



GTEC UPS MODEL:

ZY120

1 – 3 kVA

SERVICE MANUAL

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IMPORTANT SAFETY INSTRUCTIONS

This manual contains important safety instructions. Read all safety and operating instructions before operating the uninterruptible power systems (UPS). Adhere to all warnings on the unit and in this manual. Follow all operating and user instructions. This equipment can be operated by individuals without previous training.

This product designed for commercial/industrial use only. It is intended for use with lift support and other designated “critical” devices. Maximum load must not exceed that shown on the UPS rating label. The UPS is designed for data processing equipment. If uncertain, consult your dealer or local representative.



WARNING OF BATTERY

The battery can present a risk of electrical shock and high short circuit current. Following precautions should be observed before replace the battery or maintain standard ups.

- Wear rubber gloves and boots.
- Remove rings, watches and other metal objects.
- Use tools with insulated handles.
- Do not lay tools or other metal objects on the batteries.
- If the battery is damaged in any way or shows signs of leakage, contact your local representative immediately.
- Do not dispose of batteries in a fire. The batteries may explode.
- Handle, transport and recycle batteries in accordance with local representative.



WARNING

Although ups has been designed and manufactured to ensure personal safety, improper use also can result in electrical shock or fire. To ensure safety, observe the following precautions:

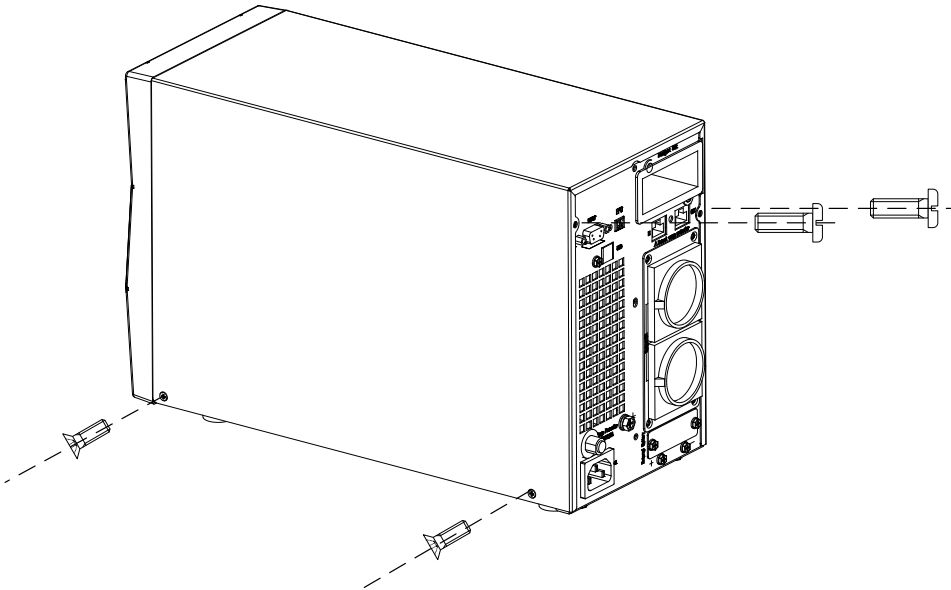
- Turn off and unplug the UPS before cleaning it.
- Clean the UPS with a dry cloth. Do not use liquid or aerosol cleaners.
- Never block or insert any objects into the ventilation holes or other openings of the UPS.
- Do not place the UPS power cord where it might be damaged.
- If fire, please use the dry powder fire extinguishers. If use liquid extinguisher, there may has get an electric shock risk.
- Before turn on ups, please check that whether the cable and the polarity of the batteries are correct.

Important Tips:

When need to replace board, please turn off ups, disconnect the mains switch and battery switch (built-in battery, please unplug at least one battery cable), wait for 10 minutes.

STEPS TO OPEN THE CASE

PLEASE FOLLOW THE STEPS TO OPEN THE CASE



1. INTRODUCTION

For all series of UPS, they are strictly tested and carefully designed. 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 unavoidable failures of this UPS. If this situation occurs, service of qualified person 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 of UPS (Uninterruptible Power System), it is very easy to maintain and service.

- * All major power components are put on PCB.
- * All PCBs are interconnected with connectors.
- * Major parts are simply connected with flexible insulated wires and plugs.

This service manual consists of 4 major parts:

1. Introduction.
2. Principle of operation: It describes the functions and principles of each part.
3. Alignments: It describes the locations and methods needed to adjust this UPS.
4. Trouble shooting: This part describes the possible failure conditions and procedures to repair it.

Before starting to serve this UPS, be sure to read this manual carefully for a correct and safe operation.

2. PRINCIPLE OF OPERATION

2.1. INTRODUCTION

This true online UPS system contains three major PCB assemblies. They are including:

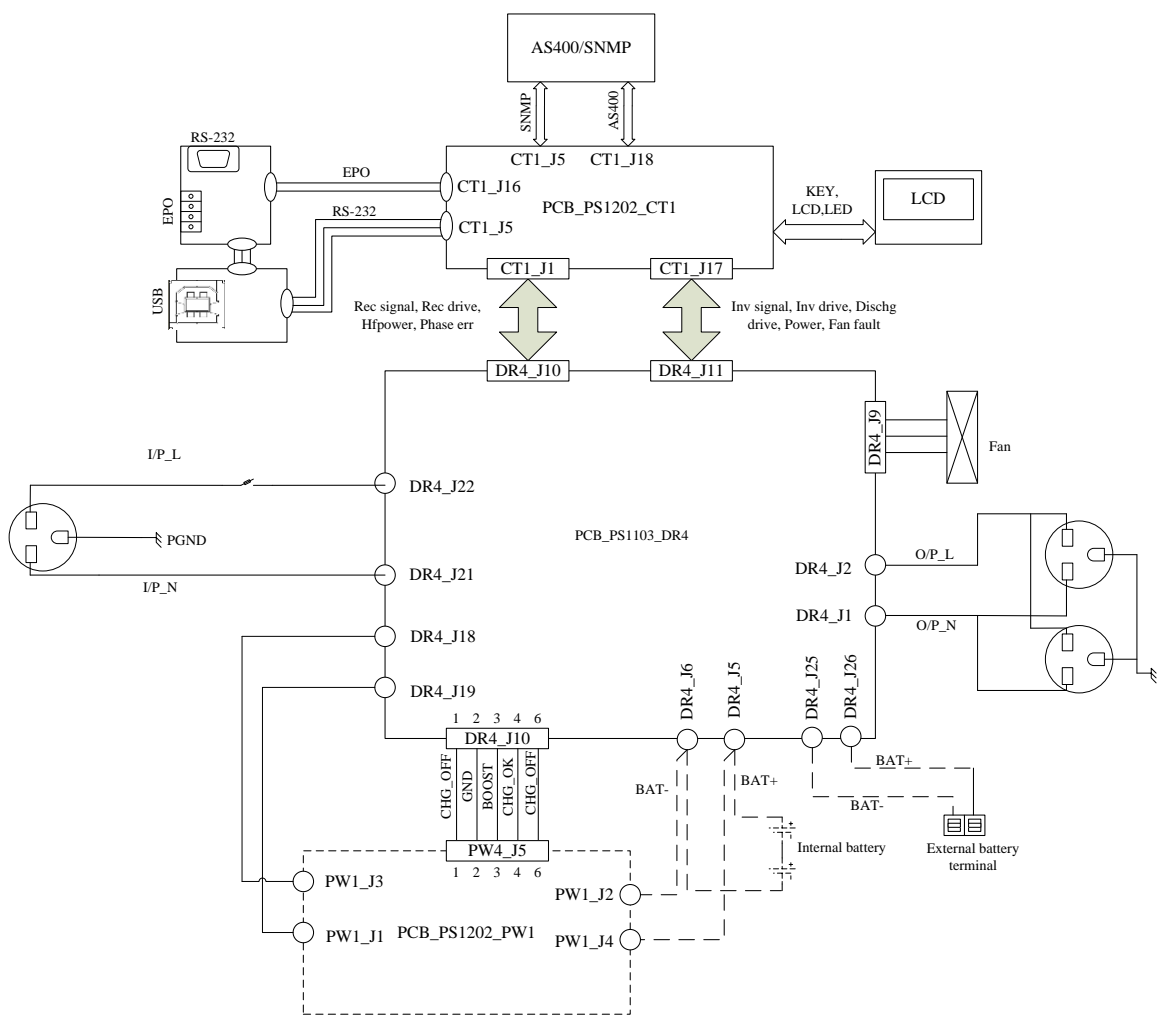
1. PCB_PS1103_DR4: 1KVA power board.
PCB_PS1103_DR5: 2KVA power board.
PCB_PS1103_DR6: 3KVA power board.
Contain major parts of (1) charger (standard backup model), (2) DC power supply, (3) power factor correction, (4) battery DC-DC converter, (5) inverter and (6) output circuits.
2. PCB_PS1202_CT1: DSP control board.
Contains major parts of protection, signaling circuits, regulation and control circuits of inverter
3. PCB_PS1202_PW1: 1KVA long backup model UPS charger. Offer maximum 8A charger current.
PCB_PS1103_PW4: 2KVA/3KVA long backup model UPS charger. Offer maximum 8A charger current.

