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COIMBATORE-35

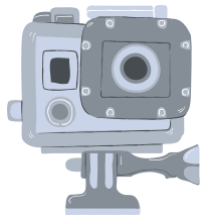
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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

**COURSE NAME: 19EET103-ELECTRIC CIRCUITS AND ELECTRON
DEVICES**

I YEAR / II SEMESTER

Unit V – RECTIFIERS AND POWER SUPPLIES



Topic POWER SUPPLY



introduction

- Power supply convert alternating current to the direct (DC) current mainly convert 110-240v AC
- Three types of power supply:
 - Linear power supply
 - Switched mode (SMPS)
 - Uninterrupted (UPS)
 - power SMPS stands for **Switch Mode Power Supply**.
- This receives **230V AC** and translates it into different DC levels such as **+5V, -5V, +12V, -12V**.



Linear power supply



- **Linear power supply:** transformer is used to convert voltage.
- Transformer convert the line AC voltage to a smaller peak voltage
- Rectifies AC signal produces large waveforms , capacitor filter is used filter the rectified wave which contain small pulses (ripple).

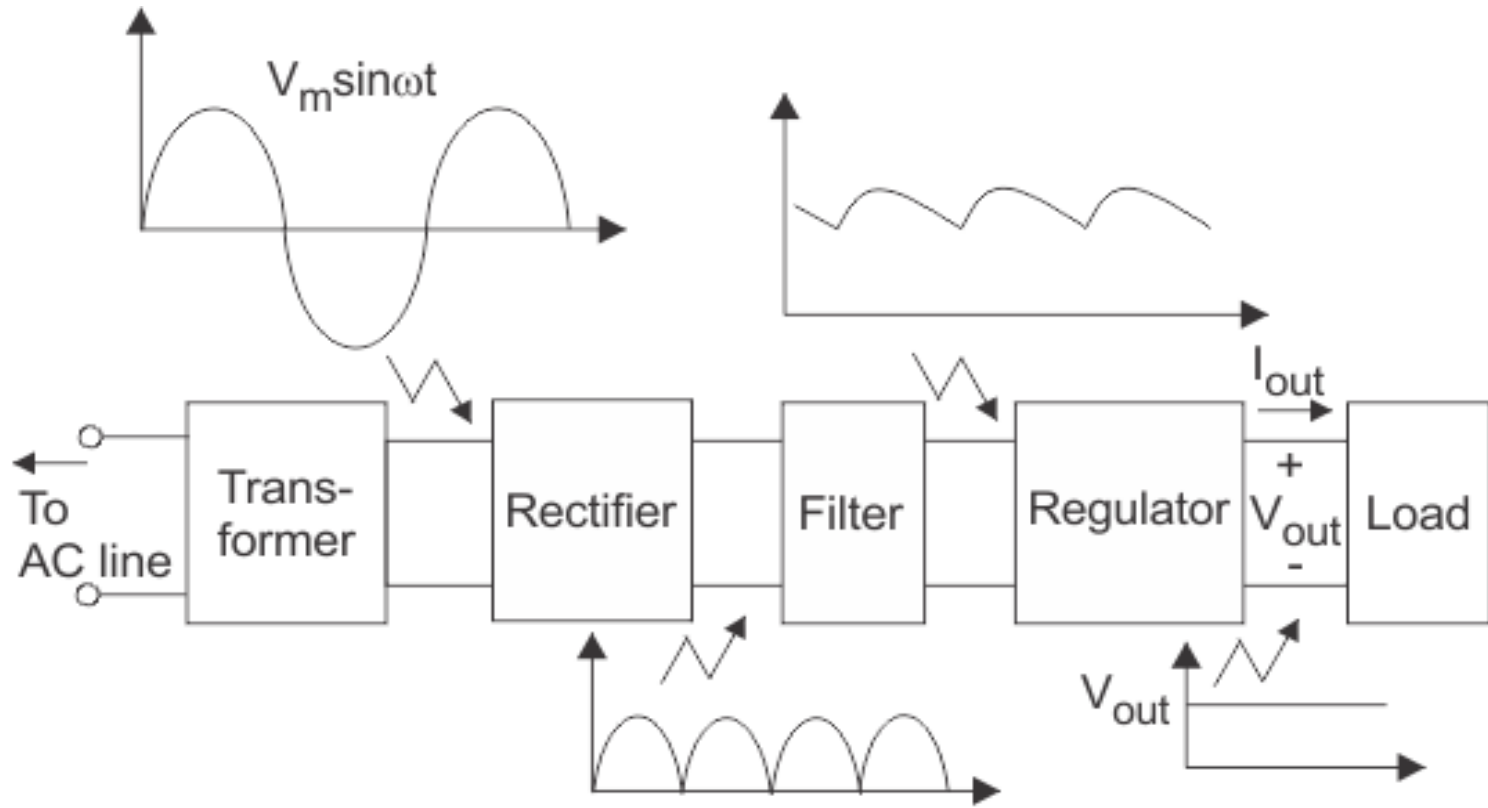


Linear power supply

- Depend on requirements regulator adjust the output voltage
- Good line and load regulation lower output voltage ripples.



