More Precision

induSENSOR // Linear inductive displacement sensors
Inductive displacement sensors with more precision

For decades, Micro-Epsilon has been renowned for its inductive displacement sensors and gauges and has extended the range of classical measurement techniques such as LVDT by further innovative developments. Electromagnetic displacement sensors from Micro-Epsilon are used extensively in applications for automated processes, quality assurance, test rigs, hydraulics, pneumatic cylinders, and automotive engineering.

The advantages of these displacement sensors are well known and highly valued, and include ruggedness, reliability under harsh conditions, high signal quality and temperature stability. They are used successfully both in single and high volume OEM applications in which often customer-specific requirements are implemented.
## induSENSOR Overview

<table>
<thead>
<tr>
<th>Model</th>
<th>Pages</th>
</tr>
</thead>
<tbody>
<tr>
<td>LVDT gauges</td>
<td>4 - 5</td>
</tr>
<tr>
<td>LVDT displacement sensors</td>
<td>6 - 7</td>
</tr>
<tr>
<td>LDR displacement sensors</td>
<td>8 - 9</td>
</tr>
<tr>
<td>Miniature sensor controller</td>
<td>10 - 11</td>
</tr>
<tr>
<td>EDS long-stroke sensors</td>
<td>12 - 13</td>
</tr>
<tr>
<td>Clamping stroke</td>
<td>14 - 15</td>
</tr>
<tr>
<td>LVP displacement sensors for specific applications</td>
<td>16 - 17</td>
</tr>
<tr>
<td>Customer-specific modifications</td>
<td>20 - 23</td>
</tr>
<tr>
<td>Customer-specific sensor development</td>
<td>24 - 27</td>
</tr>
<tr>
<td>Measuring principles</td>
<td>28 - 29</td>
</tr>
<tr>
<td>Application examples</td>
<td>30 - 31</td>
</tr>
</tbody>
</table>
LVDT gauging sensors DTA-xG8 are primarily used for the measurement and inspection of workpiece geometry (length, width, diameter, thickness, depth, height). They are ideally suitable for high volume applications.

These gauges have an axial cable output and are equipped with either a plain bearing-guided plunger and spring, or with a pneumatic push rod.

**Probe tips**

- **Standard: type 2**
- **Option: type 11**
- **Option: type 13**

<table>
<thead>
<tr>
<th>Probe tips</th>
<th>M2.5</th>
<th>M2.5</th>
<th>M2.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>External controller for high volume applications</td>
<td>Probe tips</td>
<td>Probe tips</td>
<td>Probe tips</td>
</tr>
<tr>
<td>- Proven LVDT technology</td>
<td>- Measuring ranges ± 1 … ± 10 mm</td>
<td>- Low cost especially for high volume applications</td>
<td>- Sensor diameter of just ø8mm</td>
</tr>
<tr>
<td>- Models with pneumatic push</td>
<td></td>
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</tbody>
</table>

**Article designation**

<table>
<thead>
<tr>
<th>DT</th>
<th>5-</th>
<th>G8-</th>
<th>3-</th>
<th>CA-</th>
<th>V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gauging sensor options:</td>
<td>V: pneumatic push</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Connection (axial):</td>
<td>CA integral cable (3m)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Linearity:</td>
<td>3 (± 0.3 %)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Function: gauging sensor</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Measuring range in mm</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Excitation AC</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Principle:** Differential Transformer (LVDT)
<table>
<thead>
<tr>
<th>Model</th>
<th>DTA-1G8</th>
<th>DTA-3G8</th>
<th>DTA-5G8</th>
<th>DTA-10G8</th>
<th>DTA-1G8-V</th>
<th>DTA-3G8-V</th>
<th>DTA-5G8-V</th>
<th>DTA-10G8-V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring range</td>
<td>± 1 mm</td>
<td>± 3 mm</td>
<td>± 5 mm</td>
<td>± 10 mm</td>
<td>± 1 mm</td>
<td>± 3 mm</td>
<td>± 5 mm</td>
<td>± 10 mm</td>
</tr>
<tr>
<td>Linearity</td>
<td></td>
<td></td>
<td>0.3 % FSO</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Repeatability</td>
<td>0.15 µm</td>
<td>0.45 µm</td>
<td>0.75 µm</td>
<td>1.5 µm</td>
<td>0.15 µm</td>
<td>0.45 µm</td>
<td>0.75 µm</td>
<td>1.5 µm</td>
</tr>
<tr>
<td>Temperature stability</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>250 ppm/°C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temperature range</td>
<td></td>
<td></td>
<td>-20...+80 °C (without bellows) / 0...+80 °C (with bellows)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diameter</td>
<td>8h9 mm</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sensor material</td>
<td>stainless steel / FPM</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Connection / pin connector</td>
<td>open ends</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Protection class (sensor)</td>
<td>IP65 (with bellows) / IP54 (without bellows)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cable output</td>
<td>axial</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cable length (sensor)</td>
<td>3 m</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Life cycle MTBF</td>
<td>5 million cycles</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sensitivity</td>
<td>133 mV/mm/V</td>
<td>85 mV/mm/V</td>
<td>53 mV/mm/V</td>
<td>44 mV/mm/V</td>
<td>133 mV/mm/V</td>
<td>85 mV/mm/V</td>
<td>53 mV/mm/V</td>
<td>44 mV/mm/V</td>
</tr>
<tr>
<td>Suitable controller</td>
<td>MSC7401 (pages 10 - 11)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**DTA-xG8-3-CA**

Cable diameter ca. 3.1mm
Cable length 3m (open ends)

