GTEC UPS MODEL:

ZP120N TOWER
6 K(KS) / 10K(KS)
1ph in / 1ph out

SERVICE MANUAL

www.gtec-power.eu

CONTENT

1. General Information Of This Document

1.1 Getting Start

This is a service manual for ZP120N 6/10K(s), Tower UPS, intend to help service personal perform maintenance and repair service.

If you want to know:

? **What is special for this UPS from service point of view;** please refer to section characteristic of the product.
? **Construction of the product**; how many pieces of PCB do the product make up, please refer to construction of the product
? **Functional block of the UPS, and operating principle thereof,** please refer to Principle of Operation.
? **What's wrong with the UPS and How to solve the problem**, please refer to Trouble Shooting.
? **Basic information about the product, install and operation instruction,** you may please refer to USER MANUAL

1.2 Conventions

This service manual uses the following conventions to alert you some important information for safe operation and quick working.

Warning: Denotes a procedure or operation, which, if not perform correctly, may result in personal injury. **Be sure not to continue operation until indicated conditions are fully understood and met**.

Caution: Denotes a procedure or operation, which, if not perform correctly, may cause damage to the UPS. **Be sure not to continue operation until indicated conditions are fully understood and met**.

Information and Tips: There are some tips and skills after this symbol. During service operations, these skills may help you quickly finish your work.

1.3 Important Safety Instructions

1. **For qualified service personnel only.**
2. **DO NOT** performs any internal service or adjustment of this product unless another person is capable of rendering first aid and resuscitation is present.
3. Dangerous voltage exists at several points in this product. To avoid personal injury, don't touch any exposed connections or components while UPS is active.
4. Turn off the UPS and disconnect input power cord, and wait until the UPS shuts down completely before removing outside protective cover.
5. AC voltage is always present if the input AC power is still available.
6. High voltage may present at DC capacitors. Before opening the outside cover, wait for at least five minutes after turning off the UPS. Discharge the remaining energy at DC capacitors with resistor before disassembling the power board.
7. Verify input source (voltage and frequency) is within the maximum range before service.

1. **DO NOT** short-circuit internal batteries
2. After service, verify the polarity of batteries, fasten all screws and connectors before restarting the UPS.

After opening the cover, please always check the tightness of all wires, connectors, and screws first. Then check if there are any de-colored components inside

TO DISCHARGE the residue energy on bus capacitors and charger capacitors.

2. Characteristic of The Product

For all UPS of this series, they are carefully designed and strictly tested. We always do our best to make our products more reliable and safe. This is also the goal of our company. However, due to the lifetime of electrical components and some unpredictable reasons, there will be unexpected failures may occur to the product. In this case, qualified service is needed.

This service manual will guide the technicians to repair and adjust a problematic UPS. If the UPS still does not work properly, please contact with us and we will be glad to solve any problems you met.

Because of the following unique features, this series UPS (Uninterruptible Power System) is very easy to maintain and service.

- All major power components are put on PCB.
- Minimum numbers of PCB sub-assembly.
- Major parts are simply connected with flexible insulated wires and plugs.
- All PCBs are interconnected with connectors.
- Most functional sub-circuit become modular, easy to identify the problem and repair by replacing a appropriate module

3. Construction of the Product

3.1 Open The Outside Cover

To open the outside cover, please follow steps and figures below:

STEP 1: Remove all the screws, including those on the opposite side of the case, refer to Figure 3.1

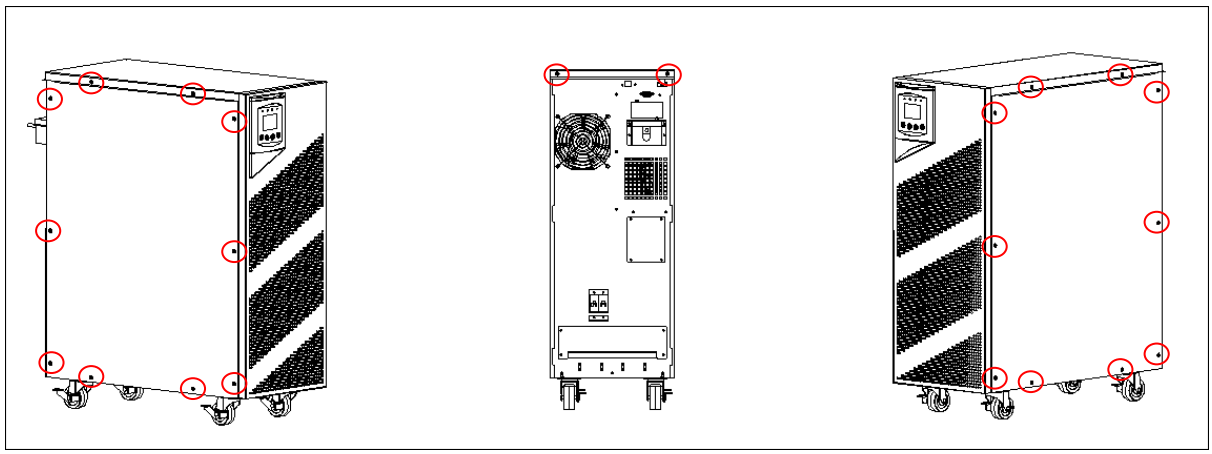


Fig. 3.1

STEP 2: Pull top cover upward first, and open both side covers as shown in Figure 3.2.

STEP 3: Done, as shown in Figure 3.3.

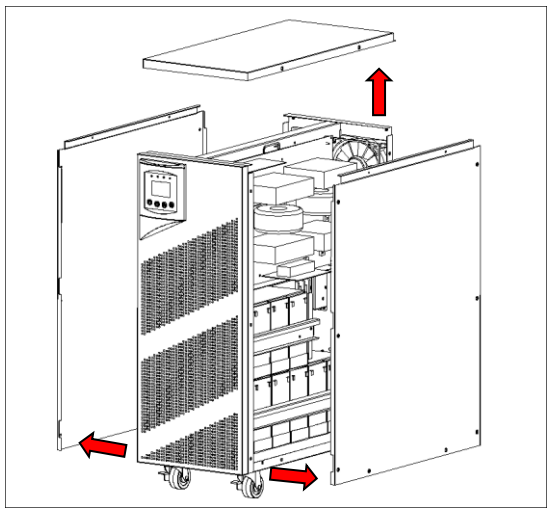


Fig. 3.2

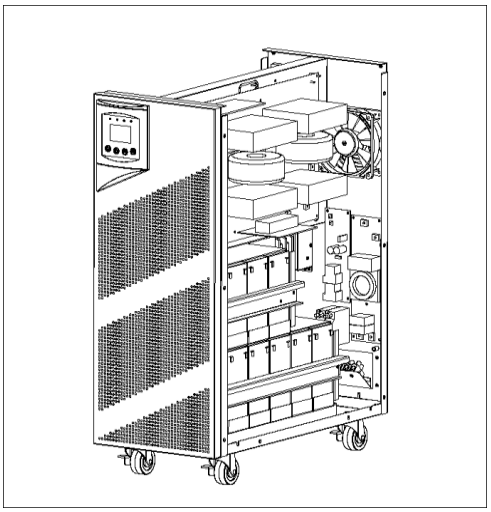


Fig. 3.3

3.2 Inside The Chassis

Warning:

Before any further operation of service, touch any parts inside the chassis. Please make sure all power supply is cut off, either mains utility or DC power from external battery pack, and discharge the possible residue energy from energy storage component such as capacitor.

Common		
CNTL board	**712-00296**	Contains major parts of protection, signaling circuits, regulation and control circuits, and supports LCD interface.
USB & EPO board	**710-03909**	Contains USB communication interface, emergence power off interface, and supports intelligent slot interface.
Dry contact board	**710-03911**	Contains dry contact interface.
Parallel board	**710-03879**	Contains parallel communication interface.
1.4A Charger board	**710-03912**	For internal battery of standard model, small charging current.
4A Charger board	**710-03913**	For external battery of long backup model, large charging current.
O/P RLY board	**710-03915**	Contains output relay for parallel function.
Only for 6K		
PSDR board	**710-09009**	Contains major circuit: 1) AC/DC converter, 2) DC/DC converter, 3) DC/AC inverter, 4) SPS
I/P EMI board	**710-03908**	Contains EMI filter and input protective circuit.
Bus board	**710-03920**	Contains Bus capacitors.
BAT RLY board	**710-03914**	Contains battery relay for battery input.
O/P EMI board	**710-09102**	Contains EMI filter and output protective circuit.
Only for 10K		
PSDR board	**710-03906**	Contains major circuit: 1) AC/DC converter, 2) DC/DC converter, 3) DC/AC inverter, 4) SPS
I/P EMI board	**710-09004**	Contains EMI filter and input protective circuit.
Bus board	**710-03921**	Contains Bus capacitors.
BAT RLY board	**710-03915**	Contains battery relay for battery input.
O/P EMI board	**710-09103**	Contains EMI filter and output protective circuit.

