R-Series – RP CANbus
Magnetostrictive Linear Position Sensors

- For mounting on machines
- Rugged industrial sensor
- Diagnostics LEDs
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 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.

RP SENSOR CANbus

Robust, non-contact and wear free, the Temposonics linear position sensors provide best durability and accurate position measurement solutions in harsh industrial environments. The position measurement accuracy is tightly controlled by the quality of the waveguide which is manufactured by Temposonics. The position magnet is mounted on the moving machine part and travels contactlessly over the sensing element with the built-in waveguide.

Temposonics® RP is a high-performance sensor for external mounting. The position magnet, mounted to the movable machine part, can either be an U-magnet or a captive-sliding magnet. The free magnets travel along the sensor profile with a defined distance. This kind of installation tolerates a lateral offset as well as a height offset. Therefore the robust sensor is very versatile. A superior performance for instance in plastic and rubber as well as in paper and wood processing industry is guaranteed.

Temposonics position sensors fulfill - as slave devices - all requirements of the CAN-Bus (ISO 11898). The sensors electronics convert the position measurements into bus oriented outputs and transfer these data directly to the control unit. The bus interface is appropriate for serial data transfer of 1 Mbit/s maximum. Sensor integrated software supports the profiles CANopen and CANbasic for a comprehensive customized configuration of the sensor-bus system.
## TECHNICAL DATA

### Output
- **Interface**: CAN fieldbus system according to ISO 11898
- **Data protocol**: CANopen: CIA standard DS301 V3.0/Encoder profile DS 406 V3.1; CANbasic: CAN 2.0 A
- **Baud rate**: | Transfer rate | 1000 kBit/s | 800 kBit/s | 500 kBit/s | 250 kBit/s | 125 kBit/s | 50 kBit/s | 20 kBit/s |
<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Cable length</td>
<td>&lt; 25 m</td>
<td>&lt; 50 m</td>
<td>&lt; 100 m</td>
<td>&lt; 250 m</td>
<td>&lt; 500 m</td>
<td>&lt; 1000 m</td>
<td>&lt; 2500 m</td>
</tr>
</tbody>
</table>

### Measurement parameters

#### Resolution

<table>
<thead>
<tr>
<th>Protocol</th>
<th>CANopen</th>
<th>CANbasic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Position</td>
<td>5 µm</td>
<td>2 µm</td>
</tr>
<tr>
<td>Velocity</td>
<td>0.5 mm/s</td>
<td>0.2 mm/s</td>
</tr>
</tbody>
</table>

#### Cycle time

<table>
<thead>
<tr>
<th>Stroke length</th>
<th>&lt; 2400 mm</th>
<th>&lt; 4800 mm</th>
<th>&lt; 5080 mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cycle time</td>
<td>1.0 ms</td>
<td>2.0 ms</td>
<td>4.0 ms</td>
</tr>
</tbody>
</table>

0.5 ms to 1200 mm additional for CANbasic

#### Linearity deviation

- < ±0.01 % F.S. (minimum ±40 µm)
- Option internal linearization (Applies for the first magnet for multi-position measurement)

<table>
<thead>
<tr>
<th>Stroke length</th>
<th>&lt; 300 mm</th>
<th>&lt; 600 mm</th>
<th>&lt; 1200 mm</th>
<th>&lt; 3000 mm</th>
<th>&lt; 5080 mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tolerance</td>
<td>max. ±25 µm</td>
<td>max. ±50 µm</td>
<td>max. ±90 µm</td>
<td>max. ±150 µm</td>
<td></td>
</tr>
</tbody>
</table>

#### 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...+75 °C (-40...+167 °F)
- **Humidity**: 90 % relative humidity, no condensation
- **Ingress protection**: IP65 (connectors correctly fitted)
- **Shock test**: 100 g (single shock), IEC standard 60068-2-27
- **Vibration test**: 15 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 ☐ ☐

### Design / Material

- **Sensor electronics housing**: Aluminum (painted), zinc die cast
- **Sensor profile**: Aluminum
- **Stroke length**: 25...5080 mm (1...200 in.)

### Mechanical mounting

- **Mounting position**: Any
- **Mounting instruction**: Please consult the technical drawings on page 4

### Electrical connection

- **Connection type**: 1 × M12 female connector (5 pin), 1 × M12 male connector (5 pin), 1 × M12 male connector (4 pin) or 1 × M16 female connector (6 pin) or 2 × M16 female connectors (6 pin) or cable outlet
- **Operating voltage**: +24 VDC (−15/+20 %); UL recognition requires an approved power supply with energy limitation (UL 61010-1), or Class 2 rating according to the National Electrical Code (USA)/Canadian Electrical Code.
- **Power consumption**: 90 mA typical
- **Dielectric strength**: 500 VDC (DC ground to machine ground)
- **Polarity protection**: Up to −36 VDC
- **Overvoltage protection**: Up to 36 VDC

