



Liebert® EXM UPS

User Manual

20 kVA to 100 kVA, 208/120V, 50/60 Hz

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Technical Support Site

If you encounter any installation or operational issues with your product, check the pertinent section of this manual to see if the issue can be resolved by following outlined procedures.

Visit <https://www.vertiv.com/en-us/support/> for additional assistance.

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1 Important Safety Instructions

SAVE THESE INSTRUCTIONS

This manual contains important instructions that should be followed during installation of the Vertiv™ Liebert® EXM UPS. 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.

A properly trained and qualified electrical contractor should oversee the installation of the equipment.

The Liebert® EXM cannot be put into operation until it is commissioned by the manufacturer or authorized engineer. Otherwise, human safety may be endangered and damage to the UPS will not be covered by the warranty.

The Liebert® EXM is designed for commercial and industrial uses and cannot be used as life support equipment.



WARNING! Risk of electrical shock. It can cause personal injury or death. This UPS has several circuits that are energized with high DC as well as AC voltages. Check for the voltage with both AC and DC voltmeters before working within the UPS. Check for the voltage with both the AC and the DC voltmeters before making contact. Only properly trained and qualified personnel wearing appropriate safety headgear, gloves, shoes and glasses should be involved in installing the UPS or preparing the UPS for installation. When performing the maintenance with any part of the equipment under power, the service personnel and the test equipment should be standing on rubber mats. 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 the installation and the maintenance. Special safety precautions are required for procedures involving handling, installation and maintenance of the UPS system. Observe all safety precautions in this manual before handling or installing the UPS system. Observe all precautions before as well as during performance of all maintenance procedures. Observe all the DC safety precautions before working on or near the DC system.



AVERTISSEMENT! Risque de décharge électrique pouvant causer des blessures graves, voire mortelles. Ce système ASC comporte plusieurs circuits à haute tension c.a et c.c. Vérifiez les tensions au moyen de voltmètres c.a. et c.c. avant d'utiliser le système ASC. Vérifiez les tensions avec des voltmètres c.a. et c.c. avant d'établir tout contact. Seuls des employés qualifiés et dûment formés portant un casque, des gants, des chaussures et des lunettes de sécurité adéquats doivent se charger d'installer le système ASC ou de le préparer pour l'installation. Les responsables de l'entretien et l'équipement d'essai doivent reposer sur des tapis de caoutchouc lors de toute intervention sur une pièce d'équipement sous tension. En cas d'incendie associé à du matériel électrique, n'utilisez que des extincteurs à dioxyde de carbone ou homologués pour la lutte contre les incendies d'origine électrique. Les opérations d'installation et d'entretien requièrent une extrême prudence. Des précautions de sécurité spéciales sont requises pour les procédures associées à la manutention, à l'installation et à l'entretien du système ASC. Observez toutes les précautions de sécurité décrites dans le présent manuel avant de manipuler ou d'installer le système ASC. Observez également toutes les précautions avant et pendant toutes les procédures d'entretien. Observez toutes les précautions de sécurité appropriées lorsque vous travaillez sur à proximité d'une source c.c. de sécurité appropriées dès que vous vous trouvez à proximité d'une source c.c.



WARNING! Risk of heavy unit falling over. Improper handling can cause damage to the equipment , injury or death. Exercise extreme care when handling the UPS cabinets to avoid equipment damage or injury to

personnel. The weight of the UPS module is up to 956 lb. (434 kg). Locate center of gravity symbols  and determine the weight of the unit before handling each cabinet. Test lift and balance the cabinets before transporting. Maintain minimum tilt from vertical at all times. Slots at the base of the module cabinets are intended for forklift use. Base slots will support the unit only if the forks are completely beneath the unit. Read all of the following instructions before attempting to move, lift, or remove the packaging from unit, or prepare the unit for installation.



AVERTISSEMENT! Le centre de gravité élevé de l'appareil présente un risque de renversement. Une mauvaise manutention peut entraîner des dommages matériels, des blessures et même la mort. Faites preuve d'une extrême prudence lors de la manutention des armoires ASC afin d'éviter de les endommager ou de blesser le

personnel. Le module ASC pèse jusqu'à 434 kg (956 lb.). Identifiez les symboles de centre de gravité  et déterminez le poids de l'appareil avant de manipuler chaque armoire. Testez le levage et l'équilibre des armoires avant de transporter l'appareil. Maintenez en tout temps l'inclinaison verticale minimale. Les fentes situées à la base des armoires du module sont conçues pour utiliser le chariot élévateur. Les fentes situées à la base peuvent soutenir le système seulement si les fourches se trouvent complètement sous le système. Lisez toutes les instructions ci-dessous avant de tenter de déplacer, lever, déballer ou préparer le système en vue de son installation.



WARNING! Risk of electrical shock and fire. It can cause damage to the equipment, personal injury or death. Under typical operation and with all the 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. 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 potential electric charges may exist at the capacitor banks and at the DC connections. All the wiring must be installed by a properly trained and qualified electrician. All the power and the control wiring must comply with all the applicable national, state and local codes. One person should never work alone, even if all the power is disconnected from the equipment. A second person should be standing by to assist and to summon help in case of an accident.



AVERTISSEMENT! Risque de décharge électrique et d'incendie. pouvant entraîner des dommages matériels, des blessures et même la mort. Les précautions de sécurité habituelles suffisent lorsque le système ASC est en mode de fonctionnement normal et que toutes les portes sont fermées. La zone entourant le système ASC doit être exempte de flaques d'eau, d'humidité excessive et de débris. Seuls des équipements d'essai conçus pour le dépannage doivent être utilisés. Cette mise en garde couvre notamment les oscilloscopes. Utilisez toujours un voltmètre c.a. et c.c. pour vérifier les tensions avant d'établir un contact ou d'utiliser des appareils. Des tensions dangereusement élevées peuvent demeurer dans les batteries de condensateurs et au niveau des raccords c.c., même une fois l'alimentation coupée. Tous les raccords doivent être effectués par un électricien dûment formé et qualifié. Tous les câbles d'alimentation et de commande doivent être conformes aux codes nationaux et locaux en vigueur. Une personne ne devrait jamais travailler seule, même si toute l'alimentation d'entrée est coupée. Une deuxième personne devrait toujours être présente pour porter assistance ou chercher de l'aide en cas d'accident.

Ground Leakage Currents



WARNING! Risk of electric shock from high leakage current. It can cause injury, damage to the property and death. EARTH CONNECTION IS ESSENTIAL BEFORE CONNECTING THE INPUT SUPPLY. Earth leakage current exceeds 3.5 mA and is less than 1000 mA. The transient and steady-state earth leakage currents, which may occur when starting the equipment, should be taken into account when selecting instantaneous Residual Current Circuit Breaker (RCCB) or Residual Current Device (RCD). RCCBs must be selected sensitive to DC unidirectional pulses (Class A) and insensitive to transient current pulses. Note also that the earth leakage currents of the load will be carried by this RCCB or RCD. This equipment must be earthed in accordance with the local electrical code of practice



AVERTISSEMENT! Risque de décharge électrique due à un courant de fuite élevé pouvant causer des blessures, des dommages matériels et même la mort. IL EST PRIMORDIAL D'ASSURER UNE CONNEXION DE TERRE AVANT DE BRANCHER L'ALIMENTATION D'ENTRÉE. La fuite à la terre est supérieure à 3,5 mA et inférieure à 1 000 mA. Vous devez tenir compte des fuites de courant transitoires et permanentes à la terre, susceptibles de se produire au démarrage de l'équipement, lors de la sélection des dispositifs DDFT instantanés. Vous devez sélectionner des disjoncteurs différentiels de fuite à la terre (DDFT) sensibles aux impulsions unidirectionnelles c.c. (classe A) et insensibles aux impulsions de courant transitoires. Notez également que les courants de fuite à la terre de la charge seront acheminés par ce dispositif DDFT. Cet équipement doit être mis à la terre conformément au code national de l'électricité.



WARNING! Risk of electric shock. It can cause injury, damage to the property and death. Under typical operation and with all the 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. Observe all the safety precautions in this manual before handling or installing the UPS system as well as during all maintenance procedures. 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 the AC and the DC voltmeters 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 the power and the control wiring should be installed by a qualified electrician. All the power and the 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 occur.



AVERTISSEMENT! Risque de décharge électrique pouvant causer des blessures, des dommages matériels et même la mort. Les précautions de sécurité habituelles suffisent lorsque le système ASC est en mode de fonctionnement normal et que toutes les portes sont fermées. La zone entourant le système ASC doit être exempte de flaques d'eau, d'humidité excessive et de débris. Des précautions de sécurité spéciales sont requises pour les procédures associées à la manutention, à l'installation et à l'entretien du système ASC. Observez toutes les précautions de sécurité décrites dans le présent manuel avant de manipuler ou d'installer le système ASC, ainsi que pendant toutes les procédures d'entretien. Cet équipement comporte plusieurs circuits à haute tension. Seuls des équipements d'essai conçus pour le dépannage doivent être utilisés. Cette mise en garde couvre notamment les oscilloscopes. Utilisez toujours des voltmètres c.a. et c.c. pour vérifier les tensions avant d'établir un contact ou d'utiliser des outils. Des tensions dangereusement élevées peuvent demeurer dans le système ASC même une fois l'alimentation coupée. Tous les câbles d'alimentation et de contrôle doivent être installés par un électricien qualifié. Tous les câbles d'alimentation et de contrôle doivent être conformes au Code national de l'électricité des États-Unis (NEC) et celui du Canada, ainsi qu'aux codes locaux en vigueur. L'entretien du système ASC ne doit être confié qu'à des professionnels qualifiés. Les responsables de l'entretien et l'équipement d'essai doivent reposer sur des tapis de caoutchouc lors de toute intervention sur une pièce d'équipement sous tension. Les responsables de l'entretien doivent porter des chaussures isolantes pour prévenir tout contact direct avec le plancher. Ne travaillez jamais seul, même si toute l'alimentation d'entrée est coupée de l'équipement. Une seconde personne devrait toujours être présente pour porter assistance ou chercher de l'aide en cas d'accident.



WARNING! Failure to follow adequate grounding procedures can result in electric shock hazard to personnel, or the risk of fire, should a ground fault occur. All operations described in this section must be performed by properly trained and qualified electricians or technical personnel. If any difficulties are encountered, contact Vertiv. See the back page of this manual for contact information.



AVERTISSEMENT! Le non-respect des procédures de mise à la terre peut entraîner des risques d'électrocution du personnel, ou des risques d'incendie en cas de défectuosité de la mise à la terre. Toutes les opérations décrites dans cette section ne doivent être effectuées que par des électriciens ou des techniciens professionnels dûment formés et qualifiés. En cas de difficultés, communiquez avec Vertiv. Pour obtenir les renseignements de contact, consultez la dernière page de ce manuel.

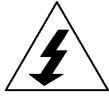
NOTICE

Risk of improper ground connection. It can cause damage to the equipment. 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.

NOTICE

Risk of improper electromagnetic shielding. It 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 is solely responsible for correcting.

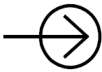
Glossary of Symbols



Risk of electrical shock



Indicates caution followed by important instructions



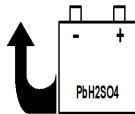
AC input



AC output



Requests the user to consult the manual



Indicates the unit contains a valve-regulated lead acid battery



Recycle



DC voltage



AC voltage



Equipment grounding conductor



Bonded to ground

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2 Introduction

The Vertiv™ Liebert® EXM UPS can be configured as either a fixed-capacity or scalable, transformer-free, online uninterruptible power system with 208/120V input and 208/120V output capability. The Liebert® EXM can operate with either a 50Hz or 60Hz input and provide a matching output frequency conversion.

When configured for scalability, the capacity of the UPS can be increased in 20 kVA increments. Based on the configuration, a power module can be set to a redundant operation mode. Contact Vertiv Services about adding capacity.

Optional transformers are available to add 208V isolation or 480V or 600V input capability to the Liebert® EXM in the optional Vertiv™ Liebert® BDC (Bypass Distribution Cabinet) and in the optional Liebert® EXM Dual Transformer Cabinet.

The Liebert® EXM provides continuous, high-quality AC power to business-critical equipment, such as telecommunications and data processing equipment. The Liebert® EXM supplies power 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® EXM utilizes the latest in high-frequency, double-conversion Pulse Width Modulation (PWM) technology and fully digital controls to enhance its reliability and increase the ease of use.

The 20-100kVA/kW Liebert® EXM requires external batteries to support the load when utility power is not present. For ancillary cabinets, refer to [Auxiliary Cabinets](#) on page 14

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3 Installation

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

Because each 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.

NOTICE

Risk of improper installation. It can cause damage to the equipment . Do not apply electrical power to the UPS equipment before the commissioning engineer arrives at the installation site. The UPS must be installed by a properly trained and qualified engineer in accordance with the information contained in this chapter. All the equipment not referred to in this manual is shipped with details of its own mechanical and electrical installation information.

NOTE: Three-phase, four-wire input power is required.

NOTE: Input power must be supplied to the Liebert® EXM from a properly grounded Wye source. The Liebert® EXM is not for use with impedance grounded systems, corner-grounded systems or high-leg Delta systems. For these applications, an isolation transformer must be installed between the input power and the Liebert® EXM.

3.1 Initial Inspections

1. While the Liebert® EXM and ancillary cabinets are still on the truck, inspect the equipment and shipping container 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 immediately and contact Vertiv Services at 800 543-2378 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 Vertiv representative immediately.
3. Check the product label on the back of front door and confirm the contents match the UPS model, capacity and main parameters that were ordered.

3.1.1 Storing the UPS and Batteries for Delayed Installation

If the Liebert® EXM system will not be installed immediately, it must be stored indoors in a clean, dry and cool location (see [UPS Environmental](#) on page 67). If the UPS includes batteries, either internally or in a battery cabinet, the batteries' requirements will dictate the storage conditions. Batteries should be unpacked, installed and charged as soon as possible after delivery.

NOTICE

Risk of failure to properly charge batteries. It can cause permanent damage to the batteries and void the warranty. The batteries will self-discharge during storage. The batteries must be recharged as recommended by the battery manufacturer. A notice of "Charge Before Date" is affixed to each unit that has batteries inside. The "Charge Before Date" is calculated based on the batteries being stored at 77°F (25°C). Storage at a higher temperature will increase the rate of self-discharge, requiring earlier recharge. Consult the battery manufacturer on how to determine when the batteries need to be recharged.

3.2 Preliminary Checks

3.2.1 Identification

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

3.3 UPS Location

3.3.1 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°F-80°F (23°C-27°C) for maximum battery life

3.3.2 Environmental Considerations

Before installing the Vertiv™ Liebert® EXM, verify that the UPS room satisfies the environmental conditions stipulated in [UPS Environmental](#) on page 67, 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 system performance and service life, maintain the operating temperature within the range of 74°F- 80°F, (23°C-27°C).

The Liebert® EXM is cooled by the internal fans. Cooling air enters the unit through the front of the unit and is exhausted from 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. The UPS requires 24in. (610mm) ventilation clearance above the unit.

See **Table 8.7** on page 69 for details on heat dissipation.

3.4 Considerations in Moving the Liebert® EXM

Ensure that the UPS weight is within the designated surface weight loading (lb./ft² or kg/cm²) of any handling equipment. See **Table 8.2** on page 68 for weights of various units.

The Liebert® EXM may be rolled on its casters for short distances only. For the longer distances, move the UPS with a forklift or similar equipment to ease the relocation and to reduce vibration.



WARNING! Risk of moving heavy unit. It can cause damage to the property, injury and death. Ensure that any equipment that will be used to move the Vertiv™ Liebert® EXM has sufficient lifting capacity. The weight of the Liebert® EXM ranges from 809 lb. to 956 lb. (367 kg to 434 kg). See **Table 8.2** on page 68 for details. The UPS presents a tipping hazard. Do not tilt the Liebert® EXM more 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® EXM off its shipping pallet.



WARNING! Risk of heavy unit tipping over while being moved. It can cause damage to the property, 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 the personnel and damaging the equipment.

Final Positioning

When the equipment has been finally positioned, ensure that the adjustable stops are set so that the UPS will remain stationary and stable (see [Installation Drawings](#) on page 41).

The Liebert® EXM and its auxiliary cabinets must be installed on a concrete or equivalent, non-resilient floor.

3.5 Mechanical Considerations

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

The UPS comes with an Operator Control Panel that provides basic operational status and alarm information. The cabinet houses the power components. Cooling is provided by the 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.



WARNING! Risk of heavy units tipping over while being moved. It can cause damage to the property, injury and death.

3.5.1 Dimensions

Figure 3.1 UPS Dimensions

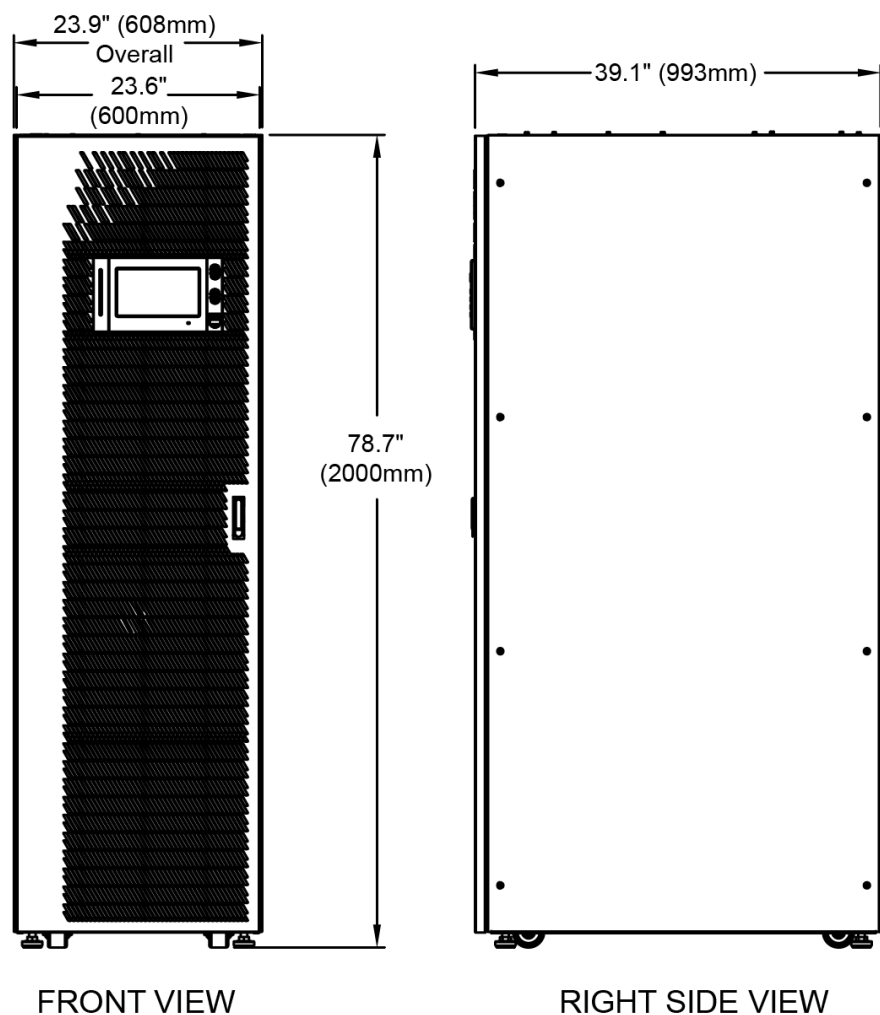


Table 3.1 Weights for Vertiv™ Liebert® EXM 20-100kVA Frame

kVA Rating	Weight, lb. (kg)	
	Unit	Shipping
20	684 (320)	784 (356)
40	758 (344)	858 (389)
60	844 (383)	944 (428)
80	981 (416)	1018 (462)
100	992 (450)	1092 (495)

3.5.2 Clearances

Provide at least the minimum clearance required by the NEC on all sides of Vertiv™ Liebert® EXM including 36in. (914mm) in front, to permit routine tightening of the power terminations within the UPS and free passage for personnel with the door fully opened. Depending on the floor anchoring system used, up to 5in. (127mm) may be required in the rear of the UPS.

There are no ventilation grilles on the sides or back of the UPS.

Leave a minimum of 24in. (610mm) between the top of the UPS frame and the ceiling to permit adequate air circulation above the unit. Vertiv recommends against using the air conditioning or other systems that blow air onto the top of the unit.

3.5.3 Floor Installation

If the Liebert® EXM is to be placed on a raised floor, the UPS should be mounted on a pedestal that will support the equipment point loading. Refer to the bottom view in **Figure 3.1** on the previous page to design this pedestal.

3.5.4 Cable Entry

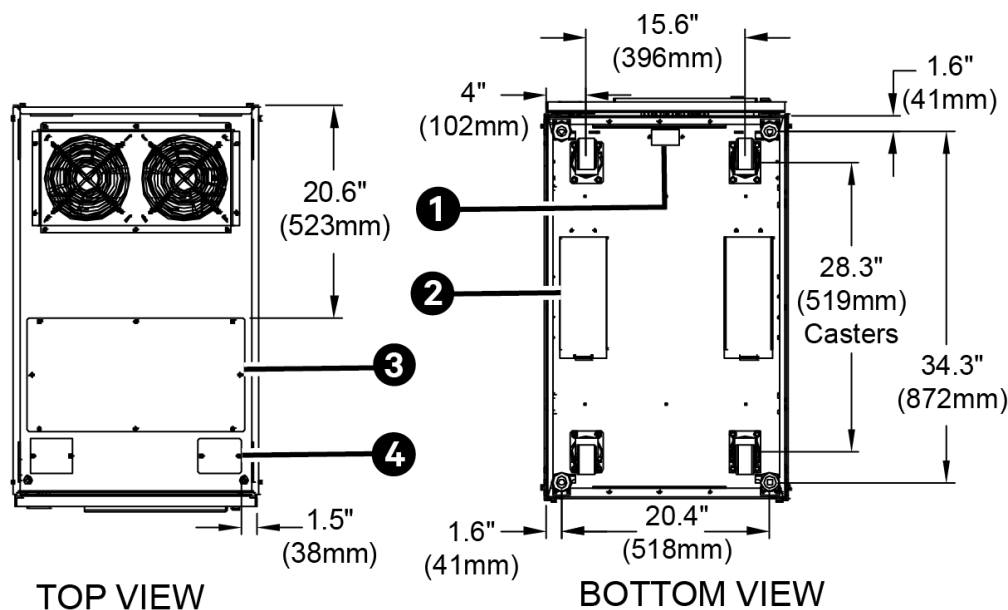
The cables can enter the Liebert® EXM from the top or the bottom through removable metal plates.

