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Owner's Guide

Photovoltaic Ground Fault Protection Assembly

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Photovoltaic Ground Fault Protection Assembly

Owner's Guide

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Contact Information

Telephone: 1 800 670 0707 (toll free North America)
1 360 925 5097 (direct)

Fax: 1 800 994 7828 (toll free North America)
1 360 925 5143 (direct)

Email: customerservice@xantrex.com

Web: www.xantrex.com

About This Guide

Purpose

The purpose of this Owner's Guide is to provide explanations and procedures for installing, operating the Photovoltaic Ground Fault Protection Assembly.

Scope

The Guide provides safety guidelines, and procedures for installing and operating the Photovoltaic Ground Fault Protection Assembly, as well as information about operating and troubleshooting the unit.

Audience

The Guide is intended for anyone who needs to install and operate the Photovoltaic Ground Fault Protection Assembly. Installers should be certified technicians or electricians.

Organization

This Guide is organized into three chapters and one appendix:

Chapter 1, "Introduction", Chapter 1 lists the features of the PVGFP-CF models.

Chapter 2, "Installation", Chapter 2 contains procedures explaining how to mount and install all models of the PVGFP-CF in a variety of enclosures.

Chapter 3, "Operation", Chapter 3 contains procedures on how to verify the installation of the PVGFP-CF and operating and troubleshooting instructions.

Appendix A, "Specifications", Appendix A contains the specifications for the PVGFP-CF.

Conventions Used

The following conventions are used in this guide.



WARNING

Warnings identify conditions or practices that could result in personal injury or loss of life



CAUTION

Cautions identify conditions or practices that could result in damage to the unit or other equipment.

Important: These notes describe things which are important for you to know, but not as serious as a caution or warning.

Related Information

You can find more information about Xantrex Technology Inc. as well as its products and services at **www.xantrex.com**

Important Safety Instructions



WARNING

This chapter contains important safety and operating instructions. Read and keep this Owner's Guide for future reference.

1. Before installing and using the Photovoltaic Ground Fault Protection Assembly (PVGFP-CF), read all instructions and cautionary markings on the PVGFP-CF, the batteries, the controller, the PV array and all appropriate sections of this guide.
2. Do not disassemble the PVGFP-CF assembly. It contains no user-serviceable parts. See Warranty for instructions on obtaining service.
3. All electrical work must be done in accordance with local, national, and/or international electrical codes.
4. Do not expose the PVGFP-CF to rain, snow or liquids of any type. This product is designed for mounting in Listed/Certified enclosures appropriate for the location (indoor or outdoor).
5. To reduce the chance of short-circuits when installing or working with the PVGFP-CF, the batteries, or the PV array, use insulated tools.
6. Remove all jewelry such as rings, bracelets, necklaces, etc., while installing this system. This will greatly reduce the chance of accidental exposure to live circuits.
7. If the PVGFP-CF must be installed in close proximity to the batteries, make sure the area is adequately ventilated to the outside.

Certifications

The PVGFP-CF is CSA certified to UL 1741-2001 (First Edition) and C22.2 No. 107.1-01. They are to be installed in a suitable wiring enclosure per the CEC (for Canada) and the NEC (for the US), such as the Xantrex DC Conduit Box (models DCCB-L, DCCB-L-175, DCCB-L250 and DCCB-L-RE).

The PVGFP-CF is intended for use as a component in CSA certified equipment where the combination is subject to the final approval of the AHJ.

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1

Introduction

Chapter 1 lists the features of the PVGFP-CF models.

For this topic...	See....
“Photovoltaic Ground Fault Protection Assembly”	page 1–2
“Features”	page 1–2
“Model Types”	page 1–3

Photovoltaic Ground Fault Protection Assembly

The Xantrex Photovoltaic Ground Fault Protection Assembly (PVGFP-CF) is designed to minimize the possibility of a fire resulting from ground faults in a PV array (in accordance with Article 690.5 of the National Electric Code (NEC) for rooftop-mounted photovoltaic (PV) systems on dwellings).

Whenever the PVGFP-CF detects a ground fault current (in excess of one ampere), it disconnects the PV sub-arrays and switches the grounding system from a low impedance, negative-ground bonding to high impedance bonding to limit fault currents to a safe level.



CAUTION: Equipment Damage

It is not designed or intended to prevent electrical shock, such as a GFCI (Ground Fault Circuit Interrupter), or to be used for PV DC overcurrent protection.

Never install a PVGFP-CF between a diversion load and controller. Overcharging may occur during a “ground fault condition”.

Features

Breakers are factory assembled with a shunt resistor for ground reference on the PV (-) when the breaker is tripped.

Number of Arrays	The PVGFP-CF comes configured to match the number of sub-arrays in the system (the quantity of sub-arrays is equal to the number value in the model designation). <i>For example, PVGFP-CF-2 is required for two sub-arrays in a stand-alone system.</i>
Charge Controllers	Each charge controller that is connected to a roof-mounted PV array on a home requires a “pole” on one of the four available PVGFP-CF configurations. <i>For example, if three controllers are used, one for a ground-mounted PV array, one for a roof-mounted PV array on a home, and one with a diversion load, only the one used for a roof-mounted array requires the use of a PVGFP-CF.</i>
Capacities	The PVGFP-CF is available in four capacities to match individual system requirements; 100, 200, 300, and 400 amps DC (100 amps maximum/circuit).
Mounting Hardware	The PVGFP-CF includes 6-32 x 1/2" flat-head mounting screws to allow for front mounting.

Model Types

The following PVGFP-CF models are available.

- The PVGFP-CF-1 for one PV array,
- The PVGFP-CF-2 for two PV arrays
- The PVGFP-CF-3 for three PV arrays
- The PVGFP-CF-4 for four PV arrays

The PVGFP-CF was specifically designed to be installed in the Long DC Conduit Box for the SW Plus Inverter/Charger systems. However, it may be installed in any electrical enclosure designed for CF-type DC breakers. See Figure 2-2 on page 2–5 and Figure 2-3 on page 2–6 for the CF breaker dimensions. Minor system modifications and additional hardware may be required.



CAUTION: Overcurrent or Short Circuit Hazard

The PVGFP-CF does NOT replace the need for branch circuit protection. Each PV sub-array still requires a fuse or circuit breaker disconnect to protect against over-current and short circuit conditions. The 100A poles on the PVGFP-CFs do not have “trip-coils” in them like a regular breaker pole. Therefore, the 100A poles will not provide any overcurrent protection.

Typically, the breaker that is used between the controller and the battery is considered the overcurrent device for the sub array if all wiring is the same size. An array disconnect switch is also required by the NEC/CEC. The PVGFP-CF can meet the intent of the required array disconnect by providing a means of disconnecting PV voltage from the charge controller during service to the controller.

Important: The ground fault protection units can not be expanded for additional PV sub-arrays. Ensure the PV ground fault unit contains the proper number of protection switches (1 through 4) for the PV sub-arrays requiring protection (or future expansion) before installing in a system. Only one PVGFP-CF assembly can be used in a system.

Important: Additional hardware may be required to complete some steps described in this manual. Please read all applicable procedures and obtain any additional hardware *before* attempting to install the PVGFP-CF.



PVGFP-CF-1



PVGFP-CF-2



PVGFP-CF-3



PVGFP-CF-4

Note: Wires shown in this Figure have been cropped for visual purposes only and do not reflect the actual length of the wires connected to these products.

Figure 1-1 Photovoltaic Ground Fault Protection Assembly

2

Installation

Chapter 2 contains procedures explaining how to mount and install all models of the PVGFP-CF in a variety of enclosures.

For this topic...	See....
“Pre-Installation Planning”	page 2–2
“Mounting in Enclosures other than the DCCB-L”	page 2–5
“Basic Wiring for Enclosures other than the DCCB-L”	page 2–7
“Mounting in the DCCB-L”	page 2–8
“Wiring for a new DCCB-L Configuration”	page 2–10
“Basic Wiring for Enclosures other than the DCCB-L”	page 2–7
“Wiring DC Controllers and Battery Bank”	page 2–11
“Labeling the DC System”	page 2–11

Pre-Installation Planning

Installations of this equipment should only be performed by skilled personnel such as qualified electricians and certified Renewable Energy (RE) system installers to ensure adherence to the local and national electrical codes applicable in your installation. For a list of Xantrex Certified RE dealers, please visit our website at www.xantrex.com.

Tools Required

- #2 Phillips screw driver
- Level
- 1/4" Slotted screw driver
- Wire strippers
- Torque wrench
- Multimeter
- Pencil

Hardware / Materials Required

- Screws (applicable for application)
- Conduit and appropriate fittings
- Wire nuts
- Electrical Tape

Optional Hardware

- Shunt (with tapped holes for bus-bar), Xantrex part number 2377-1
- Suitable length of ILSCO "NB" Bus-bar (or equivalent) (attaches to shunt)

Mounting Requirements

The PVGFP-CF is designed to be mounted in a Xantrex Long DC Conduit Box made for the Sine Wave Plus Inverter Charger Power Panel System. It can also, however, be used in any certified electrical box that allows for the use of CF-Type Breakers (front mounting) and has the minimum required clearance available around the PVGFP-CF. See Figure 2-2 on page 2-5 and Figure 2-3 on page 2-6 for specific clearance requirements.

