MICRO-EPSILON

More Precision

induSENSOR // Linear inductive displacement sensors

Inductive displacement measuring system
induSENSOR DTD-xG8

- Compact measuring system
- Proven LVDT technology with high resolution
- Excellent price/performance ratio
- Measuring ranges ±1 … ±10 mm
- Robust design for industrial applications
- Ideal for serial applications in machine building and automation

Compact design

The compact DTD inductive displacement measuring system consists of a DTA gauge with a plunger guided by a plain bearing and a controller, which are connected to each other with a cable. This system is ideal for the integration in machines as it requires only little installation space. The controller has a diameter of just 18 mm and the 3m-long cable enables flexible installation.

Characteristics & design

The DTD system is based on the proven LVDT technology. It impresses with outstanding precision and provides resolutions down to the micrometer range. The system is available for the measuring ranges ±1 mm, ±3 mm, ±5 mm and ±10 mm which cover numerous measurement tasks. Due to the high system signal stability, the induSENSOR DTD impresses in measurement tasks where high accuracy is required. The controller has a compact and robust housing made of stainless steel. As it provides high temperature stability, resistance to shocks and vibrations as well as insensitivity to dirt, this system can be used for industrial measurement tasks. The system also has an excellent price-performance ratio, which is particularly profitable in applications involving large quantities.

Interfaces & connections

The system has a lot of analog and digital interfaces. Modern fieldbuses such as Ethernet, PROFINET or EtherCAT are also supported via optionally available interface modules. If needed, parameter setting of the system can be carried out via powerful software or a web interface.

Applications

The DTD system is preferably used in applications for high precision measurement and inspection of workpiece geometry. It is ideal for series applications in machine building and automation technology.

Spring-loaded plunger

Article designation

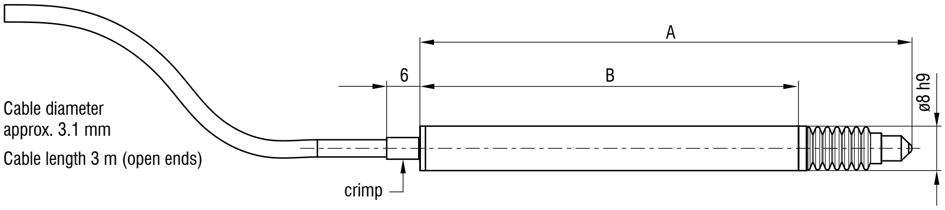
DT	Principle: Differential Transformer (LVDT)
D	Excitation DC
-5	Measuring range in mm
-G8	Function: gauge
-KE	Cable electronics
-3	Linearity: 0.5 (±0.05%)
-CC3	Connection cable 3 m
-SA	Connection (axial): 5-pin SA connector M12