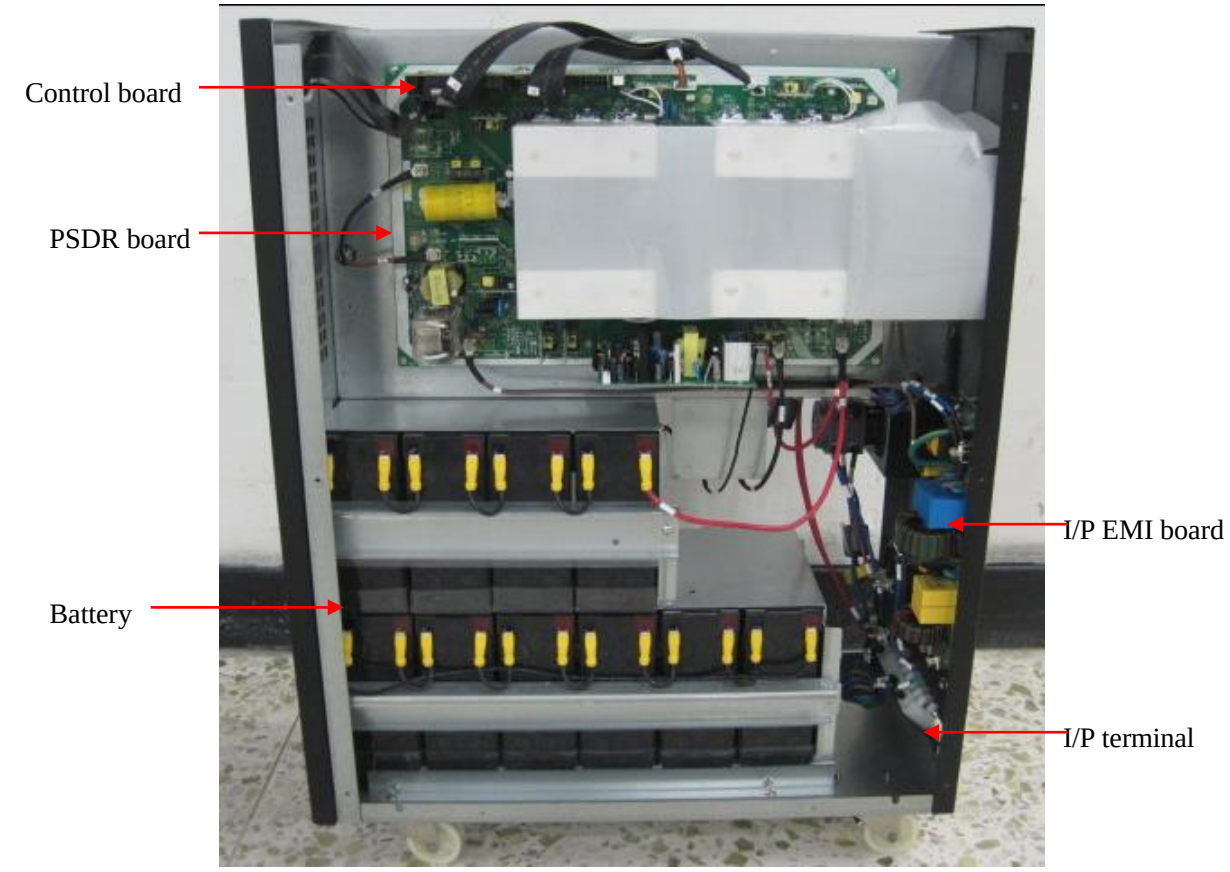


Fig. 3.2.1 6K PSDR side

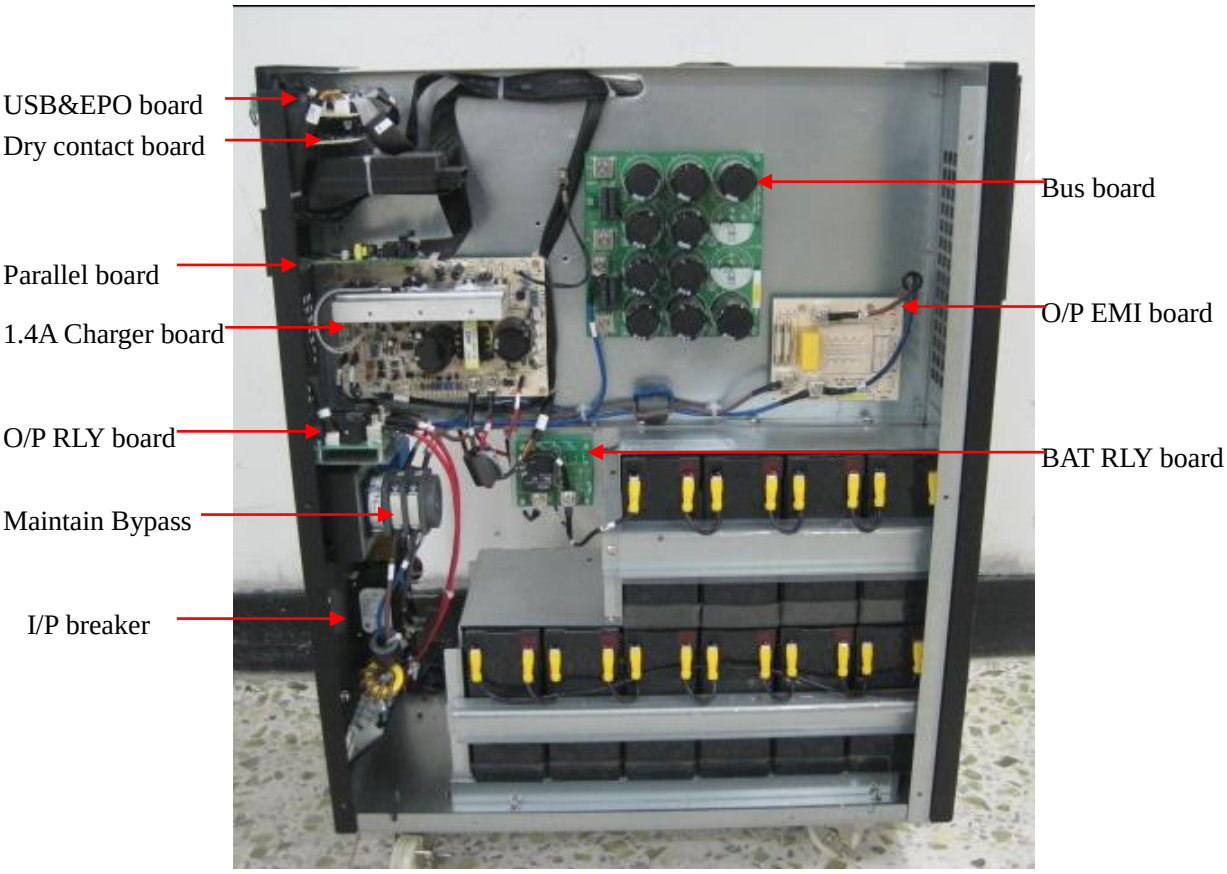


Fig. 3.2.2 6K Charger side

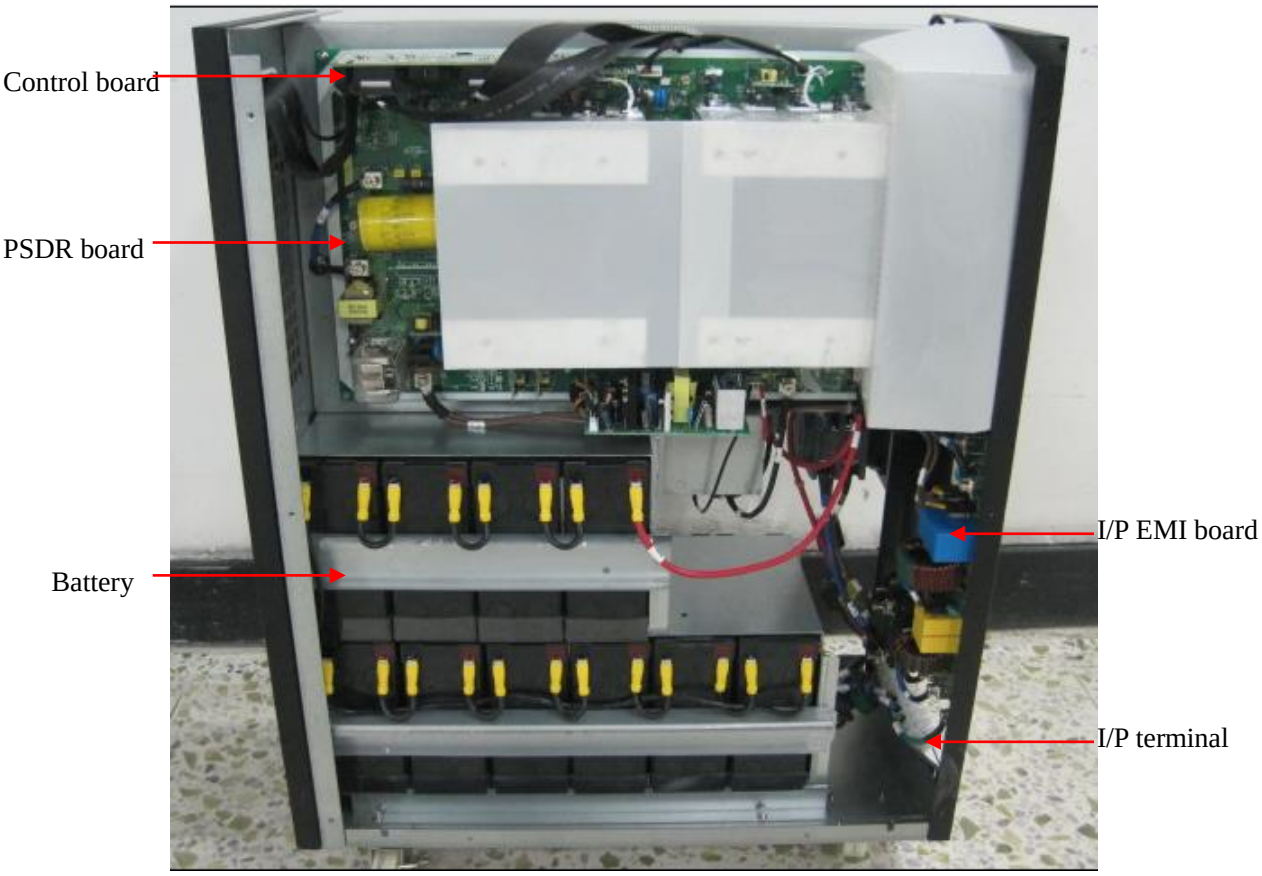


Fig. 3.2.310K PSDR side

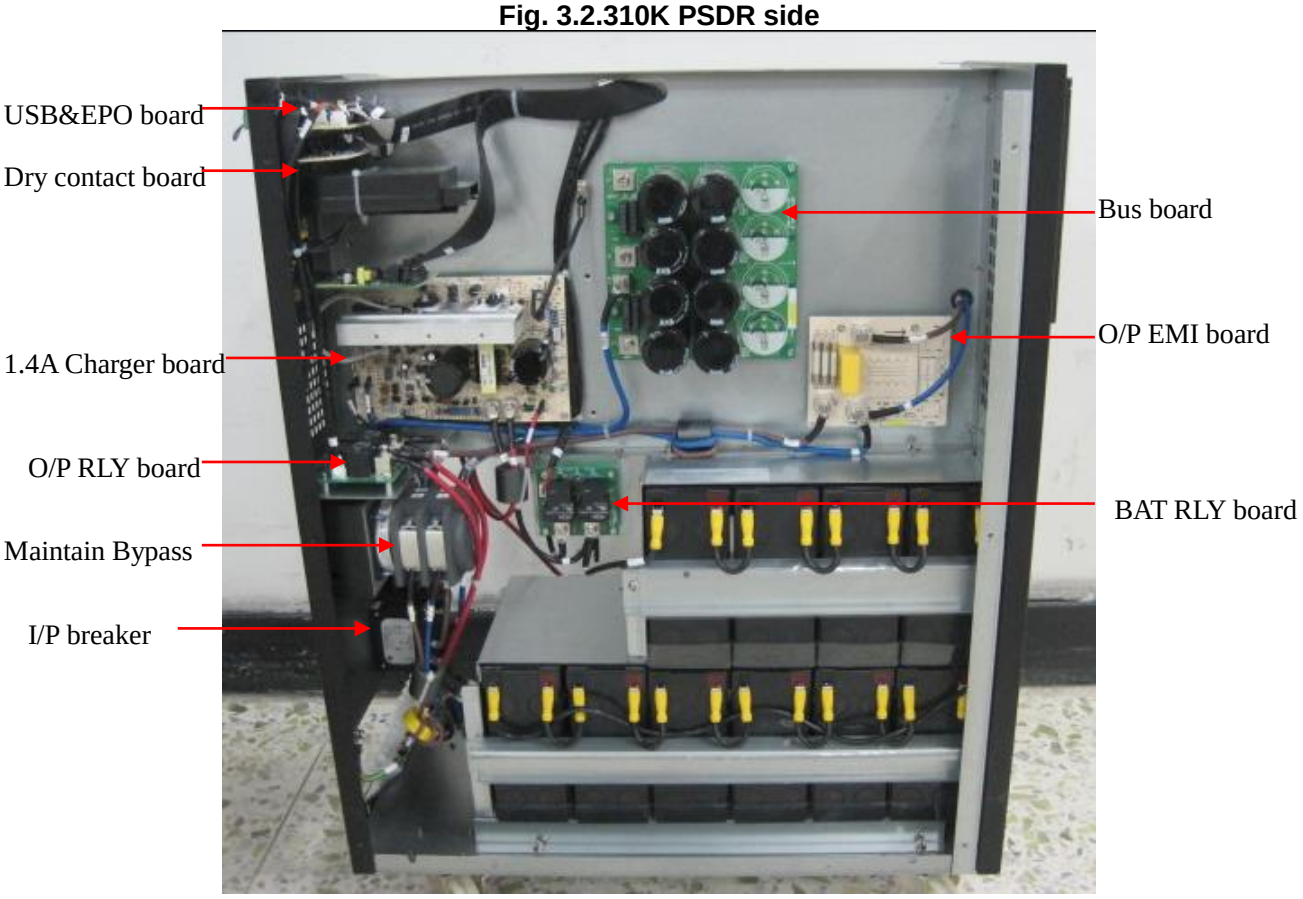
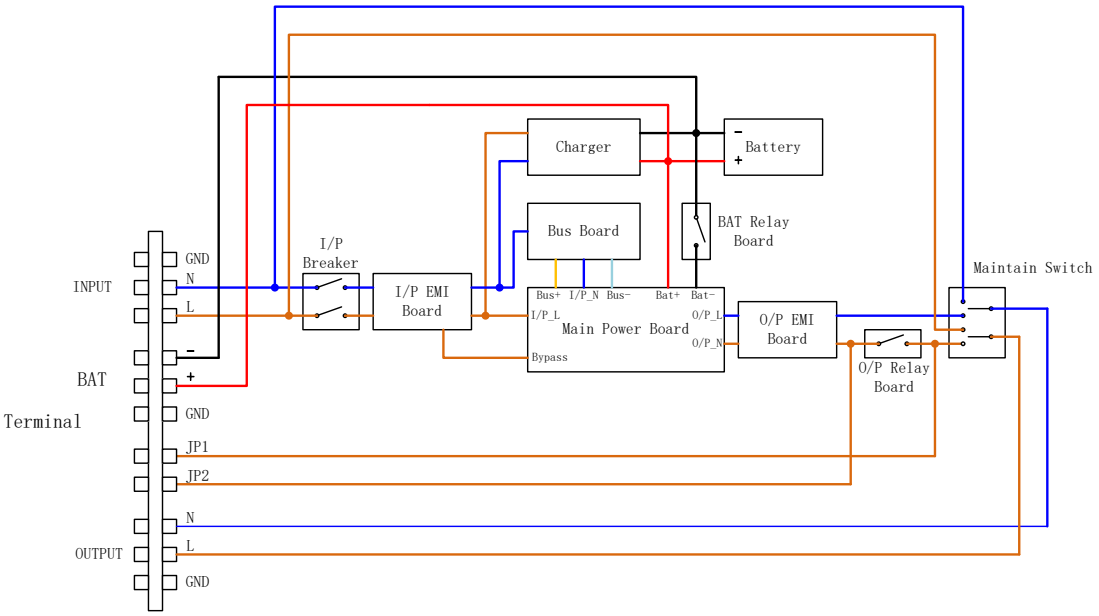


