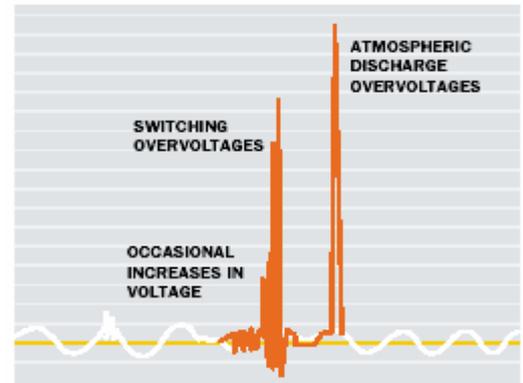


Transient overvoltages are very short duration increases in voltage between two conductors or between a conductor and the ground. They can be caused by atmospheric electrical discharges (lightning), by switching or by electrical faults (contact with earth or short circuit).

Although transient overvoltages have existed since the creation of electrical networks, the need for protection is nowadays much greater. This is due to advanced technology making electrical components ever smaller and more sensitive to electromagnetic disturbances.



Types of overvoltages

Electronic components (from valves to nanotechnology)

The effect of conducted or induced currents due to atmospheric discharges either from distant strikes, lightning between clouds or by the switching operation of heavy machines (which cause overvoltages similar to those produced by lightning strikes), can cause devastating damages on electronic equipment and electrical installations.

Atmospheric discharges produce voltage peaks at the signal, very high but also with a very short duration. Currents associated with a direct lightning strike can reach values over 100kA, thus even its secondary effects bring currents that are able to cause important damages to the lines and equipment they are connected to.

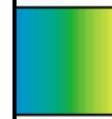
Most electrical lines are equipped with security measures to avoid short-circuits and electrical shocks to people. Almost every electric board contains protectors such as automatic circuit breakers and RCCB. However they cannot avoid the consequences of transient overvoltages, since their reaction is much slower than the voltage peak that appears.

ELECTRONIC VALVES

Large and resistant. The majority can withstand overvoltages without suffering irreparable damages.

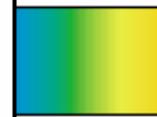


Damages caused by overvoltages



FIRST TRANSISTORS

More sensitive but with a good insulation.



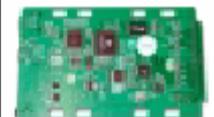
INTEGRATED CIRCUITS

Made up of a large quantity of transistors and work with very low currents and voltages.



SMD COMPONENTS

Their small size, proximity of components and lines which join them, makes them very susceptible to overvoltages.



The evolution of electronic systems and components together with an increase in their usage, has resulted in the last decade in a spectacular increase of economic damages caused by overvoltages. This is primarily because the voltage peak goes through smaller and more sensitive elements.

A special example is that of UPS (Uninterrupted Power Supply). These elements assure the power supply of the equipments connected to it even when there is a cut in the electricity supply. Most of these equipments also have a current rectifier which enables a stable power supply within a $\pm 15\%$ variation. However, because they are sophisticated equipment with microprocessor technology and very sensitive to overvoltages, they can suffer serious damages when subjected to transient overvoltages.

Surge Protective Devices complement the mentioned protections.

In general they do not activate with small deformations in the signal or network overloads. However, they respond in nanoseconds to voltage peaks and they are able to drive lightning current (main or secondary) to earth, safeguarding the connected equipment.

Consequences of overvoltages

The most typical transient overvoltages are caused by the operation of powerful machines. However, the most destructive are caused by atmospheric discharges.



Surge effects range from simple brief work interruptions to the total destruction of sensitive equipment:

DISTURBANCE

Interruption of system operation, data loss and corruption, unexplainable computer failures, etc...

DEGRADING

Transient overvoltages degrade, without user notice, electronic components and circuits, reducing equipment life and increasing the possibility of failures.

DAMAGES

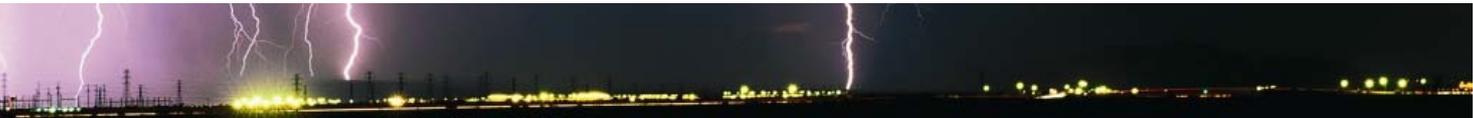
Severe transient over voltages can damage components, circuit boards and can even burn or destroy the equipment as well as producing the start of a fire.

They mainly affect electronic, computer and telecommunications systems.

All these effects imply the interruption in the normal working condition of computers and thus results in economic losses due to delays in productivity.

More importantly, these effects can carry risks to people which must be avoided at all cost according to the Health and Safety Laws:

Minimum requirements of health and security used by installation workers and work teams. R.D. 1215/97. Annex II, point 12. "Any installation or machine used for work purposes, and which could be reached by lightning, should be protected against its effects using adequate devices and measures."



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