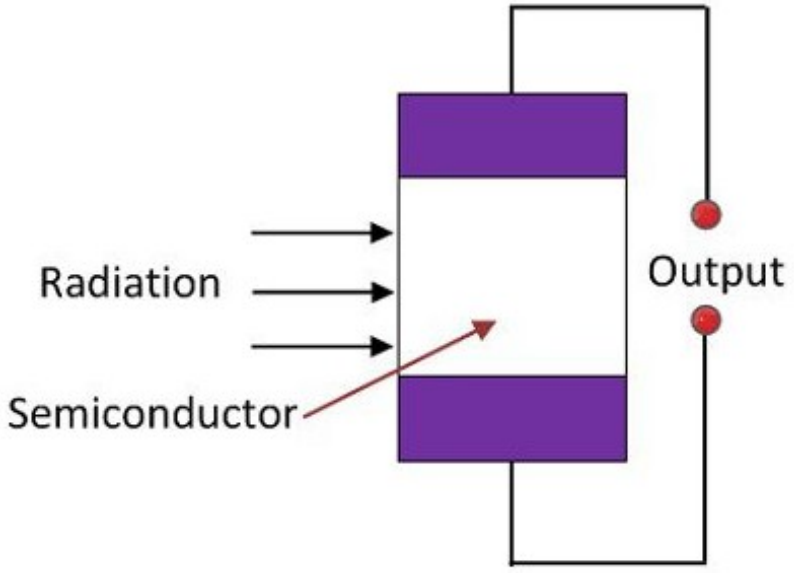
Photoelectric Transducer

Photoelectric Transducer

A photoelectric transducer converts the light energy into electrical energy. It is made of semiconductor material. The photoelectric transducer uses a photosensitive element, which ejects the electrons when the beam of light absorbs through it. The magnitude of the current is equal to the total light absorbed by the photosensitive element.

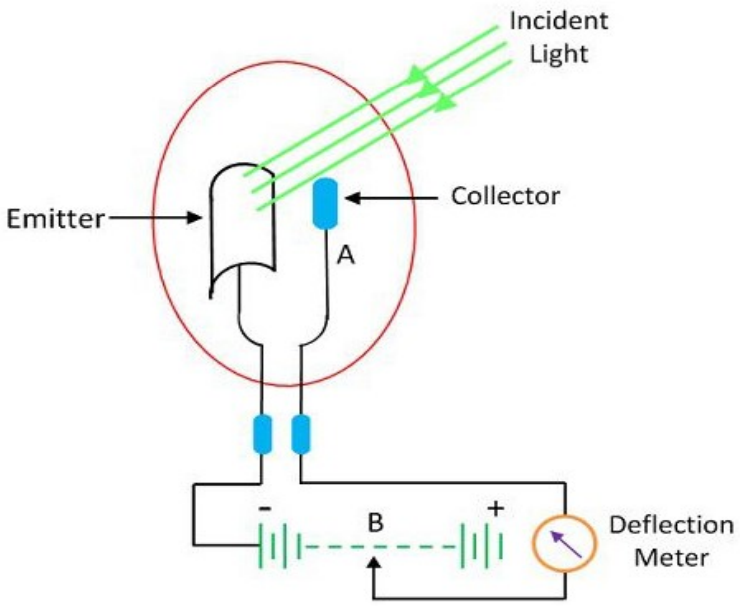


The photoelectric transducer absorbs the radiation of light which falls on their semiconductor material. The absorption of light energizes the electrons of the material, and hence the electrons start moving.

Classification of Photoelectric Transducers

1. Photoemissive Cell

The Photoemissive cell converts the photons into electric energy. It consists the anode rode and the cathode plate. The anode and cathode are coated with a Photoemissive material called caesium antimony.



