GTEC UPS MODEL:

MATRIX 6-10 kVA

SERVICE MANUAL

Summary

1 Introduction

1.1 Purpose of the document

This service manual will guide technicians to diagnose, troubleshoot and repair UPS products.

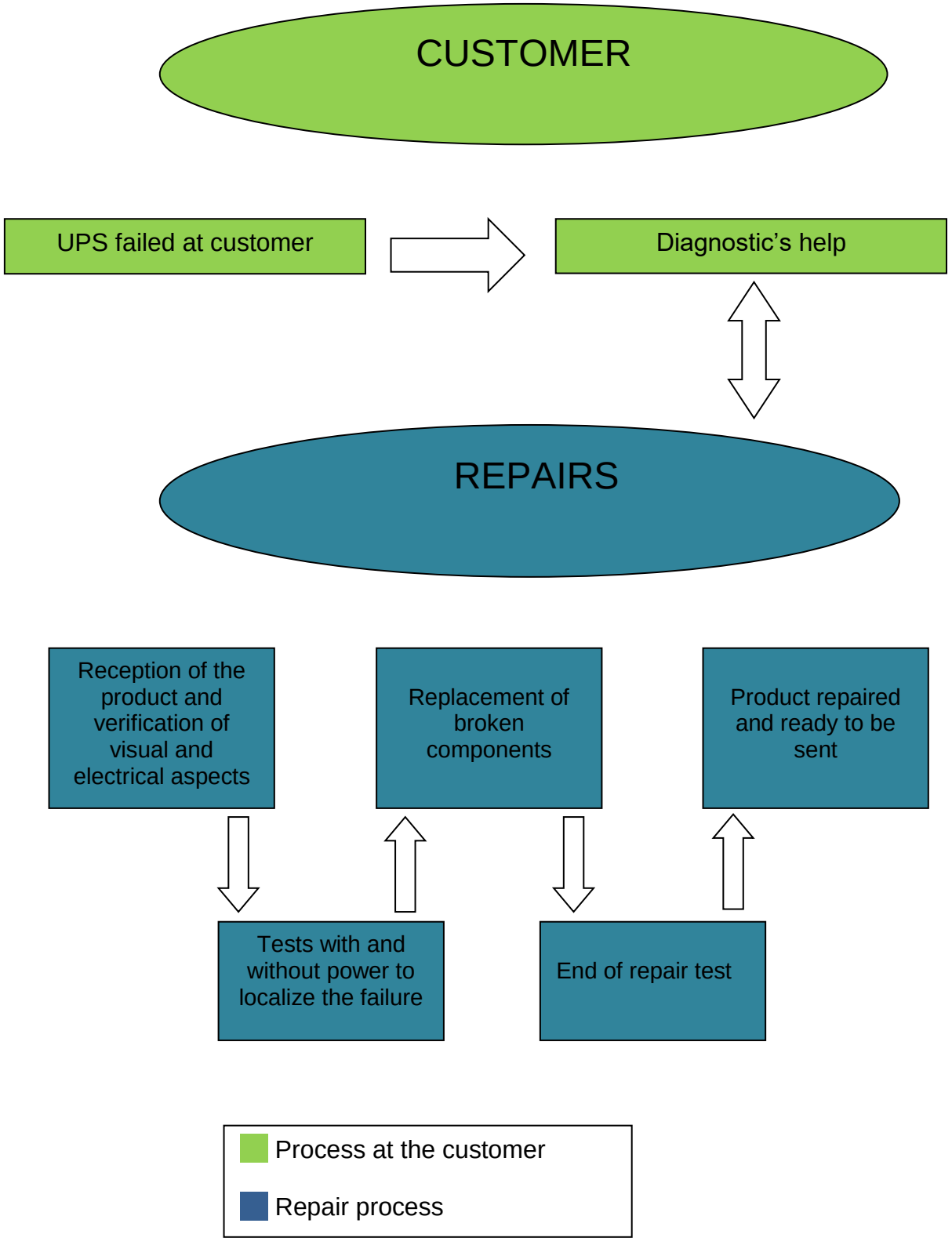
Depending on the countries, the extent of the repair of the product can be to find the failed item or the failed component. This can reduce repair costs.

It allows R&D to provide a manual that meets the expectations of users who include:

- Technical support
- Technician after sales
- Repair personnel
- etc

1.2 Analysis process

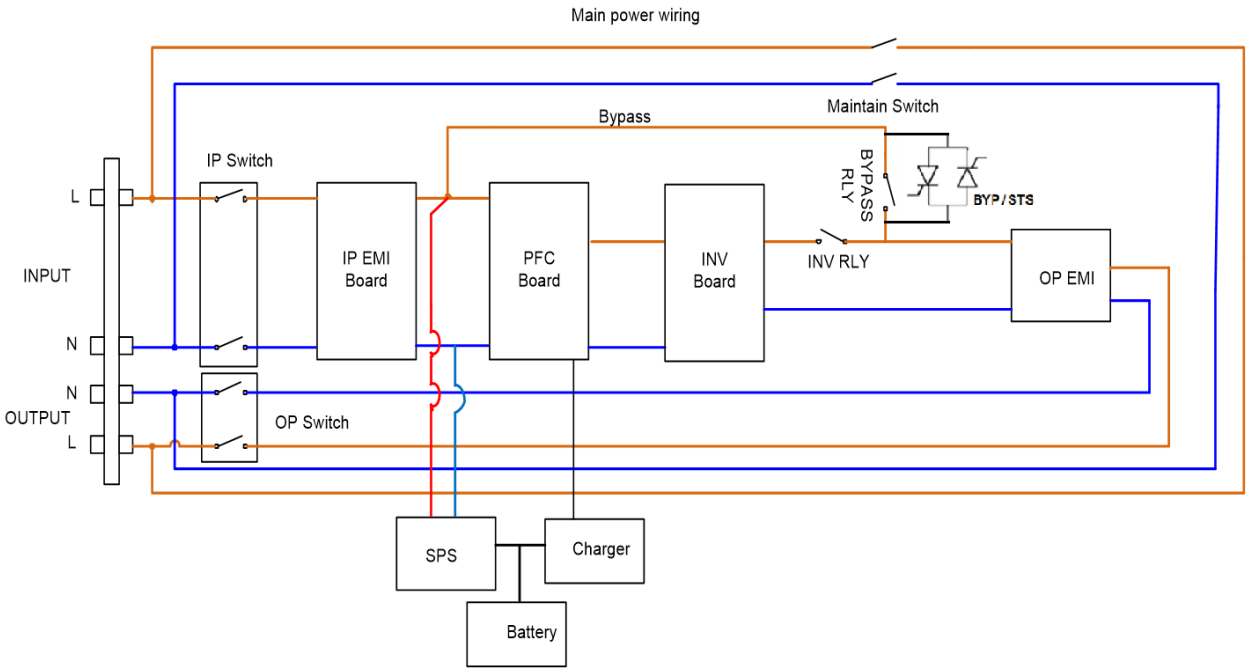
Global process showing the flow from the broken product to the test and repair steps and back to the customer



1.3 Schematic of the UPS

Goal: Identify the Board references by product model / rating

6~10K 1 :1 mode main power block



10K 3 :1 mode main power block

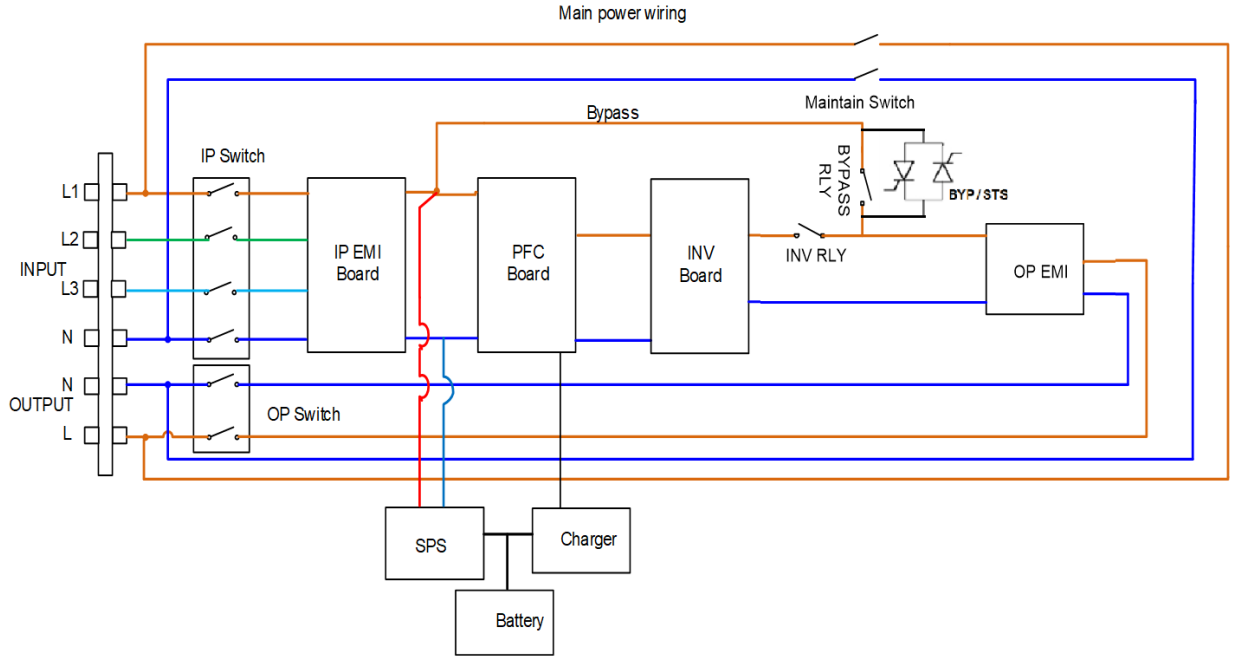


Fig. 1.3.1 6K/10K main power block

Signal and communication block

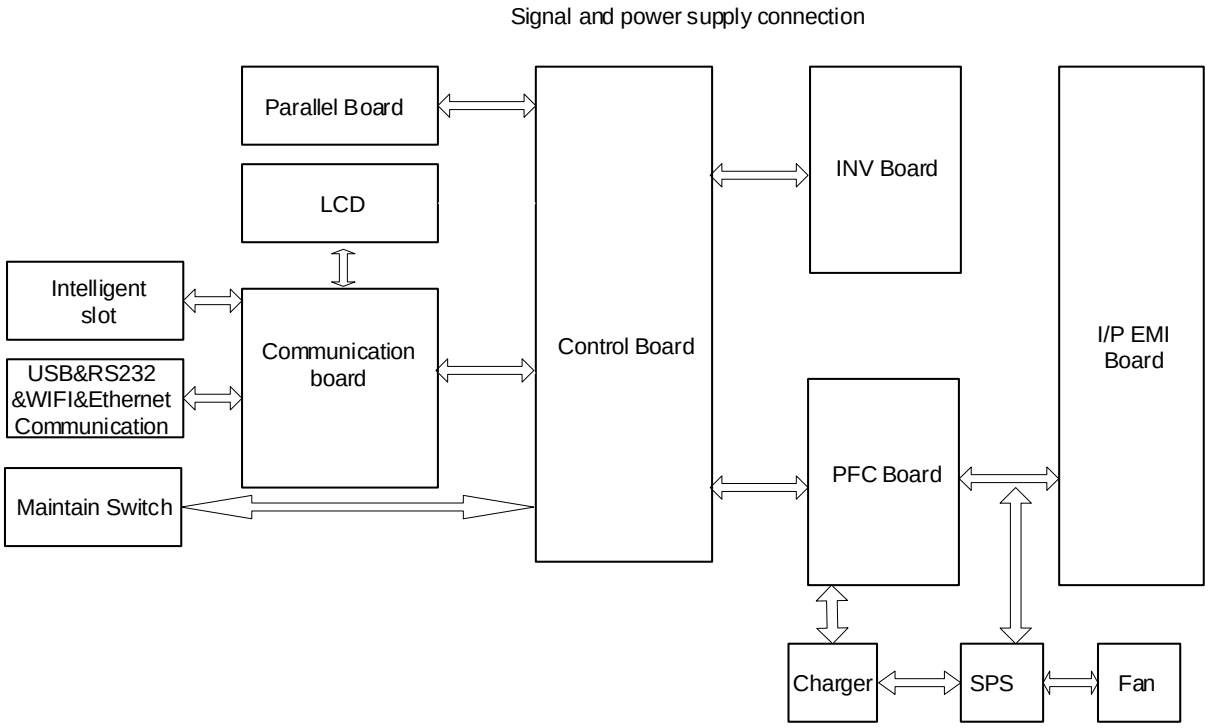


Fig. 1.3.2 6K/10K signal and communication block

CNTL board	**Contains major parts of protection, signaling circuits, regulation and control circuits, and supports LCD interface.**
Communication board	Contains serial communication & USB & WIFI & Ethernet communication interface.
EPO board	Contains EPO, DRY IN/OUT TER.
Parallel board	Contains parallel communication interface.
I/P EMI board	Contains input EMI filter.
PFC board	Contains input REC, PFC, and charger circuit.
INV board	Contains inverter circuit, OP EMI, SPS, INV/BPS RLY control circuit.
RELAY board	Contains relay circuit.
FUSE board	Contains FUSE circuit.

Table 1.3.1 board list and its function

1.4 UPS/PCBA and Spare Part PN

PCB board part number

	6K	6KS	10K	10KS	10K(3:1)	10KS(3:1)
CNTL board	1pcs, same board for whole power range					
Communication board	1pcs, same board for whole power range					
EPO board	1pcs, same board for whole power range					
Parallel board	1pcs, same board for whole power range					
I/P EMI board	1pcs		1pcs		1pcs	
PFC board	1pcs	1pcs	1pcs	1pcs	1pcs	1pcs
INV board	1pcs		1pcs		1pcs	
Only for PDU						
RELAY board	1pcs					
Only for EBM						
FUSE board	1pcs					

Recommended preventative maintenance schedule is shown as below

Description	YEAR																			Quantity	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	6kVA	10kVA
LCD display					○					○					○					○	1	1
Control Board					○					○					○					○	1	1
Interface Board										○										○	1	1
EPO board										○										○	1	1
PSDR					○					○					○					○	0	0
TOP PSDR					○					○					○					○	1	0
BOTTOM PSDR					○					○					○					○	1	0
INV PSDR					○					○					○					○	0	1
PFC PSDR					○					○					○					○	0	1
EMI board					○					○					○					○	0	0
MOV board					○					○					○					○	0	1
O/P relay board			○			○			○			○			○			○			0	0
Parallel Interface Board										○										○	1	1
Cooling fan (rear panel)					○					○					○					○	2	6

2 Security

Goal : To protect against electrical hazards

- Do not make adjustments to the product unless an authorized person is present.
- There is a risk of presence of AC voltage even if the mains power is no longer connected.
- Switch off and disconnect the UPS from the mains power before removing the cover(s).
- Remove the batteries because battery voltage is always present on the power boards, even after the product is switched off.
- To avoid injury, do not touch any connectors or components when the UPS is turned on.
- Charged capacitors can deliver high voltage.
  - Before opening the cover, wait at least five minutes after turning off the UPS.
- After opening the UPS, always check the insulation of all wires, connectors and screws.
- Before restarting the UPS :
  - Check the input (voltage and frequency) before commissioning.
  - Check the polarity of the battery connections and the state of all internal wiring and connectors.
  - Close/Cover the product

Indicate symbol in this service manual :

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**.

1. For qualified service personnel only.
2. DO NOT perform any internal service or adjustment of this product unless another person is capable of rendering first aid and resuscitation is present.
3. Dangerous voltage exists at several points in this product. To avoid personal injury, don't touch any exposed connections or components while UPS is active.
4. Turn off the UPS and disconnect input power cord, and wait until the UPS shuts down completely before removing outside protective cover.
5. AC voltage is always present if the input AC power is still available.

6. High voltage may present at DC capacitors. Before opening the outside cover, wait for at least five minutes after turning off the UPS. Discharge the remaining energy at DC capacitors with resistor before disassembling the power board.
7. Verify input source (voltage and frequency) is within the maximum range before service.

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**.

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

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

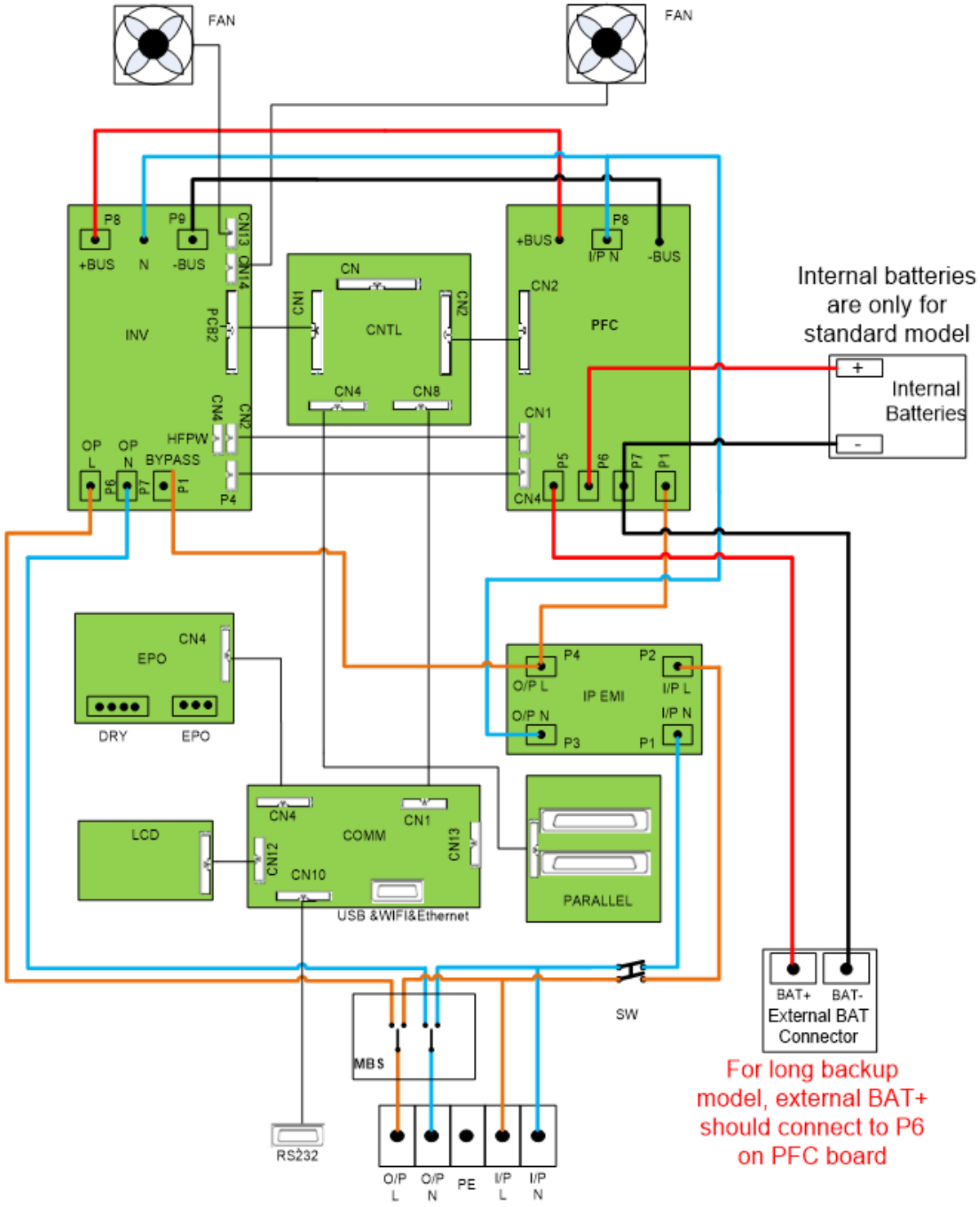
3 Interconnection diagram of products by power rating.

Goal: To know the interconnections and connectors between the boards for **different power ratings** of products.

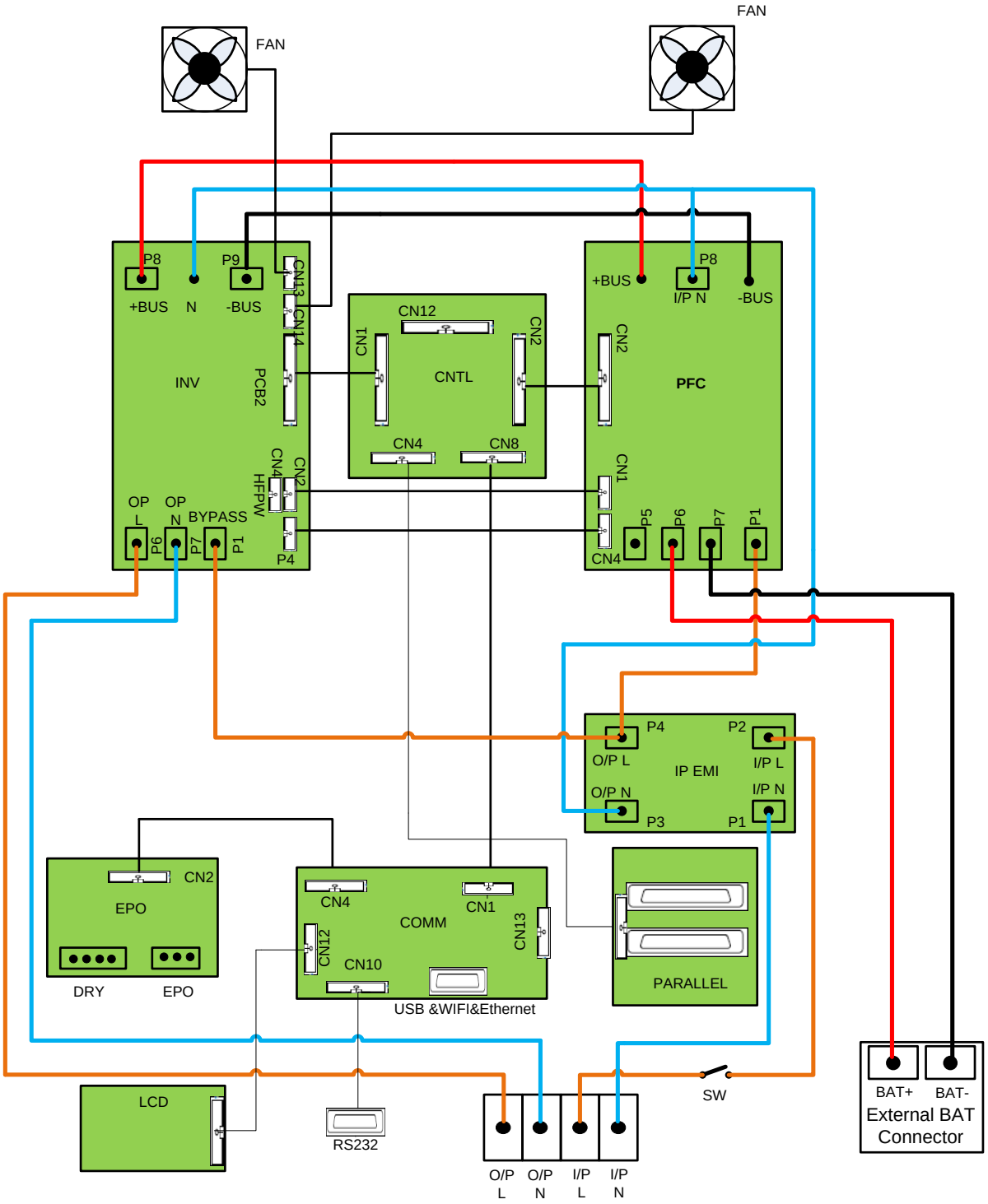
This is demonstrated by showing all the boards and their interconnections including:

- Input
- Output
- COM Cards
- Batteries (internal and external)
- LCD, LED
- Fans
- Etc

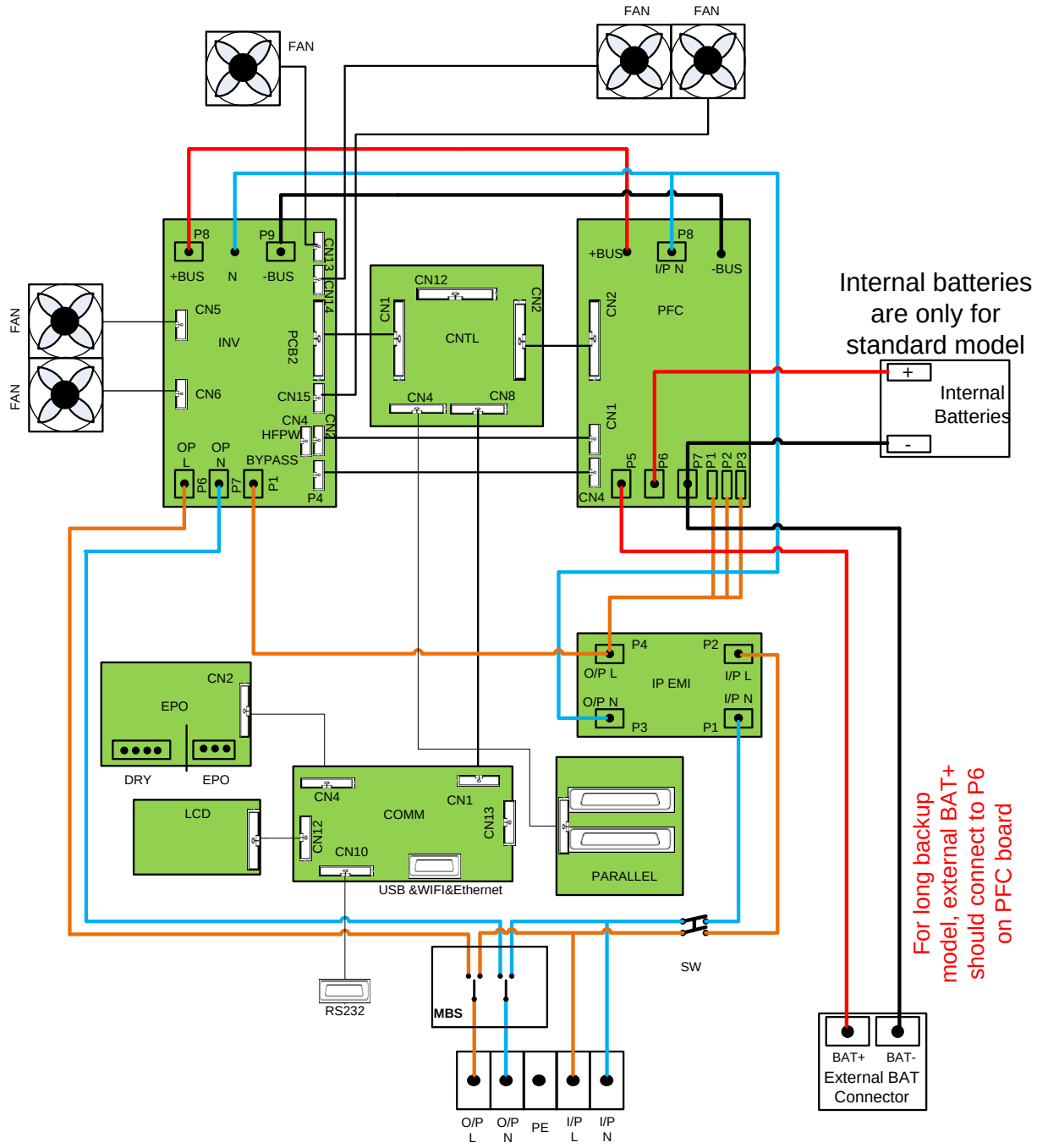
MATRIX UPS ON-LINE 6K Tower interconnection diagram



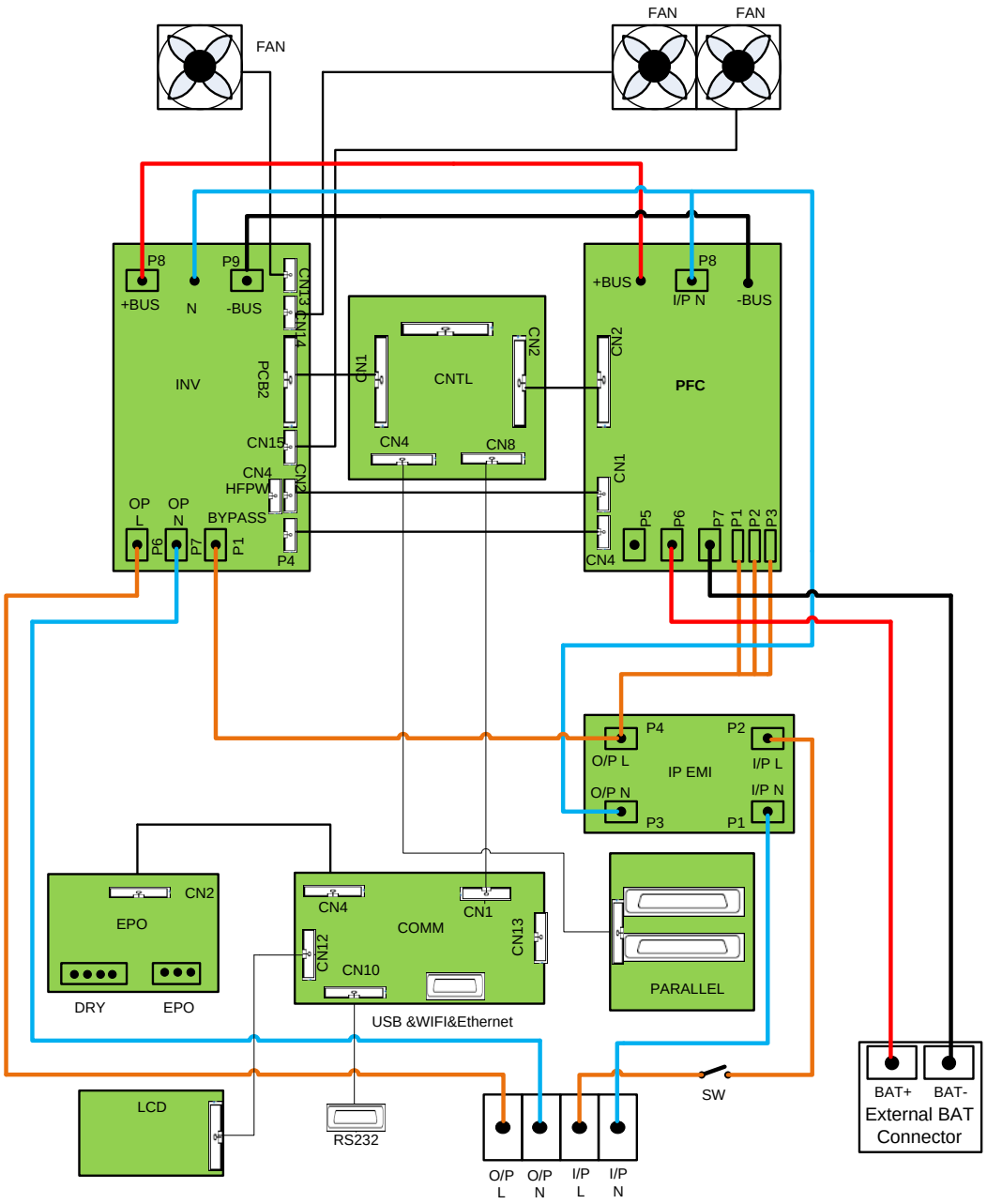
MATRIX UPS ON-LINE 6K RACK interconnection diagram



