RM Series Intelligent Modular UPS

User and installation Manual

Version: V1.0

INVT Power System(Shenzhen) CO., LTD provides full technical supports to customers, who may contact the local office or directly contact the company headquarters.

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Safety Precautions

This manual is about the installation and operation of INVT RM Series modular UPS(Hereinafter referred to as UPS)

Please carefully read this manual prior to installation.

The UPS must be debugged and maintained by the engineer commissioned by the manufacturer or the agent. Otherwise, human safety may be endangered and the damage of UPS shall not belong to the warranty scope.

 APPLICABLE STANDARDS
This product complies with CE 73/23 & 93/68 (low voltage safety) and 89/336 (EMC) , and EMC standards of Australia and New Zealand (C-Tick) , and the following UPS product standards: *IEC62040-1-1-General and safety requirements for use in operator access area *IEC/EN62040-2 EMC requirements CLASS C3 *IEC62040-3 Performance requirements and test methods

 WARNING- High earth leakage current
Earth connection is critical before connecting the input supply (include both utility supply and battery) . This equipment must be earthed in accordance with local electrical authority codes of practice. Earth leakage current exceeds 3.5 mA and is less than 1000 mA. Transient and steady-state earth leakage currents, which may occur when starting the equipment, should be taken into account when selecting instantaneous RCCB or RCD devices. Residual Current Circuit Breakers (RCCBs) must be selected insensitive to DC unidirectional pulses (class A) and transient current pulses (RCCBs). Note it that the earth leakage currents of the load will also flow across RCCB or RCD.

 Components that can be maintained by user
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 only be accessed by opening the protective cover with tools cannot be maintained by user. 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. 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 Voltage Higher Than 400Vdc
All the battery maintenance and servicing procedures involving internal access need special tools or keys and should be carried out only by trained personnel. SPECIAL CARE SHOULD BE TAKEN WHEN WORKING WITH THE BATTERIES ASSOCIATED WITH THIS EQUIPMENT. 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.

Contents

Chapter 1 Installation

This chapter introduces the installation of RM series UPS(hereby referred to as UPS), including initial checking, sitting, positioning, cabling and installation drawings.

1.1 Introduction

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

As each site has its requirements, this chapter provides step-by-step installation instructions, which acts as a guide to the general procedures and practices that should be observed by the installing engineer.

 Warning-Installation can only be done by authorized engineers
1. Do not apply electrical power to the UPS equipment before the approval of commissioning engineer. 2. The UPS should be installed by a qualified engineer in accordance with the information contained in this chapter.

 Note: 3-Phase 4-Wire Input Power is required
The standard UPS can be connected to TN, TT and IT AC distribution system (IEC60364-3) of 3-phase 5-wire

 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 contact with the skin, the affected area should be washed immediately with water.

1.2 Initial Checking

Perform the following checking operations prior to the UPS installation.

1. Visually examine if there is any damage inside and outside the UPS rack and battery equipment due to the transportation. Report any such damage to the shipper immediately.
2. Verify the product label and confirm the correctness of the equipment. The equipment label is attached on the back of front door. The UPS model, capacity and main parameters are marked on the label.

1.3 Positioning

1.3.1 Distribution Room

The UPS is designed for indoor installation, which shall be located in a clean environment with adequate ventilation to keep the environmental temperature within the required specification. The 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.

If necessary, a system of extractor fans should be installed to aid cooling-air flow. An air filter should be used when the UPS is to operate in a dirty environment and should be regularly cleaned to maintain airflow.

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

1.3.2 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, a battery protection device (a DC circuit breaker) must be mounted as close as possible to the batteries, and the connecting cables should be as short as possible.

1.3.3 Storing

If the equipment is not installed immediately, it must be stored in a room so as to protect it against excessive humidity and heat sources. The battery needs to be stored in dry and cool place with good ventilation. The most suitable storage temperature is 20 ºC to 25ºC.

1.4 Disassembly, Initial Checking and Positioning

Check the packaging first upon the arrival of product to see if there is any damage; open the packaging to check the equipment; report any such damage to the shipper immediately.

1.4.1 System Packaging:

Open the wooden case first, the open method is shown in fig 1-1:

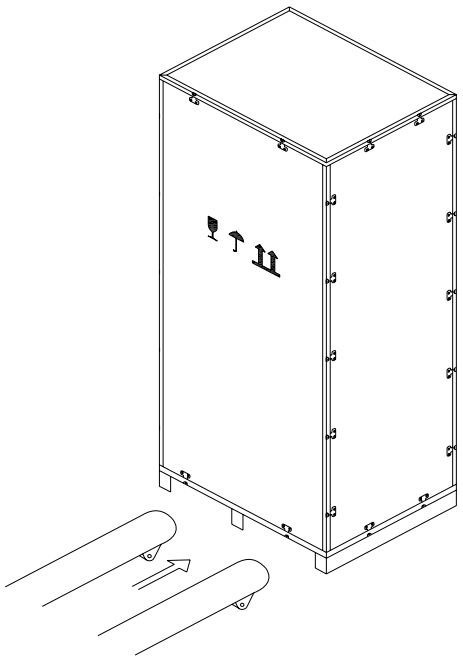


Fig 1-1 Open method

Firstly, open the top plate of the steel-edged wooden case with slotted awl and plier, followed by sideboards. Be careful not to scratch the product. See fig 1-2.

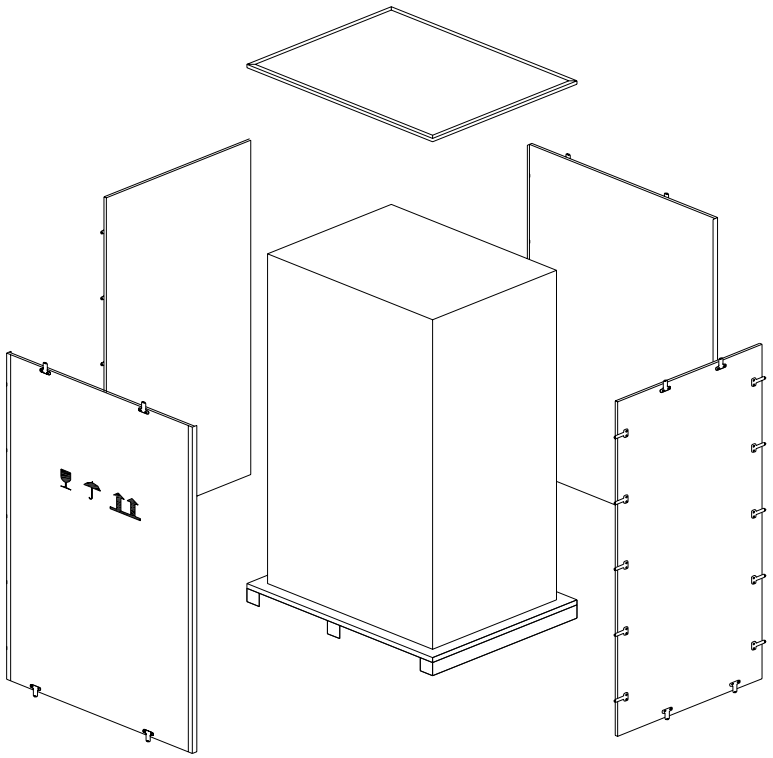


Fig 1-2 Disassemble the case

Take out the foam after disassembling the sideboards of the case as shown in fig 1-3.

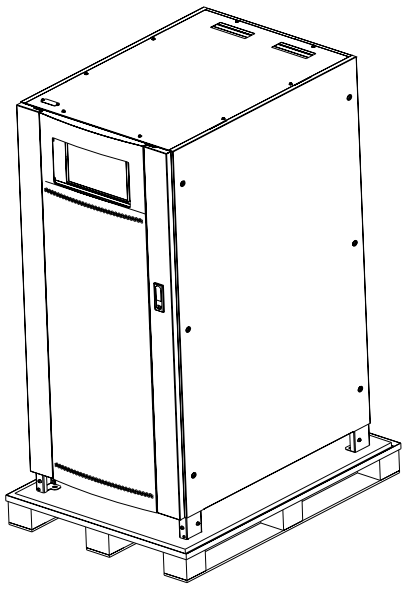


Fig 1-3 Complete the disassembly

Tip: Dismantle the bolt that connects the cabinet and wooden pallet after disassembly, then lift the cabinet to installation position. The dismantlement should be careful so as not to scratch the body.

Verify the product label and confirm the correctness of the equipment. The equipment label is attached on the back of front door. The UPS model, capacity and main parameters are marked on the label.

1.4.2 Module Packaging:

The open method is shown in fig 1-4:

The packing case should be placed horizontal and stable;

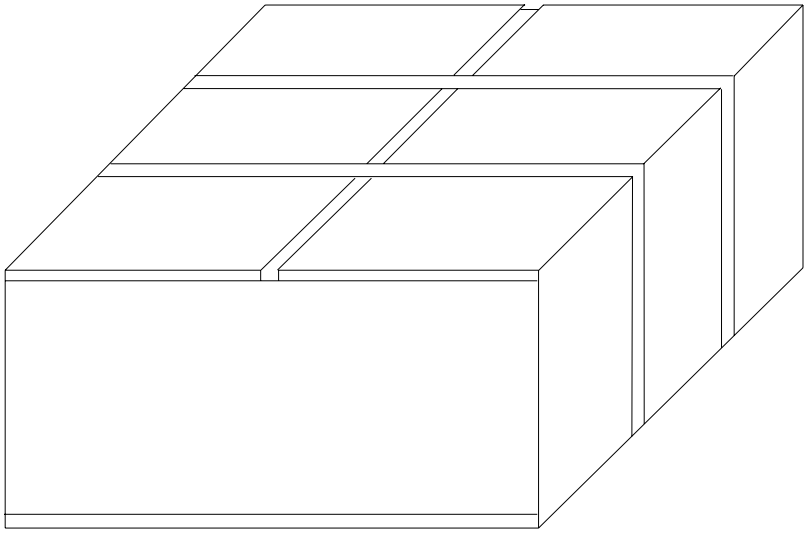


Fig 1-4 Open method

Cut the plastic packing belt and scotch tape to open the carton, see fig 1-5:

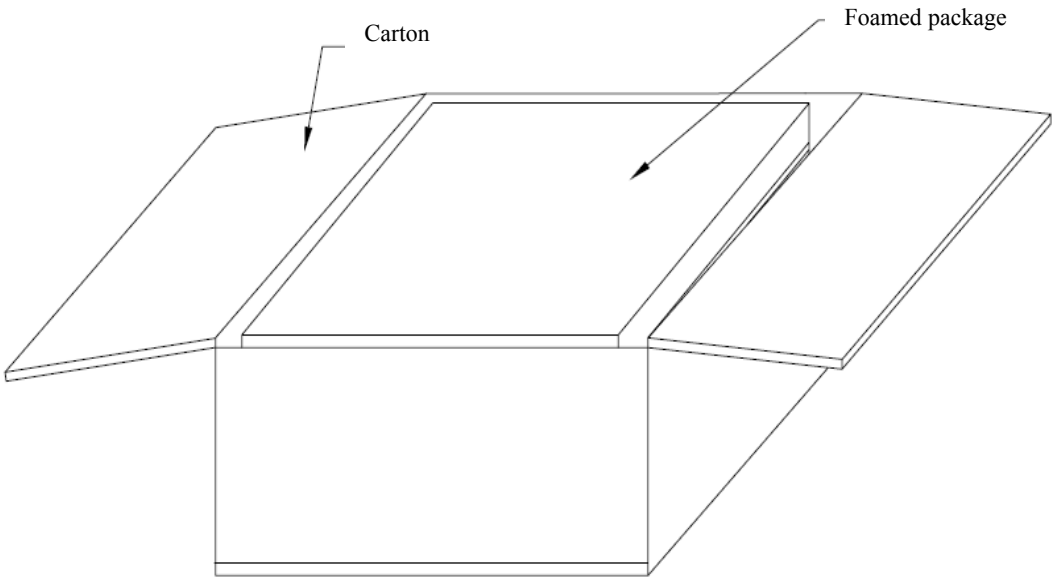


Fig 1-5 Open the carton

Open the foamed cover, the equipment with plastic package can be see as shown in fig 1-6:

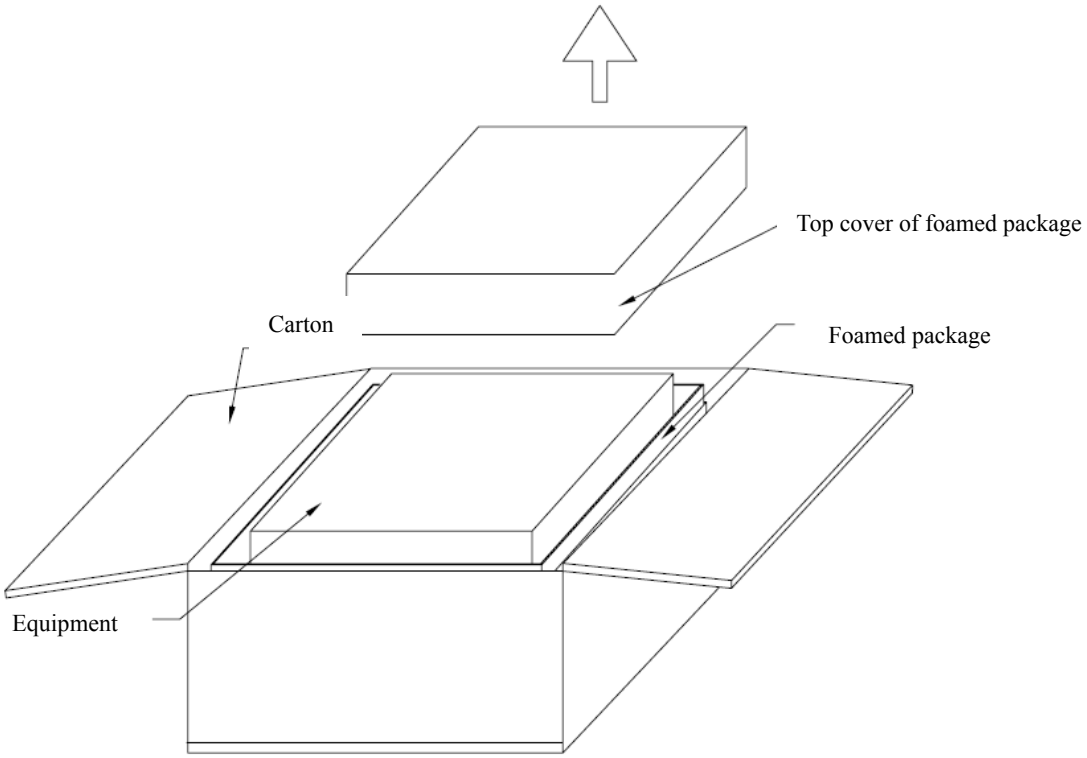


Fig 1-6 Open the foamed cover

At last, take out the equipment with plastic package, and dismantle the packaging materials.

