



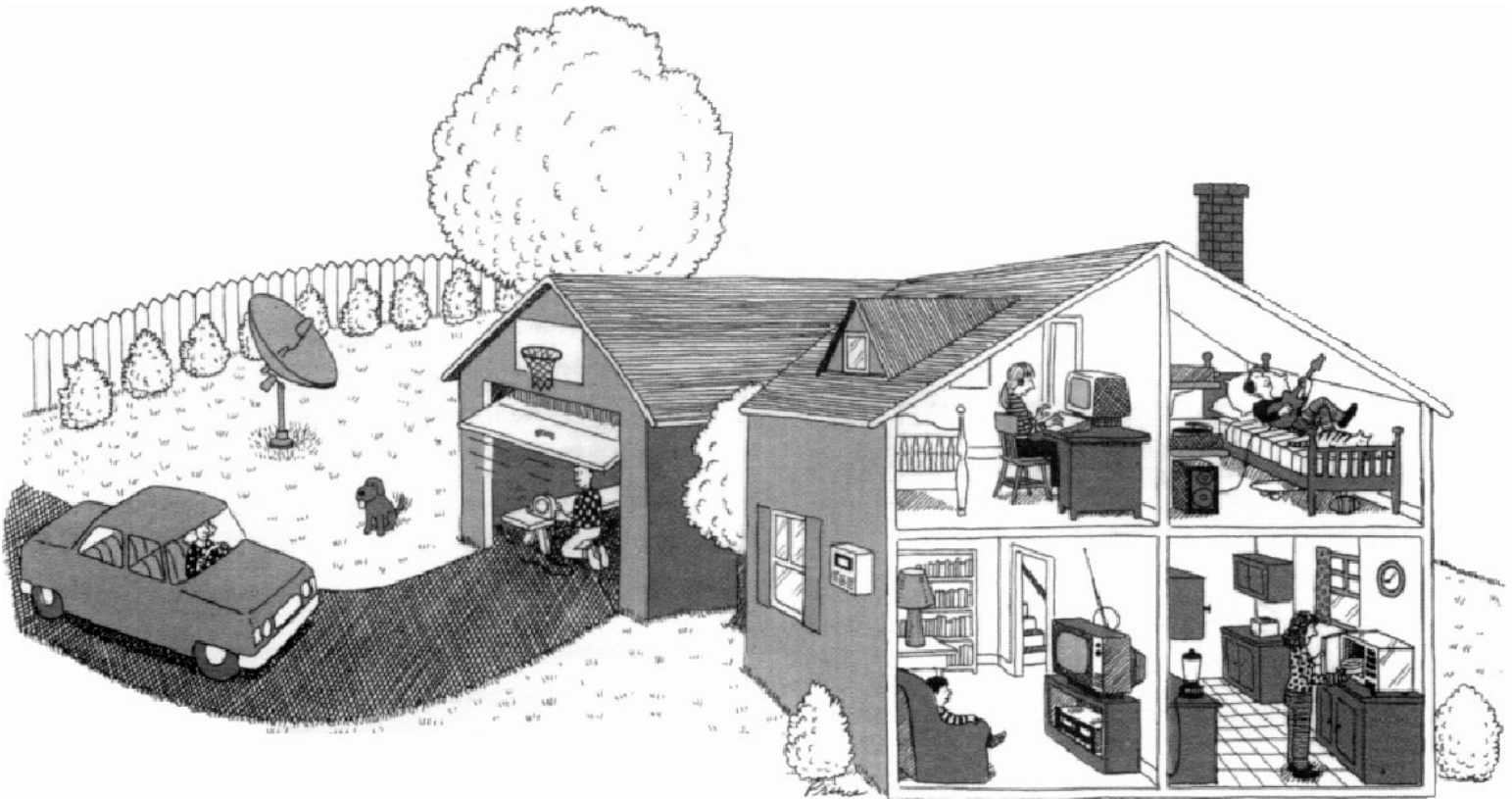
*Pacific Gas and
Electric Company™*

POWER QUALITY

IN YOUR

HOME

**How to ensure the life
and reliable operation
of your home electronics**



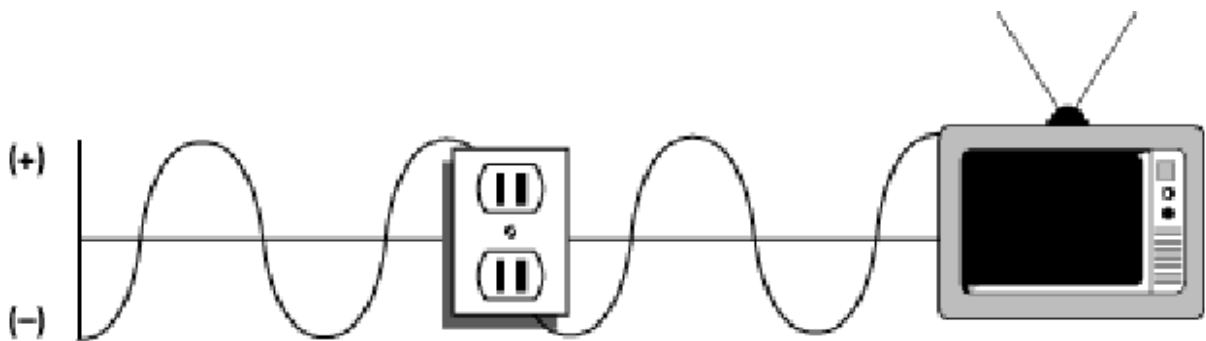


Electricity provides the power you need to run your home electronic equipment. Sometimes, interference in the supply of electricity affects how your equipment runs. Many older appliances can tolerate short power disturbances. Many newer appliances, such as personal computers, microwave ovens and sophisticated stereo systems, have sensitive electronics that can be disrupted or damaged. This booklet outlines the power disturbances that happen in your home and how to protect against them.

From Our Plant to Your Home

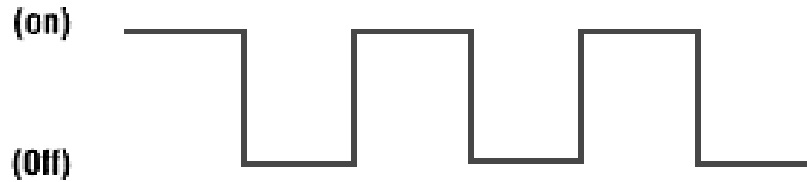
PG&E operates an extensive, sophisticated power system that supplies most of northern and central California with electricity. This system delivers a reliable supply of power that satisfies national voltage standards. But occasionally, electric systems experience voltage disturbances from natural or man-made causes (e.g., lightning, wind, cars hitting power poles) for which PG&E isn't responsible. These disturbances can interfere with your appliances and even damage some of your more sensitive equipment such as computers. Fortunately, you can use devices to protect this equipment.

