SERVICE MANUAL

ELIPSE SERIES

EL-6K/EL-6KS/EL-10K/EL-10KS

FORZA POWER TECHNOLOGIES

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CONTENT

1. General Information of This Document

1.1 Getting Started

This is a service manual for the Elipse Series Tower UPS, intended to help service technicians perform maintenance and repair services.

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** 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,** please refer to USER MANUAL (separate document)

1.2 Safety Instructions

1. **For qualified service personnel only.**

2. **DO NOT** perform any internal service or adjustment unless another person is capable of rendering first aid and resuscitation is present.

3. Dangerous voltage exists at different points in this product. To prevent electrical shock, don't touch any exposed connections or components inside the UPS while UPS is active.

4. For most safety, turn off the UPS and disconnect input power cord before removing outside protective cover.

5. Verify input source (voltage and frequency) is within the maximum range before installation or performing   any service action.

6. Prevent short-circuit of internal batteries or external battery bank.

7. After service, check all the wiring, fasten all screws and connectors, verify the polarity of batteries, polarity of the DC-BUS Cap have been correctly connected, before applying power supply to the UPS and restarting the UPS.

8. High voltage may be present at DC-BUS capacitors, Battery input filter capacitor, Even if all power supply to the ups have been cut off. Before disassembly or touching of any parts inside the UPS, use discharge fixture to discharge the residue charge on DC-BUS capacitors & battery capacitor.

TO DISCHARGE the residue charge on bus capacitor, a discharge resistor of 1kΩ/10W can be used to discharge the DC-BUS cap after all the power supply to the UPS have been cut off.

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. Characteristics 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 help in solving any problems you may encounter

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

- Full digital control, the intelligent controller provides most comprehensive information for maintenance.

- Greatly simplified control circuit; save time tuning the analog controller.

- Modular design, some identical circuits, such as drivers, detectors are designed as a module,

- High power density, the space is limited. Need careful assembly

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: Move the top cover and side cover upward, as shown in Figure 3.2.

STEP 3: Done, as shown in Figure 3.3.
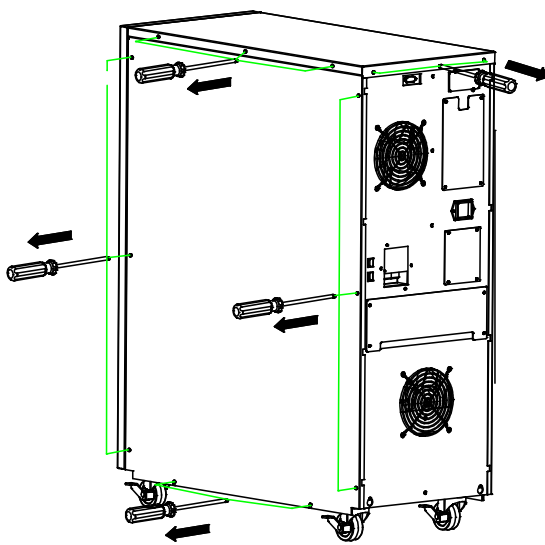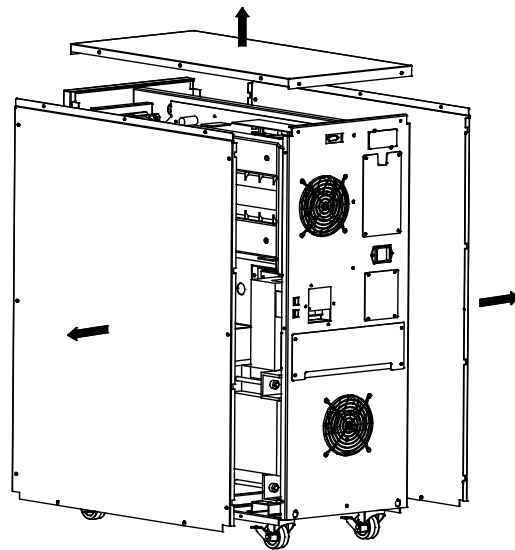
Figure 3.1   Figure 3.2
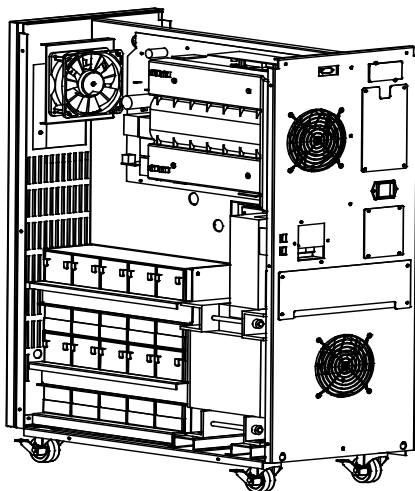
Figure 3.3

4. OPERATION PRINCIPLE OF THE UPS

The EL 6~10K UPS is a true online UPS employing a double conversion topology. Figure 4.1.1 shows the function block diagram of the UPS system.

4.1 Functional Block Of The UPS
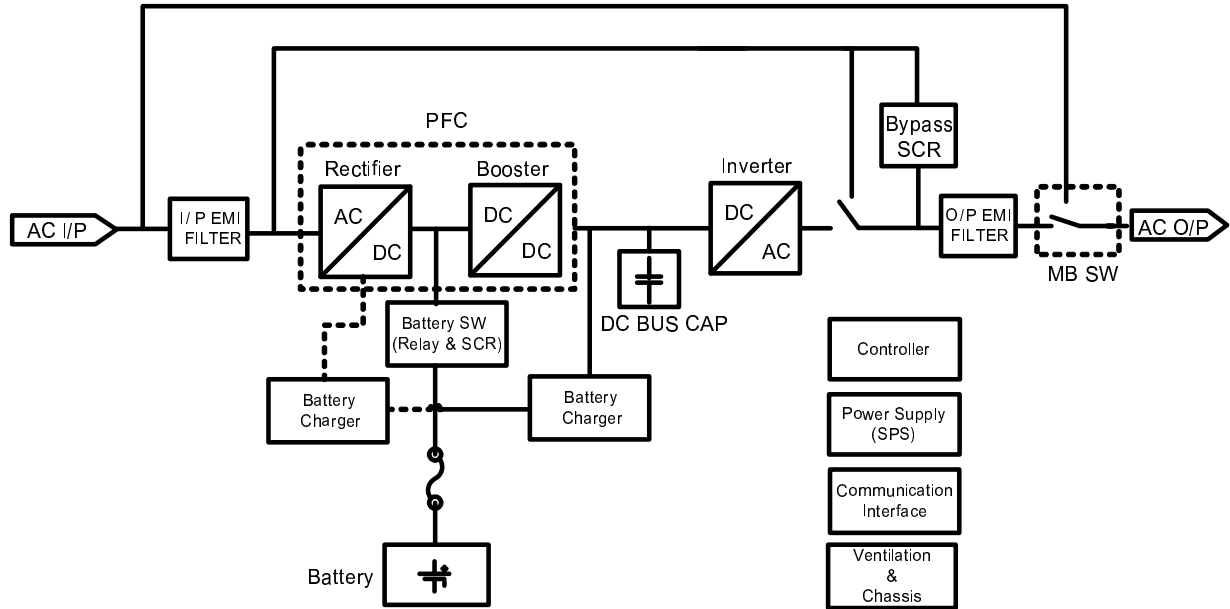
Figure 4.1.1 Functional block diagram

*The dashed indicates the interconnection of long backup time model

From logical point of view, the system comprises: An Input/output connector/terminal block, an input EMI filter, an output EMI filter, a rectifier, a battery switch, a voltage booster, an inverter, an automatic UPS switch, a maintenance bypass switch, a battery charger, a controller, an auxiliary power supply, a communication interface, a ventilation module and the chassis.

4.2 Operation Of The Functional blocks

Here after, operation and behaviors of each function block of the UPS will be described:

4.2.1 The Input/Output connector/terminal block

The part provides electrical connection of the input mains and battery power input to the UPS and the output to users load.

4.2.2 The Input EMI filter & the Output EMI filter

The EMI filter filters out the EMI (Electric & Magnetic Interference) noise from the input/output of the UPS, prevents the UPS being interfered by the external EMI noise or the noise generated inside the UPS to interference the user's load.

4.2.3 The rectifier module

When Mains input is in normal condition, the UPS works on Line mode, the Rectifier module rectifies the AC mains input into DC power of half waveform.

The rectifier remains in off state under battery mode.

4.2.4 The voltage Booster module

In line mode, the voltage Booster boost the output of the rectifier into a positive BUS voltage and a Negative BUS voltage, the Positive BUS voltage and negative bus voltage are +/-345Vdc (+/-360V for 230V output system), in respect to the Neutral.

The Rectifier and the voltage Booster form a PFC (Power factor Correction) Module, which make the input current track the input voltage, and the Power factor of the UPS close to 1, which help to minimize the power pollution and reduce the reactive power and save energy for the user.

On battery mode the voltage booster receive power from the battery via the battery switch, and boost the battery voltage of around 240V up to +/-BUS voltage of +/-345Vdc (+/-360V for 230V output system), in respect to the Neutral

The Output of the voltage Booster, i.e. the BUS voltage, keeps stable in different operating modes, regardless of input voltage.

4.2.5 The inverter module

The inverter module converts the DC voltage from DC BUS into the AC output of pure sine wave voltage.

The inverter keeps working after the UPS turns on either line mode or battery mode. Which make sure the power supply to the load is clean and stable.

4.2.6 The automatic UPS switch

The automatic UPS switch comprises of a relay and a pair of SCRs, the switch selects the inverter output to supply the load when the UPS in normal condition. And selects the bypass output when the UPS becomes overloaded, or out of normal condition and can't no longer supply the load with inverter output.

Combination of the SCR and the mechanical relay make the transfer between bypass and inverter output without any interruption (zero transfer time).

4.2.7.The maintenance bypass switch

The Maintenance Bypass switch is a mechanical rotary switch. In normal condition the maintenance bypass switch stays on "UPS" state, the inverter output or automatic bypass output will pass through the maintenance bypass switch to supply the user's load; when Maintenance Bypass Switch is turn to "BPS" state manually, all of the power conversion parts and automatic bypass are bypassed by the mechanical bypass wiring, to enable maintenance operation.

