

TRANSDUCERS

Identify transducer principles

AET 8

PURPOSE

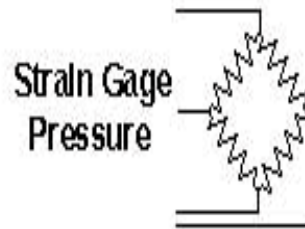
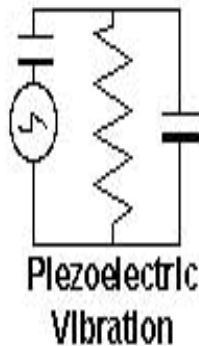
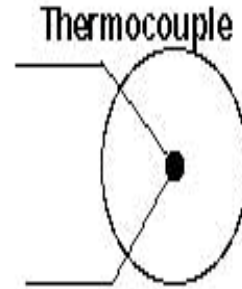
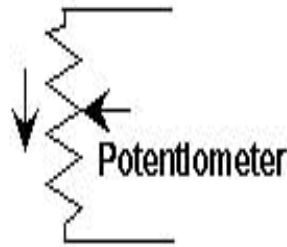
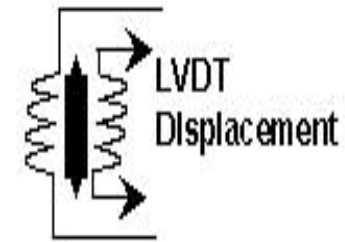
Transducers convert energy from one form to another by sensing a change in the measurand.

TRANSDUCERS

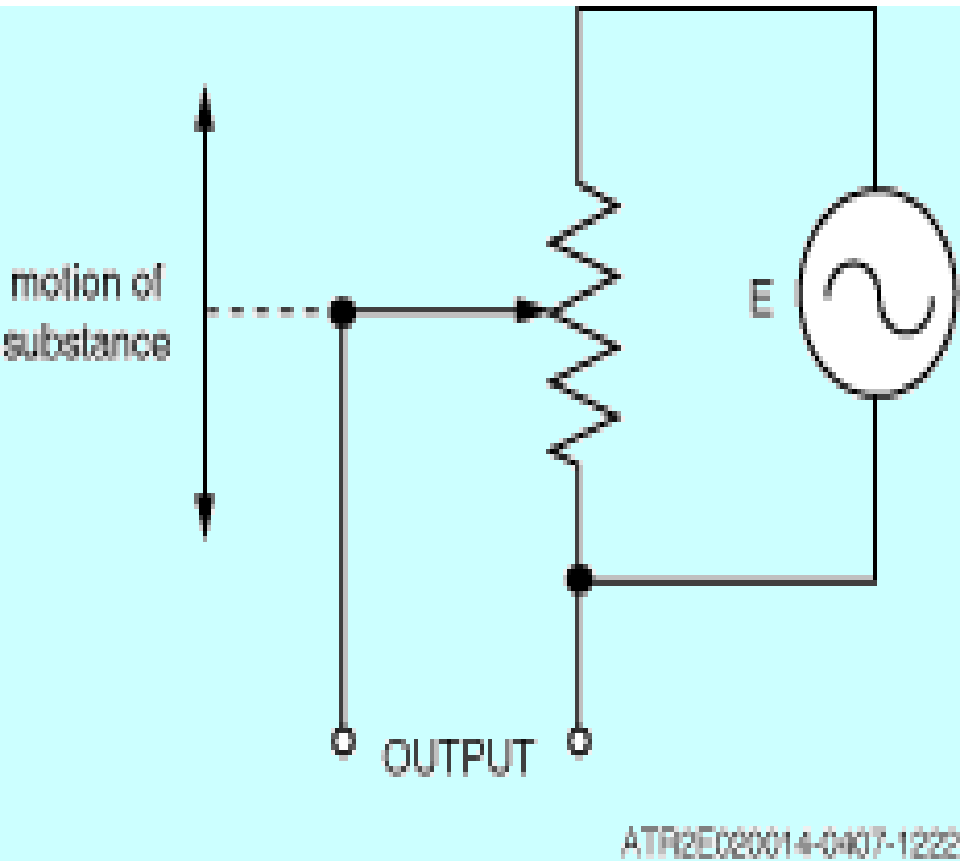
Converts energy from one form to another.

Are designed so a change in the level of a quantity being monitored, called a measurand, causes some type of change in the output.

Sensor Products

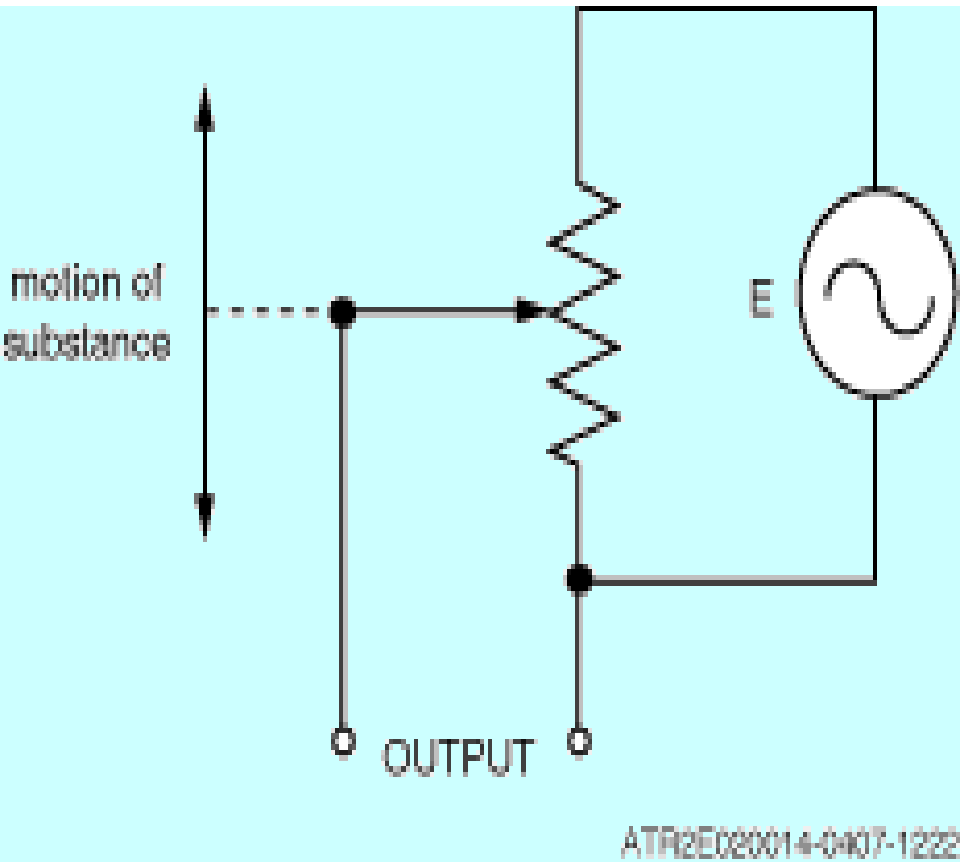


Potentiometer



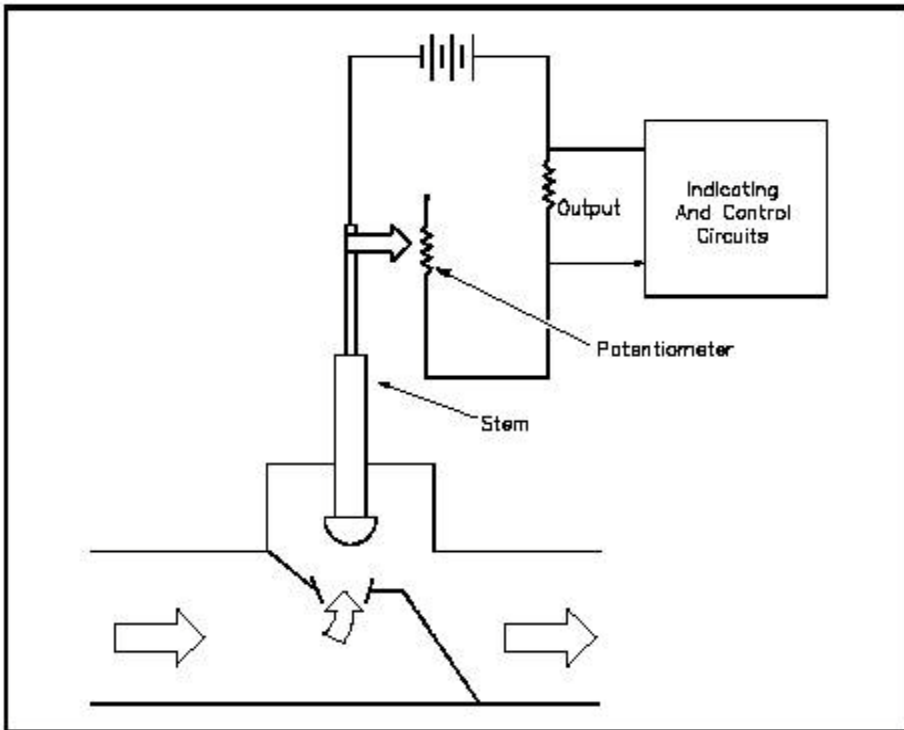
When the measureand has physical properties that make very large scale movements, the most appropriate transducer to use is a potentiometer type.

Potentiometer



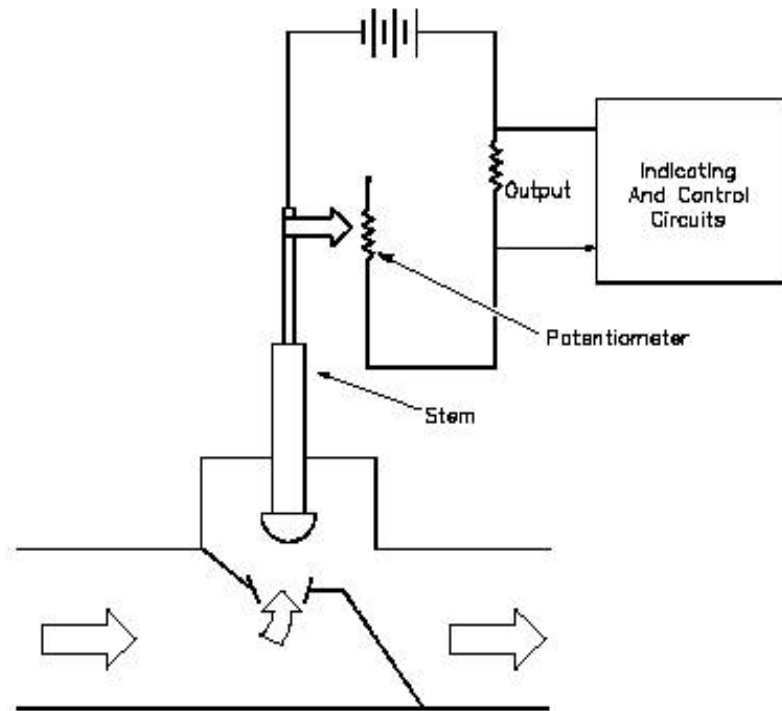
Movement of the monitored substance is linked directly to the wiper arm of the pot. The main disadvantage of this transducer is the *finite torque* required to change the resistance.

