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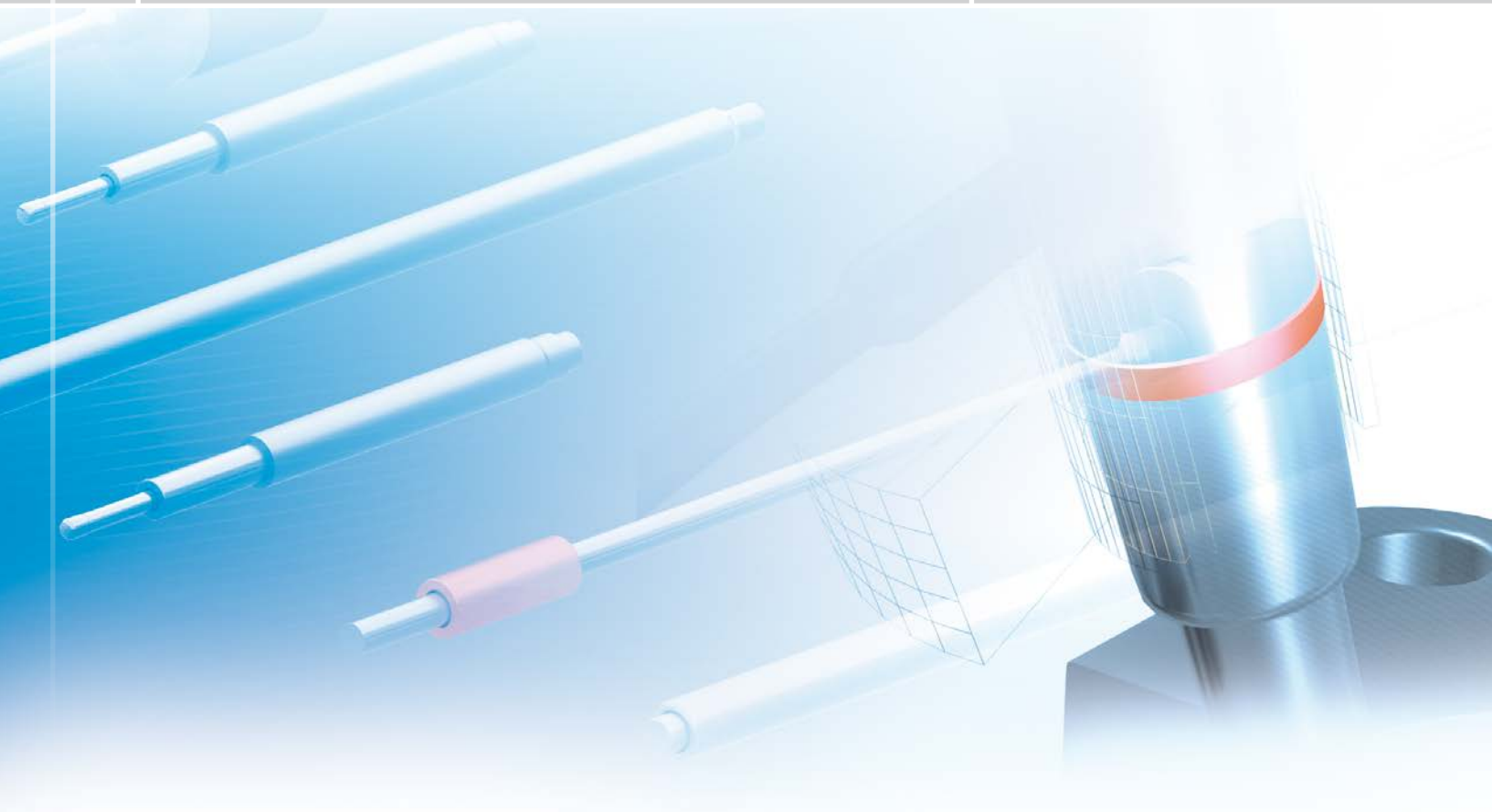
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# More Precision

**induSENSOR** // Linear inductive displacement sensors










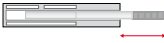
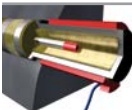


**Inductive displacement sensors with more precision**

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

	Model	Pages
	LVDT gauges	4 - 5
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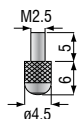
- Proven LVDT technology
- Measuring ranges  $\pm 1 \dots \pm 10 \text{ mm}$
- Low cost especially for high volume applications
- Sensor diameter of just  $\varnothing 8\text{mm}$
- Models with pneumatic push

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

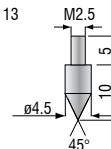
Standard: type 2



Option: type 11



Option: type 13



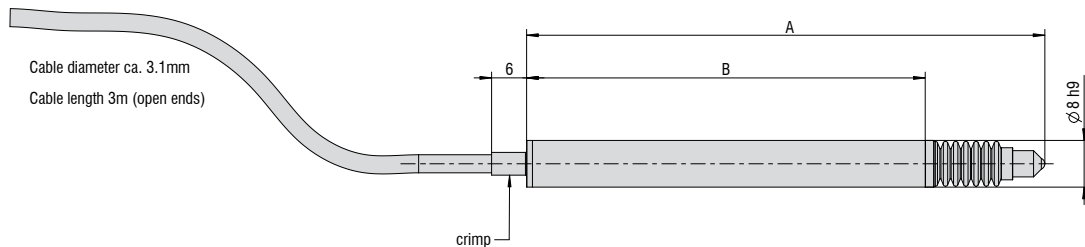
#### Article designation

DT	A-	5-	G8-	3-	CA-	V
						Gauging sensor options: V: pneumatic push
						Connection (axial): CA integral cable (3m)
						Linearity: 3 ( $\pm 0.3 \%$ )
						Function: gauging sensor
						Measuring range in mm
						Excitation AC
						Principle: Differential Transformer (LVDT)

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	0.3 % FSO							
Repeatability	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/°C							
Temperature range	-20...+80 °C (without bellows) / 0...+80 °C (with bellows)							
Diameter	8h9 mm							
Sensor material	stainless steel / FPM							
Connection / pin connector	open ends							
Protection class (sensor)	IP65 (with bellows) / IP54 (without bellows)							
Cable output	axial							
Cable length (sensor)	3 m							
Life cycle MTBF	5 million cycles							
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
Suitable controller	MSC7401 (pages 10 - 11)							

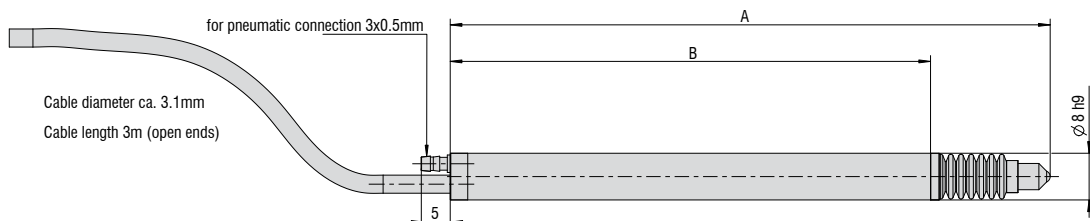
FSO = Full Scale

#### DTA-xG8-3-CA



Model	A (zero position)	B
DTA-1G8-3-CA	83 mm	64.3 mm
DTA-3G8-3-CA	89 mm	68.3 mm
DTA-5G8-3-CA	118 mm	89.5 mm
DTA-10G8-3-CA	155 mm	121.7 mm