The following precautions must be followed when installing in a non-Xantrex enclosure:

- If the PVGFP-CF must be installed in close proximity to the batteries, make sure the area is adequately ventilated to the outside.
- Mount the PVGFP-CF on a vertical surface only, otherwise the breaker will not trip at the correct value.

**CAUTION: Equipment Damage**

The PVGFP-CF must be mounted in a vertical position for proper operation.

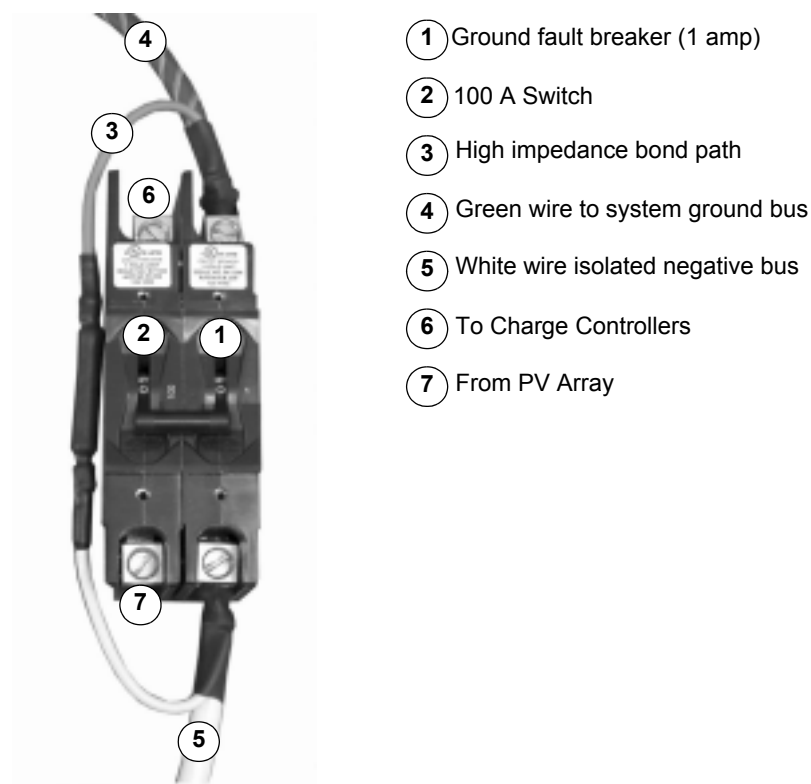


Figure 2-1 PVGFP-CF Front View

Wiring Requirements

The following precautions must be followed when wiring:

- All wiring and installation methods must conform to applicable electrical and building codes.
- The PVGFP-CF breakers accept wire sizes up to #0 AWG. Always use the same gauge wire between the PV array and the DC circuit breakers. For maximum safety, run dc cables in conduit.

Important: The PVGFP-CF does not have "line" and "load" connection requirements. Therefore, wiring from the array and controller may be swapped if required.

- The disconnects on the PVGFP are switches that open only when a PV array ground fault (of at least one amp) is detected or when the PVGFP-CF is manually deactivated.



CAUTION

The factory-installed large (#4 AWG) and small (#12 AWG) wire assembly connected to the PVGFP-CF circuit breaker must never be disassembled. Periodic tightening of all wire connections as part of a regular maintenance schedule is recommended.

Important: Never connect two wires into one pressure terminal.

- All DC negative wires (PV, battery, inverter, etc.) must be connected to an isolated negative bus-bar or bonding block (insulated from the chassis enclosure).
- All equipment grounding wires from the PV module frame, inverter/charger, controllers, enclosures, and grounding rod wire, must be connected to a separate grounding bus. This bus may be connected directly to the metal enclosure. Additional parts may be required (i.e., grounding block).
- Torque wire connection screws according to Table 2-1.



WARNING: Shock Hazard

Use insulated tools when tightening the connection screws.

Table 2-1 Wire Connection Torque Requirements

Wire Size	Torque
14 - 10 AWG	35 in. lbs
8 AWG	40 in. lbs
6 - 4 AWG	45 in. lbs
3 - 1 AWG	65 in. lbs

In some non-PVGFP-CF installations, the DC negative wires may be connected to the same grounding block used for equipment grounding via the ground rod. PVGFP-CF installations require that this bond be separated into two individual paths as the ground/negative bond is established by the PVGFP-CF. Ensure that all negative wires connect to the negative block and all grounding wires connect to the grounding block.

The PVGFP-CF wire terminals accept wire sizes from #0-14 AWG CU/AL, rated at 60/75 °C.

Torque specifications are provided up to wire size #1 AWG.



WARNING: Shock Hazard

Ensure all sources of power are disconnected before proceeding with any wiring.



CAUTION: Equipment Damage

Never install a PVGFP-CF between a diversion load and a controller. Overcharging may occur during a "ground fault condition".

Installing the PVGFP-CF in Enclosures other than the DCCB-L

The following procedures are for installing the PVGFP-CF in enclosures other than the Xantrex Long DC Conduit Box. Since installations of this type vary widely, only generic installation instructions are provided.

Mounting in Enclosures other than the DCCB-L

A custom enclosure for the PVGFP-CF is available from dealers of AEE Solar (<http://www.aeesolar.com>) under part number 53.0090 and using breaker mount part number 53.0094.

The following precautions must be followed when installing:

1. If the PVGFP-CF is installed outdoors, it must be mounted inside a weather-tight enclosure which is suitable for outdoor applications. If the PVGFP-CF must be installed in close proximity to the batteries, make sure the area is adequately ventilated to the outside.
2. Locate the PVGFP-CF as close as practical to the DC conductors (where it can be easily seen and reset) coming from the PV array and the DC negative/ground system-bonding point. Roof mounting is not recommended.
3. Install the PVGFP-CF in an approved electrical enclosure.
4. Ensure the enclosure is large enough to house the PVGFP-CF and allow for proper wire clearances around the assembly to meet code requirements.
5. Refer to Figure 2-2 for minimum enclosure dimensions.
6. If the PVGFP-CF is to be installed in a pre-existing configuration, then ensure the conditions listed on page 2–9 are met.

Important: Refer to Figure 2-5 for a basic wiring diagram.

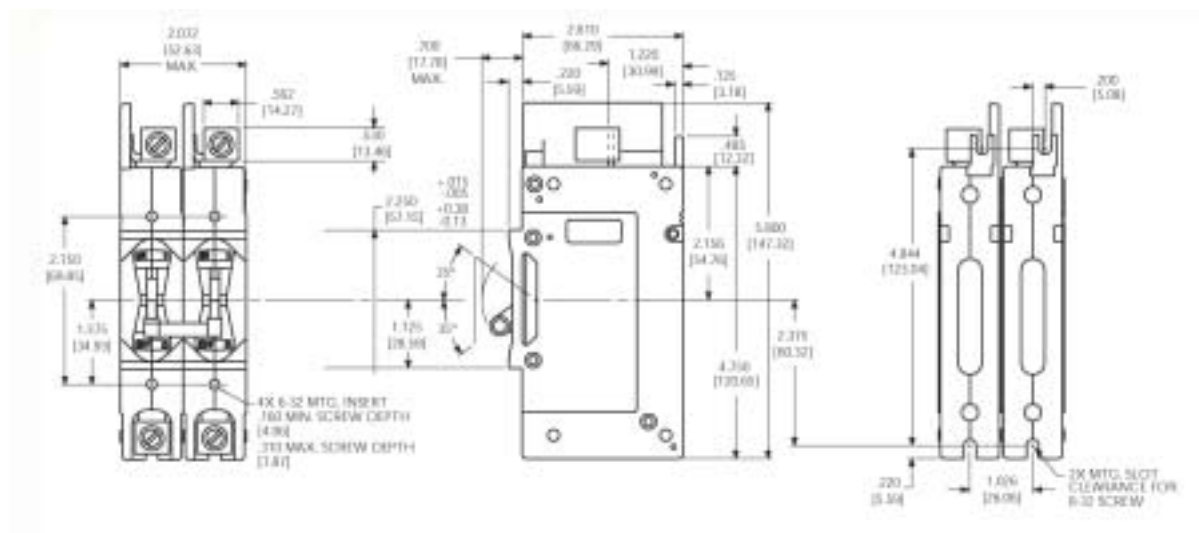


Figure 2-2 Dimensions for PVGFP-CF-x in Non-Xantrex Enclosures (Not to scale)

