# GTM Series
# 100-1200kVA Modular UPS
# User Manual

# Safety Precautions

This manual contains information concerning the installation and operation of modular UPS. Please carefully read this manual prior to installation.

The modular UPS cannot be put into operation until it is commissioned by engineers approved by the manufacturer (or its agent). Not doing so could result in personnel safety risk, equipment malfunction and invalidation of warranty.

## Safety Information Definition

Danger: Serious human injury or even death may be caused, if this requirement is ignored.

Warning: Human injury or equipment damage may be caused, if this is requirement is ignored.

Caution: Equipment damage, loss of data or poor performance may be caused, if this requirement is ignored.

Commissioning Engineer: The engineer who installs or operates the equipment should be well trained in electricity and safety, and familiar with the operation, debug, and maintenance of the equipment.

## Warning Label

The warning label indicates the possibility of human injury or equipment damage, and advised the proper step to avoid the danger. In this manual, there are three types of warning labels as below.

| Labels | Description |
|---|---|
|  **DANGER** | **Serious human injury or even death may be caused, if this requirement is ignored.** |
|  **WARNING** | **Human injury or equipment damage may be caused, if this requirement is ignored.** |
|  **CAUTION** | **Equipment damage, loss of data or poor performance may be caused, if this requirement is ignored.** |

## Safety Instruction

| | |
|---|---|
|  **DANGER** | ■ **Performed only by commissioning engineers.**<br>■ **This UPS is designed for commercial and industrial applications only, and is not intended for any use in life-support devices or system.** |
|  **WARNING** | ■ **Read all the warning labels carafully before operation, and follow the instructions.** |
|  | ■ ESD sensitive components inside the UPS, anti-ESD measure should be taken before handling. |

## Move & Installation

| | |
|---|---|
|  **DANGER** | ■ **Keep the equipment away from heat source or air outlets.**<br>■ **In case of fire, use dry powder extinguisher only, any liquid extinguisher can result in electric shock.** |
|  **WARNING** | ■ Don't start the system if any damage or abnormal parts founded.<br>■ Contacting the UPS with wet material or hands may be subject to electric shock. |
|  **CAUTION** | ■ Use proper facilities to handle and install the UPS. Shielding shoes, protective clothes and other protective facilities are necessary to aviod injury.<br>■ During positioning, keep the UPS way from shock or vibration.<br>■ Install the UPS in proper environment |

## Debug & Operate

| | |
|---|---|
|  **DANGER** | ■ **Make sure the grounding cable is well connected before connecting the power cables, the grounding cable and neutral cable must be in accordance with the local and national codes practice.**<br>■ **Before moving or re-connecting the cables, make sure to cut off all the input power sources, and wait for at least 10 minutes for internal discharge. Use a multi-meter to measure the voltage on terminals and ensure the voltage is lower than 36V before operation.** |
|  **WARNING** | ■ The earth leakage current of load will be carried by RCCB OR RCD.<br>■ Initial check and inspection should be performed after long time storing of UPS. |

## Maintenance & Replacement

| | |
|---|---|
|  **DANGER** | ■ **All the equipment maintenance and servicing procedures involving internal access need special tools and should be carried out only by trained personnel. The components that can be accessed by opening the protective cover with tools cannot be maintenance by user.**<br>■ **This UPS full complies with "IEC62040-1-1-General and safety requirements for use in operator access area UPS". Dangerous voltages are present within the battery box.**<br>**However, the risk of contact with these high voltages is minimized for non-service personnel. Since the component with dangerous voltage can only be touched by opening the protective cover with a tool, the possibility of touching high voltage component is minimized. No risk exists to any personnel** |

**when operating the equipment in the normal manner, following the recommended operating procedures in this manual.**

## Battery Safety

**DANGER**

- **All the battery maintenance and servicing procedures involving internal access need special tools or keys and should be carried out only by trained personnel.**
- **When connected together, the battery terminal voltage will exceed 400Vdc and is potentially lethal.**
- **Battery manufacturers supply details of the necessary precautions to be observed when working on, or in the vicinity of a large bank of battery cells. These precautions should be followed implicitly at all times. Particular attention should be paid to the recommendations concerning local environmental conditions and the provision of protective clothing, first aid and fire-fighting facilities.**
- **Ambient temperature is a major factor in determining the battery capacity and life. The nominal operating temperature of battery is 20℃. Operating above this temperature will reduce the battery life. Periodically change the battery according to the battery user manuals to ensure the back-up time of UPS.**
- **Replace the batteries only with the same type and the same number, or it may cause explosion or poor performance.**
- **When connecting the battery, follow the precautions for high-voltage operation before accepting and using the battery, check the appearance of the batteries. If the package is damaged, or the battery terminal is dirty, corroded or rusted or the shell is broken, deformed or has leakage, replace it with new product. Otherwise, battery capacity reduction, electric leakage or fire may be caused.**
- **Before operating the battery, remove the finger ring, watch, necklace, bracelet and any other metal jewelry.**
- **Wear rubber gloves.**
- **Eye protection should be worn to prevent injury from accidental electrical arcs.**
- **Only use tools (e.g. wrench) with insulated handles.**
- **The batteries are very heavy. Please handle and lift the battery with proper method to prevent any human injury or damage to the battery terminal.**
- **Don't decompose, modify or damage the battery. Otherwise, battery short circuit, leakage or even human injury may be caused.**
- **The battery contains sulfuric acid. In normal operation, all the sulfuric acid is attached to the separation board and plate in the battery. However, when the battery**

**case is broken, the acid will leak from the battery. Therefore, be sure to wear a pair of protective glasses, rubber gloves and skirt when operating the battery. Otherwise, you may become blind if acid enters your eyes and your skin may be damaged by the acid.**

- **At the end of battery life, the battery may have internal short circuit, drain of electrolytic and erosion of positive/negative plates. If this condition continues, the battery may have temperature out of control, swell or leak. Be sure to replace the battery before these phenomena happen.**
- **If a battery leaks electrolyte, or is otherwise physically damaged, it must be replaced, stored in a container resistant to sulfuric acid and disposed of in accordance with local regulations.**
- **If electrolyte comes into contact with the skin, the affected area should be washed immediately with water.**

## Disposal

**WARNING**

- **Dispose of used battery according to the local instructions.**

## Note

**Note**

- **Represents a supplementary explanation or emphasis to the main text.**

Contents

# 1 Installation

## 1.1 Introduction

This chapter introduces the relevant requirements for positioning and cabling of the UPS and related equipment.

**WARNING: installation can only be done by authorized engineers**

**Do not apply electrical power to the UPS equipment before the commissioning engineer arrives at installation site.**

**The UPS should be installed by a qualified engineer in accordance with the information contained in this chapter. All the equipment not referred to in this manual is shipped with details of its own mechanical and electrical installation information.**

**Note: 3-Phase 4-Wire Input Power is required**

**The standard UPS system can be connected to TN, TT AC distribution system (IEC60364-3) of 3-phase 4-wire, and a 3-wire to 4-wire conversion transformer is provided as an optional part.**

**WARNING: battery hazards**

**SPECIAL CARE SHOULD BE TAKEN WHEN WORKING WITH THE BATTERIES ASSOCIATED WITH THIS EQUIPMENT.**

**When connecting the battery, the battery terminal voltage will exceed 400Vdc and is potentially lethal.**

- **Eye protection should be worn to prevent injury from accidental electrical arcs.**
- **Remove rings, watches and all metal objects.**
- **Only use tools with insulated handles.**
- **Wear rubber gloves.**
- **If a battery leaks electrolyte, or is otherwise physically damaged, it must be replaced, stored in a container resistant to sulfuric acid and disposed of in accordance with local regulations.**
- **If electrolyte comes into contactor with the skin, the affected area should be washed immediately with water.**

## 1.2 Initial Inspections

Perform the following checking operations prior to the UPS installation.

1. While the cabinets are still on the truck, inspect the equipment and shipping container for any signs of damage or mishandling. Do not attempt to install the system if damage is apparent. If any damage is noted, file a damage claim with the shipping agency immediately and contact your supplier to inform them of the damage claim and the condition of the equipment.

2. Verify the product label and confirm the correctness of the equipment. The UPS model, capacity and main parameters are marked on the label.

3. Compare the contents of the shipment with the bill of lading. Report any missing items to the carrier.

## 1.3 Location

### 1.3.1 UPS Location

The UPS is intended for indoor installation and should be located in a cool, dry and clean environment with adequate ventilation to keep the environmental parameters within the specified operating range (see *Table.8-2*). The Modular series UPS uses forced convection cooling by internal fans. Cooling air enters the module through ventilation grills located at the front part of the cabinet and exhausted through grills located in the rear part of the cabinet. Please do not block the ventilation holes.

Note: The UPS should be installed on a cement surface or other surface that is not combustible.

### 1.3.2 External Battery Room

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

The ambient temperature of the battery must be stable. Ambient temperature is a major factor in determining the battery capacity and life. The nominal operating temperature of battery is 20°C. Operating above this temperature will reduce the battery life, and operation below this temperature will reduce the battery capacity. If the average operating temperature of battery is increased from 20ºC to 30ºC, then the service life of the battery will be reduced by 50%. If the operating temperature of the battery is above 40ºC, then the battery service life will be decreased in exponent rate. In a normal installation, the battery temperature is maintained between 15°C and 25°C. Keep batteries away from heat sources or air outlets.

If external batteries are to be used, the battery circuit breakers (or fuses) must be mounted as close as possible to the batteries, and the connecting cables should be as short as possible.

### 1.3.3 Storage

If the system will not be installed immediately, it must be stored indoors in a clean, dry and cool location (see Table 8.1 on page 63). If the UPS includes batteries, either internally or in a battery cabinet, the batteries' requirements will dictate the storage conditions. Batteries should be unpacked, installed and charged as soon as possible after delivery.

**WARNING**

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

## 1.4 Positioning

Choose a location for the UPS that offers:

- Easy connection to inputs, outputs and auxiliary equipment.
- Enough space to service the UPS.
- Air circulation sufficient to expel the heat produced by the UPS.
- Protection against moisture and excessive humidity.
- Protection against dust and other particulate matter.

- Compliance with the fire prevention regulations and practices.
- Operating environment temperature of 74 °F-80 °F (23 °C-27 °C) for maximum battery life.

### 1.4.1 System Cabinet

A UPS system comprises an UPS system, external battery cabinet, depending on the specific system requirement.

All the UPS system cabinets used in the same installation site are of the same height and should be positioned side-by-side to achieve an aesthetically appealing effect. Refer to Chapter 7 Installation Drawing for the positioning of UPS cabinet.

### 1.4.2 Moving the Cabinets

**WARNING**

**Ensure that any lifting equipment used in moving the UPS cabinet has sufficient lifting capacity. The UPS is fitted with castors – take care to prevent movement when unbolting the equipment from its shipping pallet. Ensure adequate personnel and lifting aids are available when removing the shipping pallet.**

Ensure that the UPS weight is within the weight loading capacity range of any hoisting equipment. See *Table.8-3* for UPS weight.

UPS and optional cabinets can be handled by means of a fork lift or similar equipment.

**Note:** Care must be taken when handling units fitted with batteries. Keep such moves to a minimum.

### 1.4.3 Installation of Adjustable Feet

Installation diagrams in Chapter 4 Installation drawing of this manual identify the location of the holes in the base plate through which the equipment can be bolted to the floor. If the UPS is to be located on a raised floor, it should be mounted on a pedestal suitably designed to accept the UPS point loading.

**DANGER**

**Ensure the following space margin: at least 0.8m before the front door of the cabinet, so as to easily maintain the power module with the front door fully open; at least 0.5m at behind the cabinet for ventilation and cooling; at least 0.5mm distance from the top of the cabinet. The space reserved for the cabinet is shown in Figure 1-1.**

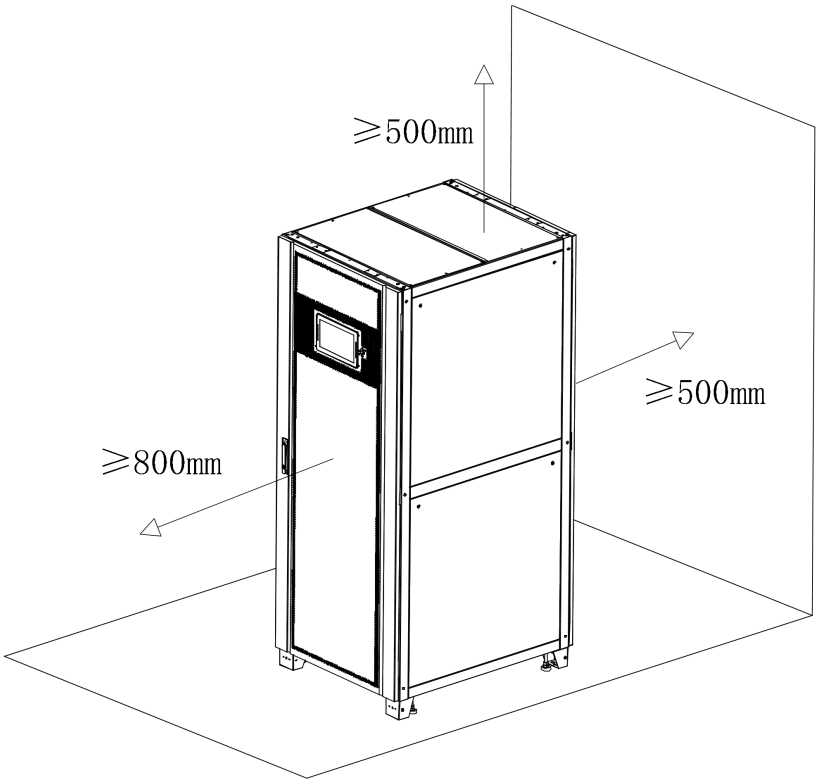
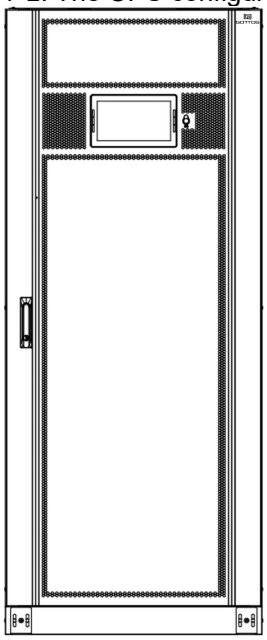
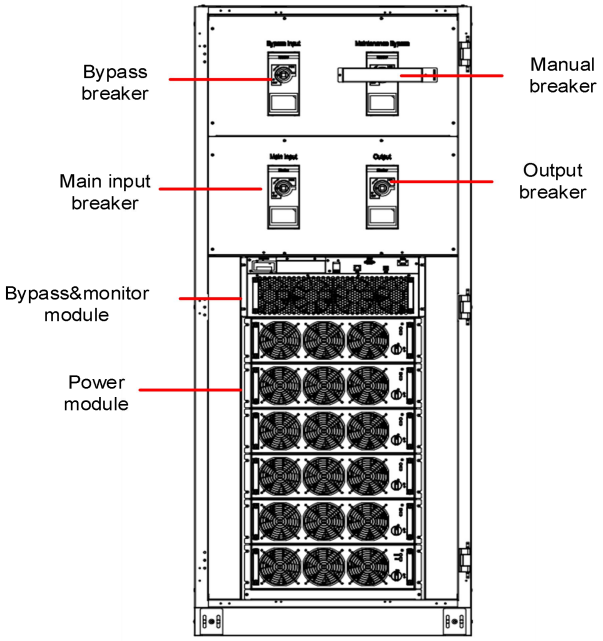



Figure 1-1 Space reserved for the cabinet (Unit: mm)

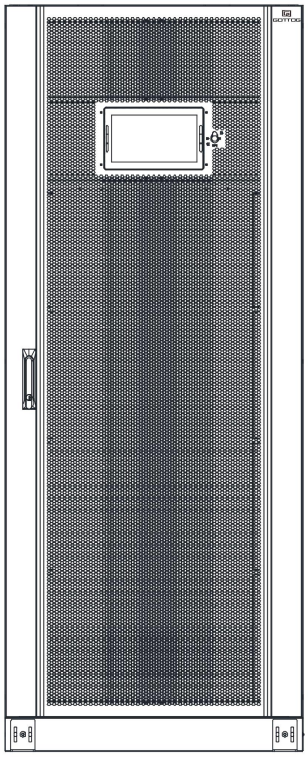
### 1.4.4 UPS Composition

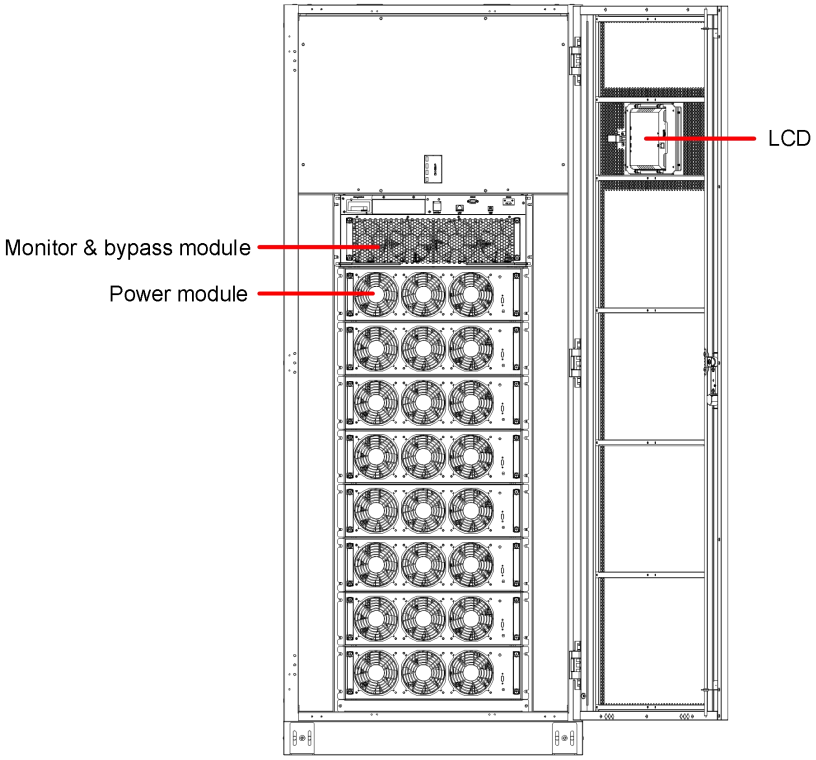
The UPS structure is shown in *Fig. 1-2*. The UPS configuration is provided in *Table. 1-1*



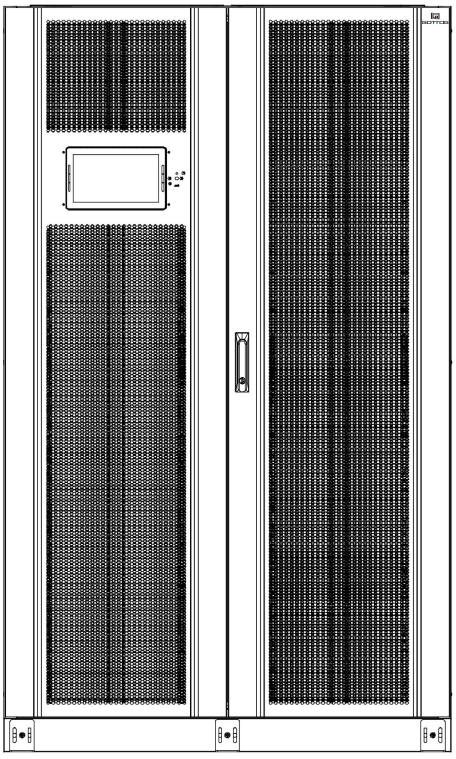


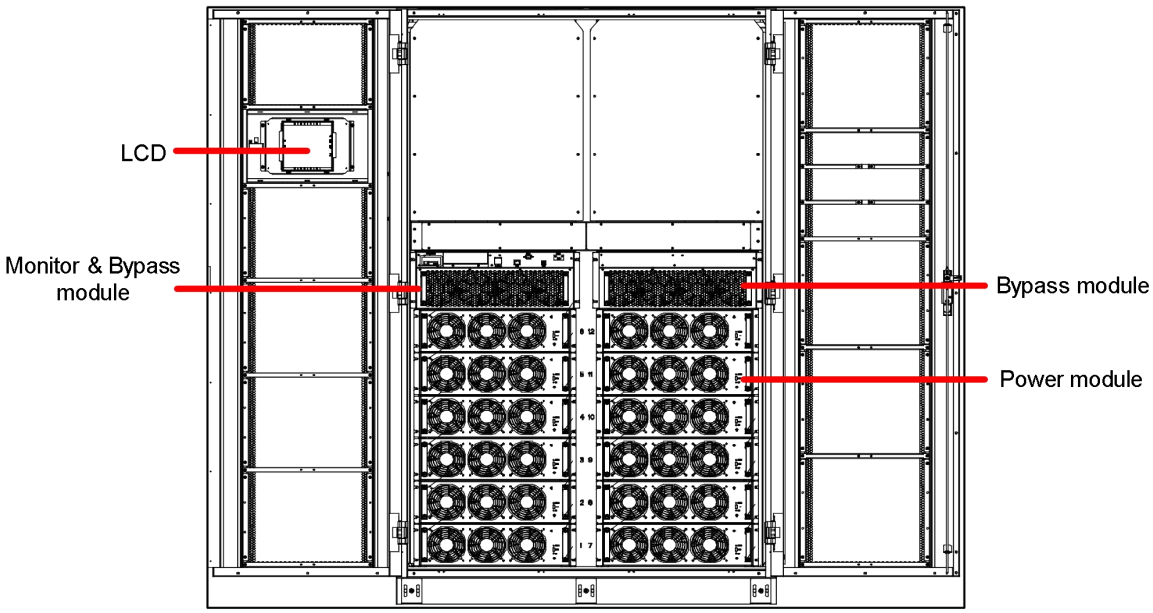

(a)6 modules cabinet(with 4 breakers)






(b)8 modules cabinet






(c)12 modules cabinet

Fig.1- 2: UPS Structure

Table.1- 1: UPS Configuration List

| Item | Component | Quantity/PCS | Remark |
|---|---|---|---|
| 6-8 module cabinet | Bypass & Monitoring module | 1 | standard |
| 100kVA power module | Power module | 1~8 | / |
| 12 module cabinet | Bypass & Monitoring module | 1 | standard |
| | Bypass module | 1 | standard |
| 100kVA power module | Power module | 1~12 | / |

### 1.4.8 Installing Power Modules

The number and possible installation positions of the Power Modules may vary according to the chosen factory configuration.

