



# Eskom Power surge protection:

## Fact Sheet

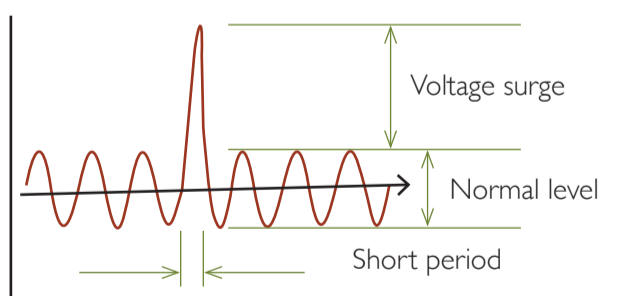


### Protecting Electrical Equipment Against Power Surges

#### Why do you need surge protection?

Power surges in the electrical supply can increase the current flowing to your electrical and electronic equipment.

An electrical spike or surge is a short-term increase in voltage. This occurs typically when the normal voltage increases for three nanoseconds or more. This can be graphically represented as follows:\*



A number of different events can cause an increase in supply voltage and/or current. The most familiar event is usually lightning during a weather storm. When lightning strikes on or near a power line, whether it's underground, in a building

or running along poles, the electrical energy can boost the voltage by millions of volts. This causes an extremely large power surge that can overpower almost any installed surge protector. The best protection, with lightning, is to unplug your equipment.

The more common cause of power surges is the operation of high-power electrical devices, such as elevators, air conditioners, refrigerators and large industrial machines. When this equipment switches on and off it creates voltage spikes/surges which upsets the steady voltage flow in the healthy electrical systems. When power is interrupted due to network faults or load shedding, the effect is the same as equipment turning on and off, which creates surges in the process destabilising the network. When the power returns after an interruption, electrical loads are added to the networks suddenly. This causes the voltage to fluctuate dramatically, creating under or over voltage over a short time period. Short term increased voltages (also referred to as power surges or voltage spikes), after repeated load shedding, outages/interruptions or heavy industrial load fluctuations may eventually cause damages. While these surges are nowhere near the intensity of lightning surges, they can be severe enough to damage components, immediately or gradually, through regular occurrences.

Other sources of power surges include faulty wiring, problems with utility equipment and downed power lines. The network infrastructure consisting of switchgear, transformers, capacitors, lightning arrestors and lines that transmits electricity from a power generator to the points of use in our facilities are extraordinarily complex. There are numerous possible points of failure and many potential errors that can cause an uneven power flow. In today's electricity distribution infrastructure, power surges are an unavoidable occurrence. Even more so when regular load-shedding is used to stabilise the overall system.

This fact sheet provides proposed options which can be used to protect equipment against power surges.

\* <https://www.eskom.co.za/sites/eas/Services/Documents/QUALITYOFSUPPLYBROCHUREfinal.pdf>

## Surge protection

Surge protection is purchased purely for the protection of electric or electronic equipment. It will not keep the lights on, neither will it keep your electronics working during load-shedding like an uninterruptible power supply (UPS) would. However, as mentioned before you need surge protection, with or without utility load shedding, because spikes or surges are often also caused by lightning, utility grid switching or heavy industrial equipment being operated.

## What is surge-protection

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Good quality, off the shelf surge protectors work by diverting the extra-high-voltage electricity away from your equipment, and in the process save your sensitive equipment. There are a variety of surge protection devices available, however – some offer only marginal protection.

Basic operation - when the voltage from the supply point surges or spikes (rises) above acceptable levels, the surge protector diverts the extra electricity into the electrical system's earthing/grounding system.

The two main types of surge protectors are:

### 1. Metal Oxide Varistor type:

In this most common type of surge protector, a component called a metal oxide varistor (MOV), diverts the extra voltage to ground.

