Special features

- exceptionally durable design for extreme environmental conditions
- absolute potentiometric measuring system
- angle ranges 120°, 200° or 350° in one or two-channel versions
- increased corrosion protection by anodized aluminum housing and stainless steel shaft, salt spray resistant
- very good linearity
- repeatability 0.01°
- no mechanical rotation limit
- sealed to IP6K9K (w/cable output)
- high temperature range
- high lifetime >100 million movements, even under high vibration environments

The IPX7900 was developed for measuring the steering angle in electro-hydraulic steering systems. It offers reliable operation in mobile applications, under extreme environmental conditions.

It uses Novotechnik’s highly-regarded conductive plastic potentiometer technology, with damped precious metal wiper.

An anodized aluminum housing and a stainless steel shaft with double ball bearing provide an extremely strong housing.

High shaft load specifications allow the use of lever arms (see options) or other couplings.

Applications

- Position measurement in steering systems
- pivotable vehicle bracings
- Transport systems with several axes
- Construction and agricultural machinery

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Description

<table>
<thead>
<tr>
<th>Description</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Housing</td>
<td>anodized aluminum; AlMgSi1, salt spray resistant</td>
</tr>
<tr>
<td>Shaft</td>
<td>stainless steel 1.4305 / X10CrNiSi18-9</td>
</tr>
<tr>
<td>Bearing</td>
<td>double ball bearings</td>
</tr>
<tr>
<td>Resistance element</td>
<td>conductive plastic</td>
</tr>
<tr>
<td>Wiper</td>
<td>precious metal multifinger wiper</td>
</tr>
<tr>
<td>Electrical connections</td>
<td>cable with cable gland or plug M12x1</td>
</tr>
</tbody>
</table>
**Connection assignment**

**Shaft versions**

IPX-79_1-——-——-

- \( \phi 4.1 \)
- \( 5 \)
- \( 11 \)
- \( \text{max. 14.5} \)

IPX-79_3-——-——-

- \( \phi 10 \)
- \( 11 \)
- \( \text{max. 18.5} \)

IPX-79_5-——-——-

- \( \phi 14 \)
- \( 12 \)
- \( 3 \)
- \( \text{max. 25.6} \)

**Electrical connections**

- IPX-79_——-202
  - Kanal 2
  - Channel 2
  - \( (22.5°) \)

- IPX-79_——-302
  - Kanal 1
  - Channel 1
  - \( (22.5°) \)

- IPX-79_——-651
  - Kanal 2
  - Channel 2
  - \( (22.5°) \)

- IPX-79_——-651
  - Kanal 1
  - Channel 1
  - \( (22.5°) \)

**Connector pin assignment**

- Pin #4 not connected!

**Connection assignment**

<table>
<thead>
<tr>
<th>Signal</th>
<th>Connector M12 one-channel</th>
<th>redundant</th>
</tr>
</thead>
<tbody>
<tr>
<td>K1 / connection 1</td>
<td>pin 1</td>
<td>K1 / pin 1</td>
</tr>
<tr>
<td>K1 / connection 2</td>
<td>pin 2</td>
<td>K1 / pin 2</td>
</tr>
<tr>
<td>K1 / connection 3</td>
<td>pin 3</td>
<td>K1 / pin 3</td>
</tr>
<tr>
<td>K1 not assigned</td>
<td>pin 4</td>
<td>K1 / pin 4</td>
</tr>
<tr>
<td>K2 / connection 1</td>
<td>-</td>
<td>K2 / pin 1</td>
</tr>
<tr>
<td>K2 / connection 2</td>
<td>-</td>
<td>K2 / pin 2</td>
</tr>
<tr>
<td>K2 / connection 3</td>
<td>-</td>
<td>K2 / pin 3</td>
</tr>
<tr>
<td>K2 not assigned</td>
<td>-</td>
<td>K2 / pin 4</td>
</tr>
</tbody>
</table>