When installing power modules always work from the lower available space upwards to prevent from raising the center of gravity. The default setting from the bottom space upwards is NO.1 to NO.6(6 modules cabinet)，NO.1 to NO.8(8 modules cabinet)，NO.1 to NO.12(12 modules cabinet).

**Note**

**If installed as standalone unit, it's recommended that install power modules from upper available space downwards to prevent from corrosion of the bottom module.**

- Remove reserved covers according to number of power modules.
- Insert the module in the installation position, and push it into the cabinet.
- Fasten the module to the cabinet through the fixing holes on both sides of the front panel of the module.

**WARNING**

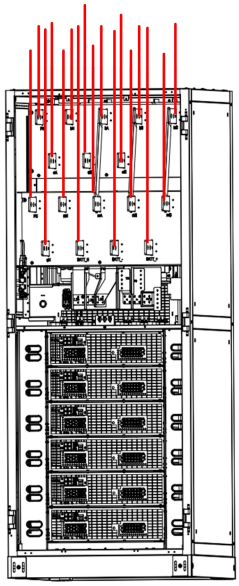
**Service rack enclosure within side doors should be chosen to cover side panel of UPS**

**cabinet, otherwise the connector for power modules might be touched with tools like screwdriver.**

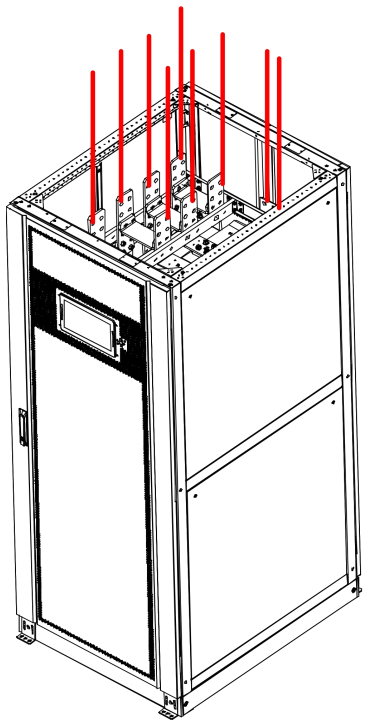
### 1.4.9 Cable Entry

The 6&8&12 module UPS have top cable entry. The recommended installation practice is to connect cables through ellipse hole or circular cable protector on the removable plates to prevent foreign material or vermin entering the cabinet. If connect cables through bottom entry, remove the cover and install a rubber cable protector in the bottom entry hole firstly.

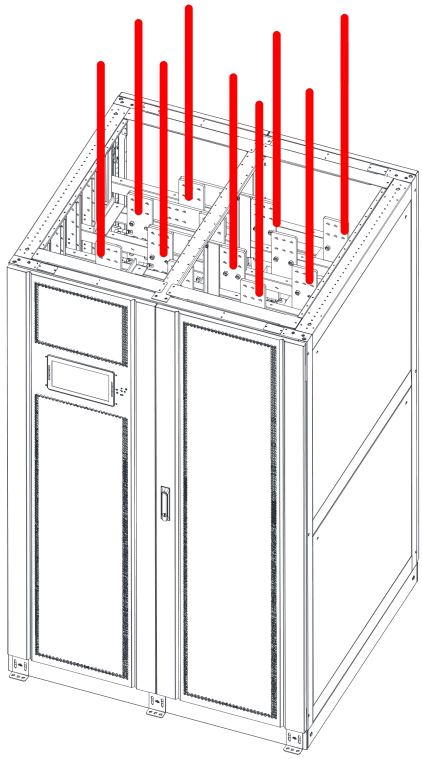
Cable entry is followed as *fig.1-3.*



6 modules cables entry



8 modules cables entry



12 modules cables entry

Fig.1- 3: power cable entry

**Note**

**Cables connection should be followed as diagram on rear panel or *appendix B.***

**Fix cables in 6-module cabinet as Fig.1-2 to make sure best ventilation.**

**Enter through reserved entry cover if ellipse holes are not big enough, and block the remained space to protect UPS from rats.**

## 1.5 External Protective Devices

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

To reduce the risk of fire, connect only to a circuit provided with branch circuit overcurrent protection in accordance with the NEC ANSI/NFPA70.

### 1.5.1 Input Supply of the UPS

Over currents

Install suitable protective devices in the distribution unit of the incoming mains supply, considering the power cable current-carrying capacity and overload capacity of the system (*see Tab. 8-7*). Generally, the magnetic circuit breaker with IEC60947-2 tripping curve C (normal) at the 125% of the current listed in Tab. 8-7 is recommended.

**Split bypass:** In case a split bypass is used, separate protective devices should be installed for the rectifier input and bypass input in the incoming mains distribution panel.

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

Earth Leakage, RCD devices:

Any Residual Current Detector (RCD) installed upstream of the input supply:

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

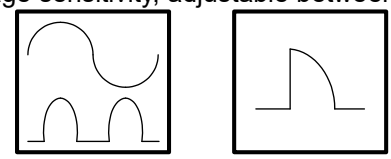


Fig.1- 3: The Symbols of RCCB

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

### 1.5.2 UPS Output

In the eventuality that an external distribution panel is used for load distribution, the selection of protective devices must provide discrimination with those that are used at the input to the UPS (*see Tab. 8-7*).

## 1.6 Power Cables

### 1.6.1 Power Cables

The selection of UPS system power cables should meet the requirements of Table 3B in IEC60950-1, and appropriate cables should be selected based on actual engineering applications. The maximum operating current of the UPS and the recommended cable diameter are shown in Table 1-2

**DANGER**

**FAILURE TO FOLLOW ADEQUATE EARTHING PROCEDURES CAN RESULT IN EMI, ELECTRIC SHOCK HAZARD, OR RISK OF FIRE, SHOULD AN EARTH FAULT OCCUR.**

| UPS power | | | 600kVA | 800kVA | 1000kVA | 1200kVA |
|---|---|---|---|---|---|---|
| Input | Current(380V) | | 1250A | 1660A | 2100A | 2500A |
| | wire diameter(mm²) | A | 4*120 | 4*185 | 4*240 | 4*300 |
| | | B | 4*120 | 4*185 | 4*240 | 4*300 |
| | | C | 4*120 | 4*185 | 4*240 | 4*300 |
| | | N | 4*120 | 4*185 | 4*240 | 4*300 |
| Output | Current(380V) | | 1150A | 1500A | 1900A | 2300A |
| | wire diameter(mm²) | A | 4*120 | 4*150 | 4*240 | 4*300 |
| | | B | 4*120 | 4*150 | 4*240 | 4*300 |
| | | C | 4*120 | 4*150 | 4*240 | 4*300 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | N | 4*120 | 4*150 | 4*240 | 4*300 |
| Bypass | Current(380V) | | 1150A | 1500A | 1900A | 2300A |
| | wire diameter(mm²) | A | 4*120 | 4*150 | 4*240 | 4*300 |
| | | B | 4*120 | 4*150 | 4*240 | 4*300 |
| | | C | 4*120 | 4*150 | 4*240 | 4*300 |
| | | N | 4*120 | 4*150 | 4*240 | 4*300 |
| Battery | Current(Battery discharging current at E.O. D=1.75V/cell,40 Batt. /String) | | 1500A | 2000A | 2500A | 3000A |
| | wire diameter(mm²) | + | 4*150 | 4*240 | 4*300 | 4*400 |
| | | - | 4*150 | 4*240 | 4*300 | 4*400 |
| | | N | 4*150 | 4*240 | 4*300 | 4*400 |
| Ground wire | wire diameter(mm²) | PE | 200 | 200 | 240 | 300 |

Table 1-2 Recommended wire diameter of power cables

Note:

*1. Input current of common input configurations of rectifier and bypass. And max current is fixed for all nominal voltage.*

*2. Take special care when determining the size of the output and bypass neutral cable, as the current circulating on the neutral cable may be greater than nominal current in the case of non-linear loads, which is usually 1.732 times of rated currents.*

*3. The earth cable connecting the UPS to the main ground system must follow the most direct route possible. The earth conductor should be sized according to the fault rating, cable lengths, type of protection, etc.*

*4. When sizing battery cables, a maximum volt drop of 4Vdc. is permissible at the current ratings given in Table.1-2. The load equipment is connected to a distribution network of individually protected busbars fed by the UPS output rather than connected directly to the UPS. In parallel multi-module systems, the output cable of each ups rack unit should be kept at equal length between the output of the ups rack output terminals and the parallel distribution busbars to avoid affecting the shared current. When laying the power cables, do not form coils, so as to avoid the formation of electromagnetic interference.*

*5. When the main load is nonlinear, the N line section needs to be increased to 1.5 ~ 1.7 times.*

### 1.6.2 Specifications for Power Cables Terminal

Cable terminal requirements are shown in Table 1-3 below.

| Type | Port | Connection | Bolt | Torque Moment |
|---|---|---|---|---|
| 6/8/12-slot cabinet | Mains input | Cables crimped OT terminal | M16 | 96Nm |
| | Bypass Input | Cables crimped OT terminal | M16 | 96Nm |
| | Battery Input | Cables crimped OT terminal | M16 | 96Nm |
| | Output | Cables crimped OT terminal | M16 | 96Nm |
| | PE | Cables crimped OT terminal | M16 | 96Nm |

Table 1-3 Cable terminal requirements

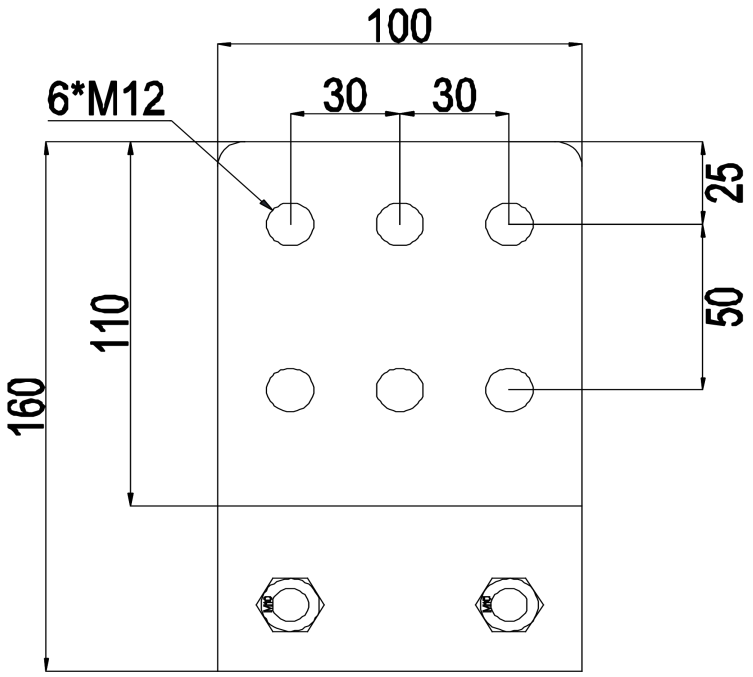



Figure 1-4 Input and output copper bar wiring holes diagram (A/B/C/N/PE)

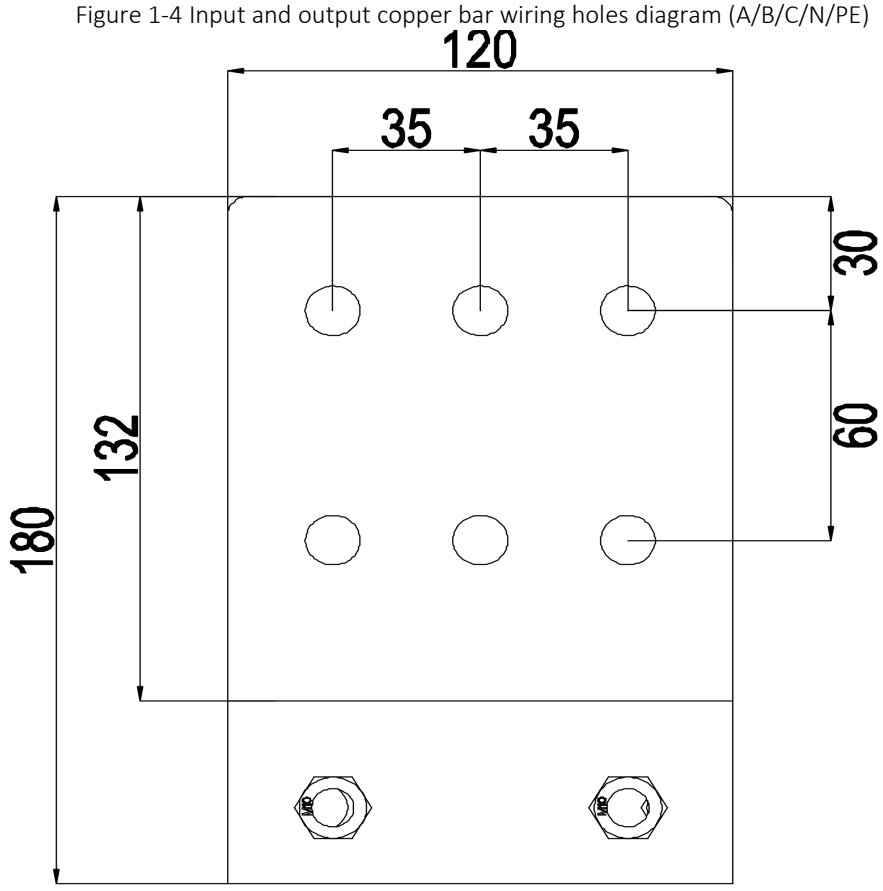



Figure 1-5 Battery copper bar wiring holes diagram (BAT+/BAT-)

### 1.6.3 Circuit Breaker

The UPS system needs to be equipped with external distribution circuit breakers, including main input circuit breaker, bypass input circuit breaker (configured when dual input is configured), output circuit breaker, maintenance bypass circuit breaker and battery output circuit breaker. The recommended circuit breaker specifications are shown in Table 1-4.

| UPS Power | **600kVA** | **800kVA** | **1200kVA** |
|---|---|---|---|
| Input breaker | 1250A/3P | 2000A/3P | 2500A/3P |
| Bypass breaker | 1000A/3P | 1600A/3P | 2500A/3P |
| Output breaker | 1000A/3P | 1600A/3P | 2500A/3P |
| Maintenance breaker | 1000A/3P | 1600A/3P | 2500A/3P |
| Battery | DC 1600A | DC 2000A | DC 3150A |

Table 1-4 Recommended circuit breaker specifications

Note:
It is not recommended to configure a circuit breaker with leakage protection function.

### 1.6.4 Cable Connections

The specific connection process is carried out as follows.

Step 1 Confirm that all input power distribution switches are completely turned off, and all power switches inside the cabinet are turned off. Put warning signs on these switches to prevent others from operating them;

Step 2 Remove the top protective cover to reveal the input and output terminals, battery terminals and grounding terminals. The wiring terminal layout is shown in Fig.1-5;

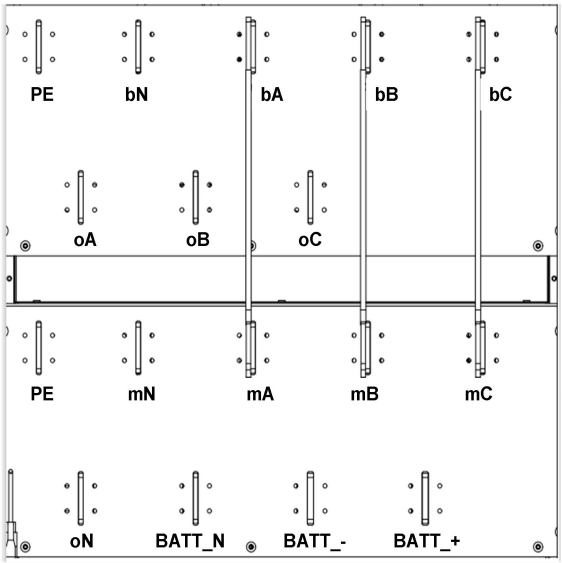



Figure 1-5-1 6-module cabinet terminal block layout diagram

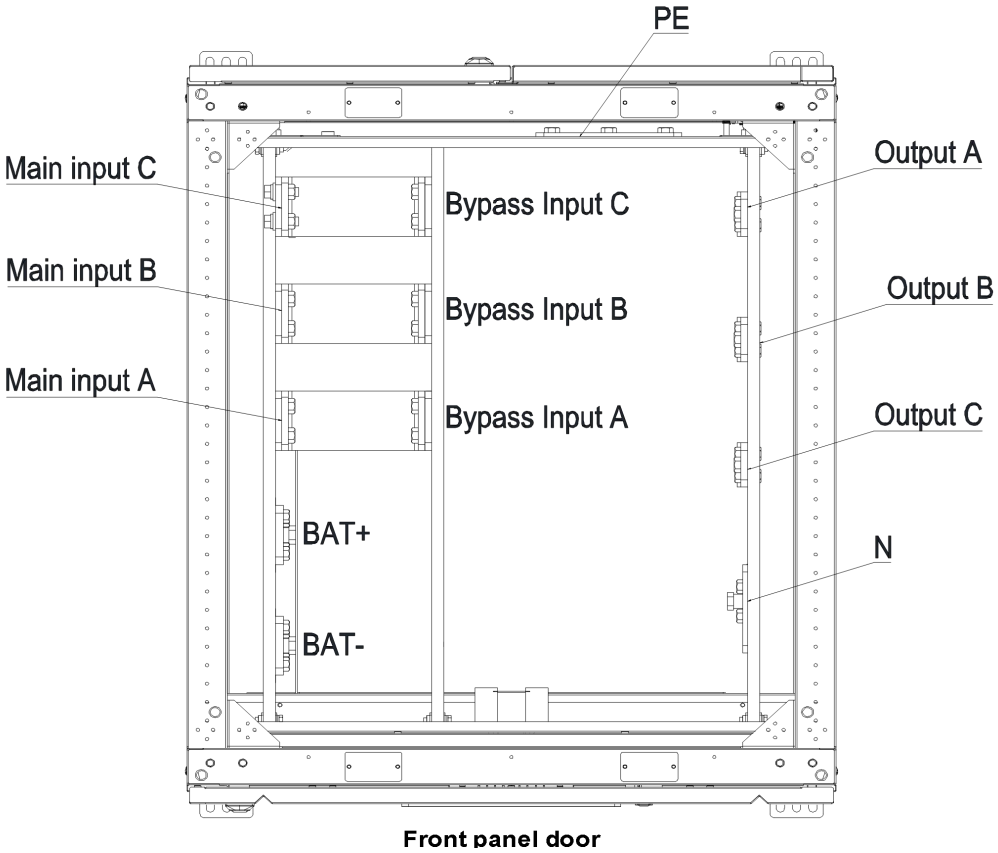



Figure 1-5-2 8-module cabinet terminal block layout diagram

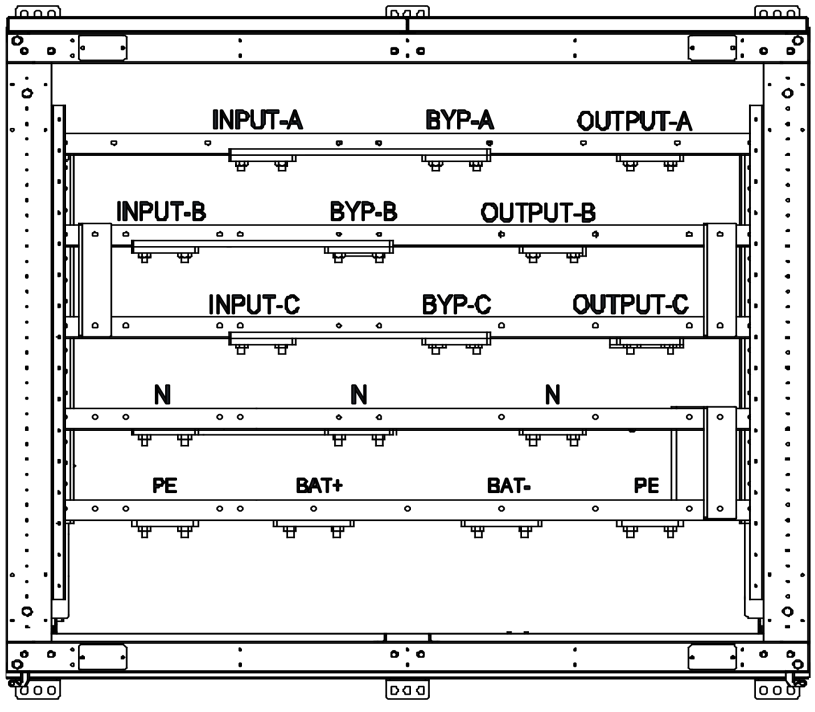



Figure 1-5-3 12-module cabinet terminal block layout diagram

Step 3 Connect the input ground wire to the input ground terminal. Note that the ground wire connection must comply with local and national regulations;

Step 4: Connect the AC input cable to the UPS input terminal (Main Input) in sequence as shown in Figure 3-10; connect the output load cable to the UPS output terminal (Output);

Step 5 Connect the battery wiring to the battery terminal (Battery) of the UPS; the external battery must have a switch.

