



## EP Series

### Line Interactive UPS Models

#### Installation & Operation Manual



### Documented Power Supply Models

The following uninterruptible power supply models, with their part numbers, are documented by this instruction manual. These power supplies may be referenced using the part numbers listed below.

MODEL	PART NUMBER	INPUT
EP350	010-038-10	120VAC/60Hz; 24VDC
EP650	010-034-11	120VAC/60Hz; 24VDC
EP1100	010-037-10	120VAC/60Hz; 48VDC

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## Critical Safety Issues

### Section 1: Critical Safety Issues

#### Safety Admonishments

Three different levels of safety admonishments are used within this instruction manual: specifically **DANGER**, **WARNING**, and **CAUTION**.

*Trois niveaux différents d'avertissements de sécurité sont utilisés dans ce mode d'emploi; spécifiquement **DANGER**, **AVERTISSEMENT** et **ATTENTION**.*



#### **DANGER**

The statement following the **DANGER** heading alerts the equipment user of a potentially life or health-threatening situation unless precautions are taken against it. Admonishments of this nature usually entail the hazards of electrical shock or those encountered that may result in physical injury.

*La déclaration sous la rubrique **DANGER** avertit l'utilisateur de l'équipement d'une situation potentiellement mortelle ou mortelle, sauf si des précautions sont prises contre lui. Les admonistances de cette nature entraînent habituellement les dangers d'un choc électrique ou ceux rencontrés qui peuvent entraîner des blessures physiques.*



#### **WARNING / AVERTISSEMENT**

The statement following the **WARNING** heading alerts the equipment user of a condition or procedure that could result in interruption of service to the users or subscribers of the service receiving power from this product.

*La déclaration sous le chapitre **AVERTISSEMENT** avertit l'utilisateur de l'équipement d'une condition ou d'une procédure qui pourrait entraîner une interruption de service pour les utilisateurs ou les abonnés du service qui reçoit l'alimentation de ce produit.*



#### **CAUTION / ATTENTION**

The statement following the **CAUTION** heading alerts the equipment user of a condition that could result in damage to the subject equipment or ancillary equipment if care is not exercised during certain maintenance or operating procedures.

*La déclaration suivant la rubrique **ATTENTION** avertit l'utilisateur de l'équipement d'une condition qui pourrait endommager l'équipement concerné ou l'équipement auxiliaire si les soins ne sont pas exercés pendant certaines procédures de maintenance ou d'exploitation.*

## **IMPORTANT SAFETY INSTRUCTIONS. SAVE THESE INSTRUCTIONS**

## Emergency Shutdown Procedure



Exercise extreme caution when performing the following procedure. Carry out the steps precisely in the order given to avoid the possibility of personal injury or equipment damage.

Perform the following procedure if the power supply must be shut down and disconnected on an emergency basis:

1. Open the Battery circuit breaker.
2. Open the Input circuit breaker.
3. Disconnect the Battery harness from its receptacle on the front panel of the UPS.
4. Disconnect the AC Input wiring and disconnect the Generator from its outside cabinet generator connector to complete shutdown of power to the load.

## General Safety Issues

The EP Line Interactive Uninterruptible Power Supplies (UPS) documented in these instructions have been designed, tested, and produced to ensure safe, trouble-free operation. Personnel using or installing these power supplies should completely read and fully understand the following safety instructions. They are provided here as informational guidelines for the continued safety in usage of the product.

## Safety Issues of Power Supply Installation and Use

The UPS has been designed and built to power Department of Transportation and Intelligent Traffic Systems equipment only. It is not intended for any other usage and provides output voltages suitable only for its intended application. It is to be installed such that unauthorized persons will not have access.



**This power supply operates from an AC source ranging from 85 to 175 volts and produces internal voltages more than 200 volts. DO NOT open any covers or panels or attempt to perform any service to the power supply without first removing and disconnecting all external AC and DC power sources. Only trained, qualified personnel should attempt service and repair work on the power supply.**

## Multiple Power Sources

All power supplies documented in this instruction manual use more than one source of power. If any reason exists to open the power supply enclosure for maintenance or adjustments, first open the battery breaker, disconnect the harness from its receptacle, and open the AC Input circuit breaker on the front panel. If a generator is in use, disconnect it from its receptacle. Internal DC circuits will retain harmful electrical charge after disconnecting both power sources from the UPS. Only trained personnel should be permitted to handle this UPS.

### Ground Fault Protection

The power supply does not contain integral ground fault protection. Where such protection is required, the power supply input should be connected to a ground fault interrupter (GFI) outlet or to a branch circuit protected by a GFI circuit breaker of proper ratings.

### Enclosure Safety Issues

The enclosure and the power supply must be installed by qualified technicians or installers only, using appropriate mounting hardware in accordance with local codes and construction practices.

The power supply must be installed within a NEMA 3R enclosure or any grounded metal enclosure suitable for accommodating DOT/ITS power supplies.

The outer enclosure housing the power supply must be of adequate strength to support the power supply and its associated batteries. Additionally, the enclosure must afford adequate ventilation for the power supply such that a minimum free air space of 52 mm (2 inches) remains around all sides and the top of the power supply.

Temperature of the air and the enclosure of the power supply may be rated up to 74° C (165° F). Unauthorized persons should not come in direct, physical contact with the UPS as surface may be hot. Air intake and exhaust openings within the enclosure must not be less than what is required to maintain this temperature requirement. If these temperature limits are routinely exceeded or ventilation requirements cannot be attained, a suitable forced-air cooling system may be required within the enclosure.



Fig. 1-1 Typical DOT/ITS Power Supply Enclosure

### EMI/RFI Statement

This device has been designed and manufactured to comply with the EMI / RFI emission limits and immunity characteristics as set forth in Standards EN 55022 and EN 55024. These limits are designed to provide reasonable protection against harmful interference when this equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed in accordance with this instruction manual, may cause harmful interference to radio communications.

### Battery Safety Issues

When choosing a battery type (gelled electrolyte or AGM) for installation, it is not recommended mixing different types of batteries in the same string. **DO NOT** use flooded type batteries containing liquid electrolyte under any circumstances. Such batteries are hazardous to use within DOT/ITS enclosures and can degrade or

destroy equipment installed in the enclosure with them. Flooded batteries also pose environmental hazards when acid containment methods cannot be employed. Use only gelled electrolyte or AGM batteries of suitable size, voltage, and capacity for use in a DOT/ITS system.



**Batteries can supply extremely large currents (>4000 amps) for a short period of time, sufficient to vaporize or melt metal objects. For this reason, installers must remove watches, rings and other jewelry before placing or connecting batteries in the cabinet. Insulating gloves and protective clothing should be worn during battery installation, consistent with local practices. Use only fully insulated tools designed for battery maintenance.**

Batteries contain Sulfuric acid in gelled or semi-liquid form. Direct contact with any spilled electrolyte from a damaged battery may result in skin irritation or chemical burns. For this reason, handle batteries carefully to avoid puncturing the case and releasing any of the electrolytes. Replace any battery that is found to have a swollen or cracked case. Always recycle used batteries to reclaim lead and other materials that can pose environmental hazards if disposed of improperly.

In case of contact with the electrolyte, thoroughly wash any contaminated areas of the skin with soap and water. In case of contact with the eyes, immediately flush with copious amounts of water and seek medical attention. Minor surface spills can be neutralized with an appropriate neutralizing agent such as bicarbonate of soda (baking soda).

Always use proper lifting techniques when handling batteries. Each 12-volt battery weighs approximately 30 Kg or 66 lbs.

Personnel installing or servicing batteries must wear eye protection (goggles or full-face shield) and protective clothing (apron and gloves) if necessary, according to local practices. Additionally, only fully insulated tools specifically designed for battery installation and service should be used for that purpose. Tools wrapped with vinyl or fabric-based electrical tapes are NOT acceptable substitutes. (Insulated wrenches complying with IEC 60900 and ASTM F-1505 Standards<sup>1</sup> are distributed by various industrial supply organizations)

The Battery harness MUST be removed from the receptacle on the front of the power supply before installing, changing, and connecting batteries. Verify correct battery polarity and voltage at the Battery harness connector before connecting the Battery harness. Applying DC input of improper polarity or voltage can seriously damage or destroy the power supply.

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<sup>1</sup> IEC 60900: Live Working – Hand Tools for Use Up to 1000VAC and 1500VDC  
ASTM F-1505: Standard Specification for Insulated & Insulating Hand Tools



## Introduction

### Section 2: Introduction

#### Overall Operation

The EP Line Interactive series of power supplies provides filtered and regulated AC output power of proper voltage and current values to operate traffic signals, conflict monitors, camera equipment, lighting, and additional applications used in Departments of Transportation and Intelligent Traffic Systems (DOT/ITS). These power supplies are designed to power an intersection or intelligent traffic system from the commercial AC utility line while maintaining an emergency battery in a state of full charge. If the commercial AC line fails for any reason or if line voltage exceeds preset low or high limits, the low voltage inverter within the power supply is enabled and begins to provide power to the intersection or highway system load while drawing its operating power from the battery string. After commercial AC utility line power has been restored, the power supply will revert to line mode operation, supplying power to the intersection or highway system while drawing operational power from the commercial AC utility line and simultaneously recharging the battery string. The power supply will also provide automatic voltage regulation (AVR) in the events of brown-outs or voltage spikes using integrated Buck and Boost circuitry.

#### Primary Voltage

The EP Line Interactive power supply has been designed for operation from standard AC utility lines with an overall voltage range of 85 to 175 volts for nominal 120VAC/60Hz models. UPS output frequency is matched with the AC input frequency.

#### Inverter Operation

The EP Line Interactive UPS provides filtered, regulated, and back-up battery power in the event of line voltage brownout, spike, or failure. During these events, the inverter draws power from the battery string and provides output voltage to the load. The point at which the UPS switches to inverter operation is determined automatically by the embedded microcontroller. When input voltage returns within operating range, the UPS will automatically return to Line Mode operation. In the event line power is not yet present and emergency power is needed, the Inverter can be forced on by turning on the battery breaker and turning the Inverter ON through the Control menu. This is referred to as a "Cold Start". Please see the Menu Options for control and Specifications for Acceptance and Detect voltages.

#### Output Over-Current Monitoring

The output of the EP Line Interactive UPS provides current limiting functions that will protect the output and the inverter in the event of overload and short circuit of the output. Over-currents not exceeding 110% of the model rated output current will provide 10 minutes of runtime upon which the output will bypass the inverter. This overload condition will test the overload every 60 seconds to see if the overload has been corrected. At 150% of overload, the UPS will provide 10 second power intervals at which time the UPS will automatically attempt to provide power to the load until the over-current condition is corrected. Short circuit conditions will disconnect the inverter and open the input/output circuit breaker. In the event a short circuit occurs, the unit will have to be manually reset.

## Automatic Voltage Regulation with Buck/Boost

Superior output voltage regulation is achieved on the EP Series UPS with features that automatically correct for high or low output voltage. Due to the linear topology of the transformer in use, the output voltage trends with the input voltage. If any fluctuation occurs on the input voltage, it will also be present on the output. Buck and Boost correct for this voltage swing by automatically selecting the appropriate transformer tap to regulate the output voltage and provide a nominal 120VAC to all equipment powered by the UPS. In the event of a continuous input voltage spike, Buck will reduce the output voltage. If a continuous input voltage sag occurs, Boost will increase the output voltage. Both features have two settings and occur at specific voltage levels across the entire rated input voltage window. Hysteresis is included around each trip point to prevent rapid output voltage fluctuation when nearing each of the settings, which are listed below.

AVR Mode	Trip-In Point	Trip-Out Point
High Input Transfer (Inverter Mode)	175VAC	165VAC
BUCK2	154VAC	145VAC
BUCK1	135VAC	127VAC
Nominal Input (Line Mode)	120VAC	135VAC or 110VAC
BOOST1	110VAC	116VAC
BOOST2	97VAC	102VAC
Low Input Transfer (Inverter Mode)	85VAC	97VAC

## Status Monitoring Interface

The EP Line Interactive UPS is factory equipped with Ethernet connectivity, providing status information regarding operation, alarm reporting, event notification via email, and onboard web page for configuration and local monitoring of UPS operation. Ethernet communication is TCP/IP ready and supports SNMP, SMTP, and HTTP protocols. Each EP Series UPS Ethernet connector provides two LEDs to report network connectivity and activity. Local system monitoring through a serial port monitoring is available through a DB-9 connector. There are also 8 dedicated dry contacts available on the front panel of the UPS to provide operating conditions to an external traffic controller and user input.

## EP Series Line Interactive UPS Features

- 120VAC/60Hz input and output voltage
- High efficiency for economical line operation and longer run time from battery input
- Pure sine wave output
- Liquid Crystal Display (LCD) for local diagnostics and configuration
- Input power factor, typically 0.9 or better (line mode)
- Temperature compensated battery charger with battery temperature sensor
- Robust rectifier/charger and inverter circuits
- PWM controlled forced-air cooling
- Ethernet and serial status monitoring
- Compliant UPS product per IEC Standard 60950-1, UL1778, and FCC Part B
- Complies with EMI/RFI limits of Standards EN 55022 and EN 55024. Unpacking and Inspection

**All EP Series Line Interactive UPS' Include**

- 1 Power supply with rack mount kit
- 1 Battery temperature sensor cable
- 1, 24VDC or 48VDC battery harness
- 8 dry contact relay connectors
- 1 Installation and operating instructions

**Missing or Damaged Items**

If items are found to be damaged or missing, contact the shipping company and a Multilink representative immediately. All damage claims must be filed with the shipping company conveying the equipment. A Multilink representative will be able to assist with immediate equipment needs if necessary.

**Original Shipping Container**

When returning a power supply for service, use its original shipping container and all original packing materials. Items damaged because of improper packaging will not be covered under provisions of warranty service.

**Other Items**

If other items such as batteries and cable kits for use with the power supply have been ordered, also ensure that those items did not sustain shipping damage. As with the power supply itself, all damage claims must be filed with the shipping company and a Multilink representative should be contacted immediately.

## Front Panel Controls, Connections, and Indicators

### Section 3: Front Panel Controls, Connections, and Indicators

The front panel of each EP Series UPS contains various connectors, all operator controls, and indicators. These items are described as follows. See figure 3-1 and 4-1 for connector locations. Further details regarding use of controls and indicators may be found in the Startup and Operation section of this manual.

#### Controls

INPUT CIRCUIT BREAKER: 10- or 20-amp circuit breaker protects input and output circuitry and wiring. This circuit breaker is also used as an AC switch to apply and remove input power to the power supply.

BATTERY CIRCUIT BREAKER: 50- or 80-amp circuit breaker protects DC input and inverter circuitry.

#### Connections

INPUT/OUTPUT TERMINAL BLOCKS: The power supply contains two, WECO 324-HDS screw type terminals to provide the attachment of AC utility mains power and the load. Each terminal block has three positions for AC utility mains conductors to be attached. Each terminal block is labeled with "L, N, G". The internal Input and Output circuits share the Neutral return path and Ground conductors. Torque to 7.0 Lbf/in. Max wire gauge of 8AWG solid wire or 10AWG stranded wire, with a minimum insulation rating of THHN. When stranded wires are used on the input/output terminal blocks, ferules or equivalent crimp terminal must be used.

BATTERY INPUT: Anderson SB-50-type connector: used for connecting the external battery string to the power supply. Test points are available on the front panel of the UPS.

BATTERY TEMPERATURE PROBE: RJ-11 connector provides connection the external temperature probe for temperature compensated battery charging.

**RELAY CONNECTORS:** 3-pin terminal block allows for external alarm reporting to a conflict monitor for 6 of the 8 dedicated dry contact relays. Each relay has a set of 3 pins labeled "1, 2, and 3" and are labeled below. Torque each connection to 4.0Lbf/in. **NOTE:** C6 and C8 relays provide up to 3.0A at nominal battery voltage to peripheral equipment. Please refer to "Pin Out" for wiring.

Relay	Function	Pin Out (1,2,3)	Notes
C1	Inverter Mode	NC – C – NO	Energizes when the UPS when line voltage is not present, and the unit is in Inverter Mode
C2	Low Batt Voltage	NC – C – NO	Energized after battery voltage reaches low battery warning threshold
C3	UPS Fault	NC – C – NO	Contact is energized when any fault is generated.
C4	Timer	NC – C – NO	The two-hour preset time has elapsed, and the relay is now energized. The user may set the timer value.
C5	General Alarm	NC – C – NO	Contact is energized when any alarm is generated.
C6	Constant 24/48V	NC – NEG - POS	Provides constant 24 or 48VDC (model dependent) voltage connection point for peripheral equipment. DC power is available in all modes after initial startup.
C7	User Input	User Input, See Below	User Inputs for Batt-Test, Door Alarm, and AC Shutdown.
C8	Switched 24/48V	NC – NEG - POS	Provides switched 24 or 48VDC (model dependent) voltage point for peripheral equipment. DC power is only enabled during Inverter mode.

**C7: USER INPUT CONTACTS:** Four contacts are used to create three user input options. Three on the C7 relay plug, and the left most position on the C8. These opto-isolated contacts are labeled, from left to right, **19, 20, 21, and 22.** "22" is the common point (C) between the other three contacts. Placing a short using a switch or wire between 22 and the other three contacts provides a specific function as described below:

UI-1: **Batt-Test** Short 19 and 22. Initiates a local battery test.

UI-2: **Door Alarm:** Short 20 and 22. This alarm is intended to be used with a normally open door-interlock switch to indicate when the door is open. Alarm activates when continuity is present between 20 and 22.

