








# More Precision

**induSENSOR** // Linear inductive displacement sensors



# Displacement sensors with external controller indu**SENSOR** DTA (LVDT)

-  Proven LVDT technology
-  Measuring ranges  $\pm 1 \dots \pm 25$  mm
-  Extremely accurate also under difficult ambient conditions
-  Long-term stability
-  Robust design IP67

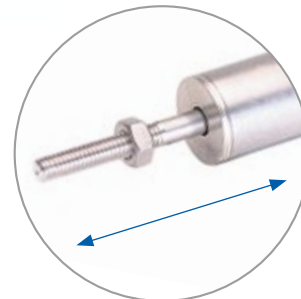


LVDT displacement sensors have a plunger which moves freely in the sensor housing. The plunger is joined to the object by a thread to transfer the movement of the measuring object. The measurement process in the sensor takes place without contact and is therefore wear-free.

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

The high sensor resolution is only limited by the noise of the sensor controller. Another advantage of the symmetric LVDT sensors is their zero point stability.

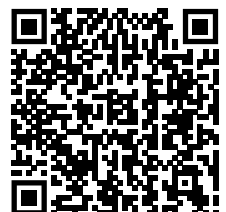
With appropriate setting possibilities for the excitation frequency and excitation voltage, the sensors can also be operated with alternative controllers.



Freely moving plunger

## Article designation

|   |   |     |     |    |      |
|---|---|-----|-----|----|------|
| DT  | A | -10 | -DX | -3 | -CA3 |
| Connection (axial): CA Integrated cable (3 m)   |   |     |     |    |      |
| Linearity: 4 ( $\pm 0.4\%$ ) 3 ( $\pm 0.3\%$ ) 2 ( $\pm 0.2\%$ ) 1.5 ( $\pm 0.15\%$ ) |   |     |     |    |      |
| Function: displacement sensor   |   |     |     |    |      |
| Measuring range in mm   |   |     |     |    |      |
| Excitation AC   |   |     |     |    |      |
| Principle: Differential Transformer (LVDT)  |   |     |     |    |      |



| Model                                | DTA-1DX  | DTA-3DX                          | DTA-5DX      | DTA-10DX     | DTA-15DX     | DTA-25DX      |
|--------------------------------------|--|----------------------------------|--------------|--------------|--------------|---------------|
| Measuring range                      | ±1 mm  | ±3 mm                            | ±5 mm        | ±10 mm       | ±15 mm       | ±25 mm        |
| Linearity <sup>[1]</sup>             | ≤ ±0.4 % FSO   | -                                | -            | -            | ≤ ±80 μm     | ≤ ±200 μm     |
|                                      | ≤ ±0.3 % FSO   | ≤ ±6 μm                          | ≤ ±18 μm     | ≤ ±30 μm     | -            | -             |
|                                      | ≤ ±0.2 % FSO   | -                                | -            | -            | ≤ ±40 μm     | ≤ ±60 μm      |
|                                      | ≤ ±0.15 % FSO  | ≤ ±3 μm                          | ≤ ±9 μm      | ≤ ±15 μm     | -            | -             |
|                                      | ≤ ±0.05 % FSO <sup>[2]</sup>   | ≤ ±1 μm                          | ≤ ±3 μm      | ≤ ±5 μm      | ≤ ±10 μm     | ≤ ±15 μm      |
| Temperature stability <sup>[3]</sup> | Zero   | ≤ 70 ppm FSO/K                   |              |              |              |               |
|                                      | Max. temp. error   | ≤ 150 ppm FSO/K                  |              |              |              |               |
| Sensitivity                          | 127 mV / mm/V  | 81 mV / mm/V                     | 55 mV / mm/V | 45 mV / mm/V | 45 mV / mm/V | 29 mV / mm/V  |
| Excitation frequency                 | 5 KHz  | 5 KHz                            | 5 KHz        | 2 KHz        | 1 KHz        | 1 KHz         |
| Excitation voltage                   | 550 mV   |                                  |              |              |              |               |
| Connection                           | integrated cable 3 m with open ends; axial cable outlet; drag chain suitable; cable diameter 3.1 mm; min. bending radii: fixed installation 25 mm, moved 38 mm, drag chain 47 mm |                                  |              |              |              |               |
| Temperature range                    | Storage  | -20 ... +70 °C                   |              |              |              |               |
|                                      | Operation <sup>[4]</sup> <sup>[5]</sup>  | (-40)...-20 ... +90 ... (105) °C |              |              |              |               |
| Pressure resistance                  | 5 bar (front)  |                                  |              |              |              |               |
| Shock (DIN EN 60068-2-27)            | 40 g / 6 ms in 3 axes, 1000 shocks each 100 g / 6 ms in 3 axes, 3 shocks each  |                                  |              |              |              |               |
| Vibration (DIN EN 60068-2-6)         | ±1.5 mm / 10 ... 58 Hz in 2 axes, 10 cycles each ± 20 g / 58 ... 500 Hz in 2 axes, 10 cycles each  |                                  |              |              |              |               |
| Protection class (DIN EN 60529)      | IP67   |                                  |              |              |              |               |
| Material                             | Stainless steel (housing), PVC-P/TPE-E (cable)   |                                  |              |              |              |               |
| Weight                               | Sensor CA  | approx. 80 g                     | approx. 85 g | approx. 90 g | approx. 95 g | approx. 135 g |
|                                      | Plunger  | approx. 1 g                      | approx. 2 g  | approx. 2 g  | approx. 3 g  | approx. 12 g  |
| Compatibility                        | MSC7401, MSC7802, MSC7602  |                                  |              |              |              |               |

