



University of Asia Pacific

## **TRANSDUCERS**

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# WHAT IS TRANSDUCER

A transducer is an electronic device that converts energy from one form to another (mechanical, visual, acoustic, electrical, thermal, chemical).

Example:

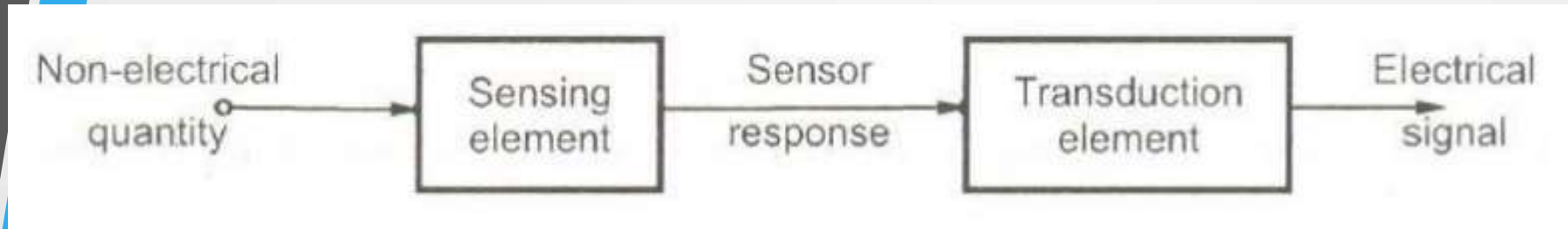
- Microphones,
- Loudspeakers,
- Thermometers

## TRANSDUCER

- **Sensors** (transducer which converts a measurable quantity (sound pressure level, optical intensity, magnetic field, etc) to an electrical voltage or an electrical current).
- **Actuators** (transducer which converts an electrical signal into another form of energy, such as sound, pressure, light, mechanical movement).

# Transducers specifications

- Range
- Span
- Error
- Accuracy
- Sensitivity
- Nonlinearity
- Resolution
- Stability
- Dead band/time
- Response time



**Sensing Element:** The physical quantity or its rate of change is sensed and responded to by this part of the transducer.

**Transduction Element:** The output of the sensing element is passed on to the transduction element. This element is responsible for converting the non-electrical signal into its proportional electrical signal.

# ELECTRICAL TRANSDUCERS

- The electrical transducers is one which converts the non-electrical quantity into the equivalent electrical quantity.
- Non-electrical quantity such as force, displacement, stress, temperature.
- Electrical quantity such as current, voltage

# CLASSIFICATION OF TRANSDUCERS

- On the basis of transduction form used.
- As primary and secondary transducers.
- As passive and active transducers.
- As analog and digital transducers.
- As transducers and inverse transducers



# ON THE BASIS OF TRANSDUCTION FORM USED

- Resistive Transducers.
  - Photoconductive Cell
  - Thermistor
- Capacitive Transducers.
  - Capacitor microphone
  - Dielectric gauge
- Inductive Transducers.
  - Magnetic circuit transducer
- Voltage and current Generating Transducers.
  - Hall effect pickup

# Passive and Active Transducers

- If transducers derive the power required for transduction from an external power source, then this kind of transducer is known as a passive transducer

Example:

(1) LDR

(2) FSR

- When there is no need for any external source then these types of transducers are Active transducers

Example :

