



Temposonics

AN AMPHENOL COMPANY

Data Sheet

R-Series V RDV POWERLINK

Magnetostrictive Linear Position Sensors

- Space-saving installation due to detached sensor electronics housing
- Backwards compatible with RD4 generation
- All advantages of the R-Series V



THE NEW **V** GENERATION

MEASURING TECHNOLOGY

The absolute, linear position sensors provided by Tempsonics rely on the company's proprietary magnetostrictive technology, which can determine position with a high level of precision and robustness. Each Tempsonics® position sensor consists of a ferromagnetic waveguide, a position magnet, a strain pulse converter and a 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.

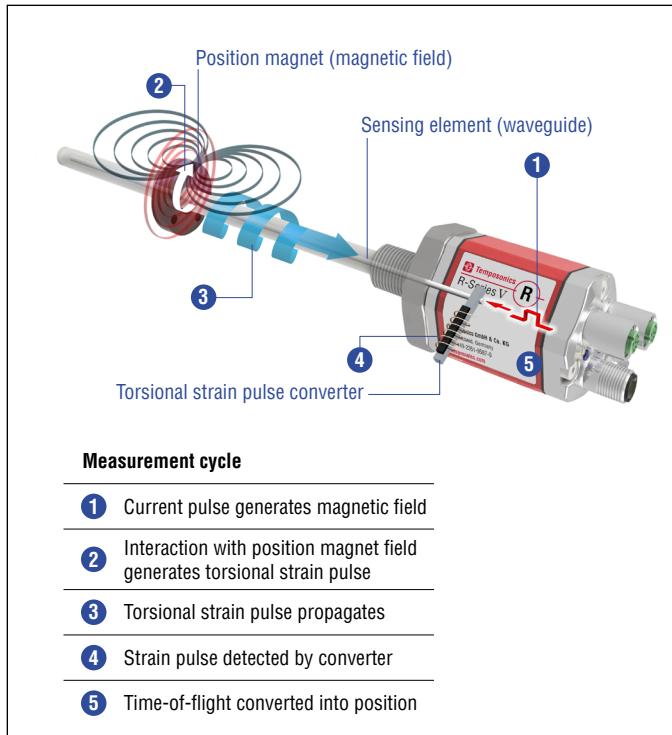
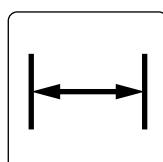


Fig. 1: Time-of-flight based magnetostrictive position sensing principle

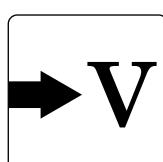
R-SERIES V RDV POWERLINK

The Tempsonics® R-Series V brings very powerful sensor performance to meet the many demands of your application. The sensor RDV is the version of the R-Series V with a detached sensor electronics. The main advantages of the version RDV are:



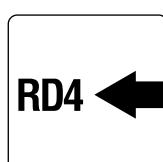
Space-saving installation

The detached sensor electronics allow space-saving installation of the compact measuring rod.



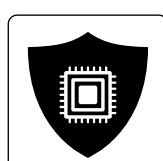
R-Series V platform

The detached sensor electronics is based on the R-Series V and offers all advantages of the innovative series.



Backwards compatible

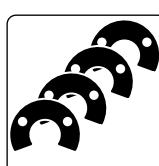
Mechanically and electrically, the sensors are backwards compatible with the RD4. This means that the sensor rod or the sensor electronics can be replaced without any problems.



Protection of the sensor electronics

By separating the robust sensor rod from the complex evaluation electronics improved protection against process influences can be realized.

In addition the R-Series V POWERLINK scores with the following features:



30 positions simultaneously

The R-Series V POWERLINK can detect and report the position and velocity of up to 30 magnets simultaneously.



R-Series V POWERLINK

In addition to the measured position value via the POWERLINK protocol further data about the current sensor status, such as the total distance travelled, the internal temperature and the total operating hours, can be displayed for diagnostic purposes.

