The Basics of Network Surge Protection

DITEK®
Surge Protection

Introduction

In a world where many disasters seem unavoidable, there are common threats to your organization's networks that can be minimized or prevented completely. Fire, security and data information networks may have distinct purposes, but they share both a high level of importance and a vulnerability to damage that drives the need for protection. IT departments often provide protection in the form of sophisticated software to detect ransomware, data breaches and other attacks, at least for the information network. However, for all network types, perhaps the most dangerous data loss threat is also a simple one – power disruptions and power-induced damage.

86% of businesses say that the cost for one hour of downtime is $300,000 or higher.

The loss of power to a network, or the network being subjected to power anomalies, is a crippling event. Two of the most catastrophic causes of power anomalies are lightning strikes and power surges. But as frequent and costly as these network threats can be, the solution can be simple and cost-effective if an organization employs appropriate surge protective technology that can help protect against blackouts, brownouts, noise, spikes, and power surges. Each of these events present a different challenge to a company's network that if not properly addressed, can have devastating effects to sensitive electronic systems including access control, video surveillance, fire, and HVAC, not to mention critical data loss and compromised company information.

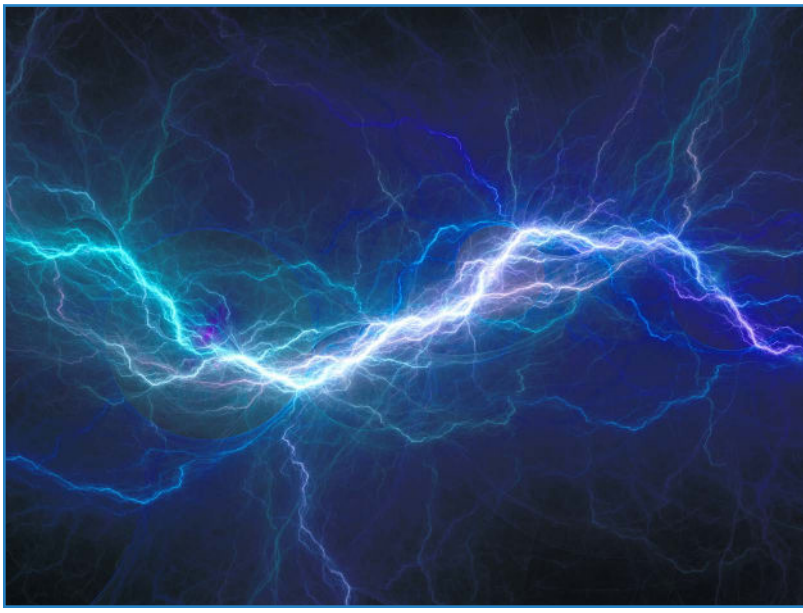
The Culprits and Cost of Power Quality Issues

Downtime as a result of power anomalies can cost a business a significant amount of money. According to the Information Technology Intelligence Consulting firm's latest survey conducted in May of 2019, hourly downtime costs continue to increase for all businesses irrespective of size or vertical market. The survey, which polled over 1,000 businesses worldwide, found that a single hour of downtime now costs 98% of firms at least $100,000. And 86% of businesses say that the cost for one hour of downtime is $300,000 or higher; this is up from 76% in 2014 and 81% of respondents in 2018 who said that their company's hourly downtime losses topped $300,000. Additionally, ITIC's latest 2019 study indicates that one-in-three organizations – 33% – say the cost of a single hour of downtime can reach $1 million to over $5 million.

DITEK® Surge Protection

These are staggering and eye-opening statistics that vividly illustrate the potential impact of power surge events. While lighting strikes often grab headlines, it is the more insidious power damaging culprits that are commonplace. Namely power surges and power spikes.

So, what exactly are surges and spikes? The simplest definition is that these occurrences are unexpected, temporary and uncontrolled increases in current or voltage in an electrical circuit. Surges and spikes can be present on any metallic conductor.



When you think of a facility, and all the different copper wires coming into that facility, those are all vulnerable paths that a power surge can cause damage. Surges and spikes can damage, degrade and even destroy electrical and electronic equipment. These power events are by far the most common cause of equipment damage and destruction.

How Surge Events are Caused

The causes of surges and spikes can be separated into two categories, external causes and internal causes.

How Does Surge Protection Work

Surge protection works by simply diverting excess voltage safely to earth ground before it reaches critical equipment. You can think of a surge protector as a pressure relief valve so to speak. It is completely passive to the circuit until it sees a voltage potential that is not supposed to be there. Then the device reacts, dissipates the energy to ground, and resets.

