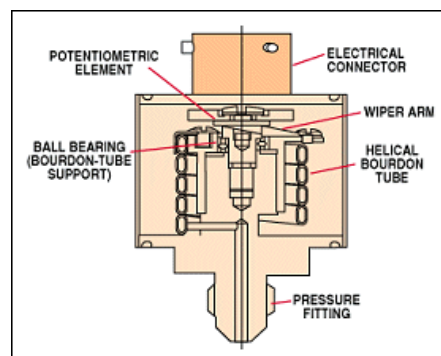


Sensor Technologies

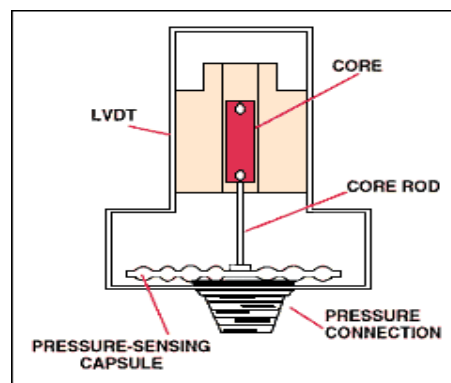
Potentiometric pressure sensor

Potentiometric pressure sensors use a Bourdon tube, capsule, or bellows to drive a wiper arm on a resistive element. For reliable operation the wiper must bear on the element with some force, which leads to repeatability and hysteresis errors. These devices are very low cost, however, and are used in low-performance applications such as dashboard oil pressure gauges. An example is shown here.



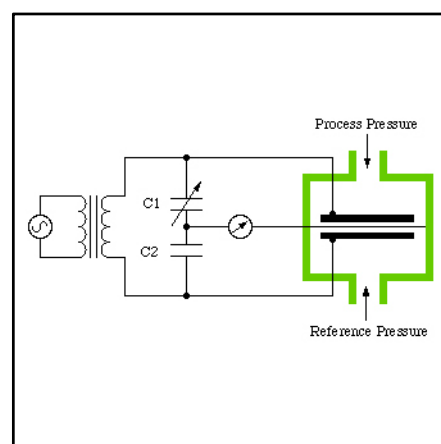
Inductive pressure sensor

Several configurations based on varying inductance or inductive coupling are used in pressure sensors. They all require AC excitation of the coil(s) and, if a DC output is desired, subsequent demodulation and filtering. The linear variable differential transformer (LVDT) types have a fairly low frequency response due to the necessity of driving the moving core of the differential transformer. The LVDT uses the moving core to vary the inductive coupling between the transformer primary and secondary



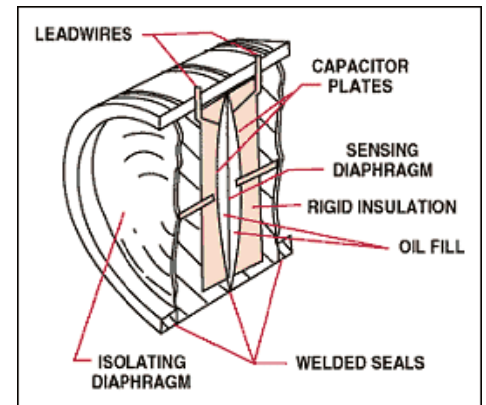
Capacitive pressure sensor

Capacitive pressure sensors typically use a thin diaphragm as one plate of a capacitor. Applied pressure causes the diaphragm to deflect and the capacitance to change. This change may or may not be linear and is typically on the order of several picofarads out of a total capacitance of 50-100 pF. The change in capacitance may be used to control the frequency of an oscillator or to vary the coupling of an AC signal through a network. The electronics for signal conditioning should be located close to the sensing element to prevent errors due to stray capacitance.



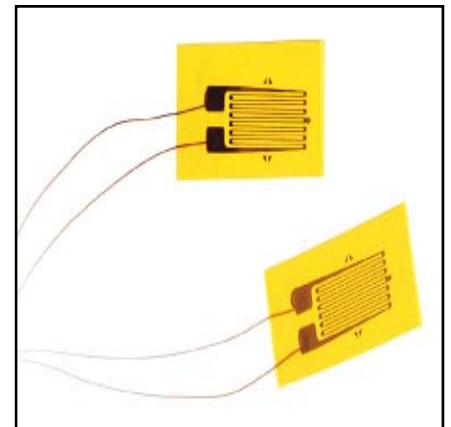
Piezoelectric pressure sensor

Piezoelectric elements are bi-directional transducers capable of converting stress into an electric potential and vice versa. They consist of metallized quartz or ceramic materials. One important factor to remember is that this is a dynamic effect, providing an output only when the input is changing. This means that these sensors can be used only for varying pressures. The piezoelectric element has a high-impedance output and care must be taken to avoid loading the output by the interface electronics.



Strain Gauge pressure sensor

Strain gauge sensors originally used a metal diaphragm with strain gauges bonded to it. A strain gauge measures the strain in a material subjected to applied stress. Metallic strain gauges depend only on dimensional changes to produce a change in resistance. Semiconductor strain gauges are widely used, both bonded and integrated into a silicon diaphragm, because the response to applied stress is an order of magnitude larger than for a metallic strain gauge. When the crystal lattice structure of silicon is deformed by applied stress, the resistance changes. This is called the piezoresistive effect.



Piezoresistive pressure sensor

In piezoresistive sensors, an applied pressure to a diaphragm changes the resistance by mechanically deforming the sensor, enabling the resistors in a bridge circuit to detect pressure as a proportional differential voltage across the bridge. Conventional resistive pressure measurement devices include thick-film resistors, strain gauges, metal alloys, and polycrystalline semiconductors. Typically on a piezoresistive sensor a wheatstone bridge will be used to measure an unknown electrical resistance by balancing two legs of a bridge circuit, one leg of which includes the unknown component.

