

## Data Sheet

# R-Series V RP5 EtherNet/IP™

## Magnetostrictive Linear Position Sensors

- EtherNet/IP™ with CIP Sync and DLR
- Position + velocity measurements for up to 20 magnets
- Field adjustments and diagnostics using the new TempoLink® smart assistant



**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 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 end 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.

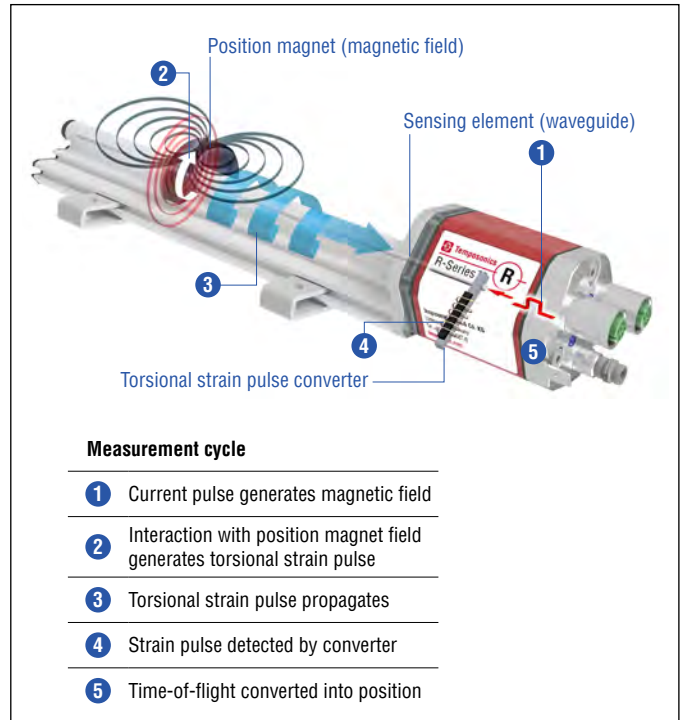


Fig. 1: Time-of-flight based magnetostrictive position sensing principle

## R-SERIES V ETHERNET/IP™

Temposonics® R-Series V brings very powerful sensor performance to meet the many demands of your application. This series is the long term solution for harsh environments that have high levels of shock and vibration. The EtherNet/IP™ sensor supports CIP Sync™ (Common Industrial Protocol) and DLR (Device Level Ring) capabilities. CIP Sync™ offers synchronization between devices in an EtherNet/IP™ network, allowing for increased control coordination in time-critical applications. DLR capability provides a fault-tolerant network so that the sensor can be used in ring connection topologies when reliable continuous system operation is required. In addition, the sensors are available with internal linearization which offers improved linearity for overall higher accuracy of the position measurement values.

With many outstanding features the R-Series V sensors are fit for a very broad range of applications.

## TempoLink® SMART ASSISTANT

The TempoLink® smart assistant is an accessory for the R-Series V family of sensors that supports setup and diagnostics. Depending on the sensor protocol it enables the adjustment of parameters like measurement direction, resolution and filter settings. For diagnostics and analysis of operational data the R-Series V sensors continuously track values such as total distance traveled by the position magnet, internal temperature of the sensor and the quality of the position signal. This additional information can be read out via TempoLink® smart assistant even while the sensor remains operational in the application. TempoLink® smart assistant is connected to the sensor via the power connection, which now adds bidirectional communication for setup and diagnostics. The TempoLink® smart assistant is operated using a graphical user-interface that will be displayed on your smartphone, tablet, laptop or PC. Just connect your Wi-Fi-enabled device to TempoLink® Wi-Fi access point and go to the website URL for the user-interface.