Step 6: After checking that the wiring is correct, install the protective cover back and the wiring is completed. After cable connection, it is necessary to seal the wire hole with sealing mud to prevent foreign objects from entering.

**Note:**

**1)When connecting power cables, follow the torque torque given in Table 3.3 to ensure the tightness of the terminals and avoid potential safety hazards.**

**2)Before wiring the UPS, make sure you know the position and status of the switch connecting the UPS input to the mains power distribution. Make sure the switch is off and attach a warning sign to prevent others from operating the switch.**



## 1.7 Control Cabling and Communication

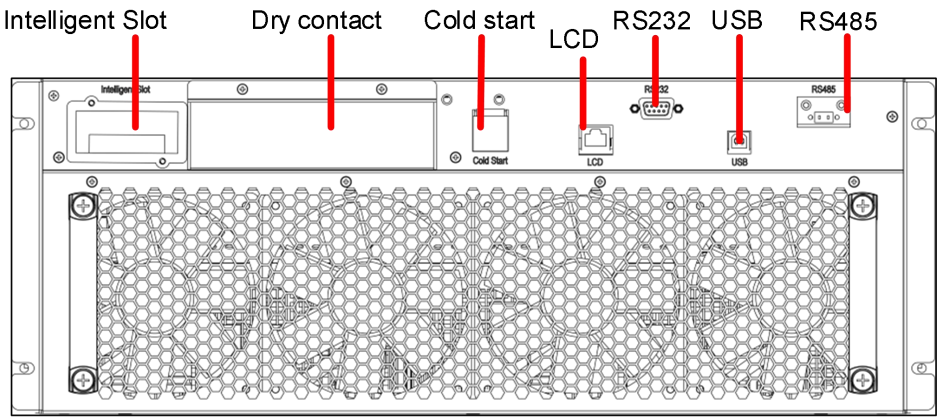
### 1.7.1 UPS Dry Contactor and Monitoring Board Features

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

- EPO
- Environment and battery temperature input interface
- Generator input dry contactor interface
- Battery warning output dry contactor interface
- Battery circuit breaker interface
- Mains failure warning output dry contactor interface
- Intelligent slots intelligent card interface
- User communication interface (RS232, RS485, USB)
- Parallel ports (optional)

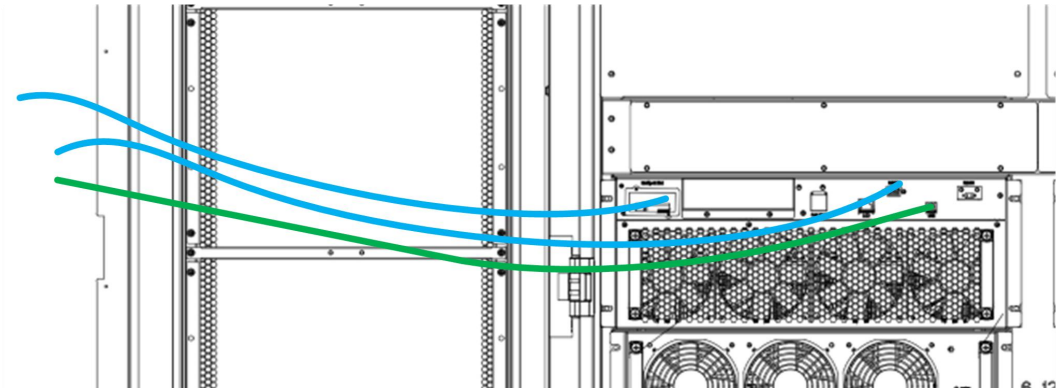


The UPS dry contactor board provides input dry contactors and output dry contactors.




(a) 6/8/12 slots system

Fig.1- 4: Static Bypass Assembly Features



6/8/12 slots entry from front side

Fig.1- 7 Communication cables connection diagram

### 1.7.2 Dry Contactor

The dry contact port includes 5 groups of interfaces, and their interface functions are shown in Table 1-5.

| Interface location | Type | Function |
|---|---|---|
| EPO-1 | REMOTE_EPO_NO | Trigger EPO when shorted to EPO-2 |
| EPO-2 | +24V_DRY | +24V |
| EPO-3 | +24V_DRY | +24V |
| EPO-4 | REMOTE_EPO_NC | EPO triggered when disconnected from EPO-3 |
| TEMP-1 | ENV_TEMP | Ambient temperature detection |
| TEMP-2 | TEMP_COM | Temperature detection common terminal |
| TEMP-3 | TEMP_COM | Temperature detection common terminal |
| TEMP-4 | TEMP_BAT | Battery temperature detection |
| IP1-1 | BCB_Status | Built-in input dry contact, function can be set. Default function: BCB Status and BCB Online are valid (when BCB Status is invalid, it will report that the battery is empty) |
| IP1-2 | GND_DRY | +24V ground |
| IP2-3 | BCB_Online | Built-in input dry contact, function can be set. Default function: BCB Status and BCB Online are valid (when BCB Status is invalid, it will report that the battery is empty) |
| IP2-4 | GND_DRY | +24V ground |
| IP3-5 | GEN_CONNECTED | Built-in input dry contact, function can be set. Default function: engine access port |
| IP3-6 | +24V_DRY | +24V |
| OP1-1 | BAT_LOW_ALARM_NC | Built-in output dry contact (normally closed), function can be set. Default setting: low battery voltage alarm. |
| OP1-2 | BAT_LOW_ALARM_NO | Built-in output dry contact (normally open), function can be set. Default setting: low battery voltage alarm |
| OP1-3 | BAT_LOW_ALARM_GND | OP1-1 and OP1-2 common terminal |
| OP2-4 | GENERAL_ALARM_NC | Built-in output dry contact (normally closed), function can be set. Default setting: Comprehensive alarm. |
| OP2-5 | GENERAL_ALARM_NO | Built-in output dry contact (normally open), function can be set. Default setting: Comprehensive alarm |
| OP2-6 | GENERAL_ALARM_GND | OP2-4 and OP2-5 common terminal |
| OP3-1 | UTILITY_FAIL_NC | Built-in output dry contact (normally closed), function can be set. Default setting: Mains power abnormality alarm. |
| OP3-2 | UTILITY_FAIL_NO | Built-in output dry contact (normally open), function can be set. Default setting: Mains power abnormality alarm |
| OP3-3 | UTILITY_FAIL_GND | OP3-1 and OP3-2 common terminal |

| | | |
|---|---|---|
| OP4-4 | BCB Drive | Built-in output dry contact, function can be set. Default function: Battery CB trip signal (valid under EOD or EPO) |
| OP4-5 | GND_DRY | +24V ground |
| OP4-6 | +24V_DRY | +24V |

Table 1-5 Dry contact interface definition

**Note:**

**The settable functions of dry contacts can be set through the background monitoring software.**

**All auxiliary cables must be double insulated twisted cables with cross sectional area of 0.5mm2 ~ 1.5mm2 for maximum connection length between 25m and 50m.**

The default functions of each dry contact are described below.

**Remote EPO Input Port**

EPO is the remote EPO input interface. During normal operation, EPO_NC needs to be short-circuited to +24V. When EPO needs to be triggered, EPO_NC needs to be disconnected from +24V. The interface schematic diagram is as follows, the interface schematic diagram is shown in Figure 1-8, and the interface description is shown in Table 1-6.

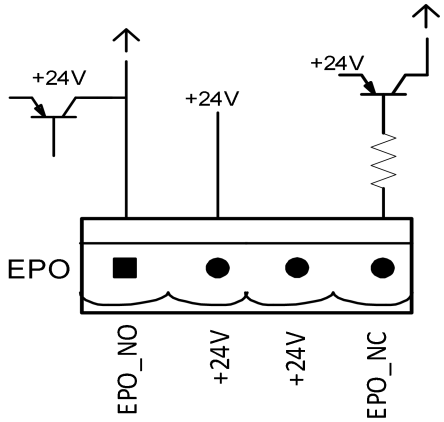



Figure 1-8 Schematic diagram of remote EPO input interface

| Location | Type | Function |
|---|---|---|
| EPO-1 | REMOTE_EPO_NC | EPO triggered when disconnected from EPO-2 |
| EPO-2 | +24V_DRY | +24V |
| EPO-3 | +24V_DRY | +24V |
| EPO-4 | REMOTE_EPO_NO | EPO is triggered when shorted to EPO-3 |

Table 1-6 Remote EPO input interface description

During normal operation of the UPS system, pins EPO-3 and EPO-4 need to be short-circuited and pins EPO-1 and EPO-2 disconnected. If EPO-3 and pins EPO-4 are disconnected or pins EPO-1 and EPO-2 are short-circuited, an emergency shutdown will be triggered.

**Note**

**1. The emergency stop action within the UPS will shut down the rectifier,**

**inverter and static bypass. However, it does not internally disconnect the mains input power supply. To disconnect ALL power to the UPS, open the upstream input circuit breaker(s) when the EPO is activated.**

**2. Pin 3 and 4 of EPO have been shorted before the UPS is delivered.**

**3. All auxiliary cables must be double insulated twisted cables with cross sectional area of 0.5mm2 ~ 1.5mm2 for maximum connection length between 25m and 50m.**

**Battery & ambient temperature detection dry contact**

The temperature dry contact detects battery temperature and ambient temperature and is used for environmental monitoring and battery temperature compensation. The schematic diagram of the temperature detection interface is shown in Figure 1-9, and the interface description is shown in Table 1-7.

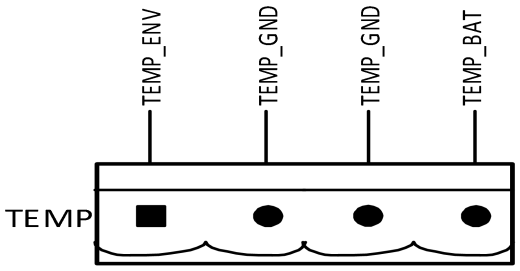



Figure 1-9 Temperature detection dry contact interface

| Location | Type | Function |
|---|---|---|
| TEMP-1 | TEMP_ENV | Ambient temperature detection |
| TEMP-2 | TEMP_COM | Temperature detection common terminal |
| TEMP-3 | TEMP_COM | Temperature detection common terminal |
| TEMP-4 | ENV_TEMP | Battery temperature detection |

Table 1-7 Description of input dry contact interfaces J2 and J3

**Note:**

**Temperature detection requires the use of a specific temperature sensor (R25=5Kohm, B25/50=3275). Please confirm with the manufacturer when ordering, or contact the office.**

**Generator Input Dry Contact**

IP3 5-6 pins are the generator connection status interface. Connect pin 5 of IP3 to the +24V power supply, indicating that the generator has been connected to the system. The interface diagram is shown in Figure 1-10, and the interface description is shown in Table 1-8.

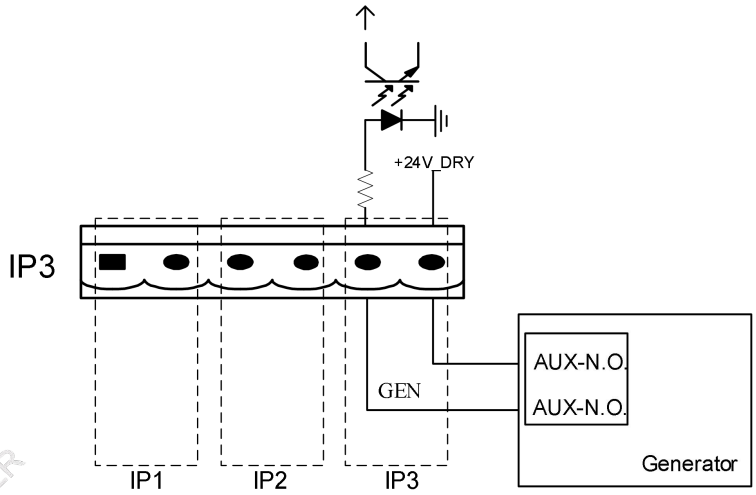



Figure 1-10 Generator access status interface and connection diagram

| Location | Type | Function |
|---|---|---|
| IP3-5 | GEN_CONNECTED | Built-in input dry contact, function can be set. Default function: generator access status port |
| IP3-6 | +24V_DRY | +24V power supply |

Table 1-8 Generator access status interface description

**BCB Interface**

IP1 and IP2 are battery switch (BCB) interfaces, and OP4 pins 4-6 are BCB breakout signal outputs. The interface diagram is shown in Figure 1-11, and the interface description is shown in Table 1-9.

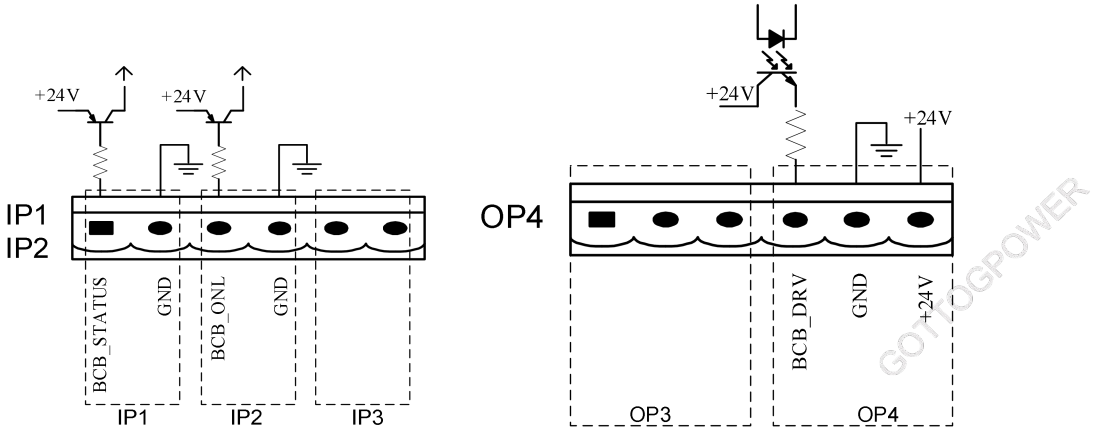



Figure 1-11 BCB interface

| Location | Type | Function |
|---|---|---|
| IP1-1 | BCB_Status | BCB contact status, connect to the normally open signal of BCB |
| IP1-2 | GND_DRY | +24V ground |
| IP2-3 | BCB_Online | BCB contact status, connected to the normally open signal of BCB |
| IP2-4 | GND_DRY | +24V ground |

| | | |
|---|---|---|
| OP4-4 | BCB_DRV | BCB trip signal output, 24V level, maximum support 100mA |
| OP4-5 | GND_DRY | +24V ground |
| OP4-6 | +24V_DRY | +24V |

Table 1-9 BCB interface description

**Battery Voltage Low Alarm Output Dry Contact Interface**

OP1 is the output dry contact interface, and OP1 1-3 pins are the output battery voltage alarm signal. When the battery voltage is lower than the set value, an auxiliary dry contact signal isolated by a relay will be provided. The interface diagram is shown in Figure 1-12, and the interface description is shown in Table 1-10.

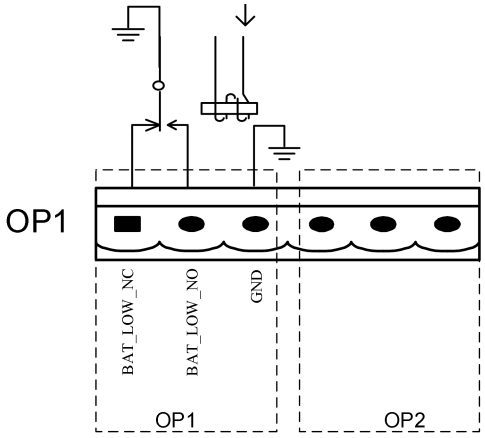



Figure 1-12 Schematic diagram of dry contact interface with similar battery voltage

| Location | Type | Function |
|---|---|---|
| OP1-1 | BAT_LOW_ALARM_NC | Battery voltage alarm relay (normally closed), disconnected when alarm occurs |
| OP1-2 | BAT_LOW_ALARM_NO | Battery voltage alarm relay (normally open), closed when alarm occurs |
| OP1-3 | BAT_LOW_ALARM_GND | OP1-1 and OP2-2 common terminal |

Table 1-10 Battery voltage alarm dry contact interface description

**General Alarm Output Dry Contact Interface**

OP2 is a general alarm output dry contact interface. When one or more preset alarms are triggered, the system will send out a general alarm message and provide an auxiliary dry contact signal isolated by a relay. The interface diagram is shown in Figure 1-13, and the interface description is shown in Table 1-11.

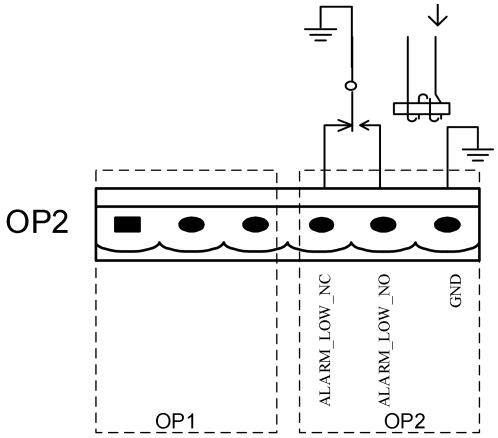



Figure 1-13 Schematic diagram of general alarm dry contact interface

| Location | Type | Function |
|---|---|---|
| OP2-4 | GENERAL_ALARM_NC | General alarm relay (normally closed), disconnected when alarm occurs |
| OP2-5 | GENERAL_ALARM_NO | General alarm relay (normally open), closed when alarm occurs |
| OP2-6 | GENERAL_ALARM_GND | OP2-4 and OP2-5 common terminal |

Table 1-11 Comprehensive alarm dry contact interface description

**Utility Fail Alarm Output Dry Contact Interface**

J10 is the utility fault alarm output dry contact interface. When the utility fails, the system will send out a utility fault alarm message and provide an auxiliary dry contact signal isolated by a relay. The interface diagram is shown in Figure 1-14, and the interface description is shown in Table 1-12.

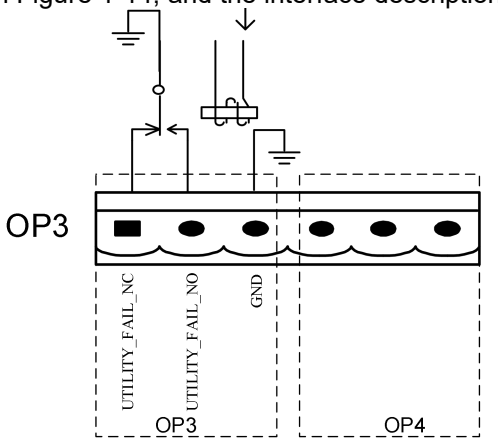



Figure 1-14 Mains fault alarm dry contact interface diagram

# 2 Battery Installation and Maintenance

## 2.1 General Recommendations

Take special care when operating the batteries of the UPS system. When all the batteries are connected, the battery voltage can exceed 400Vdc, which is potentially lethal.

**Note**

**The precautions for battery installation, use and maintenance are to be provided by the batteries manufacturers. The precautions in this section include the key issues that must be considered during the installation design, which may be adjusted according to the specific local situations.**

**WARNING**

- **The battery shall be installed and stored in a clean, cool and dry environment.**
- **Do not install the battery in a sealed battery chamber or sealed room. The battery room ventilation shall at least meet the requirement of EN50272-2001. Otherwise, battery bulging, fire and even human injury may be caused.**
- **The battery shall be installed far away from the heating source (e.g. transformer). Do not use or store the battery in the place near the heating source or burn the battery or place it into fire. Otherwise, battery leakage, bulging, fire or explosion may be caused.**
- **Batteries shall be placed in such a manner that two bare live parts with the potential difference of more than 150V shall not be connected at the same time. If it is unavoidable, insulated terminal cover and insulated cables shall be used for connection.**
- **If external batteries are to be used, the battery circuit breakers (or fuses) must be mounted as close as possible to the batteries, and the connecting cables should be as short as possible.**

**DANGER**

**When connecting the battery, follow the precautions for high-voltage operation**

- **Before accepting and using the battery, check the appearance the battery. If the package is damaged, or the battery terminal is dirty, corroded or rusted or the shell is broken, deformed or has leakage, replace it with new product. Otherwise, battery capacity reduction, electric leakage or fire may be caused.**
  - **Before operating the battery, remove the finger ring, watch, necklace, bracelet and any other metal jewelry**
  - **Wear rubber gloves.**
  - **Eye protection should be worn to prevent injury from accidental electrical arcs.**
  - **Only use tools (e.g. wrench) with insulated handles.**
- **The batteries are very heavy. Please handle and lift the battery with proper method to prevent any human injury or damage to the battery terminal.**
- **Do not decompose, modify or damage the battery. Otherwise, battery short circuit, leakage or even human injury may be caused.**
- **The battery contains sulfuric acid. In normal operation, all the sulfuric acid is attached to the separation board and plate in the battery. However, when the**

**battery case is broken, the acid will leak from the battery. Therefore, be sure to wear a pair of protective glasses, rubber gloves and skirt when operating the battery. Otherwise, you may become blind if acid enters your eyes and your skin may be damaged by the acid.**

- **At the end of battery life, the battery may have internal short circuit, drain of electrolytic and erosion of positive/negative plates. If this condition continues, the battery may have temperature out of control, swell or leak. Be sure to replace the battery before these phenomena happen.**
- **If a battery leaks electrolyte, or is otherwise physically damaged, it must be replaced, stored in a container resistant to sulfuric acid and disposed of in accordance with local regulations.**
- **If electrolyte comes into contactor with the skin, the affected area should be washed immediately with water.**

## 2.2 Battery Typologies

According to the requested configuration UPS may need batteries consisting of one or more strings of battery blocks installed on shelves in a locked cabinet or dedicated battery room

**Note**

**The Traditional external battery cabinet can make use of each even number of batteries per string between 30 and 50.**

**The default factory setting, if the unit is ordered w/o internal battery is 40.**

**The cabinet is for valve regulated maintenance-free lead-acid battery and Lithium battery**

**CAUTION: The lead acid battery may cause chemistry hazard**

### 2.2.1 Traditional Battery Installation

Only the qualified engineers are allowed to install and maintain mounted in a traditional battery cabinet or shelf. To ensure safety, install the external battery in a locked cabinet or dedicated battery room accessible just to service qualified personnel.

