

# TECHNICAL NEWS

Issue 17 May 1996

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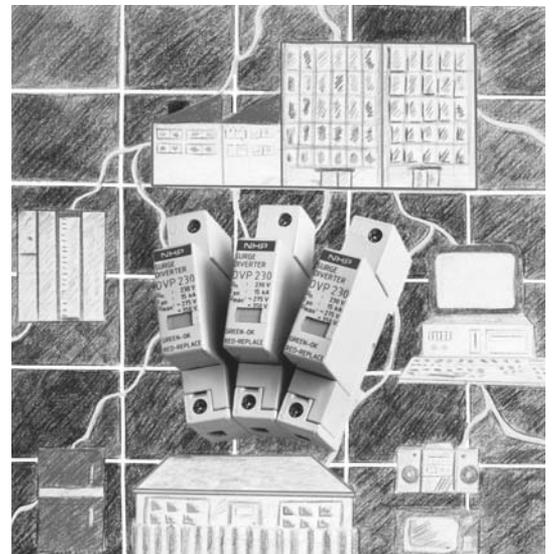
## ELECTRICAL SURGES CAN BE EXPENSIVE

By Bill Mairs

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The increase in the use of electrical equipment in society means that most homes have many thousands of dollars worth of equipment plugged into the familiar GPO. The problem for this equipment is that the GPO can sometimes deliver a fatal surge that causes damage to any device that is plugged into the GPO. This can happen even if the switch on the GPO is turned off.



Surge diverters can be used to protect your property and equipment from lightning strikes.

*The flash of lightning is the most visual surge of electrical energy and lightning does cause major disturbances on the power system.*

When the personal computer first invaded our homes people started to learn about the horrors of the electrical transient. This previously unknown foe soon became the reason for any unexplained crash of the system although it does not seem to be as significant today.

The electricity supply is in fact quite polluted in the electrical sense, with many of the household devices themselves contributing to the problem.



IN THIS ISSUE

- Electrical surges can be expensive **1**
- Cause of surges **2**
- Surge diverters **3**
- Conclusion **4**

Electrical surges can be expensive  
(continued from page 1)

## Cause of surges

### Lightning

The flash of lightning is the most visual surge of electrical energy and lightning does cause major disturbance on the power system. Measures are taken to shield parts of the distribution network from direct lightning strikes but surges will always be present.

### Electrical equipment

The operation of switches can cause significant surges. These switches may be the ones operating the solenoids in the washing machine, just the other side of the wall to the home computer or those required for the operation of the network. The closer they are located to a sensitive device the greater the problem.

### Power mixing

It is common to find uninsulated HV wiring strung on the same poles as the LV distribution network. It is not hard to envisage that under some circumstances the two systems will connect, – road accident being the most obvious with vandalism also high on the list.

### Lightning surges

There are three modes of entry for lightning surges to enter a building.

a) Direct entry by lightning hitting the exposed metal parts of the structure. This includes



there are multiple earth connections close to each other. This results in low values of earth resistance and helps prevent extreme rises in the earth potential. In areas of lower density the problem can be, much greater with quite severe rises in the earth potential.

c) Induced by magnetic or electrostatic fields caused by lightning strikes close to conductors entering the building. The energy levels for this type of impulse are comparatively low.

*Surge diverters designed to be fitted to the main or sub-switchboards are starting to become common.*

TV antennas and water pipes. They can be quite destructive to any equipment involved in the current path as the full effects of the lightning discharge are experienced.

b) Indirectly by the lightning striking the services connected to the building such as the low-voltage electricity distribution system. This results in much higher energy levels than a direct strike entering the building. The main effect of these strikes is for the discharge current to raise the potential of the earth system in the building by an amount determined by the earth resistance. In high density urban areas the MEN system of earthing ensures

Power surges cause a range of problems from a slight and temporary miss operation to electrical flash over and major damage. The performance standards for all electrical devices are introducing the concept of the device being able to withstand a certain level of disturbance and at the same time not to produce excessive disturbances. This concept extends not only to the problems of mains born transients but also to radiated electromagnetic fields in the communication frequencies.

While this addresses the equipment itself it still

Cause of surges  
(continued from page 2)

requires that external influences such as lightning are controlled to a level that both the installation and the installed equipment can withstand. Surge diverters designed to be fitted to the main or sub-switchboards are starting to become common.

*Australian Standard AS1768 recommends the fitting of surge arresters at the entry point of the electrical service.*

These diverters will limit voltage levels in the electrical installation to a magnitude that prevents insulation breakdown and also helps to prevent voltages that could be a danger to people inside the building. The risk to people in a building from lightning strikes results from many factors. To provide full

protection requires a detailed examination of all the possible modes for a lightning discharge to enter or leave the building.