<table>
<thead>
<tr>
<th>Model</th>
<th>A (zero position)</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>DTA-1G8-3-CA</td>
<td>83 mm</td>
<td>64.3 mm</td>
</tr>
<tr>
<td>DTA-3G8-3-CA</td>
<td>89 mm</td>
<td>68.3 mm</td>
</tr>
<tr>
<td>DTA-5G8-3-CA</td>
<td>118 mm</td>
<td>89.5 mm</td>
</tr>
<tr>
<td>DTA-10G8-3-CA</td>
<td>155 mm</td>
<td>121.7 mm</td>
</tr>
</tbody>
</table>

**DTA-xG8-3-CA-V**

Cable diameter ca. 3.1mm
Cable length 3m (open ends)

<table>
<thead>
<tr>
<th>Model</th>
<th>A (zero position)</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>DTA-1G8-3-CA-V</td>
<td>95 mm</td>
<td>76.3 mm</td>
</tr>
<tr>
<td>DTA-3G8-3-CA-V</td>
<td>103 mm</td>
<td>82.3 mm</td>
</tr>
<tr>
<td>DTA-5G8-3-CA-V</td>
<td>134 mm</td>
<td>106.3 mm</td>
</tr>
<tr>
<td>DTA-10G8-3-CA-V</td>
<td>170.8 mm</td>
<td>137.3 mm</td>
</tr>
</tbody>
</table>
LVDT displacement sensors have a plunger which moves freely in the sensor housing. The plunger is joined to the object by a thread to transfer the movement of the measurement object. The measurement process in the sensor takes place without contact and is therefore wear-free. The displacement sensors are mainly used to measure and monitor movements, displacements, positions, strokes, deflections, dislocations, etc. in vehicles, machines and systems.

The high sensor resolution is limited only by the noise in the sensor electronics. A further advantage of the symmetrically constructed sensors in the LVDT series is the zero point stability of the systems. The sensors are supplied with an excitation frequency of 1 to 5 kHz depending on the measuring range and an excitation amplitude of 2.5 to 5 V eff. Matched sensor electronics are available in this respect.

With appropriate setting possibilities for the excitation frequency and amplitude, the sensors can also be operated with alternative electronics.

### Article designation

**DT A- 10- D- 3- CA- W**

Options (on request):
- **D** Welded sensor housing (water proof up to 5 bar)
- **P** Pressure-resistant sensors housing with tightness test (up to 100 bar)
- **F** Pressure-resistant mounting flange O-ring seal
- **H** High-temperature sensor models up to 200 °C with integral Teflon cable (only for sensor models with -CA/-CR connections)

Axial connections
- CA integral cable (3 m)
- SA plug-in connection

Radial connections
- CR integral cable (3 m)
- SR plug-in connection

**Linearity:** 5 (± 0.5 %)  3 (± 0.3 %)  1.5 (± 0.15 %)

**Function:** displacement sensor

**Measuring range in mm**

**Excitation AC**

**Principle:** Differential Transformer (LVDT)
### Model Specifications

<table>
<thead>
<tr>
<th>Model</th>
<th>DTA-1D-</th>
<th>DTA-3D-</th>
<th>DTA-5D-</th>
<th>DTA-10D-</th>
<th>DTA-15D-</th>
<th>DTA-25D-</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Connection</strong></td>
<td>CA</td>
<td>SA</td>
<td>CA</td>
<td>SA</td>
<td>CA</td>
<td>SA</td>
</tr>
<tr>
<td><strong>Measuring range</strong></td>
<td>± 1 mm</td>
<td>± 3 mm</td>
<td>± 5 mm</td>
<td>± 10 mm</td>
<td>± 15 mm</td>
<td>± 25 mm</td>
</tr>
<tr>
<td><strong>Linearity</strong></td>
<td>Standard ± 0.5 %</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Standard ± 0.3 %</td>
<td>6 µm</td>
<td>18 µm</td>
<td>30 µm</td>
<td>60 µm</td>
<td>90 µm</td>
</tr>
<tr>
<td></td>
<td>Option ± 0.15 %</td>
<td>3 µm</td>
<td>9 µm</td>
<td>15 µm</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Excitation frequency</strong></td>
<td>5 kHz</td>
<td>2 kHz</td>
<td>1 kHz</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Excitation amplitude</strong></td>
<td>5 Veff</td>
<td>2.5 Veff</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Sensitivity</strong></td>
<td>133 mV/Vmm</td>
<td>85 mV/Vmm</td>
<td>53 mV/Vmm</td>
<td>44 mV/Vmm</td>
<td>45 mV/Vmm</td>
<td>33 mV/Vmm</td>
</tr>
<tr>
<td><strong>Temperature range</strong></td>
<td>-20 ... +80 °C</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Storage temperature</strong></td>
<td>-40 ... +80 °C</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Temperature stability</strong></td>
<td>70 ppm/°C</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>150 ppm/°C</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Sensor housing</strong></td>
<td>stainless steel including magnetic shielding</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Minimum cable bending radius</strong></td>
<td>20 mm</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Outer diameter (cable)</strong></td>
<td>- 4.6 mm</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Protection class</strong></td>
<td>IP 67</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Shock</strong></td>
<td>40 g, 1000 shocks / axis</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Vibration</strong></td>
<td>100 g, 3 shocks / direction</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Suitable controller</strong></td>
<td>MSC7401 (pages 10 - 11)</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

