xantrex

# DC/AC Wiring/Disconnect Box and NEC 690

## Application Note

### GT Series Grid Tie Solar Inverters

976-0085-01-01 Rev B

## Introduction

Xantrex GT Series inverters and the included wiring box (part# 100-0243-01-01) provide an easily accessible terminal block for PV/utility inputs, an integrated Ground-Fault Protection (GFP) circuit and a DC/AC disconnect that allows the installation of the GT Series inverter to be simple and code compliant while reducing equipment and installation costs.

The DC disconnect switch used on Xantrex GT Series inverters is a special, heavy duty 600 Vac 25 A 5- pole switch from ABB. To reduce any chance of destructive arcing on the contacts three poles are wired in series to limit the DC voltage per contact, and the two additional auxiliary contacts are used to break the inverter's AC connection prior to opening the DC contacts. These auxiliary contacts are guaranteed by design to open at least 10 ms before the DC ones, which ensures the inverter power is essentially at zero when the DC contacts open.

Using the switch in this way ensures that there is minimal stress on the contacts, and that the array can be safely disconnected from the inverter under normal operating conditions. In the extreme case when there might be a worst case inverter failure and the inverter itself is shorting the array, the auxiliary contacts will break the AC circuit, but can not interrupt the array current due to the faulted inverter. In this very rare case the three DC contacts will open the full array short circuit current, and may experience some arcing.

CSA carefully evaluated this fault condition for Xantrex, doing up to 50 successive short-circuit interrupts at 20 A with a 600 Vdc source while monitoring each actual switch contact temperature rise. Even under these extreme conditions the switch reliably opened the array circuit, with contact temperature rise not exceeding the manufacturer’s specifications.

As a result of this thorough investigation, CSA was confident in approving this switch for use in the GT Series inverter wiring box as a DC array disconnect.

## Applicable NEC Code

The U.S. National Electrical Code (NEC) requires residential rooftop photovoltaic installations to include a photovoltaic GFP device to protect the system should a short occur between a DC common (negative) and building structure (or other conductive devices) [NEC 2002, Article 690.5].

The NEC also requires each piece of equipment in the PV system to have switches (or breakers) to disconnect it from all sources of power. [NEC 2002, Article 690.15]. The disconnecting means shall consist of a manually operable switch; it must be operable without exposing the operator to contact with live parts, and it must be readily accessible. The rating of the switch should not be less than the load to be carried by the inverter, the open or closed position of the switch should be verifiable and should be permanently marked to identify it as a photovoltaic system disconnect. [NEC 2002, Article 690.17]

## Does the DC Disconnect on Xantrex GT Series Inverters Meet the NEC Requirement?

Xantrex GT Series inverters include an integrated GFP circuit that interrupts the fault current and displays a red LED (Ground Fault) on the front of the inverter. The included high voltage wiring/disconnect box is designed to accept the output of multiple high voltage PV source circuits and the utility connection along with providing NEC required AC and DC equipment disconnects.

Although Xantrex GT Series inverters are shipped as a complete system, it is essentially two separate products; a PV inverter and a wiring/disconnect box. The manual disconnect switch in the wiring box allows easy access and a quick one-turn disconnect for both AC and DC inputs. It has been designed to be physically mated to the electronics section of the GT Series inverter at the factory, but remains in place as a non-serviceable item in the event that the inverter electronics section is ever required to be removed. When used with Xantrex GT Series inverters, the DC/AC disconnect switch is rated for 600 Vdc/ac and is identified on the outside with a silkscreen illustration clearly showing the open and closed switch positions. The DC/AC wiring/disconnect box is a NEMA 3R enclosure to allow outdoor installation and is clearly marked as a PV system disconnect. This lockable switch undoubtedly meets the intention of the NEC section 690 requirements as a PVGFP and as a means of disconnect.

## Conclusion

Because all the inverter disconnects are included and code compliant, the increased costs associated with third party listed enclosures, large-frame high voltage switch disconnects and externally installed ground fault protection devices are not needed. The Xantrex GT Series inverters integrated design dramatically decreases the total balance of system equipment and installation costs and provides an aesthetically pleasing and code compliant grid tie inverter installation.



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