Potentiometer



Potentiometer valve position indicators provide an accurate indication of position throughout the travel of a valve or control rod. As the extension moves, resistance in the circuit changes, changing current flow.

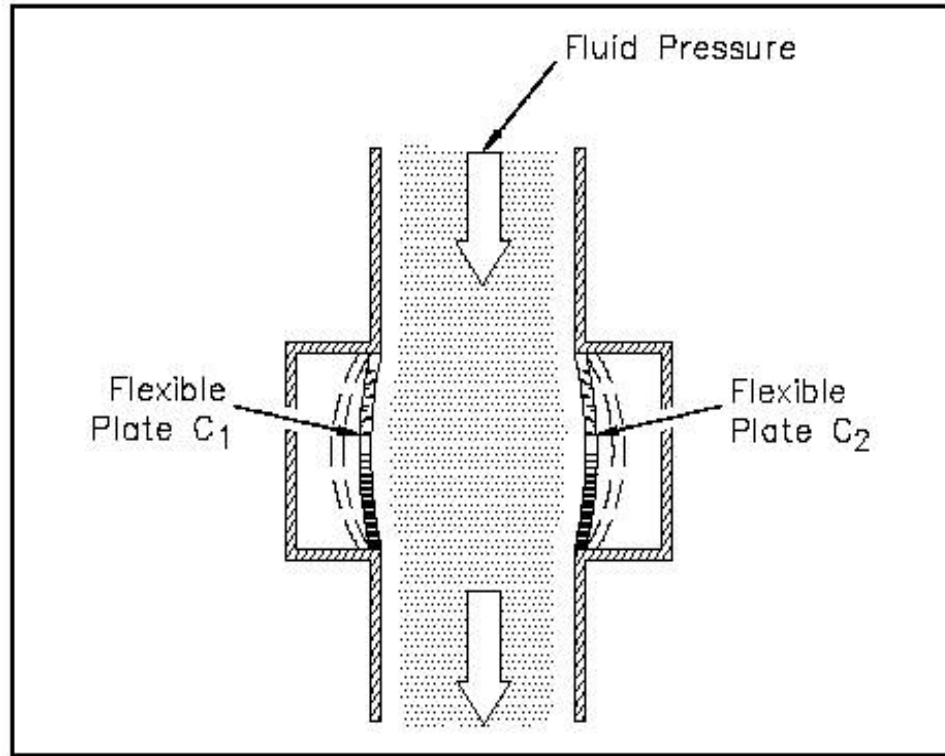
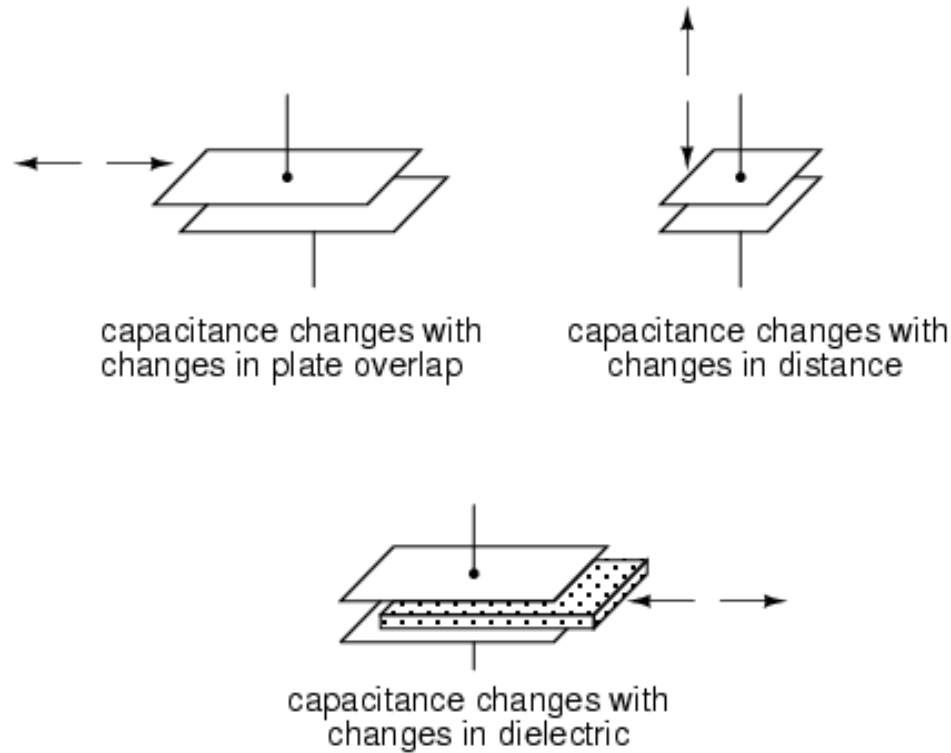
Potentiometer



The amount of current is proportional to the valve position.

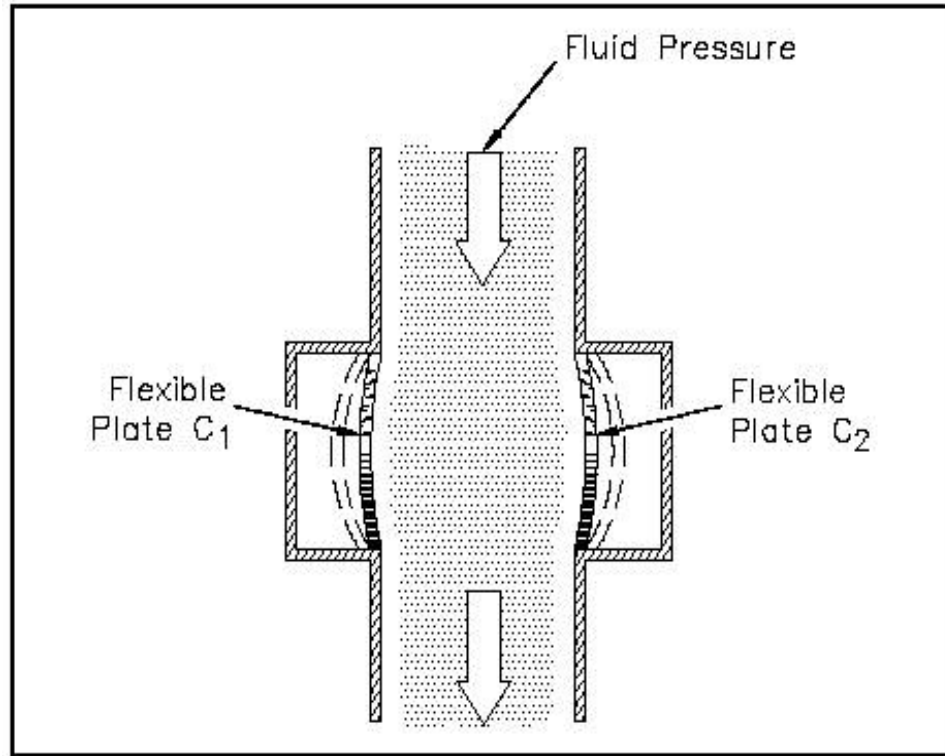
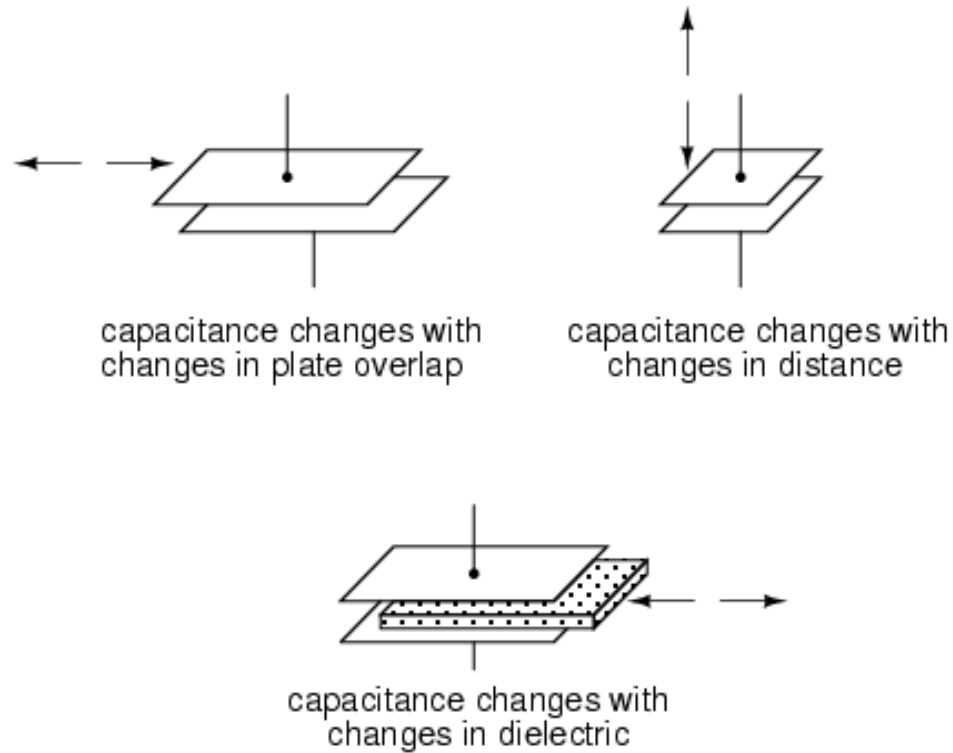
One disadvantage is it takes a *finite torque* level to move the arm.