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1/ With position magnet # 251 416-2
TECHNICAL DRAWING

RP-M, example: Connection type D54 (connector outlet)

RP-S, example: Connection type D60 (connector outlet)

RP-M, example: Connection type D62 (connector outlet)

RP-M, example: Connection type HXX/PXX (cable outlet)

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

Fig. 3: Temposonics® RP with U-magnet (connection type example D54, D62 and HXX/PXX) and magnet slider (connection type example D60)
## Connector Wiring

### D54

#### Signal

<table>
<thead>
<tr>
<th>M12 male connector (A-coded)</th>
<th>Pin</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>Shield</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Not connected</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Not connected</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>CAN_H</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>CAN_L</td>
</tr>
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</table>

#### Power supply

<table>
<thead>
<tr>
<th>M8 male connector</th>
<th>Pin</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>+24 VDC (-15/+20 %)</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Not connected</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>DC Ground (0 V)</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>Not connected</td>
</tr>
</tbody>
</table>

### D60

#### Signal + power supply

<table>
<thead>
<tr>
<th>M16 male connector</th>
<th>Pin</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>CAN_L</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>CAN_H</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Not connected</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>Not connected</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>+24 VDC (-15/+20 %)</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>DC Ground (0 V)</td>
</tr>
</tbody>
</table>

### D62

#### Signal + power supply

<table>
<thead>
<tr>
<th>M16 male connector</th>
<th>Pin</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>CAN_L</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>CAN_H</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Not connected</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>Not connected</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>+24 VDC (-15/+20 %)</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>DC Ground (0 V)</td>
</tr>
</tbody>
</table>

### PX/HXX

#### Signal + power supply

<table>
<thead>
<tr>
<th>Cable</th>
<th>Color</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>GY</td>
<td>CAN_L</td>
<td></td>
</tr>
<tr>
<td>PK</td>
<td>CAN_H</td>
<td></td>
</tr>
<tr>
<td>YE</td>
<td>Not connected</td>
<td></td>
</tr>
<tr>
<td>GN</td>
<td>Not connected</td>
<td></td>
</tr>
<tr>
<td>BN</td>
<td>+24 VDC (-15/+20 %)</td>
<td></td>
</tr>
<tr>
<td>WH</td>
<td>DC Ground (0 V)</td>
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</table>

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Fig. 4: Connector wiring D54

Fig. 5: Connector wiring D60

Fig. 6: Connector wiring D62

Fig. 7: Cable wiring PX/HXX
FREQUENTLY ORDERED ACCESSORIES – Additional options available in our Accessories Guide

**Position magnets**

- Magnet slider S, joint at top
  Part no. 252 182
  Material: GRP, magnet hard ferrite
  Weight: Approx. 35 g
  Operating temperature: −40…+85 °C (−40…+185 °F)

- Magnet slider V, joint at front
  Part no. 252 184
  Material: GRP, magnet hard ferrite
  Weight: Approx. 35 g
  Operating temperature: −40…+85 °C (−40…+185 °F)

- Magnet slider N
  longer ball-joint arm
  Part no. 252 183
  Material: GRP, magnet hard ferrite
  Weight: Approx. 35 g
  Operating temperature: −40…+85 °C (−40…+185 °F)

- Magnet slider G, backlash free
  Part no. 253 421
  Material: GRP, magnet hard ferrite
  Weight: Approx. 25 g
  Operating temperature: −40…+85 °C (−40…+185 °F)

**Position magnets**

**Mounting accessories**

- 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

- Block magnet L
  Part no. 403 448
  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.

- Mounting clamp
  Part no. 400 802
  Material: Stainless steel (AISI 304)

- T-nut
  Part no. 401 602
  Fastening torque for M5 screw: 4.5 Nm

Controlling design dimensions are in millimeters and measurements in ( ) are in inches
### Cable connectors (M12)*

<table>
<thead>
<tr>
<th>Connector Type</th>
<th>Part No.</th>
<th>Description</th>
</tr>
</thead>
</table>
| M12 A-coded female connector (4 pin/5 pin), straight | 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 |
| M12 A-coded female connector (5 pin), angled | 370 678 | Material: GD-Zn, Ni  
Termination: Screw; max. 0.75 mm²  
Contact insert: CuZn  
Cable Ø: 5...8 mm (0.2...0.31 in.)  
Wire: 0.75 mm² (18 AWG)  
Operating temperature: -25...+85 °C (-13...+185 °F)  
Ingress protection: IP67 (correctly fitted)  
Fastening torque: 0.4 Nm |