UI-3: **AC Shutdown:** Short 21 and 22. This will shut down the output of the UPS and must be manually reset using the circuit breakers to restore output.

ETHERNET COMMUNICATION PORT: RJ-45 connector; provides connection to DOT/ITS network interface.

SERIAL COMMUNICATION PORT: DB-9 connector; factory use only.

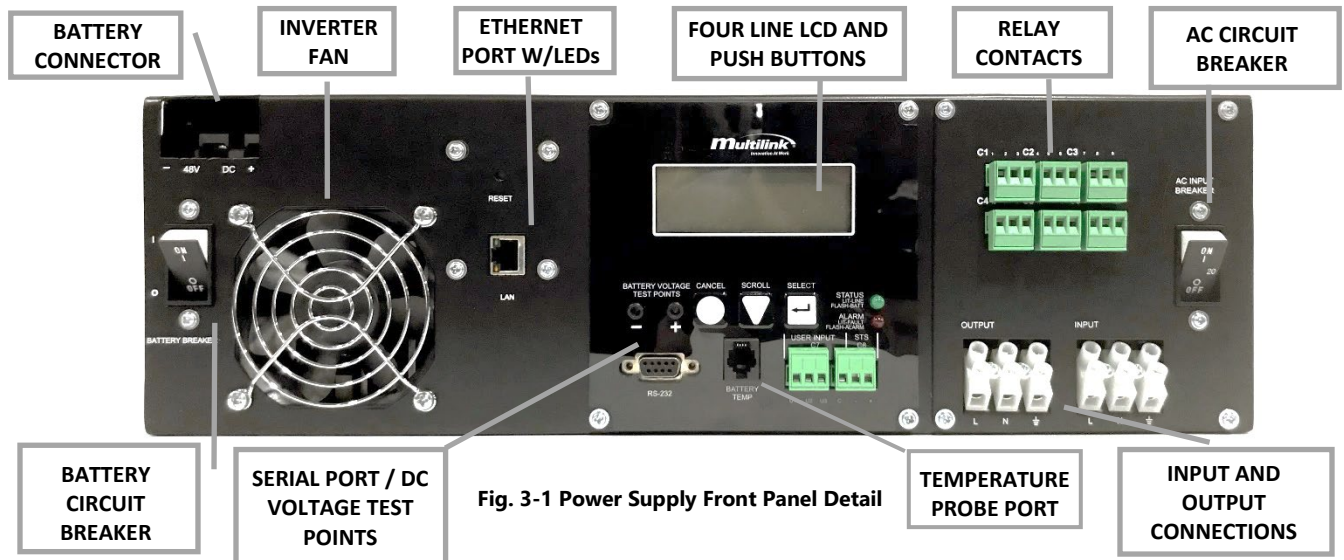


Fig. 3-1 Power Supply Front Panel Detail

## Indicators

**Liquid Crystal Display (LCD):** The four-line LCD on the front panel of the power supply serves as the main visual communications device so the user can view several operational conditions of the power supply at any time. Three membrane buttons associated with the LCD provide means for the user to navigate the individual screens. Further description of the menu tree may be found in the **Startup and Operation** section of this manual.

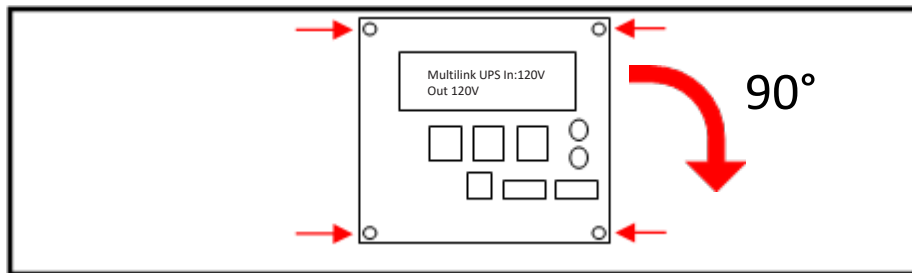
**LEDs:** Two LEDs on the front panel provide visual indication of power supply operational status. The Status LED provides the UPS operation status. If the Green LED is on, the UPS is operating from Line power. If it is flashing, the UPS is operating solely from the Inverter. If off, the output of the UPS is turned off, or the unit is in Qual or Standby modes. If the Red LED is flashing, there is an alarm that is present. If it is on, there is a fault present.

### Rotatable FrontPanel for EP1100

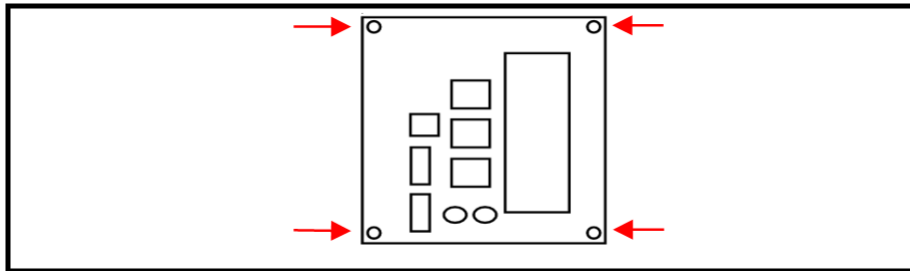
The front panel containing the LCD may be rotated 90° clockwise to allow for the UPS to be mounted in a vertical rack system. These systems are used in spaced constrained areas and allow for a more easily readable display. **NOTE:** This panel may only be rotated 90° clockwise or 90° counterclockwise to be returned to its original position. Rotating this panel may dislodge wiring harnesses internal to the UPS and should only be performed, with functionality confirmed, before deployment in the field. It may also be necessary to remove internal wire ties before rotating the panel.

To rotate the front panel:

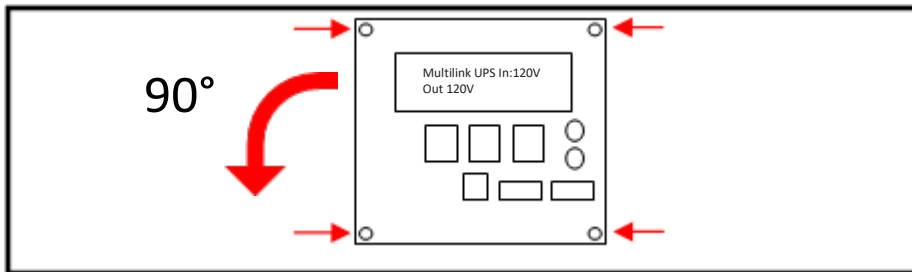
1. Locate and remove the four Phillips screws shown using a #2 Phillips screwdriver.
2. Gently pull the panel away from the chassis to clear the wiring harnesses and rotate 90° clockwise. Ensure no wire harnesses were disconnected during rotating.



3. Reinsert the panel and reassemble using the four screws. Notice the LCD position.



4. To return the front panel, follow the first two steps but rotate the panel 90° counterclockwise to return the front panel to its original position and reassemble using the four screws.



## Installation Setup

### Section 4: Installation Setup

The installation of the EP Series UPS into an enclosure may be accomplished by connecting input and output wiring to the appropriate connectors of the power supply. All connections on the front panel of the power supply use bare copper wiring or mate with industry-standard connectors widely used. Moreover, connectors used in this power supply mate with accessory harnesses and assemblies designed and manufactured by Multilink Inc. Refer to the OPTIONS section of these instructions for further information. These instructions apply to all three models of the EP Series.



#### CAUTION

In all installations, the following conditions apply and must be observed:

- A service disconnect switch containing over-current protection devices such as circuit breakers or fuses with appropriate AIC (amperes – interrupting capacity) rating shall be placed between the AC utility source and the service entrance device for the power supply. Where used, the disconnect switch and/or main branch circuit breaker must be installed in compliance with all national, state, and local codes as required. Please reference ANSI/NFPA 70 for compliance. To reduce the risk of fire, max branch circuit breaker rating for the EP350, EP650, and EP1100 are 15A, 15A, and 20A, respectfully.
- For outdoor installations, the AC utility conductors connected to the power supply service entrance device shall be physically protected through an appropriate restraining device and conduit, consistent with local codes and practices.
- Permission to mount the power supply enclosure at any site shall be made in accordance with all legal requirements and local practices of the area.

This power supply is designed for use in both existing and new ground-mount enclosures. Observe the following procedures during installation of any EP Series UPS.

#### Preparation

The EP Series Line Interactive power supplies have been factory assembled, tested, and prepared as a complete product ready for installation within an enclosure. The installer must verify that the correct type of AC power receptacle is installed in the enclosure for the input service and power supply selected for use at any given site. Additionally, the battery strings installed in the enclosure must match the battery rating. Power supply ratings may be verified from the nameplate on the power supply.

#### Grounding

Safety ground and earth ground connections must be in place for the power supply and enclosure for both personal safety and operational considerations. During power supply and/or enclosure installation, the following grounding connections must be provided or verified. Failure to provide and connect adequate safety and earth grounds at each installation site may result in improper power supply operation or permanent damage to the power supply itself.



1. The AC utility conductors installed in the service entrance box must contain a safety ground conductor. The power supply installer should verify that this grounding conductor is in place, having been installed along with the AC utility input.
2. A separate enclosure ground wire must be connected between the enclosure ground lug and an earth ground connection provided by a ground rod installed at the power supply site. In most cases, one copper or copper-clad steel ground rod of 2.5 meters (8 feet) length driven into the earth will be sufficient to provide the ground connection required. In some instances, a more elaborate grounding method (such as a ring ground) may be required; however, this may be dictated by state or local codes and depends on conductivity of the soil within the installation area.
3. The dead metal of the service entrance box must be bonded to the metal enclosure that houses the power supply. Additionally, the ground bar within the service entrance box should be bonded to the metal enclosures; however, this requirement may be subject to local codes and practices.
4. The grounding wire connected between the power supply enclosure and the earth ground rod should be no smaller in area than 13 mm<sup>2</sup> (6 AWG) copper. Both ends of the ground wire should be sealed with an appropriate anti-oxidation compound.
5. An optional ground bonding wire of the same size as specified in Step 4 above may be connected between the optional ground lug at the left side of the power supply chassis and earth ground where such connection enters the external system enclosure. Refer to the OPTIONS sections for more information.

### **Placement in the Enclosure**

This power supply has been designed primarily for use within a cabinet or enclosure offering protection from outdoor weather, entry of excessive dust, dirt, or moisture, and from unauthorized contact by untrained personnel. If used in a controlled environment, the power supply may be located within an indoor equipment cabinet or may be mounted on a rack shelf. Place the power supply within 36 inches of the line and load terminal block buses inside the cabinet.

The power supply should be mounted on a ventilated shelf that allows free air circulation, especially around the front panel of the power supply cabinet. Clearance of at least 1RU or 1.75 inches must be maintained around all surfaces of this power supply for unobstructed airflow. Temperature of the air entering the power supply should not exceed 74°C (165° F). System de-rating will occur at 55°C. See Specifications.

### **Wiring**

Connect input, output, control, and monitor wiring to the power supply according to the following procedure. Refer to Figs. 3-1 and 4-1 for control and connector positions.

1. Operate the AC line circuit breaker in the service entrance box to the OFF position. If the power supply is located at a head-end or other customer premise site, ensure that the branch circuit breaker chosen to protect the AC receptacle for the power supply is operated to the OFF position.
2. Operate both Input circuit breaker and Battery circuit breaker on the front panel of the power supply to the OFF (O) position.



Verify the terminal block buses in the cabinet for Utility, Output, Generator, and any additional buses are not active and are clearly labeled prior to wiring the power supply to the terminal block buses.

Use fully insulated tools when installing the EP Series UPS.

3. If the Safety Automatic Transfer Switch (SATS) is required, refer to the SATS installation guide and attach the corresponding wires of the cabinet's terminal block buses and the power supply. If only an EP Series power supply is in use, please continue to step 4.

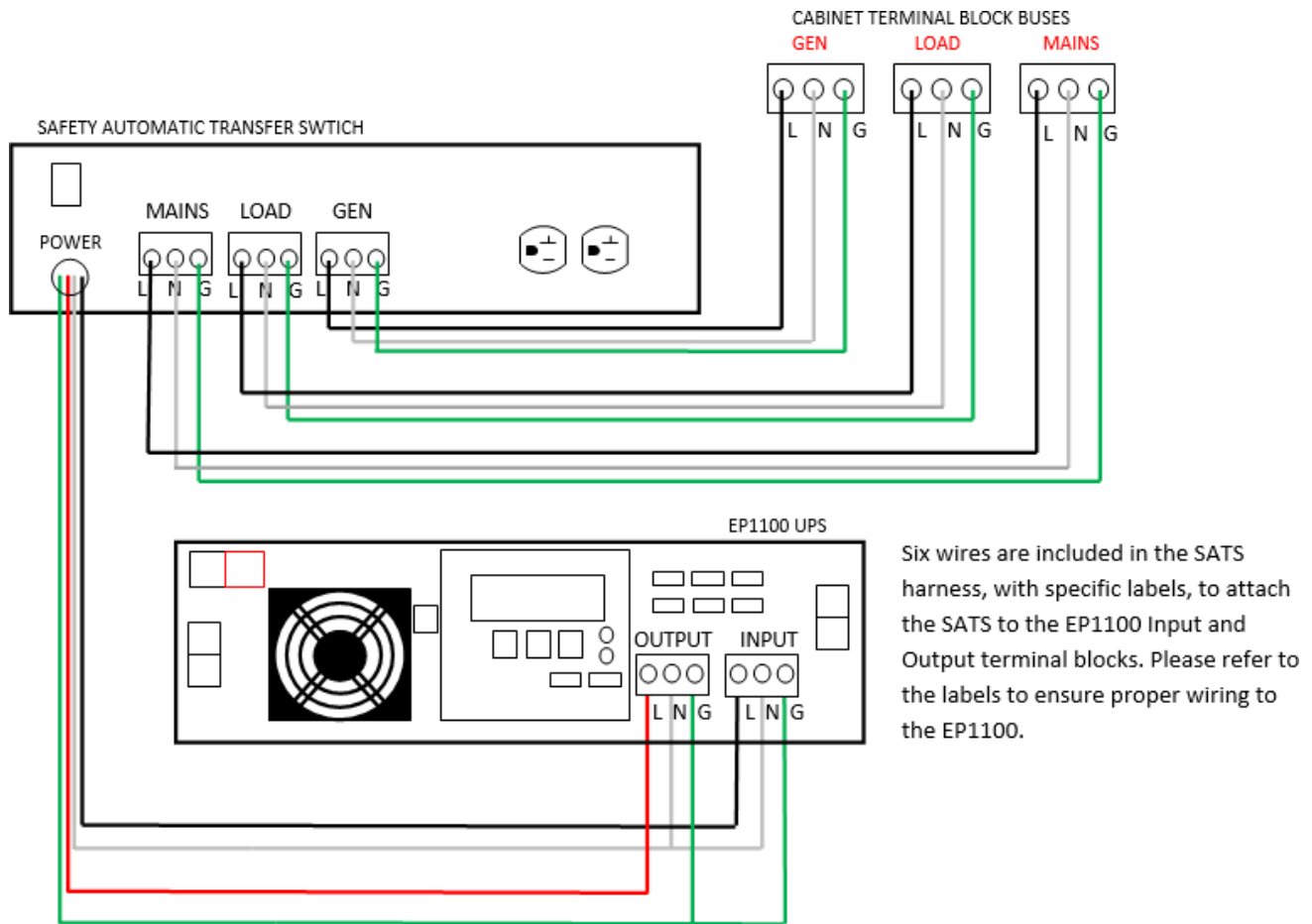


Fig. 4-1 SATS and EP Series UPS wiring example

4. Attach the corresponding wires from the input and output terminal blocks to their respective power buses in the cabinet. Take care to label each wire accordingly.
  - a. **Black** – AC Utility Line Hot Terminal Block Buses
  - b. **Red** – AC Output Hot Terminal Block Bus
  - c. **White** – AC Utility Line and Output Neutral Terminal Block Buses
  - d. **Green** – AC Utility Line and Output Ground Terminal Block Buses

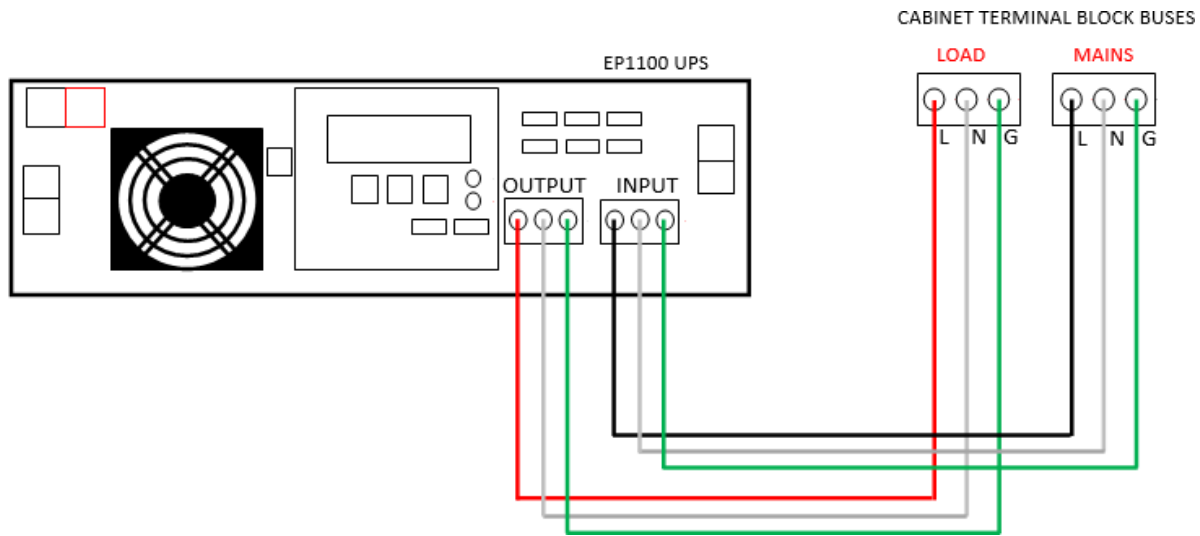


Fig. 4-2 UPS ONLY wiring example

5. If a mating battery harness has been previously installed in the cabinet, verify the correct polarity and voltage prior to connecting the battery harness to the Battery receptacle. Otherwise, battery connections will be continued in the following sub-section.
6. Attach the temperature sensor connector into the mating receptacle on the front panel of the power supply.
7. If remote monitoring of the power supply is desired, connect an Ethernet cable to the Ethernet receptacle on the front panel of the power supply.
8. Place 12 of the 7/32" black rubber terminal covers over all exposed conductor screws on the In- put and Output terminal blocks. The safety covers must remain in place and shall not be removed while the unit is in operation.