### Dimensions

**Basic model**

<table>
<thead>
<tr>
<th>Basic model</th>
<th>DTA-1D-</th>
<th>DTA-3D-</th>
<th>DTA-5D-</th>
<th>DTA-10D-</th>
<th>DTA-15D-</th>
<th>DTA-25D-</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Connection</strong></td>
<td>CA</td>
<td>SA</td>
<td>CA</td>
<td>SA</td>
<td>CA</td>
<td>SA</td>
</tr>
<tr>
<td><strong>Housing length L</strong></td>
<td>40 mm</td>
<td>40 mm</td>
<td>57 mm</td>
<td>57 mm</td>
<td>73 mm</td>
<td>73 mm</td>
</tr>
<tr>
<td><strong>Plunger length l</strong></td>
<td>19 mm</td>
<td>29 mm</td>
<td>30 mm</td>
<td>35 mm</td>
<td>35 mm</td>
<td>51 mm</td>
</tr>
<tr>
<td><strong>Housing diameter</strong></td>
<td>10 mm</td>
<td>20 mm</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1) Plunger in zero position (±10% of measuring range ±1 mm)

### Female connector

- **Dimensions apply for all models**
  - Female connector 90° dimensions apply for all models
The specific sensor configuration of the LDR series of linear displacement sensors is characterized by its short, compact design and small diameter. Three connections are required as an interface to the sensor. The compact design and the small sensor diameter facilitate the installation of the measuring systems in locations where space is restricted.

**Typical applications**
Low-cost LDR sensors are also particularly suitable for large-scale installation under restricted spatial conditions and in industrial environments with a high measuring rate.
<table>
<thead>
<tr>
<th>Model</th>
<th>LDR-10-</th>
<th>LDR-25-</th>
<th>LDR-50-</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connection</td>
<td>SA</td>
<td>CA</td>
<td>SA</td>
</tr>
<tr>
<td>Measuring range</td>
<td>10 mm</td>
<td>25 mm</td>
<td>50 mm</td>
</tr>
<tr>
<td>Measuring principle</td>
<td>LDR - sensor</td>
<td>LDR - sensor</td>
<td>LDR - sensor</td>
</tr>
<tr>
<td>Linearity</td>
<td>typ. ± 0.30 % FSO</td>
<td>typ. ± 0.35 % FSO</td>
<td>typ. ± 0.5 % FSO</td>
</tr>
<tr>
<td></td>
<td>± 0.030 mm</td>
<td>± 0.088 mm</td>
<td>± 0.35 mm</td>
</tr>
<tr>
<td></td>
<td>max. ± 0.50 % FSO</td>
<td>max. ± 0.70 % FSO</td>
<td></td>
</tr>
<tr>
<td>Excitation frequency</td>
<td>16 kHz</td>
<td>12 kHz</td>
<td>8 kHz</td>
</tr>
<tr>
<td>Excitation amplitude</td>
<td>$V_{\text{exc}}$</td>
<td>$V_{\text{exc}}$</td>
<td>2.6 $V_{\text{exc}}$</td>
</tr>
<tr>
<td>Sensitivity</td>
<td>51 mV/Vmm</td>
<td>21 mV/Vmm</td>
<td>5.5 mV/Vmm</td>
</tr>
<tr>
<td>Temperature range</td>
<td>Storage: -40 ... +80 °C / Operation: -15 ... +80 °C</td>
<td>Storage: -40 ... +160 °C / Operation: -40 ... +160 °C</td>
<td></td>
</tr>
<tr>
<td>Temperature stability</td>
<td>Zero 30 ppm / °C</td>
<td>Max. temp. error 40 ppm / °C</td>
<td></td>
</tr>
<tr>
<td>Housing (material)</td>
<td>ferromagnetic stainless steel</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight sensor (without plunger)</td>
<td>9 g</td>
<td>24 g</td>
<td>14 g</td>
</tr>
<tr>
<td>Weight (plunger)</td>
<td>1.5 g</td>
<td>2.2 g</td>
<td>3.5 g</td>
</tr>
<tr>
<td>Minimum bending radius (sensor cable fixed/moved)</td>
<td>8 / 15 mm</td>
<td>10 / 30 mm</td>
<td>8 / 15 mm</td>
</tr>
<tr>
<td>Outer diameter (sensor cable)</td>
<td>3.1 mm</td>
<td>1.8 mm</td>
<td>3.1 mm</td>
</tr>
<tr>
<td>Protection class</td>
<td>IP67</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shock</td>
<td>40 g, 3000 shocks / axis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vibration</td>
<td>5 ... 44 Hz ± 2.5 mm / 44 ... 500 Hz ±20 g</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electrical connection</td>
<td>SA: 3-pin plug-in connection (accessory cable, article 0157047/047, 3 or 5 m)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CA: integral axial cable (shielded), 2 m</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Suitable controller</td>
<td>MSC7401 (pages 10 - 11)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

FSO = Full Scale Output  SA = connector axial  CA = cable axial

1) Determined according to box method (-40 ... +160 °C)

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**LDR-x-SA**

![Diagram of LDR-x-SA](image1)

* Plunger at start of measuring range

**LDR-x-CA**

![Diagram of LDR-x-CA](image2)

* Plunger at start of measuring range
The new MSC7401 controller is designed to be operated with LVDT and LDR measuring gauges and displacement sensors. Due to its robust aluminum housing protected to IP67, this single-channel controller is predestined for industrial measurement tasks. A large variety of compatible, inductive displacement sensors and gauges from Micro-Epsilon combined with an optimized price/performance ratio opens up numerous fields of applications in automation technology and machine building. The controller is easily set up using buttons or software.