#### DTA-xG8-3-CA-V



Model	A (zero position)	B
DTA-1G8-3-CA-V	95 mm	76.3 mm
DTA-3G8-3-CA-V	103 mm	82.3 mm
DTA-5G8-3-CA-V	134 mm	105.3 mm
DTA-10G8-3-CA-V	170.8 mm	137.3 mm



- Proven LVDT technology
- Measuring ranges  $\pm 1 \dots \pm 25 \text{ mm}$
- Extremely accurate also under difficult ambient conditions
- Long-term stability
- Wear-free measurement

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

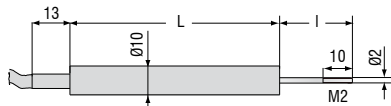
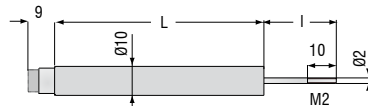
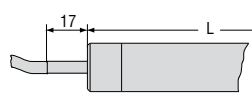
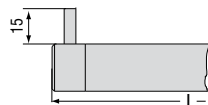
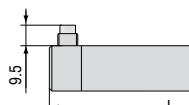
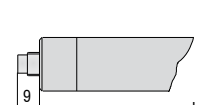
The high sensor resolution is limited only by the noise in the sensor electronics. A further advantage of the symmetrically constructed sensors in the LVDT series is the zero point stability of the systems. The sensors are supplied with an excitation frequency of 1 to 5 kHz depending on the measuring 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

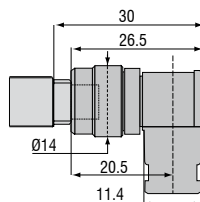
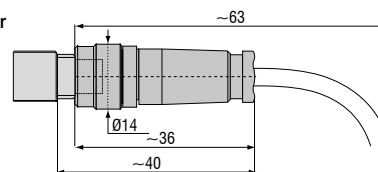
DT	A-	10-	D-	3-	CA-	W
					Options (on request): W Welded sensor housing (water proof up to 5 bar) P Pressure-resistant sensors housing with tightness test (up to 100 bar) F Pressure-resistant mounting flange O-ring seal H High-temperature sensor models up to 200 °C with integral Teflon cable (only for 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 ( $\pm$ 0.5 %)    3 ( $\pm$ 0.3 %)    1.5 ( $\pm$ 0.15 %)		
			Function: displacement sensor			
		Measuring range in mm				
	Excitation AC					
Principle: Differential Transformer (LVDT)						

Model	DTA-1D-		DTA-3D-		DTA-5D-		DTA-10D-		DTA-15D-				DTA-25D-				
Connection	CA	SA	CA	SA	CA	SA	CA	SA	CA	CR	SA	SR	CA	CR	SA	SR	
Measuring range	± 1 mm		± 3 mm		± 5 mm		± 10 mm		± 15 mm				± 25 mm				
Linearity	Standard ± 0.5 %	-		-		-		-		-				300 µm			
	Standard ± 0.3 %	6 µm		18 µm		30 µm		60 µm		90 µm				on request			
	Option ± 0.15 %	3 µm		9 µm		15 µm		on request						-			
Excitation frequency	5 kHz						2 kHz		1 kHz								
Excitation amplitude	5 V <sub>eff</sub>								2.5 V <sub>eff</sub>								
Sensitivity	133 mV/Vmm		85 mV/Vmm		53 mV/Vmm		44 mV/Vmm		45 mV/Vmm				33 mV/Vmm				
Temperature range	-20 ... +80 °C <sup>1)</sup>																
Storage temperature	-40 ... +80 °C																
Temperature stability <sup>3)</sup>	Zero	70 ppm/°C															
	Max. temp. error	150 ppm/°C															
Sensor housing	stainless steel including magnetic shielding																
Minimum cable bending radius	20 mm																
Outer diameter (cable)	~4.6 mm																
Protection class	IP 67 <sup>2)</sup>																
Shock	40 g, 1000 shocks / axis																
	100 g, 3 shocks / direction																
Vibration	10 ... 58 Hz ± 1.5 mm / 58 ... 500 Hz ± 20 g																
Suitable controller	MSC7401 (pages 10 - 11)																

FSO = Full Scale Output

<sup>1)</sup> Higher temperatures on request; <sup>2)</sup> Higher pressures on request<sup>3)</sup> Determined according to box method (-40 ... +80 °C)**Sensor types with measuring range up to  $\pm 10$  mm** (inner diameter 2.7 mm; plunger diameter 2 mm)**Type-CA** with integral cable**Type-SA** with axial plug connection**Sensor types with measuring range  $\pm 15$  mm and  $\pm 25$  mm** (inner diameter 4.8 mm; plunger diameter 4 mm)**Type - CA**  
with integral cable**Type - CR**  
with integral cable (radial)**Type - SR**  
with radial plug connection**Type - SA**  
with axial plug connection

Basic model	DTA-1D-		DTA-3D-		DTA-5D-		DTA-10D-		DTA-15D-				DTA-25D-			
Connection	CA	SA	CA	SA	CA	SA	CA	SA	CA	CR	SA	SR	CA	CR	SA	SR
Housing length L	40 mm	40 mm	57 mm	57 mm	73 mm	73 mm	87 mm	87 mm	106.5 mm				143.5 mm			
Plunger length l <sup>1)</sup>	19 mm		29 mm		30 mm		35 mm		51 mm				62 mm			
Housing diameter	10 mm								20 mm							

<sup>1)</sup> Plunger in zero position ( $\pm 10$  % of measuring range  $\pm 1$  mm)**Female connector 90°**  
dimensions apply  
for all models**Female connector**  
dimensions apply  
for all models





- *Wear-free and maintenance-free*
- *Temperature stability*
- *Operating temperature range up to 160 °C*
- *Compact design – short installation length*
- *Small sensor diameter*
- *High measurement signal quality*

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.

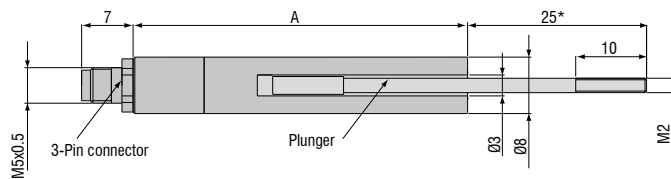


Model	LDR-10-		LDR-25-		LDR-50-	
Connection	SA	CA	SA	CA	SA	CA
Measuring range	10 mm		25 mm		50 mm	
Measuring principle	LDR - sensor					
Linearity	typ. ± 0.30 % FSO		typ. ± 0.35 % FSO		typ. ± 0.5 % FSO	
	± 0.030 mm		± 0.088 mm		± 0.35 mm	
	max. ± 0.50 % FSO				max. ± 0.70 % FSO	
Excitation frequency	16 kHz		12 kHz		8 kHz	
Excitation amplitude	1 V <sub>eff</sub>		1 V <sub>eff</sub>		2.6 V <sub>eff</sub>	
Sensitivity	51 mV/Vmm		21 mV/Vmm		5.5 mV/Vmm	
Temperature range	SA	Storage: -40 ... +80 °C / Operation: -15 ... +80 °C				
	CA	Storage: -40 ... +160 °C / Operation: -40 ... +160 °C				
Temperature stability <sup>1)</sup>	Zero	30 ppm / °C				40 ppm / °C
	Max. temp. error	100 ppm / °C				150 ppm / °C
Housing (material)	ferromagnetic stainless steel					
Weight sensor (without plunger)	9 g	24 g	14 g	28 g	23 g	37 g
Weight (plunger)	1.5 g		2.2 g		3.5 g	
Minimum bending radius (sensor cable fixed/moved)	8 / 15 mm	10 / 30mm	8 / 15 mm	10 / 30mm	8 / 15 mm	10 / 30mm
Outer diameter (sensor cable)	3.1 mm	1.8 mm	3.1 mm	1.8 mm	3.1 mm	1.8 mm
Protection class	IP67					
Shock	40 g, 3000 shocks / axis					
	100 g radial, 300 g axial					
Vibration	5 ... 44 Hz ± 2.5 mm / 44 ... 500 Hz ±20 g					
Electrical connection	SA	3-pin plug-in connection (accessory cable, article 0157047/047, 3 or 5 m)				
	CA	integral axial cable (shielded), 2 m				
Suitable controller	MSC7401 (pages 10 - 11)					

