Data Sheet

MHRM Analog
Magnetostrictive Linear Position Sensors

- For embedded or externally threaded installation
- Sensor rod with Ø 7 mm or Ø 10 mm
- Resolution: ±0.1 mm typ.
- Compliant with EN 50121-3-2
MEASURING TECHNOLOGY

For position measurement, the absolute, linear Temposonics position sensors make use of the properties offered by the specially designed magnetostrictive waveguide. Inside the sensor a torsional strain pulse is induced in the waveguide by momentary interaction of two magnetic fields. The interaction between these two magnetic fields produces a strain pulse, which is detected by the electronics at the head of the sensor. One field is produced by a moving position magnet, which travels along the sensor rod with the waveguide inside. The other field is generated by a current pulse applied to the waveguide. The position of the moving magnet is determined precisely by measuring the time elapsed between the application of the current pulse and the arrival of the strain pulse at the sensor electronics housing. The result is a reliable position measurement with high accuracy and repeatability.

PRODUCT DESCRIPTION AND TECHNOLOGY

The MHRM sensor extends the rugged design of the Temposonics® MH-Series sensors to railway applications. With two mounting styles, the responsive magnetostrictive linear position sensors can be integrated into most installations. The inherent absolute capabilities ensure that the MHRM sensor is always ready.

The new MHRM model meets the requirements for shock and vibration according to EN 61373 and IEC 60068-2-64 and are compliant with EN 50121-3-2 and EN 61000-6-x (see technical data).

Simple mechanics

Temposonics® MHRM Analog
Data Sheet

1. The extremely robust sensor consists of the following main parts:
   - The innovative connector system is easy to install without soldering or crimping. It is dust-and waterproof up to IP69K.
   - The flange housing with built-in electronics and signal converter.

2. The position magnet as only moving part, is assembled into the piston bottom. This permanent magnet travels wear-free and contactless along the pressure pipe and measures the actual position.

3. The pressure pipe placed within the drilled piston rod contains the protected magnetostrictive sensing element.

Fig. 1: Time-based magnetostrictive position sensing principle

Fig. 2: In-Cylinder installation
THE INTERCONNECTION PLUG

Temposonics presents the InterConnection plug combined with our reliable M12 connector system. The connection plug is modular, configurable and can be combined with all common connector systems. The M12 connector meets the highest protection requirements that are important for harsh environments in mobile hydraulic applications. The IP69K protection type means

✓ Safe and easy installation
✓ No soldering or crimping of connecting leads

1. The InterConnection plug invented by Temposonics.
2. The InterConnection plug combined with our reliable M12 connector system.
3. The connector insert is taken out of the cylinder through a bore hole. The flange can easily be clicked in position from outside. Four standard screws must be tightened to mount the connector system on the cylinder. In the 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 an IP rating of IP69K.
Controlling design dimensions are in millimeters

Fig. 3: MHRM embedded models
MHRM EMBEDDED – TECHNICAL DATA

Output
Signal characteristic: Analog output restricted by noise or A/D converter of control unit
Voltage: 0.25…4.75 VDC, 0.5…4.5 VDC, 0.25…9.75 VDC, 4.75…0.25 VDC, 4.5…0.5 VDC, 9.75…0.25 VDC
Current: 4…20 mA, 20…4 mA
Measured value: Position

Measurement parameters
Resolution: ±0.1 mm typical
Linearity: 0050…0250 mm, 0255…2000 mm, 2005…2500 mm
Hysteresis: ±0.2 mm
Setpoint tolerance: ±2 mm

Operating conditions
Operating temperature: -40…+105 °C
Storage temperature: -25…+65 °C
Humidity: 90 % relative humidity, no condensation
Ingress protection: M12 connector IP67 / IP69K (correctly fitted), Sensor housing IP67
Shock test (according to EN 50155): According to EN 61373 Cat2 (Bogie) and Cat3 (Axle)
Vibration test (according to EN 50155): According to IEC 60068-2-64-Fn Cat3 (Axle)
EMC test (according to EN 50155): EN 50121-3-2, ISO 14982 Agricultural and forest machines, EN 13309 Construction machines, ISO 16750-2, Electromagnetic immunity according to EN 61000-6-2, Electromagnetic emission according to EN 61000-6-3, RF immunity 200 V/m per ISO 11452-2/-4

