













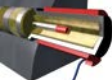


More Precision

induSENSOR // Linear inductive displacement sensors





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Inductive displacement sensors with more precision

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 good temperature stability. The electromagnetic sensors of the induSENSOR series are based on the well-proven inductive and eddy current principle. They are used successfully both in single and high volume OEM applications.

		LVDT Gauges	LVDT Displacement Sensors	LDR Sensors	LVP	VIP Sensors	EDS Sensors
Measurement principle	VIP					■	
	LVP				■		
	LVDT	■	■				
	LDR			■			
	EDS						■
Controller	integrated				■	■	■
	external	■	■	■	■		
Measuring range	up to 5mm	■	■	■			
	up to 20mm	■					
	up to 50mm		■	■	■	■	
	up to 100mm				■	■	■
	up to 150mm					■	■
	up to 200mm				■		■
	up to 300mm						■
	up to 400mm						■
	up to 630mm						■
Target	sleeve					■	
	plunger		■	■	■		
	gauge	■					
	pipe						■
Max. ambient temperature	up to 85°C	■			■	■	■
	up to 150°C		■	■			
	Option up to 200°C		■				
Max. ambient pressure	≤ 100bar		■				
	≤ 450bar						■
Output signal	4 .. 20mA	■	■	■	■	■	■
	0.5 ... 4.5VDC				■	■	■
	0/2 ... 10VDC	■	■	■			



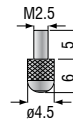
- Proven LVDT technology
- Measuring ranges $\pm 1 \dots \pm 10\text{mm}$
- Excellent price/performance ratio, especially for high volume applications
- Sensor diameter $\varnothing 8\text{mm}$
- Version with pneumatic push

LVDT gauging sensors DTA-xG8 are primarily used for the measurement and inspection of work-piece geometry (length, width, diameter,

thickness, depth, height). These new gauges are available in two basic versions: feather or pneumatic. The entire housing has a diameter of 8mm. All gauges include a cable that extends axially from the housing. Due to its special design, this series offers a very attractive price/performance ratio, especially for high volumes.

Probe tips

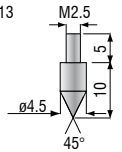
Standard: type 2



Option: type 11



Option: type 13



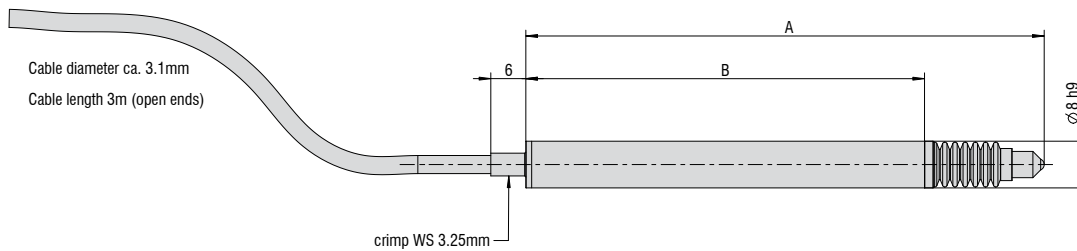
Article

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

Model	DTA-1G8	DTA-3G8	DTA-5G8	DTA-10G8	DTA-1G8-V	DTA-3G8-V	DTA-5G8-V	DTA-10G8-V
Measuring range	±1mm	±3mm	±5mm	±10mm	±1mm	±3mm	±5mm	±10mm
Linearity	0.3 % FSO							
Repeatability	0.15µm	0.45µm	0.75µm	1.5µm	0.15µm	0.45µm	0.75µm	1.5µm
Temperature stability	250ppm/°C							
Temperature range	-20...+80 °C (without bellows) / 0...+80 °C (with bellows)							
Diameter	8h9mm							
Sensor material	stainless steel / FPM							
Connection / pin connector	open ends							
Protection class sensor	IP65 (with bellows) / IP54 (without bellows)							
Cable output	axial							
Sensor cable length	3m							
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
Electronics	MSC710 (page 8 - 9)							

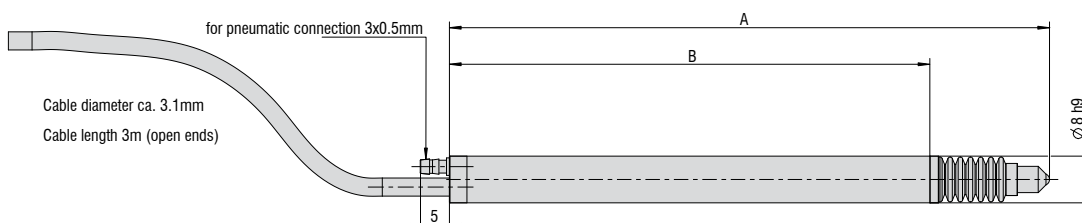
FSO = Full Scale Output

DTA-xG8-3-CA



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

DTA-xG8-3-CA-V



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



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

LVDT displacement sensors have a plunger which moves freely in the sensor housing. The plunger is joined to the object by a thread to transfer the movement of the measurement object. The measurement process in the sensor takes place without contact and is therefore wear-free. The displacement sensors are mainly used to measure and monitor movements, displacements, positions, strokes, deflections, dislocations, etc. in vehicles, machines and systems.

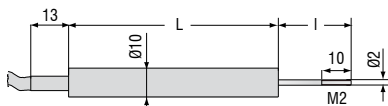
The high sensor resolution is limited only by the noise in the sensor electronics. A further advantage of the symmetrically constructed sensors in the LVDT series is the zeropoint stability of the systems. The sensors are supplied with an excitation frequency of 1 to 5 kHz depending on the measurement range and an excitation amplitude of 2.5 to 5V_{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

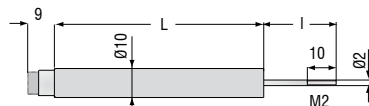
DT	A-	10-	D-	3-	CA-	W
Options:						
W welded/sealed housing (water proof up to 5bars)						
P pressure resistant housing (up to 100bar)						
F pressure resistant mounting flange O-ring seal						
H high temperature sensor up to 200°C with integral teflon cable (only for connection types -CA/-CR)						
Connection axial			Connection radial			
CA integral cable (3m)			CR integral cable (3m)			
SA plug connection			SR plug connection			
Linearity: 5 ($\pm 0.5\%$) 3 ($\pm 0.3\%$) 1,5 ($\pm 0.15\%$)						
Function: displacement sensor						
Measuring range \pm 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	±1mm		±3mm		±5mm		±10mm		±15mm				±25mm			
Linearity	standard ±0.5%		-		-		-		-				300 μm			
	standard ±0.3%		6 μm		18 μm		30 μm		60 μm		90 μm		150 μm			
	optional ±0.15%		3 μm		9 μm		15 μm		30 μm		45 μm		-			
Excitation frequency	5kHz				2kHz				1kHz							
Excitation amplitude	5V _{eff}								2.5V _{eff}							
Sensitivity	133mV/Vmm		85mV/Vmm		53mV/Vmm		44mV/Vmm		45mV/Vmm				33mV/Vmm			
Temperature range	-20°C...80°C															
Storage temperature	-40°C ... +80°C / +120°C															
Temperature stability	zero ±50ppm/°C															
	sensitivity ±100ppm/°C															
Housing	stainless steel including magnetic shielding															
Minimum cable bending radius	20mm															
Outer diameter cable	~4.6mm															
Protection class	IP 67															
Shock	40g, 1000 shocks / axis															
	100g, 3 shocks / direction															
Vibration	10Hz ... 58Hz ±1.5mm / 58Hz ... 500Hz ±20g															
Electronics	MSC710 (page 8 - 9)															

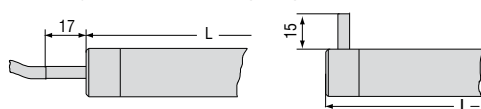
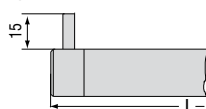
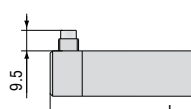
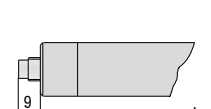
FSO = Full Scale Output

Sensor types with measuring range up to ±10mm (inner diameter ø2.7mm)

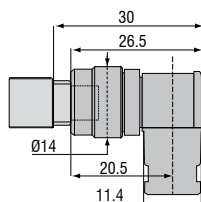
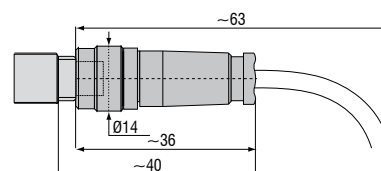
Type-CA with integral cable



Type-SA with axial plug connection

Sensor types with measuring range ±15mm and ±25mm (inner diameter ø4.8 mm)Type - CA
with integral cableType - CR
with integral cable (radial)Type - SR
with radial plug connectionType - 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
Length of housing L	40mm	40mm	57mm	57mm	73mm	73mm	87mm	87mm	106.5mm				143.5mm			
Length of plunger l ¹⁾	19mm		29mm		30mm		35mm		51mm				62mm			
Housing diameter	10mm								20mm							

