Temposonics®
Absolute, Non-Contact Position Sensors

Data Sheet
R-Series Analog

Temposonics® RP and RH
Stroke length 50…7600 mm

100% field adjustable Null and Span

- Rugged industrial sensor
- Linear and absolute measurement
- LEDs for sensor diagnostics
- Non-contact sensing with highest durability
- Superior accuracy: Linearity better 0.01 % F.S.
- Repeatability 0.001 % F.S.
- Direct analog output, position + speed
- Dual magnet position measurement
Sensor diagnostic display
Integrated LEDs (green/red) provide basic visual feedback for normal sensor operation and troubleshooting.

<table>
<thead>
<tr>
<th>LED</th>
<th>Green</th>
<th>Red</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ON</td>
<td>ON</td>
<td>OFF</td>
<td>Normal function</td>
</tr>
<tr>
<td>ON</td>
<td>ON</td>
<td>ON</td>
<td>Magnet not detected,</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Wrong quantity of magnets</td>
</tr>
<tr>
<td>ON</td>
<td>Flash</td>
<td>ON</td>
<td>Magnet out of setup range</td>
</tr>
<tr>
<td>Flash</td>
<td>ON</td>
<td></td>
<td>Programming mode</td>
</tr>
</tbody>
</table>

Output
Smart analog sensors provide direct analog outputs including voltage and current. All outputs allow 100% adjustments of zero and span setpoints. Since the outputs are direct, no signal conditioning electronics are needed when interfacing with controllers or meters.

Availability
- Single magnet sensor provides one position output over the entire active stroke length and one velocity output with 1 magnet.
- Dual magnets sensor provides two identical positions outputs; a separate output is provided for each of the two magnets positioned along sensor length.

Sensor field programming
Temposonics® R-Series sensors are preconfigured at the factory by model code designation. If needed, MTS offers different external service tools for modifying sensor parameters inside the active electrical stroke (minimum 25 mm between setpoints) via the standard connection cable. There is no need to open the sensors electronics. Following tools are available:

1. Hand-Programmer R-Analog for 1 magnet sensor
   for easy teach-in setups of stroke length and direction by moving the magnet on desired Null/Span positions and pushing the 0/100% buttons.

2. Cabinet-Programmer R-Analog
   Cabinet-Programmer R-Analog completes the accessories program of MTS absolute position sensors. The unit can be used for adjusting a connected 1-magnet sensor via the leads, using a simple teach-in procedure in the field.

3. USB-Programmer R-Analog for 1 or 2 magnet's sensors
   This hardware converter is required to communicate via USB-port of a Windows PC to the sensor. Customized settings are possible by using the MTS programming software (CD-ROM) for:
   - Zero/Span Magnet 1
   - Zero/Span Magnet 2
   - Velocity range
   - Free assignment of outputs to measured position or velocity
   - Error output value (e.g. magnet out of stroke)

Windows sensor programming

## Technical Data

### Input

| Measured value | Position, velocity / dual magnet position measurements |
| Stroke length  | Profile: 50…5000 mm, Rod: 50…7600 mm |

### Output

| Voltage          | 0…10 / 10…0 / -10…+10 / +10…-10 VDC (min. load controller: > 5 kOhms) |
| Current          | 4(0)…20 mA / 20…4(0) mA (min/max. load: 0/500 Ohms) |

### Accuracy

**Position measurement:**
- Null/Span adjustment: 100 % of electrical stroke (min. range 25 mm)
- Resolution: 16 bit; 0.0015 % (Minimum 1 μm)
- Linearity: < ± 0.01 % F.S. (Minimum ± 50 μm)
- Repeatability: < ± 0.001 % F.S. (Minimum ± 1 μm)
- Hysteresis: < 4 μm
- Update time: 0.5 ms up to 1200 mm / 1.0 ms up to 2400 mm / 2.0 ms up to 4800 mm / 5.0 ms up to 7600 mm stroke length
- Ripple: < 0.01 % F.S.

**Velocity measurement:**
- Range: 0.025 - 10 m/s
- Deviation: < 0.5 %
- Resolution: 0.1 mm/s Option 0.01 mm/s
- Update time (ms): see position measurement
- Temperature coefficient: < 30 ppm/°C

### Operating conditions

- Magnet speed: any
- Operating temperature: -40 °C…+75 °C
- Dew point, humidity: 90% rel. humidity, no condensation
- Ingress protection¹: Profile: IP65, Rod: IP67, IP68 for cable outlet, RS: IP69K
- Shock test: 100 g single hit, IEC-Standard 60068-2-27
- Vibration test: 15g / 10 - 2000 Hz, IEC-Standard 60068-2-6
- Standards, EMC test: Electromagnetic emission EN 61000-6-4, Electromagnetic immunity EN 61000-6-2, EN 61000-4-2/3/4/6, Level ¾, Criterium A, CE-qualified