PCB coating: According to EN 50155
Pressure (according to DIN EN ISO 19879)*: Ø 7 mm sensor rod, Ø 10 mm sensor rod
PN (nominal operating): 300 bar, 350 bar
Pmax (max. overload): 400 bar, 450 bar
Psmax (proof pressure): 525 bar, 625 bar

Design / Material
Housing lid: Compound PBT (glass fiber reinforced plastic), sealing ring: TPU
Sealing: O-ring NBR with back-up ring PTFE
Sensor electronics housing: Stainless steel 1.4305 (AISI 303)
Sensor rod – Ø 7 mm: Stainless steel 1.4301 (AISI 304)
Sensor rod – Ø 10 mm: Stainless steel 1.4306 (AISI 304L)
Stroke length: 50…2500 mm

Mechanical mounting
Mounting instruction: Please consult the technical drawings
Mounting position: Any

Electrical installation
Connector: InterConnection plug
Operating voltage: 12 / 24 VDC (8…32 VDC)
Load (output mA): 24 VDC supply, ≤ 500 Ω, ≤ 250 Ω
Load (output VDC): R⃞ ≥ 10 kΩ, R⃞ ≥ 10 kΩ
Inrush current: 4.5 A / 2 ms, 2.5 A / 2 ms
Operating voltage ripple: 1 %\(\text{pp}\)
Power drain: ≤ 1 W
Over voltage protection (VDC-GND): Up to +36 VDC
Polarity protection (GND-VDC): Up to +36 VDC
Insulation resistance: R ≥ 10 MΩ @ 60 sec according to EN 50155
Dielectric strength: 708 VDC (DC ground to machine ground) according to EN 50155

*/ According to calculations under use of the FKM guideline

<table>
<thead>
<tr>
<th>Cycles</th>
<th>Ø 7 mm sensor rod</th>
<th>Ø 10 mm sensor rod</th>
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<tbody>
<tr>
<td>Dynamic pressure: &lt; 2 × 10^10 pressure cycles</td>
<td>300 bar</td>
<td>350 bar</td>
</tr>
<tr>
<td>Static pressure: &lt; 2 × 10^9 pressure cycles</td>
<td>400 bar</td>
<td>450 bar</td>
</tr>
<tr>
<td>Proof pressure: Maximum 5 minutes testing time for cylinder pressure test</td>
<td>525 bar</td>
<td>625 bar</td>
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MECHANICAL INSTALLATION – MHRM EMBEDDED

Installation in a hydraulic cylinder
The robust Temposonics® MH sensor is designed for direct stroke measurement in hydraulic cylinders. The Temposonics® MH sensor can be installed from the head side or the rod side of the cylinder depending on the cylinder design. In both installation methods, the sensor seals the cylinder by using an O-Ring and backup ring which is installed on the sensor housing.

Fig. 4: Example of In-Cylinder assembly

**NOTICE**
The bore depth in piston:
Null zone + Stroke length + Dead zone + > 3 mm

Space requirements

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<th>B</th>
<th>D</th>
<th>d</th>
<th>H</th>
<th>h</th>
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<tr>
<td>52 mm</td>
<td>48H8</td>
<td>39.9 mm</td>
<td>25 mm</td>
<td>&gt; 15 mm</td>
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Fig. 5: Space requirements for cylinder

- The position magnet shall not touch the pressure pipe.
- Do not exceed the operating pressure.
- Note the piston rod drilling:
  - Ø 7 mm rod: ≥ Ø 10 mm
  - Ø 10 mm rod: ≥ Ø 13 mm

**Set screw**
e.g. retaining with set screw ISO 4026 M5×10 (with flat point!).
Fastening torque: 0.44 Nm to 0.50 Nm

**Notice:** Ensure threads are free of oil, grease and debris

Controlling design dimensions are in millimeters

Please refer to the installation manual for complete installation instructions!
## CONNECTOR WIRING

### Connector wiring for InterConnection plug with M12 connector

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<td>VDC&lt;sub&gt;GND&lt;/sub&gt;</td>
<td>VDC&lt;sub&gt;GND&lt;/sub&gt;</td>
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<td>4</td>
<td>SIG</td>
<td>SIG&lt;sub&gt;GND&lt;/sub&gt;</td>
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### Connector wiring for InterConnection plug with cable outlet