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Due to construction of the maintenance-bypass-switch.

On EL 6k and 10k UPS (single phase input and single phase Output model), Turn the Maintenance Bypass switch to Maintenance bypass state (BPS), and After switching off the I/P mains switch on the rear panel of the UPS and cutting off battery input, the PCBs or parts of the UPS can be disassembled following safety instructions without interruption of output power supply.

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4.2.8 The battery switch

The battery switch connects the battery input to the voltage booster to provide power supply for supporting the operation of the UPS and maintains the inverter output power when the mains input is out of order.

The battery switch disconnects the battery bank from input of the voltage booster when the mains input is recovered to normal condition, and the UPS transfer from battery mode to line mode.

4.2.9 The battery charger

The battery charger is a converter of energy from mains into power to re-charge the battery, in order to keep battery full energized and provide as long as possible backup time in case mains input is out of normal condition and the UPS transfer to battery operating mode.

4.2.10 The controller

The controller is the brain of the UPS, controls all actions of the UPS, response and feedback to the query or action command of the communication interface.

Basically, the controller includes the CPU (Central Processing Unit), which collects and processes the information necessary for control of the UPS, and output control action according the predetermined algorithm.

Secondary, the controller includes feedback signal conditioning circuit, it processes the signals that come from sensors detecting the change in parameters. The feedback signal include the analog signal and digital signal

Also, the controller includes an output buffer circuit to buffer the output signal of the CPU and drive the Power stage.

Due to high degree of integration, to diagnose the failure on the controller takes a long time and is not justifiable compared to the cost of the controller itself, so we recommend not to repair the controller at component level.

4.2.11 The auxiliary power supply

The Auxiliary power supply (SPS) takes energy from the battery or the charger output, converts it into a group of low voltage power supplying to each part of the UPS itself.

The output of the Auxiliary power supply (SPS) includes: +5Vdc, +/-15Vdc, +12Vdc, and a square wave high frequency power supply +/-H.F.PW2.1.12

The communication interface

As stated before the communication interface of the UPS is a bridge between the UPS and human or between the UPS and UPS.

The communication interface carries parallel operation control signal and common communication signal.

4.2.12 The ventilation module

To keep the UPS safely running, the ventilation system comprises of fans , fan drivers, and airflow guiding parts that keep the components of the UPS cool and makes sure the temperature of the components stays within the safe operation range.

The ventilation module is as essential as the rest of the electrical parts of the UPS, such as the controller.

4.2.13 The chassis

The chassis is the case where all the parts of the UPS are in.

4.3.The PCB Boards

The UPS comprises of different PCB boards and each PCB may contain more than one function block, or one functional block may need more than 1 piece of PCB to implement. hereafter is explanation of the PCB.

4.3.1 Control Board

Control board contains circuits implemented of the controller of the UPS. Figure4.3.1.1 is a photo of the Control board
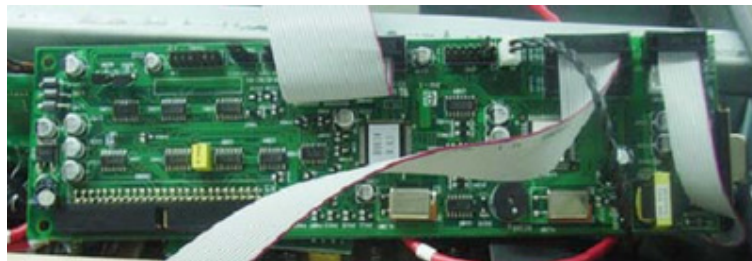
Figure4.3.1.1 The Control board.

4.3.2 PSDR board

The PSDR board includes the major power conversion circuits of the UPS: the SPS, the PFC Module, the Inverter Module battery switch, INV relay and bypass SCR.
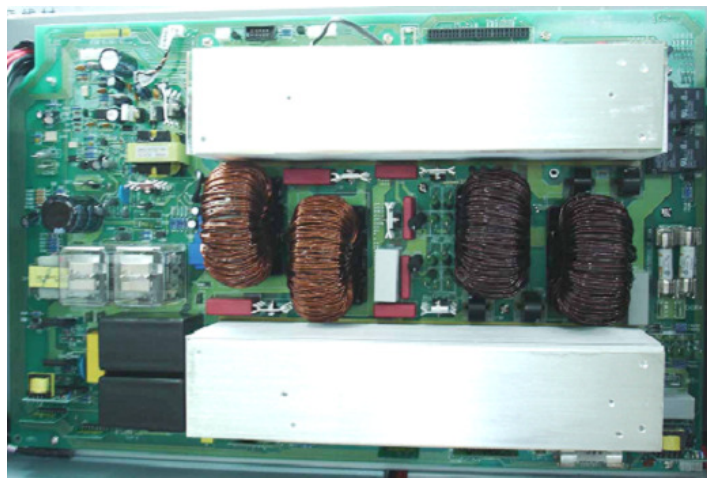
Figure4.3.2.1 The PSDR board

4.3.3 LED PANEL

As part of User interface, the LED Panel provides comprehensive information of the UPS, Figure 3.3.1 is a photo of a LED panel
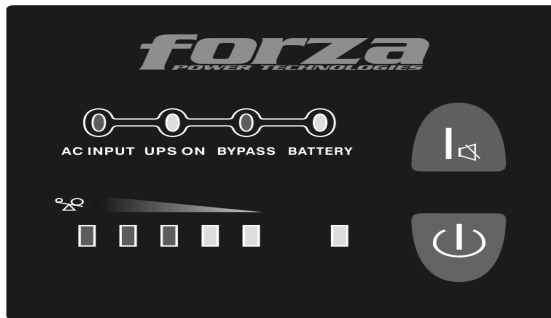
4.3.4 I/P EMI board & O/P EMI board

I/P EMI Board and O/P EMI Board is the EMI filter local in the input and output end of the UPS respectively.

Figure 4.3.4.1 EL 6/10K(s) I/P EMI   Figure 4.3.4.2 EL 6K(s) O/P EMI
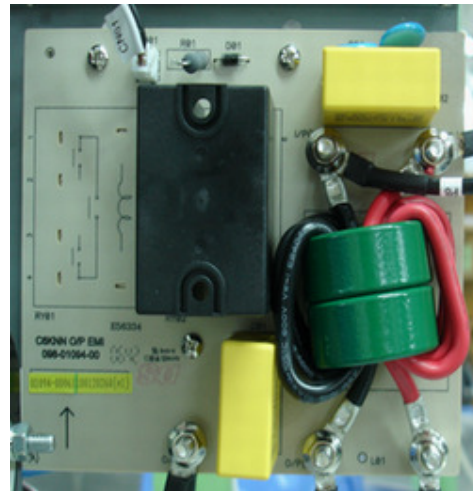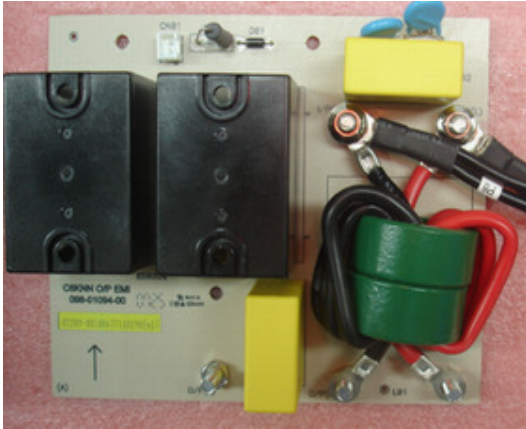
Figure 4.3.4.3 EL 10K(s) O/P EMI

4.3.5 Charger Board

Charger board contain the charger circuit. Use dfor charging the battery

Figure 4.3.5.2 Charger of standard model

Figure 4.3.5.2Charger of long-backup-time model (s)

4.3.6 Parallel Board

Parallel board is a dedicated board that has the parallel communication circuit. Figure 3.6
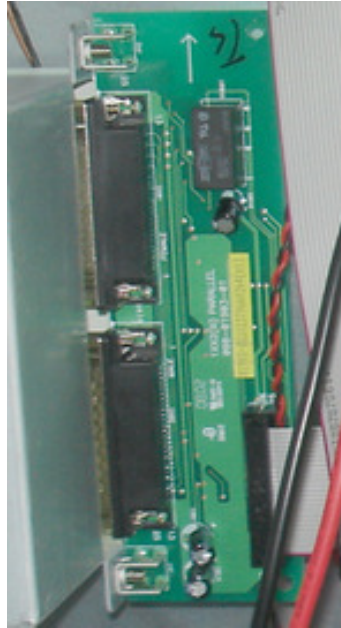
Figure 4.3.6.3 Para board of 6/10K