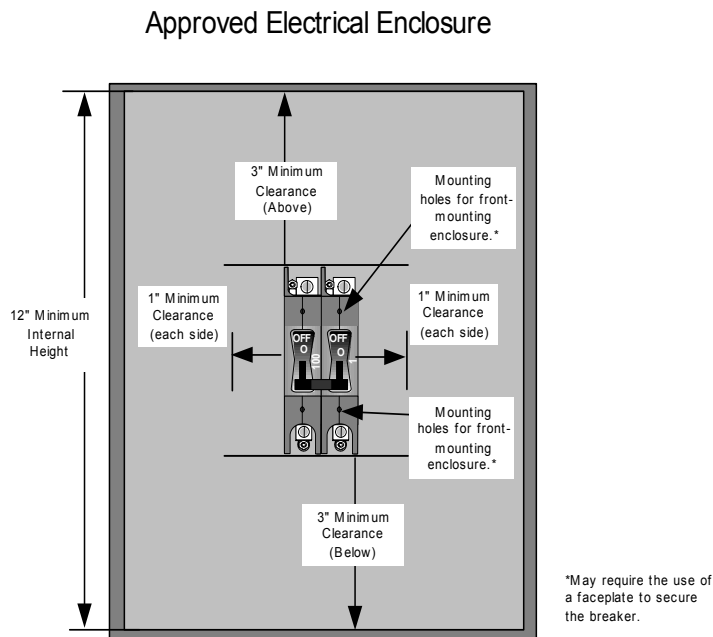
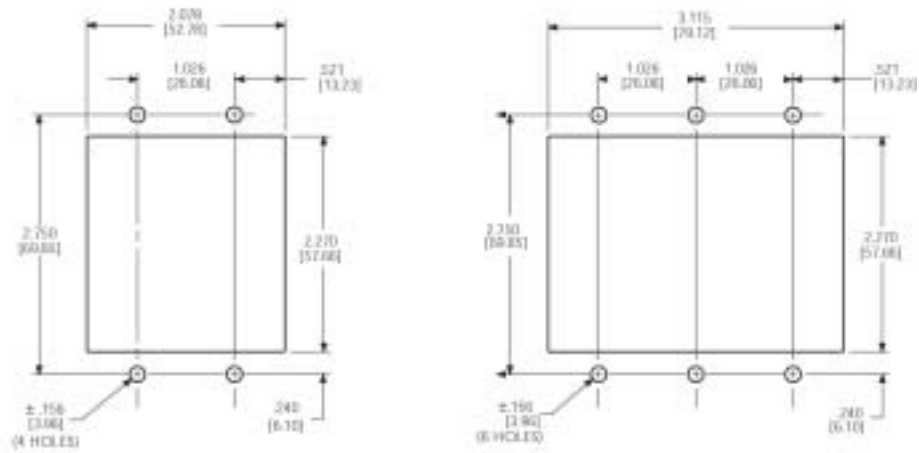


Figure 2-3 Non-Xantrex Enclosure Dimensions

The following illustration provides sample dimensions for the handle-holes required for non-xantrex installations. Use these illustrations to interpolate the necessary space required for PVGFP-CF-3s and PVGFP-CF4s.



Sample Handle-holes for PVGFP-CF-1

Sample Handle-holes for PVGFP-CF-2

Figure 2-4 Sample Handle Hole Dimensions for Non-Xantrex Enclosures for PVGFP-1 and PFGVP-CF-2

Basic Wiring for Enclosures other than the DCCB-L

The following illustration shows the basic wiring for PVGFP-CF operation.



WARNING: Shock Hazard

Ensure all sources of power are disconnected before proceeding with any wiring.



CAUTION: Equipment Damage

Never install a PVGFP-CF between a diversion load and a controller. Overcharging may occur during a "ground fault condition".

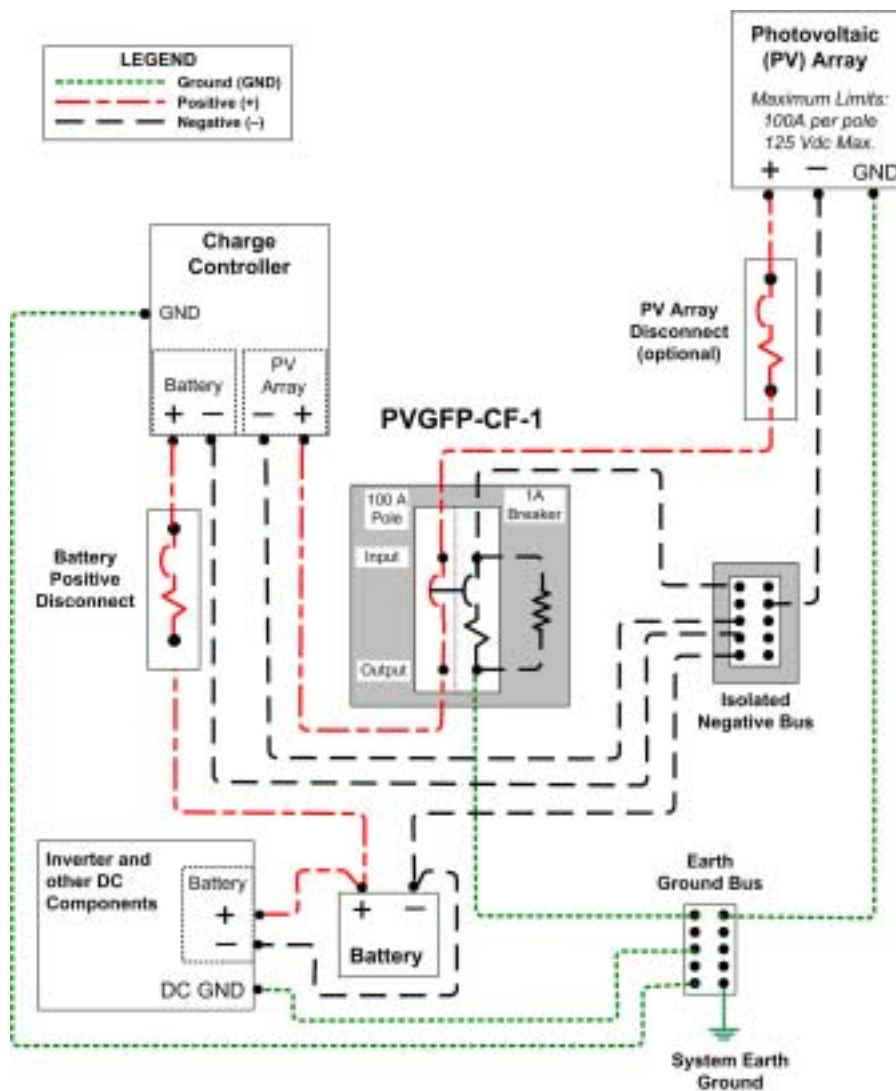


Figure 2-5 Basic Wiring for a PVGFP-CF-1

Installing PVGFP-CF in the DCCB-L

The following procedures are for installing the PVGFP-CF in DCCB-L.

Mounting in the DCCB-L

The DCCB-L has knockouts to accommodate any model PVGFP-CF.

To mount the PVGFP-CF on the Long DC Conduit Box:

1. If already installed, remove the DCCB-L cover to expose the base (see "Removing and Replacing the Long DC Conduit Box Cover" in the *DCCB-L Owner's Guide*).
2. Remove the required number of knockouts in the breaker mounting plate attached to the base of the DCCB-L. See Figure 2-6.
 - a) For PVGFP-CF-1, remove two knockouts.
 - b) For PVGFP-CF-2, remove three knockouts.
 - c) For PVGFP-CF-3, remove four knockouts.
 - d) For PVGFP-CF-4, remove five knockouts.
3. Place the PVGFP-CF behind the mounting plate and align the holes of the circuit breaker with the holes in the mounting bracket.
4. Insert the 6-32 x 1/2" flat head mounting screws from the front of the mounting bracket.
5. Torque the screws to 8 in-lb (0.90 nm).

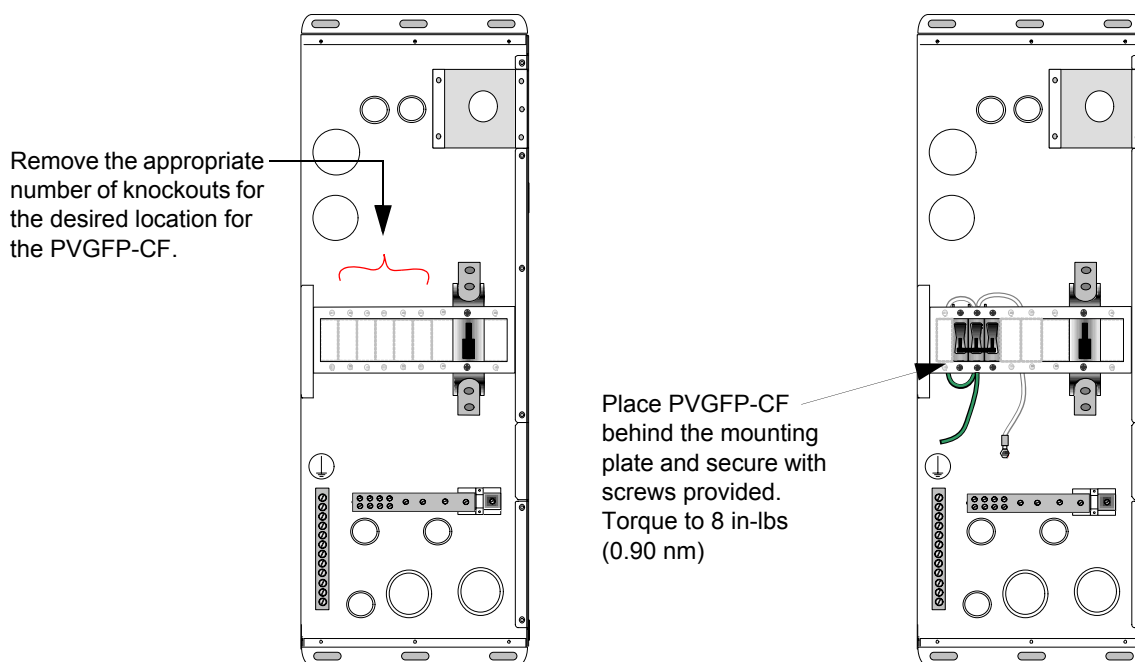


Figure 2-6 Installing the PVGFP-CF in a Long DC Conduit Box (DCCB-L)

Wiring for a Pre-existing DCCB-L Configuration

The following modifications will need to be made to a pre-existing system in order to install the PVGFP-CF.

