Data Sheet

HE-Series Analog
Magnetostrictive Linear Position Sensors

- Linearity < ± 1 mm
- Resolution < 0.2 mm
- Compact Robust Design
- Stroke lengths from 100…500 mm
MEASURING TECHNOLOGY

Temposonics linear position sensors utilizing Hall Effect technology are able to determine position with a high level of repeatability and robustness. The sensors consist of a conducting sensing element, a position magnet and supporting electronics. The sensing element is powered by an electric current. The position magnet is attached to the object in motion for the given application. The magnet’s field component perpendicular to the sensing element creates a measurable voltage that is proportional to the strength of the magnetic field that is converted into a linear position measurement. Since the output from the sensor corresponds to an absolute position, rather than a relative value, recalibration is not required.

HE SENSOR

The Temposonics® HE-Series sensors utilizing Hall Effect technology are specifically designed for direct stroke measurement in hydraulic cylinders. With virtually no dead zone, tight pin to pin measurements can be achieved. HE-Series sensors can be fully sealed and embedded in a cylinder which provides excellent protection against the environment and EMI and ensures a long operating life. With six different mounting styles, the HE-Series sensors can be installed externally from the head side or internally from the rod side of the cylinder depending on the cylinder design. An optional Temposonics M12 connector system ensures protection to IP69K. Signal output: analog.
M12 CONNECTOR SYSTEM (TYPE “D”)

**Temposonics M12 connector system**
The M12 connector system meets the highest protection requirements important for a harsh environment in mobile hydraulic applications. Ingress Protection rating of IP69K (dust proof and high pressure water cleaning) with a mating connector.

1. The HE-Series (type “D”) is delivered by Temposonics together with the connector system:
   The connector insert carrier is already connected to the sensor conductors, i.e. no soldering and no color or connection mistake.

2. The connector insert is taken out of the cylinder through a bore hole. The flange can easily be clicked in position from outside.

3. Four standard screws must be tightened to mount the connector system on the cylinder. In case of using angled type connectors the connector insert can be rotated inside the flange in 45° steps.

4. With a corresponding mating plug the connector system fulfills a ingress protection rating of IP69K.

- Safe and easy installation.
- No soldering or crimping of connecting leads.
Fig. 3: HE-Series sensors types

Controlling design dimensions are in millimeters
CONNECTOR WIRING

**M12 connector**

<table>
<thead>
<tr>
<th>Pin</th>
<th>E</th>
<th>G</th>
<th>H</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>not connected</td>
<td>VDC</td>
<td>VDC</td>
</tr>
<tr>
<td>2</td>
<td>VDC</td>
<td>not connected</td>
<td>SIG</td>
</tr>
<tr>
<td>3</td>
<td>GND</td>
<td>GND</td>
<td>GND</td>
</tr>
<tr>
<td>4</td>
<td>SIG</td>
<td>SIG</td>
<td>not connected</td>
</tr>
</tbody>
</table>

**Cable / Wires**

<table>
<thead>
<tr>
<th>Cable</th>
<th>Wires</th>
</tr>
</thead>
<tbody>
<tr>
<td>BN</td>
<td>VDC</td>
</tr>
<tr>
<td>WH</td>
<td>GND</td>
</tr>
<tr>
<td>GN</td>
<td>SIG</td>
</tr>
</tbody>
</table>

Fig. 4: Pin assignment for M12 connector

**DTM06-3S**

- **Pin**
  - A: VDC
  - B: GND
  - C: SIG

**DT04-3P**

- **Pin**
  - A: VDC
  - B: GND
  - C: SIG

Fig. 6: Pin assignment of DTM06 connector (Part no. 254 597)

Fig. 7: Pin assignment of DT04 connector (Part no. 254 600)

Fig. 5: Cable assignment

ELECTRICAL INSTALLATION

**Signal and Stroke**

- **Signal HIGH**
  - 4 mA, 0.5 V
  - 20 mA, 4.5 V

- **Stroke**
  - ≥ 2 mm for sensor + magnet
  - + add cylinder tolerances

- **Retracted piston**
  - Mechanical stroke

- **Extended piston**

Fig. 8: Electrical installation
MECHANICAL INSTALLATION

In-Cylinder assembly (e.g. with flange type “D”)  
The robust linear position sensor HE is designed for direct stroke measurement in hydraulic cylinders.  
The position sensor can be installed from the head side or the rod side of the cylinder depending on the cylinder design.

![Diagram of In-Cylinder assembly](image)

**NOTICE**
- The sequence of snap ring, spacer, O-ring, plastic spacer and position magnet must be respected.
- Orient the polarity of the position magnet as shown (North toward sensor flange).
- Assemble the sensor with the delivered position magnet, do not mix the sensor with other magnets.