Utilities transmit electricity over power lines and into your home as an alternating current (AC) wave, which looks something like an electrocardiogram (see below). This is how power travels through your wiring and passes into your appliances.

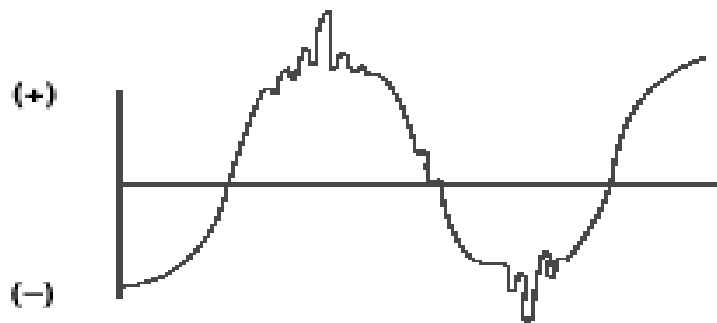


Digital Electronics

Manufacturers design electric appliances to operate smoothly with AC power. But the electronics in many appliances are digital. These appliances convert the AC wave to direct current (DC). You can picture this conversion as thousands of tiny on-and-off switches lined side-by-side as shown below. Combinations of these on-and-off switches feed instructions to the appliance and control its function. This switching operation is very sensitive and occurs thousands of times each second.



Due to the way electricity is distributed, there may be some interference in your electric service, whether from storms knocking down power lines or faulty appliance wires. When this happens, the AC wave coming into your home is distorted (see diagram below) and may not convert easily into DC. The result may be static on your stereo, flickering lights, loss of data on your computer, or even burned-out circuit boards.



Let's look at different types of electric disturbances and how to minimize or prevent damage to your equipment.

