# INVERTER 2000 Standalone Inverter

## User Manual

Part # 014-129-B2

*Effective: 02/2013*


member of The Group™

*Your Power Solutions Partner*

# IMPORTANT SAFETY INSTRUCTIONS

## SAVE THESE INSTRUCTIONS

This section contains important instructions that should be followed during the installation and maintenance of equipment and batteries. **Please read all of the instructions before operating the equipment, and save this manual for future reference.**

The following safety symbols will be found throughout this manual, carefully read all information and abide by the instructions:

**DANGEROUS VOLTAGE**
**This symbol indicates a dangerous voltage exists in this area of the product.**

**GAS HAZARD**
**This symbol indicates a gas hazard exists in the area of vented batteries.**

**NO MATCHES OR OPEN FLAMES**
**This symbol indicates a fire or explosive hazard exists in the area of the product.**

The following levels of warning will be used with the above symbols:

**DANGER:** You WILL be KILLED or SERIOUSLY INJURED if instructions are not followed closely.

**WARNING:** You CAN be KILLED or SERIOUSLY INJURED if instructions are not followed closely.

**CAUTION:** You CAN be INJURED or equipment can be DAMAGED if instructions are not followed closely.

Before using the product, read all instructions and cautionary markings on the product and any equipment connected to the product.

This unit is designed for indoor use only. Do not expose the product to rain or snow; install only in a clean, dry environment.

**CAUTION** – To reduce the risk of fire hazard, do not cover or obstruct the ventilation openings. Do not install the inverter in a zero-clearance compartment.

**CAUTION** – Unless otherwise noted, use of an attachment not recommended or sold by the product manufacturer may result in a risk of fire, electric shock, or injury to persons.

**CAUTION** – Do not operate the product if it has received a sharp blow, it has been dropped, or otherwise damaged in any way – return it to a qualified service center for repair.

**CAUTION** – Do not disassemble the product – call our qualified service centers for servicing. Incorrect reassembling may result in a risk of electrical shock or fire.

**CAUTION** – The AC Neutral Output is floating when the unit is powered by Batteries while in Invert Mode. Ensure that any electrical equipment, connected as a load, is properly grounded.

**WARNING** – The input and output voltages of the product are hazardous. Extreme caution should be maintained when servicing or touching conductive components connected to the product.

### Mechanical Safety

Power equipment can reach extreme temperatures under load.

Use caution around sheet metal components and sharp edges.

## Electrical Safety

**WARNING**
**To avoid a risk of fire and electric shock, make sure that existing wiring is in good condition and that wire is not undersized. Do not operate the inverter with damaged or substandard wiring.**

Before working with any live battery or power system, follow these precautions:

- Remove all metallic jewelry; e.g., watches, rings, metal rimmed glasses, necklaces.
- Wear safety glasses with side shields (and prescription lenses if necessary) at all times during installation.
- Use OSHA approved insulated hand tools.

Do not work alone under hazardous conditions.

Ensure no liquids or wet clothes contact internal components.

## Battery Safety

Servicing and connection of batteries shall be performed by, or under the direct supervision of, personnel knowledgeable of batteries and the required safety precautions.

Never reverse DC+ and DC- to battery.

Keeps the battery away from heat sources including direct sunlight, open fires, microwave ovens and high-voltage container. Temperatures over 60ºC may cause damage. Make sure the area around the battery is well ventilated.

Always wear eye protection, rubber gloves, and a protective vest when working near batteries. Remove all metallic objects from hands and neck.

Use OSHA approved insulated hand tools. Do not rest tools on top of batteries.

Have plenty of fresh water and soap nearby in case battery acid contacts skin, clothing, or eyes.

Batteries contain or emit chemicals known to the State of California to cause cancer and birth defects or other reproductive harm. Battery post terminals and related accessories contain lead and lead compounds; wash hands after handling (California Proposition 65).

If battery acid contacts skin or clothing, wash immediately with soap and water. If acid enters your eye, immediately flood it with running cold water for at least twenty minutes and get medical attention immediately.

If you need to remove a battery, always remove the grounded terminal from the battery first. Make sure all accessories are off so you don't cause a spark.

**WARNING**
**Follow battery manufacturer's safety recommendations when working around battery systems.**

**WARNING**
**Do not smoke or present an open flame when batteries (especially vented batteries) are on charge. Batteries vent hydrogen gas when on charge, which creates an explosion hazard.**

Batteries are hazardous to the environment and should be disposed of safely at a recycling facility. Consult the battery manufacturer for recommended local authorized recyclers.

## Wiring Requirements

Inverter is intended to be installed as part of a permanently grounded electrical per the National Electric Code ANSI/NFPA 70 (current edition). This is the single point earth ground for the unit.

The ground on the Inverter is marked with this symbol: G /⏚

The AC voltage and current on the Inverter is marked with this symbol: L / N

The DC voltage and current on the Inverter is marked with this symbol: ⎓

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# 1 Introduction

## 1.1 Scope of the Manual

This instruction manual explains the features, installation, startup and maintenance of the INVERTER 2000 standalone inverter. This manual applies to standalone inverters 014-129-10 and 014-130-10.

**NOTE:** *Images contained in this document are for illustrative purposes only and may not exactly match your installation.*

## 1.2 Product Overview

The INVERTER 2000 provides highly reliable 2000 W of AC power in a compact 1RU high, 19" wide rack mountable design.

High efficiency, better overload performance, and compact design make the INVERTER 2000 an outstanding and highly reliable power solution for various telecom applications.

The built-in Automatic Transfer Switch (ATS) function adds greater reliability by ensuring that the INVERTER 2000 continues to provide uninterruptible power to critical loads even when one of the power sources become unavailable.

Features:

- Designed for telecom grade applications
- High quality pure sine wave output
- 120% overload continuously; 200% overload for up to 5 seconds
- Up to 91% efficiency
- Unity output power factor
- DSP chip design for reliable performance
- Built-in automatic transfer switch for higher reliability
- LCD display for real time status monitoring and configuration
- USB interface for communication and connectivity to a PC
- RoHS compliant
- Low audible noise <55dBa
- Wide operating temperature range, -20 to 60 °C/ -4 to 140 °F; full performance from -20 to 50 °C/ -4 to 122 °F


**Figure 1–INVERTER 2000 Standalone Inverter**

# 2 Inspection

## 2.1 Packing Materials

All Alpha products are shipped in rugged, double walled boxes and suspended via solid inserts to minimize shock that may occur during transportation. Packaging assemblies and methods are tested to International Safe Transit Association standards.

