

Department of Electrical Engineering

Instrumentation Lab

EE-

Experiment No.-6: Instrumentation of stress, strain, load.

Objective: To study of scheme for instrumentation of strain. To measure weight with the Strain cantilever set up.

Equipment/Apparatus required: Strain measurement tutor (cantilever type).

Theory:

Due to pressure / load / stress / strain the resistance undergo changes in dimensions and thereby the change in resistance. Specially designed resistance element-strain gauges, are used to measure change in resistance ΔR caused by loading, such that there is direct relation between ΔR and input strain (due to load). Strain gauge is bonded to a beam under load (in a cantilever arrangement) and forms a part of electrical circuit, to result in an electrical output which can be measured and with proper calibration provides a measure the weight applied (refer to figure 1).

Specifications:

Max. Weight to apply	: 1 kg
Strain	: 400 micron
Resolution	: 1 micron
Excitation	: 5V DC
Analog output (max)	: 2V DC
Power source	: 230V, 50 Hz
Display	: 3½ digits
Inputs	: From strain cantilever with full bridge
Zero adjustment, span adjustment	

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 cantilever with strain gauge element at the 9 pin connector.
2. Switch ON the unit, check: red LED.
3. With no weight applied to cantilever, there is no strain and the output should read zero. If not then adjust zero adjustment (strain cal). Now the transducer bridge with full bridge configuration is balanced.

4. For full specified load of 1 kg, the arrangement should provide electrical output of 2 V, with corresponding strain being 400 microns. If the strain output meter shows different for full scale, adjust span adjustment.
5. Take the reading of both analog and digital every output for input load starting from no load for every 250gm change and record the observations.

Observations :

S.No	Weight (gm)	Display reading(μm)	Analogue o/p(V)
1	0.0	0.0	0.0
2	250		
3	500		
4.	750		
5	1000		

Results :

Plot the graphs: Load vs. Electrical output ; Load vs. Display reading

Discussion :

1. Comment on the linearity of characteristics.
2. What are the precautions to be taken, if any?
3. Derive the expression for gauge factor.
4. What is the difference between bonded and unbonded strain gauges?
5. What is a piezo- resistive effect?
6. What could be industrial applications of strain gauges?

References :

- | | |
|---------------------------------------------|---------------------|
| 1. Principle of Industrial instrumentation- | Patranabis,D. |
| 2. Instrumentation-Devices & Systems- | Rangan, Sarma, Mani |

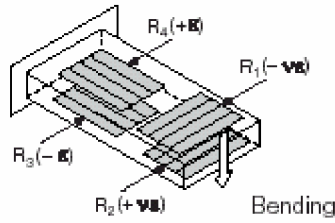


Figure: 1(a) Full-Bridge Type Rejecting axial and measuring bending Strain in a cantilever beam.

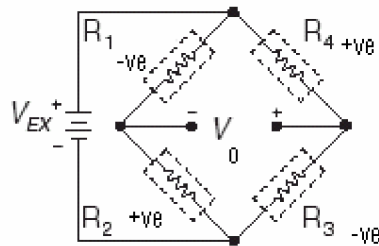


Figure:1(b) Full-Bridge Type configuration.

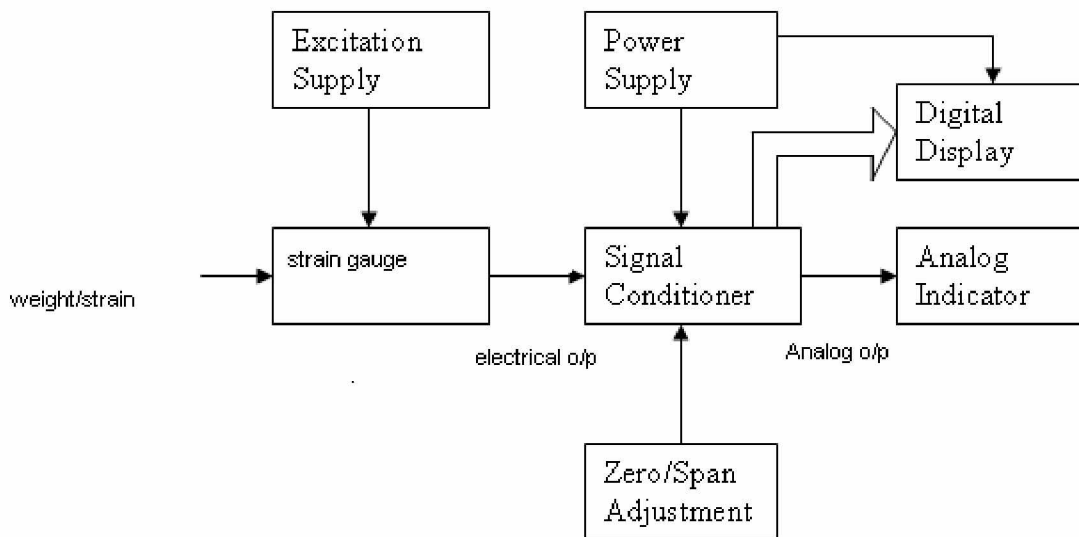


Figure:2 Functional block diagram of Strain gauge tutor