

Installation and Operation Manual

Eaton 93E UPS
300-400 kVA (380/400/415V)
Installation and Operation Manual

IMPORTANT SAFETY INSTRUCTIONS

SAVE THESE INSTRUCTIONS

This manual contains important instructions that you should follow during installation and maintenance of the UPS and batteries. Please read all instructions before operating the equipment and save this manual for future reference.

This is a product for commercial and industrial application in the second environment. Installation restrictions or additional measures may be needed to prevent disturbances.

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1 Introduction

The Eaton 93E 300-400 kVA uninterruptible power supply (UPS) is a true online, continuous-duty, transformer-free, double-conversion, solid-state, three-phase system, providing conditioned and uninterruptible AC power to protect the customer's load from power failures.

The Eaton 93E 300-400 kVA online power protection system is used to prevent loss of valuable electronic information, minimise equipment downtime, and minimise the adverse effect on production equipment due to unexpected power problems.

The Eaton 93E 300-400 kVA UPS continually monitors incoming electrical power and removes the surges, spikes, sags, and other irregularities that are inherent in commercial utility power. Working with a building's electrical system, the UPS system supplies clean, consistent power that sensitive electronic equipment requires for reliable operation. During brownouts, blackouts, and other power interruptions, batteries provide emergency power to safeguard operation.

The UPS is housed in a single free-standing cabinet, with safety shields behind the door for hazardous voltage protection. *Figure 1-1: Eaton 93E UPS (300-400 kVA)* on page 1 shows the Eaton 93E 300-400 kVA UPS.



NOTE

NOTE 1: Start-up and operational checks must be performed by a qualified service personnel authorised by Eaton. If these instructions are not followed, the warranty terms specified in Chapter 10 Warranty on page 74 become void. This service is offered as part of the sales contract for the UPS. Contact Eaton Service representative in advance to reserve a preferred startup date.

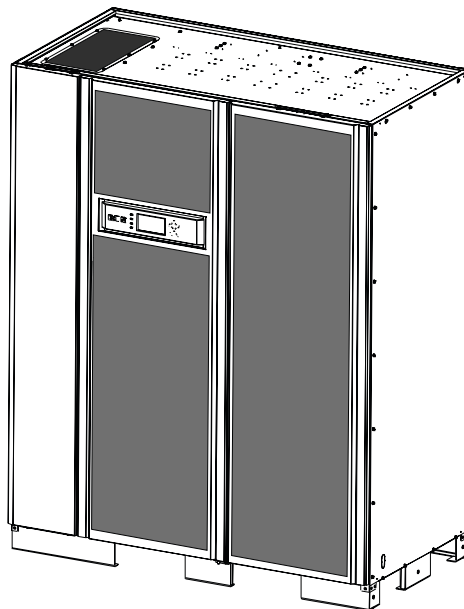


Figure 1-1: Eaton 93E UPS (300-400 kVA)

1.1 UPS standard features

The UPS has many standard features that provide cost-effective and consistently reliable power protection. The descriptions in this section provide a brief overview of the UPS standard features.

1.1.1 Installation features

Power wiring can be through the bottom or top of the cabinet with connections made to easily accessible terminals. Control wiring is routed through the right side of the cabinet and must be installed in accordance with local electrical code and good installation practice.

1.1.2 Control panel

The control panel, located on the front of the UPS, contains a liquid crystal display (LCD) and pushbutton switches to control the operation of the UPS and to display the status of the UPS system. See *Chapter 6 UPS operating instructions* on page 43 for additional information.

1.1.3 Customer interface

- Signal Input Monitoring – Up to three inputs in the UPS are available to connect the facility's alarm system contacts. Some system configurations may limit the number of inputs available. The UPS uses these inputs to monitor the signal inputs in addition to the UPS status. See *Chapter 7 Communication* on page 65 for additional information.
- Mini-Slot Communication Bays – Two communication bays are standard equipment. One to two optional mini-slot connectivity cards can be installed in the UPS module at any time. Mini-Slot cards are quickly installed at the front (behind door) of the UPS and are hot-pluggable. See *Chapter 7 Communication* on page 65 for additional information.

1.1.4 High-Efficiency mode

The 93E Series UPS offers a High-Efficiency (HE) normal mode with double-conversion on demand that allows the UPS to operate in standby bypass mode. This mode allows the 93E UPS to achieve a significantly higher efficiency while still protecting the load. See *Chapter 6 UPS operating instructions* on page 43 for additional information on setting the UPS to work in High Efficiency mode.

1.1.5 Advanced battery management

A three-stage charging system increases battery service life by optimising recharge time, and protects batteries from damage due to high current charging and inverter ripple currents. Charging at high currents can overheat and damage batteries.

1.2 Options and accessories

Contact an Eaton sales representative for information about the following options.

1.2.1 External battery cabinet

Battery backup protection is provided by equipping the UPS system with up to four External Battery Cabinets (EBCs) containing valve-regulated lead-acid, maintenance-free batteries. An EBC is a single, free-standing cabinet designed to be installed as a part of a UPS system, but may be installed separate from the UPS cabinet.

1.2.2 Parallel system

A parallel UPS system with up to 3+1 UPSs can be installed to provide a parallel capacity and/or redundant system. This load sharing system provides more capacity than a single UPS, and can provide backup, depending on the load and configuration. In addition, when one UPS is taken out of service for maintenance or is not operating properly, a redundant UPS continues to supply uninterrupted power to the critical load. A Controller Area Network (CAN) Bridge provides connectivity for system metering and operational mode control. The parallel system consists of two to four UPSs each with a parallel CAN Bridge, and a Tie Cabinet or System Parallel Module to act as a tie point and to control the output.

The tie cabinet must contain Module Output Breakers (MOBs) for each parallel UPS with dual auxiliary contacts for the control of the system. Without dual auxiliary MOBs, UPSs are not allowed to go to bypass individually during servicing. All UPSs will go to bypass instead of just the UPS needing service, decreasing critical load protection. With dual auxiliary MOBs, one UPS can be bypassed while the remaining UPSs support the load as long as the remaining UPMs have the capacity to do so. The MOBs must disconnect all 3 phases and neutral.

1.2.3 Monitoring and communication

Mini-Slot cards – Optional Mini-Slot cards support several protocols, such as SNMP, HTTP, Modbus® and RS232. See *Chapter 7 Communication* on page 65 for additional information on monitoring and communication features.

1.3 Battery system

The battery system is in an external cabinet. The battery system provides emergency short-term backup power to safeguard operation during brownouts, blackouts, and other power interruptions. The battery system is equipped with lead-acid batteries.

1.4 Basic system configurations

The following basic UPS system configurations are possible:

- Single UPS with one to four external battery cabinets
- Single UPS with external batteries and accessory cabinets

The UPS system configuration can be enhanced by adding optional accessories such as a Remote Emergency Power-off (Remote EPO) control or Mini-Slot communication cards.

1.5 Using this manual

This manual describes how to install and operate the Eaton 93E 300-400 kVA. Read and understand the procedures described in this manual to ensure trouble-free installation and operation. In particular, be thoroughly familiar with the Remote EPO (Remote Emergency Power-off) procedure (see *Chapter 6.3.13 Using the Remote Emergency Power-off Switch* on page 57).

The information in this manual is divided into sections and chapters. The system, options, and accessories being installed dictate which parts of this manual should be read. At a minimum, Chapters 1 through 4 and Chapter 6 should be examined.


Read through each procedure before beginning the procedure. Perform only those procedures that apply to the UPS system being installed or operated.

1.6 Conventions used in this manual

This manual uses these type conventions:

- **Bold type** highlights important concepts in discussions, key terms in procedures, and menu options, or represents a command or option that you type or enter at a prompt.
- *Italic type* highlights notes and new terms where they are defined.
- `Screen type`

represents information that appears on the screen or LCD.

Icon	Description
 NOTE	Information notes call attention to important features or instructions.
[Keys]	Brackets are used when referring to a specific key, such as [Enter] or [Ctrl].

In this manual, the term *UPS* refers only to the UPS cabinet and its internal elements. The term *UPS system* refers to the entire power protection system – the UPS cabinet, the battery cabinet, and options or accessories installed.

The term *line-up-and-match* refers to cabinets that are physically attached to the UPS, and the wiring between them is internal. The term *standalone* refers to cabinets that are not physically attached to the UPS, and are wired with external contractor-supplied wiring.

1.7 CE marking

The product has the CE marking in compliance with the following European directives:

- LV Directive (Safety) 73/23/EEC and 93/68/EEC
- EMC Directive 89/336/EEC, 93/68/EEC and 92/31/EEC

Declaration of conformity with UPS harmonised standards and directives EN 62040-1 (Safety) and EN 62040-2 (EMC) are available by contacting your nearest Eaton office or authorised partner.

1.8 For more information

Refer to the latest manual updates and the latest version of the **Eaton 93E UPS 300-400 kVA Installation and Operation Manual** for additional information of the UPS product.

Refer to the **External Battery Cabinet Installation Manual** for the following additional information:

- Installation instructions, including site preparation, planning for installation, wiring and safety information, and detailed illustrations of cabinets with dimensional and connection point drawings

Visit www.eaton.com/powerquality or **contact an Eaton service representative** for information on how to obtain copies of these documents.

If help is needed with any of the following:

- Scheduling initial startup
- Regional locations and telephone numbers
- A question about any of the information in this manual
- A question this manual does not answer

Please call your local service representative.

2 Safety instructions

IMPORTANT SAFETY INSTRUCTIONS

SAVE THESE INSTRUCTIONS

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

The UPS operates with mains, battery or bypass power. It contains components that carry high currents and voltages. The properly installed enclosure is earthed and IP20 rated against electrical shock and foreign objects. However, the UPS is a sophisticated power system and only qualified personnel is allowed to install and service the UPS.



DANGER

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



WARNING

- The UPS is powered by its own energy source (batteries). The output terminals may carry live voltage even when the UPS is disconnected from an AC source.
 - To reduce the risk of fire or electric shock, install this UPS in a temperature and humidity controlled, indoor environment, free of conductive contaminants. Ambient temperature must not exceed 40°C (104°F). Do not operate near water or excessive humidity (95% maximum). The system is not intended for outdoor use.
 - As a result of the connected loads high leakage current is possible. Connection to earth ground is required for safety and proper product operation. Do not check UPS operation by any action that includes removal of the earth (ground) connection with loads attached.
 - Ensure all power is disconnected before performing installation or service.
 - In parallel system, output terminals may be energised even when the UPS is turned off.
 - Ensure system grounding/PE continuity when undertaking installation or service.
 - Batteries can present a risk of electrical shock or burn from high short-circuit current. The following precautions should be observed: 1) Remove watches, rings, or other metal objects; 2) Use tools with proper insulation; 3) Do not lay tools or metal parts on top of batteries; 4) Wear rubber gloves and boots.
 - **ELECTRIC ENERGY HAZARD.** Do not attempt to alter any battery wiring or connectors. Attempting to alter wiring can cause injury.
 - Do not open or mutilate batteries. Released electrolyte is harmful to the skin and eyes. It may be toxic.
 - The UPS unit is not suitable for IT (Isolated Terra) or corner-earthed power distribution systems.
-

**CAUTION**

- **Installation or servicing should be performed by qualified service personnel knowledgeable of batteries and required precautions. Keep unauthorised personnel away from batteries. Consider all warnings, cautions, and notes before installing or replacing batteries. DO NOT DISCONNECT the batteries while the UPS is in Battery mode.**
 - **See installation instructions before connecting to the supply.**
 - **Risk of explosion if battery is replaced by an incorrect type. Dispose of used batteries according to the instructions.**
 - **Replace batteries with the same number and type of batteries as originally installed in the UPS.**
 - **Disconnect the charging source prior to connecting or disconnecting terminals.**
 - **Determine if the battery is inadvertently grounded. If it is, remove the source of the ground. Contacting any part of a grounded battery can cause a risk of electric shock. An electric shock is less likely if you disconnect the grounding connection before you work on the batteries.**
 - **Proper disposal of batteries is required. Refer to local codes for disposal requirements.**
 - **Do not dispose of batteries in a fire. Batteries may explode when exposed to flame.**
 - **Keep the UPS door closed and front panels installed to ensure proper cooling airflow and to protect personnel from dangerous voltages inside the unit.**
 - **Do not install or operate the UPS system close to gas or electric heat sources.**
 - **The operating environment should be maintained within the parameters stated in this manual.**
 - **Keep surroundings uncluttered, clean, and free from excess moisture.**
 - **Observe all DANGER, CAUTION, and WARNING notices affixed to the inside and outside of the equipment.**
-

**CAUTION**

This product is designed for commercial and industrial applications. In a residential environment, the product may cause radio interference, in which the user may be required to take additional measures.

3 UPS installation plan and unpacking

Use the following basic sequence of steps to install the UPS:

1. Create an installation plan for the UPS system (Chapter 3).
2. Prepare your site for the UPS system (Chapter 3).
3. Inspect and unpack the UPS cabinet (Chapter 3).
4. Unload and install the UPS cabinet, and wire the system (Chapter 4).
5. Install features, accessories, or options, as applicable (Chapter 4).
6. Complete the installation checklist (Chapter 4).
7. Have authorised service personnel perform preliminary operational checks and start up the system.



NOTE

Startup and operational checks for parallel systems or installations with accessory cabinets must be performed by an authorised Eaton Customer Service Engineer, or the warranty terms specified in Chapter 10 Warranty on page 74 become void. This service is offered as part of the sales contract for the UPS. Contact an Eaton service representative in advance (usually a two-week notice is required) to reserve a preferred startup date.



CAUTION

It must be ensured that no line input source can accidentally be connected to the UPS during installation.



WARNING

- **Installation may only be carried out by qualified technicians and in conformity with the applicable safety standards.**
 - **The UPS unit is not applicable to the IT (Isolated Terra) power distribution system.**
-

3.1 Creating an installation plan

Before installing the UPS system, read and understand how this manual applies to the system being installed. Use the procedures and illustrations in Chapter 3.2 and *Chapter 4 UPS system installation* on page 22 to create a logical plan for installing the system.

3.2 Preparing the site

For the UPS system to operate at peak efficiency, the installation site should meet the environmental parameters outlined in this manual. If the UPS is to be operated at an altitude higher than 1000 m, contact an Eaton service representative for important information about high altitude operation. The operating environment must meet the weight, clearance, and environmental requirements specified.

3.2.1 Environmental and installation considerations

The UPS system installation must meet the following guidelines:

- The system must be installed on a level floor suitable for computer or electronic equipment.
- Suitable for mounting on concrete or other non-combustible surfaces only.
- The system must be installed in a temperature and humidity controlled indoor area free of conductive contaminants.
- The UPS system can be installed where there is a TN or TT power distribution system.

Failure to follow guidelines may void your warranty.

The UPS equipment operating environment must meet the weight requirements shown in *Chapter 3.2.1 Environmental and installation considerations* on page 10 and the size requirements shown in *Figure 3-1: UPS cabinet dimensions (front, right, and rear side views)* on page 12. Dimensions are in millimeters.

	Eaton 93E-300	Eaton 93E-400
Shipping weight	1090 kg	1090 kg
Installed weight	970 kg	970 kg

Table 3-1: UPS cabinet weights

The UPS cabinet uses forced air cooling to regulate internal component temperature. Air inlets are in the front of the cabinet and outlets are in the back of the cabinet. Allow clearance in front of and in back of the cabinet for proper air circulation. The clearances required around the UPS cabinet are shown in *Table 3-2: UPS cabinet clearances* on page 10 and *Table 3-3: Required clearance* on page 11.

Clearance	
From top of cabinet	300 mm working space
From front of cabinet	900 mm working space
From back of cabinet	See <i>Table 3-3: Required clearance</i> on page 11
From right side of cabinet	See <i>Table 3-3: Required clearance</i> on page 11
From left of cabinet	See <i>Table 3-3: Required clearance</i> on page 11

Table 3-2: UPS cabinet clearances

The basic environmental requirements for operation of the UPS are:

- Ambient temperature range: 0-40°C

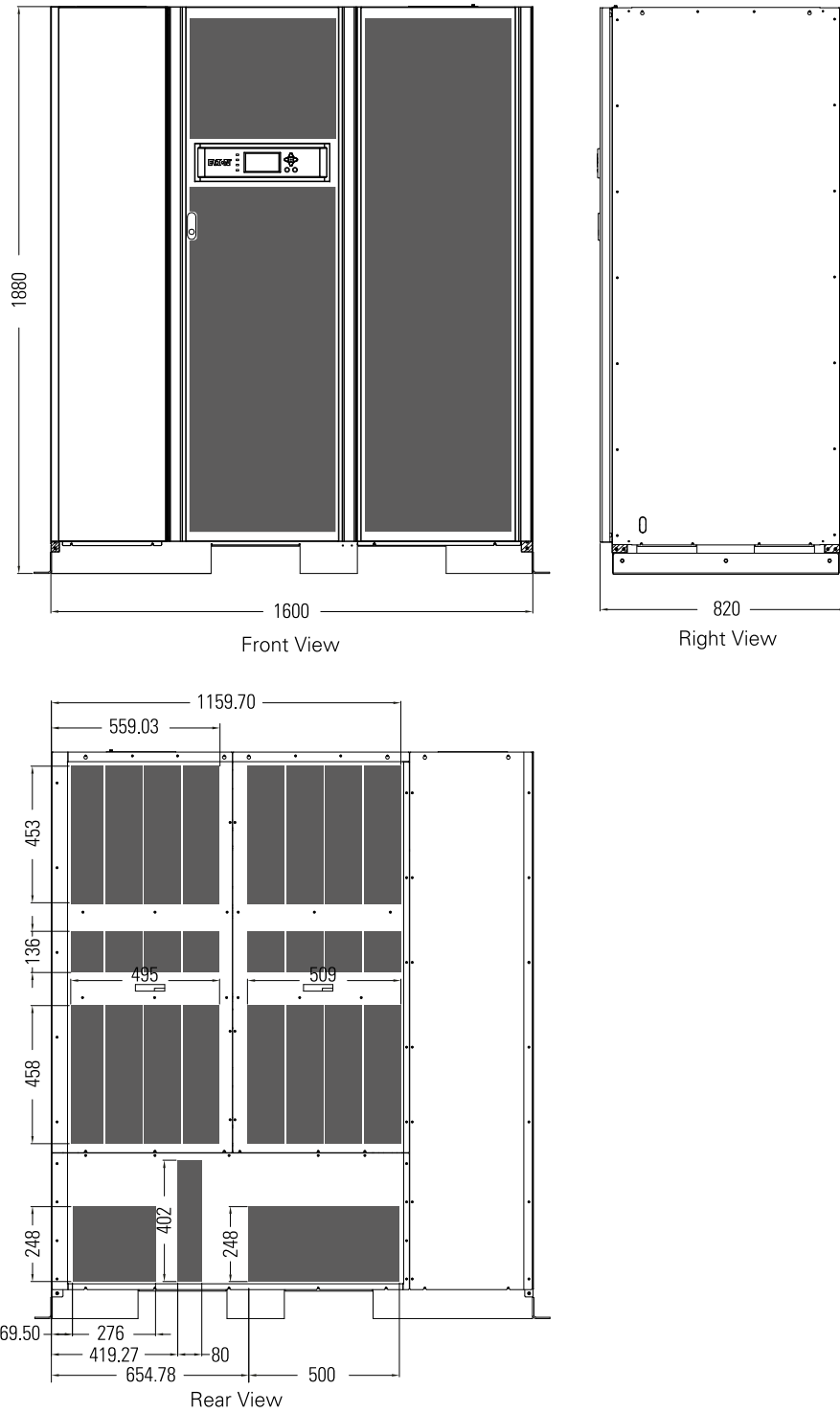
- Recommended operating range: 20-25°C
- Maximum relative humidity: 95%, noncondensing

A: 93E Required clearance for parallel adjacent UPS or UPS and adjacent PDU				
Ambient	300 kVA		400 kVA	
	D1 (mm)	D2 (mm)	D1 (mm)	D2 (mm)
25°C	≥250	≤50	≥150	≤50
30°C	≥300		≥150	
35°C	≥400		≥150	
40°C	≥500		≥250	
B: 93E Recommended clearance for UPS with adjacent battery cabinet				
Ambient	300 kVA		400 kVA	
	D1 (mm)	D3 (mm)	D1 (mm)	D3 (mm)
25°C	≥600	≥2500	≥600	≥2500
	≥800	≥2000	≥800	≥2000
	≥1000	≥1200	≥1000	≥1200

Table 3-3: Required clearance

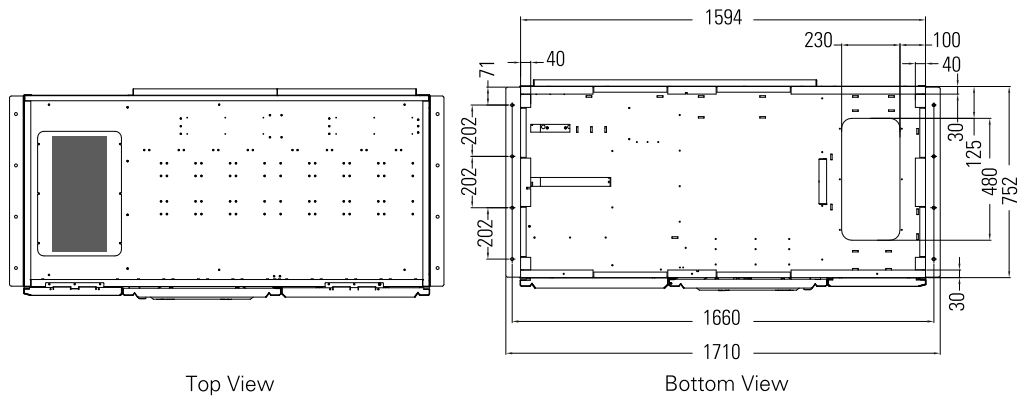
Notes:

- D1- clearance to the rear wall.
- D2- clearance between the adjacent paralleled UPS or UPS and adjacent PDU. Parallel UPS should be as close as possible.
- D3- clearance between the UPS and battery cabinet.



