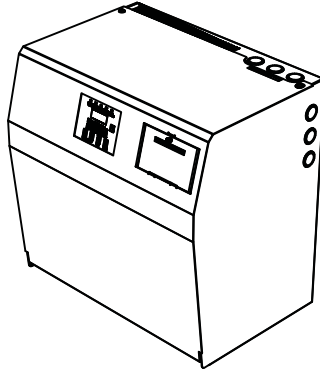


e³-SERIES

By **isolite**

Installation / Operation Manual

Emergency Lighting Central Inverter System



IMPORTANT SAFEGUARDS

When using electrical equipment, basic safety precautions should always be followed including the following:

READ AND FOLLOW ALL SAFETY INSTRUCTIONS

- A. Do not use outdoors
- B. Do not mount near gas or electric heaters.
- C. 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.
- D. Equipment should be mounted in locations and at heights where it will not readily be subjected to tampering by unauthorized personnel.
- E. The use of accessory equipment not recommended by the manufacturer may cause an unsafe condition.
- F. Do not use this equipment for other than intended use.

This unit contains lethal voltages. There are no user serviceable parts inside. Only authorized service personnel are to be used for service.

SAVE THESE INSTRUCTIONS

The installation and use of this product must comply with all national, federal, state, municipal or local codes that apply. Please read this manual thoroughly before installing and operating the **e³-SERIES** Central Inverter System.

For assistance please call technical service at 800-872-0879 and speak to a technician during normal business hours (EST).

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1.0 Introduction

The **e3-SERIES** Central Inverter System integrates the latest inverter and microprocessor technology to produce a Pure Sine wave power output intended for use in Emergency Lighting. The **e3-SERIES** is very efficient. It typically has a steady state loss of just 2 percent of full load while online which makes it ideal for energy saving and green initiatives. It is designed specifically for emergency lighting from the ground up and meets the needs of all lighting loads since it is a pure sine wave output. **e3-SERIES** was designed and developed by an Emergency Lighting Manufacturer and is a culmination of market requirements that require high efficiency, load compatibility, energy savings, low cost, and high quality.

e3-SERIES produces a Pure Sine wave and this is the ONLY method of power that will ensure any lighting load will be powered safely, efficiently and effectively.

1.1 Mechanical Design Features

Batteries and electronics are contained in a single cabinet which makes installation very easy. Mounting can be achieved on a wall or floor and there are electrical knock outs (EKO's) available on all surfaces. Quick access to the interior of the cabinet for battery inspection and maintenance is accomplished by the removal of two screws which holds the front shroud. Single module containing all electronics can be easily removed for upgrade or replacement. This module concept makes maintenance and repair easier and more cost effective because specialized training and knowledge in a Central Inverter System is not required.

1.2 Electrical Design Features

Through the use of Pulse Width Modulation (PWM) and the latest MOSFET technology, **e3-SERIES** can produce a Pure Sine wave output which is compatible with all types of lighting loads. A high crest factor of 4 is extremely beneficial for high inrush loads and also ideal for bringing Normally Off lighting loads on from a cold start. The high crest factor also improves the dynamic response so mixing Normally on and Normally Off loads together causes less performance loss than traditional inverters. Since the active PWM regulation scheme produces a very low THD waveform, the **e3-SERIES** can power up even the most demanding loads with power factor capabilities ranging from 0.5 leading to 0.5 lagging.

There are three distinct outputs from the **e3-SERIES** which are Normally On, Normally Off and the Maintained Outputs. The Normally On Output is always present under normal utility power or emergency power. The Normally Off Output is only present under emergency power so it is a switched output when the **e3-SERIES** runs under emergency power.

The Maintained Output is a user enabled output capable of switching Emergency Lighting loads on and off making energy savings and green initiatives easy to accomplish. The maintained output is enabled by a command signal of 120-277 VAC. Any output including Normally On, Normally Off or the Maintained Output is capable of producing full output power and has no de-rating which means that 100 percent of the units rating can be driven from any output. The maintained output is also tied to the VTD function for HID applications having Normally Off light sources. The batteries are charged by a temperature compensated charger integrated into a bi-directional converter. A three rate charging scheme and bi-directional converter topology ensures maximum float life and minimal ripple current on the batteries.

2.0 Receiving and Storage

2.1 Inspection

The **e3-SERIES** Central Inverter and batteries are shipped separately. Upon arrival, please inspect the contents to ensure that no shipping damage has occurred. This is especially important with the batteries to ensure that there are no cracks or leaks. If any damage has occurred, notify the shipping carrier immediately and submit a damage claim.

WARNING - Do not install damaged battery as this may cause an unsafe condition.

2.2 Storage

Storage before the installation is critical for the battery life expectancy and warranty. Store the batteries indoors in a clean, dry, and cool location. Storage at higher temperatures will result in accelerated rates of self-discharge and possible deterioration of battery performance and life.

WARNING— The maximum storage time from shipment to initial charge is 6 months for batteries stored at ambient temperatures no warmer than 77°F (25°C). For storage temperatures greater than 77°F (25°C), the batteries must be recharged one (1) month sooner for every 5°F (3°C) increase above 77°F (25°C).

Storage Temperature	Storage Time
32°F (0°C) to 50°F (10°C)	9 Months
51°F (11°C) to 77°F (25°C)	6 Months
78°F (25°C) to 92°F (33°C)	3 Months

Storage at high temperatures will result in accelerated rates of self-discharge and possible deterioration of battery performance and life. Storage times exceeding the above may result in plate sulfation, which may adversely affect electrical performance and expected life.

Failure to install and charge the batteries as noted VOIDS the battery's warranty.

DANGER-A battery can present a risk of electrical shock and high short circuit current.

Valve-regulated lead-acid (VRLA) batteries contain an explosive mixture of hydrogen gas. Do not smoke, cause a flame or spark in the immediate are of the batteries. This includes static electricity from the body. Use proper lifting means when moving batteries and wear all appropriate safety clothing and equipment.

3.0 Installation

3.1 Location

NEC article 700 EMERGENCY CIRCUITS should be referenced for proper installation of a Central Inverter System. Article 700 dictates that unit must be mounted in a permanent location. Choose a cool dry place with normal ventilation and one which will allow easy access for testing and maintenance. Avoid a location which could allow vandalism and tampering with. Avoid areas that would prohibit visual contact with the heads up LED status displays.

3.2 Operating Environment

Choose a location that is controlled between 20 and 30 degrees C. for optimum battery life and performance. **e3-SERIES** is UL listed between 20°C to 30°C (68°F to 86°F) because of battery discharge performance results. Do not install in a wet or damp location. Do not install in environments that will expose the unit to excessive temperatures like boiler rooms as this will significantly depreciate battery life.

Heat is the determining factor of battery life. Every means should be made to keep the batteries in an environment that keeps the batteries around 25 degrees C for rated battery life.