The simplified schematics in *fig. 1* shows how the major circuits are connected and illustrates the overall system functions. The locations of these assemblies in this machine are shown in *fig.2*.

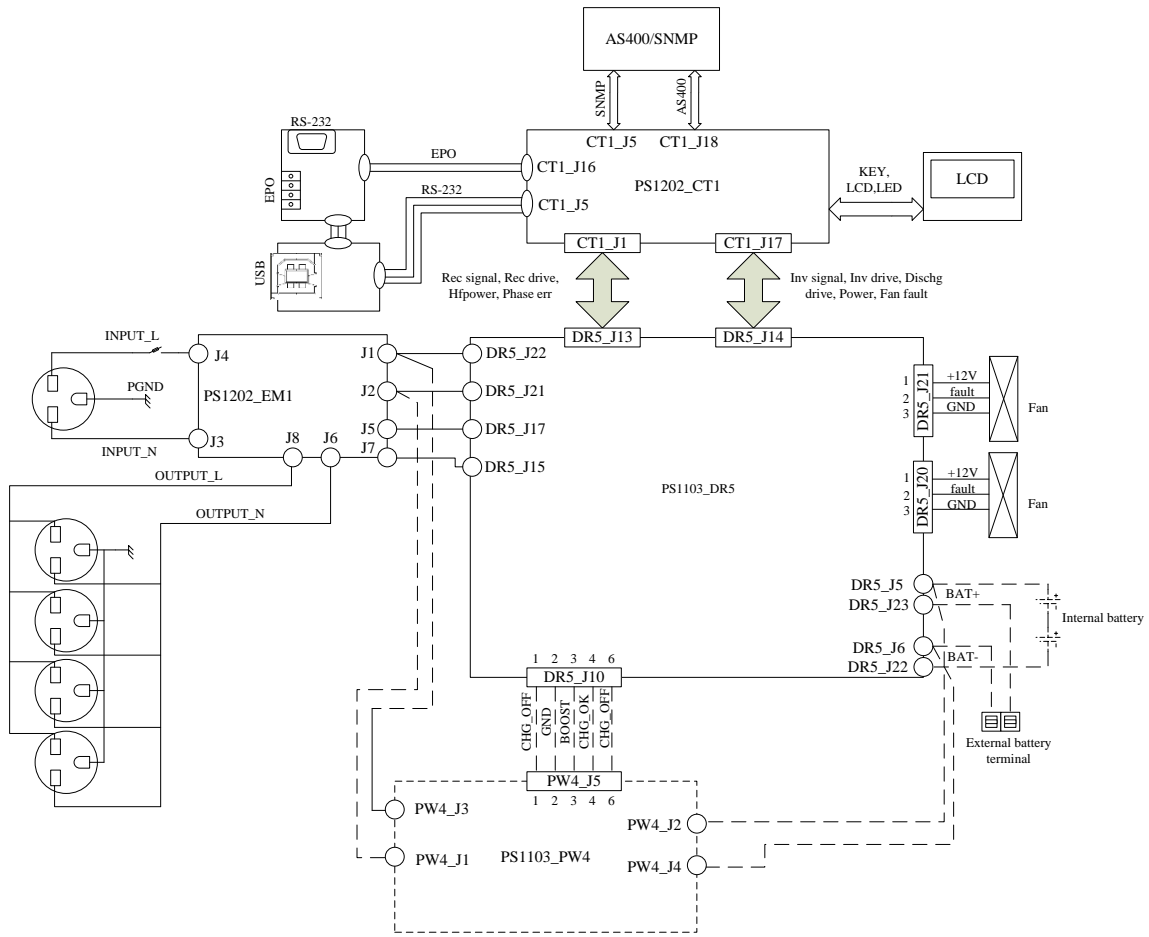
The block diagram in figure 3, shows the UPS at normal operation from left to right. When a protection circuit is triggered or a fault condition occurs, the output supply is transferred immediately from inverter to AC mains by a bypass relay.

The operation principle will be explained in later section.