Linear power supply



Components of typical linear power supply



Operation

- The **power supplies** used in computers are switched mode power supplies.
- The primary power **received** from **AC** mains is **rectified and filtered** as high-voltage DC.



SMPS



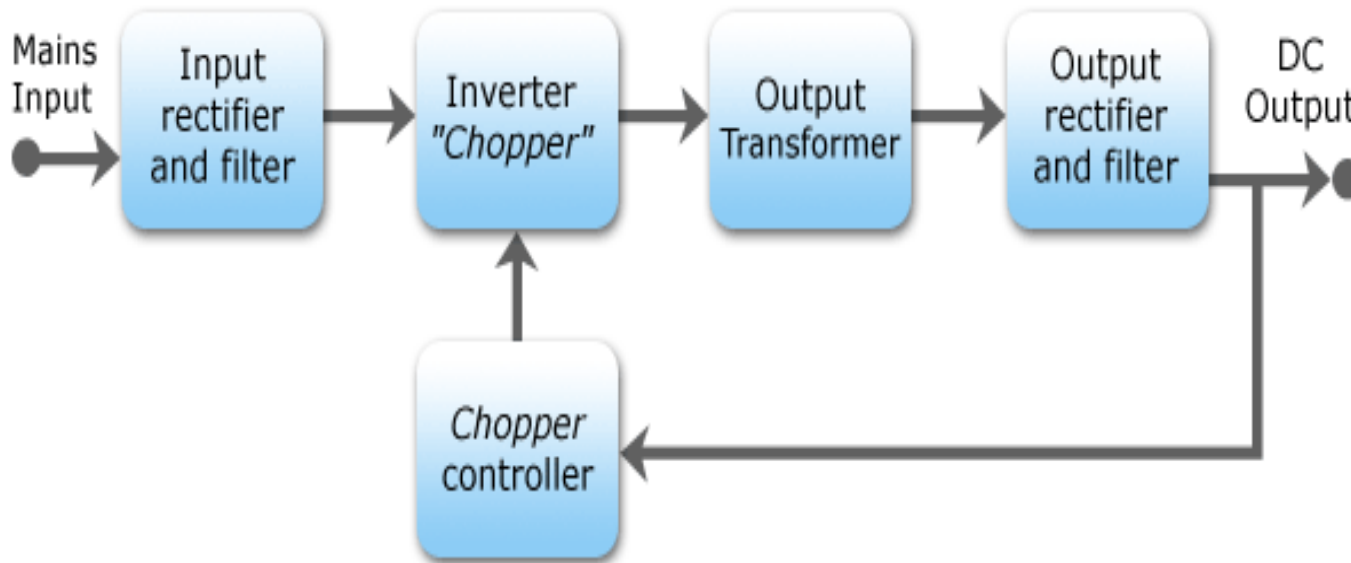


SMPS

- Switched mode : electronic power supply with **switching regulator**.
- power SMPS stands for **Switch Mode Power Supply**.
 - This receives **230V AC** and translates it into different DC levels such as **+5V, -5V, +12V, -12V**.
- it is switched to a high frequency approximately **10 to 100 KHz** by a bipolar transistor and fed to the primary side (P) of a **step-down transformer**.
- **Uses feedback mechanism**



SMPS schematic diagram





SMPS working



- Convert AC to DC voltage with rectifier
- Which is unregulated DC voltage sent it to filter
- Inverter convert DC to AC with help of power oscillator.
- Output transformer inverts AC voltage up to down to the required output level.
- Output rectifier and filter : AC output from transformer is rectified.
- For lower voltage uses silicon/schottky diodes used and smoothing the rectified output by using filter.



