

## Data Sheet

# R-Series V RM5 Analog

## Magnetostrictive Linear Position Sensors

- Super shield housing with IP68/IP69 against ingress of dust and water
- Direct analog output, position + speed
- Dual magnet position measurement



**V**  
THE NEW 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.

## R-SERIES V RM5 Analog

The Temposonics® R-Series V brings very powerful sensor performance to meet the many demands of your application. The RM5 sensor is the version of the RH5 rod sensor in a protective housing (super shield housing). The main advantages of the RM5 are:



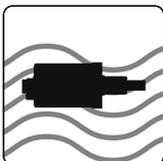
### Protection against corrosion

The housing made of high-quality stainless steel offers very good corrosion resistance. Thus, you can use the R-Series V also in aggressive environments.



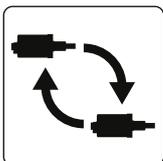
### Protection against ingress of dust

The housing protects the internal sensor against penetration of dust. This maintains the sensor's performance even in heavy dust.



### Protection against ingress of water

The housing protects the internal sensor when submerged. This allows you to use the R-Series V even under water.



### Easy and fast replacement

If necessary, the sensor inside the housing can be replaced easily and fast. This saves time and downtime costs.

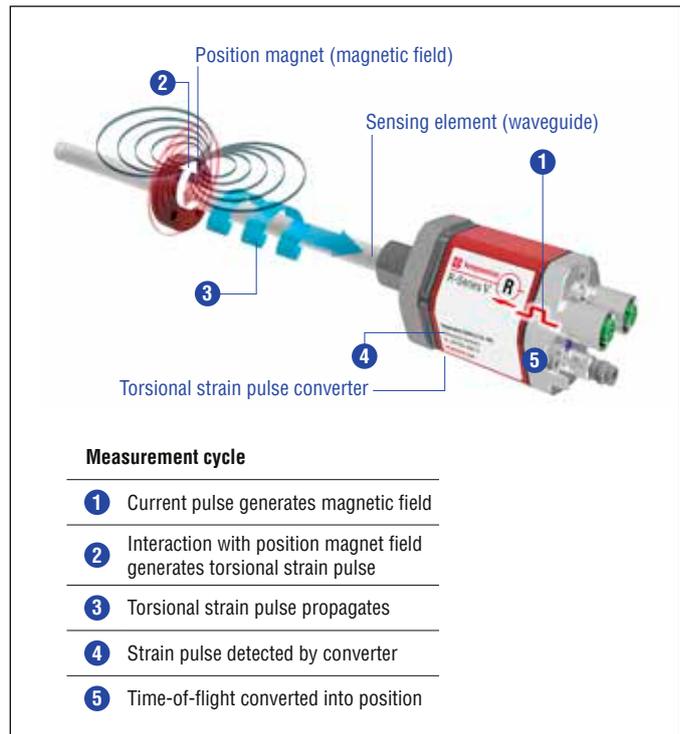
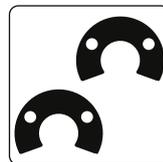


Fig. 1: Time-of-flight based magnetostrictive position sensing principle

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



### 2 positions simultaneously

The R-Series V Analog can detect and report the position of up to 2 magnets simultaneously.



### R-Series V Analog

With the R-Series V Analog you can configure the analog output (current/voltage) that it fits best for your application and also adjust it on site with the sensor assistant.

**All settings under control with the sensor assistant for the R-Series V**  
The TempoLink® smart assistant supports you in setup and diagnostics of the R-Series V. For more information of the assistant please see the data sheet:

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



## TECHNICAL DATA

Output							
Analog	Voltage: 0...10/10...0/-10...+10/+10...-10 VDC (min. controller load > 5 kΩ) Current: 4(0)...20/20...4(0) mA (min./max. load 0/500 Ω)						
Measured output variables	Position for one or two position magnets Position + speed (without direction) or velocity (with direction) for one position magnet Position for one position magnet + temperature inside the sensor electronics housing						
Measurement parameters							
Position measurement							
Null/Span adjustment	100 % of electrical stroke						
Resolution	16 bit (internal resolution 0.1 μm)						
Update time	Stroke length	≤ 200 mm	≤ 350 mm	≤ 1200 mm	≤ 2400 mm	≤ 4800 mm	≤ 7615 mm
	Update time	0.25 ms	0.333 ms	0.5 ms	1.0 ms	2.0 ms	5.0 ms
Linearity deviation <sup>1</sup>	< ±0.01 % F.S. (minimum ±50 μm)						
Repeatability	< ±0.001 % F.S. (minimum ±1 μm)						
Hysteresis	< 4 μm typical						
Temperature coefficient	< 30 ppm/K typical						
Velocity measurement							
Range	0.01...10 m/s or 1...400 in./s						
Deviation	≤ 0.05 %						
Resolution	16 bit (minimum 0.01 mm/s)						
Operating conditions							
Operating temperature	-40...+85 °C (-40...+185 °F)						
Humidity	100 % relative humidity, no condensation						
Ingress protection	IP68 (3 m/180 d)/IP69						
Shock test	100 g/6 ms, IEC standard 60068-2-27						
Vibration test	10 g/10...2000 Hz, IEC 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 RM5 sensors fulfill the requirements of the EMC directives 2014/30/EU, UKSI 2016 No. 1091 and TR CU 020/2011						
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	Stainless steel 1.4404 (AISI 316L)						
Sensor flange	Stainless steel 1.4404 (AISI 316L)						
Sensor rod	Stainless steel 1.4404 (AISI 316L)						
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...7615 mm (1...299.8 in.)						
Mechanical mounting							
Mounting position	Any						
Mounting instruction	Please consult the technical drawings and the operation manual (document number: <a href="#">552063</a> )						
Electrical connection							
Connection type	Cable outlet						
Operating voltage	+12...30 VDC ±20 % (9.6...36 VDC)						
Power consumption	< 3.25 W						
Dielectric strength	500 VDC (DC ground to machine ground)						
Polarity protection	Up to -36 VDC						
Overvoltage protection	Up to 36 VDC						

1/ With position magnet # 251 416-2

## TECHNICAL DRAWING

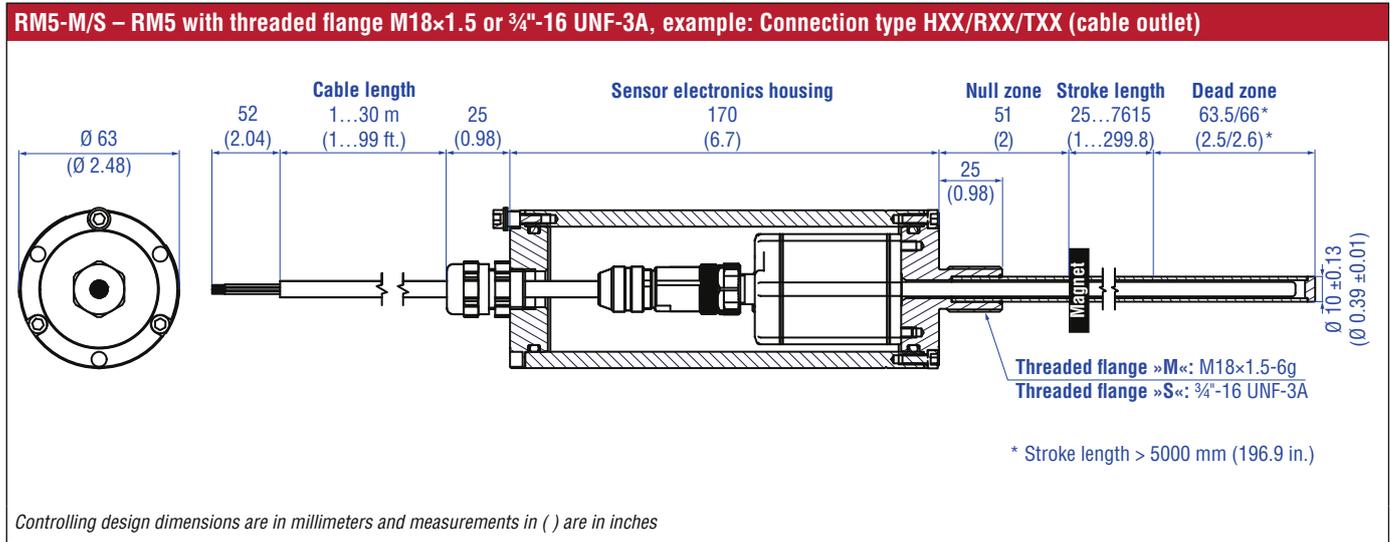


Fig. 2: Temposonics® RM5 with ring magnet

## STRUCTURE

The RM5 Analog consists of (Fig. 3)

