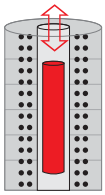
MICRO-EPSILON

More Precision.

induSENSOR

Linear inductive displacement sensors



Inductive displacement and position sensors

	VIP series	VIP-30-ISC-HRW1	KRS719(01)	LVP series	LVP-0,3-Z20-2-CR-AC	LVPxx-P-LP-I/D	EDS series	LVDTseries gaging	LVDT series	DTA-0,8D-2,5-LR	DTA-1D-CA-U	DTA-1D-20-DDV.02	DTA-6D-20(07)	DTA-15D-5-CA-(03)	DRA-25D-20-SR-02	LVP-3-Z13-5-CA	LVP-14-F-5-CR	LVP-25-Z20-5-CA-AC	ILU-50-0-10-SR	LDR series
Page	16-17	18	19	20-21	22	23	24-25	26-27	28-29	30	31	32	33	34	35	36	37	38	39	40-41
Measuring principle																				
VIP	x	x																	x	
LVP				x	x	x										x	x	x		
LVDT			x					x	x	x	x	x	x	x	x					
LDR																				x
EDS							x													
Electronics																				
integrated	x	x		x			x													
external								x	x	x	x	x	x	x	x	x	x	x	x	x
system			x		x	x														
Measuring range																				
up to 5 mm			x		x	x		x	x	x	x	x	x			x				x
up to 50 mm	x	x		x				x	x					x	x		x	x	x	x
up to 150 mm	x			x			x													
up to 200 mm				x			x													
up to 400 mm							x													
up to 630 mm							x													
Linearity																				
0.2 % FSO	x		x			x		x	x							x				
0.5 % FSO		x		x	x		x			x	x		x	x			x			x
Frequency response																				
300 Hz (- 3 dB)	x		x	x			x													
1.000 Hz (- 3 dB)		x			x	x														
Target																				
sleeve	x	x																	x	
plunger			x	x	x	x			x	x	x	x	x	x	x	x	x	x		x
probe								x												
pipe							x													
Temperature range																				
up to 85 °C	x		x	x	x	x	x	x		x	x	x	x	x	x				x	
up to 150 °C		x							x							x	x	x		x
optional up to 200 °C									x											
Pressure resistance																				
100 bar						x			x											
450 bar							x							x						
Output signal								with appropriate electronics												
4 ... 20 mA	x		x	x		x	x	x	x		x	x	x	x		x		x		x
0.5 ... 4.5 VDC	x	x		x		x	x			x					x				x	
0/2 ... 10 VDC					x			x	x		x	x	x	x		x	x	x		x
digital		x			x	x		x	x	x	x	x	x		x	x		x	x	

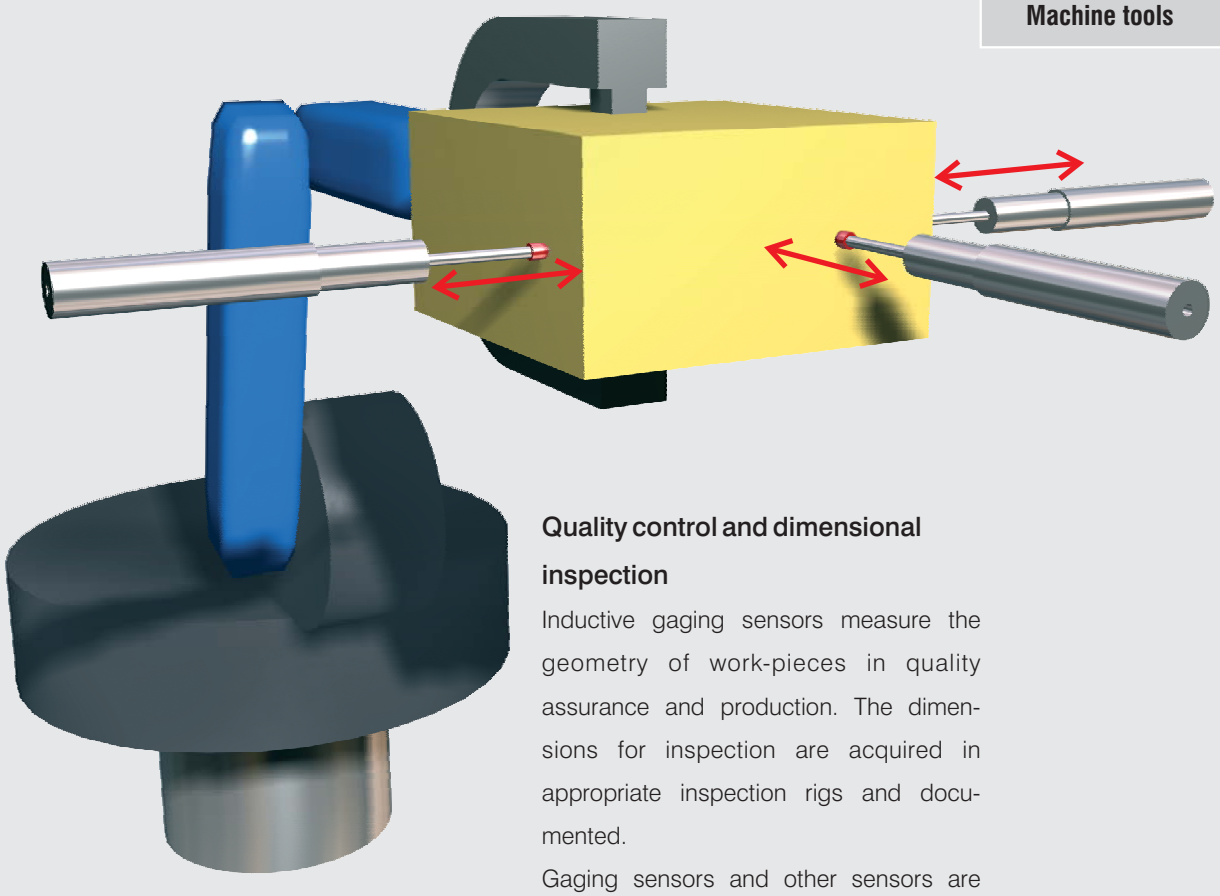
Table of content

Application examples		4 - 7
High volume production		8 - 9
Measuring principles	VIP / LVP series	10 -11
	LVDT series	12
	LDR series	13
	EDS series	14
Terms and definitions		15
Linear displacement sensors with integral electronics		
	VIP series	16 - 17
	VIP-30-ISC-HRW1	18
	KRS719(01)	19
	LVP series	20 - 21
	LVP-0,3-Z20-2-CR-AC	22
	LVPxx-P-LP-I/D	23
	EDS series	24 - 25
Linear displacement sensors	LVDT series (gaging sensors)	26 - 27
	LVDT series (displacement sensors)	28 - 29
	DTA-0,8D-2,5-LR	30
	DTA-1D-CA-U	31
	DTA-1D-20-DDV.02	32
	DTA-6D-20(07)	33
	DTA-15D-5-CA-(03)	34
	DRA-25D-20-SR-02	35
	LVP-3-Z13-5-CA	36
	LVP-14-F-5-CR	37
	LVP-25-Z20-5-CA-AC	38
	ILU-50-0-10-SR	39
	LDR series	40 - 41
Controller	MSC710	42 - 43
	MSC7210	44 - 45
	ISC7001	46 - 47
	MSC739/CRF-AD / BSC719(02)-I	48
	MSC739VS-U	49
Accessories		50 - 51

Typical applications for inductive displacement and position sensors

Sensors are the eyes and ears of a technical system. The values or states you acquire are processed in the controller or evaluated and appropriate further steps initiated. With the aid of sensors the measurement object is deflected, moved, set, guided, bent, panned, positioned, tilted, displaced or centered. The following overview shows a small extract of the possibilities for the application of the product group induSENSOR. With inductive sensors in applications, process times are shortened, operational readiness is extended, operational safety is increased, production yield is improved, setting up times are shortened and there is a gain in convenience.

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



Quality control and dimensional inspection

Inductive gaging sensors measure the geometry of work-pieces in quality assurance and production. The dimensions for inspection are acquired in appropriate inspection rigs and documented.

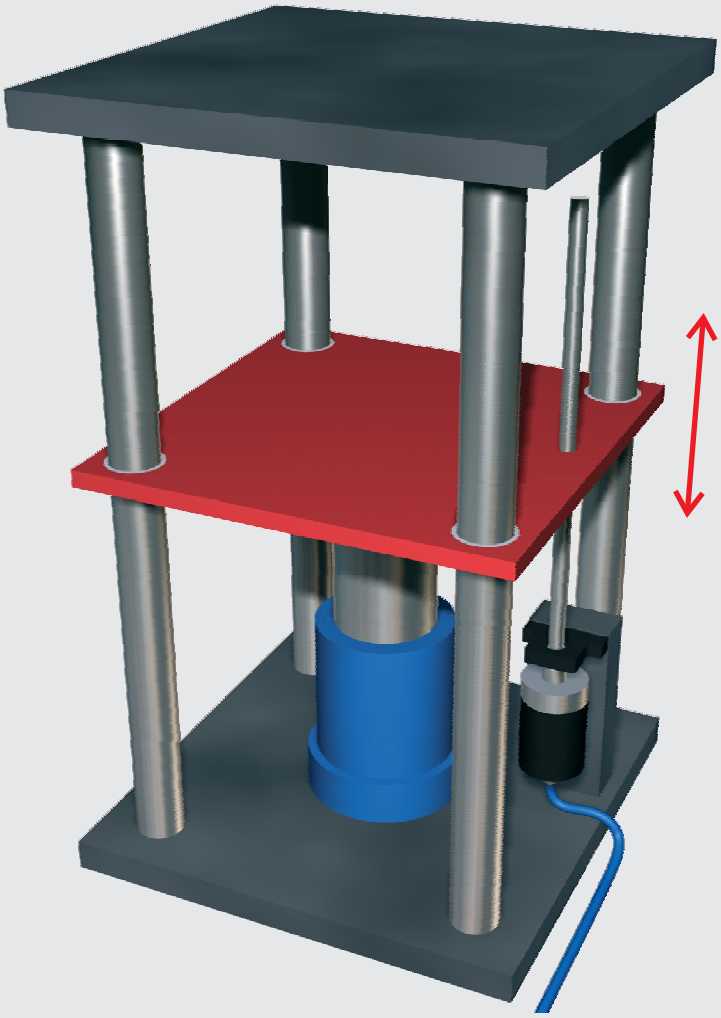
Gaging sensors and other sensors are employed for the calibration of the robot axes and for the determination of the gripping span. Furthermore, with vision4A image processing systems the position of the handling object in space is acquired.

The deflection of the probe tip in 3D co-ordinate machines is compensated using inductive sensors from Micro-Epsilon.

Inspection and testing systems

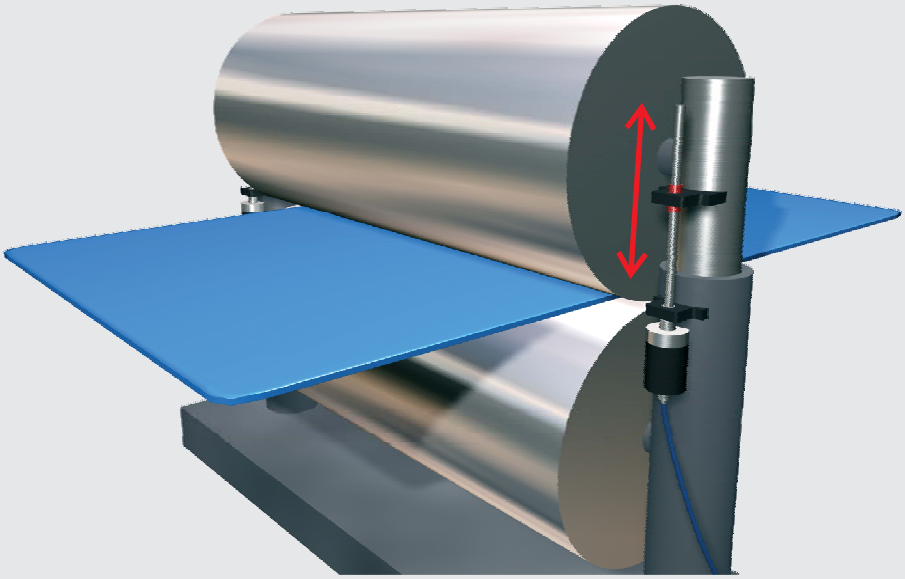
In inspection and testing systems inductive sensors acquire deflection, oscillation and vibration of the measurement positions.

In particular, the sensors of the VIP series are suitable for the measurement range from 50 to 200 mm. 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

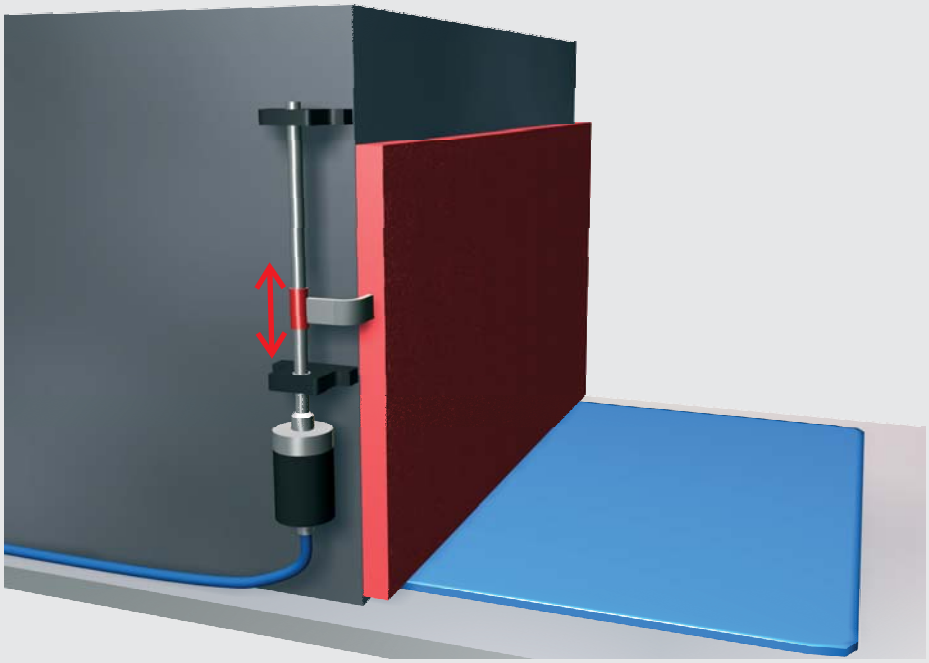
Inductive sensors from Micro-Epsilon are used for continuous measurements in civil engineering. The sensors acquire the movement of bridge elements or the walls of buildings with the change of seasons and during renewal.



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.

Typical applications for inductive displacement and position sensors



Household appliances

The integrated Micro-Epsilon load and unbalance sensor measures the depression of the suds container when the washing machine is loaded and its deviation during the spinning stage.

Medical engineering

Inductive sensors integrated into actuators supply the robot position feedback on operating robots. The burden on the operating personnel is reduced and operational safety is increased.

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

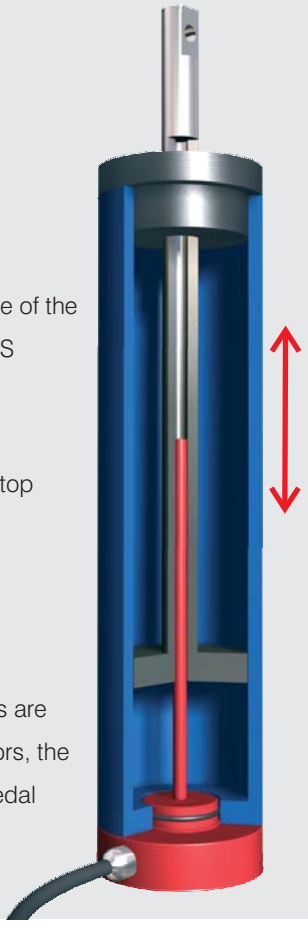
Deflection of hydraulic suspension in commercial vehicles, position of convertible top cylinders as well as pedal and clutch displacements are typical applications.