**Exemplary configuration**

MSC7401 with DTA-5G8-3-CA gauge:

<table>
<thead>
<tr>
<th>Technical Data</th>
<th>Channel with DTA-5G8-3-CA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring range</td>
<td>± 5 mm</td>
</tr>
<tr>
<td>Linearity</td>
<td>30 µm</td>
</tr>
<tr>
<td>Resolution</td>
<td>~1.2 µm</td>
</tr>
<tr>
<td>Output</td>
<td>analog</td>
</tr>
</tbody>
</table>
**Model**

MSC7401 Miniature sensor controller

**Power supply**

5 V - 14 V - 30 V

**Protection**

Reverse polarity protection, overvoltage protection

**Sensor principle**

Full-bridge sensor / LVDT (DTA series) and half-bridge sensor (LDR series)

**Input impedance (sensor)**

> 100 kOhm

**Gain**

Adjustable via buttons or software

**Zero**

Output signal (adjustable)

(0) ... 10 VDC / 0.5 ... 4.5 V / 0 ... 5 V (Rm > 1 kOhm) or (0) ... 20 mA (load < 500 Ohm)

**Resolution**

<table>
<thead>
<tr>
<th>Resolution</th>
<th>DTA series</th>
<th>LDR series</th>
</tr>
</thead>
<tbody>
<tr>
<td>13 bits</td>
<td>0.012 % FSO at 50 Hz</td>
<td>12 bits</td>
</tr>
<tr>
<td>12 bits</td>
<td>0.024 % FSO at 300 Hz</td>
<td>11 bits</td>
</tr>
</tbody>
</table>

**Linearity**

0.02 % FSO

**Frequency response**

(only adjustable via software)

300 Hz (-3dB)

**Storage**

-40 ... +85 °C

**Operation**

-40 ... +85 °C

**Temperature stability**

<table>
<thead>
<tr>
<th>Temperature stability</th>
<th>DTA series</th>
<th>LDR series</th>
</tr>
</thead>
<tbody>
<tr>
<td>±100 ppm FSO/K</td>
<td>±125 ppm FSO/K</td>
<td></td>
</tr>
</tbody>
</table>

**Protection class**

IP67

**Weight**

Approx. 200 g

**Housing material**

Aluminum die casting

**Connection**

<table>
<thead>
<tr>
<th>Connection</th>
<th>Cable gland/screw terminal; AWG 16 to AWG 24; with ferrule up to AWG 28</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connector</td>
<td>Power supply: M12x1 plug (5 poles); sensor: M9 socket; 5 poles (Binder)</td>
</tr>
</tbody>
</table>

**EMC**

DIN EN 61326-1; DIN EN 61326-2-3

**Vibration**

DIN EN 60068-2-6

**Shock**

DIN EN 60068-2-27 (40g, 6ms, 1000 per axis)

DIN EN 60068-2-27 (100g, 6ms, 3 per axis)

**FSO** = Full Scale Output

1) Restricted with load and signal span

2) Noise: AC RMS measurement via RC low-pass filter of the 1st order with fc = 5 kHz

---

**Sensor connector:**

M12x1.5 cable gland; WS15; Clamping range 1 mm ... 5 mm

Alternative (option 010):

M9 5-pole socket, series 712 (Binder)

**Supply and signal connector:**

M16x1.5 cable gland; WS19; Clamping range 4.5 mm ... 10 mm

Alternative (option 010):

M12x1 plug; 5 poles
The sensor elements of the EDS series are protected by a pressure resistant stainless steel housing. The sensor electronics and signal conditioning are completely integrated in a sensor flange.

As a target an aluminum tube is used which is integrated into the piston rod and is passed over the sensor rod in a non-contact, wear-free manner.

Due to the eddy current principle applied, no permanent magnets need to be mounted inside the cylinder.

Its robust design make the EDS long-stroke sensor ideal for the integration into hydraulic and pneumatic cylinders, especially under harsh industrial conditions.

**Typical applications**

Long-stroke EDS sensors are designed for industrial use in hydraulic and pneumatic cylinders for the displacement and position measurement of pistons or valves, e.g. for the measurement of:
- displacement, distance, position, gap
- deflection
- movement, stroke
- filling level, immersion depth and spring travel

**induSENSOR EDS**

- Measuring ranges from 75 ... 630 mm
- Linearity: ± 0.3 % FSO
- Integrated microelectronics
- Robust design:
  - pressure-resistant,
  - oil-resistant and maintenance-free
- Short offset ranges

EDS series: integration in a hydraulic cylinder
Model | EDS-75 | EDS-100 | EDS-160 | EDS-200 | EDS-250 | EDS-300 | EDS-400 | EDS-500 | EDS-630
---|---|---|---|---|---|---|---|---|---
Series | S | S, F | S, F | S | S, F | S, F | S | S, F | S, F
Measuring range | 75 mm | 100 mm | 160 mm | 200 mm | 250 mm | 300 mm | 400 mm | 500 mm | 630 mm
Linearity | ± 0.3 % FSO | 0.23 mm | 0.3 mm | 0.48 mm | 0.6 mm | 0.75 mm | 0.9 mm | 1.2 mm | 1.5 mm | 1.89 mm
Resolution | 0.05 % FSO | 0.038 mm | 0.05 mm | 0.08 mm | 0.1 mm | 0.125 mm | 0.15 mm | 0.2 mm | 0.25 mm | 0.315 mm

