Liebert® ITA™

User Manual – 16-20kVA UPS

EMERSON
Network Power

Safety Precautions

This manual contains the information concerning the installation and operation of Liebert® ITA 16kVA and 20kVA UPS (hereinafter referred to as UPS).

Please carefully read this manual prior to installation.

You must abide by the following safety symbols used in the user manual.

Safety symbol	Description
	Improper operating will take risk, it may resault in death.
	Improper operating will take risk, it may resault in serious physical injury and damage in the equipment.
	Read carefully and abide by the contents to operate the equipment.

To reduce the chance of accident, please read the safety precautions very carefully before operation. The 'Caution, Note, Warning, Danger' in this user manual and on the product do not represent all the safety points to be observed, and are only supplement to various safety points. Therefore, the installation and operation personnel must receive strict training and master the correct operations and all the safety points before operation.

When operating Emerson products, the operation personnel must observe the safety rules in the industry, the general safety points and special safety instructions provided by Emerson.

 Warning
1. The UPS must be installed, commissioned and serviced by engineers designated by the manufacturer or its agent. Failure to observe this could result in personnel safety risk, UPS malfunction and invalidation of warranty. 2. The UPS has been designed for commercial and industrial use only, and is not recommended for use in life support applications. 3. This is a Class A UPS product. In a residential environment, this product may nevertheless cause radio interference, in which case, the user is required to take additional measures to reduce the interference.

 Danger
When the UPS is operating, some parts have high voltage, therefore, contacting with them directly or through moist objects will result in fatal risk.

 Warning
1. Before moving or re-wiring the UPS, disconnect all the inputs and make sure that the UPS is completely shutdown. Or else, the output end may carry live voltage. 2. Liquid or other irrelevant external objects are prohibited inside the UPS. 3. In case of a fire, a dry chemical fire extinguisher is essential. Using a foam fire extinguisher will cause electric shock. 4. The output neutral line of the UPS is from the input, after the neutral line is suspended by the upstream protection devices, the output neutral line will be unconnected.

 Conformity and standards

The UPS complies with 2006/95/EC (LV Safety) and 2004/108/EC (EMC), with Australia and New Zealand EMC Framework (C-Tick) and with the following product standards for UPS:

- IEC 62040: 2008 General and safety requirements
- IEC62040-2: EMC requirements, Class C2 compliant
- IEC62040-3: Performance requirements and test methods

The UPS installation should follow the above instructions and use the accessories specified by manufacturer.

 Warning: high leakage current

1. Earth connection is essential before connecting the input power (AC mains and battery included).
2. Earth leakage current ranges from 3.5mA to 1000mA.
3. Transient and steady-state earth leakage currents, which may occur when starting the equipment, should be taken into account when selecting instantaneous residual current circuit breaker (RCCB) or residual current detector (RCD).
4. Note that the earth leakage current of the load will be carried by RCCB or RCD.
5. This equipment must be earthed in accordance with the local electrical codes.

 Warning: backfeed protection

The UPS has a zero-voltage contact closure signal available for use with an external automatic circuit breaker (single power), to protect against backfeeding voltage to input terminal through the static bypass circuit. Namely, before operating the circuit, isolate the UPS firstly, and then check the dangerous voltage between the ports, and that between the ports and earth.

 Maintainable components

1. All internal maintenance and servicing procedures of the equipment should be carried out only by trained personnel. Components behind the protective cover which can only be removed by using a tool are restricted to service personnel.
2. The UPS meets the safety requirements completely in operator access area. Only service personnel can contact with the hazardous voltage inside the UPS. However, the risk of contacting these voltages is minimized because the components with hazardous voltage may be contacted only by using a tool to remove the protective cover. No risk will exist if you follow the general norms and in accordance with the procedures recommended in this manual on equipment operation.

 Warning: battery high voltage

1. All the physical service and maintenance of the battery are performed by the trained technicians.
2. Operation on the battery will result in electric shock and high short-circuit current, therefore, before operating the battery, the following should be observed:
   - Remove the watches, rings and other metal objects.
   - Use the tools with insulation handle.
   - Weare rubber glove and shoes.
   - Avoid to place the tools and metal objects on the battery surface.
   - Cut off the charge power supply before connecting or disconnecting the battery terminals.
   - Check whether the battery is earthed accidently, if yes, please disconnect the earthing. Contacting any earth battery parts will result in electric shock. Therefore, make sure that the battery is not earthed during installation and maintenance.
3. Battery manufacturers provide the details of the precautions to be observed when working on, or in the vicinity of the batterys. These precautions should be followed implicitly at all times. Attention should be paid to the recommendations concerning local environmental conditions and the provision of protective clothing, first aid and fire-fighting facilities.

Contents

Chapter 1 Product Introduction

Liebert® ITA 16kVA and 20kVA UPS (UPS for short) is an intelligent online UPS system with sine wave output developed by Emerson Network Power Co., Ltd. The UPS offers reliable and high quality AC power to the precision instrument.

The UPS adopts modular design, and rack/tower installation can be used depending on your requirements. It is applicable to supplying AC power to small scale computer center, network, communication system, automatic control system and precision instrument.

This chapter introduces the features, model configurations, appearance and components, operating principle, UPS state and operation mode, and specifications of the UPS.

1.1 Features

The UPS features include:

- Compatible with two modes: 3-phase mains output and single-phase mains output. You should check the system wiring and conduct the panel setting manually
- Capable of parallel connection to achieve up to 3 + 1 parallel redundant power
- High-frequency double conversion topology structure, with high input power factor, wide input voltage range, and output immune to grid interference, thus adaptable to areas with unstable mains supply
- High power density
- Full digital control technology based on digital signal processor (DSP) to achieve high system reliability with self-protection and fault diagnosis functions
- Intelligent battery management to extend the battery module life
- Operation and display panel with both LCD and LED indication to help you learn about the UPS operation state and operating parameters
- 3U thickness. Tower installation and rack installation are optional to meet different installation requirements
- Capable of ECO power supply mode, which helps you save energy to the maximum extent
- Flexible network management with Emerson monitoring software
- Fan fault self-test and automatic recognition functions
- SNMP card optional, providing network communication function
- Capable of connecting multiple battery strings, extending the power supply time of battery mode

1.2 Model Configurations

Two types are available for Liebert® ITA 16kVA and 20kVA UPS: UHA3R-0160L, UHA3R-0200L. The model configurations are shown in Table 1-1.

Table 1-1 Model configurations

Model	Type	Description
Long back-up model	UHA3R-0160L	For single UPS system, four battery modules can be configured. For 1 + 1 parallel system and above 1 + 1 parallel system, the external battery cabinet with big capacity is recommended
Long back-up model	UHA3R-0200L	

1.3 Appearance And Components

1.3.1 Appearance

The UPS appearance is shown in Figure 1-1.

Figure 1-1 UPS appearance

1.3.2 Components

Front panel

As shown in Figure 1-2, the UPS front panel provides ventilation holes, operation and display panel, LED indicators, DIP switch and battery cold start button.

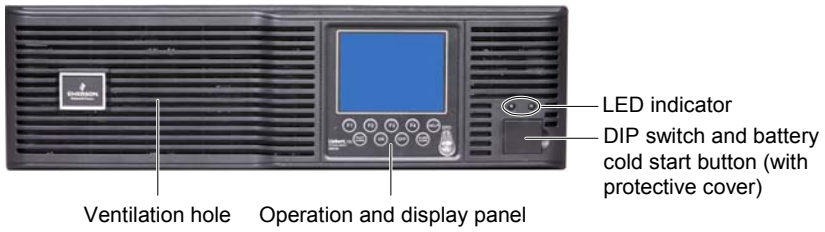


Figure 1-2 UPS front panel

Rear panel

As shown in Figure 1-3, the UPS rear panel provides parallel ports, LBS ports, I/O terminal block, intelligent card port, dry contact ports, USB port and ventilation holes. The SIC-SNMP card in the intelligent card port is optional, purchase it if you need to use.

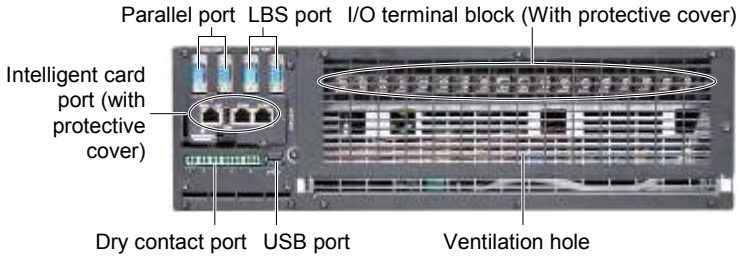


Figure 1-3 UPS rear panel

Note
Non-authorized personnel are prohibited from opening the UPS chassis cover.

1.4 Operating Principle

The operating principle of the UPS is shown in Figure 1-4.

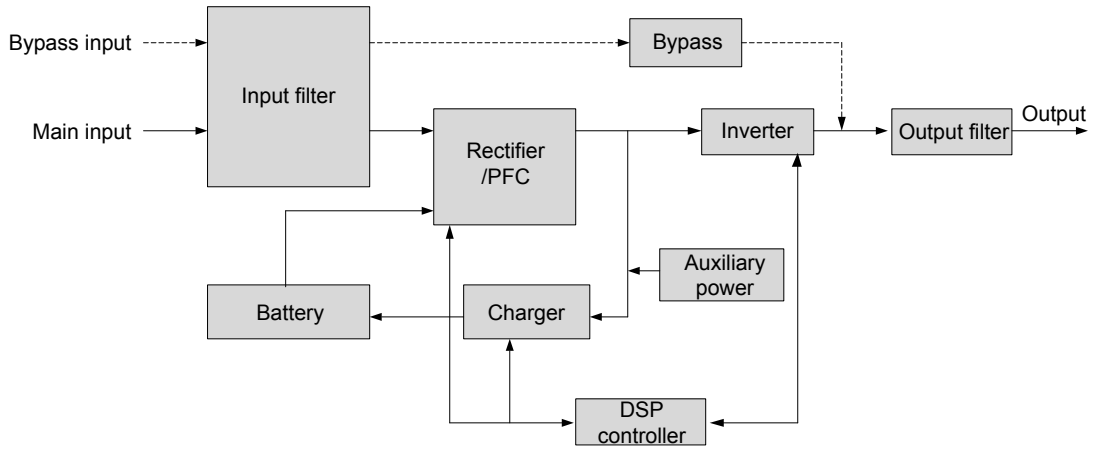


Figure 1-4 UPS operating principle

1. The UPS is composed of mains input (main and bypass), I/O filter, rectifier/PFC, charger, inverter, bypass, battery, DSP controller, auxiliary power and UPS output.

2. When the mains is normal, the rectifier will start, and the charger will charge the battery string. Before turning on the UPS, the output voltage is the bypass voltage, and the mains supplies power to the load through the bypass. After turning on the UPS, the electronic transfer switch connects the inverter output to the load, and the mains supplies DC power to the inverter through the rectifier/PFC circuit. The inverter then converts DC power into pure sine wave AC power, and supplies the AC power to the load through the electronic transfer switch.

3. When the mains is abnormal, the rectifier/PFC circuit boosts the battery voltage and supplies it to the inverter. The inverter then converts it into pure sine wave AC power, and supplies the AC power to the load through the electronic transfer switch.

4. After the mains returns to normal state, the UPS will automatically transfer from Battery mode to Normal mode, the mains supplies DC power to the inverter through the rectifier/PFC circuit, and then the electronic transfer switch supplies AC power to the load.

1.5 UPS State And Operation Mode

The UPS state and operation mode include: Normal mode, Bypass mode, Battery mode, ECO mode, Fault state and Maintenance Bypass mode. The operation schematic diagrams of Normal mode, Bypass mode, Battery mode and Maintenance Bypass mode are shown in Figure 1-5.

Note
Only when the UPS output power distribution unit (POD for short) is configured, the Maintenance Bypass mode is valid.

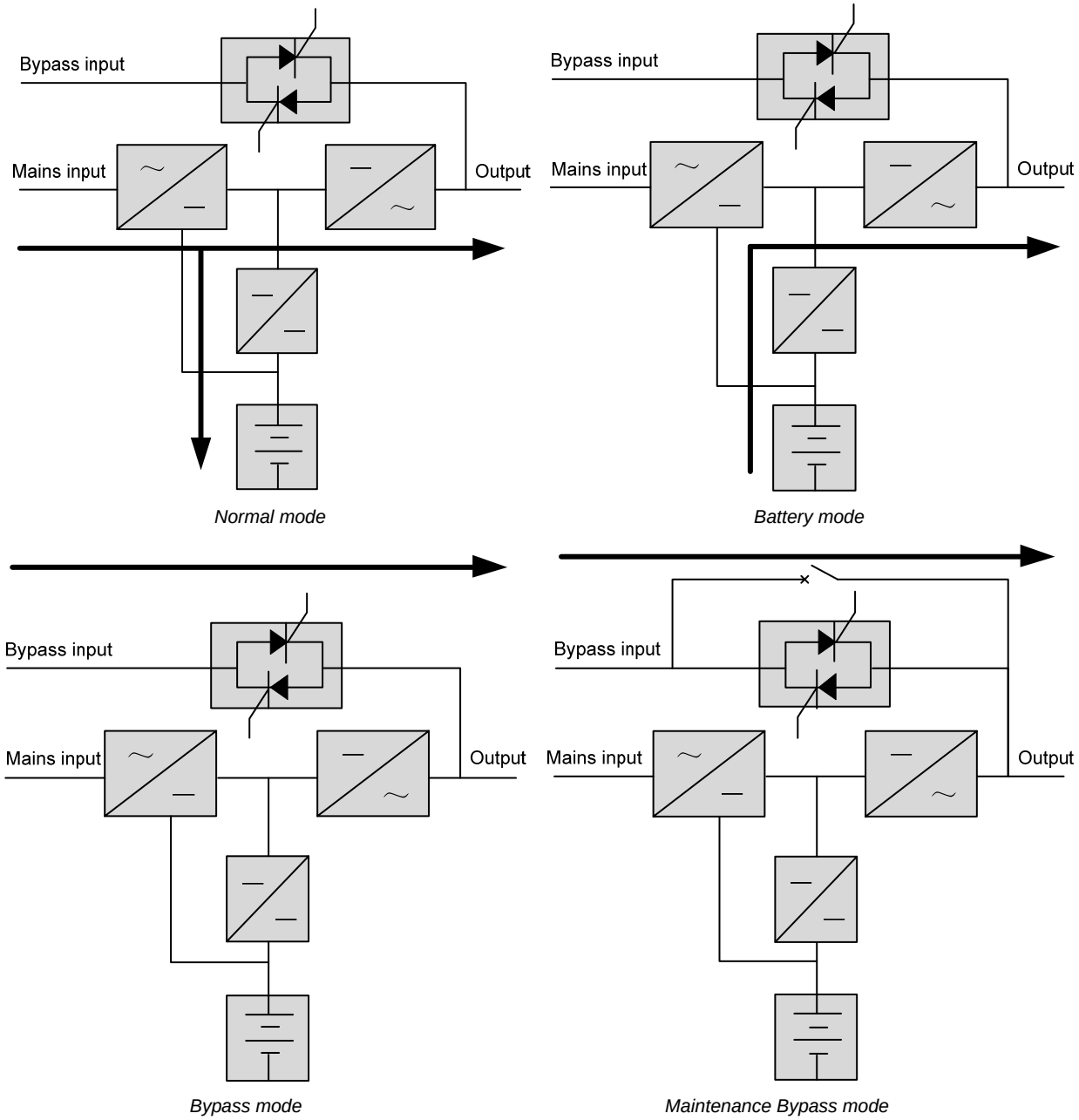


Figure 1-5 Operation schematic diagram

For the LED indicators introduced in this section, refer to *4.1.1 LED Indicators*.

1.5.1 Normal Mode

When the mains input is normal, the load is supplied with voltage-stabilizing and frequency-stabilizing power by the mains after processing of the rectifier and the inverter, and meanwhile, the charger is charging the battery. The operation mode is Normal mode.

In Normal mode, the inverter indicators are on (green).

1.5.2 Bypass Mode

If the overload overtime, inverter or rectifier failure appears during the UPS operation in Normal mode, the UPS will transfer to Bypass mode, that is, the load is powered by the bypass source, which comes directly from the mains input. If the rectifier is normal, the internal charger will charge the battery.

In Bypass mode, the inverter indicators are off.

Note
In case of mains failure or mains voltage out of range in Bypass mode, the UPS will shut down and stop the output.

1.5.3 Battery Mode

Upon mains failure or voltage out of range, the rectifier and internal charger will stop running, and the battery will supply power to the load through the inverter. The inverter indicators are on together with buzzer alarming, which notifies you that the UPS is in Battery mode.

Note
1. The battery has been fully charged before delivery. However, transportation and storage will inevitably cause some capacity loss. Therefore, it is required to charge the battery for eight hours before putting the UPS into operation for the first time, to ensure the adequate backup time for battery. 2. The battery cold start can also be used to start the UPS from the Battery (charged) mode upon mains failure. Therefore, the battery power can be used independently for improving the system availability to some extent.

1.5.4 ECO Mode (For Single UPS System Only)

In ECO mode, the load is powered by bypass when the bypass voltage is normal, and the load is powered by inverter when the bypass voltage is abnormal. ECO mode is an energy-saving operation mode. For power equipment insensitive to power grid quality, you can use the ECO mode for power supply through bypass to reduce the power loss.

Note
1. In ECO mode, if the bypass failure or abnormal bypass voltage appears when the output is not overloaded, the UPS will transfer to Normal mode. However, if the bypass failure or abnormal bypass voltage appears when the output is overloaded, the UPS will not transfer to Normal mode, but shut down the bypass. 2. In ECO mode, the efficiency of the UPS is up to 98%.

1.5.5 Fault State

In Normal mode, the UPS will transfer to Bypass mode if the inverter failure or UPS overtemperature appears. In Battery mode (with no bypass mains), the UPS will shut down and stop the output if the inverter failure or UPS overtemperature appears. In Fault state, the fault indicators will turn on, the buzzer will keep beeping, and the corresponding fault information will be displayed on LCD.

1.5.6 Maintenance Bypass Mode

If maintenance and repair for UPS are needed, you can switch the load to the Maintenance Bypass through maintenance bypass MCB, and the power to the load is not interrupted. The maintenance bypass MCB is located on the front panel of the POD, and the capacity meets the requirements of total load capacities. Refer to *Liebert® ITA 16kVA And 20kVA UPS Power Output Distribution Unit User Manual* for the detailed introductions of the POD.

Note
When the UPS has malfunctions and can not working normally, please get in touch with the nearest Emerson branch office or local service center. It is prohibited to repaire the UPS by yourself, otherwise the personnel injury and damage to the equipment will occur.

1.6 Specifications

The specifications are listed in Table 1-2.

Table 1-2 Specifications

Item		Specifications	
		UHA3R-0160L	UHA3R-0200L
Input	Rated voltage	380Vac/400Vac/415Vac	
	Voltage range	304Vac ~ 478Vac, at full load 228Vac ~ 304Vac, linear derating 228Vac, at half load	
	Rated frequency	50Hz/60Hz	
	Frequency range	40Hz ~ 70Hz	
	Power factor	≥ 0.99, at full load; ≥ 0.98, at half load	
Output	Rated power	14.4kW	18kW
	Voltage	3-in 3-out: 220Vac ± 1%, 3-phase balance load 3-in 1-out: 220Vac ± 1%	
	Frequency synchronization range	Rated frequency ±2Hz. Configurable range: ±0.5Hz ~ ±3Hz	
	Frequency track rate	1Hz/s. Configurable range: 0.1Hz/s ~ 3Hz/s (single UPS), 0.2Hz/s (parallel system)	
	Rated power factor	0.9	
	Crest factor	3:1	
	Voltage harmonic distortion	< 2% (linear load); < 5% (non-linear load)	
	Dynamic response recovery time	60ms	
	Overload capacity	At 25°C: 105% ~ 125%, 5min 125% ~ 150%, 1min	
	Bypass voltage	Upper limit: +10%, +15% or +20%; default: +15% Lower limit: -10%, -20%, -30% or -40%; default: -20%	
	Mains efficiency	> 93%, up to 94%	
Battery	Type	Sealed, lead-acid, maintenance-free battery	
	Cell No.	30, 32, 34, 36, 38, 40; default: 32	
	Rated voltage	360Vdc ~ 480Vdc	
	Charge power	4.5kW, 0°C ~ 30°C 4.05kW, 30°C ~ 35°C 3.6kW, 35°C ~ 40°C Adjust automatically according to the ambient temperature	
Transfer time	Mains←→Battery	0ms	
	Inverter←→Bypass	Synchronous transfer: ≤ 1ms Asynchronous transfer (default): ≤ 20ms Or 40ms, 60ms, 80ms and 100ms are available	
Noise		≤ 58dB	
Panel display mode		LED and LCD	
Safety		IEC/EN62040-1-1	
EMC	Conduction emission	IEC/EN62040-2	
	Immunity	I ≤ 16A, IEC/EN61000-3-3; 16A < I ≤ 75A, IEC/EN61000-3-11	
	Harmonic current	I ≤ 16A, IEC/EN61000-3-2; 16A < I ≤ 75A, IEC/EN61000-3-12; YD/T1095-2001, level 2, 15%	
Surge protection		IEC/EN-61000-4-5, endurance level 4 (4kV) (live line to earth), level 3 (2kV) (during live lines)	
Protection level		IP20	
Ambient condition	Operating temperature	0°C ~ 40°C	
	Storage temperature	-40°C ~ +70°C (battery excluded); -20°C ~ +55°C (battery included)	
	Relative humidity	5%RH ~ 95%RH, non-condensing	
	Altitude	< 2000m; derating according to GB/T3859.2 when higher than 2000m	
Size	W × H × D	435mm × 130mm × 750mm	
Weight	Net weight	35kg	
	Gross weight	57kg	

Chapter 2 Single UPS Installation And Commissioning

This chapter introduces the installation, cable connection and commissioning of the single UPS.

Each site has its peculiarity, so this chapter provides the guidance with general installation procedures and methods for the installation engineer who should conduct the installation according to the actual conditions.

 Warning: professional installation
The UPS should be installed by a qualified engineer according to the information contained in this chapter. If any problem is found, please get in touch with Emerson local service center immediately. The UPS shall not be powered on without approval of the commissioning engineer. For other equipment which is not introduced in this manual, the detailed information about mechanical installation and electrical installation are delivered with the equipment.

 Note: 3-phase 5-line for power input
The UPS can be connected to 3-phase 5-line (A, B, C, N, PE) TN, TT and IT AC power distribution system (IEC60364-3).

2.1 Unpacking Inspection

After the UPS arrival, you should unpack it and check the following items:

1. Visually inspect the UPS appearance for transportation damage. If any problem is found, please notify the carrier immediately.

2. Check the accessories and models against the delivery list. If any problem is found, please notify the dealer immediately.

2.2 Installation Preparation

2.2.1 Location

To extend the UPS life, the chosen place must offer:

- Convenient wiring
- Adequate operator access area
- Good ventilation to meet the heat dissipation requirements
- No corrosive gas, such as sulfur dioxide and so on
- No excessive moisture or heat source
- No excessive dust
- Compliance with fire-fighting requirements
- Operating temperature compliant with the specifications, see Table 1-2 for details

2.2.2 Environmental Requirement

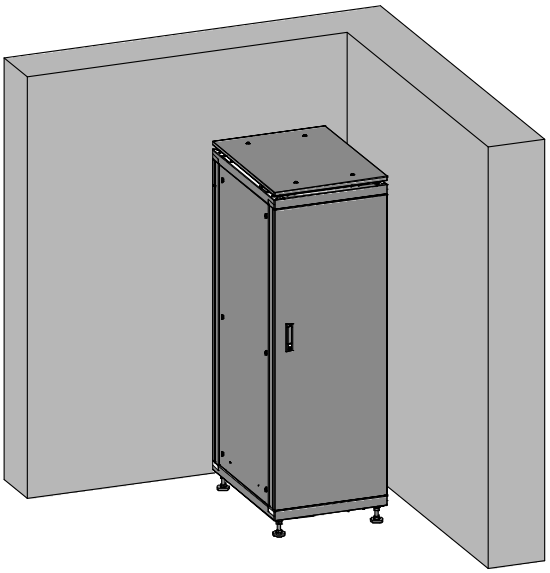
UPS room

The UPS is designed for indoor installation, which should be installed in a clean and well-ventilated environment, to keep the ambient temperature within the specifications.

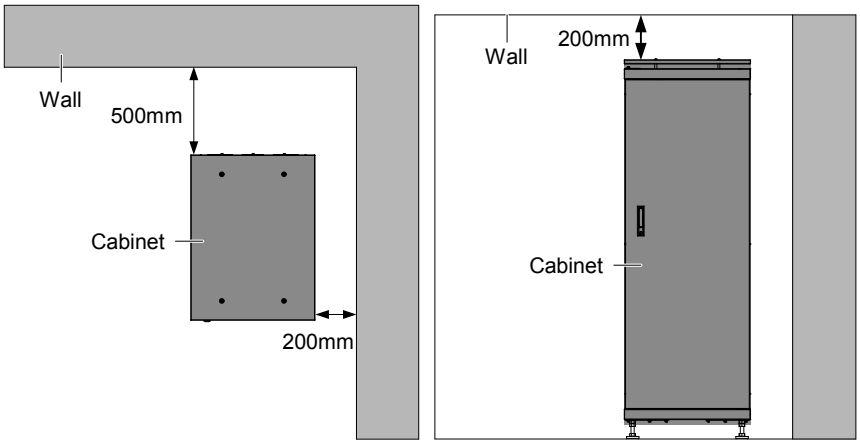
The internal fans provide forced air cooling for the UPS. Cooling air enters the UPS through the ventilation holes on the front panel, and exhausts the hot air through the back ventilation holes. Therefore, do not obstruct the ventilation holes. Maintain at least 200mm clearances between the front, rear, side panels of the UPS and the wall or adjacent

equipment (see Figure 2-1), to avoid obstructing the UPS ventilation and heat dissipation. Otherwise, the UPS internal temperature will rise, which will shorten the UPS life.

If necessary, an indoor exhaust fan should be installed to keep the indoor temperature from rising. An air filter should be used in a dusty environment where the UPS is to be operated.



General view



Top view *Front view*

Figure 2-1 Installation clearances

Note
1. The UPS should be installed only on the concrete surface or other non-flammable surfaces. 2. As shown in Figure 2-1 (top view), the demonstration of the clearance between the rear panel of the cabinet and the wall is 500mm. The clearance should not be less than 200mm, it needs to be considered according to the actaul situation for the sake of maintenance convenience.

Battery room

A small amount of hydrogen and oxygen will be generated at the end of battery charging, therefore, you must ensure that the fresh air ventilation of battery installation environment meets the EN50272-2001 requirements.

The battery ambient temperature should keep constant, for the ambient temperature is the main factor to affect the battery capacity and life. The battery standard operating temperature is 20°C, operation above this temperature will shorten the battery life, and operation below this temperature will reduce the battery capacity. If the battery average temperature in operation rises from 20°C to 30°C, the battery life will be reduced by 50%; if the battery temperature in operation exceeds 40°C, the battery life will be decreased exponentially. In general, the allowed ambient temperature of the battery is 15°C ~ 25°C. The battery should be kept away from heat and ventilation holes.

When the UPS uses an external battery, you must install a battery protective device (such as fuse or circuit breaker) in areas near the battery, and use the shortest wiring distance for the connection between the protective device and the battery.

Storage environment

When the UPS does not need to be installed immediately, the UPS must be stored indoors to be protected from the excessive moisture or overtemperature environment. The battery requires dry and low temperature, well-ventilated environment for storage, and the most suitable storage temperature is 20°C ~ 25°C.

 Warning: battery hazards
During the battery storage, the battery must be periodically charged according to the battery instructions. When charging the battery, you can connect the UPS to the mains temporarily to charge and activate the battery.

2.2.3 Installation Tools

Prepare installation tools according to Table 2-1. The tools must be insulated and ESD-proof processed prior to use.

Table 2-1 Installation tools list

Installation tool	Specification	Application
Cross screwdriver	EJ5100mm	Remove the screws of the top protective cover of the UPS, or open the chassis
Slotted screwdriver	EJ375mm	Connect I/O cables
Wire-pressure plier	YT-12	Press wires for I/O terminal block
Diagonal plier	MTC3C	Make I/O cables

2.3 External Protective Devices

The circuit breaker or other protective devices must be installed at the external AC input end of the UPS. This section provides the general guidance for qualified installation engineer. The qualified installation engineer should learn about the local wiring regulations and other related information.

2.3.1 Rectifier And Bypass Input

Overcurrent

The appropriate overcurrent protective device should be installed on the mains input power distribution, and the current capacity of power cable and the system overload requirements should be taken into account in installation (see Table 2-2). It is recommended to use the thermomagnetic circuit breaker which satisfies with IEC60947-2 tripping curve C (normal) when the current value reaches 125% of the current value listed in Table 2-2.

Split-bypass

When the system uses split-bypass, separate protective devices should be installed for the mains and bypass at the mains input power distribution.

Main/Bypass backfeed protection

When using the main/bypass backfeed protection function, you need to install a protective device with auxiliary contact function at the user's gross mains input air breaker (including the main input and bypass input), and this auxiliary contact signal should be connected to the dry contact port of the system. The recommended model for the air breaker is S1N125 R125 TM FFC 4P + 1A + 1B + YO (220Vac).

 Note
1. The same neutral line must be used for the rectifier and bypass input power. 2. For IT power grid system, the quadrupole protective device must be installed at the UPS external I/O power distribution.

Earth leakage current

The residual current detector (RCD) for the UPS upstream input power distribution should be:

- Sensitive to the DC unidirectional pulse (level A) in power distribution network
- Insensitive to the transient current pulse
- General sensitivity type, settable: 0.3A ~ 1A

The residual current circuit breaker (RCCB) must be sensitive to the DC unidirectional pulse (level A) in power distribution network, but insensitive to the transient current pulse, as shown in Figure 2-2 respectively.

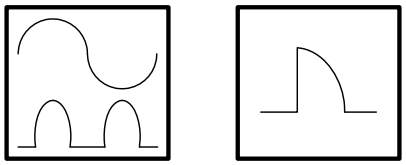


Figure 2-2 RCCB symbols

When using the earth RCD in split-bypass system or parallel system, the RCD should be located at the upstream input power distribution end to avoid generating the false alarm.

The earth leakage current fed by the RFI filter in the UPS ranges from 3.5mA to 1000mA. It is recommended to confirm the sensitivity of each differential device of the upstream input power distribution and downstream power distribution (to load).

2.3.2 Battery Input

If the battery module option is provided by Emerson, the battery module has a built-in overcurrent protective device. Otherwise, the external battery cabinet should provide DC compatible circuit breaker to provide the overcurrent protection for the UPS and its batteries.

2.3.3 UPS Output

The protective device must be installed for the UPS output power distribution. The protective device must be different from the input power distribution protection air breaker, and provide the overload protection (see Table 2-4).

2.4 Mechanical Installation

Two installation modes are available: tower installation and rack installation. You can select an appropriate installation mode according to the actual conditions.

2.4.1 Tower Installation

1. Take out the support bases from the accessories, assemble a pair of support bases and a support base extension (accessory) together through the fastenings, as shown in Figure 2-3, and put them onto the flat installation table.

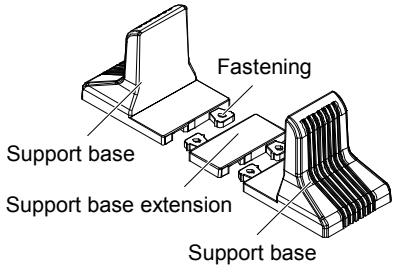


Figure 2-3 Connecting the support base with support base extension

2. If battery module installation is necessary, take out other support base extensions delivered with the battery module, and then assemble the support base extensions and the support bases through the fastenings, as shown in Figure 2-4.

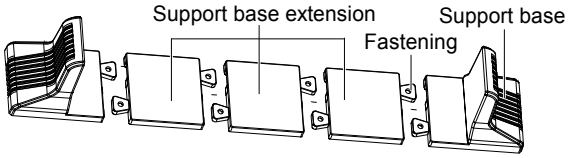


Figure 2-4 Connecting the support base with support base extension

3. Place the UPS on the support bases and support base extensions, as shown in Figure 2-5.

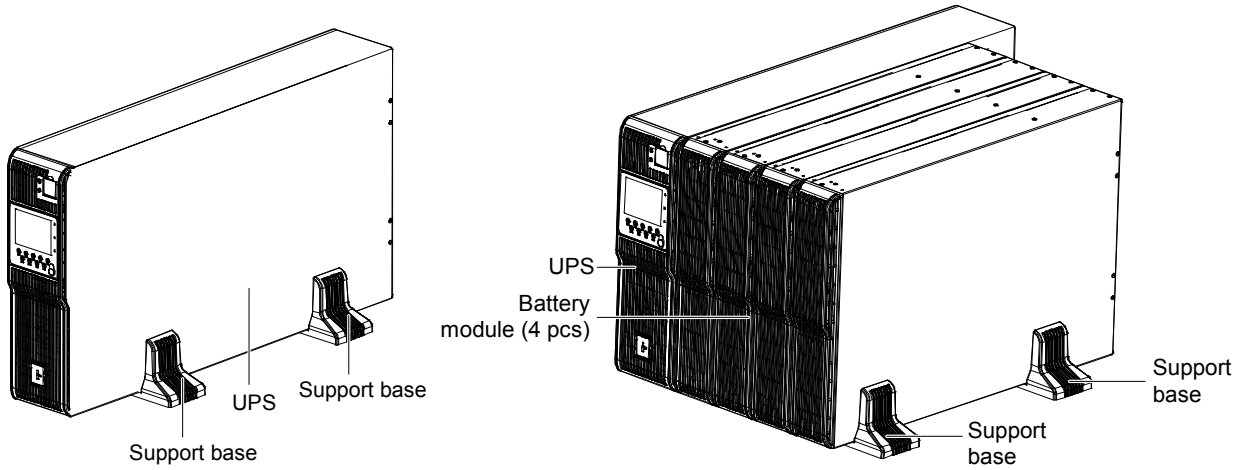


Figure 2-5 UPS and battery module Installation complete

2.4.2 Rack Installation

Installation procedures for UPS

1. Use eight M4 × 10 screws to fix two brackets (accessories) respectively on both sides of the UPS front panel, as shown in Figure 2-6.

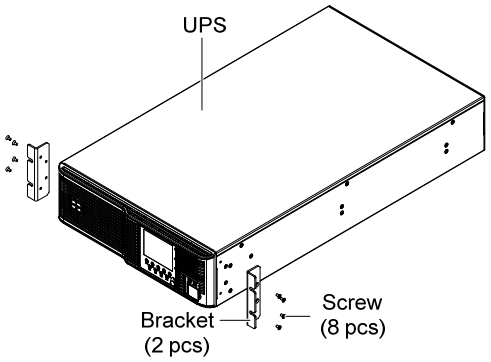


Figure 2-6 Installing brackets

Note
It is prohibited to move the UPS through the brackets.

2. Install the guide rails.

You need to use guide rails when you select Liebert® ITA series UPS and its options, and select the rack installation.

The installation procedures of the guide rails are as follows:

1) Take out the guide rails (one left guide rail and one right guide rail), guide rail screws and panel screws from the package, distinguish the left guide rail and right guide rail according to Figure 2-7, and confirm its retractable function respectively.

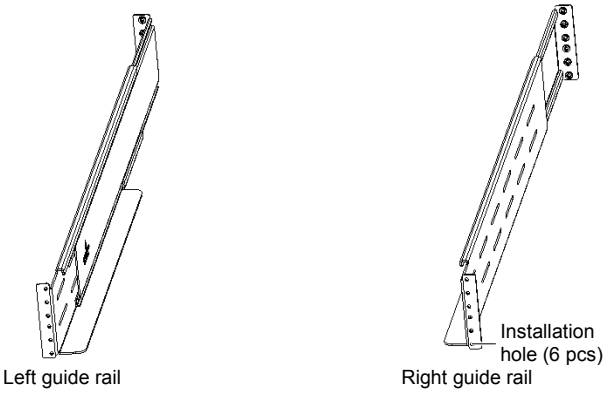


Figure 2-7 Appearance of the guide rail

Distinguish the guide rail screw and the panel screw according to Figure 2-8.

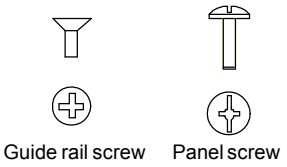


Figure 2-8 Appearance of the screw

2) Adjust the length of the guide rail according to the dimensions of the rack.

3) Align the installation holes of the guide rail with the square holes of the rack, fix the guide rail onto the rack through the guide rail screws (a total of eight), each left guide rail and right guide rail need four guide rail screws, as shown in Figure 2-9.

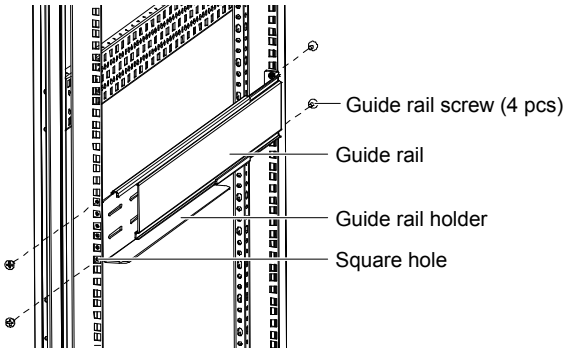


Figure 2-9 Installing the guide rail

Note
1. The guide rail holder must be close to the front of the rack. 2. Any end of one guide rail has six installation holes (see Figure 2-7), do not use the two installation holes in the middle when fixing the guide rail. It is recommended to use the top and bottom installation hole (from top to bottom, installation hole 1 and installation hole 6).

The guide rail installation is finished, as shown in Figure 2-10.

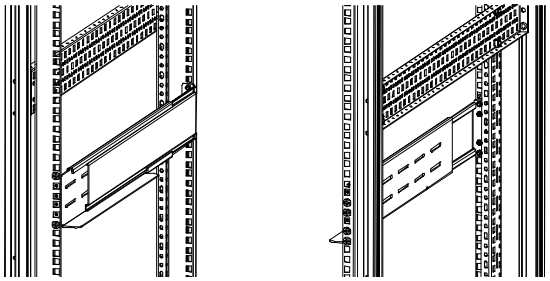


Figure 2-10 guide rail installation complete

3. Place the UPS on the guide rails in the rack, and push it completely into the rack. Use four M6 × 16 screws to fix the UPS in the rack through the brackets, as shown in Figure 2-11.

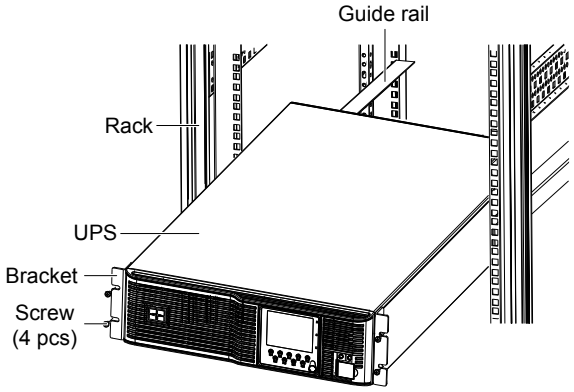


Figure 2-11 Installing the UPS

Installation procedures for UPS with battery modules

The installation method of the battery module is the same as that of the UPS. Repeat the preceding procedures to install and fix the four battery modules and a UPS in the rack one by one, as shown in Figure 2-12.

As the battery module is heavy, you should pay attention to the following items in installation:

- Install the battery modules first, start the installation from the bottom, and then place the UPS onto the top, as shown in Figure 2-12.
- It is prohibited to move the UPS and battery modules through the brackets.
- Two persons or more are required for the installation.

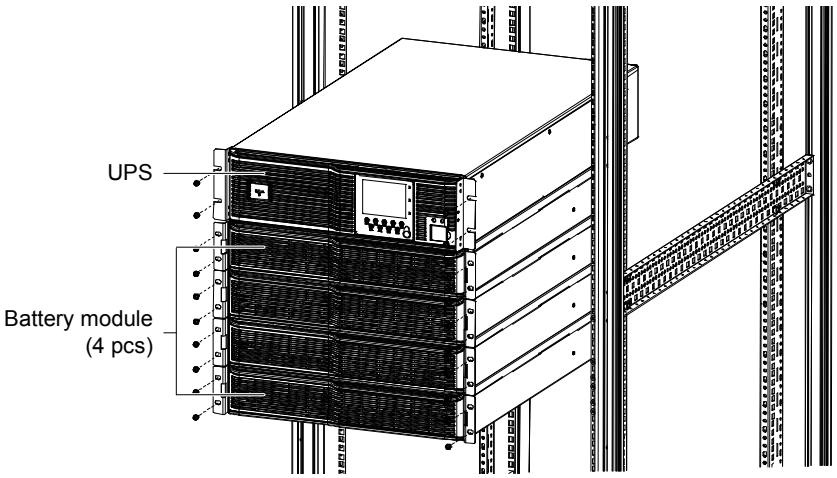


Figure 2-12 Installation of UPS with battery modules

2.5 Connecting Power Cables

I/O cables and battery cables are required for connection. When connecting the cables, you should follow the local wiring regulations, take the environment situation into account, and refer to Table 3B of IEC60950-1.

The max. current in different operating modes is listed in Table 2-2, the recommended min. cable CSA is listed in Table 2-3. Select the appropriate cables according to Table 2-2 and Table 2-3.

Table 2-2 Max. steady state AC and DC current

UPS rated power (kVA)	Rated current (A)						
	Mains input current[1, 2] upon battery charging with max. ability			Gross output current[2] at full load			Battery discharging current upon min. battery voltage
	380V	400V	415V	380V	400V	415V	
16 (3-in 3-out)	33	33	33	24	23	22	54
16 (3-in 1-out)	33	33	33	72	70	67	54
20 (3-in 3-out)	36	36	36	30	29	28	67

UPS rated power (kVA)	Rated current (A)						
	Mains input current[1, 2] upon battery charging with max. ability			Gross output current[2] at full load			Battery discharging current upon min. battery voltage
	380V	400V	415V	380V	400V	415V	
20 (3-in 1-out)	36	36	36	90	87	84	67

Note:
When the battery cables are selected, according to the current value shown in this table, the max. allowable voltage drop is 4Vdc. Do not ring the cables to avoid increasing the electromagnetic interference (EMI).
1: The input mains current of the rectifier and the bypass.
2: Non-linear load (switch mode power) affects the neutral cable design of the output and the bypass. The neutral cable current may exceed the rated phase current, up to1.732 times as large as the rated current

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

Model	Input	Output	Bypass	Neutral cable	PE	Battery
16kVA (3-in 1-out)	10	25	25	35	16	16
16kVA (3-in 3-out)	10	10	10	16	10	16
20kVA (3-in 1-out)	10	25	25	35	16	16
20kVA (3-in 3-out)	10	10	10	16	10	16

The recommended I/O MCB capability of the UPS is listed in Table 2-4, select the MCBs according to your requirements.

Note

The UPS is high leakage current equipment, it is not recommended to configure the MCB with leakage current protection function.

Table 2-4 UPS I/O MCB selection

Model	Input interface	Recommended capability of input external MCB	Battery MCB	Output interface	Recommended capability of output external MCB
16kVA (3-in 1-out)	Terminal block	3-in 1-out main 63A (3P), bypass 125A (1P)	DC 80A (3P or 4P)	Terminal block	Single phase 100A (1P)
16kVA (3-in 3-out)	Terminal block	3-in 3-out main 63A (3P), bypass 125A (1P)	DC 80A (3P or 4P)	Terminal block	Three phase 40A (3P)
20kVA (3-in 1-out)	Terminal block	3-in 1-out main 63A (3P), bypass 125A (1P)	DC 80A (3P or 4P)	Terminal block	Single phase 100A (1P)
20kVA (3-in 3-out)	Terminal block	3-in 3-out main 63A (3P), bypass 125A (1P)	DC 80A (3P or 4P)	Terminal block	Three phase 40A (3P)

Note:
The 3-in 3-out bypass MCB (125A) is used to connect the bypass input upon split-bypass configuration. The mian MCB (63A) can be used only upon common source configuration

Note

The OT terminal is default standard configuration, which is used to connect the I/O cables of the copper shorting bar in 3-in 1-out mode, it can not be used as the I/O cables of the UPS directly.

2.5.1 Connecting I/O Cables

The power cables of the UPS should be connected through the I/O terminal block located on the UPS rear panel. Remove the protective cover A of the I/O terminal block shown in Figure 2-13 to reveal the I/O terminal block.

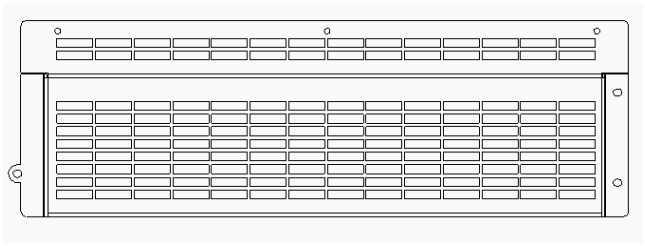
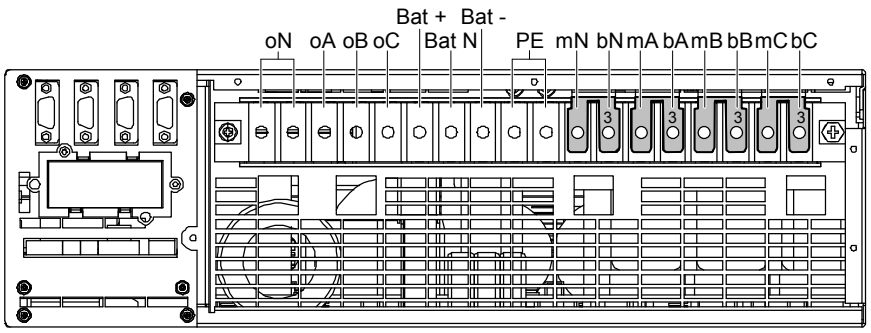


Figure 2-13 Protective cover A of the I/O terminal block

Figure 2-14 gives the terminal layout of the I/O terminal block.



Note:
1. Main input: mA, mB, mC, mN; Bypass input: bA, bB, bC, bN; Output: oA, oB, oC, oN; Battery: Bat +, Bat N, Bat -; Grounding: PE.
2. In factory, four copper shorting bars 3 have been used to short terminals between mA and bA, mB and bB, mC and bC, mN and bN respectively.

Figure 2-14 Terminals layout of the I/O terminal block

After the cable connection, install the protective cover B of the I/O terminal block to protect the I/O terminal block. The protective cover B of the I/O terminal block is shown in Figure 2-15.

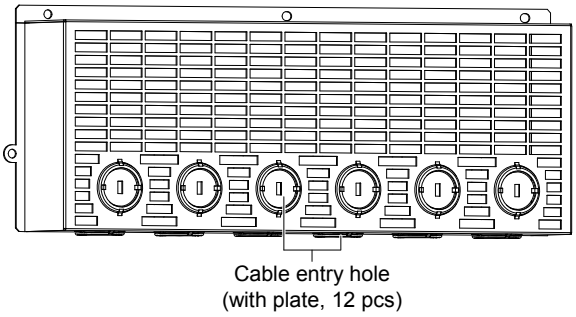


Figure 2-15 Protective cover B of the I/O terminal block

Before installing the protective cover B of the I/O terminal block, remove the iron plates on the cable entry holes, and install the bushings (label: 21101494, accessories). After the cable connection, fix the protective cover B of the I/O terminal block.

Power distribution mode

There are two modes for UPS power distribution: using the single power output distribution unit (POD, optional) provided by Emerson, self-distribution.

According to user's requirements, the I/O cable connections are divided into four types: 3-in 3-out, common source configuration (factory default), 3-in 3-out, split-bypass configuration, 3-in 1-out, common source configuration, 3-in 1-out, split-bypass configuration.

1. Using single POD power distribution

For the single POD installation and power distribution, refer to *Liebert® ITA 16kVA And 20kVA UPS Power Output Distribution Unit User Manual*.

2. Self-distribution

The I/O cable connection procedures of the self-distribution for the four types are as follows:

- 3-in 3-out, common source configuration (factory default)

1. Remove the protective cover A of the I/O terminal block.

2. Remove the plates on six cable entry holes of the protective cover B according to the cable direction.

3. Pass all the cables to be connected to the I/O terminal block through the cable entry holes of the protective cover B according to the actual situation.

4. Connect the live lines (input phase A, input phase B and input phase C), N line and PE line respectively to the I/O terminal block (mA, mB, mC, mN and PE terminals) of the UPS. Short connect mA and bA, mB and bB, mC and bC, mN and bN of the I/O terminal block of the UPS using the copper shorting bar 3 respectively.

5. Connect the live lines (output phase A, output phase B and output phase C), N line and PE line respectively to the I/O terminal block (oA, oB, oC, oN and PE terminals) of the UPS, as shown in Figure 2-16.

6. Install the protective cover B of the I/O terminal block.

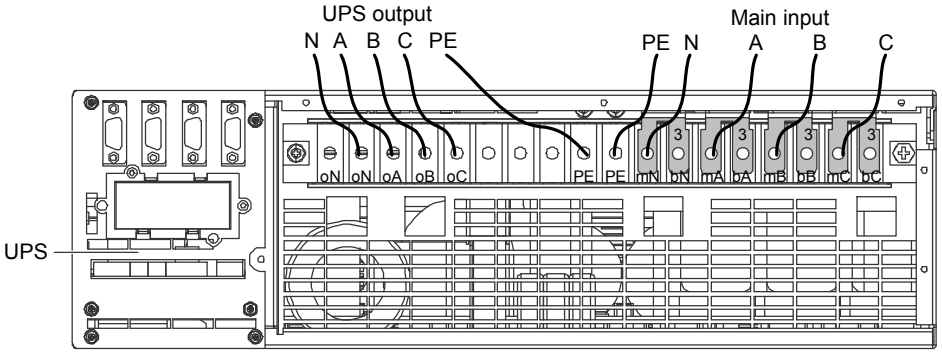


Figure 2-16 3-in 3-out, common source configuration cable connection

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

1. Remove the protective cover A of the I/O terminal block.

2. Remove the plates on six cable entry holes of the protective cover B according to the cable direction.

3. Pass all the cables to be connected to the I/O terminal block through the cable entry holes of the protective cover B according to the actual situation.

4. Remove all the copper shorting bars 3 from the I/O terminal block of the UPS.

5. Connect the live lines (main input phase A, main input phase B and main input phase C), N line and PE line respectively to the I/O terminal block (mA, mB, mC, mN and PE terminals) of the UPS.

6. Connect the live lines (bypass input phase A, bypass input phase B and bypass input phase C) and N line respectively to the I/O terminal block (bA, bB, bC and bN terminals) of the UPS.

7. Connect the live lines (output phase A, output phase B and output phase C), N line and PE line respectively to the I/O terminal block (oA, oB, oC, oN and PE terminals) of the UPS, as shown in Figure 2-17.

8. Install the protective cover B of the I/O terminal block.

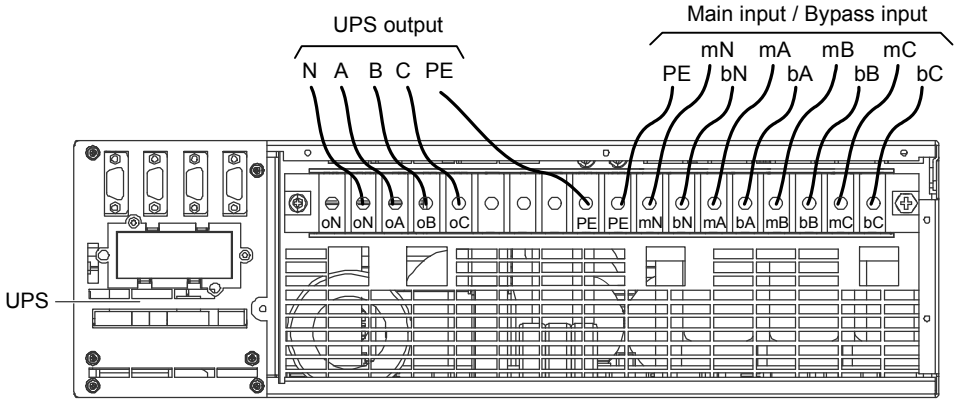


Figure 2-17 3-in 3-out, split-bypass configuration cable connection

- 3-in 1-out, common source configuration

Warning
The factory default of the UPS is 3-in 3-out, common source configuration. If you need to change the power distribution mode to 3-in 1-out ,follow the steps described in the next section *Changing power distribution mode*. Continue the input and output power cable connection and power-on commissioning after confirming that the change has been successful.

1. Remove the protective cover A of the I/O terminal block.

2. Remove the plates on six cable entry holes of the protective cover B according to the cable direction.

3. Pass all the cables to be connected to the I/O terminal block through the cable entry holes of the protective cover B according to the actual situation.

4. Confirm that the power distribution mode of the UPS has been changed to 3-in 1-out according to the steps described in the next section *Changing power distribution mode*.

5. As shown in Figure 2-18, paste the insulating film (accessory) on the copper shorting bar 10, and insert the buckles into the corresponding holes on the copper shorting bar 10.

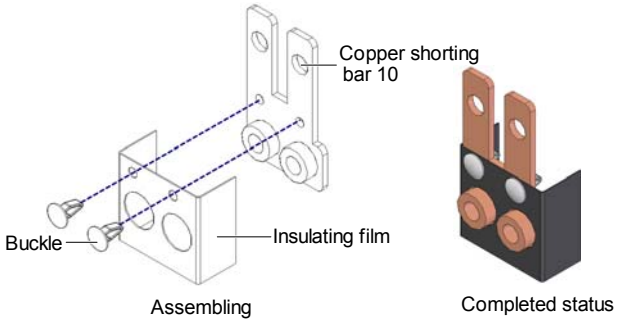


Figure 2-18 Pasting the insulating film to the copper shorting bar 10

6. As shown in Figure 2-19, short connect bA, bB and bC terminals using the copper shorting bar 7, short connect the two PE terminals of the I/O terminal block of the UPS using the copper shorting bar 10 with insulating film, short connect oA, oB and oC terminals using the copper shorting bar 5, short connect mA and bA terminals using the copper shorting bar 6, short connect mN and bN terminals, and two oN terminals using the two copper shorting bars 4.

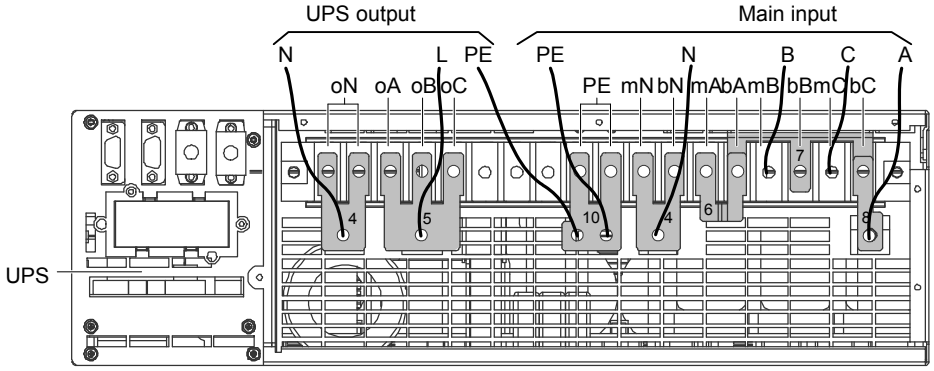


Figure 2-19 3-in 1-out, common source configuration cable connection

7. Connect the copper shorting bar 8 to one end of the copper shorting bar 7 (see Figure 2-19), and connect the live line (input phase A) to the copper shorting bar 8.

8. Connect the live lines (input phase B and input phase C), N line and PE line respectively to the I/O terminal block (mB and mC terminals) of the UPS, the copper shorting bar 4 with mN and bN terminals, and one screw hole of the copper shorting bar 10.

9. Connect the output L line, N line and PE line respectively to the copper shorting bar 5, the copper shorting bar 4 with two oN terminals, and the other screw hole of the copper shorting bar 10.

10. Install the protective cover B of the I/O terminal block.

- 3-in 1-out, split-bypass configuration

Warning
The factory default of this product is 3-in 3-out, common source configuration. If you need to change the power distribution mode of the main UPS to 3-in 1-out according to the steps described in the next section *Changing power distribution mode*. Continue the input and output power cable connection and power-on commissioning after confirming that the change has been successful.

1. Remove the protective cover A of the I/O terminal block.

2. Remove the plates on six cable entry holes of the protective cover B according to the cable direction.

3. Pass all the cables to be connected to the I/O terminal block through the cable entry holes of the protective cover B according to the actual situation.

4. Confirm that the power distribution mode of the main UPS has been changed to 3-in 1-out according to the steps described in the next section *Changing power distribution mode*.

6. As shown in Figure 2-18, paste the insulating film (accessory) on the copper shorting bar 10, and insert the buckles into the corresponding holes on the copper shorting bar 10.

7. As shown in Figure 2-20, short connect the two PE terminals of the I/O terminal block of the UPS using the copper shorting bar 10 with insulating film, short connect bA, bB and bC terminals using the copper shorting bar 7, short connect oA, oB and oC terminals using the copper shorting bar 5, short connect mN and bN terminals, and two oN terminals using the two copper shorting bar 4.

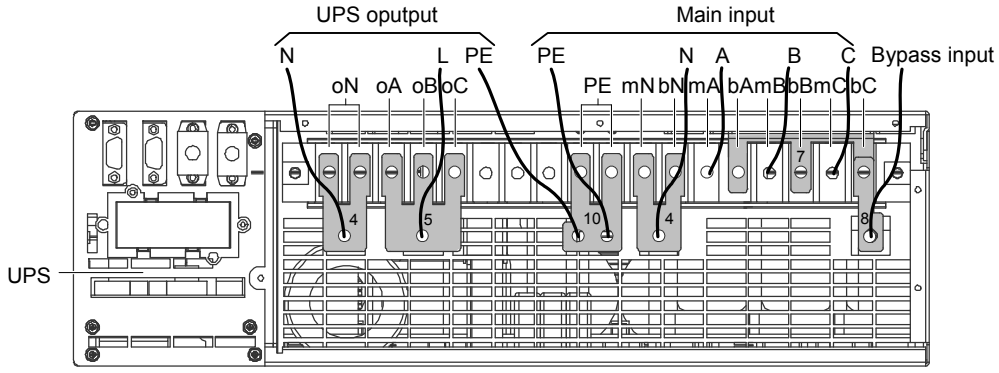


Figure 2-20 3-in 1-out, split-bypass configuration cable connection

8. Connect the live lines (main input phase A, main input phase B and main input phase C), N line and PE line respectively to the I/O terminal block (mA, mB and mC terminals) of the UPS, the copper shorting bar 4 with mN and bN terminals, and one screw hole of the copper shorting bar 10.

9. Connect the copper shorting bar 8 to one end of the copper shorting bar 7 (see Figure 2-20), and connect the live line (bypass input phase A) to the copper shorting bar 8.

10. Connect the bypass input N line to the copper shorting bar 4 with mN and bN terminals of the UPS I/O terminal block.

11. Connect the output L line, N line and PE line respectively to the copper shorting bar 5, the copper shorting bar 4 with two oN terminals, and the other screw hole of the copper shorting bar 10 of the UPS UPS I/O terminal block.

12. Install the protective cover B of the I/O terminal block.

Warning
Before the commissioning engineer's arrival, if the load is not ready for accepting the power, please take good care of the safety insulation at the end of the output cable.

After the output cable connection, find the label shown in Figure 2-21 on the top cover of the UPS and click ' √ ' after 'AC OUTPUT' and 'BYPASS INPUT' according to the actual situation for easy maintenance.

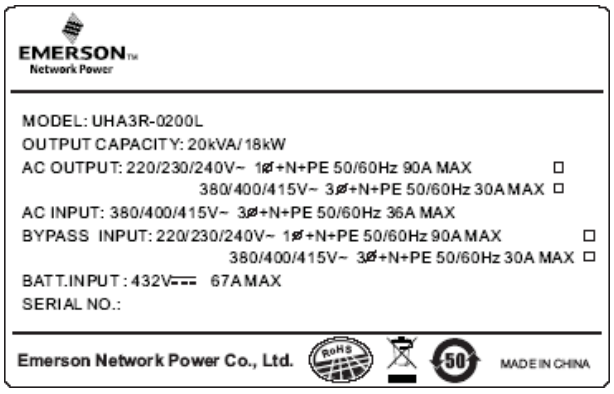


Figure 2-21 Label

Changing power distribution mode

Note
This product is compatible with 3-in 3-out and 3-in 1-out, factory default: 3-in 3-out. Change the format according to the following steps if you need to change the power distribution mode.

- From 3-in 3-out to 3-in 1-out

1. Remove all the copper shorting bars 3 shown in Figure 2-16 of the 3-in 3-out system; connect the main input cables only. It is prohibited to connect the bypass input cables, output cables and battery cables, as shown in Figure 2-22.

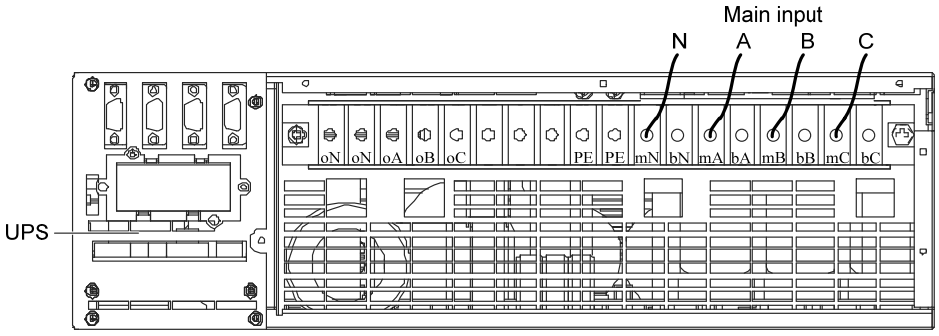


Figure 2-22 Main input

2. Remove the EPO jumpers of the dry contact port 4 (see Figure 6-2 and Table 6-1).

3. Power on the system. Set the system to ‘Single’ through the LCD menu ‘Settings’ -> ‘3 Phase Output or 1 Phase Output’ (default password: 12345), and power off the system completely, then power on the system again, enter this menu to confirm that the setting is valid.

4. Power off the system completely, and restore the EPO jumpers of the dry contact port 4, and remove the main input cable.

- From 3-in 1-out to 3-in 3-out

1. Remove all copper shorting bars shown in Figure 2-19 and Figure 2-20 of the 3-in 1-out system, connect the main input cables only. It is prohibited to connect the bypass input cables, output cables and battery cables, as shown in Figure 2-22.

2. Remove the EPO jumpers of the dry contact port 4 (see Figure 6-2 and Table 6-1).

3. Power on the system. Set the system to ‘Three’ through the LCD menu ‘Settings’ -> ‘3 Phase Output or 1 Phase Output’ (default password: 12345), and power off the system completely, then power on the system again, enter this menu to confirm the setting is valid.

4. Power off the system completely, replace the EPO jumpers of the dry contact port 4, and remove the main input cables.

2.5.2 Connecting Battery Cables

Notes

1. If the battery module is not configured, this product needs to be equipped with positive and negative batteries. Each battery string ranges from 15-cell to 20-cell, and 12V for each cell.

2. Before connecting the battery cables, confirm that the actual battery cell number and capacity are consistent with the parameter settings on the LCD menus.

3. It is prohibited to reverse the polarity of the battery cables.

4. Before replacing the battery module and connecting the battery cables, disconnect the DC battery MCB, power off the UPS completely, and conduct isolation protection on the terminals.

5. Refer to Figure 2-25 and Figure 2-26 for the length of the battery cables. If you need longer cables, please consult the dealer. It is recommended that the battery cable should not be longer than three meters. Otherwise, the UPS cannot operate normally.

Installing battery

1. Before installation, you must inspect the appearance and accessories of the battery, and carefully read this manual and the user manual provided by the battery manufactory.

2. Maintain at least 10mm clearances between the front, rear, side panels of the battery and the wall or adjacent equipment to keep well-ventilated.

3. Maintain some clearances between the top of the battery and the upper baffle to facilitate monitoring and maintenance of the battery.

4. Install the batteries from the bottom to the top to prevent too high center of gravity. Place the battery well to avoid shake and impact.

Connecting external battery string

The default battery number of the UPS is 32-cell, including 16-cell positive batteries and 16-cell negative batteries. The external battery string connection principle diagrams of the self-distribution are shown in Figure 2-23 and Figure 2-24.

Warning
1. As shown in Figure 2-23 and Figure 2-24, one DC battery MCB must be added between the battery strings and the UPS. 2. The voltage of the battery string is DC high voltage, the capacity of the MCB and output cables is listed in Table 2-4.

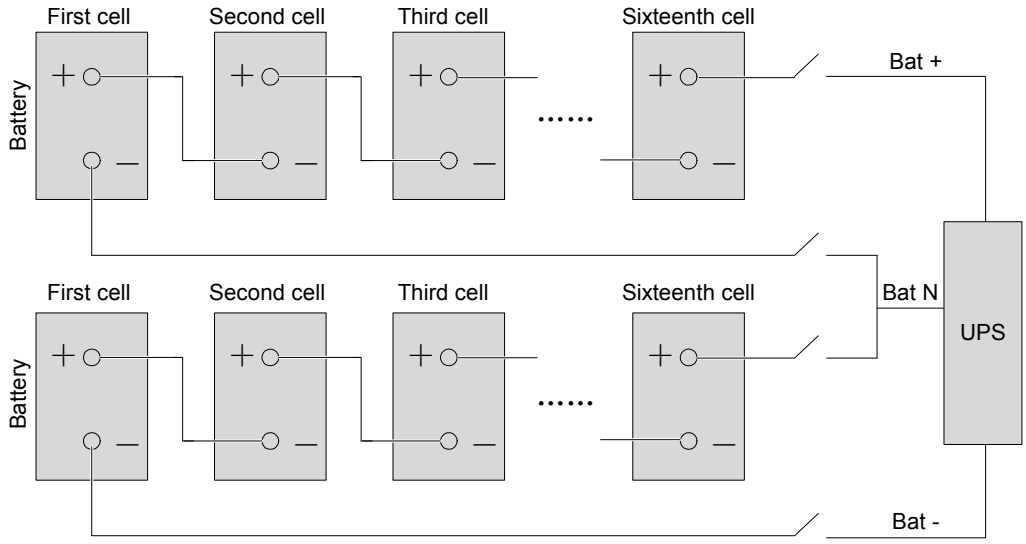


Figure 2-23 Battery string connection principle diagram 1

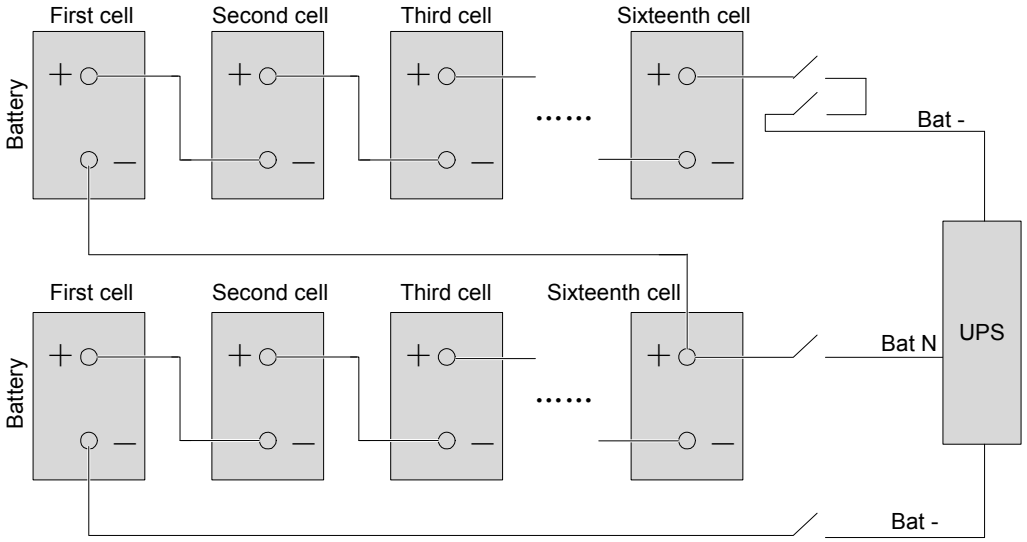


Figure 2-24 Battery string connection principle diagram 2

Connecting battery module cables

It is recommended to use four battery modules for power supply, including two positive battery modules and two negative battery modules, using one-into-multiple battery cables (optional) to connect. The cables of the positive battery module are shown in Figure 2-25, and the cables of the negative battery module are shown in Figure 2-26. Connect the Bat+, Bat-N, Bat- and PE terminal to the corresponding terminal of the UPS, and the terminals of the other end (color: red, black and yellow) to the corresponding terminals of the battery module.

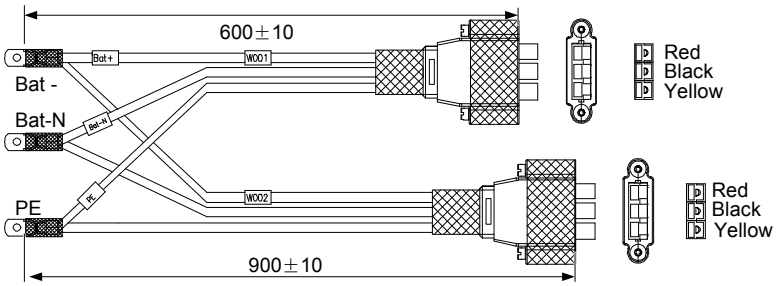


Figure 2-25 One-into-multiple battery cables 1 (unit: mm)

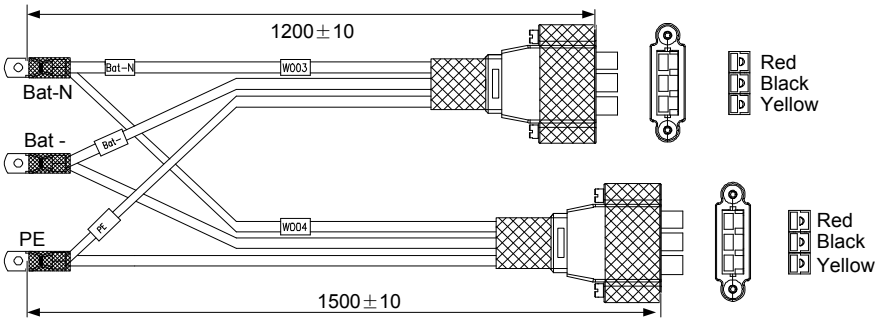


Figure 2-26 One-into-multiple battery cables 2 (unit: mm)

The cable connection of the positive battery module is shown in Figure 2-27, and the cable connection of the negative battery module is shown in Figure 2-28.

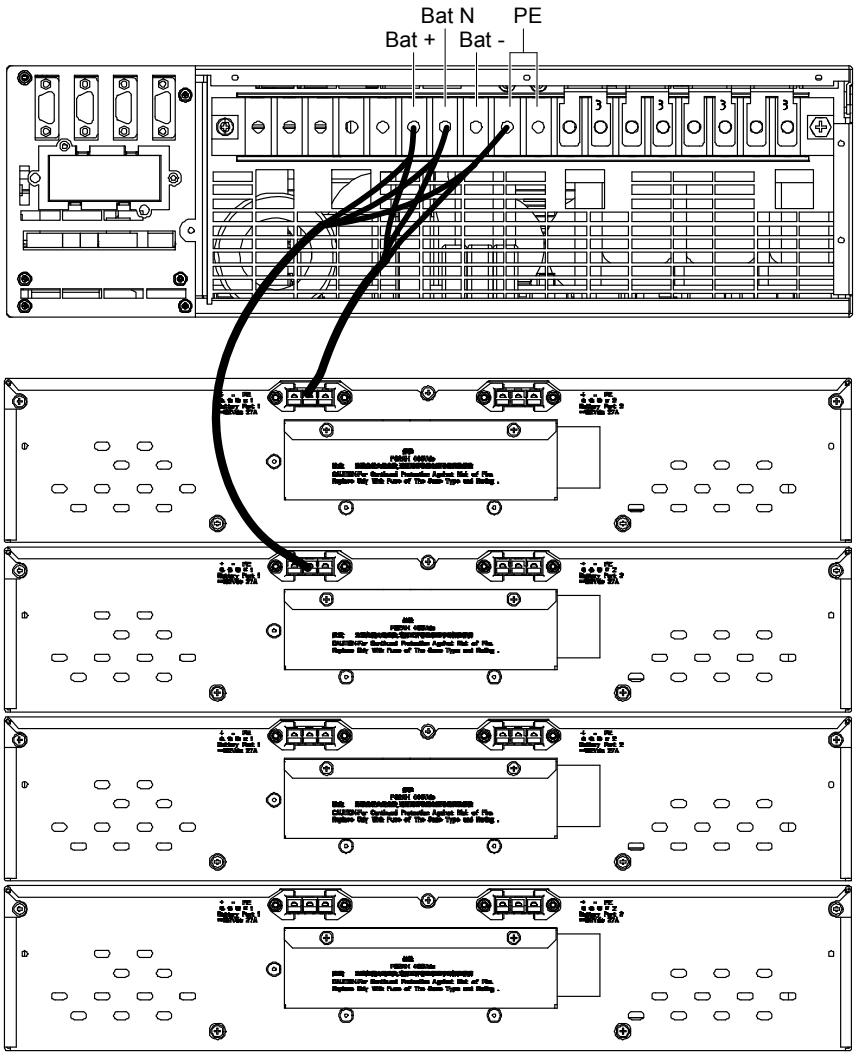


Figure 2-27 Cable connection diagram of the positive battery module

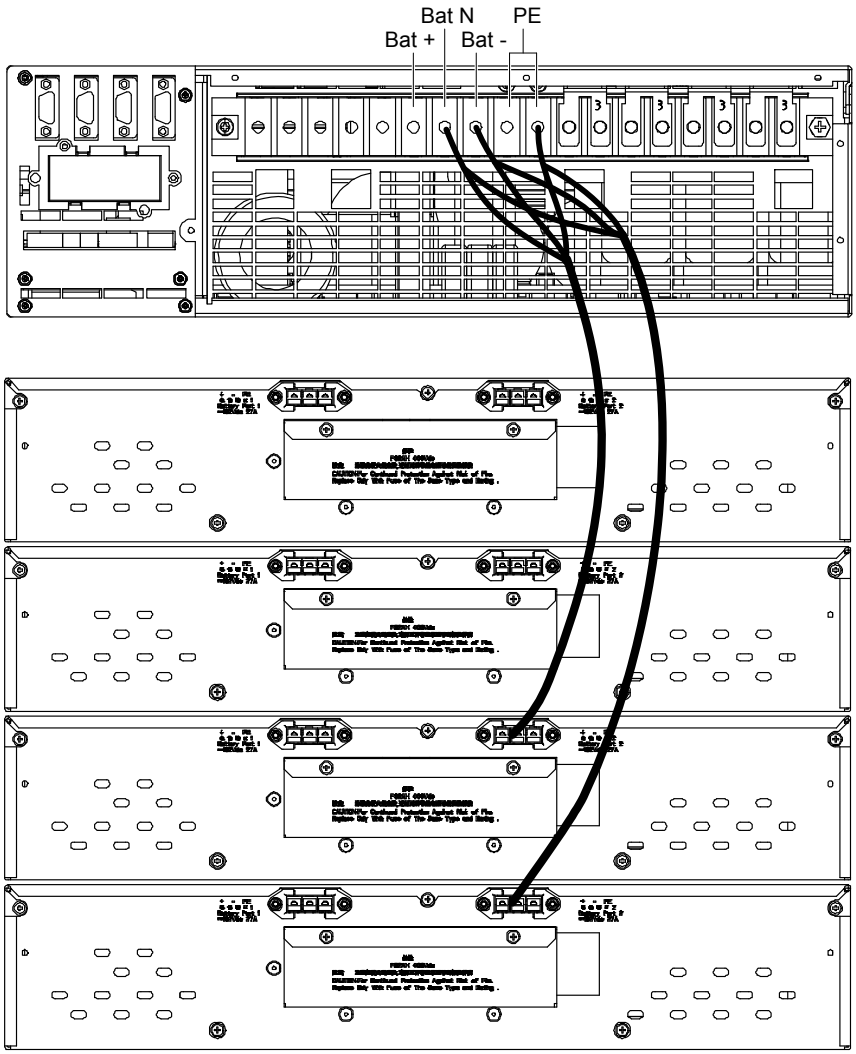


Figure 2-28 Cable connection diagram of the negative battery module

2.6 Single UPS Commissioning

2.6.1 Check Before Start-Up

1. Check and confirm that the power distribution mode of the UPS and the POD (if configured) is correct, that the connection of the power cables and signal cables is correct and there is no short circuit.

2. Check that the battery installation and the cable connection are correct, that the positive pole and the negative pole of the battery are correct.

3. Measure and confirm that the mains voltage and frequency are normal.

4. The output terminals of the UPS and the POD (if configured) are energized upon the startup. If the load is connected with the output terminals, make sure that the power to the load is safe.

2.6.2 Single UPS Parameters Setting

Power on the UPS according to step 1 ~ step 4 in *2.6.3 Normal Mode Start-Up*, it is prohibited to start the inverter.

Press the menu key to enter the function setting option, set the main single UPS parameters according to Table 2-5.

Table 2-5 Single UPS parameters setting

Parameters	Default value	Parameters setting
Single Group Batt Cap	0014	Set the parameter according to the actual battery capicitity
Battery Cells Number	32	Set the parameter according to the actual battery number
Equalize Charge Allowed	Enabled	Set the parameter according to the actual battery charicteristic

Parameters	Default value	Parameters setting
System Configuration	Single	Single
ECO Mode	Normal	Normal
Output frencency level*	50Hz	Set the parameter according to the actual power grid, 50Hz/60Hz can be selected
Output voltage level*	380V	Set the parameter according to the actual power grid, 380V/400V/415V can be selected
3 Phase Output or 1 Phase Output	Three	Select 'Three' when is 3 Phase Output, select 'Single' when is 1 Phase Output
Note*: Output frencency level and output voltage level will be active after power-off, but will not be displayed on LCD panel, the settings will be valid after manual power-off.		

The parameter descriptions and default values of the other parameters are listed in Table 2-6; you can set the parameters according to the actual requirements.

Table 2-6 Parameter descriptions and default values

Parameters	Notes	Default value
Display contrast	Adjust the LCD contrast	
Date format set	M/D/Y, D/M/Y and Y/M/D formats can be selected	Y/M/D
Date & time	Set the date and time	
Comm1 baud rate	Set the communication baud rate of the USB port	9600
Comm2 baud rate	For internal communication only, which cannot be set	9600
Comm3 baud rate	Set the communication baud rate of the SNMP card port	9600
Communication address	For RS485 communication	1
Single Group Batt Cap	Set the parameter according to the actual total battery capicitity	0014
Battery Cells Number	Set total battery number	32
Equalize Charge Allowed	Enabled or disabled	Enabled
Temp Compensation	Enabled or disabled	Disabled
Batt Temp Sensor Position	Set the position of the temperature sensor	NONE
Shared Battery	Each UPS in parallel system shares the battery string or not	Disabled
System Configuration	Set the UPS single/parallel	Single
Parallel Requisite Units	Set the parallel units	1
Parallel Redundant units	Set the redundant units	0
ECO Mode	Working in the normal mode or ECO mode	Normal
Output Frequency Level	Set the output frequency	50Hz
Output Voltage Level	Set the output voltage level	380V
LBS Function	Set the LBS function, NONE, SLAVE or MASTER can be selected	NONE
Command password	12345	12345
Protocol	Set the UPS communication protocol	YDN23
3 Phase Output or 1 Phase Output	Set the output mode: Three or Single	Three

Set 'Display contrast', 'Date format set' and 'Date & time' according to the actual requirements. For Comm1, Comm2 and Comm3 baud rate, 1200, 2400, 4800, 9600 or 19200 can be selected. The interfaces are shown in Figure 2-29.

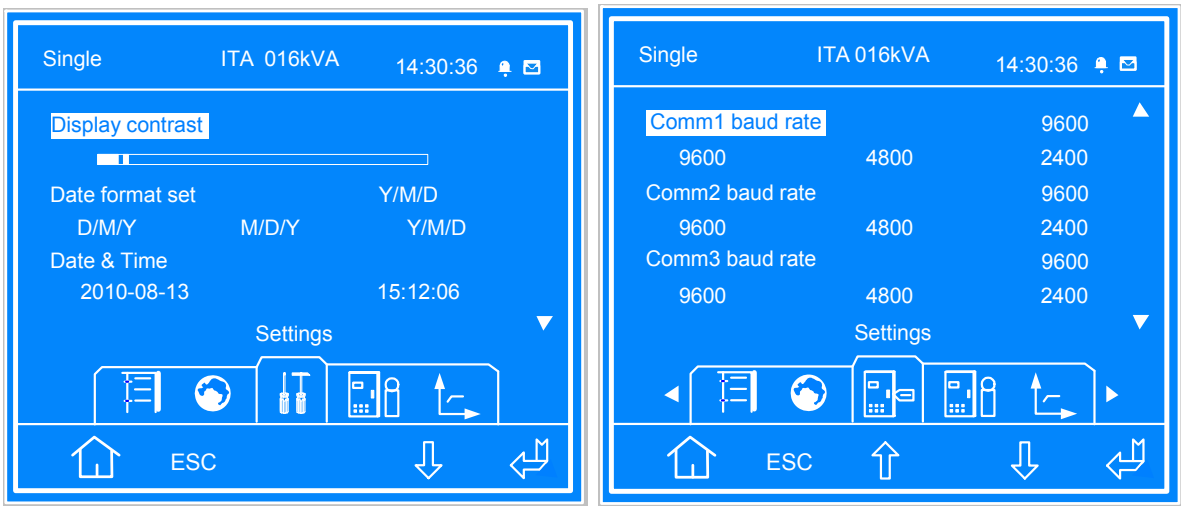


Figure 2-29 Settings interface 1

Set ‘Single Group Batt Cap’ according to the actual total battery capability, for ‘Battery Cells Number’, 30, 32, 34, 36, 38 or 40 can be selected, set ‘Equalize Charge Allowed’, ‘Temp Compensation’ and ‘Batt Temp Sensor Position’ (battery temperature sensor is optional) according to the user requirement. The interfaces are shown in Figure 2-30.

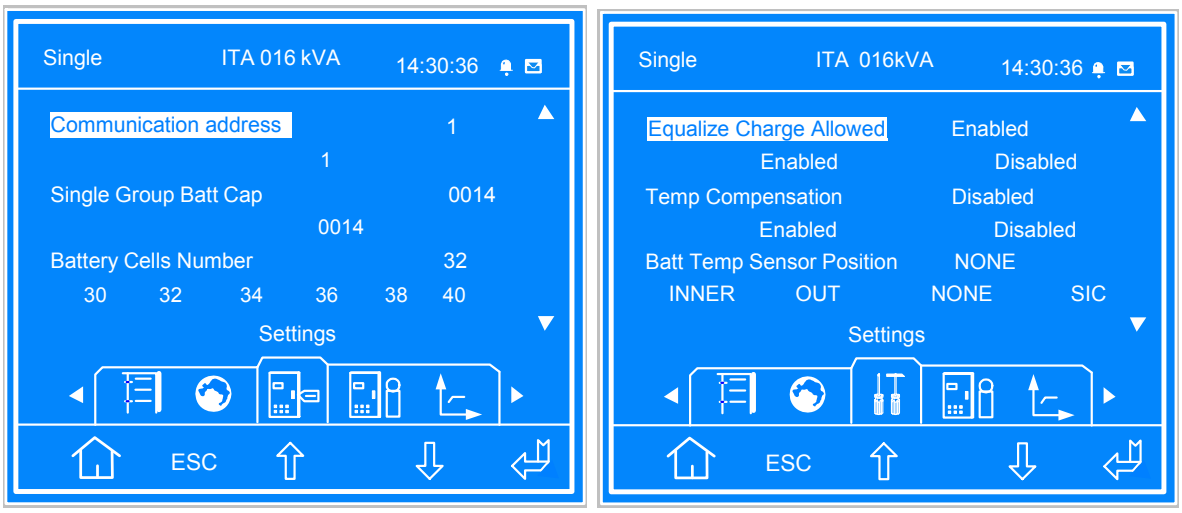


Figure 2-30 Settings interface 2

Note
The default value of ‘Battery Cells Number’ is ‘32’, set the paramerter according to the atcual requirement.

Select ‘Enabled’ in ‘Shared Battery’ according to whether the battery is shared. Set ‘System Configuration’ to ‘Single’ if the system is single system. Select ‘Normal’ or ‘ECO’ according to the UPS working mode, select ‘50Hz’ or ‘60Hz’ in ‘Output Frequency Level’ according to the power grid frequency level, as shown in Figure 2-31.

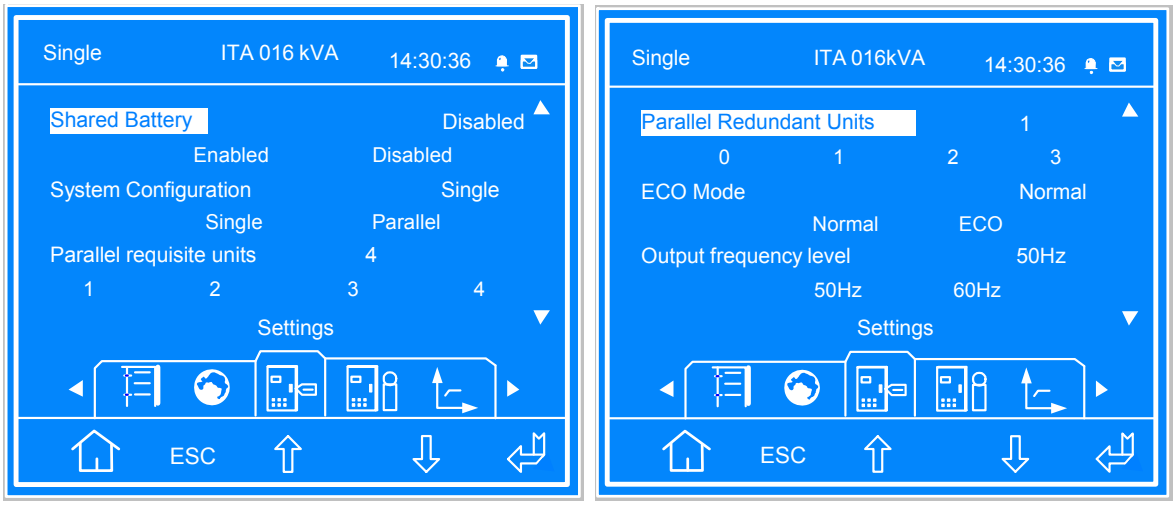


Figure 2-31 Settings interface 3

Set ‘Output Voltage Level’ and ‘LBS Function’ according to the user requirement, set ‘Command password’ to ‘12345’, the default value of ‘Protocol’ is ‘YDN23’, select ‘Three’ or ‘Single’ in ‘3 Phase Output or 1 Phase Output’, as shown in Figure 2-32.

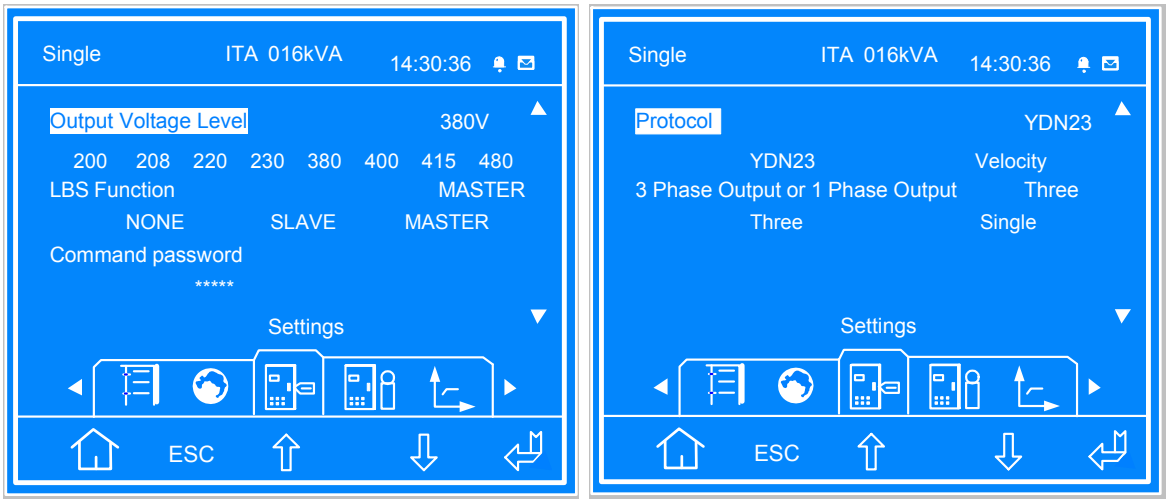


Figure 2-32 Settings interface 3

2.6.3 Normal Mode Start-Up

1. Close the external output MCB and input MCB of the UPS one by one. If the single POD is selected to connect with the UPS, close the input MCB, bypass MCB and output MCB of the POD.

Warning
After closing the UPS extenal output MCB or the POD output MCB, the output terminal block of the UPS, output terminal block of the POD and power distribution end of the load will be live, pay attention to personnal safety to avoid electric shock. Note whether it is safe to feed power to the load.

2. LCD displays the self-test screen; the fault indicator (red) and the inverter indicator (green) are on at the same time for about five seconds. After the self-test, the UPS enters the bypass state, the fault indicator turns on and the buzzer beeps for one second.

3. The rectifier runs in normal state for about 30 seconds, the start-up of the rectifier is finished.

4. Finish and check the parameter settings of the single UPS.

5. Press the ON button for two seconds, the inverter indicator (green) blinks, the inverter starts, and the inverter indicator turns on.

6. Measure whether the inverter output voltage is normal.

7. If the battery is not connected, the fault indicator blinks. If the battery is connected, the fault indicator turns off.

2.6.4 Battery Mode Start-Up

1. Close the battery MCB, and press the battery cold start button on the UPS front panel for two seconds, the LCD displays the startup screen. The fault indicator (red) will blink and the buzzer will beep continuously after the rectifier finishes the startup.

2. Press the ON button for two seconds, the inverter starts, and the inverter indicator (green) turns on.

Chapter 3 Parallel UPS Installation And Commissioning

This chapter introduces the features, requirements, installation and commissioning of the parallel system.

The UPS parallel system provides the user with N + X (2 ≤ N + X ≤ 4) parallel configuration, N stands for the basic parallel sets, X stands for the redundant sets.

1 + 1 parallel POD (optional) can provide safe and reliable power distribution function for the parallel system. The 1 + 1 parallel system only needs one 1 + 1 parallel POD; if N is not less than two, the external self-distribution will be required for the parallel system.

3.1 Features

1. The software and the hardware of each UPS in parallel system are the same as those of the single UPS. The basic parameters of the parallel system can be set through the LCD (Refer to *3.5.2 Parallel System Parameters Setting* for details), and the detailed parameters can be set through the background software (For service engineers only). For all UPSs of the parallel system, the requirements of the parameter settings are same.

2. The parallel cables form a ring connection (Refer to *3.4.2 Connecting Parallel Cables* for details) to provide reliability and redundancy for the system. The intelligent parallel logic provides the user with maximum flexibility. For example, each UPS in the parallel system can be switched off or on in random order; seamless transfer can be achieved between Normal mode and Bypass mode, and the transfer is automatically recoverable: that is, after the overload is removed, the system will return to the original operation mode automatically.

3. The total load of the parallel system can be queried through the LCD of each UPS.

3.2 Requirements

A UPS system composed of multiple parallel-connected UPSs is equivalent to a large UPS system. Nevertheless, it provides increased system reliability. To ensure equal utilization of all UPSs and compliance with relevant wiring regulations, the following requirements must be met:

1. All single UPSs must have the same capacity and must be connected to the same bypass source.

2. The bypass input power and the rectifier input power must be connected to the same neutral line input terminal.

3. If a residual current detector (RCD) is required, it must be set correctly and installed before the same neutral line input terminal, or it must monitor the protective earth current of the system. Refer to ‘Warning: high leakage current’ of *Safety Precautions* before *Contents*.

4. The outputs of all single UPSs must be connected to the same output bus.

5. Because the UPS parallel system is not fitted with any auxiliary contact detection devices for the output MCB or the maintenance bypass MCB of the UPS, removing the single UPS from the parallel system before maintenance and adding the single UPS into the parallel system after maintenance must be conducted strictly following the procedures provided in *5.2 Transfer Procedures Between Operation Modes*. Failure to observe this may affect the reliability of the load power supply.

3.3 Mechanical Installation

Taking the rack installation of the 1 + 1 parallel system without battery module for example, the mechanical installation method of the parallel system is as follows:

1. The installation method of 1 + 1 parallel UPS is the same as that of the single UPS. Refer to *2.4 Mechanical Installation* for details.

2. As shown in Figure 3-1, the UPS should be installed at the bottom; and the 1 + 1 parallel POD should be installed on the top to facilitate the cable connection and operation. The installation method of 1 + 1 parallel POD is the same as that of the UPS.

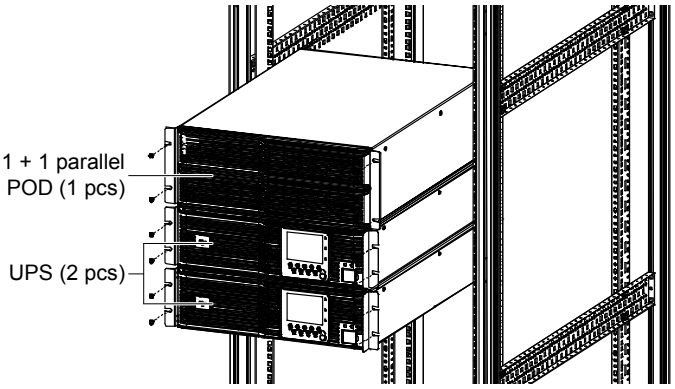


Figure 3-1 1 + 1 parallel system installation (without battery module)

3.4 Connecting Power Cables

Each single UPS of the parallel system needs to configure the MCB and cables respectively, refer to *2.5 Connecting Power Cables* for the specification. The recommended configurations of the total power cables are listed in Table 3-1 for the parallel system.

Table 3-1 Input & output cable CSA for the parallel system (unit: mm^2, ambient temperature: 25℃)

Parallel UPS number	3-in 3-out				3-in 1-out		
	Single input cable for parallel system	Single output cable for parallel system	Total neutral line for parallel system	Grounding cable for parallel system	Total output cable for parallel system	Total neutral line for parallel system	Grounding cable for parallel system
2 units	25	25	35	16	70	120	35
3 units	35	35	50	16	150	240	75
4 units	50	50	70	25	240	370	120

3.4.1 Connecting I/O Cables

The power cables of the UPS are connected to the I/O terminal block of the rear panel of the UPS, the layout of the I/O terminal block is shown in Figure 2-13.

Power distribution mode

There are two modes for UPS parallel power distribution: using the 1 + 1 parallel POD (optional) provided by Emerson, self-distribution.

The I/O cable connections are divided into four types: 3-in 3-out, common source configuration (factory default), 3-in 3-out, split-bypass configuration, 3-in 1-out, common source configuration, 3-in 1-out, split-bypass configuration. The I/O cable connection procedures of the four self- distribution modes are as follows.

1. Using parallel POD power distribution

It is recommended to use 1 + 1 parallel POD power distribution mode if you need 1 + 1 parallel system, for the installation and commissioning, refer to *Liebert® ITA 16kVA And 20kVA UPS Power Output Distribution Unit User Manual*.

2. Self-distribution for the parallel system

When the UPS number of the parallel system is more than two, use self-distribution mode.

The block diagram of three UPSs parallel system is shown in Figure 3-2. Refer to *Power distribution mode* in *2.5.1 Connecting I/O cables* for the cable connection of each UPS. Refer to *2.5 Connecting Power Cables* for the input and output MCB, the battery MCB and the cables when using the self-distribution mode.

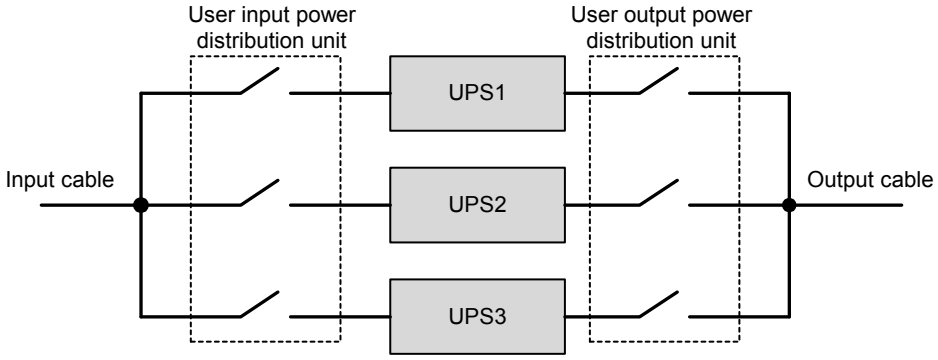


Figure 3-2 Block diagram of three UPSs parallel system

Warning
Configure each UPS with extenal input MCB and extenal output MCB when carring out the power distribution for the parallel system, as shown in Figure 3-2.

Changing power distribution mode

This product is compatible with 3-in 3-out/3-in 1-out, factory default: 3-in 3-out.

If you need to change the mode from 3-in 3-out to 3-in 1-out or from 3-in 1-out to 3-in 3-out, carry out the parallel connection after changing the single system to the needed system (Refer to *Changing power distribution mode* in *2.5.1 Connecting I/O cables* for the changing method).

3.4.2 Connecting Parallel Cables

The parallel system provides parallel cable option. The parallel cables form a ring connection through the parallel ports on the rear panel of the UPS. The cable connection schematic diagram of 3 + 1 parallel system is shown in Figure 3-3. The first port on the left is DB9 male port (pin shape), and the second port on the left is DB9 female port (hole shape).

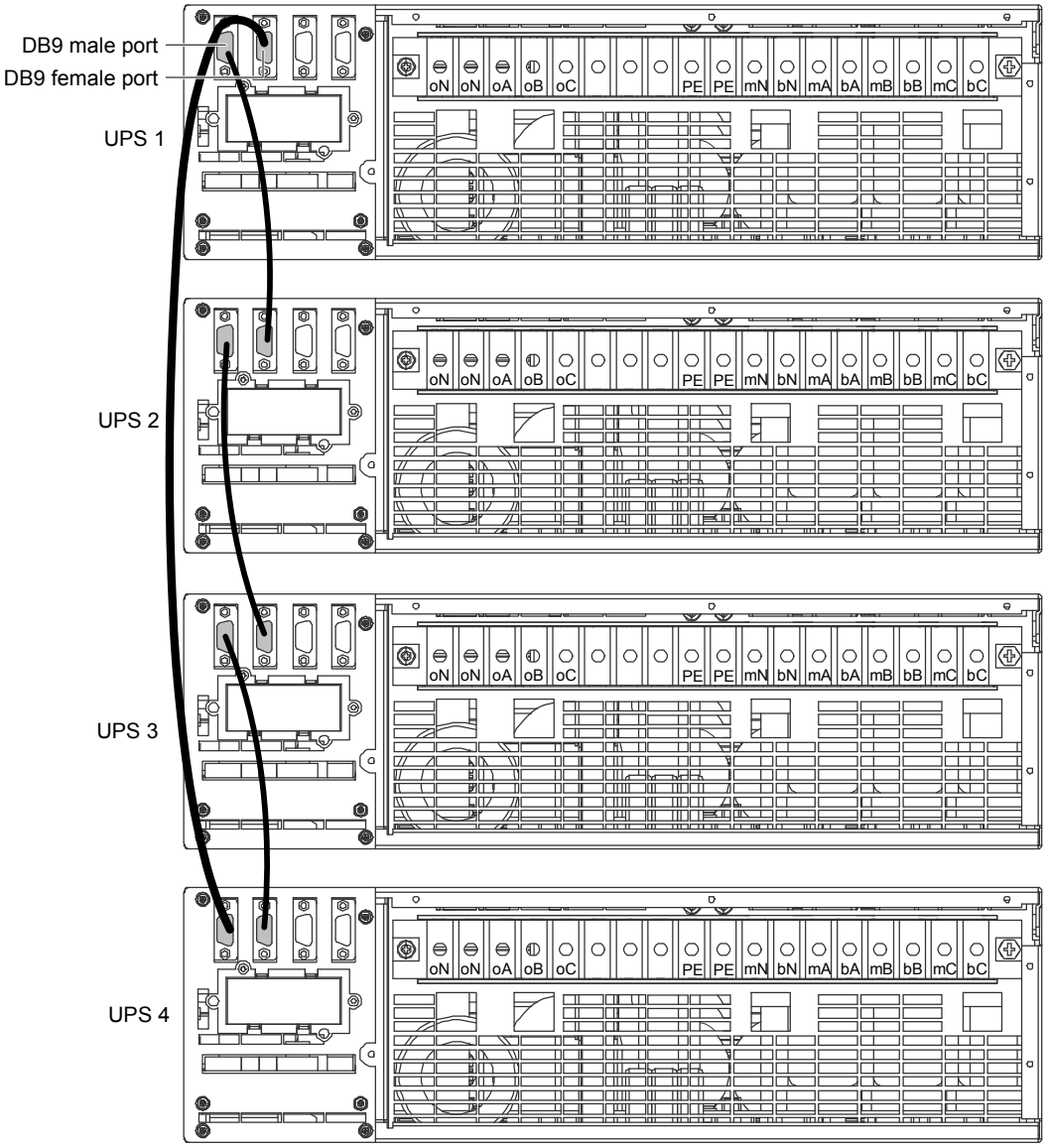
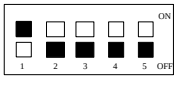
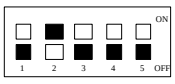
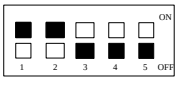
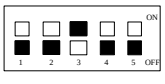


Figure 3-3 Cable connection schematic diagram of 3 + 1 parallel system

Note
1. The Emerson parallel cables must be used for the parallel system. 2. The parallel communication fault occurs during the parallel commissioning, check whether the connection of the parallel cables is correct, and whenther the pin1~ pin9 of the parallel cables are connected.

The parallel addresses for all UPSs in parallel system should be set. The parallel addresses can be set through the DIP switch on the front panel of the UPS (see Figure 1-2). Remove the cover of the DIP switch, and set the DIP switch according to Table 3-2.

Table 3-2 DIP switch settings

Parallel addresses	Parallel 1#	Parallel 2#	Parallel 3#	Parallel 4#
DIP switch position				

Warning
1. The default setting of the DIP switch is '1'. However, you should set the DIP switch position for the parallel system according to the descriptions listed in Table 3-2. Otherwise, a UPS fault will occur. 2. The parallel address for each UPS must be unique.

3.4.3 Connecting Battery Cables

All the UPSs in the parallel system can either share the battery strings, or use the battery strings independently.

Note
Each UPS should be equipped with an independent battery MCB. Refer to Table 2-4 for selection of the battery MCB.

Using battery string independently

When each UPS of the parallel system uses the battery string independently, the battery cables connection of each UPS in the parallel system is the same with that of the single UPS, refer to *2.5.2 Connecting Battery Cables* for the installation method. The schematic diagram of battery strings in 1 + 1 parallel system with independent battery strings is shown in Figure 3-4. Refer to *2.5 Connecting Power Cables* to configure a 4P MCB.

Note
Make sure that the LCD settings are correct when using the battery strings independently for the parallel system, refer to *3.5.2 Parallel System Parameters Settings* for details.

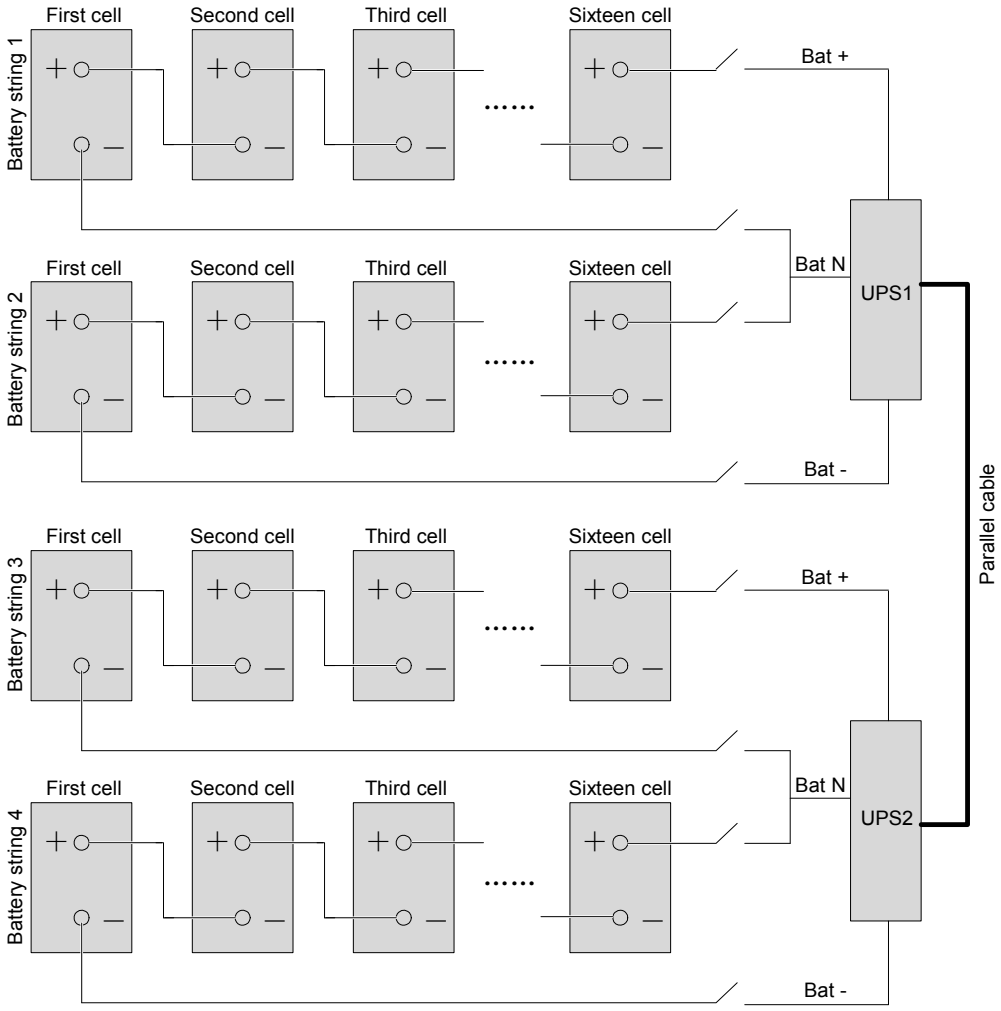


Figure 3-4 Connection principle diagram upon using battery strings independently

Sharing battery strings

Using the shared battery strings in the parallel system can save investment in equipment for the users.

Note
1. If the battery strings (four standard battery modules, option) are shared in parallel system, the backup time of the battery module ranges from two minutes to three minutes at full load. 2. To ensure the abundant backup time of the battery, it is recommended to use the external battery cabinet with big capacity.

1. Wiring

Power off the parallel system completely, disconnect the battery MCBs of all single UPSs, and then use battery cables (refer to *2.5 Connecting Power Cables* for the cables and the MCBs) to connect '+', 'N', '-' and 'PE' terminals of the battery strings respectively to 'Bat +', 'Bat N', 'Bat -' and 'PE' terminals of the corresponding I/O terminal block of the UPS in the parallel system through each battery MCB, as shown in Figure 3-5.

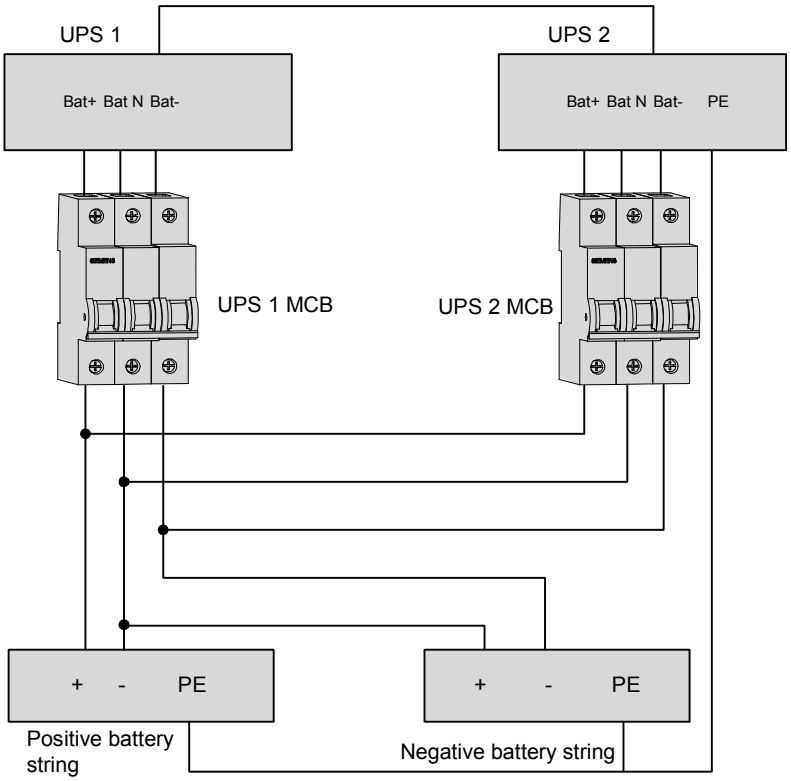


Figure 3-5 Connection diagram of shared battery string in 1 + 1 parallel system

Refer to Figure 3-6 to configure the positive battery string and negative battery string.

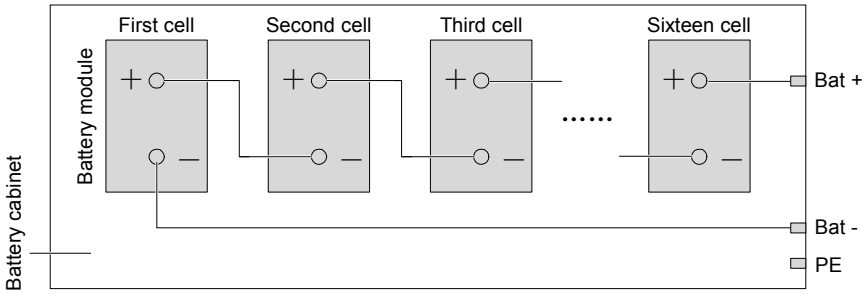


Figure 3-6 Internal connection diagram for positive battery string and negative battery string

2. Setting

Power on the system, set each single UPS to shared battery strings configuration through the LCD menu 'Settings' -> 'Shared Battery' from each UPS; set the LCD menu 'Settings' -> 'Battery Cells Number' and 'Single Group Batt Cap' from each UPS, and each UPS setting must be the same, as shown in Figure 3-7.

Note

1. For the parallel system using the shared battery strings, make sure that the LCD settings are correct. Refer to *3.5.2 Parallel System Parameters Settings* for details.
2. For the parallel system using the shared battery strings, the 'Single Group Batt Cap' on the LCD setting of each UPS stands for total capacity of the battery strings, and each UPS can calculate the shared battery capacity automatically.

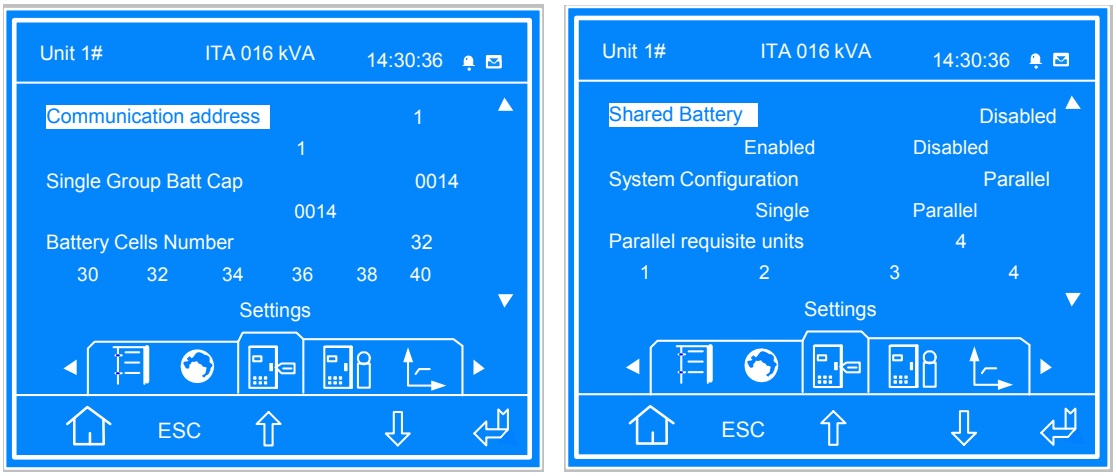


Figure 3-7 Settings interface

3. Close the battery MCB of each UPS.

3.5 Commissioning Parallel System

3.5.1 Check Before Start-Up

1. Check and confirm that the power distribution mode of the UPS and the 1 + 1 parallel POD (if configured) is correct; that the connections of the power cables and the signal cables are correct and there is no short circuit.

2. Check that the battery installation and cable connection is correct and there is no short circuit, and that the positive pole and negative pole of the battery are correct. Especially when each UPS of the parallel system shares the battery strings, check these items carefully.

3. Check all the working status of the parallel system, ensure that the phase sequence of the main, bypass and output of each UPS is correct and consistent, that the connection of the parallel cable is reliable, and that the user load is not connected during power-on.

4. Measure and confirm that the mains voltage and frequency are normal.

5. The output terminals of the UPS and the 1 + 1 parallel POD (if configured) are energized upon the start-up. If the load is connected with the output terminals, make sure that the power to the load is safe.

Warning

The output terminals of the UPS and the POD (if configured) will be live upon the start-up. When the bypass of the single UPS in the parallel system is not consistent, the system fault may occur, check and confirm the bypass before power-on.

3.5.2 Parallel System Parameters Setting

The parallel parameters for all the UPSs in the parallel system should be set. Power to each UPS of the parallel system according to step 1) ~ step 4) in *3.5.3 Power-On Commissioning For Parallel System*, it is prohibited to start the inverter. Press the menu key to enter the Settings option, set the parallel parameters according to Table 3-3.

Table 3-3 Parallel parameters setting

Parameters	Default value	Parallel parameters setting
Single Group Batt Cap	0014	Set the parameter according to the actual battery capicitity
Battery Cells Number	32	Set the parameter according to the actual battery number
Equalize Charge Allowed	Enabled	Set the parameter according to the actual battery charicteristic
Shared Battery	Disabled	Select 'Enabled' if there is shared battery, select 'Disabled' if there is no shared battery
System Configuration	Single	Parallel
Parallel requisite units	1	Set the paramerter to '3' if there are four UPSs to form 3 + 1 parallel system
Parallel Redundant Units	0	Set the paramerter to '1' if there are four UPSs to form 3 + 1 parallel system
ECO Mode	Normal	Normal
Output frencency level*	50Hz	Set the parameter according to the actual power grid, 50Hz/60Hz can be selected
Output voltage level*	380V	Set the parameter according to the actual power grid, 380V/400V/415V can be selected
3 Phase Output or 1 Phase Output	Three	Select 'Three' when is 3 Phase Output, select 'Single' when is 1 Phase Output
Note*: Output frencency level and output voltage level will be active after power-off, but will not be displayed on LCD panel, the settings will be valid after manual power-off.		

The default values of other parameters are listed in Table 2-5.

For the parallel system with N + X (2 ≤ N + X ≤ 4), set 'System Configuration' to 'Parallel', 'Parallel requisite units' to 'N' (1 ≤ N ≤ 4), 'Parallel Redundant Units' to 'X' (0 ≤ X ≤ 3). Take the 3 + 1 parallel system for example, set 'System Configuration' to 'Parallel', 'Parallel requisite units' to '3', 'Parallel Redundant Units' to '1', as shown in Figure 3-8.

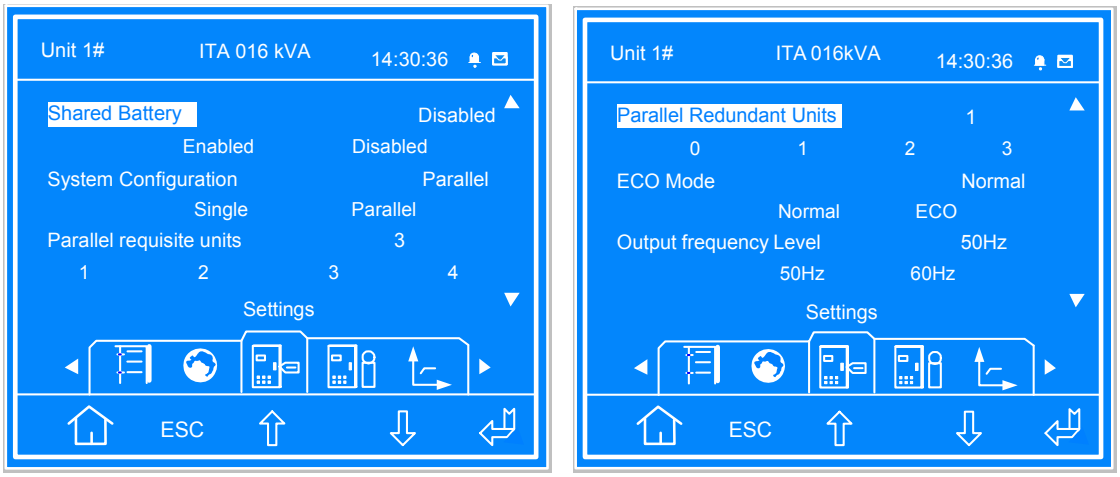


Figure 3-8 Settings interface

3.5.3 Power-On Commissioning For Parallel System

1. Set the parallel parameters of each UPS in the parallel system, then commission the inverter, the specific commissioning procedures are as follows:

1) Make sure that the output MCBs of all UPSs in the parallel system are open, and then close the external input MCB of each UPS in the parallel system, the UPS is powered on at the same time. If 1 + 1 parallel POD is configured, close the corresponding input MCB and bypass MCB. At the same time, close the corresponding output MCB of the other UPS which is being tested, and make sure that the corresponding output MCB of the other UPS is open.

Warning
After the UPS extenal output MCB or POD output MCB is closed, the UPS output terminal block, POD output terminal block and load will be live, pay attention to personnel safety to avoid electric shock. Note whether it is safe to feed power to load.

2) The LCD displays the self check screen, and the fault indicator (red) and inverter indicator (green) are on at the same time for about five seconds. After the self check, the UPS enter will enter the bypass state, the fault indicator will turn on and the buzzer will beep for one second. If 1 + 1 parallel POD is configured, the UPS which is being

tested will enter bypass state. Because the POD output MCB of the other UPS is not closed, the Input Disconnect Fault will be displayed, and Bypass unable to trace or Bypass protection may occur, ignore these alarms at the moment.

3) After the rectifier has been in normal operation state for about 30 seconds, the rectifier start-up is finished.

4) Refer to *3.5.2 Parallel UPS Parameters Setting* for the parallel parameters setting for each UPS. Note whether there is a 'Parallel comm. Fail' alarm, if yes, clear the fault according to Table 4-8. Carry out the following procedures if the UPS is running normally.

5) Press the ON button of one UPS for 2 seconds, if 1 + 1 parallel POD is configured, press the ON button of the UPS which is being tested in the parallel system, the inverter indicator (green) will blink, after 20 seconds, the inverter will start, and the inverter indicator will turn on, if 1 + 1 parallel POD is configured, the other UPS will display no power, ignore the prompt at the moment.

6) If the battery is not connected, the fault indicator will blink. If the battery is connected, the fault indicator will turn off.

7) If the UPS is working normally, press the OFF key for two seconds to turn off the inverter.

8) Repeat the preceding step1) ~ setp7) to power on and commission the inverter of other UPSs respectively.

Note
Carry out the parallel commissioning after each UPS is working normally.

2. After confirming that the inverter of each UPS is normal, commission the parallel system, the specific procedures are as follows:

1) Close the external output MCB and input MCB of each UPS, and all UPSs are powered on at the same time and enter the bypass mode. After the start of the rectifier is finished, press the ON key of one UPS for two seconds, the inverter indicator (green) will be on. Measure whether the inverter output voltage is normal. If the 1 + 1 parallel POD is configured, close the corresponding input MCB, bypass MCB and output MCB of the POD.

2) Start the inverter of the second UPS, check whether there is a alarm on the LCD, and confirm that the UPS parallel works normally.

3) Follow the methods to start the inverter of the third or the fourth UPS to connect the UPS into the parallel system.

Warnng
1. During the parallel power-on, confirm that the extenal output MCB of each UPS has been closed, and that all the inverter output of the UPSs are connnted parallelly. 2. During the parallel power-on, confirm that the system is working normally, and then feed power to the load, to void load power failure.

3.6 Installation And Commissioning For Double Bus System

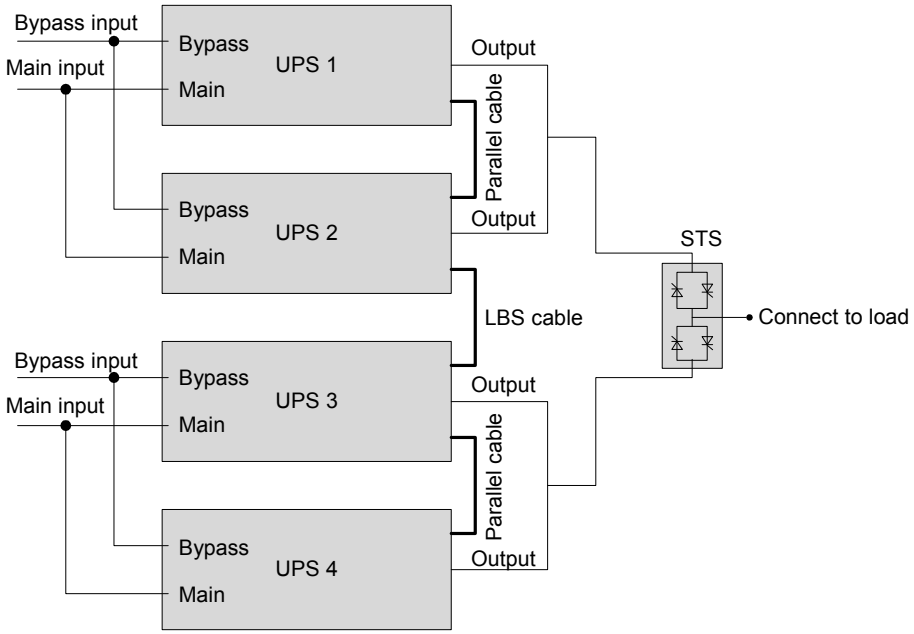
3.6.1 Introduction

The double bus system consists of two independent UPS systems; each UPS system consists of one or two parallel-connected single UPSs, or more parallel-connected single UPSs.

The double bus system has high reliability, which is suitable for the load with many input terminals. For single UPS input load, you can add a static trigger switch (STS, optional) to start the standard Load Bus Synchronization (LBS) system.

Place the UPSs side by side, and connect the UPSs as follows:

The double bus system uses the LBS system to realize the output synchronization of the two independent (or parallel) UPS systems. One is the master system, and the other is the slave system. The operation mode of the double bus system contains master system and/or slave system running in Normal mode or Bypass mode. The schematic diagram of the LBS system built by 1 + 1 parallel system is shown in Figure 3-9.



Note: UPS1 and UPS2 are master system, UPS3 and UPS4 are slave system

Figure 3-9 LBS system schematic diagram

Note
Refer to *3.4.2 Connecting Parallel Cables* and *3.5 Commissioning Parallel System* respectively for the settings of the DIP switch and the parallel commissioning.

3.6.2 Installing External Protective Device

See *2.3 External Protective Device* for details of installation and type selection.

3.6.3 Connecting Power Cables

In double bus system, refer to *2.5 Connecting Power Cables* and *3.4 Connecting Power Cables* to select the power cables for single UPS and parallel system respectively. The bypass input power and main input power must use the input terminal of the same neutral line. If the input terminal has leakage current, the leakage current protective device should be installed before the input terminal.

3.6.4 Connecting LBS Cables

In double bus system, connect the two ends of the LBS cable to any LBS port of the two parallel systems respectively, as shown in Figure 3-10. The third port on the left is DB9 male port (pin shape), the fourth port on the left is DB9 female (hole shape).

Note
1. The appearances of the LBS ports (see Figure 1-3) and the parallel ports (see Figure 1-3) are same, but the positions are different. Be careful when inserting and connecting to avoid incorrect connnection. 2. For the double bus system formed by the parallel UPS, it is recommended to prepare two LBS cables, one is used to connect any two LBS ports of the two parallel system, the other is redundant cable which is used for reliable connection. 3. As shown in Figure 3-10, one cable is LBS cable, others are parallel cables.

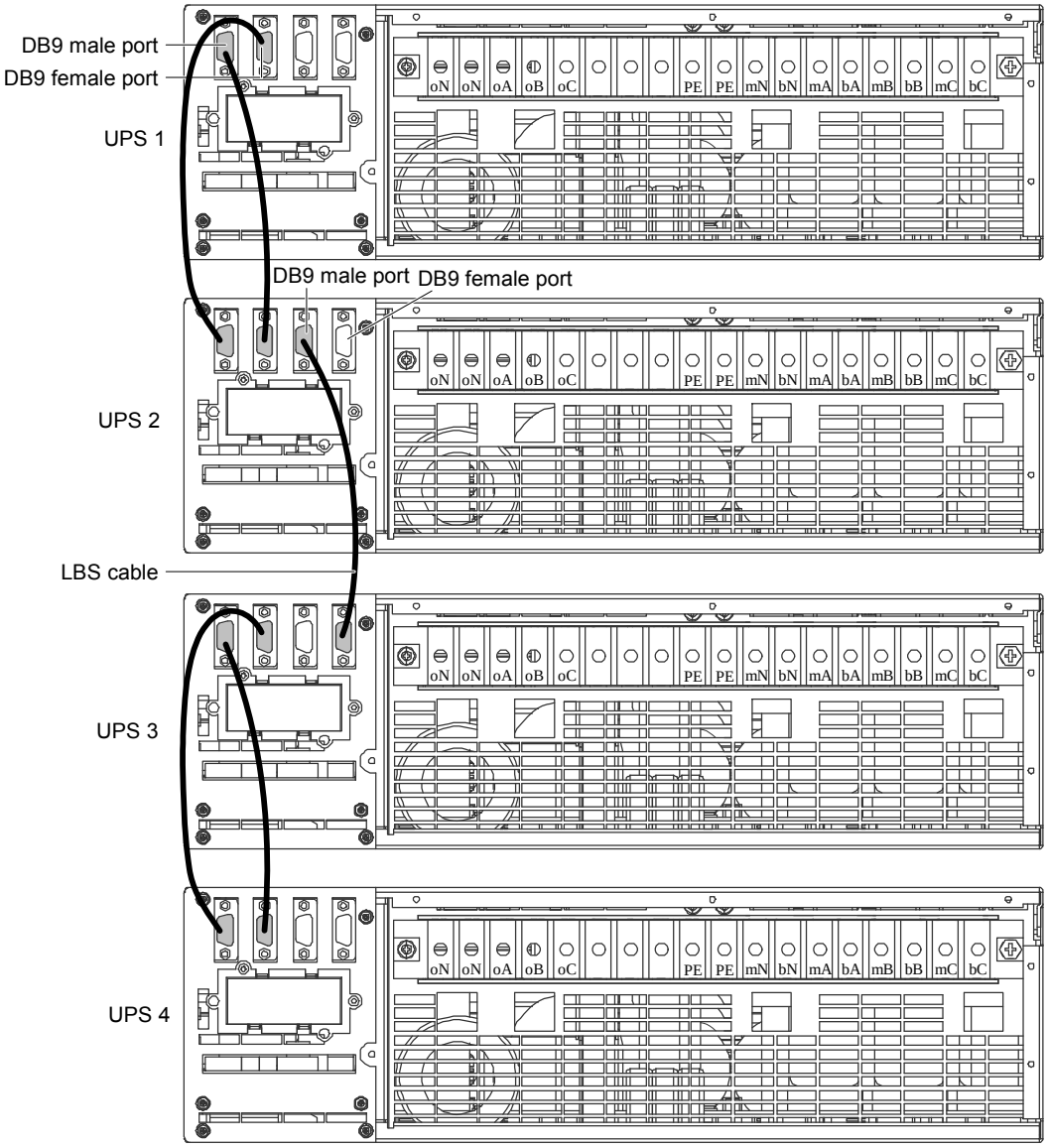


Figure 3-10 LBS cable connection

3.6.5 Setting Parameters Of Double Bus System

Take the double bus system formed by the 1 + 1 parallel system for example, set ‘System Configuration’ to ‘Parallel’, ‘Parallel requisite units’ to ‘1’, ‘Parallel Redundant Units’ to ‘1’. For the master system, set ‘LBS Function’ to ‘MASTER’. For the slave system, set ‘LBS Function’ to ‘SLAVE’. Ensure that the setting for ‘3 Phase Output or 1 Phase Output’ of each single UPS in the double bus system is same, as shown in Figure 3-11.

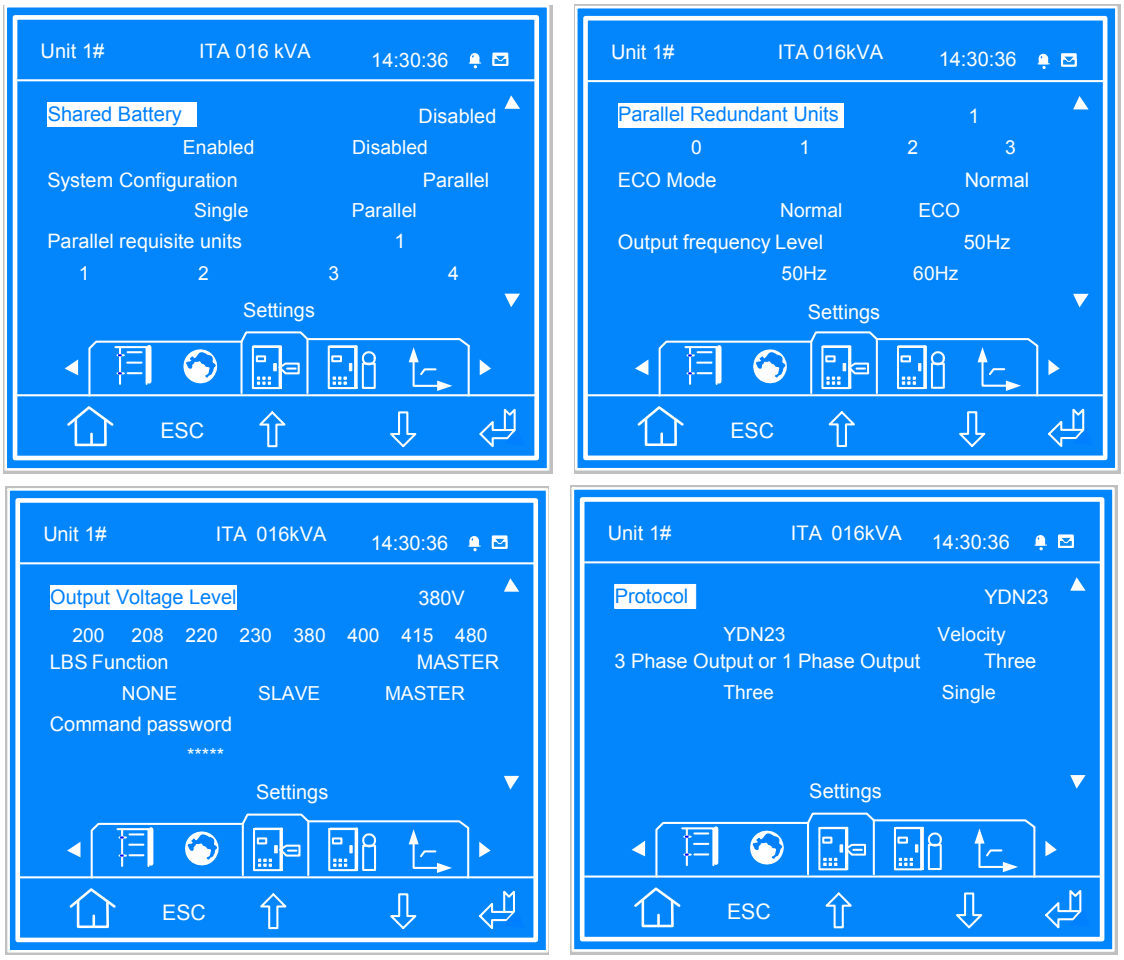


Figure 3-11 Setting interface

Chapter 4 Operation And Display Panel

This chapter introduces the functions and use of the components on the UPS operation and display panel, and provides LCD display information, including the LCD screen types, detailed menu messages, prompt windows message and UPS alarm list.

4.1 Introduction

The operation and display panel is located on the front panel of the UPS. Through the operation and display panel, you can conduct the operation and control on the UPS and query all the UPS parameters, UPS and battery states, and alarm message.

As shown in Figure 4-1, the operation and display panel provides LCD, menu buttons (F1 ~ F4, HELP), LED indicators (inverter indicator and fault indicator), control buttons (FAULT CLEAR, ON, OFF, ALARM CLEAR, EPO).

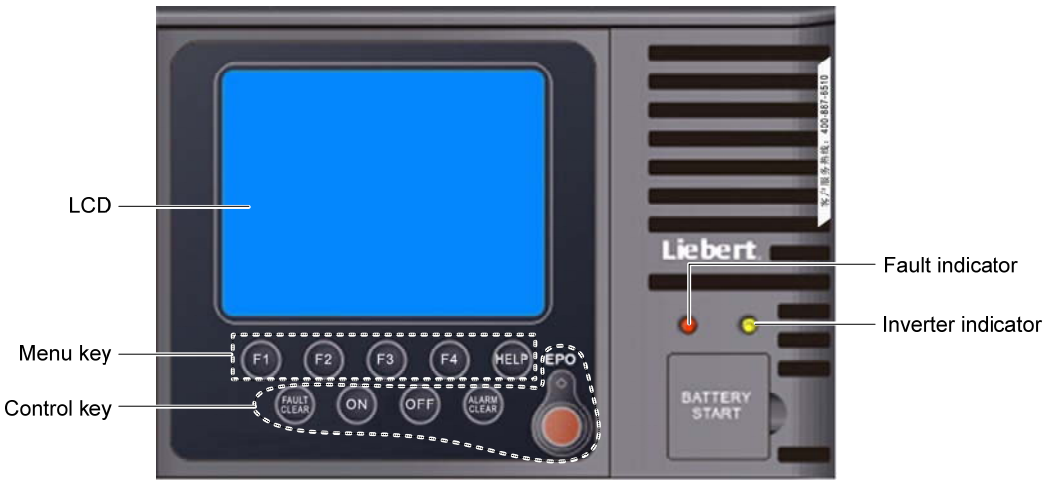


Figure 4-1 Operation and display panel

4.1.1 LED Indicators

The LED indicators are composed of the inverter indicator and the fault indicator. Table 4-1 gives the indicators description.

Table 4-1 Description of LED indicators

Indicator	Color	State	Meaning
Inverter indicator	Green	On	Load power is supplied by the inverter
		Blinking	Inverter on, starting up, synchronizing, or standing by (ECO mode)
		Off	Inverter not operating
Fault indicator	Red	Blinking	General fault (such as no battery)
		On	Serious fault (such as inverter fault)
		Off	No fault

4.1.2 Audible Alarm (Buzzer)

The UPS operation is accompanied with the following two different kinds of audible alarms shown in Table 4-2.

Table 4-2 Audible alarm description

Sound	Meaning
One beep every other second	Sound is generated when the UPS alarm appears, such as AC input failure
Continuous beep	Sound is generated when the UPS fault appears, such as fuse or hardware failure

4.1.3 Control Buttons

The operation and display panel provides five control buttons, the functions are described in Table 4-3.

Table 4-3 Description of control buttons

Control button	Silkprint	Description
EPO switch	EPO	Used to disconnect the load power and close the rectifier, the inverter, the static bypass and the battery
Inverter on	ON	Used to start the inverter
Inverter off	OFF	Used to close the inverter
Fault recovery on/off	FAULT CLEAR	Recover the UPS function (clear fault in advance)
Alarm sound silence on/off	ALARM CLEAR	When an audible alarm is active, press this button to silence the audible alarm. Press this button again can restart the buzzer

4.1.4 LCD And Menu Buttons

The operation and display panel provides an LCD and five menu buttons (F1, F2, F3, F4, HELP). Table 4-4 gives the function description of the menu buttons.

Table 4-4 Menu buttons function description

Button	F1	F2	F3	F4	HELP
Function 1	HOME	ESC Escape	Left	Right	Enter
Function 2			Up	Down	

LCD provides you with the user-friendly interface and the 320 × 240 dot matrix image display. The user-friendly and menu-driven LCD allows you to easily browse through the UPS input, output, parameters of the load and the battery, learn about the current UPS status and alarm message, perform functional settings and control operation. The LCD also stores up to 512 historical alarm records that can be retrieved for reference and diagnosis.

4.2 LCD Screen Types

4.2.1 Start Screen

Upon UPS start, the UPS executes the system self-test, and the start screen will appear and remain for about 15 seconds, as shown in Figure 4-2.

Figure 4-2 Start screen

4.2.2 Primary Screen

After the self-test of the UPS, the primary screen shown in Figure 4-3 will appear. The primary screen is composed of four windows: system information window, data window, menu window and keypad window.

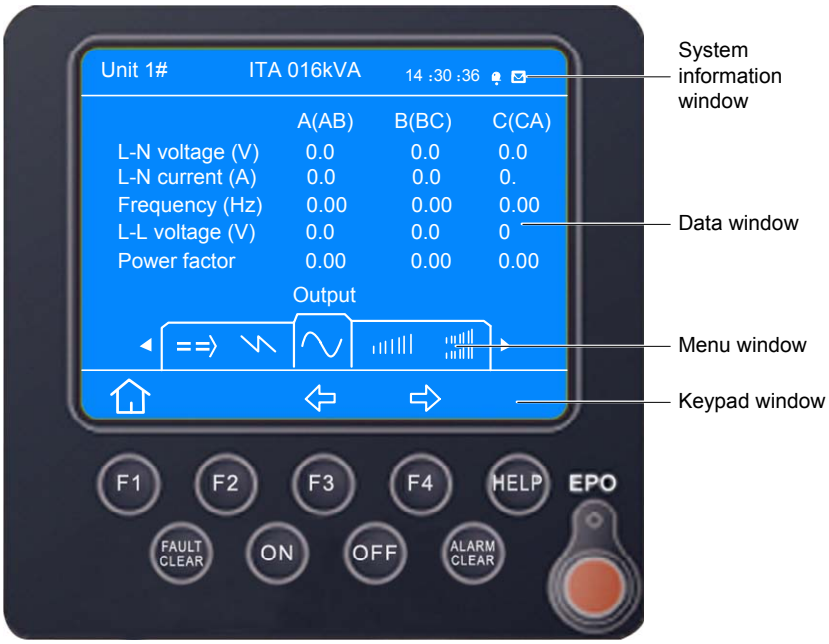


Figure 4-3 Primary screen

The current icons on top of the F1 ~ F4 and HELP menu buttons give the explanations of each button. From any menu in primary screen, pressing the F1 button can return to the 'Output' menu. For details about the primary screen, refer to *4.3 Detailed Description Of Menu Items*.

4.2.3 Default Screen

During the UPS operation, if there is no alarm within two minutes, the default screen shown in Figure 4-4 will appear. After a short while, the LCD backlight will turn off. Press any menu button (F1 ~ F4, HELP), the current screen will appear again.

Figure 4-4 Default screen

4.3 Detailed Description Of Menus

The following description refers to the LCD primary screen shown in Figure 4-3.

System information window

The system information window displays the current time and the UPS name. You are not required for operating the information of this window. For details, see Table 4-5.

Table 4-5 System information window

Item	Explanation
ITA 020kVA	UPS name, which stands for Liebert® ITA 20kVA UPS
12: 30: 36	Current time (format: 24 Hours, h: min: s)

Menu window and data window

The menu window displays the menu name of the data window. The data window displays the items of the menu selected from the menu window. UPS parameters can be browsed and functions can be set through the menu window and data window. Details are given in Table 4-6.

Table 4-6 Menu window and data window

Menu	Item	Explanation
Main input	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 input	L-N voltage (V)	Phase voltage
	Frequency (Hz)	Bypass frequency
	L-L voltage (V)	Line voltage
AC 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	Sout (kVA)	Sout: Apparent power
	Pout (kW)	Pout: Active power
	Qout (kVAR)	Qout: Reactive power
	Load level (%)	The percentage of the UPS rated load
	Crest factor	Output current crest factor
System	Sout (kVA)	Sout: Apparent power
	Pout (kW)	Pout: Active power
	Qout (kVAR)	Qout: Reactive power
Battery	Battery voltage (V)	Battery bus voltage
	Battery current (A)	Battery bus current
	Battery temperature (°C)	Battery temperature (°C)
	Battery remain time (Min.)	Battery runtime remaining
	Battery capacity (%)	Battery capacity (%), compared with the new battery capacity
	Battery boost charging	Battery is boost charging
	Battery float charging	Battery is float charging
	Battery is not connected	Battery is not connected
Event	Current alarm	Display the current alarm. See Table 4-8 for UPS alarm message list
Records	Historical alarm	Display all historical alarms. See Table 4-8 for UPS alarm message list
Language	Language selection	Options are displayed in Chinese or English
Settings	Display contrast	Adjust the LCD contrast
	Date format set	MM DD YYYY, DD MM YYYY and YYYY MM DD formats can be selected
	Date & time	Set the date and time
	Comm1 baud rate	Set the communication baud rate of the USB port

Menu	Item	Explanation
Settings	Comm2 baud rate	For internal communication only, which cannot be set
	Comm3 baud rate	Set the communication baud rate of the SNMP card port
	Communication address	For RS485 communication
	Single Group Batt Cap	Set the total battery capacity according to the configuration
	Battery cells Number	Set the battery cell. Option: 30-cell, 32-cell, 34-cell, 36-cell, 38-cell, 40-cell
	Equalize Charge Allowed	Enabled or disabled
	Temp Compensation	Enabled or disabled
	Temp Sensor Position	Set the position of the temperature sensor
	Shared Battery	Each UPS in parallel system shares the battery string or not
	System Configuration	Set the UPS / parallel
	Parallel Requisite Units	Set the parallel units
	Parallel Redundant units	Set the redundant units
	ECO Mode	Set the operation mode. Option: Normal, ECO
	Output Frequency Level	Set the output frequency
	Output Voltage Level	Set the output voltage level
	LBS Function	Set LBS function. Option: NONE, SLAVE or MASTER
	Command password	You can change the command password. Default: '123456'
	Protocol	Set the communication protocol of the UPS
	3-in 3-out / 3-in 3-out	Set the output system: 3-in 3-out or 3-in 3-out This setting can only be carried out after the EPO operation. After the setting, you must power off the system, and confirm that the system actual wiring mode complies with the setting. Power on the system again, and the setting can take effect
Command	Battery maintenance test	The battery maintenance test will partly discharge the battery to get rough assessment of the battery capacity. The load ranges from 20% to 100%
	Battery capacity test	The battery capacity test will completely discharge the battery to get accurate assessment of the battery capacity. The load ranges from 20% to 100%
	System test	The UPS self-test. The user starts this function, 5 seconds later, a pop window will appear to show the test result
	Stop testing	Manually stop the test, including the maintenance test, capacity test and system test
	Forcing charge	Manually conduct the battery forcing charge
	Stop forcing charge	Manually stop the battery forcing charge
Version	Monitor version	Provide the monitor software version
	Rectifier version	Provide the rectifier software version
	Inverter version	Provide the inverter software version

Keypad window

The function of the menu buttons (F1 ~ F4 and HELP) is shown in icon mode for the current display screen (see Figure 4-4).

4.4 Prompt Window

A prompt window is displayed during the operation of the system to alert you to certain conditions and/or to require your confirmation of a command or other operation. The prompts and meanings are given in Table 4-7.

Table 4-7 Prompts and meanings

Prompt	Meaning
Transfer with interrupt, confirm or cancel	Inverter and bypass supplies are not synchronized, and the load transfer between the bypass and inverter will cause a brief power supply interruption
This operation leads to output shutdown, confirm or cancel	The bypass is abnormal, inverter shutdown will cause the load power-off

Prompt	Meaning
Turn on more UPS to carry current load	The number of paralleled inverters already turned on is insufficient to carry the current load, thus more inverters are required
Battery will be depleted, confirm or cancel	The battery maintenance test discharges the battery completely. A prompt screen will appear to require your confirmation. Cancelling the test will end the battery discharge and return to the Normal mode
System self-test finished, everything is ok	No operation is required
System self-test finished, please check the current warnings	Check the current alarm message
Enter control password	Control password is required for battery test or UPS test
Battery self-test condition is low, please check battery state and load level	Battery test condition is not met. Please check whether the battery is in boost charge state and the load level is more than 20%
Forcing charge condition is low, please check battery state	The prompt appears when you select the forcing charge command while the forcing charge condition is not met (such as no battery, charger failure)
Check the wiring according to the settings, power-off takes effect, 3-phase (1-phase) output	After the menu '3 Phase Output or 1 Phase Output' is set, you can power off the system completely, and then power on the system again after the wiring is changed according to the settings

4.5 UPS Alarm Message List

Table 4-8 gives all UPS alarm messages based on the 'Event' and 'Records' menus.

Table 4-8 UPS alarm message list

Alarm message	Description
Inverter comm. fail	Communication failure between the internal monitoring board and the inverter
Rectifier comm. fail	Communication failure between the internal monitoring board and the rectifier
Parallel comm. fail	The communication failure between different UPSs in the parallel system. 1. Check whether some UPSs are not powered on in the parallel system. If so, power on these UPSs and check whether the alarm disappears. 2. Press the FAULT CLEAR button
Battery fault	Battery is depleted (reserved)
Battery replaced	Battery test failure, and the battery should be replaced
Battery low pre-warning	Before the end of the discharge, battery undervoltage pre-warning may occur. After this pre-warning, the battery should have the capacity for three minutes discharging with full load. The time is user-configured ranging from three minutes to 60 minutes. Shut down the load in time
Battery stop discharge	Inverter is off due to the battery end voltage. Check the mains failure and try to recover it
Main volt. abnormal	Mains voltage exceeds the upper or lower limit and results in rectifier shutdown. Check the input phase voltage of the rectifier
Main undervoltage	Mains is undervoltage, derate for running. Check the input line voltage
Main freq. abnormal	Mains frequency is out of the limit range and results in rectifier shutdown. Check the input frequency
Rectifier block	Rectifier failure. The rectifier shuts down and the battery discharges
Rectifier overtemp.	The temperature of heat sink is too high to keep the rectifier running. The UPS can recover automatically. Check the environment and ventilation
Battery charger fault	Battery charger is over voltage
Control power 1 fail	UPS operates but the control power is not available
Main phase reversed	AC input phase sequence is reversed
Rectifier overcurrent	Rectifier is over current
Soft start fail	Rectifier cannot start due to the DC bus low voltage
Bypass unable to trace	This alarm is triggered by an inverter software program when the amplitude or frequency of bypass voltage is beyond the normal range. The amplitude threshold is fixed for ±10% rating. This alarm will automatically recover when the bypass voltage is normal. 1. First verify that the bypass voltage and frequency displayed on the LCD are within the selected range. Note that the rated voltage and frequency are specified by the 'Output Voltage Level' and 'Output Frequency Level' respectively. 2. If the displayed voltage is abnormal, please verify the actual bypass voltage and frequency presented to the UPS. Check the external power if any fault is found

Alarm message	Description
Bypass protection	This alarm is triggered by an inverter software program when the amplitude or frequency of bypass voltage is too high or too low. The amplitude threshold is fixed for ±10% rating. This alarm will automatically recover when the bypass voltage is normal. 1. First check if there are some relevant alarms, such as 'Bypass Phase Reverse', 'Input Disconnect Fault'. If so, solve them first. 2. Then verify that the bypass voltage and frequency displayed on the LCD are within the selected range. Note that the rated voltage and frequency are specified by the 'Output Voltage Level' and 'Output Frequency Level' respectively. 3. If the displayed voltage is abnormal, please verify the actual bypass voltage and frequency presented to the UPS. Check the external power if any fault is found. If the utility is likely to trigger this alarm frequently, the bypass limit can be changed a little larger through the configuration software according to the user backfeed
Inverter asynchronous	This alarm is triggered by an inverter software program when the inverter and bypass waveforms are misaligned by more than 6 degrees in phase. The amplitude threshold is fixed for ±10% rating. This alarm will recover automatically when the alarm condition disappears. 1. First check if the alarm 'Bypass Unable To Trace' or 'Bypass Protection' exits. If so, solve it first. 2. Verify the waveform of the bypass voltage. If too distorted, ask the user to verify it and seek any possible measurement
Inverter fault	Inverter output voltage beyond limits. Load transfers to bypass
Inverter overtemp.	The temperature of the inverter heat sink is too high to keep the inverter running. This alarm is triggered by the signal from a temperature monitoring thermostat on the inverter bridge heat sink. After the alarm is cleared about 20 minutes, the inverter will start again automatically. The UPS will switch to bypass if the alarm is triggered above one time in 2 hours, and power on the UPS manually and stwitch to inverter working state after the alarm is cleared. Note: Wait for 20 minutes after the alarm is cleared, manual power-on will be suceesful. If the overtemperature condition is true, check the following items: 1. high ambient temperature. 2. blocked cooling airway. 3. any fan failure. 4. prolonged inverter overload
Fan fault	At least one of the cooling fans has failed
Inverter relay fail	At least one of the relays of inverter side is open or short circuit. This fault is locked until power off (for a 3-in 1-out system, possible causes for relay fault type: inverter fuse open, inverter IGBT open)
Bypass STS fail	At least one of the static switches of bypass side is open or short circuit. This fault is locked until power off
Operation invalid	Incorrect operation
Neighbor bypass SSTS fail	At least one of the static switches of UPS unit bypass side in parallel system is open or short circuit. This fault is locked until power off
Output fuse fail	At least one inverter output fuse failure. The inverter shuts down, the load transfers to bypass
Unit over load	The UPS is confirmed to be overload when the load is above 105% nominal rating. The alarm automatically recovers after the overload condition is removed. 1. Confirm that the alarm is true by checking the load percent indicated on the LCD to determine which phase is being overloaded. 2. If the alarm is true, measure the actual output current to verify that the indications are valid. Disconnect the unnecessary load and ensure the safety
Byp. abnormal shutdown	Both bypass and inverter voltages are abnormal. Load interruption
Inverter over current	Inverter pulse width modulation module is over current
Bypass phase reverse	The phase sequence direction of the bypass voltage is reversed. Normally, the phase of phase B lags 120 degrees behind phase A, and the phase of phase C lags 120 degrees behind phase B. Verify that the phase rotation of the bypass supply presented to the UPS is correct, and rectify it if the fault is found
Load impact transfers bypass	A transfer to bypass occurred due to a large step load. The UPS will recover automatically. Turn on the load in sequential order for reducing the step load of the inverter
Transfer time-out	The load is on bypass power due to the excessive number of transfers that occurred within the last hour. The UPS will recover automatically and will transfer the load to inverter power within an hour
Bus abnormal	DC bus voltage is abnormal. Inverter shuts down. Load transfers to bypass
DC bus over voltage	Rectifier and inverter are off because the DC bus voltage is too high. Check whether there is a fault in rectifier side. If not, check whether there is an overload. After recovering the fault, restart the inverter
Bypass over current	Bypass current is over limit above 135% rating. The UPS just alarms without any action

Alarm message	Description
Setting save error	Historical records are not saved (Reserved)
Input Disconnect Fault	AC mains input neutral line is not checked out
Protocol version clash	Firmware incompatibility between monitor board and Digital Signal Processor (DSP) board
Manual on	Manually turn on the inverter through pressing ON on the operation and display panel
Manual off	Manually turn off the inverter through pressing OFF on the operation and display panel
EPO	Press the EPO button directly or receive the external EPO command
Transfer confirm	Prompt to press the Enter button to acknowledge that an interrupted load transfer to bypass will happen
Transfer cancel	Prompt to press the ESC button to avoid that an interrupted load transfer to bypass will happen
Fault clear	Press FAULT CLEAR
Alarm silence	Press ALARM CLEAR
Turn on fail	Inverter failed to turn on manually. The reason may be the invalid operation (maintenance bypass air breaker closed), or DC bus or rectifier not ready
Alarm silence cancle	Press FAULT CLEAR or ALARM CLEAR
Bypass mode	The UPS is in Bypass mode
Normal mode	The UPS is in Normal mode
Battery mode	The UPS is in Battery mode
Check UPS output	The UPS is off and stops the output: 1. Whether the EPO terminal is on the dry contact port 4 2. Whether the LCD displays ‘Parallel comm. Fail’
Battery float charging	Battery status (floating charge mode)
Battery boost charging	Battery status (boost charge mode)
Battery discharging	Battery status (discharge mode)
Battery period testing	Automatically periodic battery maintenance test (20% capacity discharge)
Batt. capacity testing	User initiated battery capacity test (100% capacity discharge)
Batt. maint. testing	User initiated maintenance test (20% capacity discharge)
UPS system testing	User initiated UPS system self-test
Inverter in setting	Inverter is starting up and synchronizing
Rectifier in setting	Rectifier is starting up and synchronizing
Battery reverse	Reconnect the battery, and check the battery wiring
No battery	Check the battery and battery wiring
Auto start	UPS is off when the battery discharges completely, the inverter will automatically start after the mains is restored
REC FLASH UPDATE	Ongoing update of rectifier firmware
INV FLASH UPDATE	Ongoing update of inverter firmware
MONITOR FLASH UPDATE	Ongoing update of monitor firmware
DSP softwar error	Inverter software does not match the rectifier software
Operation invalid and Bypass unable to trace	Alarm combination, when the two alarms appear at the same time, the UPS I/O cable connection mode is not suitable with the setting mode (3-in 3-out or 3-in 1-out)
Note: If the alarm is caused through setting the software value by Emerson authorized engineer, and when you wish to change the setting values, please get in touch with the Emerson local customer service center	

Chapter 5 UPS Operation Instructions

This chapter gives a detailed description of the UPS operation procedures.

During the operation, the buzzer alarm may appear, at this point, you can press the ALARM CLEAR button to silence the audible alarm.

 Warning: hazardous mains and/or battery voltage exists behind the protective cover
No user accessable parts are located behind the protective covers that require a tool for removal. Only qualified service personnel are authorized to remove such covers. If maintenance for rack is needed, notice that the neutral line is live.

5.1 UPS Start-Up

The start-up procedures can be performed after the installation is finished, the system has been commissioned by authorized engineer and the external input MCBs are closed.

 Warning
This procedure results in mains voltage being applied to the UPS output terminals. Confirm that the load power is safe, if there is a load to be connected with the UPS output terminal. Ensure that the load is isolated with the UPS output terminal, if the load is not ready for accepting the power.

The start-up mode of the single UPS includes normal mode start-up and battery mode start-up; refer to *2.6.3 Normal Mode Start-Up* and *2.6.4 Battery Mode Start-Up* for details.

For the detailed information of the parallel UPS, refer to *3.5.3 Power-On Commissioning For Parallel System*.

5.2 Transfer Procedures Between Operation Modes

 Note
The Inverter operation mode include Normal mode (mains inverter) and Battery module (battery inverter).

5.2.1 Transfer From Normal Mode To Battery Mode

In case of mains failure, the UPS will transfer to Battery mode. If you wish to transfer the UPS from Battery mode to Normal mode, wait few seconds for mains input recovery. Ten seconds later, the rectifier will restart automatically, and the inverter will restore the power.

5.2.2 Transfer From Inverter Mode To Bypass Mode

In Inverter mode, press the OFF button for two seconds, you can transfer the UPS to Bypass mode.

 Note
In Bypass mode, the load accepts the power not from the pure power outputted by the inverter, but from the mains power directly.

For the detailed information of the Normal mode, Bypass mode, Battery and Maintenance Bypass mode, please refer to *1.5 UPS State And Operation Mode*.

5.2.3 Transfer From Bypass Mode To Inverter Mode

In Bypass mode, press the ON button for two seconds. After the inverter runs in normal state, the UPS transfers to Normal mode.

5.2.4 Transfer From Inverter Mode To Maintenance Bypass Mode

When the UPS is running in Normal mode, you can use this procedure to make the load transfer from inverter output to maintenance bypass.

Caution
1. Before performing this procedure, you should check the LED information first, and make sure the bypass is normal and synchronizes with the inverter. Otherwise, it may result in the load power interruption for a while. 2. You should select the single POD or prepare the maintenance bypass MCB by yourself to realize this function.

1. Press the OFF for two seconds.

The inverter indicators are off and the buzzer alarms. The load transfers to the static bypass, and the inverter shuts down.

Note
Press the ALARM CLEAR button can silence the alarm, but the alarm message of the the LCD is not disappeared until the alarm status is cleared.

2. Close the maintenance bypass MCB on the single POD front panel, and the maintenance bypass can supply power to the load.

Warning
If you wish to maintain the UPS, wait ten minutes for the internal DC bus capacitance voltage discharging.

3. Disconnect the main/bypass input switch and output MCB.

Caution
1. When the UPS is in Maintenance Bypass mode, the load does not have the mains abnormal protection. 2. After the UPS transfers to the maintenance bypass, the UPS is not in operation, and the LCD is no display, and only the user terminal block (silkprint: USER) of the single POD is electrified. Be careful when removes the UPS to be maintained.

5.2.5 Transfer From Maintenance Bypass Mode To Inverter Mode

After UPS maintenance, you can use this procedure to transfer the load from the maintenance bypass to the inverter.

Warning
As no auxiliary contact information of the maintenance bypass MCB is introduced into the UPS, UPS operation restoration after maintenance must be done strictly following this procedure. Failure to observe this may cause damage to the equipment.

1. Close the output MCB on the front panel of the single POD.

2. Close the main input MCB and bypass input MCB on the front panel of the single POD.

3. Wait until the UPS starts to operate in Bypass mode, and open the maintenance bypass MCB on the front panel of the single POD.

4. Press the ON button on the operation and display panel of the UPS, and the UPS transfers to Inverter mode.

5.3 UPS Complete Shutdown

For the UPS system with POD, if you need to shut down the UPS completely, transfer the UPS from Inverter mode to Maintenance Bypass mode according to the procedures in *5.2.4 Transferring From Inverter Mode To Maintenance Bypass Mode*, so as to make no effect on the use of the load during the UPS power-off. Then if the power to the load is not needed, open the maintenance bypass MCB directly, as shown in Figure 5-1.

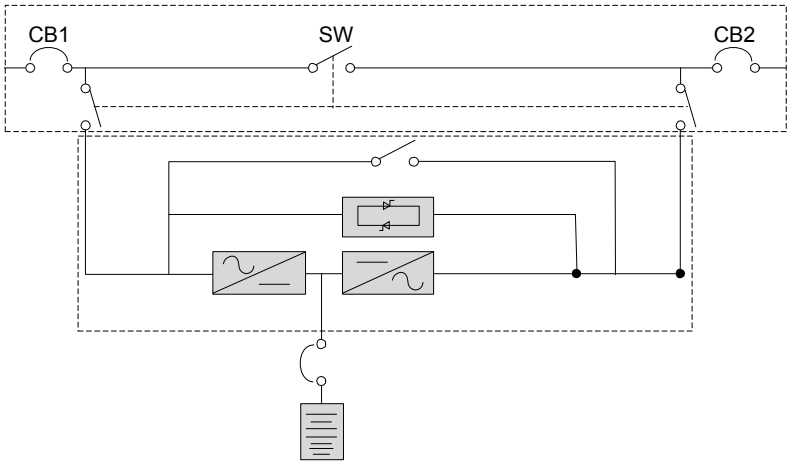


Figure 5-1 Configuration of the UPS with external maintenance bypass

For the UPS system which the distribute power is accomplished by user, if you need to isolate the UPS from AC power, disconnect the external input MCB. (If the main and bypass are independently powered, close the two input MCBs).

Caution
Cut off the maintenance power, in order to prevent the physical injury.

5.4 EPO

EPO switch is designed to switch off the UPS in emergency conditions (such as fire, flood). The system will turn off the rectifier, inverter and stop powering the load immediately (inverter and bypass output included), and the battery stops charging or discharging.

If the mains input is present, the UPS control circuit will remain active; however, the output is closed. To remove all mains power from the UPS, the external main input MCB should be disconnected.

5.5 Auto Restart

When the mains power failure, the UPS draws power from the battery to supply the load until the batteries are depleted, then the UPS will shut down.

The UPS will automatically restart and recover output power supply:

- After the mains power is restored.
- The UPS Auto Restart function is enabled.
- After the Auto Restart is delayed (default: ten minutes). During the Auto Restart delay, the UPS will charge the battery to provide a safety margin for equipment shutdown if input power fails again.

If the Auto Restart function is disabled, you can restart the UPS manually by pressing the FAULT CLEAR button.

5.6 UPS Reset

The EPO action or the following reasons such as inverter overtemperature, power-off overload, battery overvoltage and excessive switching may result in the UPS power-off. After all appropriate measures have been taken to clear the faults indicated by the alarm message appearing on the LCD, you can carry out the following steps to restore the UPS to normal operation state.

1. Press the FAULT CLEAR button to make the system exit the EPO state.
2. Press the ON button for two seconds.

Note
1. The rectifier restarts, and the bypass supplies power to the load. When the rectifier starts, the fault indicator blinks. When the rectifier runs in normal operation state (about 30 seconds later), the fault indicator will turn off. 2. Five minutes after the overtemperature signal disappears, that is, when the overtemperature fault is eliminated, the rectifier will automatically start. 3. After the EPO button is pressed, if the mains input is disconnected, the UPS will shut down completely. When the mains input is available, the UPS will start and run in Bypass mode, and also the output is available.

5.7 Language Selection

The LCD menus are available in two languages: Chinese, English.

Procedures for selecting the language:

1. From the ‘Output’ menu, press F3 or F4 (left or right arrow) to select the ‘Language’ menu.
2. Press F5 (Enter) to move the cursor to the data window of the LCD.
3. Use F3 and F4 (up and down arrow) to select the required language.
4. Press F5 (Enter) to confirm.
5. Return to the ‘Output’ menu by repeatedly pressing F2 (ESC). At this point, all texts on the LCD will be displayed in the selected language.

5.8 Changing Current Date And Time

Procedures for changing the system date and time:

1. From the ‘Output’ menu, press F3 or F4 (left or right arrow) to select the ‘Settings’ menu.
2. Press F5 (Enter) to move the cursor to the data window of the LCD.
3. Use F3 and F4 (up and down arrows) to select ‘Date & time’ option, then press F5 (Enter).
4. Move the cursor to the row in which the date and time are displayed, then press F5 (Enter).
5. Use F3 or F4 (up or down arrows), and enter the current time and date information.
6. Press F5 (Enter) to confirm, and then press F2 (ESC) to return to the ‘Output’ menu.

5.9 Control Password

The system provides the password protection for the UPS operation control. The default password of the background software is ‘123456’. Only through the password verification can you conduct the UPS and battery test operation.

Chapter 6 Communication

This chapter briefly introduces the UPS communication.

The communication ports include: intelligent card port, dry contact port and USB port.

6.1 Installing Intelligent Card

6.1.1 Intelligent Card Port

UPS provides a intelligent card port (see Figure 6-1), which is used to install the communication device options, including SIC-SNMP card, dry contact card, extended dry contact card, RS485 card and JBUS/MODBUS adapter card. The intelligent card port and USB port can be used at the same time.

Figure 6-1 Intelligent card installation

6.1.2 Intelligent Card Option

SIC-SNMP card

SIC-SNMP card (SIC card for short) is a network management card, which makes the intelligent devices (such as UPS, air conditioner, static transfer system (STS), sever power management system (SPM), and so on) produced by Emerson have network communication capability. The SIC card can also be used with the Network Shutdown designed by Emerson to provide safe automatic shutdown function for the computer, in which the Network Shutdown has been installed, to protect data and reduce loss.

Refer to the corresponding user manual for the installation and operation guide.

JBUS/MODBUS adapter card

Through the background monitoring software, JBUS/MODBUS adapter card (adapter card for short) can adopt JBUS/MODBUS (RTU) protocol to manage the UPS and the field lighting power system (FLP). The adapter card gets various electrical parameters, running state and fault type of the devices to know the operation state of the devices.

Refer to the corresponding user manual for the installation and operation guide.

RS485 card

RS485 card should be used together with Liebert® ITA series UPS provided by Emerson to realize the signal transform from RS232 to Rs485.

Refer to the corresponding user manual for the installation and operation guide.

Dry contact card

Dry contact card provides the remote with four routes relay digital signal outputs: UPS on Battery, Battery Low, UPS on Bypass or in Standby, UPS Faulty. Each dry contact signal output provides both normally open and normally closed ports for user. The dry contact card can also receive three routes digital signal inputs, two of which control the UPS turn-on and turn-off respectively, the third is reserved.

Refer to the corresponding user manual for the installation and operation guide.

Extended dry contact card

Except for the function of the UPS dry contact card, the extended dry contact card provides RS232 and RS485 communication function to support the JBUS/MODBUS (RTU) communication protocol, and provides four routes analog acquisition function.

Refer to the corresponding user manual for the installation and operation guide.

6.2 Connection Cables For Dry Contact Port

The UPS provides five dry contact ports; see Figure 1-3 for the specific positions. The silkprints of the five dry contact ports are 1, 2, 3, 4 and 5. The pin layout of each dry contact port is shown in Figure 6-2, and the port description is shown in Table 6-1.

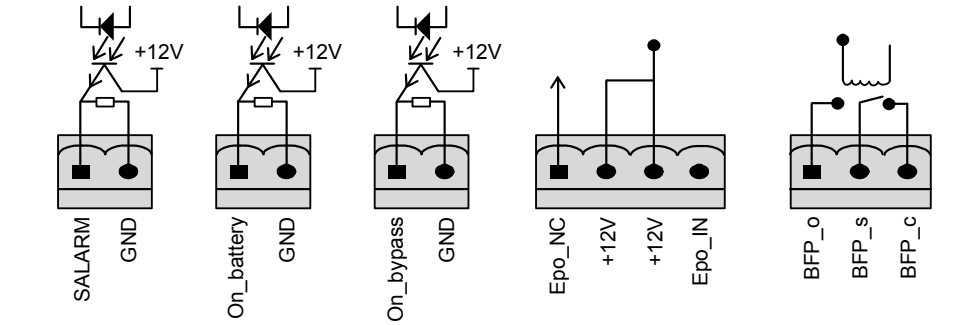


Figure 6-2 Pin layout of dry contact ports

Table 6-1 Description of the dry contact ports

Silkprint	Port name	Pin NO.	Pin name	Meaning
1	Output port of alarm	1.1	S_ALARM	The signal level is 12V when the system alarms
		1.2	GND	GND
2	Output port of battery status	2.1	ON_BATTERY	The signal level is 12V when the system runs in battery inversion mode
		2.2	GND	GND
3	Output port of bypass status	3.1	ON_BYPASS	The level is 12V when the system runs in bypass mode
		3.2	GND	GND
4	Input port of remote EPO*	4.1	EPO_NC	EPO activated when opened to 4.2
		4.2	+12V	EPO activated when opened to 4.1
		4.3	+12V	EPO activated when shorted to 4.4
		4.4	EPO_IN	EPO activated when shorted to 4.3
5	Output port of bypass reflected	5.1	BFP_O	Bypass backfeed protection relay (normally open). Closes when short circuit of bypass silicon controlled rectifier (SCR) leads to backfeed
		5.2	BFP_S	The middle point of the bypass backfeed protection relay
		5.3	BFP_C	Bypass backfeed protection relay (normally open). Opens when shoft circuit of bypass SCR leads to backfeed
Note*: Pin1 and pin2, or pin3 and pin4 of the dry contact port 4 reserves the corresponding terminals for configuring the REPO function. The REPO device also needs the shielded cable to connect to the normally open/closed remote REPO switch between the two terminals. If not necessary, you should disconnect pin3 and pin4 of the dry contact port 4, or short pin1 and pin2 of the dry contact port 4. Pin1 and pin2 of the dry contact port 4 have been shorted before delivery				

Note

The EPO action of the UPS will close the rectifier, inverter and static bypass, but it cannot disconnect the UPS mains input inside. If you want to disconnect the UPS completely, just disconnect the upstream input MCB when generating the EPO.