Warm Tips: Please dispose the wasted materials in accordance with environmental protection requirements after disassembly.

To prolong the service life, the place chosen for the UPS must guarantee:

- Easy wiring
- Sufficient space for operation
- Air sufficient enough to dispel heat produced by UPS
- Against ambient corrosive gases
- Against excessive humidity and heat sources
- Against dust
- With the current fire prevention requirements
- The operating environment temperature is within 20℃～25℃. The batteries are at maximum efficiency in this temperature range (for information about the battery storage and transportation as well as the environment, please refer to table 6-2)

1.4.3 UPS Composition

UPS composition shall refer to fig 1-7, UPS configuration shall refer to table 1-1.

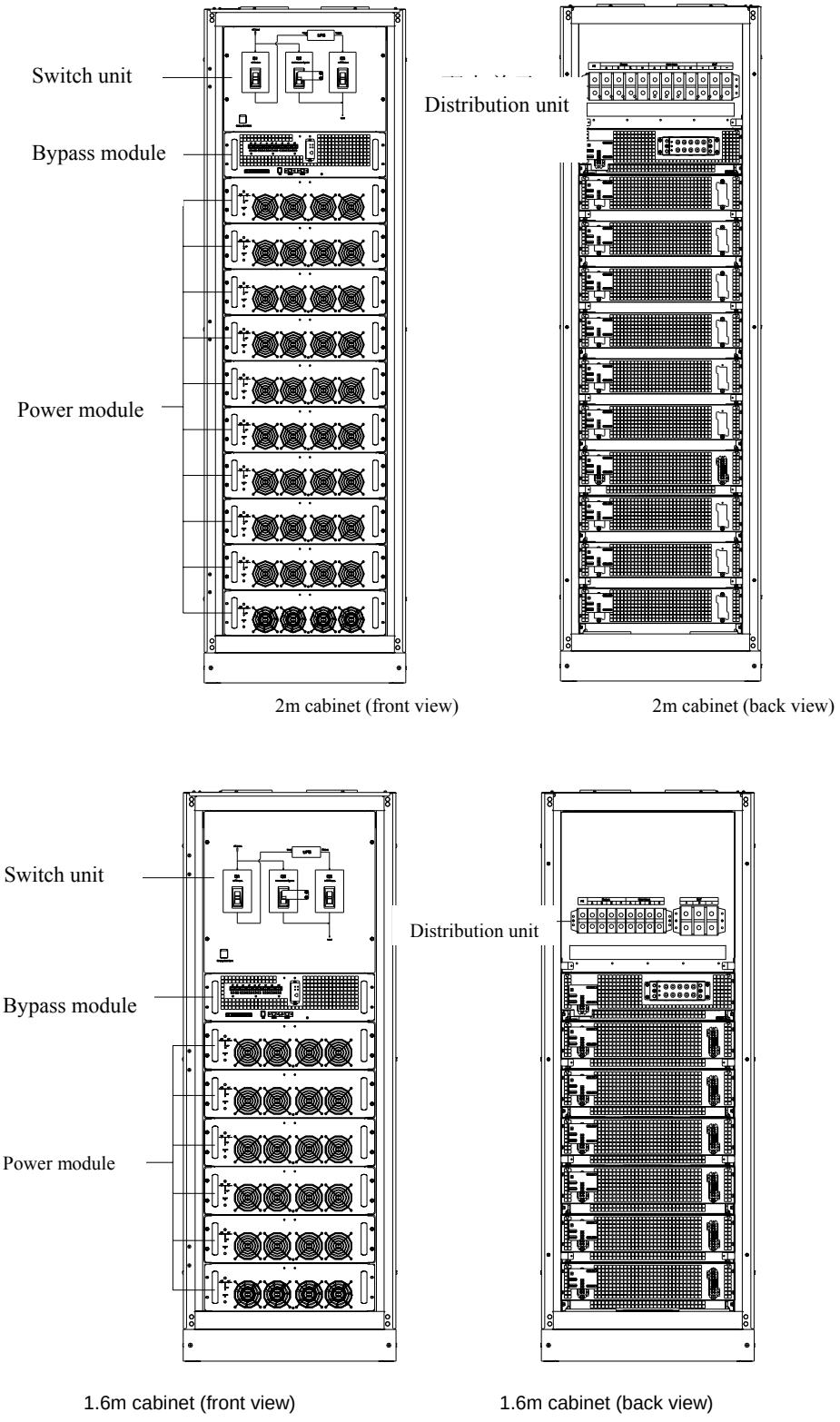


Fig 1-7 UPS Composition Diagram

Table 1-1 UPS Configuration Table

	Involved part name	Quantity (Piece)	Note
Cabinet	Switch PDU	1	Standard configuration
	Monitoring + bypass module	1	Standard configuration
Power module	Power module	1～6 or 1～10	Field installation is required

1.4.4 Operation Space

As UPS has no ventilation grills at either sides, no clearances are required for the sides.

To enable routine tightening of power terminations within the cabinet, it is recommended that clearance around the front and back of the equipment should be sufficient to enable free passage of personnel with the doors fully opened.

1.4.5 Front and Back Access

The component layout of the UPS supports front and back access for servicing, diagnosing and repairing the UPS, thus reducing the space requirement for side access.

1.4.6 Final Positioning

When the equipment has been finally positioned, ensure the adjustable feet are set so that the UPS will remain stationary and stable.

1.4.7 Power Module Installation

The installation position of power module and output distribution module are shown in fig 1-8. the installation principle of these module is to installed from bottom to top to prevent inclination of the cabinet due to high center of gravity .

As is shown in fig 1-8, the installation procedure of power module is as follows:

1. Each module shall be installed from bottom to top, the default setting of the system is module No. 1, 2, 3, 4, 5, 6, 7, 8, 9, and 10.
2. Insert the module into installation position, and push in the cabinet. The wiring terminals in between shall be tight, and excessive force shall be prevented against the damage to inserted pins of the terminals.
3. Fix the module to the cabinet though the mounting holes on two sides of the front plate of the module.

Fig 1-8 Power Module Installation Diagram

1.4.8 Cable Entry

Cables can enter the UPS from top and below as shown in fig 1-9. Both the top and bottom of the UPS have cable entrance.

The recommended installation practice is to install power cables in the entrance channel at both sides of the cabinet back door, so as not to affect the ventilation.

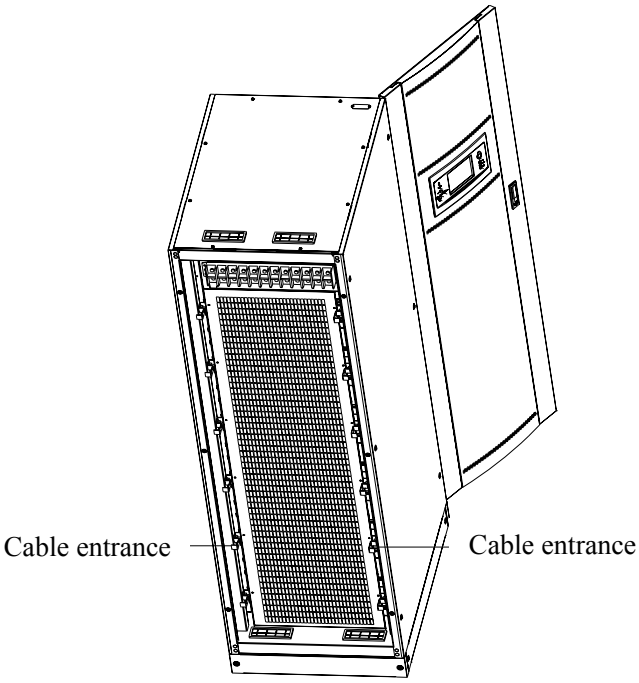


Fig 1-9 Cable Entry Diagram

1.5 Protective Devices

For safety concerns, it is recommended 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.

1.5.1 Rectifier and Bypass Input Supply of the UPS

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 Table 1).Generally, the magnetic circuit breaker with IEC60947-2 tripping curve C (normal) at the 125% of the current listed in table 1-1 is recommended.

Note
For IT power network system, 4-pole protective device must be installed on the external input distribution of the UPS.

If protection against earth faults (RCD devices) is required for the upstream of the input supply, the installed device should:

- Sensitive to DC unidirectional pulses (class A) in the network
- Insensitive to transient current pulses
- Have an average sensitivity that is adjustable between 0.3A～1A

The RCCB must be sensitive to DC unidirectional pulses (class A) in the network, while insensitive to transient current pulses, as shown in fig 1-10 respectively.

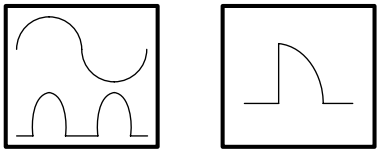


Fig 1-10 RCCB sign

1.5.2 Battery

A battery unit is composed of 40 batteries connected in series, a centreline is drawn from in between (the joint part between the 20th and 21st battery), plus the line drawn from the front and back, there are altogether 3 lines connected with UPS line contact bank. The battery line must push through a DC circuit breaker before connecting to corresponding UPS line contact bank. The detailed wiring please refer to fig 1-11 below:

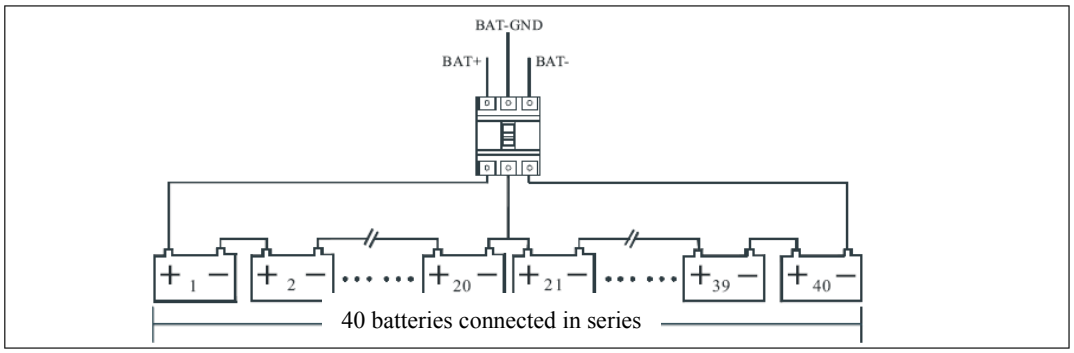


Fig 1-11 Diagram of batteries connected in series

1.5.3 UPS Output

A main output switch has been installed in UPS, the user shall install the over current protective device on the bypass of each output of the external distribution cabinet.

1.6 Power Cables

Design the cables according to the descriptions in this section and local regulatory wiring standards, and the environmental conditions should be taken into consideration. Refer to IEC60950-1 Table 3B.

Warning
Prior to cabling the UPS, confirm the status and positions of the switches of the UPS rectifier input power supply / bypass power supply and mains power distribution board. Ensure that these switches are opened and attached with WARNING label so as to prevent unauthorized operation to these switches.

1.6.1 Maximum stable state current and configuration of cable system, please refer to table 1-2.

Table 1-2 Maximum stable state current and configuration of cable system

System Name		RM-060/10	RM-090/15	RM-120/20	RM-100/10	RM-150/15	RM-200/20
Capacity	System capacity	60kVA	90kVA	120kVA	100kVA	150kVA	200kVA
	Module capacity	10kVA	15kVA	20kVA	10kVA	15kVA	20kVA
	Cabinet dimension	600*900*1600**(W*D*H mm)**			600*900*2000**(W*D*H mm)**		
Main Input	Rated current A	90	136	180	150	227	300
	Cable mm^2	25	35	50	50	75	75
Output	Rated current A	90	136	180	150	227	300
	Cable mm^2	25	35	50	50	75	75
Battery	Rated current A	106	160	212	178	265	355
	Cable mm^2	35	50	75	50	75	90
PE	Cable mm^2	35	50	75	50	75	90

Warning

FAILURE TO FOLLOW ADEQUATE EARTHING PROCEDURES CAN RESULT IN EMI, ELECTRIC SHOCK HAZARD OR RISK OF FIRE.