Model		DTD-1G8	DTD-3G8	DTD-5G8	DTD-10G8
Measuring range		±1 mm	±3 mm	±5 mm	±10 mm
Resolution [1]		13 bits (0.012 % FSO) at 50 Hz 12 bits (0.024 % FSO) at 300 Hz			
Frequency response (-3dB)		Standard setting: 50 Hz; up to 300 Hz via software			
Linearity [2]		≤ ±1 µm	≤ ±3 µm	≤ ±5 µm	≤ ±10 µm
		≤ ± 0.05 % FSO			
Repeatability [3]		≤ 0.15 µm	≤ 0.45 µm	≤0.75 µm	≤1.50 µm
		≤ ±0.0075% FSO			
Temperature stability	Sensor	≤ 250 ppm FSO/K			
	Controller	≤ 100 ppm FSO/K			
Supply voltage [4]		14 … 30 VDC (5 … 30 VDC)			
Max. current consumption		40 mA			
Digital interface [5]		RS485 / PROFINET / EtherNet/IP / Ethernet / EtherCAT			
Analog output [3] [6]		(0) 2 ... 10 VDC / 0.5 ... 4.5 V / 0 ... 5 V (Ra 1 kOhm) or 0 (4) ... 20 mA (load 500 Ohm)			
Connection	Output side	5-pin connector M12 (cable see accessories)			
	Sensor side	Sensor: integrated cable, length 3 m (±50 mm), min. bending radius: fixed installation: 8x diameter (25 mm) moving: 12x diameter (38 mm) drag chain: 15x diameter (47 mm)			
Mounting [7]		Circumferential clamping			
Temperature range	Storage	-40 °C … +80 °C			
	Operation	Sensor (without bellows): -20 … +80 °C Sensor (with bellows): 0 … +80 °C Controller: -40 °C … +85 °C			
Pressure resistance		Atmospheric pressure			
Shock (DIN EN 60068-2-27)		40 g / 6 ms in 3 axes, 2 directions and 1000 shocks each 100 g / 5 ms in 3 axes, 2 directions and 9 shocks each			
Vibration (DIN EN 60068-2-6)		± 1.5 mm / 5 … 57 Hz in 3 axes, 10 cycles each ± 20 g / 57 … 500 Hz in 3 axes, 10 cycles each			
Protection class (DIN EN 60529)	Sensor	IP65 (with bellows); IP54 (without bellows)			
	Controller	IP67			
Material	Sensor	Stainless steel (housing); FPM (bellows); PUR (cable sheath); PVC/PP (cable braids)			
	Controller	Stainless steel			
Weight	Sensor	approx. 70 g	approx. 70 g	approx. 75 g	approx. 85 g
	Controller	approx. 50 g	approx. 50 g	approx. 50 g	approx. 50 g
	Overall system	approx. 120 g	approx. 120 g	approx. 125 g	approx. 135 g
Typ. spring forces [8]	SMR	1.3 N	0.8 N	1.0 N	0.7 N
	MMR	1.55 N	1.5 N	1.9 N	1.9 N
	EMR	2.0 N	2.5 N	3.0 N	3.5 N
Typ. service life		5 million cycles			

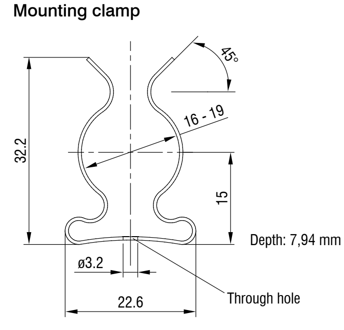
[1] Noise: AC RMS measurement via RC low-pass filter of the 1st order with fc = 5 kHz
[2] Independent linearity
[3] 200 repetitions; each repetition averaged over 100 values
[4] V+ = 5 V: no voltage output available; current output: max. load 100 Ω; V+ = 9 V: voltage output: 0.5 V ... 4.5 V or 0 V ... 5 V; current output: max. load 250 Ω
[5] Connection via interface module (see accessories)
[6] 0 V ≙ < 30 mV, 0 mA ≙ < 35 µA; for controllers with current output, the output signal is limited to approx. 21 mA
[7] Mounting clamp included in delivery (see accessories)
[8] Removing the bellows changes the spring forces

Gauge model	A (zero position)	B
DTA-1G8-3-CA	82.8 mm	64.3 mm
DTA-3G8-3-CA	88.2 mm	68.3 mm
DTA-5G8-3-CA	118.0 mm	89.5 mm
DTA-10G8-3-CA	155.0 mm	121.7 mm