### 2.1.1 Returns for Service

Save the original shipping container. If the product needs to be returned for service, it should be packaged in its original shipping container. If the original container is unavailable, make sure the product is packed with at least three inches of shock-absorbing material to prevent shipping damage.

**NOTE:** *Alpha Technologies is not responsible for damage caused by the improper packaging of returned products.*

## 2.2 Check for Damage

Prior to unpacking the equipment, perform a visual inspection and note any damage. Unpack the equipment and inspect the exterior for damage. If any damage is observed contact the carrier immediately.

**In addition to the inverter module (Figure 1), the mounting kit provided consists of:**

4 x M4 screws to connect the brackets to the cabinet: 

23” mounting brackets: 

Parallel signal port cover: 

Continue the inspection for any internal damage. In the unlikely event of internal damage, please inform the carrier and contact Alpha Technologies for advice on the consequence of any damage.


**Verify that you have all the necessary parts per your order for proper assembly.**

Call Alpha Technologies if you have any questions before you proceed: 1 (888) 462-7487
Customers outside Canada and the USA, call +1-604-436-5547 for technical support.

# 3 Installation and Wiring

## 3.1 Where to Install

**WARNING**
**This system is designed to be installed in a restricted access location that is inaccessible to the general public.**

The power inverter should be installed in a location that meets the following requirements:

- **Dry:** Do not allow water to drip or splash on the inverter.
- **Cool:** Ambient air temperature should be between -20°C and 60°C.
- **Safe:** Do not install in a battery compartment or other areas where flammable fumes may exist, such as fuel storage areas or engine compartments.
- **Ventilated:** Allow at least three inches of clearance around the inverter for airflow, ensuring that the ventilation openings on the front, rear and top of the unit are not obstructed.
- **Dust Free:** Do not install the inverter in a dusty environment where dust, wood particles or other filings/shavings are present that may be pulled into the unit when the cooling fan is operating.
- **Close to Batteries:** Avoid excessive cable lengths but do not install the inverter in the same compartment as batteries. Use the recommended wire lengths and sizes (see section 3.5).

Avoid mounting the inverter where it may be exposed to the gases produced by the battery. Prolonged exposure to these corrosive gases will damage the inverter.

## 3.2 Unit Installation

The unit is pre-installed with 19-inch rack brackets. Put the unit in the rack horizontally, and align holes of mounting brackets and the rack. Secure the unit in position with four cross-pan type nickel screws.

## 3.3 Unit Removal

The unit can be removed from the equipment rack by undoing the retaining screws.

## 3.4 AC Safety Grounding

During the AC wiring installation, AC input and output ground wires are connected to the inverter. The AC input ground wire must connect to the incoming ground from your AC utility source.

The AC output ground wire should go to the grounding point for your loads.

**WARNING**
**Do not operate the unit without connecting it to ground. Electrical shock hazard may result.**

## 3.5 DC Wiring Connections

Connect the cables to the power input terminals on the rear panel of the unit.

【+】is positive, and【-】is negative. Insert the cables into the terminals and tighten the nut to securely clamp the wires.

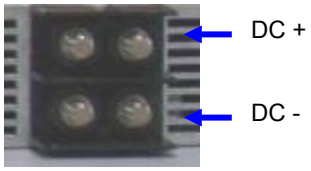



**Figure 2–DC input terminals**

**WARNING**
**Before proceeding, confirm that the DC input cable is connected correctly.**

**Make sure that all DC connections are tight (torque to 9-10 foot pounds). Loose connections will overheat and could result in a potential hazard.**

Follow this procedure to connect the battery cables to the DC input terminals on the unit.

The cables should be as short as possible (ideally, less than 10 feet / 3 meters) and large enough to handle the required current in accordance with the electrical codes or regulations applicable to your installation. Cables that are not an adequate gauge (too narrow) or are too long will cause decreased inverter performance such as poor surge capability and frequent low input voltage warnings and shutdowns. These low input voltage warnings are due to DC voltage drip across the cables from the inverter to the batteries. The longer and narrower these cables, the greater the voltage drop.

**CAUTION** – Increasing your DC cable size will help improve the situation.

**NOTE:** *We recommend #6 AWG 40A cables (48Vdc input) for optimum inverter performance (applies to both 110V and 220V series). Use only high quality copper wiring and keep cable length short (from 3-6 feet).*

### 3.5.1 DC Feeder Breaker and Wire Size Recommendation

The Inverter 2000 in inverter mode can handle a 200% load, 4000W for about 5-6 seconds. So the DC breaker should be able to handle the over current and not trip before the inverter stops running by its own protection.

It is recommended to use a 70A circuit breaker from the -53 or -63 series from Airpax or a 75A from the -62 series from Airpax. For these breakers, the recommended wire size is 6AWG with a maximum allowable conductor temperature of 90°C.

Alternatively. for faster trip breakers, use a 110A circuit breaker with a -51 or -52 delay curve. The recommended wire size is 4AWG with a maximum allowable conductor temperature of 90°C.

Contact your Alpha sales representative for help choosing a suitable breaker for your application.

# 4 Operation

## 4.1 Front Panel

Located on the front panel is the interface for signals and controls:

- **Control:** Keypad to set major parameters
- **Remote Control/Monitoring:** USB
- **Display:** LCD and 3-LEDs to display major parameters, status and alarms


**Figure 3–Front panel**

### 4.1.1 ON/OFF Switch

The POWER ON/OFF switch is a lock switch that turns the unit on or off by pressing it once.

#### 4.1.1.1 Switch on:

When the unit is connected to the DC, LCD will show content, press ON/OFF switch, unit will provide power to load in 20s.

When the unit is only connected to the AC, LCD will show content, press ON/OFF switch, unit will provide power to load in 5s.

#### 4.1.1.2 Switch off:

When unit is working, press ON/OFF switch will turn unit off, if DC or AC power exists, LCD will show content continually.

