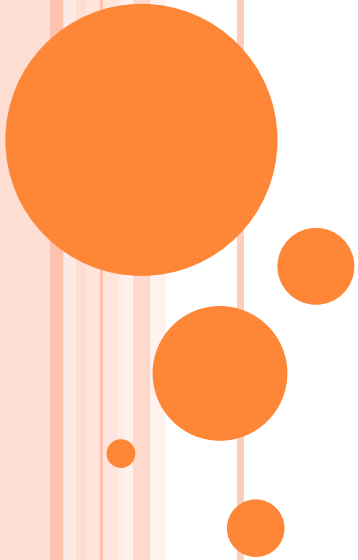
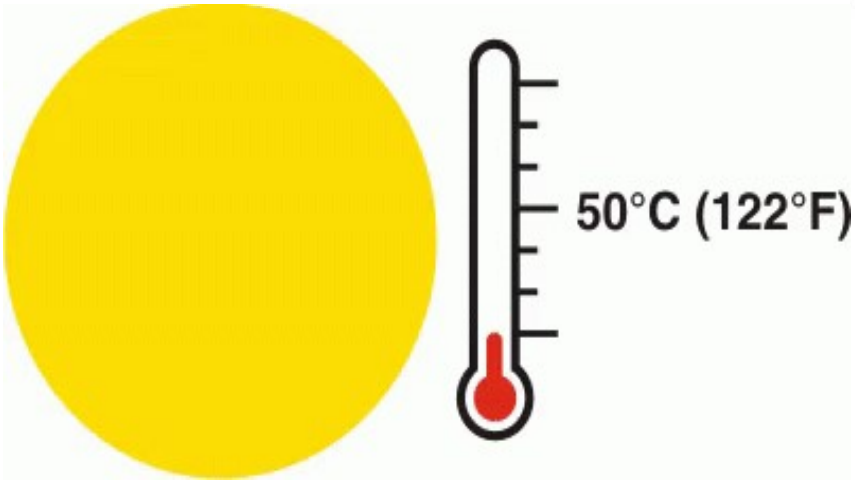
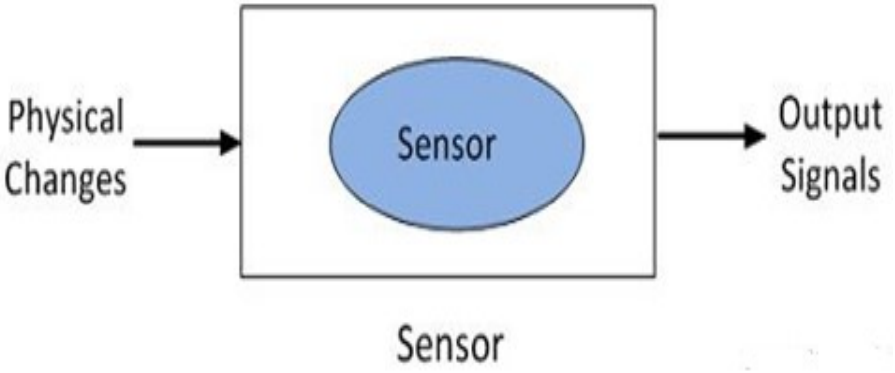
Sensor and Transducer



Sensor

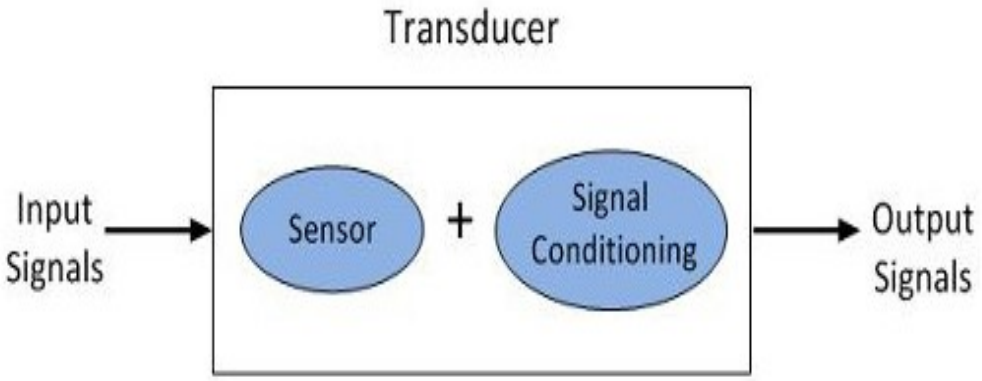
It is defined as an element that senses a variation in input energy to produce a variation in same form of energy.

