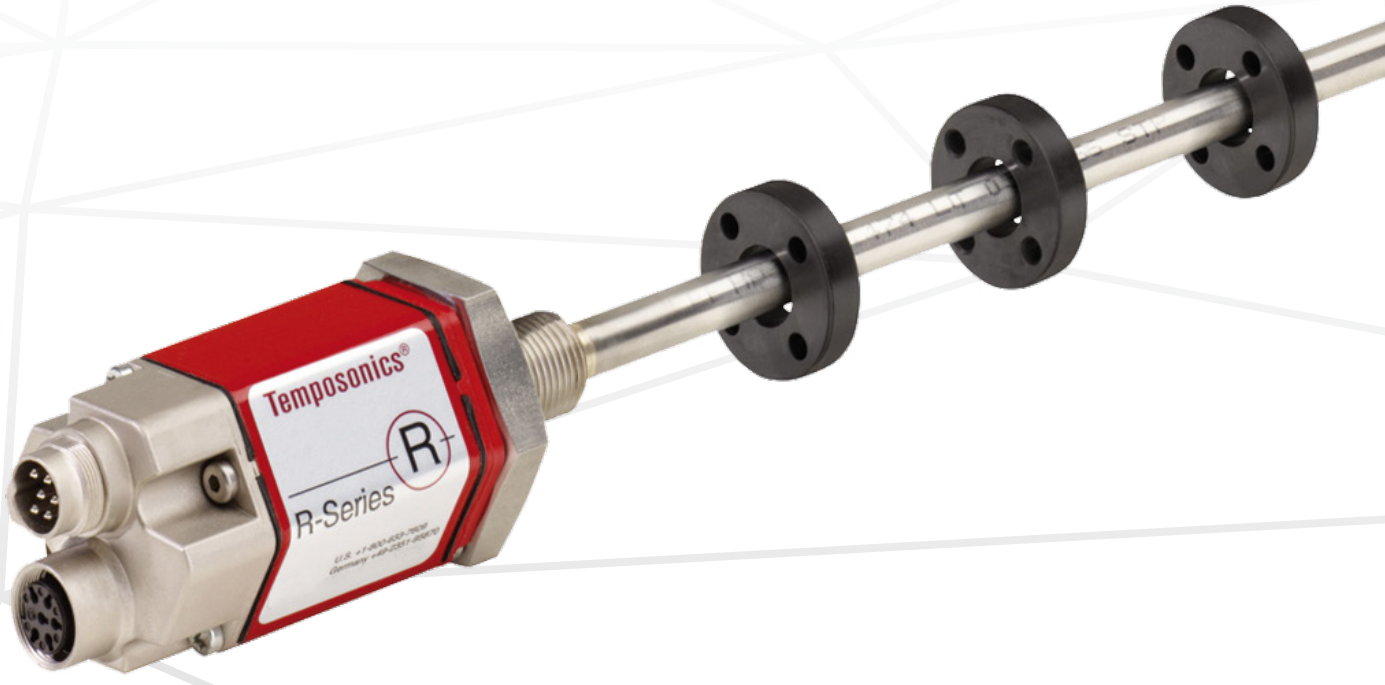
Temposonics
AN AMPHENOL COMPANY

Data Sheet

R-Series – RH PROFIBUS

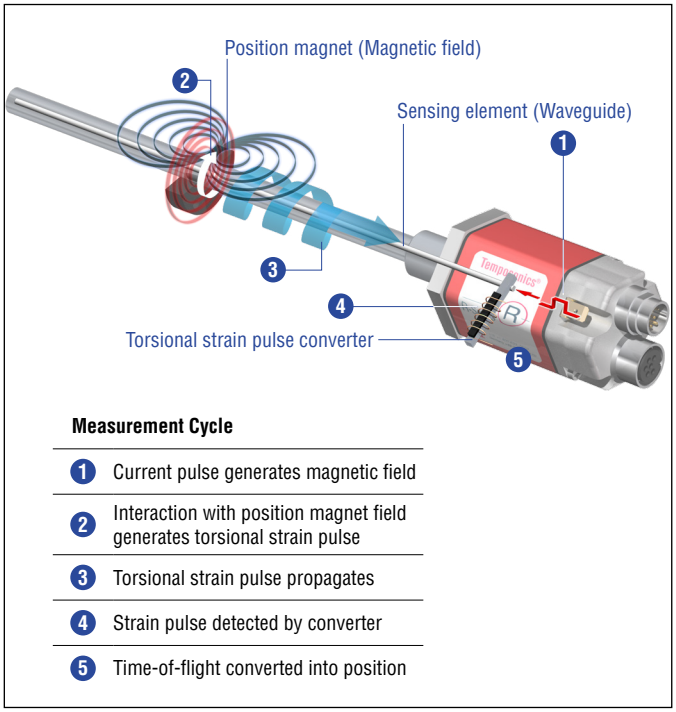
Magnetostrictive Linear Position Sensors

- 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.



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

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

