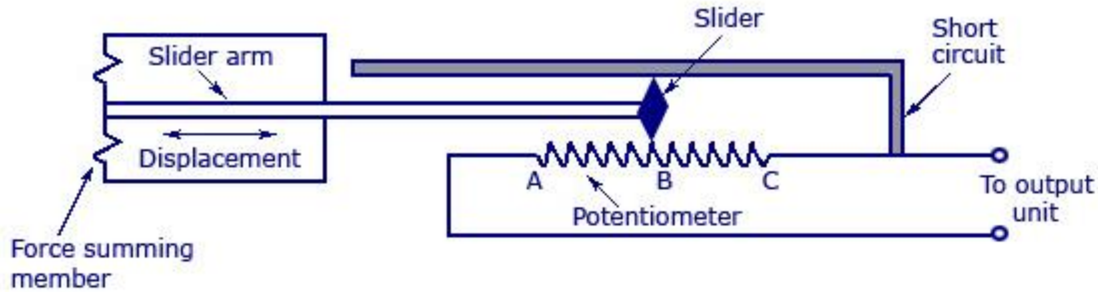
Linear Potentiometer Transducer

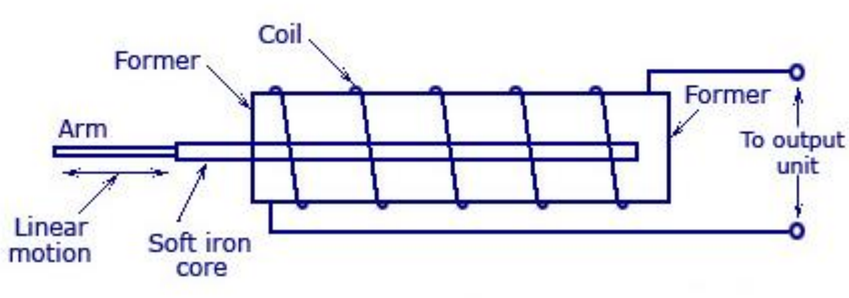
A linear potentiometer transducer consists of a potentiometer, which is short circuited by a slider. The other end of the slider is connected to a slider arm. The force summing device on the slider arm causes linear displacement of the slider causing the short circuit of a certain portion of the resistance in the potentiometer. Let the whole resistance positions on the potentiometer be ABC. Let the resistance position caused by the slider movement be BC. As the movement of the slider moves further to the right, the amount of resistance increases. This increase in resistance value can be noted according to the corresponding change in the linear displacement of the slider. The change in resistance can be calculated with the help of a Wheatstone bridge.

Another easy method than calculating the resistance with the help of a bridge connection is to connect a constant current source in series with the potentiometer. Thus a voltage will be developed. This voltage can be measured and hence the resistance, R = V/I.



Linear Potentiometer

Linear Motion Variable Inductance Transducer



Arrangement of Linear Motion Variable Inductance Transducer

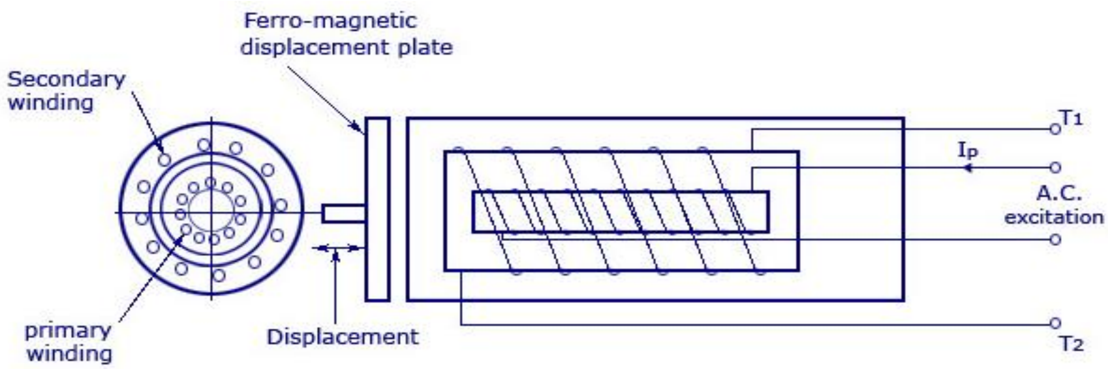
The device consists of an arm that moves linearly according to the displacement produced. It also consists of a single coil wound on a former with 'N' number of turns. The end of the arm is connected to a soft iron core which moves linearly along the axis of the former. Thus, reluctance 'R' will be produced due to the flux path. The coil inductance of the device can be written by the equation, $L= N^2/R$.