Initial installation and wiring are now complete. Verify all connections on the front panel of the power supply are securely in place.

### Battery Placement and Wiring

Proper installation and wiring of the batteries are critical to the long-term backup capability of any power supply system. Gelled electrolyte, valve regulated, or AGM batteries are recommended for use in DOT/ITS power supply applications. All batteries should be tested and fully charged prior to installation. Interconnecting wiring must be no smaller than 8 mm<sup>2</sup> in area or 8 AWG. Longer run times and improved efficiency may be realized using battery wiring of 13 mm<sup>2</sup> in area or 6 AWG.

Considering the specialized handling and connection requirements for batteries, only trained personnel should install batteries in an enclosure. Personnel must always employ appropriate safety equipment (goggles or face shields, insulated gloves, etc.) and only use fully insulated tools for tightening hardware on the battery terminals. Additionally, proper lifting tools and techniques must always be used during battery installation to avoid personal injury or equipment damage.

### Battery Installation Procedure

The EP Series UPS' have specific 24V or 48V battery harness designed for its use. The harness includes a main cabinet enclosure harness and individual disconnects for each battery. When installing the batteries, please refer to the manufacturer's instructions for installation and maintenance. The following steps provide installation and connection of the battery string used with the UPS.

1. The UPS system uses a 48VDC battery system. Refer to figure 4-3 and 4-4 when installing the battery harness for the system. **NOTE:** Follow diagram as pictured or system damage may occur.

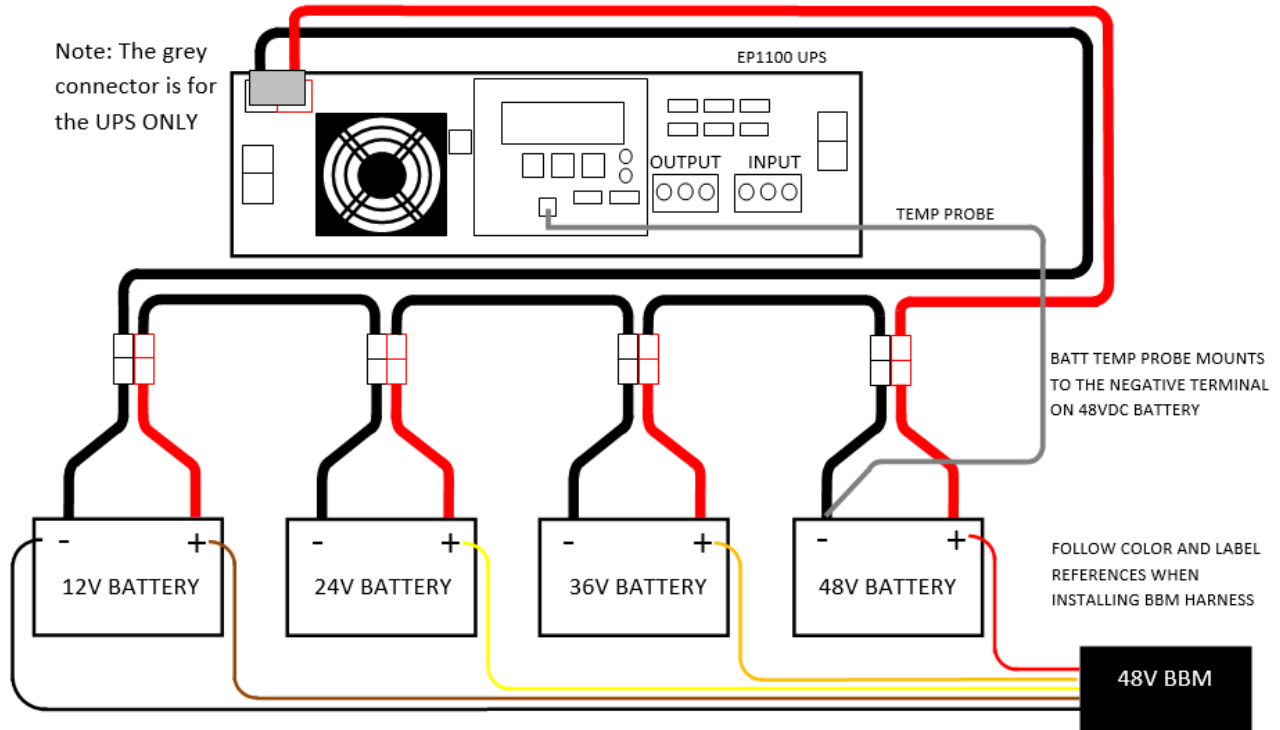


Fig. 4-3: EP1100 with 48VDC Battery Harness Kit



6. On the 48VDC battery, attach the battery temperature probe to the negative terminal.
7. Attach all individual harnesses to the main harness, with the 12VDC battery attaching to the mating connector that is furthest from the gray UPS connector.
8. Use of an anti-oxidation compound, such as NO-OX-ID "A-Special"<sup>22</sup>, is recommended at each battery termination including ring lugs and threaded hardware. Use fully insulated tools only when tightening battery connections.
9. After completing all connections to the battery terminals, use a digital multi-meter (DMM) to verify proper voltage and polarity at the battery harness connector that terminates to the power supply DC input port. For 4-battery systems, indicated voltage should be approximately 48 volts or slightly higher. When the red and black meter probes are connected to the corresponding colored terminals of the battery harness connector, the meter should indicate positive (+) voltage, assuming proper connections at the meter itself.



**WARNING**

**If voltage and polarity indications do not correspond to those described above, determine the cause before mating the battery connector to the power supply. Incorrectly wired batteries can cause personal injury or permanent damage to equipment.**

**Care and Maintenance of Batteries**

Once batteries have been installed and connected, they must not be allowed to sit without receiving a charge. The power supply must be started, even in the absence of load, and allowed to charge the batteries. Initial charging to ensure full reserve time may require seven days to accomplish. Batteries connected to an idle system without receiving a charge can be irreparably damaged, thereby requiring replacement before the system can be fully commissioned into service. Please refer to the battery manufacturer's instructions for maintenance.

---

<sup>22</sup> NO-OX-ID- "A-Special" is a registered trademark of Sanchem, Inc, Chicago, IL

## Startup and Operation

### Section 5: Startup and Operation

The power supply is ready to be placed into operation after it has been installed in its enclosure and all input and output connections have been made. Ensure that AC input power is available to the power supply receptacle then perform the following steps in sequence.



**CAUTION**

**The following steps in the startup procedure MUST be performed exactly as presented; otherwise, permanent damage to the power supply may result. Observe the LED indicators and the LCD as a guide in performing the startup procedure.**

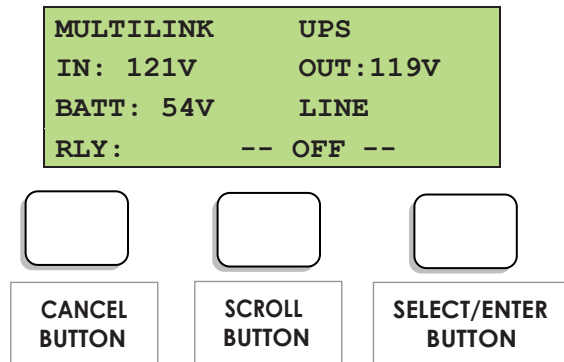
1. Verify that all connections and initial wiring is complete, as previously outlined and described.
2. Connect the battery harness to the Battery receptacle of the UPS. The receptacle is keyed to prevent incorrect insertion.
3. Operate the utility AC circuit breaker serving the power supply to the ON position.
4. Operate the Input circuit breaker on the power supply and the power supply will begin to qualify AC line voltage and the Output will be activated.
5. The LED indicators on the front panel of the power supply should be illuminated as follows upon startup and after qualification of the AC utility line:
  - **STATUS:** Solid GREEN.
  - **ALARM:** Flashing. This is in anticipation of the battery breaker being closed.
6. After the power supply initializes, the LCD will begin to display operating information.
7. Close the battery breaker. The power supply will automatically begin charging the batteries after AC Line voltage have been qualified and enters Line mode.
8. The power supply is now operating in Line mode, assuming application of appropriate AC line power and load.
9. Verify the Alarm LED is not flashing. If so, investigate the cause of the alarm and correct the alarm.

## Front Panel LCD Menus

The status of the power supply is indicated in the various menus available on the LCD located on the front panel of the power supply. Some of the displayed information may also be transmitted to a remote monitor as part of the data generated by the embedded network device.

Three membrane keys, located below LCD, provide user control for navigating the menus. These keys also provide means of configuring the UPS' operating conditions, viewing the event counters and network card information, and scrolling through all observable menu items.

Fig. 5-1 Controls



## LCD Screen

The LCD assembly chosen for the UPS has been designed for use in a wide temperature range. As such, the characters displayed on the screen should be visible under nearly all temperature conditions. The user may note that under hotter than normal conditions, the characters may fade and become less distinct as compared to those viewed at lower temperatures. The faded characters are temporary and will darken as temperature decreases.

The backlight feature of the LCD is timed to automatically shut off 5 minutes after the last pushbutton is pressed. The auto-shutoff feature extends the life of the backlight.

## LCD Menu Tree

The UPS menu tree allows for easy access to system performance parameters, history statistics, and operating conditions. On startup, the display will default to the UPS model name, operating characteristics, and its current mode of operation. Use the "Scroll" button to select from various menus and their respective sub-menus. These menus will be described below. Press the "Select" button to select a menu, the item displayed, or press the "Cancel" button to return to the previous menu or exit a configuration state.



## Menu Options and Descriptions

Status Menu: Displays the current operating conditions for the UPS

Control Menu: Displays UPS configurable items. This menu is password protected.

Fault Status Menu: Displays any faults that may have occurred during operation of the UPS.

Alarm Status Menu: Displays any alarms that may be present during operation of the UPS.

Event Status Menu: Displays a list of events with time stamps for each event that has occurred.

Relay Menu: Describes each of the 8 relays available on the front panel of the UPS.

## UPS Main Menu

<b>MULTILINK</b>	<b>UPS</b>
<b>IN: 120V</b>	<b>OUT: 120V</b>
<b>BATT: 55V</b>	<b>LINE</b>
<b>RLY: -- OFF --</b>	

This line displays the manufacturer and model type.

The line reports input and output voltage

This line reports the battery voltage and mode of operation.

This line reports active relay alarms



Each soft key has a dedicated function as described above

State of operation will appear on the bottom line of this menu. They are described as:

- **LINE**: UPS is powered from the qualified AC utility line voltage.
- **INVERTER**: Utility line voltage is absent or unqualified and the UPS is powered from the battery string.
- **QUAL**: Utility line voltage is being qualified for use.
- **BUCK**: Occurs when utility line voltage is high. This feature has two stages, BUCK1 and BUCK2.
- **BOOST**: Occurs when utility line voltage is low. This feature has two stages, BOOST1 and BOOST2.
- **STANDBY**: Indicates the power supply output is shut down and waiting for the presence of utility line voltage or acceptable battery voltage.
- **BYPASS**: The output of the UPS is bypassing the use of the inverter.
- **TEST**: A battery test is currently in process.

At any time, press any the Select or Scroll buttons to enter the menu item displayed. Below are each of the six main menus with their respective submenus described.

MENU	
<b>CONTROL</b>	<b>ALARM</b>
<b>STATUS</b>	<b>EVENT</b>
<b>FAULT</b>	<b>RELAY</b>

## Status Menu

The Status menu provides parameter values such as input voltage, frequency, event count, etc. Each item will display its respective value as measured. Use the Scroll button to view items. Use the Cancel button to return to the previous menu. Each parameter will be described below.

IN/OUT STATUS	
VI: 120V	VO: 119V
FQ: 60HZ	IO: 3.0A
OUT PWR: 360W	

Input Voltage (VI) and Output Voltage (VO).

Input/Output Frequency (FQ) and Output Current (IO).

Calculated Output Power in Watts

BATTERY STATUS	
VOL: 55.0V	TMP: 20°C
CHGR CUR:	5.0A
RUN TIME:	250 MIN

Batt string voltage and remote temperature sensor reading.

Measured battery charger current.

Estimated runtime. This value is only an estimate and varies on battery life, load conditions, and inverter operation.

NETWORK STATUS	
IP: 192.168.100.1	
MAC ADDRESS	
00:14:81:00:FC:D8	

Displays the currently assigned IP address.

This is the MAC address of the embedded network card.

System Status	
S. NO: 2010-350	
VER: 3.0.15	
12-1-20 12:30:00 PM	

This is the serial number of the unit.

Firmware version installed for the

UPS. Current Date and Time

## Controls Menu

The Controls menu is password protected and provides configurable parameters and UPS control functions. Each item may have one or more selectable options when selected. When an item is selected to be changed, the option will flash. Press the Scroll button to select a different option and press Enter to confirm this change. The item will stop flashing once it has been selected. Press cancel at any time to abort making a change or to return to the previous menu. The default factory password is "1111".

CONTROL MENU	
PASSWORD: 1111	

CONTROL MENU	
INVERTER:	DISABLE
FORCE INV:	OFF
BYPASS:	OFF

**Inverter:** Enable by default, may be disabled to prevent inverter operation

**Force Inverter:** Disable by default, may be turned on to force inverter operation.

**Bypass:** Off by default, may be enabled by user to bypass

Inverter and charger operation.

CONTROL MENU	
AC SHTDWN:	DISABLE
SENSE:	NORMAL
FUNC MODE:	AVR

**AC Shutdown:** Disable by default, may be enabled to prevent AV line operation.  
**Sense:** Normal by default. GEN can be used for noisy AC utility or generator power.  
**Func Mode:** AVR (Buck and Boost), Quality for AC input of 100-130VAC.

CONTROL MENU	
QUAL TIME:	30 SEC
INVCUTOFF:	ENABLE
INVCUTVOL:	42V

**Qual Time:** Time for UPS to qualify AV line voltage. 1, 3, 10, 30, 45, or 60 sec.  
**Invcutoff:** Enable by default. Allows UPS to shut down during low battery.  
**Invcutvol:** Inverter cutoff voltage. Prevents battery damage. 41-48V in 1.0V.

CONTROL MENU	
BAT LEVEL:	43V
CHGR CUR:	10A
BATT COMP:	-5.0mV

**Batt Level:** Threshold to energize Low Batt (C2) relay.  
**Chgr Cur:** 10A charger current by default. 0-10A in 1.0A.  
**BattComp:** Modifies the charger voltage per °C. 0 to -5.0mV.

CONTROL MENU	
BATT TEST:	OFF
BTESTTIME:	05 M
DATE FRMT:	MM-DD-YY

**Batt Test:** Local battery test. Initiated by the user.  
**Battery Test Time:** 5 minutes by default. 5, 10, 30, or 60 min.  
**Date Format:** DD-MM-YY by default. YY-MM-DD optional.

CONTROL MENU	
CLK FRMT:	12H
CLR EVENT:	NO
TEMP UNIT:	C

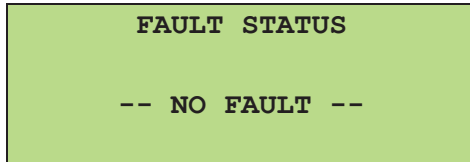
**Clock Format:** 12-hour and 24-hour formats available.  
**Clear Events:** User may use this option to clear the counters and events.  
**Temp Units:** Celsius by default, may be changed to Fahrenheit.

CONTROL MENU	
DAYLIGHT:	ON
TIMER:	120 M
BATTERY AH:	100 AH

**Daylight:** Adjust clock based on date of daylight savings time.  
**Timer Relay:** Time delay until Timer relay closes. 0-240 in 5 min increments.  
**Battery AH:** Ahr rating of battery in use. Used to calculate estimated runtime. 100Ah default, adjustable by 1Ah.

## Faults Menu

The Faults menu lists faults, if any, that may occur during operation of the UPS and prevent further use of the UPS. Faults are visually indicated by a solid RED LED on the front panel. In the event of multiple faults, use the Scroll button to see if there are additional faults.