VARIABLE CAPACITOR



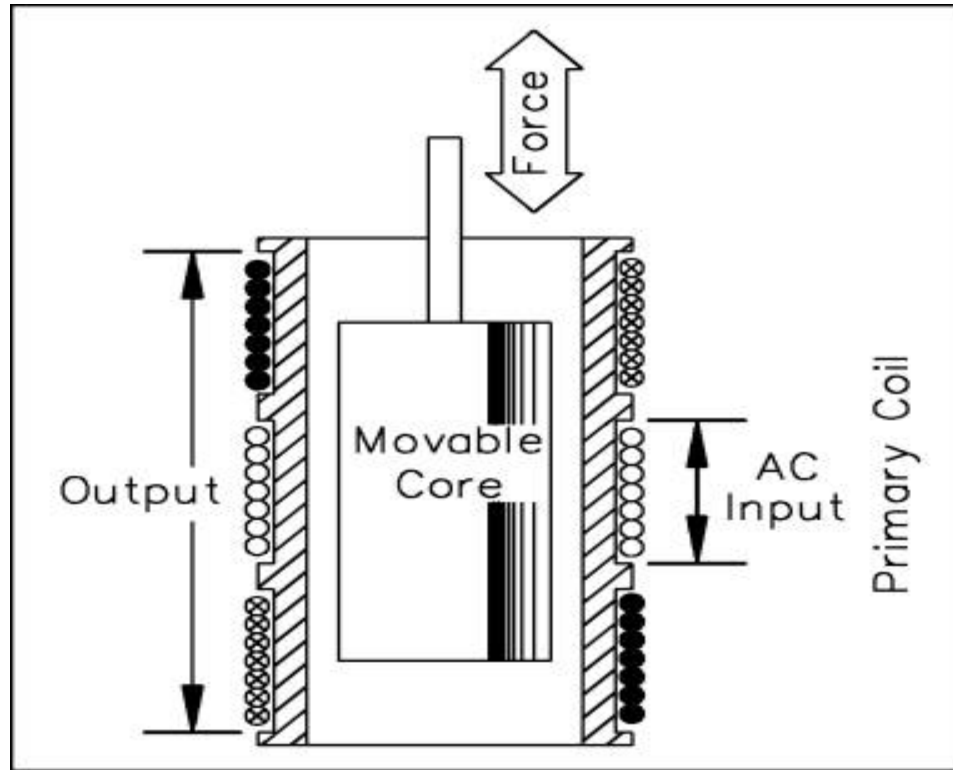
Capacitance is determined by Plate Area, Dielectric Properties, and Distance between the plates. As pressure increases, the plates move farther apart, changing the capacitance. $C = KA/d$.

VARIABLE CAPACITOR



This change is proportional to the change in pressure. By changing any of the capacitance factors, of course capacitance will change , varying the output voltage or current.

DIFERENTIAL TRANSFORMER

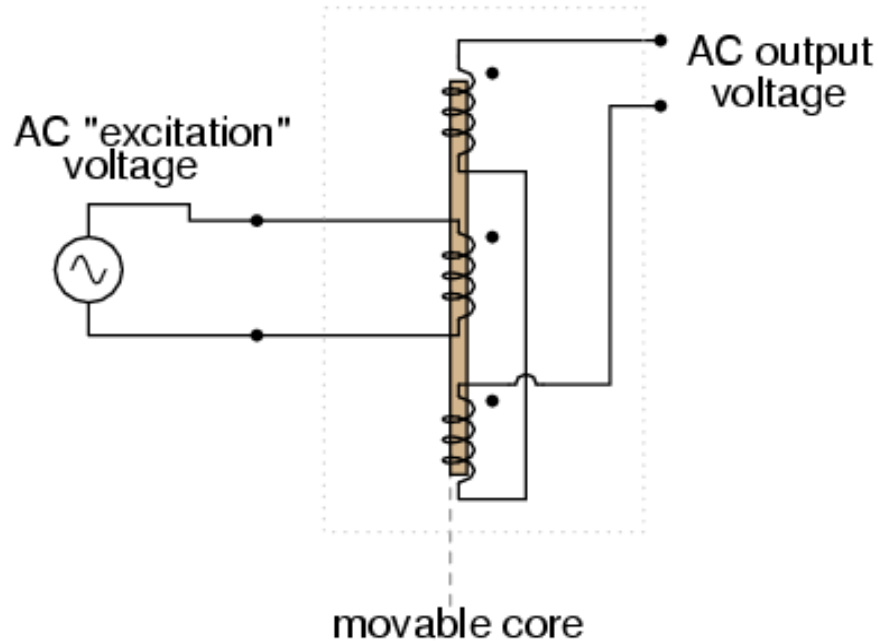


Utilizes 2 coils wound on a single tube.

The primary coil is wound around the center of the tube.

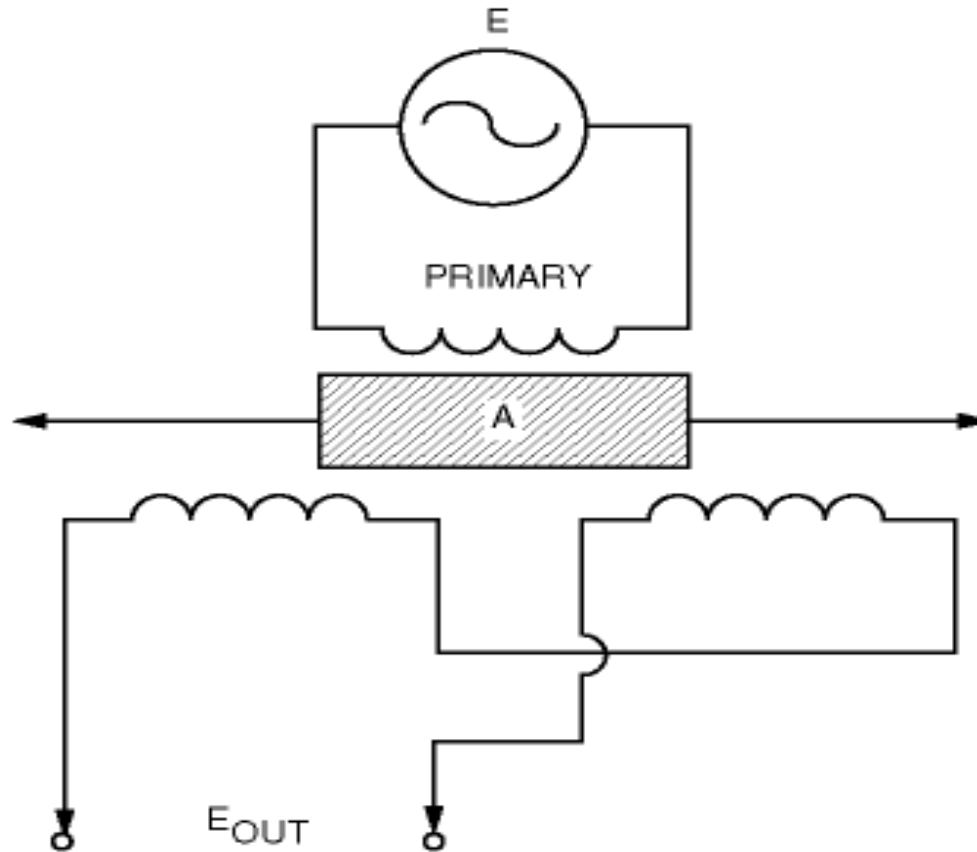
The secondary is divided; one half around each end.

DIFERENTIAL TRANSFORMER



Each end is wound in the opposite direction which causes the voltages induced to oppose each other. Because of their construction, these transducers are frequently used for pressure monitoring.

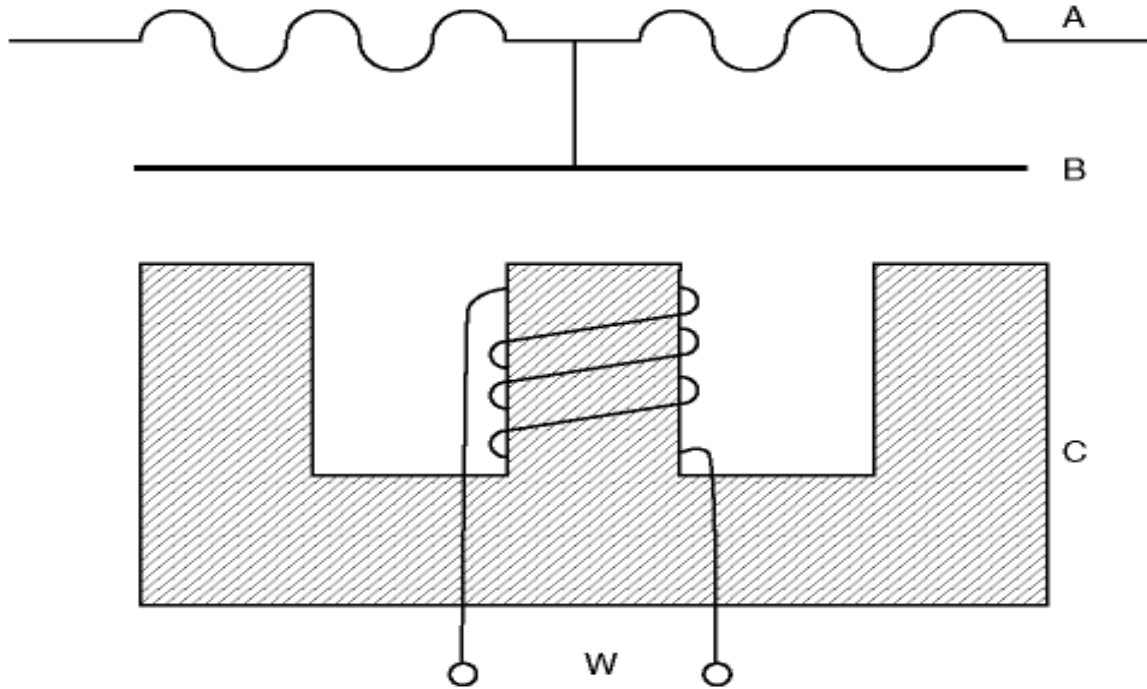
DIFERENTIAL TRANSFORMER



AQR30020010-6311-1704

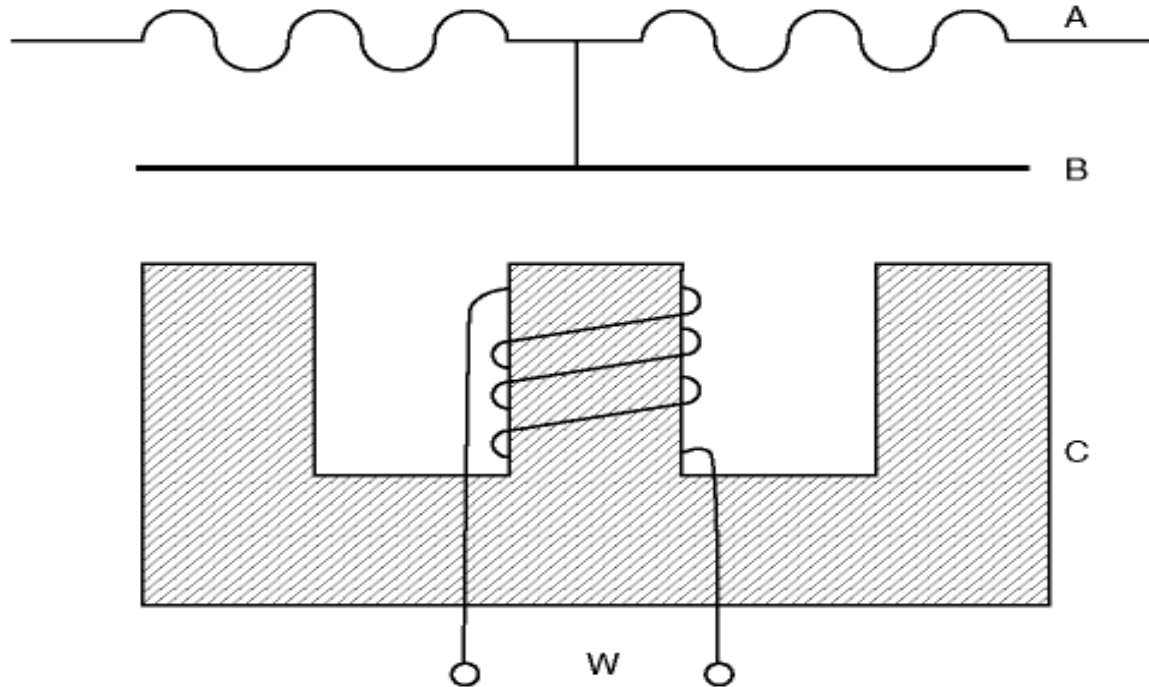
Any movement of the core material will change the output of the secondary.

