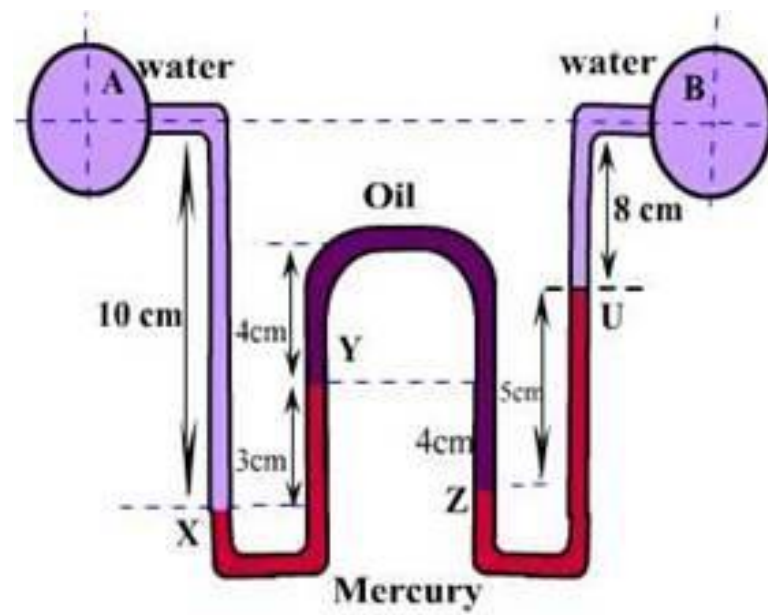


IoT 4211: Sensor Technology

Pressure Measurement

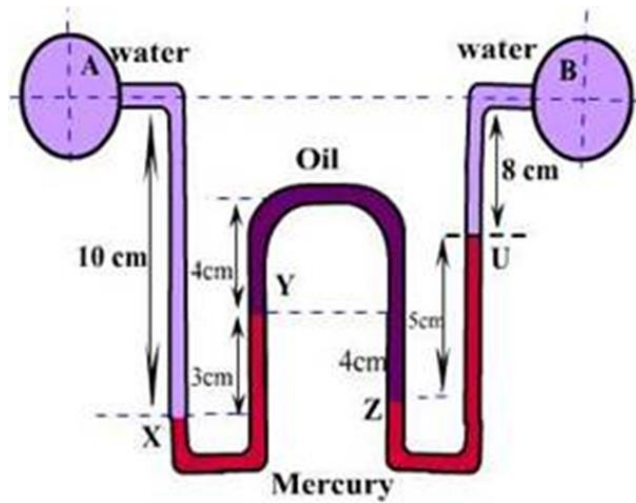


i



i

mr



$$\text{Now, } P_X = P_A + 10\rho_w g$$

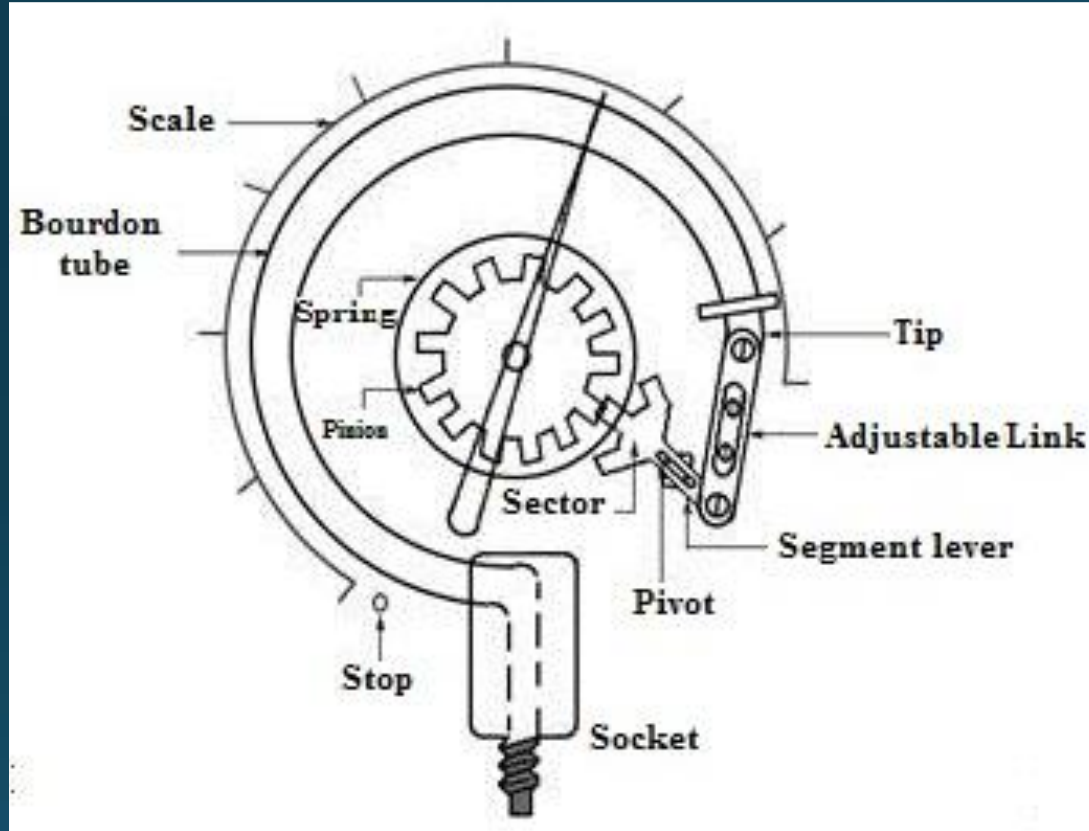
$$\text{Similarly, } P_Y = P_X - 3 \times 13.6\rho_w g$$

