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Operation and Maintenance Manual

GT100E
100 kW Grid-Tied Photovoltaic Inverter

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GT100E Grid-Tie Inverter

Operation and Maintenance Manual

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About This Manual

Purpose

The purpose of this Operation and Maintenance Manual is to provide explanations and procedures for operating, maintaining, and troubleshooting the GT100E Grid-Tie Inverter. Installation instructions are available in the GT100E Grid-Tie Inverter Planning and Installation Manual (Part # 152364).

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 GT100E Grid-Tie 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. Installation of the GT100E Grid-Tie Inverter must be performed by a certified installer.

Organization

This Manual is organized into four chapters and one appendix.

Chapter 1, "Introduction" contains information about the features and functions of the GT100E Grid-Tie Inverter.

Chapter 2, "Operation" contains information on the basic operation of the GT100E Grid-Tie Inverter.

Chapter 3, "Troubleshooting" contains information and procedures for troubleshooting the GT100E Grid-Tie Inverter.

Chapter 4, "Preventative Maintenance" lists the periodic maintenance that is required to keep the GT100E in good working order.

Appendix A, "Specifications" contains the environmental. electrical and mechanical specifications for the GT100E Grid-Tie 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.

Abbreviations and Acronyms

AC	Alternating Current
ANSI	American National Standards Institute
BTU	British Thermal Unit
CCU2	Converter Control Unit 2
CFM	Cubic Feet per Minute
CW	Clockwise
DC	Direct Current
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
IPM	Intelligent Power Module
kcmil	1000 circular mils
LAN	Local Area Network
MPPT	Maximum Peak Power Tracker
NFPA	National Fire Protection Association
PBX	Private Branch Exchange
PPT	Peak Power Tracker
PSL	Phase-Shift Loop
PV	Photovoltaic
UFCU	Universal Frontpanel Control Unit (Front Panel User Interface)

Related Information

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

Important Safety Instructions

SAVE THESE INSTRUCTIONS - DO NOT DISCARD

This manual contains important safety instructions for the GT100E Grid-Tie Inverter (GT100E) that shall be followed at all times.

WARNING: Exercise extreme caution

Read and keep this Operation and Maintenance Manual for future reference. Before using the GT100E 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 GT100E enclosures contain exposed high-voltage conductors. The enclosure doors should remain closed with the latches tightened, except during installation, maintenance or testing. These servicing instructions are for use by qualified personnel who meet all code requirements for licensing and training for the installation of Electrical Power Systems with AC and DC voltage to 650 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 GT100E, 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 switch on the GT100E. Review the system configuration to determine all of the possible sources of energy. In addition, the source of the Auxiliary Control Power must be de-energized plus allow 20 minutes for the DC bus capacitors, located within the cabinet, to discharge after removing power.

WARNING: Amputation hazard

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

WARNING: Incorrect usage

The GT100E is not intended for use in connection with life support systems or other medical equipment or devices.

Risks

WARNING: Shock hazard

Parts of the condenser charge will still be energized for a maximum of 20 minutes after being disconnected.
Open device cover plates or doors only after the device is disconnected and discharged. Check whether the device is no longer live (DC voltage) including terminals PV+ and PV-.

WARNING: Explosion hazard

The IGBT module may explode in the event of a major malfunction.
Do not operate larger devices while the pivoting part is opened.

WARNING: Crush hazard

The inverters have a very high balance point and can easily topple down. Only move while exercising care.

WARNING: Amputation hazard

WARNING: Burn hazard

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

CAUTION: Overheating damage

The inverters have a supply air and exhaust air area, which must remain unobstructed. The device can overheat and be destroyed if the installation signs are not adhered to.

CAUTION: Electrostatic damage

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

CAUTION: Component short

No connections or disconnections are allowed at the terminal strips or internal connectors during operation.
Turn device off before performing terminal work; wait 5 to 20 minutes (condenser charge) and recheck to ensure device is no longer live.

General Safety Precautions

1. When installing the GT100E 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 GT100E if it has been dropped, or received more than cosmetic damage during transport or shipping. If the GT100E is damaged, or suspected to be damaged, see the Warranty section for this unit on page WA–1.
3. To reduce the risk of electrical shock, lock-out and tag the GT100E before attempting any maintenance, service, or cleaning.

Personal Safety

Follow these instructions to ensure your safety while working with the GT100E.

Qualified Personnel

Only qualified personnel should perform the transportation, installation and initial operation and maintenance of the GT100E (IEC 364 or CENELEC HD 384 or DIN VDE 0100 and IEC 664 or DIN VDE 0110). 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 GT100E 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

WARNING: Fire hazard

In accordance with the National Electrical Code, ANSI/NFPA 70, connect only to a circuit provided with 200 amperes maximum branch circuit overcurrent protection.

1. All wiring methods and materials shall be in accordance with European Requirements, as well as all state and local code requirements (for example, DIN / VDE).
2. The GT100E has a three-phase output.
3. The AC power conductor wiring interfacing with the AC terminals in the enclosure are located at A, B, C and N. These terminals require the use of a crimp-on type ring terminal or compression-type lug. 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-4 on page A–3. See GT100E Grid-Tie Inverter Planning and Installation Manual (Part # 152364) for the location of these terminals.
4. The DC power conductor wiring interfacing with the DC terminals is terminated in the enclosure. These terminals require the use of a crimp-on type ring terminal or compression-type lug. 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–3. See GT100E Grid-Tie Inverter Planning and Installation Manual (Part # 152364) for the location of these terminals.
5. This product is intended to be installed as part of a permanently grounded electrical system as per the National Electric Code ANSI/NFPA70 and EU requirements, as well as all state and local code requirements (for example, DIN/VDE). The single point ground for the system is to be made at the ground bus bar in the AC interface enclosure.
6. The equipment grounds on the GT100E are marked with PE (see GT100E Grid-Tie Inverter Planning and Installation Manual (Part # 152364) for the location of this terminal).
7. AC overcurrent protection for the utility interconnect equipment (Grid-tie transformer) must be provided by the installers as part of the GT100E installation.

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

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 20 minutes to allow the capacitors to discharge completely.

Safety requirements mandate that this equipment not be serviced while energized. Power sources for the GT100E must be locked-out and tagged prior to servicing. A padlock and tag should be installed on each energy source prior to servicing.

The GT100E 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 GT100E.

To lockout and tag the GT100E.

1. Open, lockout, and tag the incoming power at the utility disconnect.
2. Open, lockout, and tag the AC disconnect switch on the enclosure. See Figure 1-4 on page 1–6 for the location of the AC disconnect switch.
3. Using appropriate means, open, lockout, and tag incoming PV circuits.
4. 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.
   a) AC Utility Terminals: (Bottom of A, B, C and N)
   See GT100E Grid-Tie Inverter Planning and Installation Manual (Part # 152364) for the location of these terminals.
   b) PV Terminals: (PV+ and PV-)
   See GT100E Grid-Tie Inverter Planning and Installation Manual (Part # 152364) for the location of these terminals.

De-Energize/Isolation Procedure

WARNING: Shock hazard

The terminals of the DC input may be energized if the PV arrays are energized. In addition, allow 20 minutes for all capacitors within the main enclosure to discharge after disconnecting the GT100E from AC and DC sources.

The following procedure should be followed to de-energize the GT100E for maintenance.

To isolate the GT100E:

1. Turn the ON/OFF switch to the OFF position.
2. Place the emergency switch in the active position (push in).
3. Open the AC interface disconnect switch.
4. Open, lockout, and tag the PV input circuit breaker at the PV array.
5. Open, lockout, and tag the AC Grid power circuit breaker at the Grid transformer.

Interconnection Standards Compliance

The GT100E complies with the German grid protection requirements of VDEW and the Spanish RD 661/2007.

The GT100E is designed to meet EN50178 and EN60204-1 specifications.

Refer to both documents for details of these recommendations and test procedures.

Intended Use

The GT100E may only be used in connection with PV modules. It is not suitable for any other application areas.

An initial operation (e.g. starting the intended operation) will only be allowed when observing the EMC guideline (89/336/EWG).

The GT100E complies with the 73/23/EWG low voltage directive requirements. The harmonized standards of the series EN 50178/DIN VDE 0160 in connection with EN 60439-1/DIN VDE 0660 part 500 and EN 60146/DIN VDE 0558 will be used for the inverters.

Contents

Figures

Tables

1 Introduction

Chapter 1, “Introduction” contains information about the features and functions of the GT100E Grid-Tie Inverter.

Description of the GT100E

The Xantrex Technology GT100E Grid-Tie Inverter is a single enclosure, three-phase power conversion system for grid-connected photovoltaic arrays with a rating of 100 kW. The GT100E inverter incorporates the innovative switching technology utilizing state-of-the-art IPMs (Intelligent Power Module), to convert the photovoltaic array's DC power to the utility's three-phase AC power. The power conversion system consists of a three-phase, pulse-width-modulated inverter, switchgear for isolation and protection of the connected AC and DC power systems and an isolation transformer. The system has very low standby and nighttime power consumption. The system has local communication access as well as remote communication access through a modem.

The IPMs which the GT100E uses provide low power losses during the conversion process. It uses the IPM devices with a gate drive circuit to interface the photovoltaic array with a utility grid. The GT100E consists of an inverter bridge, photovoltaic controller, and associated control electronics. The GT100E control software provides for complete overall system control with a variety of protection and safety features.

Operator Interface Controls

WARNING: Shock hazard

Before attempting to service the GT100E, follow the de-energize Lockout and Tag procedure on page xi.

The GT100E inverter enclosure is IP21 rated and contains the power electronic inverter bridge, electrical and electromechanical control components, power supplies, system sensing circuits, converter control unit 2 (CCU2), the AC and DC disconnects and the isolation transformer

Operator interface controls are located on the front door of the inverter enclosure. These controls include an ON/OFF switch, and a front panel user interface, comprised of a 4-line display and keypad. Additionally there is an AC disconnect and an emergency (E-STOP) push button.

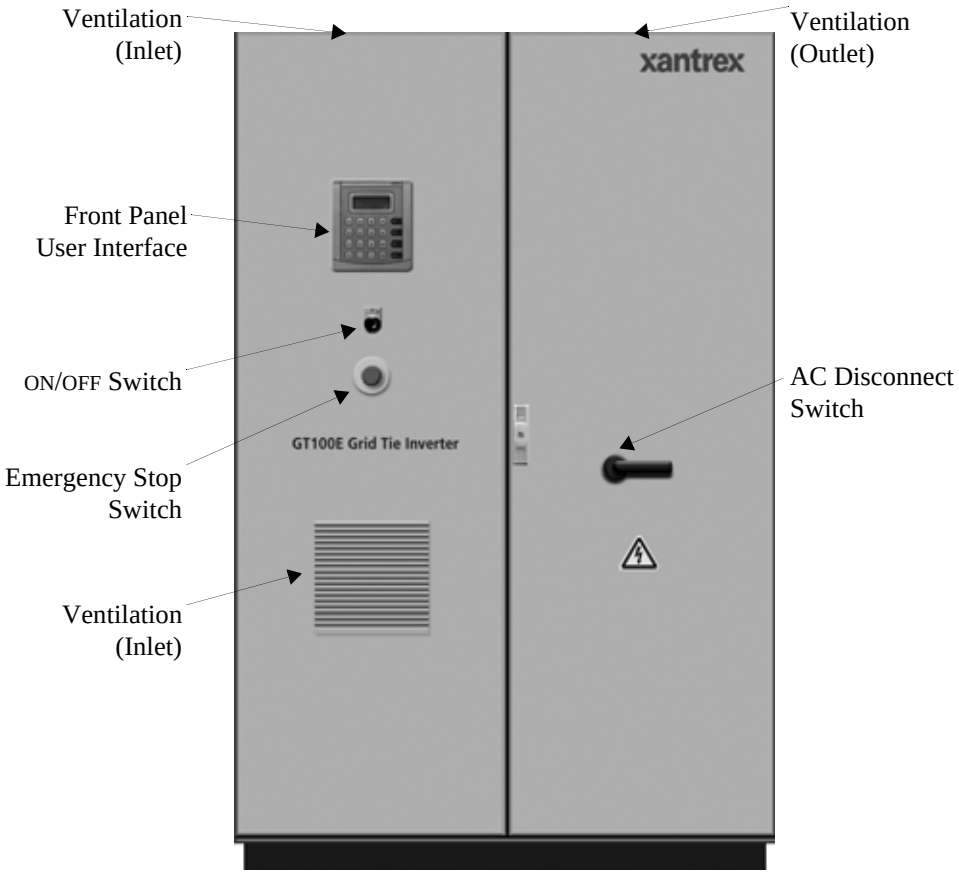


Figure 1-1 GT100E Operator Interface Components

ON/OFF Switch

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 GT100E, follow the de-energize Lockout and Tag procedure on page xi.