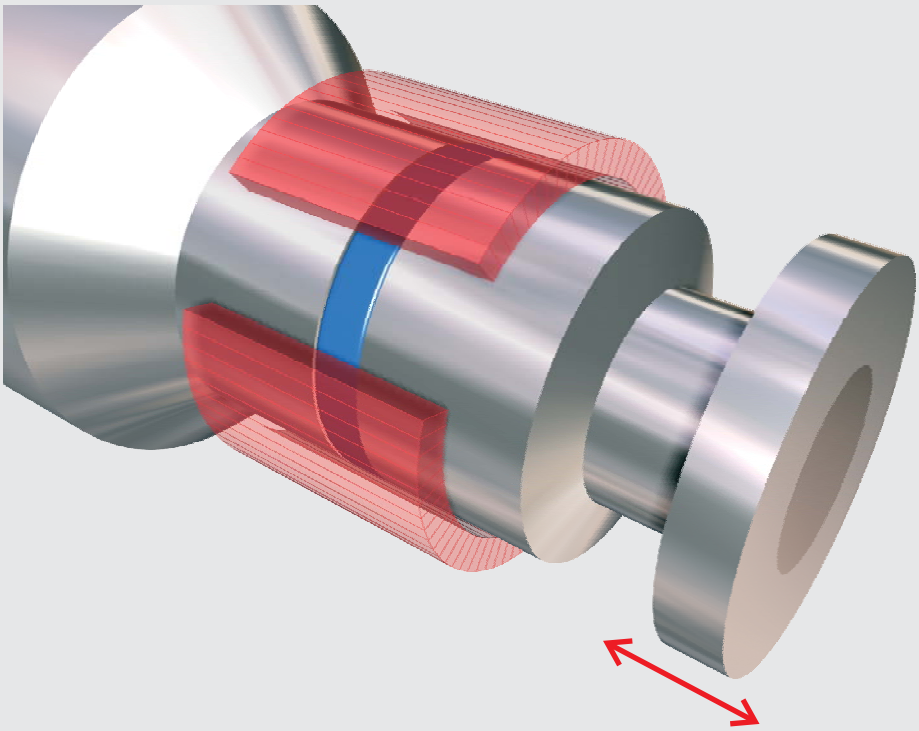
Heavy industry

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.





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

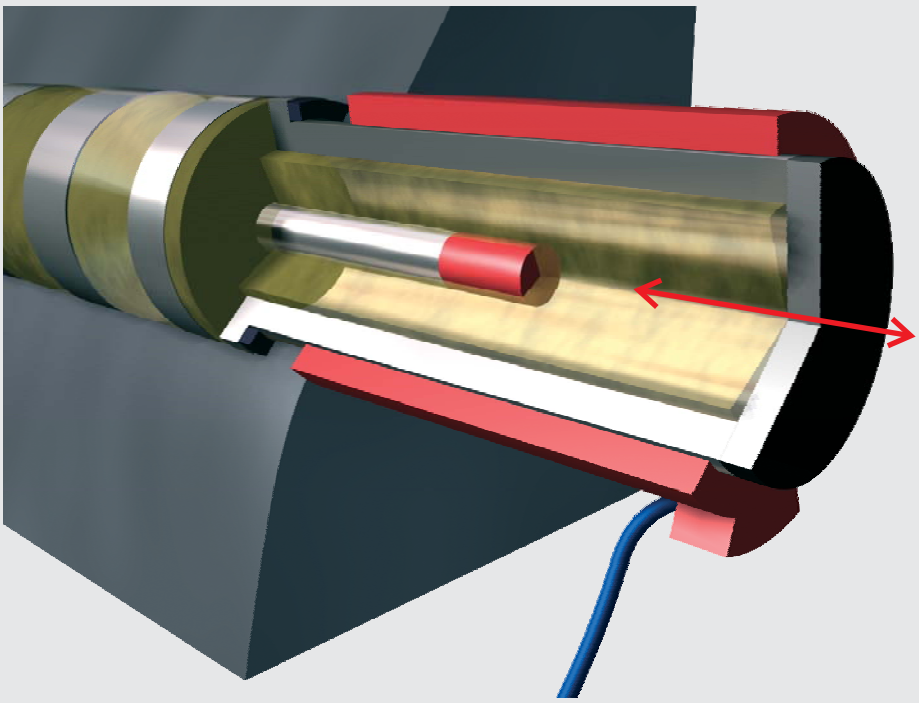
With the classical LVDT sensors and innovative sensors in the VIP series, Micro-Epsilon offers a wide selection of systems for the measurement of the piston position on hydraulic and solenoid valves. The sensors in the VIP series are particularly characterized by the small installation space and the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



Capability in large scale OEM production

Capability in large-scale production

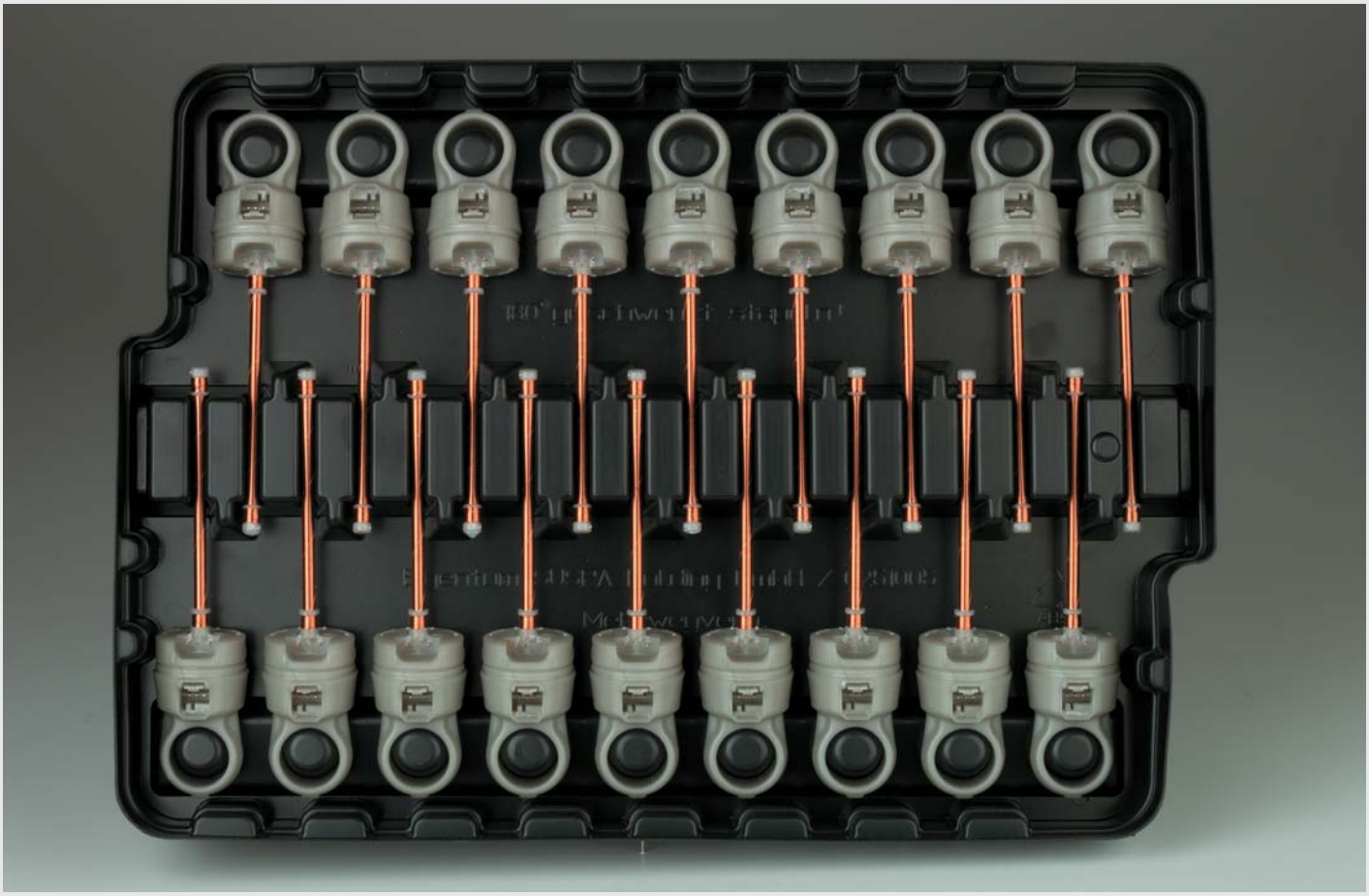
It is usually a long way from the initial idea to large-scale production. Micro-Epsilon has all the required resources available to supply solutions starting from the idea through to large-scale production, all from one source - and that at competitive prices. A cohesive process as a better path to large-scale 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 co-ordinated. The development and marketing of specific sensors for OEM customers in large quantities takes place in direct contact with the development and product specialists.

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

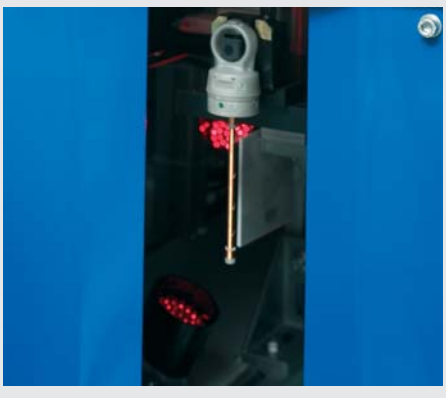
With production capacities of more than one million sensors p.a. and by utilizing internal company resources, the sensors are very economical. The production equipment available includes the following:

- 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.



Technology and measurement principle

Electromagnetic displacement sensors 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.

The measurement ranges of the Micro-Epsilon inductive sensors extend from a few tenths of a millimeter to over 600 mm. The actual measurement takes place without contact. The different measurement principles that can be offered are described below.

induSENSOR: VIP series and LVP series technology and measurement principle

VIP series and LVP series

The electromagnetic sensors in the VIP and LVP series operate using a novel, patented measuring principle. A measurement coil is wound on a coil former and has a number of voltage taps. For a measurement object a target is used of electrically conductive or ferro-magnetic material, the length of which corresponds to the distance between two taps on the measurement coil.

The measurement coil is supplied with two complementary alternating voltages from an oscillator. Depending on the position of the target, the impedance of the measurement coil changes in the covered region.

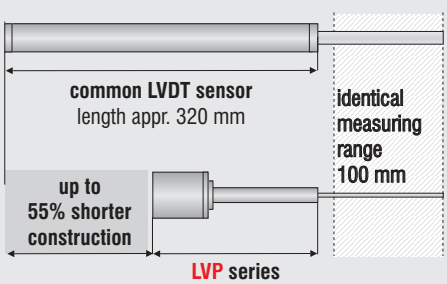
The tapped voltages are conditioned in an electronic evaluation unit which produces a continuous signal on its output which is proportional to the target position.

If the target is located, for example, in the middle of the measurement coil, the output signal corresponds to the reference voltage.

An very important advantage of sensors in the VIP series is a very compact sensor length to measurement range.

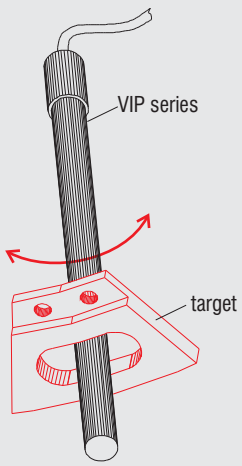
Depending on the measurement range, the overall sensor length can be reduced by up to 55 %. This means that these displacement sensors can be integrated into a restricted space envelope in machines and equipment, hydraulic and pneumatic cylinders and other applications. This opens up new possibilities for design engineers.

In particular, in the measurement ranges from 20 to 200 mm the VIP measurement principle offers the greatest advantage of any sensor in terms of performance, length, accuracy and cost-effectiveness.



Advantages

- Easy adaptation to the measurement task through the use of non standard targets
- Matching of the mechanical and electrical zero points for large-scale applications by laser trimming
- Wide frequency range, up to 20 kHz -3db
- Very low cost solutions for high volume applications



With appropriate design of the target, circular paths can also be acquired with the VIP series.

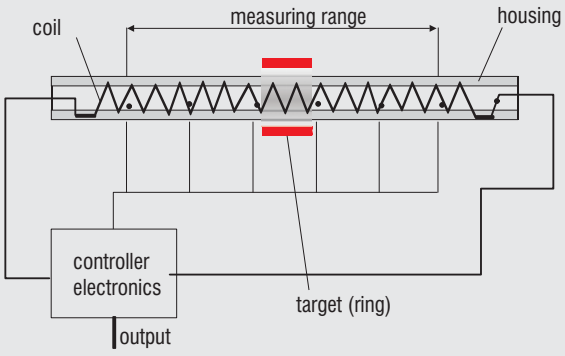
Measurement principle
VIP series and LVP series

VIP series with measuring ring

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 aluminum 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.

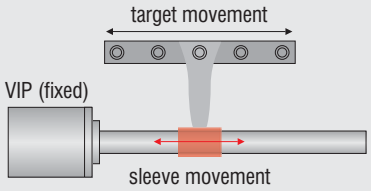
Figure 1: block diagram VIP series with target ring



Parallel mounting for the VIP series

The major difference to LVDT sensors is that with the VIP series the measurement object is mounted parallel to the sensor. This highly efficient construction gives you innovative possibilities for sensor mounting. Figure 2 shows an installation example, of how sensors in the VIP series can be mounted in a similar method to side operated potentiometers.

Figure 2: parallel mounting



LVP series with plunger (core)

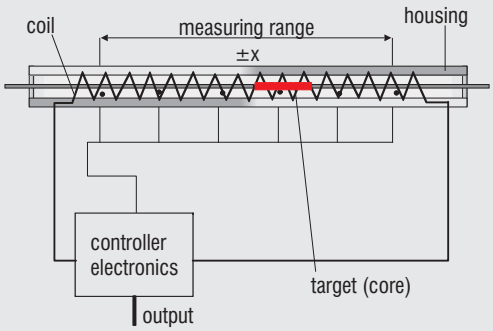
In the LVP configuration a ferrous core is used as the target. The sensor is wear free as the core does not make contact with the sensor housing (Figure 3).

The measurement coil itself is hermetically sealed in a stainless steel housing.

The mechanical interface of the LVP sensors is very similar to common LVDT sensors.

In direct comparison with LVDT displacement sensors, the LVP sensors exhibit a much improved ratio of the measurement range to the overall sensor length. The installation space needed can then be reduced by more than 50%.

Figure 3:
block diagram LVP series with core (plunger)

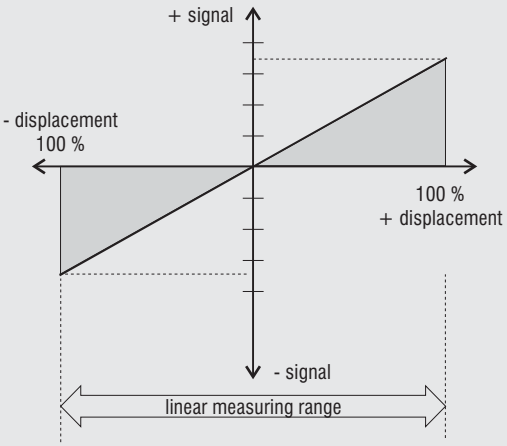


induSENSOR LVDT series technology and measuring principle

Inductive displacement sensors according to the LVDT principle (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.