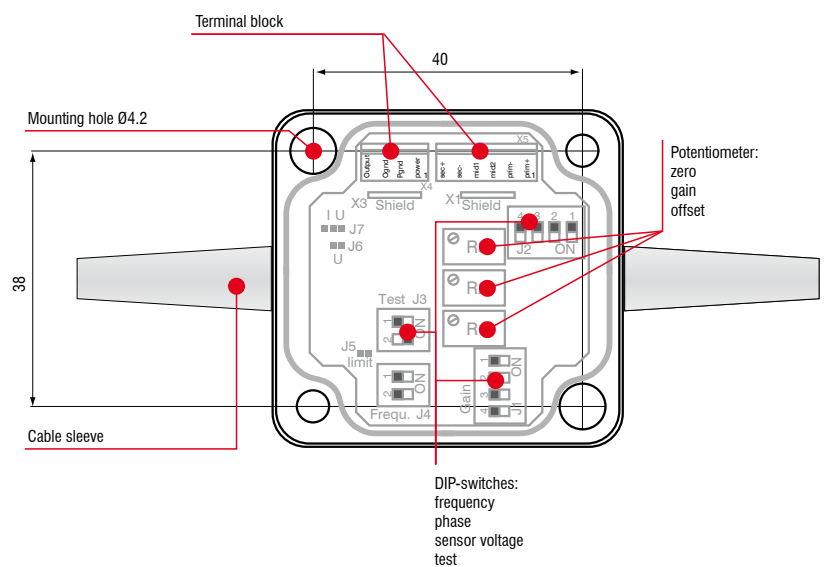
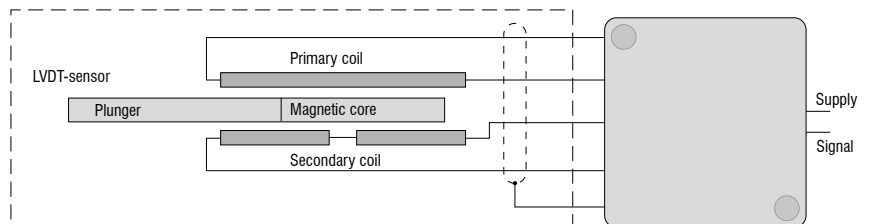
¹⁾ Plunger in zero position (±10% of measuring range ±1 mm)**Female connector 90°**
dimensions apply
for all models**Female connector 90°**
dimensions apply
for all models



- Excellent linearity and resolution
- Zero and gain adjustable coarse/fine
- Excitation frequency 1 ... 10kHz (selectable)
- Compact and robust EMI-proofed housing

The MSC710 is a single-channel miniature sensor controller for the operation of inductive displacement sensors based on the LVDT principle (Linear Variable Differential Transformer). Its compact, but rugged design, makes it suitable for both industrial and laboratory applications.

Easily accessible and simple to operate, by using DIP-switches. The electronic unit can be matched to a wide range of sensors.



Model	MSC710-U	MSC710-I
Power supply	18 ... 30 VDC (18 ... 45mA)	
Protection	Reverse polarity protection, overvoltage protection	
Sensor principle	for LVDT sensors	
Sensor excitation	150 ... 400mV	
	1/2/5kHz (selectable by DIP-switches)	
Input impedance	sensor	10kOhm
Range	gain	-20 ... +350% (trimpot)
	zero	±50% (trimpot)
Output signal	2 ... 10 VDC ($R_a > 1k\Omega$)	4 ... 20mA (load < 500Ohm)
Noise	< 1.5mV _{eff} *	< 3μA _{eff} *
	< 15mV _{ss}	< 30μA _{ss}
Linearity	< 0.02% FSO	
Frequency response	300Hz (-3dB)	
Temperature range	storage	-40°C ... +85°C
	operating	0°C ... +70°C
Temperature stability	±100ppm / °C	
Protection class	IP 65	
Weight	80g	
Housing material	ABS-plastic	
Electromagnetic compatibility (EMC)	EN 61326-1:2006 (spurious emission)	
	EN 61326-2-3:2006 (immunity to interference)	
Vibration	EN 60068-2-64 (noise)	
Shock	EN 60068-2-29 (continuous shock)	

FSO = Full Scale Output

* RMS AC-Measuring, Frequency 3 Hz ... 300 Hz



- *No wear and no maintenance*
- *Excellent temperature stability*
- *Operating temperature range up 160°C*
- *Compact design - short installed length*
- *Small sensor diameter*
- *High measurement signal quality*

The specific sensor configuration of the linear displacement sensors in the LDR series is characterised by a short, compact design with 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 measurement systems in locations where space is restricted.

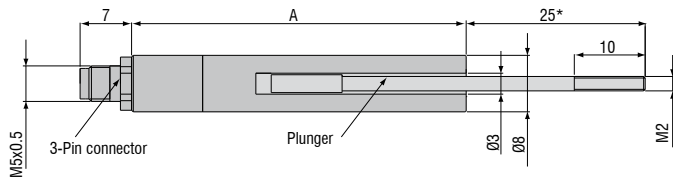
Fields of use and applications

The inexpensive 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	10mm		25mm		50mm	
Measuring principle	LDR - sensor					
Linearity	typ. $\pm 0.30\%$ FSO		typ. $\pm 0.35\%$ FSO		typ. $\pm 0.7\%$ FSO	
	$\pm 0.030\text{mm}$		$\pm 0.088\text{mm}$		$\pm 0.35\text{mm}$	
	max. $\pm 0.50\%$ FSO					
Excitation frequency	16kHz		12kHz		8kHz	
Excitation amplitude	$1V_{\text{eff}}$		$1V_{\text{eff}}$		$2.6V_{\text{eff}}$	
Sensitivity	51mV/Vmm		21mV/Vmm		5.5mV/Vmm	
Temperature range	SA	storage: $-40^{\circ}\text{C} \dots +80^{\circ}\text{C}$ / operation: $-15^{\circ}\text{C} \dots +80^{\circ}\text{C}$				
	CA	storage: $-40^{\circ}\text{C} \dots +160^{\circ}\text{C}$ / operation: $-40^{\circ}\text{C} \dots +160^{\circ}\text{C}$				
Temperature stability	zero	$\pm 30\text{ppm} / ^{\circ}\text{C}$				$\pm 40\text{ppm} / ^{\circ}\text{C}$
	sensitivity	$\pm 100\text{ppm} / ^{\circ}\text{C}$				$\pm 150\text{ppm} / ^{\circ}\text{C}$
Housing (material)	ferromagnetic stainless steel					
Weight sensor (without plunger)	9g	24g	14g	28g	23g	37g
Weight plunger	1.5g		2.2g		3.5g	
Sensor cable - minimum bending radius fixed / moved	8 / 15mm	10 / 30mm	8 / 15mm	10 / 30mm	8 / 15mm	10 / 30mm
Outer cable diameter	3.1mm	1.8mm	3.1mm	1.8mm	3.1mm	1.8mm
Protection class	IP 67					
Shock	40g, 3000 shocks / axis					
	100g radial, 300g axial					
Vibration	5Hz ... 44Hz $\pm 2.5\text{mm}$ / 44Hz ... 500Hz $\pm 20\text{g}$					
Electric connection	SA	3-pin connector (accessory cable, article 0157047/047, 3 or 5m)				
	CA	integral axial cable (shielded), 2m				
Electronics	MSC7210 (page 12 - 13)					

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

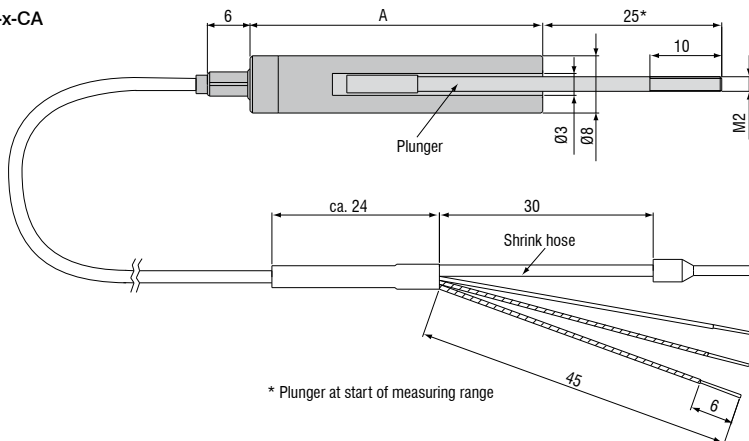
LDR-x-SA



* Plunger at start of measuring range

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

LDR-x-CA



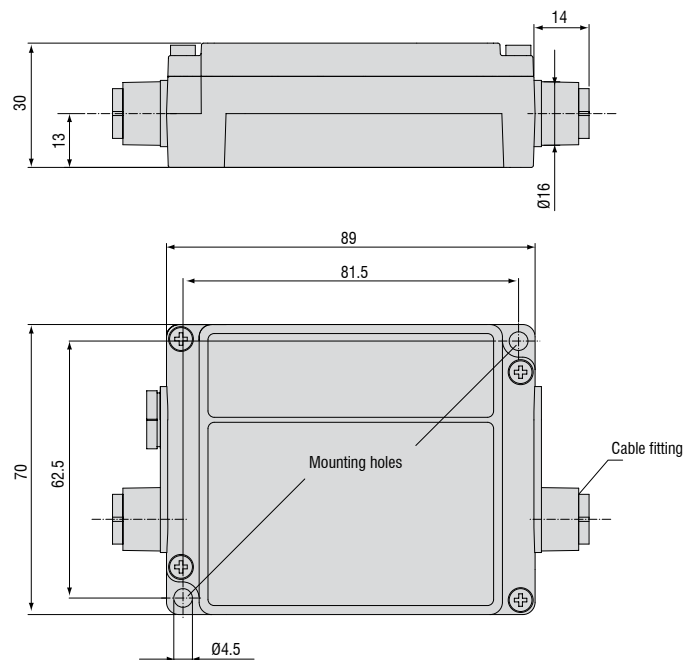
* Plunger at start of measuring range

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



- Rugged die-cast housing
- For all sensors in the LDR series
- Adjustable excitation frequency
4 ... 33kHz
- Zero point and gain can be adjusted
- High resolution and linearity

The MSC7210 is a single-channel electronic unit for the operation of inductive displacement transducers according to the LDR principle. The zero point and gain can be set over a wide range using trimming potentiometers. Due to the small size, the electronic unit is versatile in mounting.



