SERVICE MANUAL

UPS MMUST SERIES

Content

1 UPS AEEEMBLY

1.1 Features

CE

This equipment complies to EN62040-2/IEC62040-2 standard CE.

UPS FUNCTION

The Uninterruptible power system (UPS) is connected between the user's equipment or load and mains supply. Its function is to guarantee a continuous and conditioned power supply to the critical load. Even in the case of a total black-out it will supply the load for a predetermined time. In addition, the UPS provide the following advantages in comparison with conventional supply systems.

This is a class C product.

In a domestic environment, this product may cause radio interference, in which case, the user may be required to take additional measures.

1.2 UPS System Structure

The basic power supply unit is an ac/dc/ac converter; the block diagram *Fig 1.1* illustrates six essential functional components:

- Rectifier/Discharger (REC, DIS)
- Battery/Charger (BAT, CHG)
- Inverter (INV)
- Automatic inverter switch (SW)
- Static bypass (STB)
- Manual bypass (MSW)

All components are located in a single housing. They are explained in detail on the following pages.

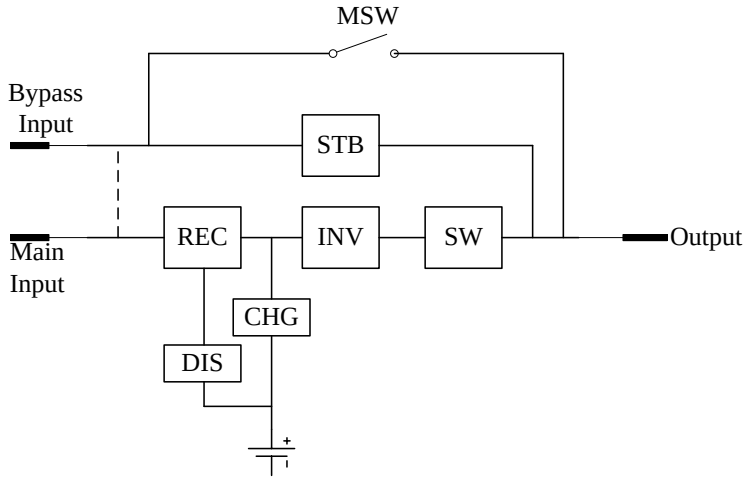


Fig 1. 1- UPS Block Diagram

1.3 Rectifier/Discharger

The rectifier is a converter that converts ac voltage to dc voltage. The rectifier is connected to mains via the filter chokes which reduce the mains distortion created by the rectifier. The PFC is included in rectifier to reduce input current harmonic, increase input PF to be near 1 and boost voltage to be DC bus voltage. The dc output of the PFC feeds the inverter and the battery. The rectifier is designed to feed both the inverter at maximum load conditions and simultaneously the battery with maximum charging current.

When mains input power is failure, UPS transfers to battery mode. Battery discharge is connected to battery string and use same PFC converter as REC. It boost battery DC voltage to be DC bus voltage.

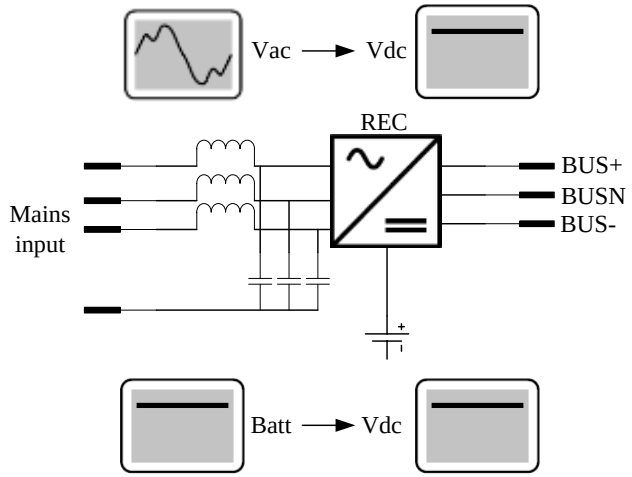


Fig 1. 2- Rectifier/Discharger

1.4 Battery/Charger

The battery supplies power in case of a short interruption or a total breakdown of the ac mains source. In case of a mains input abnormal, the load will be fed by the battery. The battery is only capable of feeding the load for a certain time (autonomy time), depending on battery capacity and actual load. The number of cells within the battery depends on the battery type and may also vary due to specific customer requirements.

The battery string consist of two strings: positive string and negative string.

The standard number is 240cells(positive 120cells, negative 120cells) for lead-acid batteries. The battery capacity (Ah) depends on the UPS output power and the required autonomy time. Normally, the battery voltage is kept at 540Vdc (floating charge, maintenance-free lead battery, 2.25volts per cell).

The battery charger is connected to DC bus, and supply the power to batteries. The charger current is constant when voltage boost charge, the voltage will be constant when floating charge or boosting charge. The charge current and charge voltage can be set via software.

1.5 Inverter

The inverter converts dc voltage supplied by the rectifier to ac voltage of precisely stabilized amplitude and frequency that is suitable for power supply to most sophisticated electrical equipment. The inverter output voltage is generated by pulse width modulation (PWM). The use of a high switching frequency (20kHz) for the PWM, an ac filter circuit consisting of choke and capacitor and a dedicated control

logic, T-type 3-level topology, assure a very low output voltage distortion (see "Technical Data" section).

The inverter control logic restricts the maximum output current to 150% of the nominal current in case of a short circuit. In case of overload (up to 150% linear load of the nominal current), the output voltage is kept constant. For higher currents the output voltage is reduced.

The inverter power modules are fully protected from severe short circuits by means of a saturation monitor or "electronic fuse".

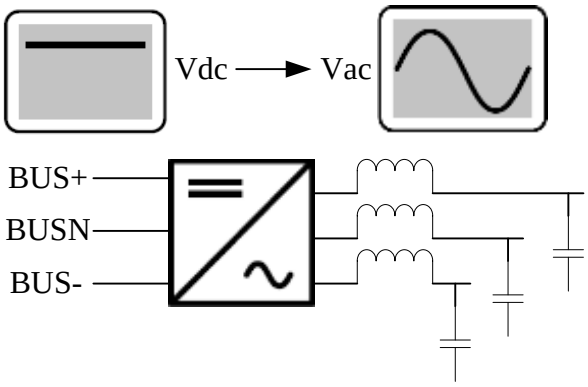


Fig 1. 3- Inverter Block Diagram

1.6 Static Bypass

The block diagram illustrates the two static switch units that use thyristors as switching elements. During normal UPS operation, SW is closed and STB is opened, thus connecting the load to the inverter output.

During overload or inverter failure conditions, SW is switched off and STB is switched on, providing power supply from a backup source. By always actuating both switches together for a short period, an uninterrupted power supply during the switching is ensured. This is an essential condition to reliably meet all power supply requirements for connected sensitive equipment.

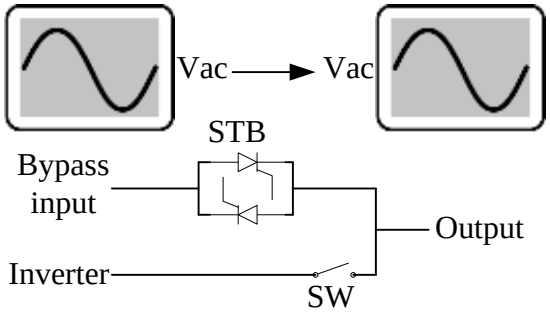


Fig 1. 4- Static Bypass Block Diagram

Transfer conditions Inverter-Bypass

a) Voltage and frequency of the bypass line have to be within tolerance limits, and the inverter has to be synchronized with the bypass line.

b) Under overload or inverter or rectifier failure conditions, the UPS switches to bypass operation.

c) If the conditions under a) are not met, the inverter stops under inverter failure conditions.

1.7 Manual Bypass

The manual bypass function is to supply power directly to the connected load during UPS system failure or maintenance. The bypass consists essentially of one switch. With this series UPS systems, commutation from different operating modes to manual bypass will take place without interruption. With the maintenance bypass on, the power supply system may be completely switched off, thus permitting maintenance of power modules and bypass modules to be carried out safely (if cabinet need to be maintained external maintenance bypass is required to disconnect all power in cabinet).

2 FRONT PANEL

2.1 Panel Description

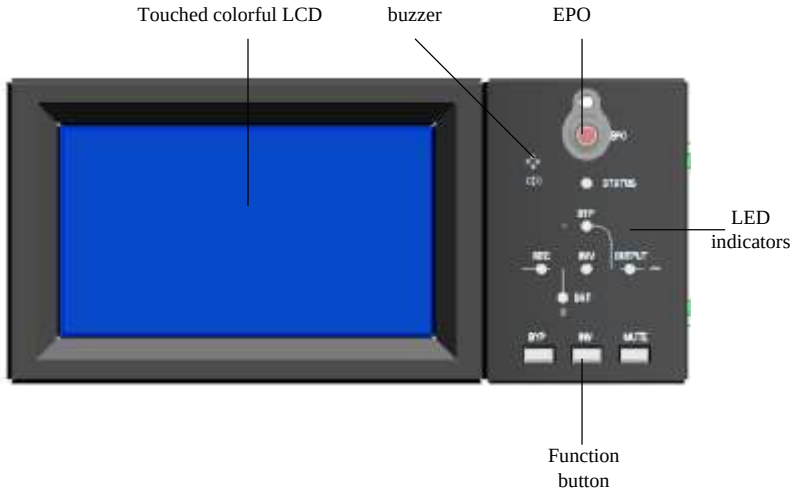


Fig 2. 1 Front panel

Front panel for UPS above 60kVA consists of colorful LCD, buzzer, EPO, function button, LED indicators as Fig 2.1.

Notes:

Front panel for UPS below 40kVA consists of colorful LCD, one buzzer, EPO and one status LED.

2.2 Remote Monitoring

The front panel provides several types for remote monitoring of the UPS status:
Connection with a PC via RS232 interface, managed by a dedicated monitoring software PowerMTR;
Connection with Remote Panel via RS485 interface;
Connection with a external equipment (generator, BCB…) via dry contactor ports.
See “Remote Control and Signalling” chapter of “PCB Description” section.

2.3 Emergency Power Off

Emergency Power Off (E.P.O) button is located on the right side of the front LCD. By pushing EPO button both static bypass and battery charger, rectifier and inverter are switched off and alarms “EPO”, thus indicating that the EPO function has been activated. See "Operation" section for EPO Operating Instructions.
In the case of parallel and hot-standby configurations, activating E.P.O. on one unit, automatically switches off the entire system.

3 INSTALLATION

3.1 Mechanical Installation

Equipment Delivery and Storage

After delivery, check equipment for damages that may have occurred during shipment. The shipper and your agency must be notified in writing about damages due to shipment, including a detailed description of visual defects. If you do not wish to install the equipment immediately, please observe the following storage recommendations:

Store equipment in a vertical position in a well conditioned room, protected against humidity. Do not store the equipment in close proximity to frequently used passageways and keep it away from movable parts.

If the UPS system is already unpacked, please ensure storage in a clean environment protected from dust, away from heat sources.

Handling the UPS system

The UPS can be lifted and moved by means of a lifting truck or a fork lifter.

Caution:

Secure equipment against being knocked over

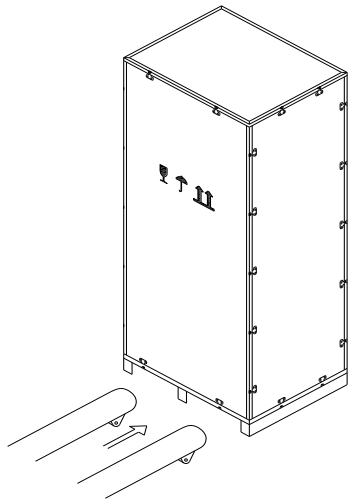


Fig 3. 1- Moving the UPS

The UPS system should be installed in a dry, clean and lockable room. Provisions have to be made to remove heat created by the system. Under all installation conditions, the unrestricted flow of cooling air must be assured.

Weight

	Net Weight (kg+-10%)	Net Weight with power modules (kg+-10%)	Static Load (kg/m2) with power modules
PM10X	13.3	/	51.7
PM15X	13.5	/	52.5
RM020/10X	30.5	57.1	168.9
RM040/10X	41	97.7	289
RM060/10X RM090/15X	70	150.8 152	414 417

Floor Space Required

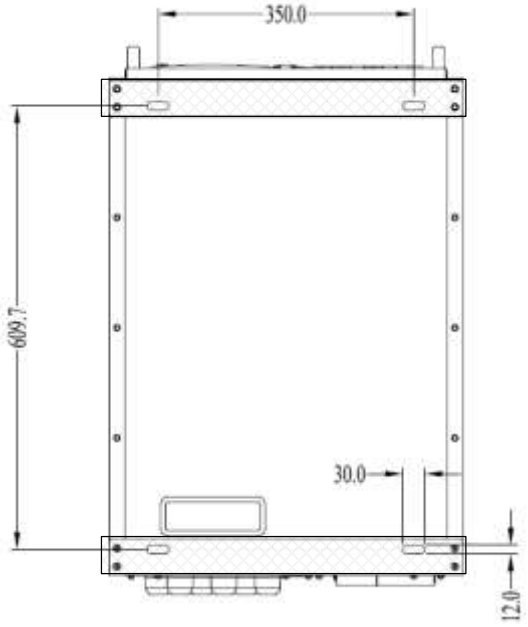


Fig 3. 2- Floor Space of 2-modules and 4-modules cabinet

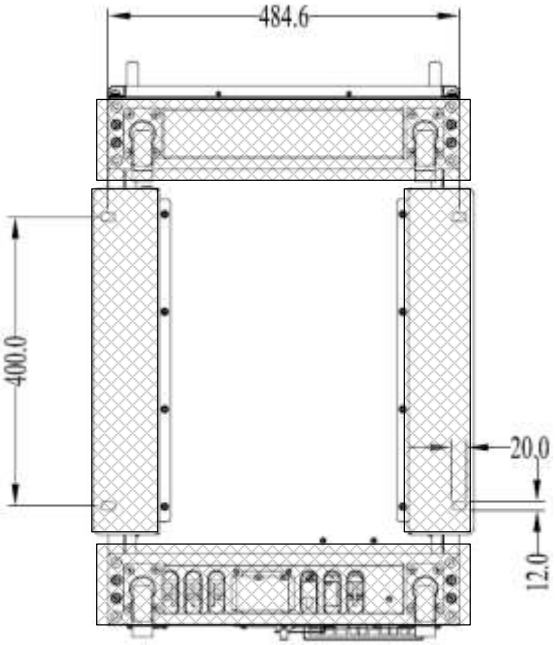


Fig 3. 3- Floor Space of 6-modules cabinet

Power Modules Installation

1. Remove two side metal strips. Loose 4 screws as *Fig 3.4*. Push the strips up-forward and take away.
2. Remove slot covers and then insert power modules as *Fig 3.5*. Push power modules into cabinet from bottom to top one by one. Then tighten the power modules with screws.

Note:

If power modules are not full of cabinet, please recover the slot covers to the remained slots.

3. Cover the two side metal strips. Loose 4 screws as *Fig 3.6* but not remove them. Hang the strips on the screws and then tighten screws.

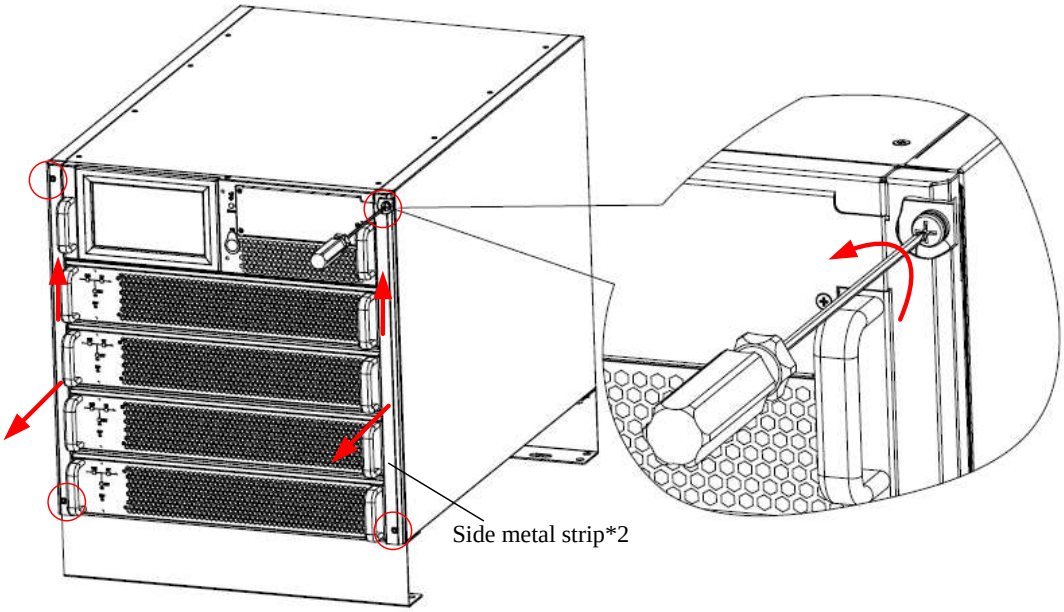


Fig 3. 4- Remove Side Metal Strips

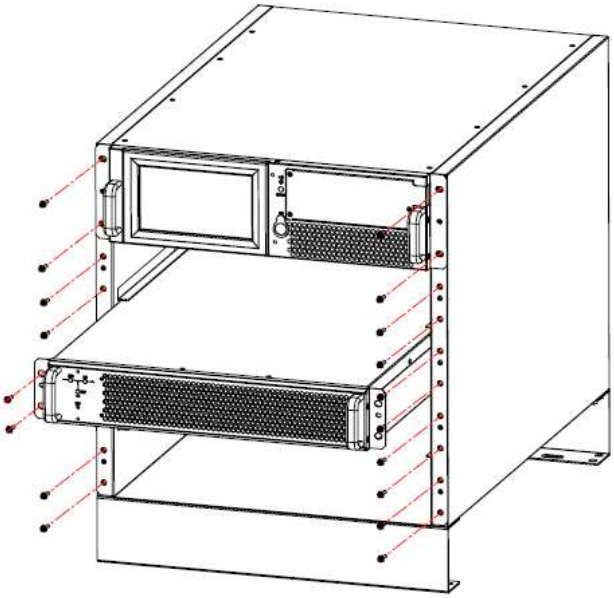


Fig 3. 5- Install Power Modules

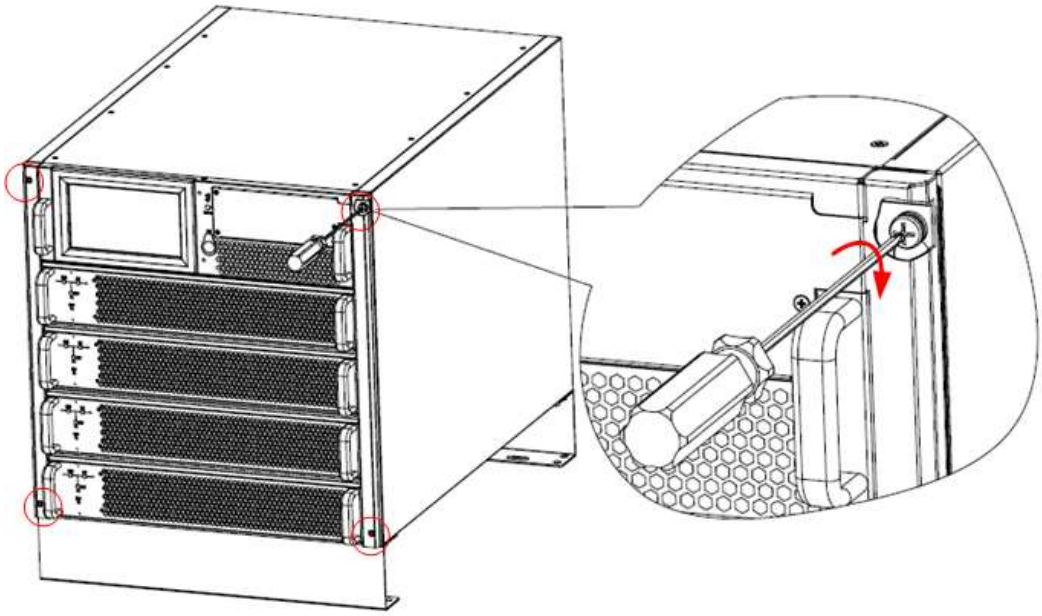


Fig 3. 6- Cover the Strips Back

3.2 Electrical Installation

This equipment must be installed by service personnel.

Caution:

Earth leakage protection: this equipment has high leakage current towards protective earthing. Earth leakage circuit breakers shouldn't be installed upstream from this equipment.

High leakage current-it is essential to effect the protective earthing connection before connecting the power supply.

All primary power switches installed remote from the UPS area will be fit with the following label: "Isolate Uninterruptible Power System (UPS) before working on this circuit".

General

All electrical connections must be made in accordance with local standards. The values given for cable cross-sections have to be observed. They are valid for voltages 380/220 V, 400/230 V and 415/240 V.

Ensure clockwise connection of conductors L1, L2 and L3 at the input terminals.

If possible, install battery cables separately from other power cables in order to avoid possible RF interference. Before wiring, open all system switches plus the battery switch.