All settings under control with the smart assistants for the R-Series V

The TempoLink® and the TempoGate® smart assistants support you in setup and diagnostics of the R-Series V. For more information of these assistants please see the data sheets:

- TempoLink® smart assistant
(Document part number: [552070](#))
- TempoGate® smart assistant
(Document part number: [552110](#))



TECHNICAL DATA

Output						
Interface	Ethernet POWERLINK					
Data protocol	POWERLINK V2					
Measured value	Position, velocity/option: Simultaneous multi-position and multi-velocity measurements up to 30 magnets					
Measurement parameters						
Resolution: Position	0.5...100 µm (selectable)					
Cycle time	Stroke length	≤ 50 mm	≤ 715 mm	≤ 2000 mm	≤ 4675 mm	5080 mm
	Cycle time	250 µs ¹	500 µs	1000 µs	2000 µs	3200 µs
Linearity deviation ^{2, 3}	Stroke length	≤ 500 mm	> 500 mm			
	Linearity deviation	≤ ± 50 µm	< 0.01 % F.S.			
	Optional internal linearization: Linearity tolerance (applies for the first magnet for multi-position measurement)					
	Stroke length	25...300 mm	300...600 mm	600...1200 mm		
	typical	± 15 µm	± 20 µm	± 25 µm		
	maximum	± 25 µm	± 30 µm	± 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...+85 °C (-40...+185 °F)					
Humidity	90 % relative humidity, no condensation					
Ingress protection	Sensor electronics: IP67 (with correctly mounted housing and connectors) Measuring rod with connecting cable for side cable entry: IP65 Measuring rod with single wires and flat connector with bottom cable entry: IP30					
Shock test	100 g/11 ms, IEC standard 60068-2-27					
Vibration test	10 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 RDV sensors fulfill the requirements of the EMC directives 2014/30/EU, UKSI 2016 No. 1091 and TR CU 020/2011 under the condition of an EMC-compliant installation. ⁴					
Operating pressure	350 bar (5076 psi)/700 bar (10,153 psi) peak (at 10 × 1 min) for sensor rod					
Magnet movement velocity	Any					
Design/Material						
Sensor electronics housing	Aluminum (painted), zinc die cast					
Sensor rod with flange	Stainless steel 1.4301 (AISI 304)					
RoHS compliance	The used materials are compliant with the requirements of EU Directive 2011/65/EU and EU Regulation 2015/863 as well as UKSI 2022 No. 622					
Stroke length	25...2540 mm (1...100 in.) for pressure-fit flange »S« 25...5080 mm (1...200 in.) for all threaded flanges					
Mechanical mounting						
Mounting position	Any					
Mounting instruction	Please consult the technical drawings on page 4 , page 5 , page 6 and the operation manual (document number: 552010)					
Electrical connection						
Connection type	2 × M12 female connectors (5 pin), 1 × M12 male connector (4 pin) 2 × M12 female connectors (5 pin), 1 × M8 male connector (4 pin)					
Operating voltage	+12...30 VDC ±20 % (9.6...36 VDC)					
Power consumption	Less than 4 W typical					
Dielectric strength	500 VDC (DC ground to machine ground)					
Polarity protection	Up to -36 VDC					
Overvoltage protection	Up to 36 VDC					

1/ Minimum cycle time for multi-position measurements (number of magnets ≥ 2): 400 µs

2/ With position magnet # 251 416-2

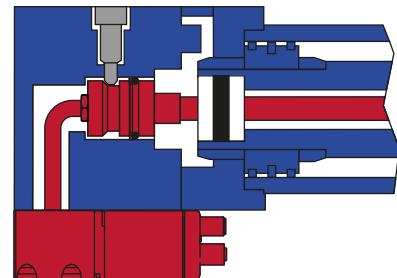
3/ For rod style »S« the linearity deviation can be higher in the first 30 mm (1.2 in.) of stroke length

4/ The cable between the sensor element and the electronic housing must be mounted in an appropriately shielded environment.

