Power Supplies

Thomas Russell, Information Technology Teacher

- Objectives
  - Explain the basics of electricity
  - Describe the details about powering the PC
  - Understand power supply troubleshooting and fire safety

- Powering the PC requires a single box – the power supply- that takes electricity from the wall socket and transforms it into electricity to run the other board and other internal components

Power Supplies

- Power supply issues are of critical importance. Problems can create system instability, crashes and data loss.

Understanding Electricity

- Electricity = the flow of electrons
- Electronics = The study of the flow of electrons in active devices

Understanding Electricity

- The flow of electrons is very similar to the flow of water through pipes.
- The pressure of the water is called *"electrons"* and measured in voltage
- The amount of water moving past a certain point is called *"current"* and is measured in amps.
- The amount of amps and voltage needed to make a device work is called "*watts".* Voltage X Amps=Watts

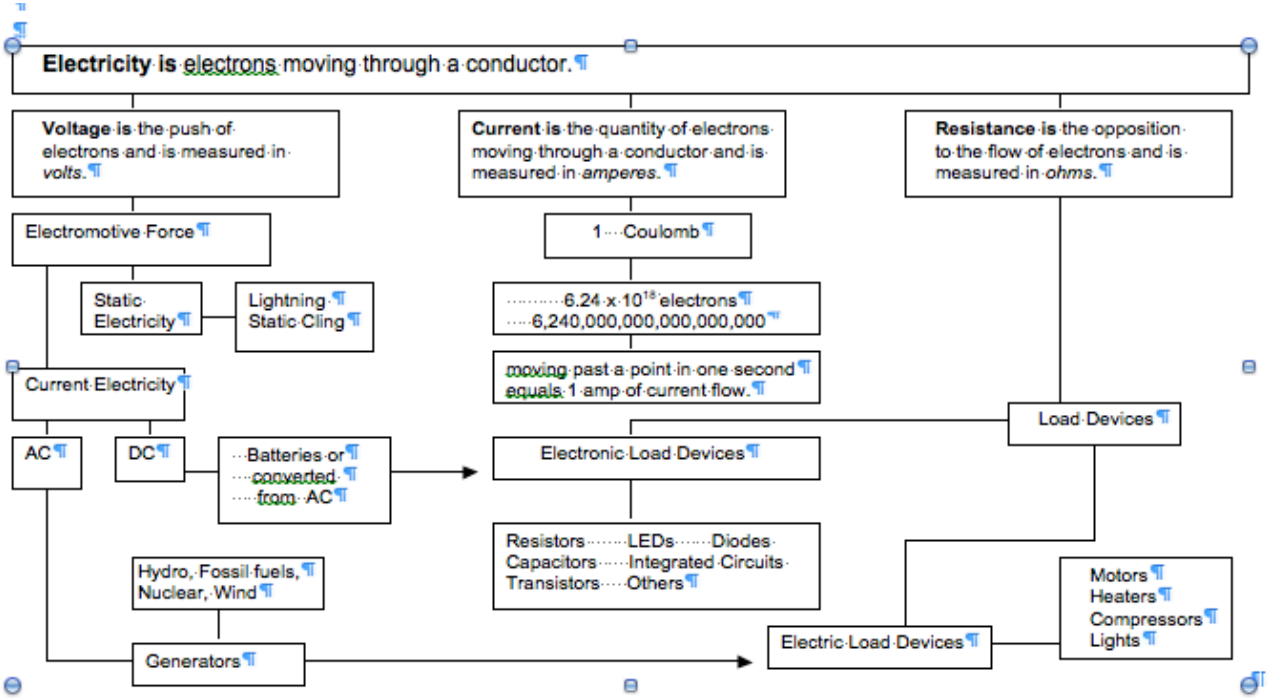
Understanding Electricity

- Wires of all sorts have a slight resistance to the flow of electrons. The resistance to the flow of electrons is measured in ohms.
  - Pressure = voltage (V)
  - Volume flowing = amperes
  - Work = wattage (W)
  - Resistance = ohms (Ω)

Understanding Electricity

- Electrical wires have amperage ratings. Pushing 30 amps through a wire rated 20 amps will result in the electrons trying to find ground. Circuit breakers stop the flow of electricity when too much amps are going through a circuit, this protects the circuits (or humans) Circuit breakers replaced fuses in man applications.