$$P_Z = P_Y + 4 \times 0.88\rho_w g$$

$$P_U = P_Z - 5 \times 13.6\rho_w g$$

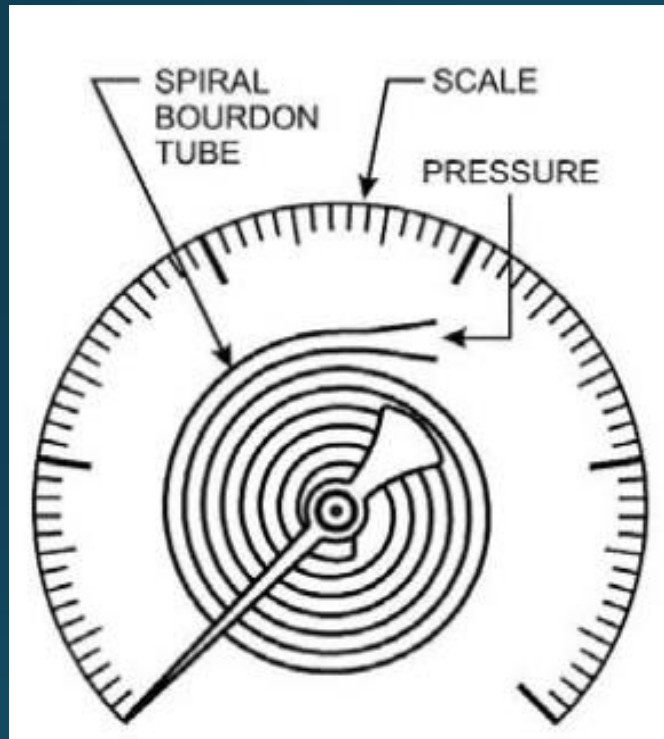
$$P_B = P_U - 8\rho_w g$$

Bourdon Tube Pressure Gauge

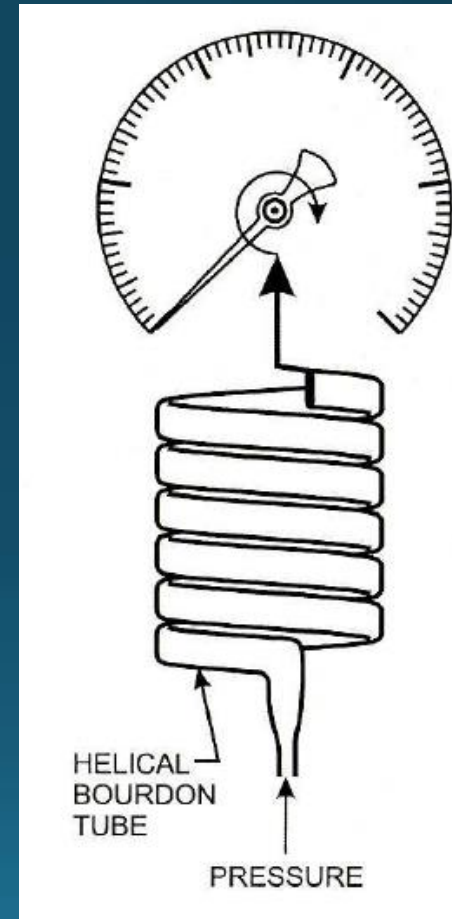


- The **bourdon tube** is a flattened thin bended metallic tube, which tries to be straightened out and returns to cylindrical form when exposed to internal or external pressure.
- Bourdon tube is connected to the dial using link, lever, teathed sector, pinion and spring.
- In a **liquid-filled gauge**, the **fluid fill** effectively dampens system pulsation, making the **gauge pointer** easier to read.

Bourdon Tube Pressure Gauge



Spiral Bourdon Tube
Gauge



Helical Bourdon Tube
Gauge

~~Source Tune Pressure~~ auge

The background of the image is an abstract composition. It features large, flowing, organic shapes in two shades of blue: a deep navy blue and a lighter, muted blue. These shapes overlap and interlock, creating a sense of movement and depth. Overlaid on these colored areas are numerous thin, black, curved lines that sweep across the frame in various directions, some forming loops and others extending towards the edges. The overall effect is a complex, layered visual texture.

Bourdon Tube Pressure Gauge

HOW IT'S MADE



"PRESSURE
GAUGES"