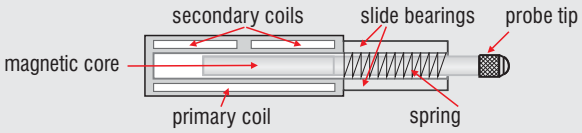
Depending on the core position alternating voltages are induced in the two secondary windings. If the core is located in its "zero position", the coupling of the primary to both secondary coils is equally large. Movement of the core within the magnetic field of the coil causes a higher voltage in one 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



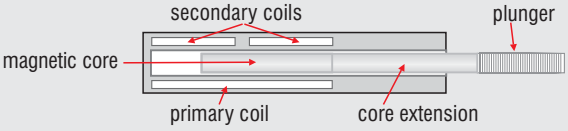
probe

Gauging sensor



plunger

Displacement sensor

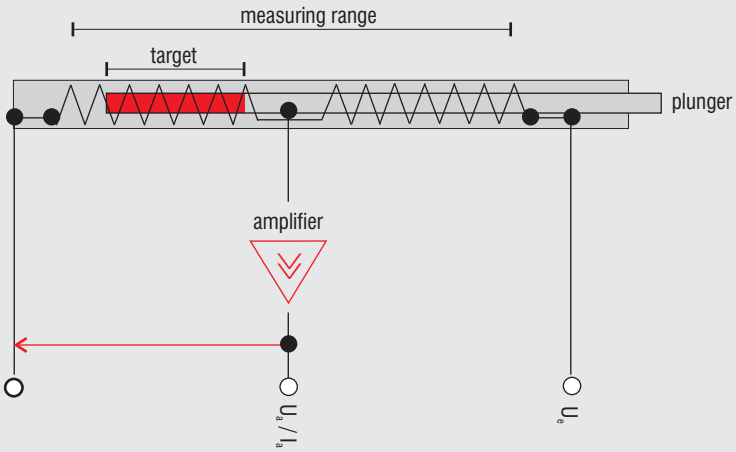


induSENSOR LDR series technology and principle

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. Compared to the familiar LVDT sensors, both the sensor length and the diameter have been significantly reduced. As with the sensors series VIP and LVDT, the LDR series represents a safe, rugged, reliable and wear free measurement method.

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.

block diagram LDR series



induSENSOR EDS series technology and measuring principle

The measurement principle of the EDS series is based on eddy current effect.

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.

An aluminum (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.

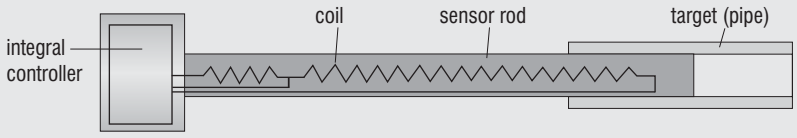
The eddy currents then arising in the target form a magnetic field which influences the measurement coil impedance. This changes linearly with the target position.

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.

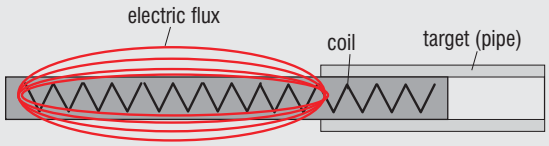
The electronic circuit generates a signal from the ratio of the impedance of the measurement coil and the compensation coil and converts the sleeve position into a linear electrical output signal of 4 - 20 mA. In achieving this, the temperature effects and the temperature gradient are essentially eliminated.

With measurement ranges from 100 mm to 630 mm, the product range in the EDS series is very versatile. For OEM systems the mechanical interfaces can be adapted to the installation situation.

block diagram EDS series



principle EDS series



Inductive displacement and position sensors terms and definitions

Adjustment:
Setting or balancing a measurement device to remedy as far as possible systematic measurement deviations as required by the intended application.

Calibration:
Determination of the relationship between the measurement, the output quantity and the associated true or correct value.

Cut-off frequency:
The cut-off frequency is the frequency at which the output signal reduces to a certain value (-3 dB = 70.7 %) below the reference value.

Linearity:
The linearity states the percentage deviation of the electrical output from the required ideal straight line. Linearity figures are given as absolute or independent linearity.

With the determination of the absolute linearity the reference line is placed through the theoretical zero and end points of the output signal. The absolute linearity is then taken as the maximum deviation of the measurements recorded in the system final inspection to these reference straight lines. This method is used with the systems in the EDS series.

When determining the independent linearity, first the linearity of the measurements taken during the final inspection of the systems are recorded. Using these recorded measurements, a reference straight line is drawn by means of a compensation calculation (method of the smallest maximum deviation). The independent linearity is then specified as the maximum deviation of the recorded measurements to this reference straight line. This method is used with the systems in the LVDT, VIP, LVP and LDR series.

Measurement object:
The measurement object is the body whose movement, position or dimension is to be acquired by the sensor.

Measurement range:
The measurement range is the total calibrated range which is converted into a signal by the following electronics with the specified limits. Beyond the defined measurement range the signal values within certain limits are output with reduced accuracy.

Noise:
Disturbance signal which is superimposed on the output signal.

Repeatability:
Quantitative specification of the deviation of mutually independent measurements which are determined under repeat conditions.

Resolution:
The resolution of a measurement device states the value of the input quantity at which a clear differentiation can be made between two measurements that lie close together.

Sensitivity:
Sensitivity is defined as the ratio of the signal change of the measurement transducer and the change of the physical input quantity.

$$\text{Sensitivity} = \frac{\text{Change of the measurement transducer signal}}{\text{Change of the physical input quantity}}$$

With inductive sensors without integrated electronics the sensitivity is stated in mV / V / mm. This means that the sensitivity of the sensor is specified per mm displacement per volt of excitation voltage.

Spring constant:
With LVDT gaging sensors which contact the part to be measured with the plunger, the measuring force of the plunger is calculated using the spring constant. The restoring force of the spring is proportional to the deflection.

Target:
Material which influences the electromagnetic properties of the coil: The target is realized as a core, ring or sleeve and is joined to the measurement object.

Temperature stability:
Relative change of the output signal in dependence of the temperature.

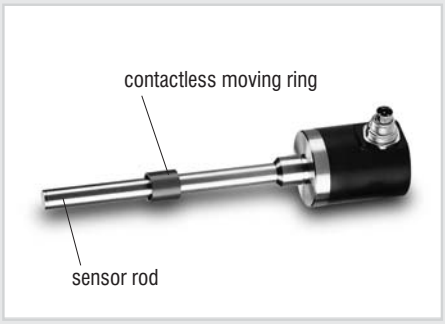
VIP series: sensors with measuring ring and integral electronics

No wear and no maintenance

Integrated microelectronics

Short and compact design

Rugged encapsulated sensor construction

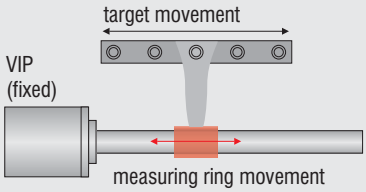


Patented measurement principle

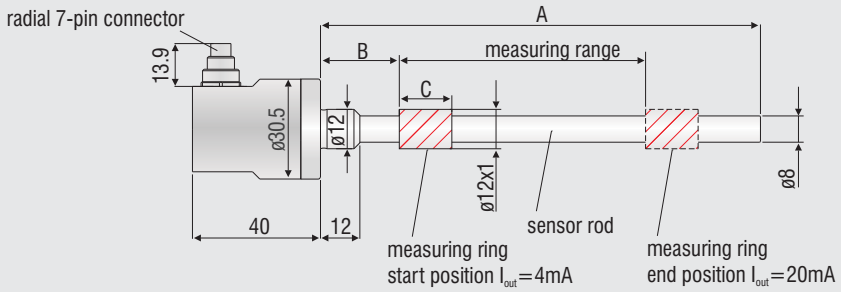
There is no mechanical contact between the measuring element (ring) and the sensor rod. The sensor therefore operates without any wear.

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.



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



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

All data in mm.

Model		VIP-50	VIP-100	VIP-150
Measuring range		50 mm	100 mm	150 mm
Linearity	standard ±0.5 % FSO	0.25 mm	0.5 mm	0.75 mm
	option ±0.25 % FSO	0.125 mm	0.25 mm	-
Resolution	<0.03 % FSO	0.015 mm	0.03 mm	0.045 mm
Temperature range		-40 °C ... +85 °C		
Temperature stability	zero	± 50 ppm / °C		
	sensitivity	±150 ppm / °C		
Frequency response (-3 dB)		300 Hz		
Output		4 - 20 mA		
Output load		500 Ohm		
Power supply		18 - 30 VDC		
Current consumption		max. 40 mA		
Protection class		IP 67		
Electromagnetic compatibility (EMC)		EN 50 081-2 spurious emission EN 50 082-2 interference immunity		
Shock[1]	IEC 68-2-29	40 g, 3000 shocks / axis		
	IEC 68-2-27	100 g radial, 300 g axial		
Vibration	IEC 68-2-6	5 Hz ... 44 Hz ± 2.5 mm; 44 Hz ... 500 Hz ±20 g		

FSO = Full Scale Output

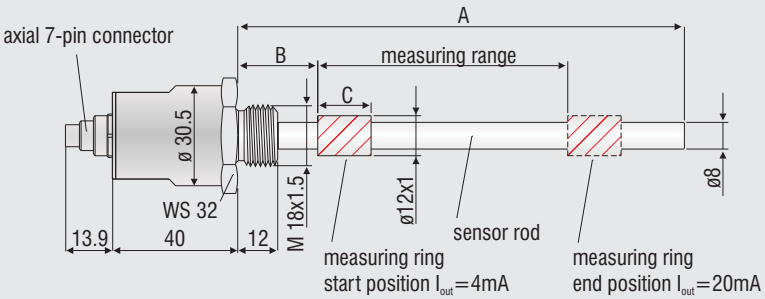
1) Half sinusoid 6 ms

Article

VIP- ***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= cylindrical housing (standard)
  GA= threaded housing (option)
- measuring range in mm

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



Sensor in plastic housing with integrated ASIC electronics VIP-30-ISC-HRW1

Excellent ratio of installed length to measurement range

Rugged and wear-free

High dynamic response

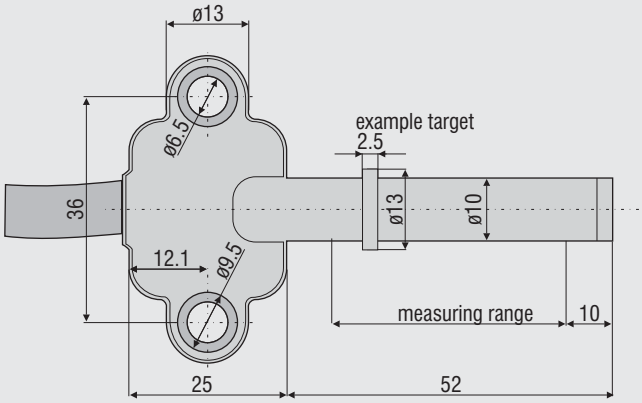
No magnet

Large-scale production system for industrial applications

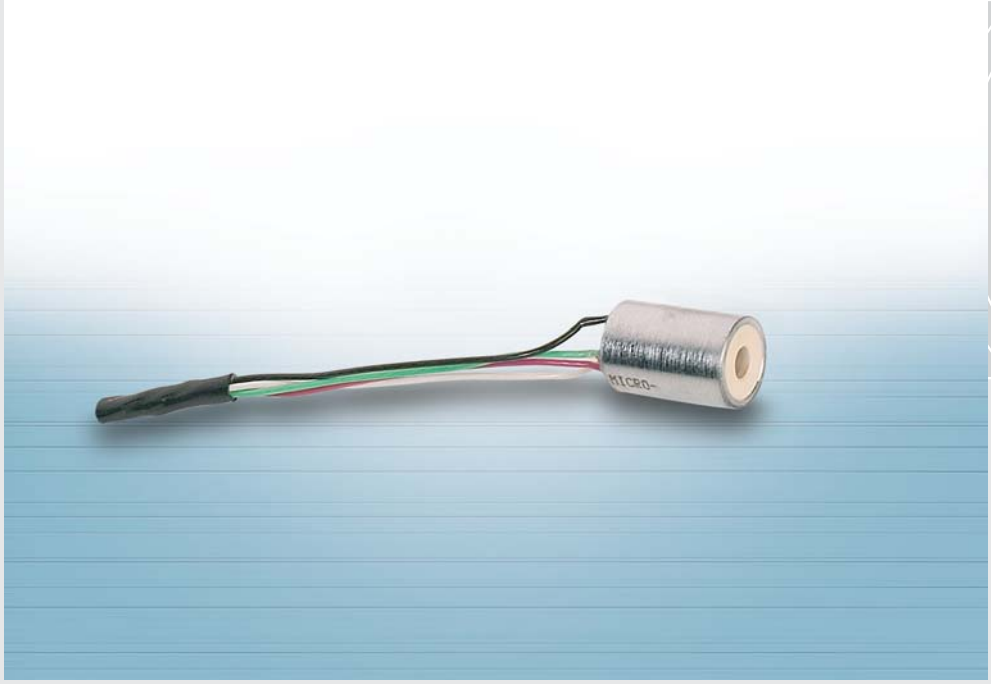
With the increasing deployment of electronic equipment in vehicles, inductive sensors are finding numerous fields of application. Ruggedness, compact design and favorable prices are regarded as basic requirements for applications in the automotive sector. It was against this backdrop that this innovative displacement sensor was developed, which is employed non-contacting and wear-free for applications particularly in the engine and gearbox, but which can also be used for industrial applications. The sensor is characterized particularly by its excellent ratio of installed length to measurement range. Further plus points are the integrated electronics, the high dynamic response and the measurement principle which does not need a magnet. These advantages take effect particularly with displacement and position measurements on the transmission, such as for example with the measurement of the clutch disengagement, shift rail or selector lever position.

Model	**VIP-30-ISC-HRW1**
Article	2617015
Measuring principle	VIP (page 10-11)
Measuring range	30 mm
Target (included)	aluminium ring ø13 x 1 mm, 2.5 mm long
Linearity	± 0.5% FSO (0.15 mm)
Resolution	10 Bit
Frequency response	1000 Hz (-3 dB)
Housing	thermosetting plastic
Temperature stability	200 ppm / °C
Output	UART (TTL-level RxD/TxD) option 0.5...4.5 VDC
Power supply	+ 5 VDC (4.9 ... 5.1 VDC) stabilized
Temperature range sensor	-40 °C ... +100 °C / temporary up to 125 °C
Protection class	IP 67, without connector

FSO = Full Scale Output



Sensor system with miniature sensor and on-board electronics KRS719(01)



Compact design

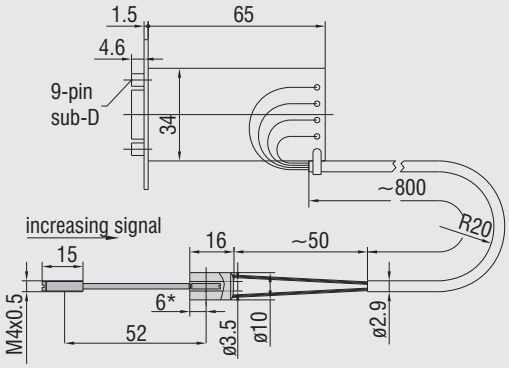
Calibrated system

On-board electronics

Model		KRS719(01)
Article		4350026.01
Measuring principle		LVDT (page 12)
Measuring range		± 1 mm
Target (included)		plunger 0800080 (ø2 x 62 long) with thread M4x0.5 (15 mm long)
Linearity		±0.15 % FSO (3 µm)
Resolution		0.07% FSO (1.4 µm)
Frequency response		100 Hz (-3dB)
Housing		nickel-plated steel
Temperature stability		zero ± 50 ppm / °C
Output		4 ... 20 mA
		options: 2 ... 20 mA / ± 3.9 VDC
Power supply		22.8 ... 25.2 VDC
Temperature range	sensor	-20°C ... +80°C
	electronics	0° C ... +50°C
Adjustment		zero, gain
Protection class		IP 67
Electronics		incl. circuit board BSC719(02)-I, article 2208078.02

FSO = Full Scale Output

The KRS719 sensor system is used for monitoring the yarn thickness in textile machines. The miniaturized sensor and the board-mounted electronics can be cost-effectively integrated into the available installation spaces and machine controllers. The system is characterized by high stability and repeatability.



