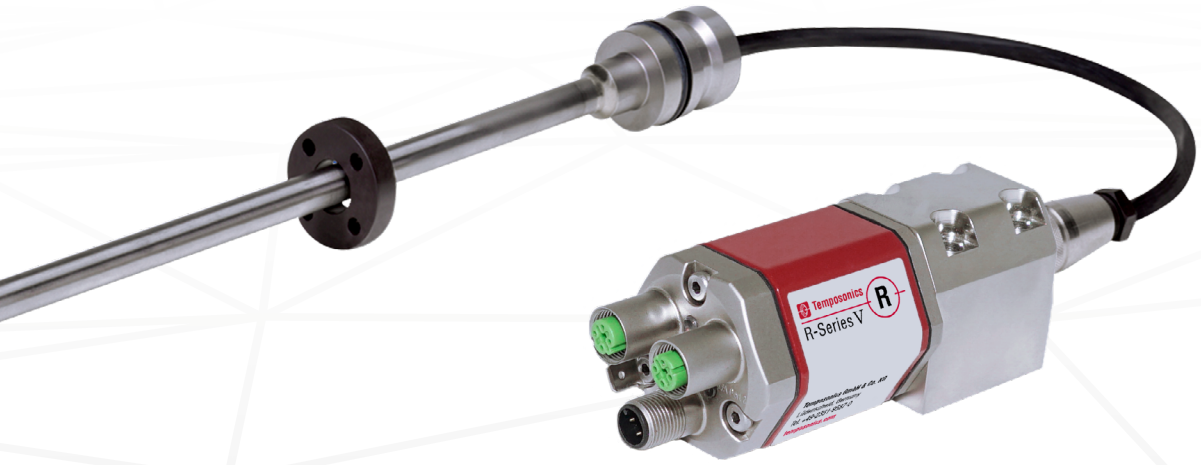
Temposonics
AN AMPHENOL COMPANY

Data Sheet

R-Series V RDV POWERLINK

Magnetostrictive Linear Position Sensors

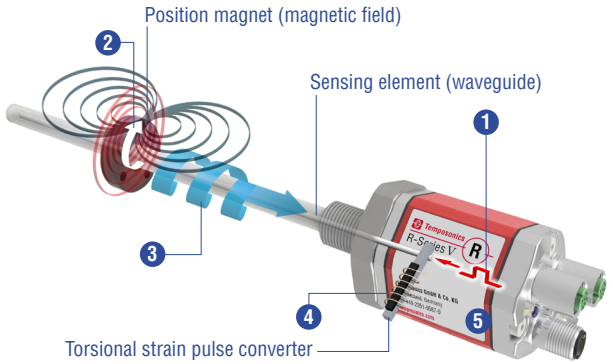
- Space-saving installation due to detached sensor electronics housing
- Backwards compatible with RD4 generation
- All advantages of the R-Series V



THE NEW V GENERATION

MEASURING TECHNOLOGY

The absolute, linear position sensors provided by 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 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.



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

R-SERIES V RDV POWERLINK

The Temposonics® 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

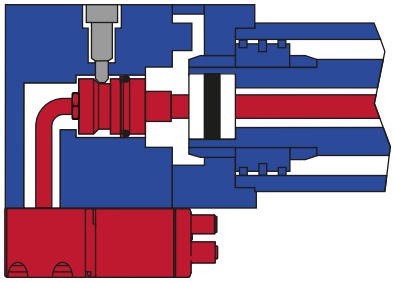
Output	
Interface	Ethernet POWERLINK
Data protocol	POWERLINK V2
Measured value	Position, velocity/option: Simultaneous multi-position and multi-velocity measurements up to 30 magnets
Measurement parameters	
Resolution: Position	0.5…100 µm (selectable)
Cycle time	Stroke length: ≤ 50 mm | ≤ 715 mm | ≤ 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.

