More Precision

induSENSOR // Linear inductive displacement sensors
Inductive displacement and position sensors

Inductive displacement sensors for numerous measurement tasks & industries

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 induSENSOR displacement sensors from Micro-Epsilon are used extensively in applications for automated processes, quality assurance, test rigs, hydraulics, pneumatic cylinders, and building monitoring. Typical measurement tasks require a long service life and reliability.

Wide range of standard sensors

<table>
<thead>
<tr>
<th>Gauges with external controller</th>
<th>Displacement sensors with external controller</th>
<th>Linear displacement sensors</th>
<th>Robust long-stroke sensors for hydraulics &amp; pneumatics</th>
<th>Special sensors</th>
</tr>
</thead>
<tbody>
<tr>
<td>DTA Gauges</td>
<td>DTA Sensors</td>
<td>Measuring ranges</td>
<td>Measuring ranges</td>
<td></td>
</tr>
<tr>
<td>Measuring ranges</td>
<td>Measuring ranges</td>
<td>±1 … ±10 mm</td>
<td>±1 … ±25 mm</td>
<td>±3 /14 /25 mm</td>
</tr>
<tr>
<td>LVDT</td>
<td>LDR</td>
<td>10 … 50 mm</td>
<td>75 … 630 mm</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>EDS</td>
<td></td>
<td>LVP / LDR</td>
</tr>
</tbody>
</table>

Individual sensors from small to large series

Micro-Epsilon has the experience and the required resources to provide solutions starting from the basic idea through to series production, all from one source – and at a convincing price/performance ratio. A team of specialist development and application engineers implements concepts and designs according to customer-specific requirements. All project members are involved in development, prototype construction and series production.
# induSENSOR Overview

## Introduction
- Advantages of inductive sensors
- Individual controllers
- Ideal for customer-specific adaptations

## Model
- LVDT Gauges
- LVDT Displacement sensors
- LDR Displacement sensors
- Sensors for displacement measurements of rotating shafts
- Compact sensor controllers MSC7401 / MSC7802
- Sensor controller MSC7602
- LVP Displacement sensors for specific applications
- EDS Long-stroke sensors

## Technology
- Measuring principle
Powerful controllers with more precision

Inductive displacement sensors from Micro-Epsilon impress with their robustness, reliability under harsh conditions, high signal quality and temperature stability. Combined with the modern MSC controller generation, numerous application fields and possibilities are opening up. Each sensor can be operated with every controller. Digital interfaces, operation via software and inclusion into bus environments support integration into different industries.

Numerous measuring ranges for multiple measurement tasks

Inductive displacement sensors cover a variety of measuring ranges. Common LVDT displacement sensors and gauges are best suited to measuring ranges up to ±25 mm. For large measuring ranges up to 630 mm, EDS long-stroke sensors are suitable.

Plunger, aluminum tube and probe tips

The different sensor series are equipped with different targets. Plunger, aluminum tube and probe tips can be selected and adapted for mechanical integration. Accurate mounting enables non-contact and wear-free measurements.
Long mechanical service life

The induSENSOR series is designed in such a way that there is usually no contact between the target and the sensor. Therefore, no parts rub against each other or wear out. This is how the inductive displacement sensors from Micro-Epsilon attain a long, mechanical service life, which is favorable for measurement tasks requiring high reliability, e.g., in industrial factory and process automation, in aviation and aerospace as well as power plants and research facilities.

Ideal for harsh ambient conditions

The induSENSOR models stand out due to their robustness and reliability under harsh conditions. As they provide high signal quality, temperature stability, resistance to shocks and vibrations as well as insensitivity to dirt and humidity, these sensors are the preferred choice for industrial measurement tasks.

High repeatability and signal stability

Inductive sensors from Micro-Epsilon impress with their exceptional precision. Based on advanced technologies, these sensors provide resolutions down to the micrometer range. Combined with high signal stability, the induSENSORs impress in measurement tasks where high accuracy is required.

Versatile integration possibilities with analog and digital interfaces

The MSC controllers convert the induced voltage into a standardized output signal. Depending on the controller, analog output types or digital outputs are available. For customer-specific sensor developments, the controller can be integrated directly into the sensor.
Long Measurement Chains and Industrial Ethernet Connection

The induSENSOR systems are universally applicable and have been tried and tested in various industries. If necessary, the cables can easily be adapted to the respective requirement. When several measuring points are required, the 2-channel controllers or multi-channel systems are used that are equipped with digital interfaces and, in addition, enable integration into Bus environments. If needed, parameter setting of the sensors can be carried out via powerful software or a web interface.

1-channel systems
The classic configuration consists of a sensor which is connected to an MSC7401 single-channel controller.

2-channel systems
For 2-channel measurement tasks, the MSC7802 controller is used which can be connected to two inductive displacement sensors.

Multi-channel systems
If more than two channels are required, the MSC7602 is used. This modular controller enables long measurement chains.
Parameter Setting via Web Interface & sensorTOOL

The IF1032/ETH interface module allows the induSENSOR series to be accessed via web interface. The web interface is primarily used for display and visualization of measured data. Moreover, sensors can be connected to an EtherCAT bus.

- Data display and scaling via Ethernet and web interface
- CSV export
- Easy integration without admin rights on PC
- Additional EtherCAT interface

The sensorTOOL software can be accessed via the IF1032/ETH and directly via the IF7001 USB converter. In addition to parameter settings, the controller displays, stores and exports measured values.

- Basic settings: sensor type, output signal, frequency response
- 2-point and zero point adjustments
- Scaling
- Visualization of data
- Sub-sampling
- Export
High Modularity & OEM Capability

From minor adaptions of standard products ...

If the standard models do not meet certain specific requirements, inductive sensors from the standard range can be adapted accordingly by Micro-Epsilon. Cost-effective 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, industry, and application, different environmental conditions occur to which the sensors are adapted:
- Ambient temperature
- Pressure
- Interference fields
- Dirt, dust, and moisture
- Vibration, shock
- Suitable for seawater, IP69K

Basic types
Three basic types are available. Based on these technologies, measuring ranges and target versions can be combined with each other.