DTA Gauges

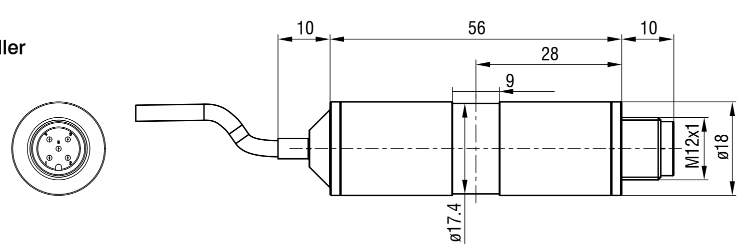


Mounting clamp



For mounting the controller

Controller



Accessories and connection possibilities
induSENSOR MSC

Accessories for MSC7401 / MSC7602 / MSC7802

Connection cables

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

MSC7602 connector kit

Service

Connection, adjustment and calibration including manufacturer certificate

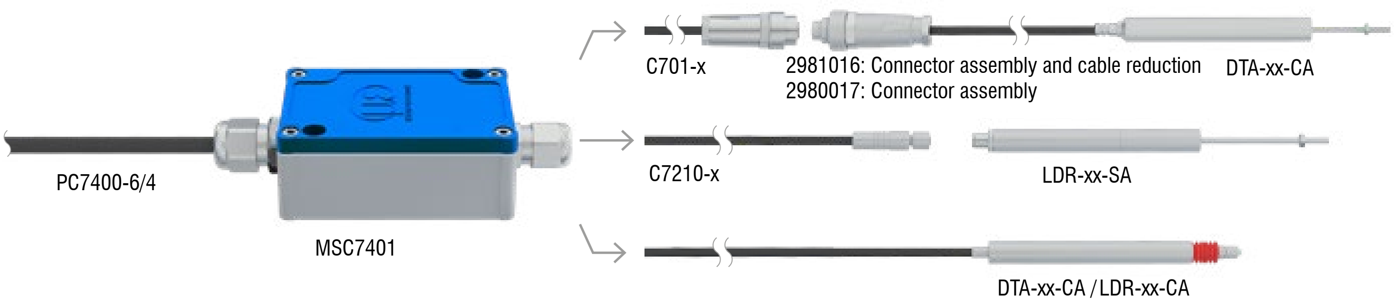
Interface modules

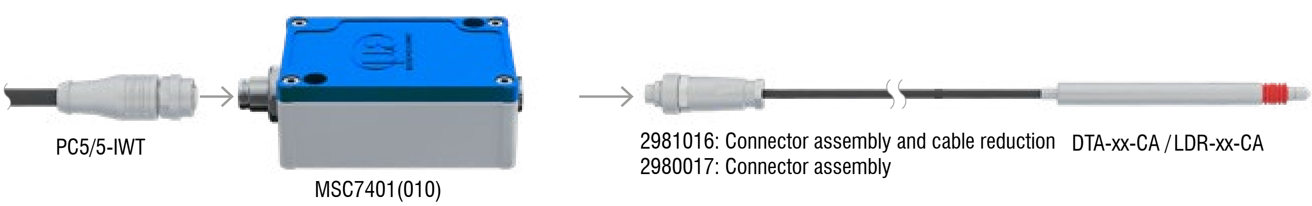
IF2035-EIP	DIN rail interface module for Ethernet/IP (multi-channel)
IF2035-PROFINET	DIN rail interface module for PROFINET (multi-channel)
IF2035-EtherCAT	DIN rail interface module for EtherCAT (multi-channel)
IF1032/ETH	Interface module for Ethernet/EtherCAT (single channel) (only MSC7401 / MSC7802)

