SERVICE MANUAL

Vista 1K(S) / 2K(S) / 3K(S) / Tower

Centralion

CONTENT

1. General Information Of This Document

1.1 Getting start

This is a service manual for Vista 1/2/3K(s), Tower UPS, intend to help service personal perform a 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 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.
7. Verify input source (voltage and frequency) is within the maximum range before service.

1. **DO NOT** short-circuit internal batteries
2. If the battery connectors **[BAT (+), BAT (-)]** are disconnected, be sure to plug in the input power cord and the input power is available before re-connect the battery connectors.
3. 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 charge on bus capacitor,

For 1k(s) model contact **P2/P8 BAT (-)** terminal and upper lead of **R4** with a 300Ω/10W resistor to discharge +BUS capacitor, contact **P2/P8 BAT (-)** terminal and upper lead of **R1** with a 300Ω/10W resistor to discharge +BUS capacitor

For 2k(s)/3k(s) model, contact **P01 BAT (-)** terminal and upper lead of R104 with a 300Ω/10W resistor to discharge +BUS capacitor, contact **P01 BAT (-)** terminal and R118

(2k/3k) upper lead with a 300Ω/10W resistor to discharge +BUS capacitor

TO DISCHARGE the energy of charger capacitor, **after disconnect the battery from PSDR/Charger**, you can use a 300Ω/10W resistor contact **BAT (+) terminal** and **BAT (-)** terminal for discharge battery filter capacitor

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 safer, 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

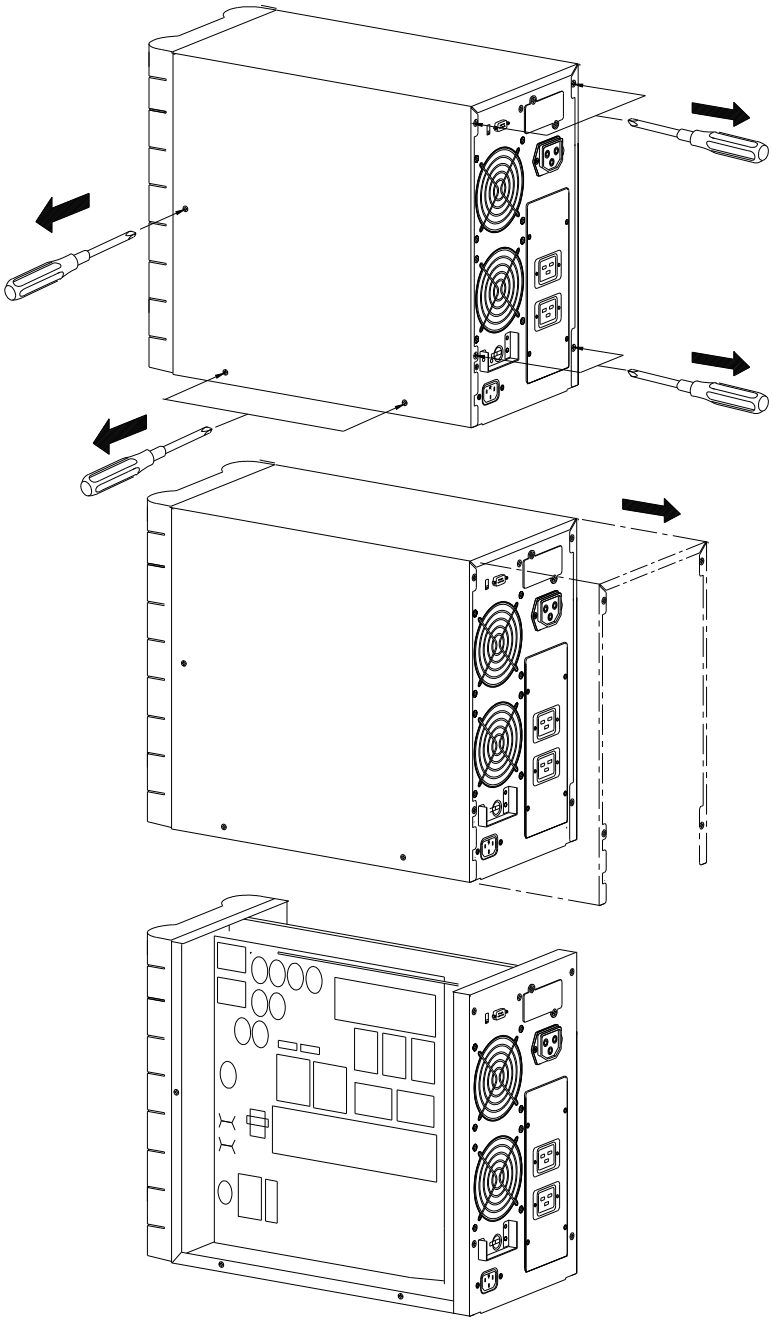
3.1 Open The Outside Cover

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

STEP 2: Slide outside cover backward, as shown in Figure 3.2.

STEP 3: Done, as shown in Figure 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 for standard model which contains internal battery, please disconnect at least one of battery connection cables and discharge the possible residue energy from energy storage component such as capacitor.