<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>
... to individual customized solutions

For special applications where large quantities are required, Micro-Epsilon develops sensors that are precisely tailored to the customer’s requirements. Geometry, controllers and packaging are custom engineered to suit these specific requirements. Due to the high vertical range of manufacturing at Micro-Epsilon, large quantities 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
- High temperature environments
- Vacuum
- EX environments
- Contaminated installation and measuring rooms

Series production

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

For series production of controllers, modern and automated production systems for screen and silk-screen printing with vision systems, automatic SMD assembly, reflow soldering in computer controlled convection ovens, CFC-free washing in multi-compartment washing systems, automatic die bonding and laser trimming are available.

With production capacities of more than 1 million sensors/year and the use of company-internal 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
- etc.

All production systems are supplied in ergonomic and installation-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.
Examples for customer-specific modifications

**Optimized Sensor Technology for Large Series**
- Hydraulic valves
- Process valves
- White goods

**Special Systems**
- Mechanical adaptions
- ATEX/FM approval
- Additional physical principles

**Miniature LVDTs**
- Small measuring ranges and designs for installation into confined spaces

**InduSENSOR**
Adapted Controller Components and Sensor Controllers

- Based on ASICs, analog or digital circuit technology
- Different shapes and connection options
- Miniature designs
- Different output signals and interfaces

Eddy Current Long-Stroke Sensors

- High resistance to shocks, vibrations and pressure
- Adapted flanges and connectors for optimal integration
- External controllers for high temperature applications
- Miniature designs for confined installation spaces
- Designs with aluminum tube or plunger
LVDT gauge sensors DTA-xG8 are primarily used for the measurement and inspection of workpiece geometry (e.g. length, width, diameter, thickness, depth, height). Therefore, different measuring ranges from ±1 mm to ±10 mm are available. The gauges are particularly suitable for applications involving a large number of pieces.

These gauges have an axial cable outlet and are equipped with either a plain bearing-guided plunger and a return spring, or with a pneumatic push rod. Depending on the measuring object, different probe tips are available.

**Article designation**

<table>
<thead>
<tr>
<th>DT</th>
<th>A-</th>
<th>5-</th>
<th>G8-</th>
<th>3-</th>
<th>CA-</th>
<th>V</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Gauge options:
- V: pneumatic push
- Connection (axial):
  - CA integral cable (3m)

Linearity: 3 (±0.3 %)

Function: gauge

Excitation AC

Principle: Differential Transformer (LVDT)

DTA gauges can be operated with every MSC controller. Depending on this controller, single-/dual-/multi-channel measurements are possible. In addition to the well-established analog output, modern fieldbuses are available for integration purposes.

Based on modern interfaces and multi-channel capability, the MSC controllers open up new fields of application.
Model DTA-1G8 DTA-3G8 DTA-5G8 DTA-10G8 DTA-1G8-V DTA-3G8-V DTA-5G8-V DTA-10G8-V
Measuring range ±1 mm ±3 mm ±5 mm ±10 mm ±1 mm ±3 mm ±5 mm ±10 mm
Linearity ≤ ±6 µm ≤ ±18 µm ≤ ±30 µm ≤ ±60 µm ≤ ±18 µm ≤ ±30 µm ≤ ±60 µm ≤ ±0.3% FSO
Repeatability 1) ≤ 0.15 µm ≤ 0.45 µm ≤ 0.75 µm ≤ 1.5 µm ≤ 0.15 µm ≤ 0.45 µm ≤ 0.75 µm ≤ 1.5 µm
Temperature stability ≤ 250 ppm FSO/K
Sensitivity 133 mV / mm/V 85 mV / mm/V 53 mV / mm/V 44 mV / mm/V 133 mV / mm/V 85 mV / mm/V 53 mV / mm/V 44 mV / mm/V
Excitation frequency 5 kHz 5 kHz 5 kHz 2 kHz 5 kHz 5 kHz 5 kHz 2 kHz
Excitation voltage 550 mV
Connection integrated cable (3 m) with open ends; axial cable outlet; drag-chain suitable; cable diameter of 3.1 mm; min. bending radii: fixed installation 25 mm, moving 38 mm, drag chain 47 mm
Temperature range Storage -40 … +80 °C
Operation -20 … +80 °C (without bellows); 0 … 80 °C (with bellows)
Pressure resistance atmospheric pressure
Shock (DIN EN 60068-2-27) 40 g / 6 ms in 3 axes, 1000 shocks each
Vibration (DIN EN 60068-2-6) ±1.5 mm / 10 … 58 Hz in 2 axes, 10 cycles each
±20 g / 58 … 500 Hz in 2 axes, 10 cycles each
Protection class (DIN EN 60529) IP65 (with bellows); IP54 (without bellows)
Material Stainless steel (housing); FPM (bellows); PUR (cable sheath); PVC/PP (cable braids)
Weight approx. 70 g approx. 70 g approx. 75 g approx. 85 g approx. 70 g approx. 70 g approx. 80 g approx. 85 g
Typ. service life 5 million cycles
For pneumatic connection 3x0.5 mm
Compatibility MSC7401, MSC7802, MSC7602

Model DTA-1G8-3-CA DTA-3G8-3-CA DTA-5G8-3-CA DTA-10G8-3-CA DTA-1G8-3-CA-V DTA-3G8-3-CA-V DTA-5G8-3-CA-V DTA-10G8-3-CA-V
Dimensions in mm, not to scale

1) Averaging over 100 values; 200 repetitions
2) Removing the bellows changes the spring forces

DTA-xG8-3-CA

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

Crimp ø8 h9

DTA-xG8-3-CA-V

for pneumatic connection 3x0.5 mm
Cable diameter approx. 3.1 mm
Cable length 3 m (open ends)
Mounting options and accessories

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

Service
Assembly of screw flange - DTA-xG8
Connector assembly M9 and cable reduction XXXX mm - DTA-x
Connector assembly M9 - DTA-x

Probe tips
Type 2 probe tip / hard metal
Type 2 probe tip / plastics
Type 2 probe tip / ruby
Type 2 probe tip / steel
Type 10 probe tip / steel
Type 11 probe tip / steel
Type 13 probe tip / steel

Sensor mounting
MBS12/8 Mounting block  Sensor mounting for circumferential clamping for reduction to D8 (gauge)
MBS12/8 Adapter ring  Mounting block Adapter ring

Mounting block MBS12/8

Adapter ring
Gauges from Micro-Epsilon have many possible fields of application. Due to different measuring ranges and configuration settings, the gauges are suitable for numerous measurement and inspection tasks. Combined with multi-channel controllers, the DTA gauges are often used for dimensional measurement and inspection tasks, e.g., in automated quality control, R&D and production monitoring.
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 measuring object. The measurement process in the sensor takes place without contact and is therefore wear-free.