Temperature range | -40 ... +85 °C
Temperature stability | ± 200 ppm / °C
Frequency response (-3 dB) | 150 Hz
Output signal | 4 ... 20 mA
Output load | 500 Ω
Supply voltage | 18 ... 30 VDC
Current consumption | max. 40 mA
Connection | S Series | 7-pin connector (sensor cable as an option) with either radial or axial output
          | F series | 5-pin radial bayonet-connector with mating plug
Pressure resistance | 450 bar (sensor rod, flange)
Protection class | IP67
Electromagnetic compatibility (EMC) | DIN EN 61326-1:2006 interference emission
          | DIN EN 61326-2-3:2007 interference immunity
Shock | 40 g, 3000 shocks / axis
          | 100 g radial, 300 g axial
Vibration | 5 ... 44 Hz ± 2.5 mm
          | 44 ... 500 Hz ± 23 g
Material | V4A-Steel 1.4571

FSO = Full Scale Output  
1) Half sinusoid 6 ms

Model S

Model F

Article designation

<table>
<thead>
<tr>
<th>EDS-300-</th>
<th>S-</th>
<th>SA7-</th>
<th>I</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current output</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SR = connector, radial bayonet (F series)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SAT = connector, axial (S series)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Series: S = compact design with housing cap</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F = flange housing with bore holes</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Measuring range in mm
To monitor the clamping position in machine tools, analog LVP sensors from Micro-Epsilon are used.

The cylindrical sensor is integrated into the release device and directly measures the clamping stroke of the drawbar. On the drawbar, a ring is fastened, which acts as the target for the sensor.

The LVP sensor can be universally used with the most varied types of tool due to an extremely compact sensor design. The sensor supplies an analog signal according to the stroke motion of the drawbar when clamping the tool. Consequently, continuous monitoring is possible without the switching point having to be laboriously set mechanically.

The miniature sensor controller can either be accommodated at the point of measurement or in the control cabinet. Thanks to its high accuracy, the LVP sensor contributes significantly to meeting the ever increasing demands on machine tool precision and availability.
<table>
<thead>
<tr>
<th>Model</th>
<th>LVP-25-Z20-5-CA-AC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring range</td>
<td>25 mm</td>
</tr>
<tr>
<td>Target (included)</td>
<td>article 0482218 for shaft diameter 8 mm</td>
</tr>
<tr>
<td></td>
<td>article 0482219 for shaft diameter 10 mm</td>
</tr>
<tr>
<td>Linearity</td>
<td>typical ± 1.5 % FSO</td>
</tr>
<tr>
<td>Sensor housing</td>
<td>stainless steel</td>
</tr>
<tr>
<td>Temperature stability (sensor)</td>
<td>&lt; ± 0.01% FSO / °C</td>
</tr>
<tr>
<td>Temperature range</td>
<td>-40 ... +120 °C (higher on request)</td>
</tr>
<tr>
<td>Protection class (sensor)</td>
<td>IP67</td>
</tr>
<tr>
<td>Medium</td>
<td>air, oil</td>
</tr>
<tr>
<td>Controller</td>
<td>MSC7401 (pages 10 - 11)</td>
</tr>
</tbody>
</table>

FSO = Full Scale Output

---

![Diagram of sensor and target sleeve](image_url)
Sensor for needle stroke movements

The compact LVP-3-Z13-5-CA displacement sensor is suitable for acquiring small measuring ranges with high accuracy. The large free hole for the passage of the core also facilitates large excessive strokes. The measurement object, realized as a simple aluminum ring, is mounted on the rod, plunger, pin, needle or other similar part to be measured. In a typical application the displacement sensor LVP-3-Z13-5-CA is used in automatic glue application guns. The continuously measuring sensor monitors the switching point, also for wear of the needle seating. Additionally, the continuous measurement offers the option of checking the needle for the correct stroke position. The small, compact sensor is easy to integrate even in tight installation spaces.

<table>
<thead>
<tr>
<th>Model</th>
<th>LVP-3-Z13-CA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Article no.</td>
<td>2617014</td>
</tr>
<tr>
<td>Measuring range</td>
<td>3 mm</td>
</tr>
<tr>
<td>Target (included)</td>
<td>ø3 x 30 long with M3 thread and aluminum ring ø4 x 3.3</td>
</tr>
<tr>
<td>Linearity</td>
<td>typical 0.3 % FSO (9 µm)</td>
</tr>
<tr>
<td>Sensor housing</td>
<td>stainless steel</td>
</tr>
<tr>
<td>Temperature stability (sensor)</td>
<td>± 100 ppm / °C</td>
</tr>
<tr>
<td>Temperature range (sensor)</td>
<td>-40 °C...+150 °C</td>
</tr>
<tr>
<td>Protection class (sensor)</td>
<td>IP67</td>
</tr>
<tr>
<td>Controller</td>
<td>MSC7210</td>
</tr>
</tbody>
</table>

FSO = Full Scale Output

The LVP-3 and LVP-14 sensors are modified LVP models designed for specific application areas and operated with external controllers.
Valve stroke sensor in stainless steel housing

Future generations of engines will be able to dispense with mechanical camshafts. The displacement of the electromechanically or electro-hydraulically driven inlet and outlet valves of internal combustion engines is acquired by the displacement sensor of the product line LVP-14-F-5-CR and fed into the control circuit. In this way a variable inlet and outlet control of the valves can be realized. Ultimately, the fuel consumption is reduced, emission values are improved and the engine power characteristic is matched to the individual driving situation.

