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Operation and Maintenance Manual

GT100 Grid-Tied Photovoltaic Inverter

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Contact Information

Telephone:	1 800 670 0707 (toll free North America) 1 408 987 6030 (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 Manual

Purpose

The purpose of this Operation and Maintenance Manual is to provide explanations and procedures for operating, maintaining, and troubleshooting the GT100 Grid-Tied Photovoltaic Inverter. Installation instructions are available in the GT100 Grid-Tied Photovoltaic Inverter Planning and Installation Manual (Document Part #:153379).

Scope

This Manual provides safety guidelines and information about operating and troubleshooting the unit.

Audience

This Manual is intended for anyone who needs to operate the GT100 Grid-Tied Photovoltaic Inverter. Operators must be familiar with all the safety regulations pertaining to operating high-voltage equipment as dictated by local code. Operators must also have a complete understanding of this equipment's features and functions.

Organization

This Manual is organized into five chapters and two appendices.

Chapter 1, "Introduction" contains information about the features and functions of the GT100 Grid-Tied Photovoltaic Inverter.

Chapter 2, "Operation" contains information on the basic operation of the GT100 Grid-Tied Photovoltaic Inverter.

Chapter 3, "Commissioning" contains information on safely commissioning the GT100 Grid-Tied Photovoltaic Inverter.

Chapter 4, "Troubleshooting" contains information and procedures for troubleshooting the GT100 Grid-Tied Photovoltaic Inverter. It provides descriptions of common situations and errors that may occur and provides possible solutions for resolving fault conditions. It also provides instructions for clearing faults manually, if required.

Chapter 5, "Preventative Maintenance" contains information and procedures for performing preventative maintenance on the GT100 Grid-Tied Photovoltaic Inverter.

Appendix A provides the environmental and electrical specifications for the GT100 Grid-Tied Photovoltaic Inverter.

Appendix B contains the Commissioning Test Record for the GT100 Grid-Tied Photovoltaic Inverter.

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.

GT100 Models

This Operation and Maintenance Manual contains information for four models of the GT100 Grid-Tied Photovoltaic Inverter.

Two of the models are designed to operate with a 208 Vac utility input; one configured for a negative grounded PV array (GT100-208), and the other configured for a positive grounded PV array (GT100-208-PG).

- The model **GT100-208** Grid-Tied Photovoltaic Inverter (208 Vac input, negative grounded) will be referred to as the GT100-208 when it is being referenced individually.
- The model **GT100-208-PG** Grid-Tied Photovoltaic Inverter (208 Vac input, positive grounded) will be referred to as the GT100-208-PG when it is being referenced individually.

Additionally, two of the models are designed to operate with a 480 Vac utility input; one configured for a negative grounded PV array (GT100-480), and the other configured for a positive grounded PV array (GT100-480-PG).

- The model **GT100-480** Grid-Tied Photovoltaic Inverter (208 Vac input, negative grounded) will be referred to as the GT100-480 when it is being referenced individually.
- The model **GT100-480-PG** Grid-Tied Photovoltaic Inverter (480 Vac input, positive grounded) will be referred to as the GT100-480-PG when it is being referenced individually.

When all models are being referenced together, they will be referred to as the **GT100**.

Abbreviations and Acronyms

ANSI	American National Standards Institute
CCU2	Converter Control Unit 2
CFM	Cubic Feet per Minute
CW	Clockwise
DSP	Digital Signal Processor
FPGA	Field Programmable Gate Array
GUI	Graphical User Interface
IEEE	Institute of Electrical and Electronics Engineers
IGBT	Insulated Gate Bipolar Transistor
kcmil	1000 circular mils
LM	Liter per Minute
NFPA	National Fire Protection Association
PBX	Private Branch Exchange
PSL	Phase-Shift Loop
PV	Photovoltaic
UFCU	Universal Frontpanel Control Unit
VFD	Vacuum Fluorescent Display

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

SAVE THESE INSTRUCTIONS - DO NOT DISCARD

This manual contains important safety instructions for the GT100 Grid-Tied Photovoltaic Inverter that must be followed during installation and maintenance procedures.

WARNING: Shock Hazard

Read and keep this Operation and Maintenance Manual for future reference.
Before operating and maintaining the GT100, read all instructions, cautionary markings, and all other appropriate sections of this manual. Failure to adhere to these warnings could result in severe shock or possible death. Exercise extreme caution at all times to prevent accidents.

WARNING: Shock Hazard

The GT100 Inverter Enclosures contain exposed high voltage conductors. The Inverter enclosure doors should remain closed with the latches tightened, except during maintenance or testing. These servicing instructions are for use by qualified personnel who meet all local and governmental code requirements for licensing and training for the installation of Electrical Power Systems with AC and DC voltage to 600 volts. To reduce the risk of electric shock, do not perform any servicing other than that specified in the installation instructions unless you are qualified to do so. Do not open the cabinet doors if extreme moisture is present (rain or heavy dew).

WARNING: Lethal Voltage

In order to remove all sources of voltage from the GT100, the incoming power must be de-energized at the source. This may be done at the main utility circuit breaker and by opening the AC Disconnect and the DC Disconnect Switch on the GT100. Review the system configuration to determine all of the possible sources of energy. In addition, allow five minutes for the DC bus capacitors to discharge after removing power. Follow the “Lockout and Tag” procedure on page xi and page 5–3 to de-energize the GT100.

WARNING: Shock hazard

If a ground fault has occurred, there may be potential between TB4 and GND. The normally grounded pole may be energized and ungrounded.

Risks

WARNING: Shock hazard

Parts of the capacitor charge will still be energized for a maximum of five minutes after being disconnected.
Open doors only after the device is disconnected and discharged. Check whether the device is no longer live (DC voltage) including terminals TB3 and TB4.

WARNING: Explosion hazard

The IGBT module may explode in the event of a major malfunction.The GT100 enclosure doors should remain closed with the latches tightened, except during maintenance or testing.

WARNING: Crush hazard

The inverters have a specific balance point that correlates to their Center of Gravity and can topple down. Exercise care when moving the GT100.

WARNING: Amputation hazard

The inverters contain integrated ventilators including rotating ventilator wheels. Do not place fingers in ventilator.

WARNING: Burn hazard

Inverters contain components that become hot during normal operation. Do not touch.

CAUTION

The GT100 incorporates an air supply and exhaust air area, which must remain unobstructed. The device can overheat and be destroyed if the installation instructions are not adhered to.

CAUTION

Sensitive electronics inside the GT100 can be destroyed when touched and when electrostatically charged. Discharge via earth potential before touching and wear appropriate protective gear.

CAUTION

No connections or disconnections are to be made at the terminal strips or internal connectors during operation.
Turn unit off before performing terminal work; wait five minutes (capacitor charge) and recheck to ensure internal components are no longer live.

General Safety Precautions

1. When installing the GT100 use only components recommended or sold by Xantrex. Doing otherwise may result in a risk of fire, electric shock, injury to persons, and will void the warranty.
2. Do not attempt to operate the GT100 if it has been dropped, or received more than cosmetic damage during transport or shipping. If the GT100 is damaged, or suspected to be damaged, see the Warranty section of this manual.
3. To reduce the risk of electrical shock, lock-out and tag the GT100 before attempting any maintenance, service, or cleaning.

Personal Safety

Follow these instructions to ensure your safety while working with the GT100.

Qualified Personnel

Only qualified personnel should perform the transportation, installation and initial operation and maintenance of the GT100 in accordance with National Electrical Code ANSI/NFPA 70, as well as all state and local code requirements. Follow all national accident prevention regulations.

Qualified personnel, within the meaning of these basic safety regulations, will be people who are familiar with the installation, assembly, start-up and operation of the GT100 and have the appropriate qualifications with respect to their functions.

Safety Equipment

Authorized service personnel must be equipped with standard safety equipment including the following:

- Safety glasses
- Ear protection
- Steel-toed safety boots
- Safety hard hats
- Padlocks and tags
- Appropriate meter to verify that the circuits are de-energized (1000 Vac and DC rated, minimum)

Check local safety regulations for other requirements.

Wiring Requirements

1. All wiring methods and materials shall be in accordance with the National Electrical Code ANSI/NFPA 70, as well as all state and local code requirements.
   - Use copper conductors only with an insulation rating of 90 °C.
2. The GT100 has a three-phase, four-wire output.
3. The GT100 is interfaced with the AC utility grid at TB1 (TB1-A, TB1-B, TB1-C and TB1-N), located in the lower left side of the enclosure. These terminals require the use of a UL-approved crimp-on type ring terminal or a UL-approved compression-type lug certified for use with the chosen interface cables. Keep these cables together as much as possible and ensure that all cables pass through the same knockout and conduit fittings, allowing any inductive currents to cancel. For torque values, see Table A-5 on page A–5. See Figure 1-3 on page 1–5 for the location of these terminals.
4. The AC neutral terminals (H0 and X0), shall be left floating (not connected) on both the utility and inverter sides of the isolation transformer.
   See page xi for details.
5. The GT100 is interfaced with the DC photovoltaic array at TB3, TB4 and TB5 (PV GND), located in the lower right side of the enclosure. Do not connect the grounded pole of the PV array directly to TB5 (PV GND); doing so will bypass the ground fault detector and violate the NEC. These terminals require the use of a UL-approved crimp-on type ring terminal or UL-approved compression-type lug certified for use with the chosen interface cables. Keep these cables together as much as possible and ensure that all cables pass through the same knockout and conduit fittings, allowing any inductive currents to cancel. For torque values, see Table A-6 on page A–5. See Figure 1-5 on page 1–8 and Table 1-1 on page 1–8 for the location and polarity of these terminals.
6. This product is intended to be installed as part of a permanently grounded electrical system as per the National Electrical Code ANSI/NFPA 70, as well as all state and local code requirements. A copper clad earth grounding electrode must be installed within 3 ft. (1 m) of the GT100 enclosure. The AC ground bus bar (TB2), located in the lower left side of the GT100 enclosure, must be used as the single point connection to the earth grounding electrode for the inverter system.
7. The equipment grounds on the GT100 are marked with  .
8. AC overcurrent protection for the utility interconnect (Grid-tie) must be provided by the installers as part of the GT100 installation.

CAUTION: Fire Hazard

In accordance with the National Electrical Code, ANSI/NFPA 70, connect only to a circuit provided with 400 amperes maximum branch circuit overcurrent protection for models GT100-208 and GT100-208-PG, and only to a circuit provided with 200 amperes maximum branch circuit overcurrent protection for models GT100-480 and GT100-480-PG.

Inverter Isolation Transformer

The GT100 includes a custom, high-efficiency, isolation transformer. The utility side windings of the isolation transformer are configured Wye and must match the voltage at the utility inter-tie. The GT100 is a balanced, three-phase, current-sourcing inverter and only operates with the presence of a stable utility voltage. The transformer is supplied with a neutral connection on both the Primary and Secondary windings. Connection of these neutral terminals will affect the operation of the GT100 and must be left floating or disconnected. Single-phase, grounded loads which may be present between the transformer and utility, will maintain their existing ground reference at the utility distribution transformer.

CAUTION: Equipment Damage

If the Isolation Transformer neutral (H0 and X0) terminals are tied to ground, they may cause irreparable damage to the GT100. Check local regulations for their requirements regarding the connection of these neutrals.

Operational Safety Procedures

Never work alone when servicing this equipment. A team of two is required until the equipment is properly de-energized, locked-out and tagged, and verified de-energized with a meter.

Thoroughly inspect the equipment prior to energizing. Verify that no tools or equipment have inadvertently been left behind.

Lockout and Tag

Safety requirements mandate that this equipment not be serviced while energized. Power sources for the GT100 must be locked-out and tagged prior to servicing. A padlock and tag should be installed on each energy source prior to servicing.

WARNING: Shock Hazard

Review the system schematic for the installation to verify that all available energy sources are de-energized. DC bus voltage may also be present. Be sure to wait the full five minutes to allow the capacitors to discharge completely

The GT100 can be energized from both the AC source and the DC source. To ensure that the inverter is de-energized prior to servicing, lockout and tag the GT100 using the following procedure.

1. Turn the GT100 main ON/OFF switch (S3) to the OFF position. This stops the inverter from exporting power to the AC utility grid.
2. Open, lockout, and tag the incoming power at the utility main circuit breaker.

3. Open, lockout, and tag the AC Disconnect (CB1) on the left door of the GT100 enclosure. See Figure 1-7 on page 1–10 for the location of the AC Disconnect.
4. Open, lockout, and tag the DC Disconnect Switch (S1) on the right door of the GT100 enclosure. See Figure 1-7 on page 1–10 for the location of the DC Disconnect Switch.

CAUTION

Once the DC Disconnect Switch (S1) is open, there will be DC voltage on the PV Array side of the switch where TB3, TB4, and TB5(PV GND) are located. This voltage may be as high as the Open-Circuit Voltage of the PV Array and is limited to 600VDC per NEC 690.

5. Using a confirmed, accurate meter, verify all power to the inverter is de-energized. A confirmed, accurate meter must be verified on a known voltage before use. Ensure that all incoming energy sources are de-energized by checking the following locations at all line-to-line and all line-to-ground configurations.
   - **AC Utility Terminals: [TB1-A, TB1-B, TB1-C, TB1-N, and TB2(GND BUS)]**
     See Figure 1-3 on page 1–5 for the location of these terminals.
   - **PV Terminals: [TB3, TB4, and TB5 (PV GND)]**
     See Figure 1-5 on page 1–8 for the location of these terminals.

De-Energize/Isolation Procedure

The following procedure should be followed to de-energize the GT100 for maintenance.

WARNING

The terminals of the DC input may be energized if the PV arrays are energized. In addition, allow five minutes for all capacitors within the main Enclosure to discharge after disconnecting the GT100 from AC and DC sources.

To isolate the GT100:

1. Turn the main ON/OFF switch (S3) to the OFF position.
2. Open the utility connection circuit breaker.
3. Open the AC Disconnect (CB1).
4. Open the DC Disconnect Switch (S1).
5. Install lockout devices on the utility connection circuit breaker, AC and DC disconnect switch.

Interconnection Standards Compliance

The GT100 complies with FCC Part 15 Class A requirements.

The GT100 is designed to meet NEC Article 690 and UL1741-2005 *Static Inverters And Charge Controllers For Use In Photovoltaic Power Systems*, which includes testing for IEEE 1547.1-2005, IEEE 929-2000 and IEEE 519-2000.

Intended Use

The GT100 may only be used in connection with PV modules. It is not suitable for any other application areas.

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2 Operation

3 Commissioning

4 Troubleshooting

5 Preventative Maintenance

A Specifications

B Commissioning Test Record

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1 Introduction

Chapter 1, “Introduction” contains information about the features and functions of the GT100 Grid-Tied Photovoltaic Inverter.

Description of the GT100

The GT100 Grid-Tied Photovoltaic Inverter is a utility interactive, three-phase power conversion system for grid-connected photovoltaic arrays with a power rating of 100 kW. Designed to be easy to install and operate, the GT100 automates start-up, shutdown, and fault detection scenarios. With user-definable power tracking that matches the inverter to the array and adjustable delay periods, users are able to customize startup and shutdown sequences. Multiple GT100 inverters are easily paralleled for larger power installations.

Power Conversion System

The GT100 power conversion system consists of a pulse-width modulated (PWM) inverter, switch gear for isolation and protection of the connected AC and DC power sources. Housed in a rugged NEMA 3R rated, corrosive resistant, powder-coated steel enclosure, the GT100 incorporates sophisticated Insulated Gate Bipolar Transistors (IGBTs) as the main power switching devices. An advanced, field-proven, Maximum Peak Power Tracker (MPPT) integrated within the GT100 control firmware ensures the optimum power throughput for harvesting energy from the photovoltaic array.

Advanced Design Features

The advanced design of the GT100 includes an EMI output filter and the main AC contactor located electrically on the utility side of the isolation transformer to minimize transformer tare losses when the unit is not operating.

The GT100 also includes an Inrush Limit assembly to prevent nuisance Utility Circuit Breaker trips when the isolation transformer is energized.

A sophisticated control scheme optimizes the operation of the GT100 cooling fan as needed for increased overall system efficiency.

Additionally, the GT100 integrated controller contains self-protection features including over and under voltage and frequency safeguards in compliance with UL 1741 Rev 2005.

Anti-islanding An integral anti-island protection scheme prevents the inverter from feeding power to the grid in the event of a utility outage.

Auto-Phase Rotation The GT100 includes the ability to auto-sense and correct for a “mis-phased” connection at the AC Interface terminals. In the event the power conductors from the utility are not phased correctly at the AC Interface terminals, the GT100 will sense the discrepancy and automatically correct for a clockwise (A-B-C) phase rotation.

Local Display and Remote Graphic User Interface

The GT100 includes a local user interface comprised of an ON/OFF switch, keypad, and 4-line, 80 character VFD display.

A user-friendly, Xantrex GT View Graphic User Interface (GUI) provides a remote interface for operator interrogation of GT100 system status, control, metering/data logging and protective functions within the GT100. The status, control, and logging features are supported by an optional modem via an RS232 connection for remote monitoring. Alternatively, a user selectable RS485/Modbus connection is also available for remote plant monitoring.

Physical Characteristics

The GT100 is assembled in a single NEMA-3R, corrosive resistant, powder-coated enclosure that includes two access doors to house the electronics described above. Internally, the GT100 is compartmentalized to include sections for the AC Interface (left side), the Power Electronics (upper middle), the Isolation Transformer (lower middle), and the DC Interface (right side). The single enclosure is constructed and delivered as one complete assembly.

These sections are identified in Figure 1-2 on page 1–4.