3.2.1 1K

Fig. 3.2.1.1 1K PSDR & CNTL

Fig. 3.2.1.2 1K Internal batteries

3.2.2 1KS Super Charger

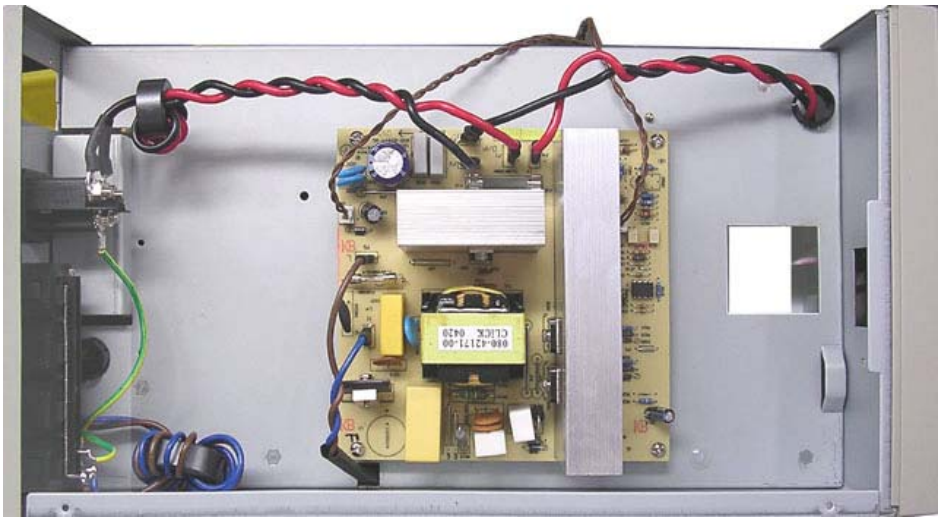


Fig. 3.2.2.1 1KS super charger

3.2.3 2K

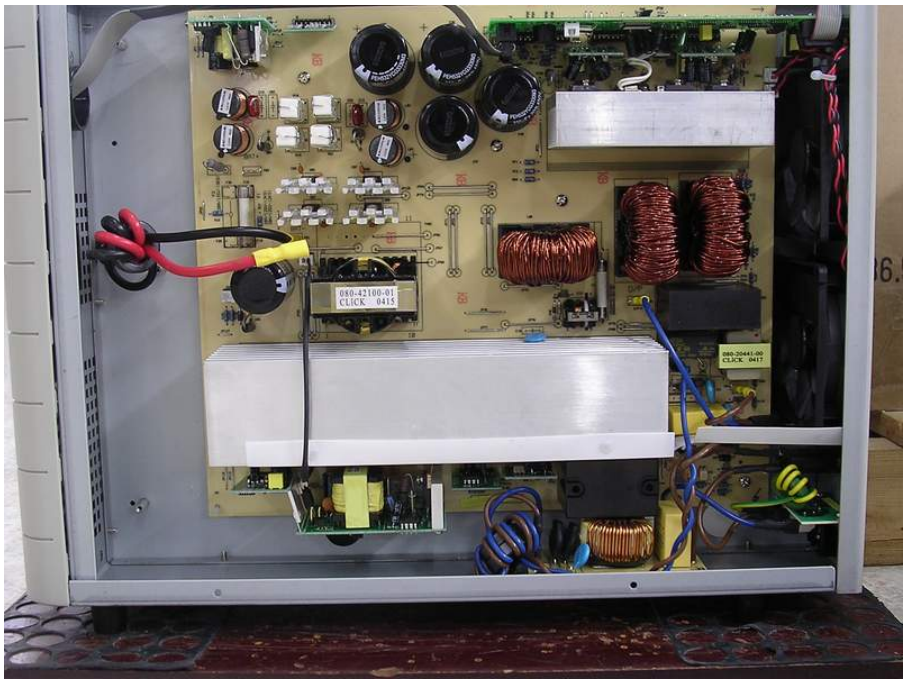


Fig. 3.2.3.1 2KS PSDR / CNTL I/P EMI

3.2.4 3K

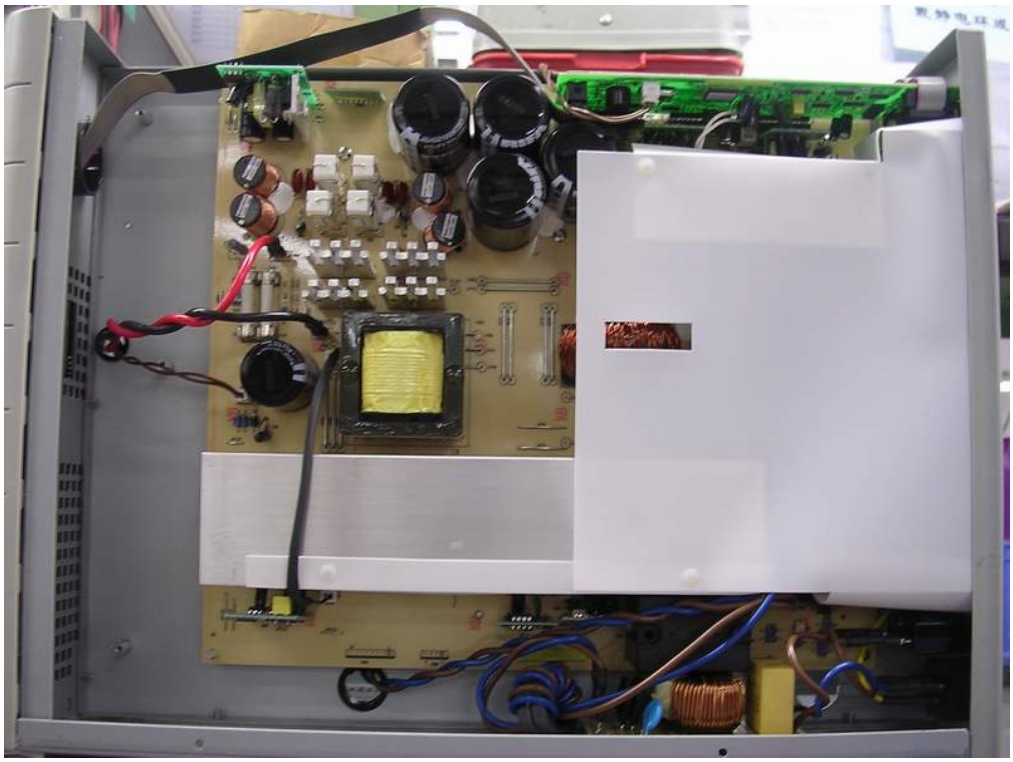


Fig. 3.2.4.1 3KS PSDR / CNTL I/P EMI

Fig. 3.2.4.2 2/3KS Internal Battery

3.2.5 2/3KS super charger

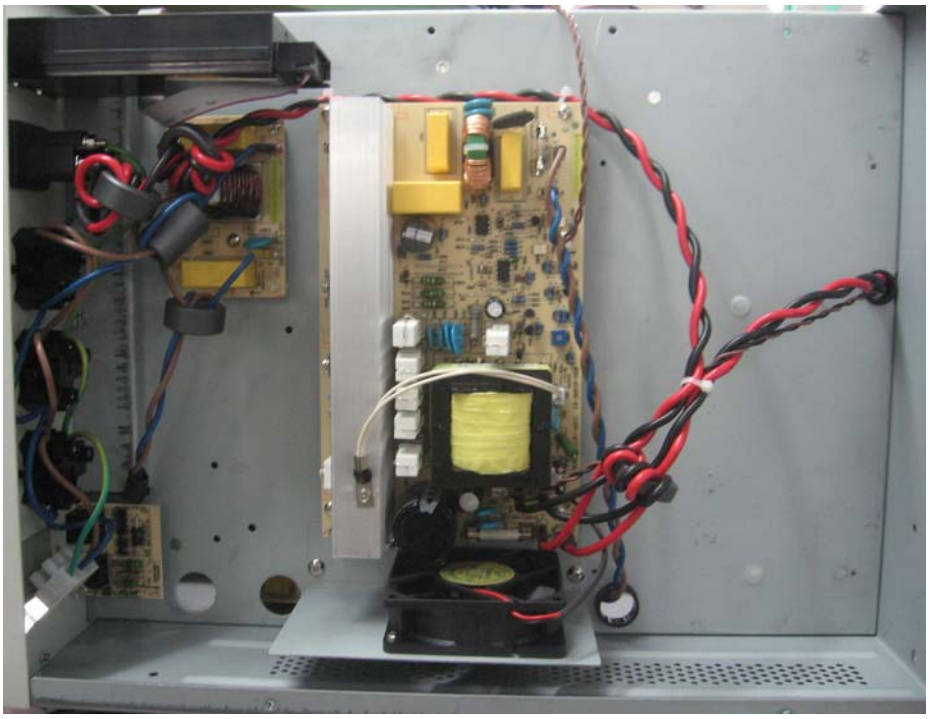


Fig. 3.2.5.1 2/3KS Super Charger

4.COMPONENTS LOCATION

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

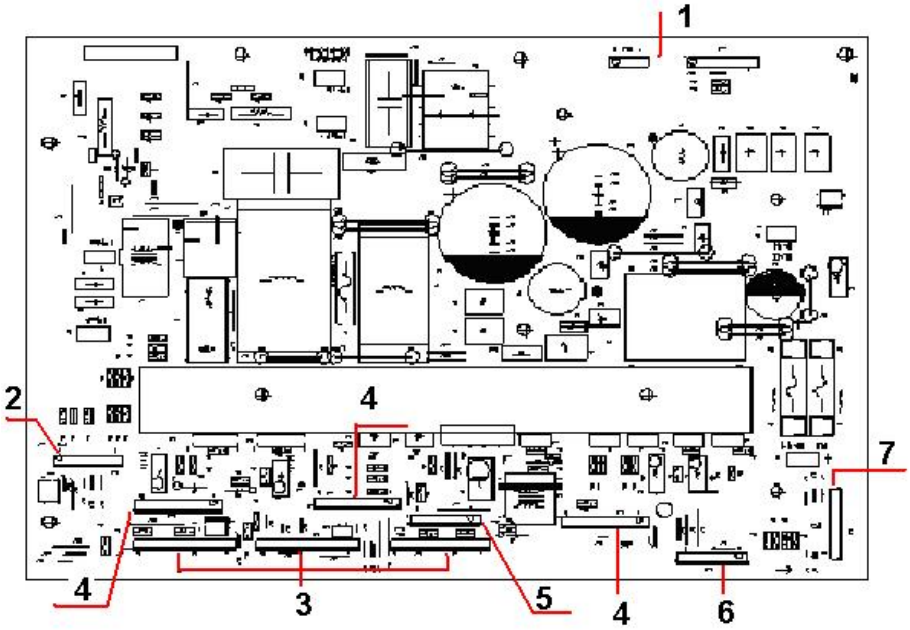


Fig.4.1 1K PSDR MODULE LOCATION

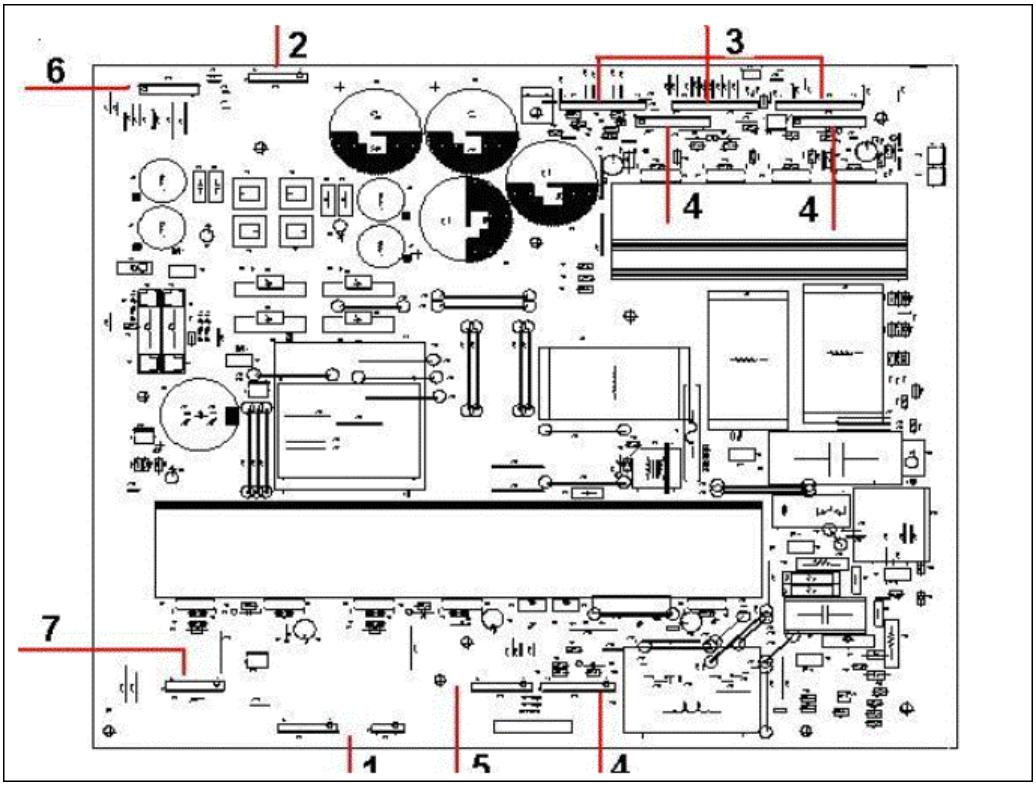


Fig.4.2 2K/3K PSDR MODULE LOCATION

No.	Module Name	Part No.	Quantity	Remark
1.	Charger Module	710-61201	1	1053
		710-61200	1	1073/1083
2.	Fan Driver	710-61000	1	1053(S)
		710-61001	1	1073(S)/1083(S)
3.	CNTL	710-01771	1	
4.	IGBT Driver	710-61800	3	
5.	PFC Control Module	710-62800	1	1073(S)
6.	SPS Module	710-61400	1	1073(S)/1083(S)
		710-61401	1	1053(S)
7.	DCDC Driver Module	710-62200	1	1073S/1083S

NOTE: On Long backup time model UPS PSDR, 1A standard charger Module is NC (Not Connected), 8A super charger is used instead.