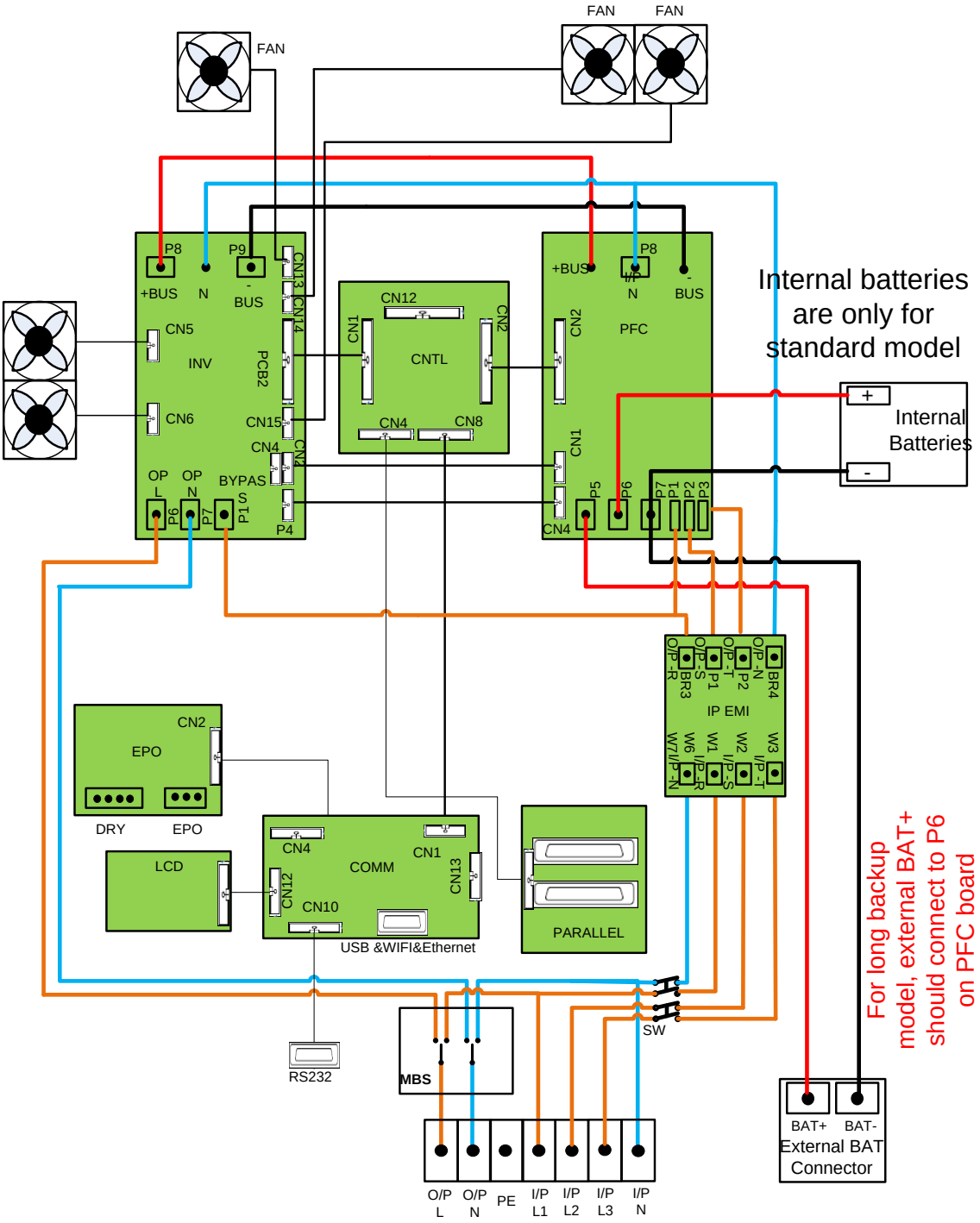
MATRIX UPS ON-LINE 10K Tower interconnection diagram



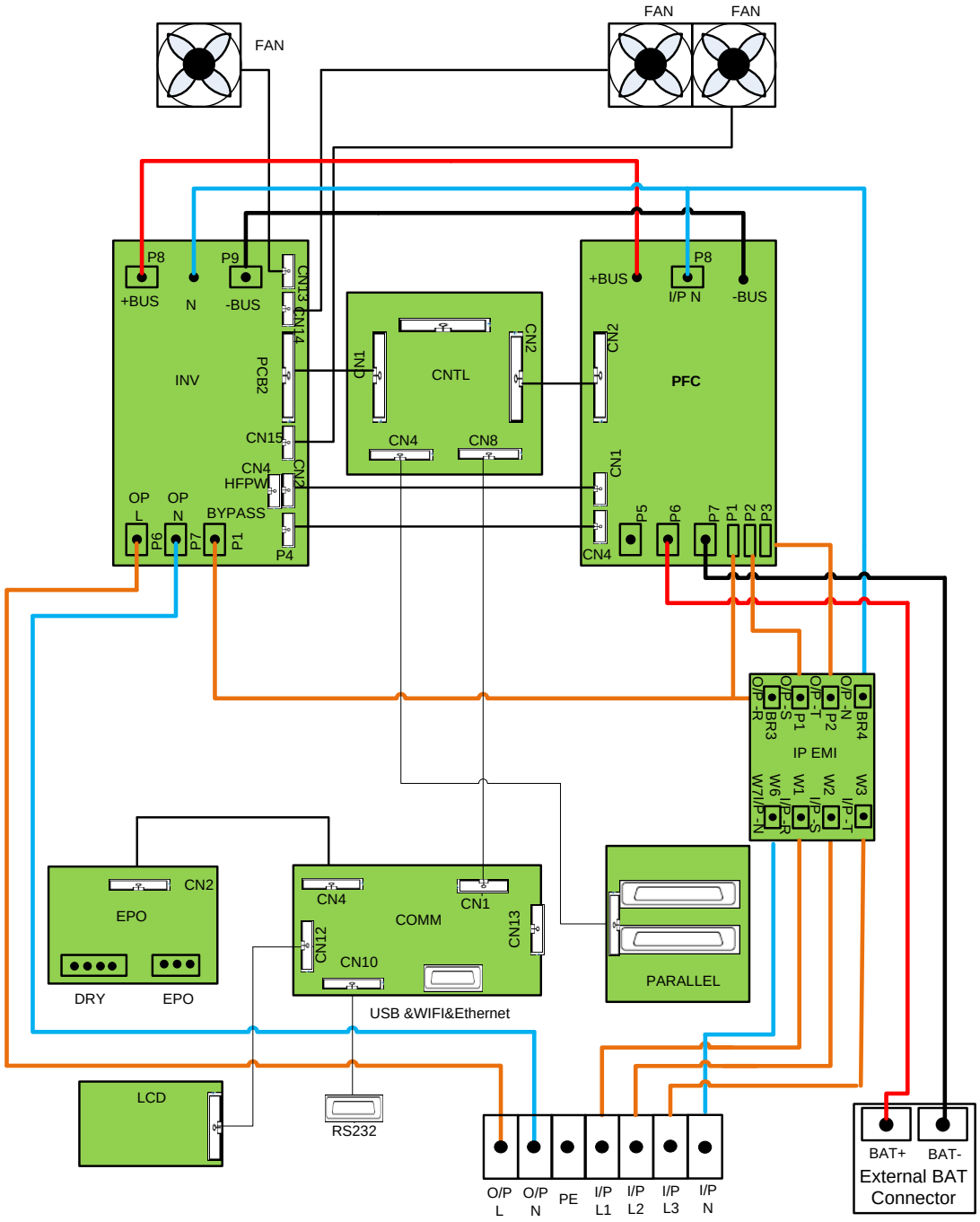
MATRIX UPS ON-LINE 10K RACK interconnection diagram



MATRIX UPS ON-LINE 10K 3:1 Tower interconnection diagram



MATRIX UPS ON-LINE 10K 3:1 RACK interconnection diagram



MATRIX UPS ON-LINE configuration for short pins.

	Jumper for disabling 3pin FAN detection	Jumper for disabling 3pin FAN detection	Jumper for disabling 4pin FAN detection	Tower/Rack Model detection	
	CN7	CN8	CN11	CN1 For 6K CN3 For 10K	Number of short pins
Tower 6K(S)	√	√	√		3
Rack 6K(S)	√	√	√	√	4
Tower 8.5K 3:1					0
Tower 10K(S) 1:1					0
Tower 10K(S) 3:1					0
Rack 10K(S) 1:1	√	√		√	3
Rack 10K(S) 3:1	√	√		√	3

For different models, there are several short pins in INV boards (710-07184-XX or 710-07177-XX). Table shows the short pins configuration and their function.

When repaire one UPS model, its short pins configuration should be correct.

4 Diagrams showing the location of each principle function on the circuit and the assembled board

Goal : To know the location of each function on of all Boards :

- On the circuit diagram
- On the Assembled board

4.1 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 4.1.1 and Figure 4.1.2

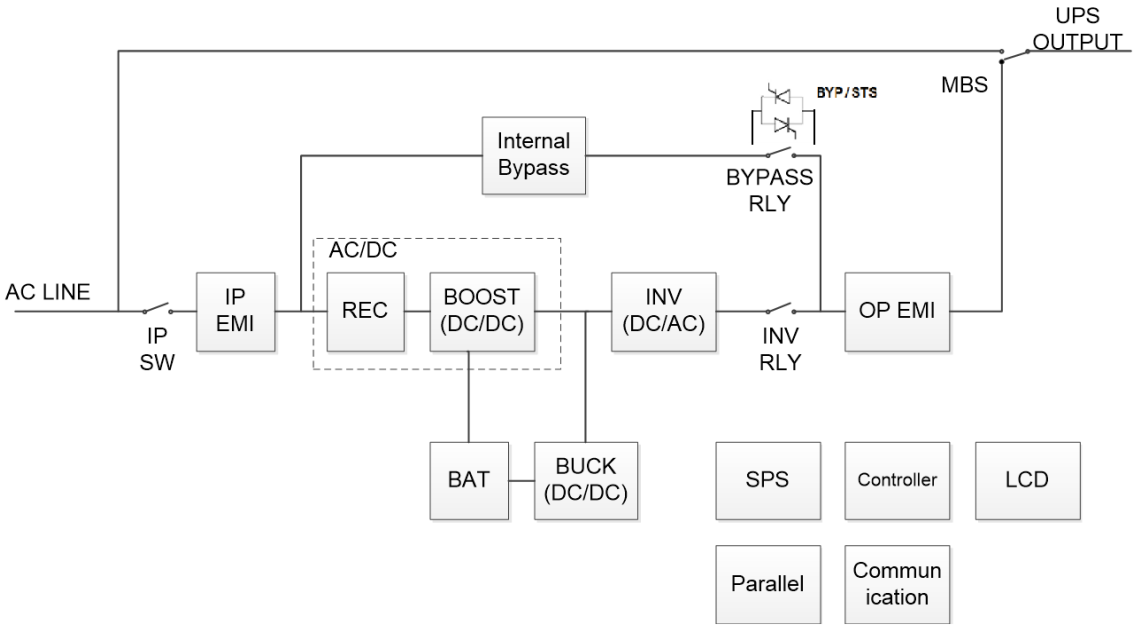


Figure 4.1.1 Function block Diagram of 6/10 K Tower

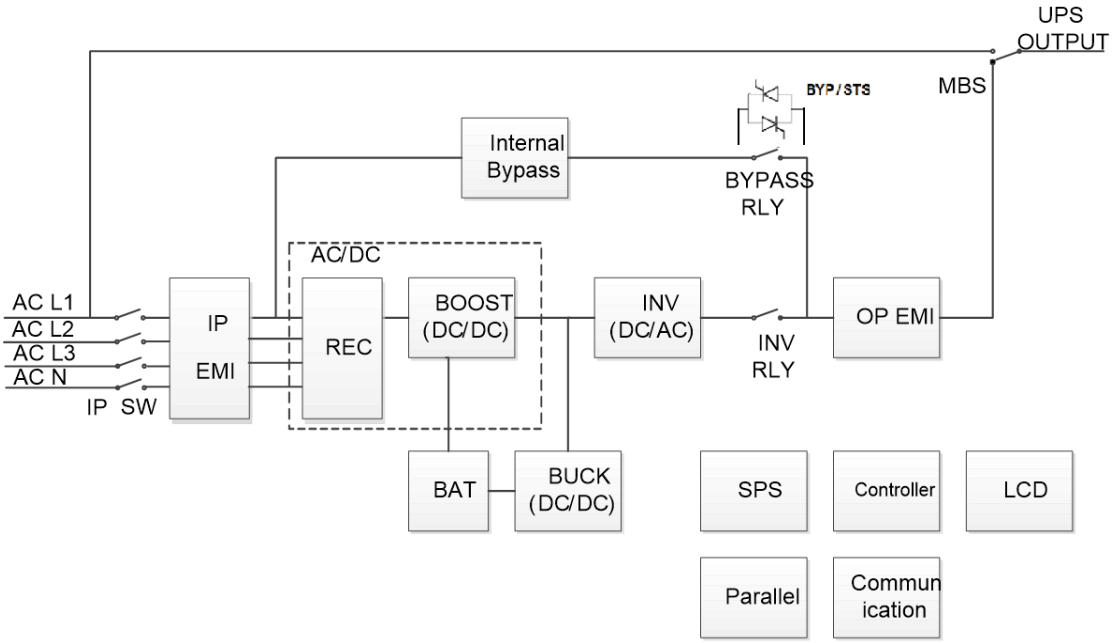


Figure 4.1.2 Function block Diagram of 10 K 3:1Tower

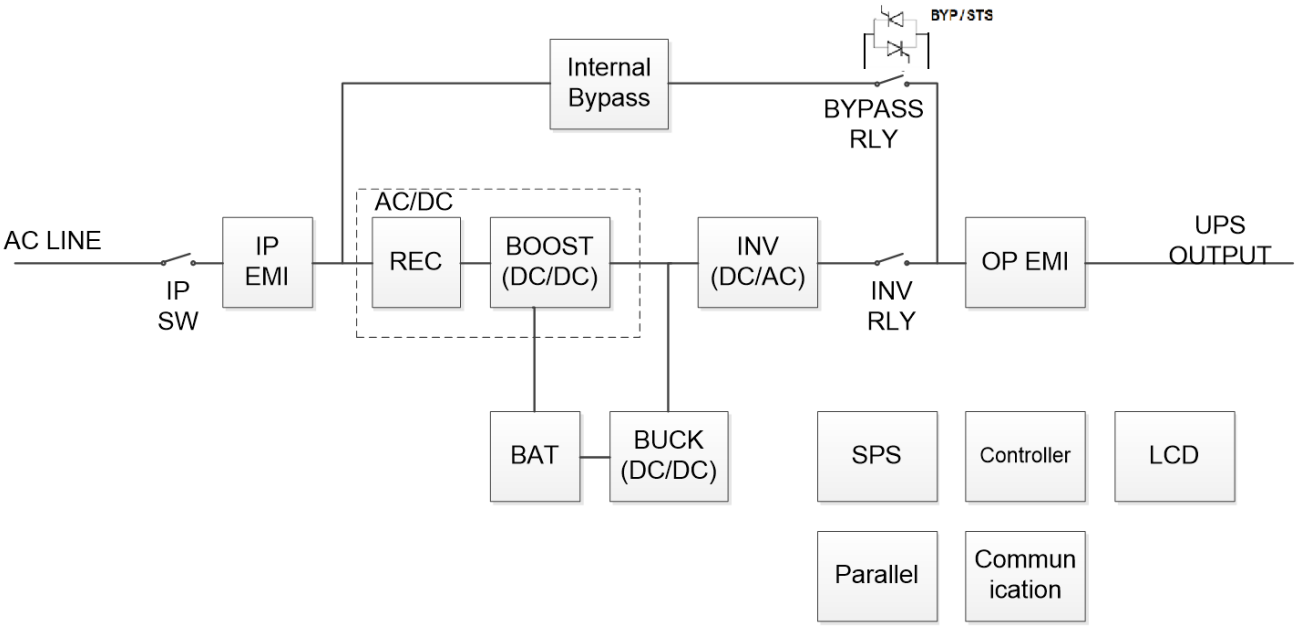


Figure 4.1.3 Function block Diagram of 6/10 K Rack

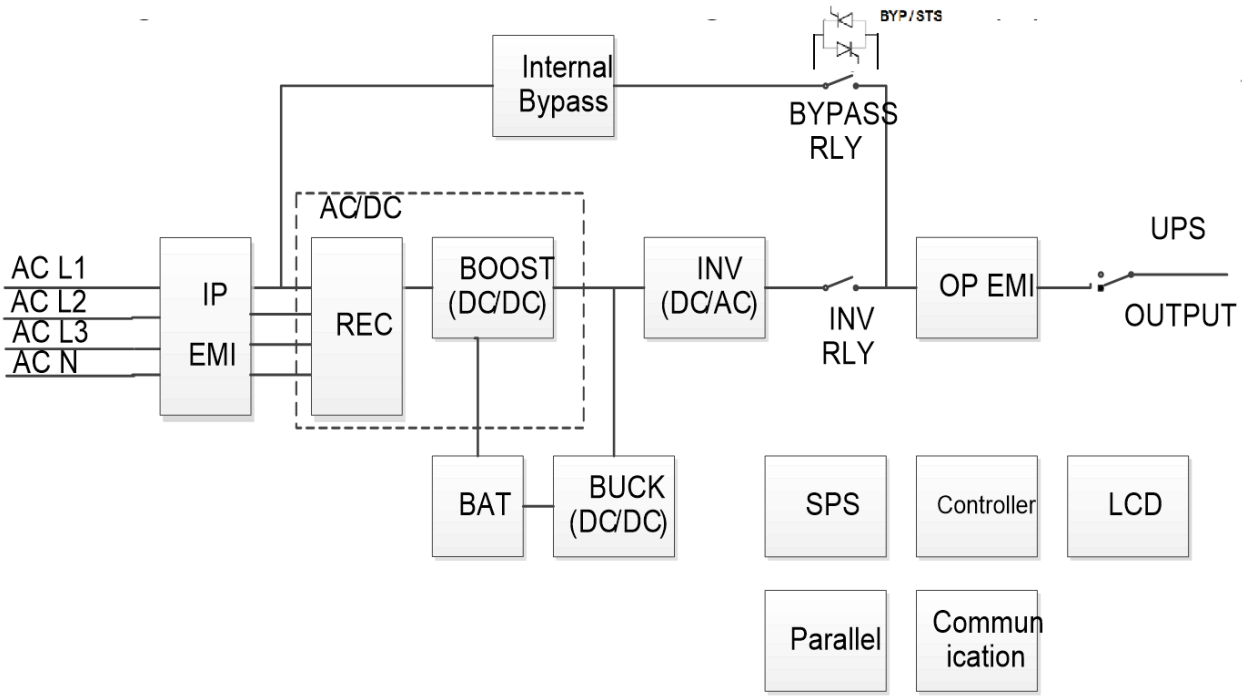


Figure 4.1.4 Function block Diagram of 10 K 3:1Rack

- **Controller:**

Control 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.

- **AC/DC:**

Also called PFC/rectifier, belongs to input stage of the UPS. The AC/DC converter block converts 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 factor can be close to 1, achieve maximum efficiency and product lowest power pollution to the power supply system.

At battery mode the boost (DC/DC) module is reused to convert the low level DC power into higher level and more stable DC power, storing on the DC-BUS also.

- **DC/AC:**

Also called inverter, belongs to the output stage of the UPS, used to convert the DC power from the DC-BUS into clean, stable AC output power.

When the mains line is within the spec, the AC/DC converter works; In case the mains line supply is out of spec, due to either the voltage or the frequency, the UPS will transfer to battery mode. The controller can detect the interruption of input mains supply in very short time, the output power will be sustained by energy stored in the DC-BUS capacitor, the interruption will never appear on output.

- **4A/12A MAX Charger:**

The battery charger converts the DC-BUS voltage into lower DC voltage to recharge the Battery. Two type of charger current can be available, 4A MAX is for the standard model(the default charging current is 1.4A) and 12A MAX is for long backup time model(the default charging current is 4A).

- **EMI:**

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

- **Internal bypass:**

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

SPS:

The Power supply generates low voltage DC power which supply to the control and operation circuit. SPS circuits are in INV boards.

LCD and communication:

The LCD, Communication card are the interface for user. They could supply the information about UPS through LCD panel, computer, internet etc.

4.2 Operating Principle Of The Major Functional Block

- **AC/DC Converter (PFC converter)**

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

Figure 4.2.1, 4.2.2, showed the topology implement the AC/DC converter.

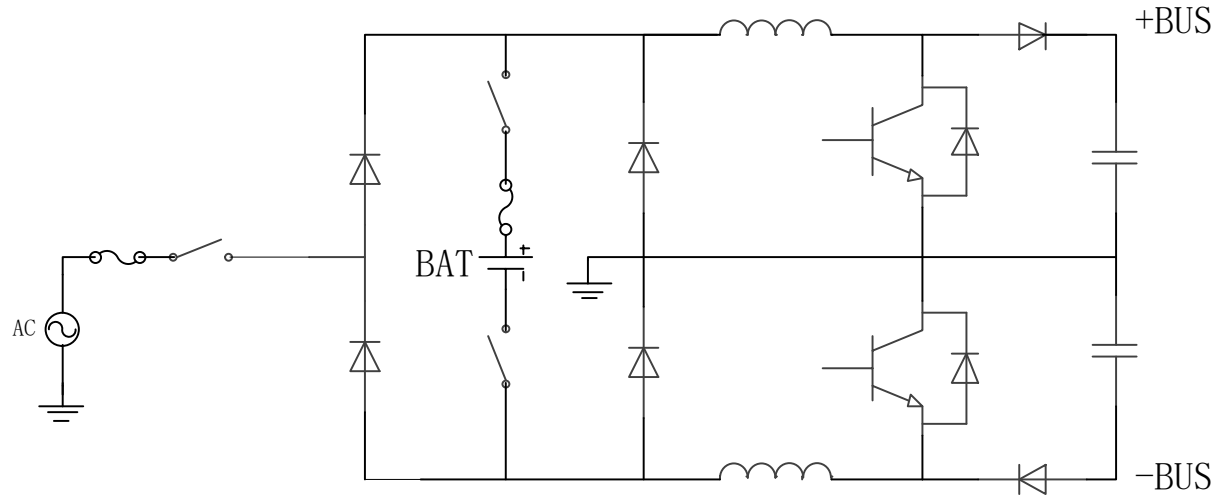


Figure 4.2.1 AC/DC converter for 6K

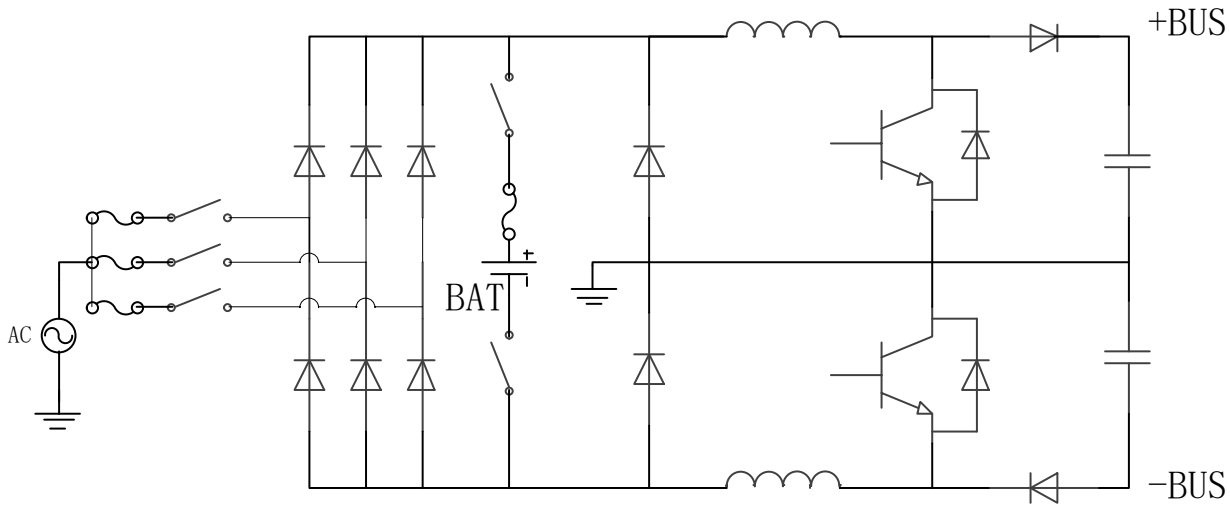


Figure 4.2.2 AC/DC converter for 10K

While AC mains is in normal condition, input switch is on. The global controller outputs PWM (Pulse Width Modulation) signal, the PWM signal will be isolated, amplified and used 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.

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

The AC/DC output voltage, i.e. the DC BUS voltage, will be regulated at ±350 Vdc to ±390 Vdc.

- **Inverter**

The inverter converts the DC power from DC BUS into the AC output to supply the load. A three level half bridge topology is employed, Figure 4.2.3 shows a diagram of inverter.

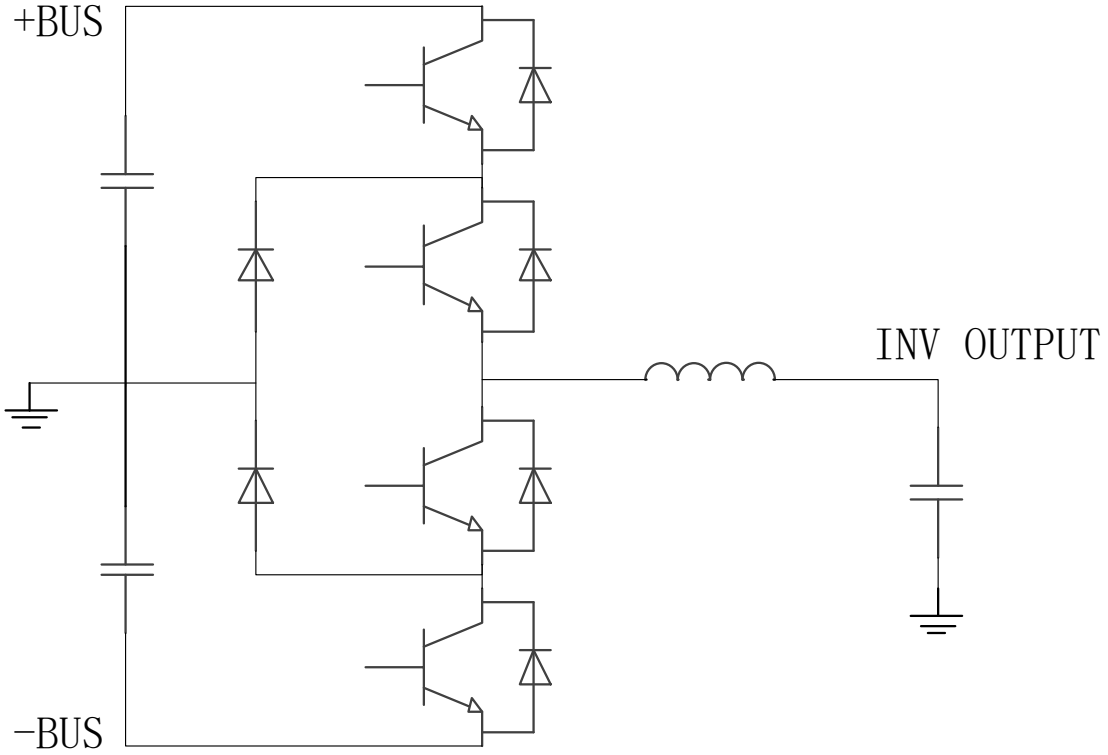


Figure 4.2.3 Inverter for 6/10K

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

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

- **Global Controller：**

The CPU can be regarded as the brains of the UPS, which is in the charge of signal detecting, measurement, processing, timing control, protection, communication. The Global Controller of UPS is composed of following major circuits as following:

1. CPU Central Processor Unit
2. Signal detecting circuit
3. Regulation & Protection circuit
4. Output buffering circuit
5. Communication interface circuit

The global controller implements following protection function:

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

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

- **4A/12A Charger**

Refer to Fig. 4.2.4; the battery charger is employed dual BUCK topology. The global controller outputs PWM (Pulse Width Modulation) signal, the PWM signal will be isolated, amplified and used to drive switching component, the IGBT. When IGBT turns on, the current in the inductor will increase, and a certain amount of energy is stored in the inductor. When IGBT turns off, the energy stored in the inductor will start to release to load side and charge the output capacitor. By controlling the duty cycle, energy transfers to load side and the output voltage can be controlled.

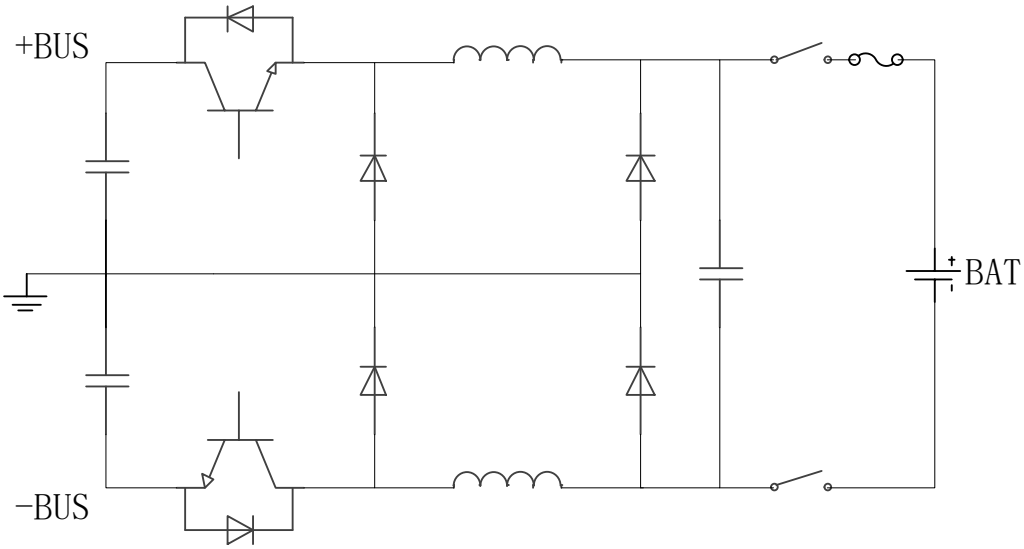


Fig. 4.2.4 4A/12A charger

There are two kinds of charger current for standard model UPS(6/10K) and long backup time model UPS(6/10KS). The one for standard model UPS is maximum 4A charging current. And the one for the long back up time model is maximum 12A charging current.

- **Auxiliary Power Supply (SPS)**

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

+12 Vdc mainly uses for Relay driving, Fans supply and generates ELV power supply for communication board.

HFPW is used to generate IGBT driver power.

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

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

- **LCD, LED and button**

The front panel consist 3 parts: push buttons, LCD and LEDs.

Fig.4.2.5 buttons

ON/OFF button : turn on and off the UPS.

1. While the UPS is in standby or bypass mode, press the on/off button continuously for more than 1 second, then the buzzer will beep once and the ups system will be turned on.
2. While the UPS is in line, battery, HE, battery test mode, press the on/off button continuously for more than 3 seconds, then the buzzer will beep once and the UPS will be turned off.
3. While the UPS is in fault mode and the fault cause has disappeared, press the on/off button continuously for more than 1 second, then the buzzer will beep once, the fault can be cleared and UPS will turn to normal mode.

Esc button: Return/Exit back one menu layer or mute the buzzer temporarily.

1. Press the esc button for more than 100ms and less than 2s, LCD will return to the former menu layer.
2. Press the esc button for more than 2s, buzzer will be muted temporarily. Buzzer will be working again when a new alarm is active or UPS enters into battery mode or bypass mode again.

Enter button: Select present menu or option to be changed

1. Press the enter button for more than 100ms, the menu is selected.
2. Press the enter button for more than 1s, the option is selected.

Up button: **Scroll backward**

Press up button for more than 100ms, scroll backward to the next menu option.

Down button: **Scroll backward**

Press down button for more than 100ms, scroll backward to the next menu option.