Figure 1-1 Main Inverter (Open Enclosure View)

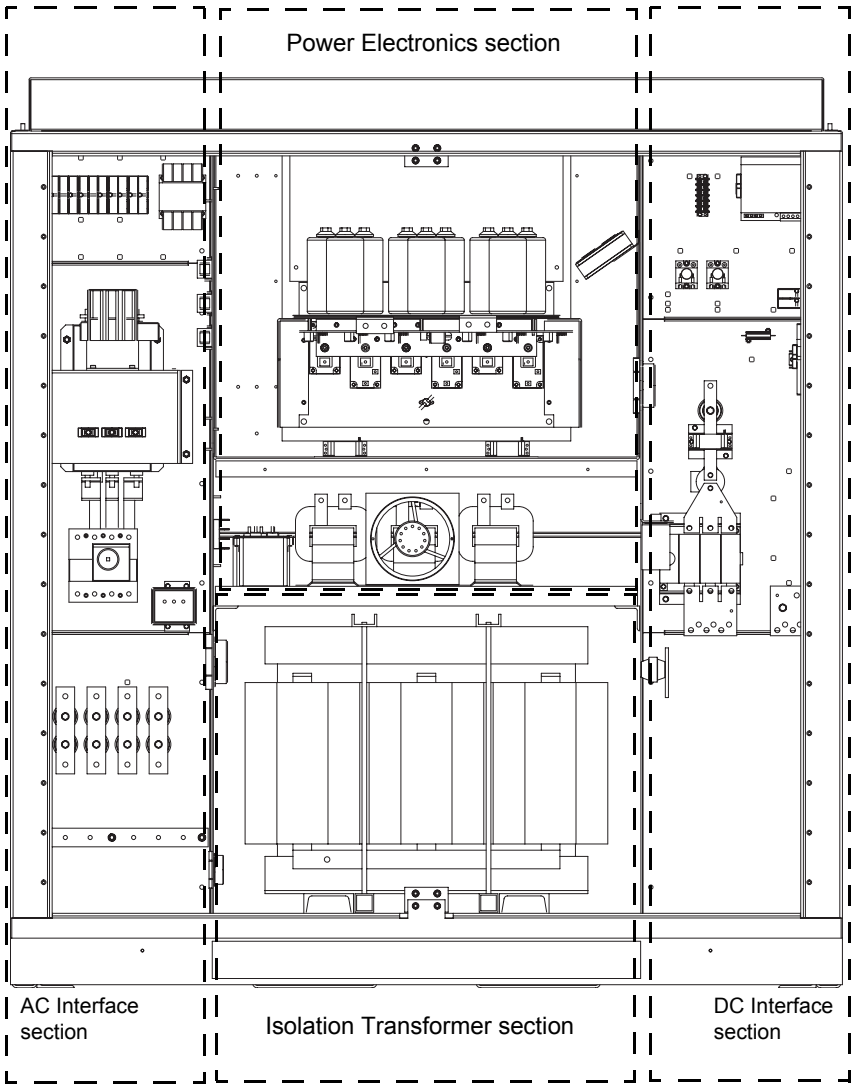

Figure 1-2 GT100 Major Sections

AC Interface

The AC Interface serves as the connection for the utility (see Figure 1-2 to locate the AC Interface). This compartment (section) houses the AC Terminals (TB1-N, -A, -B, and -C), AC Disconnect, AC Contactor, and EMI Filter. Additionally, the Inrush PCB assembly, control power transformer, control fuses, and AC sensing circuitry are also housed in this section.

AC Utility Terminals

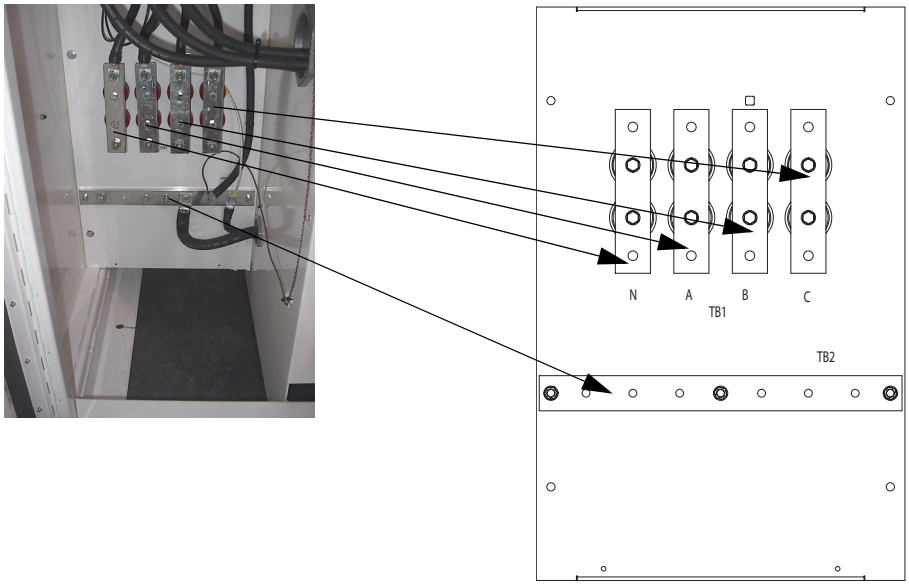

Figure 1-3 AC Utility Terminals

Each terminal provides space for two cables with a M10 bore diameter (see Table A-5 on page A–5 for torque requirements).

Auxiliary Control Interface

The GT100 has provisions within the AC Interface for installing auxiliary control signals that include a remote Emergency Stop and a remote Enable/Disable signal. Two pairs of dry contact circuits at the TB7 terminal are used for control of these input signals. Circuit termination and signal type are identified in Figure A-7 on page A–5.

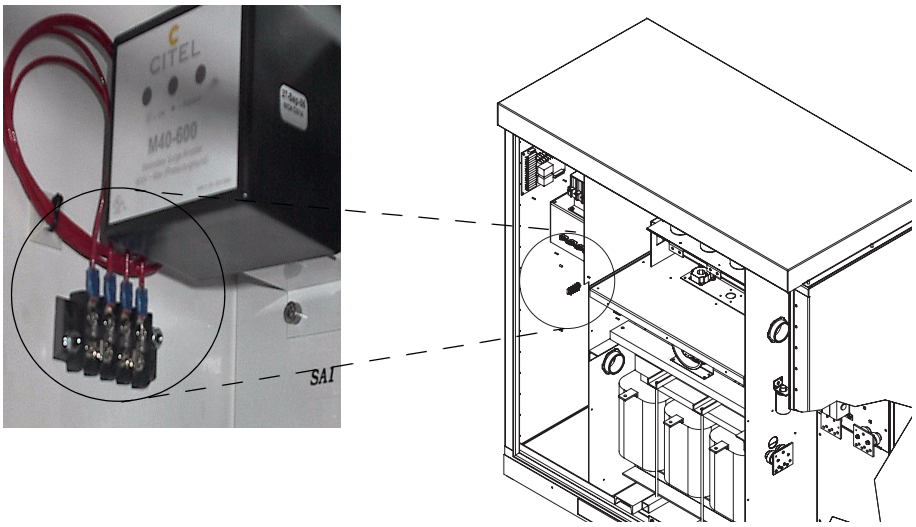

Figure 1-4 Auxiliary Control Terminals

Communications Circuit

The GT100 can be remotely accessed through an RS232 serial port or through an RS485/Modbus connection. Xantrex offers modems that can be connected to the RS232 port for remote monitoring. The remote user has the ability to control and monitor the status of the inverter through this connection.

Alternatively, a user selectable RS485/Modbus connection is also available for remote plant monitoring. The CCU2 Controller board within the GT100 may be configured for RS485 serial communication using the Modbus protocol. This enables users to monitor and control the inverter from a dedicated plant wide monitoring system.

Power Electronics

The GT100 Power Electronics section contains the converter control unit (CCU2) and the power electronics matrix. Also found within the Power Electronics section are the Hall-effect current transducers, and an internal air circulation fan.

Converter Control Unit (CCU2)

The CCU2 is a Digital Signal Processor (DSP) based control board that performs numerous control and diagnostic functions associated with GT100 operation. Its most significant tasks are control of GT100 electromechanical components and power electronics converters, communication with the Universal Front Panel Control Unit, and system sensors. The CCU2 also contains the necessary DC power supplies to support its operation.

Power Electronics Matrix

The power electronics converter matrix consists of switching transistors (IGBTs), transistor gate drive electronics, laminated DC bus structure, DC capacitors and an aluminium extrusion heatsink with a cooling fan. The fan is located behind the matrix assembly and forces air down through the heatsink.

The PV array is tied logically to the matrix DC bus within the DC Interface section. The embedded CCU2 control unit manages the transfer of power between the DC bus and the utility grid.

DC Interface

The DC Interface serves as the connection interface between the PV array and the GT100 (see Figure 1-2 on page 1–4 to locate the DC Interface). This section houses the DC Disconnect Switch and DC contactor. Additionally, the PV Ground Fault Detection circuitry, DC surge arrestor, Solid State Relays, and 48Vdc Power Supply are also housed in this section.

DC Terminals

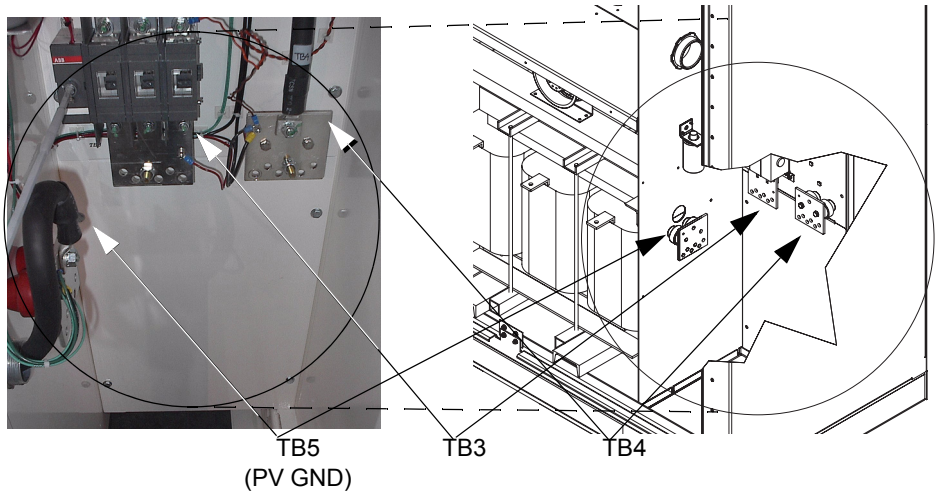

Figure 1-5 DC Terminals

The terminals provide six holes with space for twelve cables with a M10 bore diameter per pole (see Table A-6 on page A–5 for torque requirements).

The table below describes the DC terminal polarity for each GT100 model.

Table 1-1 DC Terminal Polarity

Model	TB3	TB4	TB5
GT100-208	PV+	PV–	PV GND
GT100-208-PG	PV–	PV+	PV GND
GT100-480	PV+	PV–	PV GND
GT100-480-PG	PV–	PV+	PV GND

Circuit Diagram

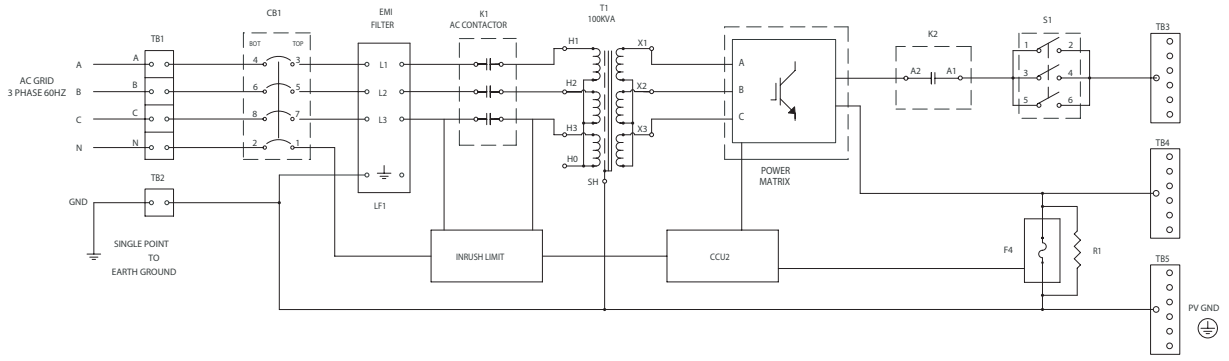

Figure 1-6 GT100 Circuit Diagram

Operator Interface Controls

Operator interface controls are located on the left front door of the main Inverter Enclosure. These controls include an ON/OFF Switch, 4-line VFD display and keypad called the Universal Frontpanel Control Unit (UFCU) used to manipulate and view system operation and status. The keypad is comprised of 20 touch-sensitive keys that provide a means to navigate through the menus and alter user-changeable settings. Additionally, there is an AC Disconnect switch handle and DC Disconnect switch handle on the AC Interface door (left) and the DC Interface door (right) respectively.

Figure 1-7 GT100 Operator Interface Components

On/Off Switch

The GT100 incorporates a maintained position ON/OFF switch located on the left front door, under the UFCU. Under normal operating conditions, the ON/OFF switch is in the ON position. Turning the switch to the OFF position will initiate an immediate controlled shutdown of the GT100 and open both the main AC and DC contactors within the unit. The main AC and DC contactors cannot be closed unless the switch is in the ON position. The GT100 is prevented from being restarted until the ON/OFF switch is turned back to the ON position.

WARNING: Shock Hazard

Turning the ON/OFF switch to the OFF position does NOT remove all hazardous voltages from inside the inverter. Before attempting to service the GT100, follow the de-energize Lockout and Tag procedure on page xi and page 5–3.

Figure 1-8 On/Off Switch

Emergency Stop (E-STOP)

Provisions are supplied for adding a remote emergency stop. Circuit termination and signal type are identified in Table A-7 on page A–5.

Auxiliary Enable/Disable

The GT100 also has provisions for installing an auxiliary Enable/Disable switch in series with the local control. Circuit termination and signal type are identified in Table A-7 on page A–5

AC Disconnect and DC Disconnect Switches

Both enclosure doors of the GT100 are equipped with lockout hasps for personnel safety. The enclosure doors should not be opened while the GT100 is operating.

The switch handles and shafts provide a mechanical door interlock for both the AC and DC Interface sections. The doors cannot be opened when the switches are in the ON position.

Although the Main ON/OFF switch (S3) is recommended for an orderly shutdown, the DC Disconnect switch is equipped with an auxiliary contact block which enables the switch to be used as a load break DC disconnect. In the event the DC Disconnect switch is opened while the GT100 is processing power from the PV array, the early-break contact block will signal the CCU2 (Converter Control Unit) to stop processing power prior to opening the DC Disconnect switch.

Additionally, opening the DC Disconnect switch will cause the GT100 to execute an immediate orderly shutdown, open both the main AC and DC contactors, and report a PV disconnect fault on the VFD of the UFCU.

Both GT100 enclosure doors must be closed and locked during normal operation.

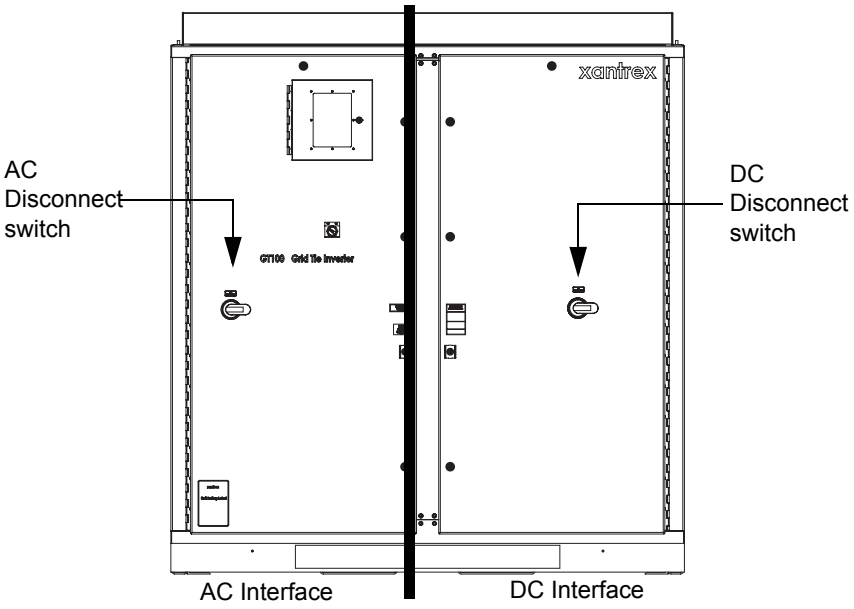

Figure 1-9 AC and DC Disconnect Switches

Operation Features

The GT100 has the following operation features.

Fixed Unity Power Factor Operation

The GT100 maintains unity power factor during operation. The control software constantly senses utility voltage, and constructs the output current waveform to match the utility voltage. The GT100 is not capable of operation without the presence of normal utility voltage, nor is it capable of varying the output power factor off unity.

Peak Power Tracking

An advanced, field-proven, Maximum Peak Power Tracker (MPPT) algorithm integrated within the GT100 control software ensures the optimum power throughput for harvesting energy from the photovoltaic array. The peak power voltage point of a PV array can vary, primarily depending upon solar irradiance and surface temperature of the PV panels. This peak power voltage point is somewhat volatile, and can easily move along the I-V curve of the PV array every few seconds. The MPPT algorithm allows the GT100 to constantly seek the optimum voltage and current operating points of the PV array, and maintain the maximum peak PV output power.

Accessible via the UFCU, there are five user-settable parameters that control the behavior of the maximum peak power tracker within the GT100. As show in Figure 1-10 on page 1–14, user settable parameters include:

- PPT V Ref (ID# 37),
- I PPT Max (ID#42),
- PPT Enable (ID# 44),
- PPT Rate (ID# 45), and
- PPT V Step (ID# 46).

Upon entering the Power Tracking mode, it takes approximately 20 seconds for the GT100 to ramp the PV voltage to the “PPT V Ref” setpoint regardless of the actual PV voltage.

With the “PPT Enable” set to “0” (power tracker disabled), the GT100 will regulate the DC Bus at the “PPT V Ref” setpoint. Regulating the DC bus means drawing more or less current out of the PV array to maintain this desired voltage.

With the “PPT Enable” set to “1” (power tracker enabled), followed by the expiration of the “PPT Rate” (MPPT decision frequency), the MPPT will reduce the reference voltage by an amount equal to the “PPT V Step” value.

