Potentiometer and Loading Effect

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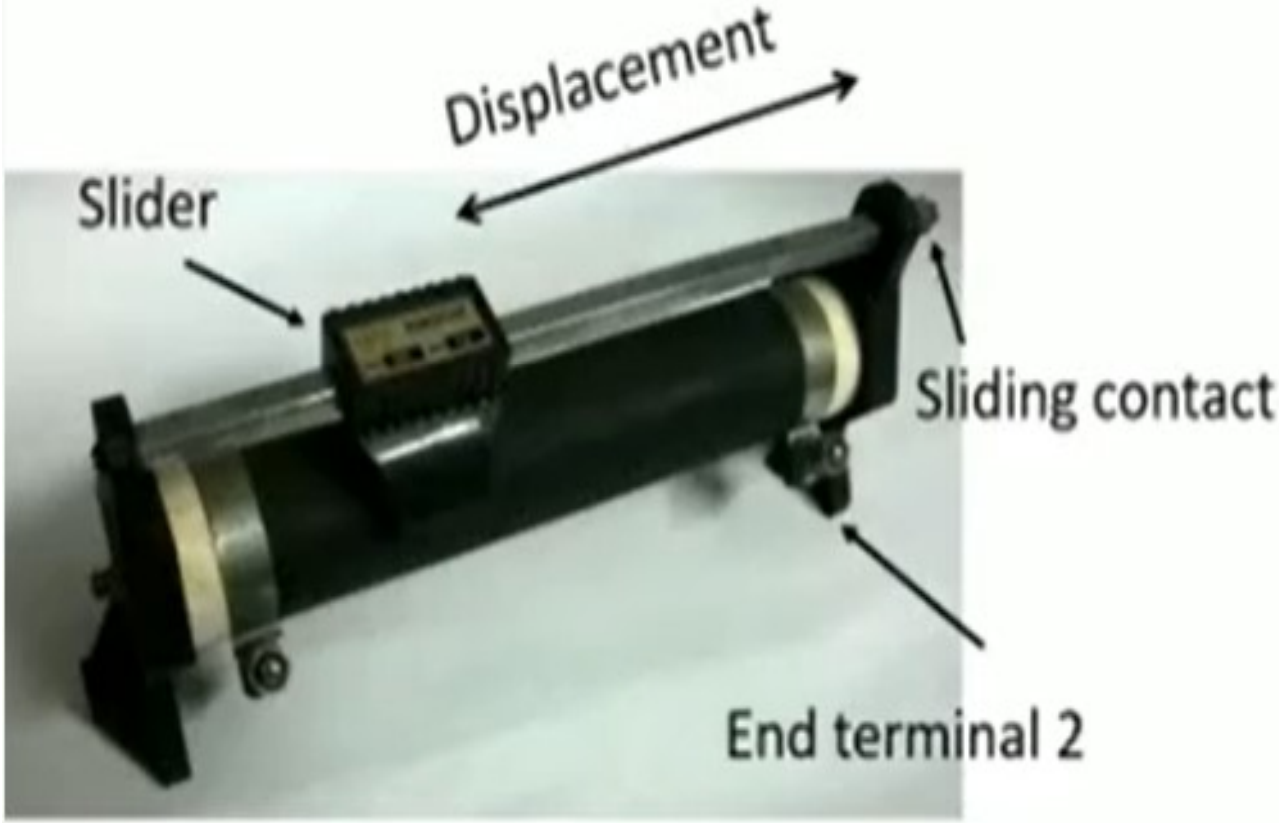
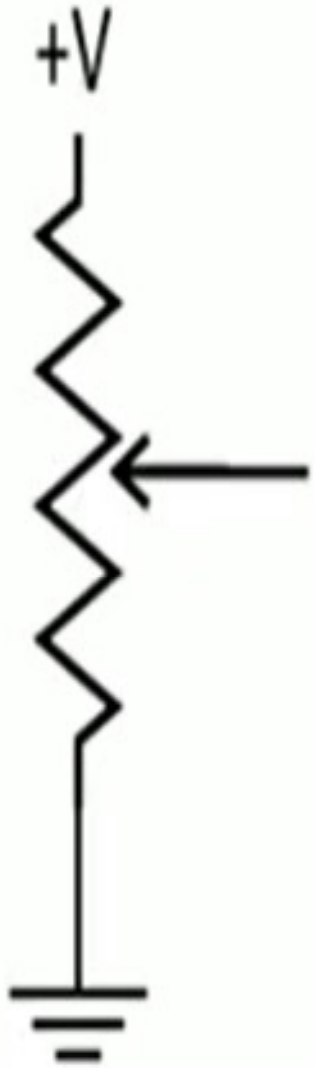
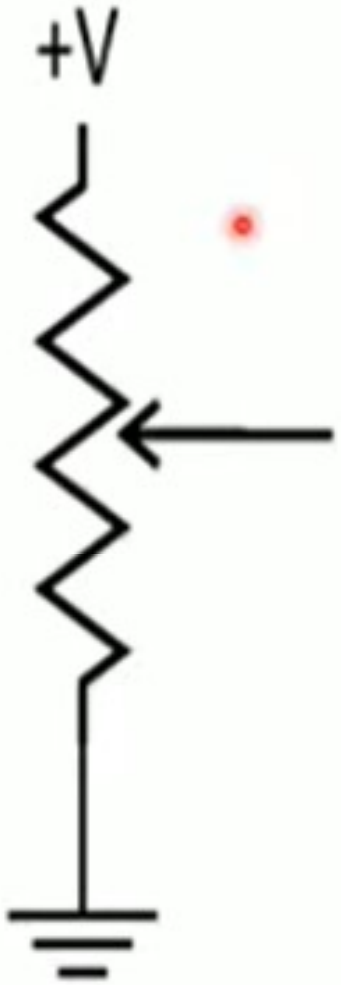
- A potentiometer is a device in which a resistive wire or material is wounded on an insulating core.