Rating(kVA)	Mains input	Bypass input	Battery input	Earth	Output
20	4*16	4*16	3*25	16	4*16
40	4*25	4*25	3*35	25	4*25
60	4*35	4*35	3*50	25	4*35
90	4*50	4*50	3*70	35	4*50

3.3 Remote Emergency Power Off

A Remote Emergency Power Off may be connected to the system. The connection terminals are J4 pin1 and pin2 on the dry contactor board. Firing PCB when using a normally closed, voltage-free contact as a pushbutton.

Or pin3 and pin4 of J4 on the dry contactor board. Firing PCB when using a normally opened, voltage-free contact as a pushbutton.

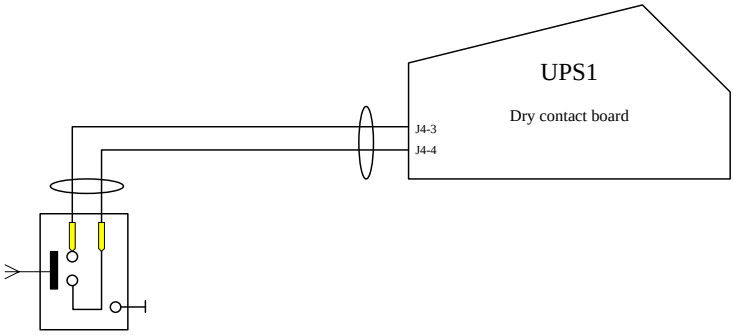


Fig 3. 7- Single Unit (with N.O contact)

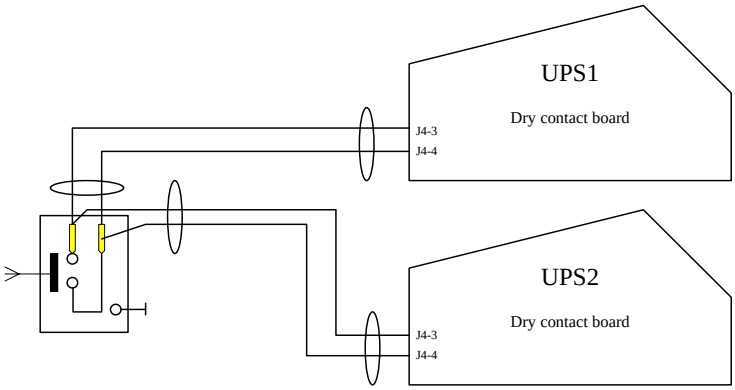


Fig 3. 8- Parallel System (with N.O. contact)

For hot-standby or parallel redundant systems, when using remote E.P.O. with N.O. contact, it is sufficient to feed one contact into one unit only. The connection terminals are the same as for the stand alone unit. When using remote E.P.O. with N.C. contact it is necessary to have one pushbutton with two normally closed contacts. The connection terminals are the same as for the stand alone unit.

The remote E.P.O. function when activated will shutdown all rectifiers and all inverters and inverter switches and static bypass. Only rectifier and bypass control will remain on.

4 INITIAL START-UP

4.1 Start-Up Procedure

General 

With the Start Up procedure the correct installation of the UPS is checked. It must be carried out by specialized personnel.

Safety precautions according to the national safety standards must be applied.

For direct control of current, voltage, UPS output power and UPS operating status by the PANEL refer to section "Front panel" of "Service Manual".

Should problems arise during the Start Up Procedure, call for service assistance.

Preparation

For carrying out the Start Up Procedure you need a multi-meter with 0.1% accuracy, a large screwdriver for the terminals and a small screwdriver for potentiometers.

The installation of the UPS must have been carried out according to chapter 3.

Check that the ventilation system of the UPS room is ready to operate.

Check that all switches are open.

A: Mains Input Power Supply Check

Switch on the external mains supply to the UPS.

Check that the supply voltage at terminals A-N, B-N, C-N is within ±15% of the UPS rated voltage.

Close mains input switch and bypass input switch

REC is starting on and REC LED is flash illuminated and then stays green: REC green

When REC is ready, BYP is starting on and BYP LED is illuminated green: REC, BYP green

INV is starting on, INV LED is flash illuminated. After about 2 minutes, INV is on: REC, INV green, BYP dark. OUT green.

B: Battery Voltage Check

Check if the batteries number is same as setting on the LCD panel.

Check the battery voltage between battery breaker BATT+ and BATTN, BATTN and BATT-.

Close external battery breaker.

Battery charger starts on, “Battery connected” displayed on the LCD: BAT LED green.

C: Current Share Check

Check if all power modules share load current on LCD: the output current difference between modules is less than 3%, normally less than 0.3A

D: DC bus voltage check

Check DC bus voltage of power modules on LCD: the DC bus voltage must be steady and positive voltage and negative voltage is same. Normally is 360Vdc, 380Vdc or 390Vdc.

E: Charging Current Check

Connect the load to the UPS. Open mains input switch.

The load is now supplied by the batteries.

Discharge the batteries for about 2 minutes or longer if the connected load is smaller than nominal load.

Close mains input switch again. After 30 seconds, check the battery current displayed on LCD.

If the current is same as setting.

Notes:

Charger current: Ichg=Po/Vfloat*x, x is the adjusted parameter of charging current on LCD.

F: Transfer Test

The UPS is working normally now, and the load is supplied by UPS.

Switch off mains input switch, UPS transfers to battery mode. After 10 seconds, switch on mains input switch, UPS transfer back to normal mode. Repeat at least 3 times.

Press  in menu  to transfer to bypass mode. And then press  in menu  to transfer back to inverter. Repeat at least 3 times.

The Start-Up procedure has been successfully completely now.

5 OPERATING MODES

5.1 General

The standard on-line UPS-system composes of four different operating modes to ensure the uninterrupted power supply of the load under various conditions. Transitions between these operating modes are performed without interruption of the power supply to the load.

Safety concept

- In “Normal Operation” any failure, internal or external, will transfer the UPS system either to “battery operation” or to “bypass operation”.
- In “Battery Operation” or “Bypass operation” an additional failure may interrupt the power supply to the load, depending on the kind of failure. In both operating modes the UPS signals a failure condition to indicate that any additional failures bears the risk of interrupting the power supply to the load.
- “Manual Bypass Operation” is used to supply the load directly from mains during maintenance or repair work.

5.2 Normal Operation

"Normal Operation" is the standard operating mode of the UPS
Mains power is present.
The rectifier converts ac power to dc power which charges the batteries and feeds the inverter.
The inverter converts this dc power to ac power used to feed the connected load.

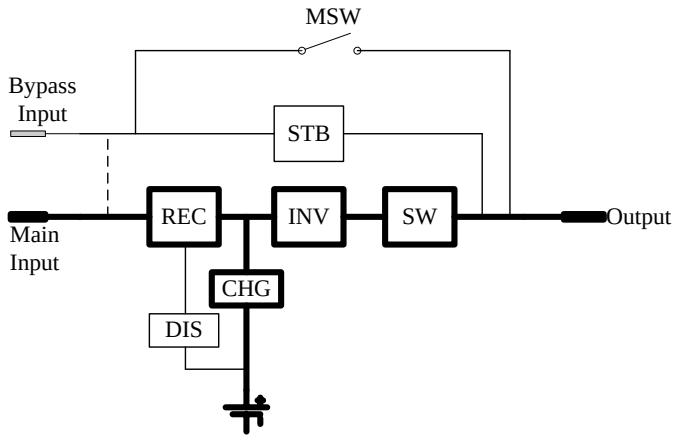


Fig 5. 1- Normal Operation

5.3 Battery Operation

The “Battery Operation” mode is activated by a mains failure or rectifier failure

- The mains input supplies no power.
- The battery supplies the required dc power to the discharger/PFC.
- The discharger supplies dc power to the inverter.

- The inverter supplies ac power to the load as described above.
- Power will only be supplied to the load for a certain period of time depending on the battery capacity.

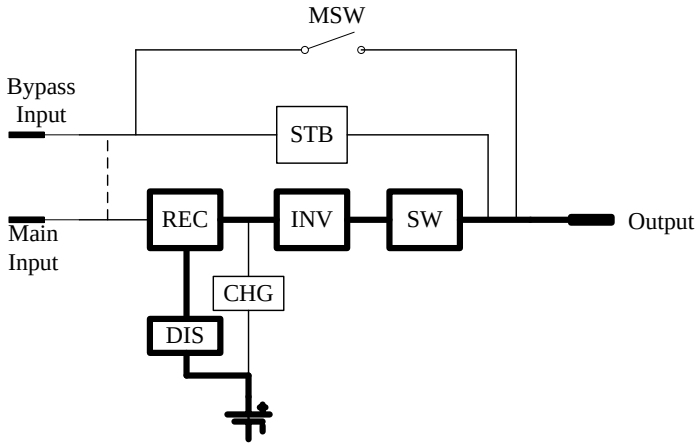


Fig 5. 2- Battery Operation

5.4 Bypass Operation

The "Bypass Operation is activated by an inverter failure or overload

- The rectifier supplies dc power only to the battery.
- The inverter switch SW opens automatically after the static bypass switch STB is closed.
- The load is supplied directly from mains through the static bypass.

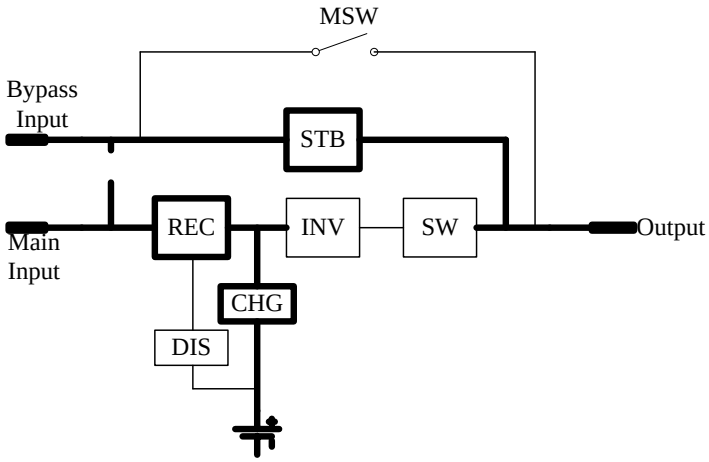


Fig 5. 3- Bypass Operation

5.5 Manual Bypass Operation

The "Manual Bypass Operation" mode is used to supply the load directly from mains during manual mode.

- In this mode, the individual functional components are completely separated from the load.
- Power for the load is supplied directly from mains through manual switch MSW.
- Power modules and bypass modules can be maintained in this mode.

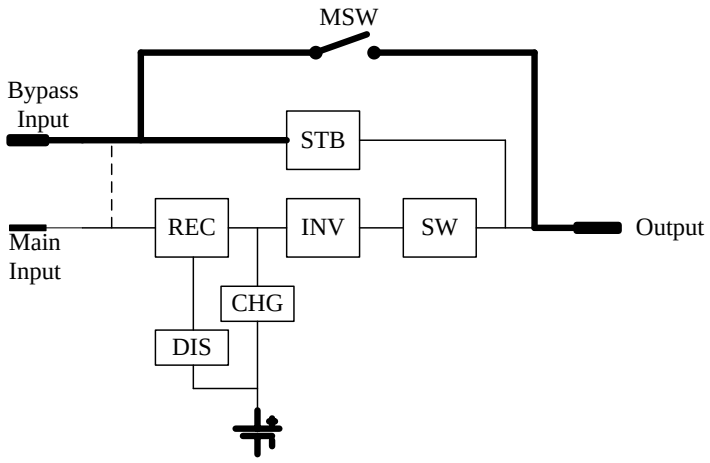


Fig 5. 4- Manual Bypass Operatio

6 OPEATING INSTRUCTIONS

6.1 Switching On

Initial UPS Operating Mode
The UPS is switched off, the load is not supplied, and all power switches are open.
Operating Steps:
Switch on the bypass breaker if is 2-modules or 4-modules cabinet.
Switch on the external mains and bypass input supply for the UPS.
The UPS performs a self-test and the rectifier starts automatically.
The bypass switches on automatically.
Wait for about 2 minutes, the inverter starts on automatically.
Switch on battery switch.
Final UPS Operating Mode:
The UPS is now in normal operation mode, as described in chapter “FRONT PANEL”, the green LEDs “REC”,”INV”,”OUT”,”STATUS” on the front panel must be illuminated. And the power flow on the LCD is also illuminated.

6.2 Switching Off

Initial UPS Operating Mode:
The UPS is in any operating mode described in chapter 5. All power switches except MSW are closed, and the load is fed either through the inverter or the static bypass.
Operating Steps:
Open external output switch for load.
Open external mains input switch.
Open external battery switch.
Open external bypass input switch if available.
After opening the external bypass input switch or battery switch, the display is only powered by the DC capacitors and will fade out within a few seconds.
Final UPS Operating Mode:
The UPS is now completely de-energized. The load is no longer supplied.

 Attention!

Although all power switches are opened and the load is no longer supplied by the UPS, there is still voltage at the inputs of the power switches and at the respective terminals and at the DC capacitors.

6.3 Switching On from Manual Bypass

Initial UPS Operating Mode:
The UPS is switched off, the load is supplied by the manual bypass, and all power switches except MSW are open.
Operating Steps:
Switch on the bypass breaker to supply for the bypass of UPS.
The BYP and OUT LEDs are continually illuminated and the current displayed on LCD flows through manual bypass and static bypass in parallel.
Open manual bypass switch MSW.
Not the load is only supplied by the static bypass.
Switch on mains input switch if split-bypass input is applied.
The UPS performs a self-test and the rectifier and the inverter start automatically. After about 2 minutes, UPS transfer from bypass to inverter.
Close external battery switch.

6.4 Switching Off to Manual Bypass

Initial UPS Operating Mode:
The UPS is in any operating mode described in chapter 5. All power switches except MSW are closed, and the load is fed either through the inverter or the static bypass.
Transfer bypass mode if in inverter.
Open external battery bypass.
Close manual bypass switch.
Now the load is supplied by the static bypass and manual bypass in parallel.
Switch off bypass input switch.
Switch off mains input switch if split-bypass input is applied.

6.5 Emergency Power Off (Single Unit)

Initial UPS Operating Mode:
The UPS is in any operating mode described in chapter 5.
Operating Steps:
Press EPO button beside the LCD.
All the converters include rectifier, inverter, bypass, charger, inverter are switched off now. UPS alarms “EPO”. Switch off mains input and bypass input switches to shutdown UPS completely. Then open external battery breaker.
Reset after activating EPO
EPO function is cleared after shutdown UPS completely.
If LCD is still on, press  in menu  to reset UPS.

7 DISPLAY PANEL

General

The front panel is the user-interface of the UPS. It is a DSP controlled panel and provides the following functions:

- Alarms are indicated by red LEDs indicators on the right side.
- Measured values are shown in the colorful LCD.
- The UPS status is indicated by both of LEDs and LCD in the block diagram of the UPS.
- Remote monitoring interfaces via RS232 and RS485, or options SNMP card.
- Use function buttons or touched LCD to operate the UPS.

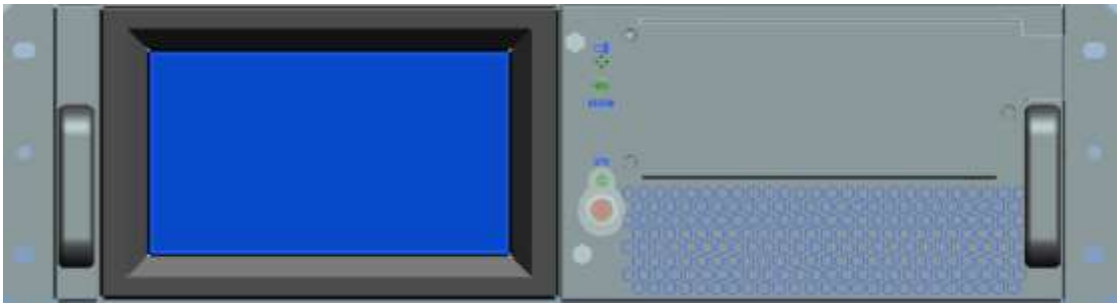
The front panel performs all function of the UPS.

As UPS systems often will be installed in datacenters, it is desirable to leave all operation functions inside the UPS cubicle, in order to prevent erroneous operation by untrained personnel.

7.1 Introduction

The operator 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 operator control panel is divided into three functional areas as shown in *fig.7-1*: mimic current path, LCD display & Menu, control and operation button. The detailed description of control and display panel is shown in *table.7-1*.

(a) 6-modules cabinet



(b) 2-modules and 4- 6 modules cabinet

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

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

Indicator	Function		Button	Function
REC	Rectifier indicator(6-modules)		EPO	EPO (emergency power off)
BAT	Battery indicator(6-modules)		HOME	Back to main menu(6-modules)
BYP	Bypass indicator(6-modules)		Left arrow Right arrow	Select main menu items; switch between submenu; increase or reduce for number input(6-modules)
INV	Inverter		ENTER	Confirm(6-modules)

	indicator(6-modules)			
OUTPUT	Load indicator(6-modules)			
STATUS	Status indicator			

7.1.1 Mimic Current Path

The LEDs shown on the mimic current path represent the various UPS power paths and show the current UPS operating status. The status description of indicators is shown in *table.7-2*.

Table.7- 2: Status Description of Indicator

Indicator	State	Description
Rectifier indicator	Steady green	Rectifier of all modules is normal
	Flashing green	At least one of module rectifier is starting
	Steady red	At least one Rectifier of module fault
	Flashing red	Main input of at least one module is abnormal
	Off	Rectifier is not working
Battery indicator	Steady green	Battery is charging
	Flashing green	Battery is discharging
	Steady red	Battery is abnormal (battery failure, no battery or battery reverse) or battery converter is abnormal (failure, over current or over temperature) , EOD
	Flashing red	Battery voltage is low
	Off	Battery and battery converter is normal, battery is not charging
Bypass indicator	Steady green	UPS is working in bypass mode
	Steady red	Bypass is failure
	Flashing red	Bypass voltage is abnormal
	Off	Bypass is normal and is not working
Inverter indicator	Steady green	Inverter is feeding the load
	Flashing green	Inverter is starting, or UPS is working in ECO mode
	Steady red	At least one module’s inverter is failure, and inverter is not feeding the load
	Flashing red	Inverter is feeding load, and at least one module’s inverter is failure
	Off	Inverter is not working in all modules
Load indicator	Steady green	UPS output is on and is normal
	Steady red	UPS output is overload and time is over, or output is shorten, or output has no power supply
	Flashing red	UPS is overload
	Off	No output voltage
Status indicator	Steady green	Normal operation
	Steady red	Fault

7.1.2 Audible Alarm (buzzer)

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

Table.7- 3: 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

7.1.3 Functional Keys

There are 4 functional buttons on operator control and display panel, which are used together with LCD. The functions description is shown in *table.7-4*.

Table.7- 4: Functions of Functional Keys

Functional key	Functions
EPO	To cut off the load power to shut down the rectifier, inverter, static bypass and battery
HOME	To return the main menu
Left arrow and righ arrow	Select options in the mian menu, switch over secondary meun pages, upward and downward roll the histrical log, add and subtract the intered number
Enter	confirm

7.1.4 Battery Pack Indicator

The LED on the front panel of battery pack indicates battery pack status. If battery fuse in battery pack is broken, LED changes to be red. Customer must contactor with our local distributer to maintain it.

7.2 LCD Display Type

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 path, current record and main menu.