<table>
<thead>
<tr>
<th>Model</th>
<th>LVP-14-F-5-CR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Article no.</td>
<td>2616078</td>
</tr>
<tr>
<td>Measuring range</td>
<td>14 mm</td>
</tr>
<tr>
<td>Target (optional)</td>
<td>Art. no. 0482273</td>
</tr>
<tr>
<td>Linearity</td>
<td>0.5 % FSO (0.07 mm)</td>
</tr>
<tr>
<td>Sensor housing</td>
<td>stainless steel</td>
</tr>
<tr>
<td>Temperature stability (sensor)</td>
<td>± 100 ppm / °C</td>
</tr>
<tr>
<td>Temperature range (sensor)</td>
<td>-30 ... +150 °C</td>
</tr>
<tr>
<td>Protection class (sensor)</td>
<td>IP67</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Controller</th>
<th>MSC739VS-U</th>
</tr>
</thead>
<tbody>
<tr>
<td>Article no.</td>
<td>4111009</td>
</tr>
<tr>
<td>Power supply</td>
<td>+10 ... 16 VDC</td>
</tr>
<tr>
<td>Output signal</td>
<td>1 ... 9 VDC</td>
</tr>
<tr>
<td>Resolution</td>
<td>0.02 % FSO</td>
</tr>
<tr>
<td>Frequency response</td>
<td>20 kHz (-3dB)</td>
</tr>
<tr>
<td>Dimensions</td>
<td>150 x 64 x 54mm</td>
</tr>
</tbody>
</table>

FSO = Full Scale Output
General accessories
2960031  MC25D  Digital micrometer calibration fixture
2420062  PS2020  Power supply on DIN rail, input 100 - 240 VAC, output 24 VDC / 2.5 A
2984026  Function and linearity inspection certificate incl. protocol with listed measurement data of the linearity inspection and documentation
2213034  IF7001 single-channel USB/RS485 converter

Accessories for LDR series
Connection cables
0157047  C7210-5/3  Sensor cable, 5 m, with cable connector
0157048  C7210/90-5/3  Sensor cable, 5 m, with 90° cable connector

Supply cable
2901087  PC710-6/4  Supply/output cable, 6 m

Spare plungers
0800136  LDR-10  Spare plunger
0800137  LDR-25  Spare plunger
0800138  LDR-50  Spare plunger

Service
Connector installation and adjustment

Accessories for EDS series
Service
2985001  Function and linearity inspection for EDS series incl. pressure inspection and documentation without recalibration

Connection cables
0157043  C703-5  VIP/LVP/EDS 7-pin connection cable for S series, 5 m
2902084  C703-5/U  VIP/LVP/EDS 7-pin connection cable for S series, 5 m for voltage output 1 - 5 V
0157050  C703/90-5  VIP/LVP/EDS 7-pin connection cable for S series, 5 m with 90° cable connector
2901143  C705-5  VIP/-LVP/-EDS 5-pin connection cable for F series, 5 m
2901160  C705-15  VIP/-LVP/-EDS 5-pin connection cable for F series, 15 m

Installation ring
0483326  EDS mounting ring
Accessories for LVDT series

**Sensor cables**
- 2902004 C701-3 Sensor cable, 3 m, with cable connector and tin-plated free ends
- 2902013 C701-6 Sensor cable, 6 m, with cable connector and tin-plated free ends
- 2902009 C701/90-3 Sensor cable, 3 m, with 90° cable connector and tin-plated free ends
- 2213034 IF7001 Single-channel USB/RS485 converter for MSC7xxx

**Service**
- 2981010 Connector installation and calibration

**Connection cables**
- 2901087 PC710-6/4 Supply/output cable, 6 m, open ends
- 29011154 PC5/5-IWT Supply/output cable, 5 m, open ends/M12

**Spare plungers**
- 0800001 DTA-1D Spare plunger
- 0800002 DTA-3D Spare plunger
- 0800003 DTA-5D Spare plunger
- 0800004 DTA-10D Spare plunger
- 0800005 DTA-15D Spare plunger
- 0800006 DTA-25D Spare plunger

**Flanges**
- 0483090.01 DTA-F10 Mounting flange, slotted for DTA-1D, DTA-3D, DTA-5D, DTA-10D
- 0483083.02 DTA-F20 Mounting flange, slotted for DTA-15D, DTA-25D

**Probe tips**
- 0459002 Type 2
- 0459001 Type 2 (hard metal)
- 0459003 Type 11
- 0459004 Type 13

Standard probe tip: type 2
Option: type 11
Option: type 13

---

**Flange DTA-F10**

**Flange DTA-F20**
Micro-Epsilon also develops sensors for special requirements that are not met by standard models. Inductive sensors from the standard range can be suitably modified. Low-cost implementation can already be achieved with medium-sized quantities (depending on the type and number of changes). Standard induSENSOR models form the basis for these modifications.

**Ambient conditions**

Depending on the location, environment, and application, different circumstances occur that require adapted sensors:

- Ambient temperature
- Pressure
- Interference fields
- Dirt, dust, and moisture
- Vibration, shock
- Seawater, IP69K

**Basic types**

Three basic types are available. Measuring ranges and target versions can be combined, based on these technologies.

<table>
<thead>
<tr>
<th>Technology</th>
<th>Measuring range</th>
<th>Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDS</td>
<td>up to 800 mm</td>
<td>tube</td>
</tr>
<tr>
<td>LDR</td>
<td>up to 150 mm</td>
<td>plunger / probe tip</td>
</tr>
<tr>
<td>LVDT</td>
<td>up to ±100 mm</td>
<td>plunger / probe tip</td>
</tr>
</tbody>
</table>
Output signal
Depending on the type of integration, one or more output signal types are required. Many types of output are available in combination with the electronics used.