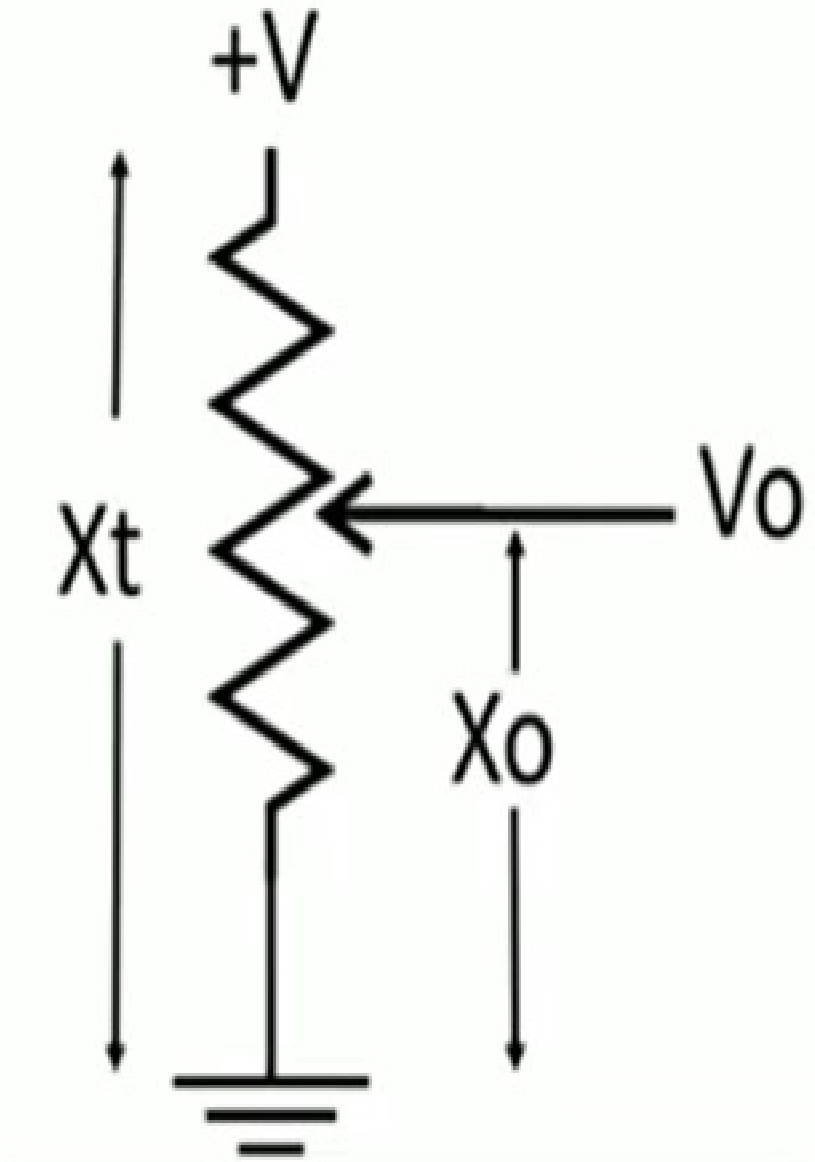


- The movement of sliding contact may be translational (straight), rotational or combination of these two.
- A dc or ac voltage source is used to energise the potentiometer.



