TOKAI

The Threat of Lightning to All Types of Security Systems

Lightning is one of the most spectacular metrological phenomena and the most common severe weather event to affect people.

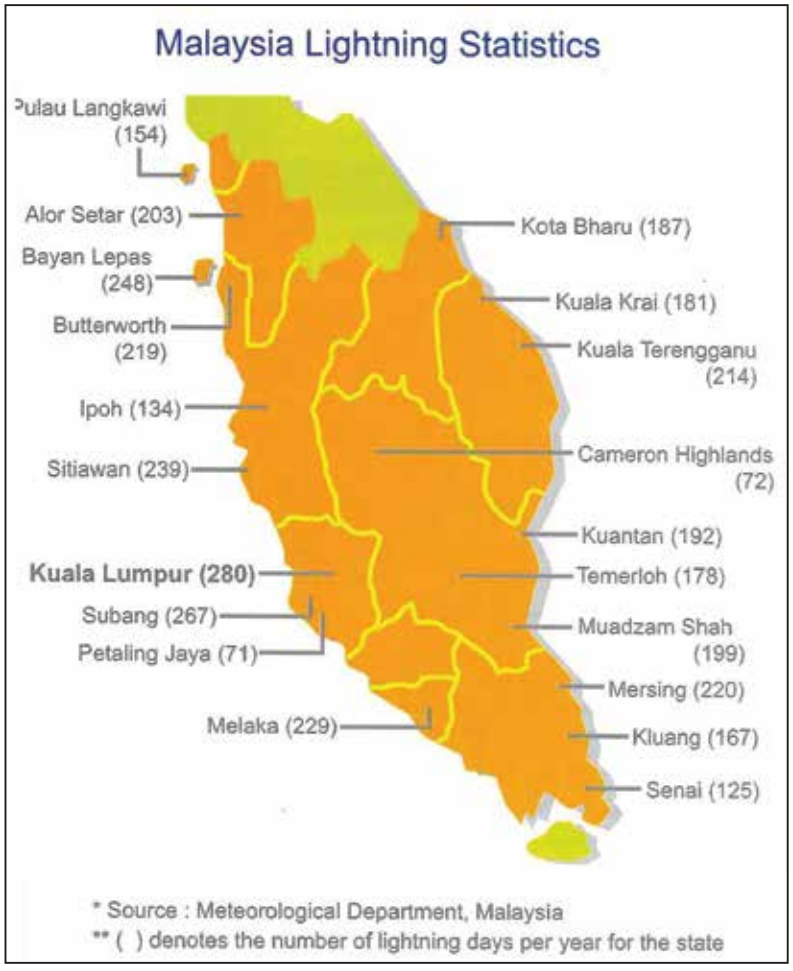
According to international research there are roughly 2000 thunderstorms in progress around the world at any one time, producing 30 to 100 cloud-to-ground flashes every second, equating to five million flashes per day. Malaysia is a lightning prone country with one of the highest lightning ground flash densities in the world. Malaysia has about 280 lightning days per year, and is the most lightning prone country in Asia.

We cannot take the lightning problem lightly, particularly when it comes to the efficient operation of protection, access and surveillance systems. These systems are as reliable as the surge and lightning protection systems that protect them.

In recent years the methods of lightning and surge protection have drastically changed, so much so that suppliers are more confident that their systems work effectively. The most important aspect is to approach protection from a holistic point of view. It is simply no good just fitting a protection device at the access control equipment and somewhere along the line on the main supply.

As an informed consumer, you must understand the system, and the concept of where and what to protect.

In the next section, we would like to bring this to your attention but before that we would like to introduce some basic theory of Lightning Surges and its source.



Main sources of surges

We have to deal with two main sources of surges. The first and probably the most common sources are mains borne surges. Switching of large industrial loads connected to the power supply grid causes these surges. As the loads are switched on, the voltage is 'pulled down' for a fraction of a second. The supply authorities automatically compensate for the additional load, which results in a short duration over voltage before the supply stabilises once more. The result is a surge. Whilst these surges are for all intents and purposes relatively low level they can be of significant duration, and the energy component is therefore enough to cause damage to sensitive electronics.

When electronic equipment is regularly subjected to these low level-switching surges the equipment will exhibit signs of premature aging as the components are regularly forced to work outside of specified parameters.