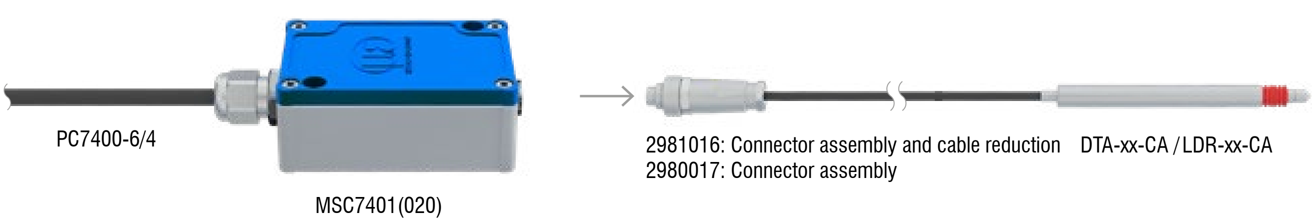
Power supply units

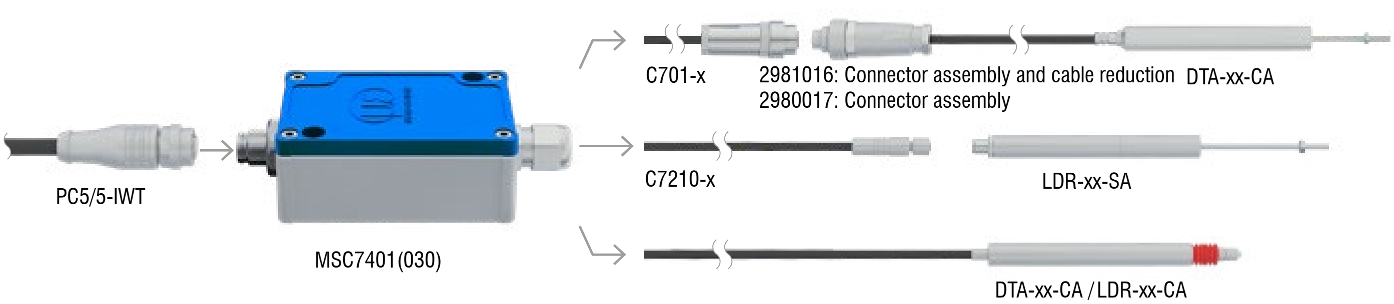
PS2401/100-240/24V/1A	Universal power supply unit with open ends