4.4 Simplified system topology & wiring diagram

Figure 4.4 shows simplified system topology and wiring diagram; for help in understanding the electrical construction of the UPS system. For more detail of the circuit and wiring connection of all PCB, please refer to "maintenance schematic and detail wiring diagram".
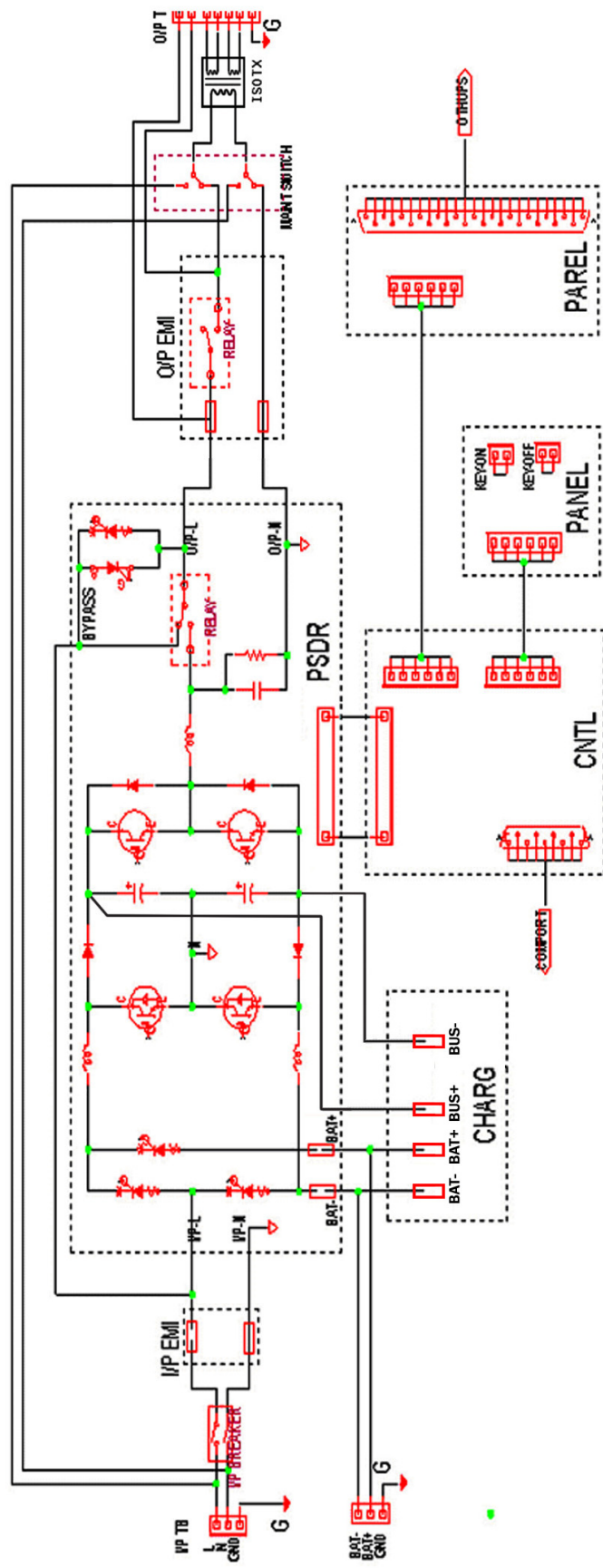
Figure 4.4 EL6K/EL10K UPS configuration diagram
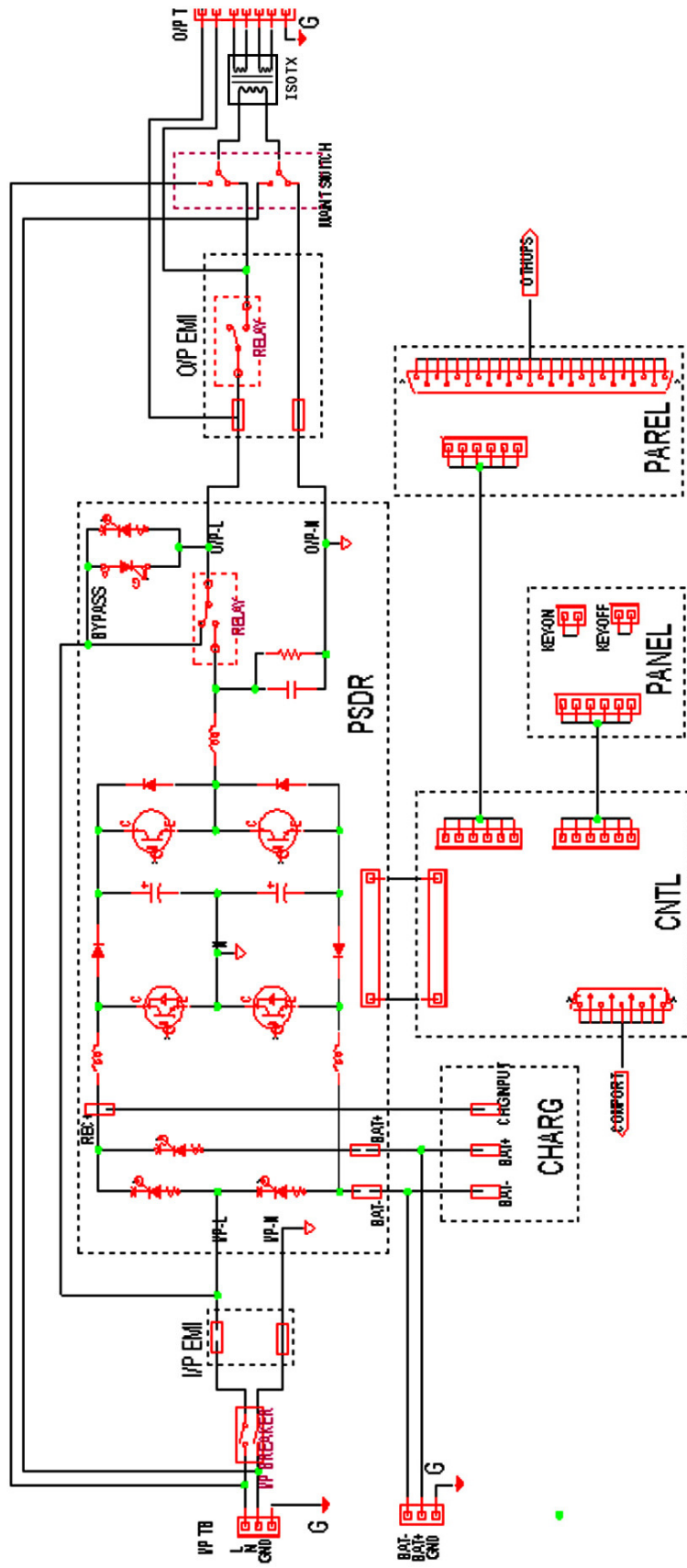
Figure 4.5 EL6KS/EL10KS UPS configuration diagram

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5. Maintenance

5.1 Maintenance Tools/Equipments

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

2. A multimeter and a current meter (clamper); If possible, an oscilloscope with appropriate probes or other kinds of waveform displayers that can provide great help to the maintenance task in most case.

3. An Output DCs balance (DC-offset) test fixture, a discharge resistor for discharging residual charge on the CAPs inside the UPS.

4. A tool box that includes: Wire cutters and clamps of different shapes, Cross screwdrivers Straight screw drivers, sleeve spanner of difference diameter, solder iron, and solder sucker, PVC insulating tapes etc.

5. Boxes or cases for carrying spare board or parts.

5.2 Common Operation used in Maintenance

5.2.1 Query & Setting the UPS status With Hyper Terminal

5.2.1.1 Setup of Hyper terminal:

Run the Hyper terminal by clicking" Start/Program/Accessory/Communication/Hyper terminal" : and create a new connection using COM1 or COM2 as figure 5.2.1.1.a:

Figure 5.2.1.1.a

Configure the COM1 or COM2 properties as figure 5.2.1.1.b:
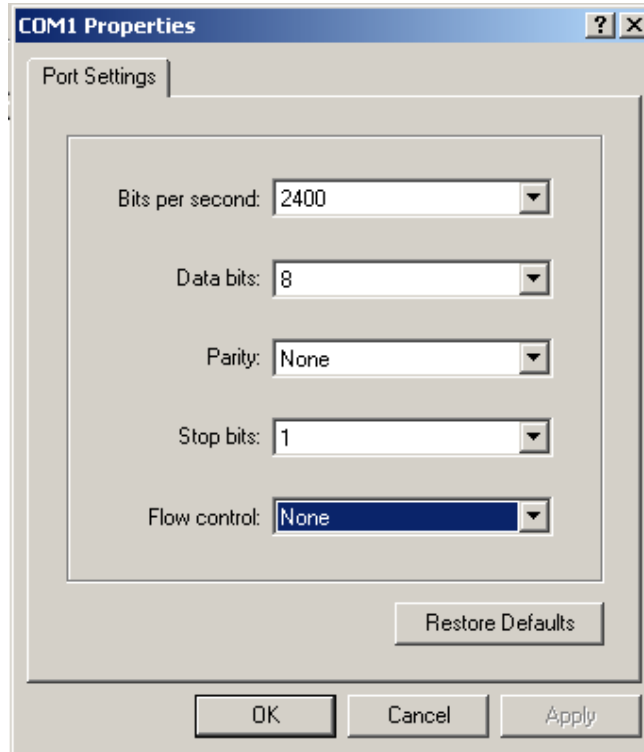
figure 5.2.1.1.b

1、   Change the ASCII setup as figure 3:
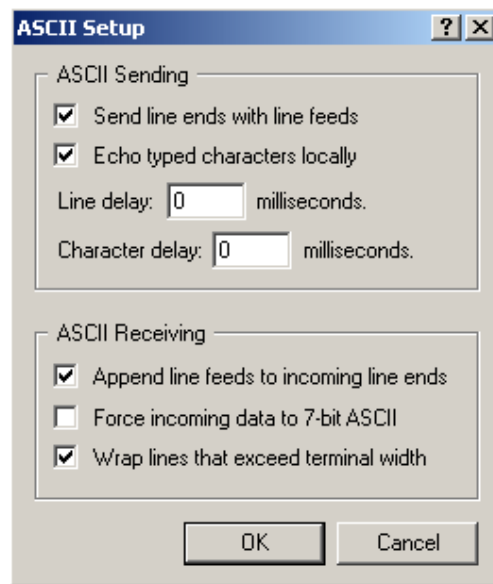
figure 5.2.1.1.C

After you finished the setting, you can see the following interface like figure 5.2.1.1.d.
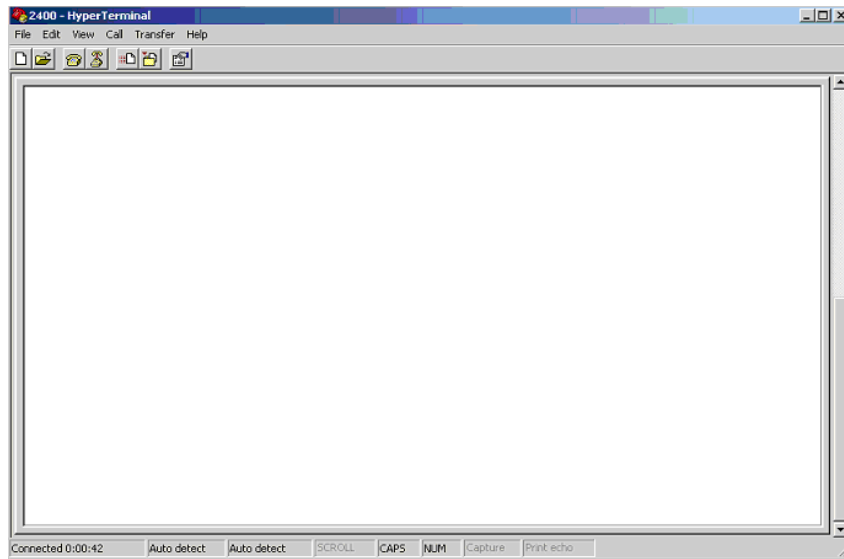
Figure 5.2.1.1.d

