THE SPEED OF ELECTRICITY

Next, lets review the speed of electricity and compare it to the response time of commonly used protection components. In its ideal state, electricity travels at the speed of light or one foot every nanosecond as shown below. Of course, this assumes that there is no resistance, no inductance, and no capacitance in the circuit.

The Speed of Electricity

How Fast Does Electricity Travel Through a Wire?	186,000 Miles/Second
Number of Feet Per Mile?	5,280
Speed (in Ft/Sec) Electricity Travels Through a Wire	1,000,000,000
Time Required for Electricity Travel One Foot?	.000,000,001 Sec. (1 Nanosecond)

Note: Fuses are a current sensitive device and are very slow to react. Carbon blocks allow the surge to travel up to two miles down the cable past the protector. The equipment is damaged before the protector even begins to react. Gas tubes are much faster but they may allow the surge to travel up to one mile past the protector. The equipment is still vulnerable. The irony is that a protector can be used but it does not perform its function fast enough to perform its intent – to protect the equipment.

Then we have our solution – the solid state device which reacts as quickly as electricity can travel. Solid state protectors limit the distance the surge can travel to within two to five feet from the protector.

Solid state protectors are the fastest technology available. So, why are the other protectors used? Well, carbon and gas tubes are the traditional protectors that were used by the Telephone companies to provide human protection. It has become expensively obvious, however, that the faster, solid state protectors are required to protect sensitive semiconductor based equipment.

In the real world, electricity travels slower than our previous assumption in an ideal state. In fact, many scientists believe that electricity travels at 60-80% of the speed of light. Assuming this to be true, consider a revision to our previous statements regarding distances but we are not revising our conclusions. At 60-80% of the speed of light, the solid state device will stop the surge within 1-4 feet of the protector. A gas tube at this speed will still allow the surge to travel 4000 feet. As you can see, the equipment must be protected quickly to prevent damage.

The chart at below shows the reaction times of solid state devices relative to surges coming into the protection device.

Response Times of Typical Protection Devices

Device	Response Time of Device	Distance Surge Traveled Past Device Before It Responded
Fuse	300,000 Nanoseconds	300,000 Feet
Carbon Block	5,000 - 10,000 Nanoseconds	5,000 - 10,000 Feet or 1 - 2 Miles
Gas Tube	4,000 - 5,000 Nanoseconds	4,000 - 5,000 Feet or 1 Mile
Solid State	2 - 5 Nanoseconds	2 - 5 Feet

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