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

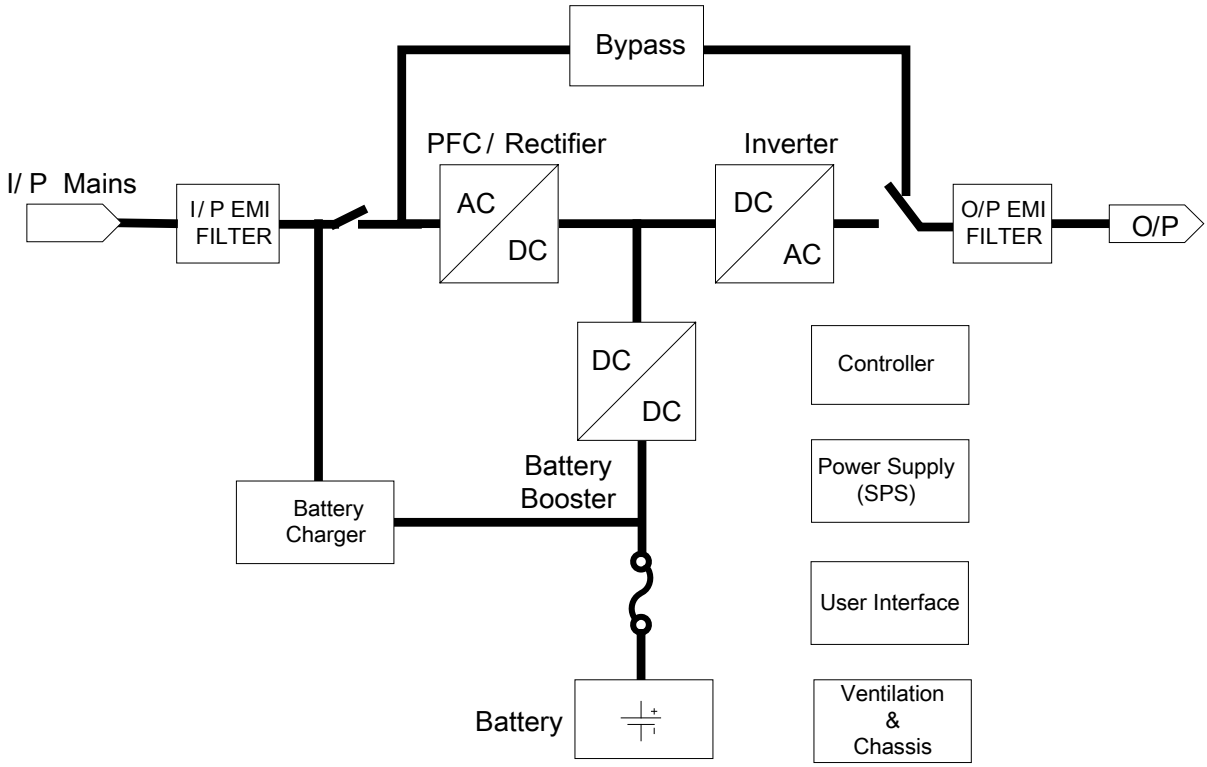


Figure 5.1.1 Function block Diagram of the product

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 very 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 UPS use the mains input, at this time, the AC/DC converter work; In case the mains line supply is output tolerance range, due to either the voltage or the frequency, the UPS will stop the AC/DC converter working and start the DC/DC module. In case the input mains supply interrupt suddenly, the controller can detect the interruption in very short time, and in the interval before detecting the interruption, the output power will be maintain by energy stored in the DC-BUS capacitor, there will never be appear interruption on output.

The battery charger module 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 that 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 interference by external electronic/magnetic noise which generated by the other electronic system, the second is to prevent the noise generated inside the UPS system interference other system.

The Power supply block generates DC power supply needed by operation of the circuit of the UPS itself.

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

5.2 Operating Principle Of The Major Functional Block

5.2.1 AC/DC converter (PFC)

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

Figure 5.2.1.1 showed the topology implement the PFC converter.

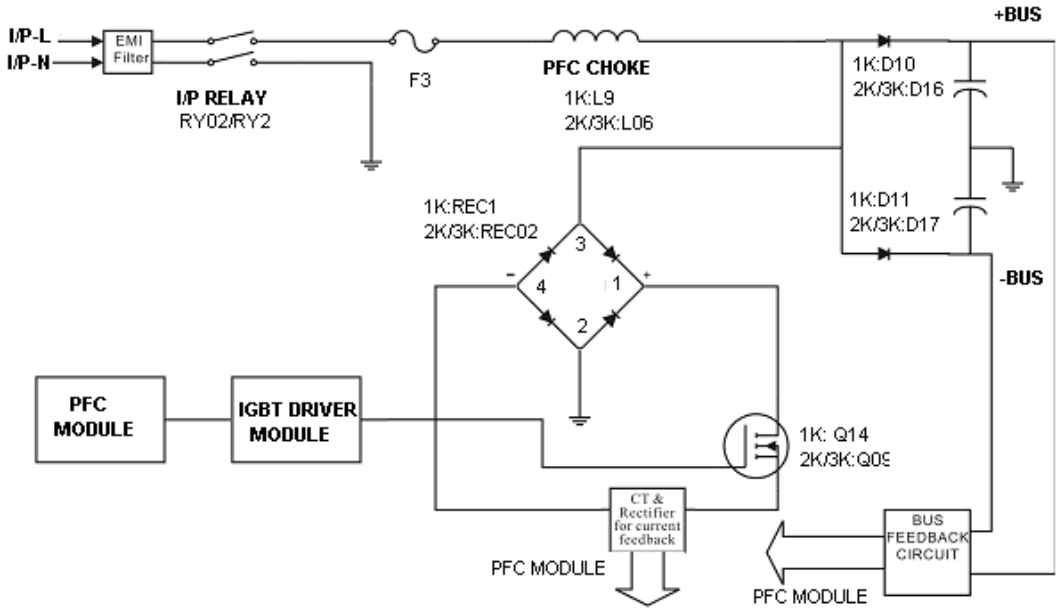


Figure 5.2.1.1 PFC converter

The PFC converter comprise several sub-circuit, the first one is the modified BOOST power topology, the second one is the driving circuit, the third one is the PFC controller, which can further divided into signal sensor, feedback circuit and the actuator.

When AC mains is in normal condition, after receive the turn on command, the global controller turns on the AC relay and enables PFC converter work, the PFC 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 P.F.C. output voltage, i.e. the DC BUS voltage, will be regulated at ±350 Vdc, ±360 Vdc, and ±370 Vdc when the UPS output voltage is set to 220Vac, 230V, and 240Vac respectively.

5.2.2 DC/DC converter (Battery Booster)

In case the AC mains interrupt or being out of tolerance range, the global controller stop the PFC converter and start the DC/DC converter to converse the DC power from the battery to maintain the DC-BUS voltage, therefore maintain the output power supply to the load.

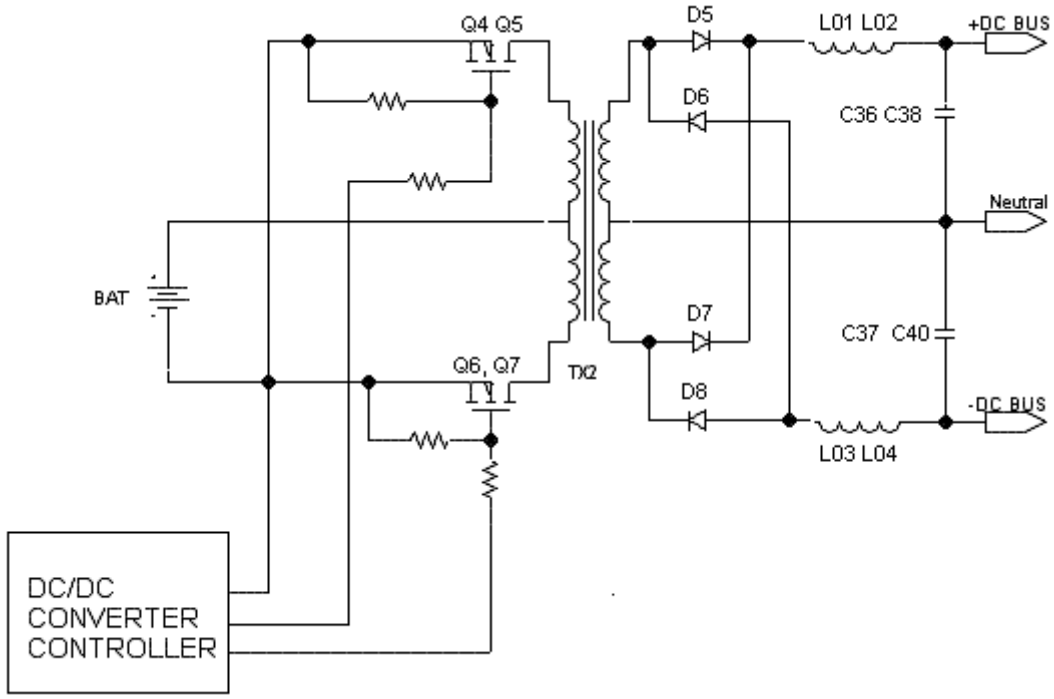


Figure 5.2.2.1 DC/DC Converter

The DC/DC converter employed a push-pull power topology, the driving circuit, and the controller. The controller is major comprise ASIC UC3525 and auxiliary circuit.