Dimensions are in millimeters.

Figure 3-1: UPS cabinet dimensions (front, right, and rear side views)



Top View

Bottom View

Dimensions are in millimeters.

Figure 3-2: UPS cabinet dimensions (top and bottom views)



Dimensions are in millimeters.

Figure 3-3: UPS cabinet center of gravity



CAUTION

If battery systems are located in the same room as the UPS, the battery manufacturer's environmental requirements should be followed if they are more stringent than the UPS requirements. Operating temperatures above the recommended range will result in decreased battery life and performance, and may reduce or void the battery warranty.

The UPS ventilation requirements are shown in *Table 3-4: Air conditioning or ventilation requirements during full load operation* on page 15.

Model	Rating	Input/Output voltage	Heat rejection
Eaton 93E-300	300 kVA	380/380 VAC 400/400 VAC 415/415 VAC	18.2 kW
Eaton 93E-400	400 kVA	380/380 VAC 400/400 VAC 415/415 VAC	24.2 kW

Table 3-4: Air conditioning or ventilation requirements during full load operation

3.2.2 UPS system power wiring preparation

The UPS system installation must meet the following guidelines:

- The system must be installed on a level floor suitable for computer or electronic equipment.
- The system must be installed in a temperature and humidity controlled indoor area free of conductive contaminants.

Failure to follow guidelines may void your warranty.

The UPS equipment operating environment must meet the weight requirements shown in *Table 3-1: UPS cabinet weights* on page 10 and the size requirements shown in *Figure 3-1: UPS cabinet dimensions (front, right, and rear side views)* on page 12. Dimensions are in millimeters.



WARNING

- **HIGH TOUCH CURRENT EARTH CONNECTION ESSENTIAL BEFORE CONNECTING SUPPLY. As a result of the connected loads high leakage current is possible. Connection of the earth (ground) is required for proper product operation. Do not check UPS operation by removal of the Earth (ground) connection.**
 - **The UPS unit is not applicable to the IT (Isolated Terra) power distribution system.**
-



WARNING

Before working on the circuit, isolate the UPS by disconnecting all inputs and output and check for hazardous voltage between all terminals, including the protective earth.

- Refer to national and local electrical codes for acceptable external wiring practices.

- For external wiring, 70°C copper cables are recommended. Cable sizes listed in *Table 3-6: Input/Output ratings and external wiring recommendations for the Eaton 93E 300-400 kVA* on page 16 are for copper cables only. If cables are run in an ambient temperature greater than 30°C, higher temperature cables and/or larger sized cables may be necessary. Cable sizes are based on using the specified breakers.
- Material and labour for external wiring requirements are to be supplied by designated personnel.
- The bypass feed into this equipment uses four wires (three line conductors and neutral conductor), plus grounding conductor (protective earthing conductor) . The rectifier feed into this equipment uses four wires (three line conductors and neutral conductor), plus grounding conductor (protective earthing conductor). The phases must be symmetrical about ground (from a Wye/Star source) for proper equipment operation.
- The bypass feed into this equipment uses five wires. The rectifier feed into this equipment uses five wires. The phases must be symmetrical about ground (from a Wye/Star source) for proper equipment operation.
- Parallel UPS input wiring size requirements and output wiring size requirements from the UPSs to the Tie Cabinet are the same as those for single systems.
- This device is not equipped with its own mains separation device. It is, therefore, essential that the customer install such a device at the installation site near the UPS.
- Install a proper three-pole overcurrent disconnect device before connecting to the UPS, the disconnect device shall disconnect simultaneously all line conductors of the AC MAINS SUPPLY.
- Do not disconnect neutral, neutral required for system operation. If a disconnect device interrupts the neutral conductor, it shall simultaneously interrupt all line conductors. Ensure that an input neutral is connected before energising the UPS.

Figure 4-3: Power terminal locations (with backfeed contactor and input breaker) on page 27 shows the location of the UPS power cable terminals.

Terminal function	Terminals	Bus landing	Tightening torque (Nm)	Screw size and type
AC input to UPS rectifier	L1, L2, L3, N	M12 bolt mounting	30	113 mm ² (M12). Hex
AC input to bypass	L1, L2, L3, N	M12 bolt mounting	30	113 mm ² (M12). Hex
AC output to critical load	L1, L2, L3, N	M12 bolt mounting	30	113 mm ² (M12). Hex
DC input from external battery	Battery (+) Battery (-)	M12 bolt mounting	30	113 mm ² (M12). Hex
Customer earth	PE (Earthing)	M10 bolt mounting	47	78.5 mm ² (M10). Hex

Table 3-5: UPS external power cable terminations for the Eaton 93E 300-400 kVA

See also *Figure 5-5: UPS system online* on page 42.

		Units	Rating 50/60 Hz	
Basic unit rating	Cross sections	kVA	300	400
		kW	270	360
Input and output voltage		Volts	400/400	400/400
AC input to UPS rectifier (0.99 Minimum pF)		Amps	460	613
Full load current plus battery recharge current (3) Phases, (1) Neutral, (1) Ground				

		Units	Rating 50/60 Hz	
1) Conductor size (L1, L2, L3, and N)	2) Minimum recommended	mm ²	2x120	2x185
	3) max	mm ²	3x240	3x240
AC input to UPS bypass (Five Wire, Dual-Feed) Full load current (3) Phases, (1) Neutral		Amps	433	577
1) Conductor size (L1, L2, L3, and N)	2) Minimum recommended	mm ²	2x120	2x185
	3) max	mm ²	3x240	3x240
DC input from external battery (1) Positive, (1) Negative		Total Amps	618	824
1) Conductor size (per pole)	2) Minimum recommended	mm ²	2x185	3x185
	3) max	mm ²	3x240	3x240
AC output to critical load (Five Wire) Full load current (3) Phases, (1) Neutral		Amps	433	577
1) Conductor size (L1, L2, L3, and N)	2) Minimum recommended	mm ²	2x120	2x185
	3) max	mm ²	3x240	3x240
Grounding				
1) - Conductor size (PE)	2) Minimum recommended	mm ²	120	185
	3) max	mm ²	3x240	3x240
Neutral (N) (Mains/Load:(Non-linear load))	1.7 times			
Backfeed protection device	Clearance distance: >= 2.0 mm Break time < = 15 s			

Table 3-6: Input/Output ratings and external wiring recommendations for the Eaton 93E 300-400 kVA

1) Conductor size recommendations are for PVC-insulated, 70 deg C copper cables. Always refer to local regulations for cable sizing.

2) Minimum recommended cable size (according to maximum current).

3) Maximum cable size fitting into the UPS terminal.

See also Figure 5-5: UPS system online on page 42.



CAUTION

External overcurrent protection is not provided by this product, but is required by codes. Refer to Table 3-6: Input/Output ratings and external wiring recommendations for the Eaton 93E 300-400 kVA on page 16 for wiring requirements. If an input/output lockable disconnect is required, it is to be supplied by the user.

Rated power	Rated voltage	Rectifier input		UPS Output/Bypass		Battery	
		Rated current	Circuit breaker rating	Rated current	Circuit breaker rating	Rated current	Circuit breaker rating
300 kVA	400 V	460 A	500 A	433 A	500 A	618 A	700 A
400 kVA	400 V	613 A	700 A	577 A	700 A	824 A	1000 A

Table 3-7: Recommended external circuit breaker ratings



CAUTION

To reduce the risk of fire, connect only to a circuit provided with maximum input circuit breaker current ratings from Table 3-7: Recommended external circuit breaker ratings on page 18 in accordance with local regulations.

The line-to-line unbalanced output capability of the UPS is limited only by the full load per phase current values for AC output to critical load shown in *Table 3-6: Input/Output ratings and external wiring recommendations for the Eaton 93E 300-400 kVA* on page 16. The recommended line-to-line load unbalance is 50% or less.

With non-linear load, neutral current may reach 1.7 times of phase current. 4-pole breaker rating shall be sufficient in this case considering the neutral current.

Readily accessible disconnect devices (Bypass and output overcurrent protection and bypass and output disconnect switches or breakers) are to be supplied by the customer.

Table 3-7: Recommended external circuit breaker ratings on page 18 lists the recommended rating for bypass and output circuit breakers.

There is no DC disconnect device within the UPS. A battery disconnect switch is recommended, and may be required by local codes when batteries are remotely located. The battery disconnect switch should be installed between the battery and the UPS in the immediate vicinity of the UPS.

External DC input overcurrent protection and disconnect switch for a remote battery location is to be provided by the user. *Table 3-7: Recommended external circuit breaker ratings* on page 18 lists the recommended rating for continuous-duty rated circuit breakers satisfying the criteria for both.

Battery voltage is computed at 2 volts per cell. Rated battery current is computed at 2 volts per cell. The battery wiring used between the battery and the UPS should not allow a voltage drop of more than 1% of nominal DC voltage at rated battery current. If the conductors used for DC input from the battery cabinets to the UPS are those provided by the UPS manufacturer, and the UPS and battery cabinets are manufactured by the same supplier, then it is acceptable if they do not meet the noted minimum conductor sizes.

3.2.3 UPS system interface wiring preparation

Control wiring for features and options should be connected at the customer interface terminal blocks located inside the UPS.



WARNING

Do not directly connect contactor contacts to the mains related circuits. Reinforced insulation is required before connecting to the mains.

Read and understand the following notes while planning and performing the installation:

- Interface wiring should be rated for 24V, 1A minimum.
- For interface wiring from 30V to 600V, the wire should be rated for 600V, 1A minimum.
- Because of the Remote EPO and signal input wiring route in the UPS cabinet, the wire should be rated for a minimum of 300V.
- Use twisted-pair wires for each input and return or common.
- All interface wiring and conduit is to be supplied by the customer.
- When installing external interface wiring between a Remote EPO or signal input and the UPS interface terminals, conduit must be installed between each device and the UPS cabinet.
- If using the power terminal wiring channel, keep interface wiring separate from power wiring or use shielded wire.
- If using conduit, install the interface wiring in separate conduit from the power wiring.
- All signal inputs require an isolated normally-open contact or switch (rated at 24 Vdc, 20 mA minimum) connected between the alarm input and common terminal. All control wiring and switch contacts are customer-supplied.
- LAN and telephone drops for use with Mini-Slot connectivity cards must be supplied by the customer.
- The Remote EPO feature opens all contactors in the UPS cabinet and isolates power from your critical load. Local electrical codes may also require tripping upstream protective devices to the UPS.
- The Remote EPO switch must be a latching-type switch not tied to any other circuits.
- A jumper wire must be connected between pins 3 and 4 on the Remote EPO terminal block if using a normally closed Remote EPO switch.
- Remote EPO wiring should be a minimum of 0.5 mm² and a maximum of 2.0 mm².
- The Remote EPO switch wiring must be in accordance with local regulations.
- The maximum distance between the Remote EPO and the UPS cannot exceed 150 meters.

3.3 Inspecting and unpacking the UPS cabinets

The cabinet is shipped bolted to a wooden pallet and protected with an outer wood container.



WARNING

The UPS cabinet is heavy (see Table 3-1: UPS cabinet weights on page 10). If unpacking and unloading instructions are not closely followed, the cabinet may tip and cause serious injury.

1. Carefully inspect the outer packaging for evidence of damage during transit.
-



CAUTION

Do not install a damaged cabinet. Report any damage to the carrier and contact an Eaton service representative immediately.



NOTE

For the following step, verify that the forklift or pallet jack is rated to handle the weight of the cabinet (see Table 3-1: UPS cabinet weights on page 10 for cabinet weight).

2. Use a forklift or pallet jack to move the packaged cabinet to the installation site, or as close as possible, before unpacking. If possible, move the cabinets using the pallet. Insert the forklift or pallet jack forks between the supports on the bottom of the pallet (see *Figure 3-3: UPS cabinet center of gravity* on page 14 for the UPS cabinet center of gravity measurements).
-



CAUTION

Do not tilt the UPS cabinets more than 15° from vertical or the cabinets may tip over.

3. Set the pallet on a firm, level surface, allowing a minimum clearance of 3 m on each side for removing the cabinet from the pallet.
 4. Remove the protective wood container from the cabinet:
-



NOTE

For the following steps, use pincer type pliers or a large flat blade screw driver to straighten the securing tabs.

- a) Straighten the tabs securing the top panel of the wooden container to the side panels of the container.

- b) Remove the top panel.
 - c) Straighten the tabs securing the side panels of the container to the front and back panels of the container.
 - d) Remove the side panels.
 - e) Straighten the tabs securing the front and back panels of the container to the bottom of the container.
 - f) Remove the front and back panels.
- 5. Remove the inner protective packaging.
 - 6. Recycle the remainder of the outer shipping container and the inner protective packaging in a responsible manner.
 - 7. Inspect the contents for any evidence of physical damage, and compare each item with the Bill of Lading. If damage has occurred or shortages are evident, contact an Eaton service representative immediately to determine the extent of the damage and its impact on further installation.



NOTE

While waiting for installation, protect the unpacked cabinet from moisture, dust, and other harmful contaminants. Failure to store and protect the UPS properly may void your warranty.

4 UPS system installation

The customer has to supply the wiring to connect the UPS to the local power source. The electrical installation procedure is described in the following section. The installation inspection and the initial start-up of the UPS and installing an extra battery cabinet must be carried out by a qualified service personnel authorised by Eaton.

4.1 Preliminary installation information



WARNING

Installation should be performed only by qualified personnel. See installation instructions before connecting to the supply.

Refer to the following while installing the UPS system:

- Chapter 3 for cabinet dimensions, equipment weight, wiring and terminal data, and installation notes.
- Do not tilt the cabinets more than $\pm 15^\circ$ during installation.
- If perforated floor tiles are required for ventilation, place them in front of the UPS.
- The UPS unit is not suitable for IT (Isolated Terra) or corner-earthed power distribution systems.
- Suitable for mounting on concrete or other non-combustible surfaces only.

4.2 Unloading the UPS cabinet from the pallet

The UPS cabinet is bolted to a wooden pallet supported by wood skids. To remove the pallet:



WARNING

The UPS cabinet is heavy, (see Table 3-1: UPS cabinet weights on page 10). If unpacking and unloading instructions are not closely followed, the cabinet may tip and cause serious injury.



CAUTION

- **Do not tilt cabinets more than 15° from vertical.**
 - **Lift the cabinets only with a forklift or damage may occur.**
-

**NOTE**

For the following steps, verify that the forklift or pallet jack is rated to handle the weight of the cabinet (see Table 3-1: UPS cabinet weights on page 10 for cabinet weight).

1. If not already accomplished, use a forklift or pallet jack to move the UPS cabinet to the installation area, or as close as possible, before unloading from the pallet. Insert the forklift or pallet jack forks between the supports on the bottom of the pallet (see *Figure 3-3: UPS cabinet center of gravity* on page 14 for the UPS cabinet center of gravity measurements).
2. Remove four bolts securing the front shipping bracket to the cabinet and four bolts securing the bracket to the pallet (see *Figure 4-1: Removing the shipping bracket* on page 23). Remove the shipping bracket. If installing the cabinet permanently, retain the shipping bracket and securing hardware for later use.
3. Roll the cabinet to the final installation location.
4. If permanently mounting the system, proceed to Step 5.
5. Using the retained hardware, reinstall the shipping brackets removed in Step 2 a to the front and rear of the UPS cabinet with the angle facing outward (see *Figure 4-1: Removing the shipping bracket* on page 23).
6. Secure the cabinet to the floor with hardware.

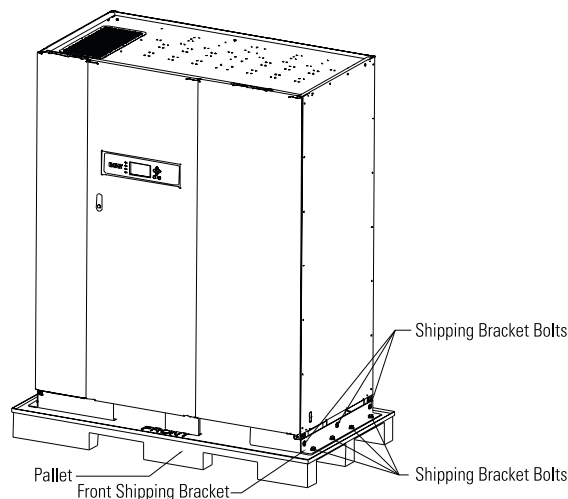


Figure 4-1: Removing the shipping bracket

**WARNING**

Do not stand directly in front of the pallet while unloading the cabinet. If unloading instructions are not closely followed, the cabinet may cause serious injury.

4.3 External maintenance bypass installation

Eaton 93E 300-400 kVA models do not feature internal Maintenance Bypass. An external MBS can be installed to enable disconnecting the UPS from the utility power for servicing the UPS.

1. Refer to *Table 3-6: Input/Output ratings and external wiring recommendations for the Eaton 93E 300-400 kVA* on page 16 for External Maintenance Bypass wiring requirements.
2. Refer to *Table 3-7: Recommended external circuit breaker ratings* on page 18 for External Maintenance Bypass breaker ratings.
3. Refer to *Figure 6-8: External Maintenance Bypass installation diagram* on page 54 for External Maintenance Bypass connection method.

4.4 External battery cabinet installation

For 93E 300-400 kVA UPS, in storage mode the power is provided by external batteries. The UPS can be equipped with up to four External Battery Cabinets (EBCs) containing valve-regulated lead-acid, maintenance-free batteries. A single EBC can contain 36, 38 or 40 batteries. Power and control wiring are not supplied with the UPS.

When installing Eaton External Battery Cabinets (EBCs), refer to the manufacturer's installation manual, see *Chapter 1.8 For more information* on page 5 for installation instructions.

If installing a customer-supplied battery system, install the battery system according to the battery and battery system manufacturer's instructions and all applicable codes and regulations.

Cable entries to the UPS are at the top, and at the bottom of the cabinet.

External DC input overcurrent protection and disconnect switch for a remote battery location is to be provided by the user and installed in the immediate vicinity of the UPS.



WARNING

- **In the event of malfunction, the battery cabinet chassis or battery cabinet frames may become live!**
 - **Special care should be taken when working with the battery cabinet associated with the equipment. Ensure the battery number is suited to the setting of the battery charging voltage before installing the battery. When the battery cabinet is connected the overall voltage exceeds nominal voltage. It is very important to ensure that the batteries are installed separately, in a dedicated battery cabinet.**
 - **If the battery setting shall be exceeded one hour, contact the UPS manufacturer for guidance.**
-



CAUTION

- **The most common battery type used in UPS installations is the valve regulated battery. Valve regulated cells are not sealed. The amount of gas given off is less than for flooded cells, but when planning the battery installation, allowance must be made for adequate ventilation and heat dissipation. Valve regulated cells are not completely maintenance-free. They must be kept clean and their connections checked periodically to ensure they are tight, and that there is no evidence of corrosion. It is inevitable that the batteries will lose charge during transportation and storage; before attempting to carry out an autonomy test, ensure that the batteries are fully charged as this may take several hours. Cell performance typically improves after a few discharge/recharge cycles.**
- **The requirements of the EC directives are satisfied when battery cabinets are used with original accessories. If alternative batteries are used, you must ensure that the applicable EC directives are met and declare conformity.**

1. Turn off the UPS.
2. Check that all the external battery breakers are open.
3. Connect PE first.
4. Route cables from positive (+) and negative (-) terminals in the first battery into the UPS cabinet through the conduit (top or bottom entry) and connect the cables to terminals BAT+ and BAT-.
5. Refer to instructions provided with the battery cabinet or by vendor.

