Dual-Lite® Trident TRF UPS

208-600V 50/60Hz

3.5 to 40kVA

USER MANUAL

Current

HLI Solutions, Inc
701 Millennium Blvd.
Greenville, SC 29607

003-2730 REV A

Dual-Lite is highly specialized in the development and production of uninterruptible power systems (UPS). The UPS's of this series are high quality products, carefully designed and manufactured to ensure optimum performance.

For technical assistance, contact Dual-Lite's Technical Support Center at 1-800-848-6439. Technicians are available during normal working hours (EST).

HLI Solutions, Inc
701 Millennium Blvd
Greenville, SC 29607
Web site: www.dual-lite.com

Thank you for choosing our product.

Applicability

UL924 Models

T R F - 2 0 8 - 4 - 0 6 0 - 2 0 8 -

Safety Warnings

IMPORTANT SAFETY INSTRUCTIONS
SAVE THESE INSTRUCTIONS

This manual contains important instructions for Models 3.5 - 40kVA Trident TRV series UPS that should be followed during installation and maintenance of the UPS. Please read all instructions before operating the UPS and save this manual for future reference.

READ AND FOLLOW ALL SAFETY INSTRUCTIONS

a. Do not use outdoors.
b. Do not route wiring across or near hot surfaces.
c. Do not install near gas or electric heaters.
d. Use caution when servicing batteries. Battery acid can cause burns to skin and eyes. If acid is spilled on skin or in eyes, flush acid with fresh water and contact a physician immediately.
e. Unit should be installed where it will not readily be subjected to tampering by unauthorized personnel.
f. The use of accessory equipment not recommended by the manufacturer may cause an unsafe condition.
g. Do not use this UPS for other than intended use.

DANGER

This UPS contains LETHAL VOLTAGES. All repairs and service should be performed by AUTHORIZED SERVICE PERSONNEL ONLY. There are NO USER SERVICEABLE PARTS inside the UPS.

WARNING

To reduce the risk of fire or electric shock, install this UPS in a temperature and humidity controlled, indoor environment, free of conductive contaminants. Do not operate near water or excessive humidity.

WARNING

Input and output over-current protection and disconnect switches must be provided by others.

High ground leakage current may be present. Do not operate the unit without a proper protective ground.

WARNING

Batteries can present a risk of electrical shock or burn from high short circuit current. Observe proper precautions. Servicing should be performed by qualified service personnel knowledgeable of batteries and required precautions. Keep unauthorized personnel away from batteries.

There is a risk of explosion if batteries are replaced by an incorrect type. Replace with same type and rating only.
Proper disposal of batteries is required. Refer to your local codes for disposal requirements.

Never dispose of batteries in a fire

This product is available with internal batteries installed. When storing this product for more than 30 days it is recommended that the internal battery be disconnected. See **2.2.2 Storage** and **6.2 Internal Battery Replacement** for instructions to disconnect the internal battery, and more details on long term battery storage.

When replacing batteries, replace them with the same number and type of batteries.

Manufacturer	**Type**
CSB Battery Co Ltd	HR 1234W
	HR 1290W
Enersys	12HX35
	12HX80

Emergency Interventions

The following information is of a general nature.

First aid interventions

Company regulations and traditional procedures should be followed for any first aid intervention that may be required.

Firefighting measures

1. Do not use water to put out a fire, but only fire extinguishers that are suitable for use with electrical and electronic equipment.
2. If exposed to heat or fire, some products may release toxic fumes into the atmosphere. Always use a respirator when extinguishing a fire.

Symbols used in the Manual

In this manual, some operations are shown by graphic symbols to alert the reader to the dangerous nature of the operations:

	**Danger / Risk of Electric Shock** *This symbol indicates possibility of serious injury or substantial damage to the unit, unless adequate precautions are taken.*
	**Warning** *This symbol indicates important information which must be understood and any stated precautions taken*
	**Note**

Protective Equipment

No maintenance operations shall be carried out on the unit without wearing the Personal Protective Equipment (PPE) described below. Personnel involved in the installation or maintenance of the unit must be properly clothed.

The following signs show the protective equipment that should be worn. The various items of PPE must be selected and sized according to the nature of the hazard (particularly electrical) posed by the unit.

	**Accident prevention footwear**		**Protective eyewear**
	**Protective clothing**		**Helmet**
	**Work gloves**		

GENERAL PRECAUTIONS

This manual contains detailed instructions for the installation, start-up, and use of the UPS. Read the manual carefully before installation. For information on using the UPS, the manual should be kept close at hand and consulted before carrying out any operation on the UPS.

This UPS has been designed and manufactured in accordance with the standards for the product, for normal use and for all uses that may reasonably be expected. It may under no circumstances be used for any purposes other than those envisaged, or in any other ways than those described in this manual. Any interventions should be carried out in accordance with the criteria and the time-frames described in this manual.

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1.1. Views

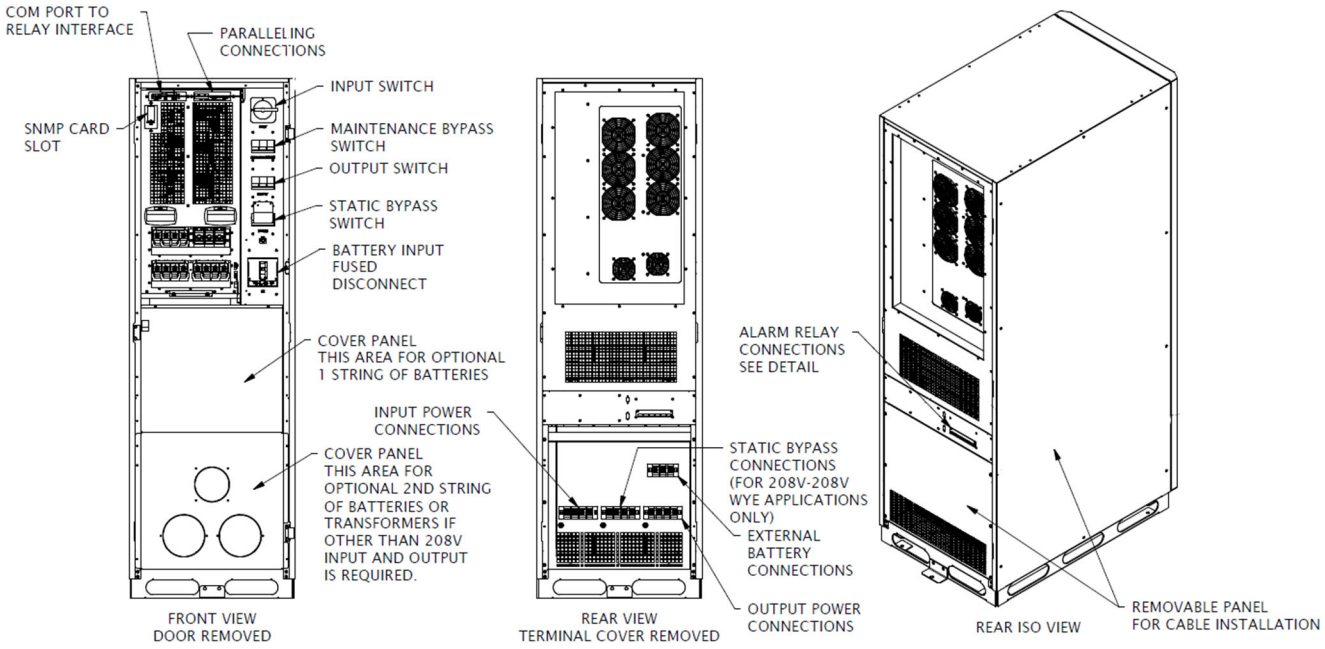


Figure 1 –Layout Views

2. Installation

- Check the Safety Instructions.
- Any incorrect connection or handling may cause damage to the UPS and/or the loads connected to it. Read these instructions carefully and follow the steps indicated.
- This UPS must be installed by a qualified electrician.
- It is advisable to provide a maintenance bypass switch or an electrical panel with individual protection for input, output, and static bypass, as well as a manual bypass. This allows isolation of unit during preventive maintenance or repair.

Upon request, a maintenance bypass switch can be sized to your specific requirements.

2.1 Important Safety Instructions

WARNING

As this is a unit with class I protection against electric shocks, it is essential to install an earth conductor. Connect the ground conductor to the ground lug, before connecting the power supply to the UPS input.

Before installing any cables, power or control, verify that all UPS switches are in open position and no power is available to the UPS.

The UPS has multiple electrical inputs and produces electrical output. Verify all terminals are at zero-voltage state before any work on the UPS is performed.

Warning labels should be placed on all primary power switches installed remotely from unit to alert the electrical maintenance personnel of the presence of a UPS in the circuit. The label should bear the following or an equivalent text:

Before working on this circuit.
- Isolate Uninterruptible Power System (UPS).
- Check for Hazardous Voltage.
Risk of Voltage Backfeed

WARNING

Once the mains power supply is powered up to the input of the UPS, there may be voltage at the output terminals. To have no voltage on the output terminals, Input Breaker, Bypass Input Breaker and Output Breaker must be in Off position.

The output terminals may have output voltage from the manual bypass. If the output power supply of the UPS has to be interrupted, open Maintain Breaker.

Precautions must be taken working around the batteries. Batteries are not isolated from the AC input, and dangerous voltage between the battery terminals and the ground may be present.

2.1.1 Battery Safety Instructions

WARNING

The handling and connection of the batteries shall be done and supervised by personnel with battery knowledge.

If an installed a -0 version UPS (no internal battery) and want to install batteries, consult with factory service before attempting to install batteries.
Only a qualified technician should attempt to install or replace batteries in this equipment. See **6.2 Internal Battery Replacement** in this manual for detailed instructions.

The battery supply can involve the risk of electric shock and can produce high short circuit current. Observe the following preventive measures before working with Battery Terminals:

- Disconnect the corresponding protection elements.
- When connecting a battery cabinet to the UPS, verify correct polarity.
- Wear rubber gloves and shoes.
- Use tools with insulated handles.
- Removes watches, rings or other metal objects.
- Do not place metal tools or objects on the batteries.
- Never short the battery terminals as it will result in a high safety risk and potential damage to the battery and the UPS.
- Avoid mechanical impacts.
- Do not open or mutilate the battery. Released electrolyte is harmful to the skin and eyes.
- Do not dispose of batteries in a fire. The batteries may explode.
- In case of contact of the acid with parts of the body, wash immediately with plenty water and seek medical help.
- Batteries involve a serious risk for health and for the environment. Their disposal should be done according to the existing laws.

2.2 Equipment Handling

2.2.1 Unpacking and Content Checking

Upon receiving the UPS, make sure that it has not suffered any damage in transport. If any shipping damage is noticed, make all pertinent claims to the carrier. Also check that the data in the nameplate, which is attached inside the front door, corresponds to those specified in the purchase order; it will be necessary to unpack it. To unpack, cut the bands on the cardboard container and remove it by lifting above or remove it with the necessary tools if made of wood; remove the corner pieces and the plastic sleeve. The UPS should be unpacked on the pallet.

When the unit has been accepted, it is best to repack the UPS until it is put into service in order to protect it from any possible mechanical damage, dust, dirt, etc....

2.2.2 Storage

Storage of the UPS should be in a dry, ventilated place and protected against rain, water or chemical agents. It is advisable to maintain the UPS in the original package which has been designed to assure the maximum protection during transport and storage.

The UPS may have installed batteries and should not be stored for more than 12 months at 77º F (25º C) or 3 months at 104º F (40º C). Extended storage at elevated temperatures will cause irreversible damage to the battery.

When a long storage time is required, the batteries can be maintained:

1 Unpack UPS
2 Connect the UPS to an Input Utility.
3 Startup UPS according to the instructions described in this manual and charge the batteries for 24 hours.
4 Then shut down the UPS, disconnect it and keep the UPS in their original packaging until the next charge is required.

Do not store the unit where the ambient temperature exceeds 104º F (40º C) or falls below -- 4º F (-20º C), as this may degrade the electrical characteristics of the batteries.

2.2.3 Transport

All UPS have castors to facilitate transport to their final location. It is important to observe the rough weights indicated in the technical specs both with respect to the site itself and the means to be used to put it there (floor, hoist, lift, stairs, etc…).

2.2.4 Location

The UPS requires a minimum of 8 inches clearance in the back. Clearance above the UPS must be 18 inches minimum. Failure to adhere these minimum clearances may result in overheating.

Adequate space must be provided in front for service and maintenance (See **Figure 2**). Using flexible conduit for power wiring may provide some benefit.

Two leveler stops located close to the front casters are used to keep UPS stationary once it is placed. Open the front door of the cabinet and loosen the leveling by turning them counterclockwise until they touch the floor, and then using a tool, continue turning until the stops are tight to floor. Close the door.

Leveler stops are not designed to carry the weight of the UPS. The casters must carry the weight of the unit.

