

# Liebert NX™ UPS

User Manual—40-200kVA, 480V, 60Hz





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## IMPORTANT SAFETY INSTRUCTIONS

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### SAVE THESE INSTRUCTIONS

This manual contains important instructions that should be followed during installation of your Liebert® NX™ UPS and ancillary equipment.

Read this manual thoroughly, paying special attention to the sections that apply to your installation, before working with the UPS. **Retain this manual for use by installing personnel.**



#### WARNING

Risk of heavy unit tipping over. Can cause property damage, injury and death.

Exercise extreme care when handling UPS cabinets to avoid equipment damage or injury to personnel. The UPS module weight ranges from 1180 to 2205 lb. (535 to 1000kg).

Determine unit weight and locate center of gravity symbols  before handling the UPS. Test lift and balance the cabinet before transporting. Never tilt equipment more than 15 degrees from vertical.

Battery manufacturers supply details of the necessary precautions to be observed when working on, or in the vicinity of, a large bank of battery cells. These precautions should be followed implicitly at all times.

Follow all battery safety precautions when installing, charging or servicing batteries. In addition to the hazard of electric shock, gas produced by batteries can be explosive and sulfuric acid can cause severe burns. When connected, the nominal battery voltage is 480VDC and is potentially lethal.

In case of fire involving electrical equipment, use only carbon dioxide fire extinguishers or those approved for use in fighting electrical fires.

Extreme caution is required when performing maintenance. Be constantly aware that the UPS system contains high DC as well as AC voltages.

Check for voltage with both AC and DC voltmeters prior to making contact.



#### WARNING

Risk of electric shock. Can cause injury and death.

Dangerous voltages are present within the UPS and battery enclosure. The risk of contact with these voltages is minimized as the live component parts are housed behind a hinged, lockable door. Further internal safety screens make the equipment protected to IP20 standards.

No risk exists to any personnel when operating the equipment in the normal manner, following the recommended operating procedures.

All equipment maintenance and servicing procedures involve internal access and should be carried out only by trained personnel.



#### WARNING

Risk of electric shock from high leakage current. Can cause injury, property damage and death.

High ground leakage current: Ground connection is essential before connecting the input supply.

This equipment must be grounded in accordance with local electrical codes.

Maximum load must not exceed that shown on the UPS rating label.



## WARNING

Risk of electric shock. Can cause injury and death.

Under typical operation and with all UPS doors closed, only normal safety precautions are necessary. The area around the UPS system should be kept free of puddles of water, excess moisture and debris.

Special safety precautions are required for procedures involving handling, installation and maintenance of the UPS system and the batteries. Observe all safety precautions in this manual before handling or installing the UPS system. Observe all precautions in this manual, before as well as during performance of all maintenance procedures. Observe all battery safety precautions before working on or near the battery.

**This equipment contains several circuits that are energized with high voltage.** Only test equipment designed for troubleshooting should be used. This is particularly true for oscilloscopes. Always check with an AC and DC voltmeter to ensure safety before making contact or using tools. Even when the power is turned Off, dangerously high electric charges may exist within the UPS.

**All power and control wiring should be installed by a qualified electrician.** All power and control wiring must comply with the NEC and applicable local codes.

**ONLY qualified service personnel should perform maintenance on the UPS system.**

When performing maintenance with any part of the equipment under power, service personnel and test equipment should be standing on rubber mats. The service personnel should wear insulating shoes for isolation from direct contact with the floor (earth ground).

Never work alone, even if all power is removed from the equipment. A second person should be standing by to assist and summon help in case an accident should occur.



## CAUTION

This equipment is fitted with RFI suppression filters.

Ground leakage current exceeds 3.5 mA and is less than 30 mA.

Transient and steady-state ground leakage currents, which may occur when starting the equipment, should be taken into account when selecting instantaneous residual current circuit breakers (RCCBs) or residual current devices (RCDs).

RCCBs must be selected sensitive to DC unidirectional pulses (Class A) and insensitive to transient current pulses.

Note also that the ground leakage currents of the load will be carried by this RCCB or RCD.

## NOTICE

Risk of improper improper electromagnetic shielding. Can cause radio communication interference.

This unit complies with the limits for a Class A digital device, pursuant to Part 15 Subpart J of the FCC rules. These limits provide reasonable protection against harmful interference in a commercial environment. This unit generates, uses and radiates radio frequency energy and, if not installed and used in accordance with this instruction manual, may cause harmful interference to radio communications. This unit is not designed for use in a residential area. Operation of this unit in a residential area may cause harmful interference that the user must correct at his own expense.

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## Battery Cabinet Precautions

The following warning applies to all battery cabinets supplied with UPS systems. Additional warnings and cautions applicable to battery cabinets may be found in **4.0 - Battery Installation**.

### WARNING

Risk of electric shock. Can cause injury, property damage and death.

Special care should be taken when working with the batteries associated with this equipment. Batteries are always live. Battery terminal voltage will exceed 480VDC and is potentially lethal.

In addition to the hazard of electric shock, gas produced by batteries can be explosive and sulfuric acid can cause severe burns.

Batteries should be installed, serviced and replaced only by properly trained and qualified service personnel trained in safe battery handling methods and who have the correct PPE (Personal Protection Equipment) and tools.

The following precautions should be observed when working with the batteries:

- Eye protection should be worn to prevent injury from electrical arcs.
- Remove rings, watches and all other metal objects.
- Use only tools with insulated handles.
- Wear rubber gloves and boots.
- When replacing batteries, replace them with the same type and number of batteries or battery packs.
- Do not dispose of batteries in a fire. The batteries may explode.
- Do not open or mutilate batteries. Released electrolyte is harmful to the skin and eyes. It is toxic.
- Never lay metal objects of any type on top of the batteries.
- Disconnect the charging source before connecting or disconnecting battery terminals.
- Determine whether the battery is grounded. If the battery is grounded, remove source of the ground. Contact with any part of a grounded battery can result in electrical shock. The likelihood of such shock can be reduced if such grounds are removed during installation and maintenance.



### WARNING

Risk of heavy unit tipping. Can cause property damage, injury and death.

Internal battery strapping must be verified by manufacturer prior to moving a battery cabinet (after initial installation).

- Battery cabinets contain non-spillable batteries.
- Keep units upright.
- Do not stack.
- Do not tilt.

Failure to heed this warning could result in smoke, fire or electric hazard.

Call 1-800-LIEBERT before moving battery cabinets (after initial installation).



### WARNING

Risk of electric shock. Can cause injury and death.

The Liebert® NX's internal batteries are connected and energized even if the UPS is turned Off. To minimize the risk of injury, a properly trained and qualified service person should disconnect the batteries before any maintenance is performed on the unit.

Servicing of batteries should be performed or supervised only by properly trained and qualified personnel knowledgeable about batteries and the required precautions.

When replacing batteries, replace with the same manufacturer and type, or equivalent. See your local Emerson® representative for a list of approved batteries.



## **CAUTION**

Risk of replacing battery with an incorrect type. Can cause property damage injury and death.

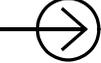
Dispose of used batteries according to the instructions.

When replacing batteries, replace with the same manufacturer and type, or equivalent. See your local Emerson representative for a list of approved batteries.

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## GLOSSARY OF SYMBOLS

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	<b>Risk of electrical shock</b>
	<b>Indicates caution followed by important instructions</b>
	<b>AC input</b>
	<b>AC output</b>
	<b>Requests the user to consult the manual</b>
	<b>Indicates the unit contains a valve-regulated lead acid battery</b>
	<b>Recycle</b>
	<b>DC voltage</b>
	<b>Equipment grounding conductor</b>
	<b>Bonded to ground</b>
	<b>AC voltage</b>

## **1.0 INTRODUCTION**

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The Liebert® NX™ Uninterruptible Power Supply system provides continuous, high-quality AC power to your business-critical equipment, such as telecommunications and data processing equipment.

The Liebert NX UPS is a SmartAisle™ technology, appropriate for use with the SmartAisle design approach.

The Liebert NX supplies power that is free of the disturbances and variations in voltage and frequency common to utility power, which is subject to brownouts, blackouts, surges and sags.

The Liebert NX utilizes the latest in high-frequency, double-conversion pulse width modulation technology and fully digital controls to enhance its reliability and increase the ease of use.

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## 2.0 INSTALLATION

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This section describes the Liebert® NX™ environmental requirements and mechanical considerations that must be taken into account when planning the positioning and cabling of the UPS equipment.

Because every site is unique, this section presents a guide to general procedures and practices that should be observed by the installing engineer, rather than step-by-step installation instructions.



### WARNING

Do not apply electrical power to the UPS equipment before the arrival of the commissioning engineer.



### WARNING

The UPS equipment should be installed by a qualified engineer in accordance with the information contained in this section.



### WARNING

Risk of electric shock. Can cause injury and death.

Special care should be taken when working with the batteries associated with this equipment. When connected together, the nominal battery voltage is 480VDC and is potentially lethal.

- Eye protection should be worn to prevent injury from accidental electrical arcs.
- Remove rings, watches and all other metal objects.
- Use only tools with insulated handles.
- Wear rubber gloves.

If a battery leaks electrolyte or is otherwise physically damaged, it must be replaced, stored in a container resistant to sulfuric acid and disposed of in accordance with local regulations.

If electrolyte comes into contact with skin, the affected area should be washed immediately with large amounts of water.



### NOTE

*The Liebert NX UPS can be used in TN utility system.*

## 2.1 External Inspections

1. While the UPS system is still on the truck, inspect the equipment and shipping container(s) for any signs of damage or mishandling. Do not attempt to install the system if damage is apparent. If any damage is noted, file a damage claim with the shipping agency within 24 hours and contact Emerson Network Power® Liebert Services at 1-800-LIEBERT to inform them of the damage claim and the condition of the equipment.
2. Compare the contents of the shipment with the bill of lading. Report any missing items to the carrier and your local Liebert representative immediately.

## 2.2 Internal Inspections

1. Remove any packaging material, then visually examine the UPS and battery equipment for transit damage, both internally and externally. Report any such damage to the shipper and to Liebert immediately.
2. Check the nameplate inside the cabinet door to verify that the model number and rating correspond to the ones specified. Record the model number and serial number in the front of this installation manual. This information is necessary should service be required.
3. Check for loose connections or unsecured components in the cabinet.
4. Check for shipping damage to internal components.

## 2.2.1 Storing for Delayed Installation

If the equipment will not be installed immediately, it must be stored indoors where the humidity is no higher than 90% and the temperature is no higher than 104°F (40°C). The storage area must protect the Liebert® NX™ from excessive moisture (see **6.2 - UPS Environmental**).



### NOTE

*If the battery cabinet must remain disconnected from power for more than six (6) months, the battery must be recharged before use. To charge the batteries, the battery cabinet must be connected to the Liebert NX UPS and the UPS must be connected to utility power and started up because the charger operates only while the Liebert NX UPS is operating*



### NOTE

When batteries are installed in a cabinet adjacent to the UPS unit, the battery—not the UPS—dictates the designed maximum ambient operating temperature.

## 2.3 Preliminary Checks

### 2.3.1 Identification

The equipment supplied has an identification tag on the back of the main door listing the type and size of the UPS.

## 2.4 UPS Location

### 2.4.1 Positioning the UPS

Choose a location for the UPS that offers:

- Easy connection to inputs, outputs and auxiliary equipment
- Enough space to service the UPS
- Air circulation sufficient to expel heat produced by UPS
- Protection against moisture and excessive humidity
- Protection against dust and other particulate matter
- Compliance with fire prevention regulations and practices
- Operating environment temperature of 74-80°F (23-27°C) for maximum battery efficiency

### 2.4.2 Environmental Considerations

Before installing the Liebert NX, verify that the UPS room satisfies the environmental conditions stipulated in **6.2 - UPS Environmental**, paying particular attention to the ambient temperature and air exchange system.

The UPS unit should be installed in a cool, dry, clean-air environment with adequate ventilation to keep the ambient temperature within the specified operating range 32°F to 104°F (0°C to 40°C).

For optimal UPS and battery system performance and service life, maintain the operating temperature within the range of 74-80°F, (23-27°C).

The Liebert NX UPS cooled by internal fans. Cooling air enters the unit through the front of the unit and is exhausted out the top. To permit proper air flow and prevent overheating, do NOT block or cover the ventilation openings or blow air down onto the unit. Ventilation clearance above the unit must be a minimum of 8 in. (203mm).

See **Table 7** for details on heat dissipation.

## Battery Location

Batteries must be installed in Liebert® NX™ 480V battery cabinets or battery room. Temperature is a major factor in determining battery life and capacity. Battery manufacturers recommend an operating temperature of 77°F (25°C). Ambient temperatures higher than this reduce battery life; temperatures lower than this reduce battery capacity. In a typical installation, battery temperature should be maintained between 74°F and 80°F (23-27°C). Batteries should be placed where there are no main heat sources or air inlets to prevent portions of batteries from being either much warmer or much cooler than other parts of the batteries.

### 2.4.3 Special Considerations for Parallel Systems

1. Consider the grounding configuration of your system before finalizing module placement. For optimal ground performance, the Liebert NX modules should be close together.
2. For optimal load-sharing performance, the UPS output cables should be approximately the same length, plus or minus 20 percent.
3. Position modules in such a way as to minimize the length of power cables and control wiring between UPS modules and the paralleling cabinet.

## 2.5 Considerations in Moving the Liebert NX

Ensure that the UPS weight is within the designated surface weight loading (lb./ft<sup>2</sup> or kg/cm<sup>2</sup>) of any handling equipment. See **Table 7** for weights of various units.

To move the UPS and optional battery cabinets:

- The Liebert NX may be rolled on its casters when moving the unit a short distance. For longer distances, move the UPS with a forklift or similar equipment to ease the relocation and to reduce vibration.

The optional battery cabinets should be moved with a forklift or similar equipment.



### WARNING

Risk of heavy unit falling. Can cause property damage, injury and death.

Ensure that any equipment that will be used to move the Liebert NX has sufficient lifting capacity. The Liebert NX weight ranges from 1180 to 2201 lb. (535 to 1000kg). See **Table 7** for details. The UPS presents a tipping hazard. Do not tilt the Liebert NX further than 15 degrees from vertical.

The UPS is fitted with casters—take care to prevent movement when unbolting the equipment from its shipping pallet. Ensure adequate personnel and lifting equipment are available when taking the Liebert NX off its shipping pallet. Do not tilt the unit more than 15 degrees from center.



### WARNING

Risk of heavy unit falling. Can cause property damage, injury and death.

The casters are strong enough for movement across even surfaces only. Casters may fail if they are subjected to shock loading, such as being dropped or rolled over holes in the floor or obstructions. Such failure may cause the unit to tip over, injuring personnel and damaging the equipment.

Care must be taken when maneuvering cabinets fitted with batteries. Keep such moves to a minimum. For further information, see **Battery Cabinet Precautions on page 3**.

## Final Position

When the equipment has been finally positioned, ensure that the adjustable stops are set so that the UPS will remain stationary and stable (see **8.0 - Installation Drawings**).

## 2.6 Mechanical Considerations

The Liebert NX is constructed with a steel frame and removable panels. Top and side panels are secured to the chassis by screws. The doors may be opened for access to power connections bars, auxiliary terminal blocks and power switches.

The UPS comes with an operator control panel, which provides basic operational status and alarm information. Cooling is provided by internal fans. The unit sits on four casters. Adjustable stops are provided to prevent the UPS from moving once it has been moved to its final position.

### 2.6.1 Clearances

There are no ventilation grilles on the sides or rear of the UPS. The unit may be placed with the rear against a wall and optional cabinets on either side.

To enable routine tightening of power terminations within the UPS, make sure there is sufficient clearance in front of the Liebert® NX™ to permit free passage of personnel with the door fully opened.

Leave a minimum of 8 in. (203mm) between the top of the UPS and the ceiling to permit adequate air circulation above the unit. Liebert recommends against using air conditioning or other systems that blow air onto the top of the unit.

### 2.6.2 Floor Installation

The diagrams in **8.0 - Installation Drawings** show the location of holes in the base plate for bolting the equipment to the floor.

If the equipment is to be placed on a raised floor, it should be mounted on a pedestal that will support the equipment point loading. Refer to the cabinet-bottom views in **8.0 - Installation Drawings** to design this pedestal.

### 2.6.3 Cable Entry

Cables can enter the Liebert NX from the top or bottom. Cable entry is made possible by removing a metal plate attached to the UPS.

These plates are designed to allow the personnel to punch holes for fitting and securing the conduit. Once the conduit holes are punched, these plates should be reattached to the UPS.



## WARNING

Risk of explosion and fire. Can cause property damage, injury and death.

To reduce the risk of fire, connect only to a circuit provided with correct amperes maximum branch circuit overcurrent protection (see **Table 8**) in accordance with the National Electric Code, ANSI/NFPA 70.



## NOTE

*When installing the UPS, the customer must provide a disconnect with overcurrent protection at the output of the UPS.*

## System Composition

A UPS system can comprise a number of equipment cabinets, depending on the individual system design requirements—e.g., UPS cabinet with External Bypass cabinet and Maintenance Bypass cabinet. In general, all cabinets used will be the same height and are designed to be positioned side-by-side to form an aesthetically appealing equipment suite.

### 2.6.4 Optional Cabinets

The Maintenance Bypass Cabinet must be cabled and bolted to the Liebert NX **before** the UPS and bypass cabinet are moved into their final position. Connect the input wiring to the Maintenance Bypass Cabinet **ONLY** after the units are connected and positioned.

Battery cabinets may be bolted to either side of the Liebert NX; see **Figure 1**.

**Figure 1 Cabinet arrangement—Liebert® NX™ units and battery cabinets**

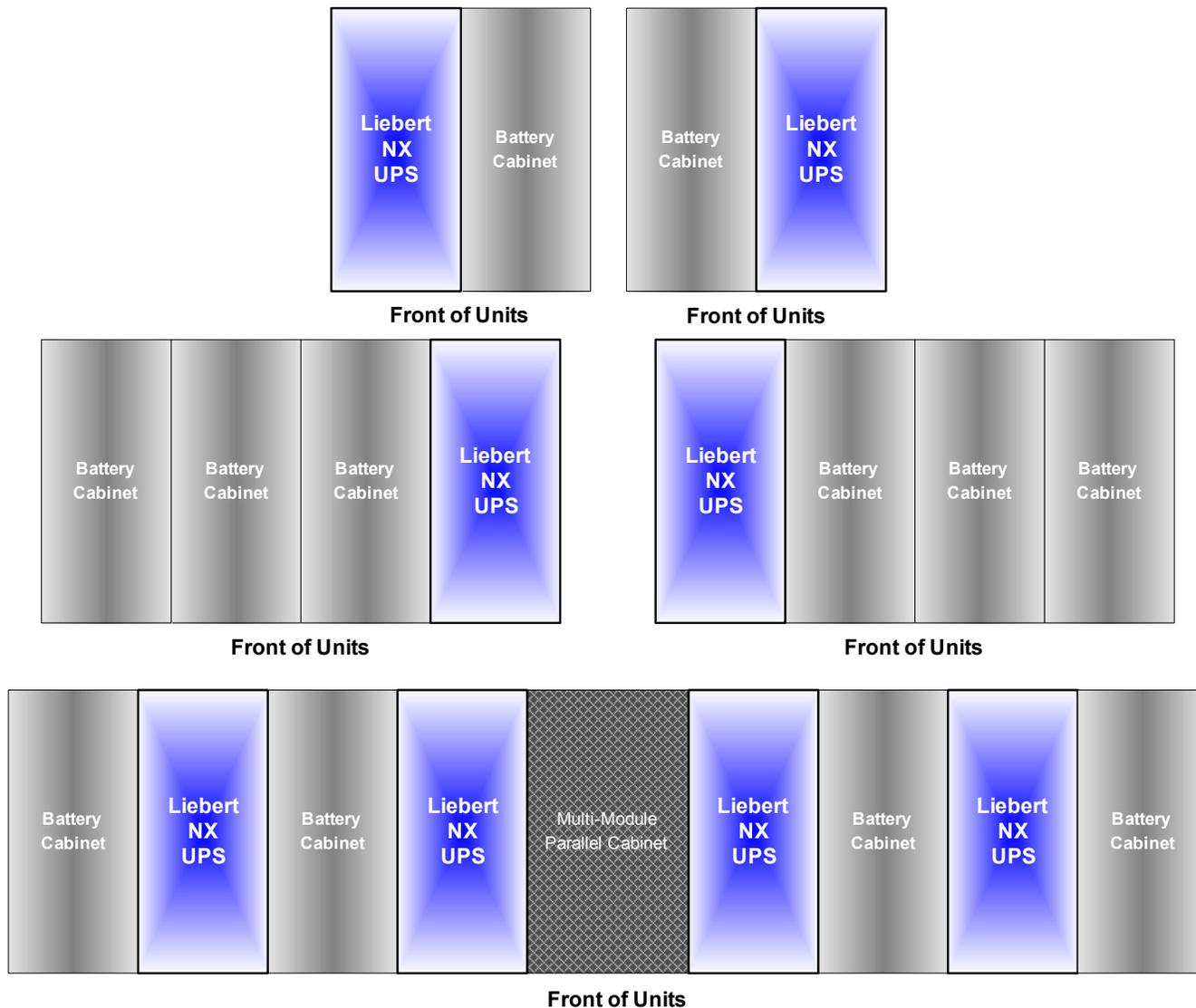
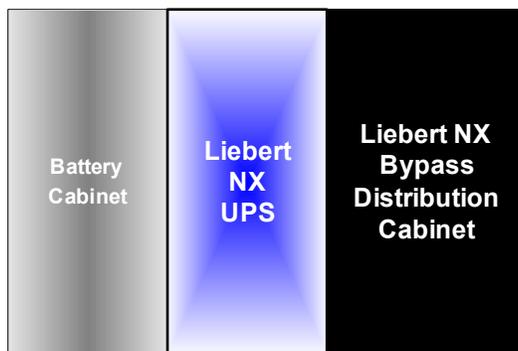
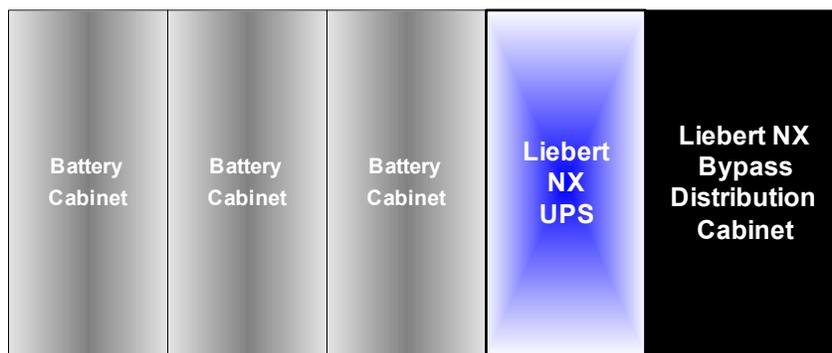


Figure 2 Cabinet arrangement—Liebert® NX™ UPS, battery cabinets and Liebert NX bypass distribution cabinets



Front of Units



Front of Units

## 3.0 ELECTRICAL CONNECTIONS

The UPS requires both power and control cabling once it has been mechanically installed. All control cables must run separate from power cables in metal conduits or metal ducts that are electrically bonded to the metalwork of the cabinets to which they are connected.



### WARNING

Risk of electrical shock. Can cause injury and death.

Before connecting input power to the Liebert® NX™, ensure that you are aware of the location and operation of the overcurrent protection devices that connect the UPS input/bypass supply to the power distribution panel.

De-energize and lockout or tagout all incoming high- and low-voltage power circuits before installing cables or making any electrical connections.

### 3.1 Power Cabling

#### 3.1.1 Cable Rating

The main factors affecting the choice and size of cable are voltage, current (also taking into account overcurrent), room temperature and conditions of installation of the cable.

The power cables of the system must be sized with respect to the following description:

- **UPS input cables** - The UPS input cables must be sized for the maximum input current, including the maximum battery recharge current, given in **Table 8**, with respect to the unit rating and the input AC voltage.
- **UPS bypass and output cables** - The bypass and output cables must be sized for the nominal output current, given in **Table 8**, with respect to the unit rating and the output AC voltage.
- **Battery cables** - When connecting an external battery cabinet, the battery cables must be sized for the battery discharge current at the end-of-discharge voltage, as given in **Table 8**, with respect to the unit rating.



#### NOTE

*Table 8 gives nominal currents for determining the size of UPS power cables. Other important factors to consider include cable route length and coordination with protective devices.*

The power cables can be sized to suit the UPS unit rating according to **Table 8**.



#### NOTE

*When installing a Liebert NX with Softscale™ capability Liebert recommends sizing the input, bypass and output cabling for the UPS's maximum rating. Properly sizing the cable will reduce the work required to upgrade the UPS.*

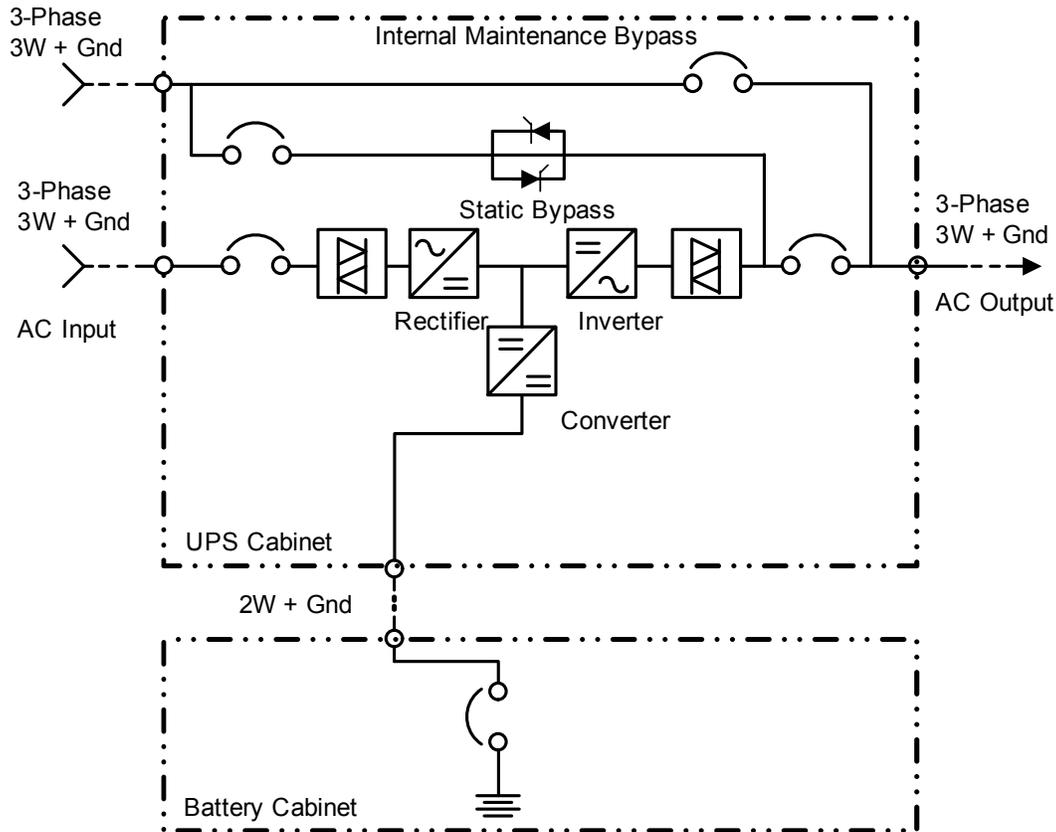
#### Lug Size and Torque Requirements

Refer to **Table 34** for lug size and torque requirements.

### 3.1.2 UPS Input Configuration

**Figure 3** illustrates the Liebert® NX™ in a split bypass (dual-input) configuration. In this configuration, the Static Bypass and the Maintenance Bypass lines are supplied from a separate feed from the Main input. Both sources must be protected externally with properly sized protective devices. By default, the unit ships with internal links installed between the bypass input and main input (Single Input configuration). To wire the unit as a dual input UPS, remove the links and wire the bypass to the input bus bars, then wire the main input directly to CB1 (see **Figure 3**).

**Figure 3** Single module block diagram—dual input configuration



### 3.1.3 Cabling Guidelines

The following are guidelines only and are superseded by local regulations and codes of practice where applicable. Use wiring rated at 75°C or greater.

1. The ground conductor should be sized in accordance with the input overcurrent protection device data in **Table 8**. The ground cable connecting the UPS to the main ground system must follow the most direct route possible. Control wiring and power wiring must be run in separate conduit. Output and input cables must be run in separate conduit.
2. Consider using paralleled smaller cables for heavy currents—this can ease installation.
3. When sizing battery cables, a maximum voltage drop of 4VDC is permissible at the current ratings in UPS terminal. For terminal connection sizing, see **Table 8**.
4. In most installations, especially parallel multi-module systems, the load equipment is connected to a distribution network of individually protected busbars fed by the UPS output, rather than connected directly to the UPS itself. When this is the case, the UPS output cables can be rated to suit the individual distribution network demands rather than being fully load-rated.



#### NOTE

*If more load is added to the distribution panel, the unit's cabling must be resized.*

5. When laying power cables, do not form coils; this will help avoid increasing formation of electromagnetic interference.

### 3.1.4 Cable Connections

The rectifier input, bypass and output are easily accessible from the front of the unit for installation. All require lug type terminations. They are connected to busbars on the front side of the Liebert® NX™ and below the circuit breaker, as shown in **Figure 3**. These busbars are accessible when the front side panel is removed. Busbars to connect external batteries are accessible from the front of the UPS.



**NOTE**

*External connection access requires removal of a protective panel on the lower front of the UPS.*



**NOTE**

*There is no battery fuse in the UPS; the battery cabinet must include a circuit breaker to cut off the current in case of short circuit. Refer to **Table 8** for current ratings.*

### 3.1.5 Safety Ground

The safety ground busbar is located below the Maintenance Bypass circuit breaker or to the right of the UPS Output breaker for 160-200KVA models as shown in **Figure 3**. The safety ground cable must be connected to the ground busbar and bonded to each cabinet in the system.

All cabinets and cable conduit should be grounded in accordance with local regulations.



## WARNING

Risk of electrical shock from ground fault. Can cause injury and death.

Failure to follow proper grounding procedures can result in electric shock hazard to personnel or the risk of fire, should a ground fault occur.



**NOTE**

*Proper grounding significantly reduces electromagnetic interference problems in systems.*



**NOTE**

*The ground busbar is easily accessible when the lower protective cover plate is removed.*

### 3.1.6 Protective Devices

For safety, it is necessary to install circuit breakers in the input AC supply and external battery battery cabinets, external to the UPS system. Given that every installation has its own characteristics, this section provides guidelines for qualified installation engineers with knowledge of operating practices, regulatory standards and the equipment to be installed.

#### UPS Rectifier and Bypass Input Supply

- **Protection from excessive overcurrents and short circuits in power supply input**

External overcurrent protection for the AC output circuit is to be provided. See **6.4 - UPS Electrical Characteristics** and **Table 9** for overload capacity.

When an external battery supply not made by Liebert is used, the customer must provide overcurrent protection for the battery circuit.

- **Dual Input**

When wiring the UPS with dual inputs, the Rectifier input and the Bypass input must be protected separately. Size the breakers according to the input currents shown in **Table 8**.

### 3.1.7 Cabling Procedure

## NOTICE

Risk of improper installation. Can cause improper operation and void warranty.

The operations described in this section must be performed by authorized electricians or qualified technical personnel. If you have any difficulties, contact your local Liebert® representative or Liebert Services.



### NOTE

*Hydraulic pressure pliers, combinative tools and piston ring pliers should be used to connect AC wiring.*

Once the equipment has been positioned and secured for operation, and the battery and ground collars have been connected (see **3.1.4 - Cable Connections**), connect the power cables as described below. (Study the reference drawing in **8.0 - Installation Drawings**.)

1. Verify that all incoming high and low voltage power circuits are de-energized and locked out or tagged out before installing cables or making any electrical connections.
2. Remove the front protective cover to gain easier access to the connections busbars.
3. Connect the safety ground and bonding ground bus cables to the copper ground busbar located on the bottom of the equipment below the power connections. All cabinets in the UPS system must be connected to the user's ground connection.



### NOTE

*The grounding bonding arrangement must comply with the National Electrical Code and all applicable local codes.*

4. Identify and make power connections with incoming cables according to **Steps 5** through **11**.

### Common Input Connections

5. For common bypass and rectifier inputs, connect the AC input supply cables between the power distribution panel and the UPS input busbars (A-B-C terminals) and tighten the connections to 88 lb-in. (10 N-m) using the M8 bolt provided.

### Dual Input Connections

6. Remove the internal links installed between the Input circuit breaker (CB1) busbars and Bypass Input busbars as shown in **Figure 3**.
7. For the bypass, connect the AC input supply cables between the power distribution panel and the UPS Rectifier Input busbars (CB1 A-B-C terminals) and tighten the connections to 88 lb-in. (10 N-m) using the M8 bolt provided.
8. For the Rectifier Input, connect AC input supply cables between the power distribution panel and the UPS Rectifier Input busbars (CB1 A-B-C terminals).

**NOTE**

*Both the rectifier and bypass feeds must come from the same utility source. The UPS can be powered from separate sources provided all the following conditions are met:*

1. *The transformers are delta/ wye isolation transformers where the wye secondary's are connected to the NX 480V UPS.*
2. *The individual transformer used to supply the Bypass of the NX 480V is solidly bonded to earth ground at the transformer.*
3. *The individual transformer used to supply the Input (rectifier) of the NX 480V is solidly bonded to earth ground at the transformer.*
4. *There are no appreciable ground currents flowing between the two transformers.*
5. *No delta/ delta (ungrounded or corner grounded) transformers are used as a source to the NX 480V UPS.*
6. *No high resistance or low resistance grounds can be used in the neutral bonding path to ground of the delta/ wye isolation transformers described above in Items 2 and 3.*
7. *All applicable NEC standards and wiring rules are enforced.*
8. *The internal bypass to input (rectifier) shorting bars in the NX 480V UPS are removed.*

*The above all apply to single-module systems.*

9. *For 1+N paralleled system, the Bypass to each unit must be fed from the same utility source.*

**Output System Connections—Ensure Correct Phase Rotation**

10. Connect the system output cables between the UPS output busbars (A-B-C terminals) and the critical load and tighten the connections to 88 lb-in. (10 N-m) (M8 bolt).

**WARNING**

Risk of electric shock. Can cause injury and death.

If the load equipment will not be ready to accept power on the arrival of the commissioning engineer, then ensure that the system output cables are safely isolated.

**Observe the battery cable polarity.** Be sure that the battery connector is made with the correct polarity.

11. Refit all protective covers removed for cable installation.

**Frequency Converter Mode**

If a frequency converter configuration is used, connect the AC input supply cables to the rectifier input busbars (A-B-C terminals). Torque to 88 lb-in (10N-m) for M8 bolts. Ensure correct phase rotation. There will not be any AC bypass supply cables to the bypass input (A-B-C terminals) and tighten the connections.

**NOTE**

*The operations described in this section must be performed by authorized electricians or qualified technical personnel. If any difficulties arise, contact Liebert® at 1-800-LIEBERT.*

**NOTE**

*For frequency converter operation, ensure that the linking busbars between the bypass and the rectifier input are removed.*

## 3.2 Control Cables

### 3.2.1 Monitor Board Features

Based on your site's specific needs, the UPS may require auxiliary connections to manage the battery system (external battery circuit breaker, battery temperature sensor), communicate with a personal computer or provide alarm signaling to external devices or for Remote Emergency Power Off (REPO). The monitor board, arranged for this purpose, is located on the rear of the operator access door. The main features are:

- Input and Output dry contacts signal (one pair of contacts of relay)
- Emergency Power Off control (EPO)
- Environmental parameter input interface
- User communication (for data setting and user background monitor)
- Liebert® IntelliSlot® interface
- Modem interface
- Temperature detect interface

Figure 4 shows the relationship and connection between the monitoring (U2) board and other boards in the UPS.

Figure 4 Monitor board U2

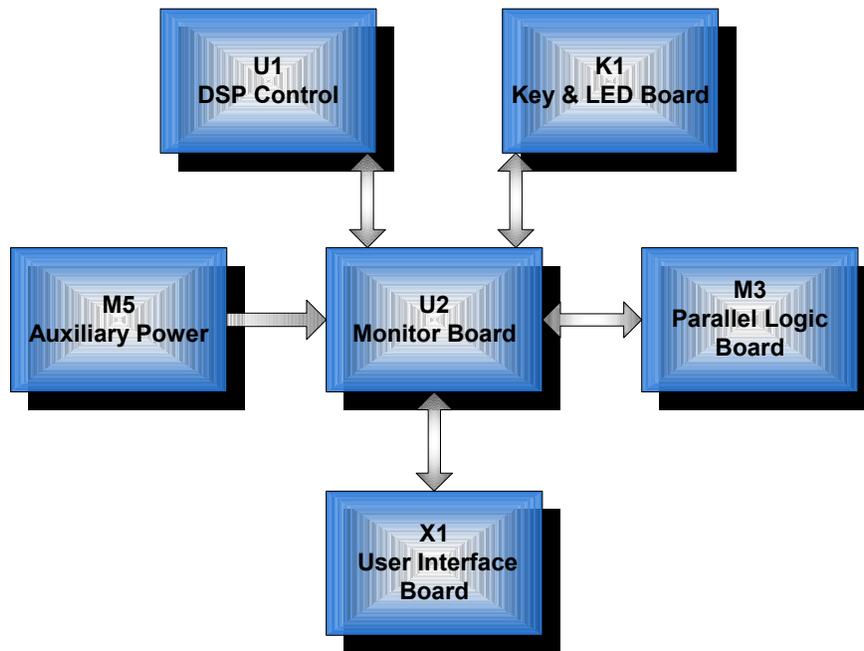
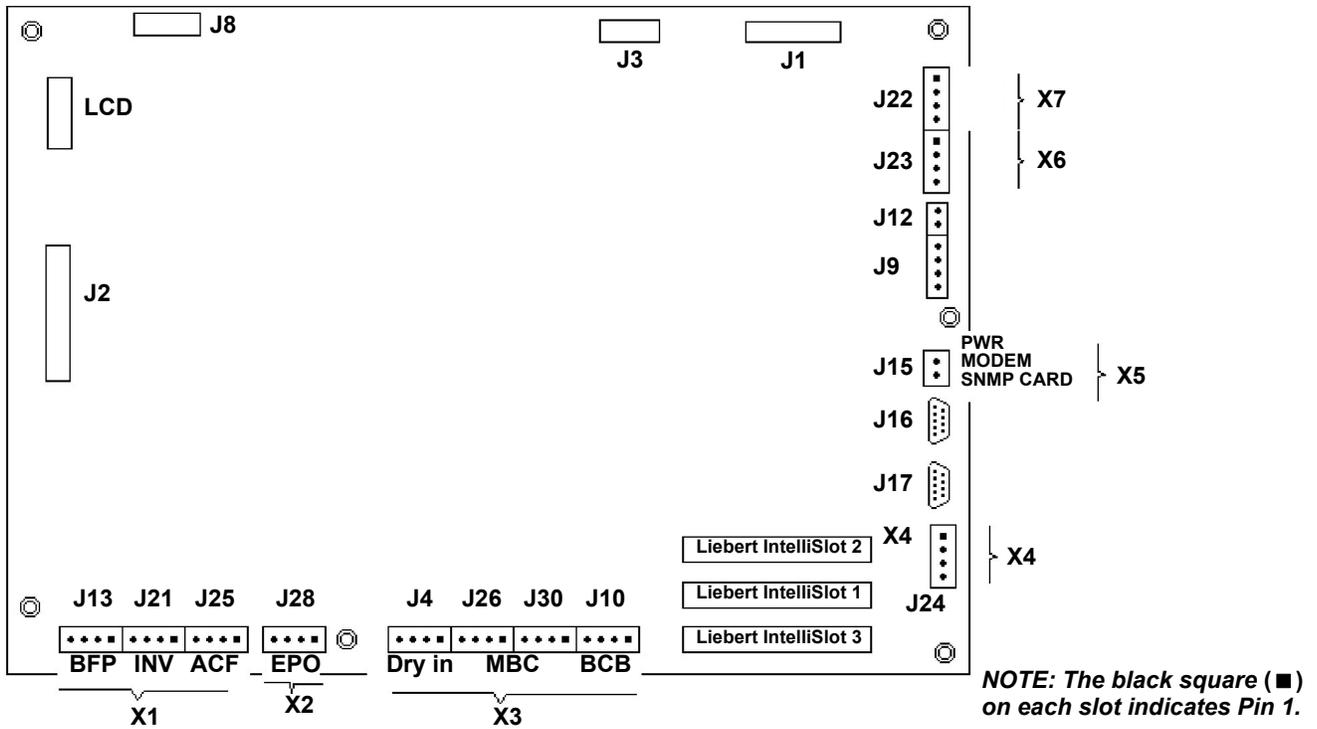


Figure 5 Auxiliary terminal block detail (Monitoring Board)



### 3.3 Dry Contacts

The UPS provides input dry contacts and output dry contacts.



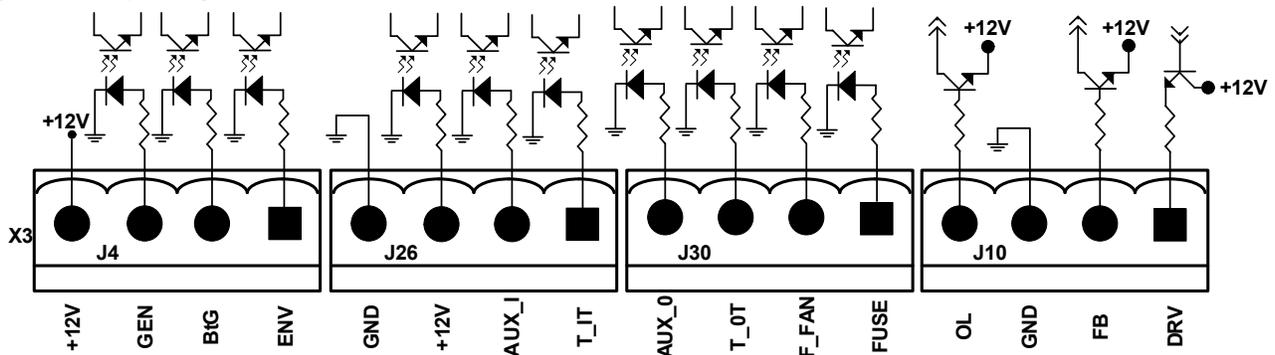
**NOTE**

When operating the Liebert® NX™ with dry contacts, ESD measures must be taken or the contacts may be damaged.

#### 3.3.1 Input Dry Contacts

There are several input dry contacts at the X3 slot.

**Figure 6 Input dry contacts**



**NOTE:** The black square (■) on each slot indicates Pin 1.

**Table 1 Input dry contacts at X3**

Position	Name	Description
J4.1	ENV <sup>3</sup>	Battery Room Alarm (Normally Closed)
J4.2	BtG	Battery Ground Fault Detection (Normally Closed)
J4.3	GEN <sup>1,2</sup>	Generator Detection (Normally Open)
J4.4	+12V	+12V Power

1 - Must be configured using configuration software before becoming active.

2 - When activated, the charger current can be limited, via software, to a percentage of the full charger current (0-100%).

3 - Activating this feature turns the battery charger off.

#### 3.3.2 Maintenance Bypass Cabinet Interface

J26 and J30 are the MBC interface.

**Table 2 Maintenance bypass cabinet interface**

Position	Name	Description
J26.1	T_IT <sup>1</sup>	Input transformer over temperature (N.C.)
J26.2	AUX_I	Reserved
J26.3	+12V	+12V Power
J26.4	GND	Power Ground
J30.1	FUSE	Reserved
J30.2	F_FAN	Fan Fail Alarm (N.C.)
J30.3	T_OT <sup>1</sup>	Output Transformer Overtemperature (N.C.)
J30.4	AUX_O	Reserved

<sup>1</sup> - Must be configured using configuration software before becoming active.



**NOTE**

All auxiliary cables of terminal must be double-insulated. The wire must be 600V, 18-16 AWG stranded for maximum runs between 82 and 197 feet (25-60m), respectively.

### 3.3.3 Battery Circuit Breaker Control Interface

J10 is the Battery Circuit Breaker (BCB) box interface.

**Table 3 BCB control interface**

Position	Name	Description
J10.1	DRV	BCB Driver Signal
J10.2	FB	BCB Contact State
J10.3	GND	Power Ground
J10.4	OL	BCB On-Line - Input - This pin will become active when BCB interface is connected. (N.O.)