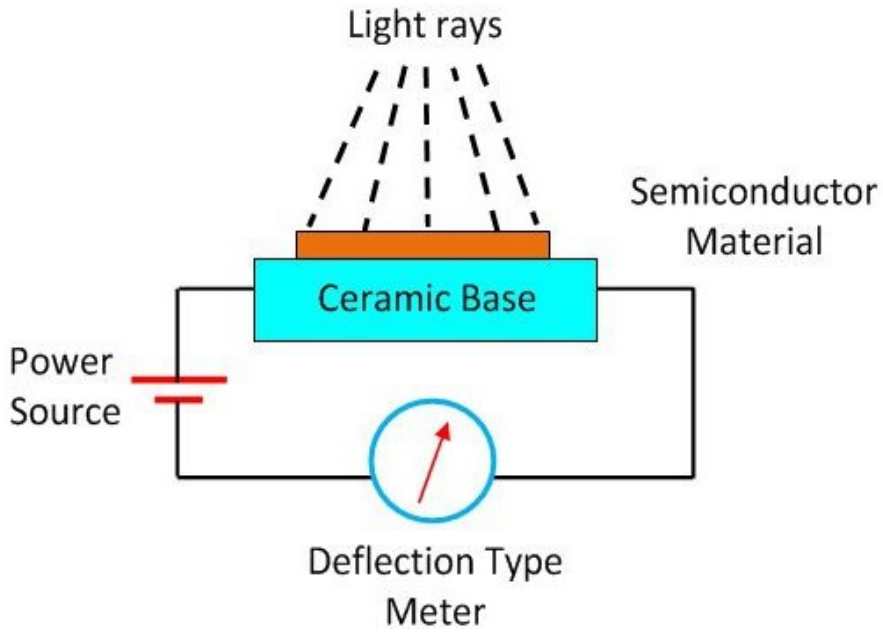
When the radiation of light fall on cathode plates the electrons starts flowing from anode to cathode. Both the anode and the cathode are sealed in a closed, evacuated tube. When the radiation of light fall on the sealed tube, the electrons starts emitting from the cathode and moves towards the anode.

The anode is kept to the positive potential. Thus, the photoelectric current starts flowing through the anode. The magnitude of the current is directly proportional to the intensity of light passes through it.

Continued

2. Photoconductive Cell

The photoconductive cell converts the light energy into an electric current. It uses the semiconductor material like cadmium selenide, Ge, Se, as a photo sensing element.

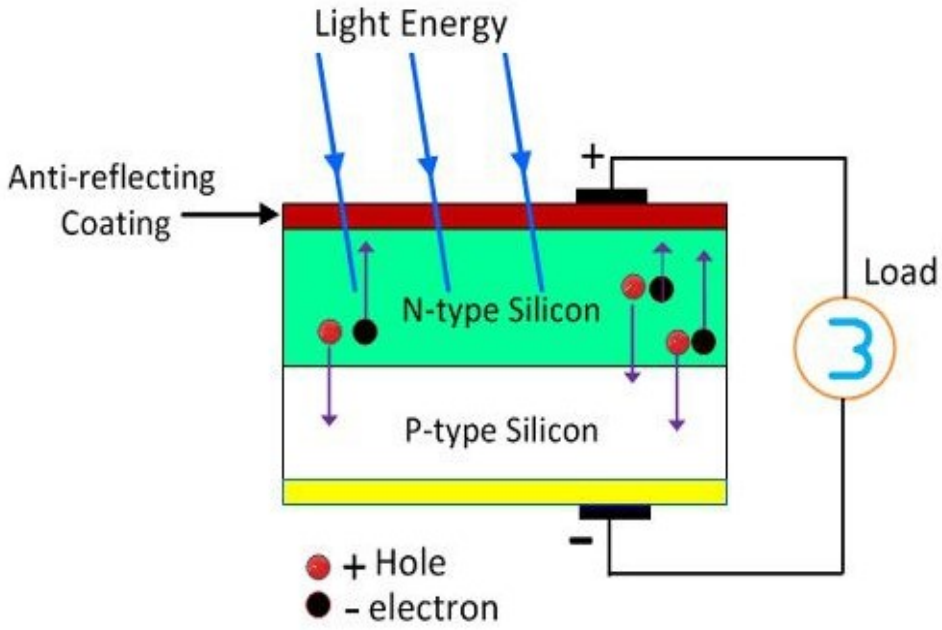


When the beam of light falls on the semiconductor material, their conductivity increases and the material works like a closed switch. The current starts flowing into the material and deflects the pointer of the meter.

Continued

3. Photo-voltaic cell

The photovoltaic cell is the type of active transducer. The current starts flowing into the photovoltaic cell when the load is connected to it. The silicon and selenium are used as a semiconductor material. When the semiconductor material absorbs heat, the free electrons of the material starts moving. This phenomenon is known as the photovoltaic effect.