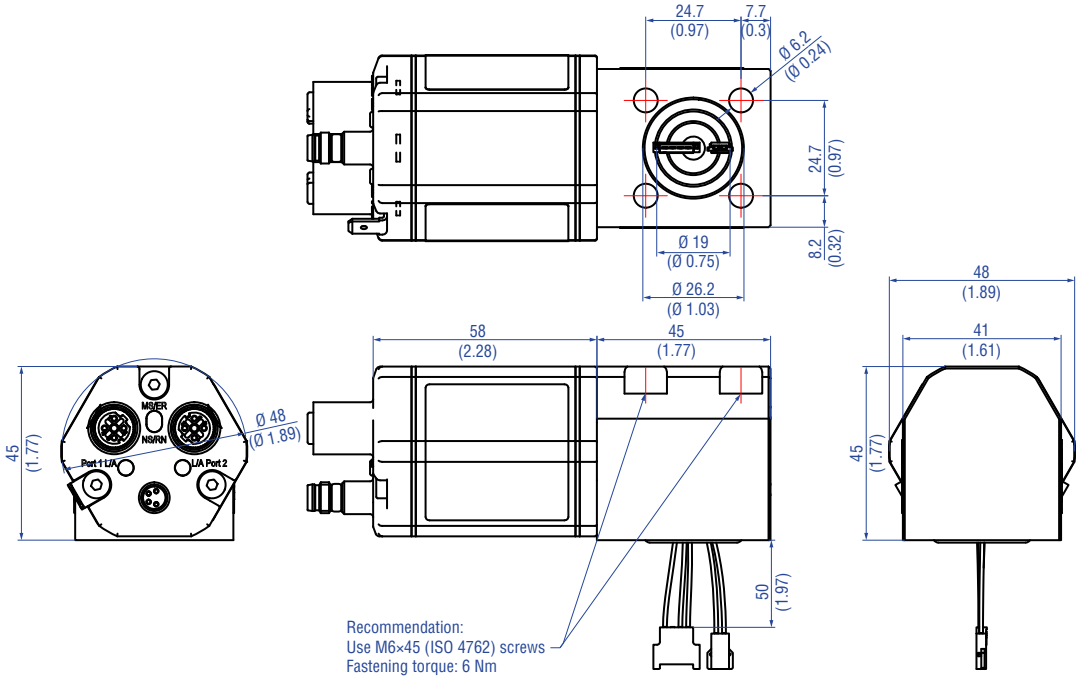
TECHNICAL DRAWING

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)

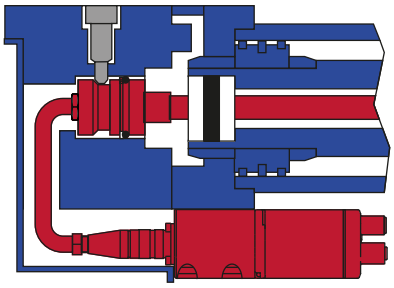


Controlling design dimensions are in millimeters and measurements in ( ) are in inches