3.3 Ventilation

Choose a mounting location that is clean and dust free. Do not install in areas where there is particulate from heavy industrial machinery, corrosive chemicals or welding and plasma cutting environments, etc.

WARNING – Batteries for e3-SERIES can weigh up to 60 pounds each. Total system weight can be up to 160 pounds. Ensure that the mechanical mounting means can support this weight.

3.4 Mounting Guidelines

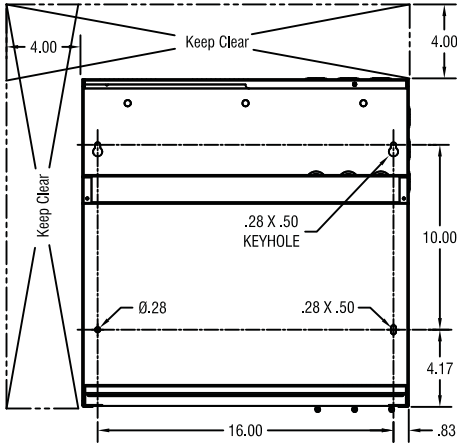
3.4.1 Clearance

e3-SERIES is convection cooled and air ventilation is through the sides and up the top. Leave at least 4 inches of clearance on the sides and top for proper air circulation.

WARNING - Never leave any objects lying on the top of the unit which would prevent proper air flow. This blocking of air circulation may result in an over-temperature fault during Battery Charging or Battery Power mode depending upon ambient conditions.

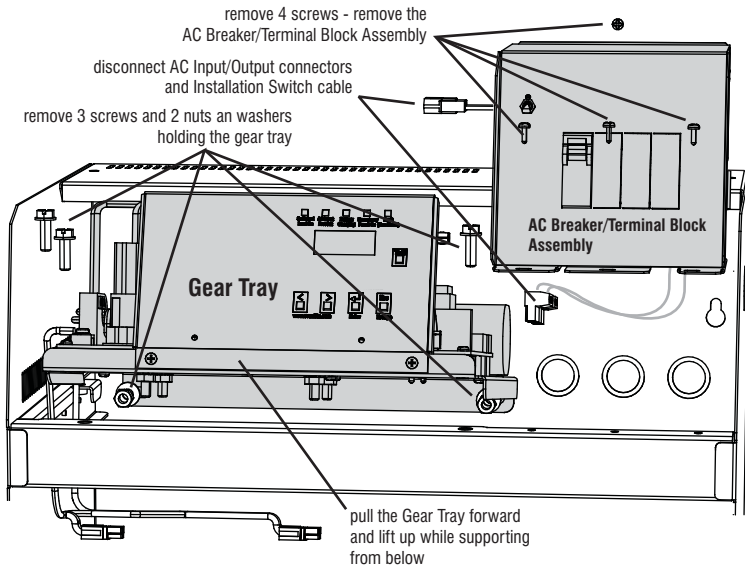
3.4.2 Wall Mounting Hole Location

Mounting holes are provided for Wall Mount purposes. The location of these holes are at the back side of the cabinet and will accommodate 1/4" mounting hardware. Four holes are provided and all 4 should be used when wall mounting.



Note:
Using the mounting holes provided in the rear of the enclosure requires removal of the gear tray and AC Breaker/Terminal Block Assembly for access.

Wall Mounting Dimensions

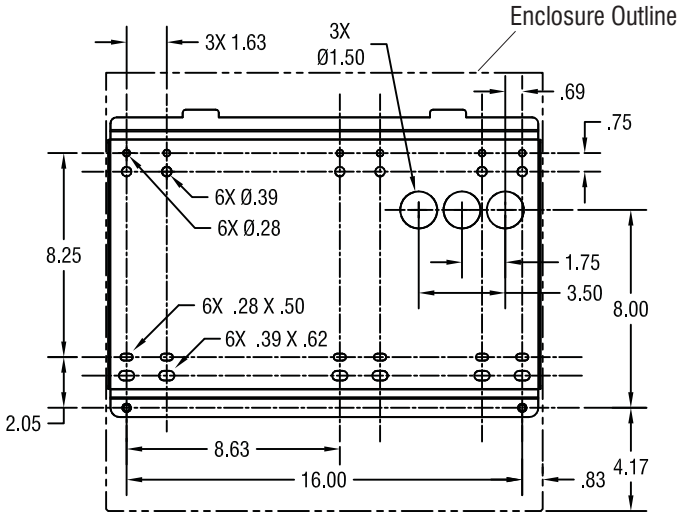


Gear Tray and AC Breaker/Terminal Block Assembly Removal

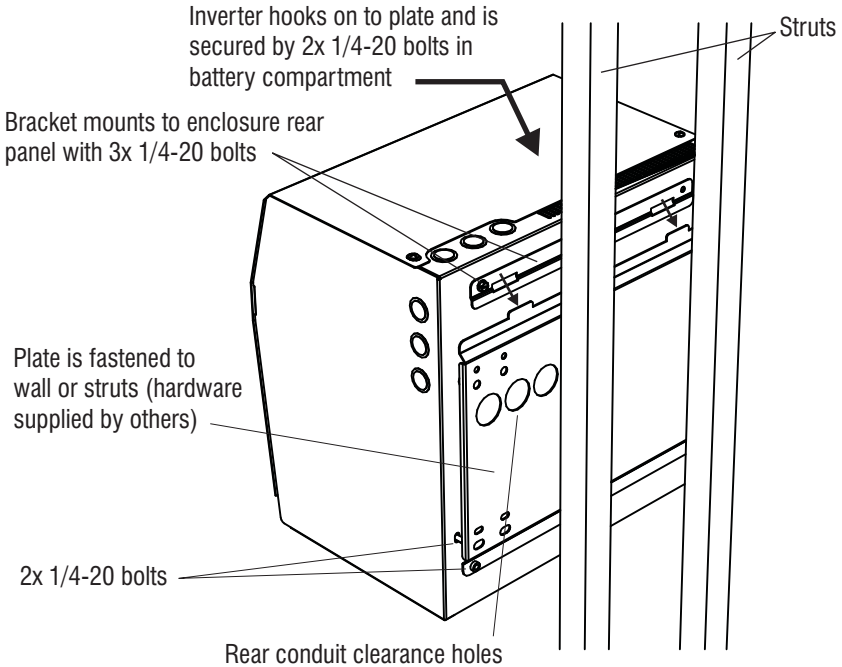
Note: See optional Wall Mounting Kit (next page)