Access to the sides will be required only for repair of the UPS.

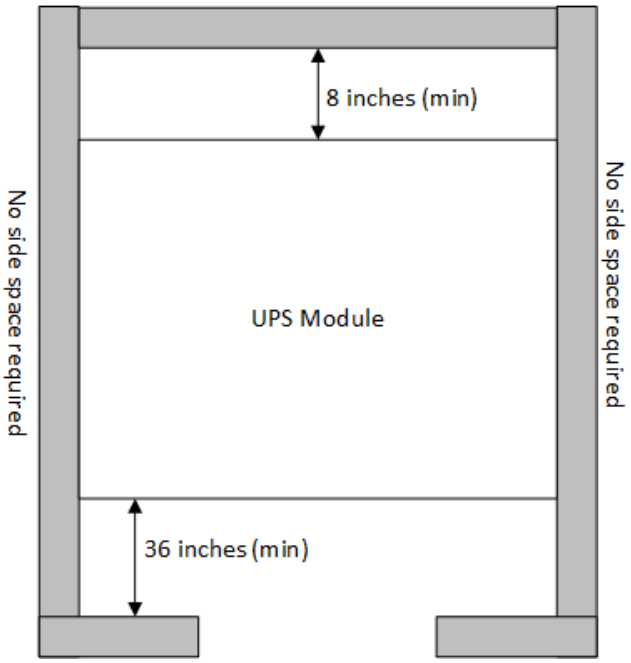


Figure 2 - Recommended spacing around unit

2.3 Power Connections

2.3.1 Preparing UPS

All of the UPS models have terminals for power connection and connectors for communications located inside the UPS front door and rear of unit. Follow the steps described below for access to all connections:

- Unlock the front door lock with the provided key.
- Connectors for communication ports are located at the top left side of the inner panel.
- Terminals for Dry Contact alarms are located in rear of unit.
- Remove the screws securing the terminal cover inside of the cabinet and set it aside. The input, output and external battery terminals are now exposed.
- Once the connection of the UPS is finished, replace the cover and close the door.

Wire size should be in accordance with NEC and local code using the currents shown in **7.2 Rated Currents and Recommend Field Wiring Information**

Circuit protection in power distribution panels should have following characteristics:

- For input and bypass, type B earth leakage breakers and circuit breakers curve C.
- For the output, circuit breaker curve C.
- Their size will be compatible, as minimum, with the currents stated in **7.2 Rated Currents and Recommend Field Wiring Information**
-

If input, output or bypass peripherals were added to the UPS, like transformers or autotransformers, follow the installation instructions in the manuals for those units.

2.3.2 Connection to Mains Input

Connection to the ground:
This unit is class I protection against electric shocks, a ground conductor must be installed. Connect the conductor from to the ground, before connecting the power to the UPS input. See **7.2 Rated Currents and Recommend Field Wiring Information** for current ratings.

Connection to the Input:
Connect the power supply cables N-A-B-C to the input power terminals, following the order of neutral and phases indicated on the label of the unit and in this manual.
See **7.2 Rated Currents and Recommend Field Wiring Information** for current ratings.

If the order of the phases is not followed, the unit will not operate. When there are discrepancies between the labeling and the instructions of this manual, the label on the UPS will always prevail.

2.3.3 Connection to the Bypass Input:

Independent Bypass Input
For UPS configurations where the bypass input is separate from the rectifier input.

Connection to the ground:
This unit is class I protection against electric shocks, a ground conductor must be installed. Connect the conductor from to the ground terminal before connecting the power to the UPS input. See **7.2 Rated Currents and Recommend Field Wiring Information** for current ratings.

Connection to the Bypass:
Some UPS configurations have jumper wires between input power terminals and the static bypass terminals. For Independent bypass configuration, these jumpers need to be removed.

Connect the bypass power supply cables N-A-B-C to the static bypass power, following the order of neutral and phases indicated on the label of the unit and in this manual.

If the order of the phases is not followed, the unit will not operate. When there are discrepancies between the labeling and the instructions of this manual, the label on the UPS will always prevail.

WARNING

Whenever a single UPS is fed with dual inputs or there are parallel connected UPSes, particular care needs to be taken with regards to the Neutral wiring. It is prohibited to create a configuration that might lead to current flowing through ground conductors except during the occurrence of an insulation fault. For a dual input configuration, this means that both the bypass input and the rectifier input must be fed from sources that have a common Neutral to Ground Bond. Typically, this means that they must be fed from the same panel. If they need to be fed from distinct sources, then the UPS installation must include an isolation transformer for each input and those transformers must share a common ground bonding point for their neutrals.

2.3.4 Connection to the Output

Connection to the ground:
This unit is class I protection against electric shocks, a ground conductor must be installed. Connect the conductor from to the ground terminal before connecting the power to the UPS input. See **7.2 Rated Currents and Recommend Field Wiring Information** for current ratings.

Connect the loads cables N-A-B-C to the output power terminals, following the order of neutral and phases indicated on the label of the unit and in this manual.

If the order of the phases is not followed, the unit will not operate. When there are discrepancies between the labeling and the instructions of this manual, the label on the UPS will always prevail. A user accessible disconnect device sized appropriately to **7.2 Rated Currents and Recommend Field Wiring Information** shall be installed from output of UPS to critical load.

2.3.5 External Battery Connection (UPS OR UL924 systems only)

Danger

On units with internal batteries, there may be a high level DC voltage across these terminal connections. Use extreme caution when connecting the external batteries. Only use properly insulated tools. Failure to comply may cause irreversible damage to the UPS or personal harm.

Connection to the ground:
This unit is class I protection against electric shocks, a ground conductor must be installed. Connect the conductor from to the ground terminal before connecting the power to the UPS input.

Danger

UPS connection with an external battery will be made by connecting properly sized cables to external battery terminals matching polarity at the external battery terminals.

Insure that the external battery complies with the battery requirements for this UPS system. See the external battery documentation for connection details. All external battery strings must include properly rated overcurrent protection and be suitable for branch circuit ratings.

If more than one external battery cabinet is to be connected, the connection will always be in parallel among them and the UPS's cable from the negative of the UPS to the negative of the first battery pack and to the negative of the second battery pack, and so on. Proceed in the same way for positive cables, half tap (N) and earth.

Danger

If after starting up the UPS, it is required to disconnect the battery cabinet cabling from the UPS, the UPS has to be completely shut down (see shut down section). Turn off the battery cabinet circuit breaker and/or DC Breaker located in the UPS. Wait at least 5 min. until the filter capacitors have been discharged.

2.3.6 Connection Main Protective Earth

Make sure that all loads connected to the UPS are only connected to the ground bonding terminal. Grounding of the load(s) and/or the battery case(s) or cabinet(s) to this single point will help prevent ground loops which will affect the quality of the power supplied.
All of the terminals identified as ground, are joined together, to the main grounding terminal and to the frame of the unit.

2.4 Control Connections

2.4.1 Dry Contacts

The dry contact lines constitute a very low safety voltage circuit. To preserve the quality, it must be installed separately from other lines that have dangerous voltages (power distribution line).

The communication port to relays provides digital signals in the form of potential free form A contacts. Dry Contact Port.

Pins	Description	Rating	Wire Size
1 & 2	Inverter Inhibit Input	30 V (AC or DC); <2 A	#22-#12 AWG
3 & 4	On Bypass		
5 & 6	Reserved		

When alarm is activated, the contact is Closed.

Table 1 - Alarms interface to Dry Contacts

2.4.2 COM port RS-232 & RS-485. Connector (J8).

The communications line (COM) constitutes a very low safety voltage circuit. To preserve the quality, it must be installed separately from other lines that have dangerous voltages (power distribution line).

In the connector DB9 there are ports of communication of the UPS to the RS-232 and the RS-485. It is not possible to use them simultaneously as both are mutually exclusive. Connector J8 can be used for connecting the UPS with any machine or units that has standard bus.

2.4.2.1 RS-232

Physical structure of the RS-232

Pin-out

- Pin 2. RXD. Serial data reception.
- Pin 3. TXD. Serial data transmission.
- Pin 5. GND. Signal mass.

Communication protocol of the RS-232

The communication protocol used is of «MASTER/SLAVE» type. The computer or computer system («MASTER») asks about a certain data, and the UPS («SLAVE») answers immediately with the required data. First the communication channel of the computer will be programmed with the same parameters as the communication channel of the UPS.

- Communication speed: 1200, 2400, 4800, 9600 or 19200 Bauds.
- No. information bits: 8 Bits.
- No. stop bits: 1 or 2 stop bits.
- Parity: - Even, Odd or None.

2.4.2.2 RS-485

Physical structure of the RS-485

The unit uses only 2 wires (pins 4 and 9 of the female DB9 connector) to perform the dialogue between the systems connected to the network. The communication will be established by sending and receiving signals in a differential mode, which gives the system great immunity to noise over a long distance (approx. 800 m).

Pin-out

- Pin 4. Output signal A (+) of the RS-485.
- Pin 9. Output signal B (–) of the RS-485.

Communication protocol of the RS-485

The communication protocol of the RS-485 channel is developed to enable the UPS to communicate with other computer systems that utilize the same protocol.

- Communication speed: 1200, 2400, 4800, 9600 or 19200 Bauds.
- No. information bits: 8 Bits.
- No. stop bits: 1 or 2 stop bits.
- Parity: - Even, Odd or None.

2.4.3. Local EPO terminal

A local EPO button is mounted on the front panel next to the LCD. After an EPO event using this button it must be depressed again to clear the EPO before the UPS can be restarted.

The EPO switch must be normally closed and latch open when pressed in order to open the circuit to activate the emergency shutdown. To restore the UPS to normal mode, return the position of the switch or button (EPO), close the circuit.

For operating instructions for the (EPO), see **3.2.3 Emergency Power Off (EPO)** of this manual.

2.4.6 Alarm Relay Board

The Alarm Board is active (powered up) when the UPS output is ON. It relays based upon the status of UPS. There are six connections, J2 through J7.

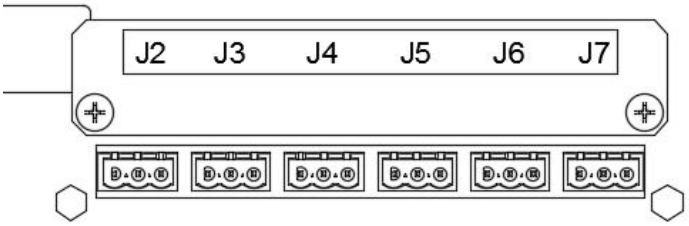


Figure 3 – Alarm Relay Board

Connection	Description	Terminal	Type	Rating	Wire Size	Torque
J1	Internal connection					
J2	Normal Operation	1	N. C.	30 V (AC or DC); <2 A	#22-#12 AWG	4.4 in-lbs.
		2	Com			
		3	N.O.			
J3	On Bypass	1	N. C.			
		2	Com			
		3	N.O.			
J4	On Battery	1	N. C.			
		2	Com			
		3	N.O.			
J5	Low Battery	1	N. C.			
		2	Com			
		3	N.O.			
J6	Over Temperature	1	N. C.			
		2	Com			
		3	N.O.			
J7	Alarm Present	1	N. C.			
		2	Com			
		3	N.O.			

N.C. – Normally Closed – shorted to Com when signal is not energized
N.O. – Normally Open – shorted to Com when signal is activated

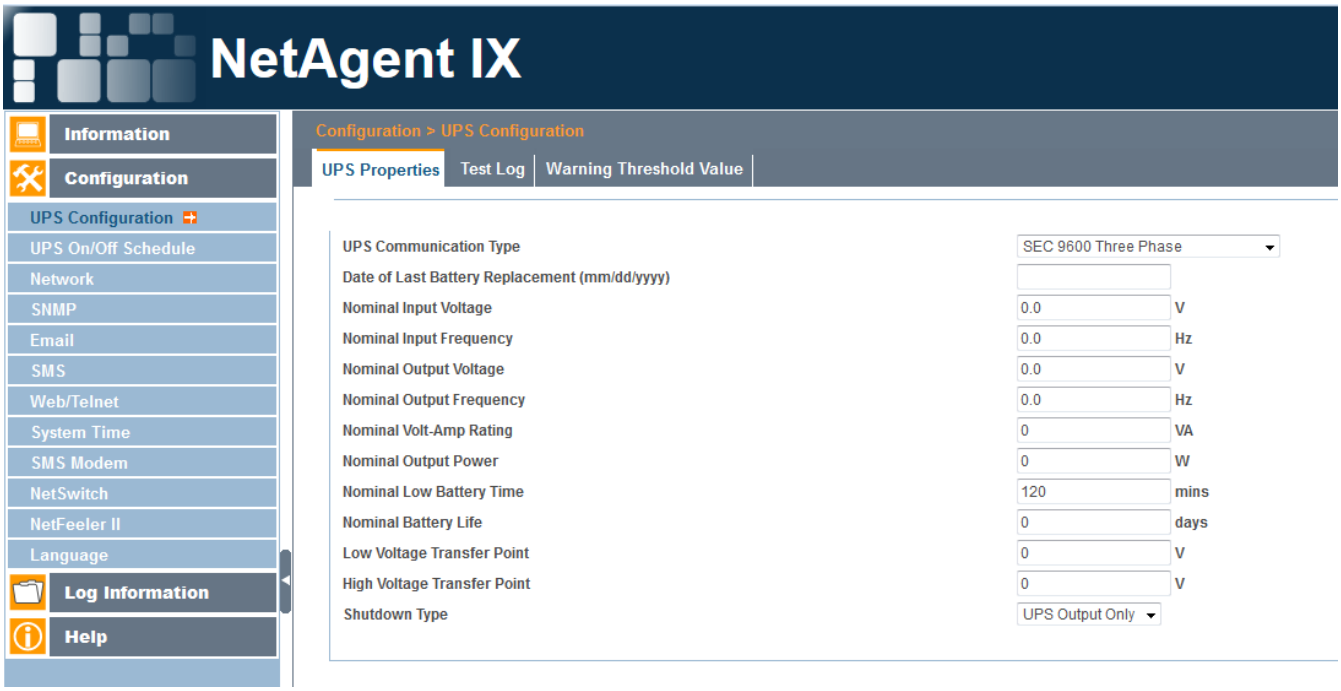
Table 2 – Alarm Relay Board

2.4.7 Optional Intellislot Communication Card

If the SNMP Card is installed, the following settings need to be made for the card to communicate properly.

