GTEC UPS MODEL:

MATRIX 1-3 kVA

SERVICE MANUAL

www.gtec-power.eu

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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.

This template allows the definition of the content of a service manual.

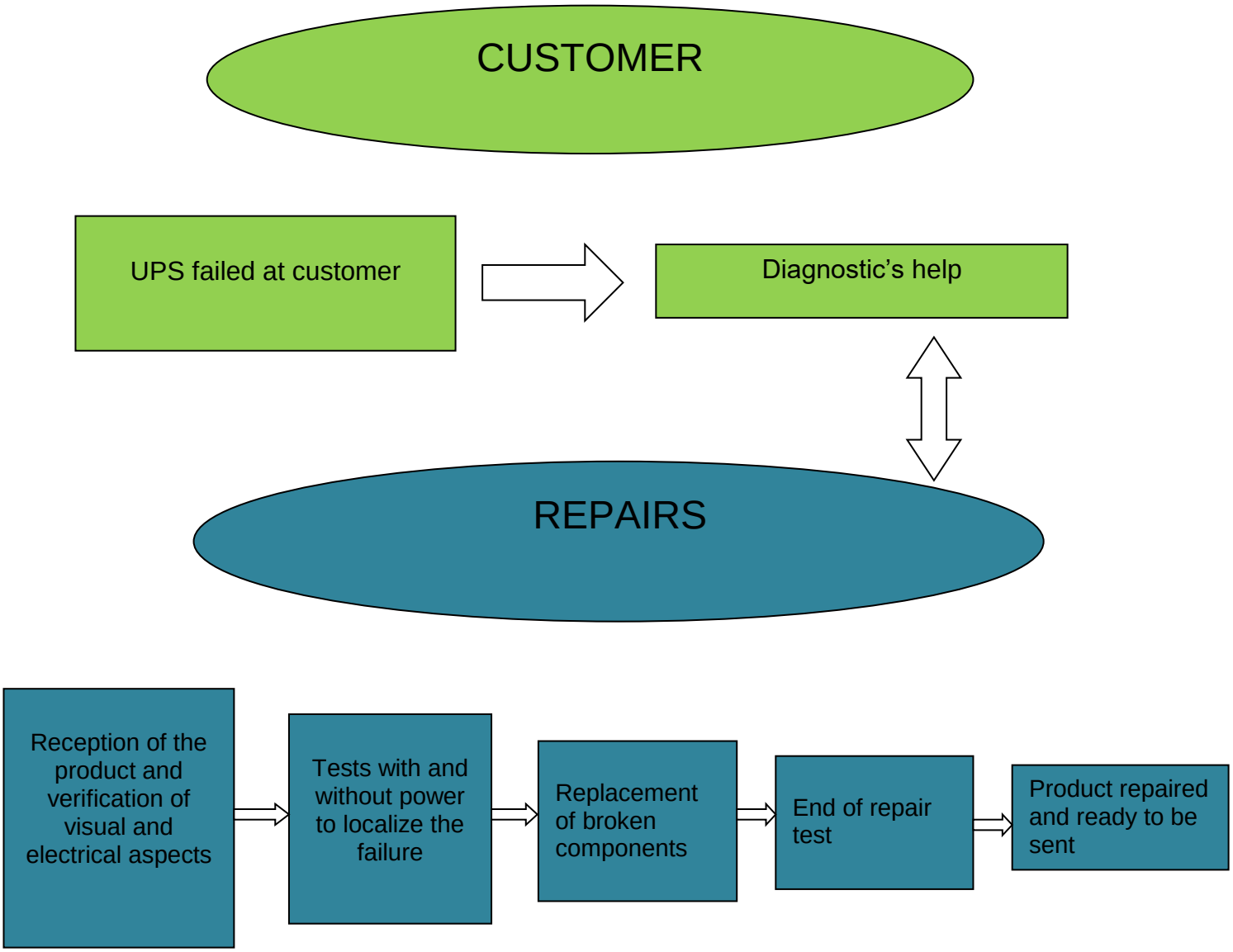
It allows R&D to provide a manual that meets the expectations of users who include:

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

1.2 Analysis Process

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

Example:



1.3 Schematic of the UPS

Goal: Identify the Board references by product model or rating.

Main power block:

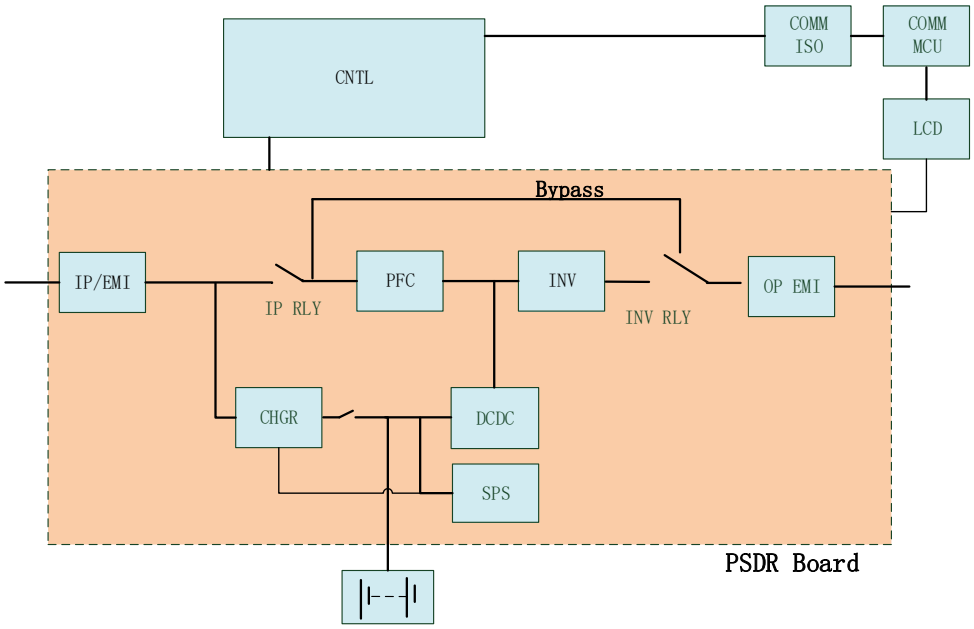


Fig. 1.3.1 1K-3K main power block

Signal and communication block :

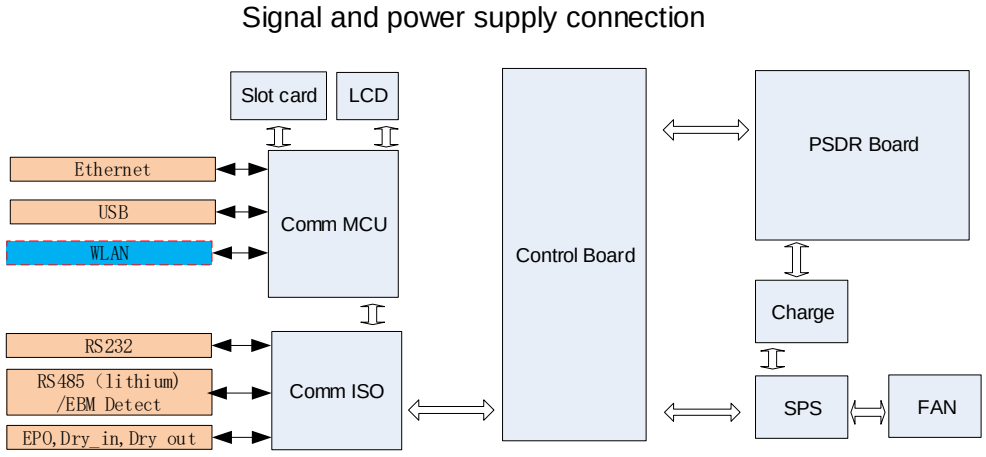


Fig. 1.3.2 1K-3K signal and communication block

Board function:

CNTL board	Contains major parts of protection, signaling circuits, regulation and control circuits.
Communication MCU board	Contains RS232, USB, Ethernet, WLAN communication, and supports LCD interface.
Communication ISO board	Contains Communication SPS, RPO, DRY IN/OUT TER.
PSDR board	Contains input EMI, output EMI, PFC, INV, charger and SPS circuit.
LCD	LCD display

Table 1.3.1 board list and its function

1.4 UPS/PCBA and Spare Part PN

1.4.1 UPS model list

Model name	GTEC Unit PN	Production PN	Description
MATRIX RT 1K	MXR1K0MM	9103-53908AH1	*MATRIX RT 1K 3 Batteries*
MATRIX RT 1KS	MXR1K0MM-KS	9103-53909AH1	*MATRIX RT 1K-KS 3 Batteries*
MATRIX RT 1,5K	MXR1K5MM	9103-63154AH1	*MATRIX RT 1,5K 3 Batteries*
MATRIX RT 1,5KS	MXR1K5MM-KS	9103-63155AH1	*MATRIX RT 1,5K-KS 3 Batteries*
MATRIX RT 2K	MXR2K0MM	9103-73932AH1	*MATRIX RT 2K 6 Batteries*
MATRIX RT 2KS	MXR2K0MM-KS	9103-73933AH1	*MATRIX RT 2K-KS 6 Batteries*
MATRIX RT 3K	MXR3K0MM	9103-83972AH1	*MATRIX RT 3K 6 Batteries*
MATRIX RT 3KS	MXR3K0MM-KS	9103-83973AH1	*MATRIX RT 3K-KS 6 Batteries*
MATRIX Tower 1K	MXT1K0MM	9103-53911AH1	*MATRIX Tower 1K 3 Batteries*
MATRIX Tower 1KS	MXT1K0MM-KS	9103-53912AH1	*MATRIX Tower 1K-KS 3 Batteries*
MATRIX Tower 1,5K	MXT1K5MM	9103-63156AH1	*MATRIX Tower 1,5K 3 Batteries*
MATRIX Tower 1,5KS	MXT1K5MM-KS	9103-63157AH1	*MATRIX Tower 1,5K-KS 3 Batteries*
MATRIX Tower 2K	MXT2K0MM	9103-73936AH1	*MATRIX Tower 2K 6 Batteries*
MATRIX Tower 2KS	MXT2K0MM-KS	9103-73937AH1	*MATRIX Tower 2K-KS 6 Batteries*
MATRIX Tower 3K	MXT3K0MM	9103-83975AH1	*MATRIX Tower 3K 6 Batteries*
MATRIX Tower 3KS	MXT3K0MM-KS	9103-83977AH1	*MATRIX Tower 3K-KS 6 Batteries*

Table 1.4.1 UPS model list

1.4.2 PCBA PN

Board Name	1K	1K-KS	1,5K	1,5K-KS	2K	2K-KS	3K	3K-KS
MATRIX RT								
CNTL	712-00646 (710-07951)							
Comm ISO	710-07427							
Comm MCU	712-00649 (710-07947)							
PSDR	710-07938	710-07939	710-07940	710-07941	710-07942	710-07943	710-07944	710-07945
Super Charger						710-07946		710-07946
MATRIX Tower								
CNTL	712-00646 (710-07951)							
Comm ISO	710-07427							
Comm MCU	712-00649 (710-07947)							
PSDR	710-07415	710-07416	710-07417	710-07418	710-07421	710-07422	710-07423	710-07425

Table 1.4.2 PCBA PN list by power rating

1.4.3 Recommended preventative maintenance schedule

Description	YEAR	Quantity

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Standard	Long
LCD display					○					○					○					○	1	1
Control Board					○					○					○					○	1	1
PSDR					○					○					○					○	1	1
COMM ISO					○					○					○					○	1	1
COMM MCU					○					○					○					○	1	1
Super Charger (only for RT 3KS)					○					○					○					○	0	1
Cooling fan (front panel)					○					○					○					○	2	6
Cooling fan (rear panel)					○					○					○					○	2	6

Table 1.4.3 Recommended preventative maintenance schedule

1.4.4 MATRIX RT Spare part

Spare part PN	Board PN	Designation for material	Description
744-00646	710-07951	CNTL RT & Tower CPQ	CNTL ASSY CPQ/1053RT S.P.P.
744-00649	710-07426	COMM MCU RT +Tower CPQ	COMM MCU ASSY CPQ/1053RT S.P.P.
744-07427	710-07427	COMM ISO RT + Tower CPQ	COMM ISO ASSY CPQ/1053T S.P.P.
744-07938	710-07938	RT PSDR- 1K(36V) CPQ	RT 1K ASSY CPQ/1053RT S.P.P.
744-07939	710-07939	RT PSDR-1KS (36V) CPQ	RT 1KS ASSY CPQ/1053RT S.P.P.
744-07940	710-07940	RT PSDR- 1,5K(36V) CPQ	RT 1,5K ASSY CPQ/1053RT S.P.P.
744-07941	710-07941	RT PSDR-1,5KS (36V) CPQ	RT 1,5KS ASSY CPQ/1053RT S.P.P.
744-07942	710-07942	RT PSDR-2K (72V) CPQ	RT 2K ASSY CPQ/1073RT S.P.P.
744-07943	710-07943	RT PSDR-2KS (72V) CPQ	RT 2KS ASSY CPQ/1073RT S.P.P.
744-07944	710-07944	RT PSDR-3K (72V) CPQ	RT 3K ASSY CPQ/1083RT S.P.P.
744-07945	710-07945	RT PSDR-3KS (72V) CPQ	RT 3KS ASSY CPQ/1083RT S.P.P.
744-07946	710-07946	RT Super Charger (72V) CPQ	RT CHG ASSY CPQ/1073RT S.P.P.
744-20161	710-20161	EBM Fuse CPQ	EBM FUSE ASSY CPQ/1053T S.P.P.
744-20160	710-20160	EBM Det.-2tring CPQ	EBM DETECT ASSY CPQ/BT07031RT S.P.P.
744-A4748	733-G2044	Fan 60*60*25 Tower & RT 1,5K（S）	FAN 6025 ASSY CPQ/1053T G2044 S.P.P.
744-A4749	733-G2043	Fan 80*80*25 RT 2-3K（S）	FAN 8025 ASSY CPQ/1073T G2043 S.P.P.
744-A4750	733-G2045	Fan 80*80*25 Tower & RT 1-1,5K（S）	FAN 8025 ASSY CPQ/1073T G2045 S.P.P.

Table 1.4.4 Spare part PN list

1.4.5 MATRIX Tower Spare part

Spare part PN	Board PN	Designation for material	Description
744-07415	710-07415	Tower PSDR- 1K(36V) CPQ	Tower 1K ASSY CPQ/1053T S.P.P.
744-07416	710-07416	Tower PSDR-1KS (36V) CPQ	Tower 1KS ASSY CPQ/1053T S.P.P.
744-07417	710-07417	Tower PSDR- 1,5K(36V) CPQ	Tower 1,5K ASSY CPQ/1053T S.P.P.
744-07418	710-07418	Tower PSDR-1,5KS (36V) CPQ	Tower 1,5KS ASSY CPQ/1053T S.P.P.
744-07421	710-07421	TOWER PSDR-2K (72V) CPQ	Tower 2K ASSY CPQ/1053T S.P.P.
744-07422	710-07422	TOWER PSDR-2KS (72V) CPQ	Tower 2KS ASSY CPQ/1073T S.P.P.
744-07423	710-07423	TOWER PSDR-3K (72V) CPQ	Tower 3K ASSY CPQ/1083T S.P.P.
744-07425	710-07425	TOWER PSDR-3KS (72V) CPQ	Tower 3KS ASSY CPQ/1083T S.P.P.