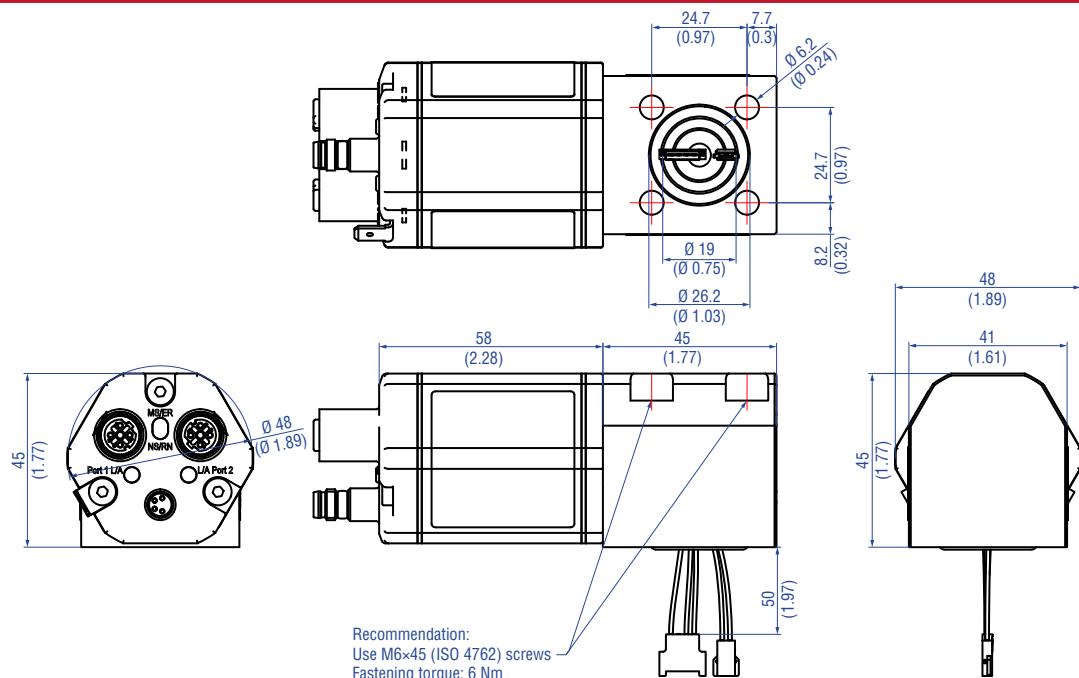
TECHNICAL DRAWING

RDV with bottom cable entry

- The connecting cables between the sensor electronics housing and the rod are routed into the interior via the bottom of the sensor electronics housing
- Rod and connecting cable are fully encapsulated and protected against external disturbances



RDV with bottom cable entry, example: Connector D56 (connector outlet)

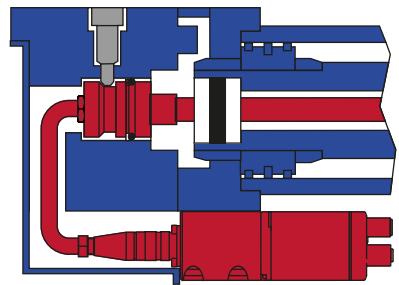


Controlling design dimensions are in millimeters and measurements in () are in inches

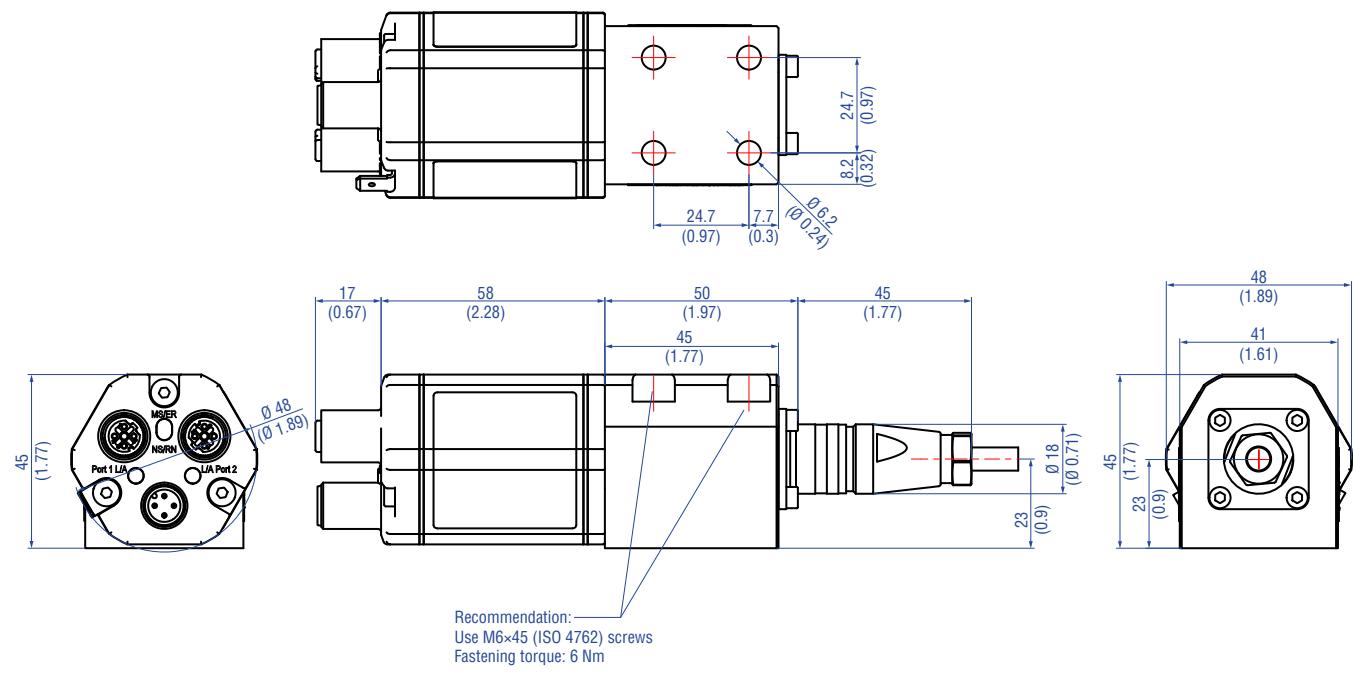
Fig. 2: Tempsonics® RDV sensor electronics housing with bottom cable entry

