Liebert® NXC 40kVA

User Manual

NXC 60kVA

UNINTERRUPTIBLE POWER SUPPLY

USER MANUAL

10H52246UM60 - rev. 1

NXC 60kVA may differ from the model displayed on the front cover.

Special Declaration

Personnel Safety

1. This product must be installed and commissioned by professional engineers designated by the manufacturer or its authorized agent. Failure to comply with this condition could result in product malfunction and/or expose personnel to safety hazards.
2. Take the time to read this product manual and the safety precautions thoroughly before installing and commissioning this product. Failure to do this could result in product malfunction and/or expose personnel to safety hazards.
3. This product may not be used as a power supply for life support equipment.
4. Never dispose of the external battery of this product in a fire, as it may explode and jeopardize personnel safety when exposed to flame.

Product Safety

1. If this product is to be stored or remain de-energized for extended periods, it must be placed in a clean, dry environment within the specified temperature range.
2. This product should be used in an appropriate operating environment. For details, refer to the section on the environmental requirement in this manual.
3. The product must not be used in places:
    - Where the temperature and relative humidity are outside the specified limits
    - That are subject to vibrations or shocks
    - Where conductive dusts, corrosive gases, salts, or flammable gases are present
    - Near sources of heat or strong electromagnetic interference

Disclaimer

Vertiv disclaims any and all responsibility or liability for defects or malfunctions caused by:

- Application range or operating environment outside the specified limits
- Unauthorized modification, improper installation or operation
- Force majeure
- Other actions that do not comply with the instructions in this manual

Safety Precaution

The following safety symbols are important, DO NOT ignore them!

Safety symbol	Explanation
	Used to alert the user to the risk of death or severe injury in the event of failure to adhere to the instructions
	Used to alert the user to the risk of injury or damage to the equipment in the event of failure to adhere to the instructions
	Used to advise the user to read the instructions carefully and adhere to them, irrespective of whether failure to do so may result in damage and/or injury

This manual contains information explaining how to install and operate single UPS modules and parallel systems consisting of Vertiv NXC 60kVA UPS.
Read this manual thoroughly before installing, using and servicing the UPS.

Important

This UPS has been designed for commercial and industrial applications in the second environment (see product standard IEC/EN 62040-2:2006). Installation restrictions or additional measures may be necessary in order to prevent disturbances.

Conformity and standards

This product complies with 2014/35/EU (low voltage safety) and 2014/30/EU (EMC), EMC standards of Australia and New Zealand (C-Tick), and the following UPS product standards:
* IEC/EN 62040-1+A1:2013 General safety requirements for UPS
* IEC/EN 62040-2:2006-EMC
* IEC/EN 62040-3 Performance requirements and test methods
For details, refer to Chapter 11 Specifications.
Continued compliance requires installation in accordance with these instructions and the use of manufacturer approved accessories only.

Warning: high earth leakage current

Always connect the unit to earth **before** connecting the input supply (including both mains and battery supplies).
This equipment is fitted with an EMC filter.
Earth leakage current is 0 ~ 1000mA.
Transient and steady state earth leakage currents, which may occur when the equipment is started, should be taken into account when selecting instantaneous RCCBs (Residual Current Circuit Breaker) or RCDs (Residual Current Device).
Select RCCBs which are sensitive to unidirectional DC pulses (class A) and insensitive to transient state current pulses.
Note also that the earth leakage currents of the load will be carried by the RCCBs or RCDs.
The equipment must be earthed in accordance with the local electrical authority codes of practices.

Warning: backfeeding protection

This UPS is fitted with a dry contact closure signal for use with an external automatic disconnecting device (not supplied) used to protect against backfeeding electrical power into the electrical mains supply via the rectifier or bypass static switch circuit. A label must be placed on the external bypass input supply disconnectng device warning service personnel that the circuit is connected to a UPS. The text of the label must read as follows: Risk of voltage backfeed! Isolate the UPS, then check for hazardous voltages between all terminals including the protective earth before working on this circuit.

Warning

The UPS upstream distribution protection equipment shall be selected in accordance with the details in 3.1.4 *Selecting the UPS I/O Switch* and shall comply with the local electrical regulations.

General safety precautions (For users)

Like other types of large power equipment, the UPS and battery circuit breaker box/battery cabinet contain high voltages. Because components with high voltage can be accessed only by opening the front door (which must be kept locked), the risk of contact with high voltage has been minimized. This equipment meets the IP20 standard, and other safety panels are installed inside the equipment.

There will not be any danger if this equipment is operated according to the general instructions and the steps recommended in this manual.

Multiple power inputs (For users)

This UPS system receives power from more than one source. Disconnect all AC sources and the DC source before servicing.

This UPS has several circuits that are energized by both high AC and DC voltages. Check for voltage with both AC and DC voltmeters before working inside the UPS.

User serviceable components (For service personnel)

All the equipment maintenance and servicing procedures involving access to the internal parts of the unit require special tools and should be carried out by trained personnel only. Components that may only be accessed by opening the protective cover using tools/special key cannot be serviced by the user.

Battery voltage: 300Vdc ~ 564Vdc (For service personnel)

Physical maintenance and servicing work on the battery requires special tools and should be carried out only by trained personnel.

Take special care when working with the batteries associated with this UPS. When the batteries are connected together, the battery terminal voltage exceeds 300 Vdc and is potentially lethal.

Battery manufacturers supply details of the necessary precautions to be observed when working on or in the vicinity of battery strings. These precautions should be adhered to strictly at all times. Particular attention should be paid to recommendations concerning local environmental conditions and the provision of protective clothing, first aid and fire-fighting facilities.

Warning

When the internal fuse of the UPS is damaged, it must be replaced with a fuse having the same electric parameters by trained, qualified personnel.

Important

The communication board is sensitive to electro-static discharge, implement ESD prevention measures when managing any communication board.

Warning

When selecting the UPS system pre-stage distribution protection equipment, ensure that it complies with the local electric regulations.

The specified upstream breakers are required to obtain the conditional short-circuit current rating, Icc at 10kA symmetrical rms. The specified upstream breakers should comply with an IEC 60947 series standard.

This Manual Describes The Following Equipment

Product	Model
Liebert NXC 60kVA	NXC 0060kTJ1AFN02000

Contents

Chapter 1 Overview

This chapter provides a brief introduction to the features, appearance and components, design concept, parallel system, operating mode, battery management and battery protection of the Liebert NXC 60kVA UPS (UPS for short).

1.1 Features

The UPS is connected between a mains power source and a critical load (e.g. a computer) in order to provide a high quality power supply for the latter. The UPS offers the following advantages:

- Increased power quality

The UPS protects its output against variations in the input power supply by means of the internal voltage and frequency controller.

- Mains failure protection

If the input power fails, the UPS will switch to battery mode so that the power supply to the loads is not interrupted.

1.2 Design Concept

1.2.1 System Design

This section introduces the working principle of the single UPS module. The UPS is based on an AC-DC-AC converter (as shown in Figure 1-1The first conversion stage (AC-DC) uses a three-phase, high frequency rectifier to convert the three-phase main input (or rectifier input) voltage into the stable DC bus voltage.

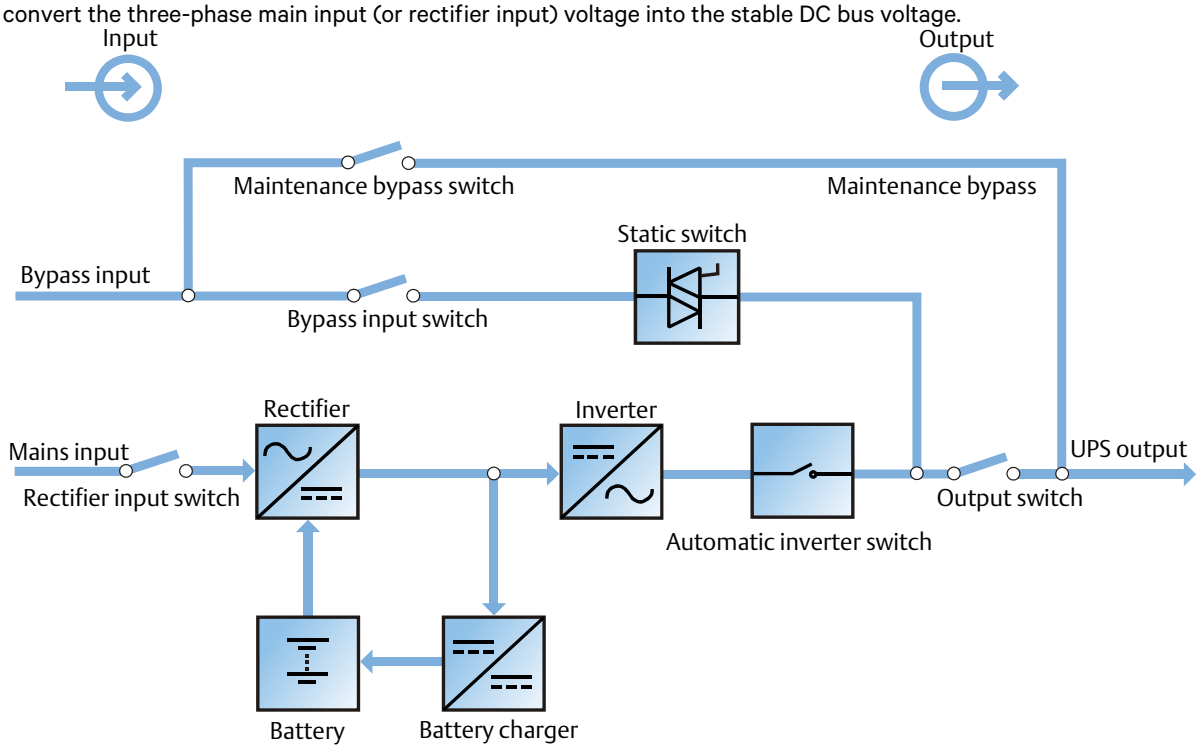


Figure 1-1 Block diagram for working principle of UPS single module

The UPS has its own battery charger and adopts advanced temperature compensation technology to effectively prolong the battery service life. The inverter mainly uses high power IGBTs, together with advanced SVPWM control technology, to reconvert the DC bus voltage to AC voltage.

When the mains input is normal, the rectifier and inverter work together to supply the loads and charge the battery. When the mains input is abnormal, the rectifier stops working, and the battery supplies power to the loads through the inverter. If the battery voltage falls to the end of discharge (EOD) voltage and the mains has not yet been restored, the UPS will shut down (if the system uses split bypass configuration and the bypass is normal, the system will transfer to bypass). The battery EOD voltage is preset. When the mains is abnormal, the battery guaranteed normal UPS operation until the battery reaches the EOD voltage, at which point the UPS shuts down: this time is called 'Backup Time'. The length of backup time depends on the battery capacity and the loads.

1.2.2 Bypass

The 'Static Switch' module (as shown in Figure 1-1) contains the controllable electronic switch, and features an intelligent control system that enables the loads to be supplied by the inverter or the bypass. Under normal conditions, the loads are supplied by the inverter, and the automatic inverter switch on inverter line is closed. In the event of an overload (the overload delay time expires) or inverter failure, the inverter switch is opened, and the 'Static Switch' module transfers the loads automatically to the bypass.

Under normal operating conditions, the inverter output must be synchronized with the bypass in order to ensure that the load is transferred from the inverter to the bypass without interruptions.

Therefore, when the bypass frequency is within the synchronization range, the inverter control circuit will synchronize the inverter output frequency with the bypass frequency and phase.

The UPS is also equipped with a manual maintenance bypass switch, which is used to de-energize the UPS during maintenance work. In this condition, the bypass supplies the critical loads directly via the maintenance bypass line.

Note

When the load is supplied by the bypass or maintenance bypass, the quality of the power supply is not guaranteed.

1.2.3 System Control Principle

Normal operation

In normal operating mode the UPS mains input is within the acceptable limits, the rectifier and inverter are operating normally, the load is supplied by the inverter, the battery circuit breaker is closed, and the battery is in stable floating charge state.

(Parallel System) Note: As the individual UPS module outputs are connected in parallel, the system checks that the inverter control circuits are perfectly synchronized with one another, and with the bypass, in terms of both frequency and phase, and that their output voltages are the same. The current drawn by the load is divided automatically between the UPS modules. A warning message appears while synchronization is in progress.

Abnormal mains

When the mains supply fails or goes outside the acceptable limits, the rectifier switches off automatically, and the system transfers to battery output (via the inverter). The length of the operating time in battery mode depends on the load and the battery capacity. During this period, if the battery voltage falls to the EOD voltage and the mains supply has not yet returned within acceptable limits, the inverter switches off automatically, and the UPS operator control and display panel display the corresponding alarm messages. If the system uses a separate bypass configuration, and the bypass supply is normal, the system transfers to the bypass line

Mains recovery

When the main input returns within its normal operating limits inside the acceptable time interval, the rectifier restarts automatically (at this point its output power starts to increase gradually), supplying the load and charging the battery again. Therefore, the power supply to the load will not be interrupted

Disconnecting the battery

If it is necessary to disconnect the external battery when carrying out maintenance work, use the external isolating switch. In this condition, the steady state performance of the UPS is not affected and all its functions are guaranteed, with the exception of the battery backup supply in the event of a mains failure.

UPS module failure

In the event of an inverter failure, an automatic inverter switching failure, a blown output fuse or a bypass STS failure, the load is transferred automatically to the bypass supply line, without interrupting the power supply to the loads. If any of these fault conditions occur, please contact your local Vertiv customer service center for technical support.

(Parallel System) If one of the UPS modules fails, it exits the parallel system automatically. If the system is still capable of providing the required power, the remaining module continues to supply the load without interruption. If the remaining modules are no longer capable of fulfilling power requirements, the load is transferred automatically to the bypass line.

Overload

If the inverter is overloaded or the inverter current remains outside the specifications (refer to Table 11-6) longer than the specified time, the load is transferred automatically to the bypass without interruption. If both the overload and the current return to a level within the specified range, the load is transferred back to the inverter. In the event of an output short circuit, the load is transferred to the bypass, and the inverter is shut down. Five minutes later, the inverter restarts automatically. If the short circuit is no longer present, the load is transferred back to the inverter. The transfer is determined primarily by the specifications of the system protection device.

In the two situations described above, alarm messages appear on the UPS operator control and display panel.

(Parallel System) The logic control system monitors load requirements constantly and controls the power supplied by each UPS module. In the event that an overload condition persists for longer than a preset interval, and the number of active modules is unable to satisfy the load power requirements, the load is transferred to the bypass. The load is re-transferred to the inverter if the power requirement is reduced to a value that can be supplied by the number of active modules remaining in the system.

Maintenance bypass

The UPS is also equipped with a maintenance bypass circuit, which provides a safe working environment for the engineers when carrying out maintenance work or repairs on the UPS system, while supplying unregulated mains

power to the loads. The maintenance bypass can be manually selected using the maintenance bypass switch, and disconnected by turning the switch to OFF.

Warning

If the UPS system consists of two or more UPS modules, and the load capacity exceeds the single module capacity, do not use the internal maintenance bypass switch.

1.2.4 UPS Power Supply Switch Configuration

Figure 1-2 illustrates the UPS module block diagram. The UPS may be used in separate bypass (where the Rectifier and Bypass inputs are connected to independent power sources) and common input configurations. In the separate bypass configuration, the static bypass and maintenance bypass share the same independent bypass power supply. When a separate power source is not available, the bypass input switch (Q2) and rectifier input switch (Q1) connections are linked together (factory fitted) so that the bypass input and rectifier input use mains power from the same source.

During normal UPS operation, all the switches are closed, with the exception of the maintenance bypass switch Q3.

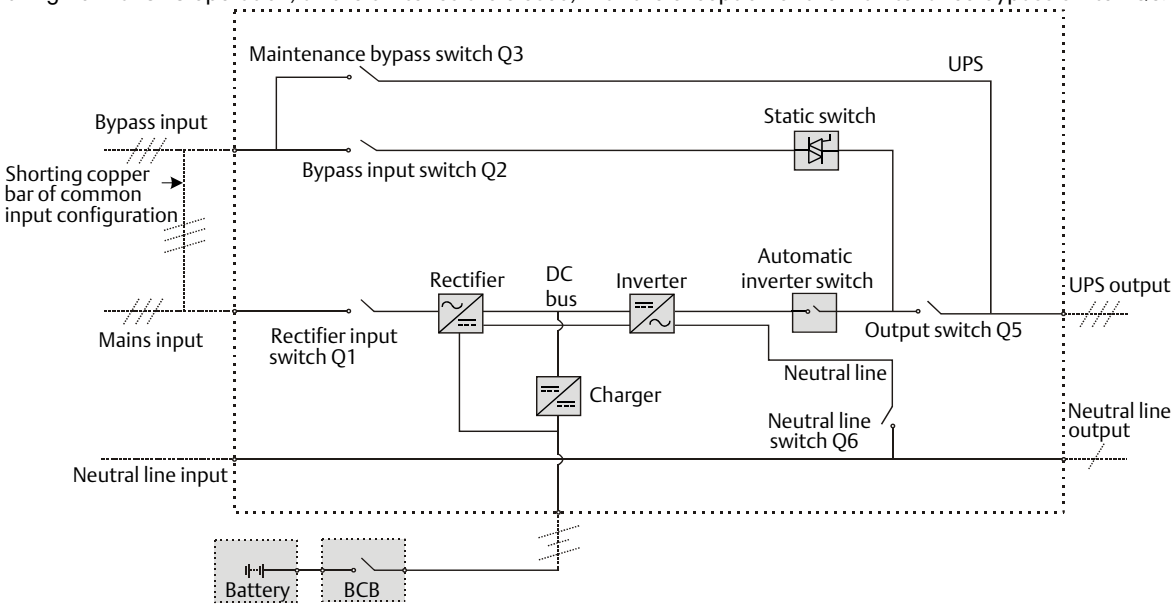


Figure 1-2 UPS power supply switch configuration

1.2.5 Battery Circuit Breaker (BCB)

The external battery must be connected to the UPS via the BCB. The BCB box, which is available as an option, must be installed close to the battery. The BCB is closed manually or electrically. The box includes an under-voltage trip coil and, in the event of a battery under-voltage, the UPS control circuit sends a signal to this coil, which trips the BCB. It also features a magnetic overload protection trip function.

1.3 Parallel System

Up to four UPS modules can be parallel-connected to form a parallel system thus increasing the capacity and reliability of the system. The load is shared equally between the paralleled UPS modules.

In addition, two UPS modules or parallel systems can be used to create a dual bus system (LBS). The independent outputs of each UPS module or parallel system are synchronized via the LBS cable, thus guaranteeing seamless load transfer between the two systems.

1.3.1 Parallel System Features

1. In parallel systems the UPS hardware and software are exactly the same as for individual modules, and the parallel configuration is achieved by means of software settings or via the control panel.
2. Parallel cables are connected in a ring, in order to guarantee system reliability and redundancy. The LBS cables are connected between any two UPS modules in each bus. The intelligent parallel logic provides maximum flexibility, for example, it permits the user to shut down, or start-up, the UPS modules in any order. Transfers between normal mode and bypass mode of operation are seamless and self-recoverable, i.e., as soon as the overload is cleared, the system reverts automatically to its original operating mode.
3. The user can view the total load applied to the parallel system on each individual UPS module LCD.

1.3.2 Parallel System Requirements

A group of paralleled modules behaves as if it were one large UPS with the advantage that it provides higher reliability. In order to ensure that the load is shared evenly by all the modules, and that the system complies with the applicable wiring regulations, the following requirements must be satisfied:

1. All UPS modules must be of the same rating and must be connected to the same bypass source.
2. The bypass and rectifier input sources must be connected to the same neutral line input terminal.
3. If any RCDs are installed they must be set-up appropriately and located upstream of the common neutral line input terminal. Alternatively, such devices must monitor the protective earth current of the system. Refer to *Warning: high earth leakage current* before *Contents*.

4. For parallel system consisting of two or more UPS modules, the bypass load sharing inductors (optional) should be selected.

1.4 Operating Modes

The UPS operating modes are as follows:

- Normal mode
- Battery mode
- Automatic restart mode
- Bypass mode
- Maintenance mode
- ECO mode
- Parallel redundancy mode (system expansion)
- LBS system mode
- Common battery string mode
- Frequency converter mode

Normal mode

As can be seen in Figure 1-3, the mains is rectified by the UPS rectifier and then inverted by the inverter to supply uninterrupted AC power to the loads. At the same time, the charger will charge the battery.

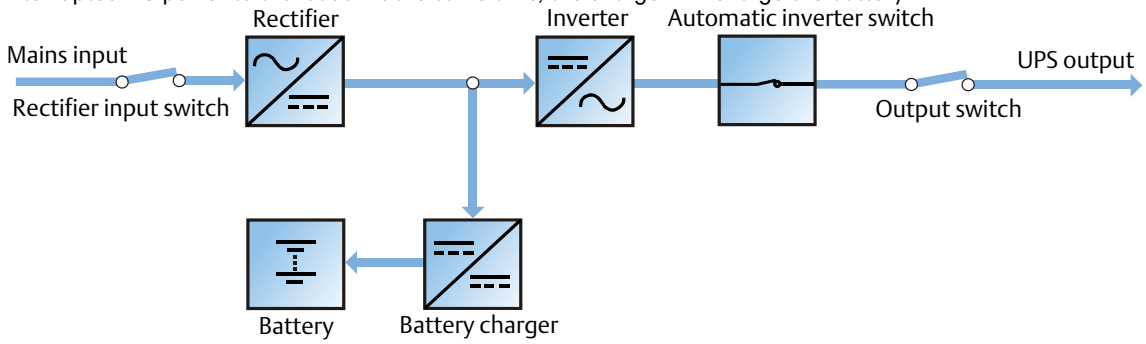


Figure 1-3 Schematic diagram of normal mode

Battery mode

Figure 1-4 illustrates battery mode, where the battery provides backup power supply to the loads through the rectifier and inverter. Upon failure of the main input, the UPS will transfer automatically to battery mode without interrupting the power supply to the loads. When the main input is restored, the UPS will automatically re-transfer to normal mode without the need for any manual intervention, and without interrupting the power supply to the loads.

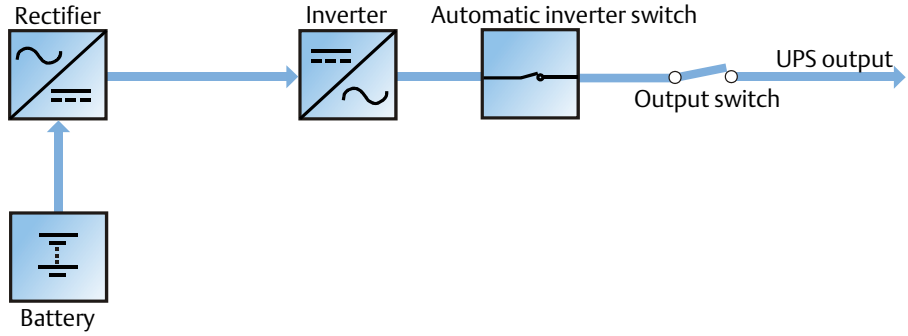


Figure 1-4 Schematic diagram of battery mode

Note: The battery cold start function can be used to switch the UPS on directly in Battery mode (provided the battery is charged) during a mains failure. Thus, the battery power supply can be used independently to improve the availability of the UPS.

Automatic restart mode

The UPS is equipped with an automatic restart function. When the inverter shuts down due to a mains failure, and the battery reaches the EOD voltage, when the mains is restored, the UPS will restart automatically after a certain delay. This function, and the automatic restart type, can be set-up by Vertiv authorized service engineers.

During the automatic restart delay period, the UPS will charge the battery to protect the load against the risk of power interruptions in the event of a new mains failure.

If the automatic restart function has not been set, the user can restart the UPS manually by pressing the FAULT CLEAR key followed by the ON key.

Bypass mode

As can be seen in Figure 1-5, in the event of an inverter failure, an inverter overload or a manual inverter shutdown, when the UPS is in normal operating mode the static switch will transfer the load from the inverter to the bypass line, without interrupting the power supply to the loads. At this point, if the inverter and bypass are not synchronized, the load power supply will be interrupted momentarily (< 20 ms).

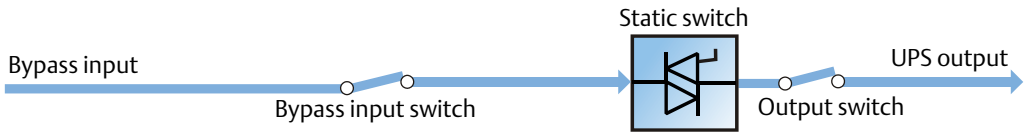


Figure 1-5 Schematic diagram of bypass mode

Maintenance mode

As illustrated in Figure 1-6, if it is necessary to service the UPS or carry out maintenance work on it, the manual maintenance bypass switch may be used to transfer the load to maintenance bypass, with no interruption in power to the load. This maintenance bypass switch is fitted in all UPS modules and rated at the full load of one module.

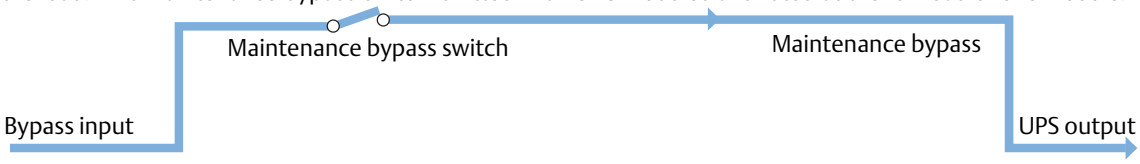


Figure 1-6 Schematic diagram of maintenance mode

ECO mode

In ECO mode, UPS double-conversion operation is inhibited most of the time in order to save energy. In this condition, the bypass is designated as the preferred source so that the critical AC load is transferred to the inverter only when the bypass supply voltage and/or frequency is/are outside the pre-defined limits: if the inverter is synchronized with the bypass source, the transfer will be instantaneous and during the transfer the output waveform will not exceed the limits established by IEC/EN 62040-3 for a UPS to be classified as VFI-SS-111.

If the inverter is not synchronized with the bypass, in order to avoid hazardous cross current, the bypass/inverter changeover is delayed for a few milliseconds (maximum 20ms) after the moment the bypass is disconnected from the load. Then, once the bypass frequency and voltage have returned within the predefined limits for at least five minutes, the load is automatically, and instantaneously, transferred back to the bypass line.

In this operating mode, the system can charge the battery as normal.

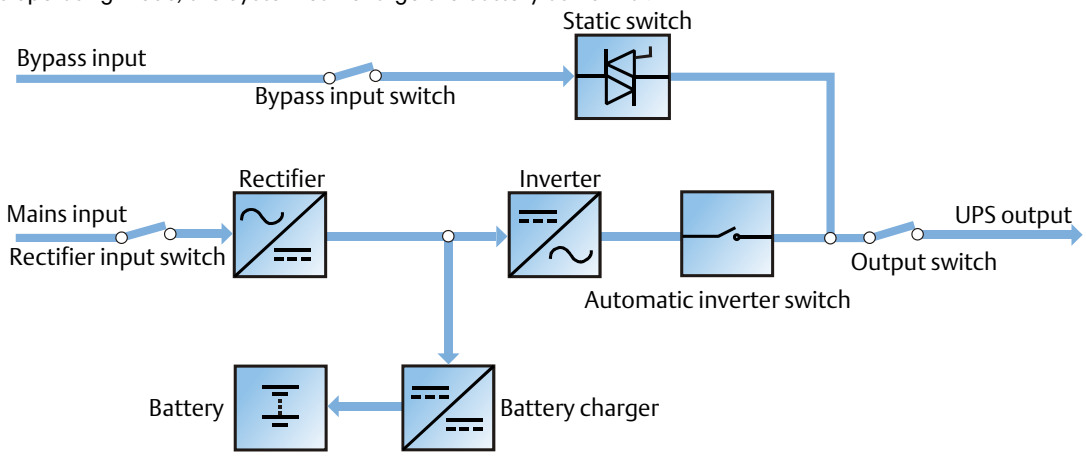


Figure 1-7 Schematic diagram of ECO mode

If ECO mode is selected, adjust the corresponding parameters via the operator control and display panel.
The ECO mode operating method is the same as described in Chapter 5 *UPS Operation Introduction*. However, in normal mode, the load is powered by the bypass, the inverter indicator flashes, the LCD displays 'Bypass mode', and the transfer interval time is less than 20ms.

Warning
The load is not protected against distortion on the mains voltage waveform in ECO mode.

Parallel redundancy mode (system expansion)

In order to achieve higher capacity or higher reliability, or both, the outputs of multiple UPS modules can be programmed for directly paralleling while a built-in parallel controller in each UPS module ensures automatic load sharing. The parallel system can consist of up to four UPS modules. See Figure 7-1 for the diagram illustrating the parallel redundancy operating principle.

LBS mode

A dual bus system consists of two independent UPS systems, each containing one or more UPS module connected in parallel. The dual bus system provides high reliability and is suitable for connection to loads with multiple inputs. Single-input loads may be supplied via an STS. See Figure 7-4 and Figure 7-5 for the diagram illustrating the LBS operating principle.

Common battery string mode

In this case, when the UPS modules (up to four UPSs) are connected in parallel, each UPS module can use the same battery string, thereby saving on costs and space.

Note

Do not mix batteries of different brands, types or ages in the same system. Common battery string mode is suitable for parallel systems only, and is not compatible with LBS mode.

Frequency converter mode

The UPS can be operated in frequency converter mode in order to provide a stable 50Hz or 60Hz output frequency, provided the input frequency remains between 40Hz and 70Hz. In this operating mode, the maintenance bypass switch must be opened (set to "OFF") in order to disable static bypass operation, and the battery becomes optional, depending on whether battery mode is required, or not.

1.5 Battery Management

The following battery management functions are set-up by the service engineer by modifying the Vertiv software settings.

1.5.1 Normal Function

1. Constant current boost charge

This charging method uses the constant current (within battery charging limit) to charge the battery, and can be used for fast battery capacity recovery. It is also possible to set-up the charging current.

2. Constant voltage boost charge

This charging method uses the constant voltage to charge the battery, and can be used for fast battery capacity recovery. In the case of VRLA batteries, the maximum boost charge voltage should not exceed 2.4V/cell.

3. Float charge

This charging method is used to maintain the battery at full capacity. The float charge voltage is generally low. The function compensates for the capacity loss due to battery self discharging, and can be used for battery capacity recovery.
In the case of VRLA batteries, the float charge voltage should be between 2.2V/cell and 2.3V/cell.

4. Automatic transfer to float charge

When the charge current falls below 'Threshold of Equalize Charge to Float Charge' or 0.5A, the charger switches automatically from boost charge to float charge. When the boost charge time exceeds the 'Equalize Charge Protect Time Limit', the charger is transferred forcibly to float charge mode in order to protect the battery.

5. Float charge temperature compensation (optional)

The UPS system also features a battery charge temperature compensation function. When the ambient temperature increases, the DC bus voltage (which charges the battery) is reduced correspondingly in order to provide the optimal charging voltage for the battery, thus prolonging the battery service life time.
This function must be used together with the Vertiv battery temperature detection device (a standard option).

6. EOD protection

When the battery voltage falls to the EOD voltage level, the battery converter shuts down automatically and the battery is isolated to avoid discharging it any further. The EOD voltage may be set to between 1.6V/cell and 1.85V/cell (VRLA).

7. Battery low pre-warning time

The Battery low alarm is activated a few minutes before the battery voltage reaches the EOD level in order to warn the user that the battery capacity is low. The battery low pre-warning time is adjustable between 3min and 60min. The default setting is 5min.

8. Maximum battery discharge time

Discharging the battery at a low current level for an extended period can result in over-discharging and may damage it permanently; therefore it is essential to set a maximum discharge time in order to protect the battery. The time limit is set-up by the service engineer by modifying the Vertiv software settings.

9. Maximum boost charge protection time

To protect the battery against overcharging damage caused by extended periods of boost charging, the Maximum boost charge protection time function limits the boost charging duration. The time limit is set-up by the service engineer by modifying the Vertiv software settings.

1.5.2 Advanced Function

The UPS includes a battery maintenance test function. At periodic intervals, 20% of the rated capacity of the battery is discharged automatically, provided that the current load exceeds 20% of the nominal UPS capacity. If the load is less than 20%, the automatic discharge cannot be executed. The test interval can be set from 30 to 360 days. The battery maintenance test function can be disabled by modifying the Vertiv software settings.
Conditions: Battery at float charge for at least 5h, load equal to 20% ~ 100% of rated UPS capacity.
Trigger: Automatically, or manually via the battery maintenance test command on the LCD.
Interval: 30 ~ 360 days (default setting: 60 days).
The UPS also features a battery capacity self-test function, which tests battery activity and residual capacity at regular intervals, evaluates the battery quality, and provides the corresponding measurements. The capacity self-test is started by the user via the operator control and display panel. During the capacity self-test, the battery discharges continuously until it reaches the battery under-voltage shutdown threshold. After the test is finished, the system updates the battery curve table. The capacity self-test command is a standalone test, and no data are stored.