External causes

There are a number of external causes that can produce damaging electrical surges and spikes. A direct lightning strike will cause equipment damage (and maybe fire and worse), but fortunately direct strikes are extremely rare in most parts of the world. Proximity strikes (lightning strikes that induce effects in nearby wiring) are more common, and can cause electrical disturbances up to several miles away from the strike itself.

Other common sources of surges and spikes include utility grid switching as well as the actions of neighbors such as welding or switching on heavy machinery.

Internal causes

The most common causes of all surges and spikes may well be sources that are within the facility itself. Switching on and off electric motors such as the HVAC systems, refrigeration equipment, pumps, and machinery can all create electrical surges and spikes. Office copiers are actually one of the most common causes of internally generated power surges. Mechanical failures can also add to the problem when components of the electrical distribution system fail. And as much as we like to think it does not happen, human error,

DITEK® Surge Protection

which might include the accidental induction of AC power on low voltage systems, can also corrupt power.

Altogether, these internal and external sources can subject sensitive electronic equipment to many small electrical surges that have a cumulative effect on the circuits and their components. Unfortunately, staff in the building are rarely aware of these small power disturbances that mostly pass by unnoticed. The effects of surges and spikes can be categorized as the three “Ds”.

- **Degradation**, which is the gradual deterioration of internal circuitry that leads to premature equipment failure. This is caused by the small, generally unnoticed everyday surges.
- **Destruction**, which is the sudden dramatic loss of expensive equipment, including electronics, motors, controllers and other instrumentation. Destruction is typically rare, either from a lightning strike or from electrical malfunction or human error such as touching low voltage cabling with high voltage service lines. Often, failures that are believed to be sudden are actually a ‘final straw’ failure after many cumulative smaller surge events and degradation.
- **Downtime,** the most important of the three Ds, describes a loss of productivity, lost revenue, and/or loss of critical data and information.

Office copiers are actually one of the most common causes of internally generated power surges.

Electrical surge-related failures can involve more than one type of loss or cost. For example, consider a video surveillance camera that fails due to electrical surges. In addition to the cost of the camera, there is also the impact of losing all the image data while the cameras are off-line. The equipment loss can prove even more costly if an event occurs during this downtime resulting in an injury or loss of assets and your security department does not have the video evidence to support an investigation or to mount a defense.

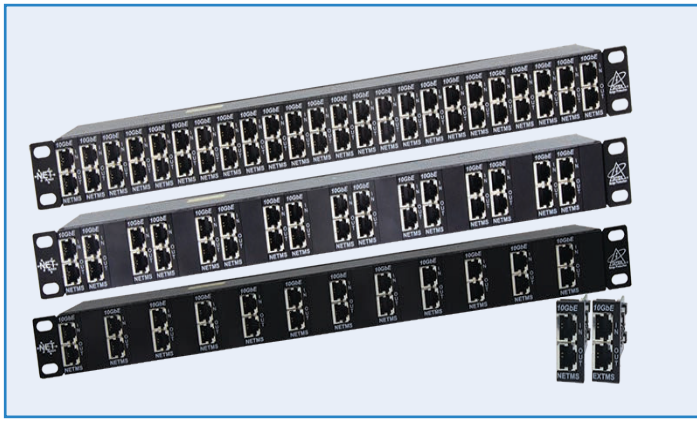
How to Assess the Basics

Like any electronic device, you get what you pay for. The lowest-priced surge protective devices simply divert excess energy that exceeds their designed threshold and may have a very short life span. A higher-quality device can divert multiple hits and remain operational, which may prove more cost-effective over the long run.

DITEK® Surge Protection

Some surge protective devices have the capability of alerting operations staff that a surge or spike has occurred and instructing them the system may need to be checked or the SPD replaced to maintain protection. This is the best approach, because operations staff may not be aware of recent power surges that may have compromised the device.

However, simply having a surge protector does not guarantee the safety of equipment, since protectors come in a range of capacities. The unit needs to have the capacity to handle the spikes and surges expected in its application environment and have a sufficient expected life span. Commercial-use surge protectors specify how much energy the unit can withstand, often stated in “Maximum Surge Current”. A higher number indicates greater protection. A listed maximum surge current rating will also confirm that the device is a surge protector and not simply a power strip.



Also note that surge protectors come in different designs and styles for protecting incoming power and protecting data/telecom devices. This is because power protection must be designed for service power voltages – typically 120V or 240V, or sometimes higher in commercial settings. Communication equipment usually operates at lower voltages (but not always) and so the protection function not only has to match the expected voltage but also allow for communication signals to pass through without being excessively attenuated.