RDV with side connection

- The connecting cable between the sensor electronics housing and the rod is connected to the side of the sensor electronics housing
- Rod and connecting cable are sealed against dust and protected against water jets



RDV with side cable entry, example: Connector D58 (connector outlet)



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

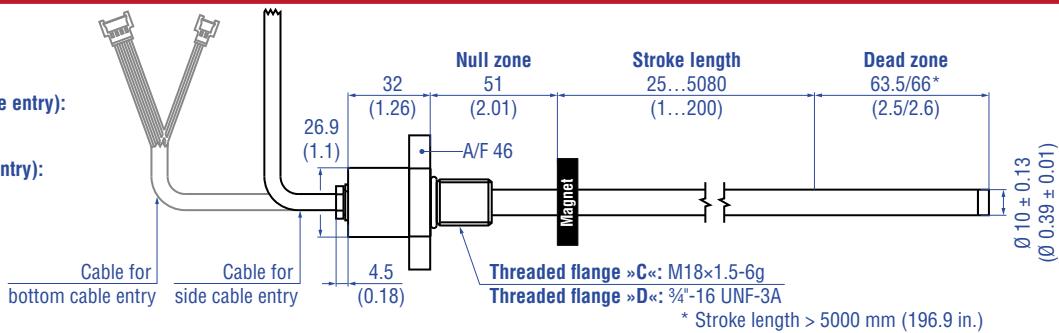
Fig. 3: Tempsonics® RDV sensor electronics housing with side cable entry

Tempsonics® R-Series V RDV POWERLINK

Data Sheet

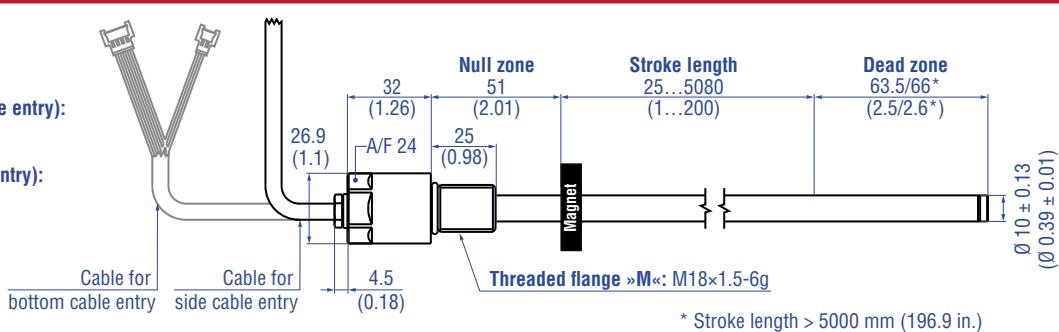
Threaded flange »C« & »D« (for bottom or side cable entry)

PUR cable:
 $\varnothing 6$ ($\varnothing 0.24$)
Bending radius:
 > 24 (> 0.94)
Cable length (bottom cable entry):
65/170/230/350
(2.6/6.7/9.1/13.8)
Cable length (side cable entry):
250/400/600
(9.8/15.7/23.6)



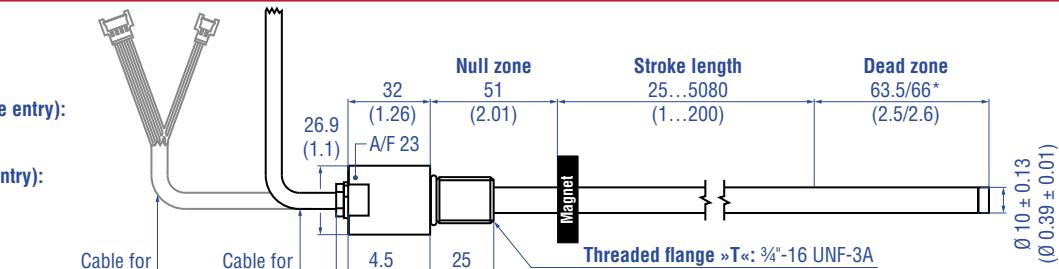
Threaded flange »M« (for bottom or side cable entry)

