

Technical Note

Built-in-Protection - Can You Trust It?

Built-in Protection...Can You Trust it?

Since lightning has most of its energy at dc and low frequencies, it makes sense to have a protector that attenuates this region of the spectrum. This is why dc continuity coaxial cable protectors cannot provide the same level of protection as dc blocked units. When looking at the level of protection necessary for equipment, most equipment is sensitive to overvoltage stress. This stress can cause immediate damage or latent damage. Immediate damage is obvious, but latent damage represents the partial destruction of a component or semiconductor junction. Later, this weakened part will fail (probably on a blue sky day) and no correlation will be made to the lightning event that caused the damage.

Each piece of equipment has its own overvoltage tolerance level. Most equipment manufacturers have not tested for this level and thus do not know the statistical maximum for their products. This has led a few manufacturers to some level of protection and is a step in the right direction. But direct lightning protection can't be accomplished inside the equipment and the level of built-in protection can mislead the buyer into thinking the equipment is safe under all conditions. The best protection is a multi-level protector or cascaded multiple protectors. Each one will handle its portion of the threat.

Direct strike protection should be "built in" to the installation, not just the equipment. Each equipment location has its own unique requirements. Some sites have good moist, conductive earth while others are on high desert mountains. This should signal the differences in installation and grounding requirements. Just as a single grounding plan cannot cover all soil conditions, a single built-in protector should not be relied upon to handle all over voltage situations.

All input/outputs (I/Os) must be protected. We recommend they be protected at the entrance to the facility. For Wireless Service Sites, this would be at the antenna/coax cable interface/penetration panel.

The most overlooked area is the "sneak path". Some sneak paths are: cabinet to concrete (concrete is a conductor); other I/Os not protected; protectors not bonded together in a low inductance manner; coax lines with no center pin protection; tower lighting and non-single point grounding. When interconnecting to other cabinets, whether in a room or between outdoor cabinets, the grounding must be in common to a single point. This means all cabinets should be bonded to a central ground plate where the I/O protectors for the system should be located. If this is not done, the individual cabinet I/Os must be protected at each cabinet's single point ground plate. This means more protectors will be required and grounding techniques will be more complex.

Since most cabinets are made of non-ferrous materials, the attenuation of the strike's low frequency magnetic field is minimal. A magnetic field can couple energy to a printed circuit board trace creating a voltage across it. The voltage level for a given dynamic magnetic field will depend on the capture area, orientation to the field, and impedance of the trace.

Even the grounding cable can radiate the magnetic field into your equipment. Getting the ground conductor from the protector plate out through the metal cabinet or shelter to the earth can be counterproductive if not done right. The conduction of surge current means a magnetic field will be created around the grounding conductor. When penetrating a conductive plane, the metal will intercept some of the magnetic field and set up eddy currents. When the event is over and the magnetic field subsides, the eddy current laden metal will re-induce a back current as the eddy fields collapse.

There are two methods to prevent the formations of eddy currents. The first method is to use an enlarged opening for the cable to exit. Typically, a hole size of 8 inches will have minimal eddies. The second way is to bond to the metal on each side and make it part of the path.

Please contact us for questions or further information on this topic.

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