Size cables according to cable size recommendations in *Table 3-6: Input/Output ratings and external wiring recommendations for the Eaton 93E 300-400 kVA* on page 16 and protective device specification in *Table 3-7: Recommended external circuit breaker ratings* on page 18.

If you are installing more than one battery cabinet, the first battery cabinet will be the only cabinet directly connected to the UPS.

UPS and battery cabinet connection diagram is as follows:

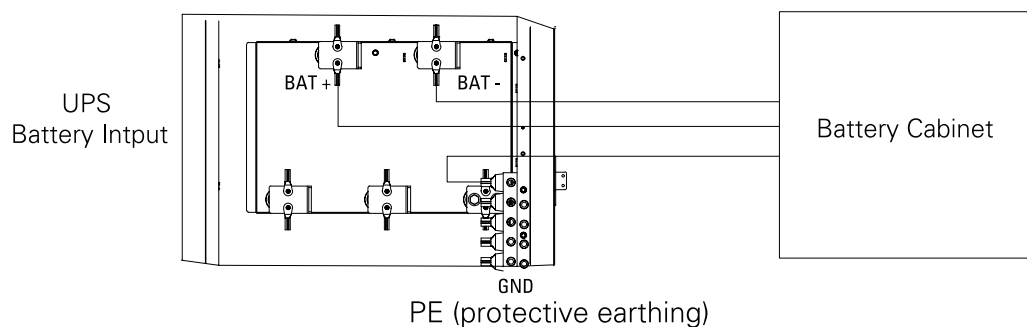


Figure 4-2: Connection between UPS and battery cabinet

4.5 External power wiring installation

To install wiring:

1. Route the wiring to the UPS terminal blocks in the UPS input and output connection area through the cable entry point at the top or at the bottom of the UPS cabinet. See *Figure 4-3: Power terminal locations (with backfeed contactor and input breaker)* on page 27 for wiring access information and terminal locations.
2. Ground the UPS according to local and/or national electrical wiring codes by routing and connecting the ground wire to the input ground lug. See *Figure 4-3: Power terminal locations (with backfeed contactor and input breaker)* on page 27 for UPS terminal locations.
3. Connect phase L1, L2, L3, and Neutral rectifier input power wiring from the utility source to the rectifier input and neutral terminals. See *Chapter 3.2.2 UPS system power wiring preparation* on page 15 for wiring and termination requirements.
4. If wiring a dual-feed system, proceed to Step 5; otherwise, proceed to Step 6.
5. Connect L1, L2, L3, and Neutral bypass input power wiring from the utility source to the bypass input terminals and neutral terminals. See *Figure 4-5: Interface terminal locations* on page 28 for wiring and termination requirements. Proceed to Step 7.
6. For single feed installation, jumpers between the input and bypass input terminals (L1-L1, L2-L2, L3-L3) must be installed.
7. Connect phase L1, L2, L3, and Neutral (if required) power wiring from output terminals and neutral terminals to the critical load. See *Table 3-5: UPS external power cable terminations for the Eaton 93E 300-400 kVA* on page 16 and *Table 3-6: Input/Output ratings and external wiring recommendations for the Eaton 93E 300-400 kVA* on page 16 for wiring and termination requirements.
8. If wiring interface connections, proceed to *Chapter 4.6 Installing interface connections* on page 28.



WARNING

- **HIGH TOUCH CURRENT. EARTH CONNECTION ESSENTIAL BEFORE CONNECTING SUPPLY.** As a result of the connected loads high leakage current is possible. Connection to earth/ground is required for safety and proper product operation. Do not install or operate the UPS without an earth/ground connection.
 - **BAT+/BAT-** are terminals connected to the battery cabinet, Battery+ polarity should use red cable, battery- polarity should use black or blue cable.
 - If using battery cabinets other than the UPS manufacturer's, make sure that local regulation for electrical installations is followed. If not provided in the external battery cabinet, installing a disconnect device near the UPS, between the UPS and the external battery cabinet, may be required by codes.
 - Input neutral line should be directly connected to input "N" terminal of UPS wire connection terminal bay at all times.
 - The external battery cabinet shall be properly earthed. There are protective earthing terminals inside the UPS for connecting external battery cabinet earthing. If installing battery cabinet protective earthing to a source other than the UPS, this source shall be in connection with the UPS grounding.
-

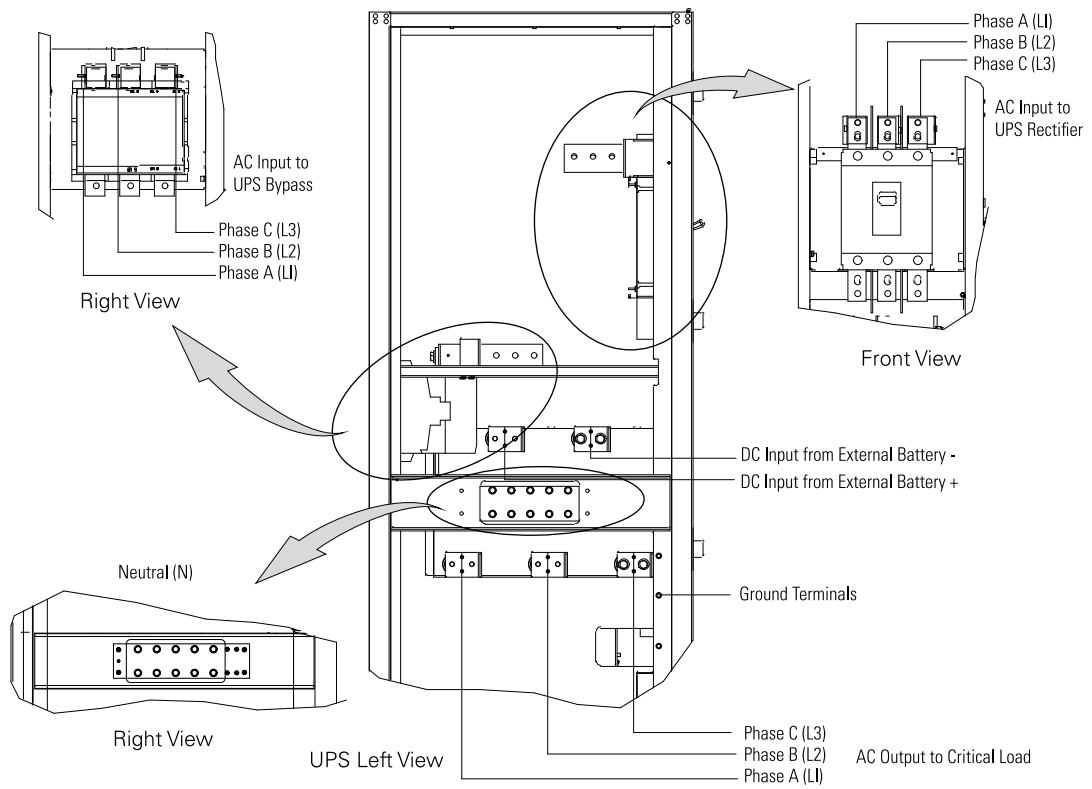


Figure 4-3: Power terminal locations (with backfeed contactor and input breaker)

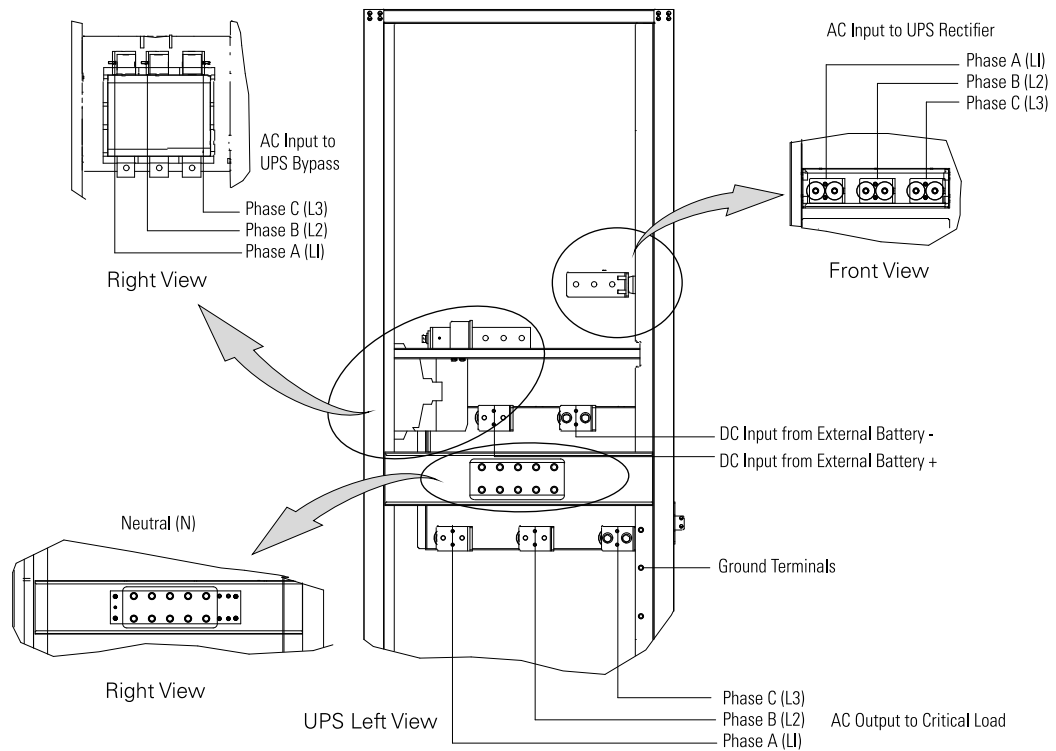


Figure 4-4: Power terminal locations (with backfeed contactor, no input breaker)

4.6 Installing interface connections

4.6.1 Installing signal input connections

To install wiring:

1. Verify the UPS system is turned off and all power sources are removed. See *Chapter 6 UPS operating instructions* on page 43 for shutdown instructions.
2. To locate the appropriate terminals and review the wiring and termination requirements, see *Chapter 3.2.3 UPS system interface wiring preparation* on page 19, *Table 4-1: Signal input connections* on page 29, *Figure 4-5: Interface terminal locations* on page 28, and *Figure 4-6: Signal input terminal block connector assignments* on page 29.

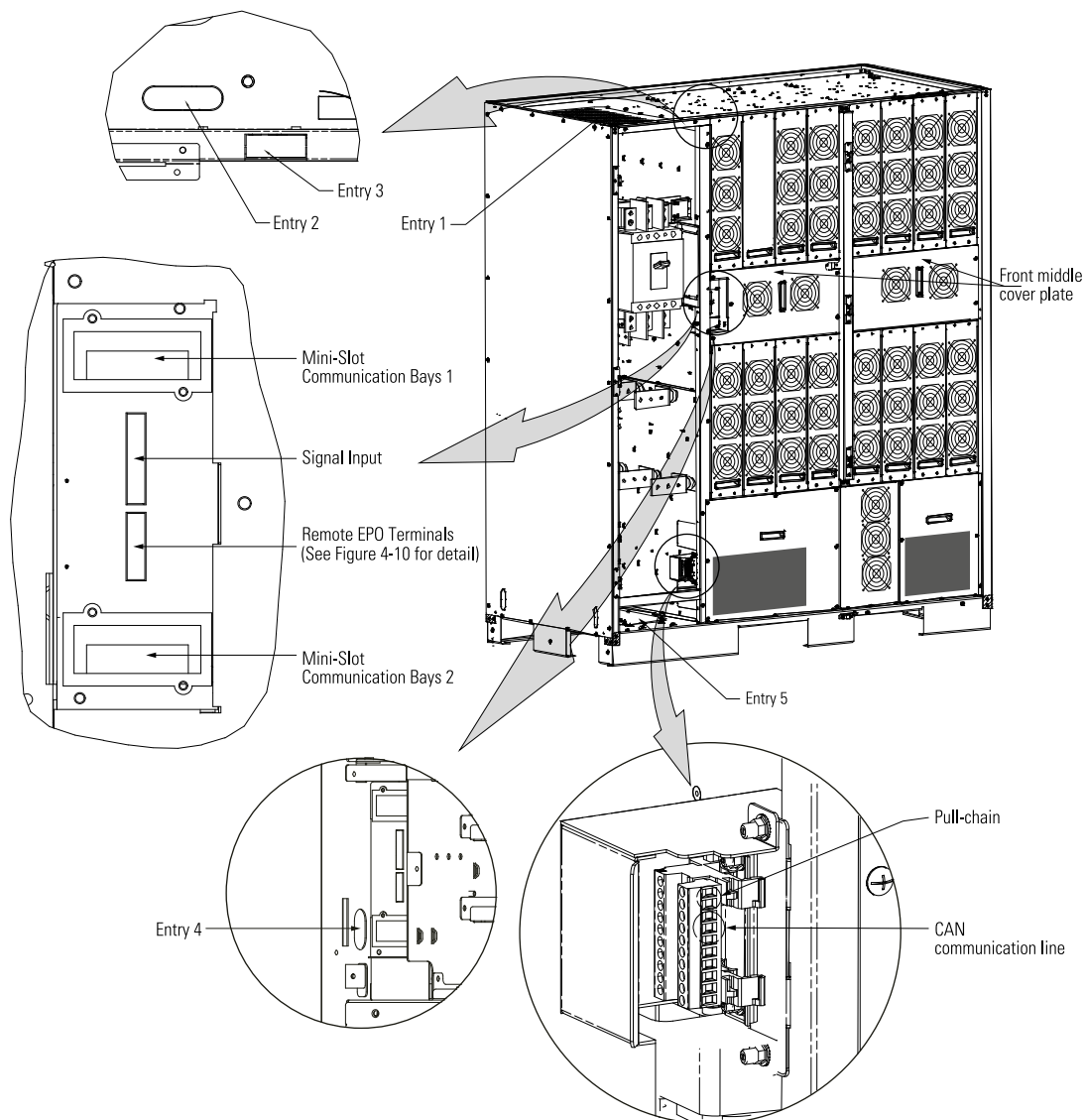


Figure 4-5: Interface terminal locations

3. External alarm interface/communication cables can enter UPS via any of the external cabinet entry points 1, 2 or 5, and connect through to the communications panel via internal entry point 4. The cables can also enter the UPS via entry point 3 and be routed directly to the communications panel without removing the cabinet door.

4. If wiring parallel connections, proceed to *Chapter 4.6.2 Installing parallel pull-chain and CAN control wiring and connections* on page 29; if wiring Mini-Slot connections, proceed to *Chapter 4.6.3 Installing mini-slot interface connections* on page 31.

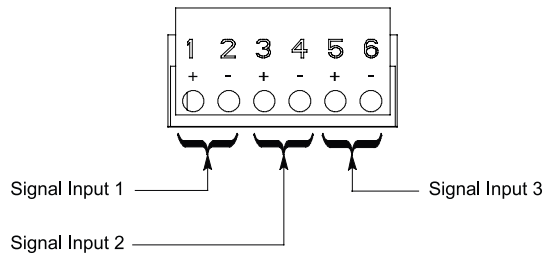


Figure 4-6: Signal input terminal block connector assignments

Signal input terminal	Name	Description
1	Signal input 1 +	Input: Programmable UPS alarm, activated by a remote dry contact closure.
2	Signal input 1 -	
3	Signal input 2 +	Input: Programmable UPS alarm, activated by a remote dry contact closure.
4	Signal input 2 -	
5	Signal input 3 +	Input: Programmable UPS alarm, activated by a remote dry contact closure.
6	Signal input 3 -	

Table 4-1: Signal input connections

4.6.2 Installing parallel pull-chain and CAN control wiring and connections

To install wiring:

1. Verify the UPS system is turned off and all power sources are removed. See *Chapter 6 UPS operating instructions* on page 43 for shutdown instructions.
2. For installing parallel system, see *Figure 4-8: Parallel UPS control wiring* on page 31, and *Figure 4-9: Parallel UPS system connections* on page 32.



CAUTION

- **Parallel system combined input and output wiring length should be in accordance with the following rule. It should be designed to ensure that wiring impedance from point of supply to load connection for each UPS module in a multi-module system is equal, or within a tolerance of approximately $\pm 10\%$. This is to ensure approximately equal current sharing when in static bypass mode.**
 - **Total length of 1A=2A=3A=4A**
 - **1B=2B=3B=4B**
- **If installing only two UPS modules (redundant), this requirement is no longer required as each UPS is capable of supporting the full bypass requirement. However, this would preclude future expansion.**
- **Ensure that each UPS static bypass is fed from a single common source, as is an external bypass switch if installed. If each UPS is fed with a separate rectifier source, please consult Eaton for advice on compatibility.**

3. To locate the appropriate terminals and review the wiring and termination requirements, see *Chapter 3.2.3 UPS system interface wiring preparation* on page 19, *Table 4-2: Pull-chain connections* on page 30, *Figure 4-5: Interface terminal locations* on page 28, *Figure 4-8: Parallel UPS control wiring* on page 31, and *Figure 4-9: Parallel UPS system connections* on page 32.

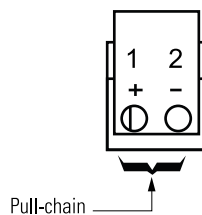


Figure 4-7: Pull-chain terminal block connector assignments

Pull-chain terminal	Name	Description
1	Pull-chain +	Output: Backup control for parallel operation.
2	Pull-chain -	

Table 4-2: Pull-chain connections

4. Parallel system communication cables (Pull Chain and CAN communications) can enter the UPS cabinet via external entry points 1, 2 or 5. See details in *Figure 4-5: Interface terminal locations* on page 28, *Figure 4-8: Parallel UPS control wiring* on page 31, and *Figure 4-9: Parallel UPS system connections* on page 32.
5. Route and install pull chain wiring (Twisted Wires 0.2-1 mm²) between the UPS cabinets and cabinet MOBs. See *Figure 4-5: Interface terminal locations* on page 28, *Figure 4-8: Parallel UPS control wiring* on page 31, and *Figure 4-9: Parallel UPS system connections* on page 32 for wiring information.

4.6.3 Installing mini-slot interface connections



NOTE

LAN drop for connection to UPS communications card is to be supplied by customer.

For installation and setup of a Mini-Slot card, contact an Eaton service representative, (see *Chapter 1.8 For more information* on page 5).

To install wiring:

1. If not already installed, install the LAN drop.
2. Route and install the LAN and other cables to the appropriate Mini-Slot cards. See *Figure 4-3: Power terminal locations (with backfeed contactor and input breaker)* on page 27 and *Figure 4-5: Interface terminal locations* on page 28 for Mini-Slot communication bay locations.
3. Refer to the manual supplied with the Mini-Slot card for operator instructions.
4. Install the power terminal cover using the provided hardware.