Fig. 2: R-Series V sensor with TempoLink smart assistant

## TECHNICAL DATA

| Output                           |  |           |               |           |
|----------------------------------|--|-----------|---------------|-----------|
| Interface                        | EtherNet/IP™   |           |               |           |
| Data protocol                    | Encoder CIP device profile with CIP Sync and DLR capabilities  |           |               |           |
| Data transmission rate           | 100 MBit/s (maximum)   |           |               |           |
| Measured value                   | Position, velocity / option: Simultaneous multi-position and multi-velocity measurements up to 20 magnets                              |           |               |           |
| Measurement parameters           |  |           |               |           |
| Resolution: Position             | 1...500 µm (selectable)  |           |               |           |
| Cycle time                       | Stroke length  | ≤ 2000 mm | ≤ 4800 mm     | ≤ 6350 mm |
|                                  | Cycle time   | 1.0 ms    | 2.0 ms        | 3.0 ms    |
| Linearity deviation <sup>1</sup> | Stroke length  | ≤ 500 mm  | > 500 mm      |           |
|                                  | Linearity deviation  | ≤ ±50 µm  | < 0.01 % F.S. |           |
| 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               | IP65 (connectors correctly fitted)   |           |               |           |
| Shock test                       | 150 g / 11 ms, IEC standard 60068-2-27   |           |               |           |
| Vibration test                   | 30 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 sensor meets the requirements of the EC directives and is marked with <b>CE</b>  |           |               |           |
| Magnet movement velocity         | Magnet slider: Max. 10 m/s; U-magnet: Any; block magnet: Any   |           |               |           |
| Design / Material                |  |           |               |           |
| Sensor electronics housing       | Aluminum (painted), zinc die cast  |           |               |           |
| Sensor profile                   | Aluminum   |           |               |           |
| Stroke length                    | 25...6350 mm (1...250 in.)   |           |               |           |
| Mechanical mounting              |  |           |               |           |
| Mounting position                | Any  |           |               |           |
| Mounting instruction             | Please consult the technical drawings on <a href="#">page 4</a> and the operation manual (document number: <a href="#">551971</a> )    |           |               |           |
| Electrical connection            |  |           |               |           |
| Connection type                  | 2 × M12 female connectors (5 pin), 1 × M8 male connector (4 pin),<br>2 × M12 female connectors (5 pin), 1 × M12 male connector (4 pin) |           |               |           |
| Operating voltage                | 12...30 VDC ±20 % (9.6...36 VDC) <sup>2</sup>  |           |               |           |
| 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/ With position magnet # 252 182