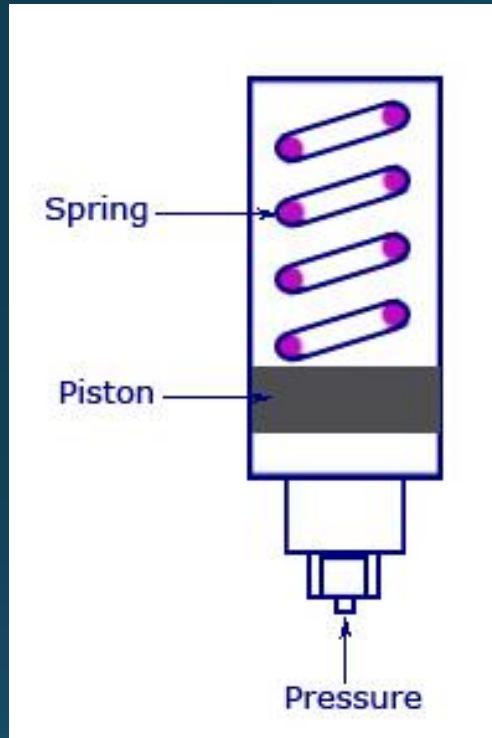
Length: 4 mins 40 secs

Starts at: 10;00;00;00

Audio 1 & 2 : English stereo mix

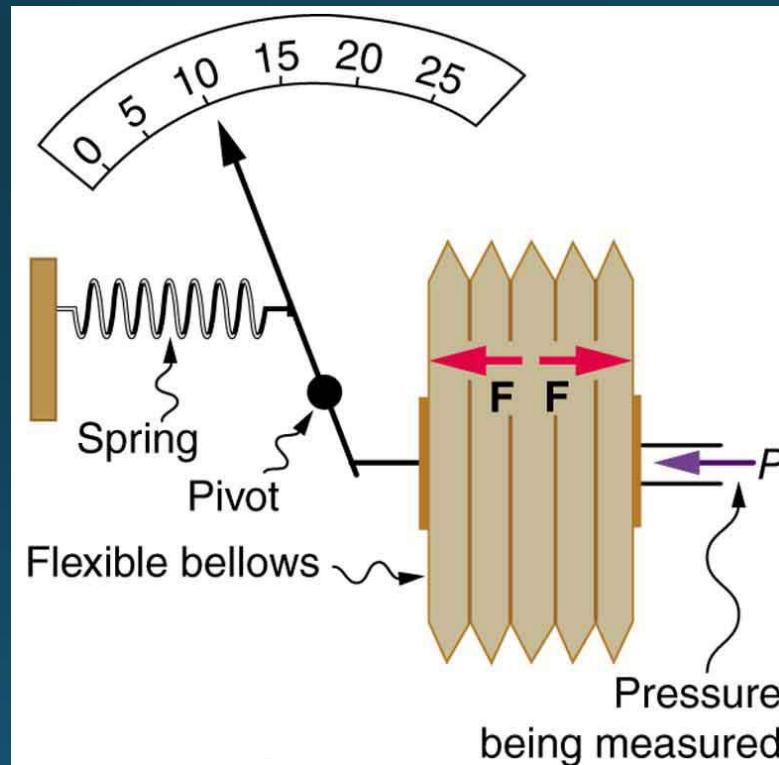
Ratio: 16:9 Letterbox