Please note that number of cells set via software must be consistent with the actual number of cells.

A minimum space of 10mm must be reserved on all vertical sides of the battery block to permit free air movement around the cells.

A certain clearance should be reserved between the top of the cells and the underside of the shelf above as this is necessary for monitoring and servicing the cells.

When installing the batteries always work from the bottom shelf upwards to prevent raising the center of gravity.

Install the batteries reliably and avoid vibration and mechanical bumping.

The bending radius of cable should be more than 10D, where "D" is the outer diameter of cable.

When connecting the cable, do not cross the battery cables and do not bind the battery cables together. The battery connection must be firm and reliable. After the connection, all the connections between the wiring terminals and the batteries must be corrected to meet the torque requirement provided in the specifications and user manuals of the battery manufacturers.

Each battery terminal should be insulated after its connection has been made.

Check if the battery is unexpectedly grounded. If the battery is unexpectedly grounded, remove the earth power supply. Contactoring any part of the grounded earth may be subject to electric shock.

Measure the battery voltage, and carry out battery voltage calibration after the UPS is started.

Diagram of batteries connection is shown as below:

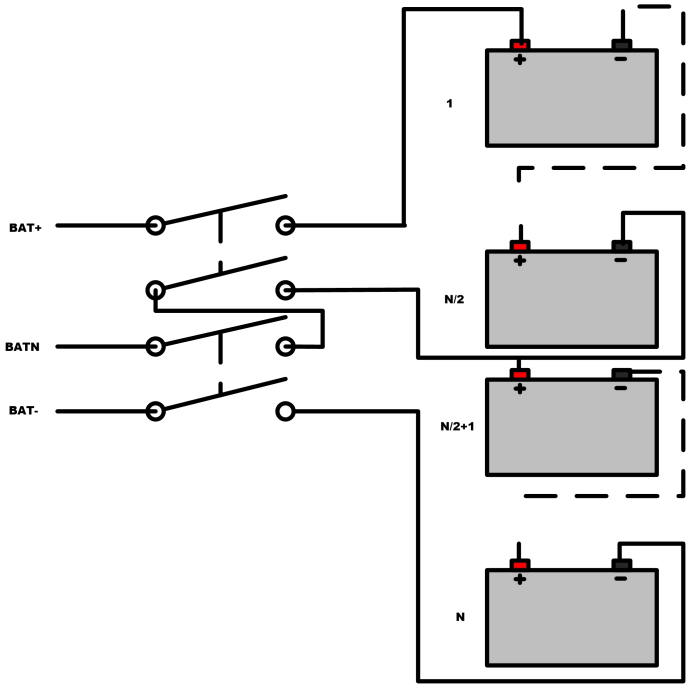



Fig.2- 1: Diagram of Batteries Connection

**WARNING**

**When using a traditional battery solution, always comply with the following precautions:**

- **Disconnect the charging power before connecting or disconnecting the cable of the battery terminals.**
- **Do not connect the cables between the UPS battery terminals and the batteries before getting the approval from the commissioning engineer.**
- **When connecting the cables between the battery terminals and the circuit breaker, always connect the circuit breaker end of the cable first.**
- **Be sure to connect the positive/negative terminals of the batteries to those of the circuit breakers and those of the circuit breakers to those of the UPS respectively with reference to the markings of positive/negative terminals. Reverse connection of battery polarities will result in explosion, fire accident, the damage of batteries and UPS, and human injury.**
- **The battery connecting terminal shall not subject to any external force, such as the pulling force or twisting force of the cable. Otherwise, the internal connection of the battery may be damaged, and in severe case, the battery may catch fire.**
- **Do not connect power until the total voltage of the battery string is verified correct through measurement.**
- **Do not connect any conductor between the positive and negative terminals of the battery.**
- **Do not close the battery circuit breakers before getting the approval from the commissioning engineer.**

## 2.3 Battery Maintenance

For the battery maintenance and precautions, please refer to IEEE-Std-1188-2005 and the

relevant manuals provided by the battery manufacturers.

**WARNING**

- **Check to ensure that all the safety devices are in place and function normally. Check if the battery management parameter setting is normal particularly.**
- **Measure and record the air temperature in the battery room.**
- **Check if the battery terminals are damaged or have the symptom of heating, and if the shell or cover is damaged.**
- **Please fasten every bolt on the terminal according to the fastening torque specified in the table below.**
- **After 1-2 months of service, recheck to make sure that each screw has been fastened according to the specified torque. Otherwise there is risk of fire.**
- **CAUTION: Use the battery with the same capacity and type, if battery is replaced by an incorrect type, it can cause explosion.**
- **CAUTION: Dispose of used battery according to the local instructions**

# 3 Installation of UPS Rack System

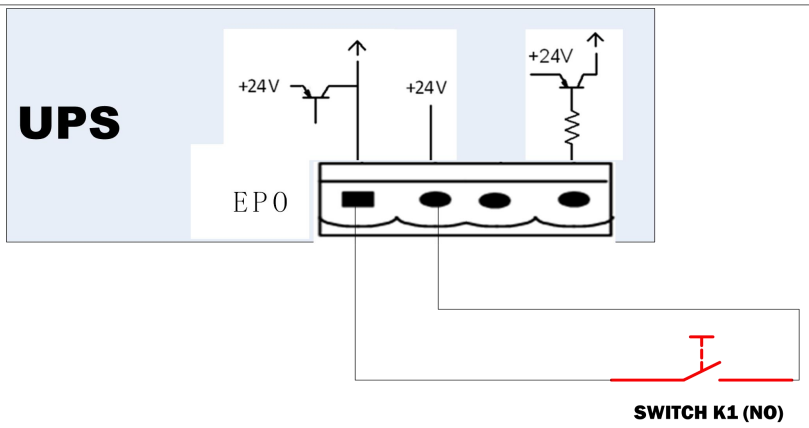
## 3.1 Overview

The single system should be installed according to the installation procedures of the UPS rack module system and the requirements in this Chapter.

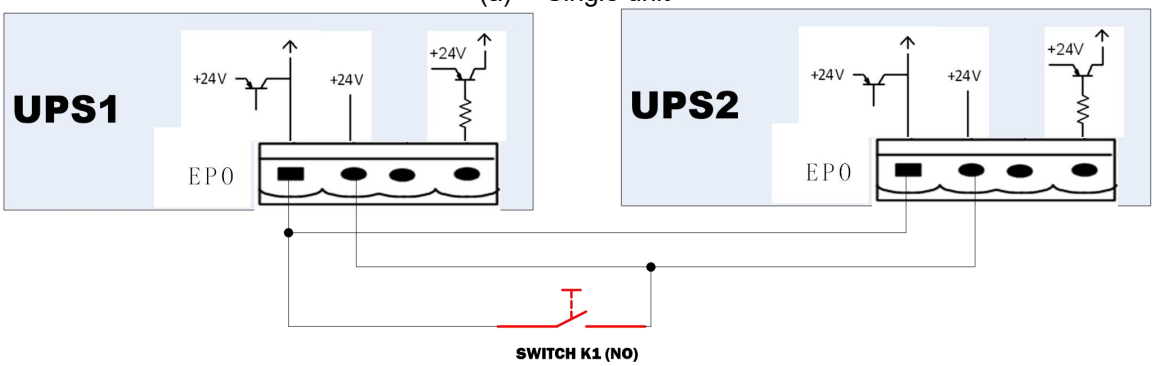
For single UPS installation the EPO button on the front panel of the UPS rack controls the emergency stop of UPS modules and bypass static switch and also supports remote emergency power off function that can be used to shut down the UPS rack module remotely.

**Note**

- **The remote EPO switch must provide normally open or normally closed dry contactor signals.**
- **The open circuit voltage is 24Vdc, and the current is less than 20mA.**
- **Normally closed EPO terminals: Pin 1 and pin 2 have been connected in factory and located on the dry contactor board.**
- **Set EPO function as available with monitoring software on PC before using remote EPO function.**




(a) Single unit




(b) Parallel system

Fig.3- 1: Circuit diagram of EPO

## 3.2 UPS in Parallel System

The basic installation procedures of parallel system are the same with those of the UPS rack module system. In this section, only the installation procedures related to the parallel system are introduced.

**WARNING**

**The operations described in this section must be performed by the authorized electricians or the qualified technical personnel. If you have any difficulties, contact your local representative or Services.**

### 3.2.1 Installation of Cabinet

To make the maintenance and system test easier, an external maintenance bypass is recommended in the installation.

### 3.2.2 External Protective Devices

Refer to Chapter 1 Installation

### 3.2.3 Power Cables

The power cable connection of the parallel system is similar to that of the single UPS system. If the bypass input and rectifier input share the same neutral terminal and if an RCD protective device is installed at the input, then the RCD device must be installed before the input cables are connected to the neutral terminal. Refer to Chapter 1 Installation

**Note:** ***The length and specification of the power cables of each UPS module should be the same, including the bypass input cables and UPS output cables, so that the load sharing effect can be achieved in bypass mode.***

### 3.2.4 Parallel Board

**Installation of parallel signal board**

Location of parallel board is shown as ***Fig.1-1: UPS Structure***. Shown as below:

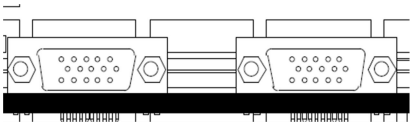


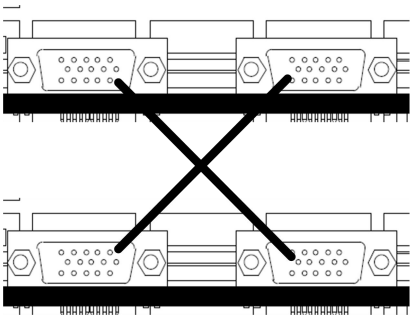
Fig.3- 2: Parallel Board

Note: The jumper pins on the parallel board need to be set according to the number of parallel cabinets and the number of cabinet slots. Please contact the manufacturer or refer to the manual.

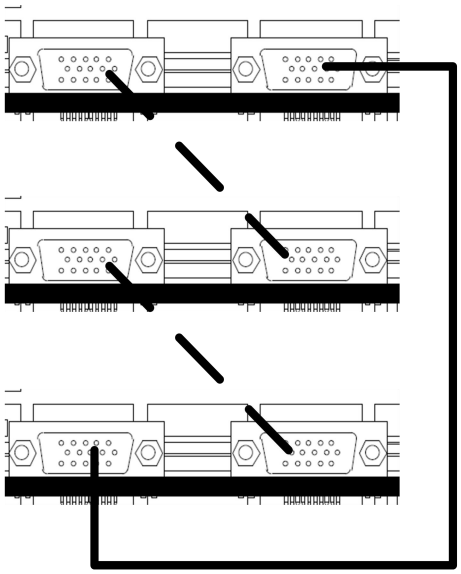
### 3.2.5 Parallel Cable Connections

**Parallel Communication Cable**

The parallel control cables are designed to be shielded and double insulated, DB15 terminals, and are connected between the UPS rack modules to form a loop as shown below. This close loop connection ensures the reliability of the parallel system control. Refer to *fig. 3-3*



1+1 system



N+1 system

Fig.3- 3: Connection of Parallel Cables of Parallel System

# 4 Installation Drawing

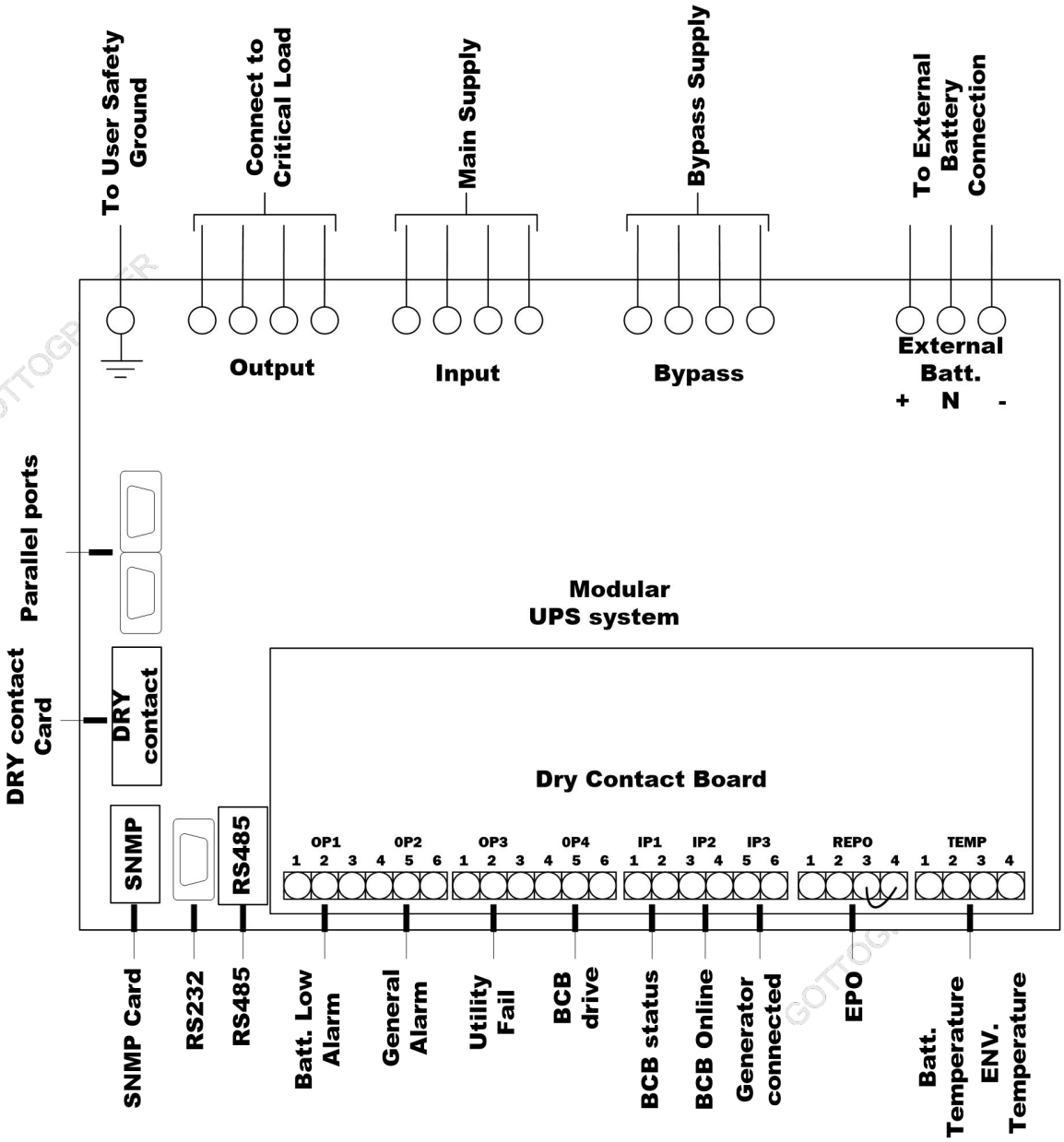



Fig.4- 1: Wiring Diagram

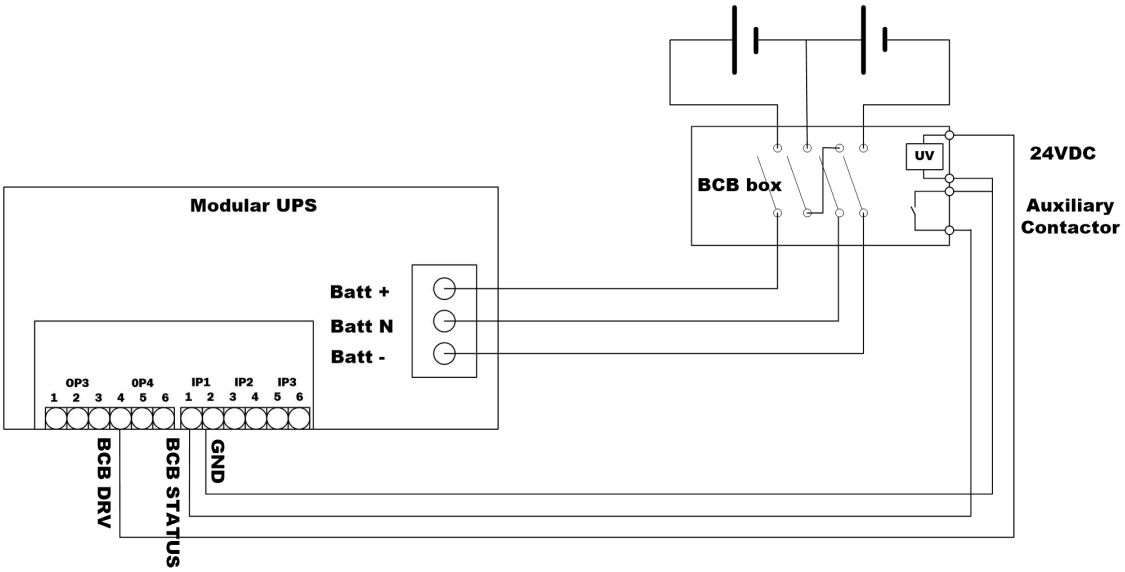



Fig.4- 2: External Battery Connection

External BCB interface:

BCB DRV (OP4-4): BCB drive signal

BCB STATUS (IP1-1): BCB contactor status, normally opened. Shorted to GND when activated