1.6.2 Cable Connection

Note

The operations described in this section must be performed by authorized electricians or qualified technical personnel.. If you have any difficulties, do not hesitate to contact our Customer Service & Support department at the address given at the beginning of this manual.

After the equipment has been finally positioned and secured, connect the power cables as described in the following procedures:

1. Verify that all the external input distribution switches of the UPS are completely opened and the UPS internal maintenance bypass switch is opened. Attach necessary warning signs to these switches to prevent unauthorized operation.
2. Open the back door of the cabinet, remove the cover and then the input and output terminal, battery terminal and earth terminal are visible..
3. Connect the input earth wire to input earth terminal. Please note: the earth wire shall be connected in accordance with related local or state regulation
4. For common bypass and rectifier inputs, connect the AC input supply cables to the UPS input terminals (Main input A-B-C-N), and connect the output loaded cable to the UPS output terminals (Output A-B-C-N) and tighten the connections to 13 Nm (M8 Bolt). **ENSURE CORRECT PHASE ROTATION.**
5. Connect the battery cables between the UPS battery terminals and battery switch. **ENSURE CORRECT PHASE ROTATION.**

Warning-Hazardous battery terminal voltage of 400Vdc

Ensure the correct polarity connection between the battery terminals and the UPS terminals: Positive terminal to positive terminal, negative terminal to negative terminal, and disconnect one or more than one cable between every two layers of batteries. Do not connect the cables and close the battery circuit breakers before getting the approval from the commissioning engineer.

6. Re-install all the protective covers.

1.7 Control and Communication Cabling

As shown in fig 1-12, the front panel of the bypass module will provide dry contact interface (J2~J10), communication interface (RS232, 485 and SNMP card interface), as well as LBS interface.

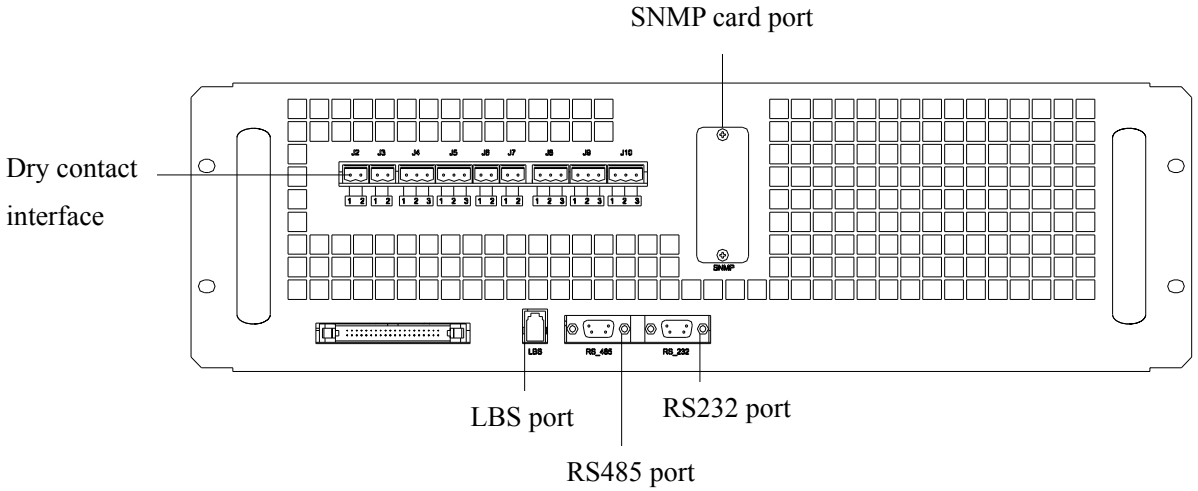


Fig 1-12 Dry contact interface and communication interface

The UPS accepts external signal from zero-voltage (dry) contacts connected through external dry contact terminals produced and phoenix terminals that are in bypass module. Through software programming, these signals become active when these contacts connect to +24V to ground).The cables connected to DRY terminal must be separated from power cables. Moreover, these cables should be double insulated with a typical 0.5 to 1.5 mm^2 cross-section area for a maximum connection length between 25 and 50 meters.

1.7.1 Dry Contact Interface of Battery and Environmental Temperature Detection

The input dry contact J2 and J3 can detect the temperature of batteries and environment respectively, which can be used in environment monitoring and battery temperature compensation 1.

J2 and J3 interfaces diagram are shown in fig 1-13, the description of interface is in table 1-3.

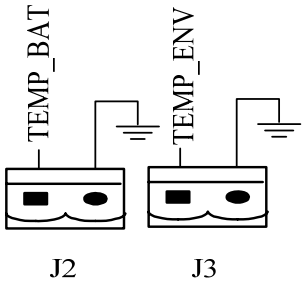


Fig 1-13 Diagram of J2 and J3 dry contact for temperature detecting

Table 1-3 Description of input dry contact interface J2 and J3

Position	Name	Purpose
J2.1	TEMP_BAT	Battery temperature detection
J2.2	GND	Power ground
J3.1	TEMP_ENV	Environment temperature detection
J3.2	GND	Power ground

Position	Name	Purpose
J2.1	TEMP_BAT	Battery temperature detection
J2.2	GND	Power ground
J3.1	TEMP_ENV	Environment temperature detection
Note: 1. Specified temperature sensor is required for temperature detection (R25=5Ohm, B25/50=3275), please confirm with the manufacturer, or contact local maintenance engineers when placing an order.		

1.7.2 Remote EPO Input Port

The UPS has an Emergency Power OFF (EPO) function. This function can be activated by pressing a button on the control panel of the UPS or through a remote contact provided by the user. The EPO pushbutton is protected by a hinged plastic cover.

J4 is the input port for remote EPO. It requires shorting NC and +24v during normal operation, and the EPO is triggered when opening NC and +24v, or shorting NO and +24v. The port diagram is shown in fig 1-14, and port description is shown in table 1-4.

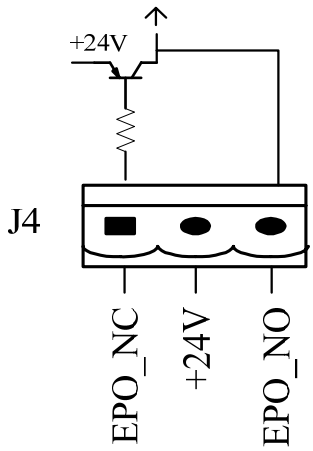


Fig 1-14 Diagram of input port for remote EPO

Table 1-4 Description of input port for remote EPO

Position	Name	Purpose
J4.1	EPO_NC	EPO is activated when disconnecting fromJ4.2
J4.2	＋12V	+24V, connect the common terminal of NC and NO
J4.3	＋12V	EPO is activated when shorting with J4.2

The EPO is triggered when shorting pin 2 and 3 or opening pin 2 and 1 of J4.

If an external emergency stop facility is required, it is connected via the reserved terminals of J10.The external emergency stop facility needs to use shielded cables to connect to the normally open/closed remote stop switch between these two pins. If this facility is not used, then pin 3 and pin 4 of J4 must be open, or pin 1 and pin 2 of J4 must be shorted.

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 1 and 2 of J4 have been shorted before the UPS is delivered

1.7.3 Generator Input Dry Contact

J5 is status interface for generator connection. Connect pin 2 of J5 with + 24 power supply, it indicates that the generator has been connected with the system. The interface diagram is shown in fig 1-15, and interface description is shown in table 1-5.

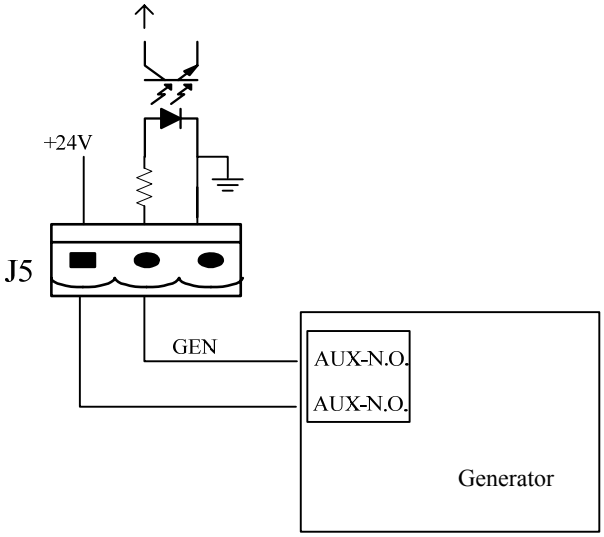


Fig 1-15 Diagram of status interface and connection of generator

Table 1-5 Description of maintenance bypass switch and output switch status interface

Position	Name	Purpose
J5.1	+24V	+24V power supply
J5.2	GEN	Connection status of generator
J5.3	GND	Power ground

1.7.4 BCB Input Port

J6 and J7 are the ports of BCB. The port diagram is shown in fig 1-16, and description is shown in table 1-6.

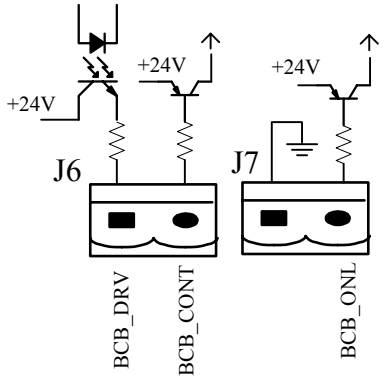


Fig 1-16 BCB Port

Table 1-6 Description of BCB port

Position	Name	Description
J6.1	BCB_DRV	BCB actuating signal, provide the actuating signal of +18V, 20mA
J6.2	BCB_CONT	BCB contact status, connect with the normally open signal of BCB
J7.1	GND	Power ground
J7.2	BCB_ONL	BCB on-line–input (normally open) , BCB is on-line when the signal is connecting with GND

1.7.5 Battery Warning Output Dry Contact Interface

J8 is the output dry contact interface, which outputs the battery warnings of low or excessive voltage, when the battery voltage is lower than set value, an auxiliary dry contact signal will be provided via the isolation of a relay. The interface diagram is shown in fig 1-17, and description is shown in table 1-7.

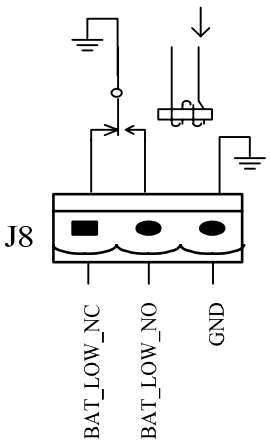


Fig 1-17 Battery warning dry contact interface diagram

Table 1-8 Battery warning dry contact interface description

Position	Name	Purpose
J8.1	BAT_LOW_NC	Battery warning relay (normally closed) will be open during warning
J8.2	BAT_LOW_NO	Battery warning relay (normally open) will be closed during warning
J8.3	GND	Center of battery warning relay

1.7.6 Integrated Warning Output Dry Contact Interface

J9 is the integrated warning output dry contact interface, when one or more than one preset warning is triggered, the system will send an integrated warning information, and provide an auxiliary dry contact signal via the isolation of a relay. The interface diagram is shown in fig 1-18, and description is shown in table 1-8.

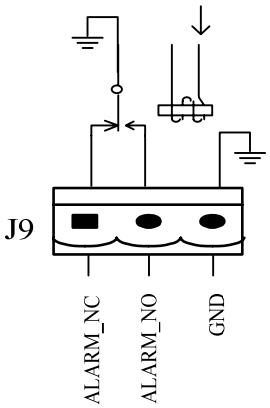


Fig 1-18 Integrated warning dry contact interface diagram

Table 1-8 Integrated warning dry contact interface description

Position	Name	Purpose
J9.1	ALARM_NC	Integrated warning relay (normally closed) will be open during warning
J9.2	ALARM_NO	Integrated warning relay (normally open) will be closed during warning
J9.3	GND	Centre of integrated warning relay

1.7.7 Mains Failure Warning Output Dry Contact Interface

J10 is the output dry contact interface for mains failure warning, when the mains fails, the system will send a mains failure warning information, and provide an auxiliary dry contact signal via the isolation of a relay. The interface diagram is shown in fig 1-19, and description is shown in table 1-9.

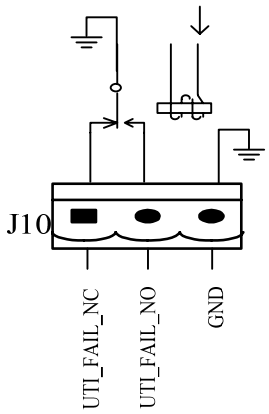


Fig 1-19 Mains failure warning dry contact interface diagram

Table 1-9 Mains failure warning dry contact interface description

Position	Name	Purpose
J9.1	UTI_FAIL_NC	Mains failure warning relay(normally closed) will be open during warning
J9.2	UTI_FAIL_NO	Mains failure warning relay normally open) will be closed during warning
J9.3	GND	Centre of mains failure warning relay

1.7.8 RS232 Port and SNMP Card Port

RS232 and RS485 Port: provide serial data which can be used for commissioning and maintenance by authorized engineers or maintainers, or can be used for networking or integrated monitoring system in the service room.