At this point the MPPT will compare the amount of AC output power produced to the previous amount of AC power produced by the GT100. If the output power has increased, the next change made (after “PPT Rate” has again expired) to the reference voltage, will be in the same direction.

Conversely, if the power comparison proves undesirable, the power tracker will reverse the direction of the change to the “PPT_V Step”. The MPPT algorithm within the GT100 will then continue this ongoing process of “stepping and comparing” in order to seek the maximum power throughput from the PV array.

The changes made by the MPPT to the reference voltage are restricted to ± 20% of “PPT V Ref” and by the maximum and minimum PV input voltage (600 and 300 V respectively). Also, the MPPT will not attempt to produce power greater than that allowed by the “I PPT Max” setpoint. If available PV power is above the maximum allowable power level of the GT100, the MPPT will increase voltage as needed to maintain output power below the rated maximum.

Optimization of the GT100 MPPT will result in an increase in energy production. The user is encouraged to study the PV array’s I-V curves and to adjust the MPPT user settable parameters accordingly.

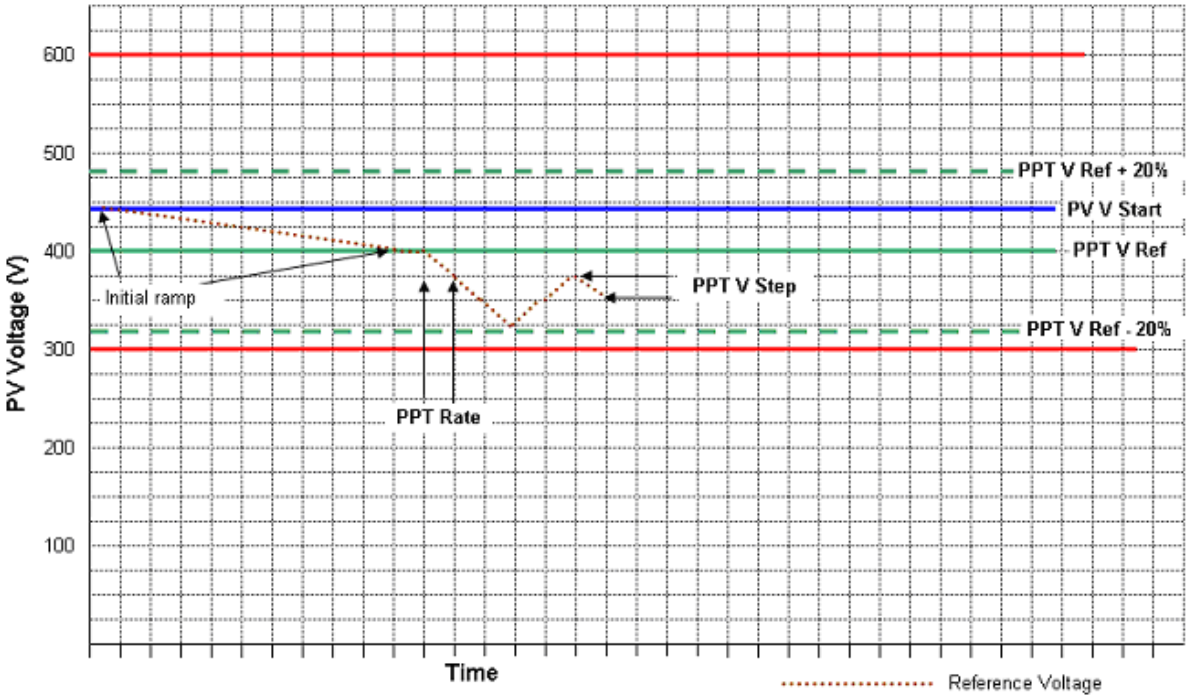

Figure 1-10 Maximum Peak Power Tracking

Utility Voltage/Frequency Fault Automatic Reset

In the event of a utility voltage or frequency excursion outside of preset limits, the GT100 will stop operation and display a fault at the operator interface. Once the utility voltage has stabilized within acceptable limits for a period of at least 5 minutes, the GT100 will automatically clear the fault and resume normal operation. Voltage and frequency fault setpoints are detailed later in this section.

Safety Features

Anti-Island Protection

A condition referred to as "Islanding" occurs when a distributed generation source (such as the GT100 Grid-tied Photovoltaic Inverter) continues to energize a portion of the utility grid after the utility experiences an interruption in service. This type of condition may compromise personnel safety, restoration of service, and equipment reliability.

The GT100 employs a method for detecting the islanding condition using a Phase-Shift-Loop (PSL). This method is implemented in the CCU2 to prevent islanding of the GT100. The CCU2 continuously makes minor adjustments to the power factor phase angle above and below unity. In the event of a utility interruption or outage, these adjustments destabilize the feedback between the inverter and the remaining load, resulting in an over/under frequency or voltage condition.

Upon detection of such a condition, the GT100 then performs an immediate orderly shutdown and opens both the main AC and DC contactors. The fault condition will remain latched until the utility voltage and frequency have returned to normal for at least 5 minutes.

This method has been extensively tested and proven to exceed the requirements of IEEE-929 (Recommended Practices for Utility Interface of Photovoltaic [PV] Systems) and UL 1741 (Static Inverters and Converters for use in Independent Power Systems).

PV Ground Fault Detection

The GT100 is equipped with a PV Ground Fault Detection and Interruption circuit. The circuit employs a 4 A fuse between TB4 and TB5 (PV GND). If sufficient ground current clears the fuse, and auxiliary contact will signal the GT100 to execute an immediate orderly shutdown, open both the AC and DC contactors and report a PV Ground on the VFD of the UFCU. The GT100 will remain faulted until the fault is remedied and the advisory is cleared at the operator interface.

DC Over-voltage Detection

In the event of DC voltage greater than 600 Vdc, the GT100 will execute an orderly shutdown and will report a PV over-voltage fault on the VFD of the UFCU. If the DC voltage remains greater than 600 Vdc, the GT100 may be irreparably damaged.

See Chapter 4, “Troubleshooting” for further information on this fault condition.

Communication Features and Methods

The GT100 provides three types of information to the user:

- system status and/or fault information,
- data logging information, and
- oscillography.

System status and fault information can be accessed using the Universal Front Panel Control Unit (UFCU), via an RS232 connection to a PC or via an RS485/ Modbus connection to a remote monitoring system. Data logging and oscillography is available via the RS232 or the RS485/Modbus connection.

The GT100 communicates system status information to the user using the following methods.

- The Front Panel Control Unit (UFCU) Display
- PC Connection (Remote) - GT View Graphic User Interface (GUI) Software required (may require additional hardware)
- External Monitoring - (Optional) via a RS485/Modbus connection for remote plant monitoring.

System Status and Fault Reporting

Basic system status and all fault conditions rising from within the GT100 are reported to the UFCU. The 4-line VFD will display a hexadecimal value and a brief text description of the fault. Additionally, the CCU2 stores the time and details of all faults in non-volatile memory for later retrieval.

The fault value is also made available to the GT View Graphic User Interface (GUI) via the RS485/Modbus protocol and will include a more extensive description of the fault.

Types of status information include:

- Current Operating State or Goal State
- Fault Code (if applicable)
- Inverter State
- Line Voltage and Current
- Inverter Matrix Temperature
- Inverter Power
- PV State
- PV Voltage and Current
- PV Power
- Grid Frequency
- Peak Power Tracker Enabled

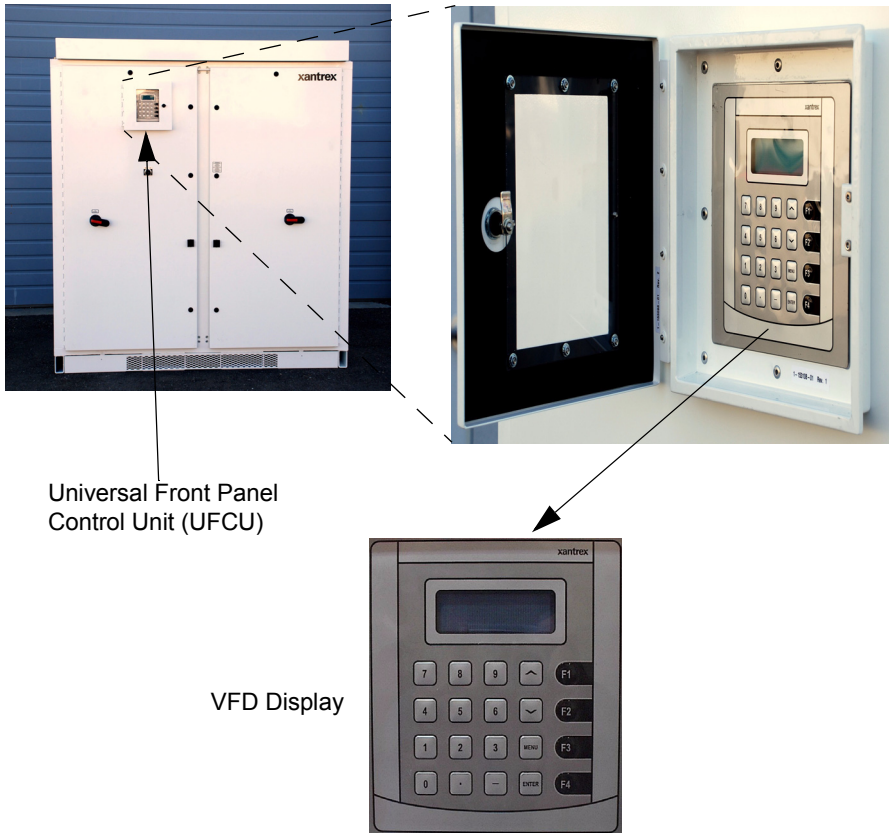

Figure 1-11 VFD Display and UFCU Location

Data Logging

The GT100 inverter stores data values and software metrics for debugging. The firmware maintains a data log located in the CCU2 non-volatile memory with a capacity of 25840 32-bit words. The GT100 records the 17 parameters listed below, and logs them into a circular buffer, such that the earliest records shall be overwritten once the capacity of the buffer is exceeded. The log capacity is 25840 / 20 = 1292 records (each record has 2 words for timestamp and 18 words for parameters). Data logging requires the use of a PC connection using the GT View Graphic User Interface (GUI) software or via the RS485/Modbus connection.

The following is the list of parameters which values shall be stored in the data logging records:

- Inverter Vab
- Inverter Vbc
- Inverter Vca
- I Phase A
- I Phase B
- I Phase C
- Grid Freq
- Real Power
- PV Voltage
- PV Current
- PV Power
- System State
- Fault Code
- Intake air Temp.
- Matrix Temp.
- Analog input
- Fan speed control

Oscillography

The GT100 includes a graphic data analysis tool known as Oscillography. The inverter firmware continuously records, in the CCU2 non-volatile memory, 500 samples of data at 1 millisecond intervals. Of these, 250 samples are taken right before a fault occurs and 250 samples are taken after the fault. Once a fault occurs and the 250 samples are logged, the log stops and goes into DONE status. The log will start recording again as soon as the fault is cleared. Oscillography requires the use of a PC connection using the GT View Graphic User Interface (GUI) software or via the RS485/Modbus connection.

The following is the list of parameters which instant values shall be stored in the oscillography records:

- Vab - Grid voltage phase A to phase B
- Vbc - Grid voltage phase B to phase C
- Vca - Grid voltage phase C to phase A
- Ia - Grid current phase A
- Ib - Grid current phase B
- Ic - Grid current phase C
- Grid Hz - Grid frequency
- DC_V - PV array voltage
- DC_I - PV array current
- Fault - hexadecimal code of the fault

Optional Equipment

The following options are available for purchase for use with the GT100 to enhance its capability. Contact a Xantrex distributor for further information on installation options.

Communication Modems

Xantrex offers modems that can be connected to the RS232 serial port for remote monitoring of the inverter. Please check with Xantrex on available modem types.

The remote user has the ability to control and monitor the status of the inverter through this connection.

PV Combiner Enclosure

The GT100 is available with an optional fused sub-array combiner. The combiner is integrated in the inverter enclosure and allows for multiple runs from the PV Arrays to the inverter directly into a fuse for circuit protection. Please check with Xantrex on available fuse sizes.

2 Operation

Chapter 2, “Operation” contains information on the basic operation of the GT100 Grid-Tied Photovoltaic Inverter.

Description of System Operation

Overview

The GT100 is a fully automated grid-interactive photovoltaic power inverter. System startup, system shutdown, PV power tracking, and fault detection scenarios are all governed and monitored by the CCU2 controller within the GT100. Manual interaction or control of the inverter is necessary only in the event of a system fault. Additionally, the following conditions govern operation of the GT100.

- Stable utility AC voltage and frequency as specified in Table A-2 must be present for all states of operation.
- PV voltage as specified in Table A-2 must be present.
- With the exception of the Matrix Test state, the ON/OFF switch (S3), located on the front door of the GT100 Inverter Enclosure, must be switched to the ON position for all operating states.
- Both the AC and DC Disconnect switches must be in the ON or closed position.
- Fault conditions must not be present.

Faults

Fault states are automatic from any state of operation. In the event of a fault condition, the GT100 will immediately stop processing power and execute an immediate orderly shutdown, open both the main AC and DC contactors, and remain in a faulted state until the fault is remedied and cleared (manually or automatically).

Most faults are latching, and only those faults associated with grid disturbances and Air Duct Intake temperature are auto-clearing and thus enable the GT100 to restart after a delay period. All fault conditions arising from within the GT100 are reported to the UFCU (Universal Frontpanel Control Unit). The 4-line VFD on the UFCU will display a hexadecimal value (fault code) and a brief text description of the fault.

Once the cause of the fault has been identified and corrected, and it is determined to be safe to proceed, GT100 faults may be cleared from the UFCU keypad or via the remote GUI.

See “Clearing Faults Manually” on page 4–4 for instructions on this procedure.

Operating States

A state machine implemented within the CCU2 control software governs the operation of the GT100 with clearly defined transitions between its operating states. There are five steady-state operating states and numerous intermediate transition states.

- Shutdown
- Transition
- Power Tracking
- Automatic Sleep Test
- Manual Current
- Matrix Test
- Fault

The user should be aware of the following conditions governing GT100 state transitions:

- Qualified utility voltage must be present for all states of operation.
- Fault states are automatic from any state of operation. A fault will cause the GT100 to immediately stop processing all power. The fault condition will be reported to the operator interface VFD.
- Most GT100 faults are latching and must be cleared at the operator interface keypad before transitioning to another operating state.
- The **ON/OFF** switch, located on the front door of the GT100, must be in the ON position for all operating states except Matrix Test, in which case it must be in the **OFF** position.

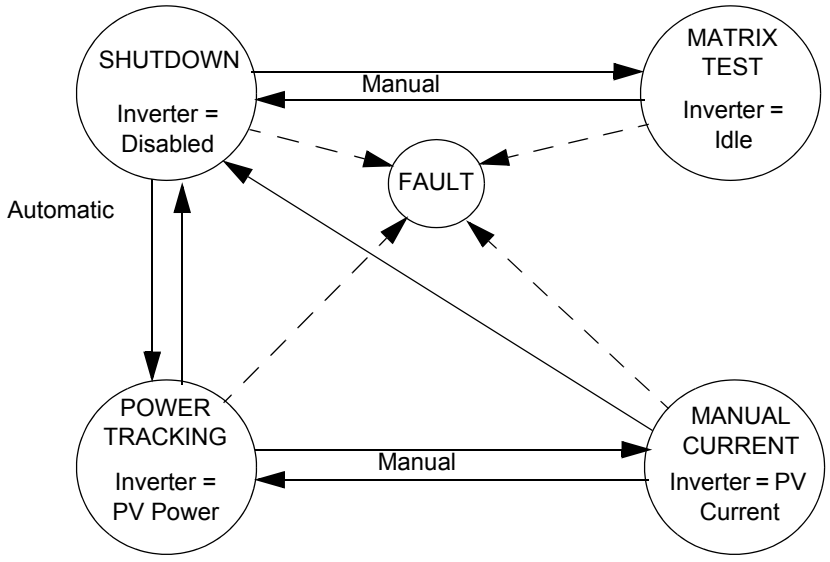

Figure 2-1 State Transition Diagram

Shutdown

The line interface controller is idle. The CCU2 monitors the status of the PV array and utility grid, waiting in standby until the PV array is available to produce power to the grid.

Transition

The intermediate transition states provide an orderly progression from one operating state to the next. The user has the ability to manually transition the GT100 between operating states via the operator interface keypad or remotely using the GUI software. Manual transitions are initiated by entering a “Goal State”, where the goal state is the desired operating state. Given all applicable system parameters are within acceptable limits, and the request is valid within the state machine, the GT100 will initiate the proper sequence of operations necessary to progress to the requested goal state. Refer to Figure 2-1 on page 2–3 for an illustration of valid state transitions.

Power Tracking

This is the standard operating state of the GT100. The GT100 maximum power tracker will demand maximum power from the PV array, given sufficient PV irradiance. Refer to Figure 2-2 on page 2–6 for an illustration of valid operating states for Power Tracking.

Automatic Sleep Test

Toward the end of every solar day, the GT100 automatically determines when to stop producing power dependent upon the output power of the inverter. As the net output power of the GT100 nears zero, a timer is started to allow the inverter to ride through any brief irradiance reductions.

Manual Current

This operating state is provided to evaluate the existing PV array V-I characteristics. The PV controller regulates a constant amount of PV current as commanded by the user from the operator interface keypad, up to the PV current limit of the GT100. If the user commands more PV current than is available, the DC bus voltage will drop below the minimum bus voltage level and the GT100 will enter Shutdown mode.

Matrix Test

This operating state is provided to verify proper operation of the matrix and associated control electronics. In this state, the CCU2 will send digitized gating signals (On/Off) to the IGBTs at a 2 Hz rate. There is no power transfer between the PV and utility in this mode. The ON/OFF switch must be in the OFF position for the GT100 to enter this state.

Fault

The GT100 has encountered a fault condition. When this happens, regardless of the GT100 state of operation, the GT100 will stop processing all power and execute an orderly system shutdown. A description of the fault and fault code will appear on the operator interface VFD. The Fault state may be cleared from the keypad once the cause of the fault has been corrected. See Chapter 4, “Troubleshooting” for a complete description of all fault codes.