As part of the overall lightning protection of a building Australian Standard AS1768 recommends the fitting of surge arresters at the entry point of the electrical service. This will provide primary protection for equipment sensitive to over voltages.

In the case of a major fault in the supply network which results in a brief injection of high voltage into the low-voltage distribution system the normal type of surge diverter mounted at the entry to a building will not be able to cope with the energy levels.

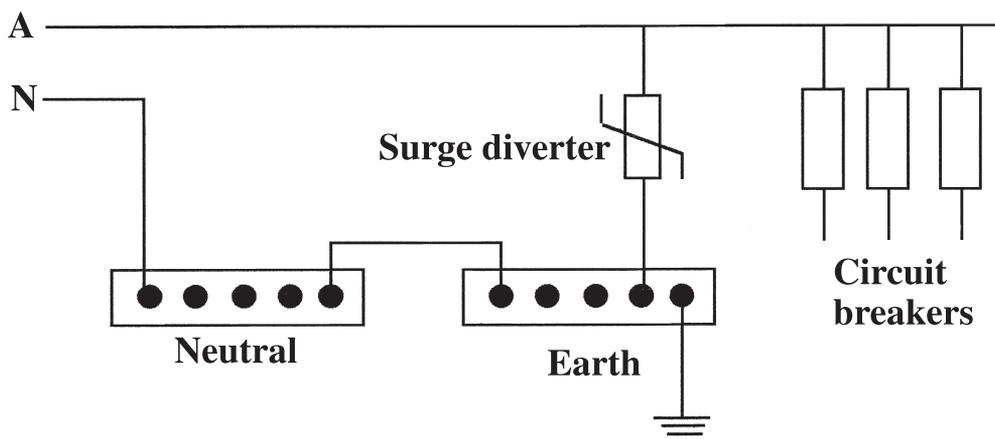
The network protection system will normally isolate the high voltage supply rapidly but the actual voltage level on the low-voltage system will depend on many factors but the effects can be expected to be quite destructive.

## Surge diverters

The Metal Oxide Varistor (MOV) is the most common form of surge diverter for providing primary protection at the point of supply entry. This material has a resistance which drops rapidly once a threshold has been exceeded. This characteristic provides a clamping action that limits the voltage entering the building. The MOV's performance does deteriorate with repeated operation and it is common to provide indication that the device has operated and needs replacement.

*The surge diverter is an important part in providing protection of an installation against incoming voltage surges.*

The MOV will typically limit the voltage surge to less than 1200 volts but it does not limit the rate-of-rise of the voltage. A rapid rate-of-rise can cause



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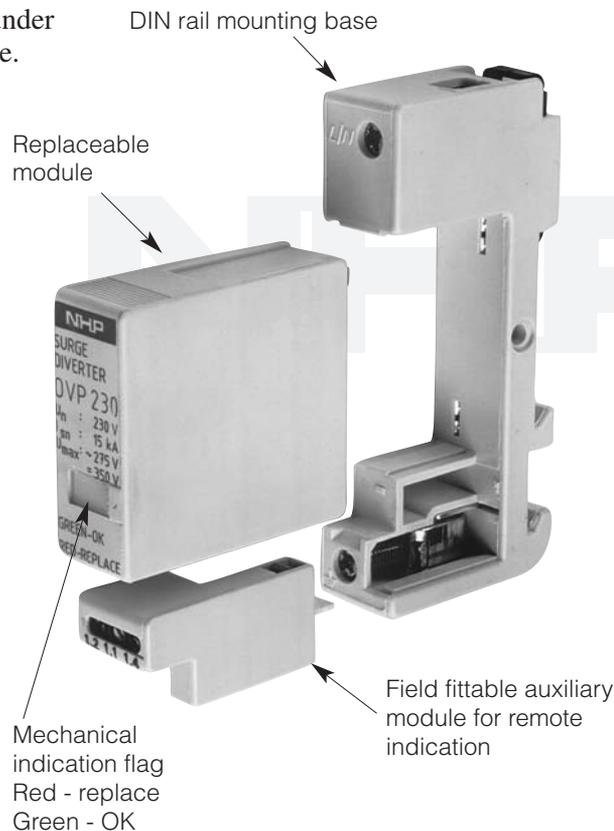
Surge diverters  
(continued from page 3)

problems for some electronic equipment and filtering may be required to prevent mis operation. The current peak required to be conducted is typically 3 kA.

Most modern electronic devices incorporate secondary surge protection and filtering to reduce the rate-of-rise of the voltage. Amendments to international standards are being made to ensure that all electrical equipment can provide satisfactory operation under conditions of supply disturbance.

## Conclusion

The increased complexity and value of installed electrical equipment requires more careful consideration of events that are likely to damage it. The surge diverter is an important part in providing protection of an installation against incoming voltage surges.



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