# POWERWARE® 9170

## User's Guide

3 kVA – 18 kVA, 50 and 60 Hz

www.powerware.com

## Requesting a Declaration of Conformity

Units that are labeled with a CE mark comply with the following harmonized standards and EU directives:

- Harmonized Standards: EN 50091-1-1 and EN 50091-2
- EU Directives: 73/23/EEC, Council Directive on equipment designed for use within certain voltage limits
  93/68/EEC, Amending Directive 73/23/EEC
  89/336/EEC, Council Directive relating to electromagnetic compatibility
  92/31/EEC, Amending Directive 89/336/EEC relating to EMC

The EC Declaration of Conformity is available upon request for products with a CE mark. For copies of the EC Declaration of Conformity, contact:

Director of Engineering
Invensys Secure Power
P.O. Box 280
Necedah, WI 54646
USA
Phone: (608) 565-7200
Fax: (608) 565-5416

## Class A EMC Statements

### FCC Part 15

**NOTE** This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

### ICES-003

This Class A Interference Causing Equipment meets all requirements of the Canadian Interference Causing Equipment Regulations ICES-003.

Cet appareil numérique de la classe A respecte toutes les exigences du Reglement sur le matériel brouilleur du Canada.

### EN 50091-2

Some configurations are classified under EN 50091-2 as “Class-A UPS for Unrestricted Sales Distribution.” For these configurations, the following applies:

**WARNING** This is a Class A-UPS Product. In a domestic environment, this product may cause radio interference, in which case, the user may be required to take additional measures.

## VCCI Notice for Class A Equipment

この装置は、情報処理装置等電波障害自主規制協議会（VCCI）の基準に基づくクラスA情報技術装置です。この装置を家庭環境で使用すると電波妨害を引き起こすことがあります。この場合には使用者が適切な対策を講ずるよう要求されることがあります。

# TABLE OF CONTENTS

CHAPTER 1

# INTRODUCTION

The Powerware 9170 uninterruptible power system (UPS) is a modular UPS that contains battery modules and power control modules (referred to as power modules). These modules plug into a rack cabinet structure containing additional control, communication, and display functions that enable integrated control of all power modules. The UPS is housed in a single cabinet, with extra battery capacity housed in auxiliary battery cabinets.

The pluggable power modules can be removed and replaced (hot-swapped) without powering the UPS down if the UPS has sufficient redundant capacity. Battery modules may also be hot-swapped for maintenance. Power control circuitry in the cabinet senses problems in power modules, and automatically transfers control and load to the remaining power modules.

All power modules share the load requirements equally. For example, three power modules are capable of supplying a total of 9 kVA. If a load requires only 4.5 kVA, each power module supplies 1.5 kVA to the output. If one power module is removed or for some reason fails, each of the two remaining power modules would supply half of the load, or 2.25 kVA. In other words, redundancy exists when the load can be supplied by less than all of the installed power modules.

The UPS can be configured with up to seven power modules; its output is limited such that an excess number of power modules allow the failure of one or more modules without causing the UPS to lose any functionality.

To permit UPS removal from the power path, while maintaining power to the loads, an external bypass switch is required. This switch is optional but recommended for system serviceability.

## Safety Warnings

Read the following precautions before you install the UPS.

**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.

**CAUTION**

- Universal power modules (model ASY-0528) have white labels on the front and produce a single output voltage: 208, 220, 230, or 240 Vac. Split-phase power modules (model ASY-0567) have blue labels on the front and produce two output voltages: 100/100 for 200, 110/110 for 220, 120/120 for 240, 120/120 for 208, or 127/127 for 220 Vac. DO NOT mix the two types of power modules in the same Powerware 9170 cabinet.
- Battery modules to be used in the Powerware 9170 system are model ASY-0529. Each battery module weighs 30 lb (14 kg). Use care in lifting and moving battery modules.
- All input and output wiring must be copper and adequate to carrying currents as listed in Table 13 on page 78.
- Torque all bolts holding input and output power conductors to values specified in Table 2 on page 27.
- The user is required to provide power input and output disconnect devices for the UPS. These must be within sight of the UPS and easily accessible. For a plug-receptacle unit, the plug serves as the power input disconnect device, which must also be readily accessible.

## Physical Features

The Powerware 9170 UPS is available in four cabinet sizes. Figure 1 through Figure 6 show the 3-slot and 9-slot configurations and identify basic Powerware 9170 system features. Six-slot and 12-slot cabinets are also available; external battery cabinets are available in 6-, 9-, and 12-slot sizes.

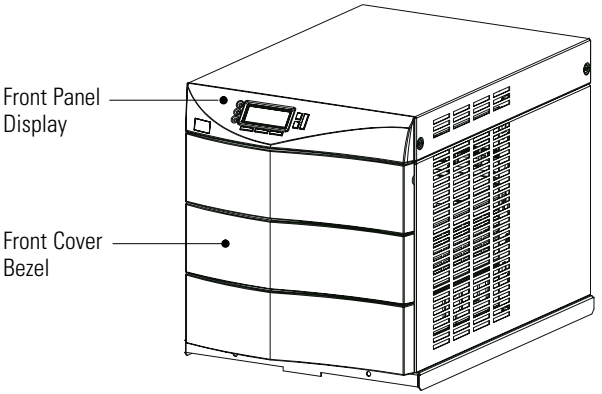



**Figure 1. Three-Slot Cabinet (Front View)**

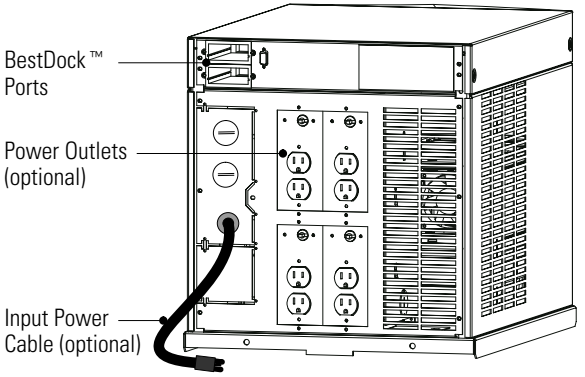



**Figure 2. Three-Slot Cabinet (Rear View)**

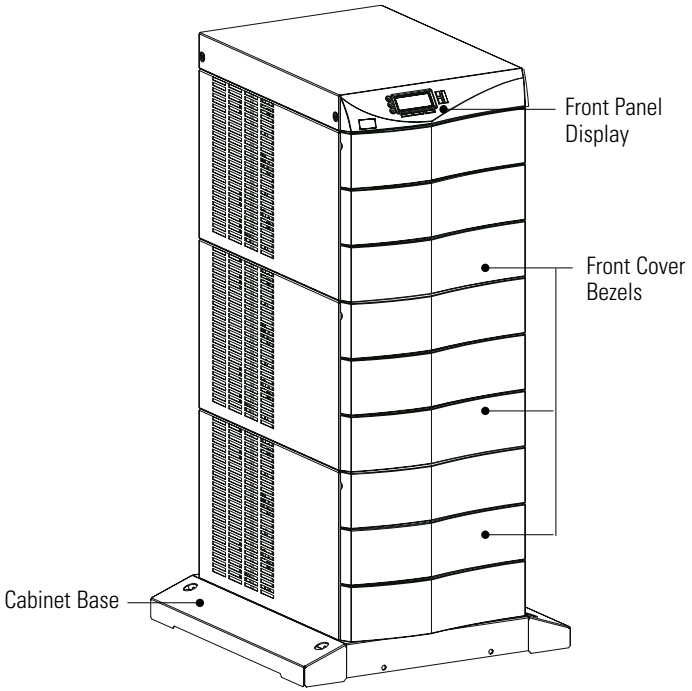



**Figure 3. Nine-Slot Cabinet (Front View)**

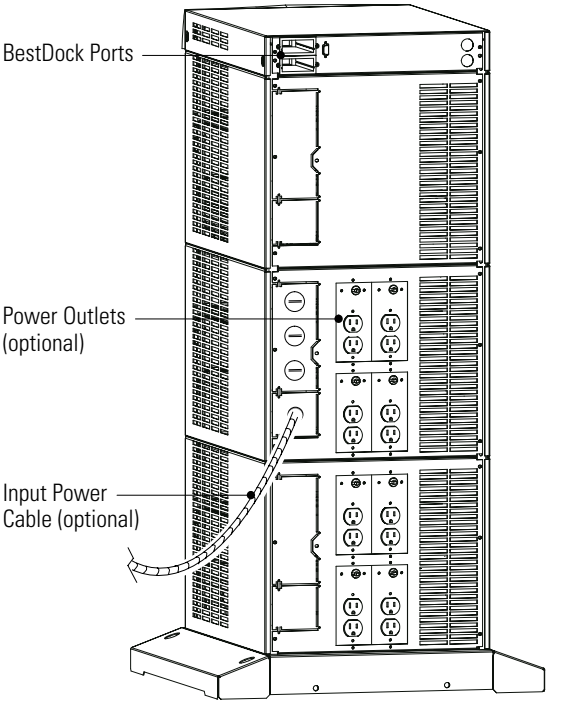



**Figure 4. Nine-Slot Cabinet (Rear View)**

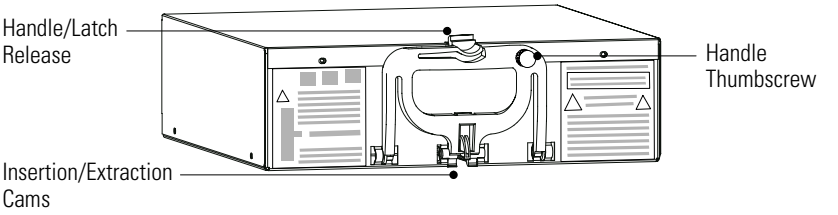



**Figure 5. Power Module (ASY-0528 and ASY-0567)**

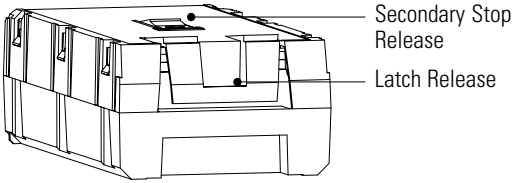



**Figure 6. Battery Module (ASY-0529)**

CHAPTER 2

# INSTALLATION SETUP

This chapter explains how to setup and install the Powerware 9170 cabinets:

- Unpacking and setup, including clearances and location requirements
- Caster cart installation
- Stabilizer bracket installation (for 12-slot cabinets with non-isolated output)
- Rack-mount installation
- Floor anchor kit installation
- Moving the cabinets

## Equipment Clearances

All cabinet sizes require the following clearances to allow for servicing and adequate ventilation:

- From the side panels: 6″ (15.2 cm)
- Top and back: 12″ (30.5 cm)
- Front: 36″ (91.5 cm)

If flexible conduit connects the UPS to the service input and load distribution panels, you may be able to gain access for servicing by moving the UPS. If this is the case, you must still leave 12″ (30.5 cm) clearance at the back and 6″ (15.2 cm) at the sides of the UPS for ventilation.

**NOTE** Do not block the ventilation holes on each side and the back of the unit.

Nine- and 12-slot external battery cabinets may be installed with bases tight against the UPS cabinet base and against each other. Six-slot cabinets require 6″ of separation.

## Location Requirements

Install the Powerware 9170 UPS as close as possible to the equipment or the load distribution panel it will protect. If this distance is more than 25 ft (7.6m), transient noise can reappear in the electrical distribution system.

If additional Powerware 9170 system batteries are in a separate cabinet, the external battery cabinet should be located as close as possible to the Powerware 9170 UPS. If the batteries will be further from the unit than the standard cables allow, contact your service representative or your local distributor for assistance.

## UPS Unpacking and Setup

The Powerware 9170 UPS is shipped in a carton on a shipping pallet. Power and battery modules are shipped in separate boxes on another pallet. Three-slot cabinets and modules are shipped on one pallet.

**NOTE** Verify that all Powerware 9170 UPS power modules are the proper type for the UPS cabinet: Universal (single-phase) modules have white labels; split-phase modules have blue labels. Do not mix blue and white modules in the same UPS cabinet.

To open the UPS carton and remove the UPS from its shipping pallet, use one of the following procedures. Also refer to the unpacking instruction sheet (LTS-1724) packed inside the UPS shipping carton.

### Three- and Six-Slot Cabinets

1. Open the top of the carton by cutting the banding straps that hold the carton to the pallet. Open the carton flaps or lift the cover off.
2. Remove any packing material inside the carton. Also remove the cartons from the cabinet module slots containing front panel bezels, electrical or mechanical hardware, and printed material.
3. Two people are required to lift the cabinet; one to lift the two front straps and one to lift the two rear straps.

**NOTE** Do not attempt to lift the cabinet by the module shelves or other convenient edges or panels.

4. If an optional caster cart is included for cabinet mobility, see "Caster Cart Installation" on page 10 for information about mounting the cabinet on the cart and stabilizing it using the cart foot pads.
5. After placing the cabinet in its intended operating location, cut the lifting straps or slip them off the cabinet base tabs.
6. If you are installing an external battery cabinet, continue to "Battery Cabinet Installation" on page 17.

   If you do not have an external battery cabinet, continue to "UPS Startup" on page 49 for plug-receptacle units or to "Electrical Installation" on page 23 for hardwired units.

## Nine- and Twelve-Slot Cabinets

**NOTE** The 12-slot Powerware 9170 UPS cabinet with non-isolated output is shipped with two stabilizer brackets. These brackets must be attached to the wall or the floor behind the UPS cabinet (see page 11).

1. Open the top of the carton by cutting the straps that hold the cover to the carton. Lift the cover off.
2. Remove the pallet ramp packed on top of the cabinet. Locate the ramp-mounting hardware (supplied in the accessory kit) and attach the ramp to the pallet as shown in LTS-1724, accompanying the hardware.
3. Remove any packing material inside the carton. Also remove cartons containing front panel bezels, electrical or mechanical hardware, and printed material.
4. Lower the four cabinet casters (one at each corner of the cabinet base) by using a 1/2″ hex-style socket wrench to turn each bolt clockwise.
5. With all casters fully extended, carefully roll the cabinet down the ramp and to its intended operating location.
6. To stabilize the cabinet in its operating location, turn the four caster bolts counter-clockwise until the cabinet rests on the floor. Place a plastic cap into each bolt access hole.

**NOTE** If the floor is uneven and the cabinet is tilted or unstable, you may need to place a thin steel plate under a corner. **Do not use the caster bolts to level the cabinet.**

7. If you are installing an external battery cabinet, continue to "Battery Cabinet Installation" on page 17.

   If you do not have an external battery cabinet, continue to "UPS Startup" on page 49 for plug-receptacle units or to "Electrical Installation" on page 23 for hardwired units.

## Caster Cart Installation

An optional caster cart (ASY-0527) is available for 3- and 6-slot cabinets for increased mobility of the UPS (see Figure 7).

**NOTE** The UPS cabinet is heavy. This procedure requires two people to lift and position the cabinet onto the caster cart. Lift the cabinet using four lifting straps shipped with the cabinet; do not attempt to lift the cabinet by the module shelves or other convenient edges or panels.

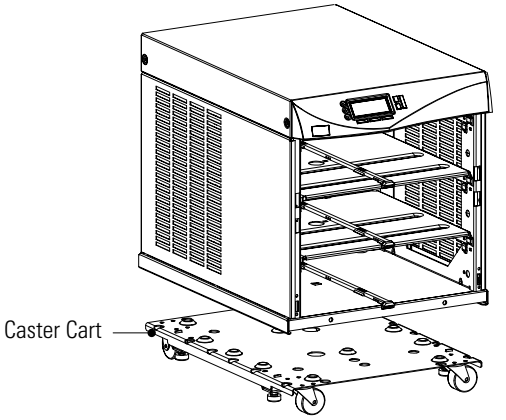



**Figure 7. Three-Slot Cabinet Being Lowered onto Caster Cart**

The caster cart, shipped separately from the UPS cabinet, must be placed under the cabinet before installing power and battery modules, and before plugging the UPS into the intended power outlet.

The cart requires no bolts or other hardware to fasten it to the UPS cabinet. It is shaped to fit securely under the cabinet, ensuring proper alignment after placing the cabinet on the cart.

Four foot pads under the cart keep the cart from rolling when it is in its intended location. Turn each threaded foot to lower it to the floor. When the foot is tight against the floor, turn the lock nut on the threaded foot up tight against the bottom of the cart to keep the foot from rotating.

If leveling of the UPS is required, use the foot pads to raise a side or corner before locking them with their lock nuts.

## Stabilizer Bracket Installation

The 12-slot Powerware 9170 UPS cabinet with non-isolated output is shipped with two stabilizer brackets. These brackets must be attached to the wall or the floor behind the UPS cabinet. Under all module-loading conditions, they act as a protective stop to prevent the cabinet from falling forward if it is unintentionally pushed away from the wall.

As shown in Figure 8, each bracket has holes that enable it to be attached by screws to either the wall or the floor (or both) behind the intended cabinet installation. The brackets are not attached to the cabinet base itself. Install the brackets as follows.

1. Select the location for the brackets, approximately 12–16″ (30–41 cm) apart, at the floor/wall intersection behind the intended cabinet location.
2. Using the proper type of customer-supplied screws for the intended mounting surface, attach each bracket as shown in Figure 8. All screws must be driven into structural material such as wall studs.
3. Roll the UPS cabinet to its intended location, positioning the rear section of the cabinet base under the open ends of the stabilizer brackets, as far as the cabinet will go.
4. Turn all four caster bolts counter-clockwise until the cabinet rests on the floor. Place a plastic cap into each bolt access hole.

**NOTE** If the floor is uneven and the cabinet is tilted or unstable, you may need to place a thin steel plate under a corner. **Do not use the caster bolts to level the cabinet.**

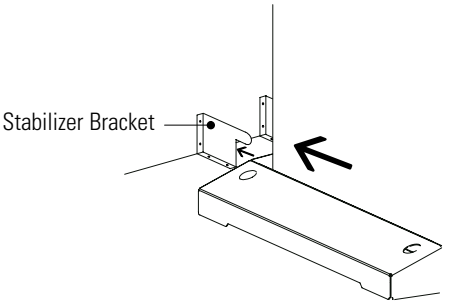



**Figure 8. Stabilizer Bracket Installation**

## Rack-Mount Installation

The 3- and 6-slot UPS cabinets may be installed in an EIA-standard 19″ (48.3-cm) equipment rack. An optional rack-mounting kit (ASY-0547), containing brackets and required hardware, is available for such an installation. For each 3-slot section, use the following mounting procedure to convert the UPS cabinet and install it in the equipment rack:

**NOTE** The UPS cabinet is heavy. This procedure requires two people to lift and position the cabinet into the equipment rack. Install the cabinet in the rack before installing power and battery modules, and before plugging the UPS into the intended power outlet.

1. Remove the four screws (two on either side) securing the top cover of the UPS cabinet. Carefully lift the cover straight up and off, to avoid stressing the front panel display. Set the cover aside.
2. Remove the two cabinet side panels (4 panels in 6-slot cabinets) by lifting the top edge. No other hardware must be detached. Store or discard the side panels.
3. Carefully replace the UPS cabinet top cover and secure with the four screws removed in Step 1. Position the cover lip to fit behind the front display panel.
4. Install three metal clip-nuts onto each side flange (6 clip-nuts on 6-slot cabinets) along the front of the UPS cabinet (see Figure 9).