Surge Protective Devices for Power

Surge protection specifications for electrical power follow either the ANSI/IEEE C62.41.2-2002 industry standard, which divides the SPD installation areas within a facility into three categories/exposure levels (A, B and C), or the UL 1449 specification that along with the NFPA 70 NEC guide also defines three distinct types of protection that they call Types 1, 2, and 3. Note that while both of these guidelines use a similar approach, they start at opposite ends of the system, so UL “Type 1” SPDs are designed for the same service area as ANSI “Category C” SPDs – at the service power entry. The primary idea of these standards is to ensure that the design of the SPD is appropriate for the service location where it will be installed. A typical installation plan prepared by a qualified installer will include specific and distinct SPD models at the electrical service entry, at distribution and sub-panels, and at the power point of use (outlets or hardwired equipment).

Planning and specifying surge protection for a system should begin with the incoming service entry.

It is important to remember that in order to keep surges from entering a facility and potentially corrupting the network, there must be a layered protection strategy in place. Planning and specifying surge protection for a system should begin with the incoming service entry because this is the primary entry point for power surges and spikes that originate outside the facility. Protecting the distribution and sub-panels also provides some protection from internally generated power anomalies traveling to other areas of the facility. A third layer of protection can be applied to potential surge sources such as welders, air handling equipment and

DITEK® Surge Protection

similar large electrical devices, as well as at the point of power connection for all sensitive electronic devices such as fire, security, and data communication networks.

This layer of protection provides the best approach to mitigating the effects of electrical surges and spikes that may enter the building, and for stopping any internally generated surges from traveling within the building wiring to cause damage to other sensitive electronic systems.

How SPDs Can Mitigate Surge Issues

The basic concept for total surge protection of any physical structure and its internal networks is to mitigate the effects of surge and spike voltages with a coordinated effort of protective best practices. This surge protection plan should include protection against external sources of surges and spikes, mitigation of internal sources of electrical disturbances, and a robust, low impedance grounding and equipotential bonding system to ensure the SPDs can effectively divert surge voltages.

It is important to consider surge protection as a preventative measure, preserving the functionality of devices and the systems they run on. Surprisingly, the design of security systems oftentimes does not include surge protection. Yet, the simple implementation of surge protective devices safeguards against over-voltage being absorbed by critical equipment and security devices, extending their lifespan. If they are not installed on existing systems, they can be easily and cost-effectively added to almost any electronic system or wired network.

A surge protector ensures that excess energy is safely diverted to ground. This prevents the surges from flowing through and damaging the equipment while at the same time allowing the normal voltage to continue along its path, so the equipment continues working without interruption.

Surge protection is vital to ensuring the integrity of video surveillance records, which provide much more than just a monitoring function. Video surveillance also provides theft and crime deterrents and forensic and analytic capabilities, all the more reason to mitigate power outages, surges and voltage transients on network data lines that can leave video surveillance systems inoperable when they are needed most.

Surge protection is vital to ensuring the integrity of video surveillance records.

Most video experts recommend that surge protection be installed at every external camera, including outdoor PoE or PoE+ IP cameras. This step helps stop a surge that can travel through the cabling from a remote device to damage or destroy a network switch. This can set off a cascading effect causing further issues with other switch-connected devices including servers running VMS software. Aside from these potential liabilities, if there is

DITEK®
Surge Protection

no data backup solution in place, the risk remains that a random power surge can permanently delete data.

While loss of equipment, data and cabling are the obvious asset victims from power surge incidents, the potential downtime could be far more costly when you consider that facilities must be evacuated when the fire alarm systems are not functional. A security system that is off-line means that an organization would be forced to bring on temporary security guards to keep watch on parking lots, doors, and secure areas at an additional cost. There is also a loss of productivity if staff is delayed by congestion and manual processes at entrances, or if their work equipment and/or work data is damaged or lost.

From a business perspective, perhaps the most insidious result of downtime is the potential loss of customer confidence and revenue. A customer using social media to complain about a website being down for a few hours can have a negative impact to the organization's brand and prove detrimental to the business for an extended time.

Protecting Networked Systems

The expanding IoT universe and the rapid migration of myriad monitoring, security and fire services to the cloud puts even more reliance on the local, physically networked devices. This is because damaging surges can easily migrate among the connected devices, increasing the risk of damage to other parts of the system. As more and more devices are networked across multiple systems, a power surge could travel from a surveillance camera through a digital network to a device on another system. The implementation of surge protection at both ends of these network connections, and especially at locations where the network moves from outside the facility to the inside, can help prevent surges from spreading across a network and damaging or destroying multiple devices and systems.

Perhaps the most insidious result of downtime is the potential loss of customer confidence and revenue.

Conclusion

The proactive approach to power surge protection is to work with your consultant and systems integrator during the proposal stage of a project build. However, if systems are already installed and in service but lack surge protection, adding protection to the existing systems must be considered a priority.

DITEK® Surge Protection