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

<sup>1)</sup> Determined according to box method (-40 ... +160 °C)

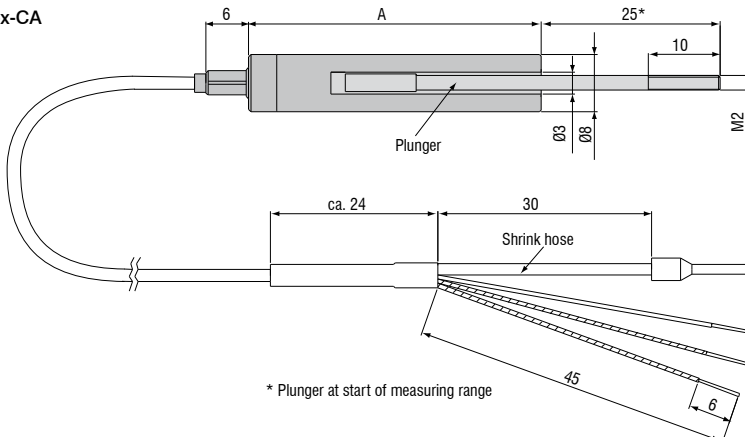
#### LDR-x-SA



\* Plunger at start of measuring range

Model	A
LDR-10-SA	47 mm
LDR-25-SA	73 mm
LDR-50-SA	127 mm

#### LDR-x-CA



\* Plunger at start of measuring range

Model	A
LDR-10-CA	41 mm
LDR-25-CA	67 mm
LDR-50-CA	121 mm

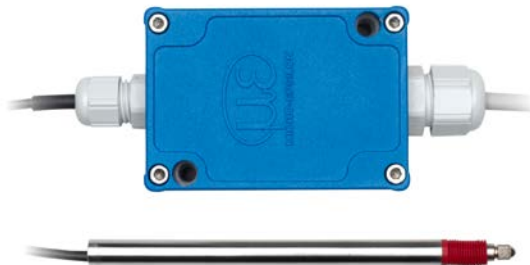


- Compact and robust aluminum housing (IP67)
- High resolution and linearity
- Universal application - compatible with LVDT and half-bridge sensors
- Ideal for high-volume applications in machine building and automation
- User-friendly set up and configuration via buttons or software

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:



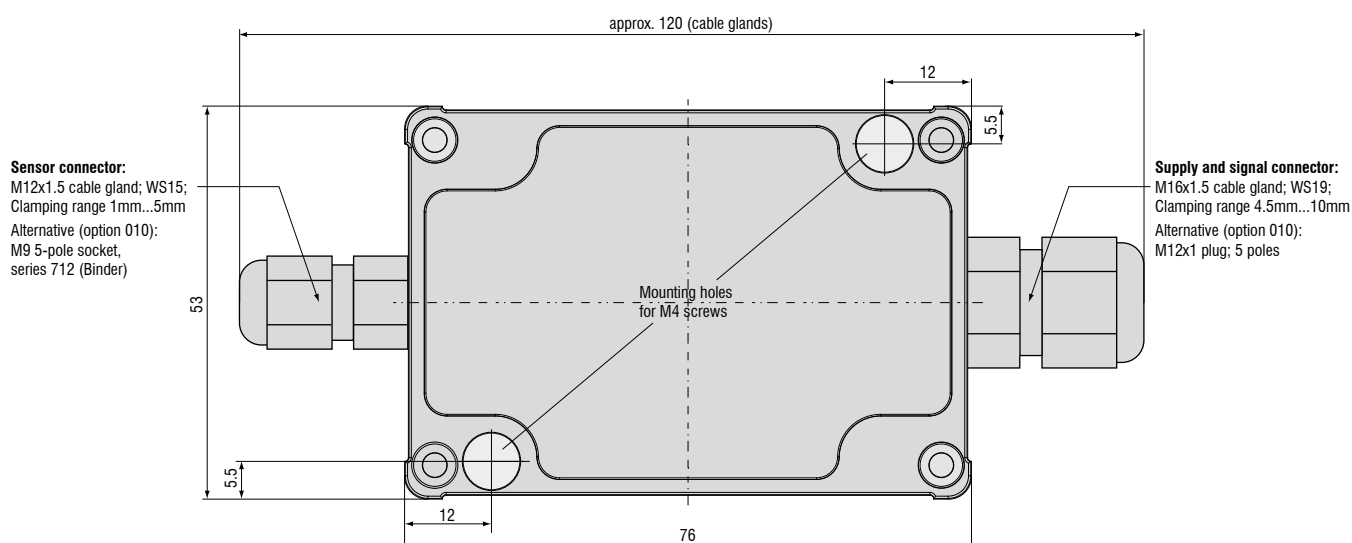
Technical Data	Channel with DTA-5G8-3-CA
Measuring range	$\pm 5 \text{ mm}$
Linearity	$30 \mu\text{m}$
Resolution	$\sim 1.2 \mu\text{m}$
Output	analog

Model		MSC7401 Miniature sensor controller	
Power supply		5 V <sup>1)</sup> ... 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)2 ... 10 VDC / 0.5 ... 4.5 V / 0 ... 5 V (Ra >1 kOhm) or (0)4 ... 20 mA (load < 500 Ohm)	
Resolution <sup>2)</sup>	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	
Linearity		0.02 % FSO	
Frequency response (only adjustable via software)		300 Hz (-3dB)	
Storage		-40 ... +85 °C	
Operation		-40 ... +85 °C	
Temperature stability	DTA series	±100 ppm FSO/K	
	LDR series	±125 ppm FSO/K	
Protection class		IP67	
Weight		approx. 200 g	
Housing material		aluminum die casting	
Connection	Cable gland	screw terminal; AWG 16 to AWG 24; with ferrule up to AWG 28	
	Connector	power supply: M12x1 plug (5 poles); sensor: M9 socket; 5 poles (Binder)	
EMC		DIN EN 61326-1; DIN EN 61326-2-3	
Vibration		DIN EN60068-2-6	
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

<sup>1)</sup> Restricted with load and signal span

<sup>2)</sup> Noise: AC RMS measurement via RC low-pass filter of the 1st order with f<sub>c</sub> = 5 kHz





- Measuring ranges from  
75 ... 630 mm

- Linearity:  $\pm 0.3\%$  FSO

- Integrated microelectronics

- Robust design:  
pressure-resistant, oil-resistant  
and maintenance-free

- Short offset ranges

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.

