

Liebert ITA 30kVA And 40kVA UPS

User Manual

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Special Declaration

Personnel Safety

1. This product must be installed and commissioned by professional engineers of the manufacturer or its authorized agent. Failure to observe this could result in product malfunction or personnel safety risk.
2. Take the time to read this product manual and the safety precaution thoroughly before installing and commissioning this product. Failure to observe this could result in product malfunction or personnel safety risk.
3. This product cannot be used as power supply of life support equipment.
4. Never dispose of the internal or external battery of this product in a fire, as it may explode and jeopardize personnel safety when exposed to flame.

Product Safety

1. If this product will be stored or remain de-energized for a long period, it must be placed in a dry and clean environment within specified temperature range.
2. This product should be used in an appropriate operating environment. For details, refer to the section on the environmental requirement in this manual.
3. It is prohibited to use this product in places:
 - where the temperature and relative humidity are outside the specifications
 - subject to vibrations or shocks
 - where conductive dusts, corrosive gases, salts, or flammable gases are present
 - near heat sources or strong electromagnetic interferences

Disclaimer

Emerson disclaims any and all responsibility or liability for the defection or malfunction caused by:

- application range or operating environment outside the specifications
- unauthorized modification, improper installation or operation
- force majeure
- other actions not in compliance with the instructions in this manual

Safety Precaution

This manual contains information concerning the installation and operation of single UPS module and 1 + 1 parallel system of the Emerson ITA 30kVA and 40kVA UPS.

Read this manual thoroughly before installing, using and servicing the UPS.

The UPS must be commissioned and serviced by trained engineers approved and qualified by the manufacturer or its agent. Failure to observe this could result in personnel safety risk, equipment malfunction and invalidation of warranty.



Warning

This UPS is a product for commercial and industrial application in the second environment. Installation restrictions or additional measures may be needed to prevent disturbances.



Conformity and standards

This product complies with CE 2006/95/EC (low voltage safety) and 2004/108/EC (EMC), EMC standards of Australia and New Zealand (C-Tick), and the following UPS product standards:

* IEC62040-1 General safety requirements for UPS

* IEC62040-2-EMC

* IEC62040-3 Performance requirements and test methods

For details, refer to *Chapter 11 Specifications*.

Continued compliance requires installation in accordance with these instructions and the use of manufacturer approved accessories only.



Warning: high earth leakage current

Earth connection is critical before connecting the input supply (including both mains supply and battery).

This equipment is installed with EMC filter.

Earth leakage current is 0 ~ 1000mA.

Transient and steady state earth leakage currents, which may occur when the equipment is started, should be taken into account in the selection of instantaneous RCCBs or RCD devices.

RCCB which is sensitive to unidirectional DC pulse (class A) and insensitive to transient state current pulse must be selected.

Note also that the earth leakage currents of the load will be carried by the RCCBs or RCDs.

The equipment must be earthed in accordance with the local electrical authority codes of practices.



Warning

The selection of the prestage distribution protection equipment of the UPS system must comply with the local electric regulations.



Warning: backfeeding protection

This UPS is fitted with a dry contact closure signal for use with an external automatic disconnect device (supplied by others) to protect against backfeeding voltage into the incoming terminal through the rectifier or bypass static switch circuit. A label must be added at the external incoming bypass supply disconnect device to warn service personnel that the circuit is connected to a UPS. The text of the label has the following meaning: Risk of voltage backfeed! Isolate the UPS, then check for hazardous voltage between all terminals including the protective earth before working on this circuit.



General safety precautions

Like other types of large power equipment, the UPS and battery circuit breaker box/battery cabinet have high voltage inside. Because the components with high voltage can be accessed only when the front door (which is locked) is opened, the risk of contacting high voltage has been minimized. This equipment meets the IP20 standard, and other safety shields are provided inside the equipment.

There will not be any danger when operating this equipment according to the general instructions and the steps recommended in this manual.



User serviceable components

All the equipment maintenance and servicing procedures involving internal access need tools and should be carried out only by trained personnel. The components that can only be accessed by opening the protective cover with tools/special key cannot be maintained by the user.



Multiple power inputs

This UPS system receives power from more than one source. Disconnection of all AC source and the DC source is required before servicing.

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



Battery voltage higher than 320Vdc

All the battery physical maintenance and servicing procedures need special tools and should be carried out only by trained personnel.

Take special care when working with the batteries associated with this UPS. When the batteries are connected together, the battery terminal voltage exceeds 320Vdc and is potentially lethal.

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



Warning

When the internal fuse of the UPS is damaged, it must be replaced with fuse of the same electric parameters by professionals.



Warning

Beside the communication board is a static sensitive area, ESD-proof action is critical before contacting with this area.



This warning mark represents all the indications for human safety.

The Manual Describes The Following Equipment

Product	Model
ITA 30kVA	UHA3R-0300
ITA 40kVA	UHA3R-0400

Contents

Chapter 1 Overview	1
1.1 Features.....	1
1.2 Appearance And Components	1
1.2.1 Appearance	1
1.2.2 Components	1
1.3 Design Concept	2
1.3.1 System Design	2
1.3.2 Bypass.....	3
1.3.3 System Control Principle	4
1.3.4 UPS Power Supply Switch Configuration	4
1.4 Parallel System	5
1.4.1 Parallel System Features.....	5
1.4.2 1 + 1 Parallel System Requirements	5
1.5 Operation Modes	6
1.6 Battery Management.....	8
1.6.1 Normal Function	8
1.6.2 Advanced Function.....	9
1.6.3 Battery Temperature Compensation.....	9
1.7 Battery Protection	9
Chapter 2 Mechanical Installation	10
2.1 Precautions.....	10
2.2 Transportation.....	10
2.3 Unpacking	10
2.4 Initial Inspection	11
2.5 Environmental Requirement	11
2.5.1 UPS Location Selection	11
2.5.2 Battery Location Selection	11
2.5.3 Storage	11
2.6 Mechanical Requirement	12
2.6.1 Moving UPS.....	12
2.6.2 Clearance	12
2.7 Installation.....	12
Chapter 3 Electrical Installation.....	15
3.1 Wiring Of Power Cable	15
3.1.1 System Configuration	15
3.1.2 Maximum Steady State AC And DC Currents	15
3.1.3 CSA Of UPS Cable.....	16

3.1.4 Selection Of UPS I/O Switch	16
3.1.5 Notes	16
3.1.6 Power Cable Connecting Terminal	16
3.1.7 Protection Ground	16
3.1.8 External Protective Device.....	17
3.1.9 Power Cable Connection Steps.....	17
3.2 Wiring Of Signal Cable.....	21
3.2.1 Overview.....	21
3.2.2 Backfeed Protection Dry Contact Port.....	21
3.2.3 Output Dry Contact Port	22
3.2.4 Input Dry Contact Port	22
3.2.5 Remote EPO Input Port.....	23
3.2.6 USB Communication Port.....	24
3.2.7 Parallel And LBS Communication Ports	24
3.2.8 RS485 Communication Port	24
3.2.9 Intellislot Port.....	24
3.2.10 Signal Cable Connection Steps	24
Chapter 4 Operator Control And Display Panel.....	26
4.1 Introduction	26
4.1.1 LED Indicators	26
4.1.2 Audible Alarm (Buzzer).....	27
4.1.3 Control Keys	27
4.1.4 LCD And Menu Keys	27
4.2 LCD Screen Type	28
4.2.1 Start Screen.....	28
4.2.2 Primary Screen.....	28
4.2.3 Default Screen.....	29
4.3 Detailed Description Of Menu Items	29
4.4 Prompt Window.....	31
4.5 Alarm List.....	31
Chapter 5 UPS Operation Introduction.....	34
5.1 Brief Introduction.....	34
5.1.1 Precautions.....	34
5.1.2 Power Switch.....	34
5.2 UPS Startup Procedures.....	34
5.2.1 Check Before Startup	35
5.2.2 Single UPS Parameters Setting.....	35
5.2.3 Startup Procedures In Normal Mode	35
5.2.4 Startup Procedures In ECO Mode	36
5.2.5 Startup Procedures In Battery Mode (Battery Cold Start).....	36

5.3 Procedures For Transfer Between Operation Modes.....	37
5.3.1 Transfer From Normal Mode To Battery Mode	37
5.3.2 Transfer From Normal Mode To Bypass Mode.....	37
5.3.3 Transfer From Bypass Mode To Normal Mode.....	37
5.3.4 Transfer From Normal Mode To Maintenance Mode	37
5.3.5 Transfer From Maintenance Mode To Normal Mode	38
5.4 Battery Self-test Procedures	38
5.5 UPS Self-test Procedures	39
5.6 UPS Shutdown Procedures	40
5.6.1 Procedures For Completely Powering Down UPS.....	40
5.6.2 Procedures For Completely Powering Down UPS While Maintaining Power To Load	40
5.7 EPO Procedures	40
5.8 UPS Reset Procedures After EPO.....	41
5.9 Automatic Restart	41
5.10 Selecting Language	41
5.11 Changing Current Date And Time.....	42
5.12 Control Password.....	42
Chapter 6 Battery	43
6.1 Introduction	43
6.2 Safety.....	43
6.3 UPS Battery	44
6.4 Precautions For Installation Design	45
6.5 Battery Installation Environment And Number Of Batteries	45
6.5.1 Installation Environment:	45
6.5.2 Number Of Batteries	46
6.6 Battery Installation And Connection	46
6.6.1 Battery Installation	46
6.6.2 Battery Connection	46
6.7 Design Of Battery Room	47
6.8 Battery Maintenance	47
6.9 Disposal Of Used Battery.....	48
Chapter 7 1 + 1 Parallel System And LBS System	49
7.1 General	49
7.2 System Installation Procedures.....	49
7.2.1 Preliminary Checks.....	49
7.2.2 Parallel Installation	49
7.2.3 Power Cable	50
7.2.4 Battery Cable.....	51
7.2.5 Parallel Cable	52
7.2.6 Remote EPO	53

7.3 Operation Procedures For Parallel System.....	54
7.3.1 Check Before Startup	54
7.3.2 1 + 1 Parallel System Parameters Setting	54
7.3.3 Startup Procedures In Normal Mode	54
7.3.4 Startup Procedures In ECO Mode	55
7.3.5 Maintenance Bypass Procedures	56
7.3.6 Procedures For Isolating One UPS Module From Parallel System.....	56
7.3.7 Procedures For Inserting One Isolated UPS Module In Parallel System	57
7.3.8 Procedures For Completely Powering Down UPS.....	57
7.3.9 Procedures For Complete UPS Shutdown While Maintaining Power To Load	58
7.4 LBS System	58
7.4.1 Cabinet Installation	58
7.4.2 External Protective Device.....	59
7.4.3 Power Cable	59
7.4.4 LBS Cable	59
7.4.5 LBS System Parameters Setting	60
Chapter 8 Options	61
8.1 Option List.....	61
8.2 Option Introduction.....	61
8.2.1 LPD Power Distribution Box	61
8.2.2 Guide Rail For Rack Installation	62
8.2.3 Battery Temperature Compensation Kit.....	62
8.2.4 SIC Card.....	63
8.2.5 Relay Card.....	64
8.2.6 Modbus Card	67
8.2.7 UF-RS485 Card	67
8.2.8 Parallel Cable And LBS Cable.....	68
Chapter 9 Communication.....	69
9.1 SNMP Protocol Communication.....	69
9.2 Modbus Protocol Communication	69
9.3 Dry Contact Communication	70
9.3.1 Communication Through Relay Card	70
9.3.2 Communication Through Dry Contact Port.....	70
Chapter 10 Service And Maintenance.....	71
10.1 Safety.....	71
10.2 Key Components And Service Life Of UPS	71
10.3 Maintenance Of UPS And Options.....	71
Chapter 11 Specifications	73
11.1 Conformance And Standards.....	73
11.2 Environmental Characteristics	73

11.3 Mechanical Characteristics	73
11.4 Electrical Characteristics (Input Rectifier)	73
11.5 Electrical Characteristics (Intermediate DC Circuit)	74
11.6 Electrical Characteristics (Inverter Output)	74
11.7 Electrical Characteristics (Bypass Input).....	75
11.8 Efficiency And Loss.....	75
Appendix 1 Glossary	76

Chapter 1 Overview

This chapter briefly introduces the features, appearance and components, design concept, parallel system, operation mode, battery management and battery protection of the Liebert ITA 30kVA and 40kVA UPS (UPS for short).

1.1 Features

The UPS is connected between a critical load (e.g. a computer) and mains power to provide high quality power for the loads. The UPS has the following advantages:

- Increase power quality

The UPS protects its output against the input power change through the internal voltage and frequency controller.

- Improve noise rejection

Due to the application of AC-DC-AC conversion mode, the noise in the input power is effectively filtered, and the load gets clean power supply.

- Provide mains failure protection

If the input power fails, the UPS will work in battery mode, and the power supply to the loads will not be interrupted.

1.2 Appearance And Components

1.2.1 Appearance

The appearance of the single UPS is shown in Figure 1-1.



Figure 1-1 Appearance of single UPS

1.2.2 Components

The front panel of the single UPS is shown in Figure 1-2.

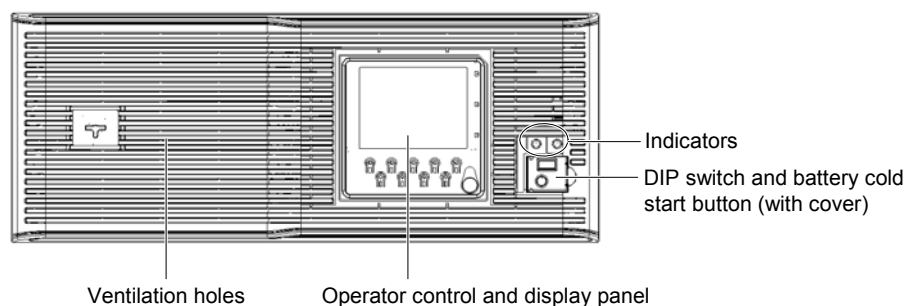


Figure 1-2 Front panel of single UPS

The rear panel of the single UPS is shown in Figure 1-3.

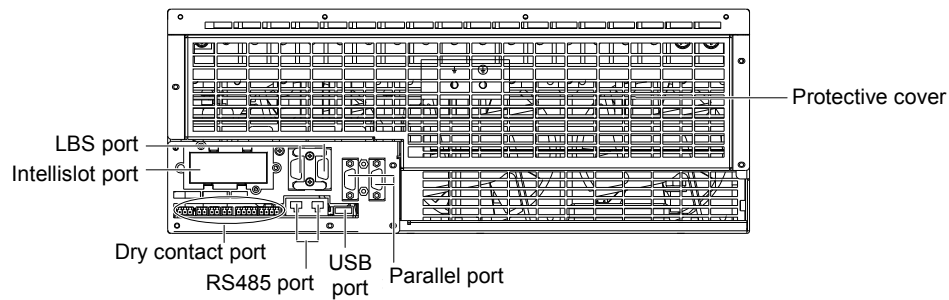


Figure 1-3 Rear panel of single UPS

The front panel of the standard UPD is shown in Figure 1-4.

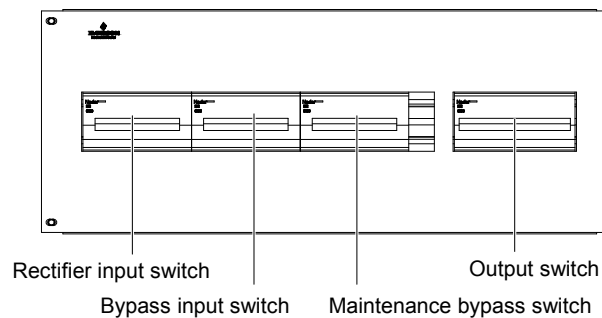


Figure 1-4 Front panel of standard UPD

The rear panel of the standard UPD is shown in Figure 1-5.

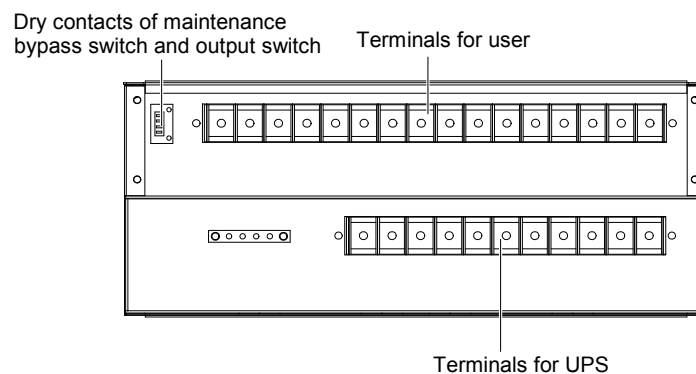


Figure 1-5 Rear panel of standard UPD

**Note**

Unauthorized personnel are not allowed to open the UPS chassis cover.

1.3 Design Concept

1.3.1 System Design

This section introduces the working principle of the single UPS module. The UPS adopts AC-DC-AC converter (as shown in Figure 1-6). The first stage conversion (AC-DC) adopts three-phase high frequency rectifier to convert the three-phase input voltage into stable DC bus voltage.

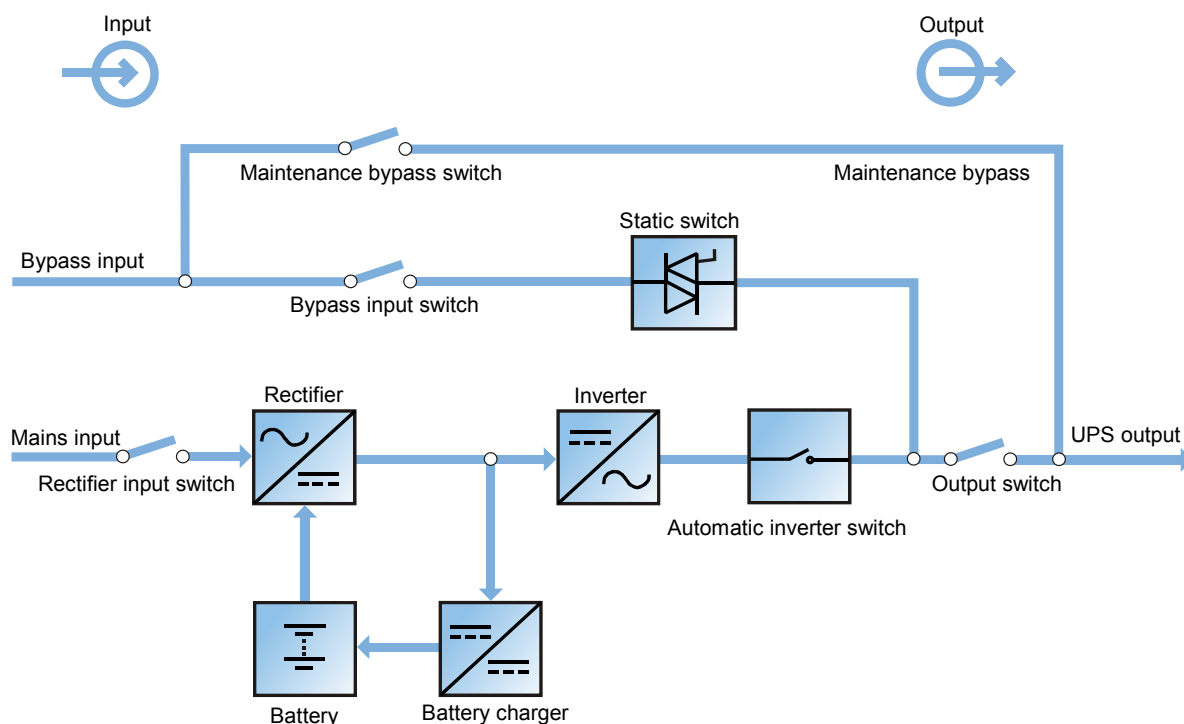


Figure 1-6 Block diagram for working principle of UPS

The UPS has its own battery charger and adopts advanced temperature compensation technology to effectively prolong the battery service life. The inverter mainly adopts large power IGBT, and adopts advanced SVPWM technology for control, to invert the DC bus voltage back to AC voltage.

When the mains is normal, the rectifier and inverter work together to supply the loads and charge the battery.

When the mains is abnormal, the rectifier stops working, and the battery supplies power to the loads through the inverter. If the battery voltage falls to end of discharge (EOD) voltage and the mains still has not been recovered, the UPS will shut down (if the system uses split bypass configuration and the bypass is normal, the system will transfer to bypass). The battery EOD voltage is preset. When the mains is abnormal, the battery maintains the UPS operation till the battery voltage is reduced to EOD voltage and the UPS shuts down, this time is called 'Backup Time'. The length of backup time depends on the battery capacity and the loads.

1.3.2 Bypass

Through the intelligent control of the 'Static Switch' module (as shown in Figure 1-6) containing the controllable electronic switch, the loads can be supplied by the inverter or the bypass. In normal situation, the loads are supplied by the inverter, in which case the inverter switch at inverter side is closed. In the case of overload (the overload delay time expires) or inverter failure, the inverter switch is opened, and the 'Static Switch' module will automatically transfer the loads to the bypass.

In normal operating state, to realize the uninterrupted transfer between inverter and bypass, the inverter output must be synchronized with the bypass.

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

Besides, the UPS has a manual maintenance bypass switch for shutdown of the UPS upon maintenance. In this situation, the bypass will directly supply the critical loads through the maintenance bypass.



Note

When the load is supplied by the bypass or maintenance bypass, the power supply quality will be uncertain.

1.3.3 System Control Principle

Normal operation

Normal mode: It means that the UPS has normal input mains, the rectifier and inverter operate normally, the load is supplied by the inverter, the battery circuit breaker is closed, and the battery is in stable floating charge state.

(1+1 Parallel System) Note: As the two UPS module outputs are connected in parallel, the system checks that the inverter control circuits are perfectly synchronized with one another and with the bypass in terms of both frequency and phase, and that they have the same output voltages. Current supplied to the load is automatically divided among UPSs. A warning message appears while synchronization is in progress.

Mains abnormal

When the mains fails or is abnormal, the rectifier will stop working automatically, and the system will transfer to battery output (through inverter). The length of the operation time in battery mode depends on the load and the battery capacity. During this period, if the battery voltage falls to the EOD voltage and the mains still has not been recovered, the inverter will stop working automatically, and the UPS operator control and display panel will display corresponding alarm messages. If the system uses split bypass configuration and the bypass is normal, the system will transfer to bypass.

Mains recovery

When the mains resumes normal within allowable time, the rectifier will start automatically (at this time its output power will increase gradually) and supply the load and charge the battery again. Therefore, the power supply to the load will not be interrupted.

UPS module failure

In case of inverter failure, automatic inverter switch failure, output fuse blowout and bypass STS failure, the load will automatically transfer to the bypass, and the output power supply will not be interrupted. In this situation, please contact the local customer service center of Emerson Network Power Co., Ltd for technical support.

(1+1 Parallel System) In the event of a fault in a UPS module, it will automatically exit from the parallel system. If the system is still capable of providing the required load, the remaining modules will continue to supply the load with no interruption. If the remaining modules are no longer capable of fulfilling power requirements, the load will automatically transfer to the bypass.

Overload

If the inverter is overloaded or the inverter current remains outside the specifications (refer to Table 11-6) longer than the specified time, the load will automatically transfer to the bypass without power interruption. If both the overload and the current are reduced to a level within the specified range, then the load will be transferred back to the inverter. In case of output short circuit, the load will be transferred to the bypass, and the inverter will shut down. Five minutes later, the inverter will start up automatically. If the short circuit is removed at this point, the load will be transferred back to the inverter. The transfer is determined first of all by the features of the protective device of the system.

In the above two situations, the UPS operator control and display panel will display alarm messages.

(1+1 Parallel System) The control logic system constantly monitors load requirements and controls the power supplied by the two UPS modules. In the event that an overload condition is sustained for greater than a preset time, the load will transfer to the bypass, when the number of active modules is unable to satisfy load requirements. The load returns to the inverter if the power is reduced to a value that can be sustained by the number of active modules in the system.

Maintenance bypass

The UPS has a second bypass circuit, i.e. maintenance bypass, which provides a safe working environment for the engineers to provide regular maintenance or repair to the UPS system and at the same time provide unregulated mains supply to the loads. The maintenance bypass can be manually selected through the maintenance bypass switch, and it can be disconnected by turning the switch to OFF.

1.3.4 UPS Power Supply Switch Configuration

Figure 1-7 describes the block diagram of the UPS module. The UPS has split bypass configuration (that is, the bypass adopts independent mains input) and common input configuration. In split bypass configuration, the static

bypass and maintenance bypass share the same independent bypass power supply. Where a separate power source is not available, the input supply connections of the bypass input terminal and rectifier input terminal at the back-end of the UPD would be linked together (linked before delivery) to make the bypass input and rectifier input use mains power of the same route.

During the normal operation of the UPS, except for the maintenance bypass switch Q3, other switches shall be closed.

