

Lightning Protection for Aviation Base Stations

What is Lightning?

Why are base radios prone to lightning strike damage?

What type of damage can I expect if my radio is subjected to a lightning strike?

How do I protect against lightning strikes?

What is Lightning?

Lightning is a sudden release of static electrical charges. Electrical charges accumulate in the clouds as air moves over the ground leaving them negatively charged compared to the earth. When a sufficient charge potential develops between the cloud and the ground a air-ground strike occurs. With a potential of 1 Billion volts/1000 Meter strike with a current of 45 to 120 KA there is enough electrical current in one lightning strike to light a 100 watt light bulb for just under two months. (Ref: Wikipedia website 2007)

Why are base radios prone to lightning strike damage?

Ground-to-Air radio transceivers for airport service typically use antennas mounted on the roofs of towers, hangars, terminals or other airport buildings. To maximize communication range, antennas are mounted as high above the ground as possible.

Since antennas are normally the highest point above buildings, they also attract lightning. They provide a point for static charges to collect. One lightning strike involves many thousands of volts and brief but intense currents of thousands of amperes. It can therefore do great damage to radio equipment, and is a threat for serious injury to a radio operator. The potential for damage and personal injury can be present even if the unit is turned off.

Lightning may also "hit" nearby power lines. This frequently causes high voltage line transients that can damage electronic equipment connected to the AC wall outlet power lines. The Mentor Radio base radios contain a line surge suppressor which provides a moderate degree of protection against such line transients. A computer grade "Surge Suppressor" may also offer some extra protection against sudden line surges, but, most are not guaranteed against lightning strikes. Further, this type of surge suppressor will degrade over time and does not give any indication that they have already been subjected to a surge and that they are degraded in their future suppression capability.

Types of damage caused by lightning.

If lightning hits the antenna, it can travel several different directions:

1. It can jump to ground at the installation site, possibly damaging the antenna.
2. It could travel down the transmission line to a sharp bend in the transmission line and jump through the transmission line to ground. This type of event could damage the coax at a point between the antenna and the radio.
3. It could travel to the radio antenna input connection and enter the radio. This type of even can cause severe damage to the radio transmitter, receiver and power supply circuits. Once lightning enters the unit it is impossible to predict to what degree the unit may be damaged as every lightning strike is a unique event.

If lightning hits a nearby power line or lightning jumps from some other structure to a power line anywhere in the vicinity of the radio the surge could enter the radio by way of the AC power cord connected to the wall power. In this event, potential damage to the radio power supply is possible. Since all Mentor Radio base radios come equipped with surge suppressors, they afford some degree of protection. However, should the surge be greater than the MOV's installed in the radio can handle, they will probably fail catastrophically. Additional damage could result.

There are two ways to protect a radio from lightning:

1. Antenna Lightning Protector - This is a device that connects inline between the antenna and the radio. This device "turns-on" when a very high voltage appears on the antenna for a very brief period of time and conducts the large current surge away from the radio. These devices have a gas discharge tube which is field replaceable.
2. AC Line Protector - This is a device that can be installed at the factory that connects between the AC Line input plug and the internal power supply. This is an optional device offered for all Mentor Radio base station radios. Older radios can be retrofitted with this option. These AC Line protectors have LED's to indicate status and serviceability. Use of this type of equipment comes in several versions. One version requires the user to perform a periodic inspection to determine that the Status LED's are checked to ensure the AC Line Protector is performing satisfactorily. There is another version that allows remote monitoring of the units status. Call Mentor Radio to discuss your installation to help determine which version would be a better fit for your application.

The cost of adding the lightning protection equipment needs to be weighed against not only the probability of having a lightning strike, but also the cost of damage done to unprotected equipment should lightning ever strike. On a cost-only basis, purchasing and installing the antenna and AC Line protectors to protect a radio having less than 1% chance per year to be hit by lightning does not seem justified. However, other considerations often make the installation worthwhile.

- ▶ Can you afford to have the unit down for several weeks during the repair? As many installations don't include backup equipment, the risk of extended downtime is increased.
- ▶ Would there be a major inconvenience for the radio to be shut down or off line?
- ▶ In the event of that 1% hit, are you prepared to spend up to the cost of a new radio to get the unprotected unit repaired?
- ▶ If you answered yes to any of the above questions, lightning protection should be seriously considered.

Mentor Radio recommends installing both the antenna and AC Line protector devices as one way to cost effectively protect against lightning damage.