The British Power Conversion Company

# BPC499-01
# POWERTOWER GREEN CMS60/15
# USER MANUAL

# Contents

# CHAPTER 1 – SAFETY WARNINGS

Read the following safety information carefully before you install or operate the BPC PowerTower Green Uninterruptible Power Supply (UPS) equipment and keep this manual within easy access of the equipment for future reference.

## 1.1 DESCRIPTION OF SYMBOLS USED IN THIS MANUAL

**WARNING:** The warning symbol is used where there is danger of an electrical shock, equipment damage or personal-injury.

**CAUTION:** The caution symbol is used to highlight important information to avoid possible equipment malfunction or damage.

## 1.2 GENERAL WARNINGS

**WARNING:** Be aware that the output from this equipment can be energized when the unit is not connected to a mains supply, even when the input AC power is disconnected

**WARNING:** The PowerTower Green assembly and peripheral equipment must be installed and commissioned by suitably qualified and trained personnel who are aware of the potential shock hazards.

**WARNING:** The PowerTower Green must be supplied by a grounded outlet. Do not operate the unit without a ground source.

**WARNING:** To reduce the risk of electric shock:

- Do not insert any object into ventilation holes or other openings
- Do not remove any equipment cover – the unit does not contain any user-serviceable parts. Refer all servicing requirements to qualified service personnel.
- Always disconnect the PowerTower Green from the mains power supply before you install a computer interface signal cable. Reconnect the power only after the signalling interface connections have been made

**WARNING:** To reduce the risk of fire:

- Install this equipment in a temperature and humidity controlled indoor area free of conductive contaminants.
- If a fuse ruptures always replace it with a fuse of the same type and rating.

## 1.3 BATTERY SAFETY

**WARNING:** The battery is not isolated from the mains voltage. Hazardous voltage may occur between the battery terminals and ground.

**WARNING:** A battery can present a risk of electric shock or burn from high short circuit currents. Always take the following precautions when working on batteries:

- Remove watches, rings or other metal objects.
- Use tools with insulated handles.

**WARNING:** The PowerTower Green system uses recyclable batteries:

- The batteries contain lead and pose a hazard to the environment and human health if not disposed of properly.
- If you replace the batteries you must dispose of the used batteries in accordance with local environmental laws and regulations.

**WARNING:** Heed the following warnings concerning battery handling:

- Do not dispose of batteries in a fire. The batteries may explode.
- Do not open or mutilate the batteries. They contain an electrolyte which is toxic and harmful to the skin and eyes.
- If electrolyte comes into contact with the skin, the affected area should be washed immediately with clean flowing water.
- The internal energy source (the battery) cannot be de-energized by the user.

**WARNING:** When changing the batteries, install the same number and same type of batteries.

# CHAPTER 2 – OVERVIEW

This chapter briefly introduces features, design idea, operating mode, battery management and battery protection of the BPC PowerTower Green.

## 2.1 Features

UPS is connected between mains and important loads (such as computers) to provide high quality power to loads. It has the following advantages:

- Provide high quality power supply

  UPS is regulated by internal voltage and frequency so that the output is unaffected by changes in its input supply.

- Protection of mains power off

  When input power fails, the UPS is powered by the battery, and the load is uninterrupted.

- Easy to install and maintenance

  Modular design, main power module, bypass power module, system control unit and system monitoring unit all support on-line hot swap, easy to maintenance.

## 2.2 Design idea

### 2.2.1 System design

This section introduces UPS stand-alone working theory. UPS adopts two levels converter. (see figure 2-1)

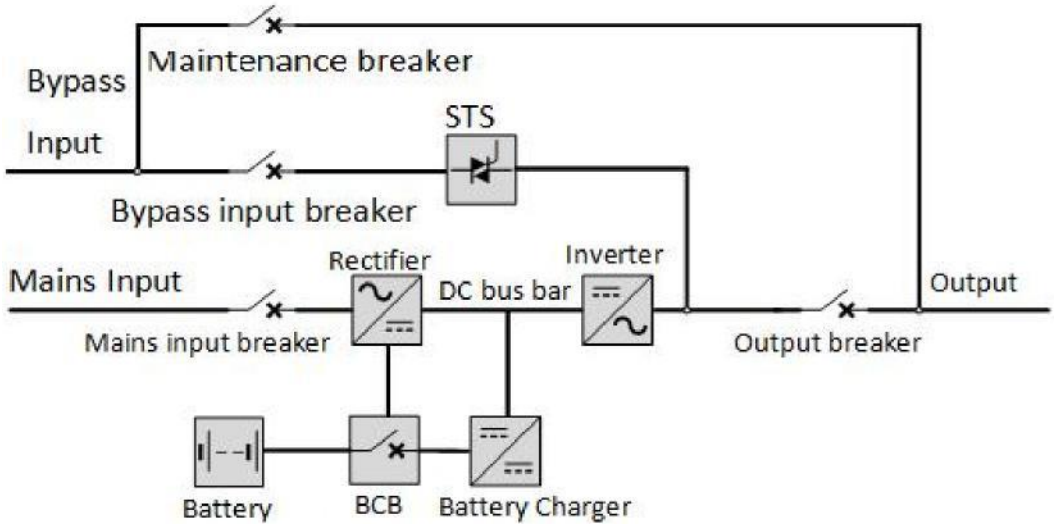



Figure 2-1 Stand-alone UPS working Schematic

First Level Conversion (AC-DC rectification mode) adopts three phase high frequency rectification to convert AC voltage of three phase into stable DC bus voltage;

Second Level Conversion (DC-AC) adopts advanced Sinusoidal pulse width modulation (SPWM) control technology to invert DC bus voltage into AC voltage.

The power module has an independent battery charger and adopts industry-leading temperature compensation technology to extend battery life.

When the mains is normal, rectifier and inverter work simultaneously to supply power to the load and charge the battery at the same time.

When the mains is abnormal, battery charger stop working, inverter works normally, the UPS will transfer from mains to battery; When battery voltage decrease to cut-off voltage of discharge, but mains still not come back to normal, the UPS will turn off if bypass is abnormal at the same time.

### 2.2.2 Bypass

By smart controlling to static switch module (see figure 1-1), to make loads are powered by either inverter or bypass. Normally, loads are powered by inverter, and now it's automatic switch is closed; when overloading (and overloading time is up) or inverter fault occurs, the switch of inverter will be cut-off automatically, and static switch module automatically closed, the UPS transfer to bypass power supply.

In normal running conditions, to achieve uninterruptible transferring between the inverter and the bypass power source, the inverter output must be fully synchronized with the bypass power source and the bypass power source is within the protection range.

As for this, when frequency of bypass power source is in the synchronize range, the inverter control circuit always keeps the inverter output frequency tracking the bypass power source frequency and phase.

In addition, UPS also has manual maintenance bypass switch used for maintenance requires, and the bypass power source provides power to important loads through maintenance bypass.

**CAUTION:** When the load is powered by the bypass line or maintenance bypass the power quality cannot be assured.

### 2.2.3 System Control Theory

**Normal operation**

When UPS operates normally, means the input mains is normal, rectifier and inverter both works normally, loads are powered by inverter, battery switch is closed, and battery is in stable floating charging.

**Mains abnormal**

If mains power off or abnormal, rectifier changes from AC to battery mode, UPS output powered by battery, battery's discharging time depends on loads and capacity of battery. During the time, when battery voltage decreases to cut-off voltage, but mains still not recovered, inverter will stop working automatically, UPS operation control display panel shows corresponding warning information. If bypass is normal, UPS transfers to bypass power supply.

**Mains recover**

When the mains returns to normal within the allowed time, the rectifier will automatically switch to AC mode, re-charge the load and charge the battery, so the power supply to the load will not be interrupted.

**Battery drop-off**

If you need to remove the external battery from the UPS system for repairing, you can separate the battery by an external isolated switch. all the specified steady performance and the other functions of the UPS are not affected except the battery backup function when mains power fails.

**Single UPS fault**

In the case of an inverter failure, output fuse break, the load will automatically switch to bypass power supply. In this case, please contact the BPC after-sales Service Center for technical support.

**Overloading**

If the inverter output is overloaded or the inverter current exceeds the index (see table 10-6), and exceeds specified time, loads will automatically switch to bypass power supply, loads power supply is uninterruptible. If overloading and current have decreased to specified range, loads switch to power supply by inverter. If short circuit happens, loads switch to bypass power supply, and inverter closed, while short circuit problem solved, the loads will switch to inverter power supply.

For above two situations, UPS operation display panel will give warning information.

**Maintenance bypass**

UPS has a second bypass for power supply, that is maintenance bypass, it provides a safe working environment for repairing man to proceed regular maintenance to UPS and supply untreated utility power to loads. It's manual optional by maintenance bypass switch, set OFF to turn it off.

### 2.2.4 UPS Power source breaker

UPS has 4 breakers: mains input breaker Q1, bypass input breaker Q2, maintenance bypass output breaker Q3, Output breaker Q5, Q1, Q2 and Q5 are optional. If the user has a breaker in the front and rear stages of the UPS system, the UPS is not equipped with a breaker option. The requirements for input and output fuse are configured according to industry standard. Therefore, there are 4 combinations for breakers and input/output fuse: breaker and fuse, breaker but no fuse, no breaker with fuse, neither breaker nor fuse.

Please see figure 2-2, mains and bypass use different power sources or same power supply are both available for UPS. As for different power source, static bypass and maintenance bypass share one independent bypass power source. If it's not able to supply independent mains to bypass, input terminals of bypass input breaker Q2 and mains input breaker Q1 should be short, circuited connection (the default is different power sources for mains and bypass) to make bypass input and main input use same utility power supply. When UPS works normally, all the other breakers are closed except maintenance bypass breaker Q3.

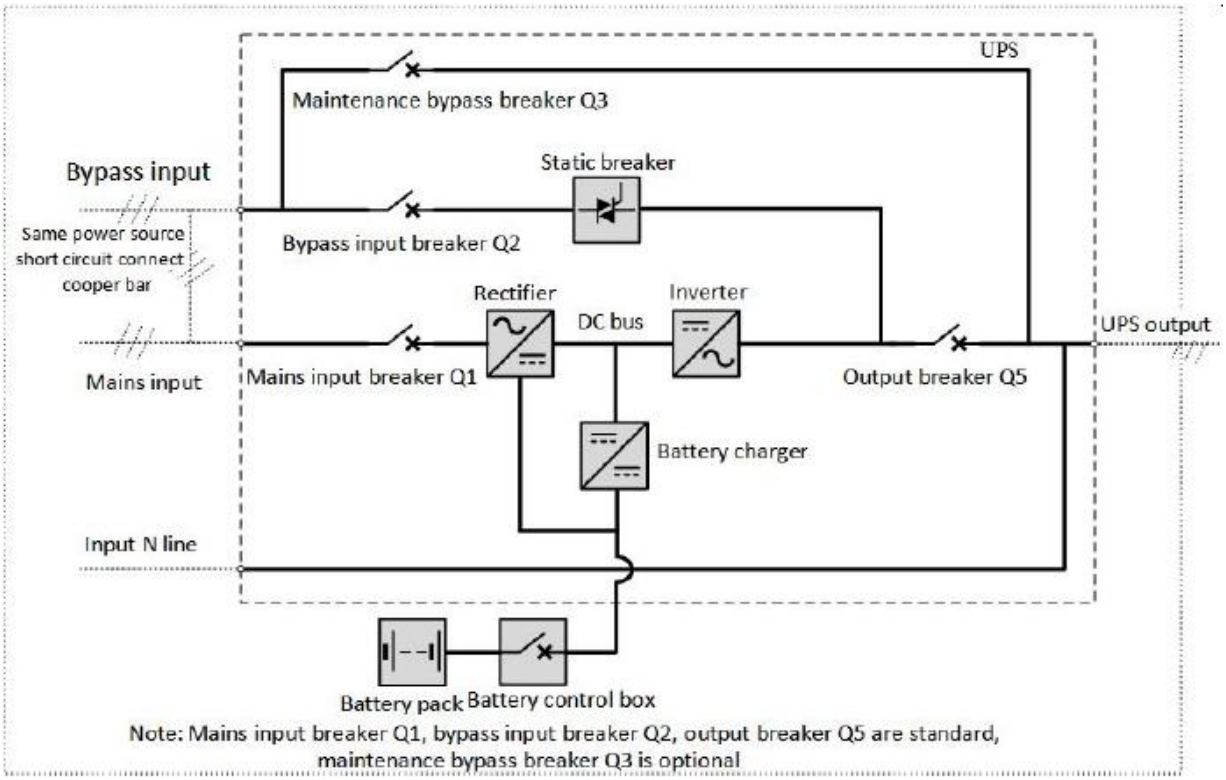



Figure 2-2 Power source breakers

### 1.2.5 Battery breaker

The external battery must be connected to the UPS via a battery isolator. The UPS provides a battery fused Isolator as a mandatory component, please install the battery isolator near the battery. The battery breaker should be closed manually.

## 1.3 Parallel system

To increase capacity and reliability, the system supports up to 4 units of stand-alone UPS in parallel connection. Please refer to *Chapter Seven Parallel System* for details.

## 1.4 Operation mode

Online UPS system, operation modes as follows:

- Normal mode
- Battery mode
- Automatic restart mode
- Bypass mode
- Maintenance mode

**Normal mode**

As figure 2-3 shows, mains power rectified via UPS rectifier, then supply uninterruptible AC power to loads via inverter, meanwhile, battery is charged by the charger.

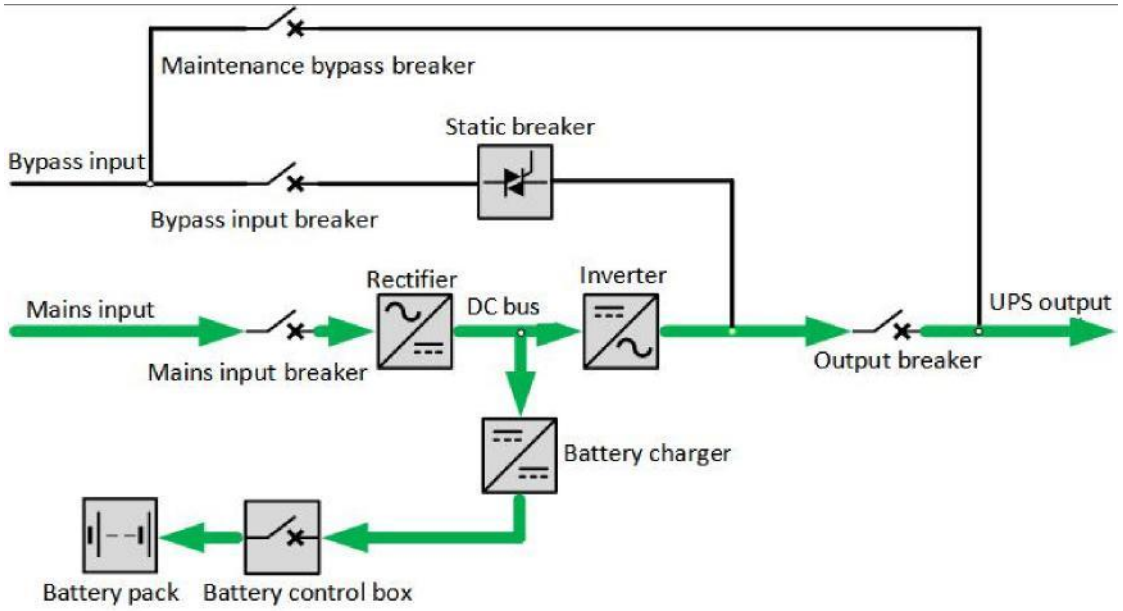



Figure 2-3 normal mode operation diagram

**Battery mode**

As figure 2-4 shows, battery mode means battery provides back up power to loads through rectifier and inverter. When mains power fails, system automatically transfer to battery mode, loads power supply is uninterrupted. Afterwards when mains power recovers, system automatically transfer to normal mode, no manual intervention required, and loads power supply is uninterruptible.

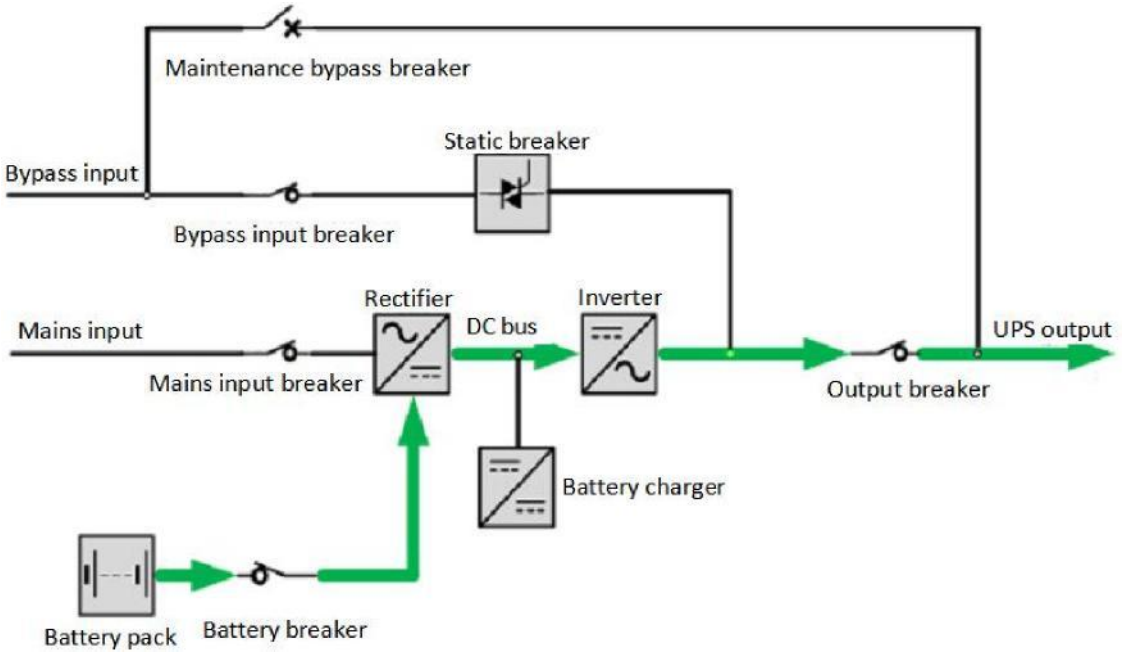



Figure 2-4 battery mode operating diagram

**Automatic restart mode**

UPS has automatic restart mode, when utility power still not recover after a longtime, and battery discharged to ultimate voltage so that inverter shuts down, if mains power recovers, UPS will boot automatically with a certain delay, this function and delay time are able to set up by service engineer.