Understanding Electricity

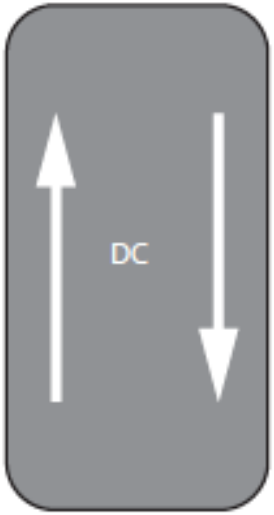


Understanding Electricity

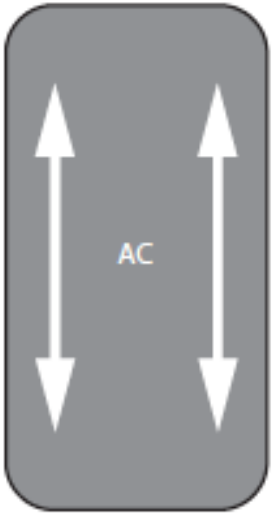
- Electricity can com in two forms: Direct Current (DC) or Alternating Current (AC).
- DC = Current flows in one direction around a continuous circuit
- AC = Current alternates direction back and forth in a circuit.

DC and AC Voltage Flow

Most electronic devices use DC power, but all power companies provide AC power because it travels long distances more effectively.



Constant voltage in one direction



Voltage in both directions, constantly switching back and forth

Powering the PC

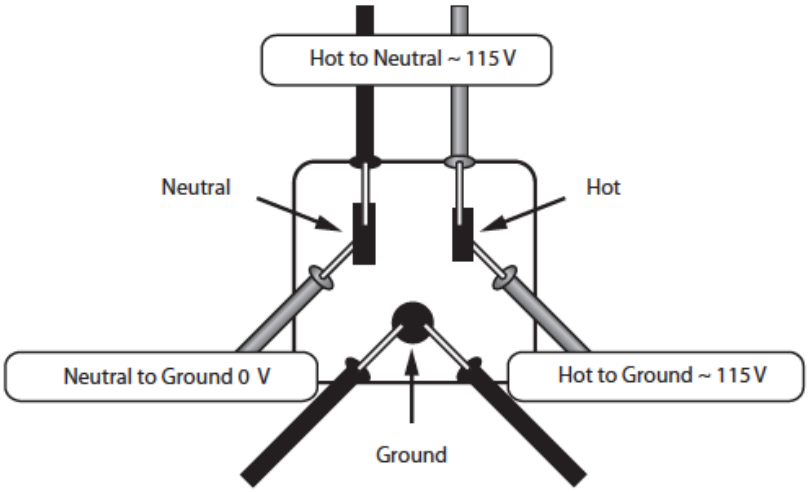
- Computers convert high voltage AC to low voltage DC. This is done by the power supply. The by-product of electricity is heat.

Supplying AC

- Power supply is connected the power cord
- AC Comes in at 110 -120V
- Power Supplies are available in 220-240 VAC to connect to the rest of the world

Supplying AC

- The IEC-320 has three holes
  - Hot – carries electrical voltage
  - Neutral – Carries no voltage, acts like a drain
  - Ground – returns excess electricitv to the earth



Voltmeters

Yon can use a voltmeter to measure a number of aspects of electrical current.

AC Adapters

- Many computing devices use an AC adaptor rather than an internal power supply. It converts AC to DC like a power supply.
- Three things must match before it is plugged in a device; voltage, amperage and polarity

Using Special Equipment to Test AC Voltage

- You can test all voltages for AC by inserting this device in an outlet.

Surge Suppressors

- A surge suppressor absorbs the extra voltage from a surge to protect the PC.

Surge Suppressors

- Surges also come from telephone and cable connections. Many manufactures make surge protectors that support these connections

UPS

- An *uninterruptible power supply (UPS)* protects your computer in the event of a power outage. It contains a battery that supplies AC Power.

UPS

- There are two main types of UPS: Online, where the devices are constantly powered through the UPS battery, and standby, where devices connected to the UPS receive battery power when the A C sags below 80-90 volts

UPS

- Every UPS has surge suppression and power conditioning, so look for a joule and UL 1449 ratings.