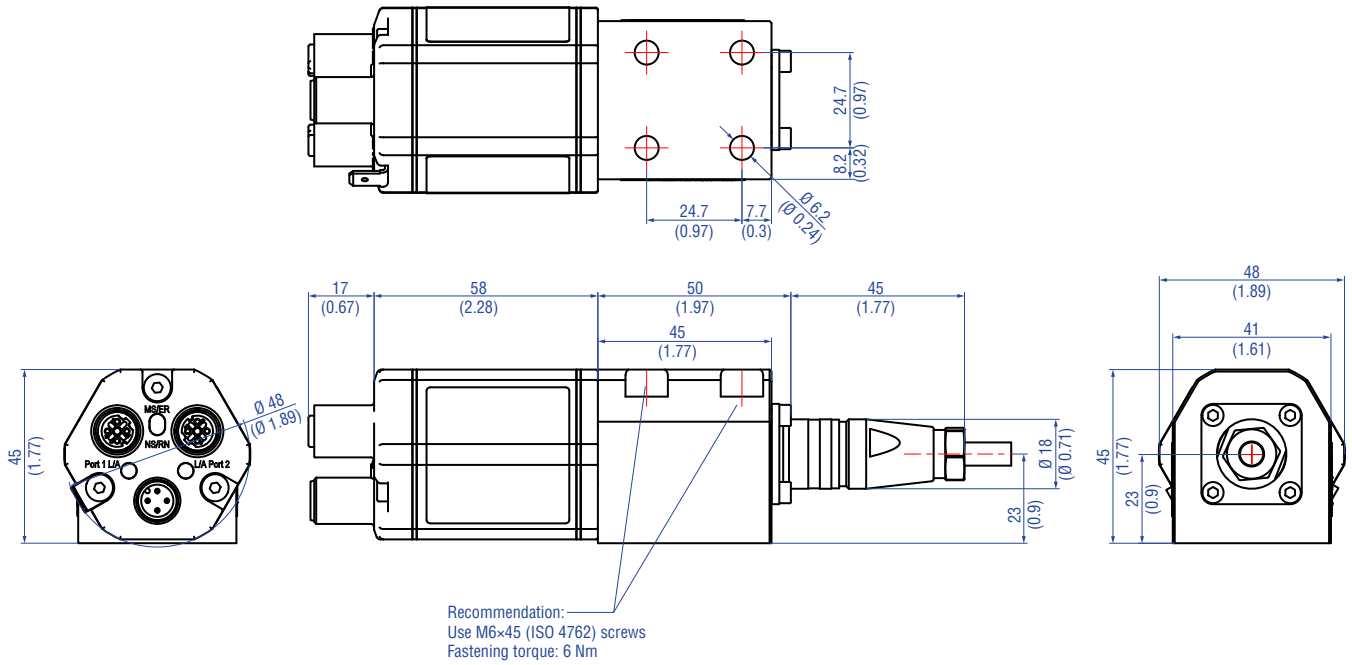
Fig. 2: Temposonics® RDV sensor electronics housing with bottom cable entry

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)

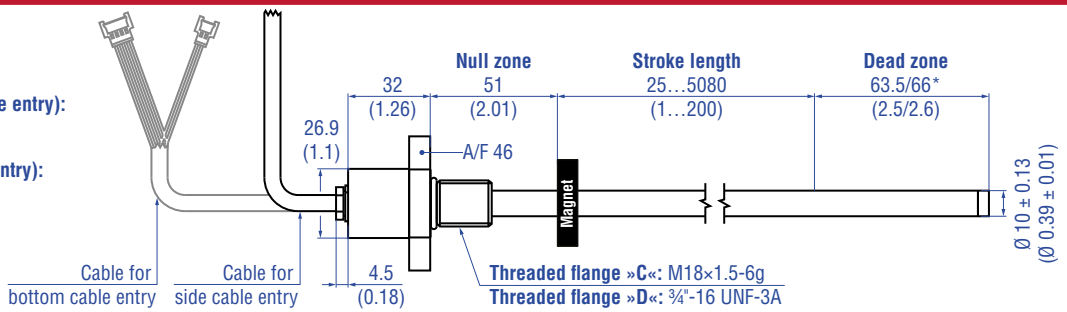


Controlling design dimensions are in millimeters and measurements in ( ) are in inches

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

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

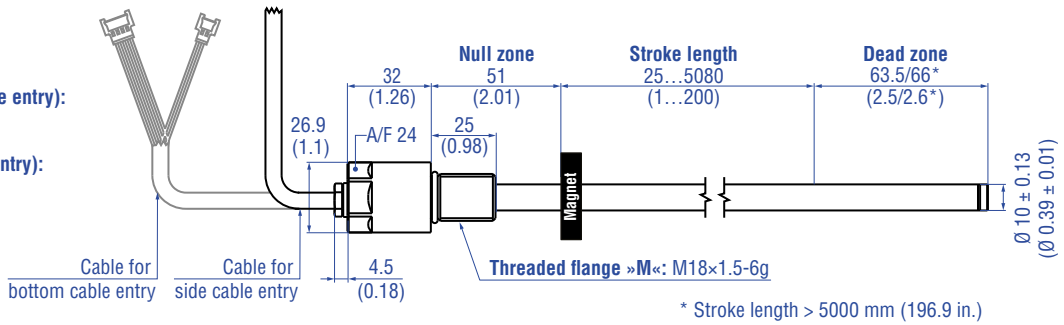
PUR cable:
Ø 6 (Ø 0.24)
Bending radius:
> 24 (> 0.94)
Cable length (bottom cable entry):
65/170/230/350
(2.6/6.7/9.1/13.8)
Cable length (side cable entry):
250/400/600
(9.8/15.7/23.6)



* Stroke length > 5000 mm (196.9 in.)