(1) Thermocouple

(2) Piezoelectric crystal

# Inverse Transducers

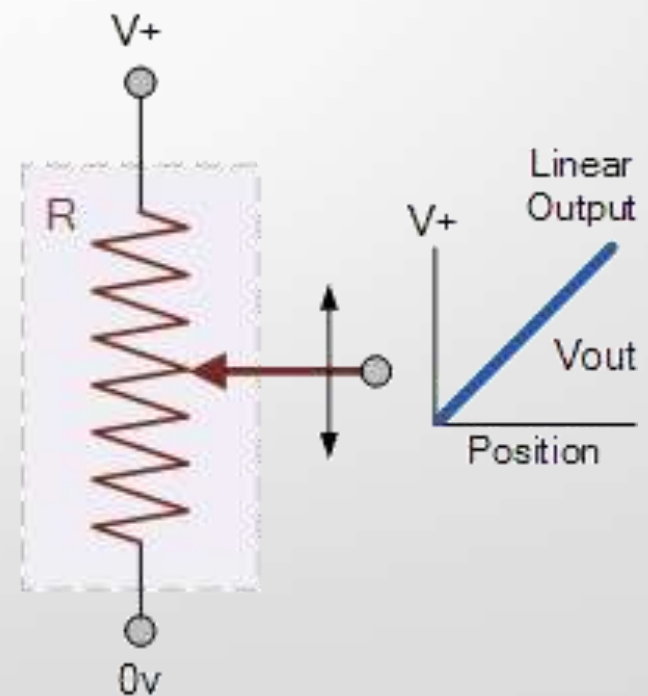
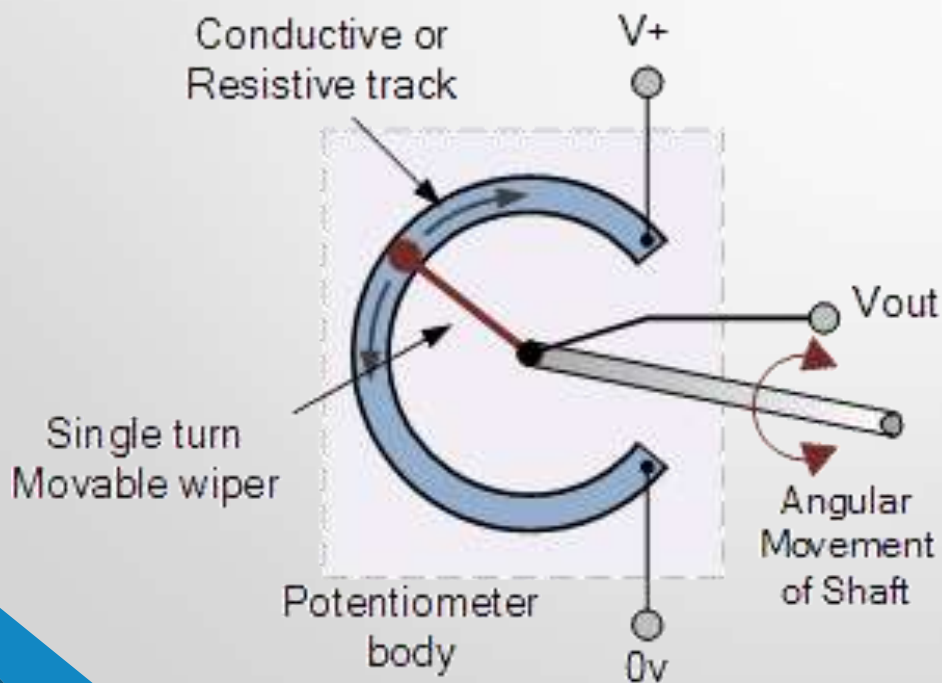
These type of transducers convert a electrical quantity into non-electrical quantity

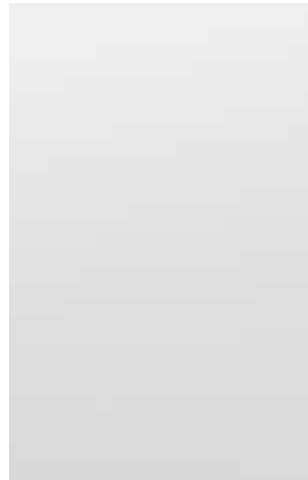
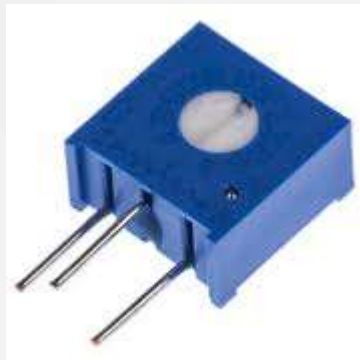
Example