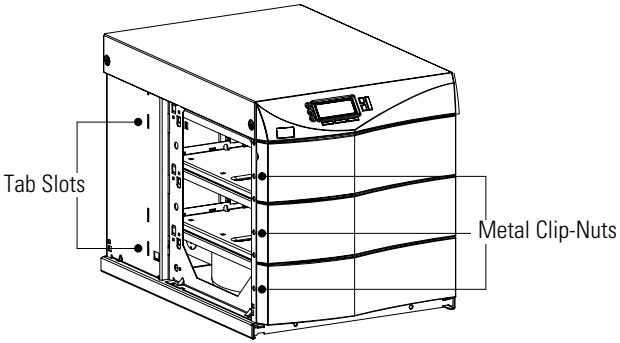



**Figure 9. Metal Clip-Nut and Tab Slot Locations**

5. Install a rack-mount ear (2 for 6-slot cabinets) on each side of the UPS cabinet (see Figure 10).

   Insert the two offset tabs on the rear edge of the ear into the matching tab slots on the cabinet side frame (see Figure 9). Pivot the ear forward, until it is flush against the UPS cabinet side frame. Secure each ear with three 1/4-20 × 1/2″ Phillips-head bolts, screwed into the metal clip-nuts installed in Step 4.

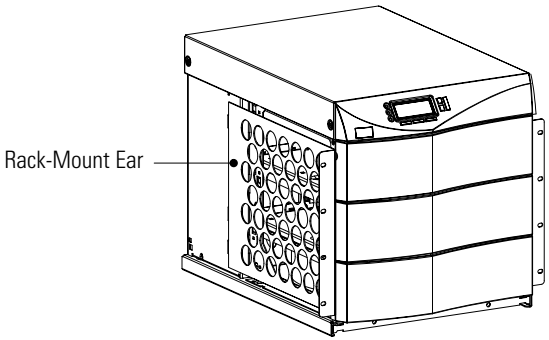



**Figure 10. Rack-Mount Ear Installed**

6. Select the position for the UPS in the equipment rack.
7. Install one equipment rail on each side of the rack using four 10-32 × 1/2″ flat-head screws per rail. Select the proper holes in the rail that position the UPS at the desired location in the rack (see Figure 11).

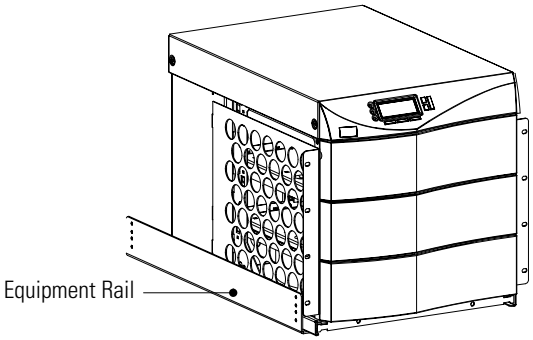



**Figure 11. Rails Holding UPS**

8. With one person lifting each side of the UPS cabinet, position the cabinet onto the two equipment rails.

   Carefully slide the UPS into the equipment rack until the rack-mount ears of the cabinet are flush with the front vertical rails of the rack. Verify that the holes in the ears align with the holes in the rack.

9. Secure the UPS in the rack using eight 10-32 × 1/2″ torx screws (16 for 6-slot cabinets) or other appropriate customer-specified screws.

## Floor Anchor Kit Installation

An optional floor anchor kit (ASY-0548) is available for all sizes of the Powerware 9170 UPS. The kit helps to stabilize the UPS or battery cabinet in the event of accidental bumps or small floor movements. Any testing to specific seismic requirements is the responsibility of the customer.

The floor anchor brackets, shipped separately from the UPS and battery cabinet, should be attached inside the lower front and rear edges of the cabinet before installing power and battery modules, and before making connections to the intended power source.

Use mounting hardware supplied with the floor anchor kit to attach the brackets to the UPS or external battery cabinet (see Figure 12). The customer is responsible for specifying and supplying floor mounting bolts.

| Mounting Centers for 5/16″ (8-mm) Floor Bolts | |
|---|---|
| Dimension (see Figure 12) | Measurement |
| A | 14.5″ (36.8 cm) |
| B (3- and 6-slot cabinets) | 30.25″ (76.8 cm) |
| B (9- and 12-slot cabinets) | 34.25″ (87 cm) |

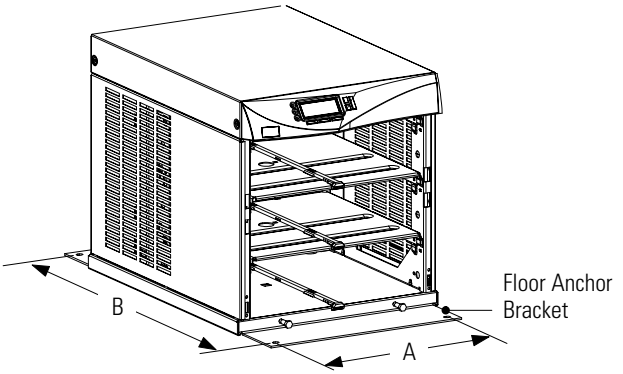



**Figure 12. Floor Anchor Brackets Bolted to UPS Cabinet**

## Moving the Cabinets

The Powerware 9170 UPS and the battery cabinet are very heavy with power and battery modules installed. Before moving the cabinets, remove the power and battery modules and move these modules separately from the cabinets.

The smaller (3- and 6-slot) cabinets may be ordered with a caster cart, to enable moving the cabinet. “Caster Cart Installation” on page 10 describes how to set the four foot pads on this cart to keep the cabinet from rolling when properly positioned.

The larger (9- and 12-slot) cabinets have casters built into the cabinet base. Use the following procedure to raise the cabinet before rolling it on its casters. For 12-slot cabinets that do not have output isolation, see “Stabilizer Bracket Installation” on page 11, for details about mounting stabilizer brackets before rolling the cabinet into place.

1. Ensure that the cabinet contains no power or battery modules.
2. Locate the four plastic caps covering the caster bolts. They are at the corners of the cabinet base.

3. Pry the caps out of the bolt access holes.
4. Use a 1/2″ hex-style socket wrench to turn each of the four bolts clockwise. Doing so lowers the casters to allow the cabinet to roll on the casters.
5. After rolling the cabinet to its intended position, turn all four caster bolts counter-clockwise until the cabinet rests on the floor. Place a plastic cap into each bolt access hole.

**NOTE** If the floor is uneven and the cabinet is tilted or unstable, you may need to place a thin steel plate under a corner. **Do not use the caster bolts to level the cabinet.**

After properly positioning and leveling the cabinet, insert power and battery modules into the rack as described in "UPS Startup" on page 49.

CHAPTER 3

# BATTERY CABINET INSTALLATION

If you are not installing battery modules into a separate external battery cabinet, continue to "UPS Startup" on page 49 for plug-receptacle units or to "Electrical Installation" on page 23 for hardwired units.

**WARNING**

Only qualified service personnel (such as a licensed electrician) should perform the battery cabinet installation. Risk of electrical shock.

**CAUTION**

- Before connecting an external battery cabinet to the UPS cabinet or to another external battery cabinet, verify that all AC input power is removed from the UPS. Open the input service circuit breaker or turn the external bypass switch to the SERVICE position.
- Disconnect all battery strings in the UPS cabinet and/or battery cabinet to ensure DC voltage is removed from the internal DC buses. You can remove all battery modules or unplug each pair of battery modules from the cabinet backplane.

1. Open the carton containing the external battery cabinet cable assembly, and check that all required parts have been shipped with it.
2. Locate the 3-slot section in the UPS cabinet that contains the power entrance panel. Unscrew and remove the rear panel of this section (see Figure 13).

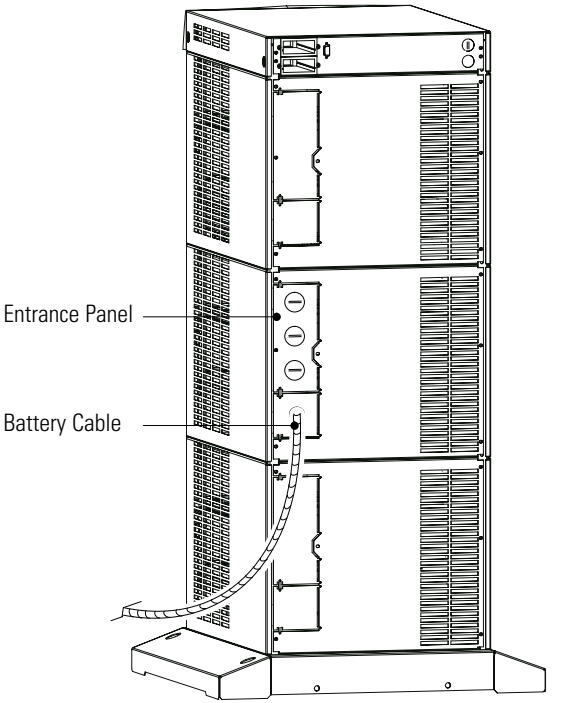



**Figure 13. UPS Power Entrance Panel**

3. Use a pair of pliers to bend the narrow links (1 and 2 in Figure 14) between the outer edge of the lower breakaway panel and the rear panel.
4. Use the pliers to bend the entire breakaway panel (at 3 and 4 in Figure 14) until it breaks away.

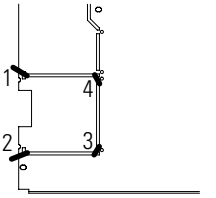



**Figure 14. Breakaway Panel Links**

5. Verify all hazardous voltages have been removed from the backplane by testing with a voltmeter or other test device.

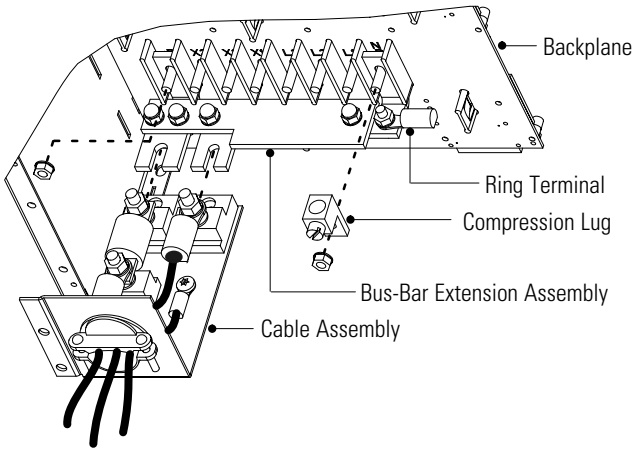



**Figure 15. Bus-Bar Extension Installation**

6. Remove the nuts holding the +DC and the –DC bus bars to the backplane as shown in Figure 15. Remove the ring terminal and the compression lug from the –DC bolt.
7. Position the bus-bar extension assembly onto the +DC and –DC bolts as shown in Figure 15. Replace the compression lug onto the –DC bolt of the bus-bar extension assembly. Secure the assembly by replacing the two nuts removed in Step 6.
8. Use the bolt and nut supplied with the cable assembly to attach the ring terminal to the empty hole in the –DC bus bar.
9. Torque all three bolts to 75–85 in lb (8.5–9.6 Nm).
10. Loosen the three large nuts on the end of the cable assembly (see Figure 15).
11. Slip the terminals of the cable assembly onto the tabs of the bus-bar extension, putting the tabs between the stud block and the fuse end and between the other stud block and the cable terminal.

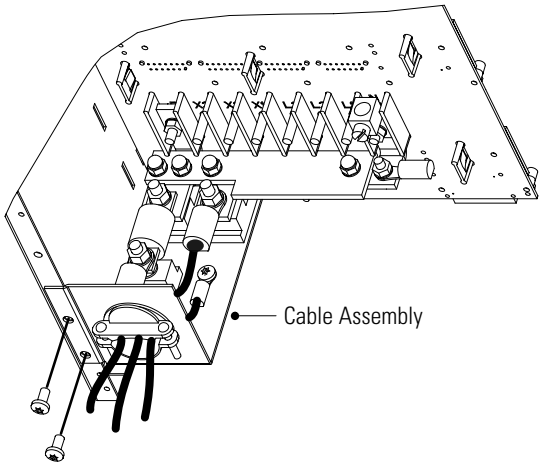



**Figure 16. Battery Cable Assembly Installation**

12. Align the screw holes of the cable assembly's entry plate with holes on the cabinet side panel as shown in Figure 16. Secure the entry plate with screws supplied with the cable assembly.
13. If the battery cable will be installed in customer-supplied flexible or other conduit (as required by local wiring codes), loosen the two screws holding the strain-relief clamp shown in Figure 16. Remove the clamp by loosening the star nut on the inside of the entry plate, leaving the nut in place. Replace the clamp with a panel-to-conduit feedthrough and secure it with the star nut.
14. Secure the cable assembly terminals by tightening the nuts onto the backplane bus bars. Also tighten the third nut, holding the other fuse end. Torque all three nuts to 75–85 in lb (8.5–9.6 Nm).
15. Replace the UPS cabinet rear panel with the screws removed in Step 2 on page 17.
16. If the battery cable will be installed in flexible or other conduit, pull the conductors through the conduit. Attach the conduit to both the UPS power entrance panel and the battery cabinet entrance panel as shown in Figure 17.

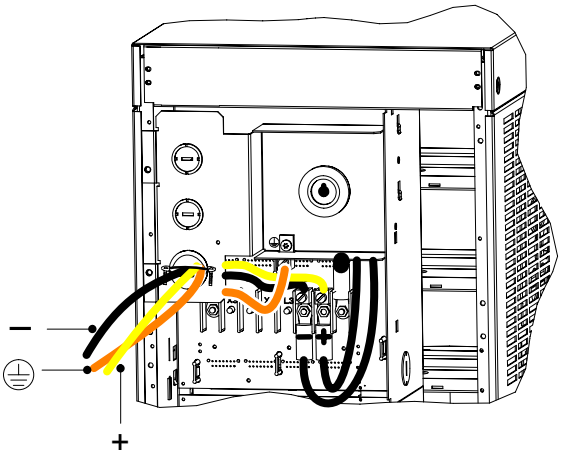



**Figure 17. Battery Cable Installed in Battery Cabinet**

17. Secure the **+**, the **–**, and the ⏚ conductors to the proper compression lugs on the battery cabinet backplane as shown in Figure 17. Torque all three compression lugs to 75–85 in lb (8.5–9.6 Nm).
18. If an additional battery cabinet will be connected to the first, in a daisy-chain configuration, use another external battery cabinet cable assembly for the connections between the battery cabinets.
19. Locate the daisy-chained cable on the rear of the first battery cabinet in the section below the location of the first cable assembly. Follow this procedure for connecting any additional daisy-chained battery cabinets.
20. Install the remaining cabinet rear panels using the original screws.
21. If your UPS is a hardwired unit, continue to “Electrical Installation” on page 23. If you have a plug-receptacle unit, skip to “UPS Startup” on page 49.

CHAPTER 4

# ELECTRICAL INSTALLATION

**NOTE** If you have a plug-receptacle unit, continue to "UPS Startup" on page 49.

**WARNING**

Only qualified service personnel (such as a licensed electrician) should perform the electrical installation. Risk of electrical shock.

The Powerware 9170 UPS input power may be hardwired through conduit to either a main power source circuit breaker or to an optional external bypass switch. For hardwired installations, it is recommended that you install a Powerware bypass switch to enable power transfer during maintenance or UPS downtime. If a bypass switch is used, both UPS input and UPS output must be hardwired–**through separate conduits**–to the bypass switch, as shown in Figure 18.

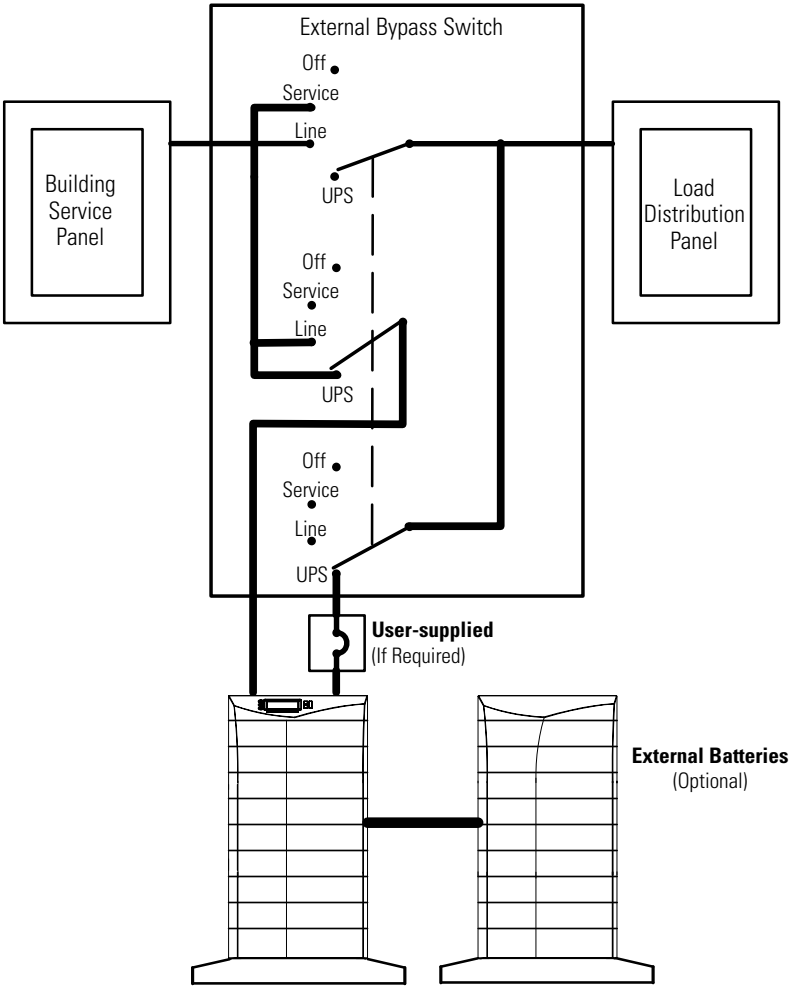



**Figure 18. Typical Installation with a Bypass Switch**

If a bypass switch is not used, the UPS input may be hardwired through conduit to a main power source circuit breaker, and the UPS output may either be hardwired to a circuit breaker in a distribution panel (as shown in Figure 19) or supplied to loads through receptacles on the back of the UPS. Without a bypass switch, power to the load cannot be maintained if the UPS is taken completely offline.

