Lowell™
Distributed Audio, Power & Rack Solutions

Surge Suppression

Let-Through Voltage

Most Surge Protection Device (SPD) manufacturers include a “let-through” voltage rating in their product specifications. In practical terms, how important is that?

The Information Technology Industry Council in Washington, DC (http://www.itic.org/resources/iti-cbema-curve/) publishes the CBEMA Curve which is based on research done by the Computer and Business Equipment Manufacturer’s Association. The ITI (CBEMA) Curve and the associated Application Notes describe an AC input voltage envelope which typically can be tolerated (no interruption in function) by most Information Technology Equipment (ITE).

The report is fairly complex, but one of the conclusions that can be drawn from it is that responsibly designed electronic equipment that operates on the nominal 120 volt AC 60 Hz power system is able to withstand high voltage transients, spikes, or surges, of up to approximately 850 volts with no ill effects ***as long as they do not last more than 100 microseconds.***

Surge protective devices (SPDs) tested to the UL 1449-4 standard are tested with what is referred to as an “8/20 microsecond combination waveform” voltage surge. That means that the surge reaches its peak level within 8 microseconds and decays to a harmless level within 20 microseconds. That waveform has been determined by ANSI, IEEE, NEMA, UL and other standards and testing organizations to be the closest possible representation of typical voltage transients experienced in real world environments.

Notice that typical voltage surges only last for about *28 microseconds or less than one-third the time it would take to damage equipment.*

Many SPDs are designed around arguably the most robust and time proven technology available, the Metal Oxide Varistor (MOV). First developed domestically in the 1960’s and 1970’s by General Electric Labs, MOVs are manufactured by numerous companies worldwide in ultra-miniature sizes (for microprocessor applications) up to several feet in diameter (for power grid substations). One of the most important characteristics of MOVs is the speed that they operate: in the single digit nanosecond range. That is approximately 1,000 times faster that surges and transients on the power line.

SPD manufacturers whose products conform to and are listed by a Nationally Recognized Testing Laboratory (NRTL) to the UL 1449-4th Edition Surge Protective Device Standard (the most current revision as of this writing) are required to label them with a Voltage Protection Rating (VPR). This is the highest let-through voltage that the device will allow. The number is based on a range table published in the UL standard. The ranges are: 0–330V, 331–400V, 401– 500V, 501– 600V, and so on in varying increments up to 6kV. The VPR rating applied to the product is the upper limit of the range that it falls into (for example VPR 330, VPR 400, VPR 500, etc.). Interestingly, MOV devices that have a VPR 330 rating are not used in AC power line applications because their continuous operating voltage rating is below the nominal AC line voltage range. Hence, the “best” VPR rating available for AC power products is 400.

All things being considered, an SPD that can be proven to keep surges well below the 850 volt danger threshold and keep them less than 100 microseconds in duration will protect sensitive electronic equipment (computer microprocessors, digital signal processors, etc.) from high voltage surge-related damage.