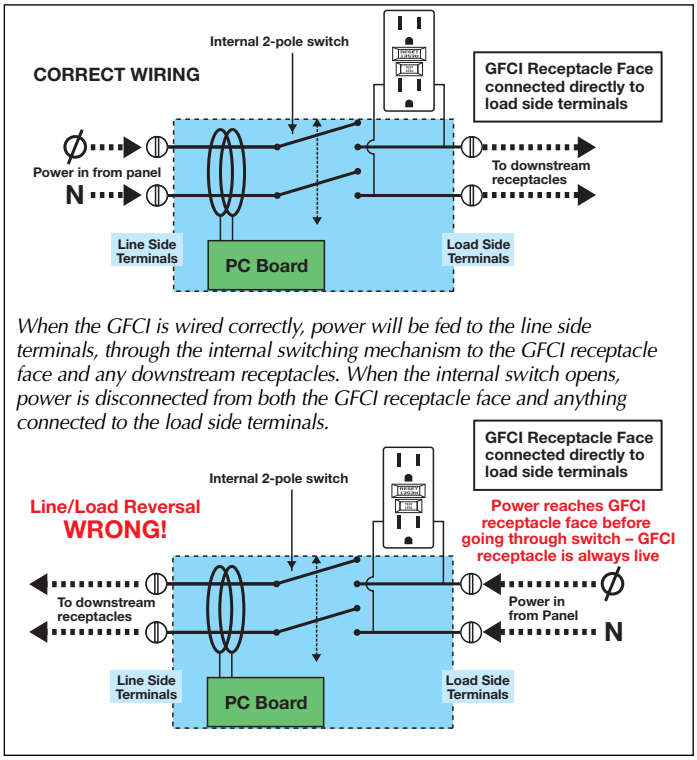
What Is Line/Load Reversal?

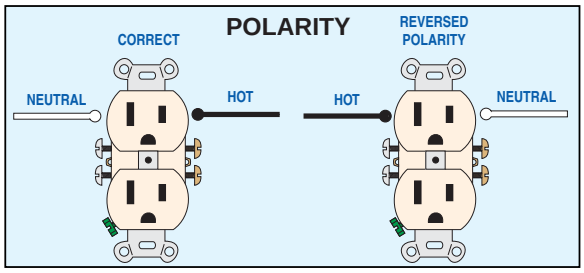
When the line and load leads are reversed **(right)**, the GFCI receptacle face is now wired directly to the power coming from the panel, completely bypassing the internal switching mechanism. The face **is not** GFCI protected and remains live even after the internal switch opens. This is a potentially hazardous condition, and the fact that the device appears to be operating properly creates a false sense of protection for end-users. UL now requires a diagnostic indication to alert installers that there is a line/load reversal.



When the GFCI is wired correctly, power will be fed to the line side terminals, through the internal switching mechanism to the GFCI receptacle face and any downstream receptacles. When the internal switch opens, power is disconnected from both the GFCI receptacle face and anything connected to the load side terminals.

What's the Difference Between Line/Load Reversal and Reversed Polarity?

Most modern plugs and receptacles are made with one slot or blade larger than the other so that there is only one way that a plug can be inserted into a receptacle. If you try and insert the larger blade of the plug into the narrower opening in a receptacle, it will not fit. The larger opening in a receptacle is where the neutral conductor should be attached and the smaller opening is where the hot leg should be attached. It is possible that, due to a wiring error, the hot and neutral conductors become reversed. This condition is called **Reverse Polarity**. Appliances and other products plugged into a receptacle that has been wired with **Reverse Polarity** will still operate. This does, however, present shock hazards under certain conditions. A GFCI receptacle will still trip if there is a ground fault and a reverse polarity condition. More importantly, a GFCI receptacle switches off both the hot and neutral sides when it trips; making sure that the hot leg is interrupted even if it was mistakenly attached to the neutral side of the receptacle.



As discussed above, line/load reversal refers to bringing in your power feed onto the incorrect side of a GFCIs internal switching mechanism. The power feed **must** be connected to the line terminals. When there's a line/load reversal, the GFCI receptacle face will still be live even if the device has tripped, creating a potentially hazardous condition.

Can You Install GFCIs in Non-Grounding Systems?