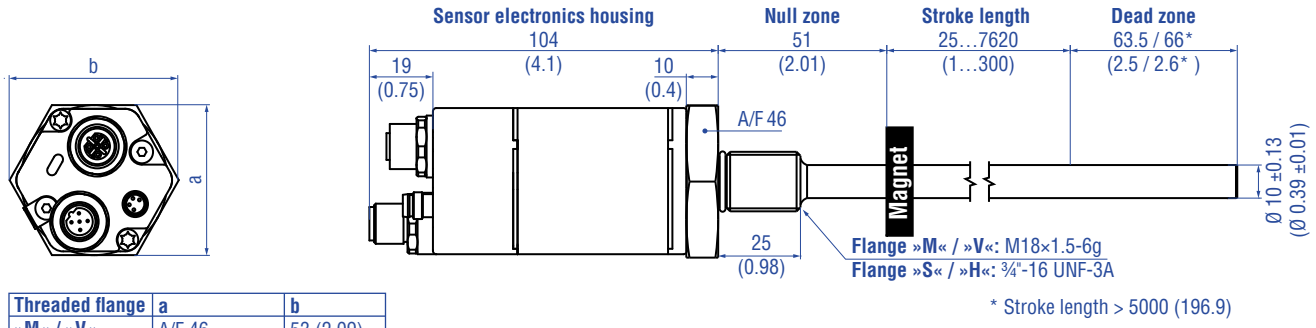
TECHNICAL DATA

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 # 251 416-2
2/ The IP rating is not part of the UL recognition

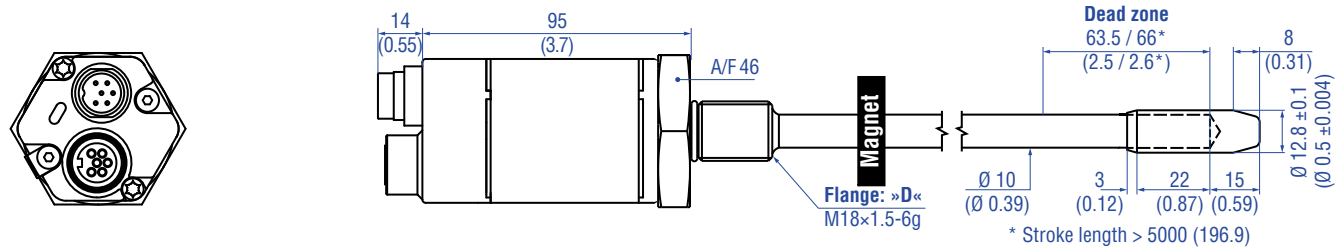
TECHNICAL DRAWING

RH-M/-S/-H/-V – RH with threaded flange M18×1.5-6g or ¾"-16 UNF-3A, example: Connection type D53 (connector outlet)