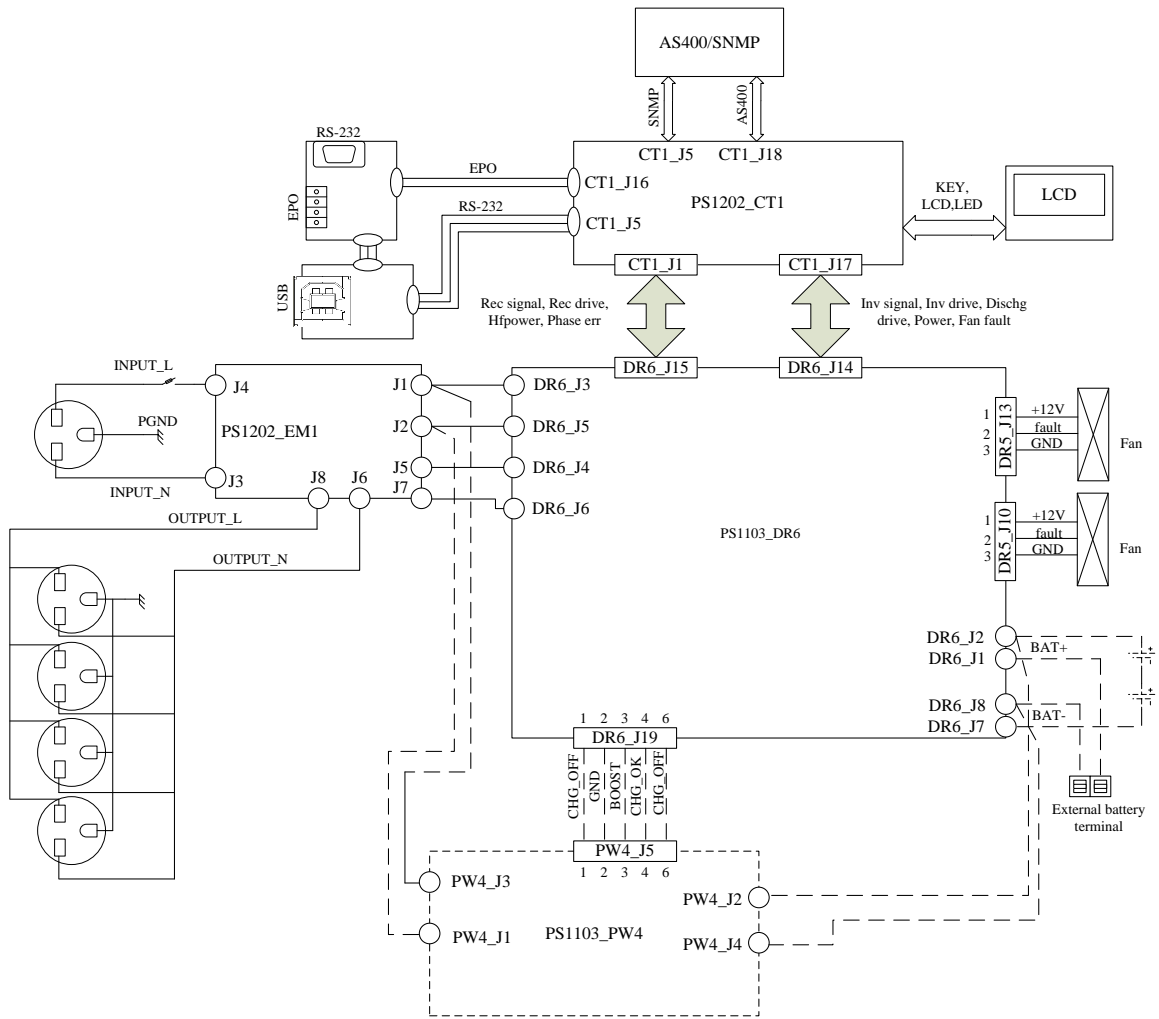
Basically, this ON-LINE UPS system utilizes high frequency PWM techniques to achieve high efficient performance. This UPS can feed a clean, regulated sine-wave output at any load under full load. The sub-systems are described as below:



(a) 1KVA

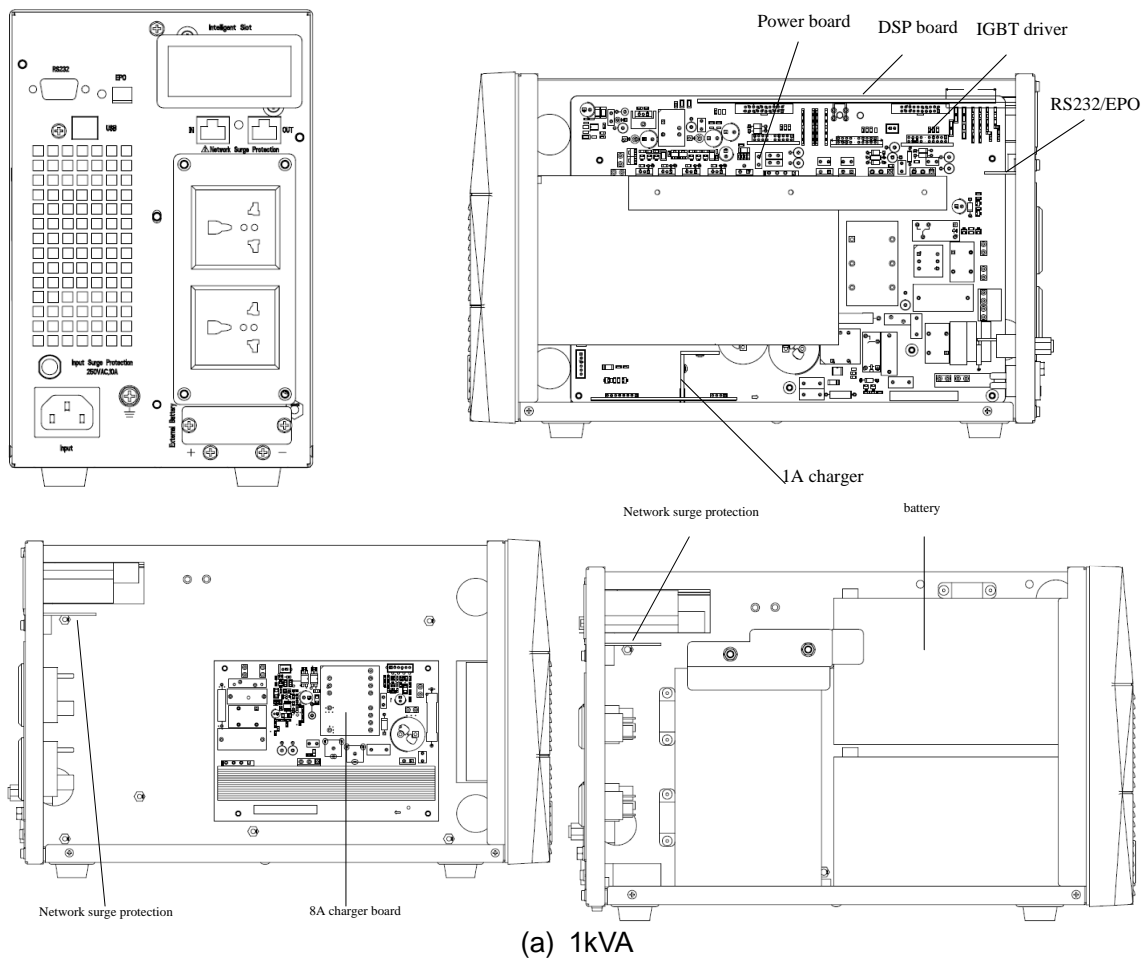


(b) 2KVA

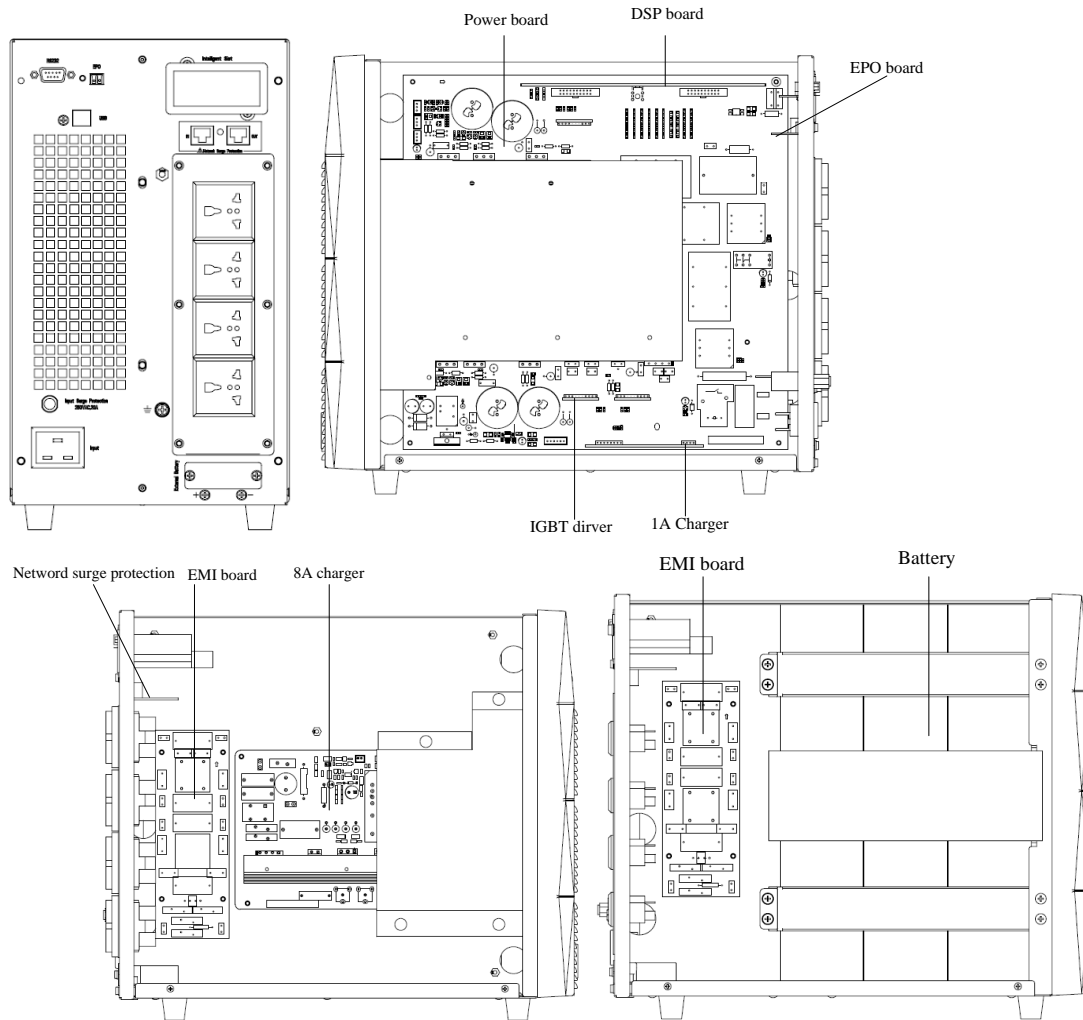


(c) 3KVA

Fig. 1: wiring diagram 1-3KVA



(a) 1kVA



(b) 2kVA

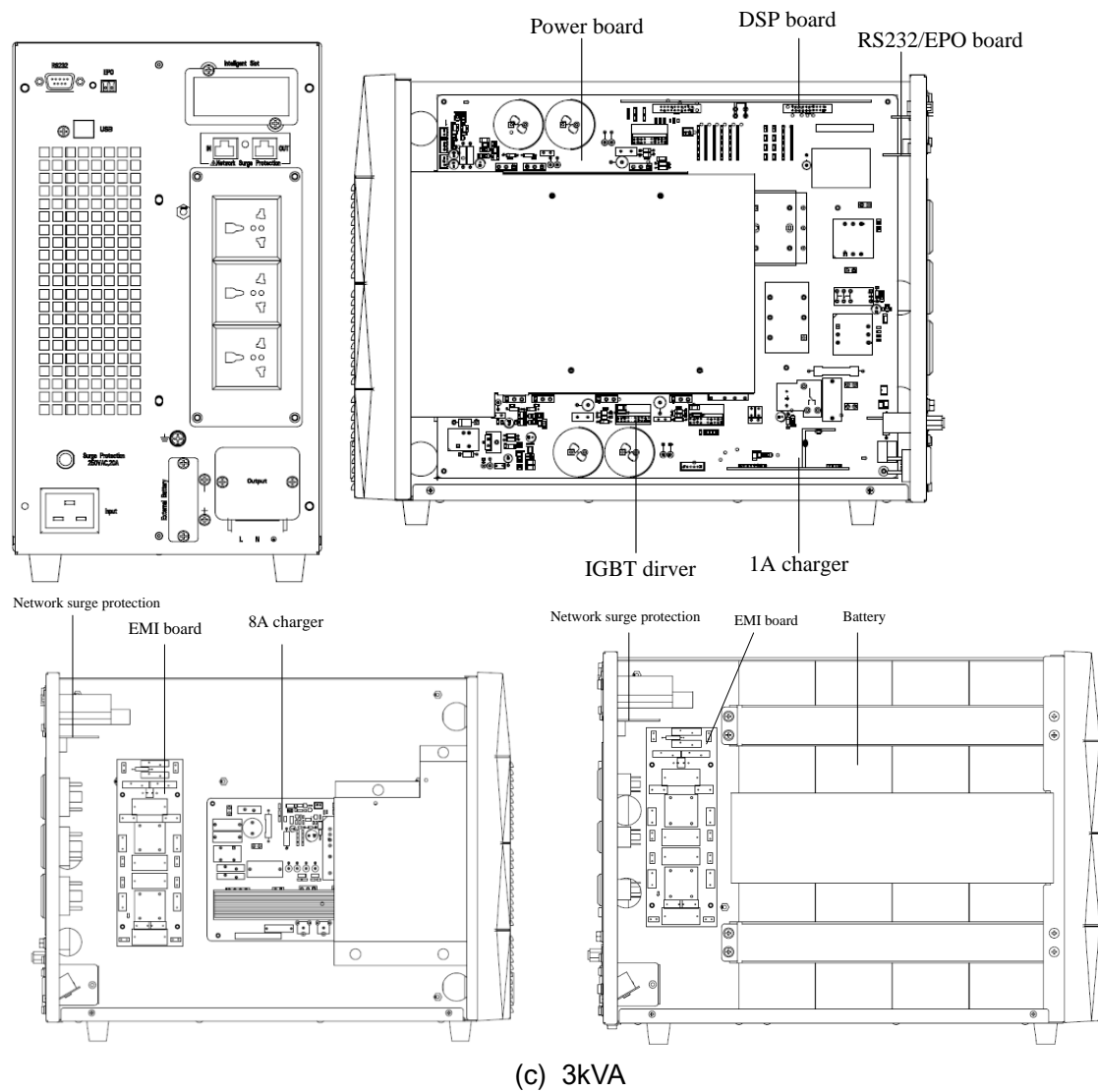


Fig. 2: Locations of Assemblies

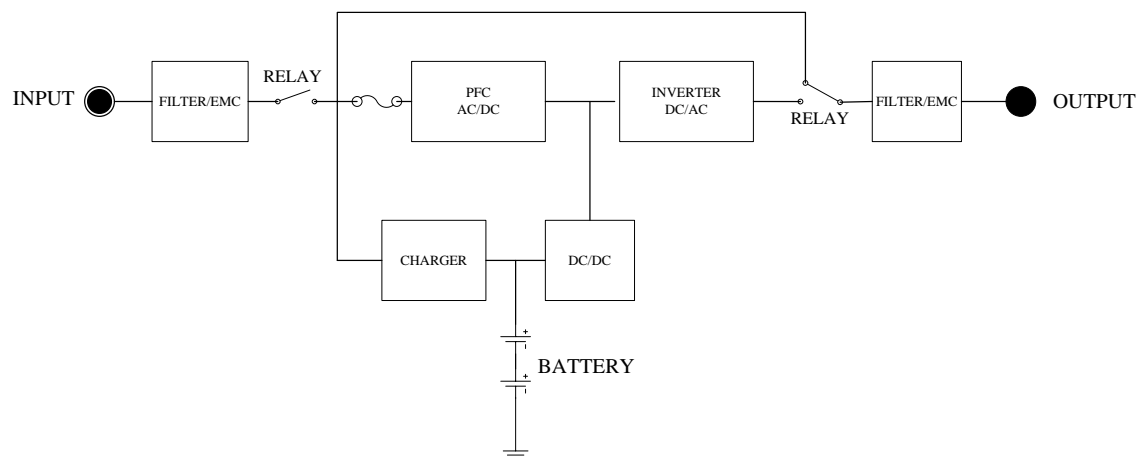


Fig. 3: 1-3KVA series block diagram

2.2 Main power circuit

The UPS consists of charger, power factor correction, DC power supply, discharge DC-DC converter, inverter and output circuits. Fig. 4 shows the functional diagram of main power circuit.