Optional Mounting Kit for Wall or Strut Mounting

No unit dis-assembly is required



Mounting Plate Dimensions

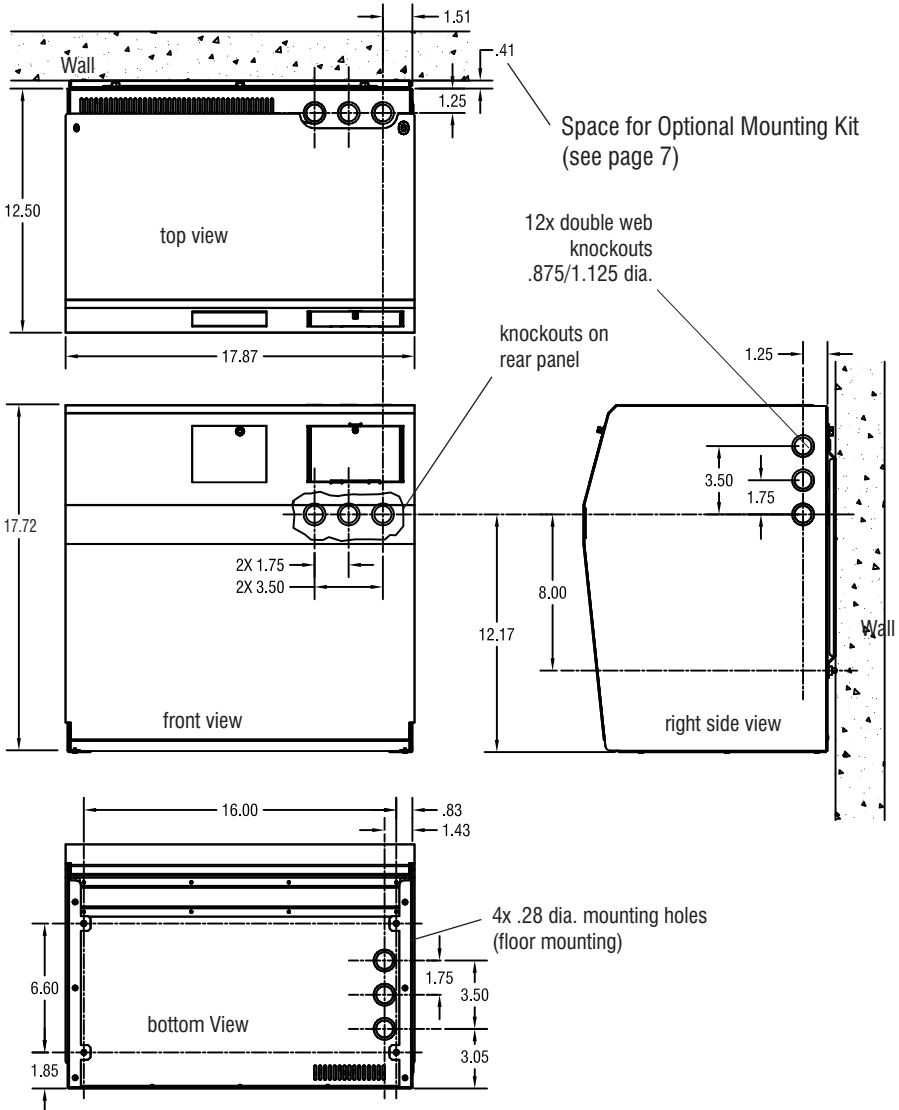


3.4.3 Knockout Locations

Electrical Knock Outs are provided on all surfaces of the **e3-SERIES**. Ensure all metal conduit is secured and tightened creating a good connection to earth ground. Use an Ohm-Meter to check that continuity between conduit and protective earth ground has been established.

At NO time is drilling allowed into the cabinet! Drilling causes metal filings to be deposited on surfaces and could land on the Printed Circuit Boards and cause short circuits.

WARNING – Drilling into cabinet may void warranty if metal filings causes unit failure.



4.0 AC Connections

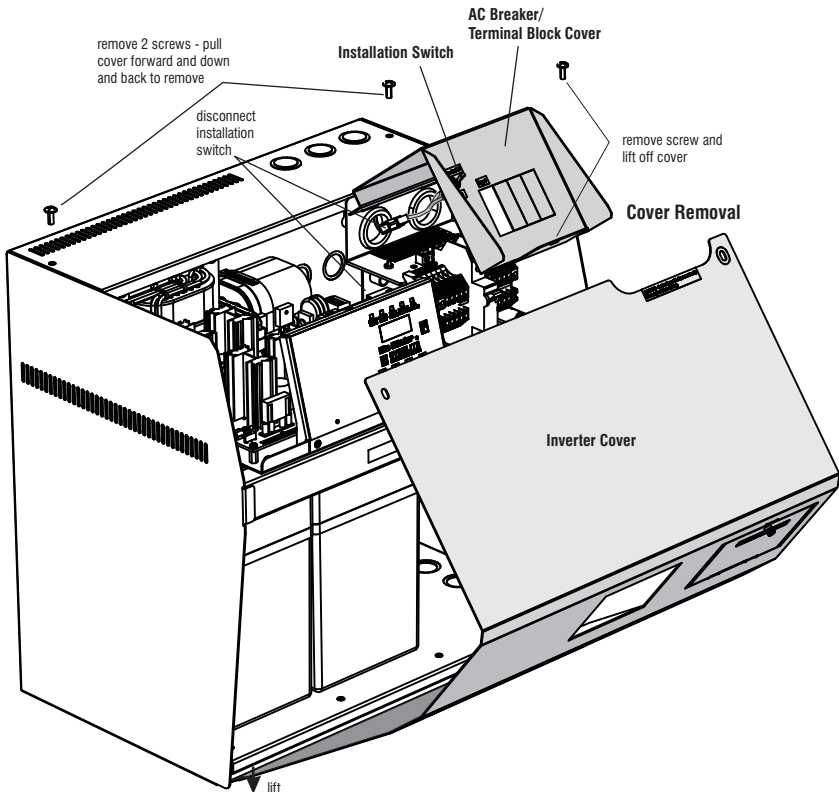
WARNING – Only qualified personnel that are familiar with AC and DC installation techniques and codes (such as an electrician) should perform the installation.

WARNING – The e3-SERIES contains lethal AC Voltages. Because of these hazards, always shut down all sources of power before you install, maintain, or service the unit.

WARNING – Remove all rings, watches, and other jewelry before doing any electrical service or installation work. Always wear protective clothing and appropriate personal protective equipment (PPE) that is suitable such as eye protection when working near batteries.

4.1 Removing the Top Cover

All the connections for the AC input and output are located on the top right side of the units' enclosure. To access this wiring area, remove the top 2 screws that secure the units Top Cover. After the two top screws are removed, simply slide the Top Cover forward and then slide it down so that the bottom flange releases from the cabinets mating flange.



4.2 Removing the AC Breaker/Terminal Block Cover

There is a single screw that holds the AC Breaker/Terminal Block Cover securely to the chassis. This cover conceals the wiring area and provides a safety cover so that fingers cannot inadvertently touch live parts after installation. After removing this screw, simply lift the cover up all the way until it is perpendicular and slide it forward so that the two flanges on the cover release from the mating two slots on the chassis.

WARNING – Always re-install the AC Breaker/Terminal Block Cover to prevent accidental contact with live wires during routine maintenance.