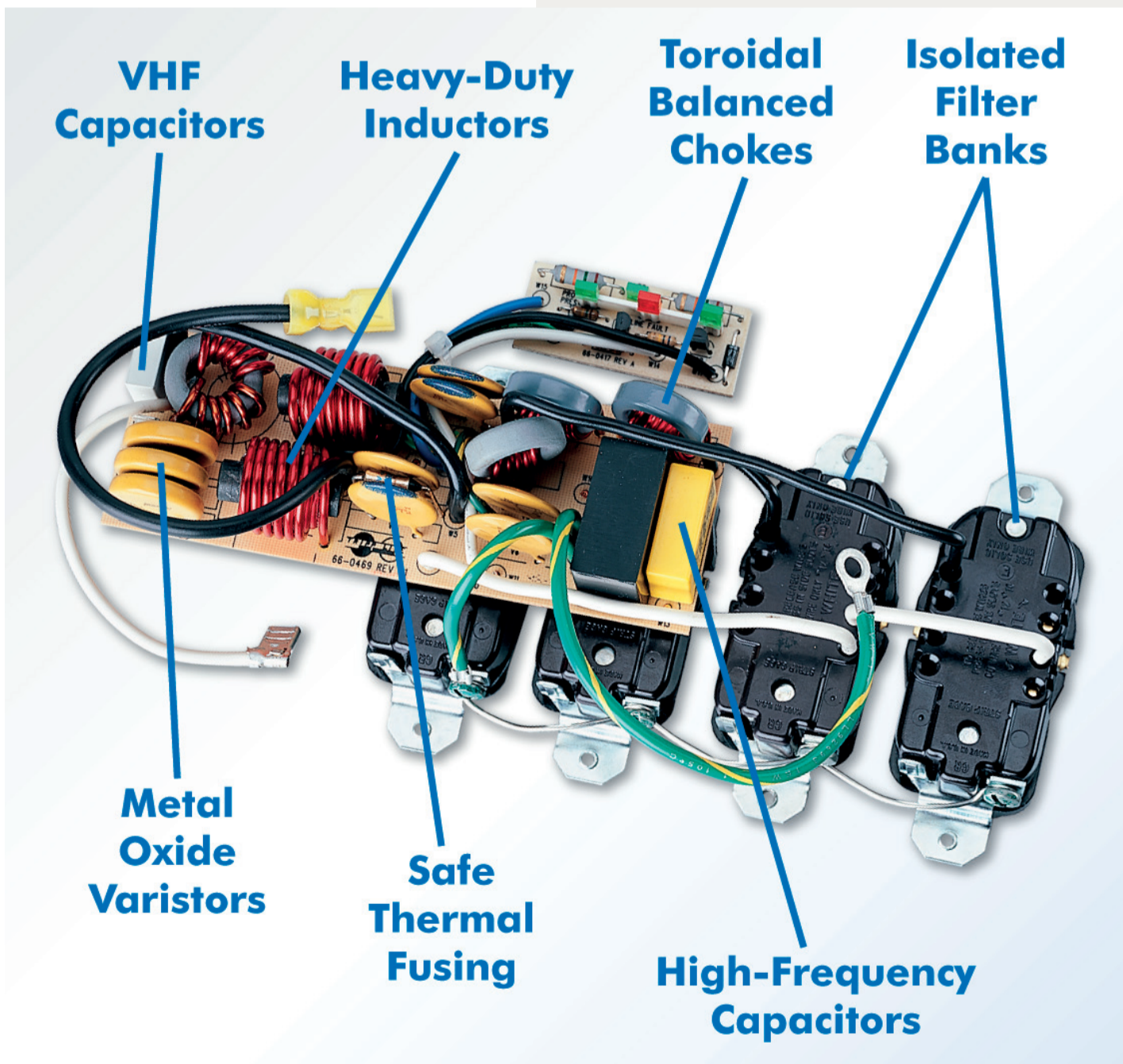
These semiconductors have a variable resistance that is dependent on voltage levels. When the voltage is within acceptable levels, the semiconductors resistance remains high, as soon as the voltage goes outside acceptable levels the semiconductors resistance lowers. When the voltage is within the correct limits, a MOV will do nothing. When the voltage is too high, a MOV conducts current of current to earth and in the process eliminates the extra voltage.

As soon as the extra current is diverted via the MOV to ground, the voltage in the live line returns to a normal level, and the MOV's resistance increases again limiting the current diversion. In this way, the MOV only diverts the surge current, while allowing the standard current to continue powering whatever equipment is connected to the surge protection.

### 2. Gas Discharge Arrestor type:

Another common surge protection device is a gas discharge arrestor or gas tube. These devices operate the same as the previously mentioned MOV's where they divert the extra current from the live line to the ground line during voltage surge conditions. They do this by using an inert gas as the conductor between the two lines.