The displacement sensors are primarily used to measure and monitor movements, displacements, positions, strokes, deflections, dislocations, etc. in vehicles, machines and systems.

The high sensor resolution is only limited by the noise of the sensor controller. Another advantage of the symmetric LVDT sensors is their zero point stability. The sensors are supplied with an excitation frequency of 1 to 5 kHz depending on the measuring range and an excitation voltage of 0.4V<sub>eff</sub>. Adapted sensor controllers are available for this purpose.

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

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**Article designation**

<table>
<thead>
<tr>
<th>DT</th>
<th>A-</th>
<th>10-</th>
<th>D-</th>
<th>3-</th>
<th>CA-</th>
<th>W</th>
</tr>
</thead>
<tbody>
<tr>
<td>Options (on request):</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>W Welded sensor housing (water proof up to 5 bar)</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P Pressure-resistant sensor housing with tightness test (up to 100 bar)</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>F Pressure-resistant mounting flange O-ring seal</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>H High-temperature sensor models up to 200 °C with integral Teflon cable (only for sensor models with -CA/-CR connections)</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Axial connections</th>
<th>Radial connections</th>
</tr>
</thead>
<tbody>
<tr>
<td>CA integral cable (3m)</td>
<td>CR integral cable (3 m)</td>
</tr>
<tr>
<td>SA plug-in connection</td>
<td>SR plug-in connection</td>
</tr>
</tbody>
</table>

Linearly: 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>Measuring range</td>
<td>≤ ±0.5 % FSO</td>
<td>≤ ±0.3 % FSO</td>
<td>≤ ±0.15 % FSO</td>
<td>≤ ±0.5 % FSO</td>
<td>≤ ±0.5 % FSO</td>
<td>≤ ±0.5 % FSO</td>
</tr>
<tr>
<td>±1 mm</td>
<td>≤ ±6 µm</td>
<td>≤ ±3 µm</td>
<td>≤ ±0.1 mm</td>
<td>≤ ±60 µm</td>
<td>≤ ±60 µm</td>
<td>≤ ±60 µm</td>
</tr>
<tr>
<td>±3 mm</td>
<td>≤ ±18 µm</td>
<td>≤ ±9 µm</td>
<td>±0.1 mm</td>
<td>≤ ±90 µm</td>
<td>≤ ±90 µm</td>
<td>≤ ±90 µm</td>
</tr>
<tr>
<td>±5 mm</td>
<td>≤ ±0.1 mm</td>
<td>±0.1 mm</td>
<td>-</td>
<td>on request</td>
<td>-</td>
<td>on request</td>
</tr>
<tr>
<td>±10 mm</td>
<td>±0.1 mm</td>
<td>±0.1 mm</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>±15 mm</td>
<td>±0.1 mm</td>
<td>±0.1 mm</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>±26 mm</td>
<td>±0.1 mm</td>
<td>±0.1 mm</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Linearity</td>
<td>≤ ±0.5 % FSO</td>
<td>≤ ±0.3 % FSO</td>
<td>≤ ±0.15 % FSO</td>
<td>≤ ±0.1 mm</td>
<td>≤ ±0.1 mm</td>
<td>≤ ±0.1 mm</td>
</tr>
<tr>
<td>≤ ±0.5 % FSO</td>
<td>≤ ±0.3 % FSO</td>
<td>≤ ±0.15 % FSO</td>
<td>on request</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Temperature stability 1)</td>
<td>≤ 70 ppm FSO/K</td>
<td>≤ 300 µm</td>
<td>≤ 180 µm</td>
<td>≤ 60 µm</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Zero</td>
<td>Max. temp. error</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>45 mV / mm/V</td>
<td>33 mV / mm/V</td>
</tr>
<tr>
<td>Excitation frequency</td>
<td>5 kHz</td>
<td>2 kHz</td>
<td>1 kHz</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Excitation voltage</td>
<td>550 mV</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Connection</td>
<td>CA/CR</td>
<td>integrated cable (3 m) with open ends; radial or axial cable outlet depending on series; cable diameter 4.6 mm; min. bending radius 20 mm</td>
<td>CA/CR</td>
<td>integrated cable (3 m) with open ends; radial or axial cable outlet depending on series; cable diameter 4.6 mm; min. bending radius 20 mm</td>
<td>CA/CR</td>
<td>integrated cable (3 m) with open ends; radial or axial cable outlet depending on series; cable diameter 4.6 mm; min. bending radius 20 mm</td>
</tr>
<tr>
<td>Temperature range</td>
<td>Storage</td>
<td>-40 … +80 °C</td>
<td>Operation</td>
<td>-20 … +80 °C</td>
<td>-20 … +80 °C</td>
<td>-20 … +80 °C</td>
</tr>
<tr>
<td>Pressure resistance</td>
<td>atmospheric pressure (optional 5 bar or 100 bar on front side on request)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Shock (DIN EN 60068-2-27)</td>
<td>40 g / 6 ms in 3 axes, 1000 shocks each</td>
<td>100 g / 6 ms in 3 axes, 3 shocks each</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Vibration (DIN EN 60068-2-6)</td>
<td>±1.5 mm / 10 … 58 Hz in 2 axes, 10 cycles each; ±20 g / 58 … 500 Hz in 2 axes, 10 cycles each</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Protection class (DIN EN 60529)</td>
<td>IP67 (plugged)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Material</td>
<td>Stainless steel (housing)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Weight</td>
<td>Sensor CA/CR: approx. 90 g, approx. 100 g, approx. 105 g, approx. 195 g, approx. 230 g</td>
<td>Sensor SA/SR: approx. 15 g, approx. 20 g, approx. 25 g, approx. 30 g, approx. 106 g, approx. 145 g</td>
<td>Plunger: approx. 2 g, approx. 3 g, approx. 4 g, approx. 5 g, approx. 12 g, approx. 17 g</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Compatibility</td>
<td>MSC7401, MSC7802, MSC7602</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

1) Determined according to box method (-40 ... +80 °C)