4.3 Installing the Input Wires

Once the Top Cover and Circuit Breaker Terminal Block Cover are removed:

1. Ensure that the incoming AC voltage to the **e3-SERIES** is the same voltage rating as the unit.
2. Ensure that the feed breaker from the panel has at least the same breaker rating as the Lite-Minder's input breaker.

Once Feed Voltage and Breaker size is correct, connect the Utilities Feed Line voltage to the Input Circuit Breaker. There will also be a dedicated position for Neutral, and Ground. Ensure that the connections are tight by giving the wires a good pull and ensure that the wires are secured into the blocks. Connection to these blocks will require a small flat bladed screw-driver.

NOTE – AC Input and AC output wires must be run in separate conduit or raceways per NEC ARTICLE 700. Please ensure all codes and standards are observed.

NOTE - e3-SERIES requires that the Neutral and Ground potential does not exceed 5 VAC for proper function. Anything above 5 VAC typically indicates that there may be a grounding issue or inadequate conductor size or continuity. This should be looked at immediately as it could cause a safety concern.

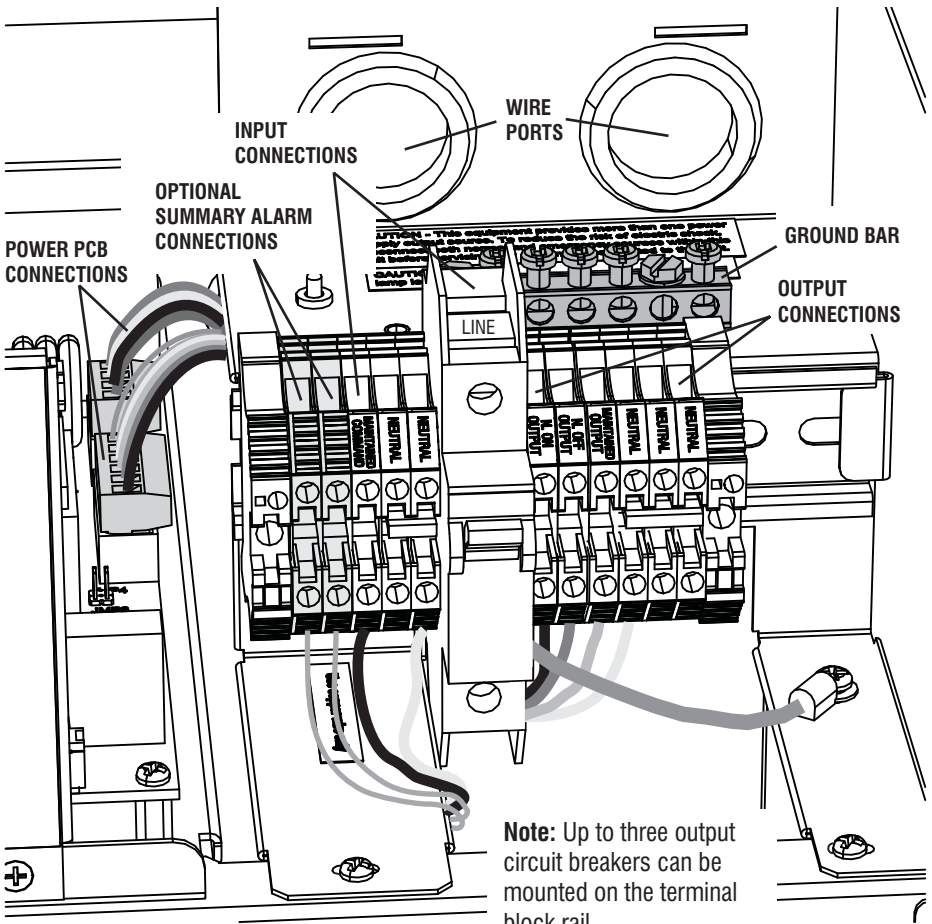
NOTE – Neutral and ground should never be tied together anywhere in the Lite-Minder. Always keep Neutral and Ground wires separate and ensure no shorts occur.

NOTE – Neutral connections in e3-SERIES are a “Pass Through” which means Input and Output Neutrals are directly connected.

NOTE – Never mix Neutrals on the building wiring(Non-Emergency) with the Emergency wiring. Dedicated wiring is required by NEC code ARTICLE 700.

4.4 Installing the Output Wires

Connect the load wires to the terminal block labeled N. On, N. Off or Maintained Outputs. There will be dedicated terminal hook up positions for each Line, Neutral and Ground similar to the AC Input section. Again, ensure that the connections are tight by giving the wires a good pull and ensure that the wires are secured into the blocks. Connection to these blocks will require a small flat bladed screwdriver. In the event that an output circuit breaker was supplied in the unit, the load hot wire will be directly connected to the breaker. Load Neutral and Ground will still connect to a terminal block.



Standard AC Input/Output Panel

NOTE –“Wiring from an emergency source or emergency source distribution overcurrent protection to emergency loads shall be kept entirely independent of all other wiring and equipment, unless otherwise permitted” NEC ARTICLE 700 excerpt.

5.0 Battery and DC Connections

WARNING – Only qualified personnel that are familiar with AC and DC installation techniques and codes (such as an electrician) should perform the Installation.

WARNING – Remove all rings, watches, and other jewelry before doing any electrical service or installation work. Always wear protective clothing and appropriate personal protective equipment (PPE) that is suitable such as eye protection when working near batteries.

WARNING - Batteries contain tremendous energy and can explode if short circuited. Precautions should be taken to eliminate possible short circuits. Do not install batteries until unit is completely mounted and secured in a permanent location with all conduit and AC wiring connected.

5.1 Battery Inspection

Inspect the batteries for any physical damage such as cracks or any other sign of leaking electrolyte. Batteries contain Sulfuric Acid which is highly corrosive. A leak from a battery will cause an unsafe condition.

Each battery comes pre-connected with wire sufficient for the current of the system and has a quick connect/dis-connect means by use of Anderson Power Pole connectors. These connectors are mated together with the inverters pre terminated connectors for fail-safe connection.