The GT100E incorporates a maintained position ON/OFF switch located on the front door of the inverter enclosure. Under normal 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 GT100E 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 GT100E is prevented from being restarted until the ON/OFF switch is turned back to the ON position.

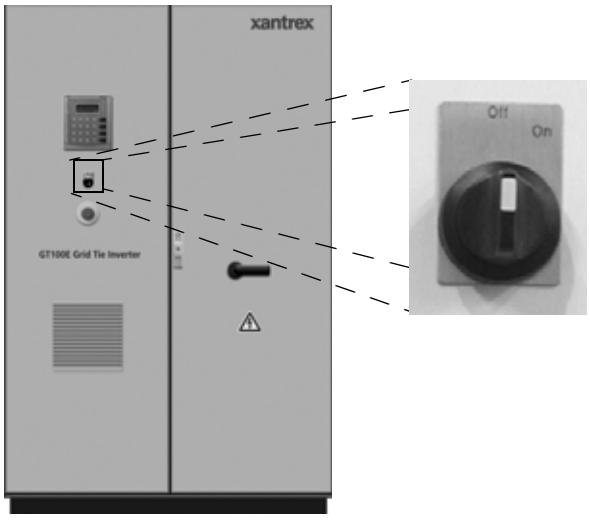


Figure 1-2 ON/OFF Switch

Emergency Stop (E-STOP)

The GT100E incorporates a maintained position E-STOP pushbutton located on the inverter enclosure. Under normal conditions, the E-STOP pushbutton is in the CLOSED (extended) position. Pushing the pushbutton to the OPEN (depressed) position will initiate an immediate controlled shutdown of the GT100E and open both the main AC and DC contactors within the unit. The main AC and DC contactors cannot be closed unless the pushbutton is in the CLOSED (extended) position. The GT100E is prevented from being restarted until the E-STOP pushbutton is in the CLOSED (extended) position.

Provisions are supplied for adding a remote emergency stop circuit.

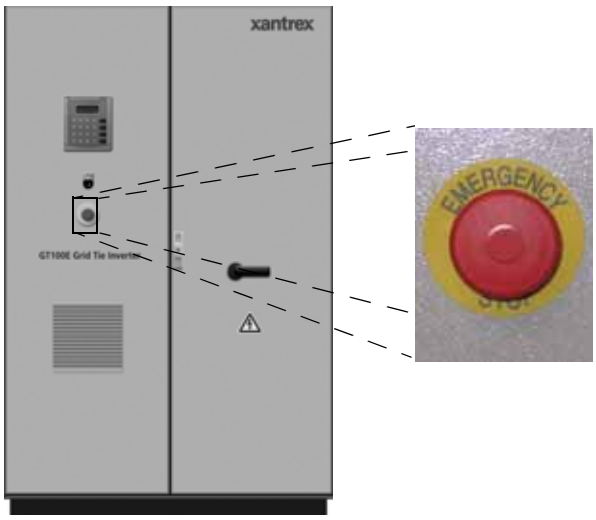


Figure 1-3 Emergency Stop

AC Disconnect Switch

WARNING: SHock hazard

Disengaging the inverter enclosure door interlock switch does not remove all hazardous voltages from inside the inverter. Before attempting to service the GT100E, follow the de-energize Lockout and Tag procedure on page xi.

The AC disconnect switch is the primary disconnect for the inverter. The inverter's doors cannot be opened until the AC disconnect switch is in the OFF position. The AC disconnect switch interrupts the AC voltage supply to the inverter. Once the switch is open there is still voltage on the grid side of the switch. There is also DC voltage on the DC input terminal block and the input of the DC contactors.

To operate the inverter the AC switch must be in the ON position.

The GT100E inverter enclosure doors must be locked during normal operation.

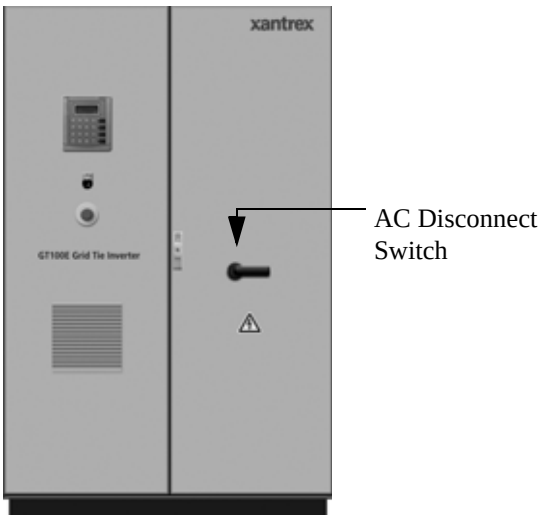


Figure 1-4 AC Disconnect Switch

Front Panel User Interface

The GT100E has a front panel user interface which is comprised of a 4-line display screen for reporting basic system status and all fault conditions plus a keypad for configuration. The keypad is comprised of 20 touch-sensitive keys that provide a means to navigate through the menus and alter user-changeable settings. See “Front Panel User Interface” on page 2–7 for configuration and fault tracking details.

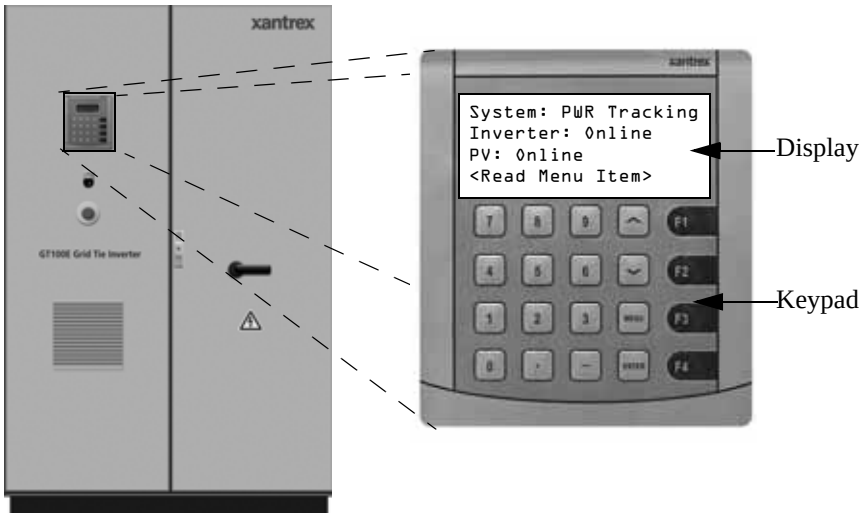


Figure 1-5 Front Panel User Interface

Interior Components

Figure 1-6 shows the location of the major interior components of the GT100E, describes their function and provides links to further information.

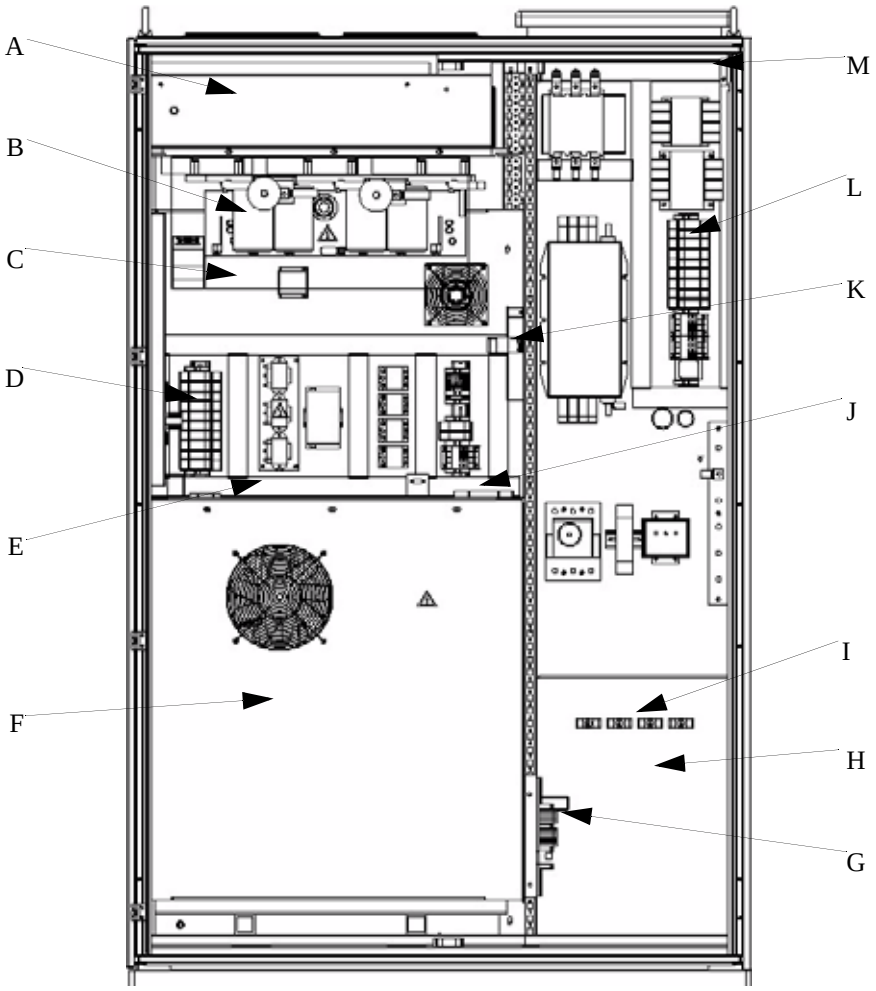


Figure 1-6 Interior Components of the GT100E

Table 1-1 Interior Components of the GT100E

Identifier	Component Name	Description
A	Power Electronics Cooling System	The system uses forced-air convection to cool the power electronics matrix.
B	Power Electronic Matrix	The power electronics inverter bridge is located at the top left side of the GT100E enclosure. The matrix is comprised of switching transistors (IPMs), IPM driver board, a laminated power bus, DC capacitor bank, and an aluminum extrusion heat sink with cooling fans. The fans are located above the matrix heatsink. The PV array is tied to the DC bus via the DC disconnect contactor. The converter control unit manages the transfer of power between the DC bus and the utility grid.

Table 1-1 Interior Components of the GT100E

Identifier	Component Name	Description
C	Converter Control Unit 2	The CCU 2is a digital signal processor (DSP) based control board that performs numerous control and diagnostic functions associated with GT100E operation. Its most significant tasks are control of GT100E electromechanical components and power electronics converters, signal conditioning for high voltage signal inputs and communication with the front panel user interface and system sensors. The CCU 2 also contains the necessary DC power supplies to support its operation.
D	Main Control Panel	This panel contains many of the control power components and protective devices necessary to support the operation of the GT100E.
E	Remote Communication Access port	The remote communication access port is a modem that is connected to a direct telephone line. This access port is used to connect the unit to a remote site.
F	Power Magnetics Enclosure	The power magnetics enclosure contains the 400Y:208Y isolation transformer, the line filter capacitor, the line reactors and the main transformer fuses.
G	Customer Interface Panel	This panel contains the customer interface terminal blocks. The following connections are terminated on this panel: The 230VAC auxiliary power, telephone line, remote emergency switch and the external fan control.
H	DC Access Panel	This panel separates the PV array terminals from the grid terminals.
I	DC Contactor Panel	This panel contains the DC contactor. The panel is located behind the DC access panel.
J	Local Communication Access port	The local communication access port is a 9 pin RS232 port. This access port is used to connect to a local laptop for troubleshooting the unit.
K	CT Panel	This panel contains the current sensing components.
L	Power Distribution Panel	This panel contains many of the electro-mechanical, protective, and control power components necessary to support the operation of the GT100E.
M	Communication Switch	This switch transfers communication from the external communication access port (door closed) to the internal communication access port (door open).