- ☐ Provide a separate, isolated negative bus bar. Run all DC negatives (inverter, controllers, PV, PVGFP, battery etc.) to the Isolated negative bus.
- ☐ Provide a separate, ground bar. Run All DC Grounds to the ground bar.
- ☐ Ensure there is only one Negative-to-Ground Bond in the DC system (i.e., provided by the PVGFP-CF).
- ☐ Once these conditions are met, following the instructions on page 2–10 to complete the wiring.

System configurations differ widely. A SW Plus, Single-inverter system is used in this illustration for simplicity only.

Wiring modifications should only be performed by qualified personnel and should be approved by the local electrical authority.

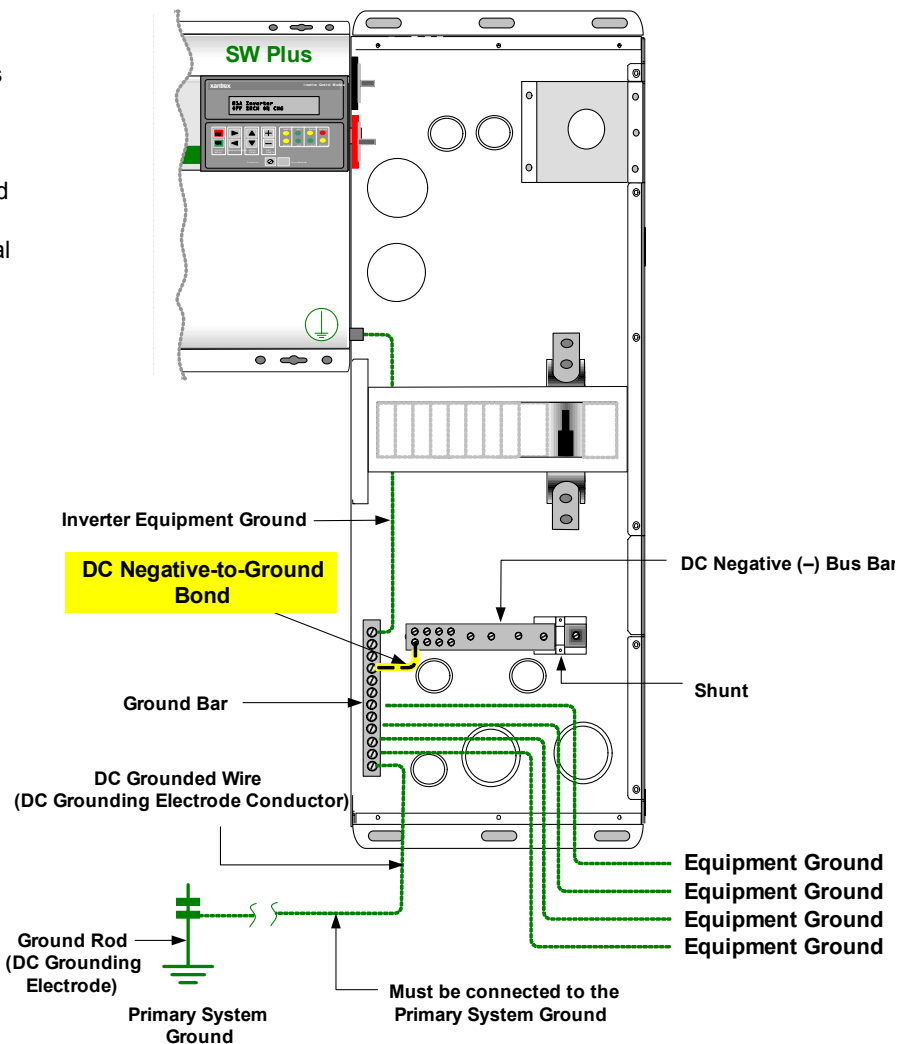


Figure 2-7 Locating the DC Negative-to-Ground Bond in a Pre-existing Configuration

Wiring for a new DCCB-L Configuration

To wire PVGFP-CF in a DCCB-L Configuration:

1. Connect the green wire from the PVGFP-CF to the Ground bar. Torque to value provided on the label on the inside of the DCCB-L.
2. Connect the white wire from the PVGFP-CF to the isolated negative bus bar. Torque to value provided on the label on the inside of the DCCB-L.

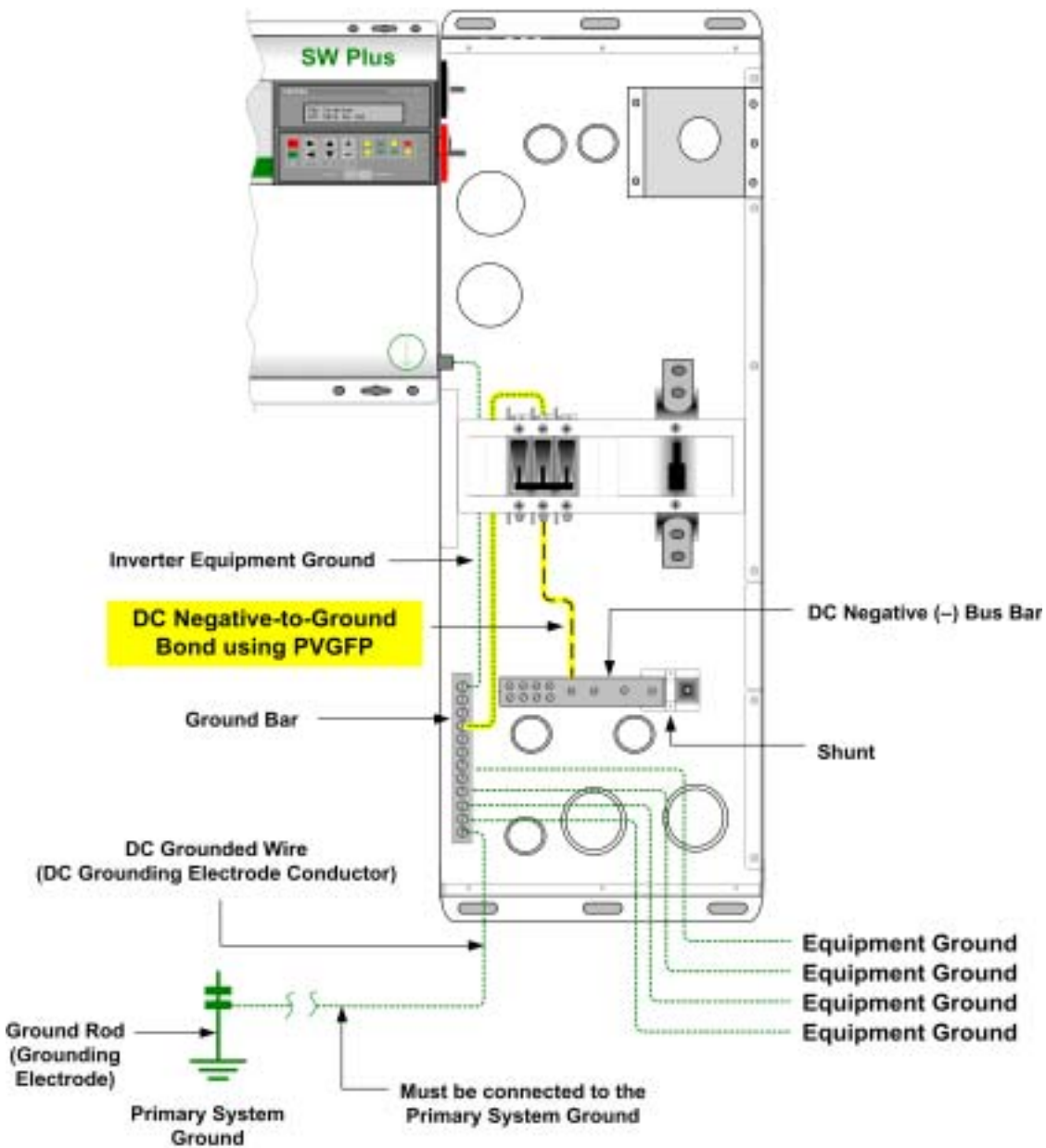


Figure 2-8 PVGFP-CF-2 Wiring (Example)

Wiring DC Controllers and Battery Bank

After connecting the PVGFP-CF wiring, you can finish making the DC connections.

1. Connect the DC Controllers per the instructions in their Owner's Manuals.
2. Connect the battery bank and inverter/charger per the instructions in the SW Plus Inverter/Charger's Owner's Manual.

Labeling the DC System

The PVGFP-CF comes with a sheet of labels, lettered A through K, and N. After mounting and wiring the PVGFP-CF, apply these labels to the breaker mounting bracket.

