

# Types of power supply and their applications



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Power supply is a device used to provide the electric energy to operate the devices running on electric power. It has many special ways to provide electric energy to a specific system “ it is mother of the system” ( Brown, 2001, p. 1 ).

The basic functionality of power supply is to convert Alternative Current voltage to regulated Direct Current voltage required by electronic devices. A typical power supply has four different modules each of them has a specific function.

(Source: <http://www.kpsec.freeuk.com/powersup.htm>)

Transformer is the first module and its function is to convert high voltage Alternative Current to low voltage Direct Current. The second module is Rectifier and its main function is to convert low voltage Alternative Current to Direct Current. The third module is Smoothing, the Direct Current produced by the Rectifier is varying, so Smoothing reduces this variation to small rippling. Last module is Regulator, it sets the Direct Current voltage to fixed value by removing the ripples. This is a basic design of power supply. The design can be huge and complicated based on the requirements.

This essay will present the four major types of power supply which are Linear Regulators and Switching Mode Power Supply, Programmable Power Supply, Uninterruptible Power Supply.

The first type of power supply is Linear Regulated Power Supplies. They are the basic type of power supply. they produce the regulated output voltage

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by dropping the input voltage. To achieve this, it relies on variable conductivity of an electronic device. Hence, the lot of power wasted in the form of heat. " it is though, a very electrically quiet power supply" (Brown, 2001, p. 11). they are often used in ground based equipment and distributed power systems.

Linear regulated power supply function by converting varying Alternative Current input to regulated Direct Current output. The typical circuit used in this type has two range. One allows more voltage at lower current and the other allows more current at lower voltage.

Linear regulated power supplies come in two basic forms called series regulators and shunt regulators. Series regulated power supplies are most common form of linear regulated power supply. The power dissipated in series regulated device is the product of power supply output current and the voltage drop. Shunt regulated power supplies are the simpler form of Linear Regulated power supply, but they are less efficient.

Simplicity is the main advantage of linear regulated power supplies. They have been widely used in industry for a long time. They are used in systems that require extremely low noise. They are more suitable and cost effective for low power applications. They are used in ground based applications and distributed power systems. Since the linear regulated power supply has very low power output voltage ripple, it is used in low noise / low ripple applications such as communication and radio device where noise is very critical. It is more efficient in the application which output voltage is almost equal to input voltage.

The second type of power supply is Switching Mode (SMPS). It operates in ON-OFF mode. It uses switching circuits and energy storage elements such as capacitors and inductors to get the regulated output voltage. “ These circuits are ideally lossless with 100% energy transfer” (Johnny, 2006, p. 1).

The main advantage of Switching Mode Power Supply is the higher efficiency because of low power dissipation. It is simpler and light weight because of the elimination of heavy low frequency transformers and generates low heat. It is used in domestic products which often have universal inputs. Mobile phones have changed their power supply technology from linear regulated to Switching Mode Technology. It is widely used in aircraft electric power such as airplane ground support.

The third type of power supply is Programmable Power Supply. It provides the power through a computer interface. It generally depends on both Linear regulated and Switched Mode technologies to produce accurate output power. A Programmable power supply typically consists of microcontroller, current, voltage programming circuits such as analog to digital convertors, serial peripheral interface, keypad and a LCD display.

The desired voltage parameter is given as the input to microcontroller through key pad. Intern, microcontroller convert analog voltage from a voltage source to digital through analog to digital convertor. This digital voltage is regulated through serial peripheral interface to get the desired voltage which is inputted to microcontroller through keypad.

The main advantage of programmable power supply is that accurate required voltage can be produced which is not possible from either linear

regulated or switching mode power supply. It is mainly used in automated equipment testing. They are also used in ultrasonic vibration measurement tools.

The last type of power supply is Uninterruptible power supply. It is widely known as UPS or power back up. It is widely used as backup power to protect the devices from crashing due to sudden power loss.

There are three major categories of Uninterruptible power supply, offline - standby, online and line-interactive.

The first category is Offline /standby Uninterruptible power supply. It provides surge protection and battery back-up up to 20 minutes. When the input power supply falls below the threshold level, then Uninterruptible power supply turns on its power circuit providing power backup to the device up in certain time (In this type 20 minutes).

Line-Interactive Uninterruptible power supply is the second category. It generally uses only one main power convertor to generate the power. " With its low cost and durability, the line-interactive UPS has been used successfully in millions of IT installations worldwide" (Hoff and Samstad , 2004) . The typical protection time varies from 5 minutes to 30 minutes.

The last category is Online, the operation of Online Uninterruptible power supply is very similar to Standby or Line-Interactive type. The typical protection time varies between 5 minutes to 30 minutes. But, it provides electrical firewall between incoming utility power and sensitive electronic equipment. The main purpose of Uninterruptible power supply is to provide

the protection to devices from crashing due to sudden power loss. Some of the Uninterruptible power supplies are also capable of correcting the common utility power problems such as, total loss of input voltage, momentary increase or decrease input voltage, spikes , noise. They are mainly used for surge protection and back power for computers, data centers and telecommunication equipment. They are used to provide the electric isolation for the equipment which are sensitive to power fluctuations.

In conclusion, there are various sources of power being used to provide the power to the systems effectively and efficiently. For example, solar energy and wind power are being converted to electric energy to provide the power to large industrial applications. Power supplies are the heart of any system which requires electrical energy. They not only provide power but also provide the protection to the system against outside disturbances.

Therefore, design and development considerations of a power supply are more important. As technology is growing, more advanced power supplies are being invented to provide best protection and efficient power to the devices.