Output signals
- Current
- Voltage
- Switching outputs
- Others on request
EDS-260-Z-LA-I-3L
Eddy current long-stroke sensor

- Measuring range: 260 mm
- Non-linearity: < ± 0.3 %
- Power supply: 18 ... 30 VDC
- Output: 4 ... 20 mA
- Temperature range: -40 ... +85°C
- Special sealing flange

EDS-200-F2-CA10-I-METSO
Eddy current long-stroke sensor

- Measuring range: 200 mm
- Output: 4 ... 20 mA
- Integrated cable: 10 m
- Special sealing flange

DTA-1D-CA-U
Inductive miniature sensor with axial cable output

- Measuring range: ± 1 mm
- Outer diameter: 10 mm
- Sensor cable: length 850 mm
**DTA-6D-20 (07)**
Inductive LVDT displacement sensor

- Measuring range: $\pm 2 \ldots \pm 8 \text{ mm}$
- Connection: 140 mm flat cable and IDC (insulation displacement connectors) RM 2.54

---

**DTA-15D-5-CA(03)**
Pressure-tight LVDT sensor with welded flange

- Measuring range: $\pm 16 \text{ mm}$
- Pressure resistance: pressed, up to 350 bar (2 min.) with mounting flange
- Connection: flat cable axial connector, approx. 140 mm long with plug

---

**EDS-330-F-SRB-I(06)**
Eddy current long-stroke sensor

- Measuring range: 330 mm
- Output: 4 ... 20 mA
- Supply: 18 ... 30 VDC
- Flange housing: diameter of 150 mm
For special applications where high volumes are required, Micro-Epsilon develops sensors that are precisely tailored to the customer’s requirements. The geometry, electronics and packaging are custom engineered to suit these specific requirements. Due to the high vertical range of manufacturing at Micro-Epsilon, large sensor volumes can be produced at low cost.

**Fields of application**
Customized OEM displacement sensors are often developed for fields of application where the highest standards apply:

- Applications with high ambient pressure
- Environments with high temperatures
- Vacuum
- EX environments
- Contaminated installations and measuring rooms
Application examples

**DRA-25D-20-SR-02 / ILU-50-0-10-SR**
Inductive differential inductor
- Load and imbalance detection in washing machines
- Integrated in damper or external installation
- Measuring range 50 mm
- External controller

**LDR-85-BUE**
Wear-free, inductive displacement sensor
- Measuring the valve position
- Measuring range 85 mm
- Integral controller

**KRS 719-400**
Miniature LVDT displacement sensor
- For use in textile machines
- External controller
- Measuring range 2 mm
- Shielded sensor

**DTA-3D-5-CR5-G-HP**
Inductive displacement sensor
- Detection of the shaft position with hermetically sealed pumps
- Measuring range 6 mm
- ATEX / FM certification

**ISC7001**
Miniature PCB controller
- Miniature design 20x25 mm
- Interfaces 0.5 - 4.5 V
  - PWM (10 bit), UART
- Resolution 11 bit

**DTA-1D-20-DDV02**
LVDT displacement sensors with coated coil
- Measuring the position of a hydraulic valve
- External controller
- Measuring range 2 mm
- Dipped paint seal

**KTL gauging sensors**
Robot calibration
- Speed measurement
- Switching output

**EDS-28-G-CA-U**
Robust, inductive miniature sensor with integrated controller in the cable
- Miniature actuator for Formula 1 vehicles
- Measuring range 28 mm
- Pressure resistance up to 350 bar

**EDS/GPS-180-ZA-I(02)**
Eddy current long-stroke sensors with integrated controller
- Piston position detection in the glass production
- Measuring range 180 mm
- High shock- and vibration-resistance
Micro-Epsilon has all the required resources available to supply solutions starting from the idea through to large-scale production, all from one source - and at competitive prices. Together with a team of engineers and customer support staff, performance specifications are converted into concepts and designs according to customized requirements.

All project participants are involved in development, prototype construction and high volume production. A total of over 2,000 man-years of engineering experience and more than 500 staff are available to you.

At the Micro-Epsilon headquarters, development projects are initiated and major projects coordinated. The development and marketing of specific sensors for OEM customers in large quantities takes place in direct contact with the development and product specialists.

For the large-scale production of the electronics, modern and automated production systems for screen and silk-screen printing are available with vision systems, automatic SMD assembly up to BF 0402, reflow soldering in computer controlled convection ovens, CFC-free washing in multi-compartment washing systems, automatic die bonding and laser trimming.
With production capacities of more than one million sensors p.a. and by utilizing internal company resources, the sensors are reasonably priced. The production equipment for sensors includes the following:

- CNC lathes and milling machines
- Fully automatic four-spindle winding machine
- Arc welding equipment for welding the coil wires
- Varnish dip system for protecting the coil
- Automatic inspection system for testing the coil parameters
- Laser welding and marking systems

All production systems are supplied in ergonomic and assembly-friendly packaging units. In this respect, environmentally friendly and economical reusable packaging is used. Within the scope of Total Quality Management, a 100% check is integrated for numerous measurement and inspection processes.
**LVDT technology and measuring principle**

LVDT displacement sensors and gauges (Linear Variable Differential Transformer) are constructed with a primary and two secondary coils, which are arranged symmetrically to the primary winding. As a target, a rod shaped magnetic core can be moved within the differential transformer. An electronic oscillator supplies the primary coil with an alternating current of constant frequency. The excitation is an alternating voltage with an amplitude of a few volts and a frequency between 1 and 10 kHz.