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

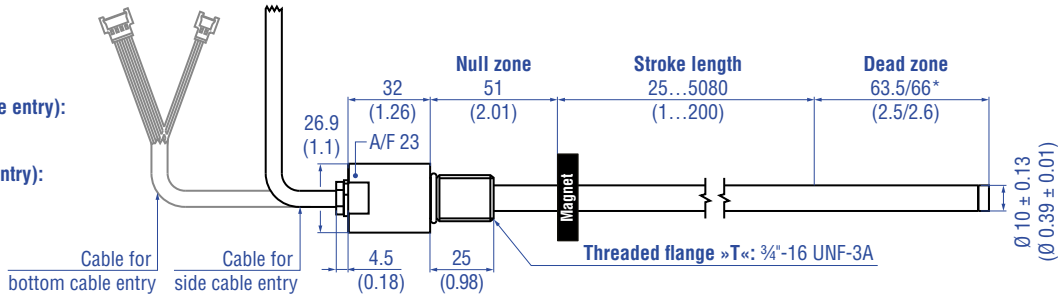
PUR cable:
Ø 6 (Ø 0.24)
Bending radius:
> 24 (> 0.94)
Cable length (bottom cable entry):
65/170/230/350
(2.6/6.7/9.1/13.8)
Cable length (side cable entry):
250/400/600
(9.8/15.7/23.6)



* Stroke length > 5000 mm (196.9 in.)

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

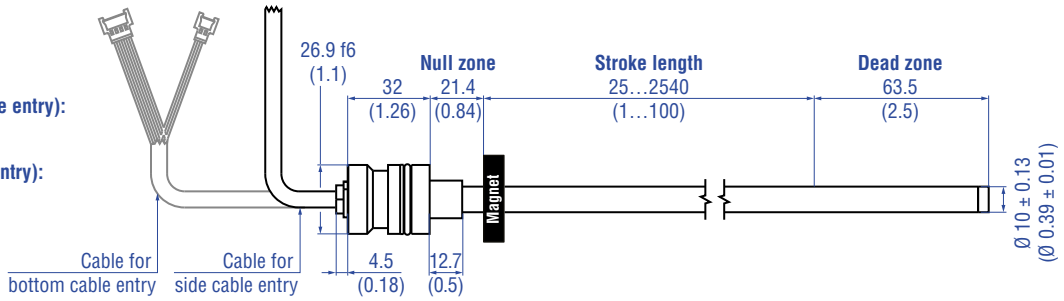
PUR cable:
Ø 6 (Ø 0.24)
Bending radius:
> 24 (> 0.94)
Cable length (bottom cable entry):
65/170/230/350
(2.6/6.7/9.1/13.8)
Cable length (side cable entry):
250/400/600
(9.8/15.7/23.6)



* Stroke length > 5000 mm (196.9 in.)

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

PUR cable:
Ø 6 (Ø 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)



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

Fig. 4: Temposonics® RDV flange types

CONNECTOR WIRING

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

Fig. 5: Connector wiring D58

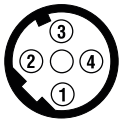
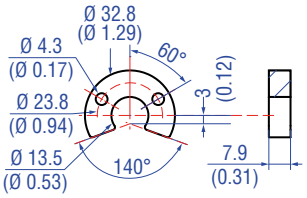
D56		
Port 1 – Signal		
M12 female connector (D-coded)	**Pin**	**Function**
 View on sensor	1	Tx (+)
	2	Rx (+)
	3	Tx (–)
	4	Rx (–)
Port 2 – Signal		
M12 female connector (D-coded)	**Pin**	**Function**
 View on sensor	1	Tx (+)
	2	Rx (+)
	3	Tx (–)
	4	Rx (–)
Power supply		
M8 male connector	**Pin**	**Function**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