- 1 Super shield housing
- 2 R-Series V sensor with connector outlet (connection type D34)
- 3 Cable for direct connection to the controller (connection type HXX/RXX/TXX)

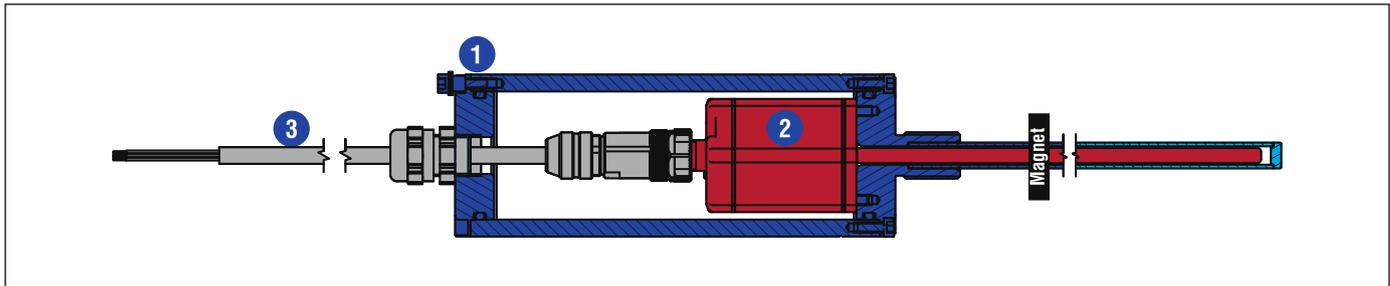


Fig. 3: Structure of RM5 Analog

## CONNECTOR WIRING

HXX/RXX/TXX			
Signal + power supply			
Cable	Output	Color	Function
	1	GY	Position (magnet 1)
		PK	Signal Ground
	2*	YE	Position (magnet 2) or reverse position (magnet 1) or speed or velocity (magnet 1) or temperature inside the sensor electronics housing
		GN	Signal Ground
		BN	+12...30 VDC (±20 %)
		WH	DC Ground (0 V)
For cable type TXX, the extra red & blue wires are not used.			

Fig. 4: Connector wiring HXX/RXX/TXX

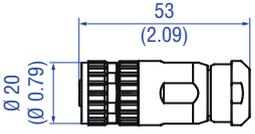
**FREQUENTLY ORDERED ACCESSORIES** – Additional options available in our [Accessories Catalog](#) 551444

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

Position magnet	Magnet spacer	O-rings	
<p><b>Block magnet L</b> Part no. 403 448</p>	<p><b>Magnet spacer</b> Part no. 400 633</p>	<p><b>O-ring for threaded flange</b> M18x1.5-6g Part no. 401 133</p>	<p><b>O-ring for threaded flange</b> ¾"-16 UNF-3A Part no. 560 315</p>
<p>Material: Plastic carrier with hard ferrite magnet Weight: Approx. 20 g Fastening torque for M4 screws: 1 Nm Operating temperature: -40...+75 °C (-40...+167 °F) This magnet may influence the sensor performance specifications for some applications.</p>	<p>Material: Aluminum Weight: Approx. 5 g Surface pressure: Max. 20 N/mm<sup>2</sup> 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>

Mounting accessories		
<p><b>Hex jam nut M18x1.5-6g</b> Part no. 500 018</p>	<p><b>Hex jam nut ¾"-16 UNF-3A</b> Part no. 500 015</p>	<p><b>Fixing clip</b> Part no. 561 481</p>
<p>Material: Steel, zinc plated</p>	<p>Material: Steel, zinc plated</p>	<p>Application: Used to secure sensor rods (Ø 10 mm (Ø 0.39 in.)) when using an U-magnet or block magnet Material: Brass, non-magnetic</p>