Model	MSC7210-U	MSC7210-I
Power supply	18 ... 30VDC	
Protection	polarity reversal and overvoltage protection	
Sensor principle	LDR sensor	
Sensor excitation	1000 ... 2600mV	
	4 bis 33kHz (16 steps selectable via DIPswitch)	
Range	gain	-20 ... +270% FSO (trimpot)
	zero	± 70% FSO (trimpot)
Output signal	2 ... 10VDC	4 ... 20mA
Noise	< 1.5mV _{eff} *	< 3μA _{eff} *
	< 15mV _{ss}	< 30 μA _{ss}
Linearity	± 0.02% FSO	
Frequency response	300Hz	
Temperature range	storage	-40°C ... +85°C
	operating	0°C ... +70°C
Temperature stability	±100ppm / °C	
Housing material	zinc die cast	
Electromagnetic compatibility (EMC)	EN 61326-1:2006 (spurious emission)	
	EN 61326-2-3:2006 (immunity to interference)	
Protection class	IP 65	
Shock	test signal: half sine wave	
	peak acceleration 15g	
	shock duration 6ms	
	test axes x, y, z	
	No. of impacts per axis: 1000	
Vibration	test signal: sine - sweep	
	frequency: 20 ... 500Hz	
	test axes x, y, z	
	No. of frequency cycles per axis: 10	
Sensor connection	plugable screw clamp 4-pin	
Signal/supply connection	plugable screw clamp 5-pin	

FSO = Full Scale Output

* RMS AC measurement, frequency 3Hz ... 300Hz



- No wear and no maintenance
- Linearity 0.25% FSO
- Integrated microelectronics
- Compact design - short installed length
- Shielded against EMI
- For use in difficult ambient conditions

The displacement sensors of the LVP series use a plunger for measurement. They are equipped with integrated electronics.

An important advantage of the LVP measuring technique lies in the short length of the installed sensor. This difference in lengths becomes clear in a direct comparison with an LVDT sensor.

The LVP displacement sensors are ideally suited for tiny installation rooms. With protection class IP67, the sensors can even be used in harsh industrial environments.

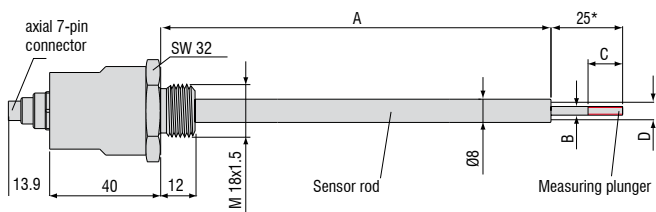


Comparison of the length of LVDT and LVP series with identical measuring ranges

Model		LVP-50	LVP-100	LVP-200
Measuring range		50mm	100mm	200mm
Linearity	standard $\pm 0.5\%$ FSO	0.25mm	0.5mm	1.0mm
	option $\pm 0.25\%$ FSO	0.125mm	0.25mm	-
Resolution	$< 0.03\%$ FSO	0.015mm	0.03mm	0.06mm
Temperature range			-40°C ... +85°C	
Temperature stability	zero		± 50 ppm / °C	
	sensitivity		± 150 ppm / °C	
Frequency response (-3dB)			300Hz	
Output			4 ... 20mA	
Output load			500Ω	
Power supply			18 ... 30VDC	
Current consumption			max. 40mA	
Protection class			IP 67	
Electromagnetic compatibility (EMC)			EN 61326-1:2006 (spurious emission) EN 61326-2-3:2006 (immunity to interference)	
Shock ¹⁾			40g, 3000 shocks / axis; 100g radial, 300g axial	
Vibration			5Hz ... 44Hz ± 2.5 mm; 44Hz ... 500Hz ± 20 g	

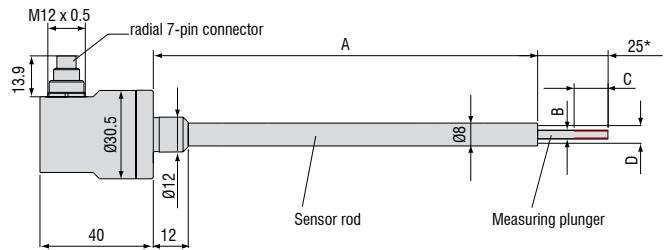
FSO = Full Scale Output
¹⁾ Half sinusoid 6ms

LVP series housing version -GA- (option)



* Measuring plunger start position $I_{out} = 4$ mA

LVP series housing version -ZA-



* Measuring plunger start position $I_{out} = 4$ mA

Article

LVP-	50-	ZA-	2.5-	SR7-	I
					Electrical output
					SA7= connector, axial (housing version GA) SR7= connector, radial (housing version ZA)
					Linearity 5 = 0.5% FSO 2.5 = 0.25% FSO
					ZA= housing, cylindrical (standard) GA= housing, threaded (option)
					Measuring range in mm

Measuring range	A	B	C	D
50	77	M2	10	4
100	138	M3	12	4
200	261	M3	12	4

All data in mm



- No wear and no maintenance
- Linearity 0.25% FSO
- Integrated microelectronics
- Short and compact design
- Rugged encapsulated sensor construction
- For use in difficult ambient conditions
- Lateral measurement possible

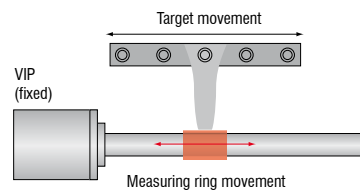
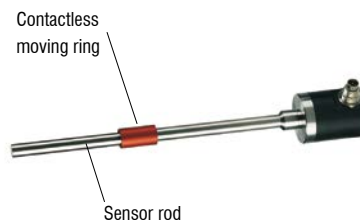
VIP sensors operate with a contactless moving ring. There is no mechanical contact between the measuring element (ring) and the sensor rod. The sensor therefore operates without any wear.

Parallel mounting

The optimum ratio of measurement range to installed length of the sensor reduces the installation space needed for the VIP series.

The parallel connection of the measurement object and measuring ring facilitates completely new construction and installation options. Whereas with conventional sensors with an axial measurement path, the length of the plunger must be added to the actual housing length, with the VIP series only the housing length has to be considered during the design.

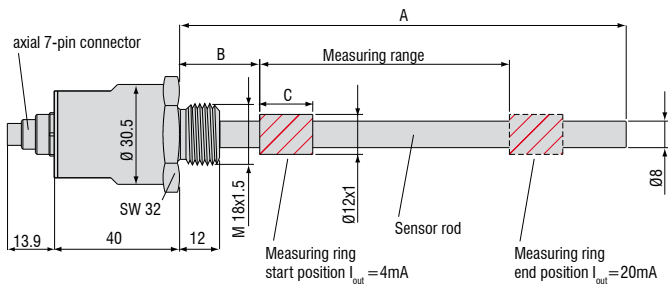
With protection class IP67, the sensors can even be used in harsh industrial environments.