The makeup of the gas is such that it is a poor conductor of electricity when the voltage is within acceptable levels. When the voltage surges above that level, the electrical power is enough to ionize the gas, making it a very effective conductor. This allows the excess current during surges to transfer to the ground line until the voltage reaches normal levels, and then becomes a poor conductor again.



Inside a surge protector with line-conditioning chokes

Source: <https://www.provantage.com/tripp-lite-isobar/2ultra~7TRPS00Q.htm>

Both of the aforementioned methods have a parallel circuit design where the extra voltage is fed away from the standard electrical path to earth/ground away from equipment which could get damaged.

A few surge protector products suppress surges with a series circuit design - the extra electricity isn't shunted to earth/ground but instead is slowed on its way through the live line. Basically, these suppressors detect when there is high voltage and then store the electricity, releasing it gradually. The manufacturers of this type of protector argue that this method offers better protection because it reacts faster and doesn't dump electricity to the ground line, which could potentially disrupt the facility's electrical system.

As a backup, some surge protectors also have a built-in fuse. A fuse is a single use

device that can easily conduct current as long as the current is below a certain level. If the current increases above the acceptable level, the heat caused by the resistance overheats the fuse, thereby cutting off the circuit. If the MOV doesn't stop the power surge, the extra current will overheat the fuse, saving the connected equipment. This fuse only works once, as it is destroyed in the process.

A problem with surge protectors is that the MOVs can also burn out with one large surge (similar to the fuse overheating). This is why it is good to get a protector with an indicator light that tells you whether or not it is functioning properly.

Note that, even if you connect surge protectors to all of your electrical supply points, your equipment might still be exposed to damaging surges from other sources. Telephone, data and network cables can also conduct high voltage - you should, therefore, guard against surges from your telephone,

data or network cables for full protection. Any lines carrying signals into your home can carry a power surge, due to lightning or a number of other factors. If your computer is connected to the phone lines via a modem, you should get a surge protector that has a phone-line input jack. If you have a coaxial cable line hooked up to expensive equipment, consider a cable surge protector. Surges on these lines can do just as much damage as surges over power lines.

#### Protectors with filtering:

Some surge protectors have a line-conditioning for filtering out "line-noise" or smaller fluctuations in electrical current. This "conditioned" current is more stable and easier on your computer or other electronic devices.

## Surge protection levels

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Determining how good a particular surge protector is, can be difficult, and will take comparative research into each system to identify its effectiveness. As a general rule of thumb, the more expensive the surge protector, the higher the level of protection. However, the cheaper surge protectors commonly provide sufficient protection for single loads. It is important to select protection suitable to the risk level and value of equipment to be protected.

A large range in both performance and price of protectors exist.

- At one end, the basic low-cost surge protector power adaptors or outlets, which usually offer very little protection.
- On the other end, you have systems costing hundreds or even thousands, which will protect against almost everything short of lightning striking nearby.

Selecting a protector system that suits your needs is a matter of balancing the cost of the system with the cost of losing data or electric/electronic equipment. Some surge protectors come with varying levels of insurance, you need to find the level of coverage you are comfortable with.

To protect your equipment from surges, you need individual surge protectors for each power outlet or one at the power supply point. There are three basic levels of power surge protectors:

- Basic power surge protection - These are basic extension cord units with a number of outlets. Generally, these models provide only basic protection.
- Mid range power surge protection - These are slightly more expensive with better ratings and extra features.
- Power surge stations - These large surge protectors fit under your computer or on the floor. They offer superior voltage protection and advanced line conditioning. Most models also have an input for a phone line to protect your router/modem from power surges and may include built-in circuit breakers.
- Uninterruptable Power Supply (UPS) - Some units combine power surge protection with a continuous UPS. The basic design of a continuous UPS is to



Source: [https://www.takealot.com/ellies-wonder-surge-adaptor/PLID27971533?gclid=Cj0KCCQjw-z4z3BRCgARIsAES\\_OVeB-VOZio-ODz5H-1SvZPQy\\_Zwwhw3h-7P\\_2YFkhw-xn0chONA-Ge42E-aAhGeEALw\\_wcB&gclidsrc=aw.ds](https://www.takealot.com/ellies-wonder-surge-adaptor/PLID27971533?gclid=Cj0KCCQjw-z4z3BRCgARIsAES_OVeB-VOZio-ODz5H-1SvZPQy_Zwwhw3h-7P_2YFkhw-xn0chONA-Ge42E-aAhGeEALw_wcB&gclidsrc=aw.ds)