Connection options MSC7401

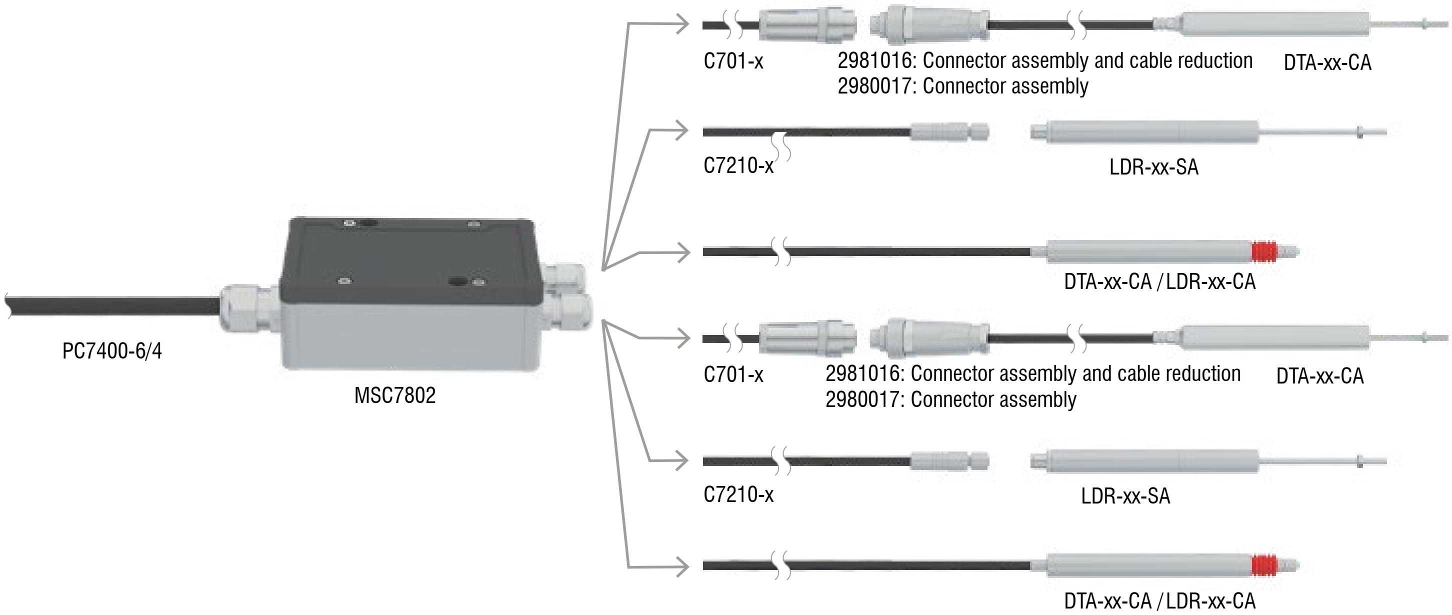


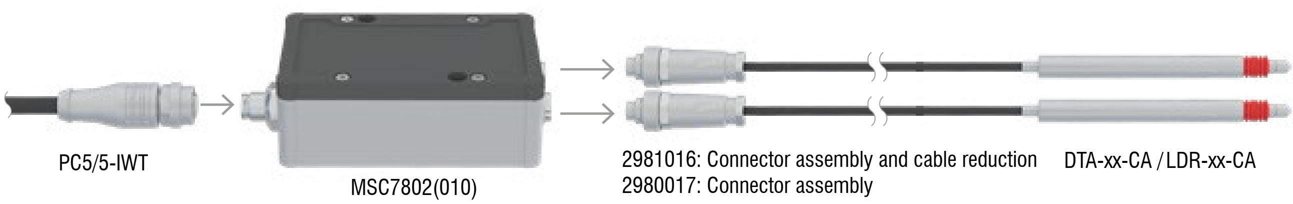


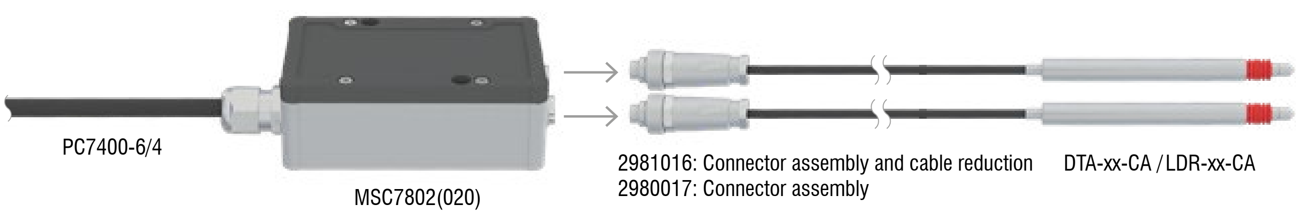


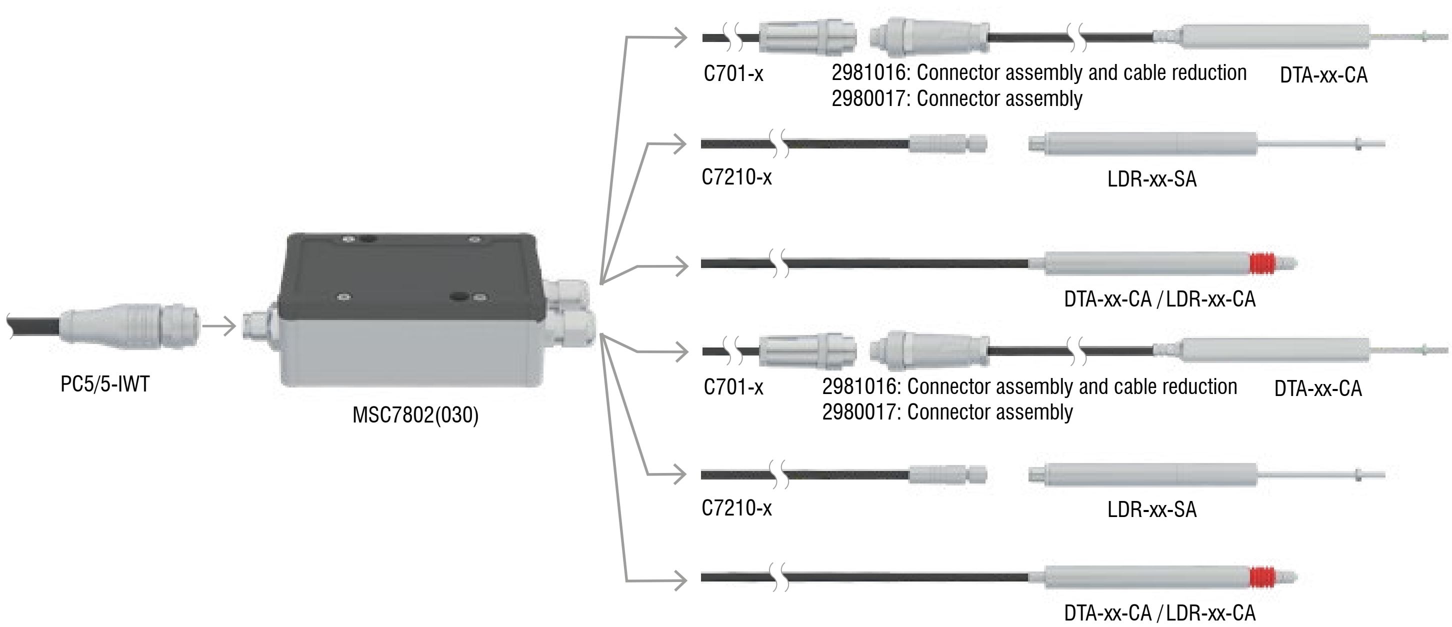


Connection options MSC7802









Technology and measuring principle
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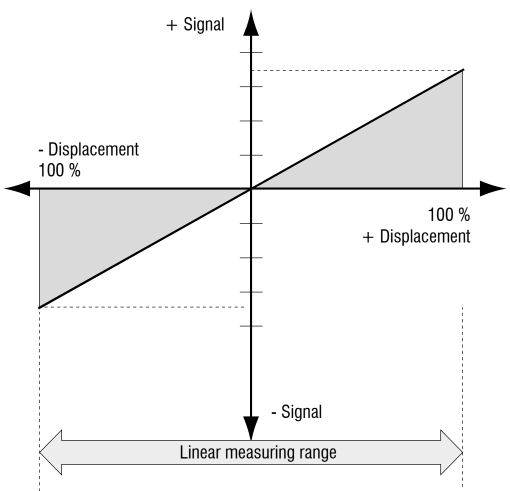
LVDT Gauges and LVDT displacement sensors (DTA series)

LVDT displacement sensors and gauges (Linear Variable Differential Transformer) are constructed with a primary and two secondary coils, which are arranged symmetrically to the primary winding. As a measuring object, a rod shaped soft-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.

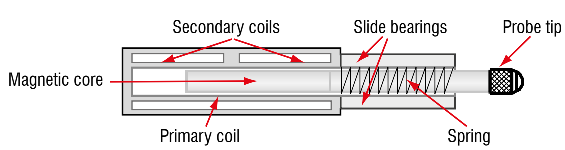