LCD

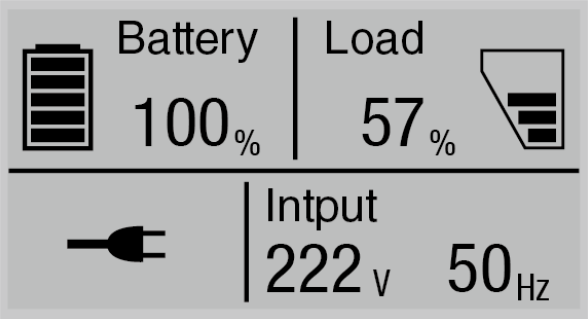


Fig.4.2.8 LCD display

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

When UPS is out of order, the fault information will be displayed and the buzzer will beep continuously. The detailed definition of the warning or fault code can be found in section 5.

- **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 serial interface, USB port, Ethernet port, WIFI port, and an intelligent slot are provided.

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

The intelligent slot can accept NMC, AS400, MODBUS etc., for more flexible application solution.

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

- **Emergence Power Off**

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

- **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, fans driver and intelligent fans speed control algorithm is employed.

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

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

4.3 Maintenance bypass operation for tower model

- **Operation from line mode to maintenance bypass mode**

You should do the follow steps when turning to maintenance bypass.

Step1: Remove the screws for the MBS latch, take off the latch and then UPS will transfer to bypass mode automatically.

Step2: Rotate the MBS, and let it locate at “BYPASS” position.

Step3: Turn off the input switch, cut off external batteries.

Note: It is 6K tower real panel. Other models are similar.

- **Checking and repairing on maintenance mode**

Some checking or repairing may be needed on maintenance bypass mode. You should do preparation as below description before you do further checking or repairing.

Step 1: check the input switch and maintenance bypass switch position. The input switch should be off. The maintenance switch should be at “BYPASS” point.

Step 2: check the external battery connection. It should be open.

Step 3: remove the screws in left/right side panel and lift up the panel one by one. for long backup tower model, the left and right panel is a whole.

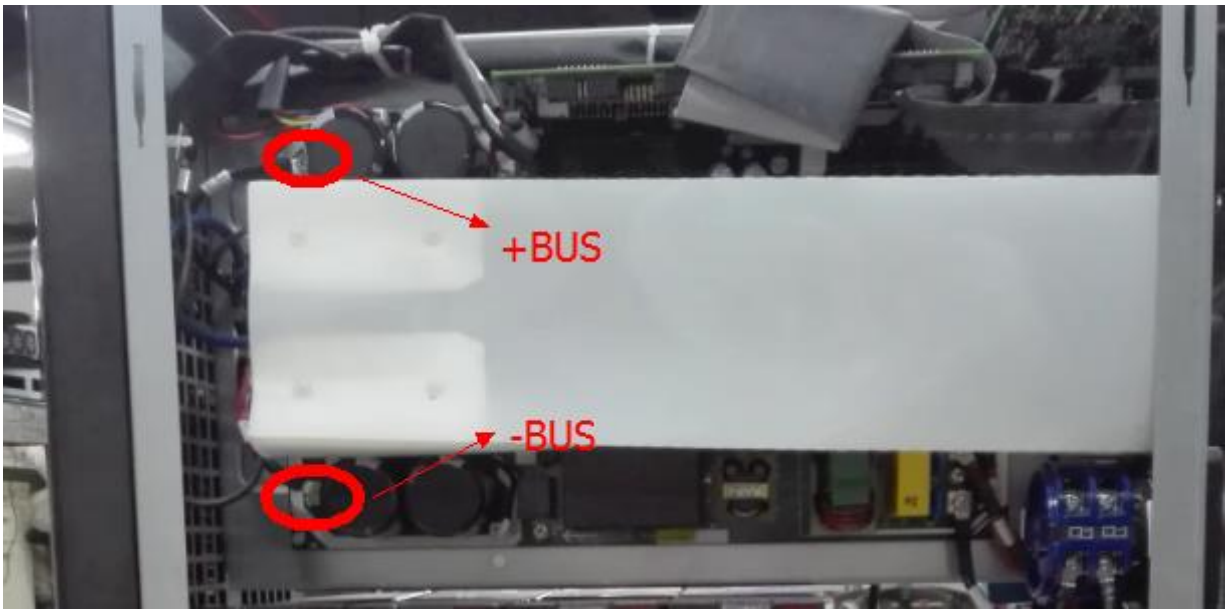
Left/right panel for standard tower model.

Cover panel for long backup tower model.

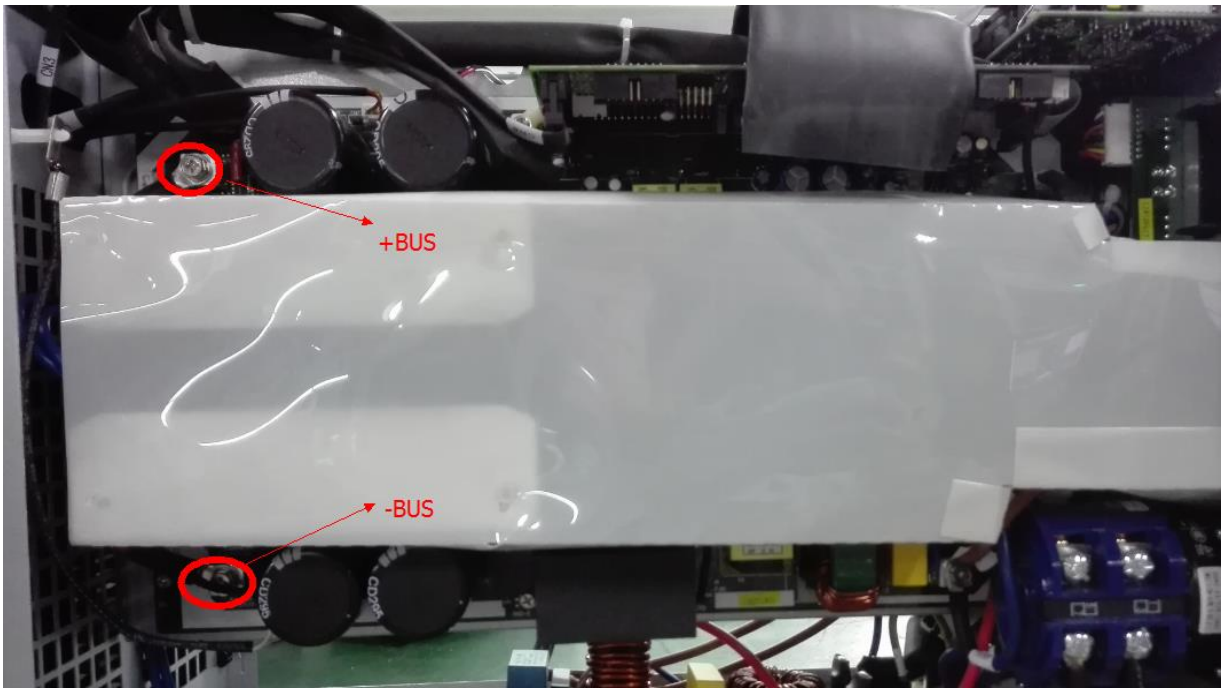
Step 4: disconnect the internal battery (only for standard tower model)

Step 5: discharging the remain electrical power in capacitor.

For 10K long backup model, the bus capacitor is 820uF*5;
For 10K standard model, the bus capacitor is 820uF*4
For 6K long backup model, the bus capacitor is 820uF*2+470uF*2;
For 6K standard model, the bus capacitor is 680uF*2+470uF*2;



BUS terminal for 6K tower



BUS terminal for 10K tower

The charger capacitor is very small, the voltage will be safe when UPS shuts down for 2 minutes.

Voltage should be test after discharging.

Step 6: Do checking or repairing.

- **Operation from maintenance bypass mode to line mode**

You should do the follow steps when turning back to normal mode from maintenance bypass.

Step 1: turn on the input switch on the back panel.

It need a little time to wait the internal bypass enable. You can check the bypass LED and output voltage on LCD. If internal bypass enable, the bypass LED will light and LCD show output voltage.

Step 2: Rotate the MBS, and let it locate at “UPS” position.

Step 3: Assemble the MBS latch.

Step 4: turn on the UPS.

4.4 Location of the main PCB board in the UPS

For 10K standard tower model, the location of PCB board is similar as that in 6K standard tower model. For 6K long backup tower model, the location of PCB board is similar as that in 10K long backup tower model.

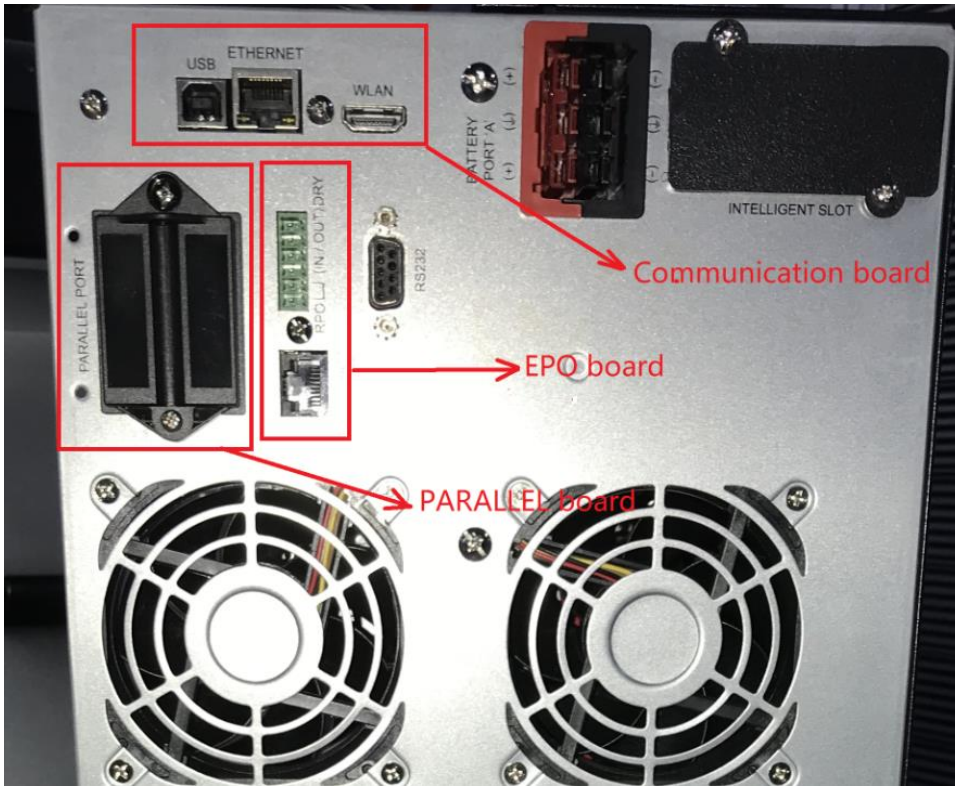


Fig. 4.4.1 Boards in 6K Tower

Fig. 4.4.2 Boards in 6K Tower

Fig. 4.4.3 Boards in 6K Tower

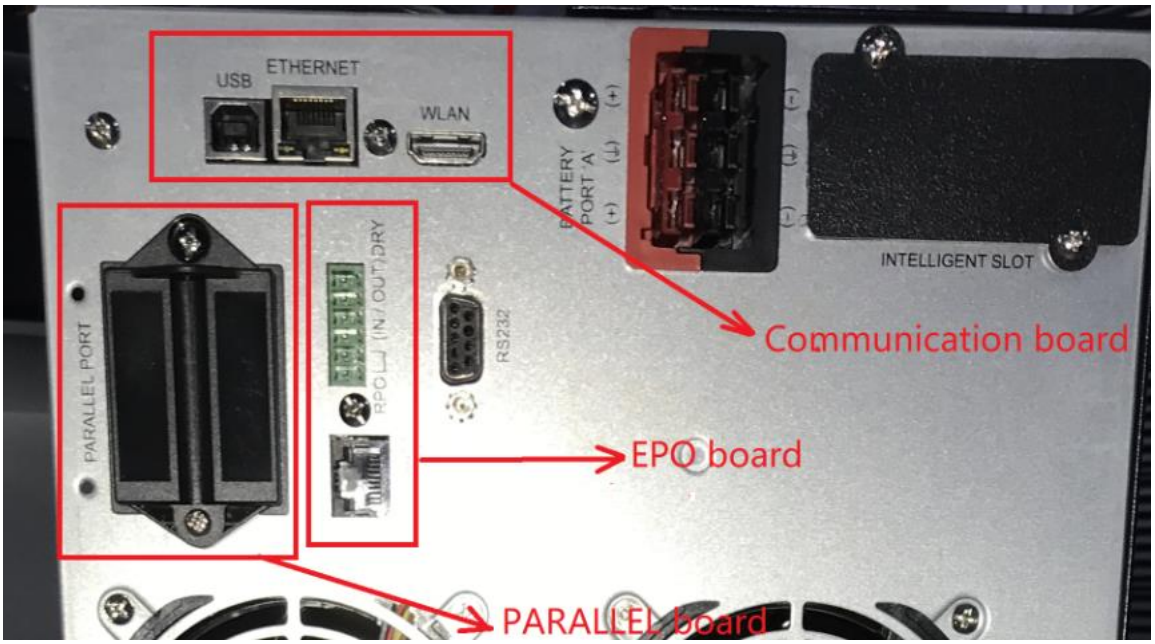


Fig. 4.4.4 Boards in 10K Tower

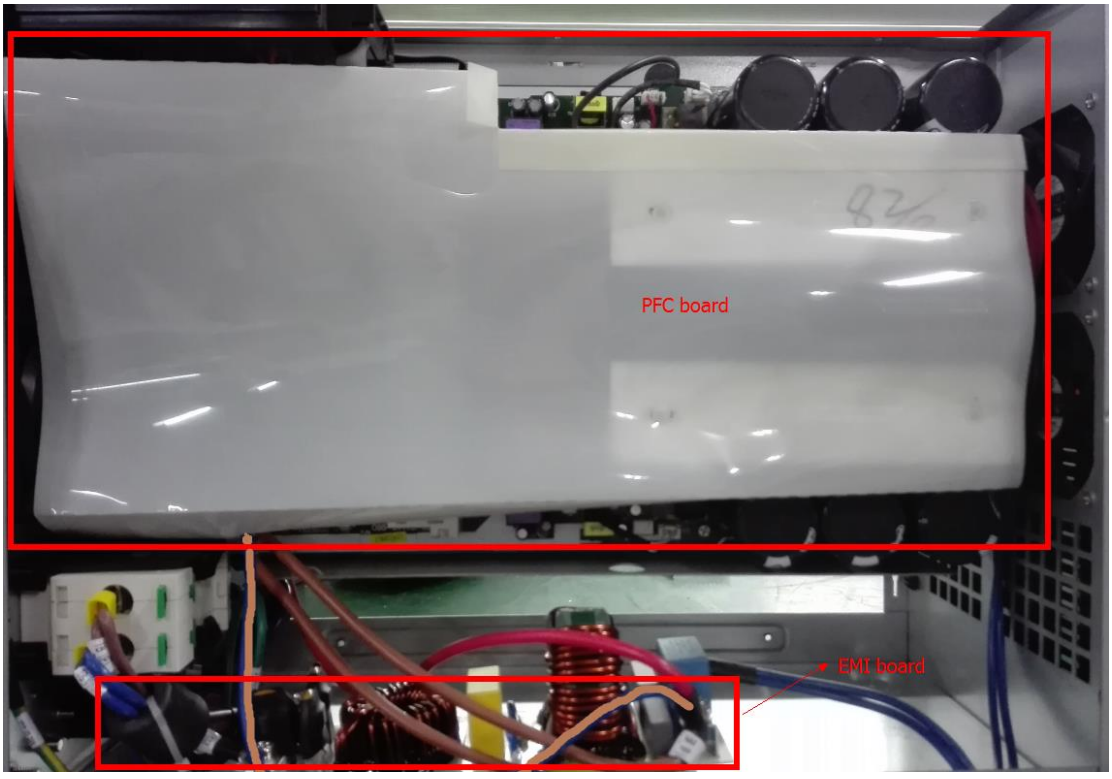


Fig. 4.4.5 Boards in 10K Tower

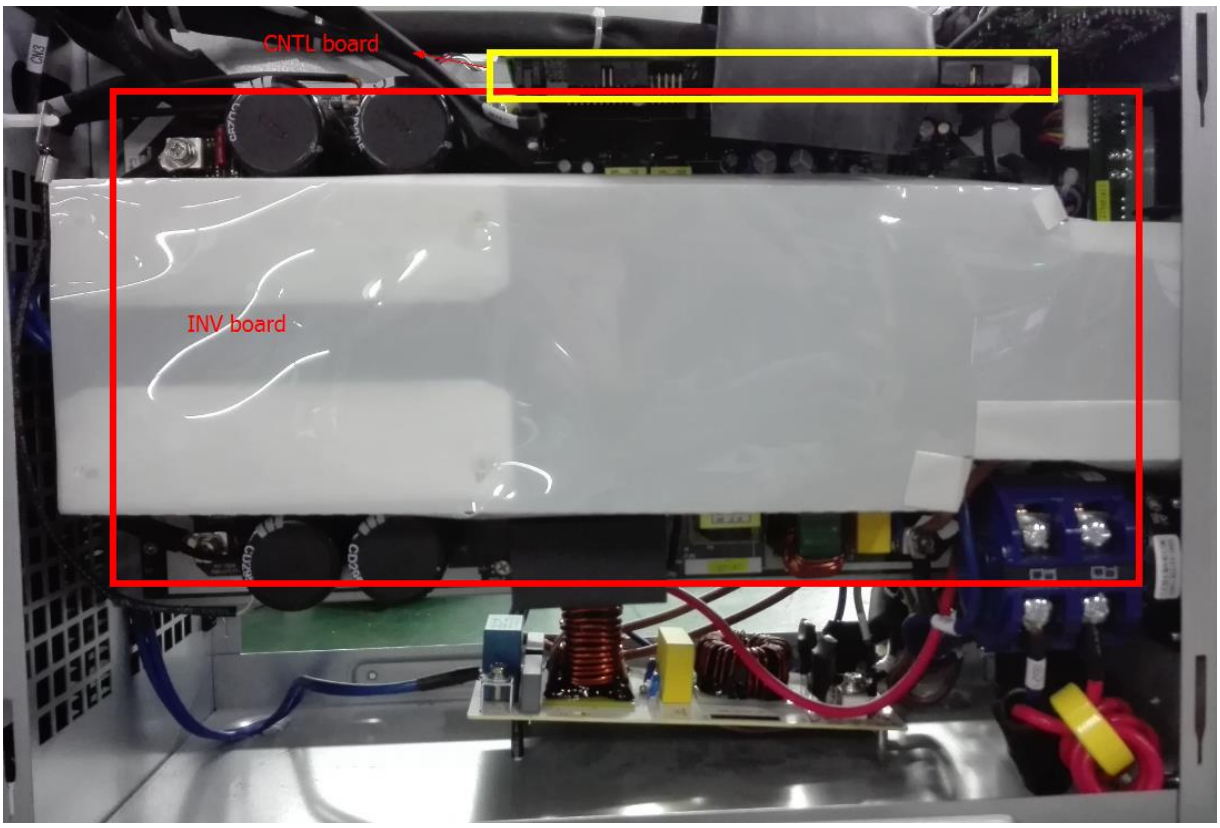


Fig. 4.4.6 Boards in 10K Tower

Fig. 4.4.7 Boards in 6K(S)/10K(S) RACK

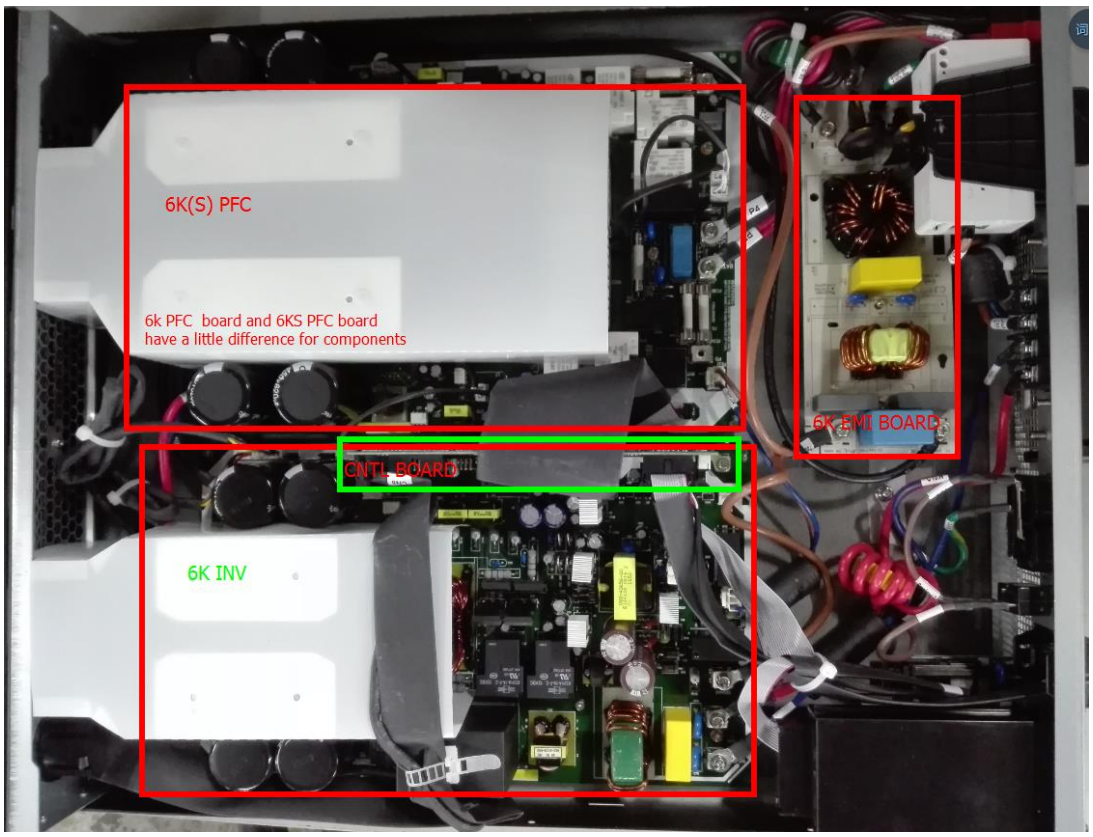


Fig. 4.4.8 Boards in 6K(S) RACK

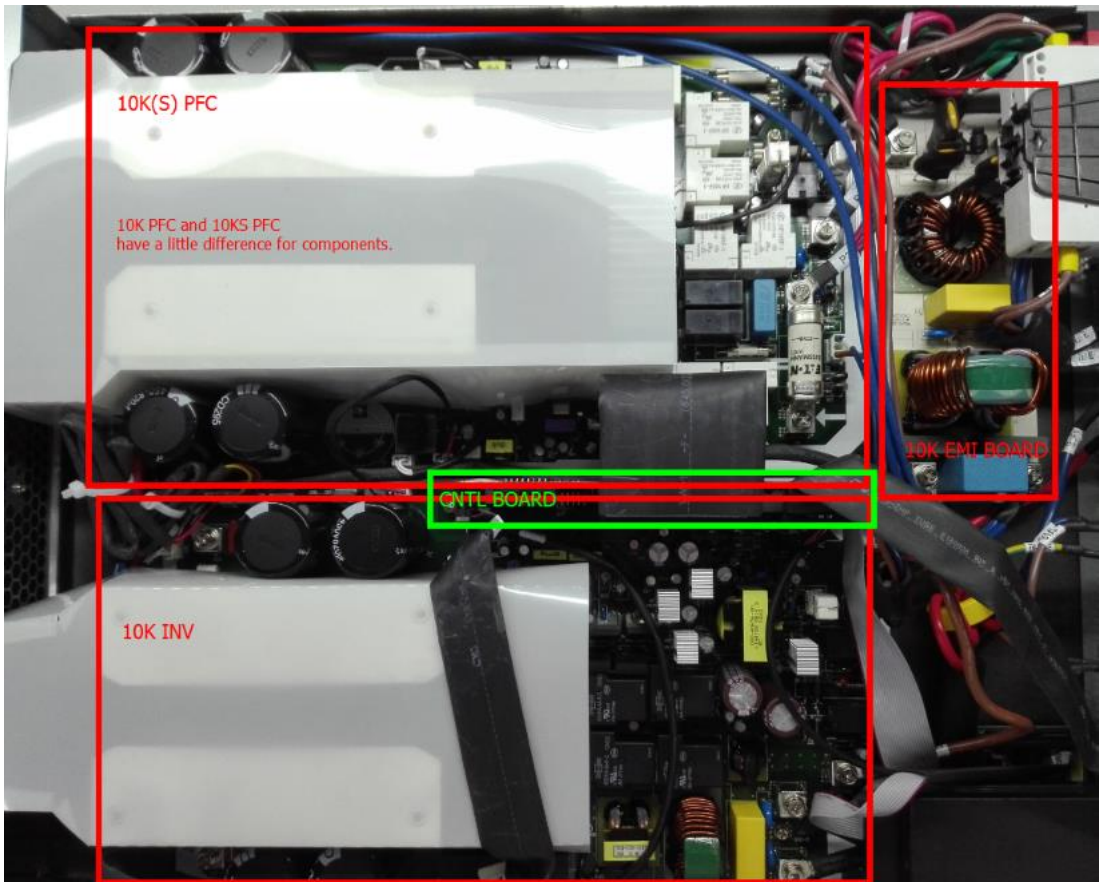


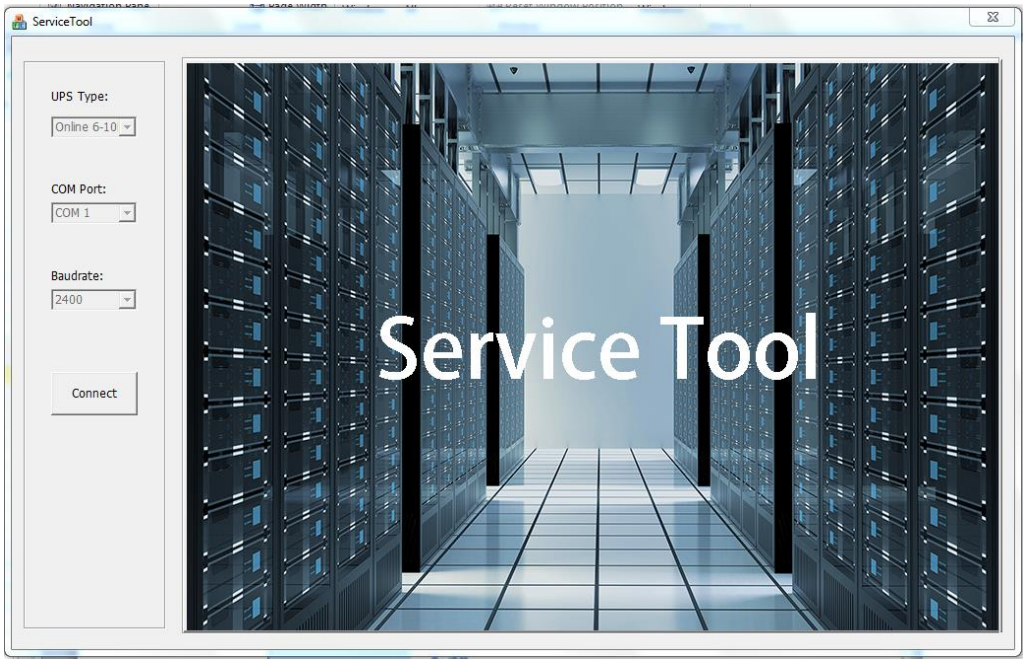
Fig. 4.4.9 Boards in 10K(S) RACK

5 Operation by service tools

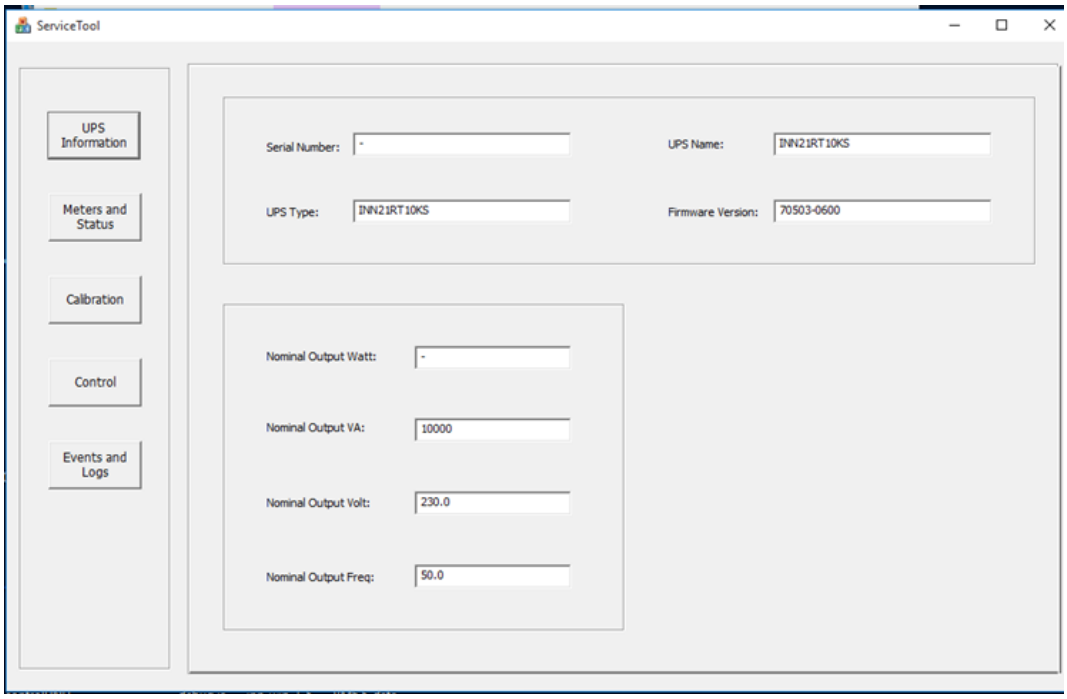
We can get UPS information，real time meters, events and logs from service tool.

Service tool also provide control and calibration.

