Transformers Encyclopedia Article

Transformers

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Transformers

Transformers are responsible for transforming an input **voltage** into a different output voltage. When a portable CD player which runs on 3.5V is plugged into a car which has a 12V battery, it is a transformer that changes the 12V into 3.5V. When virtually any electronic device is plugged into the wall, there is a transformer somewhere in the chassis of the device that turns the 110VAC that is supplied to the home into something that can be used by the equipment.

The physical components of a transformer are simple and have changed little since first introduced. The primary coil of wire and a secondary coil of wire are electrically insulated from each other. They usually share a core of iron or some other material that is easily permeable by a magnetic field, and are often wound one on top of the other so that they are concentric.

The entirety of the physics of transformers is contained in Faraday's Law, which states that a changing magnetic field produces a voltage in a conductor that the magnetic field penetrates. In the case of a transformer, current runs through the primary coil, producing a magnetic field which extends through the secondary coil. Because a changing magnetic field is necessary to produce a voltage, transformers only function when supplied with an AC signal.

Using a different number of turns for the primary and secondary coils, any input voltage can be turned into any output voltage, subject to the restriction that the output voltage is proportional to the input voltage with a proportionality constant equal to the ratio of the number of primary coil turns to the number of secondary coil turns. This may seem incompatible with the law of **conservation of energy**, but is compatible because the **power** transmitted remains constant.

A transformer that takes an input voltage and outputs a higher voltage is called a step-up transformer, while a transformer that reduces the voltage is called a step-down transformer. Using a combination of step-up and step-down transformers, power is transmitted to homes, turned into one voltage level for the entire home, and then transformed again in each device that requires **electricity**.