SNMP Card Setting:

UPS Communication Type: SEC 9600 Three Phase



3. Operation

It is critical that the following procedure be followed in the sequence given.

3.1 Start up

3.1.1 Before Start Up

- Verify that all the connections have been made correctly and are sufficiently tight, following the labeling of the phase rotation sequence.
- Check that the UPS switches and any external battery cabinet or cabinets are in off position.
- Be sure that all the loads are turned off.

3.1.2 Start-Up Procedure UPS/UL924 Module

1. If the UPS is connected to an external battery cabinet(s), close battery cabinet breaker(s).
2. Close the mains circuit breaker to provide power to the input of the UPS.
3. Turn the Input Breaker to “I” (ON) position. The display of the Control Panel will be turned on automatically. **DO NOT** close any other switches at this time.

   The UPS will verify for correct phase sequence. If Line Wiring Fault occurs, Disconnect the Input Breaker and the mains power. Swap the phases of the input terminals of the UPS according to the labeling and repeat the start-up process.
4. Close breakers in external battery packs.
5. Close UPS Battery Breaker.
6. Close the Output Breaker.
7. Start up the inverter through the keypad of the control panel.
   a. Select “Control”,
   b. Select “ON/OFF UPS”.
   c. “Turn On UPS?” will appear. Select “YES”
8. After several seconds, the rectifier and inverter will start.
9. The system will supply voltage at the output terminals.
10. Close the Bypass Input Breaker.

    The UPS will verify for correct phase sequence. If Line Wiring Fault occurs, Disconnect the Bypass Input Breaker and the mains power. Swap the phases of the input bypass terminals of the UPS according to the labeling and repeat the start-up process.
11. The system is now started up completely, and the UPS is protecting the critical load.

3.1.3 Start-Up Procedure PPC Unit

1. Close the mains circuit breaker to provide power to the input of the UPS.
2. Turn the Input Breaker to “I” (ON) position. The display of the Control Panel will be turned on automatically. **DO NOT** close any other switches at this time.

   The UPS will verify for correct phase sequence. If Line Wiring Fault occurs, Disconnect the Input Breaker and the mains power. Swap the phases of the input terminals of the UPS according to the labeling and repeat the start-up process.
3. Close the Output Breaker.
4. Start up the inverter through the keypad of the control panel.
   a. Select “Control”,
   b. Select “ON/OFF UPS”.
   c. “Turn On UPS?” will appear. Select “YES”
5. After several seconds, the rectifier and inverter will start.
6. The system will supply voltage at the output terminals.

7. Close the Bypass Input Breaker.
   The UPS will verify for correct phase sequence. If Line Wiring Fault occurs, Disconnect the Bypass Input Breaker and the mains power. Swap the phases of the input bypass terminals of the UPS according to the labeling and repeat the start-up process.
8. The system is now started up completely, and the UPS is protecting the critical load.

3.2 Shutdown

3.2.1 Inverter Disconnect

Open the Output Breaker of the UPS.

3.2.2 Complete Shutdown of UPS

1. Shutdown the loads.
2. Open any distribution breakers.
3. Shutdown the inverter.
   a. Select “Control”,
   b. Select “ON/OFF UPS”.
   c. “Turn Off UPS?” will appear. Select “YES”
4. Open Output Breaker..
5. Set the Input Switch to “O” position.
6. Open the circuit breaker on any external battery cabinet(s) and DC Breaker in UPS.
7. To completely isolate UPS, remove power to the UPS input and the bypass. The system is now completely deactivated.

Danger

After shutdown of the UPS, wait at least 5 minutes before performing any maintenance or service work to allow the electrolytic capacitors to be discharged.

3.2.3 Emergency Power Off (EPO)

Emergency Power Off (EPO) will completely shut down unit or system of units:

When activated, the output voltage to the load is turned off.

3.2.3.1 Remote Emergency Power Off (REPO)

Remote shutdown function (REPO) is activated through the REPO terminal. A Normally Closed contact is opened, REPO will activate and completely shut down the module.

3.2.3.2 Local Emergency Power Off (EPO)

Local shutdown function (EPO) is activated from front panel mounted EPO button. When the button is depressed, EPO will activate and completely shut down the module.

3.2.4 End of Discharge (UPS/UL924 Module)

When the unit is in Battery Mode, it will constantly monitor the battery voltage level. When the batteries have discharged below the Low Battery level, an alarm will activate. When the batteries have discharged below the End of Discharge (EOD) level, the unit will turn off the inverter, but the controls will remain on. Once the input power is re-qualified, the unit will automatically restart and transfer to inverter.

If the input power is off for an extended period of time after EOD, it is recommended to open the battery breakers to avoid excess discharge of the batteries.

3.3 Maintenance Bypass Transfer

3.3.1 Transfer to Manual Bypass

Procedure for passing from normal operation to manual bypass:

1. Shutdown the inverter.
    a. Select “Control”,
    b. Select “ON/OFF UPS”.
    c. “Turn Off UPS?” will appear. Select “YES”
    d. Load is now on Static Bypass
2. Remove the screws holding the metal bracket blocking operation of the switch and remove the metal bracket.
3. Close Maintain Breaker.
4. Open Output Breaker.
5. Open DC Breaker in UPS.
6. Open the circuit breaker on any external battery cabinet(s).
7. Turn Input Switch to “O” position.

The UPS supplies output voltage directly from the utility source through the manual bypass.

8. The UPS is completely shut down.

3.3.2 Transfer to Normal Operation

Procedure for switching from manual bypass to normal operation:

1. When an external battery cabinet is connected, close the battery breaker(s).
2. Set the Input Switch to “I” position.
3. Close UPS Battery Breaker.
4. Close the Output Breaker.
5. Open the Maintain Breaker and replace the metal bracket (BL) and screws. Load is on Static Bypass.

It is an important requirement for safety to replace the metal bracket (BL) to prevent accidental closure of Maintain Breaker which can result in interruption of power to the load and possible damage to the UPS.

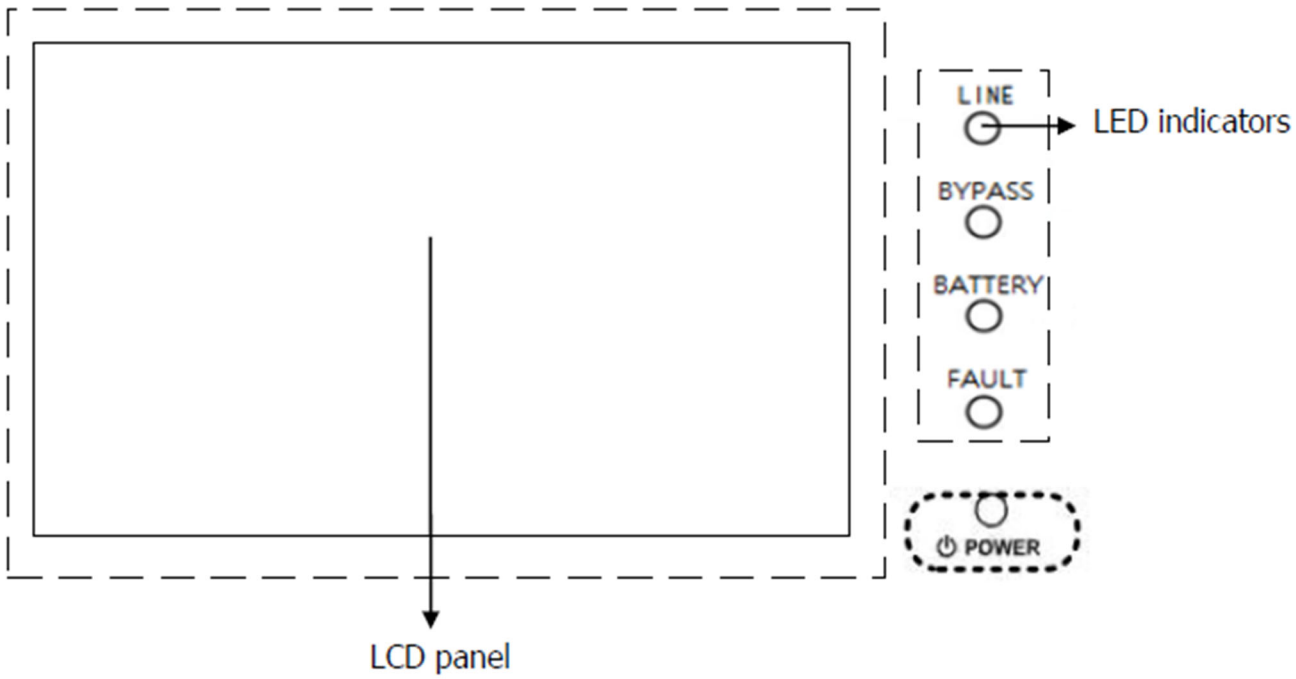
6. Start up the inverter.
    a. Select “Control”,
    b. Select “ON/OFF UPS”.
    c. “Turn On UPS?” will appear. Select “YES”

The UPS or UPS System is now online and fully protecting the load.

4. Control Panel and Display

4.1 Basic Functions of Keyboard

The LCD front screen has touch screen functions.



The four (4) LED on front panel will show the status of the UPS.

Mode LED	Bypass	Line	Battery	Fault
UPS On	●	●	●	●
Standby Mode	○	○	○	○
Bypass Mode	●	○	○	○
Line Mode	○	●	○	○
Battery Mode	○	○	●	○
Frequency Convertor	○	●	○	○
Battery Test	●	●	●	○
ECO Mode	●	●	○	○
Fault	○	○	○	●

● - LED illuminated

○ - LED is off

4.2 Screen Description

After initialization, the LCD will display main screen. There are five sub-menus: CONTROL, MEASURE, SETTING, INFO AND DATA LOG. Touch any sub-menu icon to enter into the sub-screen.