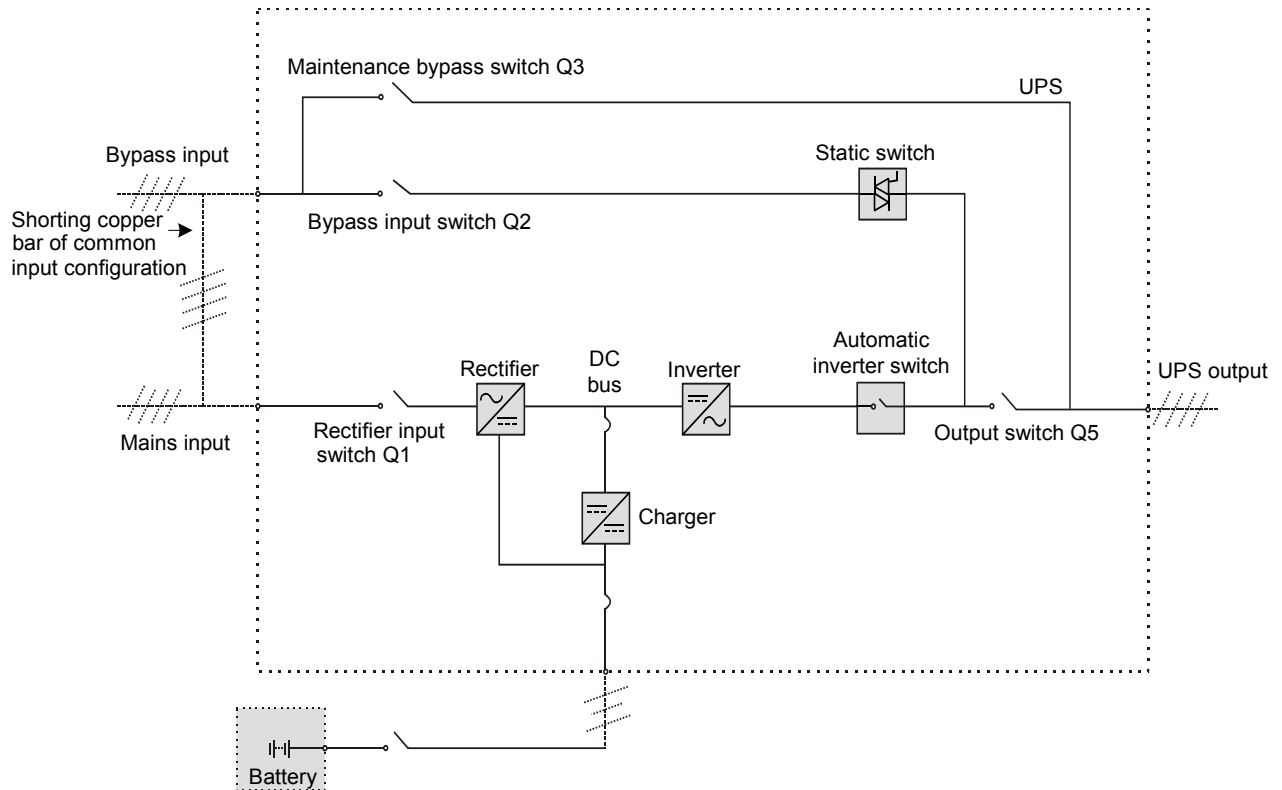


Figure 1-7 UPS power supply switch configuration

1.4 Parallel System

Two UPS modules can be parallel-connected to form a 1 + 1 parallel system to increase the system capacity or reliability, or both. The load is equally shared between the paralleled UPS modules.

Moreover, two UPS modules or 1 + 1 parallel system can comprise a dual bus system (LBS). Each UPS module or parallel system has independent output. Output synchronization is achieved through the LBS cable, thus enabling seamless load transfer between the two systems.

1.4.1 Parallel System Features

1. The hardware and software of 1 + 1 parallel system are completely the same as those of the single module. The parallel system configuration is achieved through settings in configuration software or panel buttons.
2. Parallel cables are connected in a ring, providing both system reliability and redundancy. LBS cables are connected between any two UPS modules of each bus. The intelligent parallel logic provides the user with maximum flexibility. For example, shutting down or starting up UPS modules in a parallel system can be done in any sequence. Transfers between normal mode and bypass mode of operation are seamless and self-recoverable, that is, the overload is cleared, and the system will be automatically recovered to its original operation mode.
3. The total load of the parallel system can be queried from each UPS module's LCD.

1.4.2 1 + 1 Parallel System Requirements

Two paralleled modules behave as if it were one large UPS with the advantage of presenting higher reliability. To ensure that all modules are equally utilised and to comply with relevant wiring rules, the following requirements apply:

1. All UPS modules must be of the same rating and must be connected to the same bypass source.
2. The bypass and rectifier input sources must be connected to the same neutral line input terminal.
3. Any RCD, if installed, must be of an appropriate setting and located upstream of the common neutral line input terminal. Alternatively, the device must monitor the protective earth current of the system. Refer to *Warning: high earth leakage current* before *Contents*.

1.5 Operation Modes

The UPS has the following operation modes:

- Normal mode
- Battery mode
- Automatic restart mode
- Bypass mode
- Maintenance mode
- ECO mode
- 1 + 1 Parallel redundancy mode (system expansion)
- LBS system mode
- Common battery string mode

Normal mode

As shown in Figure 1-8, the mains is rectified by the UPS rectifier and then inverted by the inverter to supply uninterrupted AC power to the loads. At the same time, the charger will charge the battery.

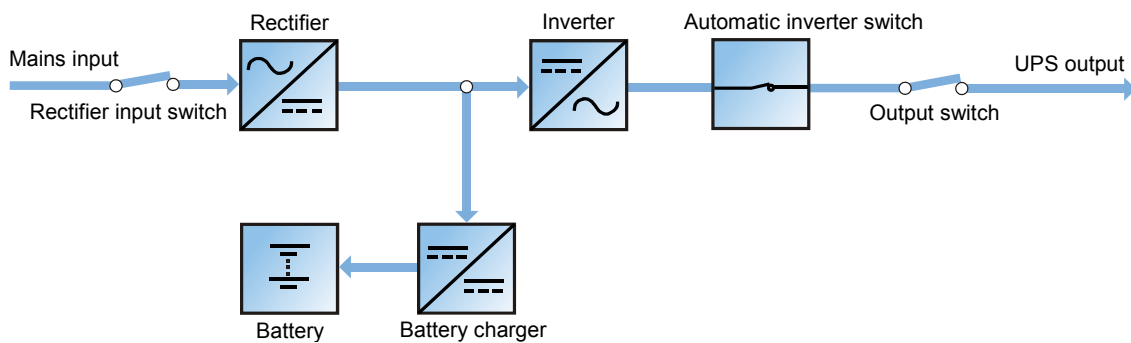


Figure 1-8 Schematic diagram of normal mode

Battery mode

As shown in Figure 1-9, the operation mode in which the battery provides backup power supply to the loads through the rectifier and inverter is called battery mode. Upon mains failure, the system will automatically transfer to the battery mode with no load power interruption. When the mains is recovered, the system will automatically transfer back to the normal mode without any manual intervention, and the power to the load will not be interrupted.

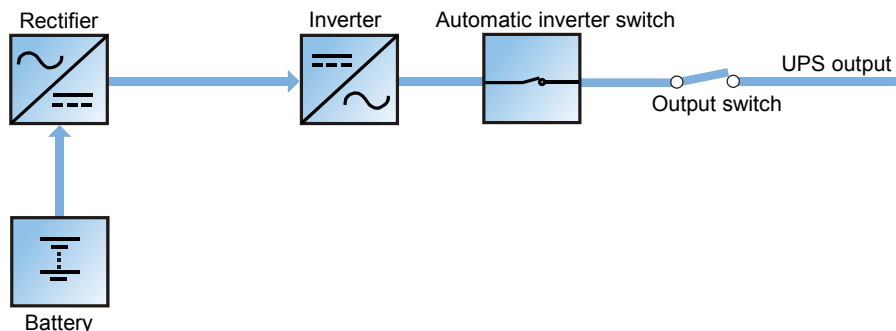


Figure 1-9 Schematic diagram of battery mode

Note: Battery cold start function is available for switching the UPS on from Battery (charged) mode directly during mains failure. Therefore, the battery power supply can be used independently to improve the availability of the UPS.

Automatic restart mode

The UPS has automatic restart function. When the inverter shuts down because the mains fails and the battery discharges to EOD voltage, if the mains is recovered, the UPS will restart automatically after a certain time of delay. This function and the automatic restart type can be set by the service engineer authorized by Emerson.

During the process of automatic restart time of delay, the UPS will charge the battery to protect against the power-off risk of the load device caused by mains power failure.

If the automatic restart function has not been set, the user can manually start the UPS through pressing the FAULT CLEAR key first and ON key next.

Bypass mode

As shown in Figure 1-10, in normal mode, in case of inverter failure, inverter overload or inverter manual shutdown, the static switch will transfer the load from the inverter side to bypass side, with no interruption in power to the load. At this time, if the inverter and bypass are not synchronized, the power of the load has transitory interruption, with time of less than 20ms.



Figure 1-10 Schematic diagram of bypass mode

Maintenance mode

As shown in Figure 1-11, if the UPS maintenance or service is required, you may use the manual maintenance bypass switch to transfer the load to maintenance bypass, with no interruption in power to the load. This maintenance bypass switch is fitted in UPD and rated for full load of one module.

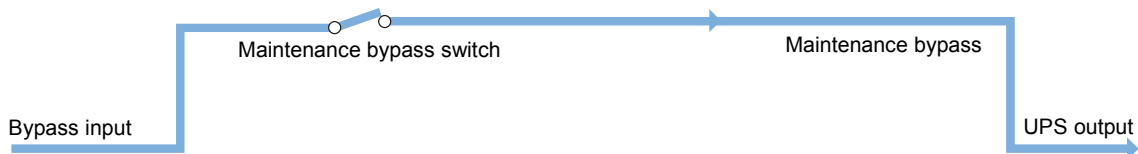


Figure 1-11 Schematic diagram of maintenance mode

ECO mode

All power switches and the battery switches are closed except for the maintenance bypass switch, and the system prefers to put the load on the bypass, to achieve the aim of energy-saving. When the bypass supply is within the range of normal frequency and normal voltage (adjustable), the load is powered by the bypass, with the inverter on stand-by; when the voltage and/or frequency of the bypass supply are beyond the pre-defined and adjustable limits, the system will transfer to the inverter output, with time of less than 20ms. In this mode, the system can normally charge the battery.

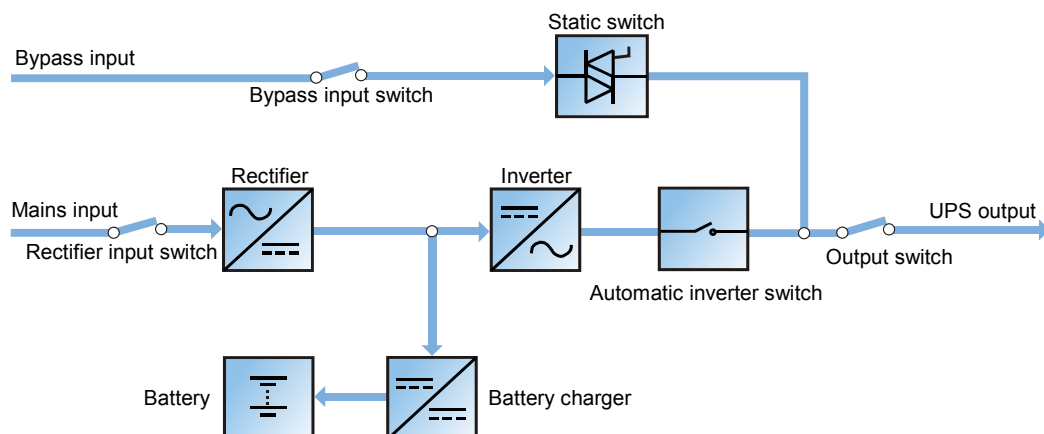


Figure 1-12 Schematic diagram of ECO mode

If ECO mode is required, adjust the corresponding parameters through the operator control and display panel.

The operation method of ECO mode is the same as the description in *Chapter 5 UPS Operation Introduction*. However, in normal mode, the load is powered by the bypass, the inverter indicator is off, and the LCD displays 'Bypass mode', and the transfer interval time is less than 20ms.



Warning

In ECO mode, the load is not protected against mains distortion.

1 + 1 Parallel redundancy mode (system expansion)

For higher capacity or higher reliability or both, the outputs of two UPS modules can be programmed for directly paralleling while a built-in parallel controller in each UPS module ensures automatic load sharing. For the operation principle diagram of the parallel redundancy mode, see Figure 7-2.

LBS mode

A dual bus system consists of two independent UPS systems, each containing one or more parallel UPS modules. The dual bus system has high reliability and is suitable for load with multiple inputs. For single-input load, an STS can be installed to power the load. For the operation principle diagram of the LBS mode, see Figure 7-9 and Figure 7-10.

Common battery string mode

It means that when the two UPS modules are parallel connected, each UPS module can use the same battery string to achieve the aim of cost-saving, clearance-saving and efficiency-improving.



Note

The batteries of different manufacturers, different types and different use time are not allowed to be used together. The common battery string mode is suitable for parallel system only, and does not support the LBS mode.

1.6 Battery Management

The following battery management functions are set by the service engineer through the Emerson setting software.

1.6.1 Normal Function

1. Constant current boost charge

The charge current can be set.

2. Constant voltage boost charge

The maximum boost charge voltage should not exceed 2.4V/cell.

3. Float charge

The float charge voltage should be between 2.2V/cell and 2.3V/cell.

4. Automatic transfer to float charge

When the charge current is less than 'Threshold of Equalize Charge to Float Charge' or 0.5A, the charger will automatically transfer from boost charge to float charge. When boost charge time exceeds the limit of 'Equalize Charge Protect Time Limit', the charger will be forcibly transferred to float charge for protecting the battery.

5. Float charge temperature compensation (optional)

This function must be used together with the battery temperature detection device. The Emerson battery temperature sensor is a standard option for your selection.

6. EOD protection

When the battery voltage drops to the EOD voltage, the battery converter shuts down automatically and the battery is isolated to avoid further battery discharge. The EOD voltage is settable from 1.6V/cell to 1.9V/cell (VRLA).

7. Battery low pre-warning time

The battery low pre-warning time is adjustable between 3min and 60min. The default setting is 5min.

8. Maximum battery discharge time

When the battery has small current discharge for a long time, the battery is over discharged and even has unrecoverable damage, thus setting a battery discharge time to protect the battery is essential. The limit of time setting shall be configured by service engineer through the Emerson setting software.

9. Maximum boost charge protection time

To protect against the battery overcharge damage caused by long time boost charge, a protect time setting is essential. The limit of time setting shall be configured by service engineer through the Emerson setting software.

1.6.2 Advanced Function

The UPS provides battery maintenance test function. At periodic intervals, 20% of the rated capacity of the battery will be discharged automatically, and the actual three-phase load must exceed 20% of the nominal UPS capacity. If the load is less than 20%, the automatic discharge cannot be executed. The periodic interval can be set from 30 to 360 days. The battery maintenance test function can be disabled through the Emerson setting software.

Conditions: Battery at float charge for at least 5h, load equal to 20% ~ 100% of rated UPS capacity.

Trigger: Automatically, or manually through the command of battery maintenance test in LCD.

Interval: 30 ~ 360 days (default setting: 60 days).

The UPS also provides battery capacity self-test function: Periodically test the battery activity, test the battery residual capacity, judge the battery quality, and then provide the corresponding measures. The capacity self-test is started by the user through the operator control and display panel. During the capacity self-test, the battery will continuously discharge to the battery undervoltage shutdown threshold. After the self-test is finished, the system will update the battery curve table. The capacity self-test command is valid only one time, without any memory. During the capacity self-test, if the battery maintenance requirement is satisfied, the system will generate audible/visual alarm and give corresponding records.

Conditions: System load rate within 20% ~ 100%, battery float charge at least 5h, and generator not connected; the current system is in float charge state.

Trigger: Start up through the LCD.

Note:

1. The battery will continuously discharge to the battery undervoltage shutdown threshold, then the battery transfer to the charging state. When the capacity self-test is finished, the system will update the battery curve table.
2. The user can manually stop the capacity self-test operation through the LCD.

1.6.3 Battery Temperature Compensation

The UPS system has battery charge temperature compensation function. When the ambient temperature is increased, the DC bus voltage (which charges the battery) will be reduced correspondingly to provide optimal charging voltage for the battery, thus prolonging the battery service life time.

This function must be used together with the Emerson battery temperature detection device (a standard option).

1.7 Battery Protection

The following battery protection functions are set by the service engineer through the Emerson setting software.

Battery low pre-warning

The battery low pre-warning occurs before the EOD. After this pre-warning, the battery should have the capacity for three remaining minutes discharging with full load. The time can be configured from 3min to 60min.

EOD protection

When the battery voltage drops to the EOD voltage, the battery converter shuts down automatically. The EOD voltage is adjustable from 1.6V/cell to 1.9V/cell (VRLA).

Chapter 2 Mechanical Installation

This chapter briefly introduces the mechanical installation of the UPS, including the precautions, initial inspection before installation, environmental requirement, mechanical requirement and installation diagram.

2.1 Precautions

This chapter describes the environmental and mechanical requirements and mechanical considerations that must be taken into account when planning the positioning and cabling of the UPS equipment.

Because each site has its particular characteristics, this chapter does not provide the detailed installation steps, it only acts as a guide for the general procedures and practices that should be observed by the installing engineer, so that they can properly handle the specific situation of the site.



Warning: professional installation required

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



Warning: battery danger

Take special care when installing batteries. When connecting batteries, the battery terminal voltage will reach 320Vdc, which is fatal to human being.

1. Please wear safety glasses to protect the eyes from being damaged by arc.
2. Remove all the metal items, including finger rings, watch, etc.
3. Use tools with insulated handle.
4. Wear rubber gloves.
5. If the battery has electrolyte leakage or the battery is damaged, it must be replaced. Place the battery into the container that can withstand sulfuric acid and dispose of it according to the local regulations.
6. If the skin contacts the electrolyte, flush it with water immediately.

2.2 Transportation

Railroad transportation and shipping are the recommended means of transportation. If truck transportation is unavoidable, choose roads that are less bumpy in order to protect the equipment.

The UPS is heavy (see Table 11-3 for the weight). It is recommended to use mechanical equipment such as an electric forklift to unload and move the equipment to the place closest to the installation site.

2.3 Unpacking

Unpack the UPS and battery packages under the guidance of authorized service engineer. Steps:

1. Remove the top cover.

Use a hammer or straight screwdriver to straighten the connection hooks that connect the top cover, as shown in Figure 2-1.



Figure 2-1 Straightening the hook

2. Remove the module, then unpack the protective foams.

2.4 Initial Inspection

Before installing the UPS, carry out the following inspections:

1. Ensure that the environment of the UPS equipment room meets the environmental requirement specified in the product technical specifications, especially the ambient temperature, ventilation conditions, and the dust situations.
2. Unpack the UPS and battery under the guidance of authorized service engineer. Visually inspect whether the inside and outside of the UPS and battery have any transportation damage. If there is any damage, report to the carrier immediately.
3. Verify the UPS label and confirm the correctness of the UPS. The UPS label is attached on the back of the door. The UPS model, capacity and main parameters are marked on the label.

2.5 Environmental Requirement

2.5.1 UPS Location Selection

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

The UPS uses forced cooling by internal fans. Cooling air enters the UPS through the ventilation grills at the front of the equipment and exhausted through the ventilation grills at the back of the equipment. Do not obstruct the ventilation holes (ventilation grills). The rear of the UPS should be kept a distance at least 200mm from the wall to avoid blocking the UPS heat dissipation, thus reducing the UPS internal temperature and improving the UPS life.

If necessary, install indoor extractor fans to aid cooling-air flow to avoid room temperature buildup. Air filters (optional) should be used when the UPS is to operate in a dirty environment.

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

Note 2: If the UPS is working in ECO mode, the power consumption will be less than that in Normal mode. Proper air conditioning system shall be selected according to the normal operating mode.

2.5.2 Battery Location Selection

Batteries generate some amount of hydrogen and oxygen at the end of charge, so the fresh air volume of the battery installation environment must meet the EN50272-2001 requirements.

The ambient temperature is the main factor that affects the battery capacity and life. The normal operating temperature of the battery is 20°C. If the ambient temperature is higher than 20°C, the battery life will be reduced. If it is lower than 20°C, the battery capacity will be reduced. In normal situation, the allowable ambient temperature for the battery is 15°C to 25°C. The ambient temperature of the battery shall be maintained constant, and the battery shall be kept away from heat source and air outlet.

Battery can be installed inside the specialized battery cabinet which shall be close to the UPS. If the battery is placed on the raised floor, bracket shall be installed under the floor, just as for the UPS. If the battery adopts rack mounting or is mounted far from the UPS with other installation mode, the battery circuit breaker shall be installed near the battery, and the cabling distance shall be minimized.

2.5.3 Storage

Should the UPS not be installed immediately, it must be stored with the original packaging in a room for protection against excessive humidity and heat sources (see Table 11-2). The battery needs to be stored in a dry and cool place with good ventilation. The most suitable storage temperature ranges from 20°C to 25°C.

**Warning**

During battery storage, periodically charge the battery according to the battery manufacturer instructions. In the charge process, temporarily connect the UPS to the mains and activate the battery by recharging the battery.

2.6 Mechanical Requirement

2.6.1 Moving UPS

**Warning**

1. The lifting equipment for moving the UPS shall have enough lift capacity.
2. Vertical hanging of the UPS is not allowed.

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

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

2.6.2 Clearance

Because the UPS has no grill at the two sides, there is no special clearance requirement on the two sides.

Besides the local regulations, to enable routine tightening of the power terminals within the UPS, it is recommended that clearance around the front of the UPS should be sufficient to enable free passage of personnel with the door fully open. Meanwhile, maintain at the back of the equipment a clearance at least 200mm to permit adequate circulation of air coming out of the UPS.

2.7 Installation

This product adopts rack installation method. Procedures:

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

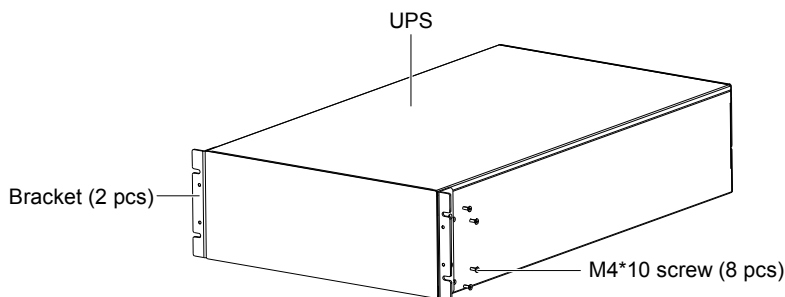


Figure 2-2 Installation of brackets

**Note**

It is prohibited to move the UPS through the brackets.

2. Install guide rails.

If users select Liebert ITA series UPS and its options, and also select rack installation, then guide rails (optional) are required.

Procedures for installing the guide rails:

- 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 2-3, and confirm its retractable function respectively.

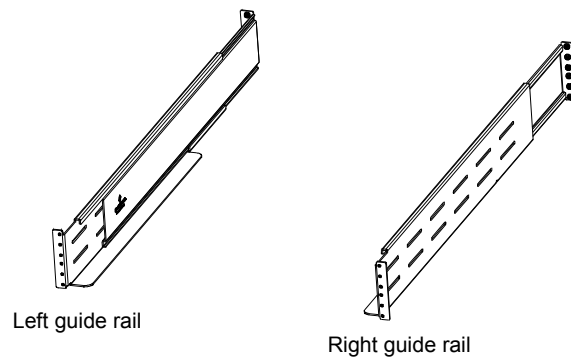


Figure 2-3 Appearance of guide rail

Distinguish the guide rail screws and the panel screws according to Figure 2-4.

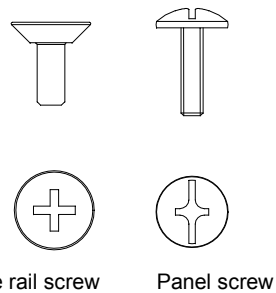


Figure 2-4 Appearance of screw

2) Adjust the length of the guide rails according to the dimension 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 with eight guide rail screws. Each left guide rail and right guide rail needs four guide rail screws respectively, as shown in Figure 2-5.

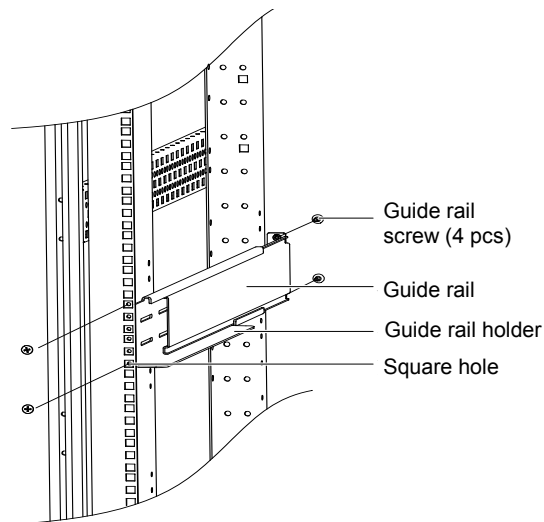


Figure 2-5 Installation of guide rail



Note

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

The guide rails installation is finished, as shown in Figure 2-6.

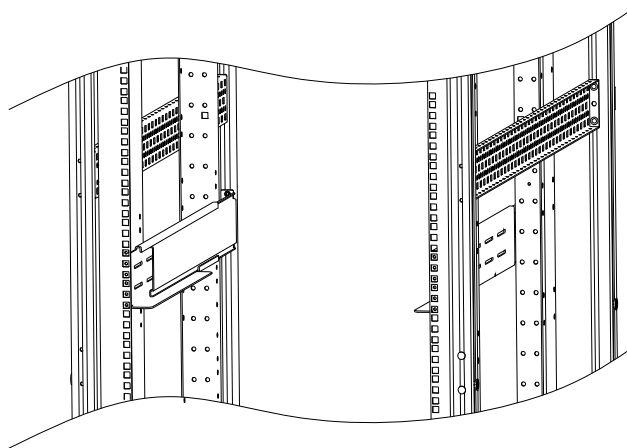


Figure 2-6 Complete installation of guide rails

3. Place the UPS on the guide rails in the rack, and push it completely into the rack. Use four M6*16 panel screws to fix the UPS in the rack through the installation holes of the brackets, as shown in Figure 2-7.

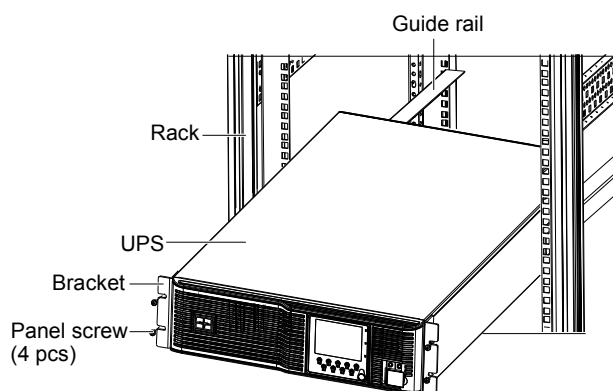


Figure 2-7 Installation of single UPS

4. The installation method of the UPD (UPS Power Distribution Unit) is the same as that of the single UPS. Just repeat the installation procedures of the UPS to install and fix the UPD. Then use four M6*16 panel screws to fix the UPS in the rack through the installation holes of the brackets, as shown in Figure 2-8.