Some plates have factory-punched holes and others 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. The conduit size and the wiring method must be in accordance with all the local, regional and the national codes and regulations, including the NEC ANSI/NFPA 70.

The UPS must be accessible from the front to allow personnel to complete the cable connections and make necessary adjustments.

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

Figure 3.2 Cable Entry Locations



Item	Description	Item	Description
1	Bottom Control Cable Entry	3	Top Power Cable Entry
2	Bottom Power Cable Entry	4	Top Control Cable Entry

3.6 Auxiliary Cabinets

The 20-100kVA frame consists of a single cabinet housing the UPS components. It does not accommodate the internal batteries. The UPS require the external battery cabinets for the extended run time.

Battery Cabinets

The optional Vertiv™ Liebert® EXM Battery Cabinets are available for each Liebert® EXM model to provide extended run times, the large battery system solutions and the optional integrated Vertiv™ Liebert® Alber™ battery monitoring. The battery cabinets are designed to be bolted to the left side of the UPS (see **Figure 3.3** on the facing page). Refer to the **Liebert® EXM Battery Cabinet Manual (SL-25651)**, for details.

Multiple battery chemistries are supported on the EXM including Lithium-Ion batteries.

Maintenance Bypass Cabinets

The optional Liebert® EXM Bypass Cabinets are available to provide a full or partial wraparound the maintenance bypass for servicing the UPS. Bypass Cabinets are designed to be bolted to the right side of the UPS (see **Figure 3.3** on the facing page). Refer to the **Liebert® EXM Maintenance Bypass Cabinet Manual (SL-25652)** for further details.

Bypass Distribution Cabinets

The optional Liebert® EXM Bypass Distribution Cabinets are available to provide a full wraparound the maintenance bypass for servicing the UPS with the optional input transformer and the output distribution. bypass cabinets are designed to be bolted to the right side of the UPS (see **Figure 3.3** on the facing page). Refer to the **Liebert® EXM Bypass Distribution Cabinet Manual (SL-25653)**, for further details.

Paralleling Cabinets

The optional Liebert® EXM Paralleling Cabinets are available to provide the connections enabling parallel operation of up to three Liebert® EXM UPS in applications offering increased capacity and redundant protection (1+1, 2+0, 2+1). A partial wraparound maintenance bypass for servicing of the parallel UPS system is included. Refer to the **Liebert® EXM Paralleling Cabinet Manual (SL-25654)**, for further details.

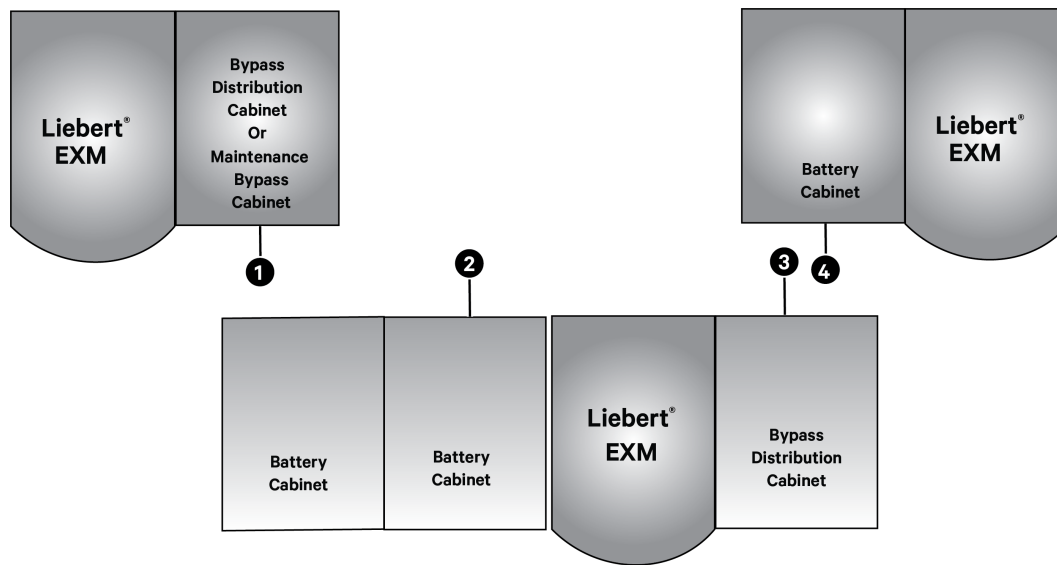
Dual Transformer Cabinets

The Optional Liebert® EXM Dual Transformer Cabinets are available to provide step down voltage transformation for the dual-input UPS applications. Refer to the **Liebert® EXM Dual Transformer Cabinet Manual (SL-25655)**, for further details.

System Composition

A UPS system can comprise a number of optional equipment cabinets, depending on the system design requirements - For Example. The UPS cabinet, The External Battery Cabinet and the External Bypass Cabinet. All the cabinets used will be the same height and will be designed to be positioned side-by-side to form an aesthetically appealing equipment suite.

Figure 3.3 Cabinet Arrangement



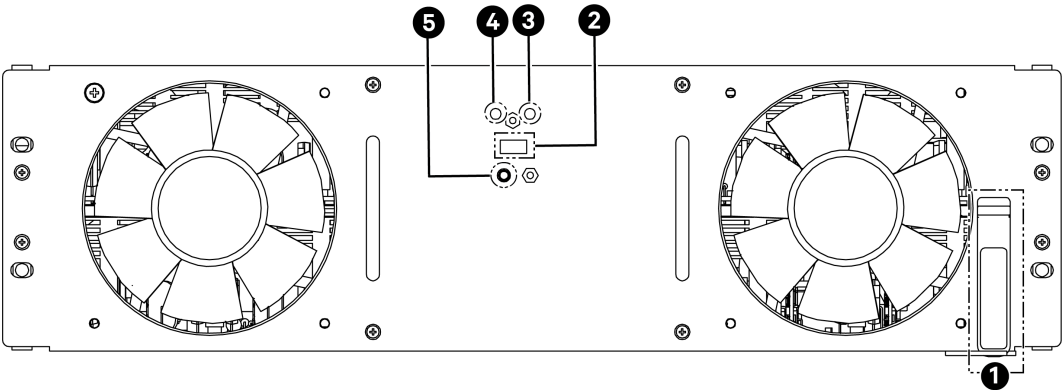
NOTE: All Units viewed from above, Layouts shown are typical not all auxiliary cabinets are shown. refer to the submittal drawings for the exact configuration of your system.

Notes To Figure

1. Vertiv™ Liebert® EXM connected only to the Vertiv™ Liebert® BDC/MBC. (The Liebert® BDC/MBC must be on right side of the Liebert® EXM.)
2. Liebert® EXM connected to the Battery Cabinets. (The Battery Cabinets must be on the left side of the Liebert® EXM).
3. Liebert® EXM Connected to the Liebert® BDC/MBC. (The Liebert® BDC/ MBC must be on right side of Liebert® EXM).
4. Liebert® EXM connected to the Battery Cabinets. (The Battery Cabinets must be on the left side of the Liebert® EXM)

3.7 Vertiv™ Liebert® Power Module Assembly

Figure 3.4 Liebert® Power Module Assembly Indicators and Controls



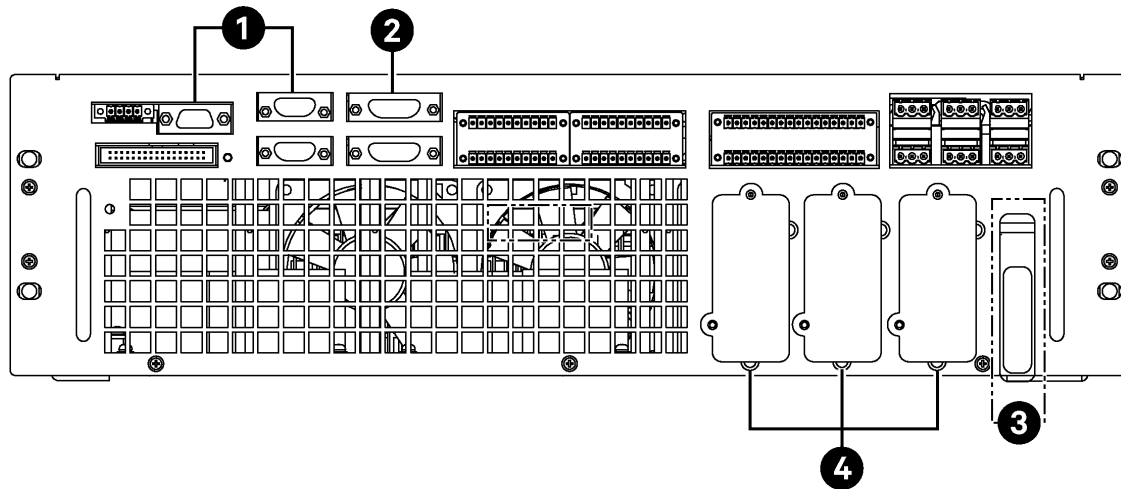
Item	Description	Item	Description
1	Ready Switch	4	Fault LED
2	DIP Switches	5	Battery Start Button
3	Run LED		

- The BATTERY START button allows starting the UPS on battery.
- The Run LED is illuminated Green when the Liebert® Power Module Assembly is operating normally.
- The Fault LED will illuminate Red when the Liebert® Power Module Assembly has a problem.

LED Status		Indication
Run LED (Green)		
Flashing Green		The inverter is starting, but has no output yet.
Constant Green		The inverter has started to supply power.
OFF		The inverter has not started up.
Fault LED (Red)		
Constant Red		Auxiliary power failure (15V or 24V), rectifier overtemperature, rectifier failure (including battery SCR short circuit), battery converter failure, soft start failure, main circuit back feed, abnormal input current, inverter failure, output short circuit, bypass SCR short circuit fault, inverter relay short circuit fault, abnormal bus voltage, module not ready, module ID out of range and duplicated module ID.
Flashing Red		Charger failure, abnormal main circuit voltage, abnormal main circuit frequency, main circuit undervoltage, main circuit reverse phase, battery unavailable, reverse battery, input zero-loss, current sharing failure, module overload, inverter relay disconnection fault, bypass SCR disconnection fault and input fuse blown.
OFF		No above failures or alarms.

3.8 Static Bypass Assembly

Figure 3.5 Static Bypass Assembly Connections



Item	Description	Item	Description
1	DB9	3	Ready Switch
2	DB15	4	Vertiv™ Liebert® IntelliSlot Bay 1,2,3

The Static Bypass Assembly has three Liebert® IntelliSlot interface card bays and connections for the optional ancillary cabinets and for other options.

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4 Electrical Connections- UPS

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



WARNING! Risk of electric shock. It can cause damage to the property, injury and death. Before connecting input power to the Vertiv™ Liebert® EXM, 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.



AVERTISSEMENT! Risque de décharge électrique pouvant entraîner des dommages matériels, des blessures et même la mort. Avant de procéder au branchement de l'alimentation d'entrée du système EXM de Liebert, veuillez à prendre connaissance de l'emplacement et du fonctionnement des dispositifs de protection de surintensité qui raccordent l'alimentation d'entrée ou de dérivation du système ASC au panneau de distribution électrique. Coupez l'alimentation et appliquez le verrouillage ou l'étiquetage à tous les circuits d'alimentation haute tension et basse tension avant d'installer les câbles ou d'effectuer tout autre branchement électrique.

4.1 Power Cabling

4.1.1 Lug Size and 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. Refer to ANSI/NFPA 70.

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 8.3** on page 68 , with respect to the unit rating and the input AC voltage.
- **UPS bypass and output cables** - The bypass and the output cables must be sized for the nominal output current, given in **Table 8.3** on page 68 , with respect to the unit rating and the output AC voltage.
- **Battery cables** - See the **Liebert® EXM External Battery Cabinet Manual (SL-25651)**, for battery installation guidelines and instructions. The manual ships with the battery cabinet and is available at Vertiv Web site: www.vertiv.com

NOTE: Table 8.3 on page 68 gives nominal currents for determining the size of UPS power cables. Other important factors to consider include cable route length and coordination with the protective devices.

The power cables can be sized to suit the UPS unit rating according to **Table 8.3** on page 68 .

Torque Requirements

Refer to **Table 4.1** below and **Table 4.2** below for lug size and torque requirements.

Table 4.1 Lug Size

Bolt Shaft Size	Lb-in (Nm)
1/2" (M12)	428 (48)

Table 4.2 Terminal Block with Compression Lugs - Control Wiring

AWG Wire Size or Range	Lb-in (Nm)
#22 - #14	3.5 to 5.3 (0.4 to 0.6)

4.2 External Protective Devices

For safety concerns, it is necessary to install the external circuit breakers or other protective devices for the input AC supply of the UPS system. This section provides generic practical information for the qualified installation engineers. The installation engineers should be knowledgeable about regulatory wiring standards and the equipment to be installed.

To reduce the risk of fire, connect only to a circuit provided with branch circuit overcurrent protection in accordance with the NEC ANSI/NFPA 70.

4.2.1 Rectifier and Bypass Input Supply of the UPS

Overcurrents

Install the suitable protective devices in the distribution unit of the incoming mains supply, considering the power cable current-carrying capacity and overload capacity of the system. Generally, the magnetic circuit breaker with IEC60947-2 tripping curve C (normal) at the 125% of the nominal current listed in **Table 8.3** on page 68 is recommended.

Split bypass: In case a split bypass is used, a separate protective devices should be installed for the rectifier input and bypass input in the incoming mains distribution panel. A shunt trip coil of 120V must be installed in the bypass and the rectifier input breakers if the system does not include a Vertiv™ Liebert® Bypass Cabinet.

NOTE: The rectifier input and bypass input must use the same neutral line.

Earth Leakage, RCD Devices

Any residual current detector (RCD) installed upstream of the UPS input supply:

- Must be sensitive to DC unidirectional pulses (Class A)
- Must be insensitive to transient current pulses, and
- Must have an average sensitivity, adjustable between 0.3 and 1A.

To avoid false alarms, The earth leakage monitoring devices when used in systems with the split bypass input or when used in the paralleled UPS configurations, must be located upstream of the common neutral sinking point. Alternatively, the device must monitor the combined four-wire rectifier and the split bypass input currents.

4.2.2 UPS Output

If an external distribution panel is used for the load distribution, the selection of protective devices must provide discrimination with those that are used at the input to the UPS (see **Table 8.8** on page 69).

4.2.3 UPS Input Configuration

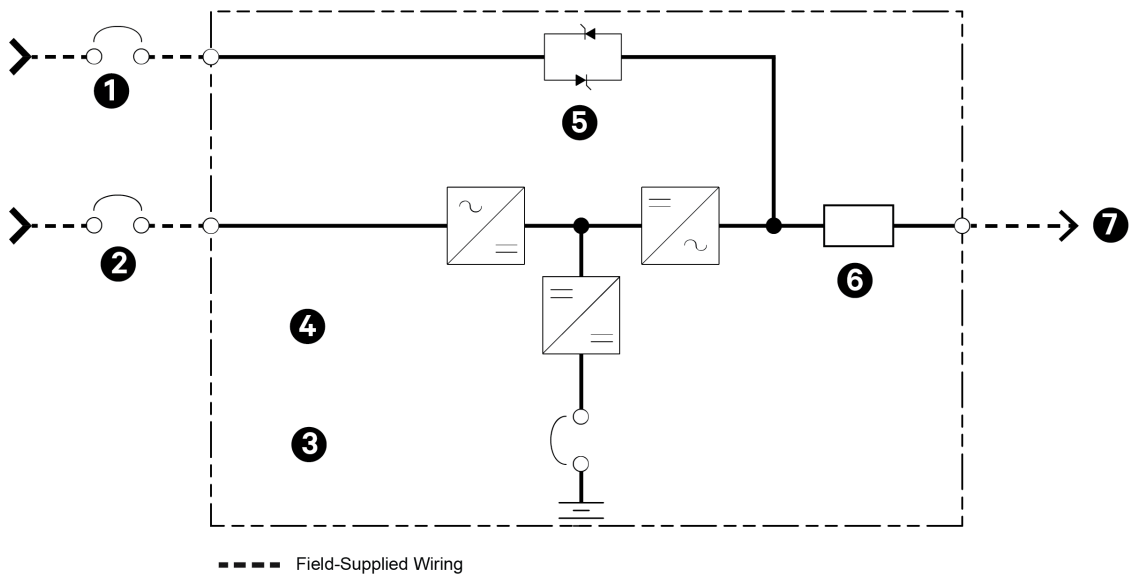
By default, the Vertiv™ Liebert® EXM which is shipped with the internal links installed between the bypass input and the main (rectifier) input (single input configuration).

Figure 4.1 below and **Figure 4.2** on the next page show the Liebert® EXM in a split bypass (single source dual-input) configuration. In this configuration, the static bypass and the maintenance bypass lines are supplied by the same source using separate feeds. Both the feeds must be protected externally with the properly sized protective devices.

Wire Liebert® EXM Input as Single Source Dual-Input

To wire the Liebert® EXM as a single source dual-input UPS, remove the factory-installed links between the rectifier and the bypass input busbar (see **Figure 4.4** on page 25).

Figure 4.1 Single UPS Block Diagram - Dual Input, Single Source Configuration, Without Bypass Cabinet



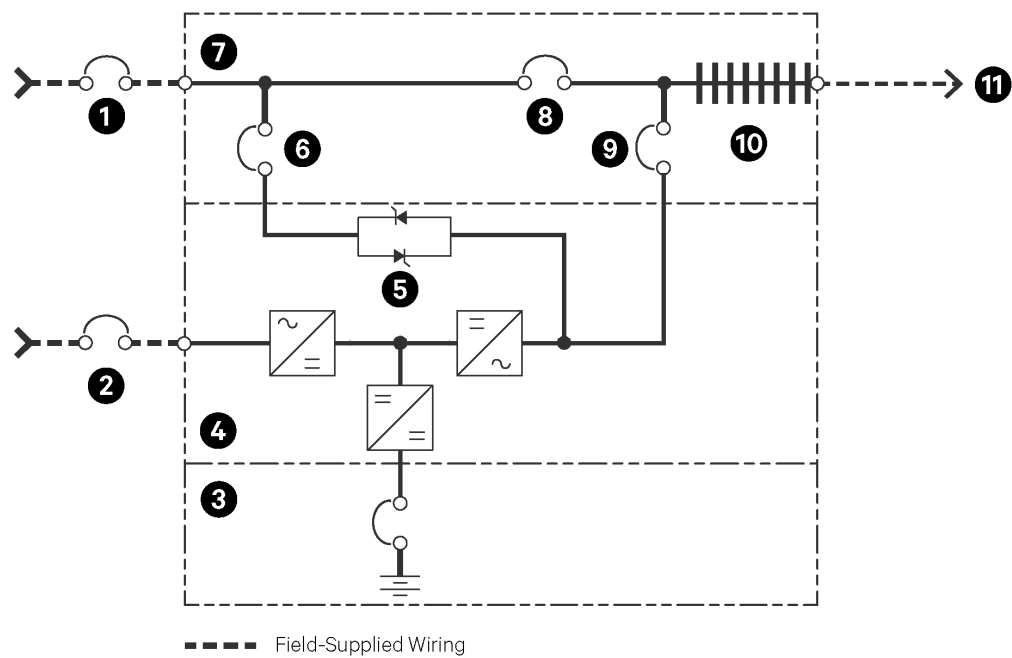
Item	Description	Item	Description
1	*Bypass AC Input 4-Wire + GND (See Note 6)	5	Static Bypass
2	*Rectifier AC Input 4-Wire + GND	6	Output Busbar
3	Battery	7	AC Output 208V 4-Wire + GND
4	UPS Cabinet	—	—

*External Overcurrent Protection by others

Notes To Figure

1. Install in accordance with the national and the local electrical codes.
2. The input and the bypass must share the same single source.
3. A neutral is required from the system AC input source. Vertiv recommends a full capacity neutral conductor and grounding conductors.
4. The bypass and the rectifier input and output cables must be run in separate conduits.
5. The control wiring must be run in the separate conduits.
6. The customer must supply shunt trip breaker with 120V coil to the bypass and the rectifier.