GND (IP1-2): common connection

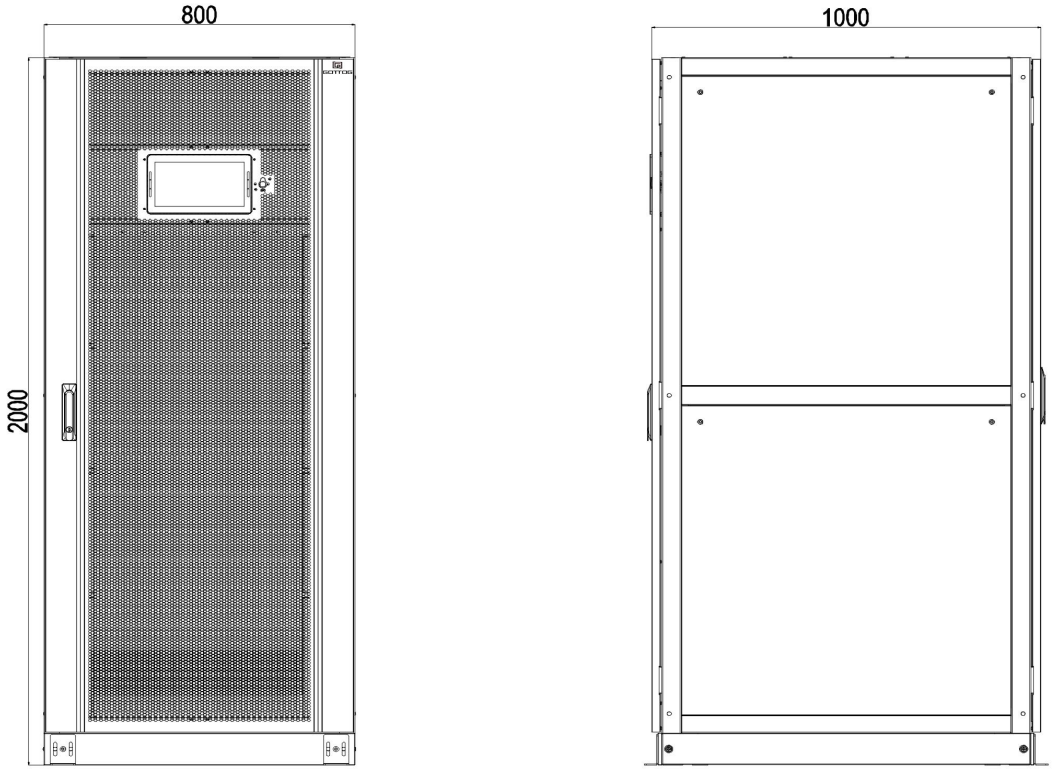



Fig.4- 3: 6-8 slots UPS Dimensions

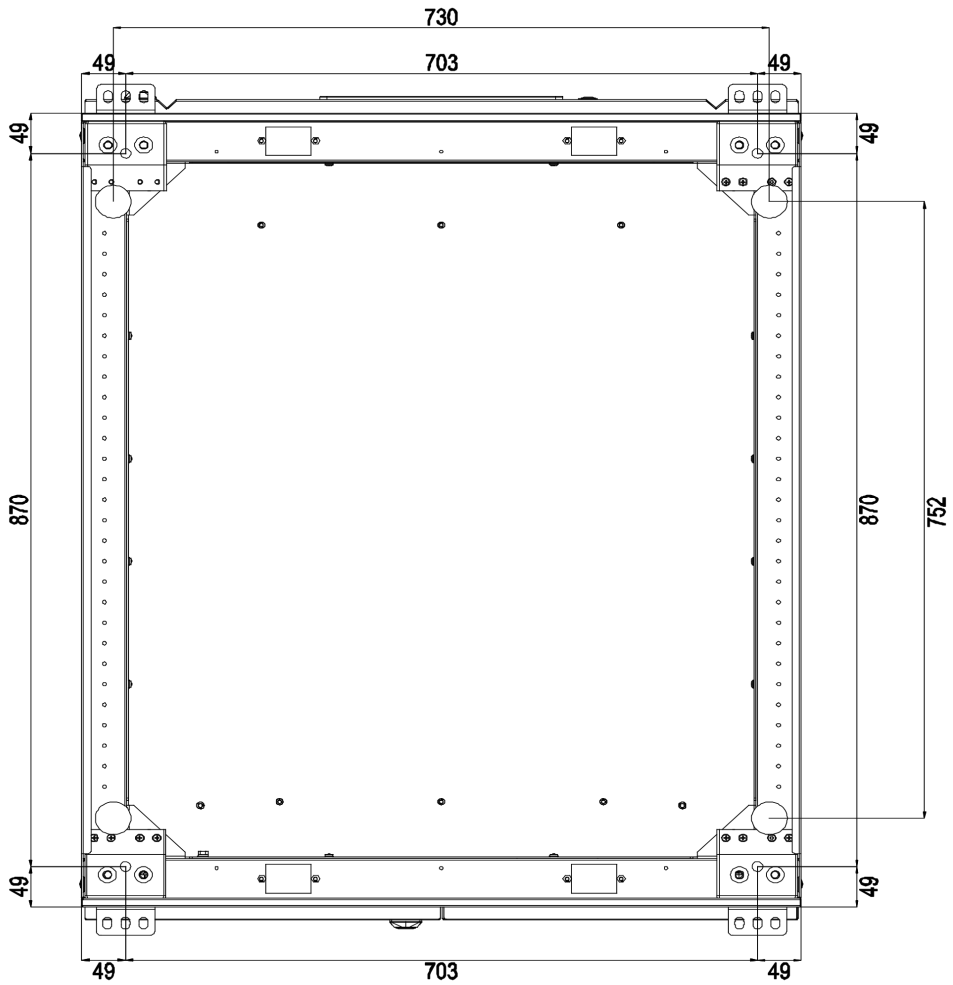



Fig.4- 4: 6-8 Slots UPS Adjustable Feet diagram

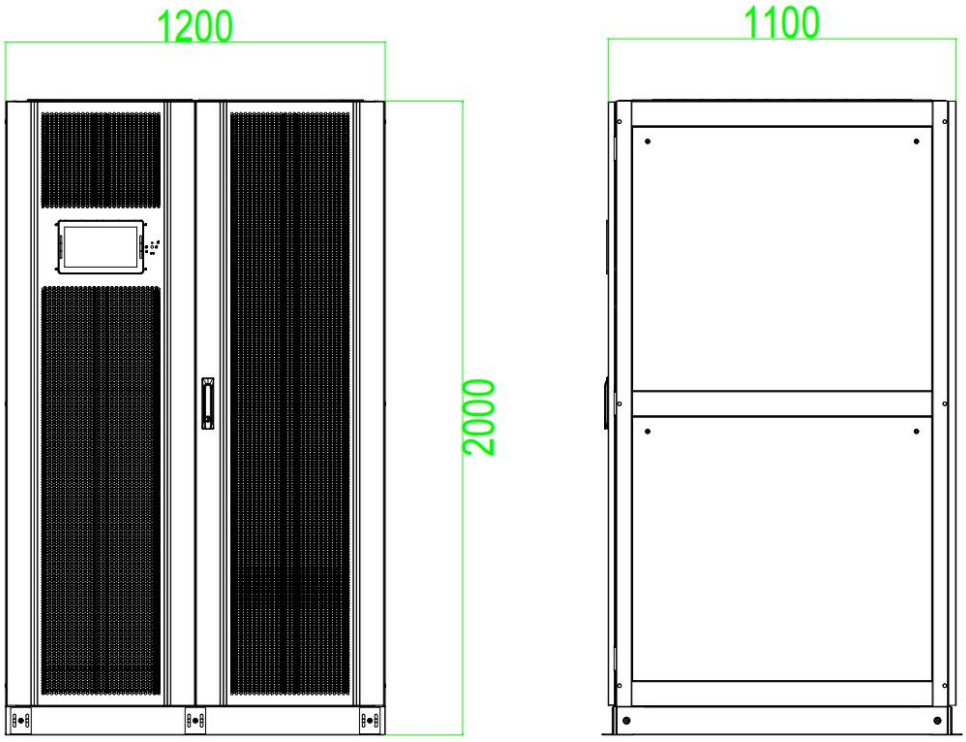



Fig.4- 5: 12 Slots UPS Dimensions

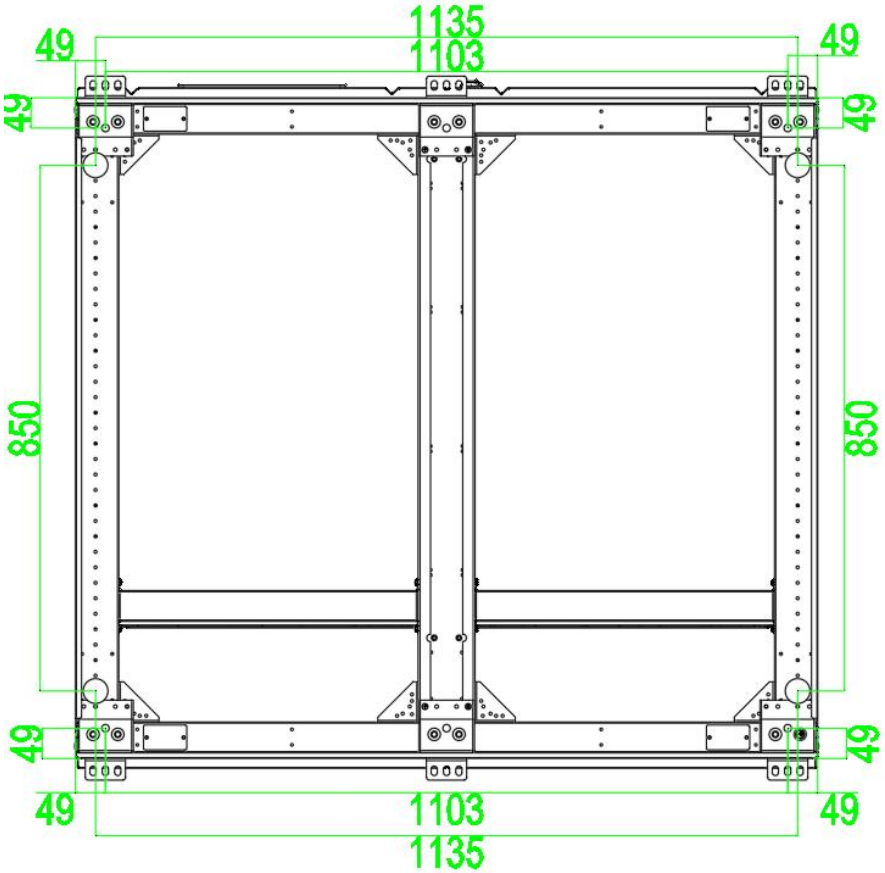



Fig.4- 6: 12 Slots UPS Adjustable Feet diagram

# 5 Operations

**WARNING: Hazardous mains voltage and/or battery voltage present(s) behind the protective cover**

**The components that can only be accessed by opening the protective cover with tools cannot be operated by user. Only qualified service personnel are authorized to remove such covers.**

## 5.1 Introduction

The UPS can be configured as either a fixed capacity or as a scalable, transformer free, online uninterruptible power system with 400/230 V input and 400/230V output capability. The UPS can operate with either a 50 Hz or 60 Hz input and provide a matching output frequency conversion.

When configured for scalability, the capacity of the UPS can be increased in 50kVA increments. Based on the configuration, a power module can be set to a redundant operation mode.

The UPS provides continuous, high quality AC power to the business-critical equipment, such as telecommunications and data processing equipment. The UPS supplies power free of the disturbances and variations in voltage and frequency common to the utility power, which is subject to brownouts, blackouts, surges and sags.

The UPS utilizes the latest in high frequency, double conversion Pulse Width Modulation (PWM) technology and fully digital controls to enhance its reliability and increase the ease of use.

The UPS requires external batteries to support the load when the utility power is not present.

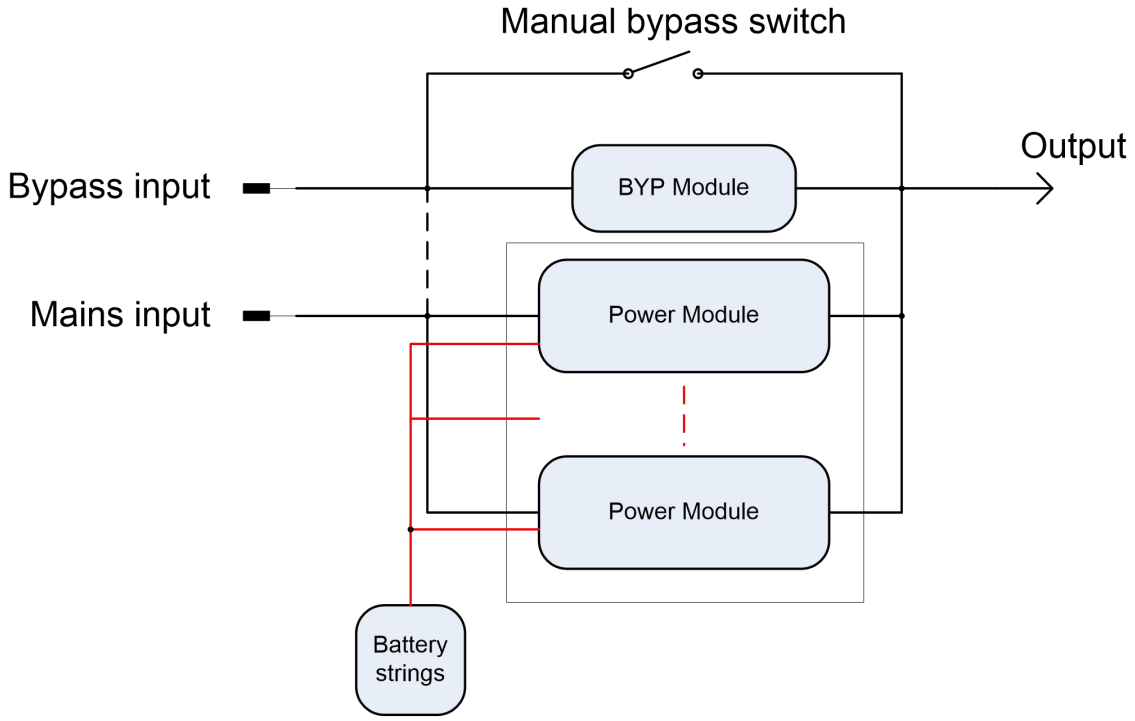



Fig.5- 1: Single Unit Block Diagram

### 5.1.1 Split-Bypass Input

Fig. 5-1 illustrates the Modular UPS in what is known as the split-bypass configuration (that is, the bypass uses a separated AC power). In this configuration, the static bypass and manual bypass share the same independent bypass power supply and connect to the power supply through a separate switch. Where a separated power source is not available, the bypass and rectifier input supply connections are linked.

### 5.1.2 Static Bypass

The circuit blocks labeled “BYP Module” in *fig.5-1* contain electronically controlled transferring circuits that enable the critical load to be connected to either the inverter output or to a bypass power source via the static bypass line. During normal system operation the load is connected to the inverter; but in the event of a UPS overload or inverter failure, the load is automatically transferred to the static bypass line. To provide a clean (no-break) load transfer between the inverter output and static bypass line, the inverter output and bypass supply must be fully synchronized during normal operating conditions. This is achieved through the inverter control electronics, which makes the inverter frequency track that of the static bypass supply, provided that the bypass remains within an acceptable frequency window.

A manually controlled maintenance bypass supply is incorporated into the UPS design. It enables the critical load to be powered from the utility (bypass) supply while the UPS is shut down for routine maintenance.

**Note**

**When the UPS is operating in bypass mode or on maintenance bypass, the connected equipment is not protected from power failures or surges and sags.**

## 5.2 1+1 Parallel System

Several “single unit” UPS modules may constitute a “1+1” system, where up to two single units operate together for the purpose of providing additional power or reliability or both. The load is equally shared between any paralleled UPSs.

### 5.2.1 Features of Parallel System

1. The hardware and firmware of single module UPS units are completely compatible with the requirements of a parallel system. Parallel configuration can be achieved merely through settings in configuration software. The parameters settings for the modules in parallel system shall be consistent.

2. Parallel control cables are connected in a ring, providing both performance and redundancy. Dual-bus control cables are connected between any two UPS modules of each bus. The intelligent paralleling logic provides the user with maximum flexibility. For example, shutting down or starting up UPS modules in a parallel system can be done in any sequence. Transfers between Normal and Bypass modes of operation are synchronized and self–recovering e.g. following overloads and their clearance.

3. The total load of the parallel system can be queried from each unit’s LCD.

### 5.2.2 Parallel Requirements of UPS Modules

A group of paralleled modules behave as if it were one large UPS with the advantage of presenting higher reliability. In order to assure that all modules are equally utilized and to comply with relevant wiring rules, the following requirements apply:

1. All UPS modules shall be of the same rating and must be connected to the same bypass source.

2. The bypass and the main input sources must be referenced to the same neutral potential.
3. Any RCD (Residual Current detecting device), if installed, must be of an appropriate setting and located upstream of the common neutral bonding point. Alternatively, the device must monitor the protective earth currents of the system. Refer to the High Leakage Current Warning in the first part of this manual.
4. The outputs of all UPS modules must be connected to a common output bus.
5. It is strongly recommended that each paralleled UPS install at least a redundant power module


Note

**Optional isolation transformers are available for applications where sources do not share the same neutral reference or where the neutral is not available.**

## 5.3 Operating Mode

The Modular UPS is an online, double-conversion, reverse-transfer UPS that permits operation in the following modes:

- Normal mode
- Battery Mode
- Auto-restart mode
- Bypass mode
- Maintenance mode (manual bypass)
- Parallel redundancy mode
- ECO Mode

### 5.3.1 Normal Mode

The UPS inverter power modules continuously supplies the critical AC load. The rectifier/charger derives power from the AC mains input source and supplies DC power to the inverter while simultaneously FLOAT or BOOST charging its associated backup battery.

### 5.3.2 Battery Mode

Upon failure of the AC mains input power; the inverter power modules, which obtains power from the battery, supplies the critical AC load. There is no interruption in power to the critical load upon failure. After restoration of the AC mains input power, the “Normal Mode” operation will continue automatically without the necessity of user intervention.

### 5.3.3 Auto-Restart Mode

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

### 5.3.4 Bypass Mode

If the inverter overload capacity is exceeded under normal mode, or if the inverter becomes unavailable for any reason, the static transfer switch will perform a transfer of the load from the inverter to the bypass source, with no interruption in power to the critical AC load. Should the inverter be asynchronous with the bypass, the static switch will perform a transfer of the load from the inverter to the bypass with power interruption to the load. This is to avoid large cross currents due to the paralleling of unsynchronized AC sources. This interruption is programmable but typically set to be less than 3/4 of an electrical cycle, e.g., less than 15ms (50Hz) or less than

12.5ms (60Hz).

### 5.3.5 Maintenance Mode (Manual Bypass)

A manual bypass switch is available to ensure continuity of supply to the critical load when the UPS becomes unavailable e.g. during a maintenance procedure.

### 5.3.6 Parallel Redundancy Mode (System Expansion)

For higher capacity or higher reliability or both, the outputs of several UPS modules can be programmed for direct parallel while a built-in parallel controller in each UPS ensures automatic load sharing.

### 5.3.7 Eco Mode

To improve system efficiency, UPS rack system works in bypass mode at normal time, and inverter is standby. When utility fails, UPS transfer to battery mode, and inverter power the loads. The efficiency of ECO system can be up to 98%.

**Note**

**There is a short interruption time (lower than 10ms) when transfer from ECO mode to battery mode, it must be sure that the time has no effect on loads.**

## 5.4 Battery Management—Set During Commissioning

### 5.4.1 Normal Function

**Constant Current Boost Charging**
Current can be set up as 0%~20%, default setting is 10%.
**Constant Voltage Boost Charging**
Voltage of boost charging can be set as required by the type of battery.
For Valve Regulated Lead Acid (VRLA) batteries, maximum boost charge voltage should not exceed 2.4V / cell.
**Float Charge**
Voltage of float charging can be set as required by the type of battery.
For VRLA, float charge voltage should be between 2.2V to 2.3V, default setting is 2.25V.
**Float Charge Temperature Compensation (optional)**
A coefficient of temperature compensation can be set as required by the type of battery.
**End of Discharge (EOD) Protection**
If the battery voltage is lower than the EOD, the battery converter will shut down and the battery is isolated to avoid further battery discharge. EOD is adjustable from 1.6V to 1.75V per cell (VRLA).

### 5.4.2 Advanced Functions (Software Settings Performed by the Commissioning Engineer)

**Battery self-test and self-service**
At periodic intervals, 25% of the rated capacity of the battery will be discharged automatically, and the actual load must exceed 25% of the rated UPS (kVA) capacity. If the load is less than 25%, auto-discharge cannot be executed. The periodic interval can be set from 720 to 3000 hours.
**Conditions:** Battery at float charge for at least 5 hours, load equal to 25~100% of rated UPS capacity Trigger—Manually through the command of Battery Maintenance Test in LCD panel or automatically Battery self-test interval.

## 5.5 Battery Protection (Settings by Commissioning Engineer)

**Battery Low Pre-warning**

The battery undervoltage pre-warning occurs before the end of discharge. After this pre-warning, the battery should have the capacity for 3 remaining minutes discharging with full load. And the

**End of discharge (EOD) protection**

If the battery voltage is lower than the EOD, the battery converter will be shut down. EOD is adjustable from 1.6V to 1.75V per cell (VRLA).

**Battery Disconnect Devices Alarm**

The alarm occurs when the battery disconnect device disconnects. The external battery connects to the UPS through the external battery circuit breaker. The circuit breaker is manually closed and tripped by the UPS control circuit.

# 6 Operating Instructions

 **DANGER: Hazardous mains voltage and/or battery voltage present(s) behind the protective cover**

**The components that can only be accessed by opening the protective cover with tools cannot be operated by user. Only qualified service personnel are authorized to remove such covers.**

## 6.1 Introduction

The Modular UPS operates in the following modes listed in *table.6-1*. This section describes various kinds of operating procedures under each operating mode, including transfer between operating modes, UPS setting and procedures for turning on/off inverter.

Tab.6-1: UPS Operating mode

| Operating mode | Descriptions |
|---|---|
| Normal mode | UPS powers the load |
| Bypass mode | The load power supply is provided by the static bypass. This mode can be regarded as a temporary transition mode between the normal mode and maintenance bypass mode, or a temporary abnormal operating status |
| Battery mode | Mains input is abnormal, UPS transfer to battery mode and battery provide the power to load via PFC and inverter. |
| Maintenance mode | UPS Shuts down, the load is connected to the mains via Manual bypass. **NOTE:** *in this mode the load is not protected against abnormal mains* |
| ECO mode | The load power supply is provided by the static bypass while the inverter is standby. If mains input is abnormal, UPS transfer to inverter and inverter provide the power for load. |
| Hibernate mode | One or more power modules are sleeping in turn in this mode according to the load percent and setting. |

**Note:**

*1. Refer to Chapter 7 Operator Control and Display Panel, for all the user operating keys and LED displays.*

*2. The audible alarm may annunciate at various points in these procedures.*

*3. The UPS function can be set via maintenance software. However, the setting and commissioning must be done by maintenance engineers trained.*

### 6.1.1 Power Switches

The 4/6 slots cabinet UPS system has a manual bypass breaker,the 10/12 slots have four breaker,input,output,bypass,maintenance bypass breaker, and all the other transfers are processed automatically.

Customer must install an external mains input breaker, an external maintenance bypass breaker and an external output breaker. An external bypass breaker is needed if split-bypass is applied for.

 Note

**It's recommended that 4-poles breakers are used, and the rated current is higher than rated current of breakers in UPS.**

## 6.2 UPS Startup

### 6.2.1 Start-Up Procedure

This procedure must be followed when turning on the UPS from a fully powered down condition.

The operating procedures are as follows:

1. Confirm that all switches are in the open state;
2. Confirm that the module is in place and the switch is in the unlocked position. Slowly insert the module into the cabinet slot as shown in Figure 6-1.