Variable inductor



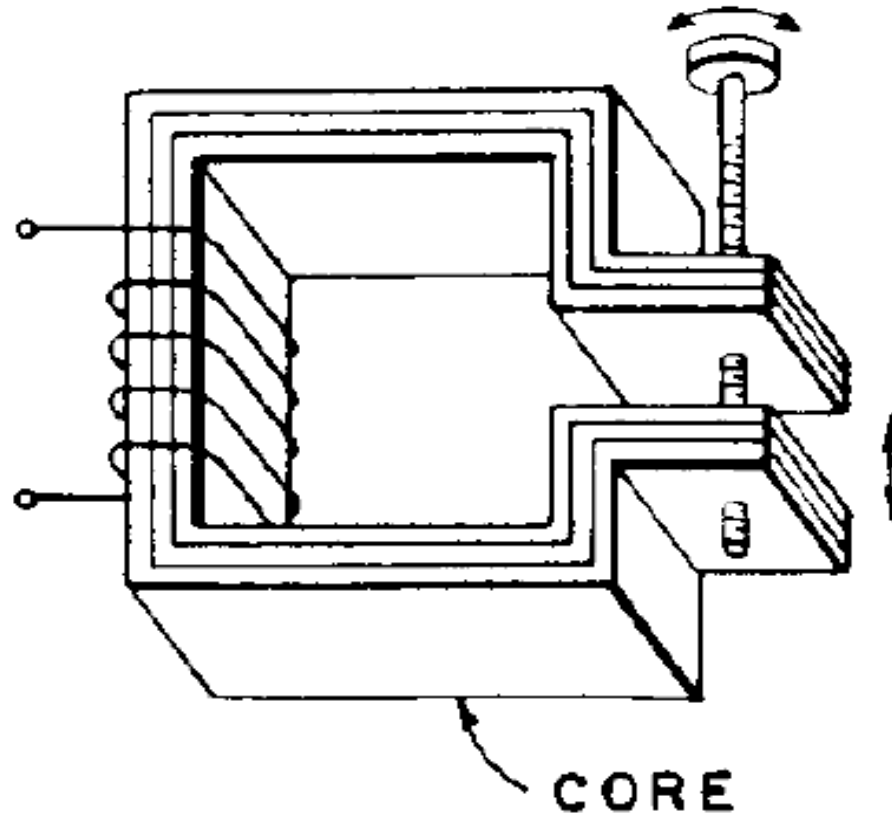
Again, because of their construction the variable inductor is frequently used for pressure monitoring.

Variable inductor



The plate –B, within a storage tank would be free to move with any change in tank pressure, this would change the flux density of the inductors and change the electrical output of the circuit.

Variable Inductor



Inductance variation is attained by changing the physical shape of either the coil or core or both. Either would change the flux density of the inductor.

PHOTOVOLTAIC

Enables sunlight to be transformed directly into electrical power. Certain materials release electrons when exposed to light energy in the infrared, visible or ultraviolet frequency range.

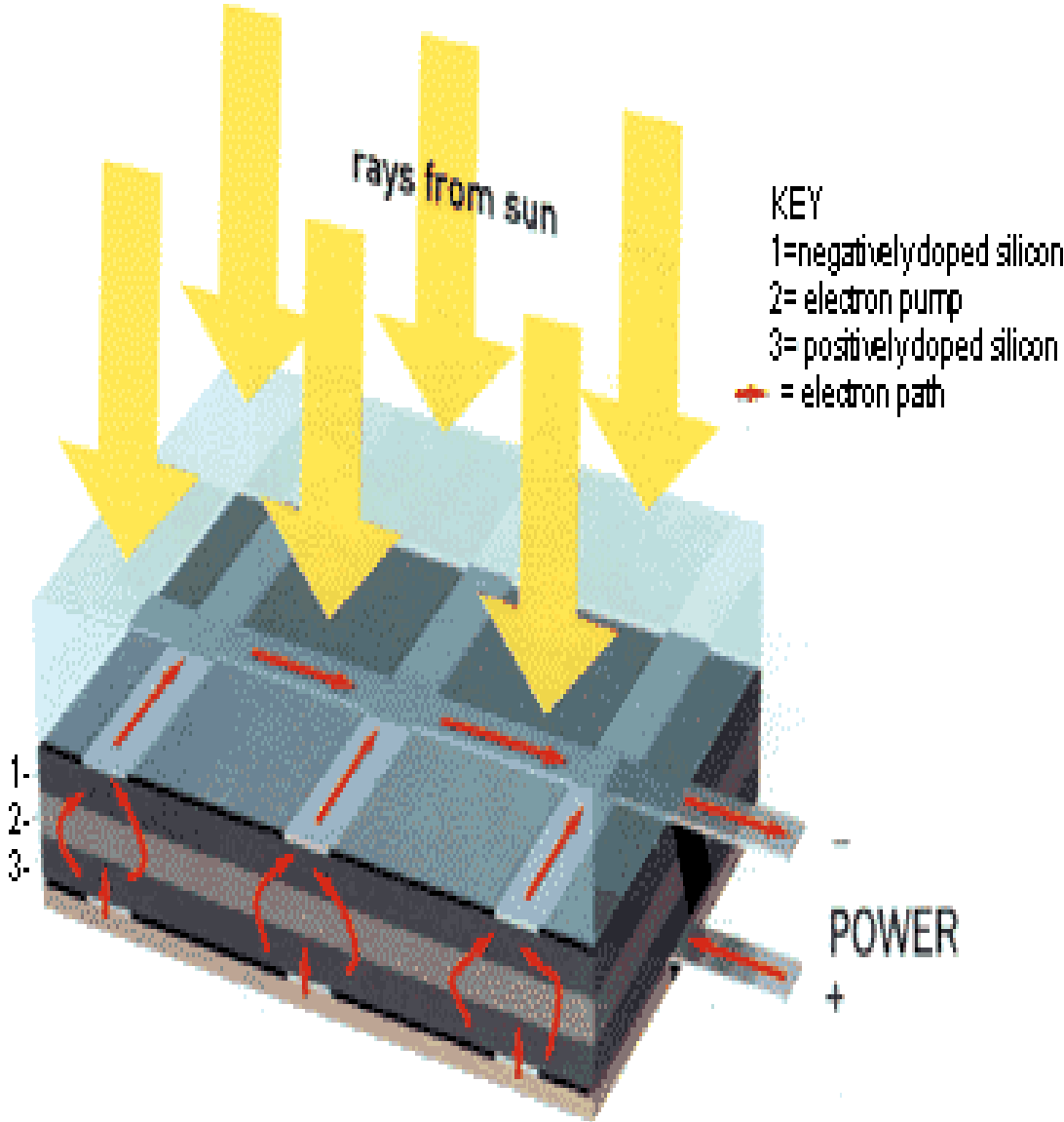


Figure 1.2: How a solar cell produces electricity

PHOTOVOLTAIC

Cells are made up of P and N type material. Common applications are garage door openers, safety circuits, and entrance buzzers.