5.2 Battery Installation

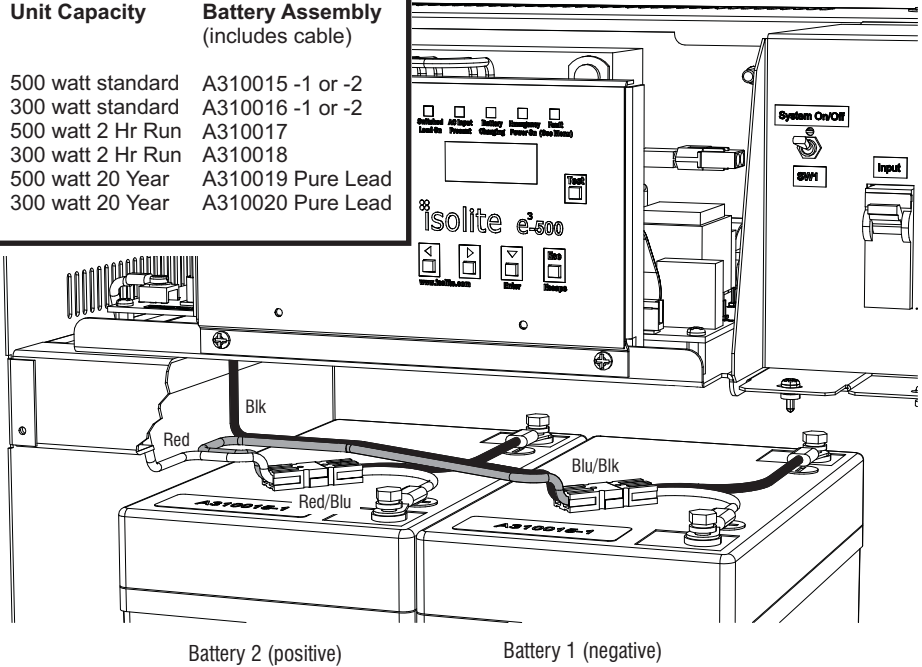
Because the batteries come pre-terminated with connectors, installation is simply placing the batteries on the inverter's bottom shelf and then connecting each batteries connector to the mating connectors in the wiring harness.

Torque on all lugs to the batteries are 5 Newton Meters or 44 Inch Pounds.

NOTE – The top cover should already be removed from installing the AC Input and Output wiring. Please refer to section 4.1 for Top Cover Removal.

Battery Connection

Replacement Batteries	
Unit Capacity	Battery Assembly (includes cable)
500 watt standard	A310015 -1 or -2
300 watt standard	A310016 -1 or -2
500 watt 2 Hr Run	A310017
300 watt 2 Hr Run	A310018
500 watt 20 Year	A310019 Pure Lead
300 watt 20 Year	A310020 Pure Lead

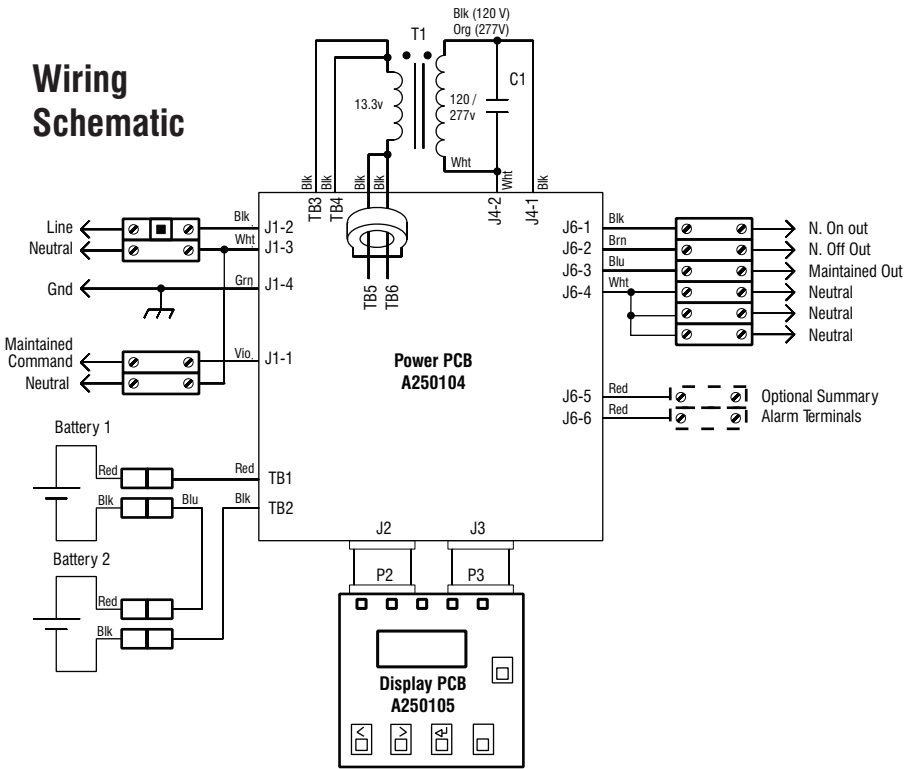


5.3 DC Voltage of System

The systems DC battery voltage for all models of **e3-SERIES** is 24 VDC nominal. This voltage is produced by connecting two batteries (each 12 VDC) in series. All required cables are provided by the manufacturer and come pre-installed on the batteries. The batteries connect to a wiring harness in a fail-safe manner to accomplish the system buss requirements.

NOTE – Battery potential has galvanic isolation from AC potential. Any battery voltage measurements must be made with both meter leads connected to the battery terminals.

Wiring Schematic



6.0 Start up and shut down procedures

Start-Up

After the AC input and output wires are connected and the batteries are properly installed, the unit is ready to be started up. Start-up requires that the AC input be present. The unit will not start up without AC input voltage.

Ensure that the incoming AC voltage is reaching the unit by turning on all feed circuit breakers. Once AC input is verified, simply turn on the systems on/off switch located behind the removable circuit breaker access door. Place the switch in the up position to on. The unit will go through a series of relay clicks to verify proper connections and then go into the charge mode. The unit is now on-line and ready. Verify that all load connections are operating within the specifications of the unit by measuring AC currents on both the line and load and measure all neutral currents to ensure line and neutral currents are the same.

Press the Test button on the front panel to verify that the normally off and maintained loads are all operational and again measure currents.

If alarms occur during start-up, see section 8.3 for possible explanations. Also see section 9.1 for Start-Up Mode explanations.

Shut-Down

To shut the system down, simply place the system on/off switch to the off position and place the input circuit breaker and any optional output breakers to the off position.

If the unit is Shut-Down for a long duration please see Battery Storage Section 2.2 to ensure that the batteries are not damaged from the effects of self-discharge and high ambient temperatures.

7.0 Specifications

Input

Voltage	120 or 277 VAC model dependent
Current	5.8A (120V), 2.5A (277V) for 500 Watt Model 4.2A (120V), 1.8A (277V) for 300 Watt Model
Frequency	60Hz +/- 2 Hz
Protection	Input Circuit breaker with fast acting KLK fuse in series a for easy Selective Coordination to upstream feed breaker
Power Factor	0.5 lead to 0.5 lag

Output

Voltage	120 or 277 VAC model dependent
Current	4.38A (120V), 1.9A (277V) for 500 Watt Model 2.7A (120V), 1.17A (277V) for 300 Watt Model
Frequency	60Hz +/- 0.02 Hz crystal controlled during emergency mode
Overload	120 percent for 10 minutes, 400 percent for 200 mS
Transfer Time	Adjustable 50mS or less than 2mS (slow or fast transfer)
Output Distortion	Less than 3% THD
Crest Factor	4 for 500W model, 6.5 for 300W model
Load Power Factor	0.5 lead to 0.5 lag
Protection	Optional circuit breakers
Output Types	Normally On, Normally Off and Maintained Outputs