You can type command on the hyper terminal. Normally, after type a command, the acknowledgement of the UPS will be displayed on the next row, For example, UPSID setting command response with an OK on the next row represent the action to set the ID of the UPS has been executed and is valid.
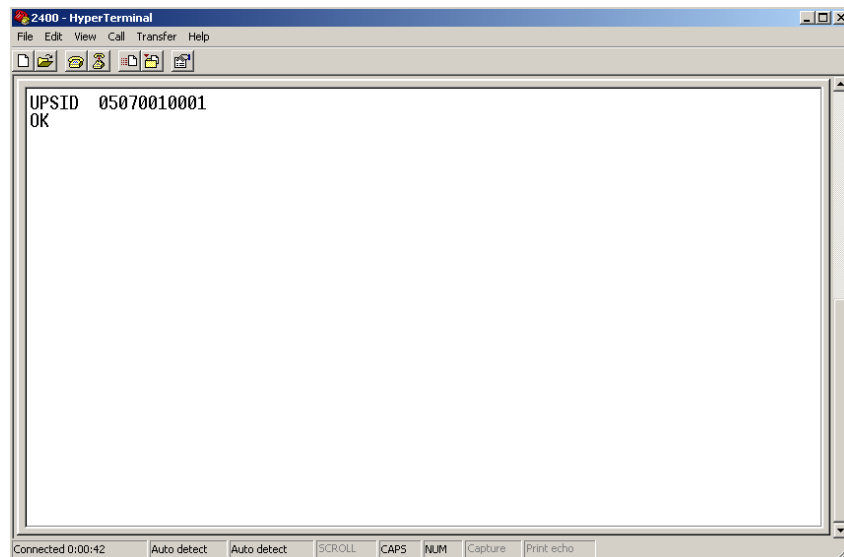
Figure 5.2.1.1.e

5.2.1.2 Frequently used Commands

All commands word is are in capital letters.

Set Ups ID command: UPSID

Computer send: UPSID   YYMMDDPPSSS <CR>

UPS reply : OK <CR>

Means: Ups product date   < YY >/< MM >/< DD > (year/month/day), lot number < PP >

ranging from 01 to 31 and serial number < SSS > ranging from 000 to 511

Notes: "UPSID" is separated from "YYMMDDPPSSS" by two space key. And

Ups ID query command: Q7

Computer send: Q7< CR >

UPS reply :   YYMMDDPPSSS   V_xx<CR>

Means: Display the UPS ID YYMMDDPPSSS. The last 4 letters V_xx not more used now

DSP Firmware query command

Computer send: VERDSP< CR >

UPS reply: (VERDSP <NNNNN.NN><CR>

Means: Display version of DSP firmware.

MCU Firmware query command

Computer send: VERMR32< CR >

UPS reply: (VERMR32 <NNNNN.NN><CR>

Means: Display version of MCU firmware

Positive DC BUS (+BUS) voltage calibration command:

Computer send: BUSP+XX < CR > or BUSP-XX

UPS reply :   : BUSP+XX or : BUSP-XX

Means: Increase average voltage of Positive Bus (+BUS), XX is two digits from 00 to 19, 1

represents about 0.5V.

Negative DC BUS (-BUS) voltage calibration command:

Computer send: BUSN+XX < CR > or BUSN-XX< CR >

UPS reply :   BUSN+XX or : BUSN-XX

Means: Increase average voltage of Negative Bus (-BUS), XX is two digits from 00 to

19, .1 represents about 0.5V.

INV output voltage calibration command

Command Format: V+X < CR > or V-X < CR >

UPS reply: V+X or V-X

Means: Increase or decrease the inverter output voltage for calibration. X is single

digit number, ranges from 0 to 6, .1 represents about 1V.

INV output rated voltage setting command

Command Format: VXXX < CR >

UPS reply: XXXV

Means: set inverter output rated voltage.

Fault history query command

Command Format: QF < CR >

UPS reply: (KK PPP FF.F OOO EE.E LLL CCC PPP NNN BB.B TT.T <b7b6b5b4b3b2b1b0><cr>

Meaning: The UPS can record latest fault /Warning code and status of the UPS when the fault occurs to the UPS. Each word represents different information as follow:

(a) Start byte: (

(b) Fault kind: KK, is the internal fault code for distinguish the type of failure or warning, the following table shows the code and status represented:

Fault Name	FAULT CODE				
	Bypass mode	Line mode	Bat mode	Bat test mode	Eco mode
Bus Fault：+BUS Over voltage	$30	$05	$0C	$40	$50
Bus Fault: -BUS Over voltage	$31	$25	$2C	$41	$51
Bus Fault: Bus Unbalance	$32	$15	$1C	$10	$11
Inverter Fault	INV Soft Fail：$8D	$04	$0B	$42	$52
OP short Fault		$0F	$0F	$0F	$0F
Over Temp Fault	$33	$06	$0A	$43	$53
Overload Fault	$35	$03	$09	$45	$55
Bat SCR Short	$0D	$0D	$0D	$0D	$0D
Communication Fault	$88	$88	$88	$88	$88
Bat Open	$89		$89		
Inverter Relay Short	$8B				
Parallel Communication Fault	$8E	$8E	$8E	$8E	$8E
Error Model Set	$8F				
Par Ups Over Number	$8G	$8G	$8G	$8G	$8G
LoadNegIFault		$8H	$8H	$8H	
LoadNegWFault		$8I	$8I	$8I	
	Warning Code				
	Bypass mode	Line mode	Bat mode	Bat test mode	Eco mode
Fan Fault	$36	$0G	$2G	$46	$56
Charge Fault	$07	$07	$07	$07	$07
ID Loss	$60	$60	$60	$60	$60
IP Fuse Loss	$70	$70	$70	$70	$70

(c) I/P voltage before fault/warning occurs: PPP.

P represents an integer number ranging from 0 to 9. The unit is Volt.

(d) I/P frequency before fault/warning occurs: FF.F.

F represents an integer number ranging from 0 to 9. The unit is HZ.

(e) Inverter O/P voltage before fault: OOO

O is an integer number ranging from 0 to 9. The unit is Volt.

(f) Inverter O/P frequency before fault: EE.E

E is an integer number ranging from 0 to 9. The unit is HZ.

(g) Load percentage before fault: LLL

LLL is maximum of W% or VA%.   VA% is a percent of maximum VA. W% is a percent of

maximum real power.

(h) O/P current before fault: CCC

CCC is a percent of maximum current.

(i) Positive Bus voltage before fault: PPP

P is an integer number ranging from 0 to 9. The unit is volt.

(j) Negative Bus voltage before fault: NNN

N is an integer number ranging from 0 to 9. The unit is volt.

(k) Battery voltage before fault: BBB.B

B is an integer number ranging from 0 to 9. The unit is volt

(l) Temperature before fault: TT.T

T is an integer number ranging from 0 to 9. The unit is degree in centigrade.

(m) UPS running status before fault: <b7b6b5b4b3b2b1b0>

<b7b6b5b4b3b2b1b0> is one byte of binary information.
Each bit is transferred into ASCII code.
<bn> is a binary number   "0" or "1".

Bit	Remarks
7	1:DCTODC on
6	1:PFC on
5	1: INVERTER on
4	Reserved(always 0)
3	1:input relay on
2	1:O/P relay on
1	Reserved(always 0)
0	Reserved(always 0)

Example:

Computer: QF<cr>

UPS: (04 208 41.0 160 50.0 102 100 160 190 041.0 69.0 01101100<cr>

Means: Inverter fault in line mode

I/P voltage is 208V.

I/P frequency is 41.0HZ.

O/P voltage is 160V.

O/P frequency is 50.0HZ

Load is 102%

O/P current is 100%

Positive Bus voltage is 160V

Negative Bus voltage is 190V

Battery voltage is 41.0V.

Temperature is 69.0 ℃

Battery SW off, PFC on , INVERTER on, input relay on , O/P relay on

5.2.2 Calibration

In most cases, The UPS works in good condition and the output and internal parameter are as precise as the defined specification. However, due to PCB / part replacement / firmware or hardware updates. The UPS needs to be calibrated to achieve the best precision. Following are the common procedure to calibrate a UPS, Major parameters that need to be calibrated include: Positive Bus voltage, Negative Bus voltage, and Inverter output voltage.

1. Calibration should be carried out under the condition that UPS work on unitary mode

2. Prepare Hyper terminal and communication connection as stated in previous section.

3. If the UPS is working, disassemble the cover of the UPS maintenance bypass switch (Turn MBS from "UPS" state to "BPS" state.

    (Note: the UPS will transfer to bypass mode automatically after disassembling the cover of the MBS, but for most safety, check the UPS status on the LED display, if the UPS does transfer to bypass mode automatically, operate the panel to turn the UPS off to bypass before the turning the MBS)

4. Switch off the mains input breaker on the rear panel of the UPS. Disconnect battery input.

5. Disassembly the top cover & left side cover of the UPS, make DC-BUS capacitor be accessible.

6. Assemble the MBS cover back in place.

7. Switch on mains input breaker on the rear panel of the UPS. Connect battery input to the UPS.

8. Turn on the UPS, observe the UPS transfer to line mode.

9. Measure the positive BUS (+Bus) with a multimeter, If the voltage of the +BUS is within Target value of 360V+/-1V for 230V output, and 345+/-1V for 220V output, calibration of +BUS is not needed, neglect this step, otherwise, send a BUSP+00 to reset the calibration, then Increase the +BUS voltage with BUSP+xx, or decrease the +BUS voltage with PBUS-xx command accordingly. 1 unit represents about 0.5V.

10. Measure the negative BUS (-Bus) with a multimeter, If the voltage of the -BUS is within Target value of 360V+/-1V for 230V output, and 345+/-1V for 220V output., calibration of -BUS is not needed, neglect this step, otherwise, send a BUSN+00 to reset the calibration, then Increase

the -BUS voltage with BUSN+xx, or decrease the -BUS voltage with NBUS-xx command accordingly. 1 unit represents about 0.5V.