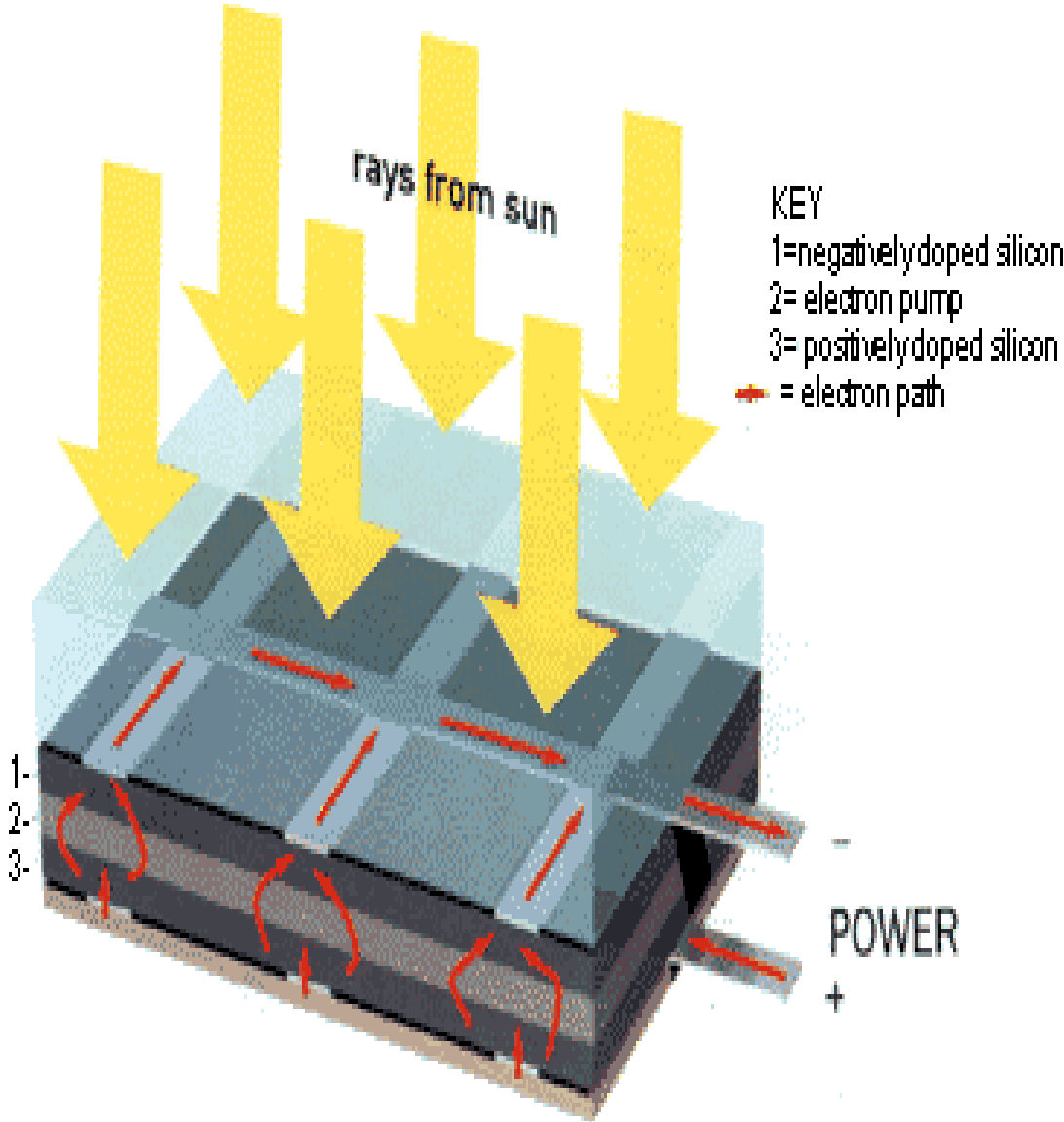


Figure 1.2: How a solar cell produces electricity

PHOTOVOLTAIC

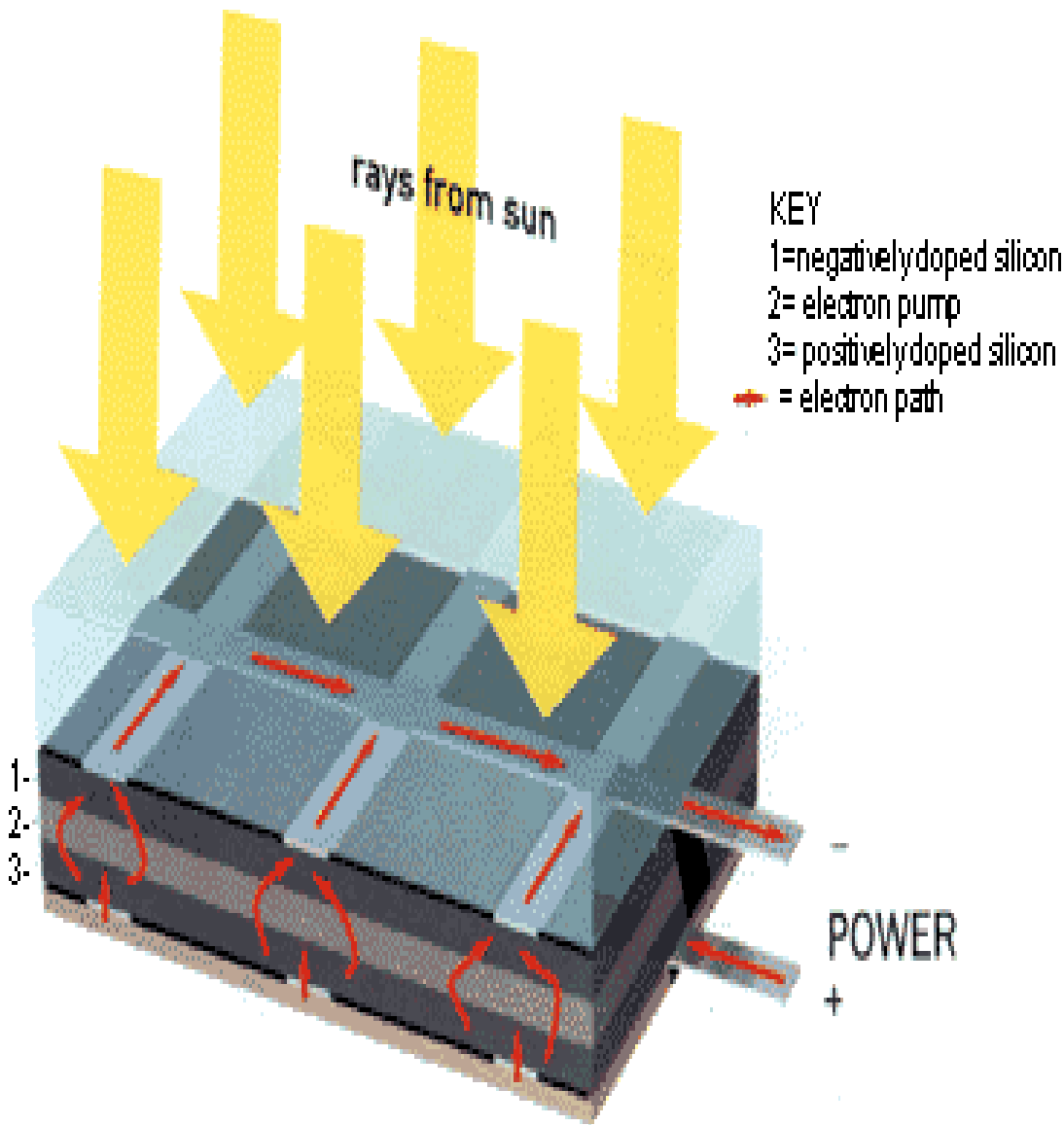


Figure 1.2: How a solar cell produces electricity

Semiconductors are “doped” in order to create excess electrons and holes. N-type has excess electrons and P-type has excess holes. Combining these creates an electric field which contributes to electron flow.

PHOTOVOLTAIC

Output voltage from this type of transducer is directly proportional to the area exposed to the light.

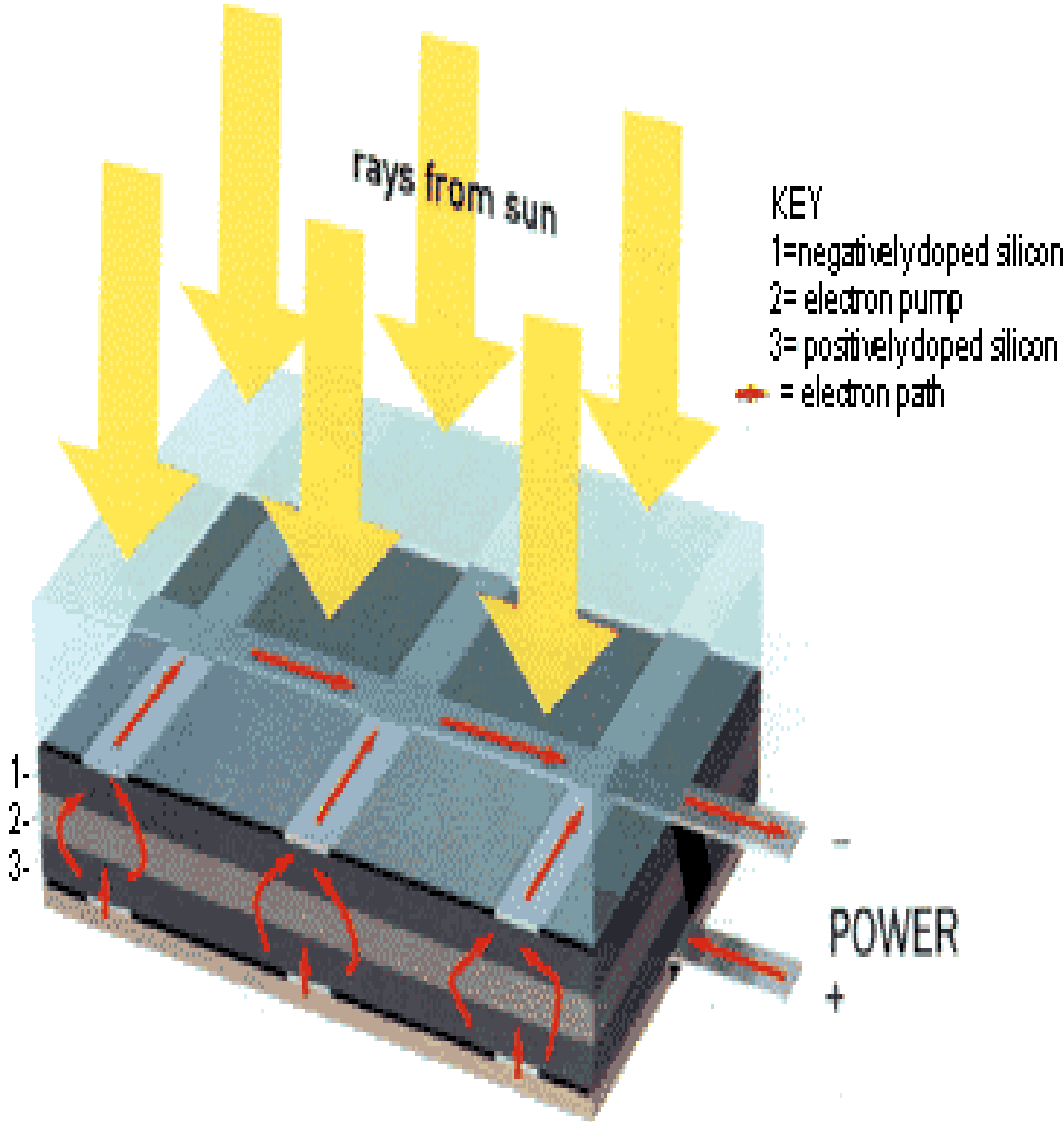
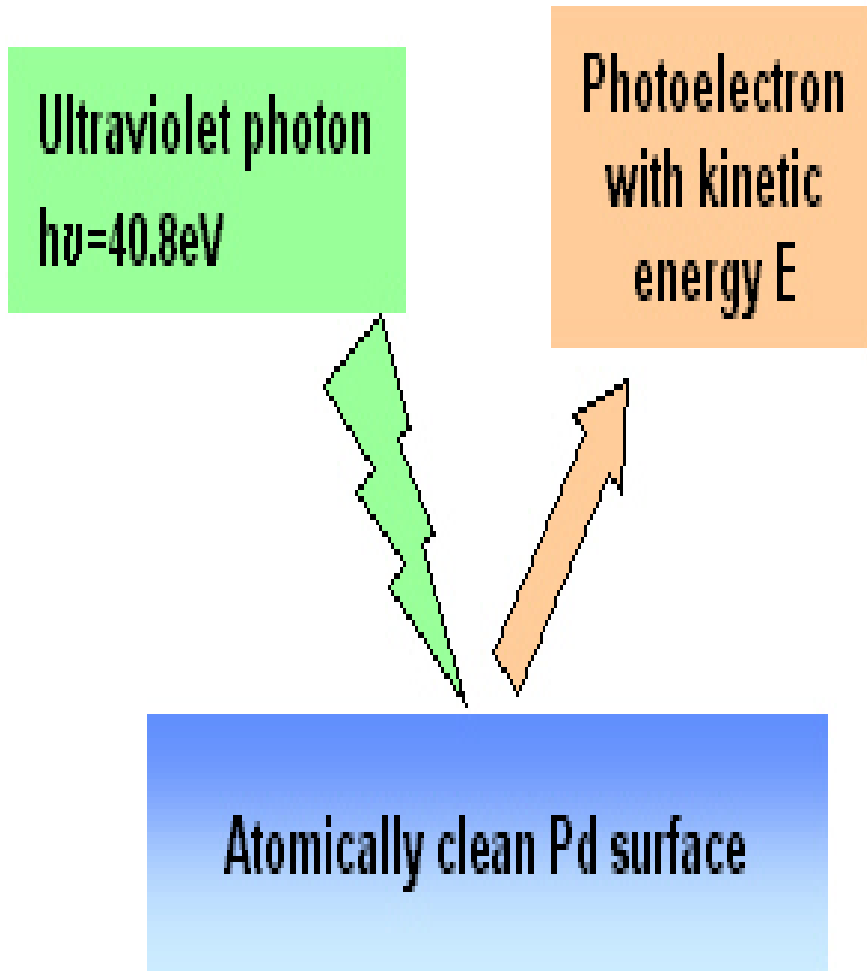


