The Temposonics® linear position transducers are based on magnetostriction technology. Magnetostriction is a ferromagnetic material phenomenon which relates a dimensional change of the material to its magnetization properties. It is the product of a general coupling between the magnetic and elastic transport properties of the materials crystal lattice. This affect is typically on the scale of a few parts per million. It is quasi linear with the material’s magnetization, may be positive or negative, and reaches a maximum at magnetic saturation. It is reversible, but exhibits a hysteretic affect if the magnetization does so. Magnetostriction was characterized in the late 19th century, the longitudinal version is called the „Joule“ effect, the torsional version is called the „Wiedemann“ effect, and the reciprocal effect where mechanical stress changes the magnetic properties is referred to as the „Villari“ effect.

The extremely robust sensor, ideal for continuous operation under harshest industrial conditions is completely modular in mechanic and electronic design.
- A profile or rod-shaped sensor housing protects the sensing element in which gives rise to the measurement signal.
- The sensor head accommodates the complete modular electronic interface with active signal conditioning. Double encapsulation ensures high operating safety and optimum EMC protection.
- The position transmitter, a permanent magnet - fixed at the mobile machine part - drives contactlessly over the sensor’s stroke and starts measuring through the housing wall.

Magnetostriiction  Design

- Rugged industrial sensor
- Linear absolute measurement
- Contactless sensing with highest durability
- Enhanced diagnostics and programming capability
- EMC tested and marked with CE
- Superior accuracy: linearity less than 0.02 % F.S.
- Repeatability less than 0.001 % F.S.
- Direct analog output
- Digital start/stop pulse output
Technical data

Input

<table>
<thead>
<tr>
<th>Measuring variables</th>
<th>position, liquid level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stroke length</td>
<td></td>
</tr>
<tr>
<td>- Analog</td>
<td>profile/rod models: 50...2500 mm (longer stroke lengths are available on a custom basis)</td>
</tr>
<tr>
<td>- Start/Stop</td>
<td>profile model: 50...5000 mm, rod model: 50...7600 mm</td>
</tr>
</tbody>
</table>

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) |
| Start/Stop pulse          | RS422 serial differential signal |

Accuracy

| Position measurement:    | 100 % of electrical stroke (min. range 50 mm) |
| - Null/Span adjustment   | analog: infinite |
| - Resolution             | digital (start/stop): 0.1 mm; 0.01; 0.005 mm (controller dependent) |
| - Linearity \(^1\)       | \(< \pm 0.02 \% \text{ F.S.} \ (\text{minimum} \pm 50 \mu \text{m})\) |
| - Repeatability          | \(< \pm 0.001 \% \text{ F.S.} \ (\text{minimum} \pm 2.5 \mu \text{m})\) |
| - Hysteresis             | \(< 4 \mu \text{m}\) |
| - Update time            | analog: \(< 1 \text{ ms typical}\) |
|                          | digital (start/stop): controller and stroke dependent |
| - Ripple                 | \(< 0.01 \% \text{ F.S.}\) |

Operating conditions

| Magnet speed              | any |
| Operating temperature     | -40 °C...+80 °C |
| Dew point, humidity       | 90% rel. humidity, no condensation |
| Ingress protection \(^2\) | profile: IP 65, rod: IP 67, IP 68 for cable outlet |
| Shock test                | 100 g single hit, IEC-Standard 60068-2-27 |
| Vibration test            | 15 g / 10...2000 Hz, IEC-Standard 60068-2-6 (resonance frequencies excluded) |
| EMC test                  | Electromagnetic emission EN 61000-6-4 (for use in industrial environment) |
|                          | Electromagnetic immunity EN 61000-6-2 |

The sensor meets the requirements of the EC directives and is marked with CE

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 |
| Position magnet           | Ring magnets, U-magnets |

Installation

| Mounting position         | any orientation |
| Profile                   | movable mounting clamps or T-slot nuts in base channel |
| Rod                       | threaded flange M18 x 1.5 or 3/4”-16 UNF-3A, hex nut M18 |
| Position magnet           | mounting plate and screws from antimagnetic material |

Electrical connection

| Connection type           | 6 pin connector |
| 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. |
| - Polarisation protection | up to -30 VDC |
| - Overvoltage protection  | up to 36 VDC |
| Current drain             | 100 mA typical |
| Ripple                    | \(< 0.28 \text{ Vpp}\) |
| Electric strength         | 500 VDC (DC ground to machine ground) |

Linearity protocol example

Sensor Temposonics® GP/GH
Stroke length 1000 mm
Tolerance allowed: \( \pm 0.2 \text{ mm} \)
Tolerance measured: typical \( \pm 0.09 \text{ mm} \)

\(^1\) with position magnet # 251 416-2.

