Complete Transient Voltage Suppression with OnFILTER CleanSweep® AC EMI Filters

OnFILTER's plug-and-play CleanSweep® AC EMI filters provide superior EMI and transient suppression on power lines and ground in real-life applications.

Clean, reliable power is at the core of reliability of any equipment. Conventional voltage transient suppression provides less than perfect protection leaving significant transients intact. OnFILTER's CleanSweep® AC filters in combination with regular transient suppressors provide complete protection against power line transients.

CleanSweep® AC EMI Filter
AF Series

Power Line Transients

Short "spikes," or transients, on power lines – brief voltage surges – can be quite high, reaching as high as 6kV. Sources of these spikes may be anything from lightning to nearby equipment turning on and off. Strong transients can disrupt the normal operation of equipment and cause hardware damage. But even moderate spikes can cause significant downtime by corrupting data and causing gradual deterioration of internal components.

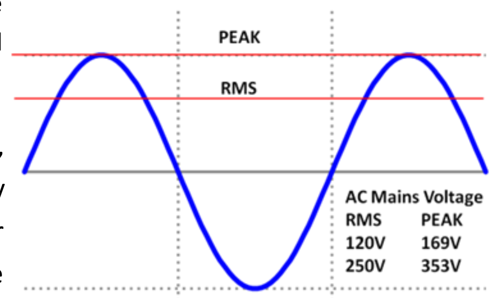

Figure 1. Peak and RMS Values

Conventional transient voltage suppression using MOV (Metal-Oxide Varistors), the method widely used today – clamps the excessive voltage spikes and is only effective for voltage spikes above a certain "clamping" level. Voltage on power lines is always listed as RMS, not as peak value. The peak values of a sinewave voltage is 1.4142 times higher than the RMS voltage. Figure 1 shows the ratio between these voltages. As seen, typical U.S. AC voltage of 120V RMS peak peaks at 169V, while 250VAC RMS typical for Europe, South America and many countries in Asia peaks at 353V.

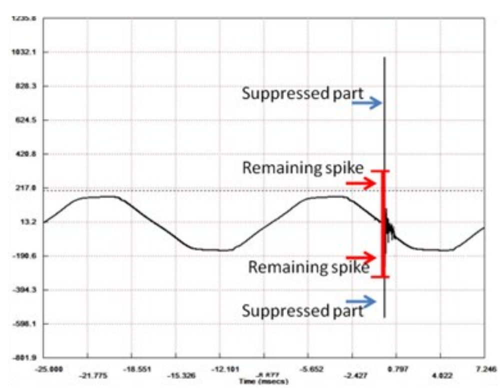

Figure 2. "Suppressed" Power Line Transient

Obviously, clamping level has to be higher than the peak voltages and should provide some headroom for typical variations in line voltage, otherwise the surge protector would frequently short the power line. For 120VAC circuits this clamping voltage is typically 330 volts, and for 250VAC lines it's 440V and above. This means that transient spikes will be clamped down only to 330V in the *best* case, and spikes below that level won't even be noticed by the surge suppressors. Figure 2 shows a typical surge protection operation on a 120VAC line. As seen, spikes as high as 330V will remain. What is more, disruptive spikes that don't reach clamping threshold, such as the ones shown in Figure 3 would be entirely missed by a surge suppressor. This is not sufficient to ensure uninterrupted operation of sensitive equipment and tools and their safety.

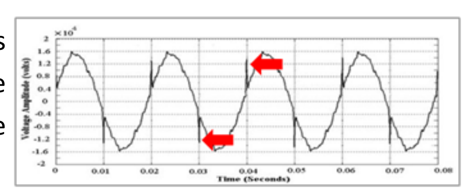

Figure 3 Unsuppressed Power Line Transient

As a reference, Figure 4 shows typical rating of a professional grade surge protector. As seen, it will allow spikes up to 700V to pass through to your equipment.

Typical Sources of Power Transients

The sources of power surges can be external to your facility, or internal.

Lightning is the most common source external to your installation. Other external sources of surges are switching of large loads by your power company, excessive current spikes in power network caused by shorts or large load switching by other power customers in your area.