During the capacity self-test, if the battery maintenance requirements are satisfied, the system generates an audible/visual alarm and provides the corresponding records.
Conditions: System load within 20% ~ 100% of nominal rated value, battery float charge at least 5h, and generator not connected, system currently in float charge state.
Trigger: Start up via LCD.
Note:
1. The battery discharges continuously until it reaches the battery under-voltage shutdown threshold, at which point it switches to the charging state. When the capacity self-test is finished, the system updates the battery curve table.
2. The user can stop the capacity self-test operation manually via the LCD.

1.5.3 Battery Temperature Compensation

The UPS system includes a battery charge temperature compensation function. When the ambient temperature increases, the DC bus voltage (which charges the battery) will be reduced correspondingly to provide optimal charging voltage for the battery, thus prolonging the battery service life time.
This function must be used together with the Vertiv battery temperature detection device (a standard option).

1.6 Battery Protection

The following battery protection functions are set-up by the service engineer by modifying the Vertiv software settings.

Battery low pre-warning

The battery low pre-warning is activated before the battery voltage reaches the EOD point, it indicates that the battery capacity is sufficient to supply the nominal load for another 3 minutes, after which it will be de-energized. This interval may be set from 3min to 6min.

EOD protection

When the battery voltage drops to the EOD voltage, the battery converter shuts down automatically. The EOD voltage is adjustable from 1.6V/cell to 1.85V/cell (VRLA).

BCB alarm

The BCB alarm occurs when the external BCB opens, if the UPS is fitted with the Vertiv BCB option.
The external battery is connected to the UPS via the BCB. The BCB is manually closed and tripped by the UPS control circuit.

Chapter 2 Mechanical Installation

This chapter provides a brief introduction to the UPS mechanical installation procedure, including the precautions, pre-installation inspection, environmental and mechanical requirements and the installation diagram.

2.1 Precautions

The following paragraphs describe the environmental and mechanical requirements, and the mechanical considerations that must be taken into account when planning the positioning and cabling of the UPS equipment. Because no two sites are the same, this chapter does not provide detailed installation instructions, and is intended solely as a guide to the general procedures and practices that should be observed by the installation engineers so that they can handle the specific situation of the site correctly.

Warning: professional installation required

1. Do not remove the packaging without permission from an authorized service engineer.
2. The UPS should be installed by an authorized engineer in accordance with the information contained in this chapter.

Warning: battery hazard

Take special care when installing batteries. When connecting batteries, the voltage at the battery terminal reaches 320Vdc, which is fatal to human beings.

1. Wear safety glasses or goggles to protect the eyes from being damaged by arcs.
2. Remove all the metal items, including rings, watches, etc.
3. Use tools with insulated handle.
4. Wear rubber gloves.
5. If the battery is damaged and/or electrolyte is leaking from it, it must be replaced. Place the battery into the container that can withstand sulfuric acid and dispose of it in accordance with the local regulations.
6. If the electrolyte comes into contact with the skin, flush immediately with water.

2.2 Shipping

Ideally the UPS system should be shipped by rail or sea. If road transportation is unavoidable, choose roads that are less bumpy in order to protect the equipment.

The UPS is heavy (see Table 11-3 for weight information), we recommended using mechanical equipment such as an electric forklift when unloading and moving the equipment to the place closest to the installation site. If an electric forklift is used, insert the forks below the bottom pallet (as shown in Figure 2-1) in order to prevent the equipment from tipping over.

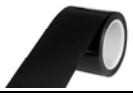
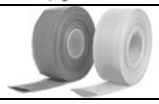
Figure 2-1 Inserting and movement

2.3 Tools

Warning

1. For safety reasons, use insulated tools only when working on live equipment.
2. The tools in Table 2-1 are for reference only; please select tools in accordance with the actual on-site installation and connection requirements.

Table 2-1 Tools

Name	Drawing	Name	Drawing
Electric hand drill		Adjustable wrench	
Flat blade screwdriver		Cross head screwdriver	
Stepladder		Forklift	
Drill		Wire cutting pliers	
Claw hammer		Diagonal cutting pliers	
Insulating shoes		Antistatic gloves	
Electrician's knife		Cable tie	
Insulating tape		Insulating gloves	
Crimping pliers		Heat shrinkable tube	
Insulated torque wrench		Torque screwdriver	
Multimeter		Clip-on ammeter	

2.4 Unpacking

Unpack the UPS and battery packages under the guidance of an authorized service engineer. Proceed as follows:

1. Remove the side panels and top cover.

Use a hammer or flat blade screwdriver to straighten the connection hooks used secure the side panels to the top cover, as shown in Figure 2-2.

Figure 2-2 Straightening the hooks

First, straighten all the hooks that secure side panel I, and then remove it. Then straighten all the hooks that secure side panel II, and then remove it. Finally, remove the top cover III, as shown in Figure 2-3.

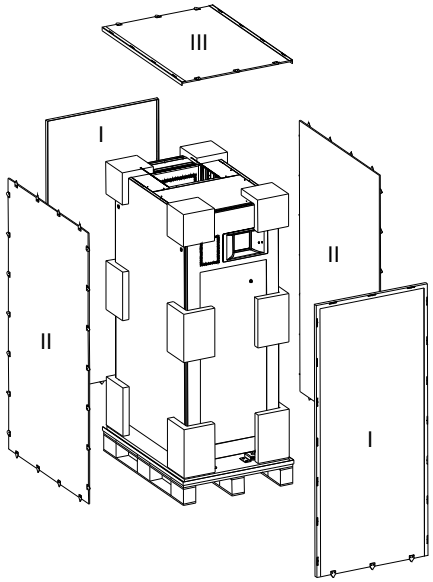


Figure 2-3 Removing side panels and top cover

2. Remove and store the bolts that secure the UPS to the pallet (see Figure 2-4). Then, use the forklift (inserting the forks in the direction indicated in Figure 2-4) to move the cabinet to the place where it is to be installed.

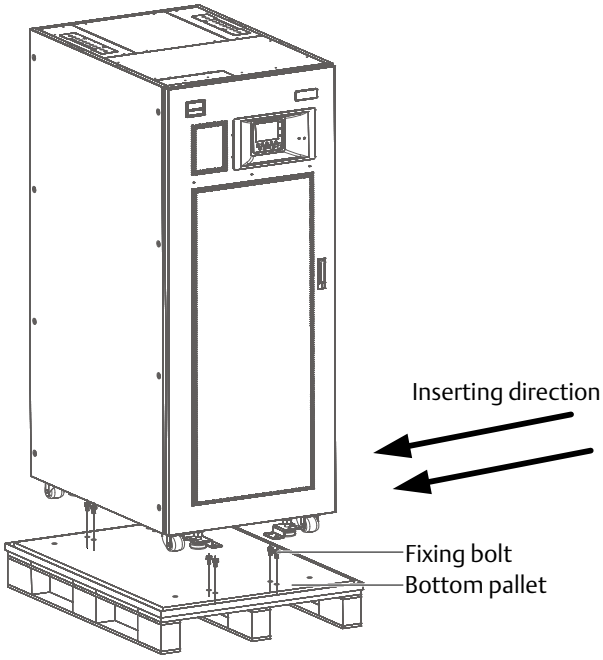


Figure 2-4 Removing bottom pallet

3. After moving the cabinet to the place where it is to be installed, raise the four adjustable feet, and use the casters to move the cabinet to its final position.
To raise the adjustable feet, proceed as follows: as shown in Figure 2-5, first loosen the nut (factory installed) by unscrewing it downwards, then remove the foot fixing piece (do not throw this part away), and rotate the foot, raising it so that the machine may be moved freely on its casters; repeat the same procedure for the other feet.

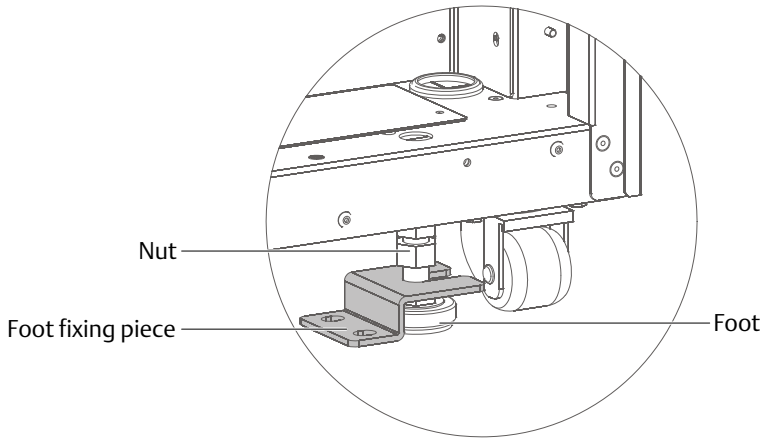


Figure 2-5 Diagram illustrating how to raise the feet

2.5 Initial Inspection

Before installing the UPS, carry out the following inspections:

1. Ensure that the UPS installation environment meets the environmental requirements indicated in the product technical specifications, especially the ambient temperature, ventilation conditions and the dust levels.
2. Unpack the UPS under the guidance of an authorized service engineer. Inspect the UPS internally and externally for signs of damage. If any damage is found, report it to the carrier immediately.
3. Check the UPS label attached to the inside of the unit front door, and confirm that the data (model, capacity and main operating parameters) correspond to the UPS model.

2.6 Environmental Requirements

2.6.1 Selecting the UPS Location

The UPS should be installed in a cool, dry, clean-air indoor environment with adequate ventilation, and should be positioned on a flat concrete floor or similar nonflammable surface. The surrounding environment should be free of conductive powder (such as metallic powder, sulfide, sulfur dioxide, graphite, carbon fiber, conductive fiber, etc.), acid mist or other conductive media (strongly ionized substances). The environment specifications should comply with relevant international standards & specifications, and the operating range specified in this manual (see Table 11-2).

The UPS uses forced cooling by internal fans. Cooling air enters the UPS through the ventilation grills at the front and is expelled through the ventilation grills at the back. Do not obstruct the ventilation grills. Leave a space of at least 200 mm between the rear of the UPS and the wall in order to allow heat to dissipate properly, thus reducing the UPS internal temperature and prolonging its working life. For exchanging the UPS Power Module or the Battery Tray a front clearance of 1200mm is necessary.

If necessary, install indoor extractor fans to aid cooling-air flow in order to avoid local temperature buildup. Install air filters (optional) when operating the UPS in a dirty environment.

Note 1: When the battery cabinet is installed near the UPS, the maximum permissible ambient temperature depends on the battery rather than the UPS.

Note 2: When the UPS is in ECO mode, the power consumption is less than in Normal mode. Suitable air conditioning systems shall be selected according to the normal operating mode.

2.6.2 Selecting the Battery Location

Batteries generate significant quantities of hydrogen and oxygen at the end of the charging cycle, therefore the fresh air volume of the battery installation environment must meet the requirements of EN50272-2001.

The ambient temperature is the main factor that affects the battery capacity and life. The normal operating temperature of the battery is 20°C. If the ambient temperature is higher than 20°C, the battery life will be reduced, whereas if it is lower than 20°C, the battery capacity will be reduced. Under normal conditions, the permissible ambient temperature range for the battery is 15°C to 25°C. Ensure that the ambient temperature of the battery remains constant and that it is kept away from heat sources and UPS air outlets.

The battery can be installed inside a special battery cabinet located close to the UPS. Due to its weight, if the battery is installed on a raised floor, the bracket must be installed under the floor, in the same way as the UPS. When using a rack-mounted battery solution, or when the battery is installed at a distance from the UPS, irrespective of the type of solution, position the battery circuit breaker close to the battery, and make sure that the connection cables are as short as possible.

2.6.3 Storage

If the batteries are not to be installed immediately, they must be stored in their original packaging in an environment where they are protected against excessive humidity and heat sources (see Table 11-2). The battery must be stored in a dry and cool place with good ventilation. The most suitable storage temperature ranges from 20°C to 25°C.

Warning

During battery storage, charge the battery periodically in accordance with the battery manufacturer's instructions. During the

charging process, connect the UPS to the mains temporarily and activate the battery by recharging it.

2.7 Mechanical Requirements

2.7.1 Moving the UPS

Warning

1. Ensure any any equipment used ot lift or move the UPS has sufficient lifting capacity.
2. The UPS is fitted with casters, take care to prevent it rolling away when removing it from the pallet. Ensure that the available personnel and lifting equipment are sufficient to carry out this operation safely and correctly.
3. Due to the weight of the unit, the casters may be valid for moving it along flat surfacrs only.
4. The UPS has a high center of gravity, take precautions to prevent it from tipping over when moving it.
5. Never suspend the UPS in a vertical position.

Caution

When the batteries are already mounted in the cabinet, ensure that each battery string has been secured before attempting to move it and make every effort to keep movement distances to a minimum.

Ensure that the UPS weight does not exceed the capacity of the lifting equipment. For UPS weight information, refer to Table 11-3.

The UPS can be moved using a forklift or other similar lifting equipment.

The casters may be used when moving the UPS over short distances.

2.7.2 Clearance

The UPS has no lateral grills; therefore there are no special clearance requirements on the two sides.

In addition to the provisions of the local regulations, in order to enable routine tightening of the power terminals within the UPS, we recommended that the clearance at the rear of the UPS be sufficient to enable the free passage of personnel. In any event, as stated above, in order to allow heat to dissipate properly, there must be a space of at least 200 mm between the rear of the UPS and the wall.

2.7.3 Cable Access Mode

The UPS is suitable for both top and bottom cable access configurations.

For more information, refer to *3.1.10 Power Cable Connection Steps* and 3.2.11 *Signal Cable Connection Steps*.

2.7.4 Final Positioning And Fixing

Once the UPS has been moved to its final position, use the four adjustable feet to secure it to the floor, as shown in Figure 2-6. To do this, proceed as follows:

1. Loosen the nuts by unscrewing them upwards.
2. Rotate the feet until they touch the floor.
3. Fit the foot fixing pieces that were put aside when removing the UPS from its pallet.
4. Align the foot fixing pieces with the pre-prepared installation holes, in with the dimensions indicated in Figure 2-7.
5. Rotate the nuts from top to bottom till they press firmly against the foot fixing pieces, and then use the M10 fixing bolts to secure the UPS to the floor.

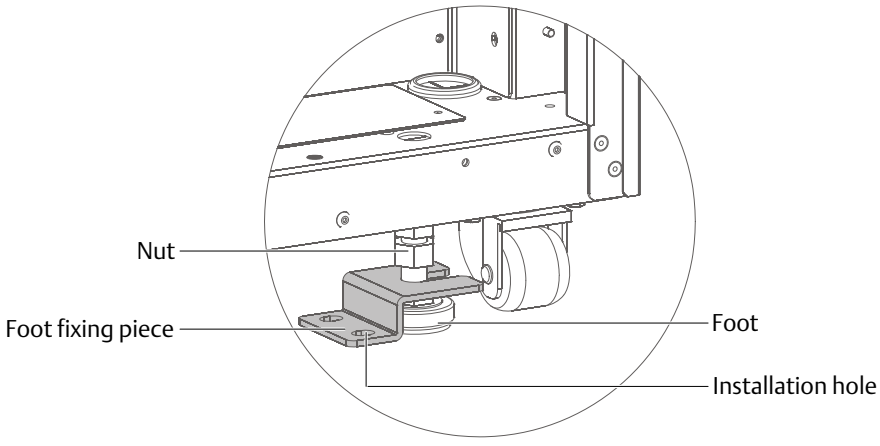


Figure 2-6 Diagram illustrating how to position and secure the UPS

2.8 Installation Drawings

Figure 2-7 illustrates the key mechanical characteristics of the UPS.

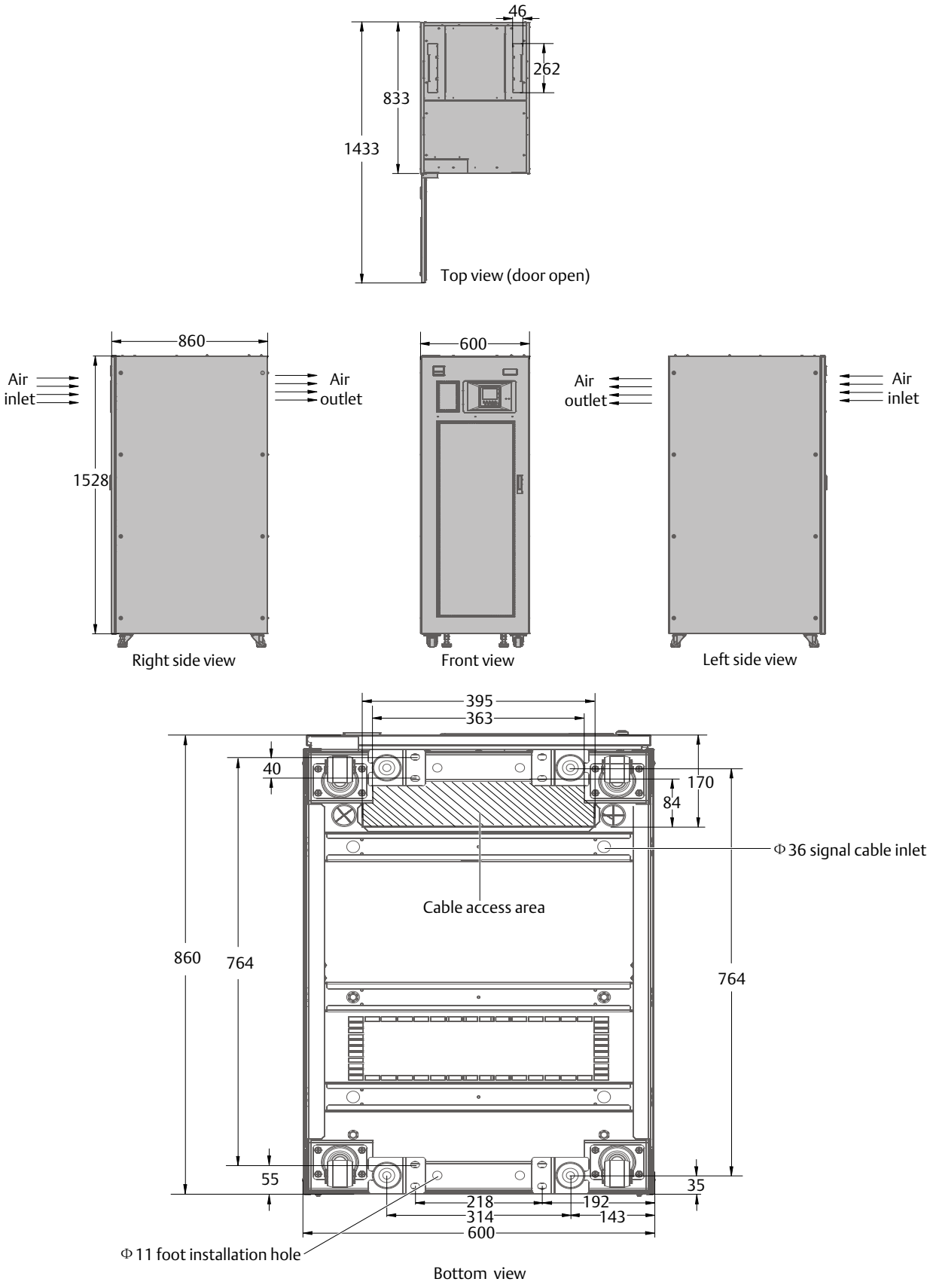


Figure 2-7 Top/front/side/bottom view of the UPS (unit: mm)

Chapter 3 Electrical Installation

This chapter provides an introduction to the UPS electrical installation procedures, including power and signal cabling procedures and methods.

After completing the mechanical installation procedure, it is necessary to connect the UPS power and signal cables. The signal cables, irrespective of whether they are shielded or not, must be kept away from the power cables.

Warning

1. Do not switch the UPS on before the authorized service engineer has arrived.
2. The UPS cables should be routed by an authorized engineer in accordance with the information contained in this chapter.

3.1 Power Cable Wiring

3.1.1 System Configuration

Select the size of the system power cables in order to satisfy the following requirements:

UPS input cable

The cable size of the UPS input cable differs according to the UPS power ratings and input AC voltages, and must be selected so that it is capable of handling the maximum input current; including the maximum battery charge current, see Table 3-1.

UPS bypass and output cable

The cable size of the UPS bypass and output cable differs according to the UPS power ratings and output AC voltages, and must be selected so that it is capable of handling the nominal output or bypass current, see Table 3-1.

Battery cable

Each UPS is connected to its battery by the three cables, one for the positive pole, one for the negative pole, and one for the neutral line. The battery cable size differs according to the UPS power ratings, and must be selected so that it is capable of handling the battery discharge current as the battery reaches the EOD voltage, see Table 3-1.

3.1.2 Maximum Steady State AC And DC Currents

The power cable must be selected in accordance with the current and voltage values indicated in Table 3-1, and the local wiring regulations, also taking environmental conditions (temperature and physical media) and the provisions of Table 3B in IEC 60950-1 into consideration.

Table 3-1 Max. steady state AC and DC currents

UPS power (kVA)	Rated current (A)					Bus stud bolt/nut specification	
	Max. input current[1,2]	Output/bypass current[2] at full load			Battery discharge current (+, -, N) at min. battery voltage	Input/battery/output/ bypass cable	Recommended torque (N.m)
		380V	400V	415V			
60 (3-in 3-out)	103	91	87	84	195/195/59	M6/M8/M6/M6	4.8/12/4.8/4.8

Note

When selecting the battery cables, a max. volt drop of 4Vdc is permissible at the current ratings given in Table 3-1. Do not form coils, so as to minimize the formation of EMI.

1. Input mains current for rectifier and bypass.
2. Non-linear loads (such as switch-mode power supplies) affect the design of the output and bypass neutral line, since the neutral line current may be up to 1.5 times the rated phase current.

3.1.3 Recommended UPS Cable Cross Sectional Area (CSA)

The recommended UPS cable CSA values are listed in Table 3-2.

Table 3-2 Recommended UPS cable CSA (unit: mm², ambient temperature: 25°C)

Model	Input	Output	Bypass	Neutral line	Earth cable	Battery
60kVA (3-in 3-out)	25	25	25	35	25	50

Note

If the user's cable CSA exceeds the value recommended in Table 3-2, please contact Vertiv service engineers.

3.1.4 Selecting the UPS I/O Switch

Note

The specified upstream breakers below are required to obtain the conditional short-circuit current rating, Icc at 10kA symmetrical rms. The specified upstream breakers should comply with an IEC 60947 series standard.

Table 3-3 indicates the recommended UPS I/O switch capacity, so that the user can select it according to actual needs.

Table 3-3 Selection of the UPS I/O switch

Model	Input	Recommended	Breaking	BCB	Output port	Recommended

	port	capacity of input external switch	Capacity			capacity of output external switch
60kVA (3-in 3-out)	Terminal block	125A (3P), bypass 125A (3P)	10kA	DC 200A (4P)	Terminal blcok	125A (3P)

3.1.5 Distance Between The UPS Connection Point And The Floor

See Table 3-4 for details.

Table 3-4 Min. distance between UPS connection point and floor

UPS connection point	Min. distance （mm）
	60kVA
Rectifier input	236
Bypass input	236
AC Output	236
Battery	265
PE terminal	220

3.1.6 Notes

The following points are for general guidance only. If there are any relevant local regulations, these shall prevail.
1. The neutral line cable size must be selected for a current 1.5 times greater than the output/bypass phase current.
2. The protective earth cable size shall be selected according to the AC power failure level, cable length and protection type. The grounding wire connection must use the shortest possible connection path.
3. In the case of cables carrying large currents, it is possible to connect multiple cables with smaller current carrying capacities in order to facilitate installation.
4. When selecting the battery cable size, refer to the current value indicated in Table 3-1, allowing a maximum voltage drop of 4Vdc.

3.1.7 Power Cable Connection Terminals

The rectifier input, bypass input, output and battery power cables are connected to the corresponding terminals shown in Figure 3-2.

3.1.8 Protective Earth

The protective earth cable must be connected securely to the PE input terminal (see Figure 3-2) using the fixing bolt.
All the cabinets and cable troughs shall be grounded according to the local regulations. The grounding cables shall be secured so as to prevent the tightening screws from being loosened when the grounding cables are pulled.

Warning

Failure to ground units correctly can cause EMI, electric shock or fire risk.

3.1.9 External Protective Device

To guarantee safety, it is necessary to install external circuit breakers on the UPS main, bypass and battery input lines. Because of the differences between specific installations, this section is intended to provide general practical information for the installation engineer only. Qualified installation engineers should have the knowledge of the local wiring regulations that apply to the equipment to be installed.

Rectifier and bypass input power supply

1. Input over-current and short circuit protection

Install suitable protection devices on the input mains supply distribution line. Such devices should be selected in order to protect the UPS against over current and short circuits, provide isolation protection and trip in the event of back-feed. When selecting the protective devices, consider the power cable current-carrying capacity, system overload capacity (see Table 11-6 and Table 11-7) and the short circuit capacity of the upstream power distribution system. We normally recommend using a thermo-magnetic circuit breaker having an IEC60947-2 tripping curve C (normal), when the current value reaches 125% of the current value listed in Table 3-1.

2. Separate bypass configuration

If the UPS is supplied by a separate bypass configuration, an independent protective device shall be installed on the rectifier input and bypass input distribution lines.

Note

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

3. Ground fault protection

If the pre-stage input power supply is fitted with an RCD, the transient state and steady state ground leakage current upon the startup of the UPS must be taken into account.
The RCCB shall meet the following requirements:

- Be sensitive to the DC unidirectional pulse (class A) of the whole distribution network
- Be insensitive to transient state current pulses
- Have an average sensitivity of 0.3A ~ 3A (adjustable)

The RCCB symbols are shown in Figure 3-1.

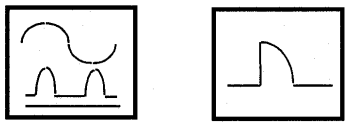


Figure 3-1 RCCB symbols

The UPS has an internal EMC filter, therefore the protective earth cable leakage current is 0 ~ 1000mA. We recommend verifying the RCD sensitivity of the upstream input distribution and the downstream distribution (to the load).

External battery

The BCB is used to protect the external battery. The UPS may be supplied with an optional BCB box, which provides over-current and short circuit protection and automatic tripping functions for the external battery. The rated voltage of the BCB is 500Vdc, and its DC breaking current is 20kA.

This BCB is important for the battery maintenance, and is generally installed near the battery.

System output

The UPS output must be fitted with a protection device. This device must differ from the input distribution protection switch and be able to provide overload protection (refer to Table 11-6 and Table 11-7).

3.1.10 Power Cable Connection Procedure

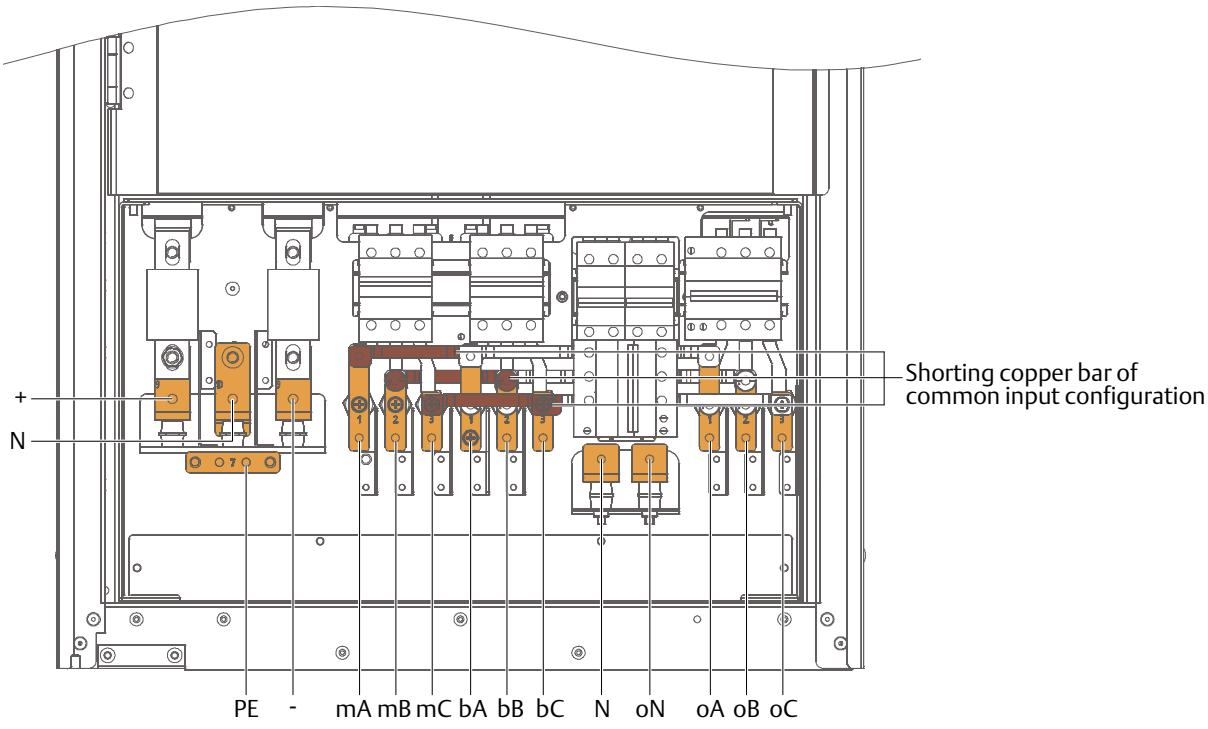
See para. 2.7.3 *Cable Access Mode* for information on the UPS cable access mode

Connection terminal and cable routing method

Figure 3-2 illustrates the UPS power cable connection terminals. Figure 3-3 and Figure 3-4 illustrate the power cable entry and routing methods.

Note

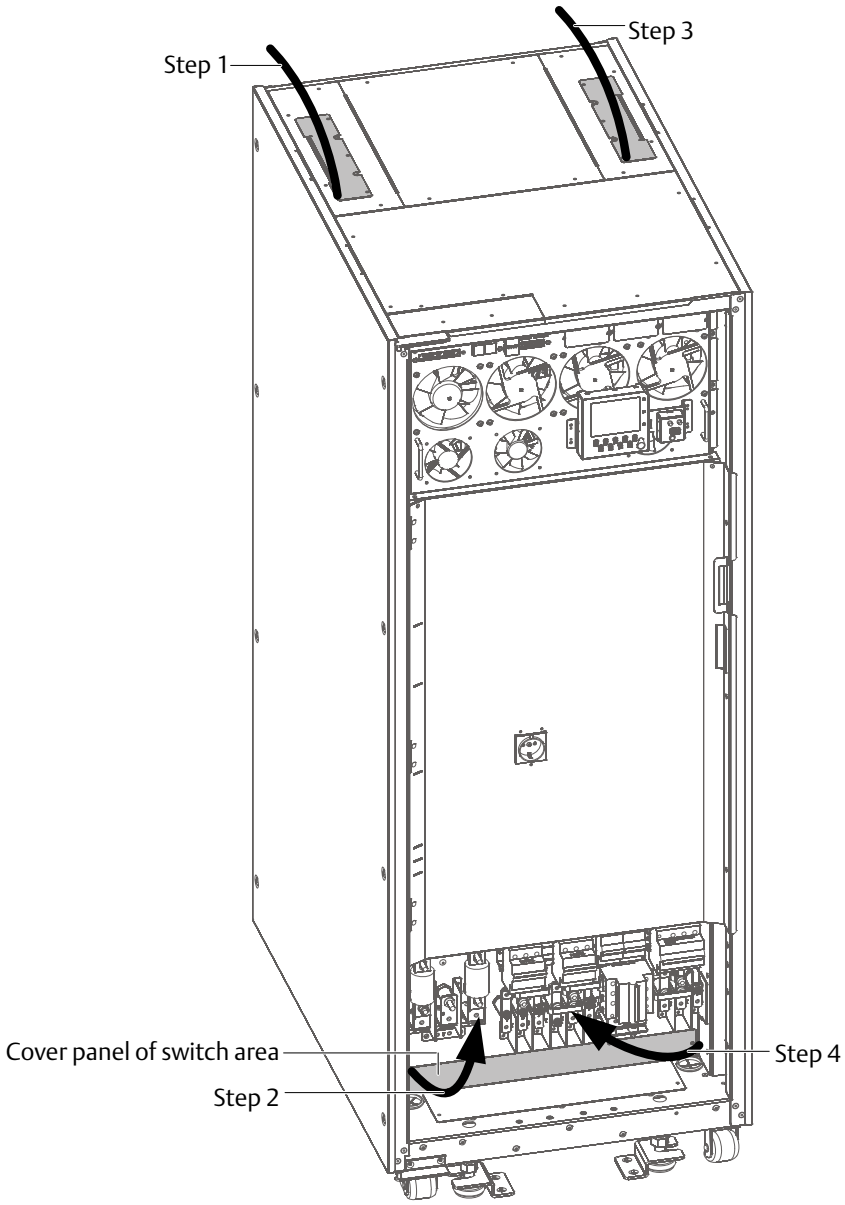
1. The power cables should be routed through conduits or cable troughs to prevent damage due to mechanical stress and reduce EMI into the surrounding environment.
2. When routing the cables inside the cabinets, they must be secured and fixed as illustrated in Figure 3-3 and Figure 3-4, in order to prevent cable damage due to mechanical stress.