744-20161	710-20161	EBM Fuse CPQ	EBM FUSE ASSY CPQ/1053T S.P.P.
744-20160	710-20160	EBM Det.-2tring CPQ	EBM DETECT ASSY CPQ/BT07031RT S.P.P.
744-A4748	733-G2044	Fan 60*60*25 Tower & RT 1,5K（S）	FAN 6025 ASSY CPQ/1053T G2044 S.P.P.
744-A4750	733-G2045	Fan 80*80*25 Tower & RT 1-1,5K（S）	FAN 8025 ASSY CPQ/1073T G2045 S.P.P.
744-A4763	733-G2062	Fan 80*80*25 Tower 2-3K（S）	FAN 8025 ASSY 1053T/CPQ G2062 S.P.P.

2 Security

Goal : To protect against electrical hazards.

Example:

- 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 as DC voltage is always present on the power cards, even after the product is switched off.
- To avoid injury, do not touch any connections 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 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
- Fans
- …

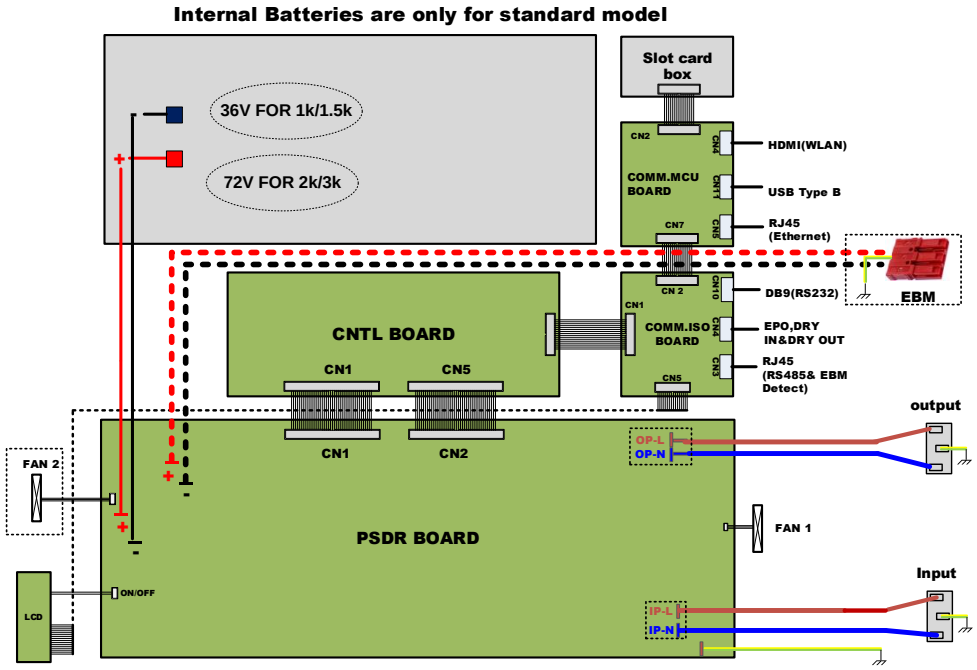


Fig. 3.1 MATRIX 1-3k interconnection diagram

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 Function Block of the Product

As a ture 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,

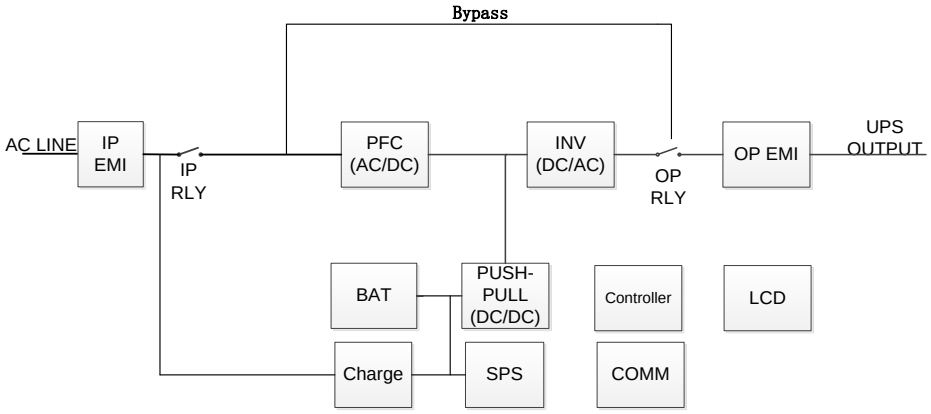


Figure 4.1.1 Function block Diagram

Controller:

Control the operation of the whole UPS. It contains major parts of protection, signaling circuits, regulation and control circuits

AC/DC:

Also called PFC, 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.

DC/DC:

At battery mode, the push-pull (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.

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.

Charger:

The battery charger converts the ac voltage into lower DC voltage to recharge the Battery. Two types of charger current can be available, standard UPS model has charger 1,5A, long backup time model (-KS) has 8A Max charger (charging current can adjust).

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.

Bypass:

The 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.

LCD Display:

The LCD is the interface for user. They could provide the information about UPS through LCD panel.

Communication:

The communication board also is the interface for user, they could provide the information about UPS through LCD panel, RS232&RS485, internet, WIFI etc.

4.2 Operating Principle of Major Functional Block

AC/DC Converter (PFC converter)

The purpose of AC/DC converter is to generate a stable DC link+ and DC link- 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 showed the topology implement the AC/DC converter.

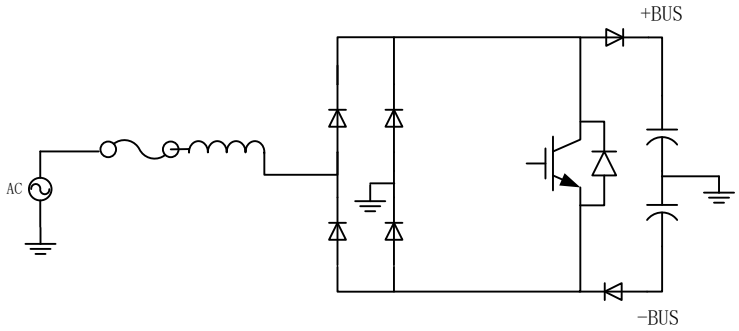


Figure 4.2.1 AC/DC converter

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.

DC/DC Converter (Push-Pull converter)

The purpose of DC/DC converter is to convert the bat voltage into DC-BUS. The convert mainly includes two MOSFETs, one isolation transformer and two diodes.

The two MOSFETs are turned on alternately and transfer energy to the secondary side through the transformer. Figure 4.2.2 showed the topology implement the DC/DC converter.

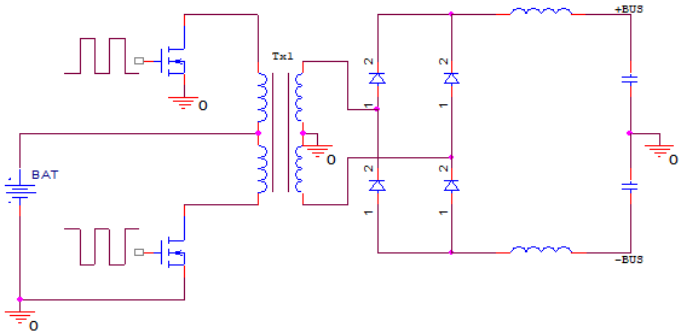


Figure 4.2.2 DC/DC converter

Inverter

The inverter converts the DC power from DC BUS into the AC output to supply the load. A half bridge topology is adopted to 1k/1,5k, and I type three level topology is adopted to 2k/3k. Figure 4.2.2, 4.2.3 shows a diagram of inverter.