11. Measure the voltage between JP2 and I/P neutral; the voltage is the inverter output voltage.

12. if the output of inverter needs to be calibrated, reset the calibration by sending a V+0, and then increase inverter output voltage with V+x command or decrease inverter output with V-x command accordingly, 1 unit represents about 1voltage.

13. Turn off the UPS, switch off the mains I/P breaker on the rear panel of the UPS. Wait for the UPS to shutdown automatically to let the calibration be saved into the memory of the UPS.

14. To make sure the calibration has been saved, you can turn on the UPS again and check the +/-BUS voltage and Inverter output voltage once again.

15. Switch off the mains I/P breaker on the rear panel of the UPS, disconnect the batter I/P

16. Assemble the left side cover and topside cover back to place.

17. Connect battery input to the UPS, switch on mains input breaker on the rear panel of the UPS, the UPS will transfer to bypass automatically.

18. Disassemble the cover of maintenance bypass switch, turn the maintenance bypass switch back to "UPS" state.

19. Assemble the cover of the maintenance bypass switch back to place, The UPS is now in good condition for normal operation.

If the UPS is not being used, operation of the maintenance bypass switch is not necessary, and the rest of the procedures to calibrate the UPS are same.

5.3 System Maintenance

5.3.1 Unitary Maintenance Operation

5.3.1.1 Routine inspection

a) Check the wiring /circuit breaker/connector

All the wiring, cable, connector should show no sign of loose, burnt, or bad contact, and the diameter of the wire should match the current it carries.

b) Check the Output voltage

The output voltage is 230V+/-1%, and the output should be stable in eithe voltage or frequency, the waveform should be clean, with no noise, and minimum distortion (THDv%<2 @ linear load).

c) Check the Battery status

Visual inspection of the battery. The battery should be placed in an environment with good ventilation. A clean, cool environment helps lengthen battery lifetime, the interconnection between batteries should be locked securely; and case of each piece of battery should show no sign of leakage of acid or deformation.

Voltage of each piece of battery should be checked; if there is any piece that has obvious voltage Difference (>2V) from the rest. We recommend changing this piece of battery, because this piece of battery will very likely fail soon.

Execute a Battery test, to check that the battery is not aged and is in good condition.

5.3.1.2 In-depth inspection

Normally, if UPS works in an environment of high dust/humidity/temperature, In-depth inspection may be needed every one to two years, In-depth inspection requires opening the cover of the UPS, all the power supply to the UPS should be cut off before opening the cover of the UPS and the DC-CAP should be discharge before further inspection. Points to inspect include:

a) Dust/Corrosion

Check if any dust accumulates on the PCB board. Vacuum dust collector is recommended to remove the dust.

Corrosion can usually be found at the PIN of the components and the copper track on the PCB. If obvious corrosion signs are found, we recommend replacing the PCB to avoid potential failure.

b) Internal Wiring /connector

Internal Wiring/connector should be checked; any wire/cable should be replace with a new one.

c) DC CAP

DC CAP is a component that ages like a battery, especially in a high temperature environments. So DC CAP should be inspected. A major sign of aged DC cap is deformation on the surface of the cap or protective vent

d) Calibration

A Calibration should be carried out in an In-depth inspection.

5.3.1.3 PCB replacement

For updates or repair purposes, PCB replacement needs to be carried out. Hereafter is the recommended procedure to replace a PCB.

1. Stop all power supplied to the UPS. Disassemble the top cover, left/right side cover of the UPS.

2. Discharge the DC-charger.

3. Find out if the PCB needs to be replaced.

4. Unplug/unlock all the cable and the wires from the target PCB. We recommend not to remove the wiring tie

5. Unscrew all the screws fastened the PCB.

6. Replace the PCB

7. Screw all the screws back into the PCB

8. Plug all the wiring back to place. There is label at the end of the wire/cable, make sure the connector/terminal has same mark as the label

9. Replace wire cable if needed.

10. Check the wiring and test the UPS.

5.3.1.4 Firmware update

Check the Firmware version with hyper terminal and Q7 command. For details on how to set the hyper terminal and methods on setting the commands please refer to previous section, if it is not the version expected. Replace the CNTL with updated version of firmware.

For the procedure of changing the control board can be referred to the procedure of replacing a PCB stated in the previous section.

5.3.2 Parallel Maintenance Operation

Recommended wiring of parallel operation system shown in figure 5.3.2, figure all of later explanations are based on this configuration.
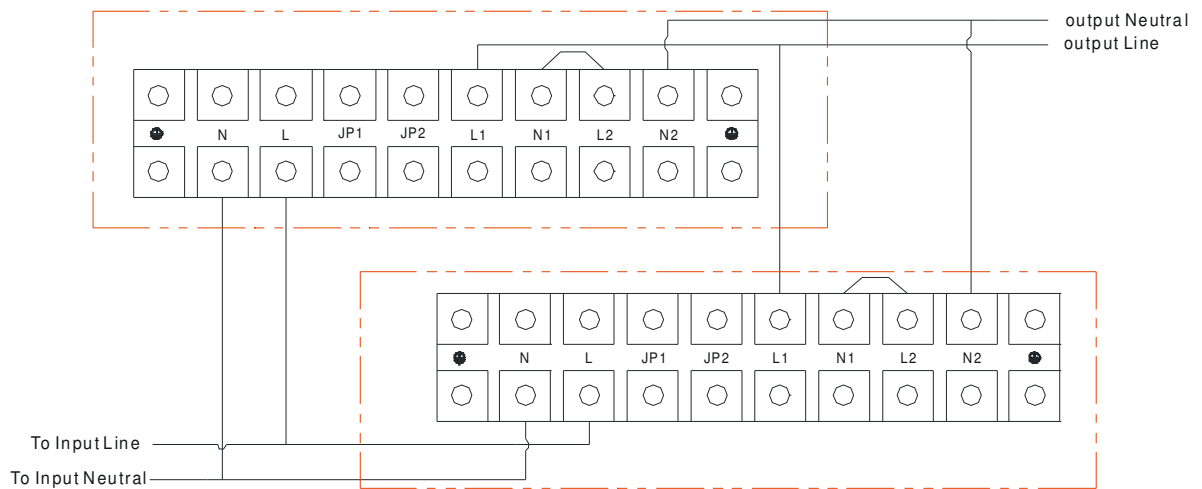

Figure 5.3.2

Important Note: If the UPS is used in Single Mode, JP1 and JP2 must be connected by 10AWG (6mm2). If the UPS is used in Parallel Mode, the Jumper between JP1 and JP2 must be removed.

5.3.2.1 Operating procedure of installating a new parallel system

1. Prepare the input and output cables, the input/output breaker (switch) and the parallel cable for all UPS to be connected in parallel.

2. Make sure power feed to the parallel system has been cut.

3. Check whether the short circuit jumper connecting the JP1&JP2 on the terminal block of all UPS have been removed.

4. Connect all the input and output wiring, input and output breaker, following the marking on the UPS. And to connect parallel cables, the female end of the parallel cable connects with the male connector on the UPS, and the male end of the parallel cable connects with the female connector on the UPS, the parallel cables of the parallel form a close ring for best operation reliability.

5. Check wiring. Refer to Figure 5.3.2

6. Keep the output breaker of the UPS off. Open the cover of maintenance bypass switch of each UPS. Turn all of the UPS to maintenance bypass switch from "UPS" state to "BPS" state.

7. Keep the mains input breaker on the rear panel of the UPS off. Turn on the EXTERNAL input breaker of the UPS. Check the output voltage of each UPS on the terminal block. They should be the same. And check the voltage difference between the output phases ("L" terminal) of each UPS, the voltage difference should be less than 1V, otherwise, there is probably a wiring issue. Check and correct it.

8. Keep all the MBS on "BPS" state, Assemble the maintenance bypass switch cover back to place.

9. (Connect the external battery to each UPS, if they are long backup time model "S"), Turn on mains input breaker on the rear panel of all UPS, check the status of each UPS, all UPS should transfer to bypass mode, and the number in the parallel system indicated in the display should be same as the real number of UPS in parallel. If incorrect, check the parallel cable or one of the UPS has a problem. Do not continue until the problem is solved.

10. Turn on all of the UPS by pressing the "ON" button of each UPS in turn and observing their LCD display. Observe if all the UPSs transfer to the INV mode at the same time. Measure the voltage between the JP1 and JP2 on the terminal block of each UPS to check if the voltage is less than 1V. Or measure the impedance value between JP1 and JP2 to check if

the resistor has a short circuit. If the voltage difference is more than 1V, the output relay of the UPS may have problem and can not be closed.

11. Measure the voltage between JP2s of each UPS (JP2 of Unit I-JP2 of Unit II, and so on) to check if the voltage value is less than 5V (Generally 2V). If the difference is more than 5V. You need to check that whether the parallel cable or the parallel board is ok.

12. Measure the inverter output voltage between JP2 and input neutral on each UPS, the inverter output voltage of each UPS should be as close as possible, if the voltage difference higher than 1V, please execute a calibration process.

13. Turn off all of the UPS systems that are running. After all of them have transferred to the bypass mode, disassemble the maintenance cover of each UPS and turn the maintenance switch from "BPS" to "UPS" and screw the maintenance cover right back.

14. Turn on the UPSs and the system should work in parallel operation.

5.3.2.2 Operating procedure of adding a new UPS to the parallel system
1. Prepare the input and output cables, the input/output breaker (switch) and the parallel cable.

2. Keep the input and output switch of the UPS to add in the off position. Connect the input and output cables as well as the battery pack according to the marking on the terminal block. Remove the short connection wire between JP1 and JP2 on the terminal block.

3. Turn off the UPS that are currently running. After all of the UPSs that are running transfer to the Bypass mode go to the next step.

4. Disassemble the maintenance bypass switch cover of each UPS (including the one to add) and turn the maintenance bypass switch from "UPS" to "BPS" state, then switch off the input breaker on rear panel of each UPS.

5. *If the UPS system that is running is single UPS, you need to remove the short connection wire between JP1 and JP2 on the terminal block.*

6. Disassemble the cover of the parallel port on the new UPS, plug one end of the parallel cable into parallel communication port and screw the connector; the other end of the parallel cable is connected to parallel communication port of the working UPS, screw the connector, and screw covers of the parallel port of all UPSs.

