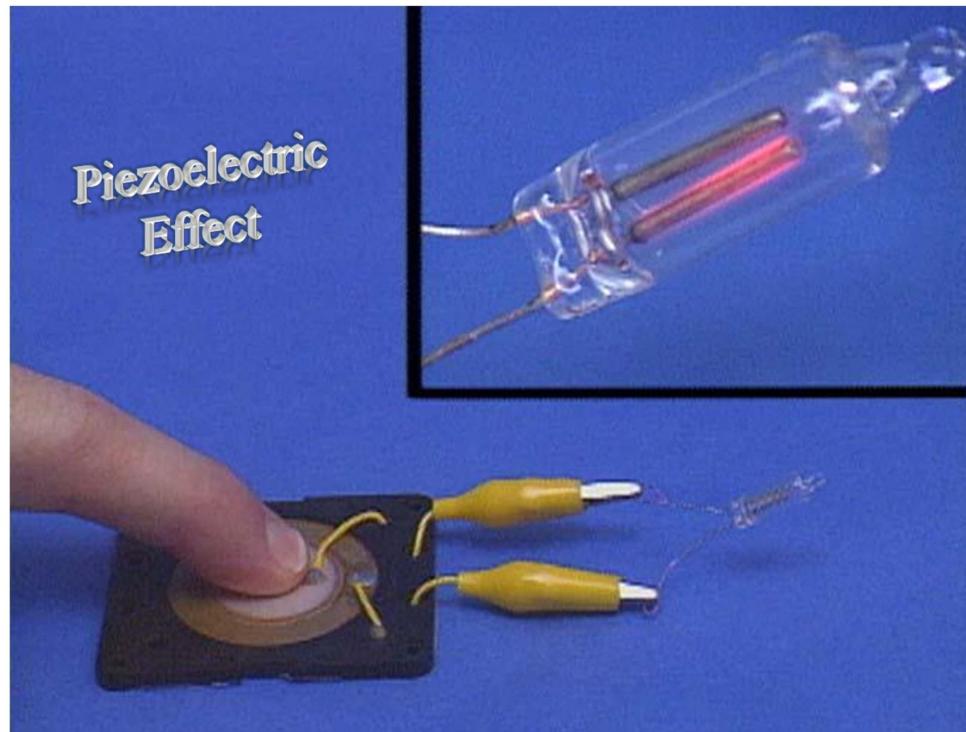




Piezoelectric Pressure Sensor

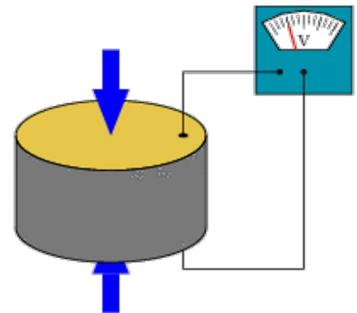
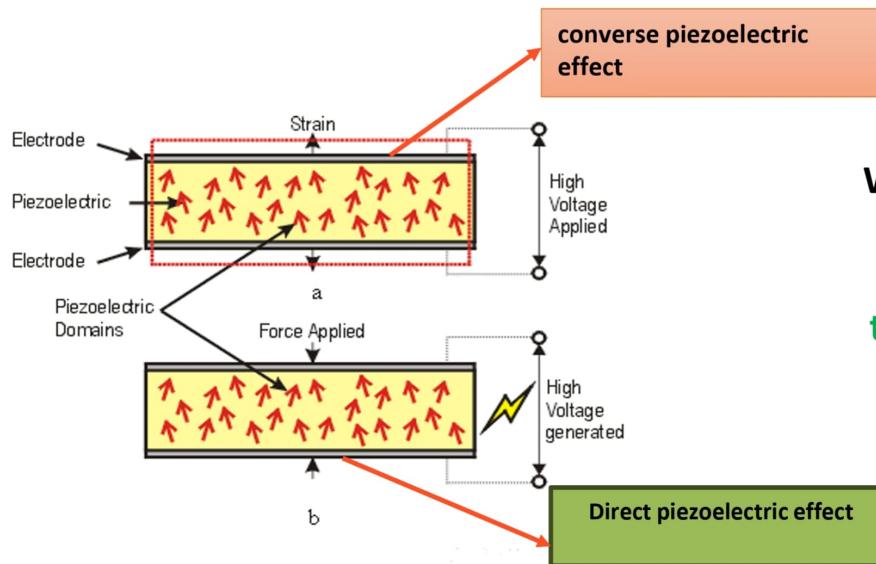