### Sensor Types

**Sensor types with measuring range up to ±10 mm** (inner diameter 2.7 mm, plunger diameter 2 mm)

**Type - CA**
- with integral cable

**Sensor types with measuring range ±15 mm and ±25 mm** (inner diameter 4.8 mm, plunger diameter 4 mm)

**Type - CA**
- with integral cable

**Type - CR**
- with radial plug connection

**Type - SR**
- with radial plug connection

**Type - SA**
- with axial plug connection

### Basic Model Specifications

<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>Connection</td>
<td>CA</td>
<td>SA</td>
<td>CA</td>
<td>SA</td>
<td>CA</td>
<td>SA, CR, SR</td>
</tr>
<tr>
<td>Housing length L</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>Plunger length l 1)</td>
<td>19 mm</td>
<td>29 mm</td>
<td>30 mm</td>
<td>35 mm</td>
<td>87 mm</td>
<td>87 mm</td>
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<tr>
<td>Housing diameter</td>
<td>10 mm</td>
<td>10 mm</td>
<td>10 mm</td>
<td>10 mm</td>
<td>10 mm</td>
<td>10 mm</td>
</tr>
</tbody>
</table>

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

### Female Connector Dimensions

Dimensions in mm, not to scale
The specific sensor configuration of the LDR linear displacement sensors is characterized by its short, compact design and small diameter. Only three connections are required as interface to the sensor. Their compact design and the small sensor diameter allow the measuring systems to be installed in confined spaces.

**Fields of application**
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.

**Article designation**

<table>
<thead>
<tr>
<th>LDR-</th>
<th>10-</th>
<th>CA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Axial connections</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CA integral cable (2 m)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SA plug-in connection</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Measuring range in mm</td>
</tr>
</tbody>
</table>

Principle: half-bridge sensor
### Model Specifications

<table>
<thead>
<tr>
<th>Model</th>
<th>LDR-10</th>
<th>LDR-25</th>
<th>LDR-50</th>
</tr>
</thead>
<tbody>
<tr>
<td>Series</td>
<td>SA, CA</td>
<td>SA, CA</td>
<td>SA, CA</td>
</tr>
<tr>
<td>Measuring range</td>
<td>10 mm</td>
<td>25 mm</td>
<td>50 mm</td>
</tr>
<tr>
<td>Linearity typ.</td>
<td>≤ ±30 µm</td>
<td>≤ ±88 µm</td>
<td>≤ ±250 µm</td>
</tr>
<tr>
<td>max.</td>
<td>≤ ±50 µm</td>
<td>≤ ±125 µm</td>
<td>≤ ±375 µm</td>
</tr>
<tr>
<td>Temperature stability Zero</td>
<td>≤ 30 ppm FSO/K</td>
<td>≤ 80 ppm FSO/K</td>
<td></td>
</tr>
<tr>
<td>Max. temp. error</td>
<td>≤ 100 ppm FSO/K</td>
<td>≤ 150 ppm FSO/K</td>
<td></td>
</tr>
<tr>
<td>Sensitivity</td>
<td>51 mV / mm/V</td>
<td>21 mV / mm/V</td>
<td>5.5 mV / mm/V</td>
</tr>
<tr>
<td>Excitation frequency</td>
<td>21 kHz</td>
<td>13 kHz</td>
<td>9 kHz</td>
</tr>
<tr>
<td>Excitation voltage</td>
<td>550 mV</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Connection</td>
<td>CA</td>
<td>integrated cable (2 m) with open ends; axial cable outlet; cable diameter 1.8 mm; min. bending radius 10 mm (fixed installation)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SA</td>
<td>3-pin connector; axial output (see accessories for connection cable)</td>
<td></td>
</tr>
<tr>
<td>Temperature range ¹)</td>
<td>Storage SA: -40 ... +80 °C; CA: -40 ... +160 °C</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Operation</td>
<td>SA: -15 ... +80 °C; CA: -40 ... +160 °C</td>
<td></td>
</tr>
<tr>
<td>Pressure resistance</td>
<td></td>
<td>atmospheric pressure</td>
<td></td>
</tr>
<tr>
<td>Shock (DIN EN 60068-2-27)</td>
<td>40 g / 6 ms in 3 axes, 1000 shocks each</td>
<td>100 g / 6 ms in 3 axes, 3 shocks each</td>
<td></td>
</tr>
<tr>
<td>Vibration (DIN EN 60068-2-6)</td>
<td>±1.5 mm / 10 ... 58 Hz in 2 axes, 10 cycles each</td>
<td>±20 g / 58 ... 500 Hz in 2 axes, 10 cycles each</td>
<td></td>
</tr>
<tr>
<td>Protection class (DIN EN 60529)</td>
<td>IP67 (plugged)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Material</td>
<td>Stainless steel (housing)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td>Sensor approx. 9 g (SA); approx. 24 g (CA)</td>
<td>approx. 14 g (SA); approx. 28 g (CA)</td>
<td>approx. 23 g (SA); approx. 37 g (CA)</td>
</tr>
<tr>
<td></td>
<td>Plunger approx. 1.5 g</td>
<td>approx. 2.2 g</td>
<td>approx. 3.5 g</td>
</tr>
<tr>
<td>Compatibility</td>
<td>MSC7401, MSC7802, MSC7602</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

¹) Determined according to box method (-40 ... +80 °C)

---

### Diagrams

**LDR-x-SA**

![LDR-x-SA diagram](image)

* Plunger at end of measuring range

**LDR-x-CA**

![LDR-x-CA diagram](image)

* Plunger at end of measuring range


**Accessories for DTA series**

**Sensor cables**
- C701-3  Sensor cable, 3 m, with cable connector and tin-plated free ends
- C701-6  Sensor cable, 6 m, with cable connector and tin-plated free ends
- C701/90-3 Sensor cable, 3 m, with 90° cable connector and tin-plated free ends

**Service**
- Connector assembly M9 and cable reduction XXXX mm - DTA-x
- Connector assembly M9 - DTA-x (see page 30/31)

**Spare plungers**
- Plunger for DTA-1D  Spare plunger
- Plunger for DTA-3D  Spare plunger
- Plunger for DTA-5D  Spare plunger
- Plunger for DTA-10D  Spare plunger
- Plunger for DTA-15D  Spare plunger
- Plunger for DTA-25D  Spare plunger

**Sensor mounting**
- 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

**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

**Service**
- Connector assembly M9 and cable reduction XXXX mm - DTA-x
- Connector assembly M9 - DTA-x (see page 30/31)

**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

**Connector assembly**
- MBS12/8 Mounting block  Sensor installation for circumferential clamping
- MBS12/8 Adapter ring for reduction to D8 (gauge / LDR)

**Mounting block MBS12/8**
The DTA / LDR displacement sensors are suitable for numerous measurement tasks which require robust designs and high signal stability. Due to their wear-free design, the DTA / LDR sensors impress with longevity and long-term stability.