Home page :



Content pages :



Following meters can be calibrated by service tool:

1	Battery voltage
2	R phase bypass voltage
3	R phase inverter voltage
4	R phase line voltage
5	R phase output current
6	Charge output voltage

6 Failure analysis

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

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

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

6.1 LCD Panel Display

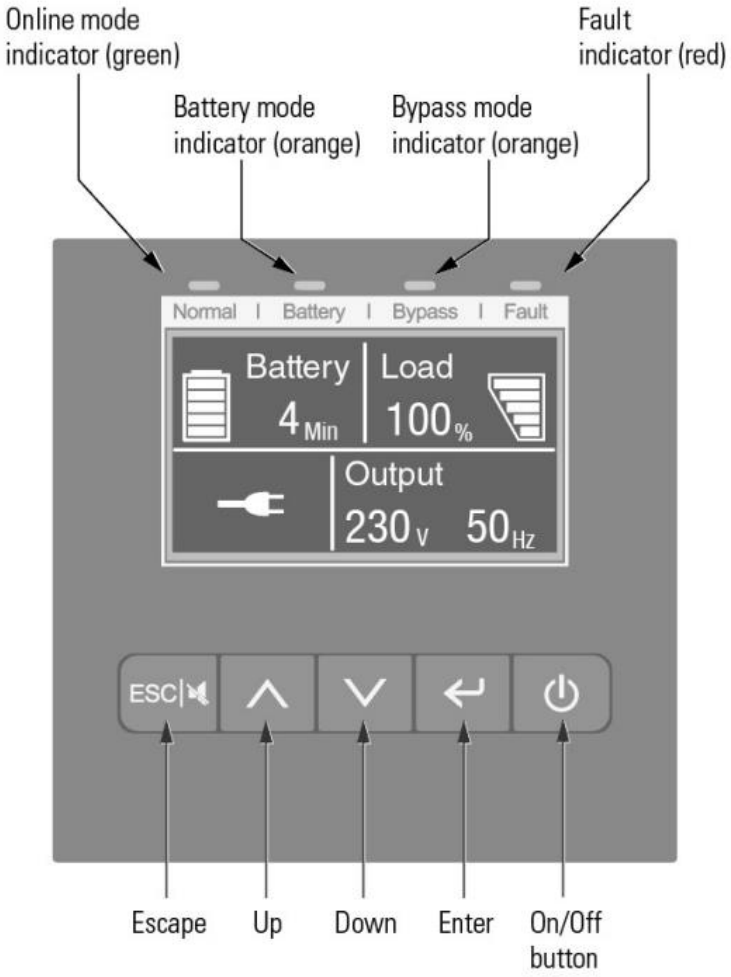


Table.6.1.1 The button

The button	Function	Illustration
	Power on	Press the Button for >100ms & < 1s can power on the UPS without utility input at the condition of battery connected
	Turn on	When the Unity is powered on, press the button for >1s can turn on the UPS
	Turn off	Press the button > 3s can turn off the UPS
	Scroll up	Press to Scroll up the menu option
	Scroll down	Press to Scroll down the menu option
	Enter menu	Select/Confirm the current selection
	Exit the present menu	Press to exit present menu to Main menu or the higher-level menu without changing a setting
	Mute buzzer	Press the button to mute the buzzer temporarily, once new warning or fault is active, buzzer will work again

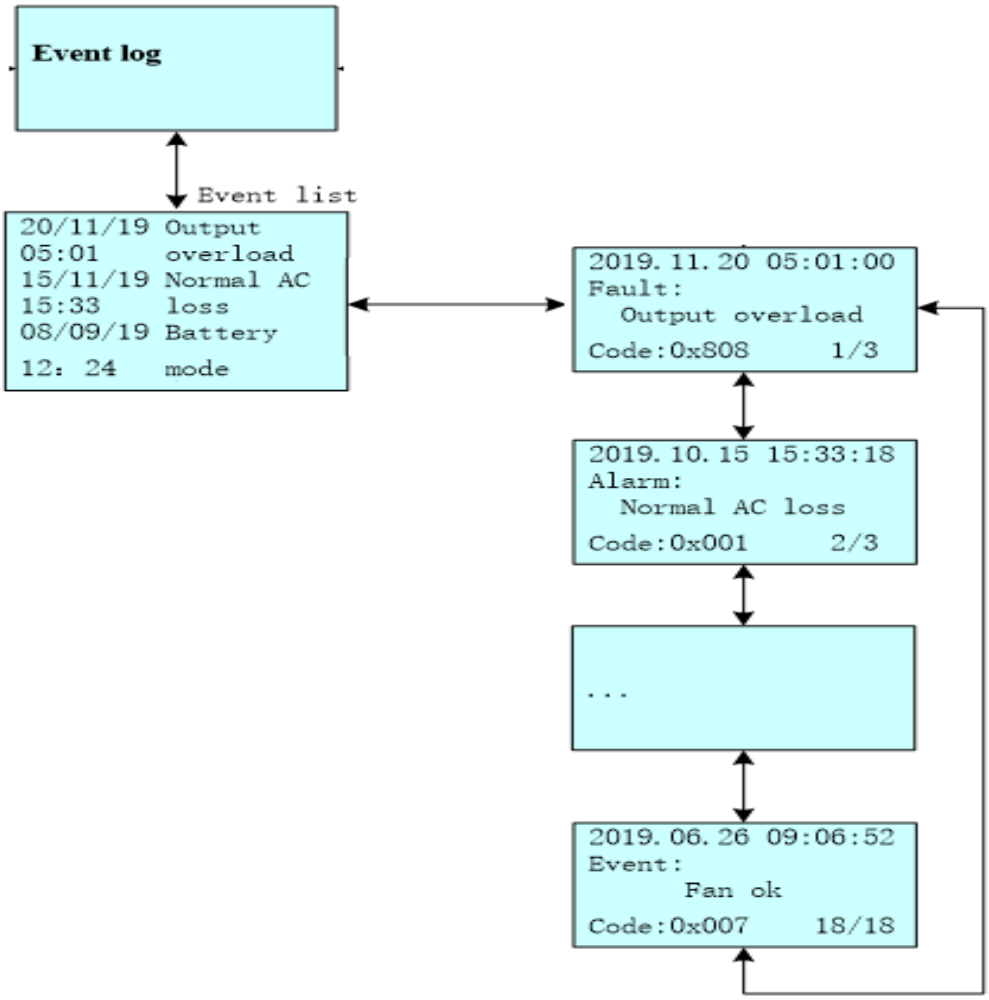
LED display information

Indicator	Status	Description
Green	On	The UPS is operating normally on Online or on High Efficiency mode.
Orange	On	The UPS is on Battery mode.
Orange	On	The UPS is on Battery mode.
Red	On	The UPS has an active alarm or fault. Please refer to section 7.1 Trouble shooting for more information

Buzzer information

The buzzer	General Meaning
1 beep every 2 minutes	Load supplied on bypass
1 beep every 4 seconds	Load supplied on battery If battery low, beep every second
1 beep every second	General warning active
2 beeps every second	Overload warning
Continuous	Fault active

In Event log menu all the old event, alarm and fault have been recorded here.



6.2 Failure Diagnosis by Static Checking

Goal:

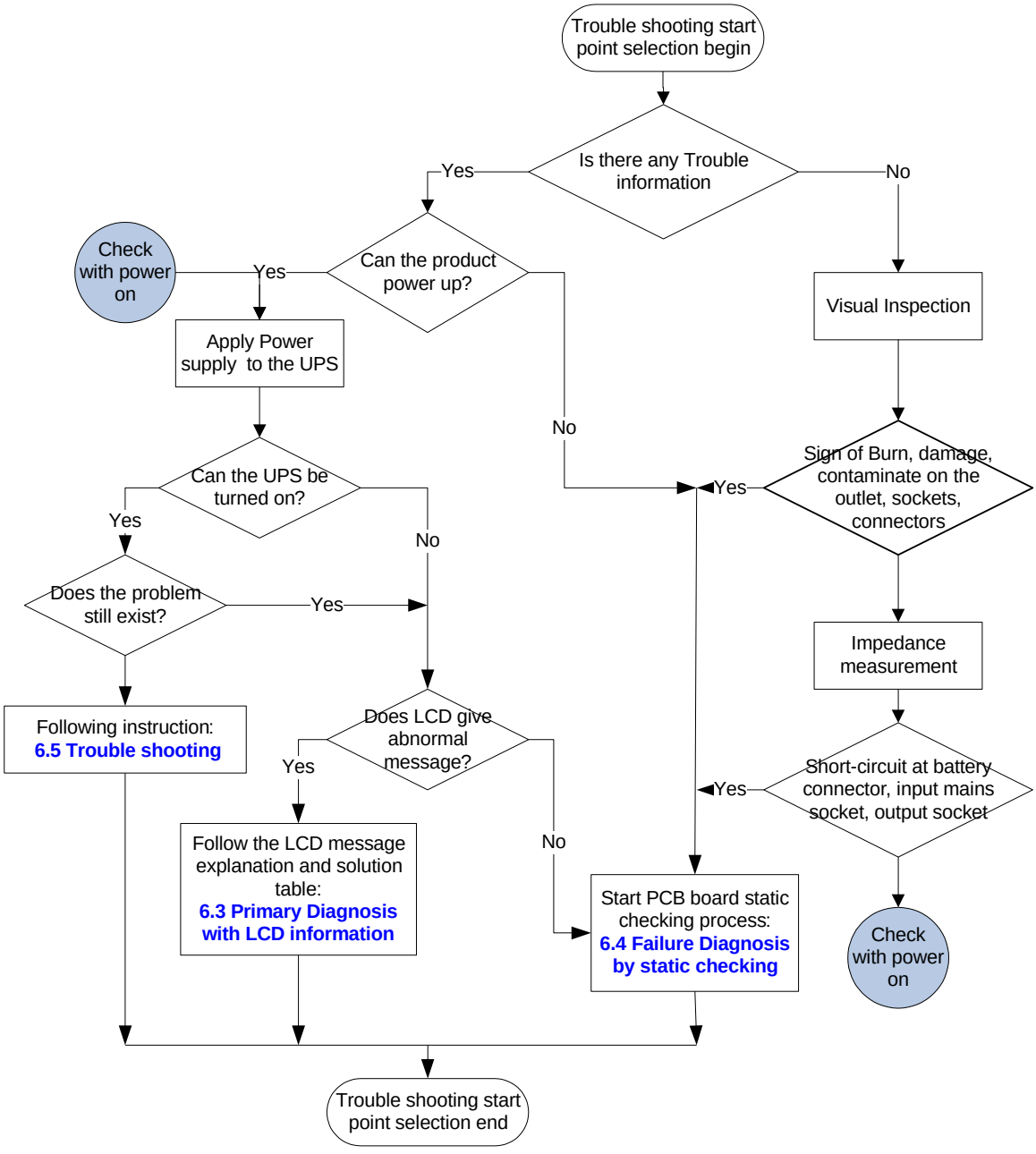
This part of the manual is focused on the localization of the function(s), or the part(s), which are faulty, from the fault shown on the display (LCD).

This type of flowchart applies to all types of faults to determine the faulty functions of the UPS such as the rectifier, battery charger etc.

How To Start

Suggest following service procedure:

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



6.3 IoT function guidance and trouble shooting

Goal:

This part is used to guide users how to configure the device correctly to connect it to the IoT cloud:

- Check network.
- Proxy configures (Disabled proxy by default)
- SNTP configure.
- Check IoT status.

6.3.1 Check network

Step 1: Check UPS IP address by UPS HMI Identification Page.

Main menu	Submenu	Display information or Menu function
UPS status		UPS mode, IoT status, date/time, battery status and current alarms
Event log		Displays the events and faults stored
Measurements		[Load] W VA A P%, [Input/Output] V Hz, [Battery] % min V EBM, [DC Bus] V, [Temperature] C
Control	Go to Bypass	Transfers the UPS on Bypass mode
	Load segment	Load segment on/off
	Start battery test	Starts a manual battery test
	Reset fault state	Clear active fault
	Reset event list	Clear events and faults
	Reset com card	Reset com card inside UPS
	Restore factory settings	Restore to default factory settings
Settings		Refer to chapter 4.4 User settings
Identification		[Product name], [Serial number], [firmware version] [IP/MAC address]

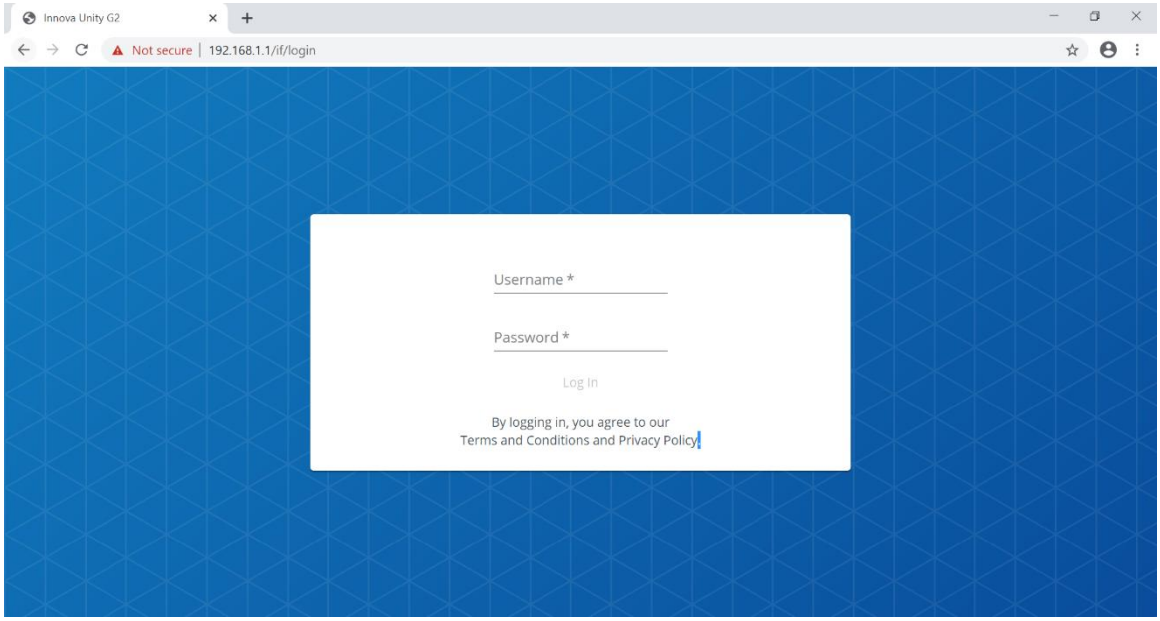
Step 2: Connect the PC to the same LAN with UPS and Input the IP address in the web browser to open the Local web.

The default Username and password of Local web is as below:

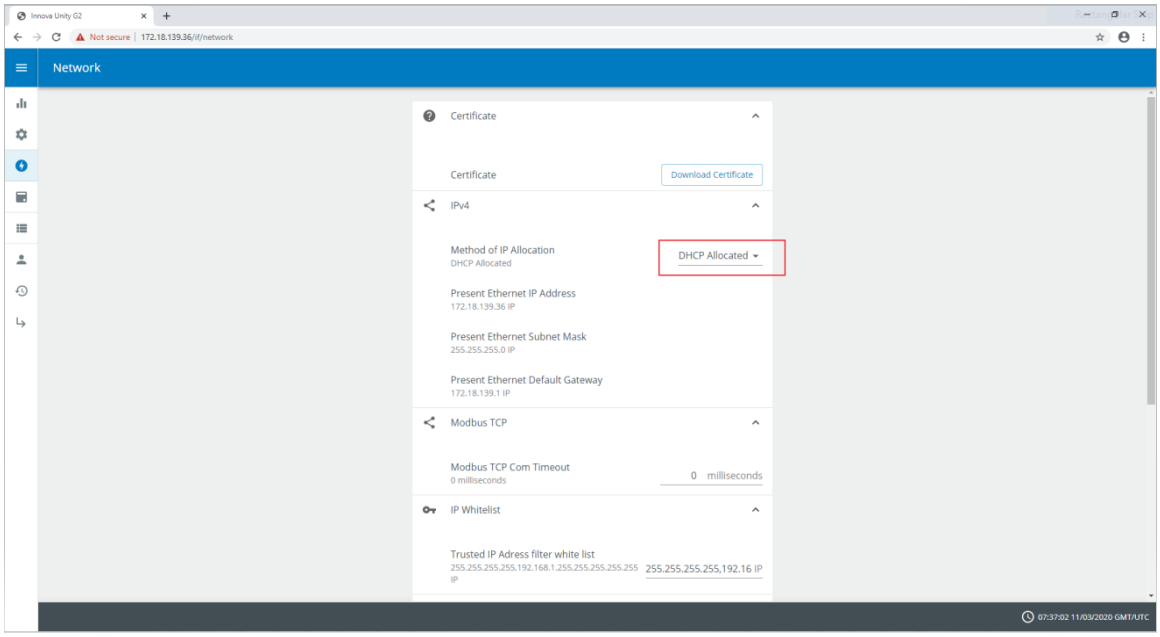
Default Username: admin

Default Password: Admin*1

(Example UPS IP address is 192.168.1.1)



Step 3: Use DHCP for device (DHCP by default).



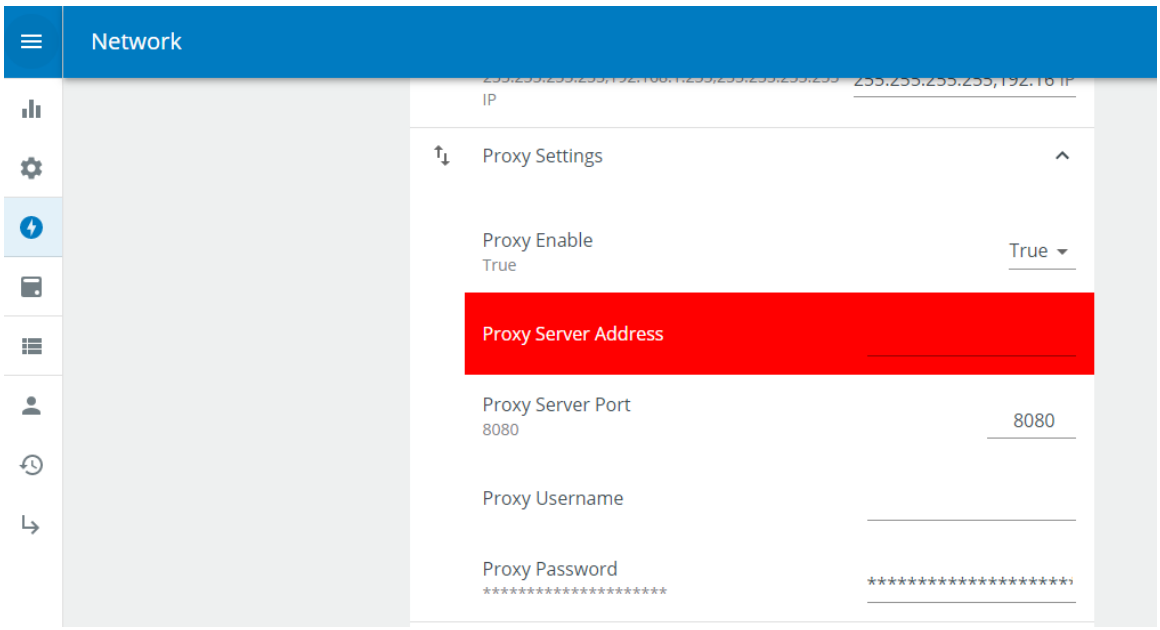
Step 4: Make sure device can access the Internet.

The device will access timer server and Azure IoT.

If you can open Local web, that means LAN is ok. Then checkout WAN: ping timeserver

6.3.2 Proxy configures (Disabled proxy by default)

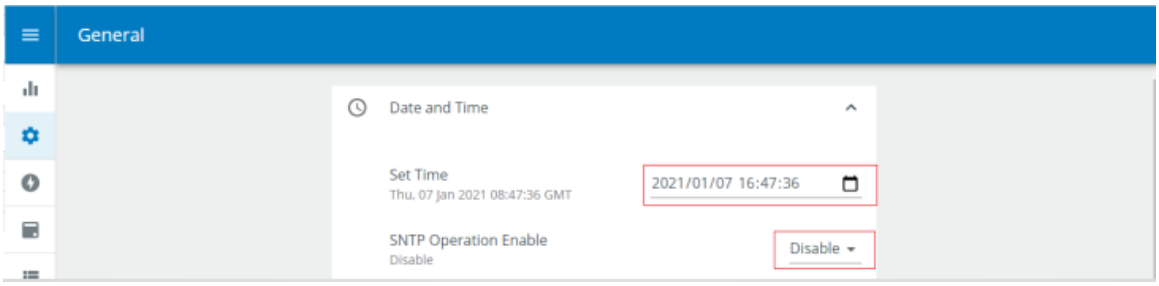
Please check you have set correct “Proxy Server Address”, if your network has no Proxy Server, please disable it.



6.3.3 Time configuration

A properly configured time server is a necessary condition for devices to connect to IoT.

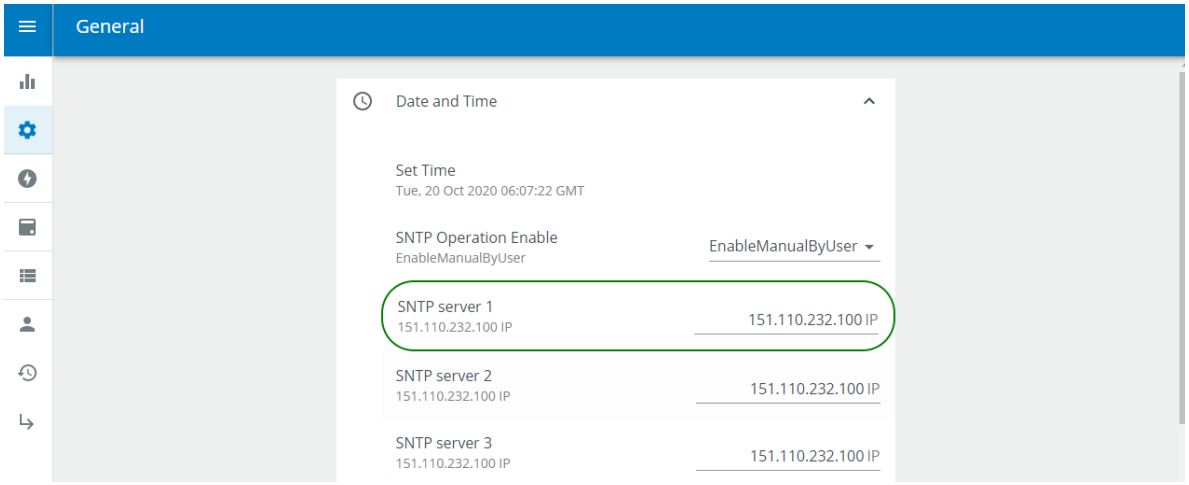
1. Manually setting time:



2. Auto get network time.

In following Page, you can modify SNTP server:

Note: Please contact your company's IT team to get the SNTP server or you can search free SNTP server ip address from internet .



6.3.4 Trouble Shooting

You can check whether the device connected IoT Hub or not from Localweb.

✓ **Cloud connected：** The device connected IoT Hub is successful.

Action: No action.

✓ **IoT disabled:** The IoT feature is disabled

Action: There two ways to enable IoT feature.

- Enable IoT from HMI, please refer HMI user manual.
- Enable IoT from localweb network setting pages.

✓ **IoT clock not correctly set:** Correct NTP server is needed.

Action: Please refer SNTP configure.

✓ **Reconnecting:** Maybe network changed, or device configuration changed.

Action: Waiting for future information.

✓ **Failed to open connection:** Excessive state, due to unstable network or incorrect configuration

Action: Check network

✓ **Too many lost messages:** Unstable network.

✓ **Invalid connection string:** The device connect string is not correct.

Action: Need to find the customer service staff to rewrite the correct Connect string.

✓ **Daily cloud message limit reached:** The amount of data uploaded to the IoT reaches the upper limit of the day, and the communication can be restored the next day. If want to increase the upper limit of data transmission, you need to seek help from customer service personnel.

✓ **AS token expired:** When the token expires, the device will automatically reacquire the network token without any operation.

✓ **Device disabled by user on IoT hub:** This device is not registered on the mobile phone, please open the mobile APP and scan the device barcode to register.

✓ **No network:** Maybe Proxy is uncurrent or the device cannot access internet.

✓ **Communication error:** Unstable network.

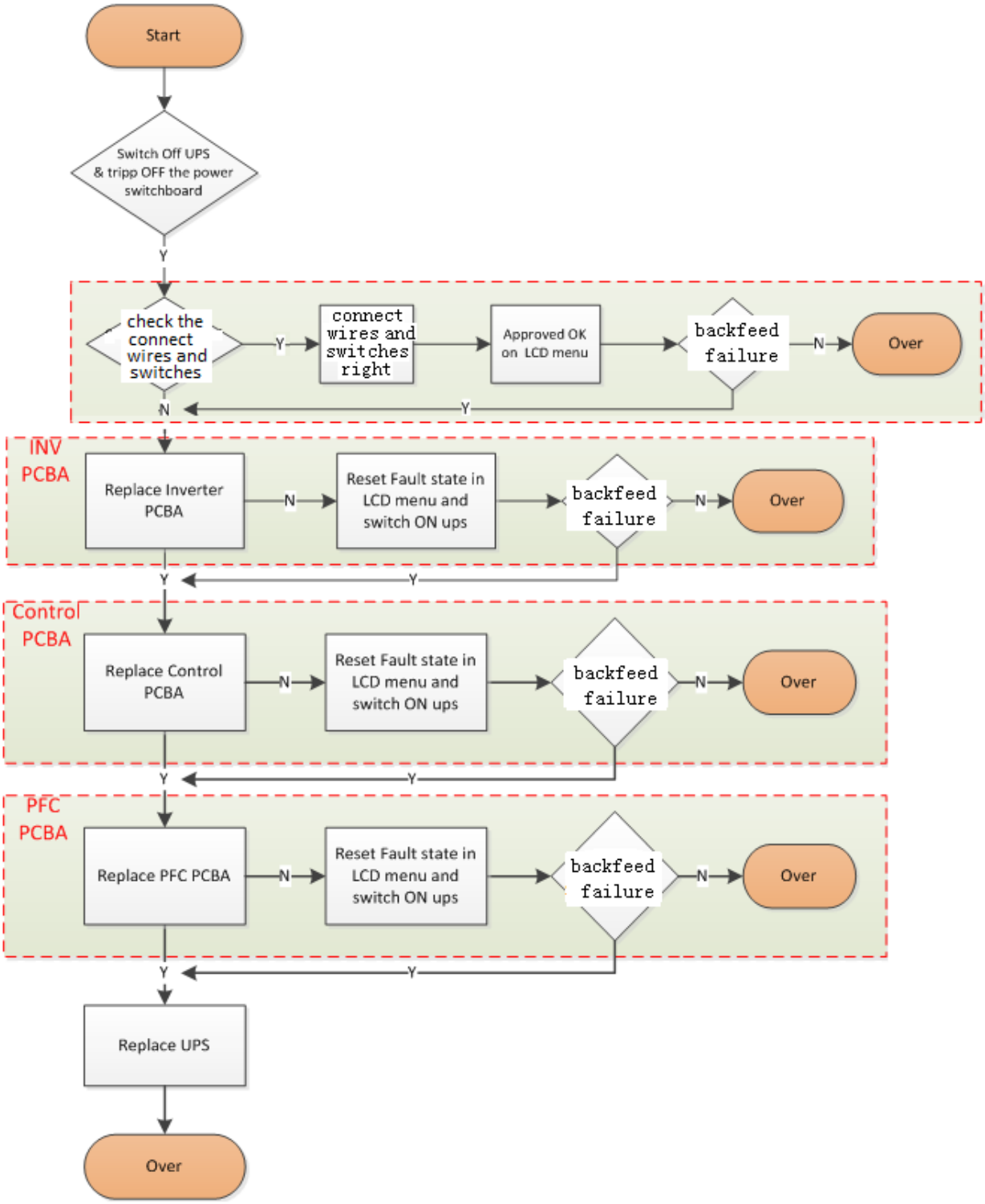
✓ **Ethernet/network interface link down:** The network cable is unplugged

6.4 Trouble Shooting According to Fault Indication

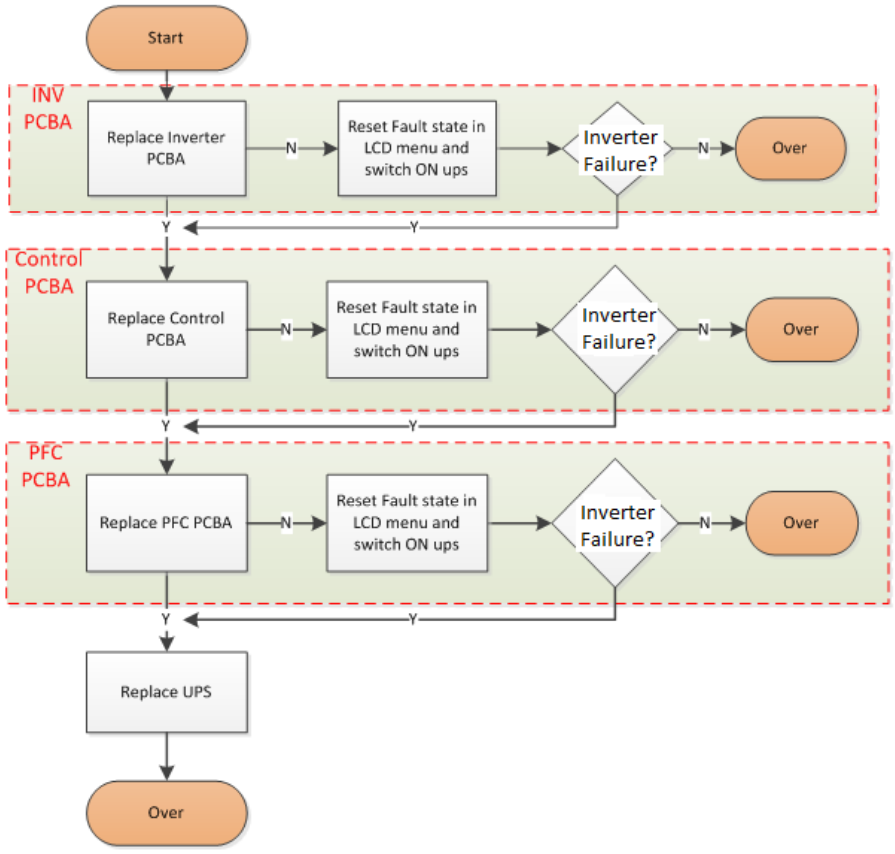
Problem Displayed	Possible cause	Remedy
End of backup time	The battery is empty	Recover the main input and recharge the battery
Remote OFF	The UPS was shut off remotely	Check the remote control
Emergency OFF	The EPO is activated	Check the EPO status
Power overload	Power requirements exceed the UPS capacity	Check the loads and remove some non-critical loads. Check if some loads are failed
Overload pre-alarm	The load exceeds the preset value	Check the loads or reset the pre-alarm value
UPS temp. alarm	Inside temperature of UPS is too high	Check the ventilation of UPS and the ambient temperature.
Amb. temp. alarm	The ambient temperature is too high	Check the environment ventilation
BP volt out range	The voltage of bypass is out of range	Check the bypass status
BP freq. out range	The frequency of bypass is out of range	Check the bypass status
BP phase out range	The UPS is on CVCF mode	Check the user settings
Fan lock	Fan abnormal	Check if the fan is running normally or fan detection cable disconnected
Battery low	Battery voltage is low	When audible alarm sounding every second, battery is almost empty.
Imminent shutoff	Insufficient battery backup time	Protect load equipment in time
End battery life	The battery has reached the end of its life	Consult dealer if replace the battery
No battery	Battery pack is not connected correctly	Do the battery test to confirm. Check the battery bank is properly connected to the UPS. Check the battery breaker is turn on or fuse OK.
Inverter overload	Overload	Check the loads and remove some noncritical loads. Check if some loads are failed.
Bypass overload	Overload	Check the loads and remove some noncritical loads. Check if some loads are failed.
Out. short circuit	abnormally low impedance placed on its output and considers it a short circuit	Remove all the loads. Turn off the UPS. Check if UPS output and loads is short circuit. Ensure short circuit is removed before turning on again.
Input bad wiring	Phase and neutral conductor at input of UPS system are reversed	Reverse mains power wiring.
Battery fault	Battery over voltage Battery test fail Battery voltage drop too fast under resting mode	Check the battery status
UPS temp. fault	Inside temperature of UPS is too high	Check the ventilation of UPS and the ambient temperature.
Amb. temp. fault	The ambient temperature is too high	Check the environment ventilation
DC bus + too high	UPS internal fault, the + DC BUS voltage is too high	Reference to section 6.2 and 6.4 BUS over voltage BUS under voltage
DC bus - too high	UPS internal fault, the - DC BUS voltage is too high	Reference to section 6.2 and 6.4 BUS over voltage BUS under voltage
DC bus - too low	UPS internal fault, the + DC BUS voltage is too low	Reference to section 6.2 and 6.4 BUS over voltage BUS under voltage