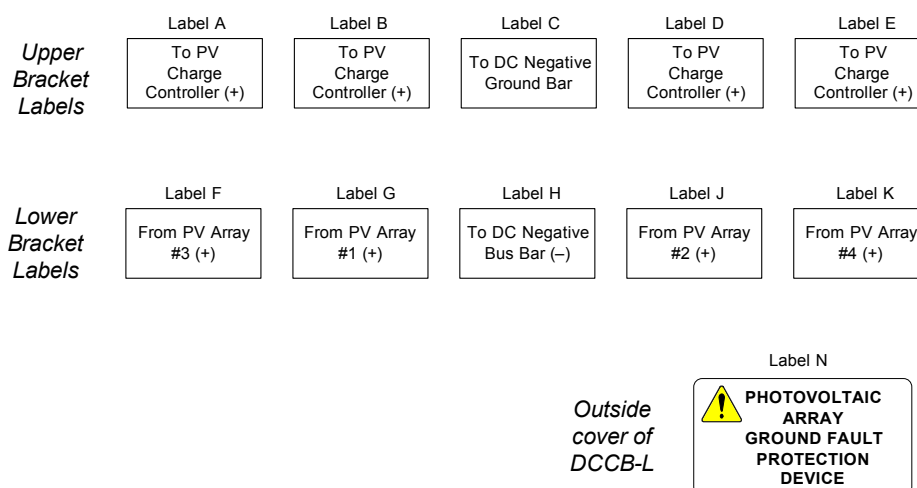


Figure 2-9 PVGFP-CF Label Set

Table 2-2 Label Requirements per PVGFP-CF Model

Model	Mounting Bracket Location	Labels from Figure 2-9 (to place on outside of mounting bracket)				
		1A Pole	100 Pole(s)			
			Array #1	Array #2	Array #3	Array #4
PVGFP-CF-1	Upper	C	B			
	Lower	H	G			
PVGFP-CF-2	Upper	C	B	D		
	Lower	H	G	J		
PVGFP-CF-3	Upper	C	B	D	A	
	Lower	H	G	J	F	
PVGFP-CF-4	Upper	C	B	D	A	E
	Lower	H	G	J	F	K

Guidelines for Applying the PVGFP-CF Labels

Apply the labels as recommended below.

- ☐ Ensure the mounting bracket surface is clean and dry.
- ☐ Labels A, B, D, and E should be applied to the upper part of the breakers mounting bracket for the 100A poles covering the lower PVGFP-CF mounting screws.
- ☐ Labels F, G, J, and K should be applied to the lower part of the mounting bracket for the 100A pole, covering the upper PVGFP-CF mounting screws.
- ☐ Label C should be applied to the upper part of the breaker mounting bracket for the 1A pole.
- ☐ Label H should be applied to the lower part of the breaker mounting bracket for the 1A pole.
- ☐ Place Label N on the outside cover of the DCCB-L or other electrical enclosure where PVGFP-CF is housed.

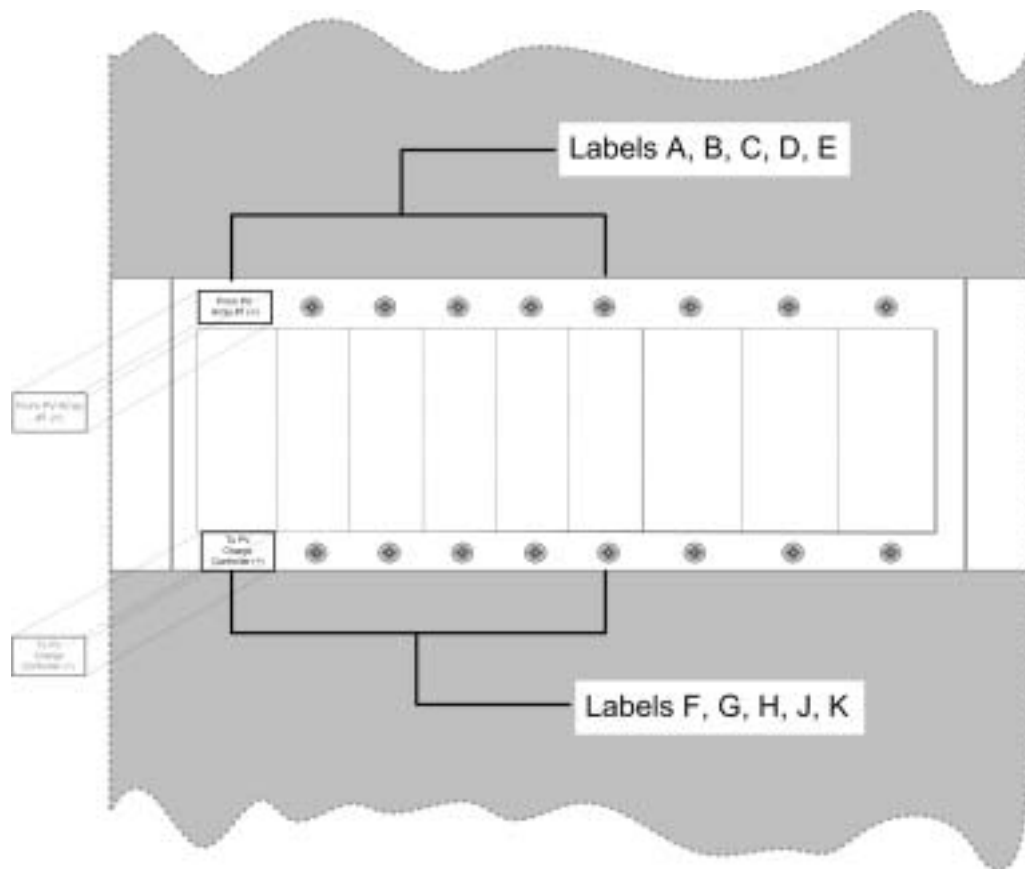


Figure 2-10 Label Placement on Mounting Bracket on the DCCB-L

3

Operation

Chapter 3 contains procedures on how to verify the installation of the PVGFP-CF and operating and troubleshooting instructions.

For this topic...	See....
"Testing the PVGFP-CF Installation"	page 3-2
"Operation"	page 3-8
"Maintenance"	page 3-8

Testing the PVGFP-CF Installation

Once the PVGFP-CF is installed, all wiring should be double-checked before proceeding.

- ☐ Ensure that the PVGFP-CF provides the only negative-to-ground bond and that no other negative-to-ground bonds exists anywhere in the DC side of the system.
- ☐ Check that each positive wire from the PV sub-array(s) is properly routed to the PVGFP-CF (100A) switches and that all contacts are tight.

Before placing the system into operation, it should be checked to ensure the PVGFP-CF is operating properly. Two functional tests are required to validate proper operation.

- ☐ The first functional test checks the bond resistance as well as the high impedance resistance.
- ☐ The second test checks the 1 amp trip current of the PVGFP-CF.

Both tests must pass in order to complete the installation.

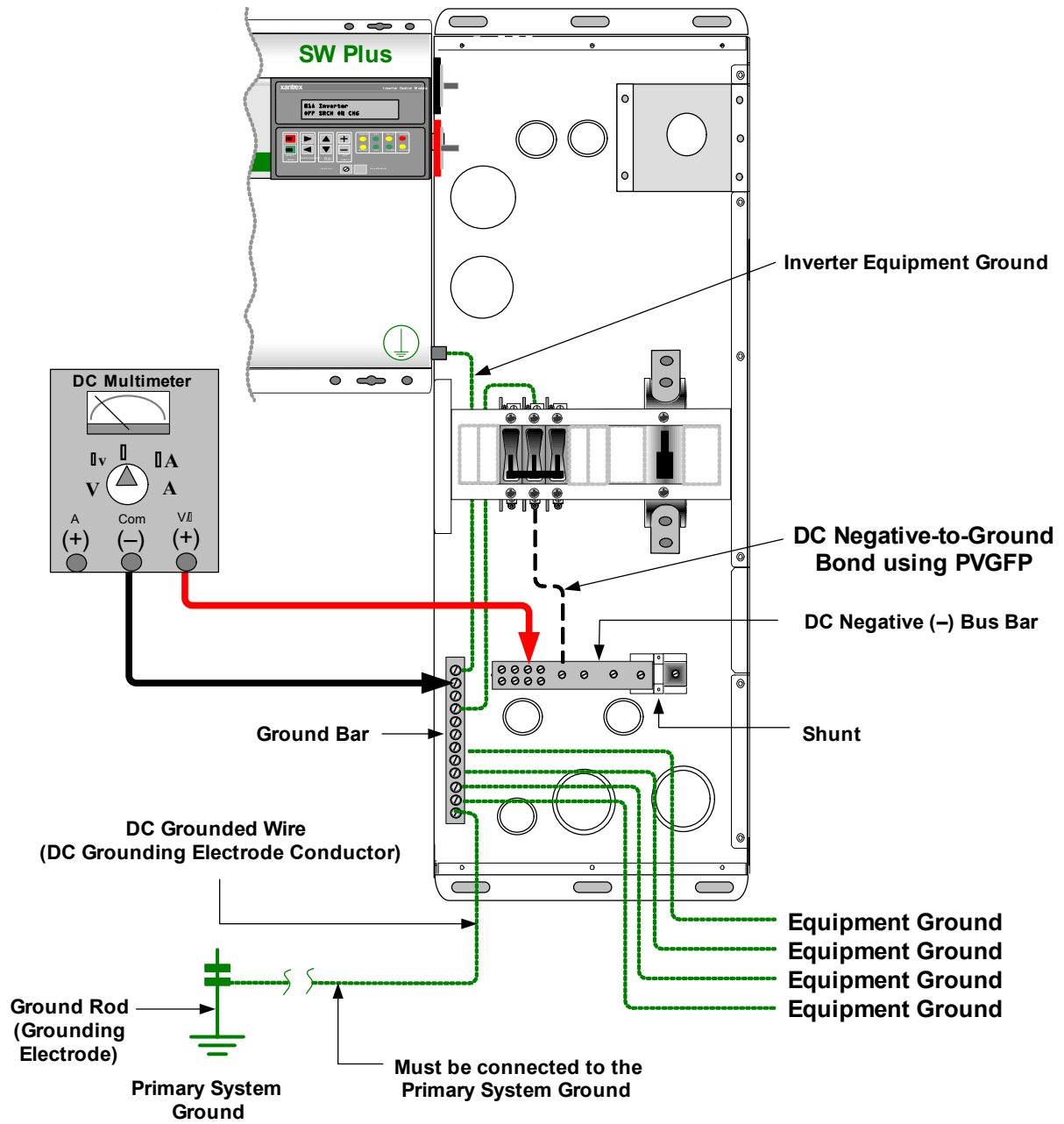
Tools Required

The following tools will be required to complete this functional test.