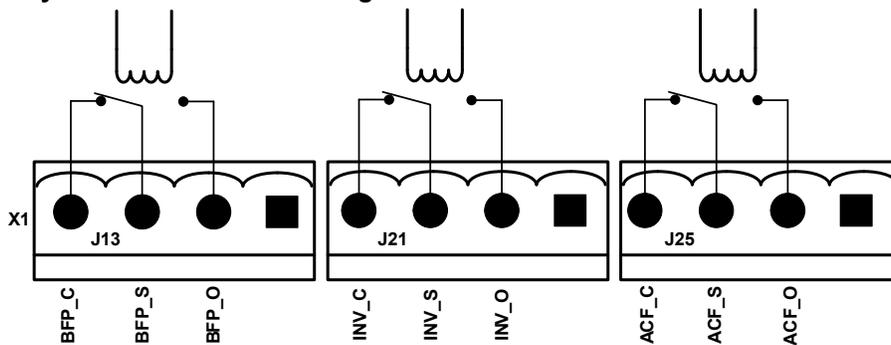
**NOTE**

All auxiliary cables of terminal must be double-insulated. The wire must be 600V, 18-16 AWG stranded for maximum runs between 82 and 197 feet (25-60m), respectively.

### 3.3.4 Output Dry Contacts

There are three output dry contact relays at the X1 slot (see **Figure 7** and **Table 4**).

**Figure 7 Output dry contacts and EPO wiring for firmware before M170**



**NOTE:** The black square on each slot ■ indicates Pin 1.

**Table 4 Output dry contact relays**

Position	Name	Description
J13.2	BFP_O	Bypass feedback protection relay. Normally open. Closed when bypass SCR is shorted;. 5A, 250VAC/24 VDC
J13.3	BFP_S	Bypass feedback protection relay center; 5A, 250VAC/24 VDC
J13.4	BFP_C	Bypass feedback protection relay. Normally closed. Open when bypass SCR is shorted; 5A, 250VAC/24 VDC
J21.2	INV_O	Inverter mode relay. Normally open. Closed when UPS is in inverter mode.; 5A, 250VAC/24 VDC
J21.3	INV_S	Inverter mode relay center; 5A, 250VAC/24 VDC
J21.4	INV_C	Inverter mode relay. Normally closed. Open when UPS is in inverter mode; 5A, 250VAC/24 VDC
J25.2	ACF_O	Main input fault relay. Normally open. Closed when main input is in fault; 5A, 250VAC/24 VDC
J25.3	ACF_S	Main input fault relay center; 5A, 250VAC/24 VDC
J25.4	ACF_C	Main input fault relay. Normally closed. Open when main input is in fault; 5A, 250VAC/24 VDC



**NOTE**

All auxiliary cables of terminal must be double-insulated. The wire must be 600V, 18-16 AWG stranded for maximum runs between 82 and 197 feet (25-60m), respectively.

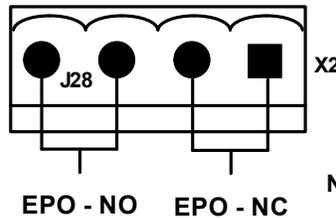
### 3.3.5 EPO Input—Optional

The UPS has an Emergency Power Off (EPO) function operated by a button on the control panel or by a remote contact provided by the user. The local EPO button is under a hinged, clear plastic shield.

The X2 slot, shown in **Figure 8**, is the remote EPO input interface. The EPO has a NO/NC contact point that becomes active when shorting terminals X2: 3 and 4 or open terminal connection X2: 2 and 1.

If an external Emergency Stop facility is required, it is connected terminals X2: 1 and 2 or X2: 3 and 4 of the auxiliary terminal block (X2). It also is connected to the Normally Open or Normally Closed remote stop switch between these two terminals using shielded cable (see **Figure 8** and **Table 5**). If this function is not used, terminals X2: 3 and 4 must be opened and X2: 1 and 2 must be closed.

**Figure 8 EPO wiring**



**NOTE:** The black square ■ indicates Pin 1.

**Table 5 EPO input contact relays**

Position	Name	Description
J28.1	EPO_NC	EPO Activated when opened to J28.2
J28.2	EPO_NC	EPO Activated when opened to J28.1
J28.3	EPO_NO	EPO Activated when shorted to J28.4
J28.4	EPO_NO	EPO Activated when shorted to J28.3



**NOTE**

*The Emergency Stop action within the UPS shuts down the rectifier, inverter and static bypass. It does not internally disconnect the input power supply. To disconnect ALL power to the UPS, open the upstream feeder breaker(s) when the remote EPO is activated.*



**NOTE**

*Normally Closed EPO – X2: 1,2, these terminals are supplied factory-linked on the monitor board and must remain installed if using NO contacts.*



**NOTE**

*All auxiliary cables of terminal must be double-insulated. The wire must be 600V, 18-16 AWG stranded for maximum runs between 82 and 197 feet (25-60m), respectively.*

## 4.0 BATTERY INSTALLATION

### 4.1 Introduction

If using multiple sets of batteries connected in parallel to provide the required battery backup run times, fit each set with an isolating device to permit working on one of the battery sets while leaving the others in service and providing backup protection.

When replacing batteries, replace with the same manufacturer and type, or equivalent. See your Liebert® representative for a list of approved batteries.

### 4.2 Safety

Special care should be taken when working with the batteries associated with the Liebert NX™ system equipment. When all batteries are connected together, the battery terminal voltage may exceed 480V and is POTENTIALLY LETHAL.

## WARNING

Risk of electric shock. Can cause injury, property damage and death.

Special care should be taken when working with the batteries associated with this equipment. Batteries are always live. Battery terminal voltage will exceed 480VDC and is potentially lethal.

In addition to the hazard of electric shock, gas produced by batteries can be explosive and sulfuric acid can cause severe burns.

Batteries should be installed, serviced and replaced only by properly trained and qualified service personnel trained in safe battery handling methods and who have the correct PPE (Personal Protection Equipment) and tools.

The following precautions should be observed when working with the batteries:

- Eye protection should be worn to prevent injury from electrical arcs.
- Remove rings, watches and all other metal objects.
- Use only tools with insulated handles.
- Wear rubber gloves and boots.
- When replacing batteries, replace them with the same type and number of batteries or battery packs.
- Do not dispose of batteries in a fire. The batteries may explode.
- Do not open or mutilate batteries. Released electrolyte is harmful to the skin and eyes. It is toxic.
- Never lay metal objects of any type on top of the batteries.
- Disconnect the charging source before connecting or disconnecting battery terminals.
- Determine whether the battery is grounded. If the battery is grounded, remove source of the ground. Contact with any part of a grounded battery can result in electrical shock. The likelihood of such shock can be reduced if such grounds are removed during installation and maintenance.



## CAUTION

Risk of explosion and fire. Can cause property damage, injury and death.

To reduce the risk of fire, connect only to a circuit provided with correct amperes maximum branch circuit overcurrent protection (see **Table 12**) in accordance with the National Electric Code, ANSI/NFPA 70.



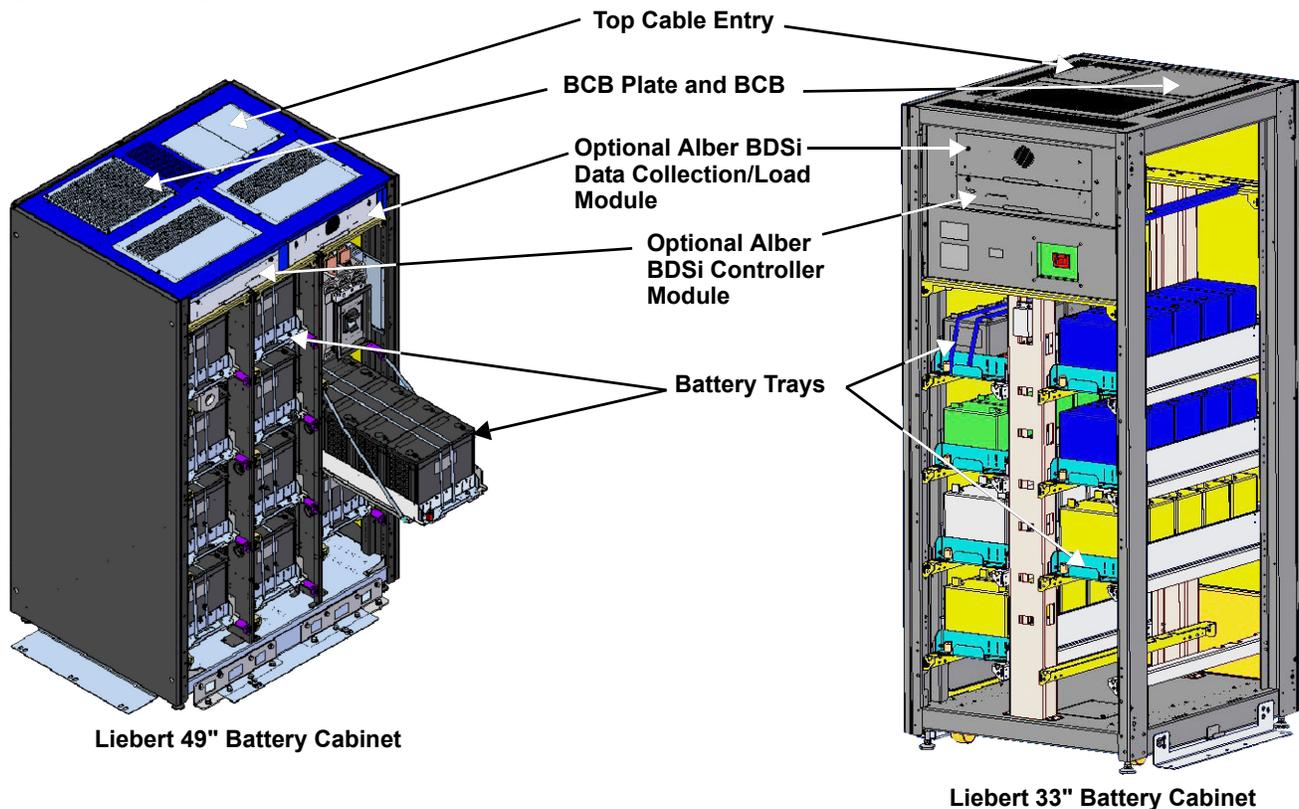
## NOTE

*The maximum available fault current from the battery supply is 8500A and the DC voltage rating of the battery supply overcurrent protective device that is to be installed near the battery supply must be at least 600VDC.*

## 4.3 External Battery Cabinet Installation

### 4.3.1 Battery Cabinets

Figure 9 Battery cabinets for Liebert® NX™



Liebert 49" Battery Cabinet

Liebert 33" Battery Cabinet

The same model battery cabinet may be installed in parallel in multiple cabinet strings for additional capacity. Battery run time depends on the cabinet model, the number of cabinets and the load on the UPS.

**Handling**—The battery cabinet has casters to facilitate movement over short distances. The bottoms of the battery cabinets are reinforced to permit movement by forklift over longer distances.

**Inspection**—Remove all panels and visually inspect the batteries, bus connections and cabinet for any damage. Exercise caution: voltage is present within the battery cabinet even before installation. If there are signs of damage, do not proceed. Call Liebert Services at 1-800-542-2378.

**Storage**—The batteries can be stored for up to six months without appreciable deterioration. If planning to store a battery cabinet for longer than six months or at temperatures higher than 77°F (25°C), contact Liebert Services for recommended precautions.



## CAUTION

Risk of electrical shock. Can cause injury and death.

Any battery system should be installed by properly trained and qualified personnel.

When installing an external battery cabinet that is NOT a Liebert NX battery cabinet, the customer must provide overcurrent protection. See **Table 8** for sizing of protection devices.



### NOTE

When using an external battery supply that is not provided by Liebert, refer to the battery manufacturer's installation manual for battery installation and maintenance instructions, available on the manufacturer's Web site.



### NOTE

When replacing batteries, Liebert recommends that all batteries in external cabinets be the same type. See **Table 11** for a list of batteries that are approved for use with this product.

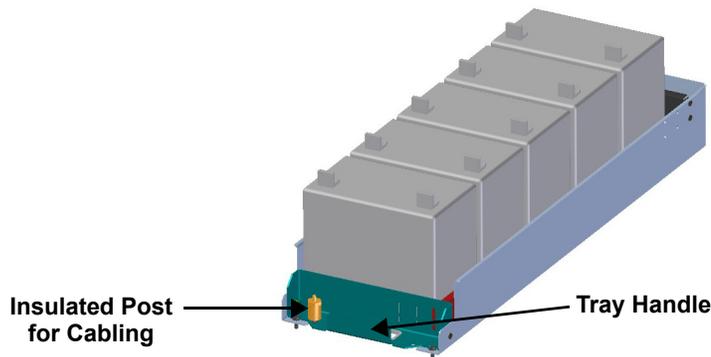
### 4.3.2 Connecting the Batteries

If the Liebert® NX™ battery cabinets are installed on a raised floor, the battery power cables and circuit breaker control cables may be routed to the UPS cabinet via the floor of the cabinet (bottom entry).

If the Liebert NX battery cabinets are installed adjacent to one another on a solid floor, these cables may be passed between the cabinets through lifting slots in the lower sides of the cabinets.

Intertray connections must be made before the battery cabinet can be used.

**Figure 10 Battery cabinet—details**



### 4.3.3 Installation Considerations

**Position**— If the system includes a matching maintenance bypass cabinet (MBC), the MBC should be installed first and the battery cabinet installed on the opposite side of the UPS. Otherwise, left-side placement of the battery cabinet is preferable.

The battery cabinet(s) are designed to be located conveniently next to each UPS module, and are also available in stand-alone configurations with painted side panels. The front access design eliminates side and rear service clearance requirements. Refer to **Table 38** for battery cabinet dimensions and weights.

**Bolt-On Cabinets**—Matching battery cabinets are designed to bolt onto the side of the UPS module cabinet. Use bolts that ship with each unit to connect cabinet frames at posts, two places in the front and two places in the rear.

**Service Clearance**—Allow front access to the battery cabinet at all times for maintenance and servicing. Electrical codes require that the battery cabinet be installed with no less than 3 feet (1m) of clearance at the front of the cabinet when operating. Side and rear panels do not require service clearance.

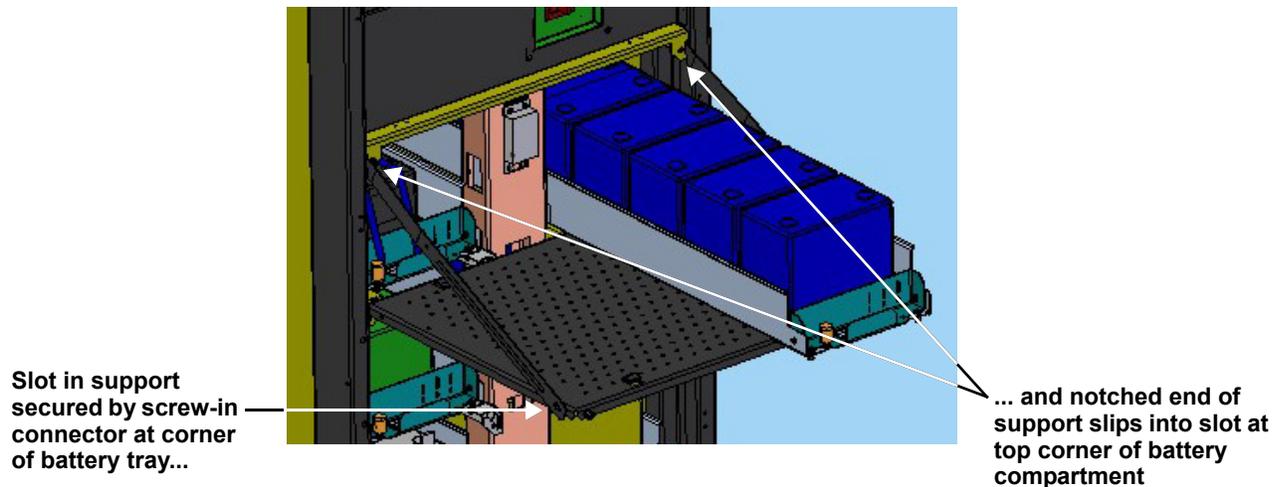
**Cables**—Cables may be run between the cabinets through cutouts in the top of the cabinet, eliminating the need for external conduit runs. Route cables before moving cabinets into final position for bolting together. No top or bottom entry cables are required, except for remotely located cabinets which require conduits.

**Software**—To allow the UPS to accurately display the battery run time, the number of battery cabinets must be noted when performing initial startup and setup using the configuration software. This is to be performed by the Liebert Services customer engineer when commissioning the unit.

**Casters and Adjustable Stops**—The adjustable stops are not designed to bear the full weight of the cabinet. Lower the stops until they are finger-tight in contact with the floor. Then tighten a small amount with a wrench (less than two turns) to give a good friction fit. When mounting the battery cabinet on seismic stands, ensure that the casters are bearing the weight of the cabinet.

**Battery Support Tray**—Be sure to connect the battery tray support to the front of the cabinet before sliding a battery tray out for connection or service. Without the support, the battery tray may fall out of the cabinet. See **Figure 11** for details.

Figure 11 Battery tray and supports



#### 4.3.4 Connecting the Battery Cabinet to the UPS

After the battery cabinet equipment has been positioned and secured for operation and the batteries have been connected, connect the power cables as described below.

1. Verify that all incoming high and low voltage power circuits are de-energized and locked out or tagged out before installing cables or making any electrical connections.
2. Remove the UPS front protective cover to gain access to the equipment ground busbar.
3. Connect the safety ground and any necessary bonding ground cables to the copper ground busbar. (example: UPS located on the bottom of the equipment below the power connections).

All cabinets in the UPS system must be connected to the user's ground connection.



#### NOTE

*The grounding bonding arrangement must be in accordance with the National Electrical Code and all applicable local codes.*

4. Connect the system battery cables. Be sure that the battery connections are made with the right polarity, and tighten the connections to 44 lb-in. (5 N-m) (M6 Bolt). Do not close the battery circuit breaker before the equipment has been commissioned.
5. Connect supplied auxiliary control cable to pins J10.2 and J10.3 on the U2 monitoring board (see 3.3 - Dry Contacts).

#### 4.4 Non-Standard Batteries

When batteries other than a matching battery cabinet are used, a remote battery disconnect switch with overcurrent protection is required per the National Electrical Code. Contact your local Liebert® sales representative about this option.

Install battery racks, cabinets and batteries in accordance with the manufacturer's instructions.

Verify that the battery area has adequate ventilation and battery operating temperature complies with the manufacturer's specifications and with all applicable national and local codes.

If you have any questions concerning batteries, battery racks or accessories, contact Liebert Services at 1-800-543-2378.

## 4.5 BCB Shunt Trip

The Liebert NX battery cabinet has the shunt trip installed in the circuit breaker. When a DC ground fault (using the optional DC Ground Fault kit), a battery overtemperature or EPO is activated, the shunt trip will open the circuit breaker.



### NOTE

*The Liebert NX battery Cabinet circuit breaker will not open at the end of a battery discharge. The UPS will isolate the batteries internally in this situation.*

## 4.6 Alber Monitoring System—Optional

The Liebert® matching battery cabinet allows installing an optional Alber® battery monitoring system in the cabinet. The Alber Battery Monitoring by Liebert continuously checks all critical battery parameters, such as cell voltage, overall string voltage, current and temperature. Automatic periodic tests of internal resistance of each battery will verify the battery's operating integrity. Additional capabilities include automatic internal DC resistance tests and trend analysis providing the ability to analyze performance and aid in troubleshooting.

The Alber monitoring system is installed inside the battery cabinet (see **Figure 9**). The monitoring system requires approximately 0.5A, single-phase 480V.



### NOTE

*This power must be UPS protected.*

This power can come from the output terminals of the UPS, a distribution panel, or another UPS-protected source. This power is to be field supplied. See **Figure 37** for wiring location.

For details about operating the Alber system, see the Alber Monitoring System manual.

## 5.0 OPTIONS

### 5.1 Load Bus Synchronization

The Load Bus Synchronizer (LBS) keeps the output of two independent UPS systems or parallel UPS systems in synchronization even when the systems are operating in different modes and even when either or both systems are operating on batteries. When the LBS is used, one UPS system is designated as master, the other as slave.

The LBS option is typically used with dual-corded equipment or with either the Liebert® SmartSwitch™ or Liebert Static Transfer Switch™ (STS) for single-corded equipment.

#### 5.1.1 Performance Requirements

The LBS operates under the following conditions:

- Both master and slave are on inverter (either system may be on inverter through the rectifier or on inverter through the batteries)
- Master on inverter and slave on bypass
- Master on bypass and slave on inverter
- Master and slave on bypass IF the bypass source is the same for both systems

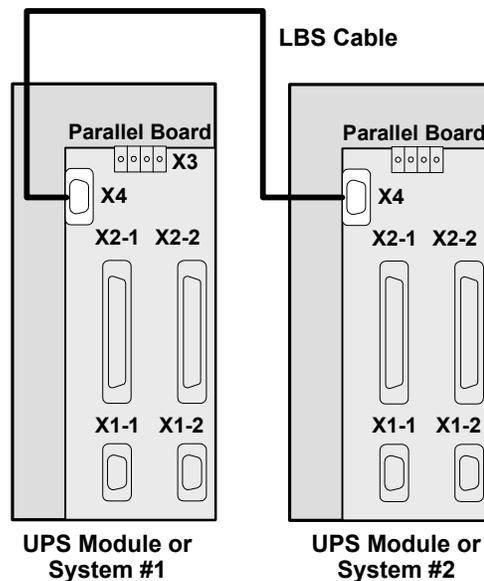
#### 5.1.2 LBS Cable and Settings

For Liebert NX™-to-Liebert NX dual bus configuration, only one optional LBS cable is required, the built-in LBS will operate normally without an extra LBS control box or interface box. The LBS port is X4 on the Parallel Board (M3). The Parallel Board is on the interior of the Liebert NX, above and left of the power electronics; see **Figures 30** and **33**.

An optional, 9-pin LBS cable is used to connect two UPS systems through each system's DB9 port on its Parallel Board. For two parallel systems, the LBS cable can be mounted between any two units belonging to different parallel systems. For information about the LBS kit or to order the optional equipment, see your local Liebert representative.

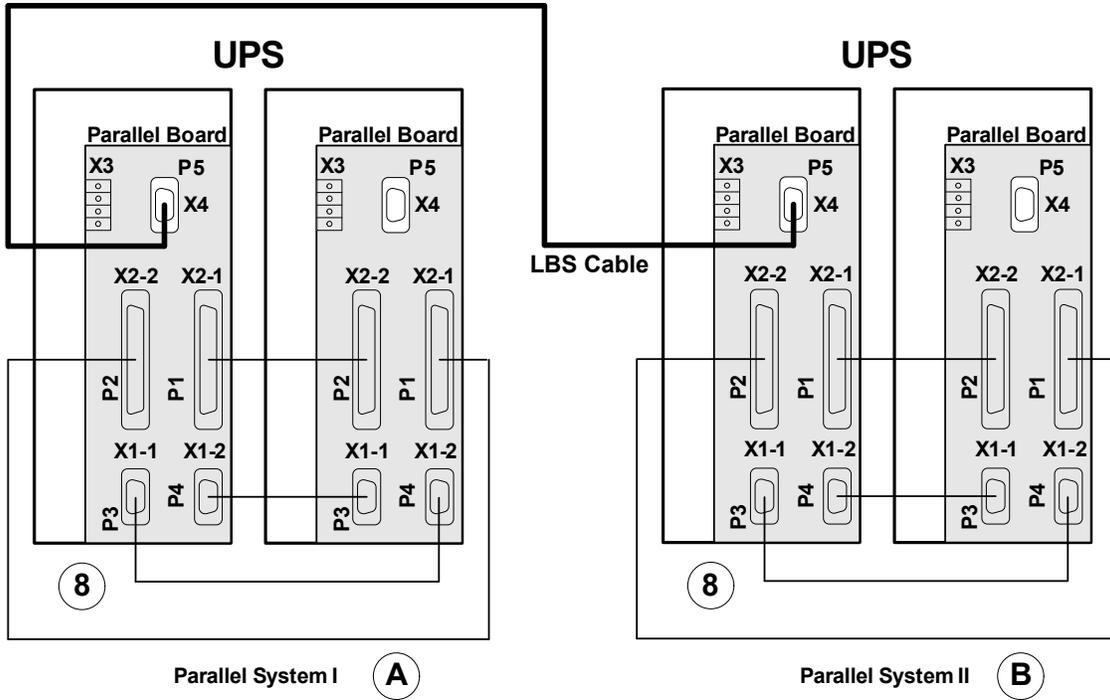
The LBS cable is connected as illustrated in **Figures 12** and **13**.

**Figure 12 Load Bus Synchronization cable connection in single module systems**



The parallel board is on the interior of the Liebert® NX™ UPS, above and left of the power electronics; see Figure 29.

Figure 13 Load Bus Synchronization cable connection with multi-module systems



The LBS function is activated with configuration software; when the LBS takes effect, the graphic LCD will display “LBS active.”

## 5.2 Configuring Parallel Sbasystem Operation

### 5.2.1 General

The Liebert® NX™ uses intelligent and reliable decentralized technology to achieve parallel operation of two or more modules.

The parallel system is used to:

- Increase the reliability of the system to ensure adequate power supply to the critical load connected.
- Increase serviceability and allow the execution of maintenance operations and repairs without affecting the ordinary operating conditions of the system (depending on the redundancy level).

### 5.2.2 Features of Parallel System

- The controls for parallel UPS module operation are standard in the Liebert NX, and the configuration can be set up by changing the settings in configuration software.
- It is easy to install the parallel cables in a ring, providing high reliability and redundancy. And the intelligent paralleling logic provides the user with maximum flexibility. For example, shutting down or starting up the UPS modules in the parallel system can be done in any sequence. If an overload transfer occurs, the whole system can recover automatically from bypass mode after the overload is cleared.
- The total load of the parallel system can be queried from each module's liquid crystal display screen.

**Figure 14 Parallel system block diagram**

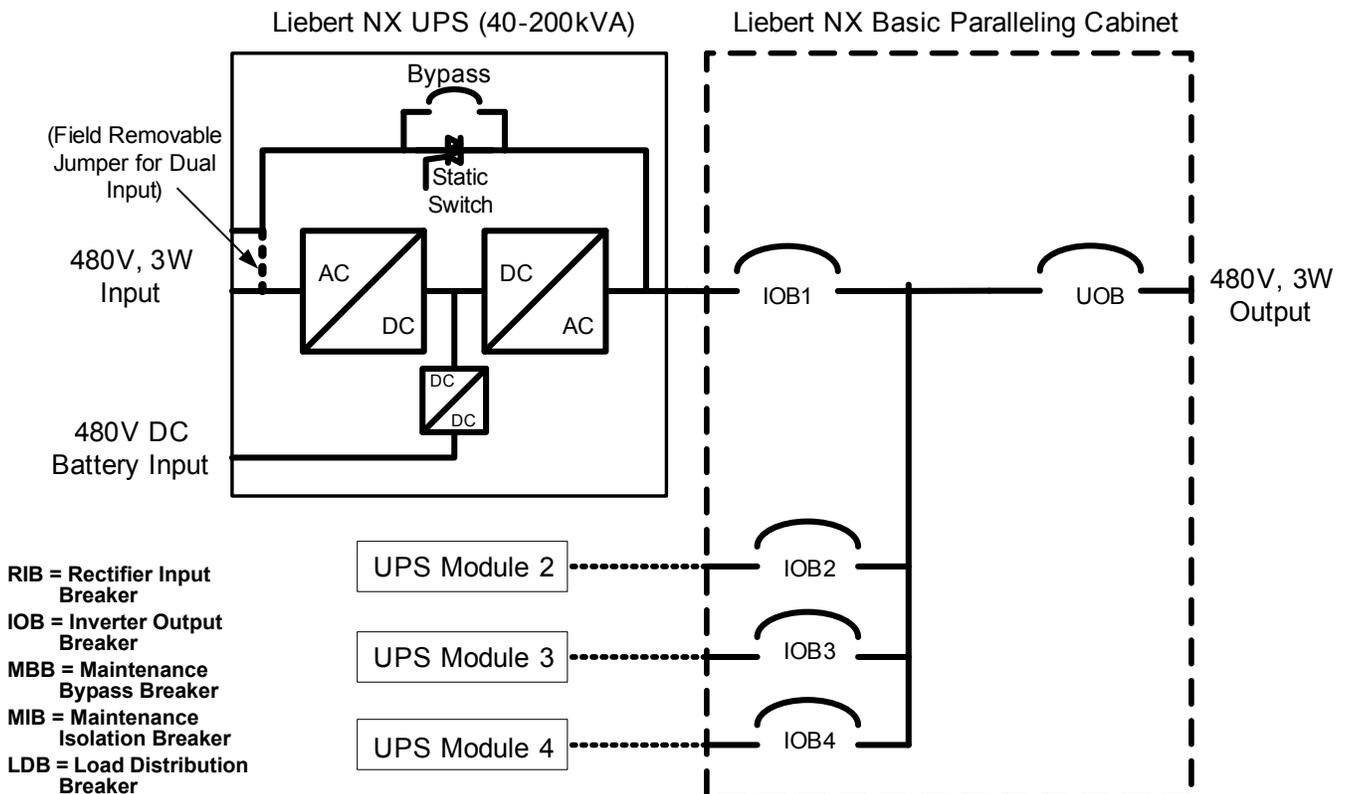


Figure 15 Paralleling cabinet with input and bypass circuit breakers

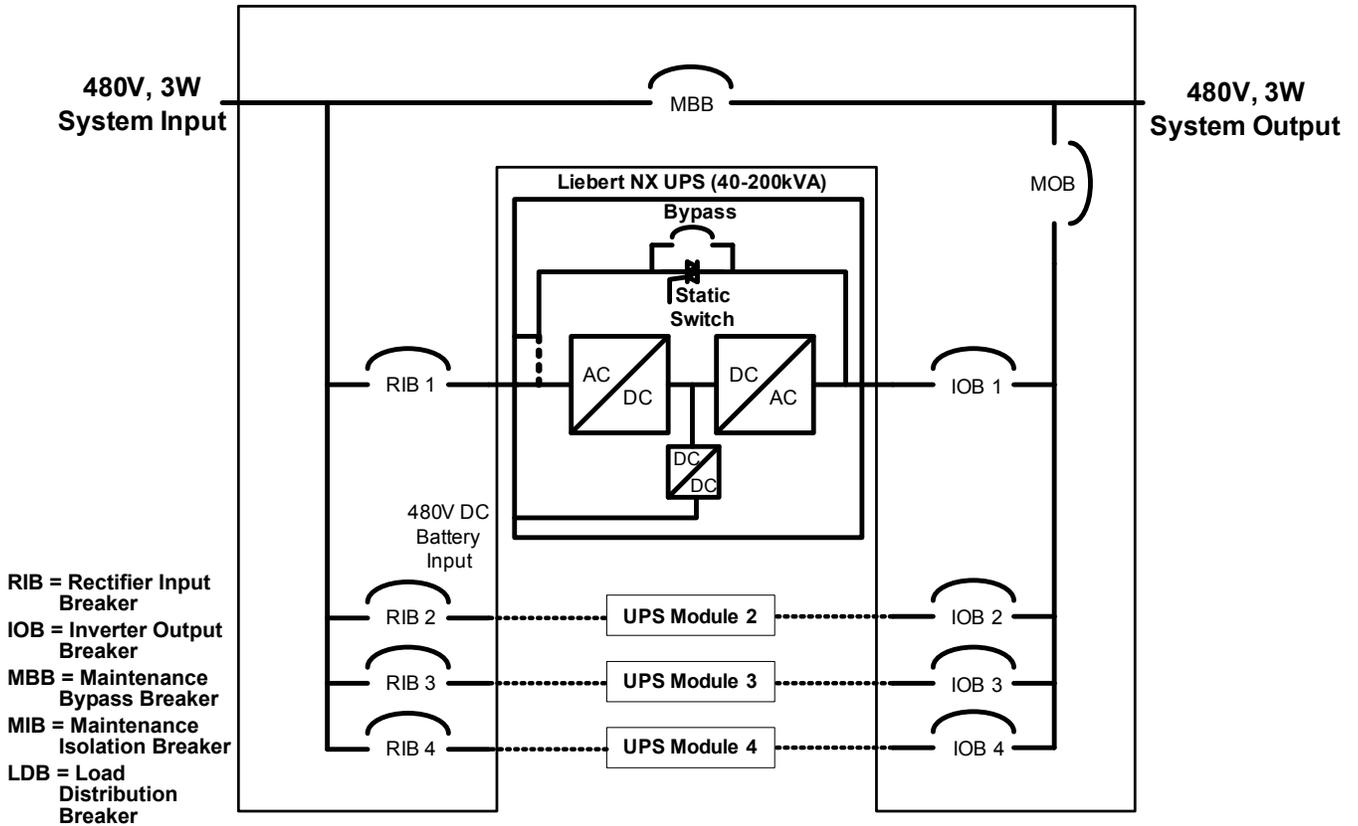
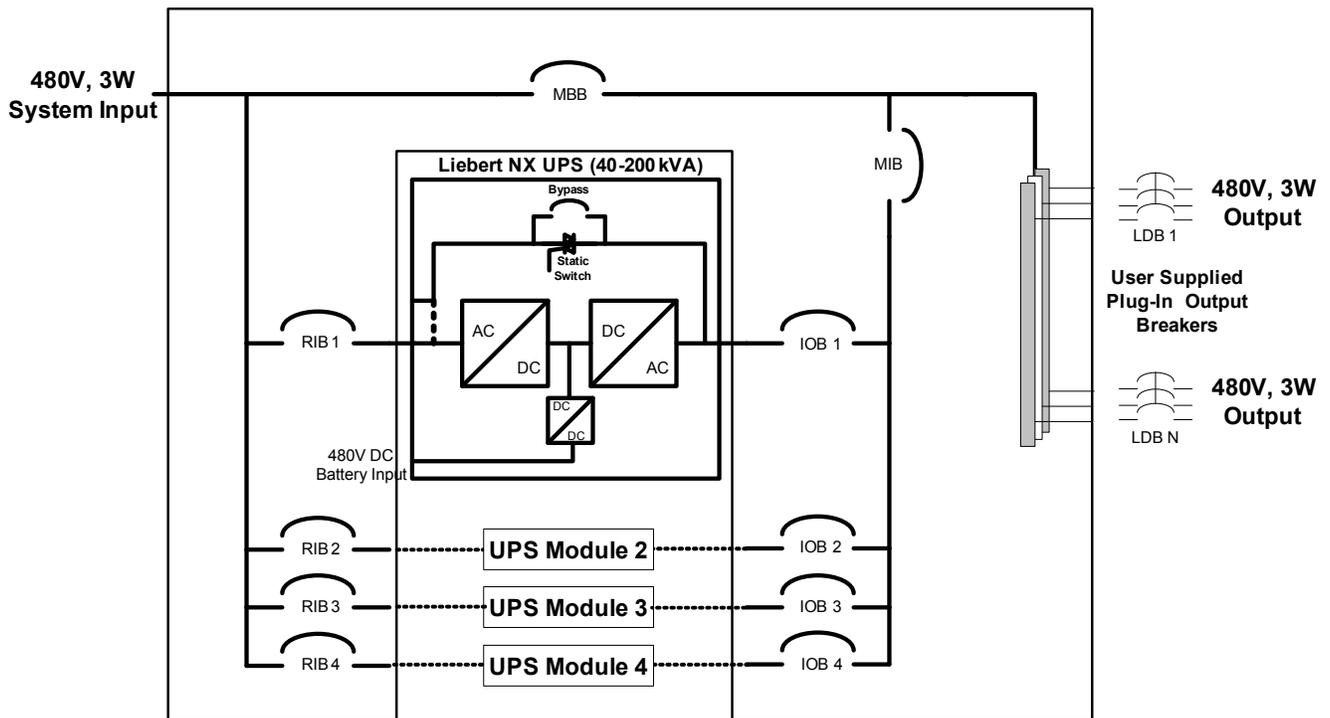


Figure 16 Paralleling cabinet with input, bypass and distribution circuit breakers



### 5.2.3 Operating Principles

#### Redundancy Paralleling

The parallel redundant system can noticeably improve system reliability. In normal condition, none of the UPS modules work at full load. That means that even if the load is increased, the system will not transfer to bypass. And when a UPS module shuts down due to any failure, the remaining UPS modules can still power and protect the load. When redundancy is lost due to module failure or load increase, the parallel system will trigger an alarm.

### 5.2.4 Operation Modes Summary

The parallel system also has operation modes such as normal, battery, bypass and maintenance bypass. All UPS modules in the parallel system operate in coordination.

- **Normal Mode Operation**

The load is powered by the inverters of all the UPS modules in the system. If the frequency of bypass is within the synchronous range, the inverter will be synchronized with the bypass. Otherwise, the system will operate at nominal frequency.

- **Battery Mode Operation**

The batteries of all UPS modules power the load through their inverters. The system operates at nominal frequency.

- **Bypass Mode Operation**

The condition to transfer to bypass mode is essentially the same as that of single module system. The bypass of all the UPS modules powers the load.

- **Maintenance Bypass Mode Operation**

The sequence to transfer to maintenance bypass mode is the same as for transferring a single-module system. The maintenance bypass switches should be switched on as synchronously as possible. Thus the system can be repaired without interrupting the power supply to critical load. If ECO mode is selected, the double-conversion UPS operation is inhibited at most times for the purpose of saving energy. In this mode of operation, not unlike UPS of line-interactive or standby technology, the bypass is the preferred source. Only when the voltage and/or frequency of the bypass supply is beyond pre-defined and adjustable limits is the critical AC load transferred to the inverter.

## 5.3 Installing Parallel System

The basic installation procedure of parallel system is the same as that of single module system. The following sections introduce only the installation procedures specific to the parallel system.

### 5.3.1 Conditions for Parallel System

- Each UPS module must have the same bypass source.
- The outputs of all UPS modules are connected altogether.
- The main inputs can be from different sources, but the phase rotation sequence of main inputs, bypass inputs and outputs must be correct and the same.
- The parallel logic cable and load sharing cable must be connected in a ring correctly (see **Figure 17**).

## NOTICE

Risk of creating parallel systems with incorrect power ratings. Can cause equipment damage. When paralleling UPS's with different power ratings, the power rating of the larger UPS can be no more than four times the power rating of the smaller UPS.

- 40-80kVA Liebert® NX™ units can be installed in parallel with 80-120kVA Liebert NX units.
- 80-120kVA Liebert NX units can be installed in parallel with 160-200kVA.
- 40-80kVA Liebert NX units must not be installed in parallel with 160-200kVA Liebert NX units.

### 5.3.2 Cabinet Installation

#### Parallel system composed of two or more UPS modules using parallel cabinet

The UPS modules that will form the parallel system should be placed side-by-side. Each battery cabinet is placed next to its corresponding UPS module.

The parallel cabinet should be placed in the middle of the system.

### 5.3.3 Preliminary Checks

Each UPS module should have the same firmware and the same hardware version. Refer to the instructions in **5.3.1 - Conditions for Parallel System**.

### 5.3.4 Power Cables

Wiring of power cables is similar to that of a single module system (See **3.1 - Power Cabling**). The bypass sources of all modules should be the same, and the outputs should be connected altogether correctly.

Power cables are field-supplied. Power cables to the UPS's of the paralleling cabinet must be routed through either the top or bottom entry access of the UPS.



#### NOTE

*The system input and/or output circuit breaker is to be field-supplied. See **Table 8** for current rating.*



#### NOTE

*The length and specifications of power cables including the bypass input cables and UPS output cables should be the same, thus the load can be shared evenly in bypass mode.*

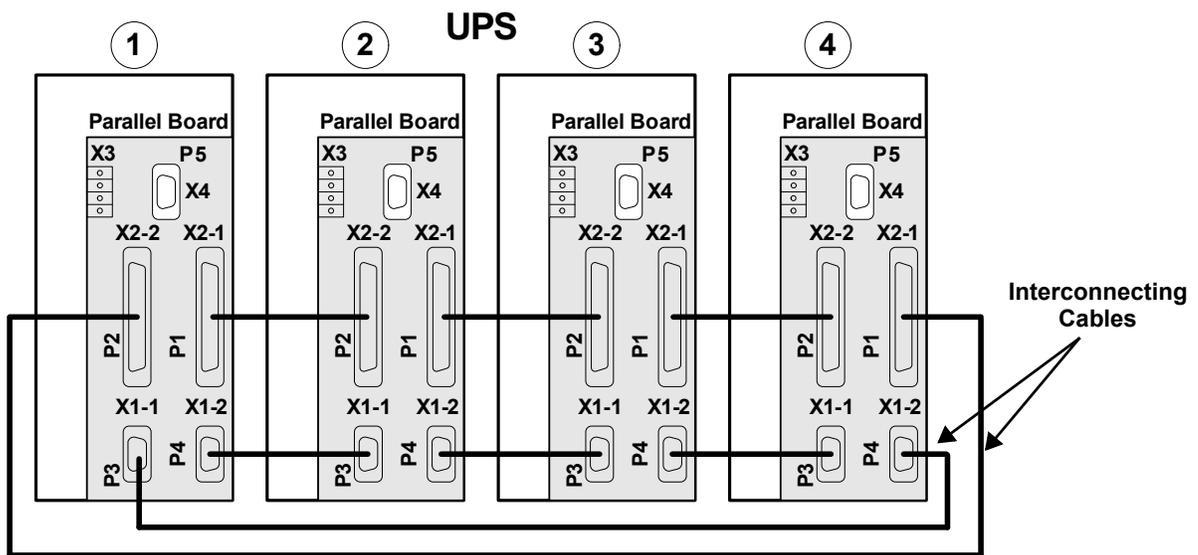
### 5.3.5 Parallel Control Cables

#### Parallel System Control Cables

Make the connections listed below on the parallel logic board (M3) inside the Liebert NX. (See **Figure 30** for the location of the parallel logic board):

Shielded and double-insulated control cables, available in lengths of up to 100 feet (30m), must be interconnected in a ring configuration between UPS modules as shown below. The ring configuration ensures high reliability of the control (refer to **Figure 17**).

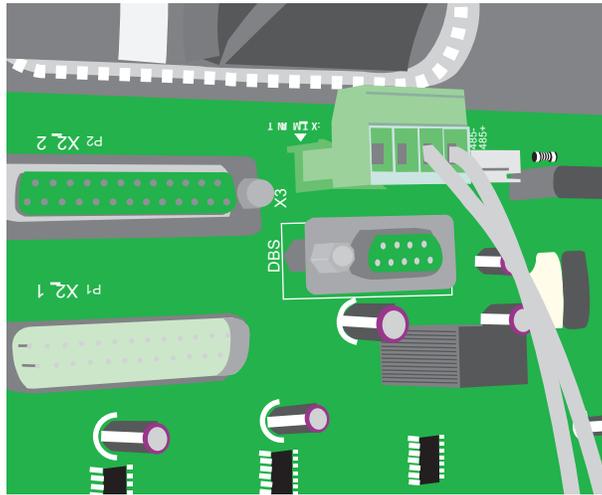
**Figure 17** Connecting system parallel control cables



## Auxiliary Dry Contact Cables

The external output breaker of each UPS must have Normally Open auxiliary contacts. These contacts must be wired to connector X3 on the Parallel Logic Board (M3). See **Figure 18**.

**Figure 18** Auxiliary dry contact cables for output breaker in multi-module system



### CAUTION

The auxiliary control wire must be installed to ensure proper operation of the system.