The DC/DC converter controller drive a pair of switching component, MosFET used here, turn on in turns, the switch frequency goes above 40kHz. Either of the MosFET is turned on, there will be power from the Battery transfer to the secondary side of the transformer to charging the DC-BUS.

The MOSFETs turn on /off in turn, can prevent the saturation of the transformer and damage of the circuit.

Like the AC/DC converter, the DC/DC converter output regulated±350 Vdc, ±360 Vdc,±370 Vdc to the DC –BUS when the UPS output voltage is set to 220Vac, 230V, 240Vac respectively.

5.2.3 Inverter

The inverter converse the DC power from DC BUS into the AC output to supply the load. A half bridge topology employed, Figure 5.2.3.1 shows a diagram of inverter in 1/2/3k product.

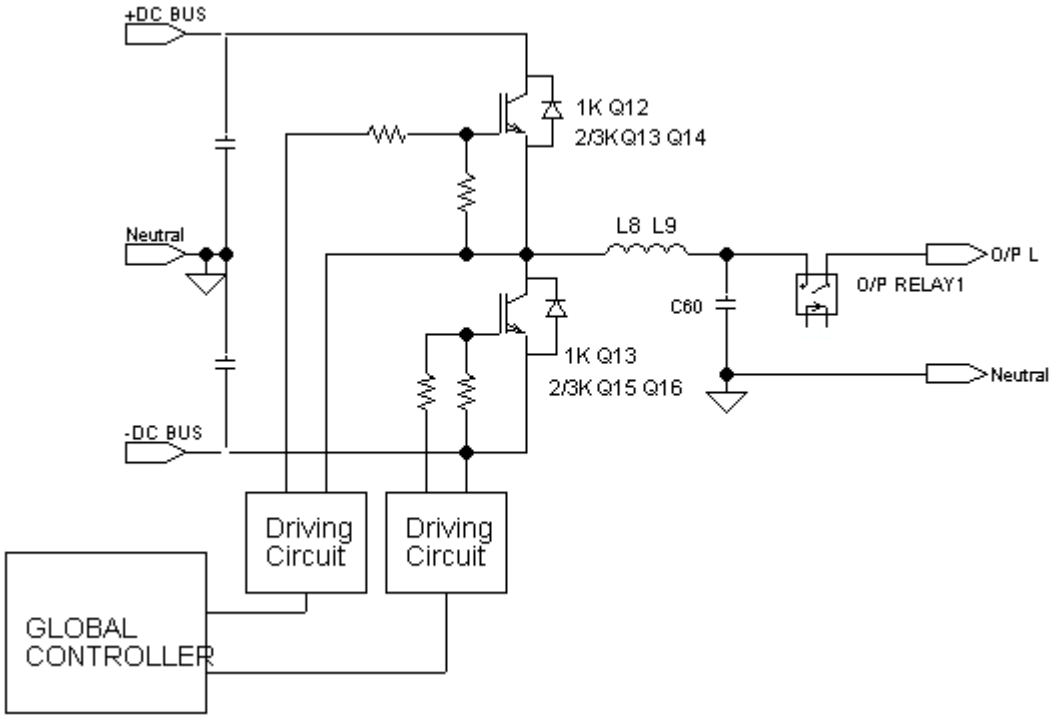


Figure 5.2.3.1 Schematics for inverter

The half bridge inverter comprise a pair of complement switching device, IGBT, a free wheel diode parallel with each IGBT, forming a switching leg, a driving circuit for each IGBT, a LC filter, and the controller. In the real circuit, an IGBT with co-pack diode is used to simplify circuit and achieve minimize stray parameter,

When the positive IGBT is turned on, The output of half bridge is equal to Positive DC-BUS voltage, when the positive IGBT is turned off, either the negative IGBT is turn on or the negative free-wheel diode is active, the output of the switching leg is negative DC-BUS, so by change the duty cycle, average of output of the switching leg can vary from +BUS voltage to –BUS voltage,

the output of the switching leg filtered by a LC filter to get clean and stable sine wave the output voltage.

5.2.4 Global Controller

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

(1) CPU Central Processor Unit

(2) Signal conditioning circuit

(3) Regulation & Protection circuit

(4) Output buffering circuit

(5) Communication interface

The CPU can be regards the brains of the UPS, in charge of signal detecting, measurement, processing, timing control, inverter operating control, protection, communication.

To control the UPS, the status of the UPS must be monitored, Difference kinds of sensor are widely used in the UPS, due the pure condition of the signal given but the sensors, so, Signal conditioning circuit is use to attenuate / amplify / filter the signal given by the sensor, became suitable to be processed by the CPU.

The regulation network of the inverter, forming a close loop controller, enable inverter run stably, and get desired performance, such as less distortion, good dynamic response performance, etc.

The global controller also implement following protection function:

1. Overload Protection
2. Cycle by Cycle Current Limitation
3. Battery over or under voltage shut down
4. Inverter output abnormal protection
5. Over temperature protection
6. Bus over-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 with test fixture; the second is to test the global controller on a PSDR that 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. The charger the battery with a constant current at initial stage, as the battery voltage keep increasing, the charge current decrease accordingly, and the voltage until the floating recharge voltage, and the charger will control the output at a constant level (2k/3k 110.4 Vdc, 1k 41.2Vdc). In this way, to make the battery full recharged but not over recharge, protects and prolongs the lifetime of charged batteries.

Refer to fig. 5.2.5.1; the battery charger employed a Flyback topology, under controlling of the controller mainly comprise an ASIC uc3845, the switching component MosFET turn on /off at a frequency around 100KHz, when the MOSFET is turn on, the current in the transformer increase, and a certain amount of energy is stored in the transformer, when the MOSFET turn off, the energy stored in the transformer start to release to from the secondary side of the transformer and charge the output capacitor, by controlling the duty cycle, energy transfer to secondary side of the Flyback circuit can be controlled, and so on the output voltage.

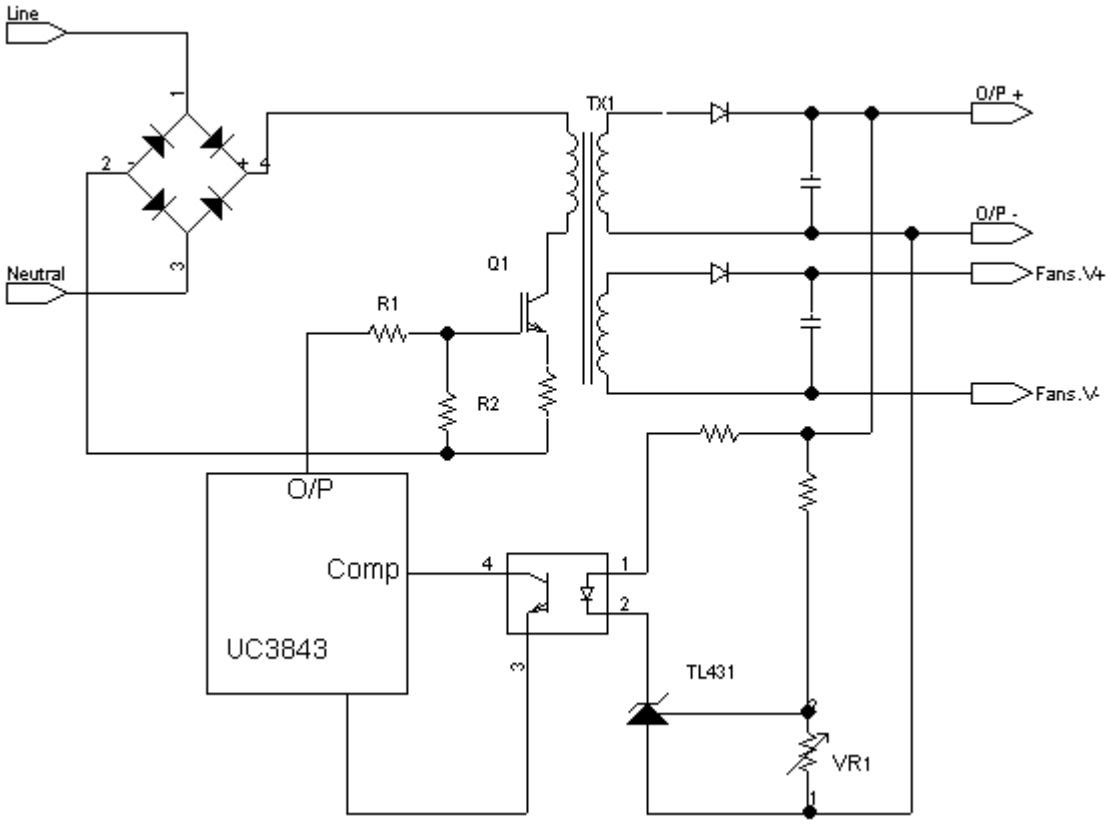
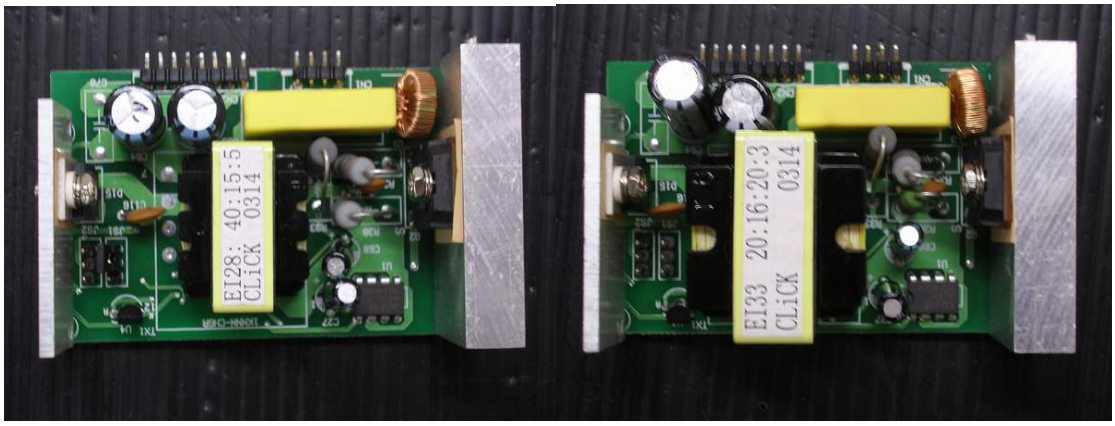