Fig. 3.2.4 10K Charger side

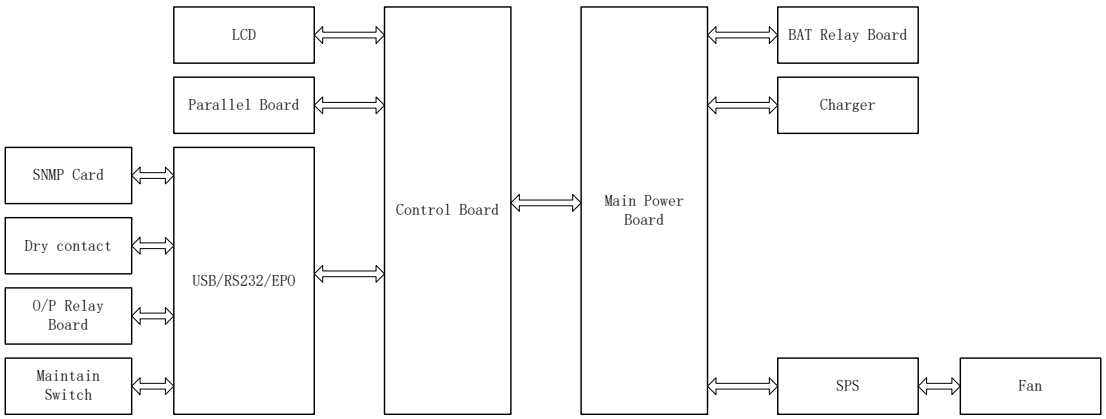
Fig. 3.2.4 6KS/10KS Charger side

3.3 The interconnection of the PCBs

Main power wiring



Signal and power supply connection



4. Modules Location

Below Figures shows location of the main components / modules in the UPS:

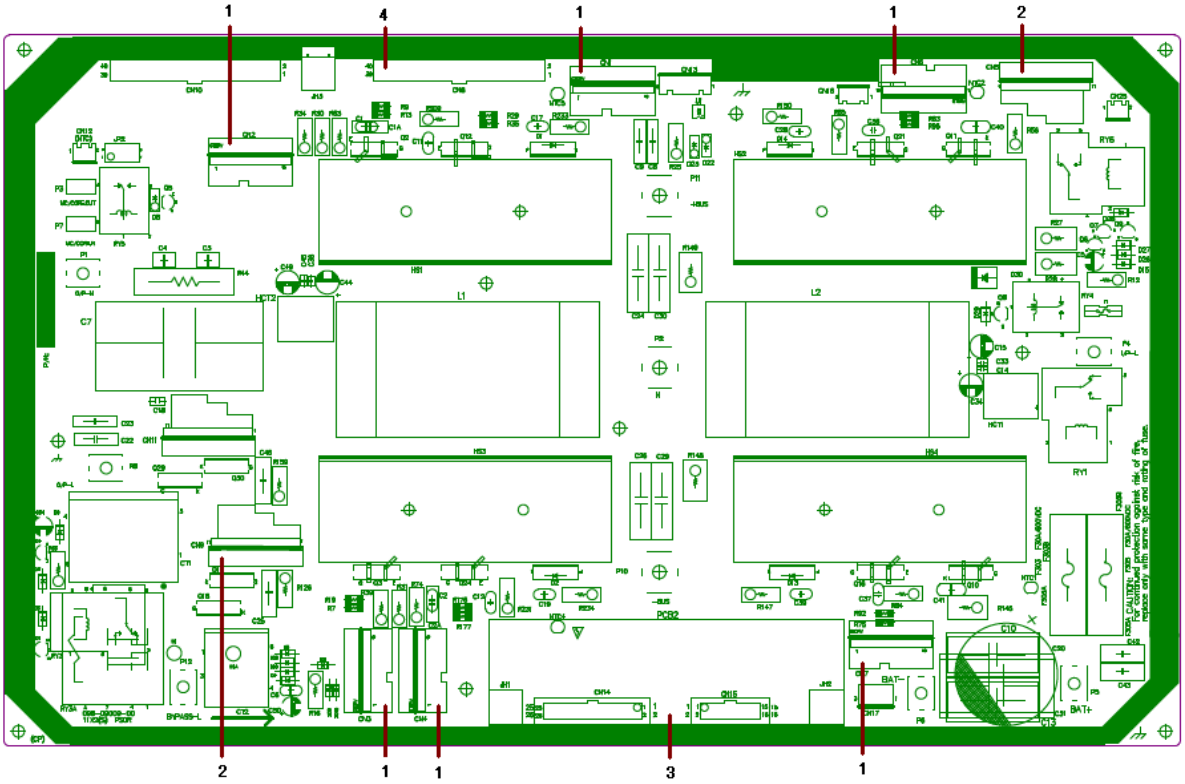


Fig.4.1 6K PSDR MODULE LOCATION

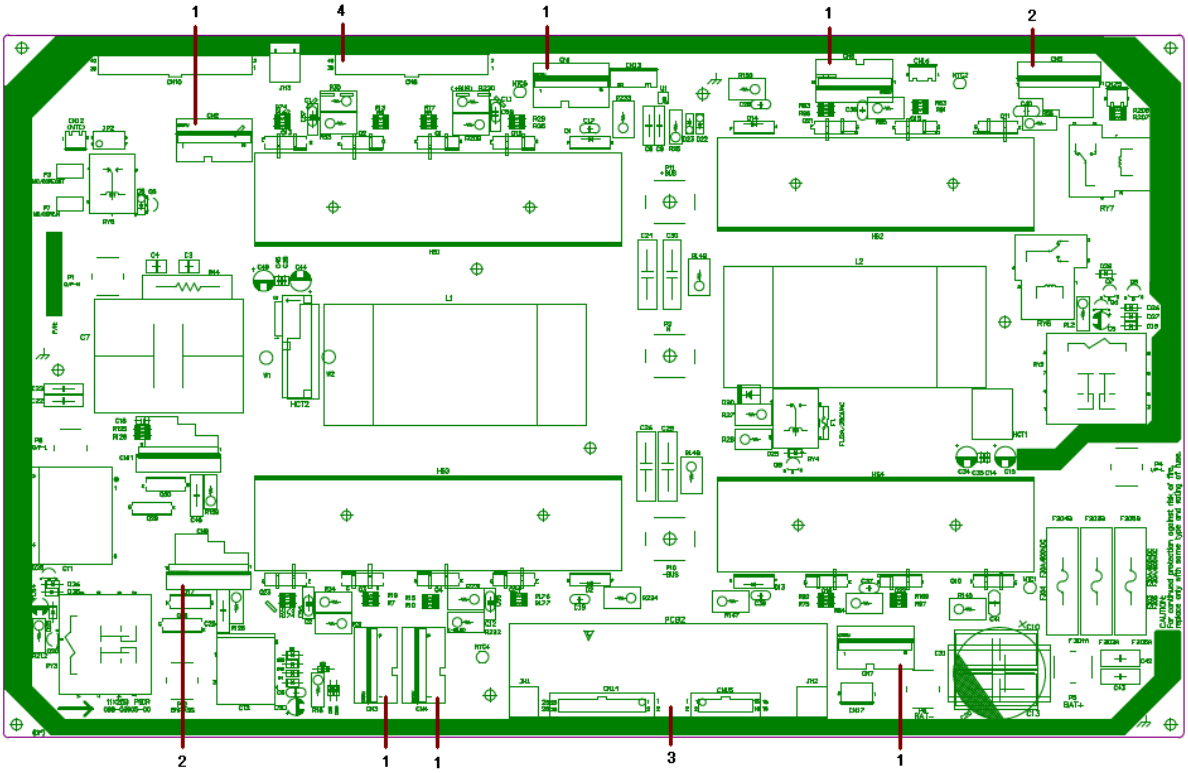


Fig.4.2 10K PSDR MODULE LOCATION

No.	Module Name	Part No.	Quantity
1.	IGBT Driver	710-61813	6
2.	SCR Driver	710-61805	2
3.	SPS Module	710-61443	1
4.	Global Controller	710-03907	1

5. Principle of Operation

5.1 Functional Block Of The Product

As a true online UPS, the product employ a double conversion topology, comprise following functional blocks, as shown in Figure 5.1.1

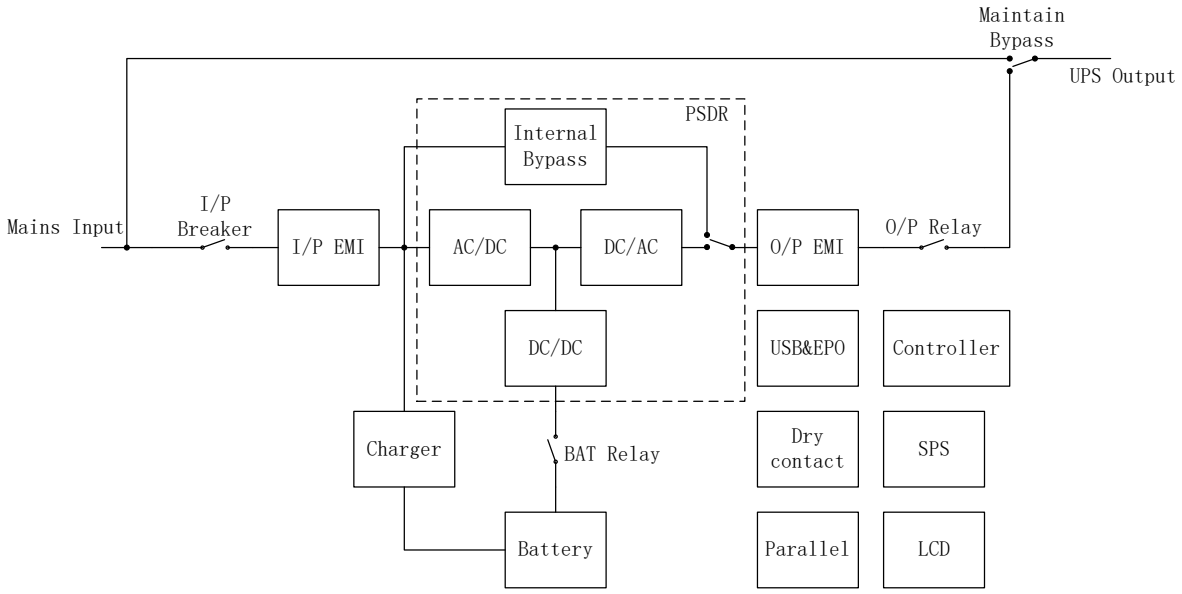


Figure 5.1.1 Function block Diagram of the product

In which:

The controller block controls the operation of the whole UPS, the controller block also provides communication interface for receiving and executing command from user via the panel or a preset protocol.

The AC/DC module, called also PFC/rectifier, belongs to input stage of the UPS. The AC/DC converter block converse the AC mains input power into a pair of stable DC power storing on the DC-BUS. In means time, Power Factor Correction is performed, the input current tracking the input voltage waveform, and the input power fact can be close to 1, achieve maximum efficiency and product lowest power pollution to the power supply system.

The DC/DC module, called also Battery Booster, is another part of input stage, used to converse the low level DC power into higher level and more stable DC power, storing on the DC-BUS also.

The DC/AC module, call also inverter, belongs to the output stage of the UPS, used to converse the DC power from the DC-BUS into clean, stable AC output power.

When the mains line is within the tolerance range, the AC/DC converter works; In case the mains line supply is out of tolerance range, due to either the voltage or the frequency, the UPS will stop

the AC/DC converter and start the DC/DC converter. The controller can detect the interruption of input mains supply in very short time, the output power will be maintained by energy stored in the DC-BUS capacitor, the interruption will never appear on output.

The battery charger converse the AC mains input into DC power for recharging the Battery. Two type of charger can be available, one is for the standard model, and another is for long backup time model which connects external battery.

The input EMI filter and output EMI filter are used for two purpose, the first one is to prevent the UPS being interfered by external electronic/magnetic noise which generated by the other electronic system, the second is to prevent the other system being interfered by the noise which generated by own UPS system.

The internal Bypass provides an alternative path in case the power conversion stage become out of order, to maintain the continuity of output supply.

The Power supply generates DC power which supplying to the UPS itself.

The LCD, USB&EPO, Dry contact are the interface for user. They could supply the information about UPS through LCD panel, computer, internet etc.

5.2 Operating Principle Of The Major Functional Block

5.2.1 AC/DC Converter (PFC converter)

The purpose of AC/DC converter is to generate a stable bipolar DC BUS for inverter first. Its another very important task is to make the input current track input voltage waveform, therefore to achieve a high input power factor which can be close to 1. That is why we also call it PFC (Power Factor Correction) converter.

