

Technical Note **Using GFCIs With Inverter/Chargers**

Inverter/Chargers

512-0102-01-01 Rev 1

Introduction

GFCIs (Ground Fault Circuit Interrupters) can be used successfully on both the AC input and AC output sides of Inverter/Chargers. There are however some things to be aware of.

Definition

GFCIs, also known in Europe as RCCBs (Residual Current Circuit Breakers), are designed to open an AC circuit if a significant amount of ground current is detected, indicating that a current leakage exists that could present a shock hazard for people. This is known as a ground fault condition. Receptacle-type GFCIs do not protect against short circuits or overloads—this is still the job of circuit breakers or fuses. Panel-mounted GFCIs however include both ground fault detection/protection for a circuit and over-current protection. Receptacle-type GFCIs will protect a whole string of outlets against ground faults if they are wired into the circuit as the first receptacle in the circuit. GFCIs are usually used for outdoor outlets and for outlets near water or plumbing such as in kitchens and bathrooms where a person is more likely to be grounded and at more risk if there is a shock hazard.

AC Input Side of the Inverter/Charger

Some RV parks and marinas have shore cord connections that are supplied through GFCI breakers. When the coach or boat is plugged in, the whole coach/boat electrical system would be protected against ground faults. If the GFCI trips when the system is connected, it indicates that there is too much AC leakage to ground. The most common cause of this problem when it is associated with the inverter/charger has to do with the way the inverter/charger is installed, not with the unit itself.

When installing an inverter/charger, it is important that the AC output side of the inverter feeds its own hot and neutral buses. These buses need to be isolated from the input MAIN hot and neutral buses. All the loads that are fed by the inverter need to connect to these isolated hot and neutral buses. Using one common ground bus however is acceptable. In many cases, where GFCIs have tripped, the installer has connected the inverter AC output neutral to the main neutral bus. Since the inverter grounds its output neutral when it is OFF or inverting, if the output neutral is connected to the main neutral, the main neutral also gets grounded. A GFCI will detect this condition and trip out before the inverter has a chance to disconnect ground from its output neutral when it transfers shorepower through.

AC Output Side of the Inverter/Charger

Using a GFCI on the AC output side of the inverter is a common practice. The brand that Xantrex has tested and uses in some models of inverters is the Pass & Seymour/LeGrand. Other brands of GFCIs will usually work fine. The main things to be aware of are testing of the GFCI and what can cause nuisance tripping of the GFCI.

A GFCI has a test button on it that simulates a ground fault condition to test that the GFCI functions properly. A reset button is also present. A GFCI should be tested only when the inverter is inverting or transferring shore or generator power through to the GFCI outlet. It should not be tested when the inverter is in idle mode. If the test button is pressed while the inverter is in idle mode, the GFCI will appear to fail the test. The circuitry inside the GFCI may be damaged by the sense pulses that are generated by the inverter during idle mode.

Nuisance tripping would be defined as the GFCI holding OK on shorepower but tripping when inverter power is present. This can sometimes be caused by marginal leakage between neutral and ground within the GFCI-protected circuit. This marginal leakage is not enough to cause a shock hazard but may be enough to trip a GFCI when inverter power is present. This marginal leakage is often caused by surge suppression circuitry in some types of electronic equipment that may be connected to the circuit. This surge suppression circuitry sometimes includes capacitors between hot and ground and between neutral and ground. On sine wave shorepower, these capacitors will not couple enough energy to ground to trip a GFCI. But with inverter power, the capacitors couple more energy due to the harmonics contained in the waveform, and this can be enough to trip a GFCI.

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Part number: 512-0102-01-01 Rev 1

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