The methodology employed in protecting against these surges is to install surge protection on the main incoming power. Since the surges enter the installation through the power lines it is only necessary to install protection at this

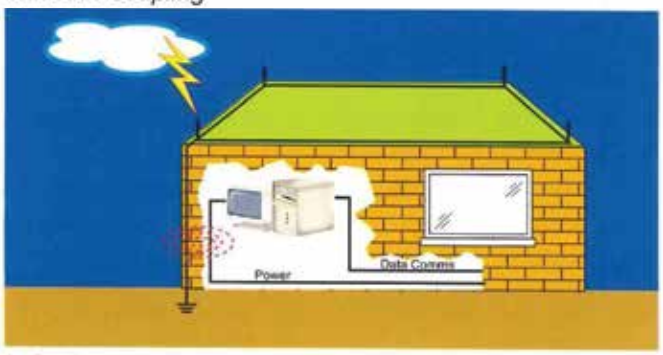
point to prevent damage from this source. This will however not protect against the major source of surges – lightning.

To fully understand how to protect against these potentially catastrophic transients it is essential to review how lightning surges enter into the system. There are two main ways in which the massive amounts of energy in a lightning strike enter into an electronic system:

(1) Inductive coupling

When lightning strikes an object, (a building, tree or pole etc.) high currents at fast wave fronts occur causing large electromagnetic fields which are then induced (hence, the term inductive) into your electrical and data communication cabling. Equalisation then occurs which could cause damage to your equipment.

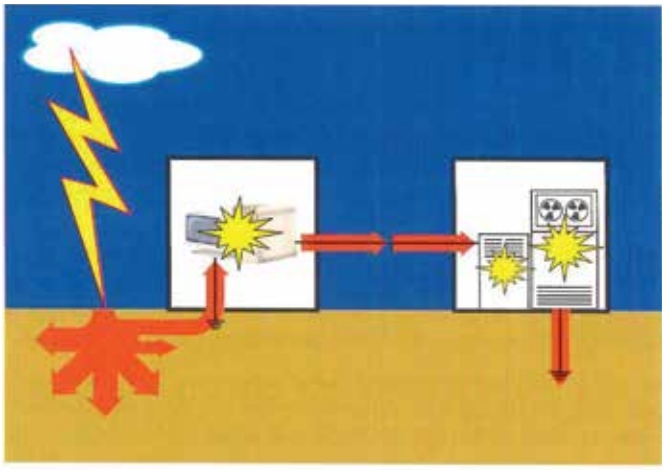
Inductive coupling



Inductive coupling from a lightning conductor

(2) Resistive coupling

When lightning strikes a structure, (a building, tree or pole etc.) a high voltage potential exists for the duration of the strike at the point of contact of the structure to the ground. Due to resistivity of the earth, decreasing voltage potentials will be experienced along the current paths moving away from this point. Should you have electronic equipment referenced to different earth systems while connected to each other via copper cables, equalisation will tend to occur via the copper cables resulting in equipment damage.