Types of Disturbance

Interruptions

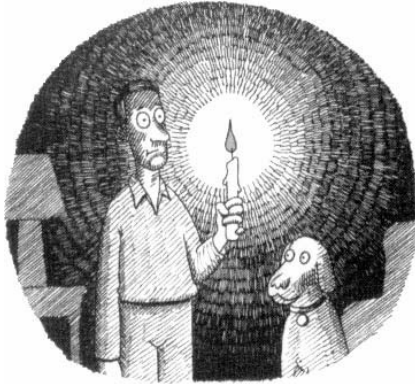
Interruptions are a complete loss of power and can last a second or several hours. Equipment failure or damage to power lines from lightning, strong winds, falling tree branches, animal contact or car accidents can cause interruptions. These outages can affect the power to one home, one street or an entire town.

Momentary interruptions are more common and can happen six to 12 times a year on overhead power lines depending on the length of the circuit to your home. Some circuits are 40 miles long, and longer circuits are more exposed to power line damage, increasing the chance of interruptions. Most utility companies such as PG&E have devices to keep these interruptions temporary, clearing them within a few seconds. The most noticeable result of a momentary interruption is a blinking digital clock. Many new digital clocks come with a battery backup, which helps you avoid resetting your clock when there's an interruption. If you're working on your computer, a momentary interruption can lose your data. Avoid this by using a UPS/battery backup, which you can buy at a computer supply store.

Sustained interruptions typically last between 30 minutes to several hours. They happen less often, once or twice a year, on a typical urban circuit where most power lines are underground. In rural areas, most power comes through overhead lines that are exposed to wind, rain and snow. Interruptions happen more often in these areas, and for longer times. Again, a UPS/battery backup helps protect you against a complete loss of power.

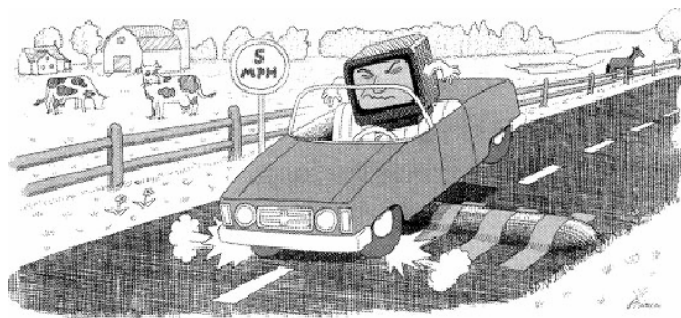
Short-term Variations

Short-term variations, known as sags and swells, can last milliseconds and create a drain on your power. You may notice these drains when the lights dim as the refrigerator starts, but usually you won't notice them. Sags and swells can happen when PG&E's automatic switching devices protect your local power supply from an outage. Large loads (refrigerator, washer or dryer) turning on or off can also cause swells and sags. The circuit supplying power to the refrigerator may be overloaded or have an internal wiring deficiency. To prevent short-term variations, use a voltage regulator. (See *Other Protective Devices* for more information.)



Transient Impulses

A transient impulse is a sharp, sudden rise in voltage and can damage sensitive electronics. The power can jump up to a few thousand volts over the normal 120 volts used in your home. It happens so fast that you usually don't notice it. But to electronic appliances, it's like hitting a speed bump at 40 miles an hour. Lightning, utility switching, or too many large switching loads (e.g., refrigerator, washer, dryer) on the same circuit can cause a transient impulse.



Don't let large loads share circuits with sensitive loads (e.g., computer, VCR, TV, stereo, fax). Most electric codes now require that large switching loads have their own circuit. In older homes, you may want to check with your electrician to make sure your system is safe and up to code. If you get a lot of disturbance from lightning, a transient voltage surge suppressor (TVSS) will protect your electronics from damage.

Noise

If you've ever noticed poor reception or sound from your TV when someone in the house turned on a hair dryer, drill, vacuum cleaner or other appliance, you've experienced noise interference. Loose wiring or poor grounding or manufacturing in your appliances can cause this. Poorly made appliances may not have enough shielding or filtering to prevent this interference.

For more information, send email to Federal Communications Commission fccinfo@fcc.gov or call 888-CALL-FCC webpage is: fcc.gov. Ask for Bulletin F0B-12, April 1993, "Locating and Eliminating Electrical Interference to TV and Radio Reception."