Figure 1.2: How a solar cell produces electricity

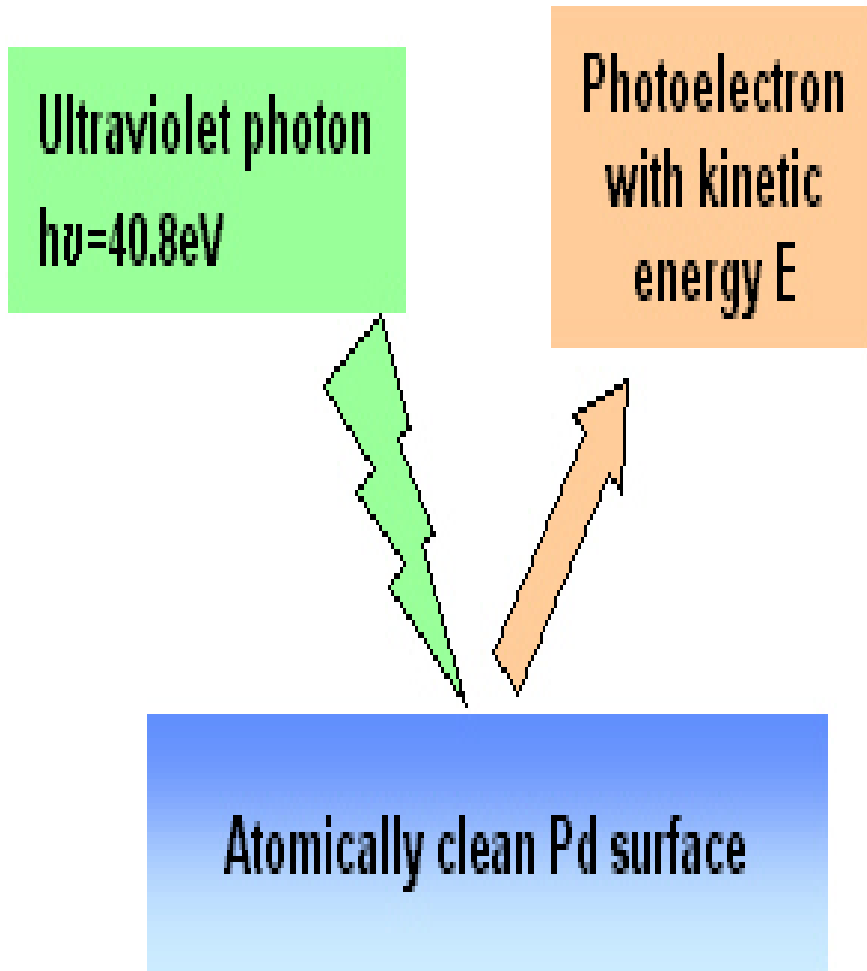
Photoemissive



The ejection of electrons from the surface of a metal plate when light falls on it.

The amount of current is proportional to the intensity of light.

Photoemissive

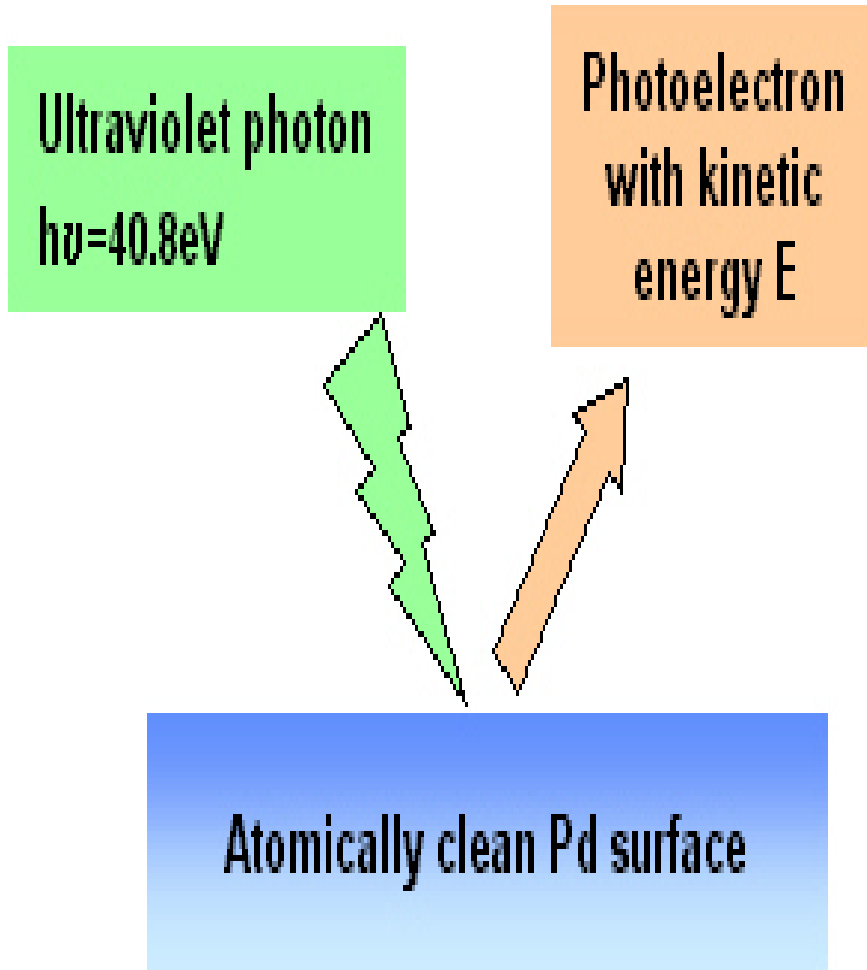


When an electron is ejected it has kinetic energy which can be measured by placing it in an electric field.

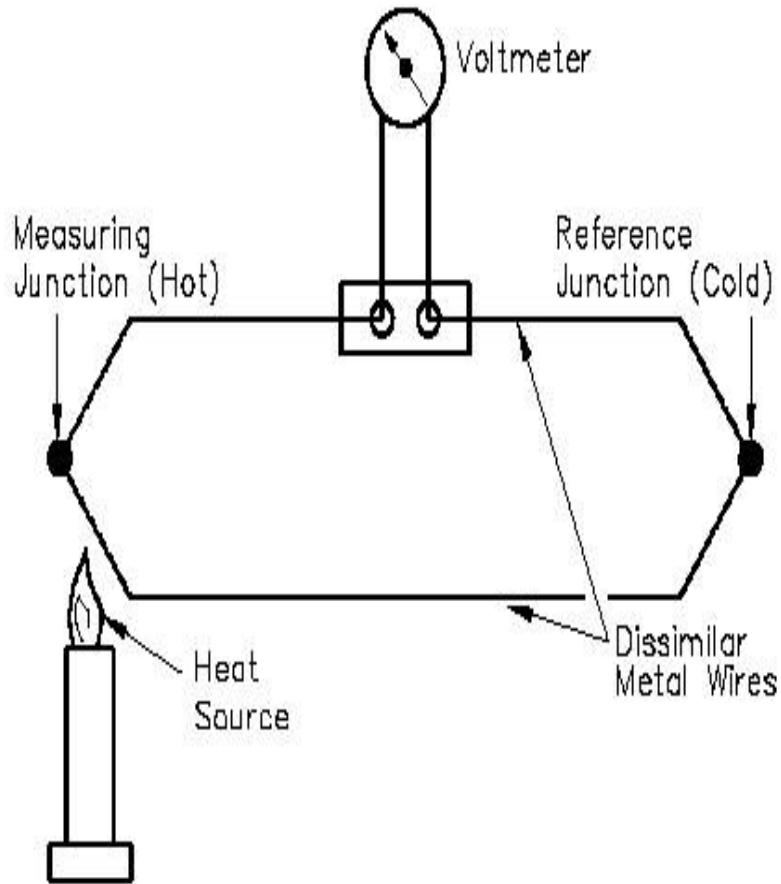
You can measure the voltage difference required to reduce its velocity to zero.

Photoemissive

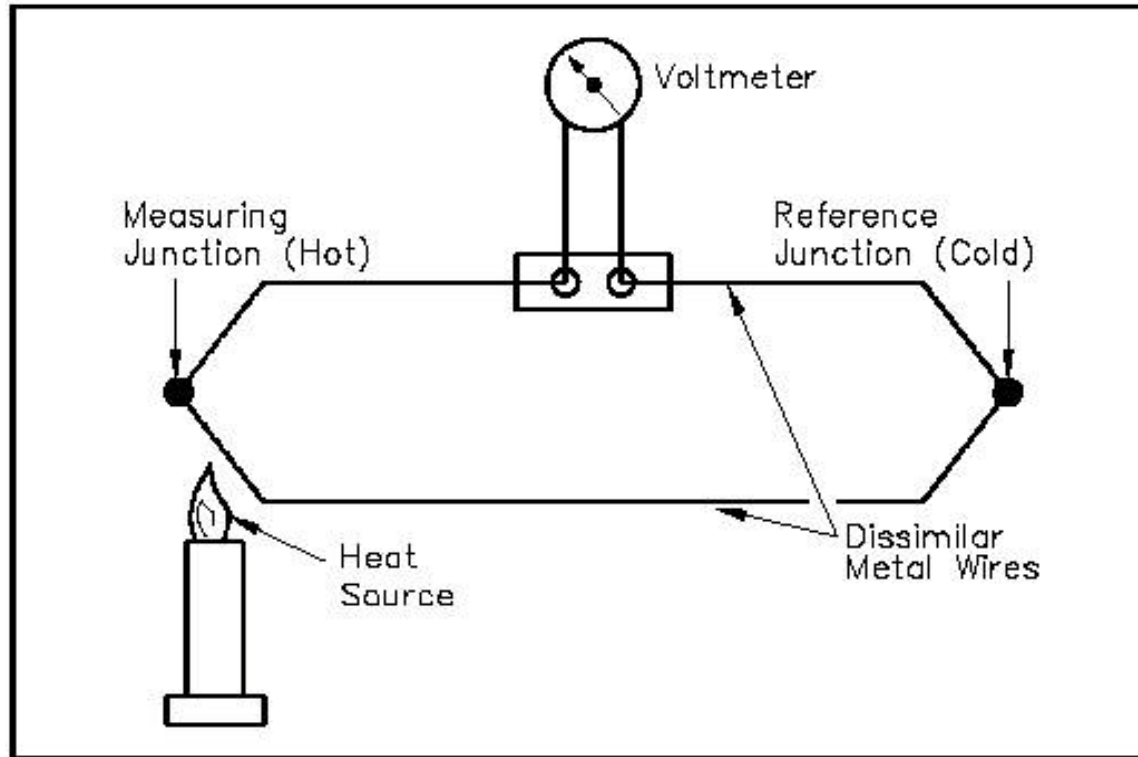
Kinetic energy depends on the light's frequency.