Figure 5.2.1.1 showed the topology implement the AC/DC converter.

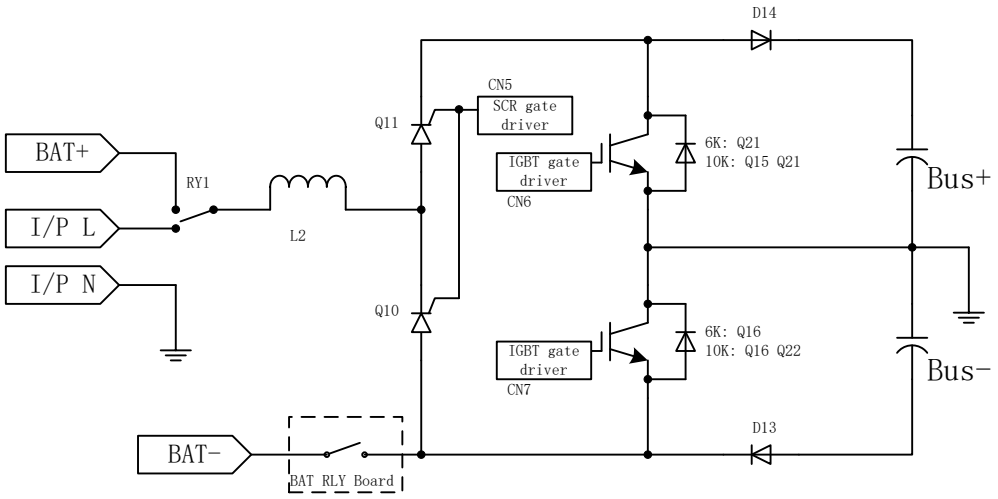


Figure 5.2.1.1 AC/DC converter

While AC mains is in normal condition, after receiving the turn on command, the input relay RY1 is on I/P_L side and BAT Relay is open, so the AC mains is the input of the converter. The global controller outputs PWM (Pulse Width Modulation) signal, the PWM signal will be isolated, amplified and use to drive switching component, the IGBT. When The IGBT is turned on, the current flow through the PFC chock increase, the chock is energized; when the IGBT is turned off, the chock de-energize and charge the DC-BUS capacitor. By controlling the Duty Cycle of the PWM signal, the energy charging the DC-BUS capacitor can be controlled, therefore the voltage of the DC BUS can be controlled, at the same time the waveform of the current can also be controlled to track the input voltage waveform, implement the power factor correction.
The PFC output voltage, i.e. the DC BUS voltage, will be regulated at ±350 Vdc to ±390 Vdc.

5.2.2 DC/DC Converter (Battery Booster)

The main circuits of AC/DC converter and DC/DC converter are almost same, Figure 5.2.1.1 showed the topology.

In case the AC mains interrupt or being out of tolerance range, the input relay RY1 would be on BAT+ and BAT Relay is close, so the battery is the input of the converter. Similarly the converter converses the DC power from the battery to maintain the DC-BUS voltage.

Normally, the DC/DC converter output will be regulated in the range of ±350 Vdc to ±390 Vdc.

5.2.3 Inverter

The inverter converses the DC power from DC BUS into the AC output to supply the load. A three level half bridge topology is employed, Figure 5.2.3.1 shows a diagram of inverter.

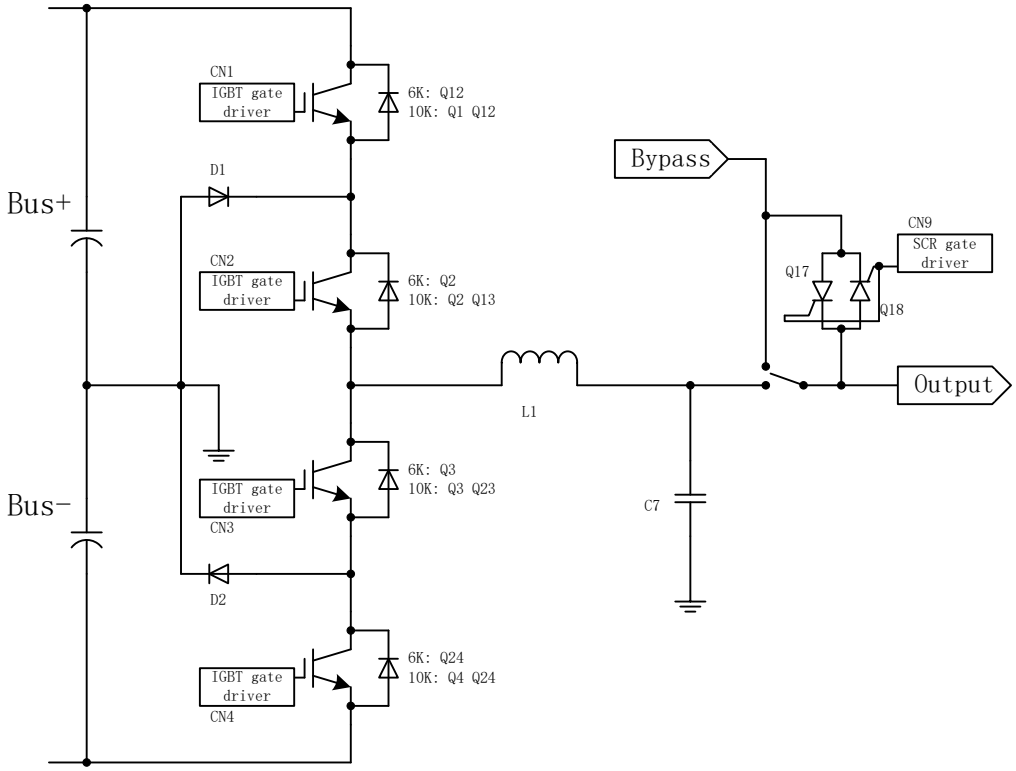


Figure 5.2.3.1 Schematics for inverter

The three level half bridge inverter comprise four switching devices - IGBT with co-pack diode, two clamp diodes, the driving circuits for each IGBT, a LC filter.

When the two positive IGBT is turned on, The output of half bridge is equal to Positive DC-BUS voltage, when the first positive IGBT is turned off and the second positive IGBT is turned on, either the positive clamp diode is active or the negative clamp diode is active, the output of the switching leg is Neutral. So by changing the duty cycle, average of output of the switching leg can vary from +BUS voltage to Neutral. It is the same that control the two negative IGBT to achieve –Bus voltage to Neutral. Then the output of the switching leg filtered by a LC filter to get clean and stable sine wave voltage.

5.2.4 Global Controller

The Global Controller of UPS is composed of following major circuits as following.

(1) CPU Central Processor Unit

(2) Signal detecting circuit

(3) Regulation & Protection circuit

(4) Output buffering circuit

(5) Communication interface circuit

The CPU can be regarded as the brains of the UPS, which is in the charge of signal detecting, measurement, processing, timing control, protection, communication.

The global controller implements following protection function:

1. Overload Protection
2. Cycle by Cycle Current Limitation
3. Battery over or under voltage protection
4. Inverter output abnormal protection
5. Over temperature protection
6. Bus over or under voltage protection
7. Fans lock protection

Due to the high level integration, the global controller is not desired to maintenance or repair out of manufacture factory. There are two methods to identify the status of global controller. The first one is to test it with test fixture; the second is to test the global controller on one piece PSDR which has been verified OK.

5.2.5 Standard Charger and Super Charger

The utility of charger is to recharge and to maintain the batteries at fully charged condition. It charges the battery with a constant current at initial stage. While the battery voltage keeps increasing, the charging current will decrease accordingly. When reaching the floating charging stage, the charger will control the output at a constant voltage level. In this way, to make the battery full recharged but not over recharged, to protect and prolong the lifetime of charged batteries.

Refer to Fig. 5.2.5.1; the battery charger is employed Flyback topology. Under controlling of the controller mainly comprises an ASIC uc3845, the switching component MOSFET turns on /turns off at a frequency around 100KHz. When MOSFET turns on, the current in the transformer will increase, and a certain amount of energy is stored in the transformer. When MOSFET turns off, the energy stored in the transformer will start to release to the secondary side of the transformer and charge the output capacitor. By controlling the duty cycle, energy transfers to secondary side and the output voltage can be controlled.

