Data Sheet

EP / EL Analog
Magnetostrictive Linear Position Sensors

- For standard applications
- Position measurement with more than one magnet
- Ideal for limited installation space
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.

<table>
<thead>
<tr>
<th>Measurement Cycle</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Current pulse generates magnetic field</td>
</tr>
<tr>
<td>2 Interaction with position magnet field generates torsional strain pulse</td>
</tr>
<tr>
<td>3 Torsional strain pulse propagates</td>
</tr>
<tr>
<td>4 Strain pulse detected by converter</td>
</tr>
<tr>
<td>5 Time-of-flight converted into position</td>
</tr>
</tbody>
</table>

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

EP / EL SENSOR

Robust, non-contact and wear free, the Temposonics linear position sensors provide the best durability and precise position measurement feedback in harsh industrial environments. Measurement accuracy is tightly controlled by the quality of the waveguide manufactured exclusively by Temposonics.

The compact Temposonics® EP as well as the ultra low Temposonics® EL are profile sensors suitable for standard applications and in particular for applications with limited installation space. The evaluation electronics is accommodated in an aluminum sensor housing. Typical fields of applications are plastics industry, metal forming and woodworking as well as factory automation.

Fig. 2: Typical application: Factory automation
## TECHNICAL DATA

### Output

**Voltage**

0…10 VDC or 10…0 VDC, 0…10 VDC and 10…0 VDC (controller input resistance \( R_L > 5 \, \text{k}\Omega \))

**Current**

4…20 mA or 20…4 mA (minimum / maximum load: 0 / 500 \( \Omega \))

**Measured variable**

Position / option: multi-position measurement (2 positions)

### Measurement parameters

**Resolution**

Infinite

**Cycle time**

Typ. 0.3 ms < \( t < 2 \, \text{ms} \) (depending on stroke lengths)

**Linearity**

Magnet slider: \( \leq \pm 0.02 \% \, \text{F.S.} \) (minimum \( \pm 60 \, \mu\text{m} \)), U-magnet: \( \leq \pm 0.02 \% \, \text{F.S.} \) (minimum \( \pm 60 \, \mu\text{m} \)),

block magnet: \( \leq \pm 0.03 \% \) (minimum \( \pm 90 \, \mu\text{m} \))

**Repeatability**

\( \leq \pm 0.005 \% \, \text{F.S.} \) (minimum \( \pm 20 \, \mu\text{m} \))

### Operating conditions

**Operating temperature**

\(-40…+75 \, ^\circ\text{C} \) (\(-40…+167 \, ^\circ\text{F} \))

**Humidity**

90 % rel. humidity, no condensation

**Ingress protection**

IP67 (if mating connectors are 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 (resonance frequencies excluded)

**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 \( \varepsilon \).

**Magnet movement velocity**

Magnet slider: \( \leq 5 \, \text{m/s} \); U-magnet: Any; block magnet: Any

### Design / Material

**Sensor electronics housing**

Aluminum

**Sensor profile**

Aluminum

**Stroke length**

50…2540 mm (2…100 in.)

### Mechanical mounting

**Mounting position**

Any

**Mounting instruction**

Please consult the technical drawings and the brief instructions (document number: 551684)

### Electrical connection

**Connection type**

M12 (5 pin) male connector

**Operating voltage**

\(+24 \, \text{VDC} \) (\(-15 / +20 \%)\); 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.

**Ripple**

\( \leq 0.28 \, \text{Vpp} \)

**Current consumption**

50…140 mA

**Dielectric strength**

500 VDC (DC ground to machine ground)

**Polarity protection**

Up to \(-30 \, \text{VDC} \)

**Overvoltage protection**

Up to 36 VDC

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1/ Magnet slider # 252 182 and # 252 184, U-magnet # 251 416-2 and block magnet # 403 448

2/ The IP rating is not part of the UL recognition

3/ The IP rating IP67 is only valid for the sensor electronics housing, as water and dust can get inside the profile
**TECHNICAL DRAWING**

**Temposonics® EP**

```
<table>
<thead>
<tr>
<th>Pin</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>+24 VDC (-15% / +20%)</td>
</tr>
<tr>
<td>2</td>
<td>Output 1</td>
</tr>
<tr>
<td>3</td>
<td>DC Ground (0 V)</td>
</tr>
<tr>
<td>4</td>
<td>Output 2</td>
</tr>
<tr>
<td>5</td>
<td>DC Ground</td>
</tr>
</tbody>
</table>
```

**Temposonics® EL**

**CONNECTOR WIRING**

**D34**

<table>
<thead>
<tr>
<th>M12 A-coded</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>Output 1</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>DC Ground (0 V)</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>Output 2</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>DC Ground</td>
</tr>
</tbody>
</table>

