User Manual

Power Ride 4

Emergency Lighting Inverter (ELI)
10-160 KVA
200-500 KVA

Document No. 6005-145P
Revision **D**

Installation and
Operation

Due to continuous product improvement this document is subject to change without prior notice.

CAUTION!

HAZARDOUS VOLTAGE EXISTS INSIDE THE ELI (INCLUDES THE CONNECTION TERMINALS). CABLE CONNECTION AND MAINTENANCE SHOULD BE DOBE BY PROFESSIONAL OR QUALIFIES PERSONNEL.
THE ELI HAS ITS OWN INTERNAL POWER SOURCE (BATTERIES). THE OUTPUT TERMINALS MAY BE LIVE EVEN WHEN THE ELI IS NOT CONNECTED TO THE AC SUPPLY.
DC CAPACITORS ARE EMPLOYED IN THIS UNIT. HAZARDOUS VOLTAGE STILL EXITS EVEN WHEN THE UNIT IS NOT ENERGIZED. DO NOT TOUCH ANY PART OF THE INSIDE OF THE ELI.

WARNING!

BE SURE TO OPERATE THE ELI WITHIN THE RATED POWER LEVEL.
PREVENT DIRECT EXPOSURE TO DIRECT SUNLIGHT, RAIN OR CONTAMINATING ENVIRONMENT.
ONLY QUALIFIED TECNICIANS SHOULD REPLACE THE BATTERIES. SINCE BATTERIES HAVE HIGH SHORT-CIRCUIT CURRENT CAPACITY, MISTAKES IN CONNECTION OR DISCONNECTION CAN CAUSE SEVERE BURS OR DEATH TO SERVICING PERSONNEL.

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Congratulations on selecting one of the fine products from Perfect Power Systems, the leader in power protection technology. Our wide product offering includes UPS (**U**ninterruptible **P**ower **S**ystems), power conditioners, automatic voltage regulators and specialty transformers (e.g., computer-grade, medical-grade). Since our founding, Perfect Power Systems has shipped many of these fine products to discerning customers around the world for use on sensitive equipment and in critical applications.

One of our goals is to make our manuals both comprehensive and easy to use. The new format of our user manual is the result of ideas and inputs from customers like you who have taken an active interest in our continued success. We invite and appreciate your feedback on our products and documentation via e-mail, fax, mail, or telephone.

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SERVICE

If you require assistance, please call our 24-hour toll free hot line **800-PWR-SRVC** (800-797-7782) or email to info@800pwrsrvc.com. Please have the following information from your unit's nameplate available to speed assistance:

Serial Number: _____
KVA/Power Rating: _____
Input Voltage: _____
Output Voltage: _____
Manufacturer Date: _____

Due to continuous product improvement this document is subject to change without prior notice.

SAFETY

Following safety precautions is important when operating or servicing electrical equipment. The symbols shown are used extensively throughout this manual. Always heed these precautions since they are essential to the safe operation and servicing of this product.

Boxes labeled with the "**Danger!"** symbol indicate that there is a high risk of personal injury or death if instructions are not followed.

Warnings labeled with the **Caution** symbol indicate that there is a high probability of equipment malfunction, damage, or destruction if instructions are not followed.

Danger!

ONLY FACTORY TRAINED OR AUTHORIZED PERSONNEL SHOULD ATTEMPT TO INSTALL OR REPAIR THE UNIT OR ITS BATTERY SYSTEM. IMPROPER INSTALLATION HAS PROVEN TO BE THE SINGLE MOST SIGNIFICANT CAUSE OF START-UP PROBLEMS. HIGH AC AND DC ELECTRICAL VOLTAGES ARE PRESENT THROUGHOUT THE UNIT (S) AND INCORRECT INSTALLATION OR SERVICING COULD RESULT IN ELECTROCUTION, FIRE, EXPLOSION, OR EQUIPMENT MALFUNCTION.

Danger!

READ THIS MANUAL IN ITS ENTIRETY BEFORE PERFORMING INSTALLATION, START-UP, OPERATION, AND MAINTENANCE OF THE UNIT OR BATTERY SYSTEMS. FAILURE TO DO SO COULD RESULT IN ELECTROCUTION, FIRE, EXPLOSION, OR EQUIPMENT MALFUNCTION.

Danger!

ALL POWER CONNECTIONS MUST BE COMPLETED BY A LICENSED ELECTRICIAN WHO IS EXPERIENCED IN WIRING THIS TYPE OF EQUIPMENT. WIRING MUST BE INSTALLED IN ACCORDANCE WITH ALL APPLICABLE NATIONAL AND LOCAL ELECTRICAL CODES. IMPROPER WIRING MAY CAUSE DAMAGE TO THE EQUIPMENT, INJURY OR DEATH OF PERSONNEL. VERIFY THAT ALL HIGH AND LOW VOLTAGE INPUT POWER CIRCUITS ARE DE-ENERGIZED AND LOCKED OUT BEFORE INSTALLING CABLES OR MAKING ANY ELECTRICAL CONNECTIONS.

Danger!

EXERCISE EXTREME CARE WHEN HANDLING UNIT AND BATTERY CABINETS TO AVOID EQUIPMENT DAMAGE OR INJURY TO PERSONNEL. CABINETS WEIGH SEVERAL HUNDRED POUNDS.

Danger!

TEST LIFT AND BALANCE THE CABINETS BEFORE MOVING. MAINTAIN MINIMUM TILT FROM VERTICAL AT ALL TIMES. THE BOTTOM STRUCTURE WILL SUPPORT THE UNIT ONLY IF THE FORKLIFT FORKS ARE COMPLETELY UNDERNEATH THE UNIT.

Danger!

OBSERVE ALL BATTERY SAFETY PRECAUTIONS DURING INSTALLATION OR SERVICE OF THE UNIT OR BATTERIES. EVEN WITH THE BATTERY CIRCUIT BREAKER IN THE OFF POSITION, THE DANGER OF ELECTROCUTION MAY STILL BE PRESENT. THE BATTERY POWER TO THE UNIT MUST BE LOCKED AND TAGGED "OFF" BEFORE PERFORMING ANY SERVICE OR WORK ON THE UNIT. THE BATTERY MANUFACTURER'S SAFETY INFORMATION AND MATERIAL SAFETY DATA SHEET IS LOCATED IN A POCKET ATTACHED TO THE INSIDE OF LEFT DOOR OF EACH UNIT. FAILURE TO FOLLOW INSTRUCTION LISTED ABOVE AND ELSEWHERE IN THIS MANUAL COULD RESULT IN AN EXPLOSION, FIRE, EQUIPMENT MALFUNCTION, OR ELECTROCUTION.

Danger!

ALL POWER TO THE UNIT MUST BE LOCKED AND TAGGED "OFF" BEFORE PERFORMING ANY SERVICE OR WORK ON THE UNIT. FAILURE TO DO SO COULD RESULT IN ELECTROCUTION.

Danger!

IN A FIRE INVOLVING ELECTRICAL EQUIPMENT, ONLY USE CARBON DIOXIDE FIRE EXTINGUISHERS, OR THOSE APPROVED FOR USE ON ELECTRICAL EQUIPMENT. USE OF WATER ON FIRES INVOLVING HIGH VOLTAGE ELECTRICAL CIRCUITS COULD RESULT IN ELECTROCUTION .

Danger!

EXTREME CAUTION IS REQUIRED WHEN PERFORMING MAINTENANCE. LETHAL VOLTAGES EXIST WITHIN THE EQUIPMENT DURING OPERATION. OBSERVE ALL WARNINGS AND CAUTIONS IN THIS MANUAL. FAILURE TO COMPLY MAY RESULT IN SERIOUS INJURY OR DEATH. OBTAIN QUALIFIED SERVICE FOR THIS EQUIPMENT AS INSTRUCTED.

Danger!

BE CONSTANTLY AWARE THAT THE UNIT SYSTEM CONTAINS HIGH DC AS WELL AS AC VOLTAGES. WITH INPUT POWER OFF AND THE BATTERY, DISCONNECTED, HIGH VOLTAGE AT THE FILTER CAPACITORS AND POWER CIRCUITS SHOULD DISCHARGE WITHIN 30 SECONDS. HOWEVER, POWER CIRCUIT MALFUNCTIONS CAN OCCUR, SO YOU SHOULD ALWAYS ASSUME THAT HIGH VOLTAGE MIGHT STILL EXIST AFTER SHUTDOWN. VERIFY THAT POWER IS OFF USING AC AND DC VOLTMETERS BEFORE MAKING CONTACT.

Danger!

SOME COMPONENTS WITHIN THE CABINETS ARE NOT CONNECTED TO CHASSIS GROUND. ANY CONTACT BETWEEN FLOATING CIRCUITS AND THE CHASSIS IS A LETHAL SHOCK HAZARD.

Danger!

INTERNAL BATTERY STRAPPING MUST BE VERIFIED BY THE CUSTOMER PRIOR TO MOVING THIS UNIT.

THIS UNIT CONTAINS NON-SPILLABLE BATTERIES. KEEP THE UNIT UPRIGHT. DO NOT STACK. DO NOT TIP. ALWAYS FOLLOW THE BATTERY MANUFACTURER'S SAFETY INFORMATION LOCATED IN A POCKET ATTACHED TO THE INSIDE OF THE LEFT DOOR OF YOUR UNIT TO PREVENT AN ACCIDENT THAT COULD RESULT IN INJURY OR DEATH.

Danger!

LEAD-ACID BATTERIES CONTAIN HAZARDOUS MATERIALS. BATTERIES MUST BE HANDLED, TRANSPORTED, AND RECYCLED OR DISCARDED IN ACCORDANCE WITH FEDERAL, STATE, AND LOCAL REGULATIONS. BECAUSE LEAD IS A TOXIC SUBSTANCE, LEAD-ACID BATTERIES MUST BE RECYCLED OR DISCARDED AS HAZADEROUS WAIST.

DO NOT DISPOSE OF BATTERIES IN A FIRE, THE BATTERIES MAY EXPLODE.

DO NOT OPEN OR MUTILATE THE BATTERIES. RELEASED ELECTROLYTE IS HARMFUL TO THE SKIN AND EYES AND MAY BE TOXIC.

A BATTERY CAN HAVE A HIGH SHORT CIRCUIT CURRENT AND PRESENT A RISK OF ELECTRICAL SHOCK. THE FOLLOWING PRECAUTIONS SHOULD BE OBSERVED WHEN WORKING ON BATTERIES:

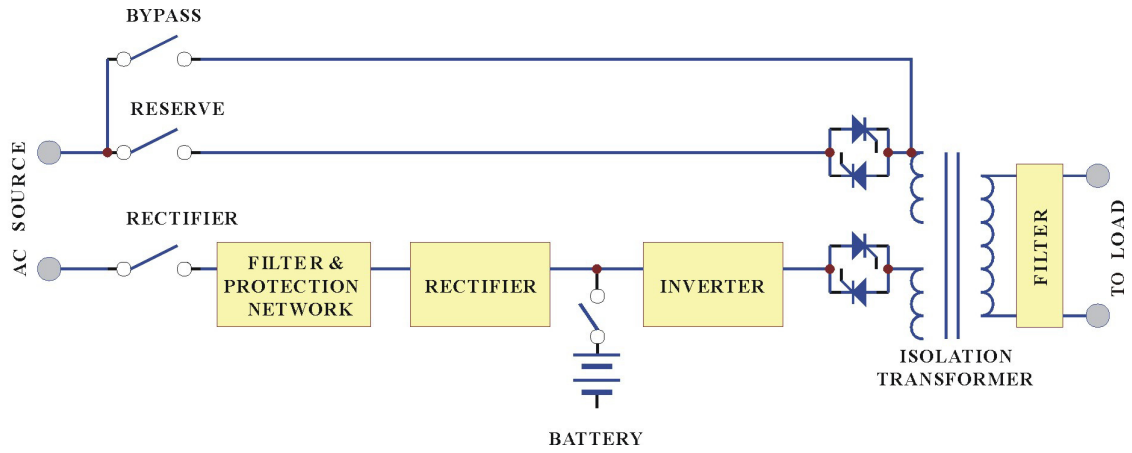
1. **REMOVE WATCHES, RINGS OR OTHER METAL OBJECTS.**
2. **USE TOOLS WITH INSULATED HANDLES.**
3. **WEAR RUBBER GLOVES AND BOOTS.**
4. **DO NOT LAY TOOLS OR METAL PARTS ON TOP OF BATTERIES.**
5. **DISCONNECT CHARGING SOURCE PRIOR TO CONNECTING OR DISCONNECTING BATTERY TERMINALS.**
6. **DETERMINE IF BATTERY IS INADVERTENTLY GROUNDED. IF SO, REMOVE THE SOURCE OF THE GROUND. CONTACT WITH ANY PART OF A GROUNDED BATTERY CAN RESULT IN ELECTRICAL SHOCK. THE LIKELIHOOD OF SUCH SHOCK WILL BE REDUCED IF SUCH GROUNDS ARE REMOVED DURING INSTALLATION AND MAINTENANCE.**
7. **LEAD-ACID BATTERIES CAN PRESENT A RISK OF FIRE BECAUSE THEY GENERATE HYDROGEN GAS. THE FOLLOWING PROCEDURES SHOULD BE FOLLOWED:**
   1. **DO NOT SMOKE WHEN NEAR BATTERIES.**
   2. **DO NOT CAUSE FLAME OR SPARK IN BATTERY AREA.**
8. **DISCHARGE STATIC ELECTRICITY FROM YOUR BODY BEFORE TOUCHING BATTERIES BY FIRST TOUCHING A GROUNDED SURFACE.**

1. SYSTEM OVERVIEW

1.1. Construction of the ELI

(Throughout the manual ELI or UPS are used for Emergency Lighting Inverter)

General Topology



The ELI system is composed of input breakers, input filter & protection network, rectifier, battery bank, inverter, static switch, bypass breaker, isolation transformer and output filter. The basic topology is shown in the diagram above. Under normal AC mode, energy from the AC source is converted to DC power and supplied to the inverter to charge the batteries to its full capacity all the time, ready to support the output load in case of AC source failure.

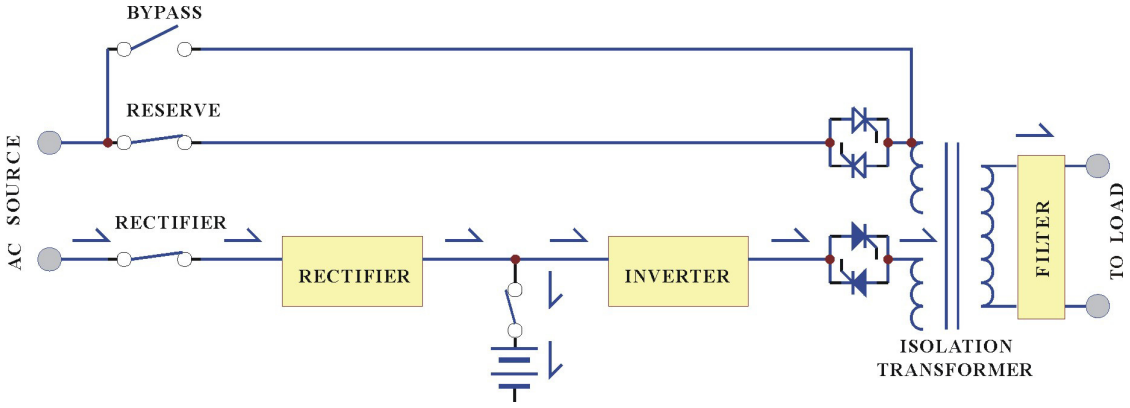
Although the principle and operation of an ELI seems simple and straightforward, the requirement for a reliable and intelligent ELI makes the design and manufacturing of a high power ELI one requiring advanced technology, intelligence, experience and most important, consideration of the user interface. Many years have been spent in designing the most rugged, intelligent and reliable ELI for the market, and a safe and convenient ELI for the user.

Choosing the best and most suitable ELI for a given application can be easy or difficult, depending on the client's knowledge of key parameters. The most obvious specification, output power, depends on the size of the load. Often, an allowance of 50% more power is added to the present load requirement, both for tolerance and for future expansion.

Another important issue is reliability. The prime aim of a ELI is to protect your load. Therefore, the ELI should be much more reliable than the AC source. An unreliable ELI may suffer the problem of frequent break down, even more frequent than AC failure, and the cost of repair may become more than the cost of the unit itself.

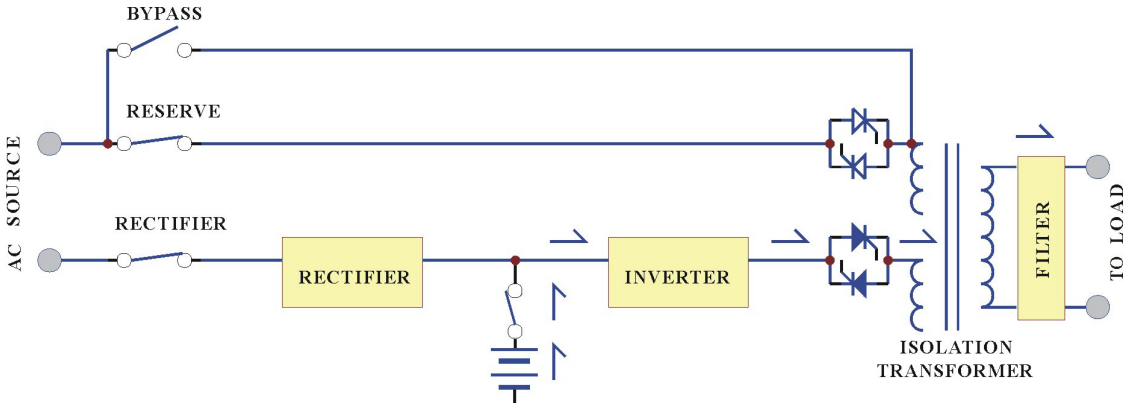
Generally, there are four different modes of operation, the NORMAL OPERATION MODE, the BACK-UP (BATTERY) MODE, the RESERVE MODE and the MAINTENANCE BYPASS MODE. These are explained below.

Normal Operation Mode:



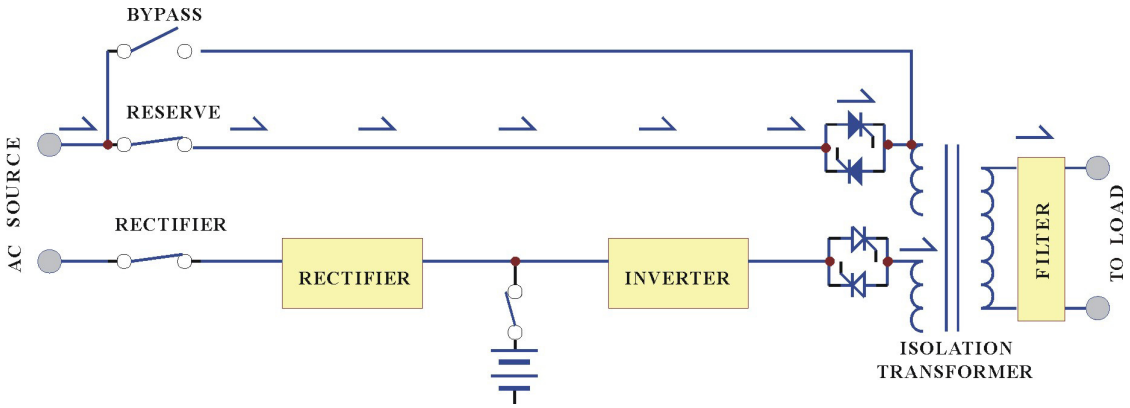
The rectifier converts the AC input to DC power to supply the inverter and charge the batteries simultaneously. All the fluctuations, surges and spikes of the AC input are removed during AC to DC conversion. Therefore, the AC supplied by the inverter is clean and stable.

Back-up Mode:



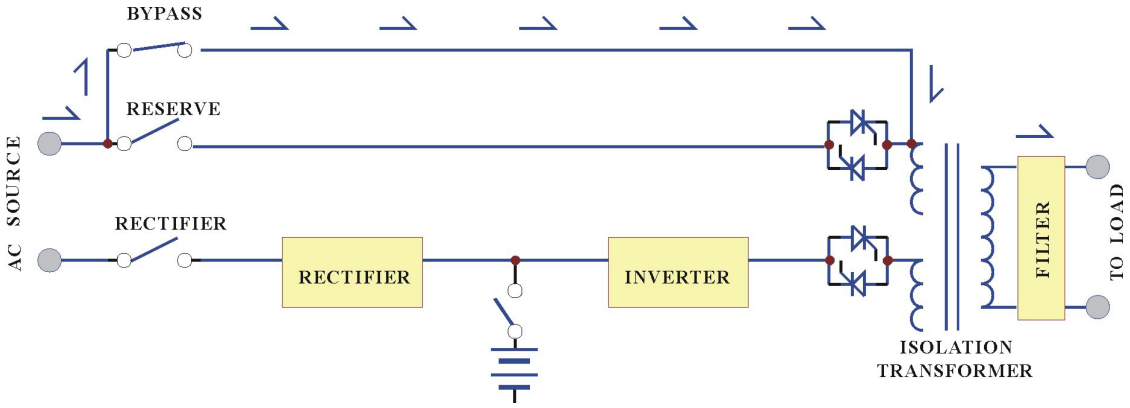
Since the batteries are connected directly to the DC bus, when the AC fails, the batteries change immediately from receiver to donor, supplying energy to the inverter instead of receiving energy from the rectifier. The output AC is not interrupted. Therefore, the load connected to the output is protected.

Reserve Mode:



When the inverter is in an abnormal condition, such as over temperature, short circuit, abnormal output voltage or overloaded for a period exceeding the inverter's limit, the inverter will automatically shut down in order to protect itself from damage. If the utility power is normal, the static switch shall transfer the load to the reserve source without interruption of AC output.

Maintenance Bypass Mode:



In case of ELI maintenance or battery replacement, and where the load cannot be interrupted, the user can turn off the inverter, close the bypass breaker and then open the rectifier and reserve breakers. The AC output will not be interrupted during manual bypass transfer procedure. Therefore, the maintenance bypass switch keeps continuously supplying power to the load. Electricity will not exist in ELI except the output transformer, thus ensuring the safety of service personnel.

Generally, the ELI is expected to run 24 Hours a day in normal operation mode once it is installed, except when the utility power fails, under overload conditions, or during maintenance.

Normal operation with batteries connected provides clean, stable, regulated and uninterrupted power to the load, free from any spikes and surges. Therefore, the ELI can be regarded as a perfect AC power source, limited in back-up time, under mains failure, only by the capacity of the batteries.

Green Mode:

Hybrid design allows customer to select this operation mode for higher efficiency (fast transfer less than 2ms).

1.2. Features and Advantages

(a) Reliable input protection: Circuit breakers are placed in each individual input loop to ensure power can continue through another loop in case of breaker trip caused by an abnormal condition in either rectifier or load.

(b) Input surge protection: An MOV (surge protector) is added at the input, providing protection to both ELI and the load from any lightning surges, or surges caused by neighboring large loads.

(c) EMI suppression: An EMI filter is added to meet the international EMC limits. Therefore, very low noise is emitted, and no interference is supplied to other equipment connected to the same AC source.

(d) Ruggedness: The rectifier employs phase control technology to regulate the DC bus voltage. This is the most efficient method to charge the batteries. The SCR used are inherently rugged. Additionally, a large inductor is added at the input to avoid deforming the AC source waveform.

(e) High frequency design: The inverter uses high frequency, high efficiency IGBT, PWM methodology to convert the DC power to AC power. Therefore, the number of components is fewer, reliability is improved, and the size and weight of ELI is reduced, performance is improved, and acoustic noise is minimized.

(f) True Galvanic isolation: An isolation transformer is placed at the output. This can solve the problem of poor input grounding, can allow a different ground between input and output, can avoid the annoying problem of ground leakage current, and can be tied to any potential provided on site. The AC output is isolated under every mode of operation. Additionally, the user gets the bonus of attenuation of common mode noise from the output isolation transformer.

(g) Plug & Play Modular design: The power circuit is separated into several modules plugged into slots in the ELI, which are easy to pull out, permitting quick maintenance and easier trouble shooting.

(h) Cold start function: the ELI can be started without an AC source, that is, can be started with battery power only. This is possible because current limit circuitry is added, preventing the problem of large inrush current blowing the battery fuse and damaging the DC capacitors when batteries are connected to an empty DC bus (before the DC bus is energized).

(i) Multi-CPU design: Several CPUs are employed in the control circuit, and critical functions are designed with parallel redundancy to improve reliability. Therefore, in case of one CPU failure, the other CPUs keep the ELI operational, and the output AC is not affected.

(j) Protection against misuse: The ELI is designed with breaker on/off sensor, power supply sensor, etc. Therefore, any operational mistake made by the user causes no harm to the ELI.

(k) Accepts wide input range: The ELI is designed to accept a wide input range, so that it can work effectively under an unstable AC source. All of the input components used are specifically selected to handle extreme high voltage and high current.

(l) Operating environment: Each component of the ELI is chosen with large safety margin to accommodate extreme environments, such as temperature, humidity, altitude, shock or contamination.

(m) Intelligent charger: The ELI will automatically recharge (boost charge) the batteries every time the batteries are depleted to a voltage level equal to 2V/Cell. Thus, the batteries can be restored to full capacity as soon as possible, and made ready for the next back-up requirement. In order to keep the batteries in the best condition, the ELI will boost charge the batteries for several hours (selectable) automatically every month. To avoid over charging the batteries, boost charge will stop when the ambient temperature is over 35^{o}C (95^{o}F).

(n) Intelligent battery test: The batteries are tested after every boost (initiated by battery discharge or by the monthly boost charge cycle). This is done without interrupting the operation of the rectifier, preventing the risk of output AC failure in case of a bad battery. The user is informed of the battery condition, so that action can be taken before the full capacity of the batteries is needed.

(o) Huge charging power: The charging power is selectable (Lo/Me/Hi) according to Ah rating of the batteries, and can charge up battery banks providing more than 8Hrs back-up time without adding an extra charger.

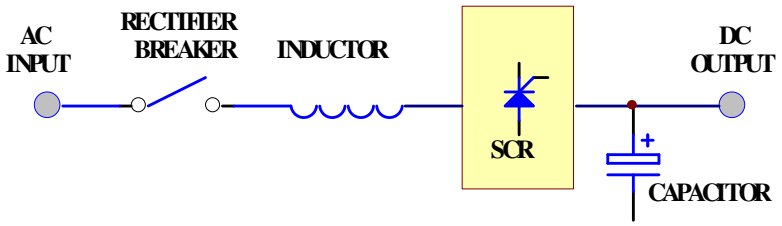
(p) MTBF of fans are extended: Fans used to cool the ELI, are designed to slow down under light load, so that the life expectancy of the fans is extended beyond the normal.

(q) Redundant power supply: A supplemental power supply is added to provide redundancy for supplying power to the static switch, so that there will be AC output no matter what happens to the ELI.

(r) Variety of accessory (options): With built-in intelligent communication interface as well as output ports of RS-232, RS-485, and dry contacts, there are several options are hence available such as remote control panel, 3 phases software for PC monitoring, auto dialing module, battery monitoring module, 3 phases SNMP card.

1.3. Rectifier

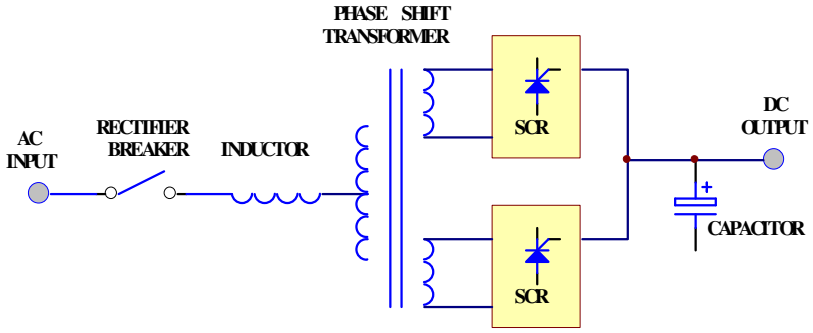
The main function of a rectifier is to convert the AC input to DC power, and supply it to the inverter. The inverter then converts the DC power to AC power for the load. The ELI use the DC power to charge the batteries as well, which is the most efficient method of charging.



6-PULSE FULL CONTROL RECTIFIER

ELIs in the sizes 10KVA to 100KVA use 6-pulse fully controlled rectification (optional 12-pulse). An inductor is added before the rectifier to improve the power factor, smooth the current waveform and eliminate the harmonic current. The control circuit regulates the DC bus within 1%. Soft walk-in circuitry (approximately 20sec.) and current limit circuitry is used to prevent over current or instantaneous surge current.

Extra under-voltage and over-voltage protections are added to improve reliability and to shutdown the rectifier in case of abnormal conditions. The DC bus is adjustable to fit different types of batteries. The power component used in the rectifier is specially selected to handle extreme high voltage and high current. The rectifier is designed to operate under a wide range of AC input, from 177 to 300VAC, to operate under the poor power conditions found in some areas.



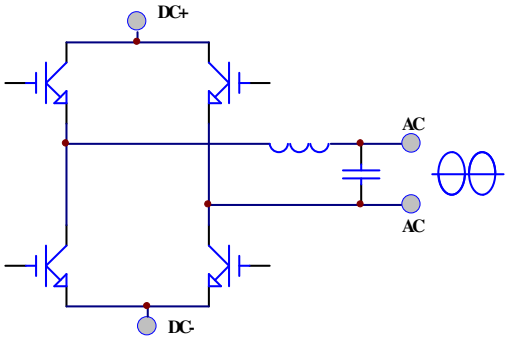
12-PULSE FULL CONTROL RECTIFIER

In order to further improve the power factor and reduce harmonic current drawn by the rectifier, ELI at 120KVA and above, use the 12-pulse full controlled rectifier. The total current harmonic current can be reduced to around 15%, and power factor improved to over 0.8. A phase shift transformer is added to achieve this performance. The input inductor is retained also to obtain the best result. Although this results in higher cost, the unit is much more reliable and rugged. Users do not need to increase the input breaker and cable sizes, since input KVA and harmonic current drawn is minimized, fulfilling the worldwide energy saving requirements.

The harmonic current can be further lowered by adding harmonic filters (factory installation available). The total harmonic current can be reduced to approximately 9%.

Another alternative method to reduce the harmonic current (especially for very large KVA unit) is to employ 18-pulse full controlled rectifier (available as an option). The total harmonic current can be reduced to approximately 7%.

1.4. Inverter



IGBT INVERTER

The inverter is composed of IGBT, inductor, capacitor, snubber, control circuitry and protection circuitry. The inverter converts the DC power from the DC bus to AC power to supply the output load. The ELI uses IGBT technology which switches at frequencies beyond the audible range, therefore producing no audible noise.

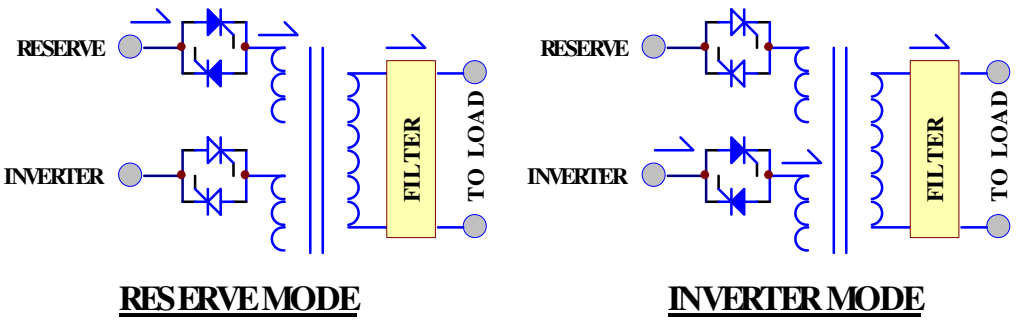
The ELI uses voltage regulation circuitry to limit the voltage variation within 1%. Special compensation circuitry is added to eliminate the output distortion. Every component is oversized to accept the wide DC input range (from 285 to 420VDC), so that the output waveform remains sinusoidal throughout the range. With the aid of dynamic feedback loop the inverter will keep a sine waveform even under non-linear load.

An independent inverter is used for each phase. Although it is more expensive, each inverter has its independent feedback, so that the voltage is unaffected when load is added to the adjacent phase, producing excellent voltage regulation under 100% unbalanced load.

The IGBT is operated in its optimal condition to obtain best efficiency, so as to minimize the power cost of the user.

Usually, the most frequent failures of the ELI occur at the inverter. Therefore, we have added redundant protection circuitry to protect the inverter. A strong snubber is added to suppress the spikes and noise, oversized, high quality components are used throughout, semi-conductor fuses are provided, and ventilation is maximized. The result of this design is a more rugged, reliable and high efficient inverter. At the same time, the inverter can sustain overload and high peak current drawn by the load. Additionally, a longer MTBF is achieved.

1.5. Static Switch



The static switch is composed of two pairs of SCRs, connected back-to-back. The switch can transfer the load from reserve to inverter or from inverter to reserve without losing power at the output. Therefore, it is a very important portion of a ELI.

Detection circuitry is added to the control circuit to achieve zero dead time transfer. Extra detection logic is employed to control when the static switch should transfer. For example, when output is short circuited, under normal mode operation, the ELI detects the short circuit and stops the inverter. The static switch will not transfer power to the reserve circuit, which might damage the reserve breaker. In case of an overload, the ELI will stop the inverter after a period the inverter can endure, and then transfer the load to the reserve circuit, since the overload capability of the static switch is higher than the inverter.

The transfer action is determined according to the reserve-input voltage and frequency to protect supplying incorrect power to the load. Finally, there is a double check by the CPU as to whether the transfer is successful or not.

1.6. Maintenance Bypass

Unlike other ELI, the maintenance bypass switch is already installed inside the ELI for convenience. It should be open under normal operation, and only closed during maintenance. For the sake of safety of maintenance personnel, all power supplies inside the ELI should be disconnected before touching any parts inside the ELI. Thus, the maintenance bypass switch is a necessity to maintain AC power at the output and yet keep maintenance personnel safe at the same time. If the bypass breaker is closed under normal operation, the inverter will stop and the load will be automatically transferred to reserve to prevent the inverter connecting directly to the AC source. Of course, you cannot switch on the inverter as long as the maintenance bypass breaker is closed.

To properly use the maintenance bypass breaker, switch off the inverter first. The static switch will automatically transfer the load to reserve without dead time. Then one can close the maintenance bypass breaker, then open the reserve breaker, so that the load gets power from the output without interruption.