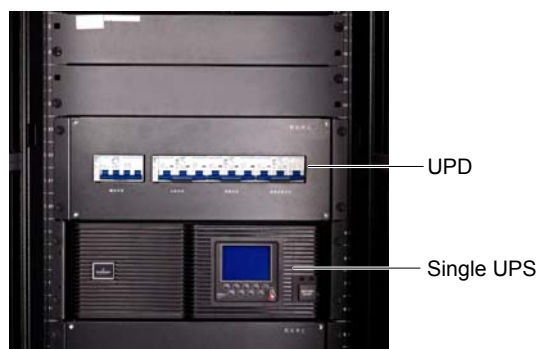


Figure 2-8 Complete rack installation of single UPS and UPD

Chapter 3 Electrical Installation

This chapter mainly introduces the electrical installation of the UPS, including the power cable and signal cable connecting procedures and methods.

After completing the mechanical installation of the UPS, it is required to connect the power cable and signal cable of the UPS. All the signal cables, whether shielded or not, shall be kept away from the power cables.



Warning

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

3.1 Wiring Of Power Cable

3.1.1 System Configuration

The cable size of the system power cable shall meet the following requirements:

UPS input cable

The cable size of the UPS input cable differs with the UPS power ratings and input AC voltages, provided that it meets the requirement of maximum input current, including the maximum battery charge current, see Table 3-1.

UPS bypass and output cable

The cable size of the UPS bypass and output cable differs with the UPS power rating and output AC voltages, provided that it meets the requirement of nominal output or bypass current, as shown in Table 3-1.

Battery cable

Each UPS connects to its battery through the three cables connecting to the positive pole, negative pole and neutral line. The cable size of the battery cable differs with the UPS power ratings, provided that it meets the battery discharge current requirement when the battery discharges to near EOD voltage, as shown in Table 3-1.

3.1.2 Maximum Steady State AC And DC Currents

The power cable must be selected according to the current and voltage values in Table 3-1 as well as the local wiring regulations, and take environmental conditions (temperature and physical media) into consideration, then refer to Table 3B in IEC 60950-1.

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

UPS power (kVA)	Rated current (A)					Bus stud bolt/nut specification	
	Max. input current ^{1,2}	Output/bypass current ² at full load			Battery discharge current (+, -, N) at min. battery voltage	Input/battery/output/ bypass cable	Recommended torque (N.m)
		380V	400V	415V			
30 (3-in, 3-out)	51	45	44	42	96/96/20	M6/M8/M6/M6	4.8/12/4.8/4.8
40 (3-in, 3-out)	68	60	58	56	127/127/25	M6/M8/M6/M6	4.8/12/4.8/4.8
Note: When selecting the battery cables, a max. volt drop of 4Vdc is permissible at the current ratings given in Table 3-1. Do not form coils, so as to minimize the formation of EMI. 1. Input mains current for rectifier and bypass. 2. Non-linear load (like switch power) affects the design of output and bypass neutral line. The neutral line current may exceed the rated phase current, at most 1.5 times of the rated phase current							

3.1.3 CSA Of UPS Cable

The minimum CSA of the UPS cable is listed in Table 3-2.

Table 3-2 Min. CSA of the UPS cable (unit: mm², ambient temperature: 25°C)

Model	Input	Output	Bypass	Neutral line	Earth cable	Battery
30kVA (3-in, 3-out)	16	16	16	25	16	35
40kVA (3-in, 3-out)	16	16	16	25	16	35

3.1.4 Selection Of UPS I/O Switch

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

 Note
The UPS is large current leakage equipment. The switch with current leakage protection function is not recommended.

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

Model	Input port	Recommended capacity of input external switch	Battery switch	Output port	Recommended capacity of output external switch
30kVA (3-in, 3-out)	Terminal block	63A (3P), bypass 100A (3P)	DC 160A (3P)	Terminal block	63A (3P)
40kVA (3-in, 3-out)	Terminal block	100A (3P), bypass 125A (3P)	DC 160A (3P)	Terminal block	100A (3P)
Note: The BCB (125A) is recommended for common input configuration					

3.1.5 Notes

The following points are for general guidance only. If there are relevant local regulations, the local regulations shall prevail.

1. The cable size of the neutral line shall be selected according to 1.5 times of the output/bypass phase current.
2. The cable size of the protective earth cable shall be selected according to the AC power failure level, cable length and protection type. The grounding wire connection must use the shortest connection route.
3. For the cables with large current, parallel connection of small cables can be adopted to facilitate the installation.
4. When selecting the battery cable size, the current value in Table 3-1 shall be referred to, and a maximum voltage drop of 4Vdc is allowed.
5. Do not form coils, so as to minimize the formation of EMI.

3.1.6 Power Cable Connecting Terminal

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

The protective earth cable is reliably connected to the PE input terminal (see Figure 3-2) through the fixing bolt.

All the cabinets and cable troughs shall be grounded according to the local regulations. The grounding wires shall be tied up reliably to prevent the loosening of the grounding wire tightening screws when the grounding wires are pulled.

  Warning
Failure to ground as required can cause EMI, electric shock or fire risk.

3.1.8 External Protective Device

To ensure the safety, it is necessary to install external circuit breaker for the input and battery of the UPS. Because of the difference of the specific installations, this section only provides general practical information for the installation engineer. The qualified installation engineer should have the knowledge of the local wiring regulations on the equipment to be installed.

Rectifier and bypass input power supply

1. Input overcurrent and short circuit protection

Install suitable protective devices in the distribution line of the incoming mains supply. The protective devices should provide functions such as the overcurrent protection, short circuit protection, isolation protection and tripping upon backfeed. When selecting the protective devices, consider the power cable current-carrying capacity, system overload capacity (see Table 11-6 and Table 11-7) and the short circuit capability of the upstream power distribution. It is generally recommended to use the thermomagnetic circuit breaker of IEC60947-2 tripping curve C (normal), when the current value reaches 125% of the current value listed in Table 3-1.

2. Split bypass configuration

If the UPS adopts split bypass configuration, independent protective device shall be installed respectively on the rectifier input and bypass input distribution lines.



Note

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

3. Ground fault protection

If the pre-stage input power supply has an RCD, the transient state and steady state ground leakage current upon the startup of the UPS shall be considered.

The RCCB shall meet the following requirements:

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

The RCCB symbols are shown in Figure 3-1.

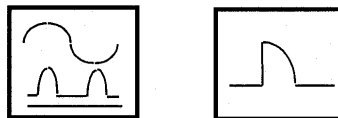


Figure 3-1 RCCB symbols

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

System output

The UPS output distribution shall be configured with a protective device. The protective device shall be different from the input distribution protection switch and able to provide overload protection (refer to Table 11-6 and Table 11-7).

3.1.9 Power Cable Connection Steps

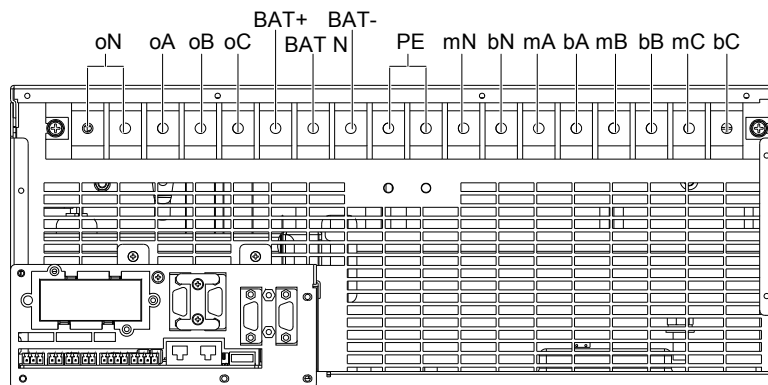
Connection terminal and cable routing method

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



Note

The power cables should be routed through tunnels or cable troughs to prevent cable damage due to mechanical stress and reduce the EMI to the environment.

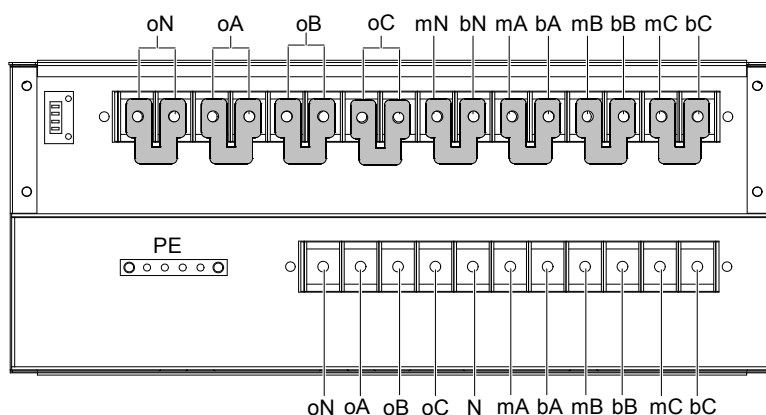


Note:

Rectifier input: mA, mB, mC, mN; Bypass input: bA, bB, bC, bN;

Output: oA, oB, oC, oN; Battery: BAT+, BAT N, BAT-; Earthing: PE

Figure 3-2 Power cable connection terminals of UPS



Note:

1. The bottom terminals must be connected to the UPS corresponding ports.
2. Terminals have been shorted by shorting copper bars before delivery.

Figure 3-3 Power cable connection terminals of UPD

Connection steps



Warning

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

Refer to Figure 3-2 ~ Figure 3-4, connect the power cables as described in the following procedures:

1. Open the front door of the UPS, and remove the protective cover to reveal the power cable connection terminals (see Figure 3-2).
2. As shown in Figure 3-4, use the cable (accessory) to connect the UPS and UPD, and ensure that the connection is reliable and the phase rotation is correct. Note to tie the cable respectively to cabling hole (at back-end of the UPD).

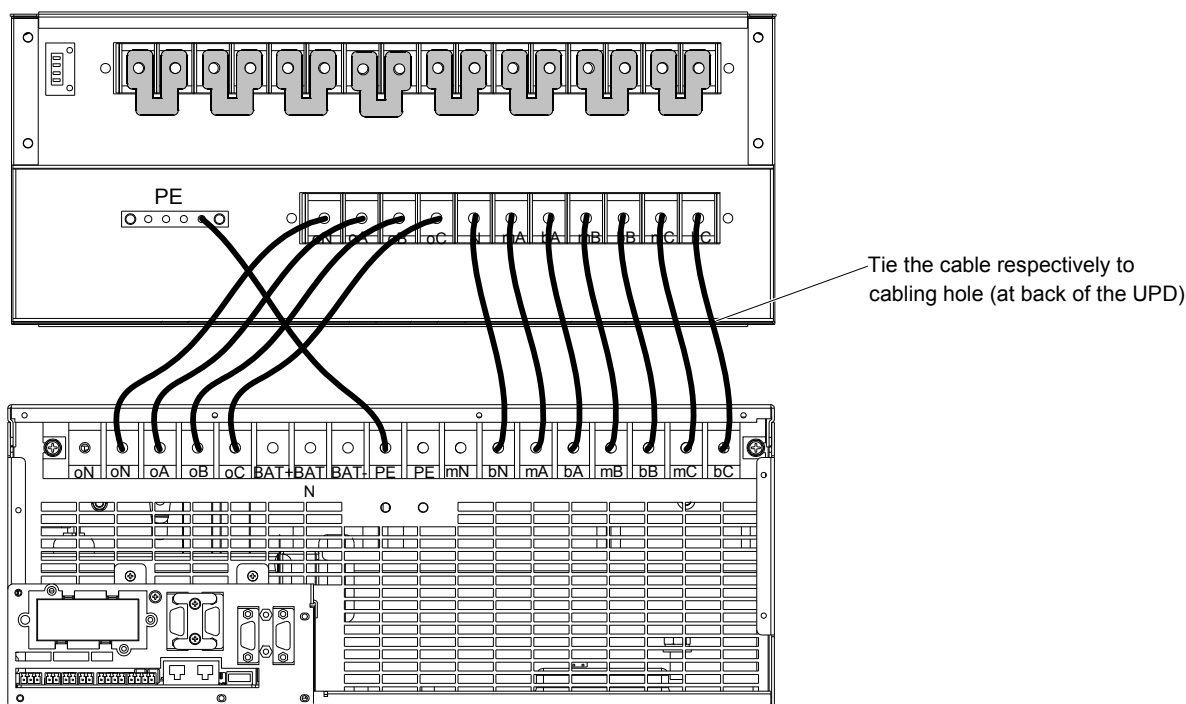


Figure 3-4 Power cable connection and cabling

**Warning**

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

3. Identify and make power connections for the input cables according to one of the following two procedures, depending on the type of installation.

Connection of common input

1) As shown in Figure 3-5, ensure that the four shorting copper bars between the rectifier input terminals (mA-mB-mC-mN) of UPS and the bypass terminal terminals (bA-bB-bC-bN) are connected correspondingly. The I/O cable of users should be respectively connected to the corresponding terminals. Use screws to fasten them and ensure the correct phase rotation.

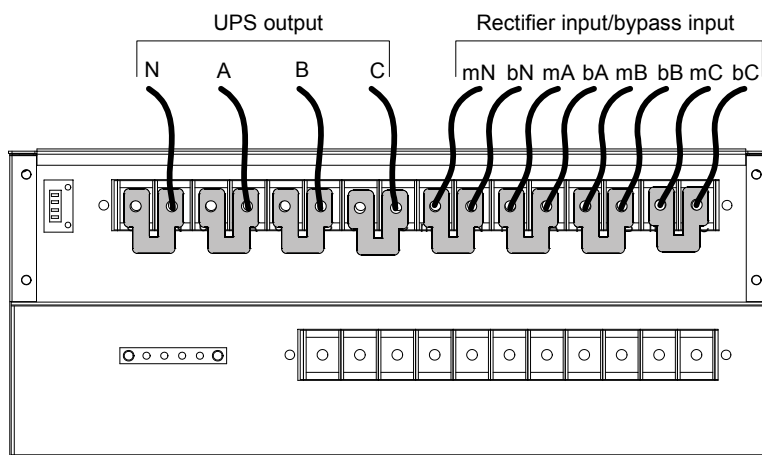


Figure 3-5 Power cable connection of common input

Connection of split bypass

2) As shown in Figure 3-6, remove the four shorting copper bars between the rectifier input terminals (mA-mB-mC-mN) and the bypass terminal terminals (bA-bB-bC-bN). The I/O cable of users should be respectively connected to the corresponding terminals. Use screws to fasten them and ensure the correct phase rotation.

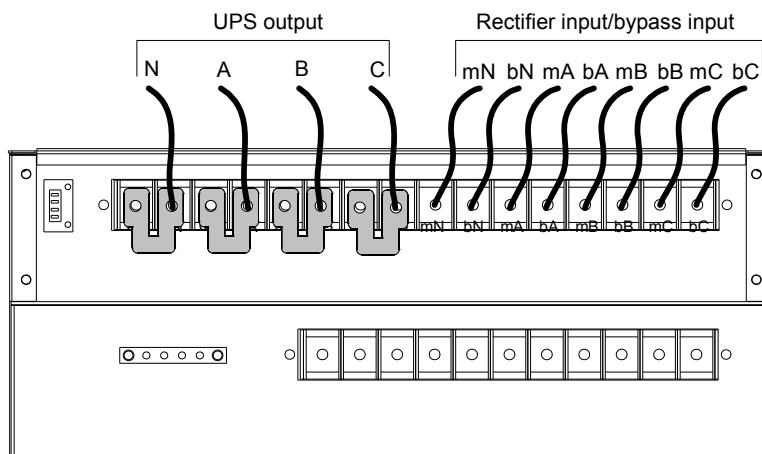


Figure 3-6 Power cable connection of split bypass

Connection of system output

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



Warning

If the load will not be ready to accept power supply before arrival of the service engineer, ensure that the system output cables are safely isolated at their ends.

Connection of battery

5. If the external battery is required, ensure correct polarity of the connections from the battery string terminals to the BCB and from the BCB to the battery input terminals (BAT+, BAT N, BAT-) in the UPS, that is, (BAT+) to (+) and (BAT-) to (-), (BAT N) to (N), but disconnect one or more battery cell links in each tier. Do not reconnect these links and do not close the BCB before authorized to do so by the service engineer.

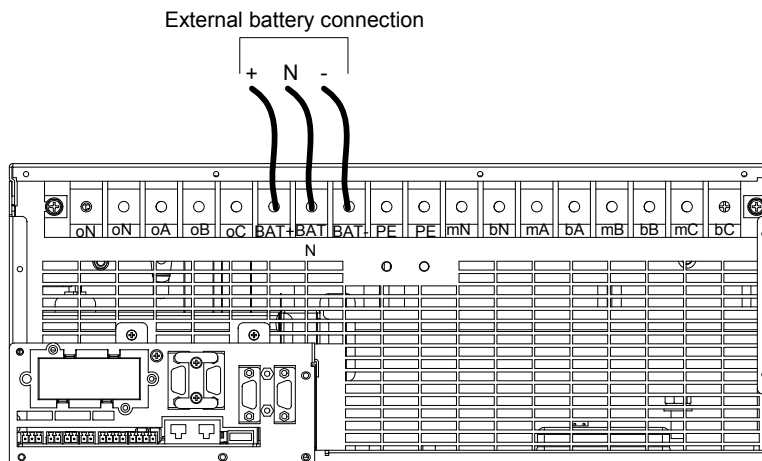


Figure 3-7 External battery connection

Note: When connecting the cables between battery terminals and BCB, the connection should begin from the BCB terminal.

6. Replace the protective covers.



Note

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

3.2 Wiring Of Signal Cable

3.2.1 Overview

For on-site specific needs, the UPS needs auxiliary connection to realize battery system (including the external battery switch) management, communicate with PC, provide alarm signal to external devices, realize remote EPO or provide bypass back feed circuit breaker signal and parallel communication. These functions are realized through the communication box in the UPS. As shown in Figure 3-8, the communication box provides the following ports:

- User dry contact port
- USB communication port
- Parallel communication port
- LBS communication port
- RS485 communication port
- Intellislot port

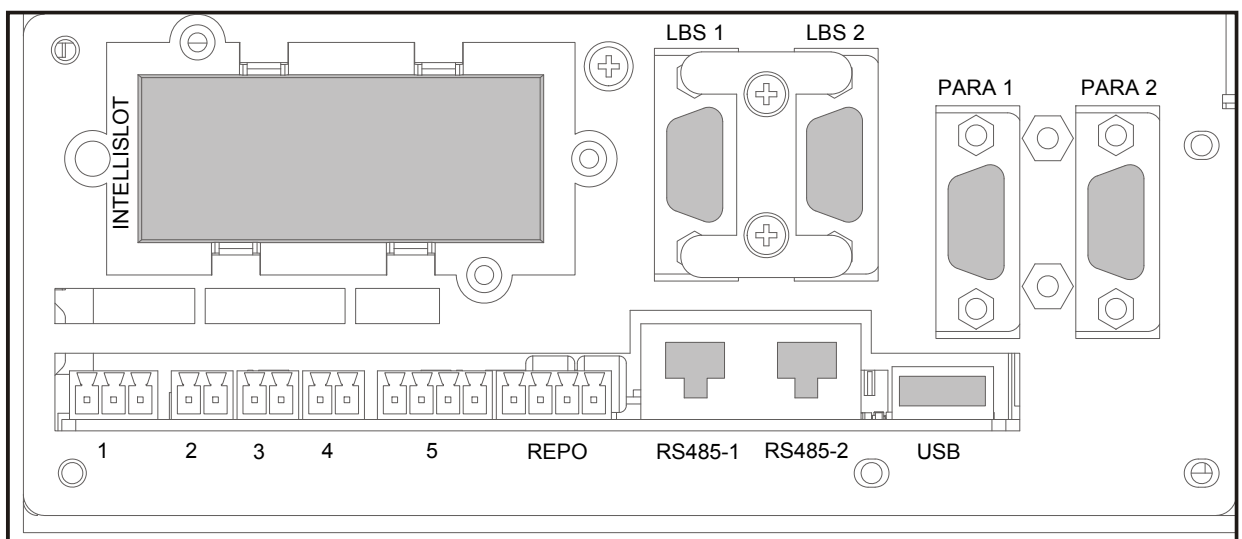


Figure 3-8 Illustration drawing of communication box ports

3.2.2 Backfeed Protection Dry Contact Port

The backfeed protection dry contact port 1 is shown in Figure 3-9 and described in Table 3-4. The rated capacity of the backfeed protection dry contact is 240Vac/24Vdc, 5A.

<b style="margin-left: 10px;">Warning
The voltage of the dry contact signal connected to backfeed protection dry contact port may be dangerous. Before connection, make sure that you are connecting the cable to the right port.

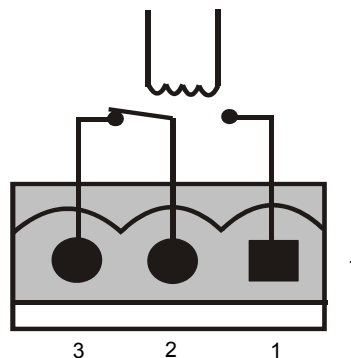


Figure 3-9 Backfeed protection dry contact port

Table 3-4 Description of backfeed protection dry contact port

Silkscreen	Port	Pin No.	Pin name	Meanings
1	Rectifier/Bypass backfeed output	1.1	BFP_O	Rectifier/bypass backfeed normally open contact. Open when there is no backfeed
		1.2	BFP_S	Rectifier/bypass backfeed common contact
		1.3	BFP_C	Rectifier/bypass backfeed normally closed contact. Closed when there is no backfeed

3.2.3 Output Dry Contact Port

The output dry contact ports 2, 3 and 4 are shown in Figure 3-10 and described in Table 3-5.

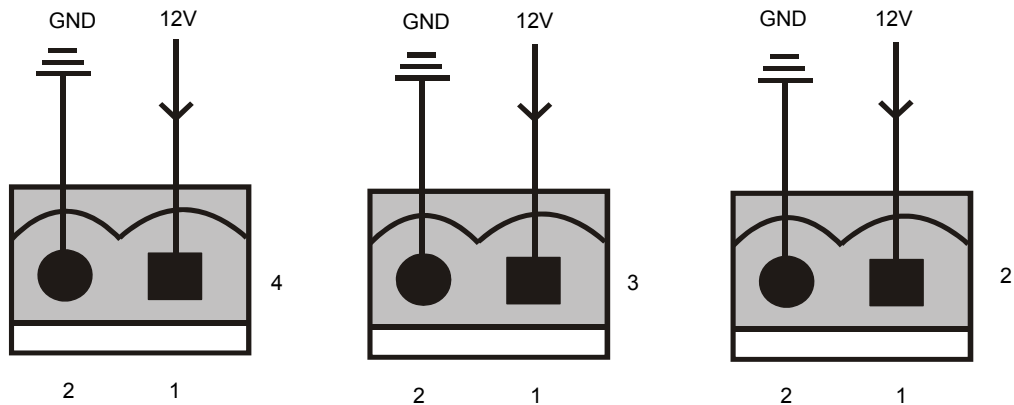


Figure 3-10 Output dry contact ports

Table 3-5 Description of output dry contact port

Silkscreen	Port	Pin No.	Pin name	Meanings
2	UPS fault output port	2.1	UPS_FAULT	UPS fault output signal. The level is 12V when UPS has fault
		2.2	GND	GND
3	Battery status output port	3.1	ON_BATTERY	Battery status output signal. The level is 12V when system works in battery inverter state
		3.2	GND	GND
4	Bypass status output port	4.1	ON_BYPASS	Bypass status output signal. The level is 12V when system works in Bypass mode
		4.2	GND	GND

3.2.4 Input Dry Contact Port

The input dry contact port 5 is shown in Figure 3-11 and described in Table 3-6. The input dry contact voltage is 12Vdc, and the current is 15mA.

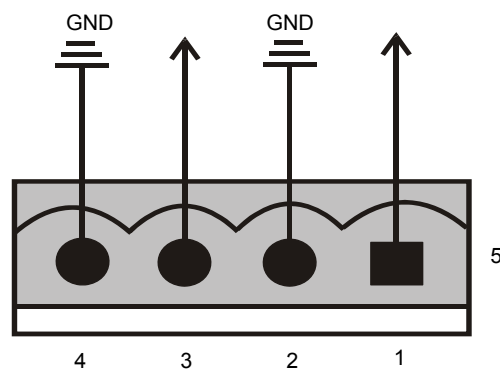


Figure 3-11 Input dry contact port

Table 3-6 Description of input dry contact port

Silkscreen	Port	Pin No.	Pin name	Meanings
5	External maintenance bypass switch	5.1	IN_Q3	Internal maintenance bypass switch state. The auxiliary contact requirement of the internal maintenance bypass switch: Auxiliary contact of external bypass closed upon switch closed
		5.2	GND	GND
	External output switch	5.3	IN_OUT	Internal output switch. The auxiliary contact requirement of the internal output switch: Auxiliary contact of external bypass closed upon switch closed
		5.4	GND	GND

Port 5 is used to report the maintenance switch status and output switch status of the UPD to the UPS.

Use one end of the corresponding signal cable to connect port 5, and the other end to the dry contact of maintenance bypass switch and output switch on the UPD rear panel. See Figure 1-5 for the detailed position.

3.2.5 Remote EPO Input Port

The UPS has an EPO function that operates by an EPO button on the operator control and display panel of the UPS or by a remote contact provided by the user. The EPO switch has a protective cover.

REPO is the remote EPO input port. The port is shown in Figure 3-12 and described in Table 3-7.

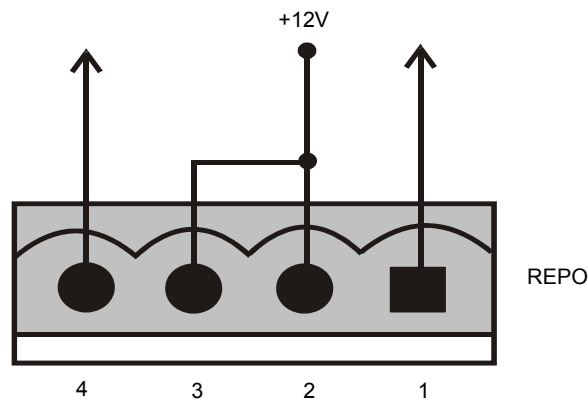


Figure 3-12 Remote EOP input port J3

Table 3-7 Description of remote EPO input port

Silkscreen	Port	Pin No.	Pin name	Meanings
REPO	Remote EPO input	REPO.1	EPO_NC	EPO activated when opened to 2. Pins 1 and 2 have been shorted in factory
		REPO.2	+12V	EPO activated when opened to 1
		REPO.3	+12V	EPO activated when shorted to 4
		REPO.4	EPO_NO	EPO activated when shorted to 3

EPO is triggered when pins 3 and 4 of REPO are shorted or pins 2 and 1 of REPO are opened.

