rotork®

Keeping the World Flowing
for Future Generations

Lightning and Surge Protection

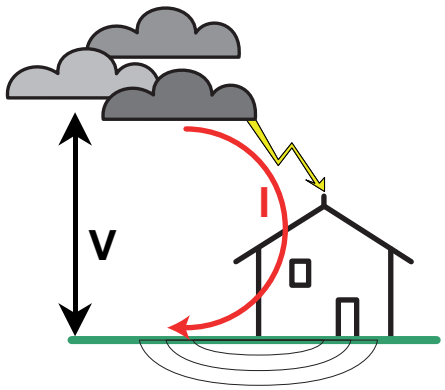
Background

Lightning is a natural phenomenon, occurring when a large static voltage potential exists between clouds and the Earth. When the potential difference rises to a very high value, an electrical energy discharge (lightning strike) occurs between the clouds and the Earth. This discharge results in current flowing between the two points, often including any conductor that helps to bridge the gap, such as trees, buildings or other structures.

When the current path is established the resulting current flow will be extremely high, typically 30,000 A up to a maximum of approximately 300,000 A. This current flows through whatever impedance there is in the route taken by the lightning strike and will produce large potential differences across relatively small impedances.

Although the voltage and current levels during a lightning strike are very high, the time duration is extremely short. The discharge period is only a few milliseconds.

Whenever electrical equipment is located in a region where lightning strikes are likely to occur, it is prudent to include protection for the equipment against these energy discharges. Electronic equipment is particularly vulnerable and where it is connected using long cables, any discharge into the area around these cables is likely to induce currents in the cables. A direct strike onto the equipment itself will almost certainly damage the equipment as the protection devices available have a limited capability. Some of the effects of a direct strike may be protected against by using lightning diverters. These often take the form of conductor rods specifically designed to provide a lower impedance discharge route for the current. In electronic circuits these diverters are semiconductor devices used to route the energy away from the sensitive components.



Effect of Lightning Strikes

Heavy current flows, from lightning strikes, create a magnetic field that can induce currents in nearby conductors. The induced currents are dependent on the coupling effects between the source and affected parts of the system.

Excessive induced currents may produce voltages above the attached equipment ratings. Additional components must be added to act as diverters for the induced signals.

There is no cost effective protection available for a direct lightning strike to the equipment or connected cables. A direct strike will likely destroy part of the system.

Protecting Against Lightning

All protection methods must consider the current flow path to ground. Primary lightning strikes rely on dissipation to ground and any secondary currents also need a suitable path to ground. Grounding of site equipment is therefore extremely important.

Critical sites in vulnerable locations should include dedicated conductor rods to mitigate the chances of a direct strike on equipment. The conductor rods are commonly installed at the perimeter of a site to reduce induced current flows through site equipment.

The effect of induced currents can be reduced by ensuring all earth conductors have low impedance. By design they should be as short as possible, have a large cross section and be tightly secured with appropriate fastenings.

Modern electronic circuits operate at low voltages and currents to minimise the power consumed and reduce heat generated by the hardware. Conventional diverter protection circuits use gas discharge tubes (GDTs), but these are sometimes not suitable as the striking voltage of the tube is above the acceptable limits for the electronic circuits. More modern designs of diverter circuits employ Transorb and Varistor devices that change their impedance characteristics as the applied voltage increases.

Actuator Protection

The lightning arrestor clamps the lightning strike down to a voltage. The lightning suppression module Rotork offer is rated at 510V_{RMS} (675 VDC) with a peak transient current of 6,500 A and a transience of 8/20 µs. When the surge current comes to the arrestor, the arrestor bypasses the current (up to 6,500 A) and prevents the voltage from rising above a certain level. Voltage increases as current passes through the resistance of the arrestor. Voltage will be clamped to 510 V_{RMS} (675 VDC) provided the current remains below 6,500 A. 675 VDC is the peak of a 510 V_{RMS} sinusoidal voltage.

The lightning suppression module protects the actuator from electrical surges due to lightning strikes on the power supply cables. The Rotork device is located in the electrical terminal cover of the actuator and does not protect against strikes directly on the actuator or pipeline. Suitable ground connections must be designed to deal with direct lightning strikes. Rotork actuators meet the immunity requirements of EN61326-1:2013, Table 2 Industrial Environment.

A full listing of the Rotork sales and service network is available on our website.

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