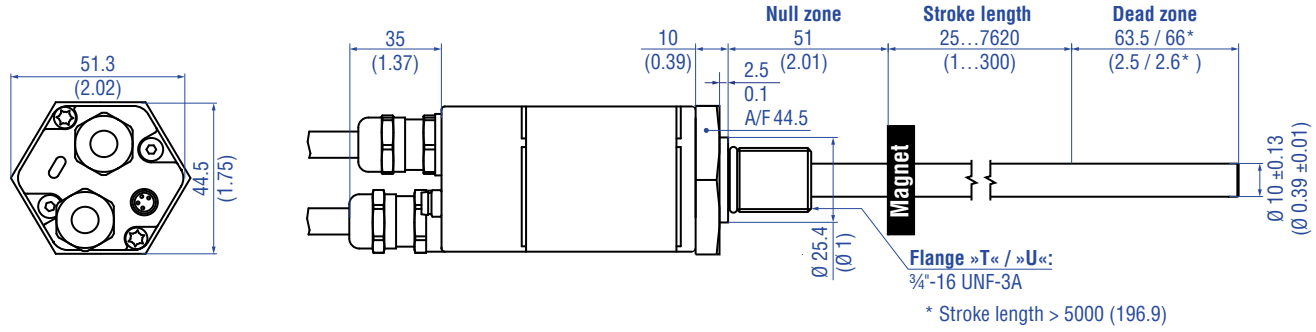


Threaded flange	a	b
»M« / »V«	A/F 46	53 (2.09)
»S« / »H«	A/F 44.5 (1.75)	51.3 (2.02)

RH-D – RH with threaded flange M18×1.5-6g, example: Connection type D63 (connector outlet)



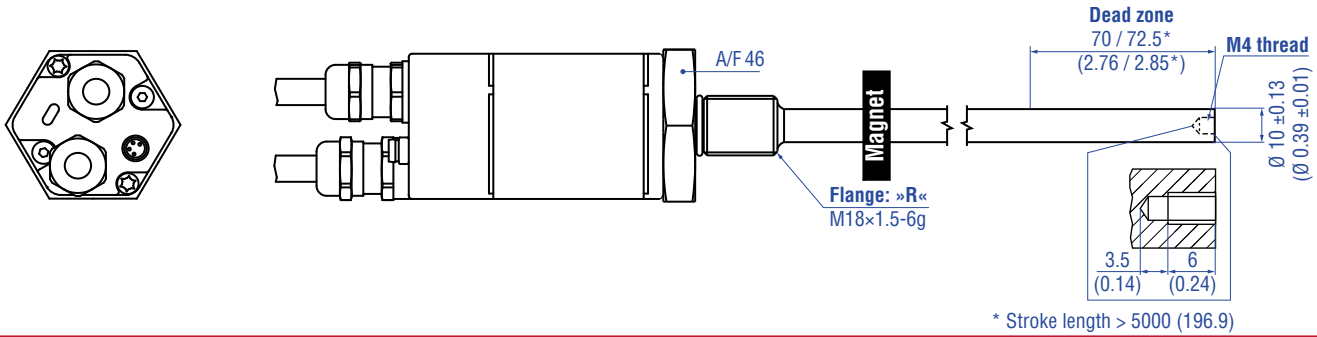
RH-T/-U – RH with threaded flange ¾"-16 UNF-3A with raised-face, example: Connection type AXX (cable outlet)



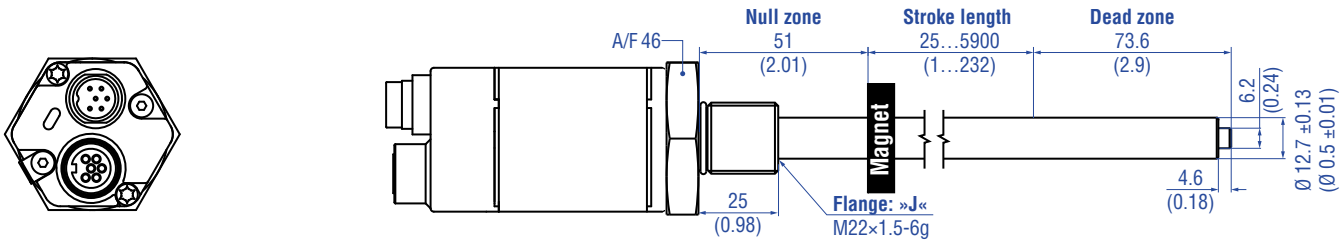
Controlling design dimensions are in millimeters and measurements in ( ) are in inches