<sup>[1]</sup> Independent linearity

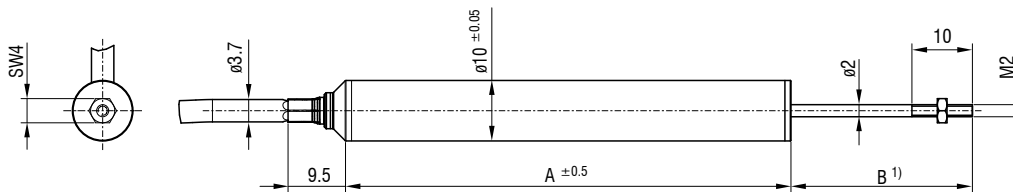
<sup>[2]</sup> Only valid with linearized controller (factory service can be added to the overall system), observe installation environment

<sup>[3]</sup> Determined using the box method (-20 ... +90 °C)

<sup>[4]</sup> -40 °C with cable at rest

<sup>[5]</sup> up to 105 °C over max. 500h

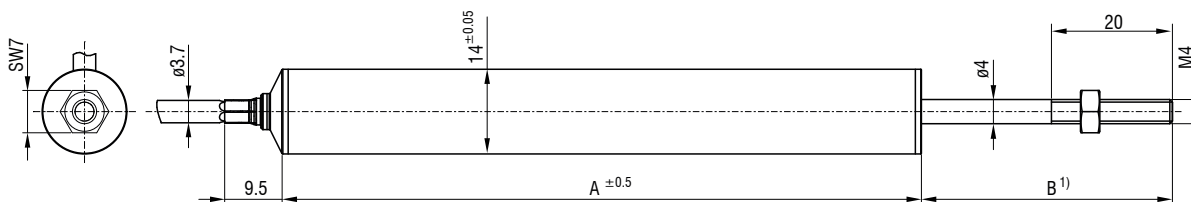
### Measuring ranges from ±1 to ±10 mm



| Model    | A       | B <sup>1)</sup> |
|----------|---------|-----------------|
| DTA-1DX  | 41.6 mm | 17.3 mm         |
| DTA-3DX  | 58.2 mm | 27.2 mm         |
| DTA-5DX  | 73.7 mm | 30.0 mm         |
| DTA-10DX | 87.7 mm | 35.1 mm         |

<sup>1)</sup> Plunger in zero position (±1mm ±10 % FSO)

### Measuring ranges from ±15 to ±25 mm



| Model    | A        | B <sup>1)</sup> |
|----------|----------|-----------------|
| DTA-15DX | 105.7 mm | 46.5 mm         |
| DTA-25DX | 140.7 mm | 61.5 mm         |

<sup>1)</sup> Plunger in zero position (±1mm ±10 % FSO)