- Piezoelectric crystal
- Analog ammeter
- Voltmeter

# Potentiometer

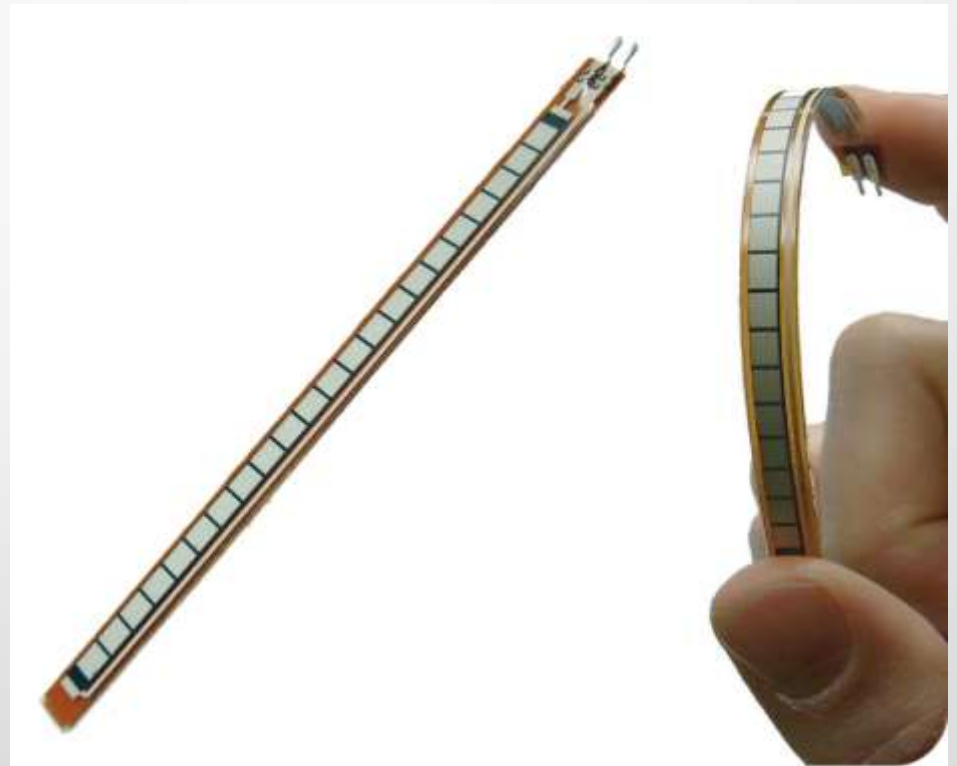
- Angular and
- Linear Position



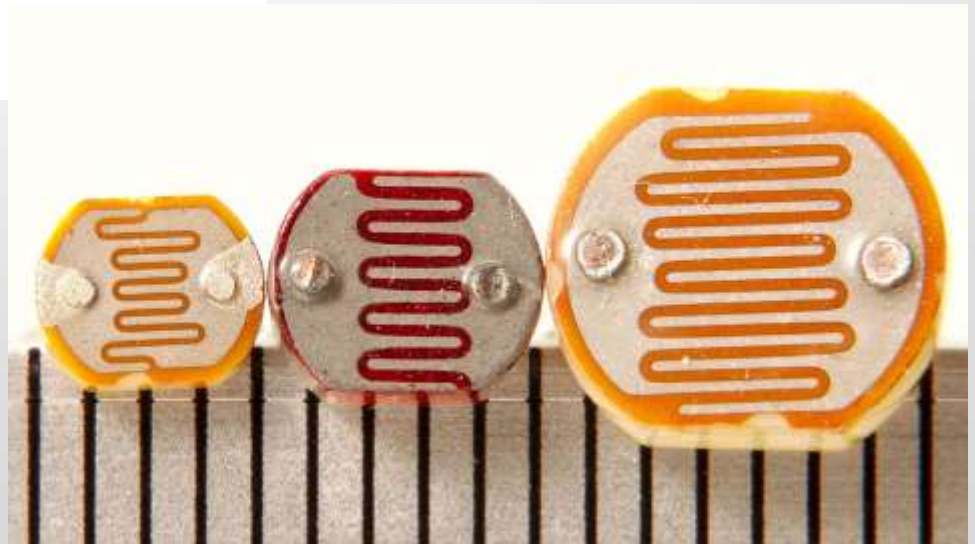
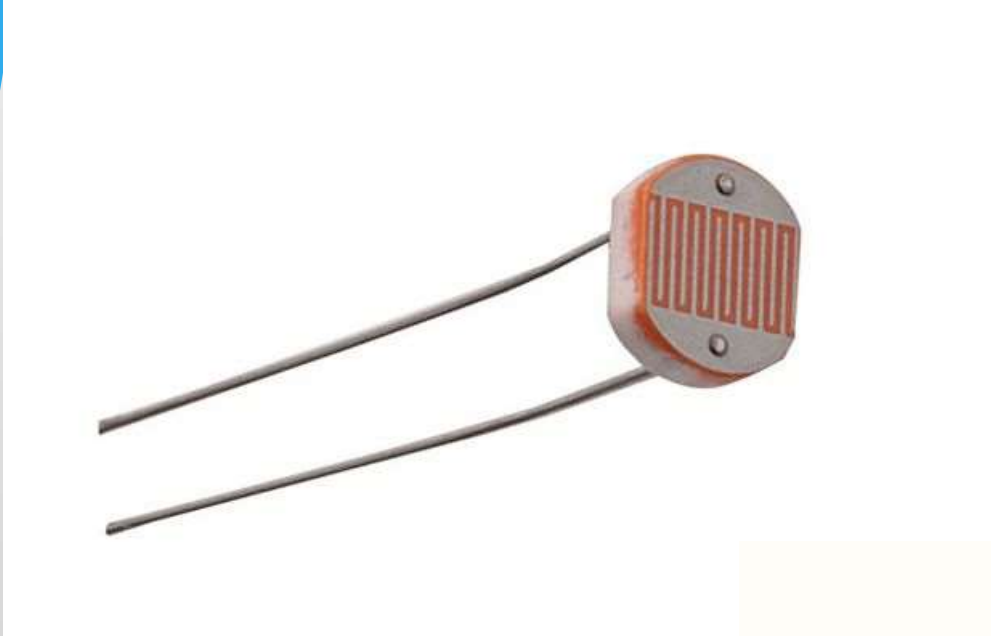