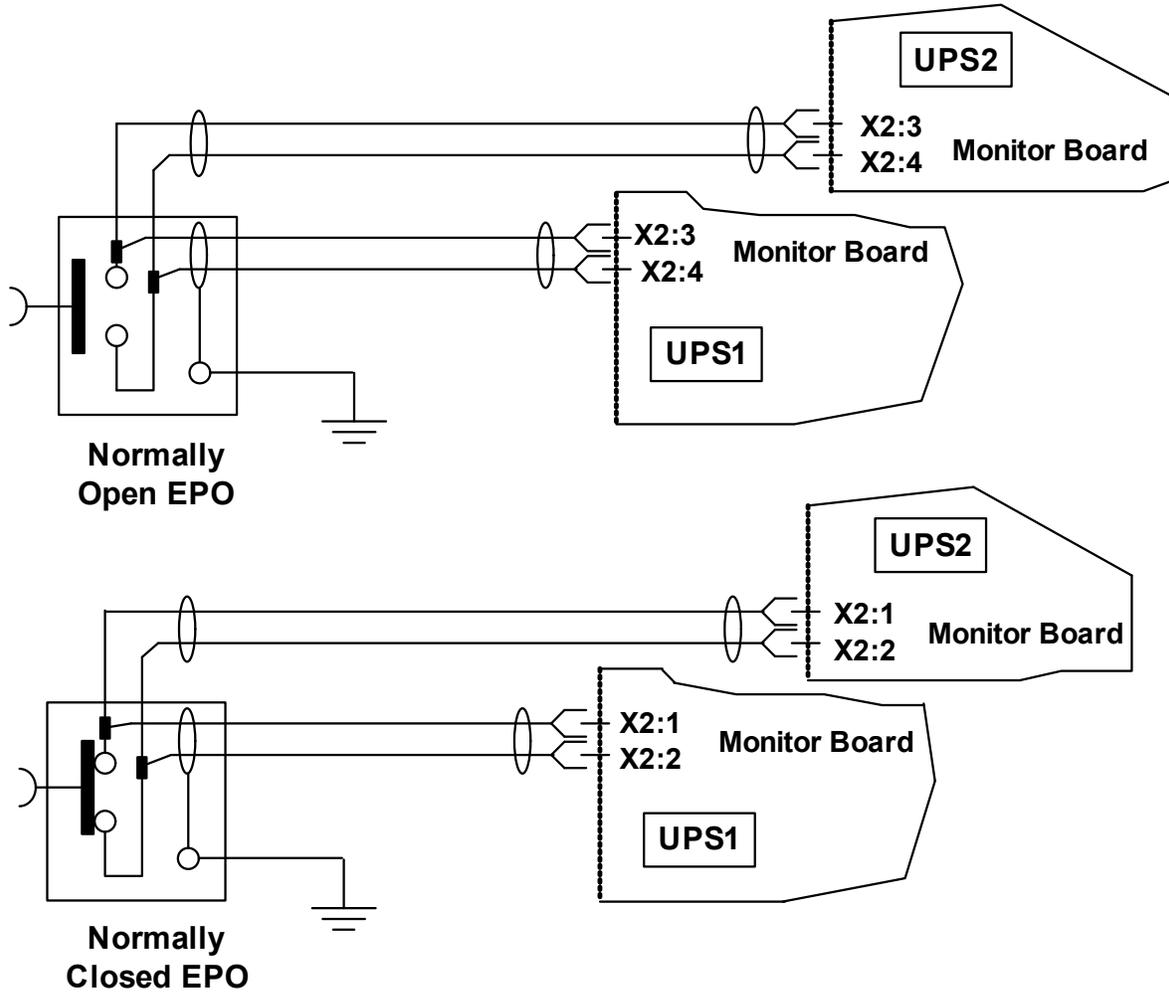
### NOTE

For startup procedure, *11.2 - UPS Startup*.

### 5.3.6 Emergency Power Off (EPO)

The external emergency stop facility is identical to that described for the single unit installation—that an individual emergency stop button is provided for each unit.

Figure 19 Connecting EPO push button



## 6.0 UPS SPECIFICATIONS

These specifications describe requirements for the Liebert® NX™ UPS.

### 6.1 Conformity and Standards

The UPS has been designed to conform to the following standards:

- UL Standard 1778
- CSA 22.2, No. 107.1
- FCC Part 15, Class A
- IEC 61000-4-5
- National Electrical Code (NFPA-70)
- NEMA PE-1
- ISTA\_1H

The UPS shall be UL and cUL listed per UL Standard 1778.

### 6.2 UPS Environmental

The UPS is designed to operate under the following environmental conditions without damage or degradation in electrical operating characteristics.

**Table 6 Environmental characteristics**

Rated Power	40kVA	60/80kVA	100/120kVA	160/200kVA
Operating Temperature, UPS	32°F to 104°F (0°C to 40°C)			
Optimal Operating Temperature, Battery	68°F to 86°F (20°C to 30°C)			
Relative Humidity	0 to 95%, non-condensing			
Accoustical Noise, dBA at 39 in. (1m) (fans at low speed)	61	61	63	68.5
Altitude of Operation	Up to 6562 ft. (2000m) above mean sea level without derating. Linearly derated from 100% load at 6,562 ft. (2000m) to 88% load at 9843 ft. (3000m)			
Storage-Transport Temperature, UPS,	-4°F to 158°F (-25°C to 70°C)			
Storage-Transport Temperature, Battery	-4°F to 86°F (-20°C to 33°C)			

### 6.3 UPS Mechanical Characteristics

**Table 7 UPS mechanical characteristics**

Parameter	40 kVA	60kVA	80kVA	80kVA	100kVA	120kVA	160kVA	200kVA
<b>Dimensions, W x D x H, inches (mm)</b>								
All Units	25.5 x 39.0 x 78.7 (648 x 978 x 2000)			—	—	—	—	—
Units for use with Liebert BDC	—	—	—	25.5 x 39.0 x 78.7 (648 x 978 x 2000)			48.8 x 39.0 x 78.7 (1239 x 978 x 2000)	
Units with Wiring Cabinet Extension	—	—	—	41.0 x 39.0 x 78.7 (1041 x 978 x 2000)				64.4 x 39.0 x 78.7 (1636 x 990 x 2000)
<b>Weight, lb (kg)</b>								
All Units	1290 (585)			—	—	—	—	—
For use with Liebert BDC	—	—	—	1422 (645)			2201 (998)	
Includes Wiring Cabinet Extension	—	—	—	1847 (837)			2626 (1191)	
<b>Heat Dissipation, BTU/H (kWH)</b>	12,200 (3.6)	15,400 (4.5)	20,600 (6.0)	19,700 (5.8)	24,300 (7.1)	28,700 (8.4)	35,900 (10.5)	47,00 (13.8)
<b>Airflow, CFM (m<sup>3</sup>/h)</b>	620 (1050)	620 (1050)	620 (1050)	1668 (2834)	920 (1550)	920 (1550)	1590 (2700)	1590 (2700)
<b>Cable Entry</b>	Bottom or Top							
<b>Color</b>	Black (ZP-7021)							
<b>Protection Grade (with open/closed front doors)</b>	IP 20							

## 6.4 UPS Electrical Characteristics

**Table 8 UPS terminal**

**Input (For Single-Input Unit)**

Unit Rating	Nominal Input Current	Maximum Input Current	OCP Current	OCP Device Rating	Bolt Size	Maximum Recommended Lug (Thomas & Betts Part #)	
						Compression 1-Hole	Mechanical 1-Hole;
40	48	60	72	80	M8	54140	ADR35
60	71	89	106.8	110/125	M8	54148	ADR35
80	94	118	141.5	150	M8	54110	ADR35
100	117	147	176.3	175	M8	54112	31015
120	140	175	210	225	M8	54174	31015
160	186	233	279.5	300	M10	54286	31015
200	234	293	351.5	350	M10	256-30695-886	31015

**Rectifier Input (For Dual Input Unit Only)**

Unit Rating	Nominal Input Current	Maximum Input Current	OCP Current	OCP Device Rating	Bolt Size	Maximum Recommended Lug (Thomas & Betts Part #)	
						Compression 1-Hole	Mechanical 1-Hole
40	48	60	72	80	M8	54140	ADR35
60	71	89	106.8	110/125	M8	54148	ADR35
80	94	118	141.5	150	M8	54110	ADR35
100	117	147	176.3	175	M8	54112	31015
120	140	175	210	225	M8	54174	31015
160	186	233	279.5	300	M10	54286	250mcm
200	234	293	351.5	350	M10	256-30695-886	500mcm

**Bypass Input (For Dual Input Units)**

Unit Rating	Nominal Input Current	Maximum Input Current	OCP Device Rating	Bolt Size	Maximum Recommended Lug (Thomas & Betts Part #)	
					Compression 1-Hole	Mechanical 1-Hole
40	48	60	70	M8	54140	ADR35
60	72	90	110	M8	54145-TB	ADR35
80	96	120	125	M8	54155-TB	ADR35
100	120	150	150	M8	54110	ADR35
120	144	180	200	M8	54112	31015
160	192	240	250	M10	54286	31015
200	241	300	300	M10	256-30695-886	31015

**Output**

Unit Rating	Nominal Output Current	Maximum Output Current	OCP Device Rating	Bolt Size	Maximum Recommended Lug (Thomas & Betts Part #)	
					Compression 1-Hole	Mechanical 1-Hole
40	48	60	70	M8	54140	ADR35
60	72	90	110	M8	54145-TB	ADR35
80	96	120	125	M8	54155-TB	ADR35
100	120	150	150	M8	54110	ADR35
120	144	180	200	M8	54112	31015
160	192	240	250	M10	54174	31015
200	241	300	300	M10	256-30695-886	31015

**Table 8 UPS terminal (continued)**

Battery					
Unit Rating	Nominal Discharge Current	Maximum Discharge Current	OCP Device Rating	Bolt Size	Maximum Recommended Lug (Thomas & Betts Part #)
					Compression One-Hole; 3/8" bolt
40	82 at 480VDC	103 at 384VDC	125	M8	54106
60	122 at 480VDC	155 at 384VDC	175	M8	54107
80	163 at 480VDC	206 at 384VDC	225	M8	54152-TB
100	204 at 480VDC	258 at 384VDC	300	M8	54157
120	244 at 480VDC	309 at 384VDC	350	M8	54167
160	367 at 480VDC	412 at 384VDC	450	M10	54115
200	408 at 480VDC	515 at 400VDC	600	M10	54115

- Nominal (Nom) current is based on full rated output load.
- Maximum (Max) current (125% of nominal) is short duration for battery recharge conditions.
- UPS input and bypass cables must be run in separate conduit from output cables.
- Nominal battery voltage is shown at 2.0 volts/cell per NEC 480-2.
- OCPD = Overcurrent Protection Device. Recommended AC input and AC output overcurrent protection represents 125% of nominal full load current (continuous) per NEC 215.
- Minimum-sized grounding conductors to be per NEC 250-122. Parity-sized ground conductors are recommended. References are per NEC 1999.
- Wiring requirements:
  - AC Input: 3-phase, 3-wire, plus ground.
  - AC Output: 3-phase, 3-wire, plus ground.
- All wiring is to be in accordance with national and local electric codes.

**6.4.1 Input Rectifier**

**Table 9 Rectifier input power**

Rated Power kVA	40	60	80	100	120	160	200
Rated Voltage, VAC	480						
Supply	3-phase, 3-wire plus ground						
Input Voltage Tolerance, VAC (without derating)	480V Nominal +15%, -20% without derating						
Overload capacity of input current	100% I <sub>max</sub> <I <125% I <sub>max</sub> : 60 min 125% I <sub>max</sub> <I <150% I <sub>max</sub> : 10 min; >150% load, less than 200msec						
Frequency, Hz	57-66						
Power Factor	> 0.99 at full load; >0.98 at half load						
Harmonic Current	Less than 3% at full rated UPS output load						

See **Table 8** for current ratings.

**Table 10 Input voltage window with derating**

Input Voltage Window (L-L Voltage)	Percentage of Nominal	Inverter Load, Percentage	Charger Load, Percentage
432VAC to 552VAC	90-115	100%	100%
431VAC to 384VAC	80-89	100%	30%
383VAC to 360VAC	75-79	100%	0%
359VAC to 288VAC	60-74	80%	0%

**Table 11 Liebert-approved replacement batteries**

Battery Manufacturer	Models Supplied
Energys	12HX205FR
	12HX300FR
	12HX330FR
	12HX400RF
	12HX505FR
East Penn	45HR2000
	24HR3000
	27HR3500
	31HR4000
	31HR5000
C&D	UPS12-100MR
	UPS12-150MR
	UPS12-210MR
	UPS12-300MR
	UPS12-400MR
	UPS12-490MR
	UPS12-540MR

**6.4.2 DC Intermediate Circuit**

**Table 12 DC intermediate circuit**

Rated Power kVA	40	60	80	100	120	160	200
Recommended number of lead-acid batteries	Total 40 battery blocks of 12VDC (240 cells of 2VDC) will be supported by UPS						
Recommended float charge voltage	2.27VDC *						
Recommended boost charge voltage	2.4VDC *						
Recommended end of discharge voltage	1.67 - 1.75 VDC						
Maximum recharge battery current, A *	14.8	22.2	29.6	37.0	44.4	59.2	74
Maximum boost charge duration, min. *	1800						
Boost-float threshold current, A *	0.1 C default						
Temperature voltage compensation, mV/°C *	From 0 to 5 mV/deg. C/cell. Default value is 3mV/deg. C/cell.*						
Ripple voltage superimposed%	≤ 1						

\* Set by configuration software and based on usage of VLRA batteries.

See **Table 8** for current ratings.

### 6.4.3 Inverter Output

**Table 13 Inverter output**

Rated Power kVA	40	60	80	100	120	160	200
Rated voltage, VAC	480						
Supply	3-phase, 3-wire plus ground						
Frequency, Hz	60 (50Hz in frequency converter mode)						
Rated Power, kW	36	54	72	90	108	144	180
Three-phase transient overload, min. load	105% to 110% for 60 minutes 111% to 125% for 10 minutes 126% to 150% for 1 minute						
Voltage Regulation%	±1% 3-phase RMS average for a balanced three-phase load for the combined variation effects of input voltage, connected load, battery voltage, ambient temperature and load power factor ±2% 3-phase RMS average for a 100% unbalanced load for the combined variation effects of input voltage, connected load, battery voltage, ambient temperature and load power factor						
Frequency Regulation%	Nominal frequency regulation is ±0.05% in single module mode, and +/- 0.25% in parallel mode.						
Maximum rate of change of frequency, Hz/sec	Selectable from 0.1Hz/sec to 3.0Hz/sec maximum for single unit Fixed maximum of 0.2Hz/sec for paralleled units						

See **Table 8** for current ratings.

### 6.4.4 Bypass Input

**Table 14 Bypass input**

Rated Power, kVA	40	60	80	100	120	160	200
Rated voltage, VAC	480						
Supply	3-phase, 3-wire plus ground						
Bypass voltage tolerance%	Upper limit: +10%, +15% or +20%; Upper limit default: +15% Lower limit: -10%, -20%, -30% or -40%; Lower limit default: -20%						
Frequency, Hz	60						
Input frequency tolerance%	±2.5%, ±5%, ±10% and ±20%; default ±10%						
Bypass overload capacity (all ratings)	<b>Rated Output Current: Duration of Overload</b> 105% to 110%: 60 Minutes 111% to 125%: 10 Minutes 126% to 150%: 1 Minute 1000%: 100 Milliseconds						

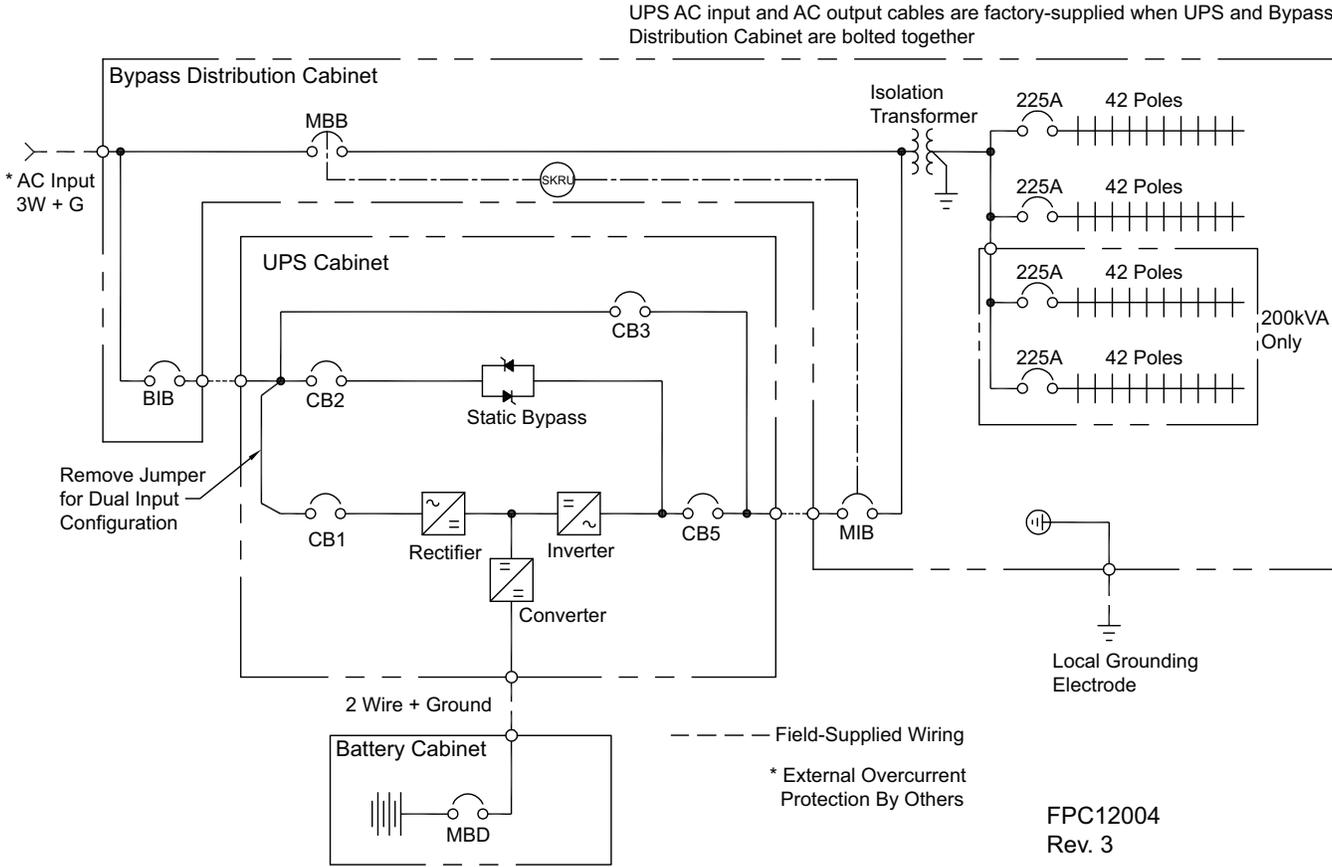
See **Table 8** for current ratings.

Bypass frequency synchronization range setting should be wider than bypass frequency shift range.

# 7.0 LIEBERT® BDC™

The Liebert BDC is designed to operate in UPS mode, bypass mode and maintenance mode. The Liebert BDC offers either 45kVA or 90kVA capacity to match the associated Liebert NX™ frame offerings. Each of the Liebert BDC capacities offer optional 480V and 600V internal transformers as well as multiple output distribution selections.

**Figure 20 Single input UPS with external Liebert BDC with optional internal transformer—typical configuration**



## 7.1 Normal (UPS) Mode

While the Liebert BDC is in Normal mode (MBB open; BIB/MIB closed), the UPS is supplying the connected load with continuous, high-quality AC power. In this mode of operation, the load is protected by the UPS.

### 7.1.1 Bypass Mode

When the Liebert BDC is in Bypass mode, it provides an alternate path for power to the connected equipment. Should the UPS need to be taken out of service for limited maintenance or repair, manual activation of the bypass will cause an immediate transfer of the equipment from the UPS inverter to the bypass source. In this mode, power will still be supplied to the UPS; however, the load is NOT protected by the UPS.

### 7.2 Maintenance Mode

When the Liebert BDC is in Maintenance mode (MBB closed; BIB/MIB open), it provides an alternate path for power to the connected equipment should the UPS need to be taken out of service for limited maintenance or repair. In this mode of operation, no power is supplied to the UPS and the load is NOT protected by the UPS.

### 7.3 Locating the Cabinet

This Liebert BDC may be mounted to the left of the UPS or installed as a stand-alone unit. In either case, ensure that the unit is in a well-ventilated area and that there is clearance for access to the switches and cable connections as required by national and local codes.

### 7.4 Cable Installation

#### 7.4.1 Wiring Preparation

Be sure that the unit is not connected to any AC utility power source or UPS before installing any wiring to this unit. This Liebert BDC should be installed by a qualified / certified electrician.

## WARNING

Risk of electrical shock and arc flash. Can cause property damage, injury and death.

Read this section thoroughly before attempting to install wiring to this unit. Read and comply with all warnings and cautions in this manual.

#### Removing the Cover Plates

Plates cover the input and output terminals on the front of the Liebert BDC. Remove these and keep the screws and plates for reinstallation.

#### 7.4.2 Power Cable Installation

Refer to **Table 15** when selecting cables.

**Table 15 Power cable size selection (Copper Wire Only)**

Terminal	Bus Type			
	Main Input		Bypass Input	Output
	Single Input	Dual Input	Dual Input	
Liebert® NX™ 40kVA UPS	4	4	4	3
Liebert NX 60kVA UPS	1	1	2	2
Liebert NX 80kVA UPS	2/0	2/0	1/0	1/0
Liebert® NX™ 100kVA UPS	4/0	4/0	2/0	2/0
Liebert NX 120kVA UPS	250	250	4/0	4/0
Liebert NX 160kVA UPS	2-3/0	2-3/0	2-3/0	2-3/0
Liebert NX 200kVA UPS	2-4/0	2-4/0	2-4/0	2-4/0
Liebert NX 480V Battery Cabinet DC Input Bus	225A 4/0AWG	350A 400kcmil	600A 2-350kcmil	—



#### NOTE

*Transient and steady state earth leakage currents may occur when starting the equipment. This should be taken into account when selecting ground current detection devices because these will carry the earth leakage currents of both the UPS equipment and the load.*

### 7.4.3 Input/Output Wiring

Follow the steps below to connect the input wiring:



#### NOTE

*Input wiring must be installed using conduit if cabinet is not mounted to the immediate right of the UPS.*

1. Locate the input wiring access (top or bottom access), remove the conduit landing plate and punch the appropriate size hole for the size conduit being used. Pull the three/four input wires through it, allowing some slack for installation. For cabinets that are located to the immediate left of the UPS, the access plate is on the lower right of the cabinet. Remove the access plate and verify that the edge guarding is installed and intact.
2. Secure the conduit to the access plate of the Liebert BDC.
3. Input power cables connect to the system input circuit breaker; refer to **Figure 21** and **Table 34**.
4. Connect the ground (earth) wire to the earth busbar and tighten it to 240lb-in. (27N-m) (M10 bolt).
5. Locate UPS input and output cables and access panel to UPS on lower right side.



#### NOTE

*If the Liebert BDC is not to be bolted to the UPS, use either top or bottom access plate.*

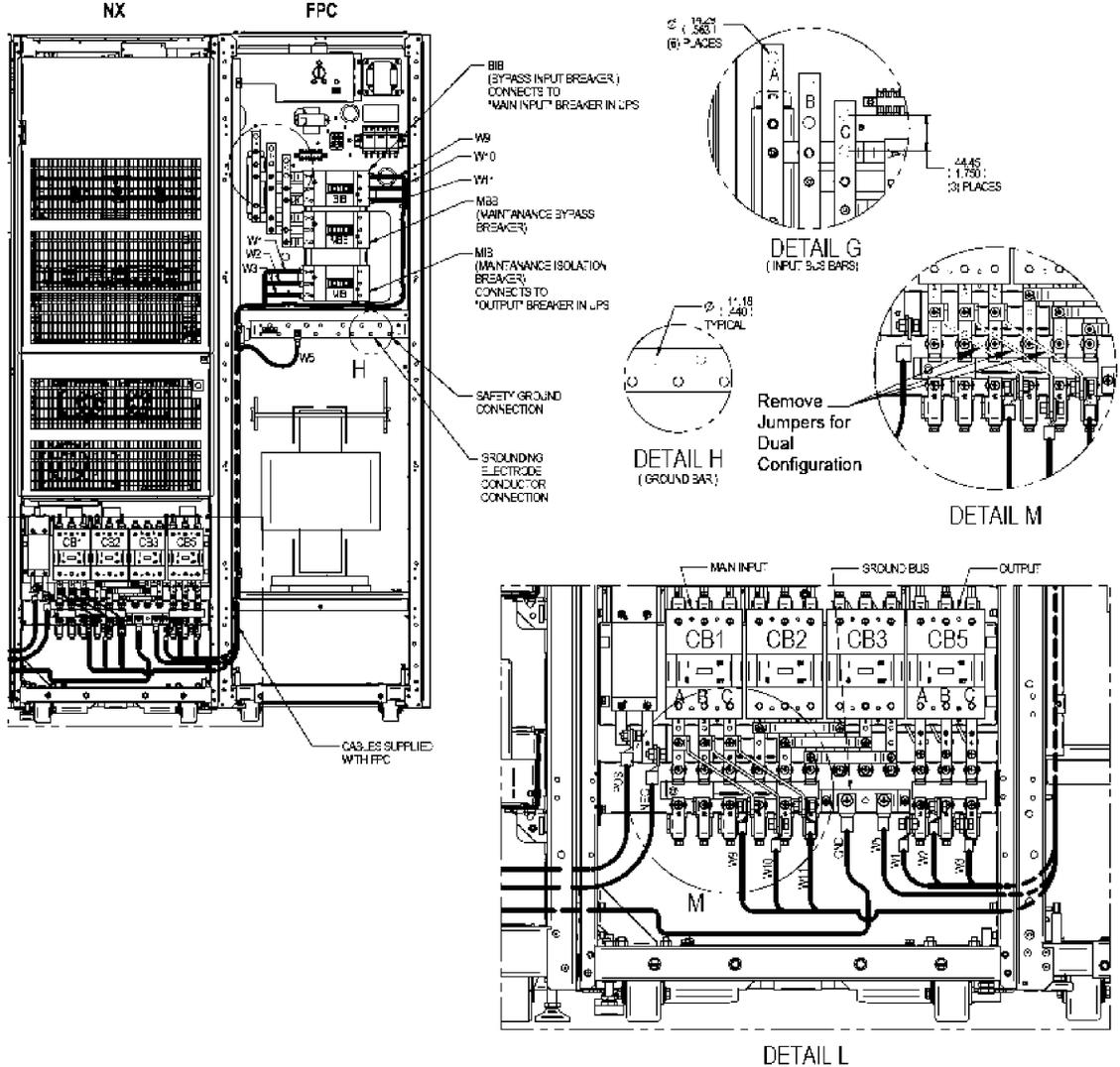
6. Connect the system ground cable between the Liebert BDC and UPS and tighten the connections to 240lb-in. (27N-m) (M10 bolt).
7. Connect the system input cables between the Liebert BDC "UPS Input" Busbars (A-B-C N terminals) and UPS input busbars (A-B-C N terminals) and tighten the connections to 240lb-in. (27N-m) (M10 bolt).
8. Connect the system output cables between the Liebert BDC 'UPS Output' Busbars (A-B-C N terminals) and UPS output busbars (A-B-C N terminals) and tighten the connections to 240lb-in. (27N-m) (M10 bolt).

## NOTICE

Risk of improper wiring connection. Can cause equipment damage.

The control wire must be installed to ensure proper operation of the system and fully protect the load when switching between bypass cabinet and UPS.

Figure 21 Liebert® BDC connection to UPS



**NOTES**

1. All Liebert-supplied cable must be repositioned prior to and while the cabinets are being placed in their final installed location.
2. All interconnection hardware supplied by Emerson®.
3. AC connections must be made to the UPS module before attaching Liebert BDC to UPS module.
4. All cabling will be field-supplied when a Liebert BDC is configured as a stand-alone cabinet.
5. Liebert BDCs must attach to the right side only of the Liebert NX™.
6. Refer to the individual drawing of each piece of equipment for additional details.

**Table 16 Control wiring for Liebert® NX™ UPS to Liebert BDC**

From	To
<b>Liebert NX UPS Monitor Board X1-J21</b>	<b>Liebert BDC Terminal Strip (TB2)</b>
J21-3 INV_S	TB1-2
J21-4 INV_C	TB2-1
NX 480 UPS Parallel Board X3	Liebert BDC Terminal Strip (TB2)
X3-1-EXT-MAINT	TB2-3
X3-2-GND2	TB2-4

Figure 22 Liebert BDC connection to Liebert® NX™

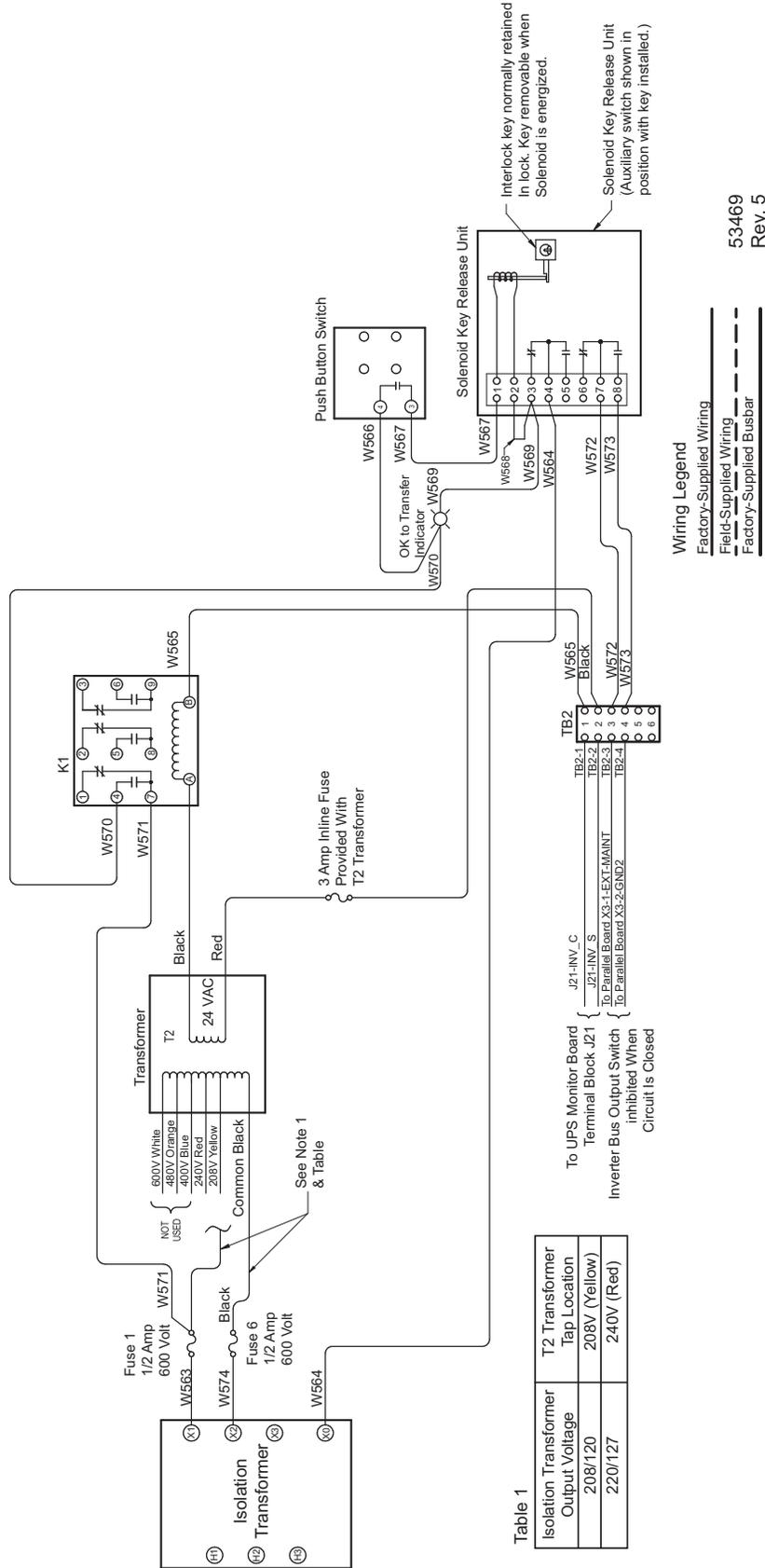


Table 1

Isolation Transformer Output Voltage	T2 Transformer Tap Location
208/120	208V (Yellow)
220/127	240V (Red)



**NOTE**

Install jumper on TB1 pins 4 and 5. For startup procedure, see 11.2 - UPS Startup.

**Table 17 Circuit breaker schedule - Main circuit breaker**

kVa	Voltage In	Vendor	Frame Amps	Trip Amps	Model Number	Interrupting Rating AIC
15	208V	ABB	250A	60A	T4S060TW-S24	100K
	240V		250A	50A	T4S050TW-S24	100K
	380V		250A	30A	T4S030TW-S24	35K
	400V		250A	30A	T4S030TW-S24	35K
	415V		250A	30A	T4S030TW-S24	35K
	480V		250A	25A	T4S025TW-S24	35K
	600V		250A	20A	T4S020TW-S24	25K
30	208V	ABB	400A	110A	T4S110TW-S24	100K
	240V		400A	100A	T4S100TW-S24	100K
	380V		250A	60A	T4S060TW-S24	35K
	400V		250A	60A	T4S060TW-S24	35K
	415V		250A	60A	T4S060TW-S24	35K
	480V		250A	50A	T4S050TW-S24	35K
	600V		250A	40A	T4S040TW-S24	25K
50	208V	ABB	600A	200A	T4S200TW-S24	100K
	240V		400A	175A	T4S175TW-S24	100K
	380V		250A	100A	T4S100TW-S24	35K
	400V		250A	100A	T4S100TW-S24	35K
	415V		250A	90A	T4S090TW-S24	35K
	480V		250A	80A	T4S080TW-S24	35K
	600V		250A	70A	T4S070TW-S24	25K
75	208V	ABB	600A	300A	T5S300TW-S24	100K
	240V		600A	250A	T4S250TW-S24	100K
	380V		400A	150A	T4S150TW-S24	35K
	400V		400A	150A	T4S150TW-S24	35K
	415V		400A	150A	T4S150TW-S24	35K
	480V		250A	125A	T4S125TW-S24	35K
	600V		250A	100A	T4S100TW-S24	25K
100	208V	ABB	250A	400A	T5S400TW-S24	100K
	240V		250A	350A	T5S350TW-S24	100K
	380V		250A	200A	T4S200TW-S24	35K
	400V		250A	200A	T4S200TW-S24	35K
	415V		250A	200A	T4S200TW-S24	35K
	480V		250A	175A	T4S175TW-S24	35K
	600V		250A	125A	T4S125TW-S24	25K
125	208V	ABB	250A	450A	T5S450BW-S24	100K
	240V		250A	400A	T5S400BW-S24	100K
	380V		250A	250A	T4S250TW-S24	35K
	400V		250A	250A	T4S250TW-S24	35K
	415V		250A	225A	T4S225TW-S24	35K
	480V		250A	200A	T4S200TW-S24	35K
	600V		250A	175A	T4S175TW-S24	25K

**Table 17 Circuit breaker schedule - Main circuit breaker (continued)**

kVa	Voltage In	Vendor	Frame Amps	Trip Amps	Model Number	Interrupting Rating AIC
150	208V	ABB	400A	600A	T5S600BW-S24	100K
	240V		250A	500A	T5S500BW-S24	100K
	380V		250A	300A	T5S300BW-S24	35K
	400V		250A	300A	T5S300BW-S24	35K
	415V		250A	300A	T5S300BW-S24	35K
	480V		250A	250A	T4S250TW-S24	35K
	600V		250A	200A	T4S200TW-S24	25K
200	380V	ABB	400A	400A	T5S450BW-S24	35K
	400V		400V	400A	T5S400BW-S24	35K
	415V		400A	400A	T5S400BW-S24	35K
	480V		400A	350A	T5S350BW-S24	35K
	600V		250A	250A	T4S250TW-S24	25K
225	380V	ABB	600A	450A	T5S450BW-S24	35K
	400V		600V	450A	T5S400BW-S24	35K
	415V		600A	450A	T5S400BW-S24	35K
	480V		400A	350A	T5S350BW-S24	35K
	600V		400A	300A	T5S300BW-S24	25K
300	380V	ABB	600A	600A	T5S600BW-S24	35K
	400V		600V	600A	T5S600BW-S24	35K
	415V		600A	600A	T5S600BW-S24	35K
	480V		600A	500A	T5S500BW-S24	35K
	600V		400A	400A	T5S400BW-S24	25K

**Table 18 Main panelboard circuit breaker**

kVA	Voltage In	Vendor	Type	Frame Amps	Tri pAmps	Model Number	Interrupting Rating AIC
15-300	208V	ABB	FIX MTD	225A	225A	T3N225TW	22k
15-300	208V	ABB	PLUG-IN	225A	225A	T3N225TW +	22k

**Table 19 Panelboard branch circuit breaker**

kVA	Voltage In	Vendor	Type	Frame Amps	Trip Amps	Model Number	Interrupting Rating AIC
15-100	208V	SQUARE D	PLUG-IN	100A	15-100A	QO	10K
15-100	208V	SQUARE D	BOLT-IN	100A	15-100A	QOB	10K
15-100	208V	SQUARE D	PLUG-IN	100A	15-100A	QOxxVH	22K
15-100	208V	SQUARE D	BOLT-IN	100A	15-100A	QOBxxVH	22K
15-100	208V	GE	PLUG-IN	100A	15-100A	THQL	10K
15-100	208V	GE	BOLT-IN	100A	15-100A	THQB	10K
15-100	208V	GE	PLUG-IN	100A	15-100A	THHQL	22K
15-100	208V	GE	BOLT-IN	100A	15-100A	THHQB	22K

**Table 20 Subfeed circuit breaker**

kVA	Voltage In	Vendor	Type	Frame Amps	Trip Amps	Model Number	Interrupting Rating AIC
15-300	208V	ABB	FIX MTD	250A	100A	T4N100TW	65K
15-300	208V	ABB	FIX MTD	250A	125A	T4N125TW	65K
15-300	208V	ABB	FIX MTD	250A	150A	T4N150TW	65K
15-300	208V	ABB	FIX MTD	250A	175A	T4N175TW	65K
15-300	208V	ABB	FIX MTD	250A	200A	T4N200TW	65K
15-300	208V	ABB	FIX MTD	250A	225A	T4N225TW	65K
15-300	208V	ABB	FIX MTD	250A	250A	T4N250TW	65K
150-300	208V	ABB	FIX MTD	400A	300A	T5N300TW	65K
150-300	208V	ABB	FIX MTD	400A	350A	T5N350TW	65K
150-300	208V	ABB	FIX MTD	400A	400A	T5N400TW	65K

**Table 21 Square D I-Line panelboard circuit breaker**

kVA	Voltage In	Vendor	Type	Frame Amps	Trip Amps	Model Number	Interrupting Rating AIC
50-300	208V	SQUARE D	PLUG-IN	150A	100A	HGA36100	65K
50-300	208V	SQUARE D	PLUG-IN	150A	125A	HGA36125	65K
50-300	208V	SQUARE D	PLUG-IN	150A	150A	HGA36150	65K
50-300	208V	SQUARE D	PLUG-IN	250A	175A	JGA36175	65K
50-300	208V	SQUARE D	PLUG-IN	250A	200A	JGA36200	65K
50-300	208V	SQUARE D	PLUG-IN	250A	225A	JGA36225	65K
50-300	208V	SQUARE D	PLUG-IN	250A	250A	JGA36250	65K
225-300	208V	SQUARE D	PLUG-IN	400A	300A	LA36300	42K
225-300	208V	SQUARE D	PLUG-IN	400A	350A	LA36350	42K
225-300	208V	SQUARE D	PLUG-IN	400A	400A	LA36400	42K

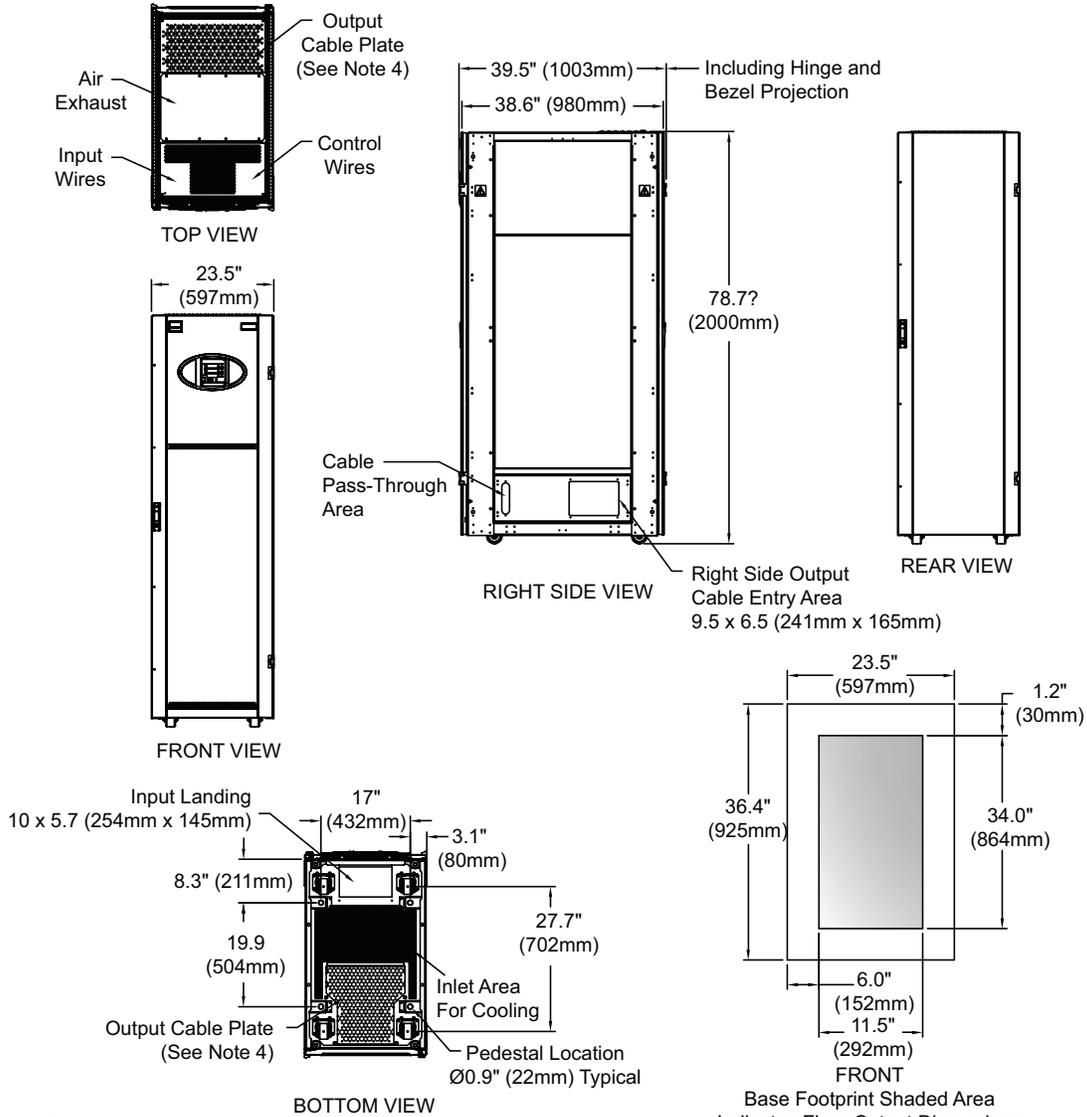
### 7.5 Bolting Cabinets Together



**NOTE**  
*UPS wiring must be completed before the cabinets are bolted together.*

1. Line up cabinets so that mounting holes are aligned.

**Figure 23 Bolting a Liebert® NX™ UPS to a Liebert BDC™**



**Notes**

1. All dimensions are in inches (mm).
2. 24" (610mm) minimum clearance above unit required for air exhaust.
3. Keep cabinets within 15 degrees of vertical.
4. Output Cable Plates  
 Panelboard Option: Top output plates have 84 knockouts for 1/2" conduit per plate. Bottom output plates have 84 plugs for 1/2" conduit per plate.  
 Output Circuit Breaker Option: Top and bottom output plates are removable blank plates. Remove, punch to suit conduit size and reinstall.
5. Control wiring and power wiring must be run in separate conduits.
6. All wiring is to be in accordance with national and local electrical codes.
7. Depth dimensions include front and rear doors.
8. Width dimensions without side panels. Add 2.2 (56mm) when adding both side panels.
9. Clearance of 36" (914mm) minimum is recommended at front and rear for service access.