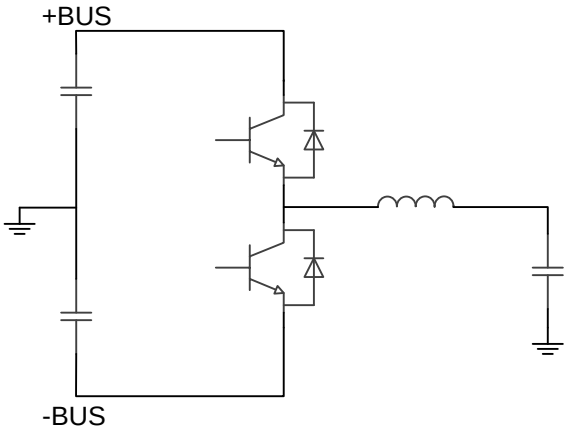


Figure 4.2.2 Inverter for 1/1,5K(S)

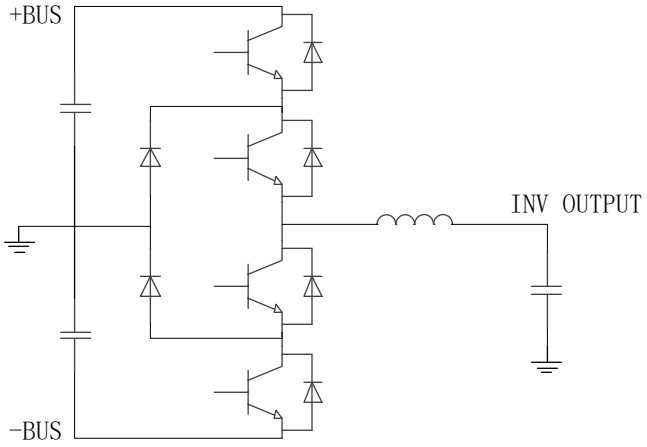


Figure 4.2.3 Inverter for 2/3K(S)

The I type three level inverter comprise four switching devices - IGBT with co-pack diode, two clamp diodes, the driving circuits for each IGBT, an 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 is filtered by an LC filter to get clean and stable sine wave voltage.

Global Controller

The CPU can be regarded as the brain of the UPS, which takes 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.

Charger

Refer to Fig. 4.2.4, Fig. 4.2.5 Flyback topology is employed for battery charger. There are two kinds of charger current standard model UPS and long backup time (-KS) model UPS. The one for standard model UPS is 1,5A charging current, the one for the long backup time model is maximum 8A charging current (settable). The long backup time model charger has an PFC (Power Factor Correction) converter to reduce THDI of input current.

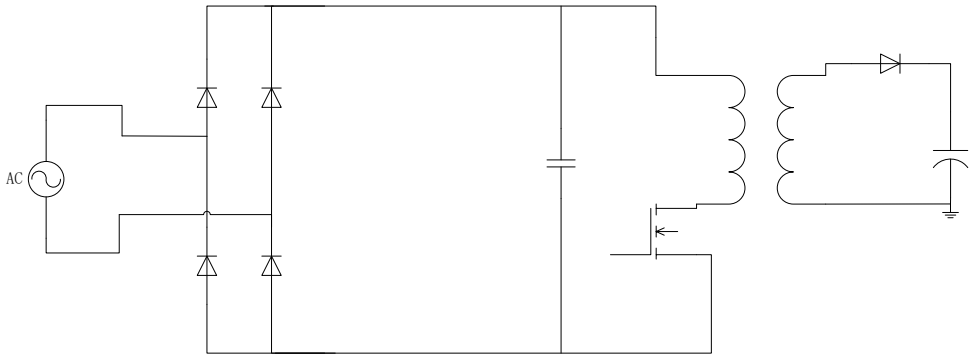


Fig. 4.2.4 standard 1,5A model charger

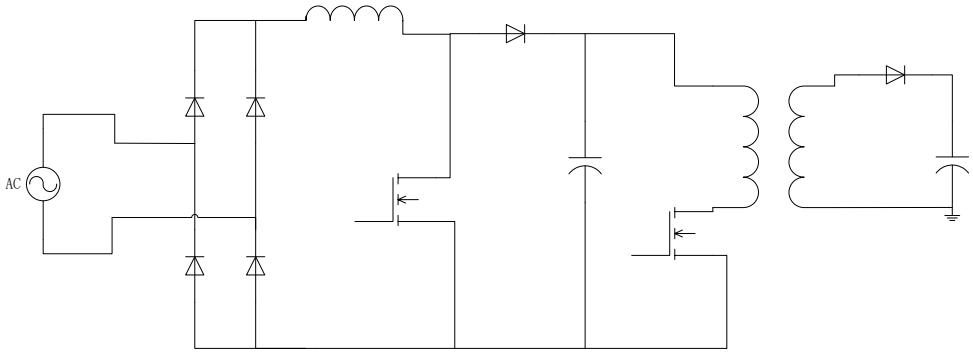


Fig. 4.2.5 long backup time 8A model charger

Auxiliary Power Supply (SPS)

The Auxiliary Power Supply (SPS) module supplies DC power for UPS operation. The SPS module is integrated in PSDR board. The input of the SPS is the battery, or the charger output. The SPS module output +12 VDC, -12VDC, +5VDC, PFC.V1+, PFC.V1-.

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

PFC.V1+, PFC.V1- is used to generate PFC IGBT driver power.

+12VDC and -12 VDC are used for signal amplifier power of CNTL board.

+5 VDC uses for generating +3,3 VDC power supply for the CPU.

LCD, LED and button

Refer to the chapter 6.1

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, WIFI and an intelligent slot are provided.

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

For more flexible application solution, the intelligent slot can accept NMC, AS400 and MODBUS etc.

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

Remote Power Off

The Remote Power Off interface provides an emergence power off function. When the RPO function is enabled, once the RPO port is open, the UPS would shut off the output and enter into RPO 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.

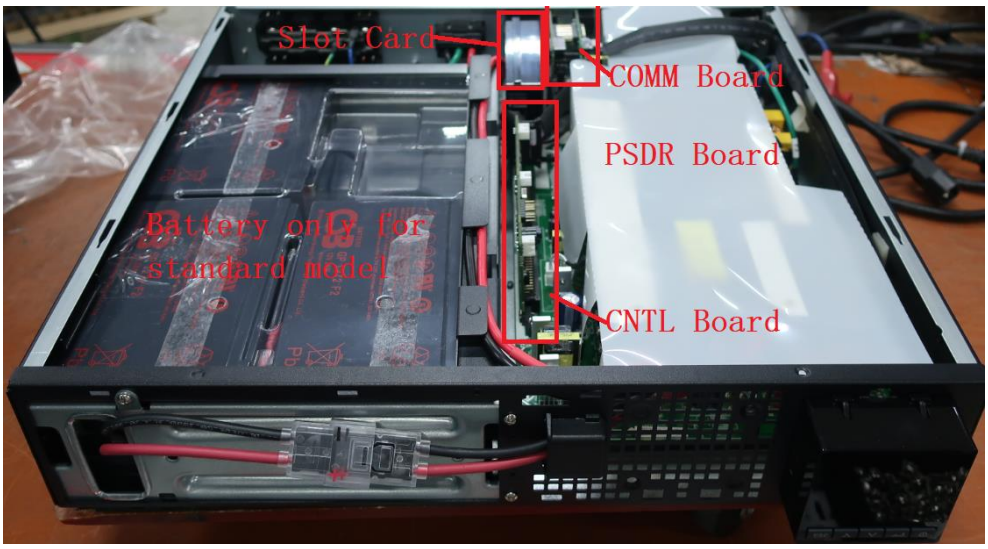
Basically, the chassis comprise a base plant, an internal support plant, a front support plant, an outside cover, a rear panel and a front panel.

4.3 Location of Every Function on Each Board

For 1K/1,5K standard RT or tower model, the location of PCB board is similar as that in 1K/1,5K long backup RT or tower model.

There is super charging board on the battery compartment location only in 2K/3K long backup RT model. For 2K/3K standard tower model ,the location of PCB board is similar as that in 2K/3K long backup tower model.