See next page for the Operating States Flow Chart for Power Tracking.

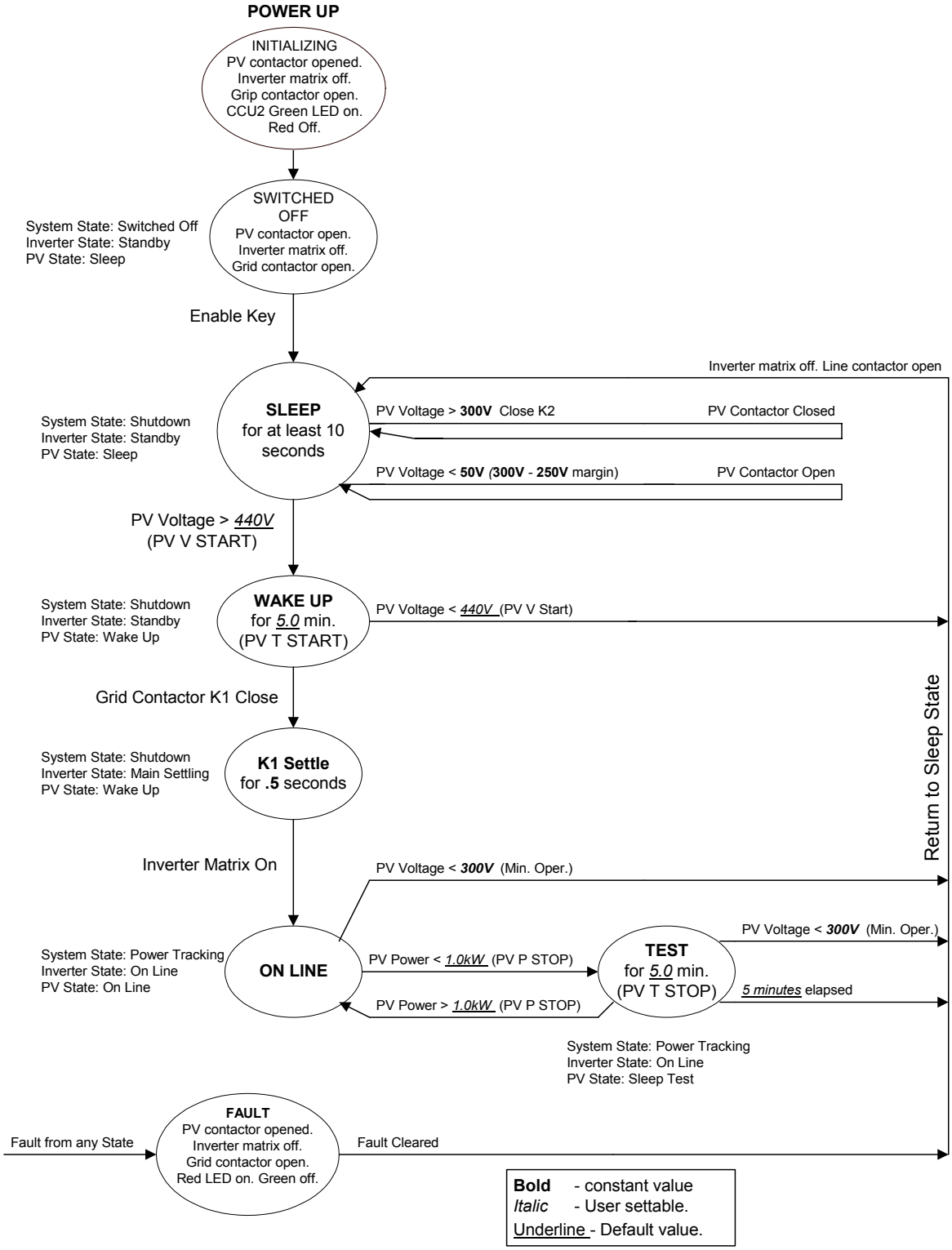

Figure 2-2 Operating States Flow Chart for Power Tracking

Operator Interface

The purpose of the operator interface is to provide a means of communicating critical operational information to and from the unit. This communication occurs between the operator and the UFCU Keypad and VFD display or between the operator and a personal computer running the GT View GUI software. The RS485/Modbus connection is also available for remote monitoring and control systems.

UFCU Keypad Operation and VFD Display

The UFCU keypad is located on the left front door of the Inverter Enclosure to manipulate and view system operation and status.

The keypad is comprised of 20 touch-sensitive, membrane switch keys that provide a means to navigate through the menus and alter user-changeable settings.

1. Four function keys are available.
   - F1 - While in the READ Menu, this key jumps to display "`INV A Volts`". If the GT100 is faulted while in the Read Menu, this key is used to send the "`Clear Fault`" message to the CCU2. While in the Write Menu, this key is used to set "`Goal`:".
   - F2 - While in the READ Menu, this key jumps to display "`INV kW`". While in the WRITE Menu, this key jumps to display "`PPT V Ref:`".
   - F3 - While in the READ Menu, this key jumps to display "`PV kW:`". While in the WRITE Menu, this key jumps to display "`PPT Enable:`".
   - F4 - While in the Read Menu, this key jumps to display "`kWH:`".
     While in the Write Menu, this key is used to both confirm and display parameters.
     When confirming a Goal State change, this key sends the "`Command Goal State`" message to the CCU2.
     When re-setting the KWH, this key sends the "`Reset kWH:`" message to the CCU2.
     When setting all Write Menu parameters to factory default, this key sends the "`Set to Factory Default`" message to the CCU2.
     While in the Write Menu, this key jumps to display "`Factory Default`".

See next page for more.

2. Two Navigation keys are available.
   - \/ or /\ moves forward or backward within the menu structure. Upon reaching the end of the menu, it will roll-over to the beginning of the same menu.
3. Ten numeric keys (0 through 9), two symbol keys (“.” and “-”), and an “**ENTER**” key are available for entering user-settable parameters.
4. The “**MENU**” key allows you to enter the password-protected Write parameters.

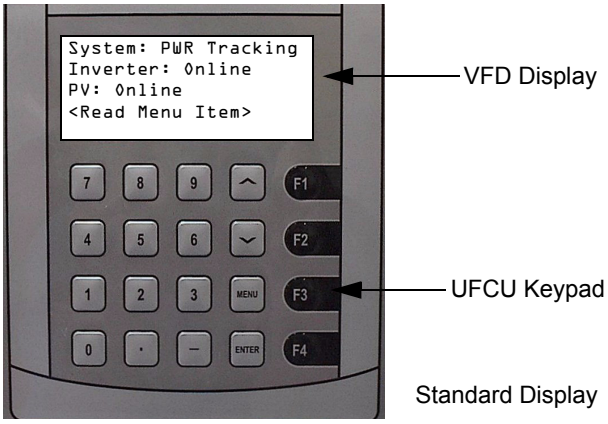

Figure 2-3 The Universal Front Panel Control Unit (UFCU) and VFD

VFD Display - Initialization Screen

Any time AC power is applied to the unit, the VFD display will cycle through the following displays while the system initializes. Once it's done with this process, the standard display will appear.

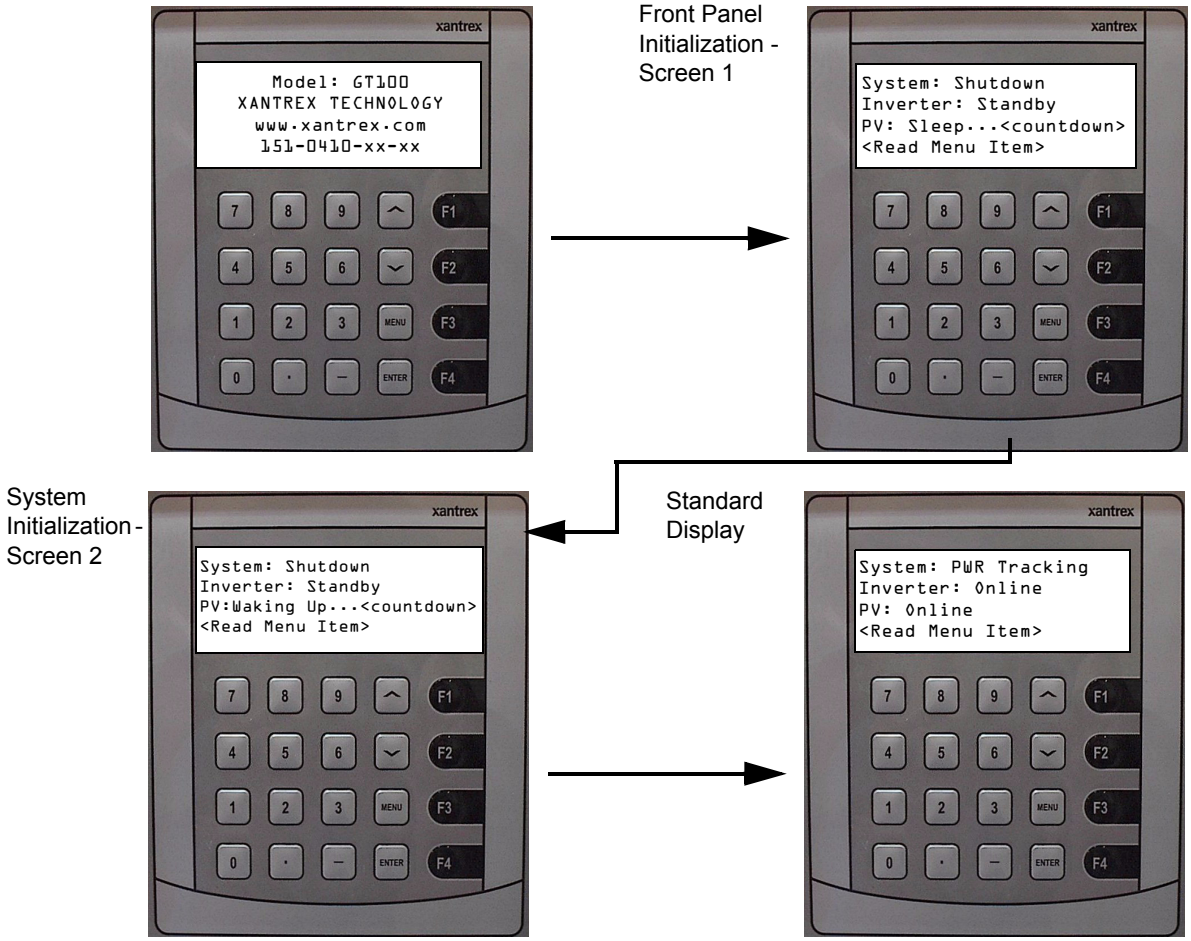

Figure 2-4 Initialization Screens

Standard Display

The Standard Display provides the following information:

- First Line - System Status (ID 1)
- Second Line - Inverter Status (ID 4)
- Third Line - PV Status (ID 13)
- Fourth Line - Goal State (ID 2)

Menu Structure

The operator interface consists of three levels:

- **READ Menu -** operation information provided *to* the user *from* the GT100. The Read Menu consists of all operational values, the date and time. These can be viewed any time the GT100 has control power.
- **WRITE Menu -** operational parameters provided *to* the GT100 *from* the user. The Write Menu consists of a goal state sub-menu, and all system configurable parameters. The Write Menu can be viewed any time the GT100 has control power. However, modifying the parameters requires a password that may only be altered by trained service technicians. Specifically, parameters relating to utility protection setpoints should not be modified.
- **Data Logging -** the collection of specific parameters values over a period of time. The data logging feature is only available if using the GT View GUI. See the list of stored parameters on page 1–18.

Information reported back to the user (READ Menu) occurs at the VFD above the Universal Front Panel Control Unit (UFCU) and (if used) at the computer running the GT View GUI monitoring program. Making changes to the parameters within the Write Menu is done with the UFCU keypad or the GUI software program and requires a password.

Important: *Specific grid-interface parameters within the WRITE Menu have been set in the factory to the limits mandated by the UL 1741. Any changes to these setpoints should be agreed upon by the local utility and the equipment owner.*

Upon system powerup, the operator interface VFD will display the system operating state on the first line. The inverter's state of operation will be reported on the second line. The PV Array's state of operation will be reported on the third line. The Goal target will be reported on the fourth line.

Important: While in the WRITE Menu, the operator interface display will reset itself to the standard display if there is no input for more than 2 minutes.

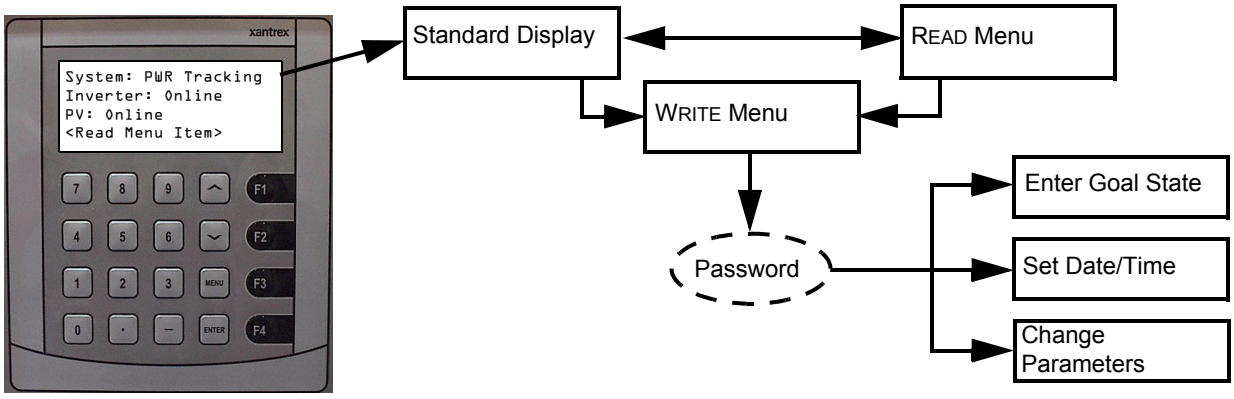

Figure 2-5 Operator Interface Menu Diagram

READ Menu

The **READ** Menu includes the following information:

- Current Operating State or Goal State
- Fault Code (if applicable)
- Inverter State
- Line Voltage and Current
- Inverter Matrix and Air Duct Intake Temperature
- Inverter Power
- PV State
- PV Voltage and Current
- PV Power
- Grid Frequency
- Accumulated Power

Table 2-1 shows how the third and fourth line of the VFD will change as the operator continues scrolling through the Menu. Table 2-2 on page 2–14 provides a detailed description of **READ** Menu operational values that are displayed on the VFD.

To Display Any Operational Value in the READ Menu

From the Standard Display, use the /\ or \/ keys on the operator interface keypad to scroll through the **READ** Menu. The fourth line of the display will change to display the appropriate information. See Table 2-1.

- The \/ key will scroll downward through the menu.
- The /\ key will scroll upward through the menu.

Table 2-1 Scrolling through the Read Menu Parameters

Read Menu Value	Fourth Line of the VFD
FP Software Version	FP V151-0410-xx-xx
CCU Software Version	CCU 151-0130-xx-xx
Model Name	G T 1 0 0 k W
Date and Time	JUN-25-2007 15:35:05
Goal State	PWR Tracking
Inverter A-B Volt	INV A Volts:
Inverter B-C Volt	INV B Volts:
Inverter C-A Volt	INV C Volts:
Inverter A Current	INV A Amps:
Inverter B Current	INV B Amps:
Inverter C Current	INV C Amps:
Inverter AC Power	INV kW:
Inverter Matrix Temperature	INV Temp:

Table 2-1 Scrolling through the Read Menu Parameters

Read Menu Value	Fourth Line of the VFD
Air Duct Intake Temperature	Ambient Temp:
PV Voltage	PV Volts:
PV Current	PV Amps:
PV Power	PV kW:
AC Grid Frequency	Grid Freq:
Accumulated Power	kWH:

When scrolling through the Read Menu Parameter list, and the last item in the menu is reached, the list will revert back to the beginning item.

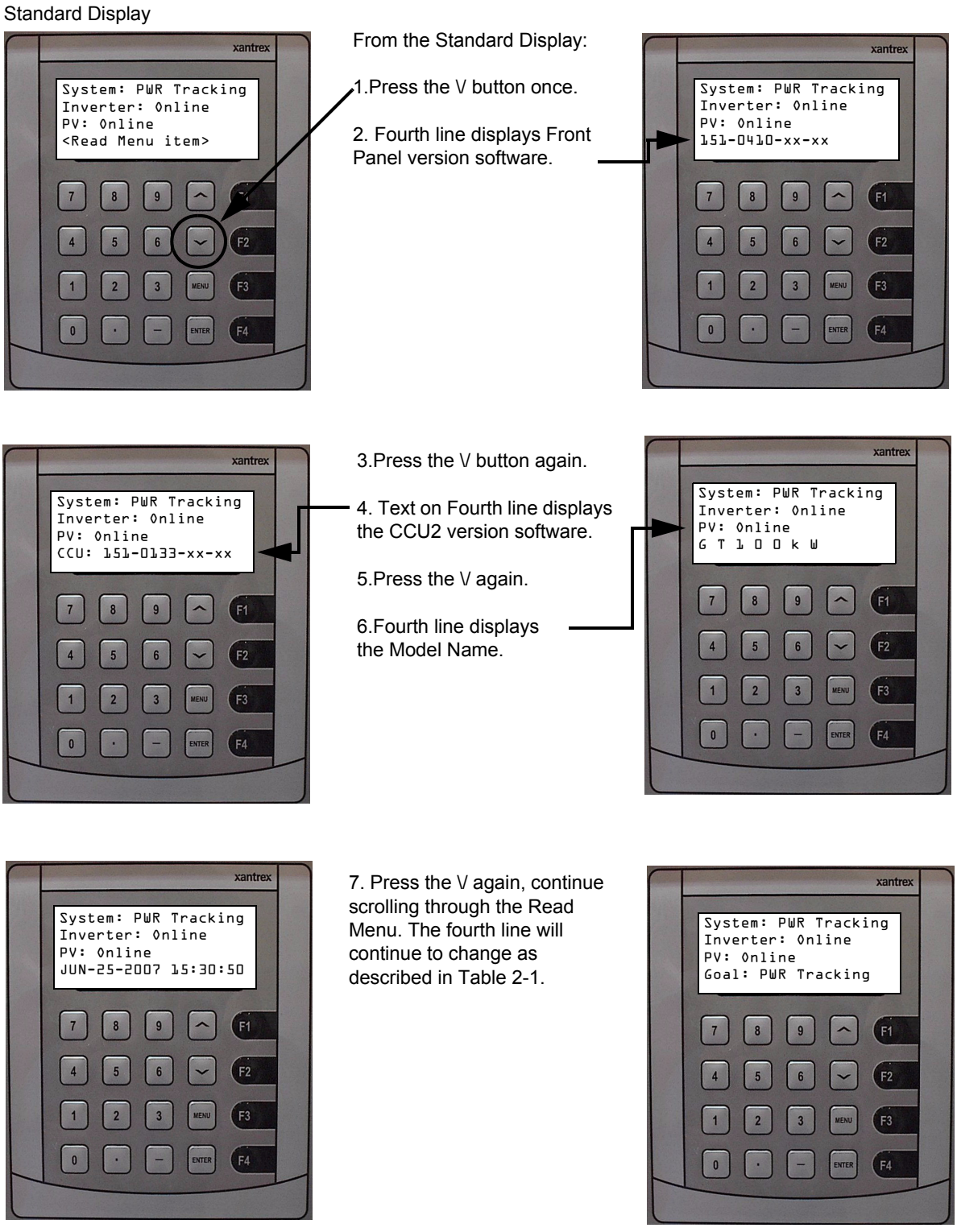

Figure 2-6 Scrolling through the Read Menu

Table 2-2 Read Menu Descriptions

Operational Parameter	Description	ID	Units

Current Operating State
 	
Displays as: `System: *`
 	
where * can be any one of the states listed in the description for this parameter.
	Current system states include the following.
	