During the delay time of auto-restart, UPS charges to battery against risks of load power off due to second time of utility power failure.

If UPS auto-boot function is unset, user can follow BPC monitoring panel instruction: maintenance-manual operation-clear fault, then press maintenance-manual operation-boot system, so you can start up the UPS by yourself.

**Bypass mode**

As figure 2-5 shows, under normal mode, when inverter failure, inverter overloading or manual shut down of inverter, load will be transferred to inverter side to bypass power supply side, load power supply is uninterrupted. If the inverter and bypass exceed tracking range during the transferring process, the load power supply will be instantaneously interrupted, and the interruption time is less than 20ms.

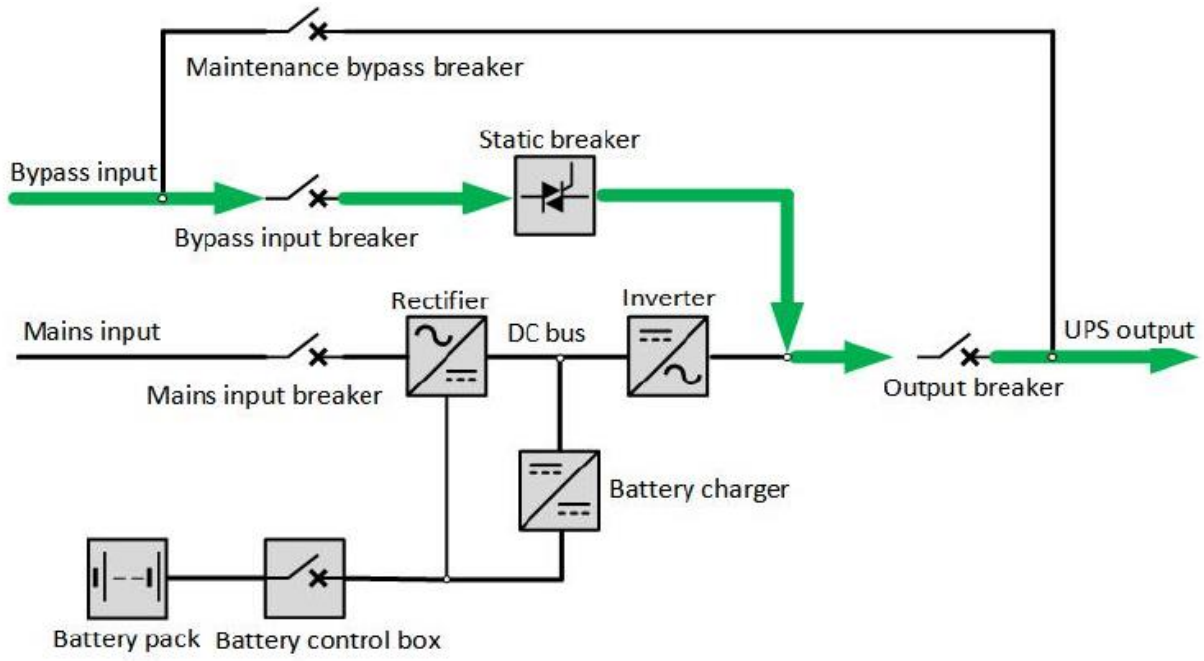



Figure 2-5 bypass mode operating diagram

**Maintenance mode**

As figure 2-6 shows, if maintenance and repairing to UPS are required, you can perform it by transferring load to maintenance bypass via manual maintenance bypass breaker, load power supply is uninterrupted. Maintenance bypass breaker sets in single UPS, capacity meets requirements of total loads capacity for single UPS.

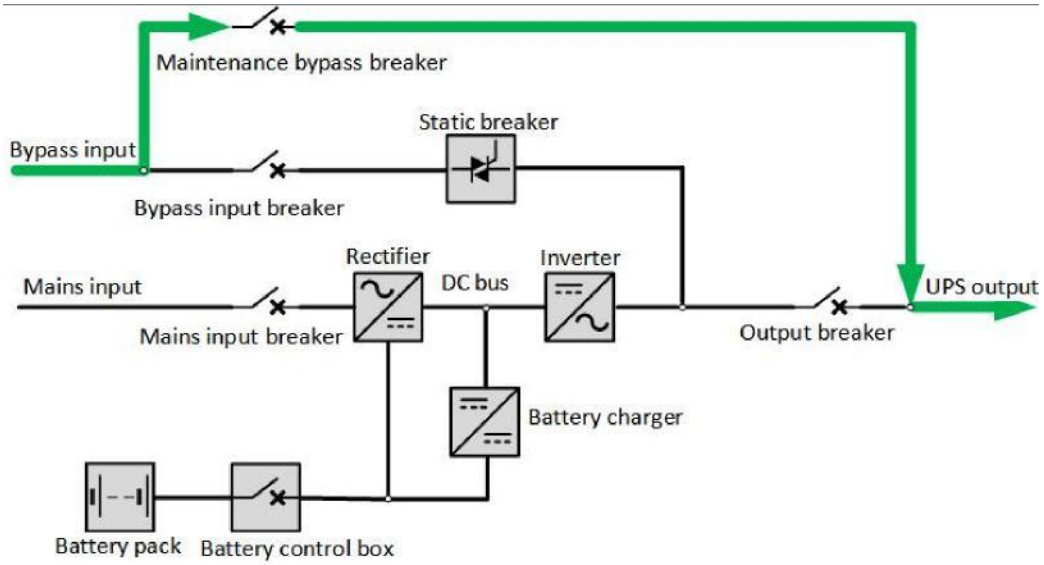



Figure 2-6 maintenance mode operating diagram

## 2.5 Battery management

Battery management function sets by service engineer through system's monitoring unit LCD. 1.5.1 General function

1.Constant current and equal charging

Charging the battery with a constant current that does not exceed the battery charge limit, usually used to fast restore battery capacity, charging current can be set.

2.Constant voltage and equal charging

Charging battery with constant voltage, usually used to fast restore battery capacity. For VRLA battery, the maximum equal charging voltage should not exceed 2.4V/cell. The default charging voltage of the monitoring unit is 2.35V.

3.Floating charge

It's a way of charging to keep the battery full capacity. Generally, the voltage is low, floating charging is used to balance the capacity loss due to self-discharge, and also used to restore battery capacity. For VRLA battery, floating voltage should be 2.2V/cell~2.3V/cell, the default floating charge voltage of monitoring unit is 2.25V.

4.Automatically switch to floating charge

When the charging current is less than the "floating charge current", the charger will automatically switch from the equal charge to the floating charge; if the equal charge time exceeds the value "equal charging protection time" which is set by monitoring, the charger will be forcibly switched to floating charge to protect the battery.

5.Floating charge temperature compensation (optional)

This function must be used together with battery temperature testing device.

6.Battery discharge termination protection

When battery's voltage decreases to battery's termination voltage of discharging, UPS will shut down automatically to avoid over discharging of battery. Battery's discharging termination is settable, setting range from 1.58V/cell -1.8V/cell for VRLA battery.

7.Maximum equal charging time protection

Setting the protection time in order to prevent the battery from being overcharged for a long time, which may cause damage to battery. The specific time limit can be set by the service engineer through background.

### 2.5.2 Battery's temperature compensation

The UPS system has a battery charging temperature compensation function. When the temperature around the battery rises, the charging voltage will be reduced accordingly, thereby providing an optimal charging voltage to the battery to maximize battery's life. This function must be used with the battery temperature testing device.

## 2.6 Protection of battery

The following protection functions are set by service engineers via system's monitoring unit LCD.

**Battery discharge termination protection**

If the battery voltage reduces to termination voltage of discharging, the battery converter will automatically turn off.

The battery discharge termination voltage is settable. For a valve-regulated lead-acid battery, the setting range is 1.58V/cell ~1.80V/cell.

**Battery breaker disconnection warning**

BPC battery control box sends warning when external battery breaker disconnected.

The external battery is connected to UPS through battery breaker. It should be closed manually, then the UPS controls the battery breaker to release.

# CHAPTER 3 – INSTALLATION

This chapter will has brief introduction of machinery installation for UPS, including precautions, initial test, environment requirements, machinery requirements and installation drawing.

## 3.1 Precaution

This chapter introduces the environmental and mechanical requirements that must be considered when selecting the position and routing for UPS. Because each site has its own particularity, this chapter only provides instructive general installation steps and methods to installer, which are handled by installer according to specific situations on the sites.

| |
|---|
| Warning |
| 1. Please do not unpack before arriving of authorized service engineer.<br>1. Authorized engineer must strictly follow instruction in this chapter for installation. |
| Warning |
| UPS is able to connect TN with three phases five wires (A, B, C, N, PE) and TT AC power distribution system (GB/T 7260-2003) |
| Warning |
| The installation of battery needs to be especially careful, it's fatal when connect the batteries which will produce more than 360Vdc voltage on battery ends.<br>1. Please be sure to wear eyes protection cover to avoid injury of electric arc.<br>2. Please remove all the metal items such as rings, watches etc.<br>3. Please use tools with insulated handle.<br>4. Please be sure to wear rubber gloves.<br>5. If the battery electrolyte leaks or the battery is damaged, the battery must be replaced, place it in a container resistant to sulfuric acid, and dispose it in accordance with local regulations.<br>Immediately wash your hands if any contacts of electrolyte to your skin. |

## 3.2 Transportation

Notice: The center gravity of the equipment is not centered. When using the forklift to unload and transport, please follow the direction shown in Figure 3-1 to prevent the equipment from falling over.

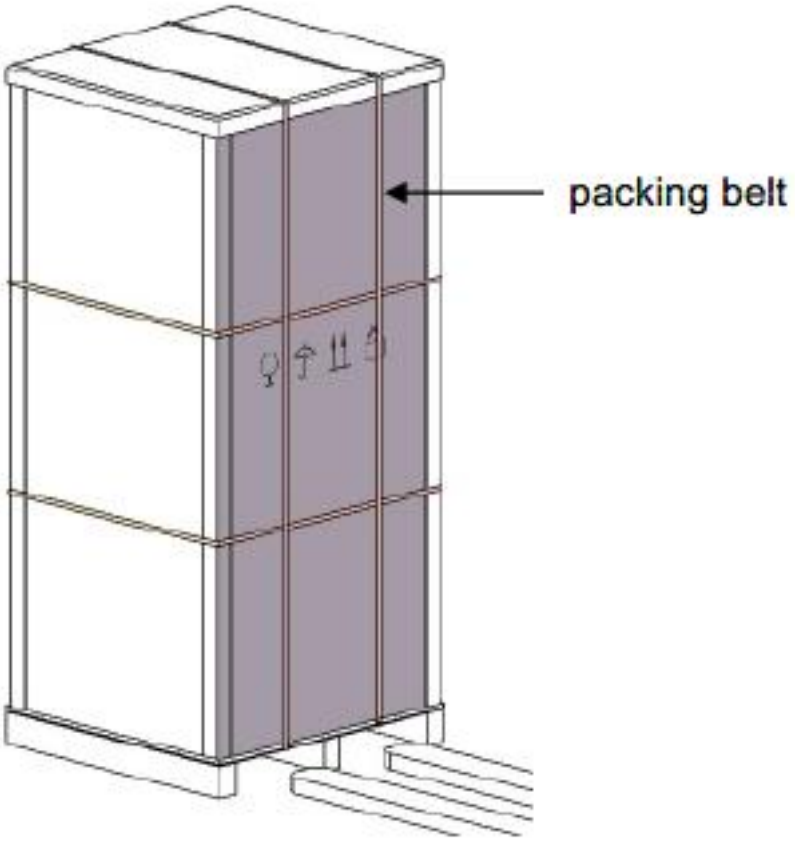



Figure 3-1 Forking direction diagram (front of cabinet)

Please choose roads with good condition for road transportation in order to prevent over bumps, railway and sea shipping are also good.

UPS cabinet is heavy, please see table 10-3 for weight parameters. Unloading and handling use mechanical handling tools such as electric forklifts as much as possible to transport the equipment to the nearest location.

**CAUTION:** Before unpacking, check the package for any damage and whether the anti-damage label is . If any issues are found with packaging, please contact BPC and the freight company that delivered the equipment.

## 3.4 Unpacking

Unpacking with the instruction of authorized service engineer, specific steps as below

1. As figure 3-2 shows, cut packing belt first, then remove Honeycomb cardboard

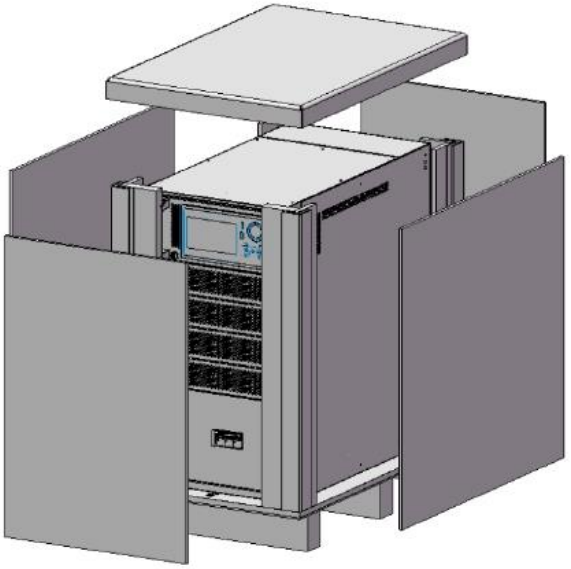


Figure 3-2: Remove honeycomb cardboard and packing belt

2. As figure 3-3 shows, remove the anti-vibration component at the bottom of the cabinet, and then use the forklift to move the cabinet to the installation position.

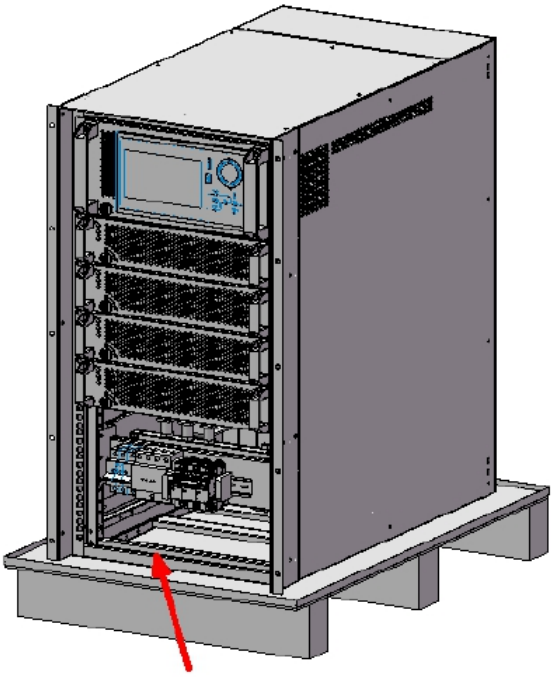



Figure 3-3 : remove fixing bolts (4 pcs) of anti-vibration component

## 3.5 Initial Checks

Before installing the UPS, Please complete the following tests first:

1. Ensure that the UPS room environment meets the environmental requirements specified in the product's technical indicators, especially the ambient temperature, ventilation conditions, and dust conditions.
2. Unpack the UPS and battery pack under the direction of BPC authorized service engineer. Visually inspect the UPS and battery for shipping damage. In case of damage, please inform the carrier immediately.
3. Check the product label to confirm the correctness of the equipment. A device label is attached to the door of the device. The label indicates the UPS model, capacity and main parameters.

## 3.6 Environment requirements

### 3.6.1 UPS position

The UPS should be installed in a cool, dry, clean, well ventilated indoor environment and should be installed on concrete or other non-flammable, flat mounting surfaces. Environmental dust must not contain conductive dust (such as metal powder, sulfide, sulfur dioxide, graphite, carbon fiber, conductive fiber, etc.), acid mist or other conductive medium (strongly ionized material). The specific environmental indicators must meet the requirements of the relevant national standards and specifications and the scope of the indicators specified in this manual (see Table 10-2).

The UPS is provided with forced air cooling by an internal fan. The cold air enters the UPS through the wind grid in front of the UPS cabinet, and the hot air is exhausted through the wind grid at the rear of the UPS. Do not block the ventilation holes (wind grid). The back of the UPS should be at least 500mm away from the wall to avoid obstructing the ventilation and heat dissipation of the UPS, causing the internal temperature increasing of the UPS and affect the service life of the UPS.

If necessary, install an indoor exhaust fan to accelerate ambient air circulation and avoid room temperature rise. In an environment with a lot of dust, an air filter should be installed in the air vents of the equipment room.

### 3.6.2 Battery's position

The battery will produce a small amount of hydrogen and oxygen at the end of charging. Therefore, it must be ensured that the fresh air ventilation of the battery installation environment meets the requirements of GB 50172-2012 electrical installation, battery construction and acceptance specifications. Ambient temperature is a major factor affecting battery capacity and life. Under normal circumstances, the ambient temperature allowed by the battery is within 5 °C 35 °C. The ambient temperature of the battery should be constant. The optimum temperature is 20 °C 25 °C. The battery should be away from the heat source and the main vent.