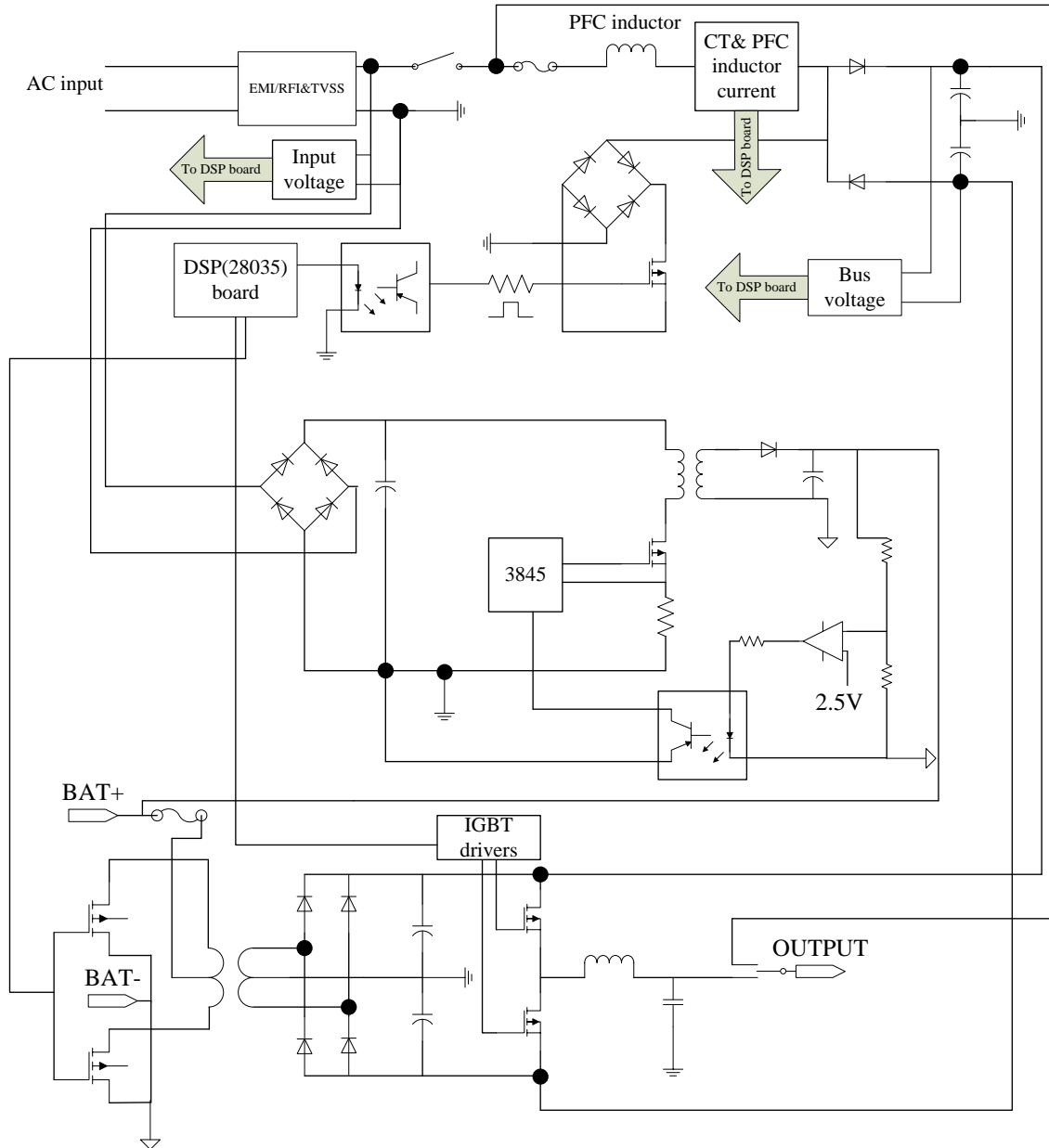


Fig. 4: Functional Diagram of Main Circuit

CHARGER

The purpose of charger is to charge and to maintain the batteries at fully charged condition. Refer to *fig.5*, a flyback switching power supply provides a constant DC voltage (41Vdc/1KVA, 82Vdc/2KVA, 110Vdc/3KVA) for batteries. Besides providing constant voltage, the power supply also limits the current flowing into batteries and therefore protects and prolongs the life time of charged batteries. If charger is failure, or overcharged, UPS will shutdown charger to protect batteries from damage.

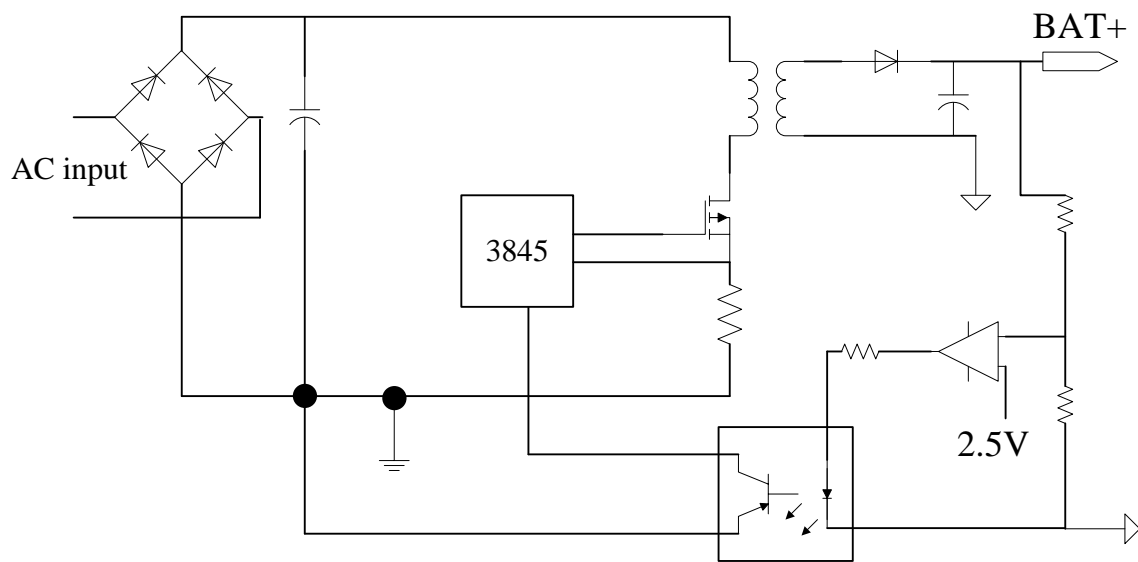


Fig. 5: charger circuit

DC POWER SUPPLY

The input of the DC power supply is connected to the battery, i.e., the output of charger. The output of DC power supplies provide +12Vdc for the control circuit, driver and the fan(s). The DC power supply works only when input power is on and PWM IC(3845)'s Vcc is over 8V. To have proper operation of PWM IC's Vcc, its input power is controlled by the switch as indicated in *fig.6*. Power supply circuit is located on power board.