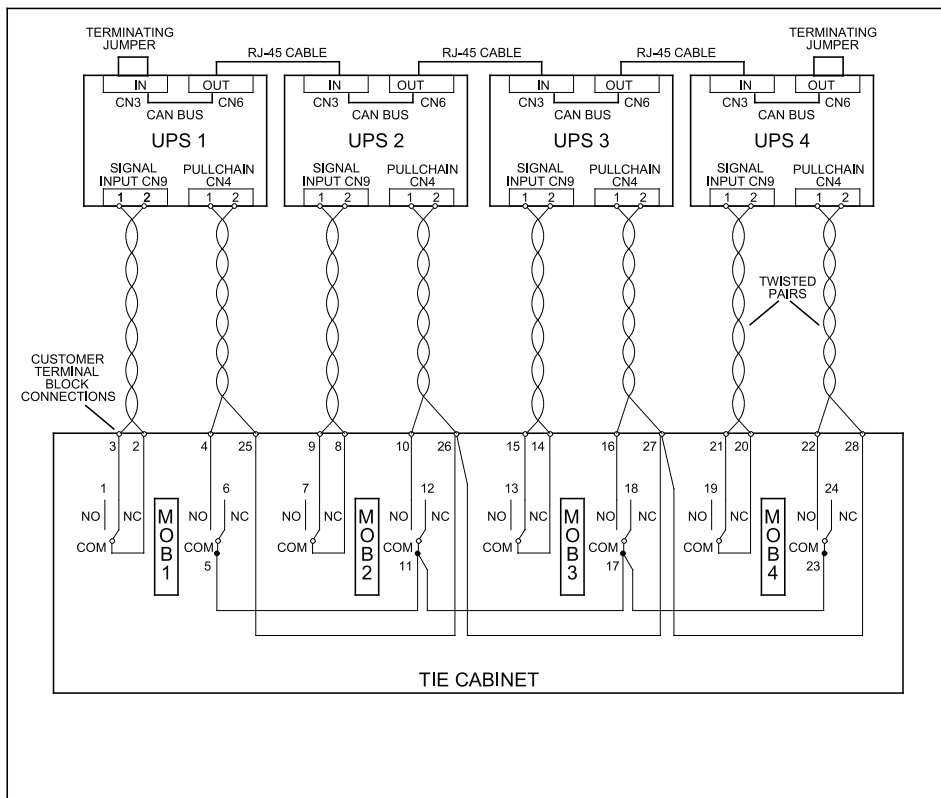


Figure 4-8: Parallel UPS control wiring

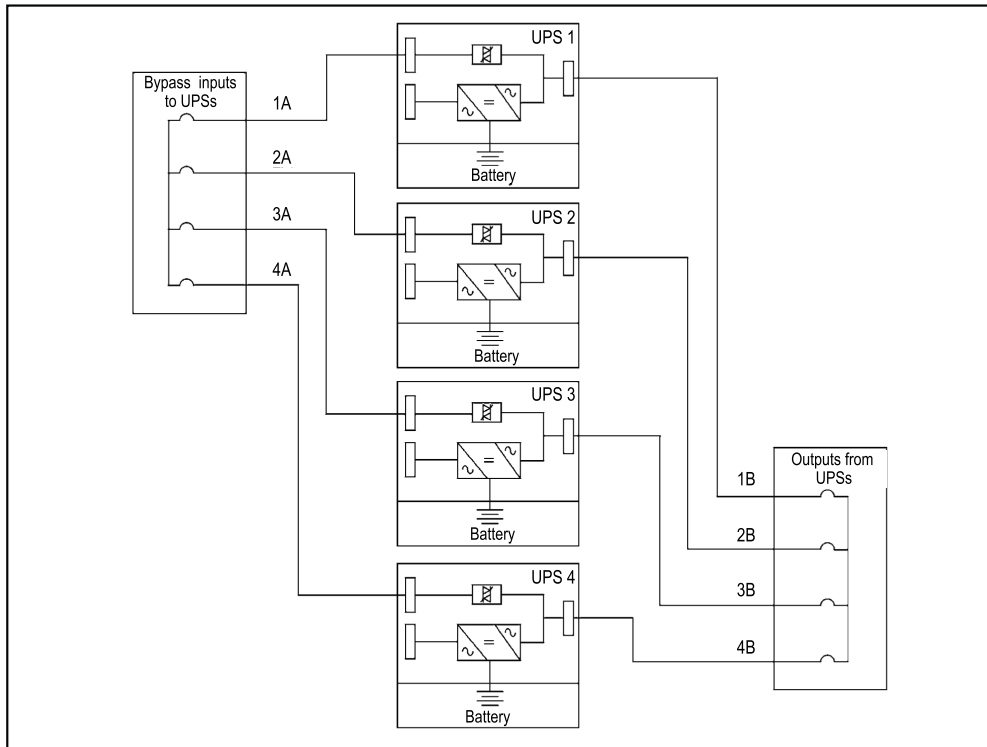


Figure 4-9: Parallel UPS system connections

4.7 Installing a remote EPO switch

A latching-type Remote Emergency Power-off (Remote EPO) switch can be used in an emergency to shut down the UPS and remove power to the critical load from a location away from where the UPS is installed.



NOTE

NOTE 1: Before installing a Remote EPO switch, verify that the UPS was installed according to the instructions in Chapters 4.2 through 4.5.

NOTE 2: When installing the Remote EPO switch, you must install conduit between the device and the UPS cabinet for wiring the switch.

NOTE 3: The Remote EPO switch must be a normally-open or normally-closed latching-type switch not tied into any other circuits.

NOTE 4: This procedure is intended for installing the Eaton-supplied Remote EPO switch. If installing another manufacturer's switch, use this procedure, and Figure 4-11: Normally-open remote EPO switch wiring on page 34 and Figure 4-12: Normally-closed Remote EPO switch wiring on page 35 as a guide.

NOTE 5: The Remote EPO switch wiring must be in accordance with local regulations.

To Install a Remote EPO switch:

1. Verify the UPS system is turned off and all power sources are removed. See *Chapter 6 UPS operating instructions* on page 43 for shutdown instructions.
2. Securely mount the Remote EPO switch. Recommended locations include operator's consoles or near exit doors.
3. To locate the appropriate terminals and review the wiring and termination requirements, see *Chapter 3.2.3 UPS system interface wiring preparation* on page 19, *Table 4-3: Remote EPO connections* on page 33, *Figure 4-3: Power terminal locations (with backfeed contactor and input breaker)* on page 27, and *Figure 4-10: Remote EPO terminal block connector assignments* on page 33.

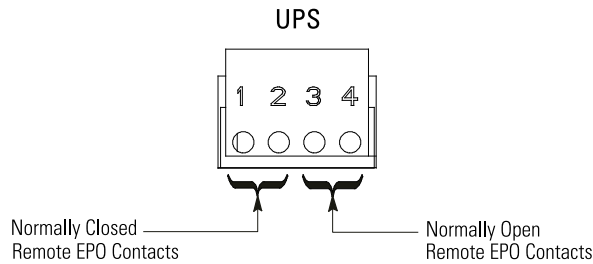


Figure 4-10: Remote EPO terminal block connector assignments

Remote EPO terminal	Description
1	Input: normally-closed dry contact used to activate UPS EPO from a remote switch
2	
3	Input: normally-open dry contact used to activate UPS EPO from a remote switch
4	

Table 4-3: Remote EPO connections

4. Route the Remote EPO wiring to the terminal block:



NOTE

Conduit and wiring enter from the central of conduit the landing plate.

- a) Route the wiring along the interface wiring channel until the wire clears the shelf.
- b) Route the wire along the shelf under the interface housing to the wiring access.
- c) Supporting the top rear panel at the back of the cabinet, reconnect the fan connectors to the wiring harnesses.
- d) Reinstall the top rear panel by tilting into position and securing the panel using the retained hardware.
- e) Reinstall the power terminal cover top using the retained hardware.
- f) Install the power terminal cover right and left sides using the provided hardware.

5. Connect the wiring as shown in *Table 4-4: Remote EPO connections* on page 34 and *Figure 4-11: Normally-open remote EPO switch wiring* on page 34 for a normally-open Remote EPO or *Table 4-4: Remote EPO connections* on page 34 and *Figure 4-12: Normally-closed Remote EPO switch wiring* on page 35 for a normally-closed Remote EPO.
6. If using a normally-closed Remote EPO switch, connect a jumper wire between pins 3 and 4 on the Remote EPO terminal block.
7. If you are installing multiple Remote EPO switches, wire additional switches in parallel with the first Remote EPO.
8. If required, install wiring from the Remote EPO switch to the trip circuitry of the upstream protective devices. A second contact block is provided on the Remote EPO switch for this function. The Remote EPO switch wiring must be in accordance with local regulations.
9. Reinstall the interface terminal cover using the retained hardware.

From Remote EPO Station(s) Switch Contact Block (Either Block)	To Remote EPO Terminal Block on Back of UPS Cabinet	Wire Size	Tightening Torque
3 NO	3	Twisted Wires (2) (0.75-4.0 mm ²)	0.8 Nm
4 NO	4		0.8 Nm

Table 4-4: Remote EPO connections

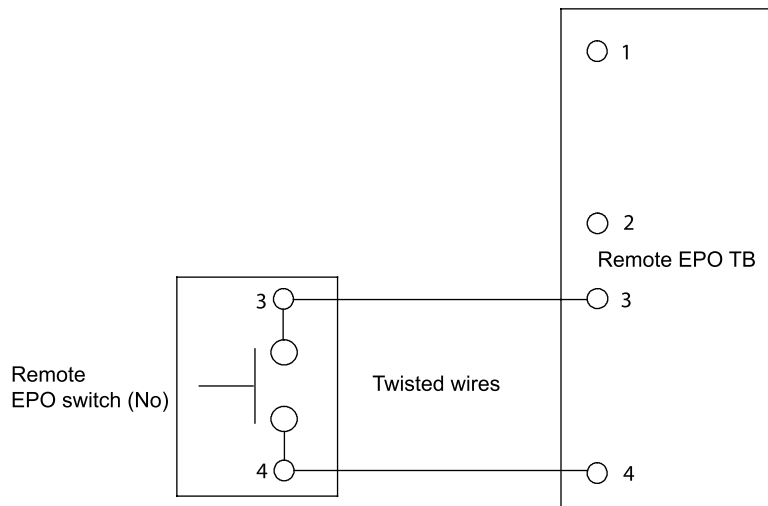


Figure 4-11: Normally-open remote EPO switch wiring

From Remote EPO Station(s) Switch Contact Block (Either Block)	To Remote EPO Terminal Block on Back of UPS Cabinet	Wire Size	Tightening Torque
1 NC	1	Twisted Wires (2) (0.75-4.0 mm ²)	0.8 Nm
2 NC	2		

Table 4-5: Remote EPO connections

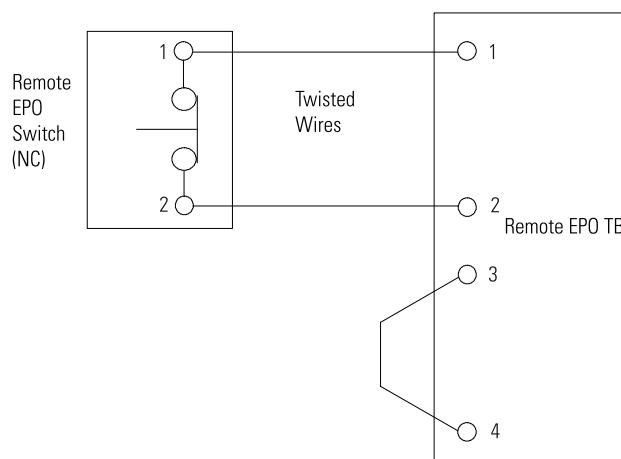


Figure 4-12: Normally-closed Remote EPO switch wiring

4.8 Initial startup

Startup and operational checks must be performed by a qualified service personnel authorised by Eaton. If these instructions are not followed, the warranty terms specified in *Chapter 10 Warranty* on page 74 become void. This service is offered as part of the sales contract for the UPS. Contact Eaton Service representative in advance to reserve a preferred startup date.

4.9 Completing the installation checklist

The final step in installing the UPS system is completing the following installation checklist. This checklist ensures that you have completely installed all hardware, cables, and other equipment. Completing all items listed on the checklist will ensure a smooth installation. Make a copy of the installation checklist before filling it out, and retain the original.

After the installation is complete, a service representative will be able to verify the operation of the UPS system and commission it to support the critical load. The service representative cannot perform any installation tasks other than verifying software and operating setup parameters. Service personnel may request a copy of the completed installation checklist to verify all applicable equipment installations have been completed.



NOTE

The installation checklist MUST be completed before starting the UPS system for the first time.

4.10 Installation checklist

-
- All packing materials and restraints have been removed from each cabinet.

 - The UPS cabinet is placed in its installed location.

 - A readily accessible disconnect device is installed between the UPS input and utility power, in the immediate vicinity of the UPS.

- All conduits and cables are properly routed to the UPS and any ancillary cabinets.

- All power cables are properly sized and terminated.

- Neutral conductors are installed.

- Ground conductors are properly installed.

- Signal inputs are wired appropriately. (Optional)

- LAN drops are installed. (Optional)

- LAN connections have been completed. (Optional)

- The Remote EPO device is mounted in its installed location and its wiring is terminated inside the UPS cabinet. (Optional)

- A jumper wire is connected between pins 3 and 4 on the Remote EPO terminal block if using a normally-closed Remote EPO switch. (Optional)

- All terminal cover plates are installed.

- Accessories are mounted in installed locations and wiring is terminated inside the UPS cabinet. (Optional)

- Air conditioning equipment is installed and operating correctly.

- The area around the installed UPS system is clean and dust-free. (Eaton recommends that the UPS be installed on a level floor suitable for computer or electronic equipment.)

- Adequate workspace exists around the UPS and other cabinets.

- Adequate lighting is provided around all UPS equipment.

- A 230 Vac service outlet is located within 7.5 metres (25 feet) of the UPS equipment.

- Startup and operational checks are performed by an authorised Eaton Customer Service Engineer or by a qualified service personnel authorised by Eaton.

Parallel system installation checklist:

- Each cabinet in the parallel system is placed in its installed location.

- All conduits and cables are properly routed to the UPSs and to the parallel tie cabinet.

- A readily accessible disconnect device is installed between the UPS input and utility power, in the immediate vicinity of the UPS.

- All power cables are properly sized and terminated.

- Neutral conductors are installed between cabinets as required.

- Ground conductors are properly installed.

- CAN wiring between the UPSs is properly installed.

- Pull-chain wiring between the UPSs is properly installed.

- Adequate workspace exists around the UPSs, parallel tie cabinet, and other cabinets.

- Startup and operational checks are performed by an authorised Eaton Customer Service Engineer or by a qualified service personnel authorised by Eaton.

5 Understanding UPS operation

5.1 UPS system overview

The Eaton 93E UPS is a continuous-duty, solid-state, transformer-free, three-phase, true online system that provides conditioned and uninterruptible AC power to the UPS system's output and critical load.

The basic system consists of a rectifier, battery converter, inverter, monitoring/operation control panel, integrated communication server, and digital signal processor (DSP) logic. *Figure 5-1: Main elements of the UPS system* on page 37 shows the main elements of the UPS system.

If utility power is interrupted or falls outside the parameters specified in *Chapter 9 Product specifications* on page 71 the UPS uses a backup battery supply to maintain power to the critical load for a specified period of time or until the utility power returns. For extended power outages, the UPS allows you to either transfer to an alternative power system (such as a generator) or shut down your critical load in an orderly manner.

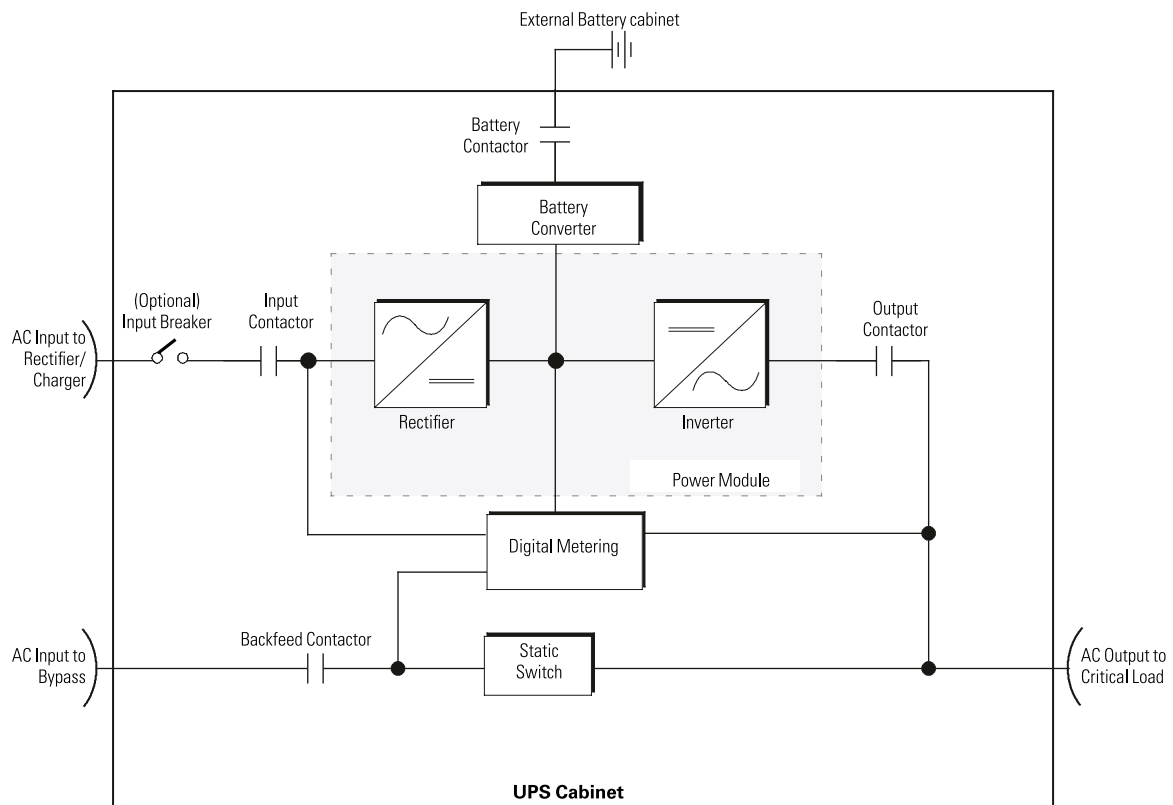


Figure 5-1: Main elements of the UPS system

The emergency bypass consists of a continuous static switch, and a backfeed protection contactor. The backfeed protection contactor is located in series with the static switch. The static switch is armed and ready during normal operation.

5.2 Single UPS

A single UPS operates independently to support an applied load from the inverter, providing conditioned and uninterruptible AC power to the critical load from the output of the module. During an outage, the inverter continues to operate, supporting power to the load from the battery supply. If the unit requires service, applied loads are transferred to the internal bypass either automatically or manually. With the exception of an optional external battery cabinet, no other cabinets or equipment are required for the single UPS to successfully support its applied loads.

5.2.1 Modes

The Eaton 93E UPS supports a critical load in four different modes of operation:

- In **Standard Normal** mode, the critical load is supplied by the inverter, which derives its power from rectified utility AC power. In this mode, the battery charger also provides charging current for the battery, if needed, Standard mode is the standard normal operating mode.
- In **High-Efficiency** (HE) mode, commercial AC power is supplied directly to the critical load through the internal static bypass switch and transfers automatically to Standard Normal mode (double-conversion on demand) if an abnormal condition is detected.
- In **Bypass** mode, the critical load is directly supported by utility power.
- In **Battery** mode, the battery provides DC power, which maintains inverter operation. The battery supports the critical load.

The following chapters describe the differences in the UPS operating modes, using block diagrams to show the power flow during each mode of operation.

5.2.2 Standard Normal mode

During Standard Normal mode, power for the system is derived from a utility input source through the rectifier input contactor. Three-phase AC input power is converted to DC using IGBT devices to produce a regulated DC voltage to the inverter. When the battery contactor is closed the battery is charged directly from the regulated rectifier output through a buck or boost DC converter, depending on the system voltage and the size of the battery string attached to the unit.

Figure 5-2: Path of current through the UPS in standard Normal mode on page 39 shows the path of electrical power through the UPS system when the UPS is operating in Normal mode.

The battery converter derives its input from the regulated DC output of the rectifier and provides either a boosted or bucked regulated DC voltage charge current to the battery. The battery is always connected to the UPS and ready to support the inverter should the utility input become unavailable.

The inverter produces a three-phase AC output to a customer's load without the use of a transformer. The inverter derives regulated DC from the rectifier and uses IGBT devices and pulse-width modulation (PWM) to produce a regulated and filtered AC output. The AC output of the inverter is delivered to the system output through the output contactor.

If the utility AC power is interrupted or is out of specification, the UPS automatically switches to Battery mode to support the critical load without interruption. When utility power returns, the UPS returns to Normal mode.

