A surge protector’s sole purpose is to safeguard the protected equipment from damage in the event of a transient. Occasionally, however, the enormous energy from a direct lightning strike exceeds the protection capabilities of the device causing the protector to fail. The big question then becomes, ‘What happens when it does fail?’

Failure modes can generally be classified as either open or closed (short). When lightning strikes a communications tower and the surge protector self-sacrifices, a fail-open scenario means that the current pathway through the protector is interrupted – it is open. Nevertheless, the electric circuit powering the equipment to be protected is still intact. In our tower top application that means the Remote Radio Head continues to receive power and the network system continues to operate, although in an unprotected state.

If the protector fails short (closed), a newly created secondary circuit route offers the traveling energy a shorter route. While energy is still running, it is not reaching the Remote Radio Head anymore, leaving the system non-operational but as an obvious consequence at least protected.
So which failure mode is the preferred one?

Several aspects should guide the decision for a particular failure mode. The order of importance for this fail safe consideration is human safety, continuity of equipment protection and continuity of system operation.

**Human safety**

The issue of safety normally revolves around fire hazards or electrical exposure. All suppressors should be designed to avoid human exposure to high voltages. Appropriate dielectrics can isolate the suppression device from human contact. In addition, in high-energy, non-fused circuits, surge suppressors need to either disconnect themselves from a circuit or short to present a very low resistance to avoid thermal runaway. UL 1449 3rd covers this aspect in the AC environment.

**Continuity of equipment protection**
Some system operators may prefer if the system does not operate without protection. If single element protection is used such as a single MOV or single diode, the components will start as shorts but the system energy may eventually open the device unsafely. In order to maintain the short, an additional element must be added to ensure a high current crowbar.

**Continuity of System Operation**

A large majority of system operators, however, require that the system continues to operate after a transient event, fully aware that it is unprotected until the failed suppression device has been replaced. To them the probability of a second strike is small enough to justify the risk for a short period of time.

**Our Recommendations**

Surge protection devices are an essential aspect of business continuity planning. A non-operational system, even if safeguarded from potential damage to the equipment is not supporting that business case. Therefore, the Protection Technology Group strongly recommends selecting a surge protector with a fail-open mode. A failure annunciation feature can further assist in avoiding that the system operates in an unprotected state for a prolonged time.

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