Thermocouple

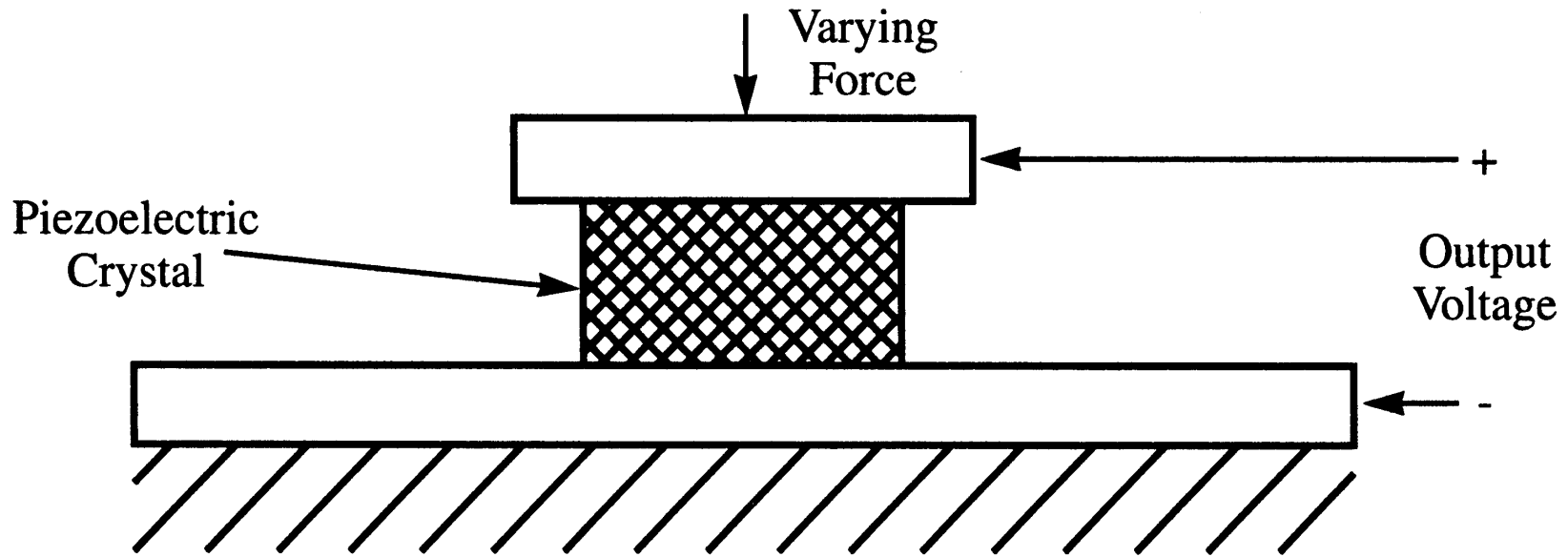


Constructed of 2 dissimilar metal wires joined at one end. They cause an electric current to flow when subjected to changes in temperature. The amount of current depends on the temperature difference between the hot and cold ends.



This device is a transducer classified as Thermoelectric. When the bonded bimetallic strip (2 metal types) is heated a voltage is produced proportionately to the heat applied. Used in heat alarms on aircraft.

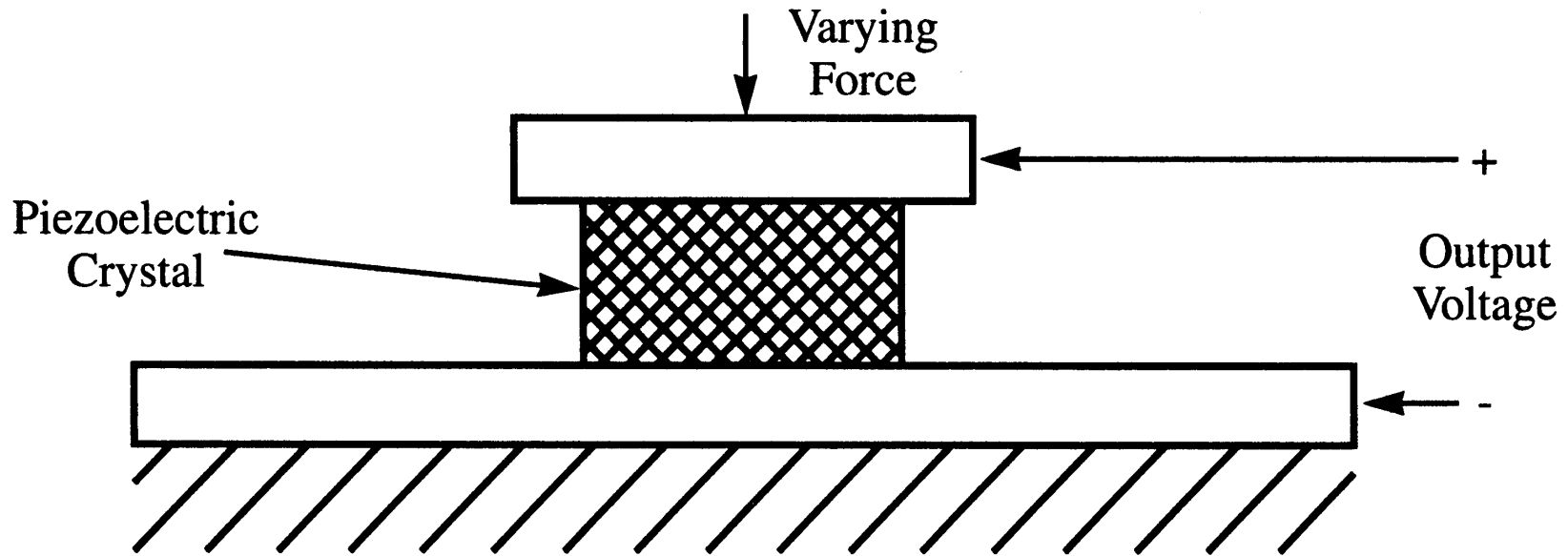
Piezoelectric



Used in the measurement of force, pressure and acceleration.

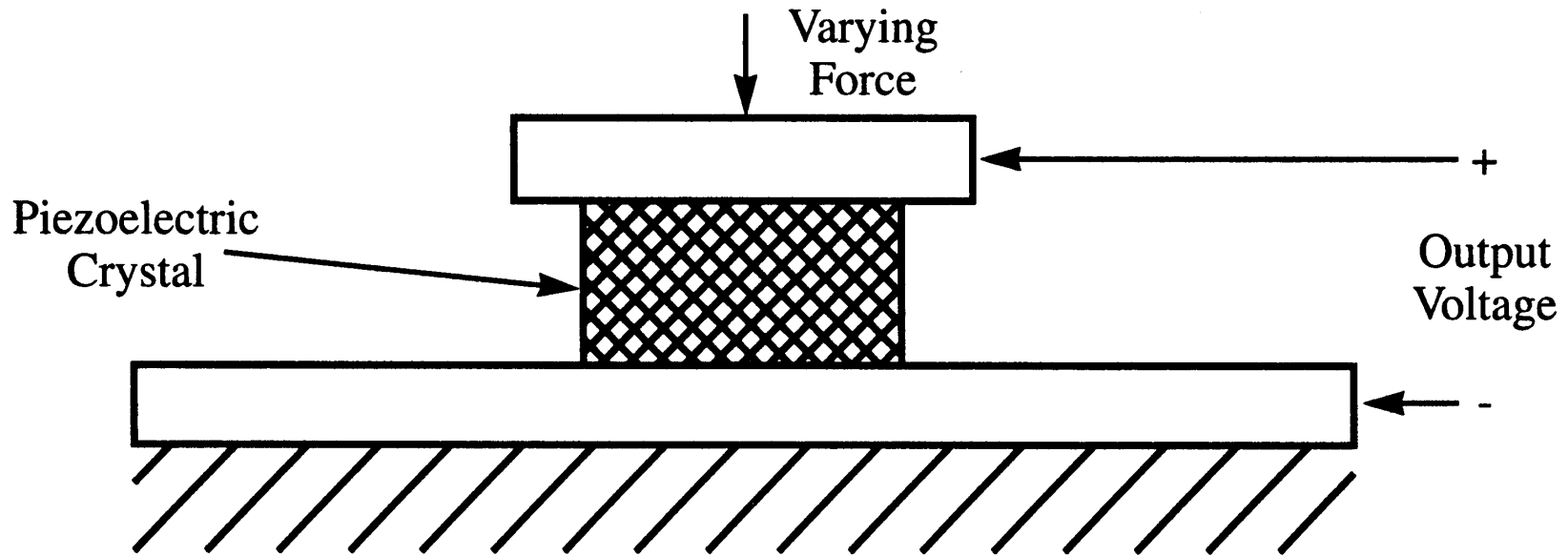
When the crystal is slightly deformed, electrical charges appear on its surface.

Piezoelectric



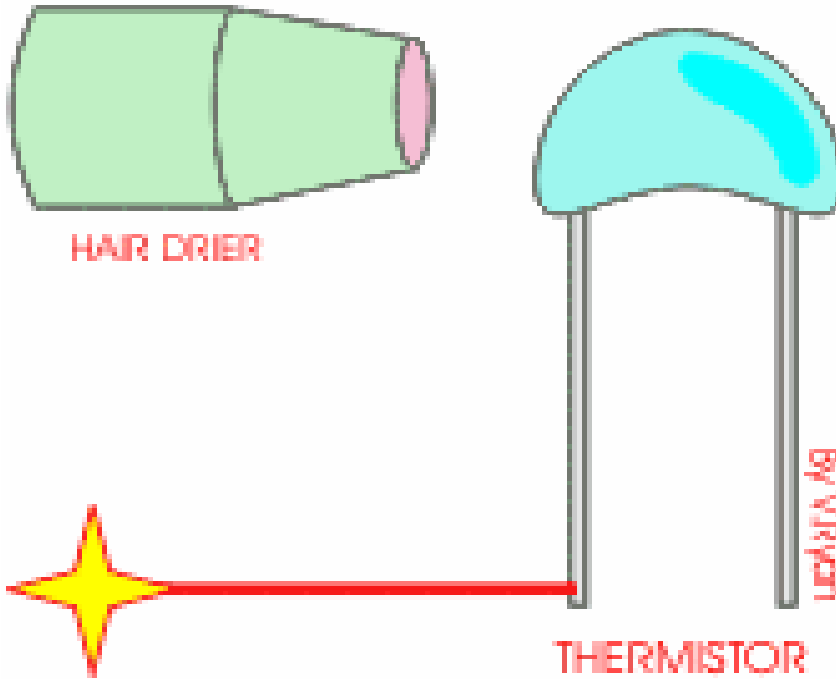
PIEZOELECTRIC EFFECT, this effect is a phenomena observed in certain crystals (QUARTZ, TOURMALINE & ROCHELLE SALTS) that have the ability to develop a voltage when the crystal is deformed by pressure applied.