Figure 4.2 Single UPS Block Diagram - Dual Input, Single Source Configuration



Item	Description	Item	Description
1	* Bypass AC Input 4-Wire + GND	7	Bypass Distribution Cabinet
2	* Rectifier AC Input 4-Wire + GND	8	MBB (Maintenance Bypass Breaker)
3	Battery	9	MIB (Maintenance Isolation Breaker)
4	UPS Cabinet	10	Optional Distribution (See Note 6)
5	Static Bypass	11	AC Output 208V 4-Wire + GND
6	BIB (Bypass Isolation Breaker)	—	—
* External Overcurrent Protection by others			

Notes To Figure

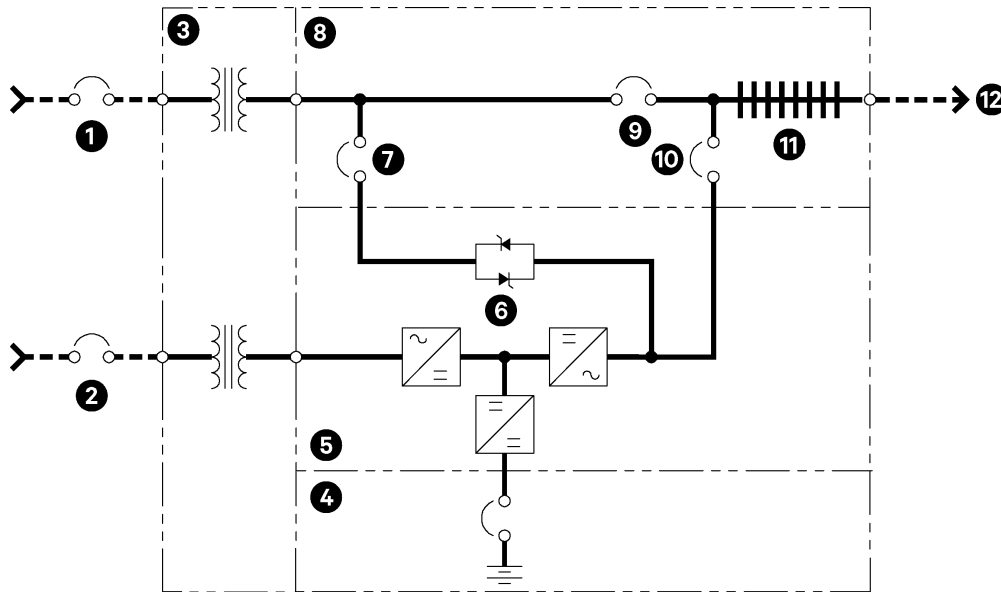
1. Install in accordance with the national and the local electrical codes.
2. The input and the bypass must share the same single source.
3. A neutral is required from the system AC input source. Vertiv recommends a full-capacity neutral conductor and grounding conductors.
4. The bypass and the rectifier input and output cables must be run in the separate conduits.
5. The control wiring must be run in the separate conduits.
6. Optional 50-pole 400A distribution panel or two 225A subfeed breakers.
7. The customer must supply shunt trip breaker with 120V coil. If an optional Vertiv™ Liebert® BDC is not present, the shunt trip must be installed to the bypass and the rectifier breakers.

4.2.4 UPS Input Configuration with Transformers

Figure 4.3 below shows the Vertiv™ Liebert® EXM in a split bypass (single-source, dual-input) configuration using two transformers inside a dual-transformer cabinet.

In this configuration, the static bypass and the rectifier lines can be supplied by the independent sources. The Liebert® EXM Dual Transformer Cabinet is the only approved method for supplying the Liebert® EXM from two independent sources. See the **Liebert® EXM Dual Transformer Cabinet Manual (SL-25655)**, for details. Both the feeds must be protected externally with properly sized protective devices.

Figure 4.3 Liebert® EXM in a Split Bypass Configuration



Item	Description	Item	Description
1	* Bypass AC Input 3-Wire + GND	7	BIB (Bypass Isolation Breaker))
2	* Rectifier AC Input 3-Wire + GND	8	Bypass Distribution Cabinet
3	Dual Transformer Cabinet, Optional	9	MBB (Maintenance Bypass Breaker)
4	Battery	10	MIB (Maintenance Isolation Breaker)
5	UPS Cabinet	11	Optional Distribution
6	Static Bypass	12	AC Output 208V 4-Wire + GND

The bypass distribution cabinet is available with a 480V, 600V or 208V optional internal transformer.

4.2.5 Cabling Guidelines

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

Take special care when determining the size of the neutral cable, as current circulating on the neutral cable may be greater than nominal current in the case of non-linear loads. Refer to the values in [UPS Electrical Characteristics](#) on page 68.

The ground conductor should be sized according to such factors as the fault rating, the cable lengths and the type of protection. The ground cable connecting the UPS to the main ground system must follow the most direct route possible. The control wiring and the power wiring must be run in the separate conduit. The output and the input cables must be run in the separate conduit.

Consider using paralleled smaller cables for heavy currents-this can ease installation.

Refer to the **Vertiv™ Liebert® EXM External Battery Cabinet Manual (SL-25651)**, for guidelines and instructions when sizing battery cables.

In most installations, 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.

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

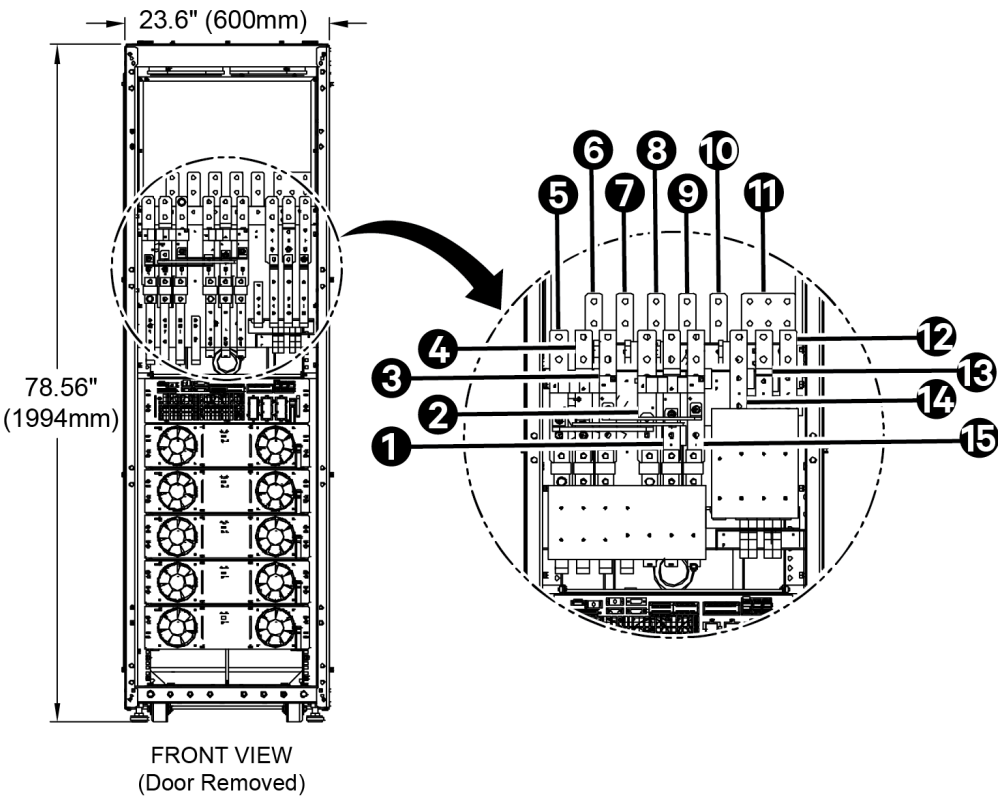
4.2.6 Cable Connections

The rectifier input and outputs, the bypass and the battery are easily accessible from the front of the unit for installation. All require lug type terminations. They are connected to the busbars on the front of the Liebert® EXM, as shown in **Figure 4.4** on the facing page. These busbars are accessible when the Input/Output panel is removed.

NOTICE

Risk of improper installation. It can cause damage to the equipment. When wiring a single-input only system, connect only the power wiring to the input busbars.

Figure 4.4 Input Busbars - Vertiv™ Liebert® EXM 20-100kVA Frame



Item	Description	Item	Description
1	Bypass Input B	9	Batt -
2	Bypass Input A	10	Output Neutral
3	Rectifire Input C	11	Ground
4	Rectifire Input B	12	Output C
5	Rectifire Input A	13	Output B
6	Input Neutral	14	Output A
7	Batt - N	15	Bypass Input C
8	Batt +	—	—

Notes To Figure

- 1. The control wiring and the power wiring must be run in the separate conduits.
- 2. Shown with the seismic mounting bracket.
- 3. All the wiring must be in accordance with the national and the local electrical codes.

4.2.7 Accessory Fuses and Back-Feed Breaker Wiring

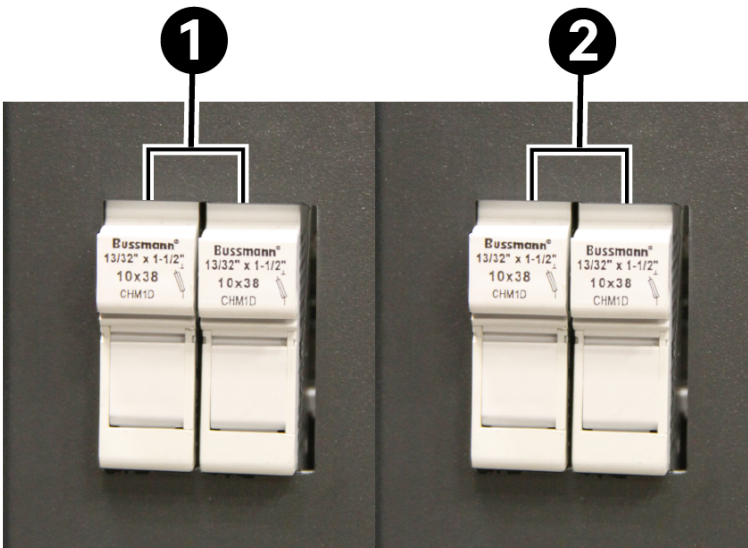
The two fuse blocks provide power for the back-feed breakers (standard) and the Vertiv™ Liebert® Alber™ BDSUi (optional). The fuse blocks are at the lower right of the I/O panel on the front of the Vertiv™ Liebert® EXM UPS. See **Figure 4.5** below for fuse-holder locations.

The back-feed breaker fuse block provides 120V nominal provided from the UPS output (L-N) and the fuse is rated for 2 amps. **Figure 4.6** on the facing page shows the back-feed breaker wiring, located on the bypass static switch assembly.

The Liebert® EXM does not include internal back-feed protection. A shunt trip coils of 120V must be installed in the bypass and the rectifier input breakers if the system does not include a Liebert® Bypass Cabinet. This is a safety feature and will prevent the UPS inverter from back-feeding the input source.

The Liebert® Alber™ BDSUi fuse block provides 208V nominal from the UPS output (L-L) and the fuse is rated at 8A. The Liebert® Alber™ BDSUi power wiring is shown in the Liebert® EXM Battery Cabinet Manual (SL-25651).

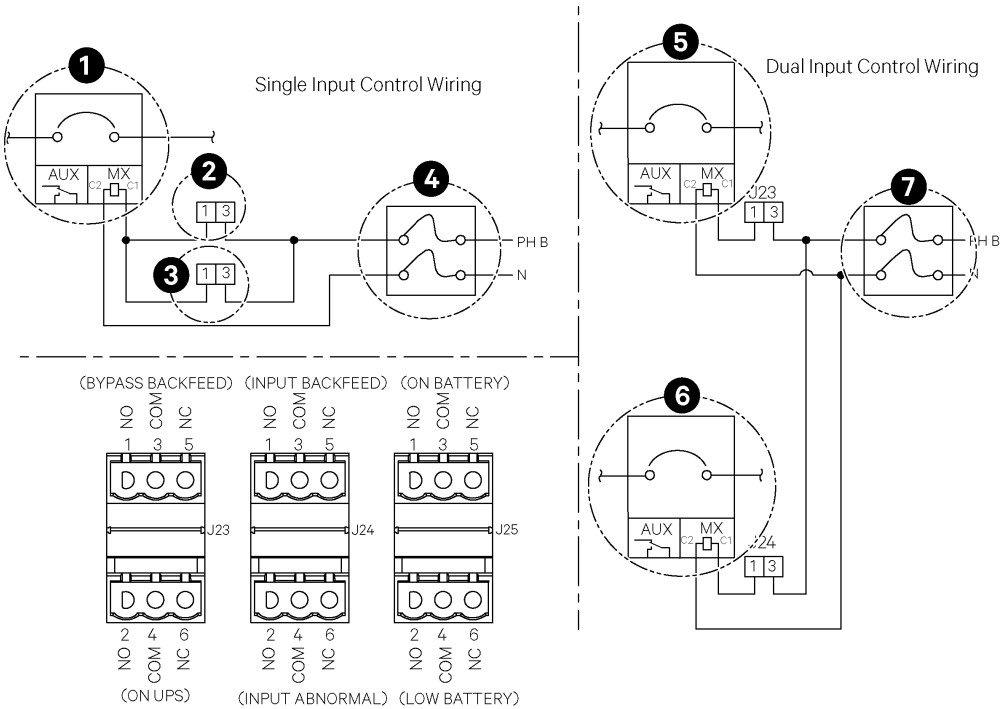
Figure 4.5 Accessory Fuses



Item	Description
1	Back-Feed Breaker Fuse Block
2	Liebert® Alber™ BDSUi Fuse Block (Optional)

NOTE: A shunt trips are required in upstream breakers to allow back-feed protection to function properly, a shunt trip of the upstream rectifier input breaker and the bypass input breaker is required.

Figure 4.6 Dual Input Back-Feed Breaker Wiring When Bypass Distribution Cabinet



Item	Description	Item	Description
1	Upstream System Input Breaker	5	Upstream Bypass Input Breaker
2	J23	6	Upstream Rectifier Input Breaker, Optional
3	J24	7	Backfeed Breaker Fuse Block (FH1)
4	Backfeed Breaker Fuse Block (FH1)		

Notes To Figure

1. Auxiliary contacts not needed for backfeed breaker operation.
2. A 120V shunt trip coil is required for proper operation.

NOTE: A shunt trips are required in the upstream breakers to allow the back-feed protection to function properly. a shunt trip of the upstream rectifier input breaker and thebypass input breaker is required.

4.2.8 Safety Ground

The safety ground busbar is below the neutral input and the output busbars as shown in the **Figure 4.7** on the facing page below. The safety ground cable must be connected to the ground busbar and bonded to each cabinet in the system. This ground busbar is then connected to the ground electrode conductor (GEC).

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



WARNING! Risk of electrical shock and arc flash. It can cause damage to the property, 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.

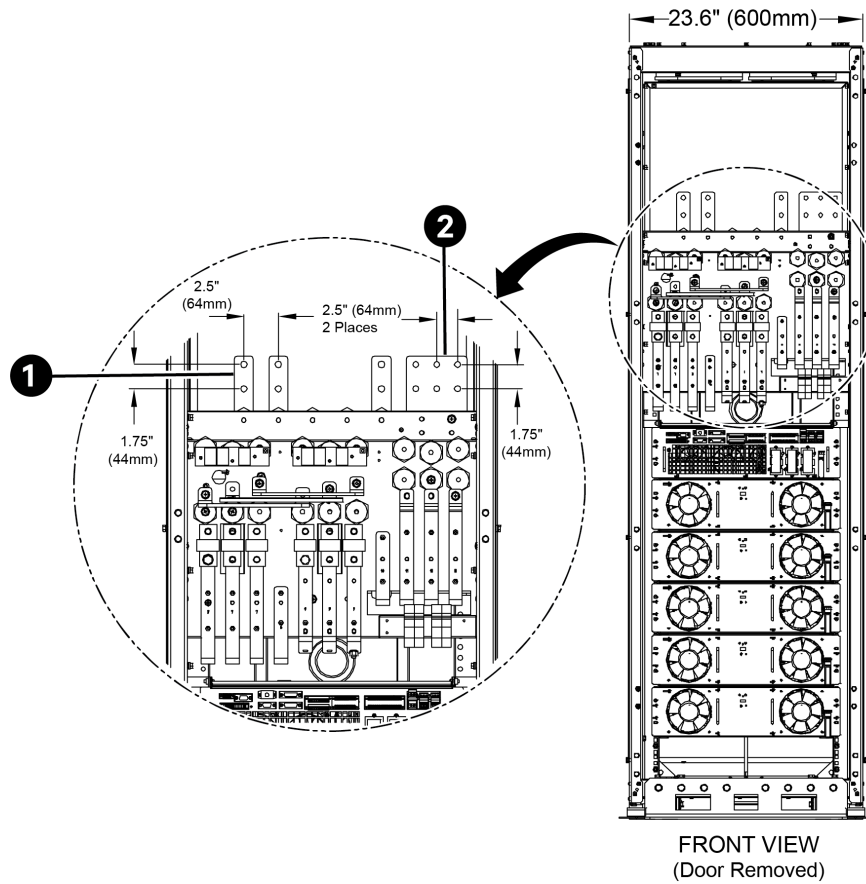


AVERTISSEMENT! Le non-respect des procédures de mise à la terre peut entraîner des risques d'électrocution du personnel, ou des risques d'incendie en cas de défectuosité de la mise à la terre. Toutes les opérations décrites dans cette section ne doivent être effectuées que par des électriciens ou des techniciens professionnels dûment formés et qualifiés. En cas de difficultés, communiquez avec Vertiv. Pour obtenir les renseignements de contact, consultez la dernière page de ce manuel

NOTE: Proper grounding significantly reduces problems caused by the electromagnetic interference.

NOTE: The ground and the neutral busbars are easily accessible when the I/O panel is removed. Cable connections should be made before a cabinet is attached to the right side of the Vertiv™ Liebert® EXM or before the UPS is placed where another obstruction, such as a wall, is against the right side of the Liebert® EXM.

Figure 4.7 Ground and Neutral Busbar Connections - 20-100kVA Frame Busbars



Item	Description
1	Neutral
2	Ground

4.2.9 Protective Devices

For safety, it is necessary to install the circuit breakers in the input AC supply external to the UPS system. Given that every installation has its own characteristics, this section provides guidelines for the 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

The external overcurrent protection for the AC output circuit is to be provided. See [UPS Electrical Characteristics](#) on page 68 and **Table 8.8** on page 69 for recommended breaker ratings. Overcurrent protection for the battery circuit must be provided by the customer when using an optional External Battery Cabinet.

Dual Input Single Source - When wiring the UPS with dual inputs but with a single input source, the Rectifier input and the Bypass input must be protected separately. Size the breakers according to the input currents shown in **Table 8.3** on page 68 and **Table 8.4** on page 68.

NOTE: For a single or a dual input, a 120V shunt trip coil(s) is required when a breaker is supplied by the customer. See **Figure 4.2** on page 22 and **Figure 4.3** on page 23 for details.

System Output

When using an external distribution panel for the load distribution, the output neutral and the input neutral must be separated at the input to the UPS.

4.2.10 Cabling Procedure



WARNING! All operations described in this section must be performed by the properly trained and qualified electricians or technical personnel. If any difficulties are encountered, contact Vertiv. See the back page of this manual for contact information.



AVERTISSEMENT! Toutes les opérations décrites dans cette section ne doivent être effectuées que par des électriciens ou des techniciens professionnels dûment formés et qualifiés . En cas de difficultés, communiquez avec Vertiv. Pour obtenir les renseignements de contact, consultez la dernière page de ce manuel.

NOTE: The hydraulic pressure pliers, the combinative tools and the piston ring pliers should be used to connect the AC wiring.

Once the equipment has been positioned and secured for operation, and the battery and ground lugs have been connected (see [Cable Connections](#) on page 24), connect the power cables as described below. (Study the reference drawing in [Installation Drawings](#) on page 41).

1. Verify that all the incoming high and low voltage power circuits are de-energized and locked out or tagged out before installing the cables or making any electrical connections.
2. Remove the front I/O panel to gain easier access to the connections busbars.
3. Connect the facility ground and the ancillary ground bus cables to the copper ground busbar located in the middle of the Vertiv™ Liebert® EXM behind the output connections. All the cabinets in the UPS system must be connected to the user's ground connection.

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

4. Identify and make power connections with the incoming cables according to Step 5 through Step 8.

Common Input Connections - Ensure Correct Phase Rotation

5. For the common bypass and the main inputs, connect the AC input supply cables to the UPS input terminals (A2-B2-C2-N1) and tighten the connections to 428 lb.-in. (48Nm) (M12 bolt). Ensure correct phase rotation.

NOTE: For the common bypass and the main inputs, the AC input cables must be connected to the bypass terminal (A2 B2 C2 N1) but not the main input terminal (A2-B2-C2).

Split Bypass Connections

6. If a split bypass configuration is used, connect the AC input supply cables to the rectifier input terminals (A1-B1-C1-N1) and the AC bypass supply cables to the bypass input terminals (A2 B2 C2-N1) and tighten the connections to 428 lb.-in. (48Nm) (M12 bolt). Ensure the correct phase rotation.

NOTE: For the split bypass operation, ensure that the busbars between the bypass and the rectifier inputs are removed. The neutral line of the bypass input must be connected to that of the rectifier input.

Output System Connections - Ensure Correct Phase Rotation

7. Connect the system output cables between the UPS output busbars (A-B-C N terminals) and the critical load and tighten the connections to 428 lb.-in. (48Nm) (M12 bolt). Ensure the correct phase rotation.



WARNING! Risk of electrical shock. It can cause damage to the equipment , personal injury and death. The following procedure provides power to the critical load distribution system. Verify that the critical load distribution is ready to accept power. Make sure that personnel and equipment are ready for the critical load distribution system to be energized.



AVERTISSEMENT! Risque de décharge électrique pouvant entraîner des dommages matériels, des blessures et même la mort. La procédure suivante fournit de l'énergie au système de distribution de la charge critique. Vérifiez que ce système est prêt à être alimenté. Assurez-vous que le personnel et les équipements sont préparés pour la mise sous tension du système de distribution de la charge critique.

Observe the battery cable polarity. Be sure that the battery connections, if any, are made with the correct polarity.

8. Refit all protective covers removed for cable installation.

4.3 Control Cables Details

4.3.1 Static Bypass Assembly Features

Based on your site's specific needs, the UPS may require auxiliary connections to manage the battery system (the external battery circuit breaker, the battery temperature sensor), communicate with a personal computer or provide alarm signaling to external devices or for Remote Emergency Power Off (REPO). Terminations for these functions are located at the front of the static bypass assembly.