7. Turn on the mains input breaker of the new UPS; Measure the voltage difference between the output line wires in the new UPS and the parallel system. If the difference is more than

1V, check if the wirings are abnormal. If the difference is less than 1v, the output breaker of the new UPS can be turn on.

8. Turn on the mains input breakers of all of the UPSs (including the new UPS) and the battery breaker in the parallel system. After all of the UPSs transfer to the bypass mode, make sure all maintenance bypass switch are on "BPS" state, then screw the maintenance cover back again.

9. Turn on all of the UPS by pressing the "ON" button of each UPS in turn and observe their LCD display. Observe if all the UPSs transfer to the INV mode at the same time. Measure the voltage between the JP1 and JP2 on the terminal block of each UPS to check if the voltage is less than 1V. Or measure the impedance value between JP1 and JP2 to check if the resistor is short circuited. If the voltage difference is more than 1V, the output relay of the UPS may have problem and can not be closed.

10. Measure the voltage between JP2s of each UPS (JP2 of Unit I-JP2 of Unit II, and so on) to check if the voltage value is less than 5V (Generally 2V). If the difference is more than 5V. You need to check that whether the parallel cable or the parallel board is normal.

11. Measure the inverter output voltage between JP2 and input neutral on each UPS, the inverter output voltage of each UPS should be as close as possible, if the voltage difference higher than 1V, please execute a calibration process.

12. Turn off all of the UPS systems that are running. After all of them transfer to the bypass mode, disassemble the maintenance cover of each UPS and turn the maintenance switch from "BPS" to "UPS" and screw the maintenance cover right back.

13. Turn on the UPSs and the system work in parallel operation

.

Note: If the UPS is abnormal in the above process, please perform maintenance according to the steps of removing single UPS.

5.3.2.3 Removing a UPS from the parallel system

1. **If you need to remove the UPS in normal running mode, press the "OFF" button of the UPS to be removed twice in succession to turn off the UPS and the UPS will also cut off its output;**

2. Disconnect the output breaker, the input breaker on the rear panel of the UPS, the external input breaker, and battery breaker of the UPS that need to be removed.

3. Disassemble the cover of maintenance bypass switch of the UPS that needs to continue to work. Turn the maintenance bypass switch from "UPS" to "BPS", turn off the input mains breaker on the rear panel, and the battery breaker of the remaining UPS

4. After all UPSs are shutdown, disassemble the cover of the parallel port on the UPS that is connected to the parallel cable of the UPS that need to be removed. Remove the parallel cable and screw the cover of the parallel port back again.

5. Disassemble the cover of the parallel port of UPS that need to be removed and remove the parallel cable.

6. Connect the parallel cables of the remaining UPSs in parallel correctly connected, to get most safety, the parallel cable should be connected from a closed ring in the parallel system, after checking cable has been correctly connected, screw the cover of the parallel port back right back to place.

7. Disassemble the input /output/battery wiring of the UPS to removed.

8. If the remained UPS system becomes a single UPS system and will work in unitary mode after removing the single UPS, it is strongly recommended to connect the short connection wire of the JP1 and JP2 located on the Terminal block of the remained UPS.

9. Close all of the input mains breakers of the remained UPSs. After all UPSs transfer to the Bypass mode, turn the UPS maintenance switch from "BPS" back to "UPS" and screw the maintenance cover in place. Then turn on all of the UPSs and the system should now work normally in parallel operation or unitary operation.

10. *If the removed UPS will be used in unitary mode, JP1 and JP2 on the terminal block should be connected with a short connection wire!*

Notes for removing UPS from parallel system:

1. The UPS in the parallel system will cut off its output if the "OFF" button is pressed twice in succession.

2. Make sure that the maintenance switches of all UPSs (including new unit) are in the same positions (either in the positions of "UPS" or "BPS") when the UPS parallel system is going to be in INV mode!

3. Normally, when maintenance bypass switch cover is opened, the UPS will transfer to bypass automatically, and the maintenance bypass switch can be operated, but for safety reasons, check the status of the UPS from LED display, make sure the UPS is on bypass mode before operating maintenance bypass.

5.4 Trouble Shooting

When the UPS is malfunctioning or an abnormality occurs, troubleshooting is needed. Here after, general trouble shooting guidance will be provided.

Basically, we can divide the trouble shooting into three difference levels, to have clear idea how to carry out service and increase service efficiency. Technician can consider selecting the level before starting action based on the service policy, available time and real situation:

a) System level

Just find out what happen to the system or the unit, replace a spare unit if the problem is not recoverable. It will take less time to finish the troubleshooting, but maybe highest cost

b) Board level

Find out which PCB board failed, and replace the PCB board. It will take medium time medium cost to finish the troubleshooting.

c) Component level

Find out which component failed, and replace the component. It will take longest time but less hardware cost to finish the troubleshooting.

So most important of all should be finding out what happened. Before taking any action, collect relative information that would normally would be valuable. Generally, the information maintenance technicians can collect include:

1. Application electrical environment

   a) Input mains voltage
   b) Input mains power quality
   c) Input mains wiring, grounding condition
   d) Capacity of the battery bank.
   e) The type of load, capacity of the load

2. Physical environment of the UPS
   a)   Temperature, Ventilation

b) Humidity

c) Dust or Salt

d) Vibration?

3. Event before the problem occurs

4. Record of fault or warning message.

After getting this information, choose a starting point and direction for finding the problem according the information obtained. Section 5.4.1 provides a general guidance for selecting a guidance point

In most case, from the fault /warning code presented on the display, the problem can be identified with the help of fault code definition and possible cause table provided in section 5.4.2.

5.4.1 How To Start
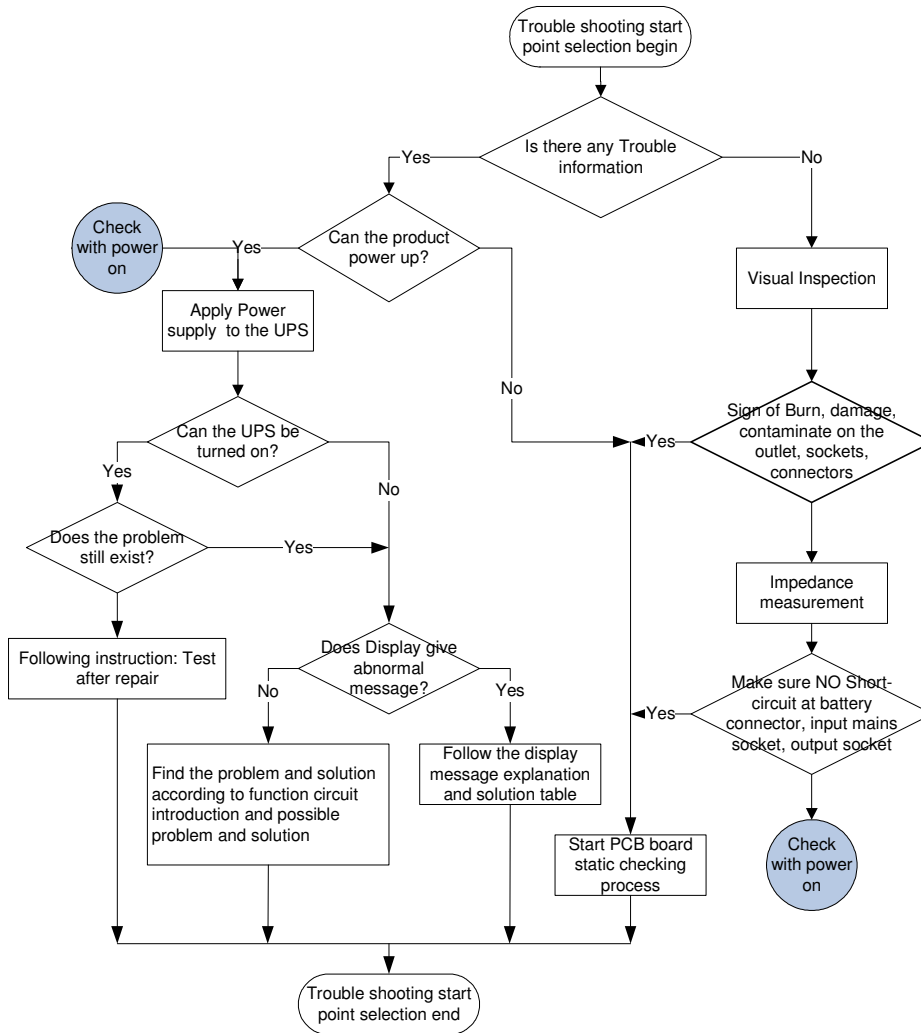
Figure 5.4.1. General Guidance to start a trouble shooting process

5.4.2 Fault code definition and possible points

LED display	Buzzer	Fault Name	Definition	Possible failure point	
				PCB Board	Component/Circuit
#1,#4	Keeps Beeping	Bus abnormal	The DC BUS voltage higher or lower than the predetermined level. Last for a certain of time.	The PSDR board or control board	Mainly check that the IGBT and SCR etc power components for the PFC and the utility power SCR are well. Meanwhile check that the components on the drive circuit are well.
#1,#5	Keeps Beeping	INV Fault	When inverter works, Inverter output voltage become abnormal, higher or lower than predetermined level for a certain of time.	The PSDR board or control board	The power components for power INV and on the drive circuit are normal. Check that the IGBT protective circuit and some PFC components are normal.
#1,#2	Keeps Beeping	Overload	The UPS is overloaded, and the overload time exceeds the endurance time.	Remove unimportant loads to be less than 90%. Restart the UPS to enter into the INV mode if it is fault at the moment.	
#1,#6	Keeps Beeping	Over temperature	Temperature of the internal critical components increased up to protective threshold.	PSDR	Over temperature can be caused by external environment, over load, or bad ventilation, Make sure the ambient temperature is within the operation range and the ventilation should not be blocked. Otherwise the there may be some hardware failure 1. Over temperature may caused by failure of snubber circuit of INV/PFC. 2. Or probably cause by a incorrect detection, it maybe misplayed by the control board or the NTC on the CN107 of the PSDR board is damaged. 3. Fans driver failure cause also can over temperature
#1,#2, #5	Keeps Beeping	INV output short circuit	When the UPS inverter output very high current and output voltage keep less than 50V.	Check the load, clean short-circuit on the output of the UPS.	
#1,#3 #4	Keeps Beeping	Communication abnormal	The CPU cannot establish communication.	The control board or the communication cable can be damaged.	
#1	Keeps Beeping	Battery Open	The UPS transfers to battery mode but the battery bank is not properly connected or battery is very weak can't support the UPS continuing work on battery mode	Check the battery or battery connection, replace the damaged battery, replace failed battery connector/breaker, otherwise, battery-detecting circuit may damage.	