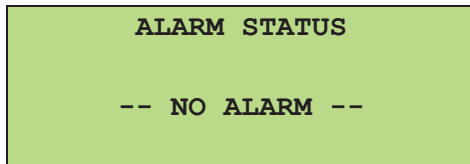


This menu shows the present faults occurred by the UPS. See fault details below. Use the scroll button to view multiple faults, if present.

- **Overload Fault** – The output of the UPS has been excessively overloaded. Remove the overload to correct this fault.
- **Short circuit** – The output has been shorted. Test the load for a short and remove to correct this fault.
- **OutputOver/UnderVoltage** – The output of the UPS is too high or too low to provide safe power to the load. Call Multilink Engineering Support.
- **Battery Fail** – Battery voltage has fallen below the inverter cut off threshold. Apply line voltage and recharge the battery string.
- **Backfeed** – The AC Input relay has welded or is unresponsive. DO NOT TOUCH THE TERMINALS. Refer to the Emergency Shutdown procedure to safely shut down the UPS.
- **BatteryOverVoltage** – The battery string voltage is too high. Test the condition of each battery in the string.
- **Temp Fault** – The UPS is being operated outside of its rated operating temperature.

## Alarms Menu

The Alarms menu lists alarms, if any, that may occur during operation of the UPS. Alarms will not prevent operation of the UPS. Alarms are visually indicated by a flashing RED LED on the front panel. In the event of multiple alarms, use the Scroll button to see if there are additional faults.



This menu shows the present alarms occurred by the UPS. See details below.  
Use the scroll button to view multiple alarms, if present.

Alarms that may occur are described below.

- **Overload** – The output is overloaded. Remove the overload to correct this alarm.
- **Batt Temp High** – The battery temperature is above the rated operating conditions. Check the battery string for damage or faulty temperature probe.
- **Batt Temp Low** – The battery temperature is below the rated operating conditions.
- **Fan Alarm** – The fan has failed. Contact Multilink Engineering Support.
- **Input Brkr Open** – The AC input breaker is open.
- **Batt Brkr Open** – The battery breaker is open.
- **Battery Test** – Indicates that a battery test is currently running.
- **Batt Low** – The battery voltage is low. Verify string is attached to UPS and breaker is closed.
- **Weak Battery** – Check condition of the batteries in the string. Replace each if necessary.
- **Temp probe** – Verify that the temperature probe is attached to the UPS. If so, check for continuity in the plug. Replace if necessary.
- **Bad Frequency** – The frequency of the AC input is outside of the rated operating conditions.
- **Utility Fail** – The AC input voltage is below the operating specs of the UPS.
- **Line High** – The AC input voltage is nearing or greater than the high operating specs of the UPS.
- **Line Low** – The AC input voltage is nearing or lower than the low operating specs of the UPS.

## Events Menu

The Events menu lists any event that occurs during operation of the UPS. Event are listed by number, date, and time. Press the Select button to select the event and use the Scroll button to view all events that have occurred.

```

EVENT MENU
EVENT 1
SELECT & SCROLL
14-5-19    13:34:34
  
```

Lists the number of the event chosen. Up to 200 events may be shown.

Use the Select button to select the number for the event. Scroll to view event(s). Date and time the event is also shown.

```

EVENT MENU
EVENT 1
BATT BKR OPEN (ALARM)
14-5-19    13:34:34
  
```

An example of the Events menu is shown.

## Relay Menu

The Relay menu lists each of the contacts and their dedicated purpose. These relays energize when the alarm or fault dedicated to each of the relays is active. These relays may be used to alert a traffic controller or other monitoring device that the UPS has an event that should be monitored.

```

C1: INVERTER ON
C2: LOW BATTERY
C3: UPS FAULT
C4: TIMER ON
  
```

C1: The inverter is currently running.

C2: The battery string voltage has reached low battery setting.

C3: A fault has occurred and must be investigated.

C4: The preset time has elapsed.

```

C5: GENERAL ALARM
C6: CONSTANT VDC
C7: USER INPUT
C8: SWITCHED VDC
  
```

C5: An alarm of any type is present on the UPS.

C6: Provides constant DC voltage for peripheral equipment

C7: An external input has been activated.

C8: Provides switched DC voltage for peripheral equipment.

## Status Monitoring

### Section 6: Status Monitoring

Embedded in all UPS' are communication devices that allow the user to monitor operating conditions and send notifications from the UPS to a Network Management System (NMS) or for on-site use in configuration, maintenance, and monitoring the UPS. Access to a Desktop or Laptop PC/MAC is required to view the embedded webpage or to communicate through SNMP.

#### Ethernet Connection Setup

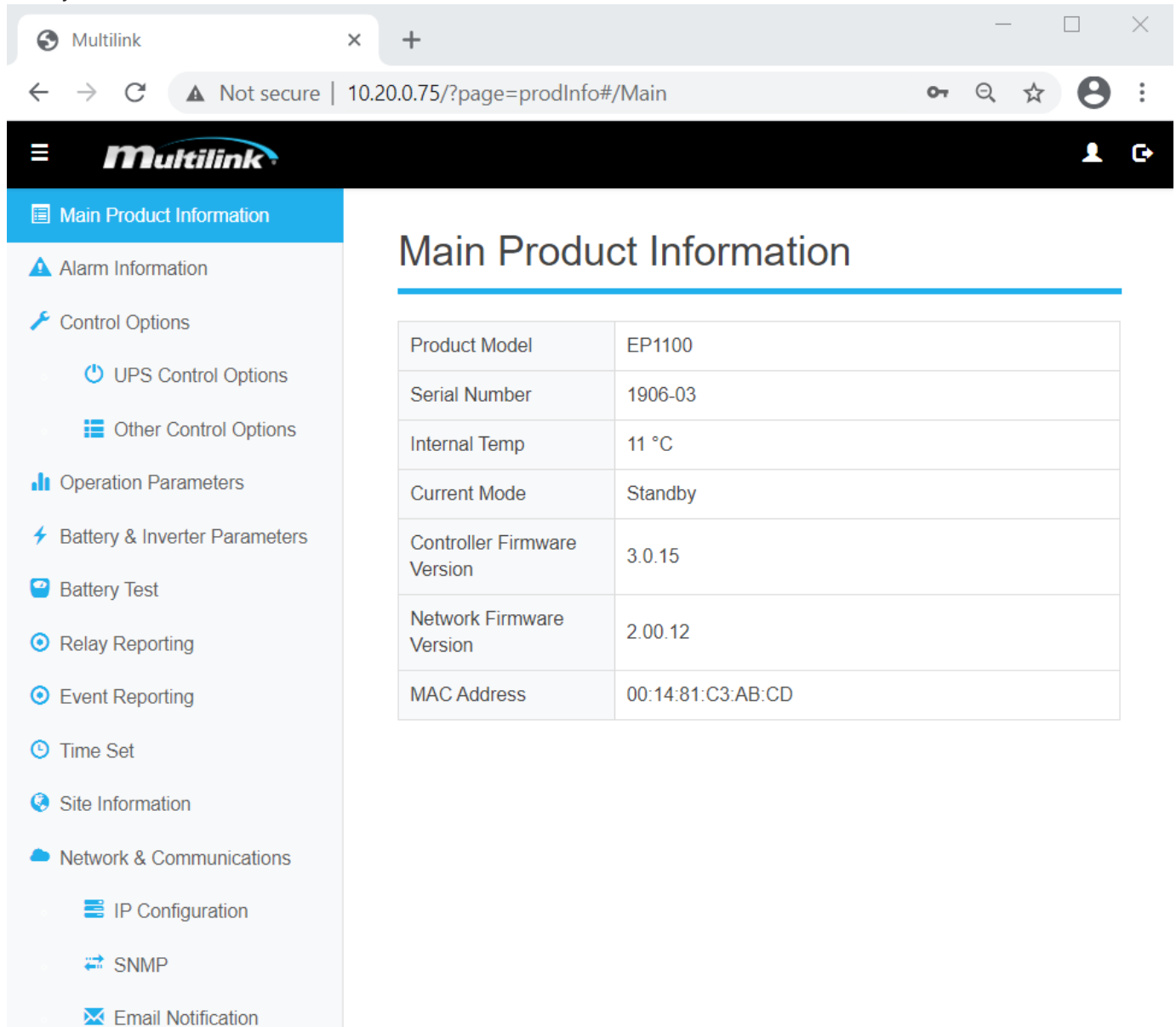
The following instructions shall be used to properly connect, configure, and monitor the network device in the UPS. These instructions assume the UPS is running, the user has local access to the UPS prior to connecting the UPS to the DOT/ITS network, and the user is operating a Windows XP/7 Based machine. Refer to the Troubleshooting section for network communication and connection problems.

1. With the UPS operating in its normal mode, connect a straight-through Ethernet cable to the "Ethernet" port on the front panel of the UPS. If the UPS is not operating in its normal mode, refer to Section 5 for "Startup and Operations".
2. Connect the opposing end of the Ethernet cable to the Ethernet port of the Desktop or Laptop.
3. Verify the current IP Address of the UPS by scrolling through the display. The factory IP Address of the UPS is 192.168.100.1. This information is displayed in the Status Menu.
4. The desktop or laptop's network interface card must be configured to the same IP range as the UPS to in order to configure the UPS.
5. Navigate to the "Network and Sharing Center" and select "Change adapter settings" from the left panel.
6. Right click on the "Local Area Connection" and select "Properties". Click to highlight "Internet Protocol Version 4 (TCP/IP)" and click the "Properties" button below.
7. Highlight the "Use the following IP Address" radio button and enter an IP Address in the range of 192.168.100.1-254. For example: 192.168.100.10. Be sure not to enter the UPS' IP Address in this textbox. If another IP Address has already been assigned to the UPS, place an IP Address in the same range of the UPS' IP Address in the textbox.
8. Enter the appropriate subnet mask into the "Subnet mask" text box if it has not already been auto filled. For example: if 192.168.100.10 is the IP Address, the Subnet mask would be 255.255.255.0.
9. Select the "OK" button and then select "Close" on the Properties window. The computer's network interface card may now begin communication with the UPS.
10. Open a preferred web browser and enter the IP address shown. Navigate to any of the pages indexed on the left side of the webpage to view or modify operating parameters.

## Webpage Description

When using the Ethernet connection, a webpage provides the current operating conditions of the UPS as well as previous history of events, configuration settings, and maintenance tools. The intuitive design of the webpage makes it easy to find parameter values, views lists of pertinent alarms, faults, and configure the UPS network settings to inform technicians via email or SNMP of timely events associated with each UPS.

The embedded webpage of each UPS is protected with user authentication to prevent unauthorized entry and control over the UPS. Parameters that are measured by the UPS are updated automatically on the webpage every 10 seconds.



The screenshot shows a web browser window with the Multilink logo in the address bar. The URL is 10.20.0.75/?page=prodInfo#/Main. The page is titled "Main Product Information" and displays a table of product details. A sidebar on the left contains various navigation options.

Main Product Information	
Product Model	EP1100
Serial Number	1906-03
Internal Temp	11 °C
Current Mode	Standby
Controller Firmware Version	3.0.15
Network Firmware Version	2.00.12
MAC Address	00:14:81:C3:AB:CD

**Navigation Sidebar:**

- Main Product Information (selected)
- Alarm Information
- Control Options
  - UPS Control Options
  - Other Control Options
- Operation Parameters
- Battery & Inverter Parameters
- Battery Test
- Relay Reporting
- Event Reporting
- Time Set
- Site Information
- Network & Communications
  - IP Configuration
  - SNMP
  - Email Notification

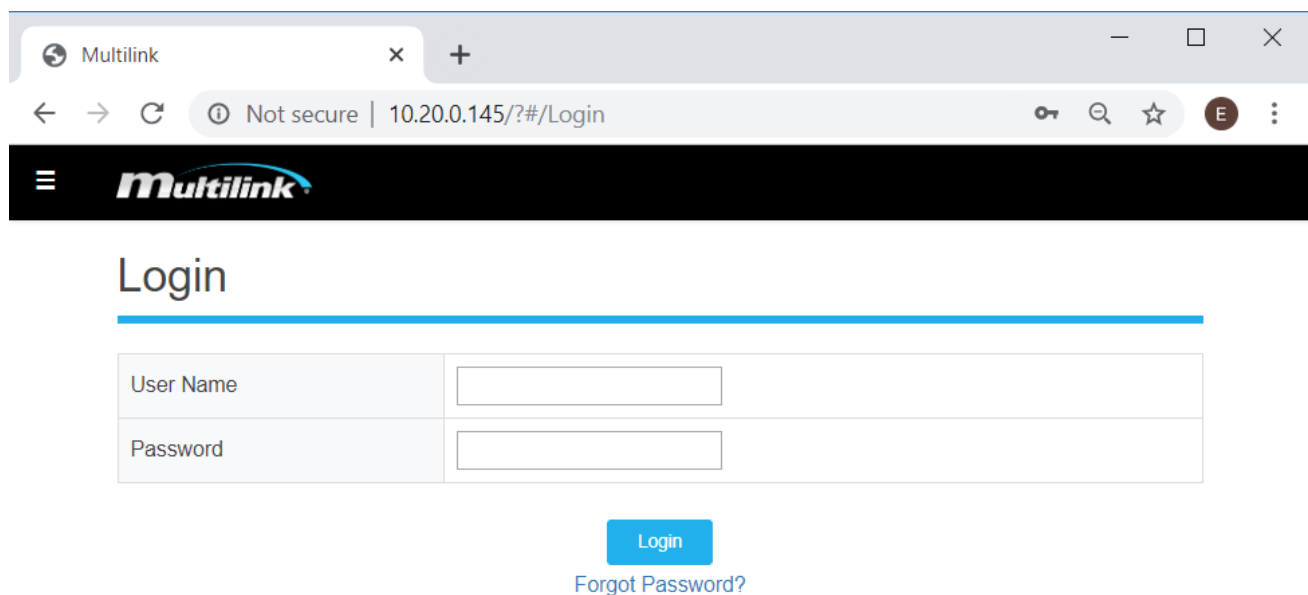


## Webpage Navigation and Default Password

When addressing the UPS remotely, the user will be prompted with a log-in screen. Each UPS ships with a default username and password combination.

The default username is "**user**", and the default password is "**multilink**".

If the incorrect combination has been entered, the user will be prompted. It is encouraged to change the user and password information upon login of each UPS. If a mistake has been made when changing the username and password, contact a Multilink representative for information on how to correct this issue.



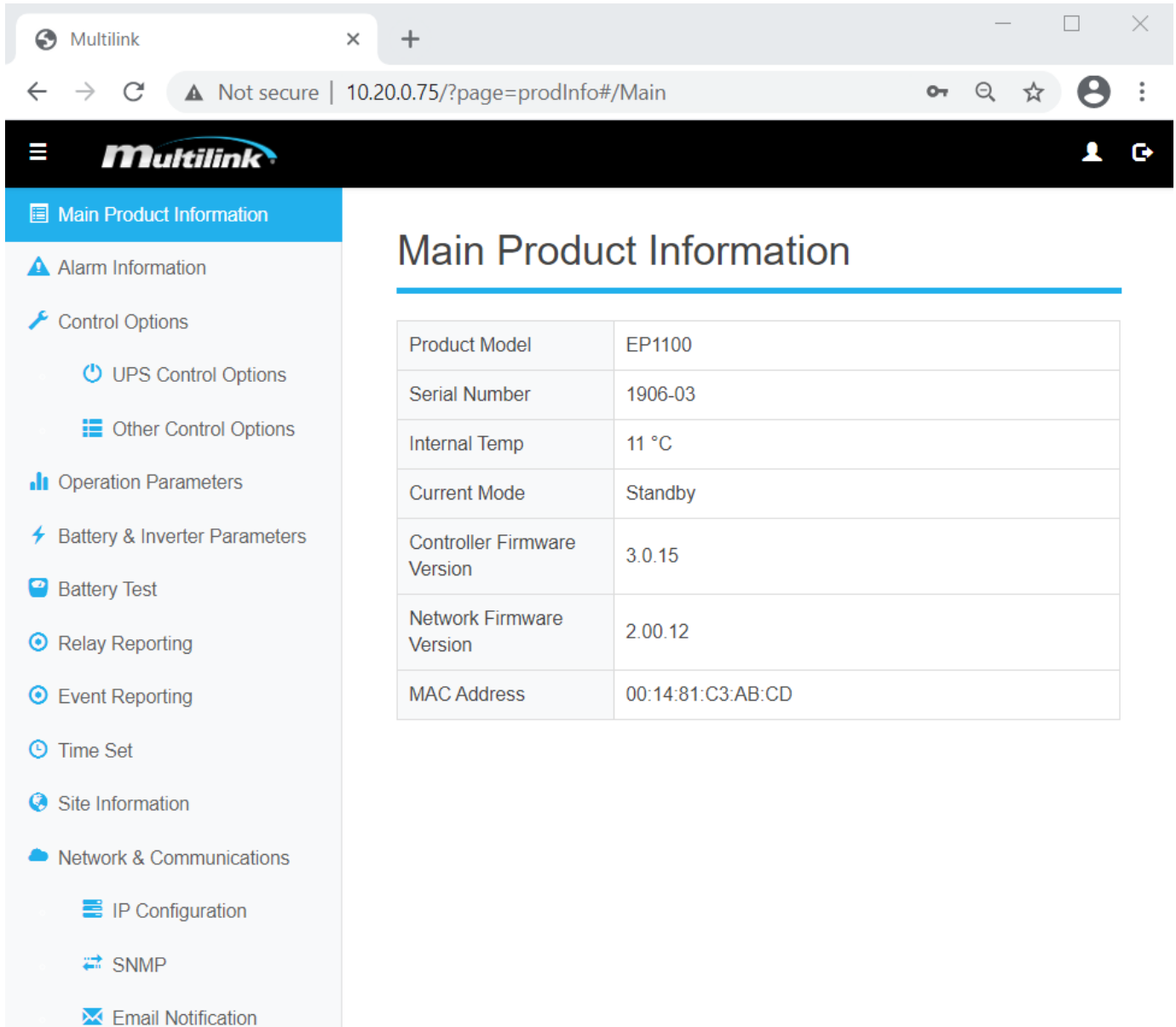
The screenshot shows a web browser window with the Multilink logo in the address bar. The URL is 10.20.0.145/?#/Login. The page has a black header with the Multilink logo and a hamburger menu icon. Below the header, the word "Login" is displayed in a large font. Underneath, there is a form with two input fields: "User Name" and "Password". Below the form is a blue "Login" button and a link that says "Forgot Password?".

