Department of Electrical Engineering

Instrumentation Lab EE-

Experiment No.-1: Displacement Instrumentation

Objective : Study of LVDT as displacement transducer with an instrumentation trainer. Obtain the operational and calibration characteristics.

Equipment/Apparatus required: LVDT trainer set up, CRO., multi meter

Theory:

Linear variable differential transformer (LVDT) is basically a inductive type of passive transducer based on variation of mutual inductance. It has coupling between primary and two secondary coils as shown in figure1.

It consists of a primary coil and two identical secondary coils, symmetrically wound on either side of primary coil with an iron (magnetic) core, free to move between the coil assemblies, in either direction from the null (central) position. When the primary is excited, equal induced emfs are produced in the two secondaries, if the core is centrally placed. The secondaries are connected in phase opposition so that in this position, an output voltage is zero and therefore this position is referred as Null. When there is a displacement of core connected to measurand, a voltage on secondary appears due to unbalance which can be calibrated to the movement of core very precisely. Ideal characteristic is shown in figure:2.

Specifications:

Range of LVDT	:	20 mm
Resolution	:	0.1mm
Excitation (built in)	:	2V rms, 5 KHz (sine)
Display	:	3 ½ digit
Adjustments	:	Zero adjust, Span calibration

Diagram:

Identify the various stages of functional block diagram (figure3) from input to output from the panel diagram and circuit diagram attached (figure 4) and report.

Procedure:

1. Connect LVDT (position sensor) at the 9 pin connector.
2. Switch on the unit, check : red LED
3. Adjust zero adjustment pot for zero input from micrometer.

4. Due to limitation of this particular trainer the input displacement is possible only in one direction up to 20mm; therefore characteristic can not be obtain as ideal. It will be possible to obtain the reading in one direction only.
5. Travel 20mm through micrometer and adjust span control for full scale defection
6. Measure voltage, see wave form of input at P_1, P_2 and record amplitude, frequency of the waveform. Verify with specifications.
7. Change micrometer from 20mm to 0mm and observe that the voltage at output terminals S_1, S_2 changes/reduces.
8. Now take the reading of both analog and digital output for input displacement (by micrometer) for every 2mm change and record the observations.

Observations:

Input excitation:

Amplitude: ---------------- Frequency:-------------------------

Displacement measurement:

Least count of micrometer: Zero error:

S.No.	Position of core(from micrometer)	analog output,(V)	Digital o/p (mm)
1	00 mm		
2	2 mm		
3	4 mm		
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11	20 mm		

Results:

Plot the graphs: Core position vs. analog output (V) ,
Core position vs. display output (mm)

Discussion:

1. Comment on linearity and accuracy of the plots
2. Derive transfer function. What is the effect of excitation frequency on the output?
3. How does the output meter impedance effect the output?
4. What could be two industrial applications? Explain.

References:

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

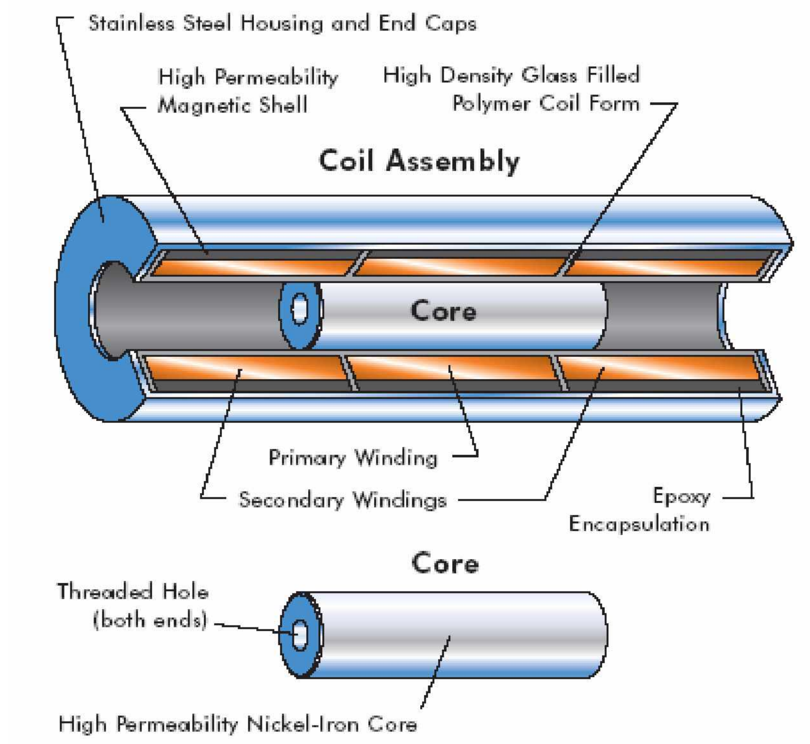

Figure: 1 Configuration of LVDT

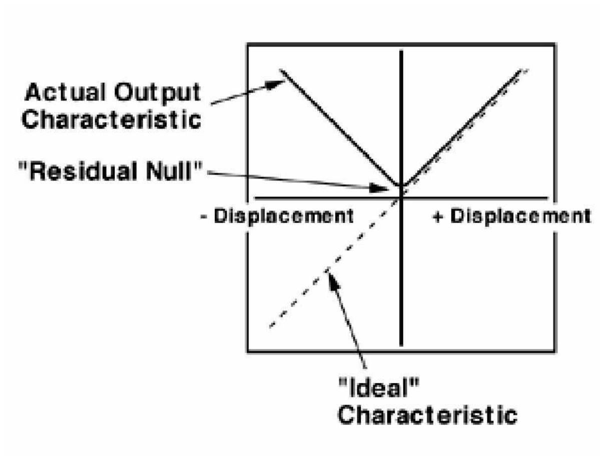

Figure2 : Ideal characteristic of LVDT.

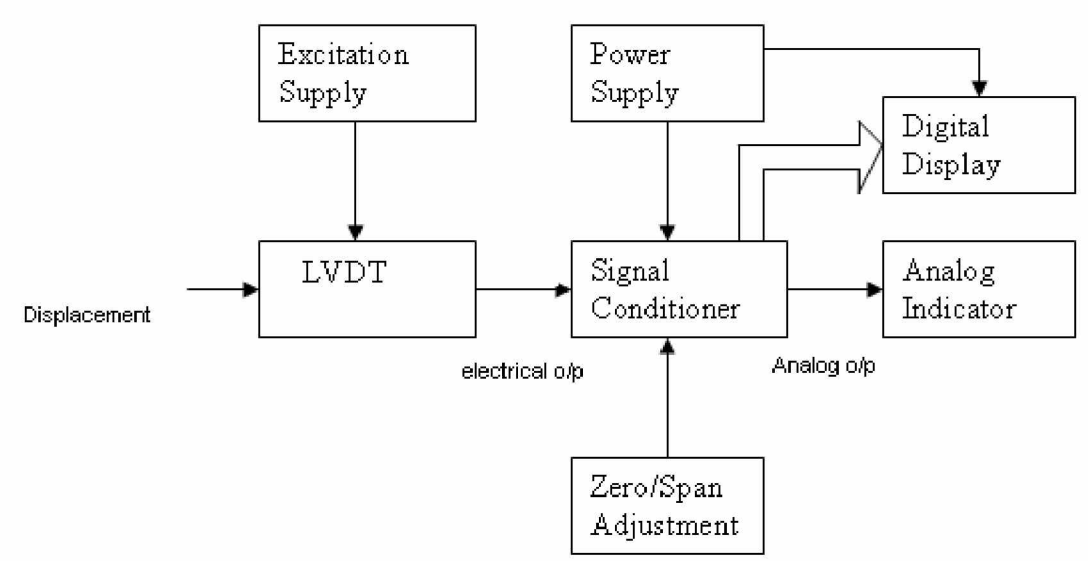

Figure3. Functional block diagram of Displacement tutor