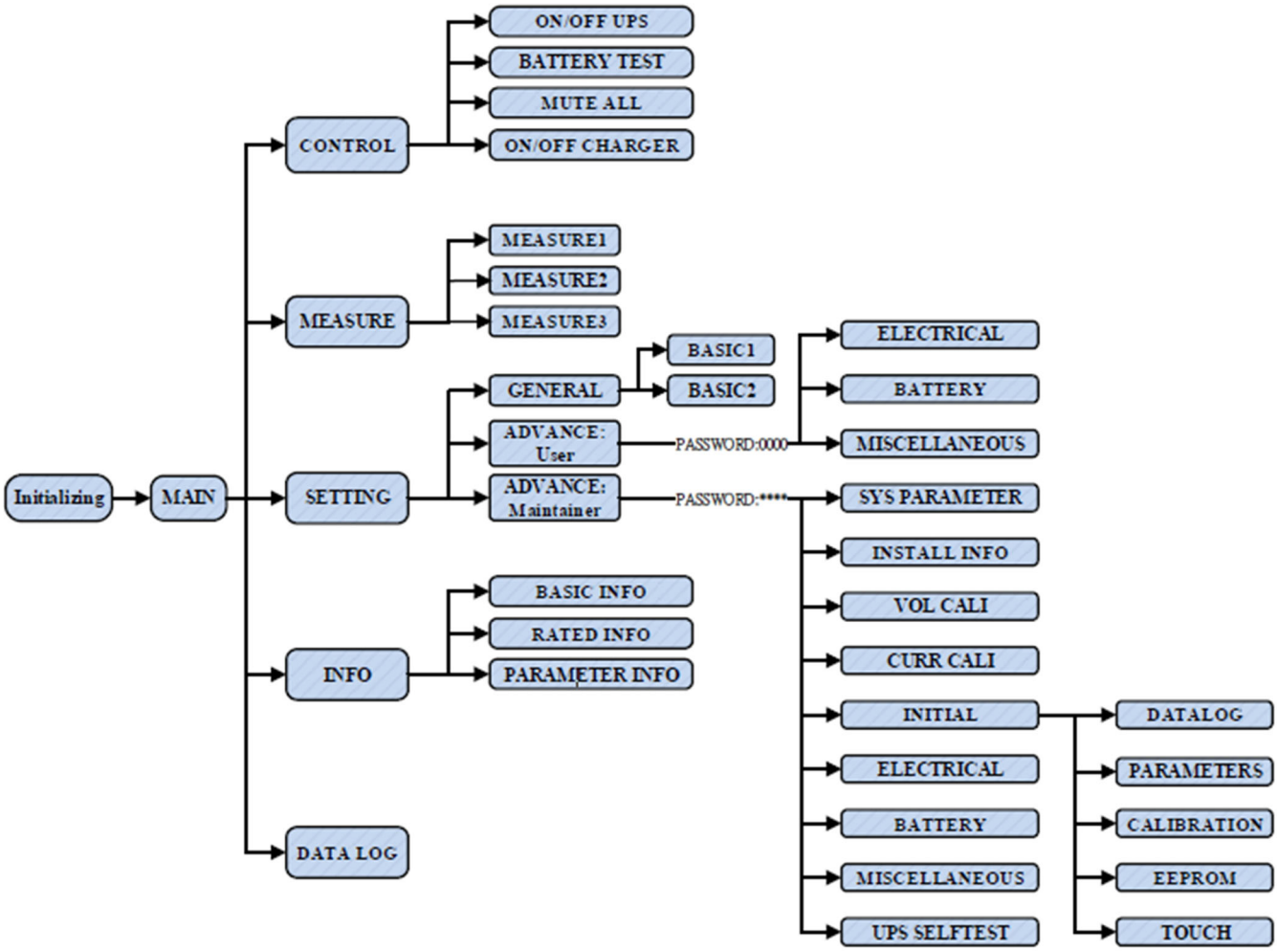
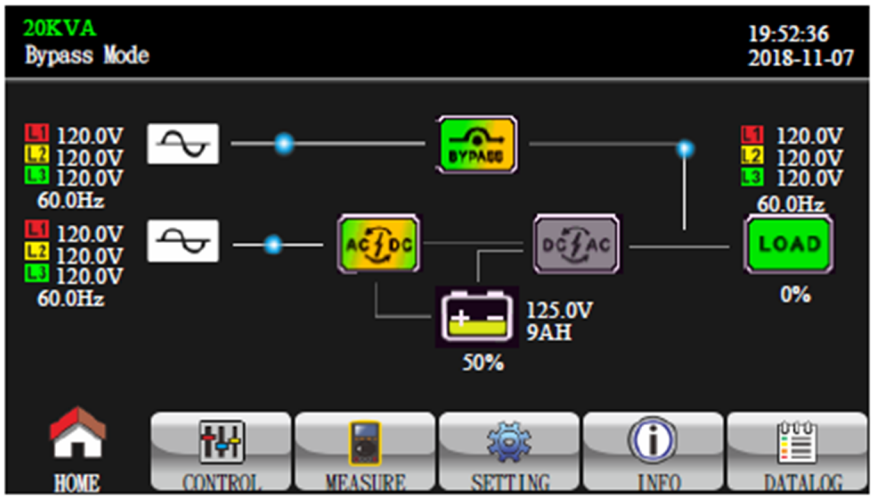


Figure 4 – HMI Menu tree

4.2.1 Main Screen



4.2.2 Control (CNTL) Menu

- Touch the icon 

to enter control sub-menu.

Figure 5 - Typical Control Screen

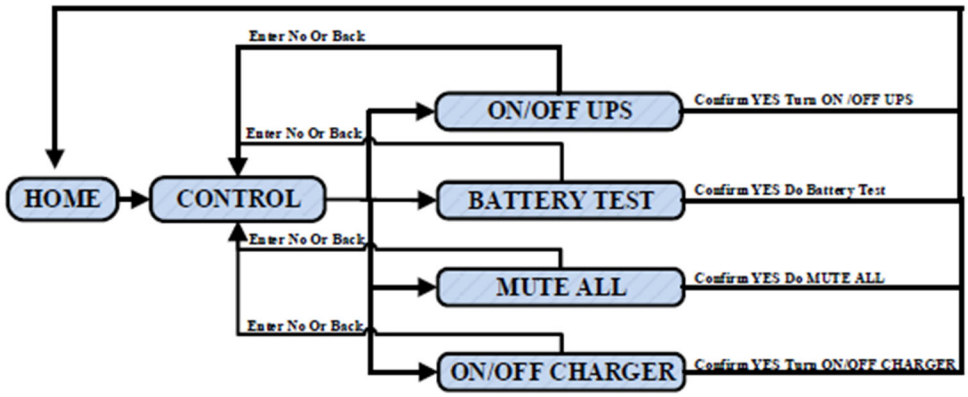


Figure 6 – Control Screen Menu tree

On/Off UPS

It will show “Turn on UPS?” when UPS is off.

It will show “Turn off UPS?” when UPS is on.

Touch “YES” to turn on or off the UPS. Then, the screen will return to main screen.

Touch “Back” to return to main screen immediately or “No” to cancel this operation and back to main screen.

Turn ON UPS

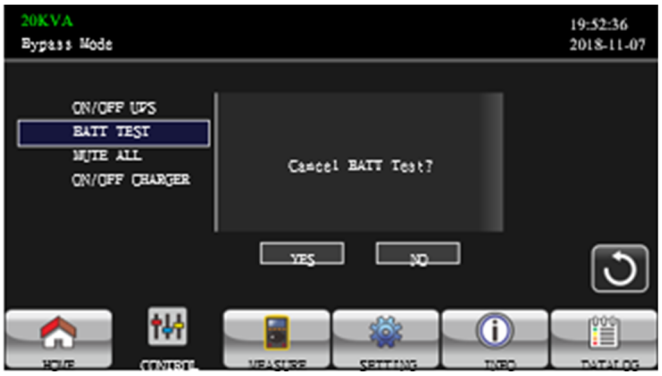
Turn OFF UPS

Battery Test

It will show “Battery Test” if the UPS is not in test. Touch “Yes” to start battery test. Then, it will show “Battery testing……“ during battery test period. After few seconds, battery test result will show on the screen. Touch “Back” to return to main screen immediately or “No” to cancel this operation and back to main screen.

It will show “Cancel battery test” if the UPS is in test.

Battery Test



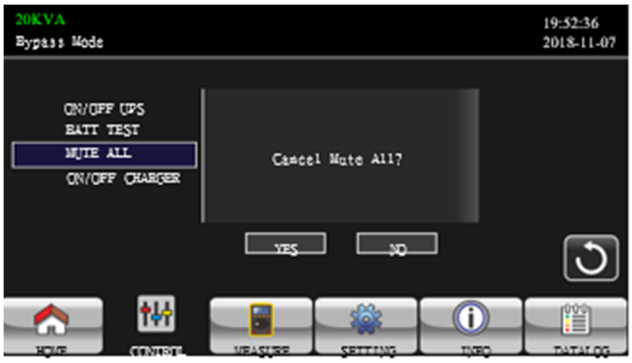
Cancel Battery Test

Audio mute

It will show “Mute all” if the audio is active. Touch “Yes” to activate mute. If “Mute all” is active, it will show icon 

on the top left corner of the main screen. Touch “Back” to return to CONTROL screen immediately or “No” to cancel this operation and back to CONTROL screen.
It will show “Cancel mute” if the UPS is mute already. Touch “Yes” to activate audio function or “No” keep mute. Touch “Back” to return to CONTROL screen.

Mute All



Cancel Mute All

On/Off CHARGER

It will show “Turn on Charger?” when Charger is off.

It will show “Turn off Charger?” when Charger is on.

Touch “YES” to turn on or off the Charger. Then, the screen will return to main screen.

Touch “Back” to return to CONTROL screen immediately or “No” to cancel this operation and back to CONTROL screen.

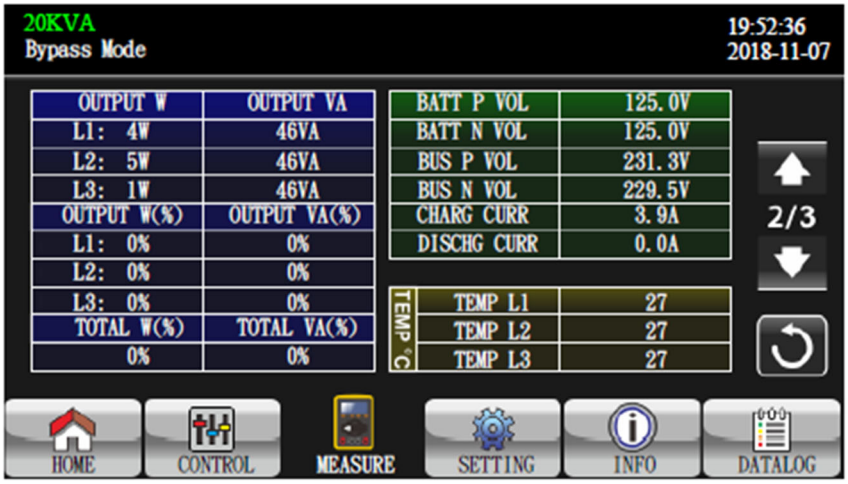
4.2.3 Measure (MEAS) Menu

This menu shows measurement values:

Page 1

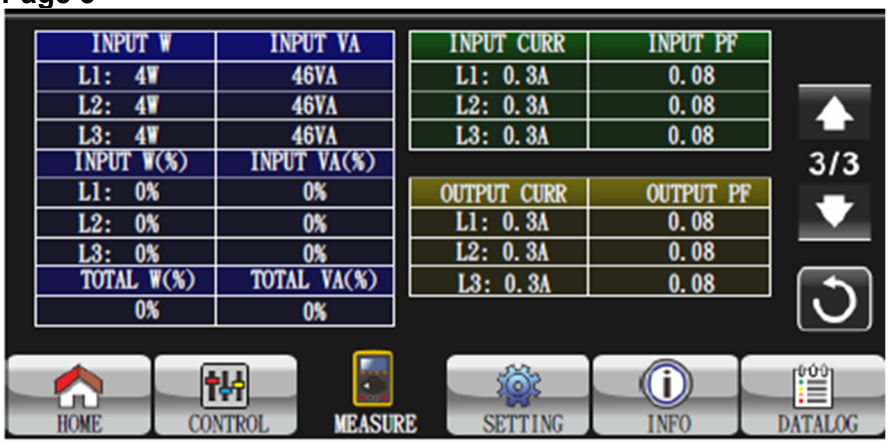
- LINE VOL: The real time value of L1, L2, and L3 phase voltage, input power in VA and input frequency.
- INVERTER VOL: The real time value of L1, L2 and L3 inverter voltage and frequency.
- BYPASS VOL: The real time value of L1, L2 and L3 bypass voltage and frequency.
- OUTPUT VOL: The real time value of L1, L2 and L3 output voltage and frequency.

Page 2



- OUTPUTW: L1, L2 and L3 output power in watt.
- OUTPUT VA: L1, L2 and L3 output power in VA.
- OUTPUT W (%): L1, L2 and L3 output power watt in percentage.
- OUTPUT VA (%): L1, L2 and L3 output power VA in percentage.
- Total watt and VA: Total output load in watt and VA.
- BATT Voltage/Bus Voltage/Charging Current/Discharging Current: The real time value of DC related information.
- Temperature: Temperature of L1, L2 and L3 phases.

Page 3



- Input current: The real-time value of input current L1/L2/L3 and L12/L23/L13.
- Output current: The real-time value of output current L1/L2/L3 and L12/L23/L13.

4.2.4 Setting Menu

This sub-menu is used to set the parameters of UPS. Touch the icon 

to enter setting menu page.

There are 2options: Basic and Advanced. Touch the icon 

to return to main screen. Touch the icon  to go back to previous menu.

NOTE: Not all settings are available in every operation mode. If the setting is not available in present mode, the LCD will keep its original setting parameter showed instead of changing the parameters.

- GENERAL: It's to set up basic information about the UPS. It's not related to any function parameter.
- ADVANCE: It's required to enter password to access to the "ADVANCE" setting. There are two types of authority, User and Maintainer.