The battery can be installed in a dedicated battery cabinet, which should be close to the UPS. If the battery is placed on a raised floor, same as UPS, a bracket should be installed under the floor. If the battery is installed on the battery rack or otherwise installed far away from the UPS, battery switches should be installed at the UPS and as close as possible to the battery, and the cable distance should be as short as possible.

### 3.6.3 Storage

If immediate installation not required, you must store the UPS with original packing indoors, to avoid any damp or overheating (see chart 11-2). Batteries need to be stored in dry, low temperature, good ventilation, the most suitable storage temperature is 20℃~25℃.

**WARNING:** The battery should be periodically charged according to the battery manufacturer's instructions.

## 3.7 Mechanical requirements

### 3.7.1 UPS compositions

600kVA UPS system includes main power distribution cabinet (system monitoring unit), module cabinet (including system control unit, main power module and bypass power module)

Note 1: Main input breaker, bypass input breaker, output breaker is optional.

### 2.7.3 Operational Clearance

There are no vents on the sides of the UPS, so no special space requirement on sides clearance.

To make it easy to reinforce the power terminal in UPS and have enough room to withdraw power module for front maintenance, in addition to meet local regulation, the distance should be more than 1300mm away from UPS front to objects, take full open of UPS door and people can pass freely as reference. At the same time, at least 500mm space should be reserved at the back of the UPS to ensure unobstructed exhaust of UPS. See Figure 3-4.

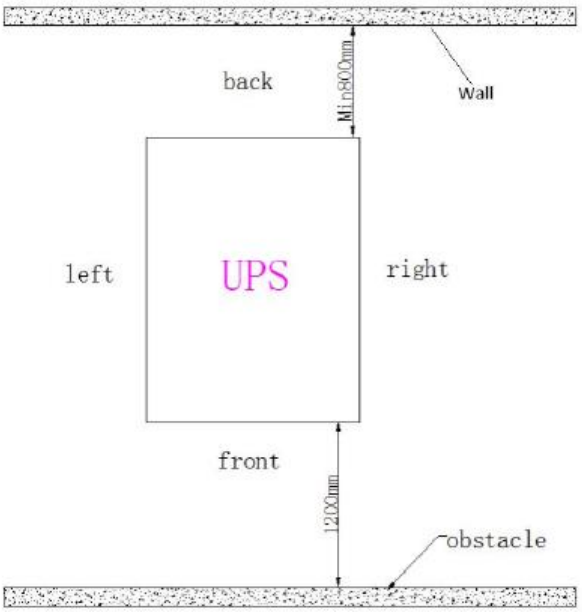



Figure 3-4 : Clearance (mm)

### 2.7.4 Cable entry mode

Support cable entry from bottom and top.

For details about the wiring method, Please refer to *3.1 Power Cable Wiring Procedure* and *3.2 Signal Cable Wiring Procedure.*

### 2.7.5 Install and remove power module

**CAUTION:** Install the power modules from bottom to top to aid in cabinet centre of gravity.

Power Module installation as per figure 3-5.

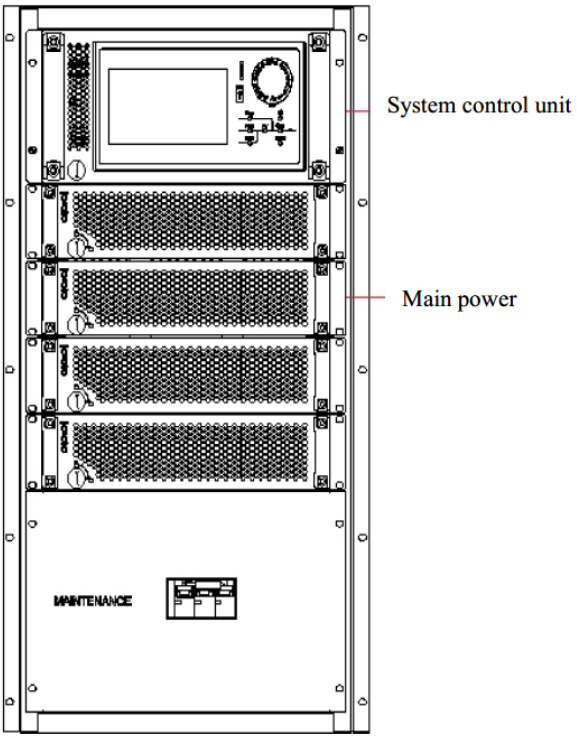



Figure 3-5 : 30 kVA power module installation diagram

Installation steps of power module shows as below:

1. Turn off the ready switch on the front panel of the module (the switch now is OFF)
2. Insert module to installation place, push cabinet in.
3. Fix modules to main power cabinet through fixing holes on the sides of front panel of module.
4. Rotate ready switch to ready state.

**CAUTION:** During first initialisation, turn all switches to OFF and test one module at a time.

### 3.8 Installation Instruction

Installation dimension of machine shows as figure 3-6, installation dimension with shockproof components shows as figure 3-7

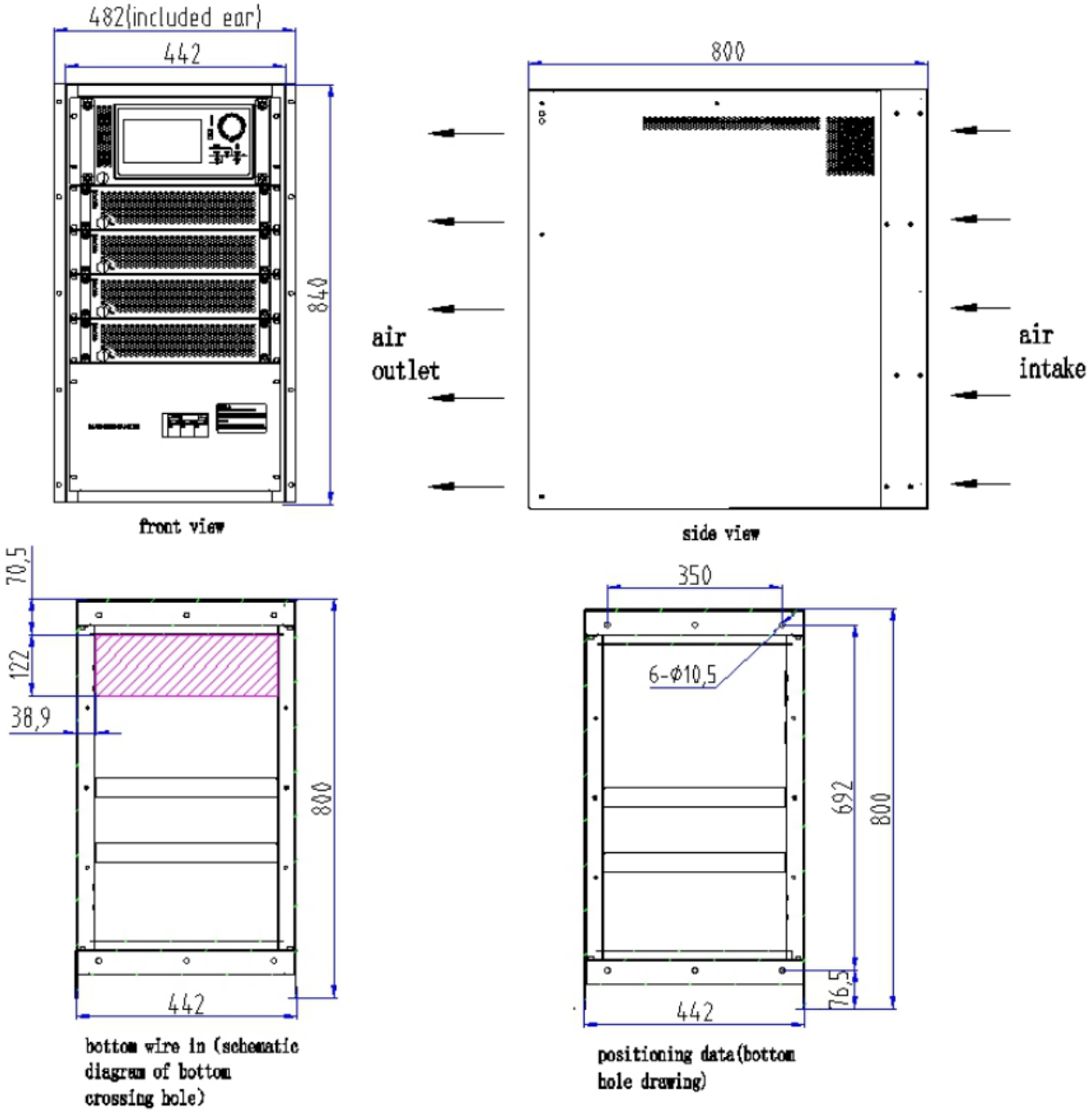



Figure 3-6 ,30 KVA installation dimension (mm)

instruction of shockproof components (bottom view picture)

# CHAPTER 4 – ELECTRICAL INSTALLATION

This chapter mainly introduces the electrical installation of UPS, including power cable wiring and signal cable routing.

After completing the mechanical installation of the UPS, you need to connect the power cable and signal cable of the UPS. All signal cables (whether shielded or not) should be routed separately from the power cables.

**WARNING:** Do not power on the UPS until authorised BPC engineer is in attendance. The UPS must be wired according to these instructions and local requirements.

## 4.1 Power Cable Routing

### 4.1.1 System Configuration

The wire diameter of the system power cable should meet the following requirements:

**UPS input power cable**

The wire diameter of the UPS input power cable varies with the UPS input AC voltage and should meet the maximum input current requirements, see Table 3-1.

**UPS bypass and output power cable**

The wire diameter of the UPS bypass and output power cables varies with the UPS output AC voltage and should meet the requirements of the nominal output or bypass current. See Table 3-1.

**Battery Power Cable**

Each UPS is connected to its battery through three cables of positive, negative and N-wire. The wire diameter of the battery cable should meet the battery discharge current requirement when the battery is near the end of discharge voltage, see Table 4-1.

### 4.1.2 Maximum steady state AC and DC current

Power cable selection must meet the current and voltage values given in Table 3-1 and refer to local wiring regulations, specific application environments (temperature and physical support media).

| UPS(kVA) | Rated current (A) | | | | Bus bar stud/nut specifications | | |
|---|---|---|---|---|---|---|---|
| | Full load output/bypass current | | | Battery discharge current at the lowest battery voltage | Input/battery/output/ bypass power cable | Battery Power Cable | PE power cable |
| | 380V | 400V | 415V | | | | |
| 60kVA | 91 | 87 | 83 | 150 | M8 | M10 | M8 |

Table 4-1 Maximum steady state AC and DC current

1. Mains input maximum current at low voltage with full capacity
2. Non-linear loads (such as switching power supplies) have an impact on the design of the output and bypass N-wire cable.
3. The discharge current at the lowest EOD point voltage of the 38-cell battery (1.58V cell).

### 4.1.3 Recommend cross-sectional area for power cable

Recommend cross-sectional area for power cable, please see table 4-2

| Model | Input (single phase) | Output (single phase) | Bypass (single phase) | Input,output neutral line | Ground wire | Battery |
|---|---|---|---|---|---|---|
| 60kVA | 25-50 | 25-50 | 25-50 | 25-50 | 16-35 | 35-90 |

Table 4-2 Recommend cross-sectional area for power cable (unit: $mm^2$ , environmental temperature: 25℃)

### 3.1.6 General precautions

The followings only provide general instruction, local regulation should be followed.

1. The wire diameter of the PGND cable should be selected according to the AC power fault level, cable length and type of protection. Ground connection must be the shortest wiring path.
2. Refer to current value in table 4-1 for selection of battery cable's wire diameter, maximum 4Vdc reduction is allowed.
3. To avoid increasing the formation of electromagnetic interference, do not loop the cable.

### 3.1.7 Power cable connection terminal

The mains input, bypass input, output, and battery power cables are connected to the corresponding UPS terminals, as shown in Figure 4-2.

### 3.1.8 Safe grounding

Connect the protective ground line to the PE copper bar reliably by bolts (see Figure 4-1).

All cabinets and cable containment should be grounded in accordance with local regulations. The grounding line should be securely tied to prevent the grounding line fastening screw from being loosened when the ground line is pulled.

### 3.1.9 External protection components

For safety consideration, a breaker should be installed to input power source in the outside of UPS. This section provides general guidance for qualified installation engineers because of differences in specific installations. A qualified installation engineer should have knowledge of the local wiring regulations for the equipment to be installed.

**Mains and bypass input power source**

1. Protection for over current input and short circuit.

Install appropriate protection devices on the mains input distribution line. The protection devices must provide over current protection, short circuit protection, isolation protection and reverse irrigation and tripping. The factors of current capacity of power cable, overload ability (see table 11-6 ,11-7) and short circuit ability for pre-stage power distribution of device need to be considered for the selection of protection components.

Machines can meet current requirements with the addition of suitable external protection devices (please use recommended models or devices with better performance than recommended models)

2. Dual power sources for mains and bypass

If UPS has dual power sources for mains and bypass, a separate protection component need to be installed on mains power distribution for mains input and bypass input.

**WARNING:** Mains and bypass input should be from the same electrical source and use the same N line.

**External Battery**

A battery breaker must be installed to protect the battery. UPS provides a battery control box (BCB) , which provide over current protection, short-circuit protection and automatic tripping for external batteries.

The battery breaker is very important for battery maintenance and is usually installed near the battery.

**System Output**

Output power distribution of UPS should be equipped with appropriate protection devices.

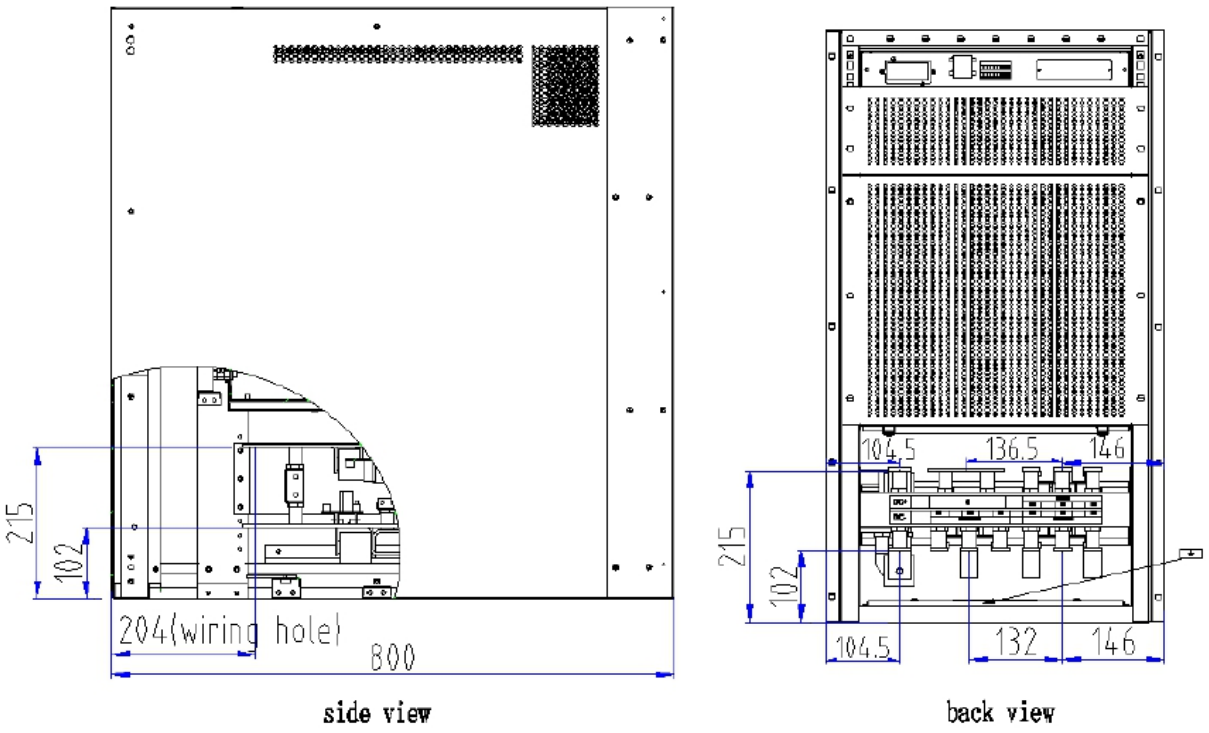
The protection device must be different from the breaker of input and provide overload protection (see Table 11-6 and Table 11-7).

### 3.1.10 The connection procedures for power cables

Please refer to 3.7.4 for cable entry mode of UPS

**Terminals and routing methods**

The wiring terminal position of the UPS power cable is shown in Figure 3-1. The position of the power cable entry hole is shown in Figure 4-2 and Figure 4-3. When wiring, remove the cover of the upper (or lower) inlet hole according to the required wire in method, and confirm the number of removed covers according to the number of cables and the wire diameter. Route the cables through the inlet holes into the cabinet and connect them to the corresponding terminals shown in Figure 4-2.