Fig. 6: Connector wiring D56

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

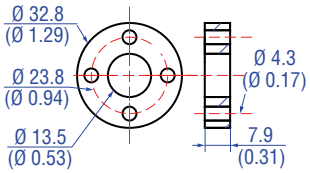
Position magnets



U-magnet OD33
Part no. 251 416-2

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)

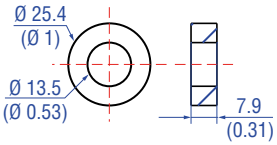
Marked version for sensors with internal linearization: Part no. 254 226



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)

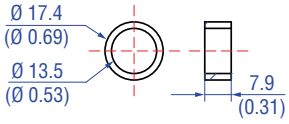
Marked version for sensors with internal linearization: Part no. 253 620



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)

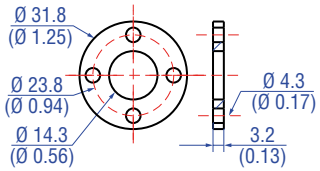
Marked version for sensors with internal linearization: Part no. 253 621



Ring magnet OD17.4
Part no. 401 032

Material: PA neobond
Weight: Approx. 5 g
Surface pressure: Max. 20 N/mm²
Operating temperature:
–40…+105 °C (–40…+221 °F)

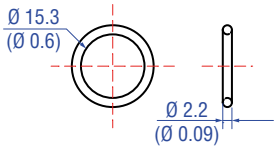
Magnet spacer



Magnet spacer
Part no. 400 633

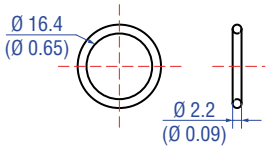
Material: Aluminum
Weight: Approx. 5 g
Surface pressure: Max. 20 N/mm²
Fastening torque for M4 screws: 1 Nm

O-rings



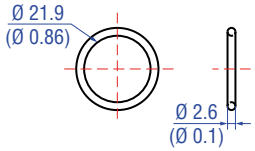
O-ring for threaded flange
M18×1.5-6g
Part no. 401 133

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

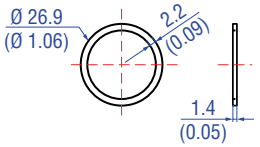
Material: Fluoroelastomer
Durometer: 75 ± 5 Shore A
Operating temperature:
–40…+204 °C (–40…+400 °F)



O-ring for pressure fit flange Ø 26.9 mm
Part no. 560 705

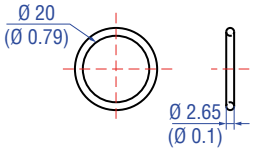
Material: Nitrile rubber
Operating temperature:
–53…+107 °C (–65…+225 °F)

O-rings



Back-up ring for pressure fit flange Ø 26.9 mm
Part no. 560 629

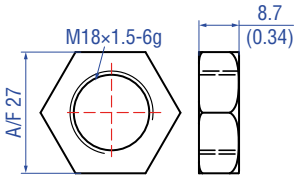
Material: Polymyte
Durometer: 90 Shore A



O-ring for mounting block with bottom entry
Part no. 561 435

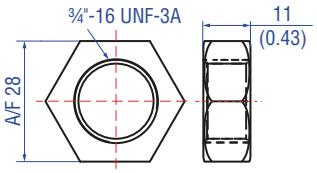
Material: FKM
Durometer: 80± 5 Shore A
Operating temperature:
–15…+200 °C (5…+392 °F)

Mounting accessories



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

Material: Steel, zinc plated

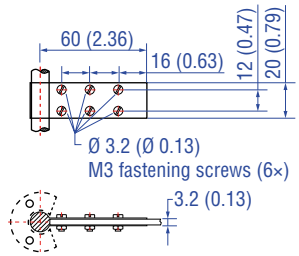


Hex jam nut ¾"-16 UNF-3A
Part no. 500 015

Material: Steel, zinc plated

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

Mounting accessories

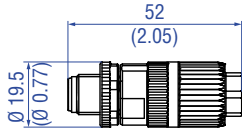


Fixing clip
Part no. 561 481

Application: Used to secure sensor rods (Ø 10 mm (Ø 0.39 in.)) when using an U-magnet or block magnet
Material: Brass, non-magnetic

