LAB SESSION 10

To use a LVDT as an element to measure the diaphragm distortion that is consequence of the pressure inside the pressure chamber.

Learning Objective:

At the end of this study, the student will be able to:

- To use different parts of Pressure Test Module such as LVDT to find the pressure.

Apparatus

In order to complete the demonstration, we need a number of pieces of equipment, differentiator.

- Main module
- 12 Vdc Power supply
- BS-3
- Linear variation differential transformer (LVDT)
- Voltmeter dc

Main Parts of Pressure Test Module

1. Potentiometer
2. LVDT
3. Compressor
4. Differential Pressure Sensor
5. Strain Gauges
6. Gauge Pressure Sensor

Related theory

The linear variable differential transformer (LVDT) (also called linear variable displacement transformer, linear variable displacement transducer, or simply differential transformer[3]) is a type of electrical transformer used for measuring linear displacement (position). A counterpart to this device that is used for measuring rotary displacement is called a rotary variable differential transformer (RVDT)

The linear variable differential transformer has three solenoidal coils placed end-to-end around a tube. The center coil is the primary, and the two outer coils are the top and bottom secondaries. A cylindrical ferromagnetic core, attached to the object whose position is to be measured, slides along the axis of the tube. 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.[3] The frequency is usually in the range 1 to 10 kHz.

As the core moves, the primary's linkage to the two secondary coils changes and causes the induced voltages to change. The coils are connected so that the output voltage is the difference (hence "differential") between the top secondary voltage and the bottom secondary voltage. When the core is in its central position, equidistant between the two secondary's, equal voltages are induced in the two secondary coils, but the two signals cancel, so the output voltage is theoretically zero. In practice minor variations in the way in which the primary is coupled to each secondary means that a small voltage is output when the core is central.

When the core is displaced toward the top, the voltage in the top secondary coil increases as the voltage in the bottom decreases. The resulting output voltage increases from zero. This voltage is in phase with the primary voltage. When the core moves in the other direction, the output voltage also increases from zero, but its phase is opposite to that of the primary. The phase of the output voltage determines the direction of the displacement (up or down) and amplitude indicates the amount of displacement. A synchronous detector can determine a signed output voltage that relates to the displacement.

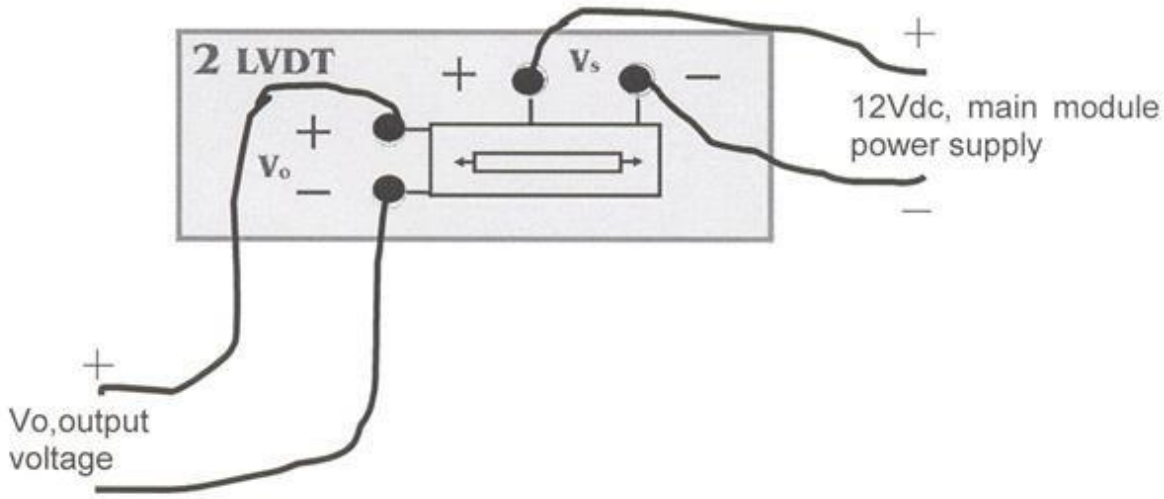

Figure 1 LVDT Circuit

Experimental procedure:

1) Set up the equipment and identify its components.

2) During this practice we will use a L VDT sensor to measure the pressure due to the lateral diaphragm distortion that the BS-3 system pressure chamber has.

3) The L VDT is a linear displacement sensor that detects the relative movement of a ferromagnetic core between the primary and the secondary.

4) It must be powered with a 12V de voltage, that starts the detection and control circuits included in the L VDT used in this equipment, this way we obtain an output signal in de voltage (Vo), that is proportional to the axle placement inside the LVDT.

5) Once all the connections have been made and the L VDT has been fed, the compressor fed by relay with 12VDC must be activated as it has been previously explained.

6) The LVDT will give a DC voltage signal proportional to the displacement caused by the membrane distortion due to the pressure.

Observations & Calculations

Table 1: Calculation of Pressure and Output voltage

Obs. n	Pressure (Bar)	Output (V)
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

Graph

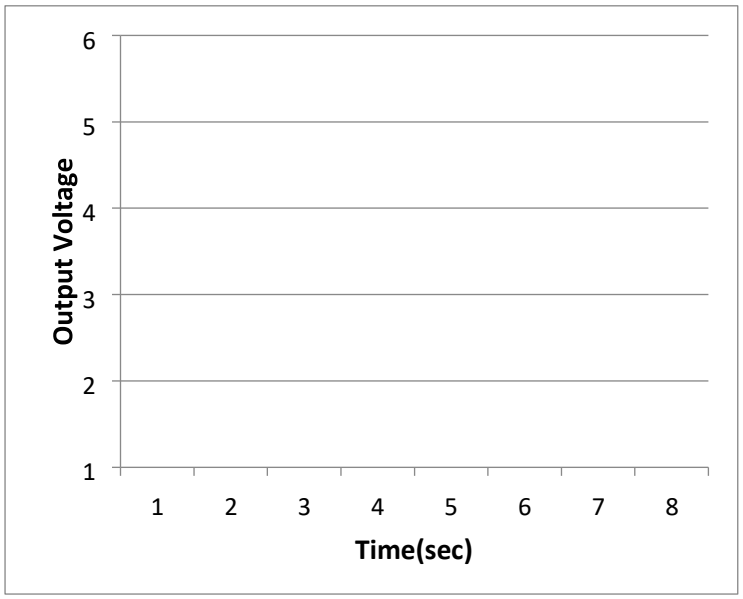

Figure 2 Characteristics of LVDT

Conclusion: