



Common Power Problems & Power Protection Solutions

Executive Summary

All systems, from home theaters and office desktops to enterprise IT equipment in data centers, are prone to downtime, damage and data loss, especially when left exposed without a proper power protection scheme in place. Equipment faces potential danger on a daily basis, whether from severe weather, poor voltage quality, or any number of factors that can cause slow equipment degradation or instantaneous loss of power and data. The importance of clean, reliable and continuous power is paramount for the technology we depend on in our everyday lives. This white paper describes the most common power problems and their causes, how they affect applications, and the range of power protection solutions available to safeguard users' equipment.



Weather anomalies heighten the risk of damage, downtime and data loss if equipment is left unprotected.

Costly Power Problems

When severe weather, heavy loads, increased power draw, background noise, or interference compromise power quality, power problems occur. The effects of poor power quality impact every system of every size, and will cause equipment downtime, damage and/or data loss unless protected.

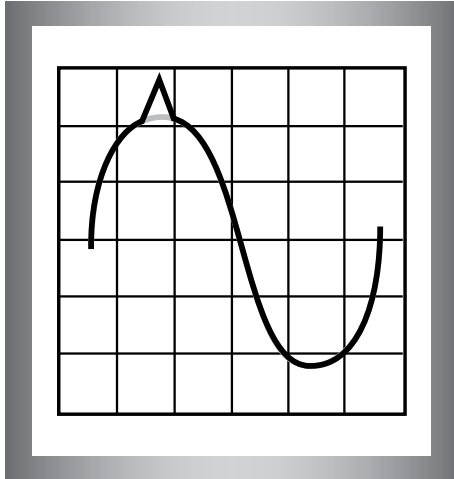
Blackouts and brownouts can knock computers off-line, causing business and productivity downtime, which costs time and money when mission-critical equipment does not receive proper power. The Electric Power Research Institute (EPRI) estimates that power outages and other power problems cost the U.S. economy up to \$188 billion per year, an unnecessary expense for users who can take proactive steps to protect their equipment. In the European Union, General Electric (GE) estimates that power interruptions cost businesses €150 billion each year.

Power surges and voltage fluctuations degrade performance and can damage or even destroy sensitive electronics, without users even knowing the cause. On average, one surge per day of 100-1,000 volts occurs in every electrical environment,¹ causing degradation over time. Slow degradation can be just as detrimental as instantaneous damage, as it causes equipment to become less and less reliable and eventually fail completely, with little or no warning.

Blackouts and voltage fluctuations can cause instantaneous data loss and system crashes with no opportunity to save important files, meaning valuable information can be lost in the blink of an eye. Power failures and surges account for over 45% of computer data loss,² which can be greatly reduced with the proper power protection solution.

The Five Main Power Problems

Something as simple as a power surge may not seem detrimental—in fact it may go unnoticed until equipment fails. At the other end of the spectrum, blackouts can cause entire systems to immediately go dark. While power anomalies are inevitable, their effects should not affect your systems, if the proper steps are taken to protect them.



Surges/Spikes (voltage increase from lightning, etc.) can damage equipment incrementally or catastrophically.

1 Surge/Spike

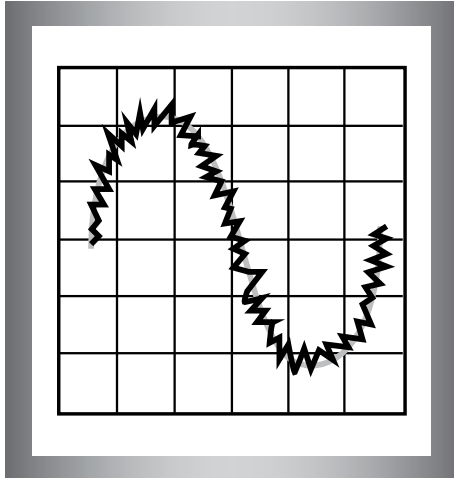
Surges and spikes are short-term voltage increases. They are typically caused by lightning strikes, power outages, short circuits or malfunctions caused by power utility companies. They cause data corruption, catastrophic and costly equipment damage and incremental damage that degrades equipment performance and shortens its useful lifespan.

Common causes of surges/spikes:

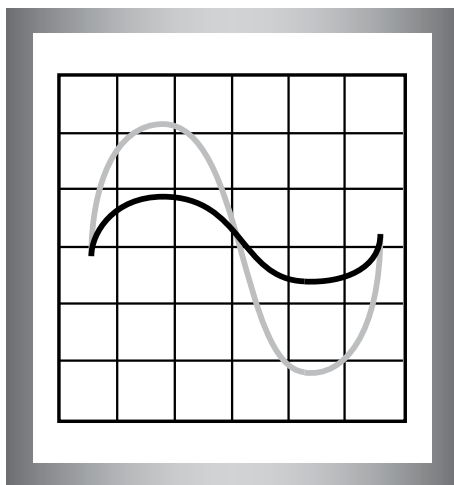
- Utility company load shifting
- Miswired electrical systems
- Lightning strikes

Problems caused by surges/spikes:

- System lockups
- Incremental or catastrophic equipment damage
- Lost productivity



Electrical noise can confuse system logic and damage electronic components, resulting in random server lockups and premature board failure.³



87% of power problems are caused by brownouts, not blackouts⁴

2 Line Noise

Line noise refers to distortion on AC, telephone/DSL, network or coaxial lines caused by Electromagnetic Interference (EMI) and Radio Frequency Interference (RFI). Line noise is unavoidable and will appear on every signal at some point, though it is not always detrimental, or even noticeable. It causes incremental electronic circuit damage, data corruption, audio/video quality problems and confusion between system components. Line noise generated by electronic devices varies greatly and can be produced by energy disturbances from a variety of sources, both natural and man-made.

Common causes of line noise:

- Radio transmissions
- High voltage power lines
- Severe weather
- Fluorescent lights

Problems caused by line noise:

- System lockups
- Audio static
- Video "snow"
- Slow electronic degradation

3 Brownout/Undervoltage/Sag

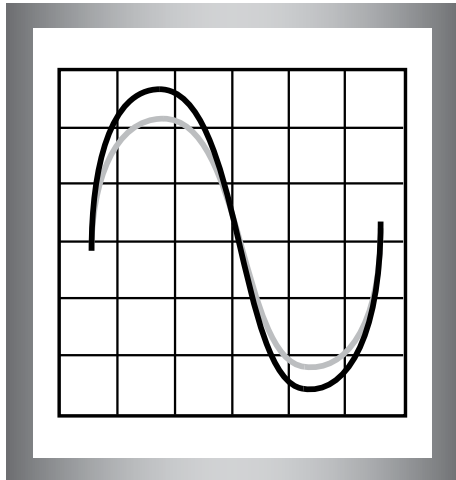
A brownout is a voltage deficiency that occurs when the need for power exceeds power availability. Brownouts typically last for a few minutes, but can last up to several hours, as opposed to short-term fluctuations like surges or spikes. They are caused by the disruption of an electrical grid and may be imposed by utility companies when there is an overwhelming demand for power. Brownouts, more common than blackouts, cause equipment failures, incremental damage, decreased equipment stability and data loss.

Common causes of brownouts/undervoltages/sags:

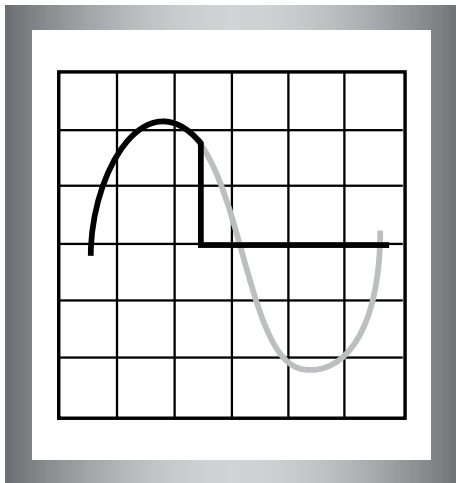
- Inadequate utility service
- Heavy power draw in area/facility
- Poor electrical circuit design

Problems caused by brownouts/undervoltages/sags:

- Active data loss
- System lockups
- Lost productivity
- Slow electronic degradation



A swell is the opposite of a sag; an increase in voltage instead of a deficiency.