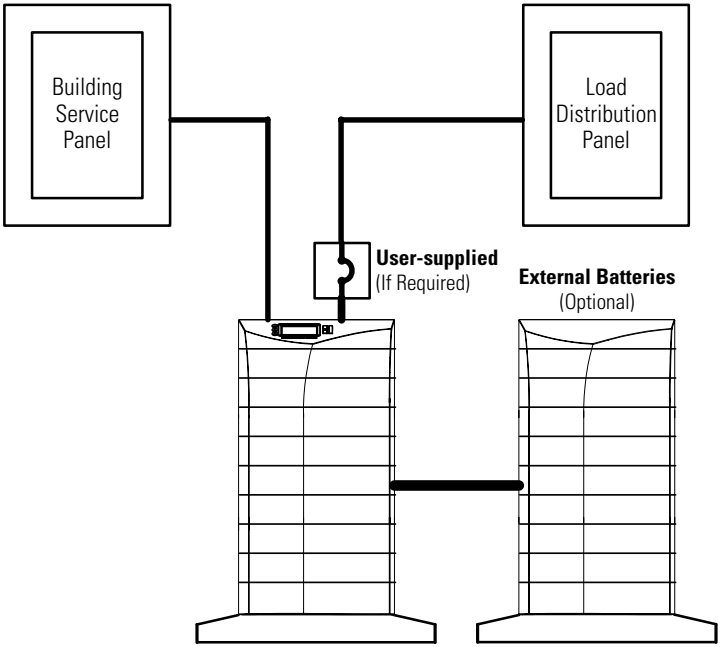



**Figure 19. Typical Installation without a Bypass Switch**

## Input Current Ratings

Table 1 contains the required circuit breaker ratings for hardwired installations. Circuit breaker ratings for units having an input line cord are determined by the current capacity of the line cord.

**Table 1. Required Input Circuit Breaker Sizes (200–240 Vac, 50/60 Hz)**

| UPS Capacity | Circuit Breaker Rating |
|---|---|
| 3 kVA | 25A |
| 6 kVA | 40A |
| 9 kVA | 60A |
| 12 kVA | 80A |
| 15 kVA | 100A |
| 18 kVA | 125A |

**NOTE** To accommodate the feature of easy system expandability, it is recommended that initial installation of the Powerware 9170 UPS contain wiring to support the maximum capacity of the UPS cabinet: 3 kVA for 3-slot cabinets; 9 kVA for 6-slot cabinets; 18 kVA for 9- and 12-slot cabinets.

See Table 2 for recommended conductor sizes to wire the input circuit breakers.

**Table 2. Recommended Wire Sizes**

| Input Circuit Breaker Size | 75°C Copper Wire Size | Conductor Screw Torque |
|---|---|---|
| 25A | 10 AWG (5.3 $mm^2$) | 20 in lb (2.3 Nm) |
| 40A | 8 AWG (8.4 $mm^2$) | 25 in lb (2.8 Nm) |
| 60A | 4 AWG (21.2 $mm^2$) | 35 in lb (4.0 Nm) |
| 80A | 3 AWG (26.7 $mm^2$) | 45 in lb (5.1 Nm) |
| 100A | 2 AWG (42.1 $mm^2$) | 55 in lb (6.2 Nm) |
| 125A | 1/0 AWG (53.5 $mm^2$) | 65 in lb (7.3 Nm) |

FOR U.S. INSTALLATIONS, READ THIS IMPORTANT NOTE!

This table lists the AWG and $mm^2$ wire size for each circuit breaker size shown on the wiring diagrams. The minimum recommended circuit breaker sizes for each model and voltage application are listed on the wiring diagrams.

Conductor sizes shall be no smaller than the 75°C wire size based on the ampacities given in Table 310–16 of the National Electrical Code, ANSI/NFPA 70-1999, and article 220. All circuit conductors, including the neutral and equipment grounding conductors, must be the same size (ampacity) wire. Code may require a larger AWG size than shown in this table because of temperature, number of conductors in the conduit, or long service runs. **Follow local code requirements**.

## Bypass Switches

Bypass switches are available in two types: Make-Before-Break (MBB) and Break-Before-Make (BBM).

An MBB switch makes a new connection before it breaks the original connection. For example, if you turn an MBB switch from UPS to LINE, the bypass switch connects the load to AC input power before disconnecting the load from UPS output power. (As noted in Figure 37 on page 47, MBB switches may not be used in certain system configurations.)

A BBM switch breaks the original connection before it makes a new one. If you turn a BBM switch from UPS to LINE, the switch disconnects the load from UPS output power before connecting the load to AC input power.

The bypass switch has four positions as described in Table 3.

**NOTE** In the UPS or LINE position, AC input power is still connected to the input terminals inside the UPS.

**Table 3. Bypass Switch Positions**

| Switch Position | Description |
|---|---|
| LINE | Connects the load directly to AC input power and disconnects UPS output. AC input power is still connected to the UPS input. |
| OFF | Disconnects the load from the UPS output power and AC input power, as well as AC input power to the UPS input. |
| UPS | Connects the UPS output to the load. |
| SERVICE | Like the LINE position, SERVICE connects the load directly to AC input power and disconnects UPS output. **However, because SERVICE also disconnects AC input from the UPS, this is the appropriate position for UPS maintenance or repair.** |

To disconnect AC input power during maintenance or service, turn the bypass switch to the SERVICE position. For MBB switches, you must press the red button beside the switch before you can change the switch position.

There are six bypass switch models available for the Powerware 9170 UPS as specified in Table 4.

**Table 4. Bypass Switch Specifications**

| Bypass Switch Models | | Rating, Continuous | See Figure 20 | | | | | Weight |
|---|---|---|---|---|---|---|---|---|
| BBM | MBB | | Height (A) | Width (B) | Depth (C) | Mounting Centers (D) | (E) | |
| BPE12BBM1A | BPE12MBB1A | 40A/300 Vac (CSA) 50A/300 Vac (UL,TÜV) | 21.0″ (534 mm) | 14.0″ (356 mm) | 6.8″ (172 mm) | 11.0″ (280 mm) | 20.0″ (508 mm) | 27 lb (12.3 kg) |
| BPE14BBM1A | BPE14MBB1A | 80A/300 Vac | 21.0″ (534 mm) | 14.0″ (356 mm) | 6.8″ (172 mm) | 11.0″ (280 mm) | 20.0″ (508 mm) | 31 lb (14.1 kg) |
| BPE22BBM1A | BPE22MBB1A | 150A/300 Vac | 26.5″ (673 mm) | 18.4″ (467 mm) | 6.6″ (168 mm) | 16.0″ (406 mm) | 25.5″ (648 mm) | 53 lb (24.1 kg) |

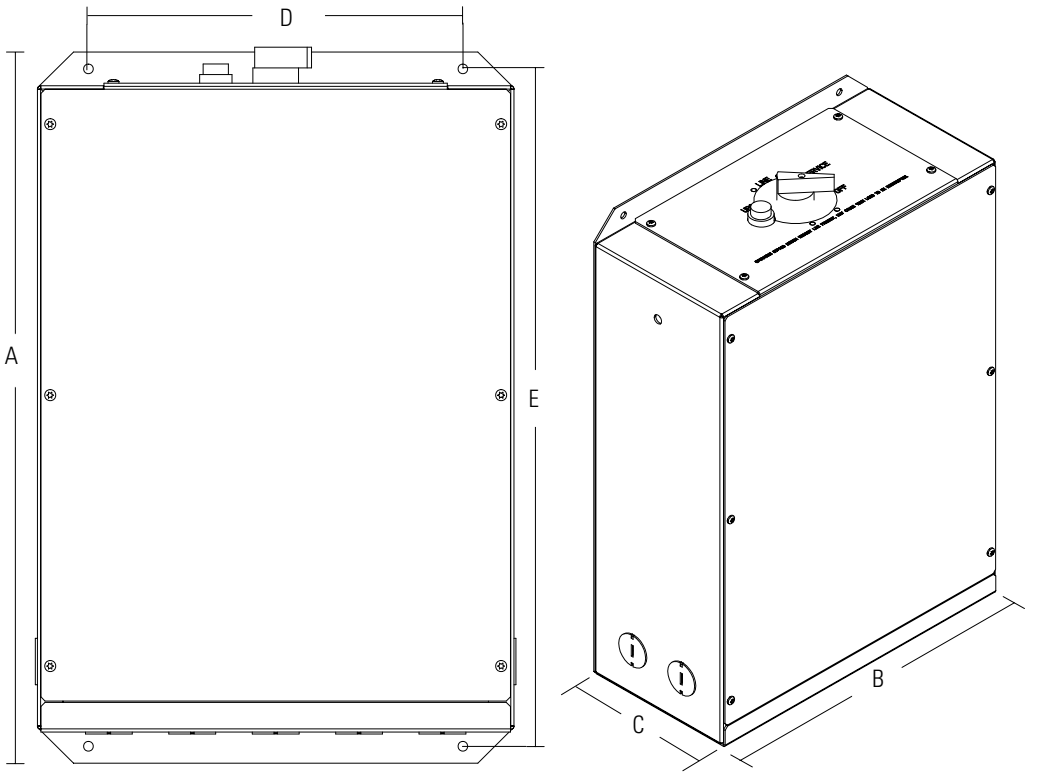



**Figure 20. Bypass Switch Mounting Dimensions**

## UPS Installation with an External Bypass Switch

**WARNING**

Only qualified service personnel (such as a licensed electrician) should perform the electrical installation. Risk of electrical shock.

**CAUTION**

To prevent electrical shock or damage to the equipment, verify that the Powerware 9170 UPS is OFF before you remove the entrance panel. The circuit breaker or disconnect switch must also be off at the AC input service panel. Also, turn OFF the AC disconnect and bypass switches before you connect any wires to the bypass switch terminal strip.

1. Mount the bypass switch within sight of the UPS. If you do not have a Powerware bypass switch or the fuse box or panel is out of sight, you must install a separate disconnect switch next to the UPS.

   The bypass switch should be mounted securely to a sturdy surface. You may need to turn the cabinet 90 degrees (on its side) to enable operator access to the switch handle.

2. Remove the six screws in the bypass switch front panel and remove the panel. Remove any packing material inside the bypass switch.

   Remove knockouts in the bottom of the bypass switch for AC Line Input, AC to UPS Input, AC from UPS Output, and AC to the UPS load.

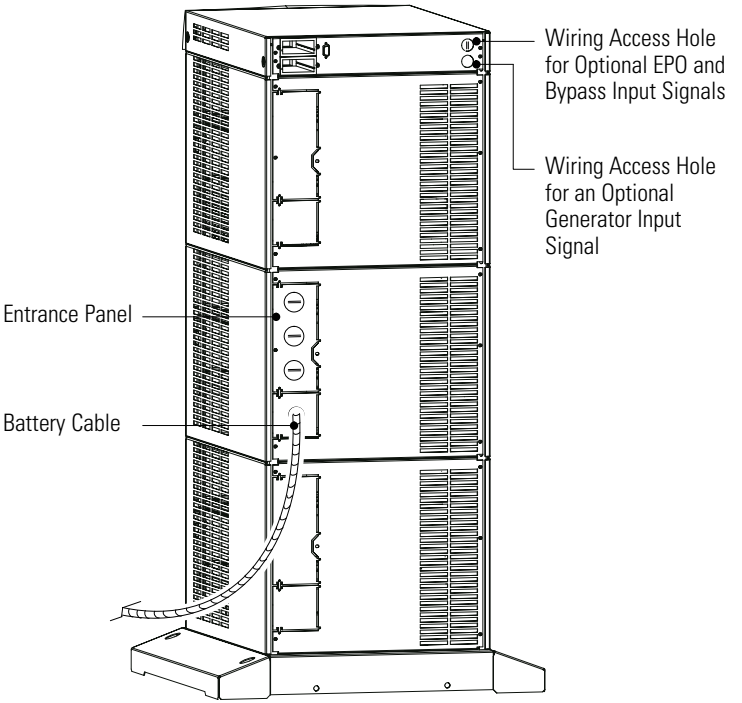



**Figure 21. UPS Power Entrance Panel**

3. Remove the rear panels of the UPS (top panel on 3- or 6-slot; top 2 panels on 9- and 12-slot) as shown in Figure 21.

   The entrance panel contains knockout openings for entrance and exit conduits and for conduit to an optional external battery cabinet. The entrance panel is located on the top 3-slot section for 3- and 6-slot cabinets; on the second section for 9- and 12-slot cabinets as shown in Figure 21.

   Wiring for optional EPO and bypass input signals passes through the opening at the top back of the cabinet. Wiring for an optional generator input signal must pass through a separate opening. Installing this wiring is described in Steps 11 and 12.

4. Remove the knockouts in the entrance panel for AC input and AC output wiring.

5. Install the conduit adapters. AC input and AC output conductors must be run through separate conduits. UPS output circuits must be installed in dedicated conduit systems and not shared with other electrical circuits.
6. Find the terminal strip inside the bypass switch cabinet. Using the label on the back of the bypass switch access panel and the proper installation wiring diagram, make the terminal strip connections and tighten all connections as specified in Table 2 on page 27. Use copper wire that is the appropriate size for the current draw. Figure 22 shows a sample label.

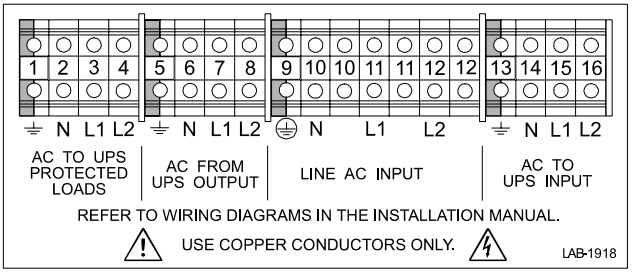



**Figure 22. Bypass Switch Wiring Label**

7. After installing bypass switch wiring, torque the screws holding all input and output power conductors to the values specified in Table 2 on page 27.
8. If your UPS has an isolated output, find the proper output neutral-to-ground connection in the output wiring diagrams beginning on page 44.

   At the UPS terminals, **connect the neutral-to-ground (neutral-to-earth) wire to the proper terminal before making any other connections to the UPS**. The neutral-to-ground wire is a green and yellow wire. One end of this wire is already connected to the ground (earth) UPS terminal. Ground terminations, inside the UPS rear panel, are located directly below the line input terminals. Figure 23 shows input and output wiring terminals inside the Powerware 9170 UPS cabinet. Figure 36 on page 45 shows the N-G bond wire connections.

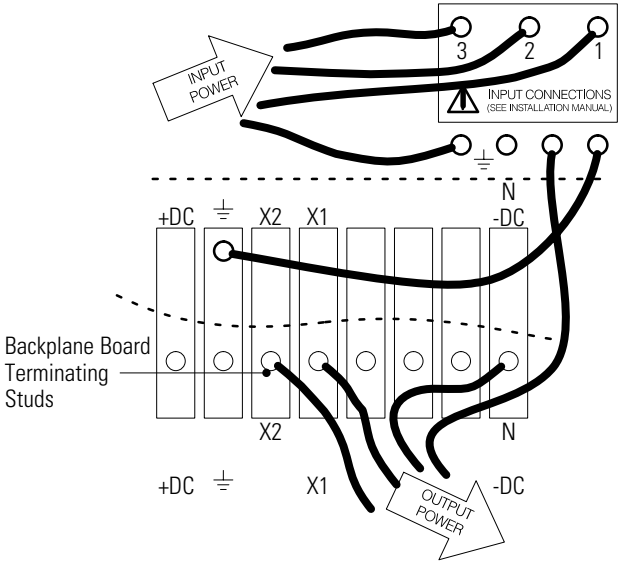



**Figure 23. UPS Input and Output Terminals**

9. Refer to the wiring diagrams beginning on page 38 which show output configurations for various voltages and isolation options. Make UPS output connections on the backplane board terminating studs. Compression lugs (supplied in the accessory kit) may be installed on the proper terminating studs. Wires may also be terminated with ring terminals, which are attached to the output terminating studs.
10. If the bypass switch is an MBB style, notice the cable routed out of the left side of the bypass switch cabinet. The red and black pair of wires (normally open) in this cable must be connected to terminals 3 and 4 in Steps 11 and 12. (Do not connect the white and black pair of wires in this cable.)
11. If any external, hardwired control signals are required, remove the rear panel on the upper section of the cabinet and locate the terminal block, as shown in Figure 24.

**CAUTION**

EPO and external bypass circuits are not isolated from line voltage, and wiring must be installed according to local codes using conduit or suitable primary supply cables.

The Generator On signal is isolated from line voltage and can be treated as NEC Class 2 wiring.

Use 14–20 AWG, 600V wire (UL) or 14–26 AWG, 300V wire (CSA) for all input control signals.

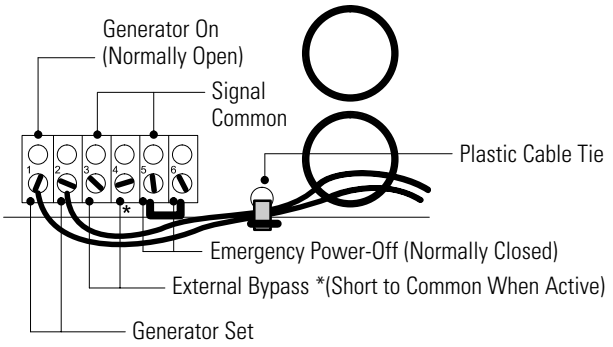



**Figure 24. Input Control Signal Wiring**

12. Place the signal wires through the proper conduit or grommet above the terminal block and attach to appropriate terminals. Secure each connection by torquing terminal screws to a maximum 3.5 in lb (0.4 Nm). Provide strain relief for cables by installing plastic cable ties.

**NOTE** Do not strain relieve EPO or external bypass wiring with the same cable tie used for Generator On wires.

13. Remove the jumper between terminals 5 and 6 only if you are wiring from an emergency power-off (EPO) switch. (See "Changing Parameter Settings" on page 65 for information about accessing menu 7, submenu 1, item 9 to view or change the EPO switch type.)
14. When all connections have been made and checked, replace the bypass switch front panel and UPS cabinet rear panels.

## Wiring Diagrams

Select wiring diagrams from Table 5 based upon the installation voltage and whether your site has an external bypass switch.

**Table 5. Wiring Diagrams for Non-Isolated Output**

| UPS Input Voltage | UPS Output Voltage | Output Wires | External Bypass | Wiring Diagrams | | |
|---|---|---|---|---|---|---|
| | | | | Input | Output | System |
| 100/200<br>110/220<br>120/208<br>120/240<br>127/220 | 100/200<br>110/220<br>120/208<br>120/240<br>127/220 | L1, L2, N* | Yes | Figure 25a | Figure 26 | Figure 28 |
| | | | No | Figure 25a | Figure 26 | Figure 29 |
| 208<br>220<br>230<br>240 | 208<br>220<br>230<br>240 | L1 – L2 | Yes | Figure 25b | Figure 27 | Figure 30 |
| | | | No | Figure 25b | Figure 27 | Figure 31 |
| 220<br>230<br>240 | 220<br>230<br>240 | L1 – N | Yes | Figure 25b | Figure 27 | Figure 32 |
| | | | No | Figure 25b | Figure 27 | Figure 33 |

*Split-phase power modules required.

## UPS Input Wiring Connections

The Powerware 9170 UPS with split-phase power modules (model ASY-0567, with blue labels on the front) is capable of supplying two output voltages: 100/100 for 200, 110/110 for 220, 120/120 for 240, 120/120 for 208, or 127/127 for 220 Vac, as selected through the front panel display. These modules produce two output voltages, typically required in North America, South America, and Japan.