SMPS working

- This **reduces** the amount of the voltage passed through the transformer.
- So the output voltage will be maintained normally.
- Then it is sent to the **output of the power supply.**
- A sample of this output is sent back as **feedback signal for regulation.**



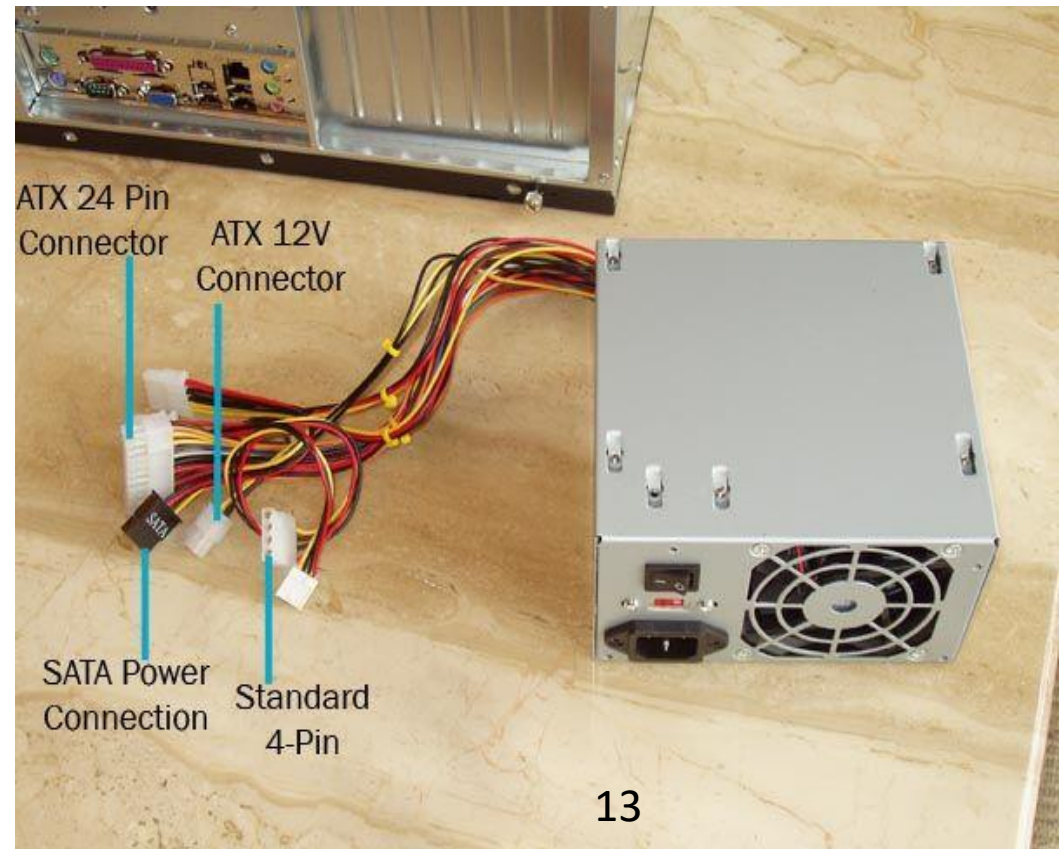
AT and ATX power supply

- PC using XT, AT, babyAT and LPX form factor uses switch to turn on the computer.
- Newer versions of motherboard send signals through motherboard to power supply.
 - AT
 - ATX/NLX