4.3.1 RT Model



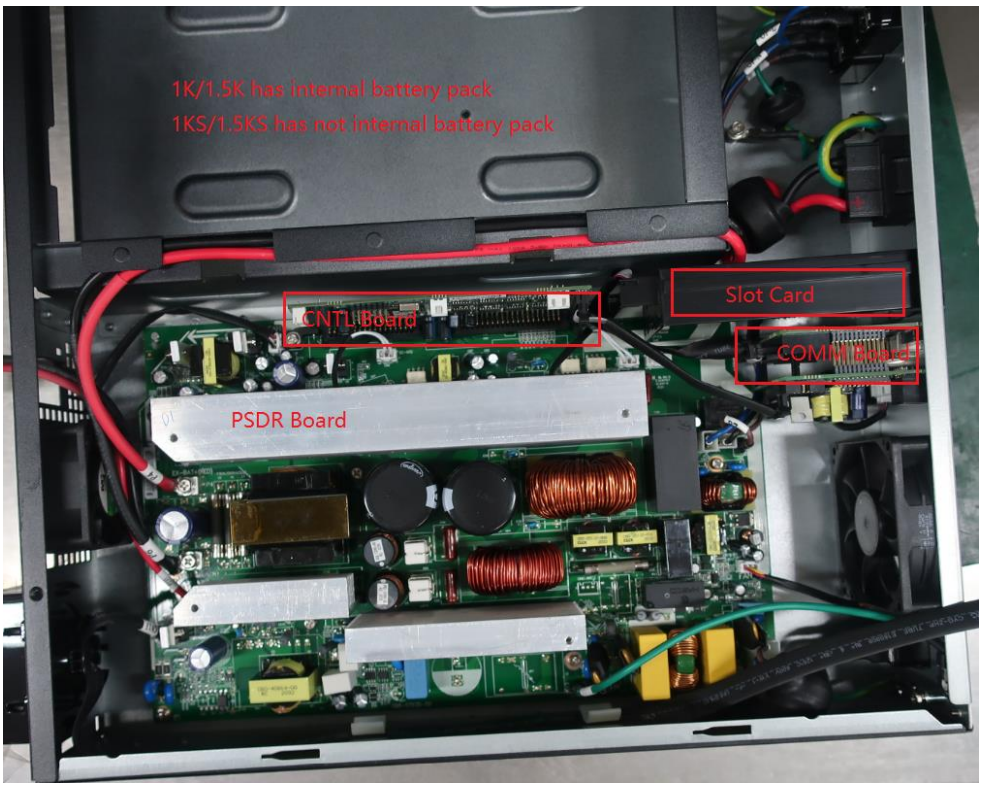


Fig. 4.3.1 Boards in 1K(S)/1,5K(S) RT model

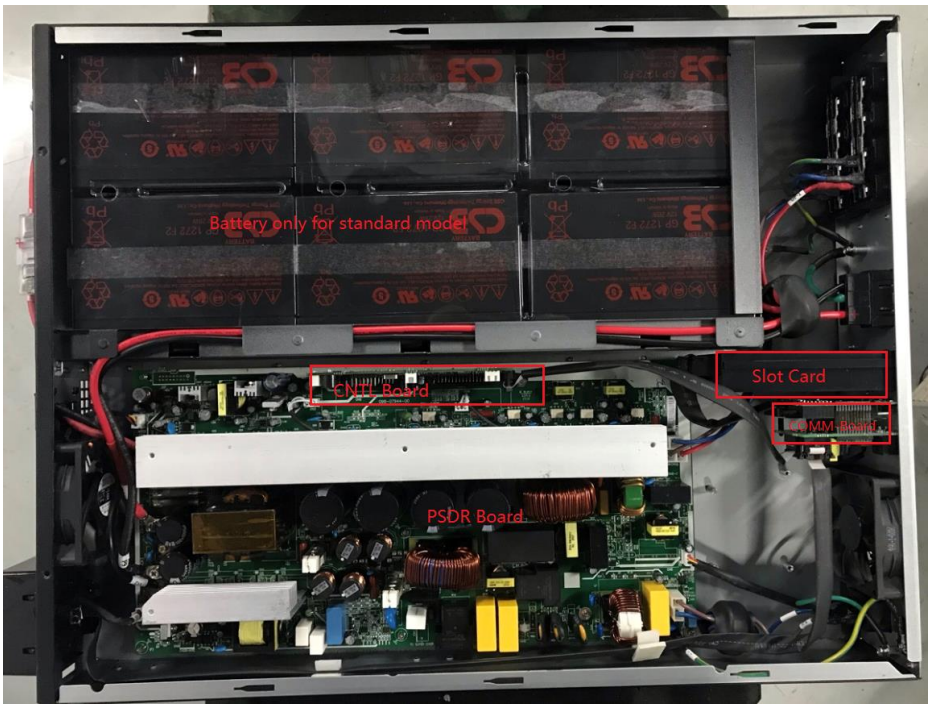


Fig. 4.3.2 Boards in 2K/3K standard RT model

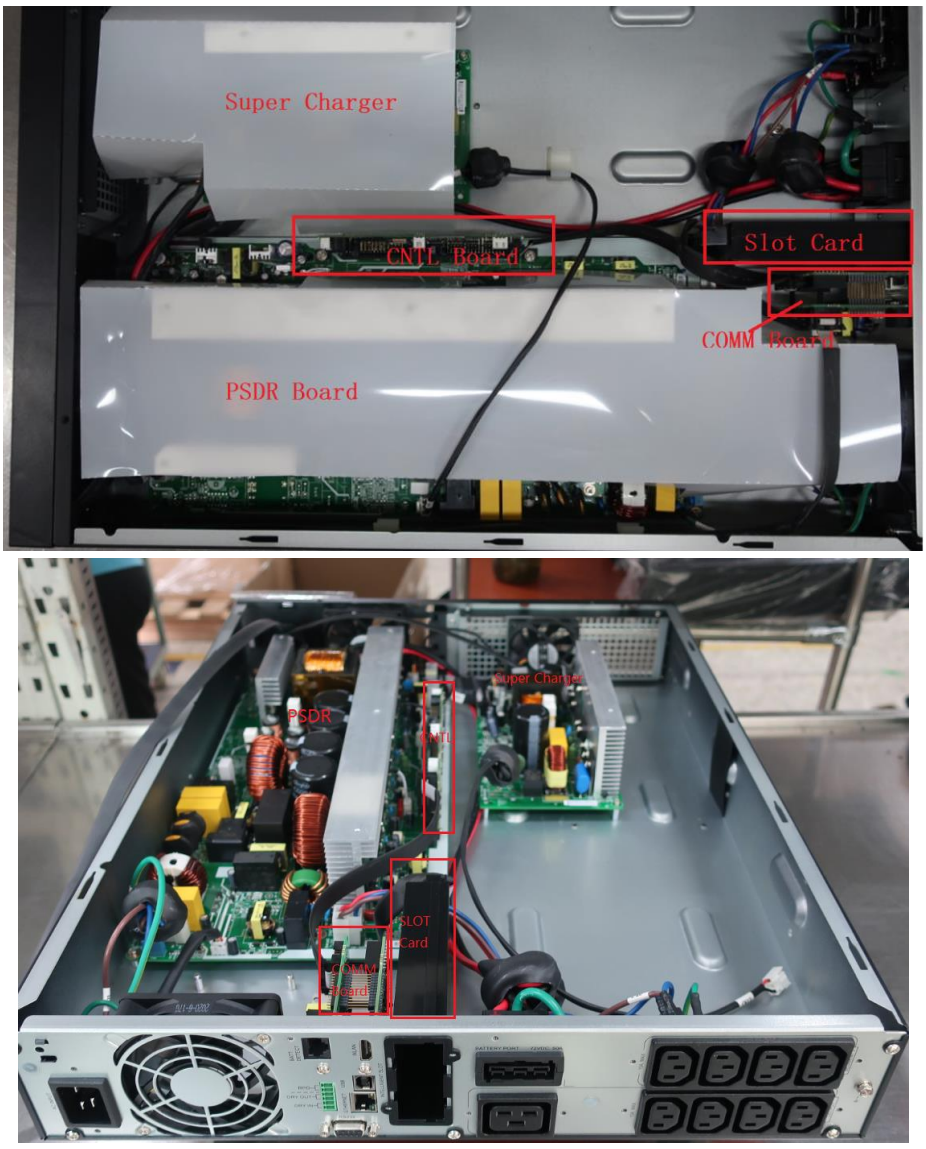


Fig. 4.3.3 Boards in 2KS/3KS long backup RT model

4.3.2 Tower Model

Fig. 4.3.4 Boards in 1K(S)/1,5K(S) Tower model

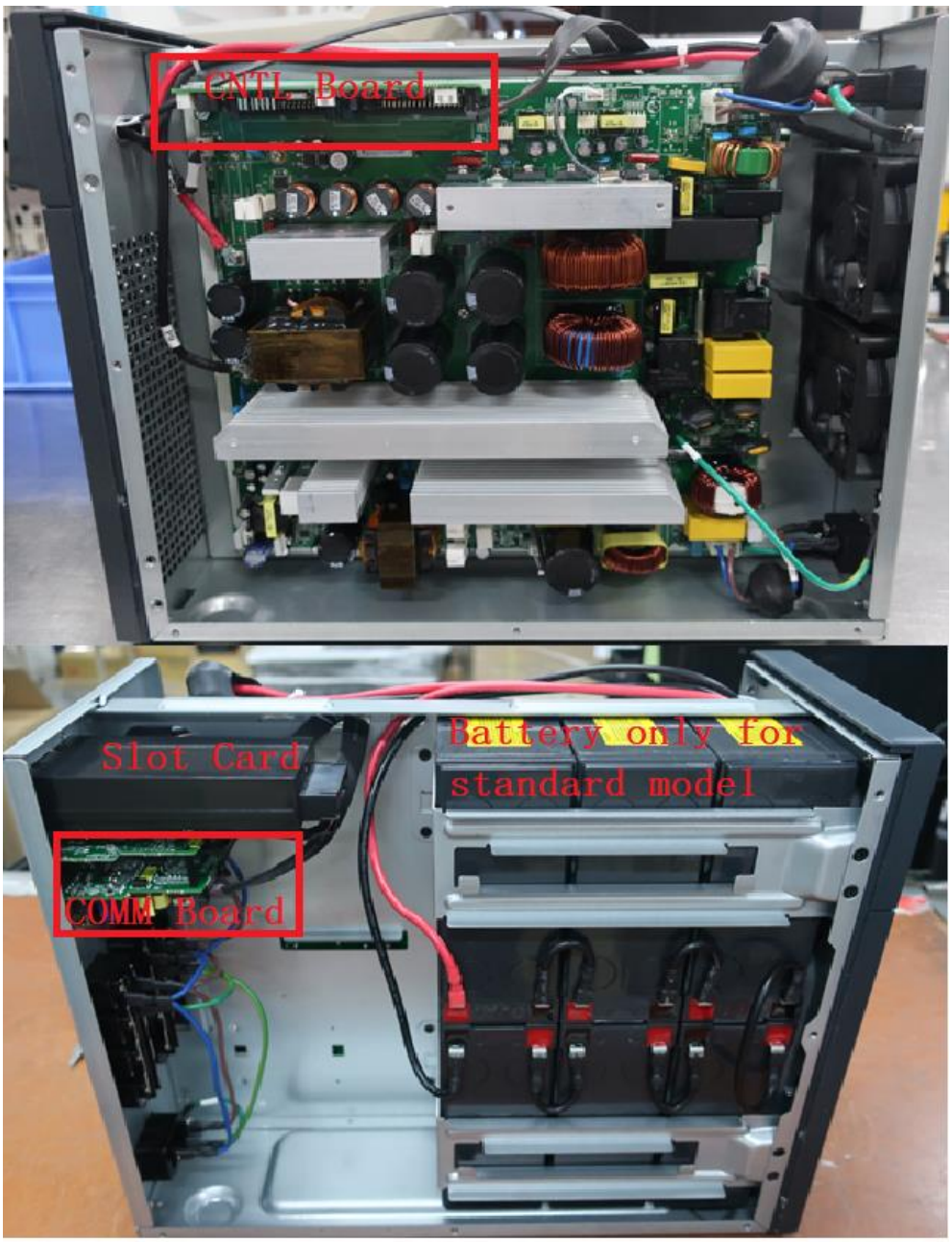


Fig. 4.3.5 Boards in 2K(S)/3K(S) Tower model

5 Operation by service tool

5.1 Service Tool Introduction

UPS information, real time meters, events can be provided from service tool. Service tool also provides control and SN/UUID/Connect String/Mac Address/Battery Brand Setting.

Home page :