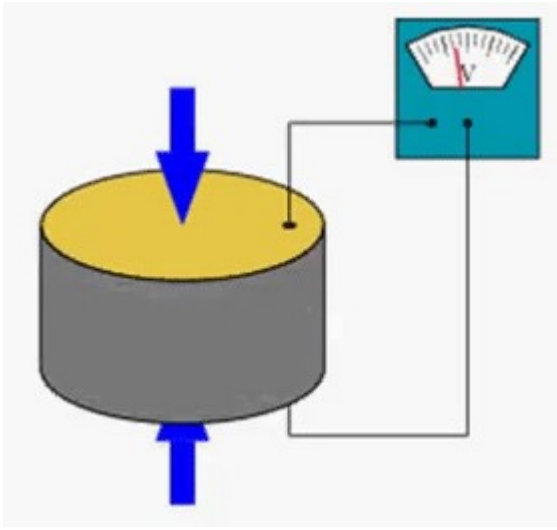




TRANSDUCERS

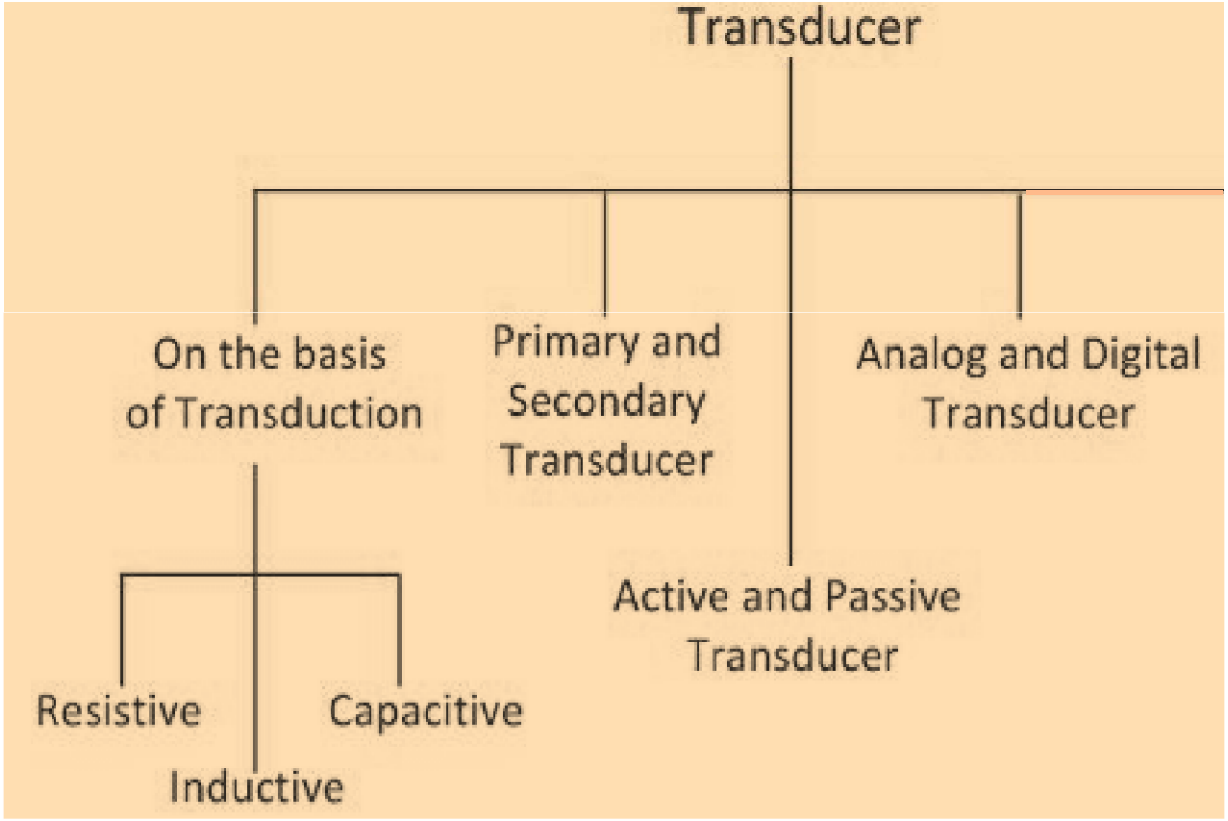
The transducer is a device that changes the physical attributes of the non-electrical signal into an electrical signal which is easily measurable. The process of energy conversion in the transducer is known as the transduction. The transduction is completed into two steps. First by sensing the signal and then strengthening it for further processing.



