Common Power Problems and Solutions

- Identify Common Power Problems from the Utility
- Review Possible Equipment and Software Solutions
- Consider Best Practices

EXECUTIVE SUMMARY:
Utility power is growing more unreliable by the day. Power problems are inevitable, but solutions to these problems exist, and these solutions have evolved over recent years. Best practices suggest that facilities review these solutions yearly to protect their equipment and uptime.

Utility power is rarely clean, consistent power. Many different external factors can affect the quality of power coming into a building. Power companies are constantly faced with inconsistencies in generation sources, emerging green power generation technologies, old grids, and increased demand for electricity. Couple those stresses with extreme temperatures and other forces of Mother Nature, and the result is utility power coming into your facility that can contain spikes, sags, brownouts and even blackouts. These power quality problems damage valuable equipment, cause expensive and frustrating downtime and even, in some settings, put lives at risk.

As these stresses on the utility continue to increase, power companies cannot ensure clean power from the pole, and common power problems will continue to be an issue. The good news is that you can prevent, or mitigate, these problems by incorporating the right power equipment into the power path of your facility to protect critical load.

What Are the Most Common Power Problems?

Common Power Problems

- *Power Surges*
- *Voltage spikes*
- *Transients*
- *Frequency Variations*
- *Power Sag*
- *Line noise*
- *Brownouts*
- *Blackouts*

Power Surges

A power surge takes place when the voltage is 110% or more above normal. The most common cause is heavy electrical equipment being turned off. Under these conditions, computer systems and other high-tech equipment can experience flickering lights, equipment shutoff, errors, or memory loss.

High-Voltage Spikes

High-voltage spikes occur when there is a sudden voltage peak of up to 6,000 volts. These spikes are usually the result of nearby lightning strikes, but there can be other causes as well. The effects on vulnerable electronic systems can include loss of data and burned circuit boards.

Transients

Transients are potentially the most damaging type of power quality disturbance that you may encounter. Transients are defined as sudden, but significant deviations from normal voltage or current levels that typically last from 200 millionths of a second to half a second and are often caused by

lightening, electrostatic discharge, load switching, or faulty wiring. Transients can fall into two categories:

- Impulsive: a sudden, non–power frequency change in the steady-state condition of voltage, current, or both that is unidirectional in polarity (primarily either positive or negative).
- Oscillatory: a sudden, non-power frequency change in the steady-state condition of voltage, current, or both, that includes both positive and negative polarity values.

Frequency Variation
A frequency variation involves a change in frequency from the normally stable utility frequency of 50 or 60 Hz, depending on your geographic location. This may be caused by erratic operation of emergency generators or unstable frequency power sources. For sensitive equipment, the results can be data loss, program failure, equipment lock-up or complete shutdown.

Power Sag
A sag is the reduction of AC Voltage at a given frequency for the duration of 0.5 cycles to 1 minute's time. Sags are usually caused by system faults, and often the result of switching on loads with high demand startup currents.

Electrical Line Noise
Electrical line noise is defined as Radio Frequency Interference (RFI) and Electromagnetic Interference (EMI) and causes unwanted effects in the circuits of computer systems. Sources of the problems include motors, relays, motor control devices, broadcast transmissions, microwave radiation, and distant electrical storms. RFI, EMI and other frequency problems can cause equipment to lock-up, and data error or loss.

Brownouts
A brownout is a steady lower voltage state. An example of a brownout is what happens during peak electrical demand in the summer, when utilities can't always meet the requirements and must lower the voltage to limit maximum power. When this happens, systems can experience glitches, data loss and equipment failure.

Blackouts
A power failure or blackout is a zero-voltage condition that lasts for more than two cycles. It may be caused by tripping a circuit breaker, power distribution failure or utility power failure. A blackout can cause data loss or corruption and equipment damage.

How To Solve These Common Power Problems

In order to protect your facility from the downtime, equipment damage and loss of business that common power problems can cause, a layered approach of equipment and assessment solutions is a best practice. Solutions include the following.

Surge Suppressors

Surge Suppressors: Transient Voltage Surge Suppression (TVSS) provides protection against transient surges, which can happen so quickly that they do not register on normal electrical testing equipment.

Surge suppressors or surge protectors are the most basic form of power protection. A surge suppressor is often used to shield important, but less critical or highly sensitive equipment. It is also used as a complement to more comprehensive power protection solutions. They are passive electronic devices that protect against transient high-level voltages.

Voltage Regulators

Voltage Regulators maintain voltage levels within acceptable ranges assuring that electrical equipment will operate properly. Voltage regulators and power conditioners can be combined into one system.

Power Conditioners

Power Conditioners are used to protect sensitive loads by smoothing out voltage fluctuations such as spikes, transients, and electrical noise. Also

known as a line conditioner, it protects equipment from power surges, helps to correct voltage and waveform distortions, and removes external electrical noise.

Uninterruptible Power Supplies

Uninterruptable Power Supplies: UPS systems are one of the most common devices to help address some power issues. They are designed to provide power to a load when the input power source fails. They can provide immediate back-up power with energy stored in batteries or flywheels. The run-time of today's UPS can range from less than a minute to hours, but long enough to start a standby power source or properly shut down the protected equipment.

Choosing the correct UPS runtime for your facility will depend on many things. How critical is your load? For hospital operating rooms and ICU's even a few seconds without power can be life threatening. If your facility is less critical and has management software that initiates a graceful shutdown to protect equipment, then you only need a few minutes of UPS runtime. Each situation and facility are unique so getting an expert opinion on runtime requirements is a valuable step.

Voltage Regulators and Power Conditioners can be separate instruments but both Line Interactive UPS and Online Double-Conversion UPS provide some level of built-in power conditioning. Line Interactive UPS systems also have automatic voltage regulation (AVR). Online double-conversion UPS provides 100% power conditioning, zero transfer time to battery, no change in output voltage and better transient suppression than line interactive UPS.

APC Smart-UPS Online provides high density, true double-conversion on-line power and is capable of supporting loads from 1 to 20kVA.
APC Symmetra LX is a redundant, scalable, double-conversion on-line modular UPS with models from 2kVA to 16kVA.

Both of these UPS provide 100% power conditioning, zero transfer time to battery and better transient suppression than line interactive UPS.

power solutions

Generators

Generators: A generator provides emergency backup power systems for many different applications, including data centers, office buildings, construction, telecommunications, food and beverage processing, agriculture, laboratories, and medical facilities. Standby diesel generators and Natural gas generators are options for providing back up power if utility power is still out.

UPS Management Software

UPS management software can initiate a controlled shutdown of the system to avoid the loss of data. When used in conjunction with standby generators, and UPS back-up, using UPS management software to gracefully shutdown less critical equipment, will give the system valuable uptime in the event of a power failure.

Power Quality Audit

Power Quality Audit: A power quality audit can help determine the causes of your power quality problems and provide a well-designed plan to correct them. The power quality audit checks your facility's wiring and grounding to ensure that it is adequate for your applications and up to code. The auditor will check the quality of the AC voltage itself and consider the impact of the utility's power system. The findings will be included in a report outlining problems found during the audit and recommend solutions.

An effective Power Quality strategy should provide the following:
Harmonic mitigation – Many applications require solutions to reduce harmonic current and voltage distortion
Interruption solutions – Reduce problems associated with outages using UPS, paralleling switchgear, generators and/or energy storage devices
Voltage regulation – Stabilizes a facility's voltage and eliminates costly problems due to under voltage and over voltage events
Surge protection – Eliminates problems associated with transients traveling on AC, telephone, and communication lines
Effective grounding – A well-designed and properly installed grounding system is required for safety and operation of all electrical equipment

---

For more information about common power problems that your facility may face, and the solutions for them, call 800-876-9373 or email sales@power-solutions.com.

Power Solutions | PO Box 100 | Barrington | RI | 02806

power solutions