

Lab Notes- Lightning Protection - Part 1

QST October 1994, pp. 81-82

Copyright © 1994 by the American Radio Relay League, Inc. All rights reserved.

Part 1 appears in *QST* October 1994, pp. 81-82 (<http://www.arrl.org/tis/info/pdf/109481.pdf>)

Part 2 appears in *QST* December 1994, pp. 45-46 (<http://www.arrl.org/tis/info/pdf/129445.pdf>)

Lightning Protection—Part 1

By Mike Tracy, KC1SX
Technical Information
Services Coordinator

Q: I haven't had any lightning problems yet. Why do I need protection?

A: When most hams think of lightning protection, they immediately think about ways to protect their station equipment. Although that is certainly important, you should have far more concern for the health and welfare of yourself and your family. Each year, lightning is responsible for the deaths of over 400 people in the US. Several hundred more suffer from injuries caused by lightning, such as burns, shock and other damage to the body's more vulnerable parts.

Q: How much of a threat do I face?

A: The number of local thunderstorm days per year in this country ranges from 1 to 100, depending on where you live. If you live in a location with a single thunderstorm day, that means that you have at least one opportunity for disaster to strike. The total number of strikes per year is more than 40 million. However impressive these statistics may seem, keep in mind that they do not include all lightning strikes. Lightning can occur even without a thunderstorm—whenever and wherever there is a sufficient charge build-up.

Many things are involved in determining the likelihood of a strike at your QTH. A brief list includes the type of structure, the materials it's made of, the location relative to other structures and so on. One way to gauge your level of risk is to go through the Risk Assessment guide found in the back of the National Fire Protection Association's Lightning Protection Code (see address below). This appendix contains an equation that you can use to determine your overall risk of being struck.

Other reasons for lightning protection include fire prevention and protection of sensitive electronic equipment. Property damage statistics indicate that lightning causes over 40 million dollars damage annually to buildings and equipment in the US.

In addition, your equipment can also be damaged by other electrical disturbances such as power line switching transients and voltage surges, as well as static build-up on outside wires and antennas.

Q: But I already have lightning protection. My station is grounded and I added a lightning arrestor to the coax.

A: Your situation is typical of many hams: a single copper rod driven into the earth as a station equipment ground and an in-line

coax lightning arrestor, often mounted in the shack at the operating position. For lightning protection this sort of installation is *not* adequate. It may even be an invitation to disaster.

Q: So what can I do?

A: Education is the key. Lightning protection is no different from any other complex technical problem; the more you know, the better you will be at making decisions about the protection you need. In this case, however, the local library may not have the information you are looking for. While most libraries have information on lightning as a natural phenomenon, only a few will have anything on lightning protection.

A good source for this information is PolyPhaser Corporation. Although this company is in the business of manufacturing lightning-protection devices, the information they offer on installations goes far beyond product promotion. PolyPhaser's book, "The Grounds for Lightning and EMP Protection," is second to none for comprehensive, easy-to-understand information on grounding systems for lightning. PolyPhaser also has a quarterly newsletter, *Striking News*, that has articles on lightning protection devices and techniques. The February and May 1994 issues of *Striking News* contain articles on Amateur Radio station protection. Complimentary copies of these issues are available from PolyPhaser.

Another good reference is the NFPA Lightning Protection Code (NFPA 780) that I mentioned earlier. In addition to the Risk Assessment Guide, this full-size booklet (44 pages) contains information on terminology, materials and techniques used for lightning protection systems. Bear in mind, however, that this guide is intended for use by professionals; local building codes may require that some parts of the installation be performed by professionals. As the code says, installations must be approved by the local authority having jurisdiction.

Q: Sounds like good information. Do you have any other sources?

A: I sure do! See the list of lightning protection information sources below.

Q: Once I've read all about lightning, what steps should I take first to add protection to my shack?

A: The most important thing to do is to keep lightning outside of your home. This includes disconnecting your equipment from the feedlines and power sources, providing a proper station ground and adding

protective devices to your installation.

As the *ARRL Antenna Book* states, "The best protection from lightning is to disconnect all antennas from equipment and disconnect all equipment from power lines." When lightning strikes, it will always try to find the shortest electrical path to ground. Unless you disconnect your station equipment, you're giving the strike a good return path—through your equipment!

The easiest way to remember to do this is to disconnect your station whenever you're not using it. To prevent lightning from using your feedlines as a sneak path into your shack, disconnect them outside. If you disconnect your coax and leave it lying on the floor, lightning can jump a gap of several feet to your grounded equipment. Remember that it has already traveled quite a distance through the air. A few more feet of atmosphere won't stop it (this phenomenon is known as a "side flash").

Install an entrance panel for your feedlines and control cables. Place the panel ground connection on the outside of your home. Don't attach it to an inside source such as the power company ground or a cold water pipe. This panel will provide a convenient disconnect point for your equipment, as well as a place to mount feedline and control cable transient protectors.

Q: I can do that. But what about my station ground system?

A: Proper grounding is critical to lightning protection. Lightning contains energy in a wide range of frequencies (which is why you can hear "static crashes" on an AM radio when a storm approaches). You must provide a low-impedance path to ground for the energy.

A single ground rod will not suffice as a lightning ground. The basic idea is to give the strike energy a place to dissipate. Given the number of station-configuration possibilities, there are too many different ground system requirements for me to detail here. The issues of *Striking News* that I mentioned earlier contain information on grounding ham installations.

Q: You also mentioned protective devices. Can you tell me more about those?

A: Products for lightning protection include feedline transient protectors, power line transient and surge protectors and transient protectors for rotor control boxes and telephone lines. Each of these devices is designed for a specific job and you should always select the correct product for each line you're trying to protect. I'll provide more details about these devices next time.

For now, you should be aware that the quality and type of products is critical for proper protection.

In the second installment of this two-part Lab Notes series, I'll discuss the techniques and products you can use to protect your home. In addition, I'll provide a list of manufacturers of lightning-protection products.

Thanks to ARRL Technical Adviser John Bittinger, KI7GW, for his assistance during the preparation of this column.

Lightning Protection Information

The ARRL Antenna Book

The ARRL Handbook (Electrical Safety chapter)

Striking News, February and May, 1994; "Ham Radio Station Protection"; PolyPhaser Corporation, PO Box 9000, Minden, NV 89423-9000

The "Grounds" for Lightning and EMP Protection; PolyPhaser Corporation

Lightning Protection Code (NFPA 780-1992); National Fire Protection Association, PO Box 9101, Quincy, MA 02269-9101

LPI Installation Code (LPI 175); Lightning Protection Institute, 3365 N. Arlington Hts Rd, Suite J, Arlington Heights, IL 60004.

Installation Requirements for Lightning Protection Systems (UL 96A); Underwriters Laboratories, 333-T Pfingsten Rd, Northbrook, IL 60062

National Electrical Code (NFPA 70-1993); National Fire Protection Association

Lightning and Lightning Protection; D. W. Consultants, Inc, State Route 625, PO Box D, Gainesville, VA 22065 