	`Initializing (0)`
	`Switched Off(1)`
	`Shutdown (2)`
	`Starting (3)`
	`PWR Tracking (4)`
	`Manual Current (5)`
	`Matrix Test (6)`
	`Faulted (7)`
		1	N/A

System Goal State
 	
Displays as: `Goal: *`
 	
where * can be any one of the states listed in the description for this parameter.
	Goal States include the following.
	
	`Shut Down (2)`
	`PWR Tracking (4)`
	`Manual Current (5)`
	`Matrix Test (6)`
		2	N/A

Fault code	See “Fault Code Descriptions” on page 4–5 for a detailed list of Fault Codes.	3	N/A

Inverter State
 	
Displays as: `Inverter: *`
 	
where * can be any one of the states listed in the description for this parameter.
	Inverter States includes the following.
	
	`Shutdown (0)`
	`Stand-by (1)`
	`Starting (2)`
	`Main-Settling (3)`
	`On-Line (4)`
		4	N/A

Line A–B voltage Displays as: `INV A volts: xxx`	AB Line to line voltage	5	V_{rms}
Line B–C voltage Displays as: `INV B volts: xxx`	BC Line to line voltage	6	V_{rms}
Line C–A voltage Displays as: `INV C volts: xxx`	CA Line to line voltage	7	V_{rms}
Phase A current Displays as: `INV A amps: xxx`	Phase A current	8	A_{rms}
Phase B current Displays as: `INV B amps: xxx`	Phase B current	9	A_{rms}

Table 2-2 Read Menu Descriptions

Operational Parameter	Description	ID	Units
Phase C current Displays as: `INV C amps: xxx`	Phase C current	10	A_{rms}
Inverter Real Power Displays as: `INV KW:`	Inverter Real Power	11	kW
Inverter Matrix Temperature Displays as: `INV Temp.:`	Temperature of the Inverter IGBT matrix heatsink	12	°C

PV State
 	
Displays as: `PV: *`
 	
where * can be any one of the states listed in the description for this parameter.
	PV States include the following.
	
	`Shut Down (0)`
	`Sleep (1)`
	`Wakeup (2)`
	`On-line (3)`
	`Sleep-test (4)`
		13	N/A

PV Voltage Displays as: `PV Volt: xxx`	PV Voltage	14	Vdc
PV Current Displays as: `PV amps: xxx`	PV Current	15	Adc
PV Power Displays as: `PV kW: xxx`	PV Power	16	kW
Grid Frequency Displays as: `Grid Freq:`	Grid Frequency	17	Hz
Air Duct IntakeTemperature Displays as: `Ambient Temperature`	Temperature of the ambient air within the intake duct at the rear of the GT100.	25	°C
Accumulated Power Displays as: `KWH:`	Accumulated AC Power produced by the GT100 since commissioning, or since the last KWH reset.	625	N/A

READ-by-ID

The Read-by-ID feature supports the ability of the user to view any Read or Write parameter available within the menu structure. See Table 2-2 for a list of the Read Menu parameters.

To use the Read-by-ID Feature:

1. From the Standard Display, press the ∨ key and scroll downward through the menu to the Read-by-ID Menu item. Stop when the 3rd and 4th line of the display change as shown in Figure 2-7.
2. Press <**ENTER**> to enter the Read-by-ID feature.
3. Use the keypad to enter the ID number of the Data Log Configuration or Accumulated Value ID number and press <**ENTER**>. See Table 2-2 for a list of **READ** Menu items and their ID numbers.
   a) Press the "." button to move upward in the Menu structure.
   b) Press the "-" to move backward in the menu structure. These keys only function in the Read-by-ID feature.

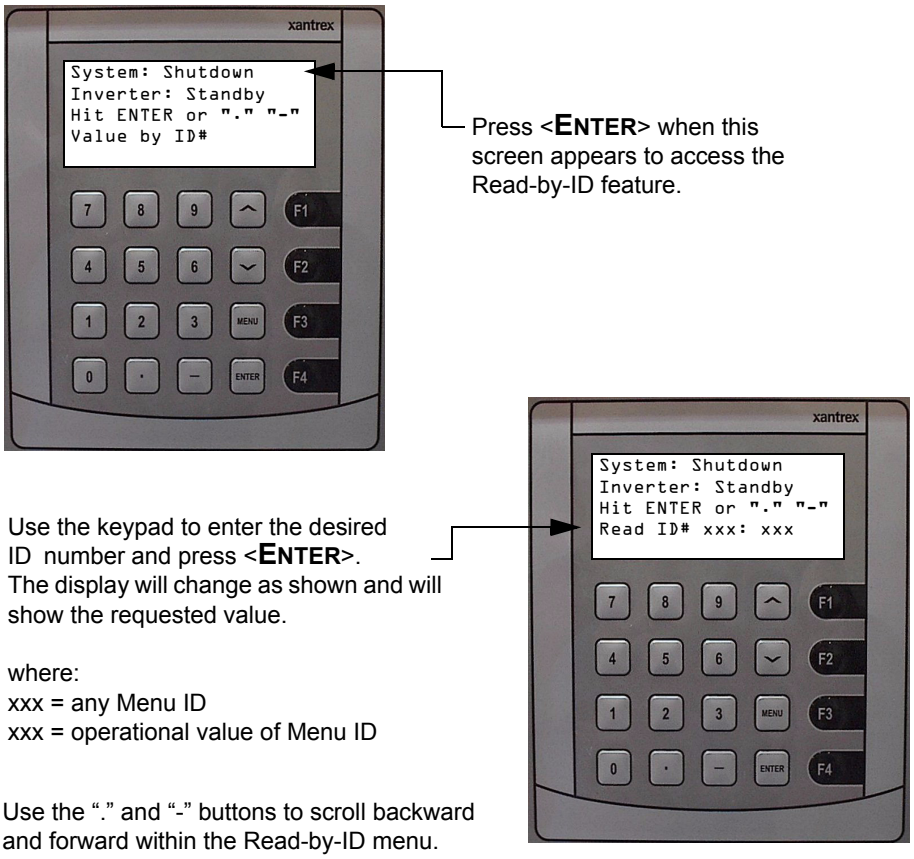

Figure 2-7 Read-by-ID Feature

WRITE Menu

Important: *Specific grid-interface parameters within the WRITE Menu have been set in the factory to the limits mandated by UL1741. Any changes to these setpoints should be agreed upon by the local utility and the equipment owner.*

The **WRITE** Menu includes the following parameters:

- Min/Max AC Volts%
- Min Max AC Volt Delay
- Min/Max AC Freq.
- Min/Max AC Freq. Delay
- PPT Voltage Reference
- PV Voltage Start
- PV Time (Start and Stop)
- PV Power Stop
- PPT Current Max%
- Manual Current%
- PPT Enable
- PPT Update Rate and Voltage Step

Important: **WRITE** parameters can be viewed, however, require a password to change and should only be done so by authorized personnel.

Table 2-3 provides a detailed description of **WRITE** parameters that are displayed on the VFD.

Changing WRITE Menu Parameter Values

Follow the procedure below to change **WRITE** Menu parameters.

To change WRITE Menu parameters:

1. From the standard display or anywhere in the **READ** Menu, you may access the **WRITE** menu parameters by pressing the <**MENU**> key.
2. Once within the Write Menu, the first item is the “Set Goal State”. Use the /\ or \/ key on the operator interface keypad to scroll through the **WRITE** Menu parameters.
   a) To change the displayed parameter, press the <**ENTER**> button.
   b) This will ask for a password.
   c) Enter the password <**5><9><4**> and press the <**ENTER**> button.
      - If the wrong password is entered, the display will again prompt the user for the password.
      - If a mistake is made while keying in the password, the /\ or \/ keys may be used as a backspace key.

d) Enter the desired value and press <**ENTER**>. If the value entered is outside the acceptable range for the parameter, the original value will remain.

e) To leave the **WRITE** Menu and return to the **READ** Menu, press the <**MENU**> button once and the standard display will reappear on the VFD.

Important: While in the WRITE Menu, the operator interface display will reset itself to the standard display if there is no input for more than 2 minutes.

Table 2-3 Write Menu Parameters

Parameter	Description	ID	Units	Default Value	Maximum Value	Minimum Value
Set Goal State Displays as: `Hit ENTER to set Goal:`	Commands a Goal State. CMD To Shutdown CMD To PWR Tracking CMD To Manual I CMD To Matrix Test					
Set Date Displays as: `042807`	The date is entered month-day-year (mmddyy): April 28, 2007 is entered `042807`.					
Set Time: Displays as: `163000`	The time is entered in military hours-minutes-seconds (i.e., 24-hour clock): 4:30 pm is entered `163000`.					
Maximum Grid Voltage Displays as: `Max AC Volts %:`	This parameter sets the trigger point value for “AC voltage High” (0013) fault. If the grid voltage is over this parameter’s value, the fault is triggered. The upper limit of this parameter is restricted by UL 1741 requirements.	32	Percentage of Nominal voltage	110	120	110
Minimum Grid Voltage Displays as: `Min AC Volts%:`	This parameter sets the trigger point value for “AC voltage low” (0012) fault. If the grid voltage is below this parameter’s value, the fault is triggered. The lower limit of this parameter is restricted by UL 1741 requirements.	33	Percentage of Nominal voltage	88	88	50

Table 2-3 Write Menu Parameters

Parameter	Description	ID	Units	Default Value	Maximum Value	Minimum Value
Maximum Grid Frequency Displays as: `Max AC Freq:`	This parameter sets the trigger point value for "AC frequency high" (0011) fault. If the grid frequency is over this parameter's value, the fault is triggered. The upper limit of this parameter is restricted by UL 1741 requirements.	34	Hertz	60.5	N/A	N/A
Minimum Grid Frequency Displays as: `Min AC Freq:`	This parameter sets the trigger point value for "AC frequency low" (0010) fault. If the grid frequency is below this parameter's value, the fault is triggered. The lower limit of this parameter is restricted by UL 1741 requirements.	35	Hertz	59.3	59.8	57
Peak Power Tracker Reference Voltage Displays as: `PPT V Ref:`	This is the initial PV voltage the inverter is going to try to keep as it goes into on line mode. If the power tracker is off, the inverter will draw current from the PV array to maintain this reference voltage. If the power tracker is on, this is the reference voltage from which the inverter start exploring voltages that produce more power.	37	Volts	400	600	300
PV Wakeup Voltage Displays as: `PV V Start:`	This is the trigger point that transitions the inverter from PV Sleep state to PV Wake Up state. When the PV voltage reaches the value of this parameter the inverter transitions into PV Wake Up mode.	38	Volts	440	600	300
Time Delay for PV Wake up Displays as: `PV T Start:`	Time delay to transition from PV wake up state to PV On-line state. Once the inverter is in PV Wake Up mode, it waits for the amount of time determine by this parameter before transitioning into PV on-line mode. During this time the inverter checks that the PV voltage is no less than the PV wake voltage, otherwise it goes into PV Sleep mode.	39	Seconds	300	1200	0

Table 2-3 Write Menu Parameters

Parameter	Description	ID	Units	Default Value	Maximum Value	Minimum Value
Time delay for PV Sleep Test Displays as: `PV T Stop:`	This is the amount of time the inverter will be in Sleep Test mode if the output power continues to be below “PV P Stop”. The inverter will exit Sleep Test mode towards on-line mode is the power is over “PV P Stop” or towards Shutdown mode is the “PV T Stop” timer expires.	40	Seconds	300	1200	0
PV Output Power to Enter Sleep Test Mode Displays as: `PV P Stop:`	This is the output power trigger point for the inverter to transition into sleep test mode. When the output power is below the value of this parameter the inverter enters sleep test mode.	41	KW	1	10.0	0.1
Power Tracker Maximum Output Power Displays as: `I PPT Max:`	This parameter sets the percentage of maximum rated power the inverter will produce when in power tracker mode. For example, a 250 kW system with this parameter set to 50 will not attempt to produce more than 125 kW.	42	Percentage of maximum output power.	100	110	0
Manual Current Output Displays as: `I Manual:`	This parameter sets the percentage of maximum out current the inverter will attempt to produce while in manual current mode.	43	Percentage of maximum output current.	25	110	0
Enable Peak Power Tracker Displays as: `PPT Enable:`	This parameter switches on and off the Power Tracker function. When the Power Tracker is on, the inverter will regulate the bus voltage to optimize output power. When the Power Tracker is off, the inverter will regulate the bus voltage to maintain it at “PPT V Ref” volts.	44	0 = Off 1 = On	1	1	0

Table 2-3 Write Menu Parameters

Parameter	Description	ID	Units	Default Value	Maximum Value	Minimum Value
Power Tracker Rate Displays as: `PPT Rate:`	This parameter sets the rate at which the Power Tracker function makes changes to the voltage reference point as it tries to find the optimal position. For example, if the value of this parameter is 0.5 then every 50mS the power tracker will increase or decrease the voltage reference point to check if more power can be produced at the new level.	45	Deci-seconds	0.5	50.0	0.1
Power Tracker Step Displays as: `PPT V Step:`	This parameter sets the size of the change the Power Tracker will make to the voltage reference point as it tries to find the optimal position. For example, if the value of this parameter is set to 1, the Power Tracker will increase or decrease the voltage reference point by one volt at a speed of "PPT Rate" to check if more power can be produced at the new level.	46	Volts	1	10.0	0.1
Maximum AC Voltage Delay Displays as: `Max Volt Delay:`	This parameter sets the time delay value, in AC cycles, for the "AC voltage high" (0013) fault. If the grid voltage remains above the maximum AC voltage setting (Max AC Volts%) for the duration of this delay period, the fault is then triggered. The limits of this parameter are restricted by UL 1741 requirements.	56	AC cycles	12	N/A	N/A
Minimum AC Voltage Delay Displays as: `Min Volt Delay:`	This parameter sets the time delay value, in AC cycles, for the "AC voltage low" (0012) fault. If the grid voltage remains below the minimum AC voltage setting (Min AC Volts%) for the duration of this delay period, the fault is then triggered. The limits of this parameter are restricted by UL 1741 requirements.	57	AC cycles	24	N/A	N/A

Table 2-3 Write Menu Parameters

Parameter	Description	ID	Units	Default Value	Maximum Value	Minimum Value
Maximum AC Frequency Delay Displays as: `Max Hz Delay:`	This parameter sets the time delay value, in AC cycles, for the "AC Frequency High" (0011) fault. If the grid frequency remains above the maximum AC frequency setting (Max AC Freq) for the duration of this delay period, the fault is then triggered. The limits of this parameter are restricted by UL 1741 requirements.	58	AC cycles	2	N/A	N/A
Minimum AC Frequency Delay Displays as: `Min Hz Delay:`	This parameter sets the time delay value, in AC cycles, for the "AC Frequency Low" (0010) fault. If the grid frequency remains below the minimum AC frequency setting (Min AC Freq) for the duration of this delay period, the fault is then triggered. The limits of this parameter are restricted by UL 1741 requirements.	59	AC cycles	10	300	10
AC Auto-Clear Delay Displays as: `AutoClear Delay:`	This parameter sets the time delay value, in seconds, for the Auto-Clear feature corresponding with the AC Voltage and Frequency (0013, 0012, 0011, and 0010) faults. The AC Voltage and Frequency must remain within their respective limits before an Auto-Clear can occur. The limits of this parameter are restricted by UL 1741 requirements.	60	Seconds	300	300	10
Modbus Protocol ON Displays as: `Modbus ON:`	This parameter sets the protocol used by the serial port (J8) on the CCU2. The serial protocol can be set to either Modbus ON (1) or to Modbus OFF (0) [Xantrex protocol].	61	0=Off 1=On	1	1	0
Modbus Address Displays as: `Modbus Address:`	This parameter sets the address used by the Modbus protocol.	62		N/A	N/A	N/A

Commanding Goal State Changes

To change the Goal State:

1. From the standard display press the <**MENU**> key. The VFD will change the third line of the display to "`Hit ENTER to set`" and fourth line of the display to "`Goal:`".
2. Press the <**ENTER**> key. This will prompt the user for a password. The VFD will change the third line of the display to "`Hit ENTER to set`" and fourth line of the display to "`Password:`".
3. Enter the password <**5><9><4**> and press the <**ENTER**> button.
4. Scroll through the goal state menu with the /\ or \/ keys until the desired goal state is displayed on the fourth line of the display.
5. Press <**ENTER**>. The VFD will then prompt the user by displaying the following text on the third line: "`Press F4 to Confirm`".
6. Press <**F4**> and the GT100 will transition to this goal state. If the goal state requested violates the conditions of the state machine, the GT100 will remain in the previous state of operation.