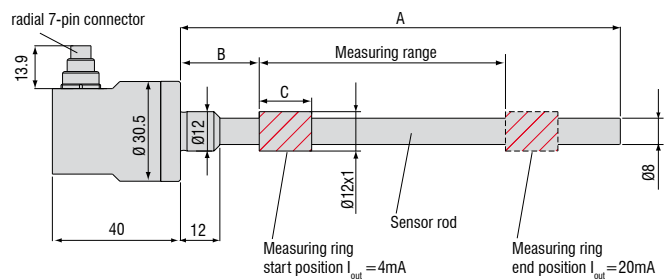
Model	VIP-50	VIP-100	VIP-150
Measuring range	50mm	100mm	150mm
Linearity	standard $\pm 0.5\%$ FSO	0.25mm	0.75mm
	option $\pm 0.25\%$ FSO	0.125mm	-
Resolution	$< 0.03\%$ FSO	0.015mm	0.045mm
Temperature range		-40°C ... +85°C	
Temperature stability	zero	$\pm 50\text{ppm} / ^\circ\text{C}$	
	sensitivity	$\pm 150\text{ppm} / ^\circ\text{C}$	
Frequency response (-3 dB)		300Hz	
Output		4 - 20mA	
Output load		500Ω	
Power supply		18 - 30VDC	
Current consumption		max. 40mA	
Protection class		IP 67	
Electromagnetic compatibility (EMC)		EN 61326-1:2006 (spurious emission) EN 61326-2-3:2006 (immunity to interference)	
Shock ¹⁾		40g, 3000 shocks / axis	
Vibration		100g radial, 300g axial	
		5Hz ... 44Hz $\pm 2.5\text{mm}$; 44Hz ... 500Hz $\pm 20\text{g}$	

FSO = Full Scale Output
¹⁾ Half sinusoid 6ms

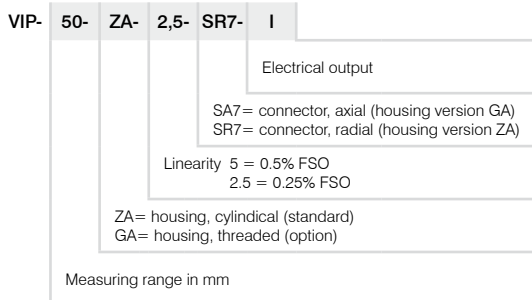
VIP series housing version -GA- (option)
 Dimensions in mm, not to scale



VIP series housing version -ZA-
 Dimensions in mm, not to scale



Article



Measuring range	A	B	C
50	105	24	11.5
100	175	27	22
150	242	30	33



- Measurement ranges 75 ... 630mm
- Linearity $\pm 0.3\%$ FSO
- Integrated microelectronics
- High pressure resistance
- 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 aluminium sleeve is used which is integrated into the piston rod and is passed without making contact and wearfree over the sensor rod. Integration in a hydraulic cylinder. Due to the use of the eddy current principle, no permanent magnets need to be mounted inside the cylinder.

Due to the rugged design of the long-stroke sensors of the EDS series, these sensor systems have proven themselves, not only through the integration in hydraulic and pneumatic cylinders, but especially under harsh industrial conditions.

Typical applications

Long-stroke sensors in the EDS series 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, spring travel

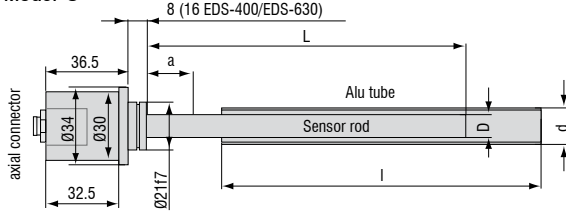


EDS series: integration in a hydraulic cylinder

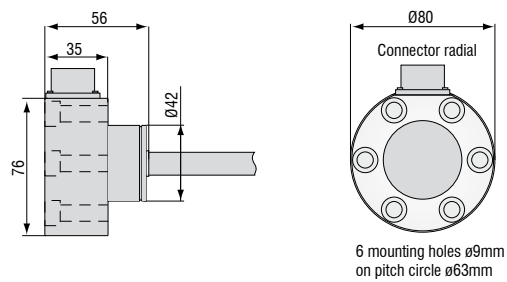
Model	EDS-75	EDS-100	EDS-160	EDS-200	EDS-250	EDS-300	EDS-400	EDS-500	EDS-630
Connection	S	S, F	S, F	S	S, F	S, F	S, F	S	S, F
Measuring range	75mm	100mm	160mm	200mm	250mm	300mm	400mm	500mm	630mm
Linearity	±0.3% FSO	0.23mm	0.3mm	0.48mm	0.6mm	0.75mm	0.9mm	1.2mm	1.89mm
Resolution	0.05% FSO	0.038mm	0.05mm	0.08mm	0.1mm	0.125mm	0.15mm	0.2mm	0.315mm
Temperature range	-40°C ... +85°C								
Temperature stability	±200ppm / °C								
Frequency response (-3 dB)	150Hz								
Output	4 - 20mA								
Output load	500Ω								
Power supply	18 - 30VDC								
Current consumption	max. 40mA								
Connector	model S	7-pin connector (sensor cable as an option) options radial or axial output							
	model F	5-pin radial bayonet-connector with mating plug							
Pressure resistance	450bar (sensor rod, flange)								
Protection class	IP 67								
Electromagnetic compatibility (EMC)	EN 61326-1:2006 (spurious emission) EN 61326-2-3:2006 (immunity to interference)								
Shock ¹⁾	40g, 3000 shocks / axis 100g radial, 300g axial								
Vibration	5Hz ... 44Hz ±2.5mm 44Hz ... 500Hz ±23g								
Material	V4A-Steel 1.4571								

FSO = Full Scale Output ¹⁾ Half sinusoid 6 ms

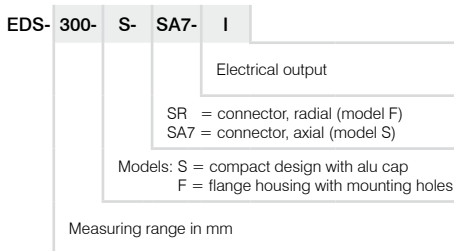
Model S



Model F



Article



Meas. range	Sensor rod		Alu tube		Offset
	L	D	l	d	
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



The LVP-3, LVP-14 and LVP-25 sensors are modified versions of the standard LVP sensors.

They are designed for specific application areas, and operated with external electronics in contrast to the standard LVP series.

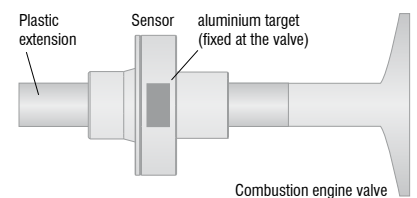
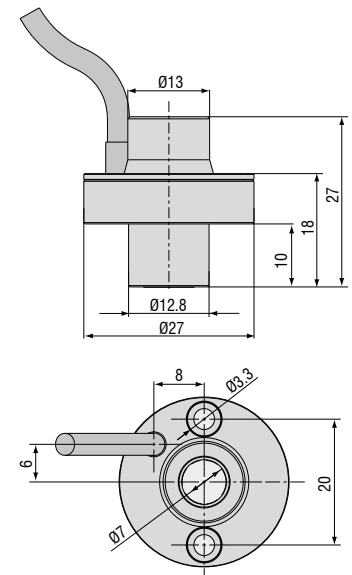
Valve stroke sensor in stainless steel housing

Future generations of engines will be able to dispense with mechanical camshafts. The displacement of the electromechanically or electrohydraulically 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 realised. 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	2616078
Measuring range	14mm
Target (optional)	article 0482273
Linearity	0.5% FSO (0.07mm)
Housing	stainless steel
Temperature stability sensor	$\pm 100\text{pmm} / ^\circ\text{C}$
Temperature range sensor	$-30^\circ\text{C} \dots +150^\circ\text{C}$
Protection class sensor	IP 67

Controller	MSC739VS-U
Article	4111009
Power supply	+10...16VDC
Output	1...9VDC
Resolution	0,02% FSO
Frequency response	20kHz (-3dB)
Dimensions	150 x 64 x 54mm

FSO = Full Scale Output

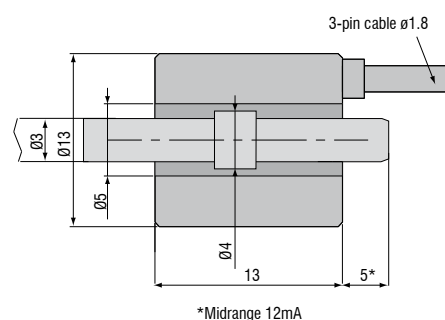
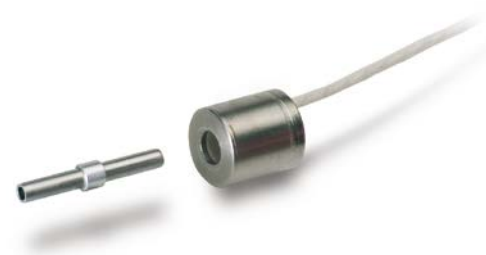


Sensor for needle stroke movements

The compact displacement sensor LVP-3- Z13-5-CA is suitable for acquiring small measurement ranges with high accuracy. The large free hole for the passage of the core also facilitates large excessive strokes. The measurement object, realised as a simple aluminium 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	2617014
Measuring range	3mm
Target (included)	ø3 x 30 long with thread M3 and alu sleeve ø4 x 3.3
Linearity	typ. 0.3% FSO (9µm)
Housing	stainless steel
Temperature stability sensor	±100ppm / °C
Temperature range sensor	-40°C ... +150°C
Protection class sensor	IP 67
Electronics	series MSC7210 (page 12 - 13)

FSO = Full Scale Output



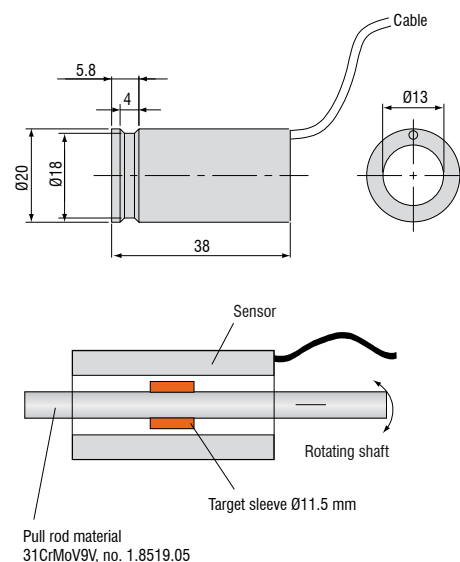
Sensor for the acquisition of displacement on rotating shafts

Analogue sensors from the series LVP offer a significant improvement to monitor the clamping position of tools. The sensor is integrated into the chuck 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 design. The sensor supplies an analogue 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 miniaturised sensor electronic unit is supplied with 24 VDC and can either be accommodated at the point of measurement or in the control cabinet.