Blackouts, a complete loss of power, result in lost productivity, time and money.

4 Swell/Overvoltage

Swells are basically the opposite of a brownout: instead of a voltage deficiency, or sag, a swell is a voltage increase for a long duration (seconds to a minute), as opposed to a brief increase, like a surge/spike. A swell is caused when the power being provided outweighs the power accepted by connected equipment, resulting in an increase in voltage. Much like sags, deterioration may not be apparent until it's too late, resulting in lost data and damaged equipment.

Common causes of swells/overvoltages:

- Sudden/large load reductions
- Oversupply of power from utility source
- Fault on a 3-phase system

Problems caused by swells/overvoltages:

- Slow electronic degradation
- Flickering lights
- Overheating and stress on equipment

5 Blackout/Power Outage

A blackout, or power outage, is a complete loss of utility power, whether short- or long-term. Blackouts cause reduced productivity, lost revenue, system crashes and data loss. Unplanned outages may occur as aging electrical grids and building circuits are overwhelmed by high demand. Blackouts are particularly dangerous at sites where safety or life support rely on power, such as hospitals, treatment centers and power plants.

Common causes of blackouts/power outages:

- Utility company failure
- Accidental AC line disconnection
- Tripped circuit breakers
- Severe weather

Problems caused by blackouts/power outages:

- Data loss
- System downtime
- Lost productivity
- Lost revenue

The Solution

Affordable solutions protect equipment, data and productivity against the hazards of power problems. Solutions are available for any size application, from home to enterprise business, and offer varying levels of protection, ranging from protection against common hazards like surges and line noise, to the most complete protection available against all hazards.

The chart below illustrates which solutions fit certain needs:

	Surge/Spike	Line Noise	Brownout	Swell	Blackout
Surge Protector	Good	Good	—	—	—
Line-Interactive UPS	Good	Good	Better	Better	Good
On-Line UPS	Best	Best	Best	Best	Best



Surge Protectors

Protect all computers and electronics

Surge protectors provide heavy-duty surge/spike protection and line noise filtration. Premium surge protectors incorporate more and substantially stronger protective components, as well as isolated filter banks that eliminate interference between devices plugged into the same surge protector. Select models include data line protection (telephone/DSL, coaxial and/or Ethernet).



Line-Interactive UPS Systems

Protect workstations, servers, data centers and network equipment

Line-interactive UPS systems provide surge/spike/line noise protection, have battery backup to keep connected equipment operating without interruption during blackouts and offer automatic voltage regulation (AVR). AVR allows the UPS system to adjust voltage to safe levels during brownouts without switching to battery power, reducing battery wear and preserving charge levels for blackout protection.



On-Line UPS Systems

Protect servers, VoIP systems and other mission-critical equipment

On-line UPS systems offer the best protection available against all power problems. True on-line operation with continuous AC-to-DC-to-AC double conversion completely isolates electronics from power problems. Precision-regulated output power with pure sine waveform guarantees maximum stability for connected equipment.

Conclusion

Power protection is a concern for every application, and the risks aren't going to go away. Protect computers, servers and mission-critical equipment from potentially irreversible damage with an optimized power protection solution.

Tripp Lite manufactures a wide range of products designed to safeguard equipment against downtime, damage and data loss caused by power problems. With a trusted, worldwide reputation for award-winning quality, superior reliability and incomparable customer service, Tripp Lite has the complete solution to keep equipment powered and protected at all times. With Product Finders for everything from UPS systems and surge protectors, to cables, racks and PDUs, it's easy to find what you need, plus, free technical support means you'll have the confidence to purchase and deploy the best solution for your application.

About Tripp Lite

Customers in the IT, telecom, industrial, commercial, corporate, healthcare, government and education sectors choose Tripp Lite for complete solutions to power, protect, connect and manage servers, network hardware and other equipment in data centers and related facilities. Tripp Lite makes more than 3,000 products, including UPS systems, battery packs, PDUs, rack enclosures, cooling solutions, surge protectors, KVM switches, cables, power strips and inverters. For more information about Tripp Lite's full line of data center solutions, visit www.tripplite.com.



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1. IBM
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