POWER PROTECTION

Common-sense Tips For Computer Power Protection

by Gordon Young

Some basic steps will go a long way toward protecting your computer system from power problems. These can be used along with an Uninterruptible Power Supply.

Cheap, Cheap, Cheap

A cheap plug-in surge protector can be worse than no protection at all. If you bought a cheap surge protector of a power bar design from a hardware or drugstore more than a year ago it may be useless by now.

Cheap surge protectors can contain as little as $1 worth of surge-protection electronics. These cheap electronics burn out when the first big power surge hits them. After that all you have is a simple power bar mislabeled as a surge protector. The only thing it's doing for you is lulling you into a false sense of security.

The Right Way

Surge protectors should be replaced every year or so. Spending sixty dollars or more to protect thousands of dollars in delicate components is cheap insurance. You can continue to use the old one as a simple power bar.

At the very least, get a surge protector with MOV (Metal Oxide Varistors) in it. Since these wear out, it's best to get a protector that can be taken apart so the MOVs can be replaced.

A good basic test when shopping is to look inside the surge protector. In general, the more stuff in there, the better.

Backup, Backup, Backup!

A regular, systematic practice of backup is one of the best defenses against power problems. The more recent the last backup, the less new information will need to be salvaged during shutdown. The gaps between backups are the amount of information you will lose when the system fails sooner or later.

It's a good habit to back up to your hard drive as you enter new data into RAM. A common-sense appreciation of the value of your own time and effort will tell you this.

If you've spent hours slaving over a word-processing or spreadsheet file without backing up, you're walking a tightrope. Power-supply failure will knock all that work out of precarious RAM. What you didn't store on the hard drive you can't recover when the power comes back on.

Electrical Ecology

Be aware of your computer's electrical environment. Loads on other parts of the power supply system can cause problems with your computer.

Loads with electric engines, like vacuum cleaners, floor polishers, rug-cleaning machines, refrigerators, washing machines or fans cause transient power problems. When electric motors first start they suck all the power on a circuit, causing a sag. If carpenters are remodeling using power tools, sags can corrupt the office power supply all day.

Electric motors rectify AC power to DC, on which they run. This process causes power demand for a motor to follow a jagged form. Echoes of this pattern can make it into other power supplies, including yours.

Modern office facilities usually have decent power systems. Older buildings and houses can have problems. If they weren't

built in the electronic age their power-system specifications aren't meant to support computers.

Computers are delicate compared to light bulbs, heaters and oven burners. Standards that served these simple devices well years ago will deliver power that destroys computers and other electronic equipment.

Dedicated Circuit

If possible, put your computer on a dedicated circuit. A dedicated circuit is a power line back to the circuit breaker in the fuse box that you use for nothing but the computer system. If you can't set up a dedicated circuit, at least keep sources of problem transients—photocopiers, motors and so on—on different circuits than your computer.

Warning Signs

Watch for signs of AC power problems. Fuses may blow out periodically, or the lights may flicker when a load comes on the system. An example is a refrigerator motor turning on automatically. If these happen, you suffer from a seriously substandard power supply.

Poor computer performance can point to power supply problems. Keyboard lock-up, computers that reboot without being ordered, lost or damaged data and flaky program behavior are all symptoms.

If performance problems pop up during weekdays and disappear at night or on the weekend, the power supply can be the culprit. If computers perform perfectly in the repair shop, only to behave badly once back in the office then the office AC may be to blame.

Pull the Plug

Leaving the computer power unplugged is the best way to protect the system from power surges. It saves the surge protector's capacity to absorb shocks. It can't be eroded away gradually by the undesirable but not uncommon surges that come down the line from the power company.

If a computer isn't going to be used for a while, say if you're going on vacation, unplug it.

Lightning Storms

Don't use a computer during a thunderstorm. A lightning strike on a power pole anywhere near you will send a spike down the line so strong you'll be roasting marshmallows over your motherboard.

Unplug the power and modem connections during a storm. A lightning strike on a phone pole can send a surge into the modem that can damage your machine's innards. Surge protectors for modems are available for $30 or less.

The Bigger They Come. . .