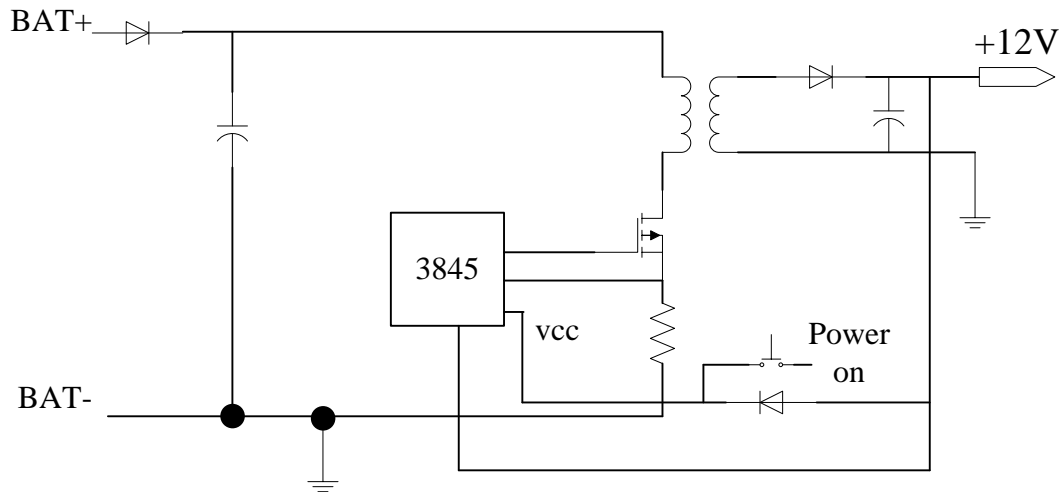


Fig. 6: DC power supply

INVERTER

The UPS transfers +/- DC bus voltages to the AC output voltage through an inverter of half bridge configuration at normal operation. The schematic diagram of inverter is shown in figure 7.

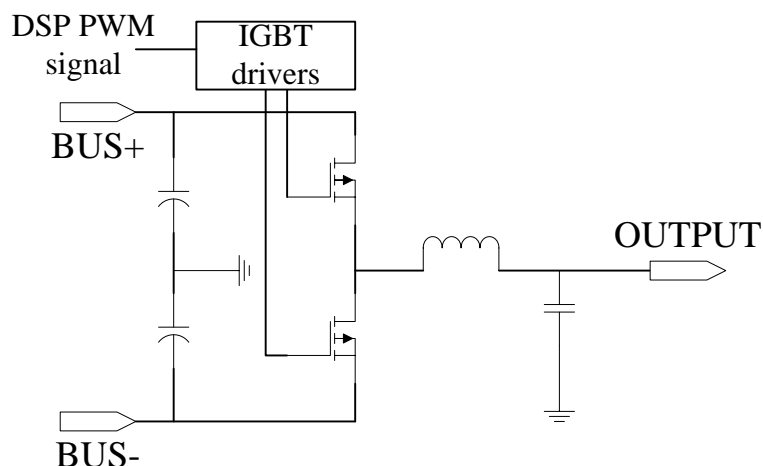


Fig. 7: Inverter

To construct a high frequency PWM inverter, the drivers receive switching signals from DSP through a pair of photo-couplers to trigger the upper IGBT and the bottom IGBT alternately. The output of IGBT's is filtered by an LC circuit to reduce the output voltage harmonics distortion.

OUTPUT

The bypass relay receives signal from control circuit to switch the output of the UPS from bypass to inverter, and vice versa. The output noise filter circuit blocks EMI noise to the loads.

INPUT POWER FACTOR CORRECTION

The purpose of power factor correction (P.F.C.) circuit is to make the input current and voltage in phase and therefore achieve a high input power factor.

The schematic is indicated in figure 8.

When the input AC power cord is plugged in, the AC relay is activated and the AC power goes through noise filter to the charger and to the line detector. Both DC buses present voltages at about 1.4 times of input RMS voltage. When the

"on" switch is pressed, the P.F.C. circuit is enabled and the DC buses are regulated at for 220VAC series.

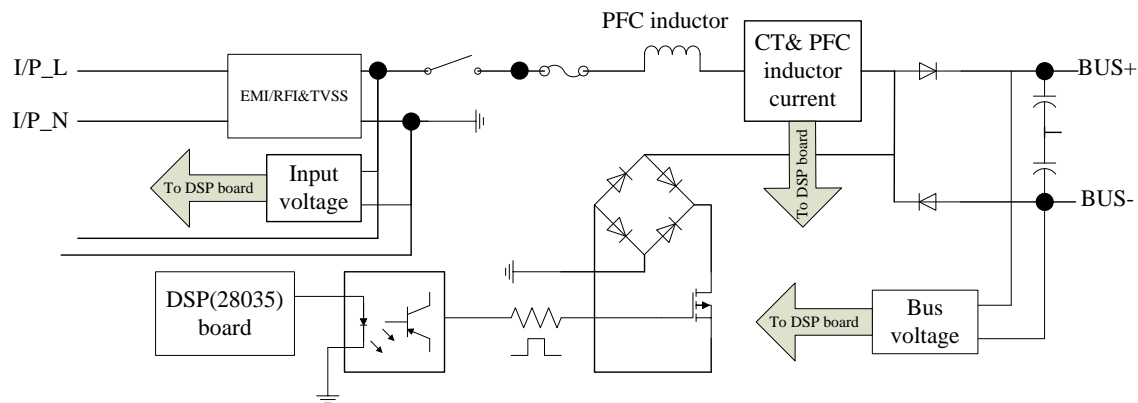


Fig. 8: Input PFC circuit

DC-DC CONVERTER

The major function of the UPS is to deliver accurate AC power to the loads connected to it whenever the AC line is correct or fails. In this system, the batteries release the stored energy to supply inverter immediately upon AC line fails. Refer to figure 9, the battery voltage is transformed through a push-pull DC-DC converter to $\pm 390\text{Vdc}$ as DC buses for inverter. When the utility fails, the $\pm 390\text{Vdc}$ DC sources are caught up to supply the power needed by the inverter immediately.

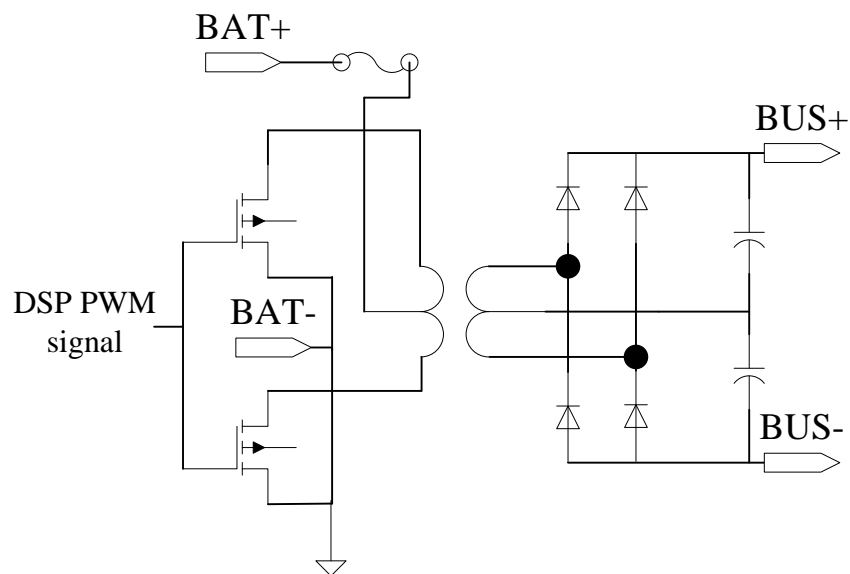


Fig. 9: DC discharge circuit

MAIN CONTROL PCB ASSEMBLIES (PS1202_CT1)

These assemblies are the control center of UPS. It is composed of three major circuits as following.