DC bus + too low	UPS internal fault, the - DC BUS voltage is too low	Reference to section 6.2 and 6.4 BUS over voltage BUS under voltage
DC bus unbalanced	UPS internal fault, the voltage difference between DC Bus+ and DC bus- is too large	Reference to section 6.2 and 6.4 BUS unbalanced
DC bus short circ.	UPS internal fault	Replace inverter board
Max inverter volt	UPS internal fault, the inverter voltage is too high	Replace inverter board
Min inverter volt	UPS internal fault, the inverter voltage is too low	Replace inverter board
Charger fault	Charging mode, charger volt low	Replace charger module
Max charger volt	UPS internal fault, the charger voltage is too high	Replace charger module
Min charger volt	UPS internal fault, the charger voltage is too low	Replace charger module
Dc-dc failure	Dc soft start fail	Shutdown and try again If still same warning, change PFC board.
BP device fault	Bypass relay stick or SCR back-feed	Replace inverter board
Input device fault	Input fuse open	Replace Input fuse
Neg power fault	Negative power output	Single mode, check output relay and SCR; Parallel mode, re-calibrate the output voltage, output/parallel current
Inverter fault	Inverter relay or STS stick	Replace inverter board
Input voltage unbalance	The 3-phase input voltage is unbalanced	Check the input status or wring

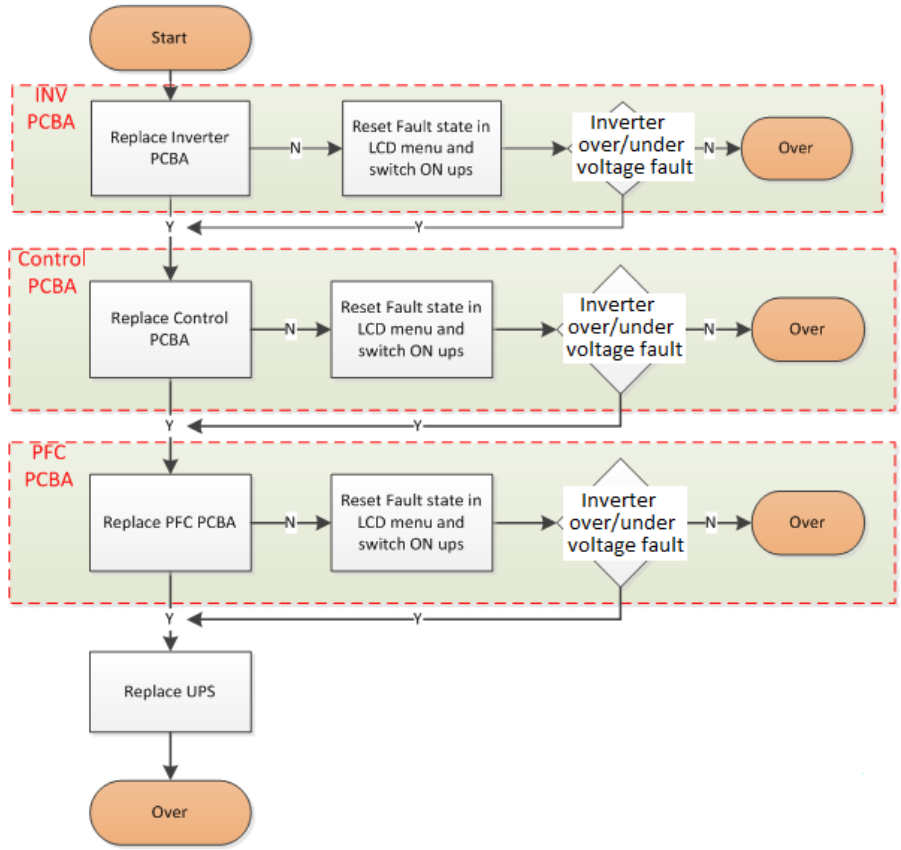
BP device fault



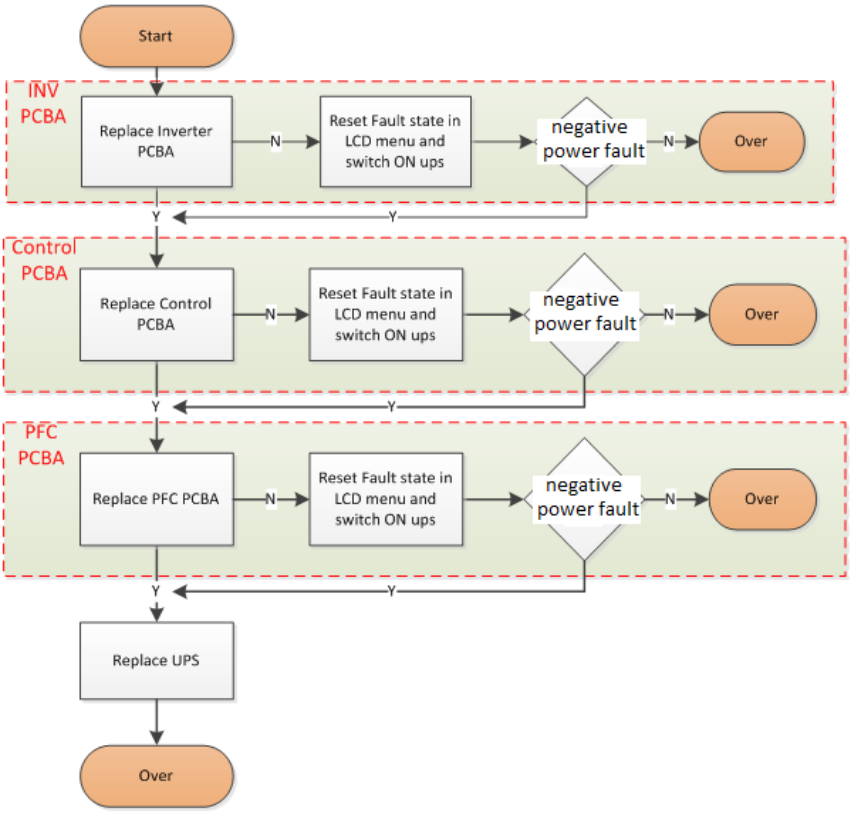
Inverter Failure



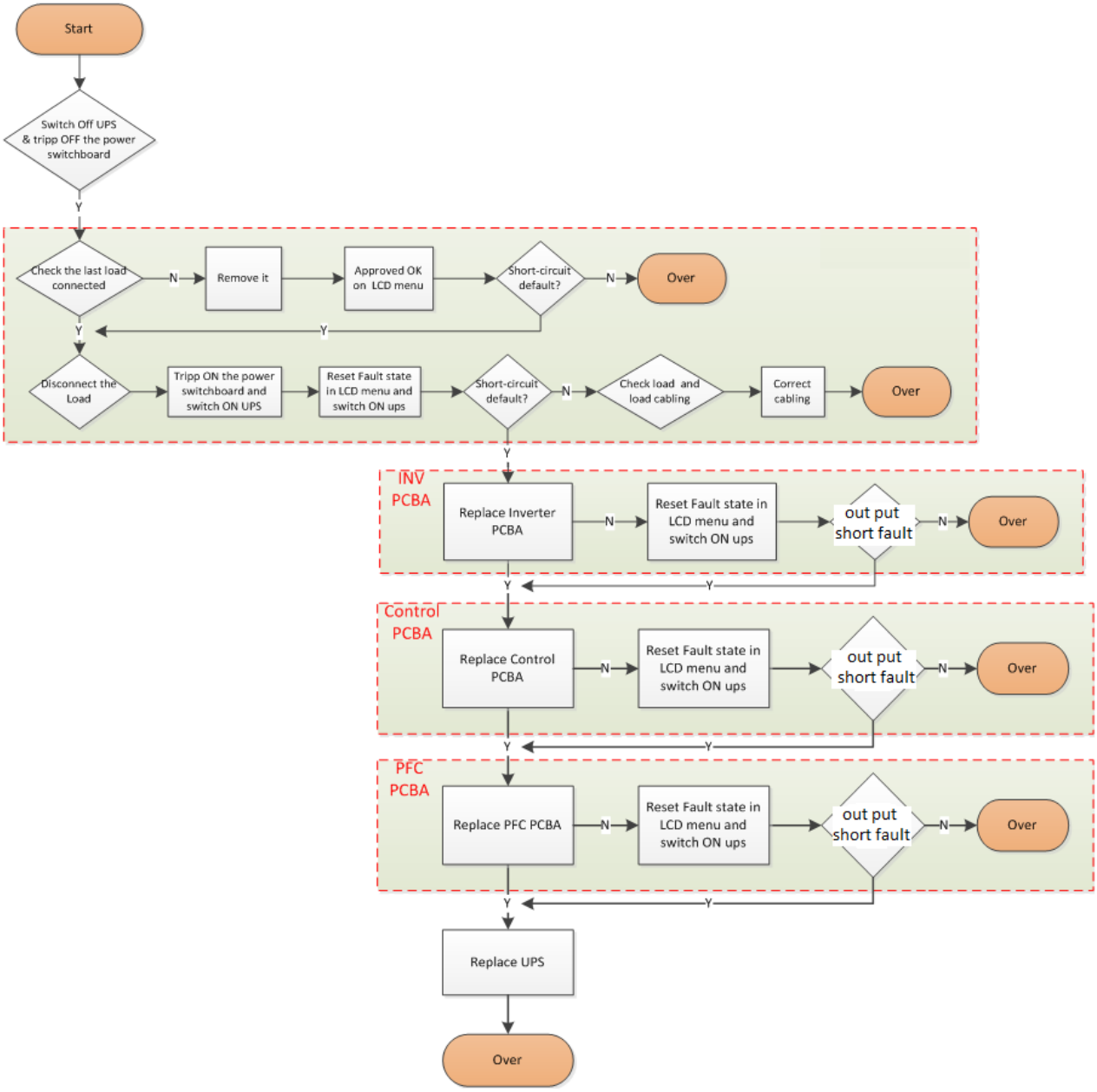
Inverter over voltage, Inverter under voltage



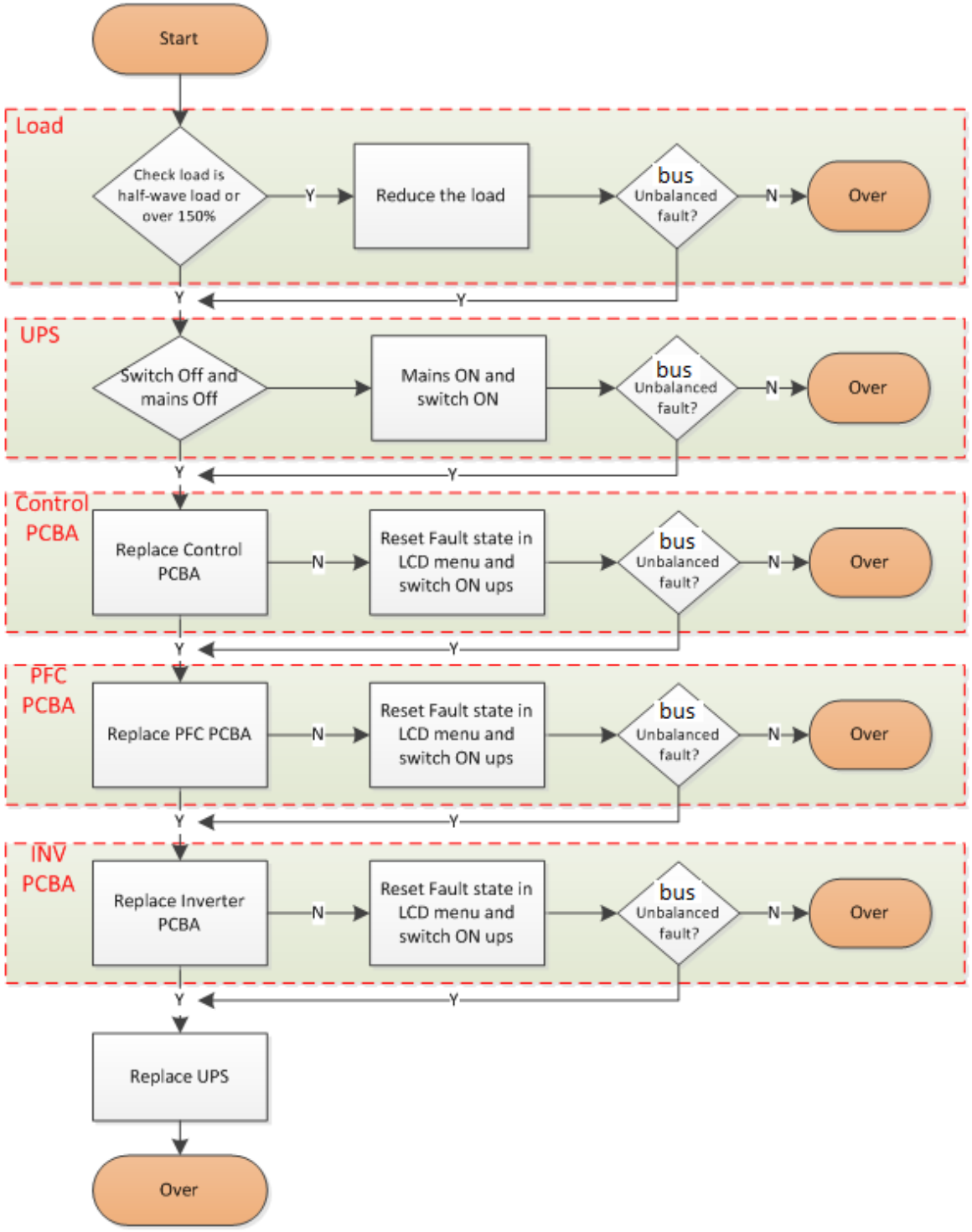
Negative power



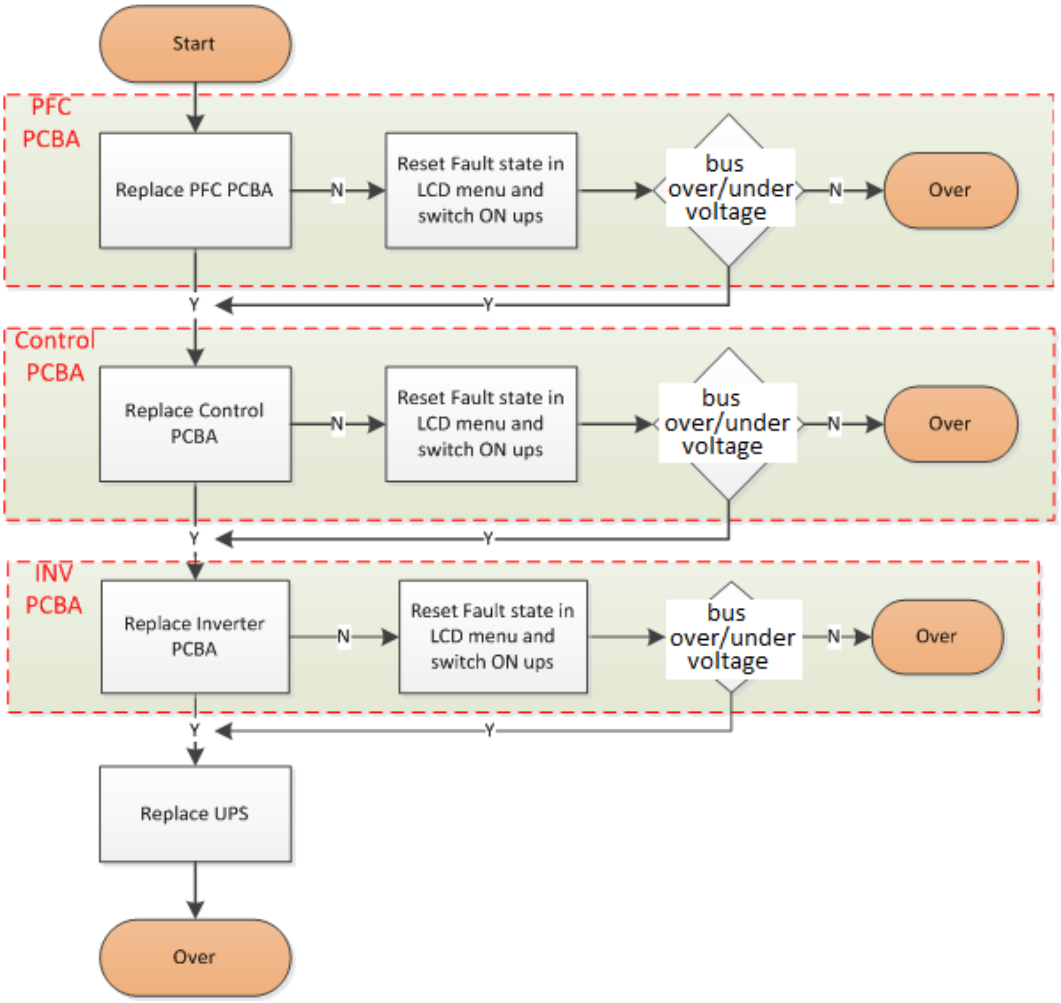
output short circuit



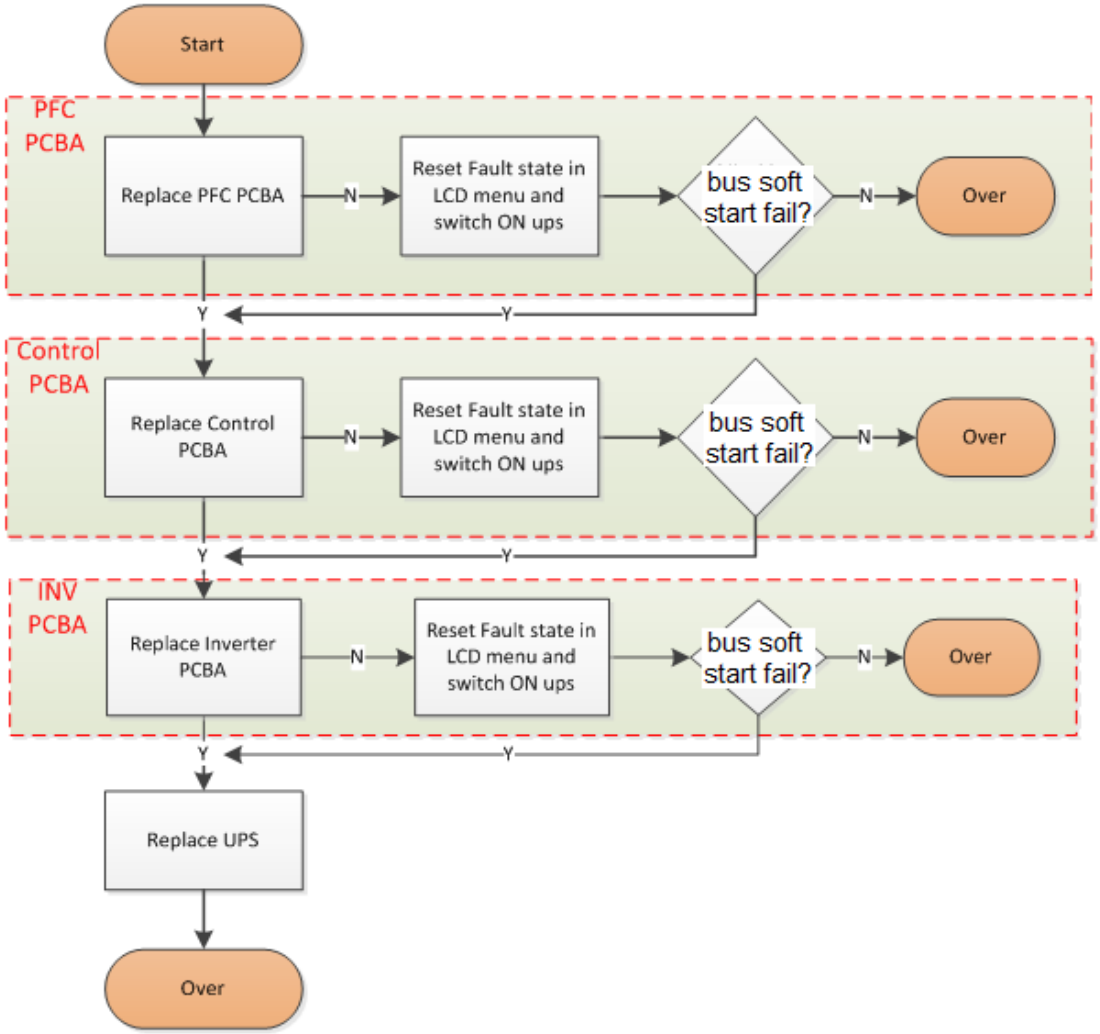
DC bus unbalanced



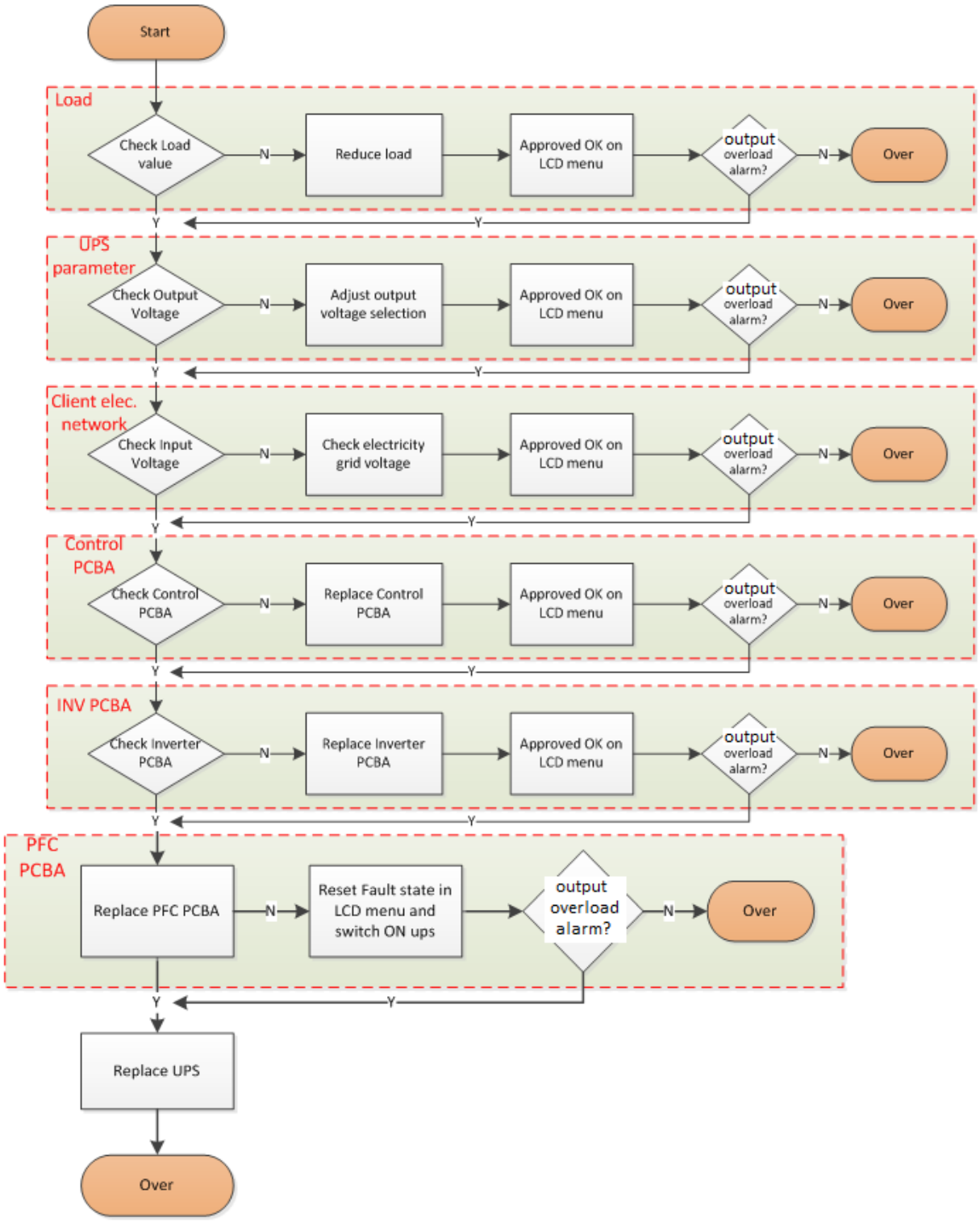
BUS over voltage BUS under voltage



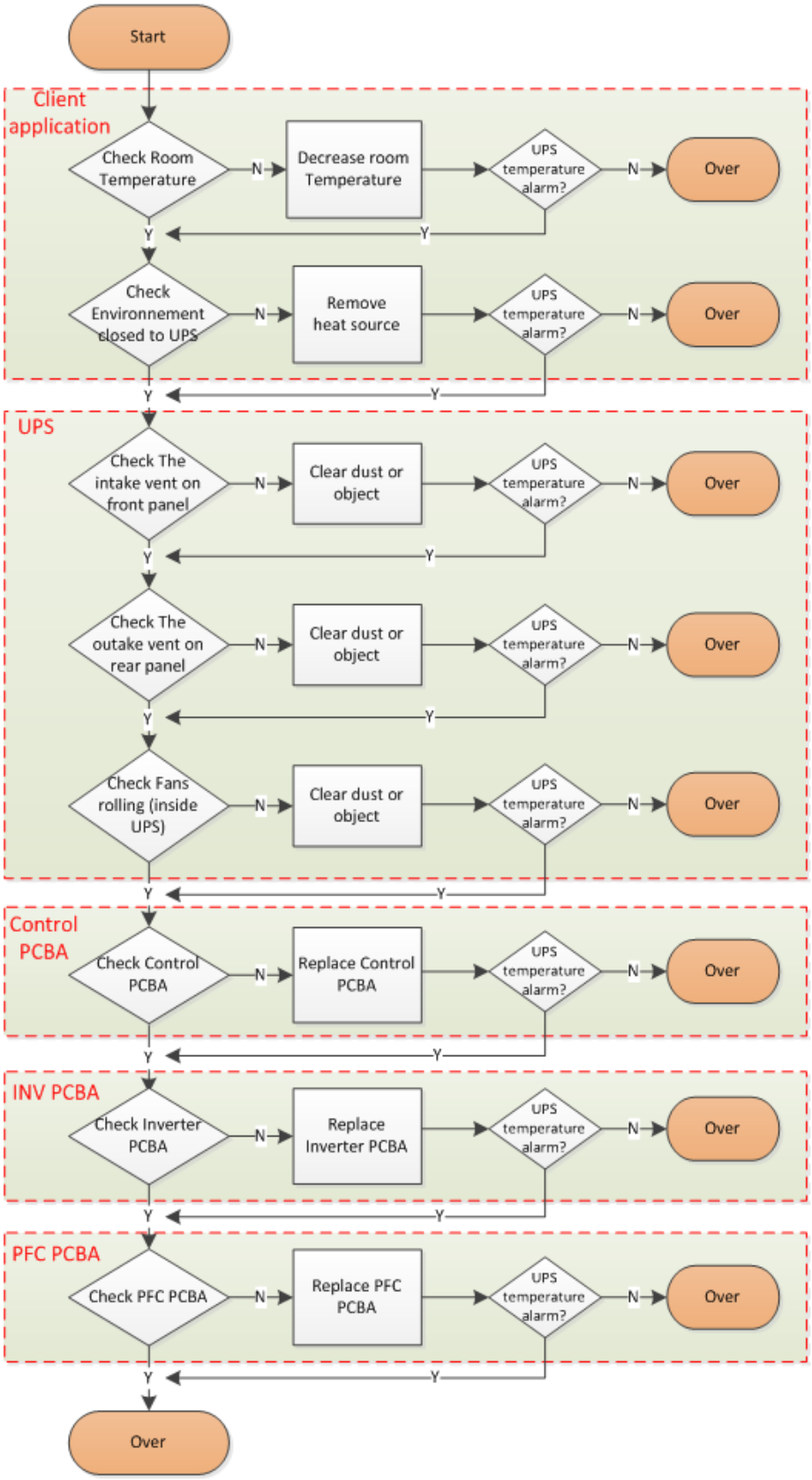
Rectifier fault



Inverter overload, Bypass overload

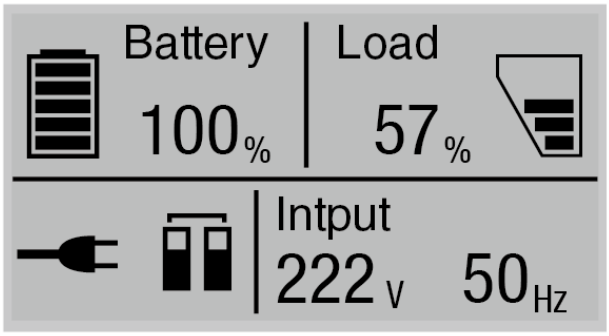


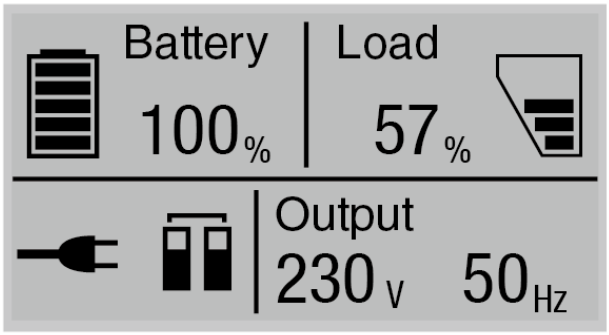
UPS temp. fault



- **LCD Panel Display**

UPS Status Summary screen is shown below.





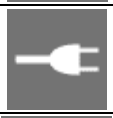
The UPS Status Summary screen is composed of four sections：
Battery Section:

1. Battery icon, it is composed of five bars and each one represent 20% battery level;
2. Battery value, it will be battery remaining time when UPS is working in battery mode and the function of battery remaining time is enabled. Otherwise it will be battery level instead.

Load Section:

1. Load icon, it is composed of five bars and each one represent 20% load level;
2. Load level value shows real-time load information;

UPS Status Section:
The icon on this section demonstrates ups working status; the following table describes the status information.

Operation status	Cause	Description
	Standby mode	The UPS is Off without output.
	Online mode	The UPS is operating normally and protecting the equipment.
 1 beep every 4 seconds	Battery mode	An utility failure has occurred, and the UPS is powering the equipment with battery. Prepare your equipment for shutdown.
 1 beep every 1 seconds	Battery mode with battery low	This warning is approximate, and the actual time to shutdown may vary significantly.
	High Efficiency mode	Once the mains are loss or abnormal, the UPS would transfer to Line mode or Battery mode and the load is supplied continuously.
	Converter mode	The UPS would free run with fixed output frequency (50Hz or 60Hz). The output maximum power and maximum charging current should be derating to 60% in converter mode.
	Bypass mode	Overload or fault has occurred, or a command has been received, and the UPS is in Bypass mode.
	Battery test	UPS is executing a battery test
	Battery fail	The UPS detects bad battery or battery disconnected
	Overload	Some unnecessary loads should be cut off to reduce the load.
	Fault mode	Some fatal problems happened.
	Parallel mode	UPS is working in parallel mode

- **Location of the faulty function or component**

Irregular UPS operation is most likely not an indication of a fault but due to simple problems or distraction. It is therefore advisable to consult the table below carefully as it summarises information which is useful for solving the most common problems.