4.2.4.1 GENERAL

Page 1

- **Date/Time**: Set the date and time. The format is YYYY-MM-DD HH:MM:SS. The calendar day will be automatically changed when the year, month and date are set.
- **Language**: Set the LCD language. Only English is available.
- **Input Source**: Select the input source. There are two options: Line (utility)and generator. Line is default setting. This setting value will show on the main page. When “generator” is selected, the acceptable input frequency will be fixed at the range of 40~75Hz. This setting value will show on the status bar.
- **Service Contact**: Set the name of contact person and the maximum length is 18 characters.
- **Service Phone**: Set the service phone number. Only 0~9, + and –are accepted. The maximum length is 14 characters.
- **Service Mail**: Set the service email accounts up to two and the maximum length is 36 characters.

Page 2

- **Audio Alarm:** There are two events available to mute. You may choose “Enable” or “Disable” alarm when related events occur.
  - Enable: When selected, alarm will be mute when related events occur.
  - Disable: When selected, UPS will alarm when related events occur.
- All Mute: When “enable” is selected, all the faults and warnings will be mute. It will show icon MUTE on the top right corner of the main screen.
- Mode Mute: UPS status mode alarm enable/disable. If “Mode Mute” is activated, it will show icon MUTE on the top right corner of the main screen.

4.2.4.2 ADVANCE

It's required to enter password (4 digits) to access to the "ADVANCE" page.

To access the "Advance➔User" Setting menu page, the default password is "0000".

If entered password is right, the page will jump to the setting screen. If the password is wrong, it will ask to enter again.

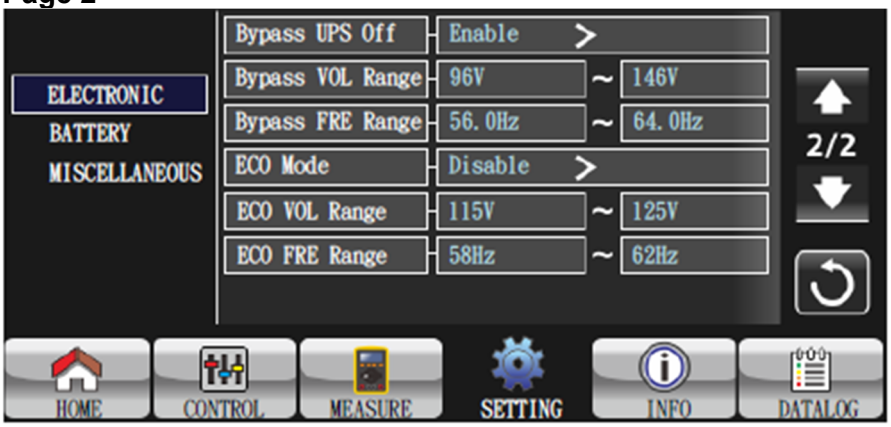
There are three sub-menus under "Advance➔User" setting: ELECTRONIC, BATTERY and MISCELLANEOUS.

ELECTRICAL

Page 1

- OutputVoltage: Select the output rated voltage.
  - There are two options, 120V and 127V. 120Vac is the default setting.
- Output Frequency: Select output rated frequency.
  - **50Hz:** The output frequency is setting for 50Hz.
  - **60Hz:** The output frequency is setting for 60Hz.
- CVCF Mode (constant voltage and constant frequency function)
  - **Enable:** CVCF function is enabled. The output frequency will be fixed at 50Hz or 60Hz according to setting of “OP Freq.”. The input frequency could be from 40Hz to 70Hz.
  - **Disable:** CVCF function is disabled. The output frequency will synchronize with the bypass frequency within 45~55 Hz for 50Hz system or within 55~65 Hz for 60Hz system. Disable is the default setting.
- Bypass Forbid:
  - **Allow**: Bypass allowed. When selected, UPS will run in Bypass mode depending on “Byp.at off” setting. It is the default setting.
  - **Forbid**: Bypass is not allowed. When selected, it’s not allowed to run in Bypass mode under any situations.

Page 2

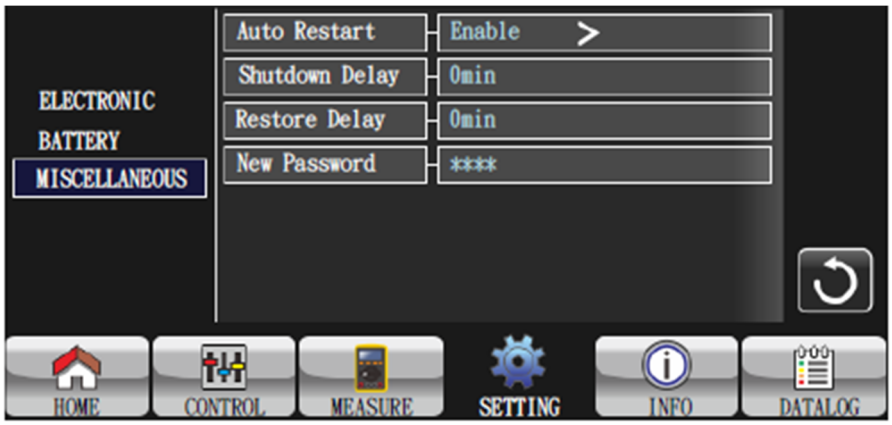


- Bypass at UPS off: Select the bypass status when manually turning off the UPS. This setting is only available when “Bypass forbid.” is set to “Disable”.
    - **Enable**: Bypass enabled. When selected, bypass mode is activated.
    - **Disable**: Bypass disabled. When selected, no output through bypass when manually turning off the UPS.
- Bypass Voltage Range: Set the bypass voltage range.
    - **L**: Low voltage point for bypass. The setting range is 96V ~ 110V. 96V is default setting.
    - **H**: High voltage point for bypass. The setting range is 130V ~ 146V. 146V is default setting.
- Bypass FRE Range: Set the bypass frequency range.
    - The acceptable bypass frequency range from 46Hz to 54Hz when UPS is 50Hz system and from 56Hz to 64Hz when UPS is 60Hz system.
- ECO mode: Enable/Disable ECO mode. Default setting is “Disable”.
- ECO Voltage Range: Set the ECO voltage range.
    - **L:** Low voltage point for ECO mode. The setting range is from “Rated output voltage –5V” to “Rated output voltage -11V”. “Rated output voltage –5V” is default setting.
    - **H:** High voltage point for ECO mode. The setting range is from “Rated output voltage + 5V” to “Rated output voltage + 11V”. “Rated output voltage + 5V” is default setting.
- ECO FRE Range: Set the ECO frequency range. The setting range is from 46Hz to 54Hz when the UPS is 50Hz system and from 56Hz to 64Hz when the UPS is 60Hz system.

BATTERY

- Battery Warning Voltage:
  - **HIGH**: High battery warning voltage. The setting range is 14.0V ~ 15.0V.14.4V is default setting.
  - **LOW**: Low battery warning voltage. The setting range is 10.1V ~ 14.0V.11.4V is default setting. This parameter setting is related to “Shutdown Voltage” setting. This setting value should be higher than “Shutdown Voltage” setting.
- Shutdown Voltage: If battery voltage is lower than this point in battery mode, UPS will automatically shut down. The setting range is 10.0V ~ 12.0V.10.7V is default setting. (The setting is only available for long-run model)
- Battery Parameter:
  - Battery AH: setting battery capacity. 9Ahis default setting.

MISCELLANEOUS



- Auto Restart:(This function is reserved for future use)
  - **Enable**: After “Enable” is set, once UPS shutdown occurs due to low battery and then utility restores, the UPS will return to line mode.
  - **Disable**: After “Disable” is set, once UPS shutdown occurs and the utility restores, the UPS will not automatically turn on.
- Shutdown Delay Min: UPS will shut down in setting minutes. The countdown will start after confirming the pop-up screen.
- Restore Delay Min: UPS will automatically restart in setting minutes after the UPS shuts down.
- New Password: Set up new password to enter “ADVANCE➔User” menu.

4.2.5 Information Screen

Touch the icon 

to enter information page. Touch the icon  or  to browse information.

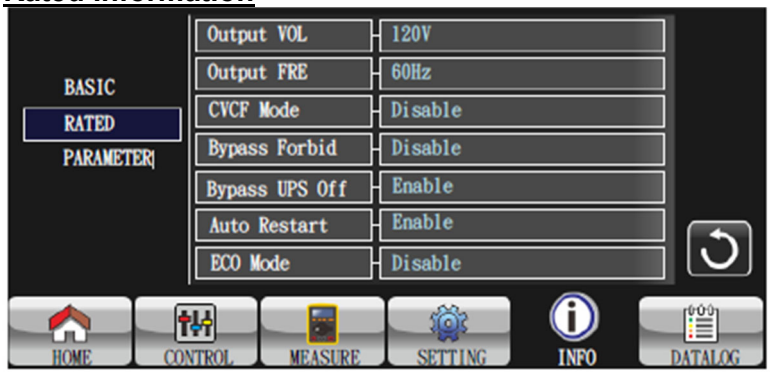
Touch the icon 

to return to main screen. Touch the icon  to go back to previous menu.

Basic Information

- MCU Version: MCU version.
- DSP Version: DSP version.
- Serial NO.: The serial number of UPS.
- Manufacturer: The information about manufacturer.
- Service Contact: The contact name is set in “Basic Setting”.
- Service Phone: The listed numbers are set in “Basic Setting”.
- Service Mail: The service email account is set in “Basic Setting”.

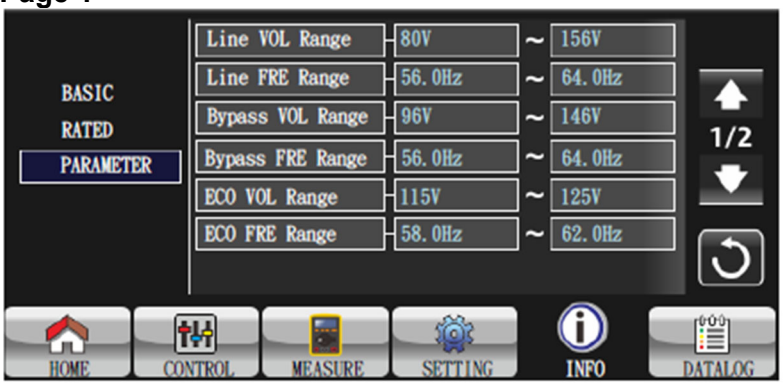
Rated Information



- Output Voltage: It shows output rated voltage.
- Output FRE: It shows output rated frequency.
- CVCF Mode: Enable/Disable CVCF mode.
- Bypass Forbid: Enable/disable bypass function.
- Bypass UPS Off: Enable/disable auto bypass function when UPS is off.
- Auto Restart: Enable/disable auto-restart function.
- ECO Mode: Enable/disable ECO function.

Parameter Information

Page 1



- Line Voltage Range: The acceptable line input voltage range.
- Line FRE Range: The acceptable line input frequency range.
- Bypass Voltage Range: The acceptable input voltage range for bypass mode.
- Bypass FRE Range: The acceptable input frequency range for bypass mode.
- ECO Voltage Range: The acceptable input voltage range for ECO mode.
- ECO FRE Range: The acceptable input frequency range for ECO mode.

Page 2

- BATT Mode Work Time: The maximum discharge time in battery mode.
- BATT Warning Voltage:
  - **HIGH**: High battery warning voltage.
  - **LOW**: Low battery warning voltage.
- Shutdown Voltage: If battery voltage is lower this point, UPS will automatically shut down.
- Shutdown Delay: UPS will shut down in setting minutes. The countdown will start after confirming the pop-up screen.
- Restore Delay: UPS will automatically restart in setting minutes after the UPS shuts down.
- Battery Number: It shows battery number.

4.2.6 Data Log Screen

Touch the icon 

to enter date log page. Data log is used to record the warning and fault information of the UPS. The record contains date & time, code, type and description.

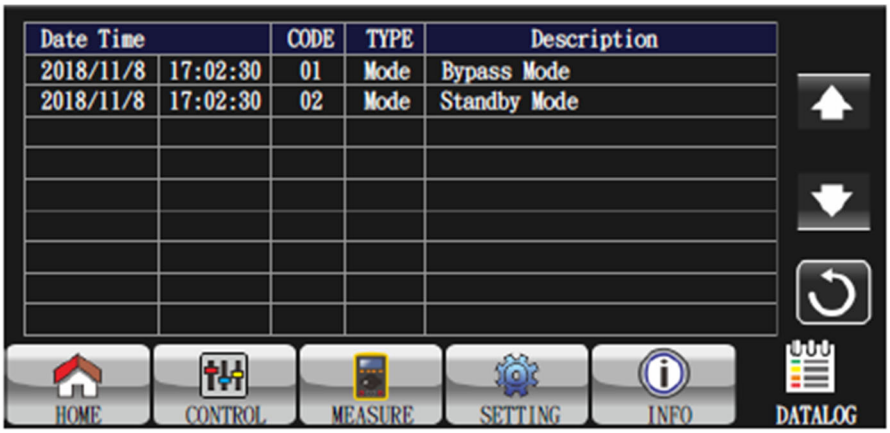
Touch the icon  or  to page up or down if there are more than one page in the date log.