Code	Beeping	Fault	Description	Related part	Solution
#1,#4,#6	Keeps Beeping	INV relay sticked	The UPS detected voltage at inverter output even when the inverter stop working.	PSDR	INV relay RY1 & RY2 on the PSDR board is in well condition.
#1,#5,#6	Reserved				
#1,#3,#6	Keeps Beeping	The battery SCR damaged	Battery over charged, battery voltage reach upper protective threshold.	PSDR, CHARGER	1. Check that the battery SCR (Q305) or the battery relay (RY3、RY4) on the PSDR board 2. Check that the components for the battery switch driving circuit are normal. Lastly, check the circuit of the utility power SCR part. 3. If the PSDR board is ok, it may indicate that the output of the charger is abnormal, failure point very like lie in feedback circuit.
#1,#2,#3,#6	Keeps Beeping	Parallel communication abnormal	The communication between UPSs in parallel operation is abnormal	Control board, parallel board, communication cable	Communication circuit.
#1,#2,#5,#6	Keeps Beeping	Current Un-share	The output current of each UPS in parallel is not equal.		1. Each UPS in parallel system need to becalibrated 2. Replace a parallel cable 3. Output power wiring of each UPS should be equal
#1,#3,#4,#5,#6	Keeps Beeping	Error Model	Model Pin configuration error, the CPU does not recognize the configuration.		Ensure the model pin plugs in right position. And correct configuration
#1,#2,#3,#4,#5,#6	Keeps Beeping	SCI RX Error	The Fault code is "18"; The UPS beeps continuously.		The control board is failing..
#1,#2,#3,#4	Keeps Beeping	Negative Output Power Fault	The Fault code is "20"; The UPS beeps continuously..		When the output power on the INV terminal is over -800W, the fault signal will be sent. Firstly, check that the input and output connections are correct. And then check that the INV relays RY1、RY2 in well condition, or the bypass SCRQ207、Q208 and their drive circuit are well.
Warning message					
#1,#4,#5	Beeps every 10 seconds.	ID Loss	The Warning code is "21"; The buzzer		UPS ID needs to be correctly set
#1,#2,#6	Beeps every second	Fan abnormal	The CPU failed to detect the rotation status. The fans may stop		Check that the fans Check the fan's driving module.
#1	Beeps every second	CHGR board abnormal	The charger stopped working, and the battery power is dissipated by the SPS.	Charger board Charger wiring	1. Charger ON/OFF wire 2. Refer to Component list of charger

#1,#3, #5	Beeps every second	IP Fuse Open	I/P Mains fuse open	PSDR	Check the IP fuse.

NOTE; LED indicators:

Indicator 1 (Fault)

Indicator 6
Indicator 5
Indicator 4
Indicator 3
Indicator 2

AC INPUT UPS ON BYPASS BATTERY

ALARM

Power On / Alarm silence

Power Off
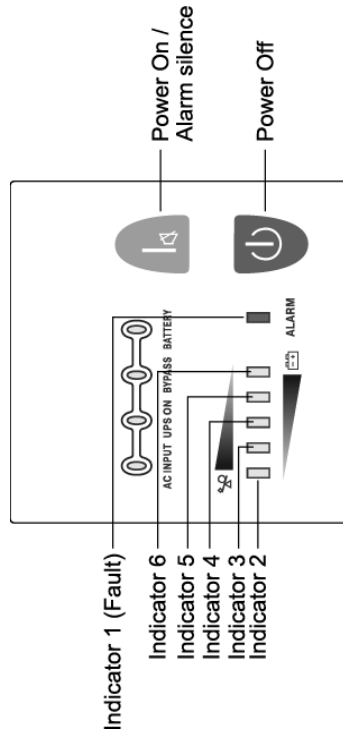
● Bypass LED (orange LED): Whenever the bypass LED is turned on, it shows that the loading current is supplied directly from the utility power.

● Utility power LED (green LED): Whenever the utility power LED is turned on, it shows that the utility power is normal.

● Inv LED (green LED): Whenever the INV LED is turned on; it shows that the loading current is supplied from utility power or battery via the inverter.

● Battery LED (orange LED): Whenever the battery LED is turned on, it shows that the loading current is supplied from battery via the inverter.

● Fault LED (red LED): Whenever the fault LED is turned on, it shows that the UPS is in abnormal condition.

● #2-#6 LEDs (the #2 LED is orange and the #3-#6 LEDs are green): These LEDs indicate the percentage of the load capacity in utility power mode or battery capacity level in battery mode.

40

5.4.3 Quick Problem Identification process

```
                    ┌──────────┐
                    │  Begin   │
                    └────┬─────┘
                         │
                         ▼
            ◇ If the panel LED light ──No──▶ ┌─────────────────┐
              and fan rotates ?              │ Check SPS and   │
                         │                   │ Charger module  │
                        Yes                  └─────────────────┘
                         │
                         ▼
            ◇ If the panel LED display ──No──▶ ┌─────────────────┐
              normally?                        │ Check Control   │
                         │                     │ board and LED   │
                        Yes                    │ board           │
                         │                     └─────────────────┘
                         ▼
    ◇ If start up the ups normally ──No──▶ ◇ If Bus soft-start ok and
      with only DC Source?                   BUS voltage stable?
```
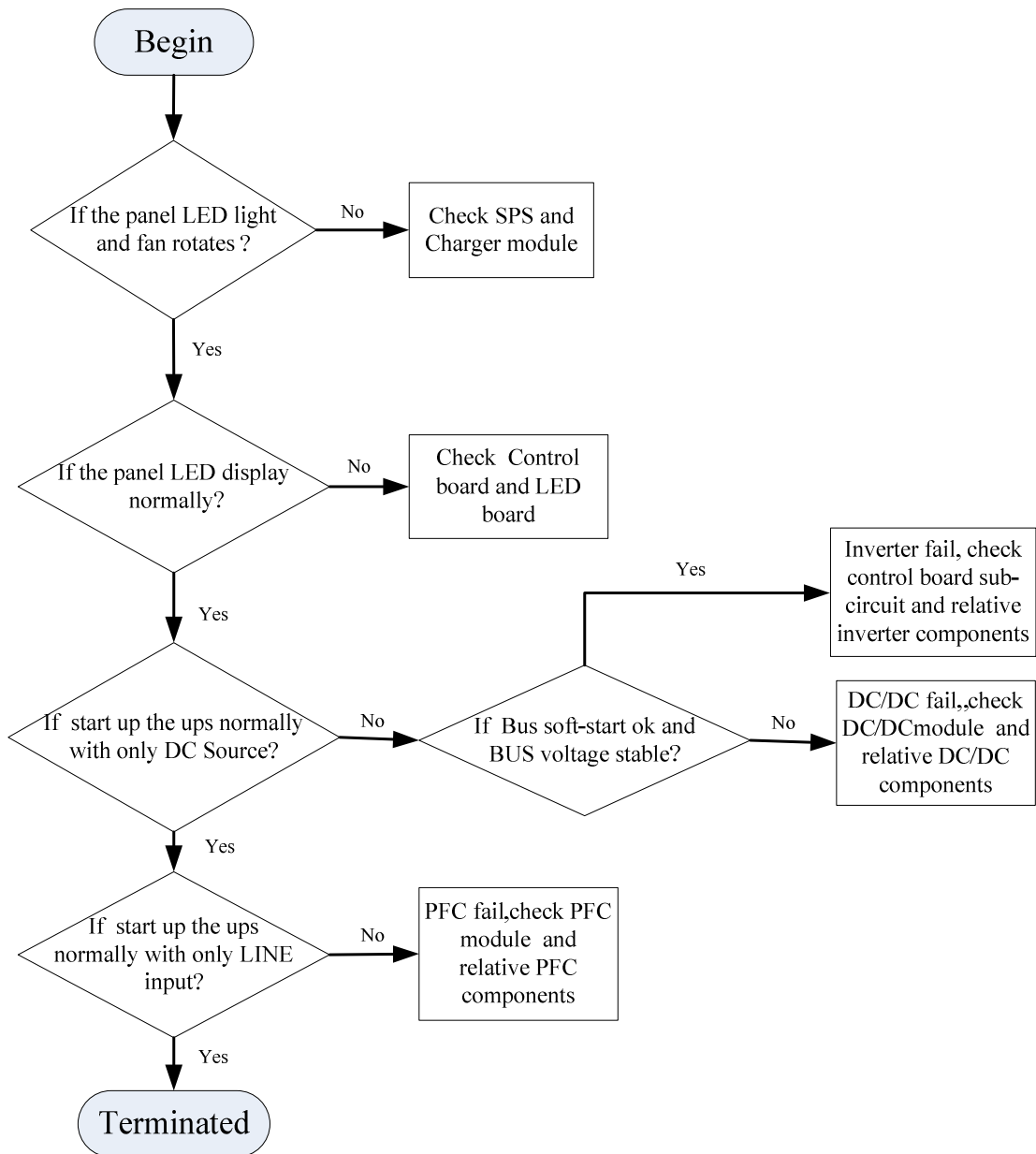

Figure 5.4.3.1 Quick problem identification process.

If the panel LED light and fan rotates ? — No → Check SPS and Charger module — Yes ↓

If the panel LED display normally? — No → Check Control board and LED board — Yes ↓

If start up the ups normally with only DC Source? — No → **If Bus soft-start ok and BUS voltage stable?** — Yes → Inverter fail, check control board sub-circuit and relative inverter components — No → DC/DC fail,.check DC/DCmodule and relative DC/DC components — Yes ↓

If start up the ups normally with only LINE input? — No → PFC fail,check PFC module and relative PFC components — Yes ↓

Terminated

5.4.4 Static Impedance Characteristic Of PCB board.

After finding out the failure board, to find the broken component, you can measure the impedance of the major components with a multimeter. Following tables record Static Impedance Characteristic Of PCB board for reference.