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<td>SIG&lt;sub&gt;GND&lt;/sub&gt;</td>
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<tr>
<td>3</td>
<td>VDC&lt;sub&gt;GND&lt;/sub&gt;</td>
<td>VDC&lt;sub&gt;GND&lt;/sub&gt;</td>
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<tr>
<td>4</td>
<td>SIG</td>
<td>SIG&lt;sub&gt;GND&lt;/sub&gt;</td>
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Fig. 7: Connecting wiring
MHRM EMBEDDED – ORDER CODE

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</table>

**a** Sensor model

MH Railway – Embedded

**b** Sensor rod diameter

1. Ø 10 mm
2. Ø 7 mm

**c** End plug

- **A** Flat
- **R** M6 female thread *(only for Ø 10 mm sensor rods)*
- **U** M8 male thread *(only for Ø 10 mm sensor rods)*

**d** Stroke length

- X X X X 0050…2500 mm *(in 5 mm steps)*

**e** Operation voltage

3. +12 / 24 VDC *(8…32 VDC)*

**f** Output

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| V | 1 | 1 | 0.25…4.75 VDC
| V | 1 | 2 | 0.50…4.5 VDC
| V | 1 | 3 | 4.75…0.25 VDC
| V | 1 | 4 | 4.5…0.5 VDC
| V | 2 | 3 | 0.25…9.75 VDC
| V | 2 | 5 | 9.75…0.25 VDC

**g** Connection

D InterConnection plug

**DELIVERY**

Sensor, O-ring, back-up ring

Accessories have to be ordered separately

Manuals, Software & 3D Models available at:

www.temposonics.com

**How to order**

**Example 1 – Sensor with M12 connector**

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|   | 1. Sensor | MHE-1-A-0400-3-V11-D
|   | 2. InterConnection plug with M12 connector | 370715-12-0060
|   | 3. M12 flange | 253 769
|   | 4. Position magnet | 401 032

**Example 2 – Sensor with cable outlet**

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|   | 1. Sensor | MHE-1-A-0400-3-V11-D
|   | 2. InterConnection plug (shielded cable) | 370800-01000
|   | 3. Position magnet | 401 032
### INTERCONNECTION PLUG WITH M12 CONNECTOR – ORDER CODE

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### INTERCONNECTION PLUG WITH CABLE OUTLET – ORDER CODE

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MHRM THREADED – TECHNICAL DRAWING

Threaded model with Ø 7 mm sensor rod and flat rod end (MHM-7-A-... / MHU-7-A-...)

- **Sensor electronics housing**: 36
- **Null zone**: 19
- **Stroke length**: 50...2500
- **Dead zone**: 52
- **Magnet**: Ø7 x 0.33
- **Connection**: M18×1.5 ¾"-16 UNF

**Dimensions**:
- Ø 7
- Ø 27
- Ø 38
- 7.9

Threaded model with Ø 10 mm sensor rod and flat rod end (MHM-1-A-... / MHU-1-A-...)

- **Sensor electronics housing**: 36
- **Null zone**: 19
- **Stroke length**: 50...2500
- **Dead zone**: 52
- **Magnet**: Ø7 x 0.33
- **Connection**: M18×1.5 ¾"-16 UNF

**Dimensions**:
- Ø 10
- Ø 27
- Ø 38
- 7.9

Fig. 8: MHRM threaded with ring magnet, part 1

Controlling design dimensions are in millimeters
Threaded model with Ø 10 mm sensor rod and M6 female thread rod end (MHM-1-R-... / MHU-1-R-...)

Threaded model with Ø 10 mm sensor rod and M8 male thread rod end (MHM-1-U-... / MHU-1-U-...)