Battery

Type	Valve-Regulated sealed lead-calcium. Upgrade option available
Charger	3 rate with Temperature Compensation
Recharge Time	24 Hour recharge standard
Protection	Automatic Low Voltage Disconnect (LVD) set at 1.67 VPC Automatic restart upon utility return
Runtime	90 Minutes, Initial margin of 125 percent at 25 deg. C
DC Voltage	24 VDC Nominal, 2.27 VPC float, temperature compensated
DC Current	24 ADC Nominal

Environmental

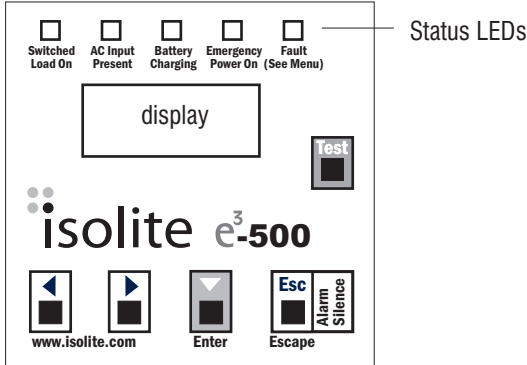
Operating Temp	20 to 30 degrees Centigrade
Storage Temp	-20 to 70 degrees Centigrade (Electronics) 0 to 40 degrees Centigrade (Batteries)
Relative Humidity	<95 % (non-condensing)

Physical

Cabinet	NEMA Type 1 enclosure, 16 AWG powder painted CRS
Cooling	Natural Convection – No fans

8.0 User Interface

The User Interface consists of a 4 button keypad and an 8x2 backlit LCD display. During normal operation the LCD will scroll through meter functions and status. There are 5 heads-up LED display indicators for system status that include Alarms, Battery Charging, Battery Power, AC Present and Maintained Output status.



8.1 Scrolling Display

The Root-Menu is a scrolling display that scrolls between Company Name and Model, Operating Mode (System Start Up, Battery Charging or Inverter On), Faults, Output Voltage, Output Current, Battery Voltage, Date and Time, Days, Events and Minutes.

To access any of the Menus (METER, ALARM, EVENT LOG and SETUP) simply press the ENTER button. Pressing the left or right arrow in the scrolling display mode will advance or retard the scroll. Pressing Escape in any of the Sub-Menu's will retard back one menu level. Pressing Escape multiple times will always return the user to the Root-Menu.

8.2 METER

To enter METER functions from the Root-Menu, press the Enter key and METER will be the first Sub-Menu. Press Enter again to enter the METER functions. Once in the METER menu, the following functions are available by scrolling left or right:

V-OUT	Output Voltage
I-OUT	Current Output
V-BATT	Battery Voltage
TEMP	Ambient Temperature in Deg. C
DAYS	Number of days the system has been on line
EVENTS	Number of times the system has transferred to battery power
MINUTES	Number of minutes the inverter has run on battery power

8.3 ALARM MENU

To enter ALARM menu and see the active alarms, press the enter key from the scrolling menu. Then press the right arrow key to get past METER and then press ENTER once the ALARM menu is visible. Once in the ALARM menu you may see an active alarm present if the heads up LED lamp is illuminated. If no alarms are active, the display will read NO FAULTS. The following alarms are available through the diagnostics within the **e3-SERIES** inverter.

Start Up Faults:

BACKFEED	This indicates that there is AC already at the output terminals Most likely scenario is that the e3-SERIES was wired incorrectly
ROTATION	This indicates that there is a wiring fault on the transformer Most likely scenario is that if a PCB was replaced, there was a mis-wire when re-connecting the transformer
OVERLOAD	This indicates that there is too much output or a short circuit load connected
MIS WIRE	This indicates there is lack of AC power at the input
BATT LOW	This indicates that the Batter Voltage is too low to start the unit up Possible fault is that the battery is mis-wired, fuse is open or batteries are dead

Faults While **e3-SERIES** is on Battery Charging:

AC FUSE	Indicates a blown fuse on the input AC. Fuse location is on the PCB
CHARGER	Indicates that the charger has malfunctioned
OVERLOAD	Indicates that there is too much load connected
OVERTEMP	Indicates that the FET's Heatsink temperature has exceeded its limits

Faults While **e3-SERIES** is on Battery Power:

LOW VOUT	Indicates that the inverter could not produce enough voltage to support the load
FET O C	Indicates that there was a severe overload that caused the crest factor to be exceeded too many times and the inverter shut down to protect itself from failure
LVD	The inverter ran on battery until the Low Voltage Disconnect point
OVERLOAD	There is too much load connected to the output
OVERTEMP	Indicates that the FET's Heatsink temperature has exceeded its limits

8.4 EVENT LOG

To enter EVENT LOG and see any of the stored logs, press the enter key from the scrolling menu, press the right arrow key to get past the METER, ALARM, and then press ENTER once the EVENT LOG is visible. Once in the EVENT LOG menu you will have to use the left and right arrow key to scroll to the desired event. When you enter for the first time the software always takes you to the last event number. Once the event number is selected, you will have to use the left or right arrow key again to view the following information:

EVENT	Indicates the event number that data is being presented on
DAY	Indicates the day that the event took place. This is a rolling day number so if the event occurred on DAY 0001, it was on the first day the e3-SERIES was started up.
LENGTH	Indicates how long the e3-SERIES ran on battery power. This is useful to indicate if there was a power outage or just a glitch in AC power.
TEMP	Indicates what the temperature of that event was in degrees Centigrade.
V-OUT	Measurement of the output voltage during that event
I-OUT	Measurement of the output current during that event
V-BATT	Measurement of the battery voltage at the end of the event

This data in the EVENT LOG is very useful in determining several things. It keeps track of the temperature for record keeping which is required for warranty purposes. It keeps track of the battery voltage at the end of the discharge to indicate how deep the battery was discharged and if it correlates to a healthy battery. The largest benefit of the log though is to keep record of tests and events for Safety Inspectors so they can see that the unit is functional and has performed discharges in accordance with NEC codes.

The **e3-SERIES** has the capability of storing the last 128 events. When the memory becomes full, the over-write process is first in – first out. This means that event number 129 will over-write event number one. The event number is kept sequential and its information is not lost so event number 129 will remain number 129 and not get re-assigned to event number 1.

8.5 SETUP MENU

8.5.1 Date and Time

The Date and Time are adjusted by using the enter key to select which parameter you want to set and then using the left and right key to change it. Once the parameter is set to the correct number, press enter or escape to lock the new number in and return to scroll to the next parameter. The parameters for date and time are:

Hour(24 hour format), Minute(Min), Month(Mon), Date , and Year.

