

TD1014: Where the lightning energy goes and what can happen. Ground Potential Rise (GPR).



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Notes:

A lightning ground system should be capable of dispersing large amounts of electrons from a strike over a wide area with minimum ground potential rise. It should be capable of doing this very quickly (fast transient response).

- Ground potential rise (GPR) means any difference in voltage between the strike's local earth sphere of influence and the "outside world."
- Outside world means any other ground outside of the lightning strike's local sphere of influence.
- By spreading electrons out over a wide area with a fast transient response ground system, the ground potential rise (step potential) for any smaller given area would be reduced.
- The speed, or transient response, of the ground system would be dependent on the combined inductance of the below grade conductive components and the resistivity/conductivity of the soil "shunting" those components. The lower the inductance of the system components and soil resistivity, the lower the impedance at higher frequencies, the faster the ground system could disperse electrons.
- Copper strap has lower inductance per unit length and more surface area in contact with conductive soil than the equivalent amount of copper in a circular conductor.

Local ground potential rise (GPR) can be the source of damage to any equipment interconnected to the outside world. A local ground potential rise looks for any path to the outside world. Some of these paths could be through your equipment.

- Any signal line with a ground return through the input/output circuitry is subject to damage. The local elevated potential would seek to equalize the signal conductor through your circuitry, and use it as a path to a lower potential. Local and remote interconnected equipment would be at risk.
- Any insulated signal lines are subject to damage as is the source power supply.
- A coaxial cable shield can carry a large amount of current at speeds exceeding 90% the speed of light with possible damage at both ends.
- The velocity factor of the coaxial cable center conductor with a fast rise time pulse can vary from 66 to 90% the speed of light. The directly applied or induced voltages on the center conductor would "roll off" and arrive after the shield pulse, producing large differential voltages



between shield and center conductor.

- Secondary ac power conductors are a two way “street” for electrons. They are usually large low inductance conductors. A strike to the power lines some distance away can conduct damaging energy to equipment. Also, a strike to the tower or building can produce a local ground potential rise with damage to your equipment from energy attempting to “escape” to the outside world through the ac secondary conductors.

A good source for more information on GPR is: www.gpr-expert.com