Main Control Panel Components

The major features of the main control panel of the GT100E are identified and described in Figure 1-7.

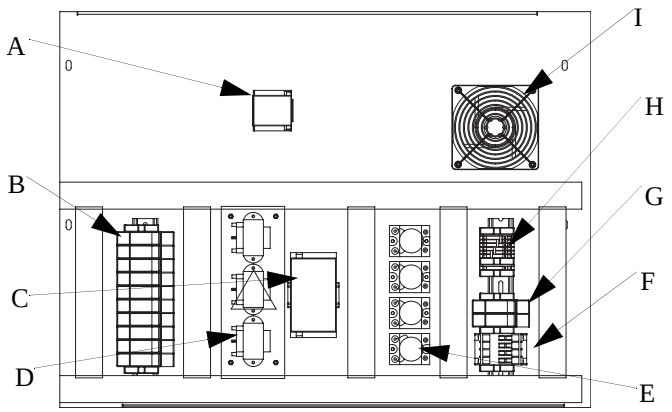


Figure 1-7 Main Control Panel Components of the GT100E

Table 1-2 Main Control Panel Components

Identifier	Component	Description
A	RS232 to Fiber Converter	This board converts the fiber optic communication signal to a RS232 communication signal.
B	Fuses	Fuses are used to provide short circuit and overload protection for internal components which include: line filter capacitor, AC line sense transformers, DC Buss sense signals and the remote emergency stop signals.
C	Power Supply	The power supply provides isolated +15Vdc to the RS232 to Fiber converter board and the IPM driver board.
D	AC Line Sense Transformers	These sense transformers are used to monitor the 400VAC Line voltage. 230V:5.2V is the transformer ratio.
E	Solid State Relays	These relays are used to interface between the CCU2 board and the contactors.
F	PV Array Sense Contactor	The contactor provides an interface and isolation between the PV array and the CCU2.
G	PV Array Sense Fuses	Fuses are used to provide short circuit and overload protection for PV array sense signals
H	Control Power Terminal	This terminal provides the 230VAC power to the main control panel components.
I	Internal Fan	The internal fan provides air circulation for the internal components.

Power Distribution Panel Components

The major features of the power distribution panel of the GT100E are identified and described in Figure 1-8.

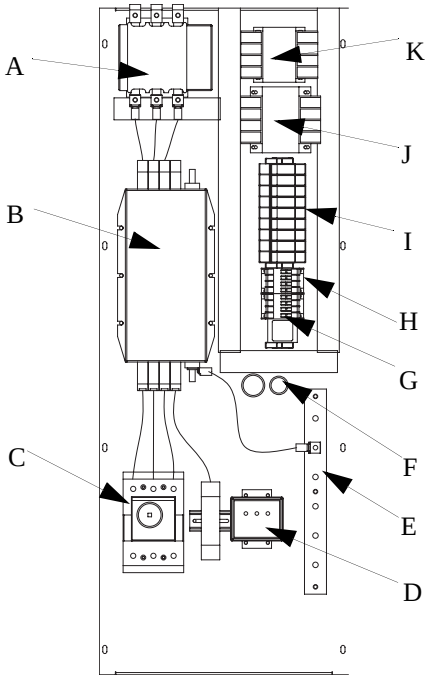


Figure 1-8 Power Distribution Panel Components of the GT100E

Table 1-3 Power Distribution Panel Components

Identifier	Component	Description
A	AC Line Contactor	The AC Line contactor is the main contactor that connects the power electronics matrix to the grid.
B	EMI Filter	The EMI Filter removes the conducted electromagnetic emissions from the GT100E unit.
C	AC Circuit Breaker	The AC circuit breaker connects the GT100E unit to the grid.
D	Surge Arrestor	This surge arrestor prevents damage to the unit from voltage surges and lightning.
E	Ground Terminal	This is the main ground terminal for the GT100E unit.
F	Fan Control Circuit	This circuit controls the Matrix and Transformers fan speed.
G	External Fan Control Contactor	This contactor engages an external fan control unit, for cooling the GT100E building.
H	Internal Fan Contactor	This contactor controls the AC power to the matrix cooling fans and the magnetics cooling fan.

Table 1-3 Power Distribution Panel Components

Identifier	Component	Description
I	Fuses	Fuses are used to provide short circuit and overload protection for internal components which include: control power transformers, internal and external fans.
J	Control Power Transformer	This transformer provides the 230VAC control power to the unit.
K	CCU2 Control Power Transformer	This transformer provides the 24VAC control power to the CCU2 board.

CT Panel Components

The major features of the CT panel of the GT100E are identified and described in Figure 1-9.

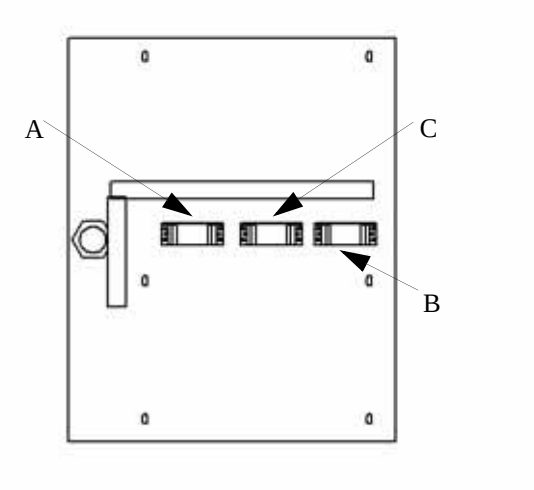


Figure 1-9 CT Panel Components of the GT100E

Table 1-4 CT Panel Components

Identifier	Component	Description
A	PV Array Current Sensor	The PV array current sensors monitor the PV Arrays current levels.
B	AC Line Current Sensor – Phase A	The AC Line current sensor monitors the Phase A current to the grid.
C	AC Line Current Sensor – Phase C	The AC Line current sensor monitors the Phase C current to the grid.

Power Magnetics Enclosure Components

The major features of the power magnetics enclosure of the GT100E are identified and described in Figure 1-10.

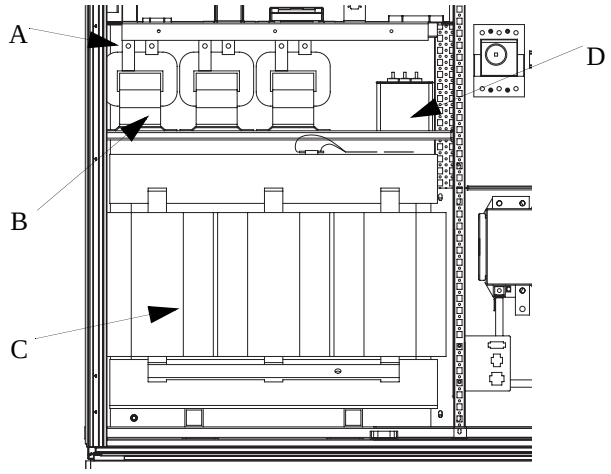


Figure 1-10 Power Magnetics Enclosure Components of the GT100E

Table 1-5 Power Magnetics Enclosure Components

Identifier	Component	Description
A	Main Transformer Fuses	Fuses are used to provide short circuit and overload protection for AC Lines from the power electronics matrix.
B	AC Line Reactors	These AC Line Reactors are part of the AC line filter, which removes harmonic currents for the grid.
C	Isolation Transformer	The transformer converts 208 VAC inverter output voltage to the 400 VAC grid voltage. The transformer will provide isolation from the inverter to the grid.
D	Line Filter Capacitor	This capacitor is part of the AC line filter, which removes harmonic currents for the grid.

DC Contactor Panel Component

The major feature of the DC Contactor panel of the GT100E is identified and described in Figure 1-11.

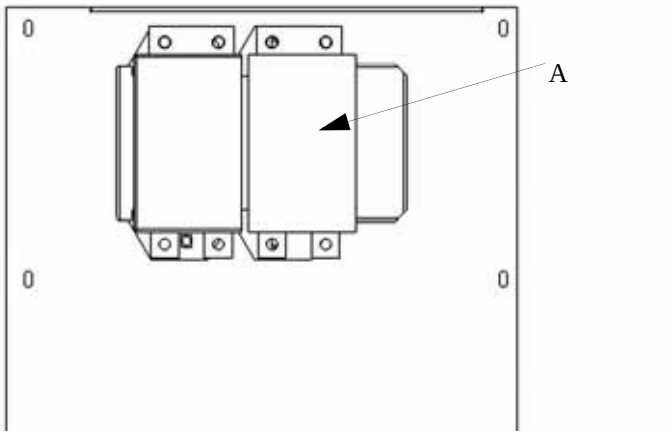


Figure 1-11 DC Contactor Panel Component of the GT100E

Table 1-6 DC Contactor Panel Component

Identifier	Component	Description
A	DC Contactor	The DC contactor is the main contactor that connects the power electronics matrix to the PV array.

Power Electronics Matrix Components

The major features of the power electronics matrix of the GT100E are identified and described in Figure 1-12.

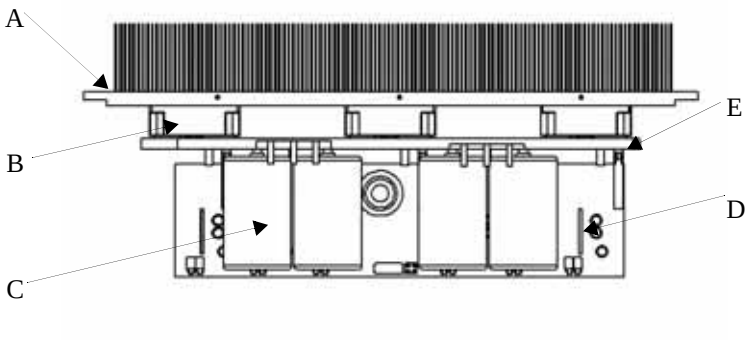


Figure 1-12 Power Electronics Matrix Components of the GT100E

Table 1-7 Power Electronics Matrix Components

Identifier	Component	Description
A	Heatsink	The heatsink is used to cool the IPM devices. The heatsink uses force air convection for cooling.
B	IPM Device	The IPM devices are the main power-semiconductor switching devices for matrix.
C	DC Capacitor Bank	The DC capacitor bank stores energy to maintain the DC bus voltage and it is used to reduce the high switching ripple of the matrix.
D	IPM Driver Board	The IPM Driver board is the interface between the CCU2 board and the IPM devices.
E	Laminated Bus	The laminated bus is the interface between the PV array, the DC filter, the IPM devices and the grid.

Operation Features

The GT100E has the following operation features.

Fixed Unity Power Factor Operation

The GT100E 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 GT100E 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 GT100E 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 GT100E 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 front panel user interface, there are five user-settable parameters that control the behavior of the maximum peak power tracker within the GT100E. As show in Figure 1-13 on page 1–18, 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 GT100E 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 GT100E 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 GT100E. 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 GT100E 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 (650 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 GT100E, the MPPT will increase voltage as needed to maintain output power below rated maximum.

Optimization of the GT100E 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.

