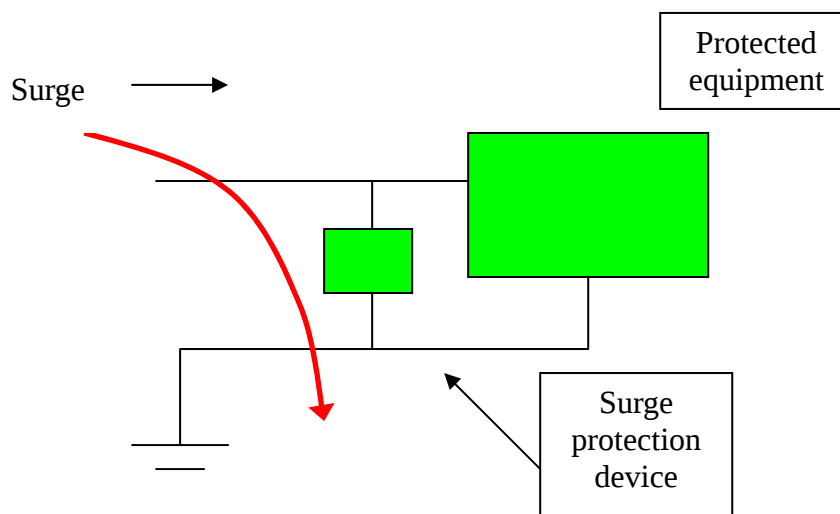




Knowing the Surge Protection Device

There are so many names for protective devices such as 'lightning barriers', 'surge arresters', 'lightning protection units', etc. In ideal condition, the surge protection devices should dissipate the instantaneous current spike out of the device, module or system to the ground.

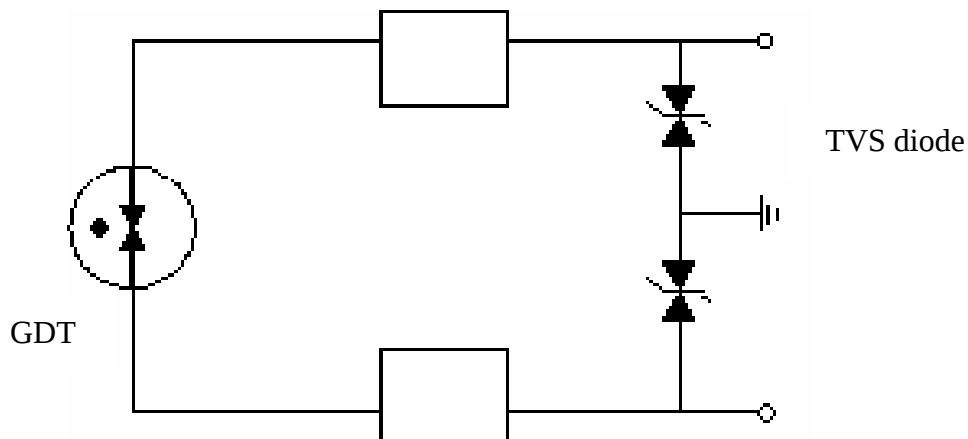
For long lasting protection, all the SPD (Surge Protection Device) should automatically restore normal operation state right after a sustainable surge has subsided.



Here after show and brief most of the practical SPD now engineers can use for surge protection application.

Gas Discharge Tubes

Gas discharge tubes (GDTs) are developed to overcome some of the disadvantages of air or carbon spark gaps by hermetic sealing, thereby eliminating environmental effects. GDTs can provide a rigorous spark discharge control performance since the breakdown voltage was decided by what kind of the gas filling and the electrode spacing. For example, low voltage protection devices have electrode spacing of around 1mm or and in an argon/hydrogen mixture sealed within a ceramic envelope at about 0.1 Bar pressure.

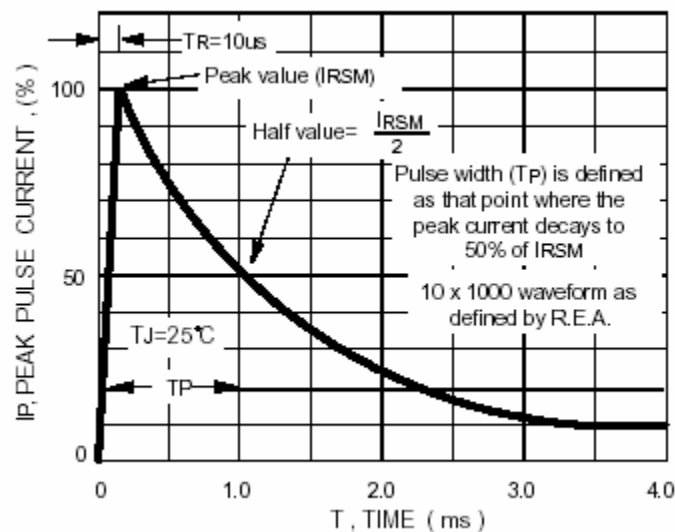


Zener diodes

About regular Zener diodes. These devices are fast in operation and are available in a wide range of voltages that provide accurate and repeatable voltage clamping. Standard Zener diodes cannot usually handle high surge currents but some modified dedicated “Surge suppression” diodes can withstand of several kW of power now are getting more and more popular in many electric circuits from power supply to data transmission. Some new applications are developed on using Zener diode to protect ultra small device.

