

See [http://bradyinspects.com/house\\_electric.html](http://bradyinspects.com/house_electric.html) for more information on basic household wiring including 2-prong and 3-prong plugs and receptacles.

See <http://bradyinspects.com/gfci.html> for more information of GFCI receptacles.

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## How do I convert two prong receptacles to three prong?

Older homes frequently have two-prong receptacles instead of the more modern three. These receptacles have no safety ground, and the cabling usually has no ground wire. Neither the NEC or CEC permits installing new 2 prong receptacles any longer.

There are several different approaches to solving this:

- If the wiring is done through conduit or BX, and the conduit is continuous back to the panel, you can connect the third prong of a new receptacle to the receptacle box. NEC mainly - CEC frowns on this practice.
- If there is a metallic cold water pipe going nearby, and it's electrically continuous to the main house ground point, you can run a conductor to it from the third prong. You **MUST NOT** assume that the pipe is continuous, unless you can visually check the entire length and/or test it. Testing grounds is tricky - see "Testing Grounds" section.
- Run a ground conductor back to the main panel.
- Easiest: install a GFCI receptacle. The ground lug should not be connected to anything, but the GFCI protection itself will serve instead. The GFCI will also protect downstream (possibly also two prong outlets). If you do this to protect downstream outlets, the grounds must not be connected together. Since it wouldn't be connected to a real ground, a wiring fault could energize the cases of 3 prong devices connected to other outlets. Be sure, though, that there aren't indirect ground plug connections, such as via the sheath on BX cable.

The CEC permits you to replace a two prong receptacle with a three prong if you fill the U ground with a nonconducting goop. Like caulking compound. This is not permitted in the NEC. The NEC requires that three prong receptacles without ground that are protected by GFCI must be labelled as such.

See the next section about computers on GFCI-protected groundless outlets.

## Surges, spikes, zaps, grounding and your electronics

Theoretically, the power coming into your house is a perfect AC sine wave. It is usually quite close. But occasionally, it won't be. Lightning strikes and other events will affect the power. These usually fall into two general categories: very high voltage spikes (often into 1000s of volts, but usually only a few microseconds in length) or surges (longer duration, but usually much lower voltage). Most of your electrical equipment, motors, transformer-operated electronics, lights, etc., won't even notice these one-shot events. However, certain types of solid-state electronics, particularly computers with switching power supplies and MOS semiconductors, can be damaged by these occurrences. For example, a spike can "punch a hole" through an insulating layer in a MOS device (such as that several hundred dollar CPU), thereby destroying it. The traditional approach to protecting your electronics is to use "surge suppressors" or "line filters". These are usually devices that you plug in between the outlet and your electronics. Roughly speaking, surge suppressors work by detecting overvoltages, and shorting them out. Think of them as voltage limiters. Line filters usually use frequencydependent circuits (inductors, capacitors etc.) to "tune out" undesirable spikes - preventing them from reaching your electronics. So, you should consider using suppressors or filters on your sensitive equipment. These devices come in a very wide price range. From a couple of dollars to several hundred. We believe that you can protect your equipment from the vast majority of power problems by selecting devices in the \$20-50 range.

**A word about grounding:** most suppressors and EFI filters require real grounds. Any that don't are next to useless. For example, most surge suppressors use MOVs (metal oxide varistors) to "clamp" overvoltages. Yes, you can have a suppressor that only has a MOV between neutral and hot to combat differential-mode voltage excursions, but that isn't enough. You need common-mode protection too. Good suppressors should have 3 MOVs, one between each pair of wires. Which means you should have a good solid ground. Eg: a solidly connected 14ga wire back to the panel, not rusty BX armour or galvanized pipe with condensation turning the copper connection green. Without a ground, a surge or spike is free to "lift" your entire electronics system well away from ground. Which is ideal for blowing out interface electronics for printer ports etc. Secondly, static electricity is one of the major enemies of electronics. Having good frame grounds is one way of protecting against static zaps. If you're in the situation of wanting to install computer equipment on two wire groundless circuits take note: Adding a GFCI outlet to the circuit makes the circuit safe for you, but it doesn't make it safe for your equipment - you need a ground to make surge suppressors or line filters effective.