1.7. Main Input Circuit Breaker

The main input circuit breaker provides the unit with incoming power isolation as a well as means of disconnect and input over current protection.

1.8. Main Output Circuit Breaker

1.9. Battery Circuit Breaker

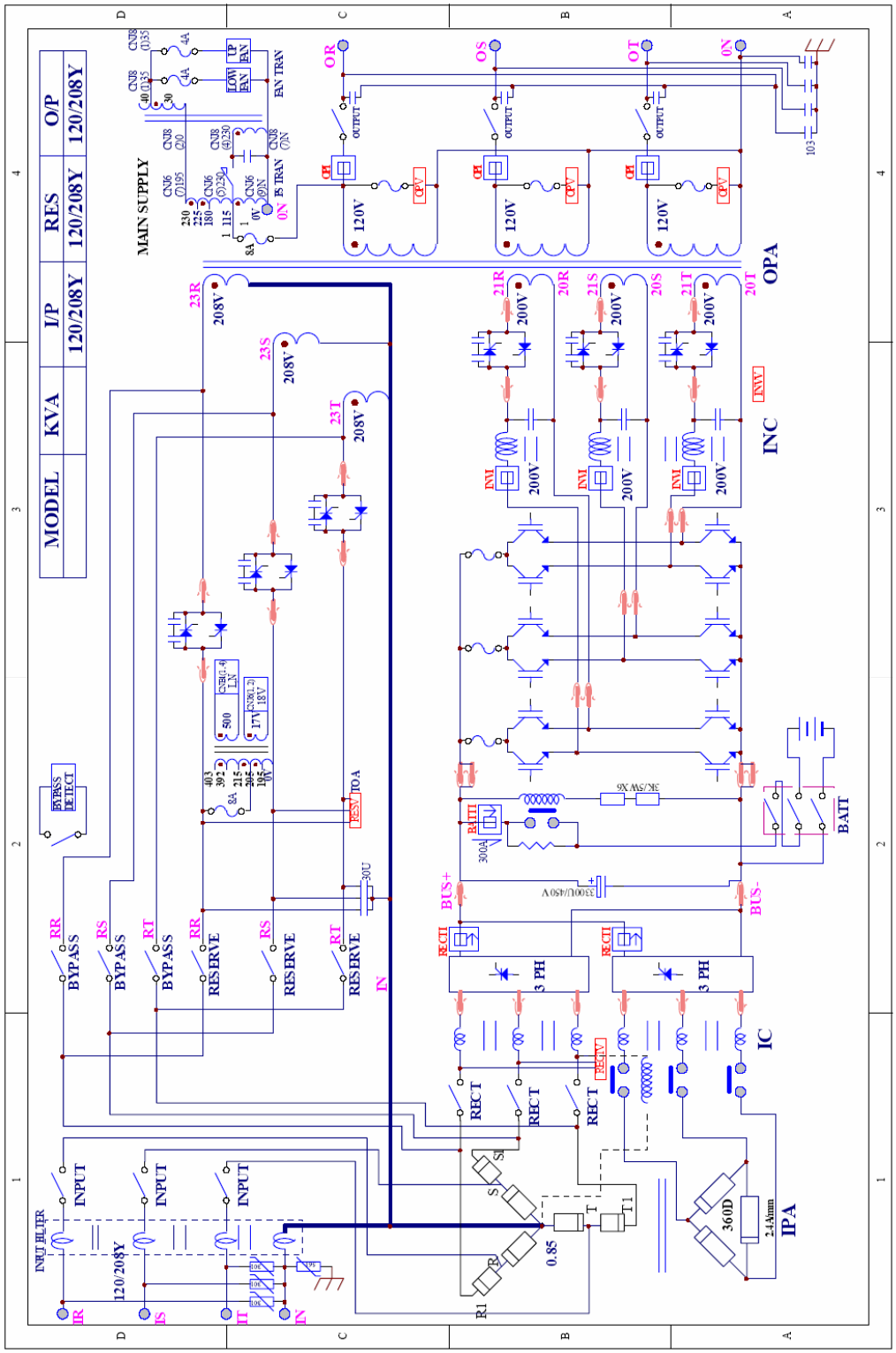
1.10. Inverter Test Switch, Located on the front panel

Inverter test switch is a push button switch for testing the System for proper operation. When units are running and Switch is held in, the unit will automatically transfer to battery operation. The unit will continue to run on batteries until the switch is released. When the switch is released, the unit returns to normal operation (provided input power is present).

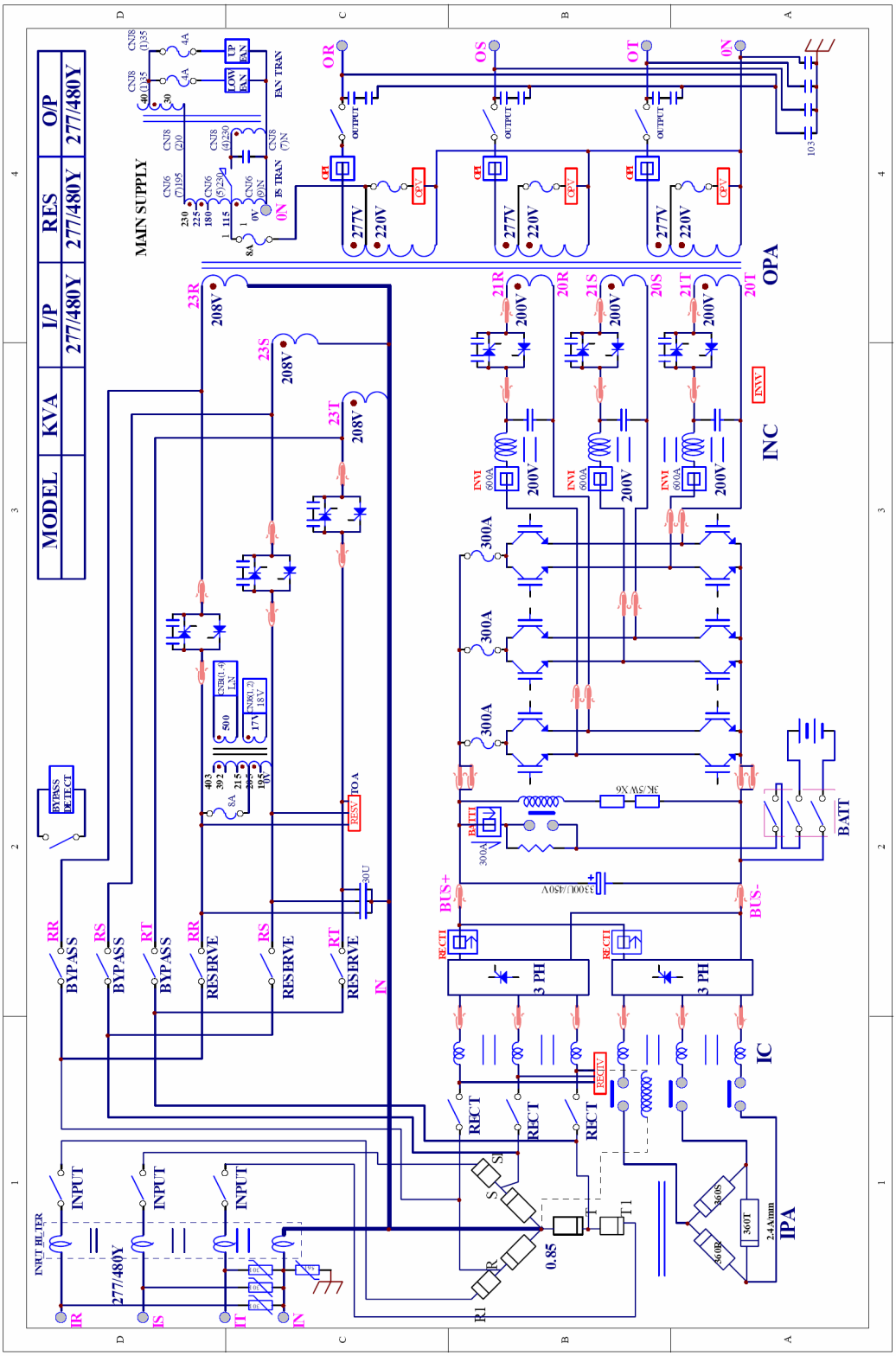
1.11. Battery

The battery bank; Provides the reserve energy to sustain the load when suitable AC input power is not present. The batteries are designed and tested to meet UL 924 requirements. The standard VRLA (**V**alve **R**egulated **L**ead **A**cid) batteries are sealed and maintenance-free.

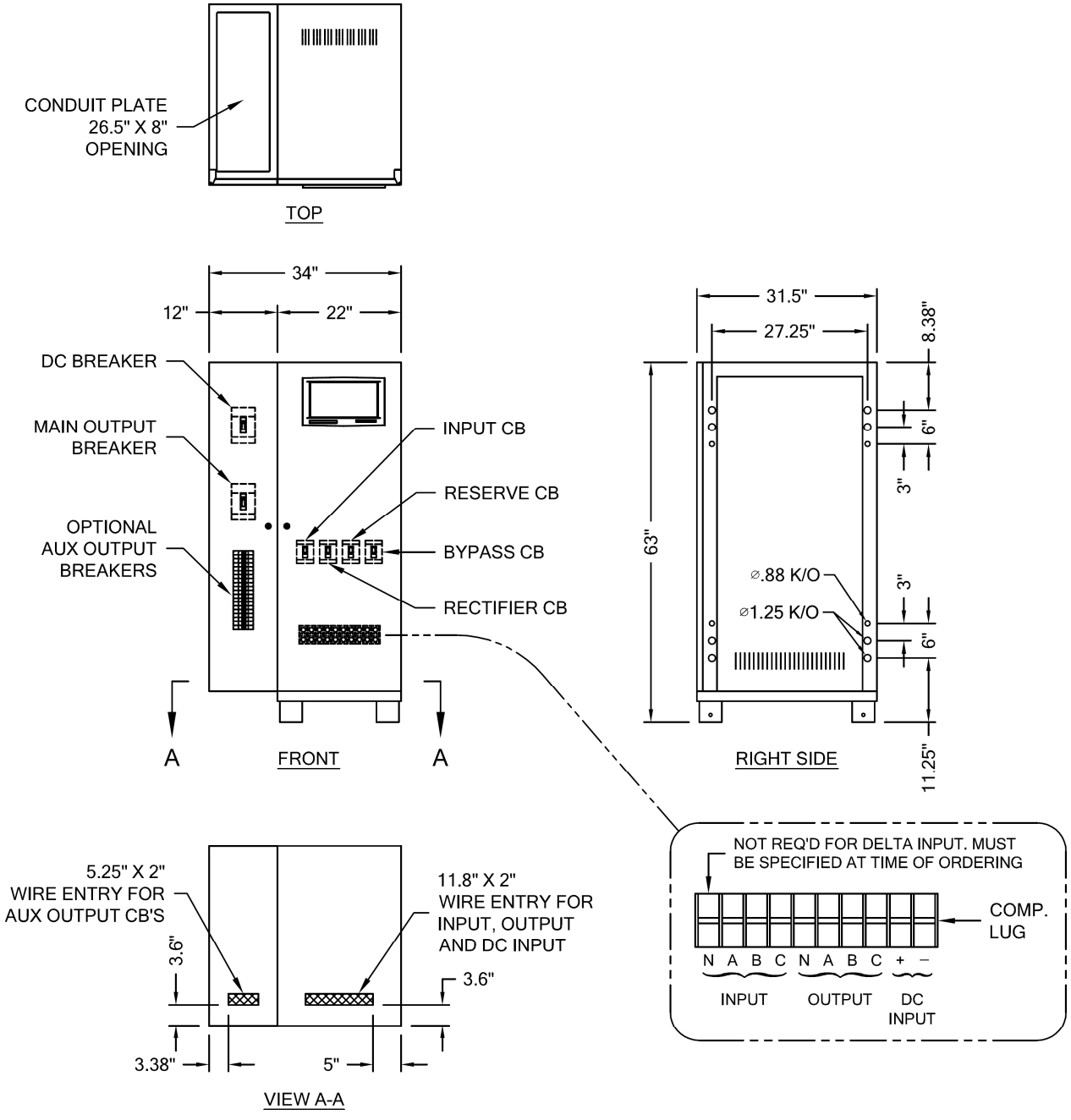
1.12. SINGLE LINE DIAGRAM – (120/208Y)



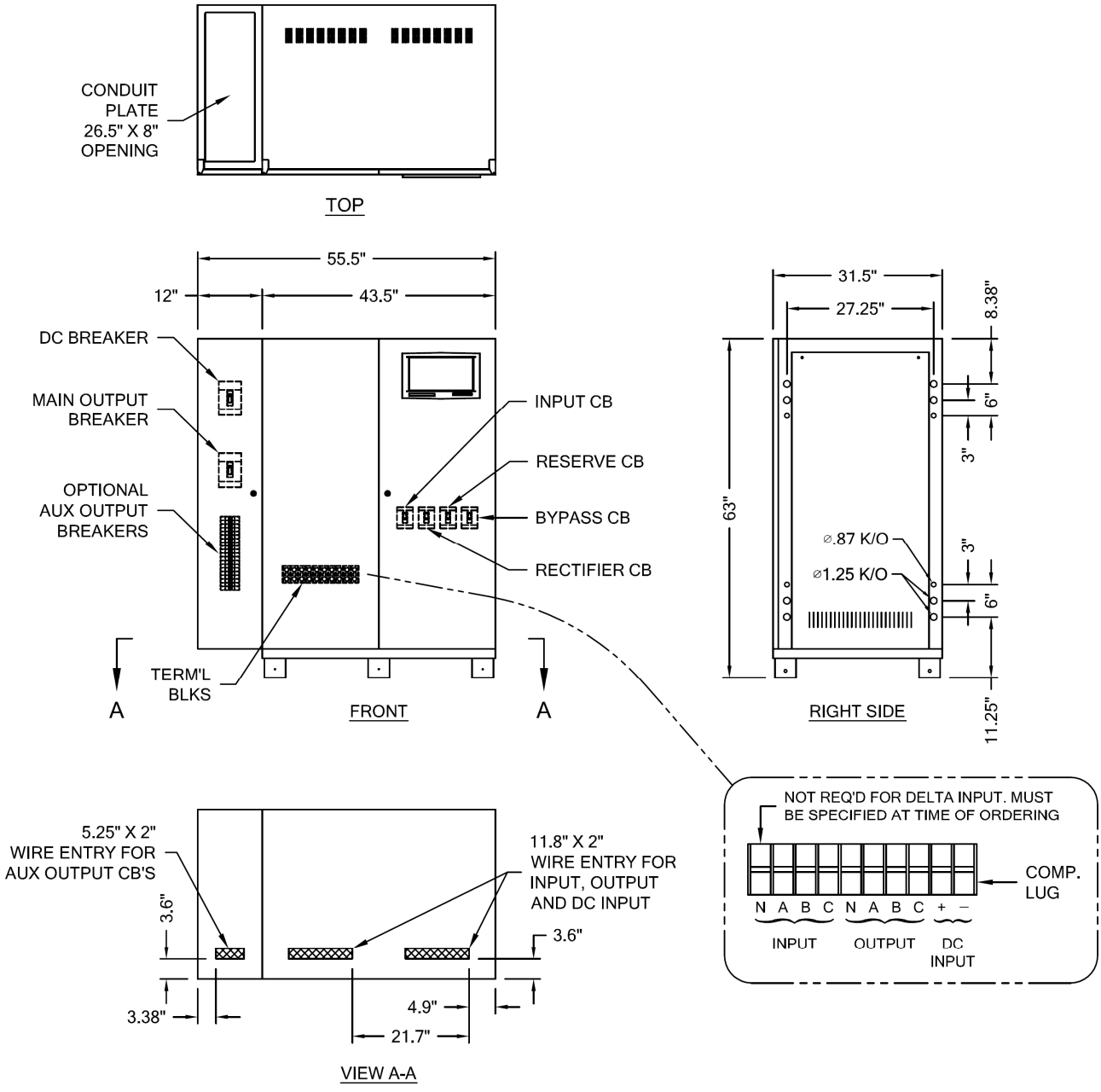
1.13. SINGLE LINE DIAGRAM – (277/480Y)



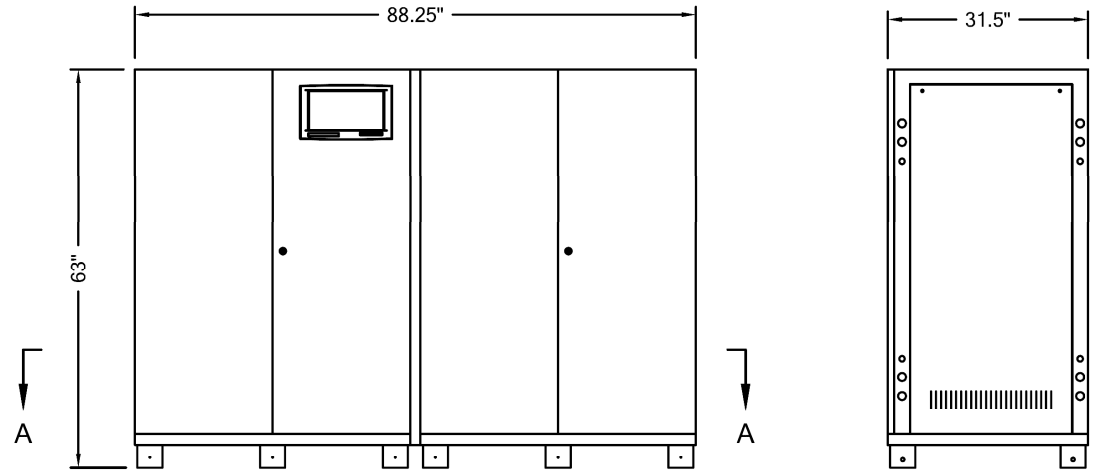
1.14 Dimension & Drawings (electronic cabinet, off white), for battery cabinet refer to section

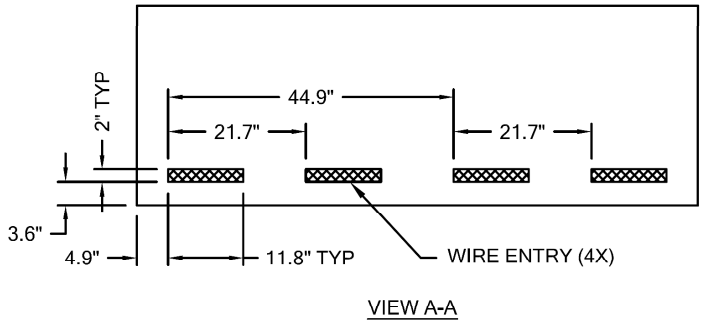


CABINET
10KVA - 60KVA
OUTLINE DRAWING



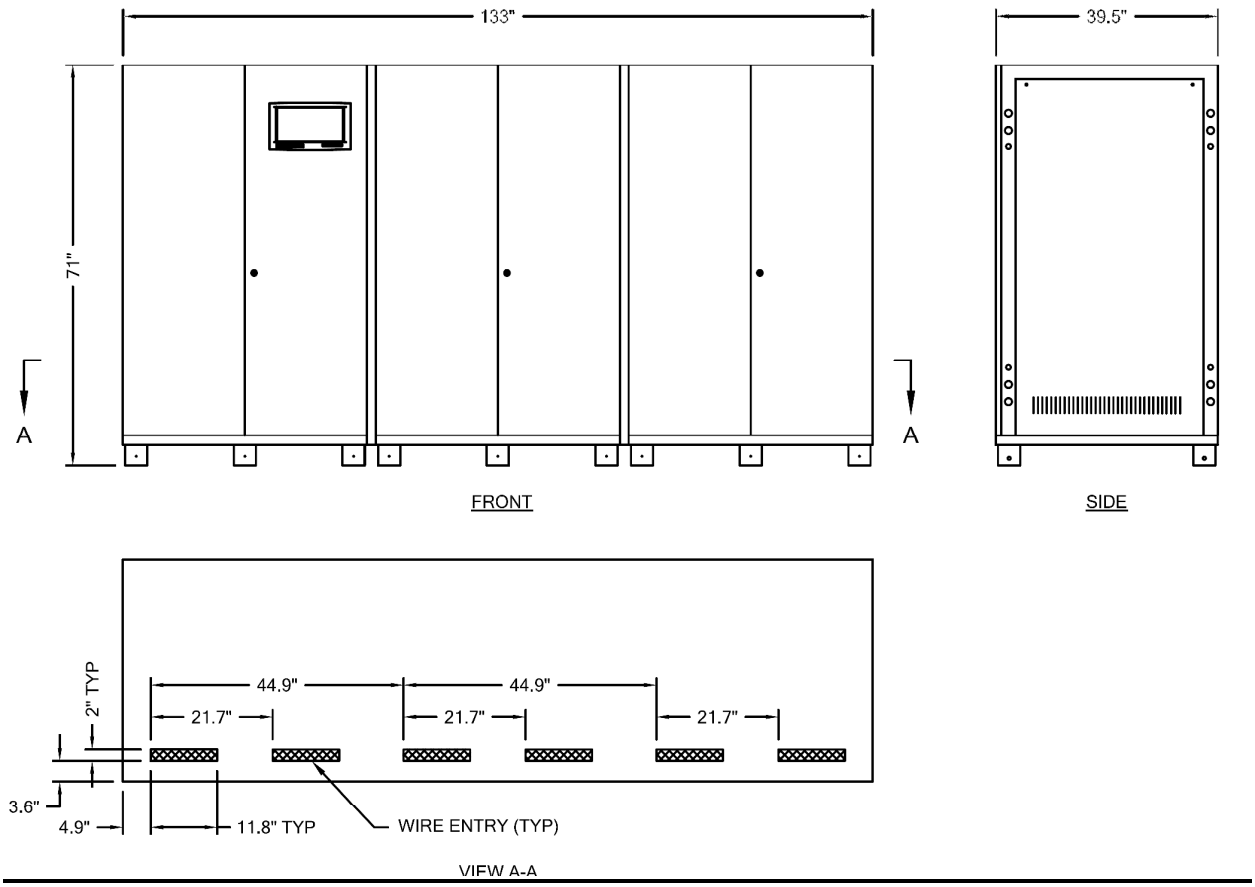
80KVA - 160KVA
OUTLINE DRAWING



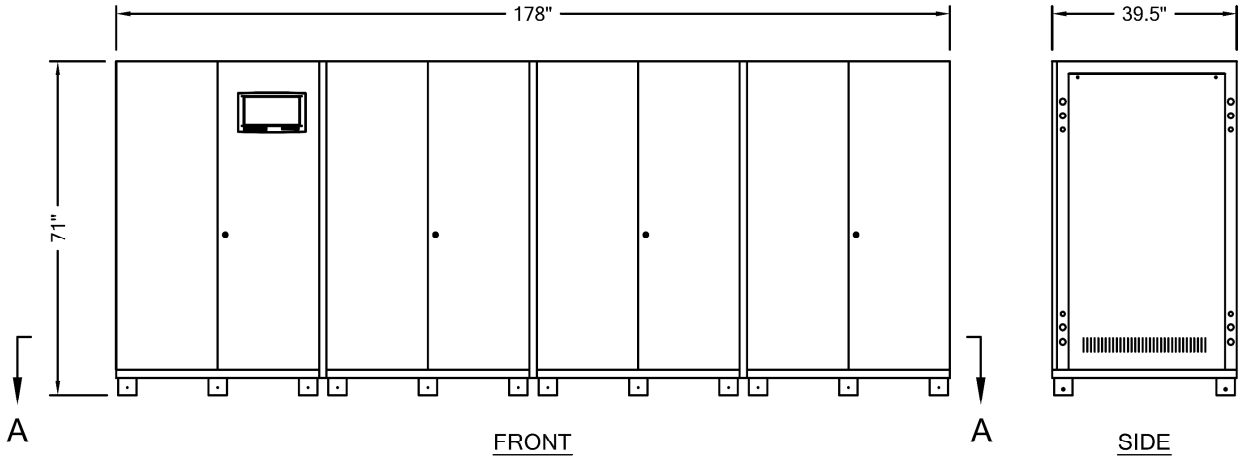


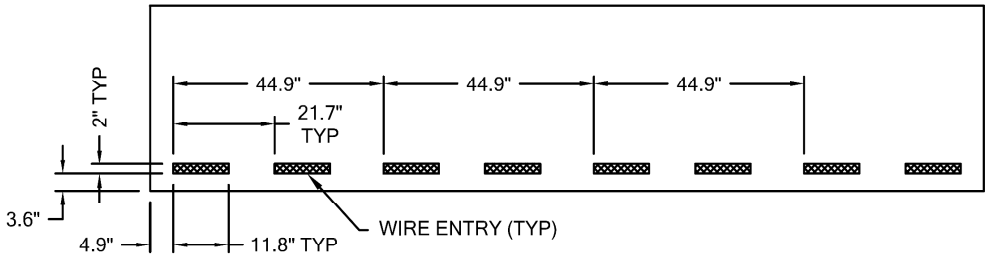
VIEW A-A

200KVA - 320KVA
OUTLINE DRAWING



400KVA
OUTLINE DRAWING

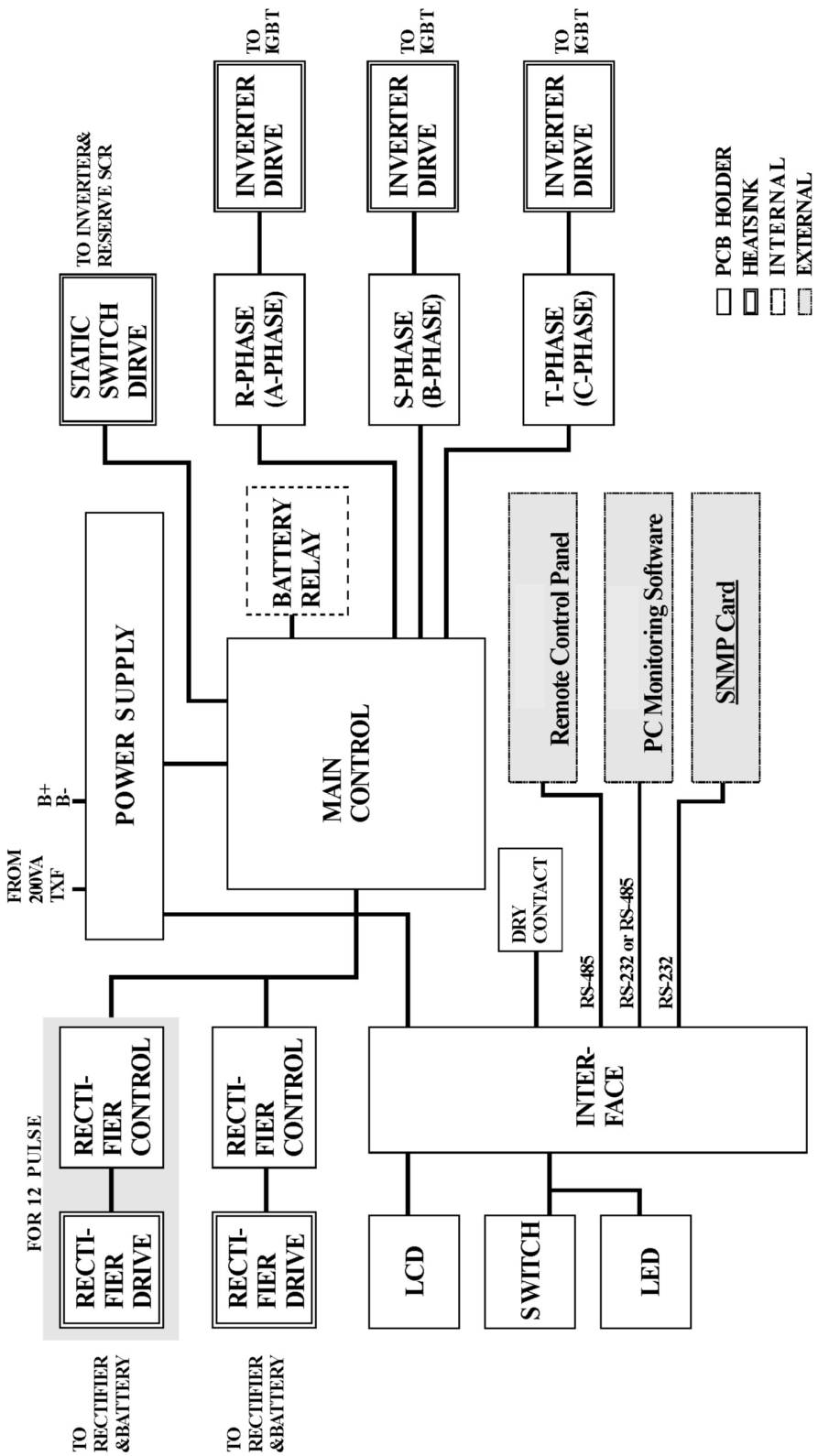




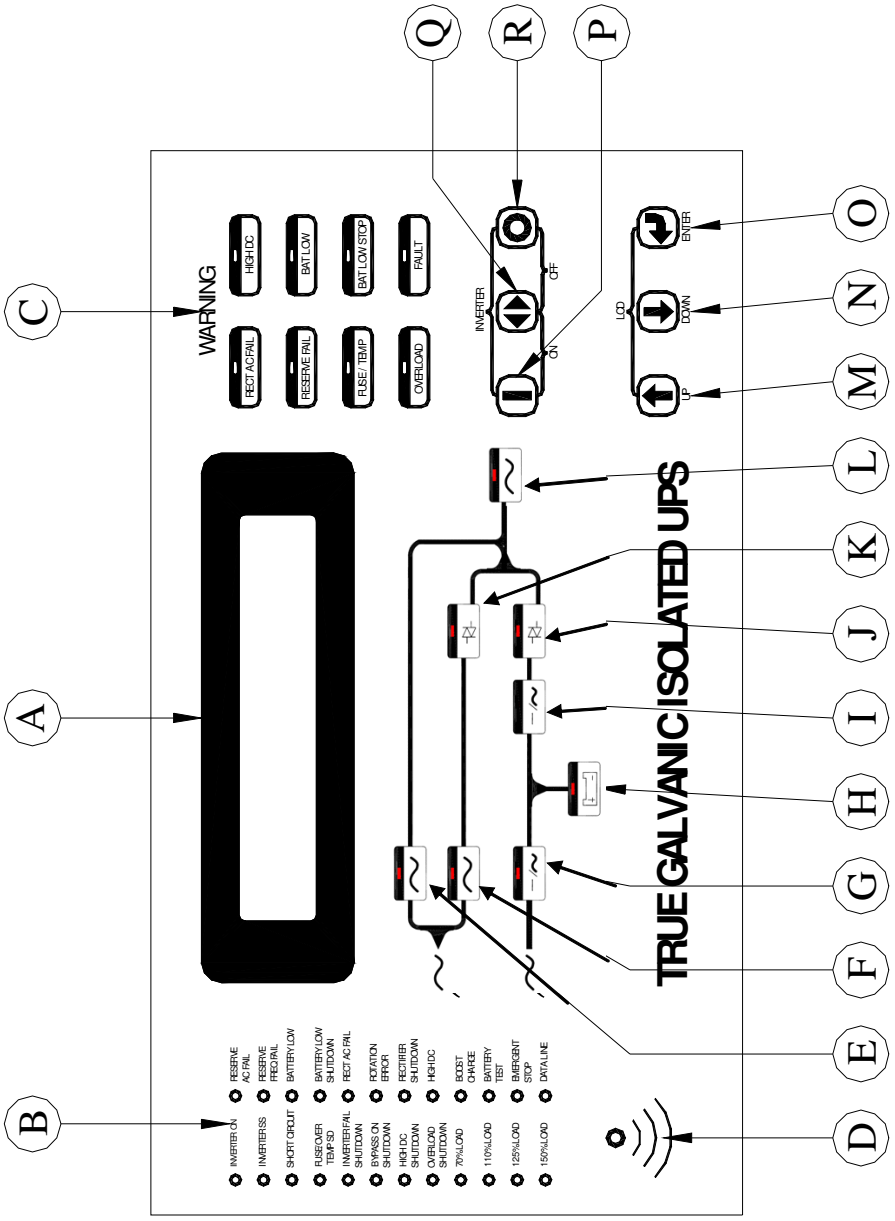
VIEW A-A

500KVA
OUTLINE DRAWING

INTER-PCB DIAGRAM



1.15 Front Panel



The front panel is located at the front of the PCB holder. It gathers the real time information of the ELI and shows them clearly to the user. It also provides switches for controlling and setting the ELI. Through this panel, the ELI can be not only a stand alone machine supplying the load, but also closely monitored by the user. Each part of the panel is explained below.

A: LCD display: Real time status, data or historical events are displayed on the LCD. The ELI parameters, real time clock, inverter, and buzzer also can be set through this LCD. The LCD is back-lighted by LEDs to provide a sharp display. In order to lengthen the LED's life time, the LED are automatically shut off 3 minutes after no key is activated, but will light up again when one of the up/down/enter key is pushed.

B: Status LEDs: 24 LEDs, representing all of the important information of the ELI, provide the most up to date information to the user. Therefore these LEDs are especially important when abnormal conditions occur. The 24 information items are as shown below:

INVERTER ON – inverter is running.

INVERTER SS – inverter static switch conducts while the reserve static switch is opened.

SHORT CIRCUIT – ELI output is in short circuit state.

FUSE/OVER TEMP SD – inverter shutdown due to either fuse broken or over temperature condition.

INVERTER FAIL SHUTDOWN – inverter shutdown due to inverter output voltage too low.

BYPASS ON SHUTDOWN – inverter shutdown due to bypass breaker being closed while the inverter is running.

HIGH DC SHUTDOWN – inverter shutdown due to overly high DC bus voltage condition while the inverter is running.

OVERLOAD SHUTDOWN – inverter shutdown due to overload of the inverter for a period over that which the inverter can endure; will restart 7 seconds after overload removed.

70% LOAD – load connected to the output is at or over 70% of the ELI rating.

110% LOAD – load connected to the output is over 110% of the ELI rating.

125% LOAD – load connected to the output is over 125% of the ELI rating.

150% LOAD – load connected to the output is over 150% of the ELI rating.

RESERVE AC FAIL – reserve AC magnitude is out of range.

RESERVE FREQ FAIL – reserve frequency is out of range.

BATTERY LOW – DC bus (or battery) is lower than 320VDC, low battery shutdown is approaching.