Applications

- Dilatation of materials
- Stress and bending tests for material experiments
- Monitoring of breaks in material tests
- Lift height measurement in outlet valves
- Position monitoring in lapping machines
- Control of the roller gap
- Construction and building monitoring
- Control of the roller gap
- Lift height measurement in outlet valves
- Stress and bending tests for material experiments
- Monitoring of breaks in material tests
- Dilatation of materials
The LVP-25-Z20 and LDR-14-Z20 sensors are designed for monitoring the clamping position in machine tools.

The cylindrical sensors are integrated into the release device and detect the clamping stroke of the drawbar. The measuring object is a ring which is glued onto the drawbar.

The sensors can be universally used for different types of tools due to their extremely compact sensor design. The sensors provide 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 set mechanically.

The miniature sensor controller can either be accommodated at the point of measurement or in the control cabinet. Thanks to their high accuracy, the sensors contribute significantly to meeting the ever increasing requirements for precision and availability of machine tools.
<table>
<thead>
<tr>
<th>Model</th>
<th>LVP-25-Z20</th>
<th>LDR-14-Z20</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring range</td>
<td>25 mm</td>
<td>14 mm</td>
</tr>
<tr>
<td>Resolution  1)</td>
<td>6 µm</td>
<td>7 µm</td>
</tr>
<tr>
<td>Resolution  2)</td>
<td>12 µm</td>
<td>14 µm</td>
</tr>
<tr>
<td>Linearity</td>
<td>≤ ±0.375 mm</td>
<td>≤ ±0.21 mm</td>
</tr>
<tr>
<td>Temperature stability</td>
<td>≤ 150 ppm FSO/K</td>
<td>≤ 200 ppm FSO/K</td>
</tr>
<tr>
<td>Sensitivity 2)</td>
<td>16 mV / mm/V</td>
<td>26 mV / mm/V</td>
</tr>
<tr>
<td>Excitation frequency</td>
<td>16 kHz</td>
<td>23 kHz</td>
</tr>
<tr>
<td>Excitation voltage</td>
<td>550 mV</td>
<td></td>
</tr>
<tr>
<td>Measuring object</td>
<td>Ring for shaft diameter 8 mm or 10 mm (included in delivery)</td>
<td></td>
</tr>
<tr>
<td>Connection</td>
<td>integrated cable (2 m) with open ends; axial cable outlet; cable diameter 1.8 mm; min. bending radius 10 mm (fixed installation)</td>
<td></td>
</tr>
<tr>
<td>Temperature range</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Storage</td>
<td>-40 … +85 °C</td>
<td></td>
</tr>
<tr>
<td>Operation</td>
<td>-40 … +120 °C 3)</td>
<td></td>
</tr>
<tr>
<td>Pressure resistance</td>
<td>atmospheric pressure</td>
<td></td>
</tr>
<tr>
<td>Shock (DIN EN 60068-2-27)</td>
<td>40 g / 5 ms, 6 axes, 1000 shocks each</td>
<td></td>
</tr>
<tr>
<td>Vibration (DIN EN 60068-2-6)</td>
<td>10 Hz - 49.9 Hz, 2 mm; 20 g / 49.9 Hz – 2000 Hz, 3 axes, 10 cycles each</td>
<td></td>
</tr>
<tr>
<td>Protection class (DIN EN 60529)</td>
<td>IP67</td>
<td></td>
</tr>
<tr>
<td>Material</td>
<td>Stainless steel, PEEK</td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td>Sensor approx. 40 g</td>
<td>Target ring &lt; 1 g</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Compatibility</td>
<td>MSC7401, MSC7802, MSC7602</td>
<td></td>
</tr>
</tbody>
</table>

FSO = Full Scale Output
1) Valid when operated with compatible Micro-Epsilon controller
2) With 10 mm reference drawbar
3) Max. temperature change: 3 K / min; higher temperatures on request.

---

LVP-25-Z20

Dimensions in mm, not to scale

LDR-14-Z20

---

<table>
<thead>
<tr>
<th>Model</th>
<th>Drawbar 1</th>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>LVP-25-Z20</td>
<td>D8</td>
<td>ø8 mm</td>
<td>ø5 mm</td>
<td>ø11.5 mm</td>
</tr>
<tr>
<td></td>
<td>D10</td>
<td>ø10 mm</td>
<td>ø5.5 mm</td>
<td>ø11.5 mm</td>
</tr>
<tr>
<td>LDR-14-Z20</td>
<td>D8</td>
<td>ø8 mm</td>
<td>ø3 mm</td>
<td>ø11.5 mm</td>
</tr>
<tr>
<td></td>
<td>D10</td>
<td>ø10 mm</td>
<td>ø5.5 mm</td>
<td>ø11.5 mm</td>
</tr>
</tbody>
</table>

1) Not included in delivery
The MSC7401 / MSC7802 controllers are designed to be operated with measuring gauges and displacement sensors of the DTA (LVDT) and LDR (half-bridge sensors) series. Due to their robust aluminum housing protected to IP67, the controllers are 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. Besides the basic settings, adjusting the measuring systems is also possible. Users can either choose the symmetrical adjustment around the zero point in order to make optimum use of the specific advantages of differential sensors, or teach in two almost arbitrary points within the measuring range. If desired, these settings can be made at the factory and documented with a manufacturer test certificate.