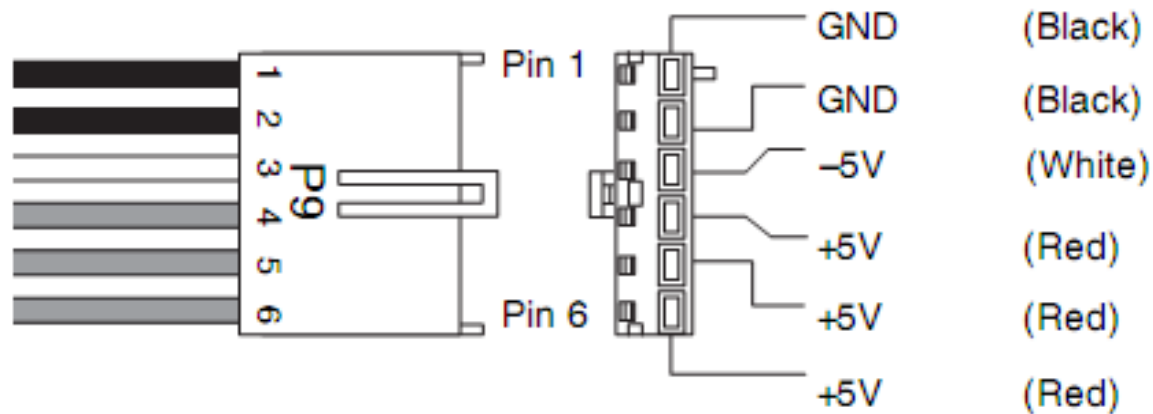
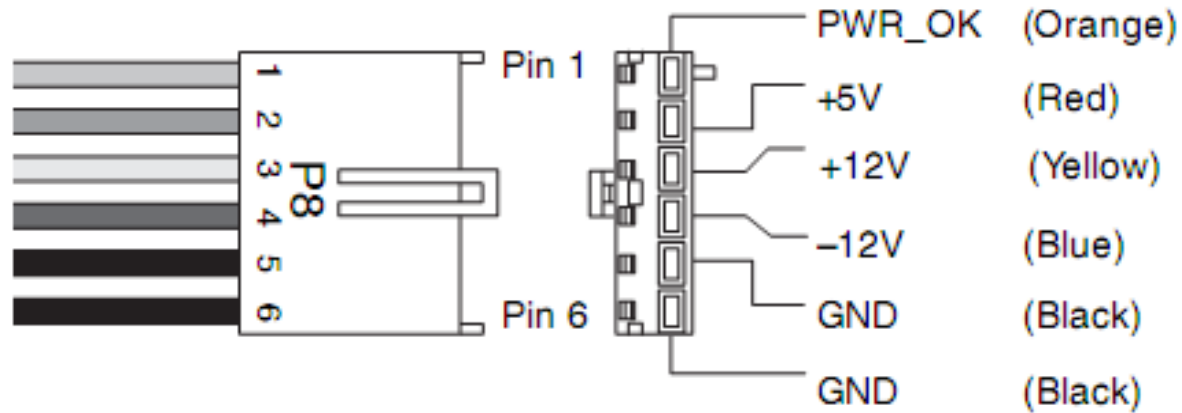
AT type SMPS

- Front side power connector to SMPS
- AT style SMPS provides DC output on two 6-pin connectors(carries DC power to motherboard) and two 4-pin connectors
- Power good flag is set output voltage stable





