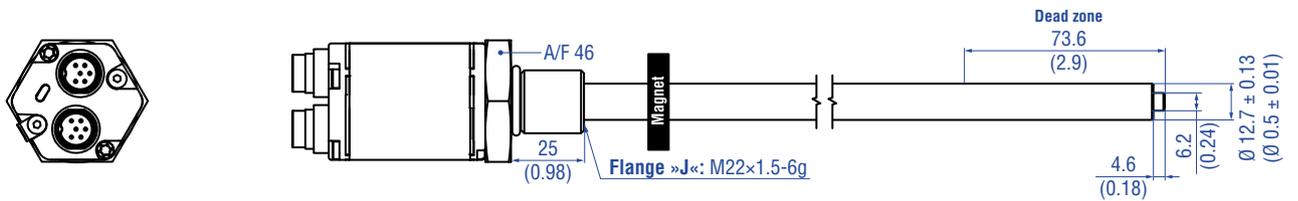
**RH-D – RH with threaded flange M18×1.5-6g, example: Connection type D62 (connector outlet)**



**RH-R – RH with threaded flange M18×1.5-6g, example: Connection type D62 (connector outlet)**



**RH-J – RH with threaded flange M22×1.5-6g, example: Connection type D62 (connector outlet)**



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

Fig. 4: Temposonics® RH with ring magnet, part 2

## CONNECTOR WIRING

D54		
Signal		
M12 male connector (A-coded)	Pin	Function
 <p>View on sensor</p>	1	Shield
	2	Not connected
	3	Not connected
	4	CAN_H
	5	CAN_L
M12 female connector (A-coded)	Pin	Function
 <p>View on sensor</p>	1	Shield
	2	Not connected
	3	Not connected
	4	CAN_H
	5	CAN_L
Power supply		
M8 male connector	Pin	Function
 <p>View on sensor</p>	1	+24 VDC (-15/+20 %)
	2	Not connected
	3	DC Ground (0 V)
	4	Not connected

Fig. 5: Connector wiring D54

D60		
Signal + power supply		
M16 male connector	Pin	Function
 <p>View on sensor</p>	1	CAN_L
	2	CAN_H
	3	Not connected
	4	Not connected
	5	+24 VDC (-15/+20 %)
	6	DC Ground (0 V)

Fig. 6: Connector wiring D60

D62		
Signal + power supply		
M16 male connector	Pin	Function
 <p>View on sensor</p>	1	CAN_L
	2	CAN_H
	3	Not connected
	4	Not connected
	5	+24 VDC (-15/+20 %)
	6	DC Ground (0 V)
M16 male connector	Pin	Function
 <p>View on sensor</p>	1	CAN_L
	2	CAN_H
	3	Not connected
	4	Not connected
	5	+24 VDC (-15/+20 %)
	6	DC Ground (0 V)