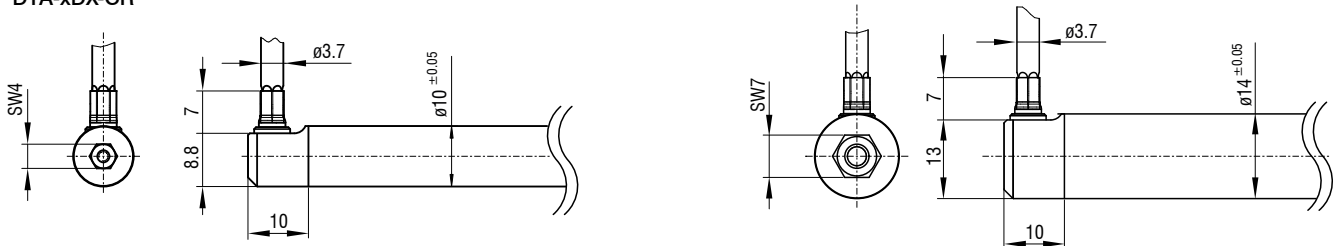
Dimensions in mm, not to scale

# Options, mounting options and accessories indu**SENSOR** DTA (LVDT)

Sensors with radial cable outlet (on request)



## DTA-xDX-CR



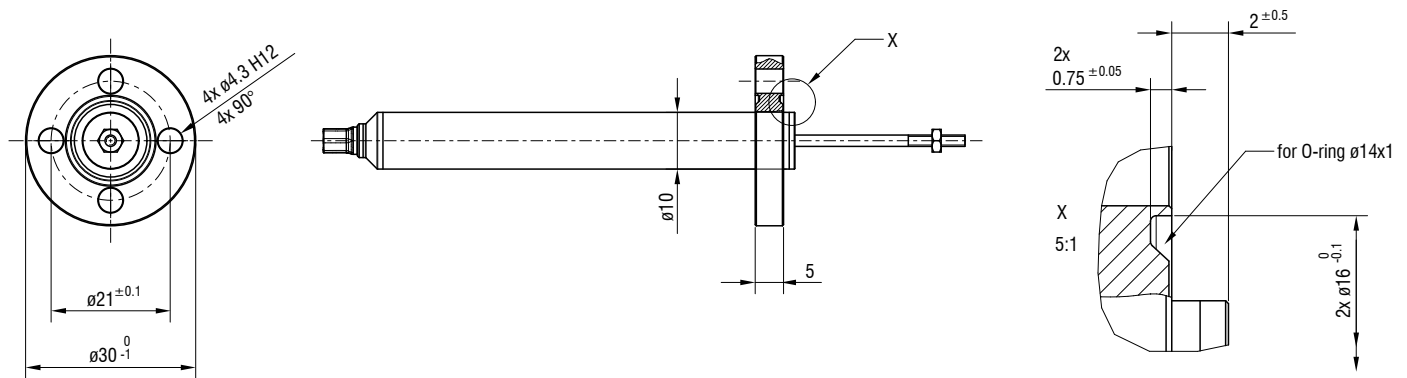
## Service: Assembly of mounting and pressure flange

2981031 Mounting pressure flange DTA-1DX, 3DX, 5DX, 10DX

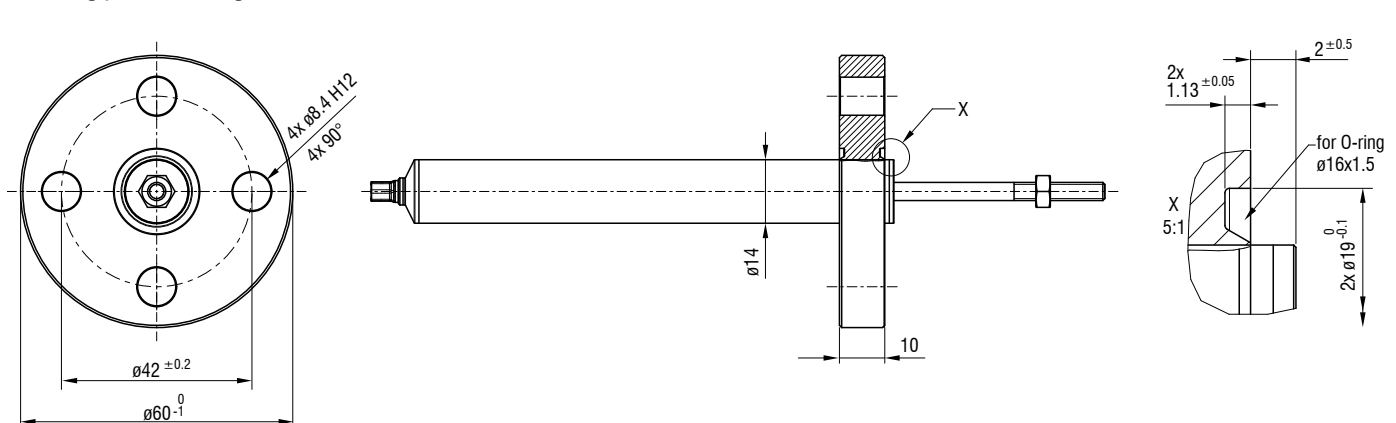
2981032 Mounting pressure flange DTA-15DX, 25DX