Note:

1. +, -, N: battery input terminals
2. PE: PE input terminal
3. mA, mB, mC: rectifier input terminals
4. bA, bB, bC, N: bypass input terminals
5. oA, oB, oC, oN: output terminals

Figure 3-2 Power cable connection terminals



Note:

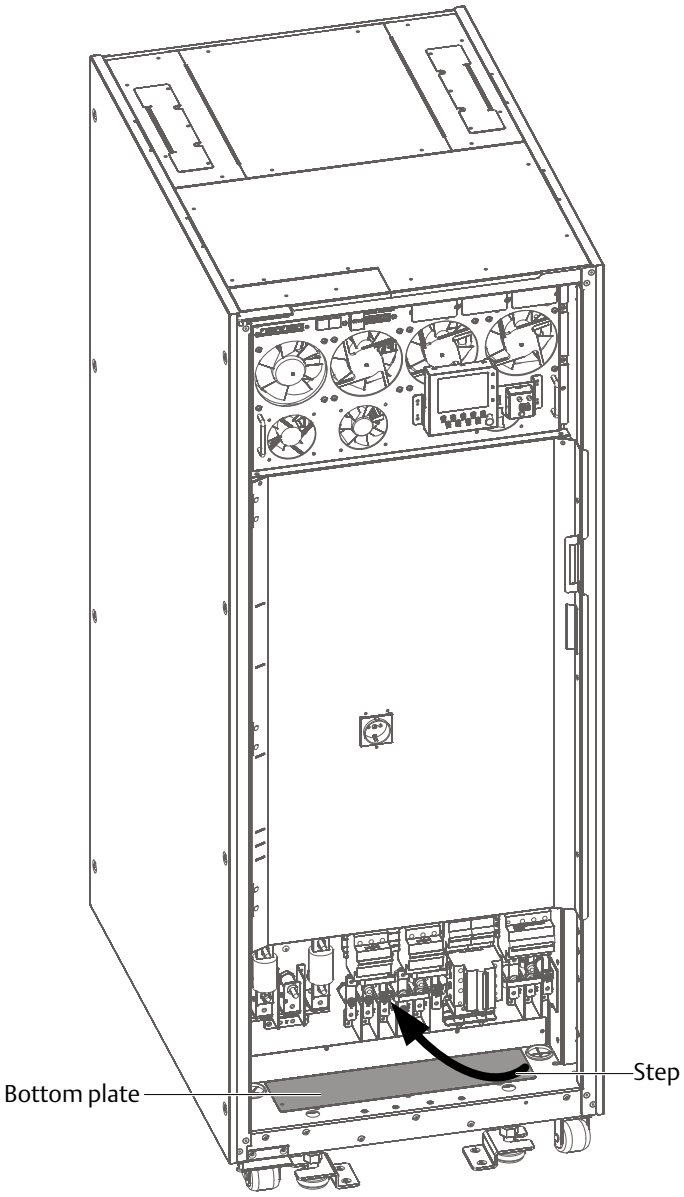
Step 1: Remove the left top cover, lead battery input cable and PE input cable into the cabinet, and route them along left side panel to cabinet base.

Step 2: Remove the cover panel of switch area, respectively connect cables to battery input terminals and PE input terminal.

Step 3: Remove the right top cover, lead rectifier input cable, bypass input cable and output cable into the cabinet and route them along right side panel to cabinet base.

Step 4: Respectively connect cables to the cabinet rectifier input terminals, bypass input terminals and output terminals.

Figure 3-3 Power cables wiring route (top cable access)



Note:

Step: Remove the bottom plate, lead cables into the cbainet and connect them to corresponding terminals.

Figure 3-4 Power cables wiring route (bottom cable access)

Warning

Before connecting the cables, make sure that all external power switches are off, and position the necessary warning signs in order to prevent inadvertent operation of the switches. Meanwhile, measure the voltages between the UPS terminals and the voltages between the terminals and earth.

Refer to Figure 3-2 ~ Figure 3-4, open the front door of the UPS, and remove the protective cover (located at the lower left corner) to reveal the power cable connection terminals (see Figure 3-2). Connect the protective earth cable to the PE input terminal in the cabinet.

Warning

1. The earth cables and neutral line must be connected in accordance with local and national codes of practice.
2. Failure to observe this could result in electric shock or fire risk.

Power distribution mode

Depending on the user's requirements, there are two possible UPS I/O cable connection configurations:

- 3-in 3-out, common input configuration (factory default)
- 3-in 3-out, separate bypass configuration

Connecting the system input

1. 3-in 3-out, common input configuration (factory default)

Refer to Figure 3-5, connect the AC input cables to the bypass input terminals (bA-bB-bC) in the cabinet, and ensure that the three copper shorting bars are connected between the rectifier input terminals (mA-mB-mC) and the corresponding bypass input terminals. Connect the input neutral line to the neutral terminal N in the cabinet. Ensure correct phase rotation.

Note that the common input copper shorting bars are factory fitted.

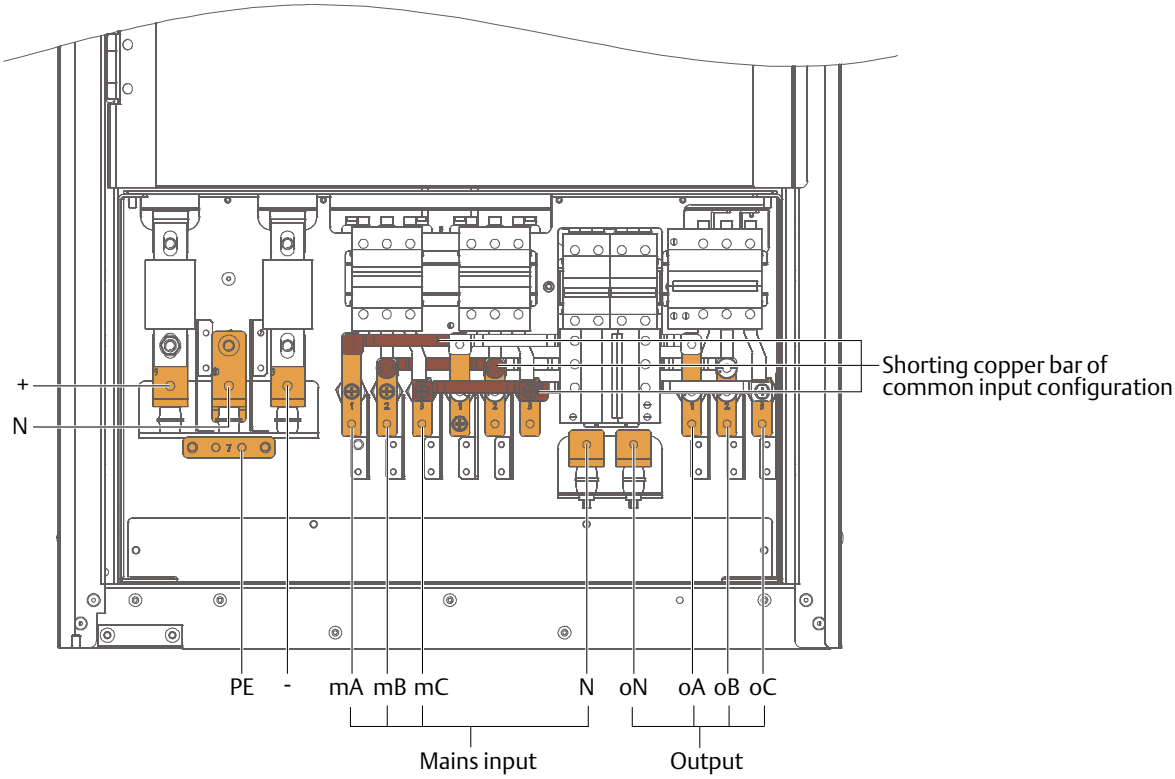


Figure 3-5 3-in 3-out, common input configuration cable connection (factory default)

2. 3-in 3-out, split bypass configuration

Refer to Figure 3-6, remove the three shorting copper bars between the rectifier input terminals (mA-mB-mC) and the bypass input terminals (bA-bB-bC). Connect the rectifier input cables to the rectifier input terminals (mA-mB-mC) in the cabinet, and connect the bypass input cables to the bypass input terminals (bA-bB-bC) in the cabinet. Connect the rectifier input neutral line and bypass neutral line to the neutral terminal N in the cabinet. Ensure correct phase rotation.

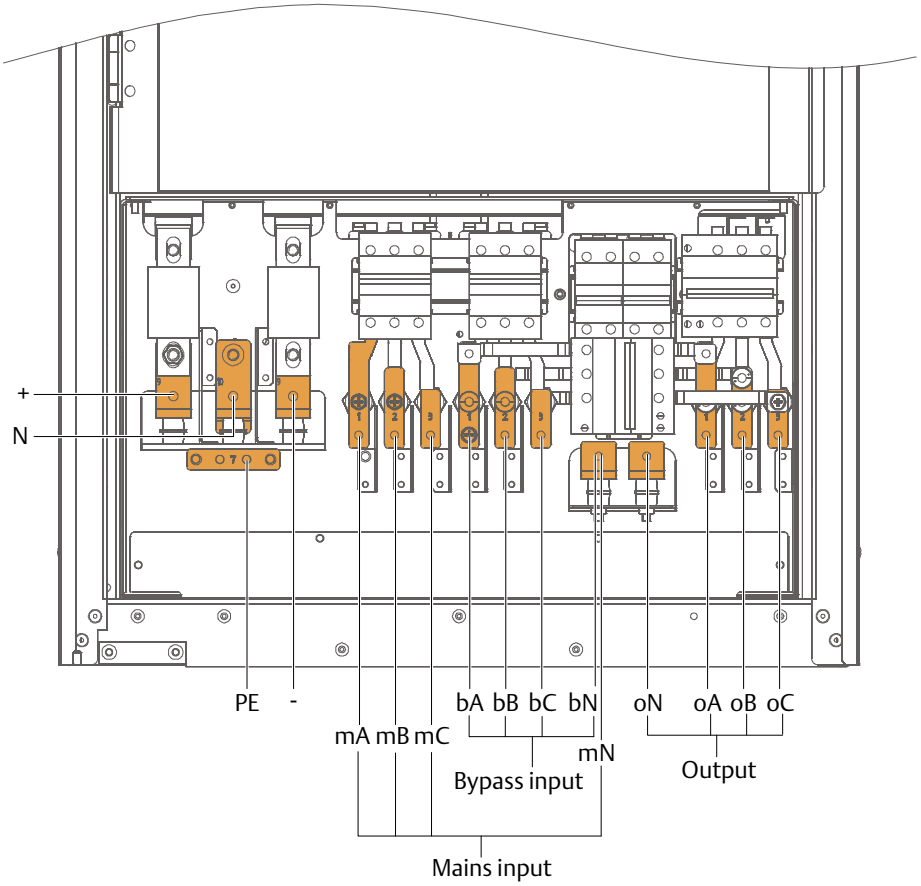


Figure 3-6 3-in 3-out, separate bypass configuration cable connection

Connecting the system output

Connect the system output cables between the output terminals (oA-oB-oC-oN) in the cabinet and the load. Refer to Table 3-1 for the tightening torque. Ensure correct phase rotation.

Warning

If the load is not to be supplied before the arrival of the service engineer, ensure that the system output cables are safely isolated at their ends.

Connecting the batteries

If the system includes an external battery, ensure that the battery string terminals are connected to the correct terminals on the BCB and that the BCB terminals (BAT+, BAT N, BAT-) are connected to the corresponding battery input terminals on the UPS, i.e. that is, (BAT+) to (+) and (BAT-) to (-), (BAT N) to (N), making sure that at least one battery link in each tier is disconnected. Do not reconnect these links or close the BCB before authorized to do so by the service engineer.

Note: When connecting the cables between battery terminals and BCB, connect them to the BCB terminals first.

Once the batteries have been connected, replace the protective covers.

Note

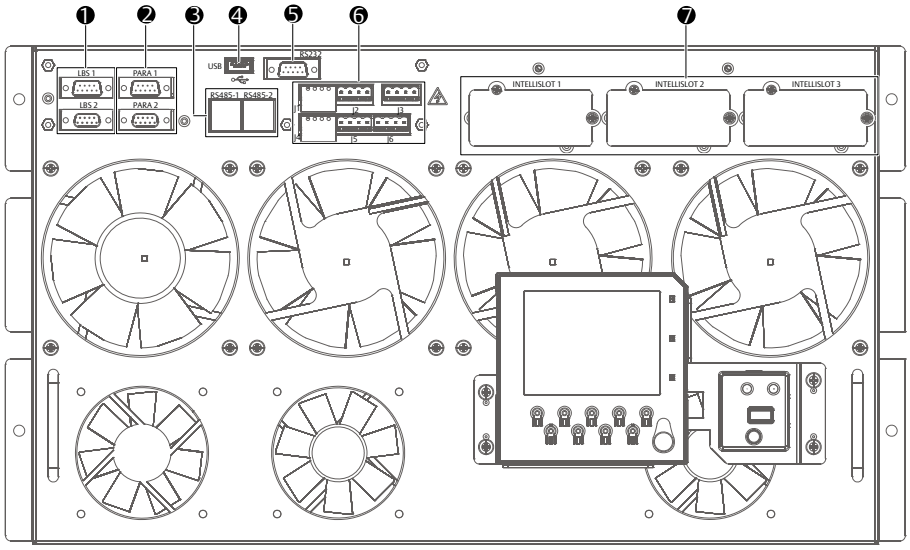
After connecting the batteries, take appropriate measures to seal the cable entry holes.

3.2 Signal Cable wiring

3.2.1 Overview

For on-site specific needs, the UPS provides auxiliary connections that can be used to manage the battery system (including the external battery switch), communicate with a PC, provide alarm signals to external devices, connect a remote EPO or provide a bypass back-feed circuit breaker signal and parallel communications. These functions are

controlled by the communication box in the UPS. As shown illustrated in Table 3-7, the communication box provides the following ports:



Note:

❶ LBS communication port

❷ Parallel communication port

❸ RS-485 communication port

❹ USB communication port

❺ RS232 communication port

❻ User dry contact port

❼ Intellislot port

Figure 3-7 Illustration of communication box ports

3.2.2 Input Dry Contact Port

The input dry contact ports J1 and J5 are shown in Figure 3-8 and described in Table 3-5. The input dry contact voltage is 12Vdc, and the current is 20mA.

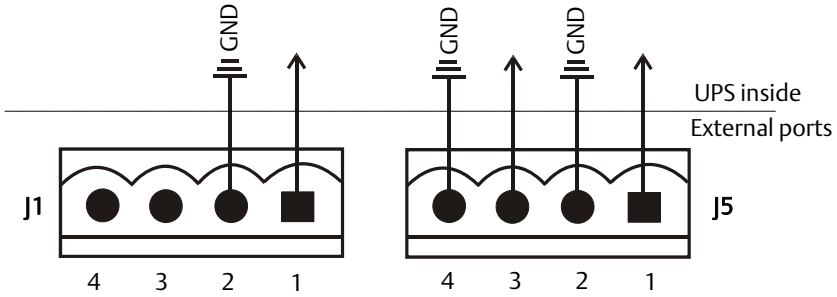


Figure 3-8 Input dry contact ports J1 and J5

Table 3-5 Description of input dry contact ports J1 and J5

Silkscreen	Port	Pin No.	Pin name	Meanings
J1	Generator mode input	1.1	GEN	Generator is connected. Shorted between 1.1 and 1.2: generator mode; open between 1.1 and 1.2: normal mode
		1.2	GND	GND
J5	External maintenance bypass switch	5.1	EXT_Q3	External maintenance bypass switch state. The auxiliary contact requirement of the external maintenance bypass switch: when 5.1 and 5.2 are shorted, the external maintenance bypass switch is closed
		5.2	GND	GND
	External output switch	5.3	EXT_OUT	External output switch. External output switch auxiliary contact state: when 5.3 and 5.4 are shorted, the external output switch is closed.
		5.4	GND	5.3 and 5.4 have been shorted in factory

3.2.3 BCB Port

J2 is the BCB port. The port is shown in Figure 3-9 and described in Table 3-6.

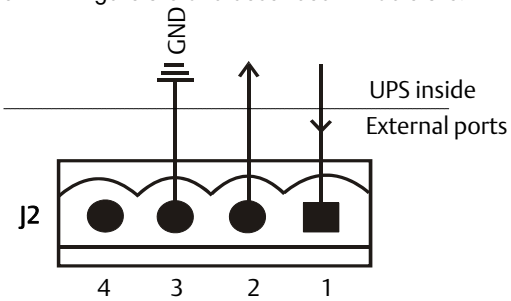


Figure 3-9 BCB port J2

Table 3-6 Description of BCB port J2

Silkscreen	Port	Pin No.	Pin name	Meanings
J2	BCB	2.1	DRV	BCB undervoltage release. Normally 12V, trip at 0V
		2.2	FB	BCB backfeed signal input (normally open). Normally open auxiliary BCB contact signal: Auxiliary contact closed when circuit breaker closed; auxiliary contact open when circuit breaker open.
		2.3	GND	GND

3.2.4 Backfeed Protection Dry Contact Port

The backfeed protection dry contact port J13 is shown in Figure 3-10 and described in Table 3-7. The rated capacity of the backfeed protection dry contact is 240Vac/24Vdc, 5A.

Warning

The voltage of the dry contact signal connected to J13 backfeed protection dry contact port is potentially hazardous. Before connection, make sure that you are connecting the cable to the right port.

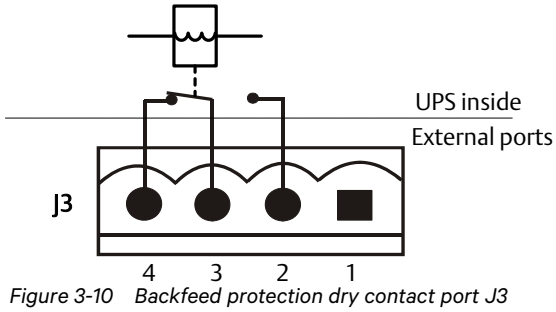


Figure 3-10 Backfeed protection dry contact port J3

Table 3-7 Description of backfeed protection dry contact port J3

Silkscreen	Port	Pin No.	Pin name	Meanings
J3	Rectifier/Bypass backfeed output	3.2	BFP_O	Rectifier/bypass backfeed normally open contact. Open when there is no backfeed
		3.3	BFP_S	Rectifier/bypass backfeed common contact
		3.4	BFP_C	Rectifier/bypass backfeed normally closed contact. Closed when there is no backfeed

3.2.5 Remote EPO Input Port

The UPS has an EPO function that is operated by pressing an EPO button located on the UPS operator control and display panel, or by a remote contact supplied by the user. The EPO switch has a protective cover.
The remote EPO input port is J4. The port is shown in Figure 3-11 and described in Table 3-8.

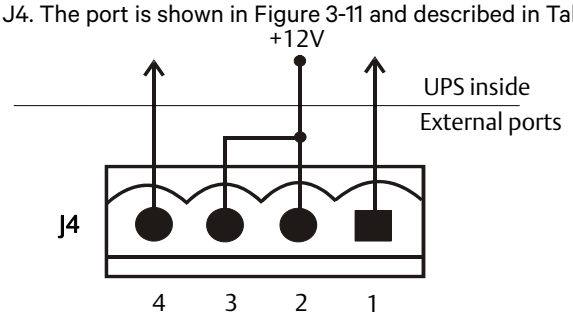


Figure 3-11 Remote EPO input port J4

Table 3-8 Description of remote EPO input port J4

Silkscreen	Port	Pin No.	Pin name	Meanings
J4	Remote EPO input	4.1	EPO_NC	EPO activated when opened to 4.2. Pins 4.1 and 4.2 have been shorted in factory
		4.2	+12V	EPO activated when opened to 4.1
		4.3	+12V	EPO activated when shorted to 4.4
		4.4	EPO_NO	EPO activated when shorted to 4.3

EPO is triggered when pins 3 and 4 of J4 are shorted or pins 2 and 1 of J4 are opened.
If an external EPO facility is required, pins 1 and 2 or 3 and 4 of the REPO port are reserved for this function. The external EPO facility is also connected to the normally open or normally closed remote EPO switch between these two terminals using shielded cable. If this function is not used, pins 3 and 4 on the REPO input port must be open, while pins 1 and 2 must be shorted.

Note

The UPS EPO action shuts down the rectifier, inverter and static bypass, but it does not disconnect the main input power internally. To disconnect all power to the UPS, open the external power switch, bypass input switch, output switch and BCB after activating the EPO.

3.2.6 RS232 Communication Port

See Figure 3-7 for the location of the RS232 port. The RS232 port can be connected to an external computer in order to monitor and set-up parameters.
The RS232 port provides serial data and is intended for use by authorized commissioning and service personnel when commissioning and servicing the UPS.

3.2.7 USB Communication Port

The location of the USB port is shown in Figure 3-7.
The USB port can be used to connect the monitoring software.
To connect the communication cable, proceed as follows:
Connect one end of the USB communication cable to the USB port (see Figure 3-7) in the communication box, and the other end to the USB port of the computer.
After connecting the pc to the USB port, install the USB driver on the installation disk.
Note: Do not connect the RS232 port and USB port to the computer at the same time as this could compromise correct communication.

3.2.8 Parallel And LBS Communication Ports

See Figure 3-7 for the positions of these ports.

3.2.9 RS485 Communication Port

See Figure 3-7 for the position of this port.
See Table 3-9 for definition of the pins, and see Figure 3-12 for the cable connection diagram of the RS485 communication port.

Table 3-9 Pins definition of RS485 communication port

Pin	1, 2	3, 6	4, 5	7	8
Definition	NC	NC	GND	D+	D-

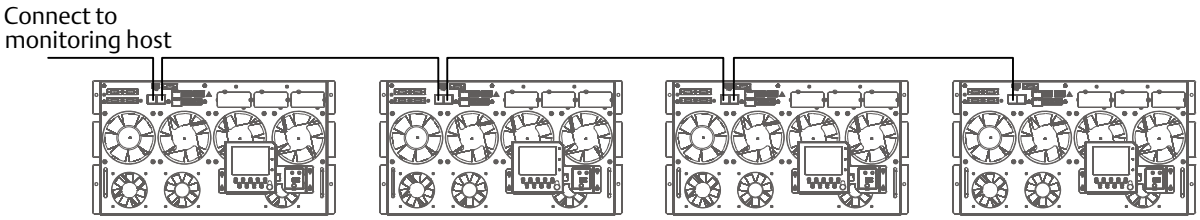


Figure 3-12 Cable connection diagram of RS485 communication port

3.2.10 Intellislot Port

The Intellislot ports are used for installing optional cards on site, including IS-UNITY-DP card, IS-Relay card, IS-485L card, IS-WEBL card. Table 3-10 lists the models and installation positions for the optional cards. For detailed installation instructions, refer to the Chapter 8 *Options*.

Table 3-10 Models and installation positions of optional cards

Optional card	Model	Installation position
IS-UNITY-DP card	IS-UNITY-DP	Intellislot ports 1 ~ 3 (Intellislot port 2 recommended)
IS-Relay card	IS-Relay	Intellislot ports 1 and 3 (Intellislot port 1 recommended)
IS-485L card	IS-485L	Intellislot ports 1 and 3 (Intellislot port 3 recommended)
IS-WEBL card	IS-WEBL	Intellislot ports 1 ~ 3 (Intellislot port 2 recommended)

Note

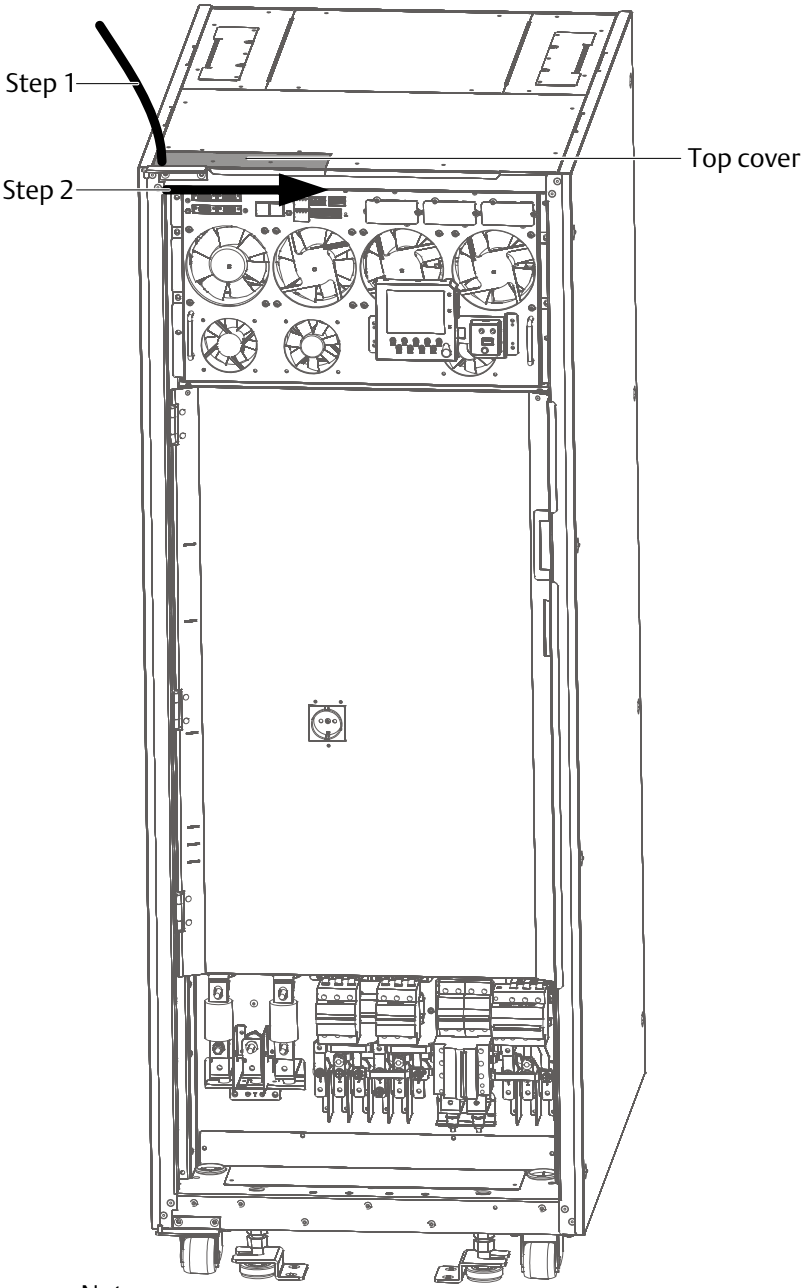
1. The Intellislot port 2 shares communication resources with the RS485 port. To avoid conflict, when using RS485 port in service and commissioning, we recommended not using Intellislot port 2.
2. The Intellislot port 3 shares communication resources with RS232 and USB ports. To avoid conflict, when using RS232 and USB ports in service and commissioning, we recommended not using Intellislot port3.

3.2.11 Signal Cable Connection Procedure

Note

Route the power cables and signal cables separately. Signal cable shields be reliably earthed.

The signal cables may be connected in top cable or bottom cable access configuration. See Figure 3-13 and Figure 3-14.

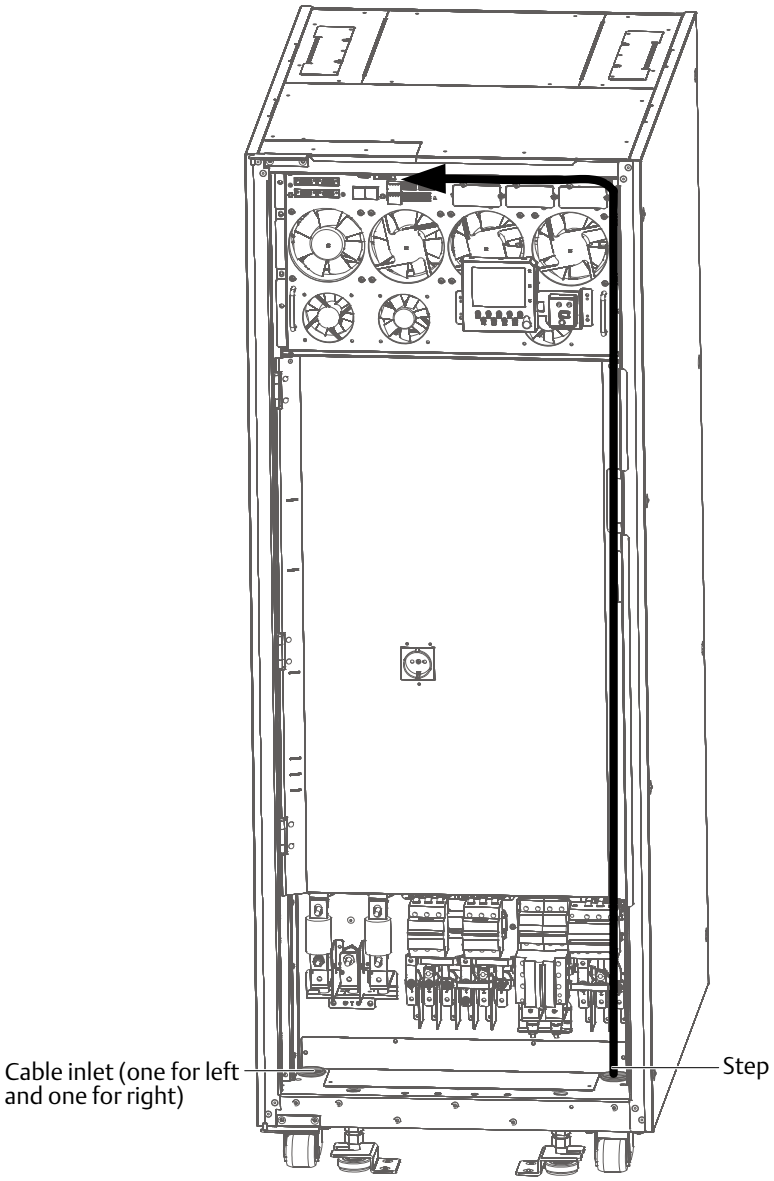


Note:

Step 1: Remove the top cover, lead cables into the cabinet.

Step 2: Connect cables to corresponding terminals.

Figure 3-13 Signal cables wiring route (top cable access)



Note:

Step: Take priority selection of the right side cable inlet, lead cables into the cabinet and route them along the cabinet inside, then connect them to corresponding terminals.

Figure 3-14 Signal cables wiring route (bottom cable access)

Chapter 4 Operator Control And Display Panel

This chapter describes the functions and use of the elements on the UPS operator control and display panel, provides LCD display information, including the LCD screen types, detailed menu messages, prompt windows and the UPS alarm list.

4.1 Introduction

The operator control and display panel is located on the front of the UPS. It permits the operator to access the UPS controls and query all the measured parameters, UPS and battery status and alarms.

The operator control and display panel is divided into three functional areas: LCD screen, LED indicator and control keys, as illustrated in Figure 4-1, and described in Table 4-1.

Figure 4-1 Operator control and display panel

Table 4-1 Description of the operator control and display panel elements

No.	Function		Key	Function
1	Alarm indicator (Red)		F1 ~ F5	LCD menu keys
			FAULT CLEAR	Fault reset switch
			ON	Inverter start switch
2	Inverter indicator (Green)		OFF	Inverter shutdown switch
			ALARM CLEAR	Alarm silencing switch
			EPO	EPO switch

4.1.1 LED Indicators

The two indicators show the operating working state of the UPS, see Table 4-2 for details.

Table 4-2 Definition of indicators

Indicator	Status	Description
Inverter indicator	Solid green	Load powered by the inverter
	Flashing green	Inverter switching on, starting up, synchronizing or in stand-by state (ECO mode)
	Off	Inverter off
Alarm indicator	Solid red	Rectifier not ready or critical fault (for example, inverter relay short circuit, bypass STS short circuit, bypass backfeed and inverter fault, etc.)
	Flashing red	General fault (for example, module overload, battery disconnected, fan failure and parallel load sharing failure, etc.)
	Off	No fault

4.1.2 Audible Alarm (Buzzer)

UPS activity is accompanied by the two different sounds, as listed in Table 4-3.

Table 4-3 Description of audible alarm

Alarm sound	Meaning
Beep every other second	Alarm generated in the event of a general fault, for example, overload, battery disconnected, fan failure, parallel load sharing failure and battery discharge pre-alarm, etc.
Continuous beep	Alarm generated in the event of a critical fault, for example, inverter relay short circuit, bypass STS short circuit, bypass backfeed and inverter fault, etc.

4.1.3 Control Keys

The operator control and display panel includes five control keys, as described in Table 4-4.

Table 4-4 Description of control keys

Control key	Silkscreen	Description
EPO switch	EPO	Use this key to cut off the load power and battery, shut down the rectifier, inverter, static bypass
Inverter start switch	ON	Use this key to start the inverter
Inverter shutdown switch	OFF	Use this key to shut down the inverter
Fault reset switch	FAULT CLEAR	Use this key to clear the fault condition in order to restart the UPS
Alarm silencing switch	ALARM CLEAR	When an alarm is active, press this key to silence the audible alarm. Press this key again to enable the buzzer again.

Note

It is necessary to press and hold the keys described above for 2s in order to activate the associated function.

4.1.4 LCD And Menu Keys

The operator control and display panel includes an LCD screen and five menu keys (F1 ~ F5). The menu keys are described in Table 4-5.

Table 4-5 Description of menu keys

Key	F1	F2	F3	F4	F5
Function 1	⌂ HOME	ESC Escape	⇦ Left	⇨ Right	⏎ Enter
Function 2			⇧ Up	⇩ Down	

The user-friendly, menu-driven 320 x 240 dot matrix graphic LCD display allows you to browse through the UPS input, output, load and battery parameters, get current UPS status and alarm information, and perform functional setting and control operations. The LCD also stores up to 2048 historical records that can be retrieved for reference and diagnosis.

4.2 LCD Screen Type

4.2.1 Start Screen

Upon UPS start, the UPS executes a self-test, and the start screen appears and remains approximately 25 seconds, as shown in Figure 4-2.

Figure 4-2 Start screen

4.2.2 Main Screen

After the self-test has been completed, the main screen appears, as shown in Figure 4-3. The main screen is divided into four windows: system information window, data window, menu window and keypad window.

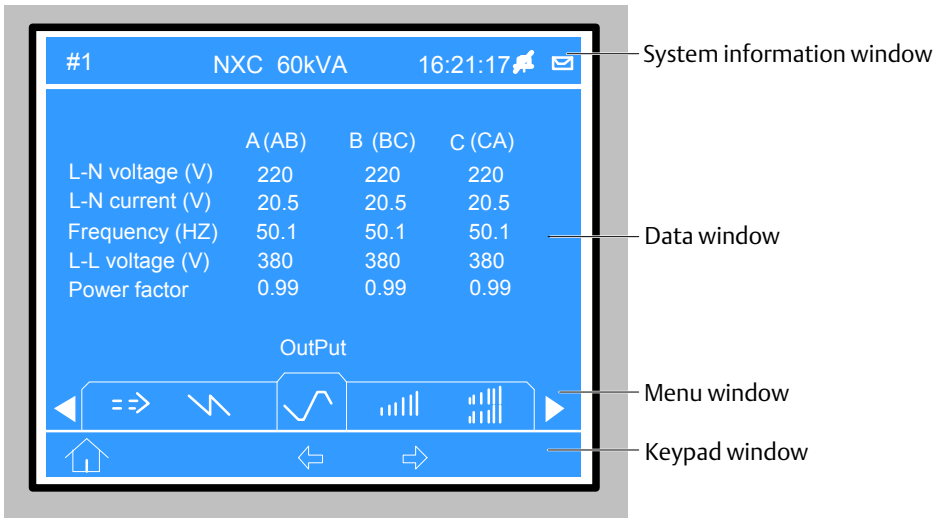


Figure 4-3 Main screen

The functions of the F1 ~ F5 menu keys that appear on the current screen are illustrated by the self-explanatory icons that appear in the keypad window as appropriate. Press the F1 key from any menu on the main screen to return to the 'OutPut' menu.

4.2.3 Default Screen

While the UPS is operating, if no alarms are generated or keys operated for two minutes, the display reverts to the default screen, as shown in Figure 4-4. After a short delay, the LCD backlight will switch off. Pressing any menu keys (F1 ~ F5) restores the default screen.

Figure 4-4 Default screen

4.3 Detailed Description Of Menu Items

The description that follows refers to the LCD main screen, as shown in Figure 4-4.

System information window

The system information window displays the current time, UPS name, configuration and alarm silencing state. This window requires no actions on the part of the user. For details, see Table 4-6.

Table 4-6 Item description of system information window

Item	Explanation
NXC	UPS series name
(Configuration) Single/ECO/Unit1#	Single: UPS module system in dual conversion mode ECO: The UPS is set-up as a UPS module system, and is running in ECO mode Unit1#: #1 of the parallel system formed by up to two UPS modules
60kVA	UPS power is 60kVA
16:21:17	Current time (format: 24 hours, hour: minute: second)
/	Audible alarm enabled or disabled. : disabled, : enabled

Menu window and data window

The menu window provides access to the data window menus. The data window displays the items included in the menu selected in the menu window. The user can browse the UPS parameters and set-up the functions via the menu window and data window. For more details see Table 4-7.

Table 4-7 Description of menu window and data window items

Menu	Item	Explanation
Mains	L-N voltage (V)	Phase voltage
	L-N current (A)	Phase current
	Frequency (Hz)	Input frequency
	L-L voltage (V)	Line voltage
	Power factor	Power factor
Bypass	L-N voltage (V)	Phase voltage
	Frequency (Hz)	Bypass frequency
	L-L voltage (V)	Line voltage
OutPut	L-N voltage (V)	Phase voltage
	L-N current (A)	Phase current
	Frequency (Hz)	Output frequency
	L-L voltage (V)	Line voltage
	Power factor	Power factor
Load	S_{out} (kVA)	S_{out}: apparent power
	P_{out} (kW)	P_{out}: active power
	Q_{out} (kVAR)	Q_{out}: reactive power
	Load level (%)	Load (expressed as a percentage of the UPS nominal load)
	Crest factor	Output current crest factor
System	S_{out} (kVA)	S_{out}: apparent power
	P_{out} (kW)	P_{out}: active power
	Q_{out} (kVAR)	Q_{out}: reactive power
	Single unit, no parallel system data	Displayed in this data window when the UPS is configured as a single unit
Battery	Battery voltage (V)	Battery bus voltage
	Battery current (A)	Battery bus current
	Battery temperature (°C)	Built-in battery temperature
	Battery remain time (Min.)	Remaining battery backup time
	Battery capacity (%)	Percentage of battery life when compared to a new battery
	Battery boost charging	Battery is boost charging
	Battery float charging	Battery is float charging
	Battery is not connected	Battery is not connected
Event	(active alarm)	Display the active alarms
Records	(alarm history)	Display the alarm history
Language	(language option)	Permits the user to select from 17 available LCD display languages
Settings	Display contrast	Adjust the LCD contrast
	Date format set	Three formats selectable: MM/DD/YYYY, DD/MM/YYYY, YYYY/MM/DD
	Date & time	Set the date and time
	Comm1 baud rate	Set the Intellislot port 1 communication baud rate
	Comm2 baud rate	Set the Intellislot port 2 communication baud rate
	Comm3 baud rate	Set the Intellislot port 3 communication baud rate
	Communication address	Applicable to RS485 communication
	Single Group Batt Cap	Set the capacity of battery unit
	Battery Cells Number	Set the battery cells connected to the UPS
	Equalize Charge Allowed	Battery boost charge is enabled or disabled
	Temp Compensation	Enabled, Disabled
	Shared Battery	Enabled, Disabled
	System Configuration	Single, Parallel
	Parallel Requisite units	Basic number of single modules in parallel system
	Parallel Redundant units	Redundant number of single modules in parallel system
	Parallel ID	Provide an ID code for a single module in a parallel system, when 'Parallel' is set
	ECO Mode	Normal, ECO
	Output Frequency Level	Set the system output frequency (unit: Hz); 50/60
	Output Voltage Level	The voltage between phase line and phase line
	LBS Function	NONE, SLAVE, MASTER
	Command password	The user can modify the command password
	Protocol	Velocity
Command (initiate, stop	Battery maintenance test	20% battery capacity is used for battery maintenance test. Load must be between 20% and 80%

Menu	Item	Explanation
	Battery capacity test	Perform a full discharge of the battery to obtain an accurate battery capacity measurement. Load must be between 20% and 80%
	System test	UPS self-test. When the user activates this function, a window appears about 5s later to show the test result
	Stop testing	Manually stop a battery maintenance test, battery capacity test or system test
	Freshening charge	Manually initiate a battery freshening charge
	Stop freshening charge	Manually stop a battery freshening charge
Eff.Curve	Eff.Curve	Display the system efficiency at current load
Run Time	UPS Run time	Display cumulative UPS run time
	Byp. Run time	Display cumulative UPS run time in bypass mode
Version	UPS version	Display UPS inverter, rectifier and monitoring software versions
	UPS model	Display UPS model information, for example, 208V-60Hz

Keypad window

The functions of the (F1 ~ F5) menu keys that appear on the current screen are illustrated by self-explanatory icons that are displayed in the keypad window, as appropriate.

4.4 Prompt Window

A prompt window is displayed while the system is running in order to alert the user to certain conditions or to require request confirmation of a command. The prompts are listed in Table 4-8.

Table 4-8 Prompts and meanings

Prompt	Meaning
Transfer with interrupt, confirm or cancel	The load executes interval transfer between the inverter and bypass
The load is too high to be transferred with interrupt	The total load must be less than the capacity of one UPS in order to allow a parallel system to perform an interrupted transfer from bypass to inverter
This operation leads to output shutdown, confirm or cancel	The bypass is abnormal, switching off the inverter will cause the load to be de-energized
This operation leads to inverter overload, confirm or cancel	Switching off this inverter will cause the remaining inverter(s) in a parallel system to overload
Switch on more UPS to carry current load	The number of inverters currently switched on is insufficient to supply the existing load. The user is requested to switch on more UPS
Battery will be depleted, confirm or cancel	If you select battery maintenance test, the battery will discharge until the UPS shuts down. This prompt appears in order to request your confirmation. Cancel to end the test and transfer the UPS to inverter mode
System self test finished, everything is OK	No action required
Please check the current warnings	Check the active alarm messages
Enter control password	Required for battery or UPS test (default: 12345)
Battery Self Test aborted, conditions not met	The battery self-test condition is not satisfied. Please check if the battery is in boost charge state and the load is more than 20%
Battery Refresh Charge aborted, conditions not met	This prompt appears when you select the Freshening charge command while the battery freshening charge condition (such as no battery, charger failure) is not satisfied.

4.5 Alarm List

Table 4-9 provides the complete list of UPS alarm messages for display either on the 'Event' menu or on the 'Records' menu described in Table 4-7.

Table 4-9 UPS alarm list

Alarm	Explanation
Fault reset	FAULT CLEAR key on the operator control and display panel pressed
Rectifier in setting	The rectifier starts up and is in synchronization
Inverter in setting	The inverter starts up and is in synchronization
Manual switch on	ON key on the operator control and display panel pressed to switch on the inverter
Manual switch off	OFF key on the operator control and display panel pressed to switch off the inverter
Switch on fail	The inverter failed to switch on when the ON key was pressed. This may be the result of an invalid operation (maintenance bypass switch closed) or DC bus or rectifier not ready
Soft start fail	Owing to low DC bus voltage, the rectifier will report this alarm
Alarm silence	ALARM CLEAR key on the operator control and display panel pressed
Audible alarm reset	ALARM CLEAR key on the operator control and display panel pressed in alarm silence state
Bypass mode	The UPS is in bypass mode
Normal mode	The UPS is in normal mode
Battery mode	The UPS is in battery mode
UPS shutdown	UPS shutdown with no output power
Output disabled	An EOD event has occurred. Check the battery voltage
System Bypass STS fail	Bypass STS open circuit fault or short-circuit fault
Mains volt. abnormal	The mains voltage is outside specifications and results in rectifier shutdown

Alarm	Explanation
Mains undervoltage	At least one mains input phase voltage is within 132V ~ 176V, therefore the load should be derated
Mains freq. abnormal	The mains frequency is outside specifications and results in rectifier shutdown
Mains phase reversed	The AC input phase rotation is reversed
Input feedback	Battery voltage fed back to rectifier input
Mains neutral lost	AC rectifier input neutral line not detected
Input current abnormal	Battery load sharing imbalance or rectifier input current abnormal
Input curr. over limit	Input current over limit
Bypass unable to trace	The bypass frequency is outside specifications. This alarm automatically resets once the bypass voltage returns within normal limits.
Bypass abnormal	The amplitude or frequency of the bypass voltage exceeds the limit. This alarm automatically resets once the bypass voltage returns within normal limits.
Bypass STS fail	At least one of the Bypass STSs is open or shorted. This fault is locked until power-off
Byp. abnormal shutdown	Both the bypass and inverter voltages are abnormal, and the output is off
Bypass phase reversed	The bypass voltage phase rotation is reversed
Bypass overcurrent	The bypass current is outside the limits
Rectifier fault	Bus voltage abnormal or battery SCR short circuit
Rectifier overtemp.	The alarm occurs when the rectifier overheats
DC bus over voltage	The rectifier, inverter and battery converter have shut down because the DC bus voltage is too high. The load transfers to bypass
DC bus abnormal	The DC bus voltage is abnormal and results in inverter shutdown. The load transfers to bypass
Inverter asynchronous	The output voltage and bypass voltage are out of phase. This alarm resets automatically once the condition is no longer true
Inverter fault	Inverter output voltage outside specifications. Load transfers to bypass
Inverter relay fail	At least one of the inverter relays is open or short circuited. This fault is locked until mains power-off
Output fuse fail	At least one of the inverter output fuses has blown
Output volt. abnormal	At least one of the output voltage phases is abnormal
Unit overload	This alarm appears when the load rises above 105% of the nominal rating. The alarm automatically resets once the overload condition is removed
System overload	This alarm appears when the total load rises above 105% of the nominal rating of the parallel system. The alarm automatically resets once the overload condition is removed
Unit overload timeout	The UPS overload status persists and the overload times out. When the time has expired, the load automatically transfers to the bypass
Load impact transfer	A transfer to bypass occurred due to a large step load. The UPS can recover automatically. Switch on the load equipment in stages to reduce the load impact on the inverter
Transfer time-out	The load remains on bypass power owing to an excessive number of transfers within a one hour period
Load sharing abnormal	The UPSs in a parallel system are not sharing the load current correctly
System transfer	All UPSs in the parallel system transfer to bypass at the same time when one of them should transfer to bypass. This message appears on the LCD of the UPS with passive transfer to bypass
Control power fail	Auxiliary power failure or power-off
EPO	EPO button on operator control and display panel pressed or external EPO command received
Fan abnormal	At least one fan has malfunctioned
Operation invalid	Maintenance bypass switch is closed when the parallel system is on inverter, or the output and maintenance bypass switches are closed when the inverter is on
LBS active	The LBS setting is active
LBS abnormal	LBS is abnormal
Maint. sw. open	Maintenance bypass switch is open
Maint. sw. closed	Maintenance bypass switch is closed
Output sw. closed	Output switch is closed
Output sw. open	Output switch is open
Charger fault	Battery charger has malfunctioned
Dischg. curr. limit	Discharge current is over limit, close the discharger
Auto start	After UPS shutdown at EOD, the inverter automatically starts when the mains supply is restored
Freshening boost charge	The battery is forced to the boost charge state
Rec flash update	Rectifier software being updated
Inv flash update	Inverter software being updated
Monitor flash update	Monitoring software being updated
FLASH operate fail	Historical record not saved
Remote switch on	Switch on the inverter using the service command
Remote switch on failed	Caused by invalid operation (maintenance bypass switch closed), DC bus or rectifier not ready
Remote switch off	Switch off the inverter using the service command
Load sharing abnormal	The individual UPS modules in the parallel system are unable to execute load sharing
Communication fail	Interruption in communication between internal monitoring board and inverter, rectifier
Parallel comm. fail	Communication between the UPS modules in a parallel system failed. Check if all UPS modules in the parallel system are on; if not, switch all the UPSs on and check if the alarm disappears
No battery	Check the battery and battery connection
Batt. converter fault	Bus voltage abnormal

Alarm	Explanation
Battery reverse	Reconnect battery and check battery wiring
Battery period testing	The periodic automatic battery maintenance test is in progress (20% capacity discharge)
Batt. capacity testing	The user initiated a battery capacity test (100% capacity discharge)
Battery maintenance testing	The user initiated a maintenance test (20% capacity discharge)
Battery end of discharge	Inverter switched off due to battery EOD
Battery overtemp.	The battery temperature is over limit
Battery low pre-warning	The battery low warning alarm is activated between 3 minutes (default setting) before the battery voltage reaches the EOD limit. At this point the battery will continue to supply the load at the nominal value for 3 minutes (this value can be set to between 3 and 6 minutes by the user).
Generator in	Dry contact signal indicating that the generator is connected
BCB status abnormal	Logic conflict between BCB drive signal and feedback signal
BCB closed	BCB state (closed)
BCB open	BCB state (open)
Bypass overtemp.	The temperature at bypass side exceeds the threshold
Byp. overcurr. timeout	The bypass current has exceeded the threshold value for a period exceeding the timeout interval; the system disconnects the bypass output
Boost Charge Timeout	The boost charge alarm occurs when the battery boost charge time exceeds the set range (12 hours by default); the system transfers to float charge

Note

1. For UPS that are fitted with the optional battery monitor, refer to the battery monitor user manual for information regarding the battery cell and charge current alarm messages.
2. If the alarm is generated as the result of a software value set-up by an Vertiv authorized engineer, and you wish to change the setting, please contact your local Vertiv customer service center.

Chapter 5 UPS Operation Introduction

This chapter describes the UPS operating precautions and operating methods in detail.

5.1 Brief Introduction

5.1.1 Precautions

Important

The user must wait until the authorized engineer has carried out the first power on and test before carrying out any of the operations described in this chapter.

Warning: hazardous mains and/or battery voltage

1. Components that can only be accessed by opening the protective cover with tools are NOT operator-serviceable. Only qualified service personnel are authorized to remove these covers.
2. Hazardous voltages are present on the UPS AC input and output terminals at all times. If the equipment is equipped with an EMC filter, hazardous voltages may be present on it.

1. See Chapter 4 *Operator Control And Display Panel* for information about the control keys and LCD relating to all the operating procedures.
2. During operation, the buzzer alarm may be activated at any time. Press ALARM CLEAR key to silence the audible alarm.
3. When the UPS uses traditional lead-acid batteries, the system provides an optional boost charge function. If this case, when the mains is restored after an extended mains failure, the battery charging voltage is higher than the normal charging voltage, this is normal, and the charging voltage of the battery will return to the normal value after a few hours.

5.1.2 Power Switches

Open the front door of the UPS cabinet to the power switches, as shown in Figure 5-1:
Q1: Rectifier input switch, which connects the UPS to the mains power supply.
Q2: Bypass input switch, which connects the UPS to the bypass power supply.
Q3: Maintenance bypass switch (lockable), which supplies power to the load when UPS is being serviced.
Note: If the UPS system consists of more than 2 UPS modules connected in parallel, do not use the internal maintenance bypass switch.
Q5: Output switch, which connects the UPS output to the load.
Q6: Neutral line switch (lockable).

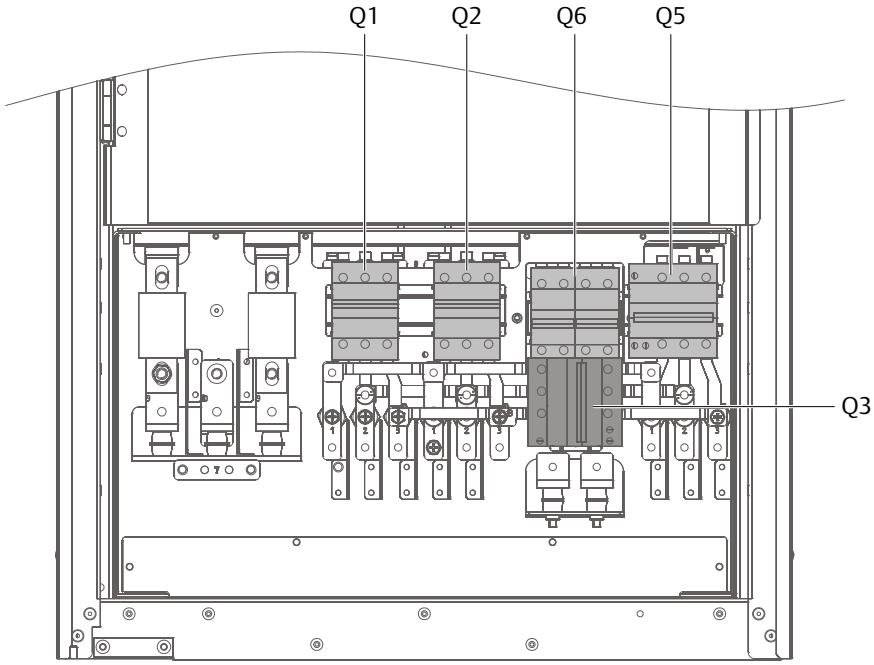


Figure 5-1 UPS power switches

5.2 UPS Startup Procedures

Once the authorized engineer has completed the UPS installation and test procedures, and the external power supply switch has been closed, it is possible to start the UPS.

5.2.1 Startup Procedures In Normal Mode

Warning

1. These procedures result in mains voltage being applied to the UPS output terminals.
2. If any load equipment is connected to the UPS output terminals, check with the user that it is safe to apply power. If the load is not ready to receive power, please disconnect the downstream load switch, and position a warning label on the load connection point.

Use the following procedures to switch on the UPS from a fully powered down condition.

1. Open the front door of the UPS, ensure that the internal maintenance bypass switch Q3 is set to OFF and switch Q6 is set to ON, and that the input cables and copper bars are connected securely.

Warning

To avoid being misinterpreted as fault conditions, all operations where it is necessary to open or close the maintenance bypass switch must be concluded within three seconds.

2. Close the UPS bypass input switch Q2, rectifier input switch Q1, output switch Q5 and any external output isolating switches in turn.

At this point, the system power is on, and the startup screen appears. Refer to para. *4.2.1 Start Screen*.
After about 25 seconds, confirm the LCD indicates that the rectifier power supply and the bypass power supply are within normal limits; if not, check whether switches QS1 and QS2 have been closed. At this point the rectifier starts up and the alarm indicator (red) is illuminated. At the same time, the bypass static switch is closed. About 30 seconds later, the alarm indicator (red) starts flashing or is extinguished (if the battery is connected), and the rectifier startup phase is complete.

3. Press the ON key for two seconds.

The inverter starts up, and the inverter indicator (green) starts flashing. Once the inverter is running normally, the UPS transfers from the bypass to inverter, and the inverter indicator (green) is illuminated (no longer flashing).

5.2.2 Startup Procedures In ECO Mode

1. If ECO mode is required, contact an Vertiv service engineer in order to set it up using the settings configuration software. If you wish to set it by yourself, use the sub-menu under 'Settings' on the LCD screen.
2. Open the front door of the UPS, and ensure that the internal maintenance bypass switch Q3 is set to OFF and switch Q6 is set to ON, and that the input cables and copper bars are connected securely.

Warning

To avoid being misinterpreted as fault conditions, all operations where it is necessary to open or close the maintenance bypass switch must be concluded within three seconds.

3. Close the bypass input switch Q2, rectifier input switch Q1, output switch Q5 and all external output isolating switches (if any) in turn.

At this point, the system power is on, and the startup screen appears. Refer to 4.2.1 *Start Screen*.

About 25 seconds later, confirm that the LCD indicates that the rectifier power supply and the bypass power supply are within normal limits; if not, check whether the switches QS1 and QS2 have been closed. Then the rectifier starts up and the alarm indicator (red) is illuminated. At the same time, the bypass static switch closes.

About 30 seconds later, the alarm indicator (red) starts flashing or is extinguished (if the battery is connected), and the rectifier startup phase is complete.

4. Press the ON key for two seconds.

The inverter starts up, and the inverter indicator (green) starts flashing. At this point, the UPS is in ECO mode, and powered by the bypass.

UPS operating in ECO mode

5.2.3 Startup Procedures In Battery Mode (Battery Cold Start)

1. Verify that the battery has been connected, and that the battery voltage is present at the UPS battery terminals.
2. Open the front door, and press the battery cold start button (see Figure 5-2 for its position).

At this point the startup screen appears. Refer to 4.2.1 *Start Screen*.
About 25 seconds later, the rectifier starts up and the alarm indicator (red) is illuminated. After another 30 seconds, the alarm indicator (red) starts flashing, and the rectifier startup phase is complete.

3. Press the ON key for two seconds.

The inverter starts up, and the inverter indicator (green) starts flashing. Once the inverter is running normally, the inverter indicator (green) is illuminated (no longer flashing). At this point, the UPS is powered by the inverter.

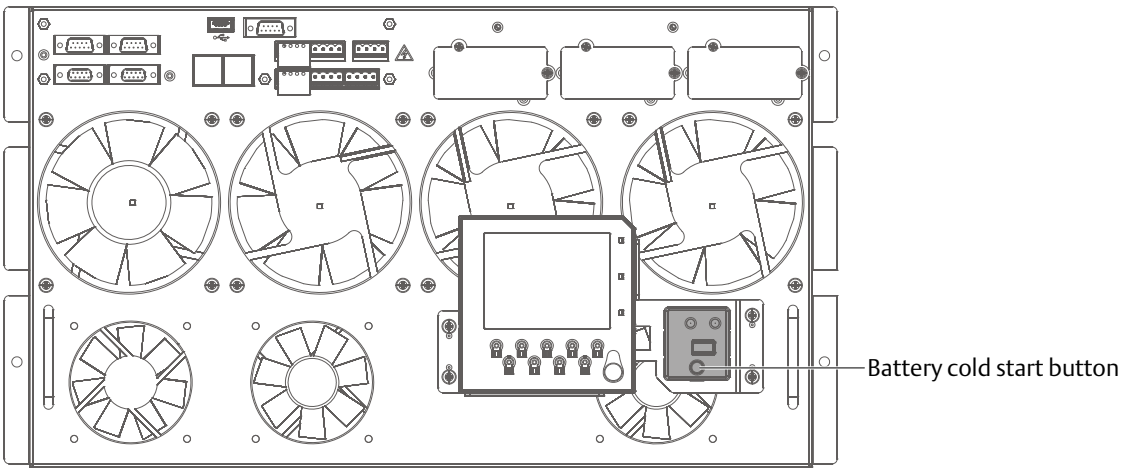


Figure 5-2 Battery cold start button

5.3 Procedures For Transfer Between Operation Modes

5.3.1 Transfer From Normal Mode To Battery Mode

Open the external rectifier input power switch to isolate the mains power and transfer the UPS to battery operating mode. To transfer the UPS back to normal mode, wait for several seconds, and then close the external power switch to re-connect the mains power to the UPS. 10 seconds later, the rectifier restarts automatically to feed power to the load via the inverter.

5.3.2 Transfer From Normal Mode To Bypass Mode

Press the OFF key for two seconds, the inverter indicator (green) is extinguished, and the UPS transfers from normal mode to bypass mode.

Note

In bypass mode, the load is directly fed by the mains power instead of the pure AC power from the inverter.

5.3.3 Transfer From Bypass Mode To Normal Mode

When the UPS is in bypass mode, press the ON key for two seconds, the inverter starts up, and the inverter indicator (green) starts flashing until the inverter is operating normally, at this point the UPS is transferred from bypass mode to normal mode.

5.3.4 Transfer From Normal Mode To Maintenance Mode

The following procedures will transfer the UPS from inverter output mode to the maintenance bypass mode.

Caution: power supply interruption risk to load

Before carrying out this procedure, read the information on the LCD to make sure that the bypass supply is normal and that the inverter is synchronized with the bypass supply, in order to avoid risking a short interruption in the power supply to the load.

1. Press the OFF key for at least two seconds. At this point, the inverter indicator (green) is extinguished, accompanied by an audible alarm. The load transfers to the static bypass, and the inverter shuts down.

Note

Pressing the ALARM CLEAR key silences the audible alarm but the alarm message is displayed until the alarm condition is rectified.

2. Close the maintenance bypass switch Q3 when the UPS is in single module mode.
3. At this point, the maintenance bypass is connected in parallel with the UPS static bypass.
4. The LCD displays 'Maint. sw. closed'.
5. Open the output switch Q5 and neutral line switch Q6.
this point, the load is powered directly by the maintenance bypass.

Caution

When the system is in maintenance bypass, the load is not protected against abnormal mains supply conditions.

6. Pressing the EPO button de-energizes the rectifier, inverter, static switch and battery, but does not affect the maintenance bypass, which continues to power the load normally.

Note

When the system is in maintenance bypass, the load is fed directly by the mains power instead of the pure AC power from the inverter.

7. If the UPS has internal battery, use the special tool to open the battery compartment door, then disconnect the three terminals 'BAT+' (W21, W11), 'BAT-' (W19, W08), and 'BAT N' (W20, W10), **arc preventive safety gloves must be worn when carrying out this operation**, see Figure 5-3 for details. If the UPS is connected to an external battery, open the corresponding external battery switch .

BAT + (Red) BAT N (Blue) BAT - (Black)

Figure 5-3 Photographs illustrating how to disconnect the internal terminals

8. Open the rectifier input switch QS1 and bypass input switch QS2.

At this point, all the internal UPS power supplies are disconnected and the LCD does not display any more.

Warning

1. If UPS maintenance is required, wait 10 minutes for the internal DC bus capacitors to discharge completely.
2. Hazardous voltages are present at some points on the UPS circuits, even when the rectifier input switch, bypass input switch and battery switch are open. Therefore, UPS maintenance must be carried out by qualified personnel only.

5.3.5 Transfer From Maintenance Mode To Normal Mode

The following procedures will transfer the UPS from maintenance bypass supply mode to normal mode.

1. Open the front door, close the neutral line switch Q6.
2. Close the output switch Q5.
3. Close the bypass input switch Q2.
4. Once the LCD has started up, the Event menu window is displayed until the system confirms that the record displays 'Bypass mode'.

Warning

Make sure that you close the bypass input switch before opening the maintenance bypass switch or the power supply to the load will be interrupted.

5. Open the internal maintenance bypass switch Q3.
6. Close the rectifier input switch Q1, the alarm indicator (red) starts flashing.
7. Press the ON key for two seconds.

The inverter starts up, and the inverter indicator (green) starts flashing. Once the inverter is running normally, the UPS is transferred from the bypass to inverter, and the inverter indicator (green) is illuminated (no longer flashing).

At this point, the load has transferred to UPS normal mode.

5.4 Battery Test Procedures

The battery test function is disabled by default. If you require this function, please contact your Vertiv customer service engineer.

Battery test type and preconditions

1. There are two battery test modes to select from:
   - Battery maintenance test: verifies the integrity of the battery integrity; the battery is partially discharged (20%) during this test
   - Battery capacity test: accurately determines the battery capacity; the battery is fully discharged during this test (until the Battery low pre-warning alarm is activated)
2. The operator can perform the tests via the UPS control and display panel provided the following conditions are satisfied:
   - The load must be greater than 5% of the rated UPS capacity and must be stable (battery maintenance test)

- The load must be between 20% and 80% of the rated UPS capacity and must be stable (battery capacity test)
- The battery must have been float charging for 5 hours or more before carrying out the battery capacity test

The battery test procedures are password controlled and menu driven. The test is immediately terminated in the event of a battery or a mains failure and the total load power is supplied by the remaining source, without interruptions.

Test procedure

1. Select the **Command** menu on the UPS operator control and display panel LCD screen.
Use the right or left key to navigate to the **Command** menu.
2. Select the desired test (the Battery maintenance test or Battery capacity test option).
Use the up and down keys (F3, F4) to highlight the desired test. Press the Enter key (F5).
After the prompt, use the F3 (up) and F4 (right) keys to enter the password, and then press the F5 (enter) key to confirm it.
3. Wait until the test is complete.
This test updates the battery information, including the battery autonomy time (battery discharge duration during AC input failure) and the battery aging coefficient (battery capacity percentage when compared to a new battery).
4. To stop the test.
If required, the test may be stopped before completion by selecting **Stop Testing** in the **Command** menu.

5.5 UPS Self-test Procedures

During the self-test, the UPS checks the UPS control functions, LED indicators and audible alarm states. This self-test is password protected and menu driven. It can be started by the user via the UPS operator control and display panel, and takes five minutes.

UPS self-test procedures

1. Select the **Command** menu UPS operator control and display panel LCD display.
Use the left key (F3) or right key (F4) to display the **Command** menu. Press the Enter key (F5) to confirm it.
2. Select the desired test.
Use the up key (F3) or down key (F4) to highlight the desired test item. Press the Enter key (F5) to confirm it.
After the prompt, use the up and right keys (F3, F4) to enter the password, and then press the Enter key (F5) to confirm it.
3. Wait until the test is complete.
After five seconds, a pop window will appear to show the result of this diagnosis: rectifier, inverter, monitor OK or fault.
4. To stop the test.
If required, the test may be stopped before completion by selecting **Stop Testing** in the **Command** menu.
Refer to Chapter 4 *Operator Control And Display Panel* for more information.

5.6 UPS Shutdown Procedures

5.6.1 Procedures For Shutting Down a UPS Completely

Upon completion of this procedure, all the UPS power switches, isolating switches and circuit breakers must be open, so that the UPS is fully de-energized and no longer supplies power to the load.

Caution
The following procedures will interrupt all power supplies to the load so that it switches off.

1. Pressing the EPO button shuts down the rectifier, inverter, static switch and battery.
2. If the UPS has an internal battery, use the special tool to open the battery compartment door, then disconnect the three terminals 'BAT+', 'BAT-' and 'BAT N' (see Figure 5-3 for details). If the UPS has external battery, open the corresponding external battery switch.
3. Open the rectifier input switch QS1, bypass input switch QS2, and output switch QS5. At this point, all the internal UPS power supplies are disconnected and the LCD does not display any more.

Warning
1. Position a label at the AC input distribution (normally located at a distance from the UPS) alerting personnel that maintenance is being carried out on the UPS. 2. Wait 10 minutes for the internal DC bus capacitors to discharge completely. At this point the UPS is completely shut down.

Warning: hazardous battery voltage
Hazardous voltages are still present on the battery terminals even after the UPS is completely shut down.

5.6.2 Procedures for Completely Shutting Down the UPS While Maintaining the Power Supply to the Load

The following procedures should be used when it is necessary to shut down the UPS completely without interrupting the power supply to the load. Refer to the procedures in *5.3.4 Transfer From Normal Mode To Maintenance Mode*.

5.7 EPO Procedures

The EPO is designed to switch off the UPS in emergency conditions (i.e., fire, flood, etc.) To perform an EPO (Emergency Power Off), simply press the EPO button: the system will switch off the rectifier and inverter and interrupt the power supply to the load immediately (the load is not supplied by the inverter or the bypass), and the battery will stop charging or discharging.

Following an EPO, if the input mains supply is present, the UPS control circuit will remain active; however, the output will be turned off. To remove all power from the UPS, first disconnect the external UPS power switch, and then disconnect the battery terminals (see Figure 5-3 for details).

5.8 UPS Reset Procedures following an EPO

After the UPS has been shut down by pressing the EPO button, or as a result an inverter over-temperature, overload, battery and/or DC bus over-voltage condition, clear the fault as directed by the alarm message displayed on the LCD screen. Then carry out the following reset procedures in order to restore normal UPS operation.

After confirming that the fault has been cleared and no remote EPO signals are active, carry out the following procedures:

1. Press and hold the FAULT CLEAR key for over two seconds, the system exits the EPO state, and the alarm indicator (red) starts flashing.

2. Press and hold the ON key for over two seconds, the inverter starts up, and the inverter indicator (green) starts flashing. Once the inverter is running normally, the UPS transfers from the bypass to inverter, and the inverter indicator (green) is illuminated (no longer flashing).

Note

1. The rectifier starts and the bypass begins to supply power to the load. The rectifier indicator flashes while the rectifier is starting up. Once the rectifier is running normally (about 30 seconds later), the rectifier indicator (green) remains on in the steady state.
2. When the over-temperature fault is cleared, the rectifier starts automatically five minutes after the over-temperature signal disappears.

3. After pressing the EPO switch, if the main input is disconnected, the UPS shuts down completely. When the main input returns, the UPS starts up in bypass mode. There will be power at the output terminals of the UPS.

Warning

Whenever the maintenance bypass switch QS3 is closed, and there is an input power supply connected to the UPS, there will be power present at the UPS output

5.9 Automatic Restart

In the case of a mains failure, the UPS draws power from the battery system to supply the load until the batteries are depleted. When the UPS reaches its EOD threshold, it shuts down.

The UPS will restart automatically and enable output power only when the following conditions are met:

1. If Auto Recovery after EOD Enabling is enabled.

2. Once the Auto Recovery after EOD Delay Time expires (the default delay is 10 minutes), the UPS restarts the bypass, followed by the inverter. During the automatic recovery delay interval, the UPS charges its batteries in order to provide a safety margin for equipment shutdown if the input power fails again.

3. If the Auto Recovery after EOD Enabling feature is disabled, the user may restart the UPS manually by pressing and holding the FAULT CLEAR key for two seconds, followed by the ON key for two seconds.

Note

During the automatic restart process, manual startup is disabled. Automatic restart must be set by the Vertiv authorized service engineer using the Vertiv configuration software.

5.10 Selecting the Display Language

The LCD menu and data display are available in 17 languages: simplified Chinese, traditional Chinese, English, Dutch, French, German, Italian, Japanese, Polish, Portuguese, Russian, Spanish, Swedish, Finnish, Norwegian, Czech and Turkish.

To select the desired display language, proceed as follows:

1. Press the F3 (left) or F4 (right) key on the 'OutPut' menu screen to select the 'Language' menu.

2. Press the F5 (enter) key to move the cursor to the screen data window.
3. Press the F3 (up) or F4 (down) key to select the desired language.
4. Press the F5 (enter) key to confirm.
5. Press the F2 (ESC) key repeatedly to return to the 'OutPut' menu.
At this point, the LCD displays all characters in the selected language.

5.11 Changing the Current Date and Time

To change the system date and time, proceed as follows:
1. Press the F3 (left) or F4 (right) key on the 'OutPut' menu screen to select the 'Settings' menu.
2. Press the F5 (enter) key to move the cursor to the screen data window.
3. Press the F3 (up) or F4 (down) key to select the 'Date & time' option, and then press the F5 (enter) key to confirm.
4. Press the F3 (up) or F4 (down) key to the move the select the row displaying the date and time, and press the F5 (enter) key to confirm.
5. Use the F3 (up) or F4 (down) key to set the current date and time.
6. Press the F5 (enter) key to confirm, and press the F2 (ESC) key to return to the 'OutPut' menu.

5.12 Control Password

Some UPS operations and controls are password protected. The default password is '12345'. You can only perform the UPS self-test and battery test if you have entered the correct password.
To change password, proceed as follows:
1. Press the F3 (left) or F4 (right) key on the 'OutPut' menu screen to select the 'Settings' menu.
2. Press the F5 (enter) key to move the cursor to the screen data window.
3. Press the F3 (up) or F4 (down) key to select the 'Command password' option, and press the F5 (enter) key to confirm; at this point 'Command password' is replaced by 'Enter old password'.
4. Press the F4 key to move the cursor to corresponding password position, and press the F3 key to select the number from '0' ~ '9' corresponding to this position. After entering all five digits in this way, press the F5 (enter) key to confirm; at this moment, 'Command password' is replaced by 'Enter new password'.
5. Using the same procedure as described in step 4, press the F3 and F4 to enter the new password and press the F5 (enter) key to confirm; at this point, 'Command password' is replace by 'Enter new password again'.
6. Using the same procedure as described in step 4, press the F3 and F4 to enter new password again, and press the F5 (enter) key to confirm, then press the F2 (ESC) key to return to the 'OutPut' menu.

Chapter 6 Battery

This chapter provides introductory information about the battery, including battery safety, installation and maintenance information, the battery protection function, as well as the optional BCB box installation procedure.

6.1 Introduction

The UPS battery string consists of a number of batteries connected in series and provides rated DC input voltage for the UPS inverter. The required battery backup time (i.e. the length of time the battery can supply power to the load in the event of a mains failure) depends on the ampere-hour capacity of the battery. Under certain conditions it is necessary to connect several battery strings in parallel.
To facilitate the UPS installation, the battery is generally installed in a specially designed battery rack or in the battery room.
When carrying out maintenance or repair work, the battery must be disconnected from the UPS. This may be done using the battery circuit breaker of proper capacity, which must be located as close as possible to the battery connecting terminal. Similarly, the length of the power and signal cables connected to the UPS must be kept as short as possible.
When several strings of battery are connected in parallel in order to increase the battery backup time, each string must be fitted with a dedicated disconnecting device, so that it is possible to carry out maintenance work on individual strings without affecting the normal operation of the others.

6.2 Safety

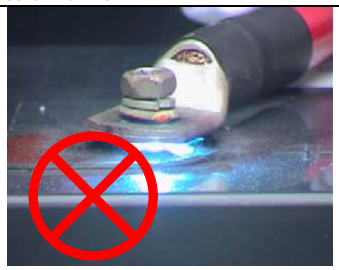
Take special care when working with the batteries associated with the UPS. When all the blocks are connected together, the battery string voltage can be up to 540Vdc; this is potentially lethal. Please follow the precautions for working with high voltages.

Only qualified personnel are allowed to install and maintain the battery. To ensure safety, the external batteries must be installed inside a lockable cabinet or in a purpose-designed, dedicated battery room, so that they are only accessible to qualified service personnel.

Confirm that the battery switch has been disconnected before carrying out maintenance work on the batteries.

Warning: hazardous battery voltage present behind covers

1. No user-serviceable parts are located behind covers that require a tool for their removal. Only qualified service personnel are authorized to remove such covers.
2. Before working on the copper bars connected to the external battery, please ensure they are disconnected from all power supplies.

Proper connection mode	Improper connection mode
Tighten the terminal bolt of the battery to the specified torque	Too little or too much torque may result in poor connection to the terminal. Under certain conditions, the terminal may arc or accumulate heat, which can result in a fire
	 

3. Observe the following safety precautions when working on the batteries:
a) The battery must be connected firmly and securely. After completing the connections, calibrate the tightening torque applied to each terminal, ensuring that the torque values are within the limits defined in the battery manufacturer's specifications and/or user manual. Inspect the connections between all the wiring terminals and the batteries at least once a year, and retighten them if necessary. Failure to do so may result in fire!
b) Perform a visual inspection of the batteries before accepting and using them. If the packaging is damaged, the terminals are dirty, eroded or rusty, or the enclosure is cracked or deformed, or if there are any leaks, replace with a new battery. Failure to do so may result in reduced battery capacity, electrical leakage or fire.

Battery damaged during handling or shipping	Experiment showing the effects of a week of the normal charge/discharge cycle

Warning: hazardous battery voltage present behind covers

c) Batteries are very heavy. Please use the correct procedures when lifting and moving batteries, in order to prevent injuries and avoid damaging the batteries. Severe damage to batteries may cause fire.
d) Do not subject the battery connecting terminal to any force, such as the pulling or twisting forces exerted by the cable, otherwise, the internal connection of the battery may be damaged. Severe damage to the battery may cause fire.
e) The battery must be installed and stored in a clean, cool and dry environment. Do not install the battery in a sealed battery chamber or a sealed room. The battery room ventilation shall at least meet the requirements of EN50272-2001. Otherwise, battery bulging, fire or even injuries to personnel may result.
f) Do not install or use the battery close to equipment that generates heat when operating (e.g. transformers) or fire sources, and NEVER place them into fire or attempt to dispose of them by burning. Failure to observe these precautions can result in battery leakage, bulging, fire or explosions.
g) Never connect a conductor directly between the positive and negative terminals of the battery. Remove rings, watches, necklaces, bracelets and any other metal items before operating the battery, and ensure that tools (e.g., wrench) are protected with insulating material. Failure to observe these precautions may cause the battery to catch fire and/or explode, and result in injury to, or even death of personnel.
h) Do not attempt to dismantle, modify or demolish the battery as this may result in battery short circuits, leakages and injuries.
i) Clean the battery enclosure using a well-wrung wet cloth. To avoid any static or arcing, do not use dry cloths or dusters to clean the battery. Do not use organic solvents (such as thinners, gasoline, volatile oil) to clean the battery as this may cause the battery enclosure to crack, resulting in fire in the worst case.
j) The battery contains diluted sulfuric acid, which can cause blindness if it comes into contact with the eyes, and burns in contact with the skin. In normal use, the diluted sulfuric acid is absorbed by the battery baffles and pole plates. However, if the battery is damaged, the acid may leak from the enclosure. Therefore, personal protective equipment (e.g., protective glasses, rubber gloves and apron) must be used when working with the battery.
k) The battery may be affected by short circuiting, electrolyte dry-up or positive pole erosion failure at the end of its life. Continuing to use it under these conditions may result in thermal runaway, bulging or liquid leakage. Replace the battery before it reaches this state.
l) Before connecting or disconnecting the battery connection cables, isolate the charging power.
m) Check if the battery has been earthed inadvertently. If so, remove the earth connection. Contact with any part of an earthed battery may result in an electric shock.

6.3 UPS Battery

The UPS normally uses valve-regulated batteries. 'Valve-regulated' or 'sealed type' batteries correspond to the old 'maintenance free' type.

Valve-regulated batteries are not completely sealed; in fact they are designed to permit a small quantity to escape, especially when they are over-charged. The volume of the gas that escapes is less than the water injection batteries. However, when installing the battery it is important to take temperature rises into account and leave enough room to ensure good ventilation.

Also, valve-regulated batteries are not maintenance free. They must be kept clean and inspected regularly to make sure that the connection is still good and not affected by corrosion. For details, please refer to para *6.11 Battery Maintenance*.

We recommend that you do not connect more than 4 strings of batteries in parallel. Do not mix batteries of different brands, types or ages in the same system. Otherwise, the resulting inconsistency will cause some of the batteries to over-discharge or under-charge frequently, eventually causing them to fail prematurely, thus compromising the back-up time of the entire string.

Batteries must be stored in the fully charged state. The battery will lose some capacity due to self discharge during shipping or storage. Charge the battery before use. During storage, ensure that the ambient temperature remains within the range -15°C ~ +45°C (the optimum temperature range is 20°C ~ 25°C). To compensate for the self discharge, recharge the batteries once every 3 months while they remain in storage. This interval may vary depending on the type of batteries. For details, refer to the battery manufacturer's specifications.

It is very important to charge the battery fully before carrying out onsite test on the battery backup time. The test may take several days. Therefore, it should be conducted after the battery has been subject to uninterrupted float charging for at least one week.

The battery performance will increase once it has been in use for several weeks or subjected to two to three charge and discharge cycles.

To avoid overcharging or undercharging the battery over-charge or under-charge, set the battery management parameters according to the equalizing/float charge voltage and temperature compensation factor specified in the manuals provided by the battery manufacturer. Please charge the battery immediately after discharge.

6.4 Installation Design Precautions

Note

1. The precautions that must be taken when installing, using and servicing the battery are described in the relevant battery manual provided by the battery manufacturer. 2. The safety precautions described in this section include important factors that must be taken into consideration when designing the installation.
3. The design results may vary depending on local conditions.

6.5 Battery Installation Environment And Number Of Batteries

6.5.1 Installation Environment

Fresh air volume (EN50272-2001)

The battery installation environment must be ventilated. The following fresh air ventilation requirements must be satisfied while the battery is in use:

Q=0.05 x n x Igas x Crt x 10–3[m3/h]

Where:

Q=The fresh air ventilation volume per hour, the unit is m3/h

n=Number of cells

Igas=The gas generating current density under battery float charging or boost charge conditions, the unit is mA/Ah

Igas=1, under the float charging condition at 2.27V/cell

Igas=8, under the boost charge condition at 2.35V/cell

Crt=20hr battery rated capacity

Temperature

Table 6-1 Ambient temperature range

Type	Temperature value	Remark
Recommended optimum temperature	20°C ~ 25°C	The ambient temperature for the battery operation must not be too high or too low. If the average operating temperature of the battery rises from 25°C to 35°C, the service life of the battery will be reduced by 50%. If the operating temperature of the battery is over 40°C, the service life of the battery will be reduced exponentially every day
Permissible temperature range for short periods	-15°C ~ 45°C	

The higher the temperature, the shorter the battery service life. At low temperatures, the charge/discharge performance of the battery will be significantly reduced.

The battery must be installed in a cool and dry environment with the humidity less than 90%, and be protected from the heat source and direct sunshine.

The ambient temperature, ventilation, space, float/boost charge voltage and ripple current will affect the battery temperature. Uneven temperature among the battery strings will cause uneven voltage distribution and compromise battery performance. Therefore, it is very important to maintain a balanced temperature in the battery string, and ensure that the temperature difference between batteries in different layers shall remains within 3°C.
Valve-regulated batteries are highly temperature-sensitive; therefore they should be used in the temperature range 15°C ~ 25°C. If the battery cabinet is installed near the UPS, the maximum design ambient temperature shall depend on the batteries rather than the UPS. In other words, if valve-regulated batteries are used, the indoor ambient temperature shall be 15°C ~ 25°C, and not the operating temperature range of the UPS units. Although the average ambient temperature must remain below 25°C, the temperature may exceed this value for short periods.

6.5.2 Number Of Batteries

The number of batteries, EOD voltage, and float charging voltage under the 380V/400V/415V voltage system are consistent, as shown in Table 6-2.

Table 6-2 Number of batteries

Parameter	380V/400V/415V
Number of cells (standard)	180 ~ 240
EOD voltage	1.60Vdc/Cell ~ 1.85Vdc/Cell, 1.63V/cell recommended
Float charging voltage	2.2Vdc/Cell ~ 2.3Vdc/Cell, 2.27V/cell recommended

6.6 Battery Protection

The UPS is fitted with a fused switch to protect the internal battery. We recommend installing the optional Vertiv BCB in order to protect the external battery.
The external battery is connected to the UPS via the BCB; the BCB can be closed manually and is also fitted with an electronic tripping device that is controlled by the UPS control circuit. In the case of rack mounted battery solutions, or if the battery is located at a distance from the UPS cabinet, the BCB shall be installed as close to the battery as possible, and the length of the power and signal cables connected to the UPS shall be as short as possible.
The BCB provides the following advantages:

- Safe and reliable battery isolation
- Short circuit protection
- When the inverter is locked due to battery under-voltage, the circuit breaker will open automatically in order to avoid over-discharging the battery
- If the remote EPO button is installed, the EPO button can be used to disconnect the circuit breaker
- Protection against incorrect operations

To obtain the required backup time, the batteries may be connected in parallel. In this case, the BCB shall be installed downstream of all the paralleled batteries.

Note

Only trained personnel may operate and service the battery circuit breaker.

6.7 Battery Installation And Connection

6.7.1 Battery Installation

1. Before installing them, inspect the batteries for damage, inspect and count the accessories, and read this manual and the user manual or installation instruction provided by the battery manufacturer carefully.

2. Maintain a gap of at least 10mm between the batteries in order to allow the ambient air to circulate freely between them.

3. Leave sufficient vertical clearance between the top of the batteries and the layer installed above them to enable personnel to monitor and service them.

4. Install the batteries starting from the bottom layer and working up, so as to avoid situations where the center of gravity is too high. Make sure that the batteries are installed correctly and that they are protected from vibration and shocks.

6.7.2 Battery Connection

1. All the battery cabinets or battery racks must be connected together and grounded correctly.

2. When multiple batteries are used, they must be connected in series and then in parallel. Before loading and power-up, check that the total voltage of the batteries is as specified. The negative and positive poles of the batteries must be connected to the negative and positive battery terminals of the UPS according to the labels on the battery and UPS. This is very important because connecting the battery poles to the wrong UPS battery terminals can cause explosions and fire, and may result in damage to the battery and UPS, as well as injuries to personnel.

3. Once the battery cable connections have been completed fit the insulating shields on the terminals.

4. When connecting the cable between battery terminal and protection device, connect the cable to the protection device terminal first.

5. The bending radius of the cable must be greater than 10D, where D corresponds to the outer diameter of the cable.

6. Once the battery cables have been connected, DO NOT pull on the battery cable or the cable terminal.

7. Do not cross the battery cables during the connection, and do not tie the battery cables together.

8. See Figure 6-1 for battery connection.

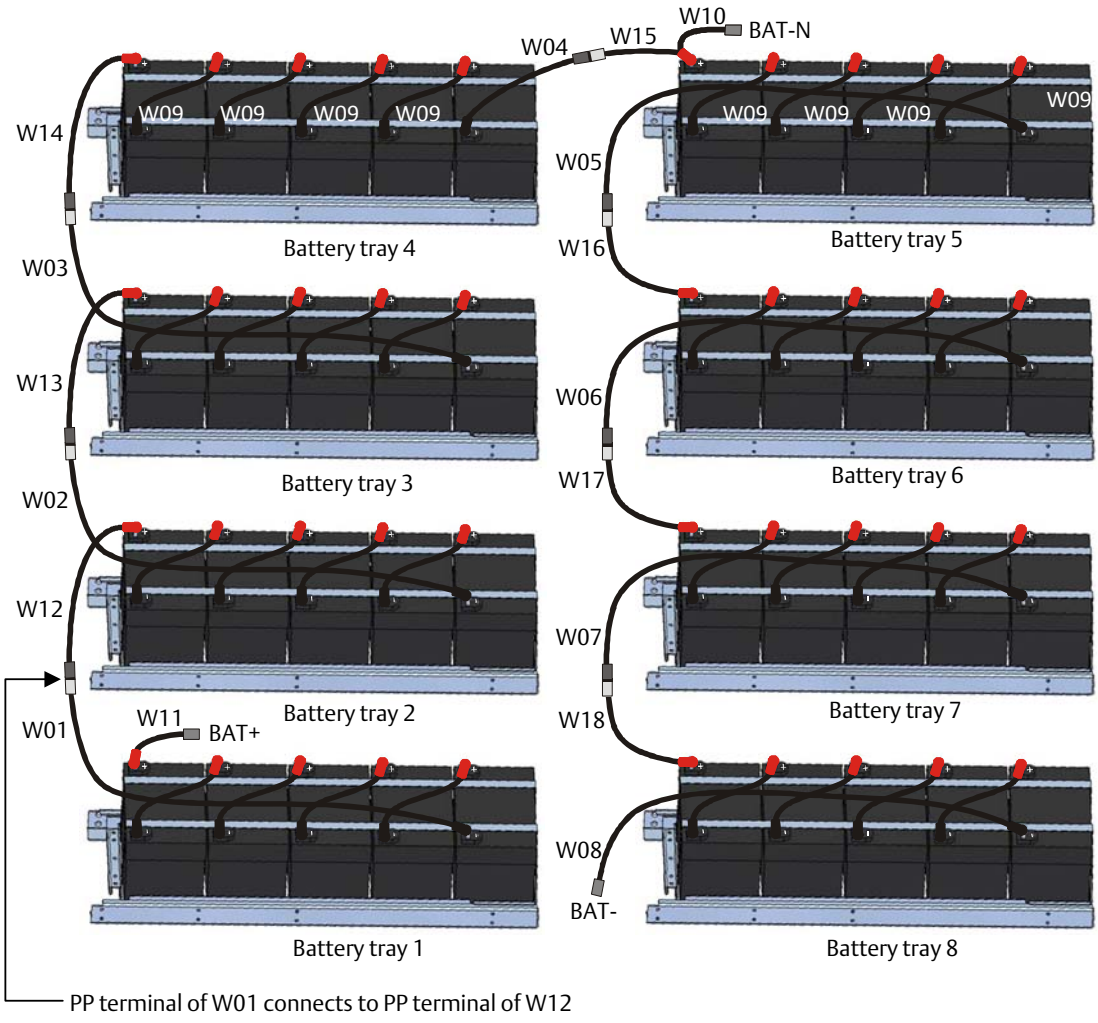


Figure 6-1 Connection for internal batteries (40-block)

6.8 Design Of Battery Room

Pay particular attention to the following items, irrespective of the type of installation (refer to Figure 6-2):

❶ Layout of cells

When planning the layout, make sure that the batteries are positioned so that no two naked parts having a potential difference in excess of 150 V can come into contact. If this cannot be avoided, use insulated terminal shields and insulated cable for any such connections.

❷Workbench

The workbench (or panel) must be skid-proof and insulated, and be at least 1m wide.

❸Wiring

All the wiring distances shall be kept to a minimum.

❹BCB

The BCB is normally installed in the wall-mounted box near the battery.

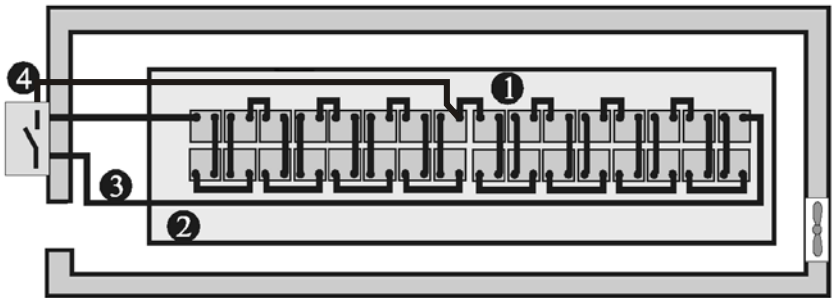


Figure 6-2 Design of battery room

6.9 BCB Box (Optional)

The BCB box contains a BCB and a BCB control board.

Vertiv provides the BCB box and BCB signal cables (length: 30m) for use when the UPS uses external batteries. In this situation, The BCB box is installed as close as possible to the battery and connected to the UPS. Refer to Figure 6-3 and Table 6-4 for a description of the BCB box and its components.

The BCB box protects the battery against over-discharge and over-current, and also isolates the UPS and battery, thus reducing the risk to a minimum for service personnel during maintenance.

The bars for connecting the power cables from the UPS and batteries are located inside the box.

Note: The signal cables from the UPS to the BCB control board must be routed in a separate cable conduit and kept separate from the battery power cables. The separate safety earth must be connected between the UPS and BCB box.

The BCB box is supplied as follows:

Table 6-3 BCB box parameters

Dimensions (H × W × D) (mm)	Weight (kg)	BCB
192 × 380 × 636	13	200A, 4 poles

Note

This weight excludes the packaging.

The BCB offers the following advantages:

Short circuit protection and EOD protection.

When the battery voltage falls to EOD level, the BCB is switched off automatically.

UPS EPO: When the EPO button is pressed, the BCB is switched off automatically.

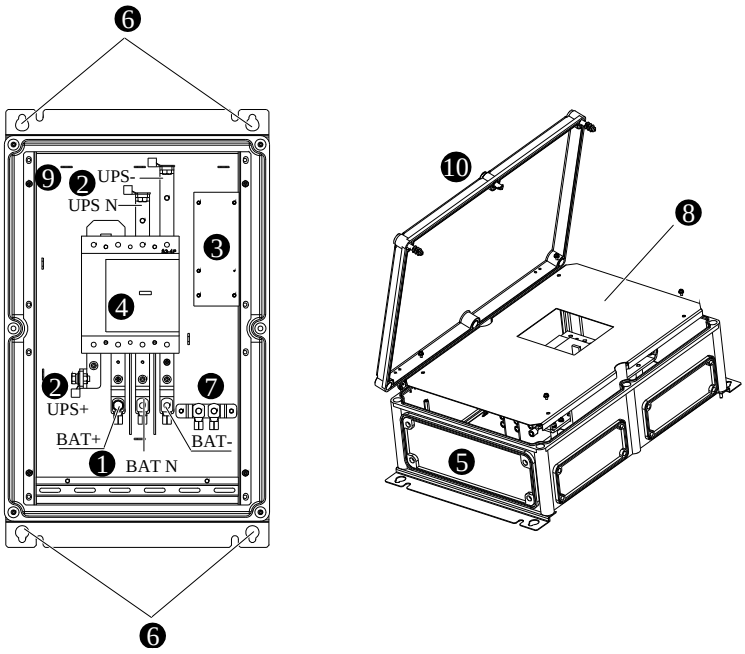


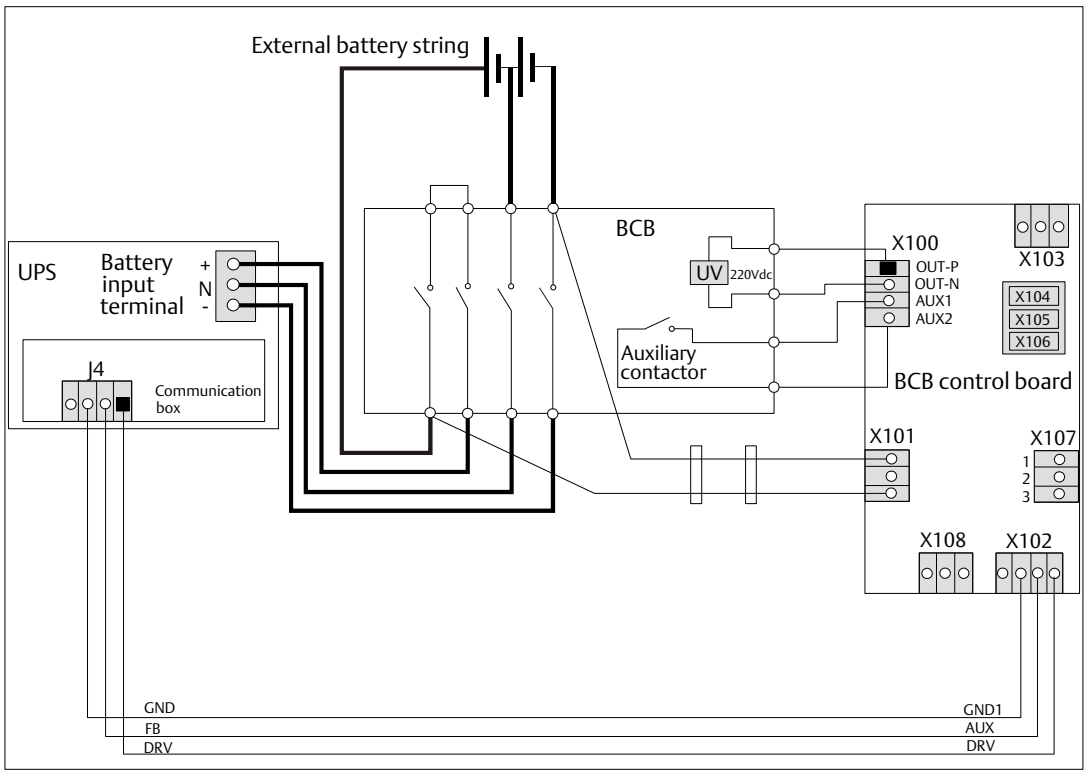
Figure 6-3 BCB box

Table 6-4 Description of BCB box components

No.	Component
1	Battery connection terminal (+/N/-)
2	UPS connection terminal (+/N/-)
3	Battery switch control board
4	Battery switch
5	Cable opening
6	Wall-mounting holes
7	Grounding bar
8	Insulating plate
9	Base plate
10	Inspection cover

Note

The BCB cables are normally routed through the bottom of the box, however the box may also be turned upside down if you wish to route the cables through the top.



Note:

1. See Table 6-5 for definition of port X102.
2. X101-Hazardous Voltage: Do not conncet this port to the battery unless a permission given by the service engineer.
3. X103 ~ X106 are used to connect temperature sensors from multiple battery cabinets.
4. X107 is used to set jumpers according to whether the UPS has been installed a battery cold button. If yes, jumpers 1, 2 setting is recommended; if not, jumpers 2, 3 setting is required.

Figure 6-4 BCB box connections

Table 6-5 Battery control port (X102)

BCB box port	Communication box port (J4)	Meaning	Signal state
DRV	DRV	BCB trip control signal from UPS	Normal: high level, BCB closed; Abnormal: low level, BCB open
IN (AUX)	FB (IN)	BCB auxiliary contact (contact off = BCB off)	Normal: 0V, BCB closed; Abnormal: open, BCB open
GND1	GND	Signal ground	GND1 to GND

Note: The cable connected to BCB port X102 must be routed separately from the power cable. It uses dual-insulated shielded cable (the CSA is generally 0.5mm^2 ~ 1mm^2 when the wiring distance is 25m ~ 50m length), and the two ends of the shield must be connected to the enclosure securely. The separate safety earth must be connected between the UPS and BCB box.