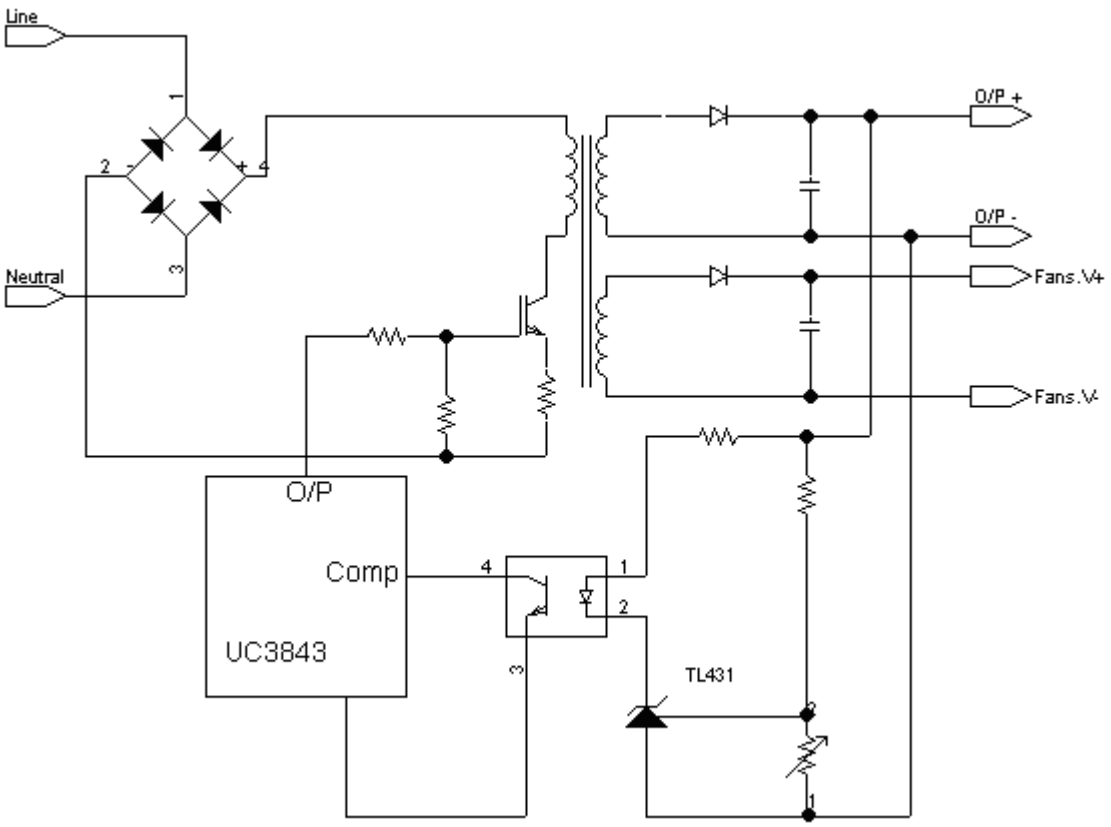


Fig. 5.2.5.1 Topology of the standards and supper charger

There are two kinds of chargers for standard model UPS and long backup time model UPS. Both operate in the samilar principle, but difference output capacity. The one for standard model UPS is maximum 1.4A charging current. A super charger for long back up time model is maximum 4A charging current.

5.2.6 Auxiliary Power Supply (SPS)

The Auxiliary Power Supply (SPS) module supplies DC power for UPS operation. The input of the SPS is the battery, or the charger output. The SPS module output +12 Vdc, +15Vdc, -15 Vdc, +5 Vdc.

+12 Vdc mainly uses for Relay driving, Fans supply, IGBT gate driver and generates +5 Vdc power supply.

+15Vdc, -15 Vdc only uses for signal amplifier, HCT power.

+5 Vdc uses for buzzer power and generate +3.3 Vdc and +1.6 Vdc power supply for the CPU.

5.2.7 User Interface

5.2.7.1 Front Panel

The front panel consist 3 parts: push button and LCD, LED indicator.

The push button is used to turn on and off the UPS, and do the setting.

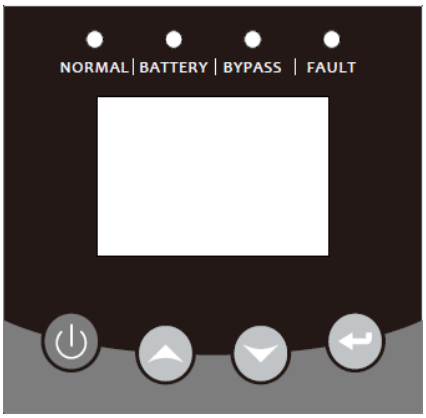


Fig.5.2.7.1 LCD display panel

All UPS information including the input, the output, the battery, the load and the status of UPS are displayed on the LCD screen. The detailed illumination of LCD display can be found in user manual.

When UPS is out of order, the fault information will be displayed and the buzzer will beep continuously. The detailed definition of the warning or fault code can be found in later section.

5.2.7.2 Communication Interface

The communication interface provides a means for using computer to manage the UPS, on the rear panel of the UPS, a standard USB port and an intelligent slot are provided.

With dedicated software, output voltage, frequency can be set via the USB port; also status of the UPS can be monitored.

The intelligent slot can accept SMNP, AS400, USB adaptor card, RS232 adaptor card, etc., for more flexible application solution.

The communication interface circuit provides isolation and voltage level transfer function for communication; the communication protocol is implemented by the CPU.

5.2.7.3 Emergence Power Off

The Emergence Power Off interface provides an emergence power off function. When the EPO function is enabled, once the EPO port is open, the UPS would shut off the output and enter into EPO mode, and the UPS would not respond anything command unless the port is close.

5.2.4 Ventilation And Chassis

Ventilation system of the UPS consist of air flow guiding insulation paper and fans, The ventilation system keeps the temperature of component of the UPS in safe range, so it is

very important for the UPS, To achieve lowest acoustic noise and longest life time of the fans, a fans driver and intelligent fans speed control algorithm is employed.

The chassis of the UPS provide a strong construction accommodate all the electrical parts, shield for EMC, and safety guard for operator.

Basically, the chassis comprise a base plant, an internal support plant, a front support plant, an out side cover, a rear panel, and a front panel.

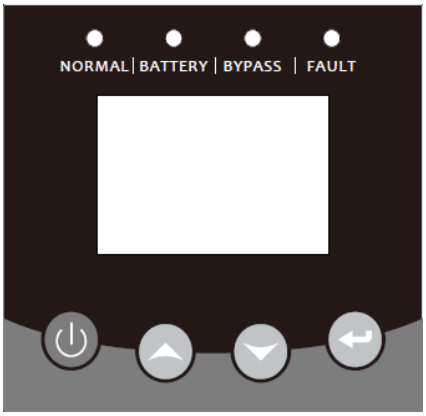
6. Trouble Shooting

Despite of careful design and strict tests, in case UPS become out of order. Basically, designer suggest following service procedure:

1. Check the UPS status and record by LCD panel display, or listen to the end user description
2. Identify the failure part/boards with the help of failure identify flowchart.
3. Observe the failure board, Static checking
4. Replace the failure components with OK parts
5. Static checking
6. Power up checking
7. Test after repair.

Following section will help service person to solve the most problems.

6.1 LCD Panel Display



The Display Panel

Table.6.1.1 The button

The Button	Funtion	Illustration
	Power on	When the unit is no power and has connected with battery, press this button for >0.1s&<1s to power on
	Turn on	When the unit is powered on and is in Bypass mode, press this button for >1s to turn on
	Turn off	When the unit has been turned on, press this button for >3s to turn off
	Enter main menu	When displaying default UPS status summary screen, press this button for >1s to enter the main menu tree
	Exit main menu	Press this button for >1s to exit the present menu to default system status display menu without executing a command or changing a setting
	Scroll up	Press this button for >0.1s&<1s to scroll up the menu option

	Scroll down	Press this button for >0.1s&<1s to scroll down the menu option
	Enter next menu tree	Press this button for >0.1s&<1s to select the present menu option, or enter next menu, but do not change any setting
	Select one menu option	Press this button for >0.1s&<1s to select the present menu option, or enter next menu, but do not change any setting
	Confirm the present setting	Press this button for >1s to confirm the edited options and change the setting

Table.6.1.2 The LED display

UPS state	Normal LED (Green)	Battery LED (Yellow)	Bypass LED (Yellow)	Fault LED (Red)
Bypass mode with no output			★	↑
Bypass mode with output			●	↑
Turning on	△	△	△	△
Line mode	●			↑
Battery mode	●	●		↑
HE mode	●		●	↑
Battery test mode	△	△	△	△
Fault mode			↑	●
Warning mode	↑	↑	↑	★