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



Note

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

3.2.6 USB Communication Port

See Figure 3-8 for the position of the USB communication port. This port does not open to the customers, just for UPS engineer commission and update the corresponding software parameters.

Method: Connect one end of the USB communication cable to the USB port in the communication box, and the other end to the USB port of the computer.

The USB port provides serial data and is intended for use by authorized commissioning and service personnel in UPS commissioning and service.

3.2.7 Parallel And LBS Communication Ports

See Figure 3-8 for their positions.

3.2.8 RS485 Communication Port

See Figure 3-8 for its position.

3.2.9 Intellislot Port

The Intellislot ports are used for installing optional cards on the site, including Relay card, Modbus card, SIC card and UF-RS485 card. Table 3-8 provides the models and installation positions of the optional cards. For the detailed installation of the optional cards, refer to the corresponding contents in *Chapter 8 Options*.

Table 3-8 Models and installation positions of optional cards

Optional card	Model
Relay card	UF-DRY410
Modbus card	UF-MOD41Z1
SIC card	UF-SNMP810
UF-RS485 card	UF-RS485

3.2.10 Signal Cable Connection Steps

 Note
Respectively route the power cables and signal cables. The shielding coat of signal cable must be reliably earthed.

See Figure 3-8 for signal cable connection position. Port 5 should be connected to the dry contact of maintenance bypass switch and output switch of UPD. See Figure 3-13 for the detailed connection method.

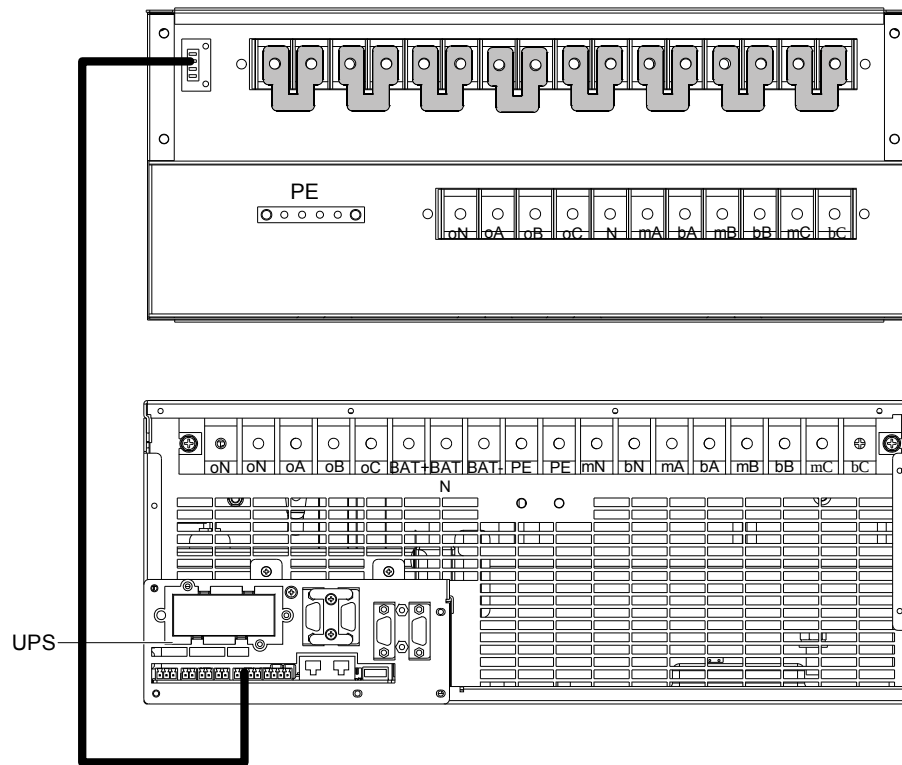


Figure 3-13 Connection between port 5 and maintenance bypass switch and output switch

For other signal cables, the user can route them according to actual site environment.

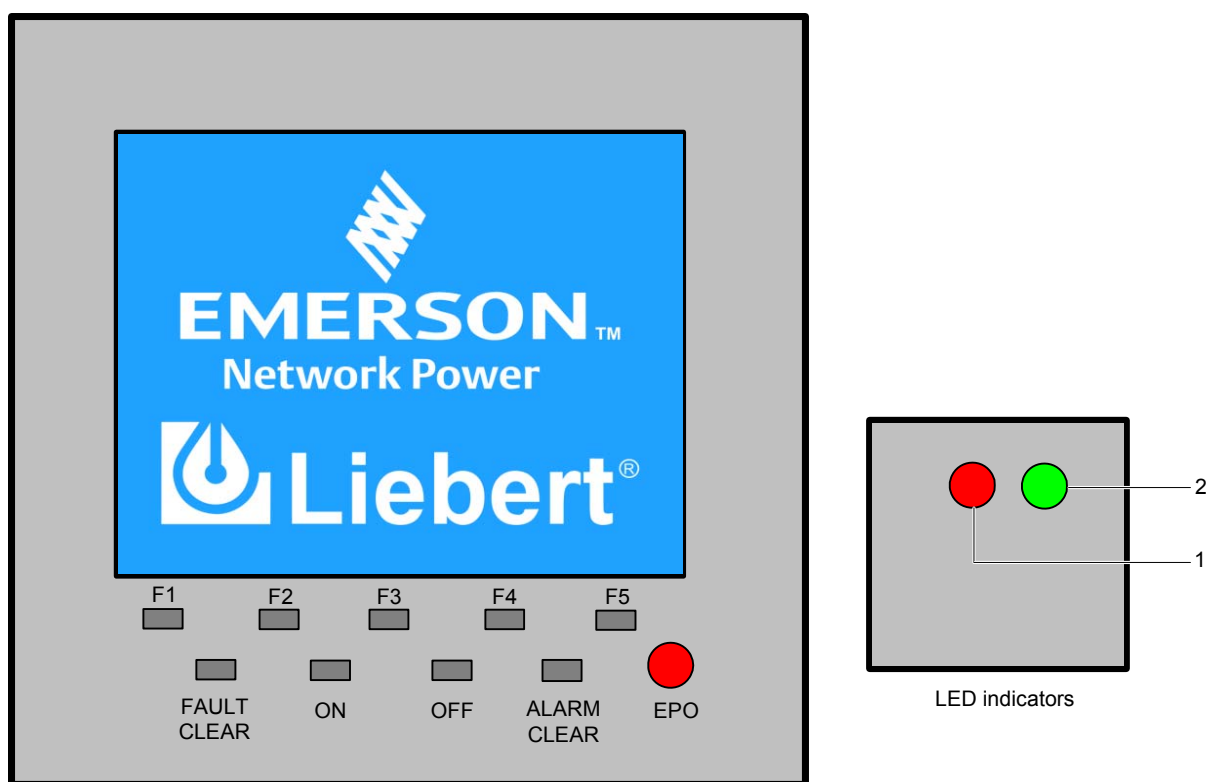
Chapter 4 Operator Control And Display Panel

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

4.1 Introduction

The UPS front provides the operator control and display panel. It is the access point for operator control and query all measured parameters, UPS and battery status and alarms.

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



LCD and control keys

Figure 4-1 Operator control and display panel

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

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

4.1.1 LED Indicators

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

Table 4-2 Definition of indicators

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

4.1.2 Audible Alarm (Buzzer)

UPS activity is accompanied by the two kinds of sound listed in Table 4-3.

Table 4-3 Description of audible alarm

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

4.1.3 Control Keys

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

Table 4-4 Description of control keys

Control key	Silkscreen	Description
EPO switch	EPO	Cut off the load power and battery, shut down the rectifier, inverter, static bypass
Inverter start switch	ON	Start the inverter
Inverter shutdown switch	OFF	Shut down the inverter
Fault reset switch	FAULT CLEAR	Clear fault to restart the UPS
Alarm silencing switch	ALARM CLEAR	When an alarm is active, pressing this key silences the audible alarm. Pressing this key again enables the buzzer again
Note: It is required to hold and press the preceding keys for 2s to initiate the key function		

4.1.4 LCD And Menu Keys

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

Table 4-5 Description of menu keys

Key	F1	F2	F3	F4	F5
Function 1	 HOME	ESC Escape	 Left	 Right	 Enter
Function 2			 Up	 Down	

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

4.2 LCD Screen Type

4.2.1 Start Screen

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

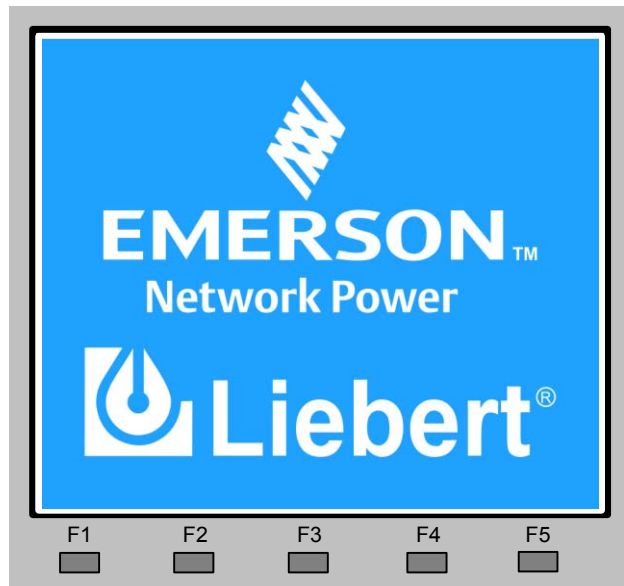


Figure 4-2 Start screen

4.2.2 Primary Screen

After the UPS starts and finishes self-test, the primary screen appears, as shown in Figure 4-3. The primary screen is divided into four windows: system information window, data window, menu window and keypad window.

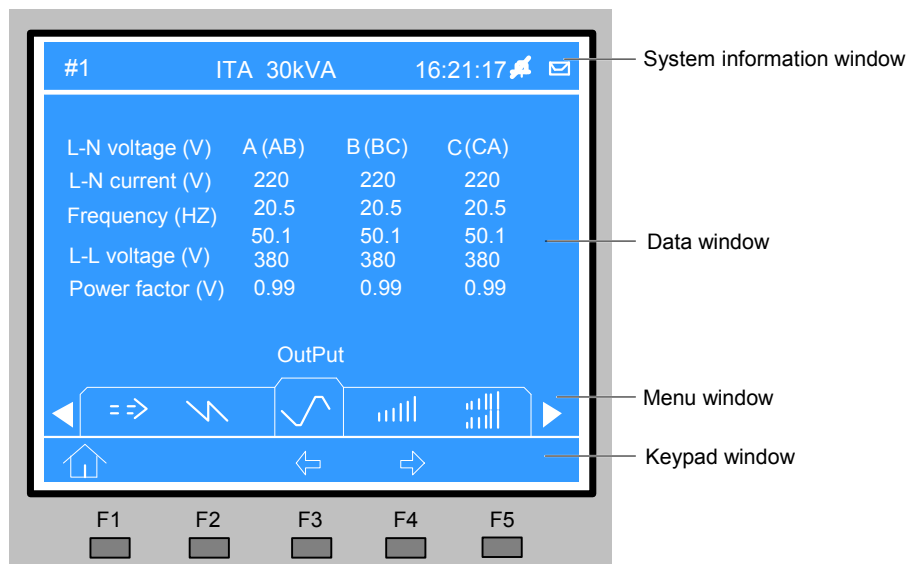


Figure 4-3 Primary screen

The functions of the menu keys F1 ~ F5 for the current screen are shown by self-explanatory icons in the keypad window as appropriate. From any menu on the primary screen, pressing the F1 key returns to the 'OutPut' menu.

4.2.3 Default Screen

During UPS operation, if there is no alarm or key action within two minutes, the default screen will appear, as shown in Figure 4-4. After a short delay, the LCD backlight will turn off. Pressing any menu keys (F1 ~ F5) restores the default screen.

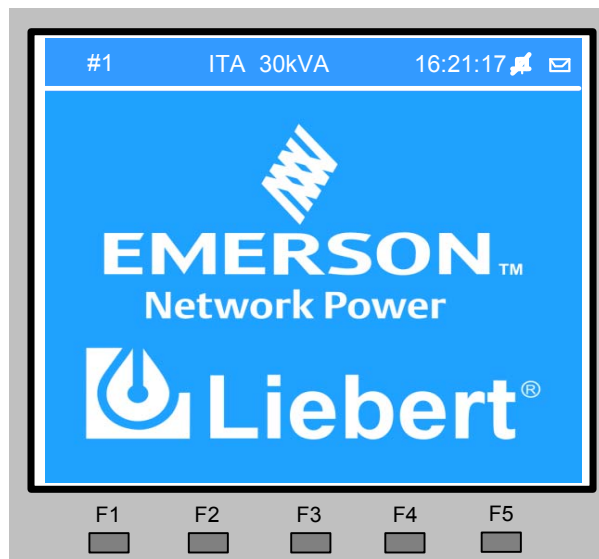


Figure 4-4 Default screen

4.3 Detailed Description Of Menu Items

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

System information window

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

Table 4-6 Item description of system information window

Item	Explanation
ITA	UPS series name
(Configuration) Single/ECO/Unit1#	Single: UPS module system with dual conversion ECO: The UPS is set as a UPS module system, and runs in ECO mode Unit1#: #1 of the parallel system formed by up to four UPS modules
30kVA	UPS power is 30kVA
16:21:17	Current time (format: 24 hours, hour: minute: second)
 / 	Audible alarm enabled or disabled.  : disabled,  : enabled

Menu window and data window

The menu window provides the menus of the data window. The data window displays the items of the menu selected in the menu window. UPS parameters can be browsed and functions can be set through the menu window and data window. Details are provided in Table 4-7.

Table 4-7 Item description of menu window and data window

Menu	Item	Explanation
Mains	L-N voltage (V)	Phase voltage
	L-N current (A)	Phase current
	Frequency (Hz)	Input frequency
	L-L voltage (V)	Line voltage
	Power factor	Power factor
Bypass	L-N voltage (V)	Phase voltage
	Frequency (Hz)	Bypass frequency
	L-L voltage (V)	Line voltage

Menu	Item	Explanation
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 (%)	Load (expressed in percentage of the UPS rating load)
	Crest factor	Output current crest factor
System	Sout (kVA)	Sout: apparent power
	Pout (kW)	Pout: active power
	Qout (kVAR)	Qout: reactive power
	Single unit, no parallel system data	Displayed on this data window when the UPS is configured as a single unit
Battery	Battery voltage (V)	Battery bus voltage
	Battery current (A)	Battery bus current
	Battery temperature (°C)	Built-in battery temperature
	Battery remain time (Min.)	Remaining battery backup time
	Battery capacity (%)	Percentage of battery life when compared to a new battery
	Battery boost charging	Battery is boost charging
	Battery float charging	Battery is float charging
	Battery is not connected	Battery is not connected
Event	(active alarm)	Display the active alarms
Records	(alarm history)	Display the alarm history
Language	(language option)	Provide 17 optional LCD languages
Settings	Display contrast	Adjust the LCD contrast
	Date format set	Three formats selectable: MM/DD/YYYY, DD/MM/YYYY, YYYY/MM/DD
	Date & time	Set the date and time
	Comm1 baud rate	Set the communication baud rate of the Intellislot port 1
	Comm2 baud rate	Set the communication baud rate of the Intellislot port 2
	Comm3 baud rate	Set the communication baud rate of the Intellislot port 3
	Communication address	Applicable to RS485 communication
	Single Group Batt Cap	Set the capacity of battery unit
	Battery Cells Number	Set the battery cells connected to the UPS
	Equalize Charge Allowed	Battery boost charge is enabled or not
	Temp Compensation	Enabled, Disabled
	Shared Battery	Enabled, Disabled
	System Configuration	Single, Parallel
	Parallel Requisite units	Basic number of single modules in parallel system
	Parallel Redundant units	Redundant number of single modules in parallel system
	Parallel ID	Provide one ID code for single module in parallel system, when 'Parallel' is set
	ECO Mode	Normal, ECO
	Output Frequency Level	Set the system output frequency (unit: Hz); 50/60
	Output Voltage Level	The voltage between phase line and phase line
	LBS Function	NONE, SLAVE, MASTER
	Command password	The user can modify the command password
	Protocol	YDN23, Velocity
Command (initiate, stop battery, system test or freshening charge)	Battery maintenance test	20% battery capacity is out upon battery maintenance test. Load must be between 20% and 80%
	Battery capacity test	Perform a full discharge of the battery to obtain a precise measure of the battery capacity. Load must be between 20% and 80%
	System test	Self-test of the UPS. When the user activates this function, a window appears about 5s later to show the test result
	Stop testing	Manually stop a battery maintenance test, battery capacity test or system test
	Freshening charge	Manually initiate a battery freshening charge
	Stop freshening charge	Manually stop a battery freshening charge
Eff.Curve	Eff.Curve	Display the system efficiency at current load

Menu	Item	Explanation
Run Time	UPS Run time	Display UPS accumulated run time
	Byp. Run time	Display UPS accumulated run time on bypass
Version	UPS version	Provide UPS inverter, rectifier and monitoring software versions
	UPS model	Provide UPS model information, for example, 208V-60Hz

Keypad window

The functions of the menu keys (F1 ~ F5) for the current screen are shown by self-explanatory icons in the keypad window as appropriate.

4.4 Prompt Window

A prompt window is displayed during the operation of the system to alert you to certain conditions or to require your confirmation of a command. The prompts are provided in Table 4-8.

Table 4-8 Prompts and meanings

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

4.5 Alarm List

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

Table 4-9 UPS alarm list

Alarm	Explanation
Fault reset	FAULT CLEAR key on the operator control and display panel pressed
Rectifier in setting	The rectifier starts up and is in synchronization
Inverter in setting	The inverter starts up and is in synchronization
Manual turn on	ON key on the operator control and display panel pressed to turn on the inverter
Manual turn off	OFF key on the operator control and display panel pressed to turn off the inverter
Turn on fail	The inverter failed to turn on when the ON key is pressed. This may be the result of an invalid operation (maintenance bypass switch closed) or DC bus or rectifier not ready
Soft start fail	Owing to low DC bus voltage, the rectifier will report this alarm
Alarm silence	ALARM CLEAR key on the operator control and display panel pressed
Audible alarm reset	ALARM CLEAR key on the operator control and display panel pressed in alarm silence state
Bypass mode	The UPS is in bypass mode
Normal mode	The UPS is in normal mode
Battery mode	The UPS is in battery mode

Alarm	Explanation
UPS shutdown	UPS shutdown with no output power
Output disabled	EOD event happened. Check the battery voltage
System Bypass STS fail	The adjacentbypass STS open circuit fault or short-circuit fault
Mains volt. abnormal	The mains voltage is outside specifications and results in rectifier shutdown
Mains undervoltage	At least one phase main input voltage is within 132V ~ 176V, thus the load should be derated
Mains freq. abnormal	The mains frequency is outside specifications and results in rectifier shutdown
Mains phase reversed	The AC input phase rotation is reversed
Input feedback	Battery voltage fed back to rectifier input
Mains neutral lost	AC rectifier input neutral line not detected
Input current abnormal	Battery load sharing imbalance or rectifier input current abnormal
Input curr. over limit	Input current over limit
Bypass unable to trace	The bypass frequency is outside specifications. This alarm automatically resets once the bypass voltage goes normal
Bypass abnormal	The amplitude or frequency of the bypass voltage exceeds the limit. This alarm automatically resets once the bypass voltage returns to normal
Bypass STS fail	At least one of the STSs at the bypass side is open or shorted. This fault is locked until power-off
By. abnormal shutdown	Both the bypass and inverter voltages are abnormal, and the output is off
Bypass phase reversed	The phase rotation of the bypass voltage is reversed
Bypass overcurrent	The bypass current is outside the rated current
Rectifier fault	Bus voltage abnormal or battery SCR short circuit
Rectifier overtem	The temperature of the rectifier radiator is so high that the inverter cannot operate normally
DC bus over voltage	The rectifier, inverter and battery converter shut down because the DC bus voltage is too high. The load transfers to bypass
DC bus abnormal	The DC bus voltage is abnormal and results in inverter shutdown. The load transfers to bypass
Inverter asynchronous	The output voltage and bypass voltage are misaligned in phase. This alarm resets automatically once the condition is no longer true
Inverter fault	Inverter output voltage outside specifications. Load transfers to bypass
Inverter relay fail	At least one of the inverter relays is opened or shorted. This fault is locked until mains power-off
Output fuse fail	At least one of the inverter output fuses is blown
Output volt. abnormal	At least one phase of the output voltages is abnormal
Unit overload	This alarm appears when the load arises above 105% of the nominal rating. The alarm automatically resets once the overload condition is removed
System overload	This alarm appears when the total load rises above 105% of the nominal rating of the parallel system. The alarm automatically resets once the overload condition is removed
Unit overload timeout	The UPS overload status continues and the overload times out. When the time has expired, the load automatically transfers to the bypass
Load impact transfer	A transfer to bypass occurred due to a large step load. The UPS can recover automatically. Turn on the load equipment in stages to reduce the load impact on the inverter
Transfer time-out	The load remains on bypass power owing to excessive number of transfers that occurred within the one hour
Load sharing abnormal	The UPSs in a parallel system are not sharing the load current correctly
System transfer	All UPSs in the parallel system transfer to bypass at the same time when one of them needs to transfer to bypass. This message appears on the LCD of the UPS with passive transfer to bypass
Control power fail	The auxiliary power failure or power-off
EPO	EPO button on operator control and display panel pressed or external EPO command received
Fan fault	At least one fan has fault
Operation invalid	Maintenance bypass switch is off when the parallel system is on inverter, or output switch and maintenance bypass switch are off when the inverter is on
LBS active	The LBS setting is active
LBS abnormal	LBS is abnormal
Maint. sw. open	Maintenance bypass switch is open
Maint. sw. closed	Maintenance bypass switch is closed
Output sw. closed	Output switch is closed
Output sw. open	Output switch is open
Charger fault	Battery charger has failure
Dischg. curr. limit	Discharge current is over limit, close the discharger
Auto start	After UPS shutdown at EOD, the inverter automatically starts upon mains restoration
Freshening boost charge	The battery is forced to be in boost charge state
Rec flash update	Rectifier software being updated

Alarm	Explanation
Inv flash update	Inverter software being updated
Monitor flash update	Monitoring software being updated
FLASH operate fail	Historical record not saved
Remote turn ON	Turn on the inverter through the service command
Remote turn ON failed	Caused by invalid operation (maintenance bypass switch closed), DC bus or rectifier not ready
Remote turn OFF	Turn off the inverter through the service command
Load sharing abnormal	Each UPS module is parallel system cannot execute load sharing
Communication fail	Interruption in communication between internal monitoring board and inverter, rectifier
Parallel comm. fail	Communication between the UPS modules of a parallel system failed. Check if any UPS modules in the parallel system are not on; if yes, power on these UPSs and then check if the alarm disappears
No battery	Check the battery and battery connection
Batt. converter fault	Bus voltage abnormal
Battery reverse	Reconnect battery and check battery wiring
Battery period testing	The battery is under automatic periodic battery maintenance test (20% capacity discharge)
Batt. capacity testing	The user initiated a battery capacity test (100% capacity discharge)
Battery maintenance testing	The user initiated a maintenance test (20% capacity discharge)
Battery end of discharge	Inverter turned off due to battery EOD
Battery overtemp.	The battery temperature is over limit
Replace battery	Battery life is finished
Battery low pre-warning	Before the EOD, battery low pre-warning will occur. After this pre-warning, the battery will have the capacity for 3min discharging with full load. The time is user-settable from 3min to 6min
Generator in	Dry contact signal, indicating generator connected
BCB status abnormal	Logic conflict between BCB drive signal and feedback signal
BCB closed	BCB state (closed)
BCB open	BCB state (open)
Note: 1. For UPS installed with the optional battery monitor, refer to the user manual of the battery monitor for the alarm messages related to battery cell and charge current. 2. If the alarm is caused through setting the software value by Emerson authorized engineer, and you wish to change the setting values, please contact the Emerson local customer service center	

Chapter 5 UPS Operation Introduction

This chapter introduces the operating precautions and daily operating methods of UPS in detail.

5.1 Brief Introduction

5.1.1 Precautions

 Important
The user can conduct relative operation only after the authorized engineer carries out the first power on and test.

  Warning: hazardous mains and/or battery voltage
1. The components that can only be accessed by opening the protective cover with tools cannot be operated by the user. Only qualified service personnel are authorized to remove such covers. 2. The AC input and output terminals of UPS have dangerous voltage at any time. If the equipment is equipped with an EMC filter, the filter may have dangerous voltage.

1. For the control keys and LCD related to all the operating steps, refer to *Chapter 4 Operator Control And Display Panel*.
2. During operation, the buzzer alarm may occur at any time. Press ALARM CLEAR key to silence the audible alarm.
3. When UPS uses traditional lead-acid battery, the system provides boost charge optional function. If the lead-acid battery is used, when the mains returns after an extended mains failure, the charging voltage of the battery will be higher than the normal charging voltage, this is normal, and the charging voltage of the battery will return to normal value after a few hours' charging.

5.1.2 Power Switch

Opening the front door of the UPS reveals the power switches, as shown in Figure 5-1, including:

- Q1: Rectifier input switch, which connects UPS to the main circuit power.
 Q2: Bypass input switch, which connects UPS to the bypass.
 Q3: Maintenance bypass switch (locked), which supplies power to the load when UPS is being maintained.
 Q5: Output switch, which connects UPS output to the load.

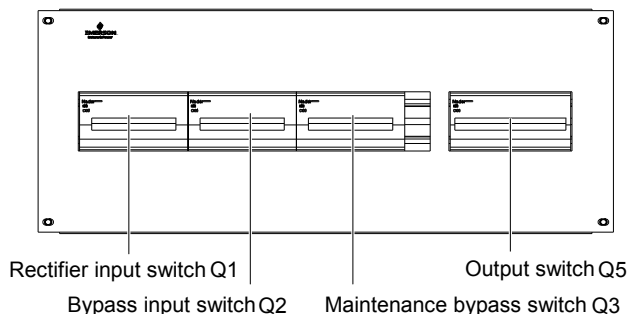


Figure 5-1 UPS power switch

5.2 UPS Startup Procedures

The UPS must be completely installed and tested by authorized engineer, and external power supply switch is closed, then you can start the UPS.