Spring and Piston Type Pressure Gauge



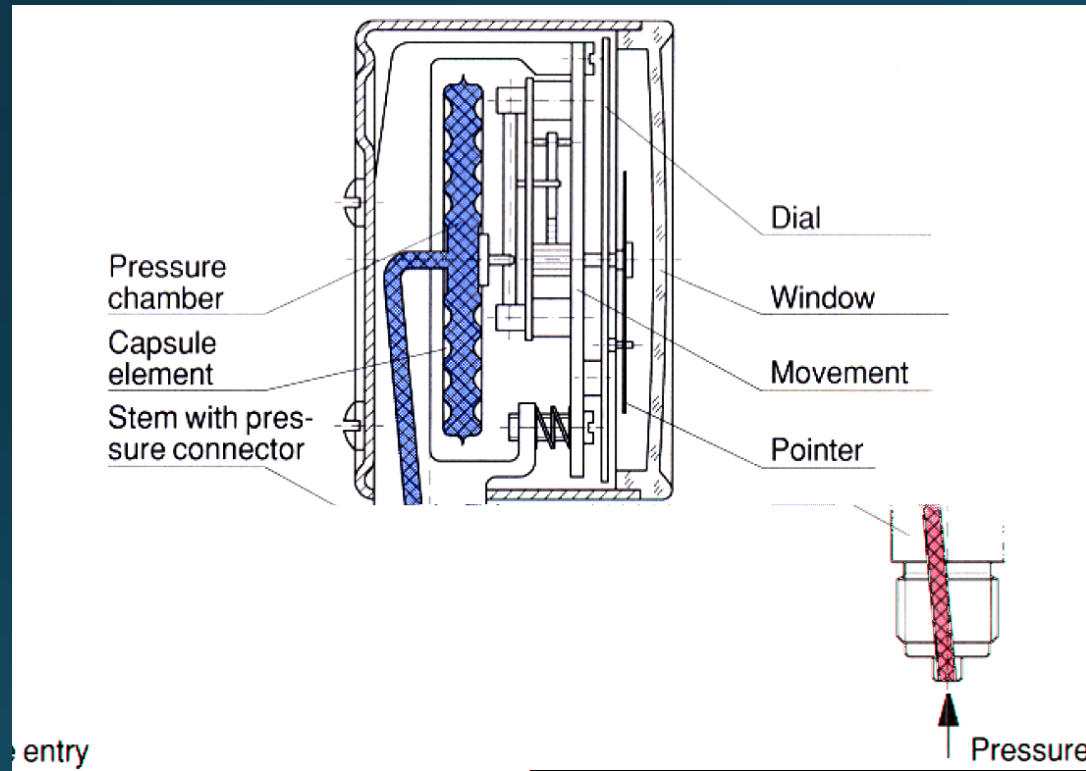
- Piston moves to due applied pressure.
- Dial is connected to piston and spring.
- Dial returns to the initial position due to spring action.