Touch the icon 

to return to main screen.

Press the icon  to go back to main menu.

Please refer to **Appendix A – Fault Codes** and **Appendix B – Warning Codes** for warning and fault code list.



4.2.7 Audible Alarm

Description	Buzzer Status	Muted
UPS status		
Bypass mode	Beeping once every 2 minutes	Yes
Battery mode	Beeping once every 4 seconds	
Fault mode	Beeping continuously	

Warning		
Overload	Beeping twice every second	No
Others	Beeping once every second	

Fault		
All	Beeping continuously	Yes

5. UL924 Emergency Lighting Systems

The Trident TRV can be used as part of an approved UL924 Emergency Lighting system.

Table 3 – UL924 Approved Systems

CSB Batteries				
Model	**kW**	**P/N**	**# of Internal Strings**	**# of External Strings**
E3U03	3.5	HRL12090W	2	0
E3U05*	5	HRL12090W	3	0
E3U05	5	HRL12200W	0	1
E3U07	7.5	HRL12280W	0	1
E3U10	10	HRL12390W	0	1
E3U15	15	HRL12670W	0	1
E3U20	20	HRL12390W	0	2
E3U30	30	HRL12390W	0	3
E3U40	40	HRL12540W	0	3

**No internal transformers in UPS*

Enersys				
Model	**kW**	**P/N**	**# of Internal Strings**	**# of External Strings**
E3U03	3.5	12HX80	2	0
E3U05*	5	12HX80	3	0
E3U05	5	12HX100	0	2
E3U07	7.5	12HX150	0	2
E3U10	10	12HX505	0	1
E3U15	15	12HX330	0	2
E3U20	20	12HX505	0	2
E3U30	30	12HX505	0	3
E3U40	40	12HX505	0	4

*No internal transformers in UPS

6. Maintenance
6.1 Basic Maintenance Guide

The uninterruptible power system is designed and produced to last, even in the most severe service conditions. It is an electronic power unit, which requires periodic maintenance. Moreover, some components have a limited lifespan and as such must be periodically checked and replaced should conditions so dictate: in particular the batteries, the fans and in some cases the electrolytic capacitors. It is therefore recommended to implement a preventive maintenance program with a specialized personnel authorized by the manufacturer.
Our Technical Support Team will be happy to recommend the various personalized options for preventive maintenance.

6.1.1 Periodic maintenance (to be carried out by trained personnel and with doors closed)

The following operations should be carried out periodically (e.g. once a month, or more frequently in particularly difficult environmental conditions):

- Ensure that the air intake slots (located on the front door and at the back of the cabinet) and the output grilles located on the top of the cabinet are clean;
- Perform a battery test.

6.1.2 Maintenance inside the UPS (factory authorized personnel only)

Danger

Maintenance inside the UPS may only be carried out by trained personnel. The UPS is designed to power the load when it is disconnected from the mains power supply.
High voltage is present inside the UPS even when the mains power supply and the battery have been disconnected.
After disconnecting the input utility and the battery source, trained service personnel must wait at least ten minutes for the capacitors to discharge before working on the inside of the UPS.

6.1.3 Ordinary maintenance for batteries (trained personnel only)

The system automatically controls the efficiency of the batteries every 24 hours, and sounds an alarm when the efficiency is lower than that calculated, according to the stored capacity value.
The lifespan of the batteries is linked to the operating temperature and to the number of charge and discharge cycles the battery has experienced.
The capacity is not constant, but increases after some charge and discharge cycles; it then remains constant for several hundreds of cycles before decreasing permanently.
Preventive maintenance of the battery:

- Keep the operating temperature within the range of 20 - 25°C;
- Perform two or three discharge and charge cycles during the first month of use;
- Repeat this operation every six months after the first month of use.

Danger

Maintenance inside the UPS may only be carried out by trained personnel.
Since the batteries are a source of energy, opening the battery circuit breaker/disconnect does not eliminate the voltage inside the battery cabinet. DO NOT TRY TO ACCESS THE INSIDE OF THE BATTERY CABINET. THERE ARE ALWAYS DANGEROUS VOLTAGES FROM THE BATTERIES. If the batteries are thought to be faulty in any way, please contact Dual-Lite technical support.

Warning

If the batteries need to be replaced, this must be done by ***factory authorized personnel***. The replaced parts must be sent to a specialized company for disposal by means of recycling. Batteries are classified by law as “toxic waste”.

6.2 Internal Battery Replacement

Danger

The internal battery compartment contains high voltage and should only be serviced by qualified technical personnel. Battery trays are very heavy. Removing a battery tray from the UPS should only be done with the use of a mechanical lift (fork lift).

When replacing batteries use only the same type and size rating as the battery being replaced.

1. Verify the UPS is completely off and the mains power is disconnected. Open the DC Breaker in UPS.
2. Remove the front panels from the cabinet.
3. Locate the battery connectors between the battery trays as shown in **Figure 7.**

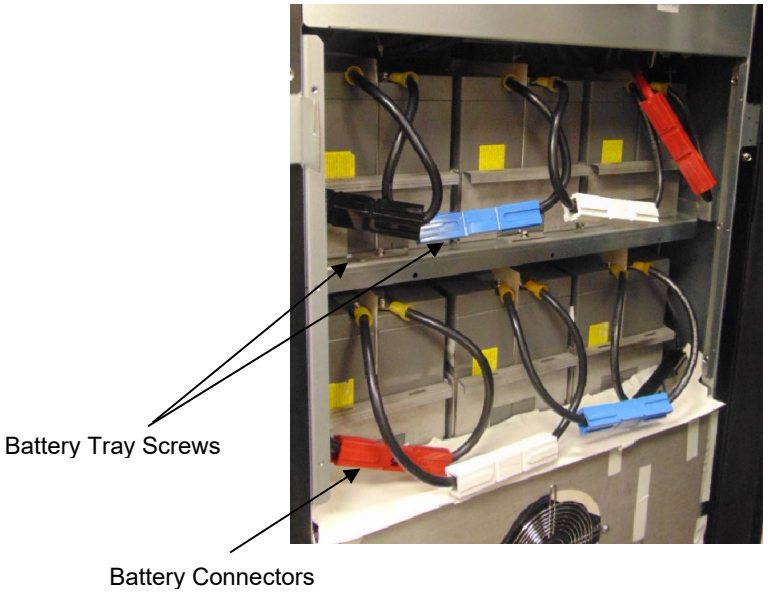


Figure 7 - UPS Internal Battery trays

4. Pull the two halves of the battery connectors apart to disconnect the batteries.
5. The batteries are mounted into trays that bolt down to the chassis as shown in **Figure 7**. Remove all of these bolts.

Before disconnecting any battery wires they should be marked to identify where they were connected. The battery string is made up of 36 batteries with three connections at Positive, Center Tap, and Negative. The wires from the battery connector are as follows: Red to Positive, Blue to center tap, and black to Negative.

6. The trays are now free to completely remove from the battery compartment.
7. Insure that the replacement batteries are installed in the trays in exactly the same orientation as the original factory installation.

8. Install the battery trays starting with the lowest tray. Insure the proper wire termination is made based on the color of the connector.
9. Once all trays are installed and all of the connections are made you can reconnect the multi-colored battery connector halves.

Replace the cabinet front and follow the startup procedure to restart the UPS. See **3.1 Start up**

6.3 Recommended Replacement Intervals

The Dual-Lite UPS has a long design life. Due to the characteristics of the part, not the design of the UPS, certain components used in the design have a limited life, even with proper maintenance.

Service and maintenance work must be performed only by factory authorized personnel.

Dual-Lite recommends these limited-life components be periodically inspected and replaced before the expected expiration of their life cycle. The recommended replacement schedule is an estimate only. The life of these parts depends on site conditions such as ambient temperature, load profile, cleanliness of environment and other factors. See Section **7.1 Technical Specifications**

Dual-Lite Recommends a Factory Authorized Preventative Maintenance review is schedule at least once a year.

Component	Recommend Replace in:
Fans	4-6 years
Batteries	4 years
AC Filter Capacitors	4-6 years
DC Filter Capacitors	4-6 years

Table 4 - Recommended Replacement Intervals

The functional lifetime of VRLA batteries is significantly affected by the temperature at which they are stored and operated. Ideally, VRLA batteries should be used in a 25º C (77º F) environment. For every 8.3º C (15º F) increase in temperature, the life expectancy of a battery will be halved.

Exposure to temperatures in excess of 32º C (90º F) should be limited to no more than 30 days per year. Under no circumstances should the VRLA battery be exposed to temperatures over 40º C (104º F) which can lead to thermal runaway, a condition that damages the battery. Thermal runaway can cause batteries to swell. If the battery cases burst, the hazardous contents may be exposed.

Maintaining proper ambient temperature usually requires installing the product in a temperature-controlled space. Equipment rooms without cooling systems do not generally maintain the proper conditions for good battery life.

7. Specifications

7.1 Technical Specifications

Input	
Voltage	See **7.2.1 Input,** Three Phase, 3 or 4 wire plus ground
Range	+20% / -17%（full load）
Frequency	50[1]/60Hz +/- 5.0 Hz (Auto-Detect)
Power Factor	0.99 at 100% load
Reflected Current Distortion (THD)	Less than 2% (100% load)
Input Current	See **7.2.1 Input**
Output	
Voltage	See **7.2.2 Output**, Three Phase, 3 or 4 wire plus ground
Static Voltage Regulation	+/- 1%
Frequency (inverter synchronous)	46Hz ~ 54 Hz @ 50Hz system 56Hz ~ 64 Hz @ 60Hz system
Frequency Slew Rate	± 1 Hz per second (inverter synchronized to static bypass)
Free Running Frequency	50[1]/60Hz +/- 0.01Hz (on battery or asynchronous)
Voltage Distortion (THD)	≦ 2 % @ 100% Linear Load; ≦ 4 % @ 100% Non-linear Load (PF≥0.8)
Inverter Overload[2]	100%~110%: 60 min; 110%~130%: 1 min; >130%:1 sec;
Bypass Overload[2]	>130%: Continuous, >130%:1min
Max Bypass Input Voltage Range	88 – 146V_{LL}
Bypass Input Frequency Tracking Range	+/- 4Hz
Output Current	See **7.2.2 Output**
Heat Rejection (BTU/Hr) @ 100% load	See **7.3 BTU/hr & Weight**
Environmental	
Altitude	< 2000 meters Derate load capability above 1000 meters 1% per 100 meters
Operating Temperature	0 ~ 40°C
Audible Noise (dbA)	<75
General	
Dimensions (HxWxD)	72.44 in (1840mm) x 23.13 in (588mm) x 36.50 in (927mm)
Weight	See **7.3 BTU/hr & Weight**
Standards	UL listed to 1778, CUL to CSA C22.2, NEMA PE-1, ASME, ASA-C-39.1-1984, FCC Part 15 Subpart J Class B, NEC, OSHA, IEEE587, ANSI C 62.41-1980, ISO9000, 14000

Notes:

1. See Dual-Lite Representative for versions that allow 50Hz operations.
2. Overload is based on the kVA, kW and current for each phase. If any phase goes over rated kVA, kW or current on any phase, the overload alarm will activate.