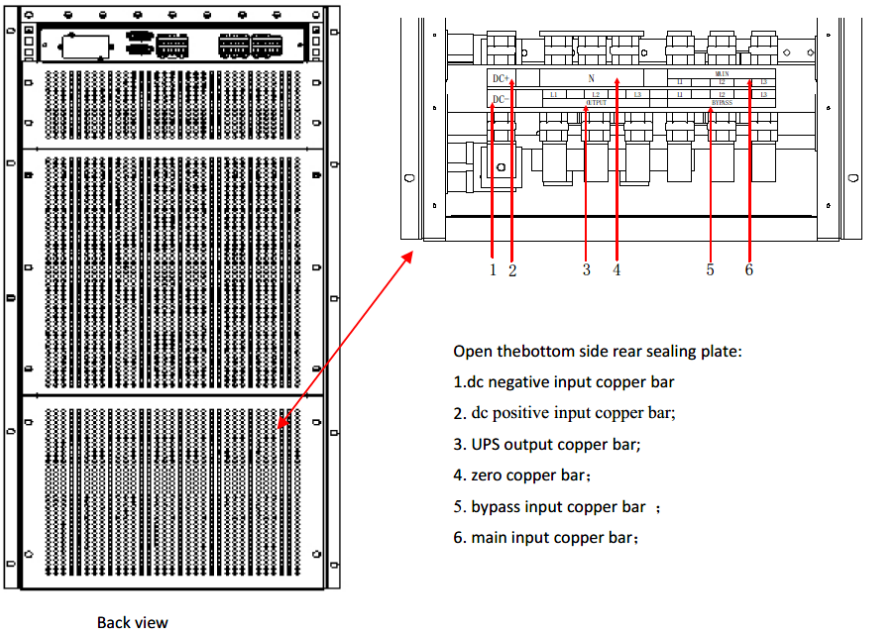




Figure 4-1：60KVA UPS power cable wiring terminal diagram

**WARNING:** Before cabling the UPS ensure that all incoming/outgoing devices are turned off and isolated. Check with dead tester that all connections are safe to work on.

Please refer to Figure 4-1 to Figure 4-3. Before wiring the power cable, open the front door of the UPS cabinet. Remove the protective cover and see the power cable terminals (see Figure 4-1). Then connect the protective ground to the PE input terminal of the cabinet.

**WARNING:** Solid Neutral and Ground wire connection should be checked and confirmed.

**Bypass input connection**

**1. The same power source for mains and bypass**

Connect the AC input power cable to the bypass input terminal (L1byp-L2byp-L3byp) of the cabinet and confirm the three short-circuit copper bars between the mains input terminal (L1main-L2main-l3main) and the bypass input terminal are connected accordingly. Connect the input N line to the N line terminal of the cabinet. Please make sure the phase sequence is correct.

The short circuit copper bar of same power source for mains and bypass is optional. If user has selected in advance, it has already been assembled before shipment, and there is no need to re-install on site. If user requires on-site installation, please refer to Figure 4-1 .

**2. Different power source for mains and bypass (default)**

Connect the mains input power cable into mains input terminal（$L1_{main}$-$L2_{main}$-$L3_{main}$） of the cabinet, and connect the bypass input power cable to bypass input terminal（$L1_{main}$-$L2_{main}$-$L3_{main}$）of the cabinet. Please make sure the phase sequence is correct.

**Output connection of system**

Connect the system output power cable between the cabinet output terminals（$L1_{out}$-$L2_{out}$-$L3_{out}$-N） and the load. See Table 4-1 for the tightening torque. Please make sure the phase sequence is correct.

**Battery connection of system**

Ensure that the polarity of power cable is correct which is connected from battery pack terminal to the battery breaker and from the battery breaker to UPS battery input cooper bar ($BAT^{+}$、 N、 $BAT^{-}$) : the battery positive terminal is connected to the "BAT+" , and the battery negative terminal is connected to the "BAT-" , battery N line terminal is connected to the "N" cooper bar.

## 4.2 Signal cable wiring

### 4.2.1 Overview

Depending on the specific needs of the site, the UPS may need an auxiliary connection to manage the battery system (including the external battery breaker), communicate with the personal computer, send alarm signals to the external device, implement a remote emergency shutdown, and provide a bypass reverse breaker signal, LBS dual bus bar and other functions. These functions are implemented by a system control unit in the UPS cabinet. As shown in Figure 4-4, the system control unit provides the following interfaces.

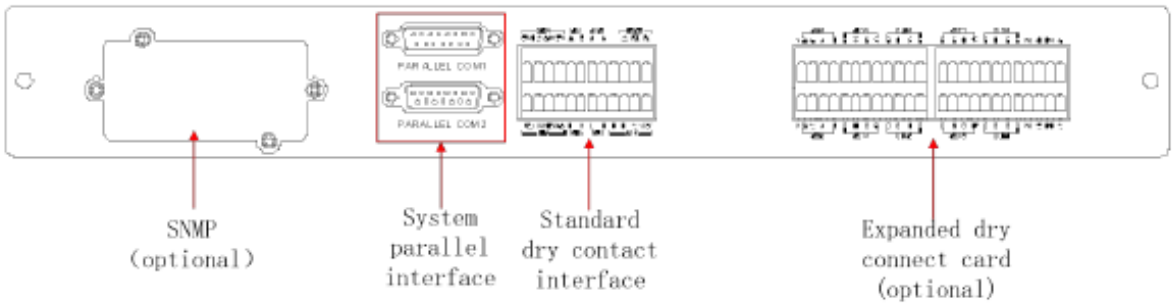



Figure 4-4 System control unit interface diagram

### 4.2.2 Communication interface definition description

The communication interface diagram is shown in Figure 4-5, and the interface description is shown in Table 4-5.

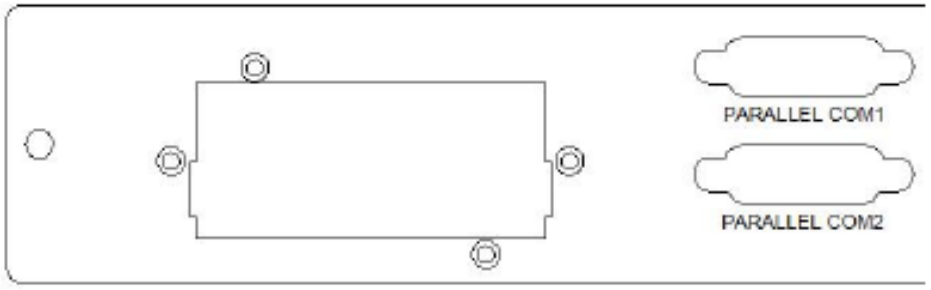



Figure 4-5: Communication interface diagram

| Interface screen printing | Meaning |
|---|---|
| SNMP | OPTIONAL |
| PARALLEL COM 1 | System parallel communication interface 1 (male) |
| PARALLEL COM 2 | System parallel communication interface 2 (female) |

Table 4-5 : Interface description

**CAUTION:** All Parallel Cables must be shielded and securely connected to chassis at both ends.

### 4.2.3 Dry contact interface description

The schematic diagram of the dry contact interface is shown in Figure 4-6. The interface description is shown in Table 4-6. The maximum withstand voltage of the dry contact interface MFP and BFP is 24Vdc or 250Vac, and the maximum current flowing is 5A. The maximum withstand voltage of the other dry contact interfaces is 24Vdc, and the maximum current flowing is 20mA

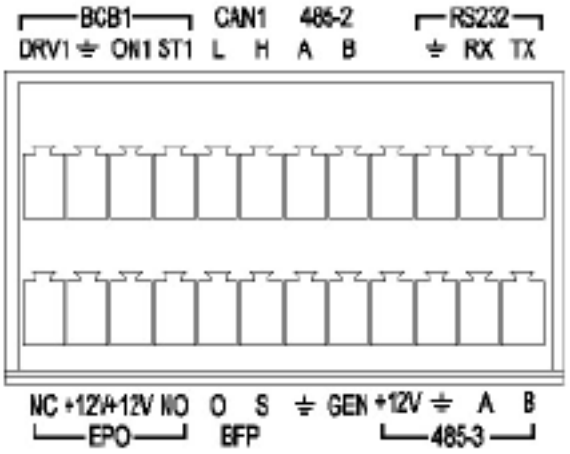



Figure 4-6: Schematic diagram of dry contact module

| Functional interface | Interface screen printing | Meaning |
|---|---|---|
| BCB1 | ST1 | Detect the status signal of battery switch 1 |
| | ON1 | Whether the battery switch box 1 is in use |
| | ⏚ | Dry contact -ground |
| | DRV1 | Battery switch 1 trip signal |
| CAN1 | L | CAN communication interface; Communication with lithium system BMS |
| | H | |
| 485-2 | A | Upper computer RS485 communication interface |
| | B | |
| RS232 | TX | Upper computer RS232 communication interface |
| | RX | |
| | ⏚ | |
| EPO | NC | Remote emergency shutdown interface (Connect normally closed contact) |
| | +12V | |
| | +12V | mote emergency shutdown interface (Connect normally open contact) |
| | NO | |
| BFP | O | Bypass reversal usual open contact |
| | S | Bypass reversal public contact |
| GEN | GEN | Motor access status monitoring signal |
| | ⏚ | |
| 485-3 | A | Connect the protective drying point card |
| | B | |
| | ⏚ | |
| | 12V | |

Table 4-6 Description of dry contact module

**WARNING:** The UPS EPO will shut down rectifier, inverter and static bypass but does not disconnect the input mains power from the UPS internally.

**CAUTION:** All LBS & BCB Cables must be shielded and securely connected to chassis at both ends.

### 4.2.4 Extended Dry contact interface description (Optional Card)

The dry port card is an optional accessory, see 4.6-1 for the interface diagram

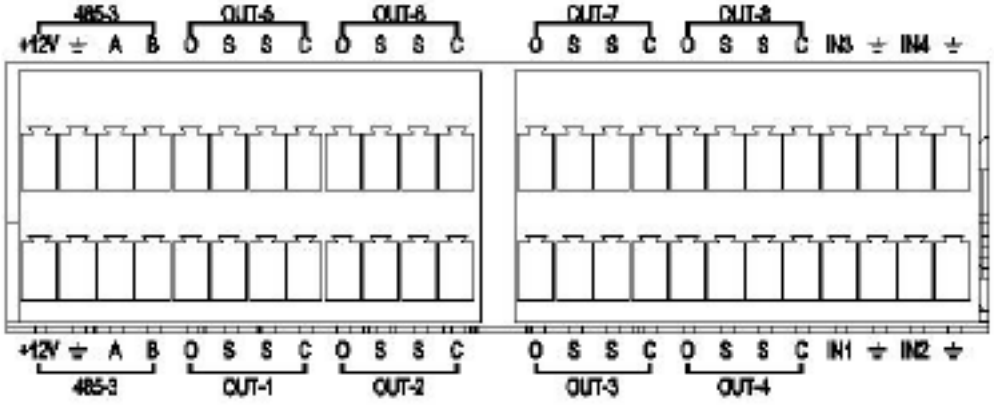



Table 4-6-1 Description of dry contact module

| input dry contact | factory settings (default definition) | status | meaning |
|---|---|---|---|
| IN1、GND | UPS on/off control | short circuit | system shutdown |
| | | open circuit | system starts up |
| IN2、GND | equal charge /float charge control | short circuit | equal charge |
| | | open circuit | float charge |
| IN3、GND | manual discharge control | short circuit | System manual discharge begins |
| | | open circuit | System manual discharge ends |
| IN4、GND | undefined | | |

| output dry contact | factory settings (default definition) | Dry contact pin | | meaning |
|---|---|---|---|---|
| | | OUT x-O | OUT x-C | |
| OUT-1 | no output | Normally open | Normally closed | when the system has an output; |
| | | Normally closed | Normally open | when the system has no output; |
| OUT-2 | battery power | Normally open | Normally closed | when the system is working in non-battery power state; |
| | | Normally closed | Normally open | when the system is working in the battery power state; |
| OUT-3 | mains abnormal | Normally open | Normally closed | when the main route of the system is normal; |
| | | Normally closed | Normally open | when the main route of the system is abnormal(include :voltage/frequency); |
| OUT-4 | Inverter | Normally open | Normally closed | When the system inverter is normal; |

| | | | | |
|---|---|---|---|---|
| | anomaly | Normally closed | Normally open | When the system inverter is abnormal |
| OUT-5 | The bypass abnormal | Normally open | Normally closed | when the system bypass is normal; |
| | | Normally closed | Normally open | when the system bypass is abnormal(include: voltage/frequency/phase sequence); |
| OUT-6 | battery pre-warning | Normally open | Normally closed | When the battery voltage alarmdisappears;l |
| | | Normally closed | Normally open | When the system battery battery generates a warming alarm(battery low voltage/SOC is low) |
| OUT-7 | battery abnormal | Normally open | Normally closed | When the system battery is normal |
| | | Normally closed | Normally open | When the system battery is connected backwards / the battery is overvoltage/the battery is not connected; |
| OUT-8 | Abnormal load | Normally open | Normally closed | When the system load is normal |
| | | Normally closed | Normally open | When the system load is abnormal |

### 4.2.5 Main power module

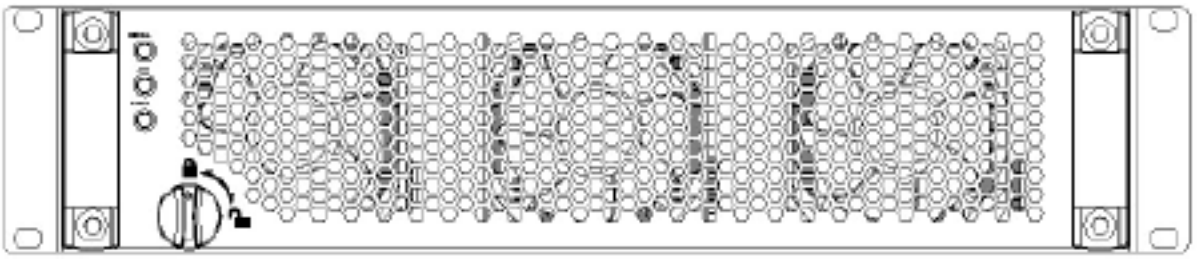


Figure 4-8 main power module diagram

| Interface Screen Printing | Meaning |
|---|---|
| NORMAL | Main power module operating status indicator (green ) |
| ALM | Main power module alarm status indicator (yellow ) |
| FAULT | Main power module fault status indicator (red ) |
|  | Main power module ready |
|  | Main power module unready |

Table 4-7 description of main power module

### 3.2.6 LBS Communication Interface

The interface distribution is shown in Figure 4-6.

# CHAPTER 5 – DISPLAY OPERATION

This chapter introduce in details about the functions and instructions of the each component of the UPS operation control display panel, and provides LCD display information, including type of LCD display screen, detailed menu information, prompt window information, and alarm list.

## 5.1 Main interface

The UPS operation control display panel is installed on the front of the cabinet. The monitoring display screen is a 10.1 inches colored touch screen. The UPS can be controlled and can search all parameters, UPS and battery status and alarm information by operating the control display panel. The main interface is shown in Figure 5-1. Description in Table 5-1 .

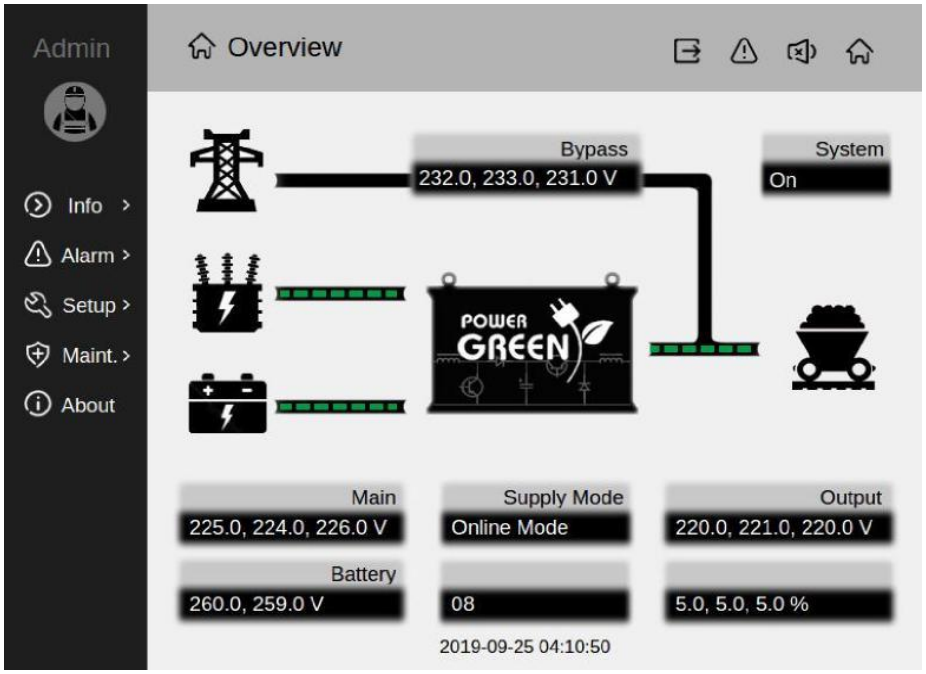



Figure 5-1 UPS operation control display panel

| Item | Description |
|---|---|
| Menu | Enter different interface to check and set parameters |
| Parameter display | Display mains voltage, battery voltage, power supply status, numbers of on-line modules, output voltage and load rate |
| Main interface | Display system power supply status |
| Login / Logout | Login and logout of different privileged users, the default password for administrator login is "123456"; |
| Load display | Directly enter the load display interface |
| Current alarm | Directly enter the current alarm display interface |
| Eliminate alarm sound | Click eliminate alarm to turn the sound off |
| Home page | Click this to return to home page no matter which interface you are browsing |

Table 5-1 Description of Operation display panel

There are two different alarm sound during operation, see table 5-3

| Alarm sound | Meaning |
|---|---|
| One buzz each second(1Hz) | This sound occurs when UPS has general alarm(such as: main power module unready, under voltage of mains, bypass out of protection alarm etc.) |
| Four buzzes each second (4Hz) | This sound occurs when UPS has general fault.(such as: failure of rectifier soft start up, EDO shut down) |
| continuous buzzing | This sound occurs when UPS has severe fault (such as opposite connection of battery, EPO shut down, maintenance bypass breaker closed) |