Supplying DC

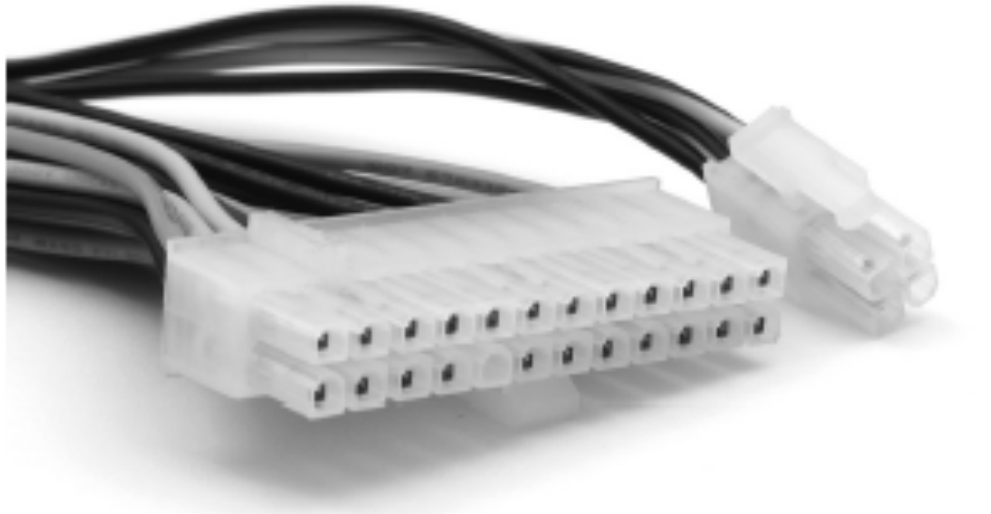
The power supply unit (PSU) converts high-voltage AC into several DC voltages such as, 5.o, 12.0, and 3.3 which is usable by the Delicate interior components.

Supplying DC

- 12.0 volts powers motors for hard drives and optical drives
- 5.0 and 3.3 volts provides current for support of onboard electronics.

Power to the Motherboard

- Modern Motherboards use a 20- or 24-pin power connector. Some require a special 4-, 6-, or 8-pin connectors to supply extra power, such as the one below.



Power to Peripherals: Molex, Mini and SATA

- Many devices inside the PC require power. These include hard drives, floppy drives, optical drives, and fans. The typical PC power supply has up to three types of connectors that plug into the peripherals.

Molex Connectors

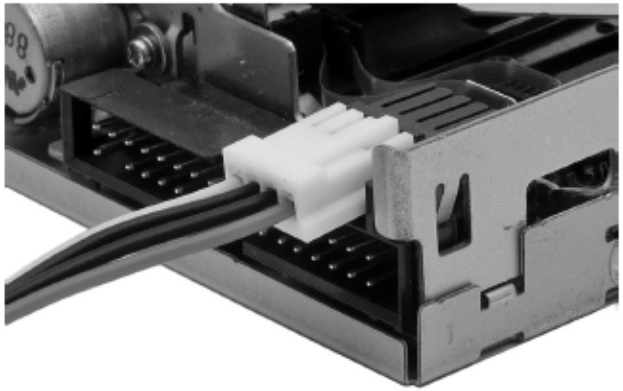
- The Molex Connector (see below) supplies 5-V and 12-V current for fans and older drives. It has notches called chamfers that guide its installation.

Mini Connectors

- All power supplies have a second type of connector, called a *mini connector*. It supplies 5V and 12V to peripherals. Only floppy drives use this connector.

Caution!

- Be careful when plugging in a mini connector. Whereas Molex connectors are difficult to plug in backward, you can insert a mini connector incorrectly. This will destroy your device. The picture below is the correct way,



SATA Power Connectors

Serial ATA (SATA) drives need a special 15-pin SATA power connector. The larger pin count supports the SATA hot-swapping feature and 3.3, 5.0 And 12.0 devices. The 3.3V pins are not used anymore and are reserved for future use.

Splitters and Adapters

You can purchase splitters to create more connections if you find yourself without enough connectors to power all of your devices inside your PC

ATX

- The original ATX had two features; the motherboard power connector and soft power.
- The motherboard power came from a single cable with 20-pin P1 power connector