Depending on the core position, alternating voltages are induced in the two secondary windings. If the core is located in its "zero position", the coupling of the primary to both secondary coils is equally large. Movement of the core within the magnetic field of the coil causes a higher voltage in one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

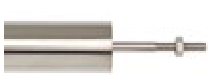


Measuring principle gauging sensor

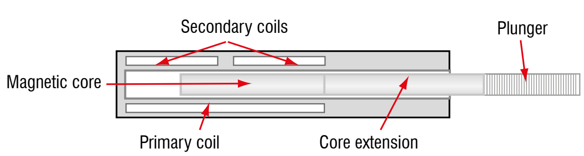
Probe tip



Measuring principle displacement sensor



Plunger

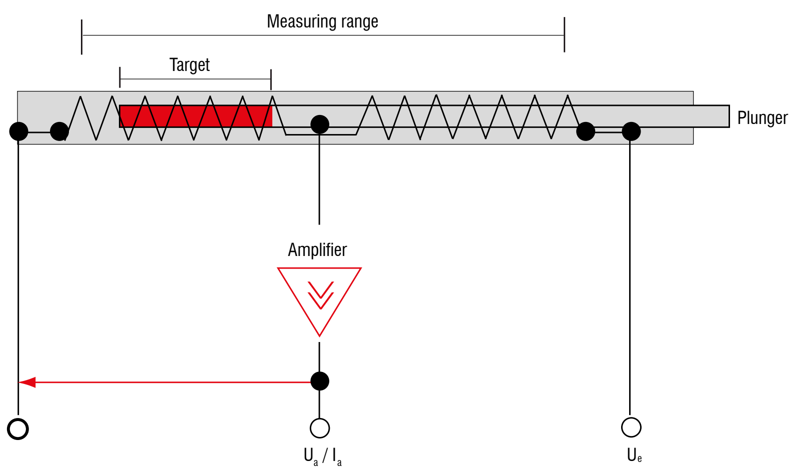


LDR Displacement sensors

The inductive sensors in the LDR series are constructed as half-bridge systems with center tap. An unguided plunger moves in the interior of the sensor coil, which consists of symmetrically constructed winding compartments. The plunger is joined to the moving measuring object via a thread.