Fig. 5.2.5.1 Topology of the standards and supper charger

There are two kind of charger for standard model UPS and long backup time model UPS. Both operating in the same principle, but difference output capacity, the one for standard model UPS capable of outputting 1A current, is soldered on the PSDR, Fig. 5.2.5.2 shows photo of standard charger. A super charger module with maximum 8A charge current capacity, is used

in the long backup time model UPS. Photos of super charger can be found in Fig. 3.2.2.1 & Fig. 3.2.5.1.

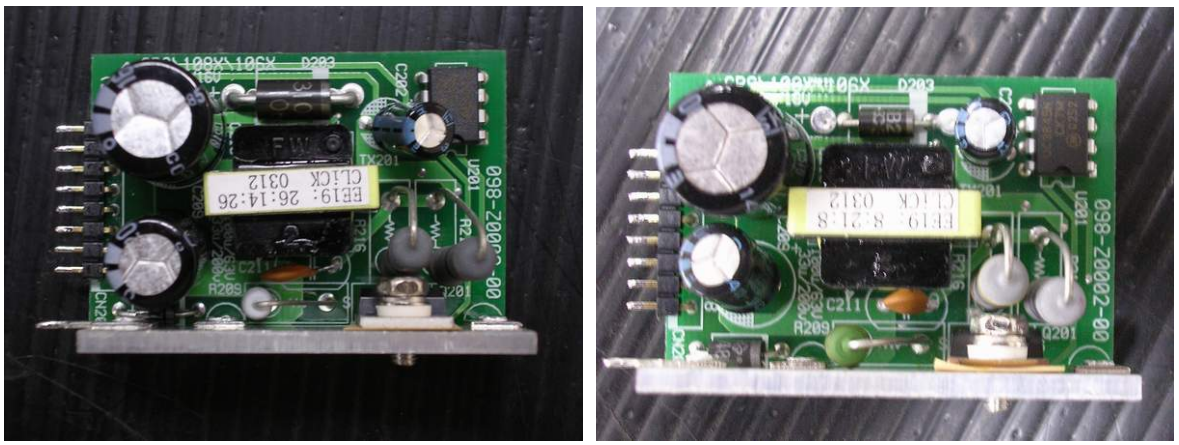


41.2V CHARGER MODULE 110V CHARGER MODULE

Fig. 5.2.5.2 Standard 1A charger

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 output of the charger. The SPS module output +12 Vdc and a High frequency low level AC power, called H.F power+/ -, +12Cdc mainly use for Relay driving, Signal amplifier, Fans supply, and generate +5V DC power supply for the CPU, And the. H.F.power+/ - is not only the source of IGBT gate drive power but also the source of the isolated power supply for communication ports on the CNTL board. The SPS module works only when the +12 Vdc regulator supplies Vcc to its control IC. Fig 5.2.6.1 shows SPS module for 1K & 2/3K UPS respectively.



1K SPS 2/3K SPS

Fig.5.2.6.1 SPS Module

5.2.7 User Interface

5.2.7.1 Front Panel

The front panel consists 2 parts: push button and LCD indicator.

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

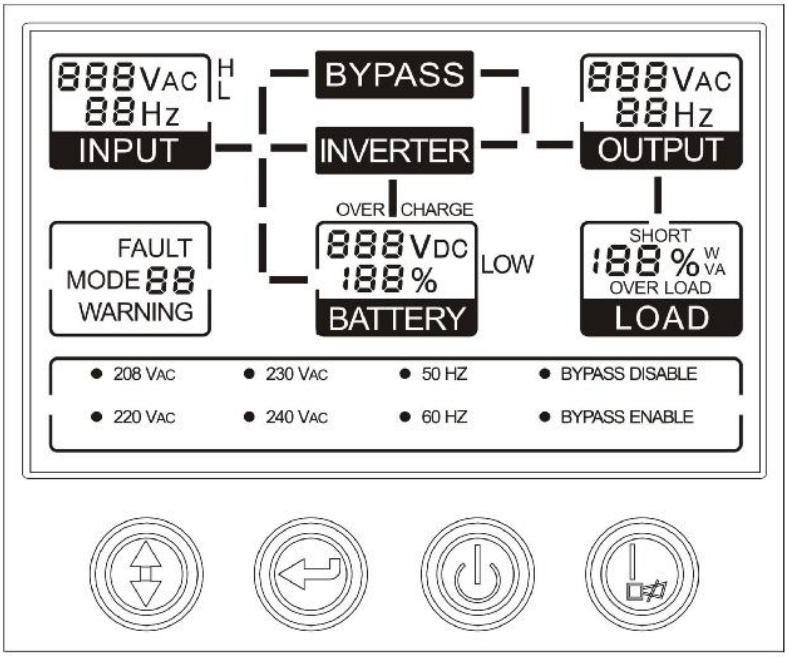


Fig.5.2.7.1 LCD display panel

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 the user manual.

When UPS is out of order, the fault code 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 RS232 port and an intelligent slot are provided.

With dedicated software, output voltage, frequency can be set via the RS232 port; also status of the UPS can be monitor.

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

The communication interface circuit is mainly located on the global controller board; the circuit provides isolation and voltage level transform function for communication; the communication protocol is implement by the CPU.

5.2.8 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 part, 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.

5.3 PCBs of the UPS

This UPS system contains two major PCB assemblies. They are including:

1.PSDR:	Contains major converter of the UPS (1) PFC converter, (2) DC-DC converter (3) inverter (4) SPS (switching power supply) and necessary sub-circuit for complement and supporting major converter which have been modulized, Includes: a) Standard charger module (for standard model only), b) DCDC controller module, c) PFC controller module, d) Fan driver module, e) IGBT driver module and appropriate sensors and conditional circuit for the system regulation and protection.
2.CNTL:	Contains major parts of protection, signaling circuits, regulation and control circuits of inverter.
3.I/P EMI	Input EMI filter
4.O/P EMI	Output EMI Filter
5 Charger	For Long backup time model product, there is a independent super charger boards
6.LCD Panel	The Panel PCB provides system information with LCD indicators, and button for turning ON/OFF The UPS.

5.4 Interconnection Of The PCBs

The simplified schematics in and Fig.5.4.1 shows how the major circuits are connected and illustrates the overall system functions. . P/N shown in the Fig.5.4.1 may vary according to customer request.