Note：

●: Lightened constantly

△: #1-#4 Lightened circularly

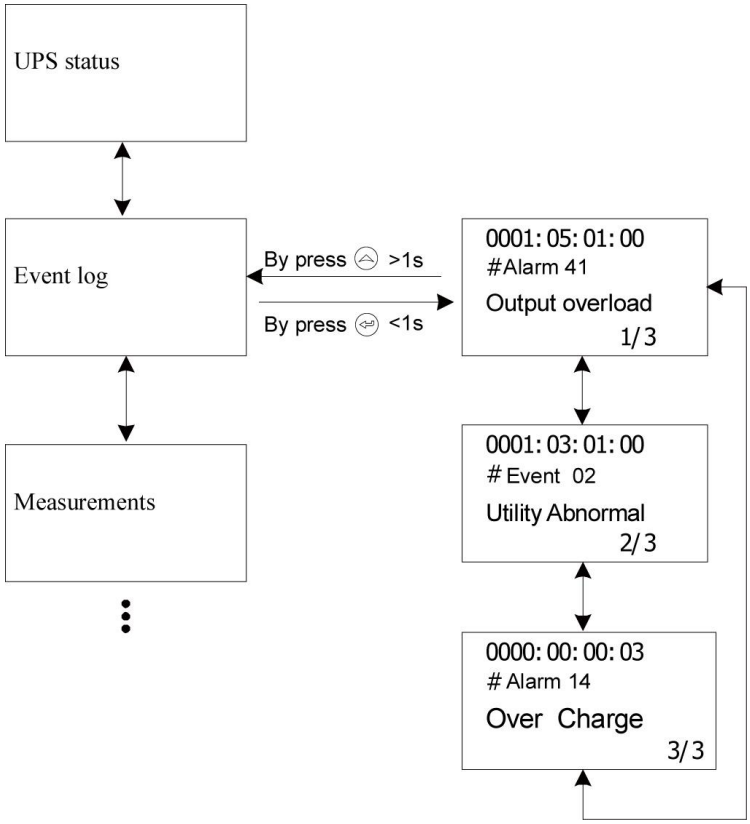
★: Flashing

↑: Depended on the fault/warning status or other status

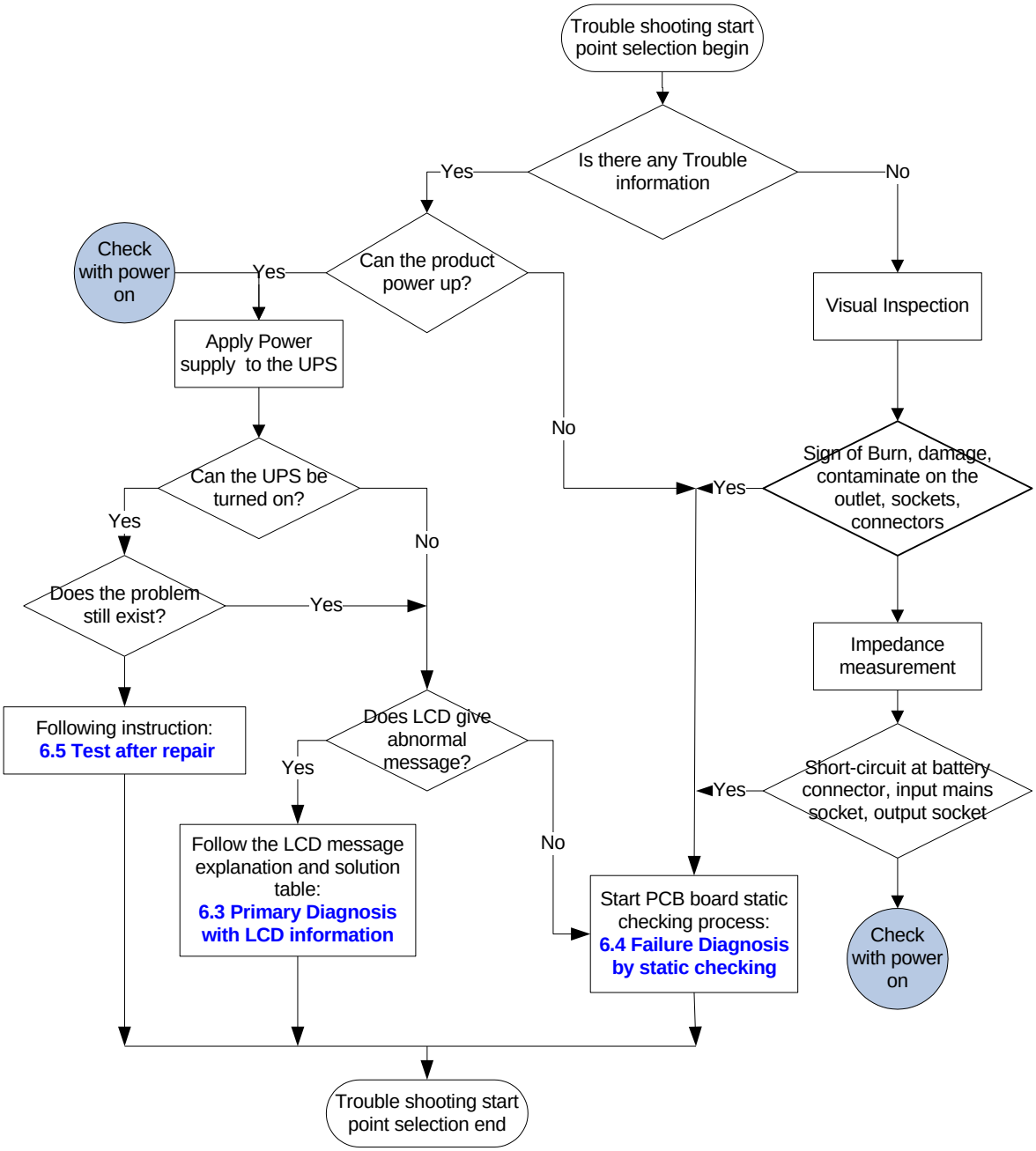
Table.6.1.3

UPS condition	Buzzer status
Fault active	Continuous
Warning active	Beep every second
Battery output	Beep every 4 seconds, if battery low, buzzer Beep every second
Bypass output	Beep every 2 minutes
Output Overload	Beep every 0.5 second

In the event log menu all the old event, alarm and fault have been recorded here. The information includes the illustration, the event code, and the operating time of UPS when the event happened.


UPS status
Event log
Measurements
By press >1s
By press <1s
0001: 05: 01: 00
#Alarm 41
Output overload
1/3
0001: 03: 01: 00
Event 02
Utility Abnormal
2/3
0000: 00: 00: 03
Alarm 14
Over Charge
3/3

6. 2 How To Start



6.3 Primary Diagnosis with LCD Information

If the UPS system does not operate correctly, and you could get the failure information on the LCD display, here are some possible causes and remedies in the table below.

6.3.1 Trouble Shooting According To Warning Indication

Problem Displayed	Possible cause	Remedy
Read EEPROM Error	UPS internal fault	Consult dealer.
Epo Active	EPO connector is open	Check the EPO connector status
On Maintain Bypass	Maintain bypass switch is open	Check the maintain bypass switch status
IP softstart failed	UPS internal fault	Consult dealer
Site Wiring Fault	Phase and neutral conductor at input of UPS system are reversed	Reverse mains power wiring.
Battery Disconnect	Battery pack is not connected correctly	Do the battery test to confirm. Check the battery bank is connected to the UPS. Check the battery breaker is turn on.
Battery low	Battery voltage is low	When audible alarm sounding every second, battery is almost empty.
Output Overload	Overload	Check the loads and remove some non-critical loads. Check if some loads are failed.
Fan Failure	Fan abnormal	Check if the fan is running normally.
Charger Fail	The charge fails	Consult dealer.
Battery Over Voltage	Battery voltage is higher than normal value	Check if the battery quantity is right.
Over Charge	Battery is over charged	The UPS will turn off the charger until the battery voltage is normal
Model Pin Error*	UPS internal fault	Consult dealer.
Ambient Over Temperature	The ambient temperature is too high	Check the environment ventilation.
Heatsink Over Temperature	Inside temperature of UPS is too high	Check the ventilation of UPS and the ambient temperature.
Ambient NTC abnormal	UPS internal fault	Consult dealer.
Para Cable Male Loss	The parallel cable is disconnected	Check the parallel cable.
Para Cable Female Loss	The parallel cable is disconnected	Check the parallel cable.
Para Bat Differ	The battery packs of some UPSs are disconnected	Check if all the battery pack is connected.
Para Line Differ	The mains input of some UPSs is disconnected	Check the building wiring and input cable. Check if the input breaker is closed. Ensure the UPSs are connected to same input source.

Para Work Mode Differ	There are different power strategy setting in parallel system	The UPSs with different power strategy setting (Ex. one Line mode and one Converter mode) are forbidden to parallel.
Para Rate Power Differ	There are different UPSs in parallel system	The UPSs with different capacity (Ex. one 6KVA and one 10KVA) are forbidden to parallel.
ECO In Para	HE function is enabled in parallel system	HE function is forbidden in parallel system.

*There are 4 pairs model connectors on the PSDR and the Model pin must set correctly as below, or there will be a warning"Model Pin Error" displayed on the LCD.

long backup time: **X** standard: O	Iso**:**X** no Iso:O	no use	6kva:**X** 10kva:O		
1,2	3,4	5,6	7,8	power	model
X	O	O	**X**	6kva	6K
O	O	O	**X**	6kva	6KS
X	**X**	O	**X**	6kva	6K-Iso
O	**X**	O	**X**	6kva	6KS-Iso
X	O	O	O	10kva	10K
O	O	O	O	10kva	10KS
X	**X**	O	O	10kva	10K-Iso
O	**X**	O	O	10kva	10KS-Iso

X:means pin insert
O:means no pin insert

**The UPS must be set as Iso model when you conntct an isolated transformer to the UPS output, on the contrary, the UPS must be no-iso model when its output is not connected to an isolated transformer.

6.3.2 Trouble Shooting According To Fault Indication

Problem Displayed	Possible cause	Remedy
Inv Overload Fault	Overload	Check the loads and remove some non-critical loads. Check if some loads are failed.
Byp Overload Fault	Overload	Check the loads and remove some non-critical loads. Check if some loads are failed.
Output Short Circuit	Output short circuit	Remove all the loads. Turn off the UPS. Check if UPS output and loads is short circuit. Ensure short circuit is removed before turning on again.
Heatsink Over Temperature Fault	Inside temperature of UPS is too high	Check the ventilation of UPS and the ambient temperature.
Bus Over Voltage	UPS internal fault	Consult dealer.
Bus Under Voltage	UPS internal fault	Consult dealer.

Bus Unbalance	UPS internal fault	Consult dealer.
Bus short	UPS internal fault	Consult dealer.
Bus Softstart Fail	UPS internal fault	Consult dealer.
Inv Over Voltage	UPS internal fault	Consult dealer.
Inv Under Voltage	UPS internal fault	Consult dealer.
Inv Softstart Fail	UPS internal fault	Consult dealer.
Negative Power Fault	The load is pure inductive and capacitive	Remove some non-critical loads. Bypass supplies the load first, ensure there is no overload, then turn on UPS.
Cable male and female Loss fault	The parallel cable is disconnected	Check the parallel cable.