**Example 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 and RS485</td>
</tr>
<tr>
<td>Model</td>
<td>MSC7401</td>
</tr>
<tr>
<td>--------------</td>
<td>------------------------------</td>
</tr>
</tbody>
</table>
| Resolution  1| DTA series 13 bits (0.012 % FSO) at 50 Hz  
12 bits (0.024 % FSO) at 300 Hz | LDR series 12 bits (0.024 % FSO) at 50 Hz  
11 bits (0.048 % FSO) at 300 Hz |
| Frequency response (-3dB) | 300 Hz (adjustable only via software) |
| Linearity    | DTA series: ≤ ±0.02% FSO  
LDR series: ≤ ±0.04% FSO |
| Temperature stability | DTA series: ≤ 100 ppm FSO/K  
LDR series: ≤ 125 ppm FSO/K |
| Supply voltage | 14 … 30 VDC (5 … 30 VDC 2)  
Max. current consumption | 40 mA  
80 mA |
| Input impedance 3) | > 100 kOhm |
| Digital interface | RS485 / PROFINET 4) / EtherNet/IP 4) / EtherCAT 4) / EtherNet/IP 4)  
Analog output 4) (0)2 … 10 V; 0.5 … 4.5 V; 0 … 5 V (Ra > 1 kOhm) or 0(4) … 20 mA (load < 500 ohm) |
| Connection | Sensor: screw terminal AWG 16 up to AWG 24; with ferrule up to AWG 28 or 5-pin M9 connector (cable see accessories)  
Supply/signal: screw terminal AWG 16 up to AWG 24; with ferrule up to AWG 28 or 5-pin M12 connector (cable see accessories) |
| Mounting | 2x mounting holes for M4 |
| Temperature range | Storage: -40 … +85 °C  
Operation: -40 … +85 °C |
| Shock (DIN EN 60068-2-27) | 40 g / 6 ms in 3 axes, 2 directions and 1000 shocks each  
100 g / 5 ms in 3 axes, 2 directions and 9 shocks each |
| Vibration (DIN EN 60068-2-6) | ±1.5 mm / 5 … 57 Hz in 3 axes, 10 cycles each  
±20 g / 57 … 500 Hz in 3 axes, 10 cycles each |
| Protection class (DIN EN 60529) | IP67 (plugged) |
| Material | Aluminum die casting |
| Weight | approx. 200 g  
approx. 280 g |
| Compatibility | full-bridge sensor/LVDT (DTA series) and half-bridge sensor (LDR series) |
| No. of measurement channels | 1  
2 |

FSO = Full Scale Output
1 Noise: AC RMS measurement via RC low-pass filter of the 1st order with fc = 5 kHz
2 With technical restrictions of the output signal (load and signal span)
3 Sensor side
4 Connection via interface module (see accessories)
5 With controllers including a current output, the output signal is limited to approx. 21 mA
The MSC7602 controller is designed to be operated with measuring gauges and displacement sensors of the DTA (LVDT) and LDR (half-bridge sensors) series. 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 ideally suited to multi-channel applications. The bus connector on the rear side significantly reduces wiring effort. The controller can be easily set up via buttons/LEDs or software.

Users can either choose the symmetrical adjustment around the zero point in order to make optimum use of the specific advantages of differential sensors, or teach in two almost arbitrary points within the measuring range. If desired, these settings can be made at the factory and documented with a manufacturer test certificate.

Long measurement chains with up to 64 subscribers/bus
Model | MSC7602
---|---
Resolution 1) | DTA series: 13 bits (0.012 % FSO) at 50 Hz, 12 bits (0.024 % FSO) at 300 Hz
LDR series: 12 bits (0.024 % FSO) at 50 Hz, 11 bits (0.048 % FSO) at 300 Hz

Frequency response (-3dB) | 300 Hz (adjustable only via software)

Linearity | ≤ ±0.02% FSO

Temperature stability | DTA series: ≤ 100 ppm FSO/K
LDR series: ≤ 125 ppm FSO/K

Supply voltage | 14 … 30 VDC (5 … 30 VDC 2) |
Max. current consumption | 80 mA
Input impedance 3) | > 100 kOhm

Digital interface | RS485 / PROFINET 4) / EtherNet/IP 4)

Analog output 4) | (0)2 … 10 V; 0.5 … 4.5 V; 0 … 5 V (Ra > 1 kOhm) or 0(4) … 20 mA (load < 500 ohm)

Connection | Sensor: screw terminal AWG 16 to AWG 28
Supply/signal: screw terminal AWG 16 to AWG 28
Supply/Sync/RS485: DIN rail bus connector

Mounting | DIN rail 35 mm

Temperature range | Storage: -40 … +85 °C
Operation: -40 … +85 °C

Shock (DIN EN 60068-2-27) | 5 g / 6 ms in 6 axes, 1000 shocks each
15 g / 11 ms in 6 axes, 10 shocks

Vibration (DIN EN 60068-2-6) | ±2 mm / 10 … 15.77 Hz in 3 axes, 10 cycles each
±2 g / 15.77 … 2000 Hz in 3 axes, 10 cycles each

Protection class (DIN EN 60529) | IP20

Material | Polyamide

Weight | approx. 120 g

Compatibility | full-bridge sensor/LVDT (DTA series) and half-bridge sensor (LDR series)

No. of measurement channels | 2

---

1) Noise: AC RMS measurement via RC low-pass filter of the 1st order with fc = 5 kHz
2) With technical restrictions of the output signal (load and signal span)
3) Sensor side
4) Connection via interface module (see accessories)
5) With controllers including a current output, the output signal is limited to approx. 21 mA

---

MSC7602

Dimensions in mm, not to scale

Optional accessories:
DIN rail bus connector
Accessories for MSC7401 / MSC7602 / MSC7802

Connection cables
- PC7400-6/4: Supply and output cable, 6 m
- PC5/5-IWT: Supply and output cable, 5 m (only MSC7401 / MSC7802)
- IF7001: Single-channel USB/RS485 converter for MSC7xxx
- MSC7602 connector kit

Service
- Connection, adjustment and calibration including manufacturer certificate

Interface modules
- IF2030/ENETIP: DIN rail interface module for Ethernet/IP (multi-channel)
- IF2030/PNET: DIN rail interface module for Profinet (multi-channel)
- IF1032/ETH: Interface module for Ethernet/EtherCAT (single channel) (only MSC7401 / MSC7802)

Power supply units
- PS2401/100-240/24V/1A: Universal power supply unit with open ends

Connection options MSC7401

- PC7400-6/4
- PC5/5-IWT
- IF7001
- IF2030/ENETIP
- IF2030/PNET
- IF1032/ETH
Connection options MSC7802

PC7400-6/4

MSC7802

C701-x

DTA-xx-SA

C7210-x

LDR-xx-SA

PC5/5-IWT

MSC7802(010)

2981016: Connector assembly and cable reduction
2980017: Connector assembly

DTA-xx-CA / LDR-xx-CA

PC7400-6/4

MSC7802(020)

2981016: Connector assembly and cable reduction
2980017: Connector assembly

DTA-xx-CA / LDR-xx-CA

PC5/5-IWT

MSC7802(030)