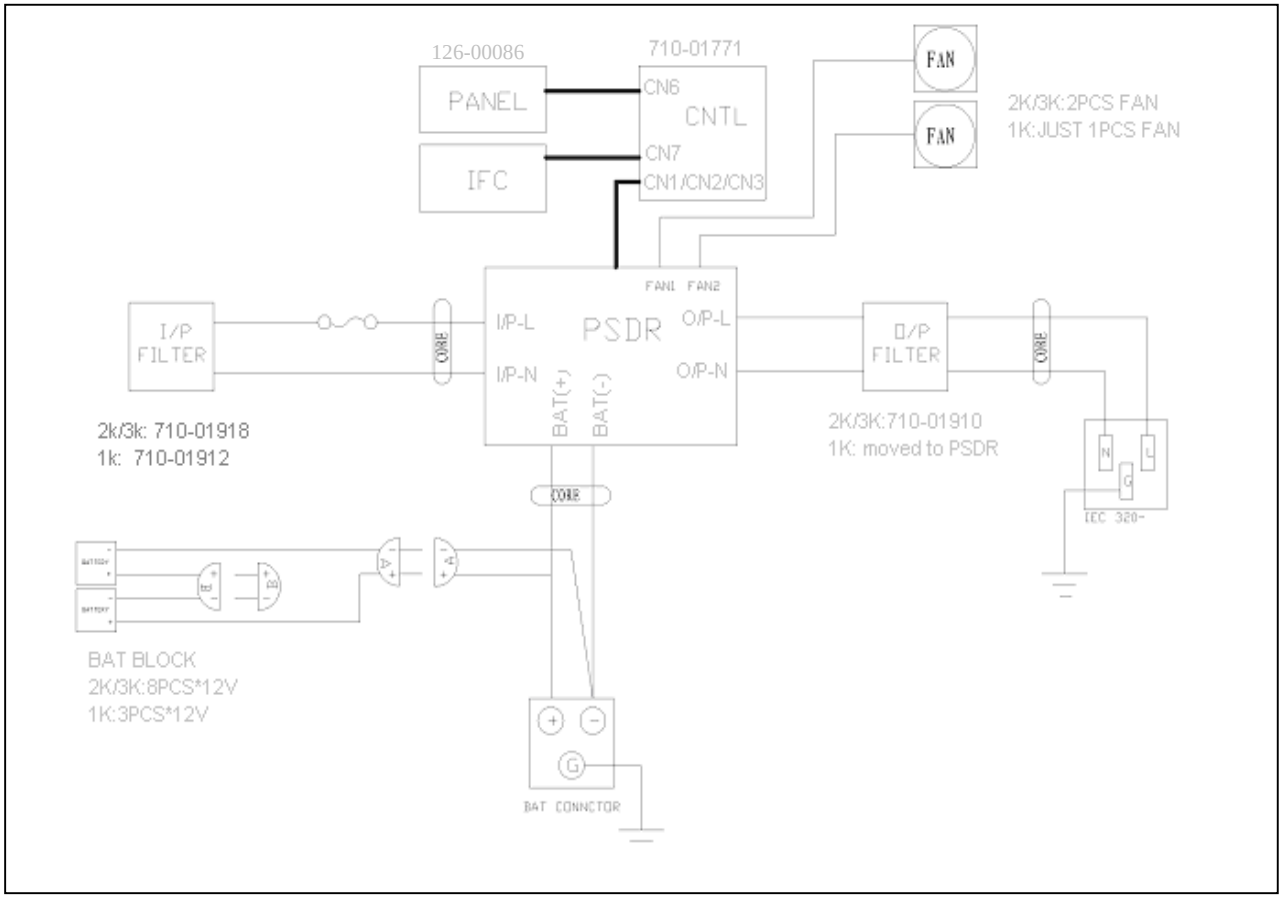


Fig.5.4.1 PCB Interconnection

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 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 Definition

No.	Operation Mode		The warning or fault code	Alarm frequency	Suggestion for service people
1	Line mode		/	NO Alarm	
2	Battery mode	0%-25% battery level	12	Once/s	
3		26%-100% battery level	/	Once/4s	
4	Bypass mode operation		/	Once/2 mins	
5	Transfer to bypass mode for over load		07	Keep Buzzing	Remove over load and restart the UPS
6	Over load, before transfer to bypass		/	Twice per sec	Remove the over load
17	Over-temperature Fault		08	Keep Buzzing	1. Don't let the UPS the work in ambient temperature over specification 2. Make sure the ventilation is good 3. Check the fans 4. Check the temperature measurement circuit
18	Inverter output Fault		06	Keep Buzzing	1. Don't let the UPS carry half-wave load, negative power load. Low PF inductive/capacitive load. 2. Don't connect the UPS (inverter) output to the mains line. 3. Check if the output is short-circuit 3. Check the Inverter voltage measurement circuit

19	BUS fault	05	Keep Buzzing	1. Don't let the UPS carry half-wave load, negative power load. Low PF inductive/capacitive load. 2. Don't connect the UPS (inverter) output to the mains line. 3. Check the BUS voltage measurement circuit.
20	Over charger	11	Keep Buzzing	1. Check the battery Number. 2. Check the charging voltage measurement circuit.
22	Line input site fault (L-N)	09	Once /2mins	1. Correct the wiring 2. Check the site-fault detection circuit 3. Replace the global controller
23	Battery / charger Fail	13	Once/s	1. Check the battery Number 2. Check validation of the BATTERY 3. Check the battery voltage measurement circuit
25	Fans fault	10	Once/s	1. Replace the Fans 2. Check and repair the fans detection circuit

Common Trouble Possible Cause And Solution

☐ ***Transfer to Bypass Due to Output Overload***

Possible Cause: O/P load is larger than rated load in VA or in Wattage.

Solution: Removed or reduce load connected to O/P socket. On line mode, the UPS will restart automatically. On battery mode, UPS must be OFF in advance and ON again.

☐ ***Transfer to Bypass Due to Over-temperature***

Possible Cause 1:Ambient Temperature is higher than allowed operation temperature.

Solution: Reduce ambient temperature or O/P load.

Possible Cause 2: Thermal detection circuit failed.

Solution: Refer to the thermal detection problem Solution on later pages.

☐ ***Transfer to Bypass Due to DC Bus Over-voltage***

Possible Cause 1: Some non-fatal misbehavior of UPS.

Solution: Turn off UPS and restart the UPS.

Possible Cause 2: PFC circuit fails.

Solution: Refer to PFC circuit failure analysis.

Possible Cause 3: DC/DC circuit fails.

Solution: Refer to DC/DC circuit failure analysis.

Possible Cause 3: Bus voltage feedback circuit problem.

Solution: Refer to bus feedback loop problem.

- ***Transfer to Bypass Due to Inverter Failure***

Possible Cause 1: O/P short circuit. (In this situation, no power will be transfer to O/P socket.)

Solution: Remove short circuit condition, turn off the UPS then turn on again.

Possible Cause 2: Inverter circuit failed.

Solution: Refer to Inverter Circuit failure analysis.

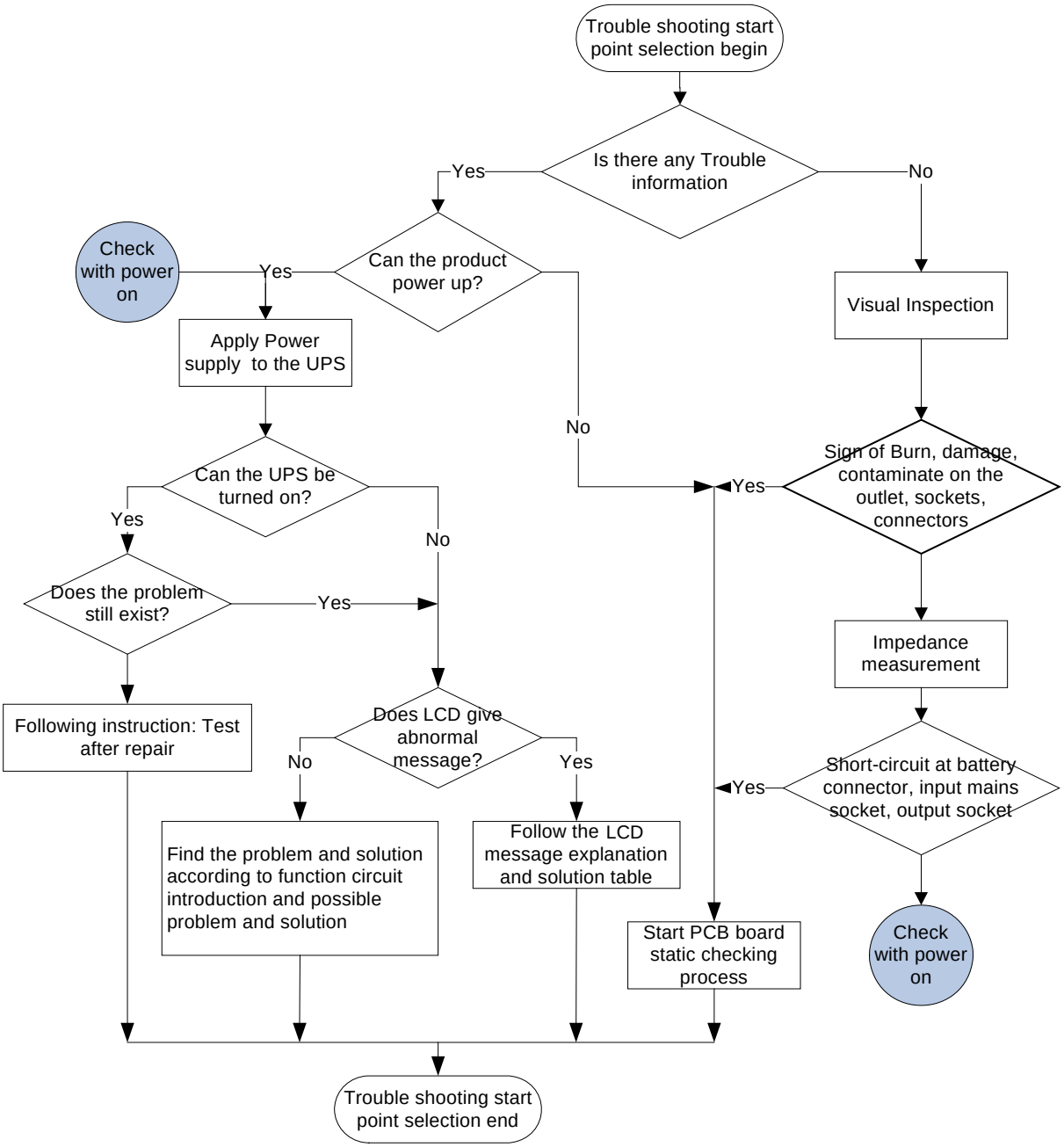
- ***Fault Due to Battery Over-Voltage***