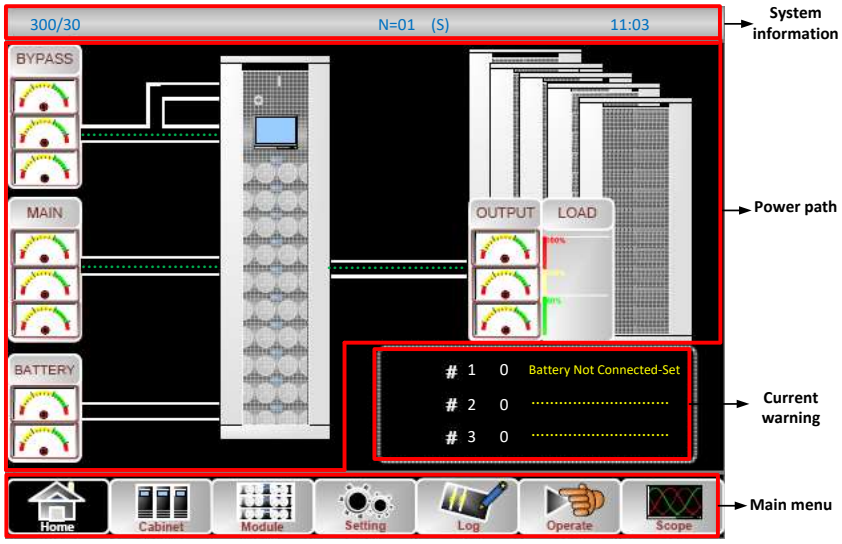


Fig.7- 2: Main LCD Display

The description of LCD icon is shown in *table.7-5*:

Table.7- 5: Description of LCD Icons

Icon	Description
	Return to main menu page

Icon	Description
	Return to main menu page
	Bypass, main, output (voltage, current, PF, frequency), battery information(capacity, remained time, worked days, battery temperature, ambient temperature), load information(percent, active load, reactive load, apparent load)
	Information of power module(main, output, load, S-code, module information)
	DATE&TIME, LAGNUAGE, COMMUNICATION, USER(use user password 1), BATTERY set, SERVICE set, RATE set, CONFIGURE
	History LOG
	Mute ON/OFF, Fault clear, transfer to bypass, transfer to inverter, enable module “off”, reset battery history data, reset dust filter using time, battery test, battery maintenance, battery boost, battery float, stop test
	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

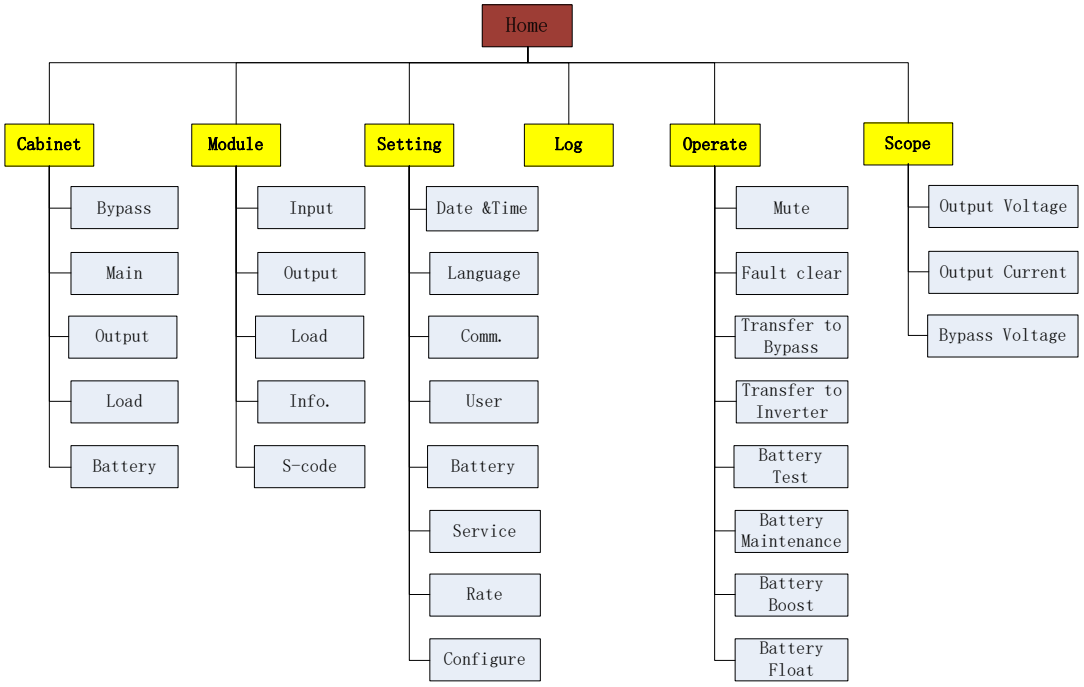


Fig.7- 3: Menu Structure

7.3 Detailed Description of Menu Item

The LCD main display shown in *fig.7-2* is described in details below.

UPS system information window

UPS information window: unit model, module numbers, unit mode, current date and time are displayed. The information of the window is not necessary for the user to operate. The information of this window is given in t*able.7-6*.

Table.7- 6: Description of Items in UPS System Information Window

Display contents	Meaning
300/30	Unit model
N=01	1 Power module in system
(s)	Unit mode: S--single unit, P-0/1--parallel mode, E--ECO mode, L--LBS mode, PE-0/1--parallel ECO mode, PL-0/1--parallel LBS mode
11:03	Date and time

Main menu window

Details of UPS menu is shown in Table.7-5.

Enter in 

to get cabinet information.

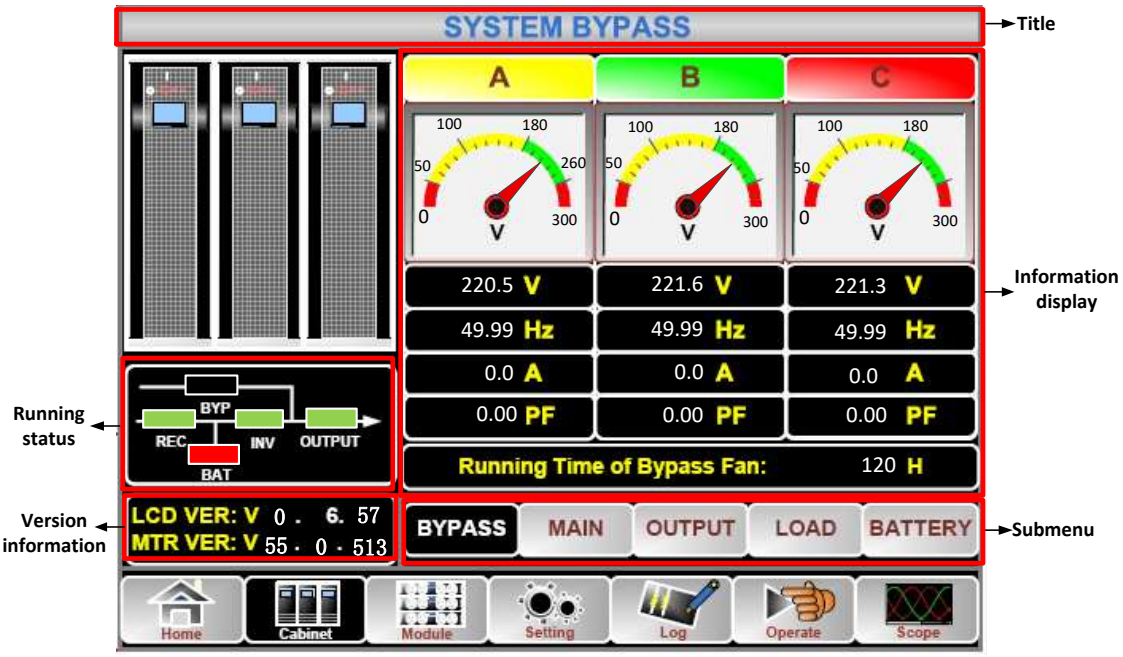
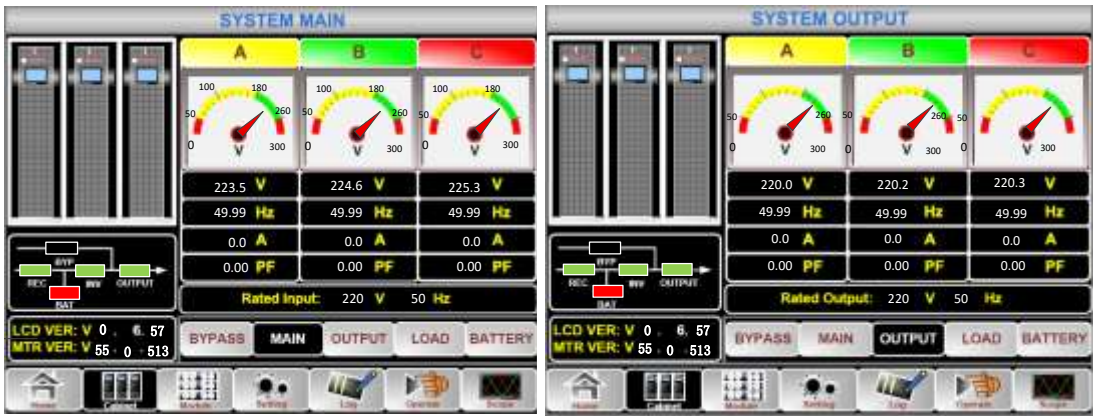


Fig.7- 4: cabinet menu

Submenu BYPASS, MAIN, OUTPUT

Bypass information, main input and output information (voltage, current, frequency, PF) are displayed in cabinet menu, voltage is also shown in meter type. Current mimic status indicators, LCD and monitoring version are displayed. Shown as below:

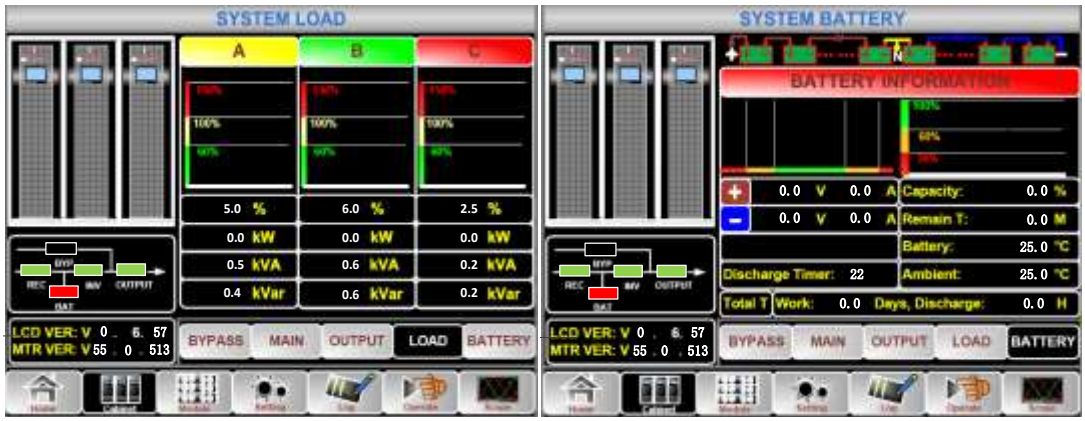


(a) Main input information (b) output information

Fig.7- 5: main input and output information

Submenu LOAD, BATTERY

Load information includes load percent, active load, reactive load, apparent load. Battery information includes battery number, battery voltage, battery current, remained capacity, remained discharge time, discharge times, working days, discharge hours, battery temperature (optional), ambient temperature (optional). Shown as below:



(a) system load information (b) system battery information

Fig.7- 6: load and battery information

Enter in  *to get power module information*

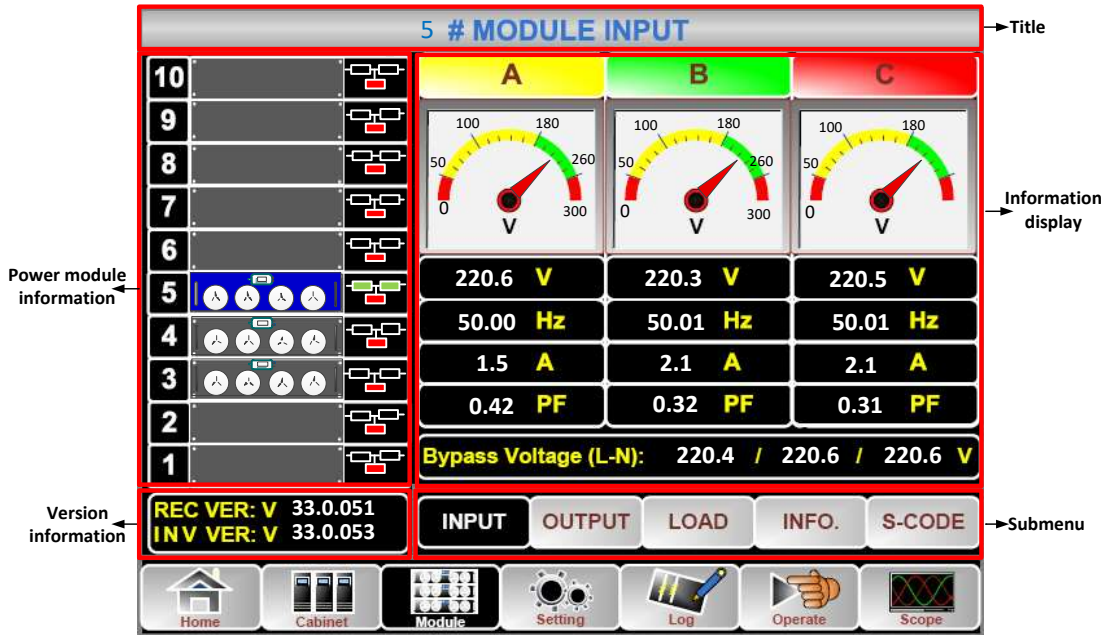


Fig.7- 7: power module information

Module information menu includes: input, output, load, internal information, S-code, software version.

Submenu INPUT, OUTPUT, LOAD

Input and output information include voltage, current, frequency, PF. Load information includes load percent, active load, reactive load, apparent load. Shown as below:

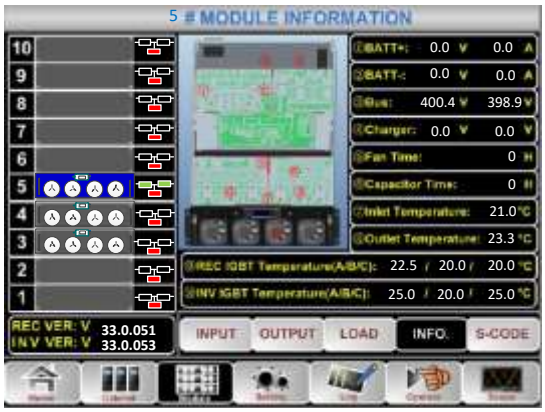
(a) module output information

(b) module load information

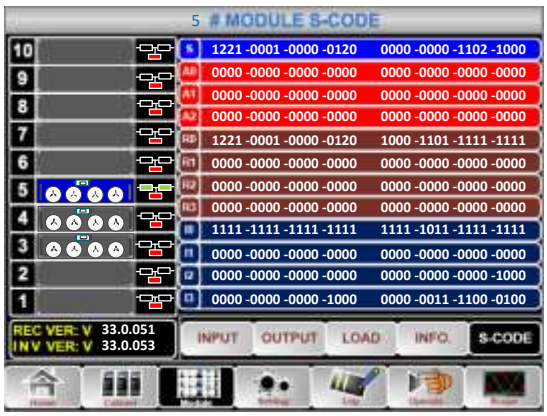
Fig.7- 8: module output and load information

Submenu INFO., S-Code

INFO menu includes modules battery information, inlet temperature, outlet temperature, IGBT temperature. And S-code menu displays S-code of power module to indicate what has happened to power module.



(a) module information



(b) S-code of the power module

Fig.7- 9: module information and S-code

Enter in  *to set UPS system.*

It includes DATE&TIME, LANGUAGE, COMM., USER, BATTERY, SERVICE, RATE, CONFIGURE. And submenu BATTERY, SERVICE, RATE, CONFIGURE is only available for service engineer or manufacturer.

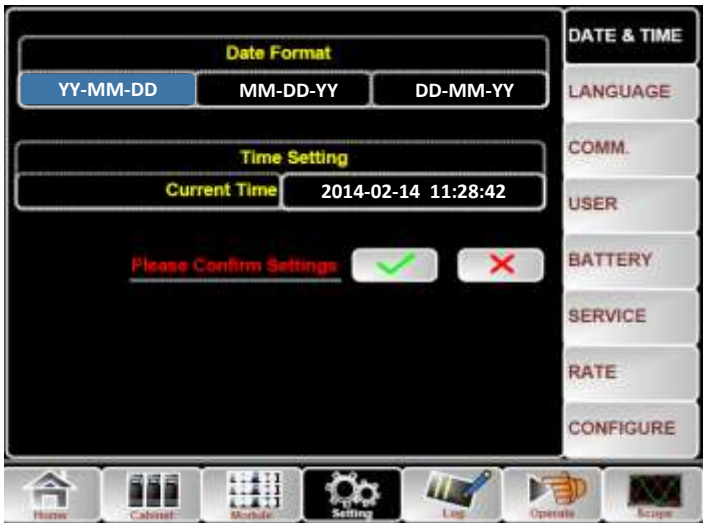


Fig.7- 10: Setting Menu

Table.7- 7: description of details of submenu in setting

Submenu Name	Contents	Meaning
Date&Time	Date format setting	Three format: (a) year/month/day,(b) moth/date/year，(c) date/month/year
	Time setting	Setting time
Language	Current language	Language in use
	Language selection	Simplified Chinese and English selectable（The setting taking action immediately after touching the language icon）
COMM.	Device Address	Setting the communication address
	RS232 Protocol Selection	SNT Protocol, ModBus Protocol, YD/T Protocol and Dwin（For factory use）
	Baudrate	Setting the baudrate of SNT, ModBus and YD/T
	Modbus Mode	Setting mode for Modbus:ASCII and RTU selectable
	Modbus parity	Setting the parity for Modbus
USER	Output voltage Adjustment	Setting the Output Voltage
	Bypass Voltage Up Limited	Up limited working Voltage for Bypass，settable:+10%，+15%，+20%，+25%
	Bypass Voltage Down Limited	Down limited working Voltage for Bypass，settable:-10%，-15%，-20%，-30%，-40%
	Bypass Frequency Limited	Permitted working Frequency for Bypass Settable：+-1Hz，+-3Hz，+-5Hz
	Dust Filter Maintenance Period	Setting Dust Filter Maintenance Period
BATTERY	Battery Number	Setting the number of the battery（12V）
	Battery Capacity	Setting of the AH of the battery
	Float Charge Voltage/Cell	Setting the floating Voltage for battery cell（2V）
	Boost Charge Voltage/Cell	Setting the boost Voltage for battery cell（2V）
	EOD(End of charge) Voltage/Cell,@0.6C Current	EOD voltage for cell battery,@0.6C
	EOD(End of charge) Voltage/Cell,@0.15C Current	EOD voltage for cell battery,@0.15C

Submenu Name	Contents	Meaning
	Charge Current Percent Limit	Charge current (percentage of the rated current)
	Battery Temperature Compensate	Coefficient for battery temperature compensation
	Boost Charge Time Limit	Setting boost charging time
	Auto Boost Period	Setting the auto boost period
	Auto Maintenance Discharge Period	Setting the period for auto maintenance discharge
SERVICE	System Mode	Setting the system mode: Single ,parallel, Single ECO, parallel ECO,LBS, parallel LBS
RATE	Configure the rated Parameter	For the factory use
CONFIGURE	Configure the system	For the factory use

Enter in  *to get history log of UPS system.* Use  to scroll the list.

Enter in  *to control UPS system.* The function and test command are shown as below:

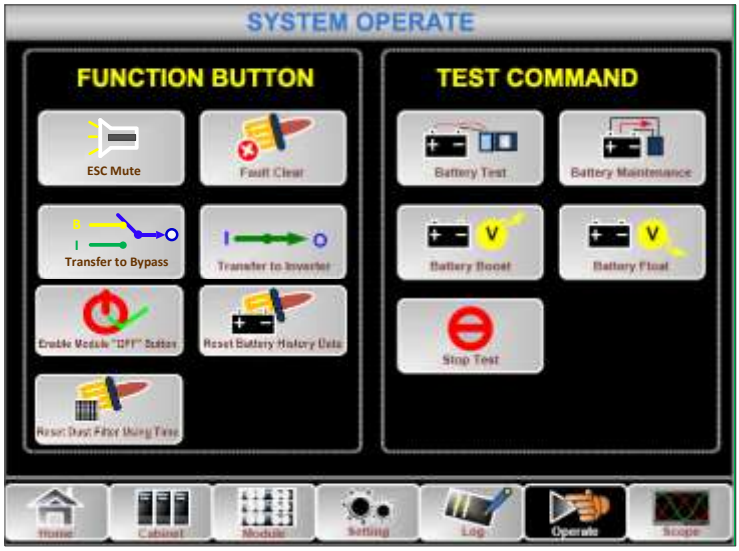


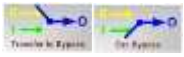
Fig.7- 11: System Operate

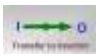
Menu of Operate includes:

Functional operation

 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, main LED indicator is dark and battery LED indicator green flashes. If battery is sick 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 normal mode after 20 seconds. If battery test is failure, UPS alarms in the history log.

 Battery maintenance command. UPS transfer to battery mode, main LED indicator is dark and battery LED indicator green flashes. 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 normal 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 mode 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 see the waveform of output voltage, current and bypass voltage.*

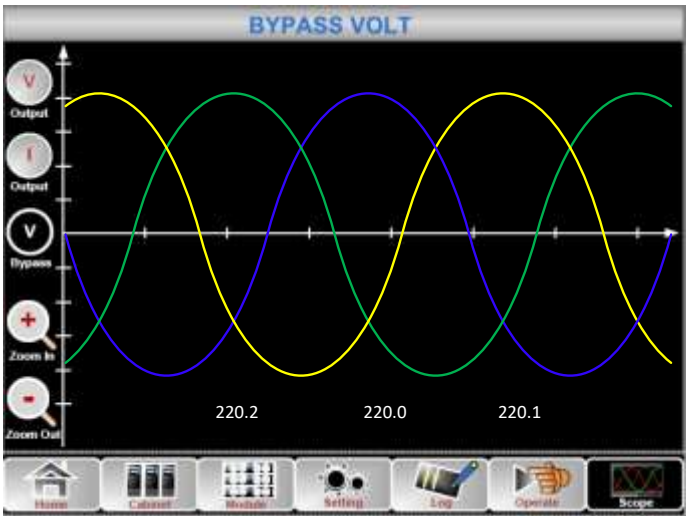


Fig.7- 12: output and bypass waveform

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- 8: UPS Event List

NO.	UPS events	Description
1	Fault Clear	Manually clear fault
2	Log Clear	Manually clear History log
3	Load On UPS	Inverter feeds load
4	Load On Bypass	Bypass feeds load
5	No Load	No load
6	Battery Boost	Charger is working in boost charging mode
7	Battery Float	Charger is working in float charging mode
8	Battery Discharge	Battery is discharging
9	Battery Connected	Battery is connected already
10	Battery Not Connected	Battery is not yet connected.
11	Maintenance CB Closed	Manual maintenance breaker is closed
12	Maintenance CB Open	Manual maintenance breaker is opened
13	EPO	Emergency Power Off
14	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.
15	Generator Input	Generator is connected and a signal is sent to the UPS.
16	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.
17	Bypass Sequence Error	Bypass voltage Sequence is reverse. Check if input power cables are connected correctly.
18	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. 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. 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”. 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
19	Bypass Module Fail	Bypass Module Fails. This fault is locked until power off. Or bypass fans fail.
20	Bypass Module Over Load	Bypass current is over the limitation. If bypass current is under 135% of the rated current. The UPS alarms but has no action.
21	Bypass Over Load Tout	The bypass overload status continues and the overload times out.
22	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. 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. 1. 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". 2. 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
23	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
24	Output Short Circuit	Output shorted Circuit. Fist check and confirm if loads have something wrong. Then check and confirm if there is something wrong with terminals, sockets or some other power distribution unit. If the fault is solved, press "Fault Clear" to restart UPS.
25	Battery EOD	Inverter turned off due to low battery voltage. Check the mains power failure status and recover the mains power in time
26	Battery Test	System transfer to battery mode for 20 seconds to check if batteries are normal
27	Battery Test OK	Battery Test OK
28	Battery Maintenance	System transfer to battery mode until to be 1.1*EOD voltage to maintenance battery string
29	Battery Maintenance OK	Battery maintenance succeed
30	Module inserted	Power Module is inserted in system.
31	Module Exit	Power Module is pulled out from system.
32	Rectifier Fail	The N# Power Module Rectifier Fail, The rectifier is fault and results in rectifier shutdown and battery discharging.