- DC Multimeter (0-1 amp minimum, 0-1 M Ω)
- DC Power Supply (optional), (0-48 Vdc, 1 amp minimum)

Resistance Check

1. Check the continuity of the high impedance bond. All power sources must be disconnected for this test.
2. Connect the ohmmeter between the ground bar and DC negative bus bar in the enclosure. Set the meter to its lowest resistance range. Refer to Figure 3-1 for location of the neutral and ground bar.
3. Close the PVGFP switch (ON position) and measure the resistance. It should measure between 0 to 2 ohms.
4. Set the meter to read a resistance of 60 k Ω (or higher). Open the PVGFP switch (OFF position) and measure the resistance. It should now read between 50-60 k Ω . This is the high impedance bond resistance.
5. Disconnect and remove the ohmmeter.

**Figure 3-1** Resistance Check Setup

1 Amp Trip Current Test

This test uses a DC current-limited power supply (laboratory power supply) set at the system voltage (i.e., 12, 24 or 48 Vdc) and a DC ammeter to supply a 1-amp current to trip the breaker. If the test power supply contains an accurate internal ammeter, the external ammeter is not required.

DC Trip Test Using a Power Supply

To perform the DC Trip Test using a DC power supply:

1. Disconnect all sources of power.
2. Set the power supply to the proper system voltage (12, 24, or 48 V dc).
3. If the power supply does not have a meter to display current, insert an ammeter in series with the power supply. Refer to Figure 3-2.
4. Connect the power supply between the negative (top) terminal and ground (lower) terminal of the 1 amp PVGFP-CF breaker.
5. Apply 1-2 amps of current from the power supply to the PVGFP-CF. The PVGFP-CF breaker should trip and open all PV disconnect switches.

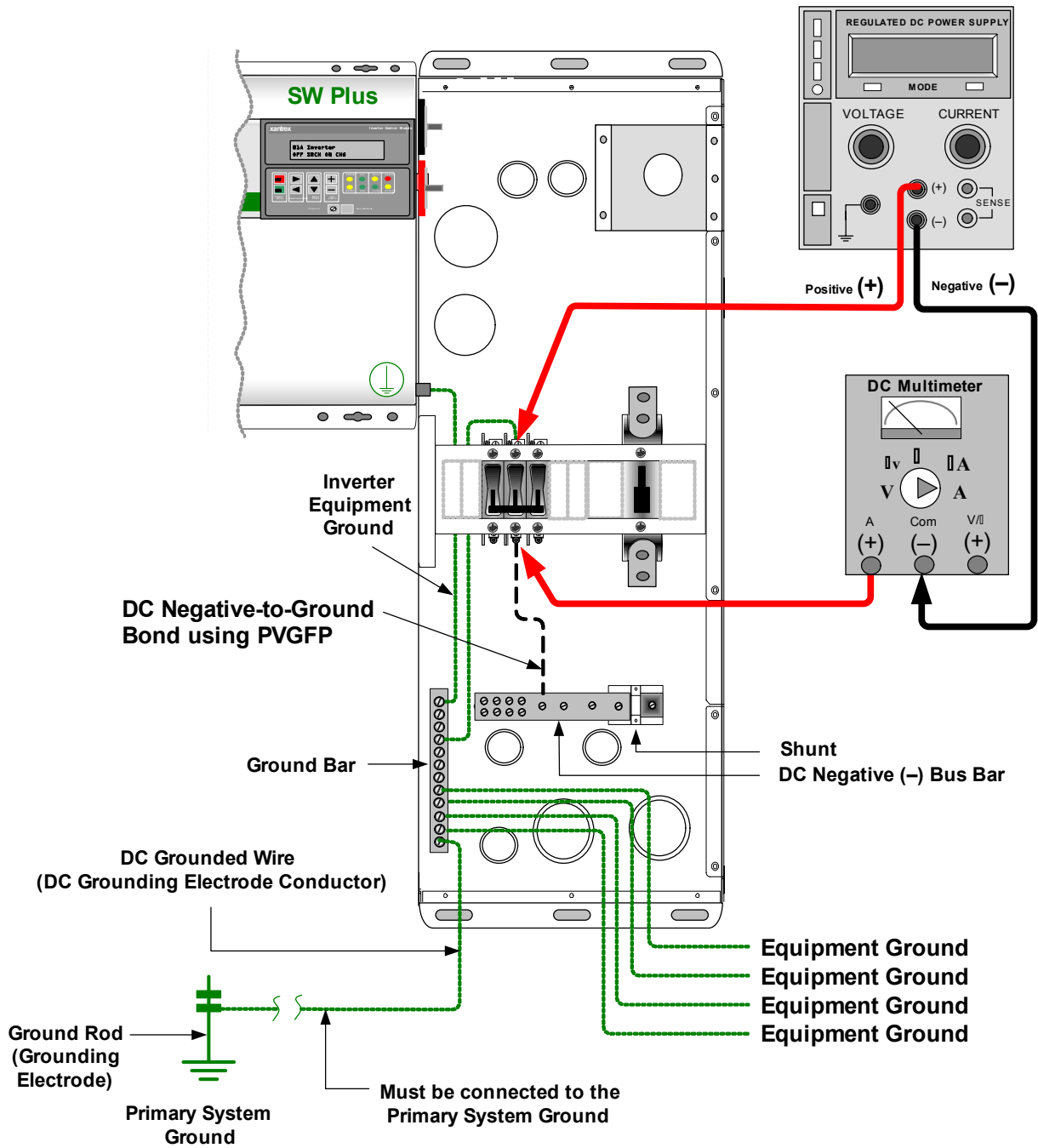


Figure 3-2 PVGFP 1 Amp Current Trip Test Using a Power Supply

DC Trip Test Using a Shorting Wire

If a power supply is not available to test the PVGFP-CF, the PV array current may be used to simulate a short circuit. This test must be performed in daylight. The PV Array must be able to deliver at least 1-2 amps.



WARNING: Shock Hazard

This method used live DC voltages and high currents. Proceed with caution when performing this test. The breakers should trip causing a loud sound. The wire may also cause a momentary arc. Be prepared.

Short Circuit Test

To perform a Short Circuit Test:

1. Switch OFF all sources of power.
2. Switch ON the primary disconnect for PV array #1 (if equipped).
3. Switch the PVGFP-CF to the ON position.
4. Use a heavy gauge “U” shaped wire, and momentarily connect it between the PV array #1 terminal and ground terminal of the 1 amp PVGFP-CF breaker. Refer to Figure 3-3.
5. The PVGFP-CF breaker should trip and open all the PV disconnect switches on the PVGFP-CF.

Important: The primary PV array disconnect breaker may also trip (if equipped). This is normal.

