

Data Sheet

R-Series V RFV POWERLINK

Magnetostrictive Linear Position Sensors

- Flexible sensor rod
- Stroke length up to 20 m
- Field adjustments and diagnostics using the new TempoLink[®] smart assistant



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.

R-SERIES V RFV POWERLINK

The Temposonics[®] R-Series V brings very powerful sensor performance to meet the many demands of your application. The RFV sensor is the R-Serie V with flexible rod. The main advantages of the flexible rod are:



Straight and curved line

The flexible measuring rod enables position measurement on straight and also curved line.



Compact for transport and storage For transport and storage, the RFV sensor can be coiled up. This saves costs and space.



Installation with little space Due to the bendable rod, the RFV sensor can be installed even if only little space is available.



Large stroke length range

The sensor is available with stroke lengths from 150 mm to 20.000 mm and thus can be used in both short and long distance applications.

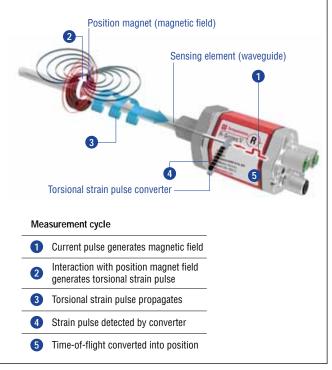


Fig. 1: Time-of-flight based magnetostrictive position sensing principle

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



30 positions simultaneously

The R-Series ∨ 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 sensor 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			
Data transmission rate	100 MBit/s (maximum)			
Measured value	Position, velocity/option: Simultaneous multi-position and multi-velocity measurements up to 30 magnets			
Measurement parameters	ана на			
Resolution: Position	0.5100 μm (selectable)			
Cycle time	Stroke length $ \le 715 \text{ mm}$ $ \le 2000 \text{ mm}$ $ \le 4675 \text{ mm}$ $ \le 10,000 \text{ mm}$ $ \le 20,000 \text{ mm}$			
	Cycle time 500 μs ⁻¹ 1000 μs 2000 μs 4000 μs 8000 μs			
Linearity deviation ²	< ±0.02 % F.S. (minimum ±100 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	IP30 (IP65 rating only for professional mounted guide pipe and if mating connectors are correctly fitted)			
Shock test	100 g/6 ms, IEC standard 60068-2-27			
Vibration test	5 g/102000 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 RFV 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. ³			
Magnet movement velocity	Any			
Design/Material				
Sensor electronics housing	Aluminum (painted), zinc die cast			
Sensor flange	Stainless steel 1.4305 (AISI 303)			
Sensor rod	Stainless steel conduct with PTFE coating			
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	15020,000 mm (6787 in.)			
Mechanical mounting				
Mounting position	Any			
Mounting instruction	Please consult the technical drawings on page 4 and in the operation manual (document number: 552010)			
Electrical connection				
Connection type	2 × M12 female connectors (D-coded), 1 × M8 male connector or 2 × M12 female connectors (D-coded), 1 × M12 male connector (A-coded)			
Operating voltage	+1230 VDC ±20 % (9.636 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			

Minimum cycle time for multi-position measurements (number of magnets ≥ 2): 400 μs
 With position magnet # 251 416-2
 The flexible sensor element must be mounted in an appropriately shielded environment.