PROBLEM	POSSIBLE CAUSE	SOLUTION
THE DISPLAY DOES NOT LIGHT UP	INPUT SWITCH OPEN	Close the input switch located on the back of the UPS.
	MAIN CONNECTION CABLE MISSING	Check that the power cable is connected correctly.
	NO MAINS VOLTAGE (BLACKOUT)	Check that the power reaches the socket where the UPS is connected (try it with a table lamp, for example).
	UPSTREAM THERMAL PROTECTION TRIP	Reset the thermal protection. CAUTION: Check that there is no output overload to the UPS.
THE DISPLAY IS ON BUT THE LOAD IS NOT POWERED	THE UPS IS IN STAND-BY MODE	Press the “ON” button on the front panel to power the loads.
	THE STAND-BY OFF MODE IS SELECTED	It is necessary to change mode. The STAND-BY OFF (emergency power supply) mode, in fact, only powers the loads in the event of a blackout.
	NO CONNECTION TO THE LOAD	Check the connection to the load.
THE UPS IS OPERATING FROM THE BATTERY DESPITE THE PRESENCE OF MAINS VOLTAGE	THE INPUT VOLTAGE IS OUTSIDE THE PERMITTED TOLERANCE RANGE FOR MAINS OPERATION	Problem with the mains. Wait until the input mains voltage returns within the tolerance range. The UPS will automatically return to mains operation.

7 Disassembly

This section defines the exact method to disassemble the UPS for all ratings.

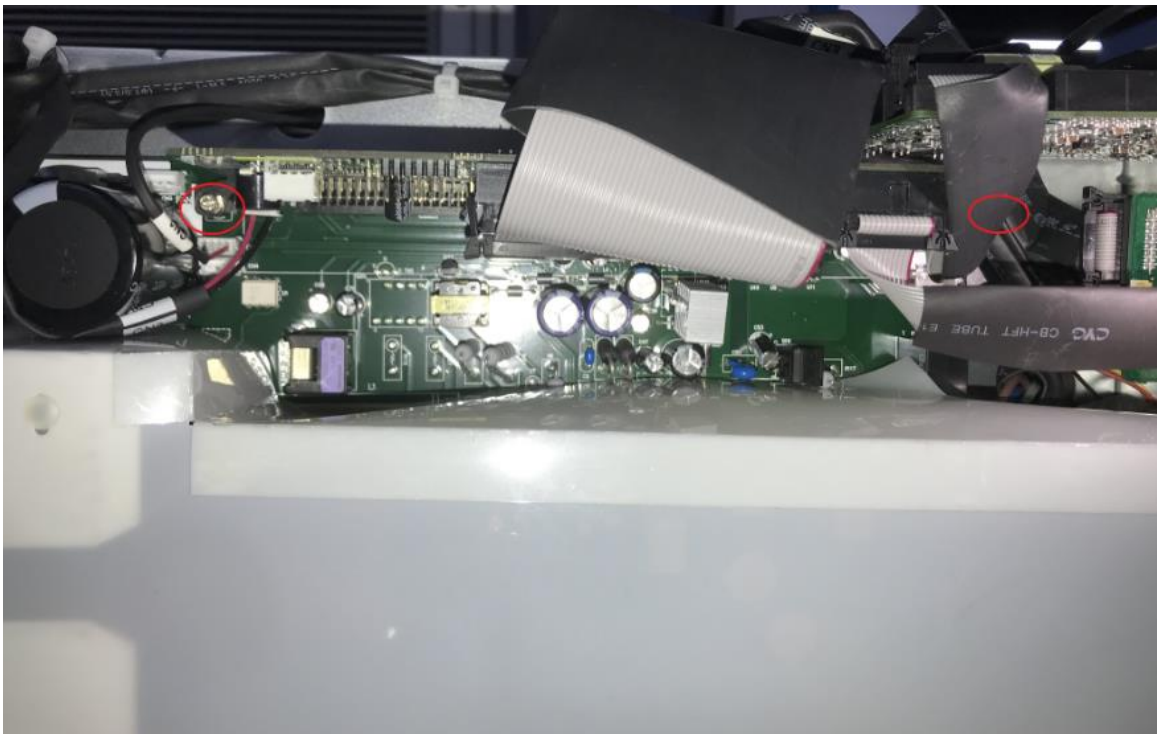
For tower UPS, the standard model and long backup model have similar assemblage, only 6K standard tower model and 10K longbackup tower model is shown.

6K Tower

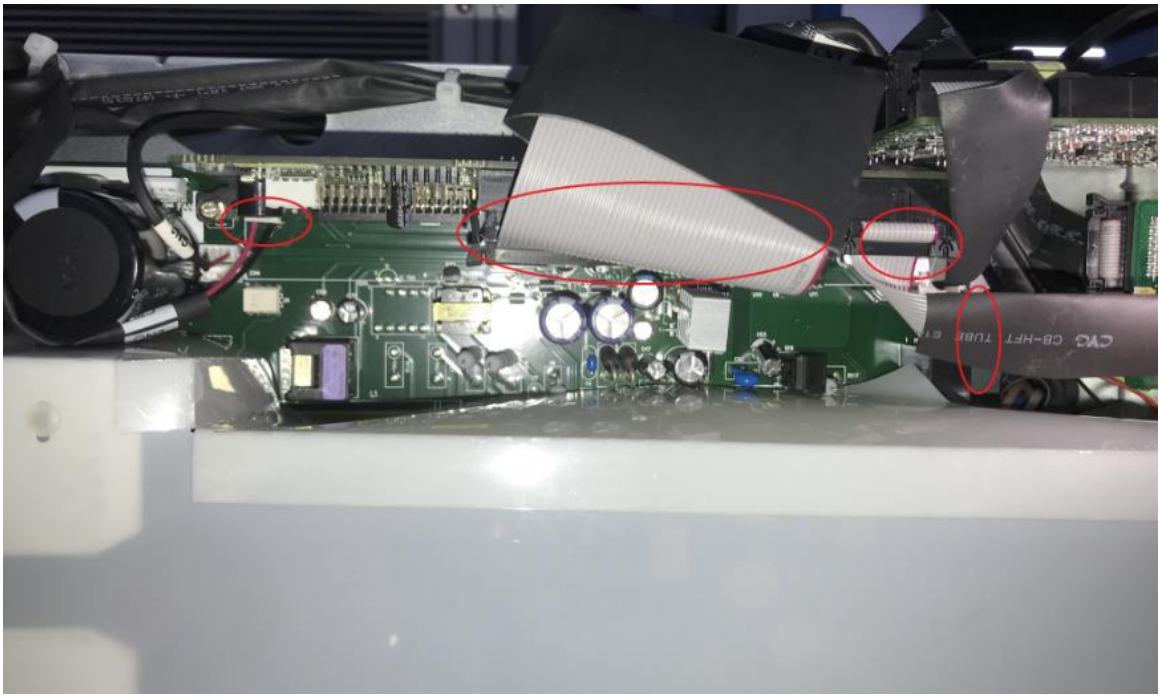
Remove the screws in left/right side panel and lift up the panel one by one.

Disconnect the internal battery

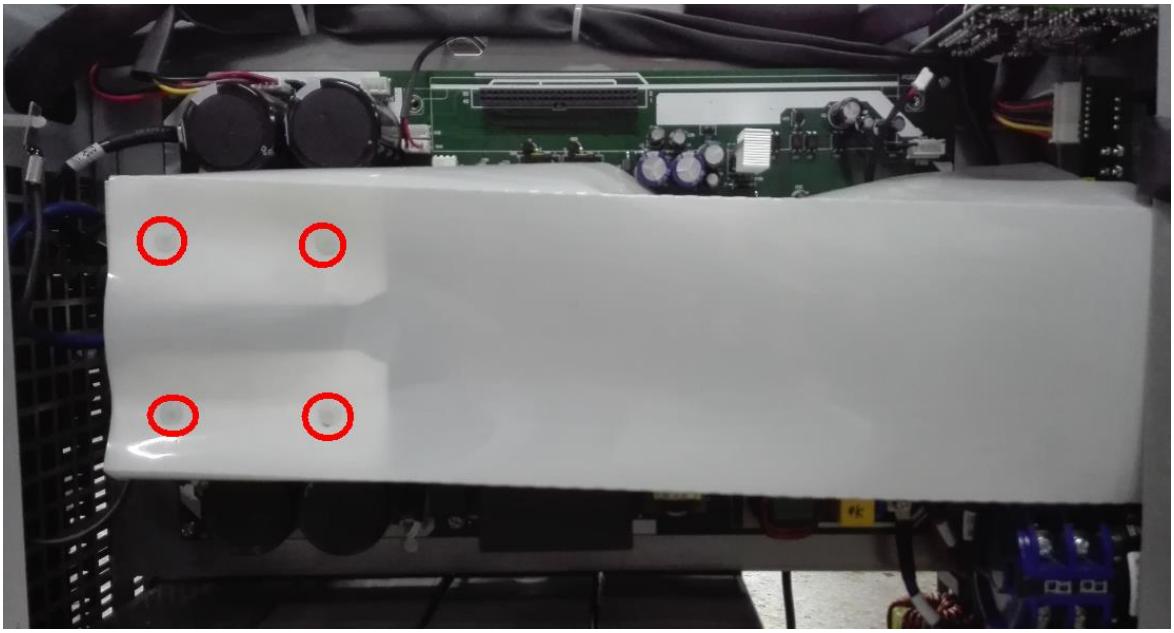
Remove the screws for CNTL board and unplug CNTL board.

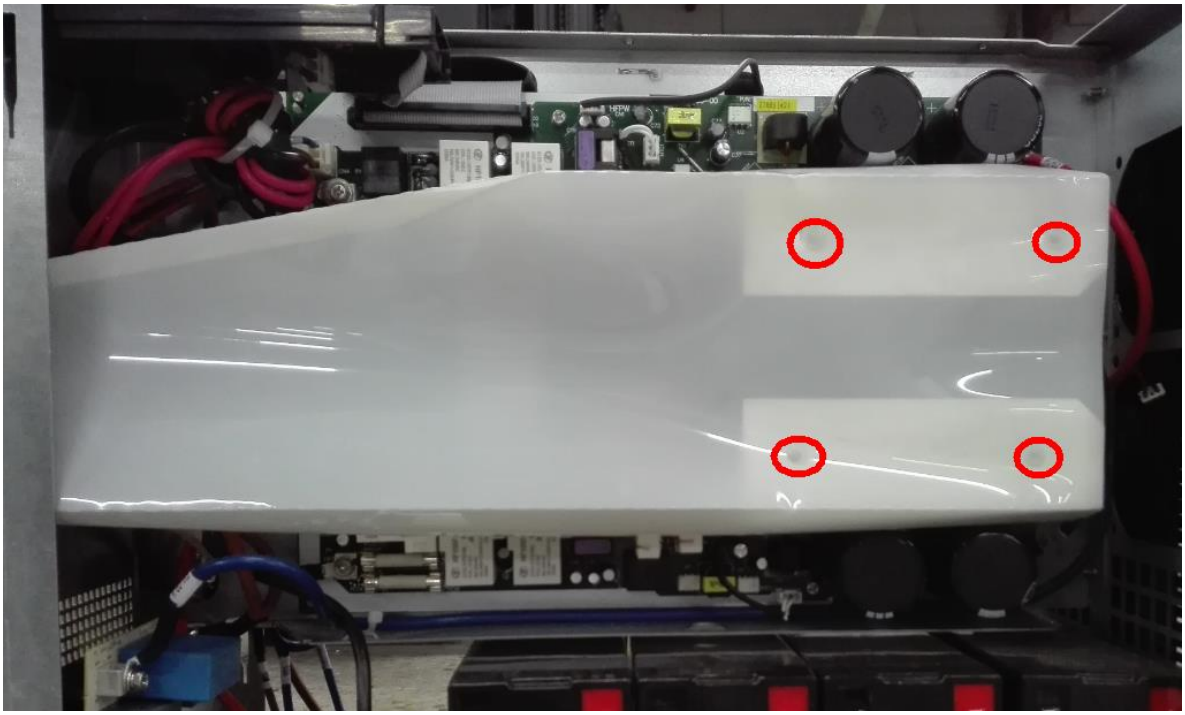


Disconnect cables on CNTL board, then take off the CNTL board.

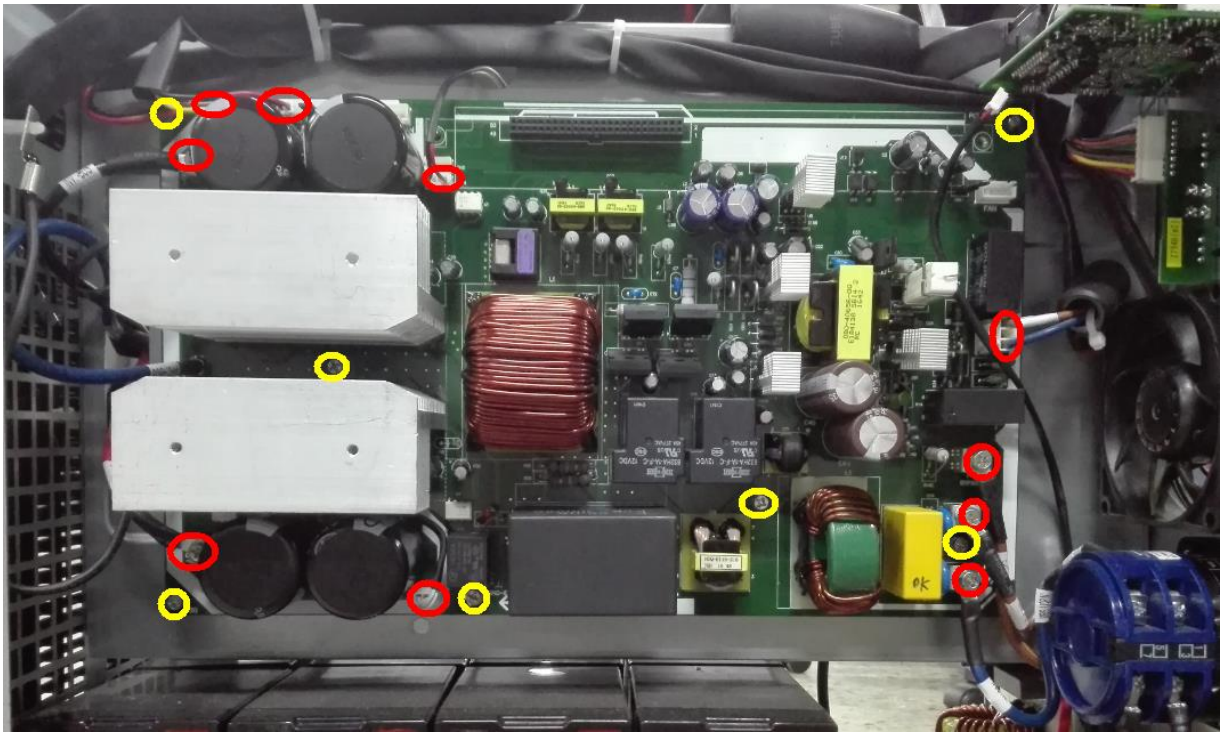


Remove the plastic screw for air channel paper (on both PFC board and INV board) and remove the air channel paper.

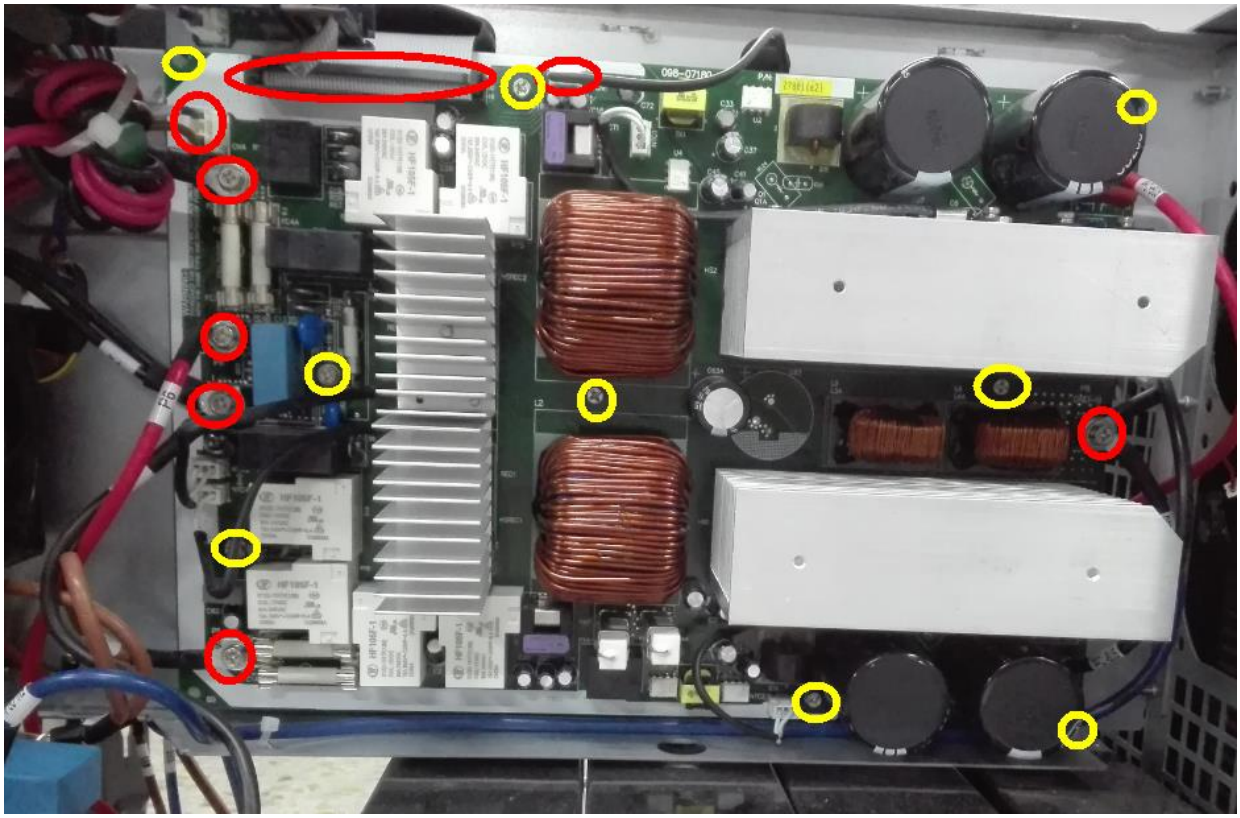




Remove all cables on INV board (also need disconnect the BUS.N cable from PFC board). Remove the screws for INV board and then take off INV board.



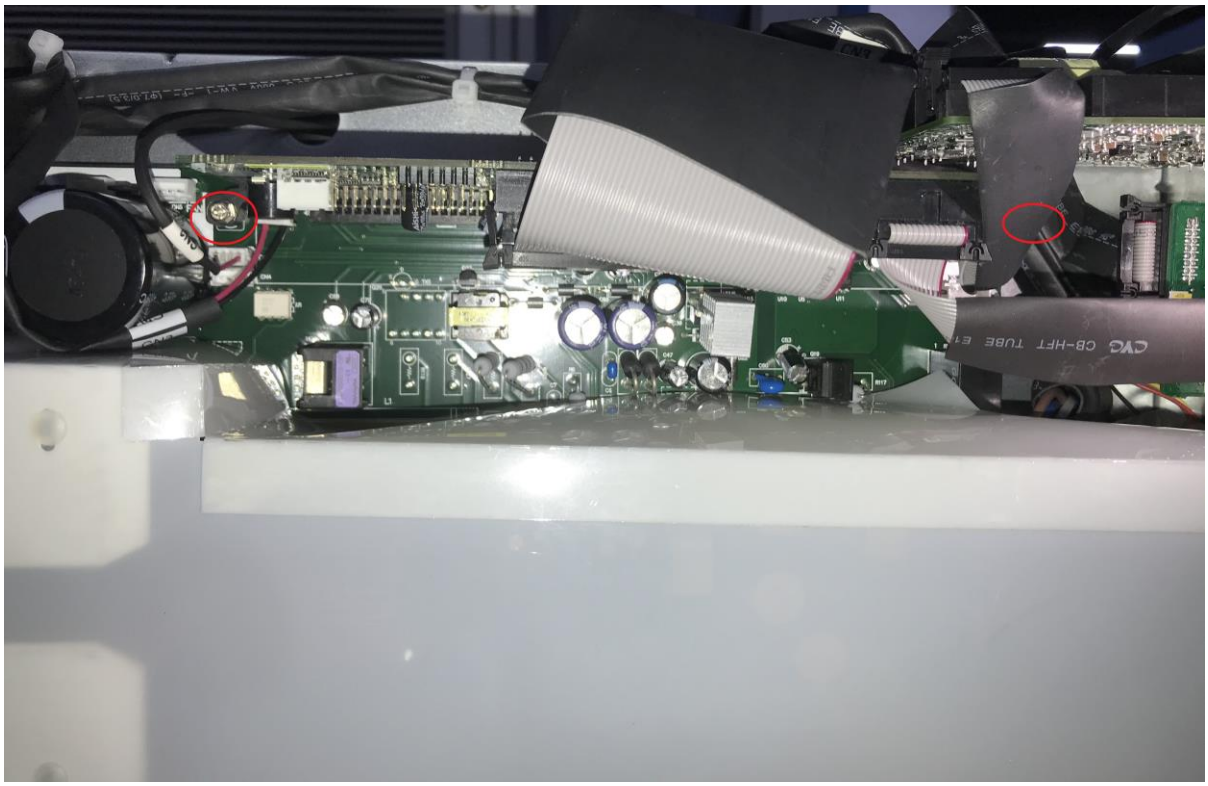
Remove all cables on PFC board (also need disconnect the BUS+ and BUS- cable from INV board). Remove the screws for PFC board and then take off PFC board.



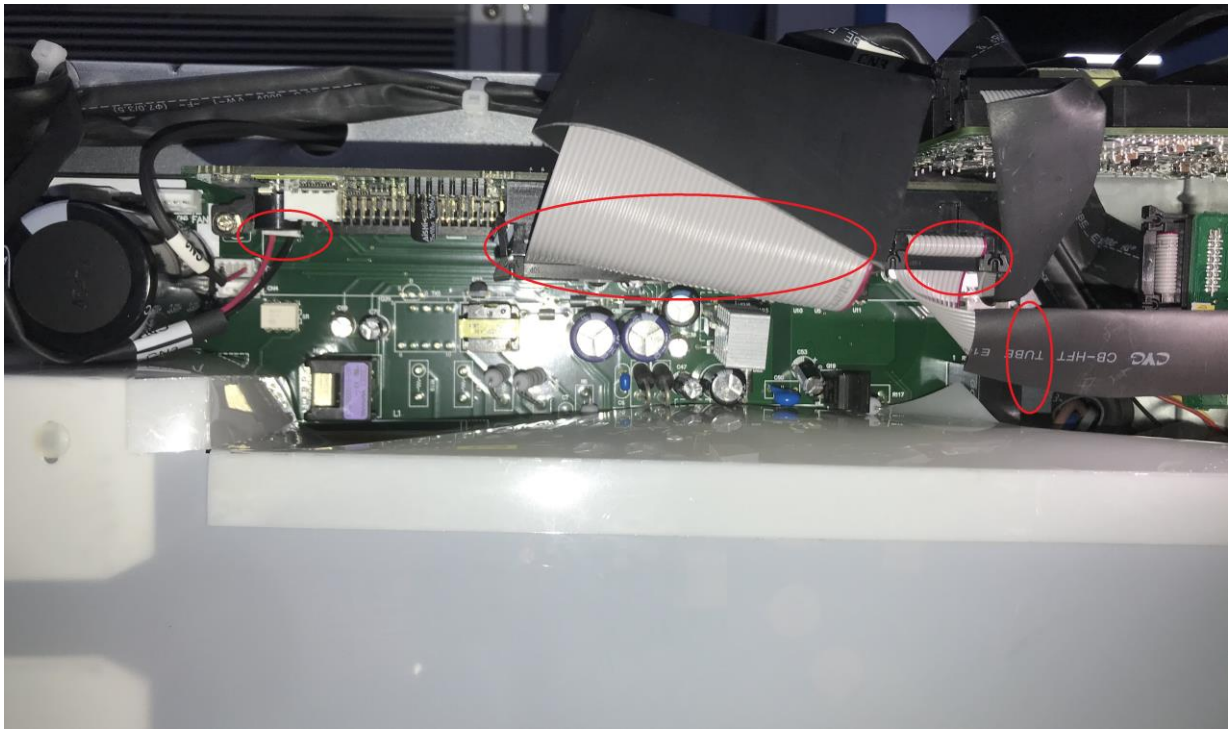
10K Tower

remove the screws in cover panel and lift up the cover.

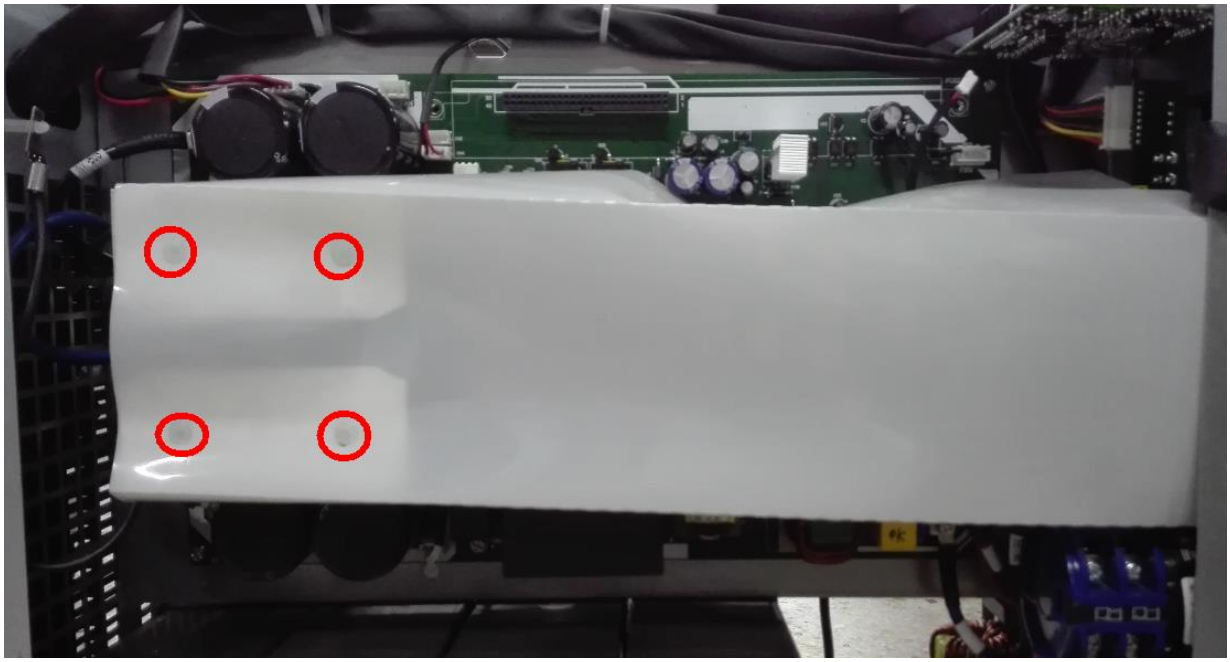
Remove the screws for CNTL board and unplug CNTL board.

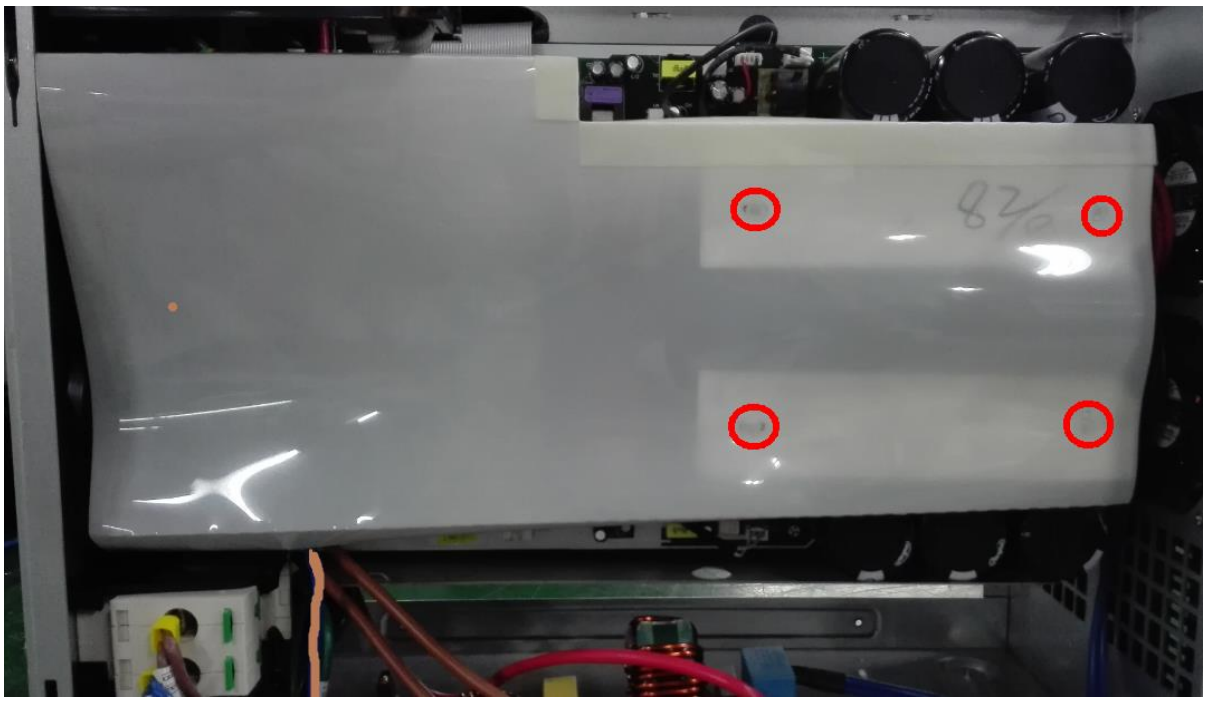


Disconnect cables on CNTL board, then take off the CNTL board .

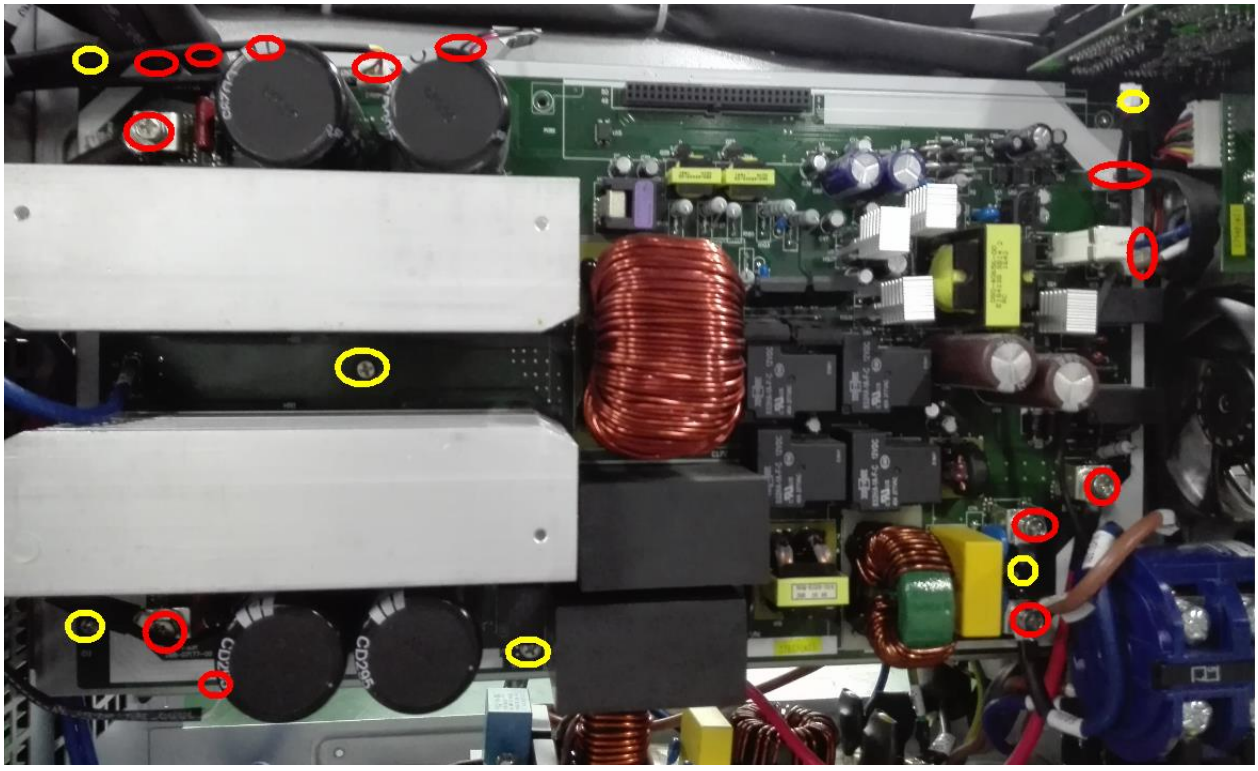


Remove the plastic screw for air channel paper and remove the air channel paper.