BATTERY LOW SHUTDOWN – inverter shutdown due to DC bus (or battery) lower than 295VDC (lower than the acceptable DC voltage of the inverter).

RECT AC FAIL – rectifier AC magnitude is out of range.

ROTATION ERROR – rectifier AC phase rotation is incorrect.

RECTIFIER SHUTDOWN – rectifier shutdown due to DC bus too high (over 445VDC), will automatically restart 30 seconds after abnormal situation has been cleared.

HIGH DC – DC voltage over 430VDC and the bus voltage will be limited at this voltage.

BOOST CHARGE – the batteries are being boost charged by the rectifier.

BATTERY TEST – batteries are being tested.

EMERGENCY STOP – inverter shutdown due to emergency stop switch pushed.

DATA LINE – blinks when data is transmitted to or received from the communication port.

C: Warning LEDs: When abnormal condition happens, these LEDs will light to warn the user according to the cause of the faulty condition. Therefore all these LEDs should be extinguished under normal condition. These LEDs are as shown below:

RECT AC FAIL – rectifier AC input is abnormal either due to AC magnitude out of the range or phase rotation error, rectifier shutdown.

RESERVE FAIL – reserve AC input is abnormal either due to AC magnitude out of range or frequency out of range.

FUSE/TEMP –Inverter fuse is blown or over temperature condition exists.

OVERLOAD – output is overloaded by over 110%, 125% or 150%.

HIGH DC – the LED will light as long as the DC voltage is over 430VDC.

BAT LOW – the LED will light as long as the DC voltage is lower than 320VDC.

BAT LOW STOP – the LED will light as long as the DC voltage is lower than 295VDC, inverter cannot start.

FAULT – the inverter is shutdown due to abnormal conditions such as overload, short circuit, high DC, fuse over temperature, bypass breaker on or emergency stop.

Since these LEDs are located behind the transparent window, the user can see them clearly without opening the door.

D: Audible (buzzer) alarm: The user should not be expected to watch the ELI all the time. Therefore, when abnormal conditions occur, an audible sound should be emitted to warn the user to check the status of the ELI. The alarm buzzer will beep under any one of the following conditions:

INVERTER IS OVERLOADED-

>110%, beep once / 3 seconds

>125%, beep once / second

>150%, beep twice / second

BACK- UP

>320VDC, beep once / 3 seconds

<320VDC, beep twice / second

<295VDC, no beeping

INVERTER IS SHORT CIRCUITED - beep continuously

FUSE BROKEN - beep continuously

HEAT SINK OVER TEMPERATURE - beep continuously

HIGH DC SHUTDOWN - beep continuously

BYPASS ON STOP - beep continuously

EMERGENCY STOP – (emergency power off) beep continuously

The buzzer will also beep once every time the inverter is switched on or off to acknowledge to the user that his key is valid and accepted.

E. Bypass LED: This LED will light when the maintenance bypass breaker is closed. When the maintenance bypass breaker is closed, the inverter cannot be switched on and will stop immediately even when inverter is already running.

F. Reserve LED: This LED will light when the reserve breaker is closed, and there is AC power supply present at the reserve terminal.

G. Rectifier LED: This LED will light when the rectifier is operating normally, meaning the rectifier Mains are within the range specified, the rotation sequence of three phases is correct, the rectifier breaker is closed, and no high DC voltage is on the bus.

H. Back-up LED: This LED will light when the ELI is in back-up mode. This is also as the indicator for battery test result. If the battery test does not pass, this LED will flash even if the ELI is not in back-up mode, to prompt the user to change the batteries.

I. Inverter LED: This LED will light when the inverter is switched on, indicating whether the inverter is running or not.

J. Inverter SS LED: This LED will light when the inverter static switch is turned on and the reserve static switch is turned off, i.e., the load is supplied from the inverter. Usually this LED will light 7 seconds after the inverter is switched on.

K. Reserve SS LED: This LED will light when the reserve static switch is turned on and the inverter static switch is turned off, i.e., the load is supplied from the reserve. Since the reserve static switch and inverter static switch will never both turn on simultaneously, the Inverter SS LED and the Reserve SS LED should never both be lit simultaneously.

L. Output LED: This LED will light when there is AC power present at the output terminal. This is an important indication to the user at to whether AC is available at the output or not.

M. Up key: This is a LCD control key. It is for moving the cursor one item upward when items are being selected or for changing the number/character forward when data or parameter of the ELI is being set.

N. Down key: This is a LCD control key. It is for moving the cursor one item downward when items are being selected or for changing the number/ character backward when data or parameter of the ELI is being set.

O. Enter key: This is a LCD control key. It is for changing backward to the previous page, and also for confirming the number/character /item is selected.

P. Inverter on switch: This is an inverter control switch. When this key is pushed with the control key simultaneously, the inverter will be switched on.

Q. Inverter control switch: This is an inverter control switch. When this key is pushed with the inverter on key simultaneously, the inverter will be switched on. Similarly, when this key is pushed with the inverter off key simultaneously, the inverter will be switched off. Thus, this key is a guard for mistaken key strokes.

R. Inverter off switch: This is an inverter control switch. When this key is pushed with the control key simultaneously, the inverter will be switched off.

2 TECHNICAL SPECIFICATION

2.1 For 208/120V Unit.

2.0 TECHNICAL SPECIFICATION FOR 208/120V UNITS

SYSTEM KVA/KW		10/8.0	20/16.0	30/24.0	40/32.0	50/40.0	60/48.0	80/64.0	100/80.0	120/96.0	160/128.0	200/160.0	240/192.0	300/240.0	400/320.0	500/400.0
INPUT/OUTPUT VOLTAGE	V	208/120V	208/120V	208/120V	208/120V	208/120V	208/120V	208/120V	208/120V	208/120V	208/120V	208/120V	208/120V	208/120V	208/120V	208/120V
INPUT V RANGE	V	± 15%	± 15%	± 15%	± 15%	± 15%	± 15%	± 15%	± 15%	± 15%	± 15%	± 15%	± 15%	± 15%	± 15%	± 15%
INPUT FREQUENCY	HZ	50/60 HZ ± 7%	50/60 HZ ± 7%	50/60 HZ ± 7%	50/60 HZ ± 7%	50/60 HZ ± 7%	50/60 HZ ± 7%	50/60 HZ ± 7%	50/60 HZ ± 7%	50/60 HZ ± 7%	50/60 HZ ± 7%	50/60 HZ ± 7%	50/60 HZ ± 7%	50/60 HZ ± 7%	50/60 HZ ± 7%	50/60 HZ ± 7%
INPUT POWER FACTOR	P.F	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
NORM INPUT CURRENT	A	30	61	92	123	153	184	245	307	368	490	612	734	918	1224	1530
MAX. INPUT CURRENT	A	38	76	115	153	192	230	306	383	460	613	765	917	1147	1530	1912
POWER WALK -IN	SEC	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
EFFICIENCY	%	99	99	99	99	99	99	99	99	99	99	99	99	99	99	99
VOLTAGE REGULATION	%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%
CURRENT LIMIT	A	46	92	138	184	230	276	367	460	552	735	918	1101	1377	1836	2295
RIPPLE VOLTAGE		0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%
RECTIFIER NO. OF PULSE		6	6	6	6	6	6	6	6	12	12	12	12	12	12	12
BATTERY		VRLA TYPE	VRLA TYPE	VRLA TYPE	VRLA TYPE	VRLA TYPE	VRLA TYPE	VRLA TYPE	VRLA TYPE	VRLA TYPE	VRLA TYPE	VRLA TYPE	VRLA TYPE	VRLA TYPE	VRLA TYPE	VRLA TYPE
NO. OF CELLS (12V)		29	29	29	29	29	29	29	29	29	29	29	29	29	29	29
VOLTAGE RANGE	V	295-410V	295-410V	295-410V	295-410V	295-410V	295-410V	295-410V	295-410V	295-410V	295-410V	295-410V	295-410V	295-410V	295-410V	295-410V
MAX CHARGE CURRENT	A	4	8	12	16	20	24	32	40	48	64	80	96	120	160	200
LOW BATT WARNING	V	320	320	320	320	320	320	320	320	320	320	320	320	320	320	320
LOW BATT SHUT DOWN	V	295	295	295	295	295	295	295	295	295	295	295	295	295	295	295
BOOST CHARGE	V	402	402	402	402	402	402	402	402	402	402	402	402	402	402	402
FLOAT CHARGE	V	390	390	390	390	390	390	390	390	390	390	390	390	390	390	390
INVERTER																
OUTPUT WAVE FORM		SINOSOIDAL	SINOSOIDAL	SINOSOIDAL	SINOSOIDAL	SINOSOIDAL	SINOSOIDAL	SINOSOIDAL	SINOSOIDAL	SINOSOIDAL	SINOSOIDAL	SINOSOIDAL	SINOSOIDAL	SINOSOIDAL	SINOSOIDAL	SINOSOIDAL
VOLT REGULATION	V	± 1%	± 1%	± 1%	± 1%	± 1%	± 1%	± 1%	± 1%	± 1%	± 1%	± 1%	± 1%	± 1%	± 1%	± 1%
100% UNBALANCED LOAD																
TOTAL HARMONIC (TD)	%	< 2%	< 2%	< 2%	< 2%	< 2%	< 2%	< 2%	< 2%	< 2%	< 2%	< 2%	< 2%	< 2%	< 2%	< 2%
FREQUENCY TOLERA	HZ	50/60 HZ ± 0.1%	50/60 HZ ± 0.1%	50/60 HZ ± 0.1%	50/60 HZ ± 0.1%	50/60 HZ ± 0.1%	50/60 HZ ± 0.1%	50/60 HZ ± 0.1%	50/60 HZ ± 0.1%	50/60 HZ ± 0.1%	50/60 HZ ± 0.1%	50/60 HZ ± 0.1%	50/60 HZ ± 0.1%	50/60 HZ ± 0.1%	50/60 HZ ± 0.1%	50/60 HZ ± 0.1%
EFFICIENCY	%	93%	93%	93%	93.5%	93.5%	94%	94.5%	94.5%	95%	95%	95%	95%	95%	95%	95%
MAX. OUTPUT PEAK CURRENT		80A	160A	240A	320A	400A	480A	640A	800A	960A	1280A	1600A	1920A	2400A	3200A	4060A
OVERLOAD 110-125%	MIN	15 MIN	15 MIN	15 MIN	15 MIN	15 MIN	15 MIN	15 MIN	15 MIN	15 MIN	15 MIN	15 MIN	15 MIN	15 MIN	15 MIN	15 MIN
OVERLOAD 125-150%	MIN	5 MIN	5 MIN	5 MIN	5 MIN	5 MIN	5 MIN	5 MIN	5 MIN	5 MIN	5 MIN	5 MIN	5 MIN	5 MIN	5 MIN	5 MIN
OVERLOAD 150%	SEC	30 SEC	30 SEC	30 SEC	30 SEC	30 SEC	30 SEC	30 SEC	30 SEC	30 SEC	30 SEC	30 SEC	30 SEC	30 SEC	30 SEC	30 SEC
STATIC SWITCH																
TRANSFER TO BY-PASS		0.2 m SEC	0.2 SEC	0.2 SEC	0.2 SEC	0.2 SEC	0.2 SEC	0.2 SEC	0.2 SEC	0.2 SEC	0.2 SEC	0.2 SEC	0.2 SEC	0.2 SEC	0.2 SEC	0.2 SEC
TRANSFER TO INVERTER		0.2 m SEC	0.2 SEC	0.2 SEC	0.2 SEC	0.2 SEC	0.2 SEC	0.2 SEC	0.2 SEC	0.2 SEC	0.2 SEC	0.2 SEC	0.2 SEC	0.2 SEC	0.2 SEC	0.2 SEC
OVERLOAD 100%		30 SEC	30 SEC	30 SEC	30 SEC	30 SEC	30 SEC	30 SEC	30 SEC	30 SEC	30 SEC	30 SEC	30 SEC	30 SEC	30 SEC	30 SEC
OVERLOAD 300%		7 SEC	7 SEC	7 SEC	7 SEC	7 SEC	7 SEC	7 SEC	7 SEC	7 SEC	7 SEC	7 SEC	7 SEC	7 SEC	7 SEC	7 SEC
ISOLATION WITH OUTPUT		YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

2.2 For 480/277V Unit.

TECHNICAL SPECIFICATION FOR 480/277V UNITS

SYSTEM KVA/KW		10/8.0	20/16.0	30/24.0	40/32.0	50/40.0	60/48.0	80/64.0	100/80.0	120/96.0	160/128.0	200/160.0	240/192.0	300/240.0	400/320.0	500/400.0
INPUT/OUTPUT VOLTAGE	V	480/277V	480/277V	480/277V	480/277V	480/277V	480/277V	480/277V	480/277V	480/277V	480/277V	480/277V	480/277V	480/277V	480/277V	480/277V
INPUT V RANGE	V	± 15%	± 15%	± 15%	± 15%	± 15%	± 15%	± 15%	± 15%	± 15%	± 15%	± 15%	± 15%	± 15%	± 15%	± 15%
INPUT FREQUENCY	HZ	50/60 HZ ± 7%	50/60 HZ ± 7%	50/60 HZ ± 7%	50/60 HZ ± 7%	50/60 HZ ± 7%	50/60 HZ ± 7%	50/60 HZ ± 7%	50/60 HZ ± 7%	50/60 HZ ± 7%	50/60 HZ ± 7%	50/60 HZ ± 7%	50/60 HZ ± 7%	50/60 HZ ± 7%	50/60 HZ ± 7%	50/60 HZ ± 7%
INPUT POWER FACTOR	P.F	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
NORM INPUT CURRENT	A	13	27	40	53	67	80	106	133	159	212	265	318	398	530	663
MAX. INPUT CURRENT	A	17	33	50	67	83	100	133	166	199	265	332	398	497	663	829
POWER WALK -IN	SEC	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
EFFICIENCY	%	99	99	99	99	99	99	99	99	99	99	99	99	99	99	99
VOLTAGE REGULATION	%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%
CURRENT LIMIT	A	20	40	60	80	100	120	159	199	239	319	398	477	597	796	995
RIPPLE VOLTAGE		0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%
RECTIFIER NO. OF PULSE		6	6	6	6	6	6	12	12	12	12	12	12	12	12	12
BATTERY		VRLA TYPE	VRLA TYPE	VRLA TYPE	VRLA TYPE	VRLA TYPE	VRLA TYPE	VRLA TYPE	VRLA TYPE	VRLA TYPE	VRLA TYPE	VRLA TYPE	VRLA TYPE	VRLA TYPE	VRLA TYPE	VRLA TYPE
NO. OF CELLS (12V)		29	29	29	29	29	29	29	29	29	29	29	29	29	29	29
VOLTAGE RANGE	V	295-410V	295-410V	295-410V	295-410V	295-410V	295-410V	295-410V	295-410V	295-410V	295-410V	295-410V	295-410V	295-410V	295-410V	295-410V
MAX CHARGE CURRENT	A	4	8	12	16	20	24	32	40	48	64	80	96	120	160	200
LOW BATT WARNING	V	320	320	320	320	320	320	320	320	320	320	320	320	320	320	320
LOW BATT SHUT DOWN	V	295	295	295	295	295	295	295	295	295	295	295	295	295	295	295
BOOST CHARGE	V	402	402	402	402	402	402	402	402	402	402	402	402	402	402	402
FLOAT CHARGE	V	390	390	390	390	390	390	390	390	390	390	390	390	390	390	390
INVERTER																
OUTPUT WAVE FORM		SINOSOIDAL	SINOSOIDAL	SINOSOIDAL	SINOSOIDAL	SINOSOIDAL	SINOSOIDAL	SINOSOIDAL	SINOSOIDAL	SINOSOIDAL	SINOSOIDAL	SINOSOIDAL	SINOSOIDAL	SINOSOIDAL	SINOSOIDAL	SINOSOIDAL
VOLT REGULATION	V	± 1%	± 1%	± 1%	± 1%	± 1%	± 1%	± 1%	± 1%	± 1%	± 1%	± 1%	± 1%	± 1%	± 1%	± 1%
100% UNBALANCED LOAD																
TOTAL HARMONIC (TD)	%	< 2%	< 2%	< 2%	< 2%	< 2%	< 2%	< 2%	< 2%	< 2%	< 2%	< 2%	< 2%	< 2%	< 2%	< 2%
FREQUENCY TOLERA	HZ	50/60 HZ ± 0.1%	50/60 HZ ± 0.1%	50/60 HZ ± 0.1%	50/60 HZ ± 0.1%	50/60 HZ ± 0.1%	50/60 HZ ± 0.1%	50/60 HZ ± 0.1%	50/60 HZ ± 0.1%	50/60 HZ ± 0.1%	50/60 HZ ± 0.1%	50/60 HZ ± 0.1%	50/60 HZ ± 0.1%	50/60 HZ ± 0.1%	50/60 HZ ± 0.1%	50/60 HZ ± 0.1%
EFFICIENCY	%	93%	93%	93%	93.5%	93.5%	94%	94.5%	94.5%	95%	95%	95%	95%	95%	95%	95%
MAX. OUTPUT PEAK CURRENT		35	69	104	139	173	208	277	347	416	555	693	831	1039	1386	1733
OVERLOAD 110-125%	MIN	15 MIN	15 MIN	15 MIN	15 MIN	15 MIN	15 MIN	15 MIN	15 MIN	15 MIN	15 MIN	15 MIN	15 MIN	15 MIN	15 MIN	15 MIN
OVERLOAD 125-150%	MIN	5 MIN	5 MIN	5 MIN	5 MIN	5 MIN	5 MIN	5 MIN	5 MIN	5 MIN	5 MIN	5 MIN	5 MIN	5 MIN	5 MIN	5 MIN
OVERLOAD 150%	SEC	30 SEC	30 SEC	30 SEC	30 SEC	30 SEC	30 SEC	30 SEC	30 SEC	30 SEC	30 SEC	30 SEC	30 SEC	30 SEC	30 SEC	30 SEC
STATIC SWITCH																
TRANSFER TO BY-PASS		0.2 m SEC	0.2 SEC	0.2 SEC	0.2 SEC	0.2 SEC	0.2 SEC	0.2 SEC	0.2 SEC	0.2 SEC	0.2 SEC	0.2 SEC	0.2 SEC	0.2 SEC	0.2 SEC	0.2 SEC
TRANSFER TO INVERTER		0.2 m SEC	0.2 SEC	0.2 SEC	0.2 SEC	0.2 SEC	0.2 SEC	0.2 SEC	0.2 SEC	0.2 SEC	0.2 SEC	0.2 SEC	0.2 SEC	0.2 SEC	0.2 SEC	0.2 SEC
OVERLOAD 100%		30 SEC	30 SEC	30 SEC	30 SEC	30 SEC	30 SEC	30 SEC	30 SEC	30 SEC	30 SEC	30 SEC	30 SEC	30 SEC	30 SEC	30 SEC
OVERLOAD 300%		7 SEC	7 SEC	7 SEC	7 SEC	7 SEC	7 SEC	7 SEC	7 SEC	7 SEC	7 SEC	7 SEC	7 SEC	7 SEC	7 SEC	7 SEC
ISOLATION WITH OUTPUT		YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

2.3 Model number charts

MODEL NUMBERS			
kVA/kW	MODEL NO.	INPUT VOLTAGE	OUTPUT VOLTAGE
	PD010B05ATT3	208Y/120	208Y/120
	PD010H05ATT3	480Y/277	208Y/120
	PD010H09ATT3	480Y/277	480Y/277
10KVA/8 KW	PD010B09ATT3	208Y/120	480Y/277
	PD020B05ATT3	208Y/120	208Y/120
	PD020H05ATT3	480Y/277	208Y/120
	PD020H09ATT3	480Y/277	480Y/277
20KVA/16 KW	PD020B09ATT3	208Y/120	480Y/277
	PD030B05ATT3	208Y/120	208Y/120
	PD030H05ATT3	480Y/277	208Y/120
	PD030H09ATT3	480Y/277	480Y/277
30KVA/24KW	PD030B09ATT3	208Y/120	480Y/277
	PD040B05ATT3	208Y/120	208Y/120
	PD040H05ATT3	480Y/277	208Y/120
	PD040H09ATT3	480Y/277	480Y/277
40KVA/ 32 KW	PD040B09ATT3	208Y/120	480Y/277
	PD050B05ATT3	208Y/120	208Y/120
	PD050H05ATT3	480Y/277	208Y/120
	PD050H09ATT3	480Y/277	480Y/277
50KVA/ 40KW	PD050B09ATT3	208Y/120	480Y/277
	PD060B05ATT3	208Y/120	208Y/120
	PD060H05ATT3	480Y/277	208Y/120
	PD060H09ATT3	480Y/277	480Y/277
60KVA/48KW	PD060B09ATT3	208Y/120	480Y/277
	PD080B05ATT3	208Y/120	208Y/120
	PD080H05ATT3	480Y/277	208Y/120
	PD080H09ATT3	480Y/277	480Y/277
80KVA/64KW	PD080B09ATT3	208Y/120	480Y/277
	PD100B05ATT3	208Y/120	208Y/120
	PD100H05ATT3	480Y/277	208Y/120
	PD100H09ATT3	480Y/277	480Y/277
100KVA/80KW	PD100B09ATT3	208Y/120	480Y/277
	PD120B05ATT3	208Y/120	208Y/120
	PD120H05ATT3	480Y/277	208Y/120
	PD120H09ATT3	480Y/277	480Y/277
120KVA/96KW	PD120B09ATT3	208Y/120	480Y/277
	PD160B05ATT3	208Y/120	208Y/120
	PD160H05ATT3	480Y/277	208Y/120
	PD160H09ATT3	480Y/277	480Y/277
160KVA/128KW	PD160B09ATT3	208Y/120	480Y/277
	PD200B05ATT3	208Y/120	208Y/120
	PD200H05ATT3	480Y/277	208Y/120
	PD200H09ATT3	480Y/277	480Y/277
*200KVA/160KW	PD200B09ATT3	208Y/120	480Y/277
	PD240B05ATT3	208Y/120	208Y/120
	PD240H05ATT3	480Y/277	208Y/120
	PD240H09ATT3	480Y/277	480Y/277
*240KVA/192KW	PD240B09ATT3	208Y/120	480Y/277
	PD300B05ATT3	208Y/120	208Y/120
	PD300H05ATT3	480Y/277	208Y/120
	PD300H09ATT3	480Y/277	480Y/277
*300KVA/240KW	PD300B09ATT3	208Y/120	480Y/277
	PD400B05ATT3	208Y/120	208Y/120
	PD400H05ATT3	480Y/277	208Y/120
	PD400H09ATT3	480Y/277	480Y/277
*400KVA/320KW	PD400B09ATT3	208Y/120	480Y/277
	PD500B05ATT3	208Y/120	208Y/120
	PD500H05ATT3	480Y/277	208Y/120
	PD500H09ATT3	480Y/277	480Y/277
*500KVA/400KW	PD500B09ATT3	208Y/120	480Y/277
* Consult Factory for application			

*Available upon request only.

3. INSTALLATION

3.1 Site & Environment Considerations

The main function of the ELI is to provide a safe, clean independent electrical supply to the sensitive load so that it is free from any random variations, disturbances or interruptions of the utility mains. The ELI also provides a constant power which is perfectly regulated in both voltage and frequency. When the mains are not available, the ELI provides optimal back-up time depending on the battery bank capacity connected to it.

The life expectancy of the ELI is 10 years and greater. Batteries are not included, because life expectancy of the batteries depend on the type of battery, the temperature and humidity of the environment in which it is installed, and the type of charger that is applied to the battery. Therefore optimal life expectancy of the ELI can be achieved by careful consideration of the site and environment.

The following precautions and recommendations should be checked in considering the site and environment of the ELI:

(a) The ELI should be located in a place with adequate ventilation (refer to the specification of the heat dissipation of the ELI). If the ELI is installed indoors, care must be taken to insure the evacuation of heat from a closed room will be exhausted.

(b) Adequate space (at least 1M) should be allowed to open the door, and unobstructed by other objects for operation or maintenance. Adequate space (at least 1M) should be allowed at the top of the ELI, to assure heat dissipation is ventilated through the openings.

(c) Do not put any objects on the top of the ELI that may obstruct ventilation. Do not locate the ELI near any heat source, machinery which produce metallic dust or powder, or any facility that will produce corrosive substances or vapor.

(d) Protect the ELI from accidental damage from fire extinguishing (sprinkler) systems. Protect the ELI from abnormal conditions with a dedicated cutoff from the incoming power.

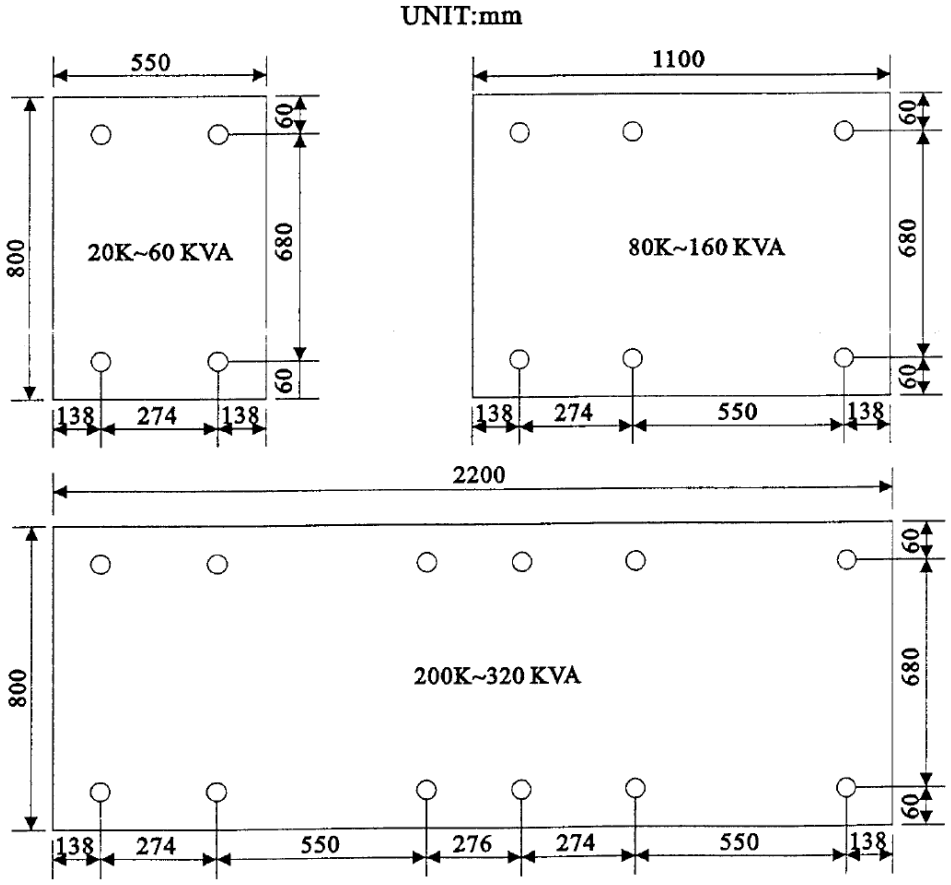
(e) It is necessary to guarantee the temperature and humidity values of the site into which the ELI will be installed. These should be within the range allowed by the specification. The ELI is capable of continuous normal operation within a temperature range of 0°(32°) to 40° (104°). For optimal performance and reliability, and to prolong lifetime, it is recommended to keep the environment temperature below 25°, and humidity below 80%.

(f) If the ELI is installed outdoors, avoid direct exposure of the ELI to the sunlight, wind, and rain. Avoid any exposure to sand or dust.

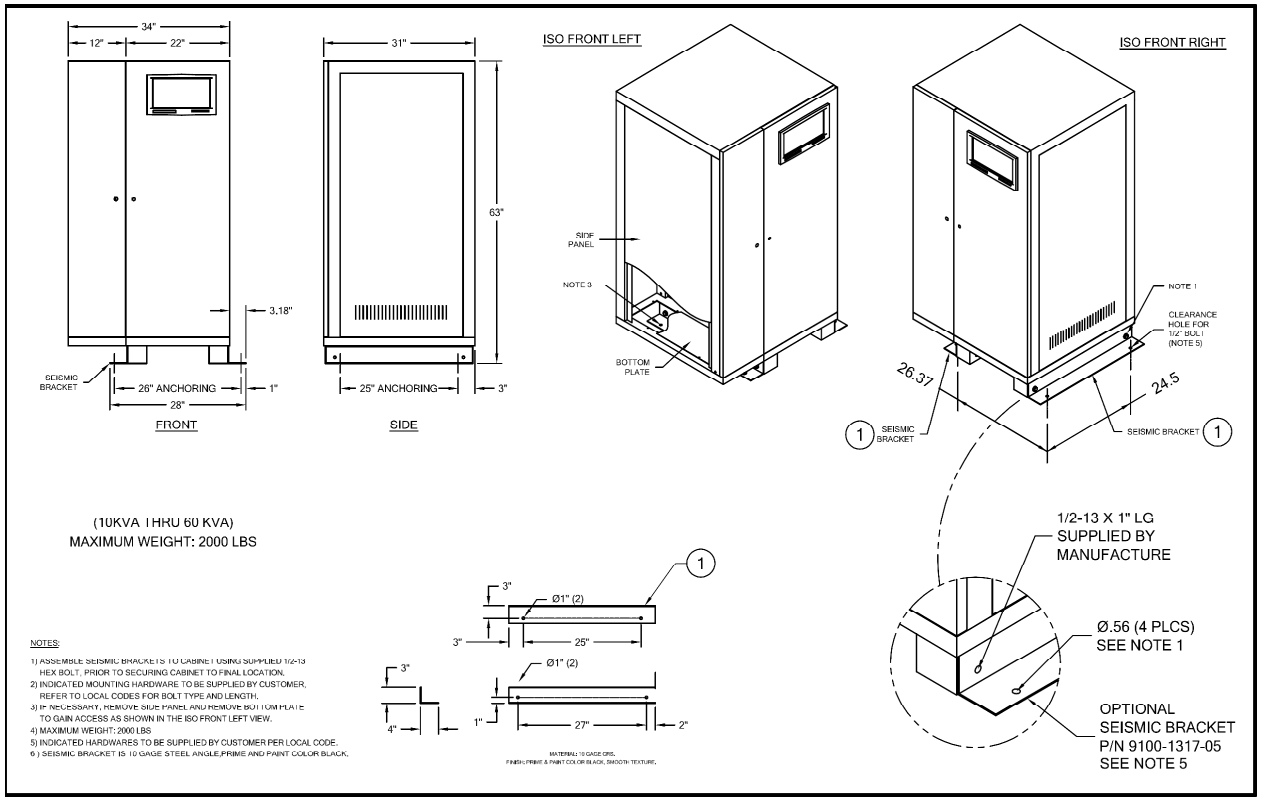
(g) The he floor loading capacity should be high enough to endure the weight of the UPS. The UPS could be mounted on the floor with four right-angled steel angles provided with the pallet, as per Detail g-1

For units with Optional Seismic anchoring Brackets refer to Detail g-2).

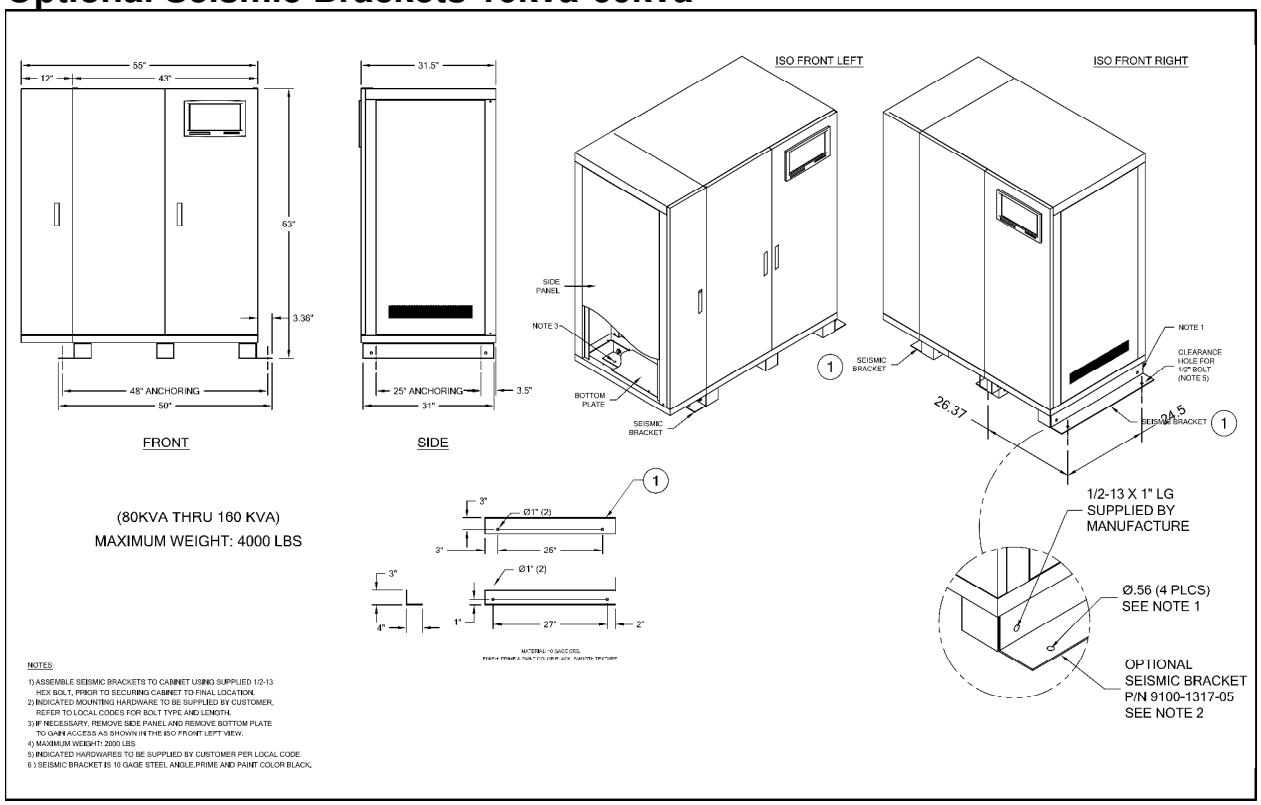
NOTE: for all floor mounting must refer to local codes.



Detail g-1



Optional Seismic Brackets 10kva-60kva



Detail g-2

Optional Seismic Brackets 80kva-200kva

For all other kva consult factory

(h) Walls, ceilings, and floors near the ELI should be preferably constructed of non-combustible materials. A portable fire extinguisher should be accessible nearby in case of hazard.

