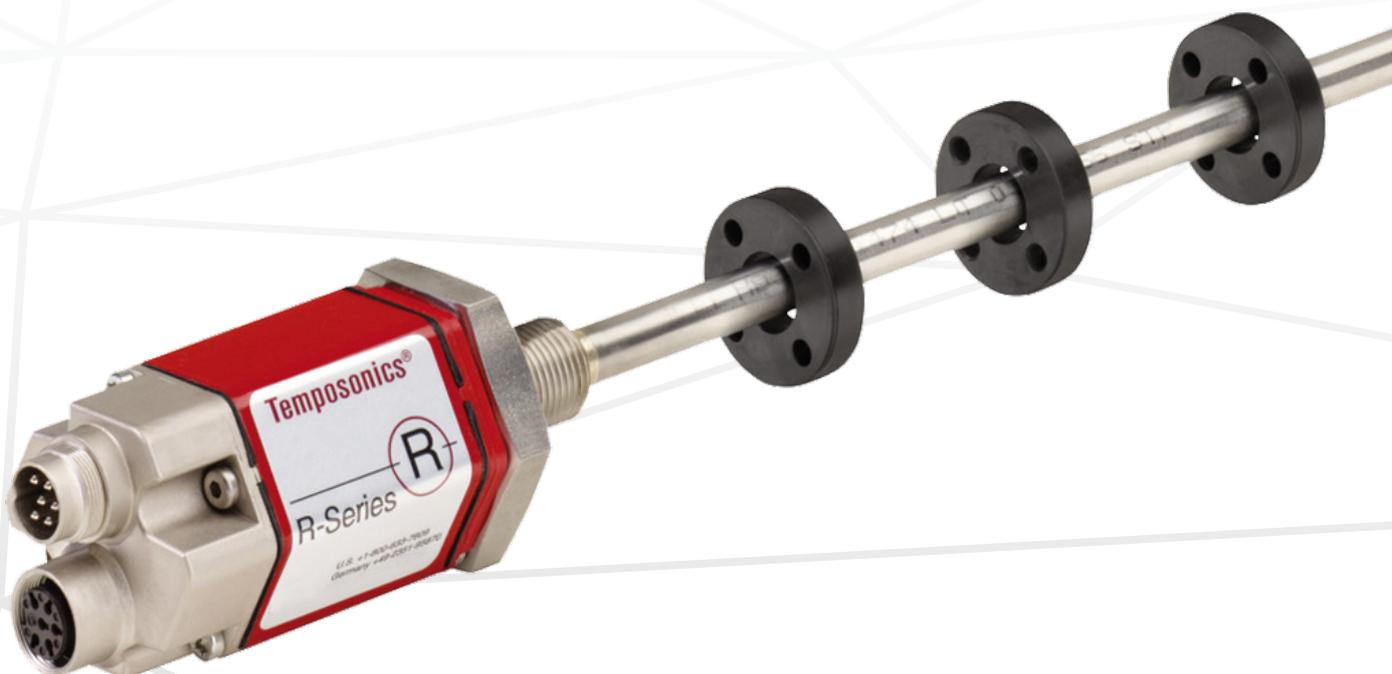


Data Sheet

R-Series – RH PROFIBUS

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.