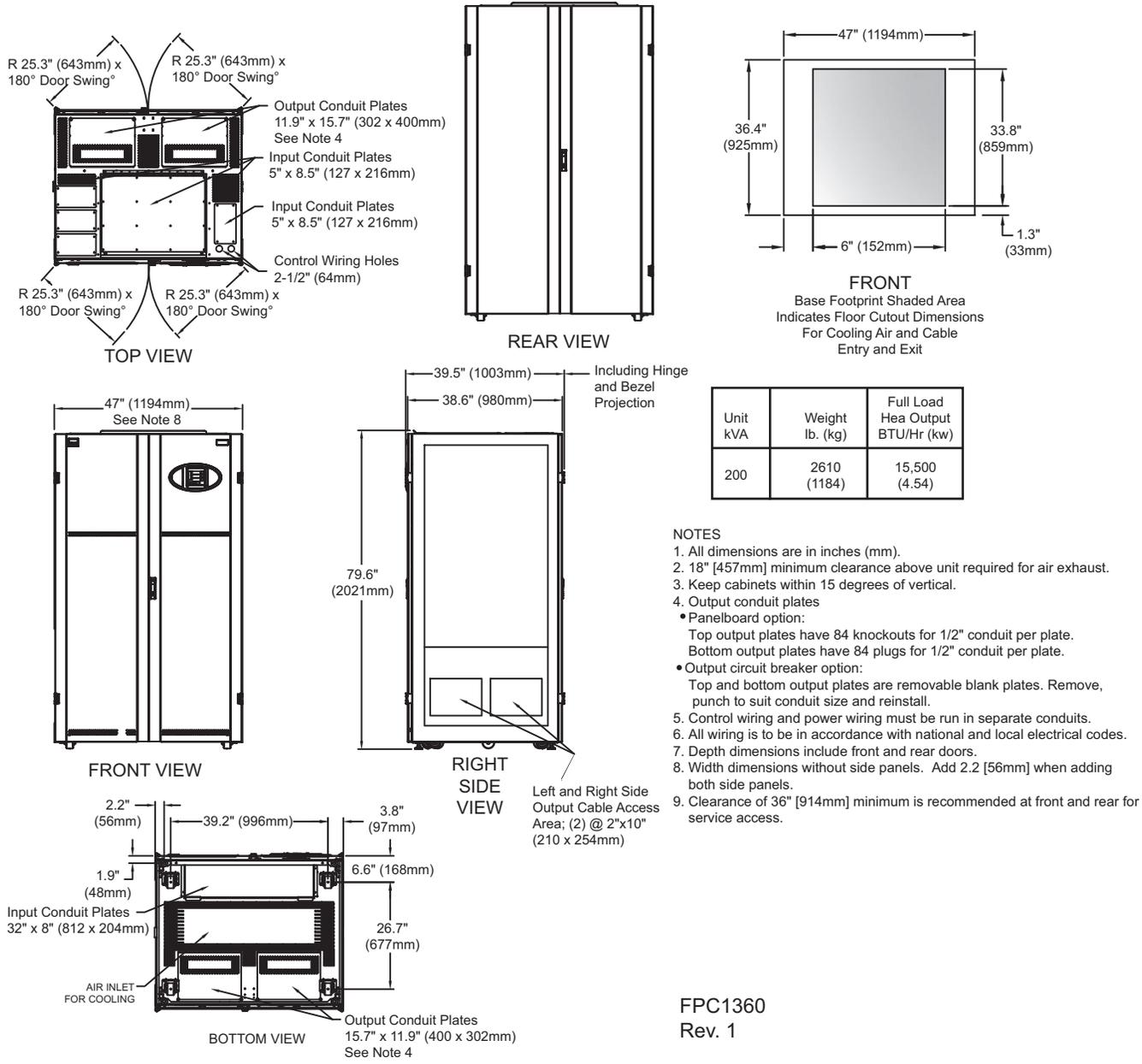
Base Footprint Shaded Area  
 Indicates Floor Cutout Dimensions  
 For Colling Air And Cable Entry/exit

Unit kVA	Weight lb (kg)	Full Load Heat Output BTU/HR (kw)
75	1350 (6128)	8150 (239)
125	1650 (748)	11,500 (3.37)

FPC13600  
 Rev. 4

2. Using supplied hardware, bolt the cabinets together. The bolts may be inserted from either the UPS side or from the Liebert BDC side, whichever is more convenient.

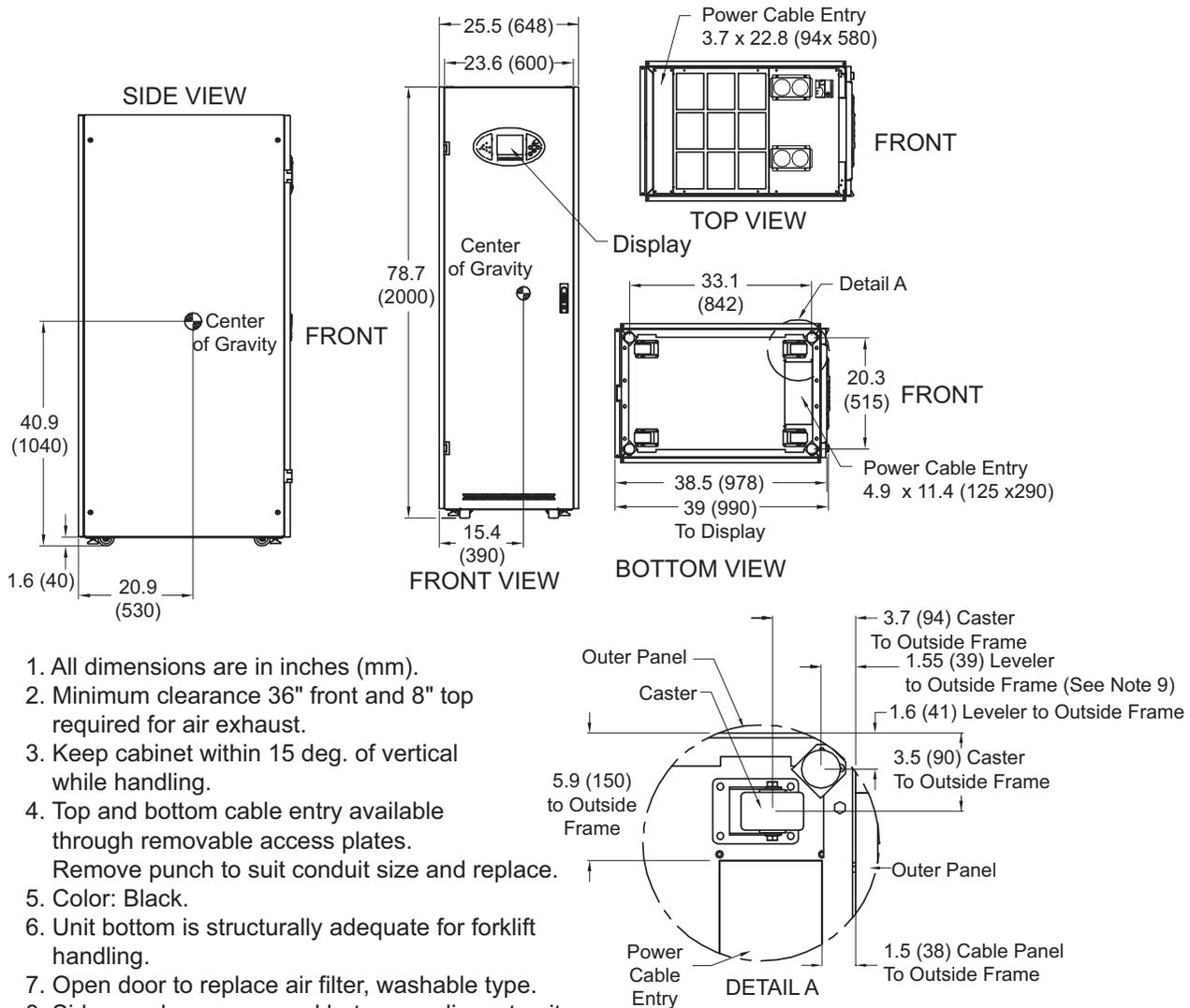
Figure 24 Outline drawing, Liebert BDC™, 47" cabinet



## 8.0 INSTALLATION DRAWINGS

The diagrams in this section illustrate the key mechanical and electrical characteristics of the Liebert® NX™ UPS System cabinets.

**Figure 25 Outline drawing, Liebert NX 40-120kVA**



1. All dimensions are in inches (mm).
2. Minimum clearance 36" front and 8" top required for air exhaust.
3. Keep cabinet within 15 deg. of vertical while handling.
4. Top and bottom cable entry available through removable access plates. Remove punch to suit conduit size and replace.
5. Color: Black.
6. Unit bottom is structurally adequate for forklift handling.
7. Open door to replace air filter, washable type.
8. Side panels are removed between adjacent units that are bolted together.
9. Leveling feet are not designed to carry the full weight of the cabinet. Finger-tighten leveler against the floor, then tighten with a wrench less than two turns for friction fit against floor.

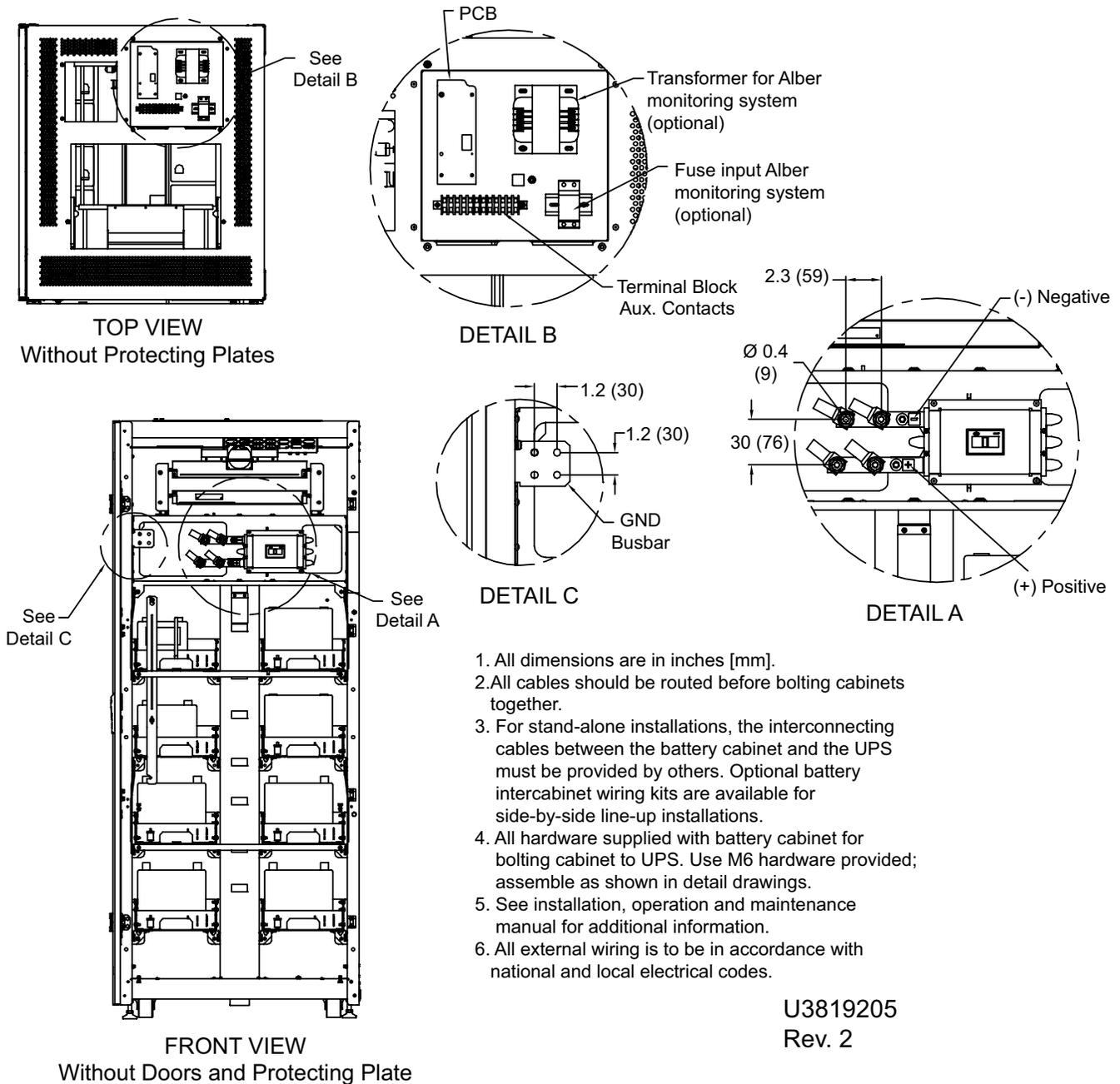
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Rev. 4

**Table 22 Weights, Liebert NX 40-120kVA**

kVA Rating	UPS Weight, lb (kg)		Heat BTU/Hr	Cooling Air CFM
	Net	Crated		
40	1290 (585)	1440 (653)	11612	620
60	1290 (585)	1440 (653)	15204	620
80	1290 (585)	1440 (653)	20273	620
80*	1422 (645)	1572 (713)	19700	920
100*	1422 (645)	1572 (713)	23496	920
120	1422 (645)	1572 (713)	28196	920

Source: U3819203, Rev. 4

Figure 26 Terminal details, 34" battery power pack system for Liebert® NX™ 480V UPS



**Table 23 Battery cabinet ground**

Unit Rating	Bolt Size	Torque lb-in (N-m)
80	1/4" (M6)	44 (5)

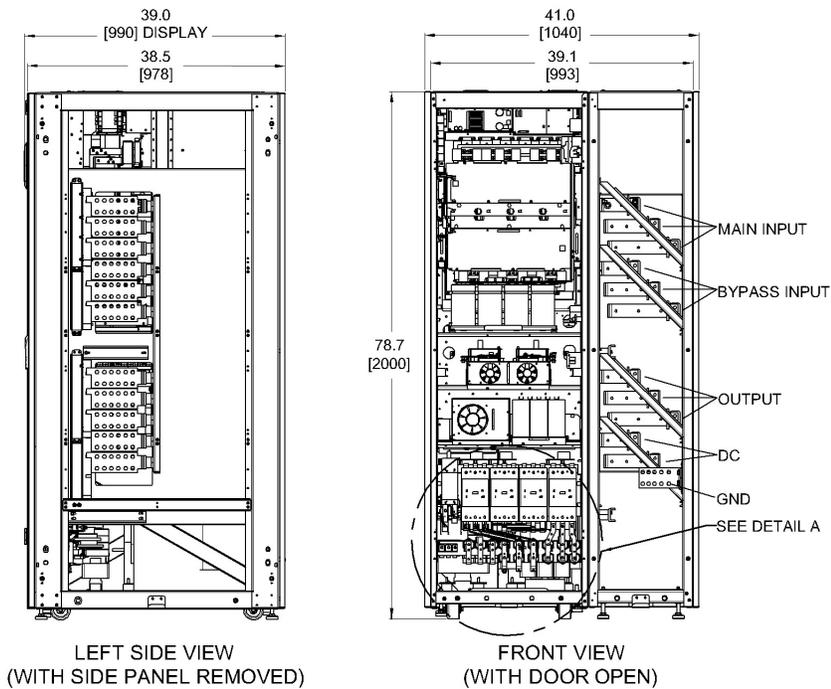
Source: U3819205, Rev. 2

**Table 24 Battery cabinet circuit breaker**

Cabinet Rating	Battery Current	OCP Device Rating	Bolt Size	Torque lb-in (N-m)
80kVA	195	225	1/4" (M6)	44 (5)

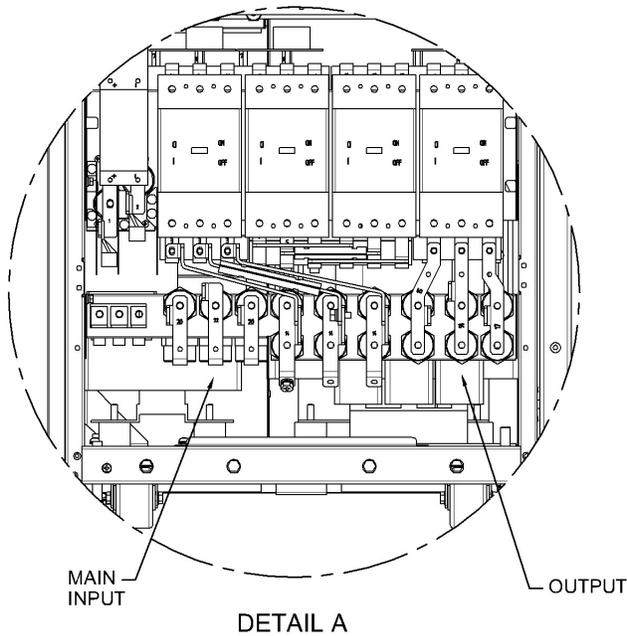
Source: U3819205, Rev. 2

Figure 27 Liebert® NX™ 80-120kVA dimensions—front and left side



NOTES:

1. All dimensions are in inches (mm).
2. Top and bottom cable entry available through removable access plates. Remove plates, punch to suit conduit size and replace.
3. Control wiring and power wiring must be run in separate conduit.
4. Aluminum and copper-clad aluminum cables are not recommended.
5. All wiring is to be in accordance with national and local electrical codes.



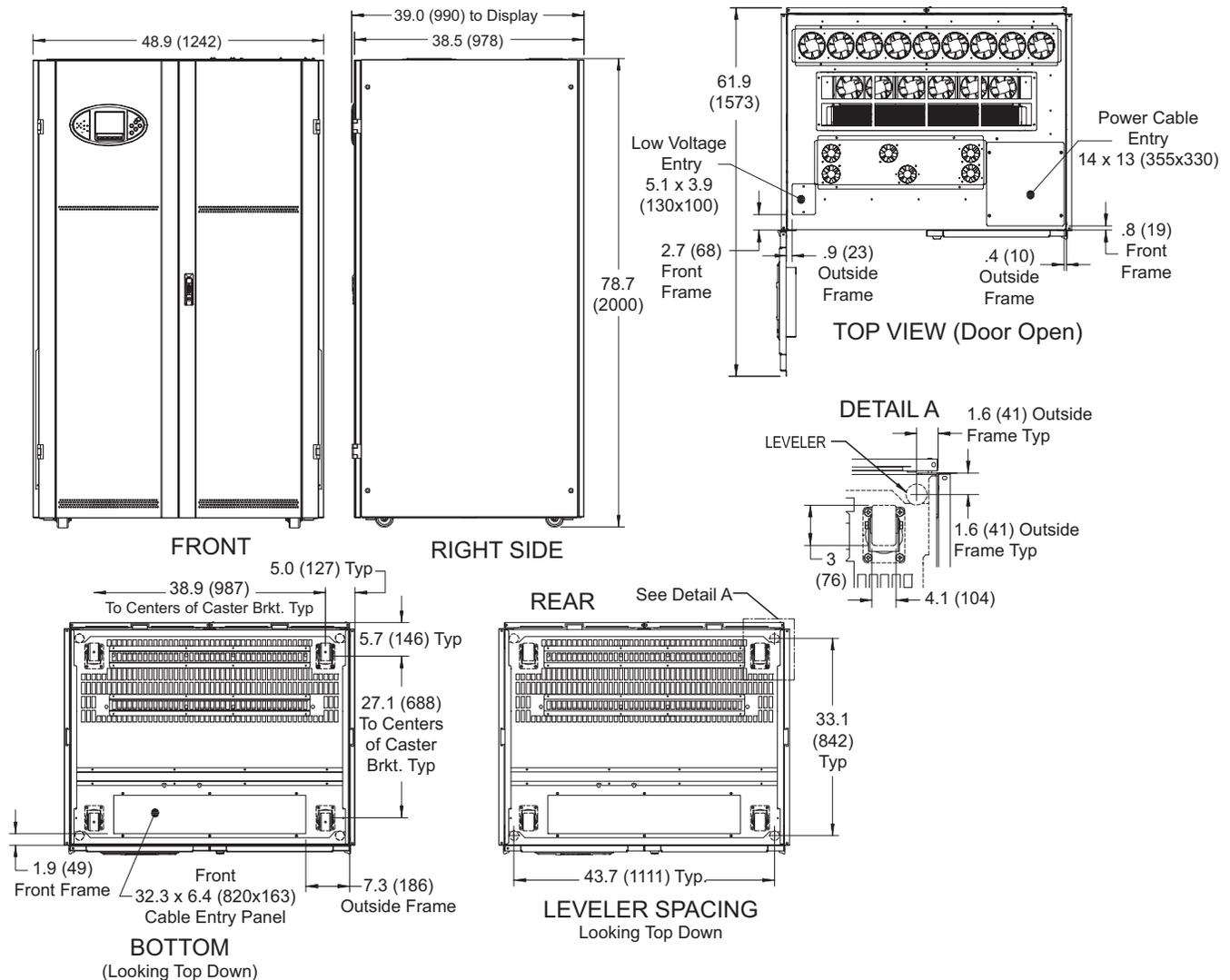
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Rev. 0

Table 25 UPS terminal specifications

Unit Rating	Utility Configurations		Breaker Size, Amps				
	Bolt Shaft Size	Torque lb-in (N-m)	CB1	CB2	CB3	CB4	CB5
80-120	M8	88 (10)	225	225	225	225	225

Source: U3819611, Rev. 0

Figure 28 Liebert® NX™ 160-200kVA dimensions—front and left side



NOTES:

1. All dimensions are in inches [mm]. Weight est. 2201 lb. (1000kg).
2. 24" [610] minimum clearance above unit required for air exhaust, and 36" [914] minimum service clearance at front of unit.
3. Keep cabinet within 15 degrees of vertical.
4. Top and bottom cable entry available through removable access plates. Remove, punch to suit conduit size and replace.
5. Control wiring and power wiring must be run in separate conduits.
6. Aluminum and copper-clad aluminum cables are not recommended.
7. All wiring is to be in accordance with national and local electrical codes.
8. Depth dimensions include front door and rear panel.
9. Width dimension includes side panels. Subtract 2.2" (56mm) when removing both side panels.

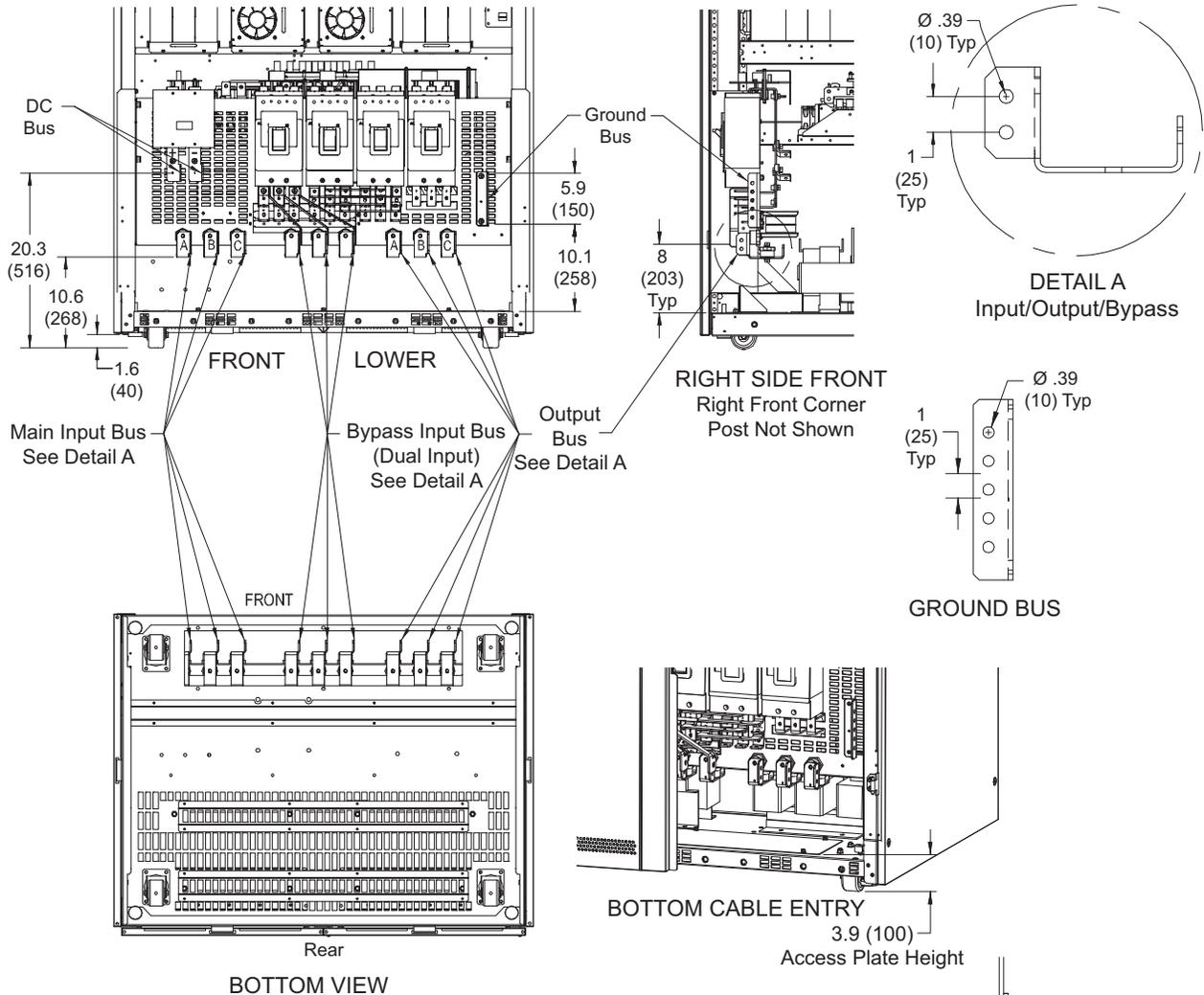
U3819621  
Rev. 1

Table 26 Electrical specifications, Liebert NX 160-200kVA

Rating, kVA	Voltage		Heat Rejection BTU/hr	Cooling Air CFM
	Input	Output		
160	480	480	35,900	1590
200	480	480	47,000	1590

Source: U3819621, Rev. 1

Figure 29 Liebert® NX™ 160-200kVA dimensions—front and left side



1. All dimensions are in inches [mm].
2. 24" [610] minimum clearance above unit required for air exhaust and 36" [914] minimum service clearance at front of unit.
3. Keep cabinet within 15 degrees of vertical.
4. Top and bottom cable entry available through removable access plates. Remove, punch to suit conduit size and replace.
5. Control wiring and power wiring must be run in separate conduits.
6. Aluminum and copper-clad aluminum cables are not recommended.
7. All wiring is to be in accordance with national and local electrical codes.
8. Terminal connecting hardware included.

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Rev. 0

Figure 30 Liebert® NX™ 40-120kVA main components—typical unit

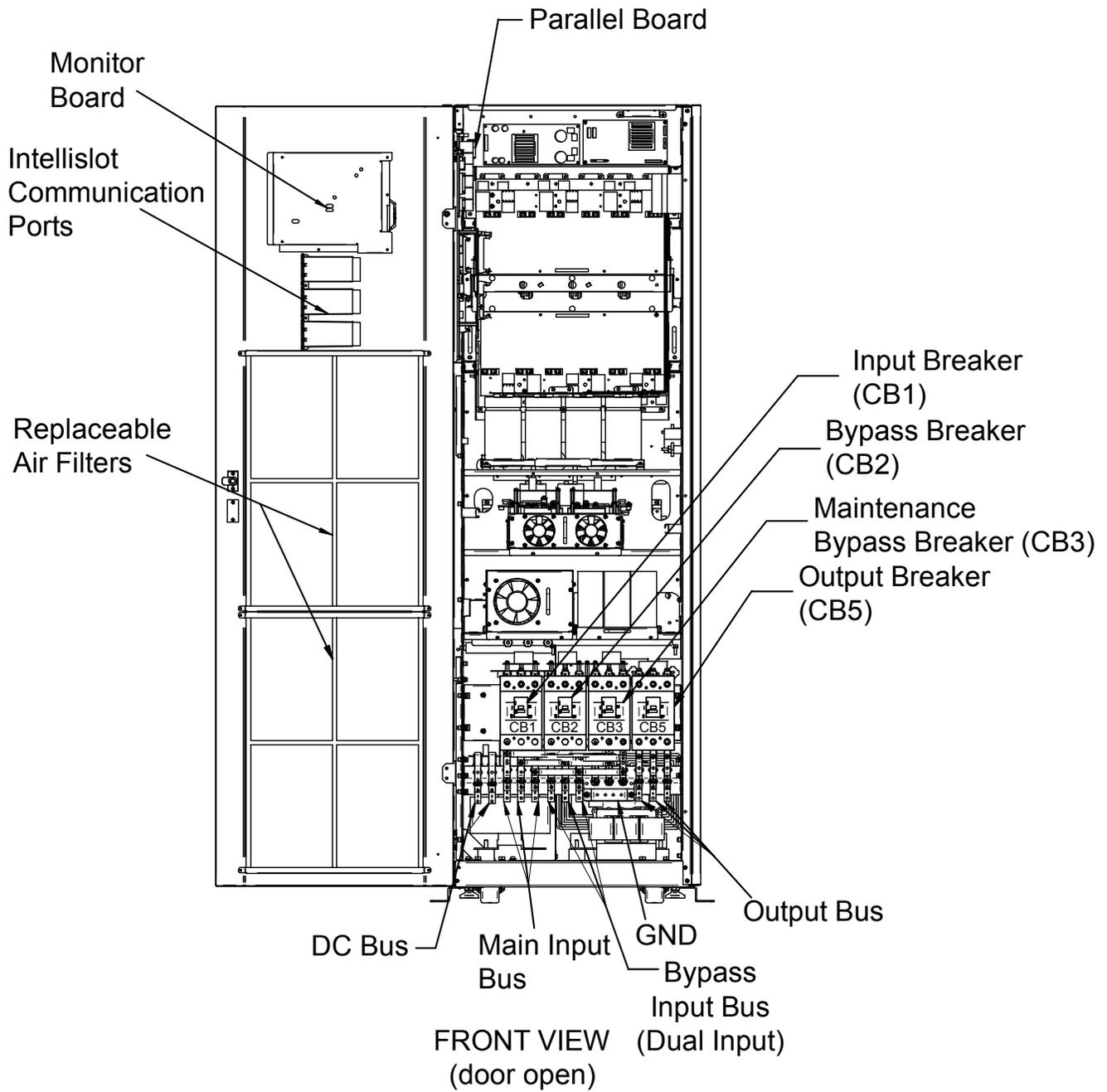


Figure 31 Liebert® NX™ 160-200kVA dimensional view—front and left side

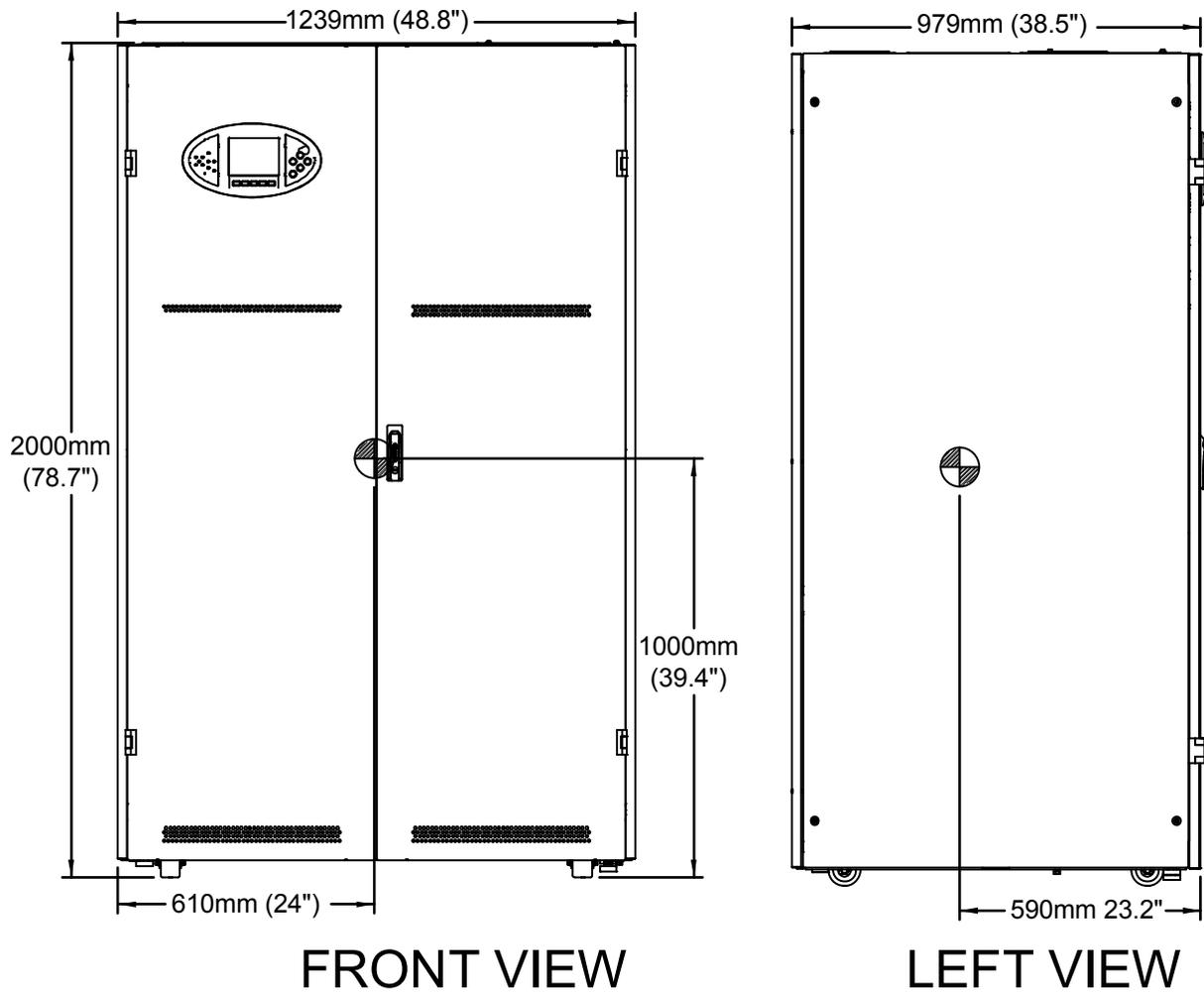


Figure 32 Liebert® NX™ 160-200kVA dimensions continued—top and bottom view

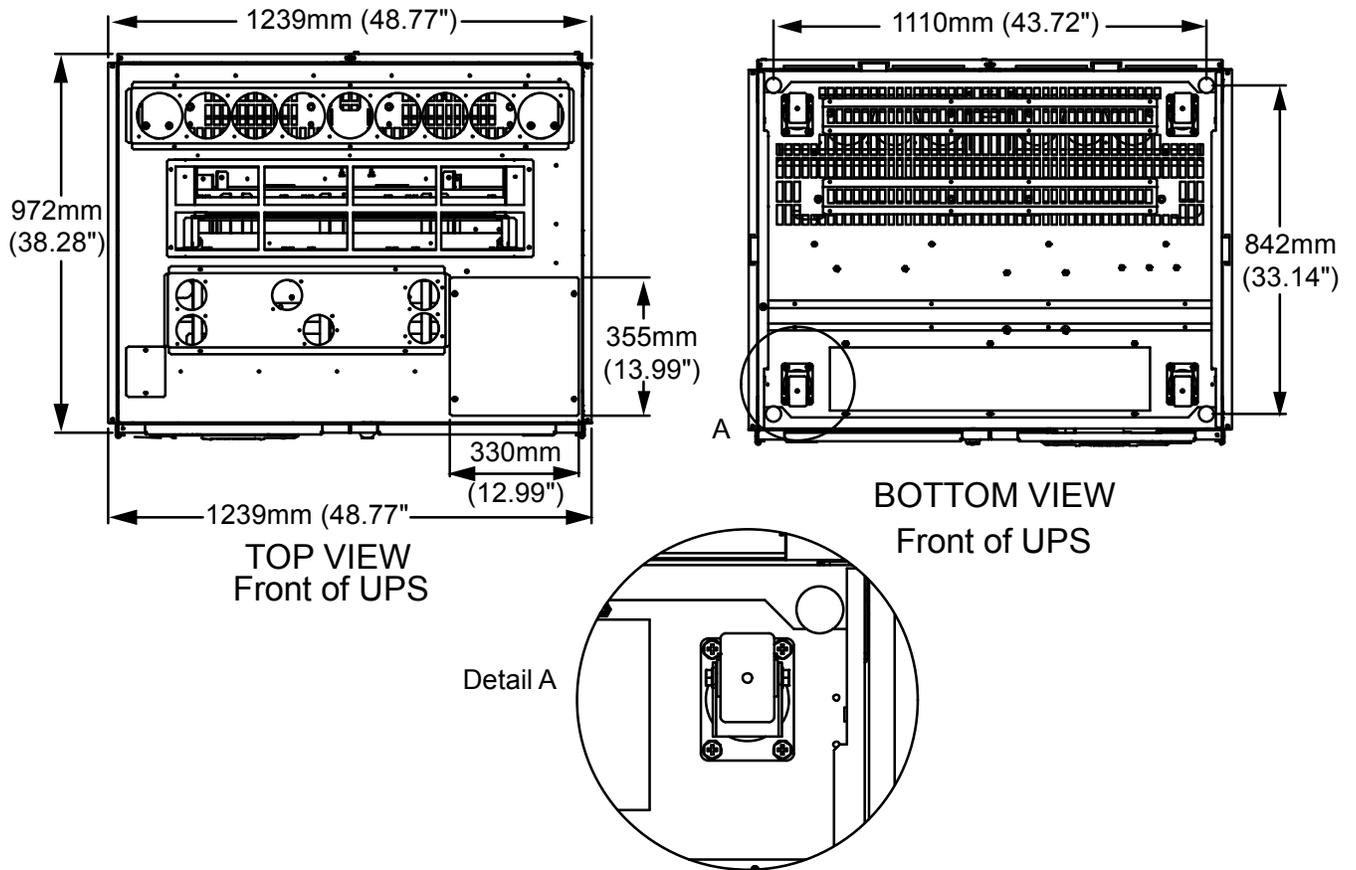


Figure 33 Liebert® NX™ 160-200kVA main components—typical unit

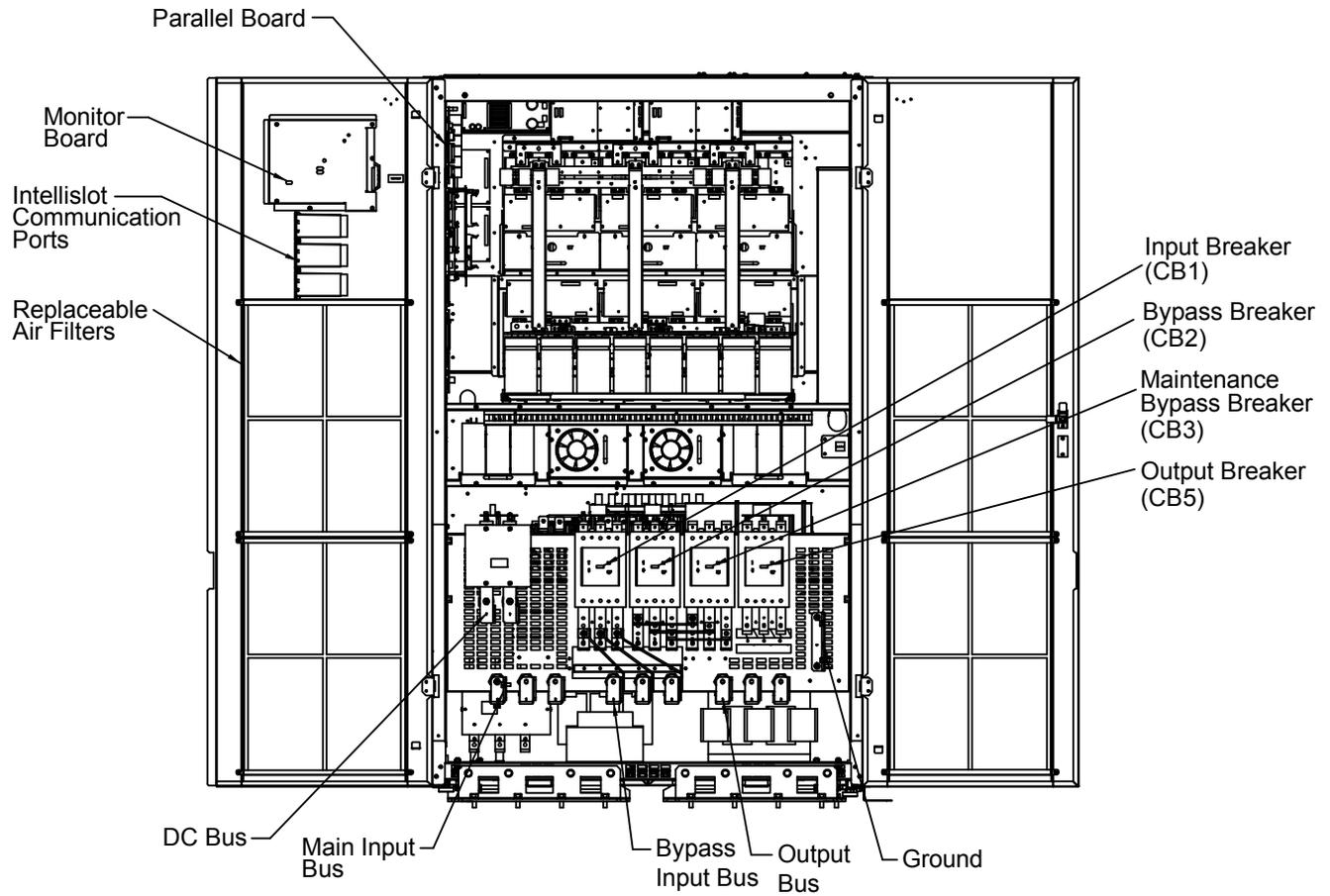
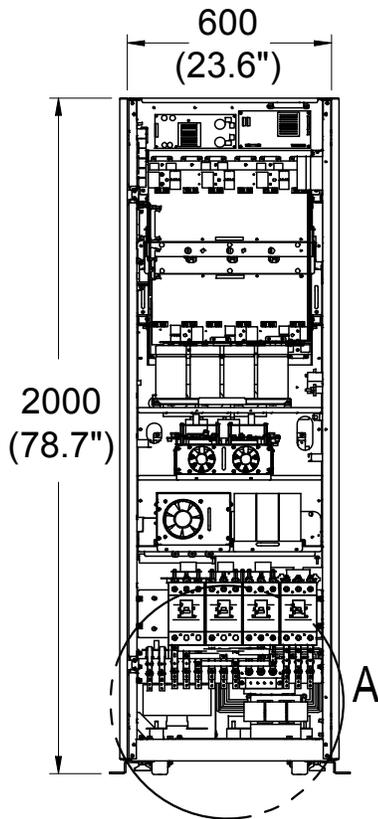
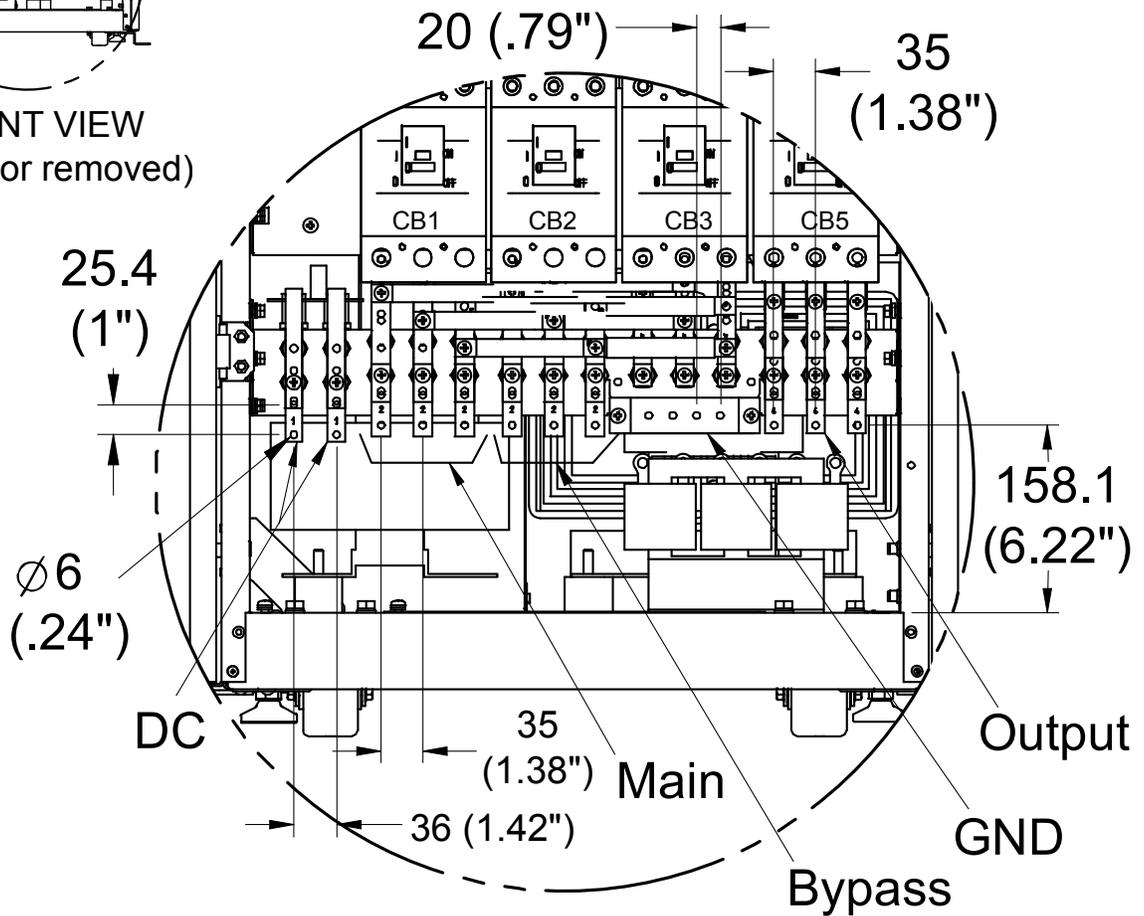


Figure 34 Liebert® NX™ 40-120kVA cable connections



FRONT VIEW  
(with door removed)



DETAIL A

NOTES

1. All dimensions are millimeters (in.).
2. Top and bottom cable entry available through removable access plates. Remove, punch to accommodate conduit size and replace.
3. Control wiring and power wiring must be run in separate conduit. Output and input cables must be run in separate conduit.
4. Aluminum and copper-clad aluminum cables are not recommended.
5. All wiring is to be in accordance with national and local electrical codes.

