

Lightning Protection for Communications Structures

A Primer on Grounding & System Design

BY DIANA NUCCITELLI

In the continental 48 states, averages of 20 million cloud-to-ground flashes have been detected every year, according to the National Lightning Detection Network (NLDN). In addition, about half of all flashes have more than one ground strike point, so at least 30 million points are struck by lightning yearly in the U.S. alone. Without proper grounding, these strikes can damage or destroy critical equipment and networks, and severely injure or even kill people.

The public safety community relies heavily on continuously advancing wireless communications technology—tower and antenna sites that can be especially vulnerable to ground faults. This vulnerability makes it essential for public safety communications sites to have the most advanced grounding and lightning protection systems available to provide total site protection.

In the research, analysis and design of lightning protection systems, earth grounding is perhaps one of the most difficult areas to understand and correctly implement. This is because earth grounding systems must be designed individually based on specific site and soil conditions, which vary widely. That information and an understanding of grounding fundamentals are often not readily available to engineers, contractors and project managers. The focus of this article is to provide the basic information and knowledge to understand and design a safe, effective and reliable earth grounding system.

SAFETY PRECAUTIONS

As mentioned before, grounding is critical for several reasons. The first is

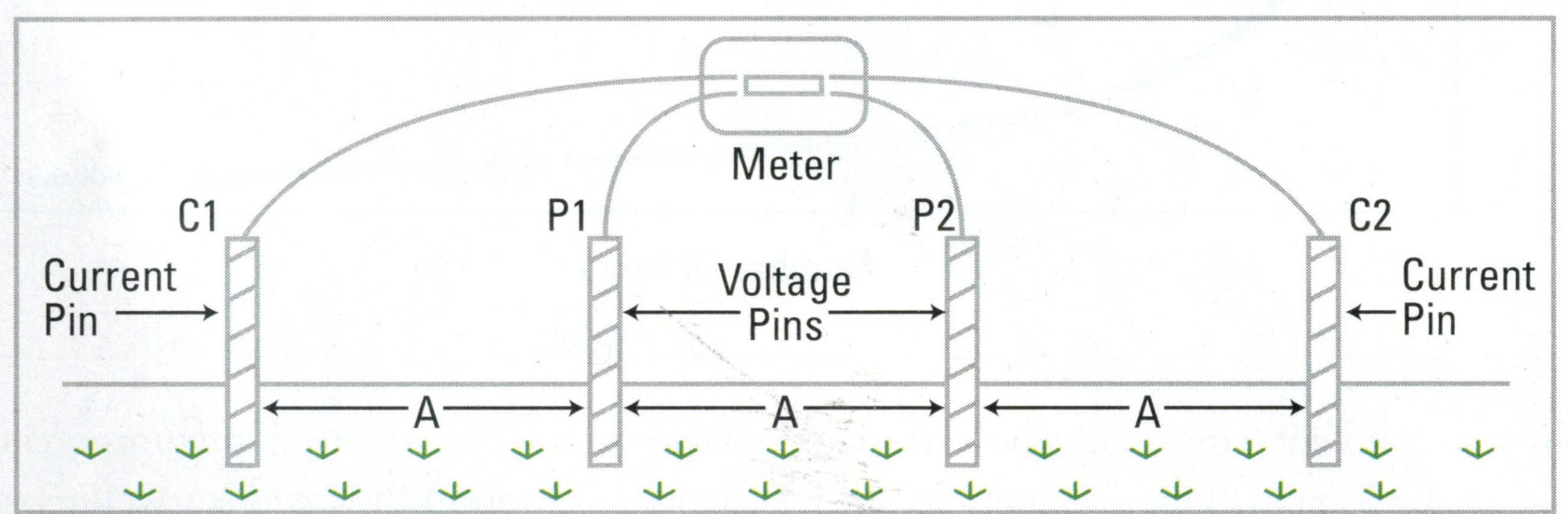
human safety. A low-resistance ground will keep equipment at or near the earth's electrical potential, reducing any voltage difference between equipment and the earth. This will prevent an accident or fatality during human contact with this equipment.

Second, grounding is meant to protect equipment from voltage surges and transients. Proper grounding, along with surge protection devices (SPDs), achieves this level of protection. Dam-

aging the electrical circuit has a direct physical connection to the earth—it is forced to assume the same zero potential as the earth. If the potential of a grounded object becomes higher or lower, the electrical current will pass through the grounding connection until the potential of the object and earth are the same again.

When an object is grounded—mean-

The Four-Pin Wenner Method



age to sensitive equipment from surges caused by lightning can result in millions of dollars in damages and downtime. That downtime can mean an interruption in mission critical services, a condition that is unacceptable to the public safety personnel for whom every second counts.

Finally, grounding offers peace of mind. When a low-resistance grounding system is installed, equipment, personnel and those who require a public safety officer's assistance are protected and able to receive uninterrupted support.

GROUNDING 101

To better understand the need for these measures, it is important to understand

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Grounding is typically achieved with an earth electrode: a piece of metal plate, pipe or other conductor partially buried in the earth. The earth electrode is the connection path between the equipment and earth. The electrode's resistance, measured in ohms, determines how quickly and at what potential energy is equalized. Hence, grounding