Model	LVP-25-Z20-5-CA-AC
Article	2617008
Measuring range	25mm
Target (included)	article 0482218 for shaft diameter 8mm article 0482219 for shaft diameter 10mm
Resolution	0.01mm
Linearity	typical ±1% FSO (0.25mm)
Dynamics	150Hz (-3dB)
Housing	stainless steel
Temperature stability sensor	< ±0.01% FSO / °C
Temperature range	-40° C ... +150° C
Protection class sensor	IP 67
Medium	air, oil
Electronics	series MSC7210 (page 12 - 13)

FSO = Full Scale Output



General accessories

2960031	MC25D	digital micrometer calibration fixture
2420062	PS2020	power supply on DIN rail, input 100 - 240VAC, output 24VDC / 2.5A
2984026		certificate function and linearity inspection certificate incl. protocol with listed measurement data of the linearity inspection and documentation

Accessories VIP and LVP series**Connection cable**

0157043	C703-5	VIP/LVP/EDS 7-pin connection cable, 5m
2902084	C703-5/U	VIP/LVP/EDS 7-pin connection cable, 5m for voltage output 1 - 5V
0157050	C703/90-5	VIP/LVP/EDS-7-pin connection cable, 5m with 90° cable connector
2962001	MBS 12/8	mounting set for VIP series with 3 mounting blocks and 2 adapting rings
0487087	MBS 12/8	mounting block VIP/LVP series

Plunger

0800114	LVP-50	plunger
0800115	LVP-100	plunger
0800116	LVP-200	plunger

Accessories LDR series**Connection cable**

0157047	C7210-5/3	sensor cable, 5m, with cable connector
0157048	C7210/90-5/3	sensor cable, 5m, with 90° cable connector

Supply cable

2901087	PC710-6/4	supply/output cable, 6m
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Plunger

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

Accessories EDS series**Service**

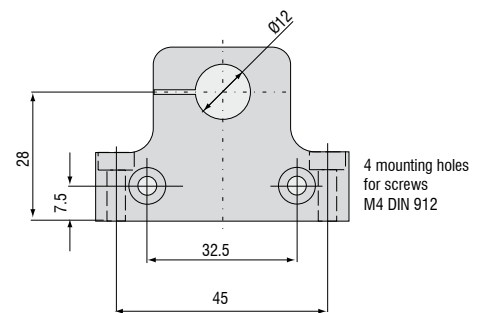
2985001		Function and linearity inspection for EDS series incl. pressure inspection and documentation without recalibration
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Connection cable

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



Linearity inspection certificate

Mounting block VIP and LVP series

Accessories LVDT series

Sensor cable

2902004	C701-3	sensor cable 3m, with connector and tin-plated free ends
2902013	C701-6	sensor cable, 6m, with connector and tin-plated free ends
2902009	C701/90-3	sensor cable, 3m, with 90° connector and tin-plated free ends
2966002	MSC710	connector set for supply/output cable
2981010		connector mounting and calibration of MSC710

Connection cable

2901087	PC710-6/4	supply/output cable, 6 m
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Plunger

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

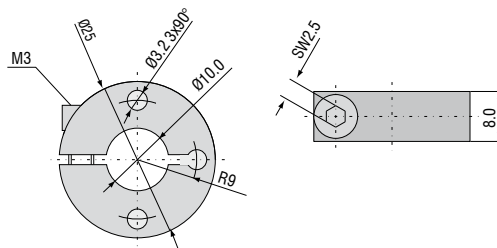
Flange

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

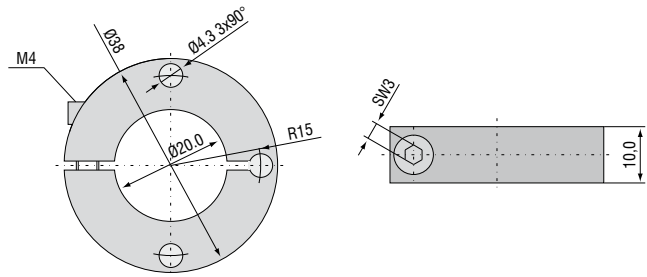
Probe tips

0459002	type 2
0459001	type 2 hard metall
0459003	type 11
0459004	type 13

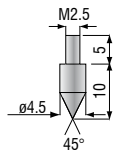
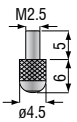
Flange DTA-F10



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 the standard models, the inductive sensors from the standard range can be suitably modified. A commercial implementation can already be achieved with medium-sized quantities (depending on the type and number of changes). The standard induSENSOR models form the basis for the modifications.

Environmental 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

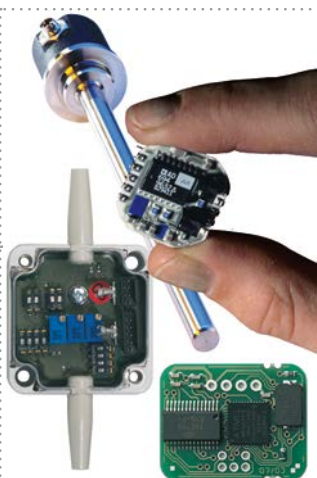
Five basic types are available. Measuring ranges and target versions can be combined, based on these technologies.

Technology	Measuring range	Target
① VIP	to 200mm	ring
② EDS	to 800 mm	pipe
③ LVP	to 200 mm	plunger / probe tip
④ LDR	to 150 mm	plunger / probe tip
⑤ LVDT	to $\pm 100\text{mm}$	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.



Electronics

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 electronics concepts

- Integrated electronics
- External electronics



Type of connection and 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

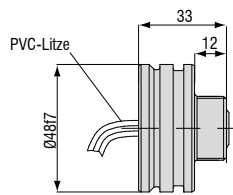


Output signal

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**

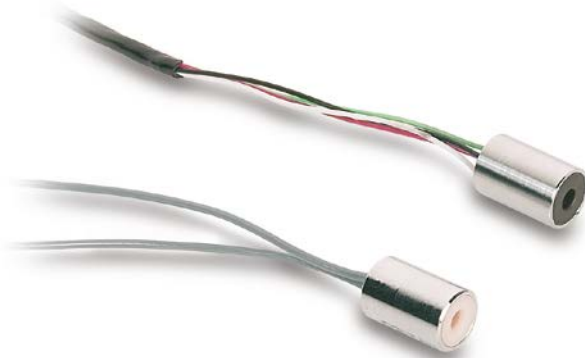
Eddy current long-stroke sensor

Measuring range 260mm
 Nonlinearity $< \pm 0.3\%$
 Power supply 18 ... 30Vdc
 Output 4 ... 20mA
 Temperature range $-40 \dots +85^{\circ}\text{C}$
 Special sealing flange

