

BASIC POWER QUALITY DEFINITIONS

1. What is power conditioning and surge protection and how does it apply to the electronics industry and how do they work?

As per the IEEE (Institute of Electrical & Electronic Engineering) Std. 1100-2005, sometimes referred to as the Emerald Book, power conditioning is a generic term given to many types of power correction devices that accept electrical power in whatever form it is available, and modify the power to improve the quality or reliability required for sensitive electronic AC equipment. Power conditioners usually include a combination or two or more of the power correction devices. The power correction devices include the following:

- a. Isolation Transformers – Attenuates common mode disturbances (N-G, L-G) on the power supply conductors; provides a local ground reference and usually a bond on the secondary between neutral & ground.
- b. Noise Filters – Noise reduction with attenuation on the audio and visual signals (EMI/RFI). These filters are designed for low energy, high frequency noise. Noise filters have more to do with improving signal quality vs. damage to equipment (i.e., true transient filtering).
- c. Harmonic Filters – Reduction on input current harmonics (usually the 3rd, 5th, & 7th harmonics) of nonlinear/electronic loads, which can cause heating of power conductors (especially the neutral conductor), transformers, motors, etc.
- d. Surge Suppressors – Referred to more formally Transient Voltage Surge Suppression (TVSS) or Surge Protection Devices (SPD) by regulatory agencies. There are various types of surge suppressors that will limit high frequency circuit over voltage typically using Metal Oxide Varistors (MOV(s)). Surge suppressors are not designed to stop a constant over voltage condition. Also available are active “transient filtering” suppressors that are able to clamp or limit the transient surges regardless of where on the power sinewave they occur. This “transient filtering” is the key to extended equipment life, reduced downtime, and increased reliability to all electronic and electrical equipment. Unfortunately very few surge suppression devices have quality true transient filtering do to first cost considerations.
- e. Voltage Regulators – Provide a relatively constant steady-state output voltage level for a range of input voltages. Voltage regulators address constant over voltage or constant under voltage conditions.

- f. Motor Generators – Voltage regulation and waveform correction for voltage loss or distortion.
- g. Standby Power Systems – Inverter and battery backup, operating as an uninterruptible power supply (UPS), when normal power fails. In standby mode the load is fed directly from the utility.
- h. Uninterruptible Power Supplies (UPS) – maintain supply of regulated voltage, wave shaping, and noise violation for a period of time after power failure.
- i. Line Monitors/Phase Monitors – monitor the voltage and sound an alarm and/or take equipment off line in the event of an over voltage or under voltage condition.

Power conditioning (that includes surge suppression as indicated above) applies to the electronics industry in that without any well selected power correction devices designed into the facility or the electronic equipment system the facility will dramatically increase the chances of catastrophic loss and will experience reduced reliability; increased maintenance/repair; and will see the life of the electronic loads reduced by about 50%.

The reason this is true is all these power and signal line disturbances happen at least hundreds of times in any given day and are unwanted energy that causes excessive heat that quickly causes degradation to electronic devices and ultimate premature failure or repair of the equipment.

2. What are some of the performance traits that installers should look for when choosing a surge protection (TVSS) device for the power panel?

The following are the key performance traits the installers should look for:

- a. Discrete and separate all mode protection – In a typical split single phase AC power system there are 2 phases (L1 & L2), neutral, and ground. The better performing surge suppression devices should have discrete and separate protection components (MOV's – metal oxide varistors) between each phase and neutral; each phase and ground; and neutral and ground. This means we should have at least 5 separate and discrete protection circuits (L1-N, L2-N, L1-G, L2-G, N-G) for a 120/240 volt split phase system. Unfortunately, many devices are not designed and built this way because of cost considerations.
- b. Component Level Fusing – This fuse design is at the component (MOV) level for each phase. External fusing/breakers are not necessary to meet

safety agency requirements. This fuse design ensures maximum performance and safety. Most surge suppression devices do not have over current component level fusing for first cost reasons.

- c. True Enhance Transient Filtering – Provides continuous clean power by filtering high frequency transient disturbances from the power sine-wave. This filter minimizes electronic equipment degradation and failure. This enhanced transient filter is the key to real dollar savings (ROI) over a long period of time. Most surge suppression (TVSS) manufacturers do not have a true enhanced transient filter because a complete filtering circuit significantly increases the first cost of the device.
- d. Warranty – Typical warranties for AC power panel surge suppression devices are 5-10 years and are usually limited in scope (workmanship and/or material defects) and therefore do not cover replacement of the failed TVSS device in the event of lightning or a utility power outage or event. Installers should strive for the longest possible warranty that includes free replacement of the TVSS device for any reason, including lightning.

In summary, the above listed features are attainable and are what the installers should strive for in selecting a panel mount surge protection device. The increased first cost associated with having these benefit and features included in the surge suppression device is far out weighed by the long term sustainable operational savings and extended reliable operating life of the electronic and electrical equipment.