33	Inverter Fail	The N# Power Module Inverter Fail. The inverter output voltage is abnormal and the load transfers to bypass.
34	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. If over temperature exists, check: 1. Whether the ambient temperature is too high. 2. Whether the ventilation channel is blocked. 3. Whether fan fault happens. 4. Whether the input voltage is too low.
35	Fan Fail	At least one fan fails in the N# power module.
36	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. 2. If this alarm is true, measure the actual output current to confirm if the displayed value is correct. Disconnect non-critical load. In parallel system, this alarm will be triggered if the load is severely imbalanced.
37	Inverter Overload Tout	N# Power Module Inverter Over Load Timeout. The UPS overload status continues and the overload times out. Note: The highest loaded phase will indicate overload timing-out first. When the timer is active, then the alarm “unit over load” should also be active as the load is above nominal. When the time has expired, the inverter Switch is opened and the load transferred to bypass. 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.
38	Inverter Over Temp.	The N# Power Module Inverter Over Temperature. 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. If over temperature exists, check: Whether the ambient temperature is too high. Whether the ventilation channel is blocked. Whether fan fault happens.

		Whether inverter overload time is out.
39	On UPS Inhibited	Inhibit system transfer from bypass to UPS (inverter). Check: Whether the power module's capacity is big enough for load. Whether the rectifier is ready. Whether the bypass voltage is normal.
40	Manual Transfer Byp	Transfer to bypass manually
41	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.
42	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.
43	Battery Reverse	Battery cables are connected not correctly.
44	Inverter Protect	The N# Power Module Inverter Protect. Check: Whether inverter voltage is abnormal Whether inverter voltage is much different from other modules, if yes, please adjust inverter voltage of the power module separately.
45	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.
46	Bypass Fan Fail	At least one of bypass module Fans Fails
47	Manual Shutdown	The N# Power Module is manually shutdown. The power module shuts down rectifier and inverter, and there's on inverter output.
48	Manual Boost Charge	Manually force the Charger work in boost charge mode.
49	Manual Float Charge	Manually force the charger work in float charge mode.
50	UPS Locked	Forbidden to shutdown UPS power module manually.
51	Parallel Cable Error	Parallel cables error. Check: If one or more parallel cables are disconnected or not connected correctly If parallel cable round is disconnected If parallel cable is OK
53	Lost N+X Redundant	Lost N+X Redundant. There is no X redundant powers module in system.
54	EOD Sys Inhibited	System is inhibited to supply after the battery is EOD (end of discharging)
55	Battery Test Fail	Battery Test Fail. Check if UPS is normal and battery voltage is over 90% of float voltage.
56	Battery Maintenance Fail	Check If UPS is normal and not any alarms If the battery voltage is over 90% of float voltage If load is over 25%

57	Ambient Over Temp	Ambient temperature is over the limit of UPS. Air conditioners are required to regulate ambient temperature.
58	REC CAN Fail	Rectifier CAN bus communication is abnormal. Please check if communication cables are not connected correctly.
59	INV IO CAN Fail	IO signal communication of inverter CAN bus is abnormal. Please check if communication cables are not connected correctly.
60	INV DATA CAN Fail	DATA communication of inverter CAN bus is abnormal. Please check if communication cables are not connected correctly.
61	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.
62	Sync Pulse Fail	Synchronization signal between modules is abnormal. Please check if communication cables are not connected correctly.
63	Input Volt Detect Fail	Input voltage of N# power module is abnormal. Please check if the input cables are connected correctly. Please check if input fuses are broken. Please check if utility is normal.
64	Battery Volt Detect Fail	Battery voltage is abnormal. Please check if batteries are normal. Please check if battery fuses are broken on input power board.
65	Output Volt Fail	Output voltage is abnormal.
66	Bypass Volt Detect Fail	Bypass voltage is abnormal. Please check if bypass breaker is closed and is good. Please check if bypass cables are connected correctly.
67	INV Bridge Fail	Inverter IGBTs are broken and opened.
68	Outlet Temp Error	Outlet temperature of power module is over the limitation. Please check if fans are abnormal. Please check if PFC or inverter inductors are abnormal. Please check if air passage is blocked. Please check if ambient temperature is too high.
69	Input Curr Unbalance	The difference of input current between every two phases is over 40% of rated current. Please check if rectifier's fuses, diode, IGBT or PFC diodes are broken. Please check if input voltage is abnormal.
70	DC Bus Over Volt	Voltage of DC bus capacitors is over limitation. UPS shutdown rectifier and inverter.
71	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 1. Whether rectifier diodes are broken 2. Whether PFC IGBTs are broken 3. Whether PFC diodes are broken 4. Whether drivers of SCR or IGBT are abnormal 5. Whether soft start resistors or relay are abnormal
72	Relay Connect Fail	Inverter relays are opened and cannot work or fuses are broken.

73	Relay Short Circuit	Inverter relays are shorted and cannot be released.
74	PWM Sync Fail	PWM synchronizing signal is abnormal
75	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.
76	Manual Transfer to INV	Manually transfer UPS to inverter. It's used to transfer UPS to inverter when bypass is over track. The interrupt time could be over 20ms.
77	Input Over Curr Tout	Input over current timeout and UPS transfer to battery mode. 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.
78	No Inlet Temp. Sensor	Inlet temperature sensor is not connected correctly.
79	No Outlet Temp. Sensor	Outlet temperature sensor is not connected correctly.
80	Inlet Over Temp.	Inlet air is over temperature. Make sure that the operation temperature of UPS is between 0-40°C.
81	Capacitor Time Reset	Reset timing of DC bus capacitors.
82	Fan Time Reset	Reset timing of fans.
83	Battery History Reset	Reset battery history data.
84	Byp Fan Time Reset	Reset timing of bypass fans.
85	Battery Over Temp.	Battery is over temperature. It's optional.
86	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.
87	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.
88	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.
89	INV IGBT Driver Block	Inverter IGBTs are shutdown. Please check if power modules are inserted in cabinet correctly. Please check if fuses between rectifier and inverter are broken.
90	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.
91	Bypass CAN Fail	The CAN bus between bypass module and cabinet is abnormal.

92	Dust Filter Expired	Dust filter need to be clear or replaced with a new one
102	Wave Trigger	Waveform has been saved while UPS fail
103	Bypass CAN Fail	Bypass and cabinet communicate with each other via CAN bus. Check If connector or signal cable is abnormal. If monitoring board is abnormal.
105	Firmware Error	Manufacturer used only.
106	System Setting Error	Manufacturer used only.
107	Bypass Over Temp.	Bypass module is over temperature. Please check If bypass load is overload If ambient temperature is over 40°C If bypass SCRs are assembled correctly If bypass fans are normal
108	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 REMOTE CONTROLED BY PC

8.1 General

The remote control by PC of the UPS Systems can be performed via RS232. Instead of installing a complete remote control panel, a dedicated software can be run on an existing control PC when needed. The RS232 interface allows communication distances of up to 15m.

8.2 Remote Control via RS232

Power MTR is the software used to Remote Control UPS systems by PC, via RS232 interface
The PC is connected to the UPS by a shielded cable 4*0.5mm of up to 15m length with 9-pole sub-D connectors

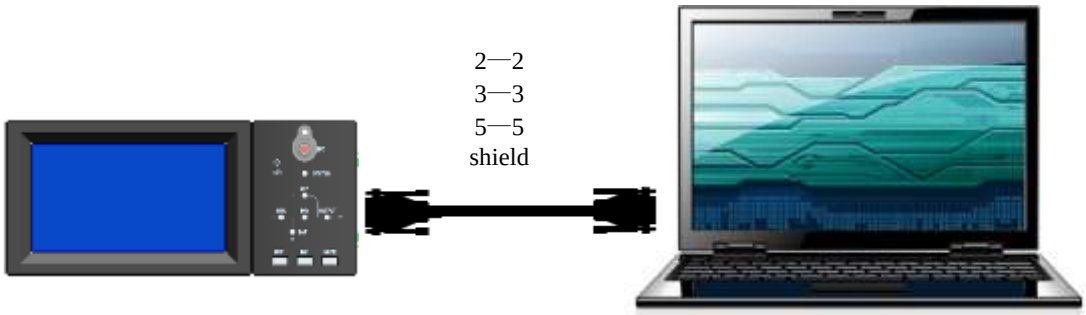


Fig 8. 1- installation

The communication parameters for the RS232 connection are:

- Baud Rate = 9600 (2400, 4800, 19200 settable)
- Parity = NULL
- Address = 1 (1~254)

The remote control software runs on all PC compatible and mainframe systems.

Functions

All functions of the front panel can also be performed by PowerMTR. the feature are in detail:

- All displayed values
- History log and S-code download
- Operating
- Setting of UPS parameters
- Adjustment of important values: bypass voltage, output voltage, output DC voltage
- Display of UPS diagrams

Note:

RS485 interface and RS232 interface can’t be simultaneously connected when using Modbus protocol.

9 PARALLEL REDUNDANT SYSTEMS

9.1 General Description

9.1.1 Field of Application

Parallel redundant UPS systems basically fulfill the same requirements as standard on-line UPS systems:

- uninterruptible power supply to critical load
- stabilized supply voltage
- uncoupling of the load from mains distortions

In addition they provide more safety than the standard on-line UPS. The parallel redundant UPS system also guarantees an uninterrupted power supply even in case of two internal failures in two separate UPS units.

Therefore, the parallel redundant system is the ideal solution for applications with high safety standards where, in the case of an internal UPS system failure, the direct connection of the load with supply mains is not permissible.

9.1.2 System Structure

The parallel redundant UPS system basically consists of two single modular UPS units connected in parallel:

- Both units consists of four functional parts:

-cabinet
-bypass module
-power module
-monitoring panel

- Both units is additionally equipped with:

-parallel communication cable

 Note:

Only 6 modules cabinet can be paralleled.

9.2 Installation

9.2.1 General Information

There are three different ways of installing a parallel redundant system:
A complete new parallel redundant system consisting of two or more UPS is to be installed.
An existing single modular UPS system is to be transformed into a parallel redundant system by adding a new or more UPSs.
Several existing independent single modular systems are to be transformed into a parallel redundant system.

9.2.2 Installation of a Complete Parallel Redundant System

Single Unit Installation

The units are fully equipped on delivery. The mechanical installation of the UPS has to be performed

according to “INSTALLATION & INITIAL STARTUP”. The units should be installed close to each other (max. distance: 5m).

Connections between paralleled units

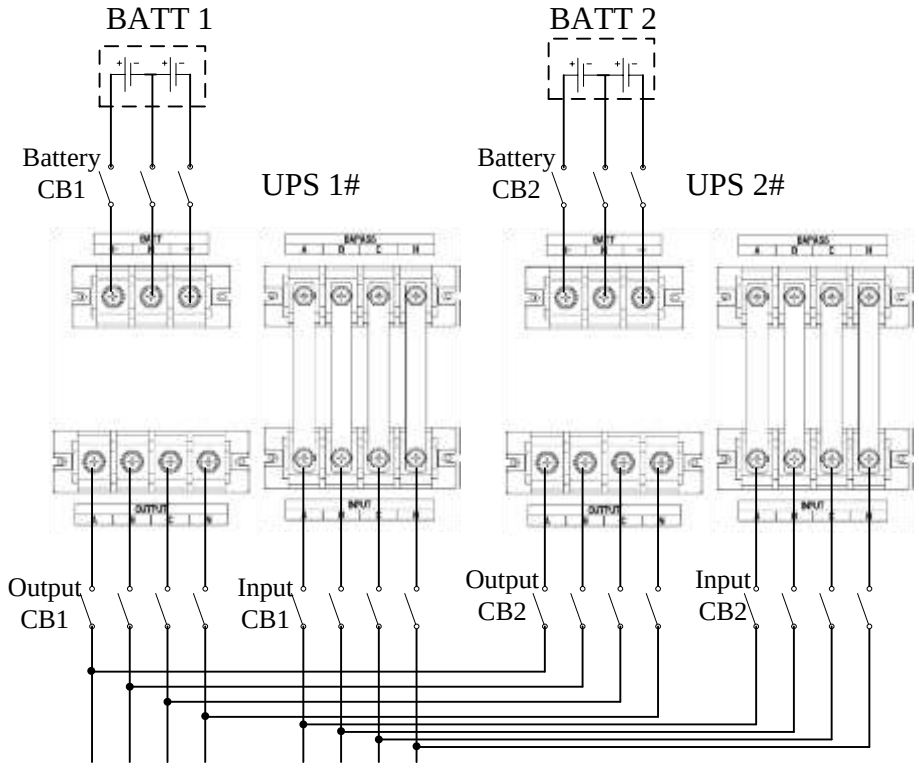


Fig 9. 1- Parallel System Power Connection

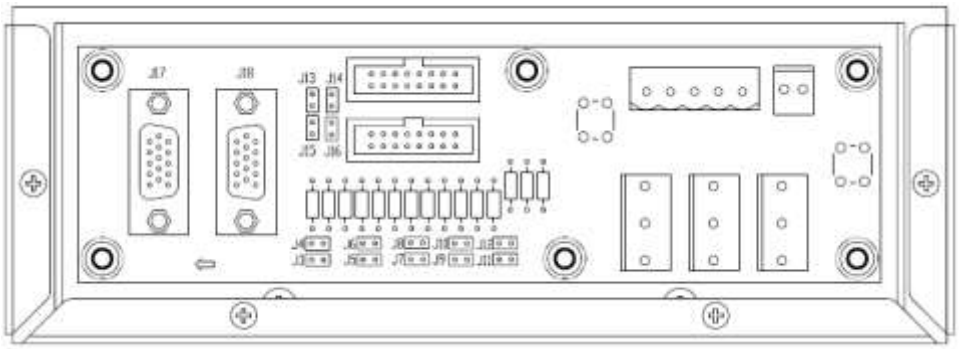
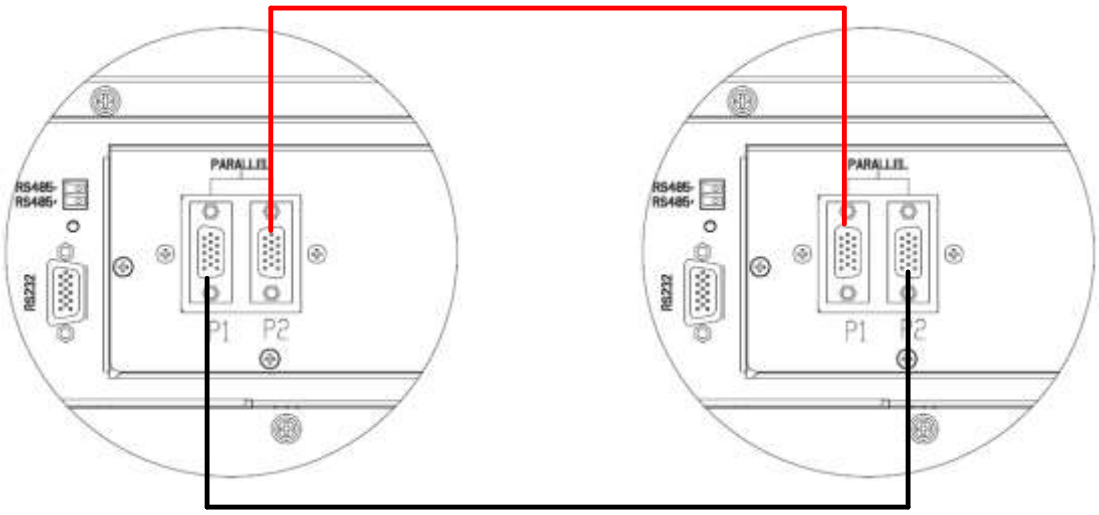


Fig 9. 2- Parallel Board on the Rear of Cabinet



UPS1 UPS2

Fig 9. 3- Parallel Communication Cables Connection

1. Connect power cables as *Fig 9.1* in parallel system.
2. Set the jumper ID on the parallel board as Fig 9.2:
   Single- all shorted
   2 paralleled- UPS1: J3,J5,J7,J9,J11,J13,J15 shorted, others are open UPS2: all jumpers are open
   3 paralleled- UPS1: all jumpers are open UPS2: all jumpers are open UPS3: all jumpers are open
3. Connect control communication cables as *Fig 9.3*.
4. Press  to enter in setting menu.
5. Press “service” menu and then enter password 2 to enter in service menu.
6. Select “Parallel”.
7. Set parallel numbers as N.
8. Set cabinet ID from 0~(N-1).
9. Press  then confirm to activate the setting.
10. Set all UPSs in parallel system as 3-8.

9.2.3 Adding a new Unit to an Existing UPS System

The new UPS should be installed close to the existing UPS (max distance: 5m).

The electrical connections between the mains and the parallel redundant system and between the parallel redundant system and the load are shown as Fig 9.1.

1. Connect power cables as *Fig 9.1* in parallel system.
2. Connect control communication cables as *Fig 9.2*.
3. Press  to enter in setting menu.
4. Press “service” menu and then enter password 2 to enter in service menu.
5. Select “Parallel”.
6. Set parallel numbers as N.
7. Set cabinet ID from 0~(N-1).

8. Press  then confirm to activate the setting.
9. Set all UPSs in parallel system as 3-8.

10 INITIAL START-UP OF REDUNDANT SYSTEM

10.1 Functional Check

After the parallel redundant system has been installed mechanically and electrically, the installation has to be tested with the functional check:
Starts up every UPS follow the start up procedure as CHAPTER “INSTALLATION & INITIAL STARTUP” one by one.
Check that the UPSs are OK and all important values (input voltage, DC bus voltage, output voltage) are normal on LCD.
Check that the output DC voltage is below 0.3Vdc with multi-meter which is 0.1% accuracy.
Check that all LEDs are ok on the front panel and power modules.

10.2 Initial Start-up

Make sure that the power cables and communication cables are connected correctly. Make sure jumpers ID is correct.
Close output CB1. Close output CB2.
Close input CB1. Close input CB2.
UPS1 and UPS2 rectifiers start up together.
UPS1 and UPS2 bypass switch on.
After about 2 minutes, UPS1 and UPS2 transfer to inverter together.
Close battery CB1 and battery CB2.
Load on now and UPS1 and UPS2 share the load.

11 TECHNICAL DATA

This chapter provides UPS product specification.

11.1 Applicable Standards

The UPS has been designed to conform to the following European and international standards:
Table.11- 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).*	

11.2 Environmental Characteristics

Table.11- 2: Environmental Properties

Items	Unit	Requirements
Acoustic noise level at 1 meter	dB	56.0(power module)
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	°C	0 to 40 deg , Battery life is halved for every 10°C increase above 20°C
UPS Storage-Transport Temperature	°C	-20~70
Recommended Battery Storage Temperature	°C	0~25 (20°C for optimum battery storage)

11.3 Mechanical Characteristics

Table.11- 3: Mechanical Properties

Cabinet Specification	Unit	20/10	40/10	60/10 90/15
Mechanical Dimension, W×D×H	mm	446×697×398(7U)	446×697×575(11U)	485*751*1033
Weight	kg	30.5	41	70
Color	N/A	Black		
Protection Level, IEC(60529)	N/A	IP20		

Module type	Unit	10/15
Mechanical Dimension, W×D×H	mm	436×590×85
Weight	kg	15.3/15.5
Color	N/A	Black(front)

11.4 Electrical Characteristics (Input Rectifier)

Table.11- 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%~+25%
Frequency[1]	Hz	50/60(range: 40Hz～70Hz)
Power factor	kW/kVA, full load	0.99

THD	THDI%	4

11.5 Electrical Characteristics (Intermediate DC Link)

Table.11- 5: Battery Information

Items	Unit	Parameters
Battery bus voltage	Vdc	Nominal: ±240V, one-side range: 198V~288V
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) 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) 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) @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 Charging Power	kW	10%* UPS capacity (selectable from : 1~20%* UPS capacity)

11.6 Electrical Characteristics (Inverter Output)

Table.11- 6: Inverter Output (to Critical Load)

Rated capacity (kVA)	Unit	10~90
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, 1 hour 125% load, 10min 150% load, 1min >150% load, 200ms
Fault current	%	300% short current limitation for 200ms
Non linear load Capability[3]	%	100%
Neutral current capability	%	170%
Steady state voltage stability	%	±1(balanced load) ±1.5(100% unbalance load)
Transient voltage response[4]	%	±5
THD	%	<1(linear load) , <5.5(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) crest ratio 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.