## Mounting pressure flange DTA-1DX, 3DX, 5DX, 10DX



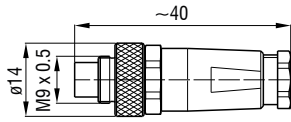
## Mounting pressure flange DTA-15DX, 25DX



**Service (see page 34/35)**

Connector assembly M9 and cable reduction XXXX mm - DTA-x

Connector assembly M9 - DTA-x



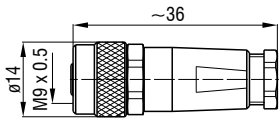
**Sensor Cable**

C701-3 Sensor cable, 3 m, with cable connector and tin-plated free ends

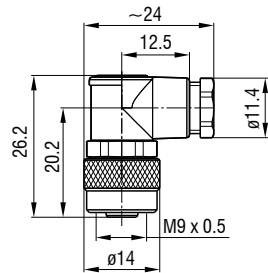
C701-6 Sensor cable, 6 m, with cable connector and tin-plated free ends

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

**Cable socket C701**



**Angle socket C701/90**



**Spare plungers**

Plunger for DTA-1DX Spare plunger Plunger for DTA-10DX Spare plunger

Plunger for DTA-3DX Spare plunger Plunger for DTA-15DX Spare plunger

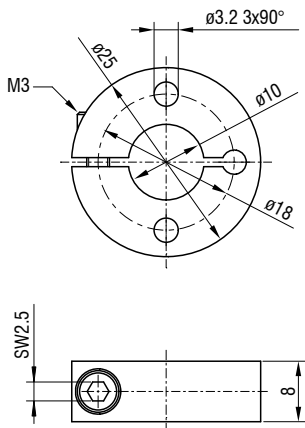
Plunger for DTA-5DX Spare plunger Plunger for DTA-25DX Spare plunger

**Sensor Mounting**

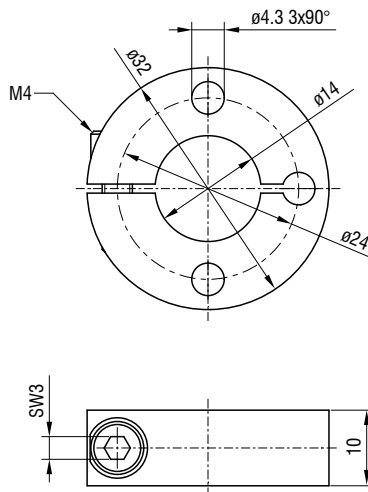
0483090.01 DTA-F10 Mounting flange, slotted for DTA-1DX, DTA-3DX, DTA-5DX, DTA-10DX