Unit shuts off when input power out of range, and it can auto restart if on/off switch is at on position and input DC or AC power recover.

### 4.1.2 USB Port

A user can operate Hyper terminal by connect the USB Cable to the USB interface on the front panel. The USB is 1.1.

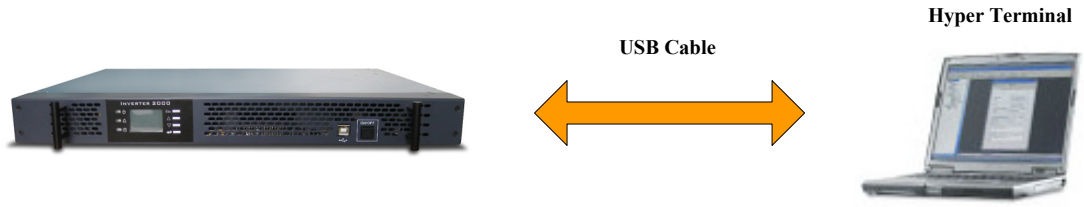



**Figure 4–USB connectivity**

### 4.1.3 LED Indicators

| Inverter Module LED Display Status | | | |
|---|---|---|---|
| **Priority** | **Green LED** | **LED Signal** | **Status** |
| Low ↓ High | Solid | | Inverter work normally |
| | Blink (intermittent (slow)) | 1S 1S | One of the status as follows:<br>1) Power On. Details refer to note.<br>2) Shut down remotely. |
| **Priority** | **Yellow LED** | **LED Signal** | **Status** |
| Low ↓ High | Blink (intermittent (slow)) | 1S 1S | Power On<br>Details refer to note. |
| | Solid | | One of the alarms as follows:<br>1) Over Load (Load > 105%);<br>2) DC input abnormal. (Vin<=45V or Vin>=58V) |
| | Blink (intermittent (fast)) | 1S 1S | Inverter shut down due to DC super low/super high input.<br>(Vin<=VLVSD or Vin>=VHVSD) |
| **Priority** | **Red LED** | **LED Signal** | **Status** |
| Low ↓ High | Blink (slow) | 1S 1S | One of the alarms as follows:<br>1) EEPROM Fault;<br>2) Inverter Fan Fault. |
| | Blink (fast) | 1S 1S | One of the alarms as follows:<br>1) Internal fault;<br>2) Temperature High. |
| | Solid | | One of the alarms as follows:<br>1) Input reverse polarity;<br>2) Inverter output Short circuit;<br>3) Abnormal output voltage;<br>4) Negative Power Protection;<br>5) Overload fault. |

**Table A–Inverter LED indicator display**

#### 4.1.3.1 Power On:

When the inverter is in “Power On” mode, the green LED and the yellow LED are flickering synchronously without any alarm.

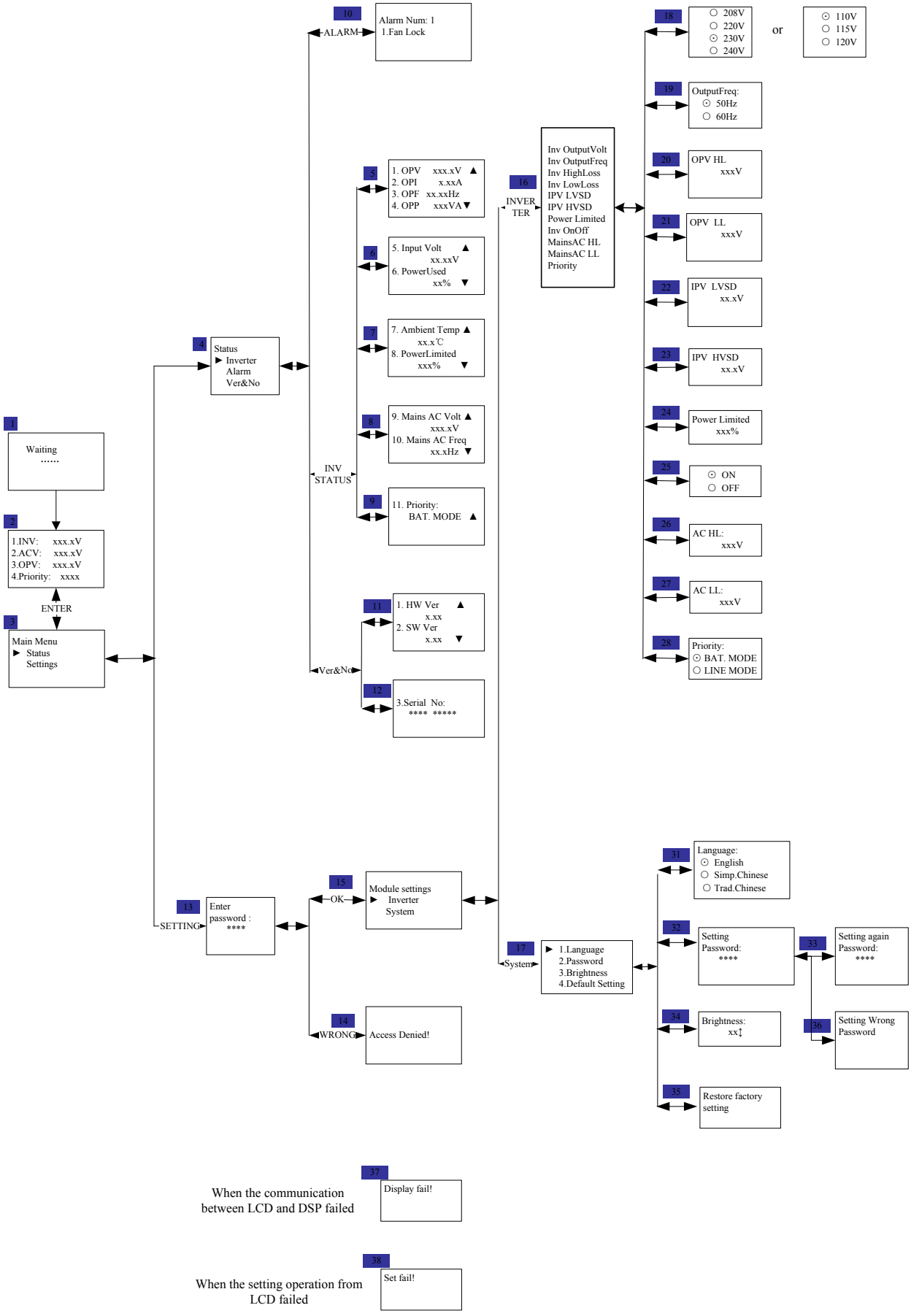
#### 4.1.3.2 Overload and Overload Fault:

When overload fault alarm occurs, the yellow LED and red LED turn on at the same time, while overload alarm occurs, only the yellow LED turns on.