Controlling design dimensions are in millimeters
**Output**

- **Signal characteristic**: Analog output restricted by noise or A/D converter of control unit
- **Voltage**: 0.25…4.75 VDC; 0.5…4.5 VDC; 0.25…9.75 VDC; 4.75…0.25 VDC; 4.5…0.5 VDC; 9.75…0.25 VDC
- **Current**: 4…20 mA; 20…4 mA
- **Measured value**: Position

**Measurement parameters**

- **Resolution**: ≤ ±0.1 mm typical
- **Linearity**: ≤ ±0.1 mm, ≤ ±0.04 % (F.S.), ≤ ±0.8 mm
- **Hysteresis**: ≤ ±0.2 mm
- **Setpoint tolerance**: ±2 mm

**Operating conditions**

- **Operating temperature**: −40…+105 °C
- **Storage temperature**: −25…+65 °C
- **Humidity**: 90 % relative humidity, no condensation
- **Ingress protection – M12 connector**: IP67 / IP69K (correctly fitted)
- **Ingress protection – Sensor housing**: IP69K (with M12 connection fitted)
- **Shock test (according to EN 50155)**: According to EN 61373 Cat2 (Bogie) and Cat3 (Axle)
- **Vibration test (according to EN 50155)**: According to IEC 60068-2-64-Fn Cat3 (Axle)
- **EMC test (according to EN 50155)**: EN 50121-3-2
  - ISO 14982 Agricultural and forest machines
  - EN 13309 Construction machines
  - ISO 16750-2
  - Electromagnetic immunity according to EN 61000-6-2
  - Electromagnetic emission according to EN 61000-6-3
  - RF immunity 200 V/m per ISO 11452-2/-4
- **PCB coating**: According to EN 50155

**Pressure (according to DIN EN ISO 19879)***

- Ø 7 mm sensor rod: 300 bar
- Ø 10 mm sensor rod: 350 bar

**Materials and dimensions**

- **Housing lid**: Stainless steel 1.4305 (AISI 303)
- **Sealing**: O-ring NBR
- **Sensor electronics housing**: Stainless steel 1.4305 (AISI 303)
- **Sensor rod Ø 7 mm**: Stainless steel 1.4301 (AISI 304)
- **Sensor rod Ø 10 mm**: Stainless steel 1.4306 (AISI 304L)
- **Stroke length**: 50…2500 mm

**Mechanical mounting**

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

**Electrical installation**

- **Connector**: 1 × M12 male connector (4 pin)
- **Operating voltage**: 12 / 24 VDC (8…32 VDC)
- **Load (output mA)**: $R_L \leq 500 \, \Omega$
- **Load (output VDC)**: $R_L \geq 10 \, k\Omega$
- **Inrush current**: 4.5 A / 2 ms
- **Operating voltage ripple**: 1 %
- **Power drain**: ≤ 1 W
- **Over voltage protection (VDC-GND)**: Up to +36 VDC
- **Polarity protection (GND-VDC)**: Up to −36 VDC
- **Insulation resistance**: $R \geq 10 \, M\Omega$ @ 60 sec according to EN 50155
- **Dielectric strength**: 708 VDC (DC ground to machine ground) according to EN 50155

---

**Dynamic pressure**

- 300 bar

**Static pressure**

- 400 bar

**Proof pressure**

- 625 bar

---

* According to calculations under use of the FKM guideline
MECHANICAL INSTALLATION – MHRM THREADED

Hydraulics sealing
For sealing the flange contact surface, a sealing via an O-ring in the undercut is necessary.

O-ring size (included with threaded sensors):
For threaded flange (¾"-16 UNF): 0-ring 16.4 × 2.2 mm (part no. 560 315)
For threaded flange (M18×1.5): 15.3 × 2.2 mm (part no. 401 133)

![Sealing via O-ring in the flange undercut](image)

- Note the fastening torque of 50 Nm.
- The flange contact surface must be seated completely on the cylinder mounting surface.
- The cylinder manufacturer determines the pressure-resistant gasket (copper gasket, O-ring, etc.).
- The position magnet should not rub on the sensor rod.
- The peak pressure should not be exceeded.
- Protect the sensor rod against wear.

**NOTICE**
- The bore depth in piston:
  - Null zone + Stroke length + Dead zone ≥ 3 mm
- Note the piston rod drilling:
  - Ø 7 mm rod: ≥ Ø 10 mm
  - Ø 10 mm rod: ≥ Ø 13 mm

CONNECTOR WIRING

**Connector wiring for M12 connector**

<table>
<thead>
<tr>
<th>Pin</th>
<th>L</th>
<th>Q</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>VDC</td>
<td>VDC</td>
</tr>
<tr>
<td>2</td>
<td>SIG</td>
<td>SIG</td>
</tr>
<tr>
<td>3</td>
<td>VDC</td>
<td>VDC</td>
</tr>
<tr>
<td>4</td>
<td>SIG</td>
<td>SIG</td>
</tr>
</tbody>
</table>

