



What is True Series ModeTM Surge Protection?

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Series Mode[®] surge protection operates in a fundamentally different way to conventional surge protection. Series Mode brand surge protectors block and contain surge energy and do not simply transfer energy between the wires of a branch circuit like all MOV based surge protectors. The term "Series Mode" is taken from the fact that the main protection element is in series with the AC. True Series Mode products **do not** use any components, sacrificial or otherwise, that shunt energy between the wires of an AC circuit.

True Series Mode surge protectors are the only ones that can safely be used on branch circuits without causing problems. Both conventional and hybrid* surge protectors operate by diverting surge energy to neutral and/or to ground instead of blocking and containing it. When installed at the service entrance, they can effectively shunt surge energy to the ground rod provided the protection components are rugged and reliable. However, when plugged into a branch circuit there may be several feet, or even hundreds of feet, of wire between the equipment and the ground rod.

The concept that surge energy can be directed to the ground rod through a branch circuit is flawed. Wire between the equipment and the service entrance (ground rod) has significant impedance to transients and surges, and only a part of that energy will take the preferred route to the ground rod. There are only two possible scenarios:

1/ Surge protectors which have MOVs between live, neutral and ground divert energy to both neutral and ground, and will contaminate both the neutral and the ground wires. The safety ground is the same as the equipment chassis and system ground, and surges diverted to ground will allow energy to flow in chasses and cables that join interconnected equipment. Dumping surge energy onto the system ground instead of blocking and containing it can result in high-voltage energy traveling along interconnecting cables and causing permanent damage to input or output stages.

2/ Surge protectors which have MOVs only between live and neutral divert energy only to neutral and do not contaminate the ground wire, but they are also not effective at completely protecting equipment. Not having any MOVs or other shunt devices to ground, they allow live and neutral to float with respect to chassis ground up to dangerously high voltage levels during a surge event. To use the technical term: they convert normal-mode surges to common-mode surges. Common-mode surges are normally only found at low, harmless levels on branch circuits, but when generated by such a piece of equipment they can be large and damaging. Power supplies in electronic equipment may be damaged, and equipment that has a common-mode filter on the AC power input will almost certainly be damaged. Common-mode filters often have capacitors from live and neutral to ground and these capacitors will be blown out by the large common-mode surges that are generated by this type of surge protector. It is extremely important that no other surge protectors which have MOVs to ground be plugged into the type of surge protector which has MOVs only between live and neutral. To do so will convert the protection back to the type which has MOVs between live, neutral and ground resulting in ground contamination exactly as per the discussion in (1) above. There is also the risk of blowing out the MOVs that are inside the second surge protector. This also applies to UPSs since most UPSs have MOVs between live, neutral and ground. Whereas it has been standard practice for many years to plug a UPS into a SurgeX in order to protect the UPS front-end, plugging a UPS into a surge protector which has MOVs only between live and neutral cannot be recommended for these same reasons. The SurgeX True Series Mode architecture effectively "disconnects" MOVs inside any equipment plugged into it but this is not the case with other architectures.



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* Hybrid surge protectors using the term "Series Mode" may be a standard shunt mode product that has a low-voltage series section following it. These hybrid products produce the same problems cited above that standard shunt-mode products produce. Interestingly, if we look at how effective such a product is at handling energy the result is startling: Energy is proportional to the square of voltage, so if we assume a hybrid product is using MOVs to drop the normal-mode voltage down to 400-500 volts, then for a 6000 volt surge this would result in more than 99% of the energy remaining on the branch circuit. **Almost all of the energy is being shunted by the MOVs and left on the branch circuit!**

Further reading:

Benefits of SurgeX Surge Suppression, Neil Muncy
The Truth About MOVs (Metal Oxide Varistors)
Series Mode vs. MOV, Tony Keane
Series Mode Suppression or Shunt Mode? What's the difference?

Glossary:

Series Mode; a brand of surge protector that uses high-voltage filtering techniques to block and contain surge energy and filter transients without dumping energy on the neutral or ground wires.

MOV (Metal Oxide Varistor); a device that operates like a voltage dependent switch. Below a preset voltage it is mostly off and above a preset voltage it is mostly on. Have been used since the 1970s in suppression and protection circuits.

Normal Mode; surges and transients that present a voltage between the live and neutral wires. (Sometimes also called differential mode.)

Common Mode; surges and transients that present a voltage simultaneously on live and neutral with respect to ground.

Branch Circuit; an AC circuit that originates at a breaker or distribution panel and feeds one or more outlets.

Service Entrance; the point at which the AC service enters a building from the power company. Usually accompanied by a breaker panel.

Ground Rod A copper stake driven into the ground to provide a safety ground for the building. Usually provided at the service entrance.

* Series Mode is a registered trademark of New Frontier Electronics, Inc.



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