Fig. 3: Temposonics® 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**
 View on sensor	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**
 View on sensor	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**
 View on sensor	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**
 View on sensor	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**
 View on sensor	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

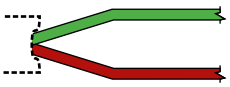
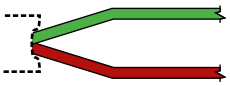
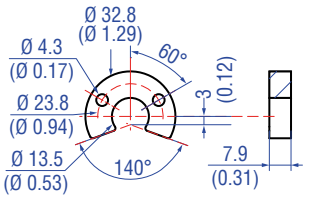
AXX		
Signal		
Cable	**Color**	**Function**
	GN	RxD/TxD-N (bus)
	RD	RxD/TxD-P (bus)
Cable	**Color**	**Function**
	GN	RxD/TxD-N (bus)
	RD	RxD/TxD-P (bus)
Power supply		
M8 male connector	**Pin**	**Function**
 View on sensor	1	+24 VDC (–15/+20 %)
	2	Not connected
	3	DC Ground (0 V)
	4	Not connected

Fig. 7: Connector wiring AXX

FREQUENTLY ORDERED ACCESSORIES – Additional options available in our Accessories Guide 551444

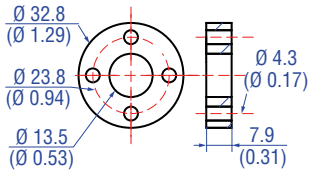
Position magnets



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…+105 °C (–40…+221 °F)

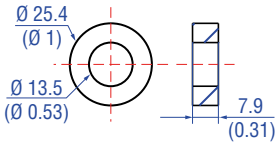
Marked version for sensors with internal linearization: Part no. 254 226



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…+105 °C (–40…+221 °F)

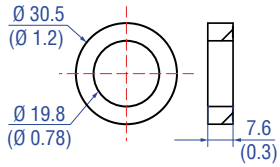
Marked version for sensors with internal linearization: Part no. 253 620



Ring magnet OD25.4
Part no. 400 533

Material: PA ferrite
Weight: Approx. 10 g
Surface pressure: Max. 40 N/mm²
Operating temperature:
–40…+105 °C (–40…+221 °F)

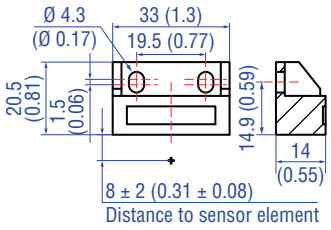
Marked version for sensors with internal linearization: Part no. 253 621



Ring magnet
Part no. 402 316

Material: PA ferrite coated
Weight: Approx. 13 g
Surface pressure: Max. 20 N/mm²
Operating temperature:
–40…+100 °C (–40…+212 °F)

Position magnet

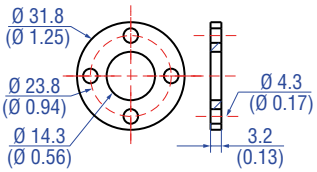


Block magnet L
Part no. 403 448

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)

This magnet may influence the sensor performance specifications for some applications.

