



# Power Play

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IT-oriented power-protection solutions can keep your data center humming.

## Power problems can mangle an ongoing transaction, corrupt stored data, crash systems and cause hardware damage. The resulting losses cost U.S. businesses tens of billions of dollars a year, according to the Electrical Power Research Institute.

Basic power problems can disrupt a business on any given day. Beth Cohen, director of operations at Broadleaf Services, a data storage/business continuity and disaster recovery solutions service company, knows about power problems.

In one situation, according to Cohen, a mid-sized construction company's corporate office was struck by lightning. The strike was so severe that it forced the hard drive out of the network storage server.

"Fortunately, we had a large UPS (uninterruptible power supply) on the onsite backup server," says Cohen. "The strike blew out the power supply, but the data survived."

Cohen adds: "Another of our customers had a power surge that was so bad, they were burning out light bulbs. They lost three drives on a four-bay mirrored RAID 10 unit."

"A surprising number of medium-sized businesses don't have as much power protection as they should," says Farah Saeed, program manager, backup power solutions, at consulting firm Frost & Sullivan. For example, she says, "While most companies have UPSs, many don't have the right topology. Many still rely on a standby-type UPS for their servers. We are seeing facilities that may have a generator or UPS, but where individual equipment still is not fully protected against surges and voltage fluctuations."

As computer room and data-center power requirements grow for mid- and large-sized business, providing reliable power — free from surges, spikes, brownouts or outages — can require communication between IT and facilities to make sure the appropriate power protection products are in place. Does your wiring closet, computer room or data center have the right power products?

### Protecting IT

Power-related problems can be organized and grouped in a straightforward list — surges, spikes, sags, brownouts, outages and so on.

Surge protectors can protect against spikes and surges. Surge power filters can also provide high-frequency and noise-filtering protection.

Line conditioners can compensate for some degree of under- or over-voltage and cost somewhat more than a surge protector, but significantly less than a UPS. "If there are a lot of brownouts, but the power never goes out, you might want to use these," suggests Greg Fournier, product line manager, home and distributed systems, at APC. "They're all good for protecting devices that draw a lot of power, like high-end laser printers that you want to protect, but you don't need to keep up if the power goes out."

For any problem where power needs to be supplied to compensate for insufficient power or to convert utility power to direct current (DC) and then back again to AC (alternating current), you need a UPS, which includes a battery and the ability to provide AC power from the battery. UPSs also include surge protection and may include filtering protection and line-conditioning features.

### UPS Topologies

There are three UPS topologies: standby, line-interactive and online. The least expensive of the three (assuming identical battery capacities and other configurations) is a standby UPS.

A standby UPS switches over to its battery as the power source if the power level goes too high or too low. However, any frequency changes or other power glitches pass through to your IT equipment. Standby UPSs are often sufficient to protect desktop PCs.

A line-interactive UPS handles smaller under-voltage or over-voltage by boosting (raising) or bucking (lowering) the voltage, using a built-in transformer and switching to battery power only when the voltage goes so low or high the transformer can't compensate adequately. Line-interactive UPSs are used to protect servers and IT processing, storage, network and telecom gear.

An online UPS converts incoming AC to direct current and then back to AC, drawing power from the battery as needed. This isolates your IT gear from all power problems (other than an outage beyond the battery capacity). Online UPSs protect mission-critical IT gear and are also often preferred for "lights-out" or other unattended locations.

The power protection products available can more or less be mapped against the group of power problems they will handle. In fact, Eaton Powerware organizes its UPS product lines into Series 3, 5 and 9, reflecting how many of the classic nine power problems each product line addresses.

### Focus on Efficiency

In medium-sized businesses, reports Ben Smith, director of product management, enterprise single-phase UPS, at APC, "Many companies are getting their first real computer space, consolidating their original equipment and face the decision whether to buy individual UPSs for each rack or purchase a single hardwired UPS."

"Power protection technology isn't changing, per se, but the size and how products are structured is," says Frost & Sullivan's Saeed. "Seven years ago, most of the power products were big cabinets and bulky batteries. Now, UPS vendors are streamlining the designs, making them easily connectable to the network."

Also, says Saeed, "Newer products are much more modular, scalable and user friendly." For example, a rack-mounted UPS can be adapted to wire closets and small computer rooms versus a UPS in the cabinet. "We're seeing a focus on integrating UPSs with cooling, remote monitoring and connecting with building-control management." »

“Availability is now a given,” says Peter Panfil, vice president of power engineering, Liebert Solutions, at Emerson Network Power. “IT is now concerned about how to make efficient changes in a rapidly changing IT environment, including to the power side.”