### Design, material

- Diagnostic display: LEDs beside connector
- Profile model:
  - Sensor head: Aluminum
  - Sensor stroke: Aluminum
  - Position magnet: Magnet slider or removable U-magnet
- Rod model:
  - Sensor head: Aluminum
  - Rod with flange: Stainless steel 1.4301 / AISI 304
- Pressure rating: 350 bar, (700 bar peak) for hydraulic rod
- Position magnet: Ring magnets, U-magnets

### Installation

- Mounting position: any orientation
- Profile: Movable mounting clamps fixed with M5 x 20 screws or T-slot nuts M5 in base channel
- U-magnet, removable: Mounting plate and screws from antimagnetical material
- Rod: Threaded flange M18 x 1.5 or ¾" -16 UNF-3A, Hex nut M18
- Position magnet: Mounting plate and screws from antimagnetical material

### Electrical connection

- Connection type: 6 pin connector M16 or cable outlet
- Supply 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.
- Polarity protection: up to -30 VDC
- Overvoltage protection: up to 36 VDC
- Current drain: 100 mA typical
- Ripple: ≤ 0.28 Vpp
- Electric strength: 500 VDC (DC ground to machine ground)

¹ The IP rating is not part of the UL recognition
Stable profile design

**Tempsonics® RP** offers modular construction, flexible mounting configurations and easy installation. Position measurement is contactless via two versions of permanent magnets.

- A sliding magnet running in profile housing rails. Connection with the mobile machine part is via a ball jointed arm to taking up axial forces.
- A floating magnet, mounted directly on the moving machine part, travels over the profile at a low distance. Its air-gap allows the correction of small misalignments at installation.

---

**Wiring**

<table>
<thead>
<tr>
<th>Pin</th>
<th>Cable</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>grey</td>
<td>Output 1: Position #1  0...10/10...-10/+10/-10/V  4(0)...20/20...4(0)/mA</td>
</tr>
<tr>
<td>2</td>
<td>pink</td>
<td>DC Ground</td>
</tr>
<tr>
<td>3</td>
<td>yellow</td>
<td>Output 2: Position #2 or velocity  0...10/10...-10/+10/-10/V  4...20/20...4 mA</td>
</tr>
<tr>
<td>4</td>
<td>green</td>
<td>DC Ground</td>
</tr>
<tr>
<td>5</td>
<td>brown</td>
<td>+24 VDC (-15/+20 %)</td>
</tr>
<tr>
<td>6</td>
<td>white</td>
<td>DC Ground (0 V)</td>
</tr>
</tbody>
</table>

**All dimensions in mm**

---

**Standard position magnet included in delivery (see chapter accessories)**

- **Position magnets**
  - Magnet slider S (part no. 252 182)
  - Magnet slider V (part no. 252 184)
  - U-magnet OD33 (part no. 251 416-2)

- **Connection types**
  - 6 pin female connector (part no. 370 623)
  - 6 pin female connector M16, 30° (part no. 370 460)
High pressure rod design

Temposonics® RH with a pressure-resistant stainless steel flange and sensing rod is suitable for use in hydraulic cylinders and externally in all applications where space is a problem. Position measurement is via ring or U-magnets travelling along the sensing rod without any mechanical contact.

Advantage

the completely operable sensor cartridge can be replaced for servicing easily without opening the fluid circuit.

Standard position magnets (not included in delivery, please order separately)

<table>
<thead>
<tr>
<th>Standard position magnet</th>
<th>Description</th>
<th>Part No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ring magnet OD33</td>
<td>Composite PA-Ferrite-GF20, Weight ca. 14 g, Operating temperature: -40...+100 °C, Surface pressure max. 40 N/mm², Fastening torque for M4 screws max. 1 Nm</td>
<td>201 542-2</td>
</tr>
<tr>
<td>U-magnet OD32</td>
<td>PA-Ferrite-GF20, Weight ca. 11 g, Operating temperature: -40...+100 °C, Surface pressure max. 40 N/mm², Fastening torque for M4 screws max. 1 Nm</td>
<td>251 416-2</td>
</tr>
</tbody>
</table>

All dimensions in mm
**Temposonics®**

**Sensor model**
- RP - Profile
- RH - Hydraulic rod

**Design**

**Profile Temposonics® RP:**
- S - Magnet slider, joint at top
- V - Magnet slider, joint at front
- M - U-magnet, OD33

**Rod Temposonics® RH:**
- M - Flange M18 x 1.5 (Standard)
- V - Flange M18 x 1.5 (Fluorelastomer housing-seal)
- D - Flange M18 x 1.5 with bushing on rod end
- R - Flange M18 x 1.5 with thread M4 at rod end
- J - Flange M22 x 1.5, rod Ø 12.7 mm, 800 bar
- S - Flange ¾" - 16 UNF - 3A