The Powerware 9170 UPS with universal power modules (model ASY-0528, with white labels on the front) is capable of supplying a single-phase output voltage: 208, 220, 230, or 240 Vac, as selected through the front panel display. These modules produce a single output voltage, typically required in Europe, the Middle East, Asia, and Africa.

**CAUTION**

Confirm that the UPS is wired for the proper input voltage as shown in Figure 25, and that the proper power modules (either universal or split-phase) are installed to produce the desired output voltage. Do not mix the two types of power modules in the same UPS cabinet.

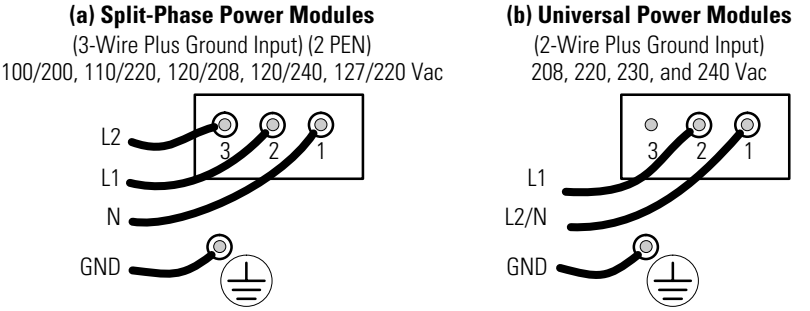



**Figure 25. UPS Input Wiring**

## UPS Output Wiring Connections (Non-Isolated Installations)

Figure 26 and Figure 27 describe output wiring configurations for various output voltages. Use Table 5 to find the desired wiring diagrams and connect the output AC wiring to the proper Powerware 9170 system power terminals. You must also set the operating menu parameter 7-3-4 for the required output voltage as shown in the wiring configuration drawings.

**NOTE** All power modules in the Powerware 9170 UPS cabinet must be of the same type: Universal (single-phase) modules have white labels; split-phase modules have blue labels. Output for each type of module must be wired differently.

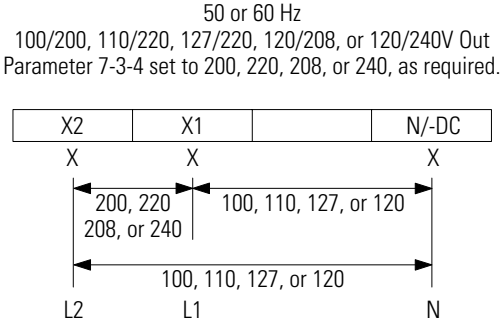



**Figure 26. Split-Phase Modules with Non-Isolated Output**

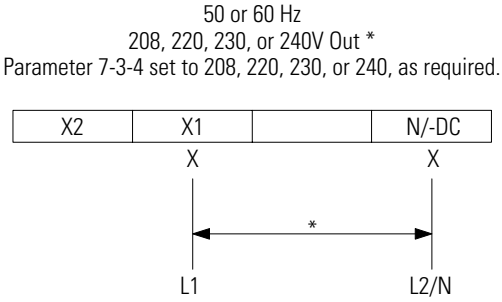



**Figure 27. Universal Modules with Non-Isolated Output**

## System Wiring Diagrams

The following notes are referenced in the non-isolated system wiring diagrams (Figure 28 through Figure 33). To determine which diagram is correct for your site, see Table 5 on page 35.

**NOTE 1** The customer must provide input overcurrent protection as stated in NEC Section 240-21 or local codes. Size the protection device according to local code requirements (see Table 1 on page 26).

**NOTE 2** The UPS bypass switch must be installed within sight of the UPS. To properly install, complete the voltage and phase check procedure in "Startup for Hardwired Units" on page 53. The wires coming from the side of the switch must be connected as described in Step 10 on page 33.

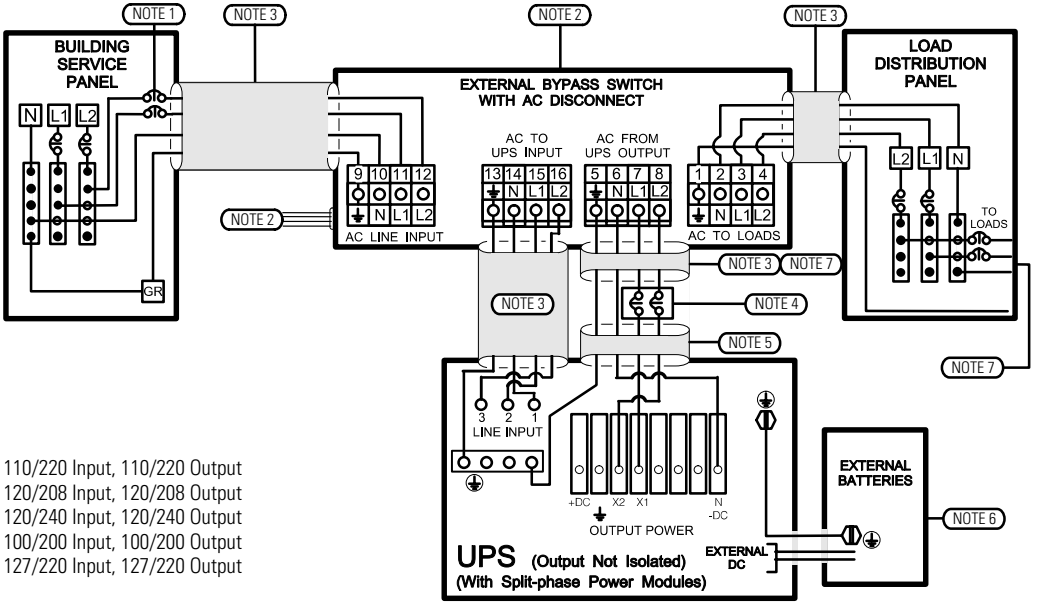
**NOTE 3** All AC circuit conductors, including the neutral and equipment grounding conductors, must be the same size (ampacity), have the same rating (75°C) copper wire, and be sized according to the input circuit breaker. The UPS input and output conductors must be run through separate conduits.

**NOTE 4** The customer must provide output overcurrent protection. See NEC Section 240-21 or local requirements. See Table 13 on page 78 for maximum output overcurrent protection device ratings.

**NOTE 5** See "Equipment Clearances" on page 7 for installation and service clearances before installing the UPS. Use flexible conduit on the UPS or the external battery cabinet if either must be moved.

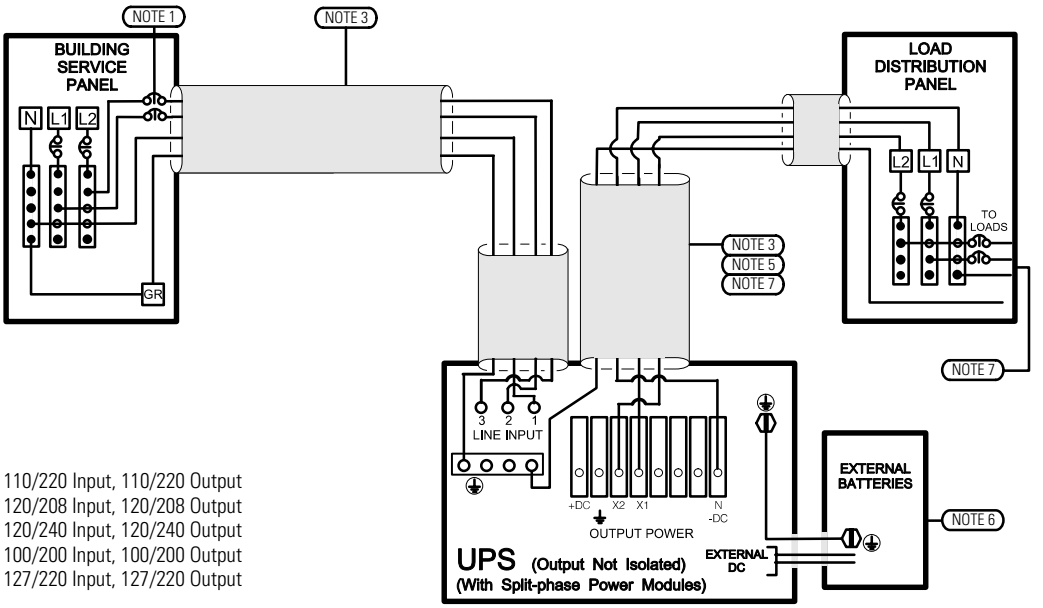
**NOTE 6** External UPS battery cabinets are optional. See "Battery Cabinet Installation" on page 17 for installation instructions.

**NOTE 7** UPS output circuits shall be installed in dedicated conduit systems and not shared with other electrical circuits.



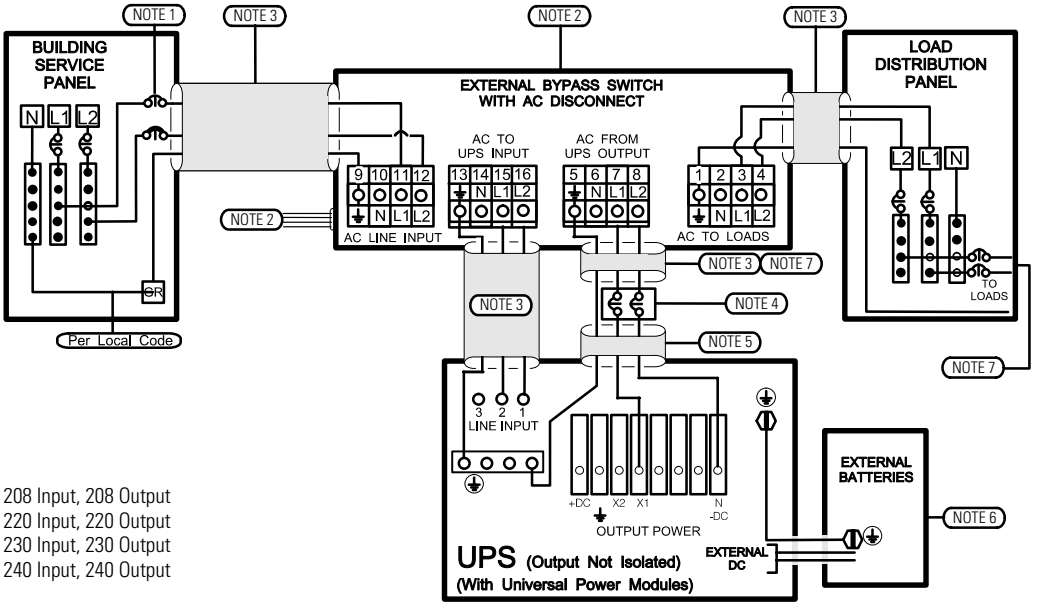

- 110/220 Input, 110/220 Output
- 120/208 Input, 120/208 Output
- 120/240 Input, 120/240 Output
- 100/200 Input, 100/200 Output
- 127/220 Input, 127/220 Output

**Figure 28. External Bypass Switch (L1, L2, N), Non-Isolated Output, and Split-Phase Power Modules**



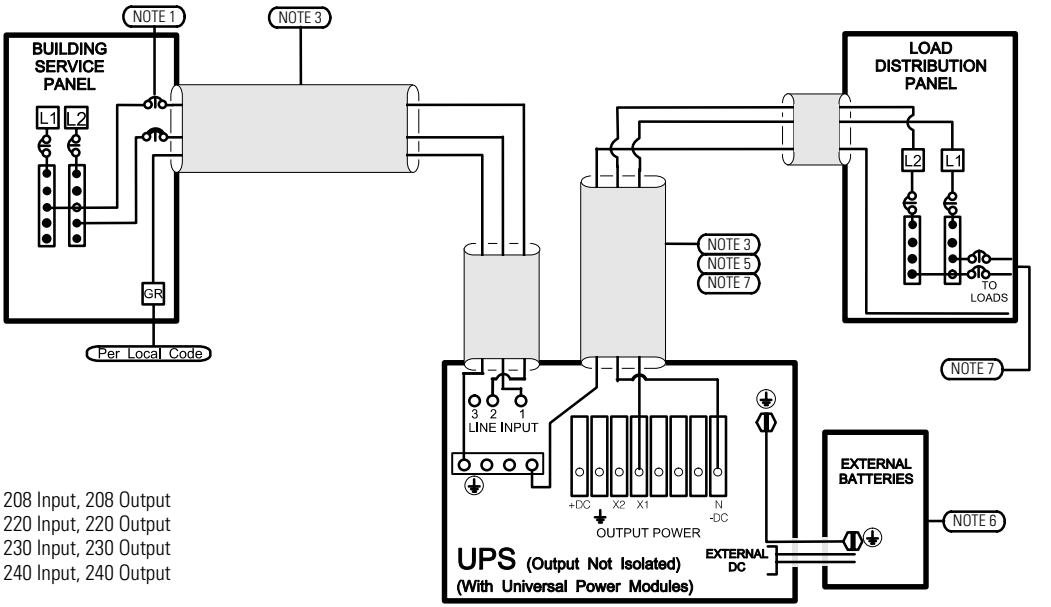

- 110/220 Input, 110/220 Output
- 120/208 Input, 120/208 Output
- 120/240 Input, 120/240 Output
- 100/200 Input, 100/200 Output
- 127/220 Input, 127/220 Output

**Figure 29. No External Bypass (L1, L2, N), Non-Isolated Output, and Split-Phase Power Modules**



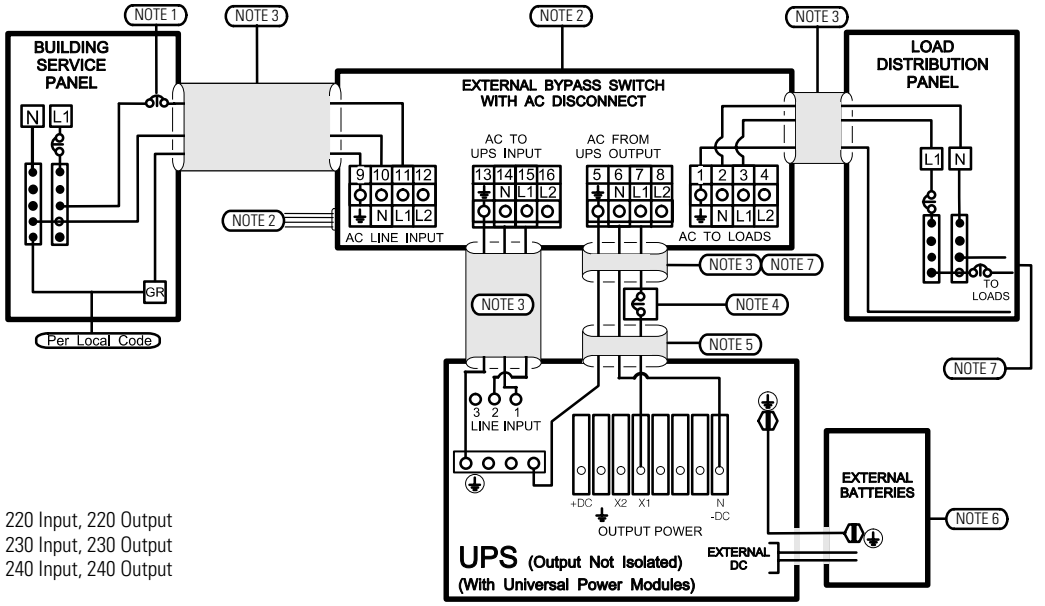

- 208 Input, 208 Output
- 220 Input, 220 Output
- 230 Input, 230 Output
- 240 Input, 240 Output

**Figure 30. External Bypass Switch (L1, L2), Non-Isolated Output, and Universal Power Modules**



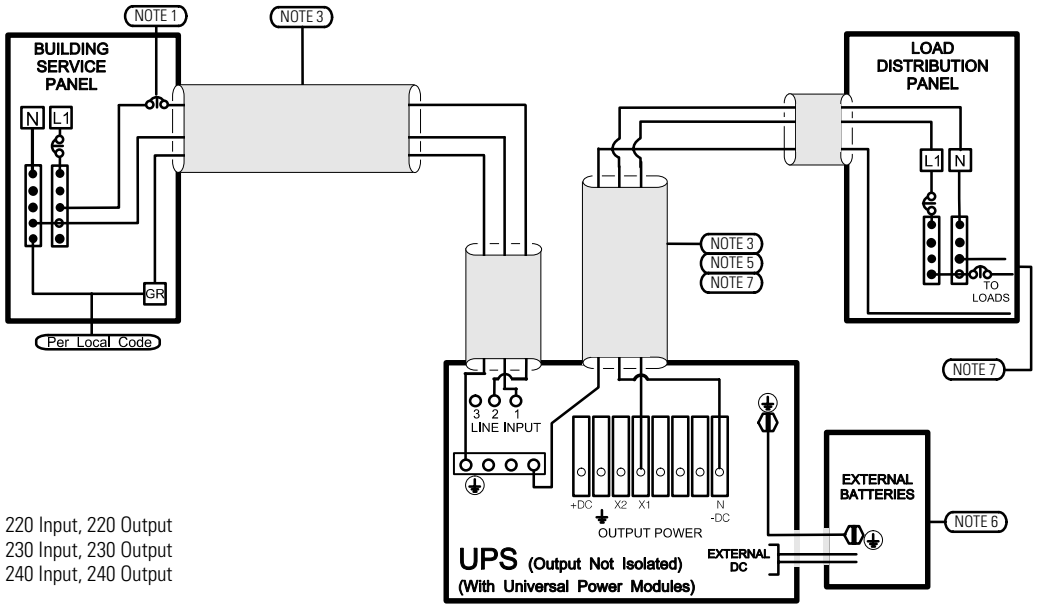

- 208 Input, 208 Output
- 220 Input, 220 Output
- 230 Input, 230 Output
- 240 Input, 240 Output

**Figure 31. No External Bypass (L1, L2), Non-Isolated Output, and Universal Power Modules**




- 220 Input, 220 Output
- 230 Input, 230 Output
- 240 Input, 240 Output

**Figure 32. External Bypass Switch (L1, N), Non-Isolated Output, and Universal Power Modules**




- 220 Input, 220 Output
- 230 Input, 230 Output
- 240 Input, 240 Output

**Figure 33. No External Bypass (L1, N), Non-Isolated Output, and Universal Power Modules**

CHAPTER 5

# ISOLATED OUTPUT WIRING DIAGRAMS

The wiring diagrams in this section are unique and specific to installations in which the output of the Powerware 9170 UPS is galvanically isolated from the input.

Figure 37 through Figure 40 describe output wiring configurations for various output voltages. Use Table 6 to find the desired wiring diagrams and connect the output AC wiring to the proper Powerware 9170 system power terminals. You must also set the operating menu parameter 7-3-4 for the required output voltage as shown in the wiring configuration drawings.

**NOTE** For isolated outputs, all power modules in the Powerware 9170 UPS cabinet must be split-phase modules, which have blue labels.

**NOTE** In isolated-output installations, connect the UPS green and yellow neutral-to-ground wire (N-G bond) to UPS output terminal as illustrated in Figure 36 on page 45.

