

HOW POWERCLAMP WORKS: *Theory of Operation*

There are dozens of TVSS units on the market. What makes PowerClamp different? How does it work? Why does it provide protection that is significantly better than other TVSS products?

Briefly, here are the important factors that make PowerClamp unique:

1. **EXTREMELY LOW CLAMPING LEVEL**
2. **NON-DEGRADING ATTENUATION**
3. **GUARANTEED PERFORMANCE**

1. CLAMPING LEVEL: PowerClamp's clamping level is *much lower* than other TVSS units.

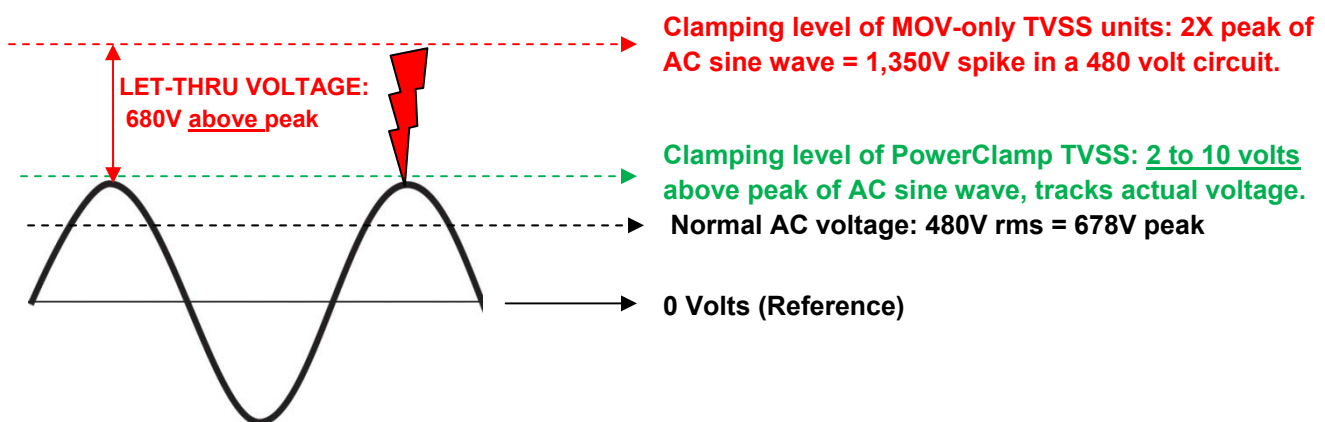
Many TVSS units rely primarily on MOVs (metal oxide varistors) for surge suppression. The problem with this approach is that the MOV threshold must be well above the nominal AC voltage to prevent MOV overheating and distortion of the AC waveform. This margin is normally 200% of the peak line voltage. Therefore, a surge or spike must be *at least 2.8 times the normal rms voltage* before any clamping occurs. On a 120 volt line, a transient of 336 volts will pass through without any attenuation. On a 480 volt line, a surge of nearly 1,350 volts will pass without attenuation. At the very least, these transients will cause unreliable and erratic behavior in electronic systems. At their worst, they will destroy your equipment.

PowerClamp does *not* rely only on MOVs. It is a multi-stage *hybrid* device. PowerClamp uses advanced risetime-sensitive *secondary circuitry* in addition to MOVs to achieve an extraordinary low clamping level. Most transients will be clamped to less than ten volts above the peak of the AC sine wave.

It is the combination of the *multiple attenuation circuits* that produces PowerClamp's extremely low clamping level. The MOVs in PowerClamp attenuate the transient to within a few hundred volts of sine wave; the secondary circuitry further reduces the transient to within a few volts of the AC waveform peak.

PowerClamp's attenuation circuitry responds to both voltage level and waveform risetime. It can differentiate between a (slow) line-surge and a (fast) spike or transient. Different types of line disturbances will activate different stages of the attenuation circuitry, depending upon their amplitude and risetime.

This illustration shows the exceptional performance of PowerClamp's ultra-low clamping level:



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An added benefit of PowerClamp's extremely low clamping level is that it not only eliminates transients, it also "scrubs" noise and harmonics from the line. (TVSS units that use only MOVs cannot remove AC line noise.)