2/ Power supply must be able to provide current of 1 A for power up process

## TECHNICAL DRAWING

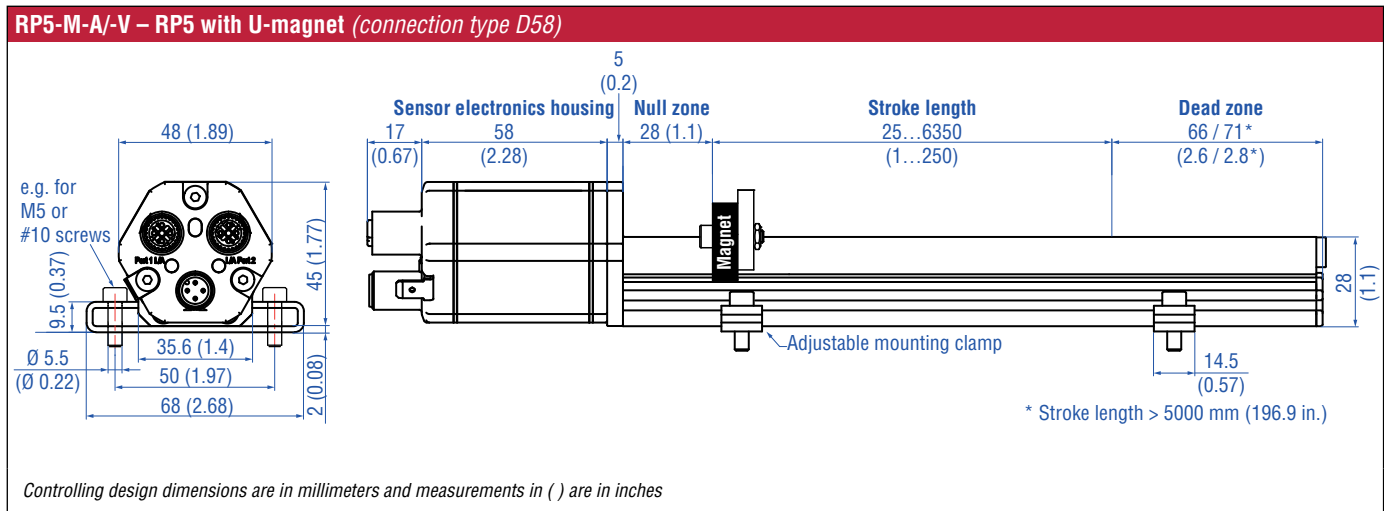


Fig. 3: Temposonics® RP5 with U-magnet


## CONNECTOR WIRING

| D56                                     |     |                     |
|---|-----|---------------------|
| Ports                                   |     |                     |
| Port 1 – M12 female connector (D-coded) | Pin | Function            |
| <p>View on sensor</p>                   | 1   | Tx (+)              |
|   | 2   | Rx (+)              |
|   | 3   | Tx (-)              |
|   | 4   | Rx (-)              |
|   | 5   | Not connected       |
| Port 2 – M12 female connector (D-coded) | Pin | Function            |
| <p>View on sensor</p>                   | 1   | Tx (+)              |
|   | 2   | Rx (+)              |
|   | 3   | Tx (-)              |
|   | 4   | Rx (-)              |
|   | 5   | Not connected       |
| Power supply                            |     |                     |
| M8 male connector                       | Pin | Function            |
| <p>View on sensor</p>                   | 1   | 12...30 VDC (±20 %) |
|   | 2   | Not connected       |
|   | 3   | DC Ground (0 V)     |
|   | 4   | Not connected       |

Fig. 4: Connector wiring D56

| D58                                     |     |                     |
|---|-----|---------------------|
| Signal                                  |     |                     |
| Port 1 – M12 female connector (D-coded) | Pin | Function            |
| <p>View on sensor</p>                   | 1   | Tx (+)              |
|   | 2   | Rx (+)              |
|   | 3   | Tx (-)              |
|   | 4   | Rx (-)              |
|   | 5   | Not connected       |
| Port 2 – M12 female connector (D-coded) | Pin | Function            |
| <p>View on sensor</p>                   | 1   | Tx (+)              |
|   | 2   | Rx (+)              |
|   | 3   | Tx (-)              |
|   | 4   | Rx (-)              |
|   | 5   | Not connected       |
| Power supply                            |     |                     |
| M12 male connector (A-coded)            | Pin | Function            |
| <p>View on sensor</p>                   | 1   | 12...30 VDC (±20 %) |
|   | 2   | Not connected       |
|   | 3   | DC Ground (0 V)     |
|   | 4   | Not connected       |

Fig. 5: Connector wiring D58

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

| Position magnets   |  |  |  |
|--|--|--|--|
|  |  |  |  |
| <p><b>Magnet slider S, joint at top</b><br/>Part no. 252 182</p>   | <p><b>Magnet slider V, joint at front</b><br/>Part no. 252 184</p>   | <p><b>Magnet slider N, longer ball-joint arm</b><br/>Part no. 252 183</p>  | <p><b>Magnet slider G, backlash free</b><br/>Part no. 253 421</p>  |
| <p>Material: GRP, magnet hard ferrite<br/>Weight: Approx. 35 g<br/>Operating temperature:<br/>-40...+75 °C (-40...+167 °F)</p> | <p>Material: GRP, magnet hard ferrite<br/>Weight: Approx. 35 g<br/>Operating temperature:<br/>-40...+75 °C (-40...+167 °F)</p> | <p>Material: GRP, magnet hard ferrite<br/>Weight: Approx. 35 g<br/>Operating temperature:<br/>-40...+75 °C (-40...+167 °F)</p> | <p>Material: GRP, magnet hard ferrite<br/>Weight: Approx. 25 g<br/>Operating temperature:<br/>-40...+75 °C (-40...+167 °F)</p> |





| Position magnets   |   | Mounting accessories                              |  |
|--|---|---|--|
|  |   |   |  |
| <p><b>U-magnet OD33</b><br/>Part no. 251 416-2</p>   | <p><b>Block magnet L</b><br/>Part no. 403 448</p>   | <p><b>Mounting clamp</b><br/>Part no. 400 802</p> | <p><b>T-nut</b><br/>Part no. 401 602</p>     |
| <p>Material: PA ferrite GF20<br/>Weight: Approx. 11 g<br/>Surface pressure: Max. 40 N/mm<sup>2</sup><br/>Fastening torque for M4 screws: 1 Nm<br/>Operating temperature:<br/>-40...+105 °C (-40...+221 °F)</p> | <p>Material: Hard ferrite<br/>Weight: Approx. 20 g<br/>Fastening torque for M4 screws: 1 Nm<br/>Operating temperature:<br/>-40...+75 °C (-40...+167 °F)</p> <p>This magnet may influence the sensor performance specifications for some applications.</p> | <p>Material: Stainless steel (AISI 304)</p>       | <p>Fastening torque for M5 screw: 4.5 Nm</p> |