6.3.3 Trouble Shooting In Else Cases

Problem	Possible cause	Remedy
No indication, no warning tone even though system is connected to mains power supply	No input voltage	Check the building wiring and input cable Check if the input breaker is closed
BYPASS LED light up even though the power supply is available	Inverter not switched on	Press On-Switch “I” to turn on UPS
BATTERY LED lights up, and audible alarm sounding every 1 beep in every 4 seconds	Input voltage and/or frequency are out of tolerance	Check input power source Check the building wiring and input cable Check if the input breaker is closed
Emergency supply period shorter than nominal value	Batteries not fully charged / batteries defect	Charge the batteries for at least 12 hours and then check capacity

6.4 Failure Diagnosis by Static Checking

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

For the reason of safety, please follow safety instruction to begin your work

High Voltage Danger: Some components contain residue energy and remain dangerous high voltage even if the external power supply is cut off, operator should follow following instruction strictly to avoid risk of electrical shock.

1. Disconnected UPS from the utility.

2. For long backup time model, disconnected UPS from battery cabinet.
3. Open outside case shown in the beginning of this manual.
4. Disconnected internal battery.
5. Discharge energy in BUS capacitors, and Charger capacitors.
6. Disassemble cable from PCB if required.
7. Disassemble PCB if required.

Before starting service, some tools are necessary, at least: A DMM (Digital Multifunction Meter) meter, screwdrivers and discharge resistor (300Ω/10W recommended). A DC power supply with current limiting (over current protection) function (240VDC/3A at least) is recommended for fast and safe diagnosis.

TO DISCHARGE the residue energy on bus capacitors,

Contact **P4 N** terminal and **P1 +BUS** terminal with a 300Ω/10W resistor to discharge +BUS capacitor, contact **P4 N** terminal and **P3 -Bus** terminal with a 300Ω/10W resistor to discharge -BUS capacitor

P1, P3, P4 is **on Bus board**

TO DISCHARGE the residue energy of charger capacitors,

After disconnect the battery from PSDR and Charger, contact **BAT+** terminal and **BAT -** terminal with a 300Ω/10W resistor for discharge battery filter capacitor

BAT+ and BAT- is **on Charger board**

If the modules including CNTL, SPS, Driver are damaged, it is not recommended to change components on the module, just replace the whole module.

DO NOT power on UPS with the mains unless you are sure that you have replaced all defective components.

6.4.1 Quick Start

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.

Related Circuit Block	Components to be checked	Component Type	Fail condition
On I/P EMI board			
I/P Fuse	6K: F7, F8 10K: F4, F5, F6	Fuse	Open
On O/P EMI board			
O/P Fuse	6K: F1, F2 10K: F1, F2, F3	Fuse	Open
On PSDR board			
BAT Fuse	6K: F303, F305 10K: F303, F304, F305	Fuse	Open
PFC Converter	Q10, Q11	SCR	Short or open
	6K: Q16, Q21 10K: Q15, Q16, Q21, Q22	IGBT	C-E short or open
	D13, D14	Power Diode	Short or open
Inverter	6K: Q2, Q3, Q12, Q24 10K: Q1, Q2, Q3, Q4, Q12, Q13, Q23, Q24	IGBT	C-E short or open
	D1, D2	Power Diode	Short or open
Bypass	Q17, Q18	SCR	Short or open
1A Charger			
Standard Charger	F1, F2, F3, F4	Fuse	Open
	Q1	MOSFET	D-S short or open
	D7, D8, D1, D4	Power Diode	Short or open
	REC1	REC	Short or open
4A Charger			
Super Charger	F1, F2, F3, F4	Fuse	Open
	Q7, Q8, Q3	MOSFET	D-S short or open
	D2, D35, D41	Power Diode	Short or open
	REC1	REC	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 failed components and replace them!

6.4.2 AC/DC and DC/DC Converter Analysis:

In this section, some components you could check to see if failure occurs to PFC Converter. **General speaking**, OPEN of fuse on I/P EMI board indicates failure of this block. Please replace all failed components before testing UPS.

Item	Checked components	Instrument function	Reference Value	Failed condition
1	Q17, Q18	Ω (G→K)	23	Short or open or value change
2	6K: Q16, Q21 10K: Q15, Q16, Q21, Q22	Diode Voltage Drop (E→C)	0.44	Short or open
		(C→E) Diode Voltage Droop	Infinite	Short
3	D13, D14	Diode Voltage Drop	0.44	Short or open
4	6K:R75, R83 10K:R63, R75, R83, R87	Ω	2.2	Short or open or value change

If failed condition stated in item 4 occurs, it is very possible that the corresponding PFC IGBT driver module is damaged, so please try to replace the PFC IGBT driver module CN6 and CN7 accordingly.

If failed condition stated in item 1 occurs, it is very possible that the corresponding SCR driver module is damaged, so please try to replace the PFC IGBT driver module CN5 accordingly.

6.4.3 Inverter Analysis

Item	Checked components	Instrument function	Reference Value	Failed Condition
1	6K: Q2, Q3, Q12, Q24 10K: Q1, Q2, Q3, Q4, Q12, Q13, Q23, Q24	(E→C) Diode Voltage Droop	0.4	Short or open
		(C→E) Diode Voltage Droop	Infinite	Short

Item	Checked components	Instrument function	Reference Value	Failed Condition
2	D1, D2	Diode Voltage Drop	0.44	Short or open
3	6K: R29, R13, R19, R176 / R35, R9, R7, R177 10K: R29, R17, R74, R13, R173, R19, R176, R15 / R35, R5, R162, R9, R174, R7, R177, R10	Ω	10.0/39.0	Short or open or value change

If fail condition stated in item 3 occurs, it is very possible that the corresponding INV IGBT driver module is damaged, so please try to replace the INV IGBT driver module CN1, CN2, CN3, CN4 accordingly.

6.4.4 Bypass Analysis

Item	Checked components	Instrument function	Reference Value	Failed condition
1	Q17, Q18	Ω (G→K)	23	Short or open or value change

If fail condition stated in item 1 occurs, it is very possible that the corresponding SCR driver module is damaged, so please try to replace the INV IGBT driver module CN9 accordingly.

6.4.5 1A Charger Analysis

Item	Checked components	Instrument function	Reference Value	Failed condition
1	F1, F2, F3, F4	Ω	0	Open
2	REC1 (~→+)/(-→~)	Diode Voltage Droop	0.4V	Short or open
3	Q1 (S→D)	Diode Voltage Droop	0.4V	Short or open
4	D1, D7, D8, D4	Diode Voltage Droop	0.45	Short or open
5	R12	Ω	10	Short or open

If all components listed above are in normal condition and charger still can't work, try to change IC U6.

6.4.6 4A Charger Analysis

Item	Checked components	Instrument function	Reference Value	Failed condition
1	F1, F2, F3, F4	Ω	0	Open
2	REC1 (~→+)/(-→~)	Diode Voltage Droop	0.4V	Short or open
3	Q7, Q8, Q3 (S→D)	Diode Voltage Droop	0.4V	Short or open
4	D2, D35, D41	Diode Voltage Droop	0.45	Short or open
5	R33, R35	Ω	20	Short or open

If all components listed above are in normal condition and charger still can't work, try to change IC U4.

6.5 Test and Finish

After replace all defected components, following test the steps can be adopted to verify the repair result and the reliability of the UPS.

1. Connect all of boards, cable, and connector.
2. Check the Wiring.
3. Apply DC Power from power source with current limitation function to the BAT terminal on the PSDR, the voltage of the DC power should be 240Vdc/3Amp (limited current).
4. Press the ON-switch on front panel to try to turn on UPS.
5. If UPS can not be turned on successfully. Check the information from LCD display. Please try diagnosing procedure again.
6. If UPS is turned on, check the output voltage and Bus voltage waveform.
7. Turn off UPS. Apply AC mains to UPS and make sure AC mains is normal. Turn on UPS again.
8. If UPS can not be turned on successfully. Check the information from LCD display. Please try diagnosing procedure again.
9. If UPS is turned on, check the output voltage and Bus voltage waveform at no-load and full load condition.
10. In most case result of step9 can represent whether product is in normal condition. If possible, however, for more reliability, perform quick check follow procedure shows in table would help in know the UPS situation in detail.
11. If possible, do a burn in test on repaired UPS before return it to customer.

12.If every step is ok, Congratulation, you have finish the maintenance/ repair work.

TEST ITEM	TEST POINT	EXPECTED RESULT
+DC Bus Voltage	P4 and P1 on **Bus board**	+350VDC to +390VDC
-DC Bus Voltage	P3 and P1 on **Bus board**	-350VDC to -390VDC
O/P voltage	P1 and P8 on **PSDR**	220Vac (or 230Vac, etc according to the setting)
O/P DC Balance	P1 and P8 on **PSDR**	100mV max.

DC Offset Measurement Fixture

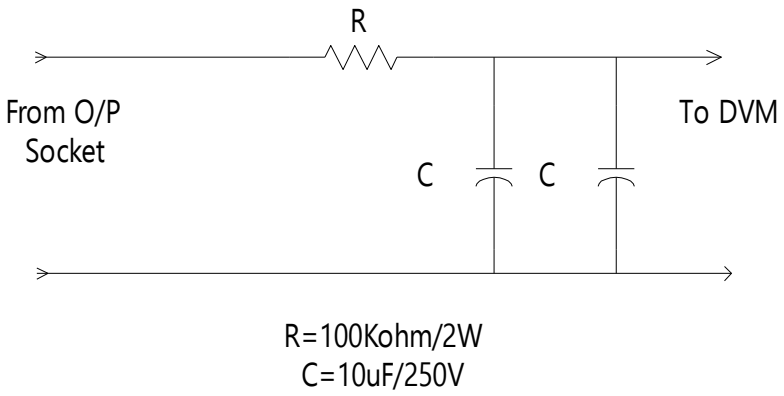


Fig. I.1 DC Offset Measurement Fixture