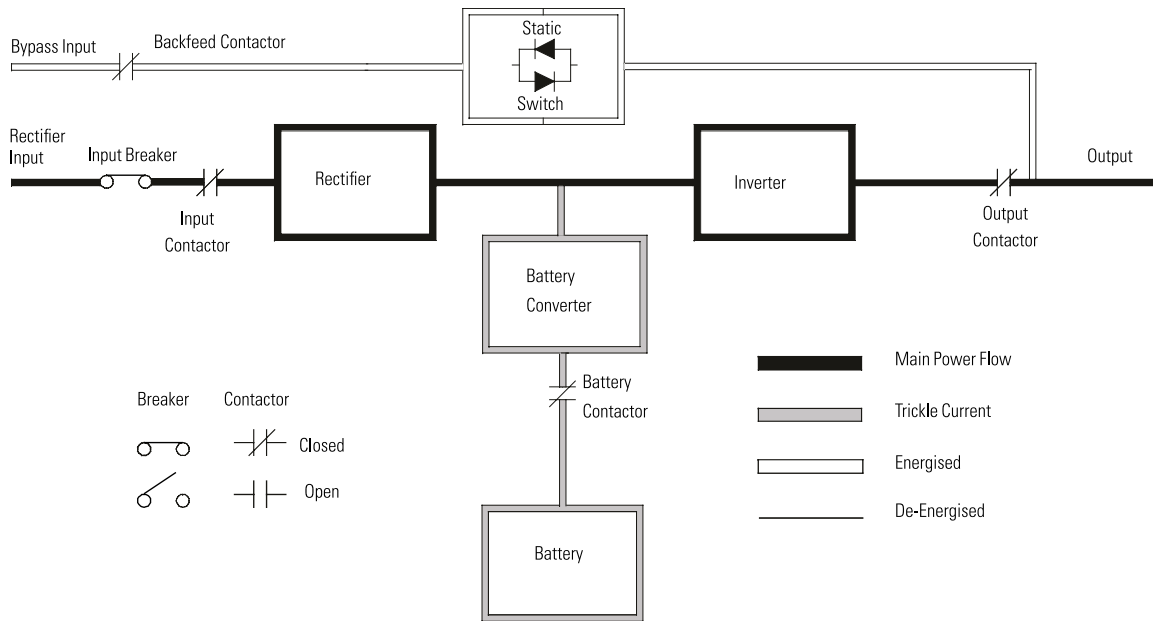


Figure 5-2: Path of current through the UPS in standard Normal mode

If the UPS becomes overloaded or unavailable, the UPS switches to Bypass mode. The UPS automatically returns to Normal mode when the overload condition is cleared and system operation is restored within specified limits.

If the UPS suffers an internal failure, it switches automatically to Bypass mode and remains in that mode until the failure is corrected and the UPS is back in service.

5.2.3 High-Efficiency mode

When the UPS is operating in HE mode, commercial AC power is supplied directly to the critical load through the internal bypass with the power module in a standby state. If a commercial power brownout, blackout, overvoltage, undervoltage, or out-of-tolerance frequency condition occurs the system forward transfers to normal mode (double-conversion on demand) or battery mode. When the input line returns to normal operating range, the UPS returns to HE operation. The UPS can charge external batteries connected to the UPS with up to 8 A charging current when running in HE mode. If the charging current need is higher than 8 A, the UPS will transfer to online mode to recharge the batteries. When the charging current level returns below 8 A, the UPS will return to HE mode.

HE mode, if selected, is a normal operating mode, and not an alarm condition. While the UPS is in this mode, the NORMAL light on the front display will illuminate.

5.2.4 Bypass mode



CAUTION

The critical load is not protected from voltage or frequency fluctuations or power outages while the UPS is in Bypass mode.

The UPS automatically switches to Bypass mode if it detects an overload, load fault, or internal failure. The UPS can also be transferred from Normal mode to Bypass mode manually. The bypass source supplies the commercial AC power to the load directly. *Figure 5-3: Path of current through the UPS in standard Bypass mode* on page 40 shows the path of electrical power through the UPS system when operating in Bypass mode.

In Bypass mode, the output of the system is provided with three-phase AC power directly from the system input. While in this mode, the output of the system is not protected from voltage or frequency fluctuations or power outages from the source. Some power line filtering and spike protection is provided to the load but no active power conditioning or battery support is available to the output of the system in the Bypass mode of operation.

The internal bypass is comprised of a solid-state, silicon-controlled rectifier (SCR) continuous static switch, and a backfeed protection contactor. The static switch is used instantaneously anytime the inverter is unable to support the applied load. The continuous static switch is wired in series with the backfeed protection contactor, and together they are wired in parallel with the rectifier and inverter.

The static switch, being an electronically-controlled device, can be turned on immediately to pick up the load from the inverter while inverter output contactor opens to isolate the inverter. The backfeed protection contactor is normally closed, ready to support the static switch unless the bypass input source becomes unavailable.

If the UPS transfers to Bypass mode from Normal mode due to any reason other than operator intervention, the UPS automatically attempts to transfer back to Normal mode (up to three times within a ten minute period). The fourth transfer locks the critical load to the bypass source and requires operator intervention to transfer.

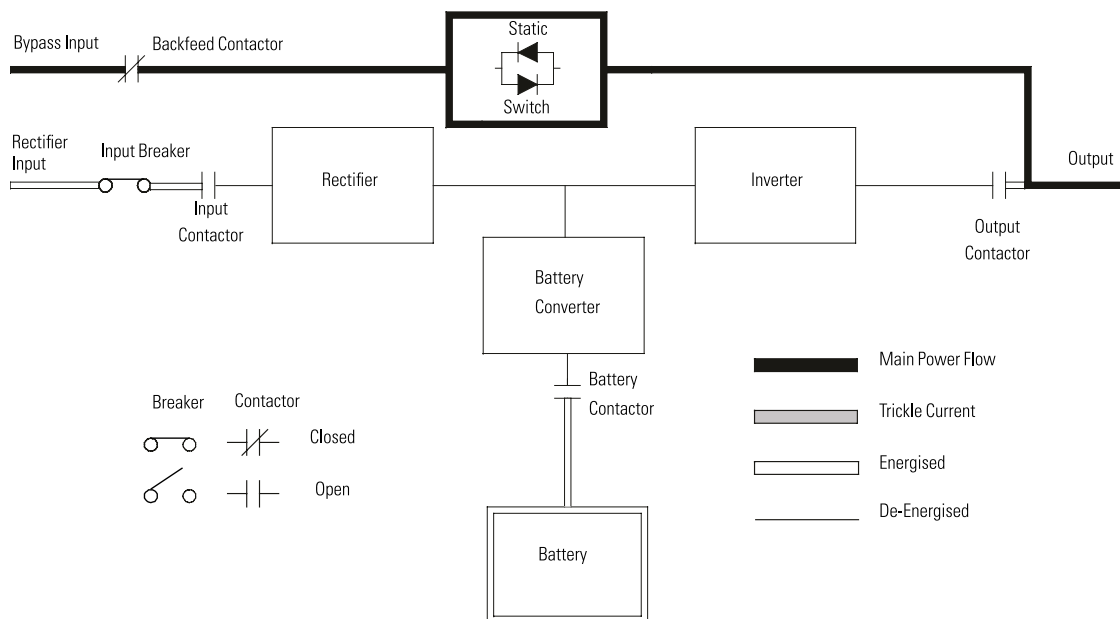


Figure 5-3: Path of current through the UPS in standard Bypass mode

5.2.5 Battery mode

The UPS automatically transfers to Battery mode if a utility power outage occurs, or if the utility power does not conform to specified parameters. In Battery mode, the battery provides emergency DC power that the inverter converts to AC power.

Figure 5-4: Path of current through the UPS in standard Battery mode on page 41 shows the path of electrical power through the UPS system when operating in Battery mode.

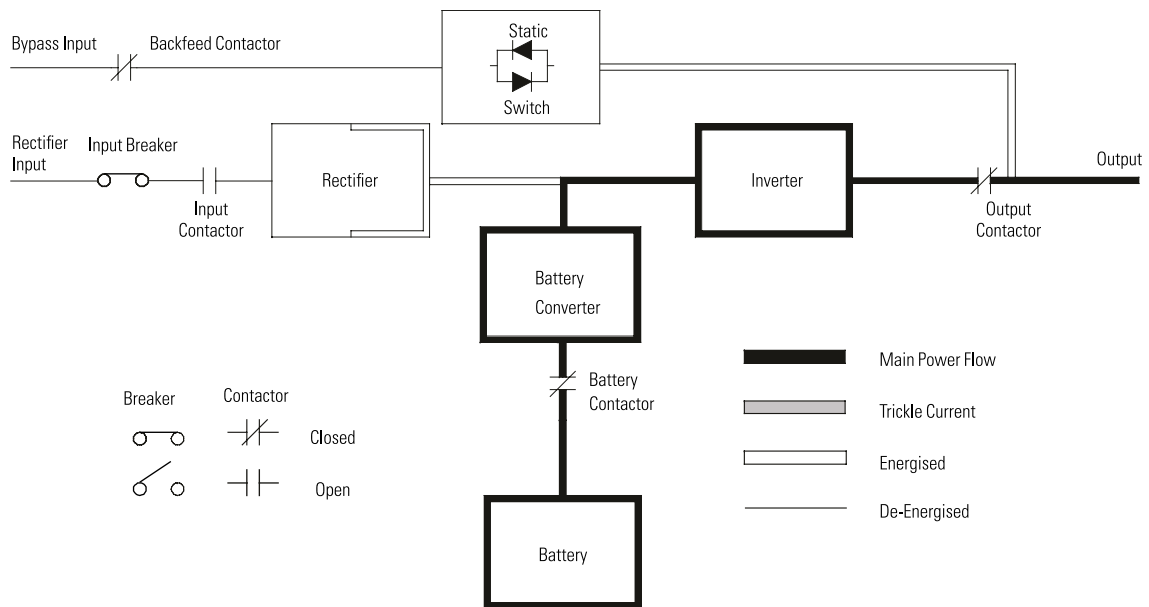


Figure 5-4: Path of current through the UPS in standard Battery mode

During a utility power failure, the rectifier no longer has an AC utility source from which to supply the DC output voltage required to support the inverter. The input contactor opens and the battery instantaneously supplies energy to the battery converter. The converter boosts the voltage so that the inverter can support the customer's load without interruption. If bypass is common with the rectifier input, the backfeed protection contactor also opens. The opening of the input and the backfeed protection contactors prevent system voltages from bleeding backwards through the static switch and rectifier snubber components to the utility source.

If the input power fails to return or is not within the acceptance windows required for normal operation, the battery continues discharging until a DC voltage level is reached where the inverter output can no longer support the connected loads. When this event occurs, the UPS issues another set of audible and visual alarms indicating SHUTDOWN IMMINENT. Unless the rectifier has a valid AC input soon, the output can be supported for only two minutes before the output of the system shuts down. If the bypass source is available, the UPS transfers to bypass instead of shutting down.

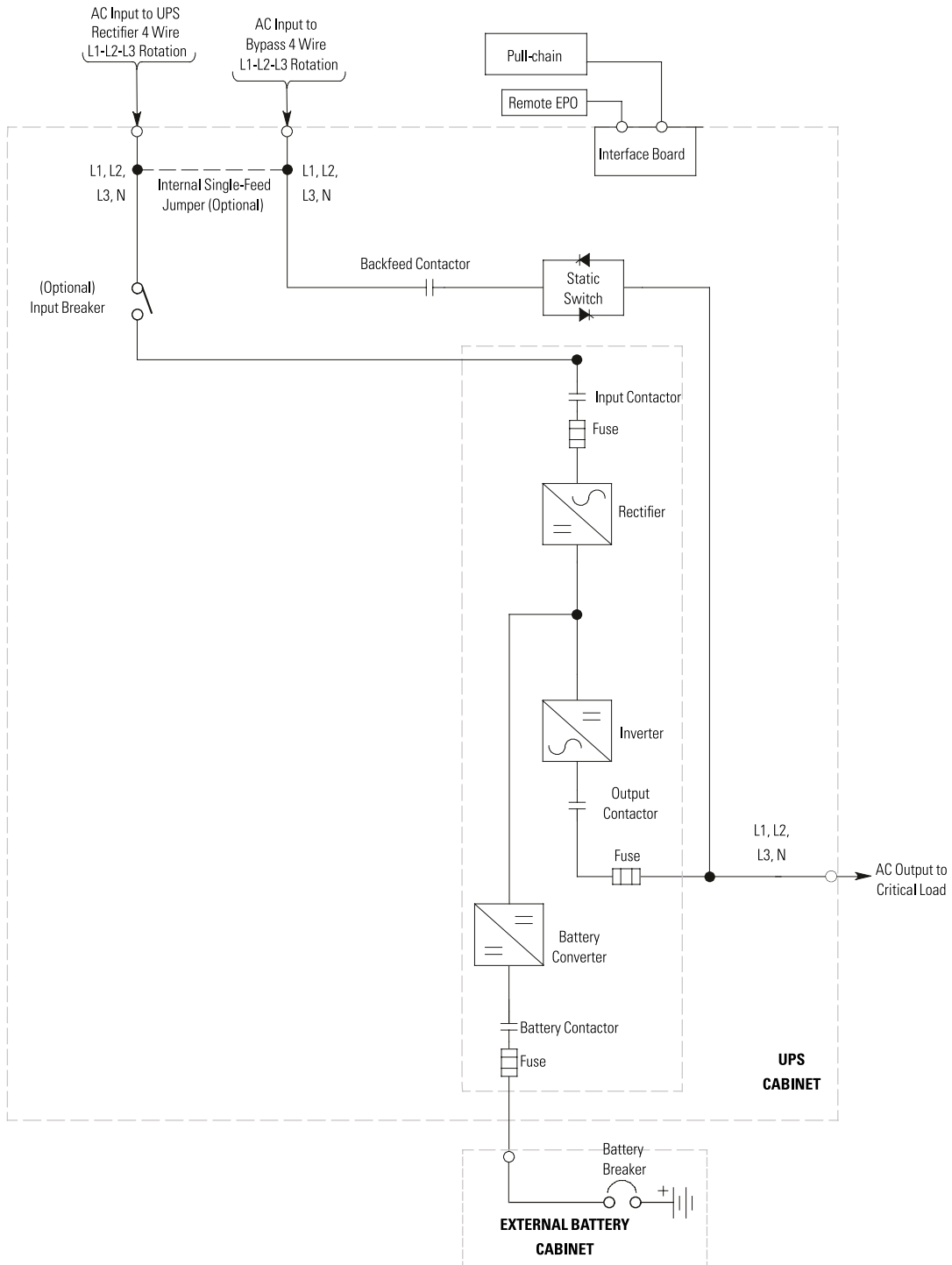
If at any time during the battery discharge the input power becomes available again, the input and the backfeed protection contactors close and the rectifier begins to supply DC current to the converter and inverter. At this point, the unit returns to Normal mode. Depending on the total load and the duration of the battery discharge, battery current limit alarms may be seen for a short time due to the current required to recharge the battery.

5.3 Single UPS unit system oneline configurations

The system oneline drawings in this section show the simplified internal structure of the UPS, battery supply, and basic maintenance bypass.

Online drawing	UPS model	Input voltage	Output voltage	System type
See Figure 5-5: UPS system oneline on page 42	Eaton 93E-300	380/400/415 VAC	380/400/415 VAC	Single Reverse Transfer UPS with External Battery
	Eaton 93E-400			

Table 5-1: Oneline configurations



See also *Table 3-5: UPS external power cable terminations for the Eaton 93E 300-400 kVA* on page 16.

Figure 5-5: UPS system online

6 UPS operating instructions

This chapter describes how to operate the UPS.



NOTE

NOTE 1: Before starting the UPS, ensure all installation tasks are complete and a preliminary startup has been performed by a qualified service personnel authorised by Eaton. The preliminary startup verifies all electrical interconnections to ensure the installation was successful and the system operates properly.

NOTE 2: Read this section of the manual and have thorough knowledge of UPS operation before attempting to operate any of the controls.

6.1 UPS controls and indicators

The controls and indicators identified and described in this section are used to control and monitor UPS operation. *Figure 6-1: UPS controls and indicators* on page 43 shows the controls and indicators and *Figure 6-2: UPS breaker* on page 44 shows the UPS switches.

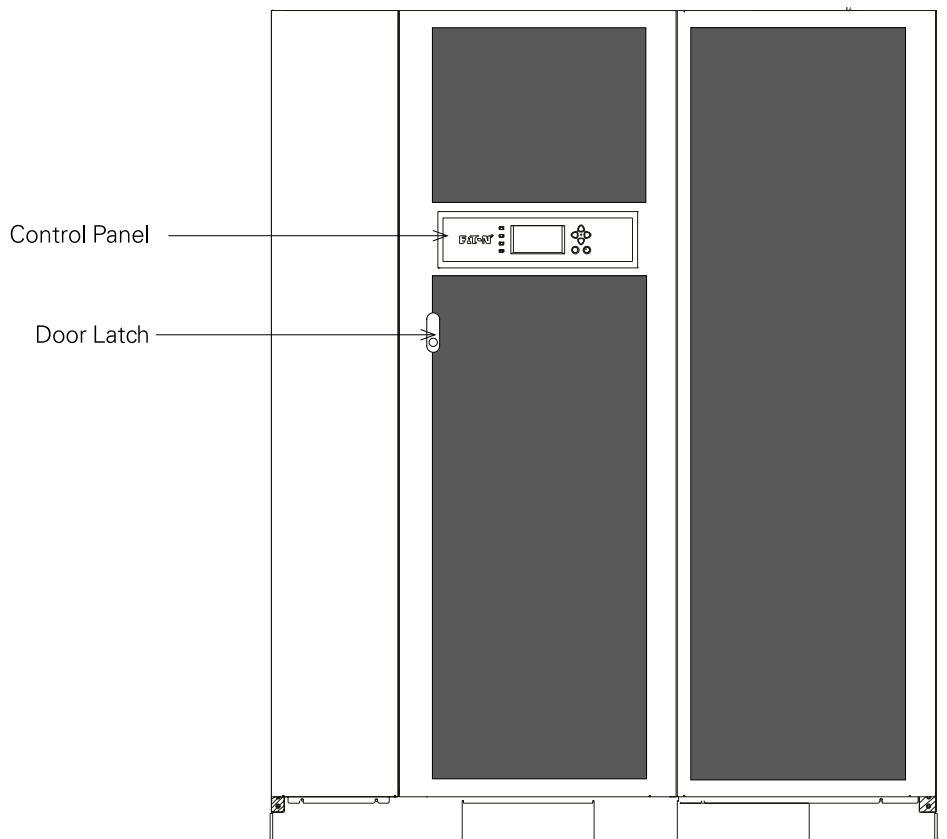


Figure 6-1: UPS controls and indicators

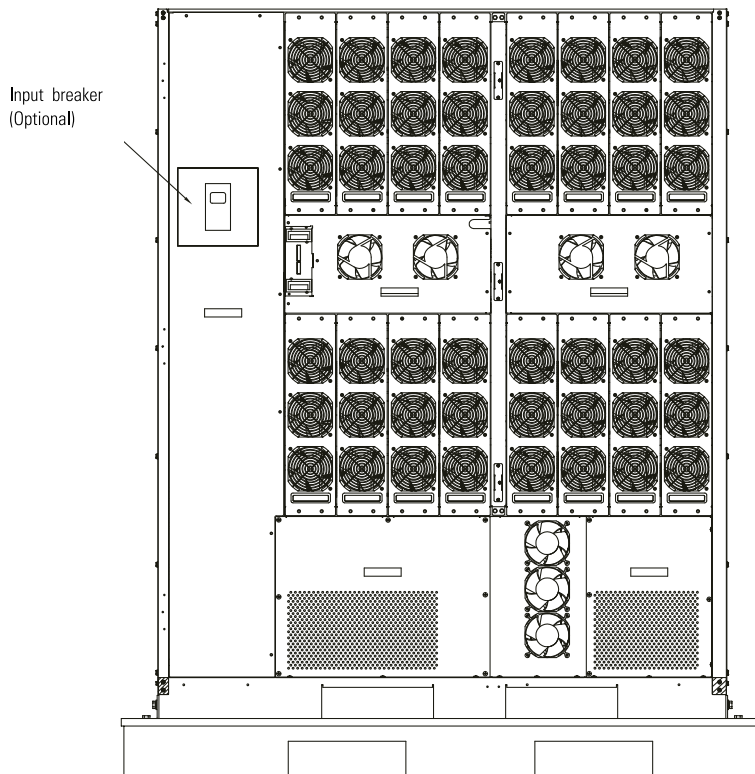


Figure 6-2: UPS breaker

6.2 Using the control panel

The following paragraphs describe the UPS control panel, including controls and indicators, and how to monitor UPS operation. The control panel (see *Figure 6-3: UPS control panel* on page 44) is located on the front door of the UPS.

