

Surge protection devices and electrical filters: applications and design considerations

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Key takeaways:

- Typical SPDs have limited filter capabilities
- If noise filtration is required, an SPD with both clamping-style surge protective components and a true series-connected, multiple-component filtration network comprised of inductors and capacitors may be the best choice
- A quality SPD/filter product can mitigate the damaging effects of surge activity and disrupt noise interference

Many, if not most, surge protective device (SPD) manufacturers routinely advertise that their products are equipped with both surge protection and filtration components to counter surge and noise-related equipment disruptions. The typical SPD with filtration capabilities often simply employs a single capacitor that is internally connected between the SPD's phase and neutral conductors. The filtration network formed by the capacitor and the surge protector's inherent inductance attributes is not intended to protect equipment loads against noise occurring throughout broad frequency spectrums. Rather, they were originally meant to attenuate the IEEE C62.41-defined .5 μ s-100 kHz oscillatory-decaying ring waves that simulate power factor correction activities that utilities and medium-to-large facilities deploy to increase the efficiency of their AC power distributions.

Some SPDs use a single-component, parallel-connected, capacitor-based, first-order filtration element. A reasonable argument can be made that this element doesn't really do much.

The switch-mode power supplies used by most sophisticated equipment loads filter out much of the unwanted spurious electrical noise activity they are subjected to during their multiple-stage AC-to-DC rectification sequences. The use of shielded cables and the implementation of filtration circuits can further abate noise interference.

Many equipment users do not require the enhanced noise protection levels that filtration networks provide. The widely available clamping-type SPDs provide ample levels of equipment protection in most applications. But, if noise



EMC filters from Phoenix Contact ensure a smooth operation in environments subject to interference.

filtration is required, then the equipment user is best served using an SPD that is constructed with both clamping-type surge protective components and a true series-connected, multiple-component filtration network comprised of inductors and capacitors.

A quality SPD/filter product (Figure 2) can mitigate the damaging effects of both lightning and switching surge-generating activity. It can also alleviate the disrupting potential of both differential-mode symmetrical and asymmetrical common-mode noise interferences. The SPD/filter's differential-mode noise attenuating components will filter the noise voltages occurring between the Phase and Neutral conductors. Its common-mode filtration circuits mitigate noise voltages occurring between the Phase and Ground and between the Neutral and Ground conductors.

Figure 2: EMC filters provide an improved filter effect for high-frequency interference.