PUR cable:
 $\varnothing 6$ ($\varnothing 0.24$)
Bending radius:
 > 24 (> 0.94)
Cable length (bottom cable entry):
65/170/230/350
(2.6/6.7/9.1/13.8)
Cable length (side cable entry):
250/400/600
(9.8/15.7/23.6)



Threaded flange »T« (for bottom or side cable entry)

PUR cable:
 $\varnothing 6$ ($\varnothing 0.24$)
Bending radius:
 > 24 (> 0.94)
Cable length (bottom cable entry):
65/170/230/350
(2.6/6.7/9.1/13.8)
Cable length (side cable entry):
250/400/600
(9.8/15.7/23.6)



Pressure fit flange »S« (for bottom or side cable entry)

PUR cable:
 $\varnothing 6$ ($\varnothing 0.24$)
Bending radius:
 > 24 (> 0.94)
Cable length (bottom cable entry):
65/170/230/350
(2.6/6.7/9.1/13.8)
Cable length (side cable entry):
250/400/600
(9.8/15.7/23.6)

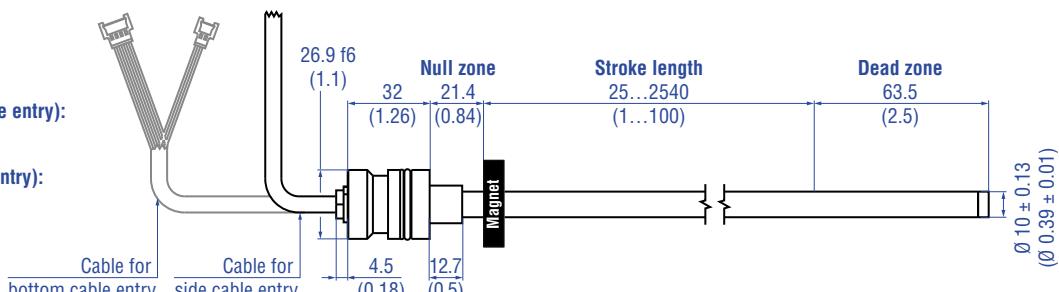


Fig. 4: Tempsonics® RDV flange types

CONNECTOR WIRING

D58			
Port 1 – Signal			
M12 female connector (D-coded)		Pin	Function
		1	Tx (+)
View on sensor		2	Rx (+)
View on sensor		3	Tx (-)
View on sensor		4	Rx (-)
Port 2 – Signal			
M12 female connector (D-coded)		Pin	Function
		1	Tx (+)
View on sensor		2	Rx (+)
View on sensor		3	Tx (-)
View on sensor		4	Rx (-)
Power supply			
M12 male connector (A-coded)		Pin	Function
		1	+12...30 VDC ($\pm 20\%$)
View on sensor		2	Not connected
View on sensor		3	DC Ground (0 V)
View on sensor		4	Not connected

Fig. 5: Connector wiring D58

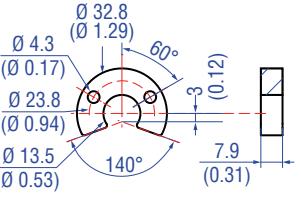
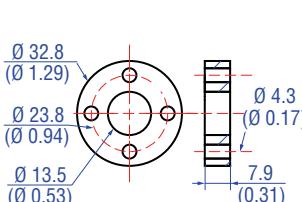
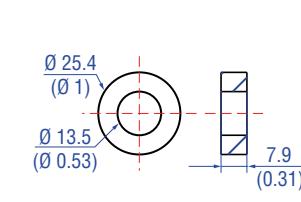
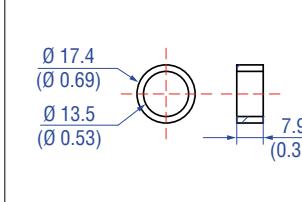
D56			
Port 1 – Signal			
M12 female connector (D-coded)		Pin	Function
		1	Tx (+)
View on sensor		2	Rx (+)
View on sensor		3	Tx (-)
View on sensor		4	Rx (-)
Port 2 – Signal			
M12 female connector (D-coded)		Pin	Function
		1	Tx (+)
View on sensor		2	Rx (+)
View on sensor		3	Tx (-)
View on sensor		4	Rx (-)
Power supply			
M8 male connector		Pin	Function
		1	+12...30 VDC ($\pm 20\%$)
View on sensor		2	Not connected
View on sensor		3	DC Ground (0 V)
View on sensor		4	Not connected