5.2.1 Check Before Startup

1. Check and confirm that the power distribution mode of the UPS and UPD is correct, that the connections of the power cables and the signal cables are correct and there is no short circuit.
2. Check and confirm that the battery installation and the cable connection are correct, that the polarities 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 UPD are energized upon the startup. If the load is connected with the output terminals, make sure that the power to the load is safe.

5.2.2 Single UPS Parameters Setting

Power on the UPS according to steps 1 ~ 2 in 5.2.3 *Startup Procedures In Normal Mode*. Do not start the inverter. Execute the function setting functions (see Table 5-1) according to *Chapter 4 Operator Control And Display Panel*.

Table 5-1 Single UPS parameters setting

Parameter	Default	Single UPS parameters setting
Single Group Batt Cap	26	Set according to actual single group battery capacity
Battery Cells Number	32	Set according to actual battery cells
Equalize Charge Allowed	Disabled	Set according to actual battery features
Temp Compensation	Disabled	Enable this function if users select the temperature compensation option
System Configuration	Single	Single
ECO Mode	Normal	Normal
Output Frequency Level	50Hz	50Hz/60Hz
Output Voltage Level	380V	380V/400V/415V

For other parameters, see Table 4-7 for details. The user can adjust the parameters according to actual needs.

5.2.3 Startup Procedures In Normal Mode

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

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

1. Ensure that the maintenance bypass switch Q3 of UPD is disconnected, while the input cables and copper bars are reliably connected.

  Warning
All operations relating to disconnect or close the switch of maintenance bypass switch shall be finished within three seconds, in case of misreporting as faults.

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

At the moment, the system is power on, and the startup screen pops up. Refer to 4.2.1 *Start Screen*.

About 25 seconds later, confirm that the LCD shows the rectifier power supply and the bypass power supply are normal; if not, check whether the switches Q1 and Q2 are closed. Then the rectifier starts up and the alarm indicator (red) is on. At the same time, the bypass static switch is closed. About 30 seconds later, the alarm indicator (red) is flashing or off (if battery connected), and then the rectifier startup is finished.

3. Press the ON key for two seconds.

The inverter starts up, and the inverter indicator (green) is flashing. After the inverter runs normally, the UPS transfers from the bypass to inverter, then the inverter indicator (green) is on.

5.2.4 Startup Procedures In ECO Mode

1. Ensure that the internal maintenance bypass switch Q3 of UPD is disconnected, while the input cables and copper bars are reliably connected.

  Warning
All operations relating to disconnect or close the switch of maintenance bypass switch shall be finished within three seconds, in case of misreporting as faults.

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

At the moment, the system is power on, and the startup screen pops up. Refer to 4.2.1 *Start Screen*.

About 25 seconds later, confirm that the LCD shows the rectifier power supply and the bypass power supply are normal; if not, check whether the switches Q1 and Q2 are closed. Then the rectifier starts up and the alarm indicator (red) is on. At the same time, the bypass static switch is closed.

3. Press the EPO button.

At this time, the system is switched off emergently, and the LCD displays 'UPS shutdown'. Set the parameter to ECO mode according to Table 5-2.

Table 5-2 Parameter setting of ECO mode

Parameter	Default	Single UPS parameters setting
ECO Mode	Normal	ECO

For other parameters, see Table 5-1 for details. The user can adjust the parameters according to actual needs.

4. Press the FAULT CLEAR key for two seconds.

The rectifier starts up, and the alarm indicator (red) is on, bypass static switch is closed. About 30 seconds later, the alarm indicator (red) is flashing or off (if battery connected). And then the rectifier startup is finished.

5. Press the ON key for two seconds.

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

UPS operated in ECO mode

5.2.5 Startup Procedures In Battery Mode (Battery Cold Start)

1. Verify that the battery has been connected, and that the battery voltage is transferred to the input terminal of the battery.
2. Open the protective cover on the front door, and press the battery cold start button (see Figure 5-2 for its position).

At the moment, the startup screen pops up. Refer to 4.2.1 *Start Screen*.

About 25 seconds later, the rectifier starts up and the alarm indicator (red) is on. About 30 seconds later, the alarm indicator (red) is flashing, and then the rectifier startup is finished.

3. Press the ON key for two seconds.

The inverter starts up, and the inverter indicator (green) is flashing. After the inverter runs normally, the inverter indicator (green) is on. At this time, the UPS is powered by the inverter.

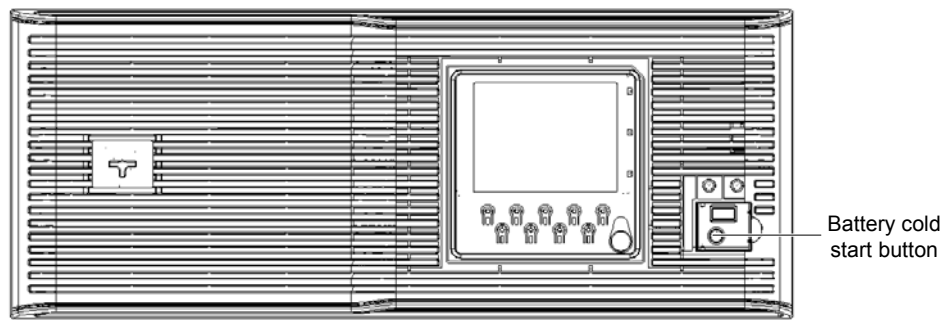


Figure 5-2 Battery cold start button

5.3 Procedures For Transfer Between Operation Modes

5.3.1 Transfer From Normal Mode To Battery Mode

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

5.3.2 Transfer From Normal Mode To Bypass Mode

Press the OFF key for two seconds, the inverter indicator (green) is off, and the UPS will be transferred from normal mode to bypass mode.



Note

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

5.3.3 Transfer From Bypass Mode To Normal Mode

When the UPS is in bypass mode, press the ON key for two seconds, the inverter starts up, and the inverter indicator (green) is flashing till the inverter enters normal operation, then the UPS is transferred from bypass mode to normal mode.

5.3.4 Transfer From Normal Mode To Maintenance Mode

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



Caution: power supply interruption danger of the load

Before making this operation, read the information on the LCD to make sure that the bypass supply is normal and that the inverter is synchronous with the bypass supply, so as not to risk a short interruption in power to the load.

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



Note

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

2. Close the maintenance bypass switch Q3 of UPD, and then the LCD displays 'Maint. sw. closed'.

3. At the moment, the maintenance bypass parallels with the UPS static bypass.

4. Disconnect the output switch Q5, and then the LCD displays 'Output sw. open'.

At the moment, the load is powered by the maintenance bypass directly.

**Caution**

When the UPS is in maintenance bypass mode, the load is not protected against abnormal mains supply.

5. Pressing the EPO button stops the operation of rectifier, inverter, static switch and battery, but this action will not affect the maintenance bypass power the load normally.

**Note**

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

6. Disconnect the rectifier input switch Q1 and bypass input switch Q2, also disconnect the external battery (if any). At the moment, all the internal power supply is closed and the LCD does not display any more.

**Warning**

1. If the maintenance is required, wait 10 minutes for the internal DC bus capacitance discharging.
2. The parts of UPS circuits also have hazardous voltage, though the rectifier input switch, bypass input switch and battery switch are disconnected. Therefore, the UPS maintenance is suitable for qualified personnel only.

5.3.5 Transfer From Maintenance Mode To Normal Mode

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

1. Close the output switch Q5 of UPD.
2. Close the bypass input switch Q2.
3. After the LCD startup, the system will transfer to the Event menu window till the system confirms that the record displays 'Bypass mode'.

**Warning**

You must start the bypass first, and then disconnect the maintenance bypass switch; or it will cause output load power failure.

4. Disconnect the internal maintenance bypass switch Q3, and then the LCD displays 'Maint. sw. open'.
5. Close the rectifier input switch Q1 and the external battery (if any), then the alarm indicator (red) is flashing or off (if battery connected).
6. Press the ON key for two seconds.

The inverter starts up, and the inverter indicator (green) is flashing. After the inverter runs normally, the UPS will be transferred from the bypass to inverter, and then the inverter indicator (green) is on.

At the moment, the load has transferred to UPS normal mode.

5.4 Battery Self-test Procedures

The battery self-test includes periodical self-test and manual maintenance self-test. The battery discharge outputs 20% energy of the total battery energy.

Periodical self-test is to test the battery activity. The periodical self-test is regular, and the self-test period can be configured via the Emerson setting software. During the periodical self-test, if the battery maintenance requirement is satisfied, the system will generate audible/visual alarm and corresponding records. The periodical self-test does not update the battery curve table.

The mode of the manual maintenance self-test is similar to that of the periodical self-test, except for the maintenance self-test mode is started manually, and this operation is valid only one time, that is the system will not be automatically start up once you exits. During the maintenance self-test, if the battery maintenance requirement is satisfied, the system will generate audible/visual alarm and corresponding records. The maintenance self-test does not update the battery curve table.

Note: The periodical self-test should satisfy the conditions of battery float charge at least 5h, and generator not connected, while the manual maintenance self-test just satisfies the conditions of battery fully charged.

Achievement

1. Manual maintenance self-test: via the LCD.
2. Periodical self-test: self-test period can be configured via the Emerson setting software. The range of battery self-test period is 30 days ~ 360 days (default: 60 days).

Self-test startup conditions

1. System load rate is within 20% ~ 100%, stable output.
2. Battery in fully charged state, battery float charge at least 5h, and generator not connected
3. Current system is in float charge state

Self-test exit conditions

1. Confirm that the system is not in self-test state for at least 10 seconds. Then if the UPS is in battery mode or rectifier is closed, the system will shift to battery charging mode.
2. During the self-test, the system will shift to float charge state if the load fluctuation, UPS module overload or no battery occurs.
3. During the self-test, if the battery voltage is lower than the calculated pre-alarm voltage, or the battery discharge exceeds the protection time, then the system will shift to float charge state.
4. The user can manually stop the maintenance test via the LCD.

Note: After the self-test is successful, the system will fully clear the self-test interval counter. If the self-test fails this time, then exits the system; when self-test conditions are satisfied again, enters self-test once more.

Procedures for manual maintenance self-test

1. Select the Command menu on the LCD screen.

Use the F3 (left) key or F4 (right) key to display the Command menu. Press the F5 (enter) key to confirm it.

2. Select the desired test.

Use the F3 (up) key or F4 (down) key to highlight the desired test item. Press the F5 (enter) key to confirm it.

After the prompt, use the F3 (up) and F4 (right) keys to input the password, and then press the F5 (enter) key to confirm it.

3. Wait until the battery test completes.

After the test, the system will automatically update the battery data which used to calculate the backup time (displayed upon mains failure), and battery actual capacity (battery capacity percentage when compared to a new battery, displayed in inverter mode).

4. Stop the battery test.

If required, the test may be stopped before completion by selecting Stop testing on the Command menu.

Refer to *Chapter 4 Operator Control And Display Panel* for more information.

5.5 UPS Self-test Procedures

During the self-test, the UPS can check the UPS control functions, LED indicators and audible alarm states. This self-test is password controlled and menu driven. It can be carried out from the UPS operator control and display panel by the operator and takes five minutes.

Procedures for UPS self-test

1. Select the Command menu on the LCD screen.

Use the F3 (left) key or F4 (right) key to display the Command menu. Press the F5 (enter) key to confirm it.

2. Select the desired test.

Use the F3 (up) key or F4 (down) key to highlight the desired test item. Press the F5 (enter) key to confirm it.

After the prompt, use the F3 (up) and F4 (right) keys to input the password, and then press the F5 (enter) key to confirm it.

3. Wait until the test completes.

After five seconds, a pop window will appear to show the result of this diagnosis: rectifier, inverter, monitor OK or fault.

4. Stop the test.

If required, the test may be stopped before completion by selecting Stop testing on the Command menu.

Refer to *Chapter 4 Operator Control And Display Panel* for more information.

5.6 UPS Shutdown Procedures

5.6.1 Procedures For Completely Powering Down UPS

Complete UPS shutdown and load power-off should follow this procedure. All power switches, isolating switches and breakers are disconnected, and then UPS no longer supplies power to load.



Caution

The following procedures will cut off the load power, making the load completely power off.

1. Pressing the EPO button stops the operation of rectifier, inverter, static switch and battery.
2. If the UPS has external battery, disconnect the corresponding switch of the external battery.
3. Disconnect the rectifier input switch Q1, bypass input switch Q2, output switch Q5. At the moment, all the internal power supply is closed and the LCD does not display any more.



Warning

1. Post a label at the AC input distribution (generally far away from the UPS) to alert that the UPS maintenance is being operated.
2. Wait 10 minutes for the internal DC bus capacitance discharging. Then the UPS is completely shut down.



Note

1. After the UPS shutdown, the load is transferred to maintenance bypass. If required, operate the maintenance bypass switch at any time.
2. Only qualified personnel shall finish the UPS installation. This procedure can be executed after the system runs normally.



Warning: hazardous battery voltage

The battery terminals still have hazardous voltage after the UPS is completely shut down.

5.6.2 Procedures For Completely Powering Down UPS While Maintaining Power To Load

The following procedures are applicable for completely powering down the UPS and still keeping the power supply to the load. Refer to the procedures in 5.3.4 *Transfer From Normal Mode To Maintenance Mode*.

5.7 EPO Procedures

The EPO is designed to switch off the UPS in emergency conditions (that is, fire, flood, etc.). To carry out EPO, you just need to press the EPO button, then the system will turn off the rectifier, inverter and stop powering the load immediately (including the inverter and bypass), and the battery stops charging or discharging.

After EPO, if the input mains is present, the UPS's control circuit will remain active; however, the output will be turned off. To remove all power from the UPS, first disconnect the external power switch of the UPS, and then pull the battery terminals.

5.8 UPS Reset Procedures After EPO

After shutting down the UPS through EPO or reasons of inverter overtemperature, overload, battery overvoltage and DC bus voltage, clear the fault according to the alarm message displaying on LCD screen. Then carry out the following reset procedures to make UPS resume normal operation.

After confirming the fault has been cleared and no remote EPO signal is received, the user can carry out the following procedures:

1. Press the FAULT CLEAR key over two seconds, the system will exit the EPO state, and the alarm indicator (red) is flashing.
2. Press and hold the ON key over two seconds, the inverter starts up, and the inverter indicator (green) is flashing. After the inverter runs normally, the UPS will be transferred from the bypass to inverter, and then the inverter indicator (green) is on.



Note

1. The rectifier will start and the bypass will begin to power the load. The rectifier indicator flashes while the rectifier is starting up. When the rectifier enters normal operation (about 30 seconds later), the rectifier indicator turns solid green.
2. The rectifier will start automatically when the overtemperature fault disappears five minutes after the disappearance of overtemperature signal.

3. After the EPO switch is pressed, if the mains input is cut off, the UPS will shut down completely. When the mains input returns, the UPS will start up on bypass. There will be power at the output terminals of the UPS.



Warning

If the maintenance bypass switch Q3 is closed, and UPS has input power, it means UPS has outputs.

5.9 Automatic Restart

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

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

1. If Auto Recovery after EOD Enabling is enabled.
2. After the Auto Recovery after EOD Delay Time expires (the default delay is 10 minutes), the UPS restarts bypass, then inverter. During the automatic recovery delay, the UPS will charge its batteries to provide a safety margin for equipment shutdown if input power fails again.
3. If the Auto Recovery after EOD Enabling feature is disabled, the user may restart the UPS manually by pressing the FAULT CLEAR key first for two seconds and then ON key for two seconds.



Note

During the automatic restart process, manual startup is disabled. Automatic restart must be set by Emerson's authorized service engineer through Emerson setting software.

5.10 Selecting Language

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

Use the following procedures to select the language:

1. On the 'OutPut' menu screen, press the F3 (left) or F4 (right) key to select the 'Language' menu.
2. Press the F5 (enter) key to move the cursor to the data window of the screen.
3. Press the F3 (up) or F4 (down) key to select the desired language.

4. Press the F5 (enter) key to confirm.
 5. Press the F2 (ESC) key repeatedly to return to the 'OutPut' menu.
- At this point, the LCD displays all characters in the selected language.

5.11 Changing Current Date And Time

Use the following procedures to change the system date and time:

1. On the 'OutPut' menu screen, press the F3 (left) or F4 (right) key to select the 'Settings' menu.
2. Press the F5 (enter) key to move the cursor to the data window of the screen.
3. Press the F3 (up) or F4 (down) key to select the 'Date & time' item, and then press the F5 (enter) key to confirm.
4. Press the F3 (up) or F4 (down) key to the row displaying the date and time, and press the F5 (enter) key to confirm.
5. Use the F3 (up) or F4 (down) key to input the current date and time.
6. Press the F5 (enter) key to confirm, and press the F2 (ESC) key to return to the 'OutPut' menu.

5.12 Control Password

The system provides password protection for UPS operation and control. The default password is '12345'. Only enters the correct password can you execute the UPS self-test and battery test operation.

To change password, carry out the following procedures:

1. On the 'OutPut' menu screen, press the F3 (left) or F4 (right) key to select the 'Settings' menu.
2. Press the F5 (enter) key to move the cursor to the data window of the screen.
3. Press the F3 (up) or F4 (down) key to select the 'Command password' item, and press the F5 (enter) key to confirm, then 'Command password' is changed to 'Enter old password'.
4. Press the F4 key to move the cursor to corresponding password position, and press the F3 key to select the number from '0' ~ '9' for this position. After the five digits input, press the F5 (enter) key to confirm, at this moment, 'Command password' is changed to 'Enter new password'.
5. Similar to step 4, press the F3 and F4 to input new password and press the F5 (enter) key to confirm, at this moment, 'Command password' is changed to 'Enter new password again'.
6. Similar to step 4, press the F3 and F4 to input new password again, and press the F5 (enter) key to confirm, then press the F2 (ESC) key to return to the 'OutPut' menu.



Note

If the user forgets the user-defined password, please contact the Emerson service personnel to reset the password.

Chapter 6 Battery

This chapter introduces the battery, including the battery safety, installation and maintenance information, battery protection function, as well as the connection of BCB box (optional).

6.1 Introduction

The UPS battery string is composed of several batteries in series connection and provides rated DC input voltage for the UPS inverter. The required battery backup time (i.e. the time for battery to supply load upon mains failure) is subject to the ampere-hour value of the battery. Sometimes, it is necessary to connect several strings of battery in parallel.

To facilitate the UPS installation, the battery is generally installed on the specially designed battery rack or in the battery room.

During the maintenance or repair, the battery must be disconnected from the UPS. This operation may be realized by the battery circuit breaker of proper capacity. This circuit breaker shall be located as close as possible to the battery connecting terminal, and the wiring distance of the power and signal cables connected to the UPS shall be minimized.

When several strings of battery are paralleled to increase the battery backup time, disconnecting device shall be equipped, so that the maintenance operation on a certain battery string will not affect the normal operation of other battery strings.

6.2 Safety

Take special care when working with the batteries associated with the UPS. When all the blocks are connected together, the battery string voltage can be up to 432Vdc. This is potentially lethal. Please follow the precautions for high voltage operation. Only qualified personnel are allowed to install and maintain the battery. To ensure safety, the external batteries are to be installed inside a lockable cabinet or in a purpose-designed, dedicated battery room, so that they are only accessible to qualified service personnel.

Confirm that the battery switch has been disconnected before battery maintenance.

 Warning: hazardous battery voltage present behind covers		
1. No user-serviceable parts are located behind covers that require a tool for their removal. Only qualified service personnel are authorized to remove such covers. 2. Before working on the copper bars connected to the external battery, please ensure they are disconnected from all power supplies.		
Proper connection mode	Improper connection mode	
Tighten the terminal bolt of the battery with specified torque	Too large or too small torque may cause poor connection of the terminal. Under certain conditions, the terminal may have arcing or heat accumulation, which finally will cause fire	
		



Warning: hazardous battery voltage present behind covers

3. Observe the following safety precautions when working on the batteries:

- 1) The battery shall be firmly and reliably connected. After the connection is completed, the screw connections between all the terminals and the batteries shall be calibrated. The requirements on torque specified in the specifications or user manual provided by the battery manufacturer shall be satisfied. The connections between all the wiring terminals and the batteries shall be inspected and tightened at least once a year. Otherwise it may cause fire!
- 2) The battery appearance must be inspected before accepting and using the battery. If there exists any package damage, dirty battery terminal, terminal erosion, rust, or enclosure crack, deformation or liquid leakage, replace it with a new battery. Otherwise, battery capacity reduction, electric leakage or fire may be caused.

Battery damaged during handling or transportation	After a week of normal charge/discharge experiment
	

- 3) The battery is very heavy. Please use proper method to move and lift the battery, so as to prevent any damage to human being or the battery terminal. Severe damage to the battery may cause fire.
- 4) The battery connecting terminal shall not be subject to any force, such as the pulling force or twisting force of the cable, otherwise, the internal connection of the battery may be damaged. Severe damage to the battery may cause fire.
- 5) The battery shall be installed and stored in a clean, cool and dry environment. Do not install the battery in a sealed battery chamber or a sealed room. The battery room ventilation shall at least meet the requirement of EN50272-2001. Otherwise, battery bulging, fire or even human injury may be caused.
- 6) The battery shall be installed far away from the heating products (e.g. transformer), used or stored far away from any fire source, and shall not be burnt or put into fire for heating. Otherwise, battery leakage, bulging, fire or explosion may be caused.
- 7) Do not directly connect any conductor between the positive and negative terminals of the battery. Remove the finger rings, watch, necklace, bracelet and other meta items before operating the battery, and ensure that the tools (e.g., wrench) are covered with insulating material. Otherwise, battery burning, human death/injury or explosion may be caused.
- 8) Do not disassemble, modify or demolish the battery. Otherwise, battery short circuit, liquid leakage or even human injury may be caused.
- 9) Clean the battery enclosure with the wringed wet cloth. To avoid any static or arcing, do not use dry cloth or duster to clean the battery. Do not use the organic solvent (such as thinner, gasoline, volatile oil) to clean the battery. Otherwise, the battery enclosure may be cracked. In worst case, fire may be caused.
- 10) The battery has diluted sulfuric acid. In normal use, the diluted sulfuric acid will be absorbed to the baffle and polar plate of the battery. However, if the battery is damaged, the acid may leak from the battery. Therefore, personal protective equipment (e.g., protective glasses, rubber gloves and apron) must be used when operating the battery. Otherwise, if the diluted sulfuric acid enter the eyes, blindness may be caused; if it contacts the skin, the skin may be burnt.
- 11) The battery may have short circuit, electrolyte dry-up or positive pole erosion failure at the end of its life. If it is still used under this state, the battery may have thermorunaway, bulging or liquid leakage. Please replace the battery before it becomes this state.
- 12) Before connecting or disconnecting the battery connection cables, please isolate the charging power.
- 13) Check if the battery has been unexpectedly earthed. If this is the case, remove the earth connection. Contact with any part of the earthed battery may result in an electric shock.

6.3 UPS Battery

The UPS generally adopts valve-regulated battery. At present, 'valve-regulated' means the 'sealed type' or 'maintenance free' mentioned in the past.

The valve-regulated battery is not completely sealed, especially when it is over-charged, there will be gas escape. The volume of the gas escape is less than the water injection battery. However, during the installation design of the battery, temperature rise shall be taken into account, and enough room shall be reserved to ensure good ventilation. Besides, the valve-regulated battery is not maintenance free. The valve-regulated battery must be kept clean, and it shall be inspected regularly to check if the connection is reliable, and if it is corroded. For details, please refer to 6.8 *Battery Maintenance*.

It is suggested to connect no more than 4 strings of batteries in parallel. Batteries of different types, names or newness shall not be used together. Otherwise, the battery inconsistency will cause frequent over-discharge or under-charge of certain battery. At last, the battery will have premature failure, and the entire string of battery will have insufficient backup time.

The battery must be stored in fully charged state. The battery will lose certain capacity because of self discharge during the transportation or storage. Charge the battery before use. During the storage, ensure that the ambient temperature shall not exceed the range of $-15^{\circ}\text{C} \sim +45^{\circ}\text{C}$, and the optimal temperature is $20^{\circ}\text{C} \sim 25^{\circ}\text{C}$. To compensate for the self discharge of the battery during the storage, the battery shall be charged every 3 months during the storage. The specific time may differ for different batteries. For details, refer to the requirement of the battery manufacturer.

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

When the battery has been running for several weeks or subject to two to three charge and discharge cycles, the battery performance will be increased.

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

6.4 Precautions For Installation Design



Note

Precautions for installation, use and maintenance of the battery are described in the relevant battery manual provided by the battery manufacturer. The safety precautions described in this section include the important matters that must be considered during the installation design. The design results may be changed according to the local situations.

6.5 Battery Installation Environment And Number Of Batteries

6.5.1 Installation Environment:

Fresh air volume (EN50272-2001)

The operating environment of the battery must be ventilated. During the operation of the battery, the following requirement for the fresh air ventilation shall be satisfied:

$$Q=0.05 \times n \times I_{\text{gas}} \times C_{\text{rt}} \times 10^{-3} [\text{m}^3/\text{h}]$$

Where:

Q—The fresh air ventilation volume per hour, the unit is m^3/h

n—Number of cells

I_{gas} —The gas evolving current density under battery float charging or boost charge conditions, the unit is mA/Ah

$I_{\text{gas}}=1$, under the float charging condition of 2.27V/cell

$I_{\text{gas}}=8$, under the boost charge condition of 2.35V/cell

C_{rt} —20hr battery rated capacity

Temperature

Table 6-1 Ambient temperature range

Type	Temperature value	Remark
Recommended optimal temperature	20°C ~ 25°C	The ambient temperature for the battery operation shall not be too high or too low. If the average operating temperature of the battery rises from 25°C to 35°C, the service life of the battery will be reduced by 50%. If the operating temperature of the battery is over 40°C, the service life of the battery will be reduced exponentially each day
Short time allowable temperature	-15°C ~ 45°C	

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

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

The ambient temperature, ventilation, space, float/boost charge voltage and ripple current will affect the battery temperature. Uneven temperature among the battery strings will cause uneven voltage distribution and thus result in problem. Therefore, it is very important to maintain balanced temperature in the battery string, and the temperature difference between batteries of different layers shall be kept within 3°C. Valve-regulated battery is very sensitive to the temperature, therefore, valve-regulated battery shall be used in 15°C ~ 25°C. If the battery cabinet is installed near the UPS, the maximum design ambient temperature shall be determined according to the battery rather than the UPS. That is, if valve-regulated battery is used, the indoor ambient temperature shall be 15°C ~ 25°C rather than the operating temperature range of the main equipment. Under the precondition that the average temperature will not exceed 25°C, it is allowed to have short time temperature deviation.