7.2 Rated Currents and Recommend Field Wiring Information

7.2.1 Input

Rectifier Input				
Unit	**Vac**	**Max Amps**	**Configuration**	**RECOMMENDED CABLES [1,2,3]**
3.5kVA	208/120Y	13	WYE (3W+N+E)	14AWG
	208Δ	14	DELTA (3W+E)	14AWG
	220/127Y	13	WYE (3W+N+E)	14AWG
	230/133Y	12	WYE (3W+N+E)	14AWG
	240Δ	12	DELTA (3W+E)	14AWG
	480/277Y	6	WYE (3W+N+E)	14AWG
	480Δ	6	DELTA (3W+E)	14AWG
	575/332Y	5	WYE (3W+N+E)	14AWG
	600/347Y	5	WYE (3W+N+E)	14AWG
	600Δ	5	DELTA (3W+E)	14AWG
5.0kVA	208/120Y	19	WYE (3W+N+E)	12AWG
	208Δ	20	DELTA (3W+E)	12AWG
	220/127Y	18	WYE (3W+N+E)	12AWG
	230/133Y	17	WYE (3W+N+E)	12AWG
	240Δ	17	DELTA (3W+E)	12AWG
	480/277Y	8	WYE (3W+N+E)	14AWG
	480Δ	8	DELTA (3W+E)	14AWG
	575/332Y	7	WYE (3W+N+E)	14AWG
	600/347Y	7	WYE (3W+N+E)	14AWG
	600Δ	7	DELTA (3W+E)	14AWG
7.5kVA	208/120Y	29	WYE (3W+N+E)	8AWG
	208Δ	29	DELTA (3W+E)	8AWG
	220/127Y	27	WYE (3W+N+E)	10AWG
	230/133Y	26	WYE (3W+N+E)	10AWG
	240Δ	25	DELTA (3W+E)	10AWG
	480/277Y	13	WYE (3W+N+E)	14AWG
	480Δ	13	DELTA (3W+E)	14AWG
	575/332Y	11	WYE (3W+N+E)	14AWG
	600/347Y	10	WYE (3W+N+E)	14AWG
	600Δ	10	DELTA (3W+E)	14AWG
10kVA	208/120Y	39	WYE (3W+N+E)	8AWG
	208Δ	40	DELTA (3W+E)	8AWG
	220/127Y	37	WYE (3W+N+E)	8AWG
	230/133Y	36	WYE (3W+N+E)	8AWG
	240Δ	35	DELTA (3W+E)	8AWG
	480/277Y	17	WYE (3W+N+E)	12AWG
	480Δ	17	DELTA (3W+E)	12AWG
	575/332Y	14	WYE (3W+N+E)	14AWG
	600/347Y	14	WYE (3W+N+E)	14AWG
	600Δ	14	DELTA (3W+E)	14AWG

Rectifier Input				
Unit	**Vac**	**Max Amps**	**Configuration**	**RECOMMENDED CABLES [1,2,3]**
15kVA	208/120Y	59	WYE (3W+N+E)	4AWG
	208Δ	60	DELTA (3W+E)	4AWG
	220/127Y	55	WYE (3W+N+E)	4AWG
	230/133Y	54	WYE (3W+N+E)	4AWG
	240Δ	52	DELTA (3W+E)	6AWG
	480/277Y	26	WYE (3W+N+E)	10AWG
	480Δ	26	DELTA (3W+E)	10AWG
	575/332Y	22	WYE (3W+N+E)	10AWG
	600/347Y	21	WYE (3W+N+E)	10AWG
	600Δ	21	DELTA (3W+E)	10AWG
20kVA	208/120Y	78	WYE (3W+N+E)	3AWG
	208Δ	80	DELTA (3W+E)	3AWG
	220/127Y	74	WYE (3W+N+E)	3AWG
	230/133Y	72	WYE (3W+N+E)	3AWG
	240Δ	69	DELTA (3W+E)	3AWG
	480/277Y	34	WYE (3W+N+E)	8AWG
	480Δ	35	DELTA (3W+E)	8AWG
	575/332Y	29	WYE (3W+N+E)	8AWG
	600/347Y	27	WYE (3W+N+E)	10AWG
	600Δ	28	DELTA (3W+E)	10AWG
30kVA	208/120Y	117	WYE (3W+N+E)	1/0
	208Δ	120	DELTA (3W+E)	1/0
	220/127Y	111	WYE (3W+N+E)	1/0
	230/133Y	107	WYE (3W+N+E)	1/0
	240Δ	104	DELTA (3W+E)	1AWG
	480/277Y	52	WYE (3W+N+E)	6AWG
	480Δ	52	DELTA (3W+E)	6AWG
	575/332Y	43	WYE (3W+N+E)	6AWG
	600/347Y	41	WYE (3W+N+E)	6AWG
	600Δ	42	DELTA (3W+E)	6AWG
40kVA	208/120Y	156	WYE (3W+N+E)	3/0
	208Δ	160	DELTA (3W+E)	3/0
	220/127Y	147	WYE (3W+N+E)	3/0
	230/133Y	143	WYE (3W+N+E)	3/0
	240Δ	139	DELTA (3W+E)	2/0
	480/277Y	69	WYE (3W+N+E)	3AWG
	480Δ	69	DELTA (3W+E)	3AWG
	575/332Y	57	WYE (3W+N+E)	4AWG
	600/347Y	55	WYE (3W+N+E)	4AWG
	600Δ	55	DELTA (3W+E)	4AWG

1: Based on 75°C copper wire.
2: Recommended cable sized based on THW cables at 30°C ambient (NEC Table 310.16). If different cables are used or installed at higher ambient, the cable size needs to be reviewed.
3: Any external battery wires use reinforced insulation or double insulated wire.
4. Input Current is based on rated input kW.

7.2.2 Output

Output				
Unit	**Vac**	**Amps**	**Configuration**	**RECOMMENDED CABLES [1,2,3]**
3.5kVA	208/120Y	10	WYE (3W+N+E)	14AWG
	208Δ	10	DELTA (3W+E)	14AWG
	220/127Y	9	WYE (3W+N+E)	14AWG
	230/133Y	9	WYE (3W+N+E)	14AWG
	240Δ	9	DELTA (3W+E)	14AWG
	480/277Y	4	WYE (3W+N+E)	14AWG
	480Δ	4	DELTA (3W+E)	14AWG
	575/332Y	4	WYE (3W+N+E)	14AWG
	600/347Y	3	WYE (3W+N+E)	14AWG
	600Δ	4	DELTA (3W+E)	14AWG
5.0kVA	208/120Y	14	WYE (3W+N+E)	14AWG
	208Δ	14	DELTA (3W+E)	14AWG
	220/127Y	13	WYE (3W+N+E)	14AWG
	230/133Y	13	WYE (3W+N+E)	14AWG
	240Δ	12	DELTA (3W+E)	14AWG
	480/277Y	6	WYE (3W+N+E)	14AWG
	480Δ	6	DELTA (3W+E)	14AWG
	575/332Y	5	WYE (3W+N+E)	14AWG
	600/347Y	5	WYE (3W+N+E)	14AWG
	600Δ	5	DELTA (3W+E)	14AWG
7.5kVA	208/120Y	21	WYE (3W+N+E)	10AWG
	208Δ	21	DELTA (3W+E)	10AWG
	220/127Y	20	WYE (3W+N+E)	12AWG
	230/133Y	19	WYE (3W+N+E)	12AWG
	240Δ	19	DELTA (3W+E)	12AWG
	480/277Y	9	WYE (3W+N+E)	14AWG
	480Δ	9	DELTA (3W+E)	14AWG
	575/332Y	8	WYE (3W+N+E)	14AWG
	600/347Y	7	WYE (3W+N+E)	14AWG
	600Δ	7	DELTA (3W+E)	14AWG
10kVA	208/120Y	28	WYE (3W+N+E)	10AWG
	208Δ	29	DELTA (3W+E)	8AWG
	220/127Y	26	WYE (3W+N+E)	10AWG
	230/133Y	26	WYE (3W+N+E)	10AWG
	240Δ	25	DELTA (3W+E)	10AWG
	480/277Y	12	WYE (3W+N+E)	14AWG
	480Δ	12	DELTA (3W+E)	14AWG
	575/332Y	10	WYE (3W+N+E)	14AWG
	600/347Y	10	WYE (3W+N+E)	14AWG
	600Δ	10	DELTA (3W+E)	14AWG

Output				
Unit	**Vac**	**Amps**	**Configuration**	**RECOMMENDED CABLES [1,2,3]**
15kVA	208/120Y	42	WYE (3W+N+E)	6AWG
	208Δ	43	DELTA (3W+E)	6AWG
	220/127Y	39	WYE (3W+N+E)	8AWG
	230/133Y	38	WYE (3W+N+E)	8AWG
	240Δ	37	DELTA (3W+E)	8AWG
	480/277Y	18	WYE (3W+N+E)	12AWG
	480Δ	19	DELTA (3W+E)	12AWG
	575/332Y	15	WYE (3W+N+E)	14AWG
	600/347Y	15	WYE (3W+N+E)	14AWG
	600Δ	15	DELTA (3W+E)	14AWG
20kVA	208/120Y	56	WYE (3W+N+E)	4AWG
	208Δ	57	DELTA (3W+E)	4AWG
	220/127Y	53	WYE (3W+N+E)	4AWG
	230/133Y	51	WYE (3W+N+E)	6AWG
	240Δ	49	DELTA (3W+E)	6AWG
	480/277Y	24	WYE (3W+N+E)	10AWG
	480Δ	25	DELTA (3W+E)	10AWG
	575/332Y	20	WYE (3W+N+E)	10AWG
	600/347Y	20	WYE (3W+N+E)	12AWG
	600Δ	20	DELTA (3W+E)	12AWG
30kVA	208/120Y	83	WYE (3W+N+E)	2AWG
	208Δ	85	DELTA (3W+E)	2AWG
	220/127Y	79	WYE (3W+N+E)	3AWG
	230/133Y	77	WYE (3W+N+E)	3AWG
	240Δ	74	DELTA (3W+E)	3AWG
	480/277Y	37	WYE (3W+N+E)	8AWG
	480Δ	37	DELTA (3W+E)	8AWG
	575/332Y	31	WYE (3W+N+E)	8AWG
	600/347Y	29	WYE (3W+N+E)	8AWG
	600Δ	30	DELTA (3W+E)	8AWG
40kVA	208/120Y	111	WYE (3W+N+E)	1/0
	208Δ	114	DELTA (3W+E)	1/0
	220/127Y	105	WYE (3W+N+E)	1/0
	230/133Y	102	WYE (3W+N+E)	1AWG
	240Δ	99	DELTA (3W+E)	1AWG
	480/277Y	49	WYE (3W+N+E)	6AWG
	480Δ	49	DELTA (3W+E)	6AWG
	575/332Y	41	WYE (3W+N+E)	6AWG
	600/347Y	39	WYE (3W+N+E)	8AWG
	600Δ	40	DELTA (3W+E)	8AWG

1: Based on 75°C copper wire.
2: Recommended cable sized based on THW cables at 30°C ambient (NEC Table 310.16). If different cables are used or installed at higher ambient, the cable size needs to be reviewed.
3: Any external battery wires use reinforced insulation or double insulated wire.
4. Output current is based on rated output kVA.

7.2.3 Bypass Input (Dual Input configuration)

Bypass Input (Dual Input)				
Unit	**Vac**	**Amps**	**Configuration**	**RECOMMENDED CABLES [1,2,3]**
3.5kVA	208/120Y	10	WYE (3W+N+E)	14AWG
	208Δ	10	DELTA (3W+E)	14AWG
	220/127Y	9	WYE (3W+N+E)	14AWG
	230/133Y	9	WYE (3W+N+E)	14AWG
	240Δ	9	DELTA (3W+E)	14AWG
	480/277Y	4	WYE (3W+N+E)	14AWG
	480Δ	4	DELTA (3W+E)	14AWG
	575/332Y	4	WYE (3W+N+E)	14AWG
	600/347Y	3	WYE (3W+N+E)	14AWG
	600Δ	4	DELTA (3W+E)	14AWG
5.0kVA	208/120Y	14	WYE (3W+N+E)	14AWG
	208Δ	14	DELTA (3W+E)	14AWG
	220/127Y	13	WYE (3W+N+E)	14AWG
	230/133Y	13	WYE (3W+N+E)	14AWG
	240Δ	12	DELTA (3W+E)	14AWG
	480/277Y	6	WYE (3W+N+E)	14AWG
	480Δ	6	DELTA (3W+E)	14AWG
	575/332Y	5	WYE (3W+N+E)	14AWG
	600/347Y	5	WYE (3W+N+E)	14AWG
	600Δ	5	DELTA (3W+E)	14AWG
7.5kVA	208/120Y	21	WYE (3W+N+E)	10AWG
	208Δ	21	DELTA (3W+E)	10AWG
	220/127Y	20	WYE (3W+N+E)	12AWG
	230/133Y	19	WYE (3W+N+E)	12AWG
	240Δ	19	DELTA (3W+E)	12AWG
	480/277Y	9	WYE (3W+N+E)	14AWG
	480Δ	9	DELTA (3W+E)	14AWG
	575/332Y	8	WYE (3W+N+E)	14AWG
	600/347Y	7	WYE (3W+N+E)	14AWG
	600Δ	7	DELTA (3W+E)	14AWG
10kVA	208/120Y	28	WYE (3W+N+E)	10AWG
	208Δ	29	DELTA (3W+E)	8AWG
	220/127Y	26	WYE (3W+N+E)	10AWG
	230/133Y	26	WYE (3W+N+E)	10AWG
	240Δ	25	DELTA (3W+E)	10AWG
	480/277Y	12	WYE (3W+N+E)	14AWG
	480Δ	12	DELTA (3W+E)	14AWG
	575/332Y	10	WYE (3W+N+E)	14AWG
	600/347Y	10	WYE (3W+N+E)	14AWG
	600Δ	10	DELTA (3W+E)	14AWG