04833082 DTA-F14 Mounting flange, slotted for DTA-15DX, DTA-25DX

**Flange DTA-F10**



**Flange DTA-F14**



# 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

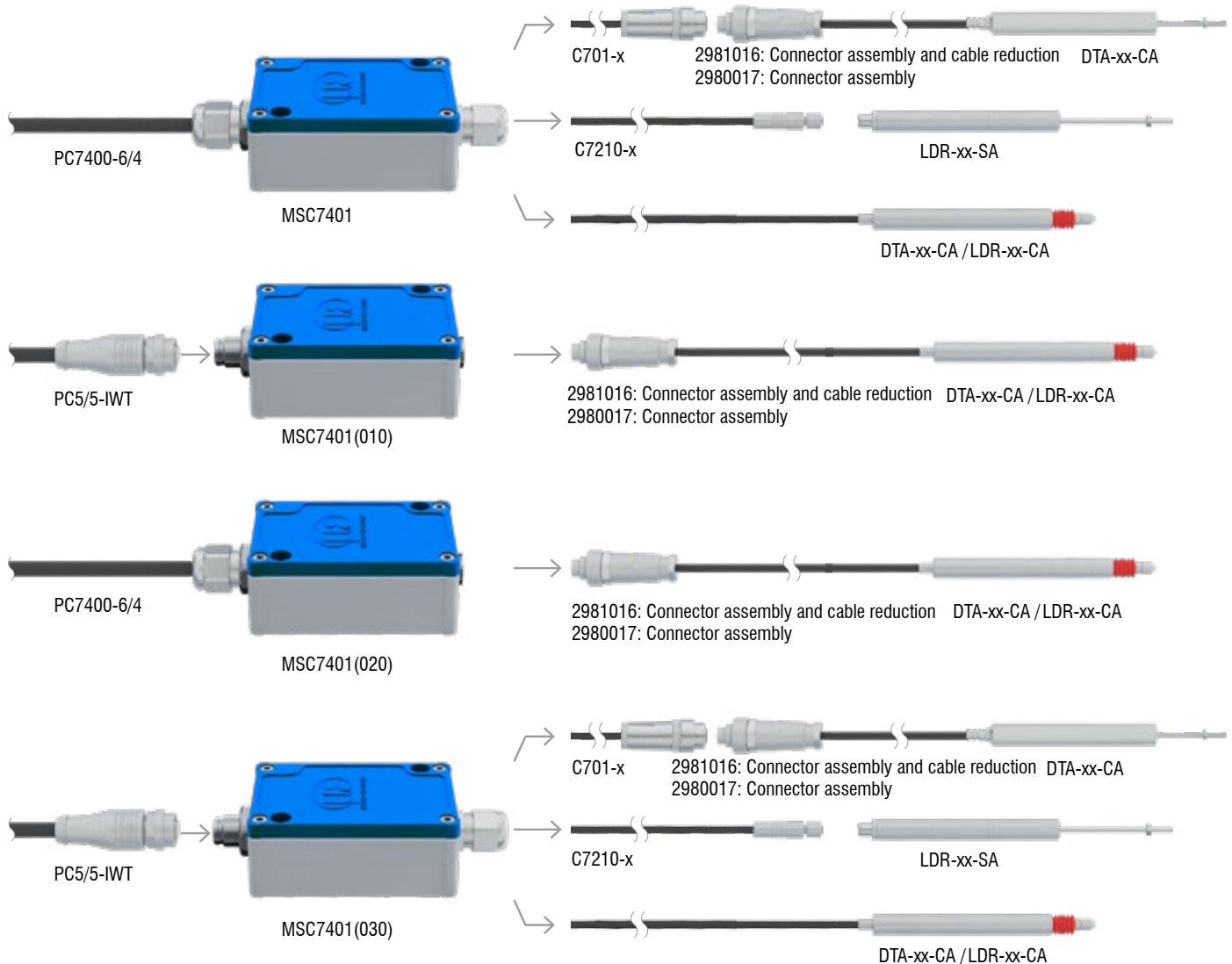
#### Interface modules

|                 |  |
|-----------------|--|
| 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) |