ATX

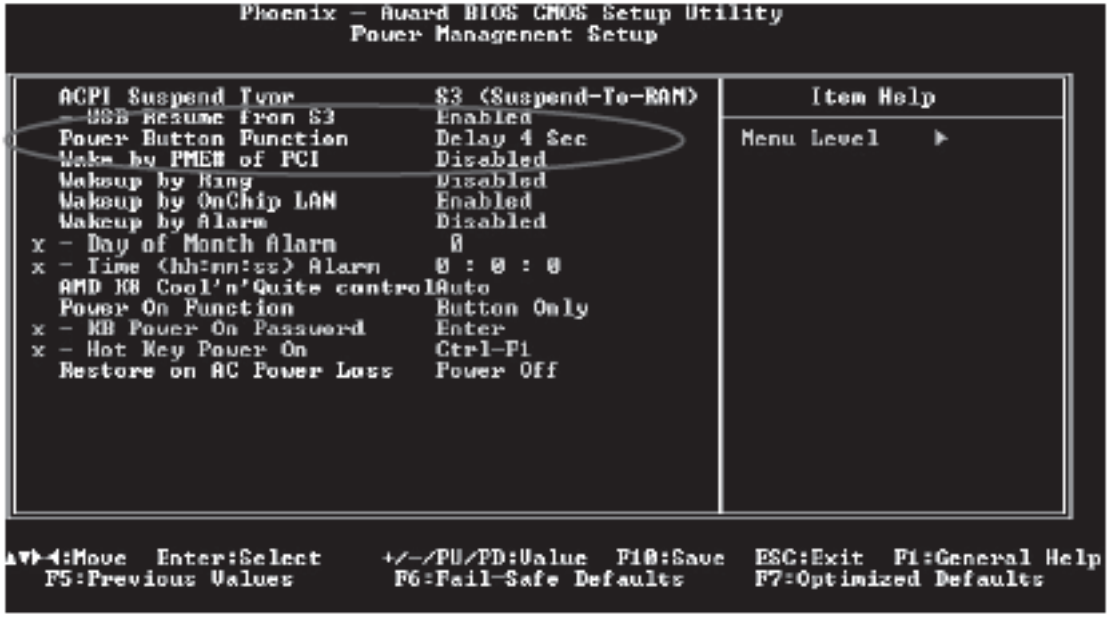
- When plugged in, ATX systems have 5V running to the motherboard. It's always "on" even when the power is down. The ATX system tells the computer whether it has been pressed. The BIOS takes over from there and handles the chore of turning the PC on or off. This is called; *Soft Power.*

Soft Power Benefits

- Prevents a user from turning off a system before the operating system has been shut down.
- Enables the PC to use power-saving modes that put the system to sleep and then wakes it up (when a key is pressed or mouse is moved).
- The important settings for ATX reside in the CMOS settings.

CMOS Settings

- Boot into CMOS and go to The Power Management Section.



Soft Power Settings in CMOS

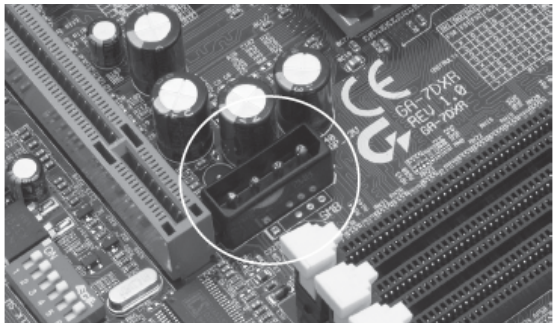
ATX12V 1.3

- This is a 4-pin motherboard power connector came out in 2003. Any power supply that provides a P4 connector is called an ATX12V.

ATX12V 1.3

- The ATX12V 1.3 also introduced a 6-pin auxiliary connector called the Aux Connector to supply 3.3 and 5.0V current to the motherboard.

Motherboards using AMD CPUs needed only the AUX connector, while motherboards using the Intel CPUs needed only the P4. As a Result many power supplies came with only a P4 or only an AUX connector to save money. Some manufacturers skipped adding either connector and used a standard Molex connector so people with older supplies would not have to upgrade because they purchased a new motherboard.



EPS12V

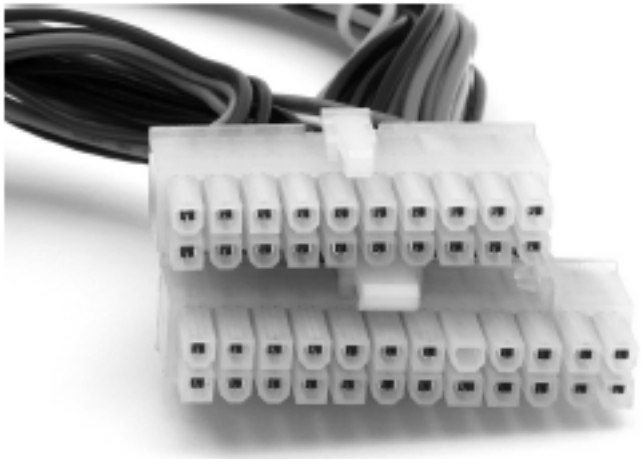
- A non ATX standard motherboard and power supply called an EPE12V was developed. It came with a 24-pin main motherboard power connector that resembled a 20-pin ATX connector. It offered more current and stability for motherboards it also came with an AUX connector, an ATX12V connector and a unique 8-pin connector.