If There Is a Problem

If you have recurring problems with your electronic equipment, these measures can minimize them:

1. Carefully follow the manufacturer's instructions when installing new appliances.
2. Check all of your appliances for loose or damaged plugs, outlets and connections, and repair or replace them (ask your electrician if you don't know how).
3. Check your home fuse box or breaker panels to make sure that your sensitive loads (computer, stereo, TV) aren't sharing a circuit with your large switching loads (refrigerator, washer, dryer, microwave). Label your fuses or circuits, showing which appliances are on which circuit. You may need help from an electrician to change or add new circuits.
4. Ask your electrician to check your electric system to make sure your wiring and grounding are in working order and up to code. Proper wiring and grounding can clear most power problems. Proper grounding of your entire home is essential for electronics to operate.

Other Preventive Measures

- When buying appliances that depend on an internal clock or timer (e.g. alarm clock or answering machine), buy one with a battery backup or super capacitor.
- Buy a TVSS for more sensitive or expensive items such as VCRs, stereos, fax machines and computers. A TVSS is the simplest, least expensive power-conditioning device. It reduces the size of voltage transients to levels safe for your electronics. You usually install a TVSS between the appliance and the wall plug.

Which TVSS to Buy

Select a TVSS that meets your electronic needs. If you have a computer with a modem, choose a TVSS that protects both. If you keep having interference with your equipment, check whether your phone, cable TV and electric power all share a common ground at the service entrance. Common grounding may clear up this interference.

There are many TVSS models to choose from; but not all of them provide the protection you need. Here are a couple of things to keep in mind when buying a TVSS:

- Not all electronic equipment needs a TVSS. Printers don't need this protection; in fact, printers are often the source of noise interference.

- Be sure that the TVSS has the UL1449 listed seal, a special performance rating. If the TVSS doesn't have this seal, it may not properly protect your appliances. Expect a cost of \$40 and up. The latest revision, the second edition, provides for non-failure of the surge protection device at double the nominal voltage.
- Most TVSS models have an indicator light or some other feature that shows whether the protection circuit is operating. Less expensive models have a light that simply shows whether power is available, but a TVSS will burn out over time, and less expensive models won't show that they no longer protect against power interruptions. The more protective models require extra fuses and circuits to show that they still work. This feature increases the cost by about \$10 to \$20.
- Top-of-the-line TVSS models include devices such as "chokes" to further reduce impulses and noise. These models cost more but last longer. Expect a cost of \$75 to \$150.
- You can buy a TVSS at almost any store that sells electric equipment. For a high-quality TVSS device, go to an electronic specialty store.
- If you want to learn more about surge protective devices, click here to go to our [surge suppressor](#) power note.

Other Protective Devices

If you need both TVSS protection and voltage regulation, the best choice is a voltage regulator. There are two types, a tap-changing regulator and a ferroresonant regulator. The ferroresonant model has no moving parts to wear out, increasing the life of the unit. A voltage regulator doesn't rely on batteries, so it has a long life. Costs vary from \$175 to \$400. These devices will not provide ridethrough for interruptions but will ride through most sags.

Another choice in protective devices for your home computer is an uninterruptible power supply (UPS). This device provides backup energy from a battery when the utility source fails, helping to protect your computer against data loss. For occasional word-processing needs, if your software can be programmed to save data automatically, a UPS is an unnecessary expense.

There are several UPS models to choose from. Added features, such as a built-in TVSS, full-time metering, voltage regulation or battery-status diagnostics, increase the cost.

All UPS models switch to battery backup when the power goes out. But batteries don't last forever. The latest technology uses built-in fast voltage regulation to extend the life of the battery. Expect a minimum two-year warranty on the components and battery. Costs vary from \$150 to \$600. Click here to go to power note on [selecting a UPS](#).

Some of the more common home electronics and appliances that may be sensitive to normal electric variations are:

- Home security systems
- Answering machines
- Cordless phones. VCRs
- Personal computers
- TVs

- Stereo equipment
- Microwave oven clocks
- Garage door openers
- Satellite receivers
- Home energy management systems
- Fax machines
- Devices that display time
- Any device that needs constant, uninterrupted power

Remember, *you* are responsible to provide any devices needed to protect your sensitive equipment that can't operate within the voltage variations of PG&E's normal electric service. These variations are listed in PG&E's [Electric Rule 2](#), on file with the California Public Utilities Commission. PG&E is not liable for damage to your equipment or any other damage from variation in service voltage that is allowed under the utilities' respective tariff (Rule 2).