Experiment: 8

Describe the Characteristics of The Linear Variable Differential Transformer (LVDT) Transducer.

EQUIPMENTS

- L.V.D.T. Transducer Trainer IT-5928
- 2mm Connecting Leads.
- Digital Multimeter.

THEORY

The linear variable differential transformer (LVDT)

Introduction:

The linear variable differential transformer (LVDT) (also called just a differential transformer, linear variable displacement transformer or linear variable displacement transducer) is a type of electrical transformer used for measuring linear displacement (position).

Operation:

The linear variable differential transformer has three solenoid coils placed/mounted end-to-end around a tube and has a ferromagnetic core that is movable within the coils. Core is attached to the object whose position is to be measured, slides along the axis of the tube.

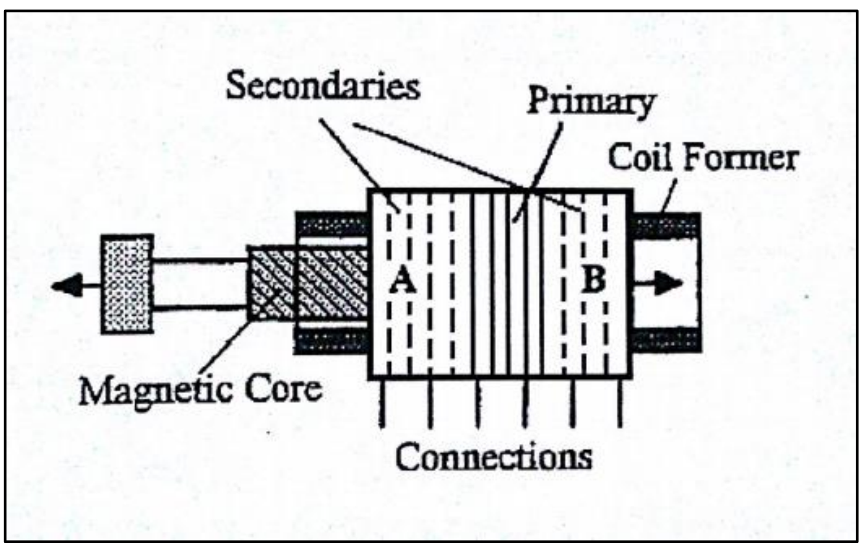


Figure 8.1 (Construction of LVDT)

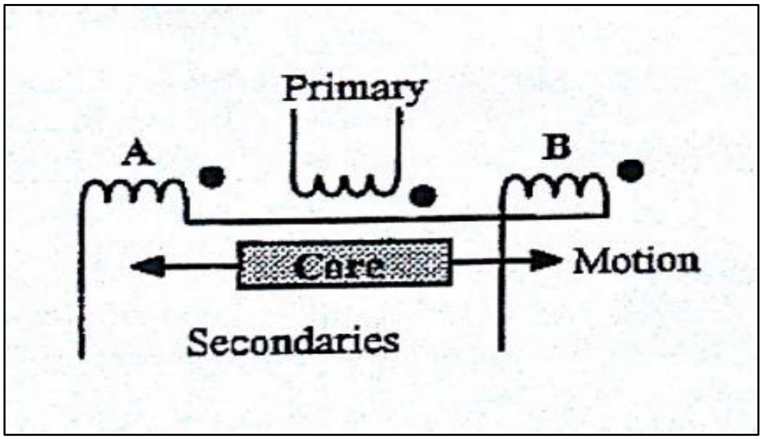


Figure 8.2 (Circuit Diagram of LVDT)

The center coil is the primary and is supplied from an AC supply and the two outer coils are the secondary coils and are labeled as A and B in the figure above. An alternating current drives the primary and causes a voltage to be induced in each secondary proportional to the length of the core linking to the secondary. Coils A and B have equal numbers of turns and are connected in series opposing so that the output voltage is the difference between the voltages induced in the coils. Figure 8.3 shows the output obtained for different positions of the magnetic core.