Depending on the core position, alternating voltages are induced in the two secondary windings. If the core is located in its "zero position", the coupling of the primary to both secondary coils is equally large. Movement of the core within the magnetic field of the coil causes a higher voltage in one secondary coil and a lower voltage in the second coil. The difference between the two secondary voltages is proportional to the core displacement. Due to the differential design of the sensor, the LVDT series has an output signal which is very stable.

**LDR displacement sensors**

The inductive sensors in the LDR series are constructed as half-bridge systems with center tap. An unguided plunger moves in the interior of the sensor coil, which consists of symmetrically constructed winding compartments. The plunger is joined to the moving measurement object via a thread. Due to the movement of the plunger within the coil, an electrical signal is produced which is proportional to the displacement covered. The specific sensor configuration facilitates a short, compact design with a small diameter. Three connections are required as an interface to the sensor.

**Block diagram LDR series**
**EDS long-stroke sensors**

The measuring principle of the EDS series is based on the eddy current effect. The displacement transducer consists of a measurement coil and a compensation coil which are integrated into a pressurized sensor rod composed of stainless, non-ferromagnetic material. An aluminum tube which can be moved along the housing without making contact is used as the target.

If both coils are supplied with an alternating current, then two orthogonal magnetic fields are produced in the sleeve. The field produced from the single-layer measuring coil has a magnetic coupling with the tube. Therefore, the eddy currents produced in the tube form a magnetic field, which influences the impedance of the measuring coil. This changes linearly with the target position. The magnetic field of the compensation coil has in contrast no coupling with the target and the impedance of the compensation coil is largely independent of the target position.

The electronic circuit generates a signal from the ratio of the impedance of the measurement coil and the compensation coil and converts the sleeve position into a linear electrical output signal of 4 - 20 mA. In achieving this, the temperature effects and the temperature gradient are essentially eliminated.
Sensors are the eyes and ears of a technical system. The values or states you acquire are processed in the controller or evaluated and appropriate further steps initiated. With the aid of sensors the measurement object is deflected, moved, set, guided, bent, panned, positioned, tilted, displaced or centered. The following overview shows a small extract of the possibilities for the application of the product group induSENSOR. With inductive sensors in applications, process times are shortened, operational readiness is extended, operational safety is increased, production yield is improved, setting up times are shortened and there is a gain in convenience.

- Construction
- Automotive
- Facility management
- Household appliances
- Hydraulics
- Measuring systems
- Medical technology
- Production plants
- Process technology
- Inspection and testing systems
- Quality assurance
- Machine tools

Quality control and dimensional inspection
Inductive gauging sensors measure the geometry of work-pieces in quality assurance and production. The dimensions for inspection are acquired in appropriate inspection rigs and documented. Gauging sensors and other sensors are employed for the calibration of the robot axes and for the determination of the gripping span. Furthermore, with vision4A image processing systems the position of the handling object in space is acquired. The deflection of the probe tip in 3D coordinate machines is compensated using inductive sensors from Micro-Epsilon.

Hydraulic and pneumatic cylinders
Railway engineering
When taking a bend, the coach body on the vehicle is then tilted towards the inside of the bend with the aid of hydraulic cylinders. This tilt is acquired with sensors in the EDS series.

Automobile construction
Deflection of hydraulic suspension in commercial vehicles, position of convertible top cylinders as well as pedal and clutch displacements are typical applications.

Heavy industry
The EDS series is used for the crusher gap control on rock crushers.

Aviation
In the dynamic control and navigation of airplanes, various sensors in the LVDT series are employed as key elements. Typical applications are in navigation, cockpit simulators, the mechanical turbine control, antenna positioning, flaps control, rudder trimming, pedal positioning and in the undercarriage.
Inspection and testing systems
In inspection and testing systems, inductive sensors detect deflection, oscillation and vibration of the measurement positions. In particular, the sensors of the VIP series are suitable for measuring ranges from 50 to 200 mm. The requirements with regard to a small installation space, wide useful measuring range and insensitivity lateral target movements are optimally fulfilled by sensors in the VIP series.

Construction
Inductive sensors from Micro-Epsilon are used for continuous measurements in civil engineering. The sensors acquire the movement of bridge elements or the walls of buildings with the change of seasons and during renewal.

Hydraulic valve
With the classical LVDT sensors and innovative sensors in the VIP series, Micro-Epsilon offers a wide selection of systems for the measurement of the piston position on hydraulic and solenoid valves. The sensors in the VIP series are particularly characterized by the small installation space and the high frequency response.

Dosing valve
In automatic dosing valves inductive sensors monitor the position of the dosing needle and ensure constant dosing quality.

Process valve
To control and block the flow of gases and liquids the spindle drives of process valves are fitted with Micro-Epsilon displacement sensors.

Machine tools, Production automation, Measuring rotating shafts
To monitor the clamping position of tools, a VIP sensor is integrated into the release device and directly measures the clamping stroke of the drawbar. It can be universally used with the most varied types of tool due to an extremely compact sensor design. In automatic screw drivers inductive sensors from Micro-Epsilon continuously measure the penetration depth from 0 to 70 mm, thus monitoring screw joints with different depths on the same station.

Production plants
In automated production plant, inductive sensors from Micro-Epsilon monitor the production tolerance of the products while the process is running. Other fields of application lie in the continuous acquisition of flap positions and slide settings.
High performance sensors made by Micro-Epsilon

Sensors and systems for displacement and position

Sensors and measurement devices for non-contact temperature measurement

2D/3D profile sensors (laser scanner)

Optical micrometers, fiber optic sensors and fiber optics

Color recognition sensors, LED analyzers and color inline spectrometer

Measurement and inspection systems