Login	
User Name	<input type="text"/>
Password	<input type="password"/>

[Login](#)  
[Forgot Password?](#)

## Main Product Information Page

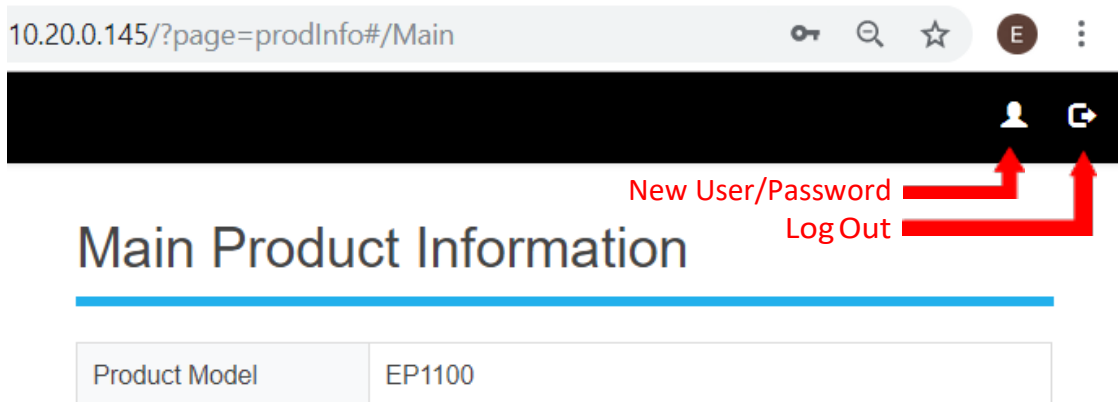
After entering the correct credentials, the user is prompted with the Main Product Information page. This page provides the user with information pertaining to the UPS currently being addressed remotely. Info such as serial number, current mode of operation, firmware revisions, MAC address, and unit temperature as shown on this page.



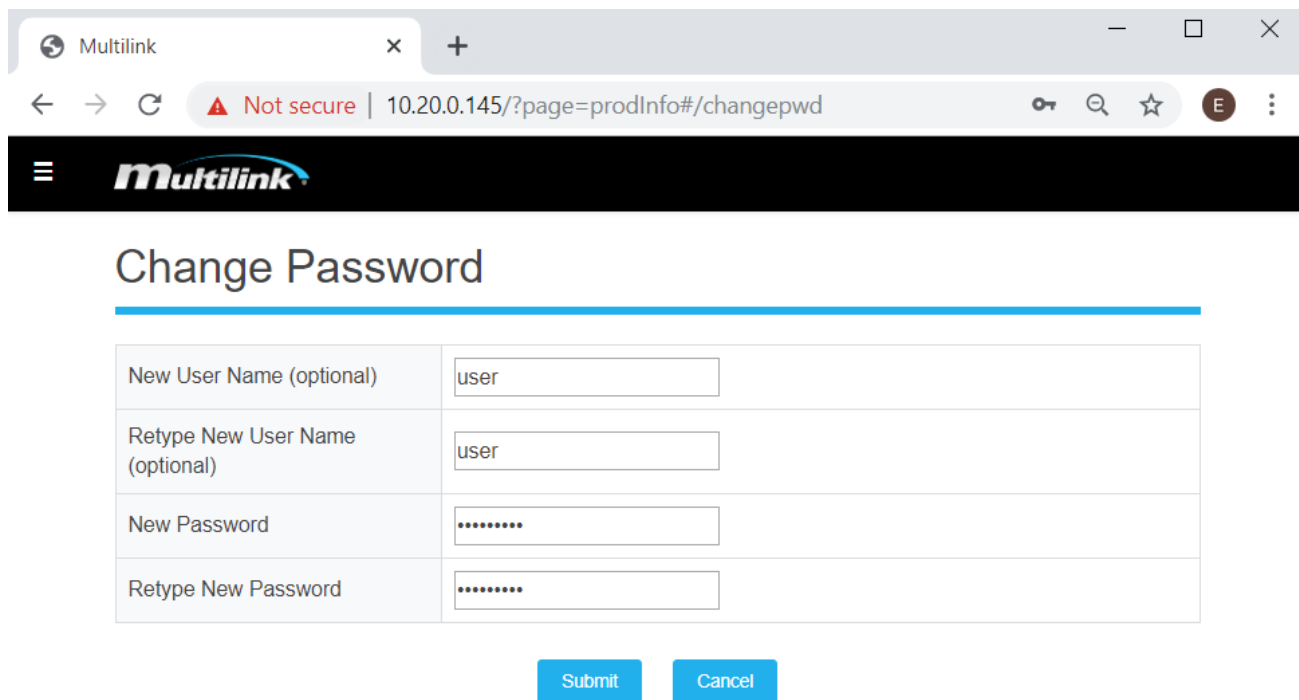
Main Product Information	
Product Model	EP1100
Serial Number	1906-03
Internal Temp	11 °C
Current Mode	Standby
Controller Firmware Version	3.0.15
Network Firmware Version	2.00.12
MAC Address	00:14:81:C3:AB:CD

## Log Out and User/Password Pages

The user may select to log out of the webpage or to enter the new user and password configuration page by selecting the small human silhouette in the upper righthand corner of the webpage. When clicking the Log Out button, the user will be returned to the Login screen.



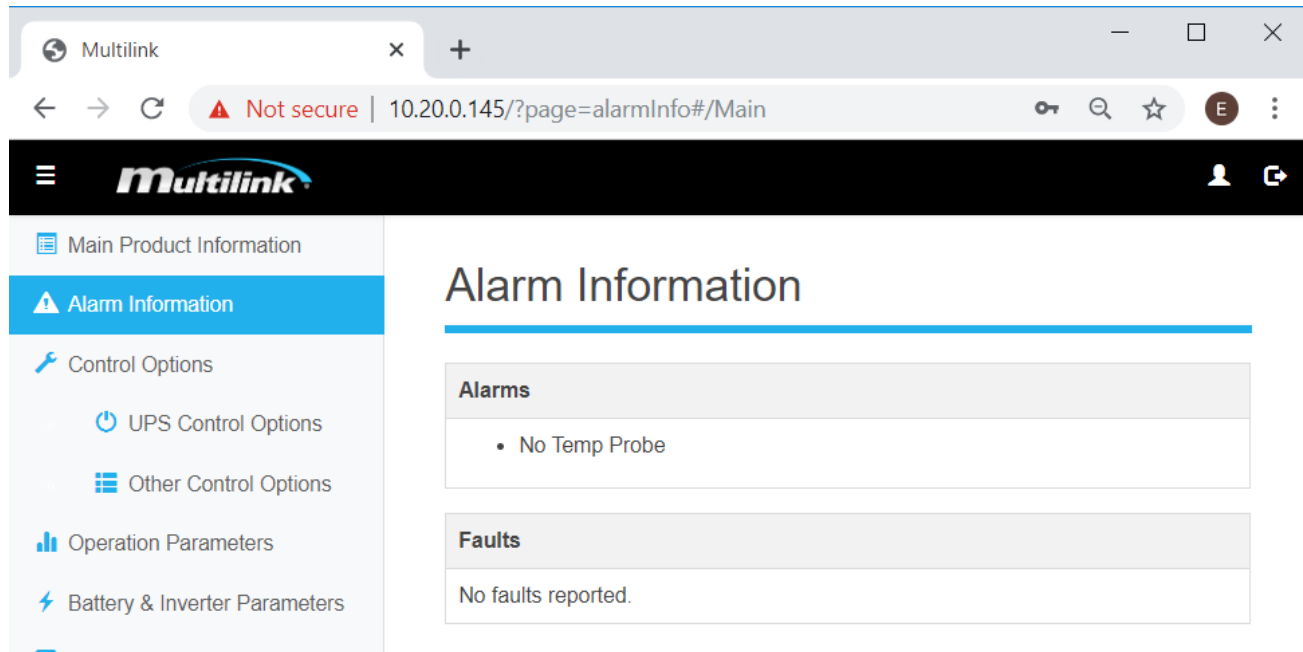
When selecting a new username and password, follow the on-screen instructions and click Submit. Be sure to double check spelling before clicking Submit to avoid errors. **NOTE:** both the username and password are case sensitive. Record the username and password combination in a safe place to prevent unauthorized access.



New User Name (optional)	<input type="text" value="user"/>
Retype New User Name (optional)	<input type="text" value="user"/>
New Password	<input type="password" value="....."/>
Retype New Password	<input type="password" value="....."/>

## Alarm Information Page

The Alarm Information page shows current, active alarms and faults experienced by this UPS. All alarms and events described on Pgs. 28-29 of this user manual will be shown on this page. Once the alarm or fault is cleared, the alarms and faults tables will display “no alarms reported” and “no faults reported”, respectively.



The screenshot shows a web browser window with the Multilink logo in the top right corner. The address bar shows the URL `10.20.0.145/?page=alarmInfo#/Main` and a "Not secure" warning. The left sidebar contains a menu with the following items: "Main Product Information", "Alarm Information" (highlighted), "Control Options", "UPS Control Options", "Other Control Options", "Operation Parameters", and "Battery & Inverter Parameters". The main content area is titled "Alarm Information" and contains two sections: "Alarms" and "Faults". The "Alarms" section shows a single entry: "No Temp Probe". The "Faults" section shows the text "No faults reported."

Alarms
• No Temp Probe

Faults
No faults reported.

## Control Options Pages: UPS Control Options

The Control Options pages allow for the remote control and configuration of UPS operating parameters for each UPS. The UPS Control Options page allows for several control options to be modified or controlled to allow customer operation of each power supply. Below is a description of each item shown in the image below. Default operation of some features are not explicitly shown. Items that may be modified using a button will display the action that will take place for each item when the button is clicked.

**NOTE:** Modification to certain options in this menu can adversely affect the operation of the UPS. Use caution and awareness when modifying options in this page as options are readily available for the user to modify and for changes to immediately take place upon modification.

**Current Mode:** The current mode of operation as described on Pg. 25 of this user manual.

**TurnOn/Off Inverter:** Allows for the remote control of the inverter. This option is enabled when the battery string voltage is higher than the low voltage acceptance threshold.

**Inverter Count:** This counter displays the number of inverter operation events that have occurred. In the event of utility line failure or forced inverter operation, this counter increments by 1.

**Inverter Time (mins):** The total number of minutes the inverter has spent in operation.

**Buck/Boost Count:** Total number of both Buck and Boost events that have occurred.

**Inverter:** This selectable option allows for the inverter to be disabled and the UPS forced to operate from utility power. This feature may be useful when performing battery maintenance. This feature is enabled by default.

**Inverter Cutoff:** To disable the inverter's ability to shut down due to low battery string voltage, this feature may be used. This feature should not be modified when using GEL, AGM, or PbC battery chemistries, and should only be used for Lithium-Ion technology.

**Inverter Cutoff Threshold (V):** Adjustable battery string voltage by 1.0V, this option controls when the inverter will shut down and enter Standby mode and awaits the return of utility power.

**Low Battery Indication Level:** This option controls the operation of the dedicated dry-contact relay labeled "Low Batt", which is relay no. C2. Adjustable by 1.0V. When the battery string voltage matches this threshold, C2 will be energized between pins 1 and 2 of the relay.

**Bypass Mode:** This mode of operation bypasses both the inverter operation and battery charger operation.

**Charger Current (A):** Adjustable battery charger current threshold. This allows for the correct charger current to be applied to batteries per the battery manufacturer's recharge specifications.

**Clear Events:** Clears the event log and resets the inverter count, inverter time, and buck/boost count to zero. When clicked, the button will only become available when the events log has been reset, which may take up to 60 seconds, depending on the numbers of events.

Multilink

←

→

↻

⚠ Not secure

| 10.20.0.145/?page=upsControl#/Main

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📄 Main Product Information

⚠ Alarm Information

🔧 Control Options

⚙ UPS Control Options

⚙ Other Control Options

📊 Operation Parameters

⚡ Battery & Inverter Parameters

🔋 Battery Test

🕒 Relay Reporting

🕒 Event Reporting

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🔄 SNMP

✉ Email Notification

## UPS Control Options

Current Mode	Line
Turn On / Off Inverter	Turn On
Inverter Count	0
Inverter Time (mins)	0
Buck/Boost Count	0
Inverter	Disable
Inverter Cutoff	Disable
Inverter Cutoff Threshold (V)	42
Low Battery Indication Level (V)	43
Bypass Mode	Turn On
Charger Current (A)	10
Clear Event	Clear

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### Control Options Pages: Other Control Options

The Other Control Options Page allows for additional operating parameters to be modified. Below is a description of each item shown in the image below. Default operation of some features are not explicitly shown. Items that may be modified using a button will display the action that will take place for each item when the button is clicked.

**NOTE:** Modification to certain options in this menu can adversely affect the operation of the UPS. Use caution and awareness when modifying options in this page as options are readily available for the user to modify and for changes to immediately take place upon modification.

**AC Input Shutdown:** This feature allows for the UPS to be forced into inverter mode and disable the return to line mode. This feature may be useful when line side maintenance is required and allows for load operation for equipment to continue. Disabled by default.

**FreqSenseType:** Selectable between Normal and Generator. Normal mode allows for typically clean utility power to be utilized by the UPS. Generator mode may be used when "dirty power", or noisy input power is being utilized by the UPS.

**O/p Regulation Function:** Selectable between AVR and Quality. AVR enables Buck and Boost mode to regulate the output voltage around 120VAC. Quality mode is used to limit the Line voltage window to 100VAC- 138VAC and prevents Buck and Boost operation.

**Line Qualification Time (secs):** Adjustable from 1-60 seconds, this time specifies the length of time the UPS monitors the return of utility power. Qual mode will be entered and the UPS monitors utility line in the event it is lost again. Qual time is useful to prevent rapid Inverter mode operation due to successive losses in utility power.

**Batt Temp Compensation (mV):** This feature adjusts the charger voltage by the selected mV/°C based on the measured battery temperature sensor. Adjustable by 0.5mV.

**Temp Format:** Selectable from Celsius and Fahrenheit.

**Daylight:** Refers to Daylight Savings Time. Enabled by default and may be disabled to prevent automatic adjustment of daylight savings time.

**Relay Timer (mins):** Timer delay in minutes before the C4 Timer dry-contact relay is energized. Adjustable between 0 and 240 minutes.

**Battery AH:** Battery Amp-hour (Ahr) rating currently in use. This value is used for estimating inverter runtime. Adjustable between 0 and 400 Ahr.