Transient Voltage Suppression Diodes

It became more and more popular in modern electrical circuit application of surge protection role. They are also known as avalanche breakdown diodes, especially in automotive application. TVS devices have several advantages in surge suppression—such as lower clamping ratio and stronger resistance to surges—over ceramic capacitors and zener diodes. The characteristic curves and typical testing waveform are shown below. The TVS diode can provide either uni-direction or bi-direction devices for different field of application and so do the various wattage rating are set up for different power need. The peak power of TVS diode can be few watts for small signal circuit protection to several thousand watts for power panel protection. Here the most popular test waveform for TVS diode is 10/1000 waveform but as the IT product increased, 8/20 and 1.2/50 testing waveform were frequently asked to complied with.



Metal oxide varistors (MOVs)

A varistor is a voltage-dependent resistor in which the increase in current with voltage through the device is non-linear. Varistors are made from metal oxide particles (usually zinc) and are thus generally known as 'metal-oxide varistors' or 'MOVs'. The zinc oxide particles are compressed together so that inter-particle contact acts as a semiconductor junction. Millions of these particles mimic millions of diodes at various voltages, so, as voltage across the MOV increases, more and more junctions become conducting. Excess current is then bled off through the component, with power being absorbed through the mass of the MOV. The power handling capability per unit-volume of varistors is much higher than that of the surge suppression diodes since the varistor effect is a feature of the total material of the component, not just the semiconductor junction area. However, the millions of junctions in a MOV lead to a much higher leakage current at low voltages. Response time to impulses is as fast as a Zener diode and varistors are mainly applied to ac load protection where networks for single-phase and three-phase supplies are easy to construct. Their characteristics of 'soft' voltage clamping and high leakage current at nominal voltage (together with a tendency for both characteristics to deteriorate with temperature changes and repeated pulse diversion) mean that MOVs are rarely used for the accurate and repeatable protection needed for instrumentation and communications equipment.

Fuses



Fuses can be used to great effect in protecting equipment from over-currents. However, as they rely upon thin sections of wire melting, they take a significant time to operate and the current passing through while this occurs can still be sufficient to damage sensitive electronics. Fuses also have the major disadvantage of being usable only once, leaving lines disconnected until the blown fuses are replaced. Thanks to modern technology, some new special design re-settable fuses are more and more popular in many applications circuits.

Surge relays

Surge relays are designed to disconnect the signal lines in the event of high current surges, thus protecting the associated equipment. Modern designs can handle high power levels and both operating level stability and sensitivity are good. Speed of response is their major disadvantage, the physical movement of the relay contacts together with the generated arc taking milliseconds to interrupt the current flow. The majority of lightning induced surges are less than 100 μ s in duration and hence surge relays are too slow. Maintenance is also needed to keep the relay contacts clean and to prevent cold welding of contacts which can prevent the disconnection of lines under surge conditions. When the relay does operate, signal lines are disconnected and reset, so contact bounce can prove a problem in data communications lines if the bounce sequence is inadvertently interpreted as valid data. Surge relays are primarily used to disconnect power surges created by failures in the power system which are of a significant duration.

Circuit breakers

Circuit breakers are normally designed for power systems and though energy handling capability can be increased to whatever level is considered necessary, speed of response is of the order of tens of milliseconds, generally too slow to be effective against transients of short duration.

Multi-stage hybrid circuits

It is generally necessary to use more than one type of the above components in a protective network to obtain the best possible combination of desirable characteristics. The most common combination forming a 'multi-stage hybrid circuit' incorporates a high-current relatively slow-acting component with a faster acting but lower power rated component in such a way as to minimize voltage and current output. The design of such a circuit should also take into



account the possible consequences of surges below the operating point of the high power component but above levels at which the lower power device can be damaged.

Component	Speed of Response	Level of protection (sensitivity)	Energy handling capability	Stability
Gas-filled discharge tube	Fast (micro-seconds)	Fair	High	Fair
Zener Diodes	Very fast (picoseconds)	Very good	Low	Very good
TVS diodes	Very fast (picoseconds)	Very good	Medium to High	Very good
Metal-oxide varistor (MOVs)	Very fast	Fair	High	Poor
Fuses	Very slow	Good	High	Fair
Surge Relay	Slow (milliseconds)	Good	High	Good
Circuit breakers	Slow	Fair	High	Fair
Multi Stage Hybrid Circuits	Mixed	Mixed	Mixed	Mixed
Carbon Gap	Fast	Poor	High	Poor
Air gap	Fast	Poor	High	Poor