Rails

- PCs power come from a single transformer that takes the AC current from the wall and converts it into DC current that is split between three primary DC voltage *rails*: 12V, 5.0V, and 3.3V

ATX12V

- This 24-pin power supply is backward compatible with older 20-pin power supplies. Below is a 24-pin and 20-pin connectors



ATX12V

- This picture shows a convertible connector. Although they look similar, those extra four pins won't replace the P4 connectors. They are incompatible.

PCI Express (PCIe)

- This auxiliary power connector is 6-pin. Some devices have 8-pin connectors that will accept a 6-pin instead. But this may limit performance.

Niche-Market

- The demand for smaller and quicker PCs led to the development of a number of niche-market power supply form factors. All use standard ATX connections but differ in size and shape from standard ATX power supplies.

Niche-Market

- **Mini-ATX and Micro-ATX** Smaller power supplies from factors designed for mini and micro ATX cases.
- **TFX12V** a small power supply form factor optimized for low-profile ATX systems.
- **SFX12V** a small power supply form factor optimized for systems using FlexATX motherboards
- **CVX12V** an L-shaped power supply optimized for micro BTX systems
- LFX12V a small power supply form factor optimized for low profile BTX systems.

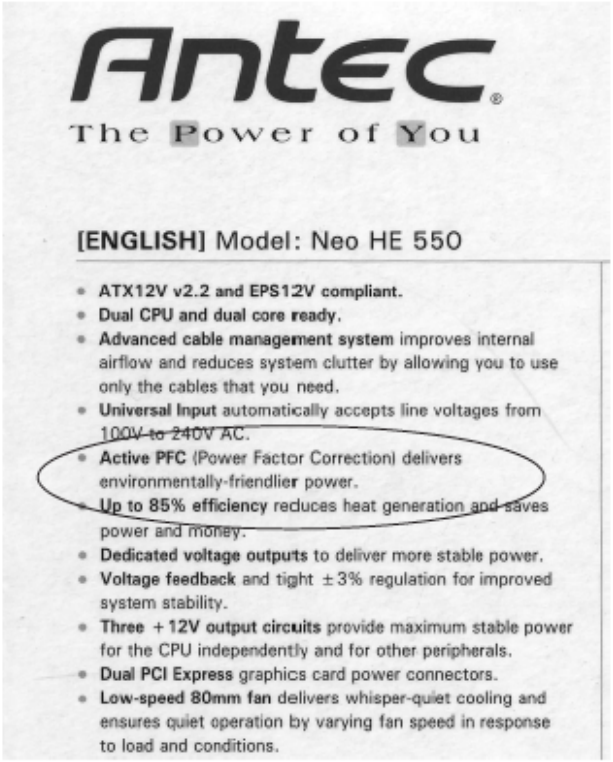
Niche-Market

SFX12V

Active PFC

- Good PC power supplies come with active power factor correction (active PFC). It is extra circuitry that smooths out power coming from the wall before passing it on to the main power supply circuits

Active PFC



Antec®

The Power of You

[ENGLISH] Model: Neo HE 550

- **ATX12V v2.2 and EPS12V compliant.**
- **Dual CPU and dual core ready.**
- **Advanced cable management system** improves internal airflow and reduces system clutter by allowing you to use only the cables that you need.
- **Universal Input** automatically accepts line voltages from 100V to 240V AC.
- **Active PFC** (Power Factor Correction) delivers environmentally-friendlier power.
- **Up to 85% efficiency** reduces heat generation and saves power and money.
- **Dedicated voltage outputs** to deliver more stable power.
- **Voltage feedback** and tight ±3% regulation for improved system stability.
- **Three +12V output circuits** provide maximum stable power for the CPU independently and for other peripherals.
- **Dual PCI Express** graphics card power connectors.
- **Low-speed 80mm fan** delivers whisper-quiet cooling and ensures quiet operation by varying fan speed in response to load and conditions.

Wattage Requirements

- Every device in a PC requires a certain amount of wattage. HD draws about 15 W of power. The total wattage of all devices combined is the minimum you need your power supply to provide.