The fancier your computer, the fussier it is about its power supply. A simple 12 MHz 80286 AT clone will run on any old power supply. By contrast, a high-end 33 MHz 80486 demands very clean power. The robustness of simpler computers is an advantage often ignored. ❐

UPS Glossary of Terms

Alternating Current (AC)
Electric current that periodically reverses direction. (see Current)

Ammeter
Meter for measuring electric current.

Ampere
The unit of electric current.

Ampere-hour (Amp.-Hr.)
A unit for battery capacity, determined by multiplying the time in hours that a current flows times the current in amperes.

Amperage
Electric current.

Apparent Power
The KVA of an alternating current source or the volt-amperage consumption of an alternating current circuit/load. Apparent power is usually greater than actual or real power. A UPS must be sized according to the total volt-amperes drawn by the proposed load.

Automatic Transfer Switch
A switch that automatically transfers electric loads to alternate or emergency-standby power sources.

Black-out
An interruption or total loss of commercial electrical power.

Brown-out
An abnormal low-voltage condition on commercial power lines. Brown-out may be intentionally produced by the power company during periods of near overload demand, or may be produced by conditions like storms, fires or accidents.

Capacitor
An AC circuit element that stores electric charge.

Common Mode Noise
A noise that happens on all power lines of an electric circuit simultaneously.

Critical Load
Equipment that needs uninterrupted power to prevent damage, loss or injury.

Current
The flow of electricity in a circuit; the volume or intensity of electric flow. Current may be either alternating or direct.

Direct Current
Electric current that flows in only one direction.

Distribution
Getting electric power from the power plant to the point of use.

Electromagnetic Interference (EMI)
Noise and transients on power lines induced by electromagnetism.

Filter
An electronic device that opposes passage of a frequency or frequency group (band), while allowing passage of other frequencies or groups (bands). Filters remove noise, leaving "clean" power.

Local Area Network (LAN)
A system of terminals connecting with one powerful computer which runs them all. LANs are popular in small- to medium-sized businesses because they are a cost-effective way for several workers to share a computer. Uninterruptible power supplies are popular on LANs because the results of a system crash with no protection can be disastrous. Data can be destroyed, work lost, and productivity time trampled. The UPS gives the LAN operator time to shut the system down in an orderly fashion, reducing risk of total disasters. Salvaging a LAN from just one power failure would make a UPS pay for itself.

Noise
Sporadic, irregular or multi-frequency electrical signals superimposed on the desired signal. With electric power, noise consists of garbage signals superimposed on the power waveform.

Off-line
When the UPS inverter is off or "cold." The computer is not relying on the UPS battery power. Switching the UPS online usually takes some time.

Online
The inverter is on and the UPS batteries are bearing load. The time the batteries can power the computer is being used up.

Sag
An under-voltage condition, 20% or more, that can last from 15 milliseconds to more than a half second. Sags are commonly

caused by adding large loads to the power line in a building. An elevator starting, a copier or coffee pot being turned on, or a large motor on a factory floor starting can cause sags.

Spike

A sharp but brief increase in voltage. commonly caused by turning off heavy loads like photocopiers, air conditioners, power tools, coffee machines or other appliances. These devices draw large amounts of power and, when they are shut off, there is a momentary excess of power on the line that can enter computers and cause problems.

Surge

Similar to a spike, a surge is a longer-lasting increase in voltage. Surges last from 15 milliseconds to a half second or more. Surges are commonly caused by the removal of heavy loads (equipment shutdown) or utility power network switching. Surges seriously damage computers.

Transformer

A device that transforms the voltage of an AC circuit. Transformers may isolate an AC circuit from its distribution. Transformers are AC devices only.

Transient

A short-term sharp deviation from the instantaneous line voltage amplitude. Transients can either increase or decrease voltage; most increase it. Lightning strikes cause severe transients.

Uninterruptible Power Supply (UPS)

A power system that protects against short-term power outages. UPSes typically rectify the incoming AC line voltage to DC. The DC voltage charges storage batteries. An inverter, driven by the DC power, supplies AC voltage for vital equipment. How long the UPS lasts depends on the load it must support and the capacity of the batteries.

Volt

Unit of electrical potential difference, or voltage.

Voltage

The electrical force or potential. Another name for voltage is the "electromotive force," or EMF.