Figure 35 Liebert® NX™ 160-200kVA cable connections

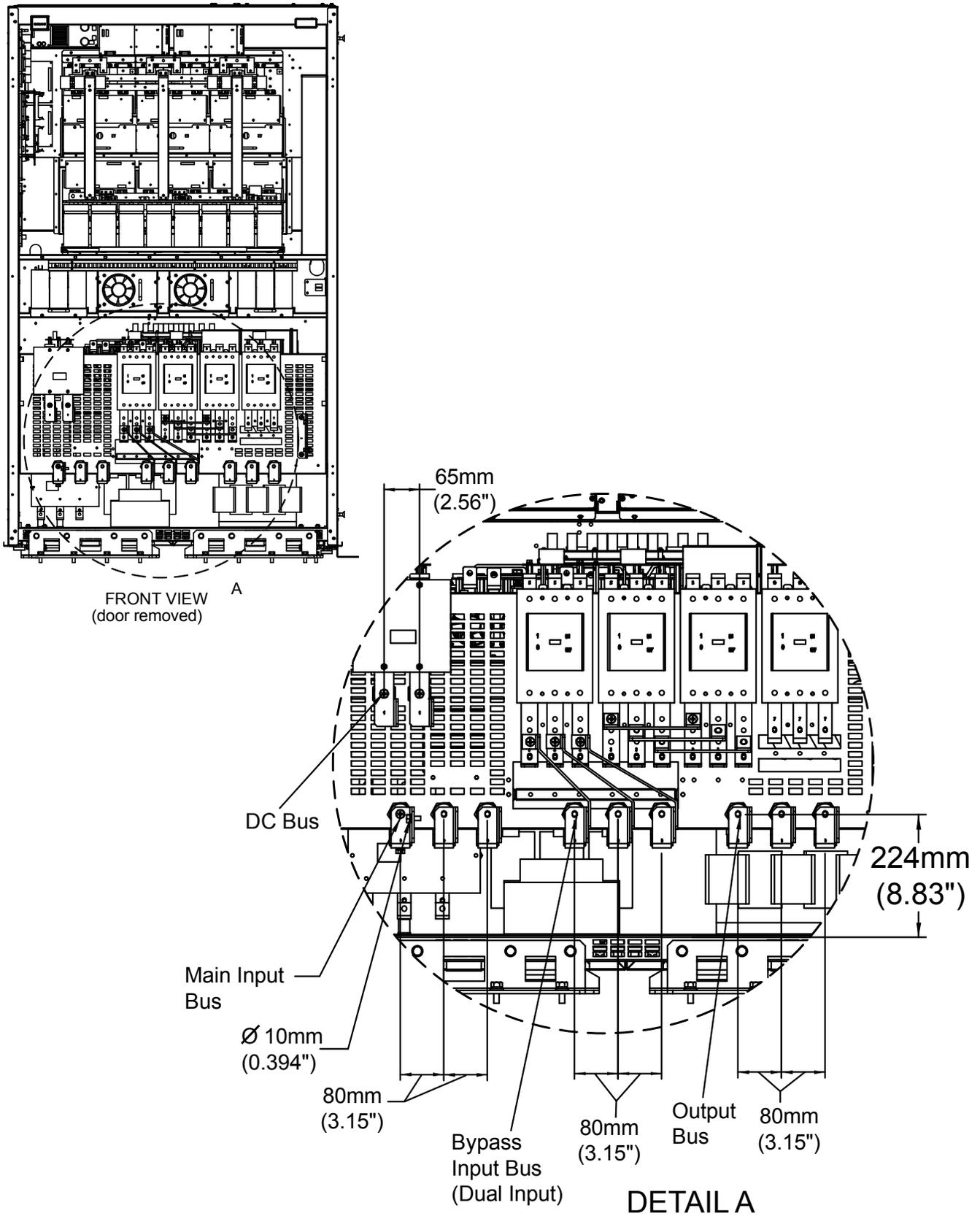
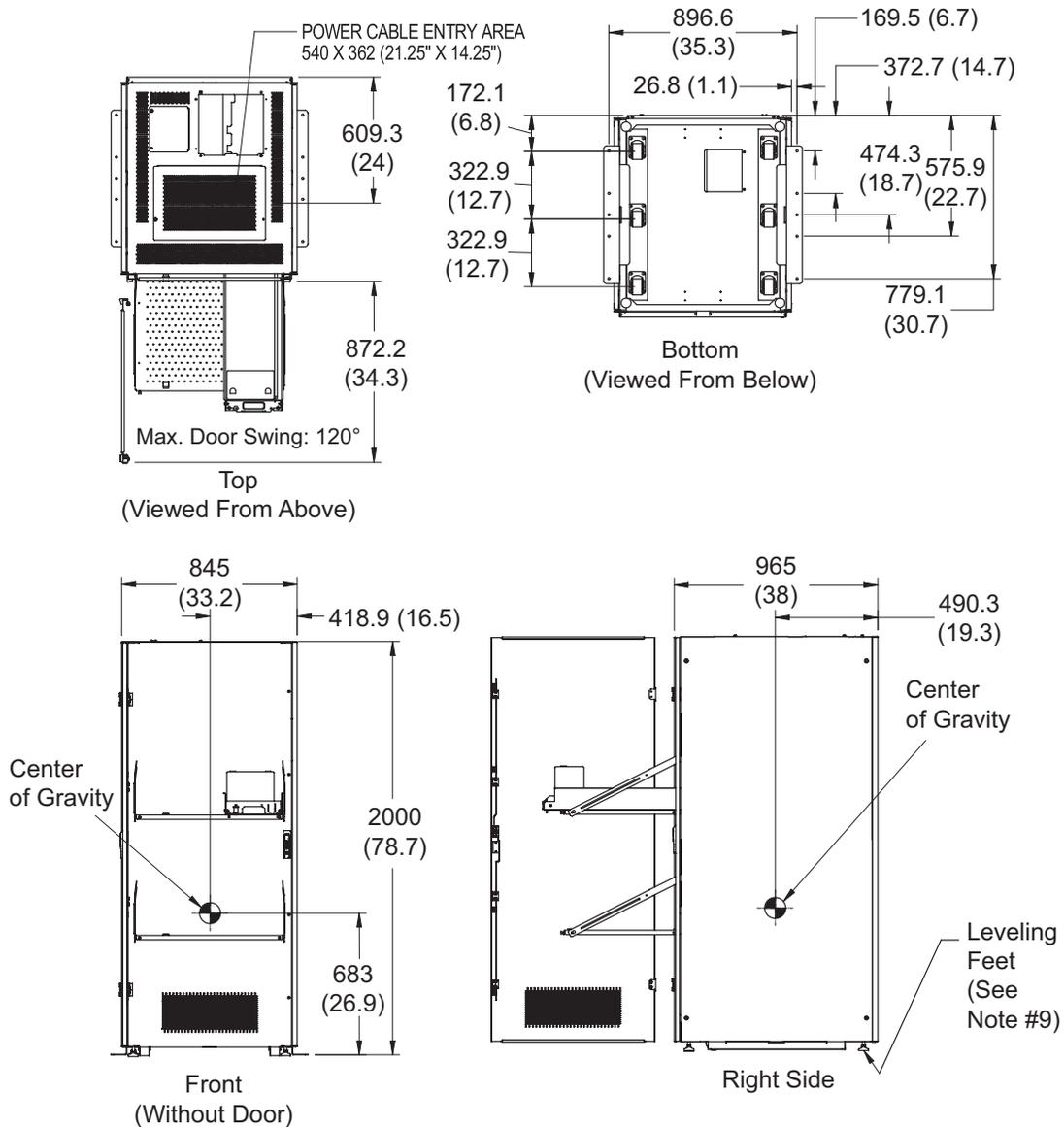


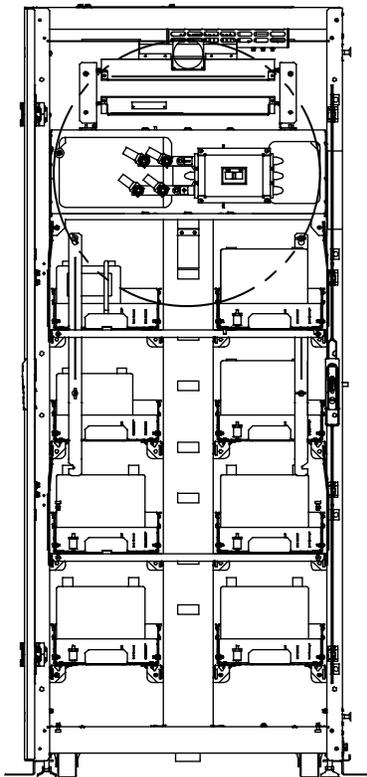
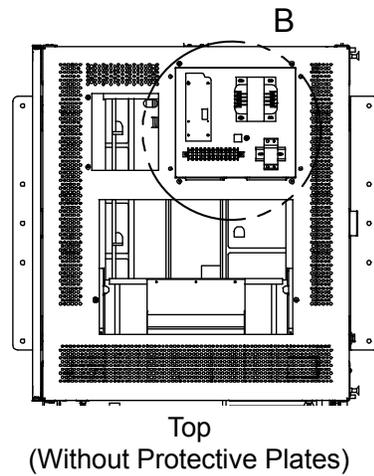
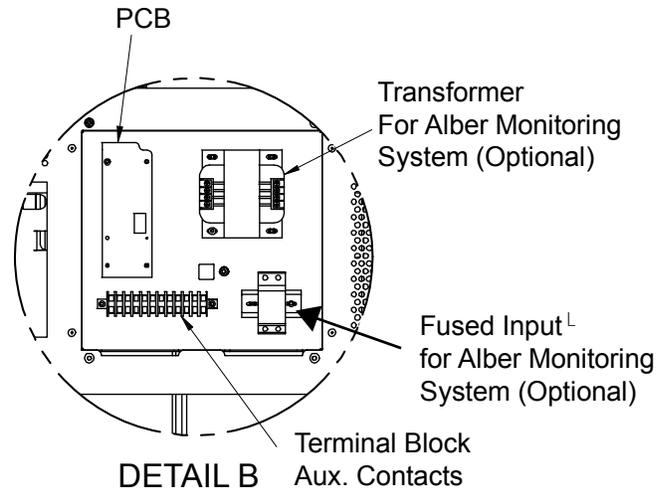
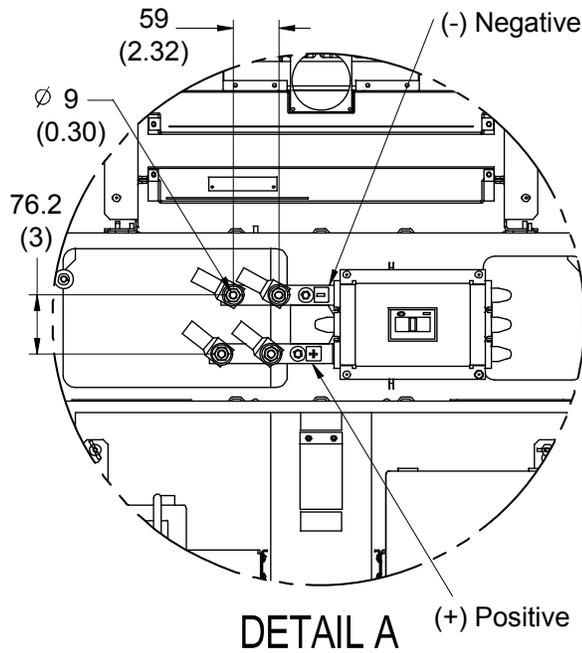
Figure 36 Outline drawing, 33" battery power pack system, single cabinet



1. All dimensions are in millimeters (inches)
2. Minimum clearance 36" front and 8" top required for air exhaust.
3. Top and bottom cable entry available through removable access plates.
4. Keep cabinet within 15 deg. of vertical while handling.
5. Control wiring and power wiring must be run in separate conduit.
6. Aluminum and copper clad cables are not recommended.
7. All wiring is to be in accordance with national and local electrical codes.
8. Intercabinet wiring between the UPS and the external battery cabinet is field-supplied.
9. Leveling feet are not designed to carry the full weight of the cabinet. Finger-tight leveler against the floor, then tighten with a wrench less than 2 turns for friction fit against floor.
10. Side panels included.
11. M10 threaded mounting holes used for seismic anchoring or floor stand.  
NOTE: If floor stand is used the weight of the unit must be supported under all casters. Mounting holes same spacing front and rear.
13. Battery-support tray connects to the front of the cabinet with the support brackets. Without the support, the battery may fall out of the cabinet.

U3819204

Figure 37 Terminal details, 33" battery power pack system, single cabinet Liebert® NX™



Front  
(Without Doors and  
Protective Plates)

A

NOTES:

1. All dimensions are in millimeters (inches).
2. All cables should be routed before bolting cabinets together.
3. The cables between the battery cabinet and the UPS cabinet must be supplied by others.
4. All hardware supplied with battery cabinet for bolting cabinet to UPS use M6 hardware provided; assemble as shown in detail drawings.
5. All external wiring is to be in accordance with national and local electrical codes.

U3819205

Figure 38 Outline drawing, 49" battery power pack system, single cabinet

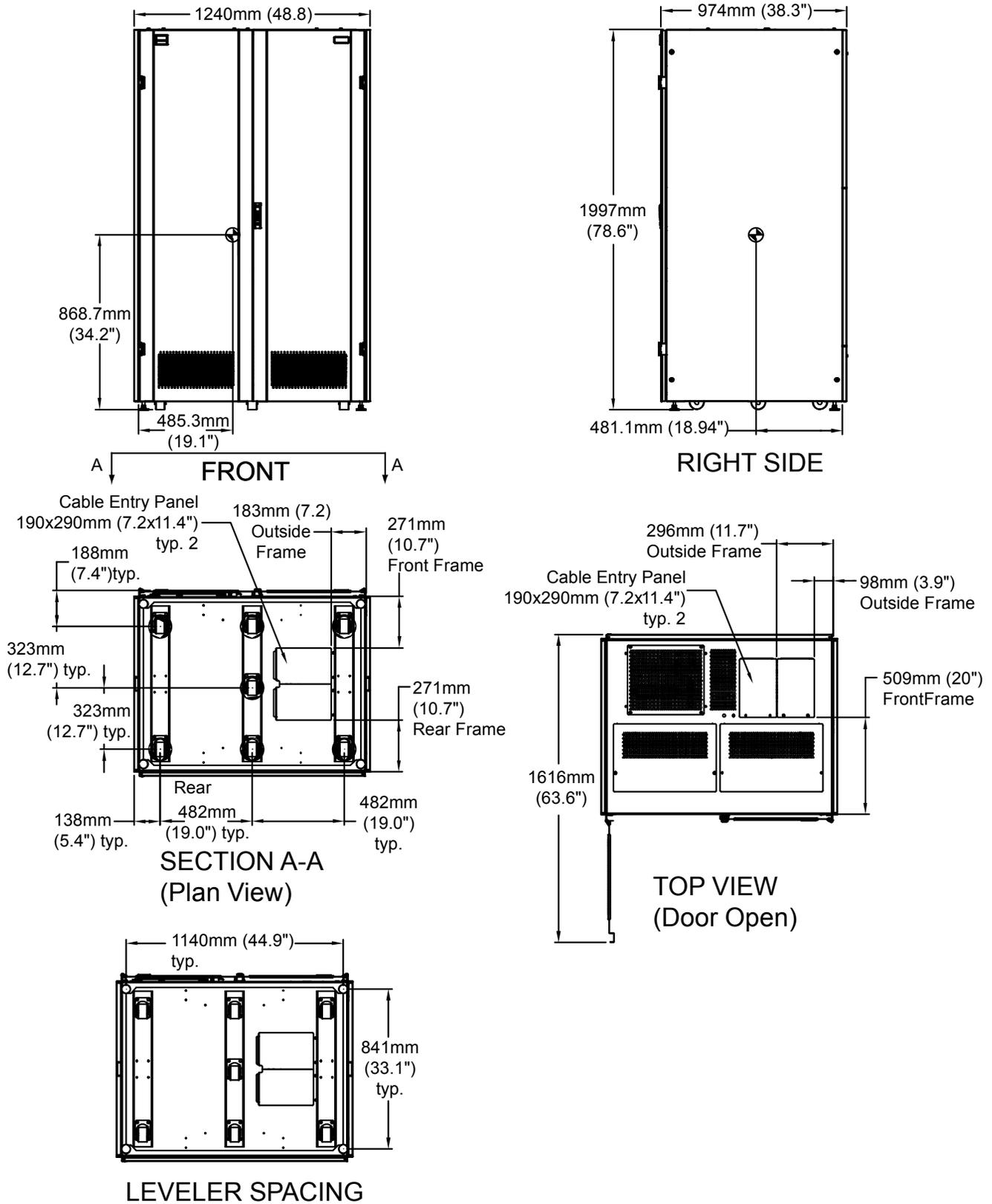


Figure 39 Terminal details, 49" battery power pack system

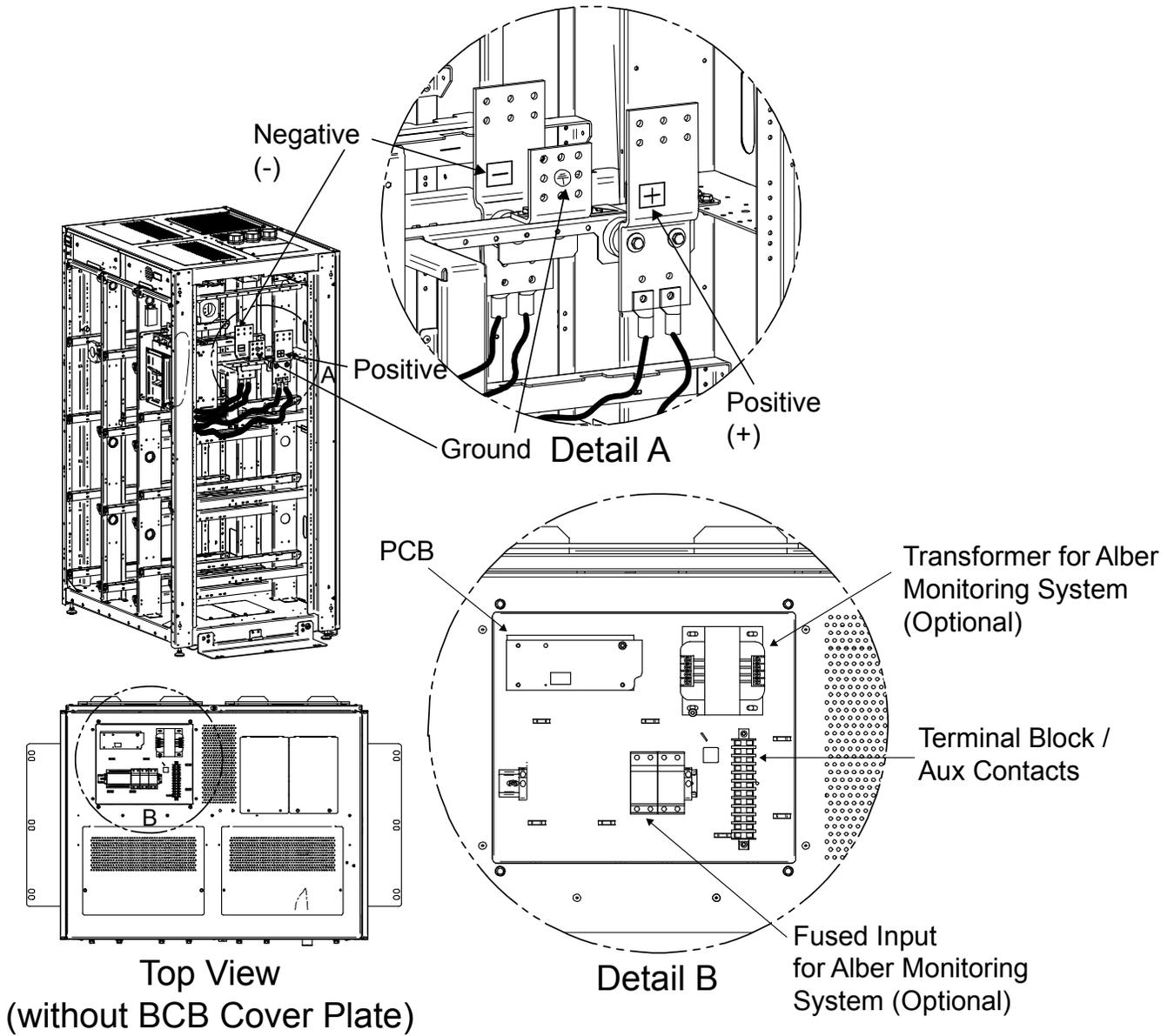
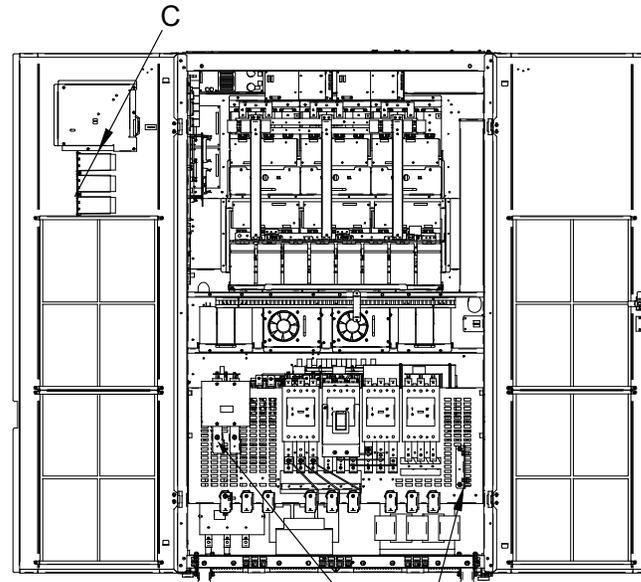
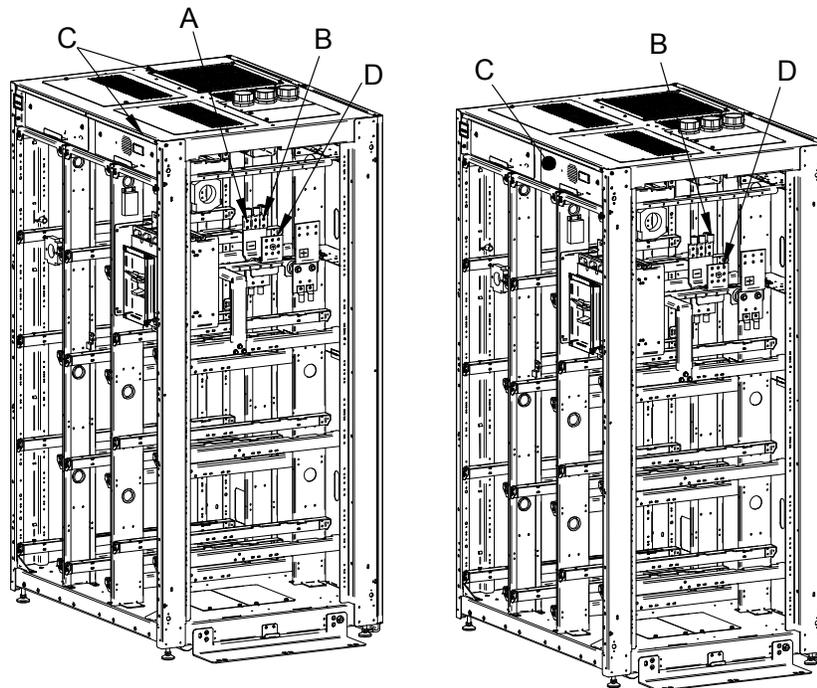


Figure 40 Liebert® NX™ 160-200kVA UPS to 49" battery cabinet interconnection



NX 160-200KVA UPS Module  
Front View



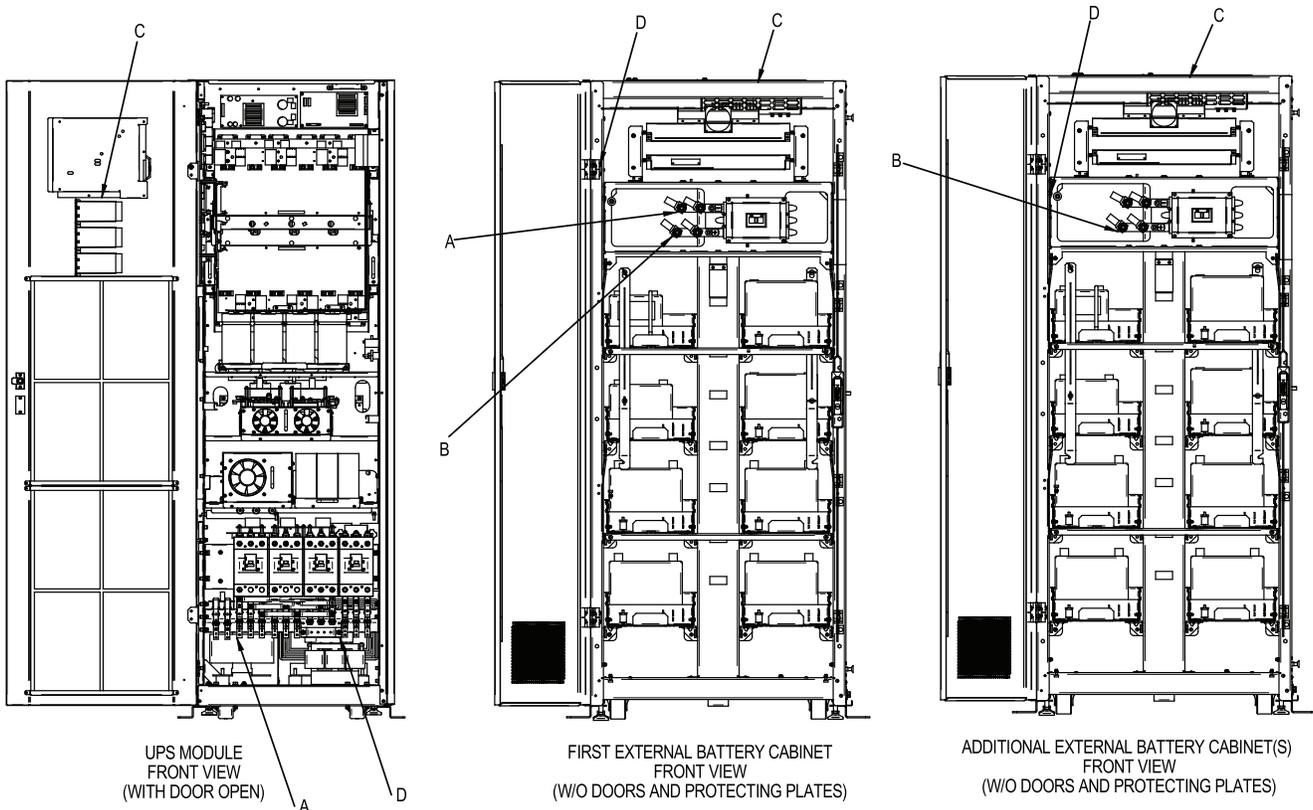
49" Battery Cabinet Right-Side Views

**NOTES:**

1. All cables must be repositioned prior to and while setting the cabinets in their installed location.
2. Refer to the individual drawing of each piece of equipment for additional details.

Run	From	To	Conductors
A	UPS Battery Terminal Block	External Battery Cabinet	Positive, Negative
B	External Battery Cabinet	Additional External Battery Cabinet(s)	Positive, Negative
C	Battery Cabinet(s) Breaker Control Terminal Block	UPS Monitoring Board	Battery Breaker Auxiliary Contacts
D	UPS Ground	Battery Cabinets Ground	Ground

Figure 41 Liebert® NX™ 40-120kVA UPS to 33" battery cabinet interconnection

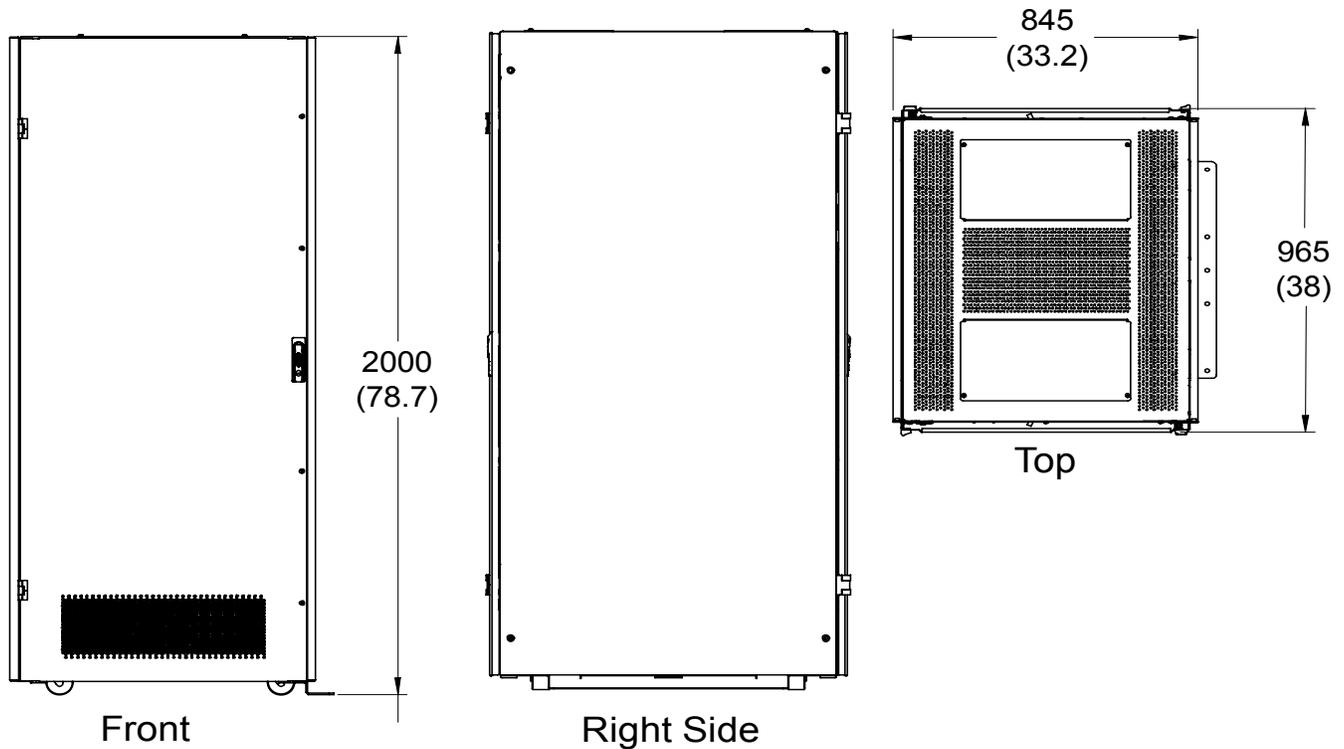


**NOTES:**

1. All cables must be repositioned prior to and while setting the cabinets in their installed location.
2. Refer to the individual drawing of each piece of equipment for additional details.

Run	From	To	Conductors
A	UPS Battery Terminal Block	First External Battery Cabinet	Positive, Negative
B	External Battery Cabinet	Additional External Battery Cabinet(s)	Positive, Negative
C	Battery Cabinet(s) Breaker Control Terminal Block	UPS Monitoring Board	Battery Breaker Auxiliary Contacts
D	UPS Ground	Battery Cabinets Ground	Ground

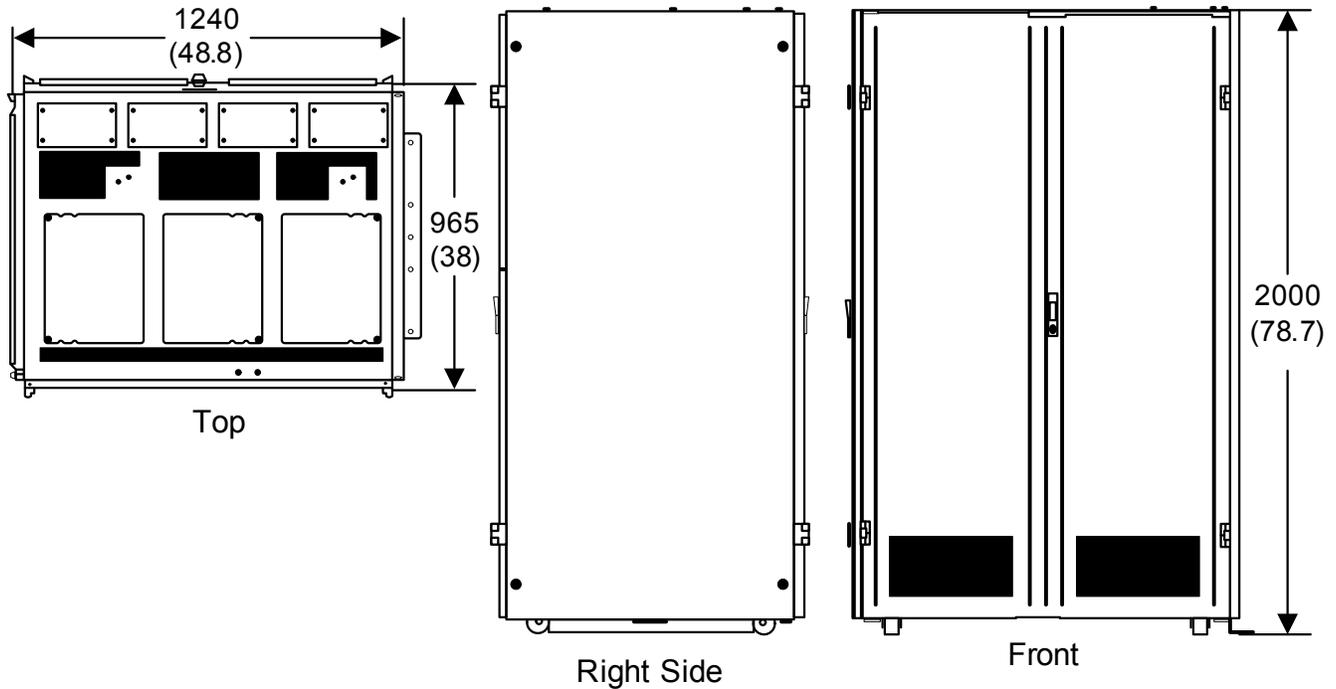
Figure 42 Outline drawing, Liebert® NX™ 480V 33" parallel cabinet



## NOTE:

1. All dimensions are in millimeters (in).
2. Eight-inch minimum clearance above unit required for air exhaust.
3. Keep cabinet within 15 degrees of vertical while handling.
4. Top and bottom cable entry available through removable access plates. Remove access plate, punch to suit conduit size and replace.
5. Color - black.
6. Unit bottom is structurally adequate for forklift handling.
7. M10 threaded mounting holes used for seismic anchoring or floor stand.  
NOTE: If floor stand is used, the weight of the unit must be supported under all casters.
8. Each mounting location is supported by two 10 ga. (.135") galvanized steel. The threaded insert is approximately 3/4" deep. Mounting holes are underneath unit base; mounting bolts must be threaded into unit.
9. Side panels must be removed from adjacent units that are bolted together.
10. Leveling feet are not designed to carry the full weight of the cabinet. Finger-tighten leveler against the floor, then tighten with a wrench less than 2 turns for friction fit against floor.

Figure 43 Outline drawing, Liebert® NX™ 480V 49" parallel cabinet



## NOTE:

1. All dimensions are in millimeters (in).
2. Eight-inch minimum clearance above unit required for air exhaust.
3. Keep cabinet within 15 degrees of vertical while handling.
4. Top and bottom cable entry available through removable access plates. Remove access plate punch to suit conduit size and replace.
5. Color - black.
6. Unit bottom is structurally adequate for forklift handling.
7. M10 threaded mounting holes used for seismic anchoring or floor stand.  
NOTE: If floor stand is used, the weight of the unit must be supported under all casters.
8. Each mounting location is supported by two 10 ga. (.135") galvanized steel. The threaded insert is approximately 3/4" deep. Mounting holes are underneath unit base; mounting bolts must be threaded into unit.
9. Side panels must be removed from adjacent units that are bolted together.
10. Leveling feet are not designed to carry the full weight of the cabinet. Finger-tighten leveler against the floor, then tighten with a wrench less than 2 turns for friction fit against floor.

Figure 44 Liebert® NX™ 480V paralleling cabinet with input and bypass circuit breakers, main components

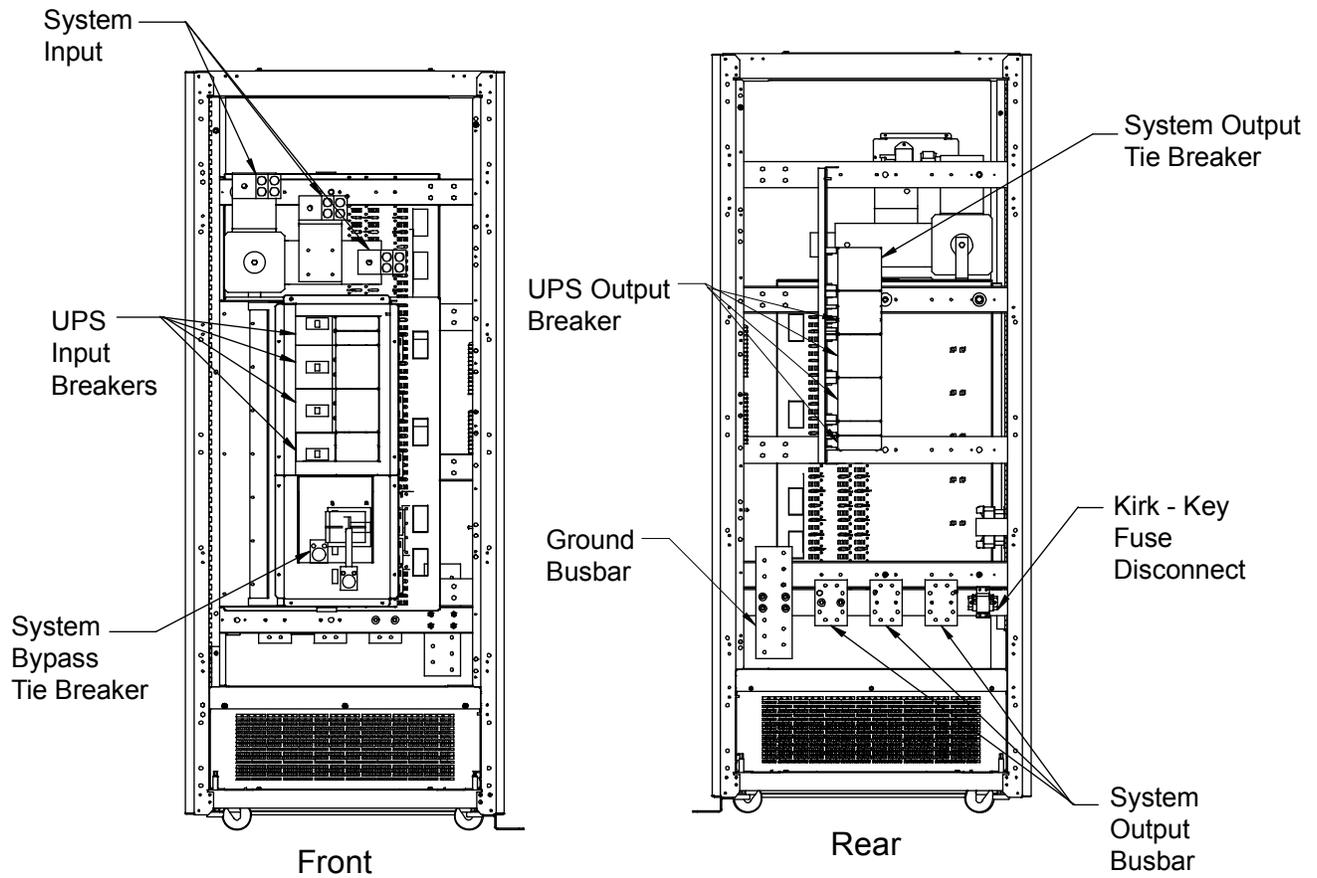


Figure 45 Liebert® NX™ 480V paralleling cabinet main components—input, bypass and distribution circuit breaker configuration

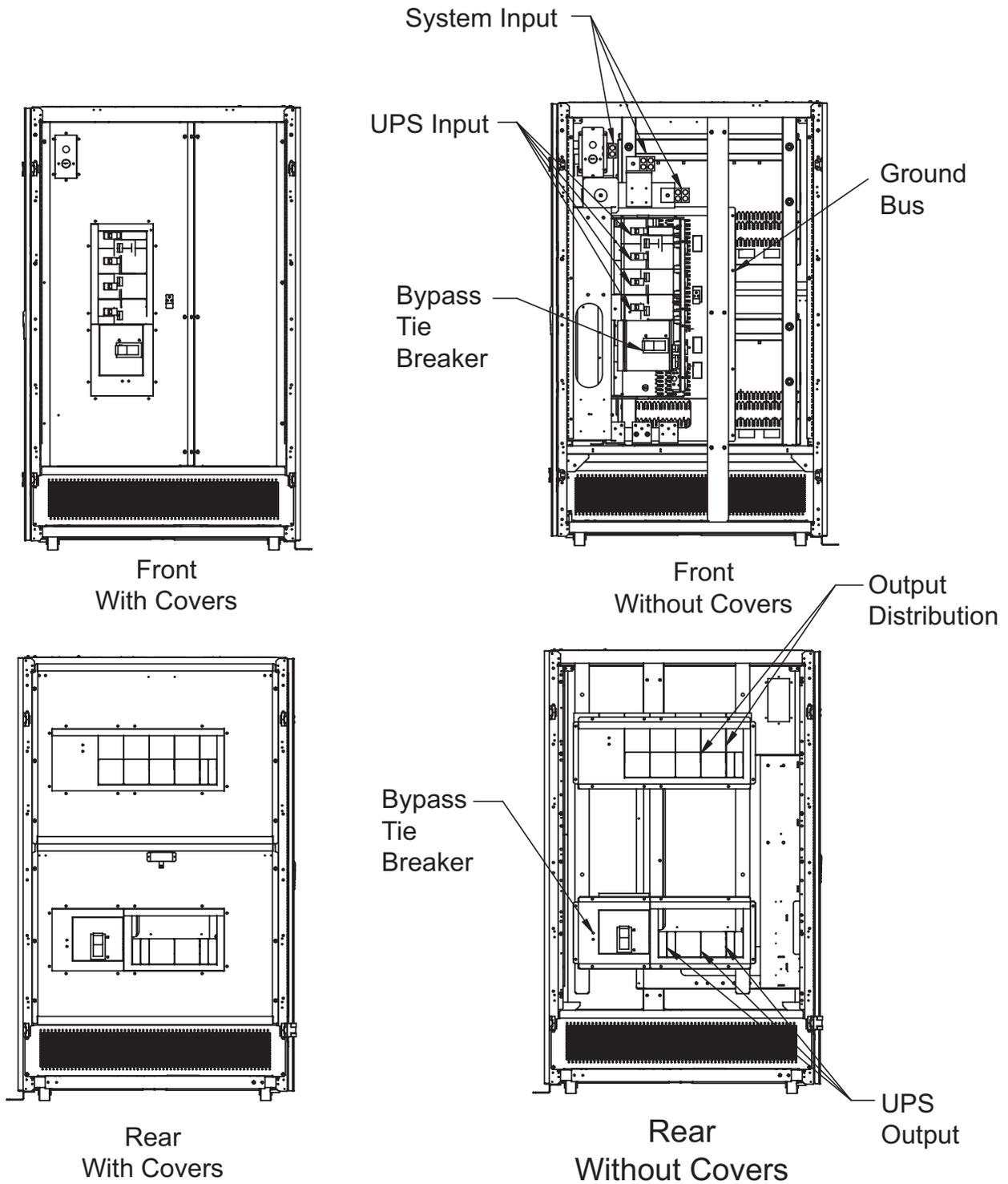


Figure 46 Main component location drawing Liebert® NX™ 480V, CB2, CB3, CB4 configurations