(i) Avoid accumulating combustible materials of any sort in or around the ELI system. The floor area surrounding the ELI should be kept clean so that foreign materials are not sucked into the unit, thus causing a short circuit and damage to the system.

(j) Access to the ELI room should be limited to a minimum number of operation and maintenance personnel only. The doors should be kept locked and the keys should be confined to authorized personnel only.

(k) Personnel who operate or maintain the ELI system should be proficient in normal and emergency operational procedures. New personnel should be trained and qualified prior to operating the equipment.

(l) Although the ELI has passed International EMC tests, it is recommended that the ELI not be installed near any equipment that is susceptible to electro-magnetic interference, such as computer systems, monitors, radios, etc.

(m) It is preferable to place the ELI near to the source rather than near to the load.

3.2 Unpacking

Carefully unpack the ELI, and then carefully locate the ELI onto the site which has selected, with all the points in section 3.1 kept in mind.

The ELI has had detailed production and QC testing of all the electrical and mechanical characteristics prior to shipment from the factory. Therefore, the ELI should be in proper condition upon receipt. Once received, the ELI should be first checked visually to determine if any physical damage has occurred during transportation.

Then check to insure that all the accessories/options (match with your purchase order) have been included.

- **DOOR KEY**
- **THIS INSTRUCTION MANUAL**
- **BATTERY FUSE (FOR BATTERY CABINET ONLY)**
- **SPARE SCREWS FOR COVER PLATE**
- **SPARE SCREWS FOR CONNECTION TERMINALS etc.**

Lastly, check to insure that the specification of the ELI is identical to the specification of your order. The key items in the specification you must check are:

- **RATED POWER OF THE ELI,**
- **INPUT VOLTAGE & FREQUENCY**
- **OUTPUT VOLTAGE & FREQUENCY**
- **NO. OF OUTPUT PHASES (1Φ OR 3Φ)**
- **BATTERY VOLTAGE OR CELL NO.**

Also check to insure that the necessary documentation is attached:

- **GUARANTEE CARD**
- **AGENT/SERVICE CENTER INFORMATION**

3.3. Cable Selection

The following tables list typical information concerning the KVA of the ELI versus the size and rating of the cables. Inadequate cable size or over sized breakers will create risk of fire or damage of insulation. Therefore, please use the following tables to determine the input circuit breaker rating and the size of cable for input, output and battery connections. All rating must comply with local electrical codes.

3.4 Input/Output protective device rating and BTU/HR with floor loading chart.

INPUT AND OUTPUT CURRENT CALCULATION, PROTECTIVE DEVIDE RATING, BTU/HR, FLOOR LOADING CHART

	UNIT	INPUT VOLT, 3Ø	OUTPUT VOLT, 3Ø	INPUT CURRENT	RECOMMEND OVER CURRENT PROTECTION	RECOMMEND OVER CURRENT INPUT C.B	OUTPUT CURRENT (A)	RECOMMEND OVER CURRENT PROTECTION	BATTERY CURRENT	BATT CB OR FUSE (A)	TOTAL UNIT WEIGHT	BTU/HR MAX (STANDARD MODE)	BTU/HR MAX (GREEN MODE)	UPS CAB SIZE(mm)	UPS CAB SIZE(Inches)	Floor Loading UPS CAB only
	KVA/KW	3PH, 4 WIRE	3PH, 4 WIRE	NORM/MAX	MAX AMP	INPUT C.B.	NORM/MAX	OUTPUT C.B	MAX AMP	AMP	LBS/KG	LOSS KW/BTU/HR	LOSS KW/BTU/HR	H x W x D	H x W x D	LBS/FT²
1	10 KVA/8.0KW	208/120V	208/120V	30/38	48	50	28/35A	45	30	40	840/380	.968/3374	0.51/1742	1600x864x800	63x34x31.5	175
		480/277V	480/277V	13/17	22	30	12/15	20	30	40	840/380	.968/3374	0.51/1742	1600x864x800	63x34x31.5	175
2	20KVA/16 KW	208/120V	208/120V	61/76	95	100	56/70	90	60	80	1083/490	1.98/6747	70.84/2873	1600x864x800	63x34x31.5	225
		480/277V	480/277V	27/33	42	40	24/30	40	60	80	1083/490	1.98/6747	0.84/2873	1600x864x800	63x34x31.5	225
3	30KVA/24KW	208/120V	208/120V	92/115	139	150	84/105	150	90	120	1260/570	2.97/10120	1.26/4310	1600x864x800	63x34x31.5	262
		480/277V	480/277V	40/50	63	70	36/45	50	90	120	1260/570	2.97/10120	1.26/4310	1600x864x800	63x34x31.5	262
4	40KVA/32KW	208/120V	208/120V	123/153	174	175	111/139	175	120	150	1414/640	3.56/12131	1.68/5747	1600x864x800	63x34x31.5	294
		480/277V	480/277V	53/67	84	90	48/60	80	120	150	1414/640	3.56/12131	1.68/5747	1600x864x800	63x34x31.5	294
5	50KVA/40KW	208/120V	208/120V	153/192	208	225	139/174	225	150	200	1525/690	4.44/15164	1.67/5687	1600x864x800	63x34x31.5	317
		480/277V	480/277V	67/83	104	125	60/75	90	150	200	1525/690	4.44/15164	1.67/5687	1600x864x800	63x34x31.5	317
6	60KVA/48KW	208/120V	208/120V	184/230	277	300	167/208	300	180	250	1724/780	5.33/18197	2.0/6824	1600x864x800	63x34x31.5	358
		480/277V	480/277V	80/100	125	150	72/90	100	180	250	1724/780	5.33/18197	2.0/6824	1600x864x800	63x34x31.5	358
7	80KVA/64KW	208/120V	208/120V	245/306	347	350	222/278	350	240	300	2276/1030	7.11/24263	2.67/9099	1600x1410x800	63X55.5X31.5	237
		480/277V	480/277V	106/133	167	175	96/120	150	240	300	2276/1030	7.11/24263	2.67/9099	1600x1410x800	63X55.5X31.5	237
8	100KVA/80KW	208/120V	208/120V	307/383	416	500	278/348	450	300	400	2984/1350	8.89/30329	3.33/11373	1600x1410x800	63X55.5X31.5	310
		480/277V	480/277V	133/166	208	225	120/150	200	300	400	2984/1350	8.89/30329	3.33/11373	1600x1410x800	63X55.5X31.5	310
9	120KVA/96KW	208/120V	208/120V	368/460	555	600	333/416	500	360	450	3138/1420	9.49/32395	2.97/10130	1600x1410x800	63X55.5X31.5	326
		480/277V	480/277V	159/199	249	250	144/181	225	360	450	3138/1420	9.49/32395	2.97/10130	1600x1410x800	63X55.5X31.5	326
10	160KVA/128KW	208/120V	208/120V	490/613	660	700	445/556	700	480	600	3868/1750	12.66/43193	3.96/13507	1600x1410x800	63X55.5X31.5	413
		480/277V	480/277V	212/265	331	400	193/241	300	480	600	3868/1750	12.66/43193	3.96/13507	1600x1410x800	63X55.5X31.5	413
11	200KVA/160KW *	208/120V	208/120V	612/765	956	1000	556/695	900	600	800	5746/2600	15.82/53992	4.95/16884	1600x2240x800	63X88X31.5	302
		480/277V	480/277V	265/332	415	450	241/301	400	600	800	5746/2600	15.82/53992	4.95/16884	1600x2240x800	63X88X31.5	302
12	240KVA/192KW *	208/120V	208/120V	734/917	1110	1200	666/833	1100	720	900	6299/2850	18.99/64790	5.94/20260	1600x2240x800	63X88X31.5	332
		480/277V	480/277V	318/398	498	500	289/361	500	720	900	6299/2850	18.99/64790	5.94/20260	1600x2240x800	63X88X31.5	332
13	300KVA/240KW *	208/120V	208/120V	918/1147	1434	1500	834/1043	1300	900	1200	7293/3300	23.74/80988	7.42/25326	1600x2240x800	63X88X31.5	489
		480/277V	480/277V	398/497	621	700	361/451	600	900	1200	7293/3300	23.94/80988	7.42/25326	1600x2240x800	63X88X31.5	489
14	400KVA/320KW *	208/120V	208/120V	1124/1530	1931	2000	1112/1390	1800	1200	1400	9061/4100	27.83/94942	9.89/33768	1600x3380x800	71X133X39.5	319
		480/277V	480/277V	530/663	829	1000	481/602	800	1200	1400	9061/4100	27.83/94942	9.89/33768	1600x3380x800	71X133X39.5	319
15	500KVA/400KW *	208/120V	208/120V	1530/1912	2390	2500	1389/1736	2200	1500	2000	10166/4600	34.78/118678	12.37/42210	1600x3380x800	71X178X39.5	358
		480/277V	480/277V	663/829	1036	1200	602/752	1000	1500	2000	10166/4600	34.78/118678	12.37/42210	1600x3380x800	71X178X39.5	358

	MAXIMUM BATTERY CHARGE CURRENT FOR EACH UNIT									
16	BATTERY	SEAL LEAD	NICD *	UNIT	AMP	UNIT	AMP	UNIT	AMP	
	NO. OF BATTERY/STRING	(QTY 29) (12V/CELL)	27/CELLS	10 KVA/8KW	4 AMP	80 KVA/64KW	32 A	300KVA/240KW	120 A	
	VOLTAGE RANGE	295-410V	285 ~ 415V	20KVA/16KW	8 AMP	100KVA/80KW	40 A	400KVA/350KW	160 A	
	LOW BATT VOLT (WARNINGS)	320VDC	305 VDC	30KVA/24KW	12 AMP	120KVA/96KW	48 A	500KVA/400KW	200 A	
	LOW BATT SHUT DOWN	295VDC	285 VDC	40KVA/32KW	16 AMP	160 KVA/128KW	64 A			
	BOOST CHARGE	402VDC	415VDC	50KVA/40KW	20 AMP	200KVA/160KW	80 A			
	FLOAT CHARGE	390VDC	410 VDC	60KVA/48KW	24 AMP	240 KVA/192KW	96 A			

1kw=3412 BTU/HR

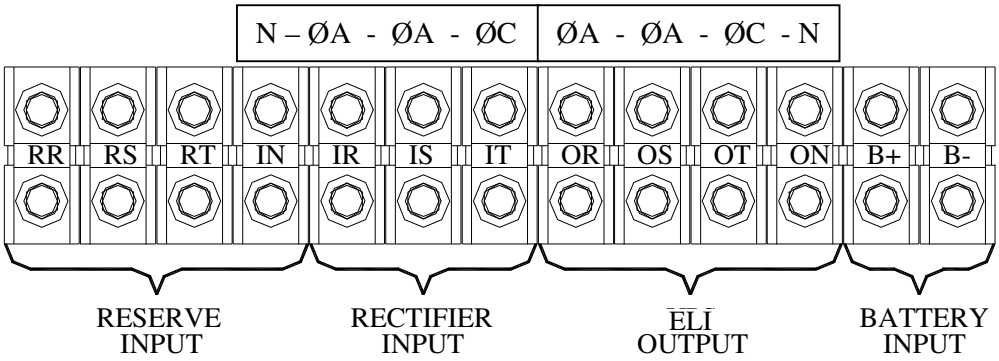
*** UNITS ARE ONLY AVAILABLE UPON REQUEST**

HB 131

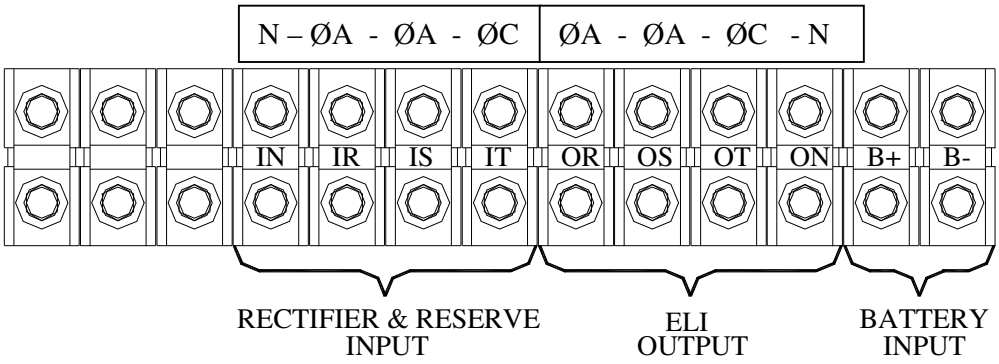
3.5 Terminal Connection

Although different sizes of ELI may have slightly different cable connection terminal blocks, all ELI connection terminal alignments falls into one of the following types:

lthough different sizes of ELI may have slightly different cable connection terminal blocks, all power connection terminal alignments falls into one of the following types:



3 PHASE INPUT / 3 PHASE OUTPUT TERMINAL WITH TWO SOURCE



3 PHASE INPUT / 3 PHASE OUTPUT TERMINAL WITH SINGLE SOURCE

Note: Tree extra terminals are installed for convenience of changing the unit to separate reserve input.

4. OPERATIONS

After all cables have been connected, and power source is available at the input terminals, the ELI is ready to operate. Before turning on any switch or breaker, once again check the following:

(a) Check that the input voltage conforms to the ELI's rated input voltage.

(b) Check that the input frequency conforms with the ELI's rated input frequency.

(c) Check that the load at the output is switched off.

(d) Check that all breakers and the battery disconnects are opened.

(e) Check that no foreign material is inside the ELI.

4.1. Startup Procedure

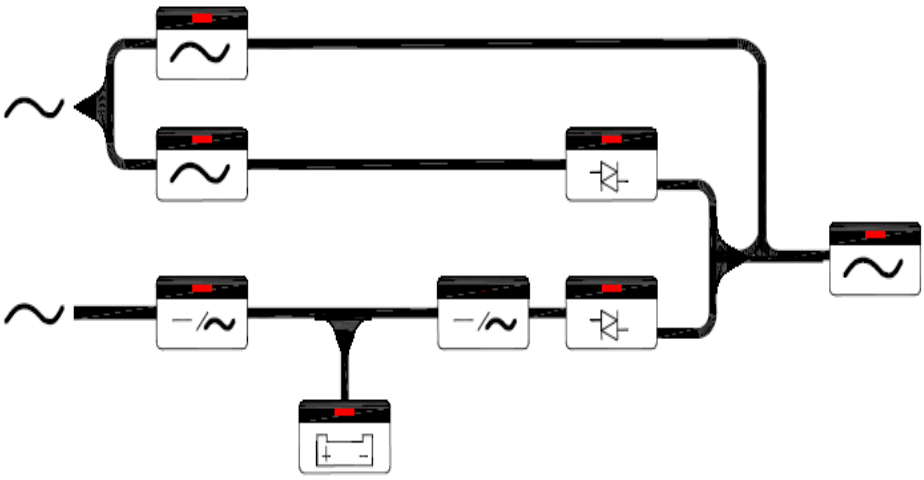
To start the ELI from complete shutoff to normal operation, follow the steps below to turn on the ELI.

(a) In case there is an extra input breaker for some special specification, please close the input breaker first.

(b) Close the reserve breaker – The reserve and output LED on the mimic panel will light up, indicating the reserve static switch loop is energized. Therefore the output has power now. The supply of power in the ELI is established and the fans will operate.

(c) Close the rectifier breaker - The rectifier will be automatically started if the power source connected is correct. Wait 30 sec for DC bus voltage to rise until the warning LEDs of "BAT LOW" and "BAT LOW STOP" go off (on the front panel). Now, the DC is already ready for the inverter.

(d) Close the (optional) battery breaker - For safety purposes, a breaker (or fuse) is employed between the batteries and the DC bus. Now the batteries will take over to supply the DC bus if rectifier mains fail.



MIMIC DISPLAY UNDER NORMAL OPERATION

(e) Push inverter ON switch – To turn on the inverter, the inverter ON switch ( ) and the control switch (◀▶) must be pressed simultaneously. The inverter will start working and inverter output will be established in 4 seconds. The load will automatically be transferred to the inverter 3 seconds later. Now the ELI is in normal operation.

(f) Check if the mimic LED is correct, as shown in the figure, above. All warning LEDs on the right side are off, two LEDs: 'INVERTER ON' and 'INVERTER SS' on the left side should be lit. If the load is over 70%, the '70% LOAD' LED will also be lit.

4.2. Shutdown Procedure

If you want to shutdown the ELI completely (no power at output or inside), please follow the steps below.

(a) Switch off the inverter – The inverter can be switched off by pressing the inverter OFF switch (O) and the control switch (◀▶) simultaneously. The load will be automatically transferred to reserve without interruption.

(b) Open the (optional) battery breaker – If you want to shutdown all the power of the ELI, continue to open the battery breaker. Now the DC bus is only supported by the rectifier.

(c) Open the rectifier breaker – Opening the rectifier breaker will further take the power source away from the DC bus, and the DC bus will start to drop slowly. After 5 minutes, the DC bus will drop to a safe level ($\leq$ 20VDC).

(d) Open the reserve breaker – Before opening the reserve breaker, power exists at the output. After opening the reserve breaker, the output (or load) will no longer have power. Therefore, before opening the reserve breaker, insure there is no critical load connected to the output.

(e) If there is input breaker, open it accordingly.

(f) At this point, all power has been cut off, and there should none of the LED's or LCD's lit. The ELI now is completely shut off.

4.3. From Inverter to Maintenance Bypass Procedure

If you want to stop the ELI for maintenance and do not stop the power supply from the load, you can follow the steps below to turn the ELI to maintenance bypass mode without interrupting the output power supply.

(a) Switch off the inverter – The inverter can be switched off by pressing the inverter OFF switch () and the control switch () simultaneously. The load will be automatically transferred to reserve without interruption.

(b) Open the (optional) battery breaker – You have to shutdown the power inside the ELI. Therefore, continue to open the battery breaker.

(c) Open the rectifier breaker – Opening the rectifier breaker will take the power source away from the DC bus, causing the DC bus to drop slowly. After 5 min., the DC bus will drop to a safe level ($\leq$20VDC).

(d) Close the bypass breaker – The reserve breaker and reserve static switch are still conducting. Therefore, when the maintenance bypass breaker is closed, power will flow through the bypass loop instead of the reserve loop because of the lower impedance of bypass loop.

(e) Open the reserve breaker – You can now open the reserve breaker to free the ELI from any power supply.

4.4. From Maintenance Bypass to Inverter Procedure

If the ELI is in maintenance bypass mode, and you want to turn the ELI to normal mode without interrupting the output AC, please follow the steps below.

(a) Close the reserve breaker – The reserve and output LED on the mimic will light, indicating the reserve static switch loop is energized, and the output has power. The power supply in the ELI is also established, and the fans will operate.

(b) Open the bypass breaker – The inverter cannot be switched on while the maintenance bypass breaker is closed (because the CPU will sense the breaker and prevent the inverter from connecting directly to AC source). Since the reserve breaker is already closed, power goes through the reserve loop if the bypass breaker is open. Thus, AC at the output will not be interrupted.

(c) Close the rectifier breaker - The rectifier will be automatically started if the power source connected is correct. Wait 30 sec for DC bus voltage to rise until the warning LEDs of “BAT LOW” and “BAT LOW STOP” go off (on the front panel). Now, the DC is already ready for the inverter.

(d) Close the (optional) battery breaker – For safety purposes, a fuse is employed in the battery to the DC bus. Now the battery will take-over to supply the DC bus if the rectifier mains fail.

(e) Push inverter ON switch – To turn on the inverter, the inverter ON switch ( ) and the control switch ( ) must be pressed simultaneously. The inverter will start working and inverter output will be established in 4 seconds. The load will automatically be transferred to the inverter 3 seconds later. Now the ELI is in normal operation.

4.5. Green Mode: customer selectable for green mode (fast transfer less than 2ms).

(a) Menu 1 – Select Menu

The Select Menu is for the user to select, via the cursor (→), the type of data the user wants to view, such as, inverter on/off, buzzer on/off, charging time and magnitude, date/time etc. The cursor (→) can be moved upward by the UP(↑) key, and can be moved downward by the DOWN(↓) key. The selection is confirmed by pressing the ENTER key (←┘), and change to the menu at which the cursor is pointing. If the item "PARAMETER SET" is selected, the LCD will jump into a screen which will ask the user to key in the password. See the figure below.

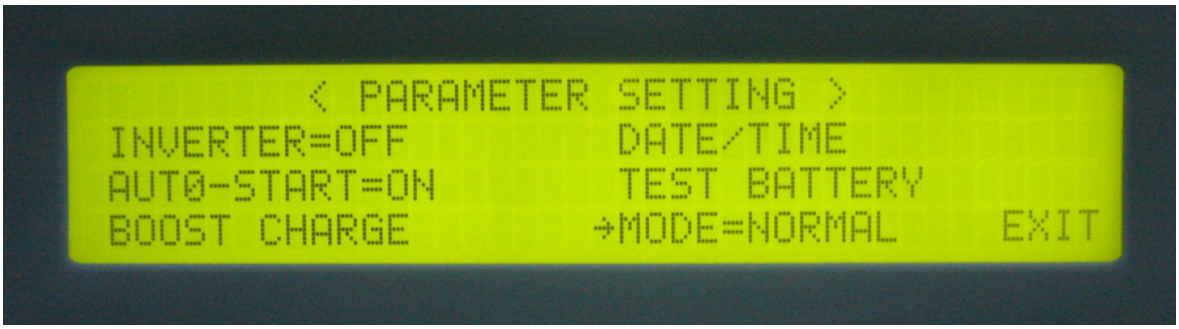
The password is a 4 digit number which can be changed upward or downward by the UP(↑) or the DOWN(↓) key, and can be confirmed by the ENTER(←┘) key. The

selection will continue if the correct password is entered, or will go back to MENU 0, the MAIN MENU, if no correct password is entered after 3 trials. The password for entering the < PARAMETER SET > menu is 1-2-3-4.

The entering of MENU 12, the OTHER SETTING menu, is permitted by another password, to be used by maintenance personnel. Users can obtain this password from the manufacturer for user's maintenance technicians.

If "EXIT" is selected (blinking instead of pointed by cursor), the screen will return to MENU 0.

Go to Model Selection Screen



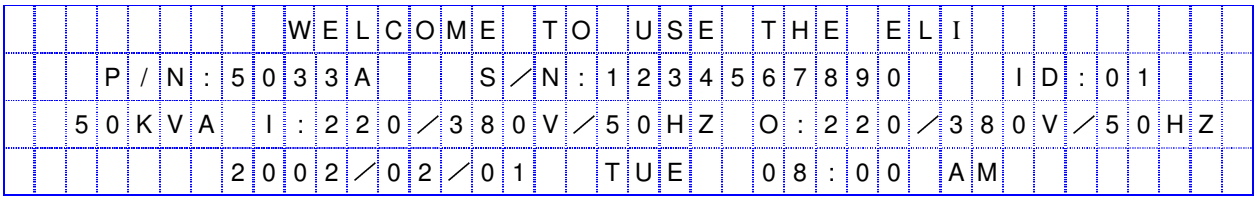
Then, Select the MODE=ECONOMIC.

Note:If you wan to Set the Operating Mode Back to NOMAL MODE, then go to the Mode Selection Screen, and then Select the MODE=NORMAL.

5. LCD DISPLAY

The LCD can display much more information than can the LEDs. In order to make the display sharp and readable, the LCD is back-lighted by LEDs. But to further prolong the life of the LEDs, the CPU will cut off power to the LEDs 3 minutes after the last keystroke of UP, DOWN or ENTER is pressed. The backlighting will resume if the UP, DOWN or ENTER key is subsequently pressed. Page displays of the LCD are described below. This screen will refresh once the system power is enabled (i.e. the default screen).

5.1. Menu 0 – Main Menu

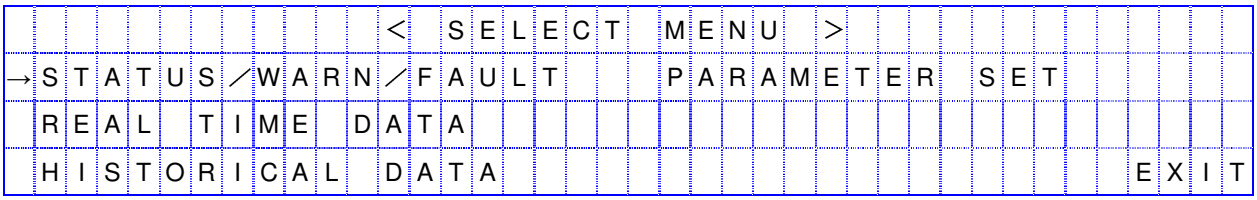


The first row will display the greeting text set by the factory. Changing the text of this row is not recommended. The parameter no. (P/N), serial number (S/N), and the identification number (ID) are displayed in the second row. While the third row will display the KVA rating, input rating and output rating of the ELI. Changing the parameter number of the second row will also change the rating displayed in the second row (rating is automatically generated by CPU inside the ELI according to the P/N number).

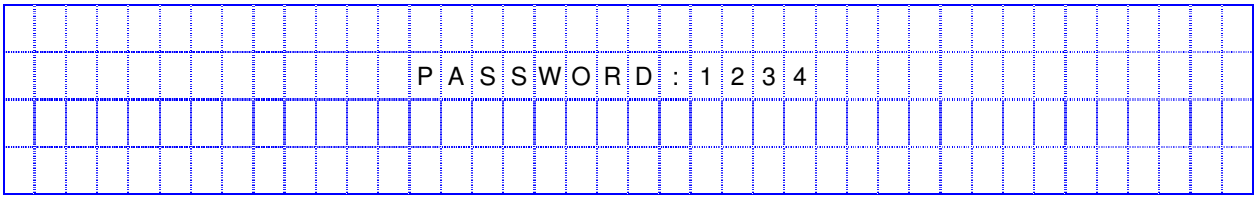
WARNING: Never change the parameter number yourself, because some parameters will be changed accordingly.

Serial number is set by factory for the convenience of maintenance personnel who may need to refer to the serial number of the ELI serviced. The identification number is set only when an external control module is connected to more than one ELI. Each ELI must have a unique number to identify itself, and it should be set by installation technical personnel after installation. The YEAR/MONTH/DATE, DAY OF THE WEEK, HOUR: MINUTE and AM (PM), from the real time clock inside the ELI, are displayed in the fourth row for user's reference and date/time stamping in the historical data when abnormal conditions occur. Pressing one of the UP, DOWN or ENTER keys will change the LCD to the MENU 1 screen.

5.2. Menu 1 – Select Menu



The Select Menu is for the user to select, via the cursor (→), the type of data the user wants to view, such as, inverter on/off, buzzer on/off, charging time and magnitude, date/time etc. The cursor (→) can be moved upward by the UP(↑) key, and can be moved downward by the DOWN(↓) key. The selection is confirmed by pressing the ENTER key (←┘), and change to the menu at which the cursor is pointing. If the item "PARAMETER SET" is selected, the LCD will jump into a screen which will ask the user to key in the password. See the figure below.



The password is a 4 digit number which can be changed upward or downward by the UP(↑) or the DOWN(↓) key, and can be confirmed by the ENTER(←┘) key. The selection will continue if the correct password is entered, or will go back to MENU 0, the MAIN MENU, if no correct password is entered after 3 trials. The password for entering the < PARAMETER SET > menu is 1-2-3-4. The entering of MENU 12, the OTHER SETTING menu, is permitted by another password, to be used by maintenance personnel. Users can obtain this password from the manufacturer for user's maintenance technicians.

If "EXIT" is selected (blinking instead of pointed by cursor), the screen will return to MENU 0.

5.3. Menu 2 – Status / Warning Menu

```
   < STATUS >                    <WARNING>
 RECTIFIER=ON
 INVERTER=OFF
 LOAD ON INVERTER
```

This menu is displayed when STATUS/WARN/FAULT is selected from MENU 1. The left hand side of this menu shows the real time status of the rectifier, inverter and static switch. The right hand side shows the warning or fault conditions, if any. Therefore, under normal conditions, the LCD display should be exactly as shown above. When minor abnormal conditions occur, these will be shown under the title < WARNING >. These will be overridden by a fault message if more serious abnormal conditions occur, and the title < WARNING > will change to < FAULT >. For example, if short circuit occurs at the output, this screen will display the following:

```
   < STATUS >                    < FAULT >
 RECTIFIER=ON                  SHORT CIRCUIT!
 INVERTER=OFF
 LOAD ON INVERTER
```

The inverter should be shut off under a short circuit condition. Since the CPU will detect a short circuit, and in order to avoid unnecessary tripping and damage to the breaker, the static switch remains connected to the inverter (will not transfer to reserve).

Listed below are all the warning conditions that can be displayed (arranged in order of priority, starting with the highest priority):

1st row : BYPASS ON / RECT AC FAIL / RECTIFIER PHASE ERROR / RESERVE FREQ. ERROR

2nd row : 170% OVERLOAD / 150% OVERLOAD / 125% OVERLOAD / 110% OVERLOAD

3rd row : BATTERY LOW STOP / BATTERY LOW / BATTERY BAD / BATTERY GND FAULT / BATTERY TESTING

Lists below are all the fault conditions that can be displayed:

1st row : HIGH DC SHUTDOWN

2nd row: SHORT CIRCUIT! / FUSE/OVERHEAT / OVERLOAD SHUTDOWN / EMERGENCY STOP / INVERTER ABNORMAL

3rd row : BYPASS ON SHUTDOWN

The UP (↑) or DOWN (↓) key has no function in this menu. The screen will go back to MENU 1 – the SELECT menu, when ENTER (←┘) is pressed.

5.4. Menu 3 – Real Time Data Menu

```
          < REAL TIME DATA >
→RECTIFIER DATA      OTHER DATA
 RESERVE DATA
 OUTPUT DATA                        EXIT
```

This menu is displayed when the REAL TIME DATA is selected from MENU 1. The cursor (→) is used to select the type of real time data the user wants to view, such as, RECTIFIER DATA, RESERVE DATA, OUTPUT DATA, OTHER DATA etc. The cursor (→) can be moved upward by the UP (↑) key, and can be moved downward by the DOWN (↓) key. The selection is confirmed by pressing the ENTER (←┘), changing the menu to that at which the cursor is pointing.
If "EXIT" is selected (blinking instead of pointed by cursor), the screen will go back to the MENU 1- the SELECT MENU.

5.5. Menu 4 – Historical Event Menu

			<		D	A	T	E	/	T	I	M	E	/	E	V	E	N	T	S		>				R	U	N	:	2	1	Y	R	0	3	M	O	
	2	0	0	0	\	0	3	\	2	9			0	9	:	3	2			S	H	O	R	T		C	I	R	C	U	I	T	!					
	2	0	0	0	\	1	2	\	0	1			2	2	:	1	5			S	H	O	R	T		C	I	R	C	U	I	T	!					
	2	0	0	1	\	0	1	\	1	0			1	5	:	4	7			H	I	G	H		D	C		S	H	U	N	T	D	O	W	N			

This menu is displayed when HISTORICAL DATA is selected from MENU 1. The records stored in EEPROM when abnormal events occur are displayed in this menu. The record display starts with the date/ time stamp of the abnormal condition, making it is possible for the user or maintenance personnel to trace the occurrence. Seventy-seven (77) records can be stored in one EEPROM, which can be increased to 154 records with a second EEPROM. These records will not be erased by cutting off of the power supply or complete shutdown of the ELI, i.e., they will be kept in EEPROM until overwritten by the 78th (or the 155th) record.
Three records can be displayed concurrently on the screen. The records displayed (once this menu is opened) are the three most recent records in the EEPROM. The displayed records will move one record upward when the UP (↑) key is pressed, and move one record downward when the DOWN (↓) key is pressed.

The abnormal conditions that can be displayed are listed below:

HIGH DC SHUTDOWN / SHORT CIRCUIT! / FUSE/OVERHEAT / OVERLOAD SHUTDOWN / EMERGENCY STOP / INVERTER ABNORMAL / BYPASS ON SHUTDOWN

Also, in the top right corner the screen, the ELI run time is displayed in year/month for the reference of the user or maintenance personnel. This can be used to estimate recurring maintenance intervals.
The screen will go back to MENU 1- SELECT MENU by pressing the ENTER (←┘) key.

5.6. Menu 5 – Parameter Setting Menu

```
      < PARAMETER SETTING >
→INVERTER=ON/OFF      DATE/TIME
 BUZZER=ON/OFF
 BOOST CHARGE                  EXIT
```

This menu is displayed when < PARAMETER SET > is selected from MENU 1, and the correct password has been entered. The cursor (→) is used to select the parameter the user wants to set, e.g., INVERTER ON/OFF, BUZZER ON/OFF, BOOST CHARGE, DATE/TIME etc. The cursor (→) can be moved upward by the UP (↑) key, and can be moved downward by the DOWN (↓) key. The selection is confirmed by pressing the ENTER (←┘) key.

The first item that can be set is the INVERTER ON/OFF. When this is selected, "INVERTER ON/OFF" will be displayed, where the "ON" will blink if the inverter status is on, and the "OFF" will blink if the inverter status is off. The intended status can be changed by UP (↑) or DOWN (↓) key, and is confirmed by ENTER (←┘) key. Then "INVERTER = ON" will be displayed if "ON" is selected or "INVERTER = OFF" will be displayed if "OFF" is selected, the ELI will switch the inverter on or off according to the selection.

The second item that can be set is the BUZZER ON/OFF. When selected, "BUZZER ON/OFF" will be displayed, where the "ON" will blink if the buzzer status is on, and the "OFF" will blink if the buzzer status is off. The intended status can be changed by UP (↑) or DOWN (↓) key, and is confirmed by ENTER (←┘) key. Then "BUZZER = ON" will be displayed if "ON" is selected or "BUZZER = OFF" will be displayed if "OFF" is selected, and the ELI will switch on or off the buzzer according to your selection.

The third item that can be set is the BOOST CHARGE. When this is selected, the screen will jump to MENU 10, the BOOST CHARGE SETTING MENU (the setting method will be explained later).

The forth item that can be set is the DATE/TIME. When this is selected, the screen will jump to MENU 11, the DATE TIME SETTING MENU (the setting method will be explained later).

If "EXIT" is selected (blinking instead of pointed by cursor), the screen will go back to the MENU 1- the SELECT MENU.