K1 = channel 1, K2 = channel 2
### Electrical Data

<table>
<thead>
<tr>
<th>Parameter</th>
<th>120 ±2</th>
<th>200 ±2</th>
<th>350 ±2</th>
<th>°</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal resistance</td>
<td>2</td>
<td>2</td>
<td>5</td>
<td>kΩ</td>
</tr>
<tr>
<td>Resistance tolerance</td>
<td>± 15</td>
<td></td>
<td></td>
<td>%</td>
</tr>
<tr>
<td>Repeatability</td>
<td>0.002 (0.007°)</td>
<td></td>
<td></td>
<td>%</td>
</tr>
<tr>
<td>Temperature coefficient of the output to applied voltage ratio</td>
<td>typ. 10</td>
<td></td>
<td></td>
<td>ppm/K</td>
</tr>
<tr>
<td>Independent linearity</td>
<td>±0.2</td>
<td>±0.1</td>
<td>±0.1</td>
<td>%</td>
</tr>
<tr>
<td>Max. permissible applied voltage</td>
<td>42</td>
<td></td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>Recommended operating wiper current</td>
<td>&lt; 1 μA</td>
<td></td>
<td></td>
<td>mA</td>
</tr>
<tr>
<td>Max. allowed wiper current in case of malfunction</td>
<td>10</td>
<td></td>
<td></td>
<td>mA</td>
</tr>
<tr>
<td>Insulation resistance (500 VDC, 1 bar, 2 s)</td>
<td>&gt; 100 MΩ</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dielectric strength (50 Hz, 2 s, 1 bar, 500 VAC)</td>
<td>≤ 1000 V&lt;sub&gt;max&lt;/sub&gt;</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Mechanical Data

<table>
<thead>
<tr>
<th>Parameter</th>
<th>8 ± 1 Ncm</th>
<th></th>
<th></th>
<th>°</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fastening torque of mounting screws at housing flange</td>
<td></td>
<td></td>
<td></td>
<td>N</td>
</tr>
<tr>
<td>Mechanical travel</td>
<td>360 continuous</td>
<td></td>
<td></td>
<td>N</td>
</tr>
<tr>
<td>Permitted shaft load (static or dynamic force)</td>
<td>300 N</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operating torque max. *</td>
<td>4 Ncm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum operational speed</td>
<td>50 min&lt;sup&gt;-1&lt;/sup&gt;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight approx.</td>
<td>500 g</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Environmental Data

<table>
<thead>
<tr>
<th>Parameter</th>
<th>-40 ... +105 °C</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Vibration IEC 60068-2-6</td>
<td>5 ... 2000 Hz</td>
<td>Amax = 0.75 mm, amax = 5 g</td>
<td>mm</td>
<td></td>
</tr>
<tr>
<td>Shock IEC 60068-2-27</td>
<td>50 g</td>
<td>6 ms</td>
<td></td>
<td>ms</td>
</tr>
<tr>
<td>Life time</td>
<td>&gt; 100 x 10&lt;sup&gt;6&lt;/sup&gt; movements</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MTTF</td>
<td>429 years</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*) Depending on the environmental temperature and standstill time, the necessary force for the initial operating of the shaft may increase.
### Ordering specifications

**Preferred types printed in bold**

| I | P | X |  | 7 | 9 | 1 | 1 | - | 8 | 3 | 5 | - | 0 | 0 | 1 | - | 6 | 5 | 1 |

- **Electrical version**
  - **001: Potentiometer with standard linearity**
    - **Electrical connection**
      - one-channel version: 1 output
      - 202: 1 x cable 4-pole, 2.0 m, shielded
      - 551: 1 x connector M12, 4-pole
      - fully redundant version: 2 outputs
      - 302: 2 x cable 4-pole, 2.0 m, shielded
      - 651: 2 x connector M12, 4-pole
    - Cable version and assembled connectors on request