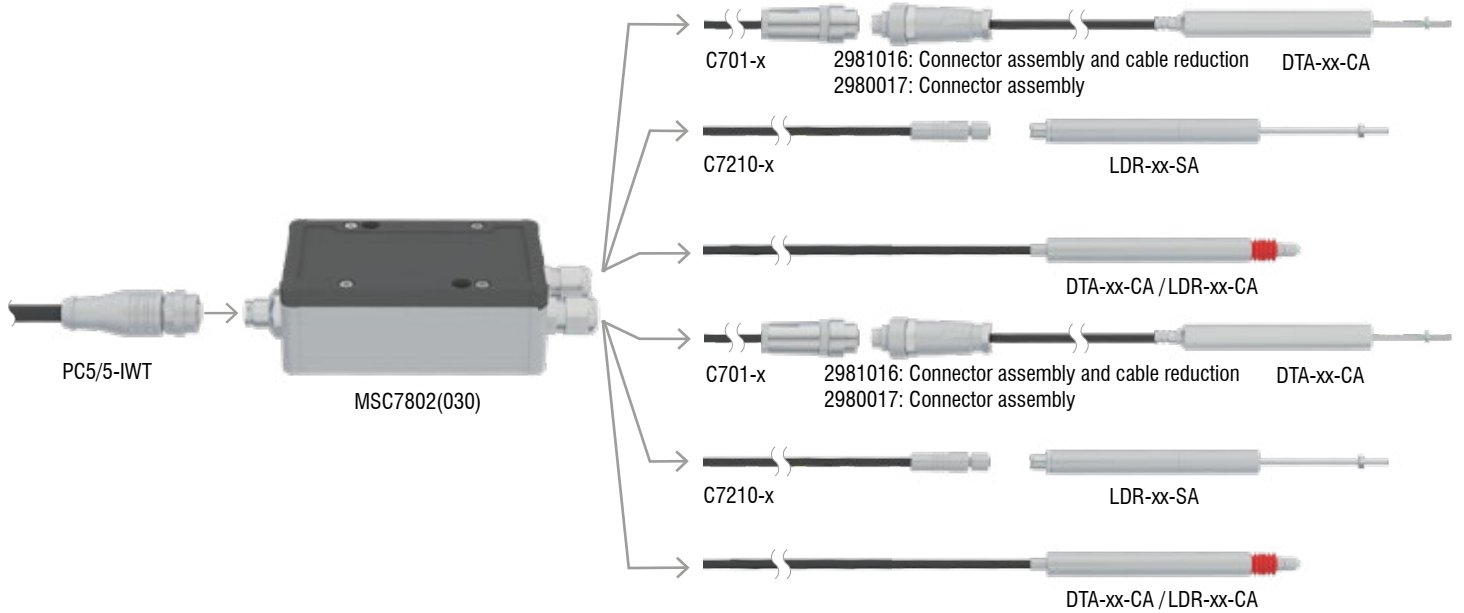
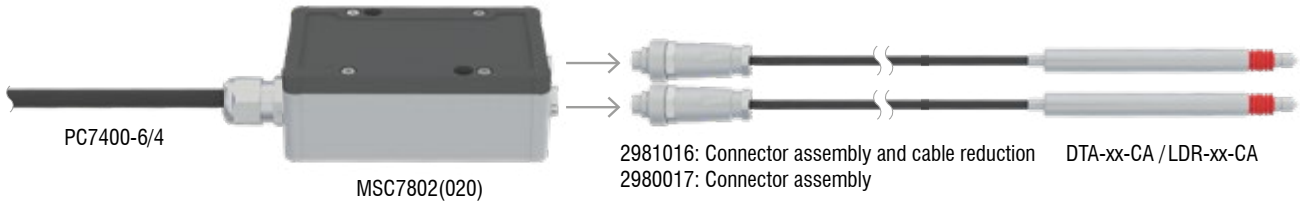
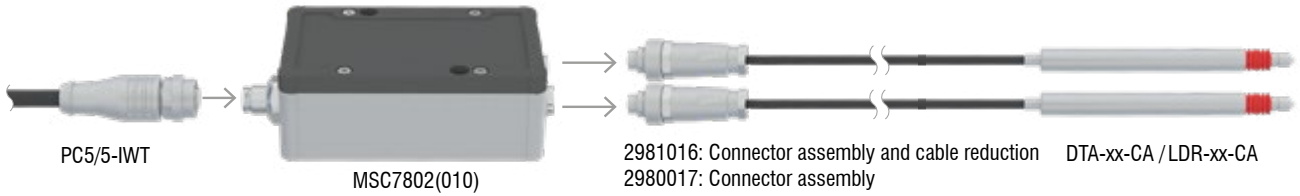
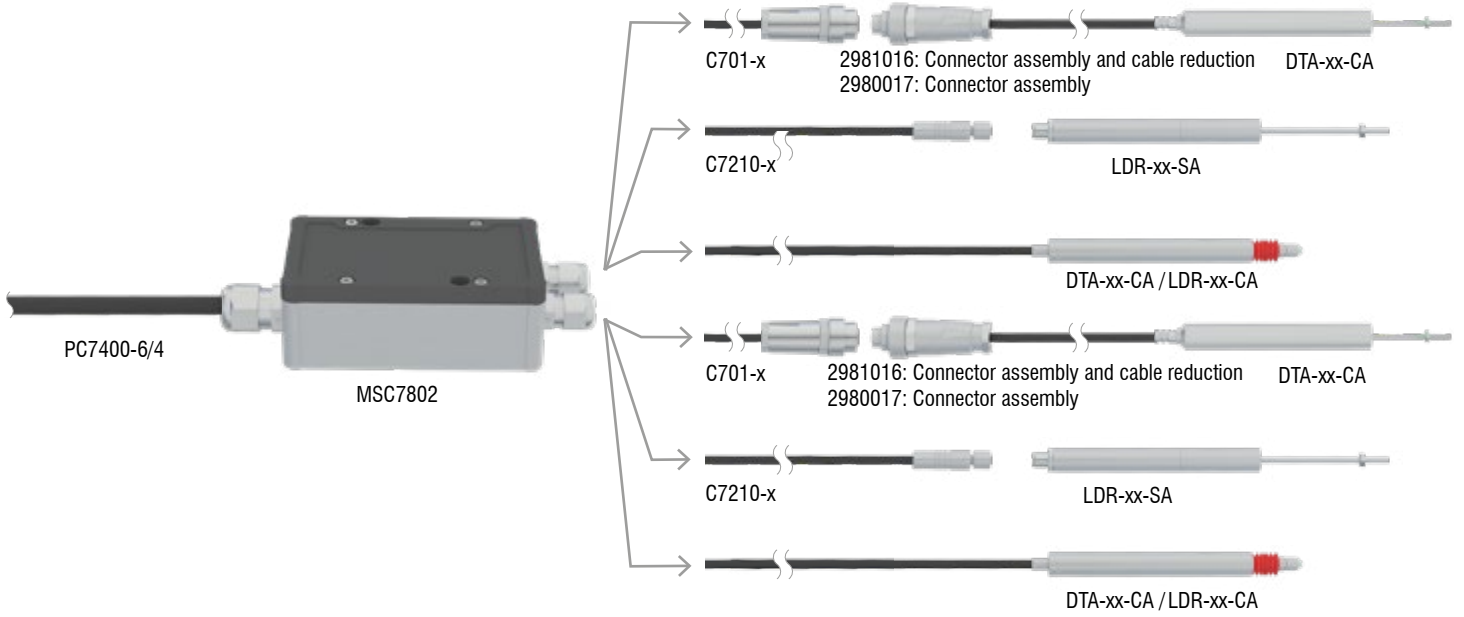
#### Power supply units