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)
- Vertiv™ Liebert® IntelliSlot interface
- Temperature detect interface

Figure 4.8 Static Bypass Assembly Connections to Display Cabinet and Options

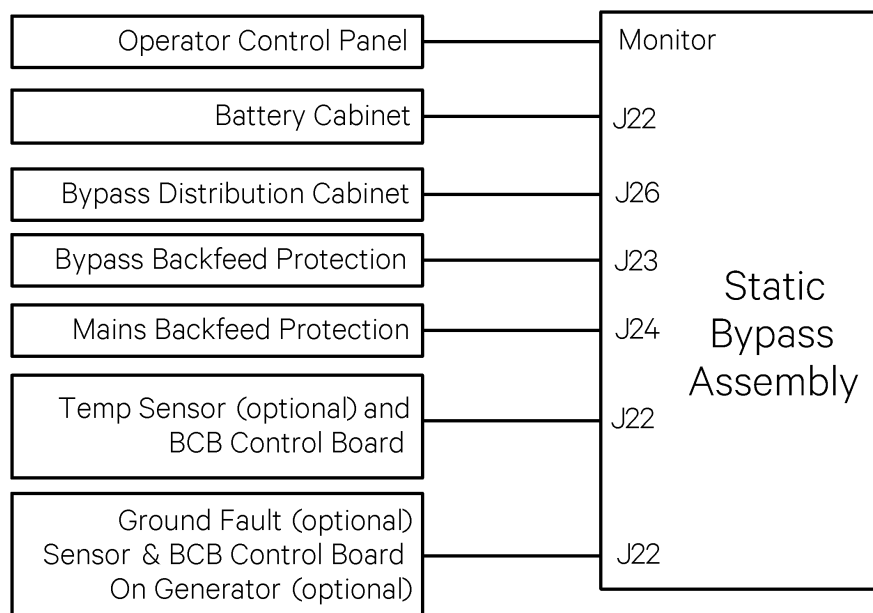
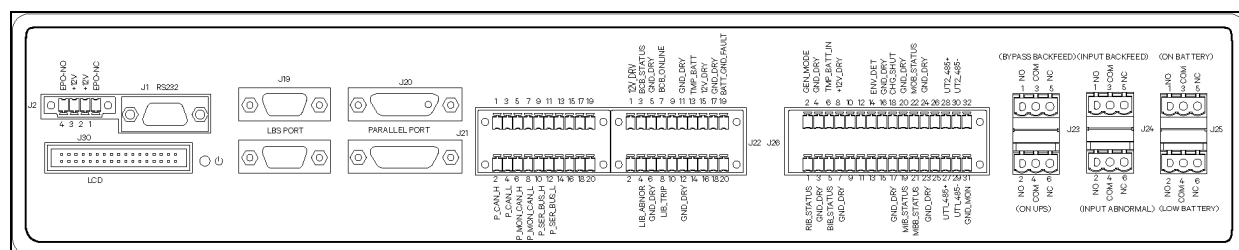


Figure 4.9 Auxiliary Terminal Block Detail (Static Switch Assembly Front Panel)



4.4 Dry Contacts

The UPS provides the input dry contacts and the output dry contacts on the Auxiliary Terminal Block.

4.4.1 Input Dry Contacts

The external input dry contacts are connected via the Dry Contact Terminal Block. Dry contacts are available for environment detection, battery ground fault detection, etc.

The UPS accepts external signal from zero-voltage (dry) contacts connected through external dry contact terminals produced, and these terminals are on the static bypass assembly. Through software programming, these signals become active when these contacts connect to +12V to ground (in the most left side). The cables connected to the monitor board must be separated from power cables. Moreover, these cables should be double-insulated with a typical cross-section of 0.5 to 1mm² for a maximum connection length between 82 ft. and 165 ft. (25m-50m). The Dry Contact Terminal Block has several input dry contacts.

Figure 4.10 Input Dry Contacts

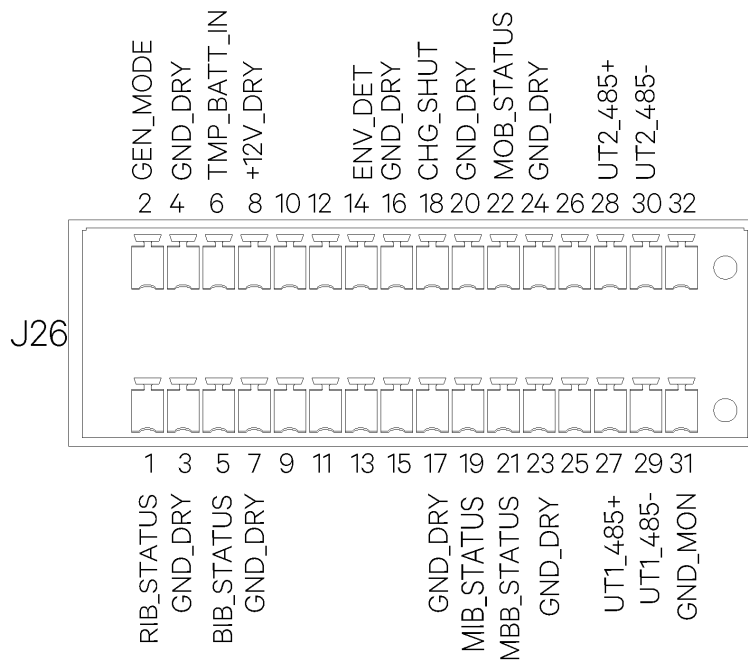


Table 4.3 Input Dry Contacts - J26

Pin	Name	Description
1	RIB_STATUS	Rectifier Input Breaker Status (Short for RIB Closed)
3	GND_DRY	Dry Ground
5	BIB_STATUS	Bypass Input Breaker Status (Short for BIB Closed)
7	GND_DRY	Dry Ground
9	LEGACY_MBB	Legacy Maintenance Bypass Breaker Status (Open for MBB Closed)
11	GND_DRY	Dry Ground
13	LEGACY_MIB	Legacy Maintenance Isolation Breaker Status (Short for MIB Closed)
15	GND_DRY	Dry Ground

Table 4.3 Input Dry Contacts - J26 (continued)

Pin	Name	Description
17	GND_DRY	Dry Ground
19	MIB_STATUS	Maintenance Isolation Breaker Status (Open for MIB Closed)
21	MBB_STATUS	Maintenance Bypass Breaker Status (Short for MBB Closed)
23	GND_DRY	Dry Ground
25	—	N/A
27	UT1_485+	RS485+ Channel #1
29	UT1_485-	RS485+ Channel #1
31	GND_MON	Monitor Ground
2	GEN_MODE	Generator Mode (N.O.)
4	GND_DRY	Dry Ground
6	TMP_BATT_IN	Battery Temperature
8	+12V_DRY	+12V Power
10	—	N/A
12	GND_DRY	Dry Ground
14	ENV_DET	Environment Room Temperature (N.O.)
16	GND_DRY	Dry Ground
18	CHG_SHUT	Charger Shutdown (N.O.)
20	GND_DRY	Dry Ground
22	MOB_STATUS	Module Output Breaker Status (Open for MOB Closed)
24	GND_DRY	Dry Ground
26	—	N/A
28	UT2_485+	RS485+ Channel #2
30	UT2_485-	RS485+ Channel #2
32	—	N/A

4.4.2 Output Dry Contacts

The Auxiliary Terminal Block has three output dry contact relays (see **Figure 4.11** below and **Table 4.4** below).

Figure 4.11 Output Dry Contacts and EPO Wiring

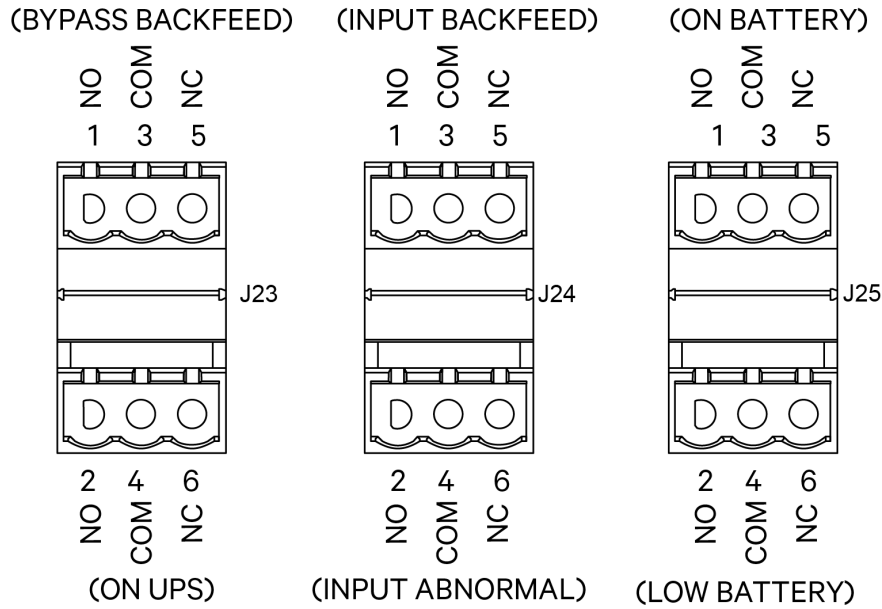


Table 4.4 Output Dry Contact Relays

Port	Pin	Description	Port	Pin	Description
J23	1	Bypass Backfeed NO	J24	2	Input Abnormal NO
	3	Bypass Backfeed COM		4	Input Abnormal COM
	5	Bypass Backfeed NC		6	Input Abnormal NC
J23	2	On UPS NO	J25	1	On Battery NO
	4	On UPS COM		3	On Battery COM
	6	On UPS NC		5	On Battery NC
J24	1	Input Backfeed NO	J25	2	Low Battery NC
	3	Input Backfeed COM		4	Low Battery COM
	5	Input Backfeed NC		6	Low Battery NC

NOTE: All the auxiliary cables of terminal must be double-insulated. The wire should be 20AWG-16AWG stranded for maximum runs between 80 ft. and 200 ft. (25m-60m), respectively.

4.4.3 Vertiv™ Liebert® BDC Interface

The Liebert® BDC interface is on the Dry Contact Terminal Block at J26. Refer to **Figure 4.10** on page 33 for circuit details. For further information, refer to the **Vertiv™ Liebert® EXM BDC Manual (SL-25653)**, available at Vertiv Web site.

NOTE: All the auxiliary cables of the terminal must be double-insulated. The wire should be 20AWG-16AWG stranded for maximum runs between 80 ft. and 200 ft. (25m-60m), respectively.

4.4.4 Battery Cabinet Interface Connectors

The battery cabinet interface is on the Auxiliary Terminal Block at J22. Refer to **Figure 4.12** below for circuit details.

Figure 4.12 Battery Cabinet Interface -J22

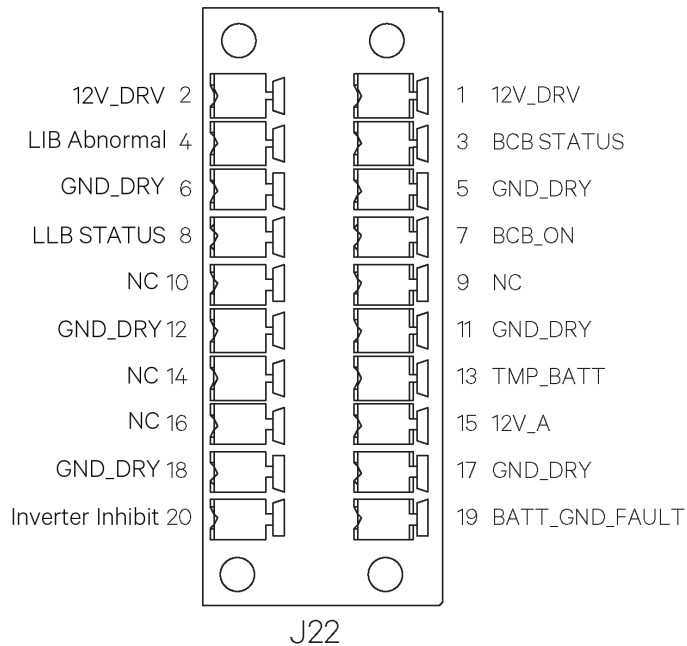


Table 4.5 5.5 Battery Cabinet Interface - J22

Pin	Name	Description
1	12V_DRV	BCB driver signal
2	12V_DRV BCB drive	12V to trip BCB
3	BCB STATUS	BCB state signal
4	LIB Abnormal	Lithium-Ion battery system operates abnormally
5	GND_DRY	Dry ground
6	GND_DRY	Dry ground
7	BCB_ON	BCB on line signal
8	LLB STATUS	Aux Status of Local Load Bank Breaker for single/each unit testing
9	NC	NC
10	NC	NC
11	GND_DRY	Dry ground

Table 4.5 5.5 Battery Cabinet Interface - J22 (continued)

Pin	Name	Description
12	GND_DRY	Dry ground
13	TMP_BATT	External Battery temperature
14	NC	NC
15	12V_A	Power
16	NC	NC
17	GND_DRY	Dry ground
18	GND_DRY	Dry ground
19	BATT_GND_FAULT	Battery ground fault signal
20	Inverter Inhibit	To turn off the inverter, often used with maintenance interlock devices

NOTE: All the auxiliary cables of the terminal must be double-insulated. The wire should be 20AWG-16AWG stranded for maximum runs between 80 ft. and 200 ft. (25m-60m), respectively.

The Pins of J22 are configurable in software. Pins 3, 4, 7, 8, 19, 20 can be configured to any of the inputs shown. The ones shown in the table above are the default inputs. There are additional inputs that can be configured in the table below

Table 4.6 J22 Additional Pin Assignments

Name	Description
Battery Trip Request	External request to trip the battery breaker
BCB2 Status	BCB state signal for BCB2
BCB2_ON	BCB on line signal for BCB2
BATT_GND_FAULT 2	Battery ground fault signal for battery string 2
SLBB Status	Aux status of System Load Bank Breaker for parallel systems

4.4.5 EPO Input - Optional

NOTICE

Risk of exceeding internal voltage limits. It can cause damage to the equipment . Do not apply more than 12V to the Emergency Power Off (EPO) input. Exceeding 12V on this input can damage the internal circuitry and control boards of the Vertiv™ Liebert® EXM . Exceeding 12V will also put the Liebert® EXM in an EPO state, and the unit will not reset, making it non-functional.

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 EPO button is under a hinged, clear plastic shield.

The J2 connector, shown in **Figure 4.13** on the next page , is the remote EPO input interface. The EPO has Normally Open/Normally Closed contacts that become active when shorting the terminals J2: 3 and J2: 4 or open terminal connection J2: 2 and J2: 1.

If an external Emergency Stop capability is required, it is connected at terminals J2: 1 and J2: 2 and at J2: 3 and J2: 4 on the monitor board. It also is connected to the NO/NC remote stop switch between these two terminals using shielded cable (see **Figure 4.13** on the next page and **Table 4.7** on the next page . If this function is not used, Terminals J2: 3 and J2: 4 must be opened and J2: 1 and J2: 2 must be closed.

Figure 4.13 EPO Wiring and Signal Names for J2

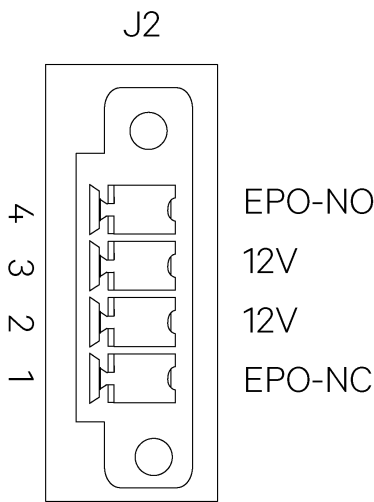


Table 4.7 EPO Input Contact Relays-J2

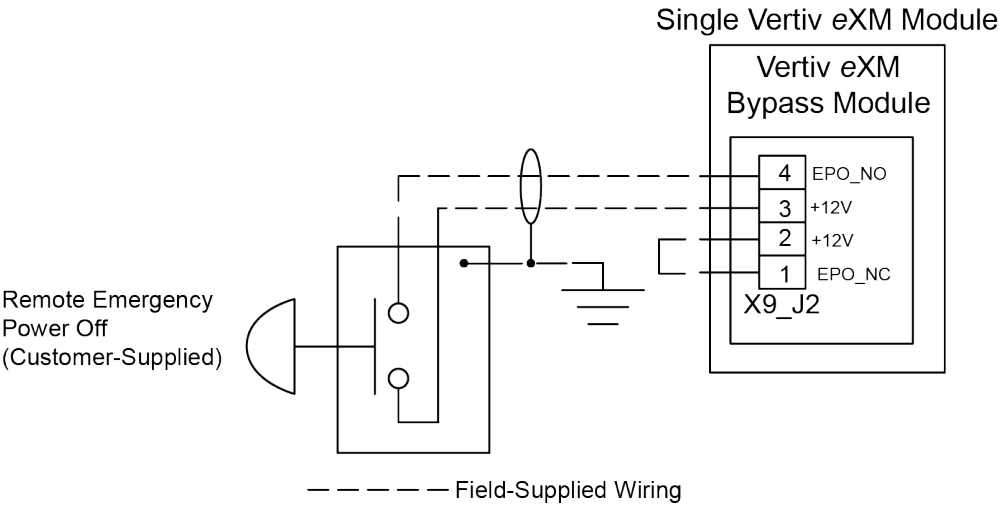
Pin	Name	Description
1	EPO-NC	EPO activated when opened to Pin 2
2	+ 12V	—
3	+ 12V	—
4	EPO-NO	EPO activated when shorted to Pin 3

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

NOTE: Normally Closed EPO – J2: 12, these terminals are supplied factory-linked on the Bypass Module on the UPS. The terminals must remain installed if using NO contacts.

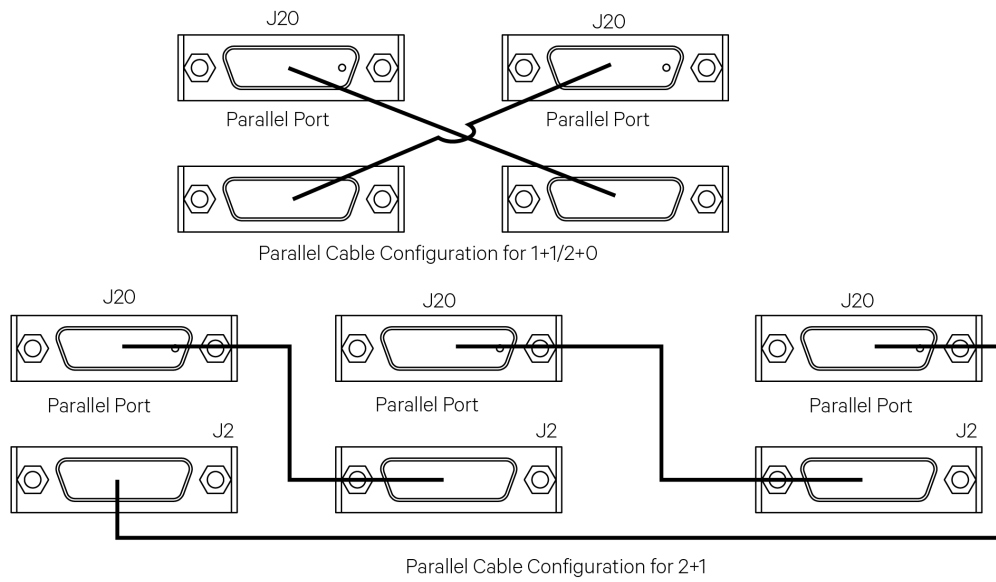
NOTE: All the auxiliary cables of terminal must be double-insulated. The wire should be 20AWG-16AWG stranded for maximum runs between 80 ft. and 200 ft. (25m-60m), respectively.