Controlling design dimensions are in millimeters and measurements in ( ) are in inches.
FREQUENTLY ORDERED ACCESSORIES  – Additional options available in our Accessories Guide 551444

Position magnets

<table>
<thead>
<tr>
<th>Magnet slider S</th>
<th>Magnet slider V</th>
<th>U-magnet OD33</th>
<th>Block magnet L</th>
</tr>
</thead>
<tbody>
<tr>
<td>Part no. 252 182</td>
<td>Part no. 252 184</td>
<td>Part no. 251 416-2</td>
<td>Part no. 403 448</td>
</tr>
<tr>
<td>Weight: Ca. 35 g</td>
<td>Operating temperature:</td>
<td>Material: PA ferrite GF20</td>
<td>Operating temperature:</td>
</tr>
<tr>
<td>−40...+75 °C (−40...+167 °F)</td>
<td>+40...+105 °C (40...+221 °F)</td>
<td>Weight: Ca. 11 g</td>
<td>−40...+75 °C (−40...+167 °F)</td>
</tr>
<tr>
<td>Surface pressure: Max. 40 N/mm²</td>
<td></td>
<td>Fastening torque for M4 screws: 1 Nm</td>
<td></td>
</tr>
</tbody>
</table>

Cable connectors 4

<table>
<thead>
<tr>
<th>M12 (5 pin) female, straight</th>
<th>M12 (5 pin) female, angled</th>
<th>M12 (5 pin) female, straight</th>
<th>M12 (5 pin) female, angled</th>
</tr>
</thead>
<tbody>
<tr>
<td>Part no. 370 677</td>
<td>Part no. 370 678</td>
<td>Part no. 370 673</td>
<td>Part no. 370 675</td>
</tr>
<tr>
<td>Termination: Screw; max. 1.5 mm²</td>
<td>Termination: Screw; max. 0.75 mm²</td>
<td>Cable: Shielded, pigtail end</td>
<td>Cable: Shielded, pigtail end</td>
</tr>
<tr>
<td>Contact insert: CuZn</td>
<td>Contact insert: CuZn</td>
<td>Cable length: 5 m (16.4 ft.)</td>
<td>Cable length: 5 m (16.4 ft.)</td>
</tr>
<tr>
<td>Operating temperature: −30...+85 °C (−22...+185 °F)</td>
<td>Operating temperature: −25...+85 °C (−13...+185 °F)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cable Ø: 4...8 mm (0.16...0.31 in.)</td>
<td>Cable Ø: 5...8 mm (0.2...0.31 in.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fastening torque: 0.6 Nm</td>
<td>Fastening torque: 0.6 Nm</td>
<td>Fastening torque: 1 Nm</td>
<td>Fastening torque: 1 Nm</td>
</tr>
</tbody>
</table>

Mounting clamp

<table>
<thead>
<tr>
<th>Mounting clamp</th>
<th>Part no. 403 508</th>
</tr>
</thead>
<tbody>
<tr>
<td>Material: Stainless steel 1.4301 / 1.4305 (AISI 304 / 303)</td>
<td></td>
</tr>
</tbody>
</table>

4/ Follow the manufacturer’s mounting instructions
Controlling design dimensions are in millimeters and measurements in ( ) are in inches
Design

1. Without position magnet (order separately)

Sensor model

1. Ultra low profile
2. Compact profile

Stroke length

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

- Standard stroke length (mm)*
  - Stroke length Ordering steps
    - 50 … 500 mm 25 mm
    - 500…2540 mm 50 mm

- Standard stroke length (in.)*
  - Stroke length Ordering steps
    - 2 … 20 in. 1.0 in.
    - 20…100 in. 2.0 in.

Connection type

1. M12 (5 pin) male connector

Operating voltage

1. +24 VDC (−15 / +20 %)

Output

1. Voltage
   - V 0 1 0…10 VDC (1 output channel with 1 position magnet)
   - V 1 1 10…0 VDC (1 output channel with 1 position magnet)
   - V 0 2 0…10 VDC (2 output channels with 2 position magnets)
   - V 1 2 10…0 VDC (2 output channels with 2 position magnets)
   - V 0 3 0…10 VDC and 10…0 VDC (2 output channels with 1 position magnet)

- Current
  - A 0 1 4…20 mA (1 output channel with 1 position magnet)
  - A 1 1 20…4 mA (1 output channel with 1 position magnet)
  - A 0 2 4…20 mA (2 output channels with 2 position magnets)
  - A 1 2 20…4 mA (2 output channels with 2 position magnets)

DELIVERY

• Sensor
• 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.

NOTICE

Use magnets of the same type for multi-position measurement,
e.g. 2 × U-magnets (part no. 251 416-2).

Manuals & Software available at: www.temposonics.com

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