Fig. 6: Connector wiring D56

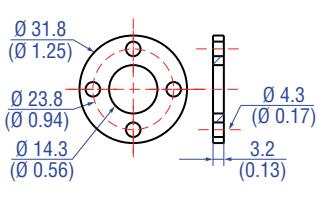
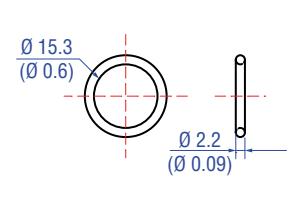
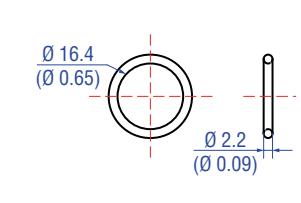
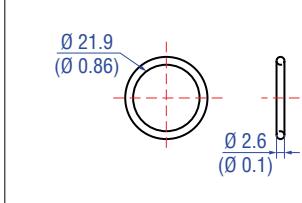
FREQUENTLY ORDERED ACCESSORIES

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

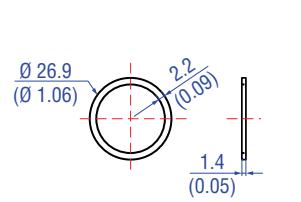
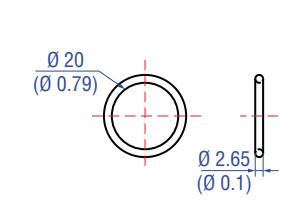
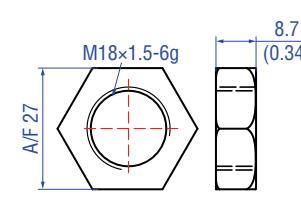
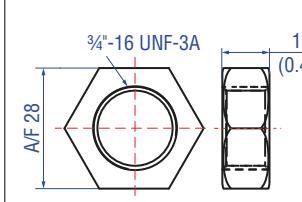
Position magnets

			
U-magnet OD33 Part no. 251 416-2	Ring magnet OD33 Part no. 201 542-2	Ring magnet OD25.4 Part no. 400 533	Ring magnet OD17.4 Part no. 401 032
<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>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>Material: PA ferrite Weight: Approx. 10 g Surface pressure: Max. 40 N/mm² Operating temperature: -40...+105 °C (-40...+221 °F)</p> <p>Marked version for sensors with internal linearization: Part no. 253 621</p>	<p>Material: PA neobond Weight: Approx. 5 g Surface pressure: Max. 20 N/mm² Operating temperature: -40...+105 °C (-40...+221 °F)</p>

Magnet spacer

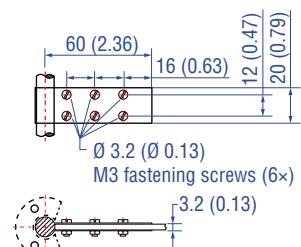
			
Magnet spacer Part no. 400 633	O-ring for threaded flange M18x1.5-6g Part no. 401 133	O-ring for threaded flange 3/4"-16 UNF-3A Part no. 560 315	O-ring for pressure fit flange Ø 26.9 mm Part no. 560 705
<p>Material: Aluminum Weight: Approx. 5 g Surface pressure: Max. 20 N/mm² Fastening torque for M4 screws: 1 Nm</p>	<p>Material: Fluoroelastomer Durometer: 75 ± 5 Shore A Operating temperature: -40...+204 °C (-40...+400 °F)</p>	<p>Material: Fluoroelastomer Durometer: 75 ± 5 Shore A Operating temperature: -40...+204 °C (-40...+400 °F)</p>	<p>Material: Nitrile rubber Operating temperature: -53...+107 °C (-65...+225 °F)</p>

O-rings

			
Back-up ring for pressure fit flange Ø 26.9 mm Part no. 560 629	O-ring for mounting block with bottom entry Part no. 561 435	Hex jam nut M18x1.5-6g Part no. 500 018	Hex jam nut 3/4"-16 UNF-3A Part no. 500 015
<p>Material: Polymyte Durometer: 90 Shore A</p>	<p>Material: FKM Durometer: 80± 5 Shore A Operating temperature: -15...+200 °C (5...+392 °F)</p>	<p>Material: Steel, zinc plated</p>	<p>Material: Steel, zinc plated</p>