![Connector wiring](image)

Controlling design dimensions are in millimeters.
Please refer to the installation manual for complete installation instructions!
### MHRM THREADED – ORDER CODE

<p>| | | | | | | | | | | | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td></td>
<td></td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>H</td>
<td></td>
<td>b</td>
<td>c</td>
<td>d</td>
<td>e</td>
<td>f</td>
<td>g</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

**a** Sensor model

- M H M: MH Railway with threaded flange M18×1.5
- M H U: MH Railway with threaded flange ¾”-16 UNF

**b** Sensor rod diameter

- 7: Ø 7 mm
- 1: Ø 10 mm

**c** End plug

- A: Flat
- R: M6 thread female (only for Ø 10 mm sensor rods)
- U: M8 thread male (only for Ø 10 mm sensor rods)

**d** Stroke length

- X X X X: 0050…2500 mm (in 5 mm steps)

**e** Operation voltage

- 3: +12 / 24 VDC (8…32 VDC)

**f** Output

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **Current**
  - A 0 1: 4…20 mA
  - A 0 4: 20…4 mA

- **Voltage**
  - V 1 1: 0.25…4.75 VDC
  - V 1 2: 0.50…4.5 VDC
  - V 1 3: 4.75…0.25 VDC
  - V 1 4: 4.5…0.5 VDC
  - V 2 3: 0.25…9.75 VDC
  - V 2 5: 9.75…0.25 VDC

**g** Pin out for M12 connector

- L: M12 connector (L: 1-3-2-4)
- Q: M12 connector (Q: 1-3-4-2)

### DELIVERY

- Sensor, O-ring: Accessories have to be ordered separately

---

Manuals, Software & 3D Models available at: [www.temposonics.com](http://www.temposonics.com)
## FREQUENTLY ORDERED ACCESSORIES

### Position magnets

<table>
<thead>
<tr>
<th>Ring magnet OD17.4</th>
<th>Ring magnet OD25.4</th>
<th>Ring magnet OD32.8</th>
<th>MH test kit (analog)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Part no. 401 032</td>
<td>Part no. 400 533</td>
<td>Part no. 201 542-2</td>
<td>Part no. 280 618</td>
</tr>
<tr>
<td>Material: PA neobind</td>
<td>Material: PA ferrite</td>
<td>Material: PA ferrite GF20</td>
<td>Kit includes:</td>
</tr>
<tr>
<td>Weight: Ca. 5 g</td>
<td>Weight: Ca. 10 g</td>
<td>Weight: Ca. 14 g</td>
<td>• 12 VDC battery charger with adapter (EU &amp; UK)</td>
</tr>
<tr>
<td>Operating temperature: −40…+100 °C</td>
<td>Operating temperature: −40…+100 °C</td>
<td>Operating temperature: −40…+100 °C</td>
<td>• Cables with M12 connector</td>
</tr>
<tr>
<td>Surface pressure #: Max. 20 N/mm²</td>
<td>Surface pressure #: Max. 40 N/mm²</td>
<td>Surface pressure #: Max. 40 N/mm²</td>
<td>• Cable with pigtailed wires</td>
</tr>
<tr>
<td>Surface pressure #: Max. 20 N/mm²</td>
<td></td>
<td></td>
<td>• Carrying case</td>
</tr>
</tbody>
</table>

### Test kit

- Kit includes:
  - 12 VDC battery charger with adapter (EU & UK)
  - Cables with M12 connector
  - Cable with pigtailed wires
  - Carrying case

- Please order test kit cables separately

### Test kit cable

- **MHRM test cable with M12 connector – banana plugs (pin assignment L)**
  - Part no. 254 827-1
  - see connector wiring on page 17

- **MHRM test cable with M12 connector – banana plugs (pin assignment Q)**
  - Part no. 254 827-2
  - see connector wiring on page 17

- **MHRM test cable with banana plug – pig tail**
  - Part no. 254 828
  - see connector wiring on page 17

---

**NOTICE**

See page 13 for InterConnection plug order code

Controlling design dimensions are in millimeters
<table>
<thead>
<tr>
<th><strong>InterConnection plug shielded cable</strong></th>
<th><strong>InterConnection plug M12</strong></th>
<th><strong>M12 flange</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Part no. 370 799 / 370 800</td>
<td>Part no. 370 715</td>
<td>Part no. 253 769</td>
</tr>
</tbody>
</table>