Fig. 7: Connector wiring D62

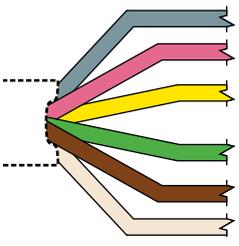
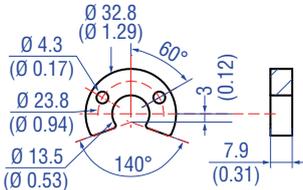
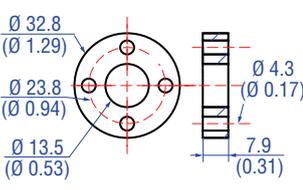
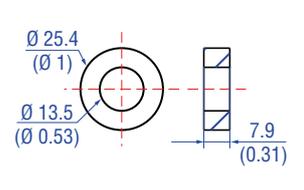
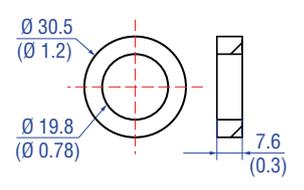
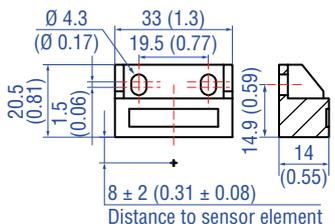
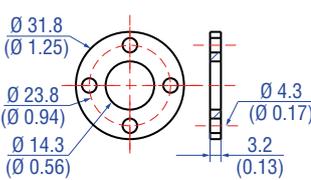
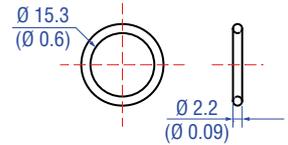
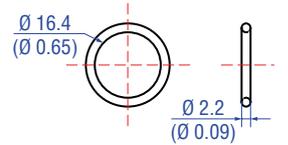
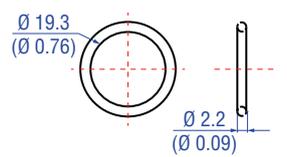
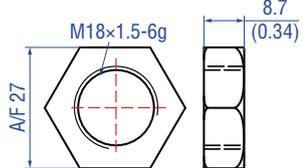
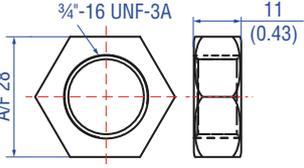
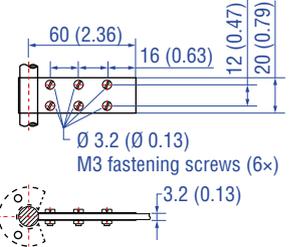
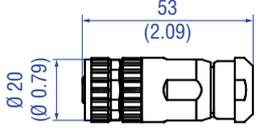
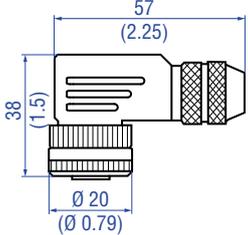
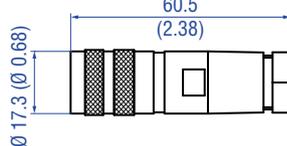
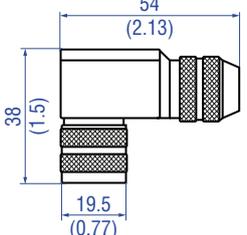
PXX / HXX		
Signal + power supply		
Cable	Color	Function
	GY	CAN_L
	PK	CAN_H
	YE	Not connected
	GN	Not connected
	BN	+24 VDC (-15/+20 %)
	WH	DC Ground (0 V)

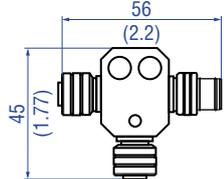
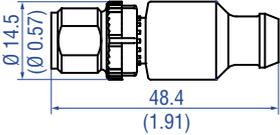
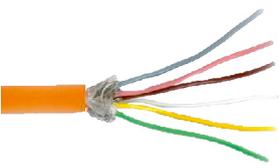
Fig. 8: Cable wiring PXX/HXX

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

Position magnets							
							
<p><b>U-magnet OD33</b> Part no. 251 416-2</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>Marked version for sensors with internal linearization: Part no. 254 226</p>	<p><b>Ring magnet OD33</b> Part no. 201 542-2</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>Marked version for sensors with internal linearization: Part no. 253 620</p>	<p><b>Ring magnet OD25.4</b> Part no. 400 533</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>Marked version for sensors with internal linearization: Part no. 253 621</p>	<p><b>Ring magnet</b> Part no. 402 316</p> <p>Material: PA ferrite coated Weight: Approx. 13 g Surface pressure: Max. 20 N/mm<sup>2</sup> Operating temperature: -40...+100 °C (-40...+212 °F)</p>				
Position magnet		Magnet spacer		O-rings			
							