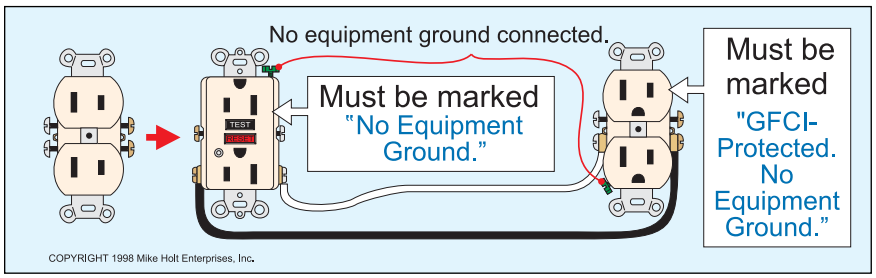
The first electrical circuits installed in homes were the 2-pole, 2-wire type, with "2-prong" receptacles (2 parallel slots for the hot and neutral conductors). The only grounding point in the 2-pole, 2-wire circuit is at the service entrance where the neutral conductor is grounded.

Experience proved that a single grounding point through the neutral conductor was not ideal for electrical safety. This led to the installation of residential 2-pole, 3-wire circuits with a grounding conductor, sometimes called the "equipment grounding conductor." The grounding conductor does not carry current during normal circuit operation. It is only connected to outlet boxes, chassis and other non-current carrying components that may carry current in case of damage or defects in the wiring system. The NEMA 5-15R grounding receptacle is typically used in residential 2-pole, 3-wire circuits. This "3-prong" receptacle provides a U-shaped grounding contact.

Although the National Electrical Code has required 2-pole, 3-wire grounding circuits for several years, there are still many homes with 2-pole, 2-wire circuits and 2-prong receptacles. You cannot simply bring these homes up to modern code standards by replacing non-grounding receptacles with the 3-prong grounding types. A qualified electrician will have to verify that there is a continuous ground path at each receptacle, which may require circuit rewiring. An alternate solution is to install a GFCI in place of the non-grounding receptacle.

Section 406.3 (D) of the National Electrical Code permits a non-grounding type receptacle to be replaced with a grounding type receptacle without a grounding connection. However, the grounding receptacle **must** be GFCI-protected.

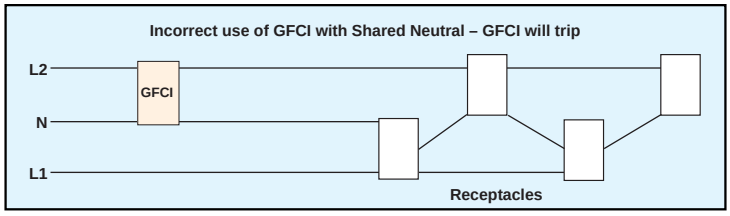
The diagram below shows a typical non-grounding (2-prong) receptacle replaced with a GFCI. The GFCI must be marked, "No Equipment Ground." The GFCI can feed through to a grounding receptacle, which must be marked "GFCI Protected. No Equipment Ground."



For increased electrical safety, Leviton strongly recommends installing a GFCI in every non-grounding circuit. A ground wire provides protection by offering a parallel path back to ground for any fault current. Without a ground wire, fault current will try and take other paths to ground and a GFCI will trip and cut power under these hazardous conditions. Ground faults are more likely to occur in non-grounding circuits and a GFCI will help protect family members from this potentially hazardous condition.

Can GFCIs Be Used in Circuits with a Shared Neutral?

Using a single neutral conductor for more than one circuit can be looked at as a way to save money on wiring. Because a GFCI receptacle looks for a balance of current flowing in a single hot conductor and a single neutral conductor, it will not operate properly when more than one hot conductor is sharing a neutral downstream from a GFCI. Current flowing in the neutral from the circuit not protected by the GFCI will cause the GFCI to see an imbalance typically associated with a ground fault and the GFCI will trip. A hazardous condition would exist in the circuit not protected by the GFCI as it may appear as though the power is off even though the hot leg is still live. In circuits wired this way, the neutral needs to be split at or before reaching the GFCI receptacle and a dedicated neutral must be run from the GFCI receptacle to all downstream receptacles protected by the GFCI.



Why Must GFCI Cord Sets Have Open-Neutral Protection?

Open-Neutral Protection immediately trips the GFCI if the neutral conductor on the line side is opened. This eliminates the possibility of the GFCI Cord Set delivering power to the load if the GFCI cannot trip in the event of a ground fault. Open Neutral Protection requires the addition of special components to the standard GFCI circuitry. Permanently wired GFCI receptacles do not require this feature, because their line-side conductors are not exposed to physical damage. In all temporary power situations, where flexible cord feeds the line side of a GFCI, there is always the risk of an open-neutral condition. Therefore, UL requires open-neutral protection for all Class A GFCI cord sets.