**Table 6. Wiring Diagrams for Isolated Output**

| UPS Input Voltage | UPS Output Voltage | Output Wires | External Bypass | Wiring Diagrams | | |
|---|---|---|---|---|---|---|
| | | | | Input | Output | System |
| 100/200<br>110/220<br>115/230<br>120/240<br>120/208** | 100/200<br>110/220<br>115/230<br>120/240<br>120/240 | L1, L2, N* | Yes | Figure 25a | Figure 34 | Figure 37 |
| | | | No | Figure 25a | Figure 34 | Figure 38 |
| 120/208**<br>127/220** | 120/208<br>127/220 | L1, L2, N* | Yes | Figure 25a | Figure 35 | Figure 39 |
| | | | No | Figure 25a | Figure 35 | Figure 40 |

*Split-phase power modules required.

**External bypass switch, if installed, must be Break-Before-Make.

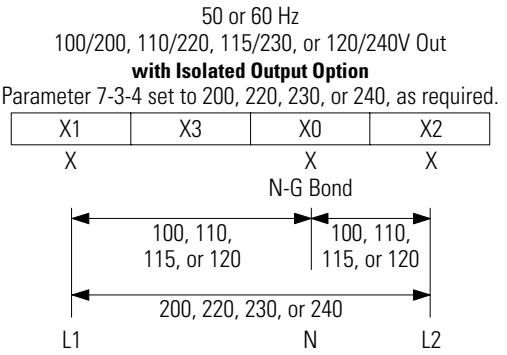



**Figure 34. Isolated Outputs – Single-Phase Voltages**

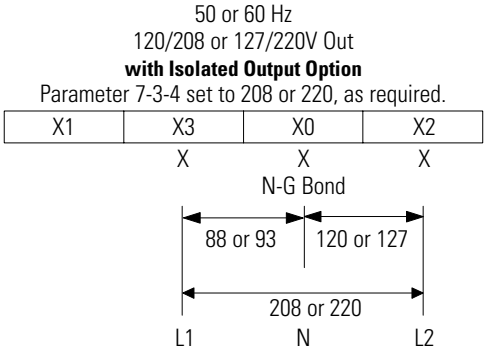



**Figure 35. Isolated Outputs – Derived 3-Phase Voltages**

## Neutral-to-Ground Bonding for Isolated Output

As required under safety regulations issued by various regulatory agencies, the UPS cabinet must have a ground-bond connection for the neutral terminal of an isolated-output system. In such a system, the customer must make the neutral-to-ground (also referred to as N-G or neutral-to-earth) connection after selecting the desired output configuration.

In isolated-output systems, a green and yellow neutral-to-ground bonding wire is supplied, with one end connected to the ground (earth) UPS terminal as shown in Figure 36. The other end of the wire (as shown by * in Figure 36) must be attached to the proper output neutral terminal, as specified in Figure 34 and Figure 35.

If there is any question as to the need for this bond wire, contact your local regulatory agency or your service representative.

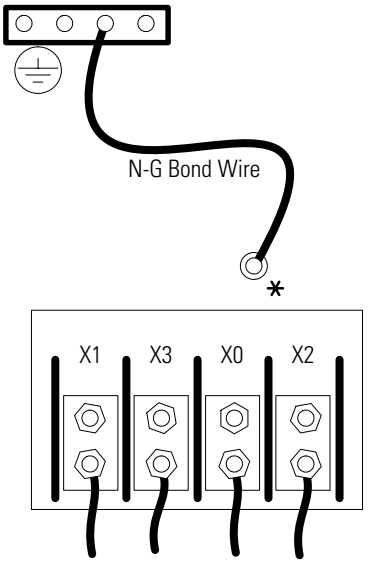



**Figure 36. N-G Bond Wire**

## System Wiring Diagrams

The following notes are referenced in the isolated system wiring diagrams (Figure 37 through Figure 40). To determine which diagram is correct for your site, see Table 6 on page 43.

**NOTE 1** The customer must provide input overcurrent protection as stated in NEC Section 240-21 or local codes. Size the protection device according to local code requirements (see Table 1 on page 26).

**NOTE 2** The UPS bypass switch must be installed within sight of the UPS. To properly install, complete the voltage and phase check procedure in "Startup for Hardwired Units" on page 53. The wires coming from the side of the switch must be connected as described in Step 10 on page 33.

**NOTE 3** The customer must provide and install this ground (earth) connection per NEC Sections 250-20, 250-30, 250-62, and 250-64, or local code requirements.

**NOTE 4** All AC circuit conductors, including the neutral and equipment grounding conductors, must be the same size (ampacity), have the same rating (75°C) copper wire, and be sized according to the input circuit breaker. The UPS input and output conductors must be run through separate conduits.

**NOTE 5** The customer must provide output overcurrent protection. See NEC Section 240-21 or local requirements. See Table 13 on page 78 for maximum output overcurrent protection device ratings.

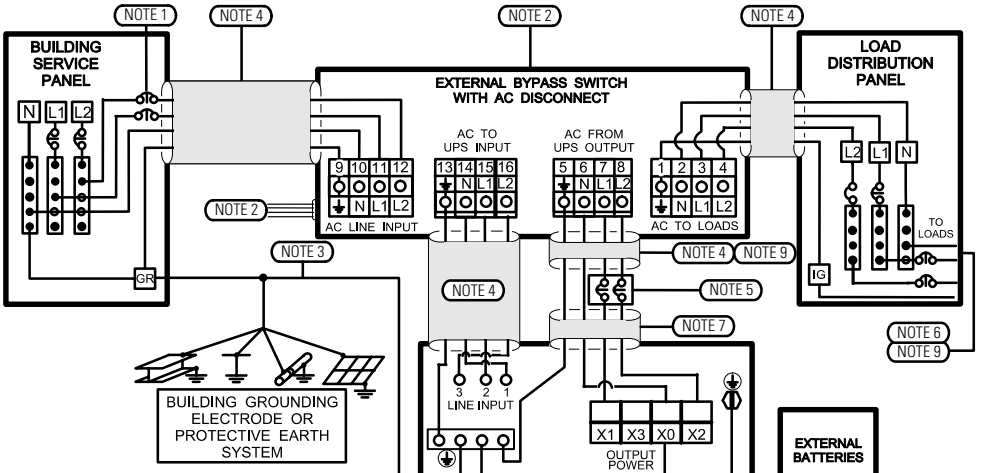
**NOTE 6** For maximum protection against electrical noise, use isolated ground receptacles. See NEC Section 250-146(d).

**NOTE 7** See "Equipment Clearances" on page 7 for installation and service clearances before installing the UPS. Use flexible conduit on the UPS or the external battery cabinet if either must be moved.

**NOTE 8** External UPS battery cabinets are optional. See "Battery Cabinet Installation" on page 17 for installation instructions.

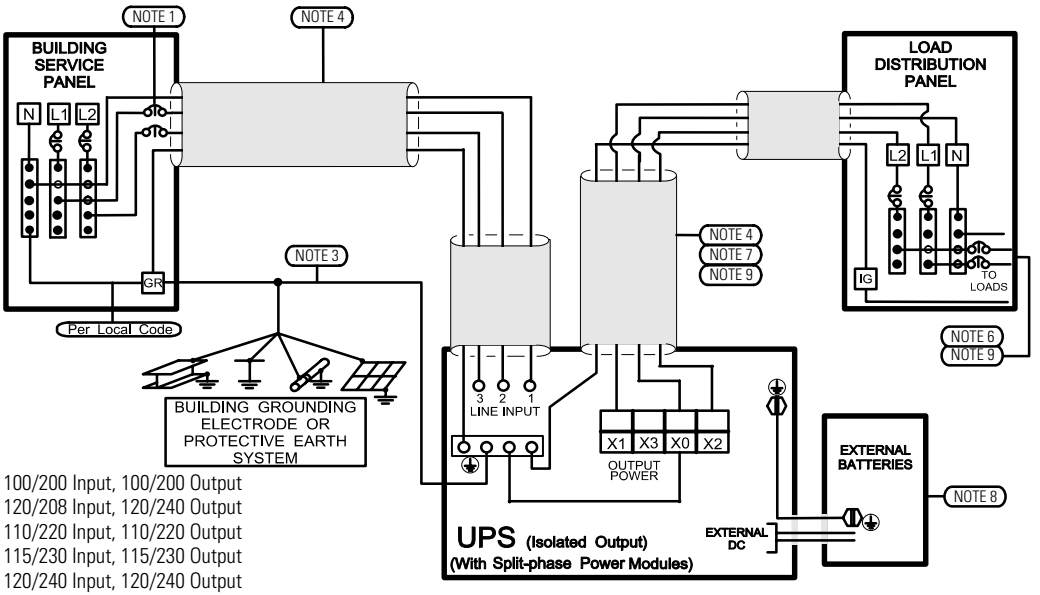
**NOTE 9** UPS output circuits shall be installed in dedicated conduit systems and not shared with other electrical circuits.

**NOTE 10** Do not connect output wiring to X1 when connecting L1 to X3. X1 produces only 88V at 208V nominal output, and 93V at 220V.



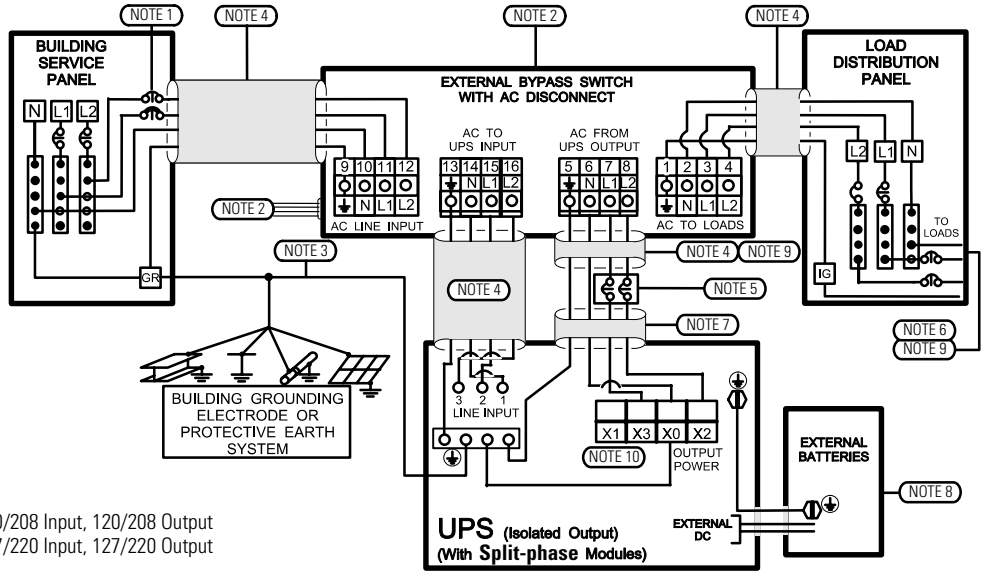

- 100/200 Input, 100/200 Output
- 120/208 Input, 120/240 Output (BBM bypass required)
- 110/220 Input, 110/220 Output
- 115/230 Input, 115/230 Output
- 120/240 Input, 120/240 Output

**Figure 37. External Bypass Switch (L1, L2, N), Isolated Output for Single-Phase Voltages**




- 100/200 Input, 100/200 Output
- 120/208 Input, 120/240 Output
- 110/220 Input, 110/220 Output
- 115/230 Input, 115/230 Output
- 120/240 Input, 120/240 Output

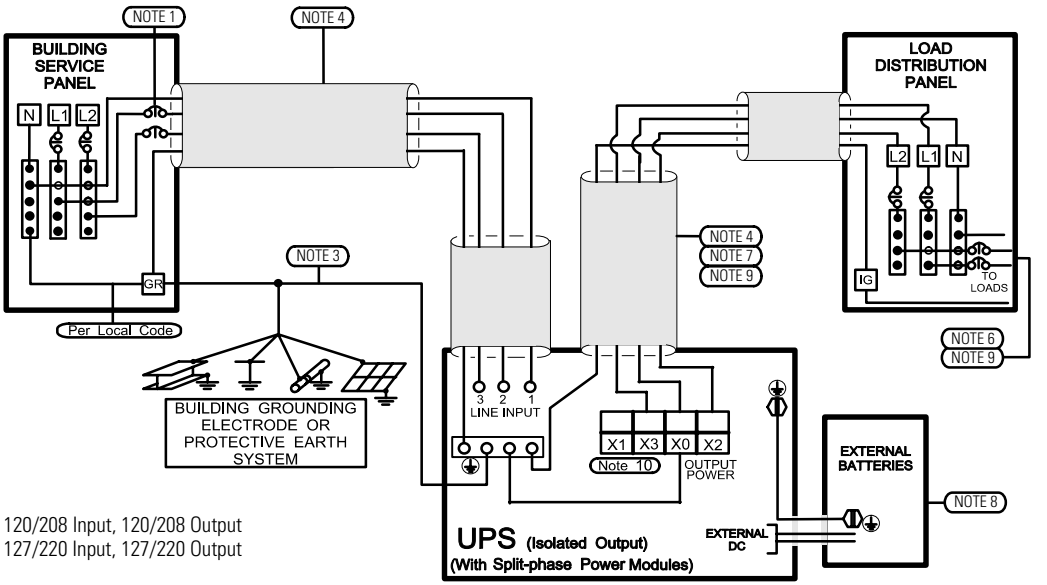
**Figure 38. No External Bypass (L1, L2, N), Isolated Output for Single-Phase Voltages**




- 120/208 Input, 120/208 Output
- 127/220 Input, 127/220 Output

(Voltages require the bypass switch to be BBM; contact your service representative for details.)

**Figure 39. External Bypass Switch (L1, L2, N), Isolated Output for Derived 3-Phase Voltages**




- 120/208 Input, 120/208 Output
- 127/220 Input, 127/220 Output

**Figure 40. No External Bypass (L1, L2, N), Isolated Output for Derived 3-Phase Voltages**

CHAPTER 6

# UPS STARTUP

This section provides step-by-step instructions for starting your Powerware 9170 system. Follow these procedures closely to avoid potential damage to your equipment or the UPS and to protect yourself and others from hazardous operating conditions.

**CAUTION**

- This UPS contains its own energy source (batteries). The output receptacles may carry hazardous voltage even when the UPS is not connected to an AC supply. When AC input voltage is present, the Powerware 9170 system can provide output voltage even though its batteries are disconnected. To confirm that there is no UPS output voltage, always disconnect all of the AC input sources and unplug all strings of internal battery modules; if the UPS has one or more separate battery cabinets, open the DC disconnect switch in each battery cabinet or unplug all battery strings in each battery cabinet.
- 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% max).

## Power and Battery Module Installation

Use the following procedure to install the power and battery modules into the Powerware 9170 cabinet:

1. Remove the front cover(s) of the cabinet.

   The covers have spring latches on the left and right sides that hold them in place.

**NOTE** Place battery modules below all power modules in the UPS cabinet. Two battery modules (side-by-side) are required to complete each battery string.

2. Insert the battery modules into the cabinet.

   Push each module firmly until the front latch snaps to secure the battery module (see Figure 41). Repeat for each additional battery module.

**NOTE** All power modules in the Powerware 9170 UPS cabinet must be of the same type: Universal (single-phase) modules have white labels; split-phase modules have blue labels. Do not mix blue and white modules in the same UPS cabinet.

3. Insert the power modules into the upper slots of the cabinet.

   To insert a power module, lower the front down slightly and lift the rear edge over the safety stop on the center support rail. Keep the module handle extended until the module is fully inserted (see Figure 41).

4. Raise the power module handle to secure the module into the cabinet. Be sure the handle latch snaps into place. Tighten the thumbscrew on the handle.

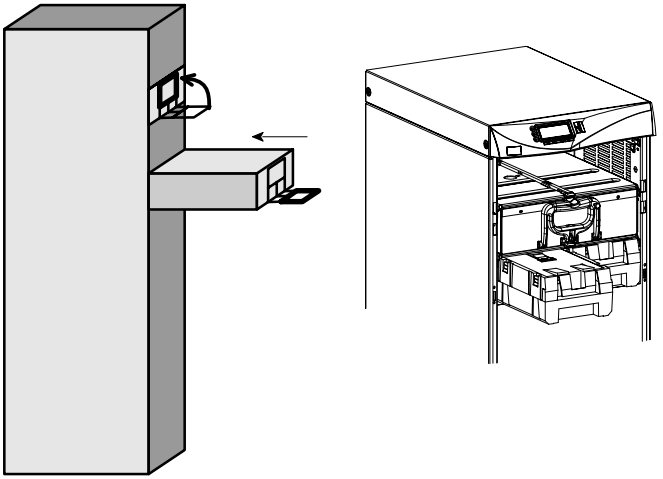


**Figure 41. Inserting the Modules**

5. If you installed an optional battery cabinet, repeat Steps 1 and 2 to install the battery modules.
6. Reinstall the front covers.
7. Continue to the following section, "Startup for Plug-Receptacle Units" if your cabinet has a power cord already attached. If you hardwired the UPS, skip to "Startup for Hardwired Units" on page 53.

## Startup for Plug-Receptacle Units

To start a plug-receptacle unit, use the following steps:

1. Plug the power cable of the unit into an approved, functional power outlet.
2. If external battery cabinets are installed, check the cable connections between the UPS and external battery cabinets.

   Close the DC disconnect switch on the back of each external battery cabinet. Insert the switch key supplied with the cabinet into the center of the switch button and turn clockwise 1/2-turn. Pull the button out to close the switch. Turn the key back counter-clockwise, and remove the key.

3. If you are installing power management software, connect your computer to the UPS communication port using the supplied communication cable.

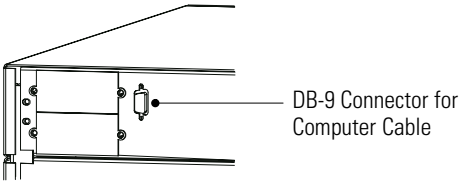



**Figure 42. Communication Port**

4. The UPS front panel display automatically turns on whenever input power is present and at least one power module is installed. Set up the initial operating parameters through the front panel display (see "Initial Startup Parameters" on page 56).

**NOTE** The unit has no physical On/Off switch. The UPS On/Off function must be accessed through the front panel display.

**NOTE** If the UPS has been manually set to operate in Bypass or Battery mode, change the System mode menu selection (menu 2) to Auto to return to normal Auto mode operation.

5. Test proper operation of optional external control signals and computer communication before connecting the load. (See "DB-9 Port Pin Functions" on page 71 for details.)
6. Plug the equipment to be protected into the UPS output receptacles. Turn on the equipment that is connected to the UPS.

   DO NOT protect laser printers with the UPS because of the exceptionally high power requirements of the heating elements.

**NOTE** The total volt-ampere load must not exceed the volt-ampere rating of the entire cabinet. See "Balancing Receptacle Loads" on page 58 for additional information.

## Startup for Hardwired Units

To start a hardwired unit, use the following steps:

1. Confirm that an electrician has completed and tested the connection to the proper power source.
2. Check the cable connections between the UPS and any external battery cabinets.
3. Ensure that all power modules are properly installed and latched into the UPS cabinet.
4. If you are installing power management software, connect your computer to the UPS communication port using the supplied communication cable.