11.7 Electrical Characteristics (Bypass Input)

Table.11- 7: Bypass Input

Rated capacity(kVA)	Unit	20	40	60	90
Rated AC Voltage	Vac	380/400/415 three-phase four-wire, sharing neutral with the rectifier input and providing neutral reference for the output			
Rated current	A	30@ 380V	60.6@380V	90@380V	135@380V
		29@400V	58@400V	87@400V	130@400V
		28@415V	55.5@415V	84@415V	126@415V
Overload	%	<125%, long term			<110%, long term
		<130%, 10mins			<130%, 5 mins
		<150%, 1min			<150%, 1min
		>150%, 300ms			>150%, 300ms
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: ≤1ms			
Bypass voltage tolerance	% Vac	Upper limit: +10,+15,+20, +25, default: +15			
		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. Commissioning engineers can set to 50Hz or 60Hz. For example, UPS is set to frequency inverter mode, and then bypass status will be neglected.					

11.8 Efficiency

Table.11- 8: Efficiency, Air Exchange

Rated Efficiency (kVA)	Unit	10～90kVA
Efficiency		
Normal mode(dual conversion)	%	95max
ECO mode	%	98
Battery discharging efficiency (DC/AC) (battery at nominal voltage 480Vdc and full-rated linear load)		
Battery mode	%	94.5
Maximum air exchange	m^3 /min	4.5/power module, 3.02/bypass module