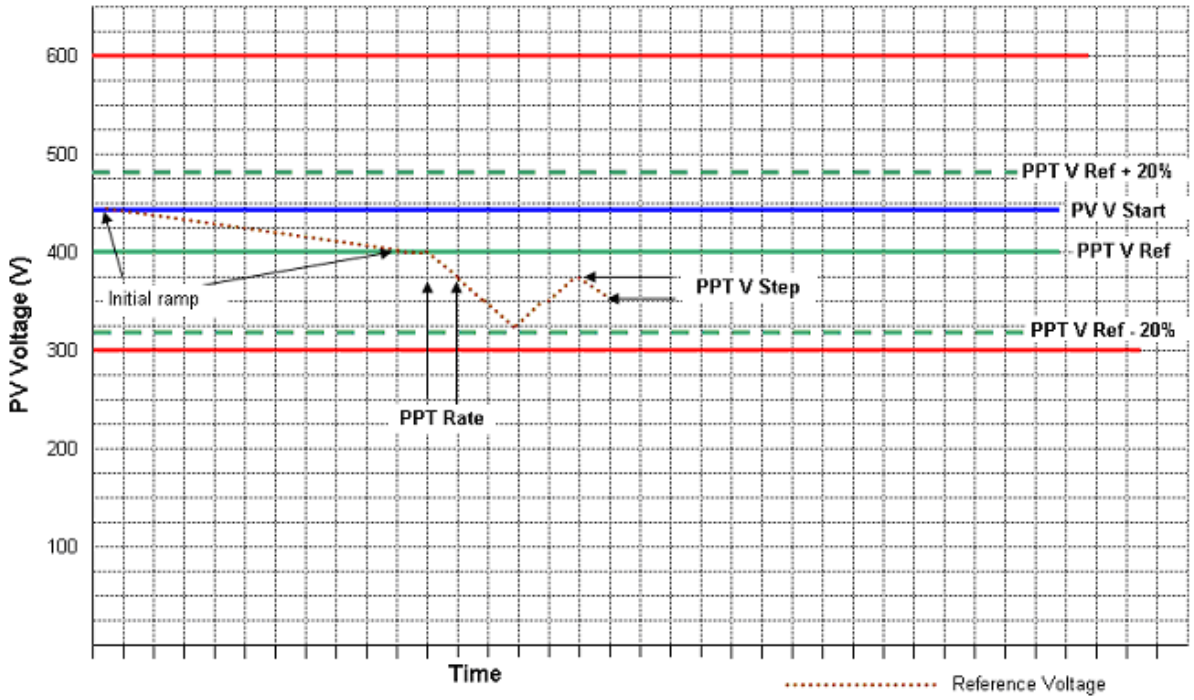


Figure 1-13 Maximum Peak Power Tracking

Utility Voltage/Frequency Fault Automatic Reset

In the event of a utility voltage or frequency excursion outside of preset limits, the GT100E will stop operation and display a fault at the user interface display. Once the utility voltage has stabilized within acceptable limits for a period of at least 5 minutes, the GT100E 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 GT100E) 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 GT100E 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 GT100E. 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 GT100E 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.

PV Ground Insulation Detection (Option)

WARNING: High voltage present

The resulting capacitive earth current is rather large due to a floating inverter and PV module assembly.

The GT100E may be equipped with an optional PV ground insulation detection circuit (PROAT Relay). The circuit measures the impedance between the PV+ circuit and ground and between the PV- circuit and ground. If the impedance drops below a preset value, the GT100E will execute an immediate orderly shutdown, open both the AC and DC contactors and report a PV ground insulation fault on the display. The GT100E will remain faulted until the fault is remedied and the advisory is cleared via the user interface.

No parallel switching of the PROAT relays is allowed.

Figure 1-14 PROAT Relay Display

The inverter disconnects itself in the event of a ground fault.

DC Over-voltage Detection

In the event of DC voltage greater than 650 Vdc, the GT100E will execute an orderly shutdown and will report a fault to the user interface. If DC voltage remains greater than 650 Vdc, the GT100E may be irreparably damaged.

See Chapter 3, “Troubleshooting” for further information on this fault condition.

Communication Features and Methods

The GT100E provides two types of information to the user:

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

System status and fault information can be accessed using the user interface keypad and display or a personal computer using the PV View GUI (Graphic User Interface) software. Data logging requires the use of a PC using the PV View GUI software.

The GT100E communicates system status information to the user using the following methods.

- Front panel user interface keypad and display
- PC Connection (direct and/or remote) - PV View required (may require additional hardware)
- External Analog Monitoring - (Optional) (for example, irradiance, PV temperature, ambient temperature, wind speed) (requires additional hardware)

System Status and Fault Reporting

Basic system status and all fault conditions rising from within the GT100E are reported to the display. The unit stores the time and details of all faults in non-volatile memory. The 4-line display will show a fault code and a brief text description of the fault.

The fault value is also made available to the PV View GUI. The GUI has a more extensive description of the fault.

This information can also be accessed using a personal computer using the PV View either directly or remotely. Alternatively, the fault reporting can be accomplished using optional communication systems.

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

Data Logging

The inverter stores data values and software metrics for debugging. These values are stored within the CCU2 controller board in non-volatile memory. Data logging requires the use of a PC connection using the PV View.

The Data Logging features include:

- Operational Values
- Internal Metrics
- Data Log Acquisition
- Graphic Data Analysis
- Fault Log Acquisition
- Software Upgrade
- Accumulated Values
- Configurable Parameters

PC Connection Methods

Personal computers can be used to access the system status, control and programming features of the GT100E. Computers can be connected either directly or remotely using the appropriate optional hardware and software. Software is available to provide a graphic user interface that relates important system information. This software is called the PV View GUI.

Direct Access Connection

The GT100E can be directly accessed by a computer using the local communication access port.

Remote Access Connection

The GT100E can be remotely accessed through several methods such as a telephone connection or local area network (LAN), wireless modem or fax modem. Optional hardware and software is needed for these features; they are available for purchase for use with the GT100E to enhance its communications capability. The additional GT100E options can be field installed. Contact a Xantrex distributor for further information on installation options.

2 Operation

Chapter 2, “Operation” contains information on the basic operation of the GT100E Grid-Tie Inverter.

Description of System Operation

Overview

The GT100E 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 GT100E. 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 GT100E.

- 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 GT100E inverter enclosure, must be switched to the ON position for all operating states.
- The AC disconnect switch 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 GT100E 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 are auto-clearing and thus enable the GT100E to restart after a delay period. All fault conditions arising from within the GT100E are reported to the front panel user interface. The 4-line display will show a 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, GT100E faults may be cleared from the keypad (see “Clearing Faults Manually” on page 3–4) or via the remote PV View GUI (follow the instructions on the display).

Operating States

A state machine implemented within the CCU2 control software governs the operation of the GT100E 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 GT100E 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 GT100E to immediately stop processing all power. The fault condition will be reported to the display.
- Most GT100E faults are latching and must be cleared at the keypad before transitioning to another operating state.
- The ON/OFF switch, located on the front door of the GT100E, must be in the ON position for all operating states except Matrix Test, in which case it must be in the OFF position.

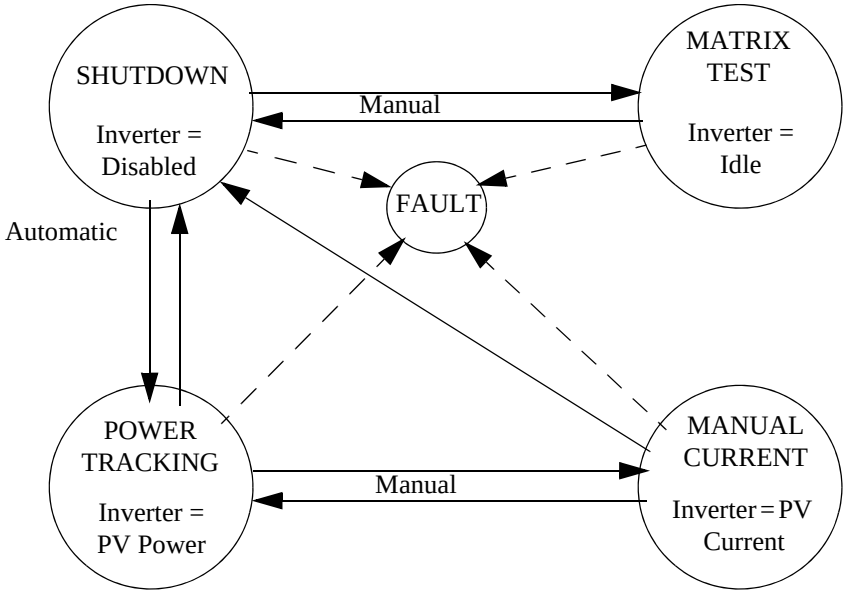


Figure 2-1 State Transition Diagram

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 GT100E between operating states via the keypad or remotely using the PV View 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 GT100E 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 GT100E. The GT100E maximum peak power tracker (MPPT) 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 GT100E automatically determines when to stop producing power dependent upon the output power of the inverter. As the net output power of the GT100E 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 keypad, up to the PV current limit of the GT100E. If the user commands more PV current than is available, the DC bus voltage will drop below the minimum bus voltage level and the GT100E 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 GT100E to enter this state.

Fault

The GT100E has encountered a fault condition. When this happens, regardless of the GT100E state of operation, the GT100E will stop processing all power and execute an orderly system shutdown. A description of the fault and fault code will appear on the display. The fault state may be cleared from the keypad once the cause of the fault has been corrected. See Chapter 3, “Troubleshooting” for a complete description of all fault codes.

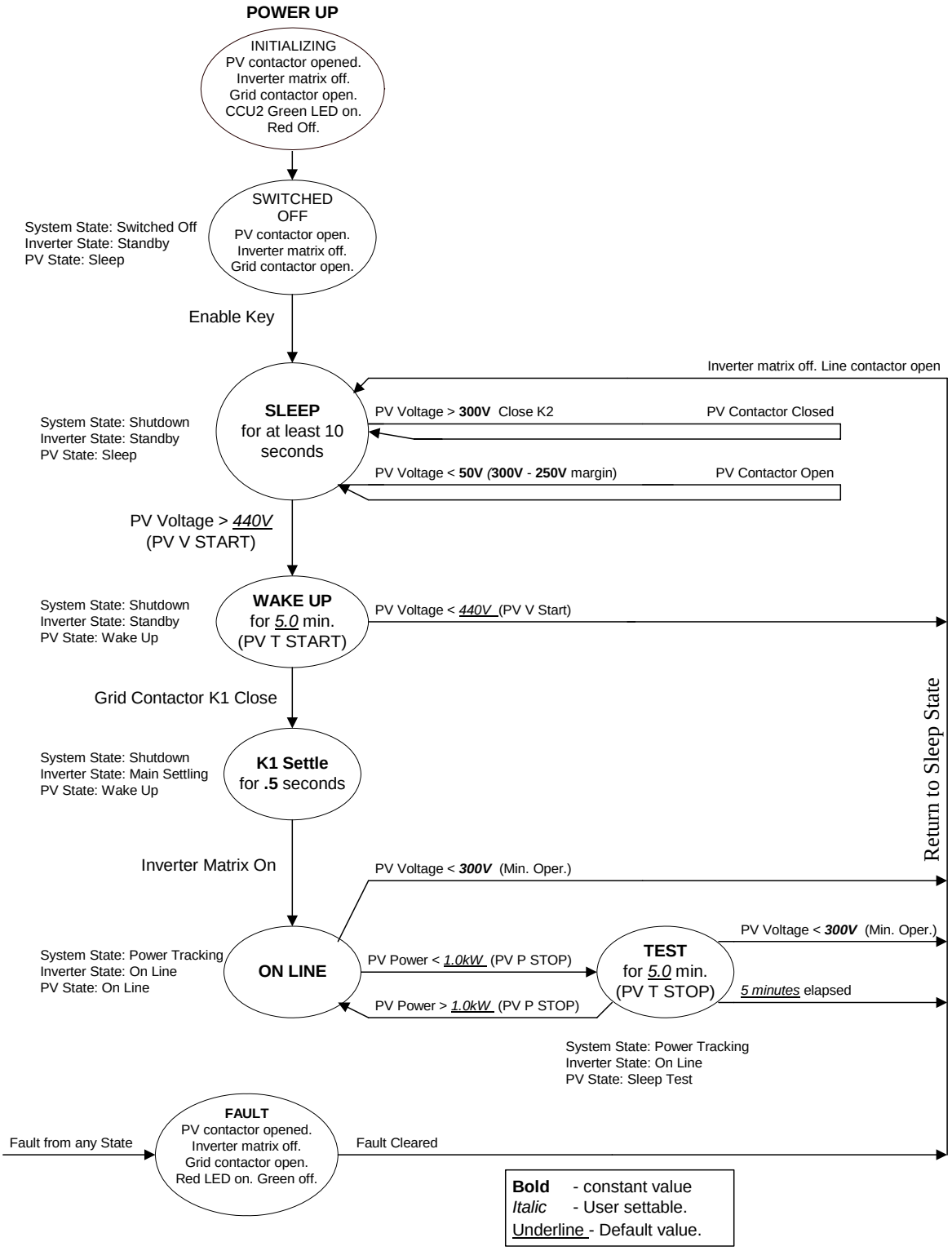


Figure 2-2 Operating States Flow Chart for Power Tracking

Front Panel User Interface

The purpose of the user interface is to provide a means of communicating critical operational information to and from the unit. This communication occurs between the operator and the user interface display and keypad, or between the operator and a personal computer running the PV View GUI software. The communication options are also available for remote monitoring and control systems.