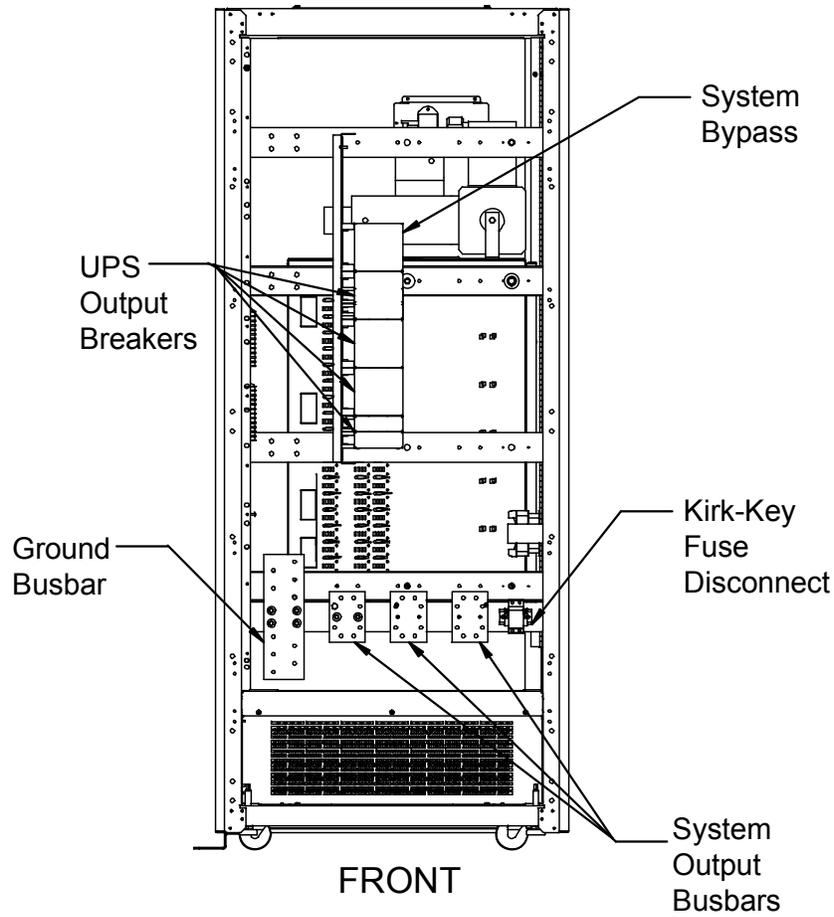
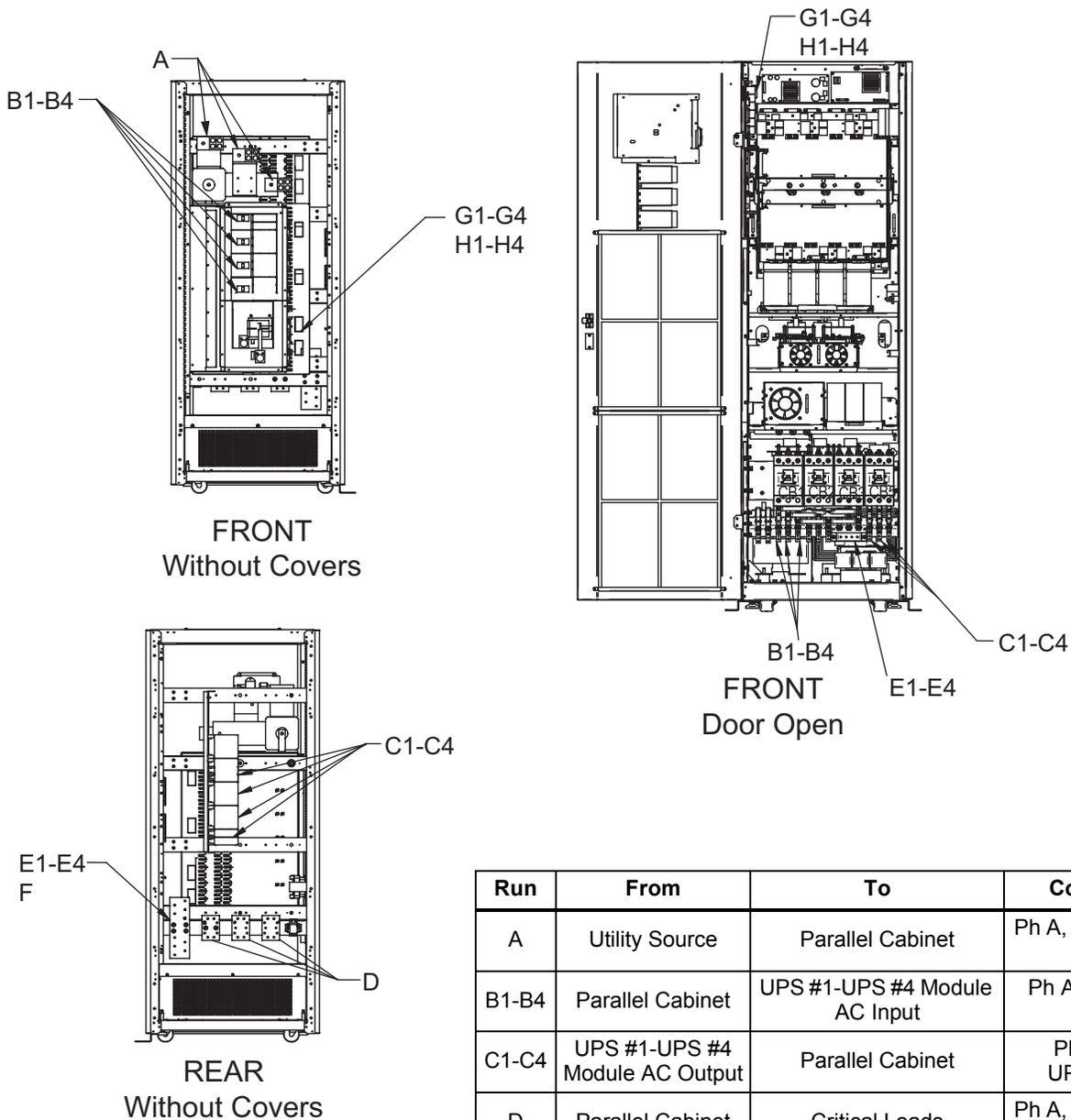
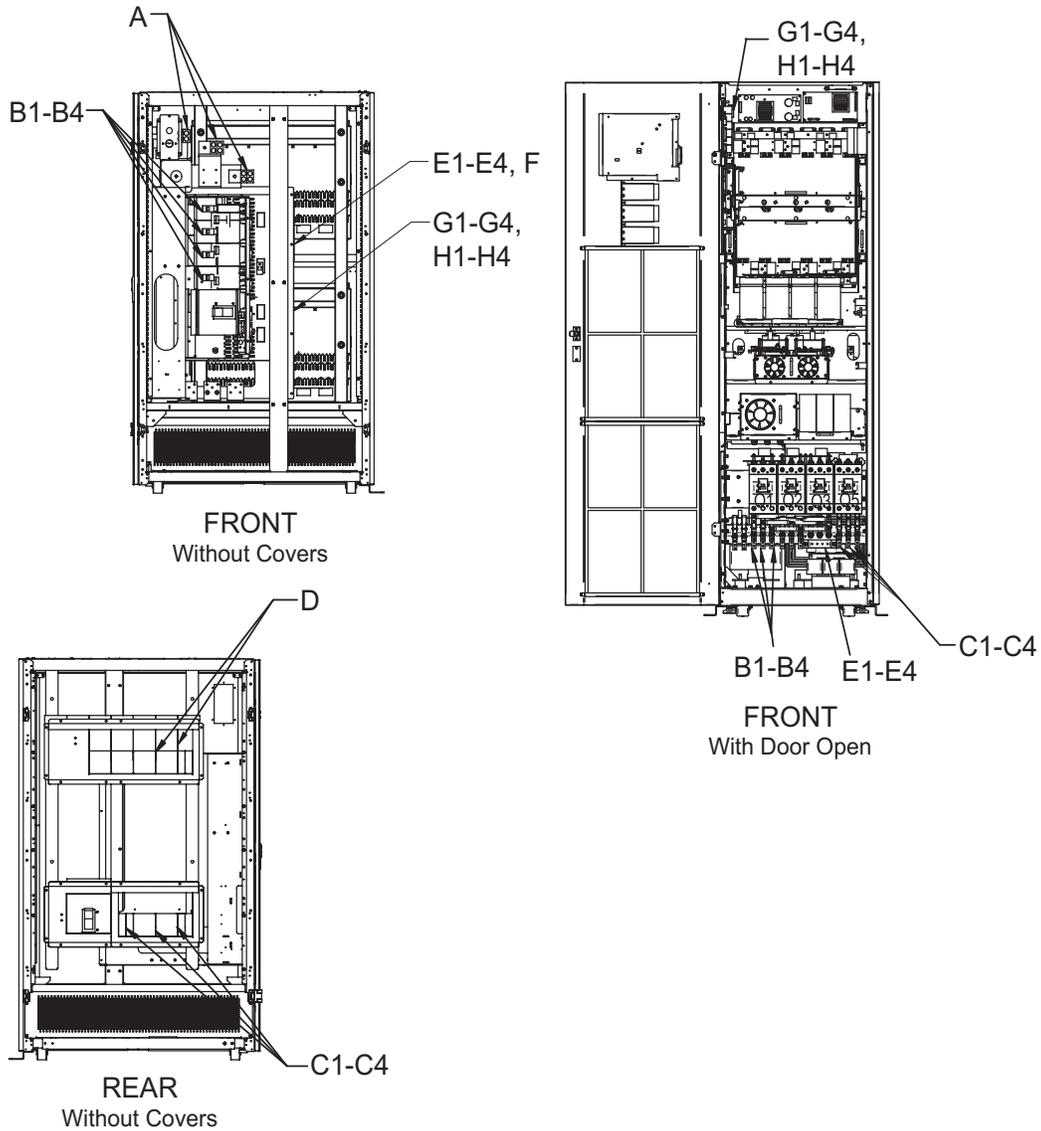


Figure 47 Liebert® NX™ 480V 40-120kVA UPS to Paralleling Cabinet Interconnection—Configuration BB0, FB0, KB0 parallel connection to Liebert NX



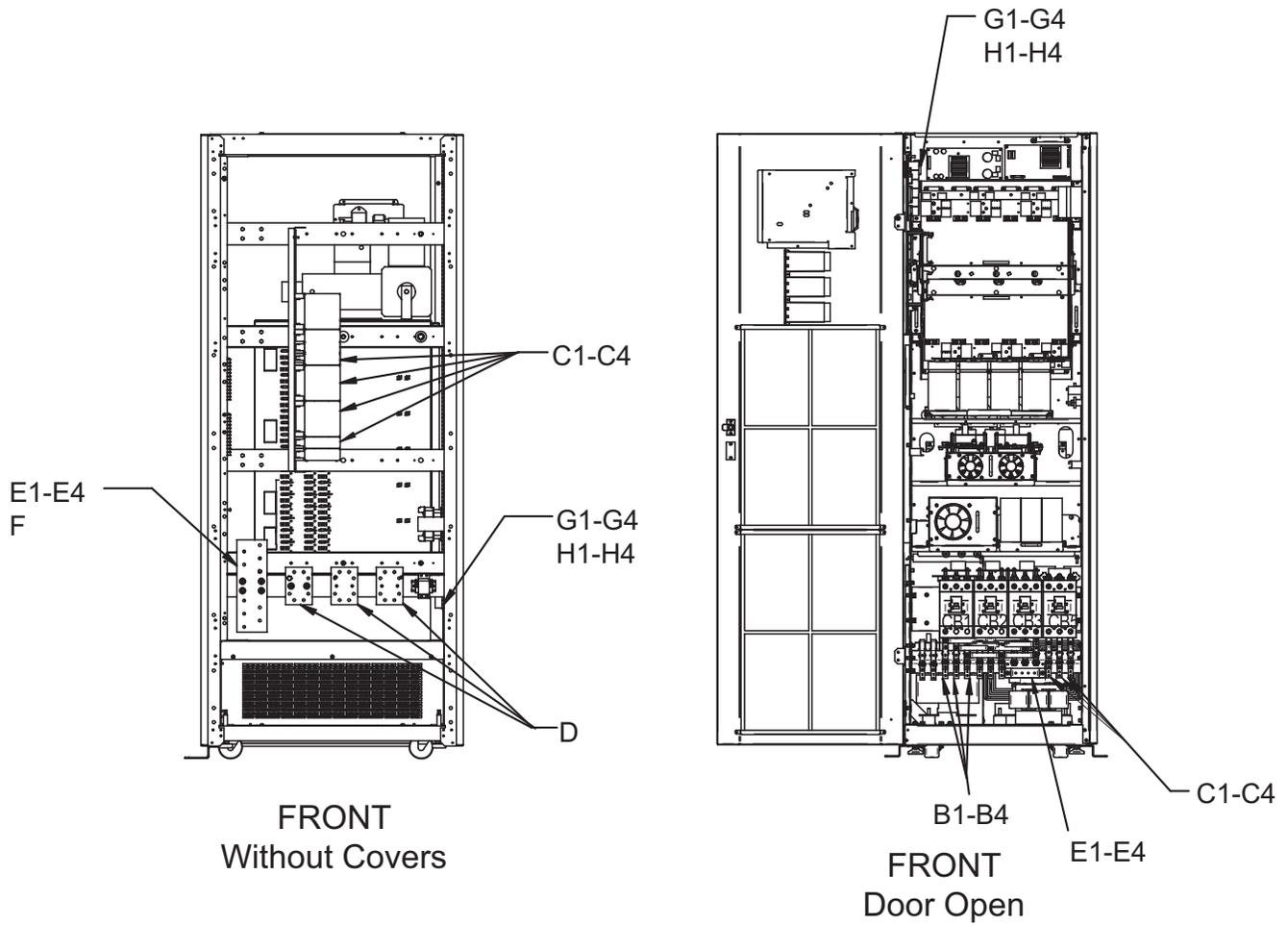
Run	From	To	Conductors
A	Utility Source	Parallel Cabinet	Ph A, B, C - System Input
B1-B4	Parallel Cabinet	UPS #1-UPS #4 Module AC Input	Ph A, B, C - UPS Inputs
C1-C4	UPS #1-UPS #4 Module AC Output	Parallel Cabinet	Ph A, B, C - UPS Outputs
D	Parallel Cabinet	Critical Loads	Ph A, B, C - System Outputs
E1-E4	Parallel Cabinet	UPS #1-UPS #4 Module Gnd	Ground - UPS
F	Parallel Cabinet	Building Gnd	Ground - System
G1-G4	Parallel Cabinet	UPS #1-UPS #4 Module UPS Parallel Logic Board (M3)	Output Breaker Aux Contact
H1-H4	Parallel Cabinet	UPS #1-UPS #4 Module UPS Parallel Logic Board (M3)	UPS Bypass Detection

Figure 48 Interconnecting details for Liebert® NX™ 40-120kVA UPS to paralleling cabinet with input, bypass and distribution circuit breakers



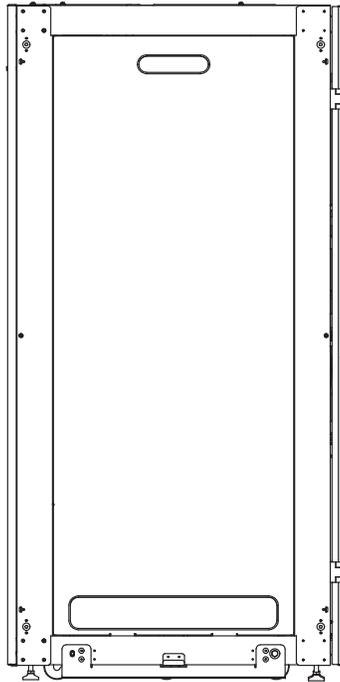
Run	From	To	Conductors
A	Utility Source	Parallel Cabinet	Ph A, B, C - System Input
B1-B4	Parallel Cabinet	UPS #1-UPS #4 Module AC Input	Ph A, B, C - UPS Inputs
C1-C4	UPS #1-UPS #4 Module AC Output	Parallel Cabinet	Ph A, B, C - UPS Outputs
D	Parallel Cabinet	Critical Loads	Ph A, B, C - System Outputs
E1-E4	Parallel Cabinet	UPS #1-UPS #4 Module Gnd	Ground - UPS
F	Parallel Cabinet	Building Gnd	Ground - System
G1-G4	Parallel Cabinet	UPS #1-UPS #4 Module UPS Parallel Logic Board (M3)	Output Breaker Aux Contact
H1-H4	Parallel Cabinet	UPS #1-UPS #4 Module UPS Parallel Logic Board (M3)	UPS Bypass Detection

Figure 49 Lineup detail—Configuration CB2, CB3, CB4 parallel connection to Liebert® NX™

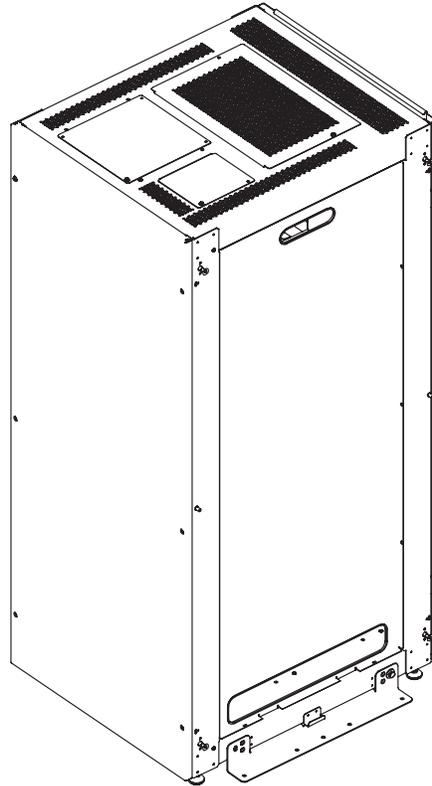


Run	From	To	Conductors
B1-B4	Utility	UPS #1-UPS #4 Module AC Input	Ph A, B, C - UPS Inputs
C1-C4	UPS #1-UPS #4 Module AC Output	Parallel Cabinet	Ph A, B, C - UPS Outputs
D	Parallel Cabinet	Critical Loads	Ph A, B, C - System Outputs
E1-E4	Parallel Cabinet	UPS #1-UPS #4 Module Gnd	Ground - UPS
F	Parallel Cabinet	Building Gnd	Ground - System
G1-G4	Parallel Cabinet	UPS #1-UPS #4 Module UPS Parallel Logic Board (M3)	Output Breaker Aux Contact
H1-H4	Parallel Cabinet	UPS #1-UPS #4 Module UPS Parallel Logic Board (M3)	UPS Bypass Detection

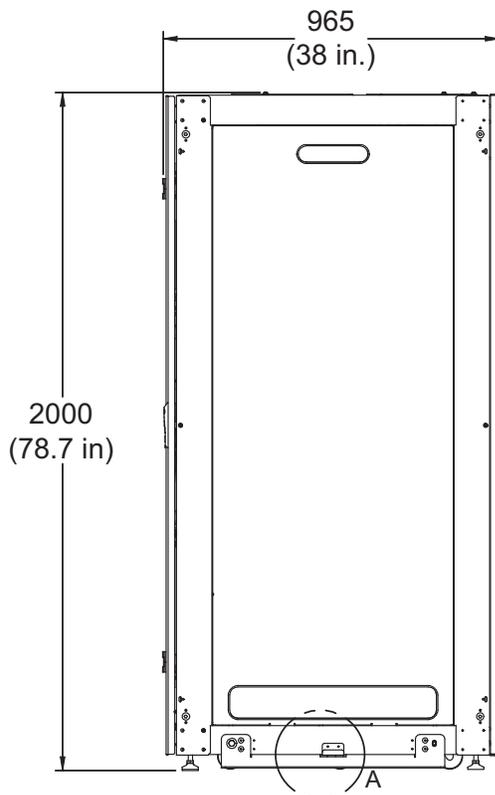
Figure 50 Line-up detail, bolt together description, 40-120 kVA Liebert® NX™



LEFT SIDE  
Without Exterior Panels



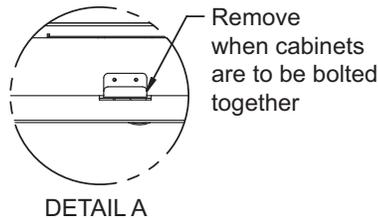
LEFT SIDE  
Isometric View



RIGHT SIDE  
Without Exterior Panels

NOTES:

1. All dimensions are in millimeters (inches)
2. All cables should be routed before bolting cabinets together.
3. The cables between the auxillary cabinets and the UPS cabinet must be supplied by customer.
4. All hardware supplied with ancillary cabinets for bolting cabinet to UPS.
5. Use M6 hardware provided. Assemble as shown in detail drawing.
6. All external wiring is to be in accordance with national and local codes.



U3819301

## 9.0 OPERATION

### 9.1 General Description

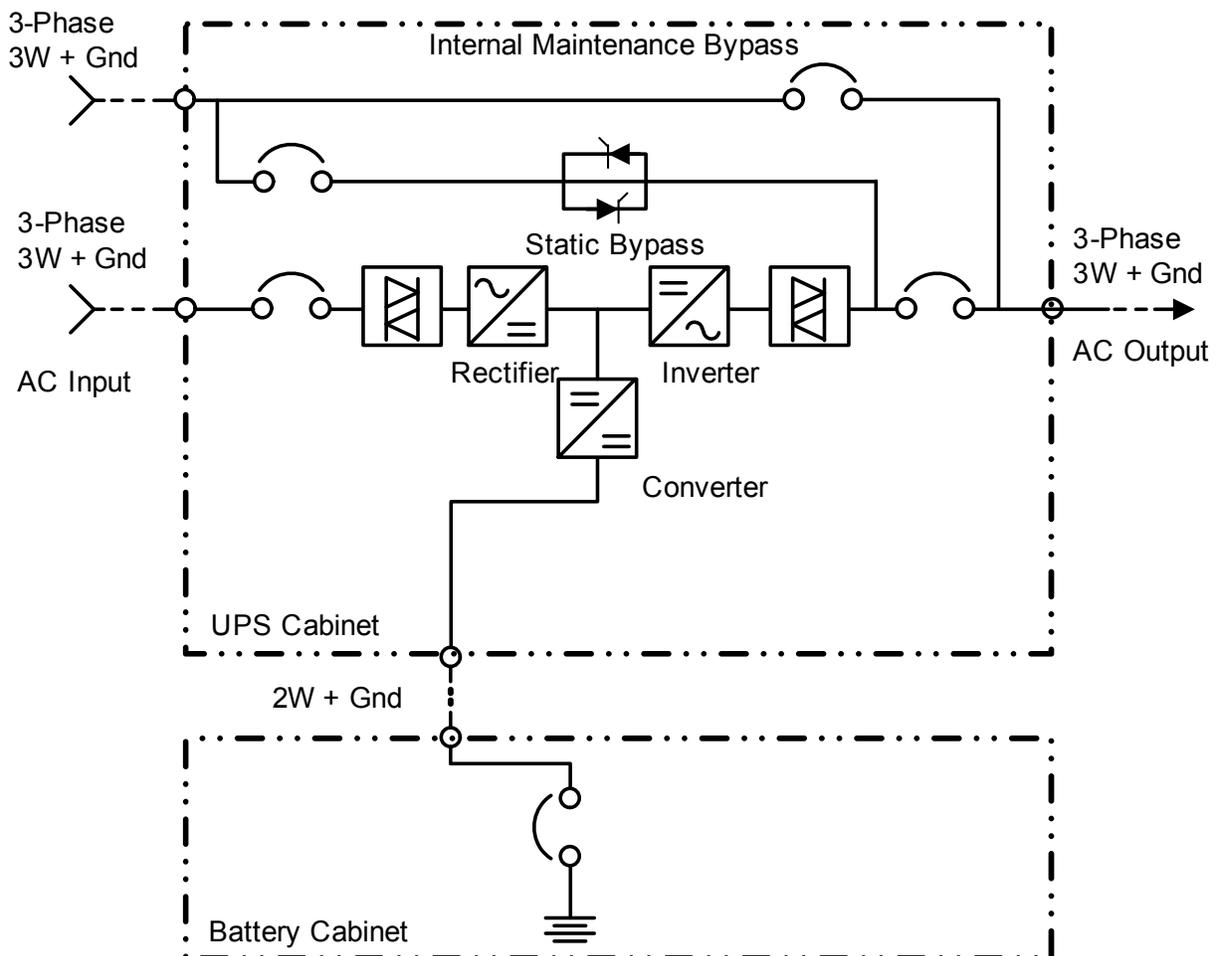
Liebert's NX provides continuous, high-quality AC power to your business-critical equipment, such as telecommunications and data processing equipment. The Liebert® NX™ UPS supplies power that is free of the disturbances and variations in voltage and frequency common to utility power, which is subject to brownouts, blackouts, surges and sags.

The Liebert NX utilizes the latest in high-frequency, double-conversion pulse width modulation technology and fully digital controls to enhance its reliability and increase the ease of use. Specifically, the Liebert NX 480V utilizes soft-switching technology to greatly enhance efficiency.

As shown in **Figure 51**, the AC utility source is input at CB1 and the rectifier converts the AC utility into DC power. The inverter converts that DC power from the utility—or DC power from the batteries—into AC power for the load. The batteries power the load through the inverter in the event of a power failure. The utility source can also power the load through the static bypass.

If maintenance or repair of the UPS is necessary, the load can be switched without interruption in service to the maintenance bypass.

**Figure 51 Single module block diagram (dual input configuration)**



### 9.1.1 Bypass Supplies

The Liebert® NX™ contains an electronically controlled switching circuit that enables the critical load to be connected to either the inverter output or to a bypass power source via the static bypass line. During normal system operation the load is connected to the inverter and the inverter contactor is closed; but in the event of a UPS overload or an inverter failure, the load is automatically transferred to the static bypass line.

To provide a clean (no-break) load transfer between the inverter output and static bypass line, the bypass static switch activates, connecting the load to bypass. To achieve this, the inverter output and bypass supply must be fully synchronized during normal operating conditions. This is achieved through the inverter control electronics, which make the inverter frequency track that of the static bypass supply, provided that the bypass remains within an acceptable frequency window.

A manually controlled, maintenance bypass supply is incorporated into the UPS design. It enables the critical load to be powered from the utility (bypass) supply while the UPS is shut down for routine maintenance.



#### NOTE

*When the UPS is operating in bypass mode or on maintenance bypass, the connected equipment is not protected from power failures or surges and sags.*

### 9.1.2 Operating Modes

The UPS is designed to operate as an on-line, double-conversion, reverse-transfer system in the following modes:

#### Normal Mode

Operating in normal mode, the Liebert NX's rectifier derives power from a utility AC source and supplies regulated DC power to the inverter, which regenerates precise AC power to supply the connected equipment. The rectifier also uses the utility source power to charge the batteries.

#### Battery Mode

When utility AC power fails, the Liebert NX protects the critical load by instantaneously channeling battery power to the inverter, which continues supporting the critical load without interruption. When utility power returns and is within acceptable limits, the Liebert NX automatically shifts back to Normal mode, with the rectifier powering the critical load.

#### Bypass Mode

When the Liebert NX is in bypass mode, the load is directly supported by utility power and is without battery backup protection.

The Liebert NX's inverter static switch and bypass static switch will shift the load from the inverter to bypass mode without an interruption in AC power if the inverter is synchronous with the bypass and any of the following occurs:

- inverter fails
- inverter overload capacity is exceeded
- inverter is manually turned off by the user



#### NOTE

*If the inverter is asynchronous with the bypass, the static switch will transfer the load from the inverter to the bypass WITH interruption in AC power to the critical load. This interruption will be less than 10ms. This interruption time may be altered by modifying the Output transfer interrupt time setting.*

---

## Maintenance Mode

For maintenance or repair, the Liebert® NX™ may be operated in maintenance mode. To place the Liebert NX in maintenance mode, the load must be transferred to bypass and the inverter must be turned off. When those conditions are met, the CB3 may be turned on and the UPS may be shut down, permitting disconnecting the batteries for maintenance.



### **WARNING**

Risk of electrical shock. Can cause injury and death.

The UPS input and output must be protected with external overcurrent protection devices. In maintenance mode, the input and output busbars remain energized.

### **NOTICE**

Risk of improper operation. Can cause loss of power to the load and damage to the UPS.

The internal maintenance bypass must not be used when the UPS system is in a parallel system. Doing so can cause a backfeed that can damage the UPS and interrupt power to the load.

## Parallel Redundancy Mode (System Expansion)

For higher capacity, higher reliability or both, the outputs of up to four UPS modules can be programmed for directly paralleling while a built-in parallel controller in each UPS ensures automatic load-sharing.

## Frequency Converter Mode

The Liebert NX can be programmed into frequency converter mode for either 50Hz or 60Hz stable output frequency. The input frequency may vary from 57Hz to 66Hz. In this mode, the static bypass operation is disabled and the battery becomes optional, depending on any requirement to operate in battery mode (stored energy mode).

## Eco Mode

If ECO mode is selected, the double-conversion UPS operation is inhibited at most times for the purpose of saving energy. In this mode of operation, not unlike UPS of line-interactive or stand-by technology, the bypass is the preferred source, and only when the voltage and/or frequency of the bypass supply is beyond pre-defined and adjustable limits is the critical AC load transferred to the inverter. This transfer takes place with an interruption of less than 3/4 of an electrical cycle, e.g., less than 15ms (50Hz) or less than 12.5ms (60Hz).

## 10.0 OPERATOR CONTROL AND DISPLAY PANEL

### 10.1 Operator Control Panel

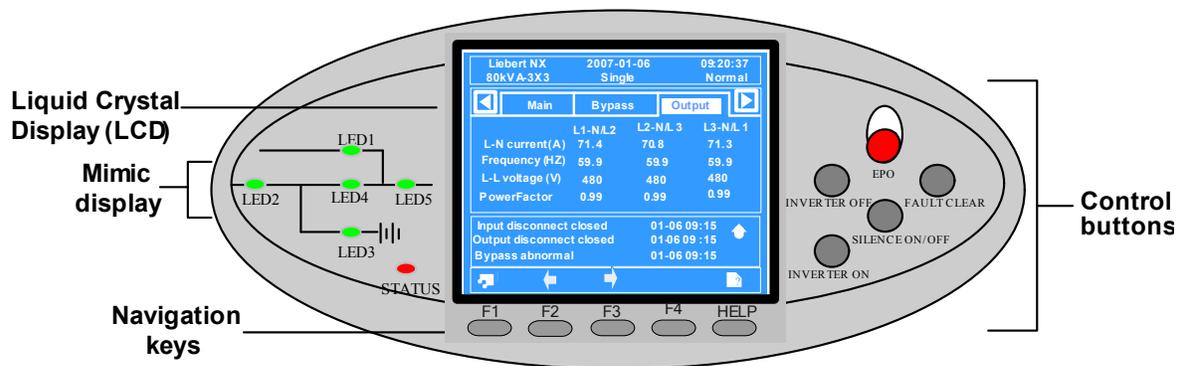
The control panel and LCD on the front of the Liebert® NX™ lets the operator:

- turn the UPS On or Off
- transfer into the various operating modes
- silence alarms
- check the status of the UPS and its batteries, including all measured parameters, events and alarms

The main areas of the control panel are shown below in **Figure 52** and detailed in **Figure 53**.

- **Mimic Display** - view the status of the Liebert NX in single-line diagram format—indicators show status by changing color when ON, flashing or OFF
- **Liquid Crystal Display (LCD)** and **Navigation keys** - view status and operational data from the Liebert NX in tabular format
- **Control buttons** - turn the Liebert NX on or off, silence alarms

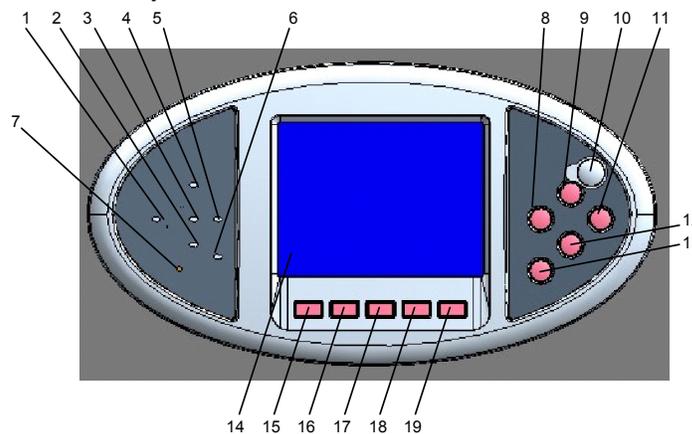
**Figure 52 Overview of control panel**



#### 10.1.1 Display Panel Layout

**Figure 53** shows the control panel in greater detail, identifying individual items that are described in the rest of this section.

**Figure 53 Detailed view of control panel**

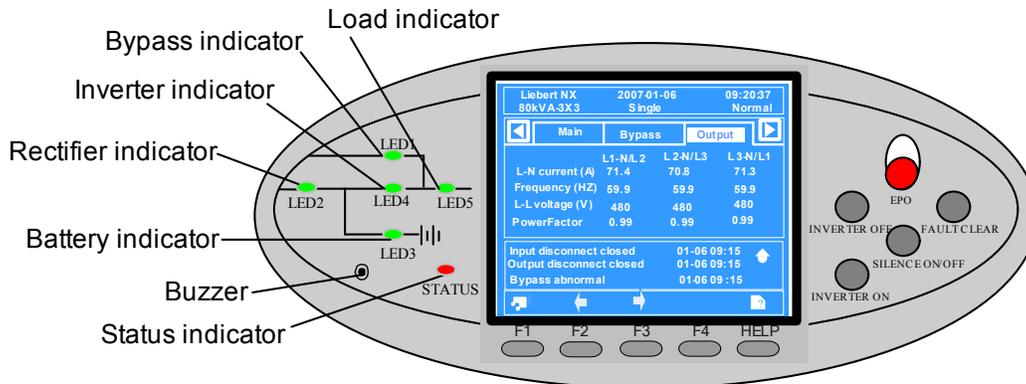


Mimic indicators	Control buttons	Navigation keys
1. Rectifier indicator	8. Inverter Off Button	15. F1
2. Battery indicator	9. Emergency Power Off Button	16. F2
3. Inverter indicator	10. EPO Cover	17. F3
4. Bypass indicator	11. Fault Clear Button	18. F4
5. Load indicator	12. Silence On/Off Button	19. Help
6. Status indicator	13. Inverter On Button	
7. Buzzer	14. LCD	

## 10.2 Mimic Display Indicators

The Mimic display on the front panel consists of six indicators arranged in a single-line diagram depicting the various paths of UPS power, as shown in **Figure 54**.

**Figure 54** Mimic display indicators location



The current operational status of the Liebert® NX™ is indicated by the color of the indicators—green, amber or red—and whether they are ON (solid), flashing or OFF. **Table 27** provides a guide to interpreting the various states of the indicators.

**Table 27** Mimic display status indicators

Indicator (see Figure 54)	Green	Flashing Green / Amber	Red	Off
<b>Rectifier</b>	Load on rectifier	Flashing Green: Utility normal, but rectifier not operating	Rectifier fault	Rectifier is normal, but utility is abnormal
<b>Battery</b>	Battery powering the load	Flashing Green: Battery pre-warning (low battery)	Battery or battery converter abnormal*	Battery and converter are normal, and battery is not discharging
<b>Inverter</b>	Inverter powering the load normally	Flashing Green: Inverter on standby	Inverter fault	Inverter normal, but off
<b>Bypass</b>	Load on Bypass power	—	Bypass out of normal range	Bypass Normal
<b>Load</b>	UPS output on	—	UPS output overloaded	UPS no output power
<b>Status</b>	No alarms—UPS working normally	Amber: UPS has a general alarm	UPS has a serious alarm	—

\* Battery or battery converter abnormal events include these event messages (see **Appendix A**): No Battery, Battery Replaced, Battery Reverse, Batt. Conv. Over. Curr., Batt. Converter Fault, Batt. Converter Overtemp.

### 10.3 Control Buttons

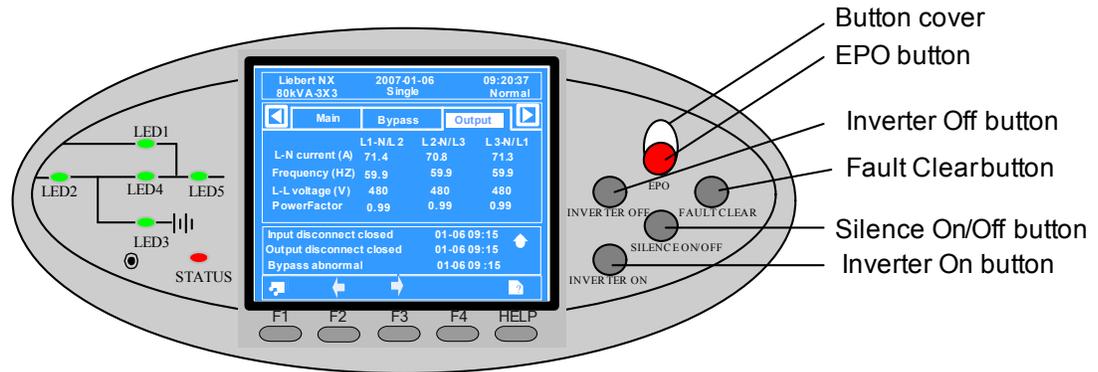
The **Control Buttons** on the front panel may be used to shut down the UPS completely, turn the inverter On or Off, restart the UPS after a fault and silence the alarm, as shown in **Figure 55**. The function of each button is described in **Table 28**.



#### NOTE

To activate a button properly, press and hold until you hear a short beep—about two seconds.

**Figure 55** Location of control buttons



**Table 28** Control buttons

Button (see Figure 55)	Function
<b>EPO</b>	Completely shuts down the UPS, including the static switch. <b>CAUTION:</b> Use caution before pressing the Emergency Power Off (EPO) button. This button completely shuts down the unit and cuts off power to the critical load.
<b>Inverter Off</b>	Press this button to shut down the inverter during operation. The load will be transferred to static bypass.
<b>Fault Clear</b>	After the UPS shuts down due to a fault and the alarm condition has been resolved, press this button to clear the fault and restart the UPS.
<b>Silence On/Off</b>	Press this button once to silence the alarm buzzer when an alarm is active. Any new fault will sound the buzzer again. If the alarm buzzer is not beeping, press this button to test the alarm sound.
<b>Inverter On</b>	Press this button to start the inverter and transfer from static bypass to inverter. <b>NOTE:</b> If the inverter is not ready, this will not activate the UPS.

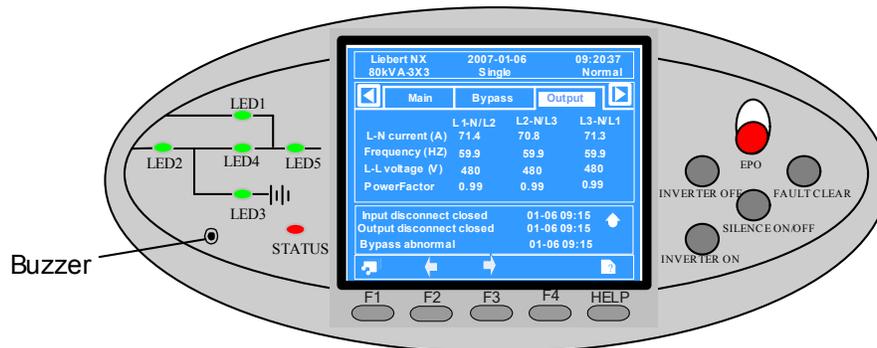
## 10.4 Audible Buzzer

The buzzer produces three types of sounds:

- **Single beep** - when any control button is pressed
- **Single beep repeating every two seconds** - the system has a general alarm
- **Continuous** - the system has a serious fault

If the buzzer makes no sound, the system may be operating properly, or an alarm may have been silenced manually.

**Figure 56 Buzzer location**



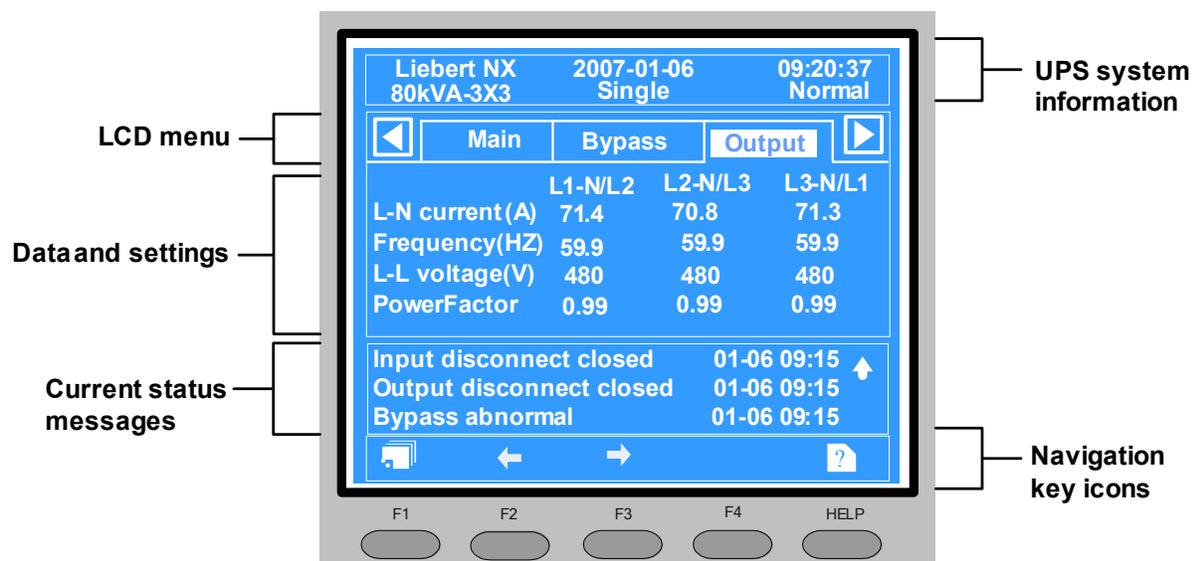
## 10.5 LCD Overview

The LCD on the front panel has five main sections, as shown in **Figure 57**. Press the F1 key below the LCD to scroll through these sections.

- **UPS System Information** - view UPS name and model, date and time, overall status (see **Table 30**).
- **LCD Menu** - choose a category of data items to appear below the menus (see **Table 31**).
- **Data and Settings** - view data items for the selected menu (see **Table 31**).
- **Current Status Messages** - check any active UPS event and alarm messages (see **Appendix A**).
- **Navigation Key Icons** - look at the icon above each navigation key to determine how the key operates when pressed (see **10.6 - Navigation Keys**).

The LCD displays alarm information in real time. After appearing in the current status section of the LCD, status messages are stored in the history log—512 records can be stored and retrieved.

**Figure 57 Sections of the LCD**



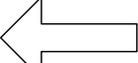
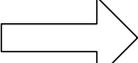
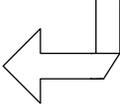
## 10.6 Navigation Keys

The navigation keys on the front panel—F1 through F4 and Help—are used to access the LCD to view the current status and other information about the Liebert® NX™.

Navigation key icons on the LCD appear above each key to indicate its operation (see **Table 29**). The keys are “soft keys” that can change functions according to the icon.

- Use **F1** either to move to a different portion of the LCD (Shift icon) or to escape to a previous view (ESC icon).
- Use **F2** and **F3** as cursor keys to move left and right or up and down, depending on the icons displayed above the keys.
- Use **F4** as an Enter key to confirm a choice.
- Use **HELP** to access help information on the LCD.

**Table 29** Icons for navigation keys

Key	F1	F2	F3	F4	HELP
Functions Available	 Shift	 Left	 Right	 Enter	 Help
	<b>ESC</b> Exit	 Up	 Down		

## 10.7 UPS System Information

The UPS system information displayed at the top of the LCD is detailed in **Table 30**.