Bellows



- A **bellows** is an expandable element made up of series of folds.
- When internal pressure is applied to the bellows, it expands.
- The dial is connected to bellows and spring. It rotates due to the expansion of the bellows and returns to the initial position due to spring action, when pressure is released from bellows.

Capsule Type Pressure Gauge



- The capsule element comprises two circular-shaped, corrugated membranes sealed tight around their circumference.
- The pressure acts on the inside of this capsule and the generated stroke movement is shown by a pointer as measurement of pressure.
- Especially suitable for gaseous media and relatively low pressures.
- Pressure ranges are between 0 ~ 2.5 mbar and 0 ~ 0.6 bar in the accuracy class 0.1 to 2.5.

Mechanical Linkage

A **mechanical linkage** in the context of capsule pressure gauges refers to the system of connected components (such as levers, arms, and rods) that transfer and amplify the small linear movement of the capsule into a form that can be translated by the gear mechanism.

a breakdown of how a mechanical linkage functions in this system:

1.Linear Motion Capture: When pressure is applied inside the capsule, it expands or contracts, creating a small linear movement.

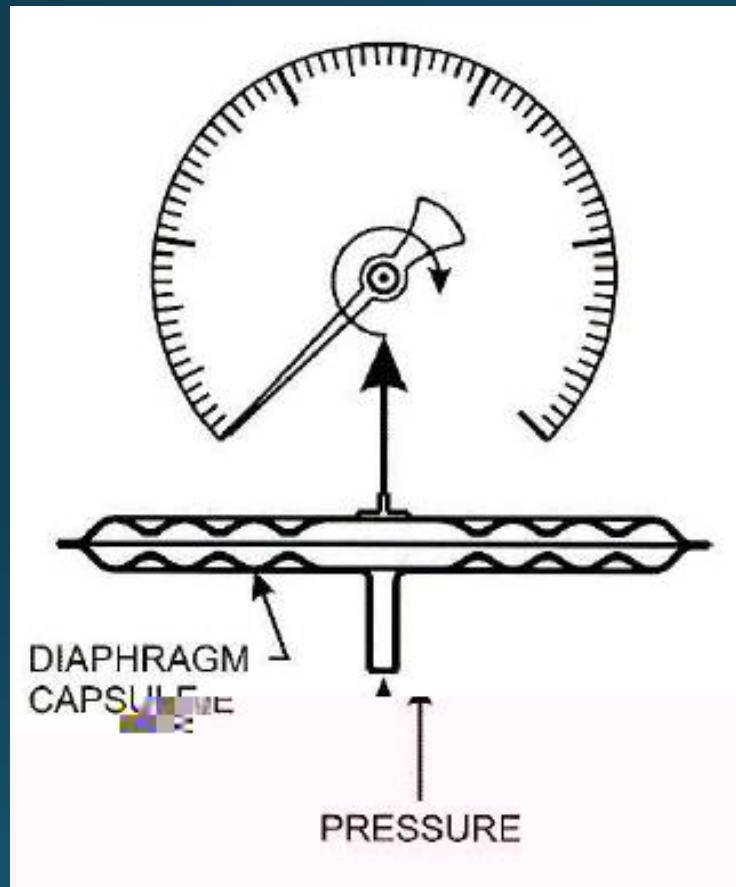
2.Linkage Transfer: This movement is then transferred to the linkage system, often made up of levers or arms that amplify or translate the motion. The linkage can adjust the range and direction of the movement to ensure efficient transmission.

3.Transmission to Gear: The end of the linkage system is connected to a gear mechanism (like a rack and pinion), which converts the linear movement into rotational motion.

4.Pointer Movement: The rotational motion, amplified by the gear mechanism, moves the pointer across the dial for an accurate pressure reading.