Caution

If the corresponding functions are not required, simply leave the corresponding ternimals unconnected.

6.10 BCB Reference Current And Connection

Table 6-6 indicates the recommended BCB rated current and battery maximum discharge current at full load. Refer to Table 3B in IEC60950-1, and select the appropriate cable CSA according to local electrical regulations.

Table 6-6 BCB rated current and battery max. discharge current at full load (recommended)

Item		Unit	UPS rating (kVA)
			60kVA
30-block battery	Max. battery discharge current at full load	A	195
	Reference rated current of BCB	A	200
32-block battery	Max. battery discharge current at full load	A	170
	Reference rated current of BCB	A	200
34-bolck battery	Max. battery discharge current at full load	A	160
	Reference rated current of BCB	A	200
36-block battery	Max. battery discharge current at full load	A	150
	Reference rated current of BCB	A	200
38-block battery	Max. battery discharge current at full load	A	140
	Reference rated current of BCB	A	200
40-block battery	Max. battery discharge current at full load	A	135
	Reference rated current of BCB	A	200

Note

Refer to Figure 6-5 for the connections between the battery, BCB and UPS.

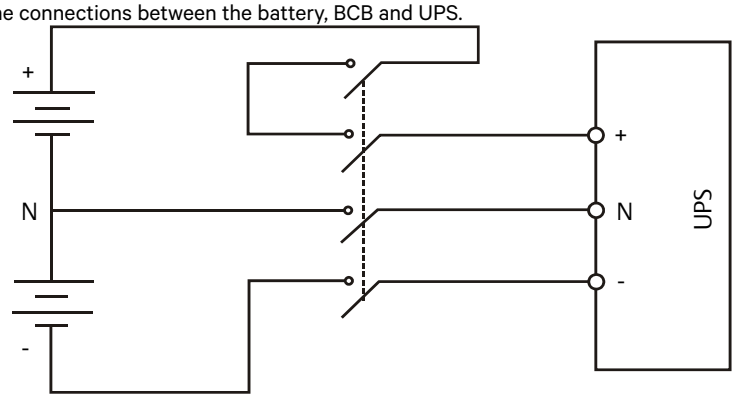


Figure 6-5 Connections between the battery, BCB and UPS

6.11 Battery Maintenance

For battery maintenance procedures and precautions, refer to IEEE-Std-1188-2005 and the manuals provided by the battery manufacturer.

Note

1. Periodically check the battery terminal connection screws and ensure that they are firmly tightened. Tighten any loose screws immediately.
2. Ensure that all safety devices are in place and function correctly, and that the battery management parameters have been set-up correctly.
3. Measure and record the air temperature inside the battery room.
4. Check the battery terminals for signs damage or overheating, and that the battery enclosures and terminal shields are intact.

6.12 Disposing of Used Batteries

If the battery leaks or is damaged, place it in a container that can withstand sulfuric acid and dispose of it in accordance with the local regulations.

Used lead acid accumulator batteries are classified as dangerous waste, and correct disposal is a very important factor in used battery pollution management. Storage, shipping, handling, use and disposal of batteries must comply with the national and local laws and regulations regarding dangerous waste and prevention of used battery pollution, and other standards.

According to the relevant national regulations, used lead acid accumulator batteries must be recycled and may not be disposed of by any other method. Uncontrolled dumping or any other improper disposal of used lead acid accumulator batteries can cause severe environmental pollution and render the transgressor liable to prosecution.

Chapter 7 Parallel System and LBS System

This chapter provides information about installing parallel and LBS systems.

7.1 General

The parallel system may consist of up to four UPS modules of the same power rating, connected in parallel without the need for a centralized mains static bypass. The bypass static switches of each UPS share the load when the system transfers to the mains bypass supply.
From a 'power' viewpoint, each module is internally identical to the 'single module' configuration. A parallel system requires inter-module control signals to manage load sharing, synchronization and bypass switching. The control signals are connected via the multi-way, ribbon parallel cables connected between the units in the system to form a ring.
When two or more modules are connected in parallel, we recommend installing the inductor on the static bypass line. This can be installed inside the UPS as an option.

7.2 System Installation Procedures

The basic installation procedure for a parallel system consisting of two or more UPS modules is the same as for a single module system. This section only covers the installation procedures that are specific to the parallel system. To install a parallel UPS system, carry out the installation procedure for a single UPS module, with the additional requirements described in this section.

7.2.1 Preliminary Checks

Make sure that the parallel cable options are correct, that the modules are the same rating and model, and that they have the same software and hardware release.

Warning

In order achieve coordinated operation of the modules in the parallel system, it is necessary to configure each module separately using the Vertiv configuration software. This must be done by Vertiv service personnel.

7.2.2 Cabinet Installation

Place the UPS modules side by side and interconnect them as shown in Figure 7-1. The output distribution mode (Q1EXT, Q2EXT must be configured) shown in Figure 7-1 is recommended, in order to simplify maintenance and system testing.

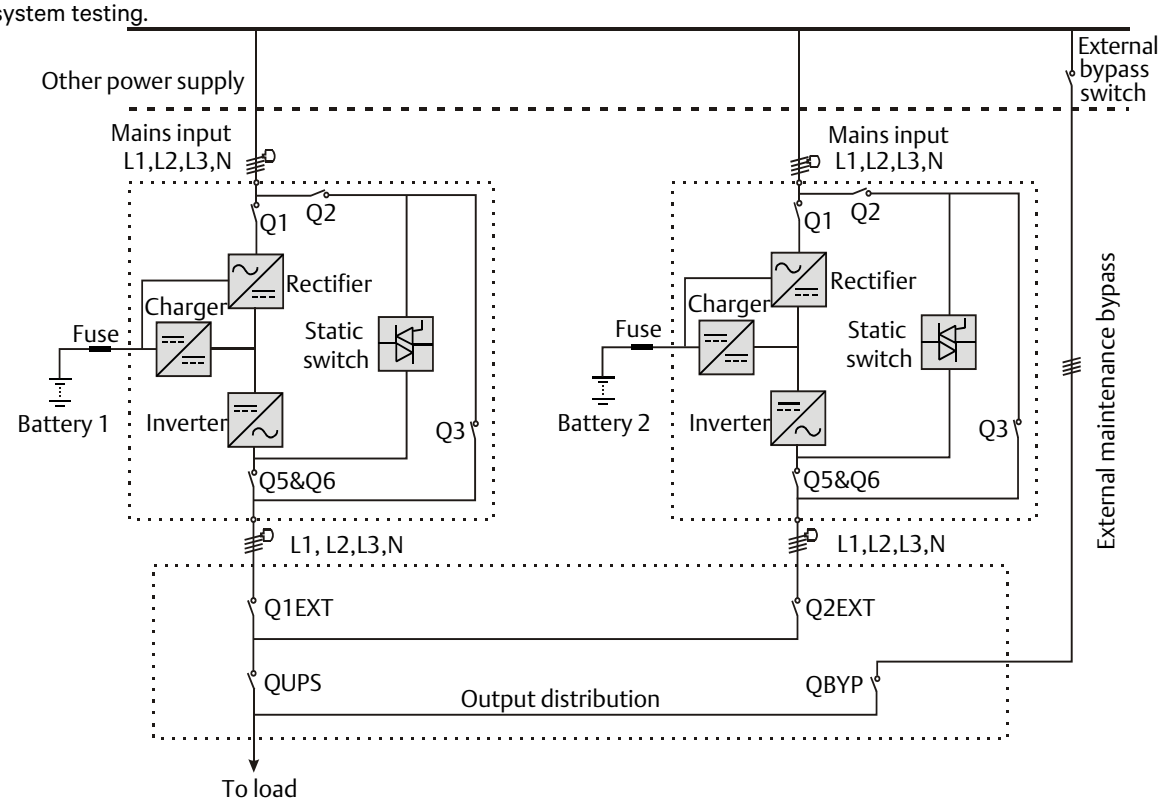


Figure 7-1 Typical parallel system circuit diagram (with common input, separate batteries and output)

7.2.3 Power Cable

The power cable wiring is similar to that of the UPS module. Refer to *3.1 Power Cable Wiring*.

The bypass and rectifier input supplies must use the same neutral line input terminal. If the input is fitted with a current leakage protective device, it must be installed upstream of the neutral line input terminal.

Note

The power cables (including the bypass input cables and UPS output cables) of each UPS module should be of the same length and specifications to facilitate load sharing.

7.2.4 Parallel Cable

Shielded and double-insulated parallel cables, available in lengths of 5m, 10m and 15m, must be interconnected in a ring configuration between the UPS modules, as shown in Figure 7-2. Method: connect a parallel cable from the PARA1 port on one module to the PARA2 port of another module and so on for all the modules in the system.
The ring connection ensures reliable control of the parallel system. Be sure to verify that the cables are connected securely before starting up the system!

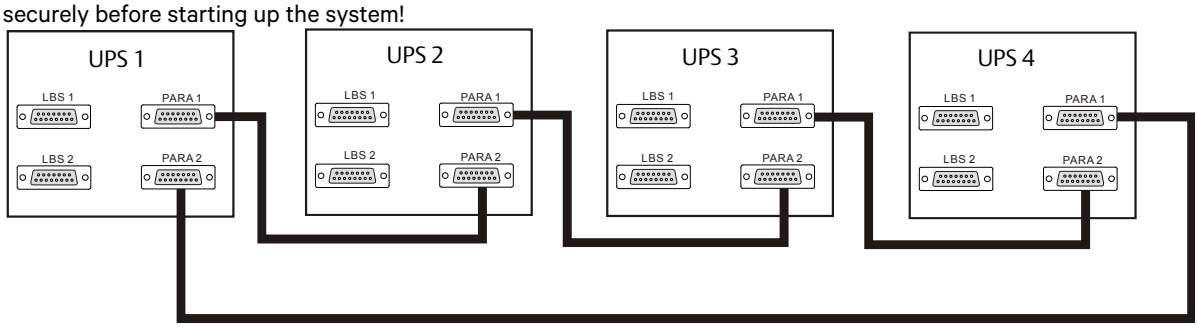


Figure 7-2 Parallel signal cables connection (Parallel system)

7.2.5 Remote EPO

In addition to the individual EPO switches located on the single UPS module operator control and display panels, the parallel system also feature a remote EPO function that can be used to shut down al the UPS modules simultaneously from a remote terminal, as shown in Figure 7-3.

Note

1. The remote EPO switch must provide a dry contact signal, with normally open or normally closed contacts.
2. The open circuit voltage is 12Vdc, < 20mA.
3. The external EPO device should consist of an additional control system capable of disconnecting the UPS mains supply and bypass input.

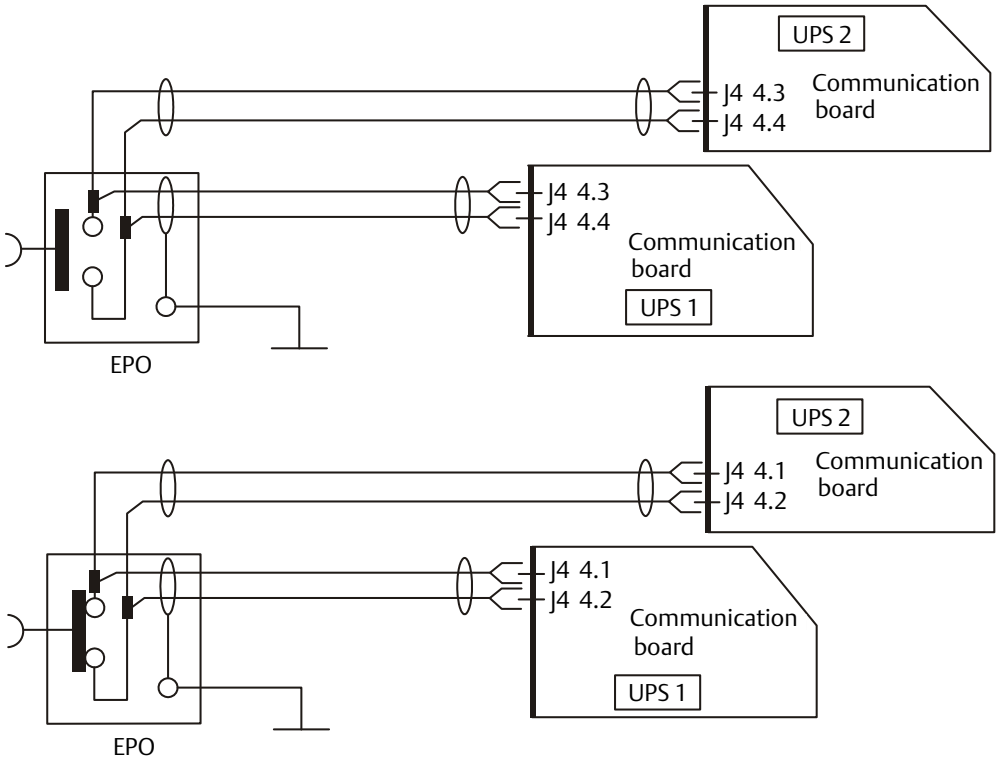


Figure 7-3 EPO circuit diagram

Note: Figure 7-3 illustrates two alternative EPO dry contact wiring diagrams, the top one is the Normally Open type, and the bottom one is the Normally Closed type.

7.3 Parallel System Operating Procedures

Warning

If an RCD is installed on the UPS input line, the differential switch must only be used on the system bypass mains supply line. At the moment of electrical connection, the current may not be separated immediately, which may cause the RCCB to trip.

The following procedures must be performed one step at a time, and each step must be completed before moving on to the next one.

7.3.1 Startup Procedures In Normal Mode

These procedures are used to switch the UPS on starting from the fully powered-down state, which means that neither the UPS nor the maintenance bypass switch have supplied power to the load before. Make sure the UPS has been completely installed and commissioned by the engineer, and that external power supply switch is open.

Warning

1. These procedures result in mains voltage being applied to the UPS output terminals.
2. If any load equipment is connected to the UPS output terminals, check with the user that it is safe to apply power. If the load is not ready to receive power, disconnect the downstream load switch, and position a warning label on the load connection point.

Use the following procedures to switch on the UPS from a fully powered down condition.
1. Confirm that all the external maintenance bypass switches are open. Open the front door of each UPS in turn and ensure that the internal maintenance bypass switch Q3 is open and switch Q6 is closed on each unit, and that the input cables and copper bars, and the parallel cables are connected securely.

Warning

To avoid being misinterpreted as fault conditions, all operations where it is necessary to open or close the maintenance bypass switch must be concluded within three seconds.

2. Close the all the bypass input switches.
3. Close the bypass input switch QS2, rectifier input switch QS1 and all external output isolating switches (if any) on each UPS in turn
At this point, the system is on, and the startup screen appears. Refer to 4.2.1 *Start Screen.*
About 25 seconds later, confirm that the LCD indicates that the rectifier power supply and the bypass power supply are within normal limits; if not, check whether the switches QS1 and QS2 are closed and the parallel cables of each UPS are connected securely. At this point the rectifier starts up and the alarm indicator (red) is illuminated. At the same time, the bypass static switch is closed. About 30 seconds later, the alarm indicator (red) starts flashing or is extinguished (if the battery is connected), and the rectifier startup phase is complete. At this point the rectifier startup phases are complete for all the UPS modules in the system.
4. Press and hold the ON key on each for two seconds. The inverters start up, and the inverter indicators (green) on each UPS start flashing. After all the UPS inverter indicators are illuminated (no longer flashing), the parallel UPS system starts supplying power to the load.

7.3.2 Maintenance Bypass Procedures

Warning

If the UPS system consists of more than 2 parallel UPS modules, and the load capacity exceeds the single module capacity, do not use the internal maintenance bypass switch.

This operation will transfer the load transfer from the protected UPS power supply output so that it is connected directly to the AC bypass input line.

Caution: power supply interruption risk to load

Before carrying out this procedure, read the information on the LCD to make sure that the bypass supply is normal and that the inverter is synchronized with the bypass supply, in order to avoid risking a short interruption in the power supply to the load.

1. Press and hold the OFF key on each UPS module in turn for two seconds. The inverter indicators are extinguished and the buzzer alarms are activated. The load transfers to the static bypass, and the inverters shut down so that the UPS system is operating bypass mode.

Note

Pressing the ALARM CLEAR key silences the audible alarm but the alarm message is displayed until the alarm condition is rectified.

2. Close all the UPS external maintenance bypass switches, but do not close the UPS internal maintenance bypass switches Q3.
3. At this point, the external maintenance bypass should be connected in parallel with the static switch on each individual UPS.
4. At this point, the message 'Maint. sw. closed' appears on the LCD on each UPS.
5. Open the output switch Q5 and neutral line switch Q6 on each UPS in turn, so that the load power is supplied by the maintenance bypass line.

Caution

When the system is in maintenance bypass, the load is not protected against abnormal mains supply conditions.

6. Pressing the EPO button on each UPS module de-energizes the corresponding rectifier, inverter, static switch and battery, but does not affect the maintenance bypass, which continues to power the load normally.

Note

When the system is in maintenance bypass, the load is fed directly by the mains power instead of the pure AC power from the inverter.

7. If the UPS has internal battery, use the special tool to open the battery compartment door, then disconnect the three terminals 'BAT+', 'BAT-' and 'BAT N' (see Figure 5-3 for details). If the UPS has external battery, open the corresponding external battery switch. All UPS modules should be disconnected from the batteries.
8. Open the rectifier input switch Q1 and bypass input switch Q2 on each UPS in turn.
At this point, all the internal UPS power supplies are disconnected and the LCD does not display any more.

Warning

1. If UPS maintenance is required, wait 10 minutes for the internal DC bus capacitors to discharge completely.
2. Hazardous voltages are present at some points on the UPS circuits, even when the rectifier input switch, bypass input switch and battery switch are open. Therefore, UPS maintenance must be carried out by qualified personnel only .

7.3.3 Procedures for Isolating One UPS Module in a Parallel System

Important

These procedures may only be carried out Vertiv service personnel or under their guidance.

Warning

Before carrying out the following operation, confirm that the system redundancy capacity is sufficient to avoid system shutdown due to overload.

The following procedures apply when one UPS module must be isolated from the parallel system for repair due to serious fault:
1. Press the EPO button on the UPS module to be isolated in order to de-energize the rectifier, inverter, static switch and battery; this action will not affect the other UPS in the parallel system, which will continue to supply power to the load normally.
2. If the UPS has an internal battery, use the special tool to open the battery compartment, then disconnect the three terminals 'BAT+', 'BAT-' and 'BAT N' (see Figure 5-3 for details). If the UPS has external battery, open the corresponding external battery switch.
3. Open the rectifier input switch Q1, bypass input switch Q2, output switch Q5 and neutral line switch Q6.
At this point, all the internal UPS power supplies are disconnected and the LCD does not display any more.

Warning

1. Position a label at the AC input distribution (normally located at a distance from the UPS) alerting personnel that maintenance is being carried out on the UPS.
2. Wait 10 minutes for the internal DC bus capacitors to discharge completely. At this point the UPS is completely shut down.

7.3.4 Procedures for Reintegrating an Isolated UPS Module into a Parallel System

Important

These procedures may only be carried out Vertiv service personnel or under their guidance.

The following procedures are used to reintegrate a UPS module that has been previously isolated from the parallel system:
1. If the UPS is connected to an external battery, simply close the external battery distribution switch or connect the three terminals 'BAT+', 'BAT-' and 'BAT N' (see Figure 5-3 for details). Then close the rectifier input switch Q1 and neutral line switch Q6.
At this point, the system power is on, and the startup screen appears. Refer to 4.2.1 *Start Screen*.
2. Close the bypass input switch Q2.
Confirm that the LCD indicates that the bypass input supply is normal; if not, check whether the switch Q2 is closed. At this point the rectifier starts up and the alarm indicator (red) is illuminated. About 30 seconds later, the alarm indicator (red) starts flashing (if the UPS internal or external battery is not connected) or is extinguished (if the UPS internal and/or external batteries are connected).
3. Close the output switch Q5, and press the ON key for two seconds.
The inverter starts up, and the inverter indicator (green) starts flashing. Once the inverter is running normally, the UPS transfers from the bypass to inverter, and the inverter indicator (green) is illuminated (no longer flashing).
At this point, the UPS will be fully reintegrated into the parallel system, and start supplying power to the load.

7.3.5 Procedures for Shutting Down a UPS Completely in a Parallel System

To shut down and de-energize a UPS completely, proceed as follows. Upon completion of this procedure, all the UPS power switches, isolating switches and circuit breakers must be open, so that the UPS is fully de-energized and no longer supplies power to the load.

Caution

The following procedures will interrupt all power supplies to the load so that it switches off.

1. Pressing the EPO button on each shuts down the corresponding rectifier, inverter, static switch and battery charger.
2. If the UPS has internal battery, use the special tool to open the battery compartment, then disconnect the three terminals 'BAT+', 'BAT-' and 'BAT N' (see Figure 5-3 for details). If the UPS has external battery, disconnect the corresponding external battery switch. All UPS modules should be disconnected from the batteries.
3. Open the rectifier input switch Q1 and bypass input switch Q2 on each UPS. At this point, all the internal UPS power supplies are disconnected and the LCD does not display any more.
4. Open the output switch Q5 on each UPS.

Warning

1. Position a label at the AC input distribution (normally located at a distance from the UPS) alerting personnel that maintenance is being carried out on the UPS.
2. Wait 10 minutes for the internal DC bus capacitors to discharge completely. At this point the UPS is completely shut down.

Warning: hazardous battery voltage

Hazardous voltages are still present on the battery terminals, even after the UPS has been completely shut down.

7.3.6 Procedures For Complete UPS Shutdown While Maintaining Power To Load

The following procedures can be used to shut down the UPS completely without interrupting the power supply to the load. Refer to the procedures in para. 7.3.2 *Maintenance Bypass Procedures*.

7.4 LBS System

7.4.1 Cabinet Installation

An LBS system consists of two independent UPS systems, each consisting of one or more UPS modules connected in parallel, as shown in Figure 7-4 and Figure 7-5. LBS systems provide high reliability and are suitable for use with multiple input loads. In the case of single-input loads, an STS can be installed to feed power to the load.
The system uses the LBS cables to ensure the outputs of the two independent (or parallel) UPS systems remain synchronized. One system is designated as the master, the other is designated as the slave. The operating modes of the parallel system care master and/or slave operation in normal or bypass mode.
Place the UPS modules side by side and interconnect the UPS modules as described below.

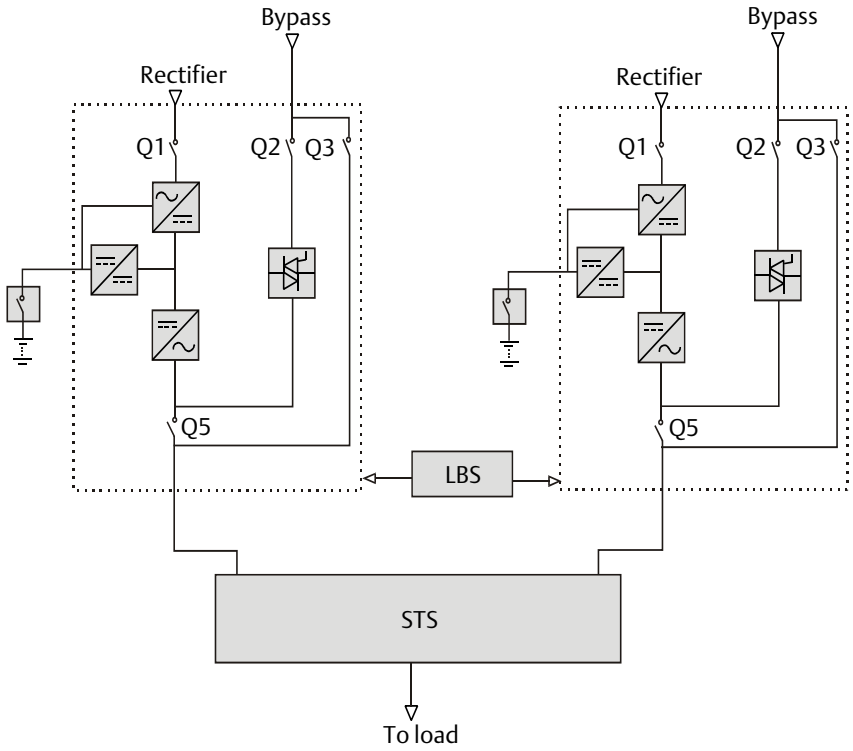


Figure 7-4 LBS system (UPS module)

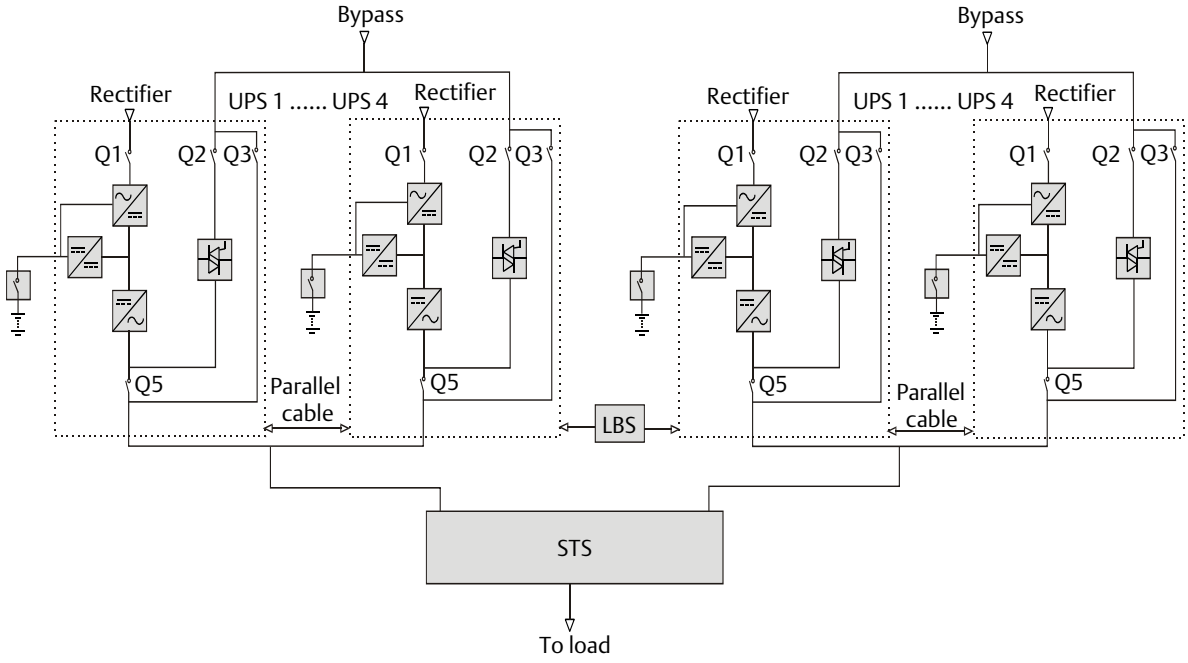


Figure 7-5 LBS system (parallel system)

Note

In a dual-bus system, the two UPS systems must have the same power rating, voltage and frequency, and the load must not exceed the power rating of a single UPS module system.

7.4.2 External Protective Device

Refer to 3.1.9 *External Protective Device.*

7.4.3 Power Cable

The dual-bus power system power cable is similar the single system power cable. Refer to 3.1 *Power Cable Wiring.*

7.4.4 LBS Cable

The shielded and double-insulated parallel cables are available in lengths of 5m, 10m and 15m. Connect the two optional LBS cables in a ring configuration: from the LBS1 port on one UPS module to LBS2 port on another UPS module, and from the LBS2 port on one UPS module to LBS1 port on another UPS module, as shown in Figure 7-6 and Figure 7-7.

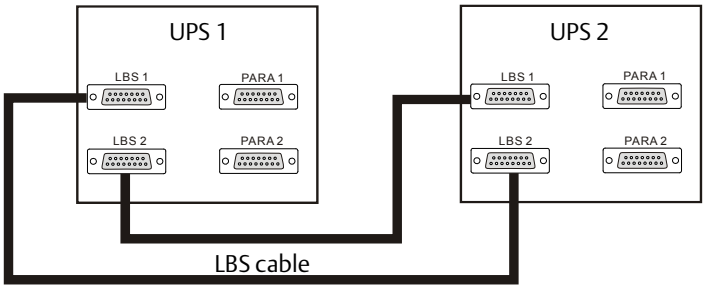


Figure 7-6 Typical LBS system connections (UPS module)

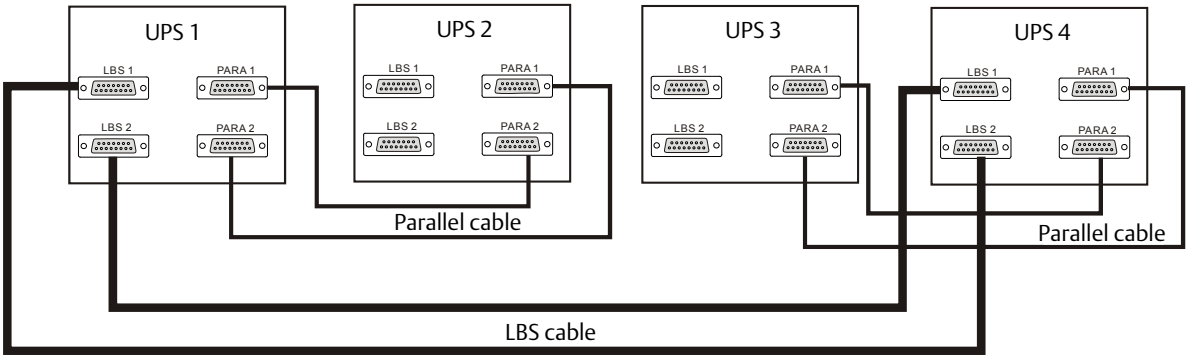


Figure 7-7 Typical LBS system connections (parallel system)

Chapter 8 Options

This chapter provides a list of the UPS options, a functional description and information on how to install and configure them.

8.1 Brief Description of Options

8.1.1 Bypass Load Sharing Inductor Kit

Install the bypass load sharing inductors for the parallel system consisting of two or more UPS modules, in order to ensure correct parallel system bypass output load sharing. The bypass load sharing inductor is used to compensate for the impedance differential between SCR and cable. See Table 8-1 for the specifications.

Table 8-1 Specifications of bypass load sharing inductor

UPS (kVA)	Dimensions (H × W × D) (mm)	Inductor value (uH)
60	170 × 108 × 169	65

When the option is installed, each UPS cabinet houses three bypass load sharing inductors, with no extra clearance occupied. The load sharing rate is generally 10% of the system rated current, depending on the external cable configuration. Every effort should be made to ensure that the length of the cable from the bypass to each UPS, and from each UPS module output to the parallel system connection point is the same.

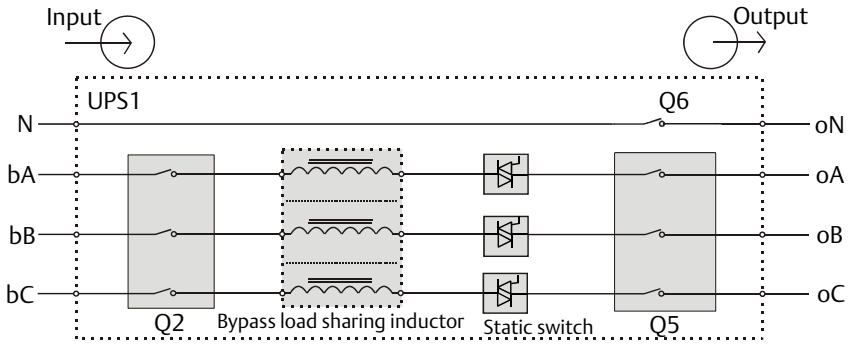


Figure 8-1 Bypass load sharing inductor operating principle

Preparation

1. Prepare the installation tools, including a cross head screwdriver, a pair of diagonal cutting pliers, a sleeve and an adjustable spanner.
2. Check that all installation materials are present and complete, including three bypass load sharing inductors, four M5 x 12 SEMS screws (for mounting the inductors), six M6 × 16 SEMS screws (for securing the power cables), six M6 flat washers and nuts.

Procedures

Warning

1. Only authorized personnel may install and replace the inductors.
2. Connect the cables strictly according to the instructions. Failure to observe this may cause damage to the UPS and the inductors.