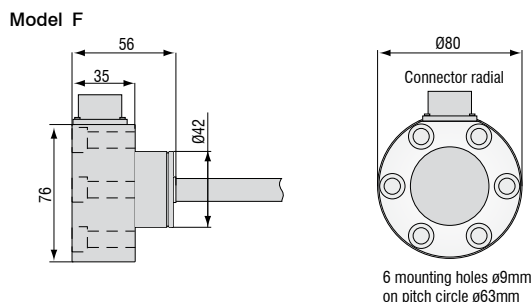
#### Typical applications

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



EDS series: integration in a hydraulic cylinder

FSO = Full Scale Output      <sup>1)</sup> Half sinusoid 6 ms

EDS-	300-	S-	SA7-	I
				Current output
				SR = connector, radial bayonet (F series) SA7 = connector, axial (S series)
				Series: S = compact design with housing cap F = flange housing with bore holes
				Measuring range in mm

Measuring ranges	Sensor rod		Aluminum tube				Offset
	L	D	I		d		a
75	110	10	110		16		15
100	140	10	140		16		20
160	200	10	200		16		20
200	240	10	240		16		20
250	290	10	290		16		20
300	340	10	340		16		20
400	450	12	450 (S)	460 (F)	18 (S)	26 (F)	25
500	550	12	550		18		25
630	680	12	680 (S)	690 (F)	18 (S)	26 (F)	25



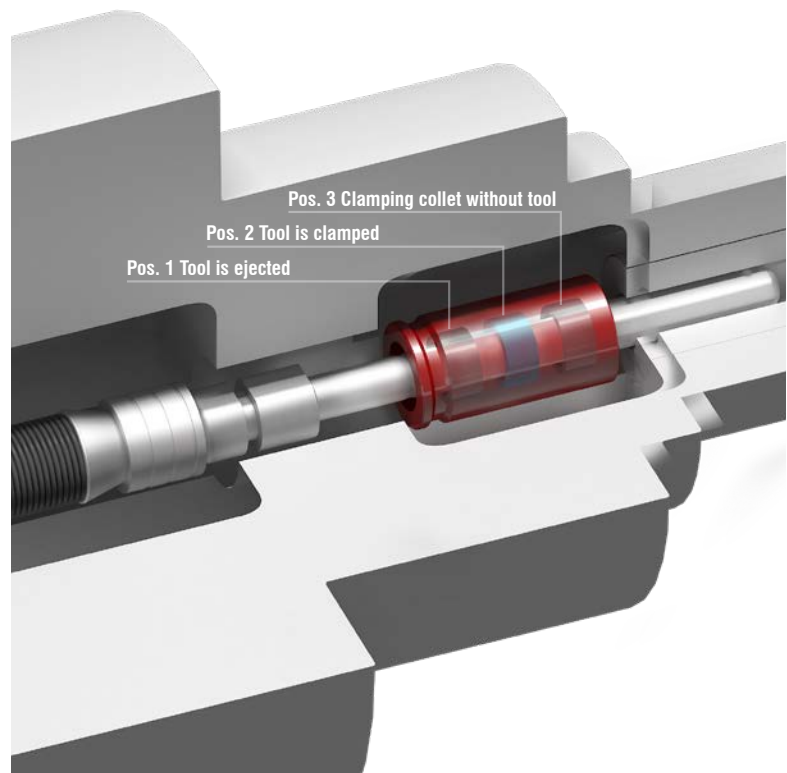
- Compact design
- High ambient temperatures
- High temperature stability
- High dynamics

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.

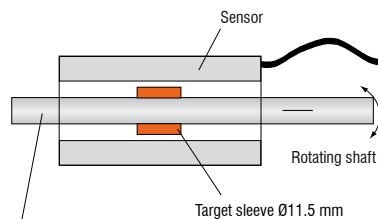
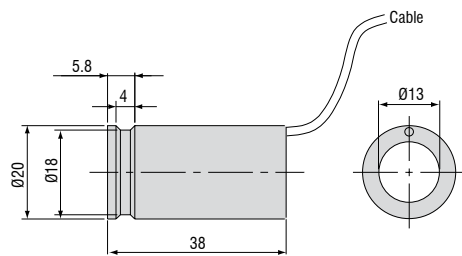
The LVP sensor can be universally used with the most varied types of tool due to an extremely compact sensor design. The sensor supplies an analog signal according to the stroke motion of the drawbar when clamping the tool. Consequently, continuous monitoring is possible without the switching point having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



Model	LVP-25-Z20-5-CA-AC
Measuring range	25 mm
Target (included)	article 0482218 for shaft diameter 8 mm
	article 0482219 for shaft diameter 10 mm
Linearity	typical $\pm 1.5\%$ FSO
Sensor housing	stainless steel
Temperature stability (sensor)	$< \pm 0.01\%$ FSO / °C
Temperature range	-40 ... +120 °C (higher on request)
Protection class (sensor)	IP67
Medium	air, oil
Controller	MSC7401 (pages 10 - 11)

FSO = Full Scale Output



Pull rod material  
31CrMoV9V, no. 1.8519.05





*The LVP-3 and LVP-14 sensors are modified LVP models designed for specific application areas and operated with external controllers.*

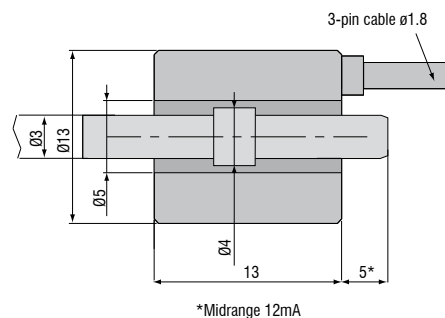
#### Sensor for needle stroke movements

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.



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

FSO = Full Scale Output



### Valve stroke sensor in stainless steel housing

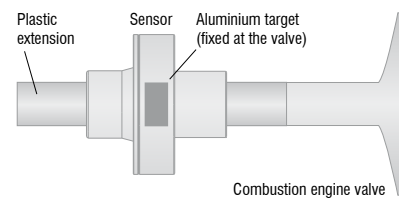
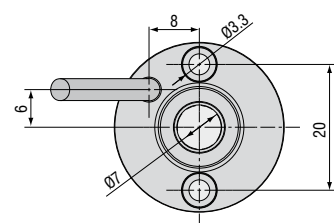
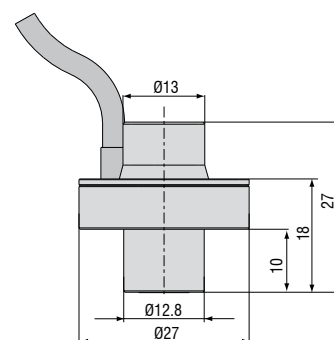
Future generations of engines will be able to dispense with mechanical camshafts. The displacement of the electromechanically or electro-hydraulically driven inlet and outlet valves of internal combustion engines is acquired by the displacement sensor of the product line LVP-14-F-5-CR and fed into the 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.



Model	LVP-14-F-5-CR
Article no.	2616078
Measuring range	14 mm
Target (optional)	Art. no. 0482273
Linearity	0.5 % FSO (0.07 mm)
Sensor housing	stainless steel
Temperature stability (sensor)	$\pm 100$ ppm / °C
Temperature range (sensor)	-30 ... +150 °C
Protection class (sensor)	IP67

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

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
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**Spare plungers**

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

**Service**

Connector installation and adjustment



Linearity inspection certificate

**Accessories for EDS series****Service**

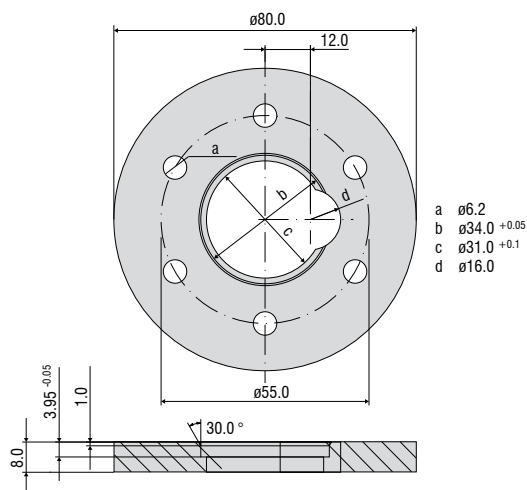
2985001		Function and linearity inspection for EDS series incl. pressure inspection and documentation without recalibration
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**Connection cables**