C701-x

DTA-xx-SA

C7210-x

LDR-xx-SA

C7210-x

DTA-xx-CA / LDR-xx-CA
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 enables over-strokes. The measuring 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-Z13-5-CA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring range</td>
<td>3 mm</td>
</tr>
<tr>
<td>Linearity</td>
<td>typ. ≤ ±0.3% FSO ≤ ±9 µm</td>
</tr>
<tr>
<td>Temperature stability</td>
<td>Max. temp. error ≤ 500 ppm FSO/K</td>
</tr>
<tr>
<td>Excitation frequency</td>
<td>25 kHz</td>
</tr>
<tr>
<td>Excitation voltage</td>
<td>550 mV</td>
</tr>
<tr>
<td>Measuring object</td>
<td>Ring on plunger Ø 3 mm, length 30 mm with M3 thread (included in delivery)</td>
</tr>
<tr>
<td></td>
<td>Aluminum ring Ø 3 mm, length 3.3 mm (included in delivery)</td>
</tr>
<tr>
<td>Connection</td>
<td>integrated cable (2 m) with open ends; axial cable outlet, cable diameter 1.8 mm, min. bending radius 10 mm (fixed installation)</td>
</tr>
<tr>
<td>Mounting</td>
<td>circumferential clamping</td>
</tr>
<tr>
<td>Temperature range</td>
<td>Storage -40 ... +150 °C</td>
</tr>
<tr>
<td></td>
<td>Operation -40 ... +150 °C</td>
</tr>
<tr>
<td>Protection class (DIN EN 60529)</td>
<td>IP67</td>
</tr>
<tr>
<td>Material</td>
<td>Stainless steel, PEEK</td>
</tr>
<tr>
<td>Weight</td>
<td>Sensor approx. 20 g</td>
</tr>
<tr>
<td></td>
<td>Target ring &lt; 0.1 g</td>
</tr>
<tr>
<td>Compatibility</td>
<td>MSC7401, MSC7602, MSC7802</td>
</tr>
</tbody>
</table>
The LVP-14-F-5-CR is designed for valve lift measurements in combustion engines. The sensor detects the displacement of the electromechanically or electro-hydraulically driven inlet and outlet valves.

The measured values are fed into the control loop in order to enable variable inlet and outlet control of the valves. Ultimately, this reduces fuel consumption, emission values and adapts engine power to the individual driving situation.

### Model: LVP-14-F-5-CR

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring range</td>
<td>14 mm</td>
</tr>
<tr>
<td>Resolution</td>
<td>0.02 % FSO</td>
</tr>
<tr>
<td>Frequency response (-3dB)</td>
<td>20 kHz</td>
</tr>
<tr>
<td>Linearity</td>
<td>typ: ≤ ±1% FSO</td>
</tr>
<tr>
<td></td>
<td>Zero: ≤ ±140 µm</td>
</tr>
<tr>
<td>Temperature stability</td>
<td>Max. temp. error: ≤ 150 ppm FSO/K</td>
</tr>
<tr>
<td></td>
<td>Zero: ≤ 250 ppm FSO/K</td>
</tr>
<tr>
<td>Supply voltage</td>
<td>12 VDC ±10%</td>
</tr>
<tr>
<td>Analog output</td>
<td>2x voltage outputs (1 ... 9 V)</td>
</tr>
<tr>
<td>Measuring object</td>
<td>Aluminum ring: inner diameter 4 mm, outer diameter 6 mm, height 3.5 mm (optionally available)</td>
</tr>
<tr>
<td>Connection</td>
<td>Supply/signal: pluggable cable via 8-pin Lumberg KV81 connector, length 6 m; Sensor: integrated cable, length 0.5 m, optional extension by 2 m (see accessories for suitable connection cable)</td>
</tr>
<tr>
<td>Mounting</td>
<td>Sensor: through bores for 2x M3 screws</td>
</tr>
<tr>
<td></td>
<td>Controller: through bores for 2x M4 screws</td>
</tr>
<tr>
<td>Temperature range</td>
<td>Sensor: -30 ... +150 °C Controller: +10 ... +50 °C</td>
</tr>
<tr>
<td>Protection class (DIN EN 60529)</td>
<td>Sensor: IP67 Controller: IP40 (plugged)</td>
</tr>
<tr>
<td>Material</td>
<td>Stainless steel, PEEK</td>
</tr>
<tr>
<td>Weight</td>
<td>Sensor: approx. 50 g Controller: approx. 400 g Target ring: &lt; 0.2 g</td>
</tr>
<tr>
<td>Compatibility</td>
<td>MSC739VS-U</td>
</tr>
<tr>
<td>No. of measurement channels</td>
<td>2</td>
</tr>
</tbody>
</table>

FSO = Full Scale Output
induSENSOR EDS long-stroke sensors are designed for industrial use in hydraulic and pneumatic cylinders for displacement and position measurements of pistons or valves, e.g., to measure:
- displacement, position, gap
- deflection
- movement, stroke
- filling level, immersion depth
- and spring travel

The sensor elements of the EDS series are protected by a pressure resistant stainless steel housing. The sensor controller and signal processing are completely integrated in a sensor flange.

An aluminum tube is used as target, which is guided over the sensor rod in a non-contact and wear-free manner.

Due to their robust, constructional design, the EDS long-stroke sensors have proven invaluable for integration into hydraulic and pneumatic cylinders and for position monitoring in harsh industrial environments. Due to the eddy current principle applied, no permanent magnets need to be mounted inside the cylinder.

induSENSOR EDS sensors impress with an optimal ratio of compact design and large measuring range. Due to their small offset, the measuring range starts very close to the flange.
### Table: Measuring Range Specifications

