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Technical Bulletin

Modern Lightning Protection for Radio Facilities: AC Power Lines

Lightning damage to electronic equipment caused by induction or direct hit and traveling along AC power lines is the most frequent port of entry in modern telecommunication systems. It's not uncommon to find facilities that have extensive lightning protective devices on RF transmission lines and telephone lines but have little or no AC line protection. It is possibly because AC line service protection is less understood, but more likely because there are few products available commercially that offer really sound protection.

The reason that AC power delivery is such a common entry source is easy to see. Power lines are heavily exposed, usually for many miles from the equipment site. They are often strung overhead, sometimes hundreds of feet high. A single lightning blast to exposed power lines can travel for miles looking for distribution means to reach earth ground. In its path the surge will divide among many low resistance points, usually damaging all of them. Virtually anything connected to AC power is subject to surge distribution, and delicate solid state electronics are normally the first items damaged.

Yet protecting AC lines is relatively easy compared to other types of entry ports. But the only truly effective method of achieving good protection is at the service entrance of AC power to the structure where electronic equipment is housed. In modern applications popular plug-in type devices sold in hardware stores offer poor, if any, protection. The reason is that they are located far from actual earth ground in most cases, and they often have voltage breakdowns so high that by the time the device begins to work the damage has already been done.

Structural type protectors offer unique advantages. First, because they are located at the service entrance they protect nearly all AC operated items in the building. The units activate on incoming high voltage AC or DC wavefronts, stopping them in the line of travel before they enter the building's AC wiring distribution system. Second, service entrance panels are most often located in a place where local earth terminal ground connections are nearby, so short leads of heavy wire are both possible and frequently installed by electricians when the service box is mounted.

A structural protector is designed for large incoming voltage surges of very high power. The better units offer hybrid action, which means that they employ two

different methods of voltage attack and power handling capability. Normally the two internal systems employed are Metal Oxide Varistor (MOV) technology and Gas Discharge (GDU). MOVs are particularly useful because they feature fast attack to overvoltage surges, dual polarity operation, and relatively high power handling capacity if paralleled, and are inexpensive. Gas discharge units offer even faster attack times, higher power handling capacity per unit and dual polarity operation but at somewhat higher cost. The use of GDUs are also a bit sensitive in the design stage because they go short when activated, possibly rupturing or not extinguishing properly in AC line service. There use must be carefully figured.

A combination of the two type's offer the best performance and a unit can be tailored to slope the attack mechanism so that the device can safely handle both small wavefronts and the inevitable large ones. MOV devices installed in equipment cabinets are also a good idea, especially if the equipment is located 100 feet or more from the service panel entrance. Another feature of MOV devices, no matter where they are located, is - that they have large distributed capacitance in the structure of the device, offering some RFI protection as well.

And don't forget to connect the AC service neutral ground to the facility's grounding bulkhead system for wider lightning current distribution.

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