User Interface Keypad Operation and Display

The 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 GT100E 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”.
2. Two Navigation keys are available.
   - \/ or /\ moves forward or backward within the menu structure. Upon reaching the end of the menu, it returns 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.

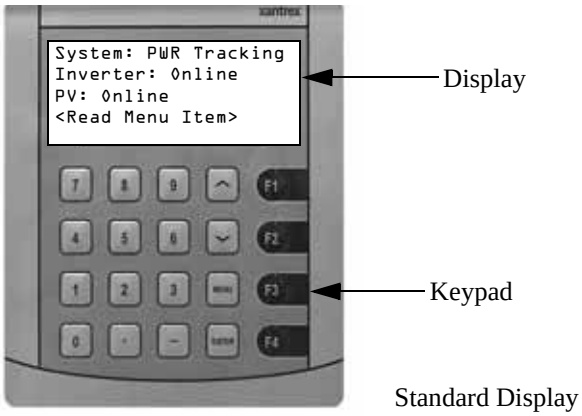


Figure 2-3 Front Panel User Interface

User Interface Display - Initialization Screen

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

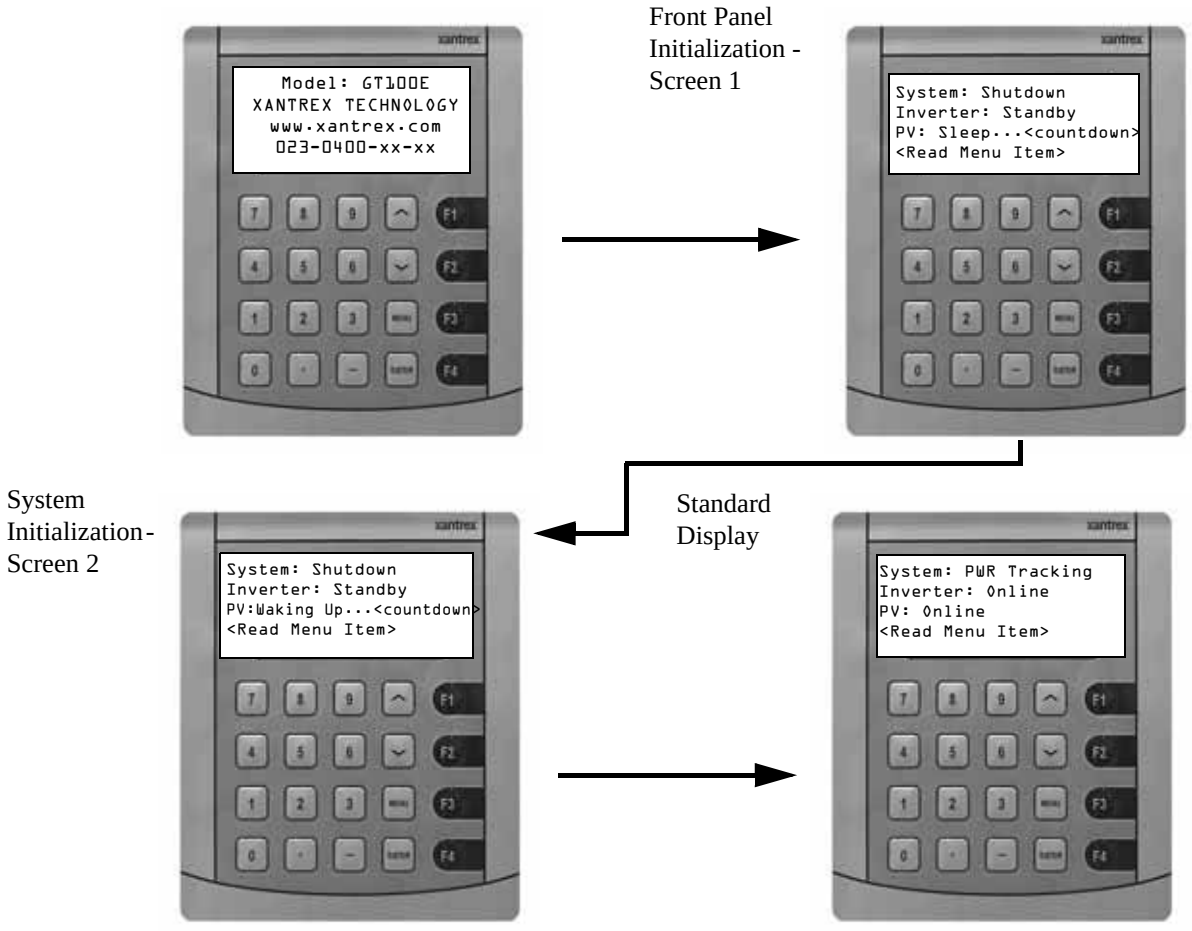


Figure 2-4 Initialization Screens

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

Important: Specific grid-interface parameters within the write menu have been set in the factory to the limits mandated by the EN60204-1. Any changes to these setpoints should be agreed upon by the local utility and the equipment owner.

Important: While in the write menu, the display will reset itself to the standard display if there is no input for more than 2 minutes.

The user interface consists of three levels:

- **READ Menu**:
  operation information provided to the user from the GT100E. The read menu consists of all operational values, the date and time. These can be viewed any time the GT100E has control power.
- **WRITE Menu:**
  operational parameters provided to the GT100E 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 GT100E 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 PV View GUI. See the list of stored parameters on page 1–21.

Information reported back to the user (read menu) occurs at the front panel display and (if used) at the computer running the PV View GUI monitoring program. Making changes to the parameters within the write menu is done with the keypad or the PV View and requires a password.

Upon system powerup, the display 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.

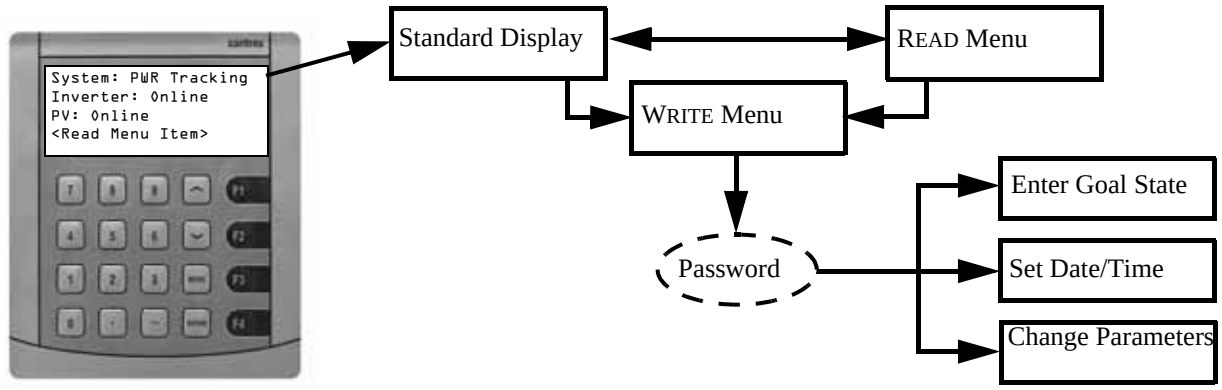


Figure 2-5 User Interface Menu Diagram

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 display will change as the operator continues scrolling through the menu.
Table 2-2 on page 2–13 provides a detailed description of read menu operational values that are displayed on the display.

To display any operational value in the read menu:

1. From the standard display, use the Λ or V keys on the keypad to scroll through the read menu. The fourth line of the display changes to show the appropriate information. See Table 2-1.
2. The V key scrolls downward through the menu.
   The Λ key scrolls upward through the menu.

Table 2-1 Scrolling through the Read Menu Parameters

Read Menu Value	Fourth Line of the Display
FP Software Version	FP V023-0400-xx-xx
CCU Software Version	CCU 151-0122-xx-xx
Model Name	GT100E
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:
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 parameters list, when the last item in the menu is reached, the list reverts back to the beginning item.

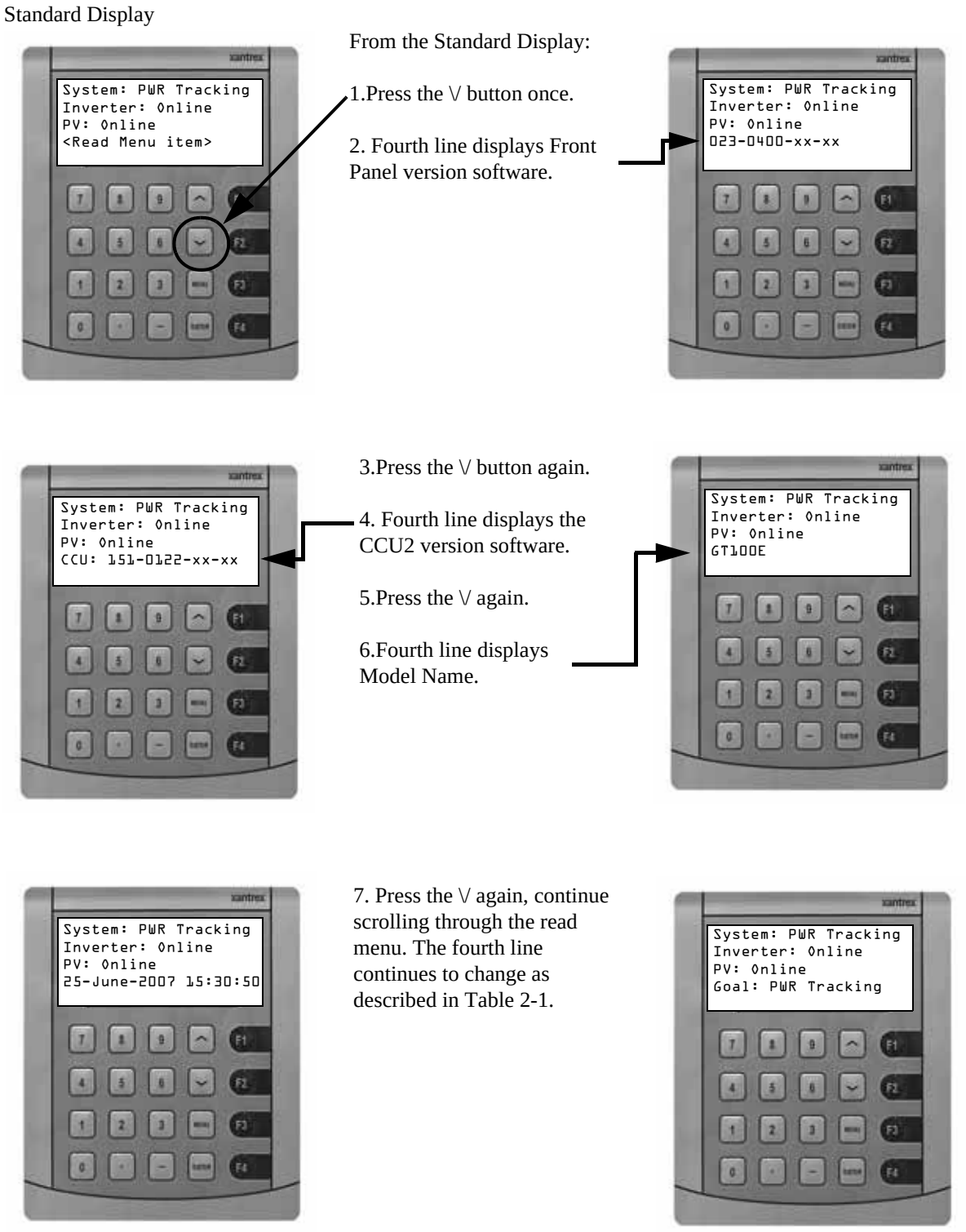


Figure 2-6 Scrolling through the Read Menu

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 3–5 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
Accumulated Power Displays as: `kWh:`	Accumulated AC Power produced by the GT100E 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 third and fourth 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.