<table>
<thead>
<tr>
<th>Model</th>
<th>EDS-75</th>
<th>EDS-100</th>
<th>EDS-160</th>
<th>EDS-200</th>
<th>EDS-250</th>
<th>EDS-300</th>
<th>EDS-400</th>
<th>EDS-500</th>
<th>EDS-630</th>
</tr>
</thead>
<tbody>
<tr>
<td>Series</td>
<td>S</td>
<td>S, F</td>
<td>S, F</td>
<td>S</td>
<td>S, F</td>
<td>S, F</td>
<td>S</td>
<td>S</td>
<td>S, F</td>
</tr>
<tr>
<td>Measuring range</td>
<td>75 mm</td>
<td>100 mm</td>
<td>160 mm</td>
<td>200 mm</td>
<td>250 mm</td>
<td>300 mm</td>
<td>400 mm</td>
<td>500 mm</td>
<td>630 mm</td>
</tr>
<tr>
<td>Resolution</td>
<td>0.038 mm</td>
<td>0.05 mm</td>
<td>0.08 mm</td>
<td>0.1 mm</td>
<td>0.125 mm</td>
<td>0.15 mm</td>
<td>0.2 mm</td>
<td>0.25 mm</td>
<td>0.315 mm</td>
</tr>
<tr>
<td>Frequency response (-3dB)</td>
<td>150 Hz</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Measuring rate</td>
<td>600 Sa/s</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Linearity</td>
<td>≤ ±0.3 % FSO</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temperature stability</td>
<td>≤ 200 ppm FSO/K</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supply voltage</td>
<td>18 … 30 VDC</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max. current consumption</td>
<td>40 mA</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Analog output</td>
<td>4 … 20 mA (load 500 Ohm)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Connection</td>
<td>S Series - 7-pin M9 screw/plug connection (Binder): axial, radial on request (see accessories for connection cable)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>F series - Bayonet 5-pin screw/plug connection; radial output (see accessories for connection cable)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temperature range</td>
<td>Storage: -40 … +100 °C</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Operation: -40 … +85 °C</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pressure resistance</td>
<td>450 bar (front)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shock (DIN EN 60068-2-27)</td>
<td>40 g / 6 ms in 3 axes, 1000 shocks each</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>100 g / 6 ms radial, 3 shocks each</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>300 g / 6 ms axial, 3 shocks each</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vibration (DIN EN 60068-2-6)</td>
<td>±2.5 mm / 5 … 44 Hz, 10 cycles each</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>±23 g / 44 … 500 Hz, 10 cycles each</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Protection class (DIN EN 60529)</td>
<td>IP65 (F series) / IP67 (S series)</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Material</td>
<td>Stainless steel (housing); aluminum (measuring tube)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Article designations

**EDS-300-S-**  
1. **S**: Compact design with housing cap  
   2. **SA7-**: Flange housing with bore holes

**Current output**  
- **SR**: Connector, radial bayonet (F series)  
- **SA7**: Connector, axial (S series)

**Measuring range in mm**

<table>
<thead>
<tr>
<th>Measuring ranges</th>
<th>Sensor rod</th>
<th>Aluminum tube</th>
<th>Offset</th>
</tr>
</thead>
<tbody>
<tr>
<td>L</td>
<td>D</td>
<td>I</td>
<td>d</td>
</tr>
<tr>
<td>75</td>
<td>110</td>
<td>10</td>
<td>110</td>
</tr>
<tr>
<td>100</td>
<td>140</td>
<td>10</td>
<td>140</td>
</tr>
<tr>
<td>160</td>
<td>200</td>
<td>10</td>
<td>200</td>
</tr>
<tr>
<td>200</td>
<td>240</td>
<td>10</td>
<td>240</td>
</tr>
<tr>
<td>250</td>
<td>290</td>
<td>10</td>
<td>290</td>
</tr>
<tr>
<td>300</td>
<td>340</td>
<td>10</td>
<td>340</td>
</tr>
<tr>
<td>400</td>
<td>450</td>
<td>12</td>
<td>450 (S)</td>
</tr>
<tr>
<td>500</td>
<td>550</td>
<td>12</td>
<td>550</td>
</tr>
<tr>
<td>630</td>
<td>680</td>
<td>12</td>
<td>680 (S)</td>
</tr>
</tbody>
</table>
Mounting options and accessories

Accessories for S series

Connection cables
C703-5    EDS connection cable for S series, 7-pin, length 5 m
C703-5/U  EDS connection cable for S series, 7-pin, length 5 m, for voltage output 1 - 5 V
C703/90-5 EDS connection cable for S series, 7-pin, length 5 m with 90° angled cable connector

Mating plug, S series

Spare tubes
Measuring tube for EDS-75-S    Spare tube
Measuring tube for EDS-100-S    Spare tube
Measuring tube for EDS-160-S    Spare tube
Measuring tube for EDS-200-S    Spare tube
Measuring tube for EDS-250-S    Spare tube
Measuring tube for EDS-300-S    Spare tube
Measuring tube for EDS-400-F    Spare tube
Measuring tube for EDS-630-F    Spare tube

Installation ring
0483326    EDS mounting ring

Accessories for the F series

Connection cables
C705-5    EDS connection cable for F series, 5-pin, length 5 m
C705-15   EDS connection cable for F series, 5-pin, length 15 m

EDS connector kit, F series

Spare tubes
Measuring tube for EDS-100-F    Spare tube
Measuring tube for EDS-160-F    Spare tube
Measuring tube for EDS-200-F    Spare tube
Measuring tube for EDS-250-F    Spare tube
Measuring tube for EDS-300-F    Spare tube
Measuring tube for EDS-400-F    Spare tube
Measuring tube for EDS-630-F    Spare tube
EDS-F: Measuring the grinding gap in crushers

EDS-S: Lift height measurement in pneumatic cylinders; flange outside the cylinder

EDS-Z: Integration in hydraulic cylinders; integrated flange and M12 built-in plug
LVDT Gauges and LVDT displacement sensors (DTA series)
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 measuring object, 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 measuring 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.
**Independent and absolute linearity of LVDT sensors**

Please consider that with LVDT sensors, two kinds of linearity must be distinguished:

With the independent linearity, an individual linearity characteristic is determined for the recorded sensor signal of each sensor. It describes the deviation of the recorded sensor signal from the individually calculated reference line (red, see figure).

The maximum deviation (d) must not exceed the values specified in the datasheet.

With the absolute linearity, a new straight line is laid through two fixed points during the adjustment which may cause the gradient of the reference line to change.

Therefore, the recorded values of the sensor signal may deviate more from the new line (blue) than is the case with the independent linearity (see figure), and also exceed the values specified in the datasheet.

---

**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 - 20mA. In achieving this, the temperature effects and the temperature gradient are essentially eliminated.
Sensors and Systems from Micro-Epsilon

- Sensors and systems for displacement, distance and position
- Sensors and measurement devices for non-contact temperature measurement
- Measuring and inspection systems for metal strips, plastics and rubber
- Optical micrometers and fiber optics, measuring and test amplifiers
- Color recognition sensors, LED analyzers and inline color spectrometers
- 3D measurement technology for dimensional testing and surface inspection