AT type SMPS





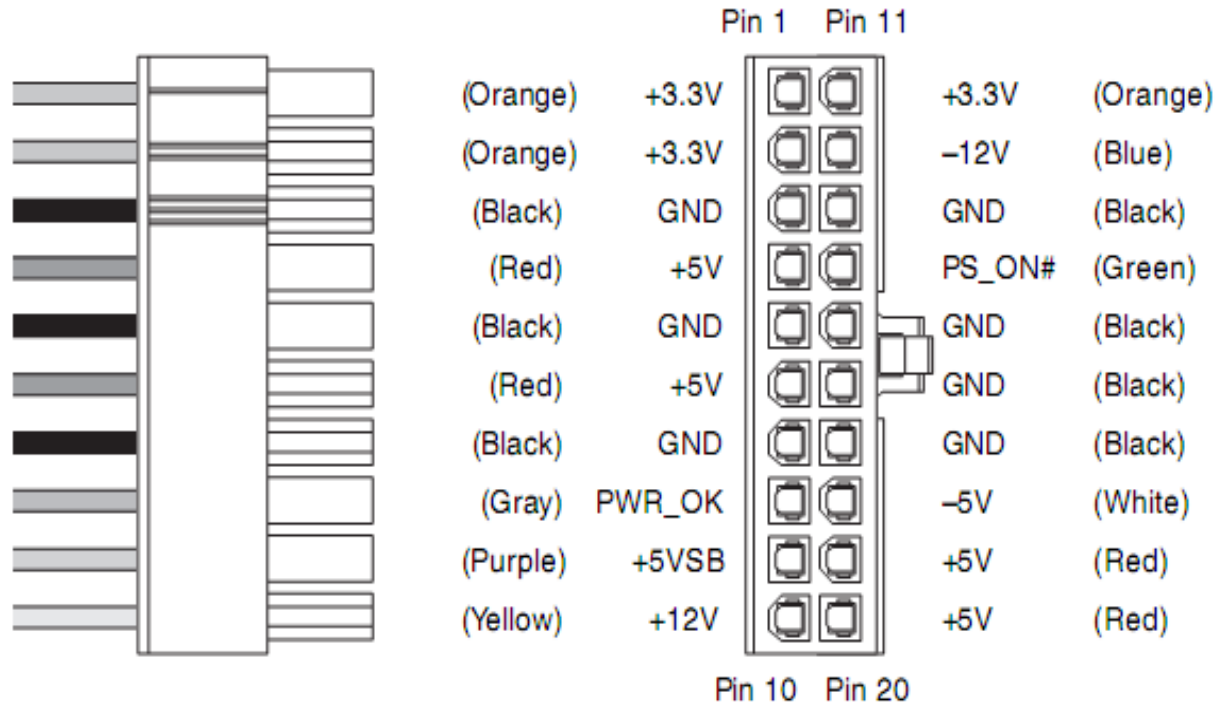
ATX/NLX type SMPS

- Doesn't connect directly to power button
- It uses five DC voltage ,20 pin connector.
 - PS-ON: when it is low SMPS is ON or else OFF.
 - 5VSB:supplies power supply to circuits
 - PW-OK:power good signal.
- Front side power connector to SMPS
- AT style SMPS provides DC output on two 6-pin connectors(carries DC power to motherboard) and two 4-pin

connectors



ATX/NLX type SMPS



.13 ATX/NLX 20-pin main power connector, terminal side view.



Power Supply Characteristic

- **Wattage:** The total, maximum output of the power supply in watts, Typical power ranges are from 200W to 500W.
- **Efficiency :**
 - Efficiency = Useful Power Output / Total Electrical Power Consume.
- **Regulation :** The ability of a SMPS to maintain an output voltage within specified limits under varying of input voltage.



Power Supply Characteristic

- **Ripple** : Also called AC Ripple or Periodic and Random Deviation(PARD) or simply Noise the Power Supply of course produces DC outputs from AC input.
- **Load Regulation:** Sometimes called voltage load regulation. This specification refers to the ability of the power supply to control the output voltage level
- **Line Regulation:** The complement of load regulation, this parameter describes the ability of the power supply to control its output levels