6.5.2 Number Of Batteries

Set the DC bus voltage and battery float charging voltage, which is usually 490Vdc, according to the rated input/output voltage of the UPS, to ensure that the expected cell float charging voltage is 2.27V. The number of batteries, EOD voltage, and float charging voltage under the 380V/400V/415V voltage system are consistent, as shown in Table 6-2.

Table 6-2 Number of batteries

Parameter	380V/400V/415V
Number of cells (standard)	192 ~ 240 PCS, 216 recommended
EOD voltage	1.60Vdc/Cell ~ 1.85Vdc/Cell, 1.62V/cell recommended, that is the EOD voltage is 389V
Float charging voltage	2.15Vdc/Cell ~ 2.3Vdc/Cell, 2.27V/cell recommended, that is the float charging voltage is 490V

6.6 Battery Installation And Connection

6.6.1 Battery Installation

1. Before installation, check the battery appearance to ensure that there is no damage, inspect and count the accessories, and carefully read this manual and the user manual or installation instruction provided by the battery manufacturer.
2. There shall be at least 10mm gap between the batteries in vertical direction, to ensure the free circulation of the ambient air of the batteries.
3. Certain clearance shall be maintained between the battery top and the upper layer to facilitate the monitoring and maintenance of the battery.
4. The batteries shall be installed from the bottom layer and from bottom to top, so as to avoid a too high gravity center. The battery shall be properly installed and protected from vibration or shock.

6.6.2 Battery Connection

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

2. When multiple batteries are used, they shall be connected in series and then in parallel. Before loading and power-up, it must be detected that the total voltage of the batteries is as specified. The negative and positive poles of the batteries must be connected to the negative and positive battery terminals of the UPS according to the labels on the battery and UPS. If the battery is reversely connected, explosion and fire may be caused, it may result in battery and UPS damage or even human injury.
3. When the battery cable connection is completed, install insulating shield for the terminals.
4. When connecting the cable between the battery terminal and the BCB, the BCB terminal shall be connected first.
5. The bending radius of the cable shall be larger than 10D, wherein D is the outer diameter of the cable.
6. When the battery cable is connected, it is prohibited to pull the battery cable or the cable terminal.
7. Do not cross the battery cables during the connection, and do not tie the battery cables together.

6.7 Design Of Battery Room

No matter which type of installation system is adopted, the following items shall be paid special attention to (refer to Figure 6-1):

① Layout of cells

No matter which battery installation system is used, the battery shall be located in a matter that it will not contact two naked live parts with the potential difference over 150V at the same time. If it is unavoidable, insulated terminal shield and insulated cable shall be used for the connection.

② Workbench

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

③ Wiring

All the wiring distances shall be minimized.

④ BCB

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

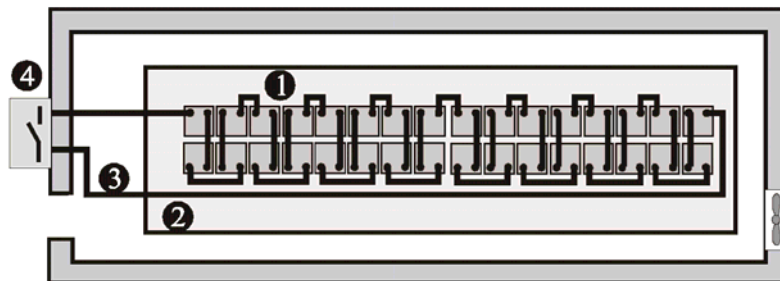


Figure 6-1 Battery room design

6.8 Battery Maintenance

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



Note

1. Periodically check the screws of the battery connection parts and confirm that they are firmly tightened. If there is any loosened screw, tighten it immediately.
2. Ensure that all safety devices are in place and operate normally, and that the battery management parameters are set properly.
3. Measure and record the air temperature inside the battery room.
4. Check to ensure that the battery terminals have no damage or heat generating trace, and the battery enclosure and terminal shields are intact.

6.9 Disposal Of Used Battery

If the battery has liquid leakage or is damaged, place the battery into the container that can withstand sulphuric acid and discard it according to the local regulations.

Used lead acid storage battery belongs to dangerous waste, and it is a key item for used battery pollution control. The storage, transportation, use and disposal of the battery shall comply with the national and local laws and regulations on dangerous waste and used battery pollution prevention and other standards.

According to the relevant national regulations, the used lead acid storage battery must be recycled and shall not be disposed of with other methods. Random discard or any other improper disposal of the used lead acid storage battery may cause severe environment pollution and the relevant person will be investigated of corresponding legal responsibilities.

Chapter 7 1 + 1 Parallel System And LBS System

This chapter gives details on the installation of 1 + 1 parallel system and LBS system.

7.1 General

The UPS parallel system provides the parallel configuration of $N + X$ ($2 \leq N + X \leq 4$) for users, N means basic parallel sets, and X means redundant sets.

This product only supports 1 + 1 redundant parallel without the need for a centralized mains static bypass. Instead the bypass static switches of each UPS share the load when the system transfers to the mains bypass supply.

From a 'power' viewpoint, each module is internally identical to the 'single module' configuration. A parallel system requires inter-module control signals to manage the load sharing, synchronizing and bypass switching. The control signals are connected through the parallel cables, which are multi-way ribbon cables connected between the units of the system to form a ring.

7.2 System Installation Procedures

The basic installation procedure of a 1 + 1 parallel system is the same as that of single module system. This section only introduces the installation procedures specific to the parallel system. The installation of a parallel UPS should follow the installation procedure for a single UPS module with the additional requirements detailed in this section.

7.2.1 Preliminary Checks

Be sure that the options of the parallel cables are correct, and that the modules are of the same rating, model, and with the same software and hardware release.



Warning

To achieve coordinated operation of the modules in the parallel system, it is required to configure each module separately using Emerson setting software. This must be done by Emerson service personnel.

7.2.2 Parallel Installation

The rack installation of 1 + 1 parallel system is as follows:

1. As shown in Figure 7-1, the single UPS is installed under the UPD for convenient cable connection and operation.

For details, see 2.7 *Installation*.

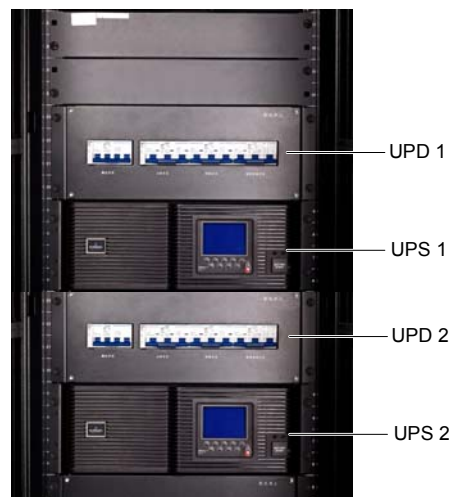


Figure 7-1 Rack installation of 1 + 1 parallel system

2. Place the UPDs and interconnect them according to Figure 7-2. The output distribution mode (Q1EXT, Q2EXT must be configured) shown in Figure 7-2 is recommended to facilitate maintenance and system testing.

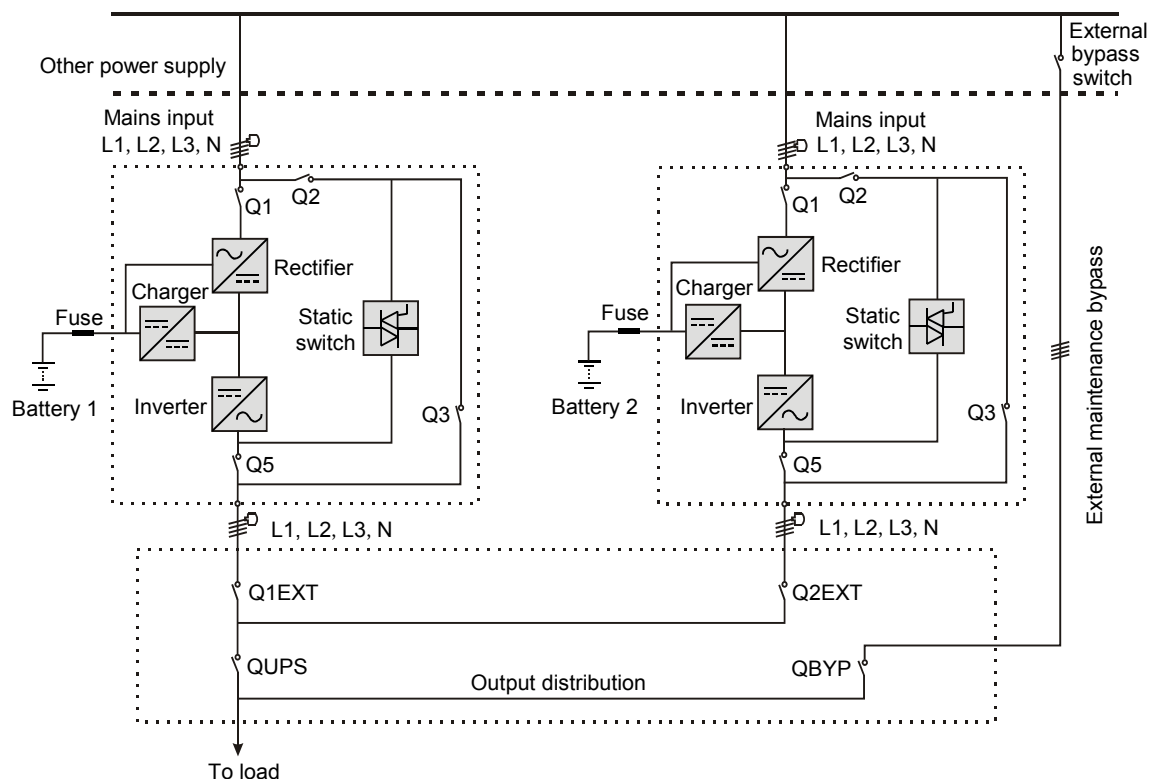


Figure 7-2 Schematic of typical parallel system (with common input, separate batteries and output)

7.2.3 Power Cable

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

As shown in Figure 7-3, the output terminals of UPD1 and UPD2 should be connected. Ensure the correct phase rotation and reliable connection.

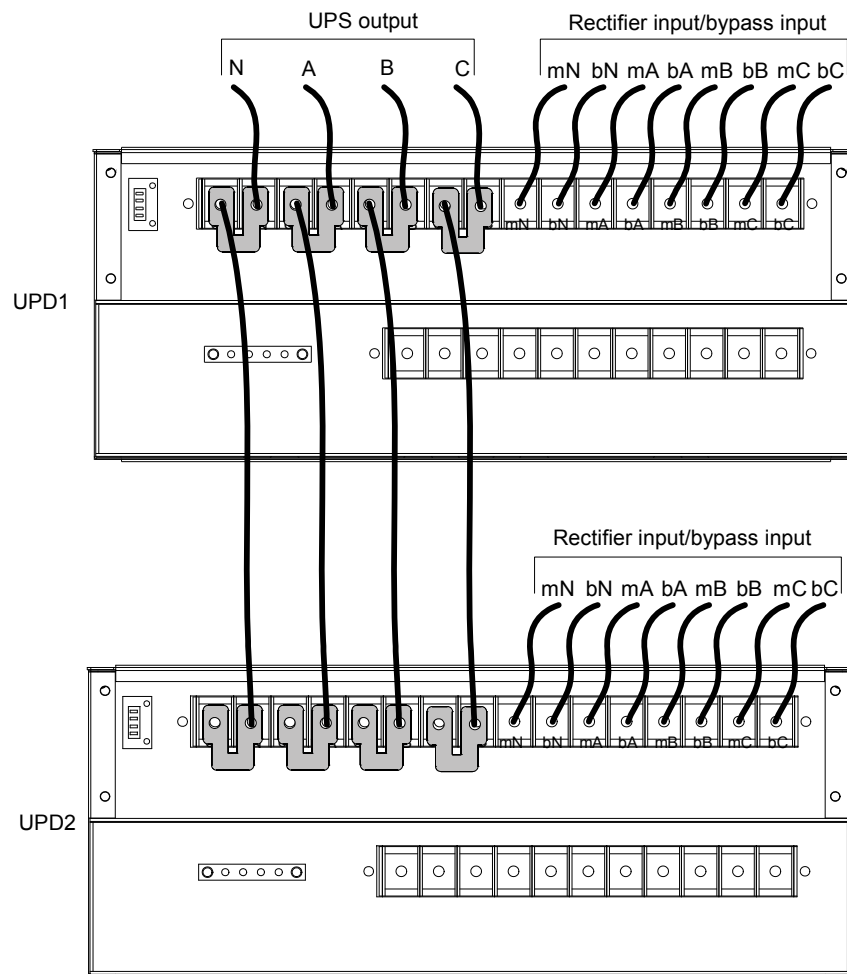


Figure 7-3 Output terminals connection of UPD1 and UPD2

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

**Note**

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

7.2.4 Battery Cable

Each UPS in parallel system not only shares battery string also uses battery string independently.

**Note**

Independent battery switch is required for each UPS. See Table 3-3 for battery switch selection.

Use battery string independently

When each UPS in parallel system uses battery string independently, the battery cable connection method is the same as that of the single UPS. See 3.1.9 *Power Cable Connection Steps* for details. See Table 3-3 for battery switch parameters setting of each UPS.

**Note**

Ensure the LCD setting is correct when parallel system uses battery string independently, see 7.3.2 *1 + 1 Parallel System Parameters Setting*.

Common battery string

Use of common battery string helps the user save equipment investment.

Use the battery cables (see *Chapter 3 Electrical Installation* for selection of battery cable and battery switch) to connect the terminals ('+', 'N', '-' and 'PE') of battery string to corresponding single UPS in 1 + 1 parallel system. Ensure that polarities of the battery string are correct. See Figure 7-4 for details.

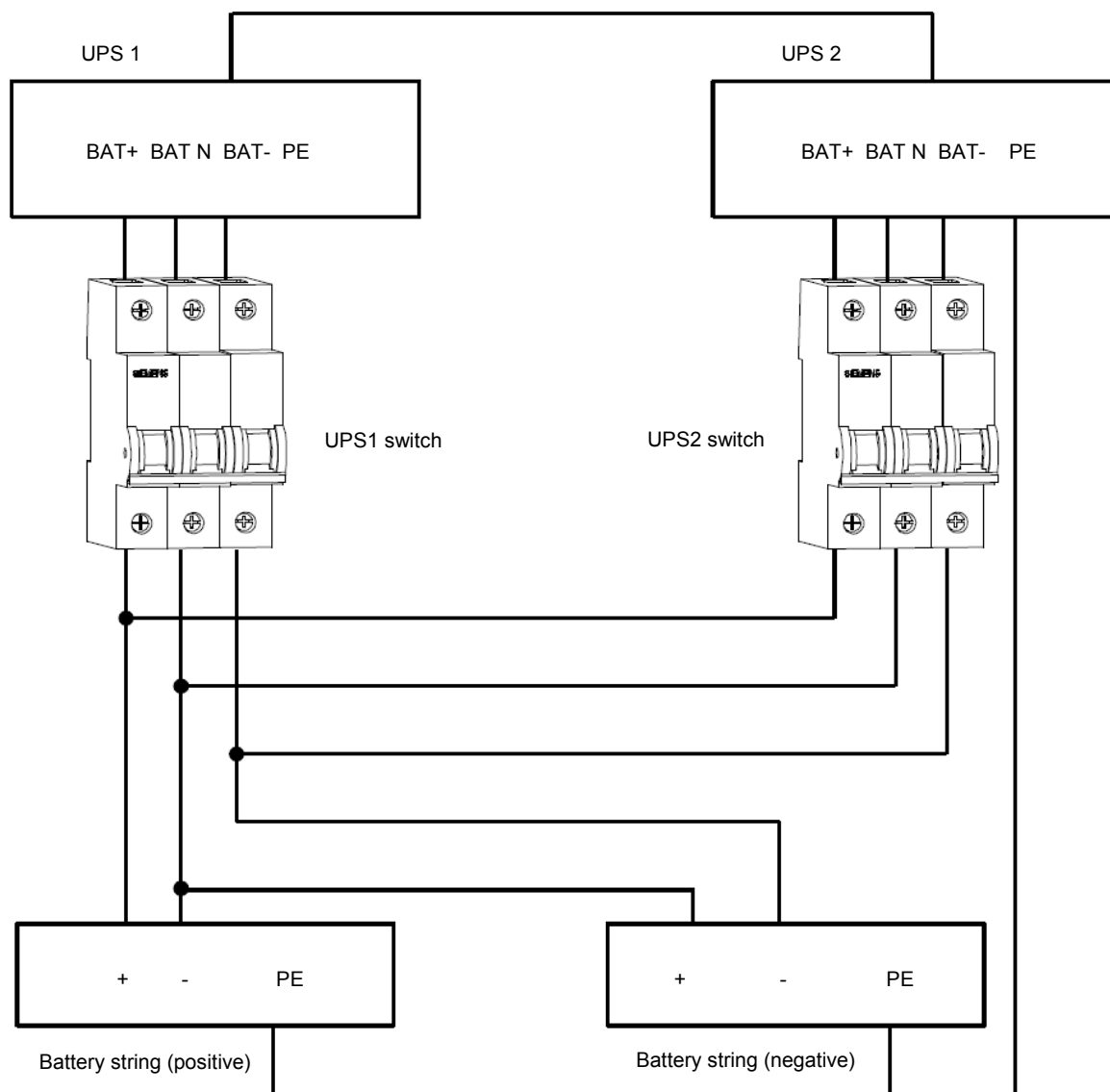


Figure 7-4 Battery cables connection of common battery string

After the system is powered on, you can do the following operation to set each UPS to common battery string configuration: Settings -> Shared Battery -> Enabled, then Settings -> Battery Cells Number -> Single Group Batt Cap. Note that the setting of each UPS must be the same.



Note

The 'Single Group Batt Cap' means the total capacity of battery string, and each UPS will calculate its own capacity from shared source.

7.2.5 Parallel Cable

Shielded and double-insulated parallel cables available in lengths 5m, 10m and 15m must be interconnected in a ring configuration between the UPS modules, as shown in Figure 7-5. Method: connect a module parallel cable from its PARA1 port to the PARA2 port of another module. Follow this method to connect other parallel cables.

The ring connection ensures the reliability of the control of the parallel system. Be sure to verify the reliable cable connection before starting up the system!

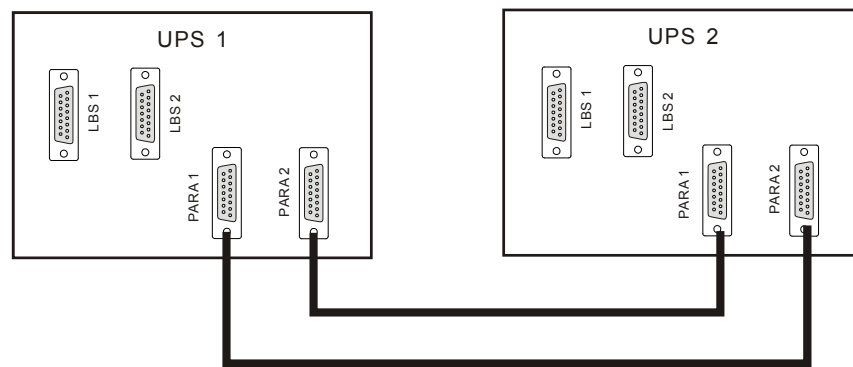


Figure 7-5 Parallel signal cables connection (parallel system)

7.2.6 Remote EPO

In addition to the EPO switch provided on the operator control and display panel of each UPS module for controlling the EPO of each module respectively, the parallel system also provides remote EPO function for controlling all UPS modules to shut down simultaneously from a remote terminal, as shown in Figure 7-6.

 Note
1. The remote EPO switch must provide dry contact signal, which is normally open or normally closed. 2. The open circuit voltage provided is 12Vdc, < 20mA. 3. The external EPO device can be composed of another control system which can disconnect UPS mains supply or bypass input.

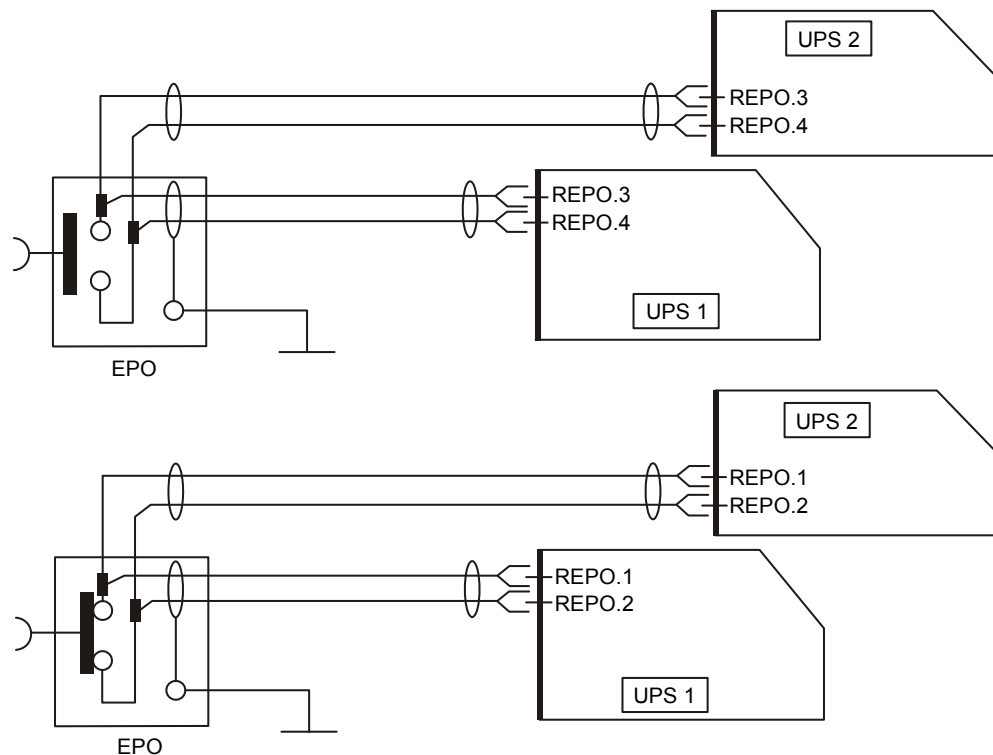


Figure 7-6 EPO circuit diagram

Note: In Figure 7-6, the upper one is Normally Open type, and the lower one is Normally Closed type.

7.3 Operation Procedures For Parallel System



Warning

If UPS input uses RCD, differential switch is only used in the system's bypass mains supply. At the moment of electrical connection, current may not be immediately separated, which may result in the tripping of RCCB respectively.

Only one step is needed for once, and only after finishing this operation step of each UPS module, the next step can be carried on.

The UPS must be completely installed and tested by authorized engineer, and external power supply switch is closed, then you can start the UPS.

7.3.1 Check Before Startup

1. Check and confirm that the power distribution mode of the single UPS and UPD 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 are correct and there is no short circuit, and that the positive pole and negative pole of the battery are correct.
3. Check that the phase sequence of the main, bypass and output of each UPS is correct and accordant. Ensure that the parallel cable connection is reliable, and that the user load is not connected during power-on, to check all the working status of the parallel system.
4. Measure and confirm that the mains voltage and frequency are normal.
5. The output terminals of the UPS system are energized upon the startup. If the load is connected with the output terminals, make sure that it is safe to feed power to the load.

7.3.2 1 + 1 Parallel System Parameters Setting

All UPSs in 1 + 1 parallel system must be configured with parallel parameters. See steps 1 ~ 3 in 7.3.3 *Startup Procedures In Normal Mode* to power on each UPS, and press EPO button, then close the rectifier and battery charger. See corresponding contents in *Chapter 4 Operator Control And Display Panel* to enter 'Settings' option, and then set parallel parameters according to Table 7-1.

Table 7-1 1 + 1 Parallel system parameters setting

Parameter	Default	Parameter setting
Single Group Batt Cap	26	Set according to actual single group battery capacity
Battery Cells Number	32	Set according to actual battery cells
Equalize Charge Allowed	Disabled	Set according to actual battery features
Temp Compensation	Disabled	Enable this function if users select the temperature compensation option
System Configuration	Parallel	Parallel
Parallel Requisite units	1	1
Parallel Redundant units	1	1
Parallel ID	1	One for1, the other for 2
ECO Mode	Normal	Normal
Output Frequency Level	50Hz	50Hz/60Hz
Output Voltage Level	380V	380V/400V/415V

For other parameters, see Table 4-7 for details. The user can adjust the parameters according to actual needs.

If the invert is started to power the load after parameters setting, press the FAULT CLEAR key of two UPSs at least two seconds. See steps 4 ~ 5 in 7.3.4 *Startup Procedures In ECO Mode*.

7.3.3 Startup Procedures In Normal Mode

These procedures are applicable to start the UPS under total power-down state, which means the UPS or the maintenance bypass switch has not supplied the load before. Make sure the UPS has been completely installed and commissioned by the engineer, and external power supply switch has been turned off.

**Warning**

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

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

1. Confirm that the total external maintenance bypass switches are disconnected. Ensure that the maintenance bypass switch Q3 of UPD is disconnected, while the input cables and copper bars are reliably connected, and the parallel cables are firmly connected.

**Warning**

All operations relating to disconnect or close the switch of maintenance bypass switch shall be finished within three seconds, in case of misreporting as faults.

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

At the moment, the system is power on, and the startup screen pops up. Refer to 4.2.1 Start Screen.

About 25 seconds later, confirm that the LCD shows the rectifier power supply and the bypass power supply are normal; if not, check whether the switches Q1 and Q2 are closed and the parallel cables of each UPS are connected reliably. Then the rectifier starts up and the alarm indicator (red) is on, at the same time, the bypass static switch is closed. About 30 seconds later, the alarm indicator (red) is flashing or off (if battery connected), then the rectifier startup is finished. And then all the rectifiers startup of the UPSs is finished.

4. For each UPS, press the ON key for two seconds. The inverter starts up, and the inverter indicator (green) of each UPS is flashing. After all the UPS inverter indicators turn solid green, the whole UPS system will power the load.

7.3.4 Startup Procedures In ECO Mode

1. Ensure that the maintenance bypass switch Q3 of UPD is disconnected, while the input cables and copper bars are reliably connected.

**Warning**

All operations relating to disconnect or close the switch of maintenance bypass switch shall be finished within three seconds, in case of misreporting as faults.