Controlling design dimensions are in millimeters.
TECHNICAL DRAWING

Type A (internal mounting (threaded flange 9/16"-18 UNF))

Type B (external mounting (thread flange 3/4"-16 UNF))

Fig. 10: Flange types “A” and “B”
Type C (pressure fit flange Ø 14 mm)

Controlling design dimensions are in millimeters
Type E (external mounting (threaded flange M18×1.5))

Type F (pressure fit flange Ø 14.5 mm)

Fig. 12: Flange types “E” and “F”

Controlling design dimensions are in millimeters
**Piston rod drilling – Magnet embedding**

![Diagram of piston rod drilling with dimensions and notes.]

**Fig. 13: Dimensions of piston drilling**

**NOTICE**

Minimum area of ferromagnetic material in the piston

Controlling design dimensions are in millimeters
## TECHNICAL DATA

### Output

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage</td>
<td>0.5…4.5 VDC</td>
</tr>
<tr>
<td>Current</td>
<td>4…20 mA</td>
</tr>
<tr>
<td>Measured value</td>
<td>Position</td>
</tr>
</tbody>
</table>

### Measurement parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resolution</td>
<td>&lt; 0.2 mm</td>
</tr>
<tr>
<td>Linearity</td>
<td>&lt; ±1 mm typ.</td>
</tr>
<tr>
<td>Repeatability</td>
<td>&lt; ±0.5 mm typ.</td>
</tr>
<tr>
<td>Hysteresis</td>
<td>&lt; ±0.5 mm typ.</td>
</tr>
</tbody>
</table>

### Operating conditions

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating temperature</td>
<td>−40…+85 °C</td>
</tr>
<tr>
<td>Humidity</td>
<td>95 % @ 55 °C (DIN EN 60068-2-30)</td>
</tr>
<tr>
<td>Ingress protection</td>
<td>M12 connector: IP69K plugged with mating connector EN60529; Sensor housing: IP67 EN60529</td>
</tr>
<tr>
<td>Shock test</td>
<td>50 g / 10 ms up to 500 mm sensor length (single shock) / IEC 60068-2-27 100 g / 6 ms up to 180 mm sensor length (single shock) / IEC 60068-2-27</td>
</tr>
<tr>
<td>Vibration test</td>
<td>Random Noise Peak Acceleration 15 g&lt;sub&gt;max&lt;/sub&gt; based on DIN EN 60068-2-64 15 g / 20…2000 Hz Sinusodial, IEC standard 60068-2-6 (resonance frequencies excluded)</td>
</tr>
<tr>
<td>EMC test</td>
<td>EN 61000-6-2 Radiated Immunity (industrial) EN 61000-6-4 Emissions (industrial) ISO 13766 Earth moving machinery DIN EN 13309 Construction machinery ISO 14982 Agricultural and forestry machinery The sensor meets the requirements of the EC directives and is marked with CE</td>
</tr>
</tbody>
</table>

### Design / Material

<table>
<thead>
<tr>
<th>Material</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensor housing</td>
<td>Stainless steel 1.4301 (AISI 304)</td>
</tr>
<tr>
<td>Sensor rod</td>
<td>Stainless steel 1.4307 (AISI 304L)</td>
</tr>
<tr>
<td>Stroke length</td>
<td>100…500 mm</td>
</tr>
<tr>
<td>Operation pressure PN (nominal operating)</td>
<td>320 bar</td>
</tr>
<tr>
<td>Operation pressure Pmax</td>
<td>400 bar</td>
</tr>
<tr>
<td>Operation pressure Pstatic (proof pressure)</td>
<td>525 bar</td>
</tr>
</tbody>
</table>

### Mechanical mounting

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
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<tbody>
<tr>
<td>Mounting position</td>
<td>Any</td>
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<tr>
<td>Mounting instruction</td>
<td>Please consult the technical drawings</td>
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### Electrical connection