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📄 Main Product Information

⚠ Alarm Information

🔧 Control Options

⏲ UPS Control Options

☰ Other Control Options

📊 Operation Parameters

⚡ Battery & Inverter Parameters

🔋 Battery Test

🔄 Relay Reporting

📡 Event Reporting

🕒 Time Set

🌐 Site Information

☁ Network & Communications

📄 IP Configuration

🔄 SNMP

✉ Email Notification

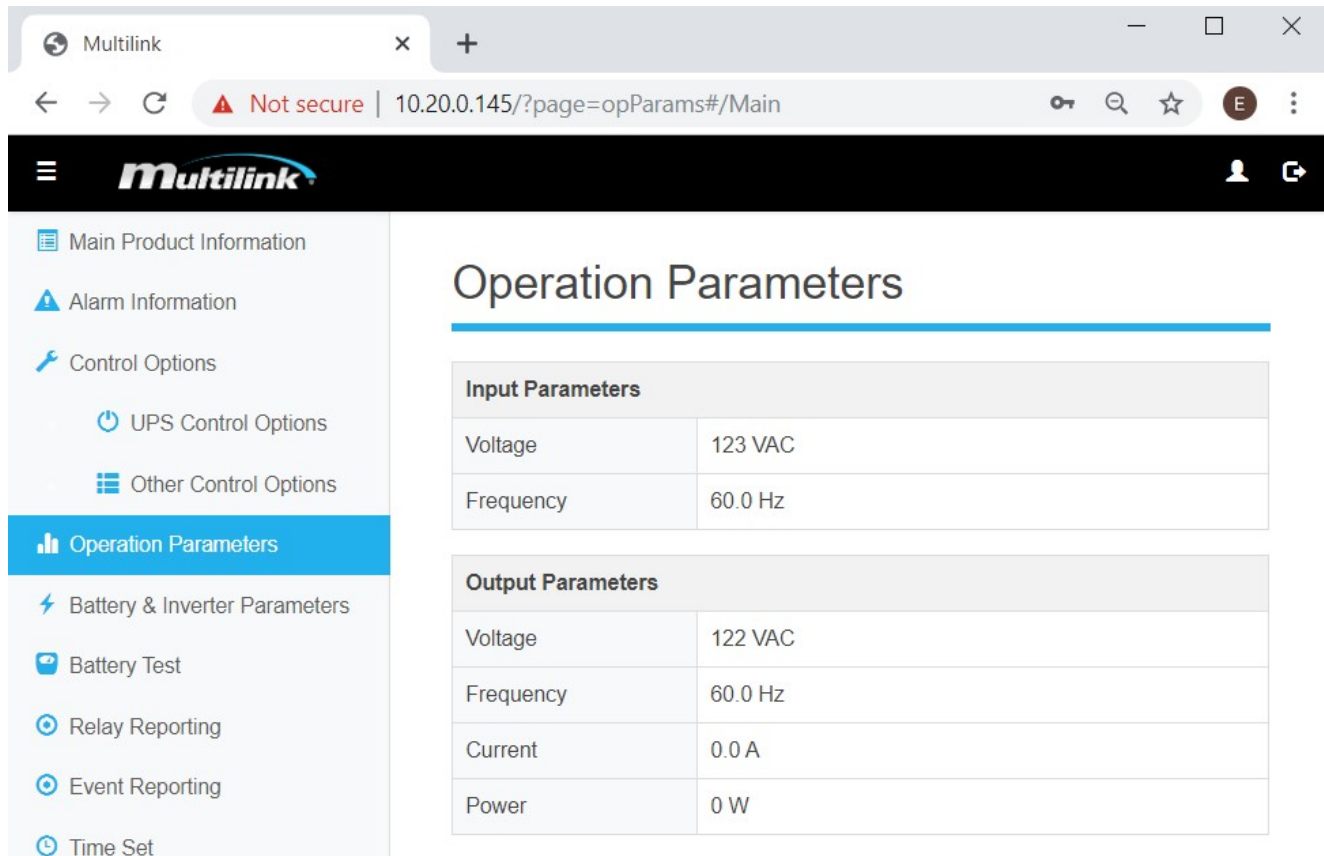
## Other Control Options

AC Input Shutdown	<button>Enable</button>
Freq Sense Type	NORMAL
O/p Regulation Function	AVR
Line Qualification Time (secs)	3
Batt Temp Compensation (mV)	-5
Temp Format	C
Daylight	<button>Turn Off</button>
Relay Timer (mins)	5
Battery AH(ahr)	75



## Operation ParametersPage

Operating parameters for both the Input and Output of the UPS are observed on this page. Input voltage and frequency, Output voltage and frequency, as well as output current draw and total output power consumption are visible on this page.



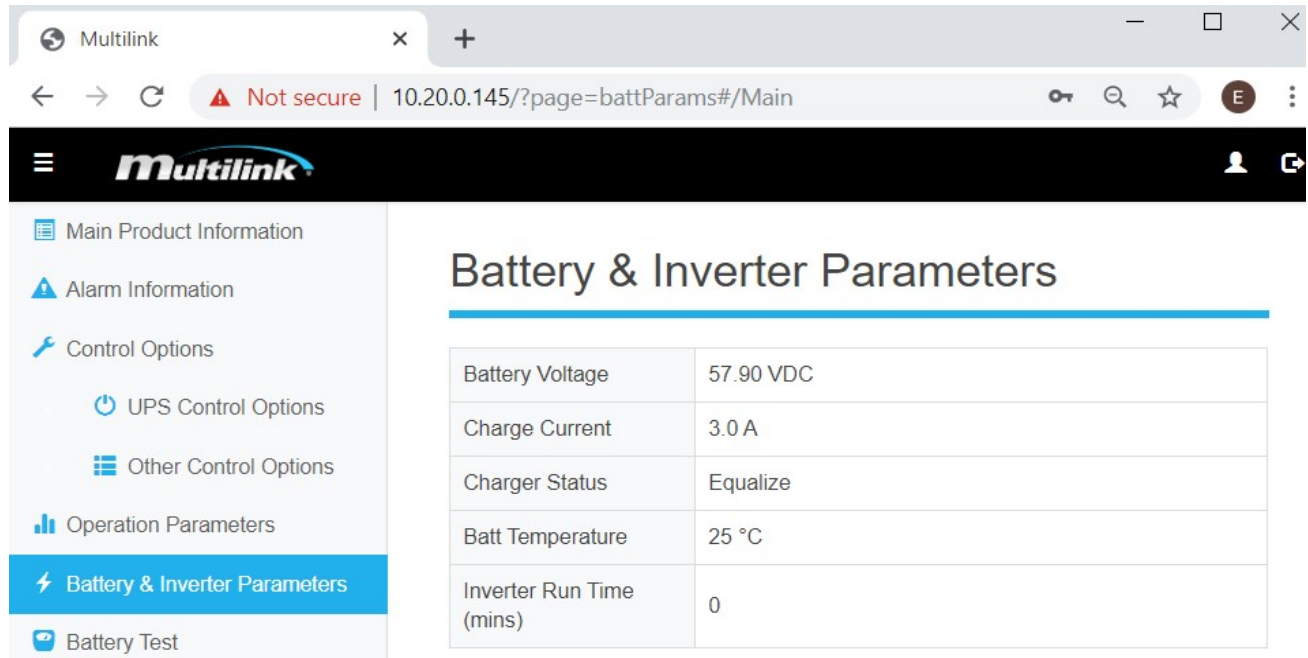
Input Parameters	
Voltage	123 VAC
Frequency	60.0 Hz

Output Parameters	
Voltage	122 VAC
Frequency	60.0 Hz
Current	0.0 A
Power	0 W

## Battery and Inverter Parameters Page

All battery and inverter parameters are observed on this page. Measured battery voltage and charger current, charger state (Bulk, Equalize, Float, and OFF), battery temperature, as well as Inverter runtime. Inverter runtime is calculated at the start of a new Inverter mode event and displays 0 minutes by default.

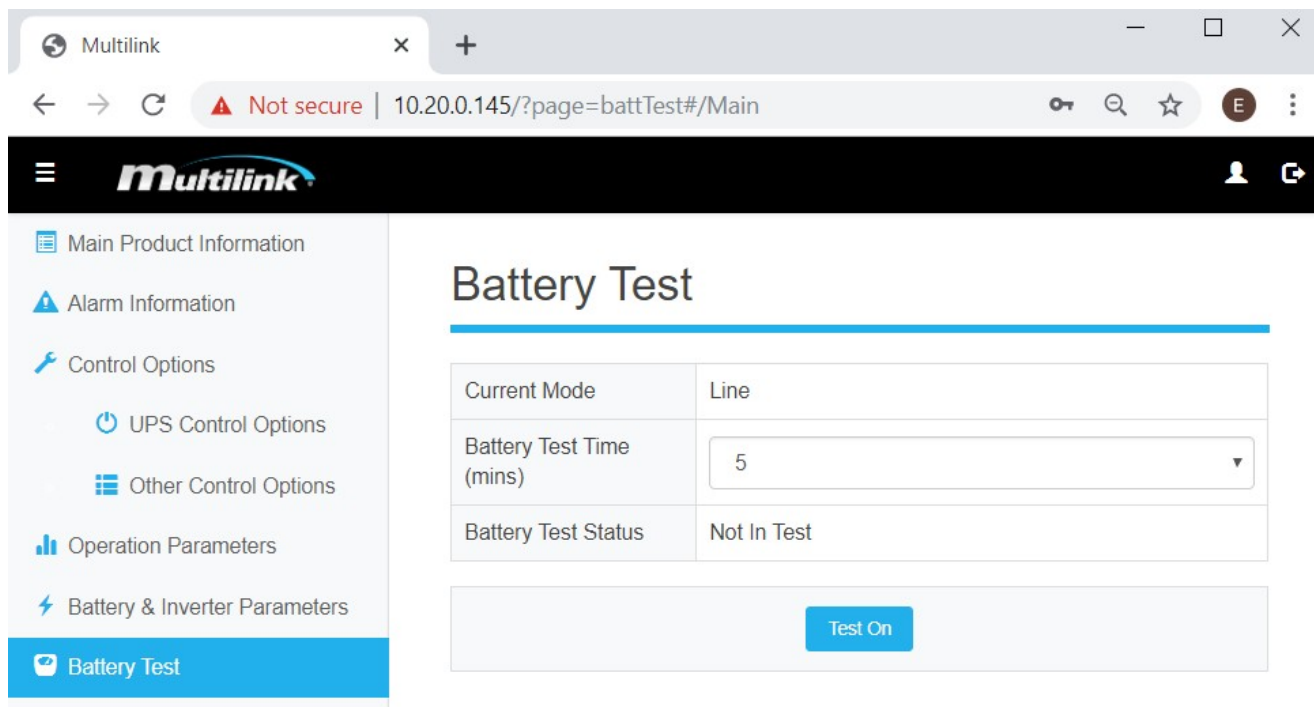


The screenshot shows a web browser window with the Multilink logo and a navigation menu on the left. The main content area displays the 'Battery & Inverter Parameters' page with a table of current values.

Battery & Inverter Parameters	
Battery Voltage	57.90 VDC
Charge Current	3.0 A
Charger Status	Equalize
Batt Temperature	25 °C
Inverter Run Time (mins)	0

## Battery TestPage

The ability to run a remote batter self-test can be found on this page. Battery self-tests are a valuable maintenance tool to determine whether the battery string has the capacity to run the load during Inverter operation. This test does not perform conductance testing and only uses battery string voltage as a reference to determine whether test pass or fail. If the test is successful for the duration of the user selectable time, the tests pass, and it may be assumed that the current condition of the overall battery string is sufficient for battery backup. Otherwise, the test is deemed a failure and the condition of each battery should be checked using a hand-held battery tester or may be monitored with a full featured battery management system that reports the true condition and age of each battery in the string. Certain conditions are required prior to performing a remote battery self-test. Any condition that is not met will be listed on this page, such as present alarms or incorrect UPS mode, and will prevent a self-test from being performed until corrected. The Battery Test Status will update every 10 seconds to allow the user to monitor the battery string voltage.

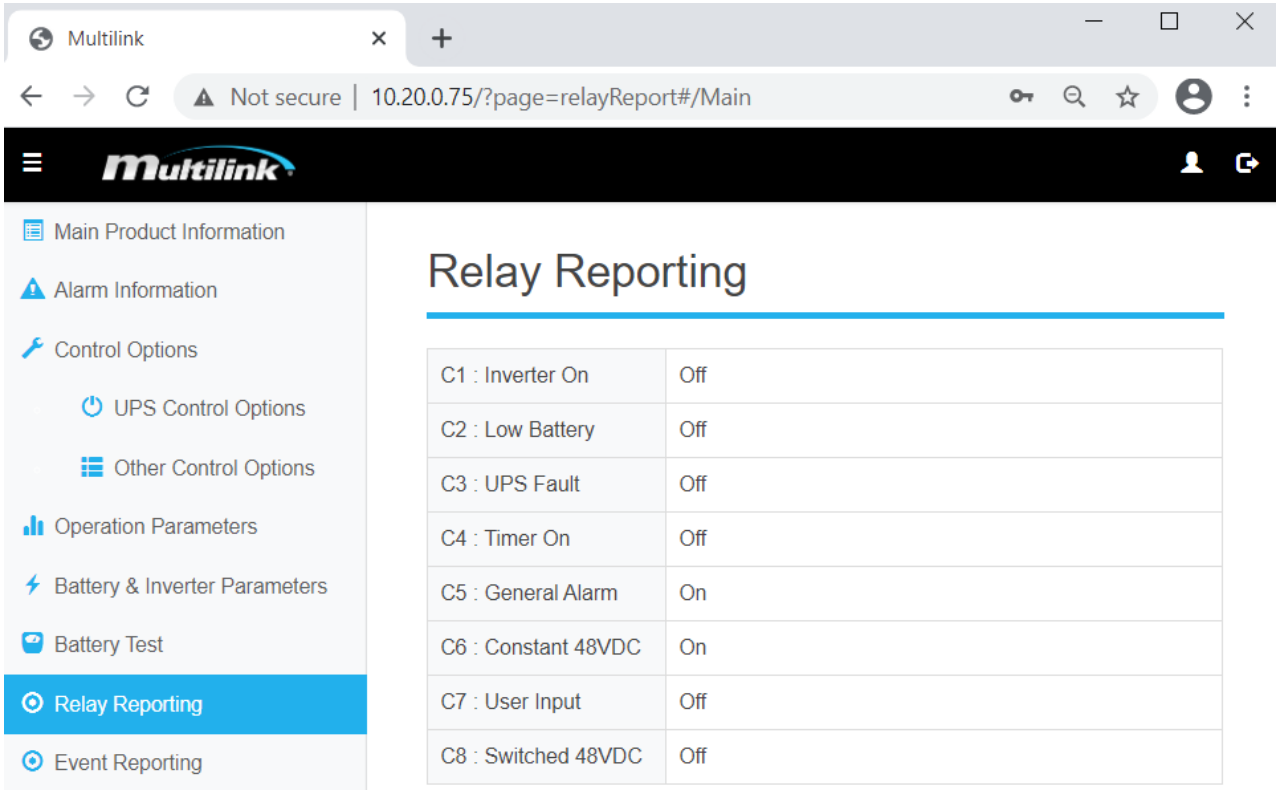


Current Mode	Line
Battery Test Time (mins)	5
Battery Test Status	Not In Test

Test On

## Relay Reporting Page

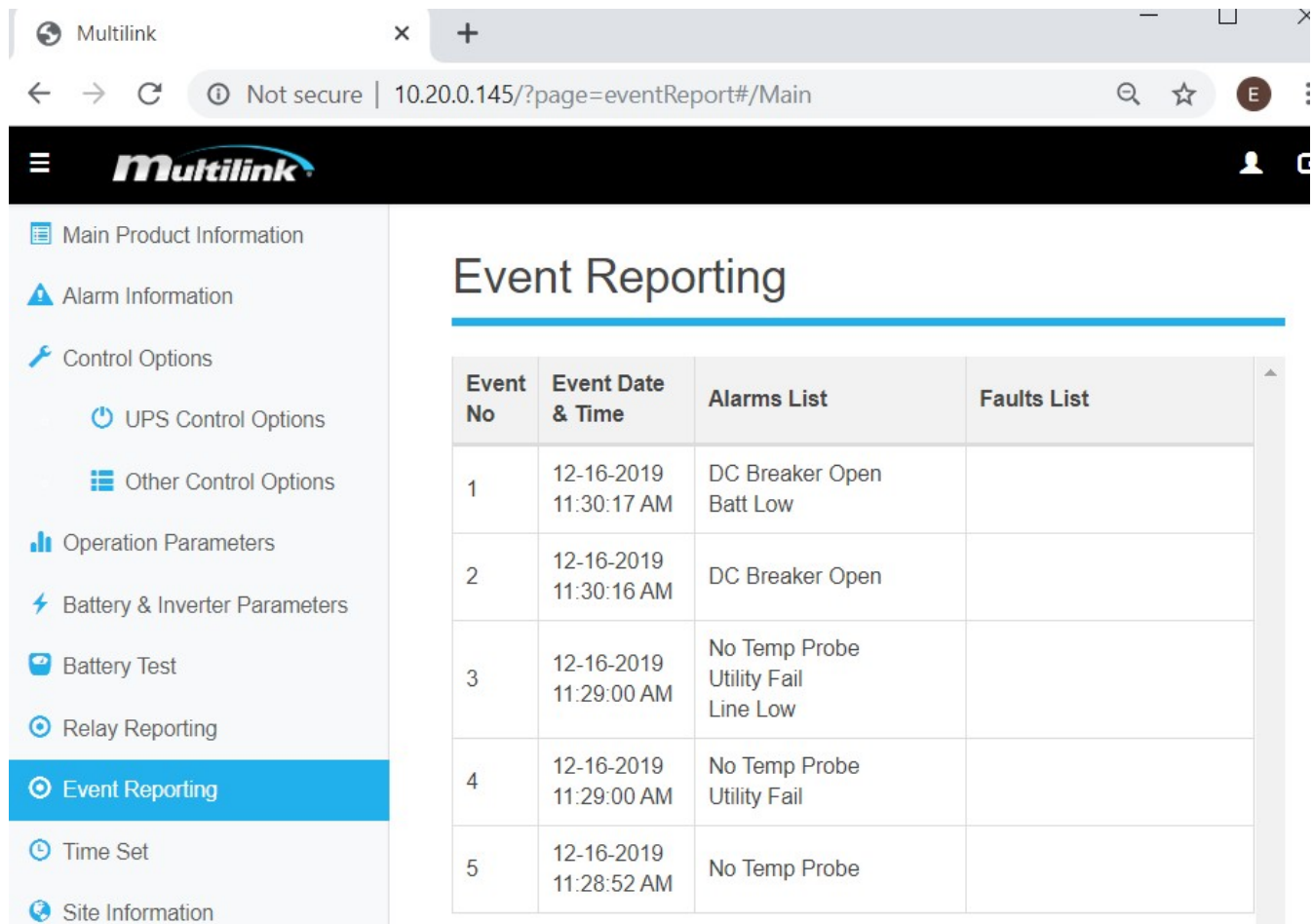
The dedicated dry-contact relays that are available on all UPS' allow the user to connect each relay to a traffic monitor or alarm detection system to alarm a system that a UPS event has occurred. This page reports the state of each relay, along with the status of a user input relay and a few reserved relays for future use. These relays are self-correcting, depending on the purpose of each relay as they are defined.