### Cable connectors (M16)*

<table>
<thead>
<tr>
<th>Connector Type</th>
<th>Part No.</th>
<th>Description</th>
</tr>
</thead>
</table>
| M16 female connector (6 pin), straight | 370 423 | Material: Zinc nickel plated  
Termination: Solder  
Cable Ø: 6...8 mm (0.24...0.31 in.)  
Wire: 0.75 mm² (20 AWG)  
Operating temperature: -40...+100 °C (-40...+212 °F)  
Ingress protection: IP65/IP67 (correctly fitted)  
Fastening torque: 0.6 Nm |
| M16 female connector (6 pin), angled | 370 460 | Material: Zinc nickel plated  
Termination: Solder  
Cable Ø: 6...8 mm (0.24...0.31 in.)  
Wire: 0.75 mm² (20 AWG)  
Operating temperature: -40...+95 °C (-40...+203 °F)  
Ingress protection: IP67 (correctly fitted)  
Fastening torque: 0.6 Nm |

### Connection accessories*

<table>
<thead>
<tr>
<th>Accessory Type</th>
<th>Part No.</th>
<th>Description</th>
</tr>
</thead>
</table>
| M12 A-coded T connector (5 pin) | 370 691 | Selfcuring coupling nut  
2 x female connector  
1 x male connector  
Feature: Shielded  
Ingress protection: IP67 (correctly fitted) |
| Passive M12 A-coded male bus terminator (5 pin) | 370 700 | Material: PUR  
Termination: Screw  
Contact insert: Au  
Operating temperature: -25...+85 °C (-13...+121 °F)  
Ingress protection: IP68 (correctly fitted) |
| PUR cable | 530 052 | Material: PUR jacket; orange  
Features: Twisted pair, shielded, highly flexible, halogen free, suitable for drag chains, mostly oil & flame resistant  
Cable Ø: 6.4 mm (0.25 in.)  
Cross section: 3 x 2 x 0.25 mm²  
Bending radius: 5 x D (fixed installation)  
Operating temperature: -30...+80 °C (-22...+176 °F)  
Ingress protection: IP65 (correctly fitted) |
| PUR cable | 530 175 | Material: PUR jacket; orange  
Features: Flexible, additional EMC protection  
Cable Ø: 6.5 mm (0.26 in.)  
Cross section: 6 x 0.14 mm²  
Bending radius: 10 x D (fixed installation)  
Operating temperature: -30...+90 °C (-22...+194 °F) |

* Follow the manufacturer’s mounting instructions.

Controlling design dimensions are in millimeters and measurements in ( ) are in inches.
### ORDER CODE

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
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<th>8</th>
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</thead>
<tbody>
<tr>
<td>R</td>
<td>P</td>
<td>a</td>
<td>b</td>
<td>c</td>
<td>d</td>
<td>e</td>
<td>f</td>
<td>g</td>
<td>h</td>
<td>i</td>
<td>j</td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### a Sensor model
- **R**: Profile

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

#### c Stroke length
- **X X X X M**: 0025…5080 mm
  - **0025 mm**: 25 mm
  - **500 mm**: 50 mm
  - **2500 mm**: 100 mm

#### d Connection type
- **D 5 4**: 1×M12 female connector (5 pin), 1×M12 male connector (5 pin) 1×M8 male connector (4 pin)
- **D 6 0**: 1×M16 male connector (6 pin)
- **D 6 2**: 2×M16 male connector (6 pin)
- **H X X**: XX m PUR cable (part no. 530 052) H01…H10 (1…10 m/3…33 ft.)* (see chapter “frequently ordered accessories” for cable specifications and note the temperature range of the cable)
- **P X X**: XX m PUR cable (part no. 530 175) P01…P10 (1…10 m/3…33 ft.)* (see chapter “frequently ordered accessories” for cable specifications and note the temperature range of the cable)

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

#### e Operating voltage
- **1**: +24 VDC (−15/+20 %)
- **A**: +24 VDC (−15/+20 %), vibration resistant (stroke length 25…2000 mm / 1…79 in.)

#### f Output
- **C 1 0 1**: CANbasic, position and velocity (1 position)
- **C 2 0 7**: CANbasic, position (1...20 position(s))
- **C 3 0 4**: CANopen, position and velocity (1...4 position(s))
- **C 5 0 4**: CANopen, position and velocity, internal linearization (1...4 position(s))

#### g Baud rate
- **1**: 1000 kBit/s
- **2**: 500 kBit/s
- **3**: 250 kBit/s
- **4**: 125 kBit/s

#### h Resolution
- **1**: 5 µm
- **2**: 2 µm

#### i Options
- **1**: Standard
Optional

<table>
<thead>
<tr>
<th>i</th>
<th>Number of magnets for multi-position measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Z</td>
<td>X</td>
</tr>
</tbody>
</table>

**NOTICE**

- Select the C207, C304 or C504 in "Output" for multi-position measurement (number of magnets ≥ 2).
- Specify magnet numbers for your sensing application and order 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).
- If the option for internal linearization (C504) in "Output" is chosen, select a suitable magnet.

**DELIVERY**

- Sensor
- Position magnet (not valid for RP with design "0")
- 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.

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