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

At the moment, the system is power on, and the startup screen pops up. Refer to 4.2.1 Start Screen.

About 25 seconds later, confirm that the LCD shows the rectifier power supply and the bypass power supply are normal; if not, check whether the switches Q1 and Q2 are closed. Then the rectifier starts up and the alarm indicator (red) is on. At the same time, the bypass static switch is closed.

3. Press the EPO button.

At this time, the system is switched off emergently, and the LCD displays 'UPS shutdown'. Set the parameter to ECO mode according to Table 7-2.

Table 7-2 Parameter setting of ECO mode

Parameter	Default	Parameters setting
ECO Mode	Normal	ECO

For other parameters, see Table 7-1 for details. The user can adjust the parameters according to actual needs.

4. Press the FAULT CLEAR key for two seconds.

The rectifier starts up, and the alarm indicator (red) is on, bypass static switch is closed. About 30 seconds later, the alarm indicator (red) is flashing or off (if battery connected). And then the rectifier startup is finished.

5. Press the ON key for two seconds.

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

UPS operated in ECO mode

7.3.5 Maintenance Bypass Procedures

This operation will make the load transfer from UPS power supply protection state to direct connection with AC input bypass state.



Caution: power supply interruption danger of the load

Before performing this procedure, you should check the LED information first, and make sure the bypass is normal and inverter synchronized. Otherwise, it may result in the load power interruption for a while.

1. Press the OFF key of each UPS in turn for two seconds. The inverter indicators are off and the buzzer alarms. The load transfers to the static bypass, and the inverter shuts down. At last, all UPSs are transferred to load supply mode.



Note

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

2. Close the maintenance bypass switch Q3 of UPD, and the LCD displays 'Maint. sw. closed'.

3. At the moment, the maintenance bypass parallels with the UPS static bypass.

4. Disconnect the output switch Q5 in turn, and the LCD displays 'Output sw. open'.

At the moment, the load is powered by the maintenance bypass directly.



Caution

When the UPS is in maintenance mode, the load does not have the mains abnormal protection.

5. Pressing the EPO button of each UPS stops the operation of rectifier, inverter, static switch and battery, but this action will not affect the maintenance bypass power the load normally.



Note

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

6. If the UPS has external battery, disconnect the corresponding switch of the external battery. All UPS modules should be disconnected from the batteries.

7. Disconnect the rectifier input switch Q1 and bypass input switch Q2 of each UPS in turn.

At the moment, all the internal power supply is closed and the LCD does not display any more.



Warning

1. If the maintenance is required, wait 10 minutes for the internal DC bus capacitance discharging.
2. The parts of UPS circuits also have hazardous voltage, though the rectifier input switch, bypass input switch and battery switch are disconnected. Therefore, the UPS maintenance is suitable for qualified personnel only.

7.3.6 Procedures For Isolating One UPS Module From Parallel System



Important

These procedures shall only be carried out by service personnel of Emerson or under their guidance.

**Warning**

Before operation, confirm that the system capacity has redundancy to avoid system shutdown due to overload.

The following procedures apply when one UPS module must be isolated from the 1 + 1 parallel system for repair due to serious fault:

1. Pressing the EPO button stops the operation of rectifier, inverter, static switch and battery, but this action will not affect other UPSs in parallel system to power the load normally.
2. If the UPS has external battery, disconnect the corresponding switch of the external battery.
3. Disconnect the rectifier input switch Q1 and bypass input switch Q2, and disconnect the output switch Q5.

At the moment, all the internal power supply is closed and the LCD does not display any more.

**Warning**

1. Post a label at the AC input distribution (generally far away from the UPS) to alert that the UPS maintenance is being operated.
2. Wait 10 minutes for the internal DC bus capacitance discharging. Then the UPS is completely shut down.

7.3.7 Procedures For Inserting One Isolated UPS Module In Parallel System

**Important**

These procedures shall only be carried out by service personnel of Emerson or under their guidance.

The following procedures are used to reintegrate a UPS module that has been previously isolated from the parallel system:

1. Ensure that the parallel cables are reliably connected, see Figure 7-5.
2. If the UPS is connected with a battery, just close the battery external distribution switch Then close the rectifier input switch Q1.

At the moment, the system is power on, and the startup screen pops up. Refer to Refer to 4.2.1 *Start Screen*.

3. Close the bypass input switch Q2 and output switch Q5.

25 seconds later, confirm that the LCD shows the bypass input supply is normal; if not, check whether the switch Q2 is closed. Then the rectifier starts up and the alarm indicator turns solid red. About 30 seconds later, the alarm indicator (red) is flashing or off (if the UPS connected).

4. Press the ON key for two seconds.

The inverter starts up, and the inverter indicator (green) is flashing. After the inverter runs normally, the inverter indicator turns solid green, and the inverter supplies power to the UPS.

At this point, the UPS will join the operation of the parallel system, and supply power to the load.

7.3.8 Procedures For Completely Powering Down UPS

Complete UPS shutdown and load power-off should follow this procedure. All power switches, isolating switches and breakers are disconnected, and then UPS no longer supplies power to the load.

**Caution**

The following procedures will cut off the load power, making the load completely power off.

1. Pressing the EPO button of each UPS stops the operation of rectifier, inverter, static switch and battery.
2. If the UPS has external battery, disconnect the corresponding switch of the external battery. All UPS modules should be disconnected from the batteries.
3. Disconnect the rectifier input switch Q1 and bypass input switch Q2 of each UPS. At the moment, all the internal power supply is closed and the LCD does not display any more.
4. Disconnect the output switch Q5 of each UPS.

**Warning**

1. Post a label at the AC input distribution (generally far away from the UPS) to alert that the UPS maintenance is being operated.
2. Wait 10 minutes for the internal DC bus capacitance discharging. Then the UPS is completely shut down.

**Note**

1. After the UPS shutdown, the load is transferred to maintenance bypass. If required, operate the maintenance bypass switch at any time.
2. Only qualified personnel shall finish the UPS installation. This procedure can be executed after the system runs normally.

**Warning: hazardous battery voltage**

The battery terminals still have hazardous voltage after the UPS complete shutdown.

7.3.9 Procedures For Complete UPS Shutdown While Maintaining Power To Load

The following procedures are applicable for completely powering down the UPS and still keeping the power supply to the load. Refer to the procedures in 7.3.5 *Maintenance Bypass Procedures*.

7.4 LBS System

7.4.1 Cabinet Installation

An LBS system consists of two independent UPS systems, each containing one or more parallel UPS modules, as shown in Figure 7-7 and Figure 7-8. The LBS system has high reliability and is suitable for load with multiple inputs. For single-input load, an STS can be installed to feed power to the load.

The system uses the LBS cables to keep the output of the two independent (or parallel) UPS systems in synchronization. One system is designated as the master, the other is designated as the slave. The operation modes of the parallel system comprise master and/or slave operation in normal or bypass mode.

Place the UPS modules side by side and interconnect the UPS modules according to the following instructions.

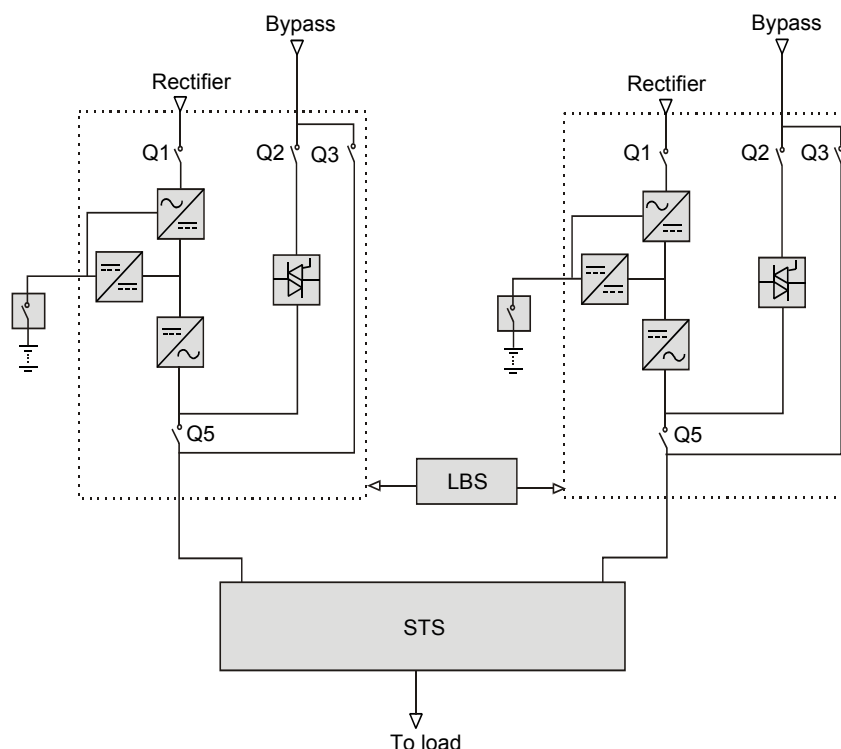


Figure 7-7 LBS system (UPS module)

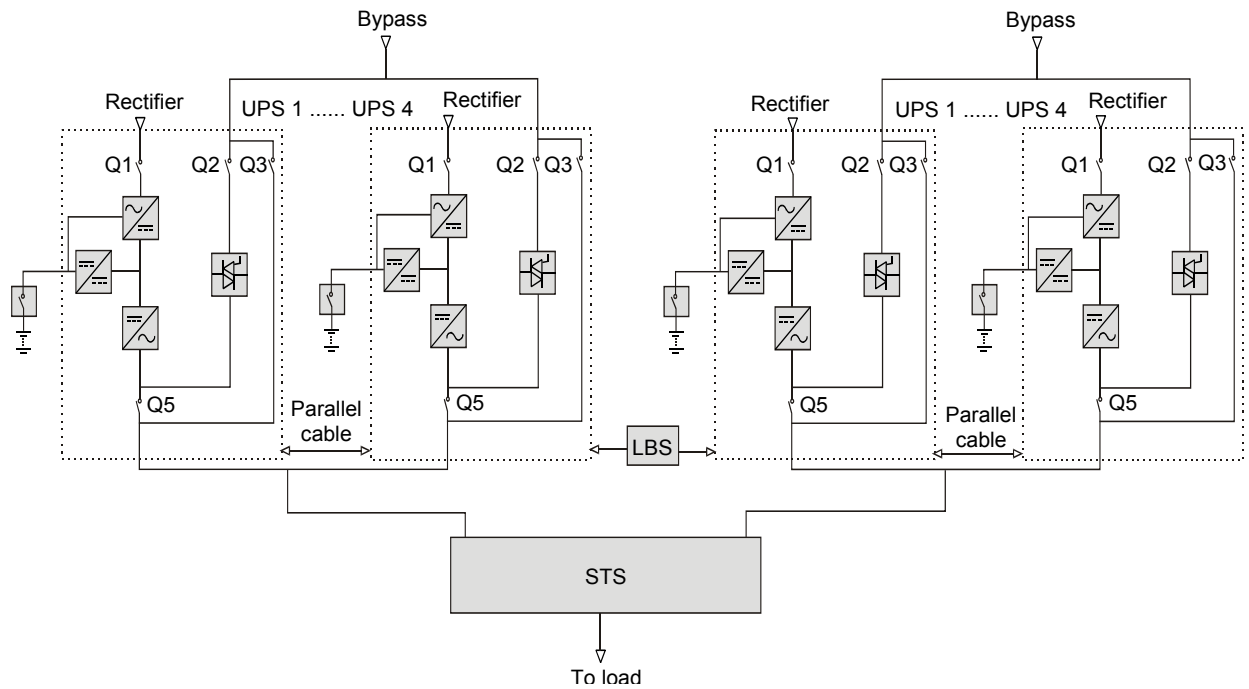


Figure 7-8 LBS system (parallel system)

**Note**

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

7.4.2 External Protective Device

Refer to 3.1.8 *External Protective Device*.

7.4.3 Power Cable

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

7.4.4 LBS Cable

**Note**

LBS port (see Figure 3-8) has been installed with protective cover before delivery. Remove this protective cover before connecting LBS cables.

The shielded and double-insulated parallel cables are available in lengths 5m, 10m and 15m. Connect the two optional LBS cables in a ring configuration: from the LBS1 port of one UPS module to LBS2 port of another UPS module, and from the LBS2 port of one UPS module to LBS1 port of another UPS module, as shown in Figure 7-9 and Figure 7-10.

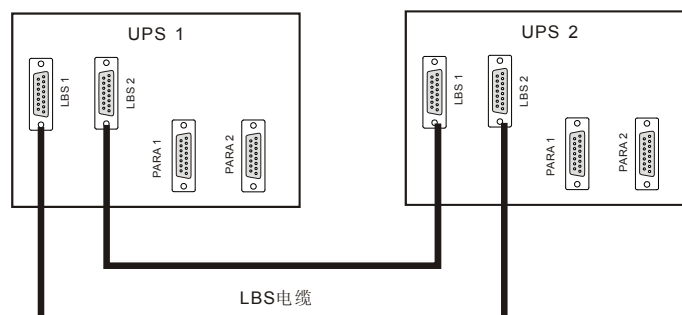


Figure 7-9 Connection of typical LBS system (UPS module)

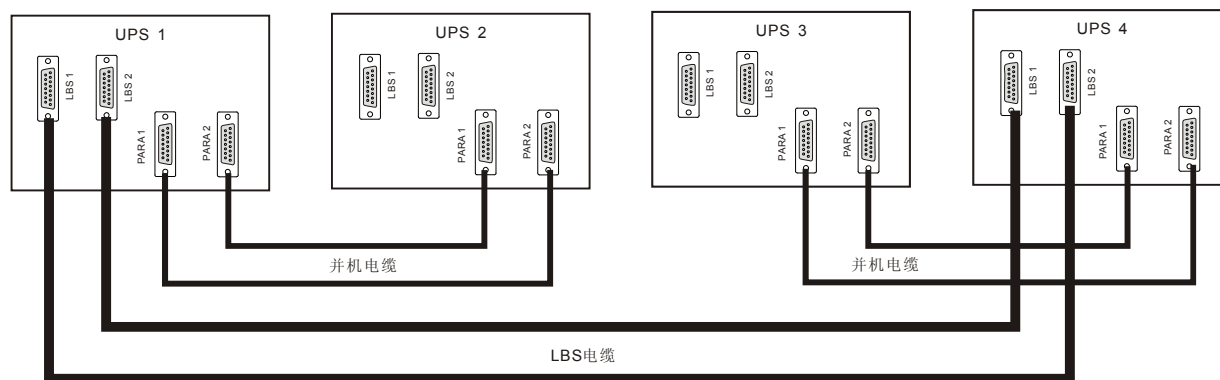


Figure 7-10 Connection of typical LBS system (parallel system)

7.4.5 LBS System Parameters Setting

Taking the 1 + 1 parallel system for example, you can see Table 7-3 for LBS system parameter settings.

Table 7-3 LBS system parameters settings

Parameter	Default	Parameter setting
System Configuration	Parallel	Parallel
Parallel Requisite units	1	1
Parallel Redundant units	1	1
Parallel ID	1	One for 1, the other for 2
ECO Mode	Normal	Normal
LBS Function	NONE	'MASTER' for priority system, 'SLAVE' for non-priority system

For other parameters, see Table 7-1 for details. The user can adjust the parameters according to actual needs.

Make sure that parameters of each UPS in LBS system should be consistent.

Chapter 8 Options

This chapter provides the UPS option list, and introduces the functions, installation and configuration of each option.

8.1 Option List

See Table 8-1 for option list of the UPS.

Table 8-1 Option list

No.	Option name	Remark
1	LPD (Rack Mount Load Power Distribution Unit)	Provide the user with safe rack mount load power distribution function
2	Guide rail for rack installation	A must for rack installation
3	Temperature sensor	Used together with UF-RS485 card
4	SIC card	Network management card
5	Relay card	Use dry contact signal to monitor the UPS
6	Modbus card	Internal protocol transfer from UPS to Modbus RTU protocol
7	UF-RS485 card	Used to connect temperature sensor, network and communication
8	Parallel cable	Available in 5m, 10m, 15m
9	LBS cable	Available in 5m, 10m, 15m

8.2 Option Introduction

8.2.1 LPD Power Distribution Box

Appearance and component

LPD is the option of the UPS, which provides safe rack mount load power distribution function for the user. See Table 8-2 for the specifications.

Table 8-2 Specifications of LPD

Option	Dimensions (W × D × H) (mm)	Weight (kg)
LPD	484.6 × 362.7 × 176	10

The front panel of the LPD is shown in Figure 8-1.

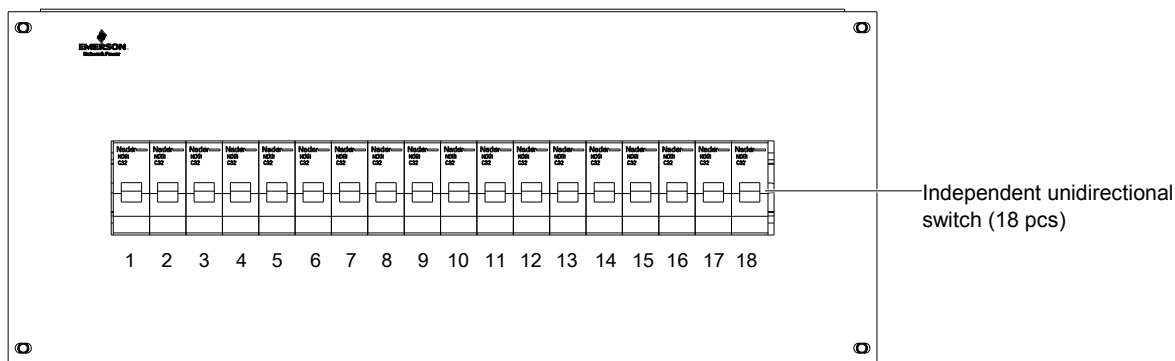


Figure 8-1 Front panel of LPD

Installation procedures

1. According to 2.7 Installation, place the UPS and the UPD into the rack, and then connect corresponding cables.
2. Similar to UPD installation, place the LPD onto the guide rails at the lower layer of the UPS, and then push it completely.
3. Use four M6*16 panel screws to fix the LPD onto the rack through brackets. See Figure 8-2.

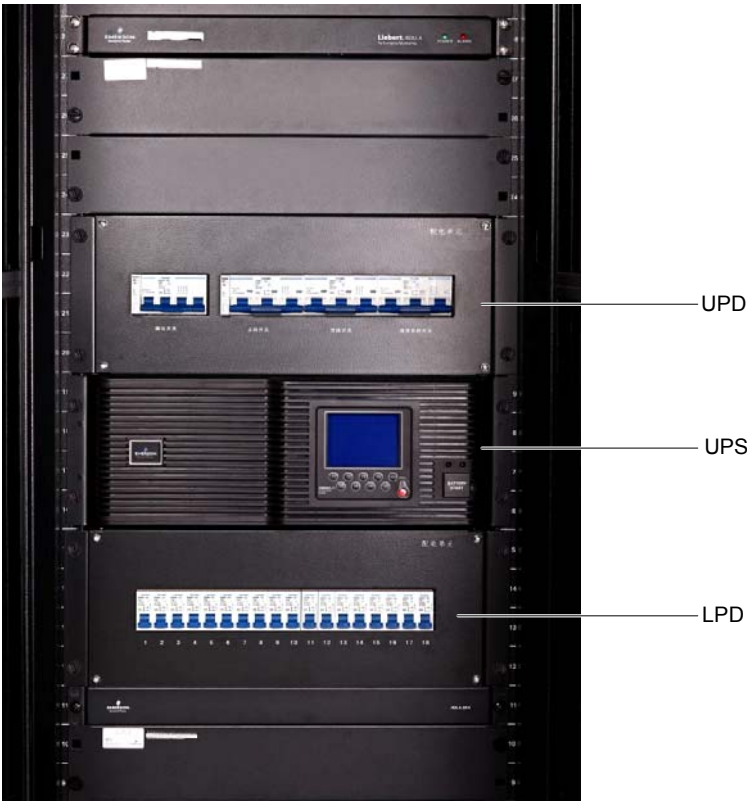


Figure 8-2 LPD installation

8.2.2 Guide Rail For Rack Installation

The guide rail is used for rack installation of single UPS, UPD and LPD (optional). The appearance of the guide rail is shown in Figure 2-3 and described in Table 8-3. See 2.7 Installation for rack installation steps.

Table 8-3 Guide Rail For Rack Installation

Model	Name	Description
UF-RMKIT2438	Rack mount guide rail	Left and right. Bearing: 70kg. Used for rack installation of server cabinet, UPS, modularized battery and UPD

8.2.3 Battery Temperature Compensation Kit

A battery temperature sensor is used to measure the battery temperature. The battery temperature is installed next to the battery for measuring battery temperature. The sensor signal output cable is connected to the UF-RS485 card of Intellislot port. At this moment, the temperature sensor is connected with the UPS internal logic circuit.

With this feature fitted, the nominal float voltage supplied to the battery is adjusted so as to be inversely proportional to the ambient temperature of the battery cabinet or battery room. This prevents the battery being over charged at high ambient temperatures.

Preparation

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

Procedures

 **Warning**

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

1. Shut down the UPS completely.
 - 1) Close the load.
 - 2) Refer to 5.6.1 *Procedures For Completely Powering Down UPS* for single UPS module shutdown, and 7.3.8 *Procedures For Completely Powering Down UPS* for parallel system shutdown.
 - 3) All the LCDS are off, wait five minutes for the internal DC bus capacitors of the UPS complete discharging.
2. Connect one end of the specified cable to either port of the battery temperature sensor, and the other end to each port of UF-RS485 card. See Figure 8-3.



Figure 8-3 Connection between UF-RS485 card and battery temperature sensor

3. According to Figure 8-4, dial the DIP switch 6 (or 5) to 'ON', making the lower left corner of the LCD screen of temperature sensor display 01 (or 02). If two temperature sensors are used together, their DIP switches are not allowed to be superposition.



Figure 8-4 DIP switch of temperature sensor

4. Place the battery temperature sensor next to the battery cabinet or battery rack. Insert the UF-RS485 card into the corresponding Intellislot port.
5. Pack the cables in order. Note that the cables should be routed separately from the power cables, to avoid EMI.

8.2.4 SIC Card

The SIC card is a network management card. It can make the UPS made by Emerson Network Power Co., Ltd real network equipment. It can also be connected to the IRM series sensor to provide environment monitoring function. When the intelligent equipment generates an alarm, the SIC card can notify the user by recording the log, sending trap information, and sending a mail.

Preparation

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

Procedures

 Note
No need to shut down the UPS during SIC card installation, because the SIC card is hot pluggable.

 Warning
Some electron components in SIC card are sensitive to static, therefore, do not touch the electron components or circuit in SIC card by hand or other conductive materials, so as to protect the SIC card against static shock. When removing or installing the SIC card, hold the card side edge to operate it.

The SIC card should be installed in the Intellislot port (see Figure 3-8) in the UPS.

Method for installation:

1. Remove the cover of Intellislot port. Note to reserve the removed screws and take care of the cover for future use.
2. Insert the SIC card (along two sides of the Intellislot port) into the port position, and then fasten the screws.

For more information of the SIC card, refer to *Site Interface Web/SNMP Agent Card User Manual* in accessory.

8.2.5 Relay Card

The UPS provides relay card for the user to use dry contact signals to monitor the UPS. It is hot pluggable for easy installation.

The relay card can provide four channels of relay digital signal output to the remote site. They are UPS on Battery, Battery Low, UPS on Bypass or in Standby, UPS Faulty. Each dry contact signal output channel provides both normally open and normally closed ports. The relay card can also receive three channels of digital signal input, two of which control the UPS turn-on and turn-off respectively, the third is reserved.

Appearance and hardware description

The appearance of the relay card is shown in Figure 8-5.

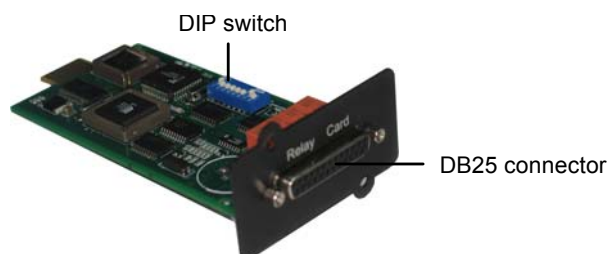


Figure 8-5 Relay card appearance

The DIP switch is used to configure the UPS turn-on and turn-off signal input function of the relay card. The DB25 connector provides dry contact signal input and output. The pins of the DB25 connector are described in Table 8-4.

Table 8-4 DB25 connector pin description

Pin No.	Pin name	Description
Pin 1	Va, power output	9 ~ 15Vdc (reserved for factory use)
Pin 14	K0_NO, Channel 0 dry contact normally open output contact	Closed: UPS on Battery
Pin 2	K0_COM, Channel 0 dry contact common output contact	
Pin 15	K0_NC, Channel 0 dry contact normally closed output contact	Open: UPS on battery
Pin 3	K1_NO, Channel 1 dry contact normally open output contact	Closed: Battery Low
Pin 16	K1_COM, Channel 1 dry contact common output contact	
Pin 4	K1_NC, Channel 1 dry contact normally closed output contact	Open: Battery Low
Pin 17	K2_NO, Channel 2 dry contact normally open output contact	Closed: UPS on Bypass or in Standby
Pin 5	K2_COM, Channel 2 dry contact common output contact	
Pin 18	K2_NC, Channel 2 dry contact normally closed output contact	Open: UPS on Bypass or in Standby
Pin 6	K3_NO, Channel 3 dry contact normally open output contact	Closed: UPS Faulty
Pin 19	K3_COM, Channel 3 dry contact common output contact	
Pin 7	K3_NC, Channel 3 dry contact normally closed output contact	Open: UPS Faulty
Pin 24	DRY_IN2, Channel 2 dry contact signal input	Reserved

Electrical
parameter:
30Vdc/1.8A,
resistive load

Pin No.	Pin name	Description
Pin 12	DRY_IN1, Channel 1 dry contact signal input	The UPS is turned off if this contact is closed for more than one second
Pin 25	DRY_IN0, Channel 0 dry contact signal input	The UPS is turned on if this contact is closed for more than one second
Pin 9	RXD_PC, for communication to PC, receive terminal	Reserved, for factory commissioning
Pin 21	TXD_PC, for communication to PC, send terminal	Reserved, for factory commissioning
Pin 13	GND, common GND	Power GND, dry contact signal input common GND
Others	NC	

Cable options

Emerson provides three cable options to connect the DB25 connector of the relay card, to suit the user's different requirements on the functions of the connector.