C1 : Inverter On	Off
C2 : Low Battery	Off
C3 : UPS Fault	Off
C4 : Timer On	Off
C5 : General Alarm	On
C6 : Constant 48VDC	On
C7 : User Input	Off
C8 : Switched 48VDC	Off

## Event Reporting Page

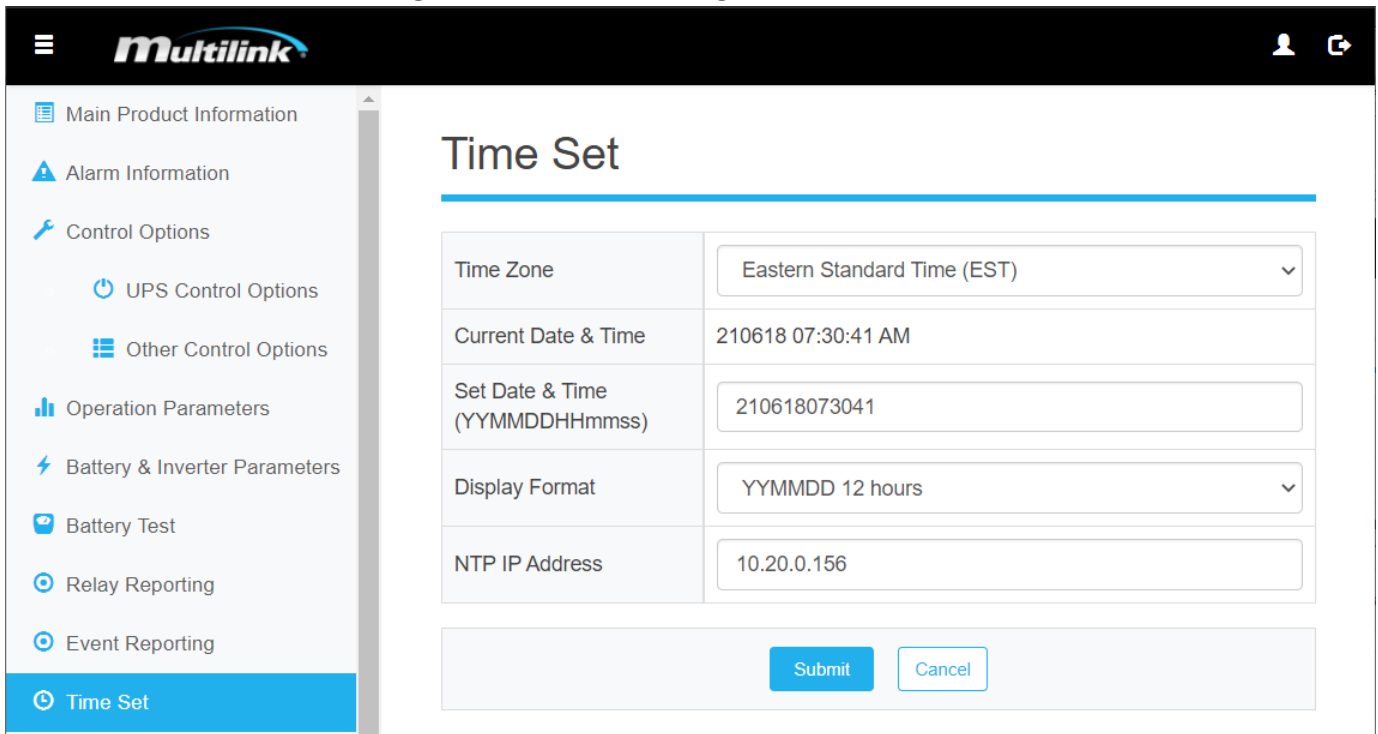
Events experienced by each UPS can be remotely monitored to correct for present alarms, determine trends in power quality, etc. All present alarms and faults at the time of the event are displayed with the date and time of the event. Up to 1,000 events can be displayed at any given time, with the oldest event being overwritten. The latest event is displayed on the top of the stack. The table may be copied and pasted directly into a spreadsheet for easy editing and printing.



Event No	Event Date & Time	Alarms List	Faults List
1	12-16-2019 11:30:17 AM	DC Breaker Open Batt Low	
2	12-16-2019 11:30:16 AM	DC Breaker Open	
3	12-16-2019 11:29:00 AM	No Temp Probe Utility Fail Line Low	
4	12-16-2019 11:29:00 AM	No Temp Probe Utility Fail	
5	12-16-2019 11:28:52 AM	No Temp Probe	

## Time Set Page

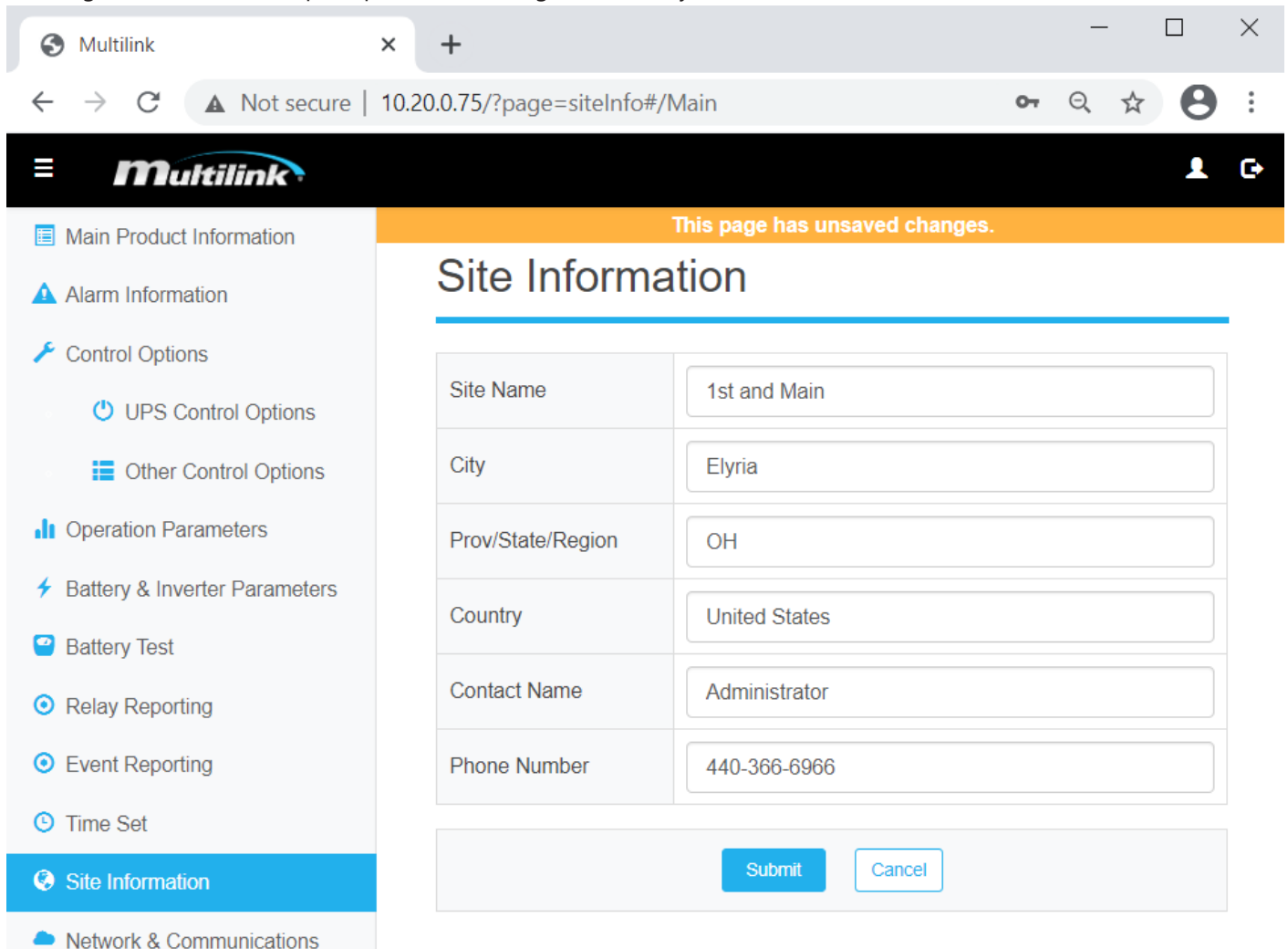
This page allows the user to manually adjust the date and time of each UPS or enter an NTP server address to automatically obtain the current date and time. The format for entering a new date and time is described in parentheses and must be adhered to, despite the currently selected format. When time and date is set, both are maintained by a Real Time Clock (RTC) that is internal to each UPS. Time and dates are stored in memory and backed up using an internal battery. The user may also manually adjust the displayed format of the date and time from this page as well. The user may also select the Time Zone which will reflect the time offset, as well as Daylight Savings Time. It is encouraged that when the format of the date and time changes to clear the events log.



Time Set	
Time Zone	Eastern Standard Time (EST) ▼
Current Date & Time	210618 07:30:41 AM
Set Date & Time (YYMMDDHHmmss)	210618073041
Display Format	YYMMDD 12 hours ▼
NTP IP Address	10.20.0.156
<div> <input type="button" value="Submit"/> <input type="button" value="Cancel"/> </div>	

## Site Information Page

The Site Information page allows the user to specify pertinent location information for each UPS. This data is stored and used with Email notifications to aid with easily locating the affected UPS as well as providing contact information for the technician or administrator. When entering Site Name information, the user may enter a specific enclosure number, custom locating code, or indicate the nearest intersection or point of interest. The city and state, providence, or region may be included as well. Be sure to click Submit to save all changes. The user will be prompted when changes have not yet been saved.



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**Site Information**

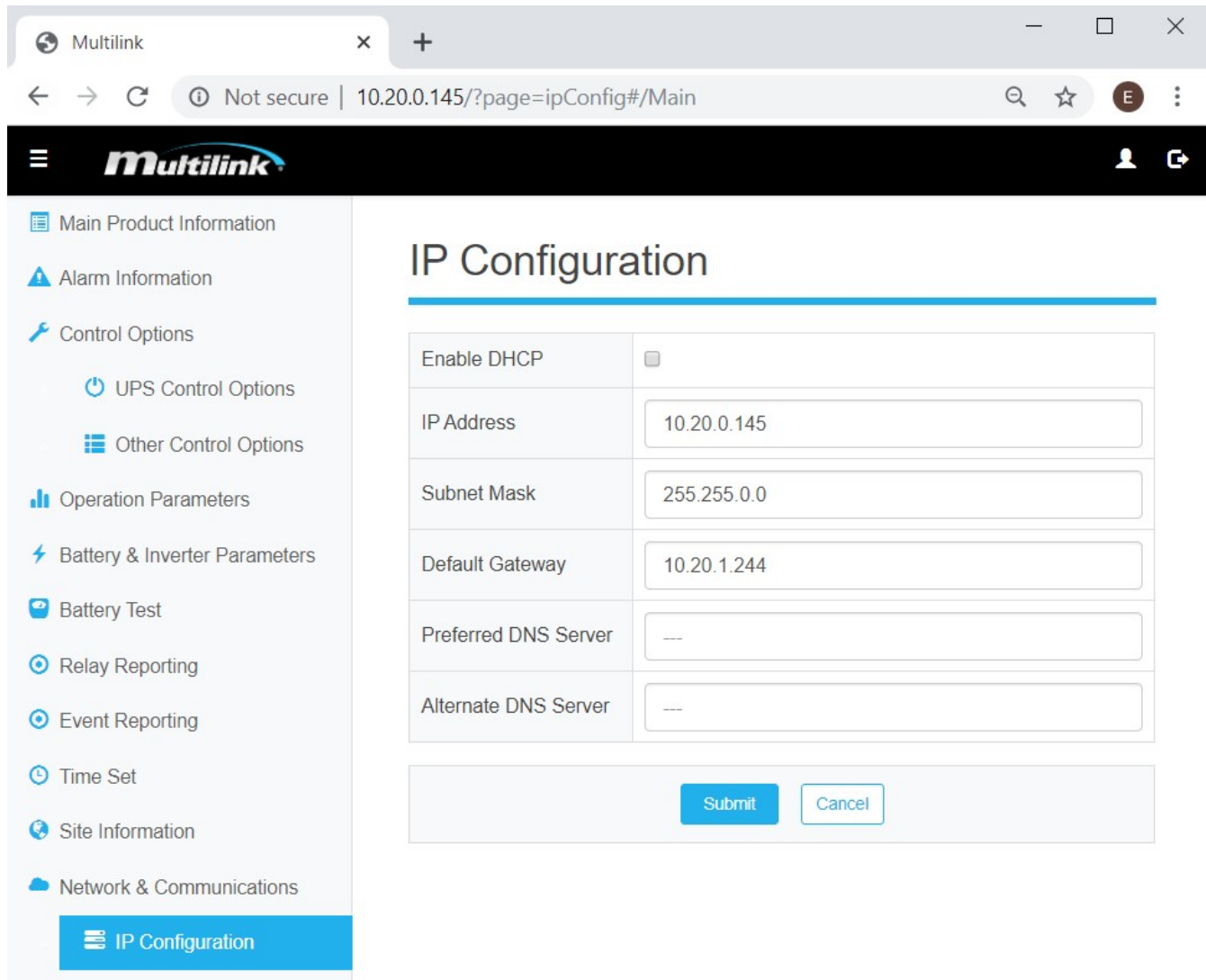
This page has unsaved changes.

Site Name	1st and Main
City	Elyria
Prov/State/Region	OH
Country	United States
Contact Name	Administrator
Phone Number	440-366-6966

Submit Cancel

## IP Configuration Page

When configuring the network parameters of the UPS, addresses may be entered on this page. Each UPS has an embedded network card to allow remotely monitoring and configuration of the UPS. This page allows for both DHCP to be enabled or disabled, allowing for static IP addresses to be used. It is encouraged that all UPS be configured and verified by the user prior to deployment in the field. Be sure to click Submit to save all changes. The user will be prompted when changes have not yet been saved.



IP Configuration	
Enable DHCP	<input type="checkbox"/>
IP Address	10.20.0.145
Subnet Mask	255.255.0.0
Default Gateway	10.20.1.244
Preferred DNS Server	---
Alternate DNS Server	---



## SNMP Page

Simple Network Management Protocol (SNMP) is included and enabled by default for each UPS. This provides an easy solution to remotely manage and monitor the UPS from a central network management system (NMS). A proprietary MIB must be used with the NMS to enable SNMP objects to be recognized and information to be passed to the NMS. This MIB is available on Multilink's website or by contacting **ENGSupport@gomultilink.com**. SNMP versions v1, v2c, and v3 are built-in, with v2c enabled by default. Community string and user information shall be entered for v2c and enhanced security with v3, is included for use. SNMP communication depends on the community string and access type to match in both the UPS and the NMS. Be sure to correctly configure both the UPS and NMS for SNMP to communicate. Contact the network administrator for information regarding SNMP setup in the user's network. Configure the SNMP information here and click submit to save. The user will be prompted to save and reboot the network card to store and maintain the SNMP information.

**Enable SNMP:** Enables or disables the UPS's ability to communication over SNMP. Enabled by default.

**Community:** This is a phrase that is used to allow SNMP communication between the UPS and the network management software. This phrase must match in both locations. The user may enter a unique community string or use a common string, such as "public" or "private".

**Trap Port:** This is the Trap Receiver's port. The trap receive must be configured to accept SNMP traps from the UPS.

**Trap IP Address:** This is the Trap Receiver's IP address. This is generally the server for which all traps from all network devices will be sent to.

**Access Type:** Allows for limited access (Read) or full access (Read/Write). This must match in both the UPS and the NMS.

**Enable v3 Authentication:** This allows for v3 authentication to be enabled. V3 offers enhanced security measures to protect SNMP messages by encrypting each message.

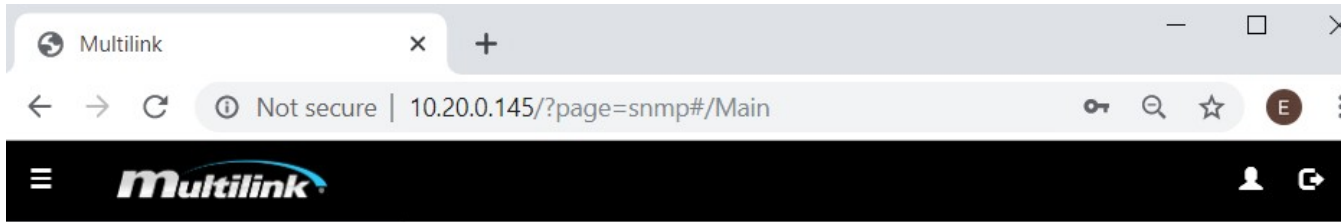
**Username:** The username of the NMS user for which SNMP messages may be received.

















**Authentication Type:** Selectable between "MD5", or Message Digest, and "SHA", or Secure Hash Algorithm, authentication types. The type to use shall be determined by the user's Network Administrator.

**Authentication Password:** This is the secret password established by the Network Administrator that must match in both the UPS and NMS for authentication

**Privacy Type:** Selectable between DES, or Data Encryption Standard, and AES, or Advanced Encryption Standard encryption types.

**Privacy Password:** This is the secret password established by the Network Administrator that must match in both the UPS and the NMS for privacy encryption.