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

### Connection options MSC7401



Connection options MSC7802



# Technology and measuring principle

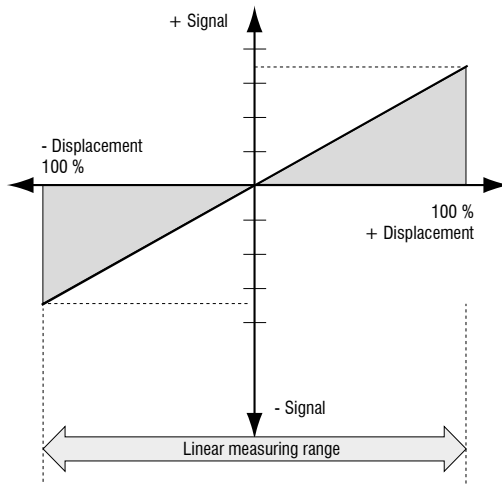
## induSENSOR

### LVDT Gauges and LVDT displacement sensors (DTA series)

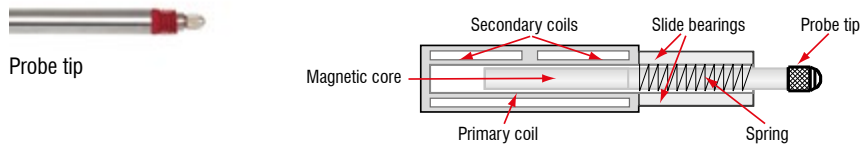
LVDT displacement sensors and gauges (Linear Variable Differential Transformer) are constructed with a primary and two secondary coils, which are arranged symmetrically to the primary winding. As a measuring object, a rod shaped soft-magnetic core can be moved within the differential transformer. An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