Table 5-3 Buzzer sound alarm description

## 4.2 User's operation interface

### 4.2.1 Running interface

When system is running, values monitoring and history curve of mains input, bypass input, battery status, AC output, load status, module data and environment data, which can read the real time data, and read history data within a certain range and shows in curve state, to make it more intuitive for observation of data' s change along with the change of time, and more effective to analyze abnormal and fluctuation of data. Running interface shows in picture 5-2, internal information is explained in table 5-3

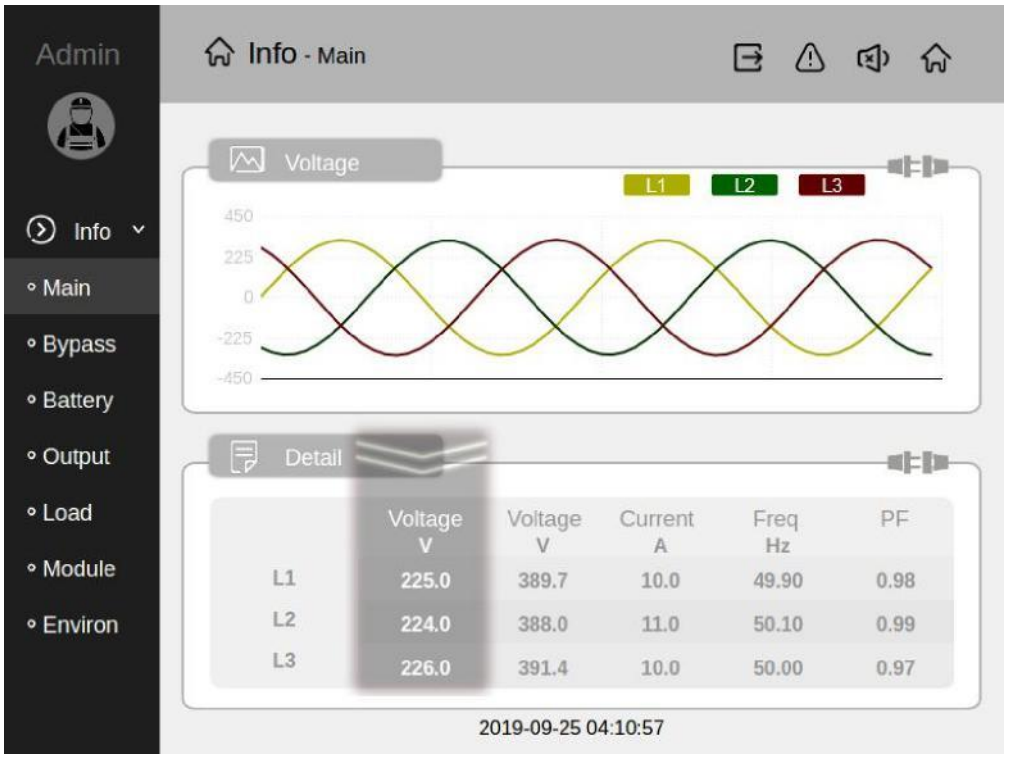



Figure 5-2 Running interface

| Menu | Items | Meaning |
|---|---|---|
| Mains input | Phase voltage(V) | Mains phase voltage |
| | Phase current(A) | Mains phase current |
| | Frequency(Hz) | Mains input frequency |
| | Line voltage(V) | Mains line voltage |
| | Power factor | Mains input Power factor |
| Bypass input | Phase voltage(V) | Bypass phase voltage |
| | Frequency (Hz) | Bypass Frequency |
| | Line Voltage (V) | Bypass Line Voltage |
| Battery status | Voltage (V) | Battery Voltage |
| | Current (A) | Battery Charging and Discharging Current |
| | Temperature (℃) | Battery temperature |
| | Remaining capacity(%) | Battery Remaining Capacity |
| | Back up time(Min) | Battery backup time |
| AC output | Phase Voltage (V) | Output Phase Voltage |
| | Phase current (A) | Output Phase Current |
| | Frequency (Hz) | Output frequency |
| | Line Voltage (V) | Output frequency |
| | Power factor | Output power factor |
| Load status | Apparent power(kVA) | Sout: Apparent power (kVA) |
| | Active power(kW) | $S_{out}$: Active power (kW) |
| | Reactive power(kVAR) | $Q_{out}$:Reactive power |
| | Percentage of load(%) | Load (UPS rated load percentage) |
| | Peak ratio | Peak factor of output current |
| Module data | L1 Load Rate (%) | Phase A Output Load Rate of each Module |
| | L2 load rate(%) | Phase B Output Load Rate of each Module |
| | L3 Load Rate (%) | Phase C Output Load Rate of each Module |
| | Working Status | Module status (ON/OFF) |
| Environment data | Temperature | Display current temperature |
| | Humidity | Display current humidity |

Table 5-3 menu interface and data interface description

### 4.2.2 Alarm interface

Including current alarm and history alarm. When there is a alarm, you can check it through icon on the main interface. When alarm occurs, one more current alarm added, and one more added in history log for record, 1000 alarms max. both for current alarm and history. Alarm interface shows in figure 5-3, common alarms in table 5-4 .

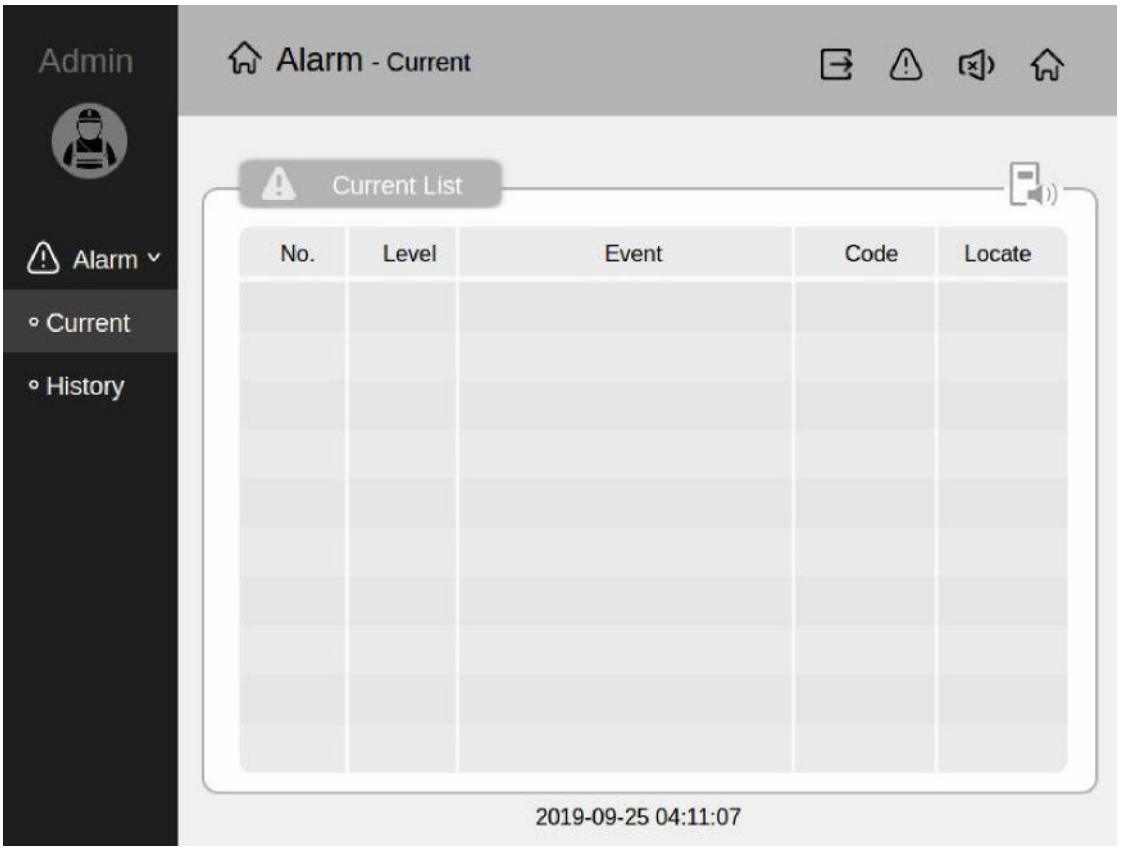



Figure 5-3 Alarm interface

| Alarm | Recommended solutions |
|---|---|
| No battery | 1. Check if the DC voltage of system monitor screen is normal.<br>2. Check if DC positive and negative breaker is closed<br>3. Check if the top voltage of the DC positive and negative terminals is normal.<br>4. Check if the bottom voltage of the DC positive and negative terminals is normal. |
| Reverse connection of battery | Check if the battery connection is correct; |
| Low temperature of battery | Check if temperature in battery room is too high or too low, and improve ambient temperature |
| High temperature of battery | |
| Abnormal ambient temperature of battery | |
| High ambient temperature | |
| Under voltage of mains | 1. Check if mains input breaker is closed<br>2. Check if the three-phase voltage at upper of mains input breaker is normal. 3.Check if the three-phase voltage at the upper of the UPS AC terminal is normal. 4.Check if the three-phase voltage at the bottom of the |
| Abnormal mains voltage | |
| Abnormal shutdown of bypass | 1. Check if bypass voltage is normal<br>2. Check if bypass frequency is normal |
| Reverse of mains phase sequence | Check if the mains input phase sequence of three phase is correct |

Table 5-4 Alarm list

| | |
|---|---|
| Abnormal mains frequency | Check if the mains input frequency is in the normal working range. |
| Reverse of bypass sequence | Check if the bypass phase sequence of three-phase is correct |
| Abnormal output voltage | 1.Check if the output breaker is closed.<br>2.Check if the three-phase voltage at the upper of output breaker is normal.<br>3.Check if the three-phase voltage at upper of UPS output terminal is normal.<br>4.Check if the three-phase voltage at the bottom of the UPS output terminal is normal. |
| Fan abnormal | Check if the corresponding module fan is plugged or damaged. |
| Output overloading | Check the system for overloading and unloading in time; |
| Over time of output overloading | |
| System overloading | |
| Capacity overloading | |
| No power supply | Check if the system working status is normal |
| Battery remaining capacity alarm | Alarm for reminding; please restore the mains supply asap, and stop battery discharging; or, please shut down the important load, the system may transfer to bypass or power off; |
| Battery back up time alarm | |
| Over discharging current | Too big load for system, please change battery |
| Power module unready | Check if the power module is connected well |
| Abnormal parallel connection cable | Parallel connection cable is not connected well |
| LBS connection abnormal | The sync signal cable is not connected well. |
| Parallel cabinet connection fault | parallel cable is not connected well |
| Parallel cabinet connection is abnormal | |
| Bypass auxiliary power supply off | Check if the bypass power supply is normal |
| Input without N line fault | Check if the N line is connected properly. |
| Bypass control box unready | 1 Check if bypass control box is connected well<br>2 Check if ready switch of bypass control box is pressed |
| Dry contact box off-line | Check if the dry contact box is connected well |
| Monitor control box off-line | Check if the monitor control box is connected well |
| Bypass power unit unready | Check if the bypass power unit is connected well |
| Bypass SCR fan abnormal | Check if the fan of system static switch is plugged or damaged. |
| Bypass over temperature | Dedusting the system static switch module |
| Bypass over current | Check the system for overload |
| Out of protection of bypass | 1. Check if the bypass phase sequence is correct;<br>2. Check if the bypass voltage is in the normal operating range<br>3. Check if the bypass frequency is in the normal working range |
| Abnormal state of BCB1 | Check if the battery switch has a problem of tripping |
| Abnormal state of BCB2 | |
| Abnormal state of BCB3 | |

| Alarm | Recommended solutions |
|---|---|
| No battery | 1. Check if the DC voltage of system monitor screen is normal.<br>2. Check if DC positive and negative breaker is closed<br>3. Check if the top voltage of the DC positive and negative terminals is normal.<br>4. Check if the bottom voltage of the DC positive and negative terminals is normal. |
| Reverse connection of battery | Check if the battery connection is correct; |
| Low temperature of battery | Check if temperature in battery room is too high or too low, and improve ambient temperature |
| High temperature of battery | |
| Abnormal ambient temperature of battery | |
| High ambient temperature | |
| Under voltage of mains | 1.Check if mains input breaker is closed<br>2.Check if the three-phase voltage at upper of mains input breaker is normal.<br>3.Check if the three-phase voltage at the upper of the UPS AC terminal is normal.<br>4.Check if the three-phase voltage at the bottom of the UPS AC terminal is normal |
| Abnormal mains voltage | |
| Abnormal shutdown of bypass | 1.Check if bypass voltage is normal<br>2.Check if bypass frequency is normal |
| Reverse of mains phase sequence | Check if the mains input phase sequence of three phase is correct |
| Abnormal mains frequency | Check if the mains input frequency is in the normal working range. |
| Abnormal state of BCB4 | |
| BCB1 disconnection | Check the reason of battery disconnection |
| BCB2 disconnection | |
| BCB3 disconnection | |
| BCB4 disconnection | |
| Neighbor equipment request transferring to bypass | Check the cause of the bypass request of the neighbor equipment; |
| Maintenance breaker closed | Prompt warning: no troubleshooting required |
| Maintenance breaker disconnected | |
| EPO emergency shutdown | |
| External maintenance breaker closed | |
| External maintenance breaker open | |
| Output breaker closed | |
| Output breaker disconnected | |
| External output breaker closed | |
| External output breaker disconnected | |
| Battery EOD shutdown | Prompt warning: no troubleshooting required |
| Wrong operation | |

### 5.2.3 About the interface

This screen displays the model number of the device, the manufacturer, the software version no. of the system, the total system operation time, the total inverter /bypass operation time, and the times of battery discharging. The interface is shown in Figure 5-4.

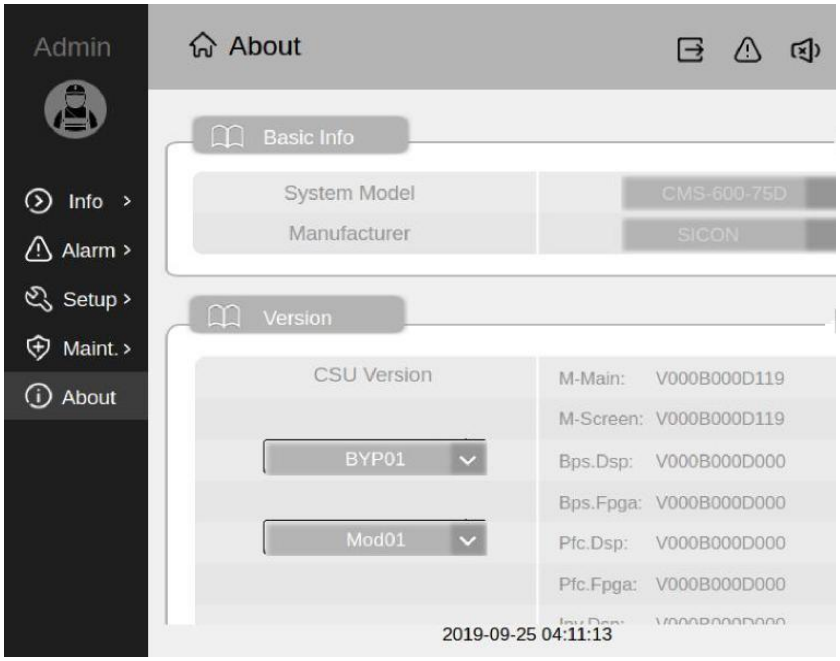



Figure 5-4 About the interface

## 4.3 Administrator operation interface

### 4.3.1 Setting interface

The administrator setting interface is shown in Figure 5-5. The setting content is shown in Table 5-5.

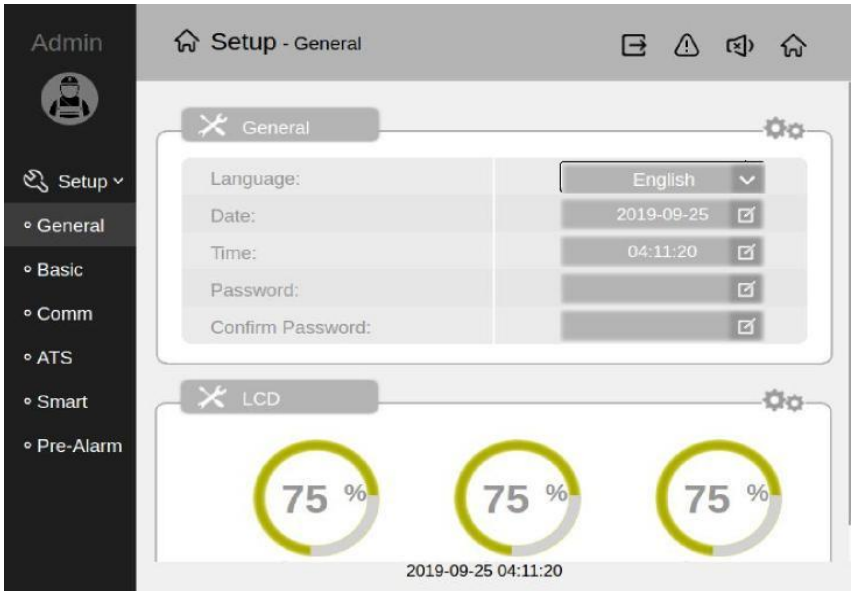



Figure 4-5 Setting interface

| Menu | Item | Description |
|---|---|---|
| Common parameters | language | Chinese/English optional |
| | date | settable |
| | time | settable |
| | administrator password | settable |
| | confirm password | reconfirm the password |
| | brightness | The default is 75%; range 0"100% adjustable |
| | contrast | The default is 75%; not adjustable; |
| | saturation | The default is 75%; not adjustable; |
| Basic parameters | battery capacity | The default is 150Ah; range from 50 to 3000 settable; |
| | battery blocks | The default is 32; 32-44 for option |
| | Charging current limitation coefficient | The default is 0.1C, settable range 0.05"0.15 |
| | Discharging current limitation coefficient | The default is 1C, settable range 0.3"1 |
| | Single cell floating charge voltage | The default is 2.35V/cell, settable range 2.23"2.27V/cell |
| | Single cell equal charging voltage | The default is 2.35 V/cell, settable range 2.3"2.4 V/cell |
| Communication parameter | IP automatic allocation | Can be set to enable |
| | IP address | Settable;default:192.168.0.232 |
| | subnet mask | settable;default: 255.255.255.0 |
| | Gateway | Settable;default: 192.168.0.1 |
| | RS485 communication baud rate | Default is 9600, optional value: 1200 2400 4800 9600 19200 38400 |
| | RS485 initial address | default is 1, settable range 0"255 |
| Alarm | battery low temperature alarm | the default is 0℃, settable range -20"5 |
| | battery high temperature alarm | the default is 50℃, settable range 40"70 |
| | System ambient temperature alarm point | the default is 40℃,settable range 30"50 |
| | battery back up time alarm | Can be set to enable; |
| | Early warning value of battery back up time | the default is 30, settable range 5"30 |
| | Early warning of battery remaining capacity | Can be set to enable |
| | Early warning value of battery remaining capacity | the default is 80, settable range 5"80 |
| | alarm sound | Can be set to enable |
| | Inverter asynchronous alarm | Can be set to enable |

Table 5-5 Description of items on setting interface

| Menu | Item | Description |
|---|---|---|
| | extreme difference of charging voltage | The default is 10, settable range 5"20 |
| | extreme difference of discharging voltage | The default is 10, settable range 5"20 |

Table 5-5 Description of items on setting interface

### 4.3.2 Maintenance interface

The administrator maintenance interface is shown in Figure 5-6, operation contents are in Table 5-7.