<p><b>Block magnet L</b> Part no. 403 448</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><b>Magnet spacer</b> Part no. 400 633</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><b>O-ring for threaded flange M18x1.5-6g</b> Part no. 401 133</p> <p>Material: Fluoroelastomer Durometer: 75 ± 5 Shore A Operating temperature: -40...+204 °C (-40...+400 °F)</p>	<p><b>O-ring for threaded flange 3/4"-16 UNF-3A</b> Part no. 560 315</p> <p>Material: Fluoroelastomer Durometer: 75 ± 5 Shore A Operating temperature: -40...+204 °C (-40...+400 °F)</p>	<p><b>O-ring for threaded flange M22x1.5-6g</b> Part no. 561 337</p> <p>Material: FPM Durometer: 75 Shore A Operating temperature: -20...+200 °C (-6...+392 °F)</p>	<p><b>Hex jam nut M18x1.5-6g</b> Part no. 500 018</p> <p>Material: Steel, zinc plated</p>	<p><b>Hex jam nut 3/4"-16 UNF-3A</b> Part no. 500 015</p> <p>Material: Steel, zinc plated</p>	<p><b>Fixing clip</b> Part no. 561 481</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>

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

Cable connectors (M12)*		Cable connectors (M16)*	
			
<b>M12 A-coded female connector (4 pin/5 pin), straight</b> <b>Part no. 370 677</b>  Material: GD-Zn, Ni Termination: Screw Contact insert: CuZn Cable Ø: 4...8 mm (0.16...0.31 in.) Wire: 1.5 mm <sup>2</sup> Operating temperature: -30...+85 °C (-22...+185 °F) Ingress protection: IP67 (correctly fitted) Fastening torque: 0.6 Nm	<b>M12 A-coded female connector (5 pin), angled</b> <b>Part no. 370 678</b>  Material: GD-Zn, Ni Termination: Screw; max. 0.75 mm <sup>2</sup> Contact insert: CuZn Cable Ø: 5...8 mm (0.2...0.31 in.) Wire: 0.75 mm <sup>2</sup> (18 AWG) Operating temperature: -25...+85 °C (-13...+185 °F) Ingress protection: IP67 (correctly fitted) Fastening torque: 0.4 Nm	<b>M16 female connector (6 pin), straight</b> <b>Part no. 370 423</b>  Material: Zinc nickel plated Termination: Solder Cable Ø: 6...8 mm (0.24...0.31 in.) Operating temperature: -40...+100 °C (-40...+212 °F) Ingress protection: IP65/IP67 (correctly fitted) Fastening torque: 0.6 Nm	<b>M16 female connector (6 pin), angled</b> <b>Part no. 370 460</b>  Material: Zinc nickel plated Termination: Solder Cable Ø: 6...8 mm (0.24...0.31 in.) Wire: 0.75 mm <sup>2</sup> (20 AWG) Operating temperature: -40...+95 °C (-40...+203 °F) Ingress protection: IP67 (correctly fitted) Fastening torque: 0.6 Nm

Connection accessories*		Cables	
			
<b>M12 A-coded T connector (5 pin)</b> <b>Part no. 370 691</b>  Selfcuring coupling nut 2 × female connector 1 × male connector Feature: Shielded Ingress protection: IP67 (correctly fitted)	<b>Passive M12 A-coded male bus terminator (5 pin)</b> <b>Part no. 370 700</b>  Material: PUR Termination: Screw Contact insert: Au Operating temperature: -25...+85 °C (-13...+121 °F) Ingress protection: IP68 (correctly fitted)	<b>PUR cable</b> <b>Part no. 530 052</b>  Material: PUR jacket; orange Features: Twisted pair, shielded, highly flexible, halogen free, suitable for drag chains, mostly oil & flame resistant Cable Ø: 6.4 mm (0.25 in.) Cross section: 3 × 2 × 0.25 mm <sup>2</sup> Bending radius: 5 × D (fixed installation) Operating temperature: -30...+80 °C (-22...+176 °F)	<b>PUR cable</b> <b>Part no. 530 175</b>  Material: PUR jacket; orange Features: Flexible, additional EMC protection Cable Ø: 6.5 mm (0.26 in.) Cross section: 6 × 0.14 mm <sup>2</sup> Bending radius: 10 × D (fixed installation) Operating temperature: -30...+90 °C (-22...+194 °F)

\*/ Follow the manufacturer's mounting instructions.