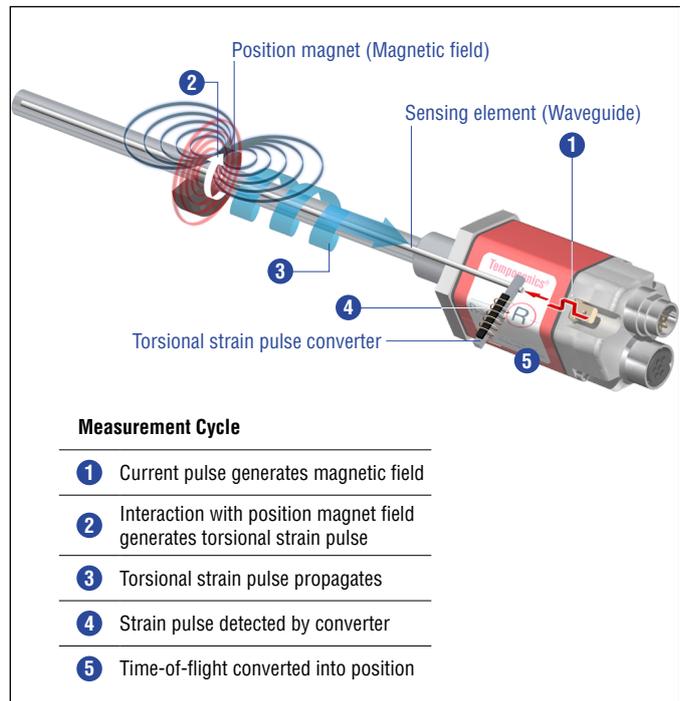


Fig. 1: Time-of-flight based magnetostrictive position sensing principle

RH SENSOR PROFIBUS

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 over the sensor rod with the built-in waveguide.

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

Temposonics sensors fulfill all requirements of PROFIBUS-DP according to EN 50170. The sensor realizes the absolute position measuring with direct transmission of serial, bitsynchronous data in RS485 standard to control units in a baudrate of 12 Mbit/s maximum. In addition to data transmission, PROFIBUS provides powerful functions for diagnostics and configuration, loaded into the bus via the GSD (General Station Description).



Fig. 2: Typical application: Steel industry

TECHNICAL DATA

Output					
Interface	IEC 61158 CPF3 PROFIBUS				
Data format/Data transmission rate	PROFIBUS-DP slave/Maximum 12 Mbit/s				
Measured value	Position/option: Simultaneous multi-position measurements up to 20 magnets				
Accuracy					
Resolution Position	1...1000 µm (selectable)				
Cycle time	Stroke length	≤ 500 mm	≤ 2000 mm	≤ 4500 mm	≤ 7600 mm
	Cycle time	0.5 ms	1.0 ms	2.0 ms	3.1 ms
(each additional magnet + 0.05 ms)					
Linearity deviation ¹	< ±0.01 % F.S. (minimum ±50 µm)				
	Optional internal linearization: Linearity tolerance (Applies for the first magnet for multi-position measurement)				
	Stroke length	< 300 mm	> 300...600 mm	> 600...1200 mm	
Tolerance	typ. ±15 µm/max. ±25 µm		typ. ±20 µm/max. ±30 µm	typ. ±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 ²	90 % relative humidity, no condensation				
Ingress protection ²	IP67 (if mating connectors are correctly fitted)				
Shock test	100 g (single shock), IEC standard 68-2-27				
Vibration test	15 g/10...2000 Hz, IEC standard 68-2-6 (resonance frequencies excluded)				
EMC test	Electromagnetic emission EN 61000-6-3				
	Electromagnetic immunity EN 61000-6-2				
	The sensor meets the requirements of the EU directives and is marked with CE				
Operating pressure	350 bar (5076 psi)/700 bar (10,153 psi) peak (at 10 × 1 min) for sensor rod/RH5-J: 800 bar (11,603 psi)				
Magnet movement velocity	Any				
Design / Material					
Sensor electronics housing	Aluminum				
Sensor 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.)/RH5-J: 25...5900 mm (1...232 in.)				
Installation					
Mounting position	Any				
Mounting instruction	Please consult the technical drawings on page 4 and 5				
Electrical connection					
Connection types (selectable)	1 × M16 male connector (6 pin), 1 × M16 female connector (6 pin) or 1 × M12 male connector (5 pin), 1 × M12 female connector (5 pin), 1 × M8 male connector (4 pin) or 2 × cable outlet, 1 × M8 male connector (4 pin)				
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.				
Current consumption	110 mA typical				
Dielectric strength	500 VDC (DC ground to machine ground)				
Polarity protection	Up to -30 VDC				
Over voltage protection	Up to 36 VDC				