**Cable connector\***                      **Cables**

			
<p><b>M12 A-coded female connector (4 pin/5 pin), straight</b> <b>Part no. 370 677</b></p> <p>Material: GD-Zn, Ni Termination: Screw Contact insert: CuZn Cable Ø: 4...8 mm (0.16...0.31 in.) Wire: 1.5 mm<sup>2</sup> Operating temperature: -30...+85 °C (-22...+185 °F) Ingress protection: IP67 (correctly fitted) Fastening torque: 0.6 Nm</p>	<p><b>PVC cable</b> <b>Part no. 530 032</b></p> <p>Material: PVC jacket; gray Features: Twisted pair, shielded, flexible Cable Ø: 6 mm (0.23 in.) Cross section: 3 × 2 × 0.14 mm<sup>2</sup> Bending radius: 10 × D (fixed installation) Operating temperature: -40...+105 °C (-40...+221 °F)</p>	<p><b>PUR cable</b> <b>Part no. 530 052</b></p> <p>Material: PUR jacket; orange Features: Twisted pair, shielded, highly flexible, halogen free, suitable for drag chains, mostly oil &amp; flame resistant Cable Ø: 6.4 mm (0.25 in.) Cross section: 3 × 2 × 0.25 mm<sup>2</sup> Bending radius: 5 × D (fixed installation) Operating temperature: -30...+80 °C (-22...+176 °F)</p>	<p><b>FEP cable</b> <b>Part no. 530 112</b></p> <p>Material: FEP jacket; black Features: Twisted pair, shielded, flexible, high thermal resistance, mostly oil &amp; acid resistant Cable Ø: 7.6 mm (0.3 in.) Cross section: 4 × 2 × 0.25 mm<sup>2</sup> Bending radius: 8 – 10 × D (fixed installation) Operating temperature: -100...+180 °C (-148...+356 °F)</p>

**Cable sets**                                      **Programming tools**

			
<p><b>Cable with M12 A-coded female connector (5 pin), straight – pigtail</b> <b>Part no. 370 673</b></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><b>Hand programmer for analog output</b> <b>Part no. 253 124</b></p> <p>Easy teach-in-setups of stroke length and direction on desired zero / span positions. For sensors with 1 magnet.</p>	<p><b>Cabinet programmer for analog output</b> <b>Part no. 253 408</b></p> <p>Features snap-in mounting on standard DIN rail (35 mm). This programmer can be permanently mounted in a control cabinet and includes a program/run switch. For sensors with 1 magnet.</p>	<p><b>TempoLink® kit for Temposonics® R-Series V</b> <b>Part no. TL-1-0-AD60 (for D60)</b> <b>Part no. TL-1-0-AS00 (for cable outlet)</b> <b>Part no. TL-1-0-AD34 (for D34)</b></p> <ul style="list-style-type: none"> <li>• Connect wirelessly via Wi-Fi enabled device or via USB with the diagnostic tool</li> <li>• Simple connectivity to the sensor via 24 VDC power line (permissible cable length: 30 m)</li> <li>• User friendly interface for mobile devices and desktop computers</li> <li>• See data sheet "TempoLink® smart assistant" (document part no.: <a href="#">552070</a>) for further information</li> </ul>

\*/ Follow the manufacturer's mounting instructions  
Color of connectors and cable jacket may change. Colors of the cores and technical properties remain unchanged.  
Controlling design dimensions are in millimeters and measurements in ( ) are in inches

Extension cables



**PVC cable with M12 female connector (6 pin), straight – pigtail**

PVC cable (part no. 530 032) with M12 female connector, straight (part no. 370 677)

Order code:  
**K2-A-370677-xxxxyy-530032-0**  
(where xxxx = cable length and yy = unit in centimeters “CM” or feet “FT”)



**PUR cable with M12 female connector (6 pin), straight – pigtail**

PUR cable (part no. 530 052) with M12 female connector, straight (part no. 370 677)

Order code:  
**K2-A-370677-xxxxyy-530052-0**  
(where xxxx = cable length and yy = unit in centimeters “CM” or feet “FT”)



**FEP cable with M12 female connector (6 pin), straight – pigtail**

FEP cable (part no. 530 112) with M12 female connector, straight (part no. 370 677)

Order code:  
**K2-A-370677-xxxxyy-530112-0**  
(where xxxx = cable length and yy = unit in centimeters “CM” or feet “FT”)

*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	21	22	23	
R	M	5		A											1								
a			b	c	d					e	f			g	h	i	j	k	l				

optional

a	Sensor model
R M 5	Super shield housing

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

c	Mechanical options
A	Standard

d	Stroke length
X X X X M	0025...7615 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... 7615 mm	250 mm

X X X X U	001.0...299.8 in.
-----------	-------------------

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... 299.8 in.	10.0 in.