\(^2\) The IP rating is not part of the UL recognition
**Temposonics® GP – Stable profile design**

Temposonics® GP 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.

**Position magnets** (not included in delivery, please order separately)

![Diagram of position magnets](image)

**Magnet slider S**  
Part no. 252 182

- Rotation:  
  - Vertical 18º  
  - Horizontal 360º
- Ball joint CuZn39Pb3 nickel plated
- Weight: 30 g
- Operating temperature:  
  - -40 ... +75°C

**Magnet slider V**  
Part no. 252 184

- Rotation:  
  - Vertical 18º
- Ball joint CuZn39Pb3 nickel plated
- Weight: 30 g
- Operating temperature:  
  - -40 ... +75°C

**U-Magnet OD33**  
Part no. 251 416-2

- Composite PA-Ferrite-GF20
- Weight: 11 g
- Operating temperature:  
  - -40 ... +100°C
- Surface pressure max. 90 N/mm²
- Fastening Torque for M4 screws max. 1 Nm

**Other position magnets on request.**

All dimensions in mm
**Tempsonics® – High pressure rod design**

Tempsonics® GH 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 done 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.

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**Position magnets (not included in delivery, please order separately)**

1. **Ring magnet OD33**
   - Part no. 201 542-2
   - 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

2. **U-magnet OD33**
   - Part no. 251 416-2
   - Composite 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

3. **Ring magnet OD25,4**
   - Part no. 400 533
   - Composite: PA-Ferrite
   - Weight ca. 10 g
   - Operating temperature: -40 ... +100°C
   - Surface pressure max. 40 N/mm²

**Other position magnets on request.**

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*All dimensions in mm*
Temposonics® G-Series – The next sensor generation

Temposonics is proud to introduce our new G-Series linear position sensors utilizing our next generation technology platform. G-Series sensors feature a microprocessor-based design with enhanced diagnostics and programmability to maximize backwards compatibility.

Sensor diagnostic display

Integrated LEDs (green/red) provide basic visual feedback for normal sensor operation and troubleshooting.

<table>
<thead>
<tr>
<th>Green</th>
<th>Red</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ON</td>
<td>OFF</td>
<td>Normal function</td>
</tr>
<tr>
<td>ON</td>
<td>Flashing</td>
<td>Missing external start signal</td>
</tr>
<tr>
<td>ON</td>
<td>ON</td>
<td>Magnet not detected</td>
</tr>
<tr>
<td>Flashing</td>
<td>OFF</td>
<td>Serial programming mode</td>
</tr>
</tbody>
</table>

Analog output

Temposonics® G-Series with analog outputs provide direct analog outputs including voltage and current, forward or reverse acting. All outputs allow full adjustment of Null and Span setpoints (minimum range 50 mm between setpoints) inside the active electrical stroke length. Since the outputs are direct, no signal conditioning electronics are needed when interfacing with controllers or meters.

Connector wiring

The digital Temposonics® G-Series is equipped with a start/stop output. The sensor requires a start signal from an external indicator in the control system and returns a stop signal corresponding to the magnet’s position. The time elapsed between the two signals is proportional to the position. Time measurement is done by the control unit and used for calculating the position value.

Option multi-magnet measurement: One Sensor can detect the positions of several magnets simultaneously.

Connectors (not included in delivery, please order separately)

<table>
<thead>
<tr>
<th>Pin</th>
<th>Cable</th>
<th>Analog</th>
<th>Digital</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>GY</td>
<td>V/mA</td>
<td>Stop (-)</td>
</tr>
<tr>
<td>2</td>
<td>PK</td>
<td>DC ground</td>
<td>Stop (+)</td>
</tr>
<tr>
<td>3</td>
<td>YE</td>
<td>USB-programmer</td>
<td>Start (+)</td>
</tr>
<tr>
<td>4</td>
<td>GN</td>
<td>USB-programmer</td>
<td>Start (-)</td>
</tr>
<tr>
<td>5</td>
<td>BN</td>
<td>+24 VDC (-15/+20 %)</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>WH</td>
<td>DC ground</td>
<td></td>
</tr>
</tbody>
</table>

All dimensions in mm
Flexible installation in any position

Profile model
Normally, the sensor is firmly installed - fixed on a straight surface of the machine with movable mounting clamps or M5 screws in base channel - whilst the magnet is mounted at the mobile machine part.

Mounting clamp with screws M5x20
Tightening torque: max. 5 Nm

1 U-Magnet
2 Mounting plate and screws non-ferrous material

Rod model
Mount the sensor via flange thread or a hex nut. If possible, non-magnetizable material should be used for mounting support (dimensions as shown). With horizontal mounting, longer sensors (from 1 meter) must be provided with mechanical support.