8.5.2 VTD

The VTD (Variable Time Delay) feature is adjustable from OFF (zero minutes) up to 15 minutes in 1 minute increments. This function is useful if there is High Pressure Sodium, Metal Halide, or Mercury Vapor High Intensity Discharge Lamps used for illumination. If these types of HID lights are used, the variable time delay will keep the normally off and maintained lights energized for the duration the VTD is set for. This allows time for the HID lights to re-strike after cooling down. The factory default value for this function is OFF.

8.5.2 I-MON (OFF or ON)

This feature is used for self- testing and self- diagnostics. If the I-MON is selected ON, the output current will be compared against the I-MON stored current and if there is a difference by more than 10 percent, the **e3-SERIES** will display a fault.

This feature is only functional when the **e3-SERIES** is under Battery Power. When the **e3-SERIES** is in the Battery Charging mode, this function will not be active since it may require all connected loads of Normally On, Normally Off and Maintained to be connected. This feature is Self-Testing, Self-Diagnostic and is only performed when the inverter is producing power.

NOTE: If there are shunt relays or photo-sensors or any other means of load shedding connected, this feature should not be used. The use of load shedding devices may cause false alarms since the stored load current value is compared against the actual load current value.

The factory default value for this function is OFF.

8.5.3 I-MON (xx.xx A)

This function is the stored current for the self-testing self-diagnostic feature. The xx.xx value can be anywhere from 00.00 up to the maximum output current capability of the **e3-SERIES**. To change this value, press ENTER at this menu and then there will be a display capable of scrolling with the right arrow key that will read PRESS ENTER > TO UPDATE > I-MON VALUE. If the ENTER button is pressed, the connected load current at the output of the **e3-SERIES** will be stored as the new value.

It is important to note that the load current could be different under the different operating modes of Battery Charging or Battery Power. This is due to the fact that Normally Off loads are not energized and the Maintained loads may or may not be energized when the **e3-SERIES** is in the Battery Charging mode.

If there are Normally Off or Maintained loads connected, you must set the value of I-MON when the unit is in Battery Power. To do this, simply press the TEST button or Disconnect AC power to cause the **e3-SERIES** to enter Battery Power mode. Once in Battery Power mode, all connected loads are energized.

9.0 System Operation

9.1 Start-Up Mode

When the **e3-SERIES** is first turned on, it goes through a sequence of self-tests to ensure proper connections and it checks for faults that may be present. This is the System Start Up mode and it must qualify several things before advancing to go into the Battery Charging mode.

There will be two distinct clicks of relays as it goes through the self-check sequence. These relay clicks are the **e3-SERIES** turning on the output relays to check if any voltages are present and then tickling the output with a small voltage to see if short circuits or overloads are present.

The faults that are checked for during start-up mode are:

BACKFEED – This is when AC voltages are present at any of the outputs. If there are AC voltages present at any of the outputs, it means that there is a mis-wire and the utility AC power is being back-fed into the inverter.

ROTATION – This fault would occur if the module was replaced and re-connected improperly. The Phase Rotation diagnostic energizes the inverter and looks for output voltages out of regulation.

BATT LOW – This fault would occur if the DC voltage at the power PCB is too low. Possibilities for this fault to occur are blown DC fuse on the power PCB, Battery wiring incorrect or battery voltages too low to start the system up without a failure.

OVERLOAD – This fault would occur if the connected load exceeds that of the rating of the **e3-SERIES**. This check is performed by tickling the output to a low voltage for one cycle and looking for overcurrent faults. This diagnostic features connects all the outputs such as the Normally Off and the Maintained Output.

MISWIRE – This fault would occur if the AC input voltage is not within specification. For example if the unit is a 277V model and only 120V was connected, a MISWIRE fault would occur. Conversely if a 120V model had 277 VAC connected, a MISWIRE fault would occur. Also if no AC voltage was applied to the input, a MISWIRE would occur.

After all the Start-Up diagnostics are performed, the **e3-SERIES** is OK to proceed to the Battery Charging mode.

9.2 Battery Charging Mode

The Battery Charging mode is where the system will remain for 99.9+ percent of its life. In this mode, AC power is being passed through to the units output and subsequently its loads and the batteries are keeping a float charge. The charger is floating at 2.27 Volts per Cell (VPC) and is temperature compensated to 4mV per deg. C (per cell), centered at 25 degrees C. For higher temperatures, the float voltage would go down and for lower temperatures, the float voltage would go up.

The **e3-SERIES** nominal DC battery voltage is 24 VDC. The float voltage is 27.2 VDC (2.27 VPC) and the LVD voltage is 20.5 VDC (1.67 VPC).

Float voltage varies with temperature, LVD voltage is fixed.

The typical voltages that the **e3-SERIES** charger would float the batteries are:

10 Deg. C	27.60 VDC
15 Deg. C	27.48 VDC
20 Deg. C	27.36 VDC
25 Deg. C	27.24 VDC
30 Deg. C	27.12 VDC
35 Deg. C	27.00 VDC
40 Deg. C	26.88 VDC

Above 40 deg. Centigrade no additional compensation is performed.

9.3 Maintained Output

The Maintained output is an output that can be switched on and off and is controlled by an external voltage applied to the Maintained Enable input. The designed function is to act as an interface to energy saving controls such as time clocks, daylight harvesting, photo-sensors or any building occupation sensing. It is also tied in to the VTD function so if the VTD is desired for normally off loads, connect these loads to the Maintained Output.

The Maintained output can be energized while in the Battery Charging mode of operation by applying 120 or 277 VAC to the Maintained Enable Input.

When the **e3-SERIES** changes mode of operation to the Battery Power mode, the Maintained output will automatically energize.

9.4 Battery Power Mode

Battery Power Mode can have several other names such as Emergency Power and Inverter Mode. This terminology may be used throughout this document.

During Battery Power mode, the inverter is producing a pure sine wave for the output loads and the batteries are being discharged. The output current is limited by an active pulse by pulse current limit technique and limits the inverter from failure. The current limit is set to the crest factor value or 4 times the average output current.

In the event of an overload there are several ways that the inverter will protect itself. First is the pulse by pulse limit and second is by average sensing. The pulse by pulse is a transient protection and occurs in the micro-second time scale, the average sensing looks at a heavily filtered signal and occurs in the seconds time scale.

Since the crest factor is very high on the **e3-SERIES**, loads that have high inrush currents are quickly up and running. This is very beneficial with normally off loads which seem to be more prevalent with modern lighting and green building design techniques.

Transfer time between Battery Charge Mode and Battery Power mode occurs at two different speeds. Since the **e3-SERIES** is a line interactive inverter, it senses the utility power and transfers when it thinks that the utility has failed. This analysis sometimes causes transfers when in actuality no power is lost and only a transient occurred from the incoming utility. The two different speeds of Fast Transfer and Slow Transfer are important for different applications.

Fast Transfer – Used for applications that require HID lights to be supported. The transfer time is guaranteed to be less than 2 milli-Seconds and is sufficient for any HID application.