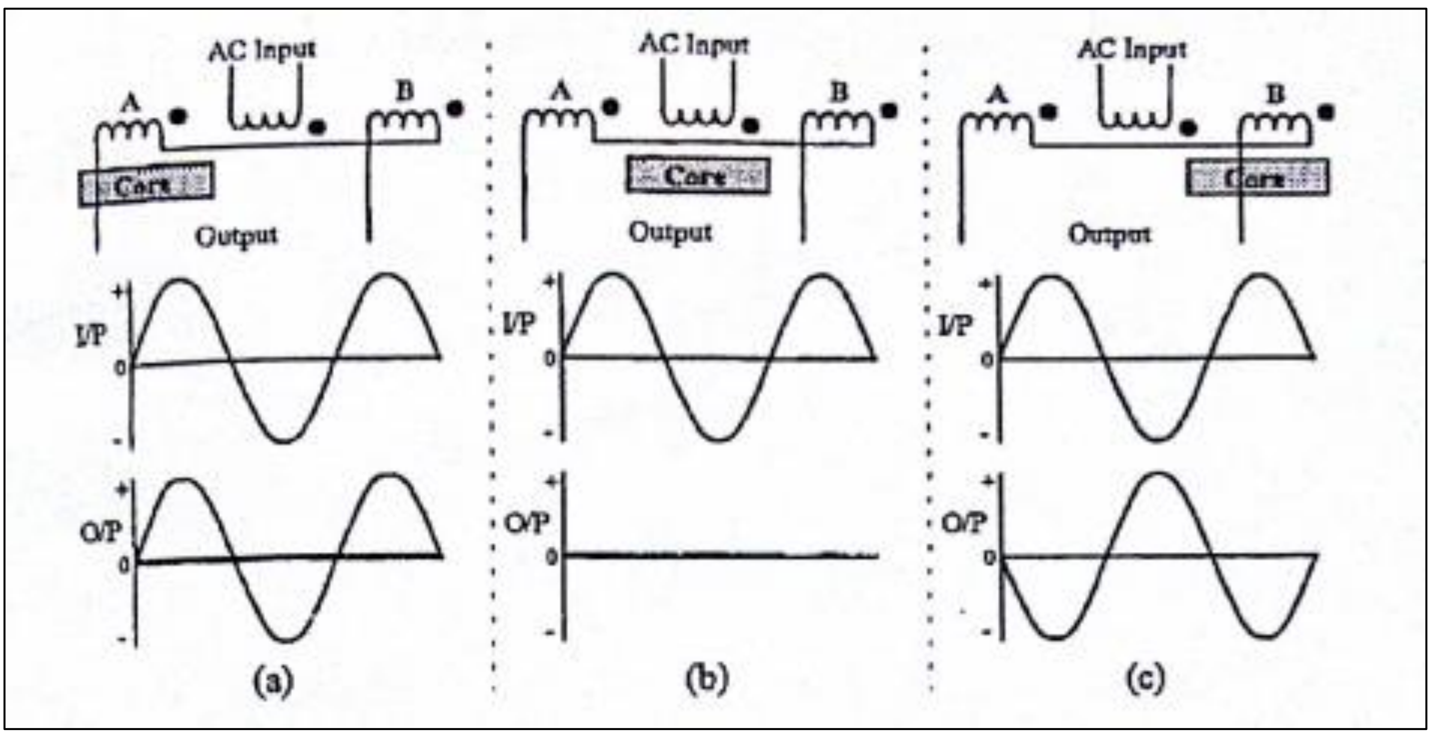


Figure 8.3 (Different Positions of Core)

With the core in the central position as shown in the figure (b), there should be equal voltages induced in the coils A and B by normal transformer action and the output voltage would be zero. In practice this ideal condition is unlikely to be found, but the output voltages will reduce to a minimum.