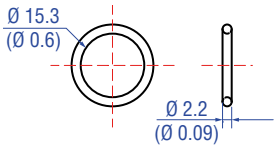
Magnet spacer



Magnet spacer
Part no. 400 633

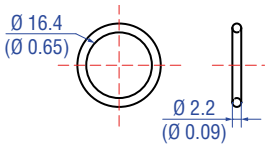
Material: Aluminum
Weight: Approx. 5 g
Surface pressure: Max. 20 N/mm²
Fastening torque for M4 screws: 1 Nm

O-rings



O-ring for threaded flange
M18×1.5-6g
Part no. 401 133

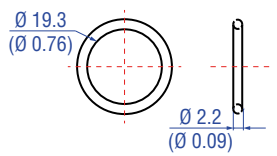
Material: Fluoroelastomer
Durometer: 75 ± 5 Shore A
Operating temperature:
–40…+204 °C (–40…+400 °F)



O-ring 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)

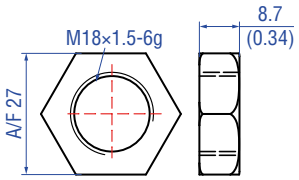
O-ring



O-ring for threaded flange
M22×1.5-6g
Part no. 561 337

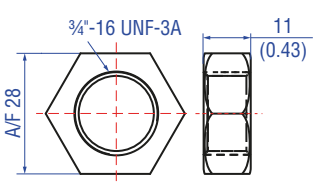
Material: FPM
Durometer: 75 Shore A
Operating temperature:
–20…+200 °C (–6…+392 °F)

Mounting accessories



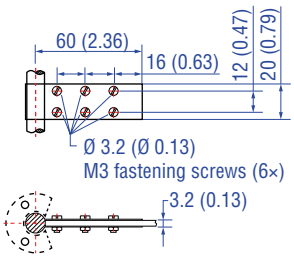
Hex jam nut M18×1.5-6g
Part no. 500 018

Material: Steel, zinc plated



Hex jam nut ¾"-16 UNF-3A
Part no. 500 015

Material: Steel, zinc plated

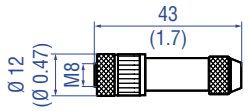


Fixing clip
Part no. 561 481

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

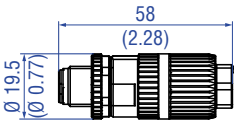
Controlling design dimensions are in millimeters and measurements in ( ) are in inches

Cable connectors*



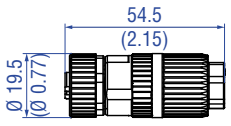
M8 female connector (4 pin), straight
Part no. 370 504

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



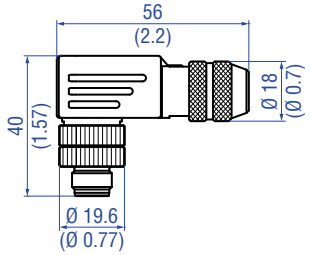
M12 B-coded male connector (5 pin), straight
Part no. 560 884

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



M12 B-coded female connector (5 pin), straight
Part no. 560 885

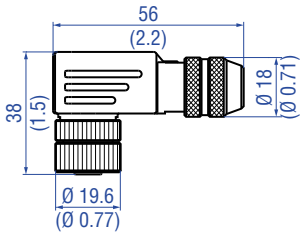
Material: Zinc nickel plated
Termination: Insulation-displacement
Contact insert: Silver plated
Cable Ø: 7…8.8 mm (0.28…0.35 in.)
Wire: 0.34 mm² (22 AWG)
Operating temperature:
–40…+85 °C (–40…+185 °F)
Ingress protection: IP65/IP67 (correctly fitted)
Number of contacts: 3 pin
Fastening torque: 0.6 Nm



M12 B-coded male connector (5 pin), angled
Part no. 370 515

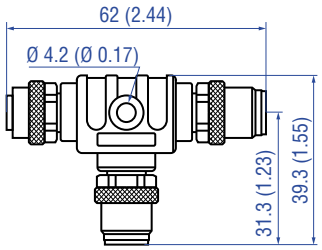
Material: Zinc nickel plated
Termination: Screw
Contact insert: Silver plated
Cable Ø: 6…8 mm (0.24…0.31 in.)
Wire: 0.75 mm² (18 AWG)
Operating temperature:
–40…+85 °C (–40…+185 °F)
Ingress protection: IP67 (correctly fitted)
Fastening torque: 0.4 Nm