- The voltage across the slider contact and ground

$$Vo = \frac{Xo \,.V}{Xt}$$

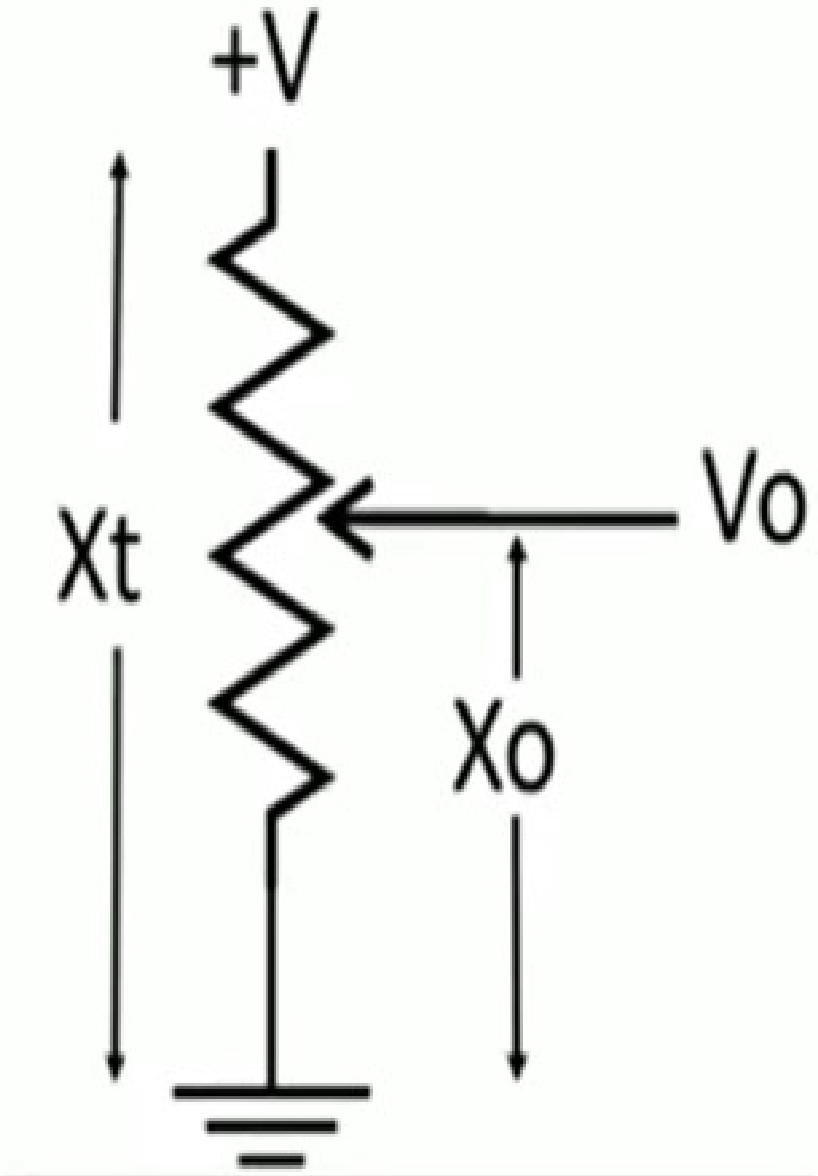


- If the total resistance of the potentiometer is Rt and Ro is the resistance of the portion of the potentiometer from the slider to electrical ground.

- Then the voltage

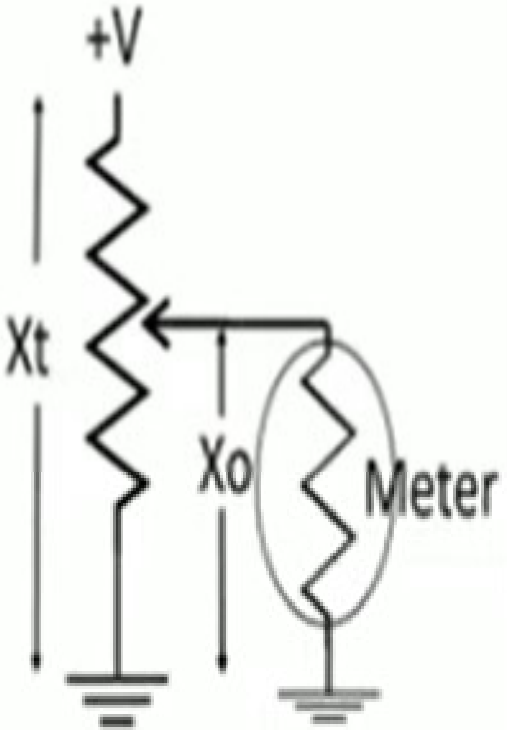
$$Vo = \frac{Ro \,.\, V}{Rt}$$

- The voltage Vo is proportional to the displacement.