1. Shut down the UPS completely.

Note

This procedure will interrupt the power supply to the load.

a) Shut down the load.
b) Refer to 5.6.1 *Procedures for Shutting Down a UPS completely* when shutting down a single UPS module, and 7.3.5 *Procedures For Shutting Down a UPS Completely in a Parallel System* when shutting down a parallel system.
c) All the LCDS switch off, wait five minutes for the internal UPS DC bus capacitors to discharge completely.
2. Remove the left side panel of the UPS cabinet, keep the screws.
3. Install the three bypass load sharing inductors, see Figure 8-2.

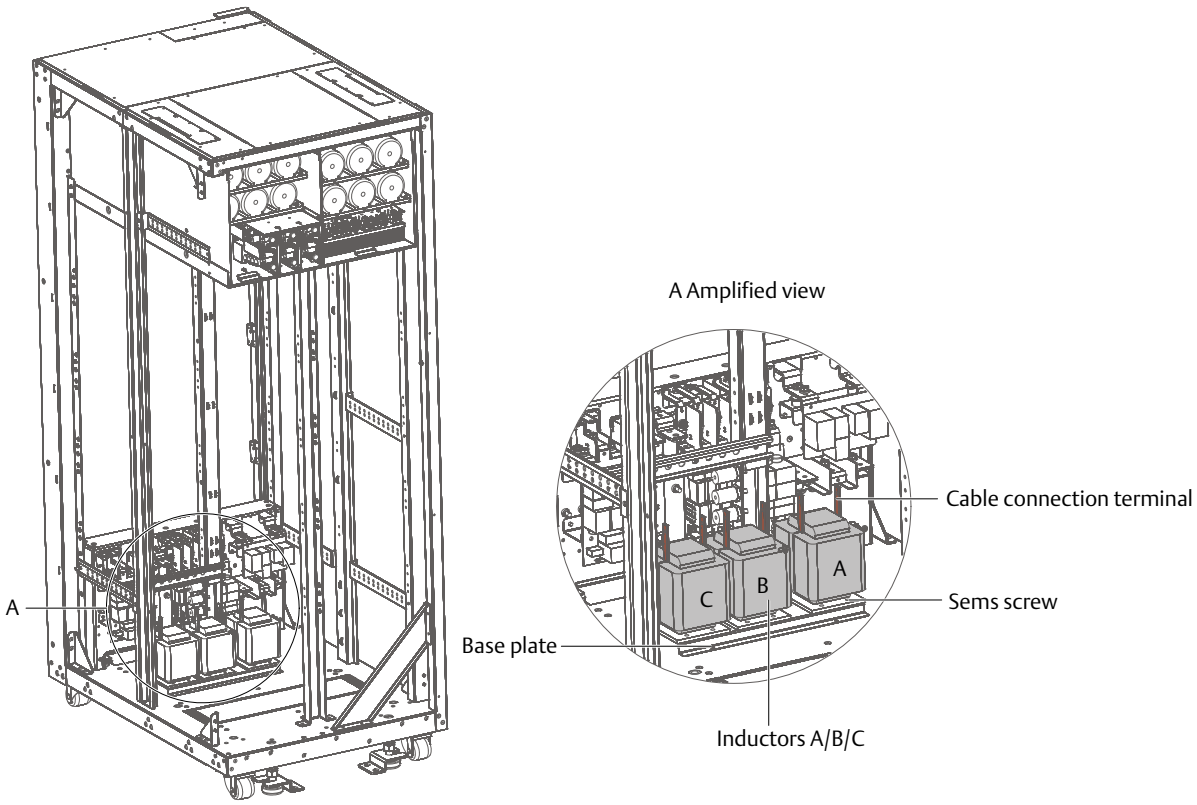


Figure 8-2 Position of bypass load sharing inductors

There are 12 installation holes on the base plate of the UPS cabinet for fixing the three inductors, four installation holes for each inductor. Place the three inductors in the installation positions shown in Figure 8-2, and secure them to the base plate of the UPS cabinet using the M5 × 12 SEMS screws (12 pcs).

4. Connection of bypass load sharing inductors.

a) Remove the fixing screws on three cables W01, W02 and W03.

b) Refer to Figure 8-3, connect one end of W31 ~ W36 to inductor A, Inductor B, and Inductor C, respectively. Use the M6 × 16 SEMS screws, M6 flat washers and nuts to secure them to the terminals. The torque value is 4.8N.m.

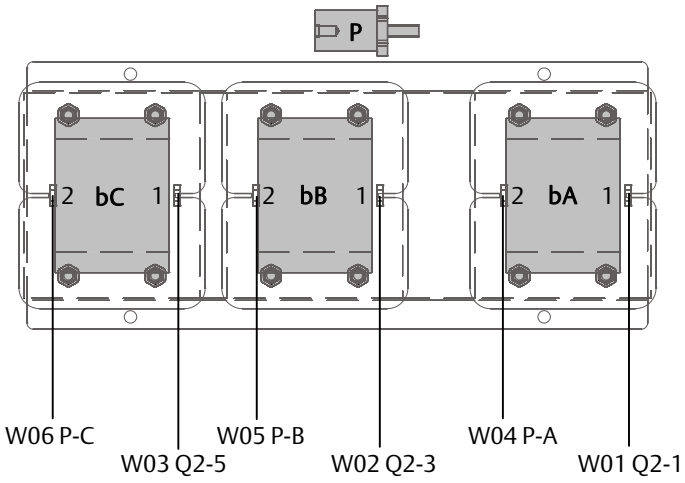


Figure 8-3 Inductor connections (1)

c) Connect the other end of cables W31 ~ W33 to the corresponding terminals on top of bypass Input switch Q2, and use the M6 × 16 SEMS screws to secure them to the terminals. The torque value is 4.8N.m. See Figure 8-4.

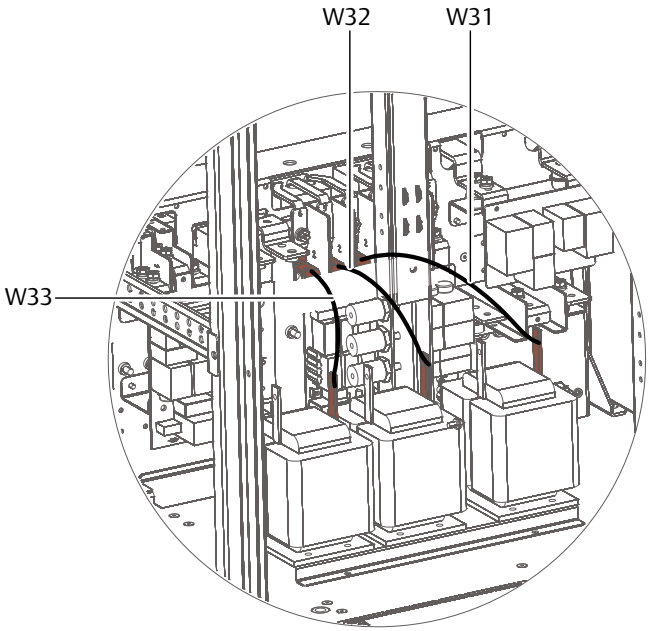


Figure 8-4 Inductor connections (2)

d) Use the M6 × 16 SEMS screws to connect the other end of W34 to one end of the disconnected cable, W01, at insulating terminal PA, the torque value is 4.8N.m. Then connect W35 and W02 together at insulating terminal PB, and W36 and W03 at insulating terminal PC. See Figure 8-5.

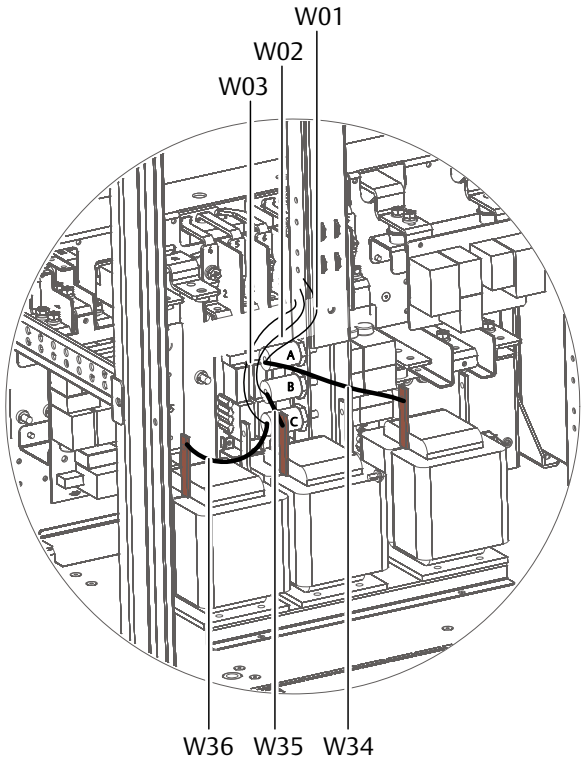


Figure 8-5 Inductor connections (3)

5. Replace the left side panel and close the front door of the UPS.

Note
Ensure that there are no foreign objects inside the UPS cabinet before closing the door.

At this point, the bypass load sharing inductors installation procedure is complete.

Maintenance

1. Make sure that all the connections are secure. Check all the connections at regular intervals, tightening them where necessary.
2. Keep the inductors clean, ensuring that they remain free of dust and moisture.
3. Keep accurate records and request on-site maintenance in time.

8.1.2 Internal Battery Kit

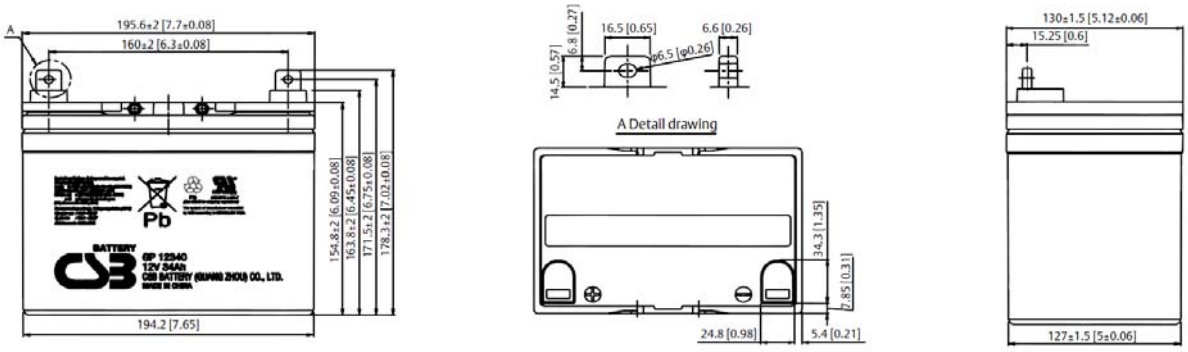
Vertiv can supply two different types of internal battery kits for the users that require internal UPS battery solutions or corresponding kits:

- A factory installed, 40-block internal battery kit
- A site installed kit including battery cables, battery trays, screws, cable ties, protective caps and battery fuses.

Note: In the case of the factory installed 40-block internal battery kit, Vertiv provides - GP 12340-12V-34.0Ah valve-regulated lead acid batteries (see Table 8-2 for parameters) or equivalent model.

Table 8-2 GP 12340-12V-34.0Ahvalve-regulated lead acid battery parameters

Dimensions	Overall height (H)	Container height (h)	Length (L)	Width (W)
mm (inch)	178.3±2 (7.02±0.08)	154.8±2 (6.09±0.08)	195.6±2 (7.7±0.08)	130±1.5 (5.12±0.06)



Note

1. The site installed, 40-block internal battery kit DOES NOT include batteries
2. The battery cables, battery trays and protective caps are designed according to the specifications of the GP 12340-12V-34.0Ah valve-regulated lead acid batteries or equivalent model. If you request the site installed, 40-block internal battery kit, please purchase batteries of the same specification.

Preparation

1. Prepare the installation tools, including a cross head screwdriver, a pair of insulated gloves, a sleeve, an adjustable spanner, and a multi-meter.
2. Check that all installation materials are present and complete, including internal battery, eight battery trays and corresponding battery power cables.

Procedures

1. Shut down the UPS completely.

a) Shut down the load.

b) Refer to 5.6.1 *Procedures for Shutting Down a UPS completely* when shutting down a single UPS module, and 7.3.5 *Procedures For Shutting Down a UPS Completely in a Parallel System* when shutting down a parallel system.

c) All the LCDS switch off, wait five minutes for the internal UPS DC bus capacitors to discharge completely.

2. Install the internal battery fuse and the battery cables.

Open the cabinet front door, remove the switch cover, side panel and rear panel, and then install the cables (W19, W20 and W21), as shown in Figure 8-6.

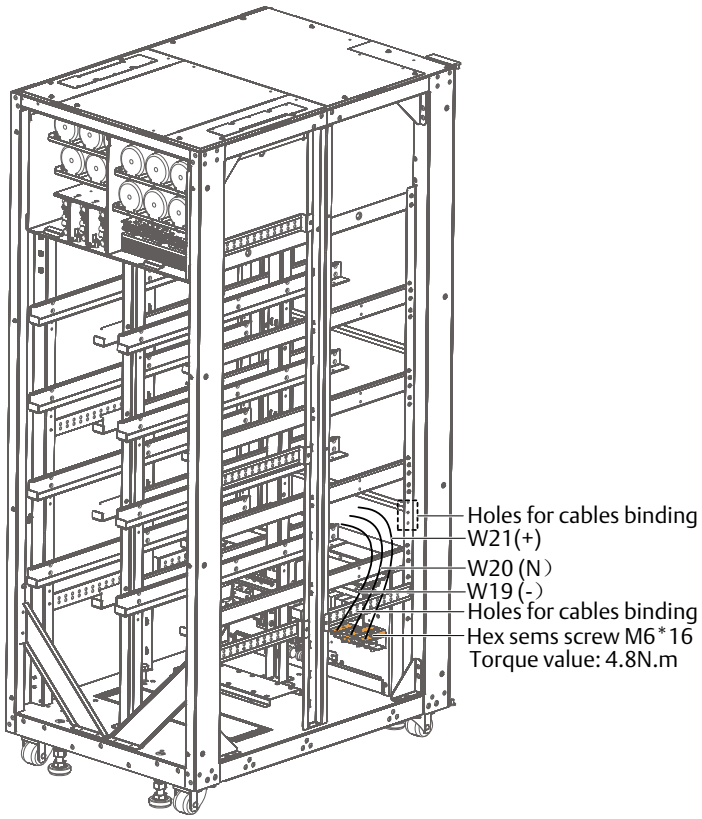


Figure 8-6 Installing internal battery fuse and battery cables (front view)

3. Open the cabinet front door, remove the screws in order to open the battery compartment door (see Figure 8-7), and keep them.

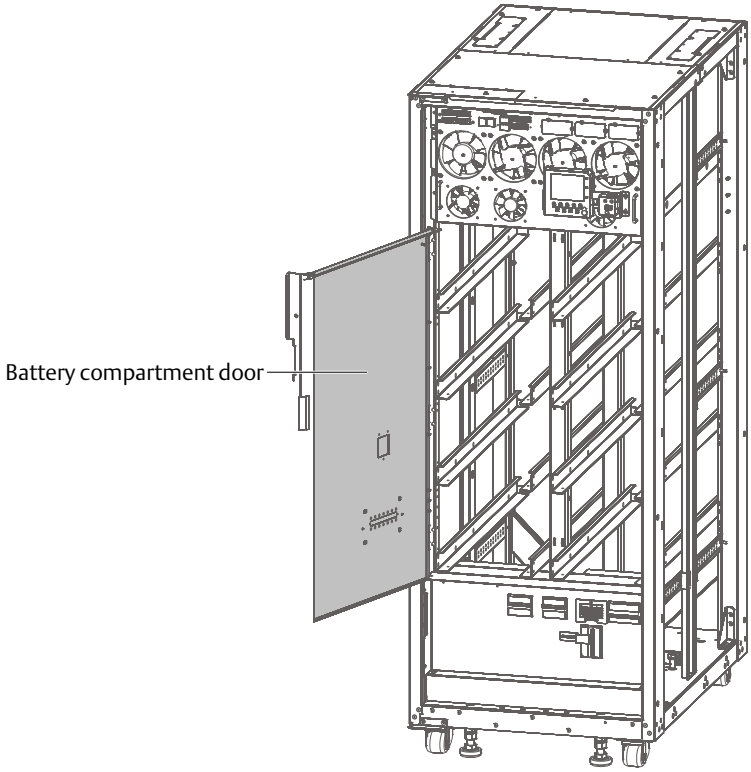


Figure 8-7 Opening the battery compartment door

Warning

The following operations on the battery and battery tray may only be operated by authorized service engineers wearing the appropriate insulating safety gloves.

4. Place the batteries into corresponding positions on battery trays, one by one, in accordance with the internal battery connection layout, as shown in Figure 6-1, and then use M6*20 SEMS screws/spring washers/flat washers

and to secure the cables to the battery terminals; the torque value is 4.8 N.m. Note that the protective caps should be fitted on the battery terminals (red for +, black for -).
Use straps to secure the batteries to the battery trays. Note that the straps must pass through the slots on both sides of the battery tray. Use four straps for each tray. Then interconnect the battery trays, as shown in Figure 8-8.
Use the multi-meter to measure the voltages (50Vdc ~ 70Vdc) between connection terminals, so as to verify that the cables have been connected correctly.

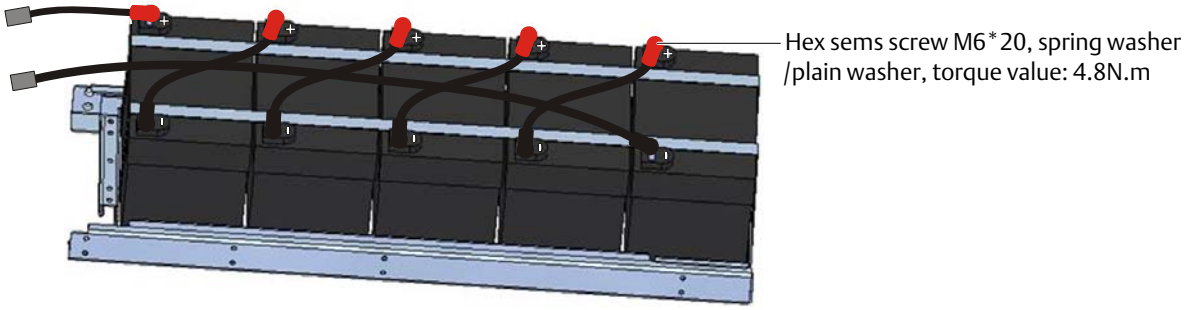


Figure 8-8 Positioning the batteries on the battery tray

5. AS shown in Figure 8-9, insert the trays with batteries mounted into the battery compartment one by one, and ensure that battery trays N. 1 - 8 correspond to layers 1 - 4 (from bottom to top) of the battery compartment, otherwise the battery voltage may be abnormal.

Warning

Install battery trays from the bottom upwards, in order to avoid creating a high center of gravity, which could cause the UPS to tip over.

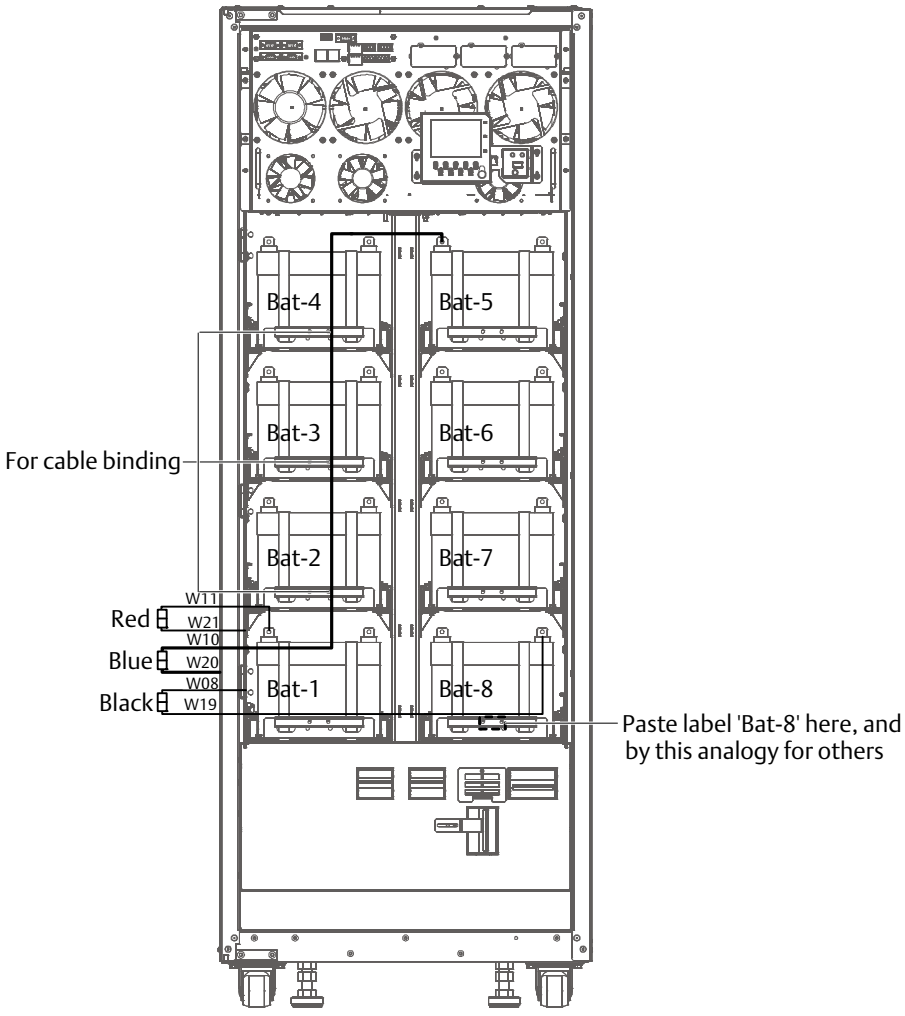


Figure 8-9 Battery tray interconnections

6. Use torque value indicated in Figure 8-10 to secure both sides of the battery tray, then raise the limiting baffle plate.

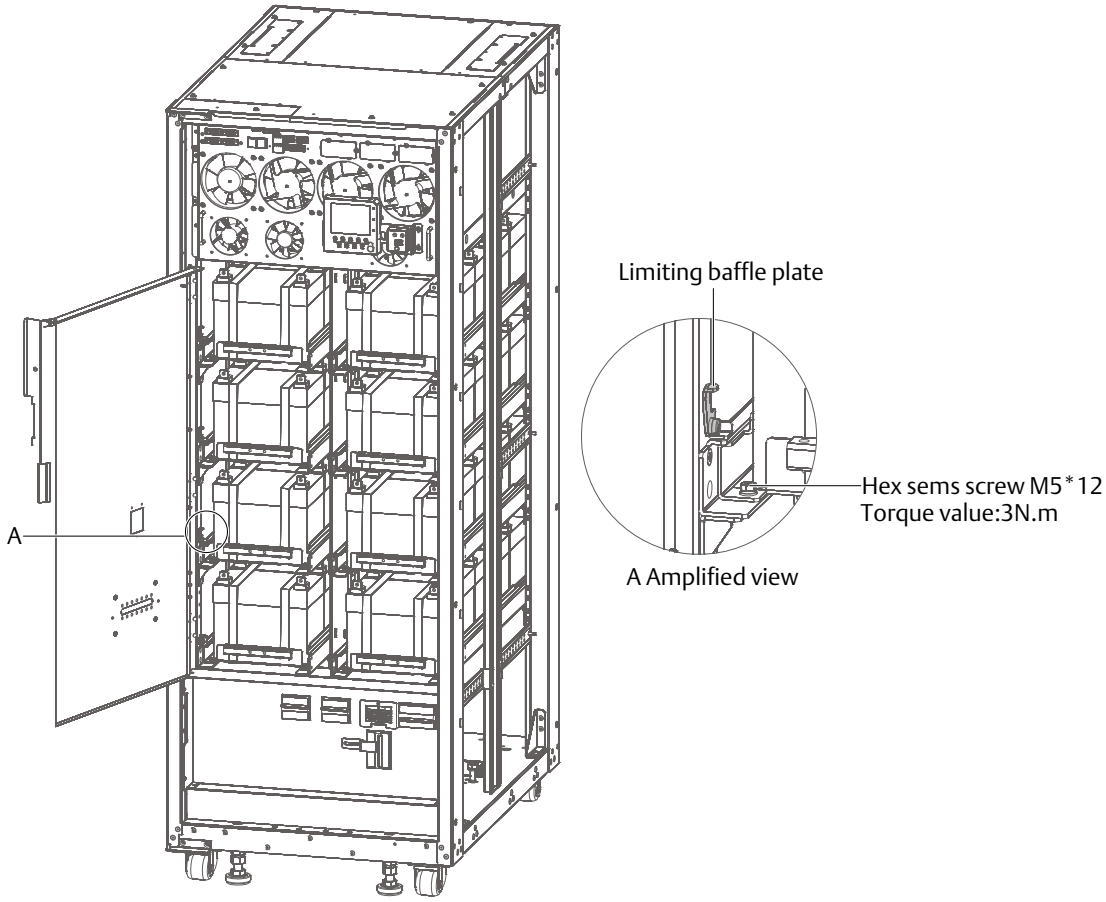


Figure 8-10 Securing the battery trays

7. As shown in Figure 8-9, connect the positive terminal of battery tray 1 to the cabinet positive terminal; connect the neutral line terminal of battery tray 3 to the cabinet neutral line terminal, and connect the negative terminal of battery tray 5 to the cabinet negative terminal. Use the multi-meter to measure voltages between battery terminals (+, -, N) shown in Figure 3-2, so as to verify that the cables are connected correctly.

Warning
At this point, the battery voltage connected to the UPS cabinet exceeds 480V. Insulating gloves and other protective measures must be used.

8. Close the battery compartment door and then reinstall the switch cover plate, and then use hex SEMS screw M5*12 (4 pcs) to secure the column reinforcements on lower left/right corner of the cabinet, as shown in Figure 8-11.

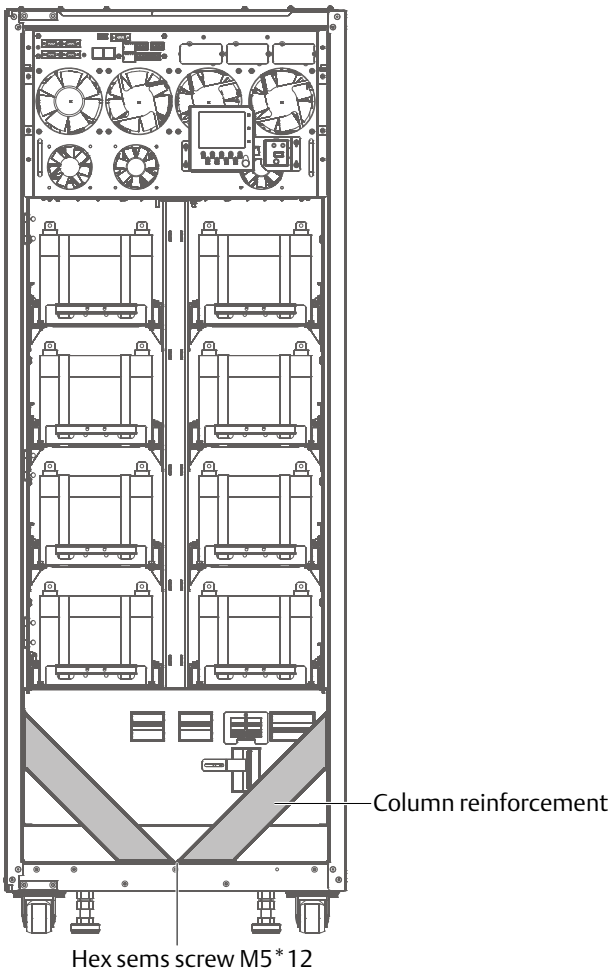


Figure 8-11 Installing the column reinforcements (front view)

9. Reinstall the side panel and back door of the cabinet, and then close the front door.
For more information of the battery, refer to Chapter 6 *Battery*.

8.1.3 Battery Temperature Compensation Kit

This option consists of a sensor, which is installed next to the battery and used to measure the battery temperature. The sensor signal output cable is connected to the UPS internal logic circuit via the UF-RS485 card in Intellislot port 1.
When this option is installed, the variations in the nominal float voltage supplied to the battery are inversely proportional to the ambient temperature of the battery cabinet or battery room. This prevents the battery from being over charged at high ambient temperatures.

Preparation

1. Prepare the installation tools, including a cross head screwdriver.
2. Check that all installation materials are present and complete, including a battery temperature sensor and a UF-RS485 card.

Procedures

Warning

1. Connect the cables strictly according to the instructions. Failure to observe this may cause damage to the UPS and the battery.
2. Shut down the UPS when installing the battery temperature sensor. During installation, do not touch the battery terminals, exposed copper bars and components.

1. Shut down the UPS completely.
a) Shut down the load.
b) Refer to 5.6.1 *Procedures for Shutting Down a UPS completely* when shutting down a single UPS module, and 7.3.5 *Procedures For Shutting Down a UPS Completely in a Parallel System* when shutting down a parallel system.
c) All the LCDS switch off, wait five minutes for the internal UPS DC bus capacitors to discharge completely.
2. Connect one end of the sensor output cable to the battery temperature sensor port, and the other end to one of the UF-RS485 card ports. See Figure 8-12.

Figure 8-12 Connection between UF-RS485 card and battery temperature sensor

3. As illustrated in Figure 8-13, set the temperature sensor DIP switch 5 to 'ON', so that the bottom left corner of the temperature sensor display LCD screen indicates 01 (or 02). If two temperature sensors are used together, their DIP switch settings must not be the same.

Figure 8-13 Temperature sensor DIP switch

4. Remove the right side panel of the cabinet, position the battery temperature sensor at the rear of battery tray 1, and then insert the UF-RS485 card into the Intellislot port 1. Refer to Figure 8-14 for more information on installing and connecting the battery temperature sensor.

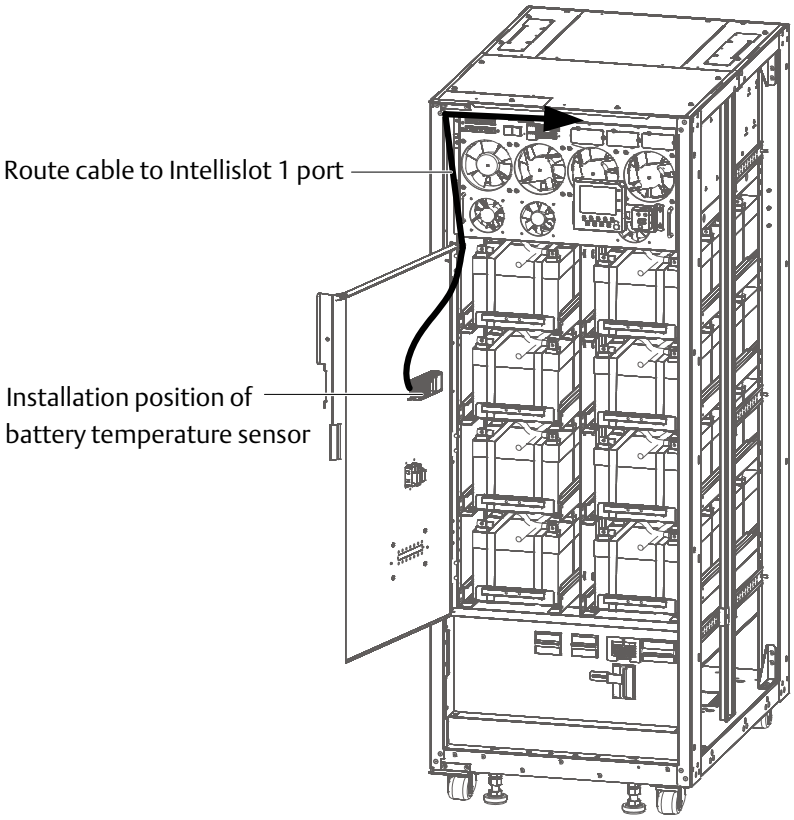


Figure 8-14 Installing and connecting the battery temperature sensor

5. Route the cables as indicated in Figure 8-14. Note that the cables should be routed separately from the power cables, to avoid EMI.

8.1.4 IS-UNITY-DP Card

Important

When using the 485 port, it is important to use the shielded braid cables, and ensure that the shield is connected securely to the UPS chassis.