1/ With position magnet # 251416-2

2/ The IP rating is not part of the UL recognition

TECHNICAL DRAWING

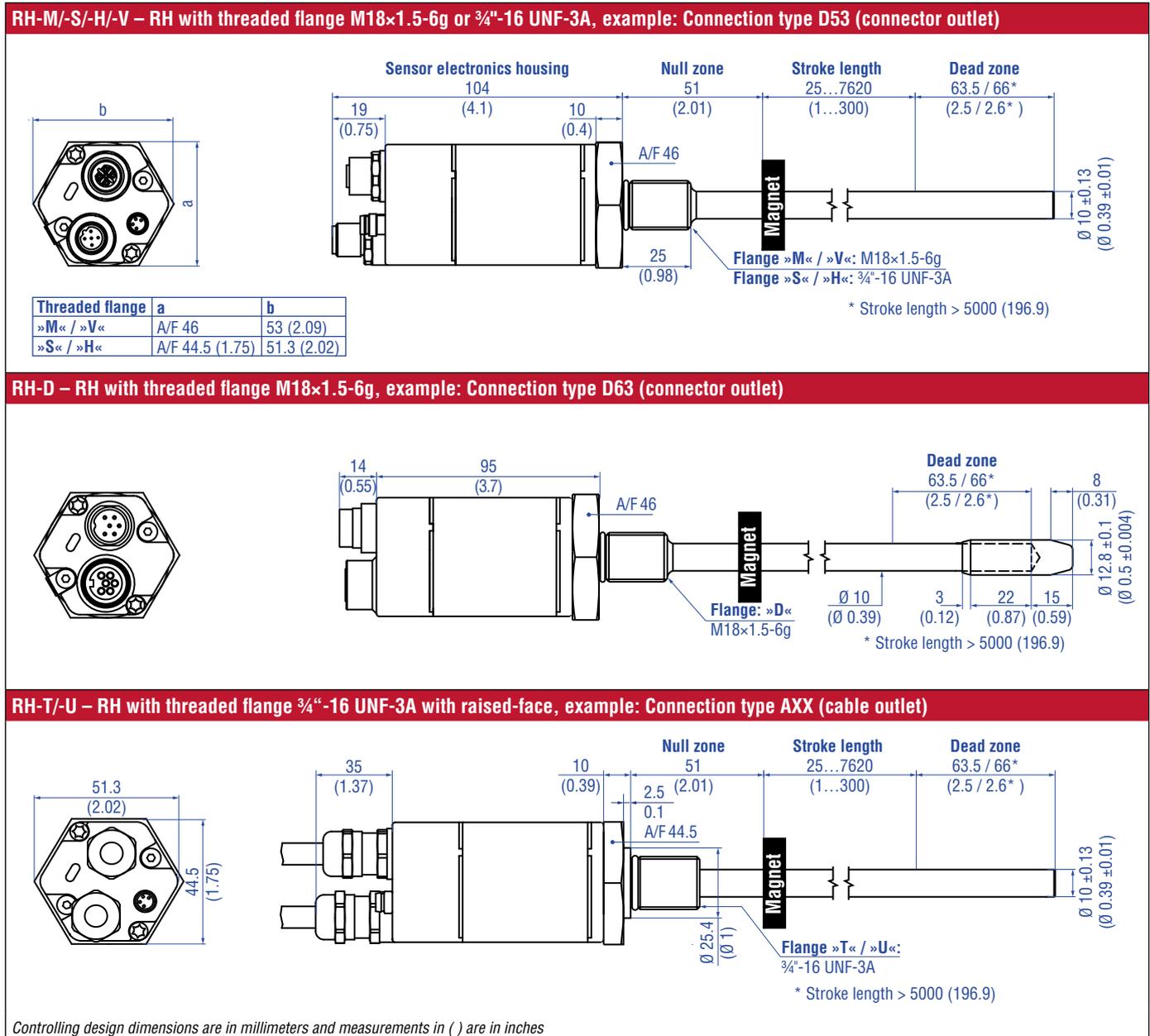
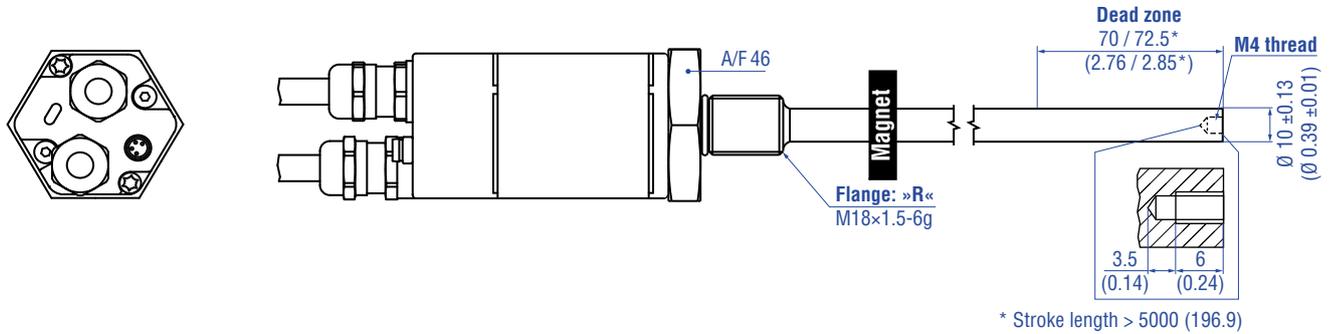
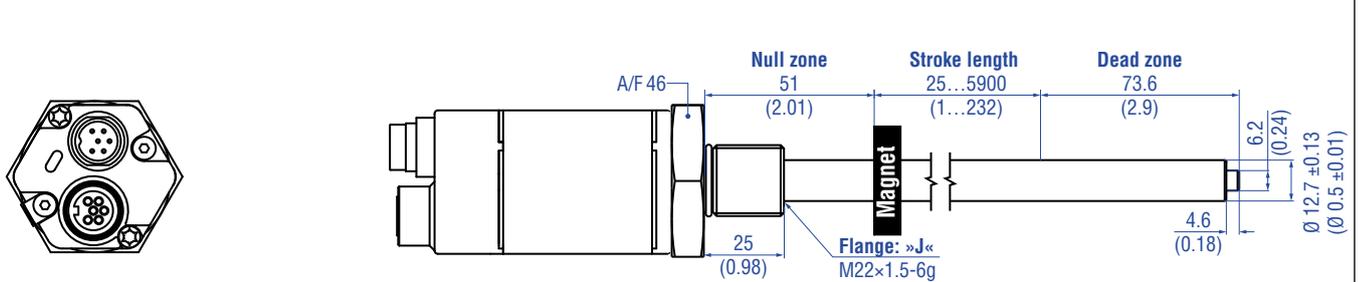