Possible Cause: Charger circuit fail

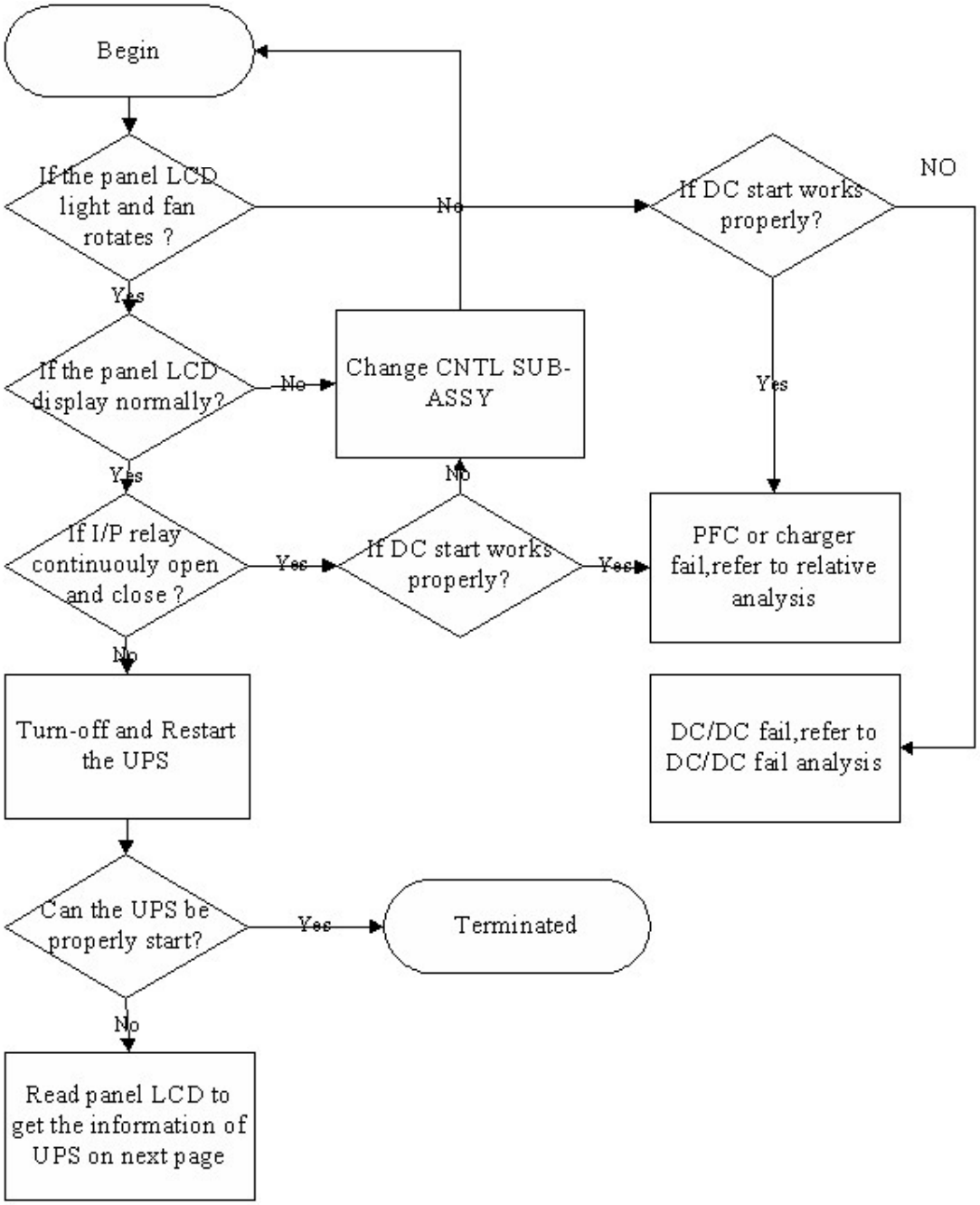
Solution: Refer to charger circuit analysis.

6. 2 Trouble Shooting Procedures

6.2.1 How To Start



6.2.2 Find Out The Problem Quickly



6.3 Failure Diagnosis

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 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 charge and remain dangerous high voltage even if the external power supply is cut of, operator should follow following instruction strictly avoid risk of electrical shock.

1.Unplug the power cord from the utility.
2.Open outside case shown in the beginning of this manual
3.Remove connectors from battery, for long backup time model, unplug battery cabinet connector to UPS.
4.Discharge energy in BUS CAPACITORS, and CHARGER CAPACITORS
5.Disassemble cable from connectors, if required.
6.Disassemble PCB if required.

Before starting service, some tools are necessary, at least: A DMM (Digital Multifunction Meter) meter, screwdrivers and discharge resistor (100Ω/10W recommended). A DC power supply with current limiting (over current protection) function (120VDC/3A at least) is recommended for fast and safe diagnosis.

TO DISCHARGE the residue charge on bus capacitor,

For 1k(s) model contact **P2/P8 BAT (-)** terminal and upper lead of **R4** with a 300Ω/10W resistor to discharge +BUS capacitor, contact **P2/P8 BAT (-)** terminal and upper lead of **R1** with a 300Ω/10W resistor to discharge +BUS capacitor

For 2k(s)/3k(s) model, contact **P01 BAT (-)** terminal and upper lead of R104 with a 300Ω/10W resistor to discharge +BUS capacitor, contact **P01 BAT (-)** terminal and R118 (2k/3k) upper lead with a 300Ω/10W resistor to discharge +BUS capacitor

TO DISCHARGE the energy of charger capacitor, **after disconnect the battery from PSDR/Charger**, you can use a 300Ω/10W resistor contact **BAT (+) terminal** and **BAT (-)** terminal for discharge battery filter capacitor

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

6.3.1 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
BAT FUSE	1K/3K:F1/F2; 2K:F1	Fuse	Open
I/P FUSE (on PSDR)	F3,	Fuse	Open
PFC converter	2K/3K:D16, D17, REC02 1K:D10, D11, REC1	Diode	Short or open
	2K/3K:Q09, 1K:Q14	IGBT	C-E short or open
Push-Pull Booster	2K/3K:Q04, Q05, Q06, Q07 1K:Q4, Q6, Q10Q11	MOSFET	D-S short or open
	2K/3K:D05, D06, D07, D08 1K:D12, D13, D14, D15	Power Diode	Short or open
Inverter	2K/3K:Q13, Q14, Q15, Q16 1K:Q12, Q13	IGBT	C-E short or open
Charger module	Q2	MOSFET	D-S short or open
	D10, D11, D12, D13, D15	Power Diode	Short or open
SPS module	Q201	MOSFET	D-S short or open
	D202, D203	Power Diode	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!

6.3.2 P.F.C Converter Analysis:

In this section, some components you could check to see if failure occurs to P.F.C Converter. **General speaking**, OPEN of fuse F3 indicates failure of this block. Please replace all fail to check components then utility can be connected to your UPS.

Item	Checked components	Instrument function	Reference Value	Failed condition
1	F3	Ω	Short	Open
2	2K/3K:Q09, 1K:Q14 (C→E)	Diode Voltage Droop	Infinite	Short or open
3	2K/3K:D16, D17 1K: D10, D11	Diode Voltage Droop	0.44	Short or open
4	2K/3K:R66, R208 1K:R68	Ω	47.0/36.0/36.0	Open or value change
5	2K/3K:REC02/ 1K:REC1 (+, ~),(~ ,-)	Diode Voltage Droop	0.46	Short or open

If all components listed above are in normal condition and UPS still can't work, try to change PFC control module and IGBT driver module

6.3.4 Push-Pull DC-DC Converter Analysis

General speaking, the most obvious phenomenon of failure on the section is open of F1 and F2. Knowing this will be very helpful to repair them.

Item	Checked components	Instrument function	Reference Value	Failed Condition
1	F1, F2	Ω	0Ω	Open
2	2K/3K:Q04~Q07 (S→D) 1K:Q4, Q6, Q10, Q11 (S→D)	Diode Voltage Droop	0.42V	Short or open
3	2K/3K:Q04~Q07 (D→S) 1K:Q4, Q6, Q10, Q11 (D→S)	Diode Voltage Droop	Infinite	Short or open
4	2K/3K:R31, R33, R34, R36 1K:R7, R73, R76, R77	Ω	10Ω	Open
5	2K/3K:D05, D06, D07, D08 1K:D12, D13, D14, D15	Diode Voltage Droop	0.41V	Short or open

BE SURE TO use fuse with same spec as original ones to replace failure ones, otherwise, unpredictable danger could happen.

If all components listed above are in normal condition and UPS still can't be DC started, try to change DCDC module.