## Meeting Challenges

One challenge Panfil sees is that most data centers were set up for the IT configuration at the time of the proposal, rather than taking into account equipment growth or the need to move power provisioning up to higher tiers of availability.

“We’re formatting our products for greater density and also greater serviceability and manageability,” says Dave Slotten, director of product management at Tripp Lite. “We let you match the redundancy on your UPS to the redundancy level your equipment was designed for. For example, servers that do or don’t have multiple power supplies, or adding UPSs and intelligent Power Distribution Units (PDUs) to provide this redundancy.”

Growing 24 x 7 operations in medium- and large-sized businesses add other requirements to power solutions, says APC’s Smith. This includes products and configurations where servicing doesn’t require computers or the network to be brought down — and ideally, maintain power protection during service procedures.

“In the past, you could do a UPS replacement at midnight,” says Smith. Now, companies either get an external bypass panel — which takes the UPS out of the loop while being worked on with the hope that there are no power glitches during the service — or get redundant UPSs.

Part of UPS redesign is making it possible for IT to handle more of the service tasks, notes Tripp Lite’s Slotten. “We’ve taken systems that are traditionally electrician-oriented, from the installation and interface point of view, back to the IT department. Now, the people who care about the equipment the most can service it.

“For example, you need an electrician to hardwire a traditional 7500 to 10 kVA (kilo volt-ampere) UPS,” continues Slotten. “You rarely have power receptacles you can plug them into. But once the electrician has installed power service to the box, and you have servers, voice systems, databases and other IT dependent on the UPS, suppose you have a problem.

“What’s the response time of a typical electrician? An onsite IT person with the right tools would like to be able to resolve the problem. We can let you completely replace the UPS, using no other tools than a screwdriver — swap out batteries, modules and the entire electronics, without dropping the load. We’ve built in automatic and manual service bypass, so you can just flick a switch.”

## Powerful Solutions

New UPSs are becoming more powerful and also more informative. APC’s new Back-UPS RS 1300 and 1500 LCD line-interactive UPSs “offer more run time and their displays indicate what’s going on with the power,” says APC’s Fournier. “You can see whether there’s been a voltage fluctuation, how many power events you’ve had, whether the power has gone out, and if so, how much run time you’ve got left.”

One thing most often overlooked in ensuring safe, reliable power is the actual quality of the wiring itself, says APC’s Smith. “UPSs are only as good as the grounding system they sit on. This includes the surge protection aspects. The most violent damage due to power problems is violent surges destroying data and hardware. Without a good grounding system, you’re susceptible to lightning.”

Lastly, don’t forget about cooling and the backup power to run your cooling equipment. Have enough of both, so your equipment doesn’t overheat during a power outage. ◇

# Most Common Power Problems

The most common power problems, according to Eaton Powerware, are:

- 1. Power failure (blackouts)** — Total loss of utility power can be caused by lightning strikes, downed power lines, grid overdemands and accidents.
- 2. Power sag** — Short-term low voltage typically triggered by the startup of large loads, utility switching, utility equipment failure, lightning and inadequate power service for the demand. A power sag can cause system crashes and hardware damage.
- 3. Power surge (spike)** — Short-term high voltage above 110 percent of nominal. Surges can be triggered by a rapid reduction in power loads, heavy equipment being turned off or by utility switching. A spike almost always results in data loss and/or hardware damage.
- 4. Undervoltage (brownout)** — Reduced line voltage for extended periods ranging from a few minutes to a few days. Causes include an intentional utility voltage reduction to conserve power or heavy loads that exceed supply capacity.
- 5. Overvoltage** — Increased line voltage for extended periods ranging from a few minutes to a few days. Overvoltage can be caused by a lightning strike.
- 6. Electrical line noise** — High-frequency waveform interference that can be caused by either Line RFI (radio frequency interference) or EMI (electromagnetic interference) generated by transmitters, welding devices, SCR-driven printers and lightning.
- 7. Frequency variation** — Change in frequency stability, resulting from generators or small cogeneration sites being loaded and unloaded. It can cause erratic operation, data loss, system crashes and equipment damage.
- 8. Switching transient** — Instantaneous undervoltage (notch). Normal duration is shorter than a spike.
- 9. Harmonic distortion** — Distortion of the normal waveform, caused by switch-mode power supplies, variable-speed motors and drives, copiers and fax machines and other nonlinear loads. It can result in communication errors, overheating and hardware damage.

Of these, the most dangerous power problems are the most often overlooked — problems such as frequency variation, switching transients and harmonic distortion are virtually invisible, making them difficult to detect.



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