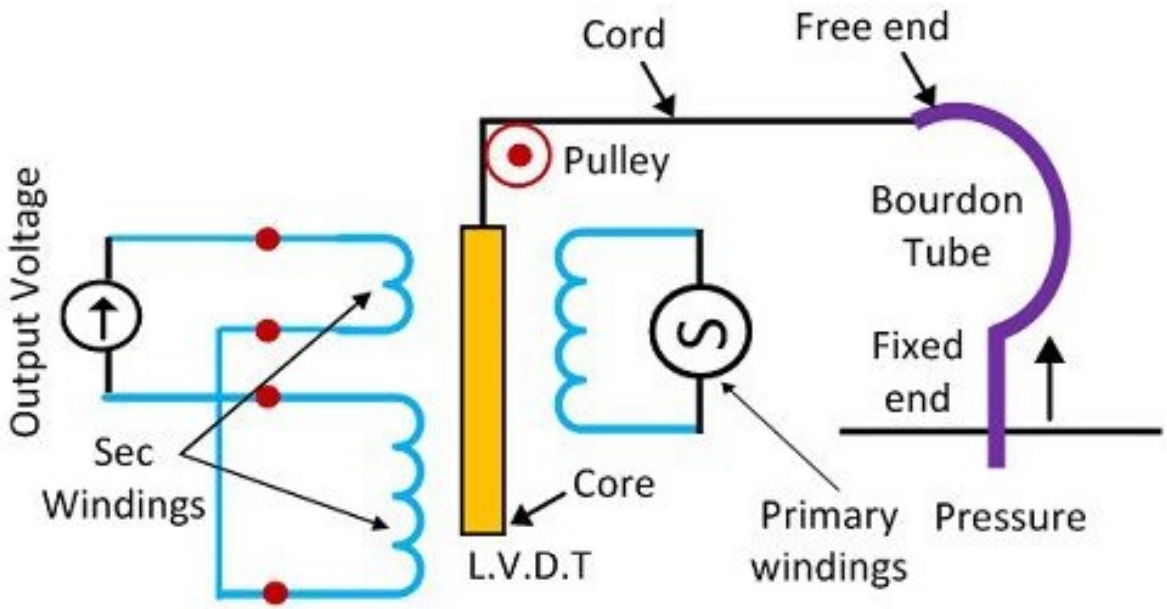


CLASSIFICATION OF TRANSDUCERS

The transducer is of many types, and they can be classified by the following criteria.