Slow Transfer – Used for applications that do not require a Fast Transfer and this is less susceptible to transfer to Battery Power during normal operation. Power must be out for a complete line cycle or 16 milli-Seconds. Slow Transfer is the mode preferred to run the inverter with Normally Off loads. Normally Off loads may require darkness at all times unless there is definitely a power outage as the case like a movie theater.

The Normally On, Normally Off and Maintained Outputs are all producing voltage during Battery Power mode.

10.0 Warranty

There are two separate warranty periods for the **e3-SERIES** Central Inverter System. The Electronics/Cabinet warranty period is for 3 years from the date of shipment. It is warranted against defects in workmanship and materials under normal and proper use.

The batteries are covered under a separate warranty and these durations may change dependent on battery type.

Battery Type	Warranty Duration
Pure Lead	3 years full, 10 years pro-rata
Standard VRLA	1 year full, 9 years pro-rata

Extended Warranty is available through a factory start-up plan. Please call 1-800-967-5573 for details.

10.1 Technical Service and Support

Our technical support staff is available before, during, and after the units installation for help on any detail of this product. Should you need help, please contact our service center at:

Service Center	1-800-967-5573
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They are available during normal business hours Eastern Standard Time Zone.

10.2 Return Material Authorization (RMA)

At no time will material be accepted as returned goods without a RMA number issued from the factory. If parts are deemed defective by our Technical Service group and are troubleshot at the site to be defective they can be exchanged at no cost during the warranty period with an RMA. When returning defective parts back to the factory, the RMA number must be written on the packaging, bill of lading, or shipping labels so it can be properly identified.

Technical Service will make every effort to troubleshoot the problem over the phone before an RMA will be issued. Phone troubleshooting may save both the customer and manufacturer added time and thus expense. Cooperation is greatly appreciated.

11.0 Maintenance and Service

CAUTION – Whenever maintenance and service is to be performed, it may be desirable to shut unit down. Please refer to Start up and Shut Down procedures for details.

CAUTION – Always assume AC and DC Voltages are present at the e3-SERIES terminals because the inverter is capable of providing output voltage from the batteries when there is no AC input. The unit can pass through AC voltages from input to output with no batteries connected if the installation switch is on.

Routine Maintenance

Routine Maintenance should be considered any maintenance that does not require removing the Inverters' shroud (top/front cover). These maintenance items includes Circuit breaker re-setting and periodic cleaning of dust from the cover and cabinet base to ensure proper convection air flow. Since no fans are required on this system, air flow moves by convection. Convection air circulation is from bottom to top as heat naturally rises.

Keep all foreign objects off the top and away from the sides of the unit as these may impede convection air flow.

e3-SERIES automatically performs monthly tests (every 28 days) and keeps a log of all the events and monthly tests in the event log. **e3-SERIES** has a self-clearing 28 day counter and resets any time the unit transferred to battery power. If on day 14 the unit had a brief power outage, the counter gets reset and 28 days later (pending no other transfers) a monthly test would be performed.

Periodic inspection of the logs will see how the unit is performing. A quick test by manually pressing the test button will transfer the system to Battery Power and will turn on all the connected loads such as the Normally Off and the Maintained load.

Ensure there are no faults present. If there are faults, please refer to the User Interface section for a complete detail of what this fault may indicate.

Test

By pressing the TEST button on the front panel, the unit will transfer to Battery Power. This test will run for at least 15 seconds and will exit back to Battery Charging upon synchronizing to utility power.

Yearly Test

The NFPA code requires that a yearly test of 90 minutes be performed and the system must be able to run the full 90 minutes without going into a LVD fault.

A yearly test of 90 minutes can be initiated by holding in the TEST button for 5 seconds. When the system enters into the yearly test, the scrolling display will display 90M TEST, MIN:XX, where XX is the elapsed minutes during the yearly tests. The elapsed time starts at 00 and ends at 90.

An alternate method of performing the 90 minute yearly test would be to turn off the input breaker for the 90 minutes and then re-apply when the 90 minute duration is complete.

11.1 Battery Maintenance

The batteries used in the **e3-SERIES** are sealed lead calcium and are termed "Maintenance Free". This term may be misleading because ALL batteries require periodic maintenance even if it only consists of a visual inspection. We recommend the following maintenance plan:

* Once every 3 to 4 months the batteries should be visually inspected for cracks, leaks, bulging or deformities and corrosion buildup on terminals.

* Once every year all the batteries should be inspected to ensure all connections are tight and re-torqued to the requirements outlined in the Battery Installation section.

11.2 Battery Replacement

e3-SERIES is a UL approved and listed component with exact battery requirements. Failure to replace the batteries with the exact same type will VOID the UL approval. For battery replacement, please call the service number listed in the warranty section so that the unit performs as it was intended.

WARNING – Only qualified personnel that is familiar with AC and DC installation techniques and codes (such as an electrician) should perform the removal and replacement.

WARNING – Remove all rings, watches, and other jewelry before doing any electrical service or installation work. Always wear protective clothing and appropriate personal protective equipment (PPE) that is suitable such as eye protection, etc. when working with batteries.

WARNING - Batteries contain tremendous energy and can explode if short circuited. Precautions should be taken to eliminate possible short circuits.

WARNING – Batteries contain lead. Follow all local and state requirements for battery disposal. Please dispose of properly by recycling.

TIP – Discharging the batteries by letting the **e3-SERIES** run on Battery Power can be beneficial for several reasons. First, it verifies that the batteries need replacing if it does not make 90 minutes of discharge time. Second, it depletes the battery which reduces the fault current available at the batteries terminals. A completely discharged battery that ran to LVD still has fault current available – just not nearly as much. By running the battery to LVD, the available fault current would be substantially less and safer if an inadvertent short circuit were to happen during the removal or transportation process to the recycling facility.

To remove the batteries, shut the unit completely down by turning off the System On/Off switch and remove AC power Feed source by turning off the input circuit breaker.

Remove the quick connect/dis-connect connectors attached to each battery and carefully slide the battery forward and then remove by lifting. Do not remove the bolts from the batteries – dis-connect the Anderson Power Pole connectors for battery removal.

DANGER – The worst thing that can happen when removing or installing batteries is an inadvertent short circuit. All means must be taken to ensure that all lugs are secure and insulated after removal from the batteries post. Batteries contain tremendous short circuit energy and are on the magnitude of thousands of amps. When a short circuit occurs, it first creates a very loud shock wave similar to a shotgun blast. If the short circuit creates a welded lug so that the short circuit remains conducting current, the battery may explode.

Extreme danger and bodily injury can be caused by primary and secondary effects of the short circuit. Primary effects would be burns, vision or hearing loss. Secondary effects could be falling off a ladder or sustaining injuries not created by the battery itself.

DANGER – DO NOT TOUCH BATTERIES UNLESS TRAINED OR KNOWLEDGEABLE AND KNOW THE HAZARDS!

WARNING – Always use the correct tools with insulated handles and wear the appropriate personal protective equipment (PPE) required for battery work.

To install new batteries, see section 5.0 Battery and DC Connections.