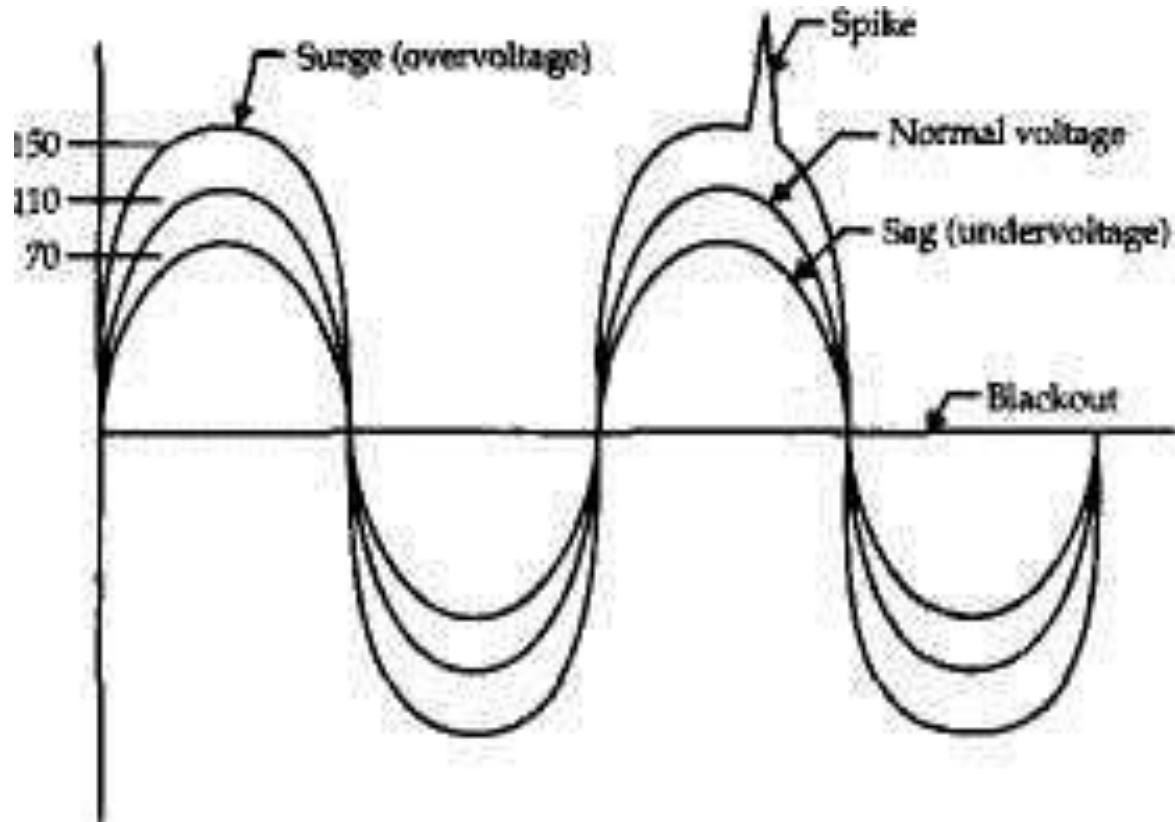


Power Supply problems

- **Blackouts:** it is complete loss of electric power where voltage and current drop to **0**, usually caused by **physical interruption in the power line** due to **accidental damage** by a person or act of nature, **loss of AC** will invariably **shutdown the computer, loss of data, reduction productivity, corrupt file structure and damage files.**



ATX/NLX type SMPS





Power Supply problems

- **Blackouts:** it is complete loss of electric power where voltage and current drop to 0, usually caused by **physical interruption in the power line** due to **accidental damage** by a person or act of nature, **loss of AC** will invariably **shutdown the computer, loss of data, reduction productivity, corrupt file structure and damage files.**
- **Brownouts (Sag):** The under voltage condition The high load items like air conditioners, welding machine, motor etc draw too much current that the AC voltage level drops.
- power supply will **fall out which resulting in intermittent system operation.**
file may be lost or corrupted on the hard drive.



Power Supply problems

- **Surge:** small over voltage conditions that take place over relatively long periods and regulate power to a desired level excess energy must be switched (in SMPS).
- **Spikes:** A spike is a large over voltage condition that occurs in the milliseconds. high energy switches can cause spikes on the AC line. Example equipment like drill machine, grinders, welding equipment etc. can produce power spikes.

Symptoms Supply problems

1. Flickering Lights, 2. Premature Component Failure, 3. Hard Drive Crashes, 4. The PC stalls, crashes, or reboots for no apparent reason.5. You suffer chronic or frequent hard drive failures or file access problems.
6. The CMOS RAM or modem NVRAM periodically loses its contents or becomes corrupted.
7. The PC behaves erratically when other high-energy devices are turned on.
8. The modem regularly loses its connection, or fails data transfers.
9. The monitor display flickers or waves.



Protection Devices

- To run a computer system properly requires a steady power supply with clean and noise free power.





