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Surge suppression takes the bite out of transients

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Voltage transients are just one of those things you may not give a lot of thought to until they've done their worst. Taking preventive measures will put transients in their place and allow you to rest easier. An effective program can even have a positive impact on the bottom line. In fact, one particular deployment of transient voltage surge suppressors brought 80% annual savings in equipment repair costs while helping maintain smooth operations.

Outside threats and those from within

A voltage transient is a high-rising, short-lived voltage on one or more phases of a system. Transients can reach 20,000 V or more. While they last but two milliseconds or less, the damage they can cause can be considerable and long term.

Transients are generally thought of as being threats from outside the facility. While many do arise from outside sources (most particularly lightning, but also distribution system short circuits, load switching and capacitor switching), in truth, 80% originate within the facility.

Internal transients can be caused by virtually any load turning on or off; by the starting and stopping of motors; by photocopiers, arc welders, florescent lighting and even light dimmers.

***TVSSs are designed** to prevent damage, disruption and degradation to electrical and electronic equipment by operating as 'pressure relief valves,' shunting harmful surge current to ground under a surge condition.*

Transients are a bigger threat today than ever before. The potential danger of transients occurring lies not only in AC power systems but with all conductors. A communications network, for example, must also be protected. Today's power systems are increasingly challenged by the ubiquity of electronics and microprocessor-based equipment. Microprocessors are getting ever smaller, faster and more sensitive and they require clean power. Non-electronic loads may operate without disturbance in an environment with low to medium transients; devices such as electric motors, incandescent lighting and resistive heating loads typically take longer to be damaged by medium and low-level voltage transients.

But electronics – particularly microprocessors – operate at much lower voltage levels and are therefore far more susceptible to transient damage. Microprocessor-based loads often share circuits with transient-generating equipment such as switching power supplies, lighting panels and non-linear demand loads.

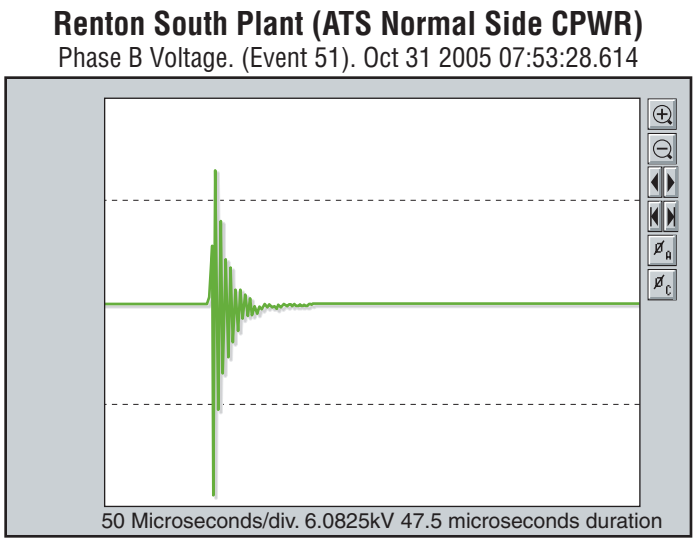

Fig. 1. A voltage transient is a high-rising, short-lived voltage on one or more phases of a system and can reach 20,000 volts or more. Although they can originate outside the facility, 80% come from inside the plant, with sources being photocopiers, arc welders, lighting and even the switching of a circuit breaker.

Identifying a transient problem

Since transient voltages occur very quickly – typically lasting 50 nanoseconds to 2 milliseconds – they can't be captured by most conventional meters found on electrical distribution equipment or most standard voltage and current meters. High-speed power-quality meters and oscilloscopes are able to capture transient activity, but these devices can cost tens of thousands of dollars each and are therefore often economically impractical.

But it doesn't necessarily take tens of thousands of dollars to find a transient problem. There are often telltale signs that voltage transients are negatively affecting the electrical system and equipment. They include:

- Equipment damage
- Insulation breakdown on electrical conductors
- Premature aging of electrical and electronic equipment
- Process interruption
- Data loss and data transfer-rate reduction.

Transients also can affect logic signals in electronic equipment, in that noise can be interpreted as legitimate signals, resulting in operating errors and downtime.

Unfortunately, many users chalk these damages up to 'unavoidable business costs' or to 'normal maintenance expenses.' In fact, these damaging effects can be easily and cost-effectively downgraded to manageable transient voltage surge events, saving time and money and avoiding data loss.

Transient voltage surge suppressors are the answer. The bottom-line objective of a TVSS is to prevent damage, disruption and degradation to electrical and electronic equipment. TVSSs serve as pressure relief valves, shunting a harmful surge current to ground under a surge condition. Most surge suppressors use metal oxide varistors, which are primarily composed of zinc oxide grains, as the common building block for surge diversion.