With the core moved to the left as shown in figure (a), the voltages induced in the coil A (Va) will be greater than that induced in coil B (Vb). There will be therefore an output voltage Vout = (Va - Vb) and this voltage will be in phase with the input voltages as shown Fig-8.3.

With the core moved to the left as shown in figure (c), the voltages induced in the coil A (Va) will be less than that induced in coil B (Vb). There will be therefore an output voltage Vout = (Va - Vb) but in this case, the output voltage will be anti-phase with the input voltages as shown in Fig-8.3.

Movement of the core from it neutral or central position produces an output voltage. This voltage increases with the movement from the neutral position to a maximum value and then may reduce for further movement from this maximum setting. Note that he phases will remain constant on either side of the neutral position. There is no gradual change of phase, only an abrupt reversal when passing through the neutral position. An amplitude only measurement of the output voltages, such as that provided by a meter, gives an indication of movement from the neutral position but will not indicate the direction of that movement. Used in conjunction with a phase detector, an output can be obtained that is dependent on both magnitude and direction of movement from neutral position. The oscilloscope gives both phase and magnitude indications.

Figure 8.4 shows the circuit arrangement and device characteristics in IT-5928.

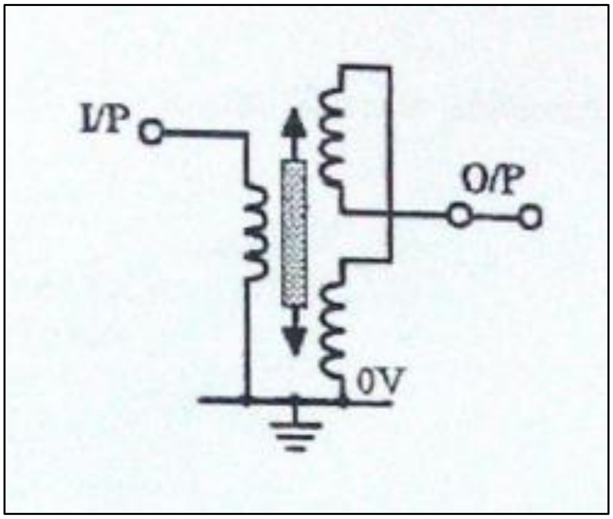


Figure 8.4 (Circuit Arrangement LVDT)

Applications:

- In making tablets from medicinal powder, dual LVDTs control pill weight & thickness.
- Low-cost LVDT, with refined signal conditioning, resolves to a millionth of an inch for this automotive crankshaft balancer.
- Special AC LVDT is critical part of this medical instrument that assists with brain surgery
- Hydraulic oil compatible LVDT is used to continuously monitor fluid level as part of leak detection system.

EXPERIMENT

Refer to figure 8.5 to configure setup for the present experiment.