In emergency conditions, close the REPO switch (prepared by users) to shut down the rectifier and inverter, and the UPS is powered off. In normal condition, the REPO switch cannot cut off the UPS input power. If a switch of electronic control tripping function is adopted at the UPS input, the REPO switch can help the switch trip and thus cut off the UPS input power. The position of the REPO switch is shown in Figure 1-3, and the REPO cable connection is shown in Figure 6-3.

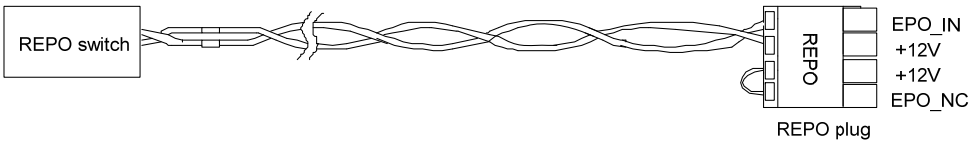


Figure 6-3 REPO cable connection

The cable connection procedures are as follows:

1. Loosen the '+12V' and 'EPO_IN' connection terminals of the REPO port.

2. Insert the two ends of the copper core cables with the insulation leather peeled into the '+12V' and 'EPO_IN' connection terminals of the REPO port, and press down the terminals. The REPO cable is complete. Ensure that the REPO cable is firmly connected to avoid no action or wrong action of the REPO caused by accidental dropping or infirm contact.

3. For parallel UPSs, when connecting the REPO cable, users should parallel connect '+12V' of the REPO port with one end of the electronic switch, and parallel connect 'EPO_IN' with the other end of the electronic switch. Note the difference between the port silkscreen '+' and '-' during connection.

When the REPO switch at the user end closes, the UPS will generate an alarm and cut off the output immediately, and the UPS will not return to the normal operation state automatically. At this point, you must change the REPO switch state, and power on the UPS manually.

Note
1. It is recommended to use 0.82mm^2 ~ 0.33mm^2 (signal cable of 18AWG ~ 33AWG) copper core cable. 2. If the switch you have configured is of electronic control tripping function, when the REPO signal takes action, you need to close the switch before restart the UPS.

6.3 Connecting USB Communication Cables

The USB port is located on the rear panel of the UPS, as shown in Figure 1-3.

The USB port can connect the monitoring software.

The methods to connect the communication cable are as follows:

Insert one end of the USB communication cable to the USB port (see Figure 1-3) on the rear panel of the UPS, and connect the other end to the USB port of the computer.

After the connection, you need to install the USB drive program in the installation disk.

Chapter 7 Maintenance

This chapter focuses on the UPS maintenance, including the fan maintenance, battery maintenance, UPS cleaning, UPS state check, UPS function check.

7.1 Fan Maintenance

The UPS fans are expected to run for 20000 hours ~ 40000 hours continuously. The higher the ambient temperature, the shorter the fan life is.

During the UPS operation, please verify the fan status once every half year by confirming that air blows out from the ventilation holes on the rear panel.

7.2 Battery Maintenance

Note
1. Never reverse-connect the battery, otherwise the fire will occure. 2. Never open the battery to prevent physical injury because of the electrolyte. If you accidentally touch the electrolyte, wash the area immediately with plenty of clean water and go to hospital.

The internal battery module of the UPS is sealed, lead-acid, maintenance-free battery. The battery life depends on the ambient temperature, charge and discharge times. High ambient temperature and deep discharge shortens the battery life.

To ensure the battery life, it is required to:

- Keep the ambient temperature ranging from 15°C to 25°C.
- Prevent small current discharge. Continuous battery operation time exceeding 24 hours is strictly prohibited.
- Charge the battery for at least 12 hours, if the battery hasn't been charged for three months at specified ambient temperature, or two months at high ambient temperature.

Note
1. Check regularly the screws at the battery connection parts, fasten it immediately if not tight. 2. Make sure that the safety equipment are complete and that the function is normal, especially that the settings of the battery management parameters are normal. 3. Measure and record the internal temperature of the battery room. 4. Check whether the battery ports are damaged or hot, and whether the chassises and the covers are damaged.

If liquid leakage and damage to the battery are found, place the battery in the anti-vitriol tank, and deal with it according to the local regulations.

The waste lead-acid battery is dangerous waste material. It is one of the national emphases to control the waste battery pollution. Its storage, transportation, usage and disposal must follow the national and local law and other criterions about the dangerous waste material and the waste battery pollution prevention.

According to the related regulations, recycle the waste lead-aid battery, and other disposal methods are prohibited. Throwing away randomly the waste lead-aid battery and other improper disposal methods can result in serious environment pollution, which will be investigated the legal responsibility.

As the provider of the lead-acid battery, Emerson has built perfect service network and recycle system for the waste battery to assist users to deal with the waste battery by law. Contact Emerson or the nearest service center for the detailed information of the recycle system about the waste battery.

Emerson is not liable for the environment results caused by failure to comply with the notices in this section or to use the waste battery recycle system provided by Emerson.

7.3 Cleaning UPS

Clean the UPS periodically, especially the ventilation holes, to ensure free airflow inside the UPS. If necessary, clean the UPS with a vacuum cleaner. Confirm that the ventilation holes are unobstructed.

7.4 Checking UPS State

It is recommended to check the UPS operation status once every half year.

Check the following items:

1. Check if the UPS is faulty: Is the FAULT indicator on? Is the UPS giving any alarm?

2. Check if the UPS is operating in Bypass mode. Normally, the UPS operates in Normal mode; if it is operating in Bypass mode, you should find out the reason, such as operator intervention, overload, internal fault, and so on.

3. Check if the battery is discharging: When AC mains is normal, the battery should not discharge; if the UPS operates in Battery mode, you should find out the reason, such as mains failure, battery test, operator intervention, and so on.

7.5 Checking UPS Functions

Note
UPS functions check procedures may cause power interruption to load!

It is recommended to check the UPS functions once every half year.

Backup the load data before conducting the UPS functions check. Procedures are as follows:

1. Press the OFF button to check if the buzzer beeps, indicators are on and the LCD display is normal.

2. Press the ALARM CLEAR button to check again if the indicators are on, the LCD display is normal and the UPS has been transferred to the inverter mode.

Chapter 8 Options

This chapter introduces the options of the UPS.

8.1 Option List

See Table 8-1 for the option list.

Table 8-1 Option list

Option name	Model	Remark
Battery module	U16-07C1	Battery module with built-in 16-cell 12V (7.2Ah) batteries
	U16-09C1	Battery module with built-in 16-cell 12V (9Ah) batteries
POD	UF-POD3U20K10	Liebert® ITA 16/20kVA UPS single POD
	UF-POD6U20K11	Liebert® ITA 16/20kVA UPS 1 + 1 parallel POD
Communication cables	UHRK2S671SL4	Liebert® ITA 16/20kVA UPS paralle communication cables
Guide rail	UF-RMKIT2438	Guide rail for rack installation
Double bus assembly	UHRK2S671SL5	Liebert® ITA 16/20kVA UPS LBS cables
	UF-LTS16-1P	16A single-phase LTS
Battery cabinet	PM32-75C4-2-50-A	Cabinet with 4-layer 32-cell 100Ah batteries
	PM32-38C4-50-A	Cabinet with 4-layer 32-cell 26Ah, 40Ah, 52Ah, 75Ah batteries
Communication options	UF-SNMP810	Intellislot UPS SIC card assembly
	UF-DRY410	Dry contact card and its options for UPS
	UF-DRY420	Extended dry contact card assembly for UPS
	UF-MODBUS410	MODBUS assembly for Liebert NX and ITA UPS
	UF-RS485	232 to 485 communication assembly for ITA UPS
	UF-RS232	RS232 communication card options for Liebert® ITA UPS
Monitoring options	UPS02R100	SiteMonitor network license monitoring software (number of users ≤ 5)
	UPS03R100	SiteMonitor network license monitoring software (number of users ≤ 20)
	UPS04R100	SiteMonitor network lisence monitoring software (limitless)
Temperature/humidity sensor	RDU-A-S01T	Temperature/humidity sensor used with SIC card together
	RDU-A-S01TH	

8.2 Battery Module

8.2.1 List Of Battery Module Options

The battery module options are listed in Table 8-2.

Table 8-2 Battery module options

Type	Name	Description
U16-07C1	Battery module (2U)	Built-in 16-cell 12V 7.2Ah batteries, be used to prolong the running time. Note: It is recommended to extend four battery modules, at least two every time. The accessory of the battery module is a cable
U16-09C1	Battery module (2U)	Built-in 16-cell 12V 9Ah batteries, be used to prolong the running time. Note: It is recommended to extend four battery modules, at least two every time. The accessory of the battery module is a cable
UHRK2S671SL25	One-into-multiple battery cable	Used to connect the battery module (at most four pieces) with the UPS

Note
1. The battery loop and the AC input are not insulated, so the hazardous voltage may exist between the battery port and the earth. Never touch them by hand to avoid electrical shock. 2. See Figure 2-25 and Figure 2-26 for the appearance and the length of the battery cable (battery module accessory). If the longer cables are needed, please contact the dealers.

8.2.2 Appearance Of Battery Module

The appearance of the battery module is shown in Figure 8-1.

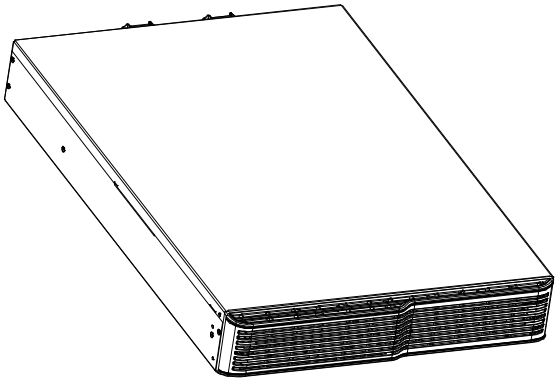


Figure 8-1 Appearance of the battery module

There is no operation and display panel on the front panel of the battery module. The plastic panel can be removed and adjusted according to actual requirement, as shown in Figure 8-2.

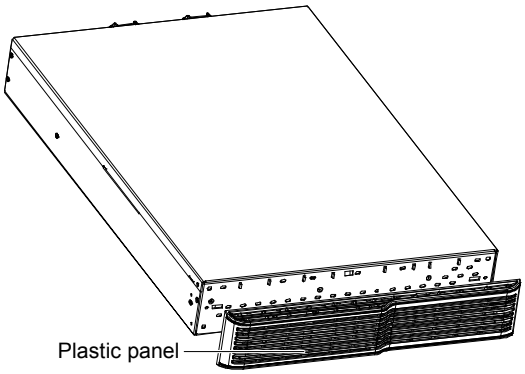


Figure 8-2 Removing the plastic panel

The battery module provides ventilation holes, battery ports and battery fuse box on the rear panel, as shown in Figure 8-3.

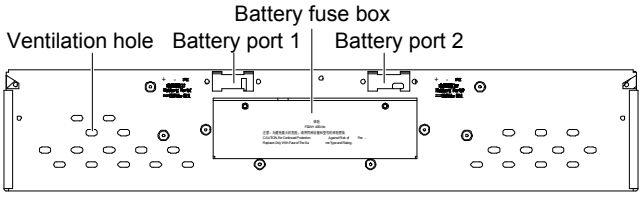


Figure 8-3 Rear panel of the battery module

8.2.3 Backup Time Of Standard Battery Module For Single UPS

For U16-07C1 battery module, when it is at full load (18kW), the backup time of four battery modules is about five minutes, and backup time of ten battery modules is about 30 minutes. When it is at half load (9kW), the backup time of four battery modules is about 15 minutes, and backup time of ten battery modules is about an hour. See Table 8-3 and Table 8-4 for details.

Table 8-3 Backup time list 1

No. of the battery module	Backup time					
	18kW	14.4kW	13.5kW	10.8kW	9kW	7.2kW
4	5m	8m	9m	13m	16m	25m
6	10m	15m	16m	25m	30m	45m
8	17m	25m	27m	35m	50m	1h
10	25m	33m	38m	50m	1h	1h30m

Table 8-4 Backup time list 2

No. of the battery module	Backup time					
	5.4kW	4.5kW	3.6kW	3kW	1.8kW	1.5kW
4	38m	50m	1h	1h25m	2h30m	3h
6	1h	1h25m	1h48m	2h10m	4h	4h53m
8	1h36m	1h54m	2h30m	3h	5h40m	7h
10	2h	2h30m	3h10m	4h	7h17m	8h21m

For U16-09C1 battery module, when it is at full load (18kW), the backup time of four battery modules is about six minutes, and backup time of ten battery modules is about 30 minutes. When it is at half load (9kW), the backup time of four battery modules is about 20 minutes, and backup time of ten battery modules is about 75 minutes. See Table 8-5 and Table 8-6 for details.

Table 8-5 Backup time list 3

No. of the battery module	Backup time					
	18kW	14.4kW	13.5kW	10.8kW	9kW	7.2kW
4	6m	10m	11m	16m	20m	31m
6	12m	18m	20m	31m	37m	56m
8	21m	31m	33m	43m	62m	1h15m
10	31m	41m	47m	62m	1h15m	1h52m

Table 8-6 Backup time list 4

No. of the battery module	Backup time					
	5.4kW	4.5kW	3.6kW	3kW	1.8kW	1.5kW
4	47m	62m	1h15m	1h46m	3h07m	3h45m
6	1h15m	1h46m	2h15m	2h42m	5h	6h06m
8	2h	2h22m	3h07m	3h45m	7h05m	7h35m
10	2h30m	3h07m	3h57m	5h	9h06m	10h26m

Note

The backup time will have some difference owing to the different battery manufacturer, model and using time. The data in above table is only for reference.

8.3 POD

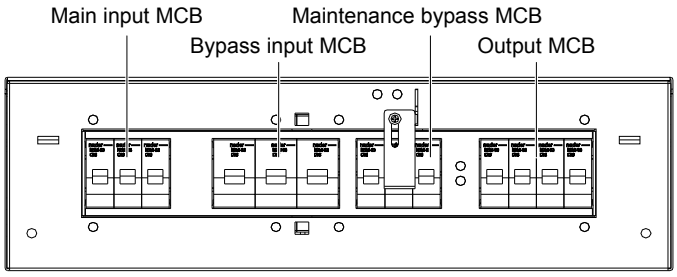
POD (option of the UPS) can provide safe and reliable power distribution function. The descriptions of the POD are listed in Table 8-7.

Table 8-7 POD

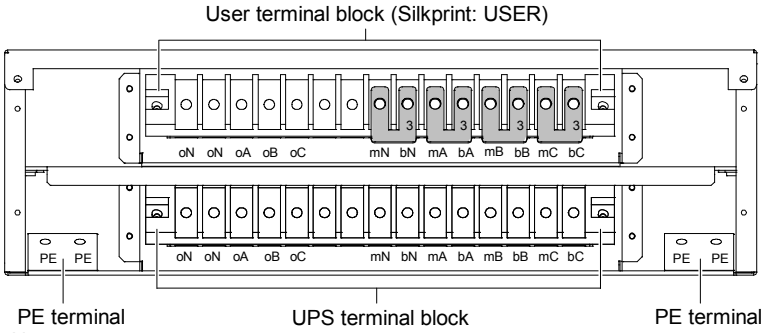
Type	Name	Description
UF-POD3U20K10	Single POD	Dimension (Height × Width × Depth): 435mm × 130mm × 500mm; Weight: 17kg
UF-POD6U20K11	1 + 1 parallel POD	Dimension (Height × Width × Depth): 435mm × 260mm × 500mm; Weight: 25kg

For the installation and commissioning of the POD, refer to *Liebert® ITA 16kVA And 20kVA UPS Power Output Distribution Unit User Manual*.

Remove the plastic panel to reveal the POD front panel; remove the rear baffle plate to reveal the POD rear panel. The front panel and rear panel of the single POD are shown in Figure 8-4. The front panel and rear panel of the 1 + 1 parallel POD are shown in Figure 8-5.



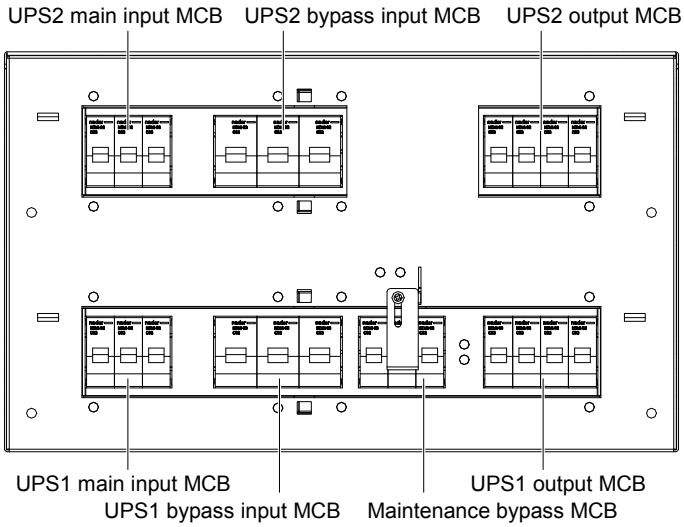
Front panel of the single POD



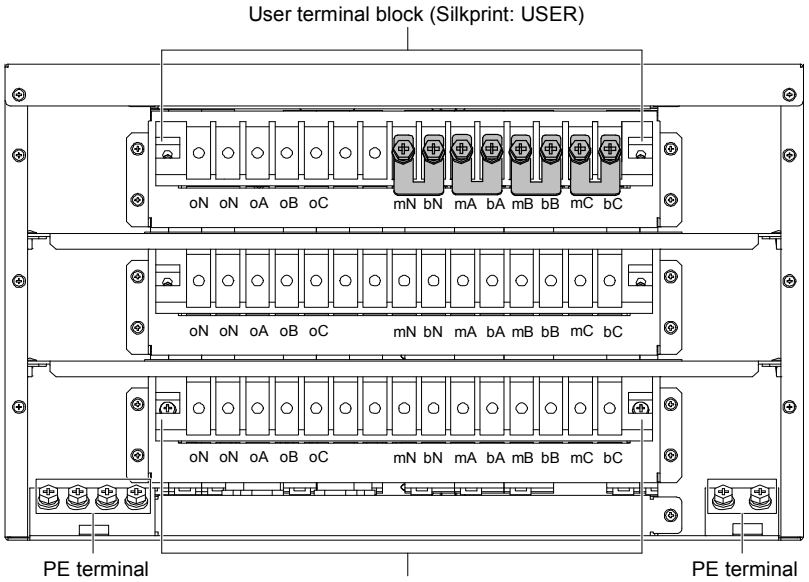
Note:
1. Main input: mA, mB, mC, mN; Bypass input: bA, bB, bC, bN;
   Output: oA, oB, oC, oN; Grounding: PE
2. In factory, four copper shorting bars 3 have been used to short terminals between mA and bA, mB and bB, mC and bC, mN and bN respectively.

Rear panel of the single POD

Figure 8-4 Front panel and rear panel of the single POD



Front panel of the 1 + 1 parallel POD



Note:
1. Main input: mA, mB, mC, mN; Bypass input: bA, bB, bC, bN; Output: oA, oB, oC, oN; Grounding: PE.
2. In factory, four copper shorting bars 3 have been used to short terminals between mA and bA, mB and bB, mC and bC, mN and bN respectively.

Rear panel of the 1 + 1 parallel POD

Figure 8-5 Front panel and rear panel of the 1 + 1 parallel POD

8.4 Communication Cables

Communication cable is compulsory in parallel system. See Table 8-8 for cable description.
Refer to *3.4.2 Connecting Parallel Cables* for the methods to connect the parallel cables.

Table 8-8 Description of the communication cable

Type	Name	Description	Appearance
UHRK2S671SL4	Communiation cable	For N + 1 parallel system, N + 1 communication cables are needed. For example, two communication cables are needed in 1 + 1 parallel system; three communicatio cables are needed in 2 + 1 parallel system; four communication cables are needed in 3 + 1 parallel system	

8.5 Guide Rail

The guide rail is used in rack installation of UPS, POD (optional) and battery module (optional). The detailed description is listed in Table 8-9.

Table 8-9 Description of the guide rail

Type	Name	Description	Appearance
UF-RMKIT2438	Guide rail for rack installation	A set of guide rail includes a left guide rail and a right guide rail, and its bearing is 50kg. Use the guide rail in the rack installation. It is applicable to the various server cabinet, UPS, modularize battery and POD with standard size	

For the rack mode installation procedure, refer to *2.4.2 Rack Installation*.

8.6 Double Bus Parts

The LBS cables are compulsory in double bus system. See Table 8-10 for the double bus parts.

Table 8-10 Double bus parts

Type	Name	Description	Appearance
UHRK2S671SL5	LBS cable	Be used to form LBS system. Two LBS cables are recommended	
UF-LTS16-1P	16A single-phase load transfer switch (LTS)	16A single-phase LTS (Height: 1U) is a single pole double-throw switch, which is used for the priority load with single power input, and is applicable to rack installation	 Front panel  Rear panel

Refer to *3.6 Installation And Commissioning For Double Bus System* for the installation and commissioning of the LBS system.

8.7 Battery Cabinet

If the cost saving and the more backup time are required, the external battery cabinet with big capacity (battery cabinet for short) is recommended.

The battery cabinet is designed with the appearance of the e-rack cabinet, in which can embed 32-cell or 30-cell CBS batteries, including cables and MCBs in the battery string. The battery cabinet has vertical pole and the layer partition board with great bearing. Top cabling and bottom cabling is available. The appearance of the battery cabinet is shown in Figure 8-6.

Figure 8-6 Appearance of the battery cabinet

Note
Change the battery MCB according to the system capacity.

The standard battery cabinets are listed in Table 8-11.

Table 8-11 Standard battery cabinet list

Battery cabinet type	UPS power	Configuration	Corresponding battery (CSB)	Dimension/Weight
PM32-75C4-2-50-A	≤ 90kVA	Four layers, can load 32-cell batteries; configure 250A ABB three-pole air breaker and 50mm^2 cables	12V 100Ah	800mm × 1100mm × 2000mm 227kg
PM32-38C4-50-A	≤ 90kVA	Four layers, can load 32-cell batteries; configure 250A ABB three-pole air breaker and 50mm^2 cables	12V 26Ah 12V 40Ah 12V 52Ah 12V 75Ah	600mm × 1100mm × 2000mm 203kg

Note

1. The connection cables between the battery cabinets are not configured. Please contact the local dealer if you need.
2. The parallel bus bar (3 pcs) of the battery cabinet is a copper bar used to connect battery cabinets in parallel. Sets = battery cabinet number - 1.

8.8 Communication Options And Monitoring Options

The communication options and the monitoring options are listed in Table 8-12.

Table 8-12 Communication options and the monitoring optios

Name	Type	Description	Appearance
SIC card	UF-SNMP810	Remote monitor UPS through TCP/IP protocol and Internet; Support remote safe shutdown; Provide an extended net port, cascade-connect up to eight temperature humidity sensors	
RS485 card	UF-RS485	Be used to connect UPS to RDU-A monitoring unit, or connect to the cascade-communication in parallel system	
MODBUS card	UF-MODBUS410	Select it when the UPS is connected to the monitoring system of building	
Dry contact card	UF-DRY410	Offer four routes relay signal outputs and three routes digital signal inputs	
Extended dry contact card	UF-DRY420	Offer four routes relay signal outputs, three routes digital signal inputs, RS232 and RS485 communication function and four routes analog signal acquisition function	
Remote monitoring software	SiteMonitor	SiteMonitor PC license monitoring software (Monitors at the site server; a VCD is delivered with the UPS, and the Network Shutdown program is provided in it)	
		SiteMonitor network license monitoring software (Number of user ≤ 5)	
		SiteMonitor network license monitoring software (Number of user ≤ 20)	
		SiteMonitor network license monitoring software (limitless)	
Temperature sensor	RDU-A-S01T	With LCD screen, the SIC card is needed to be connected	
Temperature humidity sensor	RDU-A-S02TH	With LCD screen, the SIC card is needed to be connected	

Note

1. When using the SIC card to connec to the temperature sensor as battery temperature compensation, connect to the COM1 port of the SIC card, and set DIP switch of the temperature sensor to '1'. For the installation and setting of the SIC card, refer to *RDU-SIC Card User Manual*.
2. When using the SiteMonitor monitoring software, connect the USB port on the UPS rear panel, and install the corresponding drive programmes in the SiteMonitor monitoring software VCD.

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