#### 4.1.3.3 Priority:

If more than one warning exists at the same time, then the LED will display the highest priority.

### 4.1.4 LCD Menu Structure



## 4.2 Rear Panel

Located on the rear panel are the terminations for wiring:

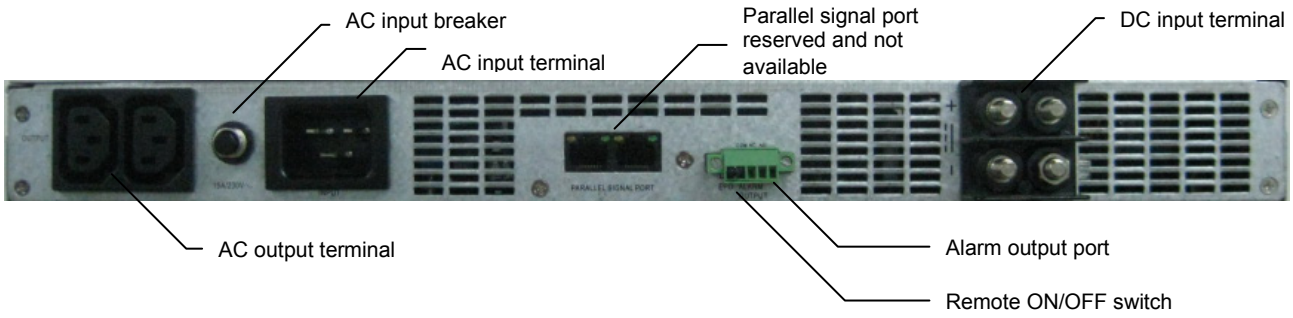



**Figure 5–Rear panel**

### 4.2.1 DC Input

ST722B2502 (300 Volts (UL 1059 Class B and C) / 175 Amps)

Wire Range #2 - #8

(Accommodates two-hole compression lugs on 0.625" centers – wires #2 and larger may require narrow lugs)

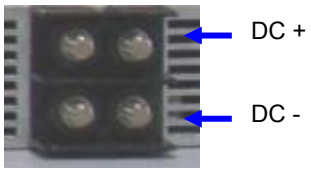



**Figure 6–DC input terminals**

Connect to a 48Vdc battery or DC power source.

Upper terminal【 **+** 】is positive, and【 **-** 】is negative. Reverse polarity connection will cause red alarm LED to illuminate (indicator solid), but the inverter will not be damaged.

### 4.2.2 AC Input

230Vac model: RECEPTACLE /WS-044-7 16A 250V INLET GAP1.5

120Vac model: cable P.C.#12*3C 20A 125Vac 5-20P UL 2200

### 4.2.3 AC Input Breaker

230Vac model: N.F.B1P15A 250Vac JOEMEX/PE747415-214D-051

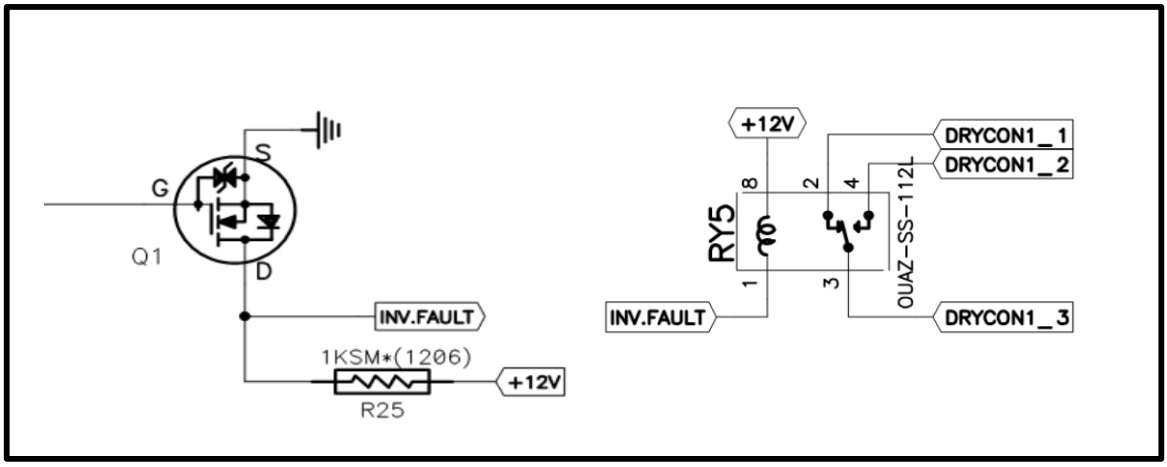
120Vac model: NFB 1P20A/120Vac (CIRCUIT PROTECTOR) UL489