Cable connectors*



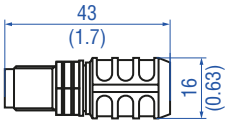
M12 B-coded female connector (5 pin), angled
Part no. 370 514

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



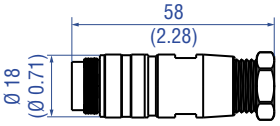
M12 B-coded T connector (5 pin)
Part no. 560 887

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)



Active M12 B-coded male bus terminator (5 pin)
Part no. 560 888

Housing: PUR
Termination: Screw
Contact insert: Silver plated
Operating temperature:
–40…+75 °C (–40…+167 °F)
Ingress protection: IP67 (correctly fitted)



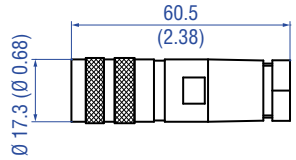
M16 male connector (6 pin), straight
Part no. 370 427

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)

*/ Follow the manufacturer's mounting instructions

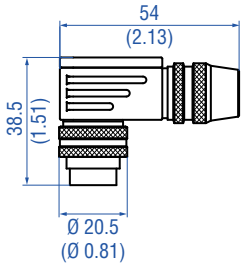
Controlling design dimensions are in millimeters and measurements in ( ) are in inches

Cable connectors*



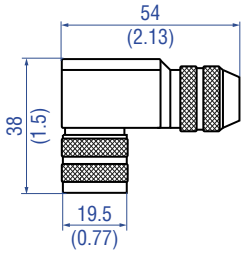
M16 female connector (6 pin), straight
Part no. 370 423

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



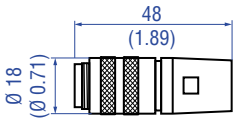
M16 male connector (6 pin), angled
Part no. 370 621

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)



M16 female connector (6 pin), angled
Part no. 370 460

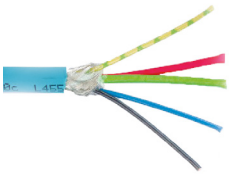
Material: Zinc nickel plated
Termination: Solder
Cable Ø: 6…8 mm (0.24…0.31 in.)
Wire: 0.75 mm² (20 AWG)
Operating temperature:
–40…+95 °C (–40…+203 °F)
Ingress protection: IP67 (correctly fitted)
Fastening torque: 0.6 Nm



Active M16 male bus terminator (6 pin)
Part no. 370 620

Material: Zinc nickel plated
Contact insert: Silver plated
Operating temperature:
–40…+75 °C (–40…+167 °F)
Ingress protection: IP67 (correctly fitted)

Cable



PVC signal cable
Part no. 530 040

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)

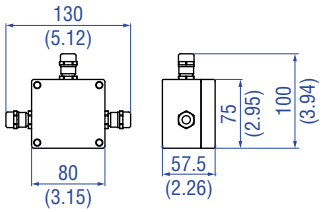
PVC power cable
Part no. 530 108

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)

PUR signal cable
Part no. 530 109

Material: PUR jacket; violet
Features: Highly flexible, halogen free, suitable for drag chains, mostly oil & flame restistant
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)

Filter box



PROFIBUS filter box, M16 (6 pin)
Part no. 252 916

EMC conformal feeding of +24 VDC operating voltage into the Profibus-DP hybrid cable.

*/ 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
R	H											P	1	0				
a		b	c					d			e	f				g		

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), 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 connetor (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:
www.temposonics.com

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 2415 1000 / 2415 1001
E-mail: info.cn@temposonics.com

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

Document Part Number:
551796 Revision A (EN) 02/2022

ISO 9001 CERTIFIED

PROFIBUS®

temposonics.com

© 2022 Temposonics, LLC – all rights reserved. Temposonics, LLC and Temposonics GmbH & Co. KG are subsidiaries of Amphenol Corporation. Except for any third party marks for which attribution is provided herein, the company names and product names used in this document may be the registered trademarks or unregistered trademarks of Temposonics, LLC or Temposonics GmbH & Co. KG. Detailed trademark ownership information is available at **www.temposonics.com/trademarkownership**.