Additionally, PowerClamp's *sine wave tracking circuitry* dynamically tracks the AC input, and automatically adjusts the clamping level as the input voltage rises and falls. This maintains the clamping level even if the input voltage varies by as much as +/- 20%.

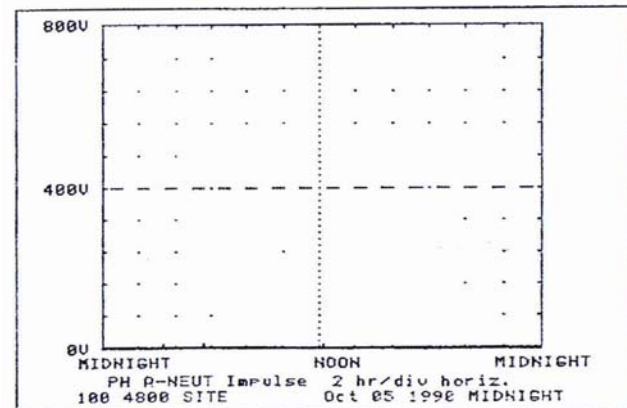
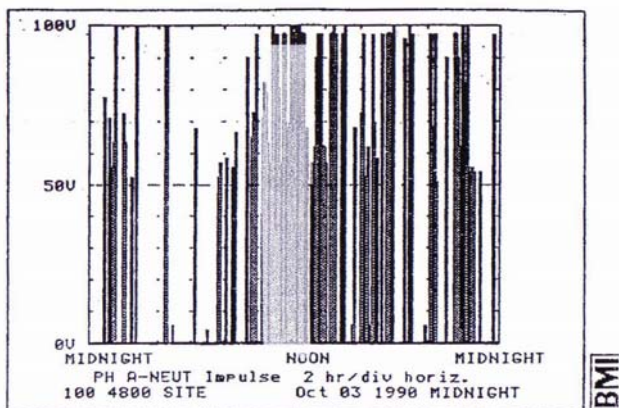
Here are actual strip-chart recordings of a PowerClamp installation at a Los Angeles area hospital. Before, 300+ volt spikes from X-Ray and MRI machines were damaging nearby computer and medical diagnostic equipment. These problems were eliminated when a PowerClamp TVSS unit was installed.

Before: With a competitor's TVSS unit installed, strip-chart recordings indicated 1,238 spikes over a 24-hour period, many of which were more than 500 volts above the normal AC voltage.

After: When a PowerClamp TVSS unit was installed, only 3 spikes were recorded during the next 24-hour period. None were more than a few volts above the normal AC line voltage.

BEFORE: 1,238 spikes over a 24 hr period.

AFTER: 3 spikes, all below 10 volts.



2. NO DEGRADATION: PowerClamp's performance does NOT degrade even after many years of use.

MOVs in other TVSS units will degrade over time because they are used to dissipate large amounts of power. This degradation causes the clamping level to gradually increase, further reducing surge attenuation. Eventually the clamping threshold will be so far above the AC line voltage that the TVSS unit will be rendered useless. Spikes and surges *many times the normal line voltage* will pass without attenuation, causing serious damage to your equipment.

This does not happen with PowerClamp. PowerClamp's extremely low clamping level and incredibly fast (1-2 ns) response time results in *very low power dissipation* in the suppression components and virtually no degradation. The clamping level and overall performance remains consistent even after thousands of powerful "hits" and many years of continuous service. All PowerClamp TVSS units include a 5-year pro-rated warranty.

3. GUARANTEED PERFORMANCE: PowerClamp datasheets quote accurate technical specifications.

The **CLAMPING LEVEL** (also called the "let-through voltage") is the most important parameter that describes the real-world performance of any TVSS device. When comparing PowerClamp to other TVSS units, always check for this critical specification! (Don't be surprised if other manufacturers refuse to quote this essential information.) PowerClamp's performance is specified and *guaranteed* in writing.

PowerClamp TVSS clamps most transients to within 2 volts of the sine wave.