

# SAVING YOUR DELICATE ELECTRONIC EQUIPMENT

*How to use MOV's (Metal Oxide Varistors) for surge protection.*

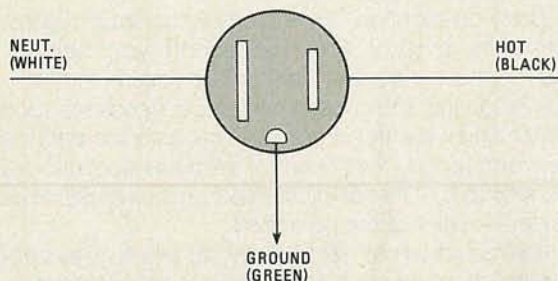
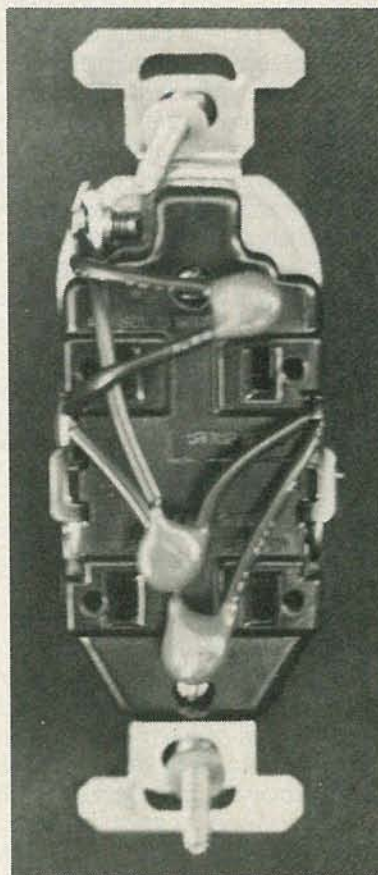
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■A lot of attention has been paid to protecting computers and other electronic equipment against power-line surges. These can be the result of either natural or man-made conditions. Examples of natural surges would be lightning hitting power lines, poles or transformers. The man-made are often the result of switching between power-line feeders or other malfunctions that originate at the source of power generation and distribution.

Regardless of the cause, the results are usually the same. Nominal line voltage (108 to 125 volts) undergoes an abrupt upward swing. Values can reach two or three times normal line voltage. Increased demands of air conditioning, power tools or heating systems cycling on the line can also produce "glitches" with similar results. The incoming line voltage rises and as a result, voltage-sensitive components inside a piece of electronic equipment are subjected to high-voltage spikes.

## Let's protect everything

We don't hesitate to protect our computers and related equipment against these surges, but what about television receivers, videocassette players, stereo

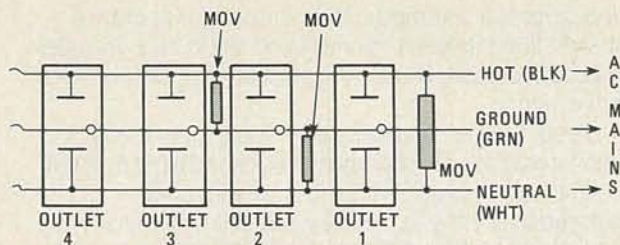


**FIG. 1—WIRING FOR THE typical electrical outlet. Note that the outlet shows a polarized plug receptacle.**

equipment and other electronic equipment whose value may equal the cost of our computers? We tend to regard these more as fixtures than as voltage-sensitive devices.

The typical outlet, shown in Figure 1, consists of three wires. A "hot" wire (black), a "neutral" wire (white) and a "ground" wire (green). When a power surge occurs, it could be impressed on either the black or white lines. The green or ground wire traditionally conducts all stray voltages safely to ground.

