



# Series Mode vs. MOV

## SURGE SUPPRESSOR TECHNOLOGY

**I have enjoyed your magazine since the first issue and find your reviews to be accurate and informative. I am curious about the series mode surge suppression device mentioned in your "Out of the Box" section. Could you explain how series mode protection works and why it is better than the typical surge suppression technology currently on the market? This could be quite useful to me, as I have had equipment crash on me while being "protected" by MOV surge suppressors.**

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**New Frontier Electronics** recently introduced a line of patented series mode AC powerline surge suppressors. The question arises of how this technology differs from the MOV shunt technology dating from 1980. There are four fundamental differences:

1. MOV technology is basically diversion technology. Powerline surges are diverted to either the neutral wire, or the ground wire, or both. Series mode technology is adaptive filter technology, which stores surge energy and slowly releases it to the neutral wire.
2. The MOV technology has a "joule rating" limitation. The joule rating limitation is something like the mileage rating on a tire. When the joule rating has been exceeded, it is advisable to replace the MOV. Since its capacity to function has been depleted, MOV failure is imminent. Series mode technology has no similar limitation, since the components do not "wear out" with use.
3. An MOV has a FIXED voltage clamping level. This clamping level must be chosen to be high enough that with the MOV and powerline tolerances, the MOV does not conduct on the powerline energy, otherwise the MOV may overheat, explode or catch fire. Series mode technology employs active tracking circuits to track and clamp at 2 volts above the peak value of the powerline voltage.
4. An MOV has a surge current limitation. There is no comparable limitation with series mode technology, since a massive two pound surge reactor provides current limiting. A surge with enough current behind it to blow out the largest MOV will be effectively filtered off with series mode technology.

An MOV product has a joule rating limitation. This rating is the maximum surge energy that the MOV should be exposed to, or failure is likely. An MOV should be able to withstand its maximum rated surge one time, or lesser surges several times, but the component is basically a "sacrificial" component that will wear out when hit with repeated surges.

Manufacturers will sometimes inflate this rating by totaling the individual MOV ratings, even though the MOVs are wired in such a way as to not share the surge equally. This is something like saying that your automobile can travel 200,000 miles on its tires, since you have four tires on your automobile, one in the trunk, and each tire is rated for 40,000 miles. Since series mode technology relies on a surge reactor and capacitors, there is no fundamental sacrificial component to the design. Filters do not wear out simply from use. Series mode surge suppressors will effectively suppress the maximum design surge (based on IEEE C62.41



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Industry Standard) of 6,000 volts, 3,000 amperes hundreds of times more than sample MOV products.

A sample MOV product claims a fixed clamping level of 200 volts, implying that a surge will be limited to this value. This 200 volt clamp level is determined by passing 1 milliampere of current through the MOV. But the MOV is rated at 6,500 amperes of surge current, not 1 milliampere; this is 6,500,000 times as much current as the current used to establish the clamp level. What do you think the clamp level voltage is at 6 million times the rated clamp level? It is not 200 volts!

By using active tracking, the series mode technology will begin clamping at 2 volts above the peak of the power wave (172 volts nominal). A 400 ampere surge would produce a clamp (letthrough) voltage of about 350 volts for a sample MOV product (with a nominal clamp level of 200 volts), compared with only 190 volts for the series mode products.

Also, sample MOV products simply divert harmful surge energy from the hot line to the neutral and ground wires, in a process usually described as "all three modes of protection." The hot line is the only source of dangerous external surges since the neutral and ground are bonded together and fastened to an earth rod at every service entrance. Unfortunately, this "3 mode protection" process diverts high energy powerline surges directly into reference grounds in audio/video systems and delicate, low voltage data lines in computers.

Sample MOV suppressors merely divert the surge energy without altering its nature. Surges diverted this way are still dangerous and will seek other paths to service ground. With interconnected computers, they will find such a path through all datalines which use the safety ground as their signal reference voltage. With audio/video systems, chassis ground is often tied to signal ground at some point in the system. When this is the case, significant damage can result from diverted surges.

Thousands of people in the U.S. have lost millions of dollars worth of expensive audio/video and computer equipment using standard MOV technology. We believe series mode technology is the most effective available surge protection technology available on the market today.

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