SNMP Card Port: used for field installation of the communication option card(SNMP card).

1.7.9 LBS (Load Bus Synchronizer) Port

The dual bus system (DBS) consists of two independent UPS rack module systems, as shown in fig 1-20. The dual bus system is configured for high availability and is suitable for powering the load with dual inputs. If the load is single-input load, the static transfer switch and LBS control is recommended to maintain both UPS outputs synchronized for uninterrupted transfers. Please install the system according to the installation descriptions for different system configurations.

The dual bus system is supported by UPS, it requires connecting the LBS signal cables of two UPS when constructing the dual bus system; please refer to relevant chapter for detailed configuration and installation, and the system software shall be configured as required.

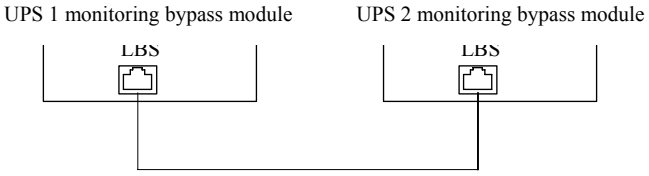


Fig 1-20 LBS Connection Diagram

1.8 Installation Drawing

Please refer to fig 1-21, fig 1-22, fig 1-23 and fig 1-24:

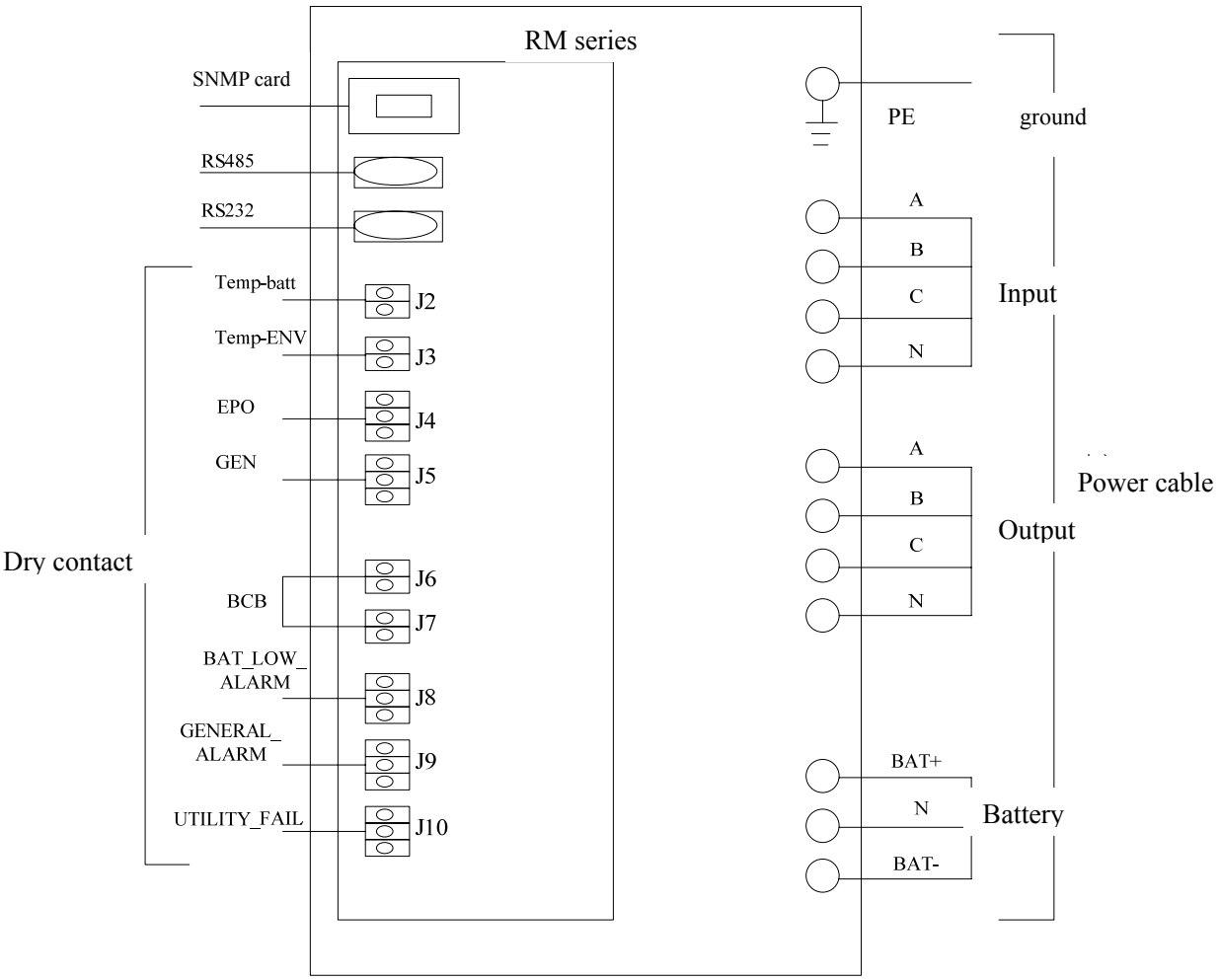
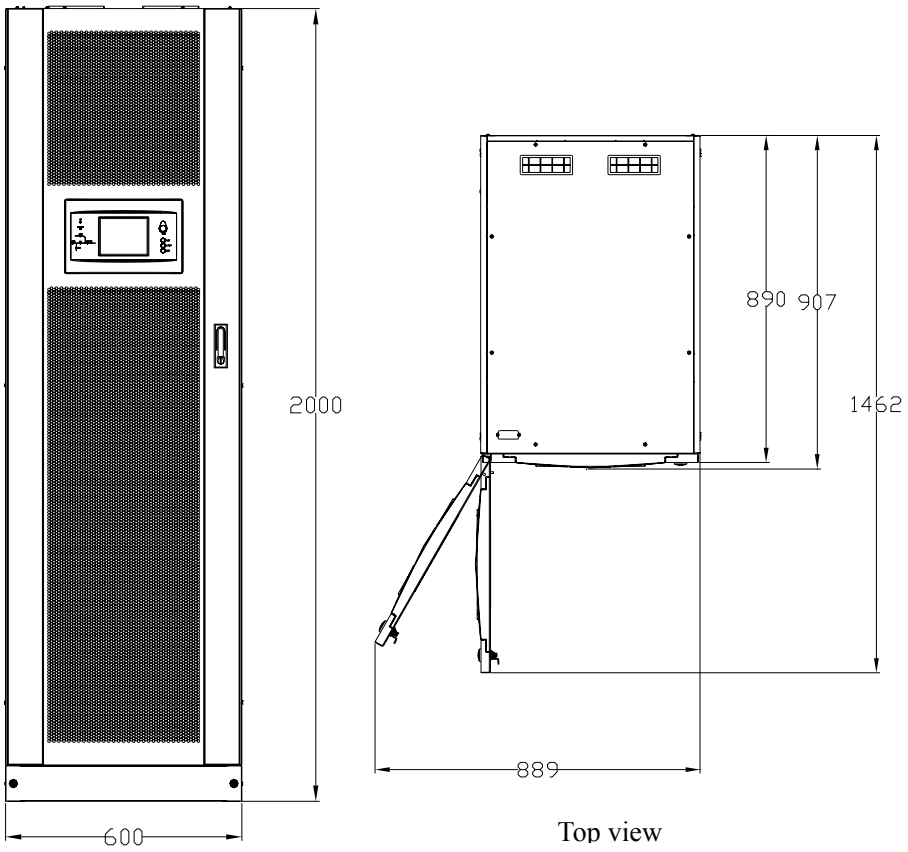


Fig 1-21 Installation Diagram



2m cabinet front view

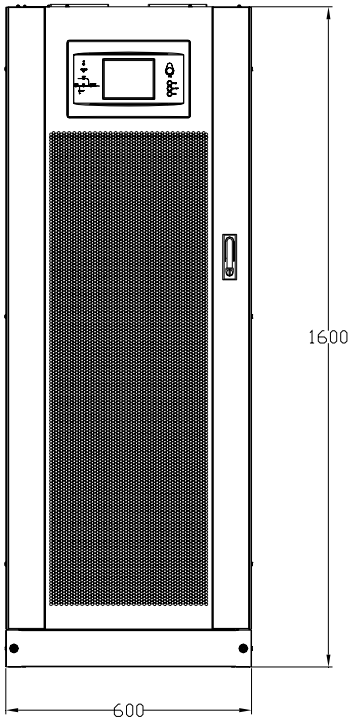
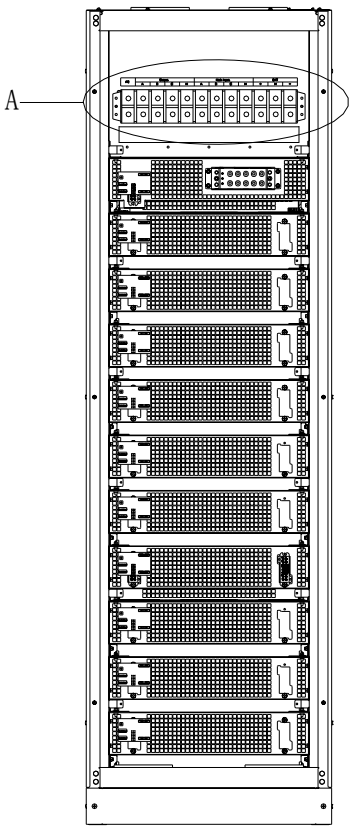
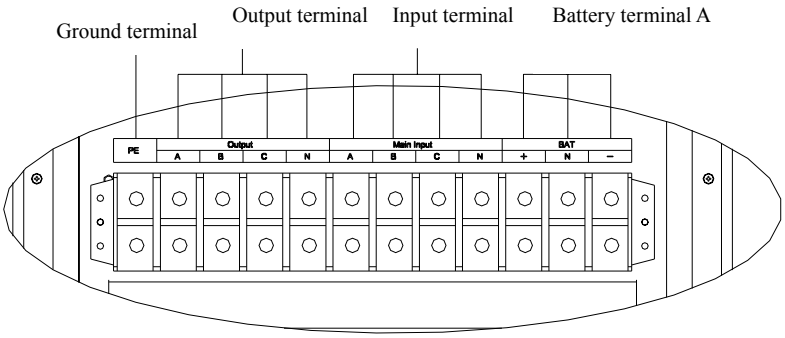


Fig 1-22 UPS front view (Unit: mm)

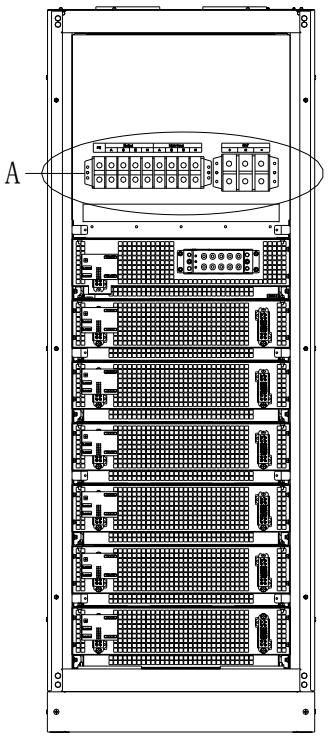
1.6 m cabinet (front view)

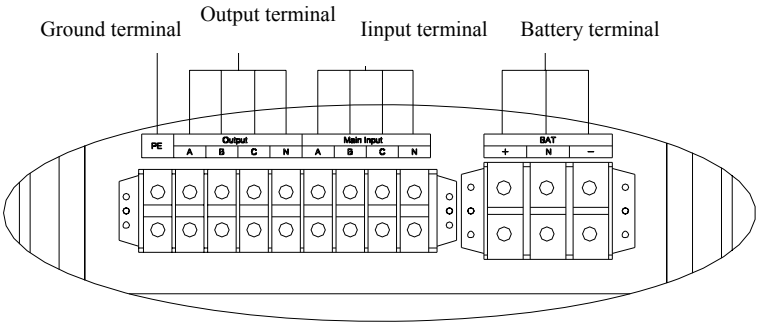




Amplification of A

2m cabinet

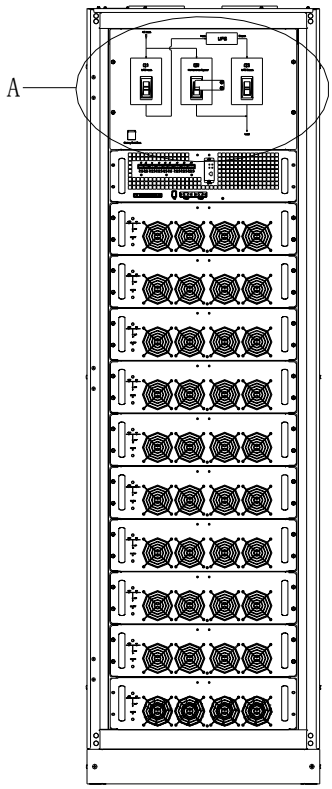


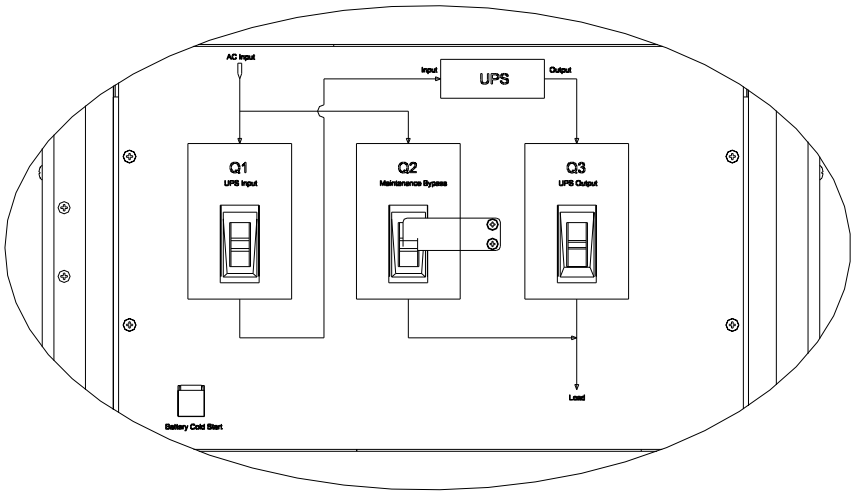


Amplification of A

1.6m cabinet

Fig 1-23 UPS back view





Amplification of A

Fig 1-24 UPS front view

Chapter 2 Operations

This chapter introduces the basic knowledge of UPS operations, including working principle, operation mode, battery management and protection.