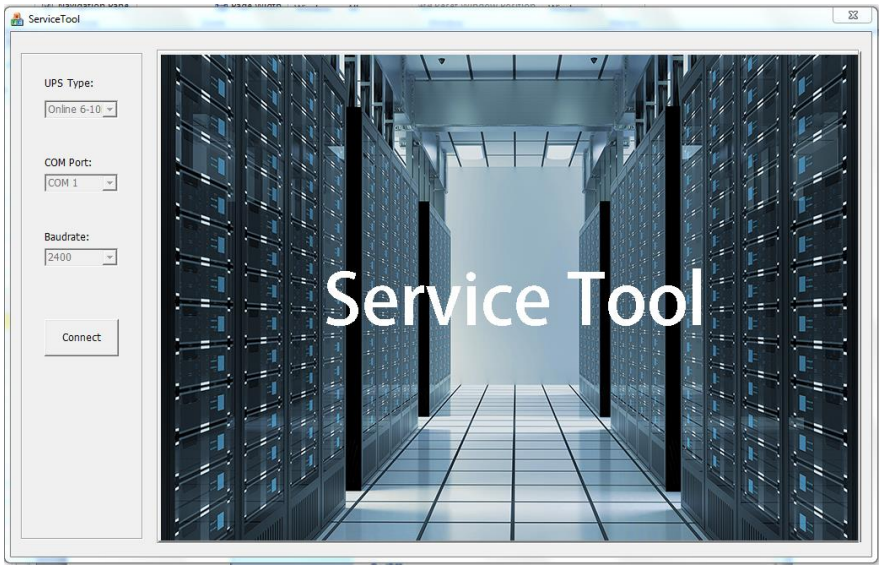


Fig. 5.1.1 Home page of service tool

Content pages :

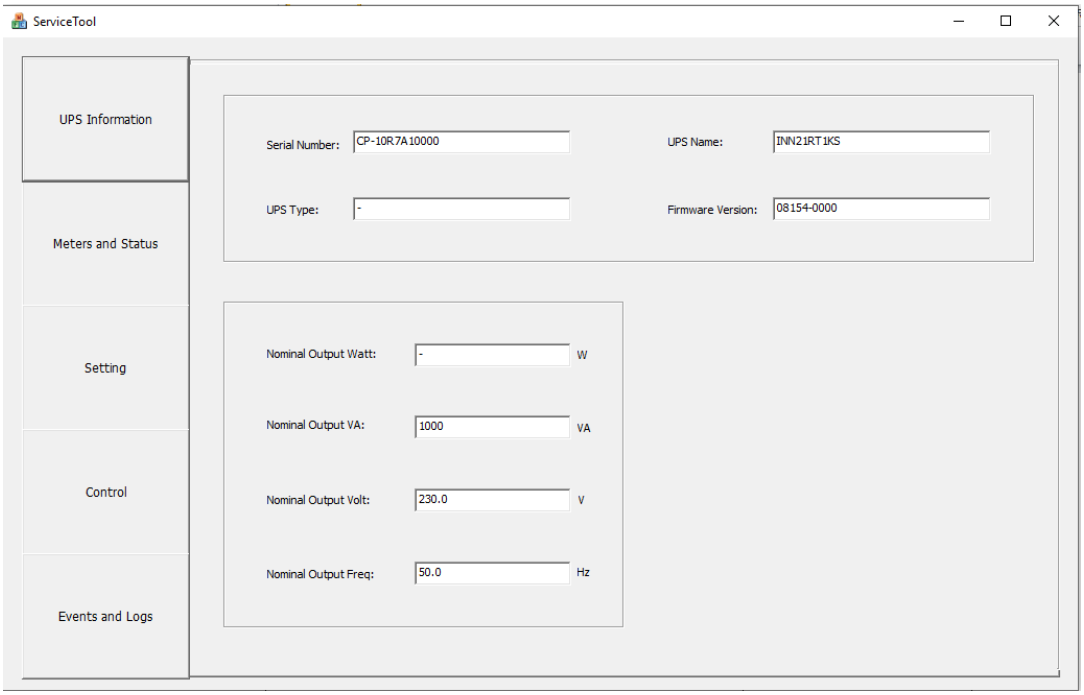


Fig. 5.1.2 Content page of service tool

5.2 Battery Configuration

EBM Cable terminal definition for UPS connector to other EBM as below:

Color	Description
White cable	Battery +
Black cable	Battery -
Yellow-Green cable	PE

6 Failure analysis

Despite of careful design and strict tests, in case UPS become out of order. Basically, designer suggests 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 boards and static checking.
4. Replace the failure components with OK parts.
5. Static checking.
6. Power up checking.
7. Test after repair.