- (1) Control
- (2) Protection
- (3) Sampling

1). CONTROL:

It provides the control PWM signal to the switching devices which deliver power to the output. It also control the output to ensure that the UPS is delivering pure AC voltage to the loads.

The inverter voltage signal is sensed directly by a differential amplified circuit. The control DSP detecting the signal and then the duty cycles of switching to regulate the output voltage within specification.

In order to avoid un-wanted surge current while transfer to bypass, inverter voltage tracks the bypass phase if bypass voltage is normal.

2). PROTECTION:

The UPS provides the following protection:

1. Overload protection

UPS calculates the inverter load by detecting output voltage and current.

If the output load is 130% of rated load(VA ,or Wattage) **the UPS keeps running on inverter for 60 seconds.**

If the output load is **150%** of rated load, the UPS transfers to bypass after 30 seconds.

When a big surge current be detected, inverter IGBT will be turned off pulse-by-pulse to protect IGBT. The output relay stays at inverter output position unless a continuous overload is detected or an inverter fault occurs.

2. Battery over or under shut down

Upon the battery voltage declines to battery-under level, a signal is generated to cut off the power supply of the whole system after 20 seconds, The buzzer becomes silent and all the LEDs extinguish. When the utility is coming, the UPS will start up automatically. In case of the battery voltage is high voltage, the UPS

will shutdown charger. The panel will indicate the fault condition.

3. Inverter output abnormal protection

The inverter failure signal shuts down the inverter immediately, the buzzer alarms continuously, “status” and “INV” LED light as red. The panel will indicate the fault condition.

4. Over temperature protection

One NTC detects the temperature of IGBT’s heatsink. CPU calculates the temperature using NTC resistor. If temperature is over the setting point, the panel will indicate the fault.

5. Bus over-voltage protection

To protect any BUS over-voltage condition especially for the half-bridge load. The UPS will indicate the fault.

3). SIGNALING:

When the AC power is abnormal, the batteries feed the inverter immediately. At the same time, the input relay is activated and the buzzer beeps.

Upon the batteries are discharged to battery-low level, the battery-low alarm is activated and the buzzer beeps.

Remote shutdown signal is activated at battery discharge mode. It will generate battery-under signal to cut off the power supply of the UPS system completely.

FRONT PANEL:

The front panel consists 3 parts: button and display LED, LCD.

There are 2 buttons. One is “ON/OFF”, used to turn on or turn off UPS. One is “FUNC”, used to select menu. Use “ON/OFF” and “FUNC” together to set rated parameters.

There are 4 LED indicators.

REC indicates AC power is normal. Bypass LED indicates bypass is active.

Inverter LED indicates inverter is working. Bypass LED flashes and others are dark, indicates UPS is not working and switch power supply is on.

LCD includes information about input, output, battery, fault, warn, working mode, load. Please refer to user manual to get detailed information.

3. TROUBLE SHOOTING

For the reason of safety, you must unplug the power cord and disconnect the batteries from UPS.

Check the components listed below to confirm which block is out of order and follow the procedures listed on the following pages to repair them.

CAUTION: DO NOT supply UPS with the mains unless you are sure that you have

replaced all defective components.

Upon you meet alarms:

1). record

Record the input, output, battery and load information from LCD, check if something is wrong

2). get the warn information

Check the fault NO. or warn NO. on LCD

3). check the events

Check the NO. with events list to get the detailed warns

Code	Event	Possible cause	Solution
16	Warn: Input voltage abnormal	Utility is failure	/
		Input surge protector opens	If utility is normal but rectifier is not working, reset input surge protector
18	Warn: Line neutral wires reversed/PE not grounded	Input Line and neutral is reversed	Check the polarity of line wire and neutral wire
		PE wire is not connected correctly in UPS	Check if PE on input plug is shorted with UPS rear panel. If not ,contact with distributor or service center. If yes, please check PE wire in input power socket
20	Warn: Bypass voltage abnormal	Bypass voltage is out of bypass range or is off	Check if utility power is indeed out of range.
24	Warn: Bypass over load	Load is on bypass and is overload	Remove some loads to ensure that total loads is less than 95% of rated capacity
26	Warn: Bypass overload timeout	Load is on bypass and overload. Overload time is longer than the overload capacity of	Remove some loads and restart UPS again. When UPS is working normally, turn on loads one by one.

		bypass. UPS will shutdown output and loads will loss power.	
30	Warn: Transfer times over limit in 1 hour	Transfer times between inverter and bypass is over 5 in recent 1 hour. UPS works in bypass mode.	Check if output is overload or some loads are shorted. Remove the failure loads and restart the UPS or wait for starting inverter automatically.
32	Warn: output shorted	Something shorted	Please remove all loads from UPS output. Check if UPS output is shorted. If not, please check all loads.
34	Warn: End of discharge	UPS works in battery mode for long time after utility failure. UPS output will be off until utility power is on.	Please save your data when UPS alarm "utility fail"
38	Warn: Battery test failure	Battery capacity is low or load is low.	Please ensure that battery voltage is higher than 36VDC and the load is more than 30%.
47	Fault: Rectifier fault	Bus over voltage, bus unbalance, rectifier starting failure, bus under voltage, input fuse is off	Please contact with distributor or service center.
49	Fault: Inverter fault	Inverter over voltage, inverter under voltage,	Please contact with distributor or service center.
51	Fault: UPS over temperature	Environment temperature is higher than permitted point, ventilation is blocked	Please ensure that nothing blocks ventilation and environmental temp must be 0~40°C
53	Fault: Fan failure	One or more fans are failure, fan wires are loosen	Please contact with distributor or service center
55	Fault: Inverter overload	Loads are on inverter and over the capacity of the UPS	Remove some loads to ensure that total loads is under the capacity of the UPS
57	Fault: Inverter overload timeout	Load is over the capacity of the UPS and timeout, UPS will transfer to bypass mode if bypass is available	Remove some loads to under 95%, UPS will transfer to inverter automatically
65	Fault: Battery low	UPS works in battery and battery voltage is low	Recover input power or save data upon "battery low"
71	Fault: Charger fault	There is no charger output.	Please contact with distributor or service center
72	Warn: input over current	Abnormal large current enter in rectifier.	Please contact with distributor or service center

74	Warn: Manual shutdown	UPS will shutdown output or transfer to bypass mode	/
/	Battery discharge time diminishes	The battery has not been fully charged	Charge the battery for more than 10 hours
		UPS is overload	Check the loads and remove some devices
		Battery aged	Replace the batteries. Please contact with distributor or service center to obtain replacement components for batteries.
82	Fault: output CT reverse	output power is minus when starting	Check if output CT is assembled incorrectly