Figure 4.14 Single UPS Remote Emergency Power Off



4.5 Parallel Cable Connections

Figure 4.15 Parallel Cable Wiring Diagram

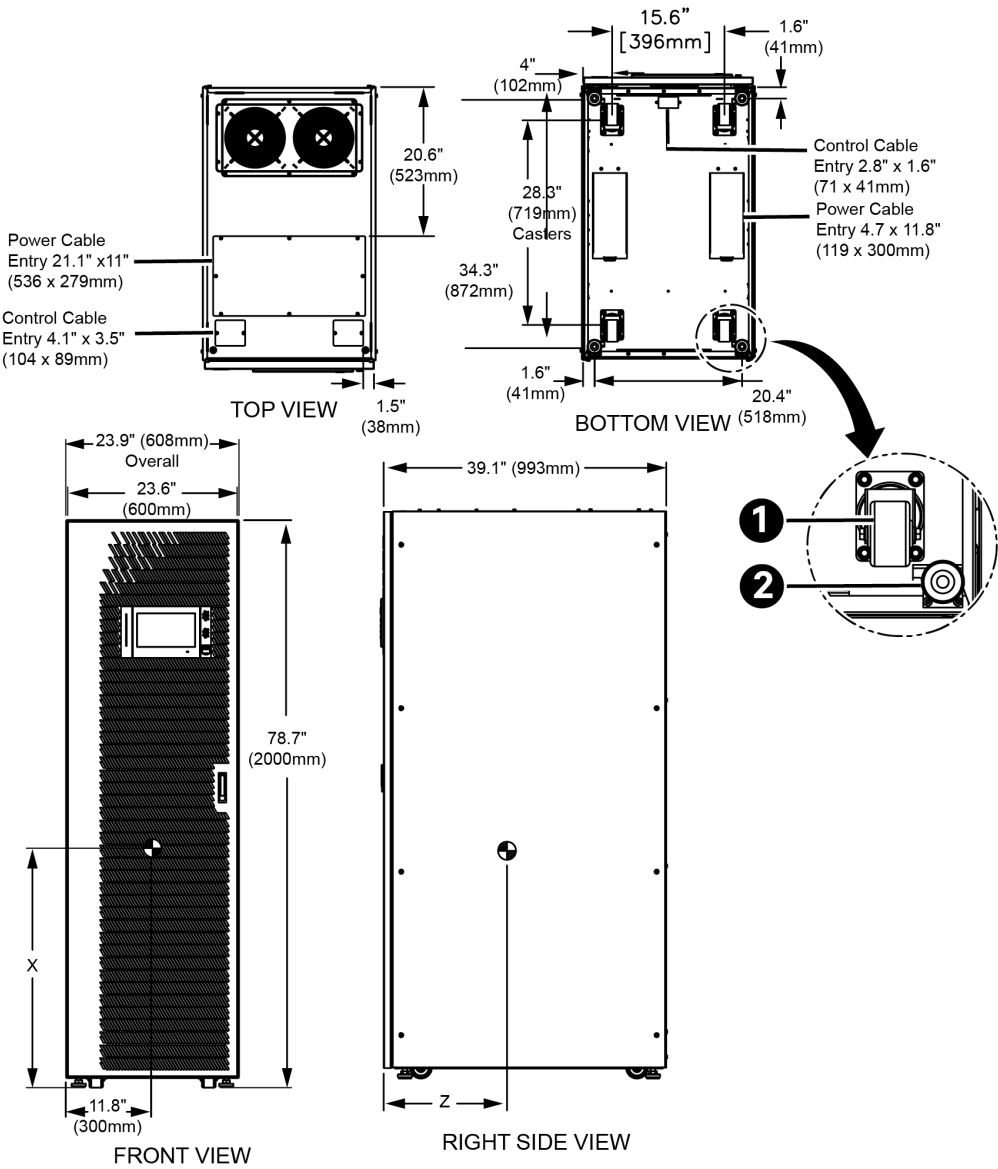


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5 Installation Drawings

The diagrams in this section illustrate the key mechanical and the electrical characteristics of the Vertiv™ Liebert® EXM UPS System Cabinets (UPS, Vertiv™ Liebert® BDC and battery).

Figure 5.1 UPS Dimensions

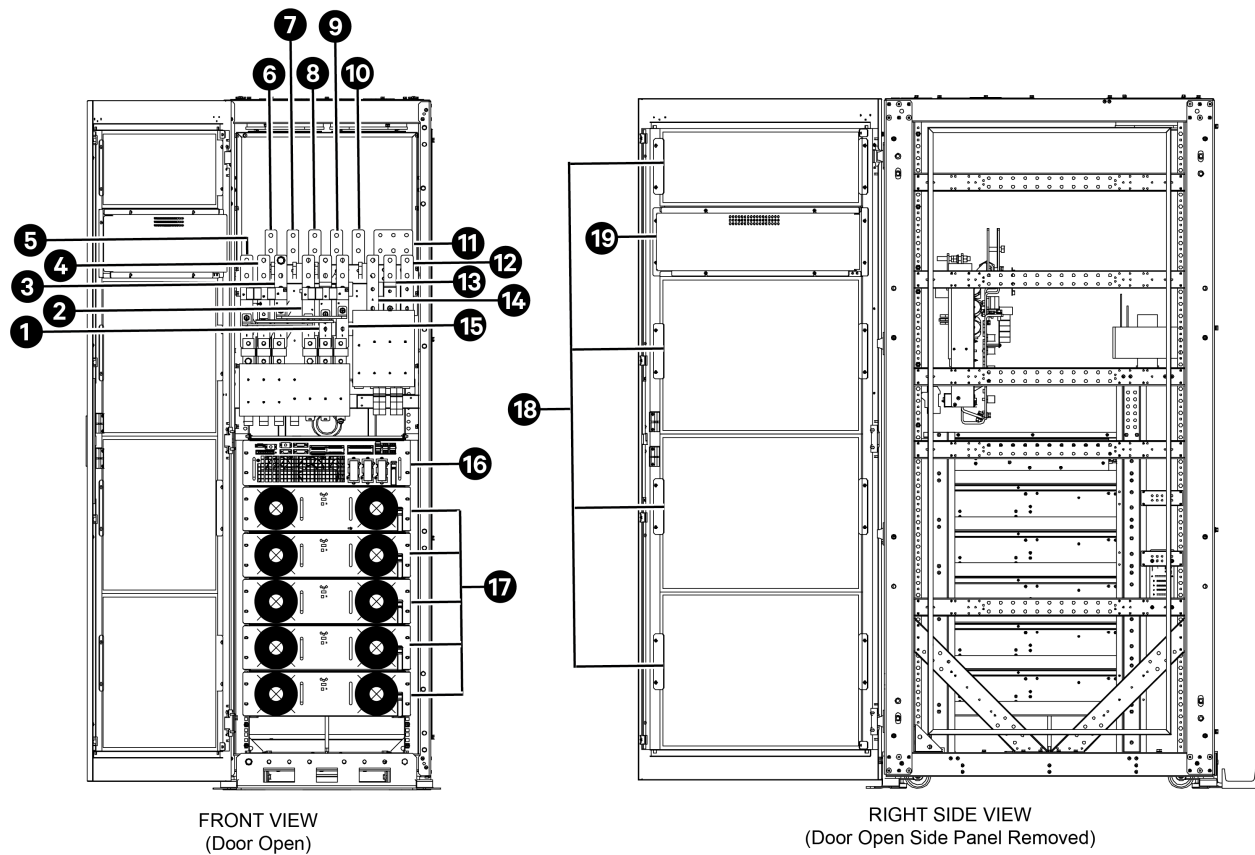


Item	Description
1	Caster
2	Leveler

Notes To Figure

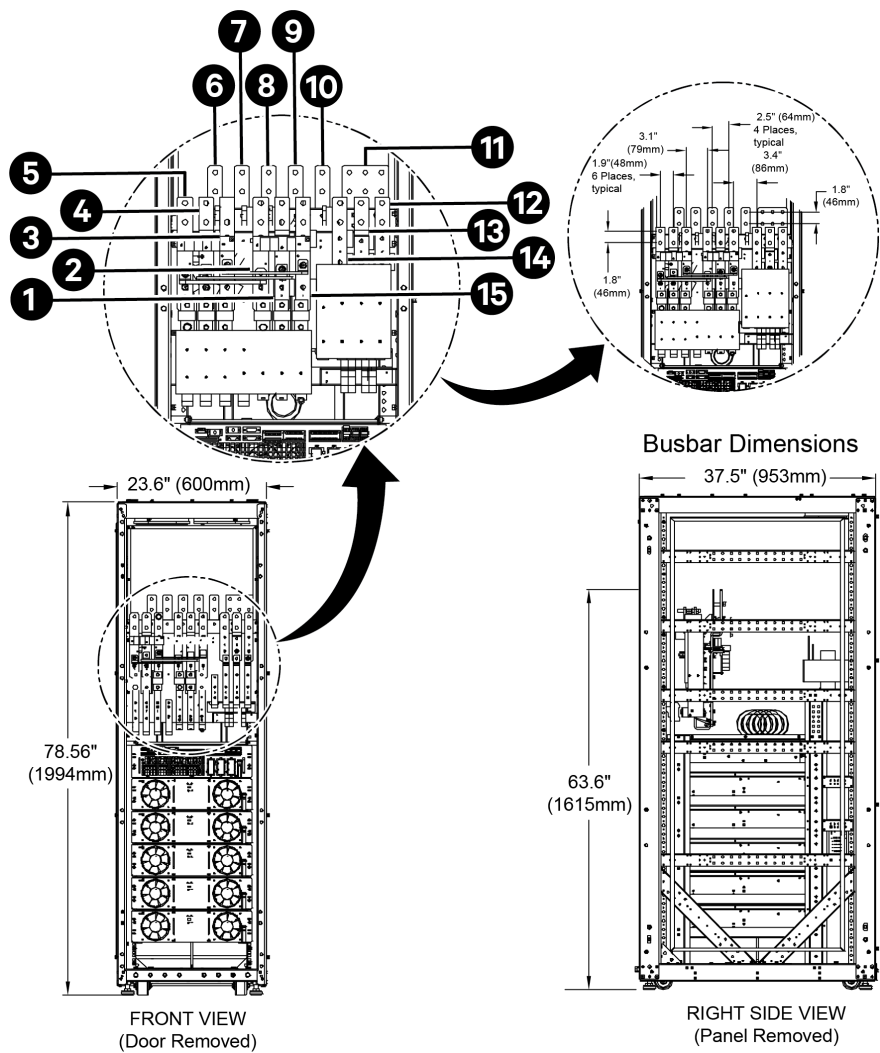
1. 24in. (610mm) minimum clearance above unit for air exhaust.
36in. (914mm) front access required for service. No clearance required in rear except when using seismic anchoring; allow 5in. (127mm) clearance.
2. Keep the cabinet within 15 degrees of vertical.
3. The top and the bottom cable entry available through removable access plates. Remove, punch to suit conduit size and replace.
4. Unit bottom is structurally adequate for forklift handling.
5. The control wiring and the power wiring must be run in the separate conduits.
6. Vertiv recommends using only copper cables.
7. All the wiring is to be in accordance with the national the and local electrical codes.
8. Overall dimensions are shown with side panels.

Figure 5.2 UPS Main Components -Typical 20-100kVA Unit



Item	Description	Item	Description
1	Input bB	11	Ground
2	Input bA	12	Output oC
3	Input mC	13	Output oB
4	Input mB	14	Output oA
5	Input mA	15	Input bC
6	Input mN	16	Bypass Module
7	Batt -N	17	Power Modules
8	Batt +	18	Replaceable Air Filter
9	Batt -	19	Operator Control Filter
10	Output oN	—	—

Figure 5.3 UPS Cable Connections - 20-100kVA Frames



Item	Description	Item	Description
1	Bypass Input B	9	Batt -
2	Bypass Input A	10	Output Neutral
3	Rectifier Input C	11	Ground
4	Rectifier Input B	12	Output C
5	Rectifier Input A	13	Output B
6	Input Neutral	14	Output A
7	Batt - N	15	Bypass Input C
8	Batt +	—	—

6 Option Installation

6.1 Vertiv™ Liebert® IntelliSlot Communication

The Vertiv™ Liebert® EXM has three Liebert® IntelliSlot ports to allow field-installation of optional communication cards. The Liebert® IntelliSlot cards communicate via Liebert's proprietary Velocity protocol to cards that translate the information into such protocols as SNMP and Modbus. Other cards provide dry contact signals for external signaling of operating status.

The Liebert® IntelliSlot communication ports may be installed or removed while the Liebert® EXM is operating.

6.2 Vertiv™ Liebert® IntelliSlot WebCard - 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-base T-Ethernet connection. The same card also will transmit the same status information and all measured parameters for display via a Web browser. The Liebert® IntelliSlot bays are on the right side of the control module and labeled as IntelliSlot1, IntelliSlot2 and IntelliSlot3.

Table 6.1 Liebert® EXM Communication Options

Port Type and Location	Labeled ID Name of Port	Monitoring Devices Supported
Left Liebert® IntelliSlot	IntelliSlot 1	IS-Relay
		Vertiv™ Liebert® IS-UNITY-DP
		IS-Unity- Vertiv™ LIFE™
		IS-485EXI
Center Liebert® IntelliSlot	IntelliSlot 2	IS-Relay
		Liebert® IS-UNITY-DP
		IS-Unity- Vertiv™ LIFE™
		IS-485EXI
Right Liebert® IntelliSlot	IntelliSlot 3	IS-Relay
		Liebert®IS-UNITY-DP
		IS-Unity-Vertiv™ LIFE™
		IS-485EXI

6.2.1 Liebert® IntelliSlot Unity Cards - IS-UNITY-LIFE, IS-UNITY-S, IS-UNITY-DP

IS-UNITY-LIFE: This standard card is used for communication between the Liebert® EXM and Vertiv™ Liebert® *Trellis*™ NMS and Vertiv™ LIFE™ services.

IS-UNITY-DP: This card can be used instead of the standard card if communication to two third party platforms is required. Third-party platforms include SNMP and 485 (Modbus/BACnet) protocols. This card would still be used for communication between the Liebert® EXM and Liebert® *Trellis*™ NMS and Vertiv™ LIFE™ Services. All communication protocols are active simultaneously.

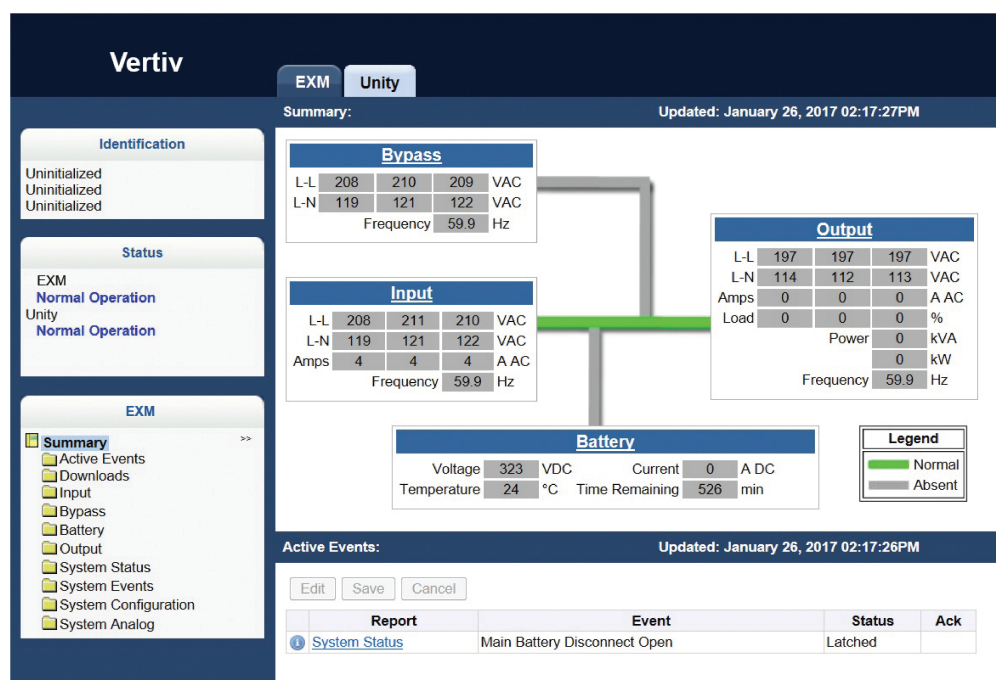
Vertiv™ Liebert® IntelliSlot Dry Contact Card (IS-RELAY): Provides dry contact alarm information, including: On Battery, On Bypass, Low Battery, Summary Alarm, UPS Fault and On UPS signals for communication to a remote monitoring system.

IS-485EXI: The Liebert® IntelliSlot 485 EXI Card provides connection to a Vertiv™ Liebert® SiteLink-E allowing Vertiv™ SiteScan™ Web 4.0 monitoring and control of your Liebert equipment.

6.3 Vertiv™ Liebert® IntelliSlot Web Card - Optional

An optional Web card is available that provides remote access to the UPS. A wide variety of status and summary information is available through an Ethernet connection.

Figure 6.1 Vertiv™ Liebert® IntelliSlot Web Card Display



6.4 Liebert® IntelliSlot Relay Card

The Liebert® IntelliSlot Relay card (IS-RELAY) provides voltage-free contact closures for remote monitoring of alarm conditions.

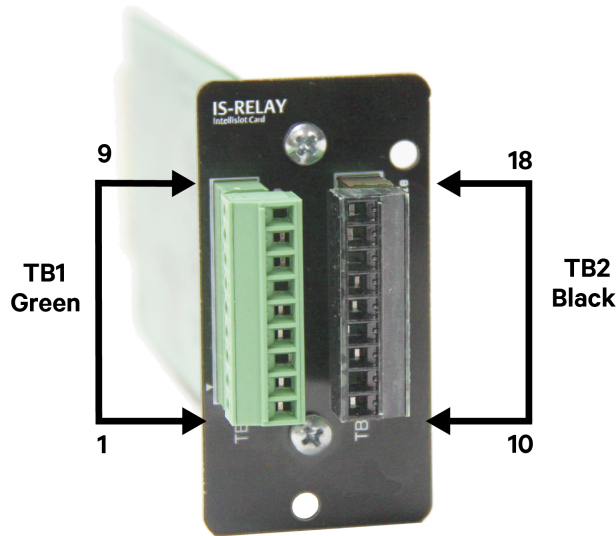
Delivering On Battery, On Bypass, Low Battery, Summary Alarm, UPS Fault and On UPS signals, the easy to install card integrates with AS/400 computers (additional cable required) and other relay contact monitoring systems.

The relay card is rated for 24 VAC/DC at 1A. and supported in any of the three Liebert® IntelliSlot bays on the Vertiv™ Liebert® EXM.

6.4.1 Vertiv™ Liebert® IntelliSlot Relay Card Pin Configuration

The card has two terminals blocks, TB1 (Green, numbered 1-9) and TB2 (Black, 10-18), as shown in **Figure 6.2** below .

Figure 6.2 Pin Location and Numbering



Refer to your Liebert product user manual for the pin configuration for the terminal blocks.

Table 6.2 Relay Card Pin Configuration

Pin	Function	Operation	Pin	Function	Operation
1	Common - Low Battery	—	10	Not Used	—
2	Low Battery	Closed if Low Battery point occurs.	11	Not Used	—
3	Low Battery	Closed if battery is OK	12	Not Used	—
4	Common - UPS Fault	—	13	Summary Alarm*	Closed if no alarm conditions are present
5	UPS Fault	Closed if UPS fault occurs	14	Summary Alarm*	Closed if Summary Alarm occurs
6	UPS Fault	Closed if no UPS failure	15	Common - Summary Alarm*	—
7	Common - On Battery	—	16	On UPS	Closed if On UPS (inverter) power
8	On Battery	Closed if On Battery power (Utility failure)	17	On Bypass	Closed if On Bypass
9	On Battery	Closed if not On Battery power (Utility OK)	18	Common - On Bypass	—

6.4.2 Vertiv™ Liebert® IntelliSlot Relay Card Jumper Setup

The Liebert® IntelliSlot Relay Card has five jumpers, P3 through P7, as shown in **Figure 6.3** on the next page . Each jumper connects two pins.

Figure 6.3 Jumper Location and Numbering

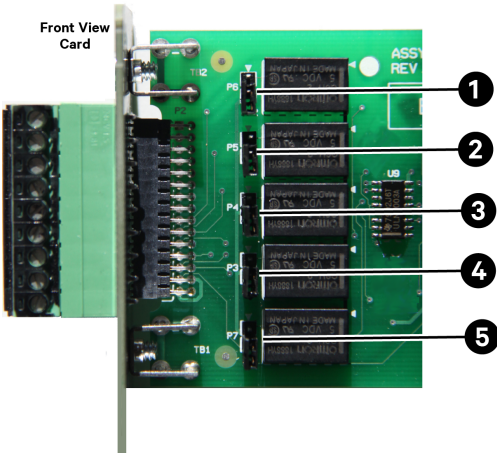


Table 6.3 Jumper Connections

Item	Jumper	Relay
1	P6	On Battery
2	P5	UPS Fault
3	P4	Low Battery
4	P3	On Bypass
5	P7	Summary Alarm

By default, all five jumpers have shunts installed. The two pins are shunted together to provide the functions shown in **Table 6.3** above allowing relay commons to be tied together.

The jumpers should be removed if there is any external voltage source that may intentionally or inadvertently be connected to the relay.

Removing the shunt from any two pins breaks the connection between the relay commons so they are not tied together.

NOTE: Refer to the Liebert® IntelliSlot Relay Card Manual (SL-23211), for additional details. the document is available at Vertiv Web site: www.vertiv.com.

7 Operation



WARNING! Risk of electrical shock. It can cause personal injury or death. This UPS has several circuits that are energized with high DC as well as AC voltages. Check for the voltage with both the AC and the DC voltmeters before working within the UPS. Check for the voltage with both the AC and the DC voltmeters before making contact. Only properly trained and qualified personnel wearing appropriate safety headgear, gloves, shoes and glasses should be involved in installing the UPS or preparing the UPS for installation. When performing maintenance with any part of the equipment under power, the service personnel and the test equipment should be standing on rubber mats.



AVERTISSEMENT! Risque de décharge électrique pouvant causer des blessures graves, voire mortelles. Ce système ASC comporte plusieurs circuits à haute tension c.a et c.c. Vérifiez les tensions au moyen de voltmètres c.a. et c.c. avant d'utiliser le système ASC. Vérifiez les tensions avec des voltmètres c.a. et c.c. avant d'établir tout contact. Seuls des employés qualifiés et dûment formés portant un casque, des gants, des chaussures et des lunettes de sécurité adéquats doivent se charger d'installer le système ASC ou de le préparer pour l'installation. Les responsables de l'entretien et l'équipement d'essai doivent reposer sur des tapis de caoutchouc lors de toute intervention sur une pièce d'équipement sous tension.

The Vertiv™ Liebert® EXM operates in the modes shown in [Vertiv™ Liebert® EXM Operating Modes](#) on the next page. This section describes various kinds of operating procedures under each operating mode, including transfer between operating modes, UPS setting and procedures for turning On/Off inverter. As shown in the [Liebert® EXM Battery Cabinet Manual \(SL-25656\)](#), the AC utility source is supplied through the input breaker, and the rectifier converts the alternating current into DC power. The inverter converts the AC power from the utility or DC power from an optional External Battery Cabinet 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 the maintenance or repair of the UPS is necessary, the load can be switched without interruption in the service using the optional Vertiv™ Liebert® MBC.