**Table 30** Description of items in UPS system window

Item Type	Explanation
Liebert NX	UPS name
2007-10-12	Current date
12:30:36	Current time
080kVA-3x3	<b>080</b> means UPS model is 80kVA; <b>3x3</b> means 3 by 3 system (three-phase input and three-phase output)
Unit #1	#1 of 6 Paralleled changed to “Unit #1”
Single	UPS is configured as a single unit system running in Normal mode
Normal	UPS in normal operation, inverter powering load, no warnings
Warning	UPS has a general alarm
Fault	UPS has a serious fault

## 10.8 LCD Menus and Data Items

The LCD menus provide access to the following categories of information and settings for the UPS. Selecting a menu changes the information displayed in the UPS data items portion of the LCD. The menu choices are listed below and described in detail in **Table 31**.

- **Mains** - view utility power input data: voltage, current, frequency and power factor
- **TX Input** - view input transformer voltages
- **Bypass** - view bypass data: voltage and frequency
- **Output** - view output data: voltage, current, frequency and power factor
- **Load** - view load data: load percent, output current, output power and crest factor (CF)
- **System** - view system data
- **Battery** - view battery characteristics—voltage, current, temperature and remaining time—and messages when the battery is boost/float charging or disconnected
- **Records** - access the history log—displays all records in the log (newest records added at end)
- **Language** - select a language for LCD text (choices appear in the native language)
- **Settings** - configure UPS settings: adjust the display contrast, choose a format for date display, set the date and time, set up the UPS for modem communications (baud rate, address, mode and phone numbers to dial for alarm notifications) and change the password
- **Command** - start or stop a battery maintenance test, battery capacity test or system test
- **Version** - view firmware versions for the inverter, rectifier and software display board and the model information for the UPS

**Figure 58** shows a menu tree of the options available from the LCD menus.

Figure 58 Menu tree

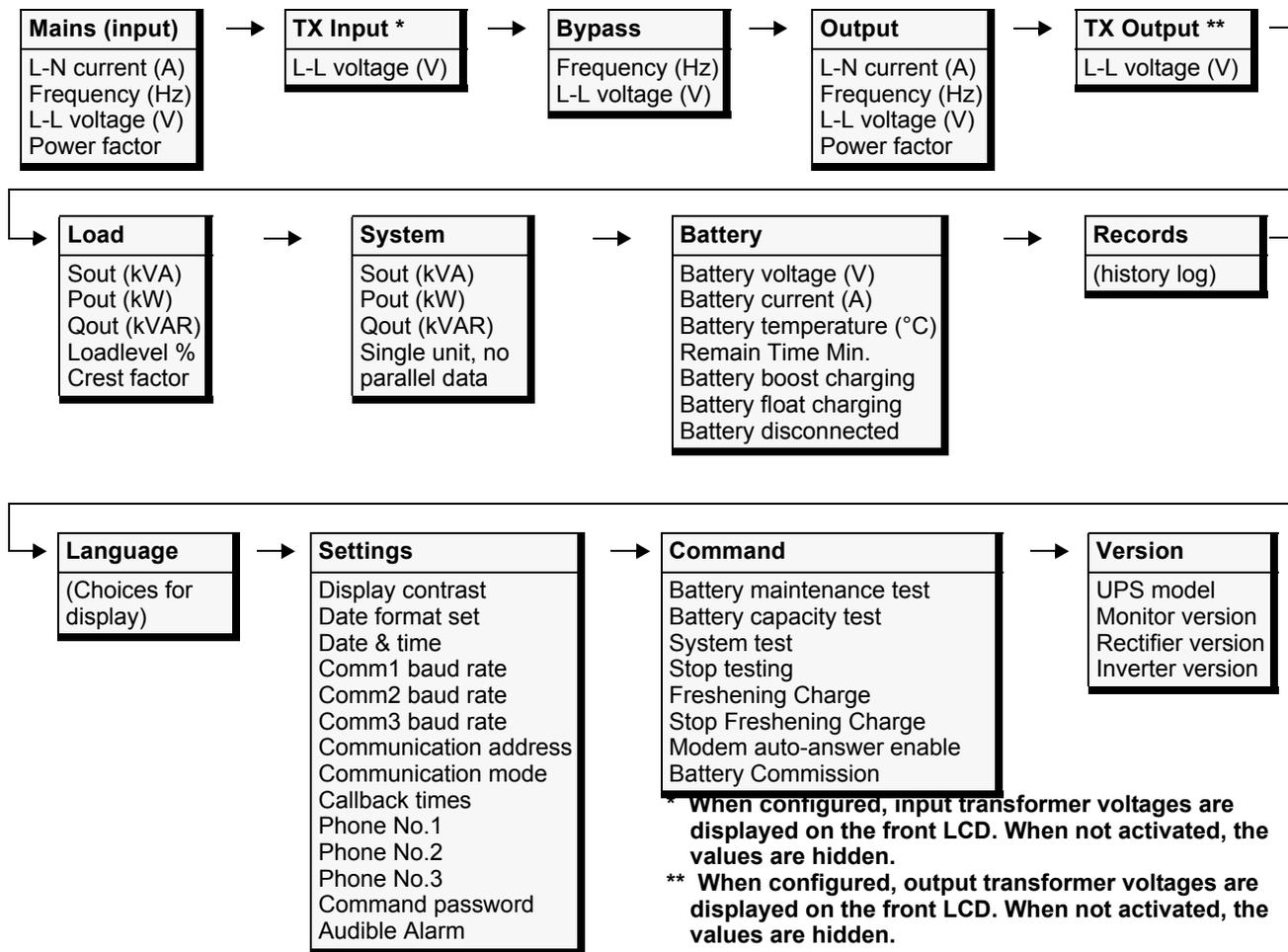


Table 31 Descriptions of UPS menus and data window items

Menu Type	Item Type	Explanation
Mains (input)	L-N current (A)	Phase current
	Frequency (Hz)	Input frequency
	L-L voltage (v)	Line-line voltage
	Power factor	Power factor
TX Input	L-L voltage (V)	Line-line voltage
Bypass	Frequency (Hz)	Bypass frequency
	L-L voltage (A)	Line-line voltage
Output	L-N current (A)	Phase current
	Frequency (Hz)	Output frequency
	L-L voltage (V)	Line-line voltage
	Power factor	Power factor
TX Output	L-L voltage (V)	Line-line voltage
Load	Sout (kVA)	Sout: Apparent power
	Pout (kW)	Pout: Active power
	Qout (kVAR)	Qout: Reactive power
	Loadlevel %	The percent of the UPS rating load
	Crest factor	Output current Crest Factor

Table 31 Descriptions of UPS menus and data window items (continued)

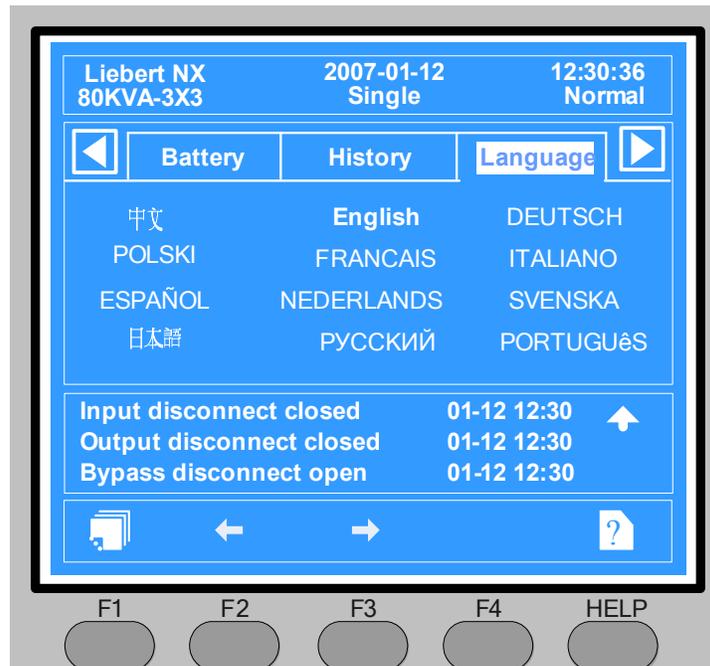
Menu Type	Item Type	Explanation
<b>System</b>	Sout (kVA)	Sout: Apparent power
	Pout (kW)	Pout: Active power
	Qout (kVAR)	Qout: Reactive power
	Single unit, no parallel data	When configured as a single unit, UPS has only native load, no system load.
<b>Battery</b>	Battery voltage (V)	Battery bus voltage
	Battery current (A)	Battery bus current
	Battery temperature (°C)	Internal battery temperature °C
	Remain Time Min.	Battery run time remaining.
	Battery boost charging	Battery is boost charging.
	Battery float charging	Battery is float charging.
	Battery disconnected	Battery is not connected.
<b>Records</b>	(History Log)	Displays all records in the history log.
<b>Language</b>	(choices for text displayed)	User may select any of 12 languages for LCD text.
<b>Settings Settings</b>	Display contrast	Adjust the LCD contrast
	Date format set	Choose the format for date display: M/D/Y, D/M/Y, M/D/Y, Y/M/D
	Date & time	Set the date and time
	Comm1 baud rate	Communication baud rate setting for Liebert IntelliSlot 1
	Comm2 baud rate	Communication baud rate setting for Liebert IntelliSlot 2
	Comm3 baud rate	Communication baud rate setting for Liebert IntelliSlot 3
	Communication address	This setting is applicable to RS485 communication mode.
	Communication mode	Communication Mode Setting
	Callback times	When Liebert IntelliSlot 1 Communication mode is Modem, this parameter sets the number of times a number is redialed to send an alarm notification.
	Phone No.1	When Liebert IntelliSlot 1 Communication mode is Modem, this is the first phone number to be dialed (to send an alarm notification).
	Phone No.2	When Liebert IntelliSlot 1 Communication mode is Modem, this is the second phone number to be dialed (to send an alarm notification).
	Phone No.3	When Liebert IntelliSlot 1 Communication mode is Modem, this is the third phone number to be dialed (to send an alarm notification).
	Command password	User can modify the command password.
	Audible Alarm	User can Enable and Disable the UPS audible alarm.
<b>Command (start/stop battery &amp; system tests)</b>	Battery maintenance test	This test performs a partial discharge of the battery to obtain a rough estimate of the battery capacity. Load must be between 20% and 80%.
	Battery capacity test	This test performs a full discharge of the battery to obtain a precise measure of the battery capacity. Load must be between 20% and 80%.
	System test	This is a self-test of the UPS. When the user activates this function, a pop-up window appears about 5 seconds later to show the results.
	Stop testing	Manually stops a battery maintenance test, battery capacity test or system test.
	Freshening Charge	Allows a temporary Equalize charge for the batteries. This charge is configurable for 1 to 36 hours.
	Stop Freshening Charge	Manually stops a Freshening Charge.
	Modem Auto-answer enable	Manually enable the modem's auto-answer function.
	Battery Commission	Resets the UPS battery detection logic after new/fresh batteries are installed.
<b>Version</b>	UPS version	Provides UPS firmware version numbers for the inverter, rectifier and software display board.
	UPS model	Provides UPS model information—for example, 480V-60Hz.

## 10.9 Language Selection

The LCD menus and data display are available in 12 languages (Chinese, Dutch, English, French, German, Italian, Japanese, Polish, Portuguese, Russian, Spanish and Swedish). To select a different language:

- From the main menu, press the **F1** (Shift) key to move the cursor to the menu at the top of the screen.
- Press **F2** and **F3** (left and right arrows) as needed to select the **Language** menu.
- Press **F1** (shift) to move the cursor to the data and settings area of the LCD.
- Use **F2** and **F3** (up and down) to select the required language.
- Press the **F4** (enter) key to accept the language selection.
- Return to the main menu by repeatedly pressing **F1** (ESC) as needed; all text on the LCD will now be displayed in the selected language.

Figure 59 Language selection

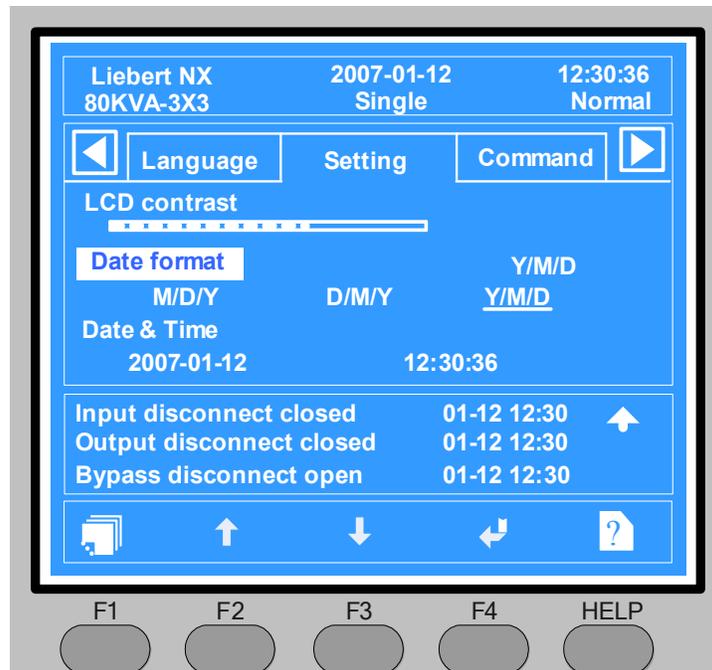


## 10.10 Current Date and Time

To change the system date and time:

- From the main menu, press the **F1** (shift) key to move the cursor to the menu at the top of the screen.
- Press **F2** and **F3** (left and right arrows) as needed to select the **Settings** menu.
- Press **F1** (shift) to move the cursor to the data and settings area of the LCD.
- Use **F2** and **F3** (up and down) to select the **Date & Time** option, then press **F4** (enter).
- Position the cursor on the row in which the date and time are displayed, then press **F4** (enter).
- Using the **F2** and **F3** (up and down) keys, enter the current time and date information.
- Press **F4** (enter) to save the settings, then press **F1** (ESC) to return to the main menu.

Figure 60 Set date and time

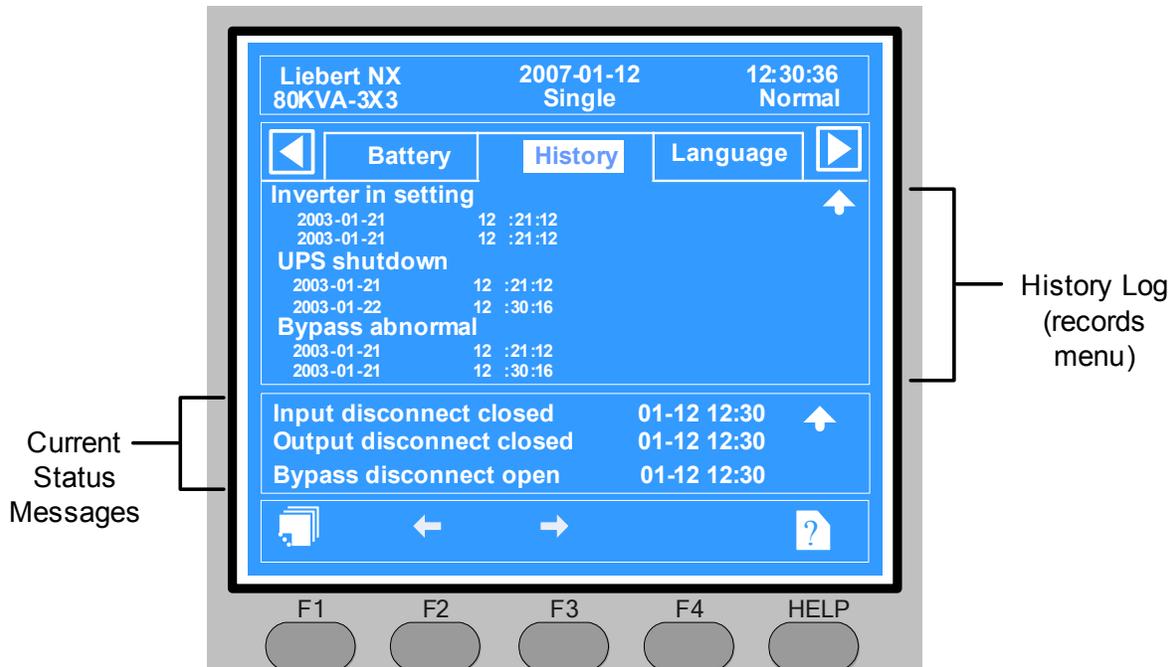


## 10.11 UPS Status Messages

The Liebert® NX™ displays status changes as they occur in the **current status window of the LCD**, then stores that data in the **history log**, as shown in **Figure 61**.

- **Current Status Window:** The status messages are displayed chronologically and include the date and time of the events. Three status messages are visible in the window at a time. To see other messages, use the navigation keys to scroll up or down the list. A status message remains in the current status area of the LCD until the status changes, when it is moved to the history log.
- **History Log:** When a record moves to the history log, the time the status changed is recorded. The history log can hold up to 512 records. History log records may be viewed by accessing the Records menu.

**Figure 61** Current status and history log records



See **Appendix A** for a complete list of status messages, along with a description and any recommended actions.

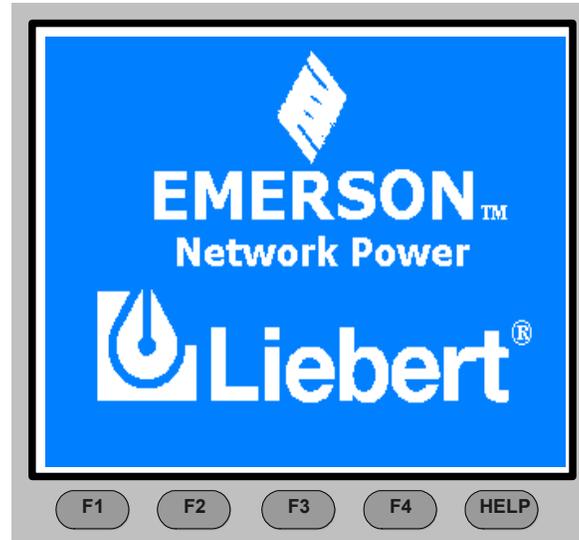
## 10.12 Types of LCD Screens

This section provides a quick guide to the main types of LCD screens.

### 10.12.1 Opening Display

As the UPS begins powering up, the opening display appears, as shown in **Figure 62**.

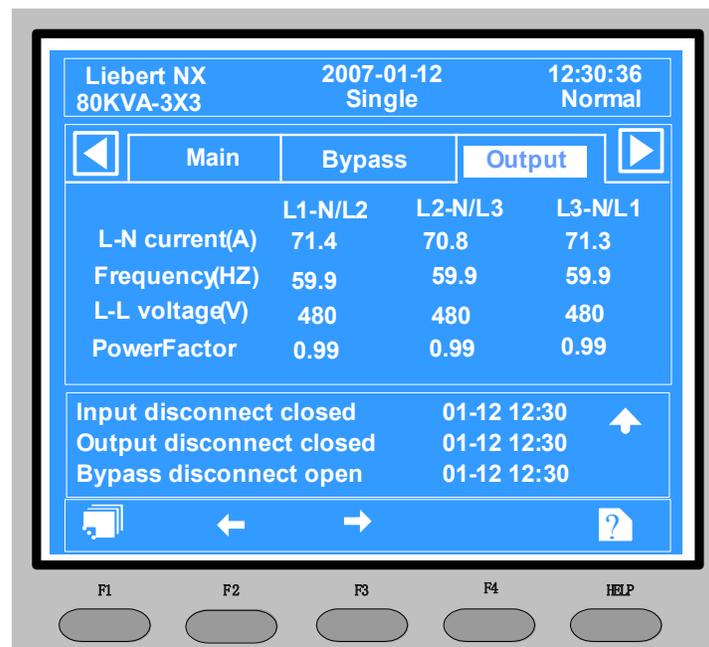
**Figure 62** Opening display



### 10.12.2 Default Screen

After the UPS has powered up and completed a self-test, the output screen appears, as shown in **Figure 63**. This window is the default screen.

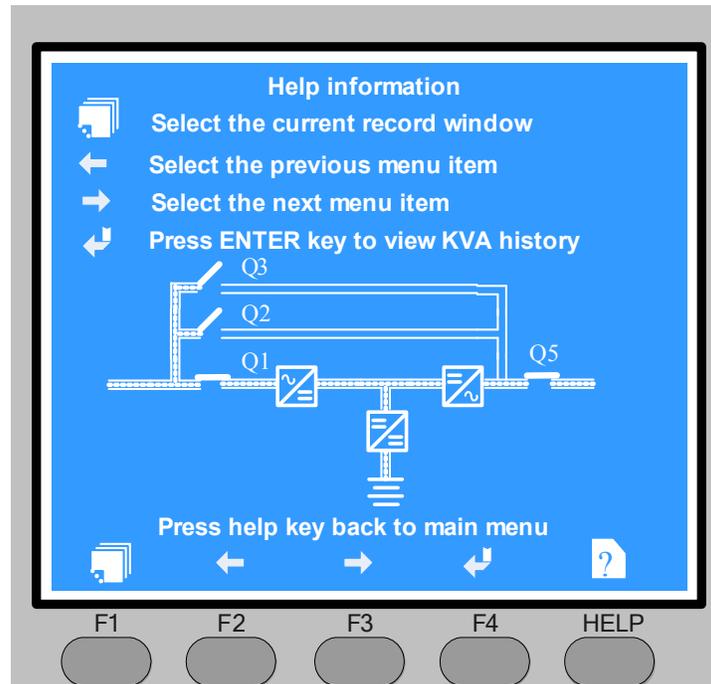
**Figure 63** Default screen



### 10.12.3 UPS Help Screen

Press the HELP key below the LCD to display the Help window shown in **Figure 64**. (Press the HELP key again to exit the Help window.)

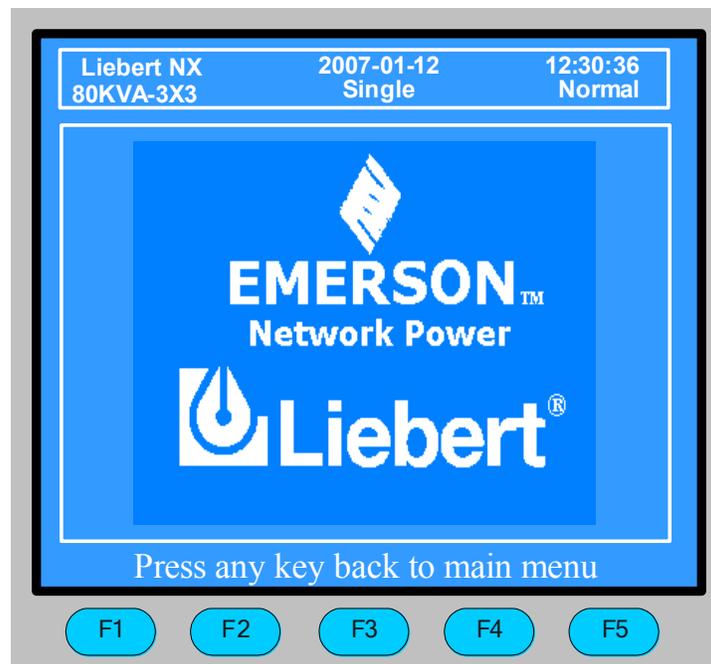
**Figure 64** Help screen



### 10.12.4 Screen Saver Window

If there has been no interaction with the Liebert® NX™ LCD for 2 minutes, the screen saver window appears. It remains on the LCD for 2 minutes, then the screen will go dark. The LCD will become active again when any key is pressed.

**Figure 65** Screen saver window



## 10.13 Pop-Up Windows

Pop-up prompt windows appear when the user must confirm a choice or perform an operation. This section describes the pop-up windows.

### 10.13.1 From Bypass to Inverter Mode With Power Interruption

If the bypass voltage or frequency exceeds the synchronized range and utility voltage or frequency is normal, the inverter cannot be in synchronization with the bypass, and the output can transfer to inverter only after an interruption of about 15ms when the user presses the INVERTER ON button. Before transferring, the system will let the user confirm whether the interruption can be accepted, as shown at right. If the bypass voltage returns to normal before the user makes confirmation, the UPS will transfer to inverter mode automatically. At the same time, the prompt window will close.

Transfer with Interrupt,  
please confirm or cancel

### 10.13.2 From Inverter to Bypass Mode With Interruption

If the bypass voltage or frequency exceeds the synchronized range and the UPS is in inverter mode, the user must confirm and accept the power interruption danger before pressing the INVERTER OFF button to shut down the output of the inverter. The user can also cancel the shutdown operation, as shown at right. If the bypass voltage returns to normal before the user makes the confirmation, the UPS will transfer to bypass operation mode automatically, and at the same time the prompt window will close disappear soon.

This operation leads to  
output shutdown  
Confirm or cancel

### 10.13.3 System Self-Test

When a system self-test is completed, a pop-up window reports the results of the test, as shown at right.

- Press the **F4** (Enter) key and the pop-up window closes.

System Self-Test finished,  
Everything is OK

### 10.13.4 Battery Capacity Test Confirmation

When a battery capacity test is started from the Command menu, the battery will be discharged to low-battery warning level. The Liebert® NX™ asks for confirmation before the test is started, as shown at right.

- To confirm the choice and begin the battery capacity test, press the **F4** (Enter) key and the pop-up window disappears.
- To cancel the test, press the **F1** (ESC) key. The pop-up window closes.

Battery will be depleted,  
Confirm or cancel



#### NOTE

*For a battery capacity test to function properly, the load must be between 20% and 100%.*

### 10.13.5 Battery Self-Test Aborted, Condition Not Met

When a battery capacity test is started from the Command menu and the battery self-test criteria are not met, the Liebert NX will not perform a battery test. User should check whether the battery state is boost charging and whether the load level is greater than 20 percent.

- Press the **F4** (Enter) key and the pop-up window closes.

Battery Self-Test aborted,  
Conditions not met

### 10.13.6 Battery Refresh Charge Aborted, Condition Not Met

When a battery refreshing charge is started from the Command menu and battery refreshing condition fails to meet requirements, the Liebert NX will not perform a battery refreshing charge. User should check if boost charging condition has not met the test criteria, such as (No battery, charger failed, etc.).

- Press the **F4** (Enter) key and the pop-up window closes.

Battery Refresh Charge  
aborted,  
Conditions not met

## 11.0 OPERATING INSTRUCTIONS

### 11.1 Liebert® NX™ Operating Modes

The Liebert NX can operate in any of four modes, as shown in **Table 32**. This section provides instructions on switching between modes, resetting the UPS, switching the inverter On and Off and performing other operations.

**Table 32** UPS operating modes

Operating Mode	Circuit Breaker State	Description
<b>Normal Operation</b>	CB1:ON CB2:ON CB3:OFF CB5:ON	The UPS is powering the load.
<b>On Maintenance Bypass</b>	CB1:OFF CB2:OFF CB3:ON CB5:OFF	The UPS is shut down but the load is connected to utility power via the Maintenance Bypass Supply line. <b>NOTE:</b> The load is not protected against disturbances in AC input power in this mode.
<b>On Test</b>	CB1:ON CB2:ON CB3:ON CB5:OFF	No load power is supplied by the UPS. The load is connected to utility power via the Maintenance Bypass Supply line. <b>NOTE:</b> The load is not protected against disturbances in AC input power in this mode.
<b>On Static Bypass</b>	CB1:ON or OFF CB2:ON CB3:OFF CB5:ON	The load power is supplied through the static bypass line. This may be considered as a temporary mode during load transfers between inverter and maintenance bypass or supply under abnormal operating conditions.



#### NOTE

1. The user controls and indicators mentioned in these procedures are identified in **10.0 - Operator Control and Display Panel**.
2. The audible alarm may sound at various points during these procedures. It can be canceled at any time by pressing the **SILENCE ON/OFF** push button.



#### NOTE

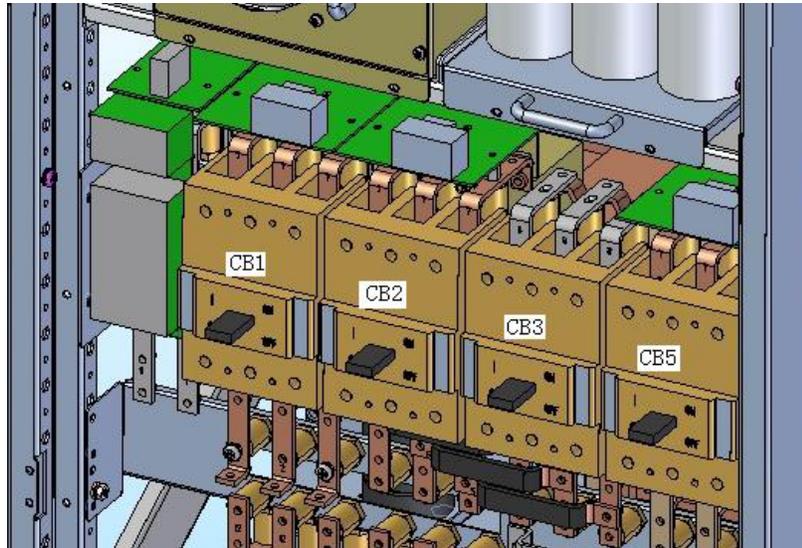
This section refers to some modes and conditions that are set or adjusted using proprietary service software. To take advantage of all the available features for the Liebert NX, the unit must be commissioned by a Liebert factory-trained service engineer.

### 11.1.1 Circuit Breakers

The UPS can be isolated by means of circuit breakers, mounted inside the cabinet and accessible after opening the front door.

The location of the UPS power switches is shown in **Figure 66**.

**Figure 66** Circuit breakers



The UPS unit circuit breakers are CB1, CB2, CB3 and CB5.

- **CB1**—Main Input circuit breaker; connects the utility supply to the UPS main input.
- **CB2**—Bypass circuit breaker; connects the utility supply to the UPS bypass.
- **CB3**—Maintenance Bypass breaker; connects the utility supply to the UPS maintenance bypass.
- **CB5**—Output breaker; connects inverter or bypass to the external output transformer or power distribution panel.

## 11.2 UPS Startup

The Liebert® NX™ must be fully installed and commissioned before startup, and external power isolators must be closed. Once those general conditions are met, the UPS may be started.

### 11.2.1 Startup Procedure

To start the UPS from a fully powered-down condition:

1. Open the UPS door to gain access to the main input circuit breakers.



## WARNING

Risk of electrical shock. Can cause injury and death.

During this procedure the output terminals will become live. If any load equipment is connected to the UPS output terminals, please check with the load user and ascertain whether it is safe to apply power to the load. If the load is not ready to receive power, then ensure that it is safely isolated from the UPS output terminals.

2. Close CB1, CB2 and CB3 (CB5 is open).

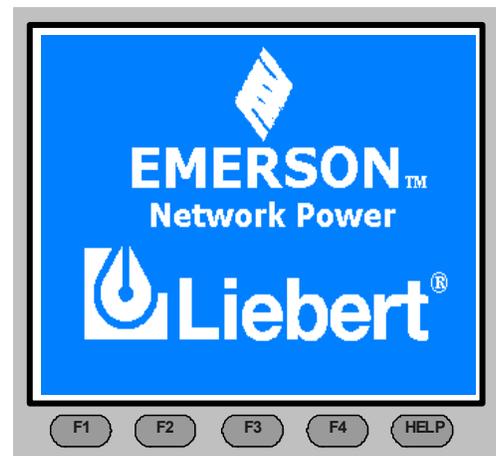
The main input contactor closes automatically and the LCD begins to show startup screens. The Rectifier indicator flashes green while the rectifier is starting up. It stops flashing and becomes solid green about 30 seconds after the rectifier enters the normal operation state.

After initialization, the bypass SCR closes. Because the output circuit breaker is still open, the UPS channels power through the Maintenance Bypass Supply line (CB3). The bypass indicator extinguishes, provided that the bypass is normal.

The opening display is shown in the figure at right.

The UPS Mimic display indicators will be:

Indicator	State
Rectifier indicator	Green
Battery indicator	Red
Bypass indicator	Off
Inverter indicator	Off
Output indicator	Off
Status indicator	Off



- Close CB5 (CB1, CB2, CB3 and CB5 are closed).
- The Maintenance Bypass supply is now in parallel with the UPS Static Switch supply.
- Verify that the Bypass indicator is Green, then open CB3.

The UPS powers from static bypass instead of from maintenance bypass. The bypass and load indicators turn on. The design of the hardware and software ensures uninterrupted output.

3. Close external battery circuit breaker.

After the UPS detects that the battery is connected, the red battery indicator extinguishes moments after the battery charger starts operation.

The UPS Mimic display indicators will be

Indicator	State
Rectifier indicator	Green
Battery indicator	Off
Bypass indicator	Green
Inverter indicator	Off
Output indicator	Green
Status indicator	Amber

4. Press the INVERTER ON control button for 2 seconds.

The inverter will start and the inverter indicator will flash green. After the inverter is ready, the UPS will transfer from bypass to inverter, the bypass indicator will turn off and the inverter and load indicators will turn on.

The UPS is operating normally. The UPS Mimic display indicators will:

Indicator	State
Rectifier indicator	Green
Battery indicator	Off
Bypass indicator	Off
Inverter indicator	Green
Output indicator	Green
Status indicator	Green

## 11.2.2 Verify Switching Between Operation Modes

### Switch from Normal Mode to Battery Mode

- Open CB1 to enter battery mode. This breaks the utility connection to the Liebert® NX™. To return to normal mode, close CB1 after a few seconds. The rectifier will restart automatically after 10 seconds and resume feeding power to the inverter.

### Switch from Normal Mode to Bypass Mode

- Press the INVERTER OFF button to switch to bypass mode.



#### NOTE

*In bypass mode, the load is being powered by the utility and is not receiving conditioned power through the inverter.*

### Switch from Bypass Mode to Normal Mode

- In bypass mode, press the INVERTER ON button. When the inverter is ready, the UPS will switch to normal mode.

### 11.3 Partially De-Energize the Liebert Nx 480 with Internal Maintenance Bypass

Follow the procedure below to transfer the load from the inverter output to the internal Maintenance Bypass line of the UPS.

## NOTICE

Risk of improper operation. Can cause property damage from loss of power to connected load. Before performing this operation, read the messages on the LCD to be sure that bypass supply is regular and the inverter is synchronous with it. If those conditions are not present, there is a risk of a short interruption in powering the load.

This procedure assumes that the UPS is operating normally.

1. Press the INVERTER OFF button on the operator control panel for longer than 2 seconds. The Inverter indicator will turn off and the status indicator will turn amber and an audible alarm will sound. The load will transfer to static bypass and the inverter will shut off.



### NOTE

*Pressing the Alarm Silence Switch cancels the audible alarm, but leaves the warning message displayed until the relevant condition is rectified.*

2. Close maintenance breaker CB3.  
The Maintenance Bypass supply is now in parallel with the UPS Static Switch supply.
3. Open output breaker CB5. This ends the bypass procedure. The load is now powered directly from the Maintenance Bypass supply.
4. Press the EPO (Emergency Power Off) button at the UPS front panel of this UPS module only. This will disable further Rectifier, Inverter, Static Switch and Battery operation. This will not affect the manual maintenance bypass power switch. If a Liebert® NX™ battery cabinet is connected, the battery circuit breaker will shunt trip open.
5. Open the rectifier switch CB1 and bypass breaker CB2.  
All operator indicators and messages will turn off as the utility-driven internal power supplies decay. The unit will power down, but the load will continue to be supplied by the manual Maintenance bypass.



## WARNING

Risk of electrical shock. Can cause injury and death.

Wait 5 minutes for the internal DC busbar capacitors to discharge before attempting to remove the internal protective barriers.



## WARNING

Risk of electrical shock. Can cause injury and death.

Even with the UPS in maintenance bypass and “Off,” portions of the unit are still energized. Service is to be performed by qualified personnel only.

## NOTICE

Risk of loss of power to connected load. Can cause property damage.

The load equipment is not protected from normal supply aberrations when operating in maintenance bypass mode.

- To return unit to normal operation, follow the steps in **11.2.1 - Startup Procedure**.

## 11.4 Partially De-Energize the Liebert Nx 480 with Bypass Distribution Cabinet (BDC)

Follow the procedure below to transfer the load from the UPS inverter output to the Maintenance Bypass line of the UPS. To partially de-energize Liebert NX 480V UPS with Liebert BDC:

### NOTICE

Risk of load being dropped by the UPS. Can cause equipment damage.

This procedure must be performed by properly trained and qualified personnel who are knowledgeable about the operation of this system. Failure to follow these instructions will result in loss of power and possible damage to critical equipment.

Before performing this operation, read any messages on the LCD to be sure that bypass supply is regular and the inverter is synchronous with it. If those conditions are not present, there is a risk of a short interruption in powering the load.

1. On the Control Panel, press the INVERTER OFF button for 2 seconds.
2. Close the CB3 Maintenance Bypass Breaker.
3. Open the CB5 Output Breaker.
4. Manually open the external battery breaker(s).
5. Open the CB2 Bypass Input Breaker.
6. Open the CB1 Rectifier Input Breaker.
7. Verify that the indicator on the SKRU unit is illuminated.
8. Press and hold the “Alarm Present Silence” button while rotating and removing the key.
9. Insert the key into the lock on the MBB and turn the key.
10. Close the MBB.
11. Verify MBB is closed.

### NOTICE

Risk of improper operation. Can cause property damage from loss of power to connected load.

Failure to close the MBB will interrupt power to the load. The load equipment is not protected from normal supply aberrations when the Liebert® NX™ is operating in the maintenance bypass mode.

12. Open the MIB.
13. Turn the key to complete lockout of MIB.
14. Remove the key from lock on MIB.
15. Insert the key into the SKRU lock unit and turn the key.

UPS is now isolated from the critical load.

**For a single-input system**—The bypass isolation breaker (BIB) remains closed. This allows power to remain present at the UPS input; refer to **Figure 51**.

**For a single-source, dual-input system**—The bypass isolation breaker (BIB) can be opened to further isolate the UPS from input power; refer to **Figure 21**.



### WARNING

Risk of electrical shock and arc flash. Can cause property damage, injury and death.

Wait 5 minutes for the internal DC busbar capacitors to discharge before attempting to remove the internal protective barriers.



### WARNING

Risk of electrical shock and arc flash. Can cause property damage, injury and death.

Even with the UPS in maintenance bypass and Off, portions of the Liebert® NX™ system are still energized. Service must be performed by properly trained and qualified personnel only.

### NOTICE

Risk of improper operation. Can cause property damage from loss of power to connected load.

The load equipment is not protected from normal supply aberrations when the Liebert® NX™ is operating in the maintenance bypass mode.

## 11.5 De-Energize the Liebert Nx 480 with Bypass Distribution Cabinet (BDC)

To de-energize the Liebert NX 480V UPS w/ BDC:

1. On the Control Panel, press the INVERTER OFF button for 2 seconds.
2. Close CB3 Maintenance Bypass Breaker
3. Open CB5 Output Breaker
4. Manually open external battery breaker(s).
5. Open CB2 Bypass Input Breaker
6. Open CB1 Rectifier Input Breaker
7. Verify the indicator on the SKRU unit is illuminated
8. Press and hold the “Alarm Present Silence” button while rotating and removing the key.
9. Insert the key into the lock on the MBB and turn the key.
10. Close the MBB.
11. Verify the MBB is closed.

### NOTICE

Risk of improper operation. Can cause property damage from loss of power to connected load. Failure to close the MBB will interrupt power to the load. The load equipment is not protected from normal supply aberrations when the Liebert® NX™ is operating in the maintenance bypass mode.

12. Open the MIB
13. Turn the key to complete the lockout of MIB
14. Remove Key from MIB lock.
15. Insert key into the SKRU lock unit and turn the key.  
UPS is now isolated from the critical load.
16. Open CB3 Maintenance Bypass Breaker.

## 11.6 Energize Nx 480 with Bypass Distribution Cabinet (BDC)

To re-energize the partially de-energized Liebert NX 480V UPS with Liebert BDC:



### NOTE

*UPS system must be in bypass prior to the start of any transfers. Safety features prevent transferring the load to bypass while the Liebert NX inverter is powering the load.*

1. Verify the indicator on the SKRU unit is illuminated.
2. Press and hold the Alarm Present Silence button while rotating and removing the key.
3. Insert the key into the lock on the MIB and turn the key.
4. Close the MIB.
5. Verify that the MIB is closed.

### NOTICE

Risk of power interruption. Can cause equipment damage. Failure to close the MIB will interrupt power to the load.

6. Open the MBB.
7. Turn the key to complete locking out the MBB.
8. Remove the key from the MBB lock.
9. Insert the key into the SKRU lock unit and turn the key.  
The UPS system is now available to be returned to normal operations.
10. Close the CB1 Rectifier Input Breaker.
11. Close the CB2 Bypass Input Breaker.
12. Verify that the Rectifier LED flashes green, then turns solid green after about 30 seconds.

13. Close the CB5 Output Breaker.
14. Close the external battery breaker(s).
15. Verify the Battery Alarm LED extinguishes.
16. Open the CB3 Maintenance Bypass Breaker.
17. On the Control Panel, press the INVERTER ON button for 2 seconds.
18. Verify that the Inverter LED turns solid green, and that the unit indicates Normal Mode after about a minute.

## 11.7 Auto Restart

When the main and bypass sources fail, the UPS draws power from the battery system to supply the load until the batteries are depleted. When the UPS reaches its end of discharge (EOD) threshold, it will shut down.

The UPS will automatically restart and enable output power:

- after utility power is restored
  - if “Auto Recovery after EOD Enabling” is enabled
  - after the “Auto Recovery after EOD Delay Time” expires (the default delay is 10 minutes)
- During the auto recovery delay, the Liebert® NX™ will be charging its batteries to provide a safety margin for equipment shutdown if input power fails again.

If the “Auto Recovery after EOD Enabling” feature is disabled, the user must restart the system manually.

## 11.8 Emergency Shutdown With EPO

This circuit has been designed to switch off the UPS in emergency conditions (i.e., fire, flood, etc.). The system will turn off the rectifier and inverter and will stop powering the load immediately (including the inverter and bypass), and the battery stops charging or discharging. If a Liebert NX battery cabinet is connected, the circuit breaker in the battery cabinet will shunt trip open.

If input utility power is present, the UPS's controls will remain active; however, the output will be turned off. To remove all power from the UPS, open the external feeder breaker.

## 11.9 Reset After Shutdown for Emergency Stop (EPO Action) or Other Conditions

Once all appropriate measures have been taken to correct the problem indicated by the alarm message appearing on the operator control panel display, carry out this procedure to restore the UPS to regular operation following an EPO action or for the following reasons: Inverter Overtemperature, Cut-off Overload, Battery Overvoltage, excessive switching (BYP: XFER COUNT BLOCK), etc.

When the user confirms that the fault is cleared:

1. Press the FAULT CLEAR button to let the system exit the emergency-off state.



### NOTE

*The rectifier will start again, and the bypass will begin to power the load. The Rectifier indicator flashes while the rectifier is starting up. When the rectifier enters the normal operation state (about 30 seconds), the rectifier indicator turns green.*

2. Press the INVERTER ON button on the right side of the operator control panel for longer than 2 seconds.



### NOTE

*The rectifier will automatically turn on 5 minutes after the Inverter Overtemp alarm has cleared.*

After the EPO button is pressed, if the input utility is removed, the UPS will shut down completely. When input utility is returned, if the Bypass input circuit breaker (CB2) and UPS output circuit breaker (CB5) are closed, the UPS will start up on Bypass. There will be power at the output terminals of the UPS.



## WARNING

Risk of electrical shock. Can cause injury and death.

If the internal maintenance bypass circuit breaker (CB3) is closed and input utility is present, there will be power at the output terminals of the UPS.

## 11.10 Battery Protection

### 11.10.1 Battery Undervoltage Pre-Warning

Before the end of discharge, the Liebert® NX™ displays a Low Battery pre-warning. After this pre-warning, the battery has the capacity for 5 minutes discharging with full load (default time). The Liebert NX can be user-configured to display this warning from 3 to 60 minutes before end-of-discharge.