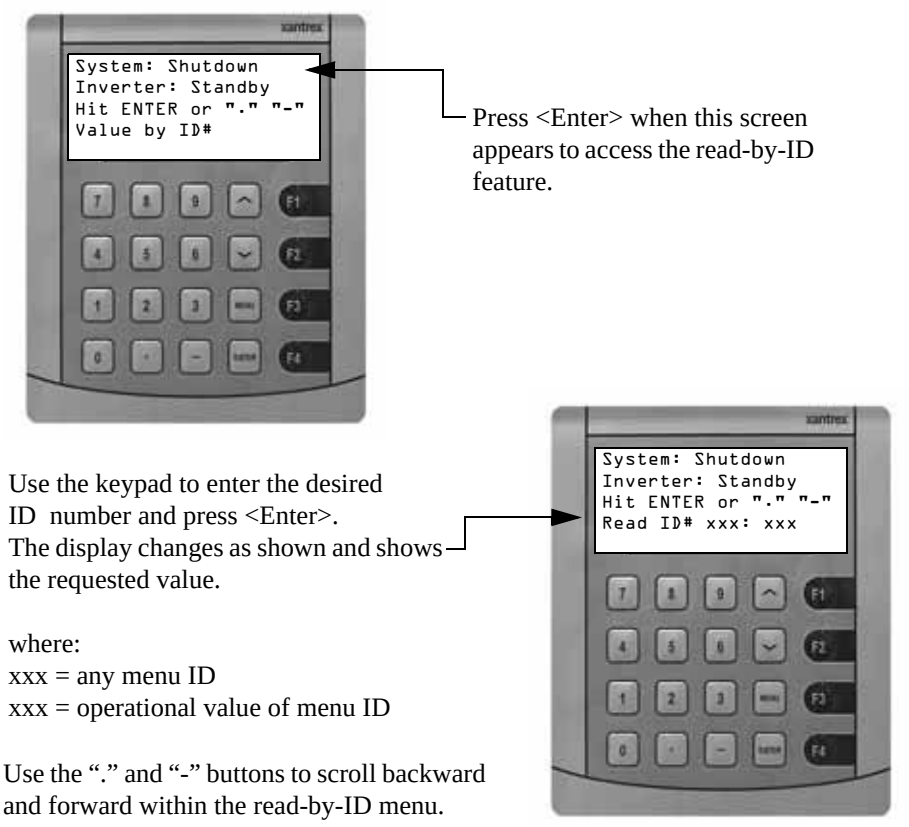


Figure 2-7 Read-by-ID Feature

WRITE Menu

Important: Specific grid-interface parameters within the write menu have been set in the factory to the limits mandated by EN60204-1. 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 Freq.
- 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 shown on the display.

Changing Write Menu Parameter Values

Important: While in the write menu, the display will reset itself to the standard display if there is no input for more than 2 minutes.

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 keypad to scroll through the write menu parameters.
   a) To change the displayed parameter, press the <Enter> button.
   b) The display asks for a password.
   c) Enter the password <5><9><4> and press the <Enter> button.
   d) If the wrong password is entered, the display again prompts you for the password.
   e) If a mistake is made while keying in the password, the /\ or \/ keys may be used as a backspace key.

f) Enter the desired value and press <Enter>. If the value entered is outside the acceptable range for the parameter, the original value remains.

g) To leave the write menu and return to the read menu, press the <Menu> button once and the standard display reappears on the display.

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. Command To Shutdown Command To PWR Tracking Command To Manual I Command To Matrix Test					
Set Date Displays as: `280407`	The date is entered day-month-year (DDMMYY): April 28, 2007 is entered `280407`.					
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.	32	Percentage of nominal voltage	110	112	98
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.	33	Percentage of nominal voltage	90	102	85
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.	34	Hertz	51.0	52.0	49.5
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.	35	Hertz	49.0	50.5	48.0

Table 2-3 Write Menu Parameters

Parameter	Description	ID	Units	Default Value	Maximum Value	Minimum Value
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	650	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	650	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
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 if the power is over “PV P Stop” or towards Shutdown mode is the “PV T Stop” timer expires.	40	Seconds	300	1200	0

Table 2-3 Write Menu Parameters

Parameter	Description	ID	Units	Default Value	Maximum Value	Minimum Value
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
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 0.5 s the power tracker will increase or decrease the voltage reference point to check if more power can be produced at the new level.	45	Seconds	0.5	10.0	0.1

Table 2-3 Write Menu Parameters

Parameter	Description	ID	Units	Default Value	Maximum Value	Minimum Value
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
Set Language Displays as: 0=English 1=German 2=Spanish	This parameter sets the display language.	48				

Commanding Goal State Changes

To change the Goal State:

1. From the standard display press the <Menu> key. The third line of the display changes to “Hit ENTER to set” and fourth line of the display changes to “Goal:”.
2. Press ENTER. This prompts you for a password. The third line of the display changes to “Hit ENTER to set” and fourth line of the display changes to “Password:”.
3. Enter the password <5><9><4> and press ENTER.
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 display then prompts you by showing the following text on the third line: “Press F4 to Confirm”.
6. Press <F4> and the GT100E transitions to this goal state. If the goal state requested violates the conditions of the state machine, the GT100E remains in the previous state of operation.

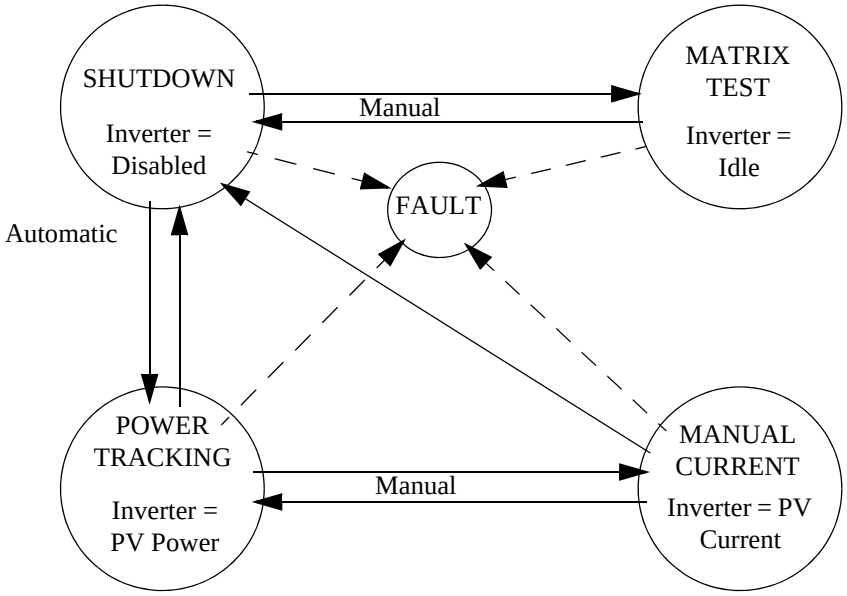


Figure 2-8 State Transition Diagram

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 third line of the display changes to “Hit ENTER to set” and fourth line of the display changes 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 display show:
   “Type and hit ENTER”
   “Set Date: "DDMMYY”
   b) If you’re changing the time, the third and fourth lines of the display show:
   “Type and hit ENTER”
   “Set Time: "HHMMSS”
3. Press ENTER. This prompts you for a password. The third and fourth lines of the display show:
   “Hit ENTER to set”
   “Password:”.
4. Enter the password <5><9><4> and press ENTER.
5. Enter the proper date or time in a six digit format. For example:
   a) The date is entered day-month-year (ddmmyy):
   22 October 2007 is entered 221007 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 Day/Month “DDMM” that the user interface accepts is a “3112” or 31st December. The maximum allowable time entry the user interface accepts is “235959”.
6. Once the entry is accepted, the third and fourth lines of the display revert back to the following:
   a) If you’re changing the date, the third and fourth lines of the display show:
   “Hit ENTER to set”
   “Set Date:”
   b) If you’re changing the time, the third and fourth lines of the display show:
   “Hit ENTER to set”
   “Set Time:”
7. Pressing the <Menu> key returns you to the standard display.

Manual State Transitions

State conditions can also be transitioned manually. Refer to “Commanding Goal State Changes” on page 2–21 for instructions on commanding GT100E goal states for manual transitions.

Shutdown → Matrix Test → Shutdown

1. Turn the ON/OFF switch to the OFF position.
2. Command the GT100E to the matrix test.
3. After completing the matrix test, command the GT100E to shutdown.

If the ON/OFF switch is turned to ON while the GT100E is in the matrix test state, the GT100E transitions 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 GT100E to manual current mode from the 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 GT100E transitions to shutdown.
3. To exit the manual current mode, you must manually command the GT100E to power tracking.

Automatic State Transitions

State conditions can also be transitioned automatically. Refer to “Commanding Goal State Changes” on page 2–21 for instructions on commanding GT100E 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 GT100E starts 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 GT100E transitions to power tracking.
   b) If the PV power drops below the PV power stop set point, (PV P Stop) the GT100E starts 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 GT100E transitions to shutdown.

Any State → Fault

If the GT100E encounters a fault, regardless of operating state, it transitions to the fault state. The GT100E remains in this state until the fault condition has been remedied and cleared. The first line of the display shows the fault code number.

The second line of the display shows a description of the fault. The third line of the display shows “F1 to Clear Fault?”. The fourth line of the display shows the goal state.

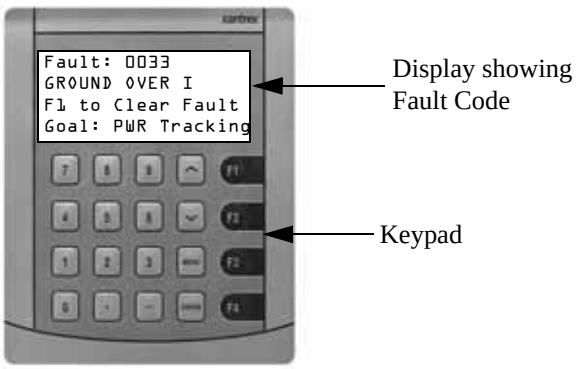


Figure 2-9 User Interface Display Showing Fault Code

To clear the fault:

1. See Table 3-1, “Fault Codes” on page 3–5 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 returns to the read menu, and “F1 to Clear Fault” appears on the third line of the display.

Auto-restart Feature

In the event of a utility voltage or frequency excursion outside of those specified, the GT100E automatically transitions to a fault condition. Once the utility voltage and frequency recovers and remains within the excursion limits for a period of five minutes, the GT100E automatically clears the fault, then resumes normal operation.

Energize Procedure (Startup)

To start up the GT100E:

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. Turn the ON/OFF switch to the ON position.

After a 15 second initialization period, the GT100E automatically transitions to 'Waking Up', given the PV voltage is greater than the PV V Start set point.

De-Energize/Isolation Procedure (Shutdown)

WARNING: Shock hazard

The terminals of the DC input may be energized if the PV arrays are energized. In addition, allow 20 minutes for all capacitors within the inverter enclosure to discharge after disconnecting the GT100E from AC and DC sources.