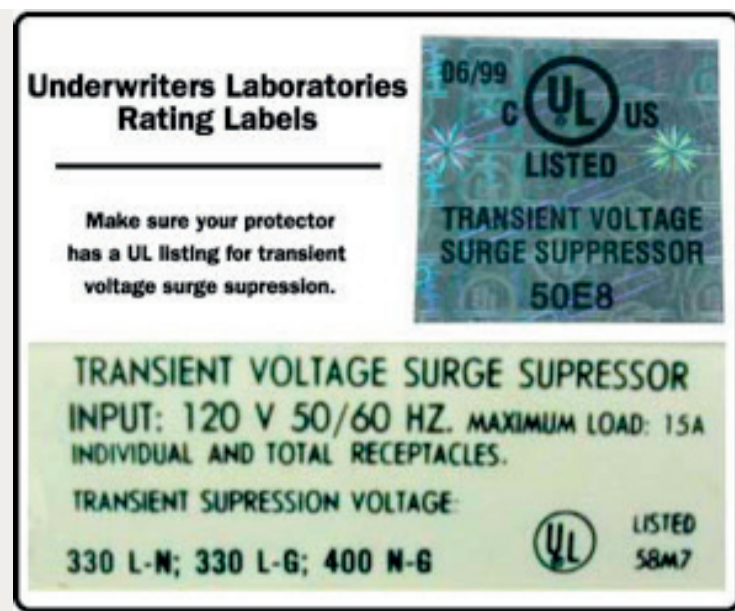


convert alternating current (AC) power to direct current (DC) power and store it in batteries. The UPS then converts the battery's DC power back to AC power and supplies it to the AC outlets for your equipment. If the power goes out, your equipment will continue to run, feeding off the stored battery power. The conversion process also gets rid of most of the line noise coming from the AC outlet. These units need to be sized correctly and tend to be more expensive depending on the size required. An ordinary UPS will provide you with a high level of protection, but you should still use a surge protector. A UPS will stop most surges from reaching your equipment, but it will probably suffer damage itself. It's a good idea to use a basic surge protector to save your UPS.

## What to look for when considering power surge protection

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It would help to look for the Underwriters Laboratories certification - usually indicated with a UL1449 sticker - note



that this has no official recognition in South Africa. The UL label provides information which shows for which voltage (V), frequency (Hz - South Africa operates on 50Hz) and the maximum load (A) of equipment the protection would be suitable for. The:

- L-N rating represents the voltage between a Live and Neutral conductor,
- L-G the voltage between a Live and Ground conductor, and,
- the N-G the voltage between Neutral and Ground.

Many plug manufacturers and online retailers in South Africa, unfortunately, neglect to mention all of these figures, or they bury them in complex acronyms and numbers that most consumers are not able to understand. Instead, suppliers tend to shift the focus onto

terms like “medium-duty rating”, and focus on features like “overload protection” and “illuminated on/off switches”, etc. which is often only nice-to-haves and not of much use.

Some manufacturers offer some form of “connected equipment” warranty, which means the manufacturer will cover the cost of your damages, under certain conditions and provided you were using the equipment correctly. One South African Supplier, for example, offers a R30 000 surge protection warranty that excludes direct lightning strikes and loss of the neutral conductor. And, another supplier will replace or repair equipment damaged by surges, including lightning, up to the value of R25 000, while connected correctly to one of their qualifying products.

Not all surge protectors are however created equal, and many products do not supply sufficient information on how helpful the devices may be in the event of lightning strikes or power surges.

## Surge protection ratings

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Three key numbers should be used when looking for surge protection:

1. Clamping voltage (lower is better),
2. Energy in Joules (the higher the number, the better), and,
3. Response time (where lower numbers are better).

