

# Department of Electrical Engineering

## Instrumentation Lab

EE-

**Experiment No.-3:** Instrumentation of Pressure.

**Objective :** Study of Piezo-electric sensor as pressure transducer with instrumentation trainer. Obtain the operational and calibration characteristics.

**Equipment /Apparatus required** Pressure measurement tutor, multi meter, dial type Pressure gauge

### **Theory:**

Piezo-electric transducer works on the principle of Piezo-electric effect. When a Piezo-electric crystal (Rochelle salts, quartz etc) is stressed, the ions in each unit cell are displaced, causing the electric polarization of the molecular structure. Because of asymmetry developed in the crystalline structure, these effects accumulate, causing the appearance of an electric potential difference across the faces of crystal, this is known as Piezo-electric effect (refer figure1).

By measuring this voltage precisely it is possible to calibrate the stress / force / pressure applied on the crystal . Since the device is able to produce a voltage on applying the measurand pressure, it is referred as an active transducer.

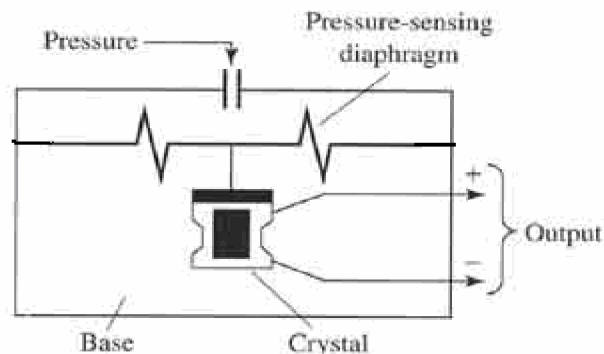


Figure:1

### **Specifications:**

Range	: 10 kg/cm <sup>2</sup>
Resolution	: 0.1 kg/cm <sup>2</sup>
Excitation (built in)	: 5.0V DC
Display	: 3 ½ digit
Adjustments	: Zero adjust, Span calibration
Analog output	: 2V, DC
Power source	: 230V, 50 Hz

**Diagram:**

Identify the various stages of functional block diagram (figure2) from input to output from the panel diagram and circuit diagram attached (figure 3) and report.

**Procedure:**

1. Connect piezoelectric sensor (pressure sensor) at the 9 pin connector.
2. Switch on the unit, check : red LED
3. Adjust zero adjustment pot for zero input observed in the dial type pressure gauge.
4. Apply 10 kg/cm<sup>2</sup> through plunger and adjust span control for full scale deflection as 10.0.
5. Take the reading of both analog and digital output for input pressure (by plunger) for every 0.5kg/cm<sup>2</sup> change and record.

**Observations:**

S.No	Pressure applied ( kg/cm <sup>2</sup> )	Display( kg/cm <sup>2</sup> )	Analog o/p(V)
1	No pressure	0.0	0.0
2	0.5		
3	1.0		
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21	10		

**Results:**

Plot :      Input/output characteristic:      Gauge Pressure vs. analog output (V)  
                 Calibration graph :                      Gauge Pressure vs. Display reading.

**Discussion:**

1. What are the materials for the piezo-electric crystal?
2. Derive the expressions for frequency response characteristics of piezo-electric transducer.
3. How does the output meter impedance affect the output?
4. What could be two industrial applications? Explain.
5. What are the different modes of operation of Piezo-electric transducer?

**References :**

1. Principle of Industrial instrumentation-
2. Instrumentation-Devices & Systems-

Patranabis,D.  
Rangan, Sarma, Mani

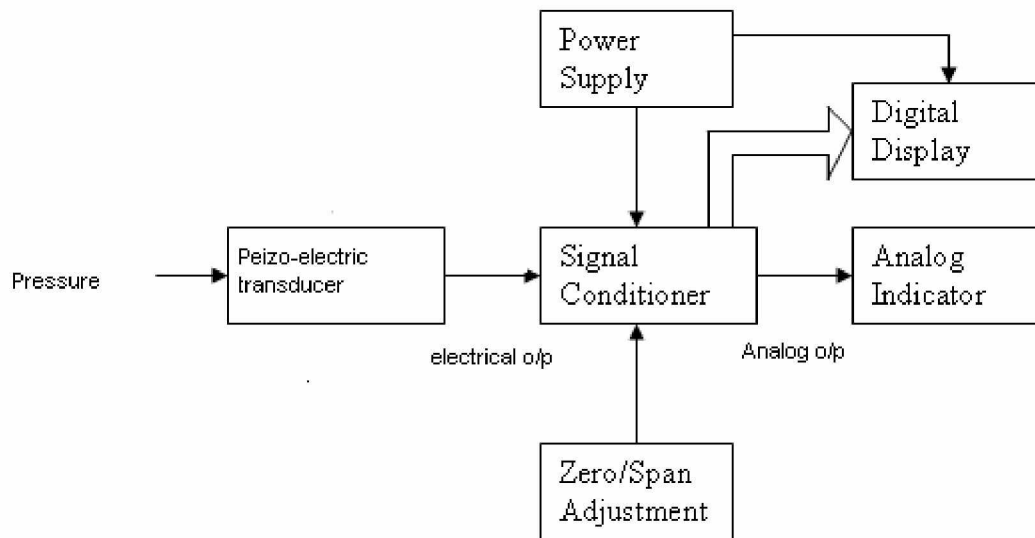


Figure:2 functional block diagram for Pressure Instrumentation set up