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

6.1 LCD Panel Display

The UPS provides useful information about the UPS itself, load status, events, measurements and settings.

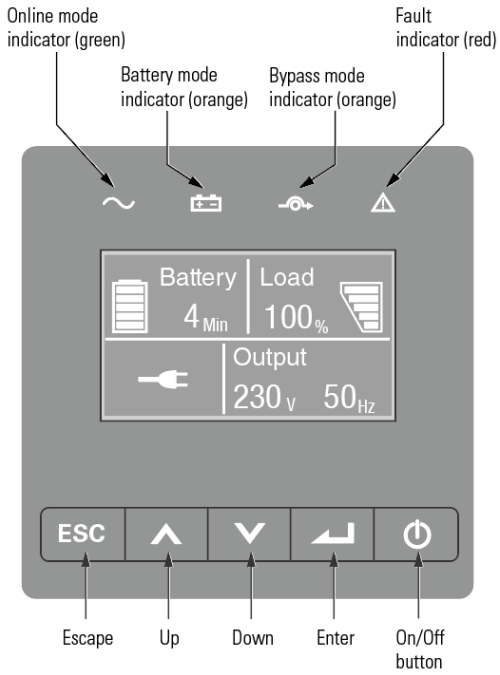


Fig. 6.1.1 LCD dispaly

The button introduce as below,

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

Table 6.1.1 button information

The following table shows the LED bar status and description.

Ups mode	sub mode	UPS leds				LED STATUS
		on line	battery	bypass	fault	
						
Power on/shutdown						
Standby						
BYPASS						continuous
ON LINE						continuous
BATTERY						continuous
HE						continuous
Converter						continuous
UPS start						lights for 1sec in turn
battery test						lights for 1sec in turn
warning						flashing for 1sec
Fault						continuous

Table 6.1.2 LED display information

The buzzer introduce as below,

Priority	UPS condition	Buzzer
1	UPS fault and failure	Continuous
2	Normal mode	No beep
3	Battery/battery test mode	One beep per 4 sec (One beep per 1s when battery low)
4	Bypass mode	One beep per 2 minutes
5	Overload	One beep per 500ms
6	Other alarm	One beep per 1s

Table 6.1.3 Buzzer information

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

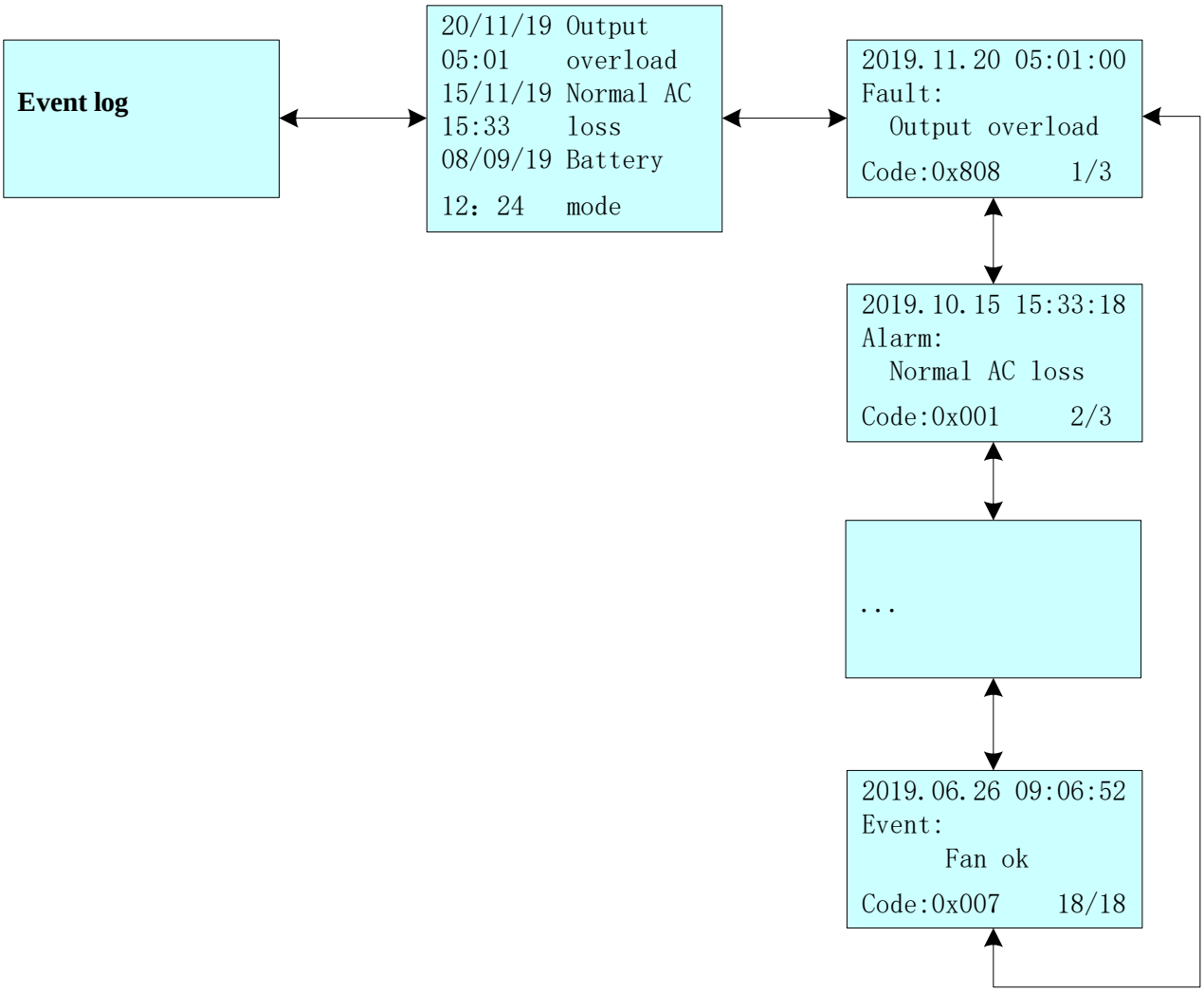


Fig. 6.1.2 History log veiw chart

6.2 UPS Alarms and Faults

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

Typical alarms and faults:

To check the UPS status and Event log:

1. Press any button on the front panel display to activate the menu options.
2. Press the button to select Event log.
3. Scroll through the listed alarms and faults.