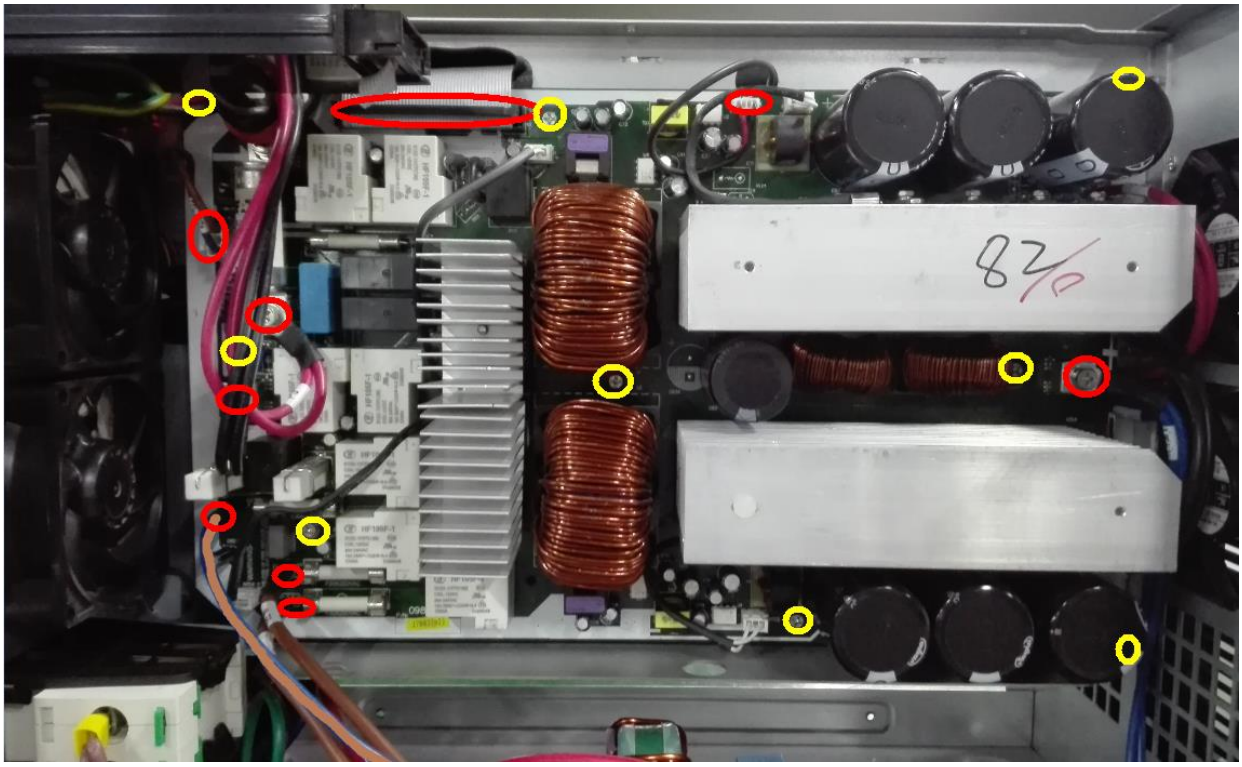




Remove all cables on INV board (also need disconnect the BUS.N cable from PFC board).Remove the screws for INV board and then take off INV board.



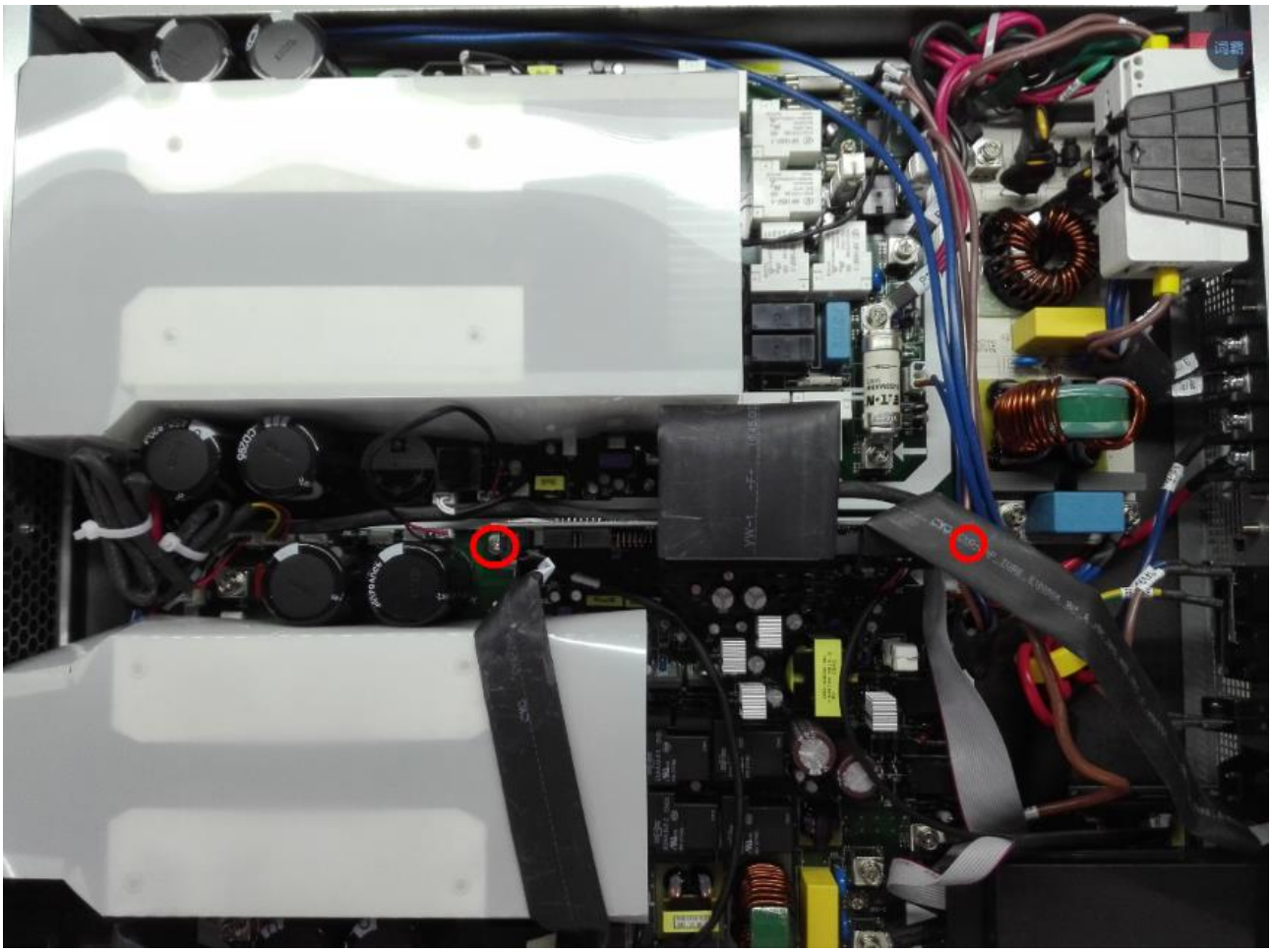
Remove all cables on PFC board (also need disconnect the BUS+ and BUS- cable from INV board) . Remove the screws for PFC board and then take off PFC board.



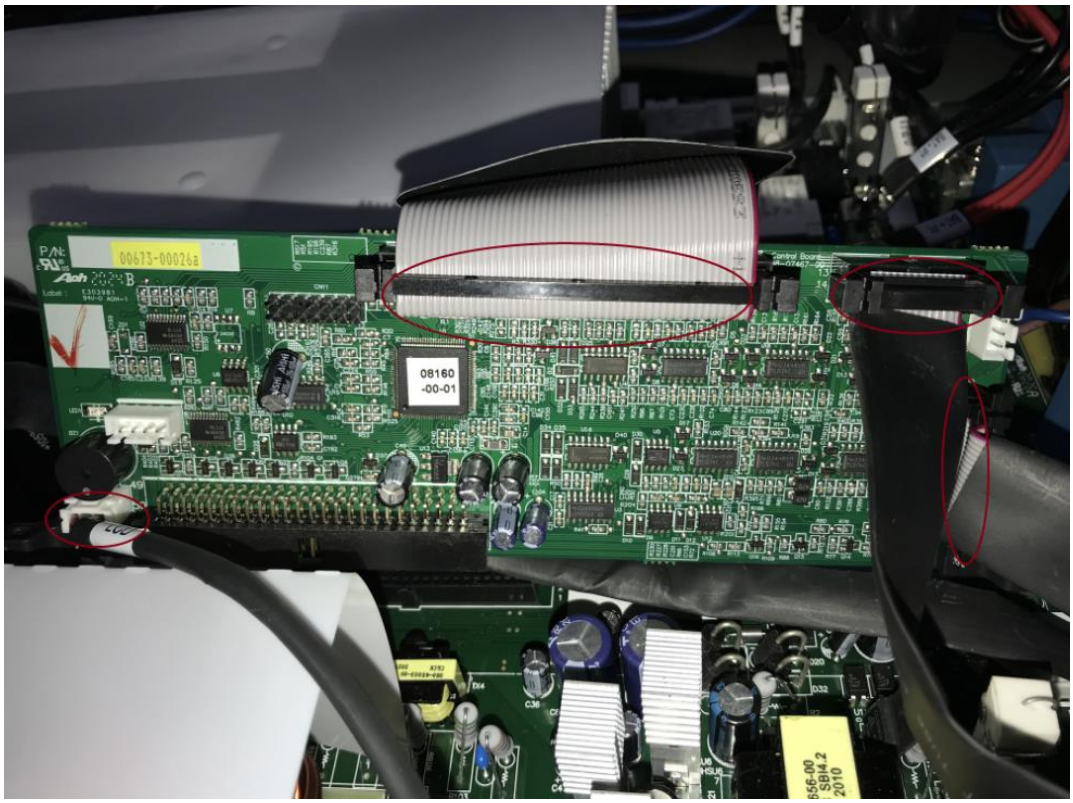
6K RACK

Remove the screws for cover panel and remove the cover panel.

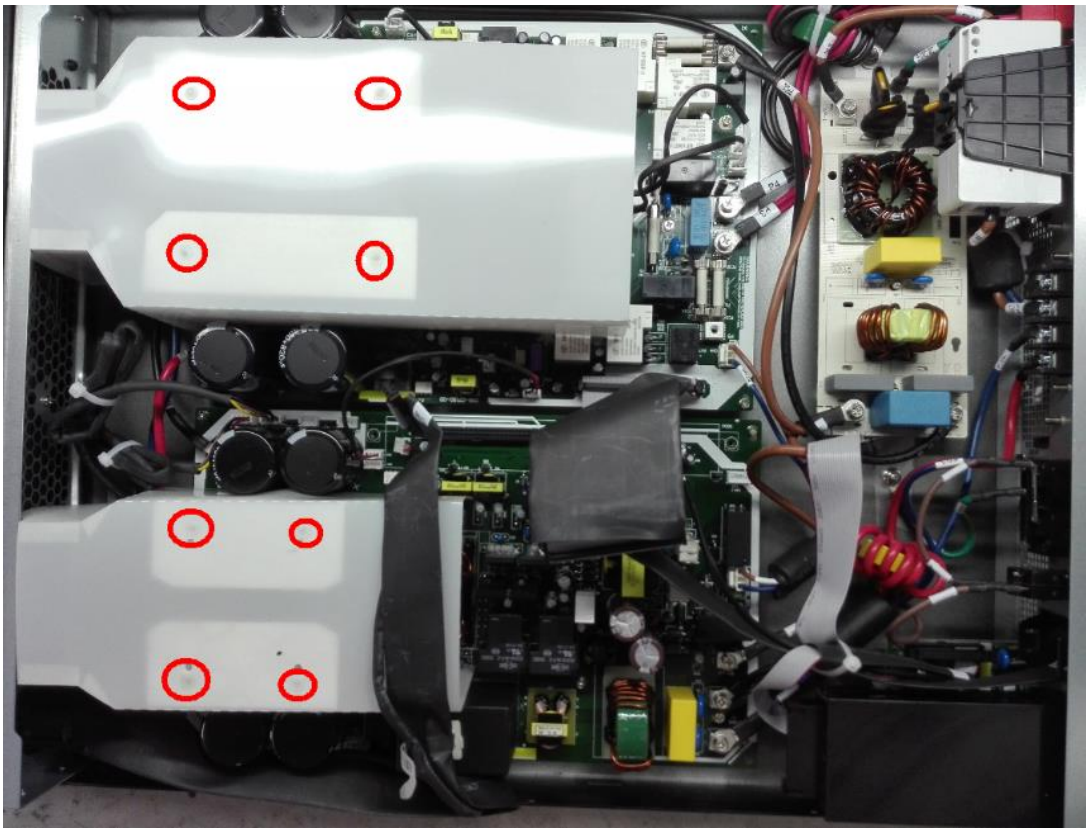
Remove the screws for CNTL board and unplug CNTL board.

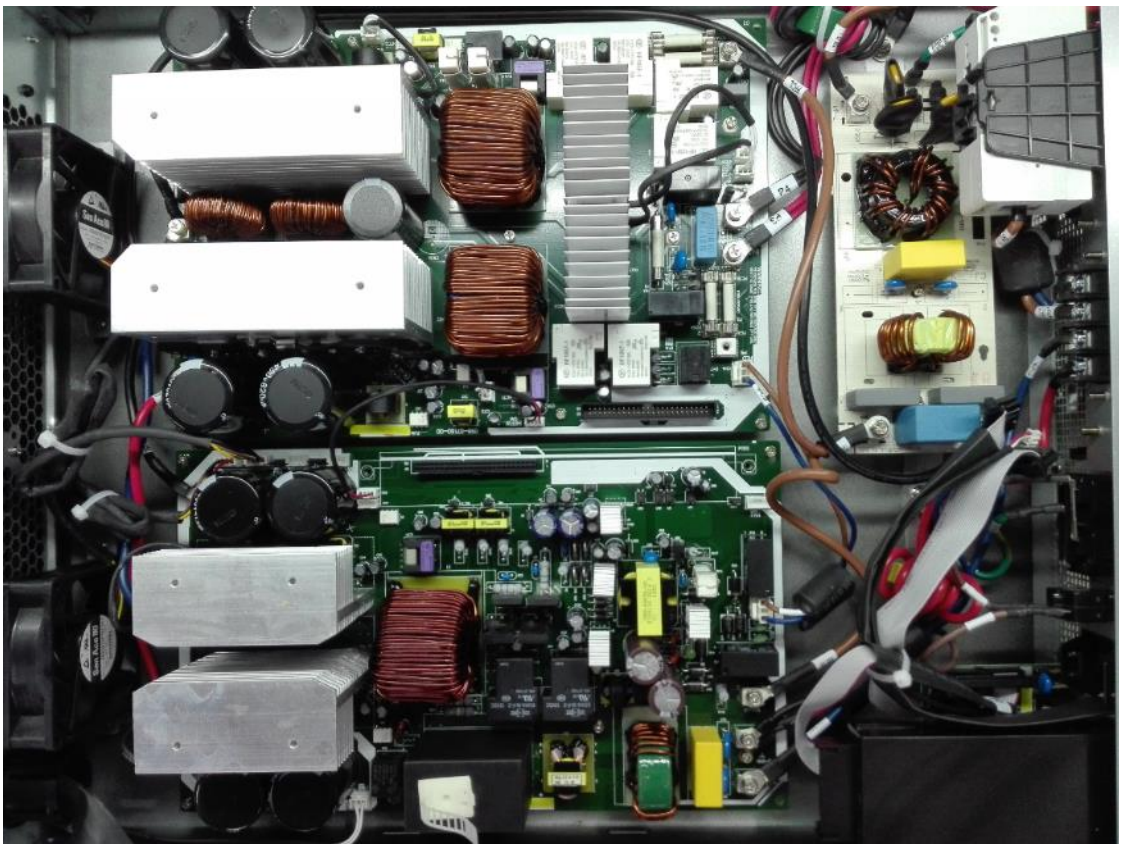


Disconnect cables on CNTL board, then take off the CNTL board .

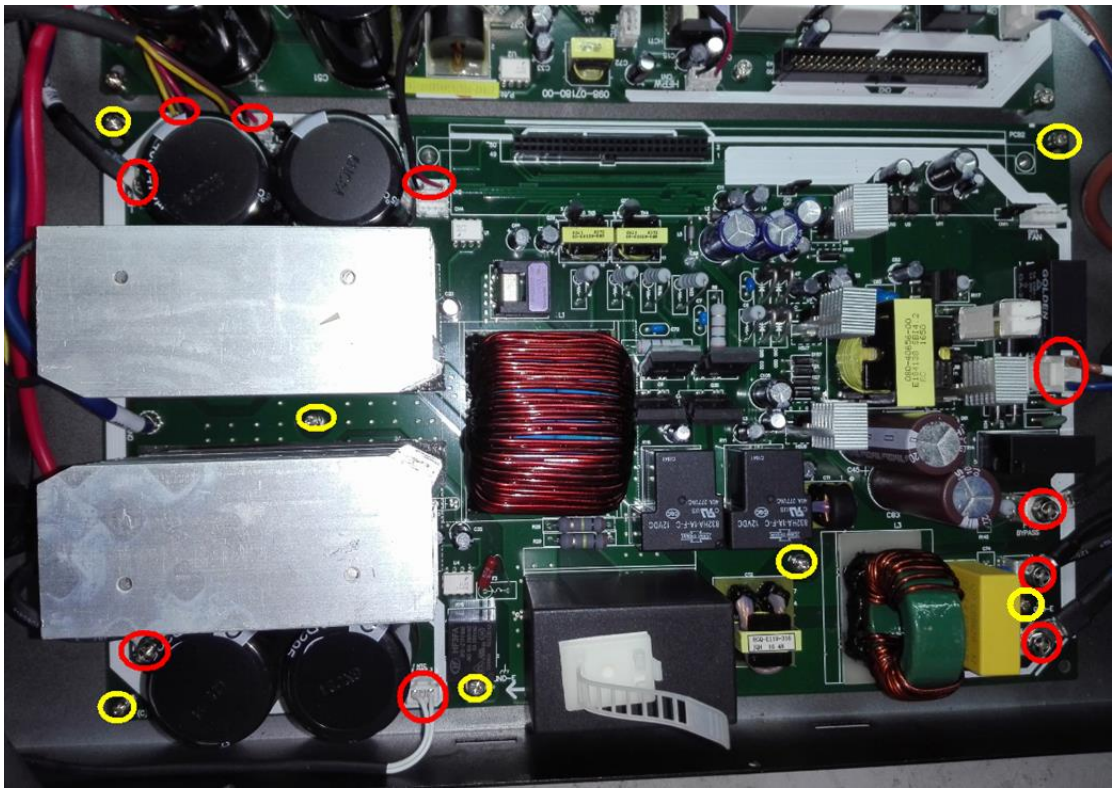


Remove the plastic screw for air channel paper and remove the air channel paper.

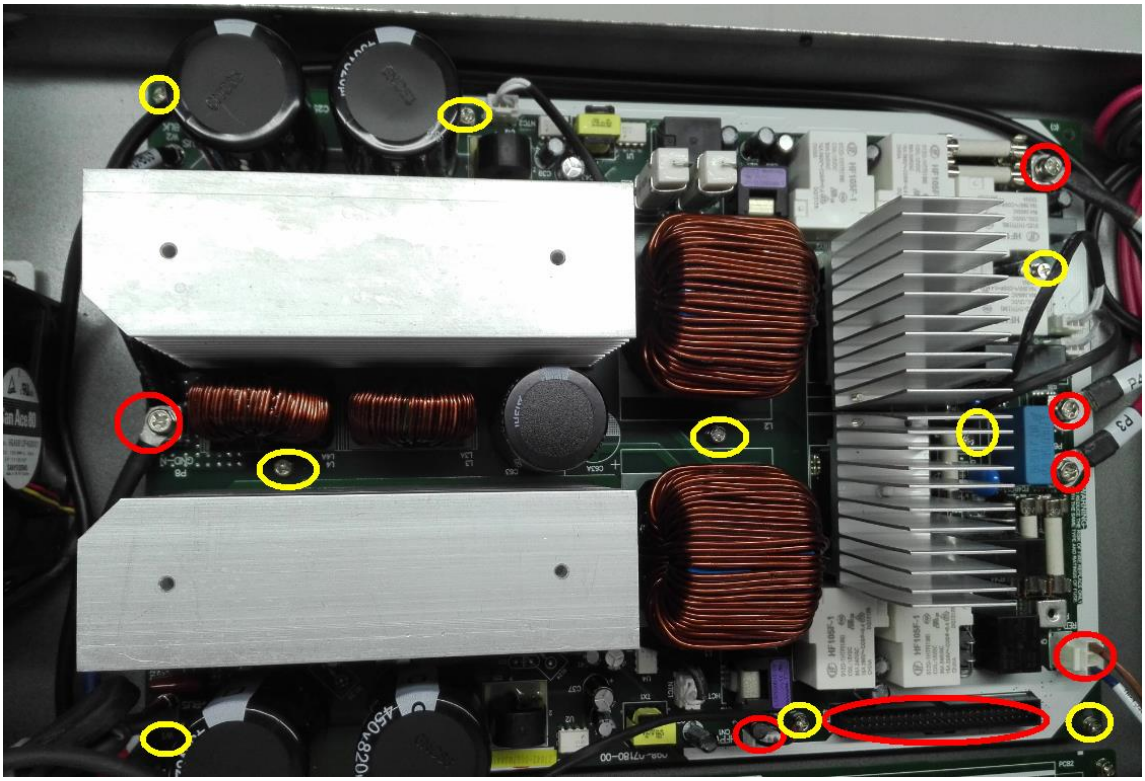




Remove all cables on INV board (also need disconnect the BUS.N cable from PFC board). Remove the screws for INV board and then take off INV board.



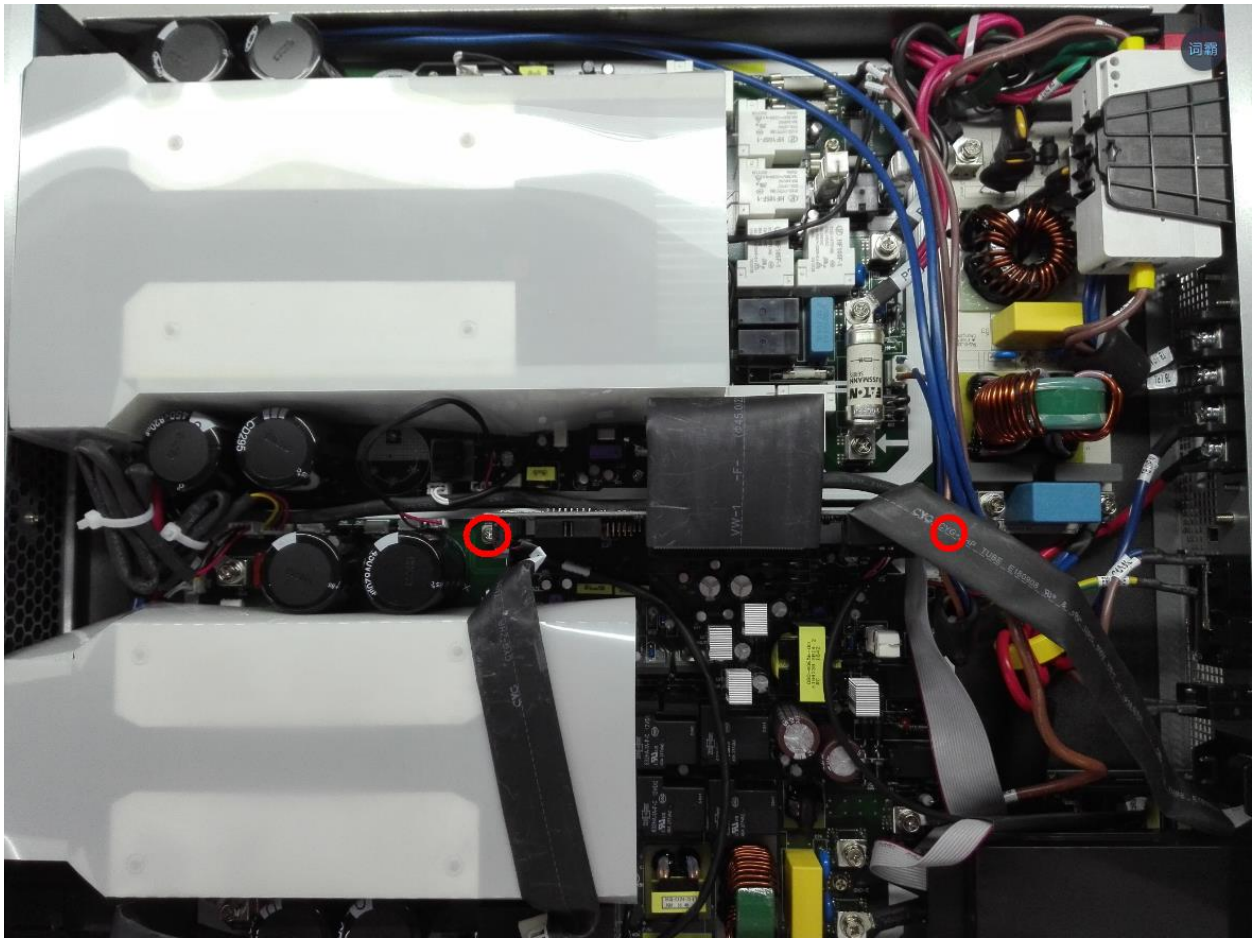
Remove all cables on PFC board (also need disconnect the BUS+ and BUS- cable from INV board). Remove the screws for PFC board and then take off PFC board.



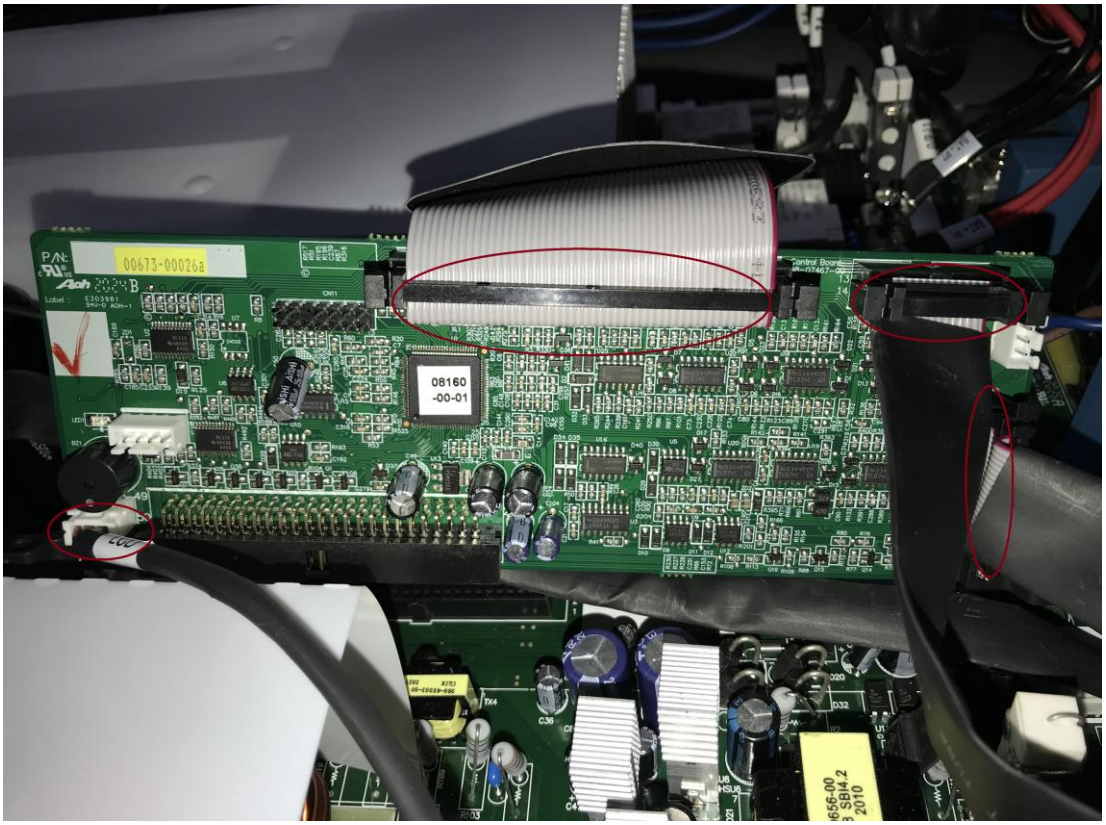
10K RACK

Remove the screws for cover panel and remove the cover panel.

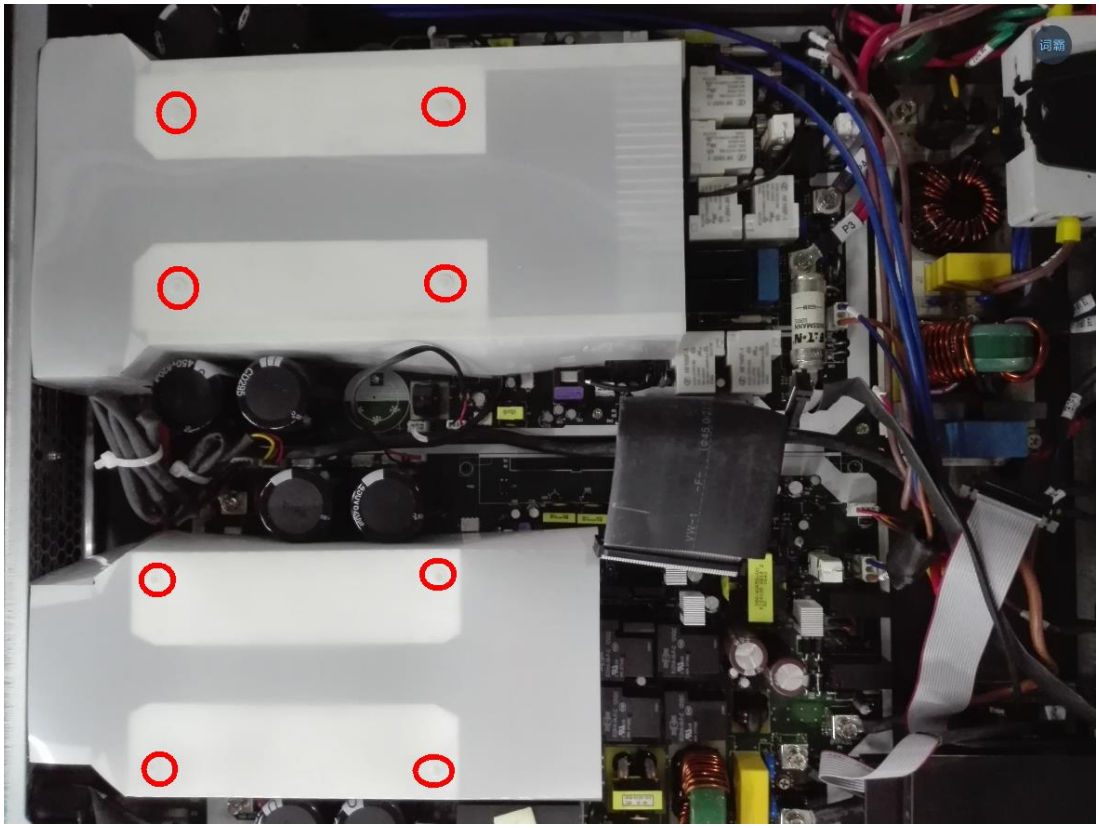
Remove the screws for CNTL board and unplug CNTL board.