* plunger in midrange

The plunger can be introduced into the sensor from both ends.

Series LVP DC: Inductive sensors with measuring plunger and integrated electronics

No wear and no maintenance

Integrated microelectronics

Compact design - short installed length

Shielded against EMI

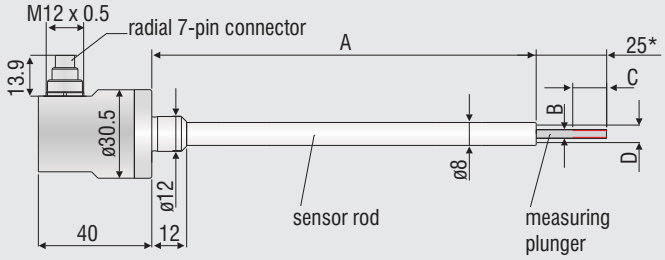
For use in difficult ambient conditions

Comparison of the installed length of the LVP sensor with a conventional LVDT sensor

Comparison of the installed length of the LVP sensor with a conventional LVDT sensor

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.

LVP series **housing version -ZA-**



* measuring plunger start position I_{out} = 4 mA

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

Model		LVP-50	LVP-100	LVP-200
Measuring range		50 mm	100 mm	200 mm
Linearity	standard ±0.5 % FSO	0.25 mm	0.5 mm	1.0 mm
	option±0.25 % FSO	0.125 mm	0.25 mm	-
Resolution	<0.03 % FSO	0.015 mm	0.03 mm	0.06 mm
Temperature range		-40 °C ... +85 °C		
Temperature stability	zero	±50 ppm / °C		
	sensitivity	±150 ppm / °C		
Frequency response (-3 dB)		300 Hz		
Output		4 - 20 mA		
Output load		500 Ohm		
Power supply		18 - 30 VDC		
Current consumption		max. 40 mA		
Protection class		IP 67		
Electromagnetic compatibility (EMC)		EN 50 081-2 spurious emission EN 50 082-2 interference immunity		
Shock[1]	IEC 68-2-29 IEC 68-2-27	40 g, 3000 shocks / axis; 100 g radial, 300 g axial		
Vibration	IEC 68-2-6	5 Hz ... 44 Hz ± 2.5 mm; 44 Hz ... 500 Hz ±20 g		

FSO = Full Scale Output

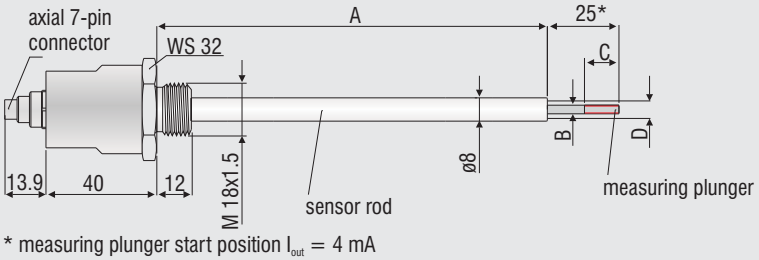
1) Half sinusoid 6 ms

Article

LVP - ***50*** - ***ZA*** - ***2.5*** - ***SR7*** - I

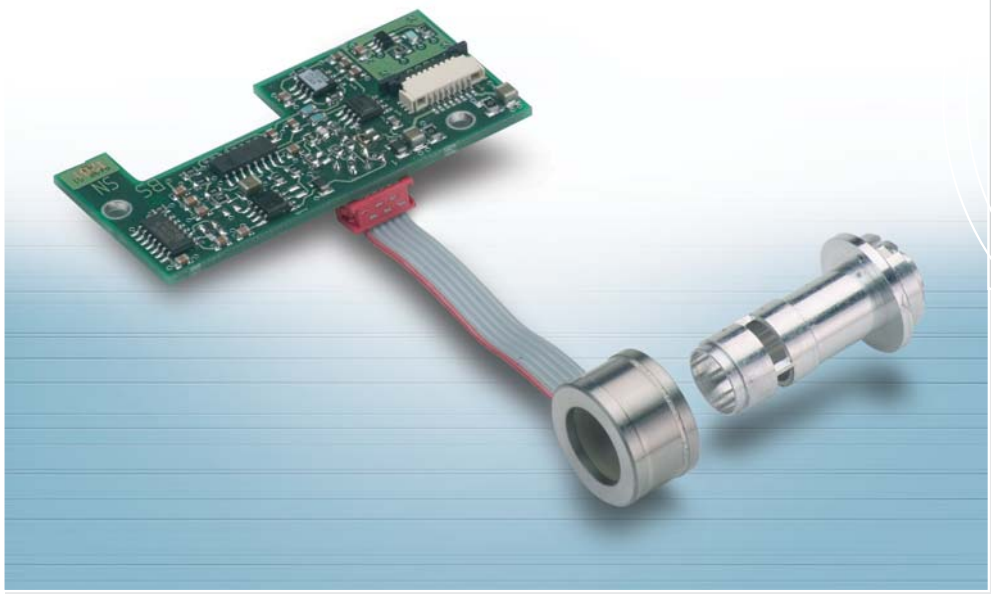
- Electrical output
- SA7= connector, axial (housing version GA)
  SR7= connector, radial (housing version ZA)
- Linearity 5 = 0.5 % FSO
  2.5 = 0.25 % FSO
- ZA= housing, cylindical (standard)
  GA= housing, threaded (option)
- measuring range in mm

LVP series **housing version -GA- (option)**



* measuring plunger start position I_{out} = 4 mA

Sensor system with on-board electronics
LVP-0,3-Z20-2-CR-AC



Excellent ratio of installed length to measurement range

On-board electronics

Rugged and wear-free

High dynamic

Functional target

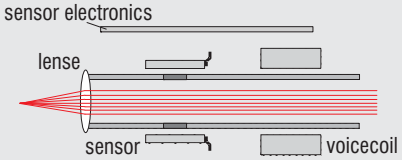
Voice coil actuators are used for positioning with small displacements, with a high dynamic response, high repeatability and positioning accuracy as well as with strong accelerations. In conjunction with a servo system the voice coil actuator and the displacement sensor are operated in a closed circuit. These systems are used in applications in the optical industry, such as for optical scanning, focusing, tracking and stabilizing. Through the use of the sensor the optical beam path and the mechanical system can be set up on one axis. The optical path is combined with the line of center of gravity for the motor and the measurement object.

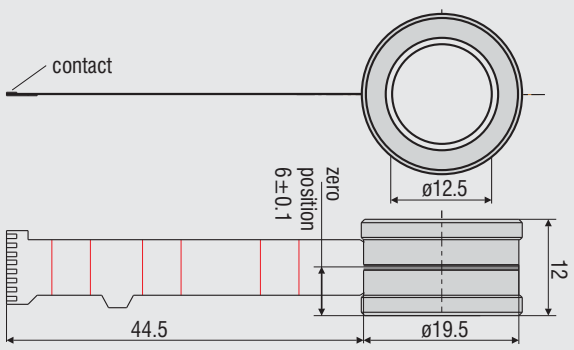
This produces a simpler mechanical construction, higher stability and a smaller installation space.

Model		LVP-0,3-Z20-2-CR-AC
Article		2617009
Measuring principle		LVP (page 10-11)
Measuring range		0.3 mm
Target		customer specific, not included
Linearity		0.25 % FSO (0.75 µm)
Resolution		0.025 % FSO (0.1 µm)
Frequency response		3 kHz
Housing		stainless steel
Temperature stability		± 200 ppm / °C
Output		digital, TTL
Power supply		+ 3.3 VDC
Temperature range	sensor	-10 °C ... +40 °C
	electronics	-10 °C ... +65 °C
Protection class		IP 65
Electronics		including PCB electronics 4111006.03, MSC739/CRF-AD

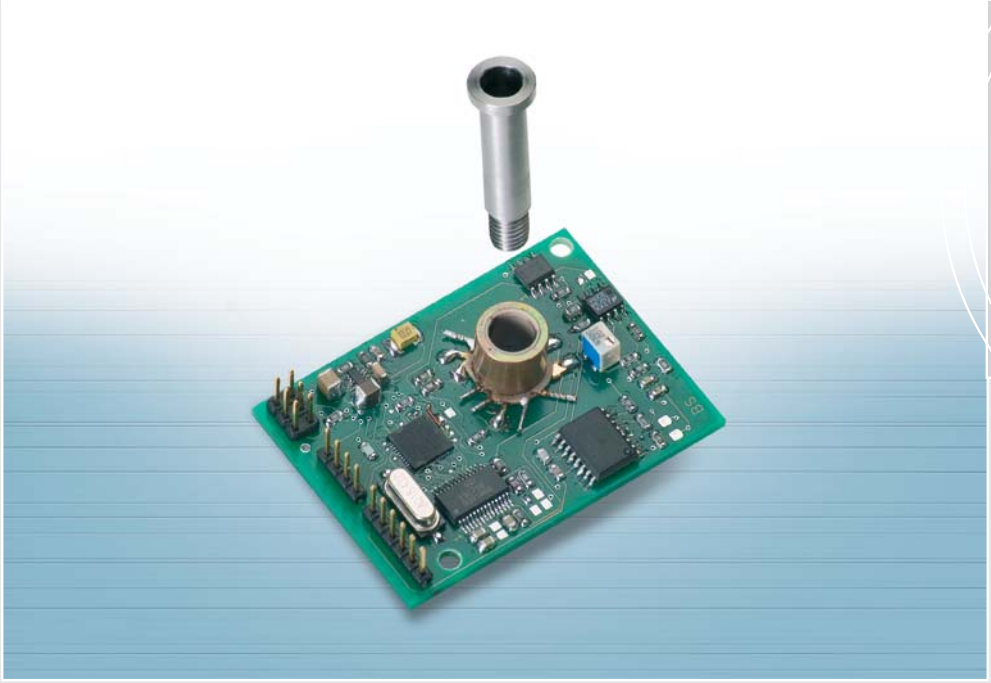
FSO = Full Scale Output

Sensor integrated in an optical and mechanical voice coil axis.





Sensor module with ASIC electronics LVPxx-P-LP-I/D



Market leading technology

Stroke measurement in hydraulic and solenoid valves

Measurement ranges from 1 to 10 mm with only one sensor module

Customer specific target

Model	**LVPxx-P-LP-I/D**				
Article	2616079				
Measuring principle	LVP (page 10-11)				
Measuring range	±1 mm	±2 mm	±3 mm	±4 mm	±5 mm
Target, plunger length	10.5 mm	8.5 mm	8 mm	7 mm	5 mm
Linearity	0.2 % FSO			0.5 % FSO	1 % FSO
Resolution	2 µm	4 µm	6 µm	8 µm	10 µm
	10 bit				
Frequency response	200 Hz ... 1 kHz (-3dB)				
Temperature stability	± 100 ppm / °C (zero)				
	± 150 ppm / °C (sensitivity)				
Output	0.5 ... 4.5 VDC and 4 ... 20 mA				
	option: PWM, digital (serial)				
Power supply	+ 8 ... 35 VDC				
Temperature range	-40 °C ... +85 °C				
Storage temperature	-40 °C ... +100 °C				
Circuit dimensions	41 x 52 mm				
Alu tube dimensions	ø7 x 0.5 mm, 35 mm long				

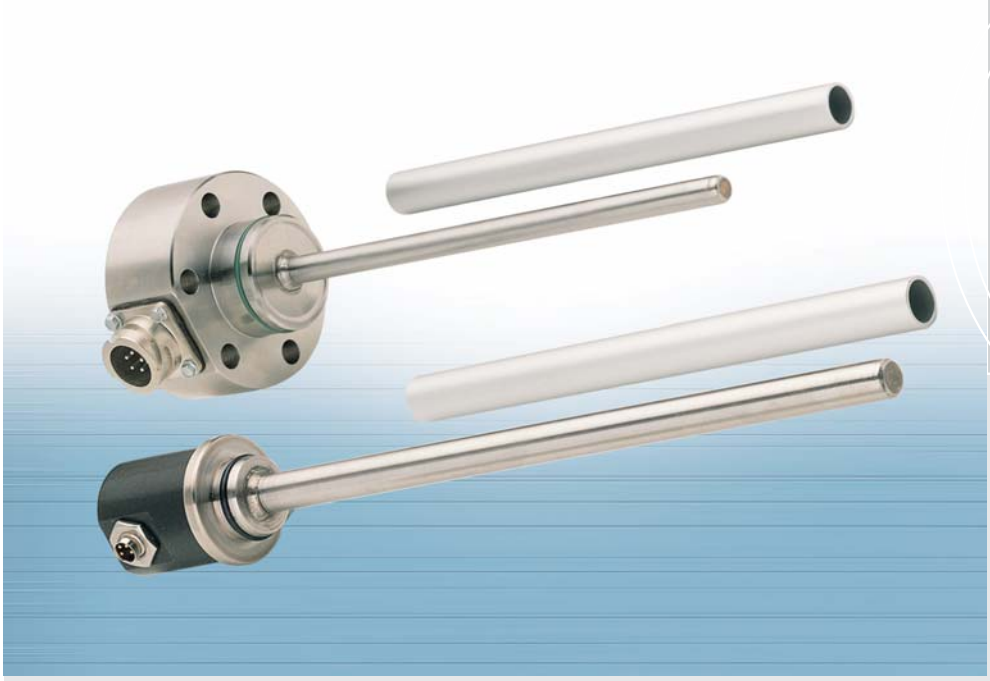
FSO = Full Scale Output

The sensor system LVP-xx-P-LP-I/D is used as a testing system for the verification and inspection of the functionality of the system in electro-hydraulic servo valves.

The modular sensor construction facilitates a fast and simple adaptation to the specific application for use in large-scale production. The sensor and electronic system can be constructed as one unit or with a sensor cable. The LVP principle enables matching of the measurement ranges in a span from ±1 to ±5 mm by simply changing the target length.

The sensor element is mounted in the pressure-free space and is protected by a pressure pipe. The acquisition of the target position occurs through the pressure pipe.

EDS series: long-stroke sensors for hydraulics & pneumatics



Measurement ranges 100 ... 630 mm
Output signal 4 ... 20 mA
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 aluminum sleeve is used which is integrated into the piston rod and is passed without making contact and wear-free over the sensor rod.