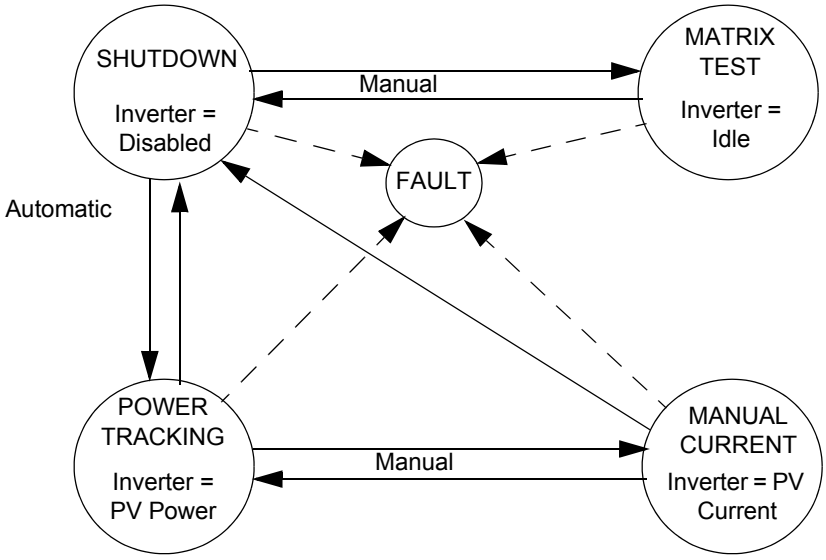

Figure 2-8 State Transition Diagram

Setting the Date and Time

Follow the procedure below to change the date and time.

To change the Date and Time:

1. From the standard display, press the <**MENU**> key. The VFD will change the third line of the display to "`Hit ENTER to set`" and fourth line of the display to "`Goal:`".
2. Scroll down with the \/ key until date or time parameters are reached.
   a) If you're changing the date, the third and fourth lines of the VFD will display as follows:
   "`Type and hit ENTER`"
   "`Set Date: "MMDDYY`"
   b) If you're changing the time, the third and fourth lines of the VFD will display as follows:
   "`Type and hit ENTER`"
   "`Set Time: "HHMMSS`"
3. Press <**ENTER**>. This will prompt the user for a password. The VFD will change the third and fourth lines of the VFD display as follows:
   "`Hit ENTER to set`"
   "`Password:`".
4. Enter the password <**5><9><4**> and press the <**ENTER**> button.
5. Enter the proper date or time in a six digit format. *For example*:
   a) The date is entered month-day-year (mmddyy):
   April 28, 2005 is entered `042805` <**ENTER**>.
   b) The time is entered in military hours-minutes-seconds
   (i.e., 24-hour clock): 4:30 pm is entered `163000` <**ENTER**>.

   If a mistake is made while entering the date or time, the /\ and \/ keys may be used as a backspace key. Any two-digit year "YY" may be entered for the date, but regardless of the keyed entry, the maximum Month/Day "MMDD" that the UFCU will accept is a "1231" or Dec. 31st. The maximum allowable time entry the UFCU will accept is "235959".
6. Once the entry is accepted, the third and fourth lines of the VFD display will revert back to the following:
   a) If you're changing the date, the third and fourth lines of the VFD will display as follows:
   "`Hit ENTER to set`"
   "`Set Date:`"
   b) If you're changing the time, the third and fourth lines of the VFD will display as follows:
   "`Hit ENTER to set`"
   "`Set Time:`"
7. Pressing the <**MENU**> key will return the user to the standard display.

Manual State Transitions

State conditions can also be transitioned manually. Refer to "Commanding Goal State Changes" on page 2–23 for instructions on commanding GT100 goal states for manual transitions.

Shutdown → Matrix Test → Shutdown

1. Turn the **ON/OFF** switch to the **OFF** position.
2. Command the GT100 to the Matrix Test.
3. After completing the Matrix Test, command the GT100 to Shutdown.

If the **ON/OFF** switch is turned to **ON** while the GT100 is in the Matrix Test state, the GT100 will transition to Shutdown.

Power Tracking→ Manual Current→ Power Tracking or Shutdown

1. Verify the PV manual current parameter (`I Manual %`) is set to the desired percent of rated.
2. Command the GT100 to Manual Current mode from the operator interface keypad. While in the manual current mode, the user may change the PV manual current parameter. However, the user may demand greater current than the capacity of the PV array. If this causes the PV voltage to drop below the minimum operating voltage (300 Vdc), the GT100 will transition to Shutdown.
3. To exit the Manual Current mode, the user must manually command the GT100 to Power Tracking.

Automatic State Transitions

State conditions can also be transitioned automatically. Refer to "Commanding Goal State Changes" on page 2–23 for instructions on commanding GT100 goal states.

Shutdown → Power Tracking → Shutdown

1. The **ON/OFF** switch must be turned to the **ON** position.
2. Once the PV voltage exceeds the PV voltage start set point (`PV V Start`) the GT100 will start a wake-up timer (`PV T Start`).
   a) If the PV voltage remains above the PV start voltage set point for the duration of the wake-up timer, the GT100 will transition to Power Tracking.
   b) If the PV power drops below the PV power stop set point, (`PV P Stop`) the GT100 will start a PV sleep timer (`PV T Stop`).
   c) If the PV voltage and power remain below their respective setpoints for the duration of the sleep timer, the GT100 will transition to Shutdown.

Any State → Fault

If the GT100 encounters a fault, regardless of operating state, it will transition to the Fault state. The GT100 will remain in this state until the fault condition has been remedied and cleared. The Fault Code number will appear on the first line of the VFD. A description of the fault will show on the second line. The third line of the VFD will read "`F1 to Clear Fault?`". The fourth line shows the goal state.

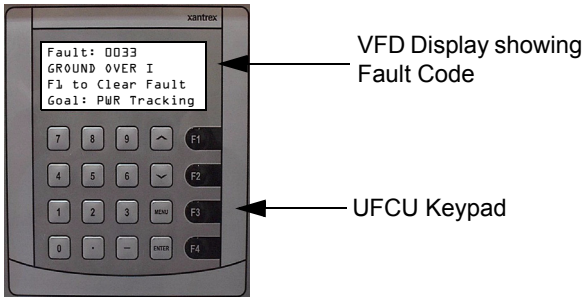

Figure 2-9 VFD showing Fault Code

To clear the fault:

1. See Table 4-1, "Fault Codes" on page 4–5 for a complete listing of Fault Codes and possible remedies. Correct the fault condition if possible and attempt to clear the fault by pressing "**F1**".
2. The ability to clear the fault can only be done from the **READ** Menu. If a fault occurs while accessing the **WRITE** Menu, pressing <**MENU**> once will return to the Read Menu, and "`F1 to Clear Fault`" will appear on the third line of the VFD display.

Auto-restart Feature

In the event of an Air Duct Intake temperature excursion beyond -15 to 55° C, or a utility voltage or frequency excursion outside of those specified in Table A-4 on page A–4, the GT100 will automatically transition to a Fault condition. Once the Air Duct Intake temperature recovers and remains within the excursion limits for a period of five minutes, and/or the utility voltage and frequency recovers and remains within the excursion limits for a period set by the Auto-Clear Delay (ID 60), the GT100 will automatically clear the fault, then resume normal operation.

Energize Procedure (Startup)

To start up the GT100:

1. Remove any lockout devices from the Utility connection circuit breaker and PV disconnect switch.
2. Close the Utility connection circuit breaker.
3. Close the AC Disconnect (CB1).
4. Close the DC Disconnect Switch (S1).
5. Turn the ON/OFF switch (S3) to the ON position.

After a 15 second initialization period, the GT100 will automatically transition to 'Waking Up', given the PV voltage is greater than the PV V Start set point.

De-Energize/Isolation Procedure (Shutdown)

The following procedure should be followed to de-energize the GT100 for maintenance:

WARNING

The terminals of the DC input may be energized if the PV arrays are energized. In addition, allow five minutes for all capacitors within the Inverter Enclosure to discharge after disconnecting the GT100 from AC and DC sources.

To isolate the GT100:

1. Turn the ON/OFF switch (S3) to the OFF position.
2. Open the utility connection circuit breaker.
3. Open the AC Disconnect (CB1).
4. Open the DC Disconnect switch (S1).
5. Install lockout devices on the utility connection circuit breaker and DC disconnect switch.

Computer Communications with the GT100

The GT100 provides an option for communicating system status, oscillography, or data logging through a personal computer via an RS232 connection and a modem using the GT View Graphic User Interface (GUI) software. System status, oscillography, and data logging are also available via the RS485/Modbus connection.

The GT View Graphic User Interface (GUI) software is a Windows™-based program that:

- displays system status,
- accesses inverter controls,
- accesses metering and data logging capabilities, and
- controls protective functions.

If multiple inverters are networked together, the software is capable of tracking multiple inverters on the same network.

Ensure the appropriate hardware is in place before proceeding with installing the GUI. See the “PC Connection Methods” section of the GT100 Grid-Tied Photovoltaic Inverter Planning and Installation Manual (Document Part #:153379) for instructions on establishing the desired connection if this has not already been done.

3 Commissioning

Chapter 3, “Commissioning” contains information on safely commissioning the GT100 Grid-Tied Photovoltaic Inverter.

Commissioning Procedure

This section provides the procedure necessary to safely and correctly commission a GT100 inverter.

Important: It is important to record any issues encountered while following this procedure.

Summary

To commission the GT100:

1. Ensure the Verification Tests have been completed and have passed successfully. See the GT100 Grid-Tied Photovoltaic Inverter Planning and Installation Manual (Document Part #:153379), Section 4.
2. Begin the GT100 Commissioning Procedure as described in detail further in this section. The steps are summarized below.
   a) Record the Serial Number.
   b) Inspect GT100 Inverter Enclosure.
   c) Verify AC and DC Voltages.
   d) Apply Grid Voltage.
   e) Check the Front Panel Display.
   f) Confirm Operational Parameters (AC, DC and Power Tracker).
   g) Apply DC Voltage.
   h) Perform the Matrix Test.
   i) Operate Inverter.
3. Submit the Commissioning Test Record (page B–3) and Fax a copy of the Product Registration Form (page WA–4) to Xantrex.

Starting the Commissioning Test

Serial Number

Enter the information required on the form that appears on page B–3 of Appendix B, “Commissioning Test Record”. The converter serial number is located on a label placed on the lower-left front of the Inverter Enclosure door.

Inverter Enclosure

1. Open both doors of the GT100 Inverter Enclosure and inspect the connections.
2. Check for loose cables, rubbing, or interference.
3. Correct and record any defects.
4. Close the Inverter Enclosure doors.

Verify AC Voltage

1. Open the left door of the GT100 Inverter Enclosure and verify that the Grid AC cables have been installed at TB1-A, TB1-B, TB1-C, and TB1-Neutral within the AC Interface.
2. With a voltmeter, verify if AC Grid voltage is present at the bottom of TB1-A, TB1-B, TB1-C, and TB1-Neutral (208 or 480 Vac). These terminals are located in the AC Interface.
3. If grid voltage is not available to the unit, close and lock the GT100 Inverter Enclosure. The Commissioning Test procedure must cease at this point. Do not attempt to continue the test until each step can be checked and verified.

Verify DC Voltage

1. Open the right door of the GT100 Inverter Enclosure and verify that the PV DC cables have been installed correctly within the DC Interface.
2. With a voltmeter, verify if PV DC voltage is present at TB3 and TB4.
3. Verify the correct polarity.
4. If the voltage is not present, contact the installer, site electrician or site operator to supply PV voltage to the unit.
5. If PV DC voltage is not available to the unit, close and lock the GT100 Inverter Enclosure. The Commissioning Test procedure must cease at this point. Do not attempt to continue the test until each step can be checked and verified.

Apply Grid Voltage

1. Verify both GT100 Inverter Enclosure doors are closed and locked.
2. Close the AC Disconnect (CB1). This will energize the control power circuits.
3. Look, listen and smell for signs of defects.
4. Record any defects found.

Front Panel Display

1. Open then close the AC Disconnect (CB1) and look at the VFD Display of the UFCU. It will display the Software Versions of the CCU2 and Front Panel within the **READ** menu. Record these numbers.
2. After about 20 seconds it will be in its “ready” mode. At this time the Fault Code “0071 PV SWITCH OPEN” will be reported. Close the DC Disconnect Switch (S1) and verify alarm 0071 clears by pressing the “F1” key on the keypad of the UFCU. If additional alarms are present, refer to Table 4-1 on page 4–5.
3. Once all faults are clear, the front panel should report “Switched Off” and show Inverter Status.
4. Using the \/ key, scroll down in the **READ** Menu and verify that the Time and Date are correct.
5. If not, refer to the “Setting the Date and Time” on page 2–24.
6. Scroll thru the parameters and verify that they are present.

Confirm AC Operational Parameters

For each of the following steps, refer to VFD Display on the UFCU.

Access the **WRITE** Menu parameter list by pressing the "MENU" key. Using the \/ key, scroll down in the **WRITE** Menu and verify the parameter settings.

1. Verify the inverter’s AC limits.
2. Make any necessary changes.
3. Record these values.

Confirm DC Operational Parameters

1. Verify the Inverters PV Settings.
2. Make any necessary changes.
3. Record these values.

Confirm Power Tracker Configuration Operational Parameters

1. Verify the inverter's Power Tracker Configuration.
2. Make any necessary changes.
3. Record these values.

Apply DC Voltage

1. Verify both GT100 Inverter Enclosure doors are closed and locked.
2. Close the DC Disconnect (S1) Switch. This will energize the DC circuits.
3. Look, listen and smell for signs of defects.
4. Record any defects found.

Matrix Test

1. Confirm that the **ON/OFF** Switch (S3) in the **OFF** position.
2. From the front panel, select Matrix test from the Goal State menu.
3. Verify that the GT100 enters the Matrix Test mode.
4. In this mode, the GT100 will be operating the IGBT Matrix without closing either the AC or DC contactors.
   If a fault occurs, refer to the Matrix Gate Faults listed on page 4–5 of the Troubleshooting section.
5. To stop the test, select Goal state from the GUI or Front Panel and choose Shutdown.

Operate Inverter

1. Make sure all doors are closed and locked.
2. Using the Front Panel or the GUI, set the I PPT Max percent to 25%.
3. Place the **ON/OFF** Switch in the **ON** position. If the PV voltage is above PV Start voltage threshold, followed by a 5-minute delay period, the PV contactors (K2) will close, followed by the Main AC contactor (K1). The inverter will begin to produce power up to 25% of rated power.
4. Look, listen and smell for any defects.
5. Make sure the internal enclosure fans are operating.
6. If everything is okay, increase the I PPT Max until you reach 100%.
7. Check all the operating data with the GUI or front panel. Record any irregularities.
8. Let the inverter run.
9. Verify the matrix fans operate after the matrix temperature reaches at least 30°C, and the "INV kW" is at least 30 kW.

Completed Commissioning

1. Once you have successfully completed all the commissioning steps, ensure all the information is documented.
2. Email the completed Commissioning Test Record to:

   pvcommissioningreport@xantrex.com
3. Fax a copy of the Product Registration Form (page WA–2) to Xantrex.

4 Troubleshooting

Chapter 4, “Troubleshooting” contains information and procedures for troubleshooting the GT100 Grid-Tied Photovoltaic Inverter. It provides descriptions of common situations and errors that may occur and provides possible solutions for resolving fault conditions. It also provides instructions for clearing faults manually, if required.

Faults and Fault Codes

Fault states are automatic from any state of operation. In the event of a fault condition, the GT100 will immediately stop processing power and execute an immediate orderly shutdown, open both the main AC and DC contactors, and remain in a faulted state until the fault is remedied and cleared (manually or automatically).

- Faults associated with a grid disturbance or Air Duct Intake temperature excursions clear automatically. The GT100 will automatically re-start after a period set by Auto-Clear delay or five minutes respectively.
- All other faults must be cleared manually.

All fault conditions arising from within the GT100 are reported to the UFCU (Universal Frontpanel Control Unit). The 4-line VFD will display a hexadecimal value (fault code) and a brief text description of the fault.

Most faults are latching and only those faults associated with grid disturbances and Air Duct Intake temperature excursions are auto-clearing and thus enable the GT100 to restart after a delay period.

Once the cause of the fault has been identified and corrected, and it is determined to be safe to proceed, GT100 faults may be manually cleared from the UFCU keypad or using the remote GUI.

See “Clearing Faults Manually” on page 4–4 for instructions on this procedure.

General Troubleshooting

Respond to any GT100 alarm or fault as follows:

1. Note and document the alarm or fault code and brief text description.
2. Determine the source of the alarm or fault by referring to Table 4-1, “Fault Codes” on page 4–5.
3. Rectify the alarm or fault condition, determine it is safe to proceed, and attempt to clear the fault from the UFCU keypad and display. See “Clearing Faults Manually” on page 4–4 for instructions on this procedure.

Important: Before clearing a fault, it is recommended that the Oscillography data be retrieved from the CCU2. The log will start recording again, and over-write the previous data, once the fault is cleared.

4. If the condition is sustained and cannot be corrected, again note and document the fault code and description, and contact either your Distributor / Reseller, or Xantrex Customer Service.

WARNING: Lethal Voltage

In order to remove all sources of voltage from the GT100, the incoming power must be de-energized at the source. This may be done at the Utility main circuit breaker, and by opening the AC Disconnect and the DC Disconnect switches on the GT100. Review the system configuration to determine all of the possible sources of energy. In addition, allow five minutes for the DC bus capacitors to discharge after removing power.

Clearing Faults Manually

Faults associated with a grid disturbance clear automatically. These faults include:

- 0010 (AC Frequency Low),
- 0011 (AC Frequency High),
- 0012 AC Voltage Low), and
- 0013 (AC Voltage High).