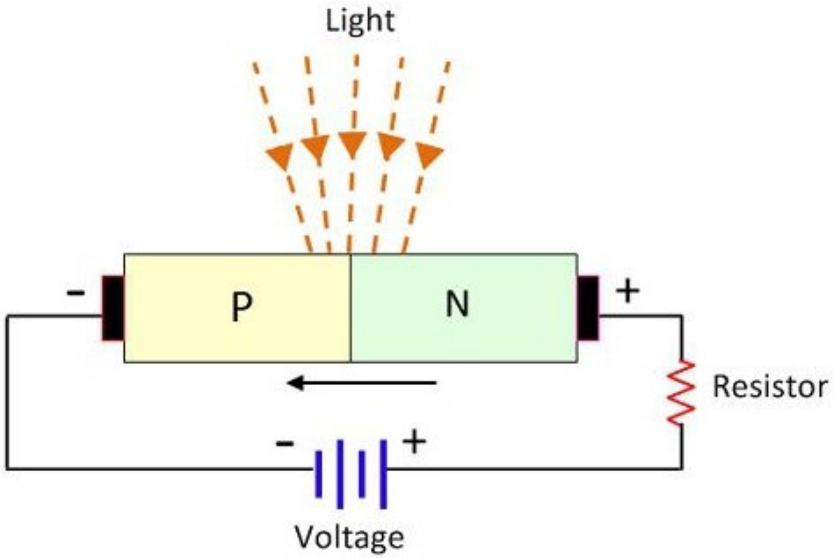


The movements of electrons develop the current in the cell, and the current is known as the photoelectric current.

Continued

4. Photodiode

The photodiode is a semiconductor material which converts the light into the current. The electrons of the semiconductor material start moving when the photodiode absorbs the light energy. The response time of the photodiode is very less. It is designed for working in reverse bias.

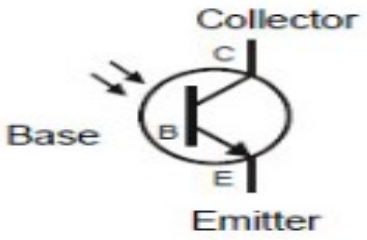


Continued

5. Phototransistor

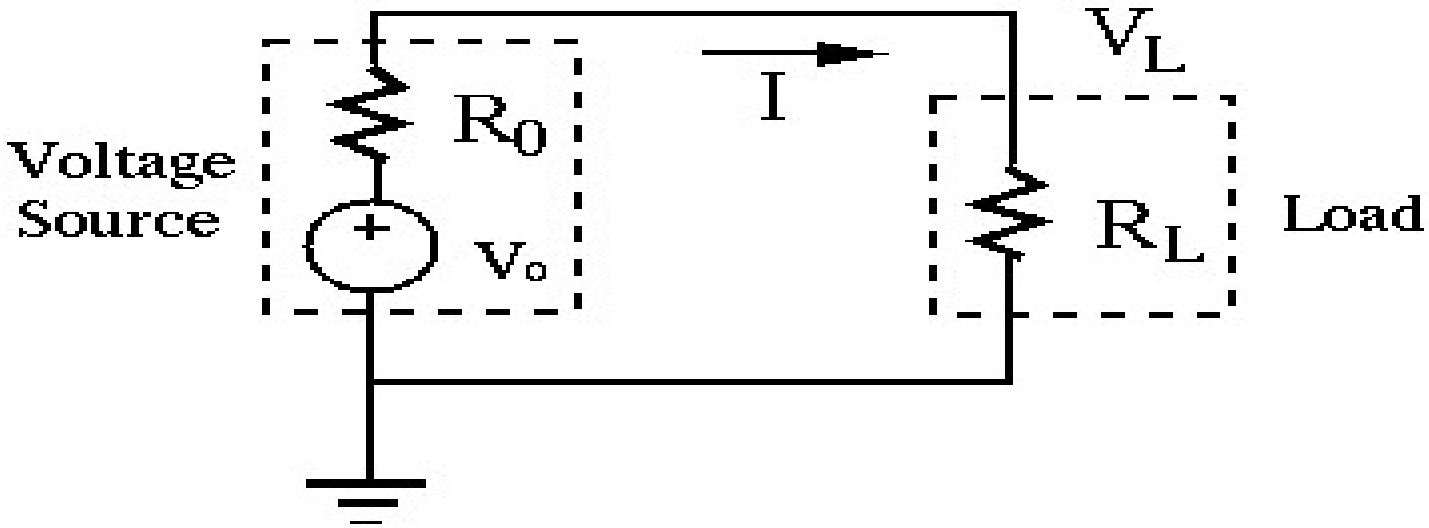
A Phototransistor is a Photojunction device (so, is Photodiode) that is similar to a regular transistor except that it has a light sensitive Base terminal (or Collector – Base Junction, to be precise).
In other words, a photo transistor can be considered as a Photodiode with current amplifier. A phototransistor converts photons to charge directly, just like a photodiode, and in addition to this, a phototransistor also provides a current gain.