Hydraulic sealing
Recommended is sealing of the flange facing with O-Ring (e.g. 22.4 x 2.65) in a cylinder cover nut or an O-Ring 15.3 x 2.2 in undercut.

Minimum assembly distance
1. Non-magnetizable material
2. Magnetizable material

Cylinder installation
When used for direct stroke measurement in fluid cylinders, the sensor’s high pressure, stainless steel rod should be installed into a bore in the piston head/rod assembly as illustrated. That guarantees a longlife and trouble-free operation - independent from the used hydraulic fluid.

The sensor cartridge can be removed from the flange and rod housing while still installed in the cylinder. This procedure allows quick and easy sensor cartridge replacement, without the loss of hydraulic pressure.

Hydraulic sealing
Recommended is sealing of the flange facing with O-Ring (e.g. 22.4 x 2.65) in a cylinder cover nut or an O-Ring 15.3 x 2.2 in undercut.

A liquid level sensor
With installation of the position magnet into a float, the application range of G-series extends substantially. These highly precise float sensors supply exact level values or - provided with suitable floats - interface heights e.g. in the process-industry or laboratory technology etc.

All dimensions in mm
**Temposonics® GP/GH**

**Analog or Start/Stop**

---

**Temposonics® ordering information**

<table>
<thead>
<tr>
<th>G</th>
<th>U</th>
<th>M</th>
<th>1</th>
</tr>
</thead>
</table>

**Sensor model**

GP - Profile

GH - Hydraulic rod

**Form factor**

**Profile Temposonics® GP:**

S - Magnet slider, joint at top

V - Magnet slider, joint at front

**M - U-magnet, OD33**

**Rod Temposonics® GH:**

M - Flange M18 x 1.5 (Standard)

V - Flange M18 x 1.5 (Fluorelastomer housing-seal)

S - Flange 3/4" - 16 UNF - 3A

**Measuring length**

**Analog** - Profile/Rod 0050...2500 mm

**Digital** - Profile: 0050...5000 mm / Rod: 0050...7600 mm

- Standard: up to 1000 in 50 mm, greater 1000 in 250 mm steps
- Other lengths upon request

**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**

T = +24 VDC

**Output**

V0 = 0...10 VDC

V1 = 10...0 VDC

V2 = -10...+10 VDC

V3 = +10...-10 VDC

A0 = 4...20 mA

A1 = 20...4 mA

A2 = 0...20 mA

A3 = 20...0 mA

R01 = Start/Stop

- Option: R0X = If more than 1 magnet, denotes number (2...9 pcs.) for start/stop multi-magnet measurement

**Delivery includes:**

**On delivery profile model:** Sensor, Position magnet, 2 mounting clamps up to 1250 mm + 1 clamp for every additional 500 mm

**On delivery rod model:** Sensor, O-ring, please order magnets separately.

**Accessories**

<table>
<thead>
<tr>
<th>Description</th>
<th>Part no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Magnet slider type »S«</td>
<td>252 182</td>
</tr>
<tr>
<td>Magnet slider type »V«</td>
<td>252 184</td>
</tr>
<tr>
<td>U-Magnet OD33</td>
<td>251 416-2</td>
</tr>
<tr>
<td>Ring magnet OD33</td>
<td>201 542-2</td>
</tr>
<tr>
<td>Ring magnet OD25.4</td>
<td>400 533</td>
</tr>
<tr>
<td>Magnet float</td>
<td>251 447</td>
</tr>
<tr>
<td>Collar</td>
<td>560 777</td>
</tr>
<tr>
<td>Hex nut</td>
<td>500 018</td>
</tr>
<tr>
<td>Mounting clamp</td>
<td>400 802</td>
</tr>
<tr>
<td>T-slot nut M5 for base channel mounting</td>
<td>401 602</td>
</tr>
<tr>
<td>6 pin female cable connector M16</td>
<td>370 423</td>
</tr>
<tr>
<td>6 pin 90°-female cable connector M16</td>
<td>370 460</td>
</tr>
<tr>
<td>PVC-cable 3 x 2 x 0.14 mm²</td>
<td>530 032</td>
</tr>
<tr>
<td>PUR-cable 3 x 2 x 0.25 mm²</td>
<td>530 052</td>
</tr>
</tbody>
</table>

**Servicetools**

- Analog Hand-Programmer G
- Analog USB-Programmer G, incl. power supply
- 100...240 VAC / 24 VDC, connection cable and CD-ROM
- Digital USB-Programmer G, incl. power supply
- 100...240 VAC / 24 VDC, connection cable and CD-ROM

**Stroke length standard (GP):**

<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>
<tr>
<td>&gt; 5000 mm</td>
<td>250 mm</td>
</tr>
</tbody>
</table>

**Stroke length standard (GH):**

<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>
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<td>100 mm</td>
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<tr>
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</tr>
</tbody>
</table>