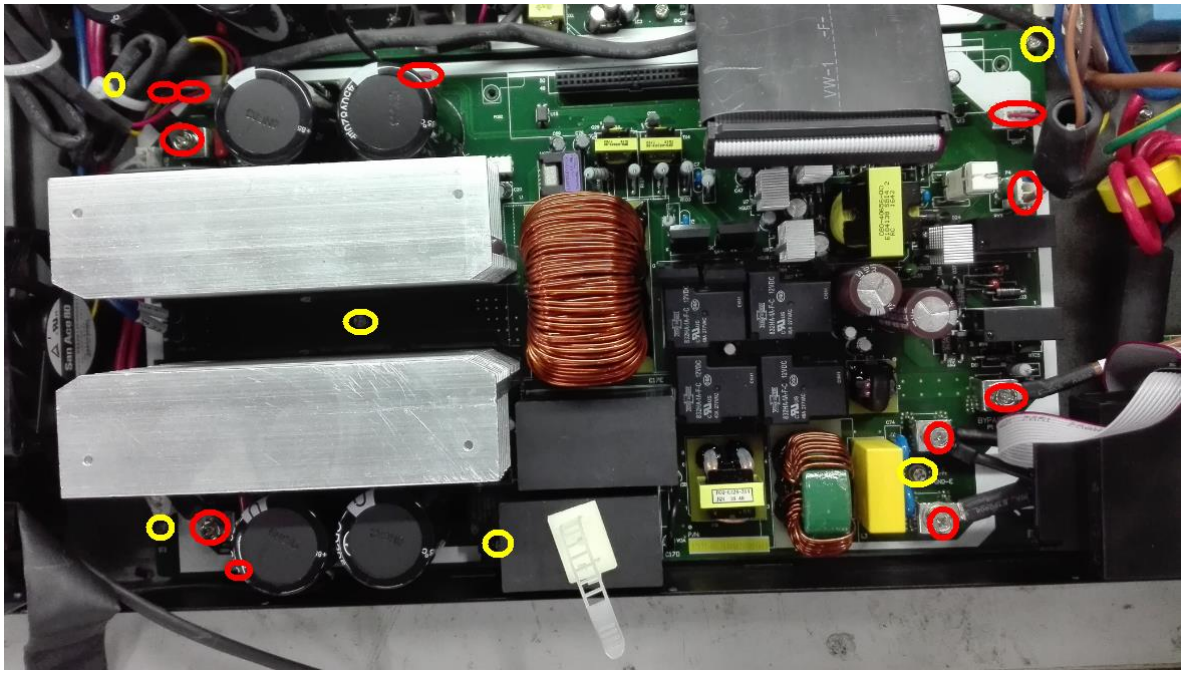
Disconnect cables on CNTL board, then take off the CNTL board .



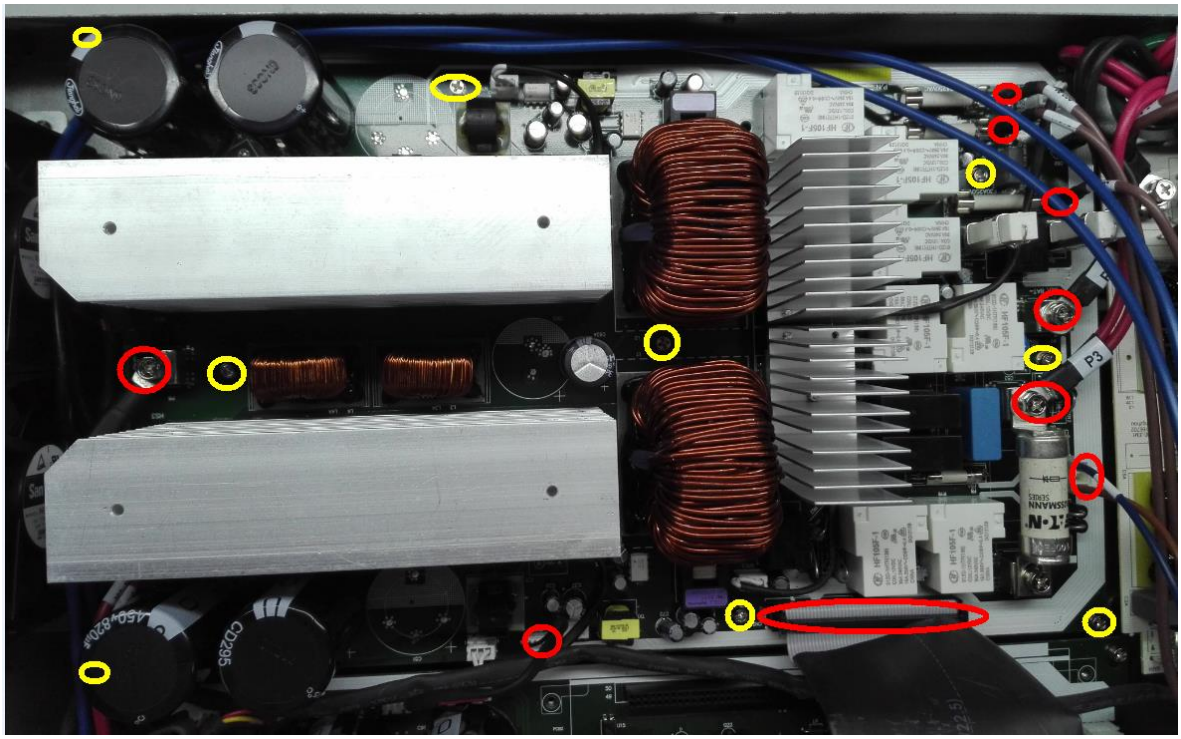
Remove the plastic screw for air channel paper and remove the air channel paper.



Remove all cables on INV board (also need disconnect the BUS.N cable from PFC board). Remove the screws for INV board and then take off INV board.



Remove all cables on PFC board (also need disconnect the BUS+ and BUS- cable from INV board). Remove the screws for PFC board and then take off PFC board.



8 Component level Tests by function and by board

Goal: Find failure through component level testing on the boards, the function or failed component.

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.

- **Fuse position:**

Related Circuit Block	Fuses to be checked	Component Type	Fail condition
PFC board			
I/P Fuse	6K(S): F1, F2 10K(S):F1,F2,F3	Fuse	Open
BAT Fuse	6K(S): F3,F4 10K(S):F5	Fuse	Open
Charger fuse	6K(S): F8(A) 10K(S): F8(A)	Fuse	Open
INV board			
SPS	6K(S): F1, F2 10K(S): F1, F2	Fuse	Open
EBM			
Fuse board	F5, F6	Fuse	Open

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

- **AC/DC Converter Analysis:**

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

	Checked components	Instrument function	Reference Value	Type	Failed condition
1	6K(S): Q4,Q5,Q8,Q24 10K(S): Q4,Q5,Q33,Q8,Q24,Q34	Diode Voltage Drop (E→C)	0.39	IGBT	Short or open
		(C→E) Diode Voltage Droop	/	IGBT	Short
2	6K(S): D2,D15	Diode Voltage Drop	0.38	Diode	Short or open
3	10K(S): D2,D15	Diode Voltage Drop	0.37	Diode	Short or open

	Checked components	Instrument function	Reference Value	Type	Failed condition
4	6K(S): REC1,REC2 10K(S): REC1,REC2	Diode Voltage Drop	0.48	Diode	Short or open
5	6K(S): D35,D36 10K(S): D35,D36	Diode Voltage Drop	0.39	Diode	Short or open
6	6K(S): R31,R32,R43,R160 10K(S): R31,R32,R181,R43,R160,R184	Ω	10	Resistance	Short or open or value change
7	6K(S): R22,R23,R24,R25	Ω	47	Resistance	Short or open or value change
	10K(S): R92,R156,R45,R33,R90,R180,R95,R42,R101,R159,R98,R183	Ω	121/2=60.5	Resistance	Short or open or value change

- **DC/AC Inverter Analysis:**

	Checked components	Instrument function	Reference Value	Type	Failed condition
1	6K(S): Q1,Q4	Diode Voltage Drop (E→C)	0.42	IGBT	Short or open
		(C→E) Diode Voltage Droop	/	IGBT	Short
2	6K(S): Q2,Q3	Diode Voltage Drop (E→C)	0.42	IGBT	Short or open
		(C→E) Diode Voltage Droop	/	IGBT	Short
3	10K(S): Q1,Q36,Q2,Q37,Q3,Q38,Q4,Q39	Diode Voltage Drop (E→C)	0.4	IGBT	Short or open
		(C→E) Diode Voltage Droop	/	IGBT	Short
4	6K(S): D9,D14 10K(S): D9,D14	Diode Voltage Drop	0.37	Diode	Short or open
5	6K(S): R3,R12,R16,R33 10K(S): R3,R191,R12,R194,R16,R197,R33,R200	Ω	10	Resistance	Short or open or value change
6	6K(S): R5,R13,R18,R35	Ω	47	Resistance	Short or open or value change

	Checked components	Instrument function	Reference Value	Type	Failed condition
7	10K(S): R5,R192,R35,R201	Ω	51	Resistance	Short or open or value change
8	10K(S): R13,R51,R195,R85,R18,R91,R198,R144	Ω	121/2=60.5	Resistance	Short or open or value change

- **Charger Analysis**

4A Charger

	Checked components	Instrument function	Reference Value	Type	Failed condition
1	6K: Q1A,Q10A 10K: Q1A,Q10A	Diode Voltage Drop (E→C)	0.44	IGBT	Short or open
		(C→E) Diode Voltage Droop	/	IGBT	Short
2	6K: D3,D11,D13,D14 10K: D3,D11,D13,D14	Diode Voltage Drop	0.42	Diode	Short or open
3	6K: R2,R52 10K: R2,R52	Ω	47	Resistance	Short or open or value change

12A Charger

	Checked components	Instrument function	Reference Value	Type	Failed condition
1	6KS: Q1,Q10 10KS: Q1,Q10	Diode Voltage Drop (E→C)	0.50	IGBT	Short or open
		(C→E) Diode Voltage Droop	/	IGBT	Short
2	6KS: D3,D11,D13,D14 10KS: D3,D11,D13,D14	Diode Voltage Drop	0.38	Diode	Short or open
3	6KS: R2,R52 10KS: R2,R52	Ω	47	Resistance	Short or open or value change

- **Test after repairing**

After repairing all failed components or PCB board, the next check and test procedure should be followed.

1. Check the internal wiring connection.
2. Fix the side and top cover.
3. Connect the external wiring. PE must be connected.
4. Check all switch status is right.
5. Take on the battery power.

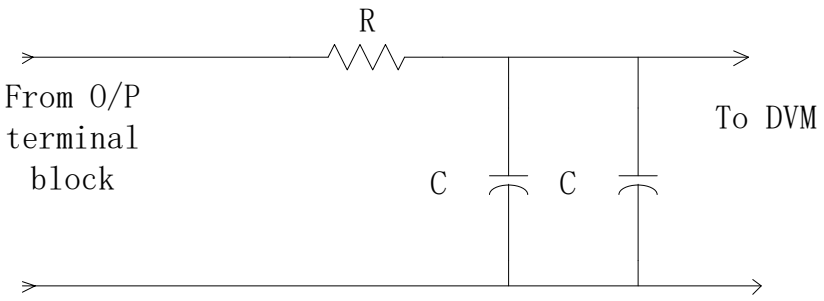
   Note: It is suggested to use DC power which has current limit function as the battery power. It can protect the UPS in case there is still some failure part. The limit current should be 3A.
6. Turn on the UPS. And then check the voltage and UPS status. If turn on failed, please check the fault code.
7. Turn off UPS. Take on the input AC power.
8. Turn on the UPS again. And then check the voltage and UPS status. If turn on failed, please check the fault code.
9. If possible, take on full load test after finish before test. Then return UPS to end user.

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

Typical voltage

TEST ITEM	TEST POINT	EXPECTED RESULT
+DC Bus Voltage	P8 and P9 on **PFC board**	+350VDC to +390VDC
-DC Bus Voltage	P8 and P9 on **PFC board**	-350VDC to -390VDC
O/P voltage	P6 and P7 on INV **board**	230Vac (or 220Vac, etc according to the setting)
O/P DC offset	P6 and P7 on INV **board**	100mV max.

DC Offset Measurement Fixture: A RC net shown in below picture can be used to measure output voltage DC offset.



R=100Kohm/2W
C=10uF/250V

9 Annex parallel function

The parallel function is optional.

9.1 Safety Instructions

- This is permanently connected equipment, and it must be installed by qualified maintenance personnel.
- The utility power must be cut off before install the parallel card.
- The UPS must be shut down completely before install the parallel card.
- Do not disconnect the protective earthing from the UPS.
- While the UPSs work as a parallel system, the external parallel cable should be reinforced insulation.

9.2 Installation

Install a new parallel UPS system

Maximum parallel model number is 3.

Before installing a new parallel UPS system, user need to prepare the input and output wires and the parallel cable.

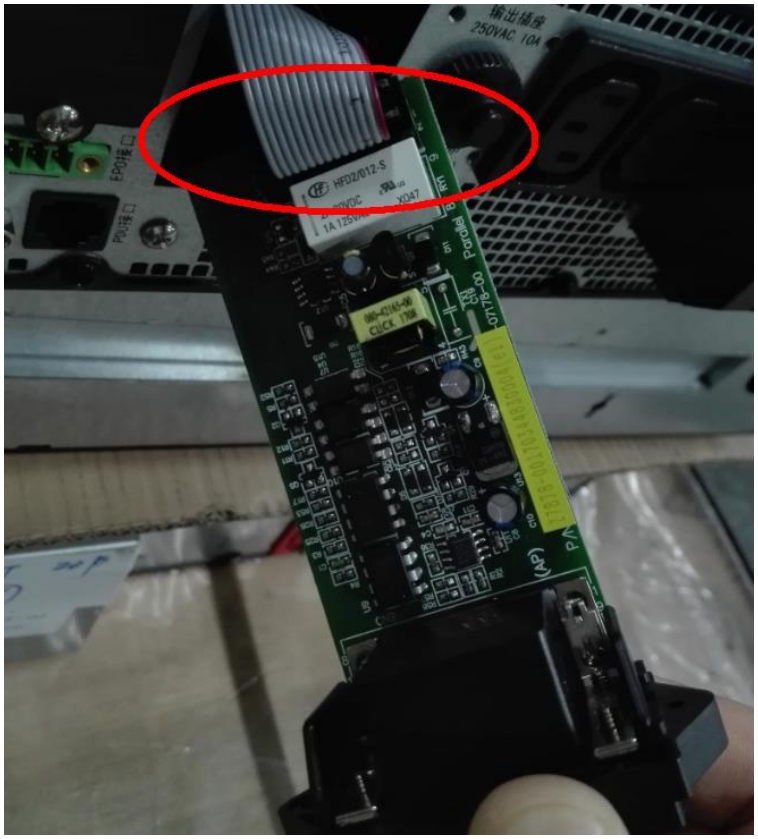
Users need to use a standard 25-pin communication cable in the parallel kit.

Remove the cover plate of the parallel port on the UPS, then install the parallel card, connect each UPS one by one with the parallel cable.

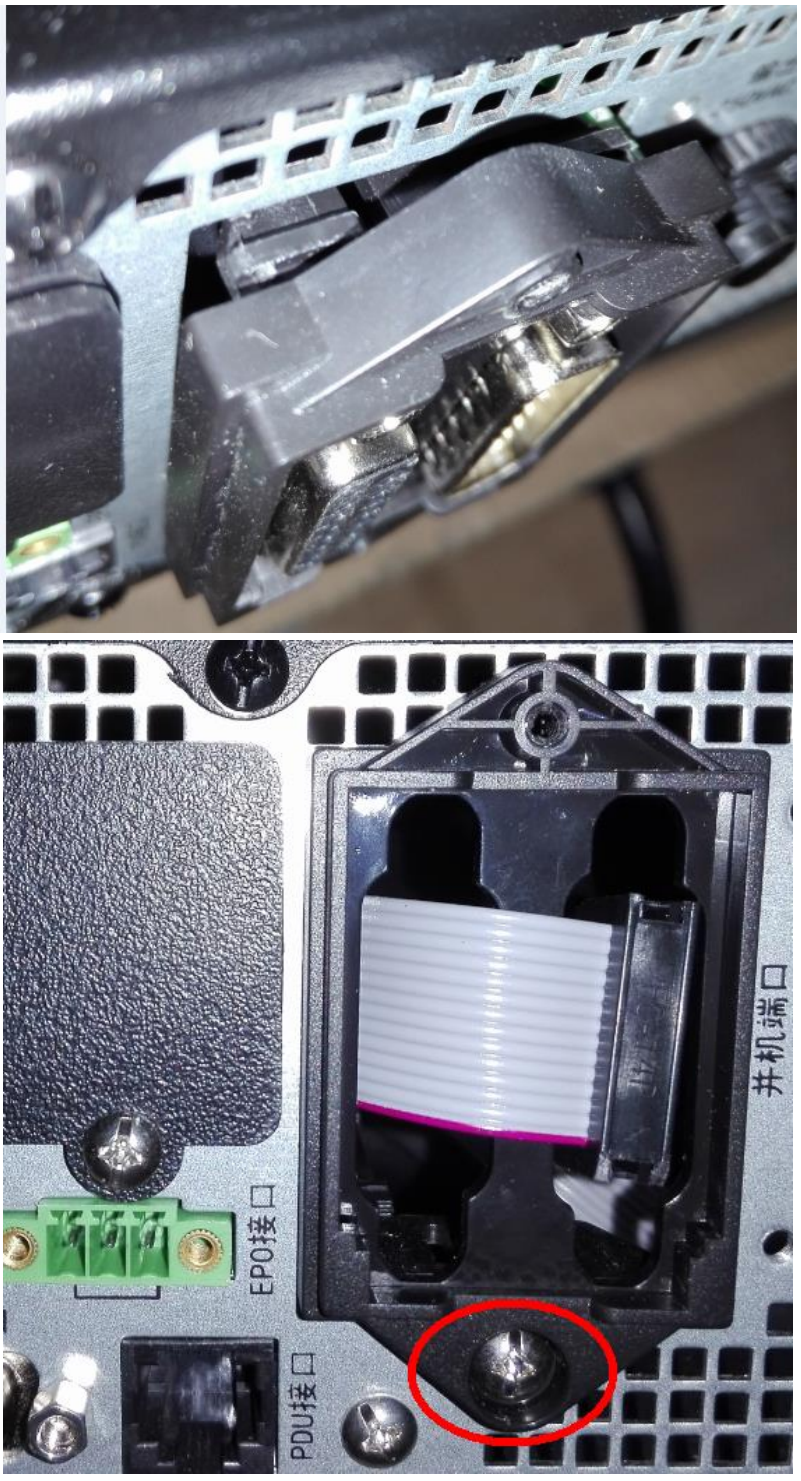
Step1. Unscrew the parallel cover.

Step2. Unscrew the parallel box

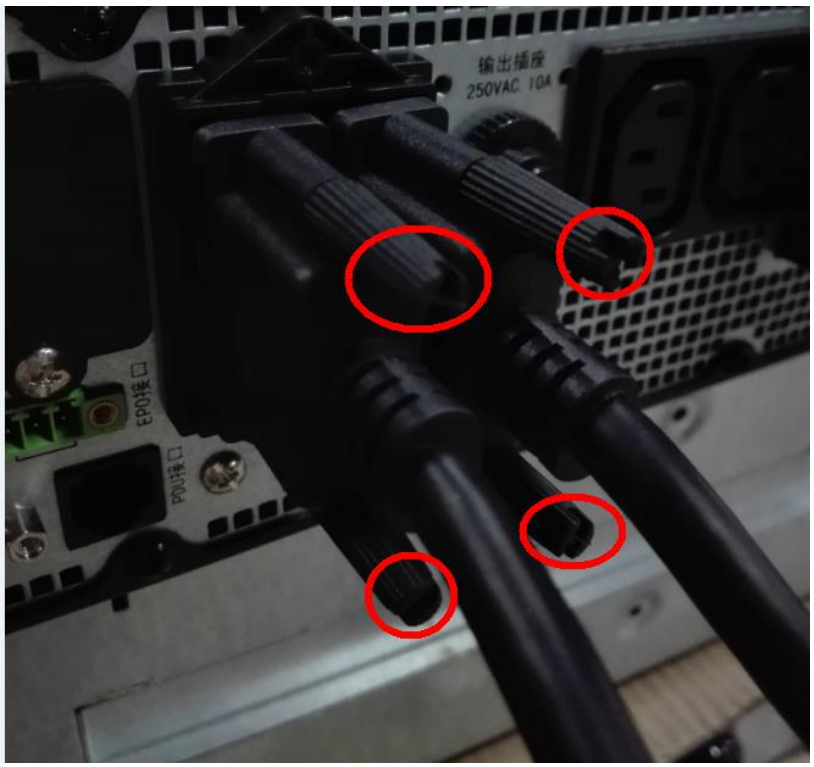
Step 3. Insert parallel board into parallel box



Step 4. Connect the signal wire to parallel board



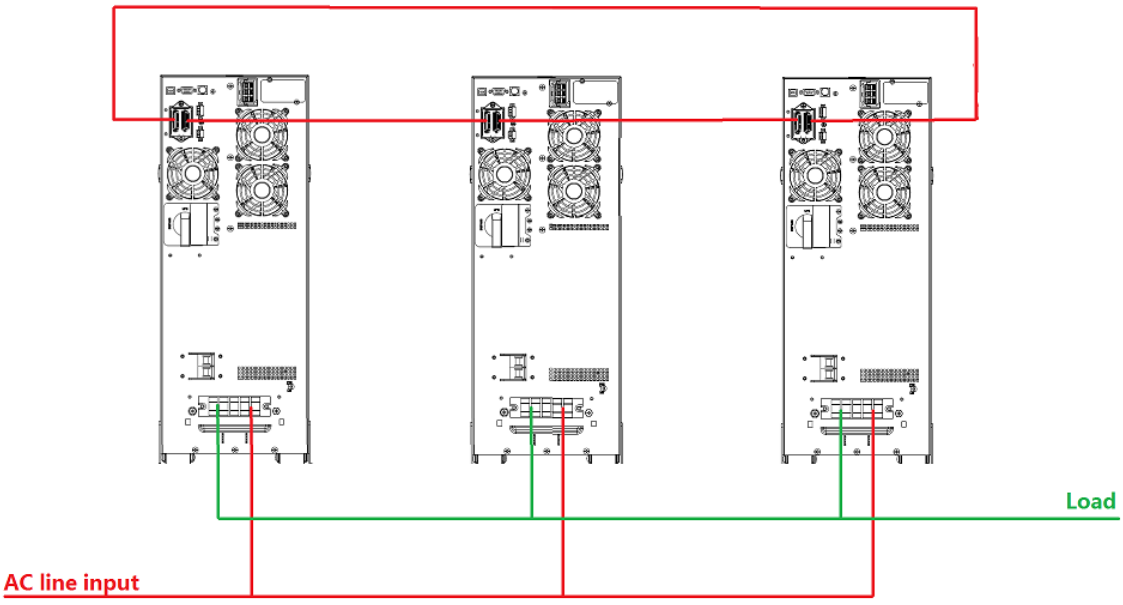
Step5. Insert parallel box into UPS and assemble the screw.



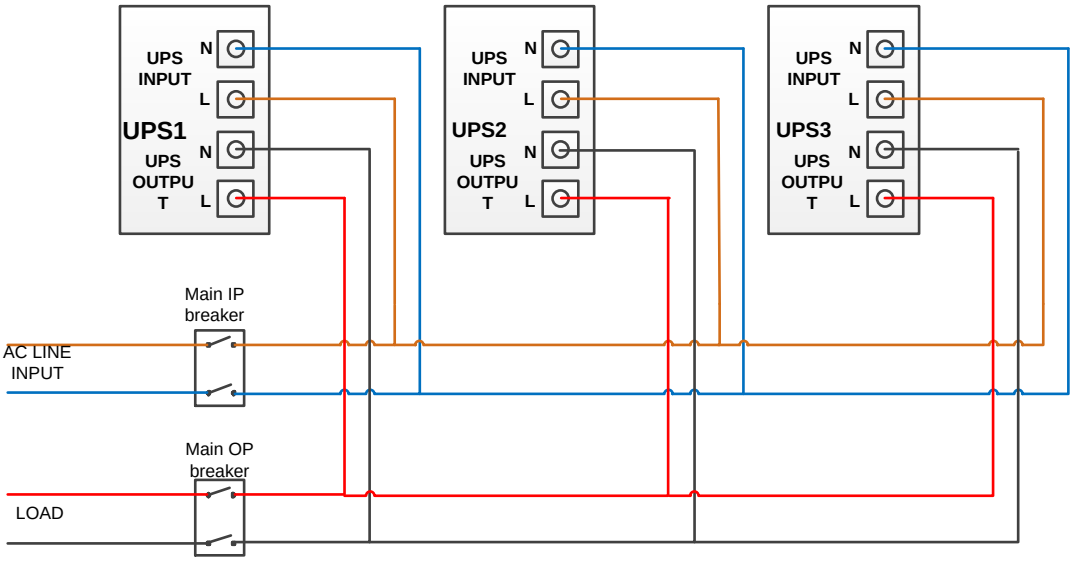
Step 6. Connect parallel communication cable

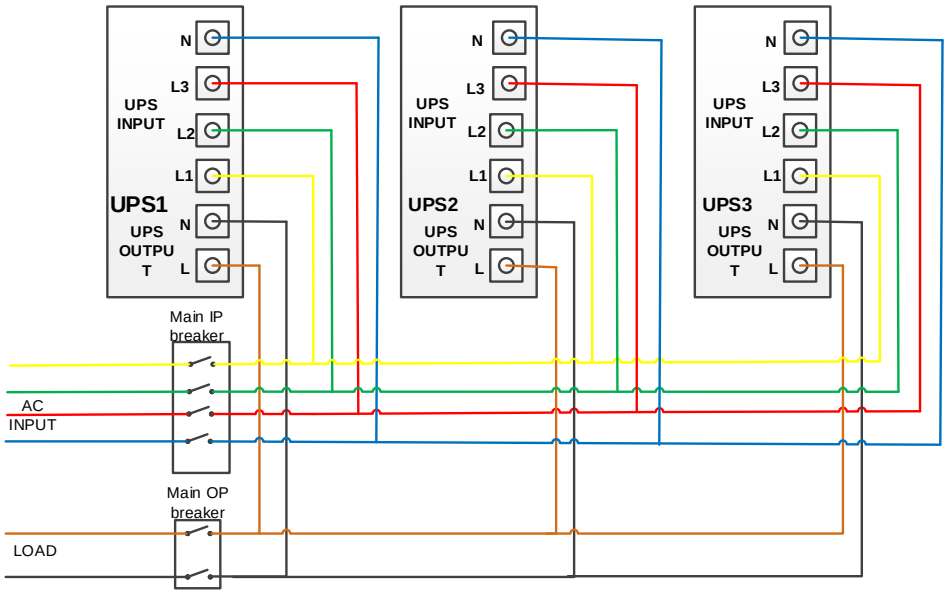
Step 7. Wiring connection for parallel system.

Just use 10k tower standard model as example. Connect parallel ports in a ring chain for parallel system.



6K/10K single phase power wiring connection





Note： Main I/P Breaker and Main O/P Breaker should be provided by end user.

Connect the input wires of each UPS to an input breaker panel.

Connect the output wires of each UPS to an output breaker panel.

Each UPS need an independent battery pack.

The distance between the UPSs in parallel and the breaker panel is required to be less than 20 meters. The difference between the wires of input and output of the UPSs is required to be less than 20%.

9.3 Operate parallel UPS system

Turn on and turn off a parallel system:

Check the wiring and confirm the connection is right.

Do not switch on the output breaker of each UPS, switch on the input breaker of the each UPS. Press the ⏻ button of one UPS, each UPS would start to turn on, all the UPSs would transfer to the INV mode together. Measure the output voltage of each UPS separately to check if the voltage difference between them is less than 0.5V. If the difference is more than 0.5V, the UPSs need to be regulated.

Press the ⏻ button of one UPS, the whole parallel system will be turned off no matter whether the parallel system is in redundancy mode or not.

Press the ⏻ button of one UPS, each UPS would start to turn on, after turning on, the UPSs should work parallel in the Line mode.

Join a new UPS to a parallel system

1) First the parallel system must be installed one main maintenance mechanical switch or static switch.
2) Regulate the output voltage of the new UPS separately: check if the output voltage difference between the new UPS and the parallel system is less than 0.5V.
3) Ensure the bypass of the parallel system is normal and the bypass setting is “enable”, switch on the maintenance switch of each UPS.
4) Set the main maintenance switch or static switch from “UPS” to “BPS”, switch off the main output breaker and the main input breaker, the UPSs would shut down.
5) Ensure the UPSs shut down totally, add the new UPS and reinstall the new UPS parallel system by following step 1) to 9) of last chapter - “install a new parallel UPS system”.
6) Switch on the main input breaker and the main output breaker, and set the main maintenance switch or static switch from “BPS” to “UPS”, then switch off the UPS own maintenance switch. Press the ⏻ button of one UPS, each UPS would start to turn on, after turning on, the UPSs should work parallel in the Line mode.

Remove a single UPS from a parallel system

1) First the parallel system must be installed one main maintenance mechanical switch or static switch.
2) Ensure the bypass is normal and the bypass setting is “enable”, switch on the maintenance switch of each UPS, the UPS system would transfer to bypass automatically.
3) Set the main maintenance switch or static switch from “UPS” to “BPS”, switch off the main output breaker and the main input breaker, and the UPSs would shut down.
4) Ensure the UPSs shut down totally, remove the wanted UPS and reinstall the new UPS parallel system by following step 1) to 7) of last chapter - “install a new parallel UPS system”.
5) Switch on the main input breaker and the main output breaker, and switch off the UPS own maintenance switch, then set the UPS own maintenance switch from “BPS” to “UPS”. Press the ⏻ button of one UPS, each UPS would start to turn on, after turning on, the UPSs should work parallel in the Line mode.

9.4 Trouble Shooting

If the UPS system does not operate correctly, first check the operating information on the LCD display.

Please attempt to solve the problem using the table below. If the problem still persists, consult your dealer.

Problem Displayed	Possible cause	Remedy
Para same ID	UPS ID is the same in parallel system	Shut down the UPS and repower it, UPS will get a new UPS ID automatically
Para power rating diff	There are different UPSs in parallel system	The UPSs with different capacity (Ex.one 6KVA and one 10KVA) are forbidden to parallel.
Para battery diff	Battery connection status is different	Check battery status and connection cable.
Para AC input diff	The mains input of some UPSs is disconnected	Check the building wiring and input cable. Check if the input breaker is closed. Ensure the UPSs are connected to same input source.
Para bypass diff	Bypass status is different in parallel system	Check the bypass voltage of each UPS
Para PW strategy diff	There are different power strategy setting in parallel system	The UPSs with different power strategy setting (Ex. one Line mode and one Converter mode) are forbidden to parallel.
Neg power fault	Negative power output	check the output voltage difference between UPSs
Para cable loss	The parallel cable is disconnected	Check the parallel cable.
Para load unbalance	Load of each ups is unbalanced	check the output voltage difference between UPSs