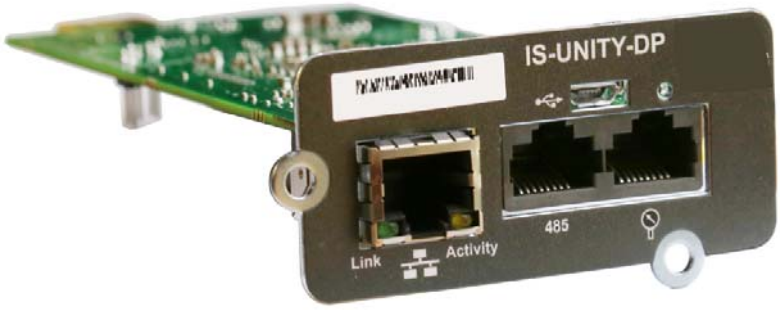


Figure 8-15 IS-UNITY-DP card

For more information about the IS-UNITY-DP card, refer to the specific *Liebert IntelliSlot Unity Card Web, SNMP, Modbus, BACnet, YDN23 User Manual*.

8.1.5 IS-WEBL Card

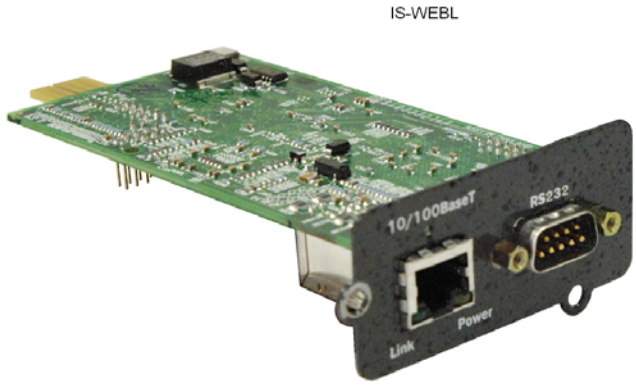


Figure 8-16 IS-WEBL card

The IS-WEBL card is a network management card. It can be used to convert the UPS into a fully compatible network device. It can also be connected to the IRM series sensor to provide environmental monitoring functions. When the intelligent equipment generates an alarm, the IS-WEBL card can notify the user by logging the event, sending any information that may be captured, and sending a mail.

Preparation

1. Prepare the installation tools, including a cross head screwdriver.
2. Check that all installation materials are present and complete, including an IS-WEBL card.

Procedure

Note

The IS-WEBL card is hot pluggable, therefore there is no need to shut the UPS down when installing it.

Warning

Some electronic components are IS-WEBL card are static sensitive, therefore in order to protect it against static discharge, do not touch the electronic components or circuit on the IS-WEBL card with hands or other conductive materials. When removing or installing the IS-WEBL card, hold it by the edges.

The IS-WEBL card should be installed in the UPS Intellislot port (see Figure 3-7). See Table 3-10 for the optional card installation positions.
Installation procedure:
1. Remove the Intellislot port cover. Remember to keep the cover and retaining screws cover for future use.
2. Insert the IS-WEBL card into the port position indicated in Table 3-10, and then secure using the screws.
For more information about the IS-WEBL card, refer to the *Liebert IntelliSlot Web Card Quick Start Guide*.
Refer to 3.2.11 *Signal Cable Connection Procedure* for information on cabling and routing signal cables.

8.1.6 IS-Relay Card

Figure 8-17 IS-Relay card

The UPS IS-Relay card option enables the user to use the dry contact signal to monitor the UPS.
The IS-Relay card functions are listed in Table 8-3.

Table 8-3 Function of UPS IS-Relay card

Pin	Function	Operation
1	Common-Low Battery	
2	Low Battery	Closed if low battery point occurs
3	Low Battery	Closed if battery is OK
4	Common-UPS Fault	
5	UPS Fault	Closed if UPS fault occurs
6	UPS Fault	Closed if no UPS failure
7	Common-On Battery	
8	On Battery	Closed if On Battery power (Utility failure)
9	On Battery	Closed if not On Battery power (Utility OK)
10	Signal Ground	Use for UPS Any-Mode Shutdown
11	Signal Ground	Use for UPS Any-Mode Shutdown
12	UPS Any-Mode Shutdown	SWitch UPS output Off when shorted to Pin 10 or 11
13	Summary Alarm	Closed if no alarm conditions are present
14	Summary Alarm	Closed if Summary Alarm occurs
15	Common-Summary Alarm	
16	On UPS	Closed if On UPS (inverter) power
17	On Bypass	Closed if On Bypass
18	Common-On Bypass	

For more information of the IS-Relay card, refer to the *Liebert IntelliSlot Relay Card User Manual*.
The installation procedure for the IS-Relay card is the same as for the IS-WEBL card, as described in 8.1.5 *IS-WEBL card*. Refer to 3.2.11 *Signal Cable Connection Procedure* for information on cabling and routing signal cables.

8.1.7 IS-485L Card

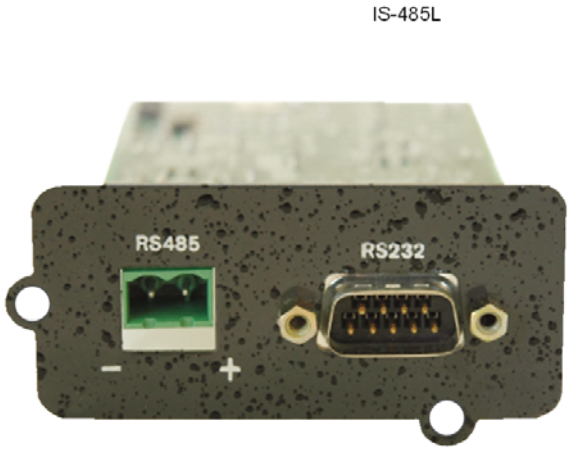


Figure 8-18 IS-485L card

The IS-485L card can be used to convert the UPS internal protocol to Modbus RTU protocol, enabling the user can use the Modbus RTU protocol to manage the UPS, acquire the UPS parameters, operating status and fault types for UPS monitoring purposes.
For more information about the IS-485L card, refer to the *Liebert IntelliSlot Modbus 485, Modbus IP And BACnet IP Reference Guide*.
The installation procedure for the IS-485L card is the same as for the IS-WEBL card, as described in 8.1.5 *IS-WEBL card*. Refer to 3.2.11 *Signal Cable Connection Procedure* for information on cabling and routing signal cables.

8.1.8 BCB Box

Refer to 6.9 *BCB Box (Optional)* for more information about the BCB box specifications and battery connections.

8.1.9 Parallel Cables

Shielded and double-insulated parallel cables available in lengths of 5m, 10m and 15m, must be interconnected in a ring configuration between the UPS modules, as shown in Figure 7-2.
Method: connect a module parallel cable from its PARA1 port to the PARA2 port of another module, repeat for all the other parallel cables.
The ring connection ensures the reliability of the parallel system control circuit. Be sure to verify the parallel cables have been connected correctly before starting up the system!

8.1.10 LBS Cables

The shielded and double-insulated parallel cables are available in lengths OF 5m, 10m and 15m. Connect the two optional LBS cables in a ring configuration: from the LBS1 port of one UPS module to LBS2 port of another UPS module, and from the LBS2 port of one UPS module to LBS1 port of another UPS module, as shown in Figure 7-6 and Figure 7-7.

8.1.11 Transformers

Liebert NXC Input Transformer Version

This UPS includes an isolation transformer at the UPS input. This transformer provides electrical isolation between the load and the input mains utility.

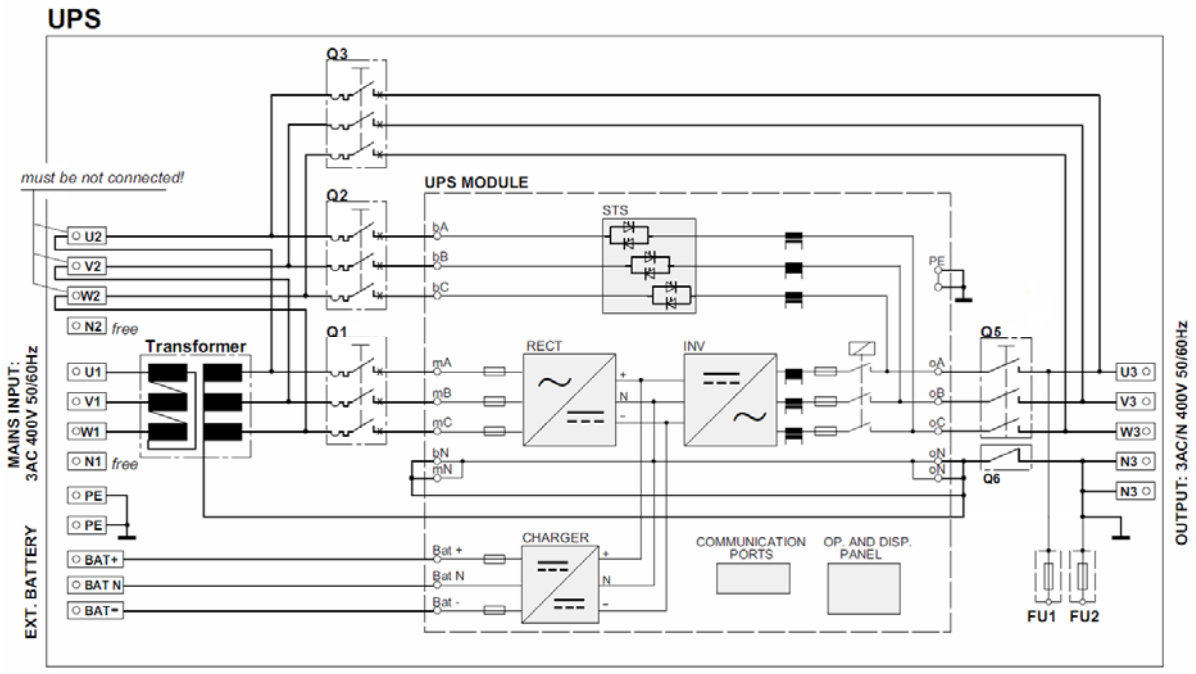
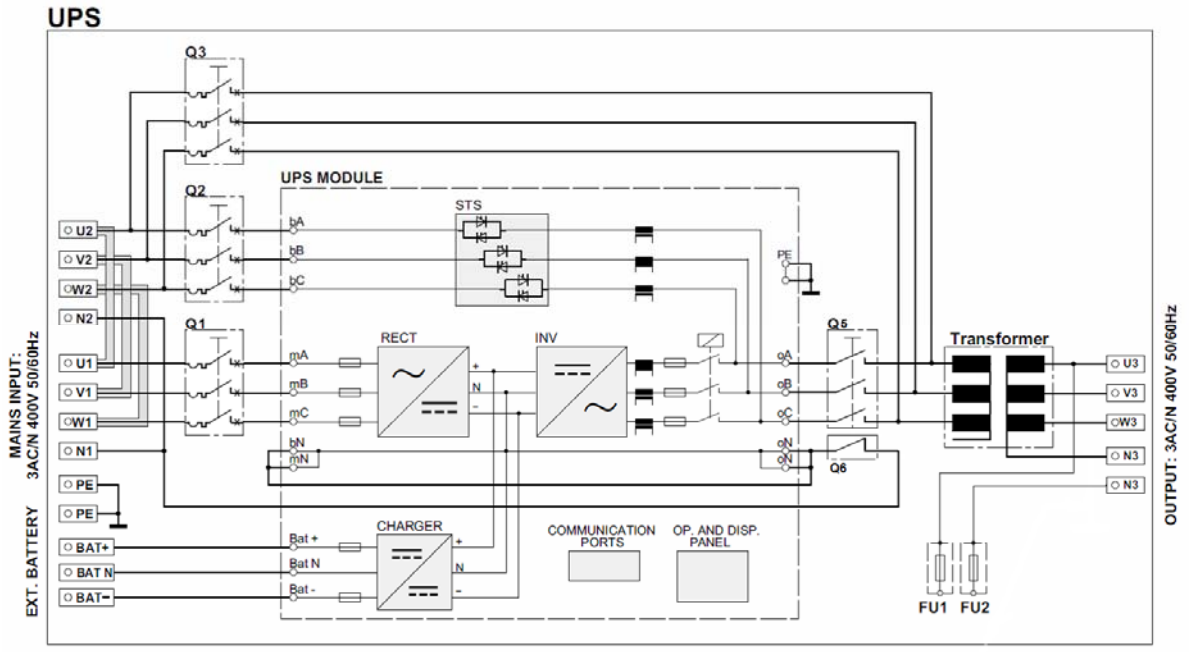


Figure 8-19 UPS with input isolating transformer

Liebert NXC Output Transformer Version

This UPS includes an isolation transformer at the UPS output. This transformer provides electrical isolation between the UPS output and the load.



WARNING: the connection between neutral and earth on the output transformer secondary terminal is delegated to the customer, if required

Figure 8-20 UPS with output isolating transformer

Chapter 9 Communication

The UPS supports SNMP communication, Modbus protocol, dry contact and Velocity protocol communication. This chapter provides information about these communication systems.
Refer to the corresponding settings in Table 4-7 for communication protocol transfer. Selecting 'Velocity' means the system supports the Velocity protocol communication.

9.1 SNMP Protocol Communication

If you need to monitor the UPS via a network, you may select the IS-WEBL card supplied by Vertiv.
The IS-WEBL card is a network management card that supports the SNMP protocol and can be used to convert the UPS into a fully compatible network device. It can also be connected to the IRM series sensor to provide environmental monitoring functions. When the intelligent equipment generates an alarm, the IS-WEBL card can notify the user by logging the event, sending any information that may be captured, and sending a mail.
The IS-WEBL card provides three approaches for you to monitor your intelligent equipment and equipment room environment:

- Web browser. You can use a Web browser to monitor your intelligent equipment and equipment room environment using the IS-WEBL card Web server function.
- Network management system (NMS). You can use NMS to monitor your intelligent equipment and equipment room environment via the IS-WEBL card SNMP function.

The IS-WEBL card should be installed in the UPS Intellislot port (see Table 3-7).
For information about installing and setting up the IS-WEBL card, refer to the *Liebert IntelliSlot Web Card Quick Start Guide*.

9.2 Modbus Protocol Communication

The UPS can achieve Modbus communication through the optional IS-485L card. For information about installing and using the IS-485L card, refer to the *Liebert IntelliSlot Modbus 485, Modbus IP And BACnet IP Reference Guide*.

9.3 Dry Contact Communication

The UPS provides the following two dry contact communication methods:

- IS-Relay card (option)
- Dry contact port

9.3.1 Communication via IS-Relay Card

The UPS may be supplied with an optional IS-Relay card that can be used to manage UPS monitoring dry contact signals. The IS-Relay card should be installed in an Intellislot port (see Figure 3-7) on the communication box in the cabinet. For information about installing and using the IS-Relay card, refer to the *Liebert IntelliSlot Relay Card User Manual*.

9.3.2 Communication via Dry Contact Port

For specific, on-site needs, the UPS may require auxiliary connections for functions such as acquiring external equipment status information, providing alarm signals to external devices, and remote EPO. These functions may be realized using the following interfaces on the external interface board (EIB):

- Input dry contact port
- Output dry contact port
- EPO input port

For detailed information about these ports and the associated functions, refer to 3.2 *Signal Cable Wiring*.

Chapter 10 Service And Maintenance

The UPS system (including battery) requires regular service and maintenance in order to guarantee a long working life. This section provides information about service life, regular inspections, maintenance and replacing key UPS components. Efficient maintenance of the UPS system can reduce the risk of UPS failure and prolong the UPS service life.

10.1 Safety

Warning

1. Daily inspections of the UPS systems may be performed by personnel who have received the appropriate training, whereas inspection and replacement of components must be carried out by authorized professionals.
2. Components that can only be accessed by opening the protective cover with tools may not be operated by the user. Only qualified service personnel are authorized to remove such covers.
3. Note that hazardous voltages may be present on the neutral line when servicing the UPS.

10.2 Key Components and UPS Service Life

Some UPS system components will have a shorter service life than the UPS itself due to the wear and tear they are subjected to when in use. In order to guarantee the safety of the UPS system, it is necessary to inspect and replace such components on a regular basis. This section lists the key UPS components and their respective projected service life. In the case of systems where the operating parameters differ from the nominal working conditions (environment, load rate, etc.), request professional assessment and advice on whether to replace such components, with reference to the information provided in this section.

10.2.1 Service life parameters and proposed replacement intervals of key components

The key components listed in Table 10-1 are used in the UPS system. To prevent system failures caused by these components malfunctioning due to wear and tear, we recommend carrying out regular inspections and replacing them upon or before the expiry of their projected service life.

Table 10-1 Service life parameters and proposed replacement intervals of key components

Key components	Estimated life	Proposed replacement time	Proposed inspection period
Fan	Not less than 7 years	Five to six years	One year
Air filter	One year to three years	One to two years	Two months
VRLA battery (5-year life)	Five years	Three to four years	Six months
VRLA battery (10-year life)	10 years	Six to eight years	Six months

10.2.2 Replacing Air Filters

The air filters must be inspected regularly and replaced at regular intervals, depending on the ambient conditions in the area where the UPS is installed. Under normal environmental conditions, the air filters should be cleaned or replaced once every two months, and more frequently in dusty or other hostile environments. The filters should also be inspected more frequently when installed in new buildings.

The UPS air filters are fitted on the rear of the cabinet front doors and can be replaced without interrupting UPS operation.

Each air filter is secured by a fixing bar on either side (see Figure 10-1).

To replace the air filters, proceed as follows:

1. Open the front door of the UPS to reveal the air filter on the back of the front door.
2. Remove a fixing bar on one side and loosen the screws that retain the fixing bar on the other side; it is not necessary to remove this fixing bar.
3. Remove the air filter to be replaced, and insert a clean one.
4. Re-install the fixing bar that was removed in step 1 in its original position and re-tighten the retaining screws.
5. Tighten the retaining screws on the fixing bar on the other side.

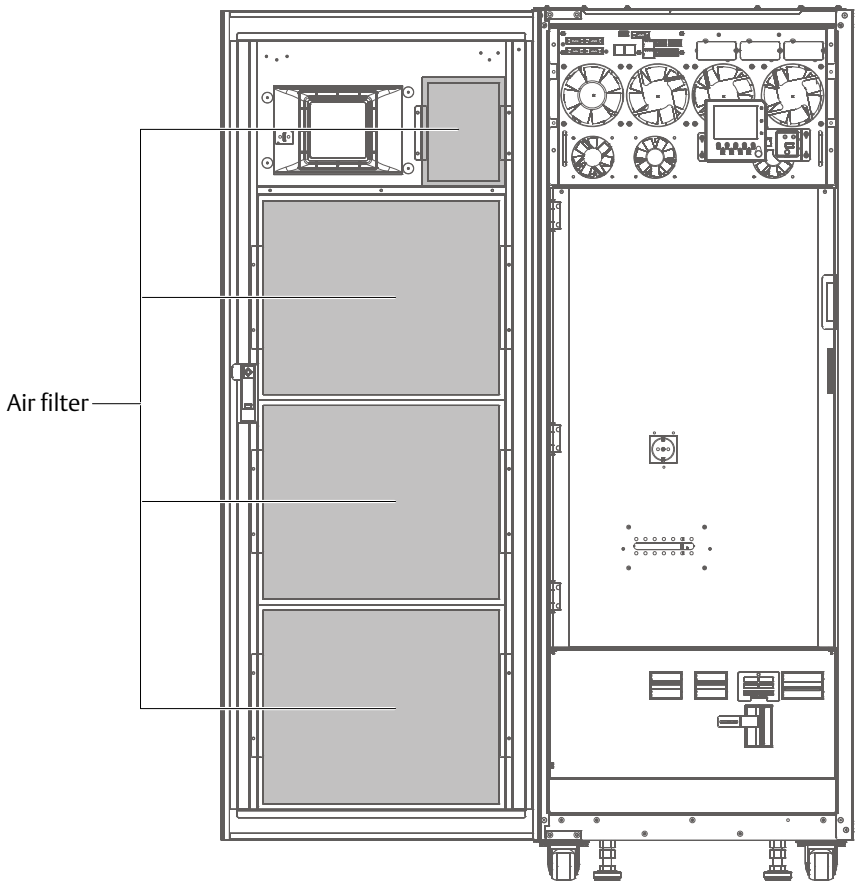


Figure 10-1 Replacing air filters

10.2.3 Replacing Fuses

When replacing the fuses on the battery input terminal copper bars, use fuses of the same model as the original ones. Note that the AC fuses and DC fuses in the system are not interchangeable.

10.3 UPS And Options Maintenance Procedure

It is necessary to implement a common maintenance procedure for the UPS and its options:

1. Keep a good service history log. Keeping a good service history log makes it easier to manage failures.

2. Keep clean the UPS clean in order to prevent dust and/or moisture from getting into it.

3. Maintain the correct ambient temperature. The ideal temperature for the battery is 20°C to 25°C. If the temperature is too low it will reduce the battery capacity whereas if it is too high it will reduce the battery life.

4. Check the wiring. Check the tightening torque on all connection screws, and retighten them where necessary at least once a year.

5. Check the input and output circuit breakers at regular intervals to make sure that they operate correctly and are not damaged in any way, in order to ensure that they trip in the event of an overload condition. Maintenance staff should be familiar with the typical ambient conditions where the UPS is installed so that they are enable to identify any unusual conditions as soon as they occur; they should also be familiar with the UPS operation control panel settings and set-up procedures.

For information on UPS battery maintenance, see para. *6.11 Battery Maintenance*.

Chapter 11 Specifications

This chapter lists the UPS specifications.

11.1 Conformance And Standards

The UPS has been designed to comply with the European and international standards listed in Table 11-1.

Table 11-1 European and international standards

Item	Normative reference
General safety requirements for UPS	IEC/EN 62040-1+A1:2013/AS62040-1
EMC requirements for UPS *	IEC/EN 62040-2:2006/AS62040-2
Method of specifying the performance and test requirements of UPS	IEC/EN 62040-3/AS62040-3 (VFI SS 111)

Note

The product standards in this table incorporate the relevant compliance clauses with generic IEC and EN standards for safety (IEC/EN/AS60950), electromagnetic emission and immunity (IEC/EN/AS61000 series) and construction (IEC/EN/AS60146 series and 60529).

* Category C3 (C2 optional)

11.2 Environmental Specifications

Table 11-2 Environmental characteristics

Item	Unit	Rated power (kVA)
		60kVA
Noise at 1m (at front)	dB (A)	60
Altitude	m	≤ 1000 (derate power by 1% for every 100m above 1000m)
Relative humidity	%RH	0 ~ 95%, non condensing
Operating temperature	°C	0 ~ 40°C (Note: Battery life is halved for every 10°C increase above 20°C)
Storage and shipping temperature for UPS	°C	-40°C ~ +70°C
Over-voltage level		Overvoltage level 2
Pollution level		Pollution level 2

11.3 Mechanical Specifications

Table 11-3 Mechanical specifications

Item	Unit	Rated power (kVA)
		60kVA
Dimensions (W × D × H)	mm	600 × 850 × 1600
Net weight	kg	223.5
Gross weight	kg	258.5
Color		Black ZP7021
Protection degree, IEC (60529)		IP20 (front door open or closed)

11.4 Electrical Specifications (Rectifier Input)

Table 11-4 Rectifier AC input (mains)

Item	Unit	Rated power (kVA)
		60kVA
Rated AC input voltage[1]	Vac	380/400/415, 3-phase 4-wire (+PE) TN/TT power distribution system
Input voltage range[2]	Vac	305 ~ 477
Frequency[2]	Hz	50/60 (range: 40 ~ 70)
Power factor	kW/kVA, full load (half load)	0.99 (0.98)
Input current	A, rated[3]	84
Total current harmonic distortion	%	Linear full load < 3% (battery float charge) (3-in 3-out) Non-linear full load < 5% (battery boost charge) (3-in 3-out)
Duration of progressive power walk-in	s	5s to reach full rated current (selectable 10s through 25s in 5-second intervals)

Note

1. Rectifiers operate at any of the rated voltages without further adjustment.
2. At 305V the UPS maintains the specified output voltage at rated load without discharging the battery.
3. IEC/EN 62040-3/EN50091-3: at nominal load and input voltage 400V, battery fully charged.

11.5 Electrical Specifications (Intermediate DC Circuit)

Table 11-5 Battery

Item	Unit	Rated power (kVA)
		60kVA
Max. charging current	A	18
Quantity of lead-acid blocks	Block	30*, 32, 34, 36, 38, 40 (12Vdc)
Float voltage	V/cell (VRLA)	2.27 (selectable from 2.2V/cell to 2.3V/cell) Constant current and constant voltage charge mode
Temperature compensation	mV/°C/cl	-3.0 (selectable from 0 to -5.0 around 25°C or 30°C, or inhibit)
Ripple voltage (float charge)	%	≤ 1%
Boost voltage	V/cell (VRLA)	2.35 (selectable from 2.3 to 2.4) Constant current and constant voltage charge mode
Boost control		Float-boost current trigger $0.050C_{10}$ (selectable from 0.001 to 0.070) Boost-float current trigger $0.010C_{10}$ (selectable from 0.001 to 0.025) 12h safety time timeout (selectable from 8h to 30h) Boost mode inhibit also selectable
EOD voltage	V/cell (VRLA)	1.60 ~ 1.85

*: When the model is 40kVA and the battery cell is 30, the Vertiv authorized personnel shall set the EOD voltage value to 1.75 V/cell.

11.6 Electrical Specifications (Inverter Output)

Table 11-6 Inverter output (to critical load)

Item	Unit	Rated power (kVA)
		60kVA
Power factor		0.9
Rated AC voltage[1]	Vac	380/400/415 (3-phase 4-wire, with neutral reference to the bypass neutral) (3-in 3-out)
Frequency[2]	Hz	50/60
Overload	%	For linear load requirement: < 105%, continues; 105 ~ 125% of rated load, 10min; 125 ~ 150% of rated load, 1min; > 150%, 200ms
Non-linear load capability[3]	%	100%
Steady state voltage stability	%	±1% for balanced three phase load; ±2% for unbalanced load
Transient voltage response[4]	%	±5% for 100% rated linear load step
Total harmonic voltage	%	2% (100% linear load); 5% (100% non-linear load)
Synchronisation window	Hz	Rated frequency ±0.5, ±1, ±2, ±3 (optional)
Slew rate (max. change rate of synchronisation frequency)	Hz/s	Setting range: 0.1 ~ 0.6 (UPS module), 0.6 (parallel system)

Note

1. Factory set to 400V. 380V or 415V can be selected by service engineer at site.

2. Factory set to 50Hz. 60Hz can be selected by service engineer at site. Note that the system frequency can be changed only when the UPS is on bypass. It is strictly prohibited to change the system frequency when the UPS is on inverter.

3. EN 50091-3 (1.4.58) crest factor 3:1, non-linear load.

4. IEC/EN 62040-3/EN 50091-3 also for 0 ~ 100% ~ 0 load transient. Transient recovery time: returns to within 5% of steady state output voltage within half a cycle.

11.7 Electrical Specifications (Bypass Input)

Table 11-7 Bypass input

Item		Unit	Rated power (kVA)
			60kVA
Rated AC voltage[1]		Vac	380/400/415, 3-phase 4-wire, sharing neutral with the rectifier input and providing neutral reference to the output, (3-in 3-out)
Rated current	380V	A	91 (3-in 3-out)
	400V	A	87 (3-in 3-out)
	415V	A	84 (3-in 3-out)
Overload		%	Based on nominal voltage and rated load current under apparent power: < 105%, continues; 105 ~ 125% of rated load, 10min; 125 ~ 150% of rated load, 1min; 150 ~ 400% of rated load, 1s; > 400%, 200ms
Frequency[2]		Hz	50/60
Bypass voltage tolerance		%Vac	Upper limit: +10%, +15% or +20%, default: +15%; Lower limit: -10%, -20%, -30% or -40%, default: -20%
Bypass frequency tolerance		%	±10% or ±20%, default: ±20%
Synchronisation window		Hz	Rated frequency ±0.5, ±1, ±2, ±3 (optional)

Note

1. Factory set to 380V. 400V or 415V can be selected by service engineer at site.
2. Factory set to 50Hz. 60Hz can be selected by service engineer at site.

11.8 Efficiency And Losses

Table 11-8 Efficifency and loss

Item		Unit	Rated power (kVA)
			60kVA
Efficiency			
Normal mode	100% load	%	95%
	75% load	%	95.35%
	67% load	%	95.36%
	50% load	%	95.33%
	33% load	%	94.88%
	25% load	%	94.36%
ECO mode (100% load)		%	98.9%
Loss			
Normal mode (no load)		kW	0.43
Normal mode (full load)		kW	2.84

Note

The above conditions apply when the voltage input and output ranges are set to 400 V and the battery is fully charged.

Appendix 1 Disposal Of Old Appliances

NOTICE TO EUROPEAN UNION CUSTOMERS: DISPOSAL OF OLD EQUIPMENT

This product has been supplied by an environmentally responsible manufacturer that complies with the Waste Electrical and Electronic Equipment (WEEE) Directive 2002/96/CE.

The 'crossed-out wheelie bin' symbol (see left) is reproduced on this product in order to encourage you to recycle wherever possible. Please be environmentally responsible and recycle this product at your local recycling facility at the end of its service life. Do not dispose of this product as unsorted municipal waste. Follow local municipal waste ordinances for proper disposal provisions in order to reduce the environmental impact of waste electrical and electronic equipment (WEEE).

For information about scrapping of this equipment please contact your local Vertiv Representative.

Appendix 2 Glossary

AC	Alternating current
BCB	Battery circuit breaker
CSA	Cross sectional area
DC	Direct current
EIB	External interface board
EMC	Electromagnetic compatibility
EMI	Electromagnetic interference
EOD	End-of-discharge
EPO	Emergency power off
I/O	Input/output
IGBT	Integrated gate bipolar transistor
LBS	Load bus synchronizer
LCD	Liquid crystal display
LED	Light-emitting diode
PC	Personal computer
PE	Protective earth
RCCB	Residual current circuit breaker
RCD	Residual current detector
SCR	Silicon-controlled rectifier
SNMP	Simple network monitoring protocol
STS	Static transfer switch
SVPWM	Space vector pulse width modulation
UPS	Uninterruptible power system
VRLA	Valve-regulated lead-acid

Appendix 3 Hazardous Substances or Elements Statement

Parts	Hazardous substances or elements					
	Lead	Hydrogen	Cadmium	Chrome^{6+}	PBB	PBDE
	Pb	Hg	Cd	Cr^{6+}	PBB	PBDE
Hex copper stud	×	○	○	○	○	○
PCBA	×	○	○	○	○	○
AC capacitor	×	○	○	○	○	○
DC capacitor	×	○	○	○	○	○
Fan	×	○	○	○	○	○
Cables	×	○	○	○	○	○
LCD	×	×	○	○	○	○
Sensors	×	○	○	○	○	○
Large-medium power magnetic components	×	○	○	○	○	○
Circuit breaker/rotating switch	×	○	○	○	○	○
Semiconductors	×	○	○	○	○	○
Battery (when applicable)	×	○	○	○	○	○
Insulation monitoring device (when applicable)	×	○	○	○	○	×

○: Means that the content of the hazardous substances in all the average quality materials of the parts is within the limits specified in SJ/T-11363-2006

×: Means the content of the hazardous sustances in at least one of the average quality materilals of the parts is outsides the limits specified in SJ/T-11363-2006

Vertiv is committed to designing and manufacturing environmentally friendly products. It is currently implementing a rigorous research and design program with the final aim of eliminating all hazardous substances from its products. However, due to the limits imposed by current levels of technology, the following parts still contain hazardous sustances due to lack of reliable substitutes or currently viable alternative solutions:

1. All solder used in the products contains lead
2. Copper alloy contains lead
3. Backlighting lamps contain lead
4. The ceramic materials used in certain capacitors, the copper terminals and the copper leads of metallic film capacitors contain lead.
5. The resistor glass contains lead.
6. The LCD glass screen contains lead, and the backlighting lamp contains hydrogen.
7. The lead in the battery is determined by the battery specifications and technical levels.
8. The insulation monitoring device contains lead and PBDE.

Environment protection period: The environment protection period is indicated on the productitself. Under normal working conditions and if used normally in accordance with the relevant safety precautions, the hazardous substances in the product will not seriously affect the environment, personnel safety or property throughout the duration of the environment protection period, which starts from the manufacturing date.

Battery life: The battery life is dependent on the ambient temperatire and charging/discharging times. The battery life will be shortened if the battery is used at high temperatures or subject to frequent charging/discharging cycles. Refer to the product manual for more details.

Applicable scope: NXC 60kVA UPS

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