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

e	Number of magnets
0 X	01...02 Position(s) (1...2 magnet(s))

f	Connection type
H X X	XX m PUR cable (part no. 530 052) H01...H30 (1...30 m/3...99 ft.) (Note the temperature range of the cable!) See "Frequently ordered accessories" for cable specifications
R X X	XX m PVC cable (part no. 530 032) R01...R30 (1...30 m/3...99 ft.) See "Frequently ordered accessories" for cable specifications
T X X	XX m FEP cable (part no. 530 112) T01...T30 (1...30 m/3...99 ft.) See "Frequently ordered accessories" for cable specifications

Encode in meters if using metric stroke length.  
Encode in feet if using US customary stroke length.

g	System
1	Standard

h	Output
A	Current
V	Voltage

i	Function
1	Position (1 or 2 magnets/outputs)
2	Position and speed (1 magnet and 2 outputs) Specify the maximum speed value in section <b>I</b>
3	Position and velocity (1 magnet and 2 outputs) Specify the maximum velocity value in section <b>I</b>
4	Position and reverse position (1 magnet and 2 outputs)
5	Position and temperature inside the sensor electronics housing (1 magnet and 2 outputs)
6	Differential (2 magnets and 1 output)

j	Options
0	Standard
3	Over range output mode

**Temposonics® R-Series V RM5 Analog**  
Data Sheet

k	Output range
0	0...10 VDC or 4...20 mA
1	10...0 VDC or 20...4 mA
2	-10...+10 VDC or 0...20 mA
3	+10...-10 VDC or 20...0 mA
V	0...10 VDC for position, -10...+10 VDC for velocity

l	Max. speed or velocity value
<b>(optional: use when i "Function" is 2 or 3)</b>	
<input type="checkbox"/>	For metric stroke lengths encode speed or velocity in m/s for the values 0.01 to 9.99 m/s (001...999)
<input type="checkbox"/>	For US customary stroke lengths encode speed or velocity in inches/s for the values 1 to 400 in./s (001...400)
To get a speed or velocity output of 0.025 m/s or 10 m/s for the R-Series V Analog, enter code (00E) for 0.025 m/s or (A00) for 10.0 m/s in the order code.	

**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 differential/multi-position measurement.

**DELIVERY**

- |   |   |
|---|---|
|  <ul style="list-style-type: none"> <li>• Sensor</li> <li>• O-ring</li> </ul> | <p>Accessories have to be ordered separately.</p> |
|---|---|

**Manuals, Software & 3D Models available at:**  
[www.temposonics.com](http://www.temposonics.com)

## GLOSSARY

### A

#### Analog output

For a sensor with analog output, the measured value is output as an analog voltage signal or current signal.

### D

#### Differential

For differential measurement, the distance between the two position magnets is output as a value.  
(→ multi-position measurement)

### M

#### Max. speed or velocity value

For speed or velocity, the output value generated is scaled based on the maximum speed or velocity value indicated in the order code.

#### Measuring direction

- Forward: Values increasing from sensor electronics housing to rod end/profile end
- Reverse: Values decreasing from sensor electronics housing to rod end/profile end

#### Multi-position measurement

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

### O

#### Over range output mode

When enabled this mode allows the position output values to continue to increase or decrease when the magnet travels beyond the active stroke range.

### R

#### Resolution

The sensor precisely measures time to provide the position measurement. For the analog output the measured time value is converted into an analog voltage signal or current signal using a high-performance **D**igital to **A**nalog **C**onverter (DAC) having 16 bits of resolution.

### S

#### Speed

The output value for speed indicates how fast the position magnet is being moved, independent of the measuring direction. (→ Velocity)

### T

#### Temperature inside the sensor electronics housing

The temperature inside the sensor electronics housing is reported as an analog voltage signal or current signal. For each output range, the 0 % output value has the factory default setpoint at -40 °C, and the 100 % output value has the default setpoint at +100 °C.

Note: A dedicated temperature chip is used for the output signal and its values may vary from those reported on the TempoLink® application screen.

### V

#### Velocity

The output value for velocity indicates how fast the position magnet is being moved, and in which direction. (→ Speed)

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