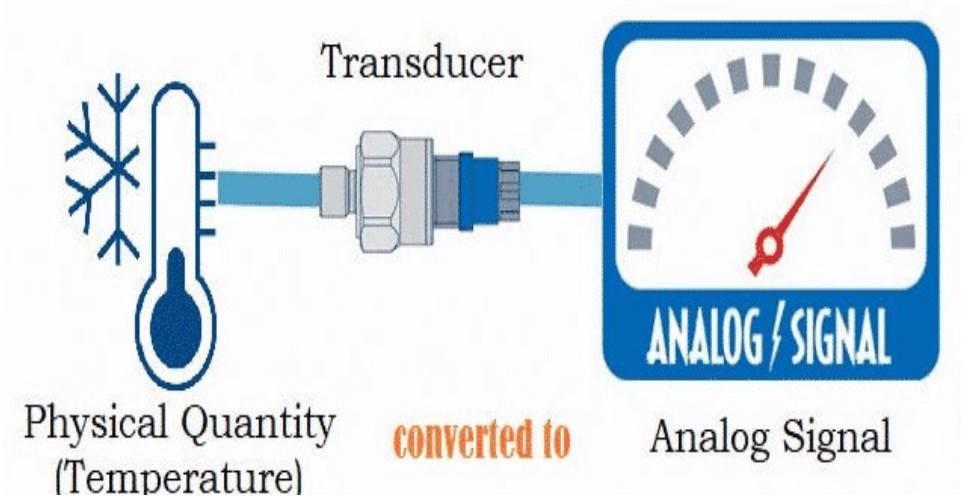
PRIMARY AND SECONDARY TRANSDUCER



The bourdon tube acts as a primary transducer. It detects the pressure and converts it into a displacement from its free end. The displacement of the free end moves the core of the linear variable displacement transformer. The movement of the core induces the output voltage which is directly proportional to the displacement of the tube free end. Thus, the two type of transduction occurs in the Bourdon's tube. First, the pressure is converted into a displacement and then it is converted into the voltage by the help of the L.V.D.T.

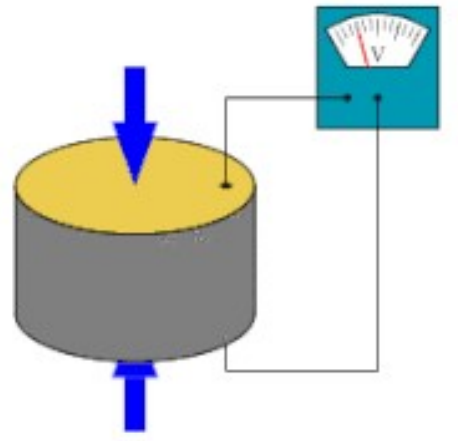
ANALOG AND DIGITAL TRANSDUCER

Analog transducers converts input signal into output signal, which is a continuous function of time such as THERMISTOR, strain gauge, LVDT, thermocouple etc. Digital transducers converts input signal into the output signal in the form of pulses e.g. it gives discrete output.

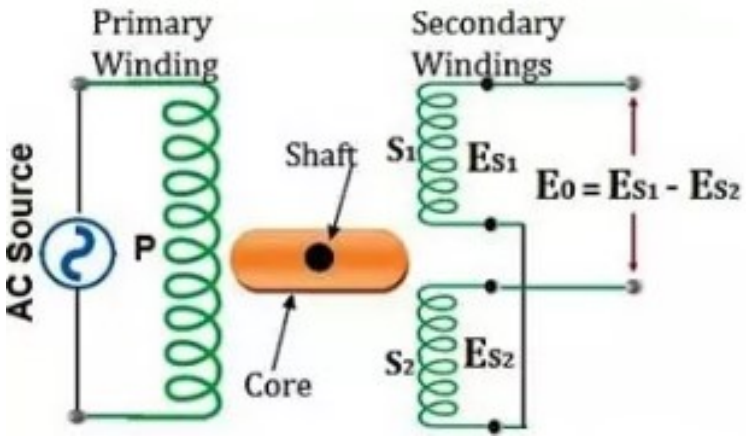


ACTIVE AND PASSIVE TRANSDUCERS

Active transducers are those which do not require any power source for their operation. They work on the energy conversion principle. They produce an electrical signal proportional to the input (physical quantity). **Transducers** which require an external power source for their operation is called as a **passive transducer**.