 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.

2.1 Introduction

UPS provides the critical load (such as communication and data processing equipment) with high quality uninterruptible AC power. The power from UPS is free from voltage and frequency variations and disturbances (interruption and spike) experienced at the Mains AC input supply.

This is achieved through high frequency double conversion power pulse width modulation (PWM) associated with full digital signal processing control (DSP), which features high reliability and convenience for use.

2.1.1 Principle

As shown in fig 2-1, the AC input mains source is supplied at UPS input and converted into a DC source. This DC source feeds the Inverter that converts the DC source into a clean and input independent AC source. The battery powers the load through the inverter in case of an AC input mains power failure. The utility source can also power the load through the static bypass.

When the UPS needs maintenance or repair, the load can be transferred to maintenance bypass without interruption and the power module and bypass module can be removed for maintenance.

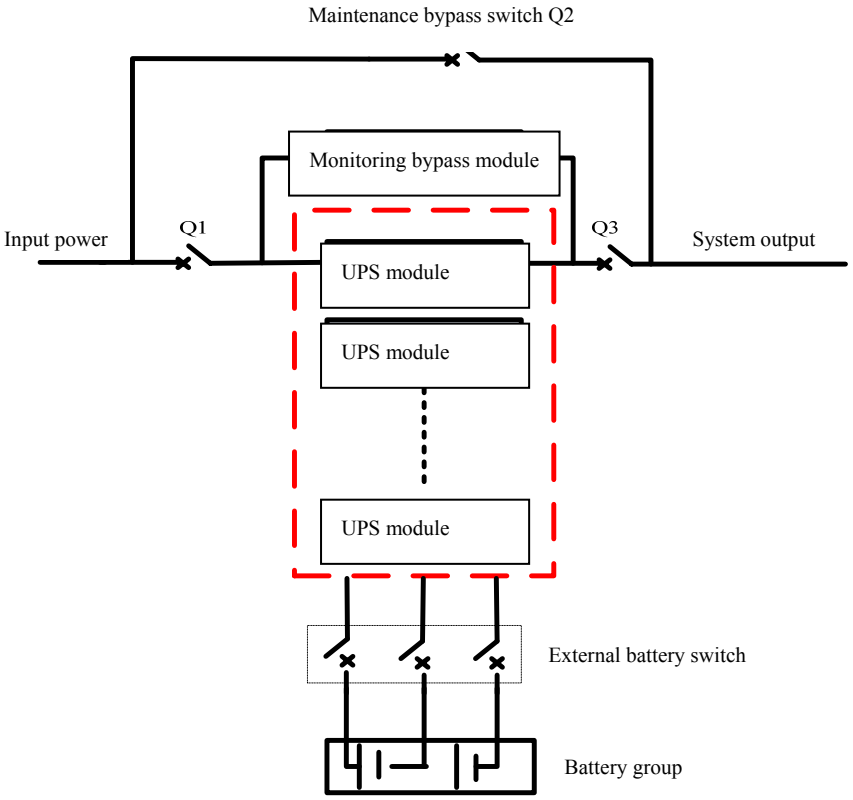


Fig 2-1System principle framework

2.1.2 Bypass Module

The circuit blocks labeled “bypass module” in fig 2-1 contain electronically controlled switching 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.

2.2 Operation Mode

The RM UPS is an on-line, double-conversion, reverse-transfer UPS that permits operation in these modes::

- Normal mode
- Battery mode
- Auto-Restart mode
- Bypass mode
- Maintenance mode (manual bypass)

- ECO mode
- Frequency converters mode

2.2.1 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.

2.2.2 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.

Note: UPS can also be started through battery (charged) mode via battery cold start function upon failure of the AC mains. Therefore, the battery power can be used independently to improve the utilization rate of UPS.

2.2.3 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.

During the process of delay time, the battery will be charged by UPS to prevent any risks to load equipment from future mains failure.

2.2.4 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.

2.2.5 Maintenance Mode

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.

Note: This manual bypass switch is fitted in all UPS modules. Transfer UPS system to bypass module for power supply first, then close maintenance bypass switch Q2, followed by Q1 and Q3.

 Warning: hazard may occur after transferring to maintenance bypass
After UPS being transferred to maintenance bypass, power module and bypass module do not work, no display on LCD, and input and output terminals as well as N bus are electrically connected.

2.2.6 ECO Mode

If economical (ECO) mode is selected, the double-conversion UPS will stop to work so as to save energy. During the operation of ECO mode, the load power will be supplied by bypass preferentially. When bypass power is within the range of normal frequency and voltage, load power will be supplied by bypass, or the system will transfer to inverter input, followed by load power interruption which extends within 3/4 of the utility period. E.g. when the frequency is 50Hz, the interruption time will be less than 15ms; when the frequency is 60Hz, the time will be less than 12.5ms.

2.2.7 Frequency Converters Mode

If the frequency converter configuration is used by UPS, it will provide 50Hz or 60Hz stable output frequency. The range of output frequency is 40Hz～70Hz. Under this mode, static bypass is unavailable, but battery can be selected according to the actual requirements of battery mode.

2.3 Battery Management

2.3.1 Normal Function

The following functions should be fitted by commissioning engineers with specified software.

1. Constant current boost charging

   Current can be set up.

2. 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.

3. 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.

4. Float charge temperature compensation (optional)

   A coefficient of temperature compensation can be set as required by the type of battery.

5. 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) or 0.9 to 1.1 V per cell

6. Battery low warning time

   It is adjustable between 3 and 60 minutes. The default is 5 minutes.

2.3.2 Advanced Functions (Battery Self-checking and Maintenance)

At periodic intervals, 20% of the rated capacity of the battery will be discharged automatically, and the actual load must exceed 20% of the rated UPS (KVA) capacity. If the load is less than 20%, auto-discharge cannot be executed. The periodic interval can be set from 30 to 360 days. The battery self-test can be disabled.

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

Trigger—Manually through the command of “Battery Maintenance Test” in LCD panel or automatically

Battery Self-Test Interval—30-360 days (default setting is battery self-test disabled).

2.4 Battery Protection

The following functions should be fitted by commissioning engineers with specified software.

1. Battery Low Pre-warning

The battery under voltage 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. The time is user configured from 3 to 60 minutes.

2. Battery discharge (EOD)off 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) or 0.9 to 1.1 V per cell (NiCd)

3. Battery Circuit Breaker (BCB) 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.

Chapter 3 Operating Steps

This chapter describes UPS operation instructions in detail.

All functional keys and LED display involved in operation instructions please refer to chapter 4. During operation, the buzzer alarm may occur at any time. Select “mute” on LED to muffle the audible alarm.

Warning-Hazardous mains voltage and/or battery voltage present(s)behind the protective cover
1. The components that can only be accessed by opening the protective cover with tools cannot be operated by user. 2. Only qualified service personnel are authorized to remove such covers.

3.1 Power Switches

As shown in fig 3-1, open the front door of UPS, the power switch is visible, which includes: input switch, output switch and maintenance bypass switch (with anti-misoperation stop plate) .

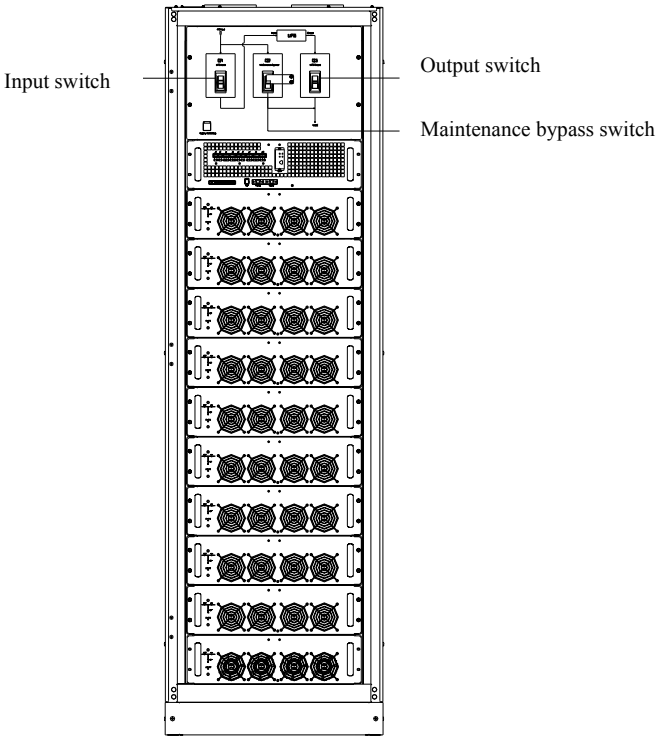


Fig 3-1 Power switch location diagram

3.2 UPS Start-up

The UPS system only has a maintenance bypass isolating switch, and all the other transfers are processed automatically by internal control logics.

3.2.1 Normal Module Start

This procedure must be followed when turning on the UPS from a fully powered down condition. The operating procedures are as follows:

Warning

This procedure results in mains voltage being applied to the UPS output terminals. If any load equipment is 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 to close the output switch of external distribution cabinet.

1. Close UPS output switch and input switch in turns.

The LCD starts up at this time. The Rectifier indicator flashes during the startup of rectifier. The rectifier enters normal operation state, and after about 30s, the rectifier indicator goes steady green. After initialization, the bypass static switch closes. The UPS Mimic LEDs will indicate as shown in table 3-1:

Table 3-1 Indicator status

LED	Status
Rectifier indicator	Green
Battery indicator	Red
Bypass indicator	Green
Inverter indicator	Off
Load indicator	Green
Status indicator	Green

Note

The output circuit breaker must be closed first, followed by input circuit breaker, or the rectifier cannot be started, and alarm “rectifier failure”.

The inverter starts up at this time, the inverter indicator flashes. After the rectifier enters normal operation state, UPS power supply will transfer from bypass to inverter, then the bypass indicator turns off, and load indicator lights. The status of indicators is shown in table 3-2...

Table 3-2 Indicator Status

LED	Status
Rectifier indicator	Green
Battery indicator	Red
Bypass indicator	Off
Inverter indicator	Green
Load indicator	Green
Status indicator	Green

Close external battery switch again, battery indicator turns off, a few minutes later, the battery will be charged by UPS which will enter normal mode operation. The indicator status is shown in table 3-3.

Table 3-3 Indicator status

LED	Status
Rectifier indicator	Green
Battery indicator	Green
Bypass indicator	Off
Inverter indicator	Green
Load indicator	Green
Status indicator	Green

3.2.2 Operating steps of Battery cold Start

1. Check if the batteries have been connected, close the external battery switch.
2. Press the red start-up button of battery under the rectifier input circuit breaker for 3 seconds (see fig 3-2).

The LCD starts up at this time. The green battery indicator flashes. The rectifier enters normal operation states and after about 30s, the battery indicator goes steady green.

3. The inverter starts up automatically, the green inverter indicator flashes. The output of inverter appears after 60s. The UPS works on battery mode.