7.1 Touchscreen Control Panel

The Touchscreen Control Panel of Liebert® EXM is active whenever the UPS has input power. The touchscreen LCD on the front of the UPS permits:

- Logging in to the system
- Customizing the user interface
- Checking the status of the UPS and its external batteries, including all measured parameters, events and alarms
- Determining when users logged in and out
- Silencing alarms
- Turning the UPS On and Off
- Resetting faults
- Enabling Energy Saving Mode
- Scan the QR code at right to obtain a copy of the Touchscreen Control Panel Manual.



7.2 Access Level Log-In

The Touchscreen Control Panel provides security by limiting the authority to change how the UPS operates. Each of the four access levels offers different authority:

1. **Observer** - Viewing permission only, can choose graphic or text display, view logs and silence alarms; no PIN required
2. **Operator** - Permission to start and shut down the UPS, edit the display layout, test the battery, reset faults, enable or disable Eco Mode operation, enable equalize battery charging and acknowledge alarms; PIN required
3. **Administrator** - All functions of Operator plus permission to change PINs for Operator and Administrator level, configure the Status Gauge, set energy saving mode and change network communication protocols; PIN required
4. **Service** - All functions of Administrator plus permission to alter system configuration and change Service PIN; PIN required.

7.3 Default PINs

Vertiv Services sets PINs when setting up the UPS. These default PINs may be changed by those with [Administrator - All functions of Operator plus permission to change PINs for Operator and Administrator level, configure the Status Gauge, set energy saving mode and change network communication protocols; PIN required](#) above or [Access Level Log-In](#) above access. Default PINs are:

- **Operator:** 1234
- **Administrator:** 2345

NOTICE

Risk of unauthorized changes to operational settings. It can cause damage to the equipment. The default PIN numbers should be changed immediately to prevent unauthorized personnel from changing UPS operation or even shutting down the UPS. Refer to the **Touchscreen Control Panel Manual (SL-26200)**, available at Vertiv Web site: www.vertiv.com for details.

7.4 Vertiv™ Liebert® EXM Operating Modes

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

- Load on Inverter Mode
- Load on Battery Mode
- Auto-Restart Mode
- Eco Mode
- Load on Bypass Mode
- Module Redundancy Mode
- Frequency Converter Mode
- Power Conditioner Mode

- Maintenance Mode (Manual Bypass)
- Sleep Mode
- Paralleling Mode
- Output Voltage Adjustment
- Generator Mode

NOTE: The user controls and indicators referred to in these procedures are detailed in the UPS Control Panel Manual (SL-26200), available at Vertiv Web site: www.vertiv.com

NOTE: The audible alarm may sound at various points during these procedures. It can be canceled at any time by pressing the menu button (under any login), pressing Alarms and then pressing Alarms.

NOTE: This unit 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 Vertiv™ Liebert® EXM, the unit must be commissioned by a Vertiv authorized engineer.

Load on Inverter Modes

Operating in the Load on Inverter Mode, the rectifier of the Liebert® EXM 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.

Load on Battery Mode - Requires Optional External Battery Cabinet

When utility AC power fails, the Liebert® EXM protects the critical load by instantaneously channeling battery power from optional External Battery Cabinets to the inverter, which continues supporting the critical load without interruption. When the utility power returns and is within acceptable limits, the Liebert® EXM automatically shifts back to Load on Inverter Mode, with the rectifier powering the critical load.

Auto-Restart Mode

The battery may become exhausted following an extended AC utility failure. The inverter shuts down when the battery reaches the End of Discharge voltage (EOD). The UPS may be programmed to “Auto Recovery after EOD” after a delay time if the AC utility recovers. This mode and any delay time may be programmed by the commissioning engineer.

ECO Mode (Single-Module UPS System Only)

When ECO mode is selected, the Liebert® EXM switches inverter power from the UPS input to the bypass input to save energy by improving UPS efficiency. In this mode, the bypass is the preferred source. If the bypass voltage or frequency becomes outside preset limits, the UPS load is transferred back to the inverter.

Load on Bypass Mode

When the Liebert® EXM is operating in Load on Bypass Mode, the load is directly supported by utility power and is without battery backup protection.

The static transfer switch of Liebert® EXM will shift the load from the inverter to Load on Bypass Mode without 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 user

Module Redundancy Mode

When the Liebert® EXM is in Module Redundancy Mode, the load percentage is calculated using the available power module capacity or nameplate rating capacity, whichever capacity is lower.

Module redundancy mode can be set at the factory or by the user. A maximum of one module can be set for redundancy. Availability of this feature depends on module capacity of the frame. Refer to the UPS Control Manual (SL-26200), for instructions on setting this feature. The manual is available at Vertiv Web site, www.vertiv.com

Example 1

- Four 50kVA power modules installed
- Nameplate rating capacity = 150kVA
- One power module in redundant mode
- Configured capacity = 150kVA
- Load = 150kVA

The load percentage will be calculated based on the nameplate rating capacity = 150kVA capacity. In the event of a single power module fault, the system will signal a Loss of Redundancy Alarm and a Power Hardware Mismatch and continue in double-conversion mode and provide up to 150kVA capacity.

Example 2

- Four 50kVA power modules installed
- Nameplate rating capacity = 200kVA
- One power module in redundant mode
- Configured capacity = 150kVA
- Load = 150kVA

The load percentage will be calculated based on available power module capacity = 200kVA capacity. In the event of a single power module fault, the system will signal a Loss of Redundancy Alarm and a Power Hardware Mismatch Alarm. The system will continue in double-conversion mode and provide up to 150kVA capacity.

Example 3

- Four 50kVA power modules installed
- Nameplate rating capacity = 200kVA
- One power module in redundant mode
- Configured capacity = 150kVA
- Load = 175kVA

The load percentage will be calculated based on available power module capacity = 200 kVA capacity. The system will signal a Loss of Redundancy Alarm. The system will continue in double-conversion mode and provide up to 200kVA capacity.

Frequency Converter Mode

When the Vertiv™ Liebert® EXM is set to Frequency Converter Mode permits configuring the unit for 50Hz output, bypass is disabled and battery is optional to support load. This mode can only be enabled at the factory or by Vertiv Services.

Power Conditioner Mode

When Liebert® EXM is set to Power Conditioner Mode, the battery is disabled in this mode. This mode can only be enabled at the factory or by Vertiv Services.

Maintenance Mode

For maintenance or repair, the Liebert® EXM may be operated in Maintenance Mode. To place the Liebert® EXM in maintenance mode, follow the instructions in [Switching the UPS from Normal Operation to Maintenance Bypass](#) on page 56



WARNING! Risk of arc flash and electric shock. It can cause damage to the equipment, injury and death. The UPS input and output must be protected with external overcurrent protection devices. In the maintenance mode, the input and the output busbars remain energized and present an electric shock hazard.



AVERTISSEMENT! Risque d'arc ou de décharge électrique pouvant entraîner des dommages matériels, des blessures et même la mort. L'entrée et la sortie du système ASC doivent être protégées par des dispositifs de protection de surintensité externes. En mode d'entretien, les barres omnibus d'entrée et de sortie demeurent sous tension et présentent un risque de décharge électrique.

Paralleling Mode

This option is available only on 208V Input Parallel with the optional Vertiv™ Liebert® EXM Paralleling Cabinet. It can parallel the following:

- Two Liebert® EXM
- 60-100kW frames in any module capacity
- Redundant
- Can allow up to 200kW of load capacity

A sharing inductor and optional Liebert® EXM Paralleling Cabinet are required for parallel units.

NOTE: To parallel non-208 input voltages, an upstream transformer must drop the input voltage to 208V before the paralleling gear.

Output Voltage Adjustment

This feature allows a Liebert Customer Engineer to adjust the output voltage of the Liebert® EXM over a range of 5% to +5% of nominal. The output voltage adjustment can be used to compensate for any drop in line voltage that may occur when the UPS is a significant distance from the protected load. In addition, it can be used to optimize the UPS output voltage for loads that operate more efficiently at a voltage different from the nominal Liebert® EXM output voltage.

Generator Mode

The Liebert® EXM UPS can be set up for operation in Generator Mode by a Vertiv Services engineer. The setup requires connecting Pins J26: 2 to J26: 4. The battery charger is disabled in Generator Mode.

7.5 UPS Startup

The Liebert® EXM 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.



WARNING! Risk of electrical shock and arc flash. It can cause damage to the property, 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.



AVERTISSEMENT! Risque d'arc ou de décharge électrique pouvant entraîner des dommages matériels, des blessures et même la mort. Durant cette procédure, les bornes de sortie seront sous tension. Si un équipement chargé est raccordé aux bornes de sortie du système ASC, veuillez vous informer auprès de l'utilisateur de la charge s'il est sécuritaire d'appliquer une alimentation à la charge. Si la charge n'est pas prête à recevoir une alimentation, alors assurez-vous qu'elle est isolée sécuritairement des bornes de sortie du système ASC

NOTICE

Risk of improper startup when feeding a downstream transformer. It can cause damage to the connected equipment. If the UPS is supplying a downstream transformer not provided by Liebert, the UPS should be put on maintenance bypass to energize it to mitigate the risk of in-rush current.

7.5.1 Startup Procedure

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

1. Log in as Operator, Administrator or Service.
2. Ensure that the Vertiv™ Liebert® power module assembly ready switches are latched (in Down position).
3. Close the external input circuit breaker and connect input power. The touchscreen activates.
4. The rectifier goes through its startup sequence and the bypass static switch is activated.
5. Close the external output circuit breaker.
6. Touch the *OPERATE* Tab.
7. Touch the *Inverter On* button. When asked to confirm, touch *On* again.

The power module run lights will start flashing green while the unit goes through the inverter startup sequence. After about a minute, the inverter will turn On, the static bypass will open and the power module run lights will be solid green.

8. Close the *Battery Breaker*.

7.5.2 Startup in Eco Mode

Eco Mode is available only on a single-module Vertiv™ Liebert® EXM.

- Log in as Operator, Administrator or Service.
- Touch the *OPERATE* Tab.
- Touch *Energy Saving Mode Activation Setup*.
- In the drop-down menu, touch *Enable*.
- Touch *Save*.

The UPS should now be operating in Load on Bypass Mode with the inverter on standby. The status bar at the top of the screen will display ENERGY SAVING MODE ACTIVE.

7.5.3 Switching Between UPS Operation Modes

To switch from Load on Inverter Mode to Load on Bypass Mode

- Log in as Operator, Administrator or Service.
- Touch the *OPERATE* Tab.
- Touch *Inverter Off* button to switch to Load on Bypass Mode.
- To continue, confirm turning Off the inverter when prompted.

NOTICE

Risk of power loss to connected load. It can cause damage to the equipment. The load equipment is not protected from supply aberrations, such as spikes, sags and failures, when the Liebert® EXM is operating in Load on Bypass Mode.

To Switch From Load on Bypass Mode to Load on Inverter Mode:

- Log in as Operator, Administrator or Service.
- Touch the *OPERATE* Tab.
- Touch *Inverter On* button.
- To continue, confirm turning On the inverter when prompted

7.6 Switching the UPS from Normal Operation to Maintenance Bypass

Follow the procedure below to transfer the load from the UPS inverter output to the Maintenance Bypass System.

NOTICE

Risk of loss of power to the connected load. It can cause damage to the equipment. 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 touchscreen 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 UPS is operating normally

1. Log in as Operator, Administrator or Service.
2. Touch the *OPERATE* Tab.
3. Touch the *Inverter Off* button.
4. To continue, confirm turning Off the inverter when prompted.

NOTE: Pressing Silence from the OPERATE Tab cancels the audible alarm, but leaves the warning message displayed until the appropriate condition is rectified.

5. Open the Vertiv™ Liebert® MBC door to gain access to the Bypass Isolation Breaker (BIB), Maintenance Bypass Breaker (MBB) and Maintenance Isolation Breaker (MIB).
6. When the lamp indicator on the MBC is illuminated, press and hold the adjacent push button and remove the Key from the lock (KO).
7. Insert the *Key* into the lock on the MBB and turn the *Key*.
8. Close the *MBB*.
9. Verify the MBB is closed. Failure to close the MBB will interrupt power to the load.
10. Open the *MIB*.
11. Remove the key from the lock on the MIB. Insert the key into the lock (KO) and turn the key.

The UPS system 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 7.1** on page 58.

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 7.2** on page 61.



WARNING! Risk of electrical shock and arc flash. It can cause damage to the property, injury and death. Wait 5 minutes for the internal DC busbar capacitors to discharge before attempting to remove the internal protective barriers.



AVERTISSEMENT! Risque d'arc ou de décharge électrique pouvant entraîner des dommages matériels, des blessures et même la mort. Attendez 5 minutes que les condensateurs de barre omnibus c.c. internes se déchargent avant d'essayer de retirer les barrières de protection internes.



WARNING! Risk of electrical shock and arc flash. It can cause damage to the property, injury and death. Even with the UPS in maintenance bypass and Off, portions of the Vertiv™ Liebert® EXM system are still energized. Service must be performed by properly trained and qualified personnel only.

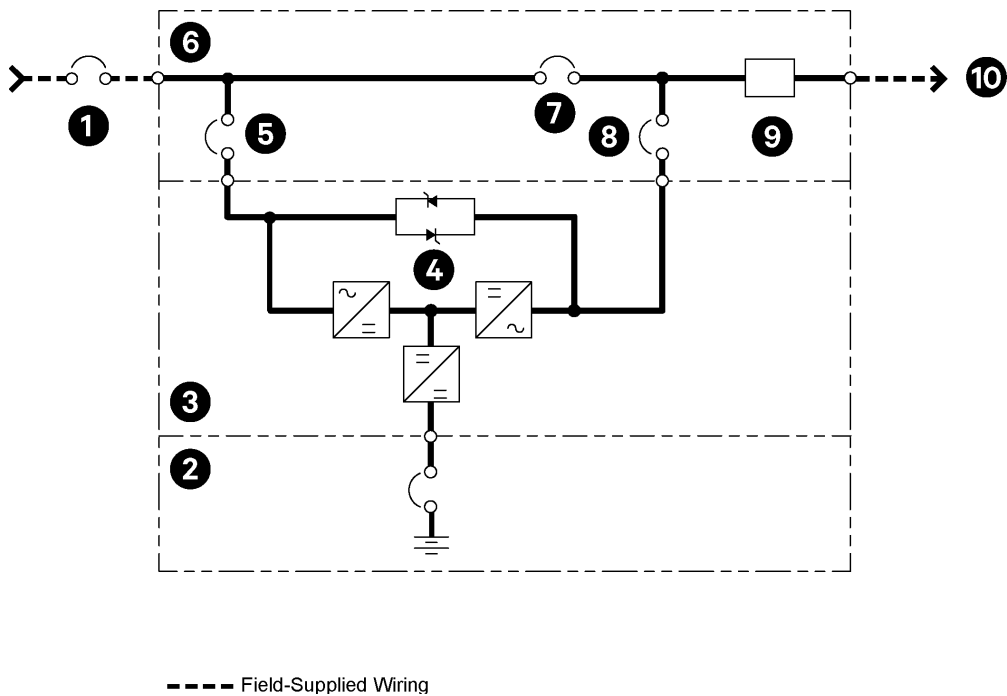


AVERTISSEMENT! Risque d'arc ou de décharge électrique pouvant entraîner des dommages matériels, des blessures et même la mort. Même lorsque le système ASC est en mode de dérivation d'entretien et hors tension, des parties du système EXM de Liebert demeurent sous tension. L'entretien ne doit être confié qu'à un personnel qualifié et dûment formé.

NOTICE

Risk of power loss to connected load. It can cause damage to the equipment. The load equipment is not protected from supply aberrations, such as spikes, sags and failures, when the Liebert® EXM is operating in Load on Bypass Mode.

Figure 7.1 One- Line Diagram, Single - Input UPS with 3-Breaker Maintenance Bypass Cabinet and Panelboard



Item	Description	Item	Description
1	* Bypass AC Input 3 Wire + GND	6	MAINTENANCE BYPASS CABINET
2	BATTERY	7	MBB (Maintenance Bypass Breaker)
3	UPS CABINET	8	MIB (Maintenance Isolation Breaker)
4	Static Bypass	9	Output Busbar
5	BIB (Bypass Isolation Breaker)	10	AC Output 480V 3 Wire + GND
* External Overcurrent Protection By Others			

Notes To Figure

- 1. Install in accordance with the national and the local electrical codes.
- 2. The input and the bypass must share the same single source.
- 3. Vertiv recommends a grounding conductor.
- 4. The bypass and the rectifier input and output cables must be run in the separate conduits
- 5. The control wiring must be run in the separate conduits.

7.7 Switching the UPS from Maintenance Bypass to Normal Operation

Follow the procedure below to transfer the load from the Maintenance Bypass system to the UPS inverter output.

These conditions must be met for this operation to proceed:

- The UPS must be operating normally.
- The BIB breaker must be closed.
- The UPS system must be operating in Load on Bypass Mode.

NOTICE

Risk of loss of power to the connected load. It 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 touchscreen 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. Verify that the Vertiv™ Liebert® EXM is operating in Load on Bypass Mode.

NOTE: Pressing the Alarm Silence Switch cancels the audible alarm, but leaves the warning message displayed until the appropriate condition is rectified.

2. Open the *Vertiv™ Liebert® MBC door* to gain access to the bypass isolation breaker (BIB), maintenance bypass breaker (MBB) and the maintenance isolation breaker (MIB).
3. When the Lamp indicator on the MBC is illuminated, press and hold the adjacent *push* button and remove the key from the lock (KO).
4. Insert the *key* into the lock on the MIB, and turn the *key*.
5. Close the *MIB*.
6. Verify the MIB is closed. Failure to close the MIB will interrupt power to the load.
7. Open *MBB*.
8. Remove the *key* from the lock on the MBB.
9. Insert the *key* into the lock (KO) and turn the *key*.

The UPS system is now supplying power to the critical load.

10. Log in as Operator, Administrator or Service.
11. Touch the *OPERATE* Tab.
12. Touch the *Inverter On* button.
13. To continue, confirm turning On the inverter when prompted.

7.8 De-energize Vertiv™ Liebert® EXM with Maintenance Bypass Cabinet

NOTICE

Risk of loss of power to the connected load. It can cause damage to the equipment. This procedure must be performed by properly trained and qualified personnel who are knowledgeable about the operation of this system. This procedure will remove power from the critical bus. Take precautions by providing a backup power supply or shutting down equipment before de energizing the Liebert® EXM.

To de-energize the system:

1. Log in as Operator, Administrator or Service.
2. Touch the *OPERATE* Tab.
3. Touch the *Inverter Off* button.
4. To continue, confirm turning Off the inverter when prompted.
5. Open all *battery circuit breakers*(s) including the internal battery breaker (if applicable).
6. If the MBC is a vertiv cabinet, open the Maintenance Isolation Circuit Breaker (MIB). If the MBC is a customer-issued switchgear or a non-Vertiv cabinet, open the breaker(s) that supply power to the critical bus.
7. Open the *Rectifier Input Circuit Breaker* and Bypass Input Breaker (if dual input).
8. If the MBC is a customer-issued switchgear or a non-Vertiv cabinet, open the breaker(s) that supply power to the UPS input and bypass input (if dual input).
9. Allow 5 minutes for all DC circuits and capacitors to fully discharge.
10. Open the *external feeder breaker* to the MBC or bypass switchgear.
11. Install a Lockout / Tagout on the external feeder breaker to the MBC or bypass switchgear.
12. Use a digital multimeter to verify there is no AC or DC voltage present at the UPS input, output and bypass busbars.
13. Use a digital multimeter to verify there is no AC or DC voltage present at the MBC BIB, MIB and MBB breakers.

7.9 De-energize Liebert® EXM Without Maintenance Bypass Cabinet

NOTICE

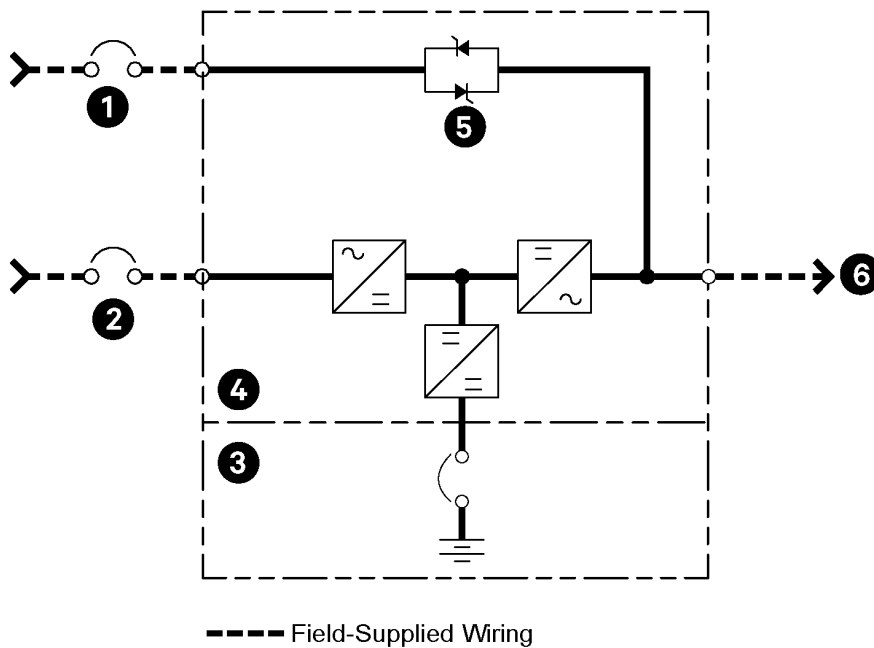
Risk of loss of power to the connected load. It can cause damage to the equipment. This procedure must be performed by properly trained and qualified personnel who are knowledgeable about the operation of this system. This procedure will remove power from the critical bus. Take precautions by providing a backup power supply or shutting down equipment before de energizing the Liebert® EXM

To de-energize the Liebert® EXM:

1. Log in as Operator, Administrator or Service.
2. Touch the *OPERATE* Tab.
3. Touch the *Inverter Off* button.
4. To continue, confirm turning Off the inverter when prompted.
5. Open all battery circuit breaker(s) including the internal battery breaker (if applicable).
6. Open the UPS output circuit breaker(s).
7. Open the UPS input circuit breaker and bypass circuit breaker (dual input systems only).
8. Allow 5 minutes for all the DC circuits and capacitors to fully discharge.