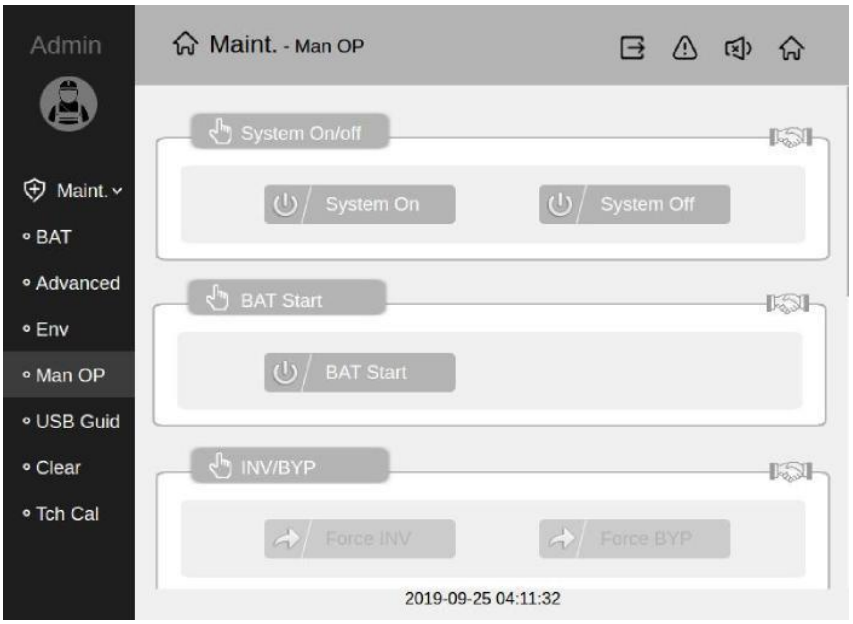



Figure 5-6 maintenance interface

| Menu | Item | Description |
|---|---|---|
| Advanced maintenance | Stand-alone working mode setting | default: stand-alone mode;<br>Option: stand-alone mode, parallel mode |
| Environment maintenance | Sensors Number for ambient temperature and humidity | default: 0 ; range: 0"4 |
| | Ambient temperature sensor baud rate | default: 9600;<br>option: 1200, 2400, 4800,9600,19200,38400 |
| | Sensors initial address for ambient temperature and humidity | default:1; range:0"255 |
| Manual operation | UPS boot | UPS boot |
| | UPS shutdown | UPS shut down |
| | manual equal charging | battery charging transfer to equal charging |
| | manual floating charge | battery charging transfer to floating charge |
| | Fault clearing | fault clearing |
| | battery cool starting up | battery starting up |
| Touch screen | | LCD touch screen calibration |

Table 5-7 Description of maintenance interface item

### 4.3.3 Prompt window

When the system is running, and it needs to remind the user to pay attention to certain system status, or needs user

to confirm a command or perform other operations, the system will pop up the prompt window, see Table 5-8.

| Prompt window information | Operation option |
|---|---|
| UPS boot | UPS boot (confirm/cancel) |
| UPS shutdown | UPS shutdown (confirm/cancel) |
| manual equal charging | battery charging transfer to equal charging(confirm/cancel) |
| manual floating charging | battery charging transfer to floating charging(confirm/cancel) |
| fault clearing | fault clearing (confirm/cancel) |
| battery cool starting up | battery start up (confirm/cancel) |
| Invalid data, please re-enter | confirm |
| log in/out user | administrator initial password "123456" |
| Touch screen calibration | confirm/cancel |

Table 5-8 Information and meaning of prompt window

# CHAPTER 6 – OPERATION PROCEDURES

This chapter introduce in details of the daily operation precautions and operating procedures of the UPS.

## 6.1 Brief introduction

### 6.1.1 Precautions

**WARNING:** Initial Start up should be performed by authorised BPC Service Engineer. Only qualified personnel should access the internal parts of the UPS system. The UPS terminals can have live voltages present at any time.

1. Refer to Chapter Four, Operation Control Display Panel, for all control operation keys and system monitoring unit LCD involved in the operation steps.
2. Buzzer alarms may appear at any time while operating, press in system monitoring unit LCD to clear alarm.

### 6.1.2 Power source breaker

The power source breakers installed in the UPS cabinet can be seen by opening the front door with a key. The positions of the breakers are shown in Figure 6-1. including:

Q1: Mains input breaker, connect the UPS to the mains power source.

Q2: Bypass input breaker, connect UPS to bypass power source.

Q3: Maintenance bypass breaker (with lock), maintenance bypass directly supply power to the load when repairing the UPS.

Q5: Output breaker, connect UPS output to load

**CAUTION:** Q1, Q2 & Q5 are optional breakers and may not be fitted to standard chassis.

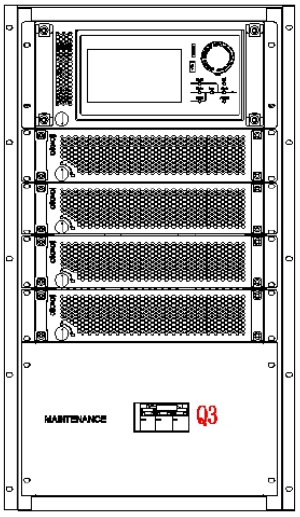



Figure 6-1 UPS power source switch position diagram

## 5.2 UPS booting-up steps in normal mode

The booting-up can be performed only after the UPS is fully installed, fist time of powered on and authorized engineer has confirmed the external power source is normal.

**WARNING:** The following steps will energise the output terminals of the UPS, please ensure all loads that cannot be energised are isolated.

The following boot procedure is applicable to booting the UPS when the UPS is completely powered off.

1.Open the front door of the UPS, confirm that the internal maintenance bypass switch Q3 is disconnected, and the access cable is reliably connected to the terminal block.

2. Close bypass input breaker Q2, at this point, the system is powered on, system control unit is working, and LCD of system control unit starts up . After about 70 seconds, confirm whether the LCD displays that the bypass power supply is normal. Read the version of the system monitoring unit and the system control module software from the main interface of the system monitoring unit LCD-about-version number. Otherwise, you need to check whether the system control module of system control unit, and bypass input breaker Q2 are fully closed.

3. When closing the main input breaker Q1, you need to confirm whether the system monitoring unit LCD shows that the main power supply is normal. Otherwise, you need to check whether the system control module of the system control unit and the mains input breaker Q2 are fully closed.

After 50 seconds, the rectifier of the main power module is turned on. The red and yellow light on front panel of the main power module are on. From the LCD main interface of the system monitoring unit-About-version number, read the software version of the main power module. From the LCD main interface of the system monitoring unit-Alarm-Current Alarm, read the alarm status of all the main power modules, and display the alarm "The main power module is not ready".

Turn it on ready state for main power module ready switch in position 1 . Press the LCD main interface of the system monitoring unit-Maintenance-Manual operation-UPS boot up. On the front panel of the main power module at position 1, the green light flashes, the red and yellow lights are continuous on. After 60 seconds, the green light is continuous on, the red light is off, and the yellow light is continuous on. The inverter of main power module at position 1 outputting. From the LCD main interface-operation-module data of the system monitoring unit, read the power module information at position 1, and from the LCD main interface of the system monitoring unit, check the current power supply status of the system for online power supply.

5. Turn it to ready state for the main power module ready switch in position 2 . On the front panel of the power module in position 2, the green light flashes, the red and yellow lights are continuous on, a. After 60 seconds, the green light is continuous on, the red light is off, and the yellow light is continuous on , the inverter of power module at position 2 outputting. Reading the power module information on position 2 from the LCD main interface of system monitoring unit -Operation-Module Data, and the remaining power module operates by analogy.

6. After all the main power modules are started, close the external battery breaker. After 10 seconds, on the front panel of the main power module, yellow light will turn off and green light will be on. After 75 seconds, read battery information and charger information from the system monitoring unit LCD main interface-operation-battery status.

7. Close the output breaker Q5, the UPS output is connected to the load, and the UPS is operating in normal mode.

| Indicator light | Status |
|---|---|
| Fault indicator | off |
| Battery indicator | off |
| Output indicator | green |
| Status indicator | green |

Table 6-1 shows the indicator status of main power module

UPS IS RUNNING IN NORMAL OPERATION

## 6.3 Operation mode transfer step

### 6.3.1 Transferring from normal mode to battery mode

Disconnect the mains input breaker Q1, cut off the mains power supply, the UPS will transfer to battery mode. To transfer the UPS back to normal mode, you need to close the mains input breaker Q1 to restore the mains . Then the rectifier of the main power module restarts automatically, UPS will return to normal mode.

### 6.3.2 Transferring from normal mode to bypass mode

Press the main interface of the system monitoring unit LCD-maintenance-manual operation-UPS shutdown. The power supply state of the system monitoring unit LCD main interface is power supplying by bypass. UPS will transfer from normal mode to bypass mode.

### 6.3.3 Transferring from bypass mode to normal mode

In bypass mode, press the system monitoring unit LCD main interface - maintenance - manual operation - UPS boot-up, the main power module inverter starts up, and the inverter indicator light flashes in green until the inverter indicator light are continuous green, then UPS transfers to normal mode.

### 6.3.4 Transferring from normal mode to maintenance mode

Transferring the load from the inverter output to the maintenance bypass by this operation when the UPS is running in normal mode.

1) Press the system monitoring unit LCD main interface - maintenance - manual operation - UPS shutdown. The power module indicator light is red and the green light is off. The system monitoring unit LCD main interface is power supplying by bypass, and buzzer alarms, load is transferred to static bypass, and the inverter is turned off.

2) Close internal maintenance bypass break Q3

3) At this moment the maintenance bypass is connected in parallel with the static bypass of the UPS

4) System monitoring unit LCD main interface - alarm - current alarm, display alarm "maintenance breaker closed"

5)The operation of the rectifier, inverter, static switch and battery can be stopped by pressing the EPO button on the cabinet panel without affecting the normal power supply from maintenance bypass to the load.

6)Disconnect the mains input breaker Q1 and the bypass input breaker Q2, and then disconnect the output breaker Q5. At this moment, all internal power is cut off and the system monitor unit LCD display is off.

**WARNING:** If Maintenance is required wait for 10mins to allow the DC capacitors to fully discharge. When the UPS is isolated some arts of the UPS may still be live

### 5.3.5 Transferring from maintenance mode to normal mode

The following operations will transfer the load from the maintenance bypass power supply to the mains inverter power supply.

1)Take turns to close the output breaker Q5 , (if there is external power bypass breaker and external power mains breaker, please close them) bypass input breaker Q2, mains input breaker Q1;

2) At this moment, the main power module rectification is starting up. After 70 seconds, the system monitoring unit LCD main interface displays that the system is in bypass power supply and the UPS is running in bypass mode;

3) Disconnect maintenance bypass breaker Q3;

4) After the rectifier of the main power module has been started, press the system monitoring unit LCD main interface-maintenance-manual operation-UPS boot. After 60 seconds, the main power module indicator light turns continuous green , then close the external battery breaker.

UPS is working in normal mode.

## 6.4 UPS shutdown steps

### 6.4.1 UPS completely power off

This step for UPS need to be completely shut down and the load need to be powered off. All power switches, isolation switch, and breakers are disconnected and the UPS no longer supplies power to the load.

1) Press LCD main interface of the system monitoring unit-maintenance-manually operation- UPS shutdown, then inverter shutdown, and the system is transferred from the inverter to bypass power supply. (If emergency power-off is required, press EPO to stop the operation of the rectifier, static switch and battery)

2) Disconnect the external battery breaker

3) Disconnect the mains input breaker Q1, bypass input breaker Q2, and output breaker Q5. At this moment, all internal power is off and the LCD display is closed.

### 6.4.2 The UPS is completely powered off but continues to supply power to the load.

This procedure is for completely powering off the UPS, but continues to supply power to load. Please refer to the operation procedure of *5.3.4 Transferring from normal mode to maintenance mode*.

## 6.5 Emergency power off (EPO) procedure

The EPO button on UPS panel or remote EPO dry contact provides an emergency stop (EPO) for shutting down the UPS in an emergency (eg, fire, flood, etc.). To perform an emergency shutdown, simply press the EPO button or the remote EPO control unit, the system will shut down the rectifier, inverter, and quickly cut off the load power supply (including inverter and bypass output), and the battery stops charging or discharging.

After the emergency shutdown, the UPS still has the mains input, and the UPS control circuit is still energized, but the UPS output is closed. To completely disconnect the mains power supply, first to disconnect the UPS external mains input breaker and external bypass input breaker.

## 6.6 UPS reset procedure after an emergency shutdown (EPO) or abnormal shutdown

After using EPO (emergency power off) or UPS shutdown due to UPS fault, take measures to clear the fault according to the alarm information prompted on the screen, use the following UPS reset steps to return the UPS to normal state.

After user confirms that the fault has been cleared, then perform the following steps:

1.The UPS is in bypass power supply state;

2. After the rectifier of the main power module has been started up, press the LCD main interface of the system monitoring unit-maintenance-manually operation-UPS boot, after the inverter is running normally, the UPS will transfer from the bypass power supply to the inverter online power supply.

## 6.7 Automatically starting

When mains fails, the UPS supplies power to the load through the battery until the battery discharges to cutoff voltage (EOD), and the UPS power supplying transfers to the static bypass.

When the following conditions are met, the UPS will automatically restart up and restore the inverter online power supply:

1. Confirm that EOD auto-recovery is enabled.

2. The mains restores the power supply, the main power module rectifier is turned on, close the external battery breaker, and the main power module charger is turned on;

3. After the EOD self-recovery delay (default is 10 minutes), then UPS boot, the inverter is starting, and the system will be transferred from the bypass mode to the normal mode;

4. If UPS doesn't be set for automatic boot, after the mains recovery, the user can manually boot up the UPS by pressing: LCD main interface of system monitoring unit-maintenance-manual operation-UPS boot.

## 6.8 Select Language

At present, the system monitoring unit LCD is displayed in two languages only, Chinese and English, and the default is "English".

To change the system language, please perform the following steps:

1. On the LCD main interface of the system monitoring unit, log in the administrator, the default password is "123456". If the user has changed the password, please enter the correct password.

2. Press setting-common parameters-general parameters on LCD main interface to set language as your required.

## 5.9 change current date and time

To change the system date and time, go to following steps:

1. On the LCD main interface of the system monitoring unit, log in administrator, the default password is "123456". If the user has changed the password, please enter the correct password.
2.On LCD main interface, please press Settings - Common Parameters - General Parameters, enter the date and time.

## 5.10 change password

The system provides password protection for the operation of the UPS. The default password is "123456".

The UPS setting operation can only be performed after the password is verified.

To change your password, please perform the following steps:

1. On LCD main interface of the system monitoring unit, log in the administrator, the default password is "123456". If the user has changed the password, please enter the correct password
2. On LCD main interface, press setting - common parameters - general parameters, first enter the administrator password, then enter the confirmed password, the two times of password inputting are consistent

# CHAPTER 7 – BATTERY

This chapter introduce battery related information, including battery safety, installation and maintenance information, battery protection, battery control box (BCB) etc.

## 7.1 Brief introduction

The UPS battery pack consists of several batteries connected in series to provide a rated DC input voltage to the UPS inverter. The required battery backup time (i.e. the duration of battery power supply to the load when the mains is interrupted) is limited by the Ah of battery. Therefore, sometimes it is necessary to connect several packs of batteries in parallel.

To cooperate with the installation of UPS, the battery is usually installed in a specially designed battery cabinet or battery rack.

The battery must be disconnected from the UPS during maintenance or repair. This operation can be achieved by a battery breaker with suitable capacity. This breaker must be installed as close as possible to the battery, and the power and signal cable wiring distances from the UPS should be as short as possible.

If multiple packs of batteries are connected in parallel to increase the battery backup time, a slitting device must be provided to perform maintenance operations on one battery pack without affecting the normal operation of the remaining battery packs.

## 7.2 Safety

Special care should be taken when operating UPS batteries. The battery can be set from 30~44 blocks. When all the battery cells are connected, the rated battery pack voltage can reach to 360Vdc ~ 528Vdc. Please observe the high-voltage operation safety precautions, and only qualified personnel can perform battery installation and maintenance operations. In safety aspect, the room and installation should conform to EN620485 or to local guidance.