In essence, the mechanical linkage acts as a bridge that connects the small expansion of the capsule to the gear system, making it possible for a small change in pressure to result in a noticeable movement of the gauge's pointer.

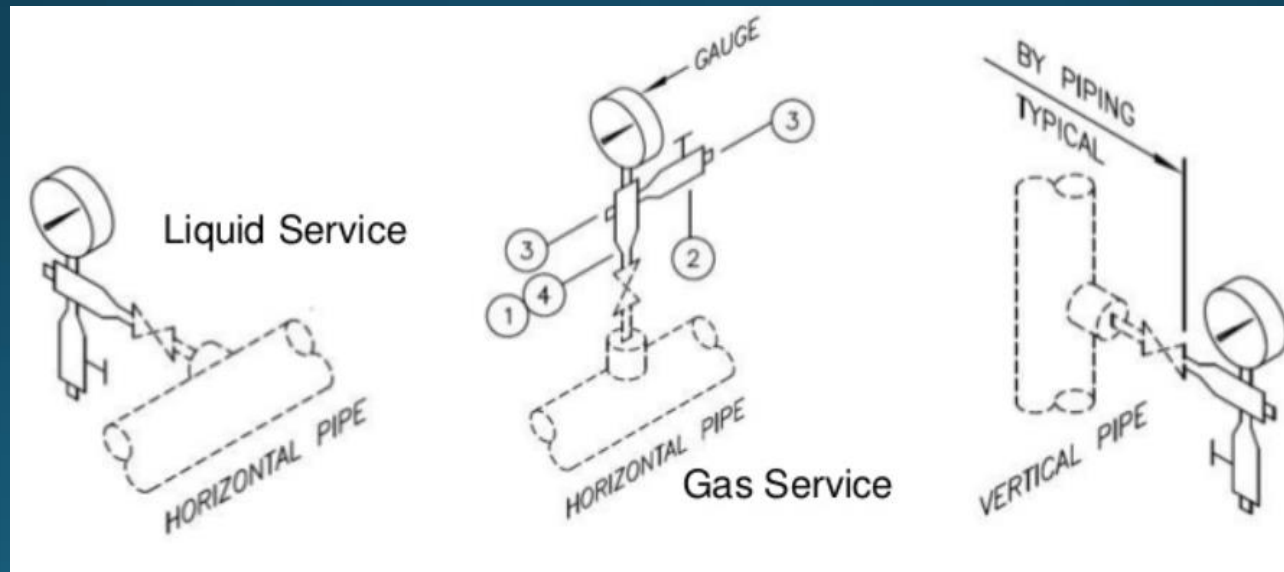
Diaphragm Pressure Gauge



These are similar in principle to the capsule but the diaphragm is usually very thin and perhaps made of rubber. The diaphragm expands when very small pressures are applied. The movement is transmitted to a pointer on a dial through a fine mechanical linkage.

Pressure Gauge Installation

- Top connection preferred for gas installations & side connection preferred for liquid installations.
- The pressure gauge can be connected to the pipe by individual block and bleed valves or a two way manifold.



Pressure Gauge Selection

- Accuracy required
- Dial size
- Operating pressure range
- Chemical compatibility with gauge construction materials
- Operating temperature range
- Vibration, pulsation, and shock
- Pressure fluid composition
- Mounting requirement

Pressure Transducers

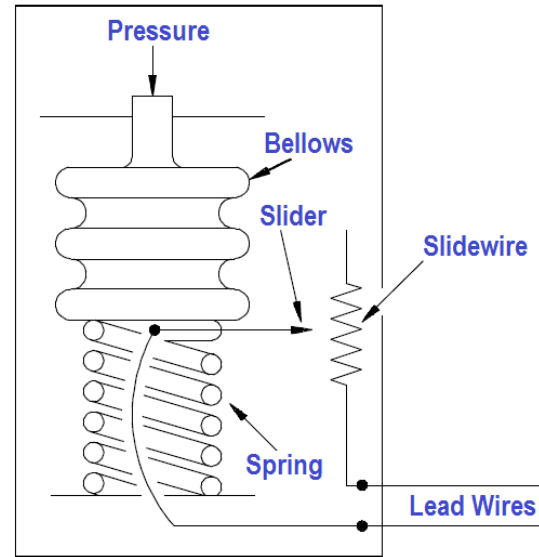
Displacements produced by force summing devices are converted to outputs of electrical format.