Piezoelectric



Transducers of this type are self generating and the amount of voltage is proportional to the pressure applied that causes the deformity.

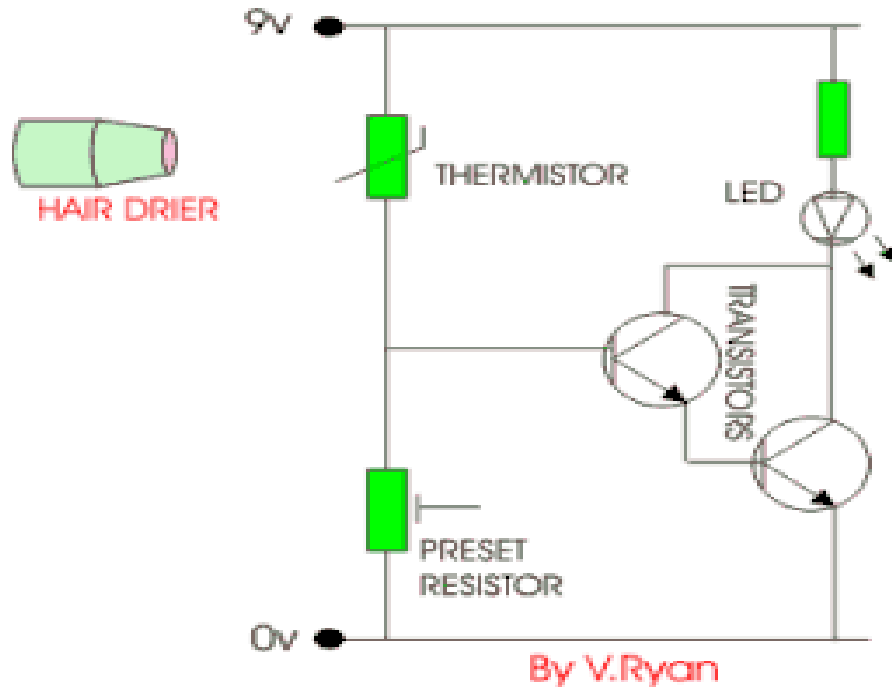
Thermistor



Are thermally sensitive resistors.

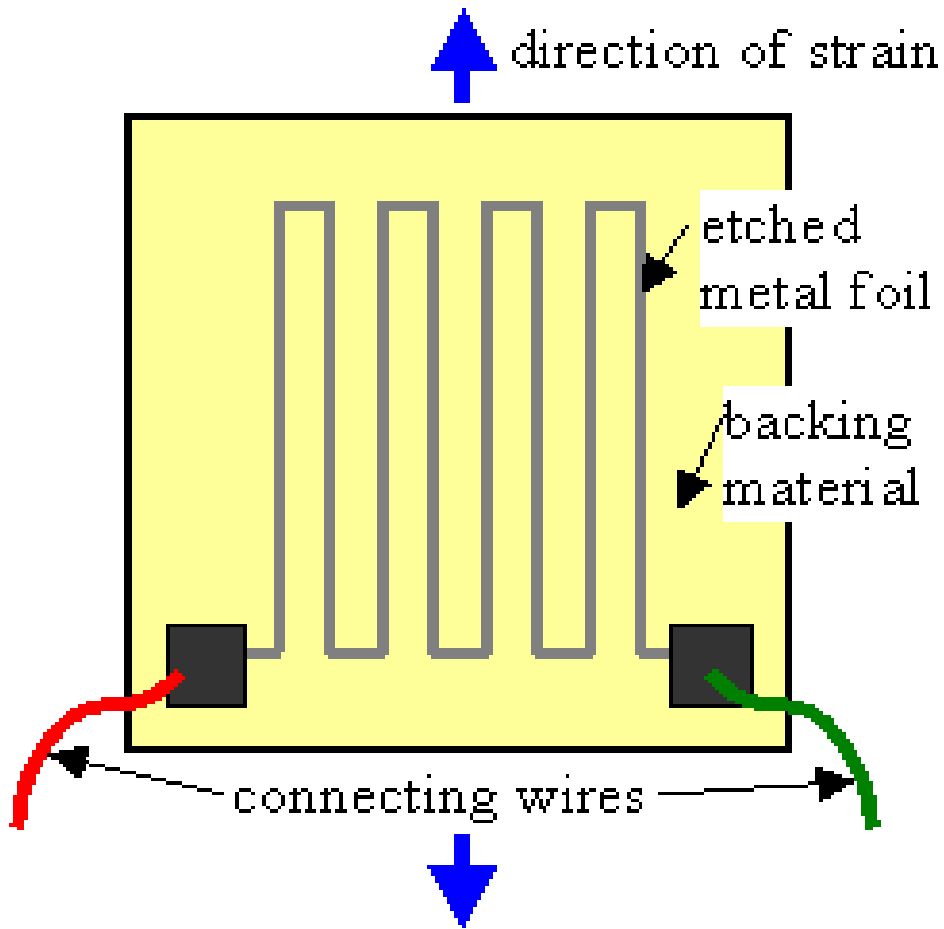
When the thermistor is cold, resistance is high and current can not pass through.

Thermistor



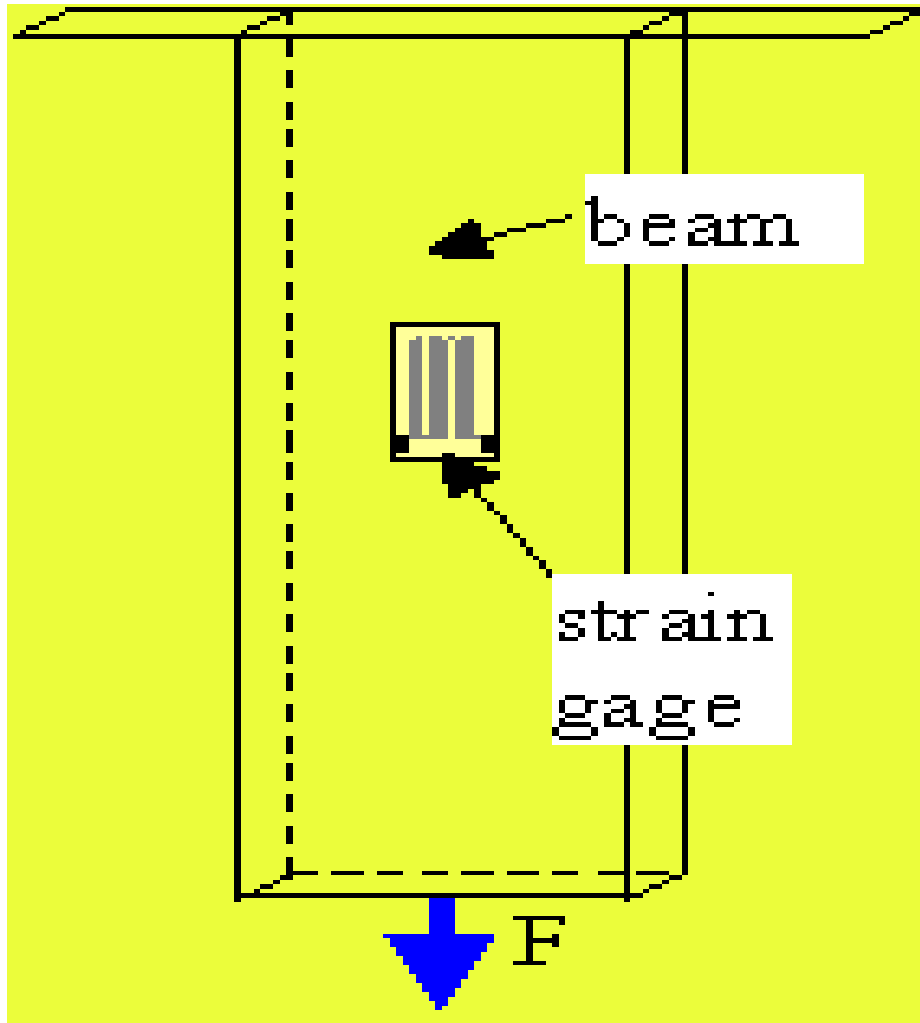
Utilizes semiconductor materials having a non-linear variation and a negative temperature coefficient. Remember that as temperature increases the resistance of the device decreases. This type of transducer can detect temperature changes based on resistance.

Resistance-Wire Strain Gage



A strain gage consists of a small diameter wire attached to a backing material. The longer the wire, the larger the resistance. The connecting wires or leads go to an electronic circuit to measure the strain.

Resistance-Wire Strain Gage



The longer the wire is stretched, the greater the resistance. This change in resistance when incorporated in an electronic circuit can measure the flex or strain on structural support beams in buildings.

TRANSDUCERS

4.b. Identify transducer principles.

APPRAISALS

- 1. What type of transducer is used large scale movement is required?**
- 2. What is the main disadvantage of using the Potentiometer transducer?**
- 3. In a Differential Transformer, what measurand is changed to change the electrical output?**
- 4. In a Photovoltaic transducer, the output voltage is directly proportional to the _____.**

APPRAISALS

5. As the wire in the Wire Strain Gauge is stretched its' resistance is _____.
6. What type transducer changes its' resistance when temperature changes?
7. The Thermocoupled transducer will increase its' output voltage when the heat is _____.
8. Photovoltaic devices are constructed with _____.

APPRAISALS

- 9. Variable Inductor transducers are frequently used for _____.**
- 10. What is the purpose of Transducers?**

APPRAISALS

1. What type of transducer is used large scale movement is required? *Potentiometers*
2. What is the main disadvantage of using the Potentiometer transducer? *Must use a finite torque to change the measurand.*
3. In a Differential Transformer, what measurand is changed to change the electrical output? *The core material*
4. In a Photovoltaic transducer, the output voltage is directly proportional to the _____
_____.

APPRAISALS

5. As the wire in the Wire Strain Gauge is stretched its' resistance is *increased*.
6. What type transducer changes its' resistance when temperature changes? *Thermistor*
7. The Thermocoupled transducer will increase its' output voltage when the heat is *increased*.
8. Photovoltaic devices are constructed with *semi-conductor materials*.

APPRAISALS

9. Variable Inductor transducers are frequently used for *Pressure monitoring*.

**10. What is the purpose of Transducers?
*Transducers convert energy from one form to another.***

SUMMARY

**The Main Points of the lesson
are;**

1. Transformers

2. Relays

3. Motors and Generators

**4. Synchros/ Servos/ Resolvers/
Transducers**

**Your knowledge of
transducers will have an
impact on how well you can
perform your job.**

This concludes this unit of instruction.