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
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</thead>
<tbody>
<tr>
<td>Connection type</td>
<td>M12 male plug or cable assembly</td>
</tr>
<tr>
<td>Operating voltage</td>
<td>5 / 12 / 24 VDC (4.75…32 VDC) (400…500 mm 4.75…28 VDC)</td>
</tr>
<tr>
<td>Load (voltage output)</td>
<td>R&lt;sub&gt;L&lt;/sub&gt; ≥ 5 kΩ</td>
</tr>
<tr>
<td>Load (current output)</td>
<td>R&lt;sub&gt;L&lt;/sub&gt; ≤ 50 Ω (5 VDC), R&lt;sub&gt;L&lt;/sub&gt; ≤ 250 Ω (12 VDC), R&lt;sub&gt;L&lt;/sub&gt; ≤ 500 Ω (24 VDC)</td>
</tr>
<tr>
<td>Current consumption*</td>
<td>≤ 530 mA (5 VDC), ≤ 200 mA (12 VDC), ≤ 125 mA (24 VDC)</td>
</tr>
<tr>
<td>Polarity protection (GND – VDC)</td>
<td>Up to 32 VDC</td>
</tr>
<tr>
<td>Overvoltage protection (GND – VDC)</td>
<td>Up to 50 VDC</td>
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</table>

* length dependent
ORDER CODE

<table>
<thead>
<tr>
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<th>5</th>
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<th>16</th>
</tr>
</thead>
<tbody>
<tr>
<td>H</td>
<td>E</td>
<td>a</td>
<td>b</td>
<td>c</td>
<td>d</td>
<td>e</td>
<td>f</td>
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<td>h</td>
<td>i</td>
<td>j</td>
<td>k</td>
<td>l</td>
<td>m</td>
<td>n</td>
</tr>
</tbody>
</table>

**Sensor model**

H E Hall effect

**Design**

2 2nd Generation

**Flange**

A Threaded flange 9/16”-18 UNF (for internal mounting), AF 17.5
B Threaded flange ¾”-16 UNF (for external mounting), AF 24
C Small pressure fit flange (14 mm)
D Large pressure fit flange (20 mm) incl. M12 connector & flange
E Threaded flange M18×1.5 (for external mounting), AF 24
F Small pressure fit flange (14.5 mm)

**Stroke length**

X X X M 100…500 mm (20 mm increments)

**Connection type**

Single wires (for all flange options)

N 0 4 40 mm
N 0 6 60 mm
N 0 8 80 mm
N 1 0 100 mm
N 1 2 120 mm
N 1 4 140 mm
N 1 6 160 mm
N 1 8 180 mm
N 2 0 200 mm
N 2 2 220 mm
N 2 4 240 mm
N 2 5 250 mm

PUR Cable (for all flange options)

T 0 3 300 mm
T 0 5 500 mm
T 1 0 1000 mm
T 2 0 2000 mm
T 3 0 3000 mm
T 5 0 5000 mm

**Cable / Wire / Pin termination**

For all flange options

A Cable / wire assignment “A”

With flange option “D” (with M12 connector)

E Pin assignment “E”
G Pin assignment “G”
H Pin assignment “H”

**Operating voltage**

3 +5 / 12 / 24 VDC (4.75…32 VDC)

**Output**

V 1 2 0.5…4.5 VDC
A 0 1 4…20 mA

DETERMINATION

Position sensor with flange O-ring(s), magnet, spacer, washer, mounting clip, M12 connector with flange (optional)

Accessories have to be ordered separately.

NOTICE

- Consider the mechanical tolerances
- Consider the minimum area of ferromagnetic material in the piston
- The sequence of snap ring, spacer, O-ring, plastic spacer and position magnet must be respected
- Orient the polarity of the position magnet (North toward sensor flange)
- Assemble the sensor with the delivered position magnet, do not mix the sensor with other magnets
# HE-Series Analog Data Sheet

## Frequently Ordered Accessories

<table>
<thead>
<tr>
<th>Test kit</th>
<th>Cord sets and adapter cables</th>
<th>M12 flange</th>
</tr>
</thead>
</table>
| Test kit Analog  
Part no. 280 618 | 4 pin M12 to DTM06 connector  
Part no. 254 597 | 4 pin M12 to DT04 connector  
Part no. 254 600 | M12 flange  
Part no. 253 769 |

**Scope of delivery:**
- Analog / PWM Tester
- 12 VDC battery charger with adapter (adapter main plug EU, adapter main plug UK)
- cables with M12 connector
- cable with pigtailed wires
- cable with Deutsch DT06-3S connector
- carrying case
- CD-Rom with user’s guide

- M12 connector: Brass/Nickel
- DT connector: DTM06 3 pin
- Material: PVC Jacket
- Cable length: 274 mm
- Cable Ø: 5 mm
- Operating temperature: −40...+105 °C

- M12 connector: Brass/Nickel
- DT connector: DT04 3 pin
- Material: PVC Jacket
- Cable length: 274 mm
- Cable Ø: 5 mm
- Operating temperature: −40...+105 °C

- Material flange: Brass nickel-plated
- Material O-ring: 13×1.6 NBR70

*Controlling design dimensions are in millimeters*