Piezoelectric Pressure Sensor

Piezoelectric effect

Piezoelectricity (from the Greek “piezin”, meaning to press) is a property of certain materials which show non-centre of symmetry



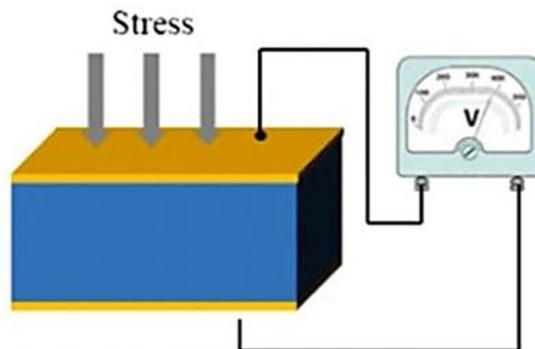
When **PRESSURE** is being applied to certain crystals they produce an electric output and vice-verse



Piezoelectric Pressure Sensor

a

Piezoelectric Effect

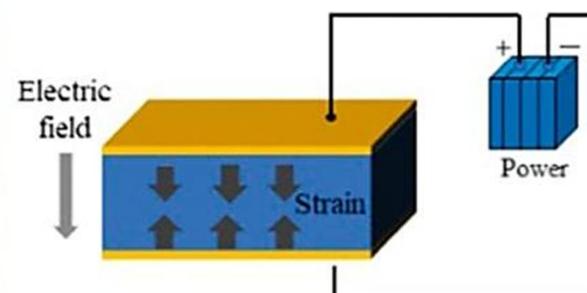


Stress → Electric charge

↓
Sensing

b

Converse Piezoelectric Effect



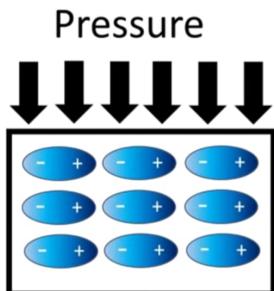
Electric field → Strain

↓
Actuating



Piezoelectric Sensor

Physical Phenomena → **SENSOR** → Electrical Signal



Input

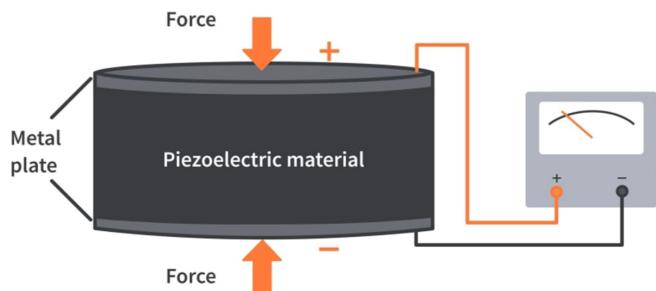
(Physical quantity)

SENSOR

(or Detector)

Output

(Electrical Signal)





Piezoelectric Pressure Sensor

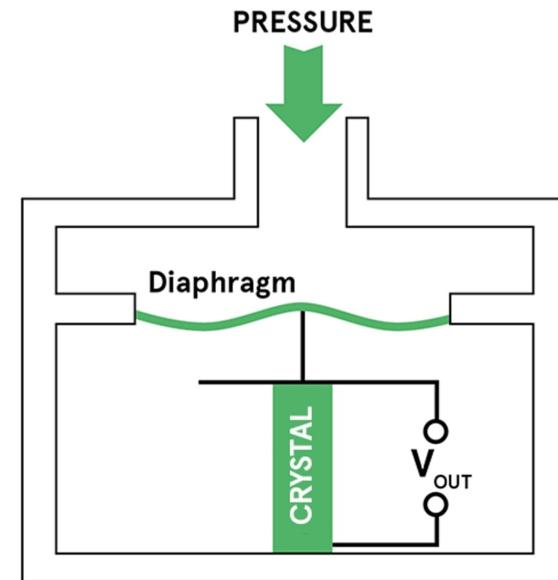
Introduction

- Piezoelectric pressure sensors are a unique class of devices that convert mechanical pressure into electrical signals.
- These sensors are increasingly popular due to their diverse applications, high sensitivity, and ability to operate in harsh environments.