1. **InterConnection plug**  
   Material: PPE (glass fiber reinforced plastic)

2. **4 wires**  
   0.50 mm² (AWG20) copper strands according to IEC 60228 – insulation polyolefin  
   Cable jacket: Black Elastomer compliant with fire performance for rolling stock equipment according to EN 50306-1

3. **M12 plug**  
   Material: PA reinforced  
   (with O-ring 7 × 1.35 mm NBR70)  
   Pins: Brass with gold plating

4. **InterConnection plug**  
   Material: PPE (glass fiber reinforced plastic)

5. **4 Wires**  
   4 × 0.22 mm² (AWG24) – PE insulation according to ISO 6722-C

6. **M12 flange**  
   Material flange: Brass nickel-plated  
   Material O-ring: 13×1.6 NBR70

Controlling design dimensions are in millimeters
### CONNECTOR WIRING

#### Connector wiring for test kit cable 254 827-1 (pin assignment L)

<table>
<thead>
<tr>
<th>Pin</th>
<th>Function</th>
<th>Wire color</th>
<th>Banana plug color</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>VDC</td>
<td>BN</td>
<td>BN</td>
</tr>
<tr>
<td>2</td>
<td>SIG GND</td>
<td>WH</td>
<td>WH</td>
</tr>
<tr>
<td>3</td>
<td>VDC GND</td>
<td>BU</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>SIG</td>
<td>BK</td>
<td>GN</td>
</tr>
</tbody>
</table>

#### Connector wiring for test kit cable 254 827-2 (pin assignment Q)

<table>
<thead>
<tr>
<th>Pin</th>
<th>Function</th>
<th>Wire color</th>
<th>Banana plug color</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>VDC</td>
<td>BN</td>
<td>BN</td>
</tr>
<tr>
<td>2</td>
<td>SIG</td>
<td>WH</td>
<td>GN</td>
</tr>
<tr>
<td>3</td>
<td>VDC GND</td>
<td>BU</td>
<td>WH</td>
</tr>
<tr>
<td>4</td>
<td>SIG GND</td>
<td>BK</td>
<td></td>
</tr>
</tbody>
</table>

#### Connector wiring for test kit cable 254 828

<table>
<thead>
<tr>
<th>Wire color</th>
<th>Function</th>
<th>Banana plug color</th>
</tr>
</thead>
<tbody>
<tr>
<td>BN</td>
<td>VDC</td>
<td>BN</td>
</tr>
<tr>
<td>WH</td>
<td>SIG</td>
<td>GN</td>
</tr>
<tr>
<td>YE</td>
<td>VDC GND</td>
<td>WH</td>
</tr>
<tr>
<td>GN</td>
<td>SIG GND</td>
<td></td>
</tr>
</tbody>
</table>

---

**NOTICE**

* test cables to be ordered separately
**MECHANICAL INSTALLATION – POSITION MAGNET**

For cylinder installation:

- Note the piston rod drilling:
  - Ø 7 mm rod: ≥ Ø 10 mm
  - Ø 10 mm rod: ≥ Ø 13 mm

The bore depth in piston:

- Null zone + Stroke length + Dead zone + > 3 mm

---

**Magnet installation for In-Cylinder applications**

1. Circlip
2. Non-magnetic spacer
3. Position magnet
4. Non-magnetic spacer (≥ 5 mm)

**Position magnet (Part no.)**

<table>
<thead>
<tr>
<th></th>
<th>401 032</th>
<th>400 533</th>
<th>201 542-2</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>&gt; 17.4 mm</td>
<td>&gt; 25.4 mm</td>
<td>&gt; 32.8 mm</td>
</tr>
<tr>
<td>B</td>
<td>≥ 18 mm</td>
<td>≥ 18 mm</td>
<td>≥ 18 mm</td>
</tr>
<tr>
<td>C</td>
<td>Rod Ø 7 mm</td>
<td>Piston rod drilling ≥ Ø 10 mm</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Rod Ø 10 mm</td>
<td>Piston rod drilling ≥ Ø 13 mm</td>
<td></td>
</tr>
</tbody>
</table>

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_Fig. 15: Dimensions for magnet mounting_