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	18	19	20	21	22	
R	H											C										
a		b	c					d			e	f			g	h	i	j				

optional

a	Sensor model
R H	Rod

b	Design
D	Threaded flange M18×1.5-6g (bushing on rod end)
H	Threaded flange ¾"-16 UNF-3A (with fluorelastomer seals for the sensor electronics housing)
J	Threaded flange M22×1.5-6g (rod Ø 12.7 mm, 800 bar)
M	Threaded flange M18×1.5-6g (standard)
R	Threaded flange M18×1.5-6g (female thread M4 at rod end)
S	Threaded flange ¾"×16UNF - 3A (standard)
T	Threaded flange ¾"×16UNF - 3A (with raised-face)
U	Threaded flange ¾"-16 UNF-3A (with raised-face & fluorelastomer seals for the sensor electronics housing)
V	Threaded flange M18×1.5-6g (fluorelastomer seals for the sensor electronics housing)

c	Stroke length
X X X X M	0025...7620 mm

Standard stroke length (mm)	Ordering steps
25...500 mm	5 mm
500...750 mm	10 mm
750...1000 mm	25 mm
1000...2500 mm	50 mm
2500...5000 mm	100 mm
5000...7620 mm	250 mm

X X X X U	001.0...300.0 mm
Standard stroke length (in.)	Ordering steps
1...20 in.	0.2 in.
20...30 in.	0.4 in.
30...40 in.	1.0 in.
40...100 in.	2.0 in.
100...200 in.	4.0 in.
200...300 in.	10.0 in.

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

d	Connection type
D 5 4	1 × M12 female connector (5 pin), 1 × M12 male connector (5 pin) 1 × M8 male connector (4 pin)
D 6 0	1 × M16 male connector (6 pin)
D 6 2	2 × M16 male connector (6 pin)
H X X	XX m PUR cable (part no. 530 052) H01...H10 (1...10 m/3...33 ft.)* (see chapter "frequently ordered accessories" for cable specifications and note the temperature range of the cable)
P X X	XX m PUR cable (part no. 530 175) P01...P10 (1...10 m/3...33 ft.)* (see chapter "frequently ordered accessories" for cable specifications and note the temperature range of the cable)

\* / 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 %)
A	+24 VDC (-15/+20 %), vibration resistant (stroke length 25...2000 mm / 1...79 in.)

### NOTICE

The replacement of the base unit is not possible for the vibration resistant sensor version **A**.

f	Output
C 1 0 1	CANbasic, position and velocity (1 position)
C 2 0 7	CANbasic, position (1...20 position(s))
C 3 0 4	CANopen, position and velocity (1...4 position(s))
C 5 0 4	CANopen, position and velocity, internal linearization (1...4 position(s))

g	Baud rate
1	1000 kBit/s
2	500 kBit/s
3	250 kBit/s
4	125 kBit/s

h	Resolution
1	5 µm
2	2 µm

i	Options
1	Standard

**Optional**

j	Number of magnets for multi-position measurement
Z	X X Z02...Z20 (2...20 magnets)

**NOTICE**

- Select the C207, C304 or C504 in **f** “Output” for multi-position measurement (number of magnets ≥ 2).
- Specify magnet numbers for your sensing application and order separately.
- The number of magnets is limited by the stroke length. The minimum allowed distance between magnets (i.e. front face of one to the front face of the next one) is 75 mm (3 in.).
- Use magnets of the same type for multi-position measurement, e.g. 2 × U-magnets (part no. 251 416-2).
- If the option for internal linearization (C504) in **f** “Output” is chosen, select a suitable magnet.

**DELIVERY**

 **RH-D / -H / -J / -M / -R / -S / -T / -U / -V:** Accessories have to be ordered separately.

- Sensor
- O-ring

**Manuals, Software & 3D Models available at:**  
[www.temposonics.com](http://www.temposonics.com)

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