



# MORGAN SYSTEMS

Technical Bulletin

## Modern Lightning Protection for Radio Facilities: Control Lines

Most communication facilities have a variety of unshielded control line wires used for antenna switching, sensor monitoring, antenna rotation, telephone service delivery, or other local functions. While these lines are a necessary part of the overall station design, they also complicate matters from a lightning perspective because they offer multiple entry ports for large and potentially damaging EW currents during storms. The same lines also couple into transmitted RF energy and often re-radiate the signal at ground level where interference is likely to occur.

Protection from both of these possible ailments is a necessity in modern facility design, and the best way to achieve such protection is in the station's bulkhead grounding system. Both protective and bypass devices can be easily fitted into the scheme if the lead length from the connection point to earth ground is kept short. The length of attached leads running to ground is far more important than the specific material used for the connections, but heavy copper wire in the size range of #2 or larger is recommended.

Here are a few reminders when feeding station equipment with control lines:

1. Make a map of the entire control line layout to assure that no lines are missed when designing protection schemes. Include the estimated length of lines between destinations and include overvoltage protection and bypass devices for any lines exceeding about 25 feet. Make the map in pencil so changes can be made easily and date the map for future reference.
2. Try to keep control lines bundled together where possible but group them separately from RF transmitting coaxial lines. Coupling of RF signals into control lines can be severe if they are bundled together and run considerable distance due to coax cable shield leakage. It's best to run RF lines up one tower leg and attach control lines to another tower leg to help decouple the two.
3. The use of lumped inductance in control line leads is generally a good idea. An inductor should have the same wire size as is being used for the lead and a measured inductance of 100uh or greater should be used. The effect from inductance in lightning protection is that it slows down the incoming wavefront from the reactance of the coil presented to the

- incoming wave risetime. In RF interference it acts like an RF choke to help stop re-radiation of signals. Bypass both sides of the choke for additional RF decoupling with capacitors rated to 1,000V or greater.
4. Installing rotator/control line protection devices (such as our Models M-348 or M-349) provide an excellent method of shunting overvoltages to a grounding bulkhead termination. Always try to shunt all lines to a single bulkhead point close to where the connected equipment is located. If the station is elevated (2nd floor or higher) always bring lines to ground level first for the installation of protective and bypass devices, then route the cables upward to the equipment. Never run coaxial or control lines from antennas or towers directly to an elevated facility. That type of layout has the very unfortunate effect of placing your delicate equipment chassis in series with any incoming lightning currents, possibly causing both damage and injury if you're hit.
  5. If you're in a position to install control line runs in conduit or buried plastic pipe it's generally a good idea. Not only does the pipe protect cables from weather but they are also protected from small animals (who like to chew on them) and the appearance of the facility improves!

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