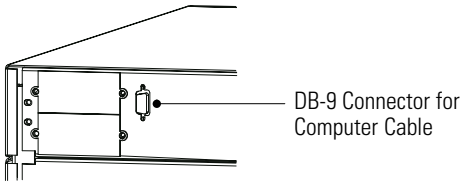



**Figure 43. Communication Port**

5. If your unit is wired to an external bypass switch, you must perform a voltage and phase check (Steps 6 through 16). Otherwise, skip to Step 17.

**CAUTION**

Before operating the bypass switch, use the following procedure to check the wiring for correct installation. To prevent damage to the load, turn off the main circuit breaker in the load service panel or verify that the load cannot receive power from the UPS.

6. At the bypass switch, press the red button and turn the switch to UPS.
7. Remove the cover panel on the bypass switch to gain access to the terminal block for voltage measurements.
8. If external battery cabinets are installed, close the DC disconnect switch on the back of each external battery cabinet. Insert the switch key supplied with the cabinet into the center of the switch button and turn clockwise 1/2-turn. Pull the button out to close the switch. Turn the key back counter-clockwise, and remove the key.

9. Use an AC voltmeter to measure voltages on the terminal block inside the bypass switch cabinet. See Figure 22 on page 32, which shows the terminal numbering for input and output UPS connections.

   Record your measurements in the following chart. The voltages in the first column should be nearly equal to the voltages in the second column. If the values differ by more than a few volts, check the terminal block connections and correct any wiring problems.

| AC Line Input | Measurement | AC from UPS Output | Measurement |
|---|---|---|---|
| L1 to L2 (11 to 12*) | | 7 to 8* | |
| N to L1 (10 to 11*) | | 6 to 7* | |
| N to L2 (10 to 12*) | | 6 to 8* | |

   *For some installations, there is no connection at terminals 6, 8, 10, or 12.

10. If the bypass switch is a Break-Before-Make type, skip this step and proceed to Step 11.

    If the bypass switch is a Make-Before-Break type, verify that the AC voltages from the UPS and the AC line input are in phase. Measure the voltage between the following points on the terminal block. These measurements must be no more than 20 Vac; if they are, call your service representative.

| |
|---|
| Terminal 7 to 11 |
| Terminal 8 to 12 |

11. Measure the AC voltage between the following points on the terminal block. This reading must be no more than 1 Vac; if it is, call your service representative.

| |
|---|
| Terminal 6 to 10 |

12. Switch the bypass switch to LINE. Measure the voltage to the protected equipment (at the load distribution panel) and verify that it is correct.
13. Switch the bypass switch to UPS and verify the voltage to the protected equipment is still correct.
14. Reinstall the cover on the bypass switch, and tighten all cover screws.

15. Reinstall all UPS cover panels.
16. If the UPS will not be operated immediately, switch the bypass switch to SERVICE and push the DC disconnect switch on the back panel of the external battery cabinet closest to the UPS.

    When starting the UPS, apply input power to the UPS by closing the service circuit breaker or turning the bypass switch to the LINE position. If an external battery cabinet is connected, unlock and pull out the DC disconnect switch on its back panel.
17. The UPS front panel display automatically turns on whenever input power is present and at least one power module is installed. Set up the initial operating parameters through the front panel display (see "Initial Startup Parameters" on page 56).

**NOTE** The unit has no physical On/Off switch. The UPS On/Off function must be accessed through the front panel display.

**NOTE** If the UPS has been manually set to operate in Bypass or Battery mode, change the System mode menu selection (menu 2) to Auto to return to normal Auto mode operation.

18. Test proper operation of optional external control signals and computer communication before connecting the load. (See "DB-9 Port Pin Functions" on page 71 for details.)
19. If there are receptacles on the UPS rear panel, plug the equipment to be protected into the UPS output receptacles.

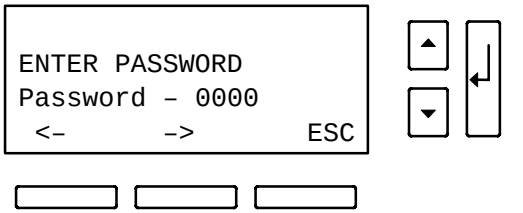
    DO NOT protect laser printers with the UPS because of the exceptionally high power requirements of the heating elements.
20. Turn on the equipment that is connected to the UPS.
21. If there is an external bypass switch, turn it to UPS. Otherwise, close the load distribution circuit breaker(s).

**NOTE** The total volt-ampere load must not exceed the volt-ampere rating of the entire cabinet. See "Balancing Receptacle Loads" on page 58 for additional information.

## Initial Startup Parameters

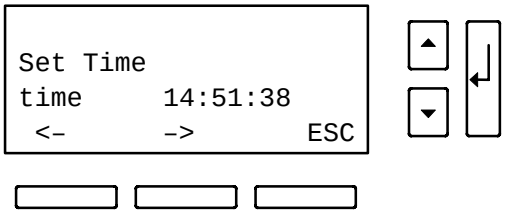
The first time the UPS is turned on, you must set or verify certain operating parameters before placing the UPS into operation. Use the following procedure to set these initial configuration parameters.

1. Enter the correct user security password: 0377. Move left and right by pressing the buttons below the <- and -> on the display. To change the value of the selected digit, press the ▲ and ▼ buttons. When the password shows 0377, press the ↵ button.

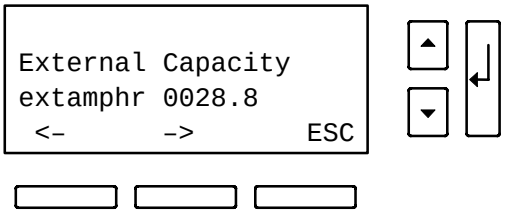



2. Select the desired language for the display. Use the ▲ and ▼ buttons to scroll between English, French, German, and Spanish. Enter your selection by pressing the ↵ button.
3. Set the clock for the local time and date. If the time or the date is correct as displayed, press the ↵ button to advance to the next configuration setting. Time must be entered in 24-hour format.

   Press the <- and -> buttons to move left and right. Press the ▲ and ▼ buttons to increase or decrease the value of each selected digit. When the displayed value is correct, press the ↵ button.

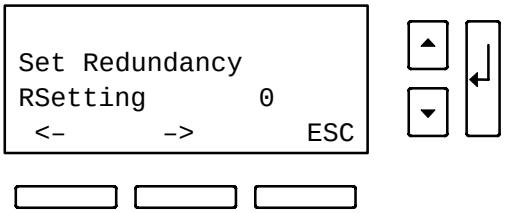


4. The output voltage is the most important operating parameter you must set as part of the initial configuration screens. Select the desired UPS output voltage using the ▲ and ▼ buttons. Possible selections are 200, 208, 220, 230, and 240 Vac. (Low voltages are derived from these voltages, as listed in Table 5 on page 35 and Table 6 on page 43.) Press the ↵ button when the desired output value is displayed.
5. If the system includes any external battery cabinets, record the ampere-hour capacity of batteries installed in these cabinets. Count the number of battery strings (two battery modules, side-by-side equals one string). Each battery string contains 7.2 ampere-hours. Enter the total value in the next startup screen.

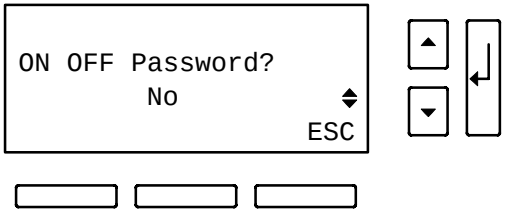



6. The system signals an alarm when required output cannot be maintained with the loss of redundant power modules. The alarm is essentially disabled with a redundancy level set at 0.

   If you want the system to notify you when the number of redundant power modules is less than a specified level, enter a redundancy level. Each increment above 0 indicates the number of modules that can be removed from operation before the alarm occurs. This setting only affects the alarm; the system continues to operate as an N+X system even if this parameter is left at the default value of 0.



7. To password-protect the UPS On/Off function, press the ▲ or ▼ button to make your selection; then press the ↵ button. If a password is required, the UPS On and Off functions are accessible only after first entering the correct password value (0377).




8. The UPS is now ready to operate, and displays the normal On/Off function screen.

   These configuration parameters are accessible during normal UPS operation by pressing the Config button through the front panel display.

## Balancing Receptacle Loads

For Powerware 9170 UPS models with low-voltage output receptacles, it is recommended to divide loads between upper and lower receptacles as equally as possible. (In some configurations, each set of receptacles is limited to one half of the total UPS capacity.) Whether the cabinet has one panel containing eight receptacles, two panels containing 16 receptacles, or three panels containing 24 receptacles, you should try to supply half of the UPS output through the upper half of the receptacles (X1) and the other half through the lower half of the receptacles (X2), as shown in Figure 44.

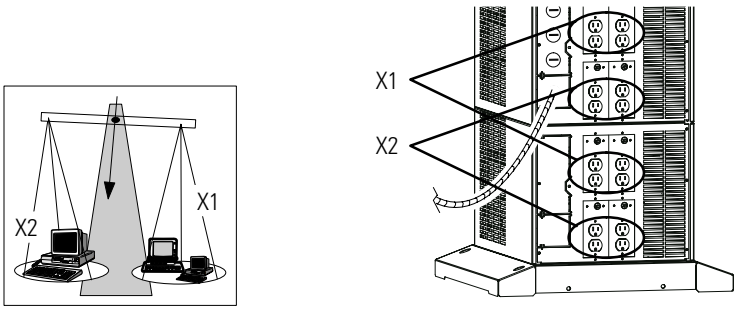



**Figure 44. Balancing Receptacle Loads**

# CHAPTER 7
# OPERATION

The Powerware 9170 UPS operates in several different modes. Normally it operates under internal control, called Auto mode, to automatically protect loads connected to it. It also functions under operator control to enable manual override should servicing or testing be required.

Figure 45 is an illustration of the operating modes. In Auto mode, the UPS automatically switches between modes depending on line and load conditions.

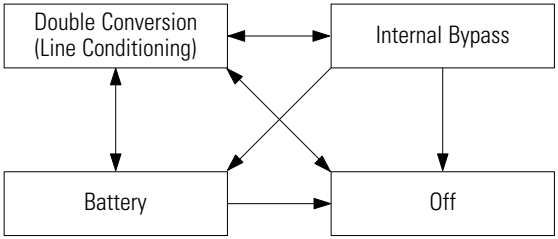



**Figure 45. UPS Operating Modes Under Auto Mode Control**

Double Conversion mode produces output power from the internal DC bus. The AC input power is rectified and boosted to supply this DC bus. The UPS switches automatically to and from Battery mode with no interruption (0 ms transfer time) as AC input power drops and returns. Batteries are charged in this mode.

Battery mode produces power from the batteries to supply the internal DC bus.

Internal Bypass (Bypass) mode shunts power flow around the DC/AC internal circuitry to keep the output powered with no line conditioning. Electromagnetic interference (EMI) and surge circuitry still protect the loads from voltage spikes and noise.

The High Efficiency (H.E.) mode is a user-programmable automatic mode of operation. This mode allows power to flow through the internal UPS bypass path for as long as AC input stays within the user-defined setpoints. If the input voltage or frequency deviates beyond these setpoints, the Powerware 9170 system transfers to the Double Conversion mode of operation. Complete loss of input voltage causes the UPS to transfer to Battery mode. While in H.E. mode, the Powerware 9170 system provides passive EMI filtering in the power path.

Off mode turns off the output and most internal circuitry. Within this mode, another mode (Sleep) turns off all internal circuitry when AC line is not present and battery voltage drops to a low threshold. If AC input voltage is not present in Off mode, the user can direct the UPS to enter Sleep mode by selecting the Battery Protect (BP) feature. When AC input voltage returns in the Off mode (caused by a low battery alarm condition), the UPS automatically recovers and, if the Auto Restart parameter is enabled, switches to Double Conversion. Auto Restart is enabled as a factory-default.

The UPS will not automatically recover from the Sleep mode, regardless of the state of the Auto Restart parameter.

Figure 46 shows the basic functional elements of the UPS.

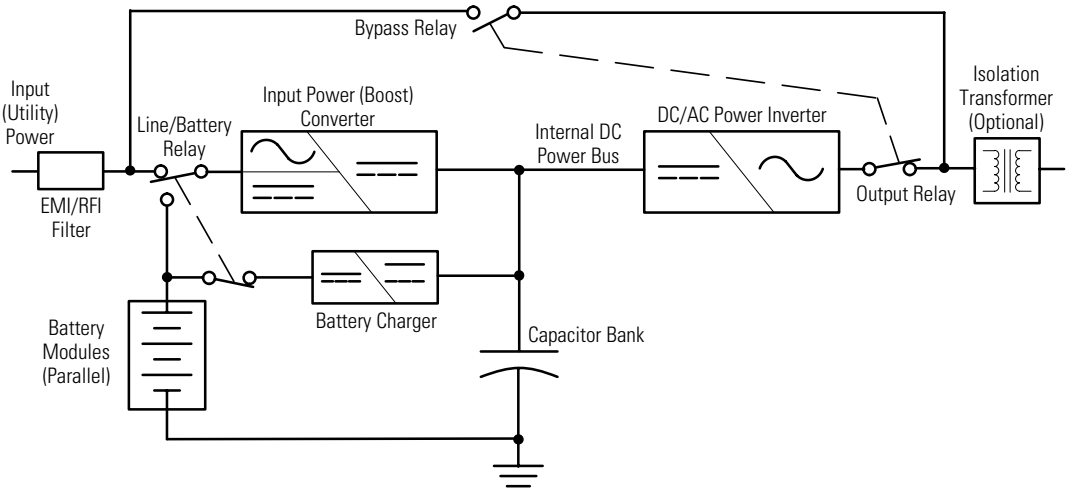



**Figure 46. Powerware 9170 UPS Functional Block Diagram**

## Removing Input Power

Always put the Powerware 9170 UPS into the Off mode before removing input power. Powerware 9170 system batteries will discharge if the input line voltage is disconnected or turned off without first turning off the Powerware 9170 UPS.

If the input power source will be disconnected or turned off for more than a day or two, you should put the UPS into Sleep mode. Do this by turning the UPS off, removing AC input power, and then pressing the On button and selecting Battery Protect (BP). Sleep mode allows the UPS to remain unpowered for up to six months without having to remove or recharge batteries.

Failure to properly power down the Powerware 9170 UPS could permanently damage any installed batteries. Also, if batteries become severely discharged, the UPS might not start immediately when input power is restored.

## Turning the UPS On

If the UPS has been turned off, press the ON button through the front panel display to turn the UPS on again.

If the UPS has been manually set to operate in Bypass or Battery mode, change the System mode menu selection (menu 2) to Auto to return to normal Auto mode operation.

**NOTE** The UPS will not start operating if AC input voltage or frequency is beyond acceptable limits or if the system mode selection is set to Battery. The UPS can not go directly from Off to Battery.

## Front Panel Display

The front panel has an alphanumeric display, three LED indicators, and six pushbuttons as described in Figure 47 and in Table 7.

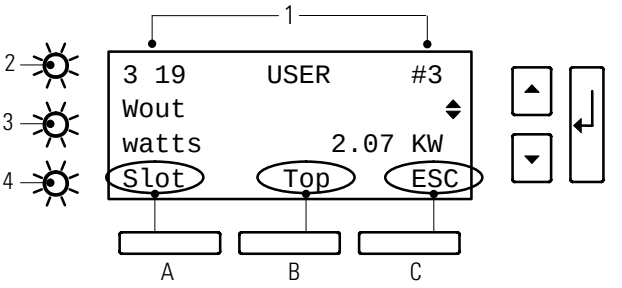



**Figure 47. UPS Front Panel**

**Table 7. Front Panel Details**

| Item | Description |
|---|---|
| 1 | Alphanumeric display of unit function and operating parameters. Also displays alarm/data logs. |
| 2 | Alarm LED (red). Illuminates to signal that the unit has detected an alarm condition. |
| 3 | Battery LED (yellow). Illuminates to signal that the unit is operating on battery power and producing output voltage. |
| 4 | Line LED (green). Illuminates to signal that the unit is operating on AC utility power and producing output voltage. |
| A and B | Multi-function buttons, as labeled by the bottom line of the alphanumeric display. |
| C | Menu/Escape button, for moving into and out of display menus. Also, for avoiding a change to a parameter value. |
| ▲ and ▼ | Menu scroll up and down buttons. Also, for increasing/decreasing parameter value digits. |
| ↵ | Enter button, to activate/accept displayed parameter or operating mode. |

## Using the Front Panel Display

The front panel display shows several important things (see Figure 48). The numbers in the upper left corner (for example, 3 19) are the display location within the operating menu structure. The word in the top center (for example, USER ) is the security level, which allows various operating parameters to be changed.

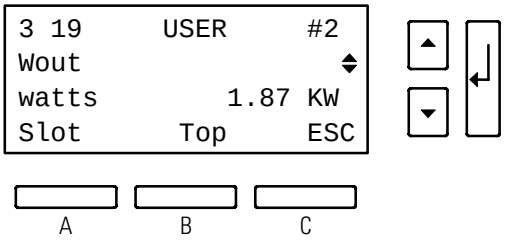



**Figure 48. Typical Front Panel Display**

The number in the upper right corner (for example, #2) identifies the cabinet slot (numbered from the top down) for a specific power module's parameters. #0 is defined as System, enabling you to observe overall system operation.

One or two triangles at the right of the display tells you which arrow buttons are active for moving to various parameters within a menu level. See Figure 50 on page 68 for the complete system menu.

The words or symbols in the bottom line of the display define the function of the three buttons below the display. In Figure 48, Slot (button A) enables you to observe the operation of a specific power module (the module in slot #2, in this case) or the overall system (selected as slot #0). Top (button B) takes you to the top item in the current menu level (in this case, 3 1). And ESC (button C) enables you to move out of the current menu level (in this case, to menu 3).

During normal operation, the display appears as shown in Figure 49. Md: indicates the current UPS operating mode and St: indicates the operational state. The number of power modules (M) and number of battery module strings (B) that are currently online, and the total number of module slots in the cabinet—for example, M4-B7-12—is shown in the upper right corner of the display. (The count of battery strings does not include additional battery strings contained in connected external battery cabinets.)

Operating parameters shown on the third line of the display vary depending on the operating mode. As shown in Figure 49, the UPS output voltage is displayed while the Powerware 9170 UPS operational state is ON LINE.

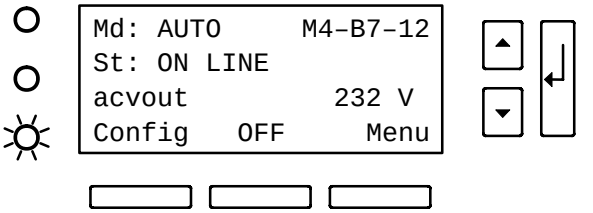



**Figure 49. Front Panel Display (Normal Operation)**

## Parameters

The parameters describe the Powerware 9170 system operation. Some useful parameters are input and output voltage, input and output current, and battery voltage. The UPS measures or records many other parameters. Some are operator-adjustable, such as the local date and time and various operating limits. All parameters are password-protected. Although every operating condition and parameter is accessible through the front panel display, you may change a value **only** if you have entered the correct password to allow you to change it.