### 11.10.2 Battery End-of-Discharge (EOD) Protection

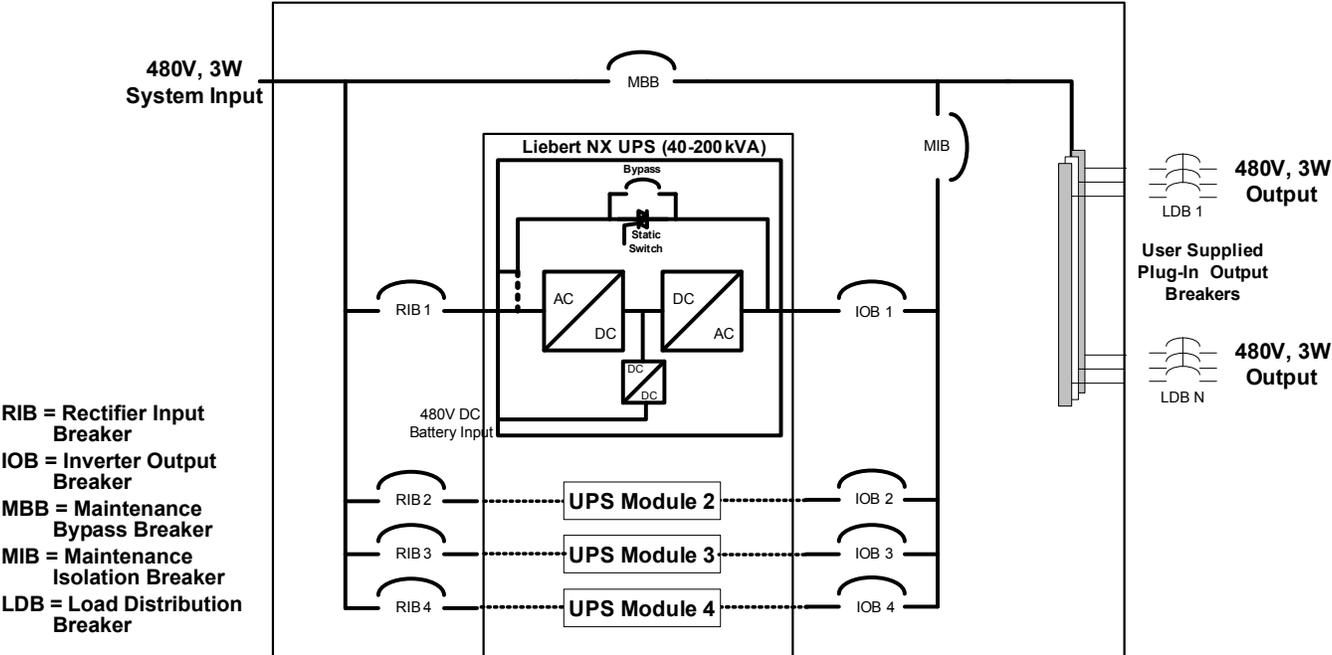
If the battery voltage is lower than the end-of-discharge voltage, the battery converter will be shut down.

## 11.11 Multi-Module System Procedures

### 11.11.1 Isolating One Module in a Multi-Module System

1. Turn Off the inverter.
2. Open External Output CB4 in Parallel Cabinet (see **Figure 67**).  
The UPS enters Isolation Status automatically, parallel signaling and communication become masked and output becomes inhibited.
3. Power Off the unit for maintenance.
4. Power On the unit.
5. Unit enters Test Mode by configuration software setting.
6. Diagnosis or testing.
7. The UPS exits Test Mode by configuration software setting.  
Output becomes inhibited because of Isolation Status.
8. Return all switches to the Normal position.
9. Close External Output CB4 in Parallel Cabinet (see **Figure 67**).  
The UPS exits Isolation Status automatically, parallel signaling and communication recovers, output becomes enabled but interlocking works now.
10. Turn On inverter and join the parallel system.

Figure 67 Typical parallel system block diagram with common input supply, with separate batteries and optional output / bypass distribution panel



**NOTE**  
*All equipment servicing procedures must be carried out only by trained personnel.*

### 11.11.2 Inserting One Module into a Multi-Module System

This procedure outlines how to integrate a UPS module that has been previously isolated from other modules of a group of paralleled UPS modules. It is assumed that the installation is complete, the system has been commissioned by authorized personnel and the external power isolators are closed.



## WARNING

Risk of electrical shock. Can cause injury and death.

Utility power will be applied to UPS output terminals.

No operator serviceable parts are located behind covers that require a tool for their removal.

Only properly trained and qualified service personnel are authorized to remove such covers.

1. Open the UPS door to gain access to the main circuit breakers.
2. Open (or confirm disabled) maintenance bypass circuit breaker CB3.
3. Close Input breaker CB1.  
The Rectifier indicator flashes on the UPS mimic panel during the startup of the rectifier and becomes steady green once the rectifier reaches normal operation state after about 30 seconds.
4. Close external battery circuit breaker. This breaker is inside the battery cabinet or is otherwise adjacent to the battery racks.
5. After the UPS detects the batteries, the red battery indicator extinguishes when the battery charger starts operation.
6. Close bypass circuit breaker CB2.
7. Press the INVERTER ON control button for 2 seconds.  
The inverter will start up and the inverter indicator flashes while it synchronizes to the load voltage and frequency. After the inverter is ready, the UPS connects to the load, the inverter indicator becomes steady green and the output indicator turns green.
8. Check that no “Warning” message is displayed in the top right corner of the LCD and that the indicators have the status shown below.

# LED	LED Function	Status
1	Rectifier indicator	Green
2	Battery indicator	Off
3	Bypass indicator	Off
4	Inverter indicator	Green
5	Output indicator	Green
6	Alarm indicator	Off

The UPS is now operating in NORMAL mode.

### 11.11.3 Shutdown Procedure—Complete UPS and Load Shutdown

This procedure must be followed to completely power down the UPS and the load. All power switches, isolators and circuit breakers will be opened and power will be removed from the load.

In multi-module systems, perform each step of the procedure in every UPS module before proceeding to the next step.

## NOTICE

Risk of improper operation. Can cause property damage from loss of power to connected load. This procedure will shut off power to the load. Before beginning this procedure, shut down the connected load to prevent the possibility of damage.

1. Press the EPO (Emergency Power Off) button at the UPS front panel only. This will disable Rectifier, Inverter, Static Switch and Battery operation. The load will be de-energized.



## CAUTION

Except in an emergency situation, do not press any remote EPO button.

2. Open the UPS door to gain access to the main circuit breakers.
3. Open the Rectifier input circuit breaker CB1.
4. Open external battery circuit breaker. This breaker is inside the battery cabinet or is otherwise adjacent to the battery racks.
5. Open Output circuit breaker CB5.
6. Open bypass input circuit breaker CB2.
7. Ensure maintenance bypass circuit breaker CB3 is open.
8. All mimic panel LED indications and messages will extinguish as the mains-driven, internal power supplies decay.
9. To completely isolate the UPS from the AC supplies, the main external power input isolator (both isolators, where dual supplies are provided for rectifier and bypass) and external output isolator must be opened and tagged with warning labels accordingly.

### 11.12 Commissioning a Parallel System



## CAUTION

The operations described in this section must be performed by authorized electricians or qualified technical personnel. If you have any difficulty, call 1-800-LIEBERT for assistance.

Check the input and output wiring of each UPS module. Ensure that the phase rotation sequence of the main inputs and the bypass inputs and outputs of each UPS module are the same. Ensure that the parallel cables are connected firmly.

It is assumed that the installation is complete, the system has been commissioned by authorized personnel and the external power isolators are closed. Disconnect the load before startup.

### 11.13 Parallel System Startup

1. Start each UPS normally as described in **11.2 - UPS Startup**.
2. Turn on the inverter of each UPS module one at a time.
3. Apply the load after the last UPS module transfers to inverter. The total load can be determined through the LCD of either UPS.
4. Verify the load rate of each UPS module. If the load rates are roughly the same, then the parallel system may be assumed to be operating normally.



## NOTE

*If one module cannot transfer to inverter mode long after its inverter is on, its output connection may not be good or its output phase rotation may not be coincident with other modules. At this time, the LCD for the UPS module will display “inverter asynchronous” and the inverter indicator will flash continuously. If either UPS module makes abnormal noise after it transfers to inverter, its parallel cables may be incorrectly connected.*



## 12.1.4 Communication and Monitoring

### Liebert IntelliSlot Web Card - SNMP/HTTP Network Interface Card

This network interface card provides all real-time data and status information as SNMPv1 traps for connection to a 10/100-baseT Ethernet connection. The same card also will transmit the same status information and all measured parameters for display through a Web browser.

**Table 33** Liebert® NX™ communication options

Physical description of port	Labeled ID Name of Port	On the UPS LCD screen, under Settings, controlled by:	Monitoring Devices supported	Baud rate	Comments
Top Liebert IntelliSlot	Intellislot 2 (On Monitor Board)	Comm 1	Multiport 4	any	
			Relaycard-int	any	
			Liebert IntelliSlot WEB-LB	2400	Not simultaneous with Multilink in RS232-1; See <b>12.1.5 - Configuring Baud Rates</b>
			Modbus/Jbus	2400	See <b>12.1.5 - Configuring Baud Rates</b>
Middle Liebert IntelliSlot	Intellislot 1 (On Monitor Board)	Comm 2	Multiport 4	any	
			Relaycard-int	any	
			Liebert IntelliSlot WEB-LB	2400	See <b>12.1.5 - Configuring Baud Rates</b> Not simultaneous with Multilink in RS232-2
			Modbus/Jbus	2400	See <b>12.1.5 - Configuring Baud Rates</b>
Bottom Liebert IntelliSlot	Intellislot 3 (On Monitor Board)	Comm 3	Multiport 4	any	
			Relaycard-int	any	
			Liebert IntelliSlot WEB-LB	2400	See <b>12.1.5 - Configuring Baud Rates</b>
			Modbus/Jbus	2400	See <b>12.1.5 - Configuring Baud Rates</b>
Top DB9 port	RS232-1	Comm 1	MultiLink Serial	9600	Not simultaneous with Web card in top Liebert IntelliSlot.
Bottom DB9 port	RS232-2	Comm 2	Service Software (Reserved)	9600	Not simultaneous with Web card in middle Liebert IntelliSlot.

### 12.1.5 Configuring Baud Rates

The default baud rate for Liebert IntelliSlot cards is 9600. To communicate with the Liebert OCWEB-LB, Modbus/Jbus or the adapters to permit using Liebert MultiLink, the baud rate must be set to 2400.

To change the baud rate (refer to **Table 33**):

1. Use the Navigation keys directly below the LCD to highlight the Settings Screen.
2. Press F1 to move the highlight into the Data & Settings area of the LCD.
3. Use the Navigation keys to scroll down to highlight the current baud rate across from the appropriate Comm Channel.



#### NOTE

*The Comm Channel settings are not immediately visible because of window-size constraints. Scroll down to view them on the screen.*

4. Press the Enter (F4) key to select the Comm Channel to change.
5. Navigate to underline the desired baud rate (2400).
6. Press the Enter (F4) key to lock in the new baud rate.

Figure 69 Liebert® IntelliSlot™ Web card display

The figure displays two screenshots of the Liebert OpenComms Web Card interface, accessed via Microsoft Internet Explorer. The browser address bar shows the URL `http://142.100.150.244/`.

**Top Screenshot: Summary Page**

The page title is "Liebert OpenComms Web Card - Microsoft Internet Explorer provided by Liebert Corporation". The interface includes the Emerson Network Power logo and the Liebert logo. Navigation tabs for "monitor", "configure", and "support" are visible. The "monitor" tab is active.

**Device Information:**  
 NXa UPS  
 Block N3, Regents Park...  
 NX UPS - Technical sup...  
 142.100.150.244

**Device Status:**  
 Load Protected:  
 No Alarms Present

**Monitor Categories:**  
 Summary  
 Active Alarms  
 Battery  
 Bypass  
 Input  
 Rectifier  
 Inverter  
 Output  
 Parallel System  
 Hardware  
 Configuration  
 Other

**Summary:** Updated: September 21, 2004 01:22:21PM

**Legend:**  
 Normal (Green)  
 Marginal/Fault (Yellow)  
 Absent (Grey)

**Status Diagram:** A schematic diagram showing the flow of power. "Input" is connected to "Output" via a green line (Normal). "Bypass" is connected to "Output" via a grey line (Absent). "Battery" is connected to "Output" via a grey line (Absent).

**Active Alarms:**  
 No Alarms Present

**Bottom Screenshot: Battery Page**

The page title is "Liebert OpenComms Web Card - Microsoft Internet Explorer provided by Liebert Corporation". The "monitor" tab is active.

**Device Information:**  
 NXa UPS  
 Block N3, Regents Park...  
 NX UPS - Technical sup...  
 142.100.150.244

**Device Status:**  
 Load Protected:  
 No Alarms Present

**Monitor Categories:**  
 Summary  
 Active Alarms  
 Battery  
 Bypass  
 Input  
 Rectifier  
 Inverter  
 Output  
 Parallel System  
 Hardware  
 Configuration  
 Other

**Battery:** Updated: September 21, 2004 01:25:58PM

Supported Status	Value	Units
Battery Time Remaining	783	min
Battery Voltage	547.1	V
Battery Current (Charge/Discharge)	0.2	A
Battery Charge Percentage	99	%
Battery Temperature	24.0	°C
Battery Charge Compensation	False	
Battery Test Result	Unknown	
Battery Charge Mode	Float	

Supported Alarms	Status
Battery Under Test	Normal
Load On Battery	Normal
Charger Failed	Normal
Low Battery - Shutdown Imminent	Normal
Battery Fault	Normal
Battery Contact Fail	Normal
Battery Converter Over Temperature	Normal
Battery Converter Over Current	Normal
Battery Converter Fail	Normal
UPS Load Joint Mode	Normal

## Relay Card

The relay card provides voltage-free contact closures for remote monitoring of alarm conditions.

Delivering **On Battery**, **On Bypass**, **Low Battery**, **Summary Alarm**, **UPS Fault** and **On UPS** signals, the easy-to-install card integrates with AS/400 computers (additional cable required) and other relay contact monitoring systems.

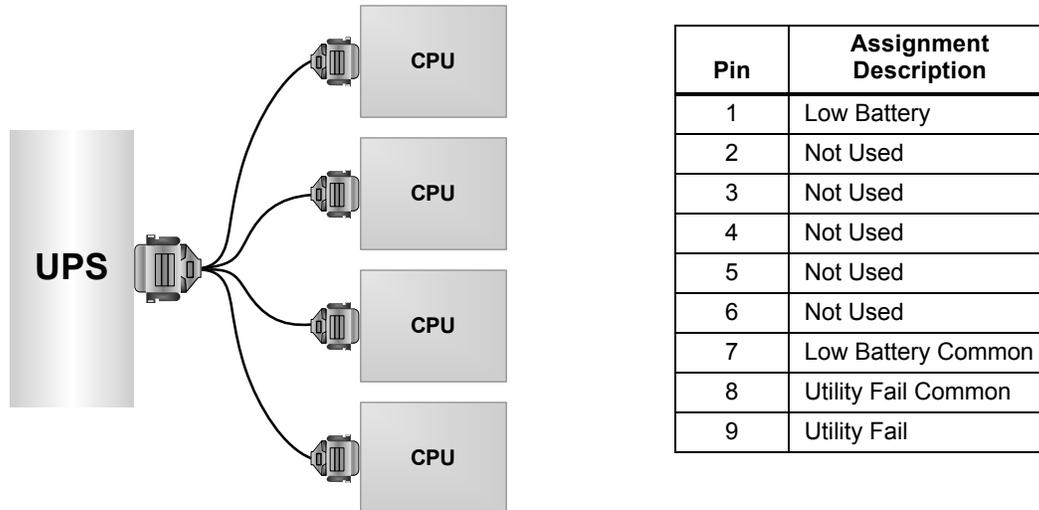
The relay card is rated for 24 VAC/DC at 1A and supported in any of the three Liebert® IntelliSlot® bays on the Liebert NX™. Refer to the Liebert IntelliSlot Relay Card user manual, SL-23211, for pin and jumper configuration. The manual is available at Liebert's Web site: [www.liebert.com](http://www.liebert.com)

## MultiPort 4 Card

The MultiPort 4 card provides four sets of voltage-free contact closures for remote monitoring of alarm conditions UPS operation On Battery and Low Battery condition. A typical application is to allow a maximum of four computer systems to simultaneously monitor the status (e.g., utility power failure-low battery) of a single UPS.

This card is supported in any of the three Liebert® IntelliSlot® bays on the Liebert NX™.

**Figure 70 MultiPort 4 card pin assignment**



## 12.2 LBS Mode—Load Bus Synchronization

The function of LBS is to keep the output of two independent UPS systems (single unit or multiple unit) in synchronization even when the two systems are operating in different modes (bypass/inverter) or on batteries. It is usually used with a Static Transfer Switch connected to the critical load to achieve dual bus configuration.



### NOTE

*In LBS configuration, both units must be supplied from the same utility source.*

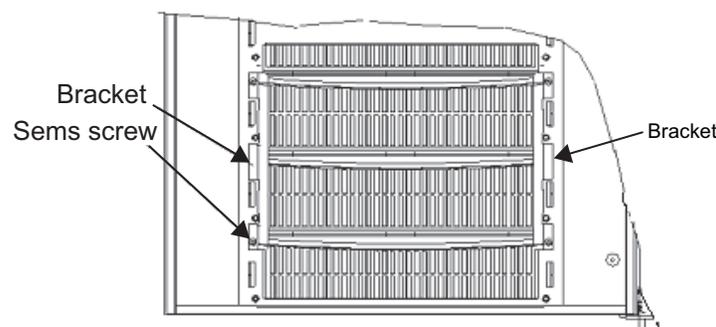
### 12.2.1 Remote Alarm Monitor

Status and alarm conditions are available on an optional remote alarm monitor (RAM) panel, which is driven by volt-free alarm status contacts (from an optional relay alarm board).

## 12.3 Replacing Dust Filters

1. Open the UPS door.
2. The dust filters are behind the door. For each filter, there is a bracket on either side holding the dust filter in place, as shown in **Figure 71**.
3. Remove one bracket and loosen the other. The second bracket need not be removed.
4. Remove the old filter and replace with the new filter.
5. Reinstall the bracket that was removed and tighten the other bracket.

**Figure 71 Dust filter replacement**



## 13.0 SPECIFICATIONS AND TECHNICAL DATA

### 13.1 Lug Size and Torque Requirements

Use commercially available solderless lugs for the wire size required for your application. Refer to **Table 34**. Connect wire to the lug using tools and procedures specified by the lug manufacturer.

**Table 34 Torque specifications**

<b>Nut and Bolt Combinations</b>				
<b>Bolt Shaft Size</b>	<b>Grade 2 Standard</b>		<b>Electrical Connections with Belleville Washers</b>	
	<b>Lb-in</b>	<b>N-m</b>	<b>Lb-in</b>	<b>N-m</b>
1/4	53	6.0	46	5.2
5/16	107	12	60	6.8
3/8	192	22	95	11
1/2	428	22	256	29

<b>Circuit Breakers With Compression Lugs (For Power Wiring)</b>		
<b>Wire Size or Range</b>	<b>Lb-in</b>	<b>N-m</b>
#6 - #4	100	11
#3 - #1	125	14
1/0 - 2/0	150	17
3/0 - 200 MCM	200	23
250 - 400 MCM	250	28
500 - 700 MCM	300	34

<b>Circuit Breakers With Compression Lugs (For Power Wiring)</b>		
<b>Current Rating</b>	<b>Lb-in</b>	<b>N-m</b>
400 - 1200 Amps	300.00	34.00

<b>Terminal Block Compression Lugs (For Control Wiring)</b>		
<b>AWG Wire Size or Range</b>	<b>Lb-in</b>	<b>N-m</b>
#22 - #14	3.5 to 5.3	0.4 to 0.6

**NOTE:** Use the values in this table unless the equipment is labeled with a different torque value.

**Table 35 Battery torque rating**

<b>Battery</b>	<b>Initial Torque in-lb (N-m)</b>
UPS12-100MR	40 (4.5)
UPS12-150MR	25 (2.8)
UPS12-210MR	25 (2.8)
UPS12-300MR	110 (12.4)
UPS12-350MR	110 (12.4)
UPS12-400MR	110 (12.4)
UPS12-490MRLP	110 (12.4)
UPS12-540MR	110 (12.4)
HX300	60 (6.8)
HX330	60 (6.8)
HX400	60 (6.8)
HX500	60 (6.8)
HX540	60 (6.8)

### 13.2 Cable Lengths: Floor to Connection Point Inside UPS

To help calculate the total cable length required, refer to **Table 36** for the distance from the floor to selected connection points inside the Liebert® NX™. Determine the cable length required to reach the Liebert NX, then add the appropriate length from the table and adequate slack for repair and maintenance.

**Table 36 Distance to connection points on the Liebert NX UPS**

Connection Point on UPS	Distance	
	From Floor in. (mm)	From Top of Unit in. (mm)
Bypass AC input supply	13 (330)	66 (1676)
UPS output AC	13 (330)	66 (1676)
Battery power	13 (330)	66 (1676)
Auxiliary cables: Monitor board (U2)	67 (1702)	11 (279)
Liebert IntelliSlot Communications	60 (1524)	19 (483)
Ground	13 (330)	66 (1676)
Parallel Board	70 (1780)	11 (279)

**Table 37 Parallel system current table**

System Size	Type	kVA	System I/P Voltage (VAC)	System Max Input Current	System Input OCPCB Size (A)	O/P Voltage (VAC)	Nominal O/P Current Rating (A)	Output OCPCB Size (A)
1+1	E	80	480V	135.0	200	480V	96.2	125
		120	480V	202.5	300	480V	144.3	200
	E1	80	480V	135.0	200	480V	96.2	125
		120	480V	202.5	300	480V	144.3	200
	E2	80	N/A	N/A	N/A	480V	96.2	125
		120	N/A	N/A	N/A	480V	144.3	200
2+1	E	80	480V	270.0	350	480V	192.5	250
		120	480V	405.0	600	480V	288.7	400
	E1	80	480V	270.0	350	480V	192.5	250
		120	480V	405.0	600	480V	288.7	400
	E2	80	N/A	N/A	N/A	480V	192.5	250
		120	N/A	N/A	N/A	480V	288.7	400
3+1	E	80	480V	405.0	600	480V	288.7	400
		120	480V	607.5	800	480V	433.0	600
	E1	80	480V	405.0	600	480V	288.7	400
		120	480V	607.5	800	480V	433.0	600
	E2	80	N/A	N/A	N/A	480V	288.7	400
		120	N/A	N/A	N/A	480V	433.0	600

Type E: BB0, FB0 and KB0 configurations  
 Type E1: CB1, GB1, LB1 configurations;  
 Type E2: CB2, CB3, CB4 configurations  
 Use wiring rated at 75°C or greater.

**Table 38 External cabinet dimensions, including side panels**

<b>Wide Parallel Cabinet</b>			
<b>Unit</b>	<b>Width</b>	<b>Depth</b>	<b>Height</b>
mm (inch)	1240 (48.8)	965 (38)	2000 (78.7)
<b>Narrow Parallel Cabinet</b>			
<b>Unit</b>	<b>Width</b>	<b>Depth</b>	<b>Height</b>
mm (inch)	845 (33.2)	965 (38)	2000 (78.7)
<b>33 in. Battery Cabinet</b>			
<b>Unit</b>	<b>Width</b>	<b>Depth</b>	<b>Height</b>
mm (inch)	845 (33.2)	965 (38)	2000 (78.7)

### 13.3 Cable size and tightening torques

**Table 39 Cable size tightening torque at Liebert® NX™ 40kVA UPS terminals**

<b>Bus Type</b>	<b>Cable Size (Copper Wire Only)</b>	<b>Torque to Tighten Terminal Bus &amp; Lug Body</b>
Main Input (Single Input)	4	10 N-m
Main Input (Dual Input)	4	10 N-m
Bypass Input (Dual Input)	4	10 N-m
Output	3	10 N-m

**Table 40 Cable size tightening torque at Liebert NX 60kVA UPS terminals**

<b>Bus Type</b>	<b>Cable Size (Copper Wire Only)</b>	<b>Torque to Tighten Terminal Bus &amp; Lug Body</b>
Main Input (Single Input)	1	10 N-m
Main Input (Dual Input)	1	10 N-m
Bypass Input (Dual Input)	2	10 N-m
Output	2	10 N-m

**Table 41 Cable size tightening torque at Liebert NX 80kVA UPS terminals**

<b>Bus Type</b>	<b>Cable Size (Copper Wire Only)</b>	<b>Torque to Tighten Terminal Bus &amp; Lug Body</b>
Main Input (Single Input)	2/0	10 N-m
Main Input (Dual Input)	2/0	10 N-m
Bypass Input (Dual Input)	1/0	10 N-m
Output	1/0	10 N-m

**Table 42 Cable size tightening torque at Liebert® NX™ 100kVA UPS terminals**

Bus Type	Cable Size (Copper Wire Only)	Torque to Tighten Terminal Bus & Lug Body
Main Input (Single Input)	4/0	10 N-m
Main Input (Dual Input)	4/0	10 N-m
Bypass Input (Dual Input)	2/0	10 N-m
Output	2/0	10 N-m

**Table 43 Cable size tightening torque at Liebert NX 120kVA UPS terminals**

Bus Type	Cable Size (Copper Wire Only)	Torque to Tighten Terminal Bus & Lug Body
Main Input (Single Input)	250	10 N-m
Main Input (Dual Input)	250	10 N-m
Bypass Input (Dual Input)	4/0	10 N-m
Output	4/0	10 N-m

**Table 44 Cable size tightening torque at Liebert NX 160kVA UPS terminals**

Bus Type	Cable Size (Copper Wire Only)	Torque to Tighten Terminal Bus & Lug Body
Main Input (Single Input)	2-3/0	26 N-m
Main Input (Dual Input)	2-3/0	26 N-m
Bypass Input (Dual Input)	2-3/0	26 N-m
Output	2-3/0	26 N-m

**Table 45 Cable size tightening torque at Liebert NX 200kVA UPS terminals**

Bus Type	Cable Size (Copper Wire Only)	Torque to Tighten Terminal Bus & Lug Body
Main Input (Single Input)	2-4/0	26 N-m
Main Input (Dual Input)	2-4/0	26 N-m
Bypass Input (Dual Input)	2-4/0	26 N-m
Output	2-4/0	26 N-m

**Table 46 Cable size tightening torque at Liebert NX 480V Battery Cabinet DC input bus terminals**

Cabinet Rating	Cable Size (Copper Wire Only)	Torque to Tighten Terminal Bus and Lug Body
225A	4/0AWG	15 N-m
350A	400kcmil	15 N-m
600A	2-350kcmil	26 N-m

All control wiring and power wiring must be 600V rated wire.

### 13.4 Battery Run Times

Table 47   Energys battery run times in minutes

External Battery Cabinet		Softscale Range							
		Scalable to 80kVA			Scalable to 120kVA			Scalable to 200kVA	
		Rated Output, kVA			Rated Output, kVA			Rated Output, kVA	
Type	Quantity	40	60	80	80	100	120	160	200
HX205FR	1	19	11	7	N/A	N/A	N/A	N/A	N/A
HX300FR	1	31	17	12	12	8	6	N/A	N/A
HX330FR	1	36	22	15	15	11	8	5	N/A
HX400RF	1	40	26	18	18	13	10	6	N/A
HX500FR	1	64	38	27	27	20	16	10	7
HX205FR	2	41	27	19	N/A	N/A	N/A	N/A	N/A
HX300FR	2	70	41	32	32	22	18	12	9
HX330FR	2	90	52	37	37	28	23	16	11
HX400RF	2	98	62	41	41	34	27	19	14
HX500FR	2	146	93	66	66	49	38	28	21
HX205FR	3	70	41	33	N/A	N/A	N/A	N/A	N/A
HX300FR	3	109	71	50	51	38	32	21	16
HX330FR	3	146	92	63	63	47	38	27	20
HX400RF	3	156	100	72	72	54	41	32	23
HX500FR	3	224	148	105	106	80	67	46	35
HX205FR	4	97	63	45	N/A	N/A	N/A	N/A	N/A
HX300FR	4	153	99	71	72	54	41	33	23
HX330FR	4	202	131	93	94	69	53	38	30
HX400RF	4	216	142	101	102	77	64	41	35
HX500FR	4	317	206	149	150	113	95	68	50

**Table 48 C&D Dynasty battery run times in minutes**

External Battery Cabinet		Softscale Range							
		Scalable to 80kVA			Scalable to 120kVA			Scalable to 200kVA	
		Rated Output, kVA			Rated Output, kVA			Rated Output, kVA	
Type	Quantity	40	60	80	80	100	120	160	200
UPS12-100MR	1	5	N/A	N/A	N/A	N/A	N/A	N/A	N/A
UPS12-150MR	1	12	6	N/A	N/A	N/A	N/A	N/A	N/A
UPS12-210MR	1	19	10	6	N/A	N/A	N/A	N/A	N/A
UPS12-300MR	1	32	19	12	13	9	6	N/A	N/A
UPS12-350MR	1	38	23	16	16	11	8	N/A	N/A
UPS12-400MR	1	41	28	19	20	14	10	6	N/A
UPS12-490MR	1	65	38	27	27	20	15	8	N/A
UPS12-540MR	1	68	40	31	31	23	17	10	6
UPS12-100MR	2	16	8	5	N/A	N/A	N/A	N/A	N/A
UPS12-150MR	2	31	18	12	N/A	N/A	N/A	N/A	N/A
UPS12-210MR	2	47	30	20	N/A	N/A	N/A	N/A	N/A
UPS12-300MR	2	74	46	33	33	25	20	13	9
UPS12-350MR	2	82	54	38	39	31	25	16	11
UPS12-400MR	2	101	64	45	46	36	28	19	14
UPS12-490MR	2	149	95	67	68	50	39	27	20
UPS12-540MR	2	156	99	70	71	53	41	31	23
UPS12-100MR	3	28	16	10	N/A	N/A	N/A	N/A	N/A
UPS12-150MR	3	50	32	22	N/A	N/A	N/A	N/A	N/A
UPS12-210MR	3	77	48	35	N/A	N/A	N/A	N/A	N/A
UPS12-300MR	3	122	75	53	53	40	34	22	17
UPS12-350MR	3	147	83	65	65	49	39	28	21
UPS12-400MR	3	159	103	73	74	55	46	33	25
UPS12-490MR	3	244	151	107	108	81	68	46	35
UPS12-540MR	3	258	158	112	113	83	71	49	37
UPS12-100MR	4	41	25	17	N/A	N/A	N/A	N/A	N/A
UPS12-150MR	4	71	41	32	N/A	N/A	N/A	N/A	N/A
UPS12-210MR	4	109	70	49	N/A	N/A	N/A	N/A	N/A
UPS12-300MR	4	162	106	76	76	56	47	33	25
UPS12-350MR	4	209	132	90	91	70	55	39	31
UPS12-400MR	4	224	146	103	104	79	66	45	35
UPS12-490MR	4	335	212	152	153	121	97	67	50
UPS12-540MR	4	343	222	159	160	130	101	70	53



## APPENDIX A - UPS STATUS MESSAGES

**Table 49** shows all event messages as they appear in the current status area of the LCD and in the history log, along with a description and recommended actions, if any. For further information on the current status area and the history log, see **2.11 UPS Status Messages**.

**Table 49 UPS status messages**

Event Message	Description / Suggested Action (if any)
Inverter Comm. Fail	The RS-485 communication between internal monitor and inverter has failed. Contact Liebert Services at 800-543-2378 for assistance.
Rectifier Comm. Fail	The RS-485 communication between internal monitor and rectifier fails. Contact Liebert Services at 800-543-2378 for assistance.
Parallel Comm. Fail	The CAN communication between different UPS units within a parallel system has failed. Check if there are some UPS units not powered on in the parallel system. If so, power on these UPS units and check if the alarm disappears. Press Fault Clear push button. If alarm does not clear, contact Liebert Services at 800-543-2378
Battery Overtemp.	The battery temperature is over limit. Check the battery temperature and ventilation
Replace Battery	Battery should be replaced. Contact Liebert Services at 800-543-2378 for assistance.
Battery Low Pre-warning	Before the end of discharging, battery under-voltage pre-warning should occur. After this pre-warning, battery should have the capacity for 3 minutes discharging with full load. The time is user configured from 3 to 60 minutes. Shut down the load in time to prevent damage to equipment and data.
Battery End of Discharge	Inverter turned off due to low battery voltage. Check the utility failure and try to recover it.
Mains Volt. Abnormal	Mains voltage exceeds the upper or lower limit and results in rectifier shutdown. Check the input line-to-line voltage amplitude of rectifier.
Mains Undervoltage	Mains voltage is undervoltage 288V~384V line to line voltage with derated load. Check the input line-to-line voltage amplitude of rectifier.
Mains Freq. Abnormal	Mains frequency is out of limit range and results in rectifier shutdown. Check the rectifier's input voltage frequency
Rectifier Fault	Contact Liebert Services at 800-543-2378 for assistance.
Input Inductor Overtemp.	The temperature of rectifier inductor of rectifier common mode inductor is too high to keep the rectifier running. Check the ambient temperature and ventilation; contact Liebert Services at 800-543-2378 for assistance.
Rectifier Overtemp.	The temperature of the heat sink is too high to keep the rectifier running. The UPS can recover automatically. Check the environment and ventilation.
Charger Fault	The charger has a fault. Contact Liebert Services at 800-543-2378 for assistance.
Control Power 1 Fail	Control Power 1 has failed or has been lost. Contact Liebert Services at 800-543-2378 for assistance.
Mains Phase Reversed	Input phase sequence is inverse. Contact Liebert Services at 800-543-2378 for assistance.
Rectifier Overcurrent	The current of rectifier is over limit. Contact Liebert Services at 800-543-2378 for assistance.
Soft Start Fail	Rectifier could not start due to low DC bus voltage. Contact Liebert Services at 800-543-2378 for assistance.
Bypass Unable to Trace	This alarm is triggered by an inverter software routine when the amplitude or frequency of bypass voltage is beyond the normal range. The amplitude threshold is fixed for positive and negative 10% rating. This alarm automatically resets once the bypass voltage goes normal. First verify that the bypass voltage and frequency displayed on the panel is within the selected range. Note here the rated voltage and frequency are specified by "Output voltage level" and "Output frequency level" respectively. If the displayed voltage is believed to be abnormal, then verify the bypass voltage and frequency presented to the UPS. Check the external supply if it is found to be faulty. Contact Liebert Services at 800-543-2378 for assistance.

Table 49 UPS status messages

Event Message	Description / Suggested Action (if any)
Bypass Abnormal	<p>This alarm is triggered by an inverter software routine when the amplitude or frequency of bypass voltage exceeds the limit.  This alarm automatically resets once the bypass voltage goes normal.  First check whether there are relevant alarms such as "Bypass disconnect open," "Bypass phase reverse" and "Mains neutral lost." If they appear, solve them first.  Then verify that the bypass voltage and frequency displayed on the panel is within the bypass limit. Note here the rated voltage and frequency are specified by "Output voltage level" and "Output frequency level" respectively.  If the displayed voltage is believed to be abnormal, then verify the bypass voltage and frequency presented to the UPS. Check the external bypass supply if it is found to be faulty. If the utility is likely to trigger this alarm frequently, the bypass limit can be increased through the configuration software according to the customer's agreement.  Contact Liebert Services at 800-543-2378 for assistance.</p>
Inverter Asynchronous	<p>This alarm is triggered by an inverter software routine when the inverter and bypass waveforms are misaligned by more than 6 degrees in phase. This alarm resets automatically once the condition clears.  First check if the alarm "Bypass unable to trace" or "Bypass abnormal" occurs. If so, solve it first.  Verify the waveform of the bypass voltage.  Contact Liebert Services at 800-543-2378 for assistance.</p>
Inverter Fault	<p>This alarm indicates a fault condition exists within the inverter.  Contact Liebert Services at 800-543-2378 for assistance.</p>
Output Voltage Abnormal	<p>This alarm indicates the inverter voltage waveform is abnormal.  Contact Liebert Services at 800-543-2378 for assistance.</p>
Input Current Abnormal	<p>This alarm indicates the rectifier input current is abnormal.  Contact Liebert Services at 800-543-2378 for assistance.</p>
Inv. Inductor Overtemp.	<p>The temperature of the inverter filter inductor or inverter common mode inductor is too high to keep inverter running.  This alarm is triggered by the signal from a thermostat mounted in the inverter filter inductor. The UPS would recover automatically after a 5 minute delay from the disappearance of the overtemperature signal.  <b>If the overtemperature condition is true then check for and verify:</b>  High ambient air temperature.  Blocked cooling airway  Any fan failure  Prolonged inverter overload.  Contact Liebert Services at 800-543-2378 for assistance.</p>
Inverter Overtemp.	<p>The temperature of the inverter heat sink is too high to keep inverter running.  This alarm is triggered by the signal from a temperature monitoring thermostat on the inverter bridge heat sink.  The UPS will recover automatically after a 5 minute delay from the disappearance of the overtemperature signal.  <b>If the overtemperature condition is true then check for and verify:</b>  high ambient air temperature.  blocked cooling airway.  any fan failure.  prolonged inverter overload.  Contact Liebert Services at 800-543-2378 for assistance.</p>
Fan Fault	<p>At least one of the cooling fans has failed. Contact Liebert Services at 800-543-2378 for assistance.</p>
Inverter STS Fail	<p>At least one of the static switches of inverter side is open or short circuit. This fault is locked until power off. Contact Liebert Services for assistance at 800-543-2378 for assistance.</p>
Bypass STS Fail	<p>At least one of the static switches of bypass side is open or short-circuited. This fault is locked until power off.  Contact Liebert Services at 800-543-2378 for assistance.</p>
Output Fuse Fail	<p>At least one of the output fuses is open. Contact Liebert Services at 800-543-2378 for assistance.</p>
Control Power 2 Fail	<p>Control Power 2 is abnormal or lost. Contact Liebert Services at 800-543-2378 for assistance.</p>

Table 49 UPS status messages

Event Message	Description / Suggested Action (if any)
Unit Overload	<p>The UPS is overloaded when the load arises above 105% nominal rating. The alarm automatically resets once the overload condition is removed. Confirm that the alarm is true by checking the load percent indicated on the LCD panel to determine which phase is being overloaded. If the alarm is true, measure the actual output current to verify that the indications are valid. Disconnect unnecessary load. In a parallel system, a severe load sharing error can also lead to the alarm. Contact Liebert Services at 800-543-2378 for assistance.</p>
System Overload	<p>The UPS parallel system is overloaded when the total load arises above 105% nominal rating for the set basic number of UPS units. The alarm resets automatically once the overload condition is removed. Confirm that the alarm is true by checking the system load percent indicated on the LCD panel to determine which phase is being overloaded. If the alarm is true, measure the actual output current to verify that the indications are valid. Disconnect unnecessary load and ensure the safety. In a parallel system, a severe load sharing error can also leads to the alarm.</p>
Unit Overload Timeout	<p>The UPS is overloaded and the overload times out.  <b>Note 1:</b> The highest loaded phase will indicate overload timing-out first.  <b>Note 2:</b> When the timer is active then alarm "unit overload" should also be active as the load is above nominal.  <b>Note 3:</b> When the timer has expired, the inverter Static Switch is opened and the load transferred to bypass. The inverter shutdown and will restart after 1 seconds.  <b>Note 4:</b> If the load decreases lower than 95% after 5 minutes, the system will transfer back to inverter mode.  Confirm that the alarm is genuine by checking the load percent indicated on the LCD. If an overload is indicated then check the load, and investigate any additional load connected prior to the alarm (if applicable).</p>
Inverter Overcurrent	<p>The current of inverter IGBT is over limit. If the fault will not reset, contact Liebert Services at 800-543-2378 for assistance.</p>
Bypass Phase Reversed	<p>The phase sequence direction of bypass voltage is reversed. Normally, the phase of Phase B lags 120 degrees behind Phase A, and the phase of Phase C lags 120 degrees behind Phase B. Verify that the phase rotation of the bypass supply presented to the UPS is correct, and rectify it if it is found to be in error. Contact Liebert Services at 800-543-2378 for assistance.</p>
Load Impact Transfer	<p>A transfer to bypass occurred due to a large step load. The UPS should recover automatically. Turn on connected equipment in sequential order to reduce the step loading of the inverter.</p>
Transfer Timeout	<p>The load is on bypass power due to excessive number of transfers that occurred within the last hour. The UPS will recover automatically and will transfer the load back to inverter power within an hour.</p>
Load Sharing Fault	<p>UPS units working within a parallel system are not sharing load current correctly. Contact Liebert Services at 800-543-2378 for assistance.</p>
DC Bus Abnormal	<p>Shut off inverter due to abnormal DC bus voltage. Contact Liebert Services at 800-543-2378 for assistance.</p>
System Transfer	<p>The whole paralleled UPS system transferred to bypass at the same time. This message will appear on the UPS which passive transfer to bypass.</p>
Parallel Board Fault	<p>Parallel board is not working correctly. Contact Liebert Services at 800-543-2378 for assistance.</p>
DC Bus Overvoltage	<p>Rectifier, inverter and battery converter were shut down because DC bus voltage is too high. Check whether there is a fault in rectifier side. If not, check whether overload occurs. Restart the inverter after resetting the fault. If fault does not clear, contact Liebert Services at 800-543-2378 for assistance.</p>
Parallel Connect Fault	<p>The parallel cables are not connected correctly in a parallel system. Reset the fault by pressing the Fault Clear button, then restart the inverter by pressing the Inverter On button. If the UPS does not resume normal operation, contact Liebert Services at 800-543-2378 for assistance.</p>
Bypass Overcurrent	<p>Bypass current is over limit above 135% rating. The UPS just alarms and does nothing. Refer to your installation documentation or contact Liebert Services at 800-543-2378 for assistance.</p>

Table 49 UPS status messages

Event Message	Description / Suggested Action (if any)
LBS Active	The LBS setting is active. The UPS is acting as an LBS master or slave in a dual bus configuration.
Battery ground fault	Battery ground fault from dry contact signal. Contact Liebert Services at 800-543-2378 for assistance.
Inverter turned On manually	Manual Turn On via front panel
Inverter turned Off manually	Manual Turn Off via front panel
EPO	Emergency Power Off
Transfer Confirm	Interrupted Transfer Confirm
Transfer Cancel	Interrupted Transfer is cancel
Unit Off Confirm	Unit Turned Off Confirm
System Off Confirm	Parallel System Turned Off Confirm
Fault Reset	Fault Reset
Alarm Silence	Alarm Silence
Turn On Fail	Turn On Fail
Alarm Reset	Audible Alarm Reset
Bypass Mode	UPS in Bypass Mode
Normal Mode	UPS in Normal Mode
Battery Mode	UPS in Battery Mode
Check UPS output	UPS Shutdown, output power-down
Output Disabled	UPS Output Disabled
Generator Connected	Generator is connected and a signal is sent to UPS
Input CB Open	Input CB is Open
Input CB Closed	Input CB is Closed
Bypass CB Open	Bypass CB is Open
Bypass CB Closed	Bypass CB is Closed
Output CB Open	Output CB is Open
Output CB Closed	Output CB is Closed
Maint. CB Open	Maintenance CB is Open
Maint. CB Closed	Maintenance CB is Closed
Battery Reverse	Connect the battery again and check the wiring of batteries
No Battery	Check the battery and the wiring of batteries
Auto start	After the UPS was shut down at end of discharge, inverter auto starts when utility is restored
BCB closed	BCB closed from dry contact signal
BCB open	BCB open from dry contact signal
Battery Float Charging	Battery is float charging
Battery Boost Charging	Battery is boost charging
Battery Mode	Battery is discharging
Battery Period Testing	Battery is period self-testing.
Batt. Capacity Testing	Battery is capacity self-testing.
Batt. Maint. Testing	Battery is maintenance self-testing.
UPS System Testing	UPS System is testing
Inverter in Setting	Inverter is in parameter setting
Rectifier in Setting	Rectifier is in parameter setting

**Table 49 UPS status messages**

Event Message	Description / Suggested Action (if any)
Balancer Fault	Internal VDC (+) and VDC (-) offset by over 50V exceeding the inverter DC offset compensation capacity. Inverter shuts down. Load transfers to bypass.
Operation Invalid	This record is registered following an incorrect operation.
By. Abnormal Shutdown	Both bypass and inverter voltages unavailable. Load interruption
Setting Save Error	History records not saved (Reserved)
Protocol version clash	Firmware incompatibility between monitor board and digital signal processor board
MBP-T cabinet Fan Fault	Maintenance bypass cabinet fans fault
Ext Input TX Overtemp	External input isolation transformer overtemperature
Ext Output TX Overtemp	External output isolation transformer overtemperature
Battery Room Alarm	Environment in Battery Room Needs Attention
Rec Flash Update	Rectifier firmware is being updated
Inv Flash Update	Inverter firmware is being updated
Monitor Flash Update	Monitor firmware is being updated
Input contactor fault	Input contactor fault
LBS abnormal	LBS is abnormal
DSP firmware error	The inverter firmware is not compatible with the rectifier firmware.
Fan power fail	Fan power has failed
Keyboard fault	Keyboard has a fault. Check the cable between keyboard with U2 board. Contact Liebert Services at 800-543-2378 for assistance.
KVA Invalid	An invalid kVA has been configured in unit. Contact Liebert Services at 800-543-2378 for assistance.
KVA updated	The capacity updating is successful.
Output ground fault	Output Line is shorted with ground

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