Types:

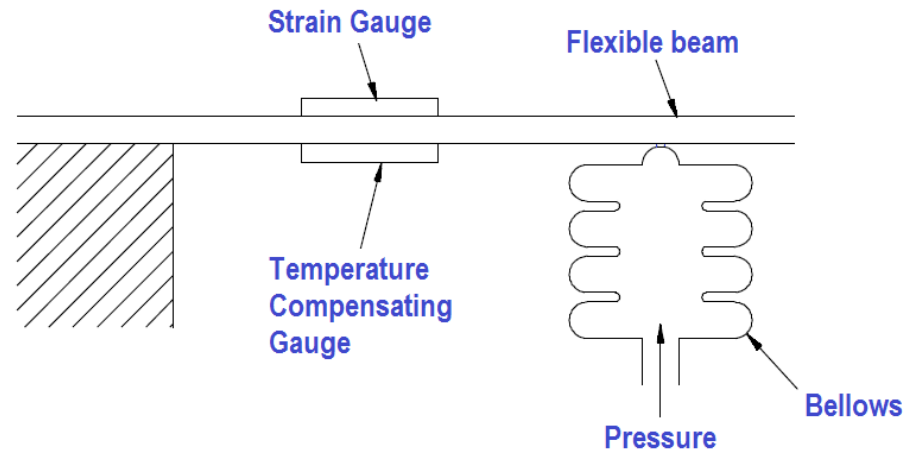
1. Resistive Transducers
2. Inductive Transducers
3. Capacitive Transducers
4. Photoelectric Transducers
5. Piezoelectric Transducers