**EDS-200-F2-CA10-I-METSO**

Eddy current long-stroke sensor

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

**DTA-1D-CA-U**

Miniature sensor with axial cable output

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

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

Inductive LVDT displacement sensor

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

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

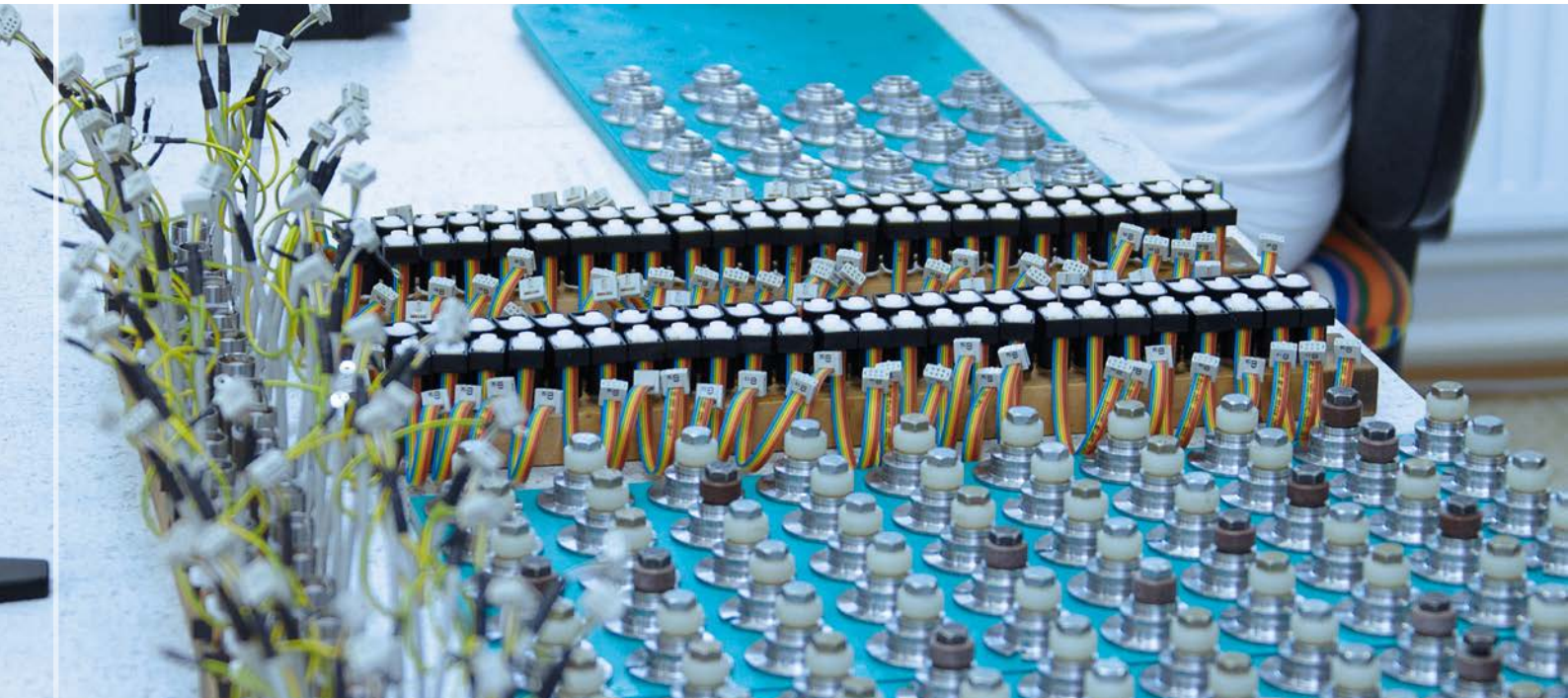
Pressure-tight LVDT sensor with welded flange

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

**EDS-330-F-SRB-I(06)**

Eddy current long-stroke sensor

Measuring range 330mm
 Output 4 - 20mA
 Power supply 18 - 30Vdc
 Flange housing 150mm diameter



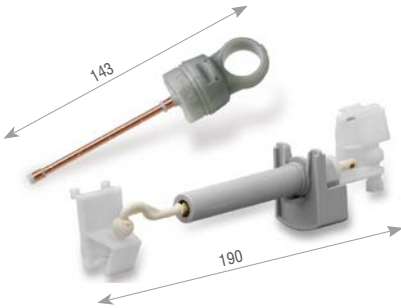
For exceptional applications with large quantities, Micro-Epsilon develops sensors that are precisely tailored to customer requirements. The geometry, electronics and packaging are customised to suit the requirements concerned. Thanks to the high production capacity at Micro-Epsilon, large quantities can be made cost-effectively.

Areas of application

Customized OEM displacement sensors are often developed for areas of applications where the highest standards apply, such as:

- Applications with high atmospheric pressure
- Environments with high temperatures
- Vacuum
- Explosive hazard environments
- Contaminated installation and measurement rooms

Realised OEM examples



DRA-25D-20-SR-02 / ILU-50-0-10-SR
Inductive differential inductor (plunger)

- Loading and unbalance detection in washing machines
- Installation integrated into damper or external
- Measuring range 50mm
- External electronics



LDR-85-BUE
Wear-free inductive displacement sensor

- Position measurement of valves
- Measuring range 85mm
- Integrated electronics



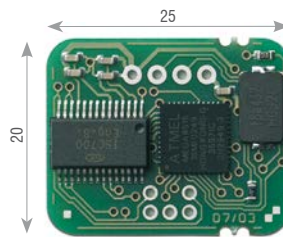
KRS 719-400
Miniaturised LVDT displacement sensor

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



DTA-3D-5-CR5-G-HP
Inductive displacement sensor

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



ISC7001
Subminiature sensor controller

- Subminiature design 20x25mm
- Interfaces 0.5 - 4.5V, PWM (10bit), UART
- Resolution 11bit



DTA-1D-20-DDV.02
LVDT displacement sensor with coated coil

- Measurement of a hydraulic valve position
- External electronics
- Measuring range 2mm
- Dipped paint seal



KTL gauging sensors

- Calibration of robots
- Speed measurement
 - Switching output



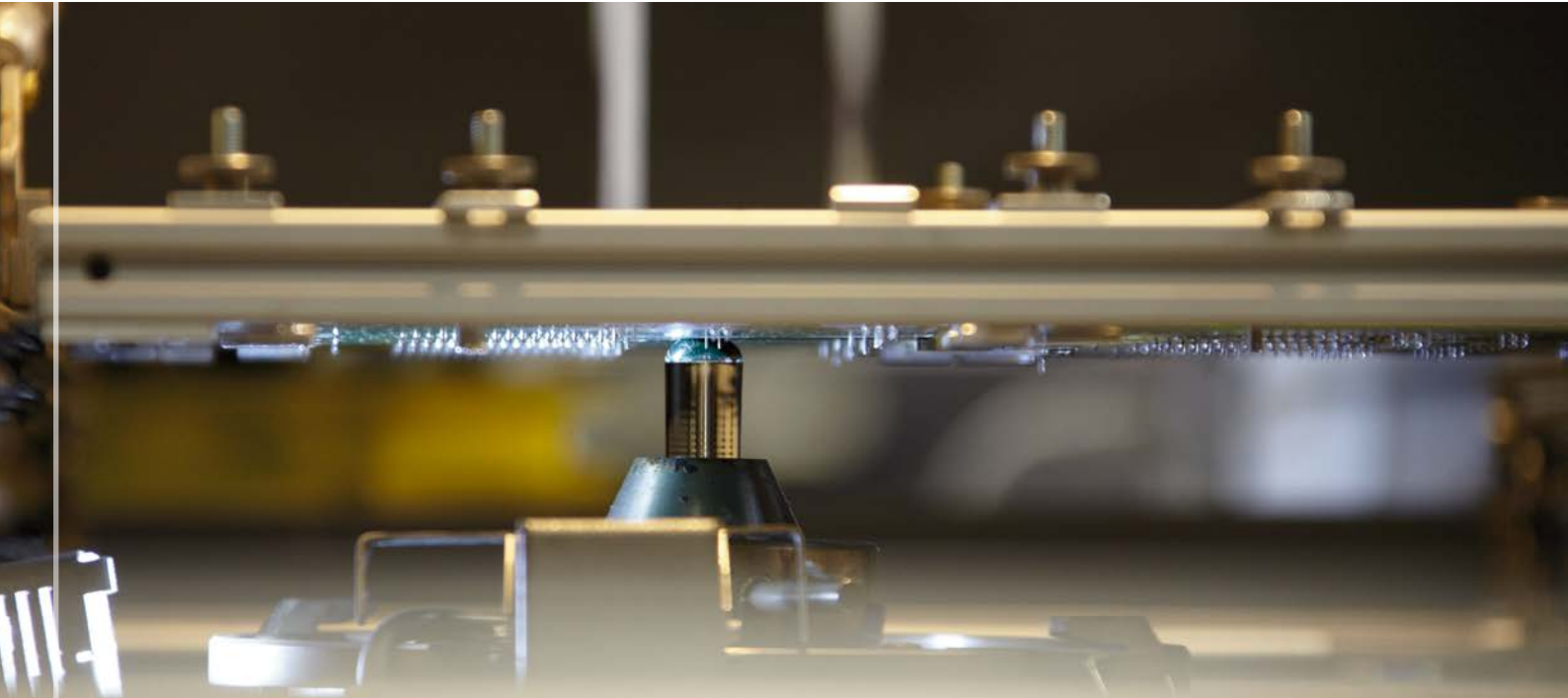
EDS-28-G-CA-U
Rugged inductive miniature sensor with in the cable integrated electronics

- Miniature actor for formula 1
- Measuring range 28mm
- Pressure resistance up to 350bar



EDS/GPS-180-ZA-I(02)
Eddy current long-stroke sensors with integrated electronics