A linear movement of the arm to the right decreases the reluctance 'R' of the flux path. Thus, according to the equation given above, the inductance increases due to the decrease in reluctance and vice versa. This inductance 'L' can be calculated or recorded with the help of an inductance bridge or through a recorder. Thus the measure of the displacement of the arm can be obtained from the corresponding change in inductance.

If the transducer is connected to the input of an oscillator tank circuit, the change in frequency 'f' of the oscillator could be taken as the measurement for the corresponding change in the displacement of the arm. A displacement of the arm changes the inductance and hence the frequency. Thus, the output can be measured in terms of inductance and frequency.

Proximity Inductive Transducers

Mutual Inductance Type Proximity Transducer



Arrangement of Mutual Inductance Type Proximity Transducer

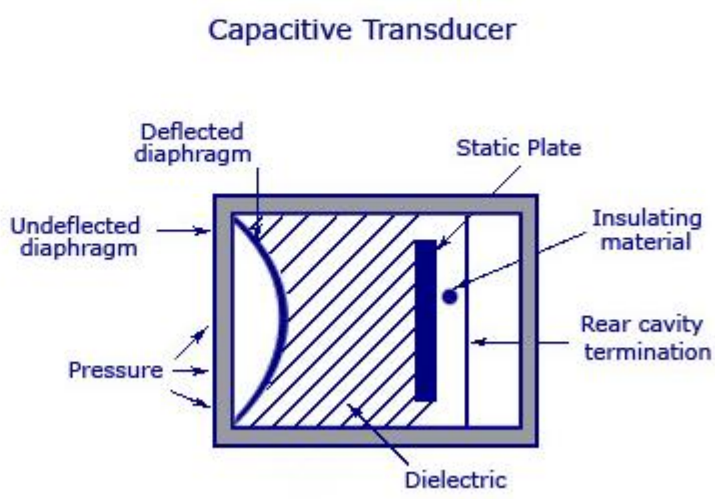
An ac source is given to the primary. This ac source excites the primary and a flux is produced. This flux is linked to the secondary coil and thus a voltage 'V' is induced. If the mutual inductance between the primary and secondary windings is represented by 'M' (Hertz) and the frequency of ac excitation is represented by 'w', then the voltage 'V' developed in secondary coil can be written as $V = MwI_p$. I_p – The current due to excitation in primary (Amperes).

As shown in the figure, a ferromagnetic displacement plate is placed very near to the windings. The current in the primary coil produces a magnetic flux that links with the secondary coil through the displacement plate. Thus, the movement of the ferromagnetic plate to the right causes a greater value of flux linkage between the two terminals. This in turn causes an increase in the resulting output voltage across the secondary terminal with a value of (T1-T2). This output is given to the input of the CRO or a recorder and the amount of displacement can be known in terms of voltage. A

Capacitive Transducers

To learn about a capacitive transducer, it is important to know the basics of a parallel plate capacitor. Being the simplest form of a capacitor, it has two parallel conducting plates that are separated to each other by a dielectric or insulator with a permittivity of E (for air). Other than paper, vacuum, and semi-conductor depletion region, the most commonly used dielectric is air.

Due to a potential difference across the conductors, an electric field develops across the insulator. This causes the positive charges to accumulate on one plate and the negative charges to accumulate on the other. The capacitor value is usually denoted by its capacitance, which is measured in Farads. It can be defined as the ratio of the electric charge on each conductor to the voltage difference between them.



As shown in the figure above, a capacitive transducer has a static plate and a deflected flexible diaphragm with a dielectric in between. When a force is exerted to the outer side of the diaphragm the distance between the diaphragm and the static plate changes. This produces a capacitance which is measured using an alternating current bridge or a tank circuit.