### 4.2.4 AC Output

230Vac model: AC output outlet IEC320-C13 10A 250Vac

120Vac model: REC. RON/RF-6005-A 5-20R 20A 125V 3P

### 4.2.5 Alarm Relay



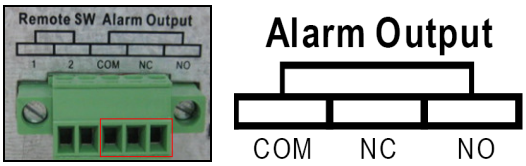
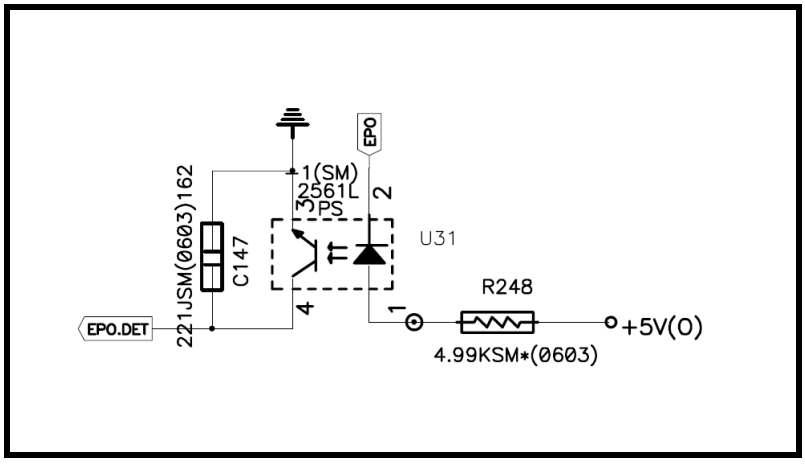



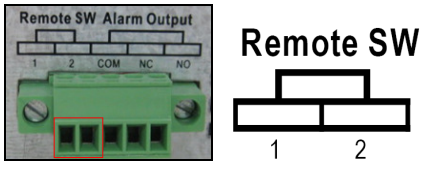

**Figure 7–Rear panel alarm output port**

| Module Status | Dry Contact Status | |
|---|---|---|
| | Alarm_NC & Com | Alarm_NO & Com |
| DC and AC power normal | Open | Closed |
| unit fail | Closed | Open |
| DC and AC power off | Closed | Open |

### 4.2.6 Remote ON/OFF Switch

Once the module power switch is in the ON position, use the Remote ON/OFF switch to control power to the unit. Shorting pins 1 and 2 will turn the unit OFF. Opening pins 1 and 2 will turn the unit ON.




| Remote SW Pins 1 & 2 | Module Power |
|---|---|
| Open | ON |
| Shorted | OFF |

**Figure 8–Rear panel remote ON/OFF switch**

## 4.3 Pre-Operation Check

### Inverter Operation Check

- Check if the DC input polarity is connected correctly.
- Ensure the input voltage is in the standard range.
- Check connecting wiring size based on the wiring table.
- Check if the ground wiring is connected on the rear cover for safety, to avoid electrical shock.
- The breakers are at ON position.
- To operate the Auto Transfer Switch, it is necessary to make sure that the nominal voltage and frequency of the grid match the corresponding settings of the unit.

Verify that the nominal frequency and voltage values are equal to those of the grid.

## 4.4 Status Monitoring

When the inverter is properly installed with power on, the LCD screen will light by displaying “Waiting” for self-diagnosis. After a few seconds, the general status is shown as follows:


**Figure 9–Power start page**

Press “Enter↵” key, “Main Menu” appears: “STATUS” and “SETTINGS” menu can be selected by pressing “PgDn▽”or “PgUp△” and “Enter↵” key.


**Figure 10–Main menu**

| Heading | Value |
|---|---|
| Address | Inverter module location |
| OPV | Output voltage of the inverter module in Volts (V) |
| OPI | Output current of the inverter module in Amperes (A) |
| OPF | Output frequency of the inverter module in Hertz (Hz) |
| OPP | Power capacity of the inverter module in Volt-Amperes (VA) |
| Input Volt | DC input voltage of the inverter in Volts (V) |
| Power Used | Load level in percentage (%) |
| Ambient Temp. | Inverter ambient temperature (ºC) |
| Power Limited | Power limited in percentage (%) |
| Mains AC Volt | Voltage of Mains AC |
| Mains AC Freq | Frequency of Mains AC |
| Priority | On-line/Off-line |

**Table B–LCD display of inverter status**

| Item | Specification | Remark |
|---|---|---|
| Inverter | Alarm name | For example:<br>***Alarm Num: 1***<br>***1. Fan Lock*** |

**Table C–LCD display of alarm log**

| Heading | Value |
|---|---|
| HW Ver | Hardware version of the inverter module |
| SW Ver | Software version of the inverter module |
| Serial No. | The serial number of the inverter |

**Table D–LCD display of version and SN**

## 4.5 Parameter Settings

The nverter allows reset of some parameters through the key function and LCD. Use PgDn▽ key and Enter ↵ key to select SETTINGS. 4-digit numeric password is requested. Use PgUp△ key to increase the number, and PgDn▽ key to decrease the number. For instance, press PgUp△ key once for 1, twice for 2, three times for 3, and so on. Press Enter ↵ to validate each digit of password once the desired number is selected. The default password is 0000. No setting modification can be executed if a wrong password is entered.


**Figure 11–Password input**

**Password Setting**

1. A new password can be set in **SYSTEM** option under **SETTINGS**. Press Enter ↵ key to enter **SETTING PASSWORD** menu for resetting the password.
2. Use PgUp△ key and PgDn▽ key to enter a new password. Press Enter ↵ to validate each digit of the password once the desired number is selected.
3. After a 4-digit new password is input, the inverter will ask to re-enter the new password as confirmation. Repeat Step 2 to key in the new password again. Once the password is successfully changed, **DONE** will appear on the screen.

**SETTINGS** section is divided into two categories: **SYSTEM** and **INVERTER**.

### 4.5.1 System Parameter Settings

| Parameter | Specification |
|---|---|
| Language | English |
| Password | Setting password |
| Brightness: LCD Brightness | From 00~63 for adjusting LCD display contrast |
| Restore Factory Setting | Reset default value |