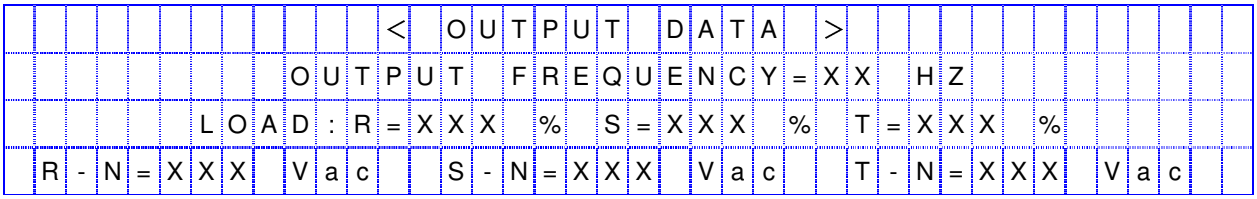
5.7. Menu 6 – Rectifier Data Menu

```
          < RECTIFIER DATA >
      RECTIFIER FREQUENCY=XX HZ
  R-N=XXX Vac  S-N=XXX Vac  T-N=XXX Vac
```

This menu is displayed when <RECTIFIER DATA> is selected from MENU 3 – the REAL TIME DATA MENU. It is a data display menu which shows real time data on the rectifier, such as, RECTIFIER FREQUENCY, R-N/S-N/T-N VOLTAGE, etc. The phase to phase voltage display is also available when input is a delta (Δ) connected source.

The UP (↑) or DOWN (↓) keys have no function in this menu. The screen will go back to MENU 3 – the REAL TIME DATA menu, when ENTER (←┘) is pressed.

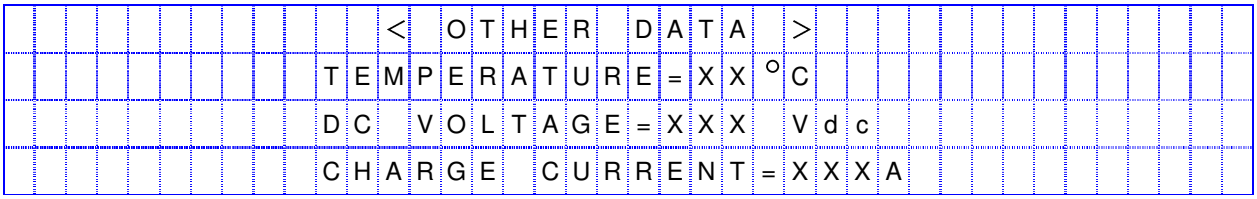
5.8. Menu 7 – Output Data Menu



This menu is displayed when <OUTPUT DATA> is selected from MENU 3 – the REAL TIME DATA MENU. It is a data display menu, which shows real time data on the output and load, such as, OUTPUT FREQUENCY, LOAD % OF R/S/T, OUTPUT R-N/S-N/T-N VOLTAGE, etc. The phase to phase voltage display is also available when input is a delta (Δ) connected source.

The UP (↑) or DOWN (↓) keys have no function in this menu. The screen will go back to MENU 3 – the REAL TIME DATA menu, when ENTER(←┘) is pressed.

5.9. Menu 8 – Other Data Menu



This menu is displayed when <OTHER DATA> is selected from MENU 3 – the REAL TIME DATA MENU. It is a data display menu, which shows real time data on the ELI, such as, TEMPERATURE, DC VOLTAGE, CHARGE OR DISCHARGE CURRENT etc. If the ELI is in normal operation mode, the data in the last row is the charging current of the batteries. The label is "CHARGE CURRENT =" (see the figure shown above). If the ELI is in back-up mode, the data in the last row will be the discharging current of the batteries, and the title will be "DISCHARGE CURRENT =" (see the figure shown below).

```
          < OTHER DATA >
     TEMPERATURE = XX °C
     DC VOLTAGE = XXX Vdc
   DISCHARGE CURRENT = XXXA
```

The UP (↑) or DOWN (↓) keys have no function in this menu. The screen will go back to MENU 3 – the REAL TIME DATA menu, when ENTER(←┘) is pressed.

5.10. Menu 9 – Reserve Data Menu

```
          < RESERVE DATA >
     RESERVE FREQUENCY = XX HZ
R-N = XXX Vac  S-N = XXX Vac  T-N = XXX Vac
```

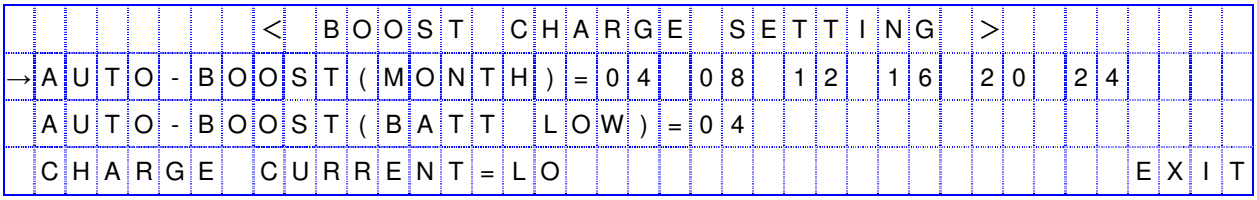
This menu is displayed when <RESERVE DATA> is selected from MENU 3 – the REAL TIME DATA MENU,. It is a data display menu, which shows real time data of the reserve input, such as, RESERVE FREQUENCY, R-N/S-N/T-N VOLTAGE, etc., for the user's reference. The phase to phase voltage display is also available when reserve input is a delta (△) connected source.

The UP (↑) or DOWN (↓) keys have no function in this menu. The screen will go back to MENU 3 – the REAL TIME DATA menu, when ENTER (←┘) is pressed.

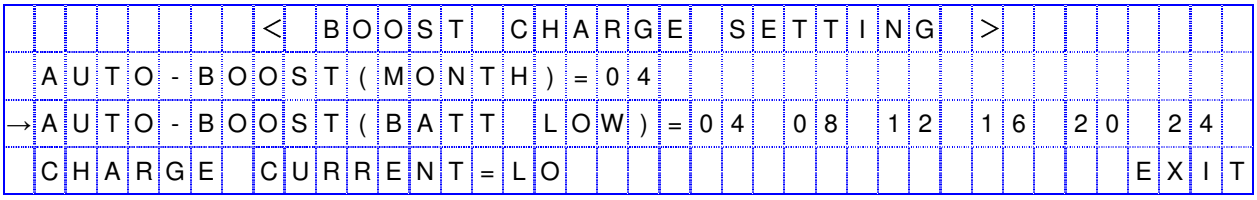
5.11. Menu 10 – Boost Charge Setting Menu

```
        < BOOST CHARGE SETTING >
→AUTO-BOOST(MONTH) = 04
 AUTO-BOOST(BATT LOW) = 08
 CHARGE CURRENT = LO                EXIT
```

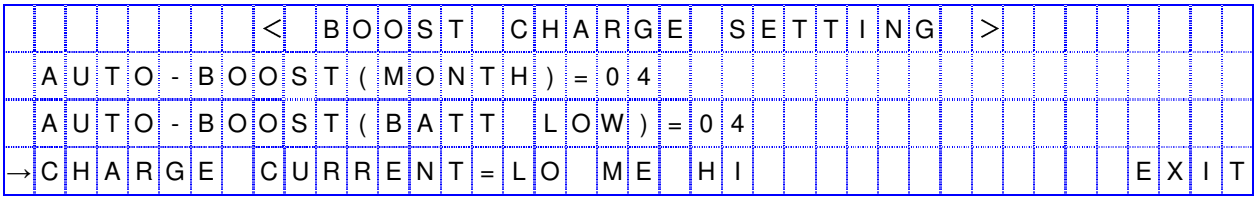
This menu is displayed when the item < BOOST CHARGE > is selected from MENU 5, the PARAMETER SETTING menu. The user can change the charger parameters through this menu. The cursor (→) can be moved upward by the UP (↑) key, and can be moved downward by the DOWN (↓) key. The selection is confirmed by pressing the ENTER (←┘) key. See in the above figure.



When AUTO-BOOST (MONTH) is selected, all the values that can be selected will be shown (04/08/12/16/20/24). The battery will be boost charged once every month. The boost charge time is set by this row, with the values being “hours”. The current value (or the value being selected) will flash, and is confirmed by the ENTER (←┘) key. Longer times are selected for bigger batteries according to the needs of the user. Refer to the figure above.



When AUTO-BOOST (BATT LOW) is selected, all the value that can be selected will be shown (04/08/12/16/20/24). The battery will be boost charged every time the battery has been discharged to below 12V/battery or 2V/cell. The boost charge time is set by this row, with the values being “hours”. The current value (or the value being selected) will flash and is confirmed by the ENTER (←┘) key. Longer times are selected for bigger batteries according to the need of the user. See the figure above.



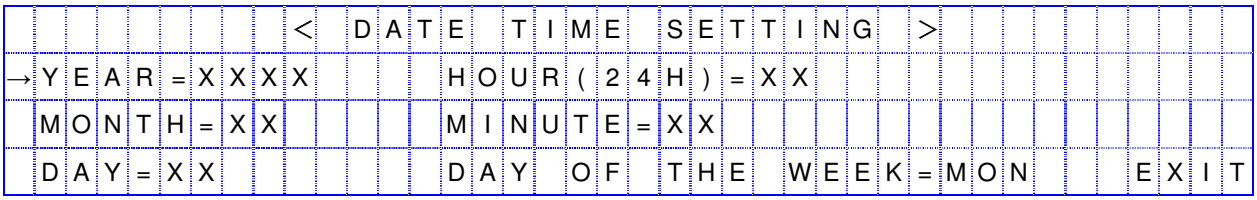
When CHARGE CURRENT is selected, the values that can be selected will be shown (LO/ME/HI). When the batteries are being boost-charged for whatever the reason, the charging current will be limited by a value according the setting in this row. The current value (or the being selected) will flash, and is confirmed by the ENTER (←┘) key.

The value can be selected by a rules listed below:

BACK-UP TIME	**SETTING**
10 – 30 MIN	**LO**
30MIN – 1HOUR	**ME**
> 1 HOUR	**HI**

If "EXIT" is selected (blinking instead of pointed by cursor), the screen will go back to the MENU 5- the PARAMETER SETTING menu.

5.12.Menu 11 – Date/Time Setting Menu



This menu is displayed when the item < DATE/TIME > is selected from MENU 5, the PARAMETER SETTING menu. The user can change the YEAR/MONTH/DAY/, HOUR/MINUTE/DAY OF THE WEEK of the real time clock through this menu. Once this menu is opened, the present value in the real time clock will be shown. The cursor (→) can be moved upward by the UP(↑) key, and can be moved downward by the DOWN(↓) key to the item the user wants to change. The selection is confirmed by pressing the ENTER (←┘) key. See the figure above. The values to be entered are numbers except the DAY OF THE WEEK (MON, TUE… provided for user selection). The values that can be entered are restricted to certain values according to which item is being set (the values are listed below).

- YEAR : 1998 – 2097

- MONTH : 01-12

- DAY : 01 – 31 (internal calendar will correct an error if 31 is entered to a 30 day month)

- HOUR : 0 – 23

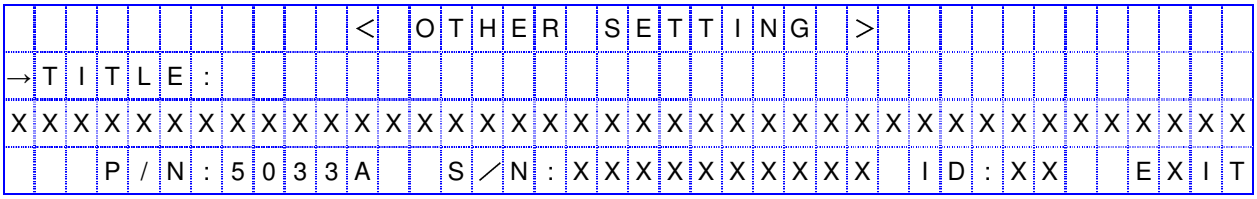
- MINUTE : 0 - 59

- DAY OF THE WEEK : MON, TUE, WED, THU, FRI, SAT, SUN

The value can be increased upward by the UP (↑) key, and can be decreased downward by the DOWN (↓) key. The value will flash as it is being set. One can continue to push the UP(↑) or the DOWN (↓) key until the desired value is displayed. Again, the selection is confirmed by pressing the ENTER(←┘) key. Thus, the values in the real clock will be changed according to the values entered.

If "EXIT" is selected (blinking instead of pointed by cursor), the screen will go back to the MENU 5- the PARAMETER SETTING menu.

5.13.Menu 12 – Other Setting Menu



This menu is displayed when the item PARAMETER SET is selected from MENU 1, the SELECT MENU and the correct password is entered. Note that this is a different password from the password used to enter PARAMETER SETTING menu, and should only be available to maintenance personnel. This menu can change the TITLE, P/N, S/N, ID etc. Once this menu is opened, the current value in the EEPROM will be shown. The cursor (→) can be moved upward by the UP (↑) key, and can be moved downward by the DOWN (↓) key to the item one wants to change. The selection is confirmed by pressing the ENTER (←┘) key.

See the figure above. Once either one of the items is selected, the values of that item are cleared; now waiting for new values to be entered. The values to be entered are either alpha or numeric, except the ID for which only numbers are allowed. The values that can be entered are restricted to certain values according to which item is being set (the values are listed below).

- TITLE : □, A – Z, 0 - 9

- P/N : □, A – Z, 0 - 9

- S/N : □, A – Z, 0 - 9

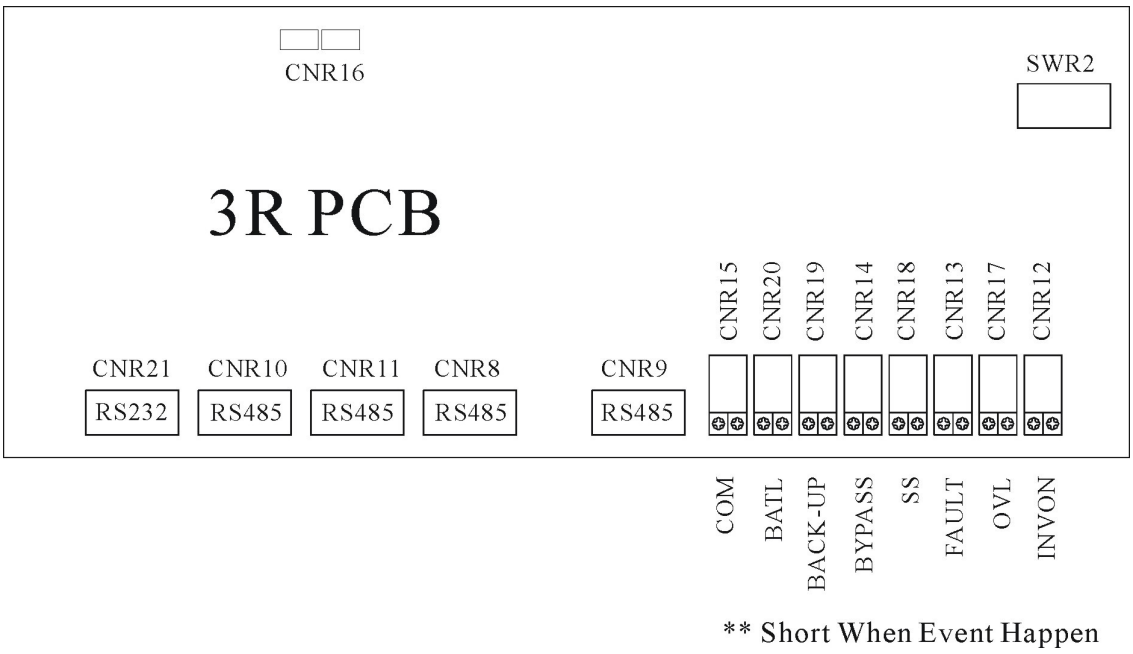
- ID : 0 - 31

**** where □ means blank**

If "EXIT" is selected (blinking instead of pointed by cursor), the screen will go back to the MENU 5, the PARAMETER SETTING menu.

6. INTERFACE CONNECTIONS

All interfaces are connected from 3R PCB. See the figure below.



** Short When Event Happen

6.1. Dry Contacts

8 terminals of dry contacts are provided. These terminals are normally open (non-conducting). When an event occurs, the terminal will close (conduct). Maximum contact rating is 16A/250VAC(16A/30VDC). The events are shown below.

INVON – Closed whenever the inverter is on, open when the inverter is off.

OVL – Closed whenever the ELI is overloaded.

FAULT – Closed when the ELI encounters a fault condition, such as high DC shutdown, short circuit, fuse/over-heat, overload shutdown, emergency stop, inverter abnormal, bypass on shutdown. The contact is latched until manual reset (off switch) or 30 seconds after the fault condition is removed.

SS – Closed when the inverter static switch is conducting, open when the reserve static switch is conducting (The two static switches will never conduct simultaneously).

BYPASS – Closed when the maintenance bypass breaker is closed, open when the breaker is opened.

BACK-UP –Closed when the inverter (running) is being backed up by the battery.

BATL – Closed when the inverter is using battery power and the batteries are about to be exhausted.

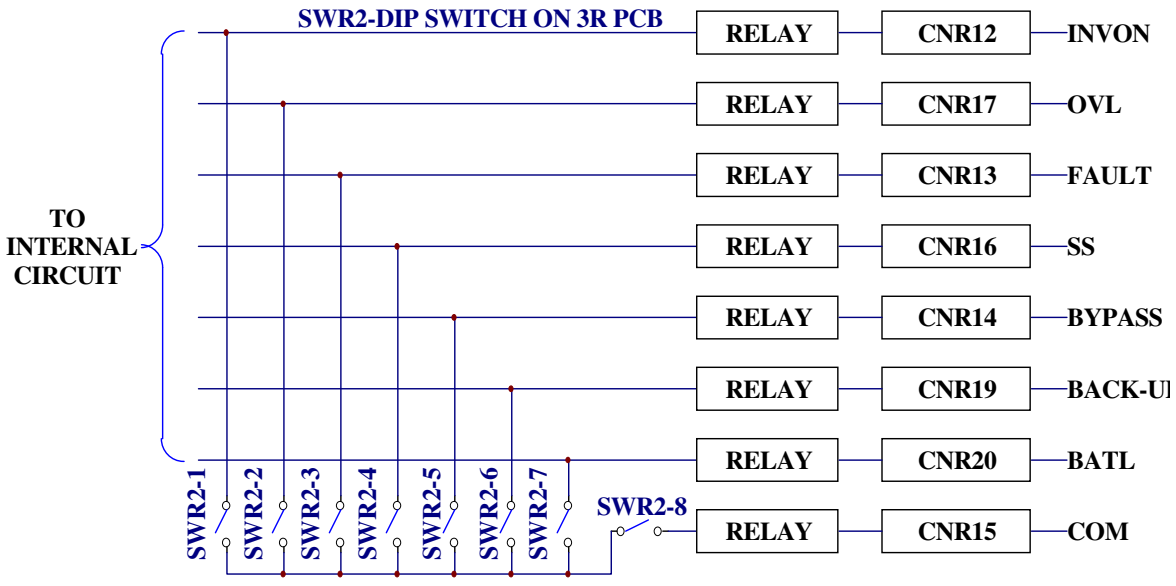
COM – This contact can be configured as the OR result of the signals described above. SWR2-1 (dip-switch pin 1) ~ SWR2-7 (dip-switch pin 7) can select one of the seven signals described above and SWR2-8 is the COM enable switch. Please refer to the dip-switch of SWR2 on the 3R PCB and the following examples and diagram.

Example 1:

If two contacts for BACK-UP are required. Switch on SWR2-6 & SWR2-8, then both CNR19 & CNR15 will close when the unit goes to back-up.

Example 2:

If one contact for OVL & FAULT is required. Switch on SWR2-2 & SWR2-3, then the CNR15 will close when either OVL or FAULT condition happens. Of course CNR17 will close when OVL happens and CNR13 will close when FAULT happens.



6.2. External Shutdown

2 pairs of terminals CNR 16 are provided for external shutdown. 10mA is needed for turning on the internal photo-coupler. The user can use this terminal to shutdown the ELI when emergency conditions occur, such as fire, short circuit etc.

6.3. DB9 Connection

Four RS-485 and one RS-232 are provided to communicate with more sophisticated (option) modules. Each connector is especially dedicated to one type of external module. The following are some connection examples of optional modules.

CNR21 (RS-232) ⇔ UPSCOM- Software for PC Monitoring、SNMP Card

CNR9 (RS-485) ⇔ DCMAN- Battery Monitoring Module

CNR10 (RS-485) ⇔ UPSCAN- Remote Control Panel

CNR12,13,14,15,17,18,19 (RS-485) ⇔ UPSCALL- Auto Dialing Module

CNR11 ⇔ for transferring RS-485 into RS-232

7. OPTIONS

This chapter supplies a brief introduction to all the options that are available for the 3 Phase ELI. Similar products from other manufacturer will not fit into this ELI. Additionally, the installation of each option needs professional, trained personnel.

7.1 **Reserved**

7.2. Remote Control Panel – UPSCAN™

UPSCAN™, remote control panel, is a hand held display module with LCD (the same as the LCD of the ELI). It is used to switch, on or off, any or all of the ELI systems. When any ELI encounters an emergency condition, the system will warn the user immediately. All the ELI status, data or commands are transmitted to external modules through 4 RS-485 ports (for long distance communication under harsh environment).

UPSCAN™ can monitor 1 to 99 units of UPSs with DB9 connections in series from distance of up to 1000M.

7.3. Software for PC Monitoring – UPSCOM™

UPSCOM™ is a hardware/software combination installed on a PC to monitor multiple ELIs with DB9 connection in series. The connector on the ELI's side is RS-485 (for long distance transmission); therefore an RS-485 ⇔ RS-232 adapter (hardware) is required to modify the signal. The software and hardware together form a package called ELICOM™. See the ELICOM™ specification for further information.

7.4. Auto Dialing Module – ELICALL™

In case abnormal situations occur, UPSCALL™ will automatically dial specified phone numbers to inform management to take prompt action. The module, with built-in 23A12V battery, consumes power only when in the process of dialing so as to be operated under AC source failure. Furthermore, with functions of multiple phone number setting and dialing, UPSCALL™ has no need of dedicated lines, and can offer user a prompt and convenient way for monitoring the ELI. See the UPSCALL™ specification for further information.

7.5. Battery Monitoring Module - DCMAN™

DCMAN™ is an intelligent module for watching each individual battery in the battery bank in a simple and direct way. DCMAN™ can distinguish for repair the initially aged battery under safe conditions, thus prolonging the battery life expectancy. One module can monitor up to 64 pieces of 12V battery. DCMAN will sound an alarm in case of an abnormal situation, such as battery failure, cable abnormal disconnection, or if the remaining battery charge is less than the parameter set in the module. See the DCMAN™ specification for additional information.

7.6. Input Transient Voltage Surge Suppressor (TVSS)

TVSS is a DIN rail mounted device, connected to the Inverter input. Its plug-in phase modules are easily replaceable. The device contains energy absorbing components and has a two-stage protection. When a protection component is damaged by absorbed transient, the module will display a flag indicating a need for replacement.

7.7 Web/SNMP Card:

This option is a web enabled monitoring device for a unit with Internet or network connection. The SNMP/Web card can monitor the Inverter on the network through a standard web browser.

7.8 Output Aux Circuit breakers

7.9 Higher kAIC Circuit breakers

7.10 Delta Input

7.11 Dual input

7.12 Seismic Bracket

7.13 Factory Set Green Mode

7.14 Battery cabinet and battery run time.

90 minutes (UL924) battery charts.

90 MINUTES BATTERY CONFIGURATION												
PART NO.		7050-384	7050-385	7050-386	7050-387	7050-388	7050-389	7050-390	7050-391	7050-392	7050-393	7050-394
KVA		**10KVA**	**20KVA**	**30KVA**	**40KVA**	**50KVA**	**60KVA**	**80KVA**	**100KVA**	**120KVA**	**160KVA**	**200KVA**
KW		**8KW**	**16KW**	**24KW**	**32KW**	**40KW**	**48KW**	**64KW**	**80KW**	**96KW**	**128KW**	**160KW**
CB / FUSE		30A	70A	100A	125A	175A	200A	250A	300A	375A	500A	700A
MAX DC CURRENT		29.2A	58.5A	87.7A	116.3A	145A	175A	232A	289A	347A	463A	579A
DC VOLT		348V	348V	348V	348V	348V	348V	348V	348V	348V	348V	348V
STANDARD BATTERY	Batt Qty	29	2 X 29 = 58	2 X 29 = 58	3 X 29 = 87	3 X 29 = 87	4 X 29 = 116	5 X 29 = 145	3 X 29 = 87	N/A	N/A	N/A
	Cab	D	D	D	2D	2D	2D	3D	4D			
FRONT TERMINAL BATTERY	Batt Qty	29	29	29	29	2 X 29 = 58	2 X 29 = 58	2 X 29 = 58	4 X 29 = 116	3 X 29 = 87	4 X 29 = 116	5 X 29 = 145
	Cab	D	D	D	D	2D	2D	2D	3D	3D	4D	5D
D= Cabinet dimensions 51w X 70h X 30.5d												

(Battery cabinets, painted black)

Other than 90 minutes, UL1778

BATTERY CONFIGURATION, UL 1778: 5 MIN~60 MIN							
PART NO.			7050-384	7050-385	7050-386	7050-387	7050-388
KVA			10KVA	20KVA	30KVA	40KVA	50KVA
KW			8KW	16KW	24KW	32KW	40KW
TIME IN MINUTES		-005	29X17AH C	29X25AH C	29X35AH C	29X50AH C	29X65AH C
		-010	29X17AH C	29X35AH C	29X50AH C	29X80AH 2C OR D	29X90AH 2C OR D
		-015	29X25AH C	29X35AH C	29X50AH C	29X90AH 2C OR D	29X100AH 2C OR D
		-020	29X25AH C	29X50AH C	29X80AH 2C OR D	29X100AH 2C OR D	29X120AH 2C OR D
		-030	29X35AH C	29X65AH C	29X100AH 2C OR D	29X120AH 2C OR D	58X80AH 3C OR D
		-045	29X50AH C	29X100AH 2C OR D	58X80AH 3C OR D	58X100AH 3C OR D	58X120AH 3C OR D
		-060	29X50AH C	29X110AH 2C OR D	58X80AH 3C OR D	58X110AH 3C OR D	87X100AH 4C OR 2D
CB / FUSE			30A	70A	100A	125A	175A
MAX DC CURRENT			29.2A	58.5A	87.7A	116.3A	145A
DC VOLT			348V	348V	348V	348V	348V

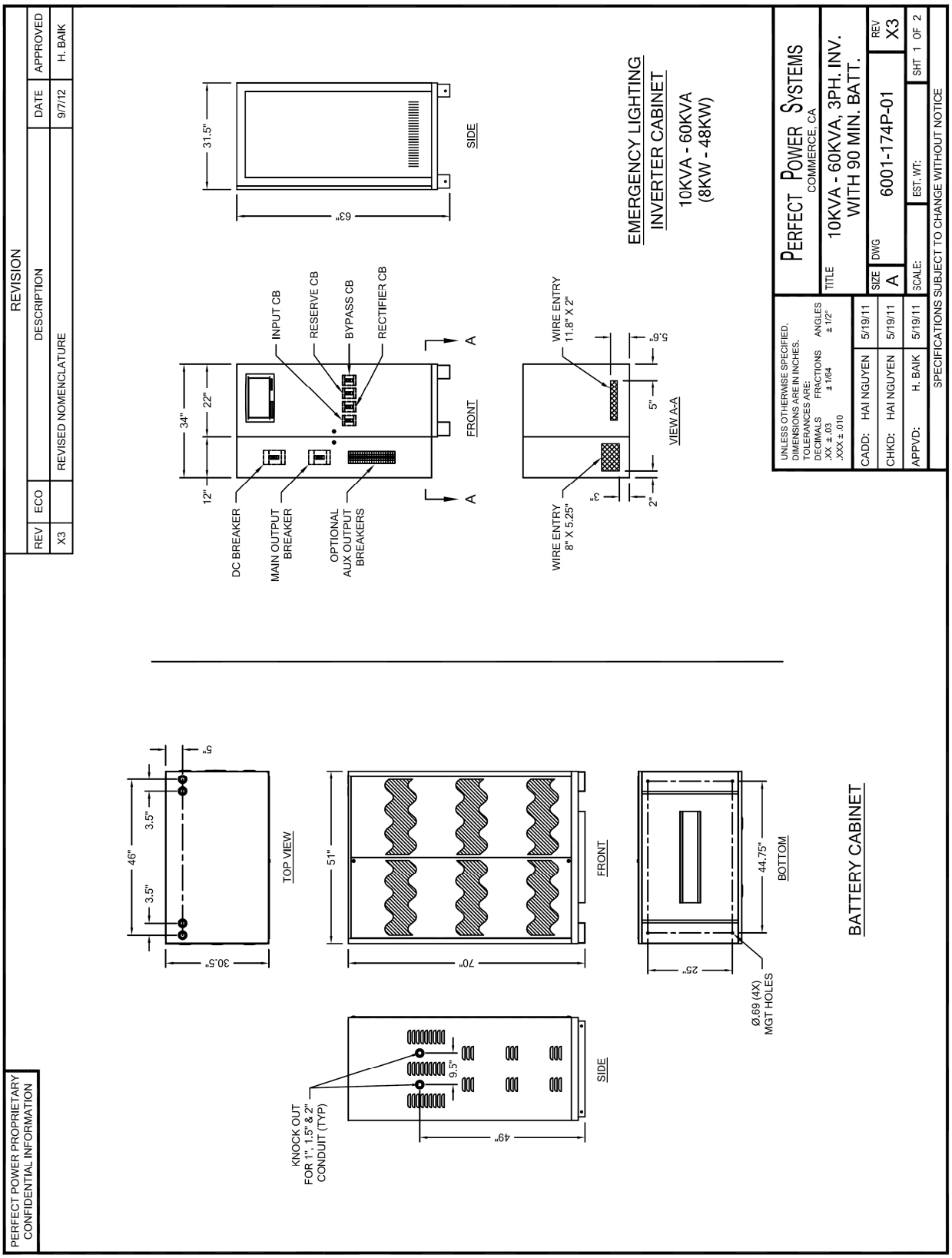
PART NO.			7050-389	7050-390	7050-391	7050-392	7050-393	7050-XXX
KVA			60KVA	80KVA	100KVA	120KVA	160KVA	200KVA
KW			48KW	64KW	80KW	96KW	128KW	160KW
TIME IN MINUTES		-005	29X80AH 2C OR D	29X90AH 2C OR D	29X120AH 2C OR D	58X80AH 3C OR D	58X90AH 3C OR D	58X120AH 3C OR D
		-010	29X90AH 2C OR D	29X120AH 2C OR D	58X90AH 3C OR D	58X90AH 3C OR D	58X120AH 3C OR D	87X100AH 4C OR 2D
		-015	29X120AH 2C OR D	58X90AH 3C OR D	58X100AH 3C OR D	58X120AH 3C OR D	87X100AH 4C OR 2D	87X120AH 4C OR 2D
		-020	58X80AH 3C OR D	58X100AH 3C OR D	58X120AH 3C OR D	87X100AH 4C OR 2D	87X 120AH 4C OR 2D	116X100AH 5C OR 2D
		-030	58X100AH 3C OR D	58X120AH 3C OR D	87X100AH 4C OR 2D	87X120AH 4C OR 2D	116X120AH 5C OR 2D	145X120AH 6C OR 3D
		-045	87X90AH 4C OR 2D	87X120AH 4C OR 2D	116X120AH 5C OR 2D	145X120AH 6C OR 3D	145X150AH 8C OR 4D	174X150AH 9C OR 4D
		-060	87X120AH 4C OR 2D	116X100AH 5C OR 2D	145X100AH 6C OR 3D	145X120AH 6C OR 3D	145X200AH 7D	174X150AH 9C OR 4D
CB / FUSE			200A	250A	300A	375A	500A	700A
MAX DC CURRENT			175A	232A	289A	347A	463A	579A
DC VOLT			348V	348V	348V	348V	348V	348V

C=Cabinet dimensions 39w X 68h X 18d

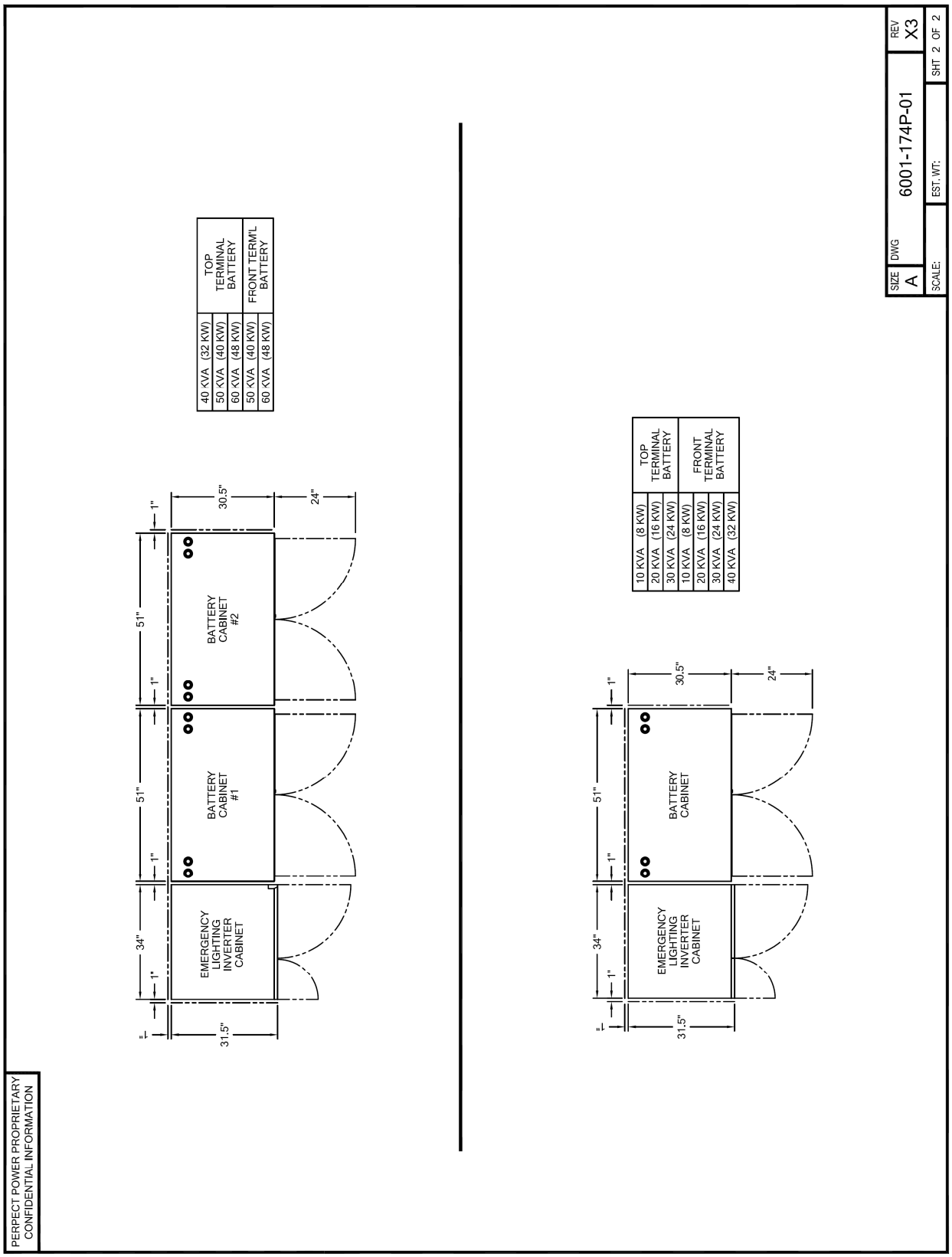
D=Cabinet dimensions 51w X 70h 30.5d

Standard battery cabinet configuration, depending on customer spacing other size cabinet or racks could be useds

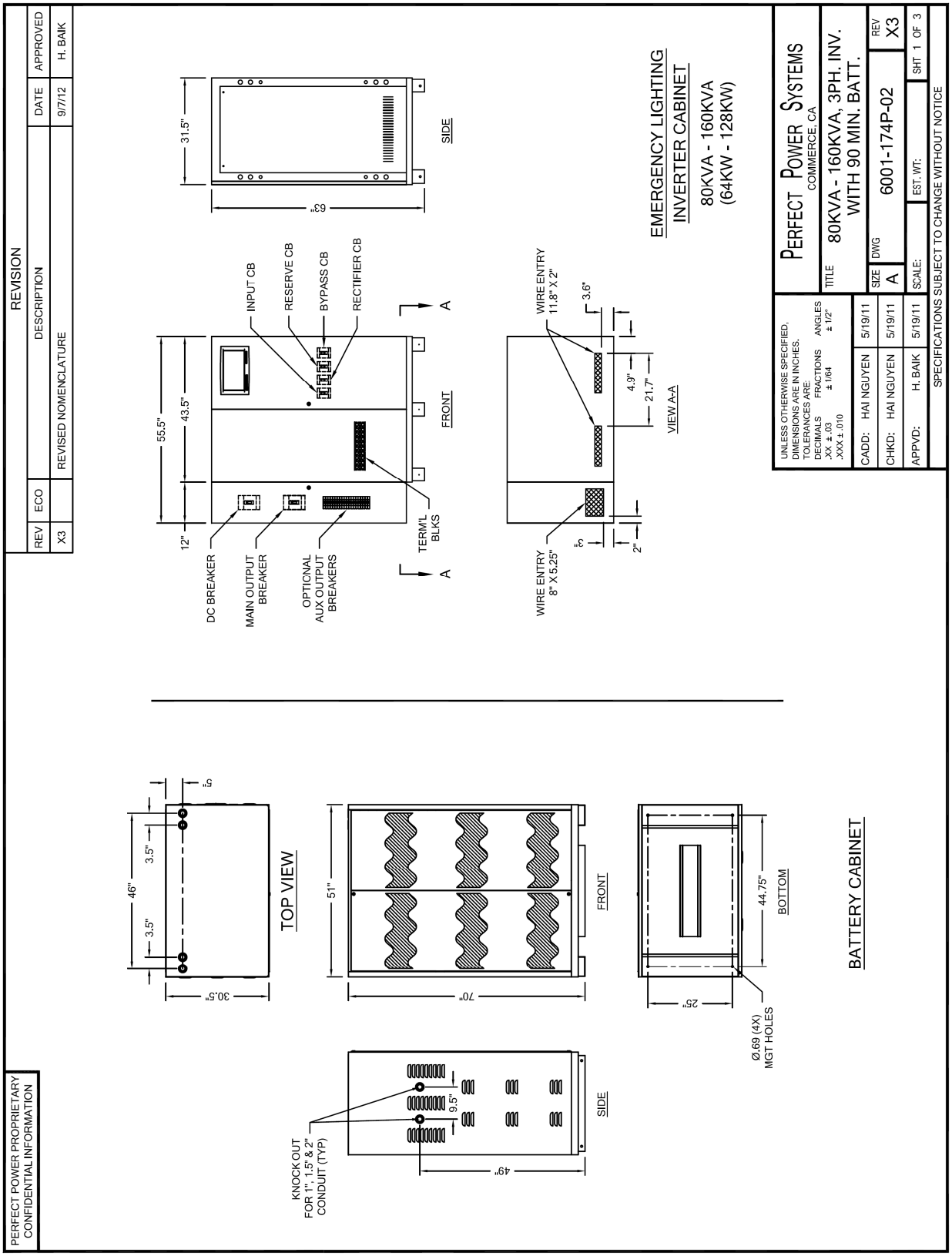
7.15 Battery Cabinets Arrangement Drawings.