The bottom-line objective of a TVSS is to prevent damage, disruption and degradation to electrical and electronic equipment.

Under normal operating voltages, a TVSS is virtually invisible to the electrical system. It may draw a few mA of current to power-monitoring circuits, but otherwise doesn't affect the electrical distribution system. When a high voltage level on the electrical system appears due to a voltage transient, the suppressor kicks into action and changes state to a very low impedance. When in this overvoltage state, the TVSS bears the brunt of the harmful transient, shunting tens of thousands of Amperes to ground.

A high-quality, modern surge suppressor can take multiple surge events over its lifetime. Many surge suppressors have been tested in high-power laboratories in accelerated lifetime testing and have been shown to survive thousands of transients of 20 kV, 10 kA. When properly applied and sized, a TVSS should have a useful life of more than 30 years. TVSSs are available in a variety of voltages and sizes, measured in kA of surge current.

No one-size-fits-all solution

A high-quality TVSS has a long life, a fast reaction time, is rugged and relatively inexpensive. It also incorporates one or more optional components such as advanced filtering (removes high-frequency noise), fusing (safely disconnects an MOV under end-of-life conditions), monitoring (indicates health and status of the TVSS) and outputs (a signal to a monitoring or alarm system when the TVSS has failed).

The proper TVSS for one application may not be the best for another. To help properly mitigate transients, locate a vendor who understands the particulars of any potential scenario and can meet your needs. Having done so, savings can be phenomenal.

A high-quality TVSS has a long life, a fast reaction time, is rugged and relatively inexpensive.

The following are a few examples of benefits reaped by businesses in several industries after having deployed a TVSS solution:

- An oil and gas production company was spending $700 a month in service costs for five variable-frequency drive units. After the installation of a TVSS, the company saw an 80% decrease in those costs

- A $275-million automobile assembly plant renovation project was in jeopardy. PC boards for robotic welders were blowing at a rate of four to eight boards per robot, per day. Repair costs were averaging $55,000 a month per robot. After the installation of a TVSS, improvements in overall operations were dramatic. Board loss and downtime disappeared
- A water filtration plant was experiencing frequent equipment damage due to surges. The plant installed a variety of TVSSs on pumps; instrumentation; communication lines; and branch, service and computer panels. Since their installation four years ago, the TVSS units have performed well and no equipment has been damaged or taken offline
- Sophisticated communications and warfare systems on carrier vessels were costing the U.S. Navy more than 100 corrective maintenance man-hours per system, per year, and millions of dollars in repair parts and circuit boards. In one system alone, after deploying a TVSS solution, corrective maintenance man-hours were reduced from 124.8 to 4.8, and the solution paid for itself in less than four months.

Turn to a proven manufacturer

A comprehensive transient voltage protection solution reduces equipment damage, decreases maintenance costs and improves system uptime and in so doing realizes savings in operational costs. TVSSs can be installed for total facility protection – from powerful motors to sophisticated lighting controls and sensitive computer-based controllers.

Protection begins at the incoming power panels and extends to system distribution centers, panel breakers, points of use and even to individual equipment. These solutions take into account the fact that every TVSS application must respond to a number of particulars – including the sensitivity of the equipment, the criticality of the process being protected and the location of conductors and electrical distribution equipment. TVSS solutions are available in varying kA ratings, filtering options and more, meeting the requirements of each specific application.

Carey Mossop is Eaton Electrical's product line manager for TVSS. With more than 25 years experience in the electrical industry, he has spent the last 17 in various roles of increasing responsibility at Eaton. After starting his career as an electrician, Mossop earned his Bachelor of Engineering degree from Lakehead University and a Masters of Business Administration degree from Seattle University. He is a member of the Industry Development Council for TVSS Products with NEMA. Mossop speaks frequently to audiences regarding Transient Voltage Surge Suppression and other power quality issues.

TheBottomLine…

- *A voltage transient is a high-rising, short-lived voltage on one or more phases of a system that, while short in duration, can cause considerable damage.*
- *While transients are generally thought of as being threats from outside the facility, 80% originate from within.*
- *With the proliferation of electronics and microprocessor-based equipment, transients are a bigger threat today than ever before.*
- *A transient voltage surge suppressor serves as a pressure relief valve, shunting a harmful surge current to ground under a surge condition.*
- *There is no one-size-fits-all solution to suppressing voltage transients.*
- *Turn to a vendor that understands the particulars of any potential scenario and can meet all your needs.*

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