The following procedure should be followed to de-energize the GT100E for maintenance:

To isolate the GT100E:

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

Computer Communications with the GT100E

The GT100E provides an option for communicating system status, oscillography, or data logging through a personal computer via an Local Communication Access Port connection and a modem using the PV View Graphic User Interface (GUI) software. System status, oscillography, and data logging are also available via the Remote Communication Option connection.

The PV View 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 PV View GUI. See the “PC Connection Methods” section of the GT100E Grid-Tie Inverter Planning and Installation Manual (Part # 152364) for instructions on establishing the desired connection if this has not already been done.

3 Troubleshooting

Chapter 3, “Troubleshooting” contains information and procedures for troubleshooting the GT100E Grid-Tie 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 GT100E 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 excursions clear automatically. The GT100E 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 GT100E are reported to the front panel user interface. The display will show a fault code and a brief text description of the fault.

Most faults are latching and only those faults associated with grid disturbances are auto-clearing and thus enable the GT100E 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, GT100E faults may be manually cleared from the keypad (see “Clearing Faults Manually” on page 3–4) or via the remote PV View GUI (follow the instructions on the display).

General Troubleshooting

WARNING: Lethal voltage

In order to remove all sources of voltage from the GT100E, 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 switch on the GT100E. 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.

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.

Respond to any GT100E 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 3-1, “Fault Codes” on page 3–5.
3. Rectify the alarm or fault condition, determine it is safe to proceed, and attempt to clear the fault from the keypad and display. See “Clearing Faults Manually” on page 3–4 for instructions on this procedure.
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.

Clearing Faults Manually

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

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 five minutes, the GT100E will automatically clear the fault and resume normal operation.

All other faults associated with the GT100E must be identified, corrected and then cleared manually using the user interface or GUI. The following procedure describes how to manually clear a fault message from the display.

To clear the fault:

1. Determine the source of the fault using Table 3-1, “Fault Codes” on page 3–5. Correct the fault condition.
2. Ensure the fault code and “Clear Fault?” message is displayed in the display.
   a) If the “Clear Fault?” message is not shown on the second line of the display, scroll through the read parameter menu with the /\ or \/ keys until the message appears.
3. To clear the fault, press <Enter>. The GT100E immediately transitions to power tracking mode.

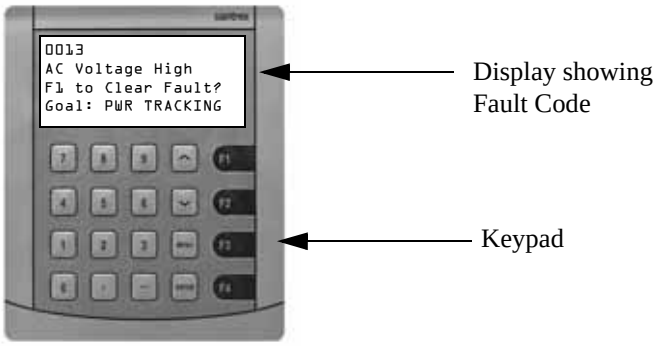


Figure 3-1 User Interface Display With Fault Code

Fault Code Descriptions

Table 3-1 provides a complete description of all the fault conditions that may occur on the GT100E. Default values are show, but some limits are user-adjustable.

Table 3-1 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 49.0 Hz (default) for greater than 2 cycles. This fault is auto-clearing. Once the utility grid frequency has recovered within the acceptable operating range, the GT100E 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. • Verify that the ground and neutral are connected correctly. See GT100E Grid-Tie Inverter Planning and Installation Manual (Part # 152364)
0011	AC Frequency High	S	This fault indicates that the Utility grid frequency is above or rose above the maximum allowed value of 51.0 Hz (default) for greater than 2 cycles. This fault is auto-clearing. Once the utility grid frequency has recovered within the acceptable operating range, the GT100E 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 90% of nominal Vac for greater than 100 ms. This fault is auto-clearing. Once the utility grid voltage has recovered within the acceptable operating range, the GT100E 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 - F10, F11 or F12 are blown. • P1001 on CCU2 is loose or disconnected • Sense Transformers - T3, T4 or T5 defective

Table 3-1 Fault Codes

Error Code	Fault Source(s)	Fault Type H=Hardware S=Software	Fault Description	Possible Causes
0013	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 100 ms. This fault is auto-clearing. Once the utility grid voltage has recovered within the acceptable operating range, the GT100E 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
0014	Phase Error	S	There is a phase rotation error on the AC input.	• The AC input to the inverter has been wired incorrectly
0015	Grid Disconnection	S	This fault indicates that the GT100E 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 GT100E was processing power.	• K1 was opened while the GT100E was processing power
0016	DC Contactor Circuit	S	The DC bus voltage is not at the same level as the PV voltage.	• PV Contactor did not close
0020	PV Over Current	H	The Fault indicates the GT100E has detected that the PV current has exceeded the maximum allowed value of 997 Amps.	• PV array short • P3 on the CCU2 is loose or disconnected
0021	PV Over-Voltage	S	This fault indicates that the GT100E has detected a DC input voltage of greater than the maximum allowed value of 650 Vdc.	• PV system wiring short • Lightning strike on PV system wiring
0023	Bus Voltage High	H	This fault indicates that the GT100E 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 3-1 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 GT100E has detected that the AC current on one or more phases of the IGBT matrix has exceeded the maximum allowed value of 1400 A_{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
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

Table 3-1 Fault Codes

Error Code	Fault Source(s)	Fault Type H=Hardware S=Software	Fault Description	Possible Causes
0035	PV Ground Insulation	S	This fault indicates that the GT100E has detected a insulation fault on the PV array. A PV+ to ground short.	• There is a cable or insulation problem on the PV array • The PROAT device is defective
0040	Programming Software	S	This code indicates that the GT100E has detected that the system is in programming mode. This fault does not indicate any malfunction with the GT100E, 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 GT100E. This fault indicates that the GT100E 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 GT100E 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
0043	Serial EEPROM Timeout	S	This fault indicates that the GT100E 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 GT100E 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

Table 3-1 Fault Codes

Error Code	Fault Source(s)	Fault Type H=Hardware S=Software	Fault Description	Possible Causes
0045	Interrupt 2 Timeout	S	This fault indicates that the GT100E 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 500 mS, an interrupt 2 timeout fault will occur.	• Internal A to D converter error • CPU error
0047	Software Test	S	This fault indicates that the GT100E 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 GT100E 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 3-1 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 GT100E 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 3-1 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 GT100E 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
0072	Local Emergency Stop	S	The emergency stop button on the GT100E cabinet has been activated	• The emergency button on the GT100E cabinet is pushed in • P2 on the CCU2 is loose or disconnected
0073	Remote Emergency Stop	S	This fault indicates that the GT100E has detected that the remote emergency stop circuit (TB4-1,2) is open or activated. This fault is primarily for personnel safety. Activating the remote emergency stop while the GT100E 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 TB4-1,2 • 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 GT100E 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 3-1 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 GT100E 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 GT100E 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

4 Preventative Maintenance

Chapter 4, “Preventative Maintenance” lists the periodic maintenance that is required to keep the GT100E in good working order.

Periodic Maintenance

Xantrex Technology recommends that the following preventative maintenance be carried out on the GT100E:

Monthly intervals

Matrix Fan Operation

Verify proper operation of the heatsink cooling fans, located above the matrix heatsinks. The fans operate when the K1 and K4 contactors are closed. Remove any debris from the fans.

Internal Circulation Fan

Verify the internal circulation fan is operating whenever there is utility power applied to the GT100E.

Transformer and Inductor Cooling Fans

Verify proper operation of the transformer and inductor cooling fan, located on the transformer cover panel. The fan operates when the K1 and K4 contactors are closed. Remove any debris from the fans.

Transformer Fan Filter

Remove and clean the transformer fan filter, located on the front door - left. If the filter is damaged, replace it.

Six month intervals

(See “De-Energize/Isolation Procedure” on page xii, and perform prior to the following)

Electrical Connections

Inspect the condition of all wiring within the GT100E. Inspect all wire crimps and connections for damage caused from high temperature. Check for corrosion. Replace any damaged wires. Verify all mechanical connections are sufficiently tightened. Verify all conduction surfaces are clean and free of corrosion.

Mechanical electrical connections will loosen over time. This is caused primarily by thermal cycling during normal operation. As connections loosen, electrical impedance will increase at the connection, eventually leading to fire and component damage. It is critical to check all electrical connections every six months.

A Specifications

Appendix A, “Specifications” contains the environmental. electrical and mechanical specifications for the GT100E Grid-Tie Inverter.

The GT100E has been designed for photovoltaic power systems, which operate within the following specifications. Application of the GT100E in a manner inconsistent with these specifications may cause damage to the GT100E and other system components, and is a violation of the terms of the warranty.

Specifications are subject to change.

System Specifications

CAUTION: Equipment damage

Operation of the GT100E in a manner other than specified in this manual may cause damage to the GT100E and other system components and will void the terms of the warranty.

The GT100E has been designed for photovoltaic power systems, which operate within the following specifications.

Environmental Specifications

CAUTION: Environmental damage

The GT100E will be destroyed if stored outside. Only store in dry areas.

Table A-1 Environmental Specifications

Operating Temperature	-10[a] to 45° C
Storage Temperature	-40 to 50° C
Maximum Ambient Temperature Rating	45° C
Relative Humidity	To 90%, Non-condensing
Elevation	Derated above 2000 m
Dimensions (mm)	1905 x 1205 x 606
Weight	870 kg
Enclosure Type	IP21

a.If ambient temperature is between -10 to 0° C, the unit must be powered up in standby for at least one hour prior to going on-line.

Electrical Specifications

Table A-2 provides the AC and DC specifications for the GT100E.

Table A-2 Electrical Specifications

Nominal AC Line Voltage	400 VAC (+10%/-12%)
Maximum AC Line Current	164 ARMS (at low line voltage)
Nominal Line Frequency	50 Hz, +0.5 -0.7 Hz
Output Power	100.0kW
Max. Open Circuit Voltage	650 VDC
Peak Power Tracking Window	300-650 VDC
PV Minimum Peak Power Tracking Voltage	300 VDC
Maximum PV Current	347 ADC

Regulatory Specifications

Table A-3 provides the regulatory specifications for the GT100E.

Table A-3 Regulatory Specifications

Standard	Regulation Met
General Standards	EN50178 VDEW CE
Emitted Interference	EN61000-6-4
Interference Resistance	EN61000-6-2

Torque and Wire Gauge Specifications

Use the following torque specifications on all electrical interfaces made during installation of the GT100E.

Table A-4 Torque Requirements

Type	Torque Setting
AC Terminal Lugs – 8mm Hex	20.0Nm
M10 Bolt (DC + and DC-)	40.0Nm

The following table shows acceptable wire sizes to be connected to the GT100E Grid-Tie Inverter AC and DC inputs.

Table A-5 Terminations and Wire Requirements

Terminal-Connections	Wire Size
AC Terminal Lugs	Up to 120 mm^2
Compression Lug (DC+ and DC-)	Up to 300 mm^2

Specifications for Options

The GT100E has the option to connect an external AC line to power the internal fans of the unit, TB3.

Table A-6 Auxiliary AC Line Requirements

Nominal Aux. AC Line Voltage	230VAC, +10%-12%
Maximum Aux. AC Line Current	4 Amps

The GT100E has the option to connect to an external remote emergency switch to the unit, TB4.