**Table E–System parameter settings**

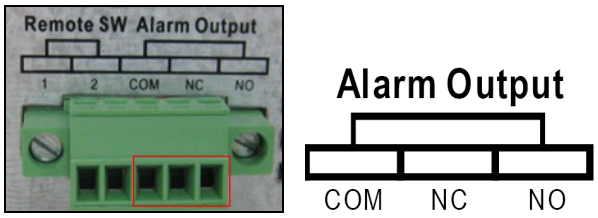
### 4.5.2 Inverter Parameter Settings

| Parameter | Setting Option |
|---|---|
| Output volt:<br>Inverter output voltage | For 230Vac output, selectable at:<br>1) 208Vac 2) 220Vac 3) 230Vac 4) 240Vac<br>For 110Vac output, selectable at:<br>1) 110Vac 2) 115Vac 3) 120Vac |
| Output Freq:<br>Inverter output frequency | Selectable at 1) 50Hz and 2) 60Hz |
| OPV HL:<br>High loss of inverter output voltage | For Output volt = 208V, adjustable between 220V and 240V<br>For Output volt = 220V, adjustable between 233V and 252V<br>For Output volt = 230V, adjustable between 244V and 264V<br>For Output volt = 240V, adjustable between 254V and 276V<br>For Output volt = 110V, adjustable between 117V and 127V<br>For Output volt = 115V, adjustable between 122V and 132V<br>For Output volt = 120V, adjustable between 127V and 138V |
| OPV LL:<br>Low loss of inverter output voltage | For Output volt = 208V, adjustable between 176V and 198V<br>For Output volt = 220V, adjustable between 176V and 209V<br>For Output volt = 230V, adjustable between 185V and 218V<br>For Output volt = 240V, adjustable between 193V and 228V<br>For Output volt = 110V, adjustable between 89V and 105V<br>For Output volt = 115V, adjustable between 93V and 110V<br>For Output volt = 120V, adjustable between 100V and 114V |
| IPV LVSD: The maximal input voltage for inverter normal operation | Adjustable between 39V and 44V |
| IPV HVSD: The minimal input voltage for inverter normal operation | Adjustable between 59V and 61V |
| Power Limited:<br>Inverter output power capacity | Adjustable between 150% and 200% of nominal. |
| Inverter On/off:<br>Setting inverter turn on or off | ⊙ ON<br>○ OFF |
| AC HL: High loss of alternative AC input | xxxV |
| AC LL: Low loss of alternative AC input | xxxV |
| Priority | Bat. Mode / Line Mode |

**Table F–Inverter parameter settings**

## 4.6 Alarm Settings

Use #30~16 AWG to connect the dry contact.

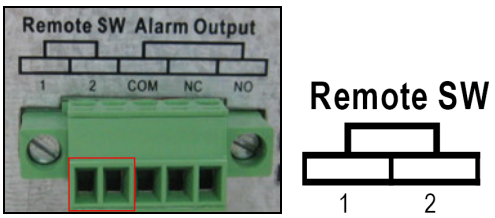



| Module Status | Dry Contact Status | |
|---|---|---|
| | Alarm_NC & Com | Alarm_NO & Com |
| DC and AC power normal | Open | Closed |
| unit fail | Closed | Open |
| DC and AC power off | Closed | Open |

**Figure 12–Rear panel alarm output port**

## 4.7 Remote ON/OFF Switch

Use #30~16 AWG to connect the remote ON/OFF switch:




| Remote SW Pins & 2 | Module Power |
|---|---|
| Open | On |
| Shorted | Off |

**Figure 13–Rear panel remote ON/OFF switch**

## 4.8 Turning On the Load

Check that the rated input power of the load is less or equal to the rated output power of the inverter.

Connect the load to the inverter as described previously.

Press the ON/OFF switch to turn the unit ON.

# 5 Maintenance and Troubleshooting

## 5.1 Preventative Maintenance

The following preventive maintenance routines should be considered as a minimum requirement. Your installation may require additional preventive maintenance to assure optimal performance from your installed inverter and associated equipment. These routines should be performed twice a year (more often if required). We strongly recommend a contract with Customer Support Services for preventive and remedial maintenance. The technician or electrician performing preventive maintenance on the equipment must read and understand thoroughly this manual and be familiar with the indicators, controls, and operation of the equipment.

## 5.2 Troubleshooting Guide

If the inverter fails to operate properly after having the installation and setup of the inverter thoroughly re-examined, use the troubleshooting table to determine the probable cause(s) and solution(s) to resolve error conditions. For unlisted error conditions, please contact your local dealer for technical assistance.

| Error Condition | Possible Cause | Recommendation |
|---|---|---|
| No AC output<br>and all LEDs off. | Lack of input power. | Ensure input cables are all firmly connected to power source.<br>Check if power source is not yet switched on, or is low in power. |
| No AC output.<br>Both green and yellow LEDs flicker. | Inverter self-diagnosis. | Inverter self-diagnosis takes a few seconds.<br>LED turns to a solid green light after the completion of self-diagnosis. |
| No AC output.<br>Both yellow and red LEDs are on. | Load exceeds 125%. | Ensure the load is no higher than 105% of the total power rating. Reduce as required. |
| No AC output.<br>Red LED is on. | 1. Input wiring is connected in reverse (i.e. reverse polarity). | Ensure input cables are connected to correct polarity (positive to positive, negative to negative). |
| | 2. Internal fault. | Restart the unit. If it fails to work, return it to factory for repair. |
| | 3. Inverter output is shorted. | Turn off the input power source to remove all short circuits. |
| | 4. Negative Power Protection. | When transfer between Mains and inverter, mains backfeed to inverter. |
| Red LED blinks fast. | 1. Inverter fails to soft start. | Reboot the inverter system by switching off and on the input power source. |
| | 2. Inverter temperature rises beyond the temperature limit. | Leave inverter idle to cool down for few minutes. |
| AC output exists with yellow LED flickering. | Input voltage is out of operating range. | Ensure input voltage is between 45 to 58Vdc. |
| AC output exists and yellow LED is on. | Load is over 100% but below 125%. | Ensure the load is no higher than 105% of the total power rating. Reduce as required. |
| Inverter continuously delivers power, but with red LED flickering slowly. | Failure of EEPROM. | Reboot the inverter system by switching off and on the input power source. |
| | Fans failure. | Check if the fans are locked or fail to work.<br>If fan is locked, remove the obstruction;<br>if fan fails to work, replace the fan. |