# Strain Gauge

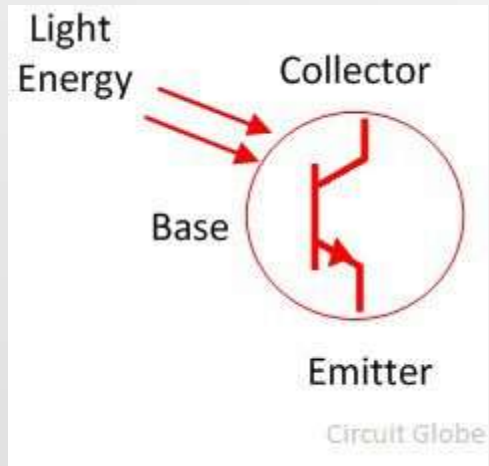
Convert physical deformation in the shape to resistance.



# Photoresistor

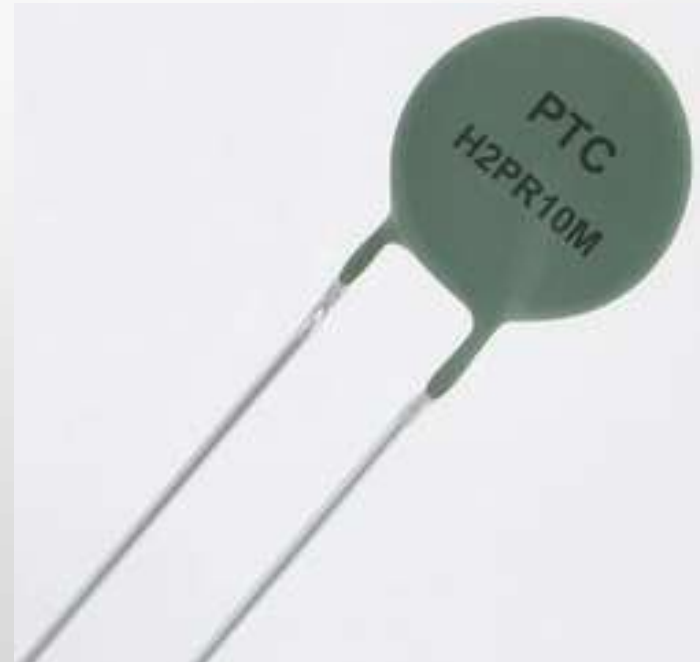


# Phototransistor





# Thermistors



# Thermoelectric sensors

- ✓ **Seebeck effect** (When two dissimilar metal wires are connected at one end forming a junction, and that junction is heated, a voltage is generated across the junction (see the figure below).
- ✓ **Peltier effect** (electrical current would produce heating or cooling at the junction of two dissimilar metals)

# Thermocouple



$$e_{AB} = \text{SEEBECK VOLTAGE}$$

*Thermocouples operate due to the Seebeck Effect*

# Peltier plate



# SELECTION CRITERIA OF THE TRANSDUCERS

- Operating principle
- Sensitivity
- Operating range
- Accuracy
- Errors
- Environmental capability
- Insensitive to unwanted Signal
- Stability

# APPLICATION

- Audio/video equipment
- Pressure indication
- Measurement of displacement
- Alarms



Thank You