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

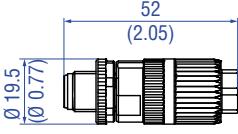
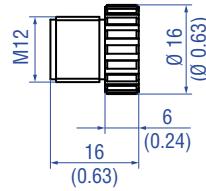
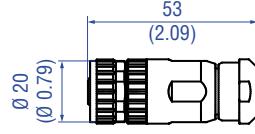
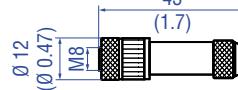
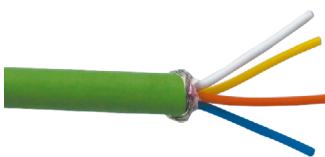
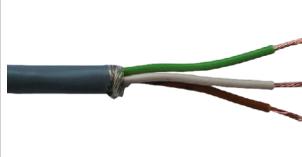
Mounting accessories



Fixing clip Part no. 561 481

Application: Used to secure sensor rods (\varnothing 10 mm (\varnothing 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* – Signal		Cable connectors* – Power	
			
M12 D-coded male connector (4 pin), straight Part no. 370 523	M12 connector end cap Part no. 370 537	M12 A-coded female connector (4 pin/5 pin), straight Part no. 370 677	M8 female connector (4 pin), straight Part no. 370 504
Cables		Cable sets	
			
PUR signal cable Part no. 530 125	PVC power cable Part no. 530 108	Signal cable with M12 D-coded male connector (4 pin), straight – M12 D-coded, male connector (4 pin), straight Part no. 530 064	Signal cable with M12 D-coded male connector (4 pin), straight – RJ45 male connector, straight Part no. 530 065
Material: PUR jacket; green Features: Cat 5, highly flexible, halogen free, suitable for drag chains, mostly oil & flame resistant Cable Ø: 6.5 mm (0.26 in.) Cross section: 2 x 2 x 0.35 mm ² (22 AWG) Bending radius: 5 x D (fixed installation) Operating temperature: -20...+60 °C (-4...+140 °F)	Material: PVC jacket; gray Features: Shielded, flexible, mostly flame resistant Cable Ø: 4.9 mm (0.19 in.) Cross section: 3 x 0.34 mm ² Bending radius: 5 x D (fixed installation) Operating temperature: -30...+80 °C (-22...+176 °F)	Material: PUR jacket; green Features: Cat 5e Cable length: 5 m (16.4 ft) Cable Ø: 6.5 mm (0.26 in.) Ingress protection: IP65, IP67, IP68 (correctly fitted) Operating temperature: -30...+70 °C (-22...+158 °F)	Material: PUR jacket; green Features: Cat 5e Cable length: 5 m (16.4 ft) Cable Ø: 6.5 mm (0.26 in.) Ingress protection M12 connector: IP67 (correctly fitted) Ingress protection RJ45 connector: IP20 (correctly fitted) Operating temperature: -30...+70 °C (-22...+158 °F)

*/ Follow the manufacturer's mounting instructions

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

Color of connectors and cable jacket may change. Colors of the cores and technical properties remain unchanged.

Cable sets	Programming tools		
			
<p>Power cable with M8 female connector (4 pin), straight – pigtail Part no. 530 066 (5 m (16.4 ft.)) Part no. 530 096 (10 m (32.8 ft.)) Part no. 530 093 (15 m (49.2 ft.))</p> <p>Material: PUR jacket; gray Features: Shielded Cable Ø: 5 mm (0.2 in.) Operating temperature: -40...+90 °C (-40...+194 °F)</p>	<p>Power cable with M12 A-coded female connector (5 pin), straight – pigtail Part no. 370 673</p> <p>Material: PUR jacket; black Features: Shielded Cable length: 5 m (16.4 ft) Ingress protection: IP67 (correctly fitted) Operating temperature: -25...+80 °C (-13...+176 °F)</p>	<p>TempoLink® kit for Tempsonics® R-Series V Part no. TL-1-0-EM08 (D56) Part no. TL-1-0-EM12 (D58)</p> <ul style="list-style-type: none"> • Connect wirelessly via Wi-Fi enabled device or via USB with the diagnostic tool • Simple connectivity to the sensor via 24 VDC power line (permissible cable length: 30 m) • User friendly interface for mobile devices and desktop computers • See data sheet "TempoLink® smart assistant" (document part no.: 552070) for further information 	<p>TempoGate® smart assistant for Tempsonics® R-Series V Part no. TG-C-0-Dxx (xx indicates the number of R-Series V sensors that can be connected (even numbers only))</p> <ul style="list-style-type: none"> • OPC UA server for diagnostics of the R-Series V • For installation in the control cabinet • Connection via LAN and Wi-Fi • See data sheet "TempoGate® smart assistant" document part no.: 552110) for further information

Color of connectors and cable jacket may change. Colors of the cores and technical properties remain unchanged.