In phototransistors, the size of base – collector junction is larger as it is a light sensitive region of the sensor. The light incident on the base of a phototransistor will induce a small current. This current is then amplified by normal transistor action, which results in a significantly large. Usually, when comparing to a similar photodiode, a phototransistor can provide a current that is 50 to 100 times that of a photodiode.

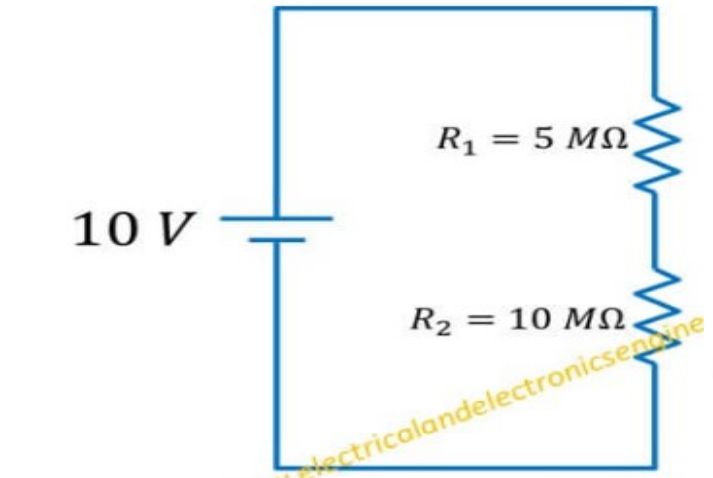


Loading Effect

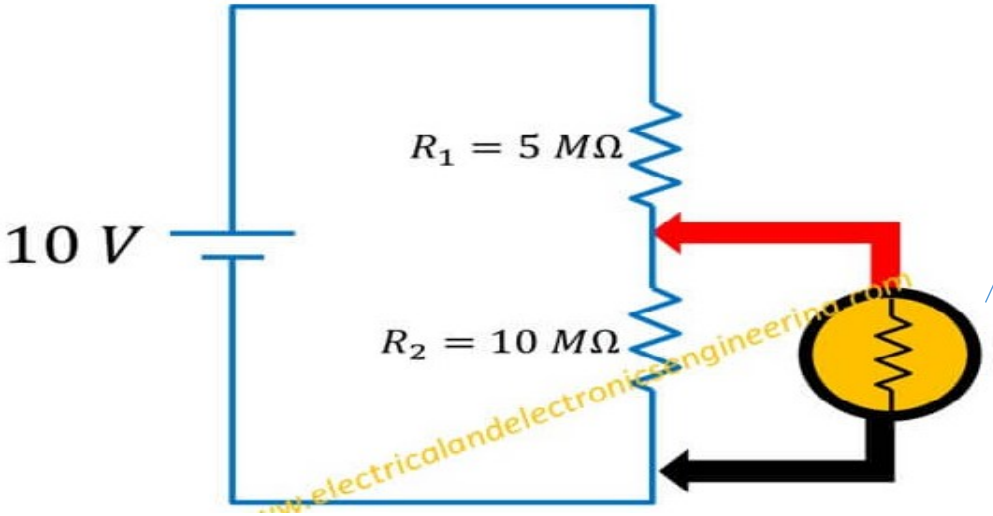
Consider the circuit shown in the figure. Here we want to supply whole of theV_0 to the load resistance R_L. This is possible only when R_0=0 and R_L=∞. As both the conditions are not possible to achieve so V_0 can never be equal to V_L. This phenomenon is called loading effect and can be minimized if we maximize the load resistance and minimize the internal resistance



example



$$V_2 = \frac{10\ M\Omega}{5\ M\Omega + 10\ M\Omega} * 10\ V = 6.66\ V$$



$$V_2 = \frac{(10\ M\Omega\ ||10\ M\Omega)}{5\ M\Omega + (10\ M\Omega||10\ M\Omega)} * 10\ V$$

$$= 5\ V$$

Thank You