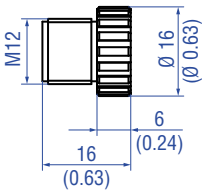
Controlling design dimensions are in millimeters and measurements in ( ) are in inches

Cable connectors* – Signal



M12 D-coded male connector (4 pin), straight
Part no. 370 523

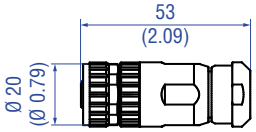
Material: Zinc nickel-plated
Termination: Insulation-displacement
Cable Ø: 5.5…7.2 mm (0.2…0.28 in.)
Wire: 24 AWG – 22 AWG
Operating temperature:
–25…+85 °C (–13…+185 °F)
Ingress protection: IP65 / IP67 (correctly fitted)
Fastening torque: 0.6 Nm



M12 connector end cap
Part no. 370 537

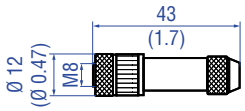
Female connectors M12 should be covered by this protective cap
Material: Brass nickel-plated
Ingress protection: IP67 (correctly fitted)
Fastening torque: 0.39…0.49 Nm

Cable connectors* – Power



M12 A-coded female connector (4 pin/5 pin), straight
Part no. 370 677

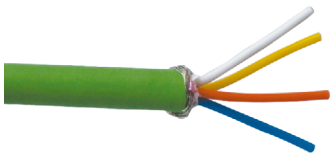
Material: GD-Zn, Ni
Termination: Screw
Contact insert: CuZn
Cable Ø: 4…8 mm (0.16…0.31 in.)
Wire: 1.5 mm²
Operating temperature:
–30…+85 °C (–22…+185 °F)
Ingress protection: IP67 (correctly fitted)
Fastening torque: 0.6 Nm



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

Cables



PUR signal cable
Part no. 530 125

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 × 2 × 0.35 mm² (22 AWG)
Bending radius: 5 × D (fixed installation)
Operating temperature:
–20…+60 °C (–4…+140 °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: 5 × D (fixed installation)
Operating temperature:
–30…+80 °C (–22…+176 °F)

Cable sets

Signal cable with M12 D-coded male connector (4 pin), straight – M12 D-coded, male connector (4 pin), straight
Part no. 530 064

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)

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 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

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.))

Material: PUR jacket; gray
Features: Shielded
Cable Ø: 5 mm (0.2 in.)
Operating temperature:
–40…+90 °C (–40…+194 °F)

Power cable with M12 A-coded female connector (5 pin), straight – pigtail
Part no. 370 673

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)

Programming tools

TempoLink® kit for Temposonics® R-Series V
Part no. TL-1-0-EM08 (D56)
Part no. TL-1-0-EM12 (D58)

- 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

TempoGate® smart assistant for Temposonics® R-Series V
Part no. TG-C-0-D*xx*
(*xx* indicates the number of R-Series V sensors that can be connected (even numbers only))

- 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			b	c	d					e		f			g	h			

a	Design
R D V	Detached sensor electronics “Classic”

b	Design
C	Threaded flange M18×1.5-6g (A/F 46)
D	Threaded flange ¾"-16 UNF-3A (A/F 46)
M	Threaded flange M18×1.5-6g (A/F 24)
S	Pressure fit flange Ø 26.9 mm f6
T	Threaded flange ¾"-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)	Ordering steps
25… 500 mm	5 mm
500… 750 mm	10 mm
750…1000 mm	25 mm
1000…2500 mm	50 mm
2500…5080 mm	100 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.	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.

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.temposonics.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 **E**thernet **P**OWERLINK **S**tandardization **G**roup (EPSG). The R-Series V POWERLINK and its corresponding XDD file are certitified 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 (**X**ML **D**evice **D**escription). 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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Document Part Number:
552138 Revision B (EN) 08/2023

ISO 9001 CERTIFIED

ETHERNET POWERLINK certified product

temposonics.com