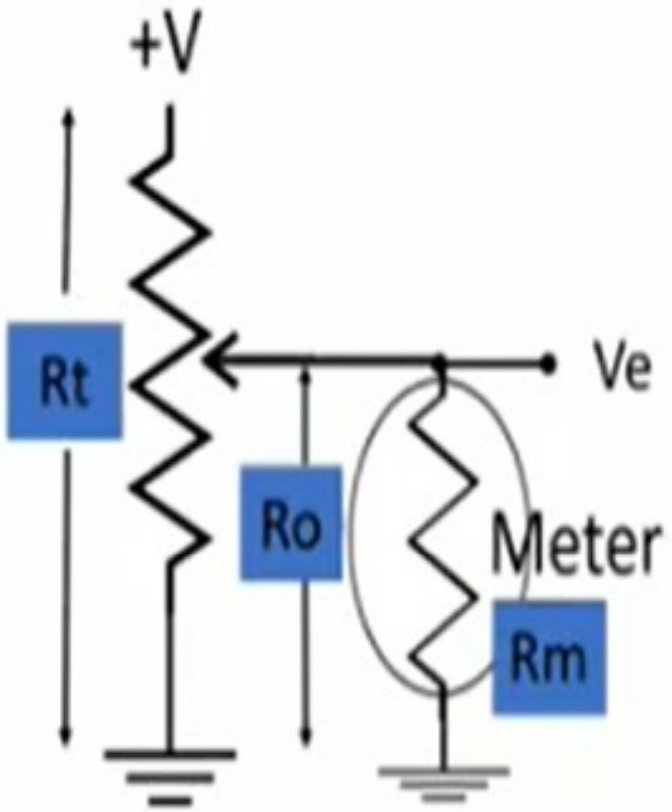


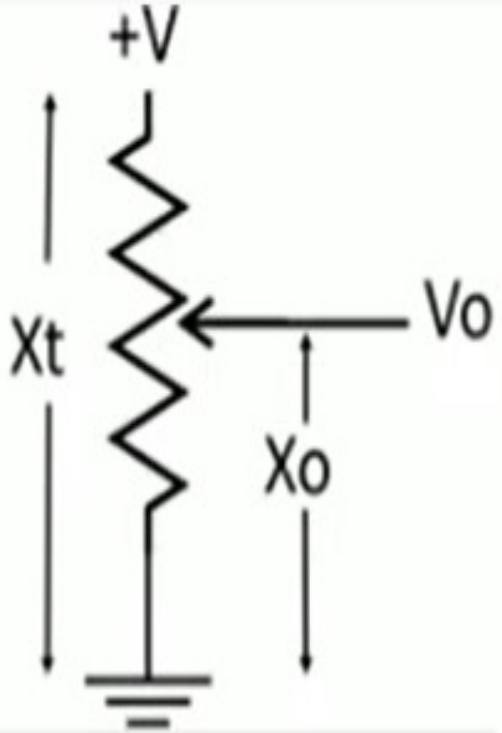
Loading effect on Potentiometer

- The output of the potentiometer is generally connected to the input of an amplifier or measuring device.
- The input resistance of the amplifier or measuring device also affects the voltage between the slider contact and ground.
- This effect is known as loading effect of the potentiometer.



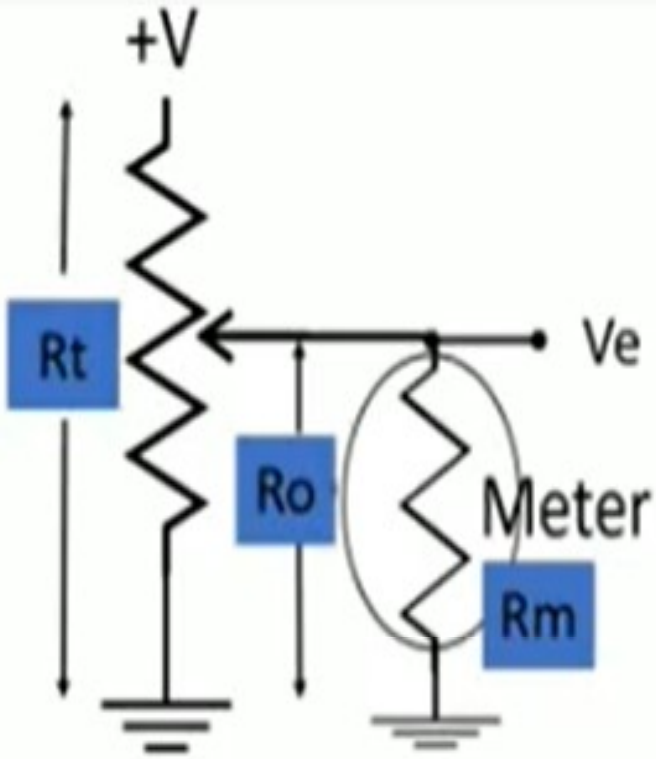
- Rm is meter resistance
- The effective resistance Re is Re= Ro||Rm
- $Re = \frac{Ro\,Rm}{(Ro+Rm)}$
- $Ve = \frac{Re\,V}{(Rt-Ro)+Re}$
- (Since the resistance between the sliding contact and +V is (Rt-Ro) and that of slider contact and ground terminal in this case is Re).





$$Vo = \frac{Ro\,.V}{Rt}$$

$$E = \frac{Ve - Vo}{Vo}$$



$$Ve = \frac{Re\,V}{(Rt - Ro) + Re}$$

- Error = $\frac{\text{Measured Value} - \text{True Value}}{\text{True Value}}$

i.e,

$$E = \frac{Ve - V0}{V0}$$

Thank you