After making any parameter changes, delete the password level to protect the UPS against unauthorized parameter changes. Press the Top or ESC buttons to return to the Enter Password screen. Press the ↵ button to view the default value (0000), and press the ↵ button again to enter 0000, which invalidates the previous level.

**NOTE** After 10 minutes of inactivity, the UPS automatically deletes any active password level and returns to the normal running display.

## Changing Parameter Settings

The method of changing any operating parameter follows the same procedure as setting initial parameters, as described in "Initial Startup Parameters" on page 56. Begin by entering the correct password to allow the change. Use the Menu Map (Figure 50 on page 68) to find the parameter you need to change, and move through the menu structure until the parameter name appears on the display. Press the ↵ button to access the parameter value and, when you have changed the value, press the ↵ button again to save the change. To avoid making a change, press ESC instead of the ↵ button.

## Reading the Powerware 9170 System Logs

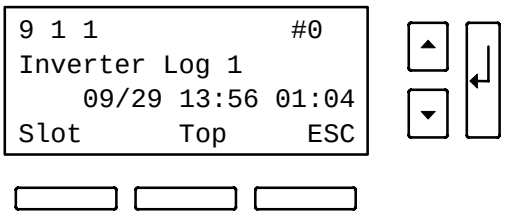
The Powerware 9170 system makes an entry in its logs each time it sounds an alarm or runs on battery power. This information can help in diagnosing power problems. You can display the UPS Inverter and Alarm logs on the unit's front panel display; these logs are in menu 9.

### Inverter Log

The inverter (Battery mode) log is in menu 9, submenu 1. Move through the menu structure by pressing the Menu button and pressing the ▼ button to move down to menu 9. Press ↵ to move to submenu 1 and press ↵ again to view the most recent entry in the inverter log.

The log stores up to 16 entries, in chronological order. You can use the ▼ and ▲ buttons to scroll up and down through the log entries. Each entry shows the date and time the unit switched to battery operation (in 24-hour format), and the duration of battery operation (in hours and minutes).

A typical entry might look like this:



In this example, the most recent inverter log (9 1 1) is being displayed. If the unit is still running on inverter (battery power), an asterisk (*) is displayed beside the date. “09/29” is the date of the Battery mode operation: September 29. “13:56” means that Battery mode operation started at 1:56 p.m. And “01:04” means the batteries supplied power for 1 hour and 4 minutes. For further information about the entry, hold down ↵. The bottom display line indicates a slot (drawer) number and a reason code associated with the entry.

Table 8 contains a description of all inverter reason codes.

**Table 8. Inverter Log Reason Codes**

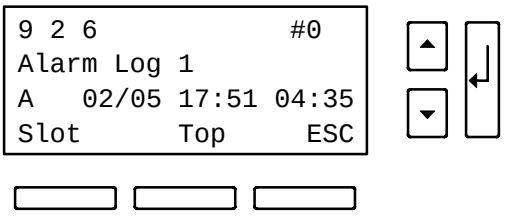
| Reason Code | Meaning | Explanation |
|---|---|---|
| 1 | Line was Lost | Input voltage was lost. |
| 2 | Battery Test | Battery test initiated inverter operation. |
| 3 | Manual | Operator initiated inverter operation. |

## Alarm Log

The alarm log is in menu 9, submenu 2. Move through the menu structure by pressing the Menu button and pressing the ▼ button to move down to menu 9. Press ↵, and press the ▼ button to move down to submenu 2. The display shows the most recent entry in the alarm log.

The log stores up to 16 entries, in chronological order. You can use the ▲ and ▼ buttons to scroll up and down through the log entries. Each entry shows the alarm code, the alarm date and time (in 24-hour format), and the duration (in hours and minutes.)

A typical entry might look like this:



In this example, the sixth most-recent alarm (9 2 6) is being displayed. "A" means the Powerware 9170 system sounded alarm A (Low Battery). If the alarm is still active, an asterisk (*) is displayed beside the letter alarm code. "02/05" is the date the alarm occurred: February 5. "17:51" means the alarm sounded at 5:51 p.m. And "04:35" means the alarm was active for 4 hours and 35 minutes.

See Table 9 and "Alarms" on page 83 for information about the alarm codes.

**Table 9. Alarm Log Reason Codes**

| Reason Code | Meaning | Explanation |
|---|---|---|
| 4 | Open Cell | Battery failure caused by open cell. |
| 5 | Weak Battery | Battery failure caused by load test. |
| 6 | Phase Error | Internal error – contact your service representative. |
| 7 | Module Failure | Internal error – contact your service representative. |
| 8 | Excessive Transfers | Internal error – contact your service representative. |
| 9 | Precharge Failure | Internal error – contact your service representative. |
| 10 | Insufficient Batteries | Too few battery modules; decrease load or add battery modules. |
| 11 | Insufficient Modules | Too few power modules; decrease load or add power modules. |

## Menu Map

Figure 50 is an illustration of how to access all Powerware 9170 system parameters. The menu structure has 11 primary-level menus, named Password (1) through Parameters (11). Under each primary menu are secondary items, each numbered by its location under the primary menu. Use the various buttons as shown in the map to navigate to the desired parameter. If you need to change the value of a parameter, you must begin by entering the correct password value first. Parameter values can be observed, but most cannot be changed, even though you have entered the correct user password.

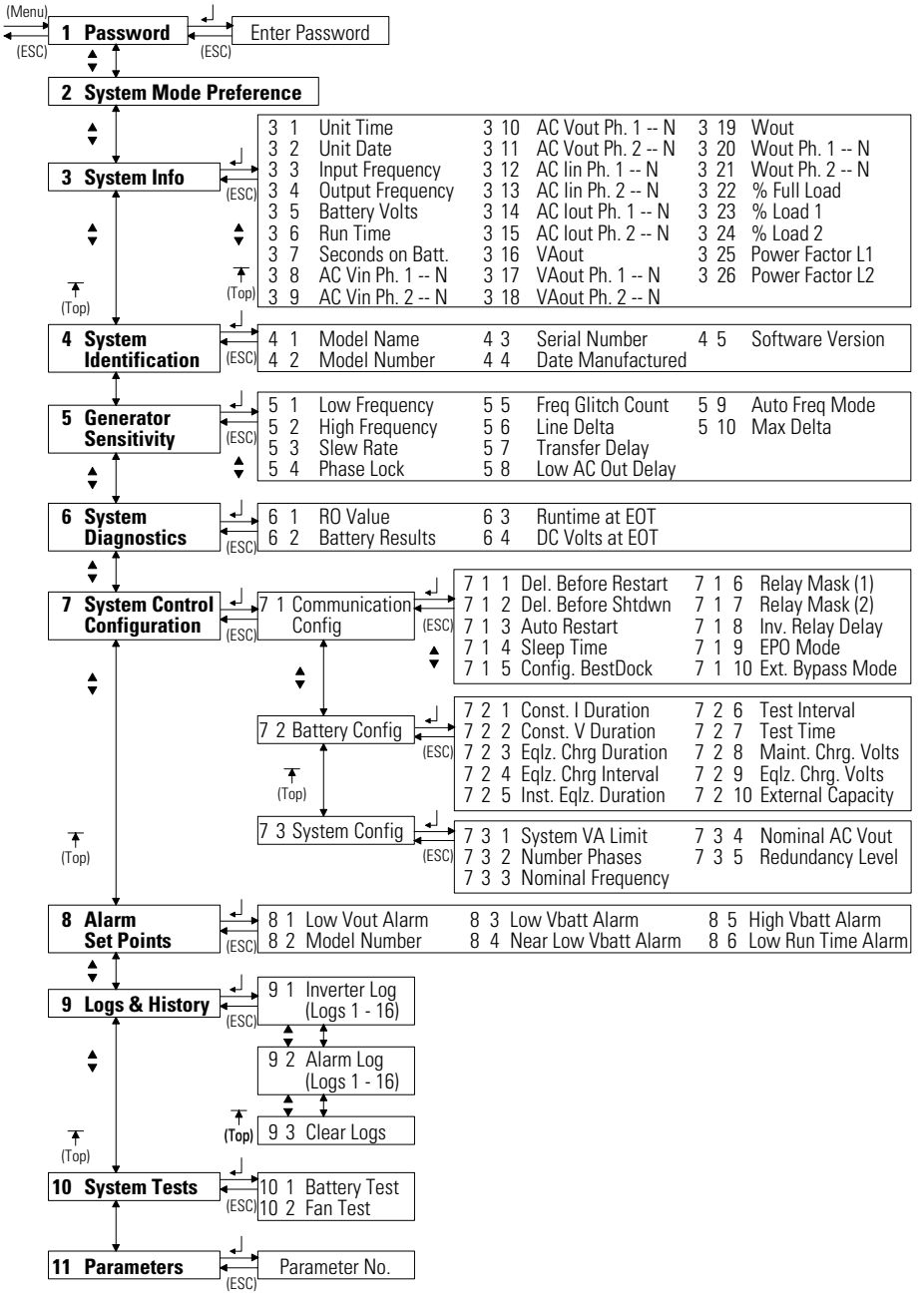



**Figure 50. Powerware 9170 System Menu Map**

CHAPTER 8

# COMMUNICATION

Powerware offers several methods of communicating with your Powerware 9170 system in addition to the front panel display:

- CheckUPS® II Software
- RS-232 Communication
- Optional Interface Kits
- Relay Card
- BestLink™ Telecom Modem Controller
- Optional Internal BestLink SNMP/WEB Adapter
- BestDock Communication Slots
- Dedicated Input Signals

## CheckUPS II Software

Each Powerware 9170 UPS ships with CheckUPS II software and an interface cable. To begin installing CheckUPS software, see the instructions accompanying the CheckUPS software CD-ROM.

CheckUPS software uses an RS-232 serial link to communicate with the UPS, and (using Windows®) it provides you with up-to-date graphics of UPS power and system data and power flow. It also gives you a complete record of critical power events, and it notifies you of important UPS or power information. If there is a power outage and the Powerware 9170 system battery power becomes low, CheckUPS software can automatically shut down your computer system to protect your data before the UPS Low Battery shutdown occurs.

## RS-232 Communication

You can connect the Powerware 9170 system to a computer running special terminal emulation software available from Powerware. The Powerware 9170 system communicates with your computer using an advanced binary protocol. For more information, contact your service representative.

## Optional Interface Kits

For computer systems that already have UPS monitoring software, Powerware offers interface cable kits for connecting the Powerware 9170 system to your computer system. The kit includes the cable, adapters, and instructions.

## Relay Card

This interface provides true relay contact output to peripheral devices. Outputs are user-selectable as normally open or normally closed.

## BestLink Telecom Modem Controller

This interface provides remote monitoring and control of the UPS through a customer-supplied modem. In the event of an alarm condition, this unit also provides automatic notification via numeric or alphanumeric pager, e-mail, or fax.

## Optional Internal BestLink SNMP/WEB Adapter

This adapter provides the Powerware 9170 system with its own ethernet network connection, allowing it to be remotely monitored and controlled via industry-standard internet browsers. The HTML interface enables UPS monitoring and management from anywhere on the internet or within your intranet. In addition, third-party Simple Network Management Protocol (SNMP) software packages may also be used to communicate remotely with the Powerware 9170 system. The BestLink SNMP/WEB Adapter also allows UPS-dependent computer systems to automatically shut down during extended power outages using the NetWatch client software provided on the CheckUPS II CD-ROM or web site.

## BestDock Communication Slots

The Powerware 9170 UPS has two communication slots that allow quick installation of the optional BestLink SNMP/WEB adapter or other similar communication interfaces. These interface adapters extend the capabilities of the Powerware 9170 system to provide compatibility with network and remote monitoring/management systems.

## Dedicated Input Signals

**Emergency Power-Off (EPO):** Connection to a facility Emergency Shutdown switch provides a method for emergency Powerware 9170 system shutdown. Opening this connection creates an immediate shutdown of the Powerware 9170 UPS output.

**Bypass:** The signal from an external bypass switch, to isolate the Powerware 9170 system for maintenance purposes, tells the UPS to go into Internal Bypass mode.

**On-Generator:** An external signal that the input power is being supplied by a generator tells the UPS to accept wider input power frequency limits.

See Figure 21 on page 31 and Figure 24 on page 34 to make the connection for all dedicated input signals.

## DB-9 Port Pin Functions

Table 10 explains the functions of the pins on the Powerware 9170 DB-9 port. This port is on the Powerware 9170 UPS rear panel, as shown in Figure 42 on page 52.

**Table 10. DB-9 Port Signals**

| Pin | Function | Description |
|---|---|---|
| 1 | RS-232 Receive Data | Receives incoming RS-232 communication data. The data protocol is 9600 baud, 8 bits, no parity, 1 stop bit, no handshaking.<br>NOTE In battery operation, a 5-second +Vdc (RS-232 low) signal applied to this pin causes the UPS to shut down after a delay of X minutes, regardless of the return of AC input power. This time is defined by the External Shutdown mode parameter n, where n and X are related as follows:<br>n X n X n X<br>0 2 3 3 6 20<br>1* 2 4 5<br>2 1 5 10<br>* For n=1, the UPS stays off when AC input power returns. For all other values of n, the UPS restarts 12 seconds after AC input power returns. |
| 2 | RS-232 Transmit Data | Sends outgoing RS-232 communication data. The data protocol is 9600 baud, 8 bits, no parity, 1 stop bit, no handshaking. |
| 3 | Normally-Open On-Battery Contact* | A normally open contact that closes (pulls to Common) 15 seconds after the UPS switches to battery power. |
| 4 | Common | The ground reference for all input and output signals. |

| Pin | Function | Description |
|---|---|---|
| 5 | Normally-Open Low-Battery-Alarm Contact* | A normally open contact that closes (pulls to Common) to signal a Near Low Battery or Low Runtime alarm. Values that affect this contact closure may be user-programmed. |
| 6 | Reserved | Reserved |
| 7 | Immediate Shutdown Mode | Set by External Shutdown parameter, n = 0:<br>Grounding this pin for 5 seconds causes the UPS to switch immediately to the Off mode. When AC input power returns, the UPS will not restart without user intervention. |
| | Remote Shutdown Mode | Set by External Shutdown parameter, n = 1 or greater:<br>In battery operation, grounding this pin for 5 seconds causes the UPS to shut down after a delay of X minutes, regardless of the return of AC input power. This time is defined by the External Shutdown mode parameter n, where n and X are related as follows:<br>n X n X<br>1 2 4 5<br>2 1 5 10<br>3 3 6 20 |
| 8 | Normally-Closed On-Battery Contact | A normally closed contact that opens (releases from Common) 15 seconds after the UPS switches to battery power. |
| 9 | Normally-Open Bypass-Switch-Status Contact* | A normally open contact that closes (pulls to Common) whenever the UPS is in internal bypass mode or is being externally bypassed and is being signalled of the external bypass. |

*Contacts consist of open-collector circuits capable of switching up to +40 Vdc, 50 mA resistive load.

CHAPTER 9

# MAINTENANCE

## Routine Maintenance

**NOTE** Technicians must observe important safety precautions while performing these checks.

The Powerware 9170 system is designed to provide years of trouble-free operation. Its internal control system checks the batteries and inverter periodically to ensure reliable operation. In fact, you'll probably find that your Powerware 9170 system requires less maintenance than any of your other computer peripherals.

Nevertheless, the Powerware 9170 UPS and optional external battery cabinets do require some attention to assure continued reliable service. Powerware recommends that you schedule preventive maintenance checks at least every six months. At these checks, the service technician should follow Powerware's recommended maintenance schedule, which includes the following items:

- Check operating environment for clean, cool, dry conditions.
- Inspect and clean the unit.
- Check operation of fans (power modules).
- Check and tighten all connections.
- View and record the alarm and inverter logs.
- Check the batteries.
- Check the displayed UPS readings against actual measurements and recalibrate if necessary.
- Perform a system test.
- Check and record the values of the parameters in menu 3 online and on battery.
- Check the MOV surge suppression pack.

For more information on preventive maintenance checks, contact your service representative.

## Storage Temperature

Store the Powerware 9170 battery modules (in the unit or battery cabinet) at –20 to +40°C (–4 to +104°F). Batteries will have a longer shelf life if they are kept below +25°C (+77°F). The Powerware 9170 UPS or battery cabinet without batteries may be stored at –40 to +60°C (–40 to +140°F).

## External Bypass Switch (Make-Before-Break Only) Operation

Before turning the Powerware MBB bypass switch, you must press the red button located next to the handle. This button serves two purposes. It sends an electrical signal to the UPS to switch to the internal Bypass mode (if it is not already operating in that mode). The button also operates a mechanical interlock, to prevent the switch from being turned without first signaling the UPS.

**NOTE** When the red button is released, the UPS remains in its internal Bypass mode and must be manually returned to the Auto mode by selecting that mode on the front panel display.

## Battery Replacement

The Powerware 9170 hot-swappable feature allows you to replace the battery modules easily without disconnecting the load or damaging the batteries.

**NOTE** The Powerware 9170 UPS will operate with uncharged (or no) batteries, but will have limited (or no) battery backup capability. Backup protection requires at least three battery strings for every four power modules.

Use the following procedure to replace battery modules in pairs.

1. Remove the front panel bezel(s) covering the battery modules you need to replace. Label the original module with masking tape or some other identifier.
2. Grasp the battery module handle and press down on the latch release.
3. Pull the module out approximately 7″ (17 cm) to the secondary stop on top of the module.

4. Press down on the secondary stop release, pull the module out further, and support the module weight with your second hand as you remove the module from the cabinet. Remove the battery module beside the first in a similar manner.
5. After removing a pair (one string) of battery modules, install a replacement pair. Replacements may be installed in empty cabinet slots before removing original battery modules.
6. When all desired battery modules have been replaced, reinstall the front panel bezel(s).

## Power Module Replacement

The Powerware 9170 hot-swap feature allows you to replace a power module easily without disconnecting the load or damaging the UPS.

**NOTE** The UPS may switch to internal bypass if the remaining power modules are insufficient to supply the required power. If empty slots exist, install replacement modules before removing original ones.

Use care in removing and installing power modules. To remove a power module:

1. Loosen the thumbscrew on the module handle. Press down on the latch release at the center of the module handle and pull the handle down.

   As the handle fully extends, the module disconnects. Slide the module slowly out of the cabinet.
2. Use two hands to support the module. When fully extended, lower the front down slightly and lift the rear edge over the safety stop on the center support rail.
3. Treat the original and replacement modules with care to avoid damaging connectors or internal circuitry. Label the original module with masking tape or some other identifier. Record the serial number of the replacement module for your warranty.

4. Insert a replacement module by sliding it carefully into the cabinet. Lower the front down slightly and lift the rear edge over the safety stop on the center support rail. Keep the module handle extended until the module is fully inserted.
5. Push the module in firmly. Raise the power module handle to secure the module into the cabinet. Be sure the handle latch snaps into place. Tighten the thumbscrew on the handle.