Wattage Requirements

- Power supplies provide less power to the system than the wattage that they draw from the wall. The difference is lost in heat generation. Power supplies should be at least 70% efficient but many operate at 80%

Installing

The power supply connect to the PC with four standard screws

Installing

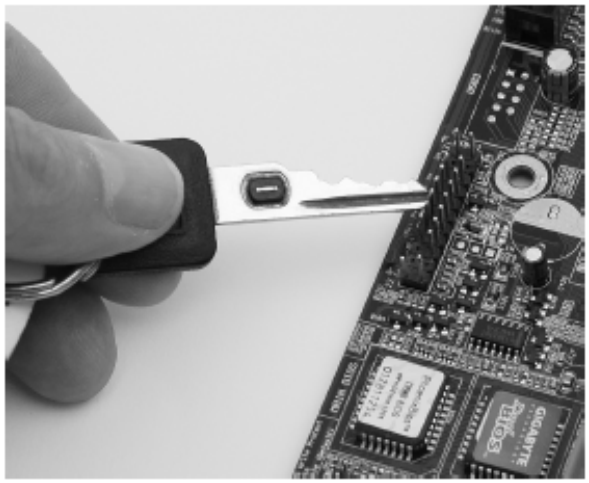
Unscrew the four and the power supply lifts out easily. Insert a new one in its place.

Installing

Many ATX power supplies provide a real on/off switch on the back of the PSU. If you really need the system to shout down with no power to the motherboard, use this switch.

Installing

You can short the on/off jumpers for situations where you have no power button when working on an ATX system.

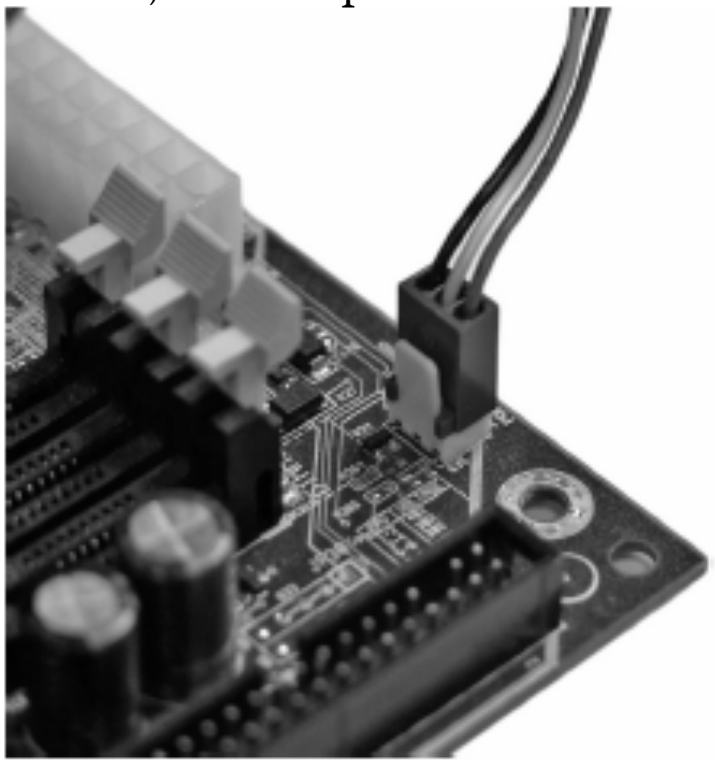


Cooling

The fan provides the basic cooling for the PC. It cools the voltage regulator within the power supply and provides a constant flow of outside air throughout the computer case.