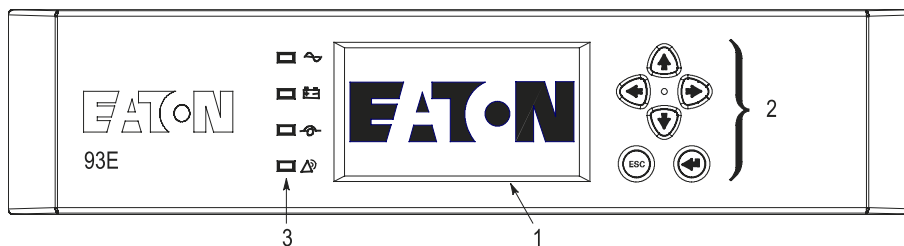


Figure 6-3: UPS control panel

The control panel consists of:




- A liquid crystal display (LCD) (1)
- Menu navigation pushbutton switches (2)
- A vertical column of status indicators (3). See *Chapter 6.2.1 Status indicators* on page 45.

The following paragraphs describe using the UPS control panel to monitor the UPS. See *Chapter 6.3 Single UPS operation* on page 51 for use of the operational controls.

When the unit powers up, the screen displays the Eaton logo as shown in *Figure 6-3: UPS control panel* on page 44. To advance to the Main Menu and Mimic screen, press any control panel pushbutton once.

6.2.1 Status indicators

The four symbols on the right side of the control panel are status indicators. They are colored light emitting diode (LED) lamps, and they work in conjunction with the alarm horn to let you know the operating status of the UPS.

Indicator	Status	Description
 Green	On	The UPS is in Normal mode. The power module is supplying power to the critical load.
	Off	The UPS is turned off.
 Yellow	On	The UPS is in Battery mode. Because Battery mode is a normal condition of the UPS, the Normal indicator also remains illuminated.
	On	The UPS is in Bypass mode. The critical load is supported by the bypass source. The Normal indicator is not illuminated when the system is in Bypass mode.
 Red	On	The UPS has an active alarm and requires immediate attention. The screen shows the highest priority active alarms. All alarms are accompanied by an audible horn. To silence the horn, press any control panel button once. The Alarm indicator may be illuminated along with other indicators.
	Flashing	There is a new UPS alarm condition. The indicator flashes until acknowledged by pressing any control panel pushbutton once.

6.2.2 System events

When the UPS system is running in Normal mode, it continually monitors itself and the incoming utility power. In Battery or Bypass modes, the UPS may issue alarms to let you know exactly what event caused the change from Normal mode. System events on the UPS can be indicated by horns, lights, messages, or all three.

Select the EVENTS symbol from the menu bar on the main menu screen to display the active events screen. This screen shows any currently active alarms, notices, or commands. This screen shows any currently active alarms, notices, or commands. For more information on using the events screen, see *Chapter 6.2.6 Display menu operation* on page 48.

- **System Event Horns** – The system event horn beeps to alert an operator that an event needing attention is taking place. The horn cycles at a half-second rate.
- **System Event Indicators** – The status indicators on the UPS control panel work with the event horn to let the operator know when the UPS is operating in any mode other than normal. Only the Normal mode indicator is illuminated during normal UPS system operation. The other indicators illuminate to indicate alarms or events. When an alarm occurs, first check these indicators to see what type of event has taken place. For descriptions of the status indicators, see *Chapter 6.2.1 Status indicators* on page 45.
- **System Event Messages** – When a system event occurs, a message appears on the LCD in the UPS status area. This message is also written to the Events Log and may be added to the History Log. The messages are divided into four categories: alarms, notices, status, and commands.

6.2.3 Using the LCD and pushbuttons

The LCD on the control panel provides an operator interface with the UPS system. *Figure 6-4: Parts of the LCD* on page 46 identifies the display areas discussed in the following sections.

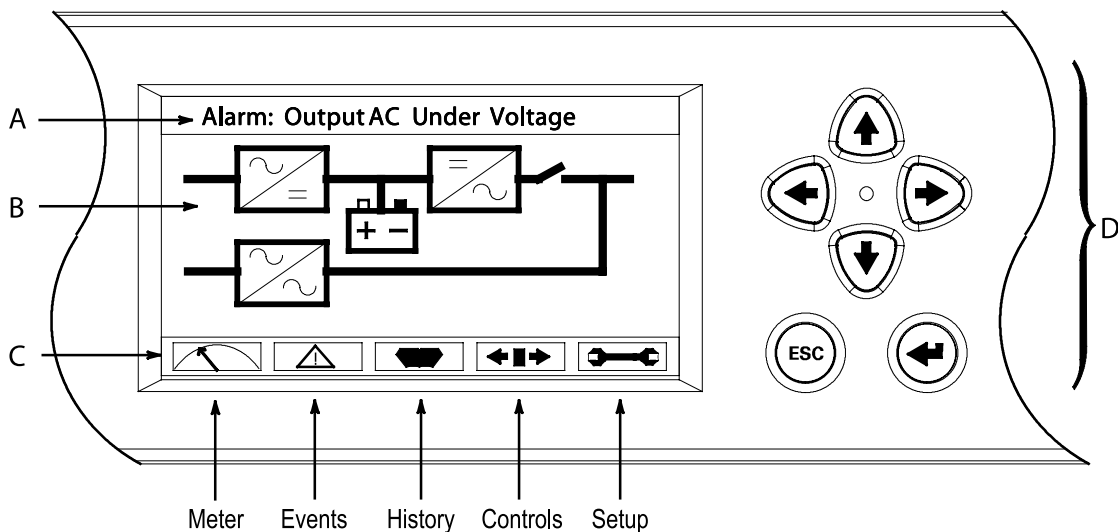


Figure 6-4: Parts of the LCD

A The UPS status area automatically scrolls between the Eaton model number, current date and time, active alarms, UPS status, load percent, and battery runtime for the UPS. The top line of display blinks while scrolling when the system needs attention. Some notices and alarms may be accompanied by an audible horn. To silence the horn, press any control panel pushbutton once. Shown is a typical alarm message. For more information about alarms and notices, see *Chapter 6.2.2 System events* on page 45.

B The information area contains data about UPS status and operations.

C The menu bar shows the symbols of the available screens. To select a screen, highlight the screen symbol using the navigation pushbuttons and then press the RETURN pushbutton.

D The navigation pushbuttons function depending on the screen displayed. Use the Up, Down, Left, and Right pushbuttons to scroll through available screens and the Esc and Enter pushbuttons to select menu screens and functions.

You can use the LCD and the pushbuttons to:

- Look at a log of UPS events (alarms, notices, and commands) (see *Chapter 6.2.6 Display menu operation* on page 48)
- Monitor UPS operation (see *Chapter 6.2.6 Display menu operation* on page 48)
- Set UPS parameters (see *Chapter 6.2.6 Display menu operation* on page 48)
- Control UPS operation (see *Chapter 6.2.6 Display menu operation* on page 48 and *Chapter 6.2.7 System controls* on page 50)

After approximately 10 minutes, the display screen darkens. To restore the screen, press any pushbutton once.

6.2.4 Using the menu

The UPS menu bar allows you to display data in the information area to help you monitor and control UPS operation. *Table 6-1: Display function menu map* on page 47 shows the basic menu structure.

Menu option	Description
METERS	Displays performance meters for the system or critical load.
EVENTS	Displays the list of Active System Events.
HISTORY	Displays a historical log of system events.
CONTROLS	Displays the System Control screen.
SETUP	Allows you to set the date and time for the time stamp, set the display language, the unit name, and meter subscripts, change the password, and view the firmware version numbers.
ESC	Returns to Main Menu and Mimic screen from the Meters, Events, History, Controls, or Setup screens. Returns to the main System Setup Level screen from a setup submenu.
←	Return arrow acknowledges or executes a command, or saves a setting.
↑ ↓	Up and down arrows scroll through screens and lists or highlight settings.
← →	Left and right arrows select or adjust settings displayed on the screen.

Table 6-1: Display function menu map

6.2.5 Mimic screen

Figure 6-5: Main menu and mimic screen on page 47 shows the Main Menu and Mimic screen. To select the Mimic screen from the Meters, Events, History, Controls, or Setup screens, press the ESC pushbutton on the current menu bar.

The Mimic screen shows the internal components of the UPS cabinet and a real-time graphical representation of the operating status of the system.

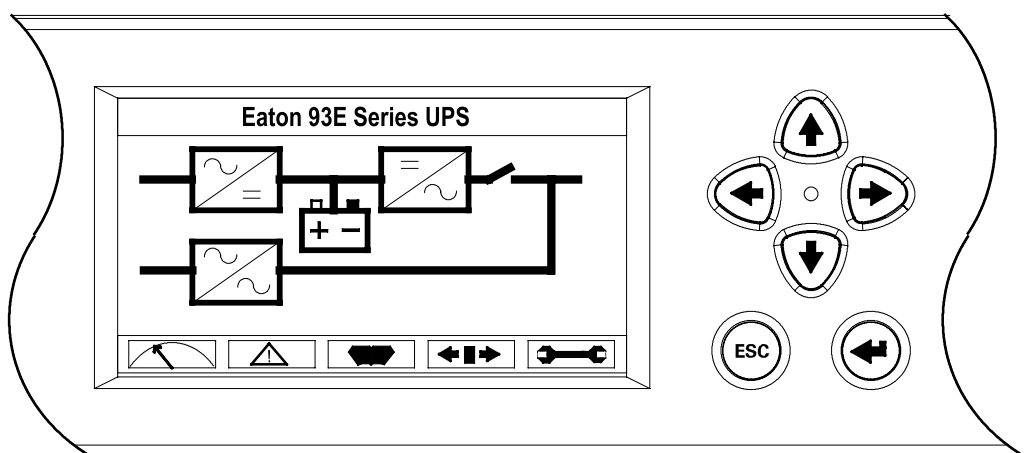


Figure 6-5: Main menu and mimic screen

6.2.6 Display menu operation

Table 6-2: UPS menu structure on page 48 describes the menu functions and how to use them.

Function	Subfunction	Operation
Meters - UPS		The Meter screens show the UPS meter readings for the unit. The default voltage displayed on these screens is phase-to-neutral. These can be changed to display the voltage phase-to-phase (L1-L2, L2-L3, L1-L3). Use the LEFT or RIGHT arrow pushbuttons to select the METER symbol on the main menu bar, to display the Meter screens. To scroll through the meter screens, press the UP or DOWN arrow pushbutton. The current UPS readings are displayed in the information area of the screen.
	Output - UPS	The Output screen shows output voltage (phase to neutral), output current (each phase), and frequency being supplied by the UPS, as well as the kVA, kW, and power factor measurements.
	Input - UPS	The Input screen shows input voltage (phase to neutral), input current (each phase), and frequency of the incoming utility source, as well as the kVA, kW, and power factor measurements.
	Bypass	The Bypass screen shows the bypass input voltage (phase to neutral), input current (each phase), and frequency of the incoming utility source, as well as the kVA, kW, and power factor measurements
	Battery - UPS	The Battery screen displays the battery voltage (Vdc) and the battery current (Idc).
Events		Use the LEFT or RIGHT arrow pushbuttons to select the EVENTS symbol on the main menu bar to display the Events screens. A listing of all system events that are currently active is displayed. The most recent event is listed first. As events clear, they are removed from the Events listing. To scroll through the events, press the UP or DOWN arrow pushbutton.
History		Use the LEFT or RIGHT arrow pushbuttons to select the HISTORY symbol on the main menu bar to display the History screen. The history Log lists up to 512 events in chronological order, with the most recent event listed last (once 512 is reached, the earliest event is overwritten). The end of the log (the most recent events) is displayed first; scroll upward to view older event listings. To scroll through the events, press the UP or DOWN arrow pushbutton.
Setup - User	Function Selection	This screen can be used to display user information and show the firmware versions installed. Use the LEFT or RIGHT arrow pushbuttons to select the SETUP symbol on the main menu bar to display the Setup screen. Use the UP or DOWN arrow pushbutton to highlight the function desired, then press the RETURN pushbutton to display the function screen. See <i>Figure 6-6: Typical initial setup screen</i> on page 49 for a typical screen display.
	User Info	The User Info screen provides the model, CTO and serial numbers of the UPS, the Output voltage, frequency, and kVA rating, the input voltage rating, and the battery run time rating. Use the LEFT or RIGHT arrow pushbuttons to select USER on the Setup menu bar. Use the UP or DOWN arrow pushbutton. to select Info, then press the RETURN pushbutton to display the function screen. To return to the System Setup screen, press the ESC pushbutton.
	About	The About screen provides the firmware version numbers installed on the UPS. Use the LEFT or RIGHT arrow pushbuttons to select USER on the Setup menu bar. Use the UP or DOWN arrow pushbutton. to select About. To return to the System Setup screen, press the ESC pushbutton.
Setup - Config (System Level 1 Setup)	Password	To enter a password if required, use the LEFT or RIGHT arrow pushbutton to select the password character position. Use the UP or DOWN arrow pushbutton to change the password character. Once the password is entered, select DONE and then press the RETURN pushbutton. The System Setup Level 1 menu screen is displayed. The default System Setup Level 1 password is 0101.
	Function Selection	This screen can be used to set the date and time, change the display language, enter a unit name, change the meter style, perform lamp test, clear the history log, and enter a password to access Level 1 functions. Use the LEFT or RIGHT arrow pushbuttons to select the SETUP symbol on the main menu bar to display the Setup screen. Use the LEFT or RIGHT arrow pushbutton to select CONFIG on the Setup menu bar. Enter a password if required.
	Clock	The Clock Setup screen allows the selection of either month/day/year or day/month/year formats and daylight savings time for display on the screen and for logging events in the Event and History Logs. Use the UP or DOWN arrow pushbutton to select CLOCK to display the Clock screen. Use the UP or DOWN arrow pushbutton to highlight the desired format, then press the RETURN pushbutton to display the Set Date and Time screen. To return to the System Setup screen, press the ESC pushbutton.
	Set Date and Time MM/DD/YYYY	The Set Date and Time MM/DD/YYYY screen allows the internal date and time of the UPS to be set in the month/day/year format. The date and time information is used for display on the screen and for logging events in the Event and History Logs. Use the LEFT or RIGHT arrow pushbutton to highlight the setting to be changed. Use the UP or DOWN arrow pushbutton to make the change. When finished making changes, use the LEFT or RIGHT arrow pushbutton to highlight SAVE and the UP or DOWN arrow pushbutton to select YES. To complete the save function and return to the System Setup screen, select the RETURN arrow pushbutton.

Function	Subfunction	Operation
	Set Date and Time DD/MM/YYYY	The Set Date and Time DD/MM/YYYY screen allows the internal date and time of the UPS to be set in the month/day/year format. The date and time information is used for display on the screen and for logging events in the Event and History Logs. Use the LEFT or RIGHT arrow pushbutton to highlight the setting to be changed. Use the UP or DOWN arrow pushbutton to make the change. When finished making changes, use the LEFT or RIGHT arrow pushbutton to highlight SAVE and the UP or DOWN arrow pushbutton to select YES. To complete the save function and return to the System Setup screen, select the RETURN arrow pushbutton.
	Language	The Language Setup screen allows the display menu language to be selected. Use the UP or DOWN arrow pushbutton to highlight Language, then press the RETURN pushbutton to display the Language screen. Use the UP or DOWN arrow pushbutton to highlight the desired language, then press the RETURN pushbutton. To return to the System Setup screen, press the ESC pushbutton.
	Unit Name	The Unit Name Setup screen allows a unit name to be entered. Use the UP or DOWN arrow pushbutton to highlight Unit Name, then press the RETURN pushbutton to display the Unit Name screen. Use the LEFT or RIGHT arrow pushbutton to highlight the character to be changed. Use the UP or DOWN arrow pushbutton to make the change. When finished making changes, use the LEFT or RIGHT arrow pushbutton to highlight SAVE and the UP or DOWN arrow pushbutton to select YES. To complete the save function and return to the System Setup screen, select the RETURN arrow pushbutton. To return to the System Setup screen, press the ESC pushbutton.
	Meters	The Meters Setup screen allows the Meters Screen display style to be selected. Use the UP or DOWN arrow pushbutton to highlight Meters, then press the RETURN pushbutton to display the Meters screen. Use the UP or DOWN arrow pushbutton to highlight the desired style, then press the RETURN pushbutton. To return to the System Setup screen, press the ESC pushbutton.
	Lamp Test	The Lamp Test screen allows the control panel status lamps to be tested. Use the UP or DOWN arrow pushbutton to highlight Lamp Test, then press the RETURN pushbutton to illuminate the status lamps. To return to the System Setup screen, press the ESC pushbutton.
	Clear Log	The Clear Log screen allows the history log to be cleared. Use the UP or DOWN arrow pushbutton to highlight Clear Log, then press the RETURN pushbutton to clear the log. To return to the System Setup screen, press the ESC pushbutton.
	P/W	The P/W screen is used to change the System Setup Level 1 password. Use the UP or DOWN arrow pushbutton to highlight P/W, then press the RETURN pushbutton to display the P/W screen. Use the LEFT or RIGHT arrow pushbutton to select the password character position. Use the UP or DOWN arrow pushbutton to change the password character. Once the password is entered, select CHANGE and then press the RETURN pushbutton.
Controls		See <i>Chapter 6.2.7 System controls</i> on page 50 for details.

Table 6-2: UPS menu structure

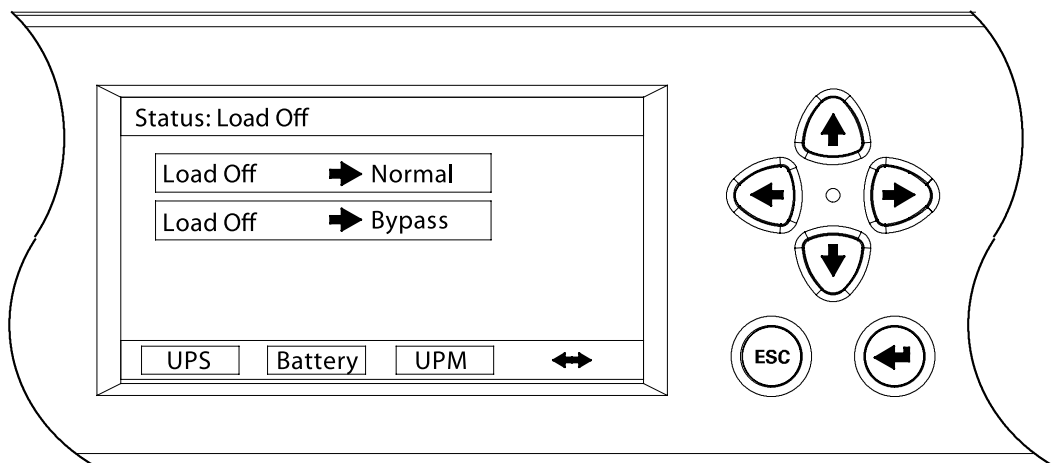


Figure 6-6: Typical initial setup screen

6.2.7 System controls

Select the CONTROLS symbol on the main menu bar, then press the RETURN pushbutton to display the Controls screen. Normal operation, transfer to bypass, load off, and charger control commands are controlled through this screen. In addition, the screen displays the current status of the UPS.

Figure 6-7: Typical system control screen on page 50 shows the System Control screen.

Use the ↑ or ↓ pushbutton to highlight the command screen desired, then press the RETURN pushbutton to display the command menu screen.

Use the ← or → pushbutton to highlight the command desired.

Table 6-3: Command menu operation on page 50 describes the control functions and provides instructions to access and use the command menu screens.

Table 6-4: Typical system status messages on page 51 lists the typical System Status Screen Messages that are displayed during UPS operation.

For detailed information about using the System Controls, see Chapter 6.3 Single UPS operation on page 51.