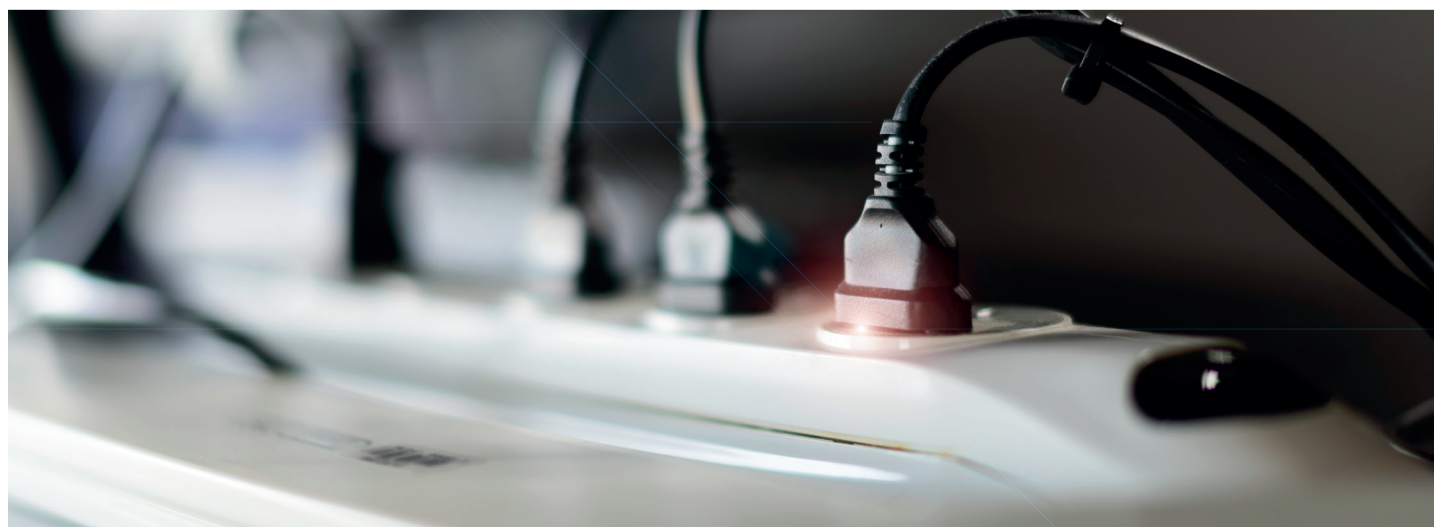
On a listed surge protector, you should find a couple of ratings:

- The Clamping voltage - this tells you what voltage will cause the MOVs to conduct electricity to the ground line. **A lower clamping voltage indicates better protection.** There are three levels of protection in the UL rating - 330V, 400V and 500V. Generally, a clamping voltage more than 400V is considered too high.

- Energy absorption/dissipation - this rating (given in joules), tells you how much energy the surge protector can absorb before it fails. **A higher number indicates greater protection.** Look for a protector that is at least rated at 200 to 400 joules. For better protection, look for a rating of 600 joules or more.
- Response time - surge protectors do not kick in immediately; there is a very slight delay as they respond to the power surge. A longer response time means that your equipment will be exposed to the surge for a longer period. **Look for a**

**surge protector that responds in less than one nanosecond.**

You should also look for a protector with an **indicator light** that tells you if the protection components are functioning correctly. All MOVs will burn out after repeated power surges, but the protector will still function as a power conductor. Without an indicator light, you have no way of knowing if your protector is still functioning properly and protecting your equipment.



Better surge protectors may come with some sort of guarantee of its performance. If you are considering more expensive units, look for a protector that comes with a guarantee on your equipment. If the unit fails to protect your equipment from a power surge, these companies will then replace your equipment. This is not total insurance and you will still lose all the data in your computer or hard drives, which could also be expensive - but it is a good indication of the manufacturer's confidence in their product. (Regarding stored information - always backup information regularly).

Better surge arrestors can handle surges up to 20 000volts, while standard outlet surge protectors can not handle more than 6 000volts.

Some high-end arrestors can actually monitor weather conditions and will shut down the power supply to more sensitive electronics when lightning is in the area.

## Surge protection installation

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Two installation methods can be used:

1. Locally distributed surge protection – this surge protection is installed at each power supply point to protect every piece of equipment independently. This could become expensive and not provide the protection that may be available at the same price, or for less, compared to method two.
2. Whole-facility surge protection – here you would generally install a suitable protection unit near your electric meter or distribution board, where the power supply comes into the facility. This protects all the circuits in your facility from a certain range of voltage surges. Units designed for whole-facility protection are built for outdoor or indoor installation.