It is necessary to confirm that the battery breaker has been disconnected before battery maintenance, and make sure that the copper bar is not charged before operating the copper bar connected with the external battery.

The following safety precautions should be considered at all times when using batteries:

1.All Battery connections should torques to the relevant setting as advised by the battery manufacturer, this should be rechecked during annual maintenance visits.

2.A visual inspection should be carried out of each battery block prior to install.

Check if the package is damaged, the battery terminals are dirty, corroded, rusted, or the outer cover is cracked, deformed, leaking, etc., battery should not be installed if any issues are seen.

3.Batteries are heavy, when installing follow all manual handling guidleines.

4.The connection terminal of the battery cannot withstand any external force, such as the tension or torque on the cable. Otherwise, the connection inside the battery may become damaged.

5.The battery should be installed and stored in a clean, cool, dry environment. Please do not install the battery in a closed battery compartment or a closed room.

The battery should be installed away from heat-generating products such as transformers. Do not use or store the battery near the fire source.

6. Do not connect any conductor directly between the positive and negative terminals of the battery. When operating the battery, remove all metallic jewelry, and make sure that the tools used (such as wrenches) are insulated to the correct voltage.

7. To prevent static electricity and sparks, do not wipe the battery with a dry cloth or duster. Do not use the organic solvent such as Thinner, gasoline, or volatile oil to clean the battery.

8. The battery contains dilute sulfuric acid inside. While normal using it, the dilute sulfuric acid is all adsorbed in the separator and the electrode plate inside the battery, but it may leak from the battery when the battery is damaged. Therefore, personal protective equipment such as safety glasses, gloves, must be used when operating the battery.

9. The battery must be replaced at the end of the battery life expectancy.

10. The charging power should be disconnected before connecting or disconnecting the battery terminal connection cable.

### 7.5 UPS battery Number of blocks

The UPS supports 30 to 44 blocks of battery, according to the actual number of the user required, set in the LCD main interface of the system monitoring unit - setting - basic parameters - battery parameters, the default is 40 blocks, other parameters are shown in Table 6 - 2.

| Parameters | Value |
|---|---|
| Cells number (standard) | 180 264 pcs |
| Discharge cutoff voltage | Discharge current 0.1C (EOD), 1.58Vdc/Cell'-'1.80Vdc/Cell, recommend 1.80<br>Discharge current 0.3C (EOD),1.58Vdc/Cell'-'1.75Vdc/Cell,recommend 1.75<br>Discharge current 0.5C (EOD),1.58Vdc/Cell'-'1.66Vdc/Cell,recommend 1.66<br>Discharge current 1C (EOD),1.58Vdc/Cell'-'1.6Vdc/Cell,recommend 1.58 |
| Floating charge voltage | 2.23Vdc/Cell'-'2.27Vdc/Cell,recommend 2.25 |
| Equal charge voltage | 2.23Vdc/Cell'-'2.4Vdc/Cell,recommend 2.35 |

Table 6-2 Battery parameters

## 7.6 Battery BCB Option

The battery is connected to the UPS via BCB that can be manually closed and has an electronic trip device controlled by the UPS control circuit. If the battery is rack mounted (or away from the UPS cabinet), the battery control box must be installed as close as possible to the battery, and the power and signal cable wiring distances from the UPS should be as short as possible.

BPC BCB has the following features:

- Isolated from the battery, safe and reliable
- Provide short-circuit protection
- UPS remotely monitor EOD, BCB battery breaker can be automatically disconnected to avoid battery over-discharge damage
- If the UPS battery EOD control signal fails, BCB can automatically disconnect the battery breaker to avoid battery over-discharge damage.
- UPS remote emergency stop breaker, which can be disconnected remotely with emergency stop breaker
- BCB remote emergency stop breaker, which can be disconnected remotely with emergency stop breaker

In order to have the required backup time, it may be necessary to connect the battery packs in parallel. In this case, the battery breaker should be placed in the rear position of all parallel battery packs.

## 7.7 Battery installation and wiring

### 7.7.1 Installation of Battery

1. Before installation, check that the appearance of the battery is not damaged, accessories are complete without missing. Read carefully the manual and the user manual or installation instructions provided by the battery manufacturer.
2. There must be a minimum of 10mm spacing between the batteries in the vertical direction to keep the air flowing freely around the battery;
3. There must be a certain space between the top of the battery and the upper partition to monitor and maintain the battery;
4. The battery should be installed in sequence from bottom to top layer to prevent the center of gravity from being too high. The battery should be installed well to protect the battery from vibration or shock.

### 7.7.2 Battery wiring

1. All battery cabinets or battery racks must be connected together and well grounded;
2. When using multiple packs of battery, connect them in series first and then in parallel. After the total voltage of the battery pack is checked to be correct, then it can be loaded and powered on. Be sure to connect correctly the positive and negative terminals of the battery and the UPS according to the marks on battery and UPS. If the polarity is incorrectly connected, it may cause damage to the battery and UPS.

3. After completing the wiring of the battery terminals, an insulating cover shall be installed for each terminal;

4. When connecting the cable between the battery terminal and the battery breaker, first connect from the battery breaker end;

5. The bending radius of the cable should be ＞10D, D is the outer diameter of the cable;

6. After the battery cable is connected, it is forbidden to pull the battery cable or cable terminal again.

7. When connecting, do not cross the battery cables, and do not bundle the battery cables together;

8. When connecting the battery, please refer to the battery wiring diagram in Figure 7-1.

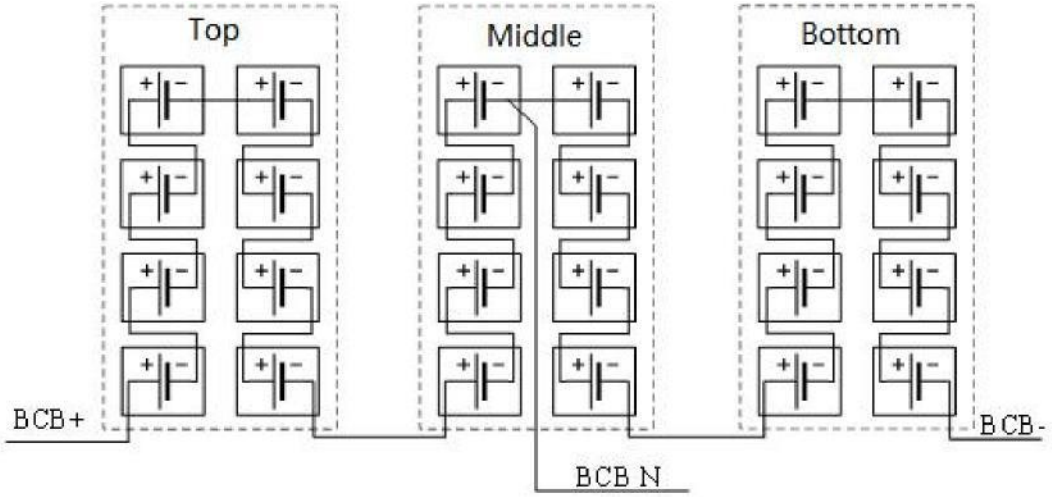



Figure 7-1 battery wiring diagram

# CHAPTER 8 – PARALLEL SYSTEM

This chapter introduce installation and operation of parallel system in details

## 8.1 Brief introduction

Parallel system supports max. 4 stand-alone UPSs with same type, same capacity in parallel, without a unified static bypass. When the system transfers to the bypass power supply state, the bypass static breaker of each UPS share the load.

For power source, the internal configuration of each single system in the parallel system is exactly the same as the normal stand-alone system configuration. The parallel control signal manages the system current sharing, synchronization, and bypass transferring. The control signal is connected by a parallel multi-core cable between the stand-alone UPSs, and form a closed loop.

## 8.2 Installation of Parallel System

The basic installation steps for the parallel system are same as for the stand-alone system. This section only introduce the differences between parallel system installation and stand-alone system installation. The parallel system installation should be carried out in accordance with the installation procedures of the stand-alone system and the requirements of this section.

### 8.2.1 Initial inspection

Correctly select the parallel cable options and confirm that each unit has the same capacity and model.

### 8.2.2 Cabinet Installation

Place each unit side by side and connect each stand-alone UPS as shown in Figure 8-1.

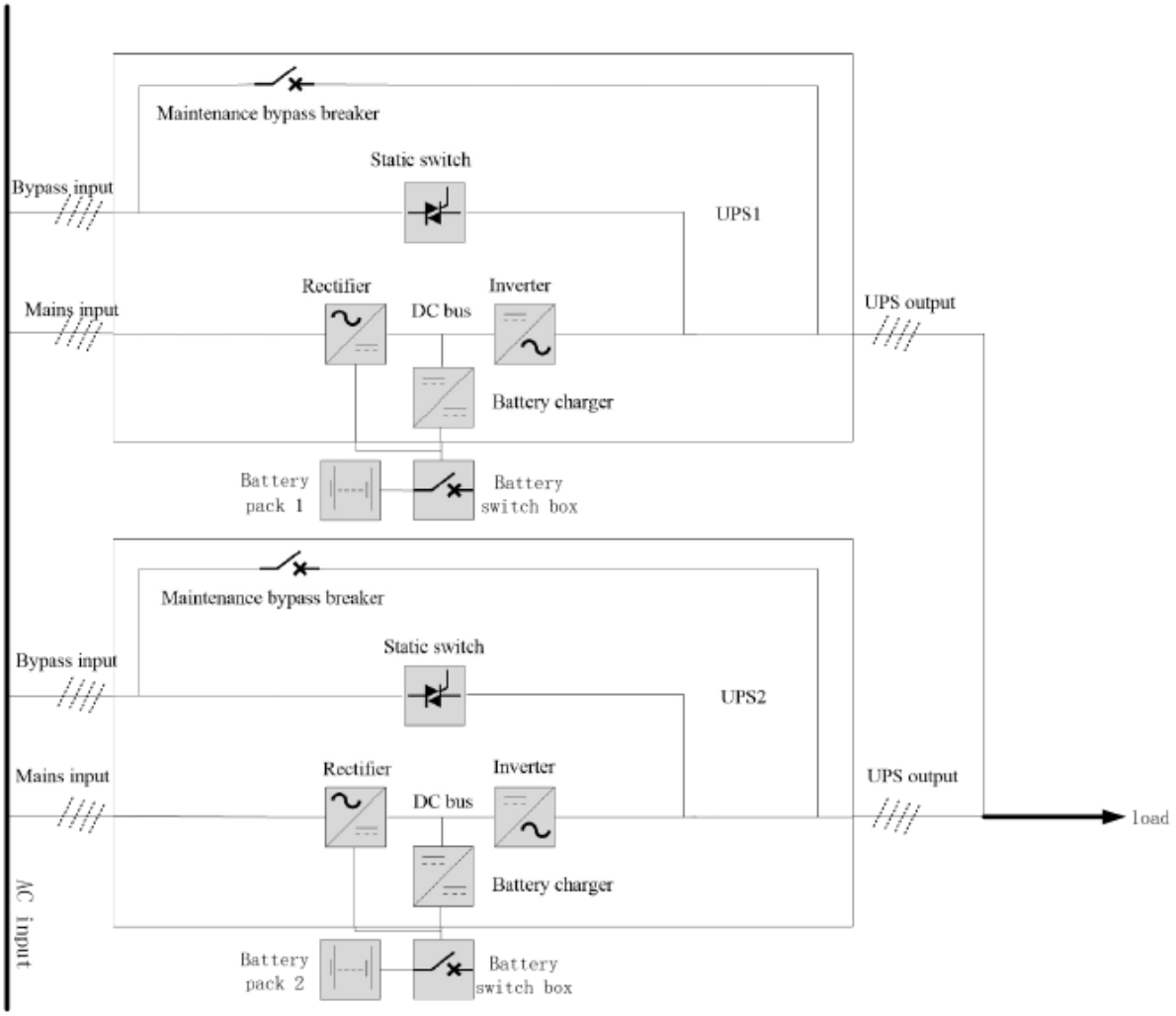



Figure 8-1 Schematic diagram of a typical parallel system
(with common input, independent battery and output)

### 8.2.3 Power cable

Power cable wiring is similar to a stand-alone system, please refer to *4.1 Power Cable Wiring.* The bypass and main input power supplies must use the same N line input terminal.

**WARNING:** The length and specifications of each power cable must be the same for each UPS (including the UPS bypass and output cables).

### 8.2.4 Parallel cable

Double-layer insulated shielded communication connection cables with lengths of 5m, 10m, 15m and 20m can be choose, and they are connected all single unit to form a closed loop, as shown in Figure 8-2. The specific connection method is as following: connect the UPS parallel communication cable of one stand-alone UPS from the PARALLEL COM1 port on bypass control module to the PARALLEL COM2 port of the next stand-alone UPS bypass control module in turns.

The front panel on system control module provides the parallel interface J25, as shown in Figure 8-3. This closed loop connection provides assurance of the reliability of the parallel system control. Make sure the cable is securely connected before starting !

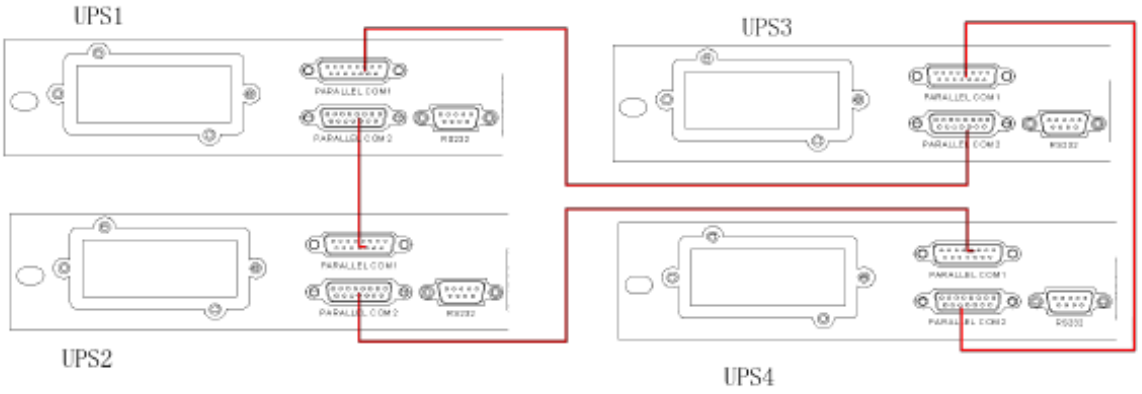



Figure 8-2 Parallel cable connection in parallel system

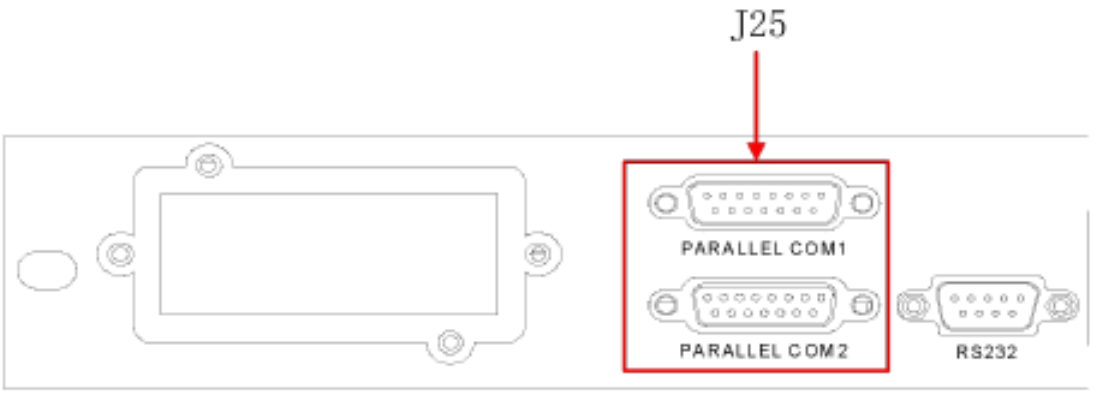



Figure 8-3 System control unit parallel interface (J25)

## 8.3 Parallel System Operation Procedure

One step must be performed at a time, and after the same step is performed for each stand-alone unit, then go to the next step.

### 8.3.1 Start Up procedure in normal mode

This procedure is used to start the UPS when it's fully powered off, i.e. before that, UPS has not supplied power to the load or supplied power through the maintenance bypass breaker. Confirm that the UPS is well installed, and the external bypass input breaker, external mains input breaker and output power distribution breaker are all closed, the following operations are performed by an authorized engineer.

For boot up procedure of the parallel system at normal mode, please refer to *6.2 UPS boot up procedure* at normal mode.

**WARNING:** In order to make each stand-alone UPS to operate in parallel. Each system controls must be set from there independent LCD screen by authorised BPC engineer.

### 8.3.2 Maintenance bypass operation steps

This procedure transfers the load from the UPS being protected by power supply state to being connected directly to the AC input bypass power supply via the maintenance bypass breaker.

**WARNING:** If the parallel system consists of more than two stand-alone UPS running in capacity the internal MBS can not be used.

1. Press LCD main interface of each UPS system monitoring unit in turn - maintenance - manual operation - UPS shutdown. The main power module inverter shuts down, buzzer alarms, and the load transfers to static bypass. Confirm that all UPSs in the system are transferred to bypass power supply;
2. Close the UPS maintenance bypass breaker Q3;
3. Now, the maintenance bypass is connected in parallel with the static switch bypass of each UPS;
4. Disconnect each UPS output breaker Q5 in turn. Now the power supply to the load is now fully provided by the maintenance bypass.
5. To further stop the operation of the rectifier, inverter, STS and battery, press the EPO button on all UPS cabinets. However, it does not affect the normal supply of the maintenance bypass to the load.
6. Disconnect the main input breaker Q1 and the bypass input breaker Q2 of each UPS. At this moment, all internal power source is off until all the system monitoring unit LCD of UPSs in the system is powered off.