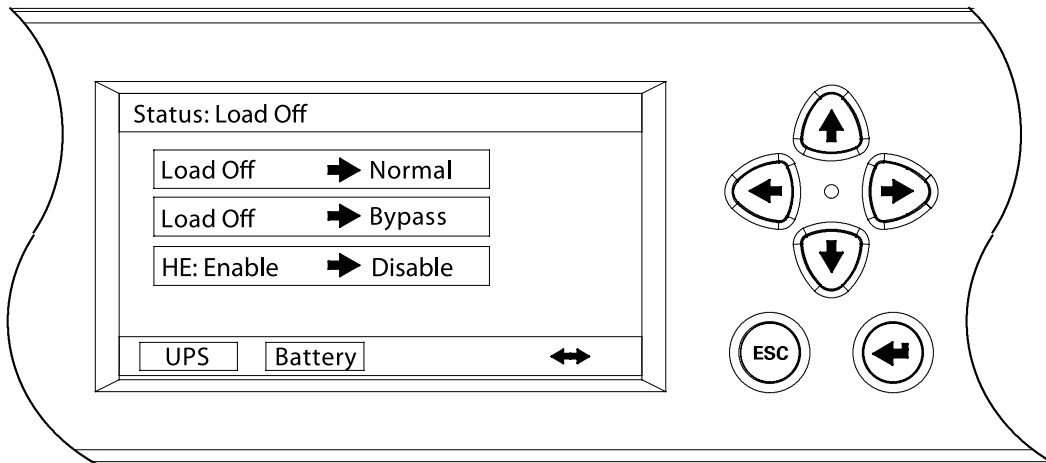


Figure 6-7: Typical system control screen

Function	Subfunction	Operation
UPS Control Commands		
	Normal mode	Starts the UPS in Standard Normal mode or transfers the UPS to Standard Normal mode from Bypass mode.
	Bypass mode	Starts the UPS in Normal mode or transfers the UPS to Normal mode from Bypass mode.
	High-Efficiency mode	Transfers the UPS from Standard Normal mode to HE mode. Transfers the UPS from HE mode to Standard Normal mode.
Battery Control Commands		
		Use the up or down arrow pushbutton to highlight the command function desired, then press the RETURN pushbutton to execute the command.

Function	Subfunction	Operation
	Charger	Turns the battery charger on.
	Resting	Turns the battery charger off.

Table 6-3: Command menu operation

Function	Message
UPS	Load Off; Bypass; Online; HE
Bypass	Off; On; Available
Charger	Charger Resting; Charger

Table 6-4: Typical system status messages

6.3 Single UPS operation



NOTE

NOTE 1: Note breakers operation nomenclature: Open = O = Off, Closed = I = On.

NOTE 2: Refer to the External Battery Cabinet Installation Manual for EBC battery breaker location.

NOTE 3: The breakers and External Maintenance Bypass switch mentioned below are not provided with the UPS except for the UPS internal input breaker (optional).

6.3.1 Starting the UPS in Standard Normal mode (Default mode)

To start the UPS system:

1. Unfasten the front door by lifting the latch from the bottom and turning to the right (counterclockwise) and swing the door open (see *Figure 6-1: UPS controls and indicators* on page 43).
2. Close the UPS rectifier input feeder circuit breaker.
3. Close the UPS bypass input feeder circuit breaker.
4. If the UPS contains an internal input breaker, verify that the input breaker is closed.
5. Close the door and secure the latch.
6. Close the external battery breakers.
7. Observe the UPS control panel display becoming active, indicating logic power.
8. Verify that no alarms are active. Notices are not to be misinterpreted as alarms.
9. Select the CONTROLS symbol on the main menu bar. The System Control screen is displayed.
10. If not already selected, select UPS on the System Control screen.
11. On the UPS System Control screen, select the LOAD OFF -> NORMAL command, then press the RETURN pushbutton.
12. If requested, enter the Level 1 password. Default password is 1111.

The rectifier and inverter turn on. The inverter continues to ramp up to full voltage. It takes approximately one minute for the UPS to achieve Standard Normal mode.

Once the inverter reaches full voltage, the UPS output contactor closes and the static switch turns off. Power is now supplied to the critical load in Standard Normal mode.

The Normal status indicator is illuminated.

13. If an external output breaker is installed, close the output breaker.

6.3.2 Starting the UPS in Bypass mode

If the inverter output of the UPS is not available and the critical load needs to be energized, perform the following procedure:



CAUTION

In Bypass mode, the critical load is not protected from commercial power interruptions and abnormalities.

1. Unfasten the front door by lifting the latch from the bottom and turning to the right (counterclockwise) and swing the door open (see *Chapter 6.1 UPS controls and indicators* on page 43).
2. Close the UPS rectifier input feeder circuit breaker.
3. Close the UPS bypass input feeder circuit breaker.
4. If the UPS contains an internal input breaker, verify that the input breaker is closed.
5. Close the door and secure the latch.
6. Close the external battery breakers.
7. Observe the UPS control panel display becoming active, indicating logic power.
8. Verify that no alarms are active. Notices are not to be misinterpreted as alarms.
9. Select the CONTROLS symbol on the main menu bar. The System Control screen is displayed.
10. If not already selected, select UPS on the System Control screen.
11. On the UPS System Control screen, select the LOAD OFF -> BYPASS command, then press the RETURN pushbutton.
12. If an external output breaker is installed, close the output breaker.

6.3.3 Transfer from Normal to Bypass mode

To transfer the critical load to Bypass mode:



CAUTION

In Bypass mode, the critical load is not protected from commercial power interruptions and abnormalities.

1. Select the CONTROLS symbol on the main menu bar. The System Control screen is displayed.
2. If not already selected, select UPS on the System Control screen.
3. On the UPS System Control screen, select the NORMAL -> BYPASS command, then press the RETURN pushbutton.

The UPS transfers to Bypass mode.

The BYPASS status indicator is illuminated. The power module remains on.



WARNING

Power is present inside the UPS cabinet.

6.3.4 Transfer from Bypass to Normal mode

To transfer the critical load to Normal mode:

1. Select the CONTROLS symbol on the main menu bar. The System Control screen is displayed.
2. If not already selected, select UPS on the System Control screen.
3. On the UPS System Control screen, select the BYPASS -> NORMAL command, then press the RETURN pushbutton.

The UPS transfers to Normal mode. If the power module is not available, the system remains on bypass and an alarm sounds.

The NORMAL status indicator is illuminated.

6.3.5 Transfer from Standard Normal mode to HE mode

To transfer the load to HE mode:

1. Select the CONTROLS symbol on the main menu bar. The System Control screen is displayed.
2. If not already selected, select UPS on the System Control screen.
3. On the UPS System Control screen, select the HE: DISABLE -> ENABLE command, then press the RETURN pushbutton.

After battery is fully charged, the UPS transfers to HE mode if no abnormal power conditions are detected. If abnormal power conditions are detected, the UPS will wait and transfer to HE mode when conditions are cleared.

The NORMAL status indicator is illuminated.

6.3.6 Transfer from HE mode to Standard Normal mode

To transfer the load to Standard Normal mode:

1. Select the CONTROLS symbol on the main menu bar. The System Control screen is displayed.
2. If not already selected, select UPS on the System Control screen.
3. On the UPS System Control screen, select the HE: ENABLE -> DISABLE command, then press the RETURN pushbutton.

The UPS transfers to Standard Normal mode.

The NORMAL status indicator is illuminated.

6.3.7 Transfer from Normal mode to External Maintenance Bypass

To transfer the load to maintenance bypass:

1. Perform transfer from Normal mode to Bypass mode as instructed in *Chapter 6.3.3 Transfer from Normal to Bypass mode* on page 52.
2. Verify that the LCD/LED display indicates the UPS is in Bypass mode.
3. Close the Maintenance Bypass Switch.

4. Perform the LOAD OFF procedure in *Chapter 6.3.12 Using the UPS LOAD OFF command* on page 56.
5. Open the Bypass input breaker, Rectifier input breaker and Output breaker separately (see *Figure 6-8: External Maintenance Bypass installation diagram* on page 54).
6. Open all external battery breakers.



WARNING

Power is present inside the UPS cabinet.

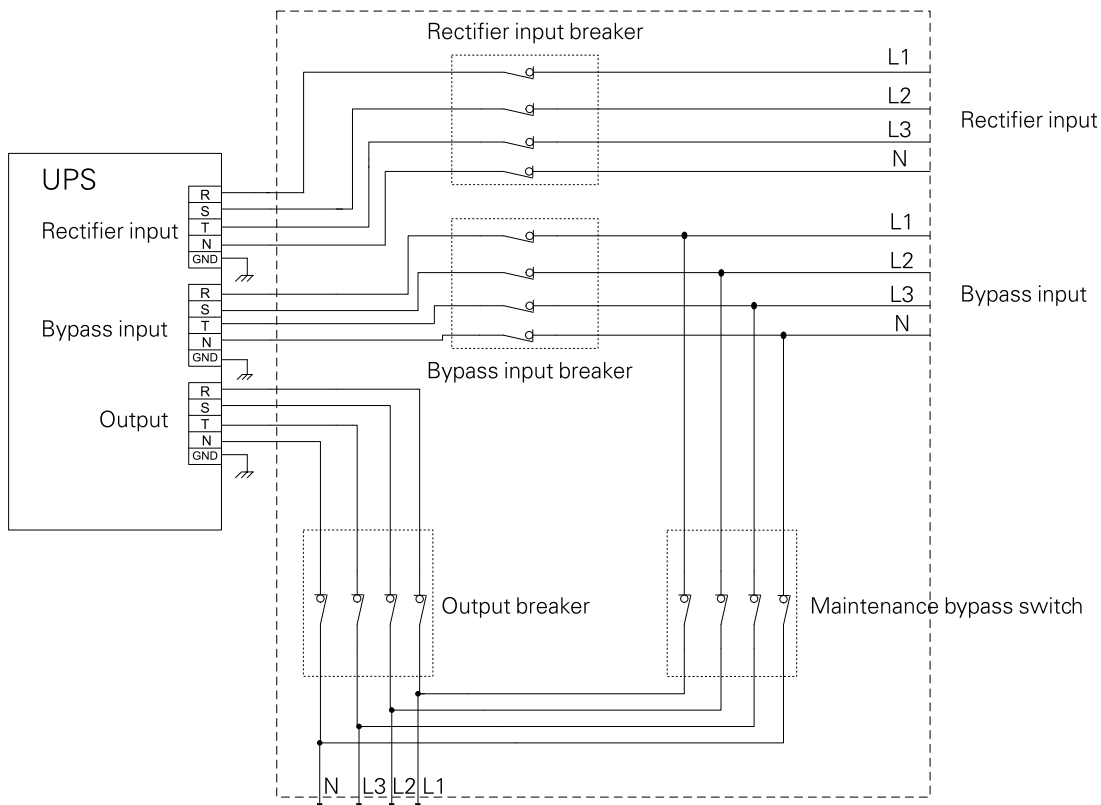


Figure 6-8: External Maintenance Bypass installation diagram

6.3.8 Transfer from External Maintenance Bypass to Normal mode

To transfer the load to Normal mode:

1. Close the Maintenance Bypass Input breaker and Bypass input breaker (see *Figure 6-8: External Maintenance Bypass installation diagram* on page 54).
2. Command the UPS to run in Bypass mode as instructed in *Chapter 6.3.2 Starting the UPS in Bypass mode* on page 52.
3. Verify that the LCD/LED display indicates the UPS is in Bypass mode.
4. Close the Maintenance Bypass Output breaker.
5. Open the Maintenance Bypass Switch.
6. Command the UPS to transfer to Normal mode via the Control panel as instructed in *Chapter 6.3.4 Transfer from Bypass to Normal mode* on page 53.

6.3.9 UPS and critical load shutdown

To perform maintenance or service on the critical load, shut down power to the load:

1. Turn off all equipment that is being powered by the UPS.
2. Perform the LOAD OFF procedure in *Chapter 6.3.12 Using the UPS LOAD OFF command* on page 56.

The output contactors open, and the power module is turned off.

The input and battery contactors open.



WARNING

Power is present inside the UPS cabinet after the upstream Input feeder circuit breakers are opened because of the installed external batteries.

3. If the UPS contains an Input breaker, open the UPS Input breaker.
4. If an External maintenance bypass is installed, ensure it is off/open
5. Open the UPS input and Bypass input feeder circuit breakers.
6. Open all External battery breakers.

6.3.10 Charger control

To turn the battery charger on:

1. Select the CONTROLS symbol on the main menu bar. The System Control screen is displayed.
2. Select Battery on the System Control screen.
3. On the Battery System Control screen, select the RESTING -> CHARGING command, then press the RETURN pushbutton.

To turn the battery charger off:

1. Select the CONTROLS symbol on the main menu bar. The System Control screen is displayed.
2. Select Battery on the System Control screen.
3. On the Battery System Control screen, select the CHARGING -> RESTING command, then press the RETURN pushbutton.

6.3.11 Battery test



NOTE

NOTE 1: This UPS has a user initiated battery test intended to determine if the batteries are able to support the load.

NOTE 2: The battery test is only able to be initiated when the battery is fully charged. This normally occurs within 72 hours of the start of a charging cycle. The command will not be shown if the test is not able to be run.

To start the battery test:

1. Select the CONTROLS symbol on the main menu bar. The System Control screen is displayed.
2. Select Battery on the System Control screen.
3. On the Battery System Control screen, select the RESTING -> TESTING command, then press the RETURN pushbutton.

6.3.12 Using the UPS LOAD OFF command

A UPS Load Off is initiated by the Load Off command on the UPS Control screen. The UPS LOAD OFF controls the UPS output by powering down the UPS and de-energising the critical load.

The UPS (including Bypass) remains off until restarted.

To use the LOAD OFF command:

1. Select the CONTROLS symbol on the main menu bar. The System Control screen is displayed.
2. Select UPS on the System Control screen.
3. On the UPS System Control screen, select the NORMAL -> LOAD OFF or BYPASS -> LOAD OFF command depending on the UPS mode, then press the RETURN pushbutton.

The Verify Action screen is displayed, providing a choice to proceed or abort the shutdown.



CAUTION

All power to the critical load is lost when the LOAD OFF is selected in the following step. You should use this feature only when you want to de-energise the critical load.

4. Select Yes or No, then press the RETURN pushbutton.
Selecting Yes will immediately shut down the UPS and de-energising the critical load. Selecting No will abort the shutdown.

**CAUTION**

Do not attempt to restart the system after Load Off until the cause of the shutdown has been identified and cleared.

5. To restart the UPS after pressing the LOAD OFF pushbutton, follow the procedure in *Chapter 6.3.1 Starting the UPS in Standard Normal mode (Default mode)* on page 51 or *Chapter 6.3.2 Starting the UPS in Bypass mode* on page 52.

**WARNING**

Power is present inside the UPS cabinet after the upstream input feeder circuit breakers are opened because of the installed external batteries.

6.3.13 Using the Remote Emergency Power-off Switch

A UPS emergency power-off is initiated by the Remote EPO pushbutton switch. In an emergency, you can use this switch to control the UPS output. The Remote EPO switch de-energises the critical load and powers down the UPS immediately, without asking for verification.

The UPS, including Bypass, remains off until restarted.

**CAUTION**

All power to the critical load is lost when the Remote EPO switch is activated in the following step. You should use this feature only when you want to de-energise the critical load.

**NOTE**

The following instructions are for the Eaton-supplied Remote EPO switch. If a customer-supplied Remote EPO switch is used, it may not activate in the same manner; refer to the operating instructions provided with the switch.

To use the Remote EPO switch:

1. Press the EPO pushbutton switch.

**CAUTION**

Do not attempt to restart the system after the Remote EPO until the cause of the shutdown has been identified and cleared.

2. To restart the UPS after using the EPO pushbutton, reset the EPO switch and then follow the procedure in *Chapter 6.3.1 Starting the UPS in Standard Normal mode (Default mode)* on page 51 or *Chapter 6.3.2 Starting the UPS in Bypass mode* on page 52.

6.4 Multiple UPS parallel operation

The paragraphs in this section provide operating instructions for a UPS system containing multiple UPSs.



NOTE

NOTE 1: Refer to the External Battery Cabinet Installation Manual listed in Chapter 1.8 For more information on page 5 for EBC battery breaker location.

NOTE 2: Start and control system wide function from UPS 1.

NOTE 3: The breakers mentioned below are not provided with the UPS, except for the UPS internal input breaker (optional).

6.4.1 Starting the Parallel UPS in Standard Normal mode (Default mode)

To start the UPS system:

1. Unfasten the front door by lifting the latch from the bottom and turning to the right (counterclockwise) and swing the door open (see *Chapter 6.1 UPS controls and indicators* on page 43).
2. Verify that all Input and Bypass input breakers or switches are open.
3. Close all Module Output Breakers (MOBs).
4. Close all input feeder circuit breakers.
5. If the UPSs are wired for dual input, close all of the UPSs Bypass input feeder circuit breakers.
6. If the UPS contains an input breaker, close the input breaker.
7. Close the door and secure the latch.
8. Close the external battery breakers.
9. Observe the UPS control panel display becoming active, indicating logic power.
10. Verify that no alarms are active. Notices are not to be misinterpreted as alarms.
11. Select the CONTROLS symbol on the main menu bar. The System Control screen is displayed.
12. If not already selected, select UPS on the System Control screen.
13. On the UPS System Control screen, select the LOAD OFF -> NORMAL command, then press the RETURN pushbutton.
14. If requested, enter the Level 1 password. Default password is 1111.

All rectifiers and inverters turn on. The inverters continue to ramp up to full voltage.

Once all inverters reaches full voltage, the UPS output contactor closes and the static switch turns off. Power is now supplied to the critical load in Standard Normal mode. It takes approximately one minute for the UPS to achieve Standard Normal mode.

The Normal status indicator is illuminated.

6.4.2 Starting the Parallel UPS in Bypass mode

If the inverter output of the parallel UPS is not available and the critical load needs to be energised:



CAUTION

In Bypass mode, the critical load is not protected from commercial power interruptions and abnormalities.

1. Unfasten the front door by lifting the latch from the bottom and turning to the right (counterclockwise) and swing the door open (see *Chapter 6.1 UPS controls and indicators* on page 43).
2. Verify that all Input and Bypass input breakers or switches are open.
3. Close all Module Output Breakers (MOBs).
4. Close the all input feeder circuit breakers.
5. If the UPSs are wired for dual input, close all of the UPSs Bypass input feeder circuit breakers.
6. If the UPS contains an input breaker, close the input breaker.
7. Close the door and secure the latch.
8. Close the external battery breakers.
9. Observe the UPS control panel display becoming active, indicating logic power.
10. Verify that no alarms are active. Notices are not to be misinterpreted as alarms.
11. Select the CONTROLS symbol on the main menu bar. The System Control screen is displayed.
12. If not already selected, select UPS on the System Control screen.
13. On the UPS System Control screen, select the LOAD OFF -> BYPASS command, then press the RETURN pushbutton.

The critical load is immediately supplied by the bypass source, in Bypass mode from all UPSs.

The BYPASS status indicator is illuminated.

6.4.3 Transfer from Normal to Bypass mode

To transfer the critical load to Bypass mode:



CAUTION

In Bypass mode, the critical load is not protected from commercial power interruptions and abnormalities.

1. On any UPS, select the CONTROLS symbol on the main menu bar. The System Control screen is displayed.
2. If not already selected, select UPS on the System Control screen.
3. On the UPS System Control screen, select the NORMAL -> BYPASS command, then press the RETURN pushbutton.

All the UPSs transfer to Bypass mode.

The BYPASS status indicator is illuminated. The power module remains on.



WARNING

Power is present inside the UPS cabinet.

6.4.4 Transfer from Bypass to Normal mode

To transfer the critical load to Normal mode:

1. On any UPS, select the CONTROLS symbol on the main menu bar. The System Control screen is displayed.
2. If not already selected, select UPS on the System Control screen.
3. On the UPS System Control screen, select the BYPASS -> NORMAL command, then press the RETURN pushbutton.

All of the UPSs transfer to Normal mode. If the power module is not available, the system remains on bypass and an alarm sounds.

The NORMAL status indicator is illuminated.



WARNING

Power is present inside the UPS cabinet.

6.4.5 Single UPS shutdown

To shut down the UPS:

1. Open the MOB for the UPS being shut down.
2. Select the CONTROLS symbol on the main menu bar. The System Control screen is displayed.
3. If not already selected, select UPS on the System Control screen.
4. On the UPS System Control screen, select the NORMAL -> UPS OFF command, then press the RETURN pushbutton.

The output and bypass backfeed contactors open, the power module is turned off on the UPS being shut down, and logic power remains on.



WARNING

Power is present inside the UPS cabinet after the upstream input feeder circuit breakers are opened because of the installed external battery cabinet.

5. Open the UPS input and, if installed, the bypass feeder circuit breakers for the UPS being shut down.
6. If EBCs are installed, open all battery breakers.

The UPS is now completely shut down.

6.4.6 Single UPS restart

To restart a single UPS from a shutdown state:

1. Close the MOB for the UPS being restarted.
2. Close the UPS input, and if installed, bypass feeder circuit breakers for the UPS being restarted.
3. If the UPS contains an input breaker, close the input breaker.
4. If an output breaker is installed, close the output breaker.
5. Close the external battery breakers.
6. On the UPS being restarted, observe the UPS control panel display becoming active, indicating logic power.
7. Verify that no alarms are active on the UPS being restarted. Notices are not to be misinterpreted as alarms.
8. On the UPS being restarted, select the CONTROLS symbol on the main menu bar. The System Control screen is displayed.
9. If not already selected, select UPS on the System Control screen.
10. On the UPS System Control screen, select the UPS OFF -> NORMAL command, then press the RETURN pushbutton.
11. If requested, enter the Level 1 password. Default password is 1111.