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
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## 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
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### Connection cables

2901087	PC710-6/4	Supply/output cable, 6 m, open ends
2901154	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

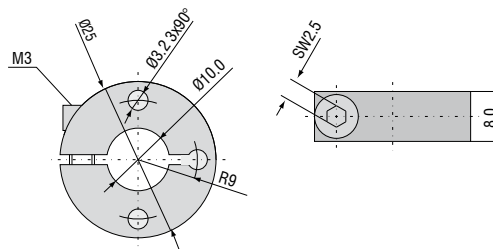
### Flanges

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

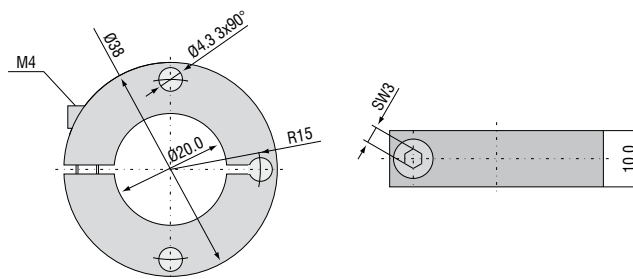
### Probe tips

0459002	Type 2
0459001	Type 2 (hard metal)
0459003	Type 11
0459004	Type 13

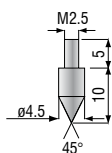
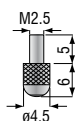
Flange DTA-F10



Flange DTA-F20



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



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:

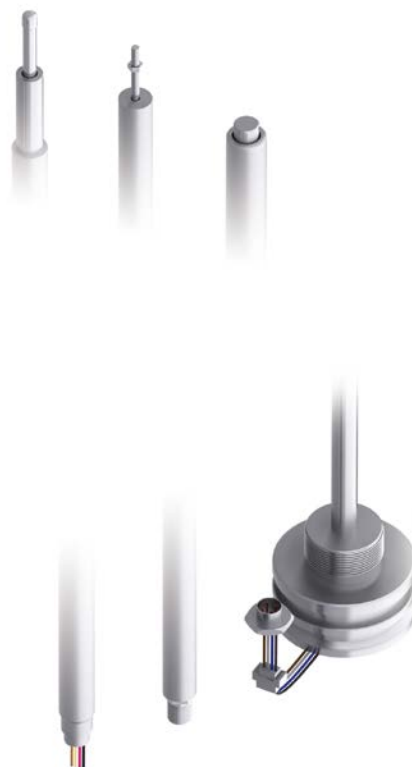
- Ambient temperature
- Pressure
- Interference fields
- Dirt, dust, and moisture
- Vibration, shock
- Seawater, IP69K



#### Basic types

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

Technology	Measuring range	Target
① EDS	up to 800 mm	tube
② LDR	up to 150 mm	plunger / probe tip
③ LVDT	up to $\pm 100$ mm	plunger / probe tip





#### Measuring range / Sensor geometry

The installation environments often require an adjustment of the sensor geometry, of the measuring range, and of the protection class. These adjustments include changes to the measuring range, sensor length and width, pressure resistance, target shape, flange and material.



#### Controller

The electronics is used for control purposes and for processing the signals from the inductive sensors.

Depending on the requirements, the electronics can be integrated in the sensor or remote. The range of functions of the electronics are specifically defined, and range from simple signal output to complex arithmetic.

#### Possible concepts

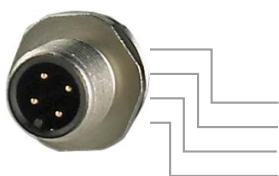
- Integrated controller
- External controller



#### Type of connection & cables

The type of connection and cable can be defined depending on the requirements.

- Connector for plugs
- Integrated cable with plug
- Integrated cable with open ends

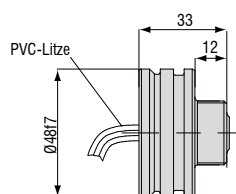


#### Output signal

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**

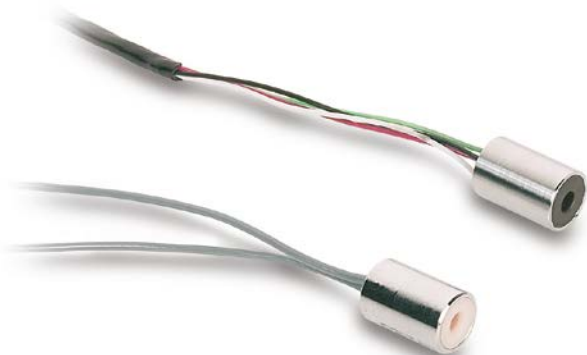
Eddy current long-stroke sensor

Measuring range	260 mm
Non-linearity	$< \pm 0.3 \%$
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

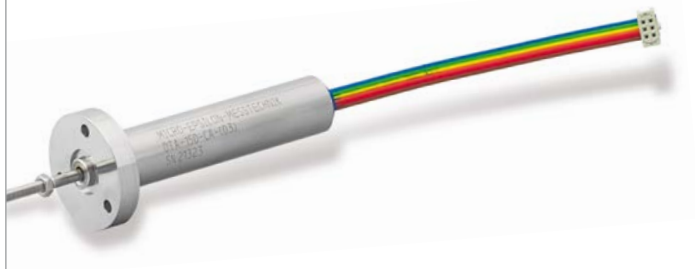
Measuring range	$\pm 1 \text{ mm}$
Outer diameter	10 mm
Sensor cable	length 850 mm



**DTA-6D-20 (07)**

Inductive LVDT displacement sensor

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

**DTA-15D-5-CA(03)**

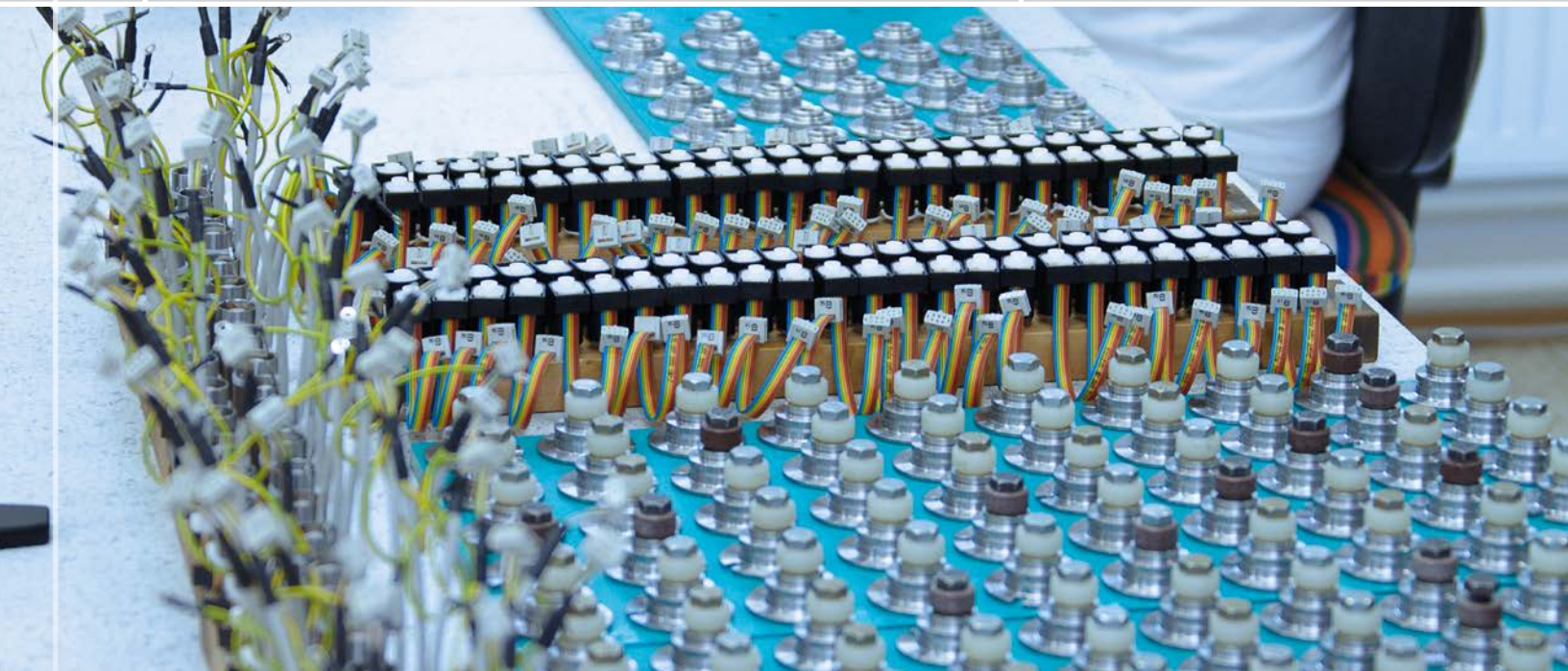
Pressure-tight LVDT sensor with welded flange