-  Main Product Information
-  Alarm Information
-  Control Options
  -  UPS Control Options
  -  Other Control Options
-  Operation Parameters
-  Battery & Inverter Parameters
-  Battery Test
-  Relay Reporting
-  Event Reporting
-  Time Set
-  Site Information
-  Network & Communications
  -  IP Configuration
  -  **SNMP**
  -  Email Notification

## SNMP

### Basic Settings

Enable SNMP	<input checked="" type="checkbox"/>
Community	<input type="text" value="public"/>
Trap Port	<input type="text" value="162"/>
Trap IP Address	<input type="text" value="---"/>
Access Type	<input type="text" value="Read"/>

### SNMP Authentication

Enable v3 Authentication	<input type="checkbox"/>
Username	<input type="text" value="---"/>
Authentication Type	<input type="text" value="None"/>
Authentication Password	<input type="text" value="---"/>
Privacy Type	<input type="text" value="None"/>
Privacy Password	<input type="text" value="---"/>

Additionally, the UPS allows for users to enable or disable seven different SNMP traps for each UPS. Traps are automatically sent upon an event to the user specified trap receiver. Some traps occur periodically until they are resolved.

- Battery Test
- Relay Reporting
- Event Reporting
- Time Set
- Site Information
- Network & Communications
  - IP Configuration
  - SNMP**
  - Email Notification

Trap Notifications	
UPS on Battery Trap	<input checked="" type="checkbox"/>
UPS Alarm Trap	<input checked="" type="checkbox"/>
UPS Fault Trap	<input checked="" type="checkbox"/>
UPS Overload Trap	<input checked="" type="checkbox"/>
UPS Battery Low Trap	<input checked="" type="checkbox"/>
UPS High Temperature Trap	<input checked="" type="checkbox"/>
UPS Return to Line Trap	<input checked="" type="checkbox"/>

## Email Notification Page

Each UPS may be configured to send Email notifications to a list of recipients when the UPS experiences a new event. This page allows for the user to setup the SMTP server settings which are required for the UPS's email client to be able to forward emails. Contact the Network Administrator for information regarding SMTP configuration in the user's network. Be sure to click "Send Test Email" and click Submit to verify the settings are saved and the connection is configured correctly.

**SMTP Server Address:** This is the user's SMTP server address that allows email forwarding. The user would enter the IP address of the SMTP server in this textbox.

**SMTP Port:** The forwarding port for the user's SMTP server.

**Username:** The user's username. This information may not be required if automatic forwarding is approved by the network Administrator.

**Password:** The user's password for authentication. This information may not be required if automatic forwarding is approved by the network Administrator.

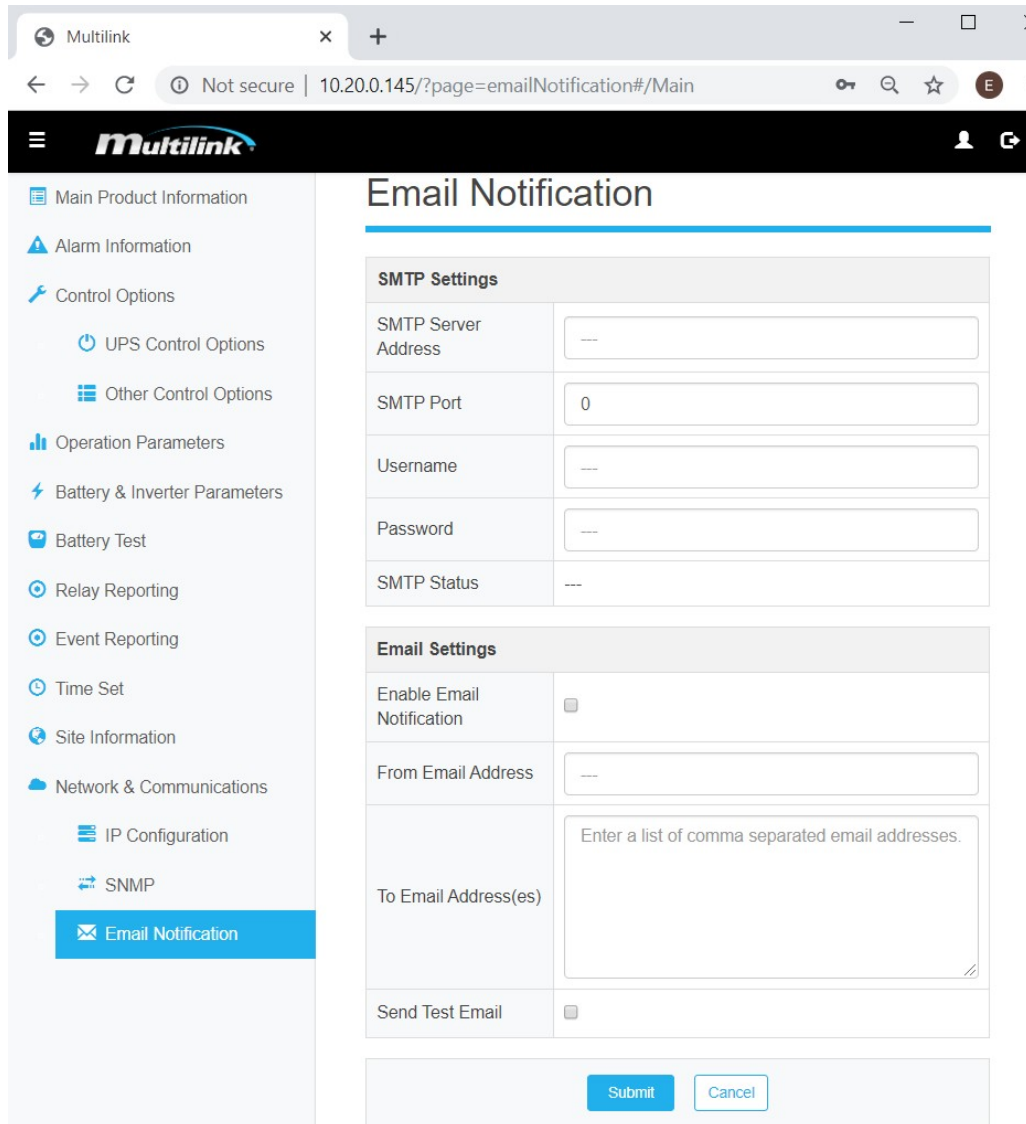
**SMTP Status:** Displays a Success or Failure message when the SMTP test email has been sent. This reports to the user whether the SMTP information have been successfully entered and email forwarding is configured correctly.

**Enable Email Notification:** Enables or disables emails from being sent from each UPS.

**From Email Address:** This is the UPS's email address. The user may choose to enter any valid email address, for example, UPS@1StandMain.com or UPSEvent@UPS.com.

**To Email Address(es):** This is recipient's email address. Multiple email addresses may be included and shall be entered and separated with a comma, without spaces.

**Send Test Email:** Selecting this option is encouraged to check the SMTP connection and verify that all settings are configured correctly. The SMTP Status will update to Success and the recipients shall receive a test email. Be sure to check the spam or junk folders if an email has not been received.



The screenshot shows a web browser window with the Multilink logo and a navigation menu on the left. The main content area is titled "Email Notification" and contains two sections: "SMTP Settings" and "Email Settings".

**SMTP Settings:**

SMTP Server Address	<input type="text"/>
SMTP Port	<input type="text" value="0"/>
Username	<input type="text"/>
Password	<input type="password"/>
SMTP Status	---

**Email Settings:**

Enable Email Notification	<input type="checkbox"/>
From Email Address	<input type="text"/>
To Email Address(es)	<div>Enter a list of comma separated email addresses.</div> <div><input type="text"/></div>
Send Test Email	<input type="checkbox"/>

At the bottom of the form are two buttons: "Submit" and "Cancel".

## Serial Connection Setup

A DB-9 serial port is located on the front of the UPS and is intended for Factory use only. This port does not provide users with options for monitoring UPS.

## Power Supply Shutdown

### Section 7: Power Supply Shutdown

If power supply shutdown becomes necessary at any time, observe the following procedure:

1. Operate the Input breaker to the OFF (O) position or operate the circuit breaker serving AC utility power to the supply to the OFF position.
2. Shut off the battery breaker and disconnect the battery harness from the battery receptacle on the front panel of the UPS.
3. If in use, operate the UPS Input circuit breaker on the Safety Automatic Transfer Switch (SATS) or Standard Transfer Switch (STS) to the OFF (O) position.

The UPS is now shutdown.

## Options

### Section 8: Options

The UPS power supply supports several additional options listed below. The options and accessories listed enhance the usefulness and longevity of the power supply system. Part numbers are listed as single piece ordering options.

#### UPS Packages

UPS packages contain the required equipment for a complete, turnkey power supply solution. The kit contains an UPS, transfer switch, battery harness kit, temperature probe, pluggable terminal blocks, and this instruction manual. Battery options are available but are not included in the UPS packages. Please contact Multilink Inc. for available options.

#### Battery Cable Kits and Accessories

The following battery cable kits have been designed for 24VDC and 48VDC applications. All harnesses are terminated using Anderson SB50 housings and mating contacts.

870-230-40: 24V harness with 4, interconnect harnesses. Hardware included.

870-230-50: 48V harness with 4, interconnect harnesses. Hardware included.

538-531-10: Battery terminal covers. Sold in pairs of black and red. One pair per battery

#### Battery Heater Mat

In harsh climates where freezing temperatures can shorten the life of the batteries, Multilink has designed a battery mat option for various battery string and cabinet shelf applications.

176-003-10: 2-Battery Heater Mat with thermostat for dual battery shelf cabinets. 13" X 14"

### **Transfer Switch Options**

The Safety Automatic Transfer Switch (SATS) provides automatic voltage detection for utility line power, UPS output power, and Generator backup power. The SATS may be used with the UPS power supply to provide bypass and maintenance capability as well, without load interruption. Alternatively, the Standard Transfer Switch (STS) provides automatic voltage detection for Line and UPS output power and bypass and maintenance capabilities. Both transfer switches are universal for line interactive power supplies.

010-505-20: Safety Automatic Transfer Switch. Provides auto transfer, generator hookup, and maintenance bypass without loss of power to the load.

010-506-20: Standard Transfer Switch. Rack mounted. Provides maintenance bypass without loss of power to the load.

010-507-20: Standard Transfer Switch. Wall/Door mounted. Provides maintenance bypass without loss of power to the load.

### **Grounding Kits**

If desired or required by state law, grounding kits are available to provide an isolated grounding point on the UPS.

035-006-11: Ground lug kit.

### **Battery Balancing and Management Kits**

Several options for battery balancing and health management are available for use with each UPS.

018-009-20: 48V External Battery Balance Manager, single 48V battery string.

018-020-20: 24V External Battery Balance Manager Plus, single 24V battery string.

018-045-10: Battery Health Monitor with Ethernet, voltage sense harness, and four conductance sensors.

018-046-10: Battery Health Monitor with Ethernet, voltage sense harness only.

## MAINTENANCE AND TROUBLESHOOTING

### Section 9: Maintenance and Troubleshooting



**There are various circuit breakers and fuses inside the power supply. These items are not field-serviceable. The enclosure cover must not be removed in the field. Repair must be done by certified technicians.**

#### **Preventative Maintenance**

For optimum performance, the following maintenance items should be performed at least every six (6) months, especially in areas where the power supply is subjected to extreme heat or cold.

- Visually inspect the enclosure for signs of damage
- Inspect the external status lamps for proper operation
- Check the LCD and the status LEDs for any alarm indications
- Check all electrical connections and covers are in place
- Check the batteries for signs of swelling, split cases, or other damage
- Check and record individual battery voltages
- Check and clean battery terminals; bolts or wing nuts must be tight
- Measure and record AC output voltage
- Measure and record AC output current
- Measure and record DC battery string voltage
- Record all maintenance performed or parts replaced
- Verify the power supply is in its normal mode of operation as indicated by the LCD.
- Close and lock the enclosure

## Troubleshooting

This troubleshooting guide has been designed to help quickly locate and resolve common problems. The table assumes normal operation and configuration of the UPS at any given time. If the problem cannot be resolved, replace the power supply with a known good unit or call Multilink Inc. for support.

Operating Conditions	UPS LED/LCD Status	Corrective Action
No output voltage	Output Status LED is OFF. Alarm/Fault LED ON.	<p>Verify output wiring from the load to the cabinet</p> <p>Verify that the UPS is not overloaded.</p> <p>Verify line voltage is within range.</p> <p>Verify battery connector is connected and battery voltage is within range.</p> <p>Verify that a fault is not present.</p> <p>Verify that the UPS is in not in Qual or Standby Modes.</p>
UPS will not transfer to Inverter mode	UPS shuts down upon loss of Line power.	<p>Verify battery string is connected and battery voltage is within range.</p> <p>Verify battery breaker is closed. Verify that UPS is not overloaded.</p> <p>Verify that a fault is not present.</p>
No communication through Ethernet connection	RJ45 Yellow LED Lit Green LED not flashing	<p>Verify that the Ethernet cable is fully seated at both ends of the cable.</p> <p>Verify computer network card configuration if addressing laptop locally.</p> <p>Verify IP address and network configuration of UPS through Status menu.</p> <p>Reset Ethernet card using Reset Button.</p>



## UPS Specifications

### Section 10: EP1100 Specifications

Parameter	Specification	Notes
Dimensions	5.25 x 17.0 x 10.8	Inches (HxWxD)
Weight	42	Lbs
Mounting	Rack or Shelf	
Temperature Range	-37°C to +74°C	Operating above 55°C or below -20°C is de-rated by 20%
Humidity	Up to 95%	Non-condensing
<b>Input</b>		
AC circuit breaker	20 Amps	
DC circuit breaker	80 Amps	
Connection	Hard wired to terminal blocks	
Phase	Single phase 3-wire	
Voltage	120VAC Nominal	85V to 175V with AVR 100-130V with Quality
Frequency	60Hz	± 5%
<b>Output</b>		
Connection	Hard wired to Terminal Blocks	
Phases	Single phase 3-wire	
Output capacity	1,100W	1,580VA with charger
Voltage	120VAC nominal	
Voltage regulation	Rated voltage ±2%	
Current Capacity	9.2A	At nominal voltage
Rated frequency	60Hz	
Frequency regulation	60Hz ±1%	
Voltage waveform	Sine wave	
Distortion factor	Linear load: 3% or less 100% rectifier load: 7% or less	At rated output
Response time	4ms or less	
Load power factor	0.7	Variation range 0.7 to 1.0
<b>Battery System</b>		
Connection	Anderson SB50	
Voltage	48VDC	4, 12VDC batteries in series
Charger capacity	10A	Adjustable
Temperature compensation	-5.0mV/°C/Cell	RJ45 plug. Adjustable

## Section 11: EP650 Specifications

Parameter	Specification	Notes
Dimensions	3.50 x 17.0 x 9.125	Inches (HxWxD)
Weight	26	Lbs
Mounting	Rack or Shelf	
Temperature Range	-37°C to +74°C	Operating above 55°C or below -20°C is de-rated by 20%
Humidity	Up to 95%	Non-condensing
<b>Input</b>		
AC circuit breaker	10 Amps	
DC circuit breaker	80 Amps	
Connection	Hard wired to terminal blocks	
Phase	Single phase 3-wire	
Voltage	120VAC Nominal	85V to 175V with AVR 100-130V with Quality
Frequency	60Hz	±5%
<b>Output</b>		
Connection	Hard wired to Terminal Blocks	
Phases	Single phase 3-wire	
Output capacity	650W	935VA with charger
Voltage	120VAC nominal	
Voltage regulation	Rated voltage ±2%	
Current Capacity	5.4A	At nominal voltage
Rated frequency	60Hz	
Frequency regulation	60Hz ±1%	
Voltage waveform	Sine wave	
Distortion factor	Linear load: 3% or less 100% rectifier load: 7% or less	At rated output
Response time	4ms or less	
Load power factor	0.7	Variation range 0.7 to 1.0
<b>Battery System</b>		
Connection	Anderson SB50	
Voltage	24VDC	2, 12VDC batteries in series
Charger capacity	10A	Adjustable
Temperature compensation	-5.0mV/°C/Cell	RJ45 plug. Adjustable

## Section 12: EP350 Specifications

Parameter	Specification	Notes
Dimensions	5.25 x 17.0 x 9.0	Inches (HxWxD)
Weight	24	Lbs
Mounting	Rack or Shelf	
Temperature Range	-37°C to +74°C	Operating above 55°C or below -20°C is de-rated by 20%
Humidity	Up to 95%	Non-condensing
<b>Input</b>		
AC circuit breaker	10 Amps	
DC circuit breaker	50 Amps	
Connection	Hard wired to terminal blocks	
Phase	Single phase 3-wire	
Voltage	120VAC Nominal	85V to 175V with AVR 100-130V with Quality
Frequency	60Hz	±5%
<b>Output</b>		
Connection	Hard wired to Terminal Blocks	
Phases	Single phase 3-wire	
Output capacity	350W	635VA with charger
Voltage	120VAC nominal	
Voltage regulation	Rated voltage ±2%	
Current Capacity	2.9A	At nominal voltage
Rated frequency	60Hz	
Frequency regulation	60Hz ±1%	
Voltage waveform	Sine wave	
Distortion factor	Linear load: 3% or less 100% rectifier load: 7% or less	At rated output
Response time	4ms or less	
Load power factor	0.7	Variation range 0.7 to 1.0
<b>Battery System</b>		
Connection	Anderson SB50	
Voltage	24VDC	2, 12VDC batteries in series
Charger capacity	10A	Adjustable
Temperature compensation	-5.0mV/°C/Cell	RJ45 plug. Adjustable



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