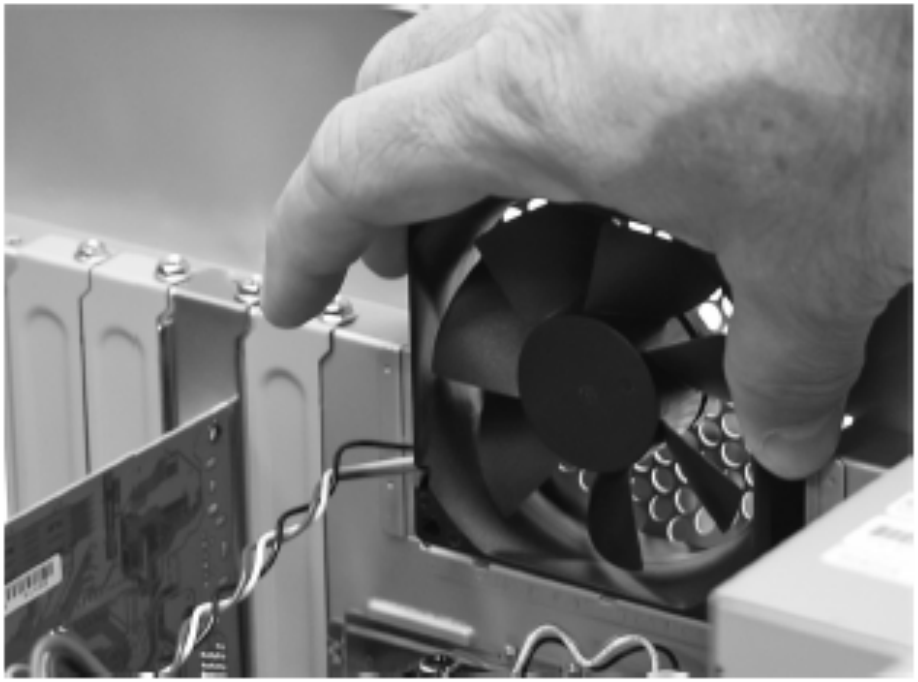
Cooling

Some power supplies come with a built-in sensor to help regulate the airflow. If the system gets too hot, the fan spins faster



Cooling

Case fans are large, square fans that snap into special brackets on the case or screw directly to the case, providing extra cooling for key components.



Cooling

Another important part of maintaining proper airflow inside the case is ensuring that slot covers are covering all empty expansion slots

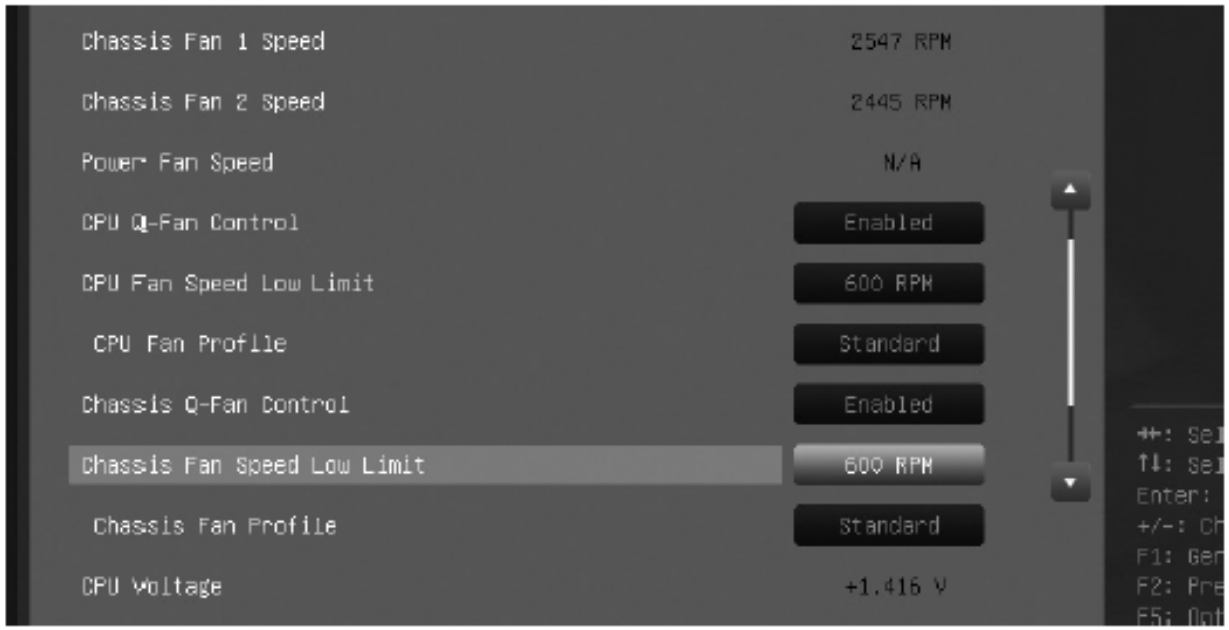
Reducing Fan Noise

Fans make noise! Manually adjustable fans have a little knob you can turn to speed up or slow down the fan.