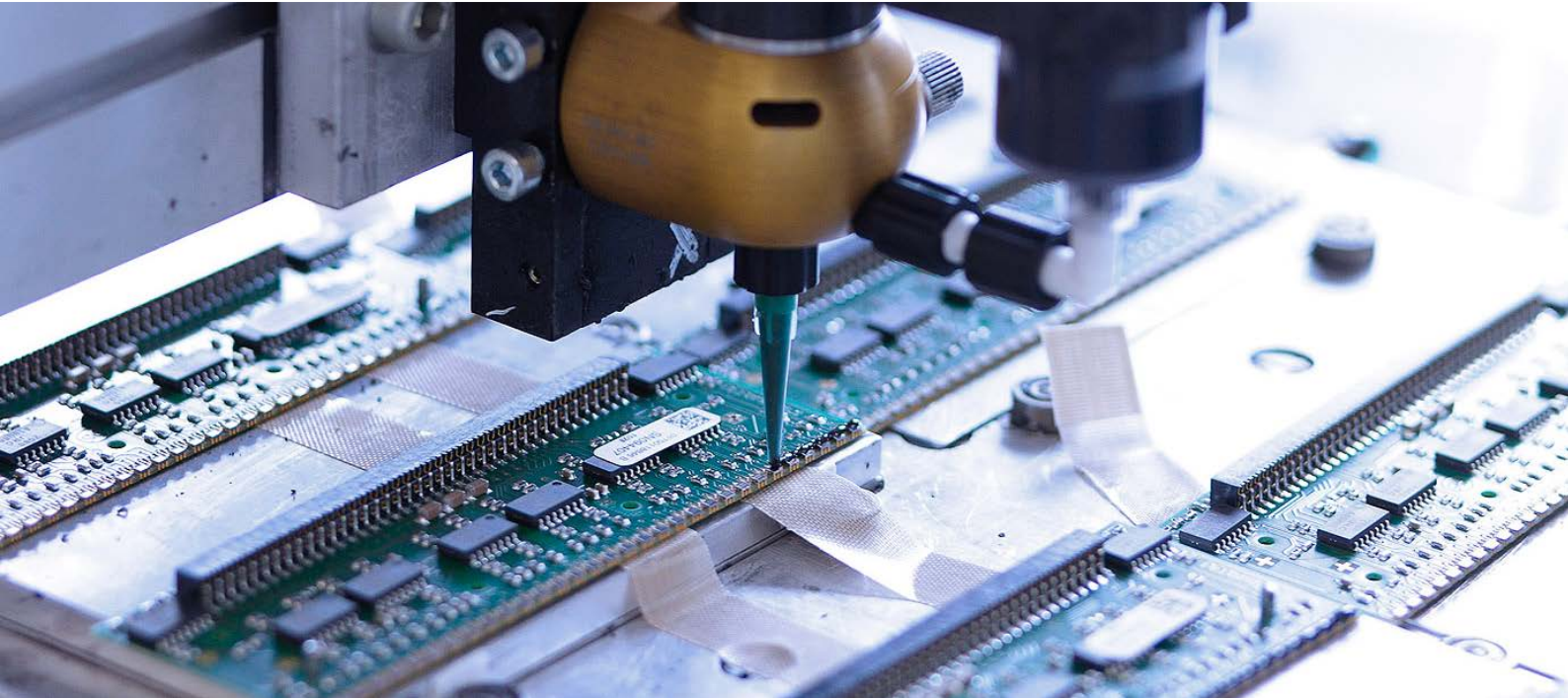
- Measuring the piston position in the glass production
- Measuring range 180mm
- High shock- and vibration-resistance



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. A cohesive process as a better path to large-scale production. 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 integrated into the process. Together with us, you can speed up your development process, prototype building and large-scale production. In achieving this, the complete material logistics is included in the process from an early stage. A total of over 2,000 man-years of engineering experience and more than 300 staff are available to you.

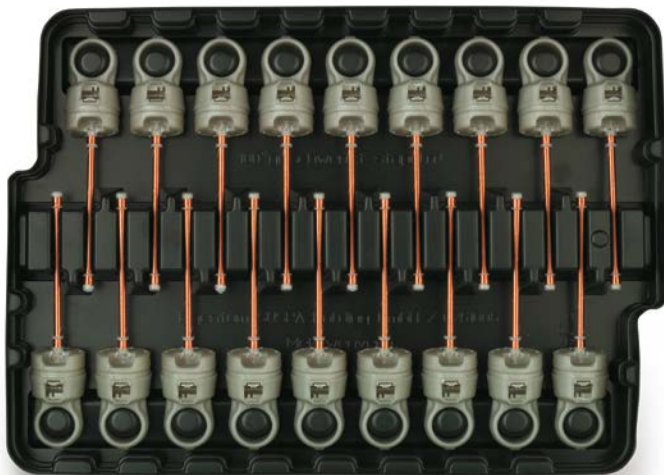
At Micro-Epsilon's head office, development projects are initiated and major projects coordinated. The development and marketing of specific sensors for OEM customers in large quantities takes place in direct contact with the development and product specialists.

For the large-scale production of the electronics, modern and automated production systems for screen and silk-screen printing are available with vision systems, automatic SMD assembly up to BF 0402, reflow soldering in computer controlled convection ovens, CFC-free washing in multi-compartment washing systems, automatic die bonding and laser trimming.



With production capacities of more than one million sensors p.a. and by utilising internal company resources, the sensors are very economical. The production equipment available 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



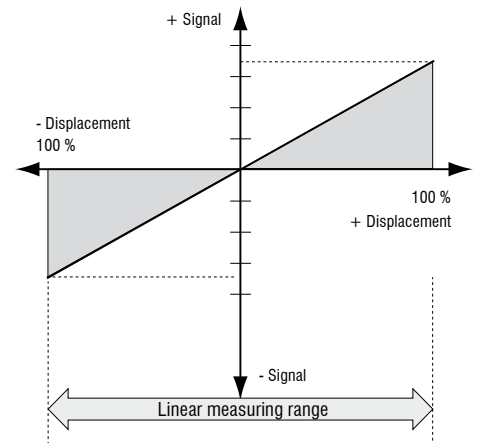
All production systems are supplied in ergonomic and assembly-friendly packaging units. In this respect environmentally friendly and economical reusable packaging is used. Within the scope of Total Quality Management a 100% check is integrated for numerous measurement and inspection processes.

LVDT gauges and LVDT displacement sensors

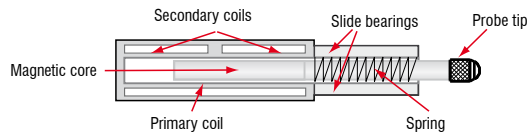
LVDT displacement sensors and gauges (Linear Variable Differential Transformer) are constructed with a primary and two secondary coils, which are arranged symmetrically to the primary winding. As a measurement object, a rod shaped magnetic core can be moved within the differential transformer. An electronic 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.

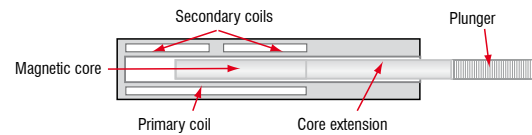
Signal LVDT



Gauging sensor



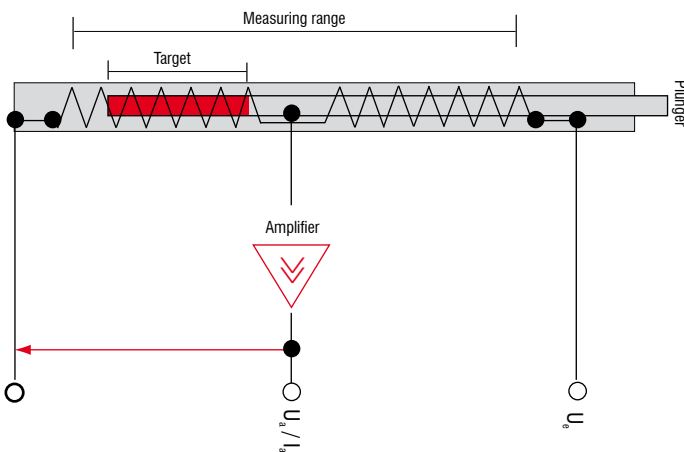
Displacement sensor



LDR displacement sensors

The inductive sensors in the LDR series are constructed as half-bridge systems with centre 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.

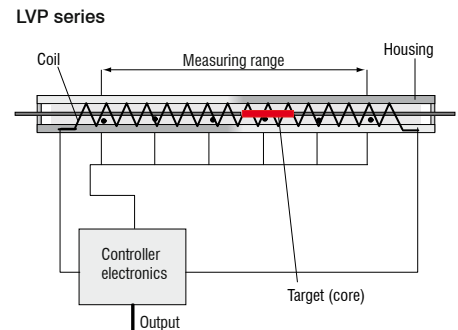
Block diagram LDR series



LVP displacement sensors

With LVP displacement sensors, a core of a soft magnetic material is used as the target, which is movable within the measuring coil without any physical contact. The measuring coil itself is mounted, hermetically sealed, in an enclosure of ferromagnetic, stainless steel.

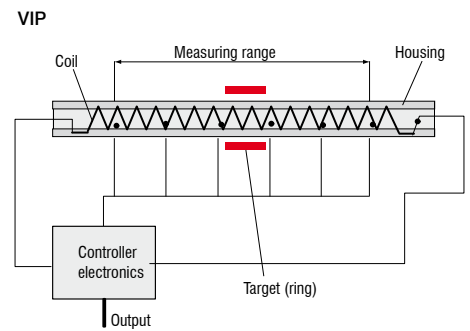
The core is firmly connected to a plunger, the length of which corresponds to the measuring range. The core length, however, does not exceed 20% of the measuring range. The mechanical connection of the LVP sensors is equivalent to that of the well-known LVDT Sensor. In direct comparison with LVDT position sensors, LVP sensors exhibit an improved ratio of measuring range to overall length. The installation space required can thus be reduced up by 100%.



VIP displacement sensors

Displacement transducers in the VIP series operate similar to conventional potentiometers, but without any sliding contact and are consequently wear-free. The measurement coil is wound as a single layer on a tube and is hermetically sealed in a stainless steel housing.

An aluminium ring which can be moved along the housing without making contact is used as the target. Exact guidance is not necessary for the ring. Radial vibrations and tilting of the measurement object, have no influence on the measurement result and the sensor life. The signal conditioning is directly integrated into the displacement transducer.