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 also 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

Artikelbezeichnung

EDS - **300** - ***S*** - ***SA7*** - I

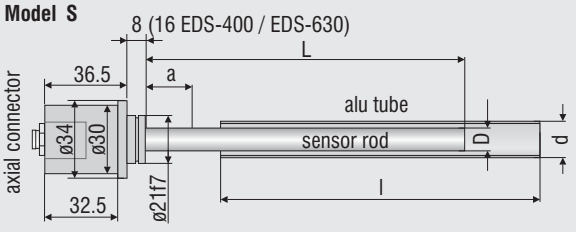
- electrical output
  - SR = connector, radial (model F)
  - SA7 = connector, axial (model S)
- Models: S = compact design with alu cap
  F = flange housing with mounting holes
- measuring range in mm

Integration in a hydraulic cylinder

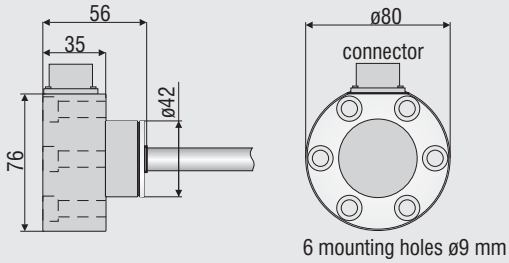
Model			EDS-100	EDS-160	EDS-200	EDS-250	EDS-300	EDS-400	EDS-630
Connection			**S, F**	**S, F**	**S**	**S, F**	**S, F**	**S, F**	**S, F**
Measuring range		mm	100	160	200	250	300	400	630
Linearity	±0.3 % FSO	mm	0.3	0.48	0.6	0.75	0.9	1.2	1.89
Resolution	0.05 % FSO	mm	0.05	0.08	0.1	0.125	0.15	0.2	0.315
Temperature range			-40 °C ... +85 °C						
Temperature stability			±200 ppm / °C						
Frequency response (-3 dB)			150 Hz						
Output			4 - 20 mA						
Output load			500 Ohm						
Power supply			18 - 30 VDC						
Current consumption			max. 40 mA						
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			450 bar (sensor rod, flange)						
Protection class			IP 67						
Electromagnetic compatibility (EMC)			EN 50 081-2 spurious emission EN 50 082-2 interference immunity						
Shock[1]	IEC 68-2-29 IEC 68-2-27		40 g, 3000 shocks / axis 100 g radial, 300 g axial						
Vibration	IEC 68-2-6		5 Hz ... 44 Hz ±2.5 mm 44 Hz ... 500 Hz ±23 g						
Material			V4A-Steel 1.4571						

FSO = Full Scale Output 1) Half sinusoid 6 ms

Model S



Model F

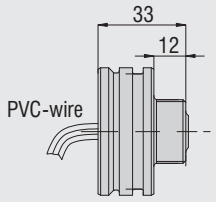


6 mounting holes ø9 mm
on pitch circle ø63 mm

OEM sensors

Modified OEM sensors with e.g. different measuring ranges, sensor rods and tubes are available on request.
Example: Model Z with axial PVC wire

Model Z



meas. range	sensor rod		alu tube				offset
	L	D	l		d		a
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
630	680	12	680 (S)	690 (F)	18 (S)	26 (F)	25

LVDT series: Gauging sensor with external electronics

Measurement ranges ±1 … ±10 mm

Extremely accurate even under difficult ambient conditions

Long-term stability, because wear-free

Easy fitting/operation

Gauging sensor with plunger guided in plain bearings and fitted with return spring. The measuring probe is mounted via a standard M2.5 thread and can be interchanged with commercially available measurement probes. Measurement probes are primarily used for the measurement and inspection of work-piece geometry (length, width, diameter, thickness, depth, height, etc.).

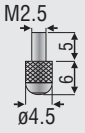
Article

DTA - ***5*** G - ***3*** - ***CA*** - ***V***

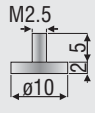
- principle: differential transformator (LVDT)
- excitation AC
- measuring range ± mm
- function: gauging sensor
- Linearity 3 (± 0.3 %) / 1.5 (± 0.15 %)
- Connection (axial): CA integral cable (3 m) / SA plug connection
- gauging sensor option: V pneumatic push

Probe tips

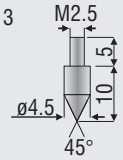
standard



option: type 11



option: type13



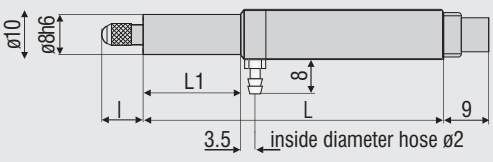
Model		DTA-1G-		DTA-3G-		DTA-5G-		DTA-10G-	
Connection		**CA**	**SA**	**CA**	**SA**	**CA**	**SA**	**CA**	**SA**
Measuring range		±1 mm		±3 mm		±5 mm		±10 mm	
Linearity	standard ±0.3 % FSO	6 µm		18 µm		30 µm		60 µm	
	optional ±0.15 % FSO	3 µm		9 µm		15 µm		30 µm	
Repeatability	<0.0075 %	<0.15 µm		<0.45 µm		<0.75 µm		<1.5 µm	
Excitation frequency		5 kHz						2 kHz	
Excitation amplitude		5 V_{eff}							
Sensitivity		133 mV/Vmm		85 mV/Vmm		53 mV/Vmm		44 mV/Vmm	
Force in midrange (typical)		0.95 N		1.00 N		1.18 N		1.23 N	
Spring force		0.22 N/mm		0.14 N/mm		0.12 N/mm		0.08 N/mm	
Temperature range		-20 °C ... 80 °C							
Options		option V with pneumatic push							
Operating temperature		-20 °C ... +80 °C							
Storage temperature		-40 °C ... +80 °C							
Temperature stability	zero	±50 ppm / °C							
	sensitivity	±100 ppm / °C							
Housing		stainless steel incl. magnetic shielding							
Protection class		SA: IP 40 / IP 54 * CA: IP 54							
Minimum cable bending radius		20 mm							
Outer diameter cable		~4,6 mm							
Shock	IEC 68-2-29	40 g, 1000 shocks / axis							
	IEC 68-2-27	100 g, 3 shocks / axis							
Vibration	IEC 68-2-6	10 Hz ... 58 Hz ±1.5 mm / 58 Hz ... 500 Hz ±20 g							

FSO = Full Scale Output *) depends on connector

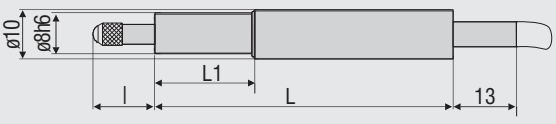
Basic model		DTA-1G-			DTA-3G-			DTA-5G-			DTA-10G-		
Connection		**CA**	**SA**	**Opt. V**	**CA**	**SA**	**Opt. V**	**CA**	**SA**	**Opt. V**	**CA**	**SA**	**Opt. V**
Length of housing L	mm	67	67	69	89	89	92,1	108	108	120	135	135	145
Length of clamping cylinder L_1	mm	21	21	19	26	26	25,1	30	30	38	42	42	46
Length of plunger l *	mm	9.5	9.5	10	12.5	12.5	12.7	14	14	17.5	20	20	22.2

* Plunger in zero position (±10 % FSO ±1 mm)

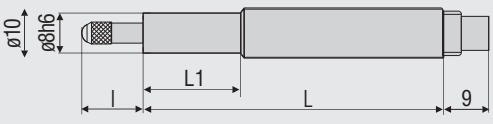
gauging sensor type - SA-V with pneumatic push



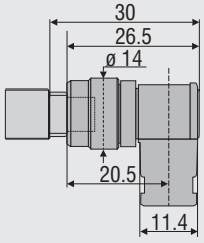
gauging sensor type - CA with integral cable



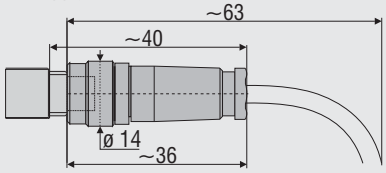
gauging sensor type - SA with axial connection



female connector 90°
dimensions apply for all models



female connector
dimensions apply for all models



LVDT series: Displacement sensors with external electronics

Measurement ranges ±1 … ±25 mm

Extremely accurate also under difficult ambient conditions

Long-term stability

Wear-free

Easy installation

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

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

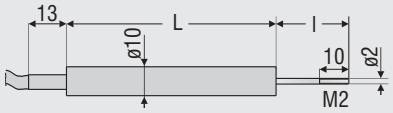
DTA - ***10*** D - ***3*** - ***CA*** - ***W***

- DTA: principle: differential transformator (LVDT)
- DTA: excitation AC
- ***10***: measuring range ± mm
- D: function: displacement sensor
- ***3***: linearity
  - 5 (±0.5 %)
  - 3 (± 0.3 %)
  - 1.5 (± 0.15 %)
- ***CA***: connection axial
  - CA integral cable (3 m)
  - SA plug connection
  - connection radial
  - CR integral cable (3 m)
  - SR plug connection
- ***W***: options
  - W welded/sealed housing (water proof up to 5 bars)
  - P pressure resistant housing (up to 100 bar)
  - 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)

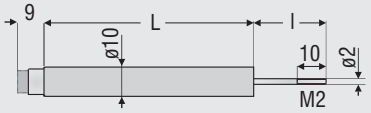
Model	DTA-1D-		DTA-3D-		DTA-5D-		DTA-10D-		DTA-15D-				DTA-25D-			
Connection	CA	SA	CA	SA	CA	SA	CA	SA	CA	CR	SA	SR	CA	CR	SA	SR
Measuring range	±1 mm		±3 mm		±5 mm		±10 mm		±15 mm				±25 mm			
Linearity standard ±0.5 %	-		-		-		-		-				250 µm			
Linearity standard ±0.3 %	6 µm		18 µm		30 µm		60 µm		90 µm				150 µm			
Linearity option ±0.15 %	3 µm		9 µm		15 µm		30 µm		45 µm				-			
Excitation frequency	5 kHz						2 kHz		1 kHz							
Excitation amplitude	5 V_{eff}								2.5 V_{eff}							
Sensitivity	133 mV/Vmm		85 mV/Vmm		53 mV/Vmm		44 mV/Vmm		45 mV/Vmm				33 mV/Vmm			
Temperature range	-20 °C ... 80 °C															
Storage temperature	-40 °C ... +80 °C / +120 °C															
Temperature stability	zero ±50 ppm/°C															
	sensitivity ±100 ppm/°C															
Housing	stainless steel including magnetic shielding															
Bending radius cable	20 mm															
Outer cable diameter	~4.6 mm															
Protection class	IP 67															
Shock IEC 68-2-29	40 g, 1000 shocks / axis															
Shock IEC 68-2-27	100 g, 3 shocks/direction															
Vibration IEC 68-2-6	10 Hz ... 58 Hz ±1.5 mm / 58 Hz ... 500 Hz ±20 g															

FSO = Full Scale Output

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

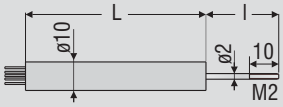


type - CA with integral cable



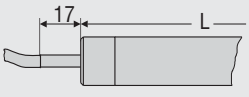
type - SA with axial plug connection

Sensors with axial solder pins and axial stranded wire on request.

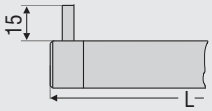


Typ - TA with axial solder pins (DTA-1D ... DTA-10D)

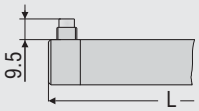
sensor types with measuring range ±15 mm and ±25 mm (inner diameter ø4.8 mm)



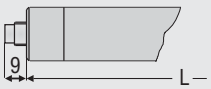
type - CA with integral cable



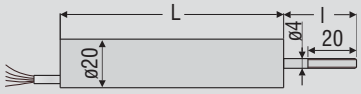
type - CR with integral cable (radial)



type - SR with radial plug connection



type - SA with axial plug connection

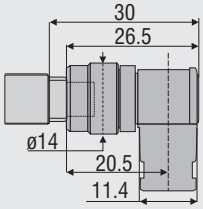


Typ - LA with axial stranded wire (DTA-15D - DTA-25-D)

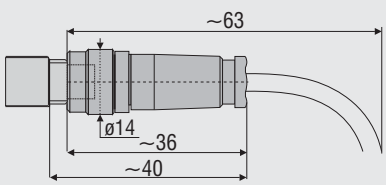
Basic model		DTA-1D-		DTA-3D-		DTA-5D-		DTA-10D-		DTA-15D-				DTA-25D-			
Connection		CA	SA	CA	SA	CA	SA	CA	SA	CA	CR	SA	SR	CA	CR	SA	SR
Length of housing L	mm	40	40	57	57	73	73	87	87	106.5				143.5			
Length of plunger l [1]	mm	19		29		30		35		51				62			
Housing diameter	mm	10								20							

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

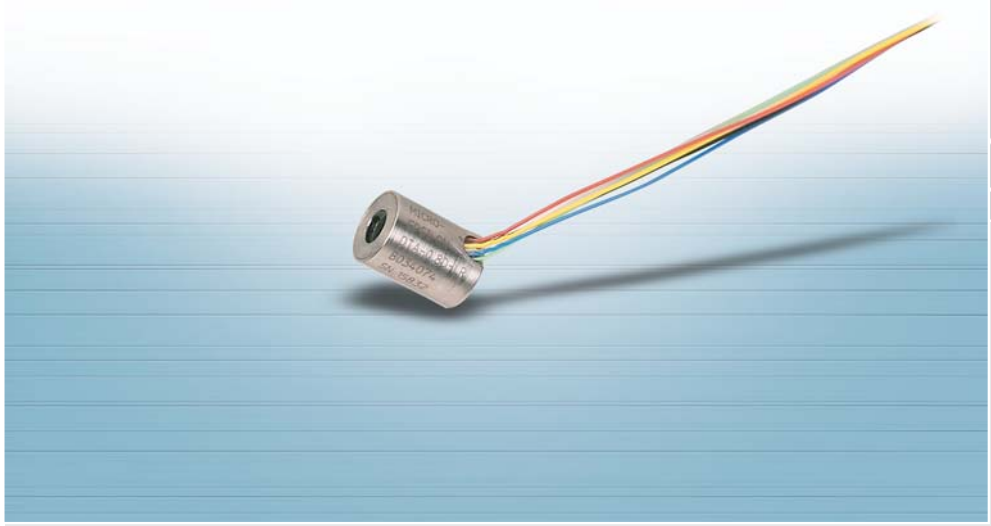
female connector 90° dimensions apply for all modelse



female connector dimensions apply for all models



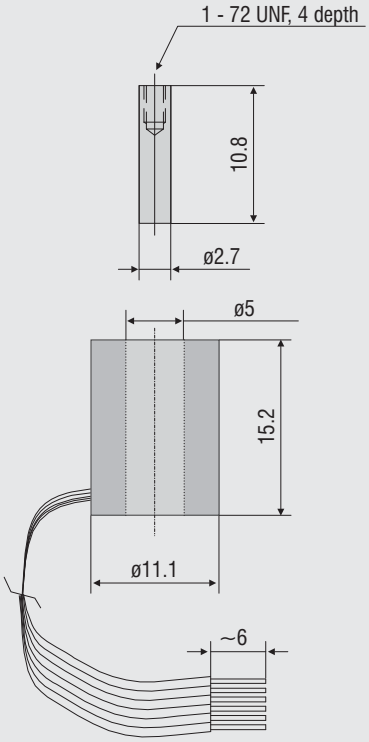
Miniature sensor with radial cable output DTA-0,8D-2,5-LR



OEM sensor for large-scale applications
Miniaturized design
Radial cable output
High accuracy

The miniature sensor DTA-0,8D-2,5-LR was designed and developed for use where the installation space is restricted. In addition, due to the low core weight the dynamic response of the measurement object is retained and mechanical loads are minimized.

Due to the radial cable output, the installation space behind the sensor can be fully exploited. With a linearity of <0.25% this sensor model is also suitable for measurements with high accuracy requirements.



Model	DTA-0,8D-2,5-LR
Article	2611045
Measuring principle	LVDT (page 12)
Measuring range	±0.8 mm
Linearity	<0.25% FSO at 5 V_{eff} / 12.5 kHz (4 µm)
Excitation frequency	1 - 20 kHz
Excitation amplitude	up to 10 V_{eff}
Target (included)	core 0304028 (ø2.7 x 10.8 long) with thread 1-72UNF (4 depth)
Housing	nickel-plated steel
Temperature stability sensor	zero: ±50 ppm / °C
Temperature range sensor	-20° C ... +80° C
Protection class sensor	IP 65
Electronics	ISC7001

FSO = Full Scale Output

Miniature sensor with axial cable output
DTA-1D-CA-U

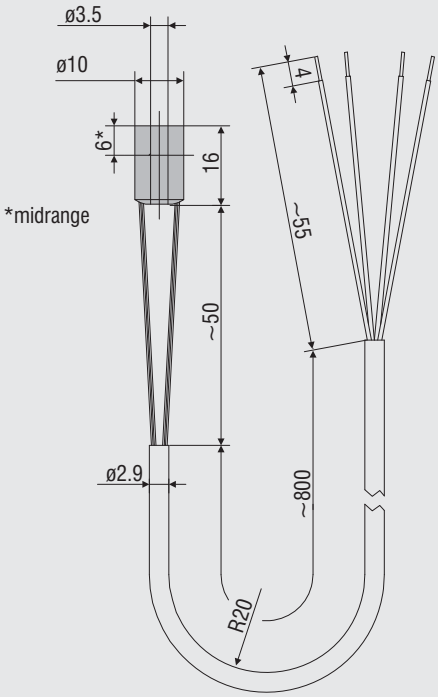
OEM sensor for large-scale applications

Miniaturized design

Axial cable output

As the sensor DTA-0,8D-2,5-LR, the miniature sensor DTA-1D-CA-U was designed and developed especially for used in restricted installation space. Due to the low core weight, the measurement object dynamic response is retained and mechanical loads are minimized.