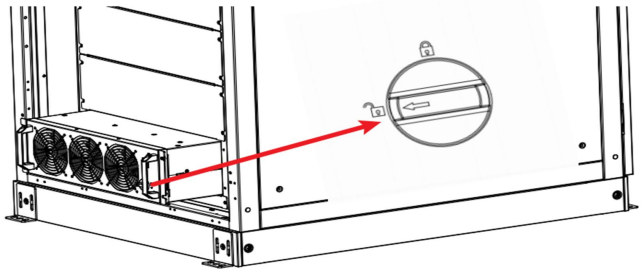


Fig.6- 1: Single Unit Block Diagram

3. Turn the module in position switch to the locked state, as shown in Figure 6-2, and tighten the module fixing screw.

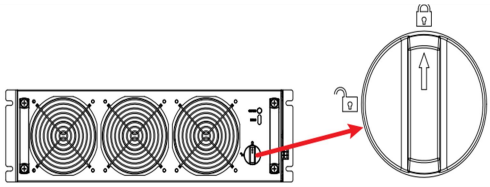


Fig.6-2: Single Unit Block Diagram

4. Close the output switch, bypass switch, and close the input switch again. The system starts initialization (6 modules and four switches have built-in rotary switches, and 6-12 single cabinets need external power distribution switch);
5. After the monitoring is started, the LCD screen in front of the cabinet is lit up and then enters the home page interface
6. Observing the energy flow diagram animation on the LCD home page, the system rectifier starts at this moment, and the module rectifier indicator light is green;
7. After about 30S, the rectifier indicator light is green and always on, the rectification is over, the bypass static switch is on, the inverter starts, and the inverter indicator light is green and flashing;
8. After the inverter runs normally, the UPS switches from the bypass power supply state to the inverter power supply state. The bypass indicator light is off, and the inverter indicator light and load indicator light are on.
9. Close the external battery switch, the battery indicator light is off, then the UPS charges the battery, the UPS enters normal mode operation, and the startup is completed.

**WARNING**

**During this procedure the UPS output terminals are live. If any load equipment are connected to the UPS output terminals please check with the load user that it is safe to apply power: If the load is not ready to receive power then ensure that it is safely isolated**

**from the UPS output terminals.**

### 6.2.2 Procedures for Switching Between Operation Modes

Switch from normal mode to bypass mode

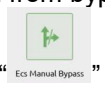
Press “ 

” menu in menu “Control”—“Func Button” to switch to bypass mode.

**WARNING**

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

Switch from bypass mode to normal mode

Press “ 

” menu in bypass mode. After the inverter is normal, the UPS transfers to normal mode.

### 6.2.3 Start up from battery

If mains input is nor ready and need to start up UPS from battery, it’s available to start up UPS directly from battery.

1. Make sure the battery string is connected already.
2. Press “Cold start” button behind LCD for about 1s. LCD turns on.
3. Press “Cold start” button on front panel of power module to start power module.
4. After about 2 minutes, the power module works in battery mode.
5. Start up the other power modules one by one.

### 6.2.4 Turn off module

When maintenance is required or the UPS is shut down, the switch button on the front panel of the module must be turned to the unlocked state before it can be pulled out, as shown in Figure 6-3.

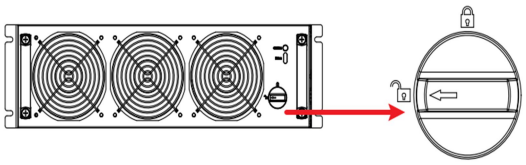


Fig.6-2: unlocked state

## 6.3 Procedure for Switching the UPS between Maintenance Bypass and Normal Mode

### 6.3.1 Procedure for Switching from Normal Mode to Maintenance Bypass Mode

This procedure can transfer the load from the UPS inverter output to the maintenance bypass supply, but the precondition is that the UPS is in normal mode before the transfer.

**WARNING**

Before making this operation, read messages on display to be sure that bypass supply is regular and the inverter is synchronous with it, so as not to risk a short interruption in powering the load.

1. Press the “ 

” to transfer to bypass mode.

**Note**

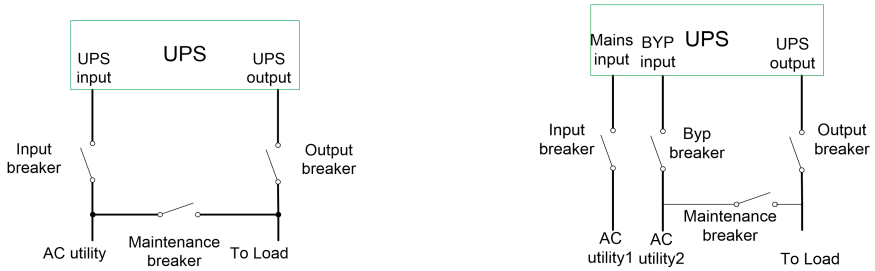
**Pressing the mute off button** 

**in “Control” menu to cancel the audible alarm but leaves the warning message displayed until the alarm condition is rectified.**

2. Close the manual bypass switch. The load power supply is provided by the manual bypass and static bypass together.

3. Press OFF on each power module shutdown all power modules. Open the external battery breaker and internal battery breaker (if built-in battery cabinet). Then power modules can be maintained.

4. If cabinet maintenance is needed, external maintenance bypass breaker is required. If external maintenance bypass breaker is available, close external maintenance bypass breaker, open the external input breaker and external output breaker, then UPS cabinet can be maintained. It’s recommended that external maintenance breaker are installed as *fig.6-1*:




(a) common input (b) split-bypass input

Fig.6- 1: External Maintenance Bypass

**DANGER**

**If you need to maintain the module, wait for 10 minutes to let the DC bus capacitor fully discharge before removing corresponding module.**

**When the manual bypass switch is on position of ON, some part of the UPS circuit still has hazardous voltage. Therefore, only qualified person can maintain the UPS.**

**WARNING**

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

### 6.3.2 Procedure for Switching from Maintenance Mode to Normal Mode

1. Close bypass breaker if available. Close manual bypass breaker. Close external output breaker. Close external mains input breaker. The LCD starts up at this time. The rectifier enters normal operation state after about 20s. After initialization, the bypass static switch closes.

2. Open the external maintenance breaker. Open manual bypass breaker.

**WARNING**

**Before opening the maintenance breaker, make sure that static bypass switch is working according power flow displayed on LCD.**

3. After about 60s, UPS transfers to inverter. Close external battery breaker and internal battery breaker (for battery built-in cabinet).

### 6.3.3 Procedure for Switching from normal mode to manual bypass mode

1. Press the “ 

” menu on the LCD. The load transfers to static bypass accompanied with an audible alarm, and the inverter standby.
2. Close manual bypass switch to ON position. Open bypass breaker.
3. Press OFF on each power module shutdown all power modules. Open the battery circuit breaker or disconnect battery terminals.

**WARNING**

**Make sure not to open external input breaker, otherwise, UPS output will be interrupted.**

### 6.3.4 Procedures for Switching from manual bypass mode to normal mode

1. Press “ 

” in function menu to clear EPO alarm.
2. Close bypass breaker and bypass turns on.
3. Switch manual bypass switch to OFF.
4. Press the “ 

” menu in bypass mode, UPS transfer to inverter after about 60s.
5. Close external battery circuit breaker or internal battery circuit breaker.

**WARNING**

**Before opening the manual breaker, make sure that static bypass switch is working according power flow displayed on LCD.**

## 6.4 Procedure for Completely Powering Down a UPS

If you need to power down the UPS completely, follow the procedures as:

- Press EPO button on the front panel
- Open external battery breaker
- Open bypass breaker, external input breaker, external output breaker

If the mains and bypass are split, you need to open these two input breakers respectively.

## 6.5 EPO Procedure

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

If the input utility is present, the UPS DSP will remain active; however, the output will be turned off. To completely isolate the UPS, you need to open the mains input breaker and battery breaker.

## 6.6 Auto Start

Commonly, the UPS is start up on static bypass. When the mains power fails, the UPS draws power from the batteries to supply the load until the battery voltage reaches the end of discharge (EOD) voltage, and the UPS will shut down.

The UPS will automatically restart and enable output power:

- After the mains power is restored
- If the Auto Recovery after EOD Enabling feature is enabled

## 6.7 UPS Reset Procedure

After using EPO to shut down the UPS, operates as following to restore UPS:

- Shutdown UPS completely
- Start UPS as section 6.2.1

After the UPS is shut down due to inverter over temperature, or overload, or over transfer times, UPS will reset the fault automatically when fault is cleared.

**Note**

**The rectifier will be turned on automatically when the over temperature fault disappears after the disappearance of over temperature signals.**

After pressing the EPO button, if the UPS mains input has been disconnected, the UPS is completely power down. When the mains input is restored, the EPO condition will be cleared and the UPS system will enable static bypass mode to restore the output.

**WARNING**

**If the manual bypass is switch to ON and the UPS has mains input, then the UPS output is energized.**

## 6.8 Operation Instruction for Power Module Maintenance

Only a trained operator can perform the following procedures

If the system is normal mode and the bypass is normal, the redundant number of power module is at least one:

1. Enter in function menu and press “ 

” to release shutdown power module function.
2. Press “off” button on the front panel of power module to manually power off power module.
3. Loose the screws of the power module, then pull out the module after 5 minutes.

If there are no redundant power modules:

1. Enter in function menu and press “ 

” to transfer to bypass mode.
2. Loose the screws of the power module, then pull out the module after 5 minutes.

**WARNING**

**To ensure the safety, use a multi-meter to measure the DC bus capacitor voltage and ensure the voltage is below 60V before operation.**

3. After finishing the maintenance of the power module, insert the power modules one by one (the inserting interval for each module is longer than 10s), the power modules will automatically join the system operation, and then tighten the screws of the power modules.

Maintenance guidance for bypass power module

**WARNING**

**The bypass power module cannot be maintained in battery mode.**

If the system is in normal mode and the bypass is normal:

1. Press " 

" on LCD to transfers to bypass. Close the manual bypass switch to ON and the UPS transfer to manual bypass. Open the bypass breaker to shutdown bypass if available.
2. Press EPO button to ensure the battery current is 0. Open the battery circuit breaker or disconnect battery terminals.
3. Open LCD panel and disconnect RJ45 cable on back of LCD. Pull out the bypass power modules that need maintenance or repair, wait for 5 minutes and then maintain the bypass power modules. After finishing the maintenance of the bypass power modules, insert the module.
4. Transfer to normal mode as *section 6.3.2.*

**WARNING**

**The terminal of bypass power module is big, and it need more power when inserting bypass module to make sure the connection is tighten enough.**

## 6.9 Language Selection

The LCD menus and data display are available in kinds of languages: Simple Chinese, English, Traditional Chinese, Russian, Spanish, Polish, Portuguese or else.

Perform the following procedure to select a language needed:

1. In main menu, press " 

" to enter in setting menu on the LCD screen.
2. Select LANGUAGE menu.
3. Select the language. At this time, all the words in the LCD will be displayed in the selected language.

## 6.10 Changing the Current Date and Time

To change system date and time:

1. In main menu, press " 

" to enter in function setting menu in the LCD screen.
2. Select DATE&TIME in SysFunc.
3. Enter new date and time, then enter to confirm it.

# 7 Control and Display Panel

This chapter introduces the functions and operation instructions of the UPS operator control and display panel in detail, and provides LCD display information, including LCD display types, detailed menu information, UPS alarm list.

## 7.1 Introduction

The control and display panel is located on the front panel of the UPS. Through the LCD panel, the operator can operate and control the UPS, and check all measured parameters, UPS and battery status, event and history logs. The detailed description of control and display panel is shown in *table.7-1*.

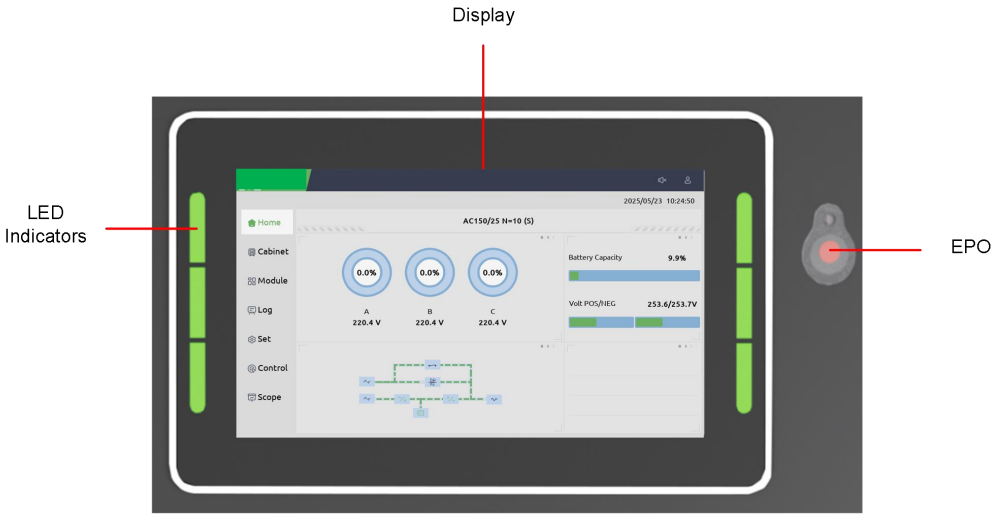



Fig.7- 1: UPS operator control and display panel

Table.7- 1: Description of UPS Operator Control and Display Panel

| Indicator | Description | Indicator | Description |
|---|---|---|---|
| Green | System is working normally | Yellow | System warns (utility fails, over load, etc) |
| Red | System fails or fault | | |

### 7.1.1 Audible Alarm (buzzer)

There are two different types of audible alarm during UPS operation as shown in *table.7-3*.

Table.7- 2: Description of Audible Alarm

| Alarm | Purpose |
|---|---|
| Two short, one long | when system has general alarm (for example: main input abnormal), this audible alarm can be heard |
| Continuous alarm | When system has serious faults (for example: fuse or hardware fault), this audible alarm can be heard |

### 7.1.2 EPO

Press EPO to shutdown UPS system (REC,INV, CHG, BYP) at the emergency situation.

## 7.2 LCD Display

Following the self-check of UPS LCD display, the main LCD display is shown as *fig.7-2*, which can be divided into 4 display windows: system information, power flow, current record and main menu.

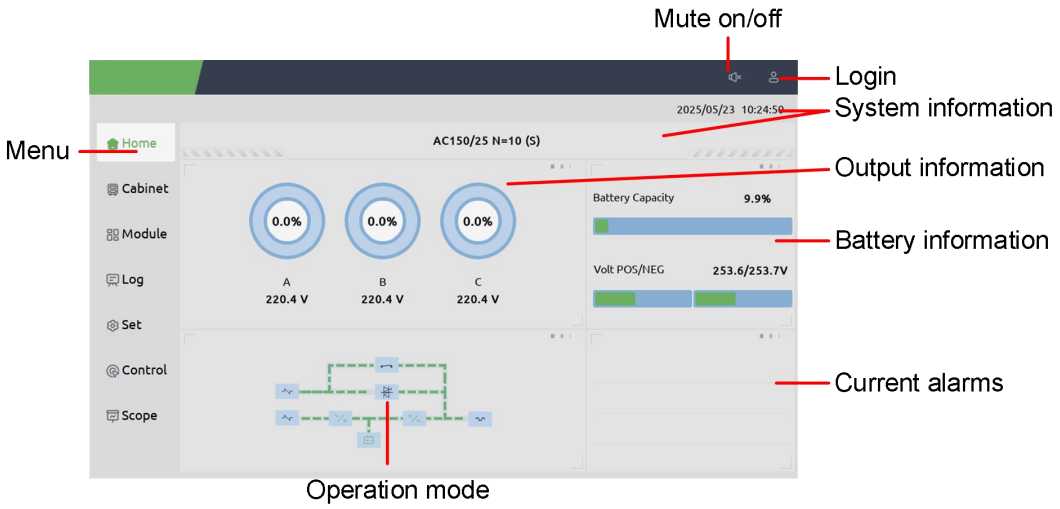



Fig.7- 2: Main LCD Display

| Items | Description |
|---|---|
| Menu | Main menu: Home, Cabinet,Module,Log,Set,Control,Scope |
| Mute on/off | Touch it if alarms to mute off. Touch again to mute on. |
| Login | Touch to enter in login window to log in or log out. |
| System information | 2023/08/10 16:01:17--- System Date and Time<br>120/30 N=4(S) ---120: cabinet capacity, 30: power module capacity, N=4: 4 power modules in system, (S): single mode, (P1): parallel mode, 1# unit |
| Output information | Output voltage and output load percent |
| Current alarms | Current alarms |
| Operation mode | Power flow of current system operation |

The description of main Menu is shown in *table.7-5*:

Table.7- 3: Description of Menu

| Menu | Description |
|---|---|
| Home | Return to main menu page |
| Cabinet | Bypass, main, output, Load, battery information |
| Module | Information of power module(input, output, load, Scode, information) |
| Set | Language, Sys Func, Change PW, BAT set, Sys Set, Calibration, Dry Contact |
| Log | History LOG, Current Alarm |
| Control | Mute ON/OFF, Fault clear, Manual bypass, Manual transfer to inverter, Esc Manual bypass, Module “on/off” enable, clear battery history data, reset dust filter using time, battery test, battery maintenance, battery boost, battery float, stop test |
| Scope | Scope of output voltage, output current, bypass voltage |

The LCD menu tree is shown as below. Please refer to *table. 7-7*: Item Description of UPS Menu

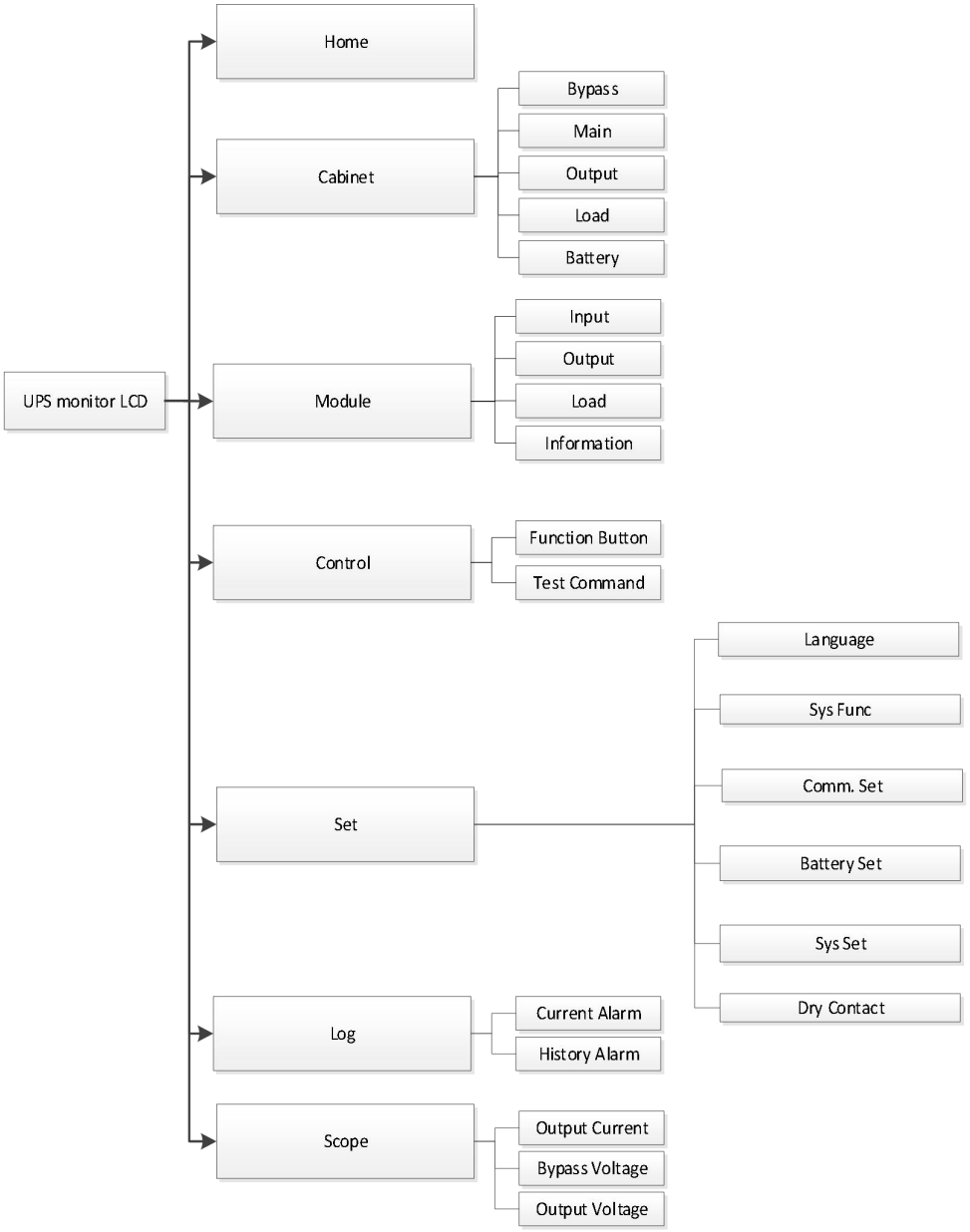



Fig.7- 3: Menu Structure

## 7.3 Detailed Description of Menu Items

The LCD main display shown in *fig.7-4* is described in details below.

UPS information window

UPS information window: unit model, module numbers, unit mode, current date and time are displayed. The information of the window is not for the user to operate. Main menu window

Details of UPS menu is shown in Table.7-6.