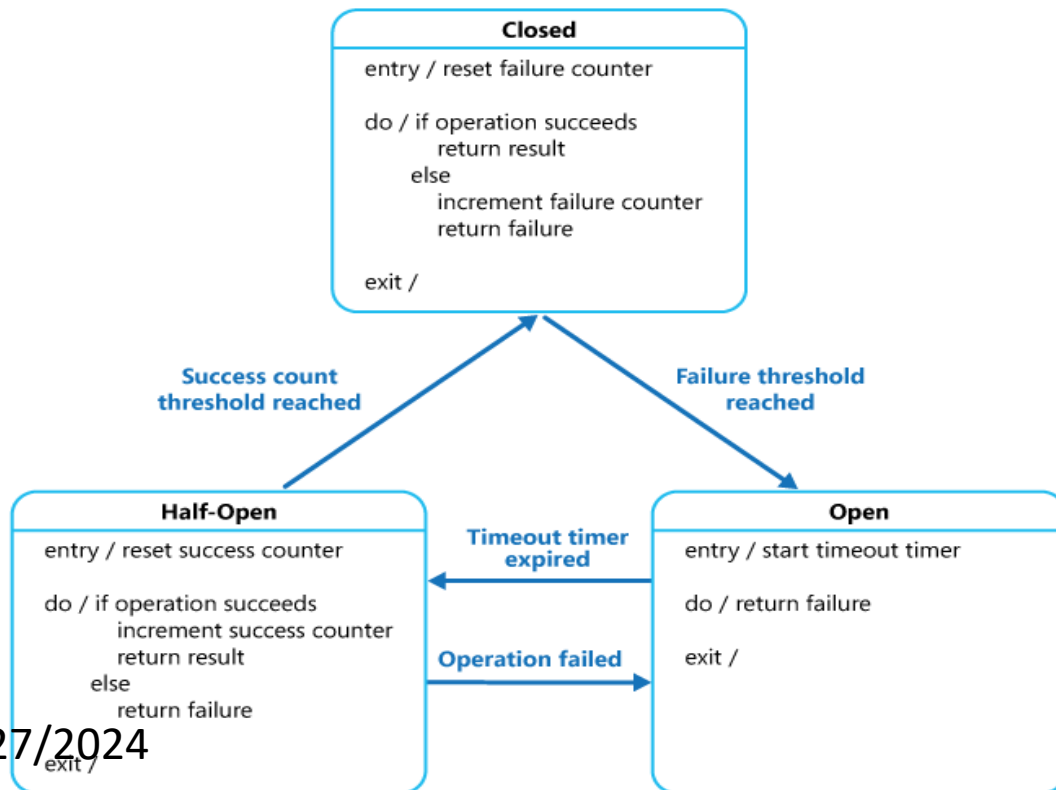
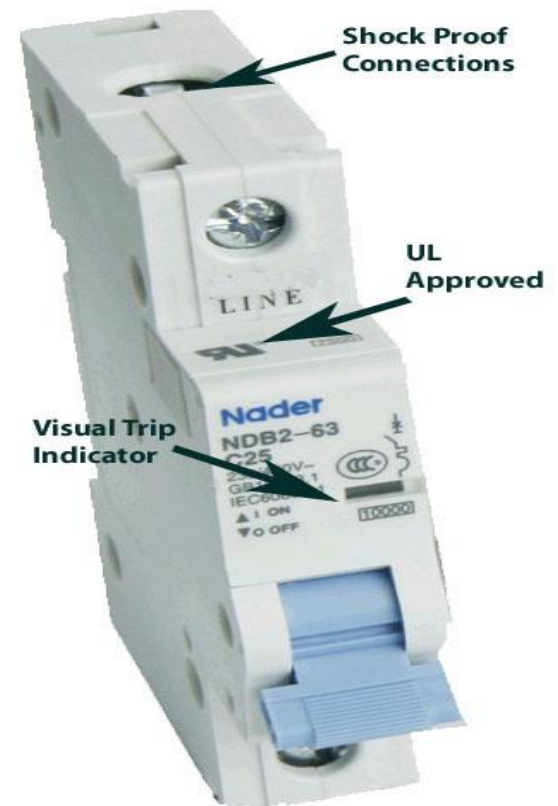
Protection Devices

- **Surge Suppressor:** simple and relatively inexpensive devices, designed to absorb high-voltage transients produced by lightning and other high-energy equipment.
- Device inserted in AC to avoid spikes.
- Avoids peak AC voltage.
- Protection is accomplished by clamping (or shunting) voltages above a certain level (usually above 200 volts).
- Metal oxide varistor, or MOV, diverts the extra voltage.
- **Circuit Breaker:** Its purpose was to protect lighting circuit wiring from accidental short-circuits and overloads.



Protection Devices

- **Circuit Breaker:** Its purpose was to protect lighting circuit wiring from accidental short-circuits and overloads.
- CB can be reset to function normal.