| Cable connectors <sup>3</sup>   |  |  |  |
|---|--|--|--|
|   |  |  |  |
| <p><b>M12 D-coded male connector (4 pin), straight</b><br/>Part no. 370 523</p>   | <p><b>M12 A-coded female connector (5 pin), straight</b><br/>Part no. 370 677</p>  | <p><b>M8 female connector (4 pin), straight</b><br/>Part no. 370 504</p>   | <p><b>M12 connector end cap</b><br/>Part no. 370 537</p>   |
| <p>Material: Zinc nickel-plated<br/>Termination: Insulation-displacement<br/>Cable Ø: 5.5...7.2 mm (0.2...0.28 in.)<br/>Wire: 24 AWG – 22 AWG<br/>Operating temperature:<br/>-25...+85 °C (-13...+185 °F)<br/>Ingress protection: IP65 / IP67 (correctly fitted)<br/>Fastening torque: 0.6 Nm</p> | <p>Material: GD-Zn, Ni<br/>Termination: Screw<br/>Contact insert: CuZn<br/>Cable Ø: 4...8 mm (0.16...0.31 in.)<br/>Wire: 1.5 mm<sup>2</sup><br/>Operating temperature:<br/>-30...+85 °C (-22...+185 °F)<br/>Ingress protection: IP67 (correctly fitted)<br/>Fastening torque: 0.6 Nm</p> | <p>Material: CuZn nickel plated<br/>Termination: Solder<br/>Cable Ø: 3.5...5 mm (0.14...0.28 in.)<br/>Wire: 0.25 mm<sup>2</sup><br/>Operating temperature:<br/>-40...+85 °C (-40...+185 °F)<br/>Ingress protection: IP67 (correctly fitted)<br/>Fastening torque: 0.5 Nm</p> | <p>Female connectors M12 should be covered by this protective cap<br/>Material: Brass nickel-plated<br/>Ingress protection: IP67 (correctly fitted)<br/>Fastening torque: 0.39...0.49 Nm</p> |

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



3/ Follow the manufacturer's mounting instructions

**Cables**

|   |  |  |   |
|---|--|--|---|
|   |   |    |    |
| <p><b>PUR cable</b><br/>Part no. 530 125</p>  | <p><b>PVC cable</b><br/>Part no. 530 108</p>   | <p><b>Cable with M12 D-coded male connector (4 pin), straight – M12 D-coded, male connector (4 pin), straight</b><br/>Part no. 530 064</p>   | <p><b>Cable with M12 D-coded male connector (4 pin), straight – RJ45 male connector, straight</b><br/>Part no. 530 065</p>  |
| <p>Material: PUR jacket; green<br/>Features: Cat 5, highly flexible<br/>Cable Ø: 6.5 mm (0.26 in.)<br/>Cross section: 2 × 2 × 0.35 mm<sup>2</sup> (22/7 AWG)<br/>Operating temperature: -20...+60 °C (-4...+140 °F)</p> | <p>Material: PVC jacket; gray<br/>Features: Shielded, flexible<br/>Cable Ø: 4.9 mm (0.19 in.)<br/>Cross section: 3 × 0.34 mm<sup>2</sup><br/>Operating temperature: -30...+80 °C (-22...+176 °F)</p> | <p>Material: PUR jacket; green<br/>Features: Cat 5e<br/>Cable length: 5 m (16.4 ft)<br/>Cable Ø: 6.5 mm (0.26 in.)<br/>Ingress protection: IP65, IP67, IP68 (correctly fitted)<br/>Operating temperature: -30...+70 °C (-22...+158 °F)</p> | <p>Material: PUR jacket; green<br/>Features: Cat 5e<br/>Cable length: 5 m (16.4 ft)<br/>Cable Ø: 6.5 mm (0.26 in.)<br/>Ingress protection M12 connector: IP67 (correctly fitted)<br/>Ingress protection RJ45 connector: IP20 (correctly fitted)<br/>Operating temperature: -30...+70 °C (-22...+158 °F)</p> |