Fig. 3: Tempsonics® RH with ring magnet, part 1

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



RH-J – RH with threaded flange M22×1.5 and Ø 12.7 mm rod, example: Connection type D63 (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

D53		
In – Signal		
M12 male connector (B-coded)	Pin	Function
 <p>View on sensor</p>	1	Not connected
	2	RxD/TxD-N (bus)
	3	Not connected
	4	RxD/TxD-P (bus)
	5	Shield
Out – Signal		
M12 female connector (B-coded)	Pin	Function
 <p>View on sensor</p>	1	VP +5 VDC (for bus termination)
	2	RxD/TxD-N (bus)
	3	Data GND (for bus termination)
	4	RxD/TxD-P (bus)
	5	Shield
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 D53

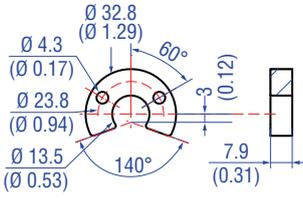
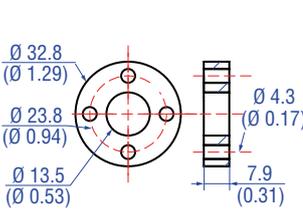
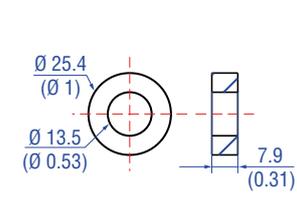
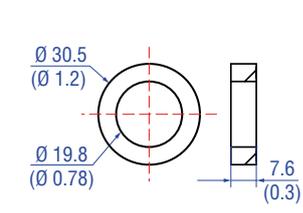
D63		
In – Signal + power supply		
M16 male connector	Pin	Function
 <p>View on sensor</p>	1	RxD/TxD-N (bus)
	2	RxD/TxD-P (bus)
	3	Not connected
	4	Not connected
	5	+24 VDC (-15/+20 %)
	6	DC Ground (0 V)
Out – Signal + power supply		
M16 female connector	Pin	Function
 <p>View on sensor</p>	1	RxD/TxD-N (bus)
	2	RxD/TxD-P (bus)
	3	Data GND (for bus termination)
	4	VP +5 VDC (for bus termination)
	5	+24 VDC (-15/+20 %)
	6	DC Ground (0 V)

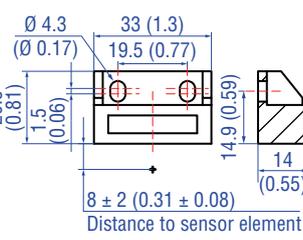
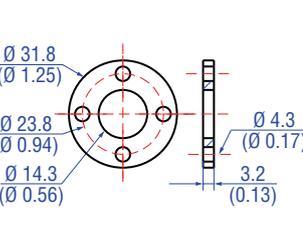
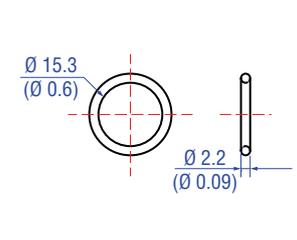
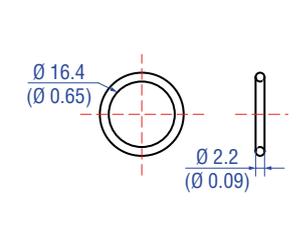
Fig. 6: Connector wiring D63

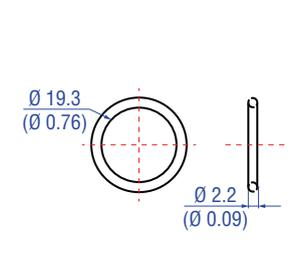
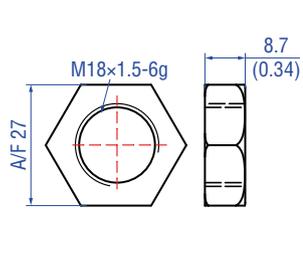
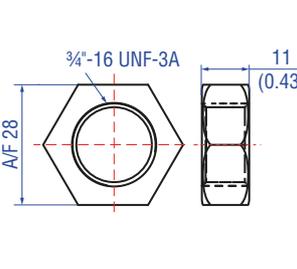
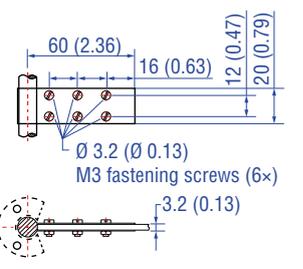
AXX		
Signal		
Cable	Color	Function
	GN	RxD/TxD-N (bus)
	RD	RxD/TxD-P (bus)
Cable	Color	Function
	GN	RxD/TxD-N (bus)
	RD	RxD/TxD-P (bus)
Power supply		
M8 male connector	Pin	Function
 <p>View on sensor</p>	1	+24 VDC (-15/+20 %)
	2	Not connected
	3	DC Ground (0 V)
	4	Not connected