A whole-facility surge protector can suppress power surges stemming from outside sources

like utility supply problems, transformer switching, etc. However, these will not do anything to suppress the high number of power surges that originate inside your facility, due to the operation of your own equipment.

## Conclusion

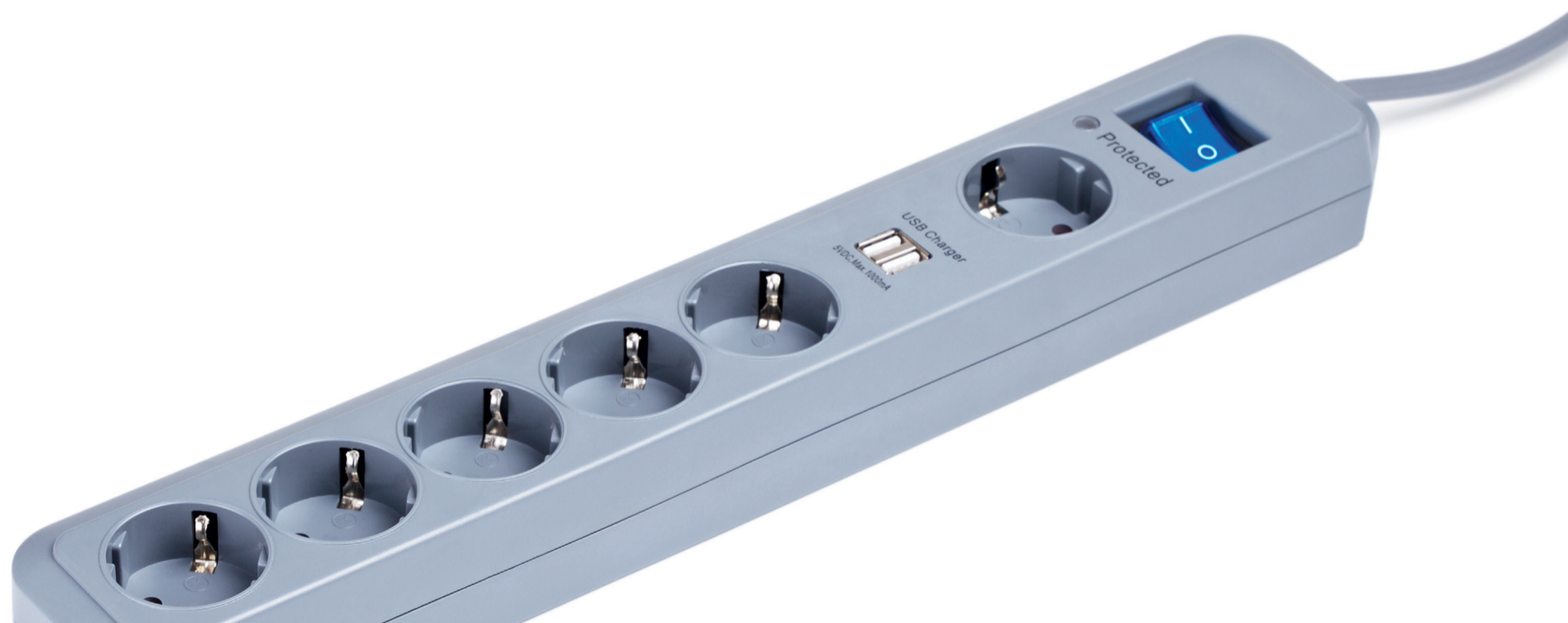
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It is important to have power surge protection installed – anything is better than nothing.

However, it is highly unlikely that surge protection will protect equipment against lightning and will certainly not do so for repeated lightning strikes.

Surge protection will usually save your equipment against normal power surges.

Note that insurance normally covers against lightning strikes and damages but do not address the loss of data or that information or actions programmed into equipment.



## Eskom advisory services

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Eskom's role is to aid the client with basic information in the decision-making process. Thereafter the Eskom Advisor will fulfil the role of energy advisor as part of the team that the business selects.