12 CONNECTIONS

12.1 System Wiring Diagram

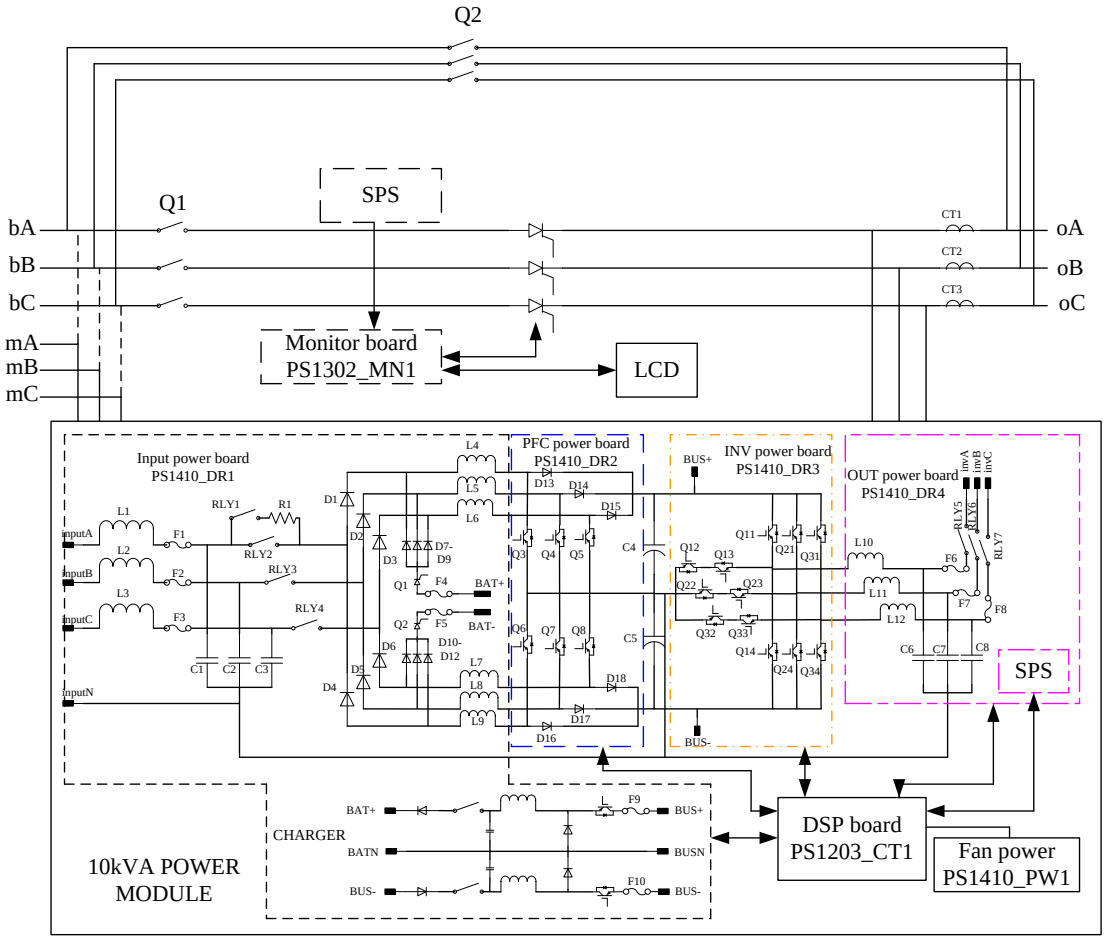


Fig 12. 1- 2* and 4* 10kVA Power Modules Cabinet Wiring Diagram

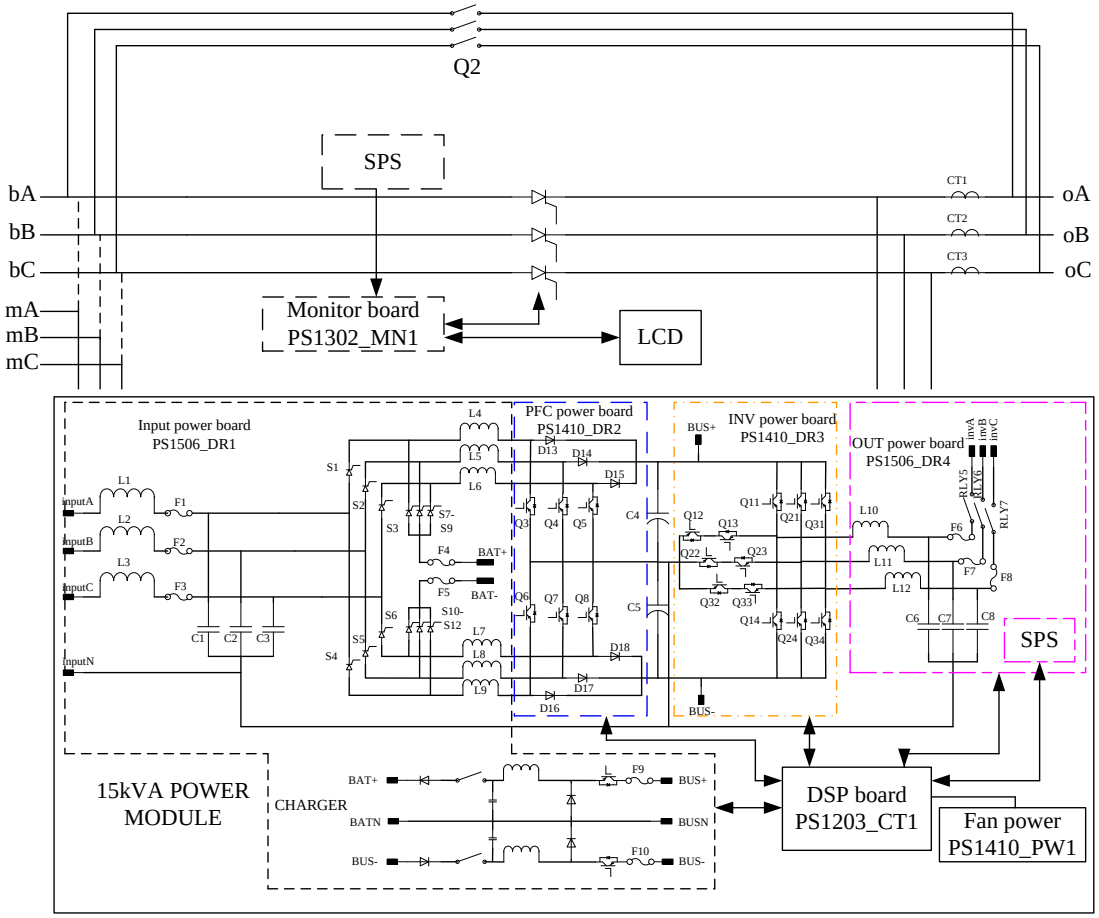


Fig 12. 2- 6*15KVA Modules Cabinet Wiring Diagram

12.2 Mechanical Drawing

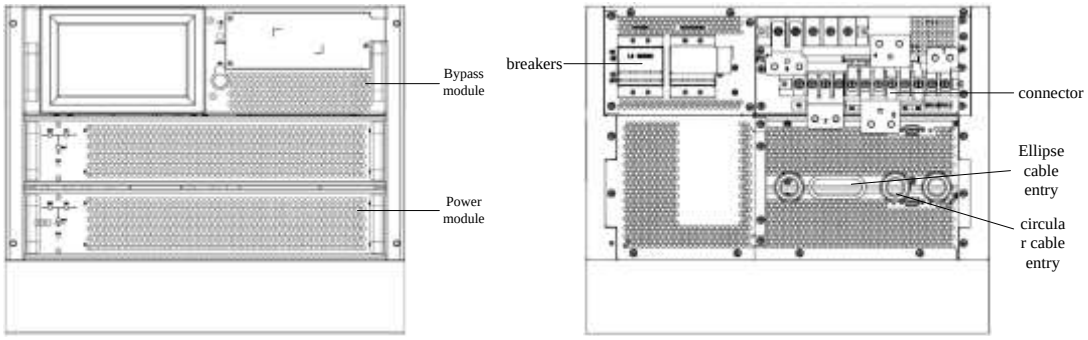


Fig 12. 3- 2*Modules UPS System, Front and Rear View

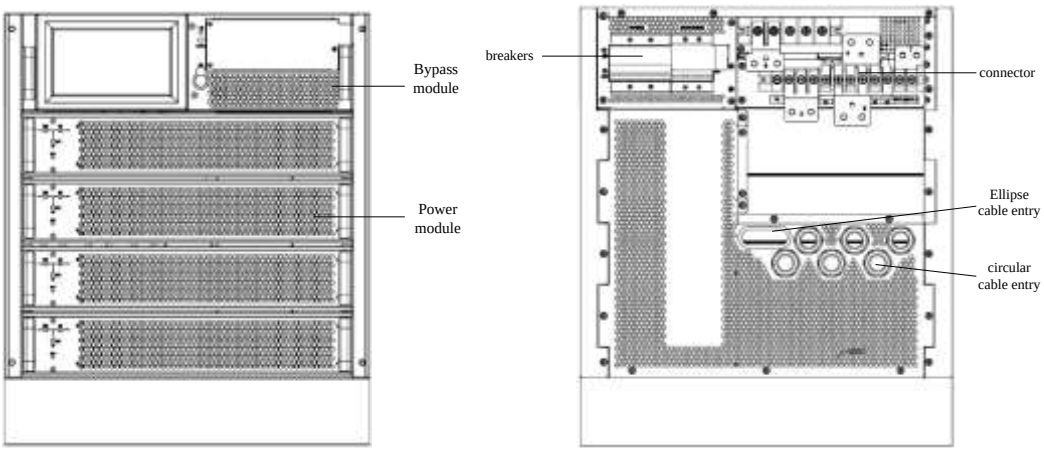


Fig 12. 4- 4*Modules UPS System, Front and Rear View

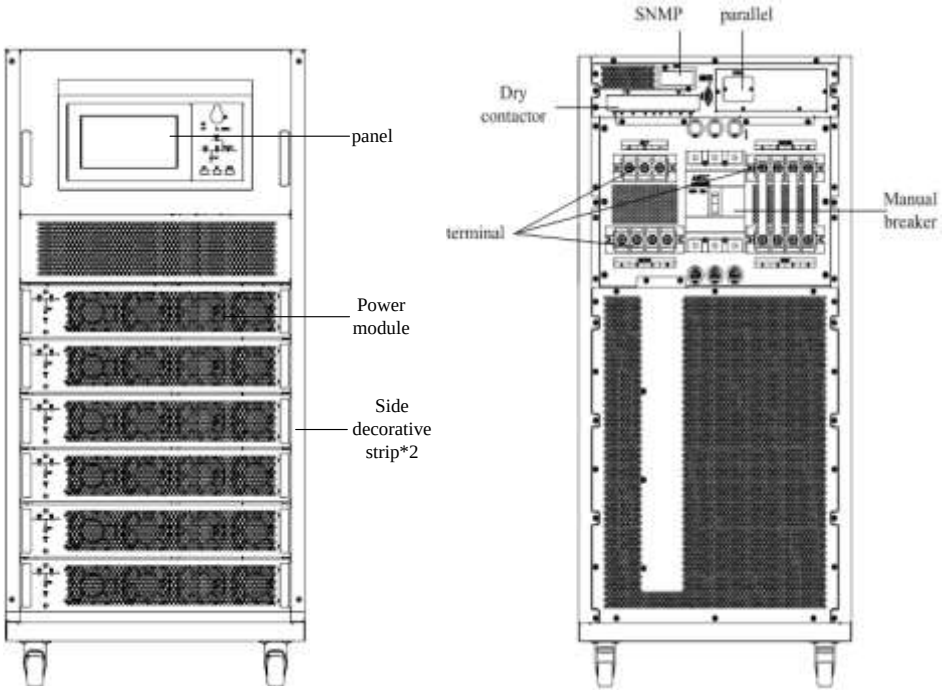


Fig 12. 5- 6*Modules UPS System, Front and Rear View

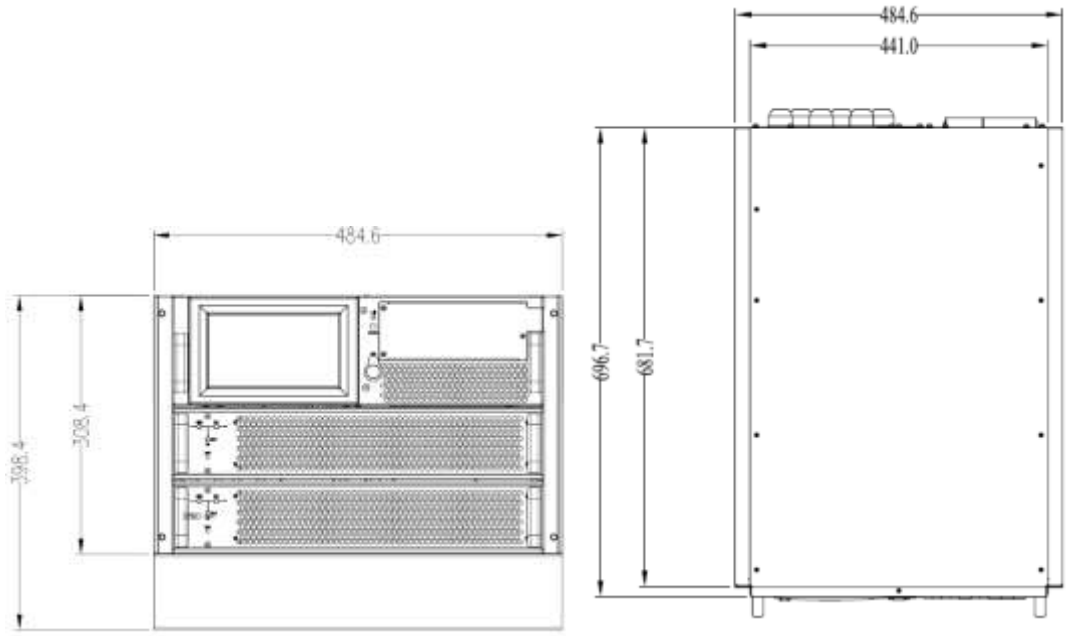


Fig 12. 6- 2*Modules UPS System External Dimension

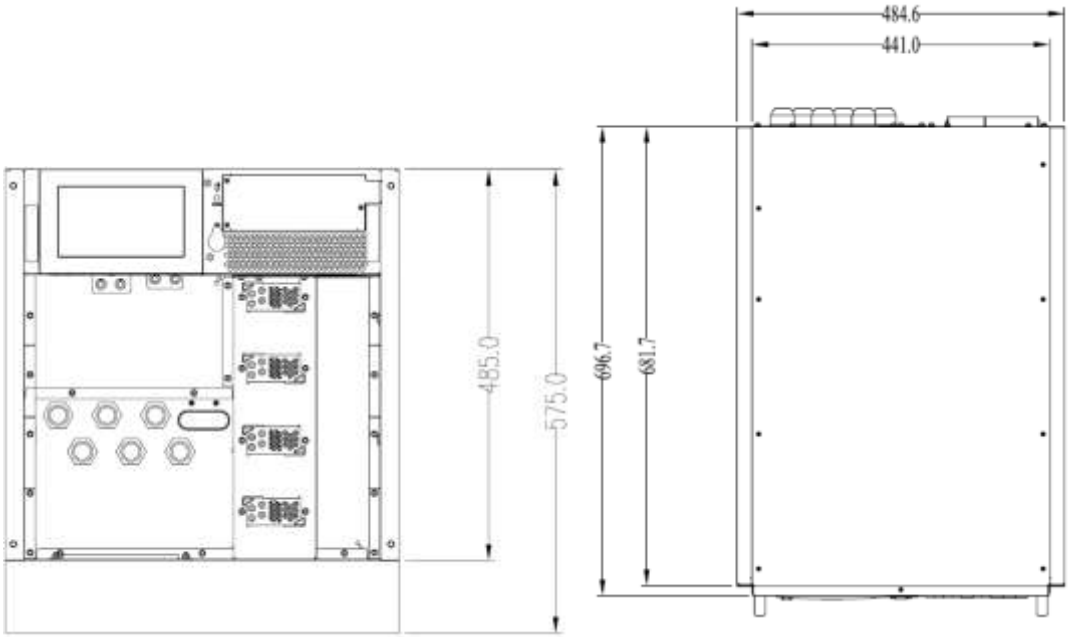


Fig 12. 7- 4*Modules UPS System External Dimension

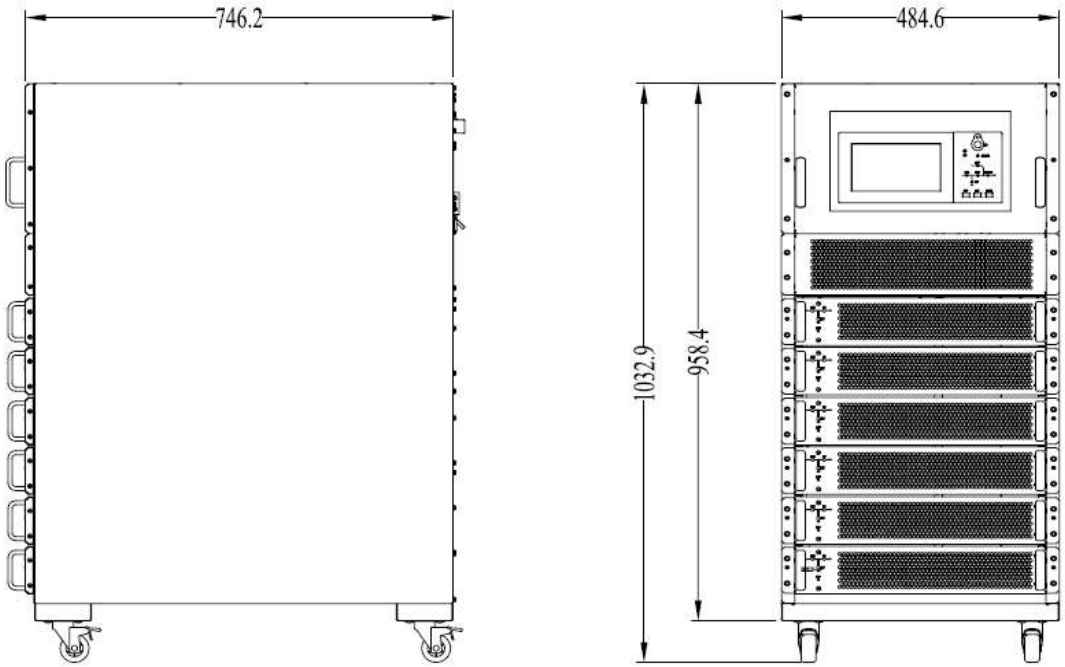


Fig 12. 8- 6*Modules UPS System External Dimension

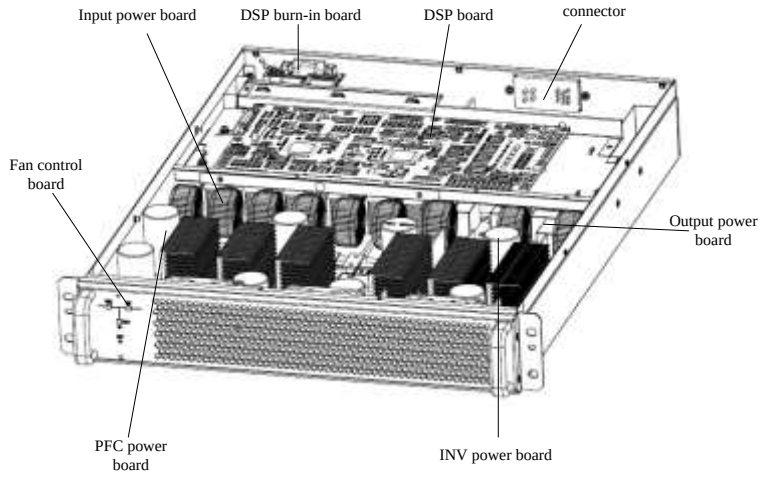


Fig 12. 9- Power Modules

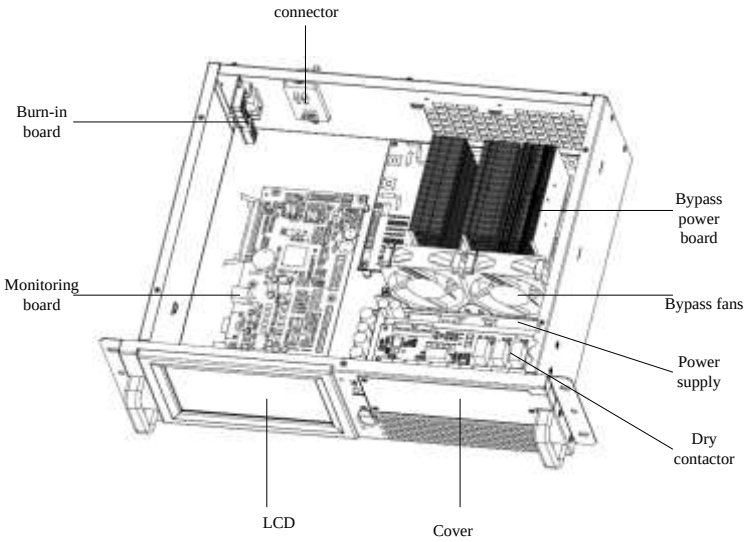


Fig 12. 10- 2*Modules and 4*Moudles Cabinet Bypass Module

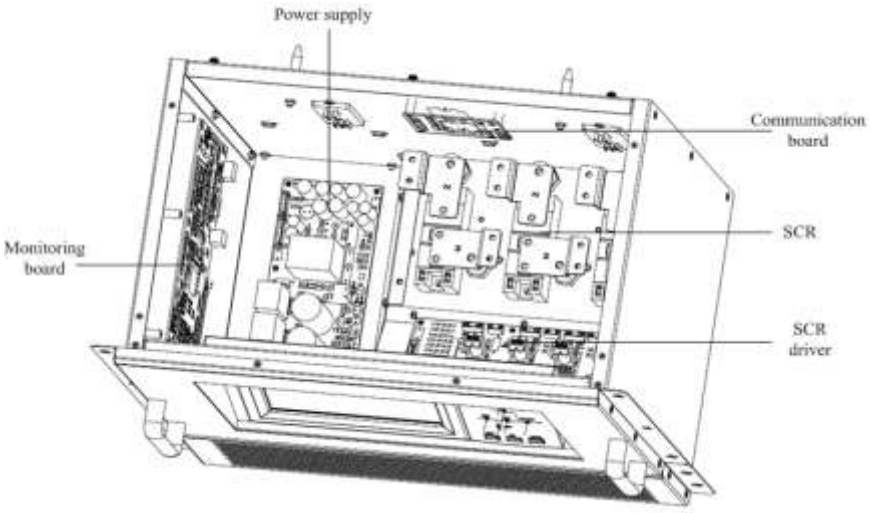


Fig 12. 11- 6*Modules Cabinet Bypass Module

12.3 Connectors

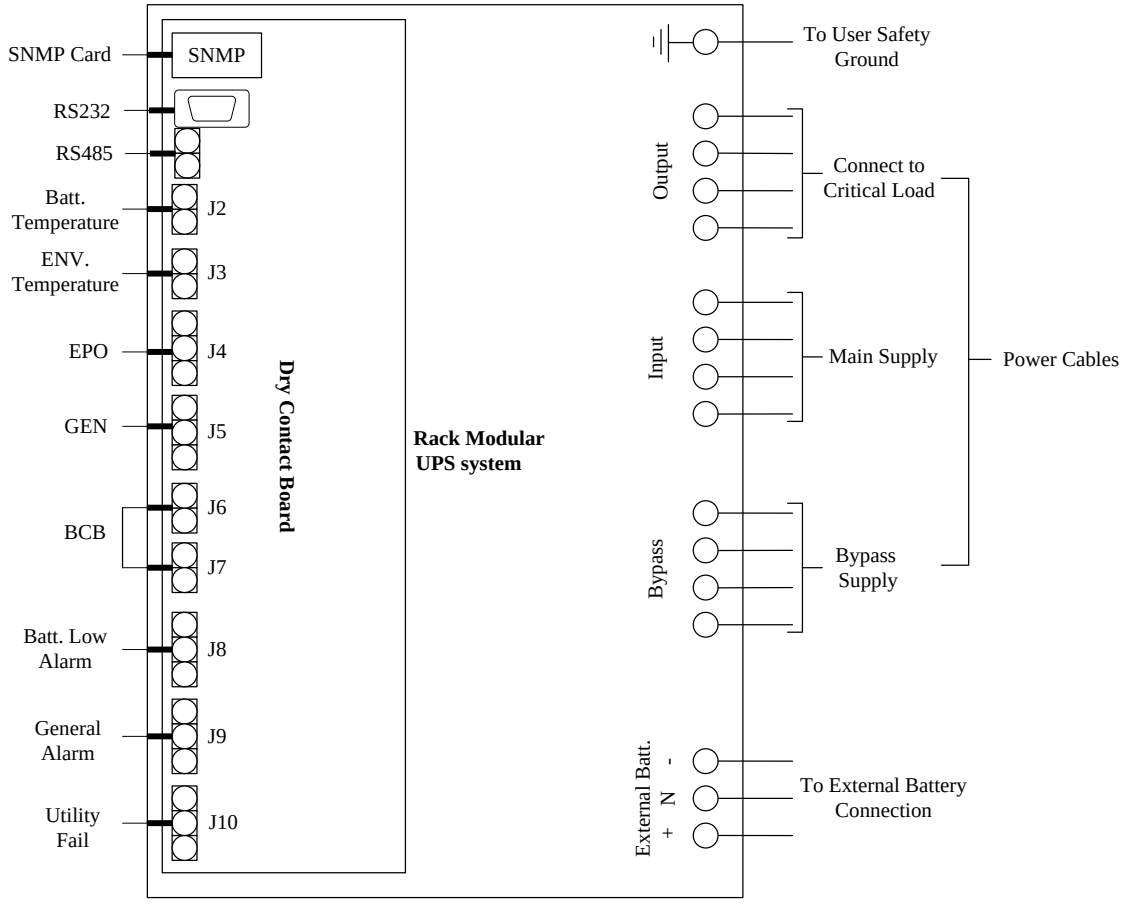


Fig 12. 12- System Connectors

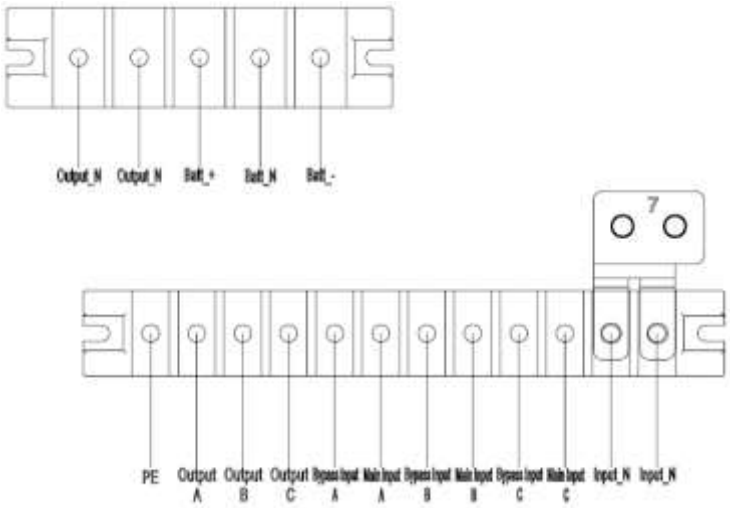


Fig 12. 13- 2*Modules and 4*Modules Cabinet Power Connectors

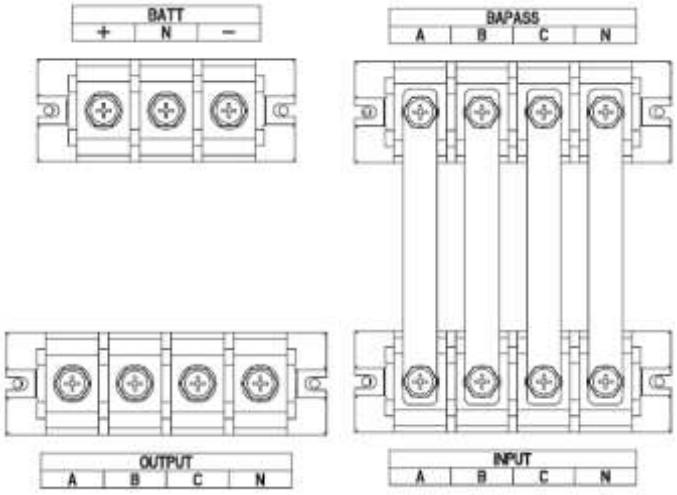


Fig 12. 14- 6*Modules Power Connectors

12.4 Cables Connection

12.4.1 Cables Entry

MMUST-20K- MMUST-40K: back entry and bottom entry

MMUST-60K – MMUST-90K: bottom entry

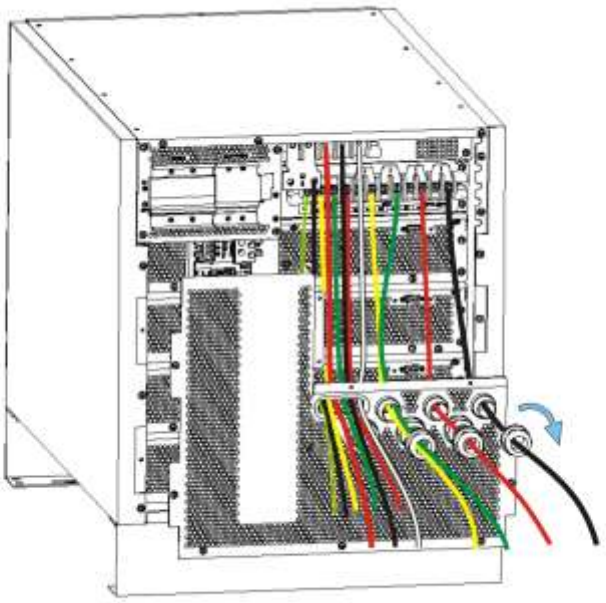


Fig 12. 15- Back Entry of 2/4 Modules Cabinet

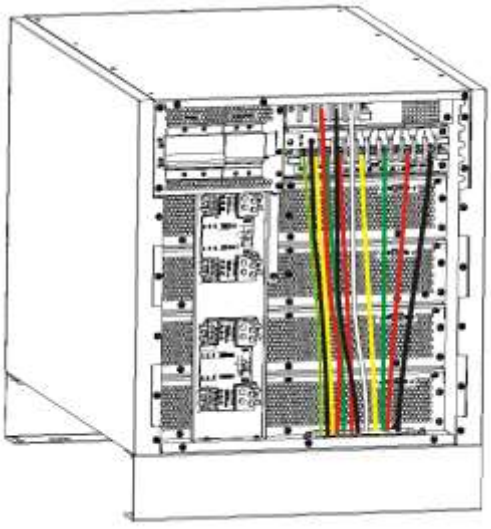


Fig 12. 16- Bottom Entry of 2/4 Modules Cabinet

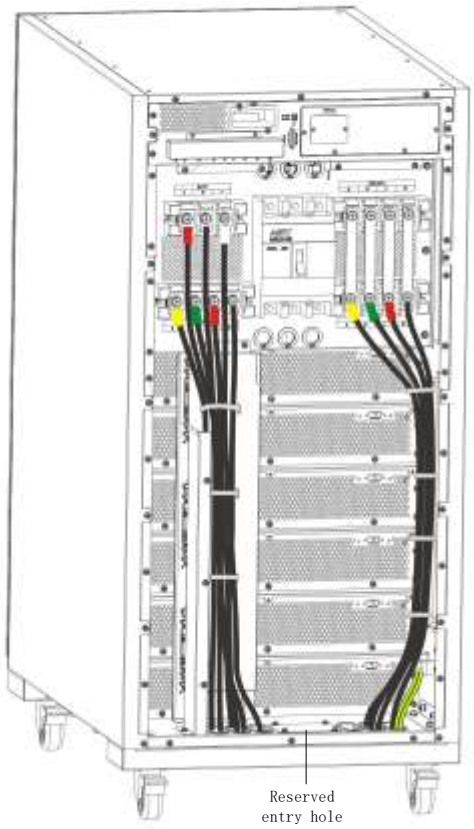


Fig 12. 17- Bottom Entry of 6 Modules Cabinet

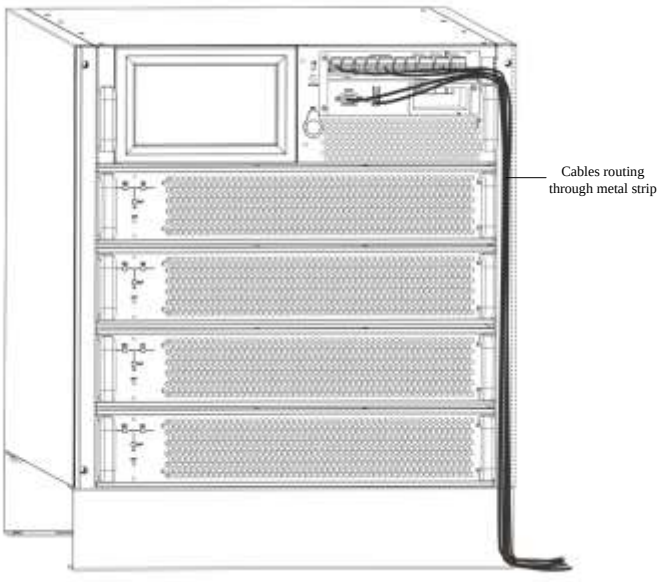


Fig 12. 18- Signal Cables Entry through Metal Strips

12.4.2 Cables Connection

MMUST-20K- MMUST-40K can be set as 3 phases in/1 phase out, 1 phase in/1 phase out.

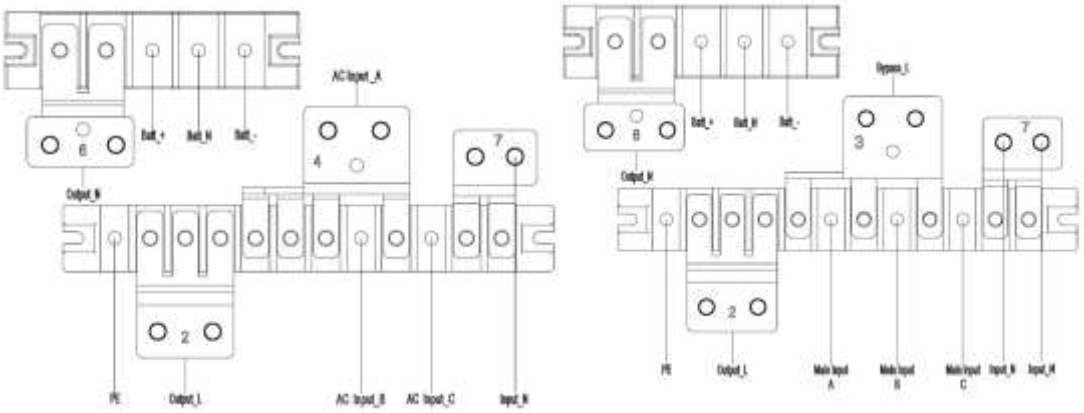


Fig 12. 19- 3 phases in, 1 phase out, common input/split bypass input

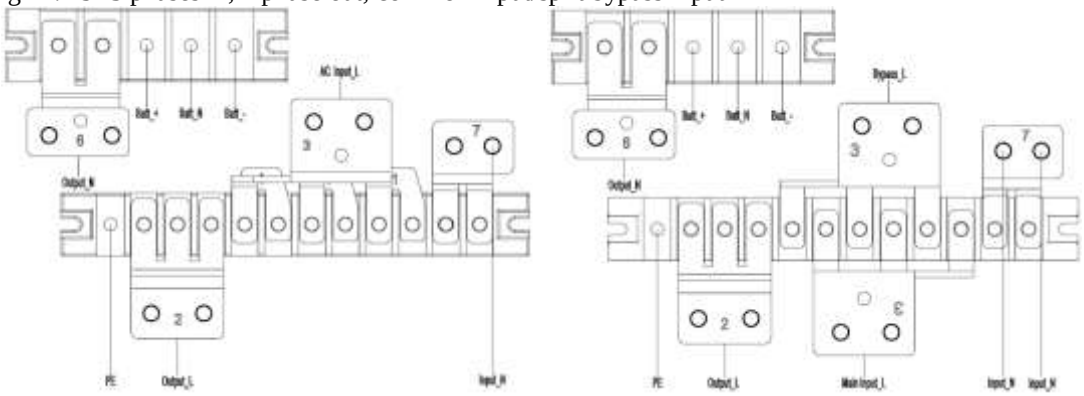


Fig 12. 20- 1 phase in, 1phase out, common input/split bypass input

13 FUNCTIONAL PRINCIPAL OF MAJOR BLOCK

13.1 PFC Power Board (DR2)

PFC：Power Factor Correction

Because the SCR will be ON only if it's positive voltage is higher than its negative voltage, after the utility power is rectified by the full waveform, the current waveform of the diode will appear characteristics of high and sine. Thus current waveform not only contains a great number of harmonics, but also makes the UPS input power factor lower.

Add a DC/DC PFC after rectifying and correct the input current as a sine wave to make the input power factor is close to 1.

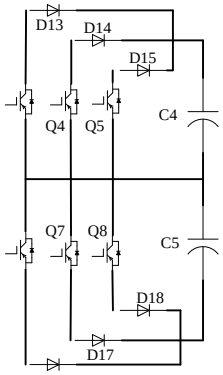
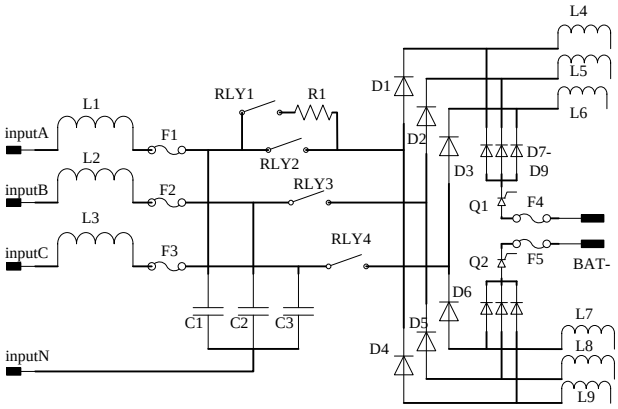


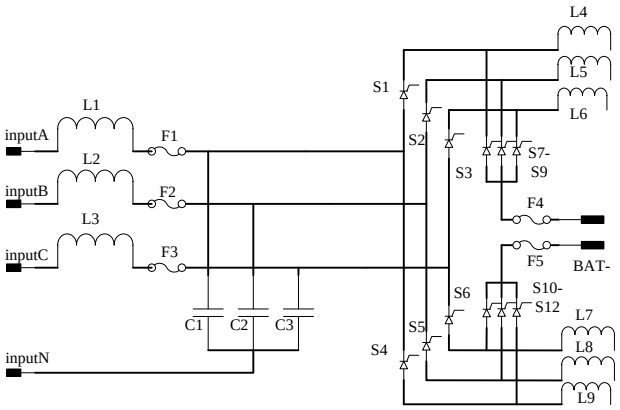
Fig 13. 1- PFC Circuit

As shown in the diagram, PFC circuit is Vienna-like topology. When the IGBT is on and the DIODE is off, the CHOKE will store energy and the current crossing the choke will increase by degrees with time pass. When the IGBT is off, the choke releases energy and the DIODE is on, the current of the choke will be descending with time pass. Therefore, we can control the current waveform of chokes (input current) by regulating the time of IGBT on and off.

13.2 Input Power Board (DR1)



10kVA (PS1410_DR1)



15kVA (PS1506_DR1)

Fig 13. 2- Input Power board

The input power board is connected to the connector of power module. The input utility power is rectified by DIODEs or SCRs. And the output is connected to the PFC power board(PS1410_DR2).

In 10kVA power module, the transfer between utility and battery is controlled via input relay and battery SCRs. In 15kVA power module, the transfer between utility and battery is controlled via input SCRs and battery SCRs.

13.3 Inverter Circuit (DR3 Inverter Power Board+DR4 Output Power Board)

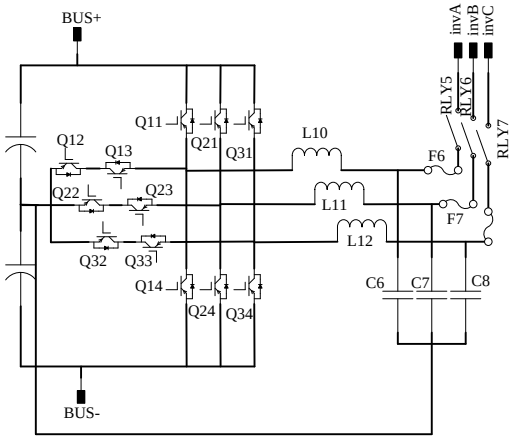


Fig 13. 3- T-type 3-Level Inverter

The input of the inverter topology is DC voltage, and the output is AC voltage.