Once the utility recovers and remains within the excursion limits for a period set by the Auto-Clear Delay (ID 60), the GT100 will automatically clear the fault and resume normal operation.

In addition, the Air Duct Intake Over and Under-temperature faults will also self-clear automatically.

- 0094 (Ambient Temperature)

All other faults associated with the GT100 must be identified, corrected and then cleared manually using the UFCU or GUI. The following procedure describes how to manually clear a fault message from the VFD.

To clear the fault:

1. Determine the source of the fault using Table 4-1, “Fault Codes” on page 4–5. Correct the fault condition.
2. Ensure the fault code and “Clear Fault?” message is displayed in the VFD.
   a) If the “Clear Fault?” message is not shown on the second line of the VFD, scroll through the read parameter menu with the /\ or \/ keys until the message appears.
3. To clear the fault, press <**ENTER**>. The GT100 will immediately transition to Power Tracking mode.

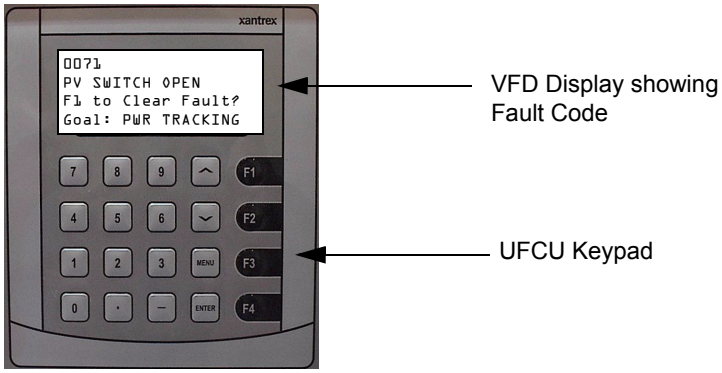

Figure 4-1 VFD showing Fault Code

Important: If the fault does not clear, the fault condition has not been corrected.

Fault Code Descriptions

Table 4-1 provides a complete description of all the fault conditions that may occur on the GT100. Default values are show, but some limits are user-adjustable.

Table 4-1 Fault Codes

Error Code	Fault Source(s)	Fault Type H=Hardware S=Software	Fault Description	Possible Causes
0000	No Faults	N/A	N/A	N/A
0010	AC Frequency Low	S	This fault indicates that the Utility grid frequency is below or fell below the minimum allowed value of 59.3 Hz (default) for greater than 10 cycles. This fault is auto-clearing. Once the Utility grid frequency has recovered within the acceptable operating range, the GT100 will qualify the value and automatically clear this fault and resume normal operation after a delay period.	• Utility grid frequency fell below the allowable limit
0011	AC Frequency High	S	This fault indicates that the Utility grid frequency is above or rose above the maximum allowed value of 60.5 Hz (default) for greater than 10 cycles. This fault is auto-clearing. Once the Utility grid frequency has recovered within the acceptable operating range, the GT100 will qualify the value and automatically clear this fault and resume normal operation after a delay period.	• Utility grid frequency rose above the allowable limit
0012	AC Voltage Low	S	This fault indicates that the utility grid voltage is below or fell below the minimum allowed value of 88% of nominal Vac for greater than 2 seconds. This fault is auto-clearing. Once the Utility grid voltage has recovered within the acceptable operating range, the GT100 will qualify the value and automatically clear this fault and resume normal operation after a delay period.	• Utility grid voltage fell below the allowable limit • Fuses - F4, F5, F6 on the Inrush Current Assembly PCB are blown. • P1001 on CCU2 is loose or disconnected

Table 4-1 Fault Codes

Error Code	Fault Source(s)	Fault Type H=Hardware S=Software	Fault Description	Possible Causes
013	AC Voltage High	S	This fault indicates that the utility grid voltage is above or rose above the maximum allowed value of 110% (default) of nominal Vac for greater than 1 second. This fault is auto-clearing. Once the Utility grid voltage has recovered within the acceptable operating range, the GT100 will qualify the value and automatically clear this fault and resume normal operation after a delay period	• Utility grid voltage rose above the allowable limit
0015	Grid Disconnection	S	This fault indicates that the GT100 has detected a sudden AC voltage increase of greater than 40% of the nominal peak-to-peak value. This normally is the result of a sudden disconnection from the Utility grid while the GT100 was processing power.	• K1 was opened while the GT100 was processing power
0021	PV Over-Voltage	S	This fault indicates that the GT100 has detected a DC input voltage of greater than the maximum allowed value of 600 Vdc.	• PV system wiring short • Lightning strike on PV system wiring
0023	Bus Voltage High	H	This fault indicates that the GT100 has detected that the DC bus voltage has exceeded the maximum allowed value of 905 Vdc.	• PV system wiring short • Lightning strike on PV system wiring

Table 4-1 Fault Codes

Error Code	Fault Source(s)	Fault Type H=Hardware S=Software	Fault Description	Possible Causes
XX30	Matrix Over Current	H	This fault indicates that the GT100 has detected that the AC current on one or more phases of the IGBT matrix has exceeded the maximum allowed value of $1400A_{rms}$. The first two digits of the fault code indicate the particular phase where the over current occurred as follows: • 0130 - Matrix over current in phase A • 0230 - Matrix over current in phase B • 0430 - Matrix over current in phase C If more than one phase faults simultaneously, the two first digits are added in hexadecimal form to indicate an over current condition in more than one phase, thus the error code will contain the summation of the faulted phases.	• P3 or P1002 on CCU2 is loose or disconnected • AC system wiring short
0033	Ground Over Current	S	This fault indicates that the GT100 has detected that the ground fault current has exceeded the maximum allowed value. This maximum allowed value for ground fault current is 4 Adc.	• P3 or P2 on CCU2 is loose or disconnected • Ground -to-AC or DC-to-System wiring short • F4 is blown • F4 fuse holder is open

Table 4-1 Fault Codes

Error Code	Fault Source(s)	Fault Type H=Hardware S=Software	Fault Description	Possible Causes
0034	Unused Matrix Over Current	H	Fundamentally, an Unused Matrix Over Current Fault should not occur, however if it does, it is generally indicative of a CCU2 malfunction. • 0834 - Unused Matrix over current in phase A • 1034 - Unused Matrix over current in phase B • 2034 - Unused Matrix over current in phase C If more than one phase faults simultaneously, the two first digits are added in hexadecimal form to indicate an over current condition in more than one phase, thus the error code will contain the summation of the faulted phases.	• CCU2 malfunction
0040	Programming Software	S	This code indicates that the GT100 has detected that the system is in Programming mode. This fault does not indicate any malfunction with the GT100, but is merely an indication that the system software is in the process of being downloaded into the EEPROMs of the CCU2.	
0041	State Invalid	S	The state machine implemented within the CCU2 system software governs the operation of the GT100. This fault indicates that the GT100 has detected an unknown system variable and has encountered an invalid state.	• Internal RAM error • CPU error
0042	Serial EEPROM Write Error	S	This fault indicates that the GT100 has detected a serial EEPROM write error. The CCU2 controller board performs a verification check of data written to ROM compared to what is read back.	• Internal ROM error • CPU error

Table 4-1 Fault Codes

Error Code	Fault Source(s)	Fault Type H=Hardware S=Software	Fault Description	Possible Causes
0043	Serial EEPROM Timeout	S	This fault indicates that the GT100 has detected that when writing data to the serial EEPROM, a confirmation timer of 300mS has expired.	• Internal ROM error • CPU error
0044	Bad NOVRAM Memory	S	This fault indicates that the GT100 has detected that one of the two non-volatile memory banks on the CCU2 controller board has failed. The CCU2 performs a series of tests to confirm the validity of the NOVRAM, and one of the two banks has produced errors.	• Internal NOVRAM error • CPU error
0045	Interrupt 2 Timeout	S	This fault indicates that the GT100 has detected that an interrupt 2 timeout has occurred. The CCU2 controller board performs a conversion validation of analog-to-digital data within the A to D converters. If validation of the conversion is not performed within 500mS, an interrupt 2 timeout fault will occur.	• Internal A to D converter error • CPU error
0047	Software Test	S	This fault indicates that the GT100 has detected that a software test fault has occurred. This is a simulated fault used for debugging purposes.	
0048	Bad Memory	S	This fault indicates that the GT100 has detected that the SRAM DIMM on the CCU2 controller board has failed. The CCU2 performs a series of tests to confirm the validity of the SRAM, and the memory module has produced errors.	• Internal SRAM error • CPU error

Table 4-1 Fault Codes

Error Code	Fault Source(s)	Fault Type H=Hardware S=Software	Fault Description	Possible Causes
XX52	Matrix Gate	H	The CCU2 controller sends digitized timing signals for gating the IGBT's via the driver board and bidirectional fiber optic communication. This fault indicates that the GT100 has detected that an IGBT gate drive fault has occurred on the Matrix. The first two digits of the fault code indicate the particular IGBT that reported the fault, as follows: • 0152 (A+) • 0252 (A-) • 0452 (B+) • 0852 (B-) • 1052 (C+) • 2052 (C-) If more than one IGBT faults simultaneously, the two first digits are added in hexadecimal form to indicate that the gate drive fault has occurred in more than one phase, thus the error code will contain the summation of the faulted phases.	• Fiber-optic harness is loose or disconnected • CCU2 ±15 Vdc Power Supply is defective • P1 on driver board is loose or disconnected
XX53	Unused Matrix Over Current	H	Fundamentally, an Unused Matrix Gate Fault should not occur, however if it does, it is generally indicative of a CCU2 malfunction. • 0153 (A+) • 0253 (A-) • 0453 (B+) • 0853 (B-) • 1053 (C+) • 2053 (C-) If more than one phase faults simultaneously, the two first digits are added in hexadecimal form to indicate an over current condition in more than one phase, thus the error code will contain the summation of the faulted phases.	• CCU2 malfunction

Table 4-1 Fault Codes

Error Code	Fault Source(s)	Fault Type H=Hardware S=Software	Fault Description	Possible Causes
0062	Matrix Temperature	S	This fault indicates that the GT100 has detected that the temperature of the IGBT matrix aluminium heatsink has exceeded the maximum allowed value of 95 °C.	• Cooling fan inoperable • Air flow on heat sink impeded due to accumulation of debris • Operation above rated ambient temperature for an extended period of time
0071	PV Switch Open	S	This fault indicates that the GT100 has detected that the DC disconnect switch (S1) is open and the auxiliary switch is in the active position. This fault is primarily for personnel safety. Opening the DC disconnect switch while the GT100 is processing power will cause an immediate orderly shutdown of the system.	• DC disconnect switch is open and auxiliary switch is active • Auxiliary switch is inoperable • P2 or P3 on CCU2 is loose or disconnected • CCU2 +/-15 Vdc Power Supply is defective
0073	Remote Emergency Stop	S	This fault indicates that the GT100 has detected that the Remote Emergency Stop circuit (TB7-1,2) is open or activated. This fault is primarily for personnel safety. Activating the Remote Emergency Stop while the GT100 is processing power will cause an immediate orderly shutdown of the system.	• Remote Emergency Stop circuit is open • Factory installed jumper is not present at TB7-1,2 • P2 or P3 on CCU2 is loose or disconnected • CCU2 +/-15 Vdc Power Supply is defective
0075	Shutdown Remotely	S	This fault indicates that the GT100 has detected that the system was commanded via the GUI to transition to the Shutdown State. This fault is not indicative of a failure or malfunction, but primarily used to disable the system remotely.	• Remote Shutdown command via the GUI

Table 4-1 Fault Codes

Error Code	Fault Source(s)	Fault Type H=Hardware S=Software	Fault Description	Possible Causes
0082	Matrix Not ON	S	This fault indicates that the GT100 has detected that the IGBT matrix (FPGA) was not enabled after having sent a command for it to turn on. The CCU2 sends an acknowledge bit to confirm the command is received. This fault is primarily a watch-dog between software and hardware to ensure control of the IGBT matrix (FPGA).	• Software acknowledge bit not accepted • FPGA inoperable
0083	Matrix Not OFF	S	This fault indicates that the GT100 has detected that the IGBT matrix (FPGA) was not disabled after having sent a command for it to turn off. The CCU2 sends an acknowledge bit to confirm the command is received. This fault is primarily a watch-dog between software and hardware to ensure control of the IGBT matrix (FPGA).	• Software acknowledge bit not accepted • FPGA inoperable
0090	Fast AC Freq Low	S	This fault indicates that the Utility grid frequency is below or fell below the minimum allowed value of 57.0 Hz (Fixed) for greater than 10 cycles (Fixed). This fault is auto-clearing. Once the Utility grid frequency has recovered within the acceptable operating range, the GT100 will qualify the value and automatically clear this fault and resume normal operation after delay period.	• Utility grid frequency fell below the allowable limit.
0092	Fast AC Voltage Low	S	This fault indicates that the utility grid voltage is below or fell below the minimum allowed value of 50% (Fixed) of nominal Vac for greater than 10 cycles (Fixed). This fault is auto-clearing. Once the Utility grid voltage has recovered within the acceptable operating range, the GT100 will qualify the value and automatically clear this fault and resume normal operation after a delay period.	• Utility grid voltage fell below the allowable limit. • Fuses -F4, F5, or F6 on the Inrush Current Limit Board are blown. • P1001 on CCU2 is loose or disconnected.

Table 4-1 Fault Codes

Error Code	Fault Source(s)	Fault Type H=Hardware S=Software	Fault Description	Possible Causes
0093	Fast AC Voltage High	S	This fault indicates that the utility grid voltage is above or rose above the maximum allowed value of 120% (Fixed) of nominal Vac for greater than 10 cycles (Fixed). This fault is auto-clearing. Once the Utility grid voltage has recovered within the acceptable operating range, the GT100 will qualify the value and automatically clear this fault and resume normal operation after a delay period.	• Utility grid voltage rose above the allowable limit.
0094	Ambient Temperature	S	This fault indicates that the GT100 has detected that the temperature of the ambient air within the intake ducting use for Inverter ventilation has exceeded either the minimum or maximum allowed values of -15 and 55 °C respectively. This fault is Auto-Clearing once the ambient temperature remains within the allowable range for greater than 5 minutes.	• Operation above or below rated ambient temperature for an extended period of time.

5 Preventative Maintenance

Chapter 5, “Preventative Maintenance” contains information and procedures for performing preventative maintenance on the GT100 Grid-Tied Photovoltaic Inverter.

Maintenance Safety

Prior to following any Maintenance Procedures, follow the System Shutdown and Lock-out and Tag procedure.

Operational Safety Procedures

Never work alone when servicing this equipment. A team of two is required until the equipment is properly de-energized, locked-out and tagged, and verified de-energized with a meter. Thoroughly inspect the equipment prior to energizing. Verify that no tools or equipment have inadvertently been left behind.

WARNING: Shock Hazard

Review the system schematic for the installation to verify that all available energy sources are de-energized. DC bus voltage may also be present. Be sure to wait the full five minutes to allow the capacitors to discharge completely.

De-Energize/Isolation Procedure

The following procedure should be followed to de-energize the GT100 for maintenance:

WARNING: Shock Hazard

The terminals of the DC input may be energized if the PV arrays are energized. In addition, allow five minutes for all capacitors within the Inverter Enclosure to discharge after disconnecting the GT100 from AC and DC sources.

To isolate the GT100:

1. Turn the ON/OFF switch (S3) to the OFF position.
2. Open the utility connection circuit breaker.
3. Open the AC Disconnect (CB1).
4. Open the DC Disconnect switch (S1).
5. Install lockout devices on the utility connection circuit breaker and DC disconnect switch.

Lockout and Tag

Safety requirements mandate that this equipment not be serviced while energized. Power sources for the GT100 must be locked-out and tagged prior to servicing. Each energy source should have a padlock and tag installed on each energy source prior to servicing.

WARNING: Shock Hazard

Review the system schematic for the installation to verify that all available energy sources are de-energized. DC bus voltage may also be present. Be sure to wait the full five minutes to allow the capacitors to discharge completely.

The GT100 can be energized from both the AC source and the DC source. To ensure that the inverter is de-energized prior to servicing, lockout and tag the GT100 using the following procedure.

1. Turn the GT100 main ON/OFF switch (S3) to the OFF position. This stops the inverter from exporting power to the AC utility grid.
2. Open, lockout, and tag the incoming power at the utility main circuit breaker.
3. Open, lockout, and tag the AC Disconnect (CB1) on the left door of the GT100 enclosure.
4. Open, lockout, and tag the DC Disconnect Switch (S1) on the right door of the GT100 enclosure.

CAUTION

Once the DC Disconnect Switch (S1) is open, there will be DC voltage on the PV Array side of the switch where TB3, TB4, and TB5(PV GND) are located. This voltage may be as high as the Open-Circuit Voltage of the PV Array and is limited to 600VDC per NEC 690.

5. Using a confirmed, accurate meter, verify all power to the inverter is de-energized. A confirmed, accurate meter must be verified on a known voltage before use. Ensure that all incoming energy sources are de-energized by checking the following locations at all line-to-line and all line-to-ground configurations.
   - **AC Utility Terminals: [TB1-A, TB1-B, TB1-C, TB1-N, and TB2(GND BUS)]**
     See Figure 5-1 on page 5–4 for the location of these terminals.
   - **PV Terminals: [TB3, TB4, and TB5 (PV GND)]**
     See Figure 5-2 on page 5–4 for the location of these terminals.