**Stroke length**
- Profile: 0050…5000 mm
- Rod: 0050…7600 mm

**Connection type**
- D60 - 6 pin male receptacle M16
- R02 - 2 m PVC cable w/o connector, Option: R01-R10 (1 - 10 m)
- H02 - 2 m PUR cable w/o connector, Option: H01-H10 (1 - 10 m)

**Supply voltage**
- 1 - +24 VDC
- A - +24 VDC, high vibration resistant (stroke length 25…2000 mm)

**Output**

### 1 Output with 1 magnet

<table>
<thead>
<tr>
<th>Output 1 (position magnet 1)</th>
<th>2 Outputs with 2 magnets</th>
</tr>
</thead>
<tbody>
<tr>
<td>V01 = 0…10 VDC</td>
<td>V02 = 0…10 VDC</td>
</tr>
<tr>
<td>A01 = 4…20 mA</td>
<td>0…10 VDC</td>
</tr>
<tr>
<td>V11 = 10…0 VDC</td>
<td>V12 = 10…0 VDC</td>
</tr>
<tr>
<td>A11 = 20…4 mA</td>
<td>10…0 VDC</td>
</tr>
<tr>
<td>V21 = -10…-10 VDC</td>
<td>V22 = -10…-10 VDC</td>
</tr>
<tr>
<td>A21 = 0…20 mA</td>
<td>-10…+10 VDC</td>
</tr>
<tr>
<td>V31 = +10…-10 VDC</td>
<td>V32 = +10…-10 VDC</td>
</tr>
<tr>
<td>A31 = 20…0 mA</td>
<td>+10…-10 VDC</td>
</tr>
</tbody>
</table>

### 2 Outputs with 1 magnet

<table>
<thead>
<tr>
<th>Output 1 (position magnet 1)</th>
<th>2 Outputs (absolute speed magnet 1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Magnet direction</td>
<td>Head</td>
</tr>
<tr>
<td>V01 xxx.x = 0…10 VDC</td>
<td>+10……0……+10 VDC</td>
</tr>
<tr>
<td>V11 xxx.x = 10…0 VDC</td>
<td>+10……0……+10 VDC</td>
</tr>
<tr>
<td>A01 xxx.x = 4…20 mA</td>
<td>20……4……20 mA</td>
</tr>
<tr>
<td>A11 xxx.x = 20…4 mA</td>
<td>20……4……20 mA</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Output 1 (position magnet 1)</th>
<th>2 Outputs (speed magnet 1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Magnet direction</td>
<td>Head</td>
</tr>
<tr>
<td>V61 xxx.x = 0…10 VDC</td>
<td>-10……0……+10 VDC</td>
</tr>
<tr>
<td>V71 xxx.x = 10…0 VDC</td>
<td>+10……0……-10 VDC</td>
</tr>
<tr>
<td>A41 xxx.x = 4…20 mA</td>
<td>4……12……20 mA</td>
</tr>
</tbody>
</table>

### Stroke Length Standard RP

<table>
<thead>
<tr>
<th>Stroke length</th>
<th>Ordering steps</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ 500 mm</td>
<td>25 mm</td>
</tr>
<tr>
<td>500…2500 mm</td>
<td>50 mm</td>
</tr>
<tr>
<td>2500…5000 mm</td>
<td>100 mm</td>
</tr>
</tbody>
</table>

### Stroke Length Standard RH

<table>
<thead>
<tr>
<th>Stroke length</th>
<th>Ordering steps</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 500 mm</td>
<td>5 mm</td>
</tr>
<tr>
<td>500…750 mm</td>
<td>10 mm</td>
</tr>
<tr>
<td>750…1000 mm</td>
<td>25 mm</td>
</tr>
<tr>
<td>1000…2500 mm</td>
<td>50 mm</td>
</tr>
<tr>
<td>2500…5000 mm</td>
<td>100 mm</td>
</tr>
<tr>
<td>&gt; 5000 mm</td>
<td>250 mm</td>
</tr>
</tbody>
</table>

Fill in blanks (xxxx) with desired max. speed (see above):  
- Speed range 1: 0.1…10 m/s (0001…0100)  
  Sample: (-5.5…0.0…5.5 m/s = 10…0…10 VDC) = V01 0055  
- Speed range 2: 25…90 mm/s (1025…1090)  
  Sample: (-50…0.0…50 mm/s = 4…12…20 mA) = A41 1050

**Accessories page 67 and following.**