**Table G–Troubleshooting for inverter module**

# 6 Default Values

| Alarm Name | Level | Remark | Output Status |
|---|---|---|---|
| Inverter fault | Critical | Inverter fault | Off |
| Over load | Observe | Inverter over-loading | On |
| Over load fail | Critical | Over load shut down | Off |
| Inv fan fault | Major | Inverter fan fault | On |
| Power limit | Observe | Inverter power limited | On |
| DC abnormal | Observe | Inverter input out of range | On |
| DC low Inv off | Observe | Inverter shut down due to low input voltage | Off |
| Inv Bus High | Critical | Inverter Bus voltage over the maximum level | Off |
| Inv Bus Low | Critical | Inverter Bus voltage under the minimum level | Off |
| BusSoft fail | Critical | Inverter Bus soft start fail | Off |
| Output short | Critical | Inverter output short circuit | Off |
| Inv OPV Low | Critical | Inverter output voltage low | Off |
| Inv OPV High | Critical | Inverter output voltage high | Off |
| Inv Temp High | Critical | Inverter temperature high | Off |
| NegPow Protect | Critical | Inverter negative power protection | Off |
| SoftStart fail | Critical | Inverter soft start fail | Off |
| Mains abnormal | Observe | Mains unavailable | On |
| Eeprom fail | Major | Inverter EEPROM fault | On |

**Table H–Alarm default levels**

**NOTE:** *Critical level fault needs manual restart.*

| Setting | Default Value |
|---|---|
| ATS priority | On-line |
| **230Vac Unit** | |
| Mains high loss volt | 276V |
| Mains low loss volt | 176V |
| Inverter output high loss volt | 264V |
| Inverter output low loss volt | 192V |
| Inverter shutdown due to low input volt | 40V |
| Inverter shutdown due to high input volt | 60V |
| Inverter output volt | 230V |
| Inverter output volt frequency | 50Hz |
| Inverter output power limit | 100% |
| **120Vac Unit** | |
| Mains high loss volt | 138V |
| Mains low loss volt | 89V |
| Inverter output high loss volt | 140V |
| Inverter output low loss volt | 90V |
| Inverter shutdown due to low input volt | 40V |
| Inverter shutdown due to high input volt | 60V |
| Inverter output volt | 120V |
| Inverter output volt frequency | 60Hz |
| Inverter output power limit | 100% |
| **System Parameter** | |
| LCD brightness value | 45 |
| Language | English |
| Password | 0000 |

**Table I–Inverter/System factory defaults**

# 7 Specifications

## 7.1 DC Input

| | |
|---|---|
| Nominal Voltage: | 48Vdc |
| Operating Range: | 40 to 60Vdc within rated limits |
| Under Voltage Warning Threshold: | 45Vdc |
| Under Voltage Threshold: | 40Vdc |
| Over Voltage Warning Threshold: | 58Vdc |
| Over Voltage Threshold: | 60Vdc |
| Inrush current: | <2 x I rated |
| Isolation DC-enclosure: | 707Vdc (varistors and filter capacitor removed)/1min |
| Input Protection: | Reverse polarity protection |
| Psophometric Noise Voltage: | ≤1.0mV ITU-T O.41 (16.66 to 6000Hz) |
| Wide Band Noise: | <1.0mV (psophometric, 25Hz to 5kHz) |
| | <20mVrms (25Hz to 20kHz) |
| Peak to Peak Noise: | <150mV up to 100MHz |

### 7.1.1 DC Feeder Breaker and Wire Size Recommendation

| Rating | Delay | Wire Size |
|---|---|---|
| 70A | Slow | #6AWG |
| 110A | Fast | #4AWG |

Refer to section 3.5.1 for more information about these specifications.

## 7.2 AC Input (with transfer switch)

| | |
|---|---|
| Voltage Range: | 110/115/120Vac: 89 to 138Vac<br>208/220/230/240Vac: 176 to 276Vac |
| Over Voltage Threshold: | 276 / 138Vac |
| Under Voltage Threshold: | 176 / 89Vac |
| Frequency Range: | 50/60 ±2.5% Hz |
| Back-feed Protection: | Comply with safety requirement |
| Transfer Time: | 8ms when Inverter → Mains AC<br>10ms when Mains AC → Inverter |

## 7.3 AC Output

| | |
|---|---|
| Power Capacity: | 2000VA/2000W |
| Waveform: | Pure sine wave |
| Power Factor: | 1.0 |
| Nominal Output Voltage: | 110/115/120Vac or 208/220/230/240Vac |
| Voltage Regulation: | ±2% |
| Output Frequency: | 50/60Hz |
| Frequency Variation: | ±0.5% |
| Frequency Setting: | Manually, field-selectable |
| Crest Factor: | 3:1 |
| T.H.D. (Current): | <3% for linear load, <5% for non-linear load |
| Capacitive/Inductive Load: | -1.0 to +1.0 without exceeding permissible distortion for resistive load |
| Efficiency: | >91% |

| | |
|---|---|
| Current Limitation: | Electronic current limitation at overloads and short circuits |
| Isolation AC-enclosure: | Basic isolation (Pri-Gnd) 2121Vdc/1min |
| Isolation AC-DC: | Reinforced isolation (Pri-Sec) 4242Vdc/1min |
| Surge Protection: | EN61000-4-5, Telcordia GR-1089 CORE, ANSI/IEEE C62.41, STD 587-1980 |
| Dynamic Response: | Better than ±10% according to IEC 62040-3 Class 1 |
| Over Load Protection: | 1.2 x Inom permanent overload capacity @30°C (86°F)<br>1.5 x Inom >10s<br>2 x Inom >5s |

## 7.4 Mechanical

| | |
|---|---|
| Dimensions: | 43.8mm H x 440mm W x 360mm D<br>[1.73" H x 17.3" W x 14.2" D] |
| Weight: | 7.4 kg (16.3 lb.) for 230Vac model<br>7.6 kg (16.8 lb.) for 120Vac model |

## 7.5 Environmental

| | |
|---|---|
| Operating Temperature: | -20 to +60°C (-4 to +140°F)<br>-20 to +50°C (-4 to +122°F) with full performance |
| Storage Temperature: | -30 to +80°C (-22 to +176°F) |
| Operating Humidity: | 0 to 95% relative, non-condensing |
| Heat Dissipation: | Forced air cooling |
| Operating Altitude: | 1500m (4922 feet) |
| Audible Noise: | 55dB ETS 300 753 Class 3.1 |

## Standards

| | |
|---|---|
| Safety Compliance: | Comply with EN 60950-1/UL 60950-1 |
| Certification: | CE |
| RoHS: | Compliant |
| EMC: | EN300 386:2001 Class B compliance |
| MTBF: | 200,000 hours as per Telcordia SR-332 |

*The above information is valid at the time of publication. Consult factory for up-to-date ordering information. Specifications are subject to change without notice.*

# 8 Warranty

Visit http://www.alpha.ca/ for full warranty information.

