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White Paper

Telephone Network & Computer Interfaces at Communication Sites

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An entrance protector is required for telephone or control lines for the same reason an entrance protector is needed for power lines. The local telephone company usually supplies the building entrance station protector as part of their installation service. This is usually a single gas tube per wire type protector. Ground it to your perimeter ground system. The telco supplied protectors prevent surge currents from entering the building and radiating a magnetic field inside the equipment room.

If a better protector is desired, it should be used in addition to the telco-supplied protector and installed after the demarcation block. The telephone lines should be run to the bulkhead panel in EMT conduit to prevent surge magnetic field pickup. Install the additional secondary protector at the bulkhead panel for single point grounding.

The telephone lines running between the entrance protector and the single point ground secondary protector are inductive and will impede fast rise time current. If the distance is short, inductance can be increased by using metal conduit or shielded loops. The line may also be enclosed by a metal conduit grounded on the equipment end or looped several times inside a steel (ferrous faraday shield) NEMA enclosure.

Fewer Lines Need Better Protection

Dedicated lines for dc remotes, tone remotes, data lines and audio lines should be treated in a manner similar to the telephone line. Since the total surge energy is a given amount, the more line pairs that enter the building, the less surge current per pair. A single pair, terminating at the equipment, needs a better protector (multi-stage) than each pair of a 25-pair line terminating at the same equipment.

For multi-pair installation, extensive use of balanced MOV/SADs provides both protection and capacitive filtering. The MOV/SADs should be placed line-to-line and line-to-ground. To prevent pair imbalance that could induce a differential voltage, both of the line-to-ground MOV/SADs should be selected so their turn on voltage matches to within 5%. The turn on of the line-to-line MOV/SAD is not critical.

Protector Placement

Protectors should be placed on the bulkhead panel in buildings using the single point grounding technique. This allows each I/O protector (coax, power and telephone lines) to have a low inductance interconnection to the perimeter ground, as well as to each other. In an installation without a bulkhead, the I/O protectors should be placed on a single point grounding plate connected to the perimeter ground.

Three-Element Gas Tube

The telephone company will usually supply a gas tube protector at the building entrance. The gas tube was originally designed to replace the older carbon buttons that became noisy with use and required maintenance. Actually, the carbon buttons weren't intended to provide lightning protection, but rather to protect personnel in the event a power line came in contact with a telephone line.

Both the carbon button and the gas tube are inadequate for protecting equipment. On balanced telephone lines both the voltage above ground (common mode) and the voltage between lines (differential mode) are important. When individual crowbar devices are used, one for each side of a single pair (line), usually one device fires before the other, creating a large differential voltage that can damage equipment.

One solution is to use a three-element gas tube. This device has a common gas chamber with two gaps, one on either side of the grounded electrode. When one side of the line reaches the ionization potential

of the gas, both sides fire simultaneously to ground. Once again, because of the rapid change (dv/dt) caused by the device firing, it is important to use some low-pass filtering.

Telephone lines, data, or control lines are similar to power lines since they provide two directions for the surge energy to flow. Since telephone, data, and control lines use wires smaller than ac power wiring, they have more impedance (inductance and resistance). With higher impedance the physical damage caused by the surge current decreases.

Voice/Data I/O

Fiber optics with non-metallic armor or strength members are the way to go, if it is affordable. This will eliminate one I/O hazard.

If wire pairs are used, protectors are necessary. Gas tube type arrestors installed by the phone company, will soon be outdated. The large dv/dt created with the crowbar action of the gas tube will cause on-line transient problems with digital equipment. Low-pass filtering is important to limit the harmonic energy created by the crowbar action of the gas tube on wire lines. Non-crowbarring protectors such as capacitively balanced MOV/ SADs are recommended.

For L-carrier coax, a coax grounding kit should be used prior to entering the building. A coaxial protector should be used to protect the equipment from the center conductor's differential surge energy.

For T-carrier on pairs, (and LAN) special protectors with high bandwidths and low (logic level) turn-on levels should be used. Special units for telco (span line) repeaters (current loop) are available.