9. Use a digital multimeter to verify there is no AC or DC voltage present at the UPS input, output and bypass busbars.

Figure 7.2 Typical Configuration for Single UPS



Item	Description	Item	Description
1	*Bypass AC Input 4-Wire + GND (See step 6)	4	UPS
2	*Rectifier AC Input 4-Wire + GND (See step 6)	5	Static Bypass
3	Battery	6	AC Output 208V 4-Wire + GND
*External Overcurrent Protection by others			

Notes To Figure

1. Install in accordance with the national and the local electrical codes.
2. The input and the bypass must share the same single source.
3. A neutral is required form the system AC input source. Vertiv recommends installing a full capacity neutral conductor and grounding conductors.
4. The bypass and the rectifier inputs and output cables must be run in the separate conduits.
5. The control wiring must be run in the separate conduits.
6. The customer must supply shunt trip breakers with 120V coils to the bypass and the rectifier inputs.
7. An internal battery breaker is optional on a UPS with internal batteries; a battery breaker is factory-supplied with the external Vertiv™ Liebert® EXM battery cabinets.

7.10 Parallel Operations - Determine Control Panel Software



Context Menu

Parallel operation differs depending on the software in the control menu. To determine which version is installed on the UPS, activate the TouchScreen menu, touch the Context Menu and touch About.

If the firmware is V1.1, perform the appropriate steps in [Parallel Operations - Software Version 1.1](#) below

7.11 Parallel Operations - Software Version 1.1

7.11.1 De-energize a Liebert® EXM Parallel System - Software Version 1.1

To shut down a UPS parallel system using V1.1 controller software:

1. Log in as Operator, Administrator or Service.
2. Verify that the system and the connected load are prepared for shutdown.
3. Touch the *OPERATE* Tab.
4. Touch the *Inverter Off* button. A pop-up window states that the system is operating in a multi-module system and asks whether to control one inverter or the entire system.
5. Touch *System*. The power module run lights will start flashing yellow while the unit goes through the inverter shutdown sequence. After a few seconds, the inverter will turn Off, the static bypass will close and the power module run lights will be Off. All UPS units in the system will go to bypass.
6. Check the parallel switchgear.

NOTICE

Risk of loss of power to the connected load. It can cause damage to the equipment. The following procedure will remove power from the critical bus. Before beginning these steps, shut down the connected load or transfer the connected load to an input power supply not dependent on the Vertiv™ Liebert® EXM system that is being de-energized.

- a. If the parallel switchgear is a matching vertiv cabinet, open the *Maintenance Isolation Circuit Breaker (MIB)*.
- b. Open all *Module Output Breakers (MOB)*.
7. Open the input breaker for each UPS and the breaker feeding the Maintenance Bypass Breaker (MBB) in the parallel switch gear.

The system is now de-energized, and its output power supply is Off.

7.11.2 Re-energize a Vertiv™ Liebert® EXM Parallel System - Software Version 1.1

To restart a Liebert® EXM parallel system from a fully powered-down condition using V1.1 controller software:

1. Log in as Operator, Administrator or Service.
2. Close the *input breakers* for all UPS units
3. The LCD on each UPS will turn On, the LCD icons will begin flashing green and the rectifier will start.

The bypass and output icons will illuminate green.

The battery LED will illuminate red.

4. Close the *Module Output Breakers (MOB)* circuit breaker to each UPS.
5. Close the *MIB circuit breaker*.



WARNING! Risk of electric shock. It can cause damage to the equipment, injury and death. The following procedure will supply power to the critical bus. Before beginning, notify all personnel that input power is being supplied to the circuits. Verify that the connected load is prepared for input current.

6. Touch the *OPERATE* Tab.
7. Touch the *Inverter On* button. A pop-up window states that the system is operating in a multi-module system and asks whether to start one inverter or the entire system.
8. Touch *System*.

The LCD icons will start flashing green while the unit goes through the inverter startup sequence. After about a minute, the inverter will turn On, the static bypass will open and the icons will be solid green.

9. Close all the *battery breakers*.

7.12 Emergency Shutdown With EPO

This circuit has been designed to switch Off the UPS in emergency conditions (e.g., fire, flood, etc.). The system will turn Off the rectifier, inverter and stop powering the load immediately (including the inverter and bypass), and the battery stops charging or discharging.

If the input utility is present, the controls of the UPS will remain active; however, the output will be turned Off. To remove all power from the UPS, the external feeder breaker should be opened.

7.13 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 in the UPS configuration (set by factory or by Vertiv Services)
- After the “Auto Recovery after EOD Delay Time” expires (the default delay is 10 minutes)

During the auto recovery delay, the Liebert® EXM 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 system must be restarted manually.

7.14 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, 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. Log in as Operator, Administrator or Service.
2. Touch the *OPERATE* tab.
3. Touch the yellow *Reset* button to clear the emergency power Off state.
4. Press the *Inverter On* button on the right side of the Operator Control Panel for longer than 2 seconds (after the rectifier has qualified).

NOTE: The rectifier will start automatically 5 minutes after the of overtemperature fault is cleared.

5. After the EPO button is pressed, if the input utility is removed, the UPS will shut down completely. When input utility is restored, the EPO condition will clear, and the UPS will enable the static bypass and restore the output.

7.15 Battery Protection

7.15.1 Battery Undervoltage Warning

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

7.15.2 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. Refer to **Table 8.9** on page 70.

7.16 Operation



WARNING! Risk of electrical shock and arc flash. It can cause damage to the property, injury and death. The Liebert® EXM contains high voltages internally. Components that can only be accessed by opening the protective cover with tools cannot be serviced or replaced by the user. Only properly trained and qualified service personnel are authorized to remove the protective covers.



AVERTISSEMENT! Risque d'arc ou de décharge électrique pouvant entraîner des dommages matériels, des blessures et même la mort. L'armoire Liebert® EXM contient des tensions élevées à l'interne. L'utilisateur ne peut ni entretenir ni remplacer des composants accessibles uniquement en ouvrant le couvercle de protection avec des outils. Seul du personnel de service qualifié et dûment formé est autorisé à retirer les couvercles de protection

The Liebert® EXM operates in the modes shown in **Table 7.1** below. This section describes various kinds of operating procedures under each operating mode, including transfer between operating modes, UPS setting and procedures for turning On/Off inverter.

Table 7.1 UPS Operating Modes

Operating Mode	Descriptions	
Load on Inverter	NORMAL	UPS powers the load
Load on Bypass	BYPASS	The load power supply is provided by the static bypass. This mode can be regarded as a temporary transition mode between Load on Inverter Mode and Load on Bypass Mode, or a temporary abnormal operating status.
Maintenance Mode	MAINT	UPS shuts down, the load is connects to the mains through the Liebert® MBC. In this mode the load is not protected against abnormal input utility power.

As shown in, the Vertiv™ **Liebert® EXM Battery Cabinet Manual (SL-25656)**, the AC utility source is supplied through the input breaker, and the rectifier converts the alternating current into DC power. The inverter converts the AC power from the utility or DC power from an optional External Battery Cabinet 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 using the optional Vertiv™ Liebert® MBC.

7.17 Static Bypass Switch

The circuit block labeled “*Static Bypass*” 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 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 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.

NOTICE

Risk of power loss to connected load. It can cause damage to the equipment. The load equipment is not protected from supply aberrations, such as spikes, sags and failures, when the Liebert® EXM is operating in Load on Bypass Mode.

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8 Specifications and Technical Data

8.1 Conformity and Standards

The Vertiv™ Liebert® EXM has been designed to conform to the following standards:

Safety	UL 1778 4th Edition, CSA 22.2 107.3
Surge	IEC 61000-4-5 Criteria B
Harmonics	IEC 61000-3-4
Electrical Fast Transient	IEC 61000-4-4, Criteria B
ESD	IEC 61000-4-2, Criteria B
FCC	Part 15, Class A
Radiated Immunity	IEC 61000-4-3, Criteria A
Conducted Immunity	IEC 61000-4-6, Criteria A
Low-Frequency Signals	IEC 61000-2-2 Criteria A
Transportation	ISTA Procedure 1H
ISO	9001
Misc	OSHA, ASME, NEMA PE-1

8.1.1 ENERGY STAR Certification

The Liebert® EXM UPS is ENERGY STAR certified satisfying “ENERGY STAR Program Requirements Product Specification for Uninterruptible Power Supplies (UPS) - Eligibility Criteria, Version 2.0.”

8.2 UPS Environmental

The Liebert® EXM is designed to operate under the following environmental conditions without damage or degradation in electrical operating characteristics:

Table 8.1 Environmental Requirements

Item	Requirements
Acoustical Noise, dBA, at 55 in. (1.4m)	59
Operating Altitude	4922 ft. (1500m) 1% maximum kW derate per 328 ft. (100m) rise between 4922 ft. and 9843 ft. (15000m and 3000m)
Relative Humidity	95%
Operating Temperature, °F (°C)	104 (40)
UPS Storage/Transport Temperature, °F (°C)	-4 to 158 (-20 to 70)

Table 8.2 UPS Mechanical Characteristics

Rated Power, kVA		20 - 100
Dimensions, W x D x H, in (mm)	23-5/8 x 39-3/8 x 78-3/4 (600 x 1000 x 2000)	
Weight, lb. (kg)	See Table 3.1 on page 12 for weights	
Color	RAL 7021 (Black)	
Protection Degree IEC (60529)	IP20	

8.3 UPS Electrical Characteristics

Refer to additional circuit breaker notes in [Accessory Fuses and Back-Feed Breaker Wiring](#) on page 26 .

NOTE: The breakers and cables used must be in accordance with the NEC ANSI/NFPA 70. A disconnect breaker must be provided for the AC input, the DC input and the AC output. Recommended cable sizes are suitable for operation at a maximum temperature of 104°F (40°C).

Table 8.3 UPS Currents and Terminals - Input (for Single-Input Unit, 208V Operation)

Unit Rating	Nominal Input Current	Maximum Input Current	OCP Device Rating	Bolt Size	75°C Wire Current, Total	Copper Wire	Aluminum Wire
20	59	68	90	M12	115	(1) #2	(1) 1/0
40	119	136	175	M12	230	(1) 4/0	(2) 1/0
60	178	205	300	M12	400	(2) 3/0	(2) 4/0
80	237	273	350	M12	460	(2) 4/0	(2) 300 kcmil
100	297	341	450	M12	610	(2) 350	(2) 400 kcmil

Table 8.4 UPS Currents and Terminals - Input (for Dual-Input Unit only, 208V Operation)

Unit Rating	Nominal Input Current	Maximum Input Current	OCP Device Rating	Bolt Size	75°C Wire Current Total	Copper Wire	Aluminum Wire
20	59	68	90	M12	115	(1) #2	(1) 1/0
40	119	136	175	M12	230	(1) 4/0	(2) 1/0
60	178	205	300	M12	400	(2) 3/0	(2) 4/0
80	237	273	350	M12	460	(2) 4/0	(2) 300 kcmil
100	297	341	450	M12	610	(2) 350	(2) 400 kcmil

Table 8.5 UPS Currents and Terminals - Bypass Input (for Dual-Input Units, 208V Operation)

Unit Rating	Nominal Input Current	OCP Device Rating	BOLT SIZE	75°C Wire Current, total	Copper Wire	Aluminum Wire
20	56	70	M12	115	(1) #2	(1) #2
40	111	150	M12	175	(1) 3/0	(1) 4/0
60	167	225	M12	285	(1) 300	(2) 2/0
80	222	300	M12	400	(2) 3/0	(2) 4/0
100	278	350	M12	460	(2) 4/0	(2) 300 kcmil

Table 8.6 UPS Currents and Terminals - Output 208V

Unit Rating	Nominal Output Current	OCP Device Rating	Bolt Size	75°C Wire Current, total	Copper Wire	Aluminum Wire
20	56	70	M12	115	(1) #2	(1) #2
40	111	150	M12	175	(1) 3/0	(1) 4/0
60	167	225	M12	285	(1) 300	(2) 2/0
80	222	300	M12	400	(2) 3/0	(2) 4/0
100	278	350	M12	460	(2) 4/0	(2) 300 kcmil

Table 8.7 AC/AC Efficiency, Loss and Air Exchange

AC/AC Efficiency		Data				
Load on Inverter (dual conversion), %		95.5 maximum				
Inverter Efficiency (DC/AC) (battery at nominal voltage 288VDC and full-rated linear load)						
Rated Power, kVA		20-100				
Load on Battery, %		94.8, Maximum				
Heat Losses and Air Exchange						
Rated Power, kVA		20	40	60	80	100
Load on Inverter, kW		0.9	1.8	2.7	3.6	4.5
No Load, kW		0.3	0.6	0.9	1.2	1.5
Maximum forced air cooling (front intake, rear exhaust), L/sec (m³/hr)		32 (115)	64 (231)	96 (346)	128 (462)	160 (575)
Heat Dissipation, BTU/Hr (kWH)						
Without Transformer		3843 (1.13)	7610 (2.23)	11,278 (3.30)	14,977 (4.39)	18,645 (5.46)

Table 8.8 Rectifier Input

Parameter	20-100kVA	
AC Input Parameters	50/60Hz, 3-Phase, 4-Wire Plus Ground	
Rated AC Voltage	208/120V	220/127V
Input Voltage Range, Startup/Operating	177-253VAC	187-264VAC
Input Voltage Range, Operating *	125-253VAC	132-264VAC
Frequency	50 or 60HZ (40-70Hz Range)	
Power Factor	0.99 Full Load, 0.98 Half Load	
THD	5% Full Load	
Derated operation for reduced input voltage: 208V Operation (125VAC-177VAC), 220V Operation (132VAC-187VAC)		

Table 8.9 Battery DC Intermediate Circuit

Parameter	20 - 100kVA
Battery Bus Voltage	288
Number of Lead-Acid Cells	144 = (24 x 6 cell [12V] blocks), nominal
Float Voltage	2.25V/cell, selectable from 2.2 - 2.3V/cell
Temperature Compensation	-3.0mV/°C, selectable from 0 to -5.0mV/°C around 77°F (25°C) or 86°F (30°C) or inhibit
Ripple Voltage	≤1%
Ripple Current	≤5%
Boost Charge Voltage	2.35V/cell (selectable from 2.30-2.40V/cell)
Boost Control	Float-boost current trigger 0.050 C10 (selectable 0.030-0.070) Boost-float current trigger 0.010 C10 (selectable 0.005-0.025) 24 hr safety time-out (selectable 8-30 hr) Boost charge mode inhibit also selectable
End of Discharge	1.63 V/cell for lower EOD timer (10-45 minutes, 15 default) 1.75 V/cell for upper EOD timer. (46-180 minutes, 60 default)
Battery Charge Operation	2.35 V/cell (selectable from 2.3-2.4V/cell) Constant current and constant voltage charge mode Programmable auto trigger or inhibit of boost mode
Battery Charging Power Maximum Current	UPS (kVA) 20, 40, 60, 80, 100 Battery Charging Power (kW) 9, 12, 15 Maximum Charging Current (A) 9, 18, 27, 36, 45

Table 8.10 Inverter Output to Critical Load

Parameter	20-100 kVA
Rated AC Voltage	208/120V or 220/127V, 50/60Hz, 3-Phase, 4-Wire Plus Ground
Frequency *	50/60Hz
Overload Capacity	105% - 110% of full load for 60 minutes at 104°F (40°C) ambient 110% - 125% of full load for 10 minutes at 104°F (40°C) ambient 125% - 150% of full load for 60 seconds at 104°F (40°C) ambient >150% of full load for a minimum of 200 milliseconds at 104°F (40°C) ambient
Fault Current	Short circuit for 200 ms
Non-Linear Load Capability	100%
Neutral Current Capability	170%
Steady State Voltage Stability	±1% (balanced load)
Voltage Regulation	±1% for balanced load ±5% for 100% unbalanced load
Phase Balance	120° ±1° for balanced load 120° ±15°± for 100 unbalanced load
Transient Voltage Response	5%
THD	<1.5% (0-100% linear load) <5% (0-100% non-linear load)
Sync Frequency Range	Rated frequency ± 2Hz (selectable ± 0.5 to ± 3Hz)
Frequency Slew Rate	0.1-3Hz

Table 8.10 Inverter Output to Critical Load (continued)

Parameter	20-100 kVA
Frequency Regulation	±0.1% (single Liebert® Power Module Assembly)
	±0.25% (five Liebert® Power Module Assemblies)
Voltage Adjustment Range	±5%
Factory-set to 60Hz; 50Hz selectable by commissioning engineer. Frequency converter operation is also selectable.	

Table 8.11 Battery Cabinet System - UPS and Battery Cabinet

UPS Rating, kVA	Battery Cabinet Breaker	Maximum Battery Current, A	Battery Cabinet Size, mm
20-40	225A	187	320, 600, 880
60-100	465A	465	600, 880

Table 8.12 Bypass Input

Parameter	20-100 kVA
Rated AC Voltage	208/120V or 220/127V, 50/60Hz, 3-Phase, 4-Wire Plus Ground
Overload	110% load, Continuous
Upstream Protection, Bypass Line	Thermomagnetic circuit-breaker, rated up to 125% of nominal output current
Current Rating of Neutral Cable, A	1.7*In
Frequency, Hz	50 or 60
Transfer Time Between Bypass and Inverter, ms	Uninterrupted transfer: <1ms interrupted transfer: <20ms(40,60,80,100, can be selected)
Bypass Voltage Tolerance, %VAC	Upper limit: +10, +15 or +20, default +15 Lower limit: -10, -20, -30 or -40; default: -20 (delay time to accept steady bypass voltage: 10 sec)
Bypass Frequency Tolerance, %	+/- 10% or +/- 20% default: +/- 20%
Synchronization-Window	±0.5, 1,2,3Hz default value: ±2Hz

Table 8.13 Recommended Lug Sizes (Compression Type) M12, 1/2-in. Bolt

Cable Size	T&B Copper Two Holes	T&B Aluminum Two Holes
#6AWG	256-030695-868	—
#4AWG	256-030695-733	—
#2-3AWG	54811BE	—
#1AWG	54857BE	—
#1/0AWG	256-30695-593	—
#2/0AWG	54862BE	60238
#3/0AWG	54864BE	60244
#4/0AWG	54866BE	60250

Table 8.13 Recommended Lug Sizes (Compression Type) M12, 1/2-in. Bolt (continued)

Cable Size	T&B Copper Two Holes	T&B Aluminum Two Holes
250kcmil	54868BE	60256
300kcmil	54870BE	60262
350kcmil	54872BE	60267
400kcmil	54874BE	60269
500kcmil	54876BE	60273
600kcmil	54878BE	60275
700kcmil	54879BE	60277
750kcmil	54880BE	60278

9 Maintenance

9.1 Safety Precautions

Observe the safety precautions in [Important Safety Instructions](#) on page 1.

Only properly trained and qualified personnel should perform maintenance on the UPS system.

Observe all of the warnings and cautions below before performing any maintenance on the UPS system and associated equipment. Also observe the manufacturer's safety precautions pertaining to the battery, along with the battery safety precautions in this document.



WARNING! Risk of electrical shock and arc flash. It can cause damage to the property, injury and death. Only Vertiv or Vertiv-trained service personnel should work on this equipment. Both AC and DC high voltages are present in lethal amounts within this equipment. Extreme care should be taken when working around the UPS equipment. Always identify the source of connecting wiring prior to disconnecting. Mark any disconnected wires, so they can be properly reconnected. Do not substitute parts except as authorized by Vertiv. Maintain the UPS cabinets free of foreign materials such as solder, wire cuttings, etc. Call Vertiv Services if you are not sure of the procedures to follow or if you are not familiar with the design or operation of the equipment.



AVERTISSEMENT! Risque d'arc ou de décharge électrique pouvant entraîner des dommages matériels, des blessures et même la mort. L'entretien et la réparation de cet équipement doivent être confiés exclusivement à un personnel qualifié du Vertiv ou formé par Vertiv. Des hautes tensions c.a. et c.c. mortelles sont présentes dans cet équipement. Faites preuve d'une grande prudence lorsque vous travaillez à proximité d'un système ASC. Identifiez toujours la source d'un câble de raccordement avant de le débrancher. Identifiez les câbles déconnectés afin de pouvoir les reconnecter correctement. Ne remplacez aucun composant sans l'autorisation expresse du Vertiv. Assurez-vous que les armoires d'ASC sont exemptes de matériaux étrangers tels que des résidus de soudure, des bouts de câble, etc. Communiquez avec Vertiv Services si vous doutez de la procédure à suivre ou si la conception ou le fonctionnement de l'équipement ne vous sont pas familiers.



WARNING! Risk of electrical shock and arc flash. It can cause damage to the property, injury and death. Extreme caution is required when performing maintenance. Be constantly aware that the UPS system contains high DC as well as AC voltages. With input power Off and the optional battery cabinet disconnected, the high voltage at filter capacitors and power circuits should be discharged within 30 seconds. However, if a power circuit failure has occurred, you should assume that high voltage still exists after shutdown. Check with a voltmeter before making contact. AC voltage will remain on the bypass and output contactors and the static bypass switch, unless the associated external circuit breakers are opened. Check for voltage with both AC and DC voltmeters before making contact. When the UPS system is under power, both the operator and any test equipment must be isolated from direct contact with earth ground and the UPS chassis frame by using rubber mats. Some components within the cabinets are not connected to chassis ground. Any contact between floating circuits and the chassis is a lethal shock hazard. Use differential oscilloscopes when measuring a floating circuit. The differential input should have at least 800 Vrms common mode input rating and a common mode rejection ratio of at least 80 dB. Exercise caution that the test instrument exterior does not make contact, either physically or electrically, with earth ground. In the case of fire involving electrical equipment, use only carbon dioxide fire extinguishers, or others approved for use in electrical fire fighting.



