



## PRESSURE SOLUTIONS

### P402: Pressure Sensors

The pressure sensor is the bit that converts pressure into electricity. There are several technologies available. This discussion covers the various types, with their strengths and weaknesses.

#### **Silicon:**

Silicon sensors are piezo-resistive, this means that the resistance of a silicon crystal changes when pressure is applied. Silicon is easily poisoned, and intended for clean non-corrosive applications. In practice, it is usually used with a metal diaphragm seal and oil fill to protect the sensor. Silicon gives very good accuracy, and is ideal for sanitary applications, because the process connection can be all-welded. They are fairly low cost, and make a good general purpose sensor.

#### **Ceramic:**

Ceramic sensors usually use aluminium oxide, which is the hardest known material next to diamond. Ceramic sensors are mounted using an O-Ring. They don't like thermal or mechanical shock very much. They are very good for low pressures, and have good temperature stability. They are good for vacuum, for oxygen service, and for abrasive applications, but have a limited maximum pressure. The ceramic diaphragm is very corrosion resistant, but care may be needed in selecting a suitable O-Ring material. This design is not good for sanitary applications.

#### **Strain Gauge:**

Semiconductor strain gauges can be sputtered onto the back of a stainless steel or similar rigid diaphragm. This technology is very robust, and good for high vibration environments, as well as very high pressure applications.

#### **Silicon-on-Sapphire (SOS):**

Silicon strain gauges are grown on a sapphire crystal. This technology is very robust, and very repeatable, with excellent temperature characteristics and capability.

#### **Differential Capacitive:**

This well known technology is extensively used in dP cells, and uses capacitance sensing of the displacement of a central diaphragm. It is bulky and expensive, but can withstand high overpressure.

Looking at some specific desired characteristics-

Temperature Stability:	Best is Ceramic or differential capacitive.
Low Temperatures:	Best is SOS, watch silicon.
High Temperatures:	Best is SOS, watch most other technologies
Low Pressure:	Best is Ceramic or differential. Watch SOS and Strain gauge.
Vacuum:	Best is Ceramic or differential. Watch SOS and Strain gauge.
Absolute Pressure:	Best is silicon.
Vibration:	Best is SOS or strain gauge, watch ceramic.

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