Bypass Input (Dual Input)				
Unit	**Vac**	**Amps**	**Configuration**	**RECOMMENDED CABLES [1,2,3]**
15kVA	208/120Y	42	WYE (3W+N+E)	6AWG
	208Δ	43	DELTA (3W+E)	6AWG
	220/127Y	39	WYE (3W+N+E)	8AWG
	230/133Y	38	WYE (3W+N+E)	8AWG
	240Δ	37	DELTA (3W+E)	8AWG
	480/277Y	18	WYE (3W+N+E)	12AWG
	480Δ	19	DELTA (3W+E)	12AWG
	575/332Y	15	WYE (3W+N+E)	14AWG
	600/347Y	15	WYE (3W+N+E)	14AWG
	600Δ	15	DELTA (3W+E)	14AWG
20kVA	208/120Y	56	WYE (3W+N+E)	4AWG
	208Δ	57	DELTA (3W+E)	4AWG
	220/127Y	53	WYE (3W+N+E)	4AWG
	230/133Y	51	WYE (3W+N+E)	6AWG
	240Δ	49	DELTA (3W+E)	6AWG
	480/277Y	24	WYE (3W+N+E)	10AWG
	480Δ	25	DELTA (3W+E)	10AWG
	575/332Y	20	WYE (3W+N+E)	10AWG
	600/347Y	20	WYE (3W+N+E)	12AWG
	600Δ	20	DELTA (3W+E)	12AWG
30kVA	208/120Y	83	WYE (3W+N+E)	2AWG
	208Δ	85	DELTA (3W+E)	2AWG
	220/127Y	79	WYE (3W+N+E)	3AWG
	230/133Y	77	WYE (3W+N+E)	3AWG
	240Δ	74	DELTA (3W+E)	3AWG
	480/277Y	37	WYE (3W+N+E)	8AWG
	480Δ	37	DELTA (3W+E)	8AWG
	575/332Y	31	WYE (3W+N+E)	8AWG
	600/347Y	29	WYE (3W+N+E)	8AWG
	600Δ	30	DELTA (3W+E)	8AWG
40kVA	208/120Y	111	WYE (3W+N+E)	1/0
	208Δ	114	DELTA (3W+E)	1/0
	220/127Y	105	WYE (3W+N+E)	1/0
	230/133Y	102	WYE (3W+N+E)	1AWG
	240Δ	99	DELTA (3W+E)	1AWG
	480/277Y	49	WYE (3W+N+E)	6AWG
	480Δ	49	DELTA (3W+E)	6AWG
	575/332Y	41	WYE (3W+N+E)	6AWG
	600/347Y	39	WYE (3W+N+E)	8AWG
	600Δ	40	DELTA (3W+E)	8AWG

1: Based on 75°C copper wire.
2: Recommended cable sized based on THW cables at 30°C ambient (NEC Table 310.16). If different cables are used or installed at higher ambient, the cable size needs to be reviewed.
3: Any external battery wires use reinforced insulation or double insulated wire.
4. Input Current is based on rated input kW.

7.2.4 DC Input

Battery Supply			
Unit	**Nominal Vdc**	**Max A dc**	**RECOMMENDED CABLES [1,2,3]**
3.5kVA	240	19	14AWG
5.0kVA	240	27	10AWG
7.5kVA	240	40	8AWG
10kVA	240	56	6AWG
15kVA	240	84	4AWG
20kVA	240	112	2AWG
30kVA	240	168	2/0
40kVA	240	224	4/0

1: Based on 75°C copper wire.
2: Recommended cable sized based on THW cables at 30°C ambient (NEC Table 310.16). If different cables are used or installed at higher ambient, the cable size need to be reviewed.
3: Any external battery wires use reinforced insulation or double insulated wire.

7.3 BTU/hr & Weight

UNIT	INPUT TRANSFORMER	OUTPUT TRANSFORMER	INTERNAL BATTERY	MAXIMUM WEIGHT	BTU/hr	Notes
3.5kVA	No	No	None	628	1100	
	No	No	(1) 34W/8Ah	880	1100	
	No	No	(1) 90W/23Ah	1259	1100	
	No	No	(2) 34W/8Ah	1132	1100	1
	No	No	(2) 90W/23Ah	1890	1100	2
	No	Yes	None	908	1400	
	No	Yes	(1) 34W/8Ah	1160	1400	
	No	Yes	(1) 90W/23Ah	1539	1400	
	Yes	No	None	908	1400	
	Yes	No	(1) 34W/8Ah	1160	1400	
	Yes	No	(1) 90W/23Ah	1539	1400	
	Yes	Yes	None	1188	1800	
	Yes	Yes	(1) 34W/8Ah	1440	1800	
	Yes	Yes	(1) 90W/23Ah	1819	1800	
5kVA	No	No	None	628	1500	
	No	No	(1) 34W/8Ah	880	1500	
	No	No	(1) 90W/23Ah	1259	1500	
	No	No	(2) 34W/8Ah	1132	1500	1
	No	No	(2) 90W/23Ah	1890	1500	2
	No	Yes	None	908	1900	
	No	Yes	(1) 34W/8Ah	1160	1900	
	No	Yes	(1) 90W/23Ah	1539	1900	
	Yes	No	None	908	1900	
	Yes	No	(1) 34W/8Ah	1160	1900	
	Yes	No	(1) 90W/23Ah	1539	1900	
	Yes	Yes	None	1188	2400	
	Yes	Yes	(1) 34W/8Ah	1440	2400	
	Yes	Yes	(1) 90W/23Ah	1819	2400	
7.5kVA	No	No	None	628	2300	
	No	No	(1) 34W/8Ah	880	2300	
	No	No	(1) 90W/23Ah	1259	2300	
	No	No	(2) 34W/8Ah	1132	2300	1
	No	No	(2) 90W/23Ah	1890	2300	2
	No	Yes	None	908	3000	
	No	Yes	(1) 34W/8Ah	1160	3000	
	No	Yes	(1) 90W/23Ah	1539	3000	
	Yes	No	None	908	3000	
	Yes	No	(1) 34W/8Ah	1160	3000	
	Yes	No	(1) 90W/23Ah	1539	3000	
	Yes	Yes	None	1188	3700	
	Yes	Yes	(1) 34W/8Ah	1440	3700	
	Yes	Yes	(1) 90W/23Ah	1819	3700	

UNIT	INPUT TRANSFORMER	OUTPUT TRANSFORMER	INTERNAL BATTERY	MAXIMUM WEIGHT	BTU/hr	Notes
10kVA	No	No	None	628	3900	
	No	No	(1) 34W/8Ah	880	3900	
	No	No	(1) 90W/23Ah	1259	3900	
	No	No	(2) 34W/8Ah	1132	3900	1
	No	No	(2) 90W/23Ah	1890	3900	2
	No	Yes	None	908	4900	
	No	Yes	(1) 34W/8Ah	1160	4900	
	No	Yes	(1) 90W/23Ah	1539	4900	
	Yes	No	None	908	4900	
	Yes	No	(1) 34W/8Ah	1160	4900	
	Yes	No	(1) 90W/23Ah	1539	4900	
	Yes	Yes	None	1188	5900	
	Yes	Yes	(1) 34W/8Ah	1440	5900	
	Yes	Yes	(1) 90W/23Ah	1819	5900	
15kVA	No	No	None	628	5800	
	No	No	(1) 34W/8Ah	880	5800	
	No	No	(1) 90W/23Ah	1259	5800	
	No	No	(2) 34W/8Ah	1132	5800	1
	No	No	(2) 90W/23Ah	1890	5800	2
	No	Yes	None	908	7300	
	No	Yes	(1) 34W/8Ah	1160	7300	
	No	Yes	(1) 90W/23Ah	1539	7300	
	Yes	No	None	908	7300	
	Yes	No	(1) 34W/8Ah	1160	7300	
	Yes	No	(1) 90W/23Ah	1539	7300	
	Yes	Yes	None	1188	8800	
	Yes	Yes	(1) 34W/8Ah	1440	8800	
	Yes	Yes	(1) 90W/23Ah	1819	8800	
20kVA	No	No	None	628	7700	
	No	No	(1) 34W/8Ah	880	7700	
	No	No	(1) 90W/23Ah	1259	7700	
	No	No	(2) 34W/8Ah	1132	7700	1
	No	No	(2) 90W/23Ah	1890	7700	2
	No	Yes	None	908	9700	
	No	Yes	(1) 34W/8Ah	1160	9700	
	No	Yes	(1) 90W/23Ah	1539	9700	
	Yes	No	None	908	9700	
	Yes	No	(1) 34W/8Ah	1160	9700	
	Yes	No	(1) 90W/23Ah	1539	9700	
	Yes	Yes	None	1258	11700	
	Yes	Yes	(1) 34W/8Ah	1510	11700	
	Yes	Yes	(1) 90W/23Ah	1889	11700	

UNIT	INPUT TRANSFORMER	OUTPUT TRANSFORMER	INTERNAL BATTERY	MAXIMUM WEIGHT	BTU/hr	Notes
30kVA	No	No	None	628	11600	
	No	No	(1) 34W/8Ah	880	11600	
	No	No	(1) 90W/23Ah	1259	11600	
	No	No	(2) 34W/8Ah	1132	11600	1
	No	No	(2) 90W/23Ah	1890	11600	2
	No	Yes	None	1028	14500	
	No	Yes	(1) 34W/8Ah	1310	14500	
	No	Yes	(1) 90W/23Ah	1689	14500	
	Yes	No	None	1058	14500	
	Yes	No	(1) 34W/8Ah	1310	14500	
	Yes	No	(1) 90W/23Ah	1689	14500	
	Yes	Yes	None	1458	17500	
	Yes	Yes	(1) 34W/8Ah	1710	17500	
	Yes	Yes	(1) 90W/23Ah	2089	17500	
40kVA	No	No	None	628	15400	
	No	No	(1) 34W/8Ah	880	15400	
	No	No	(1) 90W/23Ah	1259	15400	
	No	No	(2) 34W/8Ah	1132	15400	1
	No	No	(2) 90W/23Ah	1890	15400	2
	No	Yes	None	1028	19300	
	No	Yes	(1) 34W/8Ah	1360	19300	
	No	Yes	(1) 90W/23Ah	1739	19300	
	Yes	No	None	1108	19300	
	Yes	No	(1) 34W/8Ah	1360	19300	
	Yes	No	(1) 90W/23Ah	1739	19300	
	Yes	Yes	None	1508	23300	
	Yes	Yes	(1) 34W/8Ah	1760	23300	
	Yes	Yes	(1) 90W/23Ah	2139	23300	

Notes:
1.Add 126 lbs for each additional internal string of 34W/8Ah batteries.
2. Add 316 lbs for each additional internal string of 90W/23Ah batteries.
3. All Weights are in pounds.

Appendix A – Fault Codes

Fault code	Fault event
01	Bus start failure
02	Bus over
03	Bus under
04	Bus unbalance
06	Converter over current
11	Inverter soft start failure
12	High inverter voltage
14	Inverter Phase A output (line to neutral) short circuited
15	Inverter Phase B output (line to neutral) short circuited
16	Inverter Phase C output (line to neutral) short circuited
17	Inverter Phases A-B output (line to line) short circuited
18	Inverter Phases B-C output (line to line) short circuited
19	Inverter Phases C-A output (line to line) short circuited
1A	Phase A negative power fault
1B	Phase B negative power fault
1C	Phase A negative power fault
21	Battery SCR short circuited
23	Inverter relay open Circuited
24	Inverter relay short circuited
25	Line wiring fault
31	Parallel communication failure
36	Parallel output current unbalance
41	Over temperature
42	DSP communication failure
43	Overload

Fault code	Fault event
47	MCU communication failure
48	Two DSP firmware versions are incompatible in parallel system.
49	Input and output phase are incompatible
60	Bypass phase short circuited
61	Bypass SCR short circuited
62	Bypass SCR open circuited
63	Voltage waveform abnormal in A phase
64	Voltage waveform abnormal in B phase
65	Voltage waveform abnormal in C phase
66	Inverter current sample abnormal
67	Bypass O/P short circuited
68	Bypass O/P line to line short circuited
69	Inverter SCR short circuited
6C	BUS voltage drops too fast
6D	Current sampling error value
6E	SPS power error
6F	Battery polarity reverse
71	PFC IGBT over current in A phase
72	PFC IGBT over current in B phase
73	PFC IGBT over current in C phase
74	INV IGBT over current in A phase
75	INV IGBT over current in B phase
76	INV IGBT over current in C phase
77	LCD & MCU communication failure

Appendix B – Warning Codes

Warning code	Warning event
01	Battery unconnected
02	IP Neutral loss
04	IP phase abnormal
05	Bypass phase abnormal
07	Over charge
08	Low battery
09	Overload
0A	Fan failure
0B	EPO enable
0D	Over temperature
0E	Charger failure

Warning code	Warning event
21	Line situations are different in parallel system
22	Bypass situations are different in parallel system
33	Locked in bypass after overload 3 times in 30 minutes
34	Converter current unbalanced
3A	Cover of maintain switch is open
3C	Utility extremely unbalanced
3D	Bypass is unstable
3E	Battery voltage too high
3F	Battery voltage unbalanced
40	Charger short circuited