The rectifier and inverter turn on. The inverter continues to ramp up to full voltage.

Once all inverters reaches full voltage, the UPS output contactor closes and the static switch turns off. Power is now supplied to the critical load in Standard Normal mode along with the other UPSs online. It takes approximately one minute for the UPS to achieve Standard Normal mode.

The Normal status indicator is illuminated.

6.4.7 UPS and critical load shutdown

To perform maintenance or service on the critical load, shut down power to the load:

1. Turn off all equipment that is being powered by the UPS parallel system.
2. Perform the LOAD OFF procedure in *Chapter 6.4.10 Using the UPS LOAD OFF command* on page 62.

The output contactors open, and the power module is turned off.

The input and battery contactors open.



WARNING

Power is present inside the UPS cabinets after the upstream input feeder circuit breakers are opened because of the installed external battery cabinet.

3. If the UPSs contain input breakers, open all input breakers..
4. If installed, open Bypass input breakers.
5. If installed, open the Maintenance bypass switch.
6. Open all Module Output Breakers (MOBs).
7. Open the UPS input feeder and bypass input feeder circuit breakers.
8. Open all External battery breakers.

6.4.8 Charger control

To turn an individual battery charger on:

1. Select the CONTROLS symbol on the main menu bar. The System Control screen is displayed.
2. Select Battery on the System Control screen.
3. On the Battery System Control screen, select the RESTING -> CHARGING command, then press the RETURN pushbutton.

To turn an individual battery charger off:

1. Select the CONTROLS symbol on the main menu bar on the UPS requiring the charger to be turned on. The System Control screen is displayed.
2. Select Battery on the System Control screen.
3. On the Battery System Control screen, select the CHARGING -> RESTING command, then press the RETURN pushbutton.

6.4.9 Battery test



NOTE

NOTE 1: This UPS has a user initiated battery test intended to determine if the batteries are able to support the load.

NOTE 2: The battery test is only able to be initiated when the battery is fully charged. This normally occurs within 72 hours of the start of a charging cycle. The command will not be shown if the test is not able to be run.

To start an individual battery test:

1. Select the CONTROLS symbol on the main menu bar on the UPS to be tested. The System Control screen is displayed.
2. Select Battery on the System Control screen.
3. On the Battery System Control screen, select the RESTING -> TESTING command, then press the RETURN pushbutton.

After approximately 2 minutes, the battery test ends, indicating that the batteries are OK.

6.4.10 Using the UPS LOAD OFF command

A UPS Load Off is initiated by the Load Off command on the UPS Control screen. The UPS LOAD OFF controls the UPS output by powering down the UPS and de-energising the critical load.

The UPS (including Bypass) remains off until restarted.

To use the LOAD OFF command:

1. Select the CONTROLS symbol on the main menu bar on the UPS to be shut down. The System Control screen is displayed.
2. Select UPS on the System Control screen.
3. On the UPS System Control screen, select the NORMAL -> LOAD OFF or BYPASS -> LOAD OFF command depending on the UPS mode, then press the RETURN pushbutton.

The Verify Action screen is displayed, providing a choice to proceed or abort the shutdown.



CAUTION

All power to the critical load is lost when the LOAD OFF is selected in the following step. You should use this feature only when you want to de-energise the critical load.

4. Select Yes or No, then press the RETURN pushbutton.
Selecting Yes will immediately shut down the UPS and de-energising the critical load. Selecting No will abort the shutdown.
5. If another UPS is to be shut down, proceed to that UPS and repeat Step 1 through Step 4.



CAUTION

Do not attempt to restart the system after Load Off until the cause of the shutdown has been identified and cleared.

6. To restart the UPS after pressing the LOAD OFF pushbutton, follow the procedure in *Chapter 6.4.1 Starting the Parallel UPS in Standard Normal mode (Default mode)* on page 58 or *Chapter 6.4.2 Starting the Parallel UPS in Bypass mode* on page 58.



WARNING

Power is present inside the UPS cabinet after the upstream input feeder circuit breakers are opened because of the installed external battery cabinet.

6.4.11 Using the Remote Emergency Power-off Switch

A UPS emergency power-off is initiated by the Remote EPO pushbutton switch. In an emergency, you can use this switch to control the UPS output. The Remote EPO switch de-energises the critical load and powers down the UPS immediately, without asking for verification.

The UPS, including Bypass, remains off until restarted.



CAUTION

All power to the critical load is lost when the Remote EPO switch is activated in the following step. You should use this feature only when you want to de-energise the critical load.



NOTE

The following instructions are for the Eaton-supplied Remote EPO switch. If a customer-supplied Remote EPO switch is used, it may not activate in the same manner; refer to the operating instructions provided with the switch.

To use the Remote EPO switch:

1. Press the EPO pushbutton switch.
The input, output, battery, and bypass backfeed contactors open, and the power module is turned off immediately, without asking for verification.



CAUTION

Do not attempt to restart the system after the Remote EPO until the cause of the shutdown has been identified and cleared.

2. To restart the UPS after using the EPO pushbutton, reset the EPO switch and then follow the procedure in *Chapter 6.3.1 Starting the UPS in Standard Normal mode (Default mode)* on page 51 or *Chapter 6.3.2 Starting the UPS in Bypass mode* on page 52.



WARNING

Power is present inside the UPS cabinet after the upstream input feeder circuit breakers are opened because of the installed external batteries.

7 Communication

This chapter describes the communication features of the Eaton 93E UPS. For terminal wiring information, see *Chapter 3.2.3 UPS system interface wiring preparation* on page 19 and *Chapter 4.5 External power wiring installation* on page 26. For location of the customer interface panel and terminals, see *Figure 4-5: Interface terminal locations* on page 28.

7.1 Mini-Slot cards

The Eaton 93E UPS has two standard, factory-installed Mini-Slot communication bays. See *Figure 4-5: Interface terminal locations* on page 28 for bay locations. UPS is compatible with the following Mini-Slot cards (see *Figure 7-1: Optional Mini-Slot cards* on page 65):

- Network Management Card and Modbus/Jbus – provides remote monitoring through a Web browser interface, e-mail, and a network management system (NMS) using SNMP and connects to a twisted-pair Ethernet (10/100BaseT) network. The card also provides direct integration of UPS information (meters and status) to a Building Management System (BMS) using the Modbus RTU protocol.
- Network Management Card – provides remote monitoring through a Web browser interface, e-mail, and a network management system (NMS) using SNMP and connects to a twisted-pair Ethernet (10/100BaseT) network.
- Management Card Contact and RS232 / Serial – two types of interfaces via a DB9 connector are available with this card. Dry contact mode provides a simple way to transmit UPS information to an alarm system, PLC, or computer system via dry relay contacts. The transmitted information is load powered, load on bypass, load on battery, load on utility, battery fault, and low battery. RS232 mode provides an RS232 interface for connection to a PC or to a UPS Control display unit. Jumpers are used to select the interface (contacts or RS232).

LAN and telephone drops for use with Mini-Slot connectivity cards must be supplied by facility planners or the customer.

For installation and setup of a Mini-Slot card, contact an Eaton service representative (see *Chapter 1.8 For more information* on page 5). Refer to the manual supplied with the Mini-Slot card for user instructions.

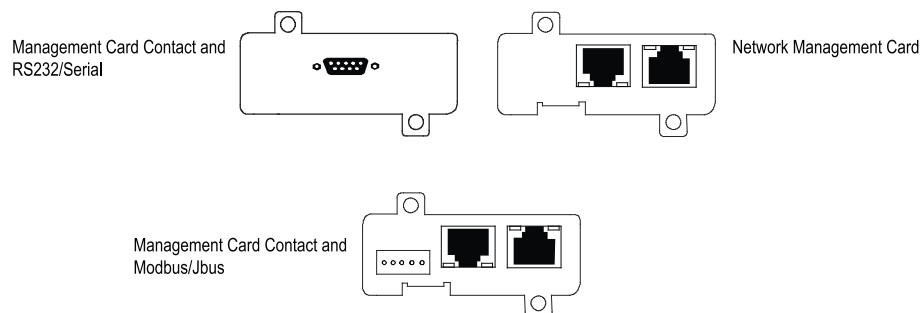


Figure 7-1: Optional Mini-Slot cards

7.2 Signal input monitoring

This standard feature lets you connect the UPS to your signal inputs, such as smoke detectors or overtemperature alarms. The customer interface terminals for external connections are located inside the UPS. You should use twisted-pair wires for each alarm input and common.

The signal inputs can be programmed to display the alarm functional name.

8 UPS maintenance

The components inside the UPS cabinet are secured to a sturdy metal frame. All repairable parts and assemblies are located for easy removal, with very little disassembly. This design allows authorised service personnel to perform routine maintenance and servicing quickly. You must schedule periodic performance checks of your UPS system to keep it running properly. Regular routine checks of operation and system parameters enable your system to function efficiently for many trouble-free years.

8.1 Important safety instructions

Remember that your UPS system is designed to supply power **EVEN WHEN DISCONNECTED FROM THE UTILITY POWER**. The UPS module interiors are unsafe until the DC power source is disconnected and the electrolytic capacitors are discharged. After disconnecting the utility power and the DC power, authorised service personnel should wait at least five minutes for capacitor bleedoff before attempting internal access to the UPS module.



WARNING

- **Servicing and maintenance should be performed by qualified service personnel only.**
 - **LETHAL VOLTAGE PRESENT. This unit should not be operated with the cabinet doors open or protective panels removed. Do not make any assumptions about the electrical state of any cabinet in the UPS system.**
-

Each battery string is an energy source in itself. DO NOT ATTEMPT TO ACCESS ANY INTERNAL AREA OF THE BATTERY STRING YOURSELF. VOLTAGES ARE ALWAYS PRESENT IN THE BATTERY STRING. If you suspect that a battery string needs service, contact an Eaton service representative.

If the string requires service contact an Eaton service representative.

Observe these precautions when working on or around batteries:

- Remove watches, rings, or other metal objects.
- Use tools with insulated handles.
- Wear rubber gloves and boots.
- Do not lay tools or metal parts on top of batteries.
- Disconnect the charging source prior to connecting or disconnecting terminals.
- Determine if the battery is inadvertently grounded. If it is, remove the source of the ground. Contact with any part of a grounded battery can result in electrical shock. The likelihood of such shock is reduced if such grounds are removed during installation and maintenance.
- When replacing batteries, use the same number of valve-regulated lead-acid batteries.
- Proper disposal of batteries is required. Refer to your local codes for disposal requirements.
- Do not dispose of batteries in a fire. Batteries may explode when exposed to flame.

- Do not open or mutilate batteries. Released electrolyte is harmful to the skin and eyes. It may be toxic.

8.2 Performing preventive maintenance

The UPS system requires very little preventive maintenance. However, the system should be inspected periodically to verify that the units are operating normally and that the batteries are in good condition.

Majority of the work must be performed by Eaton authorised service personnel. Only the actions described in *Chapter 8.2.1 DAILY maintenance* on page 68 and *Chapter 8.2.2 MONTHLY maintenance* on page 68 are allowed for the user.

8.2.1 DAILY maintenance

Perform the following steps daily:

1. Check the area surrounding the UPS system. Ensure the area is not cluttered, allowing free access to the unit.
2. Ensure the air intakes (vents on the front doors) and exhaust opening (the rear side of the UPS cabinet) are not blocked.
3. Ensure the operating environment is within the parameters specified in *Chapter 3.2.1 Environmental and installation considerations* on page 10 and *Chapter 9 Product specifications* on page 71.
4. Ensure the UPS is in Normal mode (Normal status indicator is illuminated). If an alarm lamp is illuminated or the Normal status indicator is not illuminated, contact your service representative.

8.2.2 MONTHLY maintenance

Perform the following steps monthly:

1. Monitor system parameters described in *Chapter 6.2 Using the control panel* on page 44.
2. Check the UPS air filters (located behind the front door) and wash or replace as necessary. See *Figure 8-1: Air filter location* on page 69 for filter location. Contact an Eaton service representative for replacement filters. To remove the filters:



CAUTION

Verify washed filter is thoroughly dry before reinstalling.

- a. Unfasten the front door by lifting the latch from the bottom and turning to the right (counterclockwise) and swing the door open (see *Chapter 6.1 UPS controls and indicators* on page 43).
- b. Remove the upper and lower foam filters from the frame on the front door.
- c. Remove the front door, remove foam filters from the frame on the Right UPM.
- d. Replace the washed or new foam filters into the frame on the front door.

- e. Close the front door and secure the latch.
3. Record maintenance results and any corrective actions in a suitable log

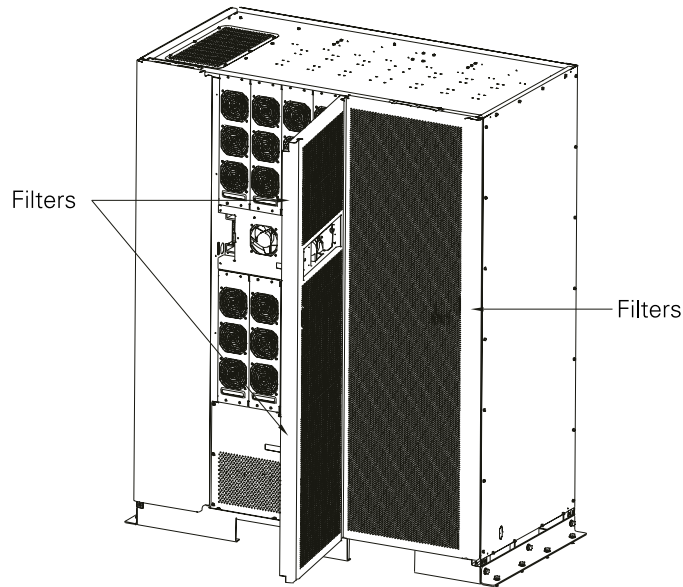


Figure 8-1: Air filter location

8.2.3 PERIODIC maintenance

Periodic inspections of the UPS should be made to determine if components, wiring, and connections exhibit evidence of overheating. Particular attention should be given to bolted connections. Maintenance procedures should specify that the compression lug connections be re-torqued to values listed in this manual.

8.2.4 ANNUAL maintenance

Annual preventive maintenance should be performed only by authorised service personnel familiar with maintenance and servicing of the UPS system. Contact an Eaton service representative for more information about service offerings.

8.2.5 BATTERY maintenance

Contact an Eaton service representative for battery maintenance. Battery replacement and maintenance should be performed only by authorised service personnel.

8.3 Recycling the used UPS or batteries

Before scrapping UPS or its battery cabinet, the battery bank must be removed. Local requirements must be followed in battery recycling or discard. The removal of batteries is allowed only by authorised service personnel due to high energy and voltage.

Do not discard waste electrical or electronic equipment in the trash. For proper disposal, contact your local collecting/recycling/reuse or hazardous waste center and follow the local legislation.

These symbols indicate on a product:



Figure 8-2: WEEE symbol

Use proper local collecting centers meeting local legislation when handling waste of electrical and electronic equipment.



DANGER

HAZARDOUS MATERIALS. Batteries may contain HIGH VOLTAGES, and CAUSTIC, TOXIC and FLAMMABLE substances. Batteries can injure or kill people and damage equipment if used improperly. DO NOT DISCARD unwanted batteries or battery material in the public waste disposal system. Follow ALL applicable, local regulations for storage, handling and disposal of batteries and battery materials.

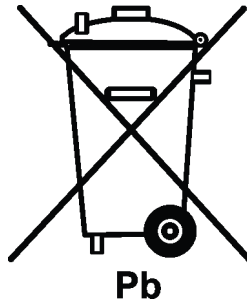


Figure 8-3: Recycling batteries symbol

8.4 Maintenance training

For more information about training and other services, contact your Eaton representative.

9 Product specifications

9.1 Model numbers

The UPS is housed in a free-standing cabinet with safety shields behind the door. The UPS is available in 50 or 60 Hz with various output power ratings.

Models	Power rating	Frequency
Eaton 93E-300	300 kVA	50/60 Hz
Eaton 93E-400	400 kVA	50/60 Hz

Table 9-1: Model numbers

9.2 Specifications

The following sections detail the input, output, environmental, and battery specifications for the UPS.

9.2.1 UPS input

Item	Value
Operating input voltage	380/400/415 Vac
Input voltage range	190/330-276/478V (-15%, +20%) at 100% load 116/201-276/478V (-50%, +20%) at 50% load
Operating input frequency	50/60 Hz
Input frequency range	40-72 Hz
Operating input current	See <i>Table 3-6: Input/Output ratings and external wiring recommendations for the Eaton 93E 300-400 kVA</i> on page 16 Adjustable
Input current harmonic content	5% THD at full load
Power factor	Minimum 0.99
Line surges	6 kV OC, 3 kA SC per ANSI 62.41 and IEC 801 4
Battery voltage	480 Vdc (40 blocks) or 456 Vdc (38 blocks) or 432 Vdc (36 blocks)
Battery charging capacity	120A maximum at any load up to 100% load for 300 kVA UPS 160A maximum at any load up to 100% load for 400 kVA UPS

Table 9-2: UPS input

9.2.2 UPS output

Item	Value
UPS output capacity	100% rated current
Output voltage regulation	± 1% (10% to 100% load)
Nominal output voltage	380 Vac, 400 Vac and 415 Vac nominal
Output voltage harmonic content	2% maximum THD (linear load) 5% maximum THD (nonlinear load)
Output current	See <i>Table 3-6: Input/Output ratings and external wiring recommendations for the Eaton 93E 300-400 kVA</i> on page 16
Output voltage balance	< 2% for 100% maximum load imbalance (linear load)
Output voltage phase displacement	< 2.5° for 100% maximum load imbalance (linear load)
Frequency regulation	0.1 Hz free running
Synchronous to bypass	± 4 Hz (default setting)
Frequency slew rate	0.1 Hz per second
Load compatibility	0.9 PF Leading 0.7 PF Lagging
Overload capability	≤125 % for 10 minutes ≤150 % for 30 seconds ≥150 % for 150 milliseconds
Output current limitation, short-circuit capability	300 kVA: 1200 A, < 400 ms 400 kVA: 1600 A, < 400 ms

Table 9-3: UPS output

9.2.3 UPS environmental specifications

Item	Value
Operating temperature	0 to 40°C without derating. The recommended operating temperature is 25°C.
Operating altitude	Maximum 1000m at 30°C without derating
Storage temperature	-25 to +55°C, excluding batteries (prolonged storage above 40°C causes rapid battery self-discharge)
Relative humidity (operating and storage)	5% to 95% maximum noncondensing
Acoustical noise	Less than or equal to 74 dB at a 1m distance, per ISO 7779

Item	Value
EMC	Meets IEC 62040-2 C3

Table 9-4: UPS environmental specifications

10 Warranty

The product is warranted against defects in materials and workmanship for a period of twelve (12) months from its original date of purchase. The local office or distributor may grant a warranty period different to the above. Please refer to local terms of liability as defined in the supply contract.

The UPS manufacturer is not responsible for

- Any costs resulting from a failure if the installation, commissioning, repair, alternation, or ambient conditions of the equipment do not fulfil the requirements specified in the documentation delivered with the unit and other relevant documentation.
- Equipment subjected to misuse, negligence or accident.
- Equipment comprised of materials provided or designs stipulated by the purchaser.

The warranty is only valid if the installation inspection and initial start up of the UPS unit is carried out by a service engineer approved by Eaton. Service and maintenance of the UPS shall also be performed only by a service engineer approved by Eaton. Otherwise the warranty will be voided.

If the product fails to meet its published specifications due to a defect in material and workmanship, covered by this warranty, the seller will repair or replace the warranted product. Such repair or replacement will be made by Eaton or by a service provider approved by Eaton. Repair or replacement during the warranty period does not extend the original warranty. Warranty does not cover taxes, which will be due in connection with replacement or repair of the product.

Batteries are warranted against failures in material and workmanship, not against the normal aging and reduction of ampere-hour capacity. The product storage environment has to meet manufacturer's specifications, failure to do this will cause the warranty to be voided.

Under no circumstances shall the manufacturer, its suppliers or subcontractors be liable for special, indirect, incidental or consequential damages, losses or penalties.

The technical data, information and specifications are valid at the time of printing. The UPS manufacturer reserves the right to modifications without prior notice.