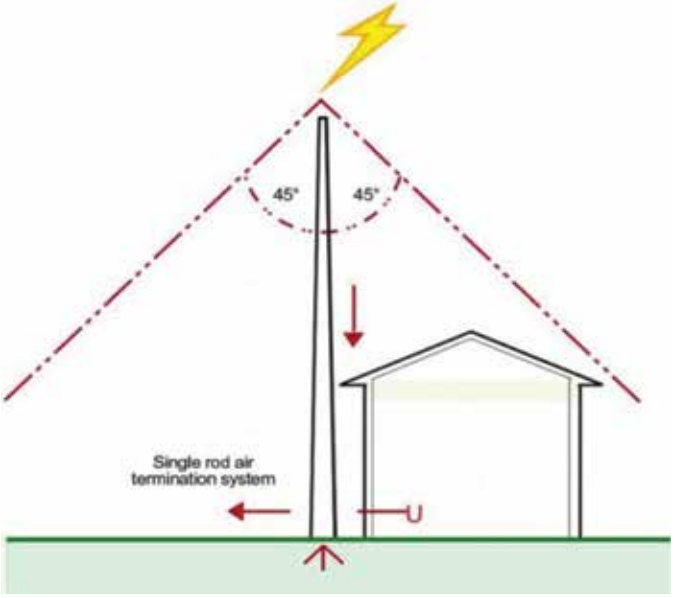
Resistive coupling through a data line

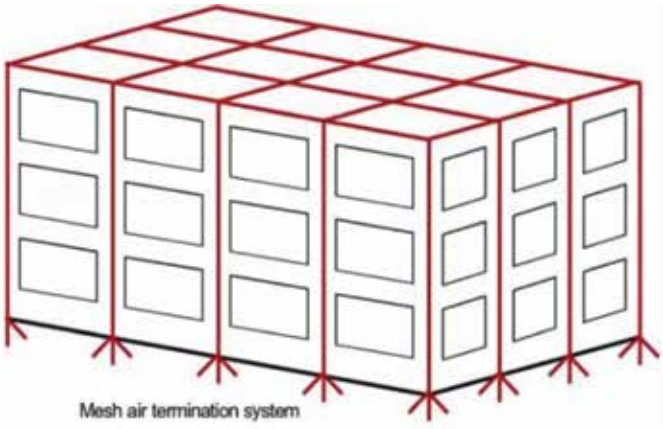
External protection

External or structural protection should always be considered as an integral part of a correctly designed protection system. As the name implies, external or structural protection will only protect the structure and not the equipment located inside the structure. When lightning current is passed into the ground, high electromagnetic fields are generated which will be induced into cabling and wiring causing equipment damage. A correctly co-ordinated protection system to MS IEC 62305:2007 Standard for Lightning Protection should be followed.

Single pole protection system

A common form of structural protection is the single pole lightning conductor. The lightning pole is located considerably higher than any other point or area of structure to be




Mesh air termination system

protected and provides a cone of protection around the structure. The object of the pole is to intercept the lightning discharge and to provide an orderly path to the ground.

Mesh air termination system

The system consists of several capturing points connected to each other through conductors. A network is formed which is extended with conductors leading to the earth electrode system. This method is suitable for larger buildings as it is usually easy to install.

Electronic surge protection for a Perimeter Intrusion Detection Security System (PIDS)

Perimeter Intrusion Detection Systems (PIDS) as its name states is a system deployed in a facility to monitor and detect any form of intrusion from the perimeter into the protected premise.

There are many types of PIDS systems, with each type using different technology to do the detection such as vibration, acoustic, movement etc. The medium used for detection also comes in many forms like fibre optic cable, vibration sensor, microwave etc.

PIDS is part of the security system which is sometimes made up of a few systems complementing one another to do the job. Example of these systems is CCTV and lighting systems etc.

These systems are highly susceptible to damage from lightning surges and hence it is imperative to seek proper consultation from a reputable and reliable lightning specialist to ensure that all these systems are well protected.

It would be of interest to know that security, like the PIDS, is designed for operation within specified current and voltage ratings. If these ratings are exceeded due to short-circuit or voltage transients, components may sustain permanent damage and the equipment may fail. Power supplies and circuit traces must also be protected against faults that may occur during installation or in the case of a shorted back-up battery.

Modems are frequently utilized in security systems to automatically alert the fire or police department in an emergency. These telecom data lines must be protected from damage caused by lightning strikes, power-line crosses or AC power induction.

Good to know : Surge protection device (SPDs) Dos/ Donts

One of the best ways to minimize the dangers of lightning and utility surges on equipment is the implementation of SPDs. Here are some electronic surge protection tips from Tokai.

- The conductor length between a SPD and the equipment being protected should be a minimum of three feet in length. This is to allow enough time for the SPD to react to the transient surge.
- A low impedance ground path is absolutely essential when installing a SPD. Never assume you have a good ground.
- The use of a grounding bus bar is strongly recommended as a means of terminating SPD ground wires to existing electrical grounding leads. You need a good solid mechanical connection of all your grounding conductors.
- When installing multiple SPDs and terminating to a common ground, a dedicated ground wire run from each individual SPD to a common grounding bus bar is recommended. In order to get a good ground do not 'daisy-chain' SPD ground wires, or use twist-on wire connectors. These practices can increase the resistance and extends the length of the ground path.

This article is brought to you by Tokai Engineering (M) Sdn Bhd. Tokai has been a Malaysian brand for the past 20 years. As a pioneer in the Lightning and Surge Protection Industry, Tokai has grown and diversified into a force to be reckoned with as a total solutions provider for both lightning and earthing protection and high security protection systems. Our prolific references include Prime Minister's Residence and Prime Minister's Office and various other Government Buildings in Putrajaya, the Istana Negara at Jalan Duta, Bank Negara Malaysia, Australia High Commission in KL, Singapore High Commission KL, KLCC Petronas Twin Towers, Menara Perak, Istana Alam Shah and many more. ■

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