3.1 Check the broken components

A. Rectifier fault (on power board)

Step	model	Components	
1	1-3K	Input fuse F1	Check the resistor of F1, if near 0 ohms, it's OK. If not, it's broken
2	1K	Rectifier bridge U4	Using diode measure function of multi-meter to measure the voltage between pin1 and pin2, pin1 to pin3, pin2 to pin4, pin3 to pin4, if the voltage is near 0.7V, it's OK. If it's shorted or opened, it's broken.
	2K/3K	Rectifier bridge U1	
3	1K	Rectifier IGBT Q3	Using diode measure function of multi-meter measure the voltage of pin3 and pin2, it should be near 0.5V. If it's shorted or opened, it's broken. If any two pins are shorted, the IGBT is broken.
	2K/3K	Rectifier IGBT Q1	
4	IGBT driver		Check the resistor value, if in the range of $\pm 5\%$ of rated value, it's ok. Using the diode measure function of multi-meter to measure the zener, if voltage is near 0.7V, it's ok. Or else, it's broken.
	1K	Resistor R84 (100 Ω) Zener D44, D45	
	2K	Resistor R25(10 Ω), R30(20 Ω) Zener D35, D39	
	3K	R275(10 Ω), R59(20 Ω) D42, D43	
5	1K	PFC D1, D2	Using the diode measure function of multi-meter to measure the voltage between pin2 and pin1, if the voltage is near 0.7V, it's ok. If it's shorted or opened, it's broken.
	2K	PFC D1, D2	
	3K	PFC D4, D5	
6	1-3K	Battery fuses F2, F3	Check the resistor of F1, if near 0 ohms, it's OK. If not, it's broken
7	Push-pull MOSFET		Using the diode measure function of multi-meter to measure the voltage between pin3 and pin2, if the voltage is near 0.5V, it's ok. If it's shorted or opened, it's broken. Check every two pins, if they are shorted, it's broken.
	1K	Q4, Q5, Q6, Q7	
	2K	Q4, Q5, Q6, Q7	
	3K	Q11, Q12, Q13, Q14	
8	MOS drivers resistor		Check the resistor value, if in the range of $\pm 5\%$, it's OK
	1K	R11-R14(10 Ω)	

	2K	R169-R176(20Ω)	Check if any two pins are shorted, if yes, it's broken.
	3K	R183-R186(20Ω)	
	MOS drivers transistor		
	1K	Q19-Q22	
	2K	Q20-Q23	
	3K	Q16,Q17,Q22,Q23	
9	Discharge diodes		Using the diode measure function of multi-meter to measure the voltage between pin2 and pin1, if the voltage is near 0.7V, it's ok. If it's shorted or opened, it's broken
	1K	D3,D4,D5, D6	
	2K	D3,D4,D5, D6	
	3K	D1.D2.D3, D6	

B. inverter fault(on power board)

step	Model	Components	
1	1K	Inverter IGBT Q1,Q2	Using the diode measure function of multi-meter to measure the voltage between pin3 and pin2, if the voltage is near 0.5V, it's ok. If shorted or opened, it's broken. Check every two pins, if shorted, it's broken.
	2K	Inverter IGBT Q2,Q3	
	3K	Inverter IGBT Q2,Q3	
2	IGBTdrivers		Check the resistor value is in range of +-5%. Using the diode measure function of multi-meter to measure the zener, if the voltage is near 0.7V, it's ok. If shorted or opened, it's broken.
	1K	Resistor R85,R86 (100 Ω) Zener D40,D41,D42,D43	
	2K	Resistor R77-R78 (20 Ω) zener D36,D37,D38,D40	
	3K	Resistor R23,R26 (20 Ω) R57,R58 (10 Ω) Zener D39,D40,D41,D44	
3	If some inverter components are broken, it need to check rectifier components too.		

C. Power supply(on power board)

Step	Model	Components	
1	1K	Mosfet Q24	Using the diode measure function of multi-meter to measure the voltage between pin3 and pin2, if the voltage is near 0.5V, it's ok. If shorted or opened, it's broken. Check every two pins, if shorted, it's broken.
	2K	Mosfet Q24	
	3K	Mosfet Q17	
2	Driver resistor		Check the resistor value, if in the range of +-5%, it's ok.
	1K	R169 (10 Ω)	
	2K	R146 (20 Ω)	
	3K	R60 (20 Ω)	
3	1K	Diode D32,D31	Using the diode measure function of multi-meter to measure the diode, if the voltage is near 0.7V, it's ok. If shorted or opened, it's broken.
	2K	Diode D25,D26,D27	
	3K	Diode D25,D26,D27	

D. Charger

1A charger(PS1103-PW3):

Step	Components	
1	Fuse F1	Measure the resistor of fuse, if near 0ohms, it's ok. If opened, it's broken.
2	Mosfet Q2	Using the diode measure function of multi-meter to measure the voltage between pin3 and pin2, if the voltage is near 0.5V, it's ok. If shorted or opened, it's broken. Check every two pins, if shorted, it's broken.
3	Driver resistor R4 (10Ω)	Check the resistor value, if in the range of +-5%, it's ok.
4	Diode D1,D4	Using the diode measure function of multi-meter to measure the diode, if the voltage is near 0.7V, it's ok. If shorted or opened, it's broken.
5	Rectifier bridge U6	Using diode measure function of multi-meter to measure the voltage between pin1 and pin2, pin1 to pin3, pin2 to pin4, pin3 to pin4, if the voltage is near 0.7V, it's OK. If shorted or opened, it's broken.

8A charger(1K: PS1202-PW1)

STEP	Components	
1	Fuses F1, F2	Measure the resistor of fuse, if near 0ohms, it's ok. If opened, it's broken.
2	MOS Q1	Using the diode measure function of multi-meter to measure the voltage between pin3 and pin2, if the voltage is near 0.5V, it's ok. If shorted or opened, it's broken. Check every two pins, if shorted, it's broken.
3	MOS driver resistor R14 (10Ω)	Check the resistor value, if in the range of +-5%, it's ok.
4	Diode D1	Using the diode measure function of multi-meter to measure the diode, if the voltage is near 0.7V, it's ok. If shorted or opened, it's broken.
5	Rectifier bridge U1	Using diode measure function of multi-meter to measure the voltage between pin1 and pin2, pin1 to pin3, pin2 to pin4, pin3 to pin4, if the voltage is near 0.7V, it's OK. If shorted or opened, it's broken.

8A charger(2K/3K: PS1103-PW4)

Step	Components	
1	Fuse F1, F2	Measure the resistor of fuse, if near 0ohms, it's ok. If opened, it's broken.
2	MOS Q1/Q2	Using the diode measure function of multi-meter to measure the voltage between pin3 and pin2, if the voltage is near 0.5V, it's ok. If shorted or opened, it's broken. Check every two pins, if shorted, it's broken.
3	MOS driver resistor R36,R37 (20Ω)	Check the resistor value, if in the range of +-5%, it's ok.
4	Diode D5	Using the diode measure function of multi-meter to measure the diode, if the voltage is near 0.7V, it's ok. If shorted or opened, it's broken.
5	Rectifier bridge U5	Using diode measure function of multi-meter to measure the voltage between pin1 and pin2, pin1 to pin3, pin2 to pin4, pin3 to pin4, if the voltage is near 0.7V, it's OK. If shorted or opened, it's broken.

CAUTION: DO NOT supply UPS with the mains unless you are sure that you have replaced all defective components