Typically, the protective devices we apply to our computers are built into the multi-outlet power strips



**FIG. 2—A TYPICAL MOV-PROTECTED outlet strip. As many additional outlets as needed can be added to the circuit.**

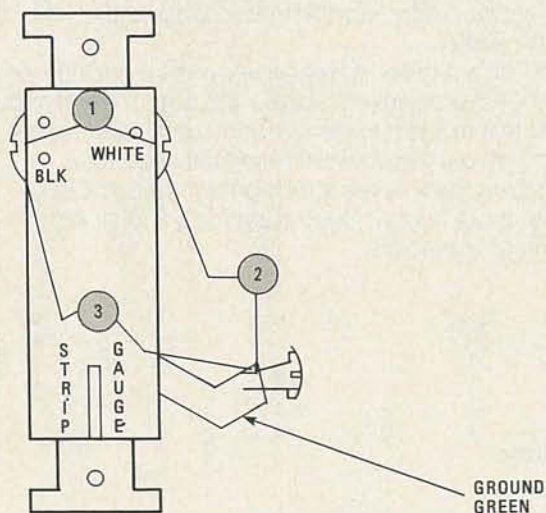
and resemble the circuit shown in Figure 2. Each line has what is called a MOV (Metal Oxide Varistor) for surge protection. These non-linear devices are voltage-dependent and divert potentially harmful overvoltage conditions. More simply, they "clamp" the voltage and hold it to a safe level.

### Building protection

We're going to show how to protect one or two devices, rather than suggest that you buy a multiple outlet strip for surge protection along with filtering that you may not require for your new TV set.

We chose the number "two" because the normal wall outlet in your home is called a "duplex" outlet. There are two identical AC outlets wired in parallel. By protecting one, we also protect the other, giving us an extra benefit at no increase in cost.

Figure 3 shows how to do this. The three MOV



**FIG. 3—WIRED RECEPTACLE (rear view) shows how MOV units are placed.**

devices required are available from Radio Shack (MOV transient protector Part No. 276-568). They sell in packages for \$1.69. You will also need some insulating tubing and some heat-shrinkable tubing.

First identify the fuse or circuit breaker controlling the outlet you plan to modify. To do this, plug a lamp into the outlet and turn the lamp on. Now proceed to unscrew the fuses or turn off the circuit breakers one at

a time until the lamp goes out. If you're dealing with fuses, remove the fuse completely. Leave the circuit breaker in the OFF position.

Do **not** attempt to do this work with a "live" circuit!

Remove the screw holding the wall plate. Place the screw aside and remove the plate. If it has become stuck in paint, you may have to pry it loose. Place the plate aside with the screw.

You will see two screws, one at the top, one at the bottom. These hold the outlet to the Gem box. Remove these screws and lift the switch out of the box.

Identify the following wires: The BLACK wire, the WHITE wire, the GREEN wire. In older homes, you may find the wire formed into a hook and located under a screw at either side of the outlet. More-modern outlets have the wire end slipped into a hole at the back of the outlet and held in place by screws on the sides. The GREEN or ground connection is usually connected to a single point at one end of the shell.

Loosen the screws as required, and connect one MOV device from the WHITE lead to the BLACK lead. Connect another from the BLACK lead to GROUND, the third MOV goes from the WHITE lead to ground. Examine your work carefully. If there is any exposed wire that might produce a short circuit, especially when the outlet is reinstalled in the gem box, cut a small piece of the insulated tubing and slip it over the exposed leads.

Carefully dress the MOV's against the outlet shell. Replace the outlet into the wall box, replace the upper and lower screws, then position the cover plate and replace the holding screw.

This completes the modification of the outlet for surge and transient protection. Now you can restore the electricity by turning the circuit breaker on or replacing the fuse.

You have provided two outlets with surge and transient protection for a total cost of less than \$5.00, with the assurance that these transients and surges can be "clamped" within a stated response time of less than 35 nanoseconds—more than sufficient to save your valuable equipment.

You might wonder why, if surge protection at the individual outlet is such a good idea, we don't simply go to the fuse or circuit-breaker box and place the MOV's right there, and in that way protect all of the outlets in the home? The answer is simple. By doing that, you're fooling with the house's primary wiring, and depending on where you live, might require a building permit to do so. The consequences can be dire. Should you have a fire in your house, this type of do-it-yourself wiring addition can void your insurance.

No, you're better off to restrict yourself to the method we describe here, and add the MOV's—judiciously—at the individual outlets. We say "judiciously," because there's really no requirement to protect some devices against surges. If all you plug into an outlet is a simple lamp, why bother with surge protection? However, should the outlet be used for a TV receiver, stereo equipment, or anything else that might be worth protecting, by all means, this is the way to go. ◀▶