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An AC-to-DC power supply operates on an AC input voltage and generates a DC output voltage. Depending on application requirements the output voltage may contain large or negligible amounts of AC frequency components known as ripple voltage, related to AC input voltage frequency and the power supply"s operation. A DC power supply operating on DC input voltage is called a DC-to-DC converter. This section focuses mostly on the AC-to-DC variant.

Switched-mode power supplies are usually regulated, and to keep the output voltage constant, the power supply employs a feedback controller that monitors current drawn by the load. The switching duty cycle increases as power output requirements increase.

SMPSs often include safety features such as current limiting or a crowbar circuit to help protect the device and the user from harm.[1] In the event that an abnormal high-current power draw is detected, the switched-mode supply can assume this is a direct short and will shut itself down before damage is done. PC power supplies often provide a power good signal to the motherboard; the absence of this signal prevents operation when abnormal supply voltages are present.

A capacitive power supply (transformerless power supply) uses the reactance of a capacitor to reduce the mains voltage to a smaller AC voltage. Typically, the resulting reduced AC voltage is then rectified, filtered and regulated to produce a constant DC output voltage.

The output voltage is not isolated from the mains. Consequently, to avoid exposing people and equipment from hazardous high voltage, anything connected to the power supply must be reliably insulated.

The voltage reduction capacitor must withstand the full mains voltage, and it must also have enough capacitance to support maximum load current at the rated output voltage. Taken together, these constraints limit practical uses of this type of supply to low-power applications.

The function of a linear voltage regulator is to convert a varying DC voltage to a constant, often specific, lower DC voltage. In addition, they often provide a current limiting function to protect the power supply and load from overcurrent (excessive, potentially destructive current).

A constant output voltage is required in many power supply applications, but the voltage provided by many energy sources will vary with changes in load impedance. Furthermore, when an unregulated DC power supply is the energy source, its output voltage will also vary with changing input voltage. To circumvent this, some power supplies use a linear voltage regulator to maintain the output voltage at a steady value, independent of fluctuations in input voltage and load impedance. Linear regulators can also reduce the magnitude of ripple and noise on the output voltage.

In modern use, AC power supplies can be divided into single phase and three phase systems. AC power Supplies can also be used to change the frequency as well as the voltage, they are often used by manufacturers to check the suitability of their products for use in other countries. 230 V 50 Hz or 115 60 Hz or even 400 Hz for avionics testing.

An AC adapter is a power supply built into an AC mains power plug. AC adapters are also known by various other names such as "plug pack" or "plug-in adapter", or by slang terms such as "wall wart". AC adapters typically have a single AC or DC output that is conveyed over a hardwired cable to a connector, but some adapters have multiple outputs that may be conveyed over one or more cables. "Universal" AC adapters have interchangeable input connectors to accommodate different AC mains voltages.