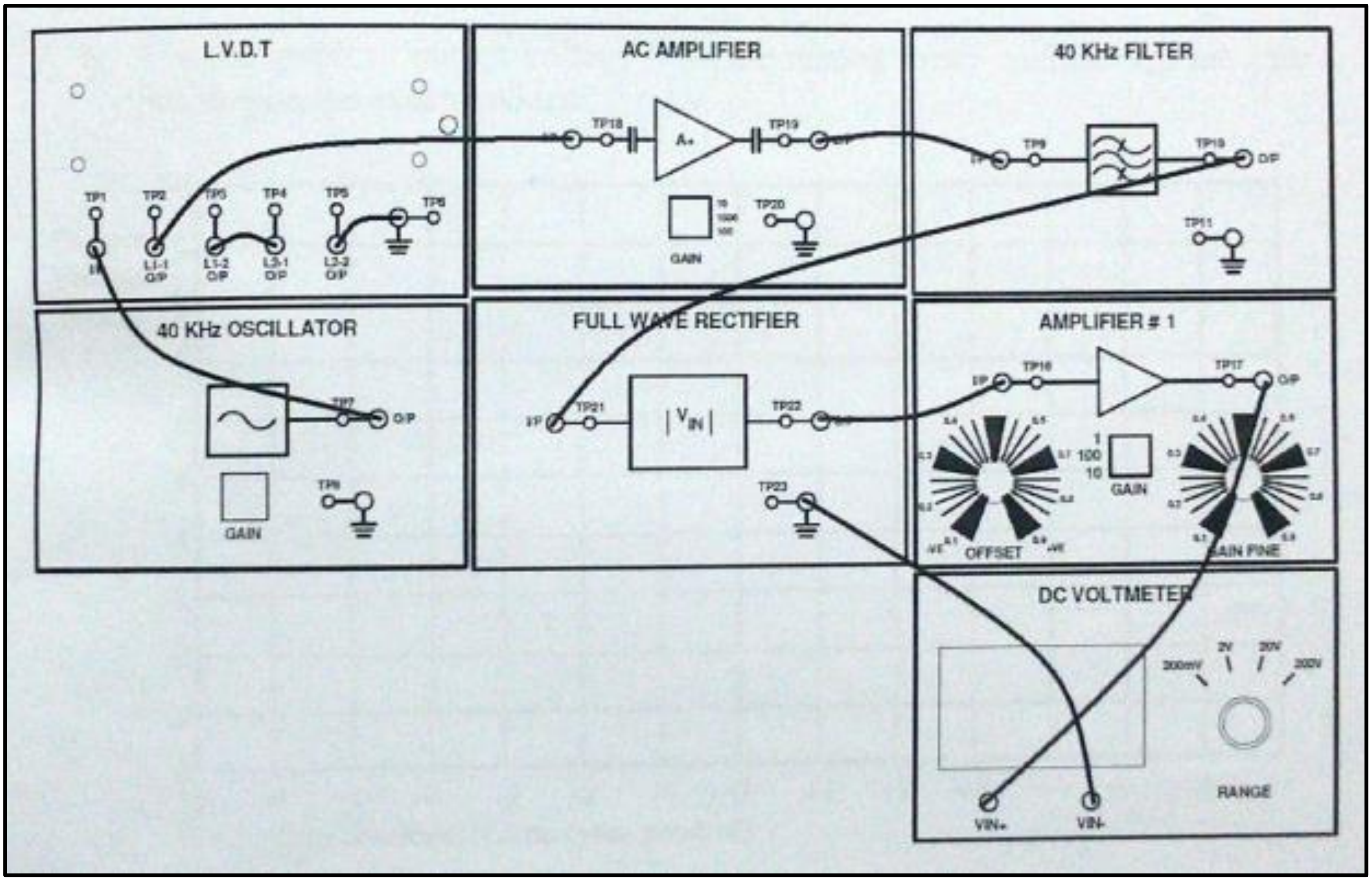


Figure 8.5 (Experimental Setup)

- Connect the circuit as shown in the figure 8.5.
- Set digital voltmeter to 2V DC range to monitor the output of the Amplifier #1.
- Switch ON the power supply.
- Set he AC amplifier gain to 10.
- Get the GAIN of amplifier #1 to 100 and GAIN FINE to 0.2.
- Check that the offset is set on zero output for zero input and adjust if necessary.
- Adjust the core position by rotation the operating screw to the neutral position. This will give minimum output voltage, note the value of this voltage from digital multimeter and record in the Table 8.1.
- Rotate the core control screw in step of 1 turn for 7 turns in the clockwise direction and record in table below. Then turn the control screw in the counter clockwise direction, again record the result in that table 8.1.
- After recording values in the table 8.1 plot a graph 8.1 on the given axes.