ORDER CODE

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
R	D	V													1	U	3		1

a	Design
R D V	Detached sensor electronics "Classic"

b	Design
C	Threaded flange M18x1.5-6g (A/F 46)
D	Threaded flange 3/4"-16 UNF-3A (A/F 46)
M	Threaded flange M18x1.5-6g (A/F 24)
S	Pressure fit flange Ø 26.9 mm f6
T	Threaded flange 3/4"-16 UNF-3A (A/F 23)

c	Mechanical options
For side cable entry	
A	PUR cable with M16 connector, 250 mm length
B	PUR cable with M16 connector, 400 mm length
C	PUR cable with M16 connector, 600 mm length
For bottom cable entry	
2	Single wires with flat connector, 65 mm length
4	Single wires with flat connector, 170 mm length
5	Single wires with flat connector, 230 mm length
6	Single wires with flat connector, 350 mm length

d	Stroke length
X X X X M	Flange »S«: 0025...2540 mm Flange »C«, »D«, »M«, »T«: 0025...5080 mm
Stroke length (mm)	
25...	500 mm
500...	750 mm
750...	1000 mm
1000...	2500 mm
2500...	5080 mm
X X X X U	Flange »S«: 001.0...100.0 in. Flange »C«, »D«, »M«, »T«: 001.0...200.0 in.

Stroke length (in.)	Ordering steps
1...	20 in.
20...	30 in.
30...	40 in.
40...	100 in.
100...	200 in.

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

e	Number of magnets
X X	01...30 position(s) (1...30 magnet(s))

f	Connection type
D 5 6	2×M12 female connectors (D-coded), 1×M8 male connector
D 5 8	2×M12 female connectors (D-coded), 1×M12 male connector (A-coded)

g	System
1	Standard

h	Output
U 3 0 1	POWERLINK, position and velocity (1...30 magnet(s))
U 3 1 1	POWERLINK, position and velocity, internal linearization (1...30 magnet(s))

NOTICE

- Specify the number of magnets for your application and order the magnets 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.
- If the option for internal linearization (U311) in **h** "Output" is chosen, select a suitable magnet.

DELIVERY



RDV-C-D-M-T:
Sensor, O-ring

RDV-S:

Sensor, O-ring, back-up ring

Accessories have to be ordered separately.

Manuals, Software & 3D Models available at:
www.tempsonics.com

GLOSSARY

E

Extrapolation

The native measurement cycle time of a sensor increases with the stroke length. With extrapolation, the sensor is able to report data faster than the native cycle time, independent of the stroke length of the sensor. Without extrapolation, if data is requested faster than the native cycle time, the last measured value is repeated.

I

Internal Linearization

The internal linearization offers an improved linearity for an overall higher accuracy of the position measurement. The internal linearization is set for the sensor during production.

M

Multi-position measurement

During the measurement cycle, the positions of every magnet on the sensor are simultaneously reported. The velocity is continuously calculated based on these changing position values as the magnets are moved.

N

Node ID

The addressing of the devices in a POWERLINK network is done via the node ID. Each node ID only exists once in a network. It can have a value between 1 and 240 (while 240 is reserved for the Managing Node). Meaning that a POWERLINK network can comprise up to 240 devices. With the R-Series V POWERLINK, the node ID (delivered with node ID 1) can be set via the TempoLink smart assistant, for example.

P

POWERLINK

POWERLINK is an Industrial Ethernet interface and is managed by the **Ethernet POWERLINK Standardization Group (EPSG)**. The R-Series V POWERLINK and its corresponding XDD file are certitifed by the EPSG.

S

Synchronization mode

R-Series V POWERLINK supports synchronization mode. The synchronization mode enables clock-synchronous data exchange between sensor and control. The synchronous measurement is an essential requirement for motion-controlled applications

X

XDD file

The properties and functions of a POWERLINK device are described in an XDD file (**XML Device Description**). The XML-based XDD file contains all relevant data that are important for the implementation of the device in the controller as well as for data exchange during operation. The XDD file of the R-Series V POWERLINK is available on the homepage www.temposonics.com.



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