Table A-7 Remote Emergency Switch Requirements

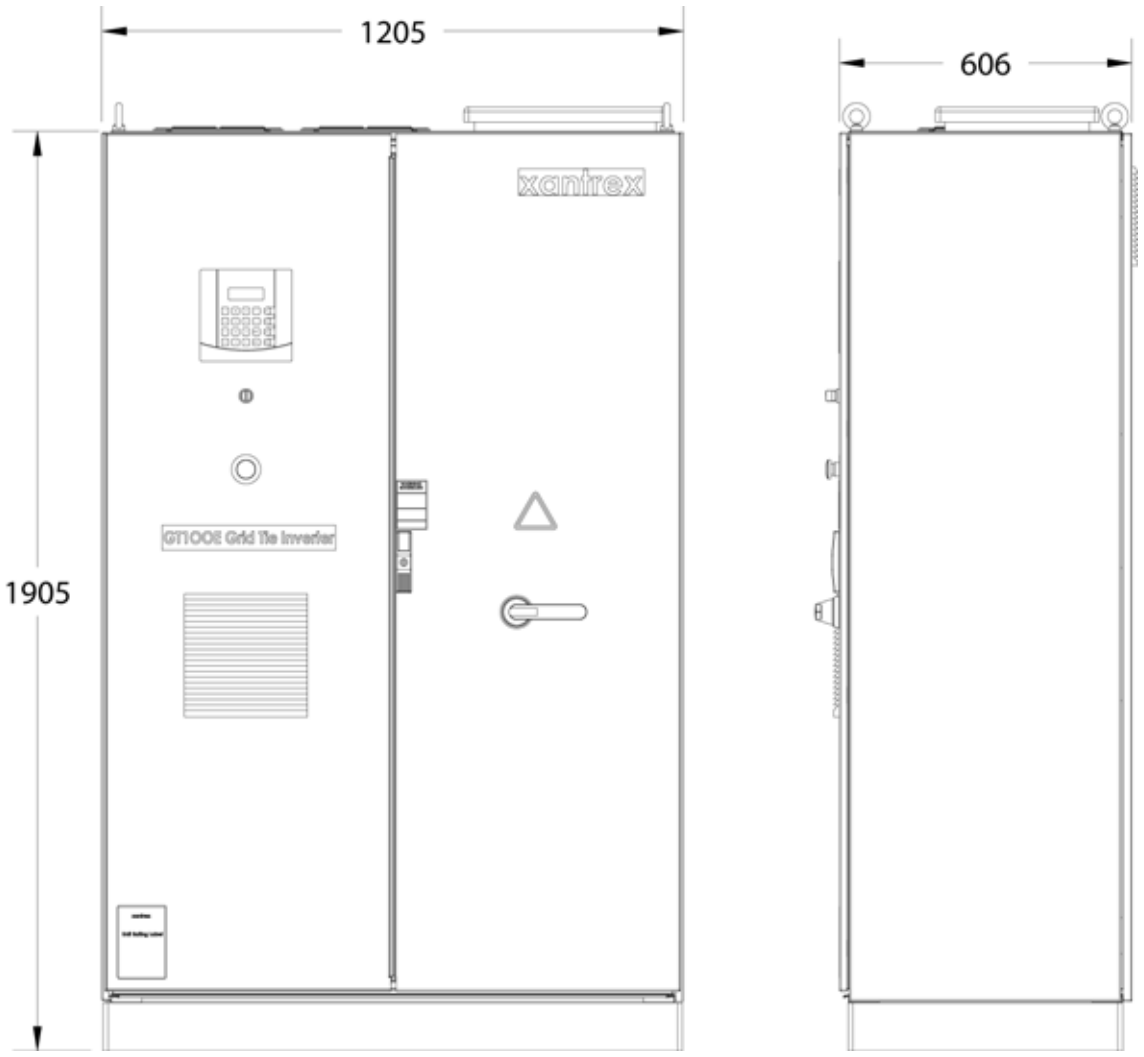
Remote Emergency Switch	No external power applied to the TB4 1 -4

The GT100E has the option to connect an external fan control contactor/unit to the unit, TB4.

Table A-8 External Fan Control Requirements

External Fan Control Voltage TB4 5-6	230VAC +10%-12%
Maximum External Fan Control Current TB4 5-6	2 Amps

Dimensions



Dimensions in mm

Figure A-1 GT100E Dimensions

Warranty and Product Information

Limited Warranty

What does this warranty cover and how long does it last? This Limited Warranty is provided by Xantrex Technology Inc. ("Xantrex") and covers defects in workmanship and materials in your GT100E Grid-Tie Inverter. This Warranty Period lasts for 2 years from the date of purchase at the point of sale to you, the original end user customer, unless otherwise agreed in writing. You will be required to demonstrate proof of purchase to make warranty claims.

This Limited Warranty is transferable to subsequent owners but only for the unexpired portion of the Warranty Period. Subsequent owners also require original proof of purchase as described in "What proof of purchase is required?"

What will Xantrex do? During the Warranty Period Xantrex will, at its option, repair the product (if economically feasible) 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, Hawaii and outside of the United States and Canada are excluded. Contact Xantrex Customer Service for details on freight policy for return shipments from excluded areas.

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

GERMANY		SPAIN	
Telephone:	49 0180 2240400	Telephone:	34 935 560 976
Fax:	49 (0) 7531 8199868	Fax:	34 934 736 093
Email	GTsupport.Germany@xantrex.com	Email	GTsupport.Spain@xantrex.com

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

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

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

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

What does this warranty not cover? Claims are limited to repair and replacement, or if in Xantrex's discretion that is not possible, reimbursement up to the purchase price paid for the product. Xantrex will be liable to you only for direct damages suffered by you and only up to a maximum amount equal to the purchase price of the product.

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

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

Disclaimer

Product

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

IN NO EVENT WILL XANTREX BE LIABLE FOR: (a) ANY SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES, INCLUDING LOST PROFITS, LOST REVENUES, FAILURE TO REALIZE EXPECTED SAVINGS, OR OTHER COMMERCIAL OR ECONOMIC LOSSES OF ANY KIND, EVEN IF XANTREX HAS BEEN ADVISED, OR HAD REASON TO KNOW, OF THE POSSIBILITY OF SUCH DAMAGE, (b) ANY LIABILITY ARISING IN TORT, WHETHER OR NOT ARISING OUT OF XANTREX'S NEGLIGENCE, AND ALL LOSSES OR DAMAGES TO ANY PROPERTY OR FOR ANY PERSONAL INJURY OR ECONOMIC LOSS OR DAMAGE CAUSED BY THE CONNECTION OF A PRODUCT TO ANY OTHER DEVICE OR SYSTEM, AND (c) ANY DAMAGE OR INJURY ARISING FROM OR AS A RESULT OF MISUSE OR ABUSE, OR THE INCORRECT INSTALLATION, INTEGRATION OR OPERATION OF THE PRODUCT.

IF YOU ARE A CONSUMER (RATHER THAN A PURCHASER OF THE PRODUCT IN THE COURSE OF A BUSINESS) AND PURCHASED THE PRODUCT IN A MEMBER STATE OF THE EUROPEAN UNION, THIS LIMITED WARRANTY SHALL BE SUBJECT TO YOUR STATUTORY RIGHTS AS A CONSUMER UNDER THE EUROPEAN UNION PRODUCT WARRANTY DIRECTIVE 1999/44/EC AND AS SUCH DIRECTIVE HAS BEEN IMPLEMENTED IN THE EUROPEAN UNION MEMBER STATE WHERE YOU PURCHASED THE PRODUCT. FURTHER, WHILE THIS LIMITED WARRANTY GIVES YOU SPECIFIC LEGAL RIGHTS, YOU MAY HAVE OTHER RIGHTS WHICH MAY VARY FROM EU MEMBER STATE TO EU MEMBER STATE OR, IF YOU DID NOT PURCHASE THE PRODUCT IN AN EU MEMBER STATE, IN THE COUNTRY YOUR PURCHASED THE PRODUCT WHICH MAY VARY FROM COUNTRY TO COUNTRY AND JURISDICTION TO JURISDICTION.

Return Material Authorization Policy

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

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

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

Record these details on page WA-4.

Return Procedure

Package the unit safely, preferably using the original box and packing materials. Please ensure that your product is shipped fully insured in the original packaging or equivalent. This warranty will not apply where the product is damaged due to improper packaging.

Include the following:

- The RMA number supplied by Xantrex Technology Inc. clearly marked on the outside of the box.
- A return address where the unit can be shipped. Post office boxes are not acceptable.
- A contact telephone number where you can be reached during work hours.
- A brief description of the problem.

Ship the unit prepaid to the address provided by your Xantrex customer service representative.

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

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

Out of Warranty Service

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

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

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

Product Registration

To ensure the fastest possible service, please ensure your system information submitted to Xantrex. Please fill the required information in and send a copy of this page to Xantrex Technology Inc.

Fax number: **925 455 0382**

Mail to: **Xantrex Technology Inc.**
161-G South Vasco Road
Livermore, CA 94551
Attention: Customer Service
USA

Customer Company Name: _____

Project Name: _____

System Location Information:

Street _____

City _____

Country _____

Xantrex Inverter Model: _____

Serial Number of Inverter: _____

Name of Distributor (if applicable): _____

_____ _____

Xantrex Authorized Signature | Customer Authorized Signature

Date: | Date:

Note: Please email the GT100E Commissioning Report File to: pvcommissioningreport@xantrex.com.

For additional CE Mark information please contact Xantrex.

Smart choice for power

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CE Declaration of Conformity
EG Konformitätserklärung
Declaración de conformidad con CE

Product Type:	**Photovoltaic Grid Tie Inverter, 100kW, 400V AC, 3 ~, 50 Hz**
Produkt Typ:	**Solarwechselrichter fuer Netzparallelbetrieb, 100kW, 400V AC, 3~, 50Hz**
Tipo de producto:	**Inversor fotovoltaico para conexión a la red, 100kW, 400V CA, 3 ~, 50 Hz**

Model / Modell / Modelo: **GT100E Grid Tie Inverter**

This product complies with and is CE-marked under the following Directives:
Dieses Produkt entspricht den nachstehend aufgeführten Richtlinien der europäischen Union:
Este producto cumple y tiene la marca CE, bajo las siguientes directivas:

EMC Directive 89/336/EEC
EMV Richtlinie 89/336/EWG
Directiva de compatibilidad electromagnética 89/336/EEC

Low Voltage Directive 73/23/EEC as last amended by EEC Directive 93/68/EEC
Niederspannungs-Richtlinie 73/23/EWG zuletzt geänderte durch Richtlinie 93/68/EWG
Directiva de baja tensión 73/23/EEC enmendada por Directiva 93/68/ECC

Compliance of these products with the above Directives is confirmed through the application of the following harmonized standards:
Die folgenden Normen wurden u. a. für die Überprüfung der Übereinstimmung mit diesen Richtlinien herangezogen:
Se confirma que el producto cumple las directivas mediante la aplicación de las siguientes normas harmonizadas:

EN 61000-6-4: 2001	**Emission for Industrial Environment** **Störaussendung für Industriebereich** **Emisión en entorno industrial**
EN 61000-6-2: 1999	**Immunity for Industrial Environment** **Störfestigkeit für Industriebereich** **Inmunidad en entorno industrial**
EN 50178: 1998	**Electronic Equipment for use in power installations** **Ausrüstung von Starkstromanlagen mit elektronischen Betriebsmitteln** **Equipos electrónicos para uso en instalaciones generadoras de energía**

Manufactured by: / Hersteller: / Fabricado por:
Xantrex Technology Inc., 5916 -195th Street NE, Arlington, WA 98223, USA

Authorized European representative: / Bevollmächtigter Europäischer Vertreter: / Representante europeo autorizado:
Xantrex Technology, S.L., Constitución 3, 4º 2ª, 08960 Sant Just Desvern, Barcelona, Spain

The certification process was conducted by: / Das Zertifizierungverfahren wurde durchgeführt von: / El proceso de certificación ha sido controlado por:
TUV Rheinland of North America Inc., 1279 Quarry Lane, Pleasanton, CA 94566, USA

Year of certification, Jahr der Zertifizierung / Año de certificación:
2003

This declaration is issued under the sole responsibility of the manufacturer.
Diese Erklärung wird unter der alleinigen Verantwortlichkeit des Herstellers herausgegeben.
Se emite esta declaración bajo la única responsabilidad del fabricante.

Douglas Blodgett

Douglas Blodgett, Director of Engineering

Date / Datum / Fecha: August 02, 2004

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