**Enter in** Cabinet **to enter in the page of cabinet menu.**

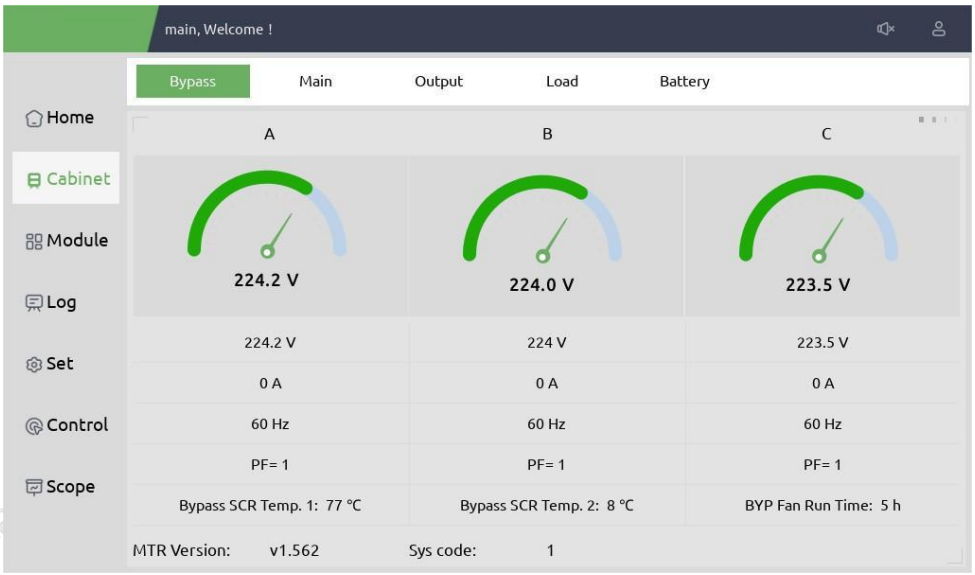



Fig.7- 4: cabinet menu

Submenu BYPASS, MAIN, OUTPUT, LOAD, BATTERY

The information of submenu is shown as below:

Table.7- 6: Submenu of Cabinet

| Sub-menu | Contents | Meaning |
|---|---|---|
| Bypass | V | Phase voltage |
| | A | Phase current |
| | Hz | Input frequency |
| | PF | Power factor |
| Main | V | Phase voltage |
| | A | Phase current |
| | Hz | Bypass frequency |
| | PF | Power factor |
| Output | V | Phase voltage |
| | A | Phase current |
| | Hz | Output frequency |
| | PF | Power factor |
| Load | kVA | Sout: Apparent Power |
| | kW | Pout: Active Power |
| | kVAr | Qout: Reactive power |
| | % | Load (The percentage of the UPS load) |
| Battery | Battery Number | Total number of battery connections per |
| | Battery Status | Battery boost/float charging status |
| | Run time | Total battery run time |
| | V | Battery positive/negative Voltage |
| | A | Battery positive/negative Current |
| | Battery Capacity (%) | The percentage compared with new battery |
| | Remain Time（Min） | Remaining battery backup time |
| | Battery Temp.(℃) | Battery temperature |
| | Ambient Temp.(℃) | Environmental temperature |

**Enter in** Module **to enter in the menu of power module**


Fig.7- 5: power module information

Module information menu includes submenu: Input, Output, Load, Information, Scode, software version.

The information of submenu is shown as below:

Table.7- 7: Submenu of Module

| Sub-menu | Contents | Meaning |
|---|---|---|
| Input | V | Input phase voltage of selected module |
| | A | Input phase current of selected module |
| | Hz | Input frequency of selected module |
| | PF | Input power factor of selected module |
| Output | V | Output phase voltage of selected module |
| | A | Output phase current of selected module |
| | Hz | Output frequency of selected module |
| | PF | Output power factor of selected module |
| Load | kVA | Sout: Apparent Power |
| | kW | Pout: Active Power |
| | kVAr | Qout: Reactive power |
| | % | Load (The percentage of the UPS load) |
| Information | DC BUS +/-(V) | Bus voltage(positive & negative) |
| | Battery +/-(V) | Battery voltage (positive & negative) |
| | Charger(V) | Charger voltage(positive & negative) |
| | Charger(A) | Charger current(positive & negative) |
| | Discharger(A) | Discharger current(positive & negative) |
| | INV Voltage(V) | Inverter phase A/B/C voltage |
| | Fan Run Time(H) | Total fan's running time |
| | Capacitor Run Time(H) | Total capacitor running time |

| Sub-menu | Contents | Meaning |
|---|---|---|
| | Air Inlet Temp.(°C) | Air inlet temperature |
| | Air Outlet Temp.(°C) | Air outlet temperature |
| | REC IGBT Temp.(°C) | REC IGBT temperature of the phase A/B/C |
| | INV IGBT Temp.(°C) | INV IGBRT temperature of the phase A/B/C |

**Enter in** Set **to set UPS system**

It includes SysFunc, Language, Comm Set, BATT Set, CHANGE PW, Calibration, Dry contact. And submenu BATT Set, Calibration, Comm Set, Dry contact are only available for service engineer or manufacturer.

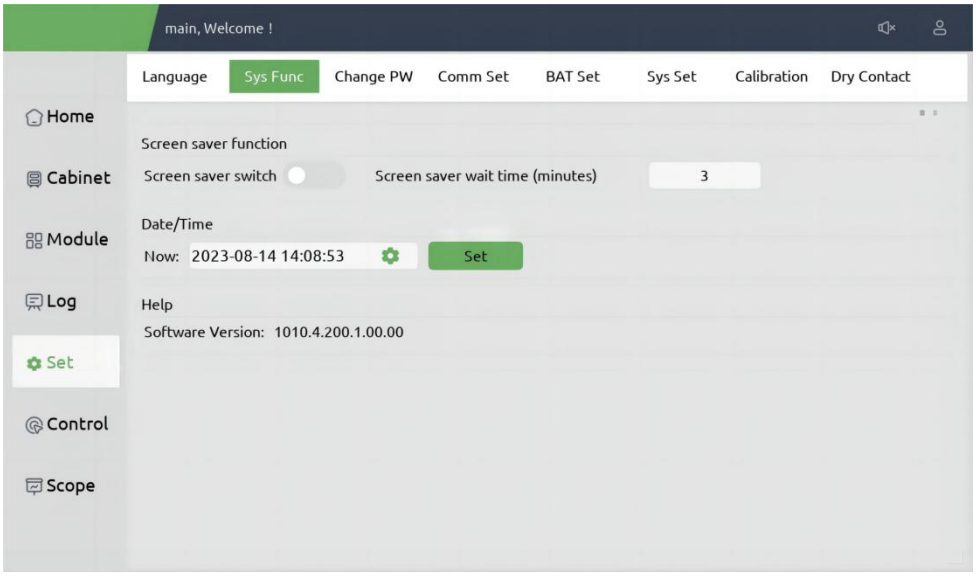



Fig.7-6: Setting Menu

Table.7- 4: Description of details of submenu in Set

| Sub-menu | Contents | Description |
|---|---|---|
| Language | Current language | Displays the currently selected language |
| | Optional language | Simplified Chinese, English and other languages for choice |
| Sys Func | System function setting | Setting screensaver, system time, check memory and software version |
| Comm Set | Comm. interface | Include RS232,RS485,USB |
| | Protocol | Include MEGA protocol、ModBus_ASCII protocol、ModBus_RTU protocol |
| | Baud-rate | Setting the baud-rate |
| | Device Address | Setting the Device address |
| Battery Set | Battery Type | Setting the battery type: VRLA or Lithium |
| | Battery Number | VRLA 12V 32-40 pcs<br>Lithium 3.2V 128-160 pcs |
| | Battery Capacity | Setting of the AH of the battery<br>VRLA Capacity=Battery(12V) Ah* N groups<br>Lithium Capacity=Battery(3.2V) Ah* N groups |
| | Float Charge Voltage/Cell* | Setting the floating Voltage for battery cell<br>VRLA (Cell/2V)＜2.5V;Lithium (Cell/3.2V)＞3V |
| | Boost Charge Voltage/Cell* | Setting the boost Voltage for battery cell<br>VRLA (Cell/2V)＜2.5V;Lithium (Cell/3.2V)＞3V |

| | | |
|---|---|---|
| | EOD Voltage(0.6C)* | EOD voltage for cell battery,@0.6C current<br>VRLA (Cell/2V)＜2V;Lithium (Cell/3.2V)＞2V |
| | EOD Voltage(0.15C)* | EOD voltage for cell battery,@0.15C current<br>VRLA (Cell/2V)＜2V;Lithium (Cell/3.2V)＞2V |
| | Charge Current Percent Limit | Charge current (percentage of the rated current) |
| | Battery Temperature Compensate | Coefficient for battery temperature |
| Sys Set | System Mode | Setting the system mode: Single , parallel, Single ECO, parallel ECO,LBS, parallel LBS |
| | Unit Number | Set the number of UPS in parallel system |
| | Cabinet ID | For parallel system, the ID starts from 0 |
| | Output Voltage Adjustment | Setting the Output Voltage |
| Calibration | Calibration product parameters | Calibration the UPS output voltage |
| Dry contact | Configuration the dry contact | Configuration the dry contact |

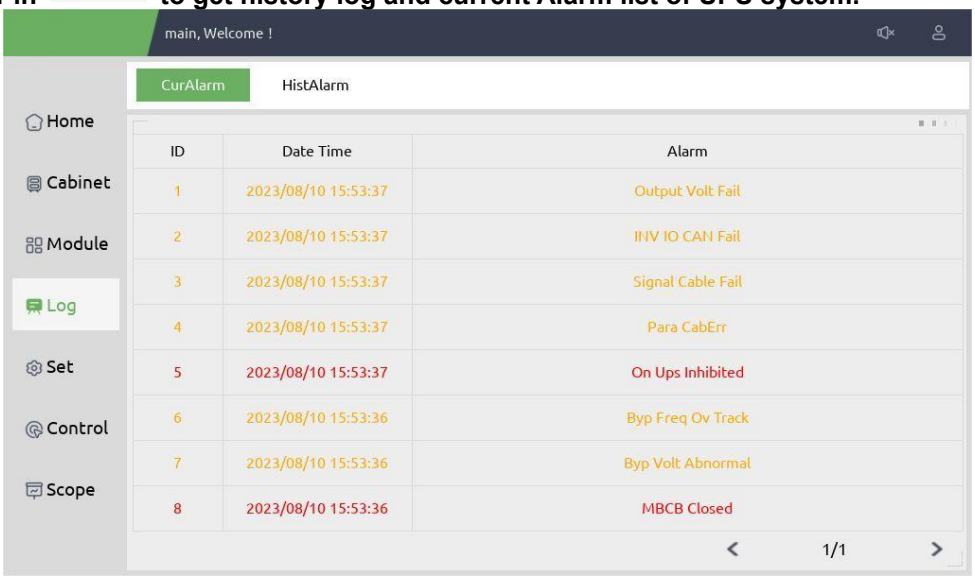
**Note**

**(*) : Please set according to the recommended values of the battery manufacturer.**

**WARNING**

**Ensure the number of the battery, set via the menu or the monitoring software, is completely equal to the real installed number. Otherwise it may cause serious damage to the batteries or the equipment.**

**Enter in** Log **to get history log and current Alarm list of UPS system.**



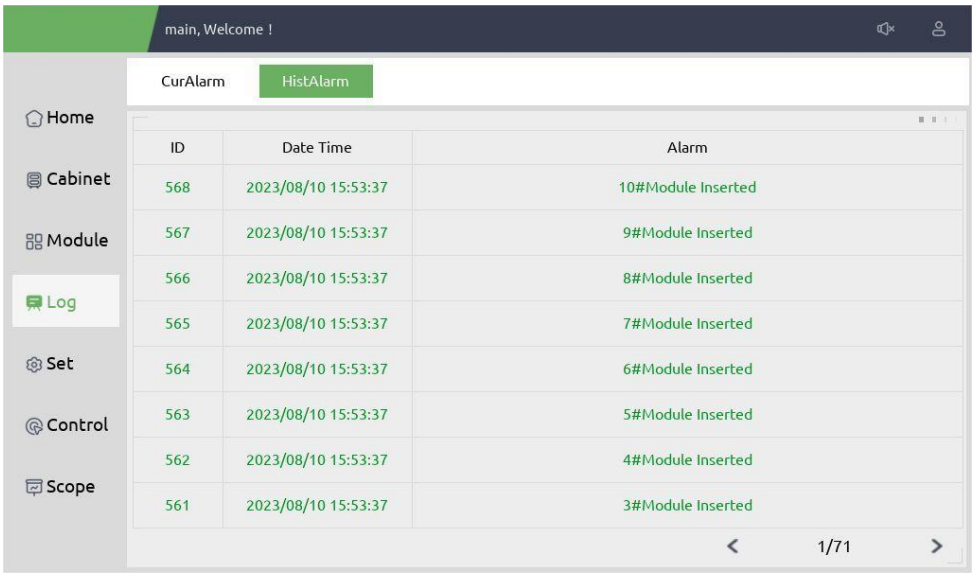
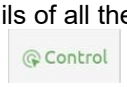
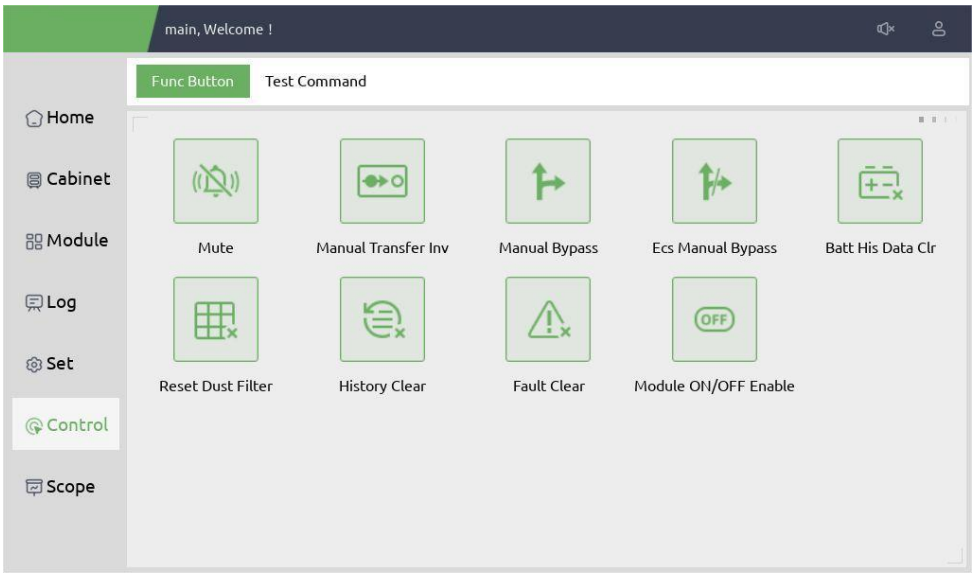



Fig.7-7: History log and current Alarm

The details of all the events are shown as ***Chapter 7-4.***

**Enter in** 

**to enter in UPS command menu.** The function and test command are shown as below:



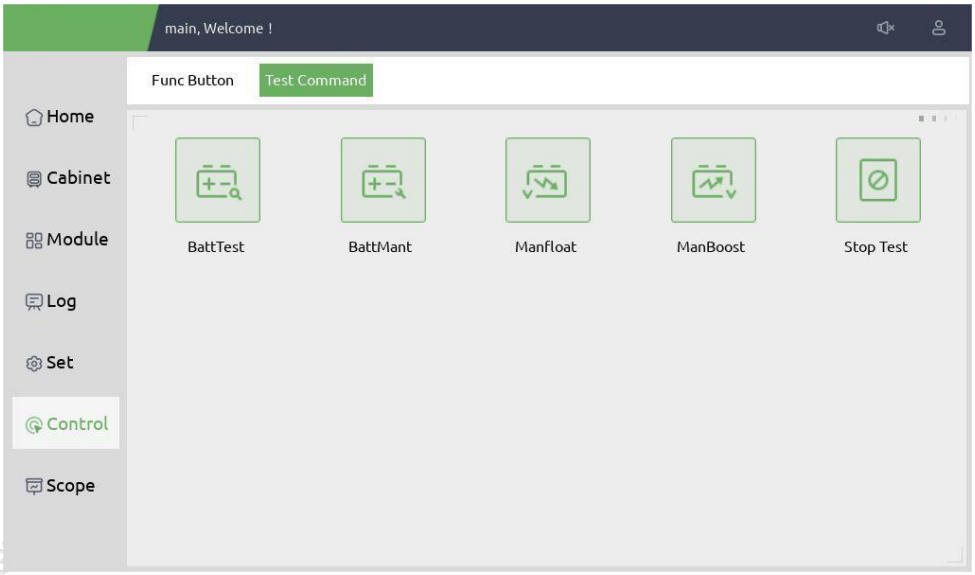
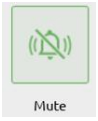
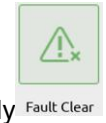



Fig.7- 8: Function and test command

Menu of Operate includes:

***Function***

Mute off or mute on 

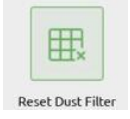

Fault clear manually 


Manually transfer to bypass or escape from bypass mode 


Transfer to inverter mode manually. The output could be interrupted. 


Enable the “OFF” button on the front panel of power module. Then the “OFF” button is available, user can press the button to shutdown the power module. 


Reset battery history data including discharge dates and hours, discharge times. Normally reset battery history data after replacing new batteries. 


Reset dust filter data including days and maintenance period. Normally reset filter data after replacing new filter or washing. 


***Command***


Battery test command . UPS transfer to battery mode to test the condition of battery. If battery voltage is low or battery is failure, UPS will alarm and transfer back to normal mode or transfer to bypass mode. Make sure there is not any warns or alarm, make sure that battery voltage is higher than 90% of float voltage. If battery is normal, UPS will transfer back to battery mode after 20 seconds. If battery test is failure, UPS alarms.


Battery maintenance command . UPS transfer to battery mode. Make sure that there is not any warns or alarm, make sure that battery voltage is higher than 90% of float voltage. If battery is normal, UPS will transfer back to battery mode until battery voltage is down to 105% of EOD voltage and then transfer back to normal mode.


Manually enable charger enter in boost charge to charge the batteries more quickly.


Manually enable charger enter in float charge mode.


Stop battery test or battery maintenance.

**Enter in main menu** 

**to check the waveform of output voltage, current and bypass voltage.**

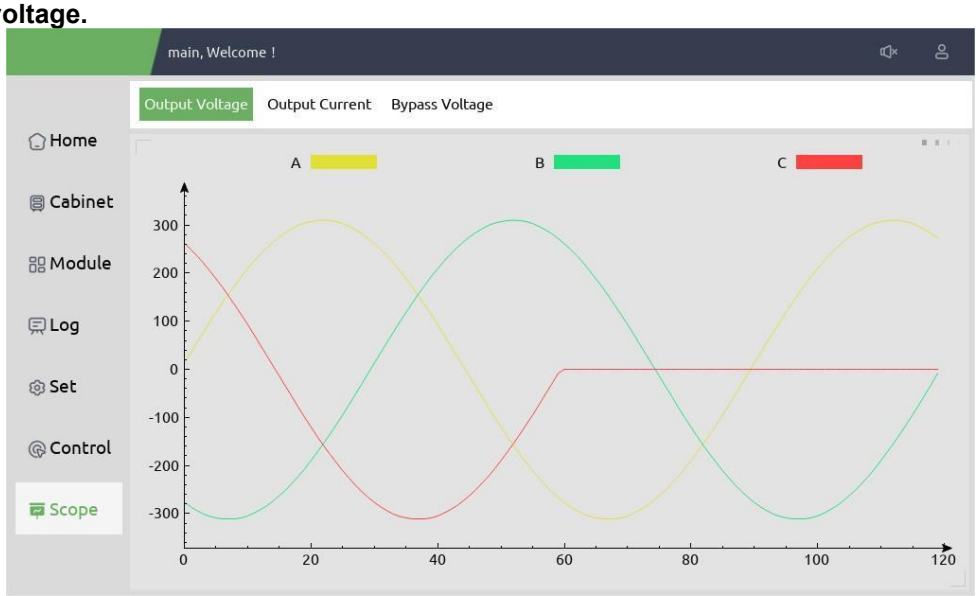



Fig.7-9: output and bypass waveform

## 7.4 UPS Event Log

The follow *table.7-8* gives the complete list of all the UPS events displayed by history record

window and current record window.