Resistive Pressure Transducers

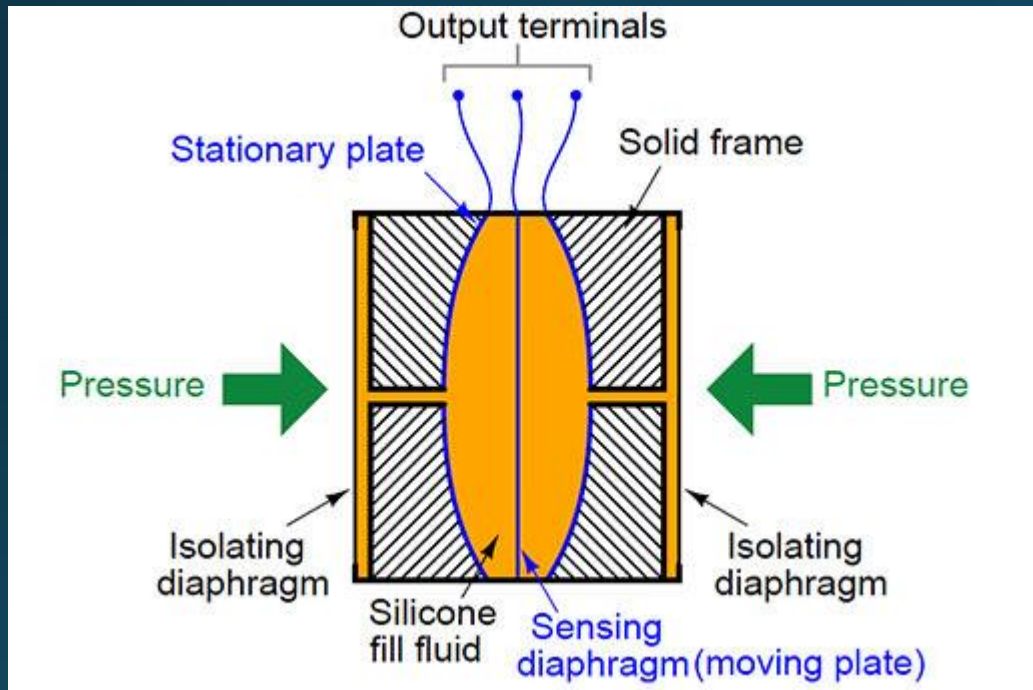
Bellows Resistance Transducer



Strain Gauge Pressure Transducer

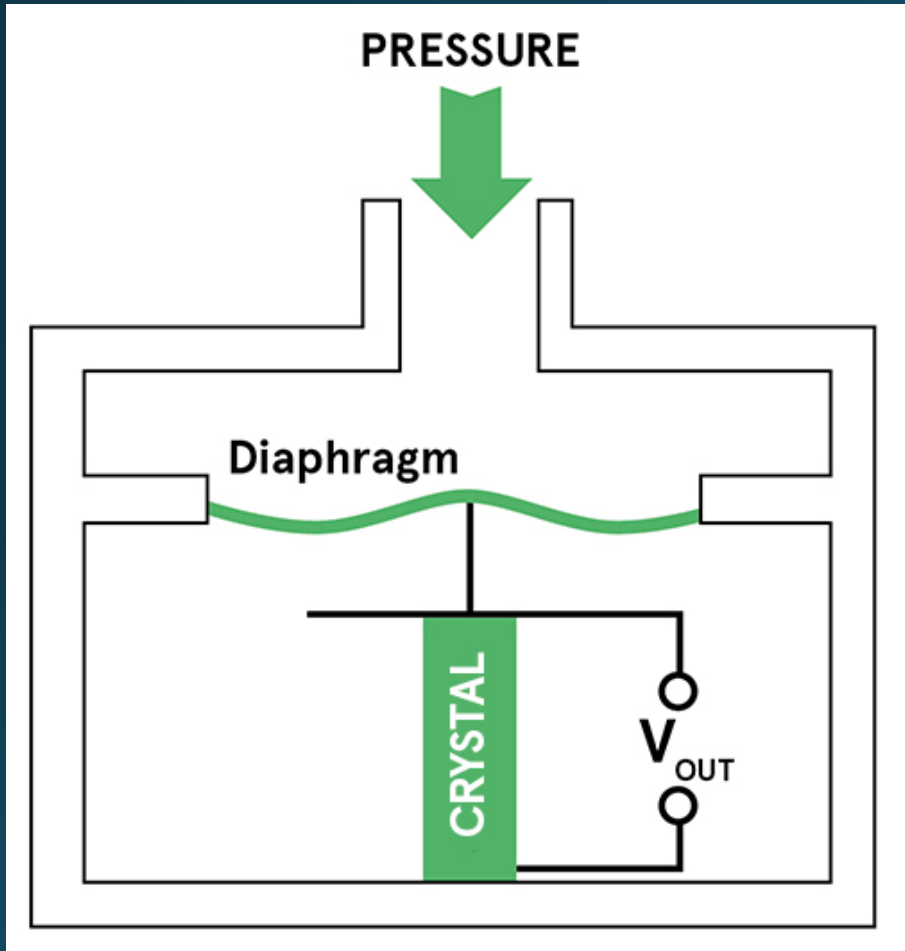


Capacitive Pressure Transducers



- A linear change in capacitance with changes in the physical position of the moving element may be used to provide an electrical indication of the element's position.
- The capacitance is reduced if the spacing between the plates is increased.
- This device is not linear.

Piezoelectric Pressure Transducers



- When a force is applied to a piezoelectric material, an electric charge is generated across the faces of the crystal.
- This can be measured as a voltage proportional to the pressure.
- No external voltage or current source is required.
- Output signal is directly generated from the applied strain.

Pressure Transmitter

- A Pressure Transmitter is used where indication and/or record of pressure is required at a location not adjacent to the primary element.
- A Pressure Transmitter is used for both indication and control of a process.
- A Pressure Transmitter is used where overall high performance is mandatory.
- Both Electronic and Pneumatic Transmitters are used.
- These can be either Gauge, Absolute or Differential Pressure Transmitters.