The topology works as follows. Qx1 and Qx3 are switched on in turn at positive half cycle, Qx2 and Qx4 are switched on in turn at alternate in negative half cycle. The junction voltage of up and down bridges is a high frequency rectangular waveform. This rectangular wave through the LC filter will become a standard sine wave.

13.4 Charger (in Input Power Board DR1)

There is one separated charger in every power module. The charger is totally digital controlled. There are 4 steps for charger to charge battery into fully charged status. The charge current and voltage can be set via INVT monitoring software. And the maximum charger power is 20% of active power of power module.

The topology of charger is dual buck converter.

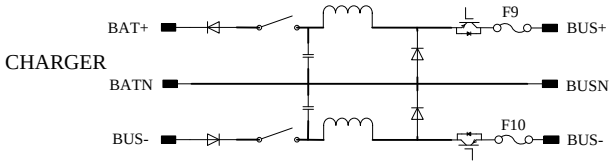
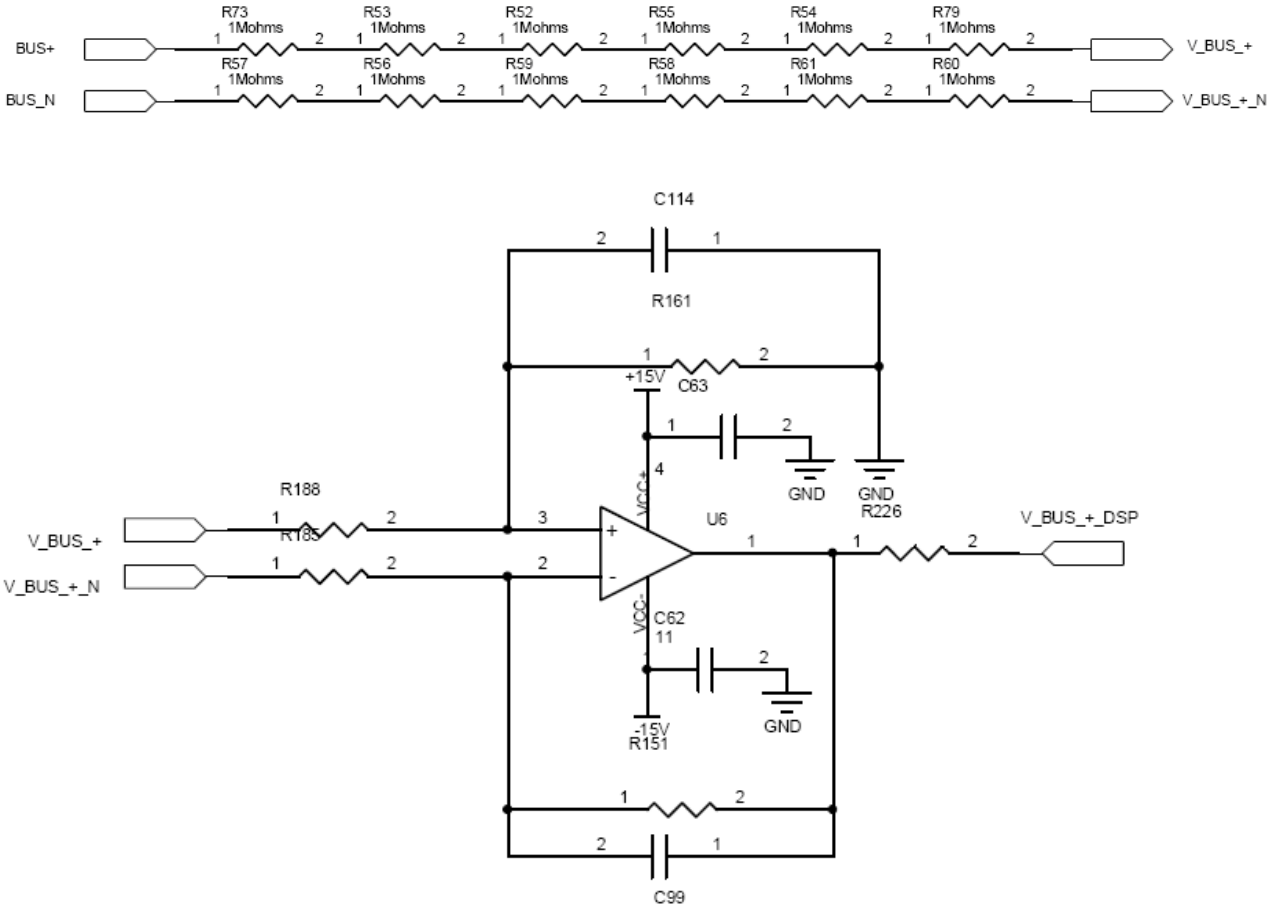
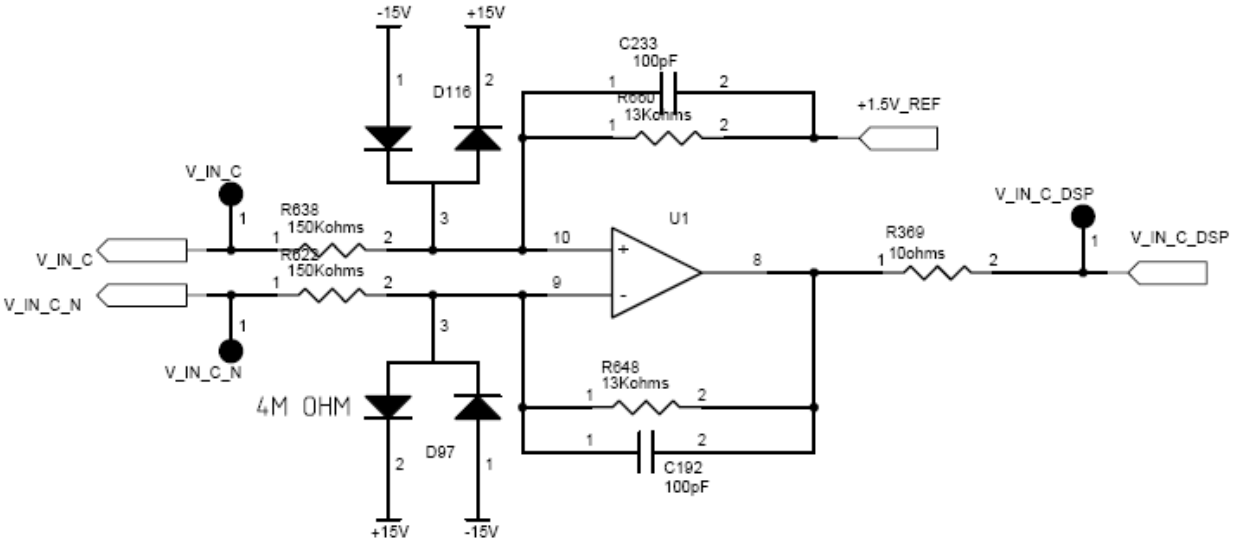


Fig 13. 4- Charger

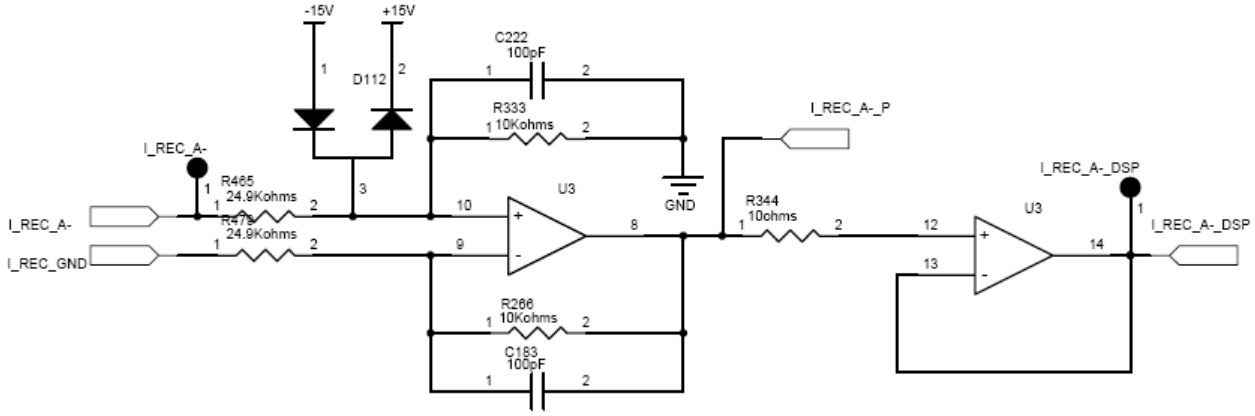
13.5 Control Circuit



(a) DC voltage detect



(b) AC voltage detect



(c) Current detect

Fig 13. 5- Detect Circuit

The sense signals adopt difference input signals through some multiple attenuations which can get a new signal. The new signal send to the AD port of DSP via a protect circuit.

13.6 Power Supply

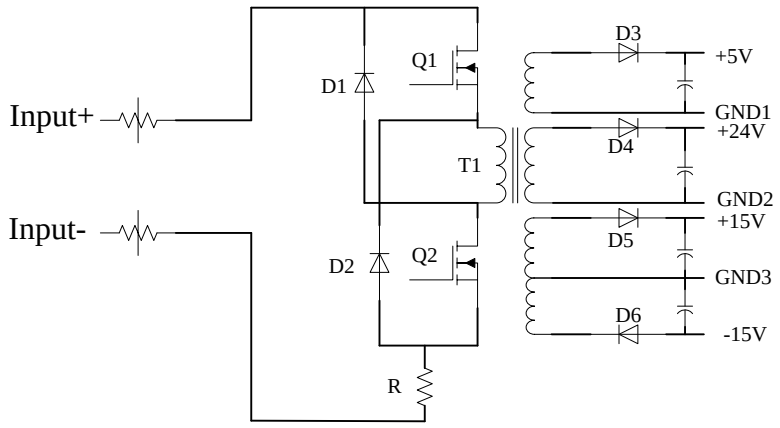


Fig 13. 6- Main Topology of Power Supply (10KVA/15KVA)

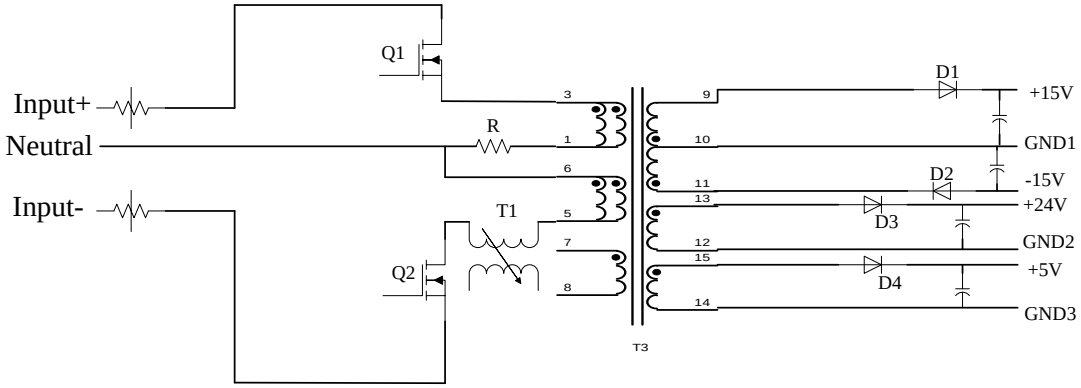


Fig 13. 7- Topology of Power Supply (PS1203_PW3)

10KVA:

The power supply of power module is located in output power board (DR4). The Power supply board of bypass is 3320_DY. Dual switch forward

15KVA:

The power supply of power modules is located in output power board (DR4), same as 10KVA.

The power supply board of 90kVA bypass is PS1203_PW3.

The power supply of power modules (as *Fig 13.6*) is designed as two switches forward converter. Q1 and Q2 switch on and off together, the feedback signal is +15V voltage. If over +15V, the duty of PWM IC 3844 output driver signal will be decreased to decrease output voltage. If under +15V, the duty of PWM IC 3844 output driver signal will be increased to increase output voltage. If output shorted, or overload, the voltage on R connected to Is of 3844 higher then 1.5V, it will make the 3844 stop work to protect power supply.

The power supply PS1203_PW3 (as *Fig 13.7*) is designed as dual fly-back converter. Q1 and Q2 are independent, input is 3 wires, input+/neutral/input-. If there is only single input input+/neutral, or neutral/input-, or input+/input-, the power supply will always be normal. For the 90K, the input power is input+/input-.

14 TROUBLE SHOOTING

14.1 General

This section describes checking the UPS's status. This section also indicates various UPS symptoms a user may encounter and provides a troubleshooting guide in the event the UPS develops a problem. By referring to "Status of UPS" and "History log", you can find the faults. Use the following information to determine whether external factors caused the problem and how to remedy the situation.
The new RM serial also have fault waveform recorded function and S-code history log. It can help service engineer easily adjust the problem of unit.

14.2 Check UPS Status

It recommended that checking the UPS operation status every six months.

- Check whether the UPS is faulty: Is the Fault Indicator on? Is the UPS sounding an alarm?
- Check whether the UPS is working in Bypass mode. Normally, the UPS operates in Normal Mode. If it is operating in Bypass Mode, stop and contact your local representative, or Channel Support.
- Check whether the battery is discharging. When the utility input is normal, the battery should not discharge. If the UPS is operating in Battery Mode, stop and contact your local representative, or Channel Support.

14.3 Adjust the Factors of Problem

Check the alarm information and history log.
Check with *chapter 7.4*- event log list to adjust what has happened.
Download S-code via PC with software PowerMTR to get the S-code log when fault occurs.
Enter in ScodeDown menu to download the recently triggered S-code shown as *Fig 14.1*

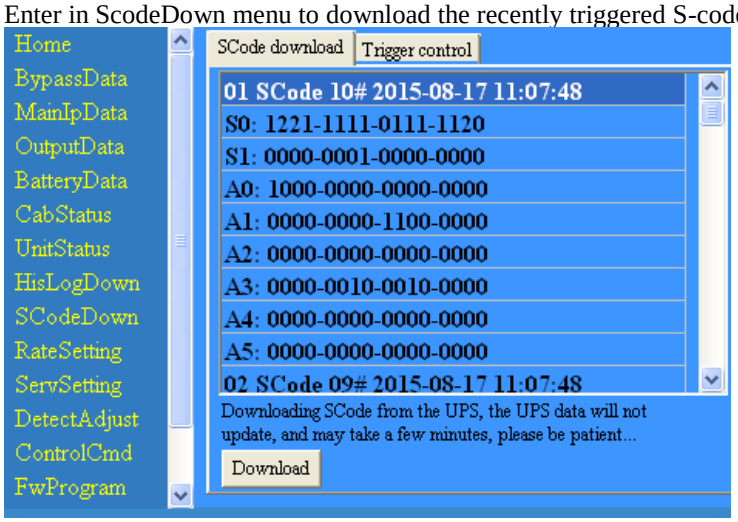
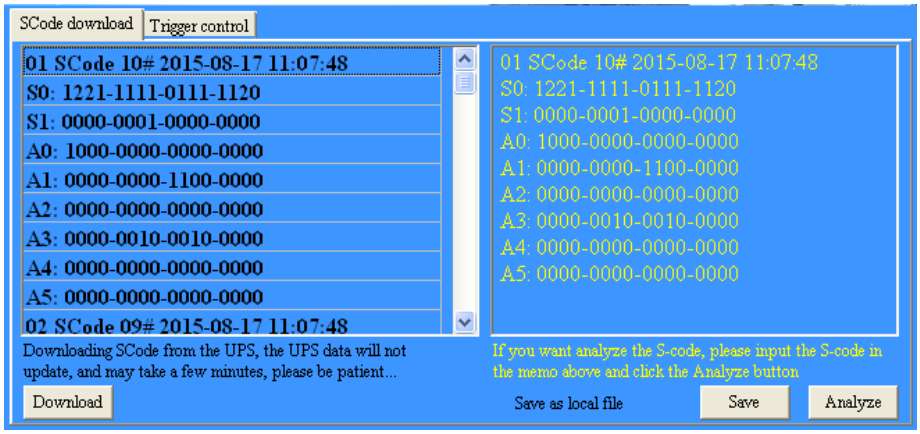


Fig 14. 1- S-code Triggered

Double press the recent S-code and it will be displayed in right window. Then press "Analyze" to get the S-code description list.



48			Output Voltage Phase A	Normal
49	A1	1	Output Voltage Phase B	Normal
50			Output Voltage Phase C	Normal
51			Output Current Phase A	Normal
52			Output Current Phase B	Normal
53		2	Output Current Phase C	Normal
54			Line Synchronization Signal	Normal
55			PWM Synchronization Signal	Normal
56			Input Current Unbalance	Normal
57		3	Utility Voltage Status	Fault
58			Utility Frequency Status	Fault
59			Main Input Sequence Status	Normal
60			REC Soft Start Status	Normal
61		4	REC IGBT Over Current	Normal
62			Input Inductance Over Temperature	Normal
63			Rectifier Over Temperature	Normal
64			Postive DC Bus Over Voltage	Normal
65			Negative DC Bus Over Voltage	Normal

Fig 14. 2- S-code Analyze

According to the S-code list, it's easily to adjust what has happened when alarms occur. Check with event log list to get the factors of alarms.

14.4 Failure Diagnosis

LED displays rectifier faults or inverter faults, sometimes the faults can be cleared by entering  , and chose  .

In this section, some debug skills are listed to help you finding the failure components and problems as soon as possible. Before continuing the following steps listed, we suggest that you should read event log list in section 7.4 then check the components listed in *Quick Start* to find out which block is out of order, in order to shorten the service time.

1.1.1 14.4.1 Maintenance Tools

1 A computer with a serial port and a standard RS232 cable;

2 A suitcase or a toolbox;

3 Wire cutters and clamps;

4 Balance equipments, current limiting resistors, a electric soldering iron, tubes and clamp

terminals with different specifications;

5 A 0.1% multi-meter and a oscilloscope（or current meter）;

6 Other tools in common use: Diagonal pliers, Snipe nose pliers, Cross screw drivers (150mm/75mm length), Straight screwdrivers (75mm length) and PVC insulating tapes etc;

7 PCB and some other materials.

14.4.2 Setting Method of UPS

Equipment:

One computer with a serial port;
One standard RS232 serial cable;
One multi-meter with 0.1% accuracy;
Parameter Setting Method:

1. Connect the RS232 port of the UPS to the serial port of the computer with a serial cable. The COM port is set “COM1” automately and the other settings as Fig.1

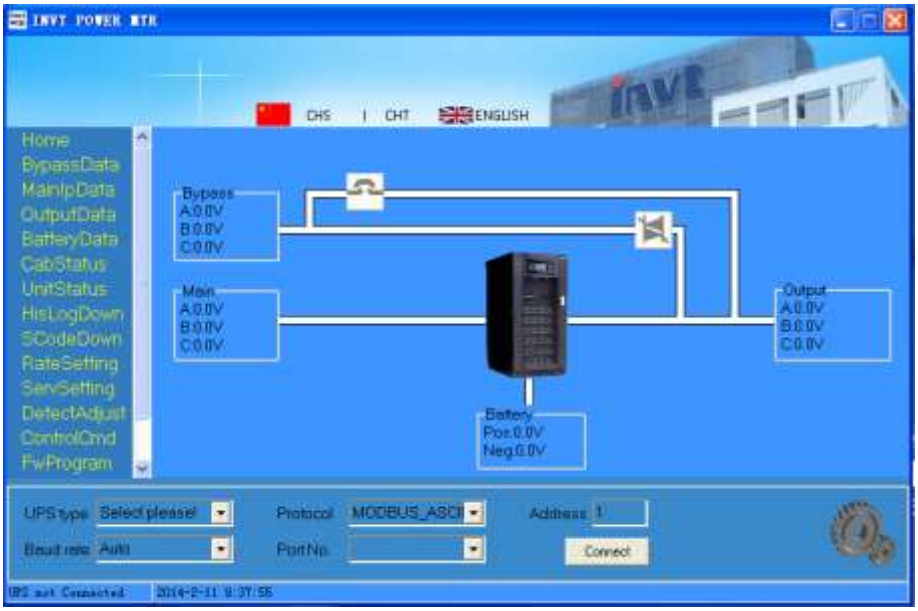


Fig 14. 3- Software connected

1. After you chose UPS type, press “Connect”, then UPS is connected with computer.

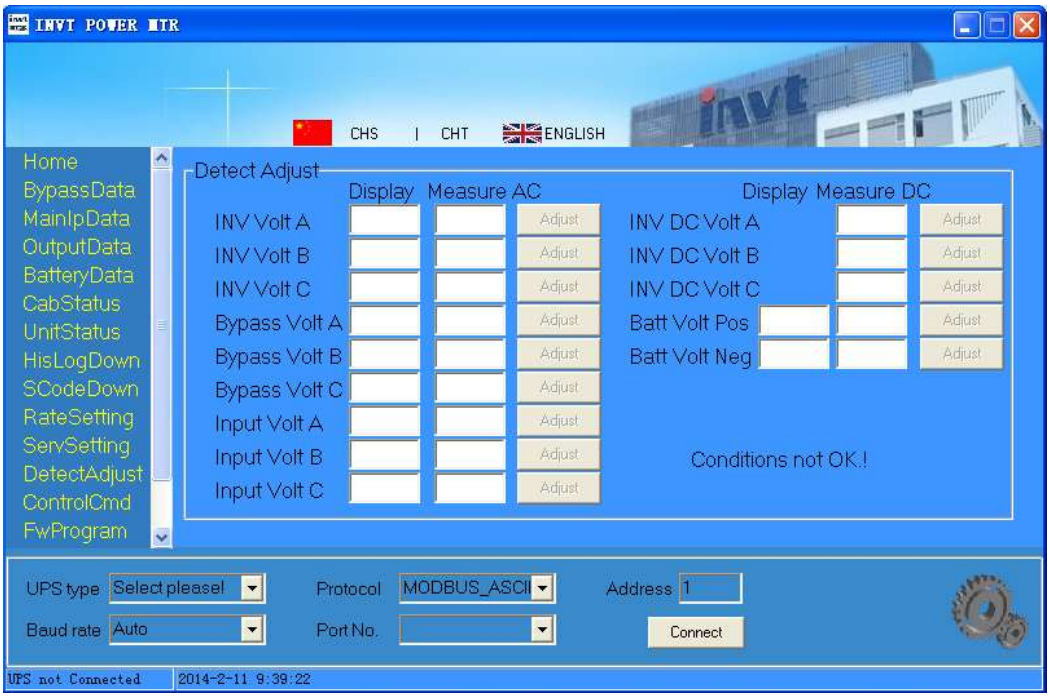
Fig 14. 4- Service Setting

3. INV output voltage tiny regulation: Set “AdjustedOpVolt” values, then press the “ENTER” key, output voltage will rise (drop) .