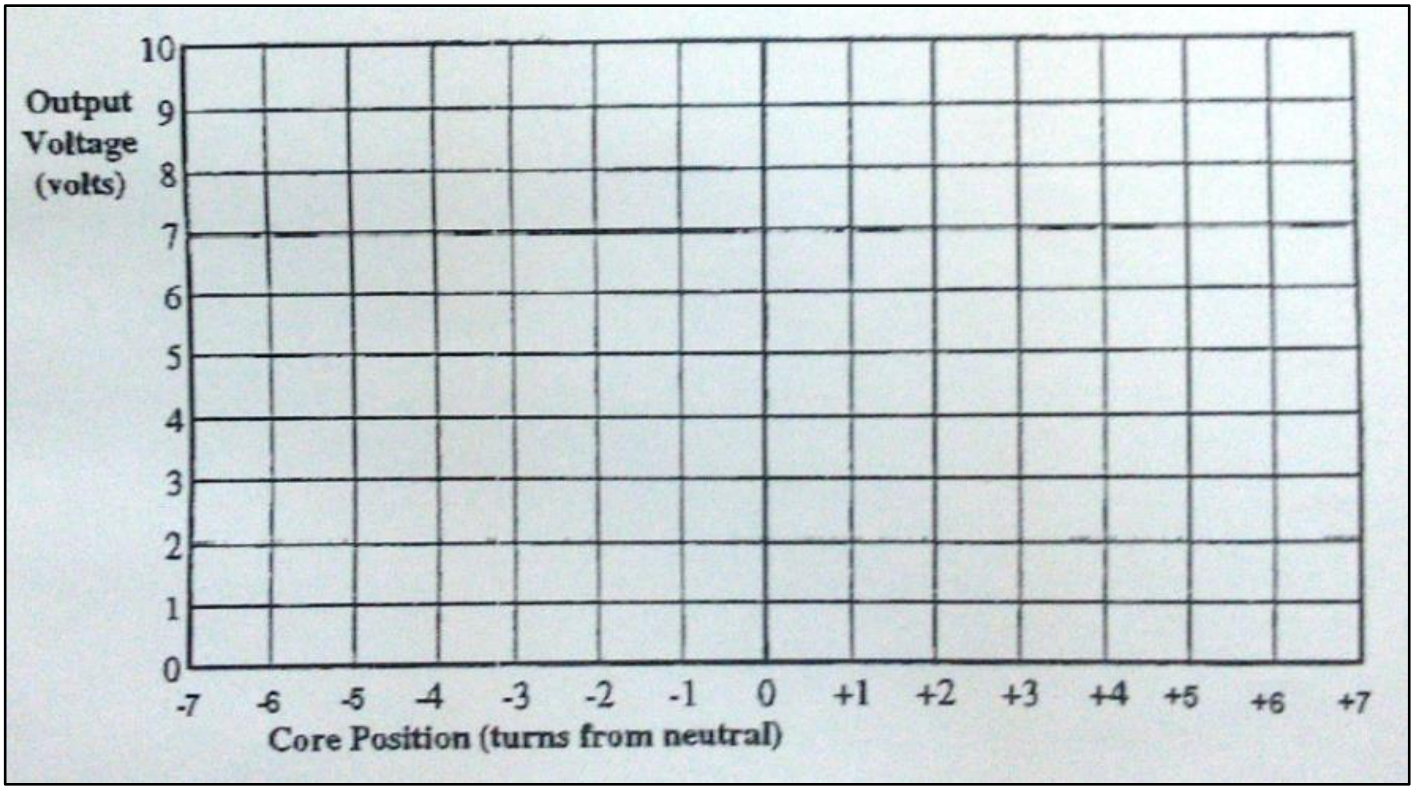
RESULTS

Record values in the table 8.1:

Core position	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7
Output Voltage (V)															

Table 8.1 (Observations LVDT)

Plot the graph of output voltage from the analog meter readings against core position on the axes provided.



Graph 8.1 (Output voltages Vs Core Positions)

CONCLUSION

Instructor Signature: ________________________________ **Date:** ________________