Figure 8-6 ~ Figure 8-8 show the appearance and wiring principle of each cable.

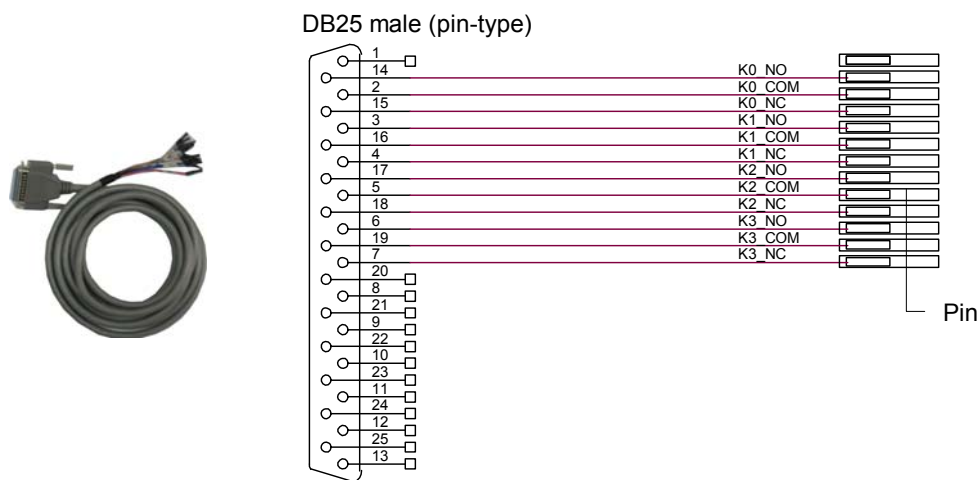


Figure 8-6 Appearance and wiring schematic of cable 1 (UFDRY21SL1)

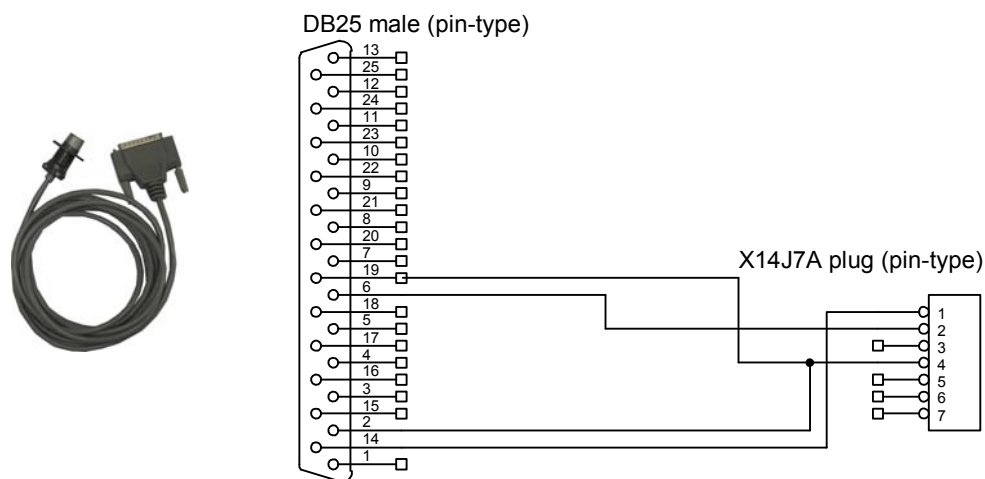


Figure 8-7 Appearance and wiring schematic of cable 2 (UFDRY21SL2)

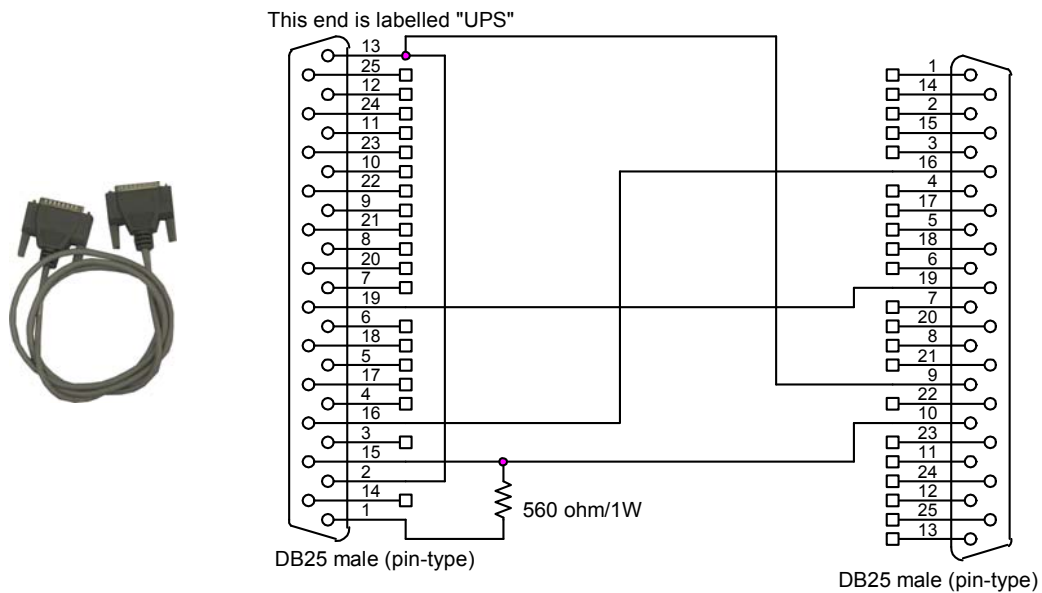


Figure 8-8 Appearance and wiring schematic of cable 3 (UFDRY21SL3)

Installation procedures



Note

Some electronic components on the relay card are sensitive to static electricity. To prevent static electricity from damaging the relay card, do not touch its electronic components or circuits, also avoid their contact with live objects. Please hold the side edges of the relay card when moving or installing it.

1. Set the DIP switch of the relay card.

Skip this step if you need not control the UPS turn-on and turn-off through the relay card.

The location of the DIP switch is shown in Figure 8-5. It is an 8-bit DIP switch. Its factory default setting is shown in Figure 8-9.

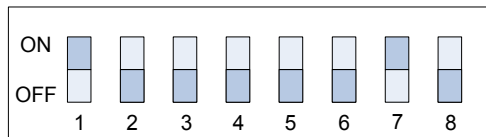


Figure 8-9 Factory default setting of the DIP switch

Bits 1 through 7 are designed for use in factory, the user is not allowed to change their default settings. Bit 8 is used to configure the UPS turn-on and turn-off signal input function of the relay card, its setting method is described in Table 8-5.

Table 8-5 Setting of UPS turn-on and turn-off signal input function

Bit 8	Function
ON	UPS turn-on and turn-off signal input function enabled
OFF	UPS turn-on and turn-off signal input function disabled

2. Insert the relay card into the UPS.



Note

1. The relay card should be installed in Intellislot port.
2. The relay card is hot-pluggable, you can install it without shutting down the UPS.

- 1) Remove the Intellislot port cover on the bypass module, reserve the screws.
- 2) Align the relay card with the Intellislot port, insert the relay card into the port along the grooves on both sides of the port.
- 3) Fix the relay card through the fixing holes on the relay card panel with the screws obtained in step 1.

3. Connect the cable.

You can select an optional cable according to your needs, or make the cable according to Table 8-4 and Figure 8-6 ~ Figure 8-8. Connect the cable end with a DB25 male connector to the DB25 connector of the relay card, and the other end to the user equipment.



Warning

The DB25 connector must connect to SELV circuit. Failure to observe this could cause damage to the relay card and even lead to safety accidents.

Troubleshooting

See Table 8-6 for the troubleshooting of the relay card.

Table 8-6 Troubleshooting

No.	Problems	Action to take
1	The dry contact output signal does not change with the UPS status	Verify that the relay card is properly inserted into the Intellislot port
2	The UPS does not respond to the UPS turn-on dry contact input signal	Verify that bit 8 of the DIP switch of the relay card is placed in the 'ON' position

8.2.6 Modbus Card

The Modbus card can realize the conversion from UPS internal protocol to Modbus RTU protocol, so you can use your host monitoring software to manage your UPS through Modbus RTU protocol, to learn about the UPS operating status by acquiring the UPS electrical parameter data, operating data and alarm data, thus achieving UPS monitoring.

One UPS can be fitted with up to two Modbus cards, which allows you to monitor the UPS through multiple hosts.

For the installation and setting of the Modbus card, refer to *UPS JBUS/MODBUS Adapter User Manual* in accessory.

The installation method of the Modbus card is the same as that of the SIC card described in 8.2.4 *SIC card*.

8.2.7 UF-RS485 Card

The UF-RS485 card converts RS232 signal to RS485 signal to realize UPS networking and communication. It should be installed in an Intellislot port of the UPS. It is hot pluggable for easy installation.

Appearance

The appearance of the UF-RS485 card is shown in Figure 8-10.



Figure 8-10 Appearance of UF-RS485 card

The goldfinger is used for insertion into the Intellislot port of the UPS. It provides RS232 input signal. The RJ45 port 1 and RJ45 port 2 are in parallel connection. They provide RS485 output signal.

Installation



Note

1. The UF-RS485 card is hot-pluggable, so you can install it without shutting down the UPS.
2. Some electronic components on the UF-RS485 card are quite sensitive to static electricity. To prevent static electricity from damaging the card, do not touch its electronic components or circuits with hands or other live objects. Please hold the side edges of the UF-RS485 card when moving or installing it.

1. Insert the UF-RS485 card into the UPS.
- 1) Remove the Intellislot port cover on the front panel of the bypass module. Save the screws.
- 2) Align the UF-RS485 card with the Intellislot port, insert the card into the port along the grooves on both sides of the port.
- 3) Fix the UF-RS485 card through the fixing holes on the UF-RS485 card panel with the screws obtained when removing the Intellislot port cover previously.
2. Connect the cable. Users can select a standard network cable in proper length as the connecting cable according to needs.
- 1) Insert one end of the standard network cable into the RJ45 port 1 or RJ45 port 2 of the UF-RS485 card.
- 2) Insert the other end of the standard network cable to the corresponding port of the user equipment.

**Warning**

1. The RJ45 ports of the UF-RS485 card must connect to SELV circuit. Failure to observe this could cause damage to the card and even result in safety accidents.
2. The connecting cable of the UF-RS485 card and the external equipment must be a double-end shielded cable.

Troubleshooting

Fault: The UF-RS485 output signal does not change with the UPS status.

Action to take: Ensure that the UF-RS485 card is properly inserted into the Intellislot port and the cable is properly connected.

8.2.8 Parallel Cable And LBS Cable

The parallel cables (see 7.2.5 *Parallel Cable* for connections) are required options for 1 + 1 parallel system, and the LBS cables (see 7.4.4 *LBS Cable* for connections) are required options for LBS system.

Table 8-7 Description of parallel cable and LBS cable

Name	Description	Appearance
Parallel cable	Two parallel cables marked with 'PARA' are required for 1 + 1 parallel system. 5m, 10m and 15m are available	
LBS cable	Two LBS cables marked with 'LBS' are required for LBS system. 5m, 10m and 15m are available	

Chapter 9 Communication

The UPS supports SNMP communication, Modbus protocol communication, dry contact communication and Velocity protocol communication. This chapter provides information relevant to these types of communication.

Refer to corresponding settings in Table 4-7 for communication protocol transfer. Selecting 'Velocity' means the system supports the Velocity protocol communication; selecting 'YDN23' means the system supports SNMP communication, Modbus protocol communication, dry contact communication.

9.1 SNMP Protocol Communication

If you need to monitor the UPS through network, you may select the SIC card provided by Emerson Network Power Co., Ltd. This card supports SNMP protocol.

The SIC card is a network management card. It can make the UPS made by Emerson Network Power Co., Ltd real network equipment. It can also be connected to the IRM series sensor to provide environment monitoring function. When the intelligent equipment generates an alarm, the SIC card can notify the user by recording the log, sending trap information, and sending a mail.

The SIC card provides three approaches for you to monitor your intelligent equipment and equipment room environment:

- Web browser. You can use Web browser to monitor your intelligent equipment and equipment room environment through the Web server function provided by the SIC card
- Network management system (NMS). You can use NMS to monitor your intelligent equipment and equipment room environment through the SNMP function provided by the SIC card
- SiteMonitor, a network management software for equipment room power and environment. You can use SiteMonitor to monitor your intelligent equipment and equipment room environment through the TCP/IP interface provided by the SIC card

The SIC card can also work with the Network Shutdown computer safe shutdown program developed by Emerson Network Power Co., Ltd. to provide automatic safe shutdown function for your computer installed with Network Shutdown, so as to prevent data loss.

The SIC card should be installed in the Intellislot port (see Figure 3-8) in the UPS.

For the installation and setting information of the SIC card, refer to the *Site Interface Web/SNMP Agent Card User Manual* in accessory.

9.2 Modbus Protocol Communication

The UPS can achieve Modbus communication through the optional Modbus card. For the installation and use of the Modbus card, refer to the *UPS JBUS/MODBUS Adapter User Manual* in accessory.

The Modbus card developed by Emerson Network Power Co., Ltd. can realize the conversion from UPS and integrated bypass cabinet internal protocol to Modbus RTU protocol, so the user can use the Modbus RTU protocol to acquire the UPS and integrated bypass cabinet switch values to achieve the UPS and integrated bypass cabinet monitoring.

The Modbus card is a built-in card. Its appearance is shown in Figure 9-1, and its hardware functions are described in Table 9-1.

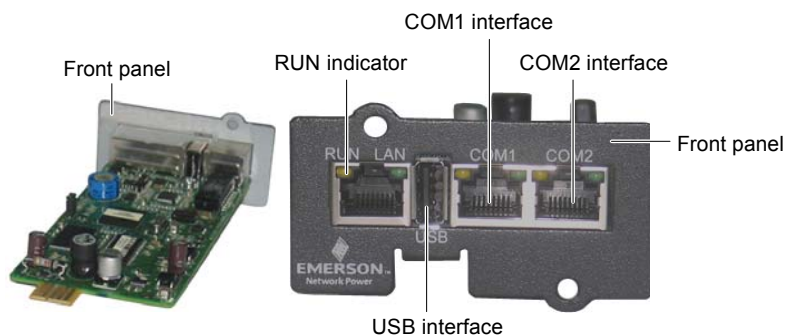


Figure 9-1 Appearance of Modbus card

Table 9-1 Hardware functions of Modbus card

Component	Function
RUN indicator (yellow)	ON: The Modbus card is powered on
	Blinking once every second: The communication between the Modbus card and UPS & integrated bypass cabinet is normal.
	Blinking once every five seconds: The communication between the Modbus card and UPS & integrated bypass cabinet is interrupted
USB interface	Connect to computer by means of the USB cable delivered with the Modbus card. Used for parameter configuration
COM1 interface	Connect to host computer supporting Modbus RTU protocol
COM2 interface	

The Modbus card provides the COM1 and COM2 interfaces for the user. These two interfaces are RJ45 interfaces. They have the same function and both support RS485 communication. The pins of the COM1 and COM2 interfaces are defined in Table 9-2.

Table 9-2 Pin definition of COM1 and COM2 interfaces

Pin	1, 2	3, 6	4, 5	7	8
Definition	+12/24V	NC	GND	D+	D-
Description	Power	Not connected	Ground	RS485+	RS485

9.3 Dry Contact Communication

The UPS provides the following two dry contact communication approaches:

- Relay card (option)
- Dry contact port

9.3.1 Communication Through Relay Card

The UPS provides an optional Relay card for the user to use dry contact signals to monitor the UPS. The Relay card should be installed in an Intellislot port (see Figure 3-8) of the communication box in the cabinet. For the installation and use of the Relay card, refer to 8.2.5 *Relay Card*.

9.3.2 Communication Through Dry Contact Port

For on-site specific needs, the UPS may need auxiliary connection to achieve functions like acquiring external equipment status information, providing alarm signals to external devices, and remote EPO. These functions are realized through the following interfaces on the external interface board (EIB):

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

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

Chapter 10 Service And Maintenance

The UPS system (including battery) needs regular service and maintenance in long-term operation. This chapter elaborates on the advice on the service life, regular inspection, maintenance and replacement of the UPS key components. Effective maintenance of the UPS system can reduce the risk in UPS failure and prolong the UPS service life.

10.1 Safety

  Warning
1. Daily inspection of UPS systems can be executed by people who have received relevant training, and the inspection and replacement of devices should be operated by authorized professionals. 2. The components that can only be accessed by opening the protective cover with tools cannot be operated by the user. Only qualified service personnel are authorized to remove such covers. 3. Note that the neutral line has hazardous voltage when servicing the UPS.

10.2 Key Components And Service Life Of UPS

When in use, some devices of UPS system will have shorter service life than UPS itself due to abrasion in work. For the safety of UPS supply system, it is necessary to have regular inspection and replacement of these devices. This section introduces the key components of UPS and the reference years of service life. For systems under different conditions (environment, load rate, and etc.), assessment and advice by professionals on whether to replace the device are required with reference to the information provided in this section.

Life Parameters And The Proposed Replacement Time Of Key Components

Key components in Table 10-1 are used in the UPS system. To prevent system failures due to some of the devices' failure by wear, it is proposed to carry out regular inspection and replacement during its estimated life.

Table 10-1 Life parameters and the proposed replacement time of key components

Key components	Estimated life	Proposed replacement time	Proposed inspection period
Fan	Not less than 7 years	Five years to six years	One year

The expected working hours of the UPS fan under continuous operation is 20000h ~ 40000h. The higher the ambient temperature is, the lower life the fan has.

Periodically check the working status of the fan every half a year, and ensure that there is air flow from the ventilation hole at the rear panel of the UPS.

10.3 Maintenance Of UPS And Options

UPS and the options need common maintenance:

1. Keep good history record. Keeping good history record facilitates failure treatment.
2. Keep clean, so as to prevent UPS and UPD from the invasion of dust and moisture.
3. Maintain appropriate ambient temperature. The most appropriate temperature for battery is 20°C to 25°C. Too low temperature will reduce the battery capacity and too high temperature will reduce the battery life.
4. Check the wiring. Check the tightening of all connected screws, and there should be routine tightening at least once a year.
5. Check regularly if there is any abnormality in the superior or subordinate switch to ensure cutting off the import or export when the current is too large. Maintenance staff should be familiar with the typical ambient conditions where

UPS is working in order to rapidly position which ambient conditions are unusual; the setting of UPS operation control panel should be known as well.

For information of the UPS battery maintenance, refer to 6.8 *Battery Maintenance*.

Chapter 11 Specifications

This chapter lists the UPS specifications.

11.1 Conformance And Standards

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

Table 11-1 European and international standards

Item	Normative reference
General safety requirements for UPS	EN62040-1/IEC62040-1/AS62040-1
EMC requirements for UPS	EN62040-2/IEC62040-2/AS62040-2
Method of specifying the performance and test requirements of UPS	EN62040-3/IEC62040-3/AS62040-3 (VFI SS 111)
Note: The product standards in this table incorporate relevant compliance clauses with generic IEC and EN standards for safety (IEC/EN/AS60950), electromagnetic emission and immunity (IEC/EN/AS61000 series) and construction (IEC/EN/AS60146 series and 60529)	

11.2 Environmental Characteristics

Table 11-2 Environmental characteristics

Item	Unit	Rated power (kVA)	
		30kVA	40kVA
Noise within 1m (in the front)	dB	58	58
Altitude	m	≤ 1000 (derate power by 1% per 100m when above 1000m)	
Relative humidity	%RH	0 ~ 95%, non condensing	
Operating temperature	°C	0 ~ 40°C (Note: Battery life is halved for every 10°C increase above 20°C)	
Storage and transport ation temperature for UPS	°C	-40°C ~ +70°C	
Over-voltage level		Overvoltage level 2	
Pollution level		Pollution level 2	

11.3 Mechanical Characteristics

Table 11-3 Mechanical characteristics

Item	Unit	Rated power (kVA)	
		30kVA	40kVA
UPS dimensions (W × D × H)	mm	484.6 × 800 × 176	
UPD dimensions (W × D × H)	mm	484.6 × 348.8 × 176	
Net weight	kg	72	
Gross weight	kg	82	
Color		Black ZP7021	
Protection degree, IEC (60529)		IP20 (front door open or closed)	

11.4 Electrical Characteristics (Input Rectifier)

Table 11-4 Rectifier AC input (mains)

Item	Unit	Rated power (kVA)	
		30kVA	40kVA
Rated AC input voltage ¹	Vac	380/400/415, 3-phase 4-wire (+PE) TN/TT power distribution system	
Input voltage range ²	Vac	305 ~ 477	

Item	Unit	Rated power (kVA)	
		30kVA	40kVA
Frequency ²	Hz	50/60 (range: 40 ~ 70)	
Power factor	kW/kVA, full load (half load)	0.99 (0.98)	
Input current	A, rated ³	50	64
Harmonic current distortion	THDI% FL	Linear full load < 4% (battery float charge) Non-linear full load < 6% (battery boost charge)	Linear full load < 4% (battery float charge) Non-linear full load < 6% (battery boost charge)
Duration of progressive power walk-in	s	5s to reach full rated current (selectable 10s through 25s in 5-second intervals)	
Note:			
1. Rectifiers operate at any of the rated supply voltages and frequencies without further adjustment.			
2. At 305V input mains the UPS maintains the specified output voltage at rated load without discharging a battery.			
3. IEC62040-3/EN50091-3: at rated load and input voltage 400V, battery fully charged			

11.5 Electrical Characteristics (Intermediate DC Circuit)

Table 11-5 Battery

Item	Unit	Rated power (kVA)	
		30kVA	40kVA
Quantity of lead-acid blocks	Block	32, 34, 36, 38, 40 (12Vdc)	
Float voltage	V/cell (VRLA)	2.27 (selectable from 2.2V/cell to 2.3V/cell) Constant current and constant voltage charge mode	
Temperature compensation	mV/°C/cell	-3.0 (selectable from 0 to -5.0 around 25°C or 30°C, or inhibit)	
Ripple voltage (float charge)	%	≤ 1.414%	
Boost voltage	V/cell (VRLA)	2.35 (selectable from 2.3 to 2.4) Constant current and constant voltage charge mode	
Boost control		Float-boost current trigger 0.050C ₁₀ (selectable from 0.001 to 0.070) Boost-float current trigger 0.010C ₁₀ (selectable from 0.001 to 0.025) 24h safety time timeout (selectable from 8h to 30h) Boost mode inhibit also selectable	
EOD voltage	V/cell (VRLA)	1.60 ~ 1.85	
Battery charge	V/cell	Constant current: 2.3 ~ 4 (settable) Constant voltage: 2.2 ~ 2.3 (settable) Programmable automatic trigger or inhibit of boost mode	

11.6 Electrical Characteristics (Inverter Output)

Table 11-6 Inverter output (to critical load)

Item	Unit	Rated power (kVA)	
		30kVA	40kVA
Rated AC voltage ¹	Vac	380/400/415 (3-phase 4-wire, with neutral reference to the bypass neutral)	
Frequency ²	Hz	50/60	
Overload	%	For linear load requirement: < 105%, continues; 105 ~ 125% of rated load, 5min; 125 ~ 150% of rated load, 1min; > 150%, 200ms	
Non-linear load capability ³	%	100%	
Steady state voltage stability	%	±1% for balanced three phase load; ±2% for unbalanced load	±1% for balanced three phase load; ±2% for unbalanced load
Transient voltage response ⁴	%	±5% for 100% rated linear load step	
Total harmonic voltage	%	2% (0 ~ 100% linear load); 5% (0 ~ 100% non-linear load)	2% (0 ~ 100% linear load); 5% (0 ~ 100% non-linear load)
Synchronisation window	Hz	Rated frequency ±0.5, ±1, ±2, ±3 (optional)	

Item	Unit	Rated power (kVA)	
		30kVA	40kVA
Slew rate (max. change rate of synchronisation frequency)	Hz/s	Setting range: 0.1 ~ 0.6 (UPS module), 0.6 (parallel system)	
Note: 1. Factory set to 380V. 400V or 415V selectable by service engineer. 2. Factory set to 50Hz. 60Hz selectable by service engineer. Note that the system frequency can be changed only when the UPS is on bypass. It is strictly prohibited to change the system frequency when the UPS is on inverter. 3. EN 50091-3 (1.4.58) crest factor 3:1, non-linear load. 4. IEC 62040-3/EN 50091-3 also for 0% ~ 100% ~ 0% load transient. Transient recovery time: return to within 5% of steady state output voltage within half a cycle			

11.7 Electrical Characteristics (Bypass Input)

Table 11-7 Bypass input

Item		Unit	Rated power (kVA)	
			30kVA	40kVA
Rated AC voltage ¹		Vac	380/400/415, 3-phase 4-wire, sharing neutral with the rectifier input and providing neutral reference to the output	
Rated current	380V	A	46	60
	400V	A	43	58
	415V	A	41	56
Overload		%	Based on nominal voltage and rated load current under apparent power: < 105%, continues; 105 ~ 125% of rated load, 5min; 125 ~ 150% of rated load, 1min; 150 ~ 400% of rated load, 1s; > 400%, 200ms	
Frequency ²		Hz	50/60	
Bypass voltage tolerance		%Vac	Upper limit: +10%, +15% or +20%, default: +15%; Lower limit: -10%, -20%, -30% or -40%, default: -20%	
Bypass frequency tolerance		%	±10% or ±20%, default: ±20%	
Synchronisation window		Hz	Rated frequency ±0.5, ±1, ±2, ±3 (optional)	
Note: 1. Factory set to 380V. 400V or 415V selectable by service engineer. 2. Factory set to 50Hz. 60Hz selectable by service engineer				

11.8 Efficiency And Loss

Table 11-8 Efficiency and loss

Item		Unit	Rated power (kVA)	
			30kVA	40kVA
Efficiency				
Normal mode	100% load	%	95.1%	94.9%
	75% load	%	94.8%	95.1%
	67% load	%	94.7%	95.0%
	50% load	%	94.3%	94.7%
	33% load	%	93.4%	94.0%
	25% load	%	93.0%	93.4%
ECO mode		%	98.5%	98.5%
Loss				
Normal mode (no load)		kW	1.116	1.116
Normal mode (full load)		kW	1.620	2.240
Note: 400Vac input and output, battery fully charged, full-rated linear load				

Appendix 1 Glossary

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