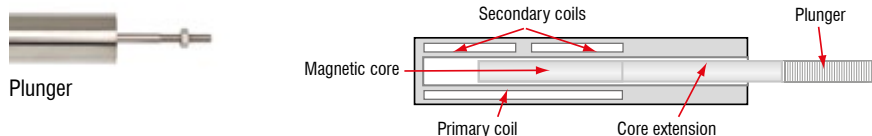
Signal LVDT sensor



Measuring principle gauging sensor



Measuring principle displacement sensor



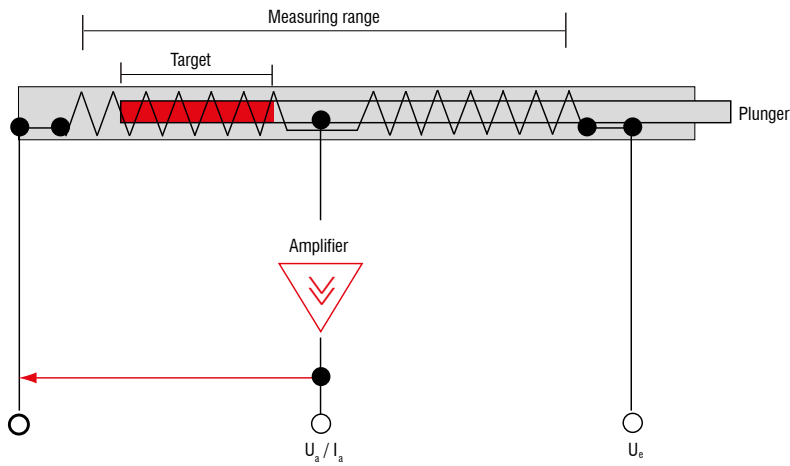


### LDR Displacement sensors

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

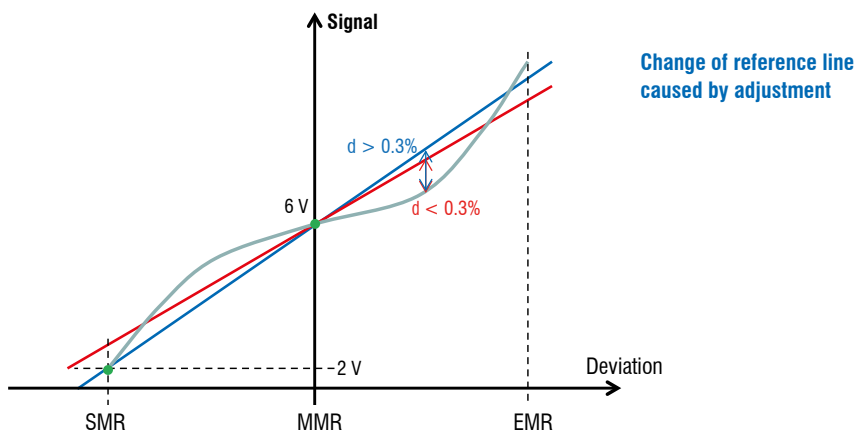
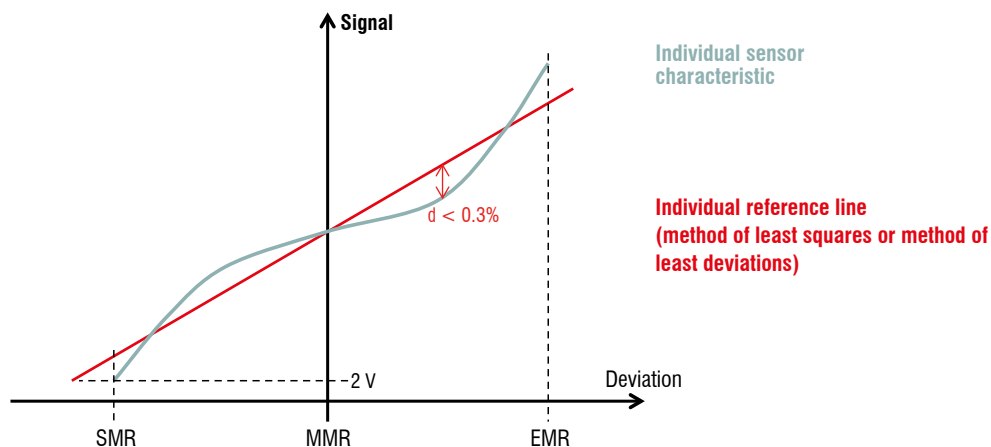
## induSENSOR

### 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.



## Sensors and Systems from Micro-Epsilon



Sensors and systems for displacement, distance and position



Sensors and measurement devices for non-contact temperature measurement



Measuring and inspection systems for metal strips, plastics and rubber



Optical micrometers and fiber optics, measuring and test amplifiers



Color recognition sensors, LED analyzers and inline color spectrometers



3D measurement technology for dimensional testing and surface inspection