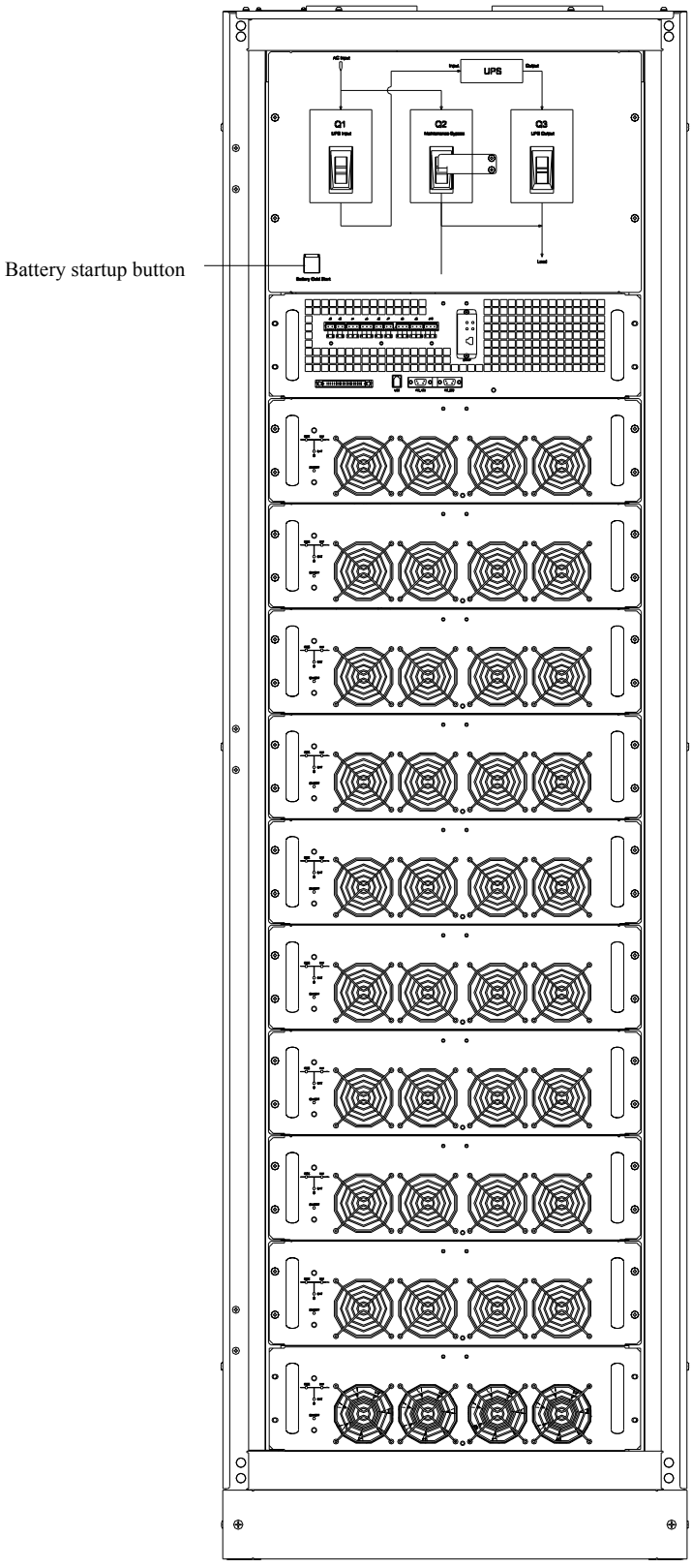


Fig 3-2 Position diagram of battery startup button

3.3 Procedure for Switching between Operation Modes

3.3.1 Procedure for Switching the UPS into Battery mode from Normal Mode

Open input switch to cut off the mains, UPS enters the battery mode. If UPS should be switched to normal mode, wait for a few seconds before close input switch, so as to supply the mains again. 10s later, the rectifier will start up automatically to supply power to the inverter.

3.3.2 Procedure for Switching the UPS into Bypass mode from Normal Mode

Select “close inverter” on the LCD, or press “off” buttons of each power module in turn.

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

3.3.3 Procedure for Switching the UPS into Normal from Bypass Mode

Select exit bypass mode on the LCD.

3.3.4 Procedure for Switching the UPS into a Maintenance Bypass from Normal Mode

In normal operation, this operation instruction will switch the load from inverter input to maintenance bypass.

Caution
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 have a risk of a short interruption in powering the load.

1. Press “inverter off” on the LCD, or press “off” on each power module in turns.

The inverter indicator and status indicator go off, the buzzer alarms. The load will be transferred to static bypass, and the inverter is closed.

2. Close maintenance bypass switch Q2, the load power will be supplied by maintenance bypass, and then close the inverter circuit breaker Q1, output switch Q3 and battery switch.

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

3.3.5 Procedure for Switching the UPS into Normal from a Maintenance Bypass Mode

This procedure can transfer the load to normal main mode when the UPS is operating under the maintenance bypass mode.

1. Close output switch Q3 and main switch Q1.

The bypass indicator goes green and the load power will be supplied by bypass and maintenance bypass.

2. Open maintenance bypass switch Q2.

The load power is supplied by bypass. In the meantime, the rectifier starts up, rectifier indicator goes green 30s later, at this time, the inverter will start up automatically, and transfer to inverter mode 1 min later automatically.

3. Close external battery switch, the battery indicator goes off. Check if the battery voltage on LCD display is normal.

3.4 Procedure for Completely Powering down a UPS

If you need to power down the UPS completely, follow the procedures in section 3.34 to transfer the UPS from normal mode to maintenance bypass mode.

If you need to isolate the UPS from the AC power supply, you should open the external input switch.

3.5 EPO Procedure

The EPO button on UPS operator control and display panel 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 output), and the battery stops charging or discharging.

If the input utility is present, the UPS control circuit will remain active; however, the output will be turned off. To completely isolate the UPS, you need to open the external mains input supply to the UPS rack.

3.6 Language Selection

The LCD is available in two languages: Chinese and English.

The language can be selected through LCD prompt window.

3.7 Control Password

When the LCD displays “input control password 1”, the initial password is 12345678.

Chapter 4 Operator Control and Display Panel

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

4.1 Introduction

The operator control and display panel is located on the front panel of the UPS. Through this LCD panel, the operator can operate and control the UPS, and check all measured parameters, UPS and battery status and event and alarm logs. The operator control panel is divided into three functional areas as shown in fig 4-1: mimic current path, LCD display & Menu keys, and Control and Operation Keys. The detailed description of parts on operator control and display panel is shown in table 4-1.

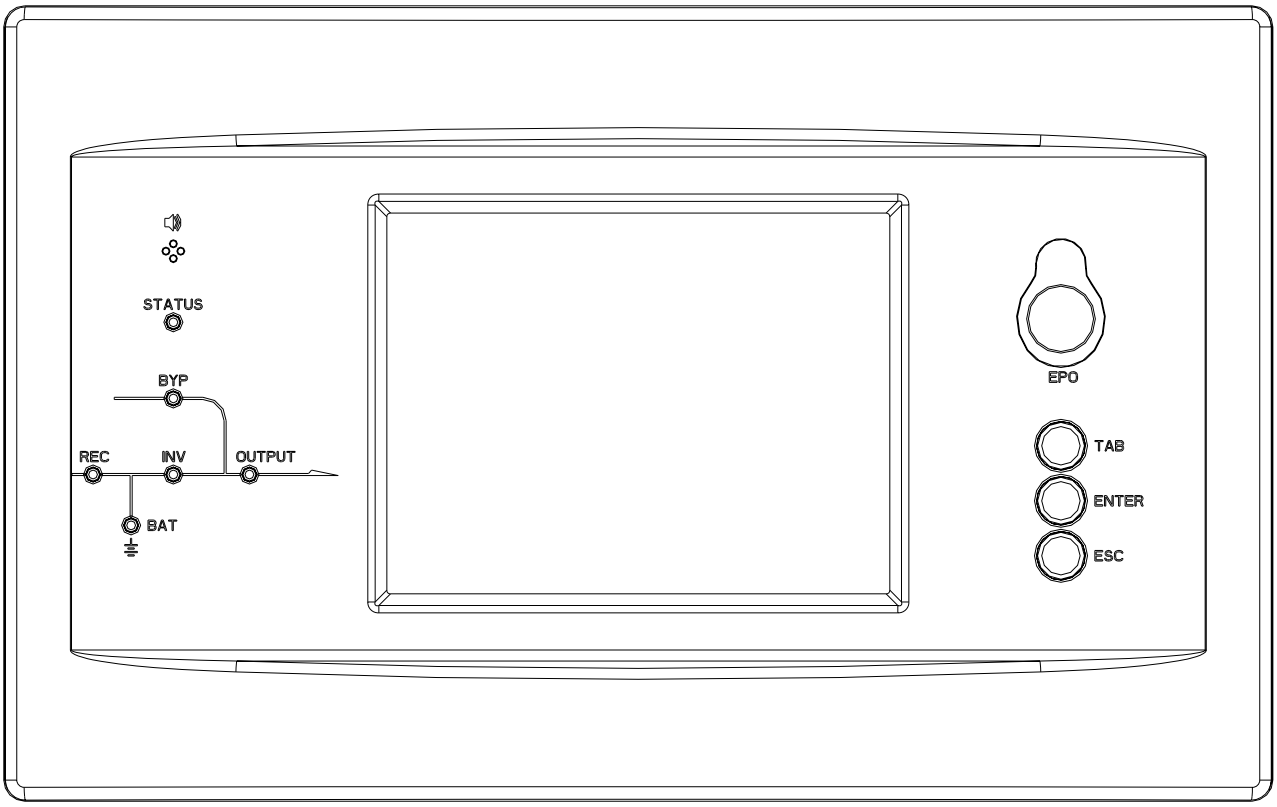


Fig 4-1 UPS operator control and display panel

Table 4-1 Description of UPS operator control and display panel

Part No.	Function		Button	Function
REC	Rectifier indicator		EPO	EPO switch
BAT	Battery indicator		TAB	switch
BYP	Bypass indicator		ENTER	confirm
INV	Inverter indicator		ESC	exit
OUTPUT	Load indicator			
STATUS	Status indicator			

4.1.1 LED Indicator

The LEDs shown on the mini current path represent the various UPS power paths and show the current UPS operating status. The status description of indicators is shown in table 4-2.

Table 4-2 Status description of indicator

Indicator	State	Purpose
Rectifier indicator	Steady green	Rectifier normal for all modules
	Flashing green	Rectifier for at least on module normal, mains normal
	Steady red	Rectifier fault
	Flashing red	Mains abnormal for at least one module
	Off	Rectifier not operating
Battery indicator	Steady green	Battery charging
	Flashing green	Battery discharging
	Steady red	Battery abnormal (battery failure, no battery or battery reverse) or battery converter abnormal (failure, over current or over temperature) , EOD
	Flashing red	Battery low voltage
	Off	Battery and battery converter normal, battery not charging
Bypass indicator	Steady green	Load power supplied by bypass
	Steady red	Bypass power abnormal or out of normal range, or static bypass switch fault
	Flashing red	Bypass voltage abnormal
	Off	Bypass normal
Inverter indicator	Steady green	Load power supplied by inverter
	Flashing green	Inverter On, start, synchronization of standby (ECO mode) for at least one module
	Steady red	System power not supplied by inverter, inverter fault for at least one module.
	Flashing red	System power supplied by inverter, inverter fault for at least one module.
	Off	Inverter not operating for all modules
Load indicator	Steady green	UPS output ON and normal
	Steady red	UPS output overload and overtime, or output short, or output no power supply
	Flashing red	Overload output of UPS
	Off	No output of UPS
Status indicator	Steady green	Normal operation
	Steady red	Failure

4.1.2 Audible Alarm (buzzer)

There are two different types of audible alarm during UPS operation as shown in table 4-3.

Table 4-3 description of audible alarm

Alarm	Purpose
Two short alarm with a long one	when system has general alarm (for example: AC fault), 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

4.1.3 Functional Keys

There are 4 functional keys on operator control and display panel, which are used together with LCD. The functions description is shown in table 4-4.

Table 4-4 Functions of functional keys

Functional key	Functions
EPO switch	To cut off the load power to shut down the rectifier, inverter, static bypass and battery
TAB	switch
ENTER	confirm
ESC	exit

4.2 LCD Display Type

Following the self-check of UPS LCD display, the main LCD display is shown as fig 4-2, which can be divided into three display windows: system information, data command and current record.

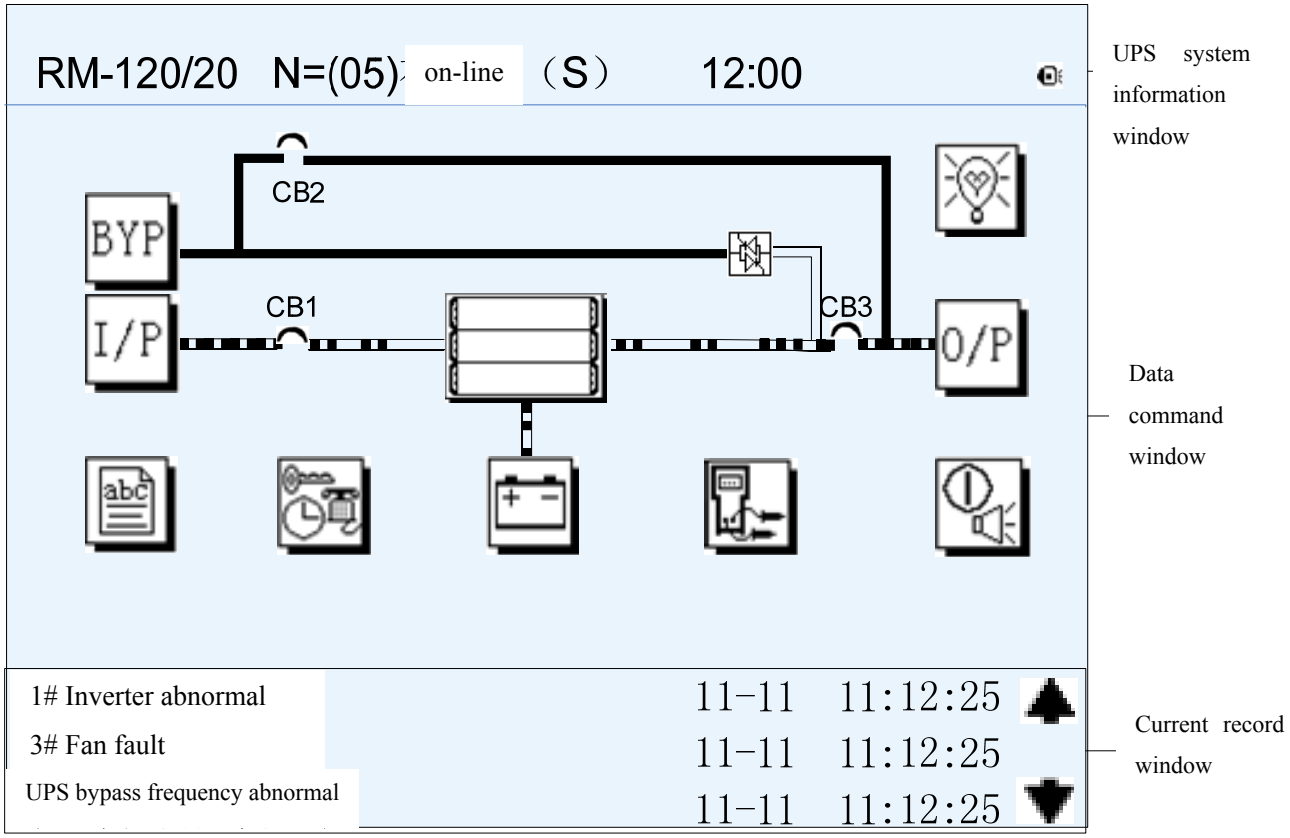


Fig 4-2 Main LCD display

The description of LCD icon is shown in table 4-5:

Table 4-5 Description of LCD icons

Icon	Description
	Bypass parameter
	Main input parameter
	History file, system information
	Function setting (display calibration, password setting, time setting, date format, communication protocol and language setting), system setting (used by product maintainers)
	Battery data, battery parameter setting (used by service staff)
	Test (battery self-test, battery maintenance)

	Functional keys used by service staff (fault clearing, history file clearing, noise clearing, manual switch of bypass), user's setting (system mode, machine number, system ID, output voltage adjustment, frequency tracing speed, frequency tracing limit)
	Output parameter
	Load
	Noise clearing, noise clearing cancel
	Log view page up/down

Select a icon on LCD, as shown in fig 4-3, to view the UPS parameter represented by this icon, e.g. select  , the LCD will display the data of system main input:

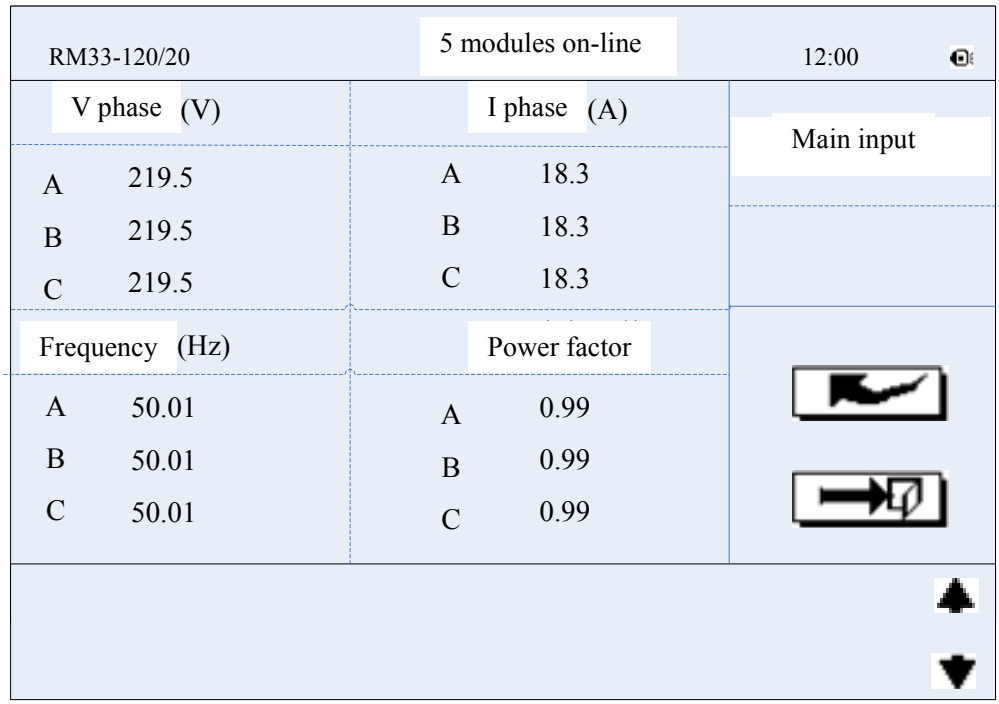
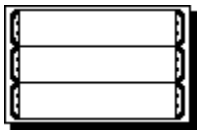


Fig 4-3 Select data

Or select  and confirm a module, as shown in fig 4-4, the LCD will display the operating status of this module:

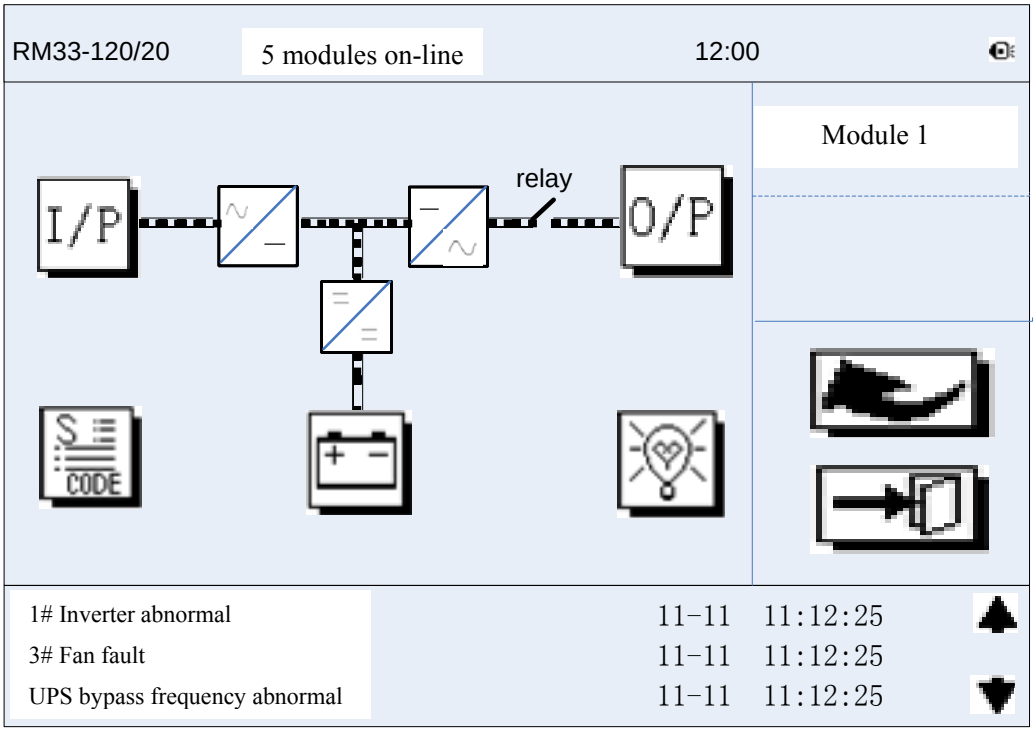


Fig 4-4 Select a module

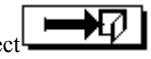
Select  in the operating status of a module, to view the main input data of this module.

Select  in the operating status of a module to view the main output data of this module.

Select  , in the operating status of a module to view the load data of this module.

Select  in the operating status of a module to view the maintenance code and module software code of this module.

Select  to return to the previous page.

Select  to return to the home page.

Default display

During the operation of system, if there's no alarm in 2 min, the system will display default. After a short delay, the backlight of LCD display goes off; press any key to reactivate the display.

4.3 Detailed Description of Menu Items

The LCD main display shown in fig 4-2 is described in details below.

UPS information window

UPS information window: display the current time and UPS name. The information of the window is not necessary for the user to operate. The information of this window is given in table 4-6.

Table 4-6 Description of items in UPS system information window

Display contents	Meaning
RM33-120/20	UPS Name
12:00	Current Time (format: 24 hours, hours, minute)

UPS menu and data window

UPS menu window displays the menu name of data window, while the data window displays the related contents of selected menu in menu window. Select UPS menu and data window to browse related parameters of UPS and set related functions. The details are given in table 4-7.

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

Menu name	Menu item	Meaning
Main input	V phase(V)	V phase
	I phase(A)	I phase
	Freq.(Hz)	Input frequency
	PF	Power factor
Bypass input	V phase(V)	V phase
	Freq. (Hz)	Bypass frequency
	I phase(A)	I phase
	PF	Power factor
AC output	V phase(V)	V phase
	I phase(A)	I phase
	Freq. (Hz)	Output frequency
	PF	Power factor
This UPS module's load	Sout (kVA)	Sout: Apparent Power
	Pout (kW)	Pout: Active Power
	Qout (kVAR)	Qout: Reactive Power
	Load (%)	Load (The percentage of the UPS rating load)
Battery data	Environmental Temp	Environmental Temp
	Battery voltage(V)	Battery bus voltage
	Battery current A)	Battery bus current
	Battery Temp(℃)	Battery Temp ℃
	Remaining Time (Min.)	Remaining battery backup time
	Battery capacity (%)	The percentage compared with new battery capacity
	battery equalized charging	Battery is equalized charging
	battery float charging	Battery is float charging
	Battery disconnected	Battery is not connected
Current record	(current alarm)	Display all current alarm. The alarm list displayed on LCD of UPS operator control and display panel please refer to table 4-9
History record	(history alarm)	Display all history alarm. The alarm list displayed on LCD of UPS operator control and display panel please refer to table 4-9
Menu Language	(language option)	2 languages can be selected
Settings	Display calibration	Adjust the accuracy of LCD display
	Date format set	MM DD YYYY and YYYY MM DD formats can be selected
	Date & Time	Date/Time set
	Language set	User can set the language (Chinese and English)
	Communication mode	Set communication mode, MODBUS, Power protocol and company custom protocol modes can be selected. Power protocol mode can be divided into equipment address, baud rate set; MODBUS protocol mode can be divided into communication, mode (RTU、ASCⅡ), equipment address, baud rate and check-bit set; Company custom protocol mode is the customed protocol of the company, no option is available.
	Control password set	User can modify control password 1

Menu name	Menu item	Meaning
Test Command (Battery Test Control / System Test Control / Forced equalized charging)	Battery maintenance test	This test will lead to the battery being partly discharged to activate battery, at the same time; the approximate battery capacity will be obtained. Bypass must be in normal condition, the battery capacity should be above 25%.
	Battery self-check test	UPS switches to battery discharge for discharging to test if the battery is normal. Bypass must be in normal condition, the battery capacity should be above 25%.
	Stop testing	Manually Stop the test including maintenance test, capacity test
UPS system information	Monitoring software version	Provide monitoring software version
	Rectified software version	Provide rectified software version
	Inverted software version	Provide inverted software version
	Serial No.	The serial no set when delivery from the factory
	Rated information	Network setting of system operating
	Module type	Type of the module

4.4 Alarm List

The follow table 4-8 gives the complete list of all the UPS events displayed by history record window and current record window.

Table 4-8 Alarm List

Alarm	Explanation
UPS power supply	The system is in normal inverted power supply status
Bypass power supply	The system is in bypass power supply status
No power supply	System no output
Battery equalized charging	Battery is in boost charging
Battery float charging	Battery is in float charging
Battery discharging	The system is operating in battery discharging status.
Battery connected	Battery is connected
Battery disconnected	Battery is not connected
Maintenance circuit breaker close	Maintenance circuit breaker is close
Maintenance circuit breaker open	Maintenance circuit breaker is open
Emergency shutdown	System emergency shutdownEPO
Generator connected	External generator is connected
Mains abnormal	Input mains abnormal
Bypass phase conversion	Bypass input phase converse
Bypass voltage abnormal	Bypass input voltage abnormal
Bypass fault	Bypass fault
Bypass overload	Bypass output is overload
Up to bypass overtime of overload	Bypass is overtime of overload
Bypass frequency tracing exceeds	Bypass frequency is out of the tracing range
Switch times up to in this hour	The times of switch between bypass and inverter exceeds 5 times in the latest hour.
Output short	System output short
Battery EOD	Battery voltage achieves shutdown point
Battery self-check	The system enters battery self-check mode
Battery self-check success	Battery normal during system self-check
Battery manual check failure	Battery fault during system self-check
Battery maintenance	The system is in battery maintenance status
Battery maintenance success	Battery maintenance status completes

Alarm	Explanation
Battery maintenance failure	Battery maintenance process is not normal
Stop testing	Battery self-check or battery maintenance status stops
Fault clearing	Clear the alarmed fault
Delete history record	Delete all history record
N# communication node connected	N# module is connected to UPS system
N# communication node disconnected	N# module is not connected to UPS system
N# rectifier fault	N# module rectifier fault
N# inverter fault	N# module inverter fault
N# rectifier overheat	N# module rectifier overheat
N# fan fault	N# module fan fault
N# output overload	N# module output overload
N# overtime of overload	N# module output overtime of overload
N# inverter overheat	N# module inverter overheat
Inverter power supply ban	Inverter power ban supply
Manual switch of bypass	Switch the system to bypass output manually
Cancel manual switch of bypass	Switch the system from bypass to inverter output manually
Battery low voltage	Battery low voltage
Battery reversal	Battery polarity reversal
N# inverter protection	N# module inverter protection
Input N line disconnected	System input N line is not connected
Bypass fan fault	Bypass module fan fault
N# manual shutdown	N# module manual power off

Chapter 5 Maintenance

This chapter introduces UPS maintenance, including the maintenance instructions of power module, monitoring bypass module and the change method of dust filter.