Fig. 7: Connector wiring AXX

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

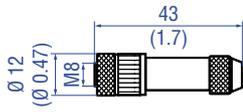
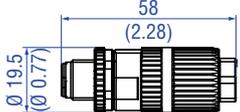
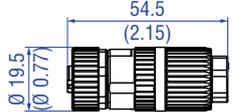
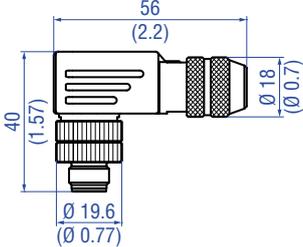
Position magnets			
			
<p>U-magnet OD33 Part no. 251 416-2</p> <p>Material: PA ferrite GF20 Weight: Approx. 11 g Surface pressure: Max. 40 N/mm² Fastening torque for M4 screws: 1 Nm Operating temperature: -40...+105 °C (-40...+221 °F)</p> <p>Marked version for sensors with internal linearization: Part no. 254 226</p>	<p>Ring magnet OD33 Part no. 201 542-2</p> <p>Material: PA ferrite GF20 Weight: Approx. 14 g Surface pressure: Max. 40 N/mm² 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>Ring magnet OD25.4 Part no. 400 533</p> <p>Material: PA ferrite Weight: Approx. 10 g Surface pressure: Max. 40 N/mm² Fastening torque: -40...+105 °C (-40...+221 °F)</p> <p>Marked version for sensors with internal linearization: Part no. 253 621</p>	<p>Ring magnet Part no. 402 316</p> <p>Material: PA ferrite coated Weight: Approx. 13 g Surface pressure: Max. 20 N/mm² Operating temperature: -40...+100 °C (-40...+212 °F)</p>

Position magnet	Magnet spacer	O-rings	
			
<p>Block magnet L 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 applications.</p>	<p>Magnet spacer Part no. 400 633</p> <p>Material: Aluminum Weight: Approx. 5 g Surface pressure: Max. 20 N/mm² Fastening torque for M4 screws: 1 Nm</p>	<p>O-ring for threaded flange M18×1.5-6g Part no. 401 133</p> <p>Material: Fluoroelastomer Durometer: 75 ± 5 Shore A Operating temperature: -40...+204 °C (-40...+400 °F)</p>	<p>O-ring for threaded flange ¾"-16 UNF-3A Part no. 560 315</p> <p>Material: Fluoroelastomer Durometer: 75 ± 5 Shore A Operating temperature: -40...+204 °C (-40...+400 °F)</p>

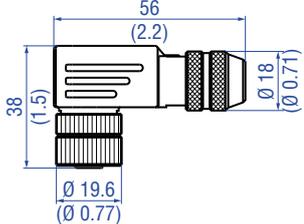
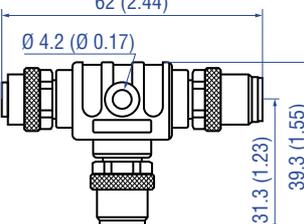
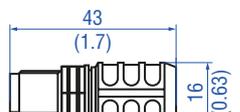
O-ring	Mounting accessories		
			
<p>O-ring for threaded flange M22×1.5-6g Part no. 561 337</p> <p>Material: FPM Durometer: 75 Shore A Operating temperature: -20...+200 °C (-6...+392 °F)</p>	<p>Hex jam nut M18×1.5-6g Part no. 500 018</p> <p>Material: Steel, zinc plated</p>	<p>Hex jam nut ¾"-16 UNF-3A Part no. 500 015</p> <p>Material: Steel, zinc plated</p>	<p>Fixing clip 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*