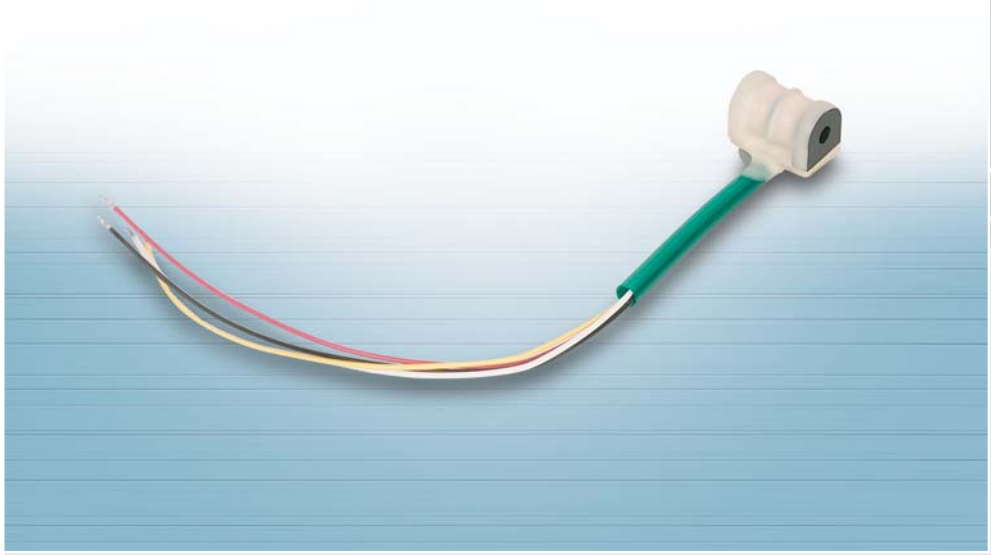
With this configuration the cable output is brought out axially so that the installation space surrounding the sensor can be fully exploited. This means, for example, that the sensor can be installed sunk into a hole.



Model	DTA-1D-CA-U
Article	2611037
Measuring principle	LVDT (page 12)
Measuring range	±1 mm
Linearity	< 0.5 % FSO at 2.5 V_{eff} / 5 kHz (0.01 mm)
Excitation frequency	1 - 20 kHz
Excitation amplitude	up to 10 V_{eff}
Target (not included)	plunger 0800080 (ø2 x 62 long) with thread M4 x 0.5 (15 long)
Sensitivity	155mV / Vmm at 2.5 V_{eff} / 5 kHz
Housing	nickel-plated steel
Temperature stability sensor	zero: ± 50 ppm / °C
Temperature range sensor	- 20° C ... + 80° C
Protection class sensor	IP 67
Electronics	MSC710 ISC7001

FSO = Full Scale Output

Sensor with coated coil
DTA-1D-20-DDV.02

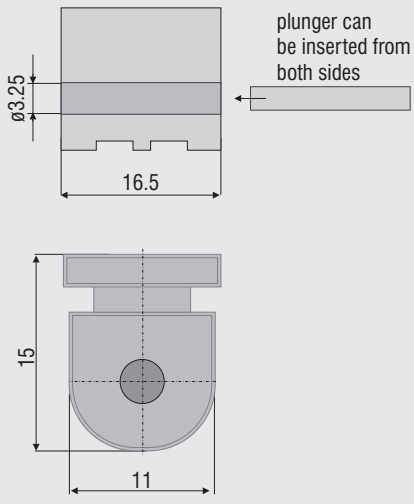


Proven OEM sensor

Miniature design

Low cost sensor

Taking into account economic boundary conditions, with the sensor line DTA-1D-20-DDV the external, mechanical sensor housing has been omitted. To protect the measurement coils the sensor has been fully coated with a protective epoxy.



Model	DTA-1D-20-DDV.02
Article	2611011
Measuring principle	LVDT (page 12)
Measuring range	±1 mm
Excitation frequency	0.5 ... 10 kHz
Excitation amplitude	up to 10 V_{eff}
Target	customer specific
Linearity	< 1% FSO (0.02 mm)
Housing	protective epoxy
Temperature stability sensor	zero: ± 50 ppm / °C
Temperature range sensor	-20° C ... + 85° C
Protection class sensor	IP 64
Electronics	MSC710
	ISC7001

FSO = Full Scale Output

Sensor for valve stroke measurements DTA-6D-20 (07)

Sensor for large-scale use for valve stroke measurements

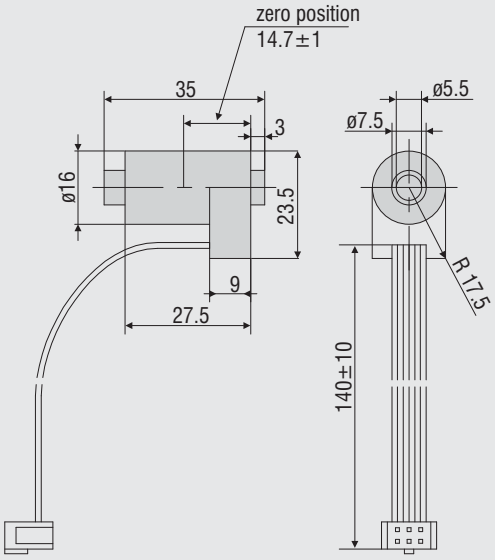
Well-proven OEM sensor

Plastic housing

Due to the use of a plastic housing, the sensor DTA-6D-20(07) can be offered at a very reasonable price. The configuration of the sensor facilitates, depending on the plunger used, a useful measurement range of ±2 mm to ±8 mm.

In a typical application this sensor is used for the measurement of the piston position in hydraulic valves. To facilitate exact dosage and therefore also a controlled movement, displacement sensors of the product line DTA-6D-20 are integrated into these valves.

The sensors acquire the position of the control plunger, controlling the volume flow. To do this, an accurate, non-contacting and primarily dynamic position acquisition is required. The sensor is mounted here outside of the pressurized area on a pressure pipe.

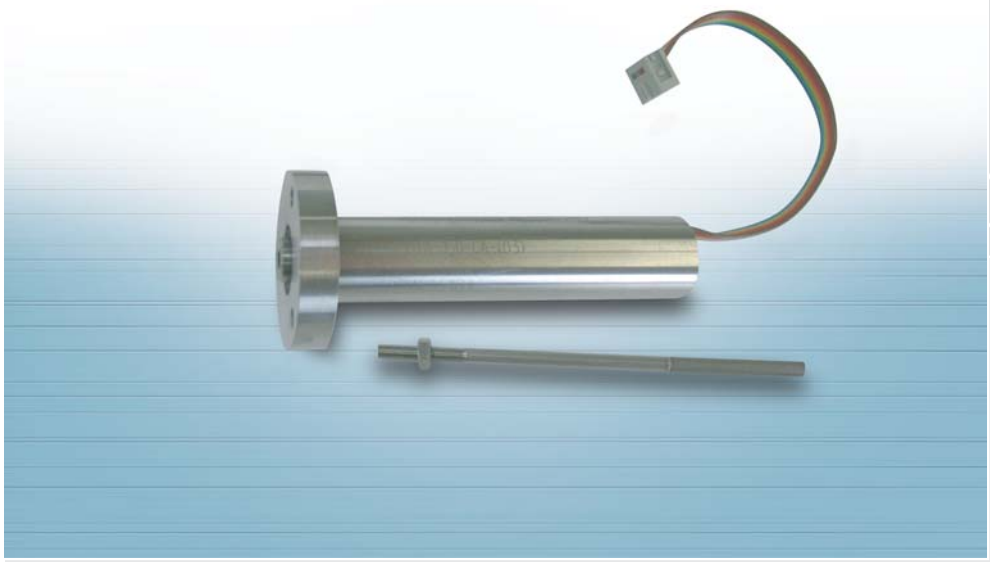


Model	DTA-6D-20(07)
Article	2611043
Measuring principle	LVDT (page 12)
Measuring range	±2 ... ±8 mm
Linearity	<0.5 % FSO at 2.5 V_{eff} / 5 kHz*
Frequency	1 - 20 kHz
Input voltage	up to 10 V_{eff}
Target (not included)	core 0304034 (ø2 x 28) pressure tube 0483331 (ø5 x 0.2)
Housing	plastics
Temperature stability sensor	zero: ±50 ppm / °C
Operating temperature sensor	-20° C ... + 80° C
Protection class sensor	IP 67
Electronics	MSC710
	ISC7001

FSO = Full Scale Output

* measuring range ± 6 mm

Pressure resistant sensor with welded flange DTA-15D-5-CA-(03)

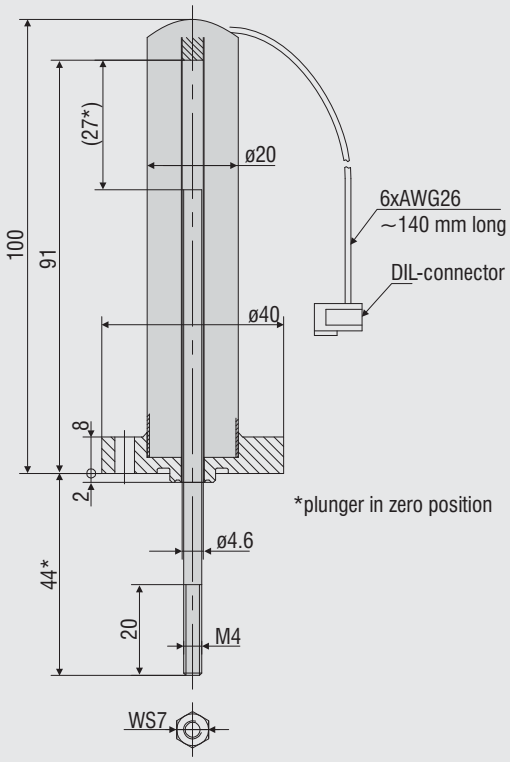


Pressure resistant version
Laser-welded stainless steel housing
Integrated flange
External electronics

For displacement measurements in applications with a very high ambient pressure, sensors of the series LVDT are integrated into a laser-welded, pressure resistant housing with an O-ring seal. The integrated flange facilitates simple sensor mounting.

Model	DTA-15D-5-CA-(03)
Article	2607026.03
Measuring principle	LVDT (page 12)
Measuring range	±15 mm
Linearity	±0.5 % FSO
Excitation frequency	1 kHz
Excitation amplitude	2.5 V_{eff}
Target (not included)	plunger 0800062 (ø4 mm, 108 mm long) thread M4 (20 mm long)
Housing	stainless steel
Temperature stability sensor	zero: ±50 ppm / °C
Temperature range sensor	-20° C ... + 85° C
Pressure resistance	150 bar
Electronics	MSC710
	ISC7001

FSO = Full Scale Output



Half-bridge sensor with plastic housing DRA-25D-20-SR-02

Plastic housing

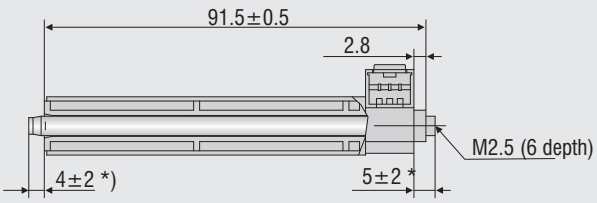
Integrated Rast 2.5 plug

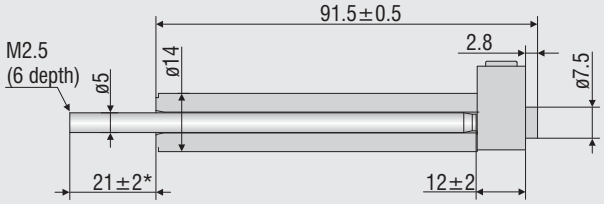
Extrusion coated core

The displacement sensor DRA-25D-20-SR(02) has been derived from the well-proven large-scale applications system for loading and unbalance detection in washing machines. The sensor is particularly well suited for applications in which displacements of up to 50 mm must be acquired economically and reliably. The sensor is integrated and protected within the machine or equipment. The integral 3-pole plug corresponds to the standardized Rast 2.5 dimensions.

Model	**DRA-25D-20-SR**
Article	2611031
Measuring principle	half-bridge
Measuring range	50 mm (±25 mm)
Linearity	±1 % FSO (0.5 mm)
Excitation frequency	500 Hz
Excitation amplitude	5 V_{eff}
Target (not included)	plunger 0800077 (ø4.76 x 98 long) with inner thread M2.5 (6 depth)
Housing	plastic
Temperature stability sensor	±0.01 % / °C (core in midrange)
Temperature range sensor	-20° C ... +70° C
Protection class sensor	IP 40
Electronics	MSC7210
	ISC7001

FSO = Full Scale Output





*) midrange

Sensor for needle stroke movements LVP-3-Z13-5-CA

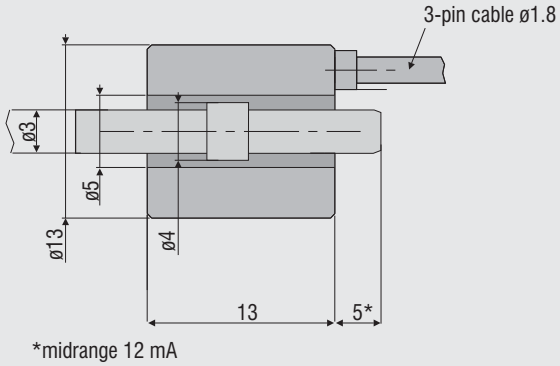
Compact design

Measurement object and sensor on one axis

No extension of the overall installed length due to sensor

Model	LVP-3-Z13-CA
Article	2617014
Measuring principle	LVP (page 10-11)
Measuring range	3 mm
Target (not included)	ø3 x 30 long with thread M3 and alu sleeve ø4 x 3.3
Linearity	typisch 0.3 % FSO (9 µm)
Housing	stainless steel
Temperature stability sensor	±100 pmm / °C
Temperature range sensor	-40 °C ...+150 °C
Protection class sensor	IP 67
Electronics	series MSC7210
	series ISC7001

FSO = Full Scale Output



*midrange 12 mA

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, 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.