Due to the movement of the plunger within the coil, an electrical signal is produced which is proportional to the displacement covered. The specific sensor configuration facilitates a short, compact design with a small diameter. Three connections are required as an interface to the sensor.

Block diagram LDR series



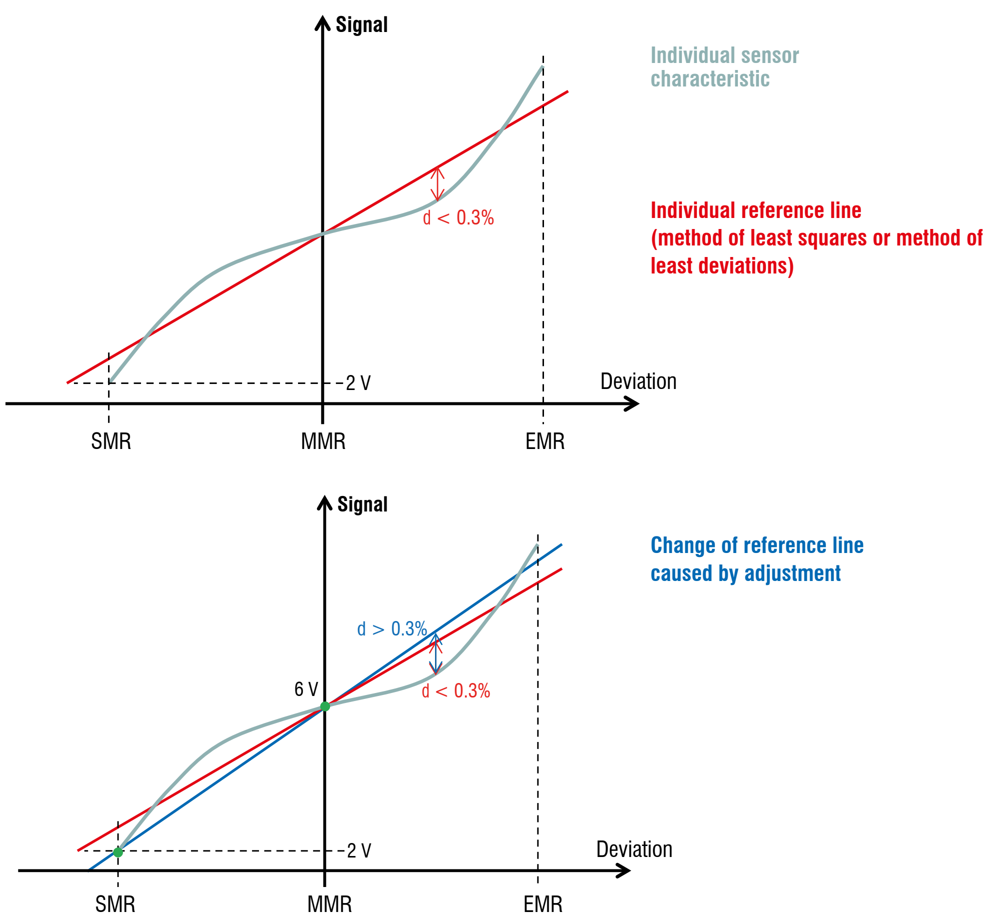
Technology and measuring principle
induSENSOR

Independent and absolute linearity of LVDT sensors

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

With the independent linearity, an individual linearity characteristic is determined for the recorded sensor signal of each sensor. It describes the deviation of the recorded sensor signal from the individually calculated reference line (red, see figure). The maximum deviation (d) must not exceed the values specified in the datasheet.

With the absolute linearity, a new straight line is laid through two fixed points during the adjustment which may cause the gradient of the reference line to change. Therefore, the recorded values of the sensor signal may deviate more from the new line (blue) than is the case with the independent linearity (see figure), and also exceed the values specified in the datasheet.



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