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



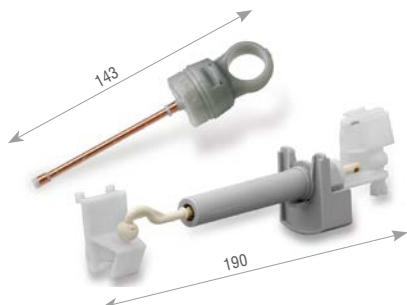
For special applications where high volumes are required, Micro-Epsilon develops sensors that are precisely tailored to the customer's requirements. The geometry, electronics and packaging are custom engineered to suit these specific requirements. Due to the high vertical range of manufacturing at Micro-Epsilon, 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

## Realised OEM 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

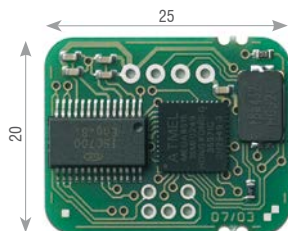
- For use in textile machines
- External controller
- Measuring range 2 mm
- Shielded sensor



**DTA-3D-5-CR5-G-HP**

Inductive displacement sensor

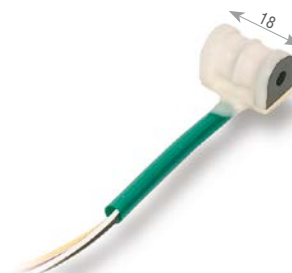
- Detection of the shaft position with hermetically sealed pumps
- Measuring range 6 mm
- ATEX / FM certification



**ISC7001**

Miniature PCB controller

- Miniature design 20 x 25 mm
- Interfaces 0.5 - 4.5 V, PWM (10 bit), UART
- Resolution 11 bit



**DTA-1D-20-DDV.02**

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

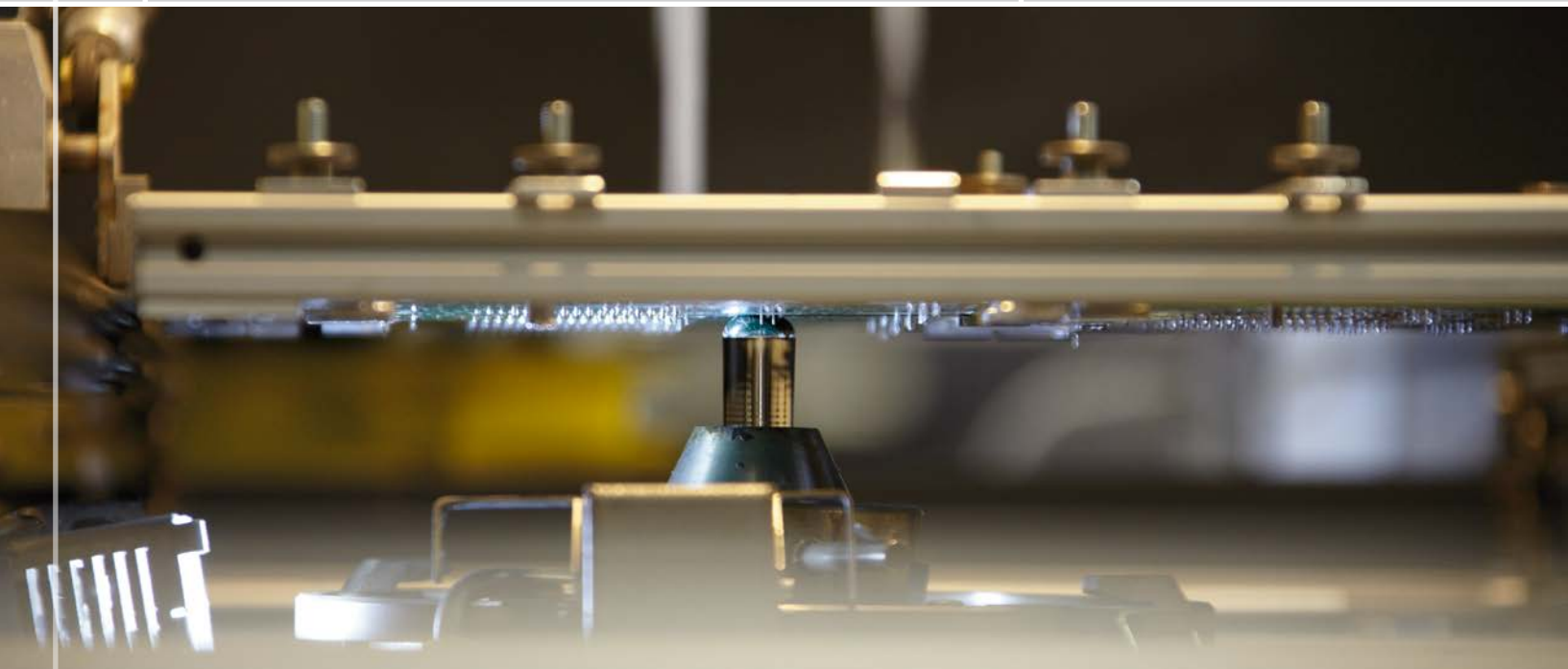


**EDS/GPS-180-ZA-I(02)**

Eddy current long-stroke sensors with integrated controller

- Piston position detection in the glass production
- Measuring range 180 mm
- High shock- and vibration-resistance