			
<p>M8 female connector (4 pin), straight Part no. 370 504</p>	<p>M12 B-coded male connector (5 pin), straight Part no. 560 884</p>	<p>M12 B-coded female connector (5 pin), straight Part no. 560 885</p>	<p>M12 B-coded male connector (5 pin), angled Part no. 370 515</p>
<p>Material: CuZn nickel plated Termination: Solder Cable Ø: 3.5...5 mm (0.14...0.28 in.) Wire: 0.25 mm² Operating temperature: -40...+85 °C (-40...+185 °F) Ingress protection: IP67 (correctly fitted) Fastening torque: 0.5 Nm</p>	<p>Material: Zinc nickel plated Termination: Insulation-displacement Contact insert: Silver plated Cable Ø: 7...8.8 mm (0.28...0.35 in.) Wire: 0.34 mm² (22 AWG) Operating temperature: -40...+85 °C (-40...+185 °F) Ingress protection: IP65/IP67 (correctly fitted) Number of contacts: 3 pin Fastening torque: 0.6 Nm</p>	<p>Material: Zinc nickel plated Termination: Insulation-displacement Contact insert: Silver plated Cable Ø: 7...8.8 mm (0.28...0.35 in.) Wire: 0.34 mm² (22 AWG) Operating temperature: -40...+85 °C (-40...+185 °F) Ingress protection: IP65/IP67 (correctly fitted) Number of contacts: 3 pin Fastening torque: 0.6 Nm</p>	<p>Material: Zinc nickel plated Termination: Screw Contact insert: Silver plated Cable Ø: 6...8 mm (0.24...0.31 in.) Wire: 0.75 mm² (18 AWG) Operating temperature: -40...+85 °C (-40...+185 °F) Ingress protection: IP67 (correctly fitted) Fastening torque: 0.4 Nm</p>

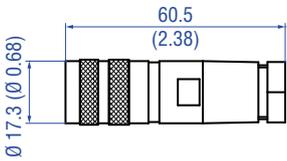
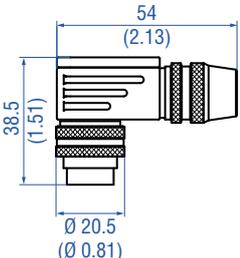
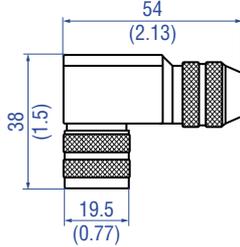
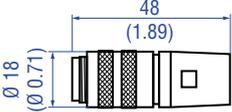
Cable connectors*

			
<p>M12 B-coded female connector (5 pin), angled Part no. 370 514</p>	<p>M12 B-coded T connector (5 pin) Part no. 560 887</p>	<p>Active M12 B-coded male bus terminator (5 pin) Part no. 560 888</p>	<p>M16 male connector (6 pin), straight Part no. 370 427</p>
<p>Material: Zinc nickel plated Termination: Screw Contact insert: Silver plated Cable Ø: 6...8 mm (0.24...0.31 in.) Wire: 0.75 mm² (18 AWG) Operating temperature: -40...+85 °C (-40...+185 °F) Ingress protection: IP67 (correctly fitted) Fastening torque: 0.4 Nm</p>	<p>Material: Zinc nickel plated Termination: Solder Contact insert: Silver plated Installation: Field installable Operating temperature: -30...+90 °C (-22...+130 °F) Ingress protection: IP67 (correctly fitted)</p>	<p>Housing: PUR Termination: Solder Contact insert: Silver plated Operating temperature: -40...+75 °C (-40...+167 °F) Ingress protection: IP67 (correctly fitted)</p>	<p>Material: Zinc nickel plated Termination: Solder Contact insert: Silver plated Cable clamp: PG9 Cable Ø: 6...8 mm (0.24...0.31 in.) Operating temperature: -40...+100 °C (-40...+212 °F) Ingress protection: IP65/IP67 (correctly fitted)</p>

*/ Follow the manufacturer's mounting instructions

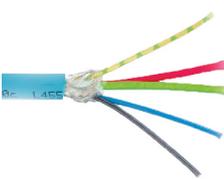
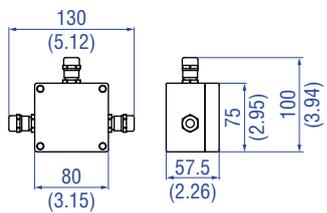
Controlling design dimensions are in millimeters and measurements in () are in inches

