

18ECO133T

Sensors and Transducers

UNIT V

Session 4: SLO - 1

DISPLACEMENT MEASUREMENT

- A displacement sensor (displacement gauge) is primarily **used to measure the range of where an object has to travel** and in relation to a reference position.
- Displacement sensors have multiple uses.
- Its primary use is for dimension measurement to figure out an object's width, height, and thickness.

Types

- **Potentiometer.**
- **Control Position Transducer (CPT)**
- **Linear variable differential Transformer(LVDT)**
- **Accelerometers**

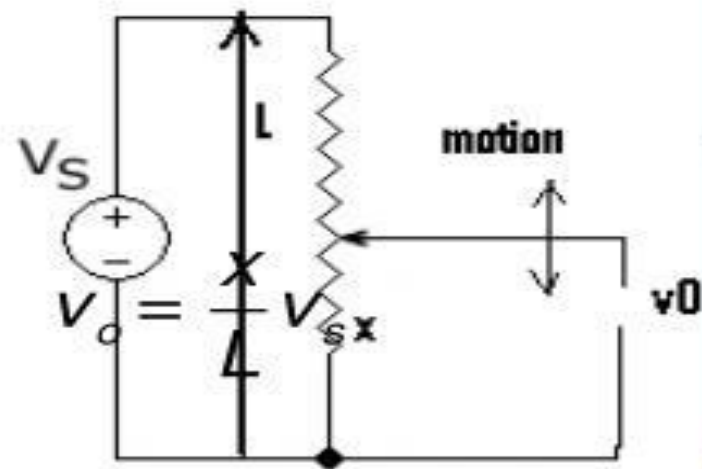
Longitudinal Displacement

Potentiometer or longitudinal displacement

Theory of Operation:

The sensor consists of a length “L” of resistance wire attached across a voltage source “ V_s ”. The wiper is pushed up or down by moving target, for which displacement “x” is required to be measured. V_o is the output voltage representing displacement in terms of volts and is given by:

$$V_o = \frac{x}{L} V_s$$

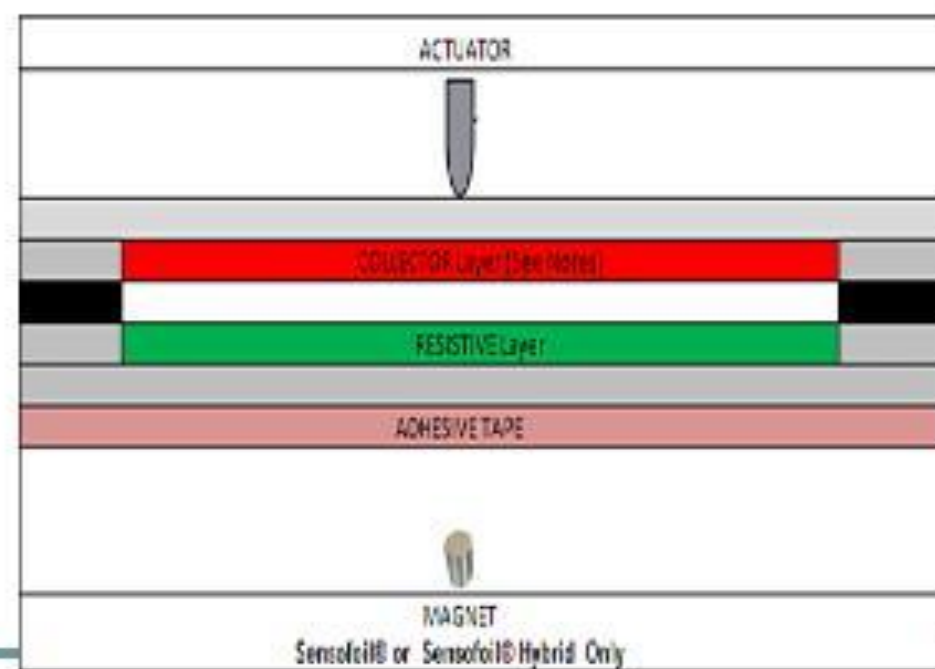
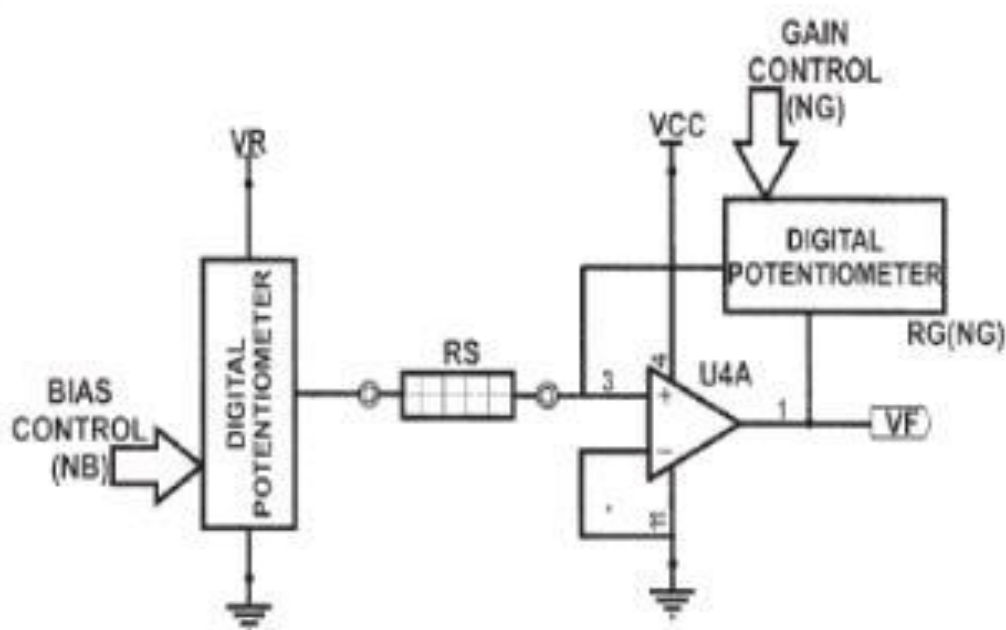


Wire-Wound Potentiometer

The resistance of the wire wound potentiometer increases in step manner as the wiper moves from one position to the adjacent turn. This step change in resistance limits the resolution of the potentiometer to L/n , where n is the numbers of turns. The resolution ranges from 0.05 to 1 percent are common. Therefore such potentiometer are not suitable for precise and finer movements.

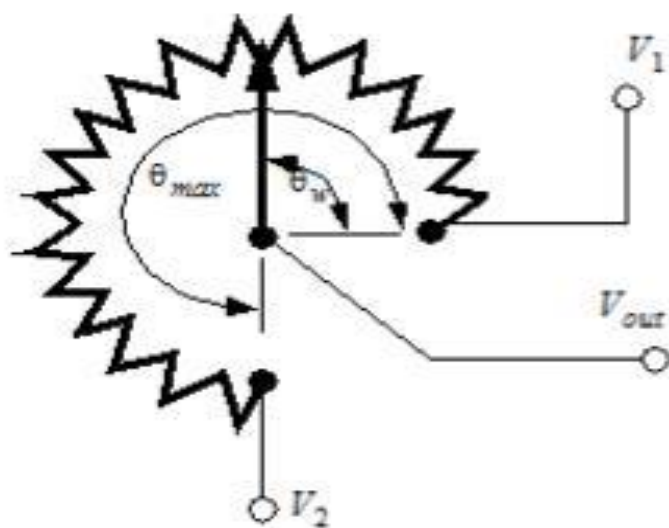
Thin film potentiometer

The film resistance on an insulating substrate exhibits high resolution, lower noise, and longer life. For example a resistance of 50 to 100 Ohm/mm can be obtained with the conductive plastic film



Thin Film Potentiometer

Thin Film potentiometer are introduced to improve resolution. Movement can be nearly continuous rather than in steps.



$$V_{out} = (V_2 - V_1) \left(\frac{\theta_w}{\theta_{max}} \right) + V_1$$

Thin Film
Potentiometer
For angular
Movements