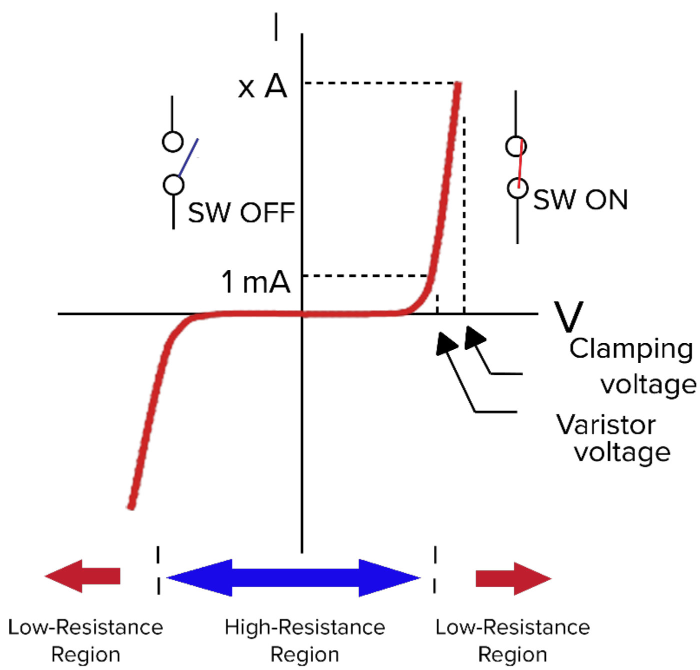
MOVs ARE SACRIFICIAL POWER PROTECTORS

A commonly used component is a surge protector (Surge Strip) is the MOV (Metal Oxide Varistor). MOV is also known as a “self-sacrificing” component, it will divert energy and weaken over time, rather than letting voltage surges harm your devices. A metal oxide varistor is a voltage dependent variable resistor. During normal voltages the resistance is high but when voltage increases the resistance lowers and excess voltage is diverted to ground. Below is a chart of voltage vs current in the high and low resistance region. As noted in the chart below the varistor will allow some of the surge through the protection device until it reaches the shunt voltage (Varistor Voltage). When the clamping voltage is reached the MOV has become a switch diverting the surge.

The concern is that 100’s of volts is allowed to pass through the MOV before the varistor starts to divert the surge at. This typically happens above 300 Volts. This is called the ‘let though voltage’. This is the critical specification for any power protection device for it details the true amount of surge that load being protected receive.



A MOV is made up of zinc oxide or similar compound. When the voltage surges to a certain point the zinc oxide particles begin conducting current internal to the MOV essentially diverting the energy of the surge. The main issue with MOVs is that there is a limit to the amount of energy they can divert. The power diverting rating of an MOV is listed in joules. They become ineffective and unable to provide any protection when the energy diverter is greater than the MOV’s joule rating. Because the MOV is placed in parallel to the load it is not readily apparent to the user that the MOV has failed, and the electronic load is no longer protected. Sometimes circuitry is added to notify the user that the MOV is no longer effective or damaged. Another issue is the potential for catastrophic failure of the surge protection device from the MOV diverting a very large surge of energy.

Designers will add fuses to protect the MOV and add MOVs in parallel to distribute the surge to increase its joule rating.   This is ok in theory but not in practice. Not all MOVs are made the same so inevitably one MOV will “turn on” before the other and a cascade failure of the MOVs will occur causing a catastrophic failure of the surge protection device.

Surge protection devices that incorporate MOVs state the let through voltage of the device on the unit. They will also document joule rating of the unit. (One Joule is equal to 1 watt for 1 second) This is the amount of energy that the MOV will absorb before it fails. Manufacturers of such equipment will recommend a rating of 1000 joules for small electronics up to 2000 joules for home theater components, gaming consoles or computers that store data. Having 2000 joules of protection may sound good but manufacturers will inflate such numbers by providing the ***cumulative*** number of joules from all the MOVs in the surge suppression device. As stated earlier no 2 MOVs are made the same so not all MOVs will “turn on” at the same time.   Inevitably one MOV will “turn on” first and cause a cascade failure of the surge protection device provided the surge energy and voltage is high enough.

The key in this discussion is that ***the joule rating itself for surge suppression devices is not even recognized by surge suppression standards!*** Surge suppression standards specify ‘let through voltage’. UL 1449 is the primary spec for UPSs, and it calls for a let through of 330V. IEEE 62.41 denotes surge protective categories and ratings for electrical circuits. It specifies a let through 10 volts of AC surge (normal mode noise) and ½ volt of ground noise (common mode noise) for a 6000V 100Khz ring wave. So, rating in power protection in joules is not part of the standards for power protection.

The goal is to provide power condition that is non-sacrificial protection and can conform to the highest protection standards which is IEEE 62.41. The best technology to meet this requirement is an isolation transformer-based solution. A low impedance transformer matched with a low impendence bandpass filter can surges, noise and strikes that cause so many problems with electronic systems. The band pass filter filters any disturbances above 60Hz to keep AC noise (Normal Mode) below 10 volts. In addition, neutral and ground are bonded at the transformer so ground noise (Common Mode) is reduced to under ½ volt. The components are non-sacrificial so these devices will last for many years!

In conclusion, there is a power protection solution that can provide the clean consistent power that your sensitive electronics demand and will work flawlessly for many years.