## 8.1 Warranty

Alpha Technologies Ltd. warrants all equipment manufactured by it to be free from defects in parts and labor, for a period of two years from the date of shipment from the factory. The warranty provides for repairing, replacing or issuing credit (at Alpha's discretion) for any equipment manufactured by it and returned by the customer to the factory or other authorized location during the warranty period. There are limitations to this warranty coverage. The warranty does not provide to the customer or other parties any remedies other than the above. It does not provide coverage for any loss of profits, loss of use, costs for removal or installation of defective equipment, damages or consequential damages based upon equipment failure during or after the warranty period. No other obligations are expressed or implied. Warranty also does not cover damage or equipment failure due to cause(s) external to the unit including, but not limited to, environmental conditions, water damage, power surges or any other external influence.

The customer is responsible for all shipping and handling charges. Where products are covered under warranty Alpha will pay the cost of shipping the repaired or replacement unit back to the customer.

# 9 Acronyms and Definitions

| | |
|---|---|
| AC | Alternating current |
| ANSI | American National Standards Institute |
| ATS | Automatic Transfer Switch |
| AWG | American Wire Gauge |
| COM | Common |
| CSA | Canadian Standards Association |
| DC | Direct current |
| DSP | Digital signal processor |
| EMC | Electromagnetic compatibility |
| HVSD | High voltage shutdown |
| IEC | International Electrotechnical Commission |
| LCD | Liquid crystal display |
| LED | Light emitting diode |
| LVSD | Low voltage shutdown |
| MTBF | Mean time between failures |
| NC | Normally closed |
| NO | Normally open |
| OSHA | Occupational Safety & Health Administration |
| PC | Personal computer |
| RoHS | Restriction of hazardous substances |
| RU | Rack unit (1.75") |
| THD | Total harmonic distortion |
| UL | Underwriters Laboratories |
| USB | Universal serial bus |

# 10 Outline Drawings

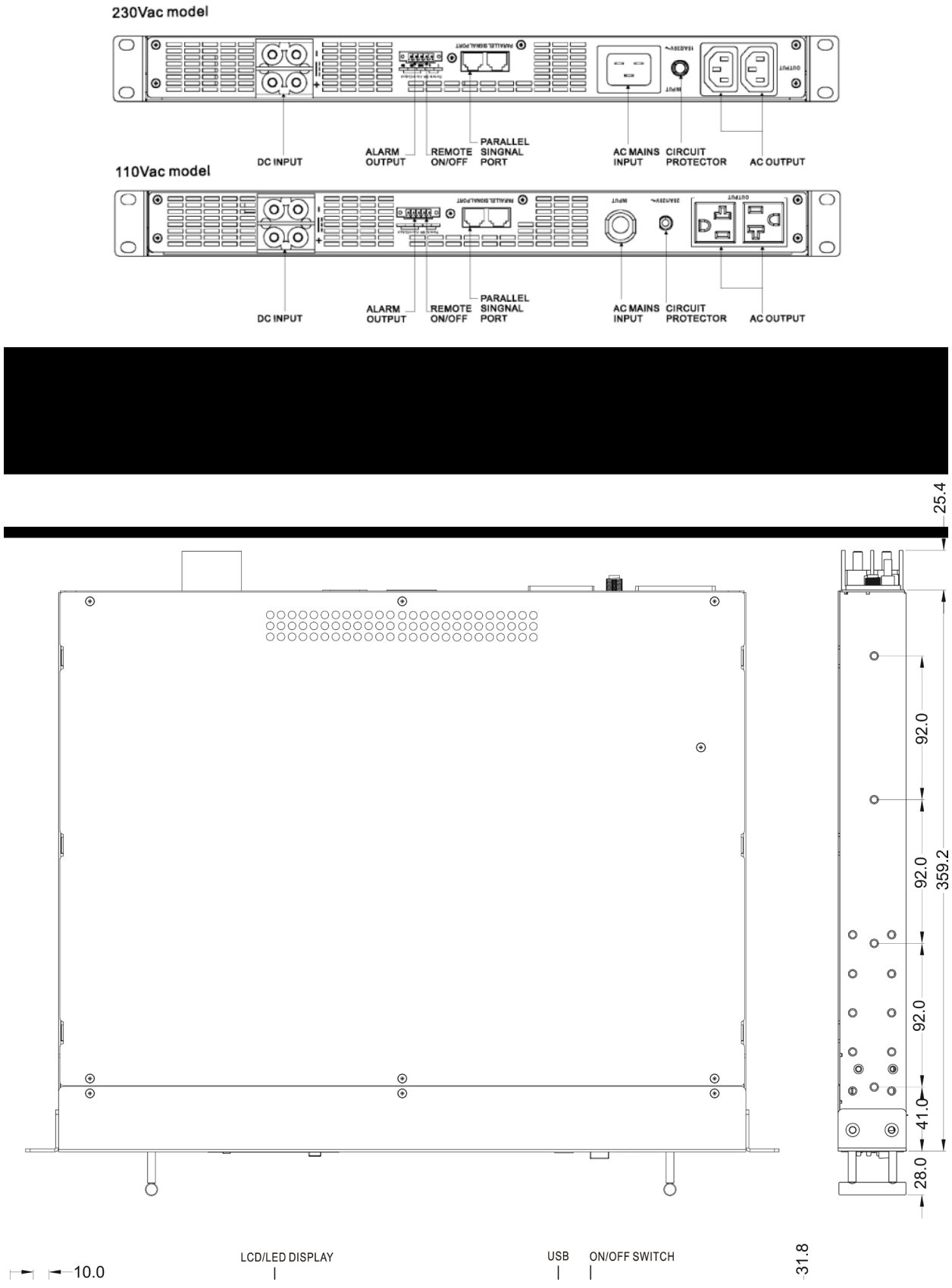



**Figure 15–Dimensional views**

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