Voltage Regulation

The process of regulating voltage to ensure a steady, even supply of power to the computer.

Watt

The unit of power.

What Bad Power Can Do To A Computer

by Gordon Young

Power problems aren't always obvious. Major power supply problems like blackouts and brownouts can cause serious damage, but at least you're aware of them when they happen. Your computer can suffer the effects of bad power without your noticing them happen. Bad power effects can vary between single computers and LAN networks.

Blackouts

A blackout is the most obvious and easily imagined effect. As power fails completely, computer systems crash. All data in RAM memory is lost, data on crashed disks is damaged, and communications links in networks are disrupted.

Brownouts

During brownouts, a drop of 10% below rated AC voltage supply can cause switching power supply damage. The computer system compensates for reduced voltage by increasing current, trying to keep power supply constant. This struggle can cause system crashes, disk crashes, memory loss and hardware damage.

Surges

Voltage surges can cause data loss, erroneous readings in monitoring systems, and hardware damage. These transients can also cause parity errors and general protection interrupts.

Sags

Voltage sags can cause unnoticed loss or corruption of data. This data can be in RAM memory or being written to disk. If a sag is long enough it can trigger automatic shutdown of some equipment.

Spikes

Voltage spikes, however brief, can destroy data in RAM or stored on disk and damage hardware—by crashing a disk head against the disk's magnetic medium, for example.

Noise

Electrical noise is the most sinister power problem. Noise can be damaging your computer without giving any sign. Photocopiers are common sources of noise. Noise can creep past your computer's defenses to do damage. The power supply filters can mistakenly think noise is a data signal. Once inside a computer, noise causes erroneous data transmissions between system components. Noise can destroy stored data. Even worse, certain high-frequency noise can travel through circuit paths, destroying integrated circuits and printed circuit board substrates. ❐

"I think this was their 'Chevy' period, circa 1974 or thereabouts."

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AC Power Basics

by Gordon Young

Computers run on imperfect power

Ideally the power from your wall outlet is a perfectly steady hum. Voltage should follow a sine wave of 60 Hertz (60 cycles per second), oscillating between -170 and +170 volts.

The power supply from your wall outlet is rated at 110 to 120 volts AC (alternating current). This rating is the RMS (root-mean-square) voltage, a kind of average that works when things follow the sine wave form.

Surprisingly, this isn't the best possible power for computers. AC is standard in North America because it transmits best over long distances and does a good job running light bulbs and heaters. These simple uses were almost the only ones around in the early days of electricity.

Other problems come along on power lines. A Bell Labs study found that transients—power supply abnormalities—happen about once per week. The power company's relay switching is a major cause of transients.

Outlets

Computer power problems can be caused by incorrectly wired outlets. If your computer is behaving badly, a basic troubleshooting step is to try plugging it into another outlet. This alone might cure it.

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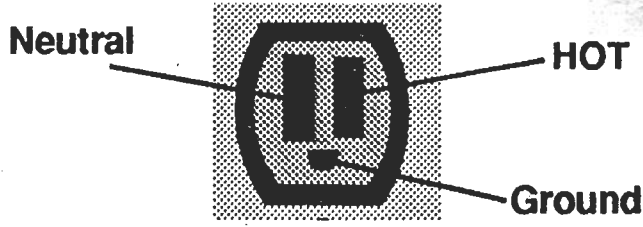
AC Power *cont. from page 27*

The holes in an AC wall outlet look like this:



The hot slot is the one charged with electricity. The voltage in this slot oscillates back and forth between +170 and -170 volts.

The neutral slot is longer than the hot slot. The ground slot is U-shaped. Sometimes the outlet may be mounted upside down or sideways. This is okay. Outlets set into floors are now illegal and should not be used—chances of them being fouled with dirt are too high. Inside the outlet, three wires attach to the three slots. The wires lead back to the main circuit breaker in the fuse box.

Outlet Problems

Electricians are sometimes careless and improperly wire power outlets by reversing connections or by failing to hook them up. The most common mistakes are to reverse hot and neutral or to not attach the ground.

Sometimes outlets are old and the springs in them are shot. The computer's power plug can't make a good contact. Have an electrician replace the outlet. ❐