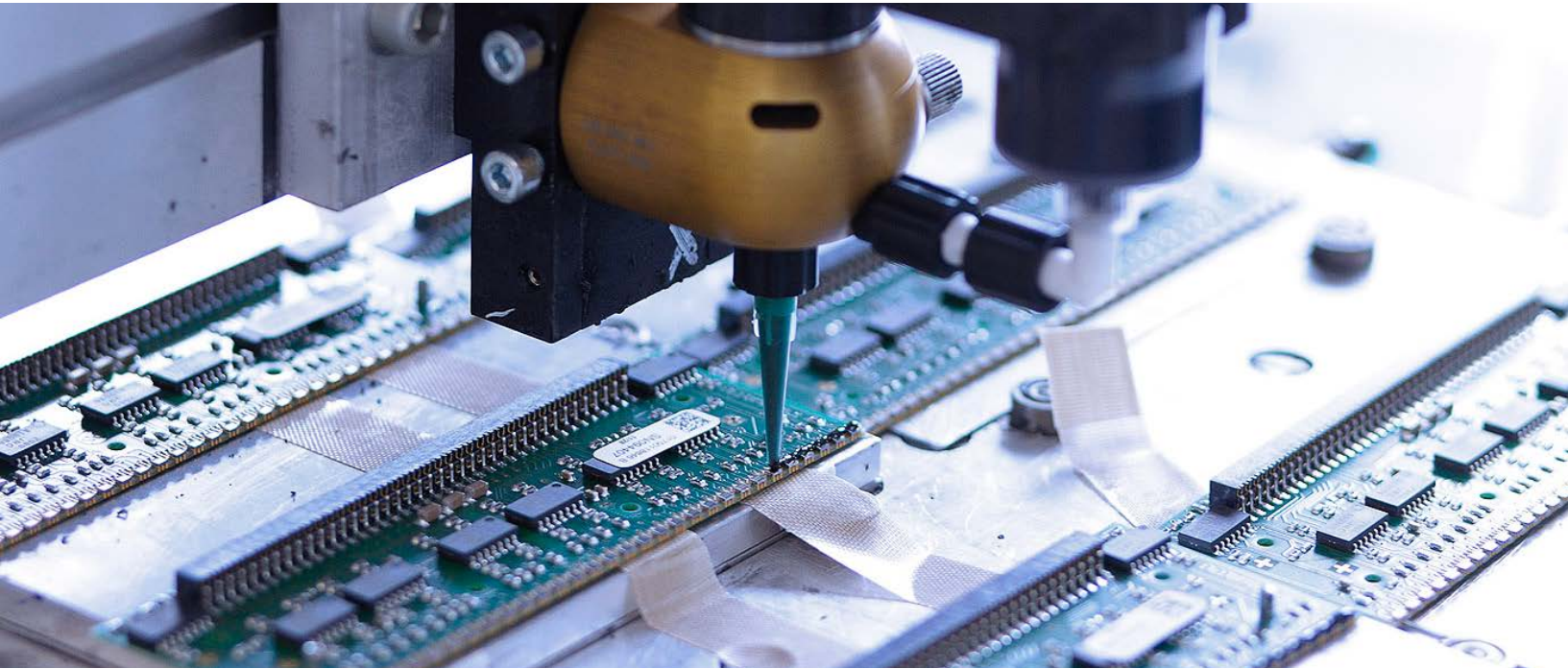


Micro-Epsilon has all the required resources available to supply solutions starting from the idea through to large-scale production, all from one source - and at competitive prices. Together with a team of engineers and customer support staff, performance specifications are converted into concepts and 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.

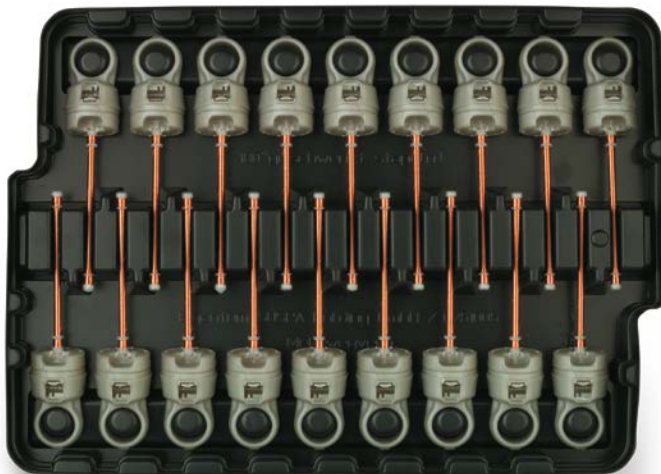
At the Micro-Epsilon headquarters, development projects are initiated and major projects coordinated. The development and sales of specific sensors for OEM customers in large quantities takes place in direct contact with the development and product specialists.

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



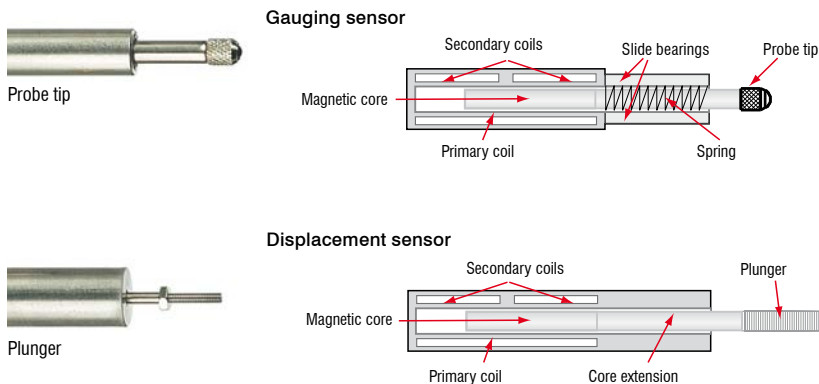
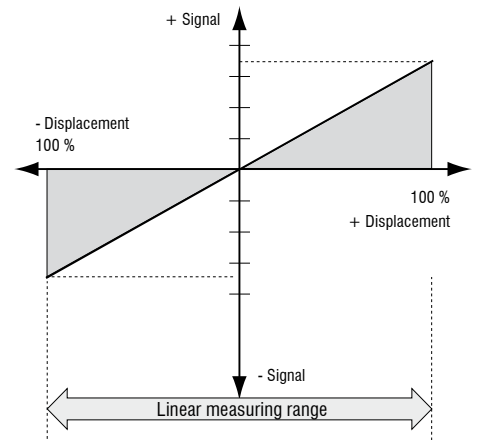
All production systems are supplied in ergonomic and assembly-friendly packaging units. In this respect, environmentally friendly and economical reusable packaging is used. Within the scope of Total Quality Management, a 100% check is integrated for numerous measurement and inspection processes.

### 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.

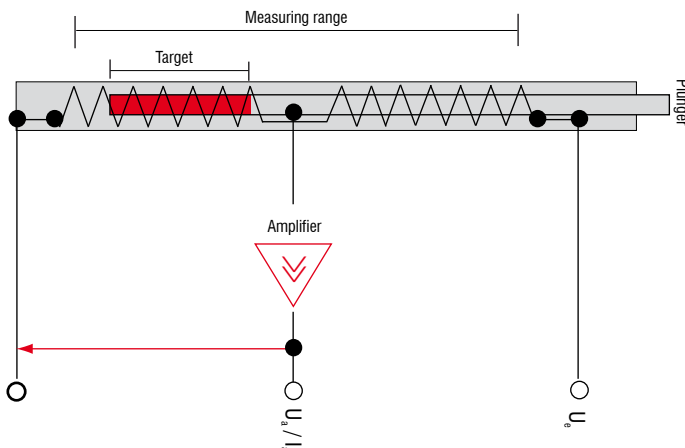
Signal LVDT



### 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



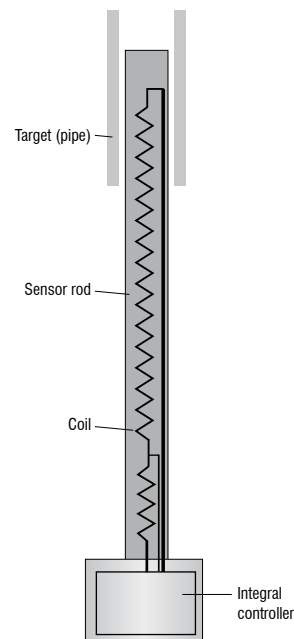
### EDS long-stroke sensors

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.