**Cable**

**Programming kit**

|  |   |
|--|---|
|    |    |
| <p><b>Cable with M8 female connector (4 pin), straight – pigtail</b><br/>Part no. 530 066 (5 m (16.4 ft.))<br/>Part no. 530 096 (10 m (32.8 ft.))<br/>Part no. 530 093 (15 m (49.2 ft.))</p> | <p><b>TempoLink® kit for Temposonics® R-Series V</b><br/>Part no. TL-1-0-EM08 (D56) Part no. TL-1-0-EM12 (D58)</p>  |
| <p>Material: PUR jacket; gray<br/>Features: Shielded<br/>Cable Ø: 8 mm (0.3 in.)<br/>Operating temperature: -40...+90 °C (-40...+194 °F)</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</li> <li>• User friendly interface for mobile devices and desktop computers</li> <li>• See product brief “TempoLink smart assistant” (document part no.: 551976) for further information</li> </ul> |

## ORDER CODE

|   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |
|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| R | P | 5 |   |   |   |   |   |   |    |    |    | D  | 5  |    | 1  | U  | 2  |    |    |
| a |   |   | b | c | d |   |   |   |    | e  |    | f  |    |    | g  | h  |    |    |    |

|          |                     |   |         |
|----------|---------------------|---|---------|
| <b>a</b> | <b>Sensor model</b> |   |         |
| R        | P                   | 5 | Profile |

|          |   |
|----------|---|
| <b>b</b> | <b>Design</b>   |
| G        | Magnet slider, backlash free (part no. 253 421)           |
| L        | Block magnet L (part no. 403 448)                         |
| M        | U-magnet, OD33 (part no. 251 416-2)                       |
| N        | Magnet slider, longer ball-jointed arm (part no. 252 183) |
| O        | No position magnet  |
| S        | Magnet slider, joint at top (part no. 252 182)            |
| V        | Magnet slider, joint at front (part no. 252 184)          |

|          |  |
|----------|--|
| <b>c</b> | <b>Mechanical options</b>                        |
| A        | Standard   |
| V        | Fluorelastomer seals for the electronics housing |

|                                      |                      |                       |   |   |                   |
|--------------------------------------|----------------------|-----------------------|---|---|-------------------|
| <b>d</b>                             | <b>Stroke length</b> |                       |   |   |                   |
| X                                    | X                    | X                     | X | M | 0025...6350 mm    |
| <b>Standard stroke length (mm)*</b>  |                      | <b>Ordering steps</b> |   |   |                   |
| 25 ... 500 mm                        |                      | 25 mm                 |   |   |                   |
| 500...2500 mm                        |                      | 50 mm                 |   |   |                   |
| 2500...5000 mm                       |                      | 100 mm                |   |   |                   |
| 5000...6350 mm                       |                      | 250 mm                |   |   |                   |
| X                                    | X                    | X                     | X | U | 001.0...250.0 in. |
| <b>Standard stroke length (in.)*</b> |                      | <b>Ordering steps</b> |   |   |                   |
| 1 ... 20 in.                         |                      | 1 in.                 |   |   |                   |
| 20...100 in.                         |                      | 2 in.                 |   |   |                   |
| 100...200 in.                        |                      | 4 in.                 |   |   |                   |
| 200...250 in.                        |                      | 10 in.                |   |   |                   |

|          |                          |  |
|----------|--------------------------|--|
| <b>e</b> | <b>Number of magnets</b> |  |
| X        | X                        | 01...20 Position(s) (1...20 magnet(s)) |

|          |                        |   |  |
|----------|------------------------|---|--|
| <b>f</b> | <b>Connection type</b> |   |  |
| D        | 5                      | 6 | 2 × M12 female connectors (5 pin),<br>1 × M8 male connector (4 pin)  |
| D        | 5                      | 8 | 2 × M12 female connectors (5 pin),<br>1 × M12 male connector (4 pin) |

|          |               |
|----------|---------------|
| <b>g</b> | <b>System</b> |
| 1        | Standard      |

|          |               |   |   |   |
|----------|---------------|---|---|---|
| <b>h</b> | <b>Output</b> |   |   |   |
| U        | 2             | 0 | 1 | EtherNet/IP™, position and velocity<br>(1...20 positions)                         |
| U        | 2             | 1 | 1 | EtherNet/IP™, position and velocity,<br>internal linearization (1...20 positions) |

### NOTICE

- For applications using more than 1 magnet, order the additional 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, e.g. 2 × U-magnets (part no. 251 416-2).

## DELIVERY



- Sensor
  - Position magnet (not valid for RP5 with design "O")
  - 2 mounting clamps up to 1250 mm (50 in.) stroke length  
+ 1 mounting clamp for each 500 mm (20 in.) additional stroke length
- Accessories have to be ordered separately.

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

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



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**Document Part Number:**  
551963 Revision B (EN) 05/2018



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