Equipment Room Precautions

Always use anti-static floor material to prevent Electro-Static Discharge (ESD) buildup and to allow bleed off of existing charge on personnel and moving carts. Anti-static flooring will prevent ESD buildup, but is of too high impedance to bleed off previously acquired charge. Ground the metal posts that support computer room raised floors. EMP gasket material should bond the cast aluminum tile squares to the structural posts. This technique will not only aid in ESD, but will also form a ground plane which will be beneficial for EMP attenuation, if the room is not a screen room enclosure. Other means such as ion generation may also be helpful.

Another problem is not maintaining a low inductance interconnect path between protectors (L & T-carrier, power and other incoming pairs) and between protectors and system ground.

The most common problem found at sites and computer rooms is the practice of running lines that can carry surge current together with other lines that should be quiet. For example, ground conductors from protectors being run together or crossing with other ground lines, battery return lines, and data lines. The coupling of the surge to the other clean lines can cause major equipment glitches or even down time. EMT conduit grounded on one end is the best way to provide faraday shielding.

Coaxial Cable Data Lines

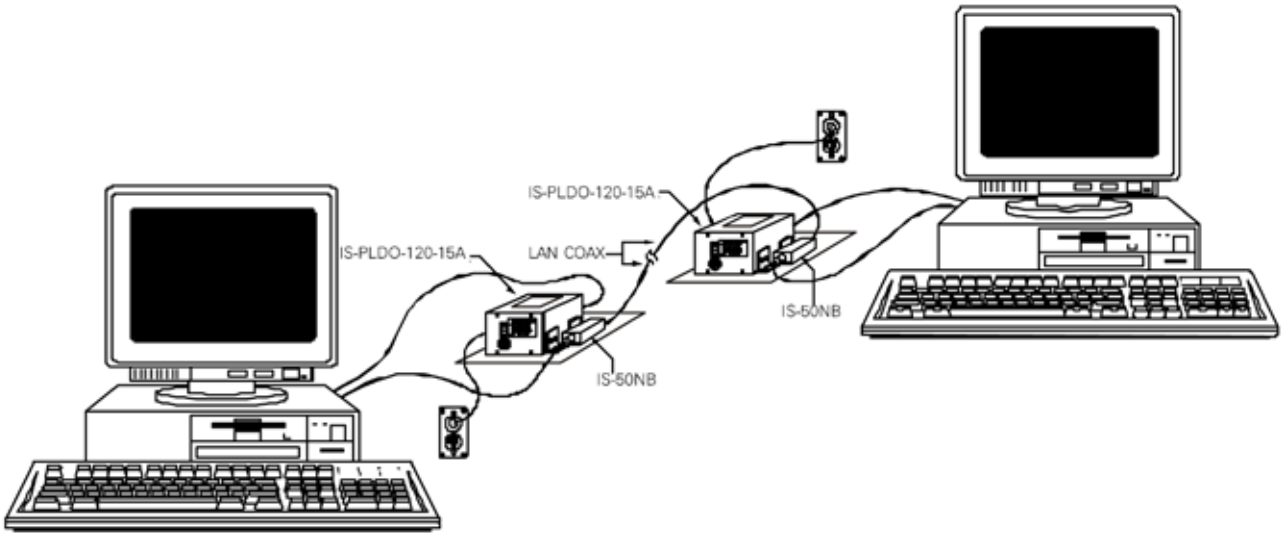
Communication lines that travel from one floor to another, or from building to building, can pose a surge threat to equipment I/Os, as well as hum or ground-loop problems.

Coaxial cable has more problems with ground-loop currents than a balanced twisted pair. The coax shield is normally grounded to the signal ground at each end, which in turn, is grounded to the local power line neutral and earth ground. Two different earth ground locations can cause ground loop currents to flow on

the shield if there are ground potential differences. Grounding the coax shield only at one end sometimes solves the ground loop, but can create other problems.

Another solution uses a PolyPhaser protector with shield continuity mounted on a ground isolator. The ground isolator can withstand up to 90V shield to ground potential without turning on. The incoming coax cable shield is not connected to the remote equipment local earth ground unless a 90V potential is exceeded. Protection is provided while still ensuring the quality of the data.

For protection at the terminal end, a standard coax protector with no isolator may be used.



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

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