Valve stroke sensor in stainless steel housing LVP-14-F-5-CR

High temperature range

Calibrated system with electronics

High temperature stability

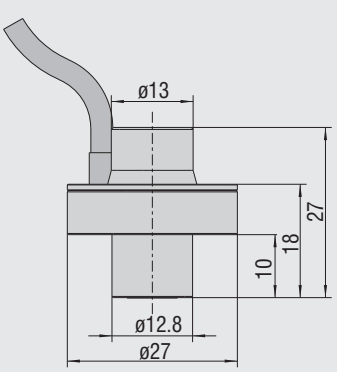
Integrable sensor design, adaptable to large-scale production

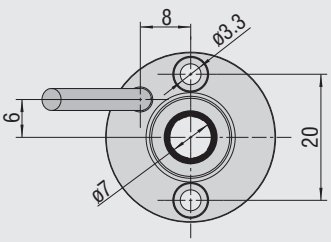
High cut-off frequency up to 20 kHz

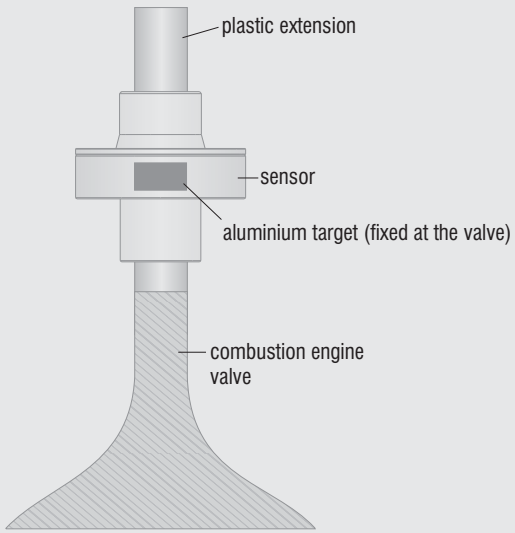
Future generations of engines will be able to dispense with mechanical camshafts. The displacement of the electromechanically or electrohydraulically driven inlet and outlet valves of internal combustion engines is acquired by the displacement sensor of the product line LVP-14-F-5-CR and fed into the control circuit. In this way a variable inlet and outlet control of the valves can be 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	2616078
Measuring principle	LVP (page 10-11)
Measuring range	14 mm
Target	customer specific
Linearity	0.5 % FSO (0.07 mm)
Housing	stainless steel
Temperature stability sensor	±100 pmm / °C
Temperature range sensor	-30 °C ... +150 °C
Protection class sensor	IP 67
Electronics	MSC739VS-U (article 4111009)

FSO = Full Scale Output







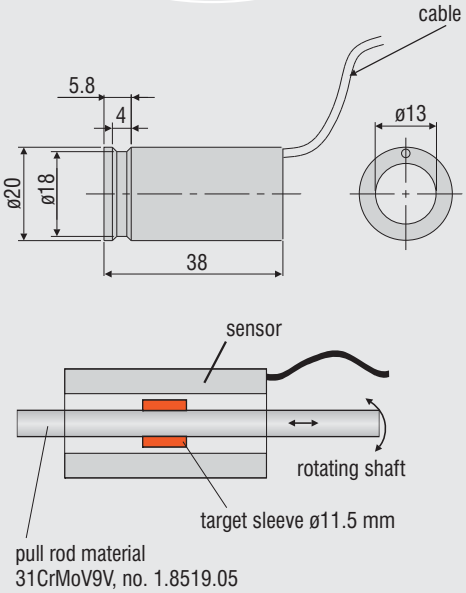
Sensor for the acquisition of displacement on rotating shafts LVP-25-Z20-5-CA-AC

Compact sensor for easy integration

High resolution

Shaft and sensor on one axis

No extension of the overall installed length due to sensor



With modern machine tools the critical moment is the change of tool. Deviations from the intended tool position can lead to severe cases of faulty production. Previously proximity sensors and connector rings were used for monitoring the clamped position, but they had to be adjusted and set, thereby incurring costs. Analog sensors from the series LVP offer a significant improvement. 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 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 miniaturized sensor electronic unit is supplied with 24 VDC and can either be accommodated at the point of measurement or in the control cabinet. Due to its high accuracy, the sensor provides a significant contribution in satisfying the continually increasing demands on the precision and availability of machine tools.

Model	**LVP-25-Z20-5-CA-AC**
Article	2617008
Measuring principle	LVP (page 10-11)
Measuring range	25 mm
Target (not included)	article 0482218 for shaft diameter 8 mm article 0482219 for shaft diameter 10 mm
Resolution	0.01 mm
Linearity	typical ±1 % FSO (0.25 mm)
Dynamics	150 Hz (-3dB)
Housing	stainless steel
Temperature stability sensor	<±0.01 % FSO / °C
Temperature range sensor	-40 °C ...+150 °C
Protection class sensor	IP 67
Medium	air, oil
Electronics	MSC7210

FSO = Full Scale Output

Integrable load and unbalance sensor ILU-50-0-10-SR

Sensor integrated into damper

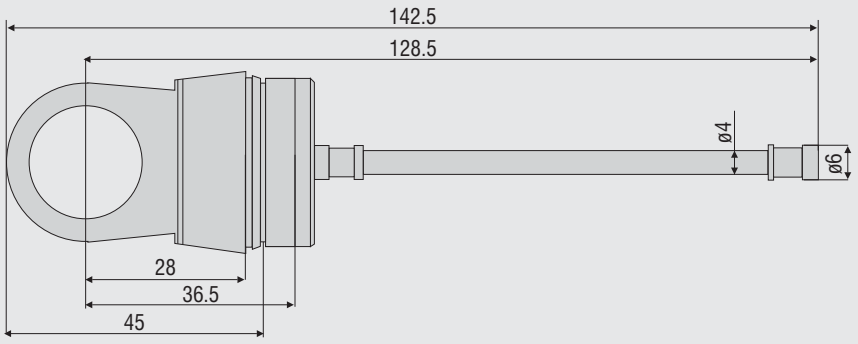
Integrated Rast 2.5 standard plug

Integral damper flange

The displacement sensor ILU-50-O-10-SR (Integrated Load and Unbalance sensor) measures the depression of the suds container when the washing machine is loaded and its deviation during the spinning stage. Due to the inductive measurement principle, the sensor provides an absolute position acquisition for static and dynamic processes. The short installed length of the patented VIP principle enables the sensor to be integrated into a compact friction damper. The displacement sensor supplies an output signal proportional to the weight of washing. Apart from the present version, the geometry of the flange can be customized for large-scale applications.

Model	**ILU-50**
Article	2611051
Measuring principle	VIP (page 10-11)
Measuring range	50 mm
Target (included)	aluminium ring
Linearity	3 % FSO
Temperature range sensor	+5 °C ... +80 °C
Electronics	MSC ILU50 (article 2208111)

FSO = Full Scale Output



LDR series
linear displacement sensors

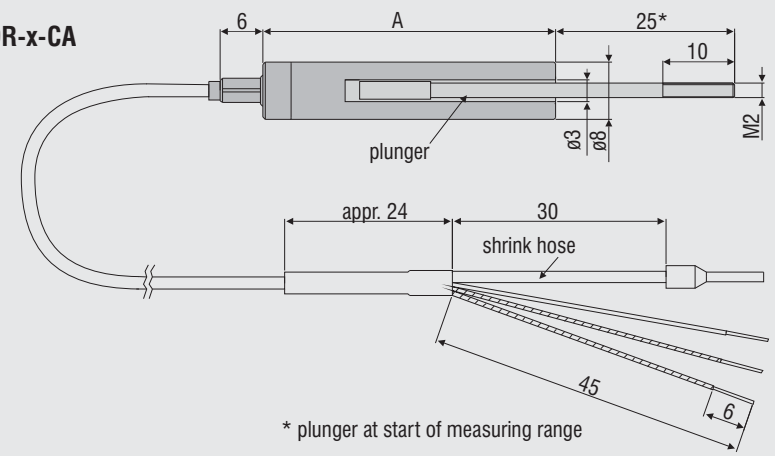
No wear and no maintenance
Excellent temperature stability
Operating temperature range up 160°C
Compact design - short installed length
Small sensor diameter
High measurement signal quality

The specific sensor configuration of the linear displacement sensors in the LDR series is characterized 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.

LDR-x-CA

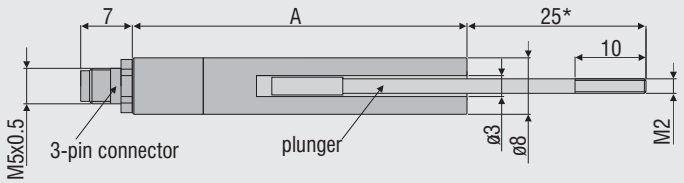


Model	A
LDR-10-CA	41 mm
LDR-25-CA	67 mm
LDR-50-CA	121 mm

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. ±0.7 % FSO	
		0.030 mm		0.088 mm		0.225 mm	
		max. ±0.50 % FSO					
Excitation frequency		16 kHz		12 kHz		8 kHz	
Excitation amplitude		1 V_{eff}		1 V_{eff}		2.6 V_{eff}	
Sensitivity		51 mV/Vmm		21 mV/Vmm		5.5 mV/Vmm	
Temperature range	SA	storage -40 °C ... +80 °C / operation -15 °C ... +80 °C					
	CA	storage -40°C ... +160 °C / operation -40 °C ... +160 °C					
Temperature stability	zero	±30 ppm / °C				±40 ppm / °C	
	sensitivity	±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	
Sensor cable - minimum bending radius fixed / moved		8 / 15 mm	10 / 30 mm	8 / 15 mm	10 / 30 mm	8 / 15 mm	10 / 30 mm
Outer cable diameter		3.1 mm	1.8 mm	3.1 mm	1.8 mm	3.1 mm	1.8 mm
Protection class		IP 67					
Shock	IEC 68-2-29	40 g, 3000 shocks / axis					
	IEC 68-2-27	100 g radial, 300 g axial					
Vibration	IEC 68-2-6	5 Hz ... 44 Hz ±2.5 mm / 44 Hz ... 500 Hz ±20 g					
Electric connection	SA	3-pin connector (accessory cable, article 0157047/047, 3 or 5 m)					
	CA	integral axial cable (shielded), 2 m					

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

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

MSC710
sensor controller for LVDT series

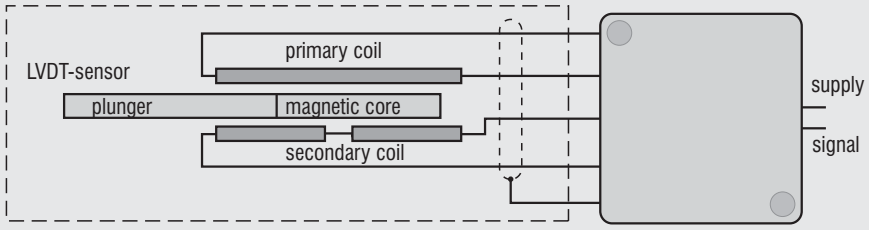
Excellent linearity and resolution

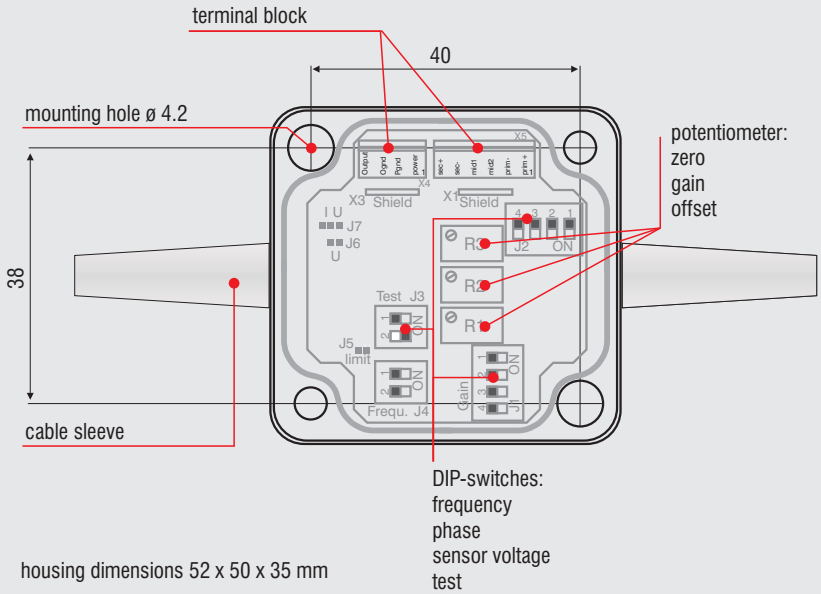
Zero and gain adjustable coarse/fine

Excitation frequency 1 ... 10 kHz (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.





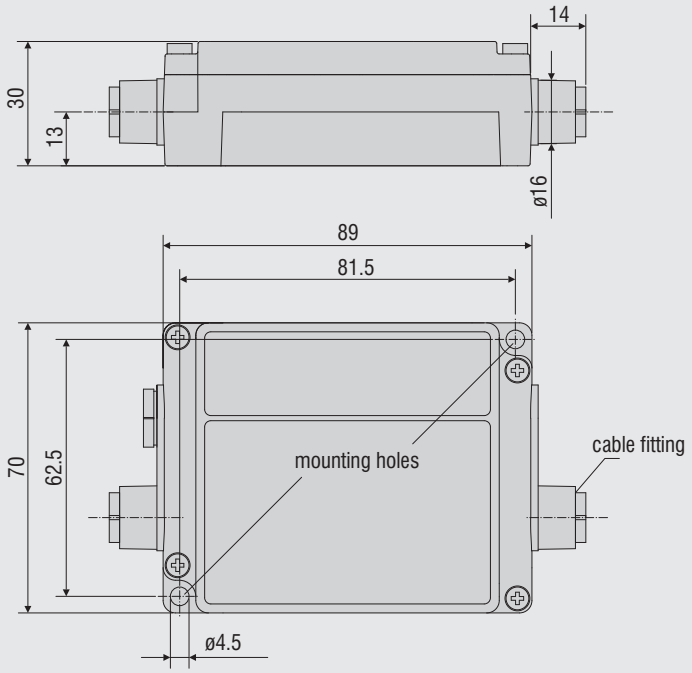
Model		MSC710-U	MSC710-I
Power supply		18 ... 30 VDC (18 ... 45 mA)	
Protection		Reverse plarity protection, overvoltage protection	
Sensor principle		for LVDT sensors	
Sensor excitation		150 ... 400 mV	
		1/2/5 kHz (selectable by DIP-switches)	
Input impedance	sensor	10 kOhm	
Range	gain	-20 ...+350 % (trimpot)	
	zero	±50 % (trimpot)	
Output signal		2 ... 10 VDC (R_a >1 kOhm)	4 ... 20 mA (load <500 Ohm)
Noise		< 1.5 mV_{eff}*	< 3 μA_{eff}*
		< 15 mV_{ss}	< 30 μA_{ss}
Linearity		<0.02 % FSO	
Frequency response		300 Hz (-3dB)	
Temperature range	storage	-40 °C ... +85 °C	
	operating	0 °C ... +70 °C	
Temperature stability		±100 pmm / °C	
Protection class		IP 65	
Weight		80 g	
Housing material		ABS-plastic	
Electromagnetic compatibility (EMC)		EN 50081-2 (spurious emission)	
		EN 50082-2 (immunity to interference)	
Vibration		EN 60068-2-64 (noise)	
Shock		EN 60068-2-29 (continous shock)	

FSO = Full Scale Output
* RMS AC-Measuring, Frequency 3 Hz ... 300 Hz

MSC7210
sensor controller for LDR series

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

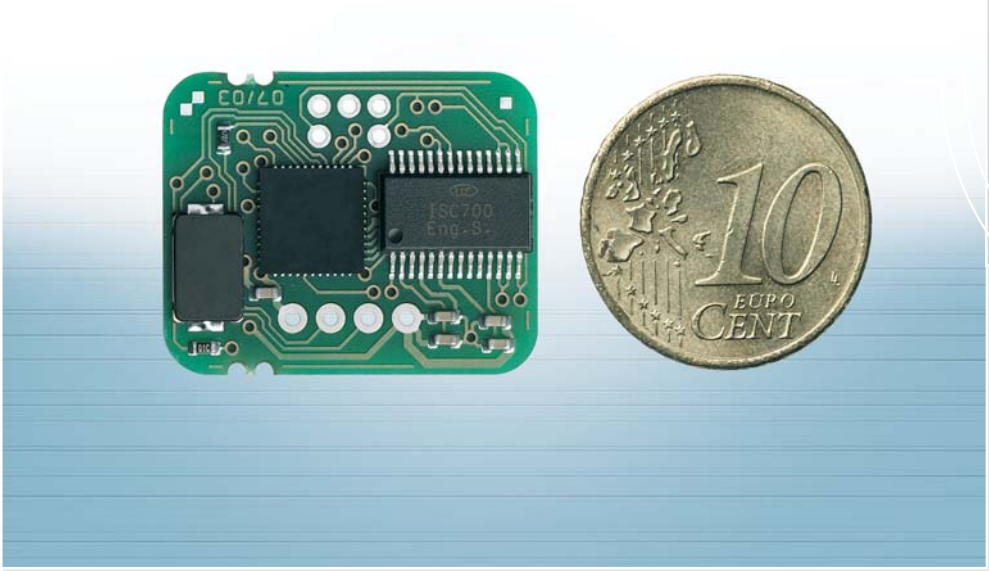
The MSC7210 is a single-channel electronic unit for the operation of inductive displacement transducers according to the LDR principle. The zero point and gain can be set over a wide range using trimming potentiometers. Due to the small size, the electronic unit is versatile in mounting.



