

Fig. Measurement of pressure using Bourdon tube and L.V.D.T.
(Example of primary and secondary transducers)

Passive and active transducer

(i) Passive Transducer:

Passive transducers derive the power required for transduction from an auxiliary power source. They also derive part of the power required for conversion from the physical quantity under measurement. They are also known as "externally powered transducers". Typical examples of passive transducers are resistive, inductive and capacitive transducers.

(ii) Active Transducers:

Active transducers are those which do not require an auxiliary power source to produce their output. They are also known as self-generating type since they develop their own voltage or current output. The energy required for production of output signal is obtained from the physical quantity being measured.

Analog and Digital Transducers

The transducers can be classified on the basis of the output which may be a continuous function of time or the output may be in discrete steps.

1. Analog Transducer:

These transducers convert the input quantity into an analog output which is a continuous function of time. Thus a strain gauge, an L.V.D.T., a thermocouple or a thermistor may be called as "Analog Transducers" as they give an output which is a continuous function of time.

2. Digital Transducers:

These transducers convert the input quantity into an electrical output which is in the form of pulses.

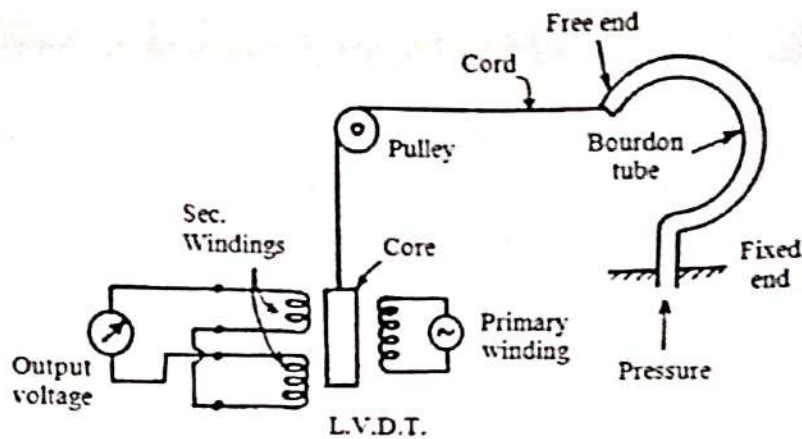


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Transducer and Inverse transducer

1. **Transducer:** A transducer can be broadly defined as a device which converts a non-electrical quantity into an electrical quantity.
2. **Inverse Transducers** An inverse transducer is defined as a device which converts an electrical quantity into a non-electrical quantity.

Types of Electrical Transducers

Electrical Parameter and class of transducer	Principle of Operation	Typical applications
Passive transducers (externally powered)		
Resistance		
Potentiometer device	Positioning of the slider by an external force varies the resistance in a potentiometer or a bridge circuit.	Pressure, displacement
Resistance strain gauge	Resistance of a wire or semiconductor is changed by elongation or compression due to externally applied stress	Force, torque, displacement
Pirani gauge or hot wire meter	Resistance of a heating element is varied by convection cooling of a stream of gas	Gas flow, gas pressure
Resistance thermometer	Resistance of pure metal wire with a large positive temperature coefficient of resistance varies with temperature	Temperature, radiant heat
Thermistor	Resistance of certain metal oxides with negative temperature coefficient of resistance varies with temperature.	Temperature flow.
Resistance hygrometer	Resistance of a conductive strip changes with moisture content.	Relative humidity
Photoconductive cell	Resistance of the cell as a circuit element varies with incident light	Photosensitive relay
Capacitance		
Variable capacitance pressure gauge	Distance between two parallel plates is varied by an externally applied force.	Displacement, pressure.
Capacitor microphone	Sound pressure varies the capacitance between a fixed plate and a movable diaphragm.	Speech, music, noise
Dielectric gauge	Variation in capacitance by change in the dielectric or dielectric constant.	Liquid level, thickness
Inductance		

Magnetic circuit transducer	Self inductance or mutual inductance of a.c. excited coil is varied by change in the magnetic circuit	Pressure, displacement
Reluctance pick up	Reluctance of the magnetic circuits is varied by changing the position of the iron core of coil.	Pressure, displacement, vibration, position.
Differential transformer	The differential voltage of two secondary windings of a transformer is varied by positioning the magnetic core through an externally applied force.	Pressure, displacement, position, force.
Eddy current gauge	Inductance of a coil is varied by the proximity of an eddy current plate.	Displacement, thickness.
Magnetostriction gauge	Magnetic properties are varied by pressure and stress.	Force, pressure, sound.
<i>Voltage and Current</i>		
Hall effect pickup	A potential difference is generated across a semiconductor plate (germanium) when magnetic flux interacts with an applied current.	Magnetic flux, current power
Ionization chamber	Electron flow induced by ionization of gas due to radio-active radiation.	Particle counting radiation.
Photo emissive cell	Electron emission due to incident radiation upon photo emissive surface.	Light and radiation.
Photomultiplier tube	Secondary electron emission due to incident radiation on photosensitive cathode.	Light and radiation, photosensitive relays.
<i>Self – generating transducers (no external power)</i>		
Thermocouple and thermopile	An emf is generated across the junction of two dissimilar metals or semiconductors when that junction is heated.	Temperature, heat flow, radiation.
Moving coil generator	Motion of a coil in a magnetic field generates a voltage.	Velocity, vibration.
Piezoelectric pickup	Motion of a coil in a magnetic field generates a voltage	Velocity, vibrations
Piezoelectric pickup	An emf is generated when an external force is applied to certain crystalline materials, such as quartz.	Sound acceleration, vibrations, pressure changes.
Photovoltaic	A voltage is generated in a semiconductor junction device when radiant energy stimulates the cell.	Light meter, solar cell.