Protection Devices

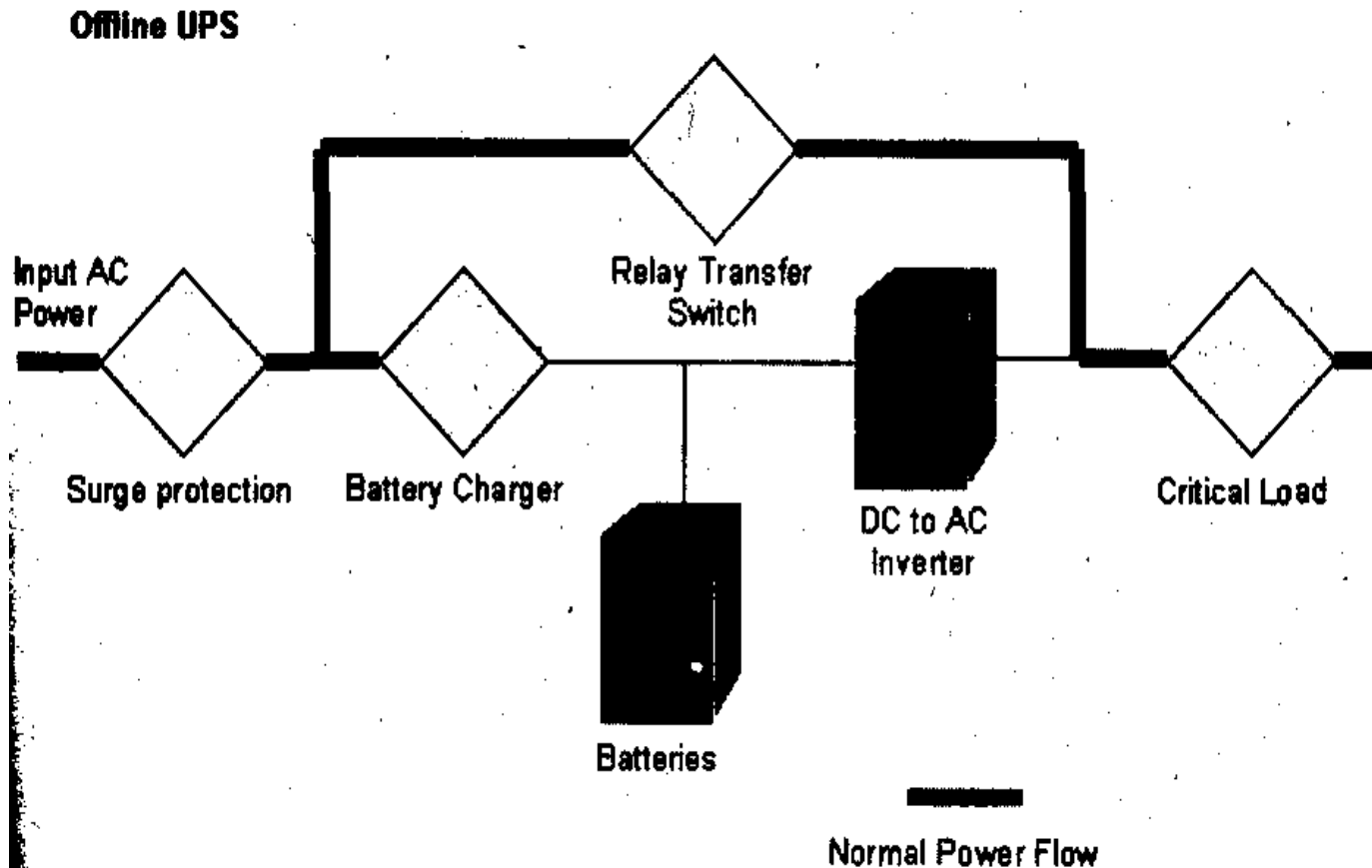
- **Circuit Breaker:**
- **1.actuator lever: trip/reset**
- **2 actuator mechanism**
- **3.Contacts:allow current**
- **6 calibration screw:**





Uninterrupted Power Supply (UPS)

- An UPS provides a back up power supply when there is a power failure from AC mains.





Uninterrupted Power Supply (UPS)

- On-line UPS.

