Inductive Displacement Measuring - Robust and versatile

Inductive systems are ideally suited for measuring displacement in a flexible and robust manner. They feature virtually infinite resolution, high reliability and extremely long life due to the contactless measuring principle. Rugged inductive systems are the number one candidate for applications under high vibrations loads, extreme accelerations, shock loads and oscillating motions. They are designed for low non-linearity and high temperature stability.

Today, inductive displacement systems are more than a set-of-coils-in-a-box. Custom design allows to meet almost any mechanical needs. Spring-loaded displacement transducers, high-pressure versions for cylinder integration are as common as integrated electronics for conditioning the transducer’s sensor signal.

Based on 30-years experience MESSOTRON can provide a comprehensive range of standard transducers, sping-loaded and high-pressure types, integrated or separate signal conditioners and custom-designed transducers. MESSOTRON is able to respond to customer needs in a prompt and flexible manner.

Displacement / Position Sensors

Inductive displacement measurement can be achieved through three different working principles. MESSOTRON supplies transducers of all three kinds. Common to all is that inductive transducers are passive sensors operated through signal conditioners/amplifiers. An AC signal supplies a set of static windings inside the transducer. A moving ferro-magnetic part couples the excitation signal into the windings proportionally to its position. The differential signal of the two windings is picked up and converted by suitable electronics to a DC (voltage or current) measuring signal that can be conveniently used.

Linear Differential Inductance Transducer (Half-bridge)

\[ \begin{align*} \text{The transducer is based on the Wheatstone (half-) bridge. Two coils are connected in series. A ferro-magnetic core is the moving part. At electrical zero, coupling into both windings is symmetric and the resulting differential signal is zero. Off this zero position, towards the end positions of the mechanical core stroke, the coupling into the two windings becomes asymmetric, with the differential signal corresponding to the core position.} \end{align*} \]

Linear Variable Differential Transformer (LVDT)

\[ \begin{align*} \text{An AC fed primary winding is coupled to the set of two secondary coils like a transformer. With the movement of the ferro-magnetic core, the coupling into the (counter-wound) secondary coils and thus signal amplitude and polarity vary proportionally to the core position. With symmetric coupling (at zero position) the differential signal is zero, off this point the measuring signal corresponds to the core position.} \end{align*} \]

(Long-stroke) Sensor with sleeved core (eddy-current based)

\[ \begin{align*} \text{Eddy-current based transducers contain two active coil-type components in differential circuitry. The field generated by one coil is modulated by the sleeved core depending on its position. Thus, the core displacement generates a resulting differential signal proportional to the core position.} \end{align*} \]
Signal conditioning (measuring amplifiers)

Inductive displacement transducers are passive sensors operated by signal conditioners/amplifiers. Those supply the AC excitation voltage of typically 5 or 10 kHz to the transducer and convert its (in amplitude and polarity varying) output signal from AC to a displacement-proportional high level DC (voltage or current), typically 0...10 V or 4...20 mA.

MESSOTRON signal conditioners feature extreme robustness, high reliability and suitability for harsh environment. They are available in plug-in Eurocard, rail-mount, field case, desktop, 19"-rack or transducer integrated, line powered or DC operated.

MESSOTRON amplifiers supplied together with a transducer are pre-calibrated to the specified transducer type thus facilitating the installation of the displacement measurement system.

Selection guide

Differential reluctance transducers are the most simple and economic way. They allow to improve linearity in an economic way. MESSOTRON transducers generally feature a low temperature drift, in particular the differential inductance (LVIT) type with maximum 20 ppm/K zero drift and 50 ppm/K sensitivity drift. Their precision makes them first choice when high accuracy measurement is needed, at moderate body length (MESSOTRON series WLH, WLG, WV).

Differential transformers (LVDT) provide a smaller ‘body-to-stroke-length ratio’ than LVITs at slightly more complex construction (MESSOTRON series DK, DU). They also feature lower susceptibility to external distortion and temperature gradients and are ideally suited for water-tight versions (MESSOTRON series DWO, DWN) and high-pressure applications (MESSOTRON series DPO, DPU, DPN, DPL).

Our sleeved core transducers (based on Eddy-current principle) contain a miniature equivalent circuitry in place of a second coil. These transducers are of relatively complex design but feature the smallest ‘body-to-stroke-length ratio’, important for measuring long strokes (MESSOTRON series WP). They are conceived for easy design-into-cylinders.

Pressure -resistant sensors

MESSOTRON’s comprehensive product range of pressure resistant transducers are primarily targeting the in-cylinder sector. Measuring strokes of up to 1000 mm and up to 450 bar operating pressure are primary characteristics. The transducers High temperature versions for up to 120°C is possible. Various mechanical interfaces (flange or threaded) are available (MESSOTRON series DPO, DPU, DPN, DGO, DGB).

Other high-pressure types are specifically designed for valve and mill applications (MESSOTRON series DF).

Sleeved core transducers (based on Eddy-current principle) feature easy mounting (MESSOTRON series WP) and smallest body-to-stroke ratio.

Sensors with integrated signal conditioner (DC-DC sensors)

Evolving miniaturisation in electronics allows to integrate the conditioning electronics in the transducer. These space-saving and economic DC-DC integrated systems are ±15 V or +24 V DC supplied and feature direct DC output signals of standard ±10 V or 4 ... 20 mA.

MESSOTRON offers a range of pressure resistant transducers with integrated conditioning electronics that allow to replace AC-AC transducers without major re-design if the integrated approach is preferable.