5.1 Instruction to Power, Bypass, and Output Power Distribution Module

5.1.1 **Precautions**

1. Only maintaining engineers can maintain the power module and monitoring bypass module.
2. In principle, the power module and bypass module should be disassembled from top to bottom, so as to prevent any inclination from high gravity centre of the cabinet.
3. To ensure the safety before maintaining power module and bypass module, be sure to use a multimeter to measure the DC bus capacitor voltage and ensure the voltage is below 60V before operation, and use a multimeter to measure the voltage between operating parts and the earth to ensure the voltage is lower than hazardous voltage, i.e. DC voltage is lower than 60Vdc, and AC maximum Voltage is lower than 42.4Vac.
4. Bypass module doesn't support any hot insertion and extraction, only when UPS is in maintenance bypass mode or UPS is completely power off, can the bypass module be disassembled.
5. The module can be maintained 10 mins after extracting power module and bypass module which can be inserted into the cabinet 10 mins later.

5.1.2 Instruction to Power Module

Suppose UPS were in normal mode, and bypass were normal, a module shall be maintained at first.

1. Press OFF of the module with a pin point or other tiny matter, the module will shut down automatically and exit the system

   Note: ensure if the remaining module will be overload when exiting a module. If there's any risk of overload, transfer the whole UPS system to bypass, followed by other operations.
2. Take off the fixing bolt on the two sides of front and back plate of power module 10 mins later; extract the module from the cabinet.
3. After maintaining the module, push the module into the equipment cabinet (the interval between two modules shall be more than 10s), fix the screw on the two sides. Then the module will be connected to UPS system automatically.

5.1.3 Instruction to Bypass Module

Suppose UPS were in normal mode, and the bypass were normal:

1. Select LCD touch screen manual switch of bypass, the UPS power will be supplied by bypass.
2. Close maintenance bypass switch, the UPS power will be supplied by maintenance bypass.
3. Open UPS output switch and input switch.
4. Open external battery switch.
5. Take off the fixing bolt at the two sides of front board of bypass module, extract the front cable assembly of the module and extract the module from the cabinet.
6. After maintaining the module, insert the module into the cabinet, tighten the screw at the two sides, and connect the front cable assembly of manufacturer's module.
7. Close UPS output switch and input switch in turn.

   2 mins later, bypass indicator on the operator control and display panel lights on, which indicates the normal power supply of bypass.
8. Open maintenance bypass switch, the inverter starts automatically, 60s later; the UPS will transfer to normal mode.

5.2 Replacing Dust Screen (option)

As shown in fig 5-1, there are 3~4 dust filters on the back of UPS' front door, each screen is held in place by a bracket on either side of each filter. The procedure of replacing each filter is as follows:

1. Open the UPS' front door and locate the filters on the back side of the front door
2. Remove one bracket.
3. Remove the dust screen to be replaced and insert the clean one.
4. Reinstall the bracket.

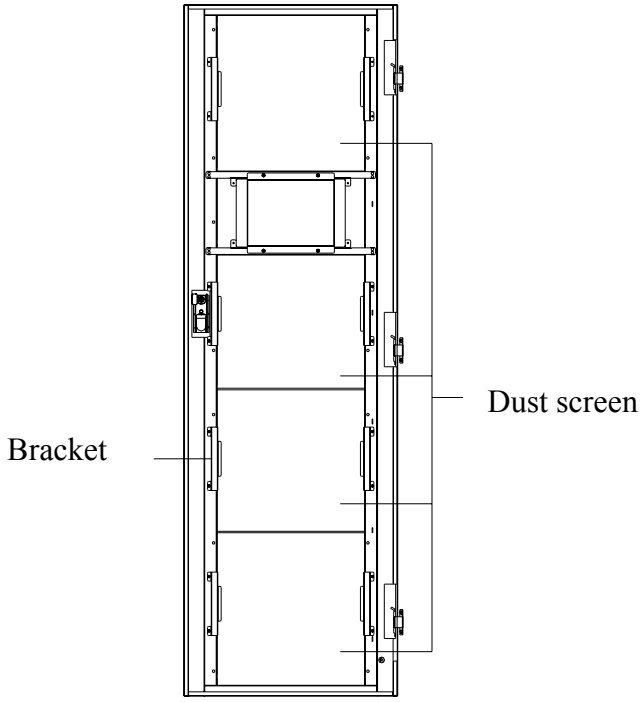


Fig 5-1 Dust screen on the back side of UPS front door

Chapter 6 Product Specification

This chapter provides UPS product specification.

6.1 Applicable Standards

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

Table 6-1 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).	

6.2 Environmental Characteristics

Table 6-2 Environmental Properties

Items	Unit	Requirements
Acoustic noise level at 1 meter	dB	56.0
Altitude of Operation	m	≤1000m above sea level, derate power by 1% per 100m between 1000m and 2000m
Relative Humidity	%RH	0 to 95% non condensing
Operating Temperature	℃	0 to 40 deg , Battery life is halved for every 10°C increase above 20°C
UPS Storage-Transport Temperature	℃	－20～70
Recommended Battery Storage Temperature	℃	－20～30 (20°C for optimum battery storage)

6.3 Mechanical Characteristics

Table 6-3 Mechanical Properties

Cabinet Specification	Unit	RM60/10, RM90/15, RM120/20	RM100/10, RM150/15, RM200/20
Mechanical Dimension, W×D×H	mm	600×900×1600	600×900×2000
Weight	kg	180	200
Color	N/A	Black	
Protection Level, IEC(60529)	N/A	IP20	

Module type	Unit	PM10	PM15	RM20
Mechanical Dimension, W×D×H	mm	440×600×133		
Weight	kg	20	21	22
Color	N/A	Black		

6.4 Electrical Characteristics (Input Rectifier)

Table 6-4 Rectifier AC input (mains)

Items	Unit	Parameter
Rated AC Input Voltage	Vac	380/400/415(three-phase and sharing neutral with the bypass input)
Input voltage range	Vac	-40%～+20%
Frequency[2]	Hz	50/60(range: 40Hz～70Hz)
Power factor	kW/kVA, full load	0.99
THD	THDI%	3

6.5 Electrical Characteristics (Intermediate DC Link)

Table 6-5 Battery

Items	Unit	Parameters
Battery bus voltage	Vdc	Nominal: ±240V, one-side range: 198V～288V
Quantity of lead-acid cells	Nominal	40=[1 battery(12V)] , 240=[1 battery(2V)]
Float charge voltage	V/cell(VRLA)	2.25V/cell(selectable from 2.2V/cell～2.35V/cell) Constant current and constant voltage charge mode
Temperature compensation	mV/℃/cl	－3.0(selectable from : 0～－5.0, 25℃ or 30℃, or inhibit)
Ripple voltage	% V float	≤1
Ripple current	% C_{10}	≤5
equalized charge voltage	VRLA	2.4V/cell(selectable from : 2.30V/cell～2.45V/cell) Constant current and constant voltage charge mode
final discharging voltage	V/cell(VRLA)	1.65V/cell(selectable from : 1.60V/cell～1.750V/cell) @0.6C discharge current 1.75V/cell (selectable from : 1.65V/cell～1.8V/cell) @0.15C discharge current (EOD voltage changes linearly within the set range according to discharge current)
Battery Charge	V/cell	2.4V/cell(selectable from : 2.3V/cell～2.45V/cell) Constant current and constant voltage charge mode
Battery Charging Power Max Current	kW	10%* UPS capacity (selectable from : 0～20%* UPS capacity)

6.6 Electrical Characteristics (Inverter Output)

Table 6-6 Inverter Output (to important load)

Rated capacity(kVA)	Unit	10～200
Rated AC voltage[1]	Vac	380/400/415(three-phase four-wire and sharing neutral with the bypass)
Freqency[2]	Hz	50/60
overload	%	110% load, 30min 125% load 10min 150% load, 1min ＞150% load, 200ms
Fault current	%	340% short current limitation for 200ms
Non linear load capability[3]	%	100%
Neutral current capability	%	170%
Steady state voltage stability	%	±1(balanced load) ±2(100% imbalance load)
Transient voltage response[4]	%	±5
THD	%	＜1(linear load) , ＜3(non linear load[3])
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

Note:
1. Factory setting is 380V. Commissioning engineers can set to 400V or 415V.
2. Factory setting is 50Hz. Commissioning engineers can set to 60Hz.
3. EN50091-3(1.4.58) peak value factor is 3: 1.
4. IEC62040-3/EN50091-3 including 0%～100%～0% load transient, the recovery time is half circle to within 5% of stable output voltage.

6.7 Electrical Characteristics(Bypass Mains Input)

Table 6-7 Bypass Mains Input

Rated capacity(kVA)	Unit	60	90	100	120	150	200
Rated AC Voltage[1]	Vac	380/400/415 three-phase four-wire, sharing neutral with the rectifier input and providing neutral reference for the output					
Rated current	A	91@380V 87@400V 83@415V	136@380V 130@400V 124@415V	151@380V 144@400V 138@415V	182@380V 174@400V 166@415V	227@380V 216@400V 207@415V	302@380V 288@400V 276@415V
overload	%	125% load, long term 150% load, 10min 1000% load, 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[2]	Hz	50/60					
Switch time (between bypass and inverter)	ms	Synchronized switch: ≤1ms					
Bypass voltage tolerance	%Vac	Upper limit: +10,+15or+20, default: +20 Lower limit: −10, −20, −30 or−40, default:−20 (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)					

Note:
1. Factory setting is 400V. Commissioning engineers can set to 380V or 415V.
2. Factory setting is 50Hz. Commissioning engineers can set to 60Hz. For example, UPS is set to frequency inverter mode, and then bypass status will be neglected.

6.8 Efficiency

Table 6-8 Efficiency, Loss and Air Exchange

Rated Efficiency (kVA)	Unit	10～200kVA
Efficiency		
Normal mode(dual conversion)	%	95
ECO mode	%	98
Battery discharging efficiency (DC/AC) (battery at nominal voltage 480Vdc and full-rated linear load)		
battery mode	%	95

Appendix 1 A Guidebook to Ordering and Selection of PM System

RM series UPS module can be divided into equipment cabinet and power module. For the cabinet lectotype please refer to the description in fig 6-1

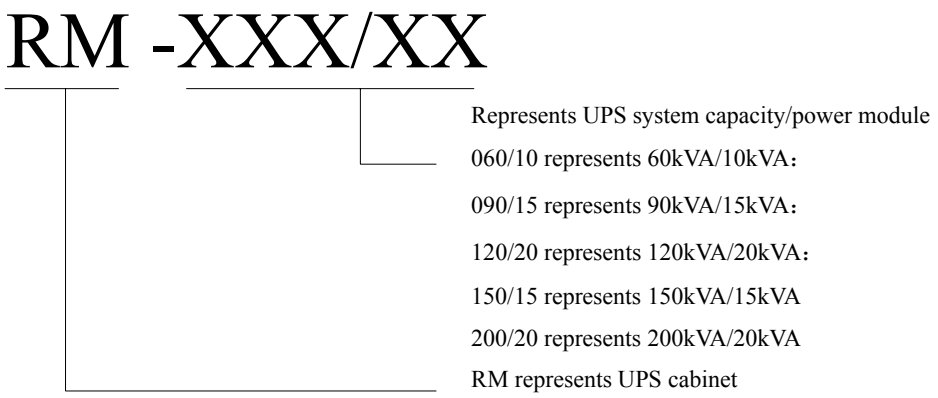


Fig 6-1 Cabinet Selection

For single power module type please refers to the description in fig 6-2:

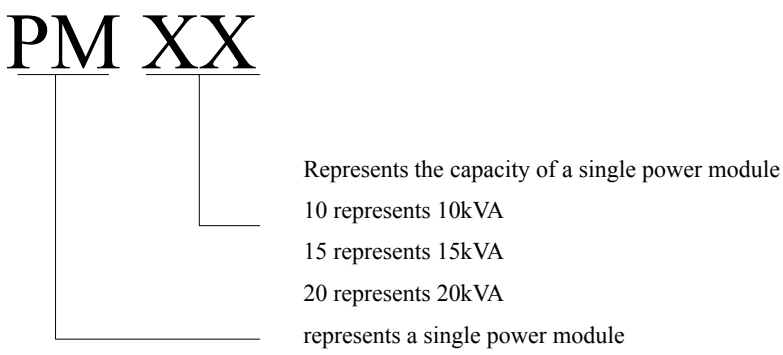


Fig 6-2 Power Module Selection

Egg: the requirements of a plant room are given below:

The maximum power supply of the plant room is 120kVA; however, it is expected to be expanded to 200kVA in 3-5 years. Therefore, a 200kVA cabinet and 6 20kVA power module can be purchased to constitute an uninterrupted 120kVA power system which can be expanded to 200kVA on-line. The order symbol is:

1 set RM-200/20

6 set PM20

Option list:

RM-SNMP card: remote network monitoring card

RM-1600 dust filter: dust screen for 1.6m cabinet

RM-2000 dust filter: dust screen for 2m cabinet