Fig 14. 5- Adjust rating output voltage

4. INV output voltage setting: Chose type “OutputVoltXXX” command (XXX is 220/230/240) without load, then press the “ENTER” key, INV output voltage will be set to 220V/230V/240V.

Regulation Process for UPS



INV output voltage regulation: When the UPS run into the Inverter mode, measure the output voltage with the multimeter. Then regulate the output voltage to 220±0.5V by using output voltage regulation command. (INV output voltage can be regulated by using output voltage regulation command).

Notes

Be sure the ground of the UPS connect earth safely while parameter regulation.

The new assembly UPS must be regulated.

The UPS who have been replaced DSP board must be regulated again.

All the commands use capital letters.

All the above parameter regulation cannot be accumulated.

All the regulation will be saved in DSP.

14.4.3 Quick Start

For various type RM series product, main boards are different, the follow table can help you find them quickly.

function	Input power board	PFC power board	INV power board	Output power board	Control board
MMUST-PM10X	PS1410_DR1	PS1410_DR2	PS1410_DR3	PS1410_DR4	PS1203_CT1
MMUST-PM15X	PS1506_DR1	PS1410_DR2(2)	PS1410_DR3	PS1505_DR4	PS1203_CT1
function	Bypass power board	Power supply	Monitoring board		
MMUST-20K	PS1410_DR5	3320_DY	PS1203_MN1		
MMUST-40K	PS1410_DR5	3320_DY	PS1203_MN1		
MMUST-90K	/	PS1203_PW3	PS1203_MN1		

Before any detail check of UPS, please check the components listed in the following table. This action could help you find problem quickly and make following debug procedures go smoothly.

Note

Make sure that the capacitor voltage is lower than the safety voltage before disassembling any parts before any checking operation.

Related Circuit Block	Components to be checked	Component Type	Fail condition
BAT FUSE (on DR1)	10K(F4,F5) 15K(F4,F6,F7,F8)	Fuse	Open
Input FUSE (on DR1)	10K/15K(F1,F2,F3)	Fuse	Open
Input and battery transfer(DR1)	10K(D89-D100)	Diode	Short or open
	15K(S1-S12)	SCR	short
PFC(DR2)	10K/15K(D11,D80-D84)	Diode	Short or open
	10K/15K(Q1-Q6)	IGBT	C-E short or open
INV (DR3)	10K/15K(Q1-Q12)	IGBT	C-E short or open
Charger(DR1)	10K(Q16,Q17) 15K(Q17,Q18)	IGBT	C-E short or open
	10K(D101-D104) 15K(D19-D22)	Power Diode	Short or open
	CABLES	Fuse	Open
Output(DR4)	10K/15K(F1,F2,F3)	Fuse	open
	10k/15K(RLY1,RLY2,RLY3)	Relay	short
Bypass (DR5)	20K/40K bypass(Q1-Q6)	SCR	Short or open
	90K bypass (module)	SCR	Short or open

 If the fuse is open, replacing fuse only DOES NOT mean you have solved the problem. In most case, open of fuse is caused by other failure of components; therefore, before restart that UPS, you must find the real failure components and replace them!

PFC Analysis

Most problem of PFC can result in component damage: input Fuses, the IGBT, the DIODE, and the SCR and the drivers. It can result in “utility abnormal”, “soft start failure”, “input current unbalance”, “REC fault” and so on.

When checked PFC Part, directly checked the IGBT with resistor probe or the DIODE with voltage probe with multi-meter.

Inverter Analysis

The most likely problems occur on the INV Part includes: IGBT broken, and lead to damage of relative gate TVS shorted, inverter relay open and output relay stick.

It can result in “INV fault”, “INV fuse or relay open”, “DC bus over voltage”, “INV protect” and so on.

Charger Analysis

The most likely problems occur on the Charger includes: IGBT broken, charger fused open and lead to damage of gate TVS shorted.

It can result in “Charger fault”, “Charge undervoltage”.

Bypass Analysis

The most likely problems occur on the bypass includes: bypass open or shorted. It can result in “Bypass open”, “bypass shorted” or bypass output voltage abnormal.

Appendix A WIRING CONNECTION

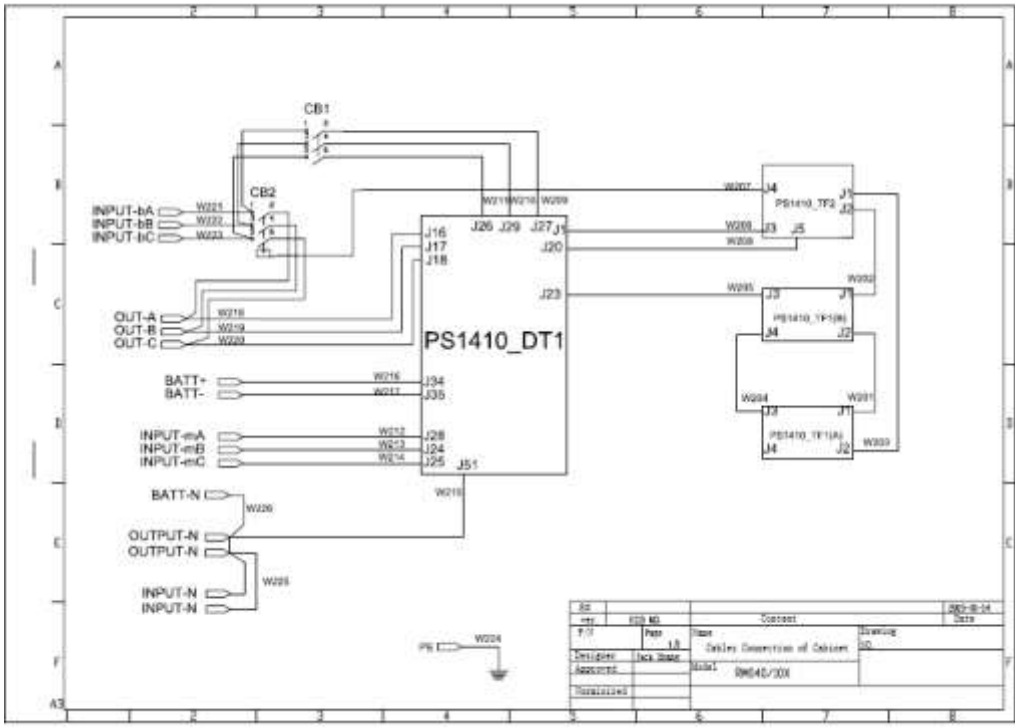


Fig A. 1- Wiring of RM040/10X Cabinet

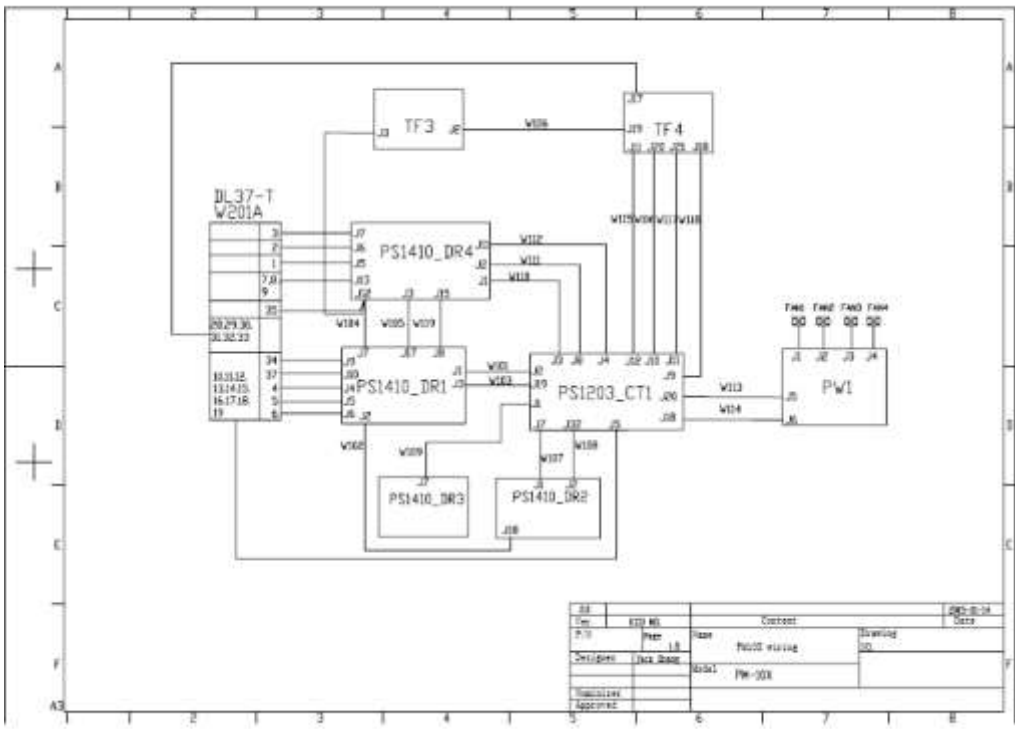


Fig A. 2- Wiring of PM10X

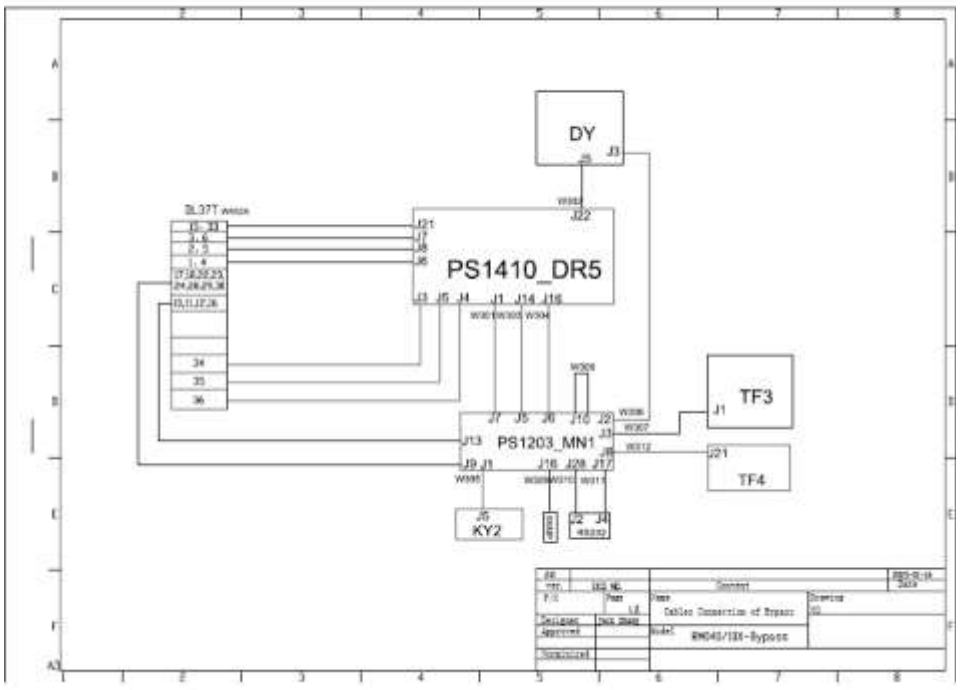


Fig A. 3- Wiring of Bypass of 20K/40K

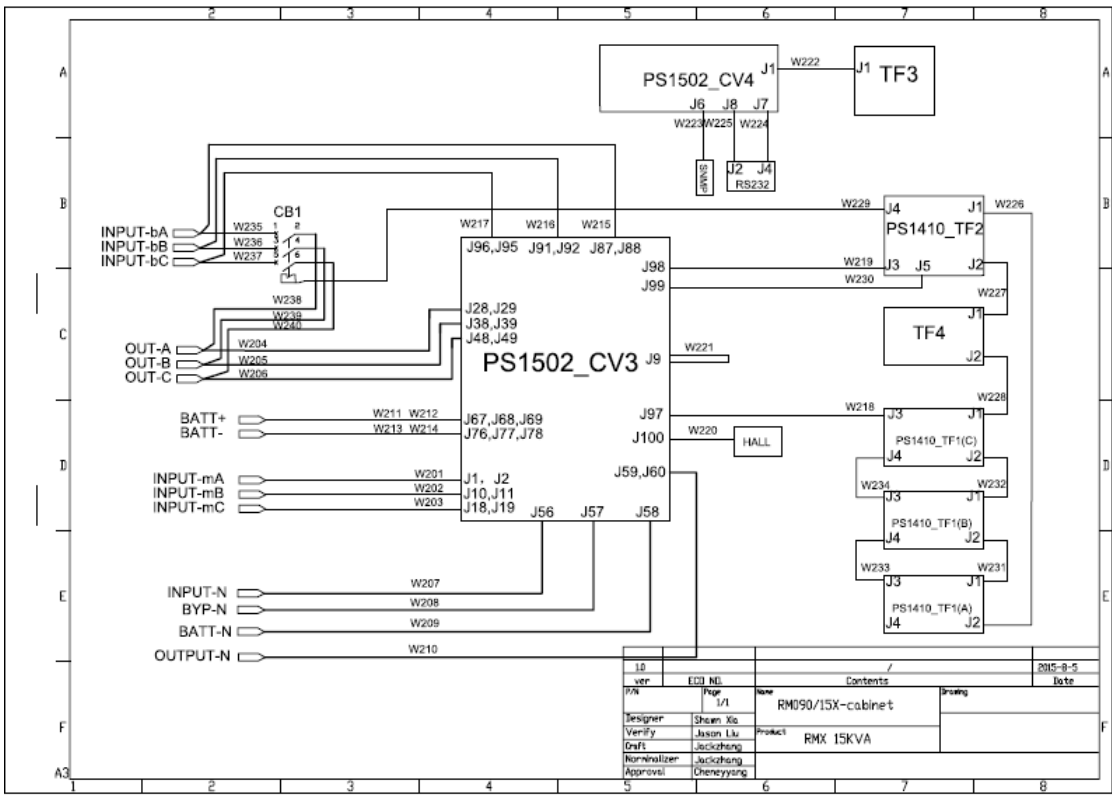


Fig A. 4- Wiring of RM090/15X Cabinet

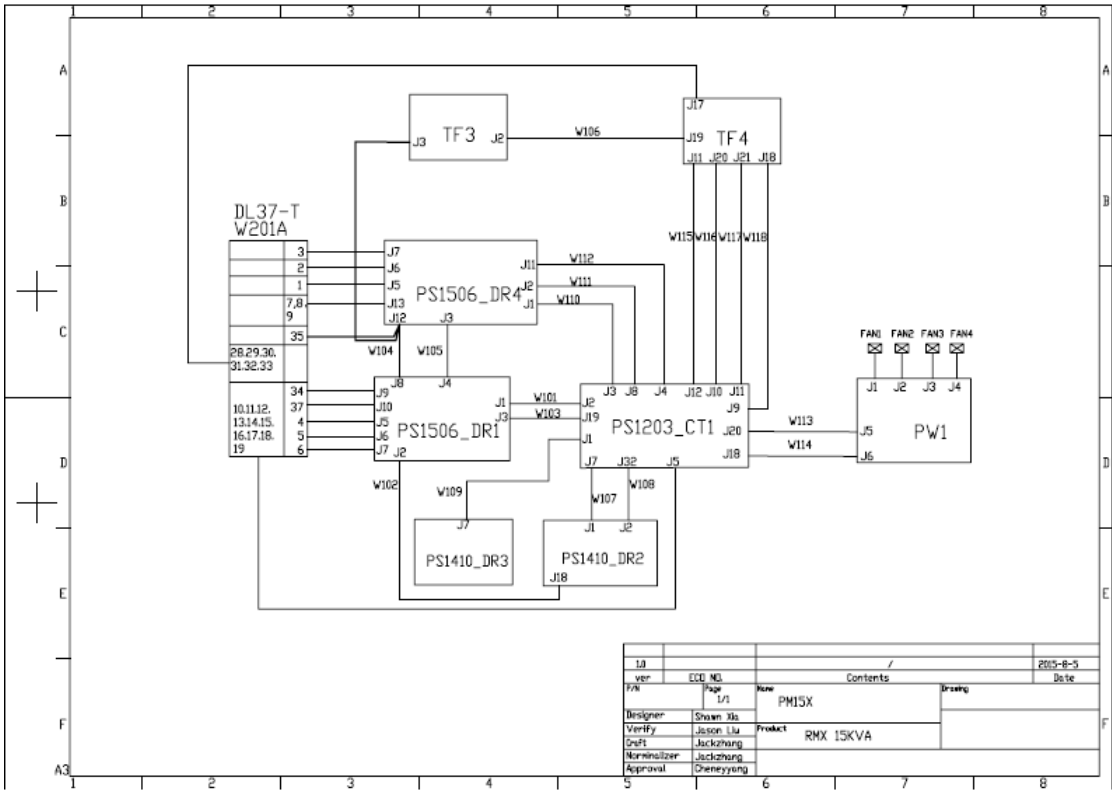


Fig A. 5- Wiring of PM15X

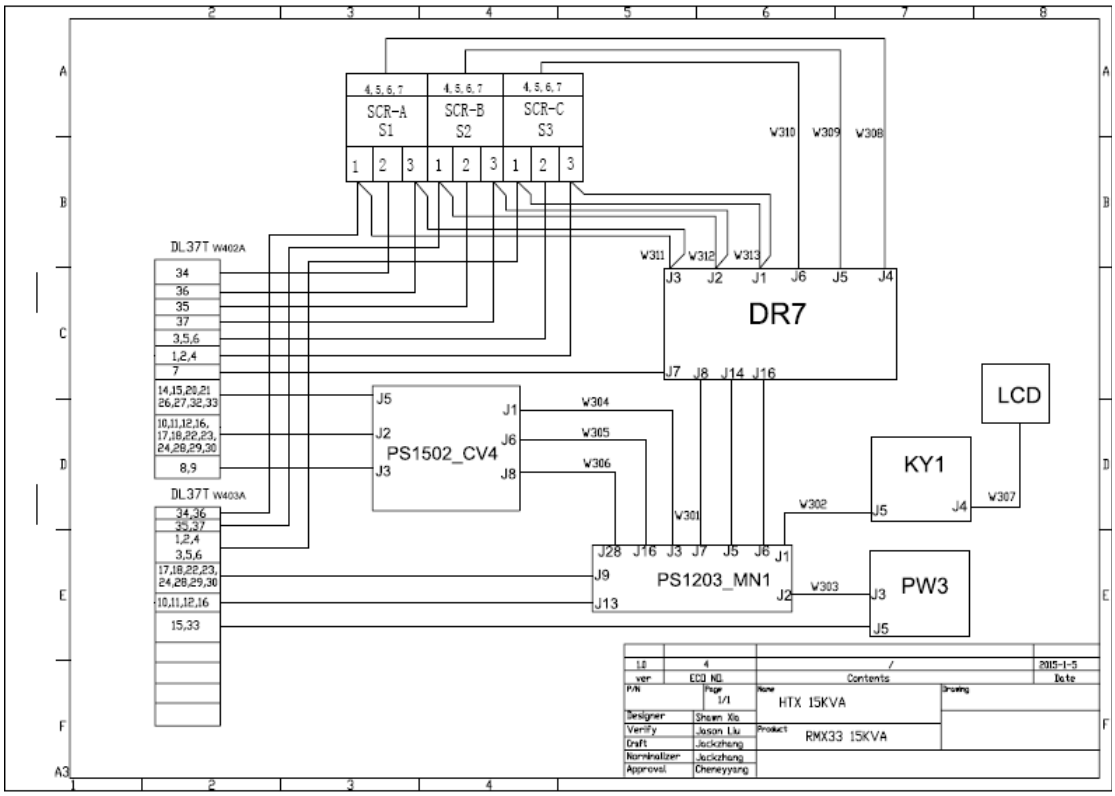


Fig A. 6- Wiring of Bypass of 60K/90K