AVERTISSEMENT! Risque d'arc ou de décharge électrique pouvant entraîner des dommages matériels, des blessures et même la mort. Les opérations d'entretien requièrent une extrême prudence. Soyez toujours conscient du fait que le système ASC contient des tensions c.c. et c.a. élevées. Une fois l'alimentation d'entrée et du boîtier facultatif de batteries coupées, la haute tension aux condensateurs de filtrage et aux circuits d'alimentation devrait se dissiper en moins de 30 secondes. En cas de défaillance d'un circuit d'alimentation, toutefois, il importe de présumer qu'une tension élevée est présente même après l'arrêt. Vérifiez toujours les tensions avec un voltmètre avant d'établir des contacts. Les contacteurs de dérivation et de sortie, de même que le commutateur statique de dérivation, continueront d'afficher une tension c.a. à moins que les disjoncteurs externes associés ne soient ouverts. Vérifiez les tensions avec des voltmètres c.a. et c.c. avant d'établir tout contact. Lorsque le système ASC est sous tension, les responsables de l'entretien et l'équipement d'essai doivent reposer sur des tapis de caoutchouc pour prévenir tout contact direct avec le sol et avec le châssis du système lors des interventions. Certains composants à l'intérieur des armoires ne sont pas connectés à la masse du châssis. Tout contact entre les circuits flottants et le châssis présente un risque de décharge mortelle. Utilisez des oscilloscopes différentiels lors des mesures d'un circuit flottant. L'entrée différentielle devrait être d'au moins 800 Vrms en mode commun et avoir un taux de réjection de mode commun d'au moins 80 dB. Il importe de veiller à ce que l'extérieur des équipements d'essai n'entre pas en contact physique ou électrique avec le sol. En cas d'incendie associé à du matériel électrique, n'utilisez que des extincteurs à dioxyde de carbone ou homologués pour la lutte contre les incendies d'origine électrique

9.2 Limited-Life Components

The Vertiv™ Liebert® EXM UPS has a design life well in excess of 10 years. Well-maintained units can continue to provide economic benefits for 20 years or more. Long-life components are used in the UPS wherever practical and cost effective. However, due to the currently available component material, manufacturing technology limitations and the general function and use of the component, a few components in your Liebert® EXM will have a shorter life cycle and require replacement in less than 10 years.

The following components utilized in your UPS system have a limited life cycle and are specifically exempt from warranty. To prevent a wear-out failure of one of these components affecting your critical load operations, Vertiv recommends these components be periodically inspected and replaced before the expected expiration of their life cycle. The expected life of each component listed below is simply an estimate and is not a guarantee. Individual users may have site-specific requirements, maintenance and other environmental conditions that affect the length of the component's useful life cycle.

Table 9.1 Component Service Life

Component	Expected Life	Replace in:
Air filters	5 years	Check four times per year
Power Modules & Static Bypass Assembly	20 years	18 years
Frame Fans	10 years	8 years

NOTE: Component Expected Life requires ambient temperature conditions (<25°C). If temperature conditions are higher, expected life will be shorter.

In most cases, replacement components must exactly match the original component specifications. These replacement components are not readily available from third-party component distributors. For assistance with your specific component specifications, replacement component selection and sourcing, call 1-800-LIEBERT. For customers using Vertiv Services preventive maintenance services, periodic inspection of these components is part of this service, as well as recommending component replacement intervals to customers to avoid unanticipated interruptions in critical load operations.

9.3 Routine Maintenance

Become thoroughly familiar with the equipment, but at no time go beyond the specific procedures in this manual while performing maintenance or correcting a malfunction. If you have any doubt as to what must be done, call Vertiv Services at 800-543-2378 for further instructions. The UPS is designed for unattended operation, but does require some common sense maintenance.

Keep good records -Troubleshooting is easier if you maintain historical service records.

Keep the UPS free of dust and any moisture.

Keep the UPS cool:

- Battery systems must be kept in the range of 72°F-77°F (22°C-25°C) in order to meet design specifications for capacity and longevity.
- The UPS will reliably meet all performance specifications at temperatures up to 104°F (40°C), and can be slightly derated for operation at even higher temperatures. However, performance and longevity will be optimized when the UPS is operated at the same temperature as the batteries

Keep connections tight.

Tighten all connections at installation and at least annually thereafter. (See [Torque Requirements](#) on page 77).

9.3.1 Record Log

Set up a maintenance log to record scheduled checks and any abnormal conditions. The log should have space for all metered data including phase readings, alarm messages, UPS mode of operation, air filter replacement date and observation notes. A second log should be maintained for the battery module as directed by the battery manufacturer. Vertiv recommends a periodic walk-through inspection of the UPS and battery rooms to check for visible and audible indications of problems. Log the inspection, metered parameter indications and any discrepancies.

9.3.2 Air Filters

The air filters must be inspected and serviced on a regular schedule. The period between inspections will depend upon environmental conditions. Under normal conditions, the air filters will require cleaning or replacement approximately every two months.

All Vertiv™ Liebert® EXM models have replaceable filter elements behind the grille in the front of the unit. This element can be changed with the UPS operating by opening the outer door. The air filters of the Liebert® EXM are washable and reusable. One set of air filters is shipped with each Liebert® EXM.

Abnormal or dusty conditions will require more frequent cleaning and replacement of air filters. Inspect installations in new buildings more often, then extend the inspection period as experience dictates.

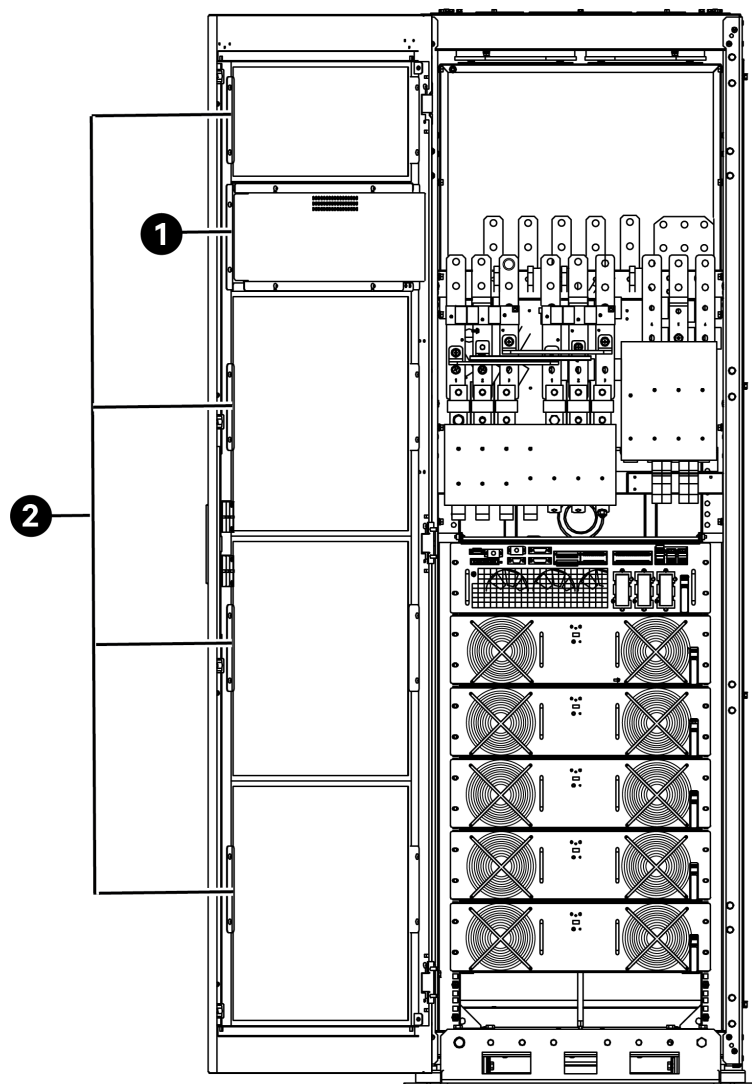
9.3.3 Replacing Air Filters

Installing the two air filter sizes in a Liebert® EXM requires only a Phillips screwdriver. Each filter is held in place by a bracket on either side of each filter. Refer to [Air Filters](#) above for details about filter maintenance.

To replace a filter:

1. Open the *UPS front door*, and locate the filters on the back side of the front door (see **Figure 9.1** on the next page)
2. Remove one *bracket* and loosen the *screw* on the second bracket. The second bracket need not be removed.
3. Remove the *dust filter* to be replaced.

4. Insert the *clean filter*.
5. Reinstall the *bracket*, tightening the screw securely.
6. Tighten the *screw* on the second bracket.

Figure 9.1 Air Filter Replacement**FRONT VIEW
(Door Open)**

Item	Description
1	Replaceable Air Filters
2	Operator Control Panel

9.3.4 Torque Requirements

All electrical connections must be tight.

Table 9.2 below through **Table 9.3** below provide the torque values for the connections in the UPS and batteries. Use these values unless the equipment is labeled otherwise.

Table 9.2 Busbars- Power Wiring

Bolt Shaft Size	Lb-in (Nm)
1/2" (M12)	428 (48)

Table 9.3 Terminal Block with Compression Lugs

AWG Wire Size or Range	Lb-in (Nm)
#22 - #14	3.5 to 5.3 (0.4 to 0.6)

9.4 Detecting Trouble

It is important that the operator check the instrument readings if abnormal equipment performance is suspected. Any metered value that differs appreciably from normal could mean an impending malfunction, and should be investigated.

Items to check on the various UPS display screens include:

1. The output voltage of all phases should be within 2% of normal voltage. Output currents on each phase should not normally differ by more than 20%. If a greater difference is noted, the load is unbalanced and corrective action should be taken to redistribute the load, if possible.
2. If the UPS has not operated on battery power during the last 10 hours, the batteries should require little charging current. Battery mimic should indicate normal DC voltage with relatively little battery charge current.
3. The input current on each phase should be within 10% of the average input current. Alarm messages indicate malfunction or impending malfunction. A daily check of the Operator Control Panel will help to provide an early detection of problems. Refer to [UPS Status Messages](#) on page 81 to interpret alarm messages.
4. Tracing a problem to a particular section is facilitated by alarm messages and the metered parameter indications. These are stored in the Status Reports and can be displayed at the Operator Control Panel or at an optional terminal.

NOTE: If the UPS system has a blown fuse, the cause should be determined before you replace the fuse. Contact Liebert Global Services.

9.5 Reporting a Problem

If a problem occurs within the UPS, review all alarm messages along with other pertinent data. This information should be given to the Vertiv Services dispatcher. Call 800-543-2378 to report a problem or to request assistance.

9.6 Corrective Actions

Recommended corrective actions for each alarm message on the Operator Control Panel and the Remote Alarm Status Panel may be found in [UPS Status Messages](#) on page 81.

9.7 Recommended Test Equipment

Table 9.4 below lists recommended test equipment and tools required to maintain, troubleshoot and repair the UPS module. Instruments of equivalent range and accuracy may be substituted. All instruments should be calibrated and be within the current calibration cycle. Calibration data for the instruments should be maintained in the equipment-history files and the instruments labeled for audit and verification.

Table 9.4 Recommended Test Equipment and Tools

Qty.	Test Equipment	Manufacturer	Model or Type
1	Oscilloscope	Tektronix, H-P or Fluke	DC to 50 MHz
2	Voltage Probes	Tektronix, H-P or Fluke	10X, with 10 ft. Cable
2	Voltage Probes	Tektronix, H-P or Fluke	100X, with 10 ft. Cable
1	Digital Multi-meter	Fluke	8060, with Test Leads
1	Tool Kit	N/A	Standard electrical contractor tools

Appendices

Appendix A: Hazardous Substances or Elements Announcement

Table A.1 Hazardous Substances or Elements

Part Name	Hazardous Substances					
	Lead (Pb)	Mercury (Hg)	Cadmium (Cd)	Chrome (Cr ⁶⁺)	Polybrominated Biphenyl (PBB)	Polybrominated Diphenyl Ethers (PBDE)
Hex copper stud	X	✓	✓	✓	✓	✓
PCBA	X	✓	✓	✓	✓	✓
AC capacitor	X	✓	✓	✓	✓	✓
DC capacitor	X	✓	✓	✓	✓	✓
Fan	X	✓	✓	✓	✓	✓
Cables	X	✓	✓	✓	✓	✓
LCD	X	✓	✓	✓	✓	✓
Sensors	X	✓	✓	✓	✓	✓
Large-medium power magnetic components	X	✓	✓	✓	✓	✓
Circuit breaker / rotating switch	X	✓	✓	✓	✓	✓
Semiconductors	X	✓	✓	✓	✓	✓
Battery (when applicable)	X	✓	✓	✓	✓	✓
Insulation monitoring device (where applicable)	X	✓	✓	✓	✓	X

✓ - Means the content of the hazardous substances in all the average quality materials of the part is within the limits specified in **SJ/T-11363-2006**

X - Means the content of the hazardous substances in at least one of the average quality materials of the part is outside the limits specified in **SJ/T11363-2006**

Vertiv has been committed to the design and manufacturing of environment-friendly products. It will reduce and eventually eliminate the hazardous substances in the products through unremitting efforts in research. However, limited by the current technical level, the following parts still contain hazardous substances due to the lack of reliable substitute or mature solution:

1. All solders in the products contain lead.
2. Copper alloy contains lead.
3. Backlight bulb contains mercury.
4. The ceramic materials of the ceramic capacitor, the copper terminals and copper leads of metallic film capacity contain lead.
5. The glass of resistor contains lead.

6. The glass of LCD contains lead, and the backlight lamp contains mercury.
7. The lead in the battery is determined by the battery feature and technical levels.
8. The insulation monitoring device contains lead and PBDE.

About Environment Protection Period: The Environment Protection Period of the product is marked on the product. Under normal working conditions and normal use of the products observing relevant safety precautions, the hazardous substances in the product will not seriously affect the environment, human safety or property in the Environment Protection Period starting from the manufacturing date.

About battery: The battery life is dependent on the ambient temperature and charging / discharging times. The battery life will be shortened if the battery is used under high temperature or in deep discharging status. Refer to the manufacturer's product literature for details.

Appendix B: UPS Status Messages

Table A.2 below shows all event messages as they appear in the current status area of the LCD or the history log, along with a description and recommended actions, if any.

Table A.2 UPS Status Messages

Event Message	Description / Suggested Action (if any)
Comm. Fail	The CAN communication between internal monitor and rectifier/inverter/bypass fails. Contact Vertiv Services at 800-543-2378 for assistance.
Battery Overtemp	The battery temperature is over the limit. Check the battery temperature and ventilation.
Ambient Overtemp	The Ambient temperature is over limit. Check the ventilation of UPS room.
Replace Battery	Battery should be replaced. Contact Vertiv 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.
Battery End of Discharge	Inverter turned off due to low battery voltage. Check the utility failure and try to fix it.
Mains Volt. Abnormal	Mains Voltage exceeds the upper or lower limit and results in rectifier shutdown. Check the input line-to-neutral voltage amplitude of rectifier.
Mains Undervoltage	Mains Voltage is undervoltage (120V~132V). 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	Rectifier Fault; Contact Vertiv Services at 800-543-2378 for assistance.
Rectifier Overtemp	The temperature of 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 failed. Contact Vertiv Services at 800-543-2378 for assistance.
Input Fuse Fail	Input fuse is open. Contact Vertiv Services at 800-543-2378 for assistance.
Control Power 1 Fail	Control Power 1 has failed or has been lost. Contact Vertiv Services at 800-543-2378 for assistance.
Mains Phase Reversed	Input phase sequence is reversed. Contact Vertiv Services at 800-543-2378 for assistance.
Soft Start Fail	Rectifier could not start due to low DC bus voltage. Contact Vertiv 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. <ol style="list-style-type: none"> 1. 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. 2. 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 Vertiv Services at 800-543-2378 for assistance.

Table A.2 UPS Status Messages (continued)

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.</p> <p>This alarm automatically resets once the bypass voltage goes normal.</p> <p>First check if there are some relevant alarms such as “Bypass disconnect open”, “Bypass phase reverse” and “Mains neutral lost”. If they appear, solve them first.</p> <ol style="list-style-type: none"> 1. 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. 2. 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 changed a little larger through the configuration software according to the customer's agreement. <p>Contact Vertiv 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 is no longer true.</p> <ol style="list-style-type: none"> 1. First check if the alarm “Bypass unable to trace” or “Bypass abnormal” occurs. If so, solve it first. 2. Verify the waveform of the bypass voltage. If it is too distorted, ask the customer to verify and seek any possible measurements. <p>Contact Vertiv Services at 800-543-2378 for assistance.</p>
Inverter Fault	<p>This alarm indicates a fault condition exists within the inverter.</p> <p>Contact Vertiv Services at 800-543-2378 for assistance.</p>
Fan Fault	At least one of the cooling fans failed. Contact Vertiv Services at 800-543-2378 for assistance.
Inverter STS (relay) Fail	At least one of the static switches of inverter side is open or short circuit. This fault is locked until power off. Contact Vertiv Services for assistance at 800-543-2378 for assistance.
Bypass STS Fail	<p>At least one of the static switches of bypass side is open or short circuit. This fault is locked until power off.</p> <p>Contact Vertiv Services at 800-543-2378 for assistance.</p>
Output Fuse Fail	At least one of the output fuses is open. Contact Vertiv Services at 800-543-2378 for assistance.
Control Power 2 Fail	Control Power 2 is abnormal or lost. Contact Vertiv Services at 800-543-2378 for assistance.
Unit Overload	<p>The UPS is confirmed to be overload when the load arises above 105% nominal rating.</p> <p>The alarm automatically resets once the overload condition is removed.</p> <ol style="list-style-type: none"> 1. Confirm that the alarm is true by checking the load percent indicated on the LCD panel to determine which phase is being overloaded. 2. 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>Contact Vertiv Services at 800-543-2378 for assistance.</p>
System Overload	<p>The UPS parallel system is confirmed to overload when the total load arises above 105% nominal rating for the set basic number of UPSs. The alarm automatically resets once the overload condition is removed.</p> <ol style="list-style-type: none"> 1. Confirm that the alarm is true by checking the system load percent indicated on the LCD panel to determine which phase is being overloaded. 2. 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.
Unit Overload Timeout	The UPS is confirmed to overload and the overload times out.

Table A.2 UPS Status Messages (continued)

Event Message	Description / Suggested Action (if any)
	<p>NOTE: The highest loaded phase will indicate overload timing-out first.</p> <p>When the timer is active, then alarm “unit overload” should also be active as the load is above nominal.</p> <p>When the timer has expired, the inverter Static Switch is opened and the load transferred to bypass. The inverter shutdown and will restart after 10 seconds.</p> <p>If the load decreases lower than 95% after 5 minutes, the system will transfer back to inverter mode.</p> <p>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>
Bypass Phase Reversed	<p>The phase sequence direction of bypass voltage is reversed.</p> <p>Normally, the phase of Phase B lags 120 degrees behind Phase A, and the phase of Phase C lags 120 degrees behind Phase B.</p> <p>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 Vertiv Services at 800-543-2378 for assistance.</p>
Load Impact Transfer	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.
Transfer Timeout	<p>The load is on bypass power due to excessive number of transfers that occurred within the last hour.</p> <p>The UPS will recover automatically and will transfer the load back to inverter power within an hour.</p>
Load Sharing Fault	UPS working within a parallel system are not sharing load current correctly. Contact Vertiv Services at 800-543-2378 for assistance.
DC Bus Abnormal	<p>Shut off inverter due to abnormal DC bus voltage.</p> <p>Contact Vertiv Services at 800-543-2378 for assistance.</p>
System Transfer	The whole paralleled UPS system transferred to bypass at the same time. This message will appear on the UPS which passive transfer to bypass.
DC Bus Overvoltage	<p>Rectifier, inverter and battery converter were shutdown because DC bus voltage is too high.</p> <p>Check whether there is a fault in rectifier side. If no, then check whether overload occurs.</p> <p>Restart the inverter after resetting the fault. If fault does not clear, contact Vertiv Services at 800-543-2378 for assistance.</p>
LBS Active	The LBS setting is active. The UPS is acting as an LBS 2. leader/follower in a dual bus configuration.
Battery ground fault	Battery ground fault from dry contact signal. Contact Vertiv 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	System Turned Off Confirm
Fault Reset	Fault Reset
Alarm Silence	Alarm Silence
Turn On Fail	Turn On Fail
Alarm Reset	Audible Alarm Reset
Load on Bypass	UPS is in Load on Bypass Mode

Table A.2 UPS Status Messages (continued)

Event Message	Description / Suggested Action (if any)
Load on Inverter	UPS is in Load on Inverter Mode
Load on Battery	UPS is in Load on Battery Mode
Output Disabled	UPS Output Disabled
Maint. Disconnect Closed	Maintenance Disconnect Closed
Reserved	—
Output Disconnect Open	Output Disconnect Open
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 UPS was shutdown at EOD, 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 Discharging	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.
Inverter in Setting	Inverter is in parameter setting.
Rectifier in Setting	Rectifier is in parameter setting.
Batt. Converter Fault	Battery converter output voltage beyond limits or battery fuse failed. Battery converter shuts down. Battery backup not available.
Operation Invalid	This record is registered following an incorrect operation.
Byb. Abnormal Shutdown	Both bypass and inverter voltages unavailable. Load interruption.
Mains Neutral Lost	AC Input mains reference neutral not detected.
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.
LBS abnormal	LBS is abnormal.

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