TECHNICAL DRAWING

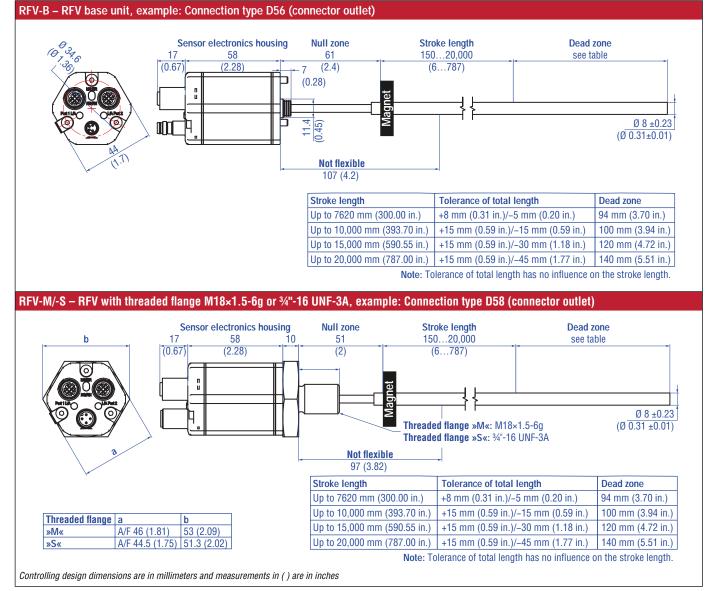


Fig. 2: Temposonics® RFV with ring magnet

CONNECTOR WIRING

D58				
Port 1 – Signal				
M12 female connector (D-coded)	Pin	Function		
	1	Tx (+)		
	2	Rx (+)		
3	3	Tx (-)		
View on sensor	4	Rx (–)		
Port 2 – Signal				
M12 female connector (D-coded)	Pin	Function		
	1	Tx (+)		
	2	Rx (+)		
	3	Tx (-)		
View on sensor	4	Rx (-)		
Power supply				
M12 male connector (A-coded)	Pin	Function		
	1	+1230 VDC (±20 %)		
60	2	Not connected		
	3	DC Ground (0 V)		
View on sensor	4	Not connected		

D56			
Port 1 – Signal			
M12 female connector (D-coded)	Pin	Function	
	1	Tx (+)	
(1)	2	Rx (+)	
3	3	Tx (–)	
View on sensor	4	Rx (-)	
Port 2 – Signal			
M12 female connector (D-coded)	Pin	Function	
	1	Tx (+)	
$2 \bigcirc 4$	2	Rx (+)	
	3	Tx (–)	
View on sensor	4	Rx (-)	
Power supply			
M8 male connector	Pin	Function	
	1	+1230 VDC (±20 %)	
	2	Not connected	
View on sensor	3	DC Ground (0 V)	
	4	Not connected	

Fig. 3: Connector wiring D58

Fig. 4: Connector wiring D56

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

Position magnets Ø 32.8 (Ø 1.29) Ø 4.5 (Ø 0.18) Ø 60 Ø 63.5 Ø 4.3 Ø 30.5 (Ø 2.36) (Ø 2.5) (Ø 0.17) 12 (Ø 1.2) Ø 4.5 Ø 41.3 ė Ġ Ø 23.8 Ø 48 (Ø 0.18) (Ø 1.63) (Ø 1.89) (Ø 0.94) 9.5 Ø 19.8 Ø 30 Ø16 Λ 7.9 15 Ø 13.5 7.6 (0.37) (Ø 0.78) 97° 140 (Ø 0.63) (0.31) (Ø 1.18) (0.59)(Ø 0.53) (0.3) U-magnet OD33 Ring magnet OD60 Ring magnet U-magnet OD63.5 Part no. 251 416-2 Part no. MT0162 Part no. 402 316 Part no. 201 553 Material: PA ferrite GF20 Material: AlCuMgPb, Material: PA ferrite coated Material: PA 66-GF30, Weight: Approx. 13 g Weight: Approx. 11 g magnets compound-filled magnets compound-filled Surface pressure: Max. 40 N/mm² Surface pressure: Max. 20 N/mm² Weight: Approx. 90 g Weight: Approx. 26 g Fastening torque for M4 screws: 1 Nm Surface pressure: Max. 20 N/mm² Operating temperature: Surface pressure: 20 N/mm² -40...+100 °C (-40...+212 °F) Fastening torque for M4 screws: 1 Nm Operating temperature: Fastening torque for M4 screws: 1 Nm -40...+105 °C (-40...+221 °F) Operating temperature: Operating temperature: -40...+75 °C (-40...+167 °F) -40...+75 °C (-40...+167 °F) **O-rings** Mounting accessories 8.7 3/4"-16 UNF-3A 11 M18×1.5-6g (0.34) Ø 15 3 (0.43)Ø 16.4 (Ø 0.6) (Ø 0.65) A/F 28 A/F 27 Ø 2.2 Ø 2.2 (Ø 0.09) (Ø 0.09) O-ring for threaded flange Hex jam nut M18×1.5-6g Hex jam nut 3/4"-16 UNF-3A O-ring for threaded flange M18×1.5-6q 34"-16 UNF-3A Part no. 500 018 Part no. 500 015 Part no. 401 133 Part no. 560 315 Material: Fluoroelastomer Material: Fluoroelastomer Material: Steel, zinc plated Material: Steel, zinc plated Durometer: 75 ± 5 Shore A Durometer: 75 ± 5 Shore A Operating temperature: Operating temperature: -40...+204 °C (-40...+400 °F) -40...+204 °C (-40...+400 °F) Mounting accessories

Threaded flange M18×1.5-6g	Threaded flange ¾"-16 UNF-3A
Part no. 404 874	Part no. 404 875
Material: Stainless steel 1.4305	Material: Stainless steel 1.4305
(AISI 303)	(AISI 303)