Table.7- 5: UPS Event List

| UPS events | Description |
|---|---|
| **Fault Clear** | Manually clear fault |
| **Log Clear** | Manually clear History log |
| **Load On UPS** | Inverter feeds load |
| **Load On Bypass** | Bypass feeds load |
| **No Load** | No load |
| **Battery Boost** | Charger is working in boost charging mode |
| **Battery Float** | Charger is working in float charging mode |
| **Battery Discharge** | Battery is discharging |
| **Battery Connected** | Battery is connected |
| **Battery Not Connected** | Battery is not connected. |
| **Maintenance CB Closed** | Manual maintenance breaker is closed |
| **Maintenance CB Open** | Manual maintenance breaker is opened |
| **EPO** | Emergency Power Off |
| **Module On Less** | Available power module capacity is less then the load capacity. Please reduce the load capacity or add extra power module to make sure that the UPS capacity is big enough. |
| **Generator Input** | Generator is connected and a signal is sent to the UPS. |
| **Utility Abnormal** | Utility (Grid) is abnormal. Mains voltage or frequency exceeds the upper or lower limit and results in rectifier shutdown. Check the input phase voltage of rectifier. |
| **Bypass Sequence Error** | Bypass voltage Sequence is reverse. Check if input power cables are connected correctly. |
| **Bypass Volt Abnormal** | This alarm is triggered by an inverter software routine when the amplitude or frequency of bypass voltage exceeds the limit. The alarm will automatically reset if the bypass voltage becomes normal.<br>First check if relevant alarm exists, such as “bypass circuit breaker open”, “Byp Sequence Err” and “Ip Neutral Lost”. If there is any relevant alarm, first clear this alarm.<br>1. Then check and confirm if the bypass voltage and frequency displayed on the LCD are within the setting range. Note that the rated voltage and frequency are respectively specified by “Output Voltage” and “Output Frequency”.<br>2. If the displayed voltage is abnormal, measure the actual bypass voltage and frequency. If the measurement is abnormal, check the external bypass power supply. If the alarm occurs frequently, use the configuration software to increase the bypass high limit set point according to the user’s suggestions |
| **Bypass Module Fail** | Bypass Module Fails. This fault is locked until power off. Or bypass fans fail. |
| **Bypass Module Over Load** | Bypass current is over the limitation. If bypass current is under 125% of the rated current. The UPS alarms but has no action. |
| **Bypass Over Load Tout** | The bypass overload status continues and the overload times out. |

| | |
|---|---|
| **Byp Freq Over Track** | This alarm is triggered by an inverter software routine when the frequency of bypass voltage exceeds the limit. The alarm will automatically reset if the bypass voltage becomes normal.<br>First check if relevant alarm exists, such as “Byp Sequence Err” and “Input Neutral Lost”. If there is any relevant alarm, first clear this alarm.<br>Then check and confirm if the bypass frequency displayed on the LCD are within the setting range. Note that the rated frequency are respectively specified by “Output Frequency”.<br>If the displayed voltage is abnormal, measure the actual bypass frequency. If the measurement is abnormal, check the external bypass power supply. If the alarm occurs frequently, use the configuration software to increase the bypass high limit set point according to the user’s suggestions |
| **Exceed Tx Times Lmt** | The load is on bypass because the output overload transfer and re-transfer is fixed to the set times during the current hour. The system can recover automatically and will transfer back to the inverter with 1 hour |
| **Output Short Circuit** | Output shorted Circuit.<br>Fist check and confirm if loads have something wrong.<br>Then check and confirm if there is something wrong with terminals, sockets or some other power distribution unit.<br>If the fault is solved, press “Fault Clear” to restart UPS. |
| **Battery EOD** | Inverter turned off due to low battery voltage. Check the mains power failure status and recover the mains power in time |
| **Battery Test** | System transfer to battery mode for 20 seconds to check if batteries are normal |
| **Battery Test OK** | Battery Test OK |
| **Battery Maintenance** | System transfer to battery mode until battery voltage is down to 1.1*EOD voltage to maintain battery string |
| **Battery Maintenance OK** | Battery maintenance succeed |
| **Module inserted** | Power Module is inserted in system. |
| **Module Exit** | Power Module is pulled out from system. |
| **Rectifier Fail** | The N# Power Module Rectifier Fail, The rectifier is fault and results in rectifier shutdown and battery discharging. |
| **Inverter Fail** | The N# Power Module Inverter Fail. The inverter output voltage is abnormal and the load transfers to bypass. |
| **Rectifier Over Temp.** | The N# Power Module Rectifier Over Temperature. The temperature of the rectifier IGBTs is too high to keep rectifier running. This alarm is triggered by the signal from the temperature monitoring device mounted in the rectifier IGBTs. The UPS recovers automatically after the over temperature signal disappears.<br>If over temperature exists, check:<br>1. Whether the ambient temperature is too high.<br>2. Whether the ventilation channel is blocked.<br>3. Whether fan fault happens.<br>4. Whether the input voltage is too low. |
| **Fan Fail** | At least one fan fails in the N# power module. |
| **Output Over load** | The N# Power Module Output Over Load. This alarm appears when the load rises above 100% of nominal rating. The alarm automatically resets once the overload condition is removed. |

| | |
|---|---|
| | 1. Check which phase has overload through the load (%) displayed in LCD so as to confirm if this alarm is true.<br>2. If this alarm is true, measure the actual output current to confirm if the displayed value is correct.<br>Disconnect non-critical load. In parallel system, this alarm will be triggered if the load is severely imbalanced. |
| **Inverter Overload Tout** | N# Power Module Inverter Over Load Timeout. The UPS overload status continues and the overload times out.<br>Note:<br>The highest loaded phase will indicate overload timing-out first.<br>When the timer is active, then the alarm “unit over load” should also be active as the load is above nominal.<br>When the time has expired, the inverter Switch is opened and the load transferred to bypass.<br>If the load decreases to lower than 95%, after 2 minutes, the system will transfer back to inverter mode. Check the load (%) displayed in LCD so as to confirm if this alarm is true. If LCD displays that overload happens, then check the actual load and confirm if the UPS has over load before alarm happens. |
| **Inverter Over Temp.** | The N# Power Module Inverter Over Temperature.<br>The temperature of the inverter heat sink is too high to keep inverter running. This alarm is triggered by the signal from the temperature monitoring device mounted in the inverter IGBTs. The UPS recovers automatically after the over temperature signal disappears.<br>If over temperature exists, check:<br>Whether the ambient temperature is too high.<br>Whether the ventilation channel is blocked.<br>Whether fan fault happens.<br>Whether inverter overload time is out. |
| **On UPS Inhibited** | Inhibit system transfer from bypass to UPS (inverter). Check:<br>Whether the power module’s capacity is big enough for load.<br>Whether the rectifier is ready.<br>Whether the bypass voltage is normal. |
| **Manual Transfer Byp** | Transfer to bypass manually |
| **Esc Manual Bypass** | Escape from “transfer to bypass manually” command. If UPS has been transferred to bypass manually, this command enable UPS to transfer to inverter. |
| **Battery Volt Low** | Battery Voltage is Low. Before the end of discharging, battery voltage is low warning should occur. After this pre-warning, battery should have the capacity for 3 minutes discharging with full load. |
| **Battery Reverse** | Battery cables are connected not correctly. |
| **Inverter Protect** | The N# Power Module Inverter Protect. Check:<br>Whether inverter voltage is abnormal<br>Whether inverter voltage is much different from other modules, if yes, please adjust inverter voltage of the power module separately. |
| **Input Neutral Lost** | The mains neutral wire is lost or not detected. For 3 phases UPS, it’s recommended that user use a 3-poles breaker or switch between input power and UPS. |
| **Bypass Fan Fail** | At least one of bypass module Fans Fails |
| **Manual** | The N# Power Module is manually shutdown. The power module |

| | |
|---|---|
| **Shutdown** | shuts down rectifier and inverter, and there's on inverter output. |
| **Manual Boost Charge** | Manually force the Charger work in boost charge mode. |
| **Manual Float Charge** | Manually force the charger work in float charge mode. |
| **UPS Locked** | Forbidden to shutdown UPS power module manually. |
| **Parallel Cable Error** | Parallel cables error. Check:<br>If one or more parallel cables are disconnected or not connected correctly<br>If parallel cable round is disconnected<br>If parallel cable is OK |
| **Lost N+X Redundant** | Lost N+X Redundant. There is no X redundant powers module in system. |
| **EOD Sys Inhibited** | System is inhibited to supply after the battery is EOD (end of discharging) |
| **Battery Test Fail** | Battery Test Fail. Check if UPS is normal and battery voltage is over 90% of float voltage. |
| **Battery Maintenance Fail** | Check<br>If UPS is normal and not any alarms<br>If the battery voltage is over 90% of float voltage<br>If load is over 25% |
| **Ambient Over Temp** | Ambient temperature is over the limit of UPS. Air conditioners are required to regulate ambient temperature. |
| **REC CAN Fail** | Rectifier CAN bus communication is abnormal. Please check if communication cables are not connected correctly. |
| **INV IO CAN Fail** | IO signal communication of inverter CAN bus is abnormal. Please check if communication cables are not connected correctly. |
| **INV DATA CAN Fail** | DATA communication of inverter CAN bus is abnormal. Please check if communication cables are not connected correctly. |
| **Power Share Fail** | The difference of two or more power modules' output current in system is over limitation. Please adjust output voltage of power modules and restart UPS. |
| **Sync Pulse Fail** | Synchronization signal between modules is abnormal. Please check if communication cables are not connected correctly. |
| **Input Volt Detect Fail** | Input voltage of N# power module is abnormal.<br>Please check if the input cables are connected correctly.<br>Please check if input fuses are broken.<br>Please check if utility is normal. |
| **Battery Volt Detect Fail** | Battery voltage is abnormal.<br>Please check if batteries are normal.<br>Please check if battery fuses are broken on input power board. |
| **Output Volt Fail** | Output voltage is abnormal. |
| **Bypass Volt Detect Fail** | Bypass voltage is abnormal.<br>Please check if bypass breaker is closed and is good.<br>Please check if bypass cables are connected correctly. |
| **INV Bridge Fail** | Inverter IGBTs are broken and opened. |
| **Outlet Temp Error** | Outlet temperature of power module is over the limitation.<br>Please check if fans are abnormal.<br>Please check if PFC or inverter inductors are abnormal.<br>Please check if air passage is blocked.<br>Please check if ambient temperature is too high. |
| **Input Curr** | The difference of input current between every two phases is |

| | |
|---|---|
| **Unbalance** | over 40% of rated current.<br>Please check if rectifier's fuses, diode, IGBT or PFC diodes are broken.<br>Please check if input voltage is abnormal. |
| **DC Bus Over Volt** | Voltage of DC bus capacitors is over limitation. UPS shutdown rectifier and inverter. |
| **REC Soft Start Fail** | While soft start procedures are finished, DC bus voltage is lower than the limitation of calculation according utility voltage. Please check<br>1. Whether rectifier diodes are broken<br>2. Whether PFC IGBTs are broken<br>3. Whether PFC diodes are broken<br>4. Whether drivers of SCR or IGBT are abnormal<br>5. Whether soft start resistors or relay are abnormal |
| **Relay Connect Fail** | Inverter relays are opened and cannot work or fuses are broken. |
| **Relay Short Circuit** | Inverter relays are shorted and cannot be released. |
| **PWM Sync Fail** | PWM synchronizing signal is abnormal |
| **Intelligent Sleep** | UPS works in intelligent sleep mode. In this mode, the power modules will be standby in turn. It will be more reliability and higher efficiency. It must be confirmed that remained power modules' capacity is big enough to feed load. It must be conformed that working modules' capacity is big enough if user add more load to UPS. It's recommended that sleeping power modules are waken up if the capacity of new added loads is not sure. |
| **Manual Transfer to INV** | Manually transfer UPS to inverter. It's used to transfer UPS to inverter when bypass is over tracking. The interrupt time could be over 20ms. |
| **Input Over Curr Tout** | Input over current timeout and UPS transfer to battery mode.<br>Please check if input voltage is too low and output load is big. Please regulate input voltage to be higher if it's possible or disconnect some loads. |
| **No Inlet Temp. Sensor** | Inlet temperature sensor is not connected correctly. |
| **No Outlet Temp. Sensor** | Outlet temperature sensor is not connected correctly. |
| **Inlet Over Temp.** | Inlet air is over temperature. Make sure that the operation temperature of UPS is between 0-40°C. |
| **Capacitor Time Reset** | Reset timing of DC bus capacitors. |
| **Fan Time Reset** | Reset timing of fans. |
| **Battery History Reset** | Reset battery history data. |
| **Byp Fan Time Reset** | Reset timing of bypass fans. |
| **Battery Over Temp.** | Battery is over temperature. It's optional. |
| **Bypass Fan Expired** | Working life of bypass fans is expired, and it's recommended that the fans are replaced with new fans. It must be activated via software. |
| **Capacitor Expired** | Working life of capacitors is expired, and it's recommended that the capacitors are replaced with new capacitors. It must be activated via software. |

| | |
|---|---|
| **Fan Expired** | Working life of power modules' fans is expired, and it's recommended that the fans are replaced with new fans. It must be activated via software. |
| **INV IGBT Driver Block** | Inverter IGBTs are shutdown.<br>Please check if power modules are inserted in cabinet correctly.<br>Please check if fuses between rectifier and inverter are broken. |
| **Battery Expired** | Working life of batteries is expired, and it's recommended that the batteries are replaced with new batteries. It must be activated via software. |
| **Bypass CAN Fail** | The CAN bus between bypass module and cabinet is abnormal. |
| **Dust Filter Expired** | Dust filter need to be clear or replaced with a new one |
| **Stop Test** | Manually stop battery test or battery maintenance, UPS transfer back to normal mode. |
| **Wave Trigger** | Waveform has been saved while UPS fail |
| **Bypass CAN Fail** | Bypass and cabinet communicate with each other via CAN bus. Check<br>If connector or signal cable is abnormal.<br>If monitoring board is abnormal. |
| **Firmware Error** | Manufacturer used only. |
| **System Setting Error** | Manufacturer used only. |
| **Bypass Over Temp.** | Bypass module is over temperature. Please check<br>If bypass load is overload<br>If ambient temperature is over 40°C<br>If bypass SCRs are assembled correctly<br>If bypass fans are normal |
| **Module ID Duplicate** | At least two modules are set as same ID on the power connector board, please set the ID as correct sequence |

# 8 Product Specification

This chapter provides UPS product specification.

## 8.1 Applicable Standards

The UPS has been designed to conform to the following European and international standards:

Table.8- 1: Compliance with European and International Standards

| Item | Normative reference |
|---|---|
| General safety requirements for UPS used in operator access areas | EN50091-1-1/IEC62040-1-1/AS 62040-1-1 |
| Electromagnetic compatibility (EMC) requirements for UPS | EN50091-2/IEC62040-2/AS 62040-2(C3) |
| Method of specifying the performance and test requirements of UPS | EN50091-3/IEC62040-3/AS 62040-3(VFI SS 111) |
| **Note:** The above mentioned product standards incorporate relevant compliance clauses with generic IEC and EN standards for safety (IEC/EN/AS60950), electromagnetic emission and immunity (IEC/EN/ AS61000 series) and construction (IEC/EN/AS60146 series and 60950). | |

## 8.2 Environmental Characteristics

Table.8- 2: Environmental Properties

| Items | Unit | Requirements |
|---|---|---|
| Acoustic noise level at 1 meter | dB | 61.0(power module) |
| Altitude of Operation | m | ≤3000m above sea level, derate power by 2% per 100m between 3000m and 4000m |
| Relative Humidity | %RH | 0 to 95%, non condensation |
| Operating Temperature | °C | 0 to 40 deg , Battery life is halved for every 5°C increase above 25°C |
| UPS Storage-Transport Temperature | °C | -20~70 |
| Recommended Battery Storage Temperature | °C | 0~25 (20°C for optimum battery storage) |

## 8.3 Mechanical Characteristics

Table.8- 3: Mechanical Properties

| Cabinet Specification | Unit | 6 slots | 8 slots | 12 slots |
|---|---|---|---|---|
| Mechanical Dimension, W×D×H | mm | 800*1000*2000 | 800*1000*2000 | 1200*1100*2000 |
| Weight | kg | 300 | 450 | 680 |
| Color | N/A | Black | | |

| | | | |
|---|---|---|---|
| Protection Level, IEC(60529) | N/A | IP20 | |
| Module type | | Unit | 100kVA |
| Mechanical Dimension, W×D×H | | mm | 475×705×140 |
| Net Weight | | kg | 45 |
| Color | | N/A | Black(front) |

**Note**

**Wheels or holders of cabinets are not included in dimension. Please refer to *Chapter 4* to get detailed dimension.**

## 8.4 Input Characteristics

Table.8- 4: Mains input

| Items | Unit | Parameter |
|---|---|---|
| Rated AC Input Voltage | Vac | 380/400/415(three-phase and sharing neutral with the bypass input) |
| Input voltage range | Vac | -20%~+25% |
| Frequency | Hz | 50/60(range: 40Hz～70Hz) |
| Power factor | kW/kVA, full load | 0.99 |
| THD | THDI% | 3 |

## 8.5 Battery Characteristics

Table.8- 5: Battery Information

| Items | Unit | Parameters |
|---|---|---|
| Battery bus voltage | Vdc | Nominal: ±192-300V |
| Quantity of lead-acid cells | Nominal | 480V=40*6cell(12V) |
| Float charge voltage | V/cell (VRLA) | 2.25V/cell(selectable from 2.2V/cell~2.35V/cell)<br>Constant current and constant voltage charge mode |
| Temperature compensation | mV/°C /cl | -3.0(selectable from : 0~-5.0, 25°C or 30°C, or inhibit) |
| Ripple voltage | %V float | ≤1 |
| Ripple current | %C10 | ≤5 |
| Boost charge voltage | V/cell (VRLA) | 2.4V/cell(selectable from : 2.30V/cell～2.45V/cell)<br>Constant current and constant voltage charge mode |
| End of discharging voltage | V/cell (VRLA) | 1.65V/cell(selectable from : 1.60V/cell～1.750V/cell)<br>@0.6C discharge current<br>1.75V/cell (selectable from : 1.65V/cell～1.8V/cell)<br>@0.15C discharge current<br>(EOD voltage changes linearly within the set range according to discharge current) |
| Battery Charging Power | kW | 10%* UPS capacity (selectable from : 1~15%* UPS capacity) |

## 8.6 Output Characteristics

Table.8- 6: Inverter Output (to Critical Load)

| Rated capacity (kVA) | Unit | 100~1200 |
|---|---|---|
| Rated AC voltage | Vac | 380/400/415(three-phase four-wire and sharing neutral with the bypass) |
| Frequency | Hz | 50/60 |
| overload | % | 110% load, 1 hour<br>125% load, 10min<br>150% load, 1min<br>>150% load, 200ms |
| Fault current | % | 300% short current limitation for 200ms |
| Non linear load Capability | % | 100% |
| Neutral current capability | % | 170% |
| THD | % | <1(linear load) , <3(non linear load) |
| Synchronization Window | - | Rated frequency ±2Hz(selectable: ±1~±5Hz) |
| Max change rate of synch frequency | Hz/s | 1: selectable: 0.1~5 |
| Inverter voltage range | %V(ac) | ±5 |

## 8.7 Bypass Characteristics

Table.8- 7: Bypass Input

| Slot | Unit | 6-12 Slots |
|---|---|---|
| Rated AC Voltage | Vac | 380/400/415<br>three-phase four-wire, sharing neutral with the rectifier input and providing neutral reference for the output |
| Rated current | A | 160-2000 |
| Overload | % | <110%, long term<br><125%, 10 mins<br><150%, 1min<br>>150%, 100ms |
| Superior protection bypass line | N/A | Thermal-magnetic breaker, the capacity is 125% of rated current output. IEC60947-2 curve C |
| Current rating of neutral cable | A | 1.7×In |
| Frequency | Hz | 50/60 |
| Switch time (between bypass and inverter) | ms | Synchronized switch: 0ms |
| Bypass voltage | % Vac | Upper limit: +10,+15,+20, +25, default: +15<br>Lower limit: -10, -20, -30 or -40, default:-20 |

| | | |
|---|---|---|
| tolerance | | (acceptable stable bypass voltage delay: 10s) |
| Bypass frequency tolerance | % | ±2.5, ±5, ±10 or ±20, default: ±10 |
| Synchronization-Window | Hz | Rated frequency±2Hz (selectable from ±0.5Hz～±5Hz) |

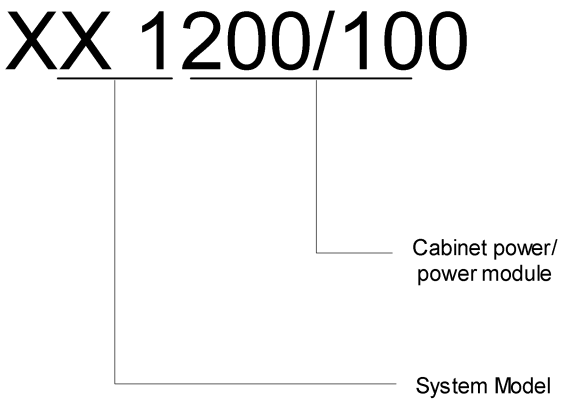
## 8.8 Efficiency

Table.8- 8: Efficiency

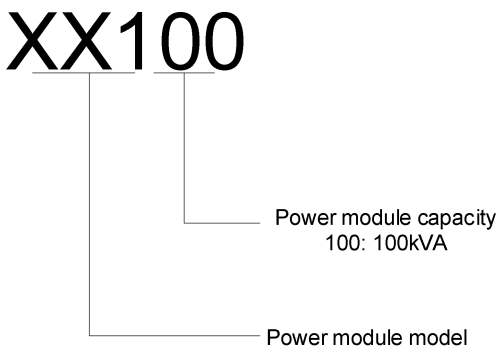
| Efficiency | | |
|---|---|---|
| Normal mode(dual conversion) | % | Up to 96.5 |
| ECO mode | % | 99 |
| Battery discharging efficiency (DC/AC) (battery at nominal voltage 480Vdc and full-rated linear load) | | |
| Battery mode | % | 95 |

# Annex A Guide for Ordering and Selection of UPS System

The UPS system includes two parts: cabinet and power modules. The model of cabinet is shown as following:




The model of power module is shown as following:



# Annex B. Parallel Setting

If finish connecting all parallel cables and connection, set each unit in parallel system via software:

Enter in **“** 

**→SysSet”** to set **“system Mode”** as **parallel**.

Set **“Unit Number”** according to actual system.

Set **“Cabinet ID”** as “0 or 1, 2…8”, make sure that all unit ID are different. For example, 4 units are in parallel system, set the ID as 0, 1, 2, 3.

## Operational Summary & Support

The GT M Series 100~1200kVA Modular UPS delivers stable, continuous power for servers, network devices, and data center infrastructure.
Follow the installation, operation, and maintenance procedures to ensure reliable performance, extend equipment life, and maintain long-term efficiency.
Perform regular inspections and battery checks, keep ventilation paths clear, and avoid unauthorized internal repairs. Always comply with applicable electrical safety regulations.
For technical assistance or after-sales support, contact our service team. Our engineers are committed to maintaining reliable operation of your critical power systems.

## About Gottogpower

Gottogpower provides UPS systems and integrated power solutions for data centers and industrial applications worldwide.
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