Cable connectors*

			
<p>M16 female connector (6 pin), straight Part no. 370 423</p>	<p>M16 male connector (6 pin), angled Part no. 370 621</p>	<p>M16 female connector (6 pin), angled Part no. 370 460</p>	<p>Active M16 male bus terminator (6 pin) Part no. 370 620</p>
<p>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</p>	<p>Material: Brass nickel plated Termination: Solder Contact insert: Silver plated Cable Ø: 6...8 mm (0.24...0.31 in.) Operating temperature: -30...+95 °C (-22...+203 °F) Ingress protection: IP67 (correctly fitted)</p>	<p>Material: Zinc nickel plated Termination: Solder Cable Ø: 6...8 mm (0.24...0.31 in.) Wire: 0.75 mm² (20 AWG) Operating temperature: -40...+95 °C (-40...+203 °F) Ingress protection: IP67 (correctly fitted) Fastening torque: 0.6 Nm</p>	<p>Material: Zinc nickel plated Contact insert: Silver plated Operating temperature: -40...+75 °C (-40...+167 °F) Ingress protection: IP67 (correctly fitted)</p>

Cable

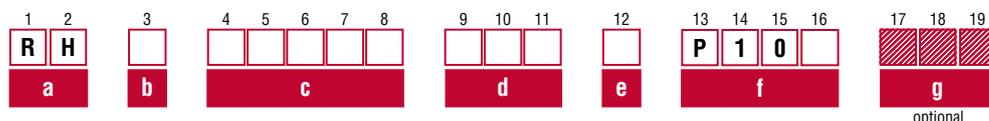
Filter box

			
<p>PVC signal cable Part no. 530 040</p>	<p>PVC power cable Part no. 530 108</p>	<p>PUR signal cable Part no. 530 109</p>	<p>PROFIBUS filter box, M16 (6 pin) Part no. 252 916</p>
<p>Material: PVC jacket; petrol Features: Hybrid cable (PROFIBUS and power supply feed in), flexible Cable Ø: 8 mm (0.31 in.) Cross section: 1 × 2 × 0.65 mm² 3 × 1 × 0.75 mm² Bending radius: 5 × D (fixed installation) Operating temperature: -30...+80 °C (-22...+176 °F)</p>	<p>Material: PVC jacket; gray Features: Shielded, flexible, mostly flame resistant Cable Ø: 4.9 mm (0.19 in.) Cross section: 3 × 0.34 mm² Bending radius: 10 × D Operating temperature: -30...+80 °C (-22...+176 °F)</p>	<p>Material: PUR jacket; violet Features: Highly flexible, halogen free, suitable for drag chains, mostly oil & flame resistant Cable Ø: 8 mm (0.31 in.) Cross section: 1 × 2 × 0.25 mm² Bending radius: 65 mm Operating temperature: -30...+70 °C (-22...+158 °F)</p>	<p>EMC conformal feeding of +24 VDC operating voltage into the Profibus-DP hybrid cable.</p>

*/ Follow the manufacturer's mounting instructions

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

ORDER CODE



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), stroke length: 25...5900 mm (1...232 in.)
M	Threaded flange M18×1.5-6g (standard)
R	Threaded flange M18×1.5-6g (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 (with 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 3	1 × M12 male connector (5 pin), 1 × M12 female connector (5 pin) 1 × M8 male connector (4 pin)
D 6 3	1 × M16 male connector (6 pin) 1 × M16 female connector (6 pin)
A X X	XX m PUR cable (Part no. 530 109) A01...A10 (1...10 m) (see chapter "frequently ordered accessories" for cable specifications and note the temperature range of the cable), 1 × M8 male connector (4 pin)
*/ 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
P 1 0 1	PROFIBUS-DP (1...20 position(s))
P 1 0 2	PROFIBUS-DP (1 position)
P 1 0 5	PROFIBUS-DP, internal linearization (1...15 position(s))

Optional

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

NOTICE

- Select the P101 or P105 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 (P105) in **f** "Output" is chosen, select a suitable magnet.

DELIVERY



RH-D / -H / -J / -M / -R / -S / -T / -U / -V:

- Sensor
- O-ring

Accessories have to be ordered separately.

Manuals, Software & 3D Models available at:
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