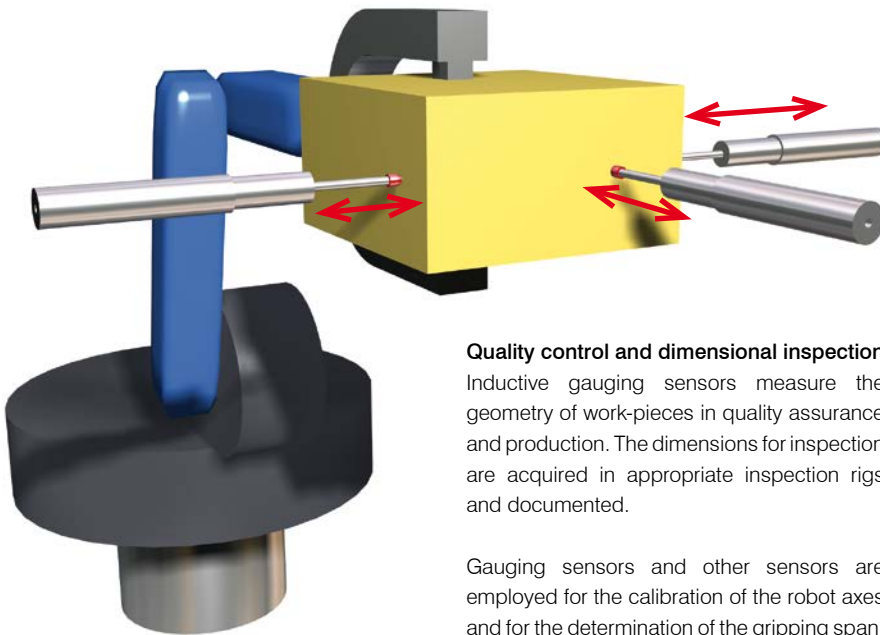
The electronic circuit generates a signal from the ratio of the impedance of the measurement coil and the compensation coil and converts the sleeve position into a linear electrical output signal of 4 - 20 mA. In achieving this, the temperature effects and the temperature gradient are essentially eliminated.

Block diagram EDS series





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.



#### 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.

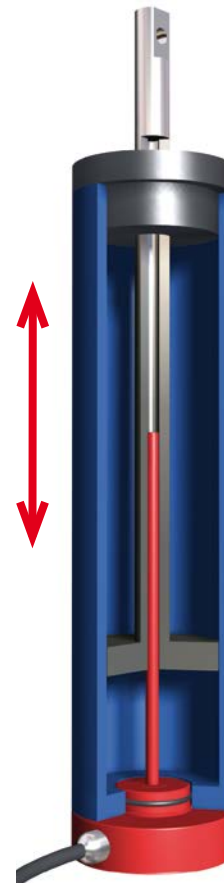
##### Heavy industry

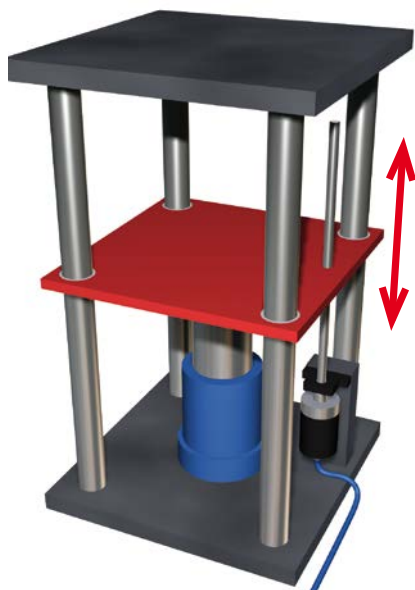
The EDS series is used for the crusher gap control on rock crushers.

##### 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.

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





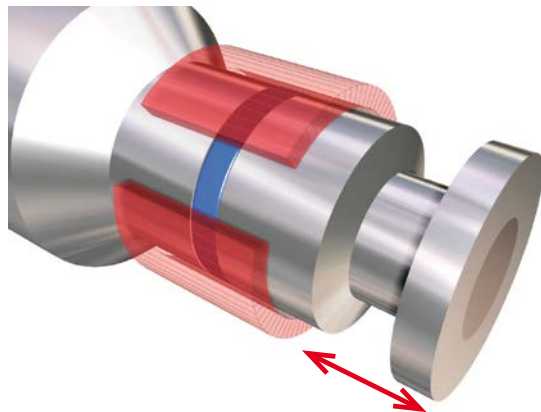
#### Inspection and testing systems

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

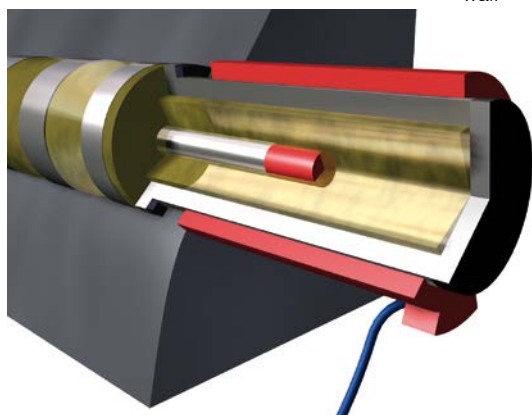
Inductive sensors from Micro-Epsilon are used for continuous measurements in civil engineering. The sensors acquire the movement of bridge elements or the walls of buildings with the change of seasons and during renewal.



#### 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.



#### Hydraulic valve

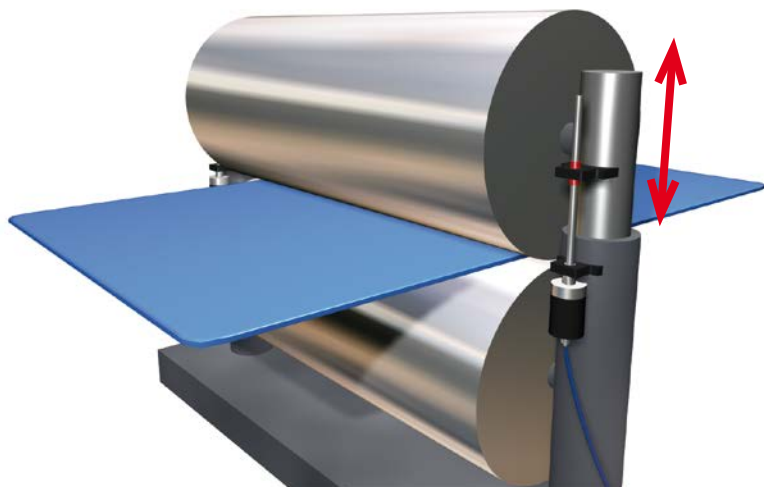
With the classical LVDT sensors and innovative sensors in the VIP series, Micro-Epsilon offers a wide selection of systems for the measurement of the piston position on hydraulic and solenoid valves. The sensors in the VIP series are particularly characterized by the small installation space and the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



#### 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



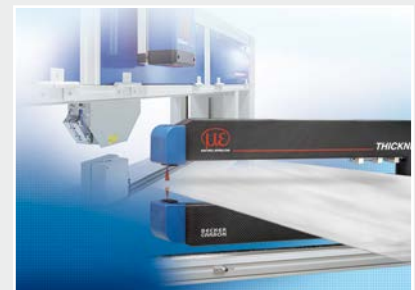
2D/3D profile sensors (laser scanner)



Optical micrometers, fiber optic sensors and fiber optics



Color recognition sensors, LED analyzers and color online spectrometer



Measurement and inspection systems