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

Mounting accessories

8	8	0
Pressure rod with threaded flange with flat-face (M18×1.5-6g) and O-ring HD [length mm: XXXX] M HD [length in.: XXX.X] U	Pressure rod with threaded flange with flat-face (¾"-16 UNF-3A) and O-ring HL [length mm: XXXX] M HL [length in.: XXX.X] U	Profile with flange HFP [length mm: XXXXX] M HFP [length in.: XXXX.X] U
Pressure rod Ø: 12.7 mm (0.5 in.) Length: 1007500 mm (4295 in.) Operating pressure: 350 bar (5076 psi) Material flange: Stainless steel 1.4305 (AISI 303) Material rod: Stainless steel 1.4301 (AISI 304)	Pressure rod Ø: 12.7 mm (0.5 in.) Length: 1007500 mm (4295 in.) Operating pressure: 350 bar (5076 psi) Material flange: Stainless steel 1.4305 (AISI 303) Material rod: Stainless steel 1.4301 (AISI 304)	Length: Max. 20 000 mm (max. 787 in.) Ingress protection: IP30 Material: Aluminum

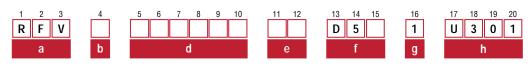
Cable connectors* – Signal		Cable connectors* – Power	
52 (2.05) 5.61 0 (2.05)	$\begin{array}{c} 16 \\ (0.63) \end{array} $	53 (2.09) 07 0 0 0 0 0 0 0	
M12 D-coded male connector (4 pin), straight Part no. 370 523	M12 connector end cap Part no. 370 537	M12 A-coded female connector (4 pin/5 pin), straight Part no. 370 677	M8 female connector (4 pin), straight Part no. 370 504
Material: Zinc nickel-plated Termination: Insulation-displacement Cable Ø: 5.57.2 mm (0.20.28 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	Female connectors M12 should be covered by this protective cap Material: Brass nickel-plated Ingress protection: IP67 (correctly fitted) Fastening torque: 0.390.49 Nm	Material: GD-Zn, Ni Termination: Screw Contact insert: CuZn Cable Ø: 48 mm (0.160.31 in.) Wire: 1.5 mm ² Operating temperature: -30+85 °C (-22+185 °F) Ingress protection: IP67 (correctly fitted) Fastening torque: 0.6 Nm	Material: CuZn nickel plated Termination: Solder Cable Ø: 3.55 mm (0.140.28 in.) Wire: 0.25 mm ² Operating temperature: -40+85 °C (-40+185 °F) Ingress protection: IP67 (correctly fitted) Fastening torque: 0.5 Nm
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: $2 \times 2 \times 0.35$ mm ² (22 AWG) Bending radius: $5 \times D$ (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 × 0.34 mm ² Bending radius: 5 × 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	
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.))	Power cable with M12 A-coded female connector (5 pin), straight – pigtail Part no. 370 673	TempoLink® kit for Temposonics® R-Series V Part no. TL-1-0-EM08 (D56) Part no. TL-1-0-EM12 (D58)	TempoGate® smart assistant for Temposonics® R-Series V Part no. TG-C-0-Dxx (xx indicates the number of R-Serie V sensors that can be connected (even numbers only))
Material: PUR jacket; gray Features: Shielded Cable Ø: 5 mm (0.2 in.) Operating temperature: -40+90 °C (-40+194 °F)	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)	 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.: <u>552070</u>) for further information 	 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



Ordering steps

50 mm

100 mm

250 mm

500 mm

1000 mm

2 in.

4 in.

10 in.

20 in.

40 in.

Ordering steps

a Sensor model R F V Flexible rod

b Design

B Base unit

d Stroke length

Stroke length (mm)

150... 1000 mm

1000... 5000 mm

5000...10000 mm

10000...15000 mm

15000...20000 mm

6... 40 in.

40...197 in.

197...394 in.

394...591 in.

591...787 in.

Stroke length (in.)

- M Threaded flange M18×1.5-6g (standard)
- S Threaded flange ³/₄"-16 UNF-3A (standard)

X X X X X X M 00150...20000 mm

X X X X X U 0006.0...0787.0 in.

1 Standard

System

D

g

Connection type

Section c is intentionally omitted.

	Out		
U	3	0 1	POWERLINK, position and velocity
		·	(130 magnet(s))

5 6 2×M12 female connectors (D-coded),

1 × M12 male connector (A-coded)

 1 × M8 male connector

 D
 5
 8
 2 × M12 female connectors (D-coded).

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.

DELIVERY

RFV-B:

- RFV-M/-S:
- Sensor
- 0-ring
- 3 × socket screws M4×59

· Base unit (without flange

& rod assembly)

Accessories have to be ordered separately.

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))

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.

Μ

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.

Ν

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.

Ρ

POWERLINK

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

Х

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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