### Optimise your energy use

Eskom's Energy Advisors, in regions across South Africa, offer advice to business customers on how to optimise their energy use by:

- Understanding their energy needs
- Understanding their electrical systems (including quality of supply) and processes
- Investigating the latest technology and process developments,

- Analysing how to reduce energy investment costs
- Optimising energy use patterns in order to grow businesses and industries

Call **08600 37566**, get a reference number, leave your name and number and request that your Energy Advisor contacts you. Alternatively, e-mail your advisor at [advisoryservice@eskom.co.za](mailto:advisoryservice@eskom.co.za).

## Disclaimer

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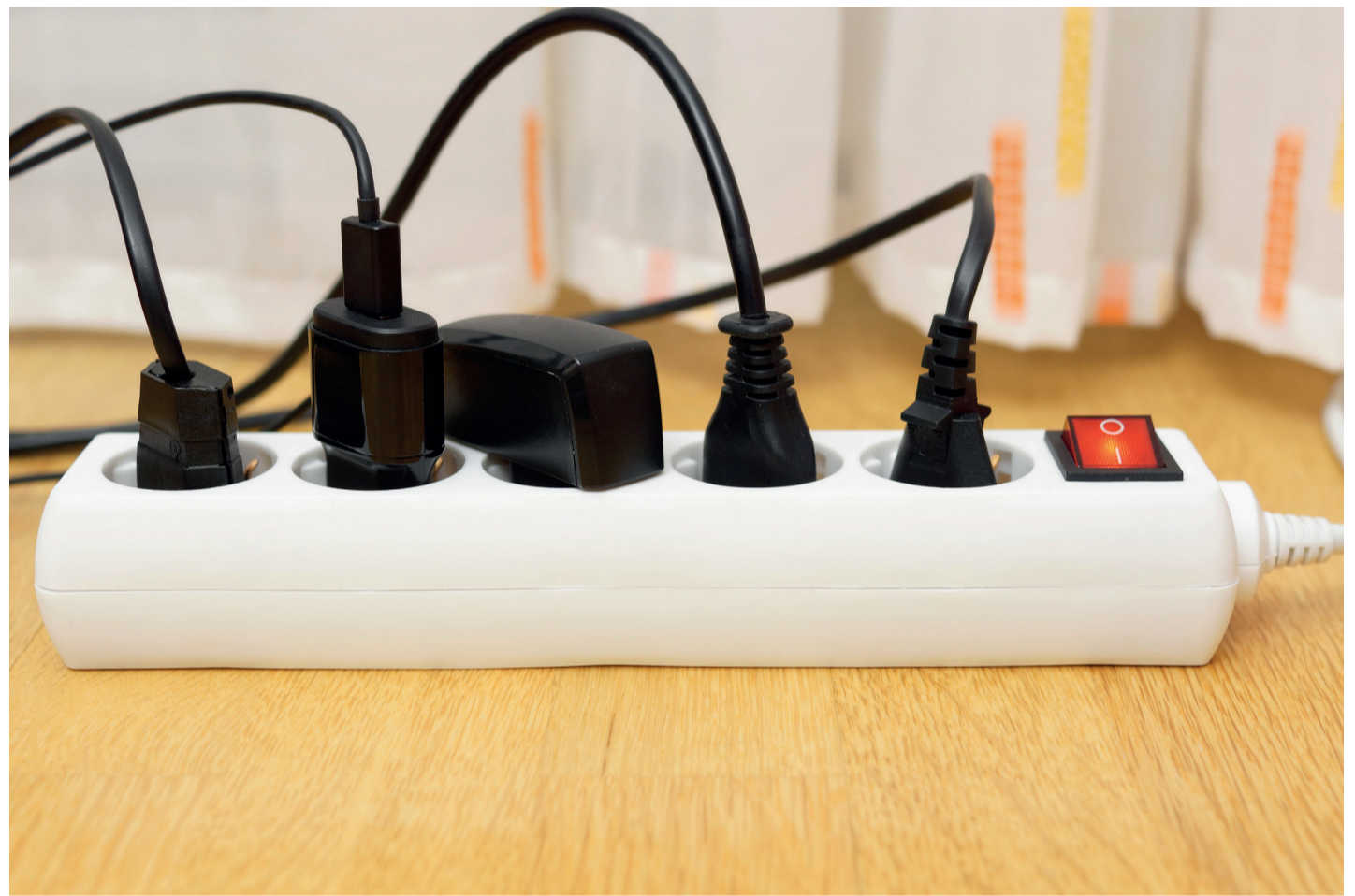
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