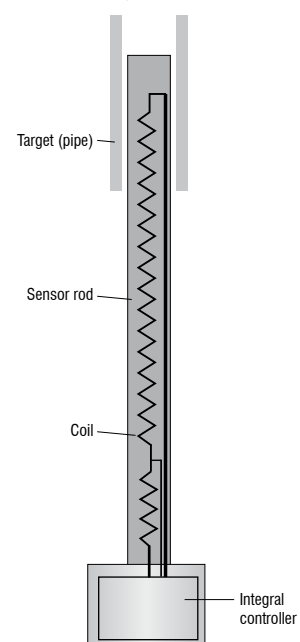
EDS long-stroke sensors

The measurement principle of the EDS series is based on eddy current effect. An aluminium (ferrous) sleeve 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 measurement coil, wound in one layer, produces a field which has a magnetic coupling with the target.

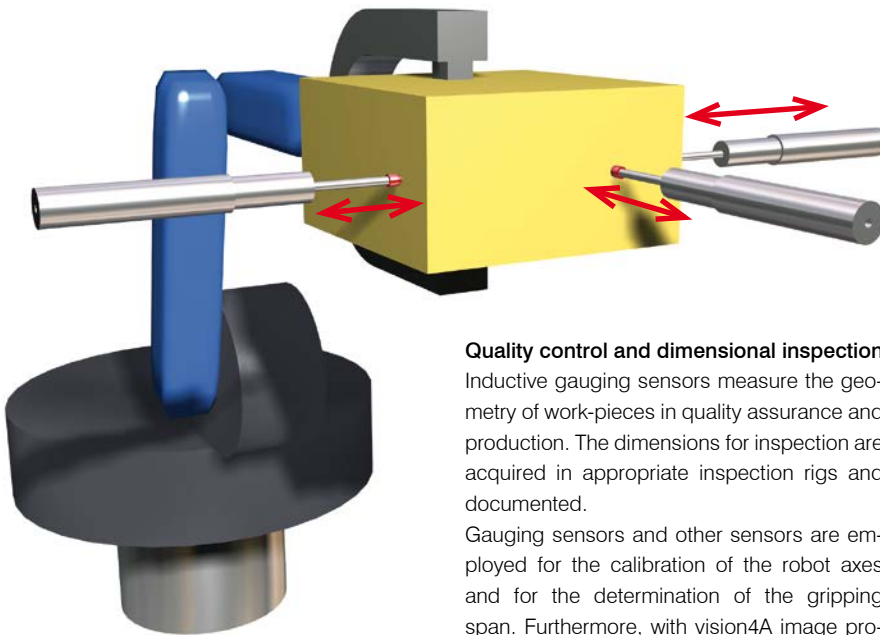
The displacement sensor uses a ferrous target sleeve of soft magnetic material, a measurement coil and a compensation coil. The coils are mounted inside a pressurised stainless steel housing. The eddy currents then arising in the target form a magnetic field which influences the measurement coil impedance. 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.

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 centred. 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.

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

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

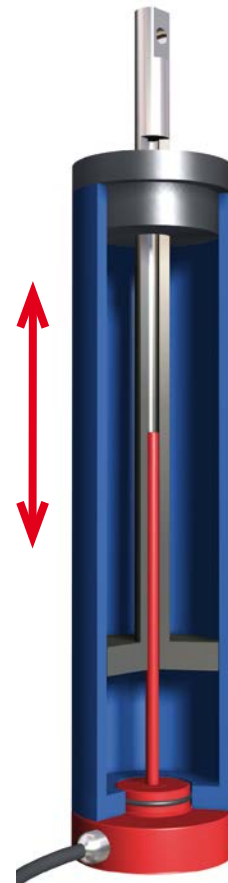
Deflection of hydraulic suspension in commercial vehicles, position of convertible top cylinders as well as pedal and clutch displacements are typical applications..

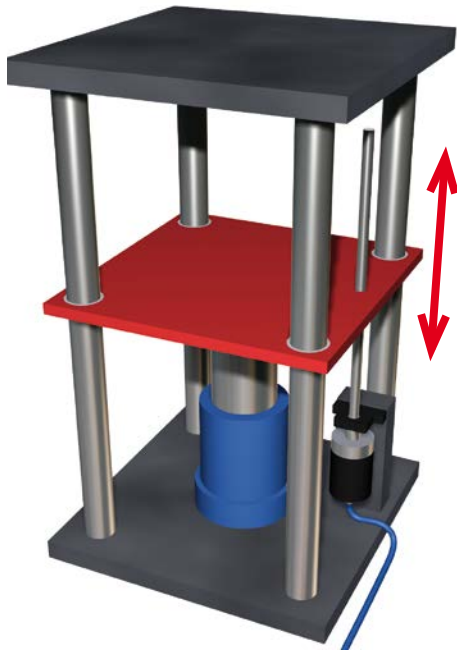
Heavy industry

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

Aerospace

In the dynamic control and navigation of aircraft various sensors in the LVDT series are employed as key elements. Typical applications are in navigation, cockpit simulators, the mechanical turbine control, antenna positioning, flaps control, rudder trimming, pedal positioning and in the undercarriage.





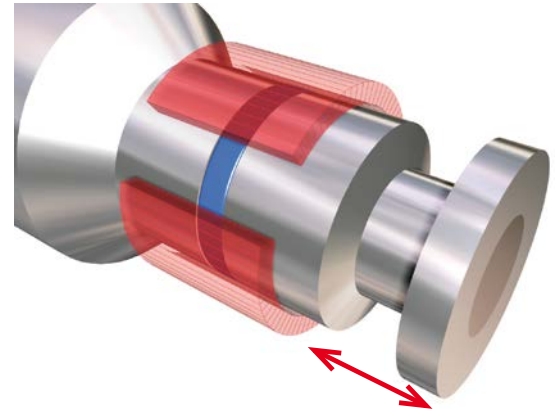
Inspection and testing systems

In inspection and testing systems inductive sensors acquire deflection, oscillation and vibration of the measurement positions.

In particular, the sensors of the VIP series are suitable for the measurement range from 50 to 200mm. The requirements with regard to a small installation volume, wide useful measurement range and insensitivity to measurement object lateral variations are optimally fulfilled by sensors in the VIP series.

Construction

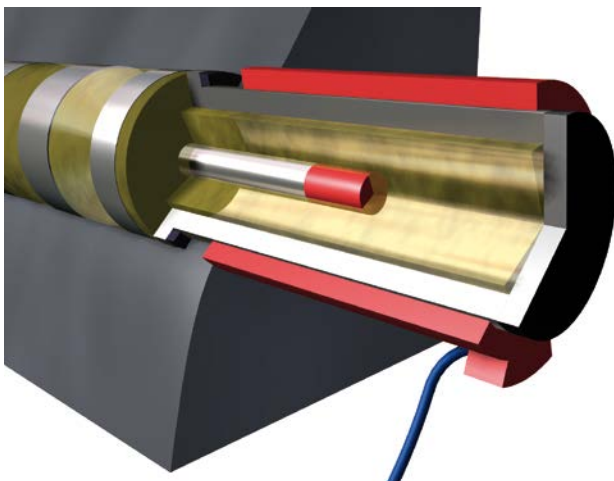
Inductive sensors from Micro-Epsilon are used for continuous measurements in civil engineering. The sensors acquire the movement of bridge elements or the walls of buildings with the change of seasons and during renewal.



Machine tools, production automation, Measurement with respect to rotating shafts

To monitor the clamping position of tools a sensor in the VIP series is integrated into the chuck 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 screwdrivers 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

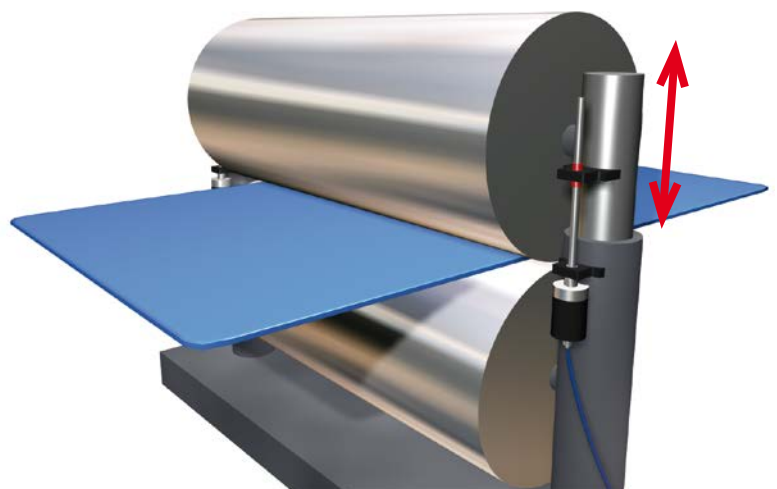
With the classical LVDT sensors and innovative sensors in the VIP series, Micro-Epsilon offers a wide selection of systems for the measurement of the piston position on hydraulic and solenoid valves. The sensors in the VIP series are particularly characterized by the small installation space and the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

Dosing valve

In automatic dosing valves inductive sensors monitor the position of the dosing needle and ensure uniform 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, fibre optic sensors and fibre optics



Colour recognition sensors, LED analyzers and colour online spectrometer



Measurement and inspection systems