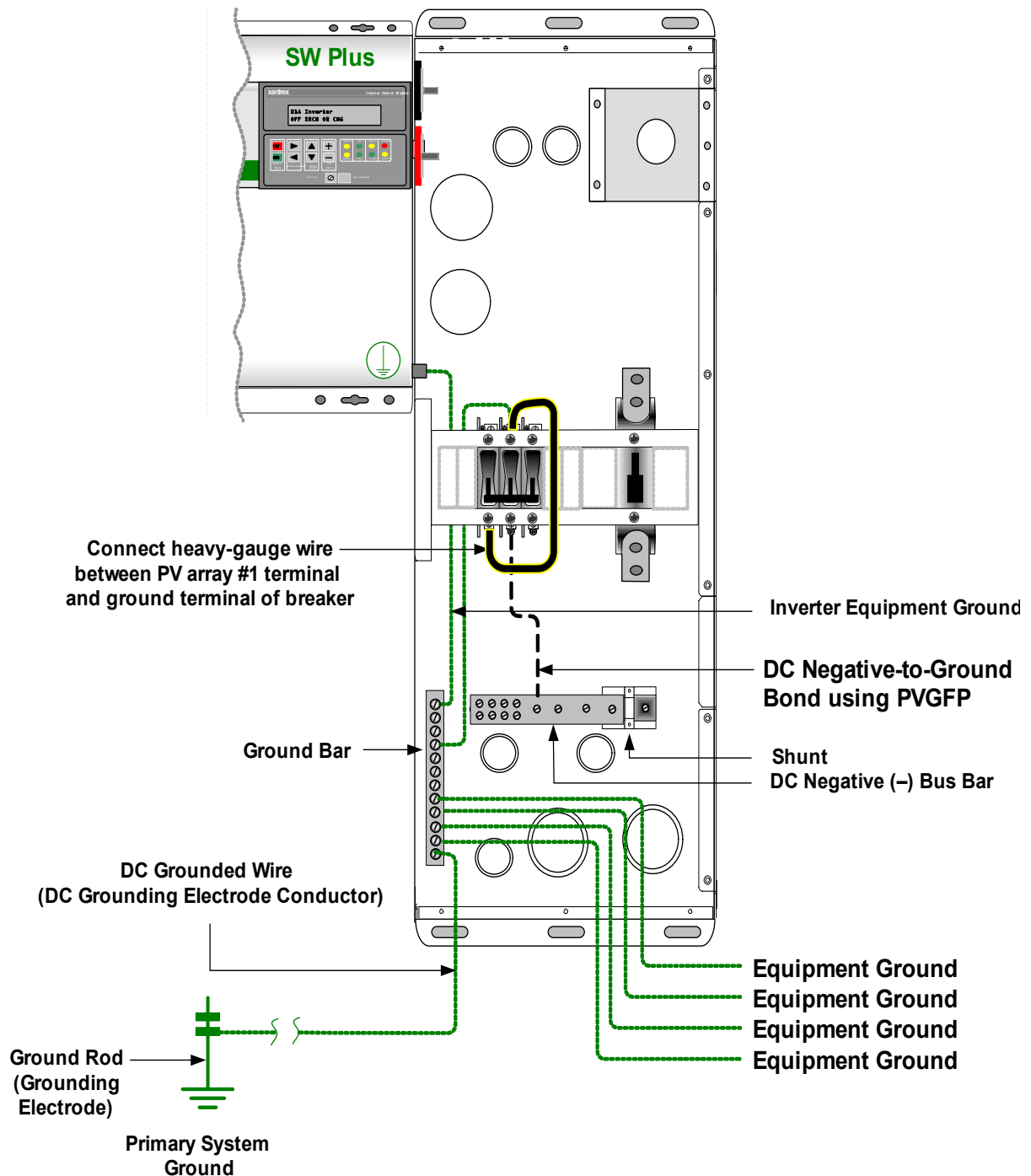


Figure 3-3 Current Trip Test Using a Shorting Wire

Troubleshooting Ground Fault Conditions

If the PVGFP-CF trips, it is detecting current flow between the DC Negative and Equipment Grounding conductors which is considered a "ground fault". To restore the system to its proper operating condition the ground fault must be found and repaired.

- ☐ Verify all DC components have separate terminals for DC negative and chassis ground. Most DC devices for the automotive industry have DC negative and the product chassis common with each other. Devices like these can not be used with a system with a PVGFP (isolated negative).
- ☐ Verify if any data communication is being used with system. Optical isolators may be required for devices that are connected to both the DC and AC part of the system.
- ☐ Disconnect system components one item at a time to find which item has current flow through its ground connection. Do not leave system components "ungrounded" to alleviate ground fault problems.
- ☐ Battery cleanliness is particularly important on systems with metal cases or racks on grounded surfaces (i.e. concrete).
- ☐ The PVGFP-CF can also trip in cases of a DC Positive to Ground fault.

Operation

Once the entire system is wired and the PVGFP-CF is tested (and inspected/approved by the local electrical authority), place the PVGFP-CF switch in the ON (upper) position.

If the PVGFP-CF breaker should trip any time during operation, troubleshoot and correct the cause of the ground fault current before resetting the breakers.

Maintenance

Annual inspection should include tightening all connections and field testing of the PVGFP-CF. Refer to Table 2-1 on page 2-4 for tightening torques.



WARNING: Shock Hazard

Use insulated tools when tightening the connection screws.

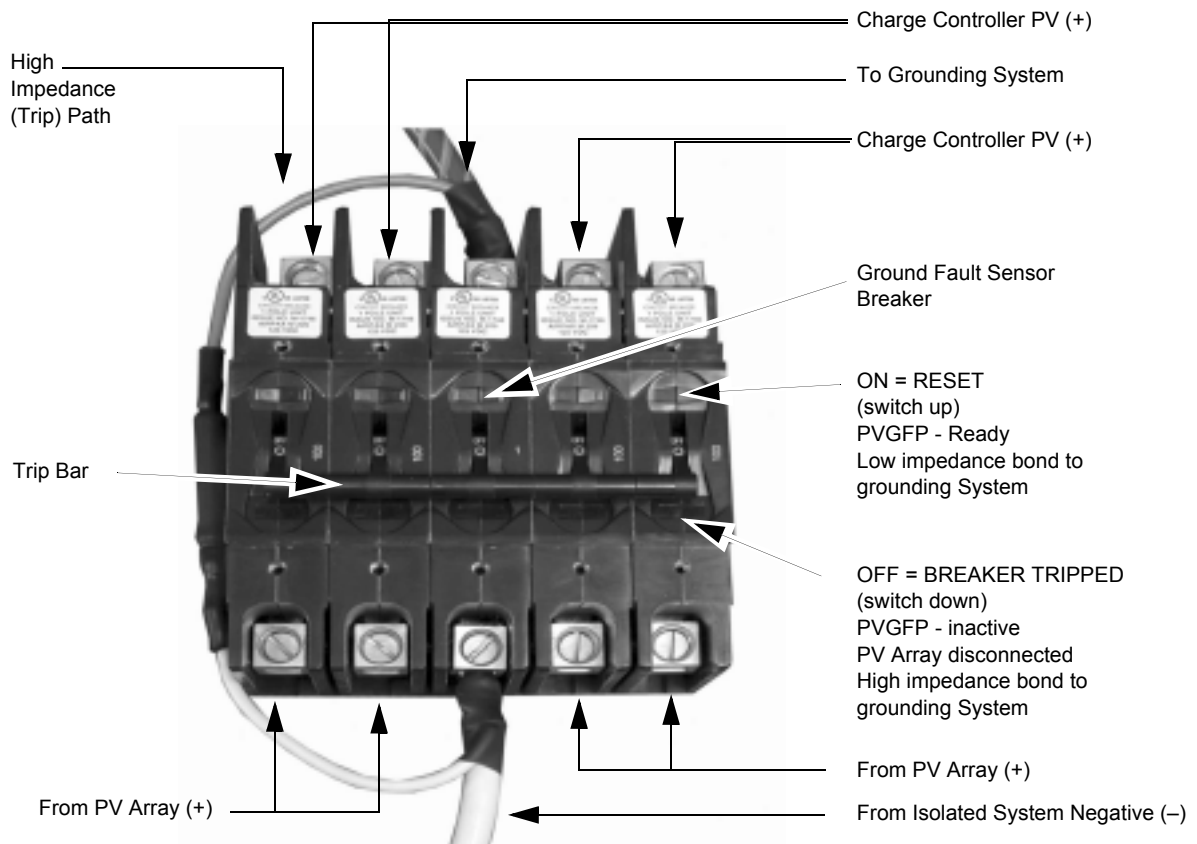


Figure 3-4 Connections and Trip Bar (PVGFP-CF-4 shown)



Specifications

Appendix A contains the specifications for the PVGFP-CF.
Specifications are subject to change without notice.

Physical Specifications

The following table provides the physical specifications for the Xantrex PVGFP-CF.

Part Numbers	PVGFP-CF-1	PVGFP-CF-2	PVGFP-CF-3	PVGFP-CF-4
Weight	3.5 lbs (1.59 kg)	4.5 lbs (2.04 kg)	5.5 lbs (2.5 kg)	6.5 lbs (2.94 kg)
Dimensions (W x H x D)	2" x 6" x 3.75" (5 cm x 15 cm x 9.5 cm)	3" x 6" x 3.75" (8 cm x 15 cm x 9.5 cm)	4" x 6" x 3.75" (10 cm x 15 cm x 9.5 cm)	5" x 6" x 3.75" (13 cm x 15 cm x 9.5 cm)
Mounting Orientation	Vertical Only	Vertical Only	Vertical Only	Vertical Only

Electrical Specifications

The following table provides the electrical specifications for the Xantrex PVGFP-CF.

Part Numbers	PVGFP-CF-1	PVGFP-CF-2	PVGFP-CF-3	PVGFP-CF-4
Maximum Number of Sub-arrays	1	2	3	4
Maximum PV Open Circuit Rating (Vdc)	125 Vdc	125 Vdc	125 Vdc	125 Vdc
Maximum PV Array Current Rating	100 amps	200 amps (100 amps x 2 sub-arrays)	300 amps (100 amps x 3 sub-arrays)	400 amps (100 amps x 4 sub-arrays)
Nominal System Voltage Rating	12, 24, 48 Vdc	12, 24, 48 Vdc	12, 24, 48 Vdc	12, 24, 48 Vdc
Maximum Ambient Temperature	40 °C (104 °F)	40 °C (104°F)	40 °C (104 °F)	40 °C (104 °F)

Warranty and Return Information

Warranty

What does this warranty cover? This Limited Warranty is provided by Xantrex Technology, Inc. ("Xantrex") and covers defects in workmanship and materials in your Photovoltaic Ground Fault Protection Assembly. This warranty period lasts for two (2) years from the date of purchase at the point of sale to you, the original end user customer. You require proof of purchase to make warranty claims.