Internal sources include equipment with inductive properties, such as motors, transformers and alike, where power periodically turns on and off, similar to an air-conditioner turning on and off based on temperature setting. Inductors try to maintain current and on disconnect they briefly generate high voltage spikes in order to do so.

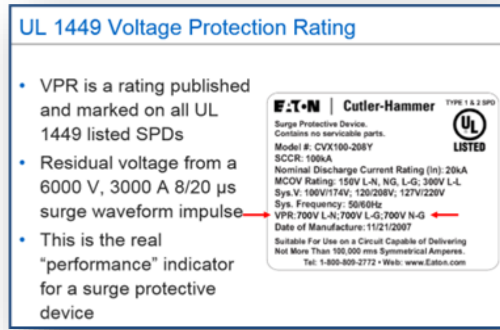

Figure 4. Typical specification of a Surge Protector
Source: Cutler-Hammer

One of the internal source is backup power switchover. Whenever there is interruption of AC power, back-up power is engaged. This transition is often accompanied by strong transients, as shown in Figure 4. As seen, there is a significant fast transient when the power is switched to a UPS. Rotating back-up generators may cause even higher transients, in part caused by synchronization issues. As discussed above, surge suppressors are ineffective at dealing with such artifacts.

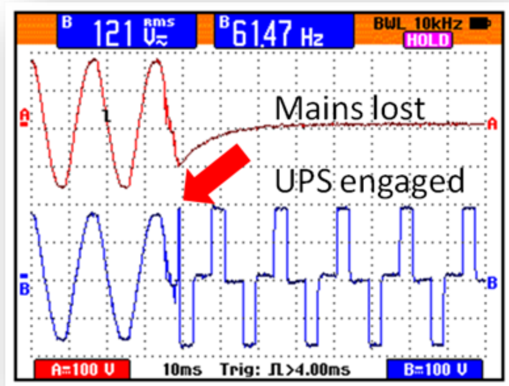

Figure 5. Switchover to UPS
Source: Repeater-Builder

CleanSweep® EMI Filters and Power Surges

OnFILTER's CleanSweep® AC filters work on a different principle than a conventional surge protector. Instead of looking at voltage levels, CleanSweep® filters see spikes as EMI events and effectively suppress them regardless of their voltage. Figure 5 shows a remaining power line spike at the output of a conventional surge protector with peak amplitude of over 300V which would pass unimpeded through a regular surge suppressor but is reduced to an insignificantly small ripple by a CleanSweep® EMI filter. CleanSweep® filters effectively suppress both differential-mode (between live and neutral) and common-mode (between live, neutral and ground) transients. CleanSweep® filters react to much shorter spikes than surge suppressors, require no recovery time between spikes, and, unlike MOVs, do not wear out.

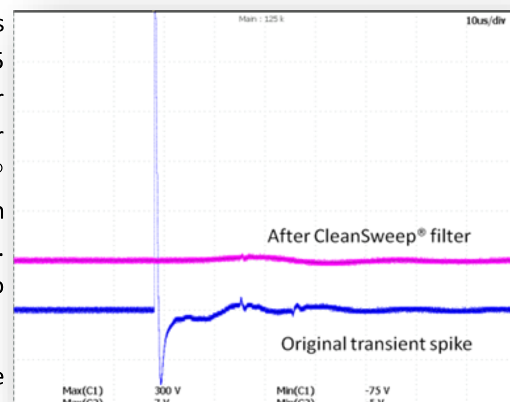

Figure 6. CleanSweep filter transient suppression performance

The best way to connect a CleanSweep® filter is at the output of a regular surge suppressor before your equipment - this offers the benefits of both technologies and maximum protection against transient signals and long-term surges, big and small.

Conclusion

OnFILTER's CleanSweep® EMI filters, in combination with conventional surge protectors, provide substantial reduction of power transients with minimum integration effort and at a reasonable cost. They also provide high level of suppression of EMI on power lines and ground which improves equipment up-time and reduces electrical overstress (EOS). Please visit www.onfilter.com for more detailed information. Contact us at info@onfilter.com.

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