

Technical Note

CCT Cameras Have Special Protection Requirements

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Pole mounted or wall mounted closed circuit television cameras have special protection requirements.

Remote Mounted CCTV Cameras - Prime Targets for Lightning

Outdoor Closed Circuit Television (CCTV) Security Cameras can be prime targets for lightning. A lightning strike can destroy the camera and can damage the control console with energy flowing back through the coax and camera power wiring.

When lightning strikes a tower or other large structure, there is a high peak voltage at the strike point with current flowing downward and outward through any path to earth ground. A support pole develops a high $L \, di/dt$ peak voltage drop along its length to earth ground. A large steel reinforced structure can conduct the energy to earth ground through its steel reinforced concrete footers and electrical ground system. A camera mounted and grounded to a building with steel reinforced construction will usually have less inductance to ground than a camera mounted on a self-supported tower or pole. Less inductance to earth ground means less peak voltage at the camera.

When lightning strikes a wood or other insulating support, whatever voltage is necessary to continue the arc is developed at the strike point to overcome the resistance of the non-conducting structure. This usually has catastrophic results to the equipment on top.

Although very different, identical conditions exist for both examples. A high peak voltage occurs at the strike point with reference to earth ground. The video and power wiring to the camera are insulated from the strike point by electrical circuitry in the camera and the external insulation around the wire. Energy will flow through the camera circuitry in an attempt to equalize the wiring with the instantaneous peak voltage occurring at the strike point.

To protect equipment, there must be a low inductance path to earth for lightning energy and properly rated protectors on all interconnected wiring from the camera to the operating console. A properly rated protector at the camera allows the outbound wiring to be equalized to the peak voltage at the strike point without allowing damaging currents flow through the camera circuitry. An appropriate protector at the console blocks damaging incoming voltages to the control / monitor console.

A camera mounted on a building should be grounded to the building's structural steel as near the camera as possible. Use 1-1/2 inch (38 mm) copper strap for grounding. If the camera is mounted on a metal pole, it should be grounded to the pole and a proper ground system installed at the base. When mounted on a wood or other insulating support, the camera should be grounded to a minimum 3 inch (76 mm) copper strap running from the camera mount to the ground system installed at the base. An additional 3 inch copper strap would run from a lightning rod or diverter to the ground system at the base. Separate the two straps on opposite sides of the pole and connect together only below grade. Side mounting the camera or providing a diverter above the camera provides some additional protection from a direct strike.

A lightning ground system would be capable of dispersing large amounts of lightning energy (usually electrons) into the earth very quickly. The faster it disperses electrons, the less time there is for damaging surges to flow in the coax and power wiring back toward your operating console.

The ground system under a metal pole could be a combination of a steel reinforced concrete base (Ufer Ground), radials and ground rods. If possible, weld a #2/0 AWG stranded wire to the steel mesh in the base before pouring concrete. Attach this wire to a "J" bolt on top of the pad after the pole is erected. Use another wire welded to the mesh to attach additional radials with ground rods. If the concrete base already exists, attach additional radials with ground rods to any "J" bolt. (Be sure to remove paint and corrosion.)

Use a double nut attachment with joint compound. Space additional ground rods at least two times their length from each other and from the “Ufer Ground.”

When grounding a wood or insulated support, tie together both 3 inch straps, below grade, to a radial strap and ground rod system. A recommended layout for a “rapid response” low resistance/inductance ground system would be four 8 foot ground rods, one at the base and three spaced 120 degrees and 16 feet out forming an equilateral triangle centered on the base of the support. Each ground rod would directly connect below grade with 1-1/2 inch straps to the rod under the pole.

Video output camera:

A camera powered by 120Vac would require IS-PLDO-120US-15A at the camera. If there is insufficient space in the weatherproof housing, an IS-PSP-120 MOV/gas tube hardwired shunt protector at the camera power input can be substituted.

If the camera is powered by 24Vac, a PolyPhaser IS-SPTV could be placed at the camera and an IS-PSP-120 protector wired across the primary of the 120Vac to 24Vac power transformer at the console end of the cable. An IS-PLDO-120US-15A protector would be used to protect the console.

In both examples, an IS-75BB (75 ohm BNC female connectors) would be inserted in the video coax at both the camera and console ends. If there is a ground loop concern, an IGA-90 Volt Isolator can be used with the IS-75BB at the camera. The camera protector should be in a sheltered location unless a weatherproof version is ordered.

“Ground Loops” can occur whenever long video coax runs are used. The symptoms include horizontal black bars (60 Hz hum bars) moving vertically through the picture. Ground loops are created when a potential difference exists between grounds and the coaxial cable is grounded at both ends. Current will flow through the coaxial cable shield and induce an opposing flow in the center conductor. The induced current is usually at the ac power line frequency.

The ground loop can be eliminated at the camera by using an IGA-90V isolated ground adapter and insulating the camera from local ground at the top of the pole. The IGA-90V isolated ground adapter isolates the IS-75BB path to local ground until a predetermined voltage from coax shield to local ground is exceeded and remains switched to local ground until another lower voltage condition exists. At the control console end, an IS-75BB protects the center conductor. Note that this arrangement will only work for low voltage ac powered (through a transformer) cameras with no safety ground.

In all cases, the IS-75BB mounted on a single point grounding panel should be used at the console end. Prior to connecting to switcher or monitor, add a few turns of coax to increase series inductance. An IS-PLDO-120US-15A inline ac power protector should also be mounted to the grounding panel. The control console and power supplies are tied back to the grounding panel via copper strap. Finally, the grounding panel should be connected to an external low inductance ground system using at least 1-1/2 inch (38 mm) copper strap. Do not rely on the third wire ground in the ac wall socket.

Please contact us for questions or further information on this topic.

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