Principle

Piezoelectric effect

- When pressure is applied to the sensor, the piezoelectric material deforms, causing a voltage difference across the electrodes.
- This voltage can then be measured and correlated to the applied pressure.

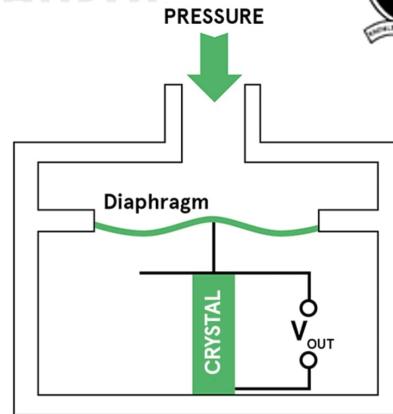




Piezoelectric Pressure Sensor

Advantages

- ✓ **High sensitivity**
- ✓ **Wide dynamic range**
- ✓ **Fast response time**
- ✓ **Excellent stability**
- ✓ **Resistance to harsh environments**



Applications

- **Automotive:** They are used in monitoring engine performance, tire pressure, and fluid pressure in braking systems.
- **Aerospace:** Measuring air pressure, cabin pressure, and fuel pressure in aircraft systems.
- **Industrial processes:** To monitor fluid pressure in pipes, tanks, and reactors,
- **Medical:** Blood pressure monitoring, respiratory therapy devices, and intracranial pressure monitoring.
- **Environmental monitoring:** They are employed in measuring atmospheric pressure, ocean depth, and groundwater pressure for various research and monitoring purposes.

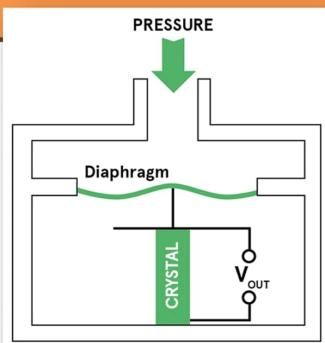
Piezoelectric Pressure Sensor

Types of Piezoelectric Pressure Sensors



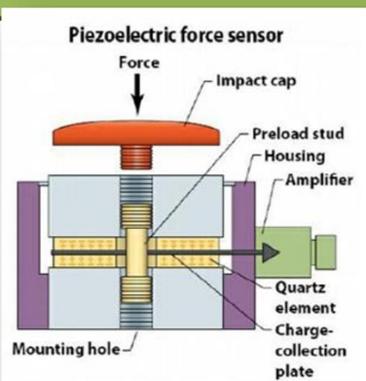
Piezoelectric diaphragm sensors

- A thin diaphragm to transfer pressure-induced mechanical stress to the piezoelectric material.
- Widely used for low-pressure measurements particularly suitable for dynamic and transient pressure applications.



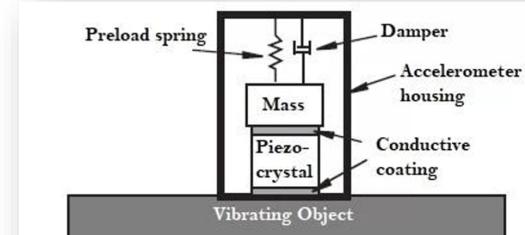
Piezoelectric force sensors

- These sensors measure pressure by converting the force applied to a rigid body into an electrical signal.
- They are commonly used in industrial applications where high accuracy and durability are required.



Piezoelectric accelerometer sensors

- These sensors detect changes in pressure by measuring the acceleration of a mass attached to the piezoelectric material.
- They are primarily used for vibration measurements and dynamic pressure applications.





Piezoelectric Pressure Sensor