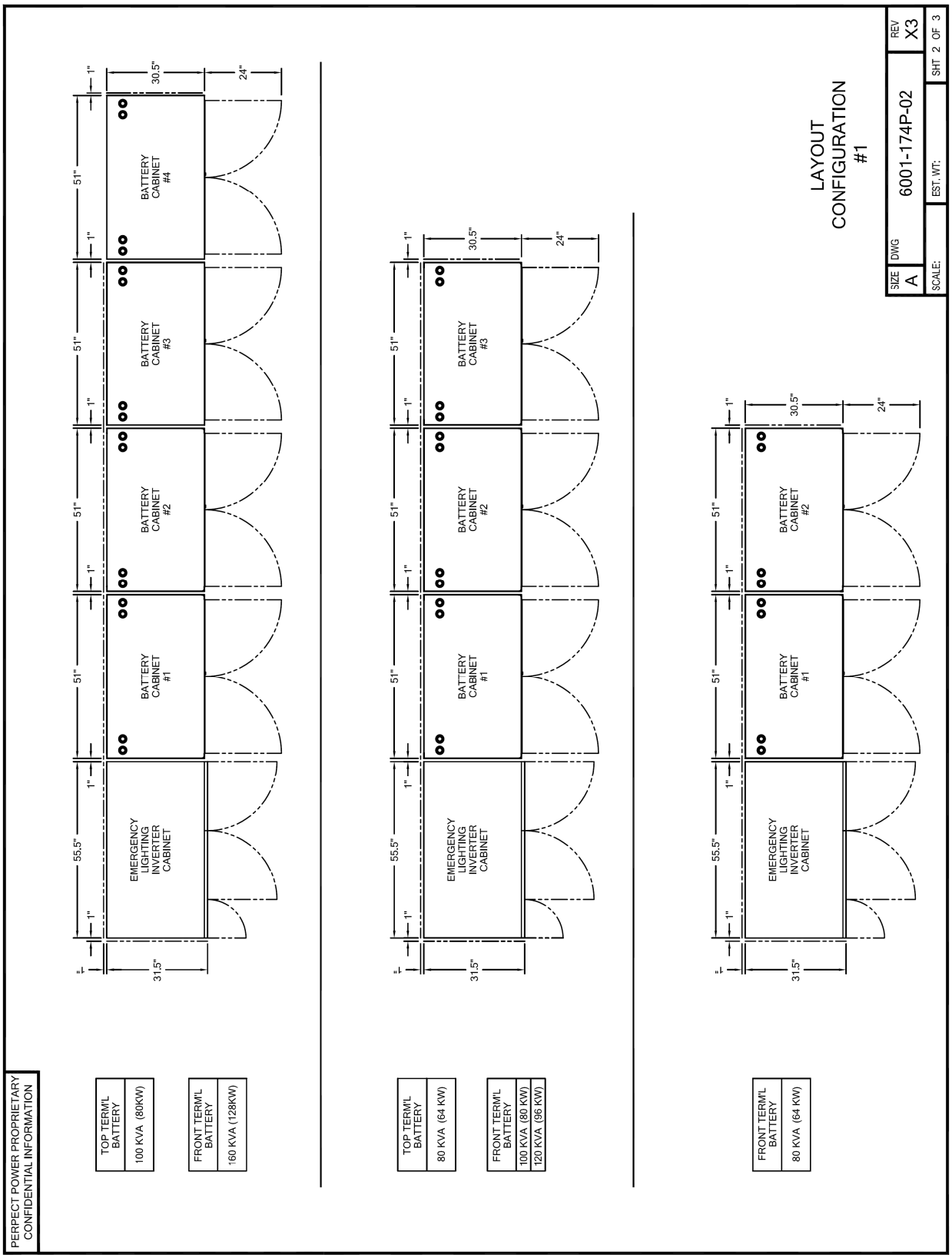
(continue) Battery Cabinets Arrangement Drawings.



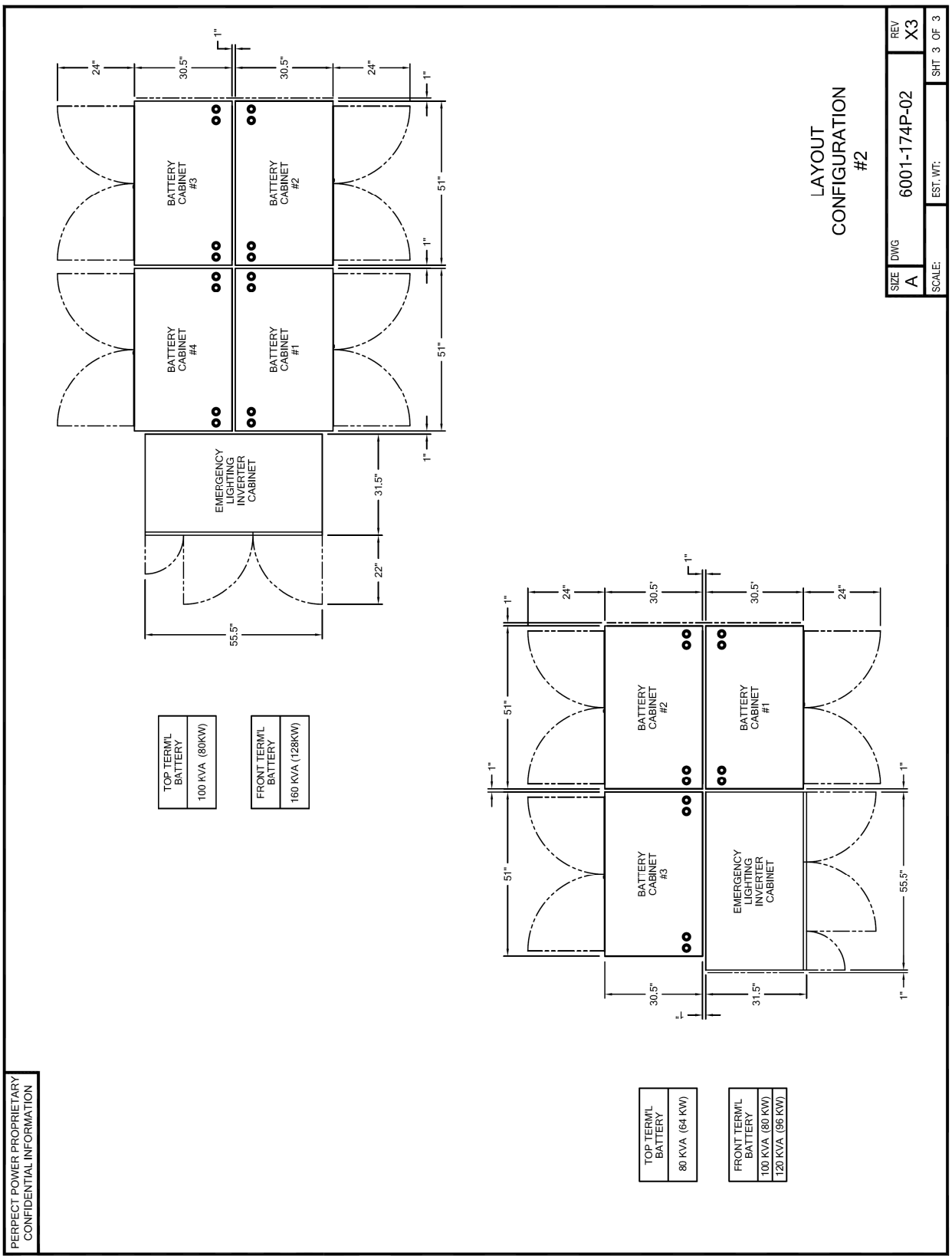
(continue) Battery Cabinets Arrangement Drawings.



(continue) Battery Cabinets Arrangement Drawings.



(continue) Battery Cabinets Arrangement Drawings.



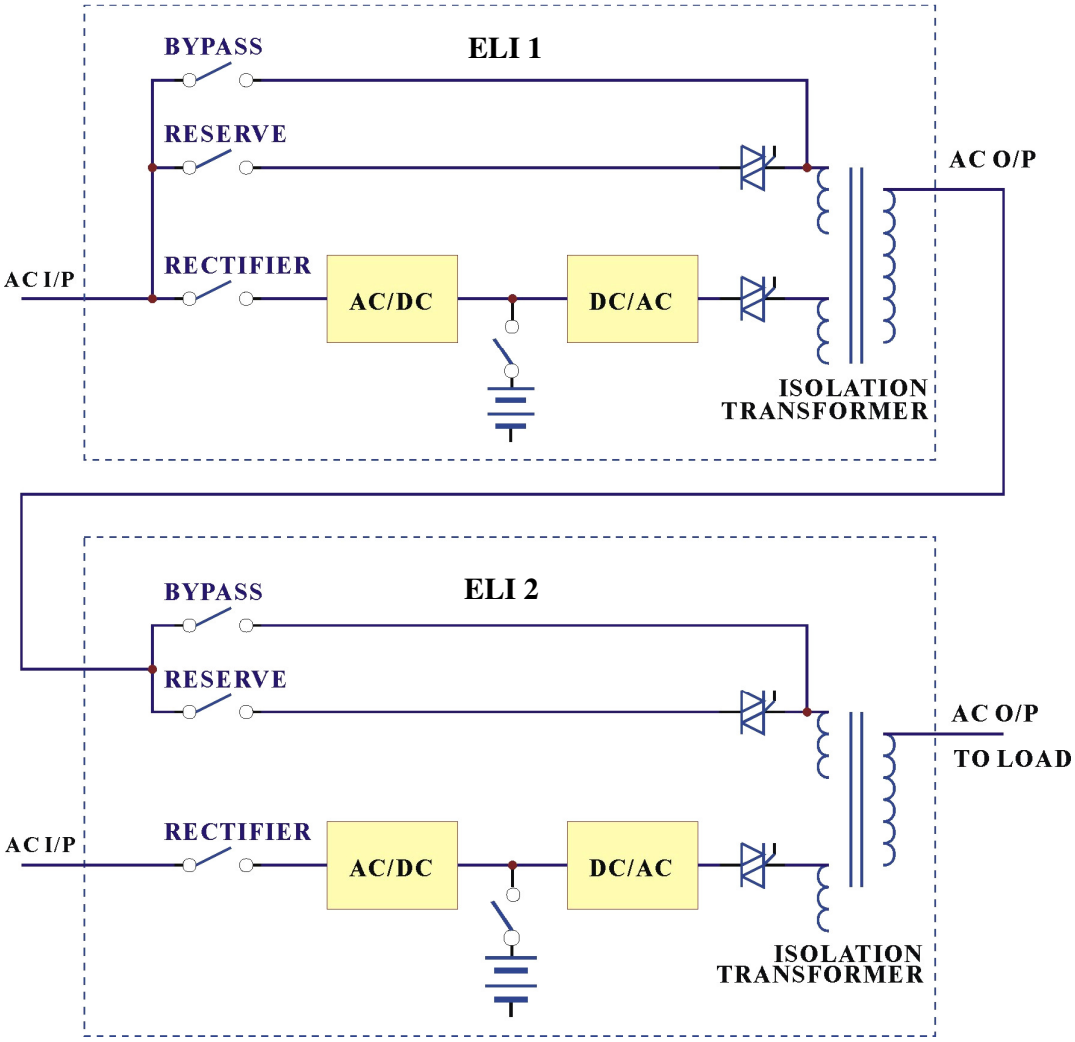
7.16 Replaceable parts list.

Part Description	Company/ Part no.	13k, 6PULSE	10k, 12PULSE	15k, 6PULSE	15k, 12PULSE	20k, 6PULSE	20k, 12PULSE	30K, 6PULSE	30K, 12PULSE	40k, 6PULSE	40k, 12PULSE	50k, 6PULSE	50k, 12PULSE	60k, 6PULSE	60k, 12PULSE	80k, 6PULSE	80k, 12PULSE	100k, 12PULSE	120k, 12PULSE	160k, 12PULSE	200k, 12PULSE	240k, 12PULSE	320k, 12PULSE	400k, 12PULSE
SCR	1690-245	9	12	9	12	9	12	9	12	9	12	6	6	6	6		6	6	6					
SCR	1690-246																							
SCR	1690-247													3	6	9	6	6		6	6			
SCR	1690-248																		6	6		6	6	
SCR	1690-249																				6			6
SCR	1690-250																					6	6	6
IGBT	1690-251	6	6	6	6	6																		
IGBT	1690-252							6	6															
IGBT	1690-253									6	6					12	12							
IGBT	1690-254											6	6	6	6			12	12		24	24		48
IGBT	1690-255																			12			24	
Inverter Fuse	2075-151	3	3	3	3	3																		
Inverter Fuse	2075-152							3	3	3	3													
Inverter Fuse	2075-153											3	3	3	3									
Inverter Fuse	2075-154															3	3							
Inverter Fuse	2075-155																	3	3	3	6	6	6	12
Inverter Drive (R.S.T.) PCB	1250-100	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	6	6	6	6
Static Switch Drive PCB	1250-101	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Rectifier Drive PCB	1250-102	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	2	2	2	2	2	2	2
Inverter Snuber PCB	1250-103	3	3	3	3	3	3	3	3	3	3	3	3	3	3									24
Inverter Snuber PCB	1250-104	3	3	3	3	3	3	3	3	3	3	3	3	3	3	12	12	12	12		24	24		24
Inverter Snuber PCB	1250-105																			12			24	
Inverter Snuber PCB	1250-106																			18			36	
Static Switch Snuber PCB	1250-107	6	6	6	6	6	6	6	6	6	6	6	6	6	6									
Static Switch Snuber PCB	1250-108															6	6	6	6	6	6	6	6	6
Static Switch Snuber PCB	1250-109																							
Rectifier Snuber PCB	1250-110	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	2	2	2	2	6	6	6
Rectifier Snuber PCB	1250-111																							
CPU Control PCB	1250-112	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Power Supply PCB	1250-113	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2
6-Pulse Rectifier Contro PCB	1250-114	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
12-Pulse Rectifier Control PCB	1250-115		1		1		1		1		1		1		1		1	1	1	1	1	1	1	1
Phase Control (R.S.T.) PCB	1250-116	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Display / Comm Interface PCB	1250-117	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Switch / Alarm PCB	1250-118	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Status LED PCB	1250-119	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Mimic LED PCB	1250-120	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Magnetic Switch Zener	1250-121																							
Cap Discharge	1250-122																							
LCD Display	1250-123	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
DC Buss Capacitor (DCCA)	1250-124	2	2	2	2	2	2	3	3	4	4	5	5	6	6	9	9	12	15	18	24	30	36	48
RelayP.S. PCB	1250-125	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Input MOV Filter PCB (RL1)	1250-126	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Output Filter PCB (FL2)	1250-127	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Output Filter Capacitor	1250-128																							
Output Filter Capacitor	1250-129																				3	3	3	3
Output Filter Capacitor (400Hz)	1250-130																							
Output Filter Capacitor	1250-131																							
Input Filter Capacitor (FL3)	1250-132	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Inverter Filter Capacitor (FL4)	1250-133	3	3									3	3	3	3									
Inverter Filter Capacitor (FL4)	1250-134			3	3	3	3												3			6		12
Inverter Filter Capacitor (FL4)	1250-135							3	3	3	3	3	3	3	3	6	6	6	6	9	12	12	24	24
Inverter Output Detect Fuse (FU1)	1250-136	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Reserve Power Fuse (FU2)	1250-137	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
AC Power Fuse for Fan (FU3)	1250-138	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
AC Power Fuse for Fan (FU3)	1250-139	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Upper Fan Fuse (FU4)	1250-140							1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Upper Fan Fuse (FU4)	1250-141															1	1	1	1	1	1	1	1	1
Lower Fan Fuse (FU5)	1250-142	1	1	1	1	1	1	1	1	1	1	1	1	1	1									
Lower Fan Fuse (FU5)	1250-143															1	1	1	1	1	1	1	1	1
Reserve Main Power Transformer (PT1)	1250-144	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Fan Power Transformer (PT2)	1250-145	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
AC Output Transformer for Fan(PT3)	1250-146	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Battery Magnetic Switch (SW1)	1250-147	1	1	1	1	1	1	1	1	1	1	2	2	2	2	1	1	1	1	1	2	2	2	2
Battery Magnetic Switch (SW1)	1250-148																							
FAN	1250-149	3	4	3	4	3	4	6	8	6	8	6	8	6	8	18	18	18	19	19	39	41	41	65
12 Pulse Rectifier Contactor - Fuji	1250-150		1		1		1		1		1													
12 Pulse Rectifier Contactor - Fuji	1250-151												1		1		1							
12 Pulse Rectifier Contactor - Fuji	1250-152																							
12 Pulse Rectifier Contactor - Fuji	1250-153																	1	1					
12 Pulse Rectifier Contactor - Fuji	1250-154																			1				
12 Pulse Rectifier Contactor - Fuji	1250-155																				1	1	1	
12 Pulse Rectifier Contactor - Fuji	1250-156																							1

8. REDUNDANCY

Redundancy can be roughly divided in two types: serial (hot standby) redundancy and parallel (active) redundancy. The ELI series adopts mainly serial redundancy.

8.1. Serial Redundancy



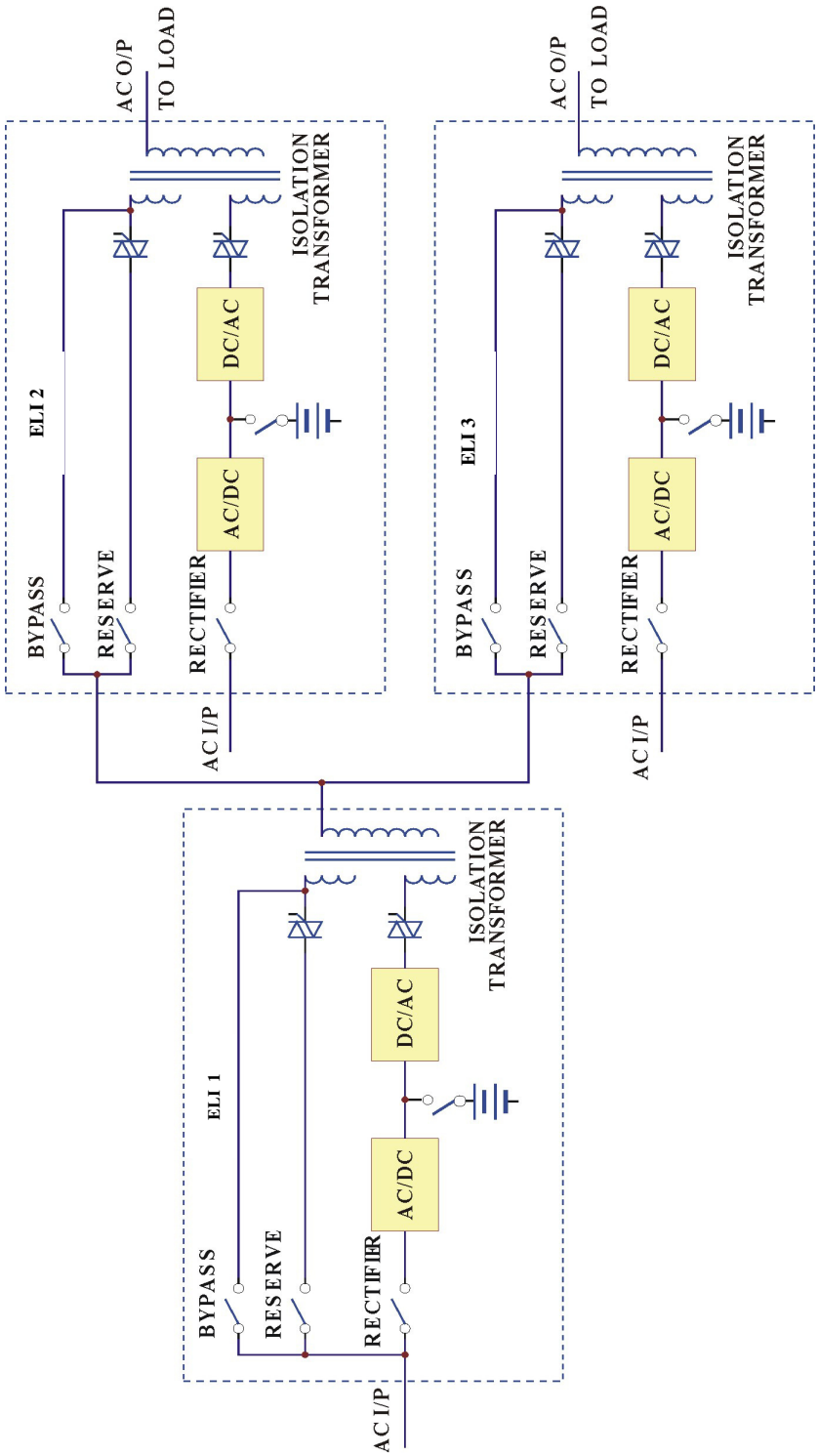
ONE TO ONE SERIAL REDUNDANCY

Serial (hot standby) redundancy consists of two ELI with one ELI's (ELI1) connected to the reserve/bypass input of the other ELI (ELI2). See the above figure. Both ELIs are running in normal mode under normal conditions. When one of them has a problem, the load will still have protection from the inverter and battery. If ELI1 fails and ELI2 is running normally, the load is unaffected, and supplied from ELI2. If ELI2 fails and ELI1 is running normally, ELI2 will transfer the load to ELI1 and the load will continue to be protected by the inverter and battery of ELI1. If both of them are running normally, ELI2 takes up all load and ELI1 bears no load. Therefore, ELI1 has a longer MTBF than ELI2 (can be interchanged after a period of time), and their MTBF multiplies to a very large MTBF.

This type of redundancy is employed most frequently. When mains fail, ELI2 is the first to contribute its battery to back-up the load. When ELI2's batteries are exhausted, the load is transferred to ELI1. Therefore, this topology can make full use of the batteries of both units. Users get a system that has redundant protection and double the back-up time.

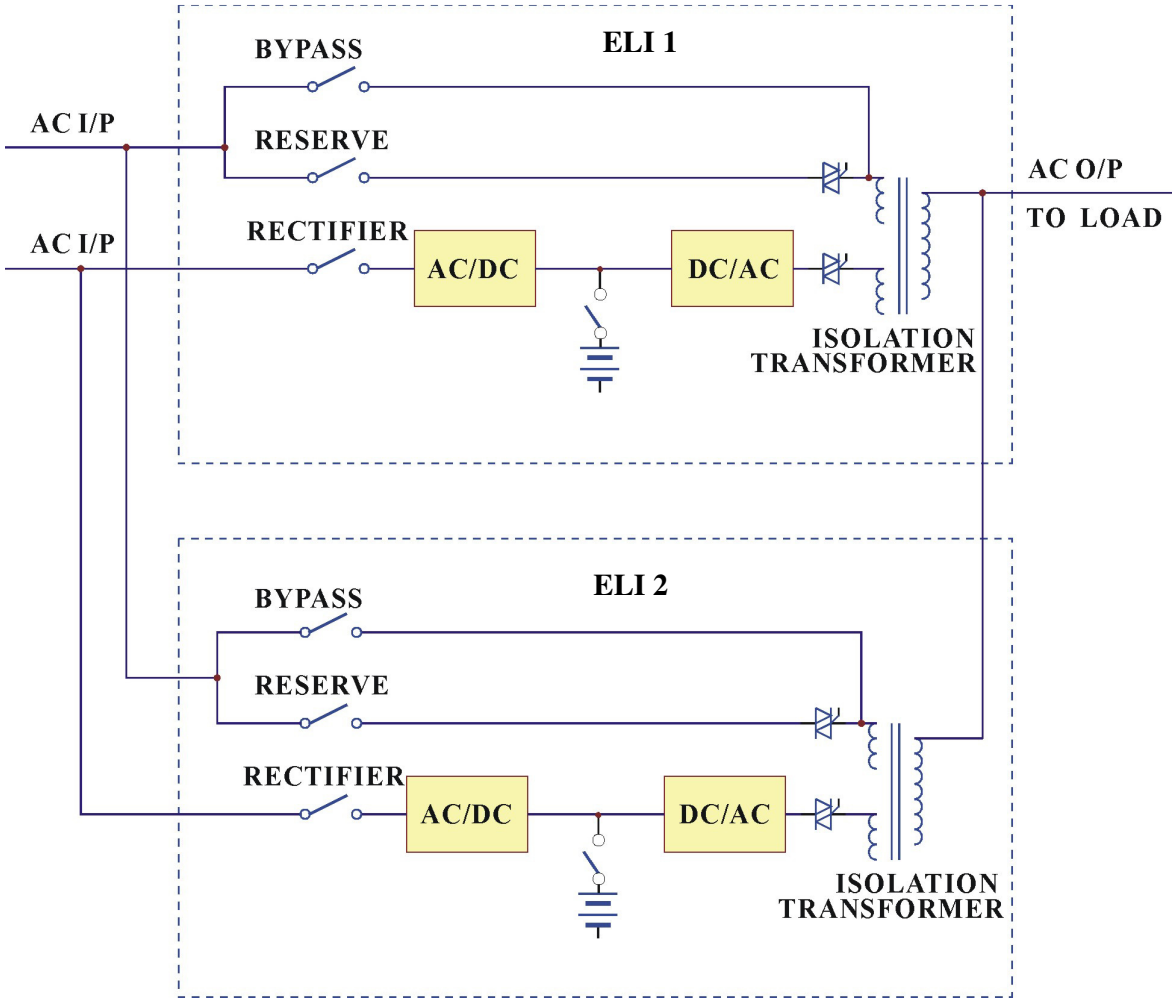
Another less expensive solution (see the figure below) is available if the load is separated. A user may intend to install two ELIs, each with the same power, and supplying half the load. A third ELI can be installed as backup to two main ELIs. It is statistically improbable that both main ELIs concurrently break down. Therefore, the third ELI can serve as a hot standby to two ELIs.

These topologies make full use of the resources to create the best protection and longest MTBF.


AC O/P
TO LOAD
ISOLATION TRANSFORMER
DC/AC
AC/DC
ELI 2
BYPASS
RESERVE
RECTIFIER
AC I/P
AC O/P
TO LOAD
ISOLATION TRANSFORMER
DC/AC
AC/DC
ELI 3
BYPASS
RESERVE
RECTIFIER
AC I/P
ISOLATION TRANSFORMER
DC/AC
AC/DC
ELI 1
BYPASS
RESERVE
RECTIFIER
AC I/P

8.2. Parallel Redundancy

The parallel redundancy configuration, like below figure, is designed to increase both the capacity and reliability. And all the ELI are sharing with equal load.



9. MAINTENANCE

9.1 **SAFETY PRECAUTIONS**

The ELI requires regularly schedule periodic maintenance.

Danger!

READ AND UNDERSTAND THIS SECTION THOROUGHLY BEFORE PERFORMING ANY MAINTENANCE WORK ON OR AROUND THE UNIT. READ THE BATTERY MANUFACTURER'S MANUAL AND MATERIAL SAFETY DATA SHEETS BEFORE WORKING ON OR NEAR THE BATTERIES.

ONLY NORMAL SAFETY PRECAUTIONS ARE REQUIRED WHEN THE UNIT IS OPERATING WITH ALL CABINET DOORS CLOSED. HOWEVER, THE UNIT AND BATTERY CABINETS MUST BE KEPT FREE OF STANDING PUDDLES OF WATER, EXCESS MOISTURE, OR DEBRIS. DEBRIS CONSISTING OF EXCESSIVE DUST IN AND AROUND THE UNIT WILL BE PULLED INTO THE UNIT BY THE COOLING FANS.

Danger!

ONLY FACTORY TRAINED OR AUTHORIZED PERSONNEL SHOULD ATTEMPT TO INSTALL OR REPAIR THE UNIT OR ITS BATTERY SYSTEM. IMPROPER INSTALLATION HAS PROVEN TO BE THE SINGLE MOST SIGNIFICANT CAUSE OF START-UP PROBLEMS. SERVICE PERSONNEL SHOULD WEAR INSULATING SHOES FOR ISOLATION FROM DIRECT CONTACT WITH THE FLOOR (EARTH GROUND), AND SHOULD MAKE USE OF RUBBER MATS WHEN PERFORMING MAINTENANCE ON ANY PORTION OF THE UNIT WHILE IT IS UNDER POWER. HIGH AC AND DC ELECTRICAL VOLTAGES ARE PRESENT THROUGHOUT THE UNIT (S) AND INCORRECT INSTALLATION OR SERVICING COULD RESULT IN ELECTROCUTION, FIRE, EXPLOSION, OR EQUIPMENT MALFUNCTION.

Danger!

SPECIAL SAFETY PRECAUTIONS AND LOCKOUT TAGOUT PROCEDURES ARE REQUIRED FOR ALL OPERATIONS INVOLVING THE HANDLING, INSTALLATION, OR MAINTENANCE OF THE UNIT SYSTEM AND ANY ASSOCIATED BATTERY CABINETS. FAILURE TO FOLLOW SAFETY PROCEDURES COULD RESULT IN DEATH, INJURY OR DAMAGE TO EQUIPMENT.

Danger!

THIS EQUIPMENT CONTAINS CIRCUITS THAT ARE ENERGIZED WITH HIGH VOLTAGES. ONLY TEST EQUIPMENT DESIGNED FOR TROUBLESHOOTING HIGH VOLTAGES SHOULD BE USED, PARTICULARLY FOR OSCILLOSCOPES AND PROBES.