Knob for adjusting fan speed

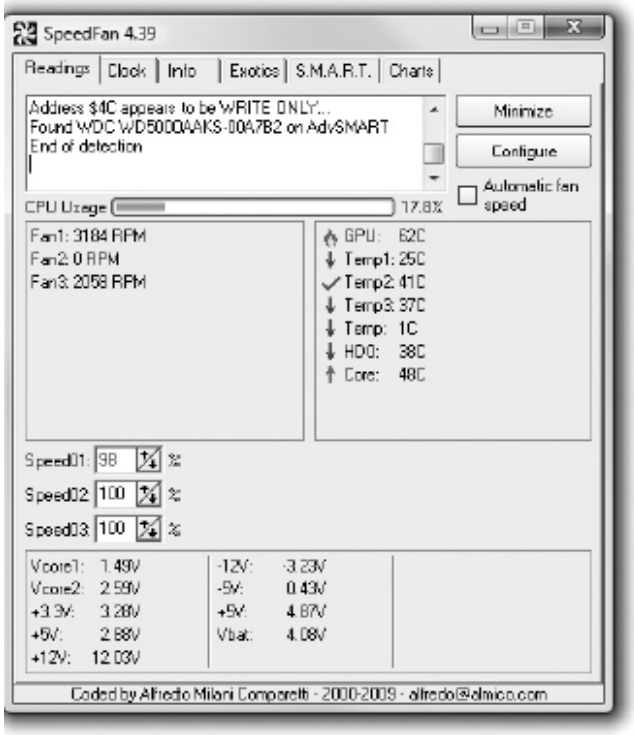
Reducing Fan Noise

Most CMOS setup utilities provide a little control over fans plugged into the motherboard.



Reducing Fan Noise

If no program came with your motherboard, try the freeware program, SpeedFan. It monitors voltages, fan speeds, and temperatures in computers with hardware monitoring chips.



Troubleshooting

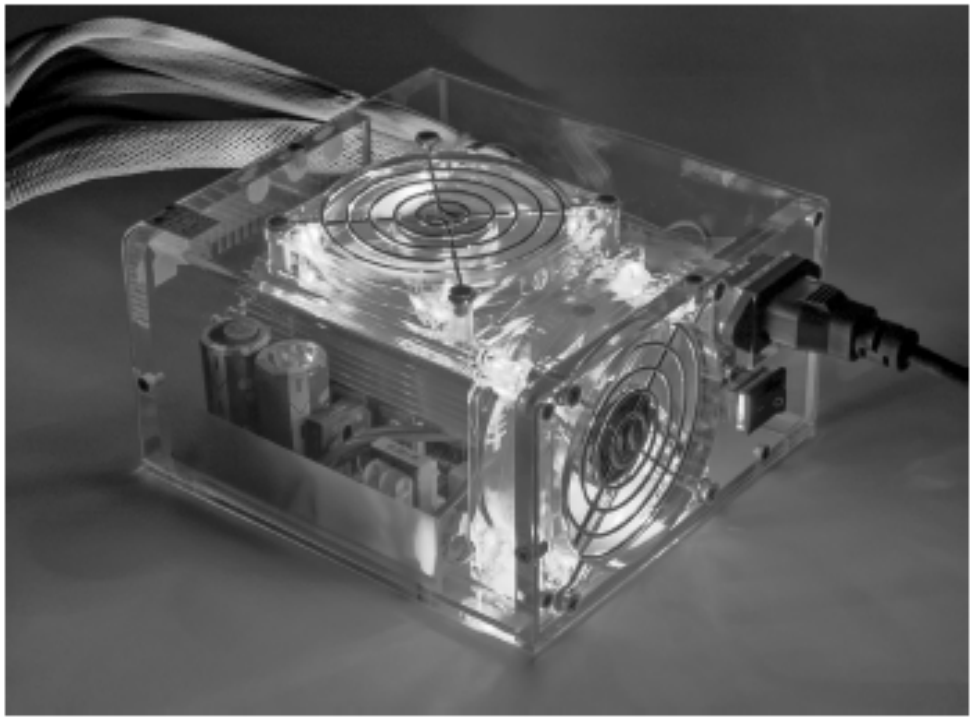
The best way to verify that a power supply is working or not working is to use a multi-meter to check the voltages coming out of the power supply.

Troubleshooting

Power supplies will not start unless they are connected to the motherboard.
If you don't have a motherboard, try an ATX tester.
Look for one that supports 20 and 24-pin motherboard connectors

Other Types of Power Supplies

Some power supplies are fancy. They can be see-through or use lights. Such as the one below that is see-through and glows blue.



Other Types of Power Supplies

Modular cables can be great because you add only the lines you need for your system.

Temperature Effeciancy

- Watch out for power supplies that list their operating temperature at 25 degree C – about room temperature. A power supply that provides 500 W at 25 degree C will supply substantially less in warmer temperatures than outside air.

END

- **POWER SUPPLIES**