Model		MSC7210-U	MSC7210-I
Power supply		18 ... 30 VDC	
Protection		Polarity reversal and overvoltage protection	
Sensor principle		LDR sensor	
Sensor excitation		1000 ... 2600 mV 4 ... 33 kHz (16 steps selectable via DIPswitch)	
Range	gain	-20 ... +270 % FSO (trimpot)	
	zero	±70 % FSO (trimpot)	
Output signal		2 ... 10 VDC	4 ... 20 mA
Noise		< 1.5 mV_{eff}*	< 3 μA_{eff}*
		< 15 mV_{ss}	< 30 μA_{ss}
Linearity		< ± 0.02 % FSO	
Frequency response		300 Hz	
Temperature range	storage	-40 °C ... +85 °C	
	operating	0 °C ... +70 °C	
Temperature stability		±100 ppm / °C	
Housing material		Zinc die cast	
Electromagnetic compatibility (EMC)		EN 50 081-2 (spurious emission) EN 50 082-2 (immunity to interference)	
Protection class		IP 65	
Shock		test signal: Half sine wave peak acceleration 15 g shock duration 6 ms test axes x, y, z No. of impacts per axis: 1000	
Vibration		test signal: Sine - sweep frequency: 20 ... 500 Hz 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 3 Hz ... 300 Hz

ISC7001
subminiature sensor controller



Subminiature ASIC design
Flexible OEM-system
Freely definable digital interface
Programmable sensor parameters
Integrated temperature measurement

Integrable subminiature sensor controller for OEM applications

The sensor ASIC, ISC700 has been designed for the control and evaluation of inductive sensors. The implemented two-chip technology with ASIC and micro-controller facilitates versatile adaptation to the measurement task in hand. An oscillator drives the sensor and the output signal is digitally conditioned by the ASIC. The signals are processed further by the micro-controller and output as a standardized signal. In line with the performance capability of the micro-controller, trouble-free migration of calibration and linearization of the sensor characteristics, together with filtering and averaging of the signals is possible. For control systems and monitoring tasks, the output of limits and switching points is programmed in the sensor electronics. The sensor becomes "intelligent".

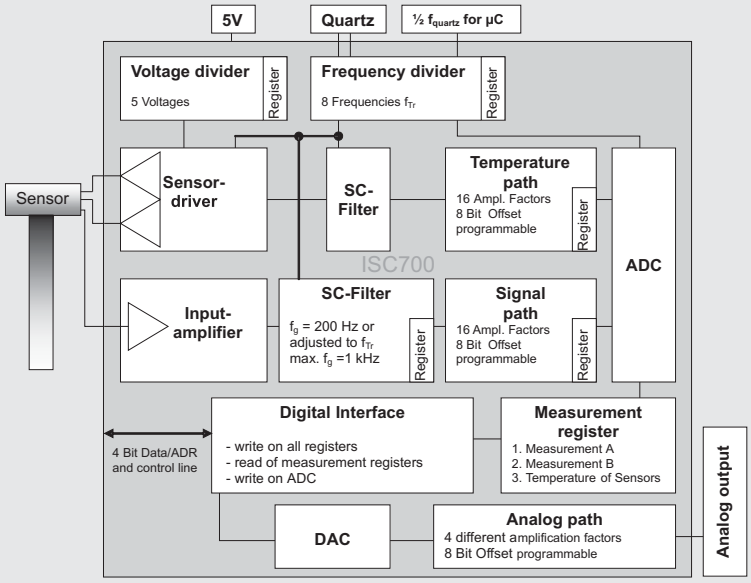
Increasing demands are being made on modern sensor systems in terms of miniaturization, flexibility, economy and digital interfaces. This is particularly true in the case of displacement and position sensors for applications involving medium to large quantities in automation, automotive production and household appliances.

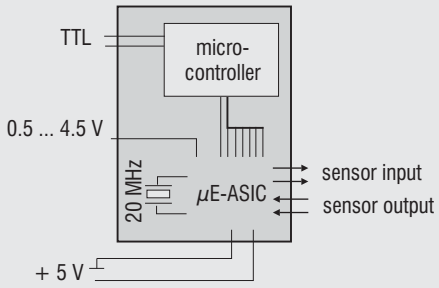
CAN-Bus, Profibus DP and industrial Ethernet, I^2C and Lin-Bus are examples of present bus systems for data transfer between sensors and their controllers. In a continually increasing number of applications decentralized data acquisition, conditioning and processing of sensor signals is demanded.

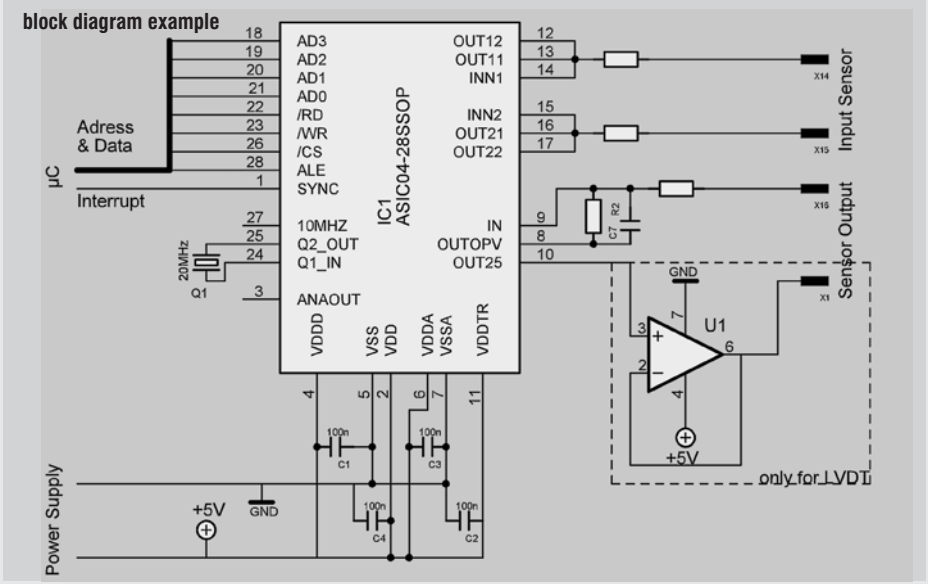
Sensor-specific parameters such as frequency selection, cut-off frequency, signal gain and offset are defined and programmed in the actual sensor ASIC. Temperature compensation of the measurement is possible through an additional integrated temperature measurement. The remaining signal conditioning occurs in a normal commercially available micro-controller. This concept ensures optimum adaptation and suitability of the computing power. Furthermore, all digital interfaces, available now and in the future, for controllers can be integrated into the system. Another advantage is the possible relief of main boards and data channels by moving the supervisory and control functions into the sensor system.

Model		ISC 7001
Dimensions		length: 25 mm, width: 20 mm, heigth: 5 mm
Operating temperature		-40° C ... 85° C
		option: up to 125° C
Supply voltage		5 V regulated, stabilized
Supply current		appr. 45 mA
Output (standard)	digital	serial output with TTL level (UART RxD und TxD)
Output (optional)	digital	free definable bus-interface
	analog	from 0.5 V to 4.5 V (voltage output RL > 100 kOhm) at 10 bit DA-converter or 10 bit PWM
Frequency response		up to 1 kHz
Resolution (bit)		up to 11 Bit

Note: all data have to be verified after the definition of the individual specifications

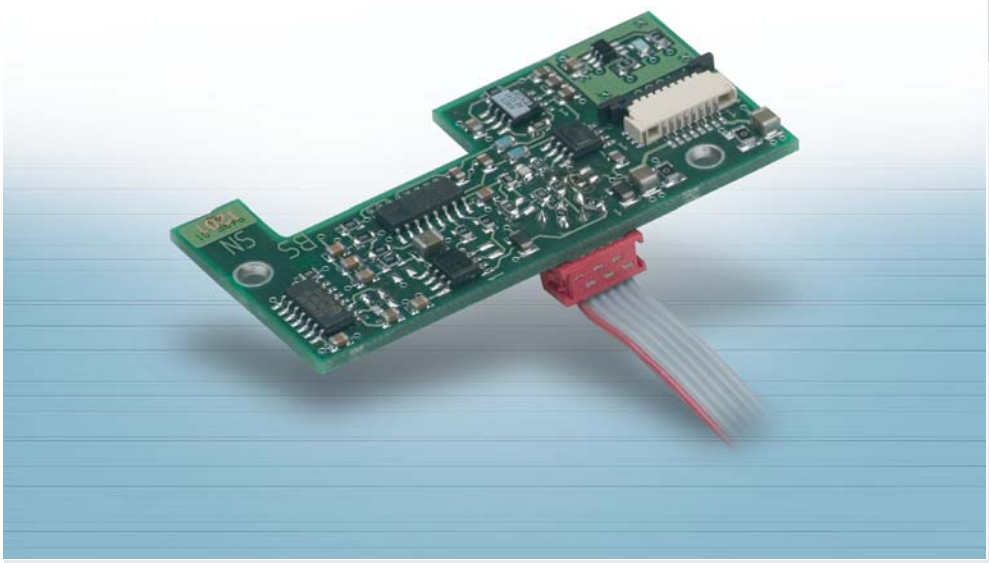


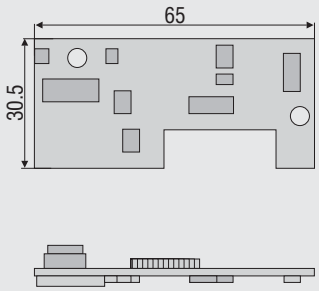




MSC739/CRF-AD sensor controller

On-board electronics for displacement sensor LVP-0,3-Z20-2-CR-AC with integral A/D converter and 8-pole FPC plug





Model	MSC739/CRF-AD
Article	4111006.03
Power supply	+ 5 V
Sensor	LVP-0.3-Z20-2-CR-AC
Output signal	digital TTL level
Resolution	0.025 % FSO
Frequency response	3 kHz (-3dB)
Temperature range	+10 °C ... +40 °C

FSO = Full Scale Output

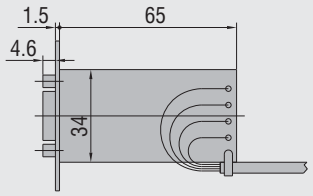
BSC719(02)-I sensor controller

Model	BSC719(02)-I
Article	2208078.02
Power supply	24 VDC
Sensor	DTA-1D-CA-U
Output signal	4 ... 20 mA
Resolution	0.07 % FSO
Frequency response	100 Hz (-3 dB)
Temperature range	0 °C ... +50 °C

FSO = Full Scale Output

On-board electronics for displacement sensor DTA-1D-CA-U with trimmers for setting the sensitivity and zero point

Connection via 9-pole Sub-D

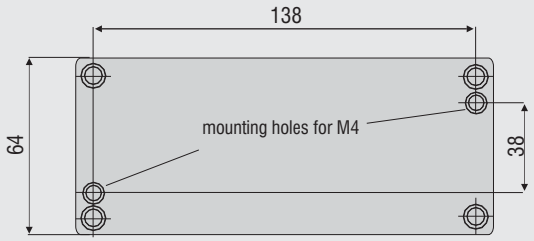


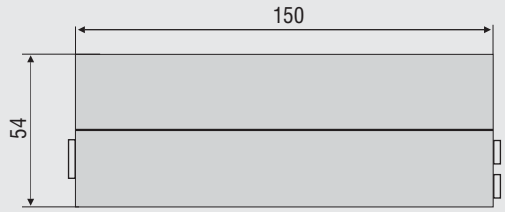
MSC739VS-U
sensor controller

Dual-channel evaluation electronics for valve stroke measurement in aluminum housing with plug connection for two valve stroke sensors

Model	MSC739VS-U
Article	4111009
Power supply	+10 ... 16 VDC
Sensor	LVP-14-F-5-CR
Output	1 ... 9 VDC
Resolution	0.02 % FSO
Frequency response	20 kHz (-3dB)
Temperature range	+10 °C ... +50 °C

FSO = Full Scale Output





Accessories for linear inductive sensors VIP, LVP, LDR, EDS and LVDT series

Accessories

2960031	MC25D	digital micrometer calibration fixture
2420019	PS2010	power supply on DIN rail, output 24 VDC, input 240 VAC, switchable 110 VAC
2984026		function and linearity inspection certificate incl. protocol with listed measurement data of the linearity inspection and documentation

linearity inspection certificate

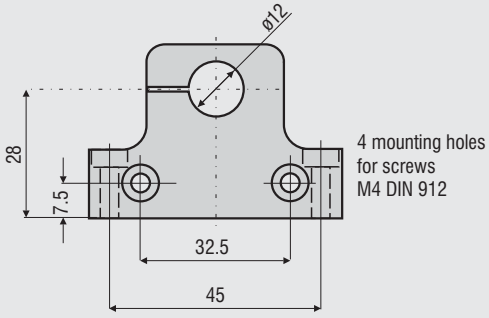
Accessories VIP and LVP series

Connection cable

0157043	C703-5	VIP/LVP/EDS 7-pin connection cable, 5 m
2902084	C703-5/U	VIP/LVP/EDS 7-pin connection cable, 5 m for voltage output 1 - 5 V
0157050	C703/90-5	VIP-/LVP-/EDS-7-pin connection cable, 5 m 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



mounting block VIP and LVP series

Accessories LDR series

Connection cable

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

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

Connection cable

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

Accessories LVDT series

Sensor cable

2902003	C700-3	sensor cable, 3 m, with connector
2902005	C700-6	sensor cable, 6 m, with connector
2902004	C701-3	sensor cable, 3 m, with connector and tin-plated free ends
2902013	C701-6	sensor cable, 6 m, with connector and tin-plated free ends
2902009	C701/90-3	sensor cable, 3 m, 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

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

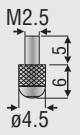
Flange

0483090.01	DTA-F10	mounting flange, slotted for DTA-1, DTA-3, DTA-5, DTA-10
0483083.02	DTA-F20	mounting flange, slotted for DTA-15, DTA-25

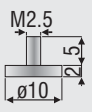
Probe tips

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

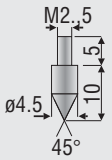
standard probe tip: type 2



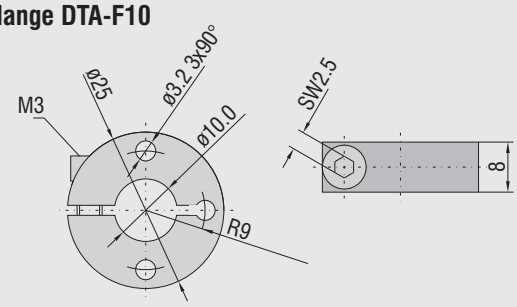
option: type 11



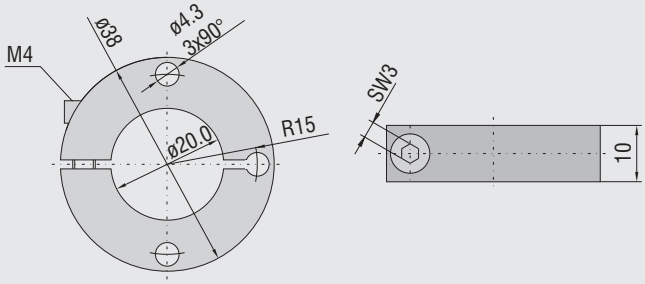
option: type 13



Flange DTA-F10



Flange DTA-F20



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Sensors and systems
for displacement, position and dimension

Sensors and measurement devices
for non-contact temperature measurement

Measurement systems
for online/offline quality control

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