

tech tips

TECHNICAL INFORMATION AND PRODUCT SOLUTIONS

Telecom Line Protection – Longitudinal vs. Metallic Voltage Considerations

The two main classifications for the types of transient voltages that can appear on telephone lines are longitudinal and metallic.

What is a longitudinal voltage?

Longitudinal voltages refer to that portion of a voltage signal that is identical in amplitude and phase on both sides of a transmission pair with respect to a reference point. The reference point is usually earth ground. Longitudinal voltages are often called common mode voltages in some electronics industries.

What is a metallic voltage?

Metallic voltages refer to potential difference between the two wires of a transmission pair. Metallic voltages are often referred to as differential voltages in some electronics industries.

How do longitudinal transients occur?

It is well known that the majority of transient voltages that appear on telephone lines are caused by lightning strikes that induce longitudinal voltages. Telephone lines are balanced configurations in that the impedance is the same from either conductor to ground. Because telephone lines are balanced, a lightning strike near a telephone line tends to induce equal voltages on each conductor relative to ground.

How do metallic transients occur?

Even though lightning induced transients typically start out as longitudinal voltages, portions of these longitudinal voltages are converted to differential voltages by the asymmetrical operation of some telephone line protection devices in a process called mode conversion. As an example, mode conversion occurs when a gas tube on only one side of a transmission pair activates during a longitudinal surge event. Effectively, this grounds one side of the transmission pair while the surge voltage remains on the other side resulting in a metallic voltage across the pair. If this process occurs on the Telephone company end of a telephone line a metallic surge voltage will be experienced on the subscriber end of the same telephone line. This type of metallic event is referenced to ground. There are other types of metallic voltage surge events that can occur that are not referenced to ground such as electrostatic discharge, but these types of events are not common on telephone lines.

Do telephone line protectors protect equally against longitudinal and metallic surge voltages?

Not all telephone line protectors provide equal protection levels against metallic and longitudinal type surge voltages. Protectors that provide equal protection against both types of surge voltages are often called balanced protectors. Unbalanced protectors sometimes let-through twice the metallic surge voltage than longitudinal surge voltage. This effect of letting through twice the metallic voltage occurs with unbalanced type protectors when the local grounding is not reliable or when the metallic surge has no ground reference.



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What constitutes reliable local grounding?

A reliable local grounding system is one that maintains a low impedance even when absorbing the large fast edged currents that can flow during lightning induced surge events. If the ground wire to the local earth is too small, wire inductance may not allow fast currents to flow to earth quickly enough to protect the attached equipment. The local soil conditions may also exhibit high resistivity limiting its ability to absorb high currents and forcing a higher let-through voltage toward the equipment that is being protected.

Can an unbalanced protector with good grounding divert surge currents from sensitive equipment?

An unbalanced protector with good grounding can direct longitudinal surge currents to ground.

However, if the surge voltage has no reference to ground, the surge will not be diverted to ground regardless of the quality of the grounding. This type of surge can only be dissipated either in an appropriate telephone line protector or in the attached equipment that could be damaged in the process.

Is it important to protect against non ground-referenced surge voltages?

The vast majority of telephone equipment interfaces that are directly connected to the subscriber side of a telephone line are electrically isolated from ground. Longitudinal voltages have little if any affect on these types of circuits. The vast majority of damage that occurs to this type of ground isolated circuitry is caused by metallic voltages on the inputs to the circuit. This is true regardless of the original nature of the surge voltage. Surge voltages with no ground reference are not common but they are commonly responsible for damaging subscriber telephone line equipment.

Does ONEAC have a solution to protect telephone line equipment in areas where good grounding cannot be guaranteed or where non ground-referenced transients occur?

ONEAC has developed an improved version of the AP protection circuit designated as DCCP. This new balanced protector design works in conjunction with ONEAC's patented filter technology to provide low let-through voltage in spite of substandard grounding conditions and in spite of the nature of the surge voltage.