Active Transducer



Passive Transducer

PASSIVE TRANSDUCERS

Passive transducer is a transducer, which produces the variation in passive element. We will consider the passive elements like resistor, inductor and capacitor. Hence, we will get the following three passive transducers depending on the passive element that we choose.

- Resistive Transducer
- Inductive Transducer
- Capacitive Transducer

Resistive Transducer

- A passive transducer is said to be a resistive transducer, when it produces the variation (change) in resistance value. the following formula for resistance, R of a metal conductor.

$$R=\rho l/A$$

- Where,

  ρ is the resistivity of conductor

  l is the length of conductor

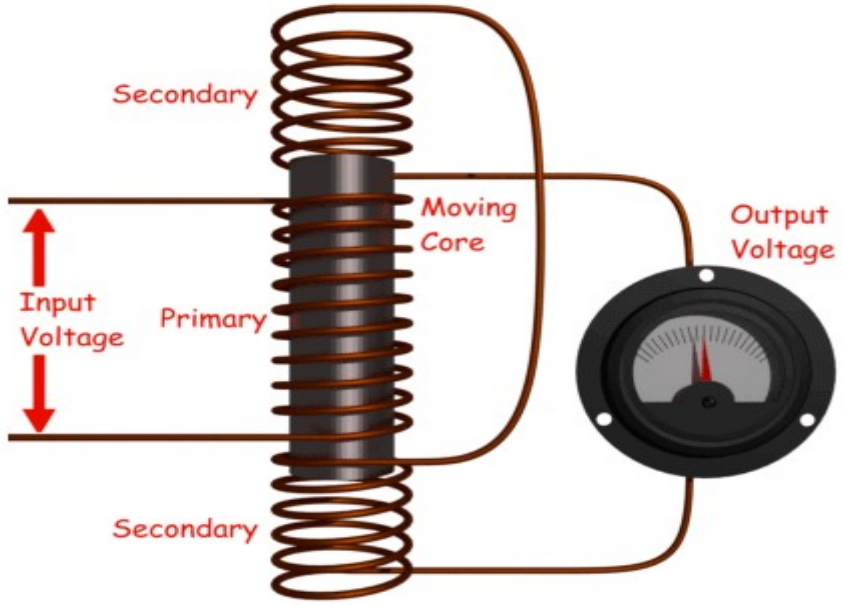
  A is the cross sectional area of the conductor

The resistance value depends on the three parameters ρ,l & A. So, we can make the resistive transducers based on the variation in one of the three parameters ρ,l & A.

Examples of resistive transducers are potentiometer, strain gauge, thermistor, RTD etc.

INDUCTIVE TRANSDUCERS

Inductive transducers work on the principle of inductance change due to any appreciable change in the quantity to be measured. For example, LVDT, a kind of inductive transducers, measures displacement in terms of voltage difference between its two secondary voltages. Secondary voltages are nothing but the result of induction due to the flux change in the secondary coil with the displacement of the iron bar.



Capacitive Transducer

A passive transducer is said to be a capacitive transducer, when it produces the variation (change) in capacitance value. the following formula for capacitance, C of a parallel plate capacitor.

$$C=\varepsilon A/d$$

Where,

ε is the permittivity or the dielectric constant

A is the effective area of two plates

d is the effective distance of two plates

The capacitance value depends on the three parameters ε, A & d. So, we can make the capacitive transducers based on the variation in one of the three parameters ε,A & d. Because, the variation in any one of those three parameters changes the capacitance value.

SELECTING A TRANSDUCER

1. Operating range
2. Sensitivity
3. Frequency response and resonant frequency
4. Environmental compatibility -
5. Minimum sensitivity measurand.
6. Accuracy
7. Usage and ruggedness
8. Electrical parameter

THANK YOU