What will Xantrex do? Xantrex will, at its option, repair or replace the defective product free of charge, provided that you notify Xantrex of the product defect within the Warranty Period, and provided that Xantrex through inspection establishes the existence of such a defect and that it is covered by this Limited Warranty.

Xantrex will, at its option, use new and/or reconditioned parts in performing warranty repair and building replacement products. Xantrex reserves the right to use parts or products of original or improved design in the repair or replacement. If Xantrex repairs or replaces a product, its warranty continues for the remaining portion of the original Warranty Period or 90 days from the date of the return shipment to the customer, whichever is greater. All replaced products and all parts removed from repaired products become the property of Xantrex.

Xantrex covers both parts and labor necessary to repair the product, and return shipment to the customer via a Xantrex-selected non-expedited surface freight within the contiguous United States and Canada. Alaska and Hawaii are excluded. Contact Xantrex Customer Service for details on freight policy for return shipments outside of the contiguous United States and Canada.

How do you get service? If your product requires troubleshooting or warranty service, contact your merchant. If you are unable to contact your merchant, or the merchant is unable to provide service, contact Xantrex directly at:

Telephone: 1 800 670 0707 (toll free North America)

1 360 925 5097 (direct)

Fax: 1 800 994 7828 (toll free North America)

1 360 925 5143 (direct)

Email: customerservice@xantrex.com

Direct returns may be performed according to the Xantrex Return Material Authorization Policy described in your product manual. For some products, Xantrex maintains a network of regional Authorized Service Centers. Call Xantrex or check our website to see if your product can be repaired at one of these facilities.

What proof of purchase is required? In any warranty claim, dated proof of purchase must accompany the product and the product must not have been disassembled or modified without prior written authorization by Xantrex.

Proof of purchase may be in any one of the following forms:

- The dated purchase receipt from the original purchase of the product at point of sale to the end user, or
- The dated dealer invoice or purchase receipt showing original equipment manufacturer (OEM) status, or
- The dated invoice or purchase receipt showing the product exchanged under warranty

What does this warranty not cover? This Limited Warranty does not cover normal wear and tear of the product or costs related to the removal, installation, or troubleshooting of the customer's electrical systems. This warranty does not apply to and Xantrex will not be responsible for any defect in or damage to:

- a) the product if it has been misused, neglected, improperly installed, physically damaged or altered, either internally or externally, or damaged from improper use or use in an unsuitable environment;
- b) the product if it has been subjected to fire, water, generalized corrosion, biological infestations, or input voltage that creates operating conditions beyond the maximum or minimum limits listed in the Xantrex product specifications including high input voltage from generators and lightning strikes;
- c) the product if repairs have been done to it other than by Xantrex or its authorized service centers (hereafter "ASCs");
- d) the product if it is used as a component part of a product expressly warranted by another manufacturer;
- e) the product if its original identification (trade-mark, serial number) markings have been defaced, altered, or removed.

Disclaimer

Product

THIS LIMITED WARRANTY IS THE SOLE AND EXCLUSIVE WARRANTY PROVIDED BY XANTREX IN CONNECTION WITH YOUR XANTREX PRODUCT AND IS, WHERE PERMITTED BY LAW, IN LIEU OF ALL OTHER WARRANTIES, CONDITIONS, GUARANTEES, REPRESENTATIONS, OBLIGATIONS AND LIABILITIES, EXPRESS OR IMPLIED, STATUTORY OR OTHERWISE IN CONNECTION WITH THE PRODUCT, HOWEVER ARISING (WHETHER BY CONTRACT, TORT, NEGLIGENCE, PRINCIPLES OF MANUFACTURER'S LIABILITY, OPERATION OF LAW, CONDUCT, STATEMENT OR OTHERWISE), INCLUDING WITHOUT RESTRICTION ANY IMPLIED WARRANTY OR CONDITION OF QUALITY, MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE TO THE EXTENT REQUIRED UNDER APPLICABLE LAW TO APPLY TO THE PRODUCT SHALL BE LIMITED IN DURATION TO THE PERIOD STIPULATED UNDER THIS LIMITED WARRANTY.

IN NO EVENT WILL XANTREX BE LIABLE FOR ANY SPECIAL, DIRECT, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES, LOSSES, COSTS OR EXPENSES HOWEVER ARISING WHETHER IN CONTRACT OR TORT INCLUDING WITHOUT RESTRICTION ANY ECONOMIC LOSSES OF ANY KIND, ANY LOSS OR DAMAGE TO PROPERTY, ANY PERSONAL INJURY, ANY DAMAGE OR INJURY ARISING FROM OR AS A RESULT OF MISUSE OR ABUSE, OR THE INCORRECT INSTALLATION, INTEGRATION OR OPERATION OF THE PRODUCT.

Exclusions

If this product is a consumer product, federal law does not allow an exclusion of implied warranties. To the extent you are entitled to implied warranties under federal law, to the extent permitted by applicable law they are limited to the duration of this Limited Warranty. Some states and provinces do not allow limitations or exclusions on implied warranties or on the duration of an implied warranty or on the limitation or exclusion of incidental or consequential damages, so the above limitation(s) or exclusion(s) may not apply to you. This Limited Warranty gives you specific legal rights. You may have other rights which may vary from state to state or province to province.

Warning: Limitations On Use

Please refer to your product manual for limitations on uses of the product.

SPECIFICALLY, PLEASE NOTE THAT THE PHOTOVOLTAIC GROUND FAULT PROTECTION ASSEMBLY SHOULD NOT BE USED IN CONNECTION WITH LIFE SUPPORT SYSTEMS OR OTHER MEDICAL EQUIPMENT OR DEVICES. WITHOUT LIMITING THE GENERALITY OF THE FOREGOING, XANTREX MAKES NO REPRESENTATIONS OR WARRANTIES REGARDING THE USE OF THE XANTREX PHOTOVOLTAIC GROUND FAULT PROTECTION ASSEMBLY IN CONNECTION WITH LIFE SUPPORT SYSTEMS OR OTHER MEDICAL EQUIPMENT OR DEVICES.

Return Material Authorization Policy

Before returning a product directly to Xantrex you must obtain a Return Material Authorization (RMA) number and the correct factory "Ship To" address. Products must also be shipped prepaid. Product shipments will be refused and returned at your expense if they are unauthorized, returned without an RMA number clearly marked on the outside of the shipping box, if they are shipped collect, or if they are shipped to the wrong location.

When you contact Xantrex to obtain service, please have your instruction manual ready for reference and be prepared to supply:

- The serial number of your product
- Information about the installation and use of the unit
- Information about the failure and/or reason for the return
- A copy of your dated proof of purchase

Record these details in on page WA-4.

Return Procedure

1. Package the unit safely, preferably using the original box and packing materials. Please ensure that your product is shipped fully insured in the original packaging or equivalent. This warranty will not apply where the product is damaged due to improper packaging.
2. Include the following:
 - The RMA number supplied by Xantrex Technology, Inc. clearly marked on the outside of the box.
 - A return address where the unit can be shipped. Post office boxes are not acceptable.
 - A contact telephone number where you can be reached during work hours.
 - A brief description of the problem.
3. Ship the unit prepaid to the address provided by your Xantrex customer service representative.

If you are returning a product from outside of the USA or Canada In addition to the above, you **MUST** include return freight funds and are fully responsible for all documents, duties, tariffs, and deposits.

If you are returning a product to a Xantrex Authorized Service Center (ASC) A Xantrex return material authorization (RMA) number is not required. However, you must contact the ASC prior to returning the product or presenting the unit to verify any return procedures that may apply to that particular facility.

Out of Warranty Service

If the warranty period for your Photovoltaic Ground Fault Protection Assembly has expired, if the unit was damaged by misuse or incorrect installation, if other conditions of the warranty have not been met, or if no dated proof of purchase is available, your inverter may be serviced or replaced for a flat fee.

To return your Photovoltaic Ground Fault Protection Assembly for out of warranty service, contact Xantrex Customer Service for a Return Material Authorization (RMA) number and follow the other steps outlined in "Return Procedure" on page WA-3.

Payment options such as credit card or money order will be explained by the Customer Service Representative. In cases where the minimum flat fee does not apply, as with incomplete units or units with excessive damage, an additional fee will be charged. If applicable, you will be contacted by Customer Service once your unit has been received.

Information About Your System

As soon as you open your Photovoltaic Ground Fault Protection Assembly package, record the following information and be sure to keep your proof of purchase.

- ☐ Purchased From _____
- ☐ Purchase Date _____

If you need to contact Customer Service, please record the following details before calling. This information will help our representatives give you better service.

- ☐ Type of installation (e.g. RV, truck) _____
- ☐ Length of time inverter has been installed _____
- ☐ Battery/battery bank size _____
- ☐ Battery type (e.g. flooded, sealed gel cell, AGM) _____
- ☐ DC wiring size and length _____
- ☐ Alarm sounding? _____
- ☐ Description of indicators on front panel _____
- ☐ Appliances operating when problem occurred _____
- ☐ Description of problem _____

Xantrex Technology Inc.

1 800 670 0707 Tel toll free NA
1 360 925 5097 Tel direct
1 800 994 7828 Fax toll free NA
1 360 925 5143 Fax direct
customerservice@xantrex.com
www.xantrex.com