ALWAYS CHECK WITH AN AC AND DC VOLTMETER TO ENSURE SAFETY BEFORE INITIATING CONTACT OR USING TOOLS. EVEN WHEN THE POWER IS OFF, DANGEROUSLY HIGH POTENTIAL VOLTAGES MAY EXIST AT CAPACITOR BANKS. ALWAYS OBSERVE BATTERY PRECAUTIONS WHEN OPERATING NEAR ANY BATTERIES.

FAILURE TO OBSERVE THESE PRECAUTIONS COULD RESULT IN DEATH, INJURY OR DAMAGE TO EQUIPMENT.

Danger!

OBSERVE ALL BATTERY SAFETY PRECAUTIONS DURING INSTALLATION OR SERVICE OF THE UNIT OR BATTERIES. EVEN WITH THE BATTERY CIRCUIT BREAKER IN THE OFF POSITION, THE DANGER OF ELECTROCUTION MAY STILL BE PRESENT. THE BATTERY POWER TO THE UNIT MUST BE LOCKED AND TAGGED "OFF" BEFORE PERFORMING ANY SERVICE OR WORK ON THE UNIT. THE BATTERY MANUFACTURER'S SAFETY INFORMATION AND MATERIAL SAFETY DATA SHEET IS LOCATED IN A POCKET ATTACHED TO THE INSIDE OF LEFT DOOR OF EACH UNIT. FAILURE TO FOLLOW THOSE INSTRUCTIONS AND THE INSTRUCTION LISTED ABOVE AND ELSEWHERE IN THIS MANUAL COULD RESULT IN AN EXPLOSION, FIRE, EQUIPMENT MALFUCTION, OR ELECTROCUTION.

Danger!

BE CONSTANTLY AWARE THAT THE UNIT SYSTEM CONTAINS HIGH DC AS WELL AS AC VOLTAGES. WITH INPUT POWER OFF AND THE BATTERY DISCONNECTED, HIGH VOLTAGE AT THE FILTER CAPACITORS AND POWER CIRCUITS SHOULD DISCHARGE WITHIN 30 SECONDS. HOWEVER, POWER CIRCUIT MALFUNCTIONS CAN OCCUR, SO YOU SHOULD ALWAYS ASSUME THAT HIGH VOLTAGE MIGHT STILL EXIST AFTER SHUTDOWN. VERIFY THAT POWER IS OFF USING AC AND DC VOLTMETERS BEFORE MAKING CONTACT.

9.2 WHEN TO CALL (1-800-PWR-SRVC – 1-800-797-7782)

Call for service if you encounter any of the following conditions:

1) Repeated start-up attempts are unsuccessful.

2) A unit fault occurs which cannot be cleared.

3) Normal operation of the critical load repeatedly causes an overload condition. This is not a unit fault but a qualified person must analyze the total load connected to the unit to prevent malfunction. Momentary overload conditions will be handled within the parameters of the unit but sustained overloads will cause failure.

4) Any indicators or alarms operate abnormally or continuously.

5) Any other abnormal function of the system occurs.

6) If any abnormal battery condition is detected.

7) When you are unsure of what action to take.

9.3 STEPS TO TAKE

If any of the above occur:

1) Consult Appendix C, LCD Display Menu and Troubleshooting Guide. Record information on the LCD Display to relay to Perfect Power Systems Customer Service and Support.

2) Call Perfect Power Systems Customer Support at 1-800-797-7782 or 1-800-PWR-SRVC.

Danger!

LETHAL VOLTAGES ARE PRESENT INSIDE THE EQUIPMENT EVEN WHEN THERE APPEARS TO BE NO INPUT POWER TO THE UNIT. PROTECT YOURSELF FROM THE RISK OF ELECTROCUTION BY REFERRING SERVICE TO QUALIFIED PERSONNEL ONLY.

9.4 PREVENTATIVE MAINTENANCE

The unit maintenance consists of the basic tasks listed in this section. Other maintenance functions require Perfect Power Systems factory trained service personnel. In order to comply with the terms of the prorated battery warranty, you must maintain at least an annual individual voltage record of each battery with evidence that the terminal connections have been torque checked.

Preventive Maintenance List

Description
Visual inspection
Check Room Temperature
Removal of dust from all electronics
Verification of all electrical connection
Check all Batteries post and connection for corrosion
Check for batteries deformations
Record all batteries Nominal Voltages
Record all batteries Floating Voltages
Functional Test of all major components
Functional test of all electronics
Functional Test of system including batteries
Record all findings

9.4.1 Maintenance Log

Carefully record keeping will ensure proper maintenance of the unit, and assist in the correction of any abnormal conditions.

At a minimum, the Maintenance log should contain the following information:

- Date of system start-up.
- Dates that battery maintenance was performed.
- Dates input, output, and battery status readings were checked and the values displayed for these readings.
- Date of load changes.
- Dates and summaries of all communications with Perfect Power Systems service personnel.
- Every six (6) months or at least annual, individual battery voltage & torque check.

9.4.2 Periodic Testing of unit

The unit should be manually exercised on a periodic basis (once every three months, for example). This forces the unit to transfer to the battery and return to main power. This process activates self-diagnostic testing, which may reveal conditions that require attention.

9.4.3 Maintaining the Batteries

Danger!

THE BATTERY CIRCUIT BREAKER OPERATES AT THE RATED BATTERY VOLTAGES AT ALL TIMES. A TRIPPED BATTERY CIRCUIT BREAKER INDICATES A SERIOUS PROBLEM THAT MAY RESULT IN SERIOUS INJURY OR DAMAGE TO THE EQUIPMENT; DO NOT CLOSE THE CIRCUIT BREAKER WITHOUT KNOWING WHY IT FAILED. CHECK FOR A SHORT IN BATTERY OR CONNECTIONS. CALL PERFECT POWER SYSTEMS CUSTOMER SERVICE AND SUPPORT FOR ASSISTANCE AT 1-800-PWR-SRVC.

Danger!

THE BATTERY ELECTROLYTE IS A DILUTED SULFURIC ACID THAT IS HARMFUL TO THE SKIN AND EYES. IT IS ELECTRICALLY CONDUCTIVE AND CORROSIVE. WEAR FULL EYE AND HAND PROTECTION ALONG WITH PROTECTIVE CLOTHING. IF THE ELECTROLYTE CONTACTS THE SKIN, WASH IT OFF IMMEDIATELY WITH WATER. IF ELECTROLYE CONTACTS THE EYES, FLUSH THOROUGHLY AND IMMEDIATELY WITH WATER. SEEK IMMEDIATE MEDICAL ATTENTION. SPILLED ELECTROLYTE SHOULD ADDRESSED PER APPROPRITE HARADIDEROUS SPILL CLEANUP PROCEDURES.

Danger!

DO NOT DISPOSE OF A BATTERY OR BATTERIES IN A FIRE. THE BATTERIES MAY EXPLODE CAUSING DEATH OR SERIOUS INJURY.

Caution

Do not substitute batteries from other manufacturers without the express approval of Perfect Power Systems Customer Service personnel.

- **The use of any battery other than Perfect Power Systems may cause damage to the inverter and voids your Perfect Power Systems warranty.**

Caution

Lead-acid batteries contain hazardous materials and must be handled, transported, and recycled or scrapped in accordance with federal, state and local regulations. Since lead is a toxic substance, lead-acid batteries should be recycled rather than scrapped.

Caution

A battery can present a risk of electrical short and high short circuit current. The following precautions should be observed when working on or around batteries:

- **Remove watches, rings, necklaces, or other metal objects.**
- **Use only tools with insulated handles.**
- **Wear rubber insulating gloves and boots.**
- **Do not lay tools or metal parts on top of batteries.**
- **Disconnect charging source prior to connecting or disconnecting battery terminals.**
- **Verify that battery cabinets are properly grounded.**

Danger!
DO NOT GROUND BATTERY POSITIVE OR NEGATIVE

Caution

Lead-acid batteries can present a risk of fire because they generate hydrogen gas. The following safety procedures must be followed:

- **DO NOT SMOKE when near batteries.**
- **DO NOT cause flame or sparks in battery areas.**
- **Discharge static electricity from your body before touching batteries by first touching a grounded metal surface.**

Caution

When replacing batteries, use the same number of batteries, of the same manufacturer, type and model that was supplied with the unit. To avoid system malfunction, replace all batteries in each string if one or more batteries fail to perform to specifications. Please record all individual cell voltages on the chart.

9.4.4 Battery Cabinets

Although the individual batteries are sealed and require minimal maintenance only, the batteries should be given a periodic inspection and electrical check every six months.

Battery Service Agreements are available through Perfect Power Systems Customer Service and Support at 1-800-PWR-SRVC (800-797-7782).

In order to qualify for battery warranty replacement, you will need to show records of the battery maintenance history including battery numbers, battery voltages (individual cells), terminal torque measurements and dates of maintenance.

9.4.5 Power Connections

- Check for corrosion and connection integrity. Visually inspect wiring for discolored or cracked insulation. Clean and / or re-torque as required.
- All Battery terminal connections must be tighten with proper torque value set in accordance with the table or instructions provided by battery manufacturer.
- Use the correct torque tool to tighten the terminal bolts as indicated in table below and use all hardware's provided with batteries.

Type – Standard VRLA Battery

Battery part number	Initial torque in LBS	Annual re-torque in LBS	Terminal Type	Hardware
PRC-12150 C (150AH)	120 IN-LB / 13.6 NM	115 IN-LB / 13.6 NM	Copper Insert Terminal	¼ - 20 UNC Bolt
UB 12750	88.5 IN-LB / 10 NM	84 IN-LB / 9.5 NM	Z1 "Z" post type terminal	1 to 1.25" long bolt w/14mm head, 14mm nut, 8mm washer & lockwasher
UB12900	88.5 IN-LB / 10 NM	84 IN-LB / 9.5 NM	Same as above	Same as above
UB12110	88.5 IN-LB / 10 NM	84 IN-LB / 9.5 NM	Same as above	Same as above

Type G – Longer warranty battery

Battery part number	Initial torque in LBS	Annual re-torque in LBS	Terminal Type	Hardware
GSLF – 10512	120 IN-LB / 13.6 NM	115 IN-LB / 13.0 NM	Copper Insert	¼ "
GSLF - 12012	120 IN-LB / 13.6 NM	115 IN-LB / 13.0 NM	Copper Insert	¼ "

Type N – Nickel-Cad battery (only nickel plated copper cable lugs should be used).

Ni-Cad P/N	Recommended Torque		Bolt Diameter
BM 112/ 138	66 IN-LB	7.5 NM	M5
BM 148/ 184	177 IN-LB	20 NM	M8
BM 195/231/277	266 IN-LB	30 NM	M10
NOTE: For annual re-torque; reduce 5 IN-LB from recommended torque value.			

CAUTION: Torque all connections in accordance with the above tables unless provided from battery manufacturer. Failure to do so may create an unsafe condition or fire hazard.

9.4.6 Battery Terminals

- Check for discoloration, corrosion and connection integrity. Clean and tighten as necessary.
- To access battery terminals, remove the top strapping material located at the lower front of the battery shelf. Pull the battery forward to access the battery connections. Disconnect the cables connected to the battery. Once disconnected, insulate the cables to prevent accidental shorts (Use a protective boot or electrical tape). Before replacing the battery connections clean and re-torque the connection hardware.
- Perfect Power Systems Customer Service personnel must approve use of non-standard batteries. Please call at 1-800-PWR-SRVC (800-797-7782).

9.5 PERFECT POWER SYSTEMS CUSTOMER SERVICE AND SUPPORT

Start-up, unit maintenance, battery maintenance, and preventative maintenance programs are available through your Perfect Power Systems sales representative or through Perfect Power Systems Customer Service and Support. A program of periodic **maintenance is recommended once every six months**, but is mandatory once every twelve months since heat and cold will effect the compression of the electrical connections and lack of maintenance will shorten the product's life expectancy possibly causing unsafe operating condition.

9.5.1 Start-Up Services

Various start-up services are available. See your sales representative or telephone Perfect Power Systems Customer Service at 1-800-PWR-SRVC (800-797-7782).

9.5.2 Maintenance Agreements

Standard Full Service, 24/7 Full Service, and Extended On or OFF Site Maintenance agreements are available. See your sales representative or telephone Perfect Power Systems Customer Service at 1-800-PWR-SRVC (800-797-7782).

9.5.3 Warranties

Contact Perfect Power Systems Customer Service and Support at 1-800-PWR-SRVC (800-797-7782) if you have any questions regarding the warranty on your unit, system or batteries.

9.5.4 HELP

Followings are some abnormal situations frequently asked and common solution is offered for trouble-shooting.

Abnormal	Description & Checkpoint	Solution
(1) AC input is correct, but rectifier does not operate and RECT AC FAIL LED lights up.	The rectifier breaker is not switch on.	Switch on the rectifier breaker.
	The input voltage is not correct (out of the normal range).	Connect the right AC source.
	The phase sequence of AC input is incorrect, input rotation error, and the LCD will display warning message "RECT PHASE ERROR" in the STATUS/WARN menu (MAIN menu → SELECT menu → STATUS/WARN menu). ROTATION ERROR LED on left side of the front panel will also light.	Correct the R.S.T. phase sequence. Generally, to exchange any two phases connection can solve this problem.
	If the abnormality cannot be corrected when the solution actions have been taken.	Refer to PCB LED Detecting Guide and check the 3C PCB.
(2) The ELI shuts down under AC mains failure.	The battery fuse (breaker/holder/dis-connector) has not been closed.	Close the battery fuse breaker/holder/dis-connector.
(3) No power supply for ELI control circuit and LCD cannot display.	The reserve breaker has not been closed (switched on).	Close the reserve breaker.
	3B PCB has problem.	Refer to PCB LED Detecting Guide and check the 3B PCB.

Abnormal	Description & Checkpoint	Solution
(4) The voltage difference between NEUTRAL and GROUND has become abnormally high.	There is external wiring error of R.S.T phase and N. G., instead of ELI unit itself,.	Correct the external wiring system.
(5) The inverter cannot start up.	Other than INVERTER SS LED in left side of the front panel, other LEDs still illuminate.	Do trouble shooting according to the LED instruction.
	Switch on the inverter before DC bus has been established completely. Normally, it takes around 30 seconds to establish the DC BUS once the reserve and rectifier breakers are closed.	Refer to the switch on procedure. Close the reserve and rectifier breakers and wait around 30 seconds or directly use batteries to establish the DC bus.
	Bypass breaker has been closed (switched on).	Open the bypass breaker.
	The output is overloaded. The LCD will display warning message ‘ XXX% OVERLOAD’ in the STATUS/WARN menu (MAIN menu → SELECT menu → STATUS/WARN menu). XXX% OVERLOAD LED on left side of the front panel and OVERLOAD LED on right side will also light.	Decrease the load to below the ELI’s rated power.
	In P&P modules1, the temperature sensor sockets on 3G PCB and hest sink are not connected properly. WARNINGLED of FUSE/TEMP still illuminate but LED in 3G PCB doesn’t, indicating DC BUS may be over 240VDC.	Take out the P&P modules and connect them properly.

Abnormal	Description & Checkpoint	Solution
(6) Fans do not work while ELI is on.	The fuses positioned behind PCB holder have been blown or are not installed properly.	Replace the fuses or install them properly.
	Abnormal voltage output in R phase.	Refer to PCB LED Detecting Guide and check the 3T PCB of R phase.
(7) The rectifier shunt down and HIGH DC LED is lit.	Voltage limit function failure in the 3B, which contributes to the DC voltage, goes over 430V.	Refer to PCB LED Detecting Guide and check the 3B PCB.
	3C PCB has problem.	Refer to PCB LED Detecting Guide and check the 3C PCB.
(8) Abnormal voltage in reserve.	RESERVE AC FAIL LED lights up. LCD menu also displays the abnormal voltage in reserve. (REAL TIME DATA menu → RESERVE DATA menu).	Check the reserve wiring and connect with the correct source.
	Fuse has blown in 3A PCB	Replace the fuse.
	If the abnormality cannot be corrected after the solution actions have been taken.	Refer to PCB LED Detecting Guide and check the 3A PCB.
(9) Abnormal frequency in reserve.	RESERVE FREQ FAIL LED lights up. LCD menu also displays the abnormal voltage in reserve. (REAL TIME DATA menu → RESERVE DATA menu).	Check the reserve wiring and connect with the correct source.
	Fuse has blown in 3A PCB	Replace the fuse.
	If the abnormal cannot be corrected after the solution actions have been taken.	Refer to PCB LED Detecting Guide and check the 3A PCB.

Abnormal	Description & Checkpoint	Solution
(10) The inverter shuts down during operation, while the FAULT LED lights and buzzer beeps continuously.	Bypass breaker has been closed (switched on).	Open the bypass breaker. The inverter will restore running automatically.
	The output is short-circuited, including the load itself.	Clear the short circuit at the output, then switch off the inverter. Secondly, switch on once more to restart the inverter.
	The output is overloaded. The LCD will display warning message ' XXX% OVERLOAD' in the STATUS/WARN menu (MAIN menu → SELECT menu → STATUS/WARN menu). XXX% OVERLOAD LED on left side of the front panel and OVERLOAD LED on right side will also light.	Decrease the load to under the ELI's rated power. Then the inverter will restore running automatically.
	Heat Sink is over temperature. WARNING LED of FUSE/TEMP still illuminates.	Decrease the load to under the ELI's rated power, then switch off the inverter. Secondly, switch on once more to restart the inverter.
	IBGT-protect fuse has blown in P&P module1 or IGBT damage.	Take out the P&P module and replace fuse or IGBT.
	When in battery back-up mode, the inverter shuts down due to battery low (lower than 295VDC).	Within 30 minutes, the inverter will restore running automatically once the AC main is back.
	The Emergency Switch has been triggered.	Switch off the inverter first then on once more to restart the inverter.

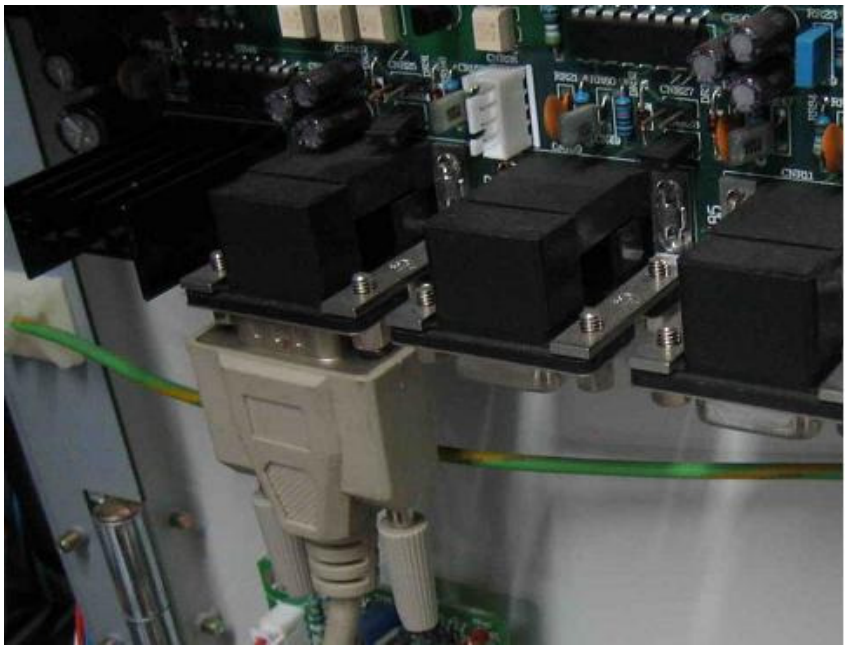
Abnormal	Description & Checkpoint	Solution
(11) Transferring failure between reserve and inverter.	DC BUS voltage becomes abnormal during transferring. DCV value can be read in LCD menu.	Take out the P&P module 2 and make sure the SCR drive connection is OK.
	3P PCB has problem.	Refer to PCB LED Detecting Guide. Take out the P&P module 2 and check the 3P PCB.
	LED A4(OTF) in the 3A PCB lights.	Refer to PCB LED Detecting Guide and check the 3G PCB.
	In P&P modules, the temperature sensor sockets on 3G/3P PCB and hest sink are not connected properly. WARNING LED of FUSE/TEMP still illuminates.	Take out the P&P module and connect them properly.
	Phase sequence error of output transformer.	Change the transformer wiring.
	If the abnormal cannot be improved as the aforesaid solution action has been taken.	Refer to PCB LED Detecting Guide and check the 3G and 3P PCB.
(12) Phase lack when AC output.	The mimic output LED in the front panel blinks.	Make sure the signal sockets in 3T PCB are connected properly.
	Fuse has blown in 3T PCB	Replace the fuse.
	If the abnormal cannot be corrected after the solution actions have been taken.	Refer to PCB LED Detecting Guide and check the 3T PCB.
(13) The mimic battery LED in the front panel blinks.	Batteries become worn out or damaged.	Replace batteries.

Abnormal	Description & Checkpoint	Solution
(14) All LED in the front panel light up.	CPU inserting error in 3A or 3R PCB	Insert the CPU into correct socket.
(15) Communication interface is not working properly.	Communication cables are connected improperly.	Correct the wiring.
	Communication software is not installed successfully.	Reinstall the software.
	Communication port setup error.	Correct the setup.
	CPU inserting error in 3R PCB.	Insert the CPU into right socket.
	If the abnormal cannot be corrected after the solution actions have been taken.	Refer to PCB LED Detecting Guide and check the 3R PCB.
(16) The inverter has been turned on but no action of inverter.	The inverter switches of ▮ & ◆▶ are not pressed simultaneously.	Try to press these two buttons simultaneously
	PCB Connection is not good.	Refer to PCB LED Detecting Guide and check the connection of 3W PCB.

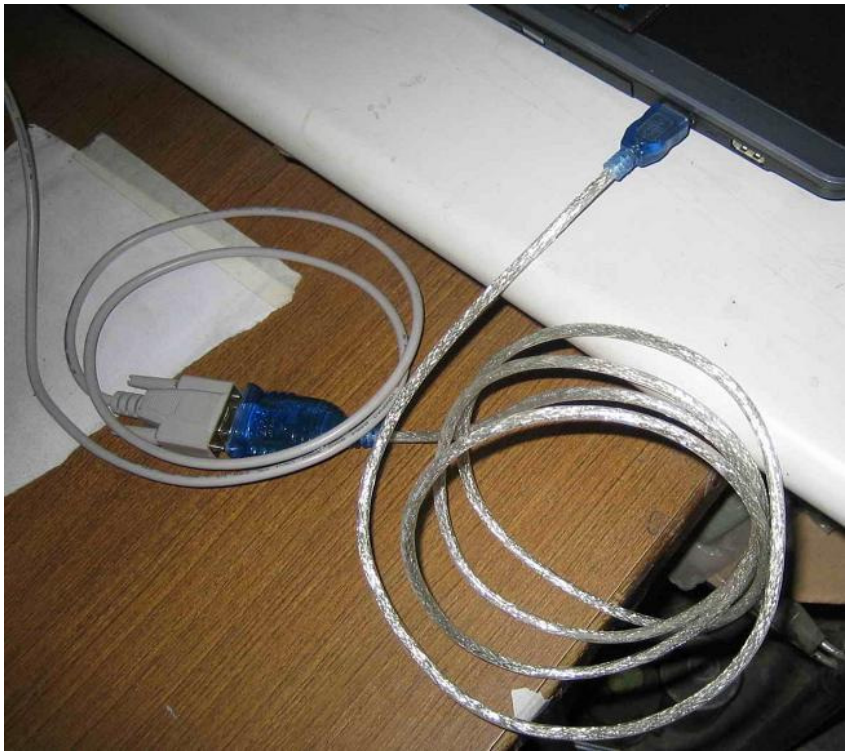
Appendix A

Battery Exerciser setting

1. CONNECT THE DB9 WIRE FROM UPPER SOCKET OF CNR21 …

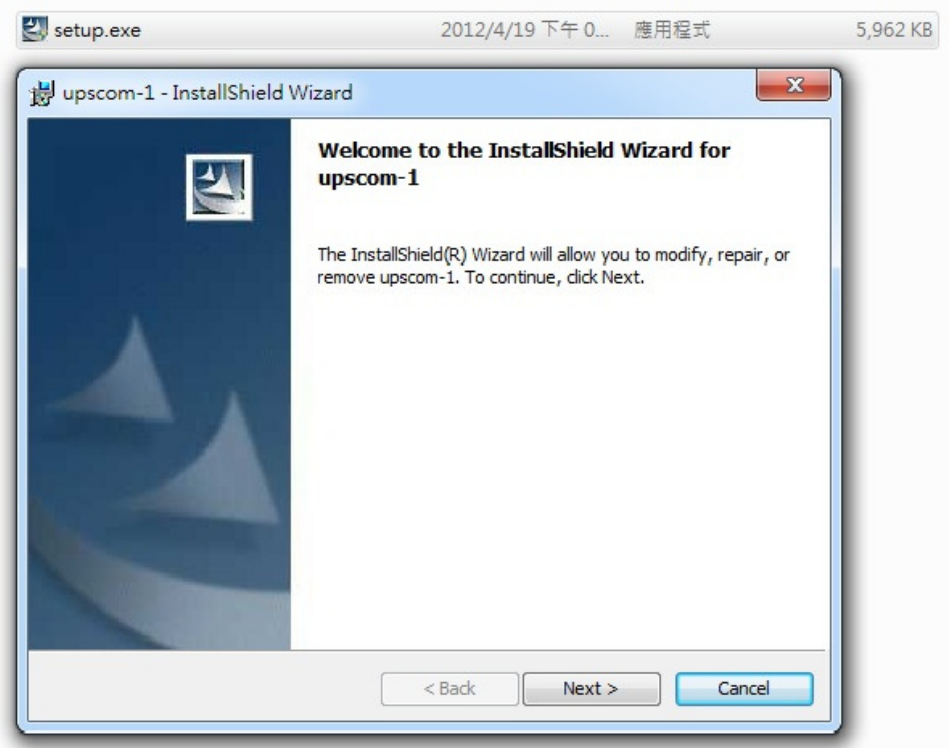


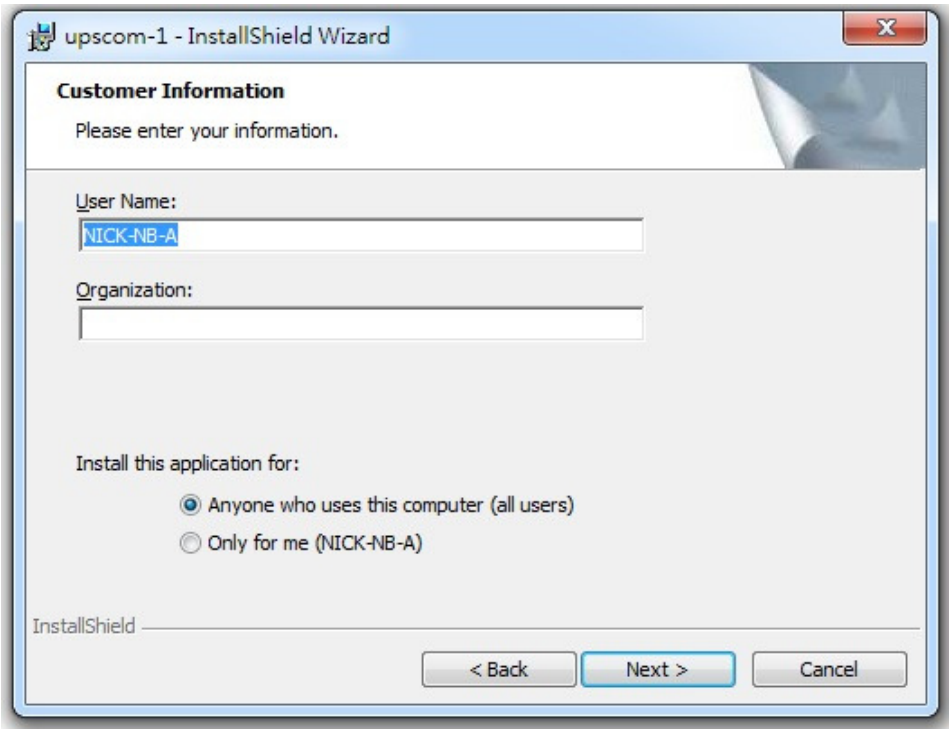
2. TO USB OF LAPTOP VIA A RS-232 TO USB CONVERTER.

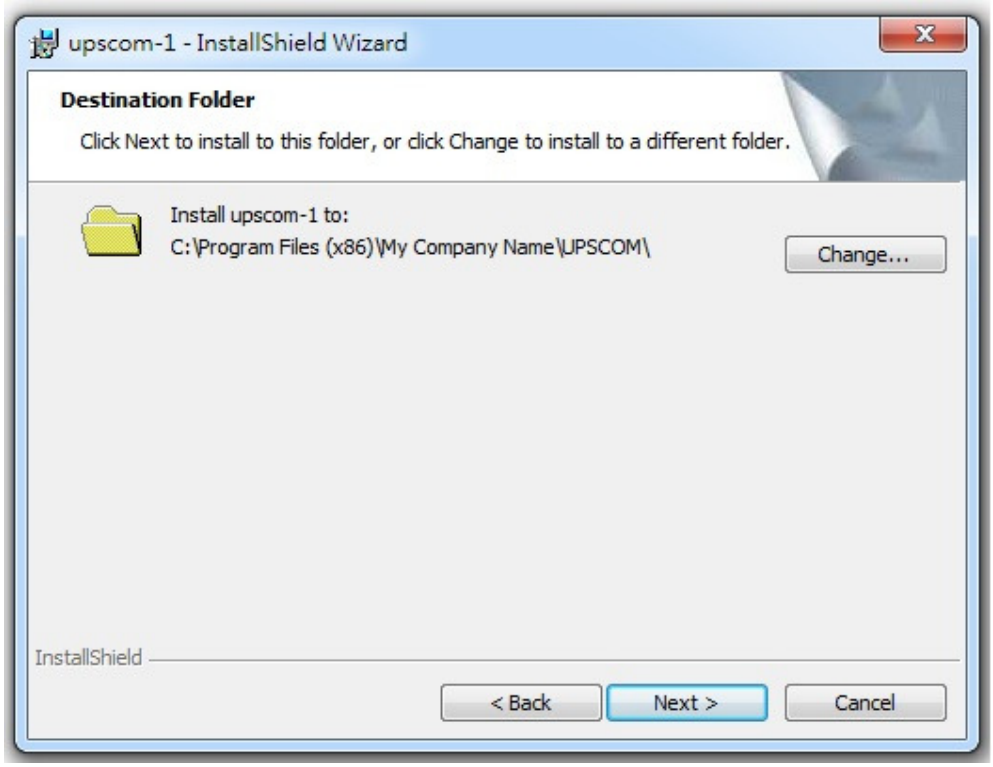


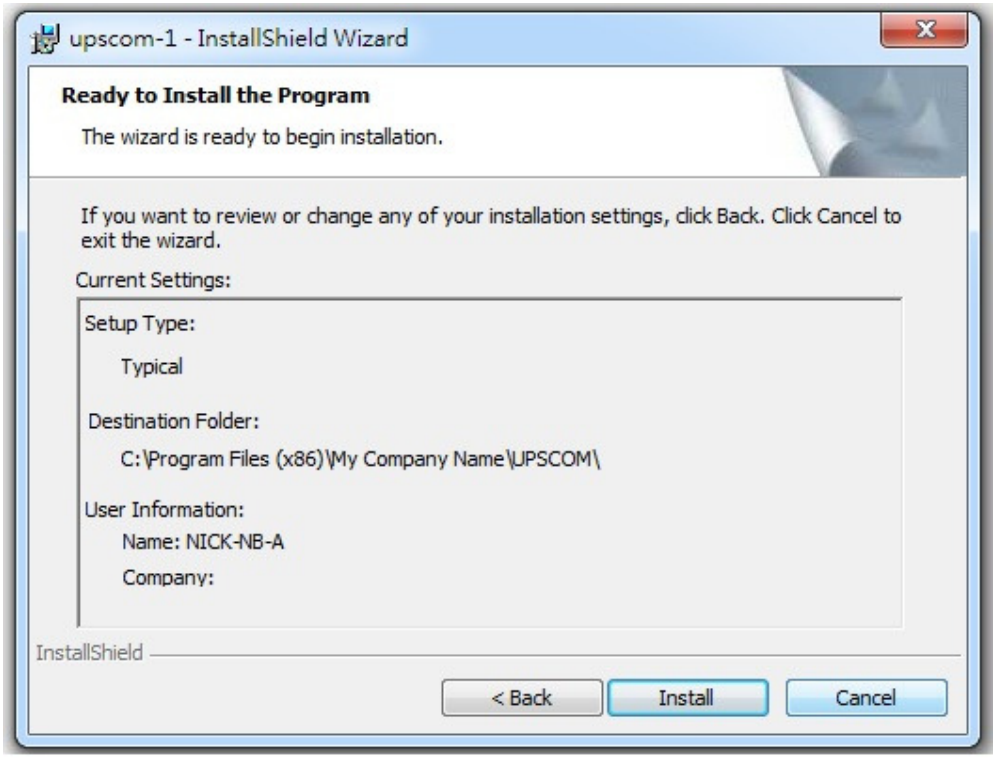
** ELI SHOULD BE GROUNDED TO AVOID NOISE INTERFERING LAPTOP.