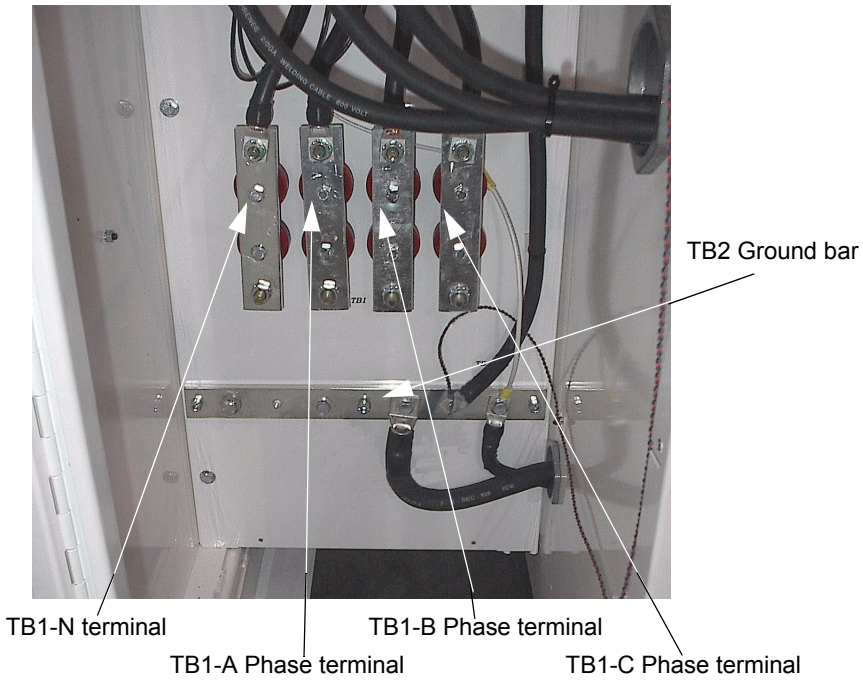

Figure 5-1 AC Terminal Connections from the Utility

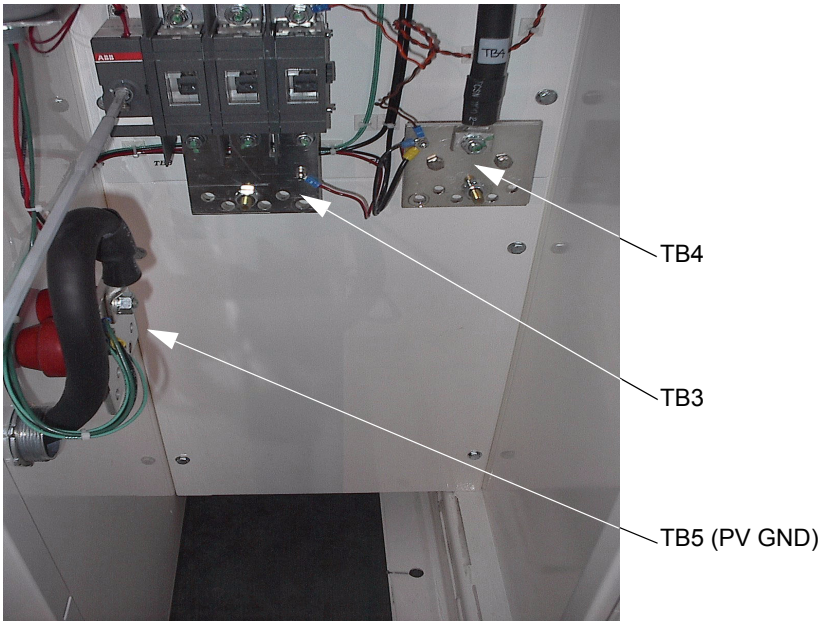

Figure 5-2 DC Terminal Locations

Maintenance Intervals

The maintenance intervals must be adhered to in order to warrant a safe and precise operation. The requirement for these maintenance intervals is an assembly at an average annual temperature of +20 °C, whereby the maximum cooling air must be within the +50 °C to -15 °C range.

In principle, customers choose between two types of maintenance intervals:

- Maintenance interval determined by the environmental degree of pollution or
- Maintenance interval determined by facility's operating time.
- Xantrex recommends at a minimum that the Maintenance Interval be annually.

Periodic Maintenance

Xantrex Technology, Inc. recommends that the following preventative maintenance procedures be carried out on the GT100.

Monthly Intervals or As Required

Perform the following preventative maintenance tasks on a monthly basis or as required.

Intake Air Duct	Inspect the intake air duct and cooling fan for accumulation of dirt and debris. Accumulation of dirt and debris within the duct and matrix cooling fan will decrease their ability to move air and thus transfer heat away from the IGBT matrix heatsink, which may cause the GT100 to enter a Fault state based upon an over-temperature alarm. Remove and clean if debris is present.
Fan Operation	Verify proper operation of the cooling fan, located at the rear of the enclosure. This fan is dependent upon GT100 power level operation and temperature of the matrix heatsink. The fan will operate if the matrix temperature reaches at least 30°C and the "INV kW" is at least 30 kW. If present, remove any debris from the fan.
Inductor Enclosure Cooling Fan	Verify the inductor cooling fan operates whenever the GT100 is processing power. The airflow can de detected from the outside at the upper vent and lower grill.

Six Month Intervals

Perform the following preventative maintenance tasks on a six-month basis or as required.

Enclosure Seals	Inspect the enclosure door seals. If damaged, replace with equivalent closed cell foam gasket. Call your Xantrex Technology distributor for factory replacements or specifications.

Electrical Connections	Inspect the condition of all wiring within and interfacing to the GT100. Inspect all compression-type cable terminations and box-type connections within the AC and DC Interface, and the Main Inverter Enclosure for damage caused from high temperature. Also check these terminations and connections for signs of corrosion. If any cabling or wiring within and interfacing to the PV GT100 are found to be or are suspected to be unacceptable, contact your Xantrex Technology, Inc. distributor for factory replacements or recommendations. Replacement of any damaged wires will be necessary. Verify all mechanical connections are sufficiently tightened. Verify all conduction surfaces are clean and free of corrosion. Mechanical electrical connections may loosen over time primarily due to thermal cycling during normal operation. As electrical connections loosen, impedance will increase at the connection, eventually leading to possible fire and component damage. It is critical to check all electrical connections every six months. See termination torque specifications for AC connections in Table A-5 on page A–5. See termination torque specifications for DC connections in Table A-6 on page A–5.
Transformer and Inductor Enclosure	Remove the access panel on the transformer and inductors and inspect for any accumulated dirt and debris within the enclosure. Vacuum enclosure whenever dust or dirt is present.

A Specifications

Appendix A provides the environmental and electrical specifications for the GT100 Grid-Tied Photovoltaic Inverter.

System Specifications

The GT100 has been designed for photovoltaic power systems, which operate within the following specifications.

CAUTION: Equipment Damage

Operation of the GT100 in a manner other than specified in this manual may cause damage to the GT100 and other system components and will void the terms of the warranty.

Environmental Specifications

Table A-1 Environmental Specifications

Specification	Value
Dimensions	1861.8 mm H x 1702.0 mm W x 1171.0 mm D (73.3 in. H x 67.0 in. W x 46.1 in. D)
Weight	1361 kg (3000 lbs)
Allowable Ambient Temperature Operating Storage	 -15 °C to 50 °C Maximum (5 °F to 122 °F) -40 °C to 50 °C Maximum (-40 °F to 122 °F)
Relative Humidity	to 95%, non-condensing
Elevation	2000 m (6600 ft)
Protection Class	NEMA 3R
Clearance (ventilation and serviceability) Top Front Sides Rear	 305 mm (12 in) 800 mm (31.5 in) (door clearance) plus local safety standards 0 mm (0 in) 0 mm (0 in)

Electrical Specifications

Table A-2 provides the AC and DC specifications for the GT100.

Table A-2 Electrical Specifications

Specification	GT100-480 and GT100-480-PG	GT100-208 and GT100-208-PG
Nominal AC Input Voltage (+10% to -12% acceptable range)	480 Vac (423 to 528 Vac)	208 Vac (184 to 228 Vac)
Maximum AC Output Current	137 A_{rms}	315 A_{rms}
Nominal AC Input Frequency (+0.5 to -0.7 Hz acceptable range)	60 Hz (57.0 to 60.5 Hz)	60 Hz (57.0 to 60.5 Hz)
Line Power Factor	>0.99	>0.99
Output Power	100 kW	100 kW
Sell Power Range	1 kW to 100 kW	1 kW to 100 kW
Peak Power Tracking Window	300 to 480 Vdc	300 to 480 Vdc
Maximum Open Circuit Voltage	600 Vdc	600 Vdc
Nominal DC Voltage	345 Vdc	345 Vdc
Maximum DC Current	347 A	347 A
DC Current Ripple	< 2% at rated power	< 2% at rated power
Maximum Array Short Circuit Current	460 A	460 A
DC Back-feed Current	0 A	0 A
AC Current Distortion	< 5% THD at rated power	< 5% THD at rated power
Efficiency	> 96.0%	> 95.0%
Standby and Night-time Tare Loss	< 100 W	< 100 W

Regulatory Specifications

Table A-3 provides the regulatory specifications for the GT100.

Table A-3 Regulatory Specifications

Standard	Regulation Met
General Standards	UL 1741 Rev 2005 UL 508C IEEE 1547 CSA 107.1-01
Emitted Interference	IEEE Std C37.90.2-1995 FCC Class A

Over Voltage, Under Voltage and Frequency Ranges

Table A-5 provides the over voltage, under voltage, over-frequency, and under-frequency detection limits for the GT100. These detection limits have been factory tested and deemed to be in compliance with UL 1741 Rev 2005 and IEEE 1547 requirements for utility interaction.

Table A-4 Over/Under Voltage and Over/Under Frequency Ranges

Vac Condition (% of Nominal)	GT100-480 and GT100-480-PG Voltage Range	GT100-208 and GT100-208-PG Voltage Range	Trip Time
Vac < 50% (Fast Under-voltage)	Vac < 240	Vac < 104	10 cycles
50% <=Vac < 88% (Under-voltage)	240 <= Vac < 423[a]	104 <= Vac < 184[a]	2 seconds
88% < Vac <= 110% (Nominal)	423 < Vac <= 528	184 < Vac <= 228	normal operation
110% < Vac < 120% (Over-voltage)	528 < Vac < 576[a]	228 < Vac < 249[a]	1 second
120% >= Vac (Fast Over-voltage)	576 >= Vac	249 >= Vac	10 cycles
f < rated -3.0 (Fast Under Frequency)	f < 57.0	f < 57.0	10 cycles
f < rated -0.7 (Under Frequency)	f < 59.3[a]	f < 59.3[a]	10 cycles[a]
f > rated +0.5 (Over Frequency)	f > 60.5	f > 60.5	10 cycles

[a] Adjustable, password-protected.

Bolt Sizing and Torque Requirements

Table A-5 provides acceptable bolt sizes, and torque values for AC terminal connections.

Table A-5 AC Terminal Bolt Size and Torque Values

AC Terminal Connections	Max. # of Conductors per Terminal	Bolt (Hardware) or Hole Size	Torque Requirements
PE (Enclosure Ground)	2	1 / M10	75 Nm (55 lb ft)
TB1-A, TB1-B, TB1-C and TB1-N	1	1 / .41 Thru M10	75 Nm (55 lb ft)

Table A-6 provides acceptable bolt sizes, and torque values to be connected to the GT100 DC terminal connections.

Table A-6 DC Terminal Bolt Size and Torque Values

AC Terminal Connections	Max. # of Conductors per Terminal	Bolt (Hardware) Size	Torque Requirements
TB3, TB4, and TB5	6	6 / .41 Thru M10	75 Nm (55 lb ft)

Table A-7 provides acceptable screw sizes, and torque values to be connected to the GT100 Auxiliary Control Interface terminal connections.

Table A-7 Auxiliary Control Interface Screw Size and Torque Values

Aux Control Connections	Max. # of Conductors per Terminal	Screw (Hardware) Size	Torque Requirements	Signal Type
TB7-1,2 Remote Emergency Stop	1	6-32 × 0.5, Pan Hd Phil (provided)	1.35 Nm (12 lb in)	N.C. Contact @15Vdc, 10mA
TB7-3,4 Aux Enable/ Disable	1	6-32 × 0.5, Pan Hd Phil (provided)	1.35 Nm (12 lb in)	N.C. Contact @15Vdc, 10mA

Dimensions

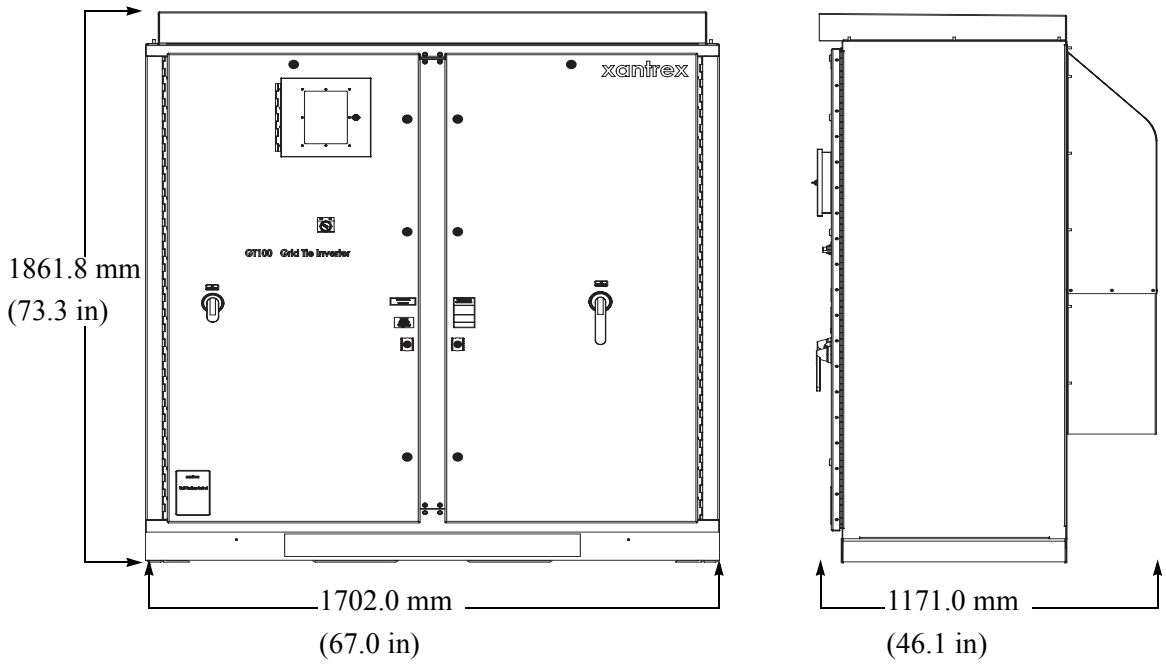

Figure A-1 GT100 Dimensions

B Commissioning Test Record

Appendix B contains the Commissioning Test Record for the GT100 Grid-Tied Photovoltaic Inverter.

Commissioning Test Record

Step 1. Record and Document Serial Number and Inverter Location	
Date and Time of Commissioning:	
Inverter Serial Number:	Technician Name:
CCU2 Board Serial Number:	Company Name:
Inverter Location: Bldg. #	Contact Email:
Address:	City: State:
Step 2. Installation and Cable Check	
Power Conductors installed correctly: Yes ❑	Terminations are properly torqued: Yes ❑
Step 3. Verify AC Utility Voltage at TB1	
A-B Measurement:	B-C Measurement:
C-A Measurement:	Phase Rotation: CW
Step 4. Verify DC PV Voltage at TB3 and TB4	
Pos - Neg Measurement: _____Vdc.	DC Polarity is correct: Yes ❑
Step 5. Apply AC Grid Voltage to the GT100	
Control Power circuits energized: Yes ❑	
Notes:	

Step 6. Confirm Operation of Universal Frontpanel Control Unit	
UFCU Boots and Displays correctly: Yes ❑	PV Disconnect Switch Fault Clears: Yes ❑
Software version (CCU2 SW):	Software version (UFCU SW):
Notes:	

Step 7. Confirm Write Menu Parameters for AC Limits	
Max AC Volts %:	Min AC Volts %:
Max AC Frequency:	Min AC Frequency:
Max GND Fault:	
Notes:	

Step 8. Confirm Write Menu Parameters for PV Settings	
PV V Start:	PV T Start:
PV P Stop:	PV T Stop:
Notes:	

Step 9. Confirm Write Menu Parameters for Power Tracker Configuration	
PPT V Ref:	I PPT Max %:
PPT Enable:	PPT Rate:
PPT V Rate:	
Notes:	

Step 10. Commanding Goal State: Matrix Test	
GT100 enters Matrix Test mode: Yes ❑	
Notes:	

Step 11. Operate the GT100 in Power Tracking Mode	
I PPT Max% initially set to10 %: Yes ❑	I PPT Max % gradually increased
GT100 operates correctly: Yes ❑	to 100 %: Yes ❑
Notes:	

Limited Warranty and Registration

What does this warranty cover? This Limited Warranty is provided by Xantrex Technology Inc. ("Xantrex") and covers defects in workmanship and materials in your GT100 Grid-Tied Photovoltaic Inverter. This warranty period lasts for 5 years from the date of purchase at the point of sale to you, the original end user customer.

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.

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 the product:

a) 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) 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) if repairs have been done to it other than by Xantrex or its authorized service centers (hereafter "ASCs");

d) if it is used as a component part of a product expressly warranted by another manufacturer;

e) if its original identification (trade-mark, serial number) markings have been defaced, altered, or removed.

Product Disclaimer

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, 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 user manual for limitations on uses of the product. Specifically, please note that the GT100 Grid-Tied Photovoltaic Inverter is not intended for use in connection with life support systems and Xantrex makes no warranty or representation in connection with any use of the product for such purposes.

Xantrex Technology, Inc.
161-G South Vasco Road
Livermore, CA 94551
USA

Warranty Registration

Please fill the required information in and send this page to Xantrex Technology Inc. (fax number: 925 455 0382) in order to apply for the 5 year Limited Warranty.

General Project and Product Information

- ❒ Customer Company Name: _____
- ❒ Project Name: _____
- ❒ System Location Information
- • Street _____
- • City _____
- • State/ZIP Code _____
- ❒ Xantrex Inverter Model: _____
- ❒ Serial Number of Inverter: _____
- ❒ Serial number of Isolation Transformer: _____
- ❒ Date of Commissioning (MM/DD/YY) _____

Xantrex Authorized Signature: Date:

_____ _____

_____

Customer Authorized Signature: Date:

_____ _____

_____

Xantrex Technology Inc.

1 800 670 0707 Tel toll free NA
1 408 987 6030 Tel direct

1 800 994 7828 Fax toll free NA
1 360 925 5143 Fax direct

customerservice@xantrex.com

www.xantrex.com