- **Shaft**
  1: Steel D13x12 mm with cross hole D 4.1 mm
  3: Steel D10x16 mm with countersink D4.5 x 90°

- **Housing**
  1: Centering shaft side
  4: Centering shaft and cover side

- **Series**
  - 79: Ø 79 x 35 mm

---

**Important**

All the values given in this data sheet for linearity, lifetime and temperature coefficient in the voltage dividing mode are quoted for the device operating with the wiper voltage driving on operational amplifier working as a voltage follower, where virtually no load is applied to the wiper (i.e. ≤ 1 µA).
**Accessories**

**Sensor mounting**

- **Z-IPX-M01**
  - Lever arm 165 x 20 mm for pivot head drive
  - aluminum, anodized
  - for shaft IPX-79_1...
  - P/N 400105430
  - Assembly material (screw, locking pin) included in delivery

- **Z-IPX-M11**
  - Lever arm 165 x 20 mm for lever arm drive, clamp connection on dimension 20 mm
  - aluminum, anodized
  - for shaft IPX-79_1...
  - P/N 400105431
  - Assembly material (screw, locking pin) included in delivery

- **Z-IPX-M21**
  - Driving plate D = 55 mm for lateral shaft drive with locking pin
  - aluminum, anodized
  - for shaft IPX-79_1...
  - P/N 400105433
  - Assembly material (locking pin) included in delivery

- **Z-IPX-M31**
  - Mounting plate for adjustable mounting on screw-hole circle 100 mm
  - aluminum, anodized
  - P/N 400105432
  - Assembly material (4 x countersink screw) included in delivery
Accessories
Connector System M12

Note: The protection class is valid only in locked position with its plugs. The application of these products in harsh environments must be checked in particular cases.

<table>
<thead>
<tr>
<th>Length</th>
<th>Type</th>
<th>P/N</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 m</td>
<td>EEM 33-32</td>
<td>005600</td>
</tr>
<tr>
<td>5 m</td>
<td>EEM 33-62</td>
<td>005609</td>
</tr>
<tr>
<td>10 m</td>
<td>EEM 33-97</td>
<td>005690</td>
</tr>
</tbody>
</table>

Protection class IP67 DIN EN 60529
UL - approved

Very good resistance to oils, coolants and lubricants
Suitable for applications in dragchains
Very good Electromagnetic Compatibility (EMC) and shield systems

M12x1 Mating female connector, 4-pin, straight, A-coded, with molded cable, shielded, IP67, open ended

Connector housing: Plastic PA
Cable sheath: PUR; Ø = max. 6 mm, -25 °C...+80 °C (moved), -50 °C...+80 °C (fixed)
Wires: PP, 0.34 mm²

<table>
<thead>
<tr>
<th>Length</th>
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<th>P/N</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 m</td>
<td>EEM 33-33</td>
<td>005601</td>
</tr>
<tr>
<td>5 m</td>
<td>EEM 33-63</td>
<td>005610</td>
</tr>
<tr>
<td>10 m</td>
<td>EEM 33-99</td>
<td>005696</td>
</tr>
</tbody>
</table>

M12x1 Mating female connector, 4-pin, angled, A-coded, with molded cable, shielded, IP67, open ended

Connector housing: Plastic PA
Cable sheath: PUR; Ø = max. 6 mm, -25 °C...+80 °C (moved), -50 °C...+80 °C (fixed)
Wires: PP, 0.34 mm²

Pin assignment
1 = brown
2 = white
3 = blue
4 = black

The specifications contained in our datasheets are intended solely for informational purposes. The documented specification values are based on ideal operational and environmental conditions and can vary significantly depending on the actual customer application. Using our products at or close to one or more of the specified performance ranges can lead to limitations regarding other performance parameters. It is therefore necessary that the end user verifies relevant performance parameters in the intended application. We reserve the right to change product specifications without notice.