CHAPTER 10

# SPECIFICATIONS

This section provides the following specifications for the Powerware 9170 models:

- Electrical input and output
- Isolation
- Model specifications
- Environmental and safety
- Battery
- Weights and dimensions

**Table 11. Electrical Input and Output**

| | |
|---|---|
| Nominal Input Voltage | 208–240 Vac or 100/200, 110/220, 120/208, 120/240, 127/220 Vac |
| Input Voltage Range | 176–276 Vac* |
| Nominal Output Voltage | 208–240 Vac or 100/200, 110/220, 120/208, 120/240, 127/220 Vac |
| Nominal Frequency | Online: 50/60 Hz auto-sensing; output frequency tracks input frequency to selectable limit (±0.1 to ±5.0 Hz; ±3.0 Hz default); switches to battery operation outside this tolerance<br>On battery: 50 Hz or 60 Hz ±0.1 Hz. |
| Regulation | ±3% load regulation (under any line, load, or battery condition) |
| Voltage Waveform | Sine wave; <3% THD at rated linear loads, computer-grade power |
| Overload Capability | 150% for 10 seconds; 300% for 12 cycles |
| DC Input Protection | DC fuse and battery charger overvoltage limit network |
| Output Protection | Microprocessor-sensed overvoltage and overcurrent, with fuse backup |
| Efficiency in Double-Conversion mode | >88% |
| Efficiency in Double-Conversion mode (with Isolated Output) | >84% |
| Efficiency in Bypass mode (with Isolated Output) | >96% |

*176–250 Vac for universal power modules producing 208 Vac nominal output voltage.

**Table 12. Isolation**

| | |
|---|---|
| Model 0650C Output Neutral-to-Ground Bonding | ±3% load regulation (under any line, load, or battery condition)<br>Neutral is carried through from input to output; a separate neutral-to-ground bond is not required |
| Model 0650I Isolation, Including Output Neutral-to-Ground Bonding | True, separately-derived power source as defined by National Electrical Code Article 250-5d, with output neutral bonded to ground. No direct connection between input and output; neutral-to-ground bond is required; other local codes may take precedence. |

**Table 13. Model Specifications**

| kVA | Watts | Input Current for 208/220/230/240V* | Output Current for 208/220/230/240V | Recommended Input Service* | Heat Dissipation Double-Conversion Mode |
|---|---|---|---|---|---|
| 3 | 2100 | 17/16/15/15A | 14.4/13.6/13.0/12.5A | 25A | 285W (0.98 kBTU/hr) |
| 6 | 4200 | 31/29/28/27A | 28.8/27.2/26.0/25.0A | 40A | 570W (1.95 kBTU/hr) |
| 9 | 6300 | 46/44/42/41A | 43.2/40.8/39.0/37.5A | 60A | 860W (2.93 kBTU/hr) |
| 12 | 8400 | 62/59/56/53A | 57.6/54.4/52.0/50.0A | 80A | 1145W (3.90 kBTU/hr) |
| 15 | 10500 | 77/73/70/67A | 72.0/68.0/65.0/62.5A | 100A | 1430W (4.88 kBTU/hr) |
| 18 | 12600 | 93/87/84/80A | 86.4/81.6/78.0/75.0A | 125A | 1720W (5.85 kBTU/hr) |
| Voltages Only Available with Split-Phase Modules | | | | | |
| kVA | Watts | Input Current for 200V* | Output Current for 100/200V, 110/220V, 120/240V | Recommended Input Service* | Heat Dissipation Double-Conversion Mode |
| 3 | 2100 | 18A | 30/15A, 27/14A, 25/12.5A | 25A | 285W (0.98 kBTU/hr) |
| 6 | 4200 | 32A | 60/30A, 54/28A, 50/25A | 40A | 570W (1.95 kBTU/hr) |
| 9 | 6300 | 48A | 90/45A, 81/42A, 75/37.5A | 60A | 860W (2.93 kBTU/hr) |
| 12 | 8400 | 64A | 120/60A, 108/56A, 100/50A | 80A | 1145W (3.90 kBTU/hr) |
| 15 | 10500 | 80A | 150/75A, 135/70A, 125/62A | 100A | 1430W (4.88 kBTU/hr) |
| 18 | 12600 | 100A | 180/90A, 162/84A, 150/75A | 125A | 1720W (5.85 kBTU/hr) |

*For redundant power module operation (N+X), increase the input current rating by 2A for each additional redundant power module.

**Table 14. Environmental and Safety**

| | |
|---|---|
| Operating Temperature | 0°C to 40°C (32°F to 104°F)<br>Optimal battery performance: 25°C (77°F) |
| Storage Temperature | UPS with battery modules: –20°C to +40°C (–4°F to 104°F)<br>UPS without batteries: –40°C to +60°C (–40°F to 140°F) |
| Relative Humidity | 5–95% noncondensing |
| Operating Altitude | Up to 3,050 meters above sea level (10,000 ft)<br>The maximum operating ambient temperature decreases 1°C per 300m above 1525m (2°F per 1000 ft above 5000 ft) |
| Non-Operating Altitude | Up to 12,200 meters above sea level (40,000 ft) |
| Ventilation | The air around the UPS must be clean and free of dust, corrosive chemicals, and other contaminants. The Powerware 9170 UPS uses internal fans to circulate the air for cooling. The air must be free to circulate around the UPS and battery cabinet(s). Do not operate the UPS in a sealed room or container. |
| Audible Noise | Less than 53 dBA |
| Surge Suppression | ANSI C62.41 Category B (formerly IEEE 587); IEC 61000-4-5 |
| Safety Conformance | CAN/CSA C22.2, No. 107.1; UL 1778;<br>EN 50091-1-1 and IEC 60950 |
| Agency Markings | UL, cUL, TÜV, CE, C-Tick, BCIQ |
| EMC (Class A) | EN 50091-2, FCC Part 15, ICES-003, VCCI |

**Table 15. Battery**

| | |
|---|---|
| Configuration | (2) 60V, 7.2 Ah batteries per string |
| Voltage | 120 Vdc |
| Type | Sealed, maintenance-free, valve-regulated, lead-acid |
| Charging | Recharge time: 4 hr after full-load resistive discharge; 8 hr after half-load resistive discharge, using standard internal battery charger.<br>Optional battery chargers at higher current ratings will be available for future product release. |

**Table 16. Weights and Dimensions**

| Cabinet Size | Height | Width | Depth | Weight* |
|---|---|---|---|---|
| 3-slot | 17.75″ (45 cm) | 17.0″ (43 cm) | 25.5″ (65 cm) | 66 lb (30 kg) |
| 3-slot (with caster cart) | 19.5″ (49.5 cm) | 17.0″ (43 cm) | 25.5″ (65 cm) | 78 lb (35 kg) |
| 6-slot | 31.5″ (80 cm) | 17.0″ (43 cm) | 25.5″ (65 cm) | 103 lb (47 kg) |
| 6-slot (with caster cart) | 33.25″ (84.5 cm) | 17.0″ (43 cm) | 25.5″ (65 cm) | 115 lb (52 kg) |
| 9-slot | 47.0″ (119.5 cm) | 24.0″ (61 cm) | 28.5″ (72.5 cm) | 158 lb (72 kg) |
| 12-slot | 60.75″ (154.5 cm) | 24.0″ (61 cm) | 28.5″ (72.5 cm) | 196 lb (89 kg) |

* Add the following weights for isolation transformers:
3-slot cabinet: 65 lb (30 kg)
6-slot cabinet: 140 lb (64 kg)
12-slot cabinet: 275 lb (125 kg)
Optional floor anchor kit weighs 9 lb (4 kg)
Each battery module weighs 30 lb (13.6 kg)
Each power module weighs 17 lb (7.7 kg)

# CHAPTER 11
# TROUBLESHOOTING

The following questions provide a few quick-to-find answers to commonly asked questions.

**Table 17. Frequently Asked Questions**

| Question: "How do I... " | Answer |
|---|---|
| Turn the UPS on? | Verify that all power modules are securely plugged into the cabinet, and each module handle is latched. Also confirm that the DC disconnect button on the back of the external battery cabinet is closed (pulled out). Turn the optional external bypass switch to the LINE or UPS position. Refer to the front panel display and press the button labeled ON. (If On/Off control is password-protected, enter the user password: 0377.) Confirm the selection by pressing the button labeled Yes. After a few seconds, the green LED illuminates to signal the UPS is operating and producing power. |
| Turn the UPS off? | Refer to the front panel display and press the button labeled OFF. Confirm the selection by pressing the button labeled Yes. (If On/Off control is password-protected, enter the user password: 0377.) In the event of a front panel display failure, you can turn the unit on or off using a computer connected to the communication port. In an emergency or when the above two methods fail to turn the unit off, remove the front cover bezels, and unlatch and pull the handles of all power modules out at least one inch (2.5 cm) to turn off the power control circuitry. If your UPS has external battery cabinets, press the large, red DC disconnect button on the back of the battery cabinet nearest to the UPS cabinet. |
| Turn off the alarm beeps? | Press the lower left button on the front panel display. Note the alarm message and see "Alarms" on page 83 to correct the problem. After the problem has been resolved, press the lower center button to clear the alarm. |
| View the alarm log? | Go to menu 9-2. Press the ↵ button to view the most recent alarm. Press the ▼ button to scroll down through the log to view older alarms. |
| Install the CheckUPS software? | See the instructions accompanying the CheckUPS software CD-ROM. |
| Check the input or output voltage? | Go to menus 3-8 and 3-9 for the input voltage; go to menus 3-10 and 3-11 for the output voltage. |
| Check the battery voltage? | Go to menu 3-5. To view other system status parameters, see the Menu Map on page 68. |

| Question: "How do I... " | Answer |
|---|---|
| Check the condition of the batteries? | The results of the most recent battery test are stored at menu 6-2. To run a test of battery condition, go to menu 10-1 and press the ↵ button. When the test is complete, the results are again stored in menu 6 parameters. |
| Change the battery low-voltage alarm threshold? (or any other alarm or operating limit?) | This is one of the parameters that require a trained person, knowing the correct password, to perform. Without the proper password, you are only able to view operating limits, not change them. Only authorized personnel should change these limits. For information about making this or other password-protected adjustments, contact your service representative. |
| Apply power to the load if the unit won't operate? | Turn the optional external bypass switch to either the SERVICE or the LINE position. In these two positions, utility power flows directly to the load. In the SERVICE position, the UPS does not receive utility power and may be worked on for maintenance purposes. |
| Turn the external bypass switch? | If the bypass switch is a Make-Before-Break type, you must press the interlocking red button next to the switch before turning the switch. |
| Set the UPS to turn on in High Efficiency mode? | Go to menu 2. Select the system mode desired at power-on by pressing the ▲ or ▼ button. When the display shows Auto High Efficiency, press the ↵ button. |
| Set the UPS to operate in High Efficiency mode on weekends? | The Powerware 9170 system will not change operating modes as a timed event. But, if you wish to conserve energy, before leaving for the weekend, go to menu 2. Select High Efficiency and press the ↵ button. After the weekend, return to the Automatic mode by going to menu 2 again, and selecting Auto followed by pressing the ↵ button. |
| Change the level of system redundancy? | To view or change the redundancy level, go to menu 7-3-5. |
| Change the batteries? | Each side-by-side pair of battery modules forms one series string on the battery bus. See "Battery Replacement" on page 74 for the battery replacement procedure. |
| Add/delete one or more strings of batteries? | Physically install or remove battery modules as described on page 50. Record capacity of external battery strings (in all external battery cabinets) by going to menu 7-2-10. |
| Add/delete one or more power modules? | Physically install or remove power modules as described on page 50. The system operating software senses the number and location of all power modules in the cabinet. If you want to change the number of redundant power modules, go to menu 7-3-5 and change the level of system redundancy. |

## Alarms

Figure 51 shows a typical alarm display. Alarms are annunciated by a constant Alarm LED and a constant beep. During alarm display, button (A) silences the audible alarm, button (B) clears the alarm display, and button (C) performs the normal Escape function to exit from the alarm display. The ↲ button enables you to scroll through all alarms, and the ▲ and ▼ buttons scroll through any other parameters related to the displayed alarm.

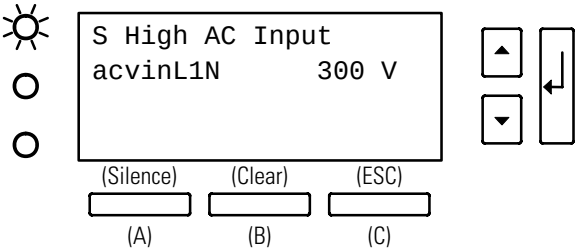



**Figure 51. Typical Active Alarm Display**

When the Powerware 9170 UPS detects an alarm condition, the UPS displays the alarm with the following indications:

- the red LED next to the front panel display illuminates
- sounds an audible alarm
- displays an alarm message

When this happens, follow these steps:

1. Observe the display to find which alarm the Powerware 9170 UPS is displaying. The parameters shown below the alarm message give you more information about the alarm condition. Use the ▲ and ▼ buttons to scroll up and down through these parameters.

**NOTE** To find out if more than one alarm is active, press ↲. This switches the display between alarm messages. To silence the audible alarm, press button (A) below the display.

2. Find the alarm message in Table 18, Table 19, or Table 20 and follow the instructions to resolve the problem. To clear an alarm after resolving the problem, press button (B) below the display. If the problem is still present, the alarm will sound again after a short delay.

Table 18 contains descriptions of critical alarm codes. Critical alarms require immediate operator attention and corrective action.

**Table 18. Critical Alarm Messages**

| Alarm Message | What It Means | What to Do |
|---|---|---|
| Low Battery (A) | The UPS has shut down after running on battery and discharging the batteries. | Wait for AC input power to be restored. When AC input power returns, the UPS begins recharging batteries and applies power to the load. |
| High Battery (C) | The battery voltage is too high because of a charger problem, battery problem, or incorrect parameter setting. | Contact your service representative. |
| Low AC Out (E) | The UPS has shut down because the AC output voltage is too low to provide power to the load. | Contact your service representative. |
| High AC Out (F) | The UPS has shut down because the AC output voltage is too high. | Contact your service representative. |
| High AC In (S) | The AC input voltage is too high; any further increase to the voltage may damage the UPS. | This alarm automatically clears when input voltage returns to normal limits. The UPS will continue to support the load until the batteries are depleted. |
| Output Overload (G) | The load is requiring more power than the UPS power modules are capable of supplying, and the UPS has switched to Bypass mode. | Switch off your equipment one piece at a time until the alarm stops. |
| Overload Shutdown (I) | The UPS has shut down due to excessive load. | Remove excess load(s) from the UPS output and restart the UPS by pressing the ON button through the front panel display. |
| High Heatsink Temperature (H) | The inverter temperature is too high. If the temperature reaches a preset limit, the unit will shut down. | If the UPS has not shut down, bypass the UPS or shut down your equipment, and turn the UPS off. Contact your service representative. |
| E P O (P) | The Emergency Power-Off (EPO) function has been activated. | Deactivate the external EPO switch and restart the UPS by pressing the ON button through the front panel display. |
| Call Service (T) | The UPS has detected a problem that requires service. | See Table 9 on page 67 and Table 20 on page 86 for information about reason codes. Contact your service representative. |
| Call Service (5) | The UPS has detected a module fan problem that requires service. | Contact your service representative. |

Table 19 contains descriptions of non-critical alarm messages. Non-critical alarms are not as urgent as critical alarms, but should be attended to as soon as convenient to avoid the problem becoming critical.

**Table 19. Non-Critical Alarm Messages**

| Alarm Message | What It Means | What to Do |
|---|---|---|
| Near Low Battery (B) | The battery voltage has reached the Near Low Battery setpoint. | If the voltage increases, the alarm clears automatically. If it drops further, it will cause a Low Battery alarm. |
| Low Runtime (D) | Batteries in the unit are nearly discharged. | Perform an orderly shutdown of all equipment and wait for AC input power to return. When AC input power returns, the UPS begins recharging batteries and automatically restarts. |
| Check Memory (O) | The configuration as stored in the system memory may have been corrupted. | Look in the alarm log for the slot number of the failed module. Contact your service representative. |
| Check Battery (M) | The batteries have failed an automatic system test. | See Table 9 on page 67 and Table 20 on page 86 for information about reason codes. Contact your service representative. |
| Low Redundancy (U) | The number of active power modules is too low to provide the programmed redundancy level to protect the current load. | The unit is able to protect the equipment, but will not be fault tolerant. To regain the desired redundancy, either add power modules or reduce the load. See Table 9 on page 67 and Table 20 on page 86 for information about reason codes. |

## Alarm Reason Codes

Some alarms have a reason code as well as the alarm code. These reason codes may help you to interpret and isolate the cause of an alarm. Table 20 contains a listing of all reason codes along with the associated alarm codes. It also gives an interpretation of the reason, and a suggested corrective action.

**Table 20. Alarm Reason Codes**

| Alarm Code and Reason Code | What it Means | What to Do |
|---|---|---|
| M Check Battery Open Cell (Reason code 4) | A battery (pair of modules) has failed an open cell test. | Look in the alarm log for the slot number of the failed modules. Verify that both battery modules are properly installed. If properly installed, replace both battery modules. |
| M Check Battery Weak Battery (Reason code 5) | The system batteries have degraded to the point where system runtime is less than the designed rating. | Replace all battery modules. |
| T Call Service Phase Error (Reason code 6) | The UPS has detected the input phase rotation to be incompatible with its output wiring and will not start up. | Correct the input wiring problem and restart the UPS. |
| T Call Service Module Failure (Reason code 7) | A power module has detected an internal fault and has shut down. | Look in the alarm log for the slot number of the power module and replace the defective module. |
| T Call Service Excessive Transfers (Reason code 8) | The UPS has detected an excessively high number of automatic transfers from High Efficiency mode, and has switched to Double Conversion (Auto) mode. | Contact your service representative. |
| T Call Service Precharge Failure (Reason code 9) | A power module has detected an initialization sequence problem and will not start up. | Look in the alarm log for the slot number of the affected module. Contact your service representative. |
| U Low Redundancy Insufficient Batteries (Reason code 10) | The UPS load exceeds 2800 watts per battery string. The system will protect the load during short power outages, but battery degradation or damage may result. | Reduce the load or install additional battery modules (two modules per string). |
| U Low Redundancy Insufficient Modules (Reason code 11) | The number of active power modules is too few to provide the programmed redundancy level while protecting the load. The UPS will protect the load, but will not be fault tolerant. | Reduce the load or install additional power modules. |

## Service and Support

If you have any questions or problems with the UPS, call your **Local Distributor** or the **Help Desk** at one of the following telephone numbers and ask for a UPS technical representative.

| | |
|---|---|
| In the United States | 1-800-365-4892 |
| In Canada | 1-800-461-9166 |
| All other countries | 1-919-870-3149 |

Please have the following information ready when you call the Help Desk:

- Model number
- Serial number
- Version number (if available)
- Date of failure or problem
- Symptoms of failure or problem
- Customer return address and contact information

If repair is required, you will be given a Returned Material Authorization (RMA) Number. This number must appear on the outside of the package and on the Bill Of Lading (if applicable). Use the original packaging or request packaging from the Help Desk or distributor. Units damaged in shipment as a result of improper packaging are not covered under warranty. A replacement or repair unit will be shipped, freight prepaid for all warrantied units.

**NOTE** For critical applications, immediate replacement may be available. Call the **Help Desk** for the dealer or distributor nearest you.

LTM-1344 B