6.3.5 DC/AC Inverter Analysis

Item	Checked components	Instrument function	Reference Value	Failed Condition
1	F3, F2, F1	Ω	Short	Open
2	2k/3k:Q14, Q13, Q16, Q15 (E→C) 1k:Q14, Q13, Q16, Q15 (E→C)	Diode Voltage Droop	0.4	Short or open
3	2k/3k:Q14, Q13, Q16, Q15 (C→E) 1k:Q14, Q13, Q16, Q15 (C→E)	Diode Voltage Droop	Infinite	Short
4	2k/3k: R110, R106, R117, R119 2k/3kR53,R37	Ω	2K/3K: 47K 1K: 20K	Open
5	2k/3k:R107, R109, R116, R120 R114, R103, R111, R122 1k: R40, R54	Ω	10.0 10.0 36.0	Open

If fail condition stated in item 3 occurs, it is very possible that the corresponding IGBT driver module is damaged, so please try to change the IGBT driver module.

6.3.6 SPS Module Analysis

Item	Checked components	Instrument function	Reference Value	Failed condition
1	Q201 (S, D)	Diode Voltage Droop	0.42V	Short or open
2	R206, R206A	Ω	47	Open
3	R209	Ω	0.10	Open
4	R207	Ω	1K	Open
5	U01 (3845) PIN 5-6 PIN 5-7 PIN 5-8 PIN 6-8	Ω	46.7K 38K 4.31K 50.9K	<10K

6.3.7 1A Charger Module Analysis

Item	Checked components	Instrument function	Reference Value	Failed condition
1	Q2 (S, D)	Diode Voltage Droop	0.45V	Short or open
2	R40	Ω	47.00	Open
3	R38	Ω	0.50	Open
4	U07 (3845) PIN 5-6 PIN 5-7 PIN 4-8	Ω	47K 20K 7.48K	Too low
5	D10.D11, D12, D13, D15	Diode Voltage Droop	0.45	Short or open

DO NOT let the charger work with full load when the outside cover is removed, without the airflow path forming with cover, it can cause over-heated of TX1, and therefore the other related components will fail again.

As usual, the most possible fail component is Q2, if this indeed happens; please replace not only that component but also R40, R38, D15, R37and U1. Since failure of Q2 may cause the other components listed above fail.

6.3.8 Super charger

Item	Checked components	Instrument function	Reference Value	Failed condition
1	1k: F501 2K/3K F801	Ω	0	Open
2	1k: REC 501 (~→ +)/(-→~) 2K/3K: REC 801 (~→+)/(-→~)	Diode Voltage Droop	0.4V	Open/Short
3	1K: Q501/Q502 (S→D) 2K/3K: Q801/Q802 (S→D)	Diode Voltage Droop	0.4V	Open/Short
4	1K:U502 2K/3K: U803 PIN 5-6 PIN 5-7 PIN 4-8	Ω	47K 20K 7.48K	Short circuit/Open
5	1K: D501, 504 2K/3K D801/809	Diode Voltage Droop	0.45	Short or open
6	1K: R515, R516 2/3K: R816, R817, R821	Ω	0.15Ω 0.1Ω	Open/ Burn
7	1K: R522/R507 2/3K: R813/R815	Ω	22 47	Short or open

On the Super charger, adjust the value of **VR1** can adjust the output voltage of the charger.

6.3.9 IGBT Driver Module Analysis

Item	Checked components	Instrument function	Reference Value	Failed condition
1	U701.PIN2/PIN3	Diode Voltage Droop	0.54	Short or open
2	R707	Ω	10.00	Open or too high
3	R708, R709	Ω	20.00	Open
4	Q702 (E.B, E.C) Q703 (B.E, C.E)	Diode Voltage Droop	0.64,1.00	Short or open

Since failure of IGBT may also cause R708, R709, Q702, Q703 and U701, so after replace the failure IGBT remember to check the IGBT driver module, replace damage component

or a whole driver module directly.

6.3.10 others

In previous sections, we pay attention to the components on PSDR/Charger, in this section, we are trying to list some possible failure phenomenon not stated before and on control PCB sub-assembly. They are list as following.

Fail for	Phenomenon	Possible components	Comment
Bus over-voltage	1.Bus over-voltage fault alarm and display occur 2.Bus voltage doesn't meet spec.	PFC IGBT Driver module, 2k/3k:Q09, 1k:Q14	
Inverter	Inverter fault alarm and display occur.	1.Components listed in previous section. 2.U8, U9, U10, U11	2. This IC's are on CNTL PCB
UPS can't start, but not the problem stated before.	1.LCD's light, but are active randomly or abnormally. 2.Buzzer beeps abnormally.	U18 (CPU on CNTL)	
Audible problem	Buzzer does not beep at start-up or for alarm.	Q5, BZ1	On CNTL PCB
Start-up	1.UPS is bypass after the mains is on. 2.No response after press ON button.	1.SPS Module Q201 2.U13	1.on PSDR 2.on CNTL PCB
O/P DC balance	O/P DC balance is out of spec.	1.PFC IGBT Driver module, Q09 or Q14 (on PSDR) 2.U22 (on CNTL)	1.Bus feedback loop. 2.Auto-balance circuit.

For O/P DC balance problem, it is almost caused by incorrect bus voltage. If this indeed happen, please try to find which mode the problem arise. For example, if it happens under Line mode, you must measure bus voltages to see if they are correct. After doing this,

debug the corresponding circuit. If unfortunately, both modes are incorrect, two possible circuits should be check: Bus feedback loop (on PSDR) and auto-balance circuit (on CNTL).

6.4 Test And Finish

After replace all defected components on power stage (PSDR), following test the steps can be adopt to verify the repair result and the reliability of the UPS.

1. Connect all of boards, cable, and connector right to place.
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 96-110Vdc/3 Amp (limited current) for 2/3K UPS, 36~41Vdc/3Amp 1K UPS
4. Press the ON-switch on front panel for 2 seconds, you will see "current limit" for a short time on the DC power supply for about only 2 seconds, then UPS should be DC started, If UPS does not start successfully. Please try diagnosing procedure again.
5. If UPS does not start up for several trying or DC power supply is on current-limit state continuously, there must be some defected components exists. Please follow trouble-shooting chart to debug again.
6. Stop the UPS; apply AC mains to the UPS module. Try on the UPS. If fail you may have start one new round of trouble shooting
7. Check and adjust Charging Voltage
8. Check the output voltage waveform and DC-offset voltage, at no-load and full load condition.
9. In most case result of step7, 8 can represent whether product 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.

Tab.

TEST ITEM	TEST POINT	TEST AND ADJUSTMENT SEQUENCE	EXPECTED RESULT
Charger Voltage	BAT (+) BAT (-)	1. Disconnect BAT (+) and BAT (-) wires from pins respectively. 2. Connect DVM (Set to measure DC) to test points and plug input power cord to utility. Adjust VR1 slowly to expected value.	1.Cooling fans on back panel begin to rotate. 2. 2K/3K 110 Vdc±0.4V 3. 1K 41.2Vdc+0.3V
+DC Bus Voltage @ Line Mode	2K/2K:R104Top (+) and GND 1K: R4 Top (+) and GND	1. Connect DVM (Set to measure DC Volt) to test point. 2. Plug input power cord to utility. 3. Press ON bottom for 2 seconds to turn the UPS on. 4. Waiting for 10 seconds to make sure the Inverter LCD lights. Check measurement result on DVM	+350VDC±15V
-DC Bus Voltage @ Line Mode	2K/3K:R118 Top (+) and GND 1K: R1 Top (+) and GND		-350VDC±15V
O/P DC Balance @ Line Mode	O/P socket	1. Keeping UPS on @ Line mode. 2. Connect DC measurement fixture to O/P socket. 3. Check reading on DVM.	100mV max.
+/-DC Bus Voltage @ Backup Mode	2K/2K:R104Top (+) and GND 1K: R4 Top (+) and GND 2K/3K:R118 Top (+) and GND 1K: R1 Top (+) and GND	1. Disconnect I/P power cord from utility and press OFF bottom for 2 seconds to turn UPS off. 2. Connect DVM (Set to measure DC) to test point. 3. Plug input power cord to utility. 4. Press ON bottom for 2 seconds to turn EUT on. 5. Waiting for 10 seconds to make sure the Inverter LCD lights. 6. Check reading on DVM	+350VDC±15V

8.If possible, do a burn-in test on repaired UPS before return it to customer, the longer the better.

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

Appendix

I. DC Offset Measurement Fixture

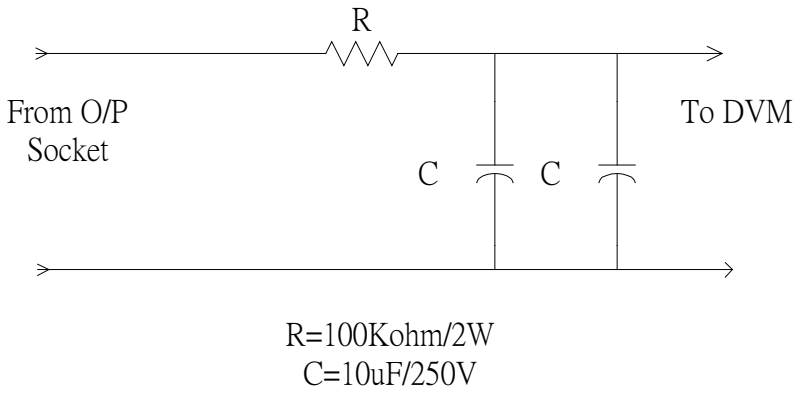


Fig.A.I.1 DC Offset Measurement Fixture