5.4.4.1 PSDR Board

a. IP Rectifier parts:

Item	Checked components		DVM Function	Reference Value	Fail Condition
1	F301, F302		Ω	0Ω	open
2	Q301 Q302	(A, K)	Ω	≈1.4MΩ	short
		(G, K)	Ω	≈10Ω	short

b. Voltage boosting parts:

Item	Checked components		DVM Function	Reference Value	Fail Condition
1	Q306, Q308、 Q310	(E, C)	Ω	≈800kΩ	short
	Q307, Q309、 Q311	(G, E)	Ω	15.8kΩ	short or open
2	D308, D310		DIODE	≈0.35V	0V
3	R325, R331, R334, R342、 R337、R328		Ω	10Ω	open
4	R390, R388, R389、 R393、 R392、R391		Ω	2.2Ω	open
4	D302, D304, D306, D303、 D305、D307		DIODE	≈12Ω	open

c. Battery switch parts:

Item	Checked components		DVM Function	Reference Value	Fail Condition
1	F303、F304		Ω	0Ω	open
2	Q305	(A, K)	Ω	≈2.5MΩ	short
		(G, K)	Ω	≈10Ω	short

d. INV parts:

Item	Checked components	DVM Function	Reference Value	Fail Condition

1	Q201, Q202, Q203,Q204	(E, C)	Ω	≈100kΩ	short
		(G, E)	Ω	23.5kΩ	short or open
2	D201, D202, D203.D204	DIODE	≈0.36V	0V
3	R201, R202, R208, R209	Ω	10Ω	open
4	R203, R204, R210,R211	Ω	36Ω	open
5	D210, D211, D212.D213	DIODE	46Ω	open

5.4.4.2 Charger of standard model

Item	Checked components		DVM function	Reference Value	Fail Condition
1	F901, F902, F903, F904, F905, F906,		Ω	0Ω	Open
2	Q907,Q908,	(S, D)	Ω	≈1.7MΩ	Short
		(G, S)	Ω	32Ω	Short or open
3	D901, D902, D903		DIODE	≈0.4V	0V
4	Q909	(A, K)	Ω	≈20MΩ	Short
		(G, K)	Ω	≈42Ω	Short

5.4.4.3 Charger of long backup time model

Item	Checked components		DVM function	Reference Value	Fail Condition
1	F1		Ω	0Ω	open
2	Q301 Q105	(E,C)	Ω	≈1MΩ	short
		(G,E)	Ω	10kΩ	short or open
3	D303		DIODE	≈0.4V	0V
4	R315		Ω	10Ω	open
5	R319		Ω	1kΩ	open
6	D106		DIODE	≈0.4V	0V
7	R112 , R159		Ω	10Ω	open
8	Q04	(A,K)	Ω	≈1MΩ	short
		(G,K)	Ω	≈12Ω	short
9	R320, R321, R322, R340,R339, R341		Ω	≈0.5/6 Ω	open

5.5 Component Level Repair

After finding a broken component, replace with a new one. The designation & part number of the component can be found in the spare part list in the appendix.

Generally, A driver or driving circuit is adopted for each power semiconductor. If the power semiconductor is broken, measure the driver resistor (listed in the table in section 5.4), if the driving resistor fails, the driver is very likely broken, so replace the driving module.

Fuse is normally blown due to failure of other parts; so, please check very carefully if fuse found blown. And just change the fuse may not cure the problem and probably cause more damage when power apply after just replace the fuse.

The PCB copper track needs to also be inspected. It can be opened for component short-circuit, or corrosion, vibration or mechanical impact during disassembling the PCB.

5.6 Test After Repair

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

1. Connect all of boards, cable, and connector right to place. Please Note the label mark the designation of terminal/connector the wire/cable should be connected to.

2. Check the Wiring again.

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 240~260Vdc/3 Amp (limited current).

4. Press the ON-switch on front panel for 1 second until you hear the Buzzer beeps and before release the button, 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, no LED indicator is lightened. 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. If the UPS works on the battery mode, stop the UPS; apply AC power to the UPS, the same if possible, current/power limitable AC source will be preferred. Turn 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 cases result of step 7 and 8 can represent whether a product is in normal condition, If possible, however, for more reliability, perform quick check following procedures show in the table below.

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

The following table is a checklist of test items for reference. Step2,3,4, are optional, but are recommended

Test items	Test procedure	Specification
1. Visual inspection	Check all of the wiring, connector, terminals	Should be correctly assembled
2.Dielectric test	Temporarily disassemble the grounding bolt on the IPEMI Apply dielectric test probe between I/P L&N and Grounding Earth	>100mΩ@500VDC
3. Grounding Impedance test	The chassis to the ground terminal	<100 mΩ
4.Hipot test	1. Short-circuit DC BUS cap(+BUS,-BUS,N) by a short circuit fixture 2. Apply Hipot test between L-N-battery+ battery- and Ground 3. If test PASS, Remove the short-circuit fixture from the DC-BUS Bars, Lock the I/P EMI grounding bolt.	@2200VDC <10mA 3sec
5.Turn on UPS with DC power source	1. Make sure all power supply to the UPS remain off 2. Clip the voltage probe to the +BUS – N , and –BUS-N, for measurement of the DC-BUS voltage 3. Set the DC power source current limiting threshold @3A, output voltage 260V, turn on the DC power output 4. Turn on the UPS. 5. Check the average voltage of positive and negative BUS, inverter output voltage, executed calibration if the BUS voltage and Output voltage is not within the expected value range. 6. If a battery low fault (code 11) appears, try turn on the UPS again after the UPS shutdown. If UPS fail to try on after 3 try, the UPS should be check again 7. If BUS fault (code xx) occurs, that means either the voltage boosting circuit or the controller still have problem.	1. The UPS can be turn on and working battery mode 2. +BUS.V =360+/-5V 3. -BUS.V =360+/-5V 4. +BUS.V-(-BUS.V)<1V 5. Inverter output voltage =230V+/-1%
6.Turn on UPS with mains	1. If the UPS can work properly on battery mode, and necessary calibration has been finished, turn off the UPS 2. Apply mains power supply to the UPS 3. Turn on the UPS 4. If possible, Check the waveform of output voltage, THDv%, DC offset	1. The UPS works on Line mode 2. There is no obvious distortion on the waveform 3. DC offset voltage <200mV
7.Test with rated	1. On line mode, Apply RCD load of rated power	1. No Interruption

load	to the output of the UPS	2. THDV%<6% @ Non-linear full load
8. Test with over load	1. On line mode, Apply RCD load of 130%~150% of rated power to the output of the UPS 2. with draw the load, the UPS will transfer back to the line mode	The UPS transfer to bypass mode in 1s after over load apply.
9. Endurance test	1. Apply battery of suitable capacity to the battery input of the UPS 2. Control the mains input to turn on/off with timer-control contactor or equivalent equipment. 10s on 2s off, 3. Control rated load to connect/disconnect from the output of the UPS, with timer-control contactor or equivalent equipment, 10s on, 1s off	The UPS work properly on mains interrupt and load impact.

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

Appendix

I. Electrical Specification

MODEL			EL-6K	EL-6KS*	EL-10K	EL-10KS*
CAPACITY	VA/W		6000 VA / 4200W		10000 VA / 7000W	
INPUT	Voltage Range					
		Line Low Transfer	176 ± 3%VAC			
		Line Low Comeback	185 ± 3% VAC			
		Line High Transfer	276 ± 3% VAC			
		Line High Comeback	266 ± 3% VAC			
	Frequency Range		46~56 Hz			
	Phase		Single Phase with Ground			
	Power Factor		≧0.98			
OUTPUT	Voltage		120*2 / 240VAC			
	Voltage Regulation		± 3%			
	Frequency (Synchronized Range)		46~54Hz			
	Frequency (Battery Mode)		50Hz ± 0.05Hz			
	Current Crest Ratio		3:1			
	Harmonic Distortion	Tower Case	≦3% THD (Linear Load)			
	Output Waveform		Pure Sinewave			
EFFICIENCY	To AC Mode		> 84%			
	To Battery Mode					
BATTERY	Tower Case	Battery Type	Panasoinc 12V/7Ah	Depending on the capacity of external batteries.	Panasoinc 12V/9Ah	Depending on the capacity of external batteries.
		Numbers of Batteries	20 pcs		20 pcs	
		Backup Time (Full Load)	7min		5min	
		Recharge Time	7hrs Recharge To 90%		8hrs Recharge To 90%	
		Charging Current (Max.)	2A	4.2A	2A	4.2A
		Charging Voltage	274Vdc ± 1%			
TRANSFER TIME	AC to DC		Zero			
	Inverter to Bypass		Zero			
INDICATOR -	Status		Load Level / Battery Level / Battery Mode / AC Mode / Bypass Mode / Fault			
AUDIBLE ALARM	Battery Mode		Sounding every 4 seconds			
	Low Battery		Sounding every second			
	Overload		Sounding twice every second			
	Fault		Continuously Sounding			

DIMENSION					
	Tower Case (DxWxH)mm	655x300x830			
WEIGHT	Tower Case (kgs)	135 kgs	80 kgs	165 kgs	101 kgs
	Rack Case (kgs)	N/A			
ENVIRONMENT	Operating Environment	0-40°C			
	Relative Humidity	20-95% (NON-CONDENSING)			
	Noise Level	<55dB @ 1 meter			
INTERFACE	Smart RS-232	Software supports Windows 98/NT/2000/XP/2003/ME, Linux, Sun Solaris, IBM Aix, Compaq True64, SGI IRIX, FreeBSD, HP-UX, and MAC			
	SNMP (option)				

II. Model Pin Configuration

To detect and control different model of UPSs, The controller needs the correct model pin configuration to recognize the UPS model.

The MODEL PORT （JP01）of the second version(710-01902-02) or the later version CNTL board should be configured as follows：

Note："1" indicates that the jumper is connected;
　　　　"0"indicates that nothing is connected;

For the pin plugs that are not listed here are not connected.

	pin11 & pin12	pin9 & pin10	pin7 & pin8	pin1 & pin2
T6K	0	0	0	1
T6KS	0	0	0	0
T10K	1	0	0	1
T10KS	1	0	0	0