### 8.3.3 Isolating a stand-alone UPS in the parallel system

Use this procedure when any stand-alone in the parallel system has to be isolated because of serious malfunction, so that it must be removed from the parallel system for maintenance.

1. Press EPO on cabinet to stop running of rectifier, inverter, STS and battery converter, without affecting other UPS in the parallel system to supply power to the load normally;

2. Disconnect the mains breaker Q1, bypass breaker Q2, output breaker Q5 and external battery breaker of this fault stand-alone UPS.

3. Connect well the parallel cables of other UPSs in parallel system, please refer to *7.2.4 parallel cables* for details.

### 8.3.4 Recovery of isolated stand-alone UPS from parallel system

This operation step is used to re-add the stand-alone UPS which was isolated from the parallel system, to the parallel system.

1.Confirm that the correct connection with input and output cables, battery cables and parallel cables of the UPS which requires recovery.

2.Ensure that the maintenance breaker Q3 or the external maintenance breaker of this UPS are disconnected ,then close the bypass breaker Q2 and the main breaker Q1 in turn.

3.At this moment, after the main power module rectifier is booted and the fault is cleared, press the LCD main interface of the system monitoring unit-maintenance-manual operation-UPS boot, after 60 seconds, the UPS transfers from the bypass mode to the normal mode;

4.Close the external battery breaker, output breaker Q5, external output breaker, then stand-alone UPS will add into the parallel system.

### 8.3.5 Shutdown Procedure (UPS is completely powered off)

This step should be followed when the UPS is completely shut down and the load is powered off. All power source breakers are disconnected and no power supplying to the load.

1. The operation of the rectifier, inverter, STS and battery converter can be stopped by pressing the EPO button on all UPS cabinets.

2. Disconnect all UPS main input breaker Q1 and bypass input breaker Q2. At this moment, all internal power is off, till all LCD of UPS is off.

3. Disconnect all UPS output breaker Q5.

### 8.3.6 Shutdown Procedure (UPS is fully powered off but continues to supply power to the load)

4. This procedure is suitable for completely powering off the UPS, but continues to supply power to load. For the operation steps, please refer to *8.3.2 Maintenance bypass operation ste*

5.

6. *ps*.

# CHAPTER 9 – COMMUNICATION

The UPS supports RS485 communication and network port (LAN) communication, and supports three communication ways for simultaneous use. This chapter mainly introduces information about various communication types.

UPS communication supports simple network monitoring (SNMP) protocol communication, Modbus protocol communication, YD/T 1363.3-2005 protocol communication and dry contact communication.

## 9.1 SNMP communication protocol

SNMP protocol communication can provide users with the following two ways to monitor the smart device and the room environment:

- Use a web browser to provide web server functions to monitor the smart devices and room environment
- Use the Network Management System (NMS) to provide SNMP functions to monitor the smart devices and room environment

## 9.2 Modbus protocol communication

Support Modbus protocol communication.

The Modbus card dev can realize the conversion of the internal YD/T 1363.3-2005 protocol of the UPS to the Modbus protocol, thus realizing the information transmission between the UPS and the background.

## 9.3 YD/T 1363.3-2005 protocol

UPS communicates through this protocol.

## 9.4 Dry contact communication

### 9.4.1 Communication via dry contact interface

Depending on the specific needs of the site, UPS may need an auxiliary connection to obtain status information of external devices, provide alarm signals to external devices, and implement remote emergency shutdown. These features are available through the following interfaces:

- Input dry contact port
- Output dry contact port
- Emergency shutdown input port

## 9.5 CAN communication

UPS provides a CAN port that can communicate with the BMS battery management system, communicates with the BMS by using the UPS internal communication protocol, and realize the intelligent management to battery through UPS and BMS.

For details on the functions and specific information of above interfaces, please refer to *4.2 Signal Cable Routing*.

# CHAPTER 10 – MAINTENANCE

UPS (including batteries) require regular maintenance during long-term operation. This chapter focuses on the service life characteristics, regular inspection, maintenance, and replacement suggestions of the critical components of UPS, as well as the maintenance of the optional components. Effective maintenance of the UPS can reduce the risk of UPS failure and provides longer service life of UPS.

## 10.1 Safety

## 10.2 Maintenance Procedure for Main Power Module, Bypass Power Module and System Control Unit

### 10.2.1 Precautions

1. Only the maintenance engineer can maintain the main power module and bypass power module.
2. Disassemble the main power module from top to bottom to prevent the cabinet from tilting or falling over because the center of gravity is too high.
3. Before maintaining the power module, for safety concerns, it is necessary to measure the voltage on the DC bus capacitor (need to be ＜60Vdc) with a multimeter, and measure the voltage between the operation parts and the earth with a multimeter to ensure that the voltage is lower than the dangerous voltage value, that is, the DC is lower than 60Vdc, AC peak is lower than 42.4Vac.

### 9.2.2 Main Power Module Maintenance Procedure

1. Turn on the ready switch on the front panel of the main power module, then the module green indicator is off and the red light is on.
2. Ensure that the indicator on the main power module is continuous red. Remove the fixing screws on both sides of the front panel of the main power module and pull the module out of the cabinet.
3. After completing the maintenance, confirm that the ready switch is off.
4. Push the module into the cabinet (no less than 15s interval for each module pushing in ) and tighten the screws on both sides.
5. Turn on the ready switch to make the module is ready, then module will automatically join the system.

### 9.2.3 Maintenance steps of bypass power module

**WARNING:** The Bypass module is not Hot-Swappable and requires system shutdown to maintain or replace

**Maintenance procedure for stand-alone UPS in bypass mode**

1. Close the maintenance bypass breaker, press the EPO, disconnect output breaker, main input breaker, bypass input breaker and battery breaker;
2. Turn off ready switch on the front panel of bypass power module;
3. Remove the fixing screws on both sides of the bypass module front panel , and the connection terminal screws in between systems, then pull out the module for maintenance;
4. After the module maintenance, push the module into the cabinet and tighten the screws;
5. Turn on the ready switch, close bypass input breaker. The LCD main interface of the system monitoring unit displays that UPS is running in bypass mode. And bypass module will automatically join the system, then disconnect external maintenance bypass breaker, close output breaker, main input breaker and battery breaker.

**Maintenance steps for a stand-alone UPS in normal mode**

1. Press LCD main interface of system monitoring unit-maintenance-manual operation-UPS shutdown, then system transfers from normal mode to bypass mode;

2. Close external maintenance bypass breaker, press EPO, disconnect output breaker, main input breaker, bypass input breaker and battery breaker;

3. Turn off the ready switch on the front panel of the bypass power module;

4. Remove the screws on both sides of the bypass power module front panel, and connection terminal screws in between systems, then pull out the module for maintenance;

5. After maintenance, push the module into the cabinet and tighten the screws;

6. Turn on the ready switch, close bypass input breaker. The LCD main interface of the system monitoring unit displays that UPS is running in bypass mode. And bypass module will automatically join the system, then disconnect external maintenance bypass breaker, close output breaker, main input breaker and battery breaker.

**Maintenance steps for parallel UPS works in normal mode**

1. Press system monitoring LCD main interface-maintenance-manual operation-UPS shutdown, then system will be transferred from normal mode to bypass mode;
2. Close external maintenance bypass breaker, press EPO, disconnect system output breaker, mains input breaker, bypass input breaker and battery breaker;

2. Turn on the ready switch on front panel of bypass power module;

3. Remove the screws on both sides of the front panel of the bypass control module, and connection terminal screws in between systems, then pull out the module for maintenance;

4. After the module maintenance, push the module into the cabinet and tighten the screws;

5. Turn on the ready switch, close bypass input breaker. The LCD main interface of the system monitoring unit displays that UPS is running in bypass mode. And bypass module will automatically join the system, then disconnect external maintenance bypass breaker, close output breaker, main input breaker and battery breaker;

7.Press system monitoring unit LCD main interface-maintenance-manual operation-UPS boot up, then system will be transferred from bypass mode to normal mode.

### 9.2.4 Maintenance Steps for system control unit

**WARNING:** The Control module is not Hot-Swappable and requires system shutdown to maintain or replace

**Maintenance steps for stand-alone UPS in bypass mode**

1. Close the maintenance bypass breaker, UPS will be transferred to the maintenance mode, then press EPO ;

2. Check if system monitoring unit LCD displays that system is working in maintenance mode;

3. Turn off ready switch on the front panel of system control unit, and remove the fixing screws on both sides of the front panel , and pull out the system control unit for maintenance;

4. After maintenance, push back the system control unit to cabinet, and fasten the screws;

5. Read software version from system monitoring unit LCD main interface-about-version no, then turn on the ready switch of system control unit, and LCD main interface displays that UPS is working in bypass mode, then disconnect maintenance bypass breaker.

**Maintenance steps for a stand-alone UPS in normal mode**

1. Turn off the ready switch on the front panel of system control unit, and remove fixing screws for maintenance;

2. After maintenance, push back the system control unit to cabinet, and fasten the screws;

3. Read software version from system monitoring unit LCD main interface-about-version no, after confirming the version no can be read, then turn on the ready switch of system control unit. Then system monitoring unit LCD main interface-alarm-history, displays that system monitoring unit is ready.

**Maintenance steps for parallel UPS in normal mode**

1. Press EPO, then turn off the ready switch on the front panel of the system control unit;
2. Remove the fixing screws on both sides of the front panel of the system control unit and pul all connection signal cables, then pull out the module for maintenance.
3. After maintenance, push the module into cabinet, and fasten the screws, restore the connection signal cable pulled in step 2 and tighten the signal cable;
4. Read the software version number from the system monitoring unit LCD main interface - about - version number, after confirming that the version number can be read , then turn on ready switch. The system monitoring unit LCD main interface - alarm - history, prompt the system control unit is read, then system control unit will automatically join the system.
5. Press system monitoring unit LCD main interface-maintenance-manual operation-UPS boot up, then system will be transferred to normal mode.

## 10.3 UPS key components and lifetime

The key components in Table 10-1 are used in UPS systems. To prevent system malfunction due to components abrasion, it is recommended to do regular inspections and replace them within their expected working life.

| Critical components | Expected working life | Recommended time for replacement | Recommended inspection period |
|---|---|---|---|
| Fan | ≥7years | 5years~6years | 1 year |
| Bus capacitance | ≥7years | 5years~6years | / |
| Dust proof net | 1year~3years | 1year~2years | 2 months |
| Valve-regulated lead-acid battery (5 years working life) | 5 years | 3years~4years | 6 months |
| Valve-regulated lead-acid battery (10 years working life) | 10 years | 6years~8years | 6 months |

Table 10-1 Lifetime and Recommended Replacement Time of Critical components

### 10.3.2 Replacing the dust-proof sheet

The dust-proof sheet must be inspected and replaced periodically. The time interval between inspection and replacement is related to the environmental conditions in which the UPS is located. Under normal environmental conditions, the dust-proof net should be cleaned or replaced every two months. In dusty or other harsh environments, it is necessary to clean and replace it more frequently. Frequency inspect and replacement should also be taken in new built buildings.

The dust-proof net of the module cabinet is located inside of the front door, it can be replaced when the machine is running.

Use a fixing strip to fix the dust-proof sheet in the top, bottom, left and right sides of the module cabinet. The dust-proof net replacement procedure is as follows:

1. Open the front door of the UPS and you will see the dust-proof net on the inside of the front door.
2. Remove all fixed strips;
3. Remove the dust-proof net to be replaced;
4. Put in a clean dust-proof net;
5. Re-install the fixing strip removed in step 2 to the original position and tighten the fixing screws.

## 10.4 Maintenance for UPS and optional components

The UPS and its options require the following common-sense maintenance :

1. Make a good history record. Making a good history record is good for troubleshooting.
2. Keep clean and protect the UPS from dust and moisture.
3. Maintain an appropriate ambient temperature. The optimum temperature for the battery is 20 ° C ~ 25 ° C, too low temperature will reduce the battery capacity, too high will reduce the service life of battery.
4. Check the connection. Check the tightness of all the connecting screws and tighten them at least once a year.
5. Regularly check the upper or lower level breaker of the UPS for abnormal conditions to ensure that the input or output can be cut off when the current is too large.

Maintenance personnel should be familiar with the typical environmental conditions of UPS operation so that they can quickly locate which environmental conditions are abnormal; they should also be familiar with the settings of the UPS operation control display panel.

For maintenance of UPS battery, please refer to*10 Battery Maintenance*.

# CHAPTER 11 – SPECIFICATION

## 11.1 Applicable standards

| Item | standards and certifications |
|---|---|
| Uninterruptible power systems (UPS) – Part 1: General and safety requirements for UPS | EN 62040-1:2008 |
| Uninterruptible power systems (UPS) – Part 2: Electromagnetic compatibility (EMC) requirements | EN 62040-2:2006 |
| Uninterruptible power systems (UPS) – Part 3: Method of specifying the performance and test requirements | EN 62040-3:2011 |
| Safety qualified mark instead of quality qualified mark | CE certificate |
| Quality management system | ISO9000 Certificate |
| Quality System Audit for Telecom Equipment Enterprise | TLC certificate |

## 11.2 Environmental characteristics

| Item | Unit | Rated power(kVA) |
|---|---|---|
| | | 60 |
| Noise (1m in front) | dB | 70 |
| Altitude | m | ≤1000; within range of 1000-4000: decreasing 1% for each 100m increasing |
| Relative humidity | %RH | 0'-'90,(40±2℃)No condensation |
| Working temperature | ℃ | 0'-'40 |
| UPS storage - transport Temperature | ℃ | Storage:-25℃'-'+55℃(battery not included);transport: -40℃'-'+70℃ |
| Pollution level | | Pollution level II |
| Applicable grid system | | TN、TT |

### 11.3 Mechanical characteristics

| Item | | Unit | Rated power(kVA) |
|---|---|---|---|
| | | | 60 |
| Mechanical size (D x W x H) | without packaging | mm | 442 x 800 x 840 cable from bottom |
| Colour | | | Sand black |
| Protection level, GB/T 7260.4-2008 | | | IP20 |

### 11.4 Electrical characteristics (input rectifier)

| Item | Unit | Rated power(kVA) |
|---|---|---|
| | | 60 |
| Rated AC input voltage | Vac | 380/400/415,3 phase 4 lines(+PE) TN/TT power distribution system |
| Input voltage range | Vac | 132~276(176~276 works at full load, 132~176 works at load of 50% max. ) |
| Frequency | Hz | 50/60(range:40~70) |
| Power factor | kW/kVA, full load (half load) | 0.99(0.99) |
| Input current | A, rated [3] | 91A |
| Total harmonic distortion | % | 3 |

1. The rectifier can work at any rated voltage and frequency without any adjustments.

2. GB/T 7260.3-2003: The output is rated full load, the input voltage is above 380V, and the battery is fully charged

### 11.5 Electrical Characteristics (Battery)

| Item | Unit | Rated power(kVA) |
|---|---|---|
| | | 60 |
| Max. Charging current | A | 12 |
| Battery voltage | Vdc | 456~528 |
| Lead acid battery cell quantity (calibration) | block | Rated 40 , settable range from 32~44 (12Vdc) |
| Floating voltage | V/cell(VRLA) | 2.25(settable range from 2.23~2.27) |
| Temperature | mV/℃/cl | -3.0 (settable range:0~-9.0) |

| | | |
|---|---|---|
| compensation | | |
| Equal charge voltage | V/cell(VRLA) | 2.35(settable range:2.3~2.4) |
| Equal and floating charge control | | Floating charge to equal charging current coefficient :0.05 (can be set: 0.02 ~ 0.08)<br>Equal charge to floating charge coefficient is 0.03 (can be set: 0.02-0.08)<br>Equal charge protection time: 18hr (can be set: 12 hr~24 hr)<br>Interval of equal charge protection: 2 hr (can be set :2 hr ~24 hr)<br>Timing equal charge interval, 30day (can be set : 15 days~ |
| discharge cut-off voltage | V/cell(VRLA) | Can be set: 1.58~1.8 |

## 11.6 Electrical characteristics (inverter output)

| Item | Unit | rated power(kVA) |
|---|---|---|
| | | 60 |
| Rated AC voltage | Vac | 380/400/415<br>(Three-phase four-line, share N line with the bypass) |
| Frequency | Hz | 50/60 |
| Power factor | / | 1 |
| Output power | | Rated 60kVA (module full configuration) |
| Overload ability | | <105,long-term;105~110,1hr;110~125,10min;<br>125~150,1s |
| Constant voltage stability | | ±1 |
| Transient voltage response | | ±5 |
| Total Harmonic voltage distortion | | <3(Linear load),<6(Nonlinear load) |
| Frequency tracking range | Hz | 50/60Hz±6 |
| Frequency tracking rate | Hz/s | can be set:0.1~3 |

1. The default set by manufacturer is 380V, and the service engineer can set it to 400V or 415V.
2. The default set by manufacturer is 50Hz, and the service engineer can set it to 60Hz. Attention to the frequency changing need to be made when system is working in bypass power supply, it's forbidden to change the frequency when it's in inverting power supply.

## 10.7 Electrical Characteristics (Bypass Input)

| Item | | unit | rated power(kVA) |
|---|---|---|---|
| | | | 60 |
| Rated AC voltage | | Vac | 380/400/415; three-phase four line (+PE) |
| Rated current | 380V | A | 91 |
| | 400V | A | 87 |
| | 415V | A | 83 |
| Frequency | | Hz | 50/60 |
| Bypass voltage range | | %Vac | upper limit：+10、 +15 or+20,default+20；<br>lower limit：-10、 -20、 -30 or -40,default-20 |

1. The default set by manufacturer is 380V, and the service engineer can set it to 400V or 415V.
2. The default set by manufacturer is 50Hz, and the service engineer can set it to 60Hz.