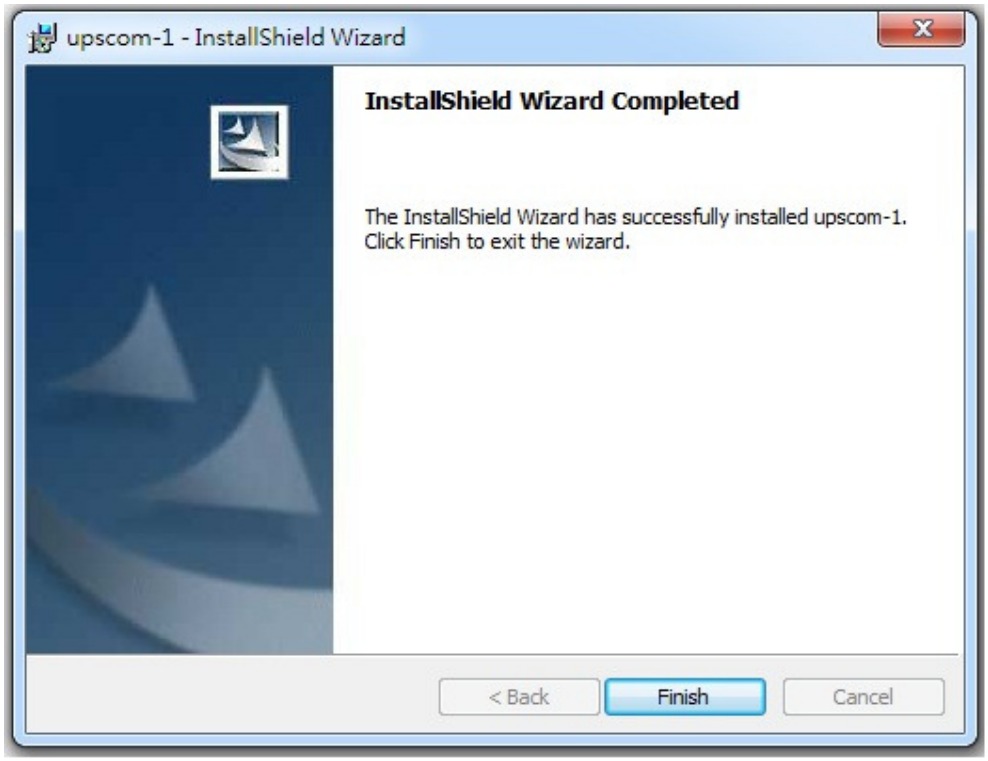
3. INSTALL ELICOM-1





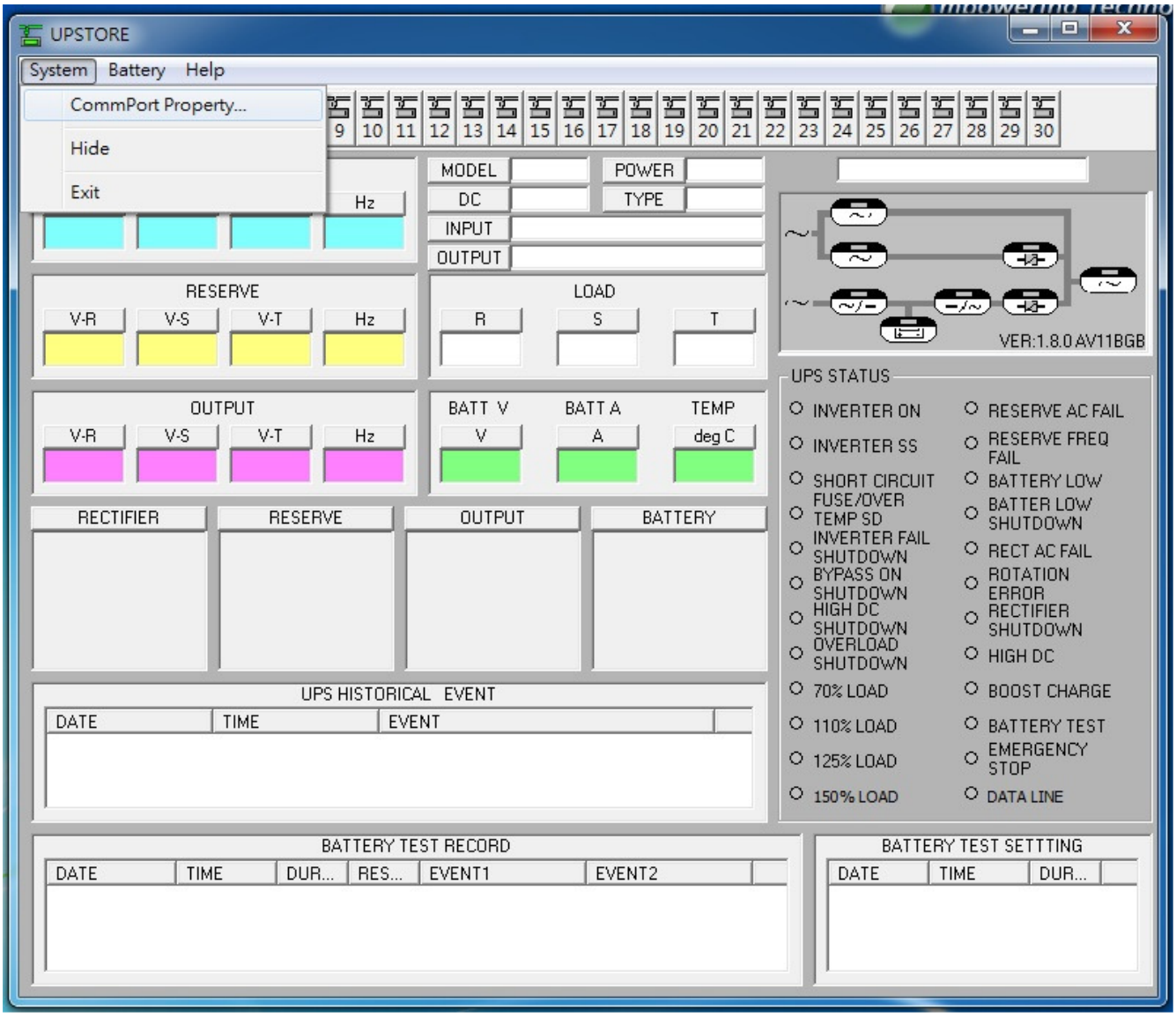

upscom-1 - InstallShield Wizard
Destination Folder
Click Next to install to this folder, or click Change to install to a different folder.
Install upscom-1 to:
C:\Program Files (x86)\My Company Name\UPSCOM\
Change...
InstallShield
< Back
Next >
Cancel

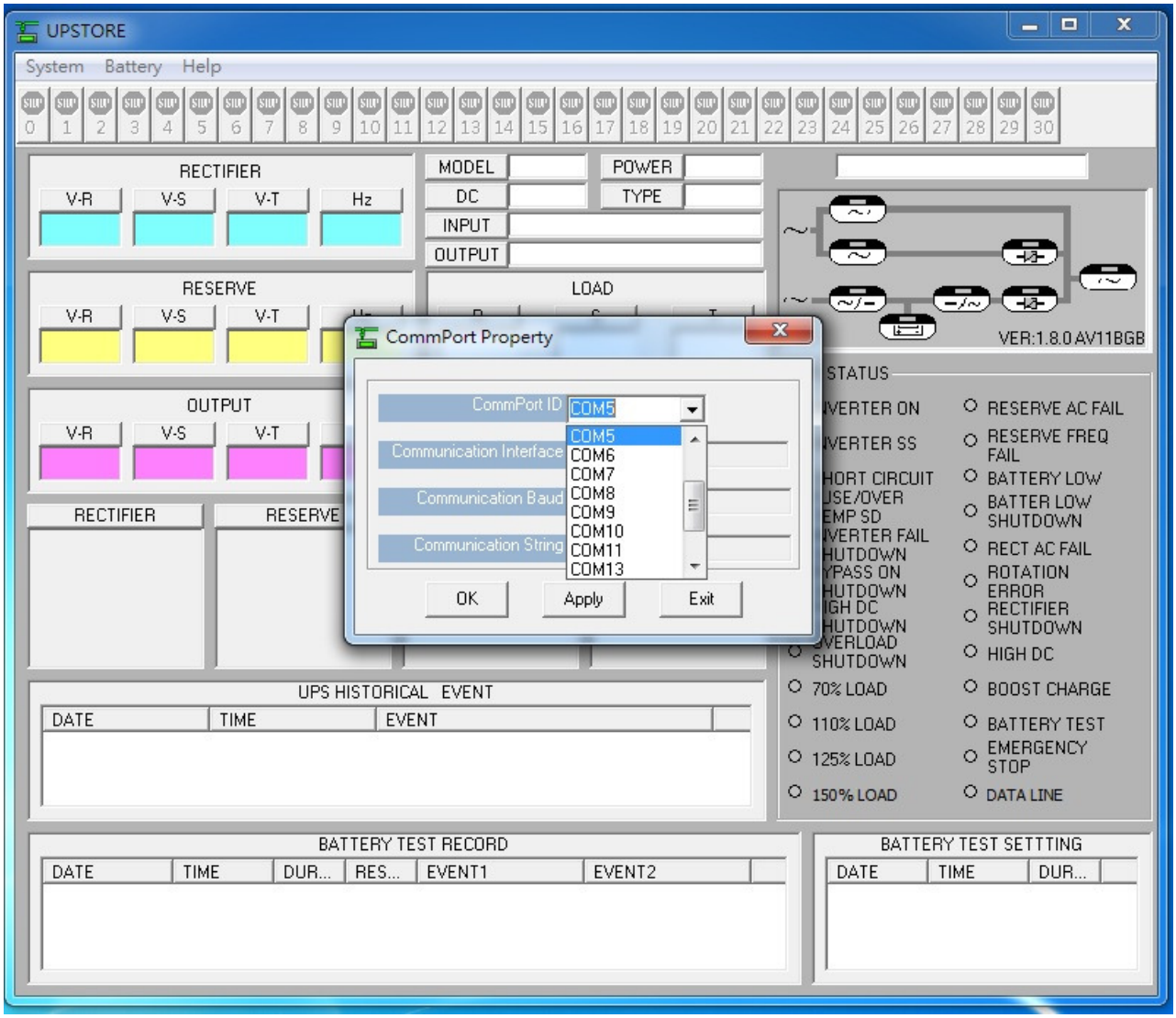

upscom-1 - InstallShield Wizard
Ready to Install the Program
The wizard is ready to begin installation.
If you want to review or change any of your installation settings, click Back. Click Cancel to exit the wizard.
Current Settings:
Setup Type:
Typical
Destination Folder:
C:\Program Files (x86)\My Company Name\UPSCOM\
User Information:
Name: NICK-NB-A
Company:
InstallShield
< Back
Install
Cancel



4. DOUBLE CLICK ELICOM-1 ICON TO LAUNCH PROGRAM

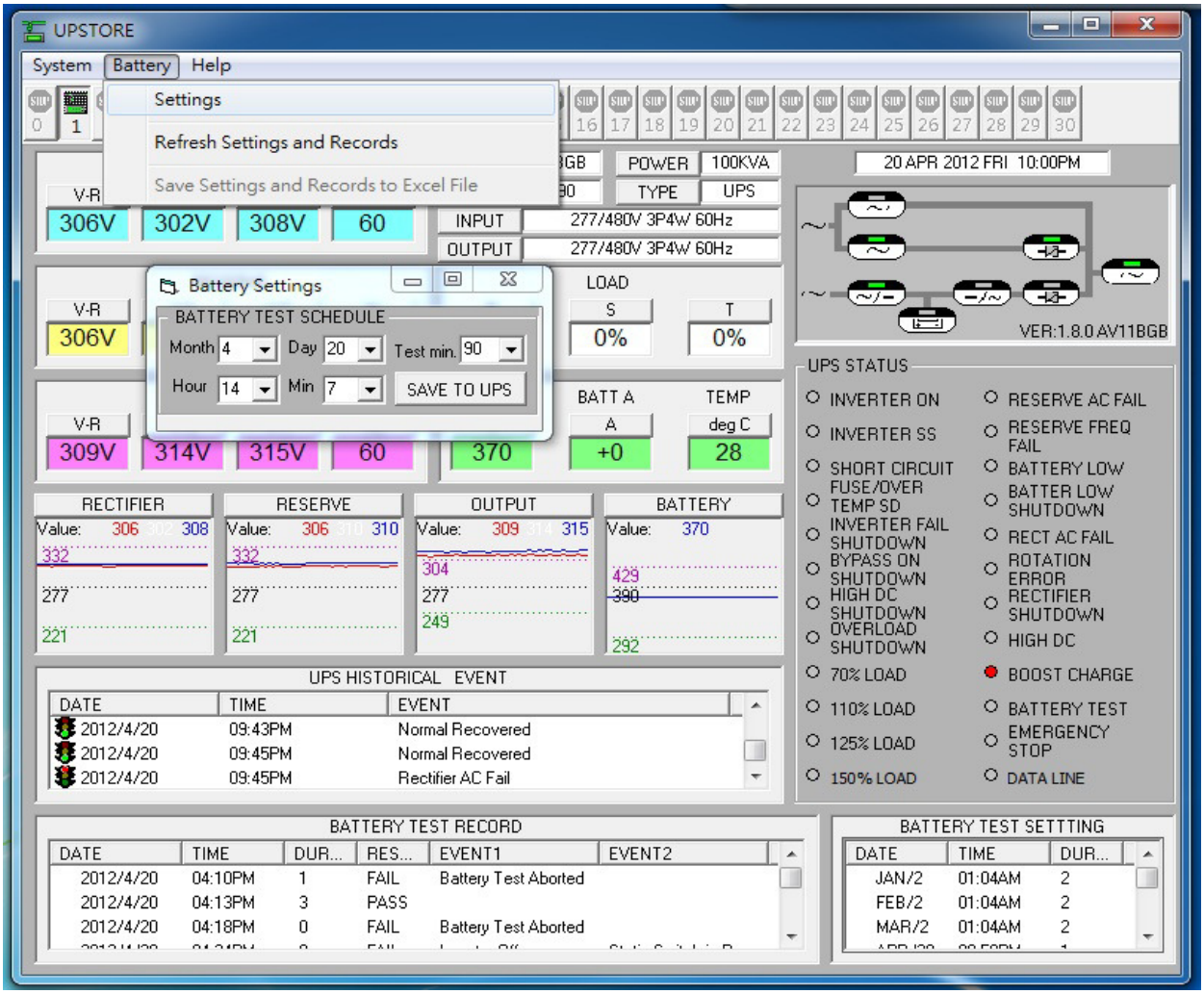
5. SET UP " Communication Port Property"



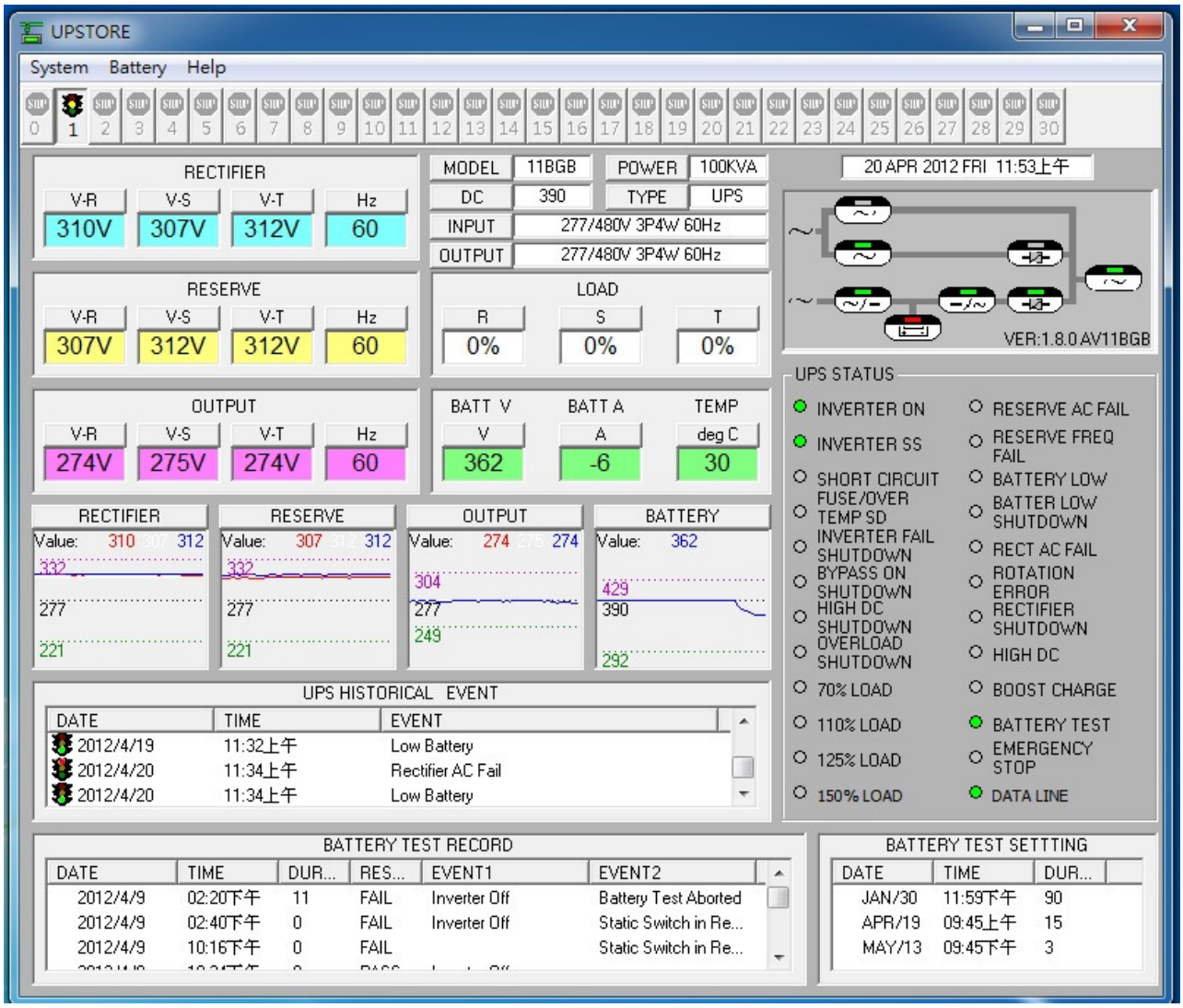

UPSTORE
System
Battery
Help
RECTIFIER
V-R
V-S
V-T
Hz
RESERVE
OUTPUT
MODEL
DC
INPUT
OUTPUT
POWER
TYPE
LOAD
VER:1.8.0 AV11BGB
STATUS
RESERVE AC FAIL
RESERVE FREQ FAIL
BATTERY LOW
BATTER LOW SHUTDOWN
RECT AC FAIL
ROTATION ERROR
RECTIFIER SHUTDOWN
HIGH DC
BOOST CHARGE
BATTERY TEST
EMERGENCY STOP
DATA LINE
70% LOAD
110% LOAD
125% LOAD
150% LOAD
CommPort Property
CommPort ID
COM5
Communication Interface
Communication Baud
Communication String
COM5
COM6
COM7
COM8
COM9
COM10
COM11
COM13
OK
Apply
Exit
UPS HISTORICAL EVENT
DATE
TIME
EVENT
BATTERY TEST RECORD
DATE
TIME
DUR...
RES...
EVENT1
EVENT2
BATTERY TEST SETTTING
DATE
TIME
DUR...

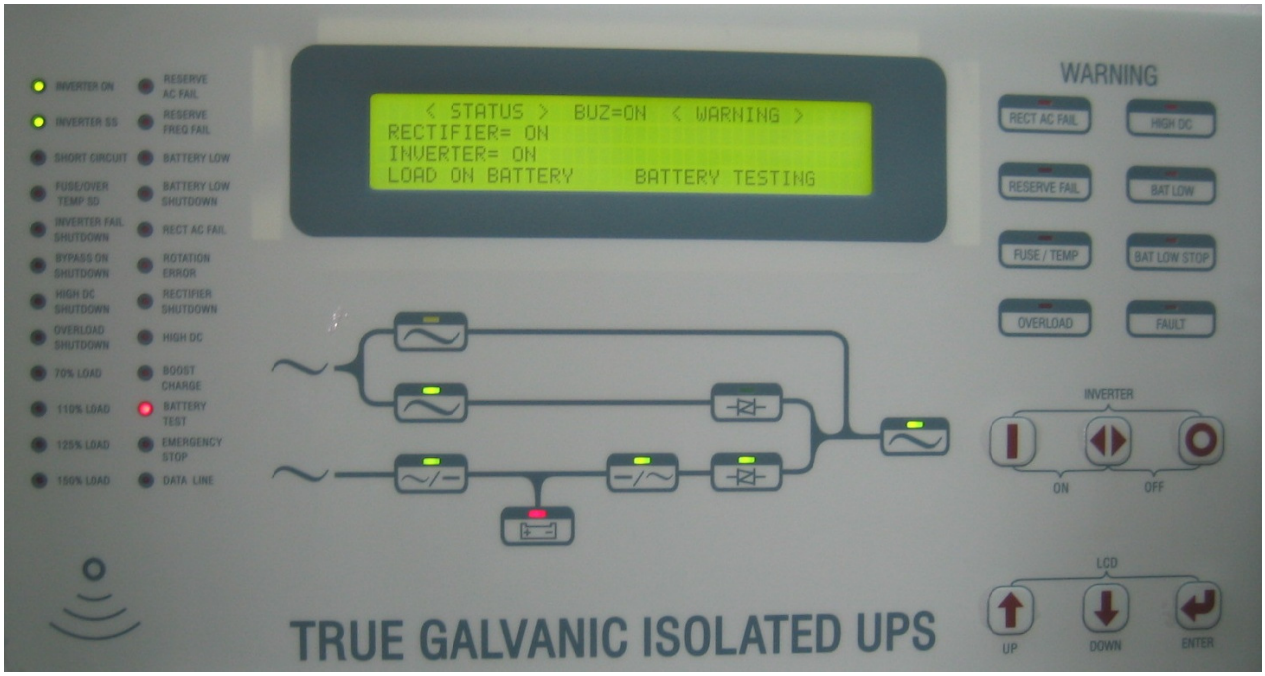
6. SAVE TO EXCEL FILE MENU IS NOT ENABLED BEFORE ALL EE DATA HAS BEEN DOWNLOADED TO COMPUTER.

SETTING THE BATTERY TEST SCHEDULE



7. BATTERY TESTING


UPSTORE
System Battery Help
RECTIFIER
V-R V-S V-T Hz
310V 307V 312V 60
MODEL 11BGB POWER 100KVA
DC 390 TYPE UPS
INPUT 277/480V 3P4W 60Hz
OUTPUT 277/480V 3P4W 60Hz
20 APR 2012 FRI 11:53上午
RESERVE
V-R V-S V-T Hz
307V 312V 312V 60
LOAD
R S T
0% 0% 0%
VER:1.8.0 AV11BGB
OUTPUT
V-R V-S V-T Hz
274V 275V 274V 60
BATT V BATT A TEMP
V A deg C
362 -6 30
UPS STATUS
INVERTER ON
INVERTER SS
SHORT CIRCUIT
FUSE/OVER TEMP SD
INVERTER FAIL SHUTDOWN
BYPASS ON SHUTDOWN
HIGH DC SHUTDOWN
OVERLOAD SHUTDOWN
70% LOAD
110% LOAD
125% LOAD
150% LOAD
RESERVE AC FAIL
RESERVE FREQ FAIL
BATTERY LOW
BATTER LOW SHUTDOWN
RECT AC FAIL
ROTATION ERROR
RECTIFIER SHUTDOWN
HIGH DC
BOOST CHARGE
BATTERY TEST
EMERGENCY STOP
DATA LINE
RECTIFIER
Value: 310 312
332
277
221
RESERVE
Value: 307 312
332
277
221
OUTPUT
Value: 274 274
304
277
249
BATTERY
Value: 362
429
390
292
UPS HISTORICAL EVENT
DATE TIME EVENT
2012/4/19 11:32上午 Low Battery
2012/4/20 11:34上午 Rectifier AC Fail
2012/4/20 11:34上午 Low Battery
BATTERY TEST RECORD
DATE TIME DUR... RES... EVENT1 EVENT2
2012/4/9 02:20下午 11 FAIL Inverter Off Battery Test Aborted
2012/4/9 02:40下午 0 FAIL Inverter Off Static Switch in Re...
2012/4/9 10:16下午 0 FAIL Static Switch in Re...
BATTERY TEST SETTTING
DATE TIME DUR...
JAN/30 11:59下午 90
APR/19 09:45上午 15
MAY/13 09:45下午 3



** BUZZER WILL BEEP

*** IF THE UPS IS IN ECO MODE, IT WILL AUTOMATICALLY COME BACK TO NORMAL MODE TO DO THE BATTERY TEST, AFTER FINISH THE BATTERY TEST, IT WILL AUTOMATICALLY GO BACK TO ECO MODE.

8. TO ABORT BATTERY TEST DURING BATTERY TESTING : PARAMETER SET, PASSWORD=1234

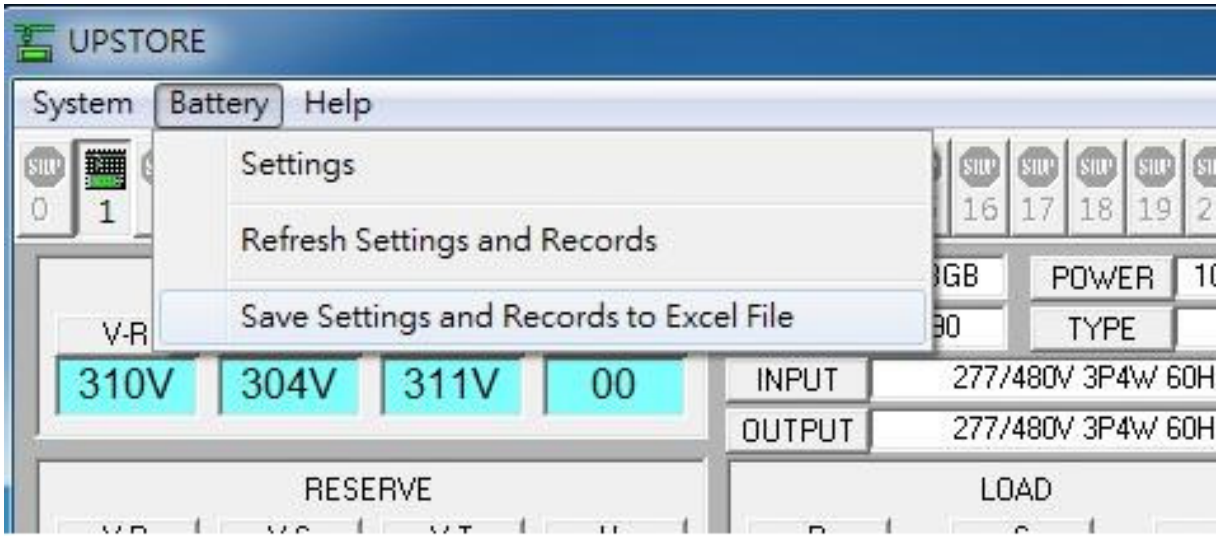
9. INVERTER MANUALLY TURNED OFF DURING BATTERY TEST, BATTERY TEST MANUALLY ABORTED & LOW BATTERY SHUTDOWN WILL BE RECORDED IN EE:

BATTERY TEST RECORD

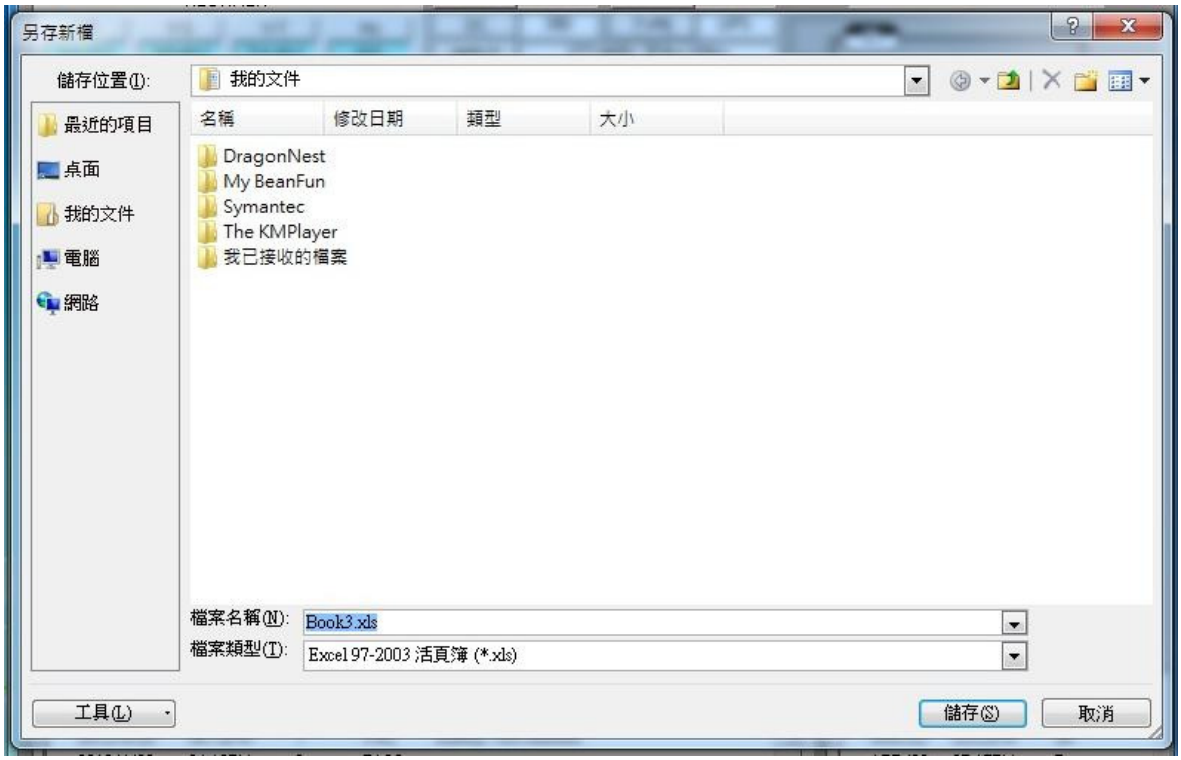
DATE	TIME	DUR...	RES...	EVENT1	EVENT2
2012/4/20	01:55PM	0	FAIL	Inverter Off	Static Switch in Re...
2012/4/20	01:57PM	0	FAIL	Battery Test Aborted	
2012/4/20	02:03PM	1	FAIL	Low Battery Shutdown	Inverter Off

10. SAVE EXCEL FILE MENU IS ENABLED AFTER ALL EE DATA HAS BEEN DOWNLOADED TO COMPUTER

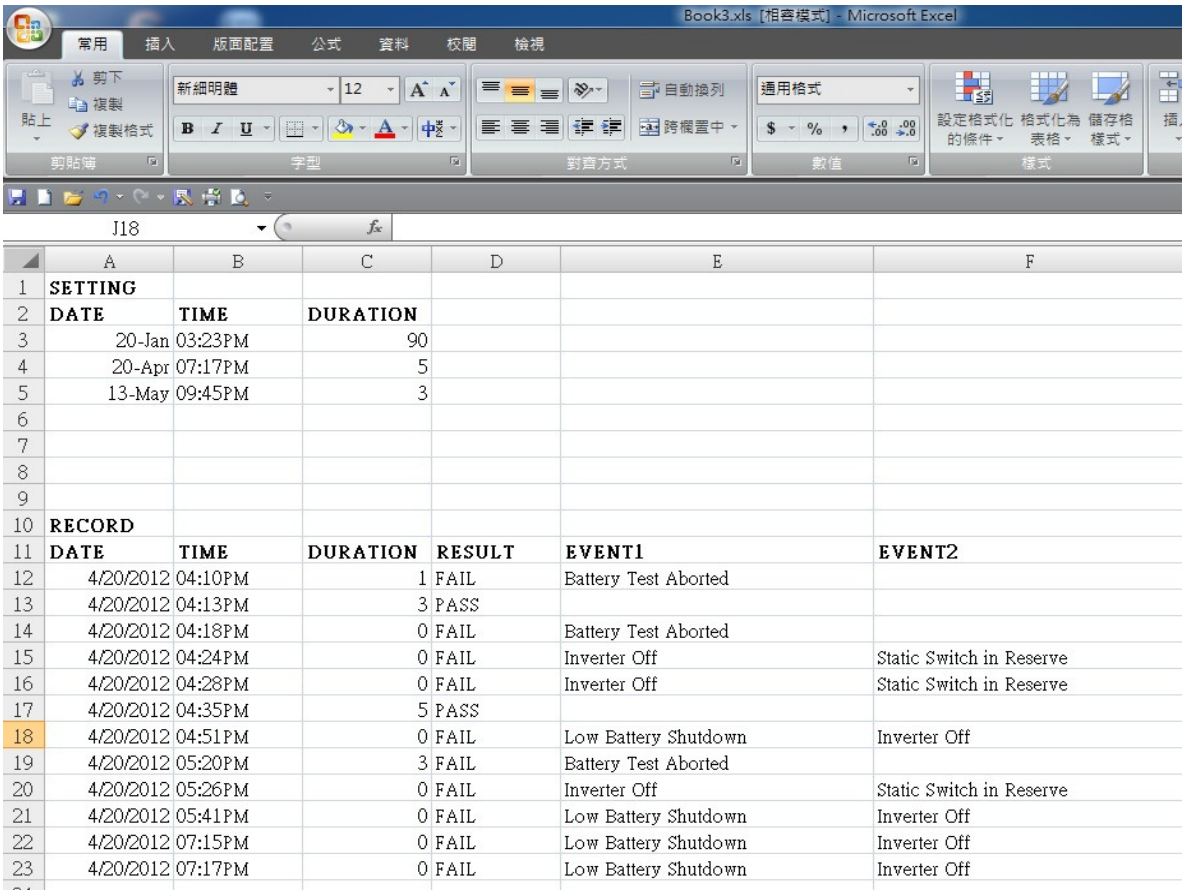
SAVE SETTINGS & RECORDS



11. SELECT PATH & KEY IN FILENAME:



12. OPEN & CHECK EXCEL FILE:



	A	B	C	D	E	F
1	**SETTING**					
2	**DATE**	**TIME**	**DURATION**			
3	20-Jan	03:23PM	90			
4	20-Apr	07:17PM	5			
5	13-May	09:45PM	3			
6						
7						
8						
9						
10	**RECORD**					
11	**DATE**	**TIME**	**DURATION**	**RESULT**	**EVENT1**	**EVENT2**
12	4/20/2012	04:10PM	1	FAIL	Battery Test Aborted	
13	4/20/2012	04:13PM	3	PASS		
14	4/20/2012	04:18PM	0	FAIL	Battery Test Aborted	
15	4/20/2012	04:24PM	0	FAIL	Inverter Off	Static Switch in Reserve
16	4/20/2012	04:28PM	0	FAIL	Inverter Off	Static Switch in Reserve
17	4/20/2012	04:35PM	5	PASS		
18	4/20/2012	04:51PM	0	FAIL	Low Battery Shutdown	Inverter Off
19	4/20/2012	05:20PM	3	FAIL	Battery Test Aborted	
20	4/20/2012	05:26PM	0	FAIL	Inverter Off	Static Switch in Reserve
21	4/20/2012	05:41PM	0	FAIL	Low Battery Shutdown	Inverter Off
22	4/20/2012	07:15PM	0	FAIL	Low Battery Shutdown	Inverter Off
23	4/20/2012	07:17PM	0	FAIL	Low Battery Shutdown	Inverter Off