Alarms

Code	Message	Description	Remarks
001	Normal AC loss	Main AC is below charger level	missing AC mains
004	Amb. temp. alarm	Ambient temperature is high	Ambient temperature alarm
104	AC freq out range	Frequency out of range	normal AC Freq out of range
106	AC Volt out range	Voltage out of range	normal AC Volt out of range
200	BP phase out range	Phase out of range (bypass input and inverter output cannot phase lock)	Bypass AC phase out of range
206	BP freq. out range	Frequency out of range	Bypass freq out of range
208	Bypass overload	Bypass overload alarm	
209	BP Volt out range	Voltage out of range	Bypass Volt out of range
603	Battery mode	Battery is discharging	UPS on battery
604	Battery low	Battery is low	
60D	No battery	Battery not present	
612	Bat. test canceled	battery test result = failed	
706	UPS temp. alarm	UPS internal temperature is high	UPS heatsink temp
806	Emergency Off	emergency stop was proceed	EPO
80E	Overload prealarm	output power above threshold	L1 settable: <105%
810	Power overload	Output power overload	Max (P,S) > L2 (L2 = 105%)

Faults

Code	Message	Description	Diagnose
007	Fan fault	Ventilator fault	Please refer below flow chart: Fault 007
107	Input bad wiring	Site wiring fault that can come of Phase neutral inversion on single phase UPS	Please refer below flow chart: Fault 107
207	BP device fault	bypass internal fault (relay, SCR)	Please refer below flow chart: Fault 207
208	Bypass overload	Bypass overload fault (max counter reached)	Please refer below flow chart: Fault 208
300	DC bus + too high	Rectifier DC Bus + voltage is too high	Please refer below flow chart: Fault 300
301	DC bus - too high	Rectifier DC Bus - voltage is too high	Please refer below flow chart: Fault 301
302	DC bus + too low	Rectifier DC Bus + voltage is too low	Please refer below flow chart: Fault 302
303	DC bus - too low	Rectifier DC Bus - voltage is too low	Please refer below flow chart: Fault 303
304	DC bus unbalanced	DC Bus is unbalanced	Please refer below flow chart: Fault 304
305	Rectifier fault	hardware fault in the rectifier input module.	Please refer below flow chart: Fault 305

308	DC bus short circ.	Dc bus short circuit	Please refer below flow chart: Fault 308
400	Dcdc fault	Hardware fault in the Dcdc module.	Please refer below flow chart: Fault 400
500	Charger fault	charger internal failure	Please refer below flow chart: Fault 500
502	Max charger volt	Recharge battery voltage is too high	Please refer below flow chart: Fault 502
503	Min charger volt	Recharge battery voltage is too low	Please refer below flow chart: Fault 503
607	Battery fault	Battery need replacement OR is faulty	Please refer below flow chart: Fault 607
706	UPS temp. fault	UPS internal temperature is high (due to temperature, UPS has transfered to bypass or stop)	Please refer below flow chart: Fault 706
70C	Min inverter volt	Inverter voltage is too low	Please refer below flow chart: Fault 70C
70D	Max inverter volt	Inverter voltage is too high	Please refer below flow chart: Fault 70D
805	Out. short circuit	short circuit on output	Please refer below flow chart: Fault 805
808	Inverter overload	Inverter overload Max (P,S) > L2 (L2 = 105%) max counter reached	Please refer below flow chart: Fault 808
815	Calibration failure	calibration failure	Please refer below flow chart: Fault 815

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

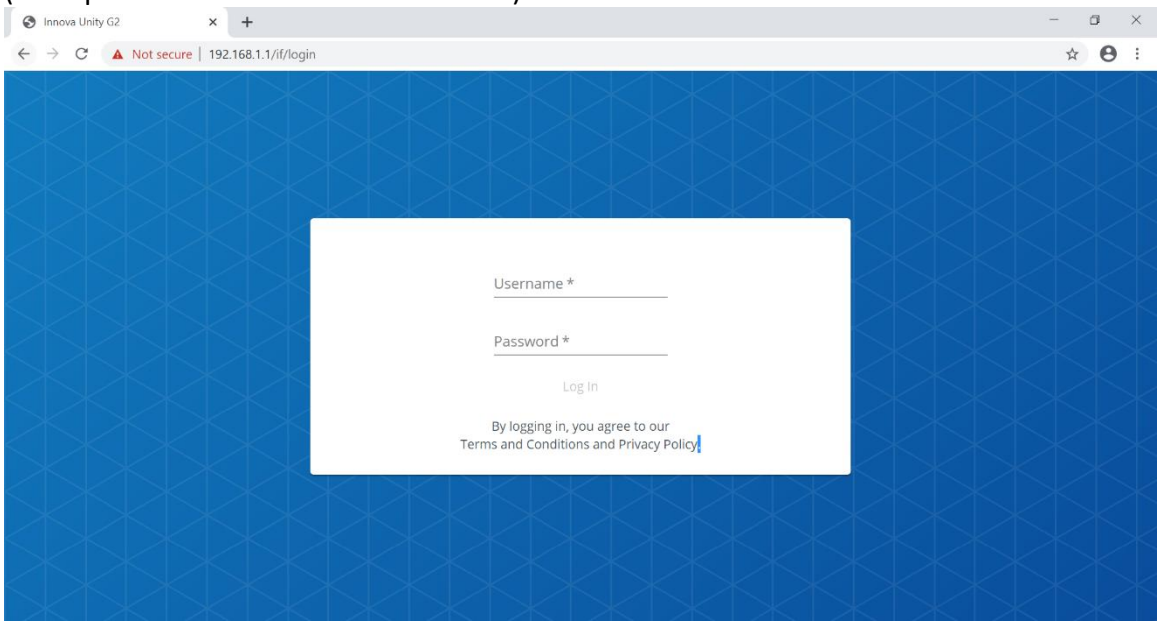
Step1: Check UPS IP address by UPS HMI Identification Page.

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]

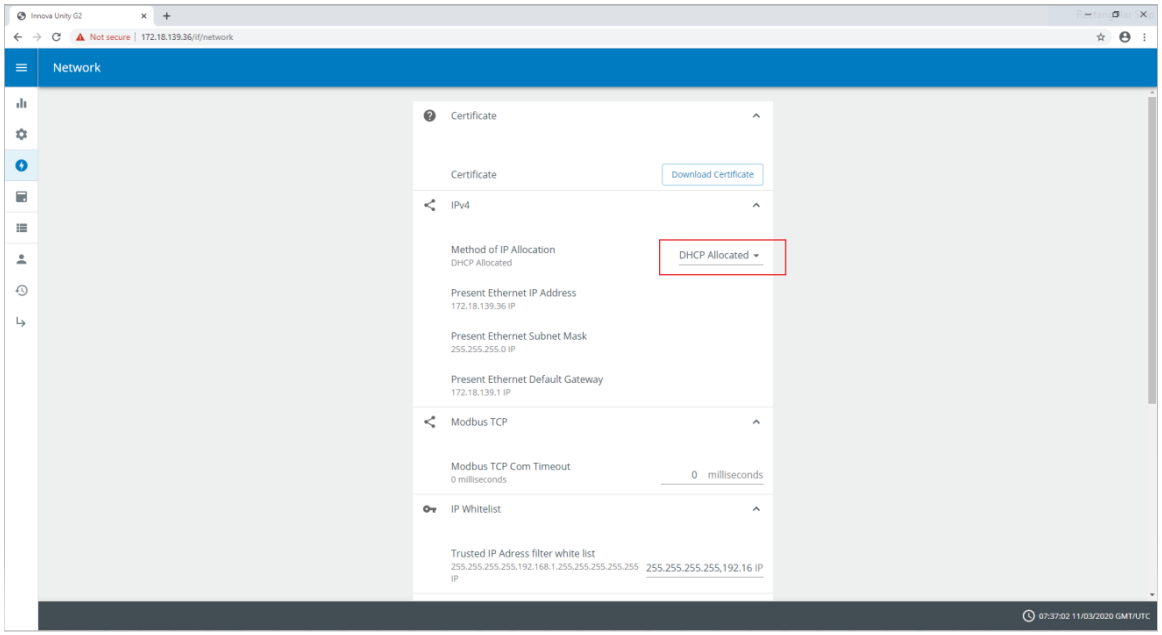
Step2: Connect the PC to the same LAN with UPS and Input the IP address in the web browser to open the Localweb.

The default Username and password of localweb is as below:
Default Username: admin
Default Password: Admin*1

(Example UPS IP address is 192.168.1.1)



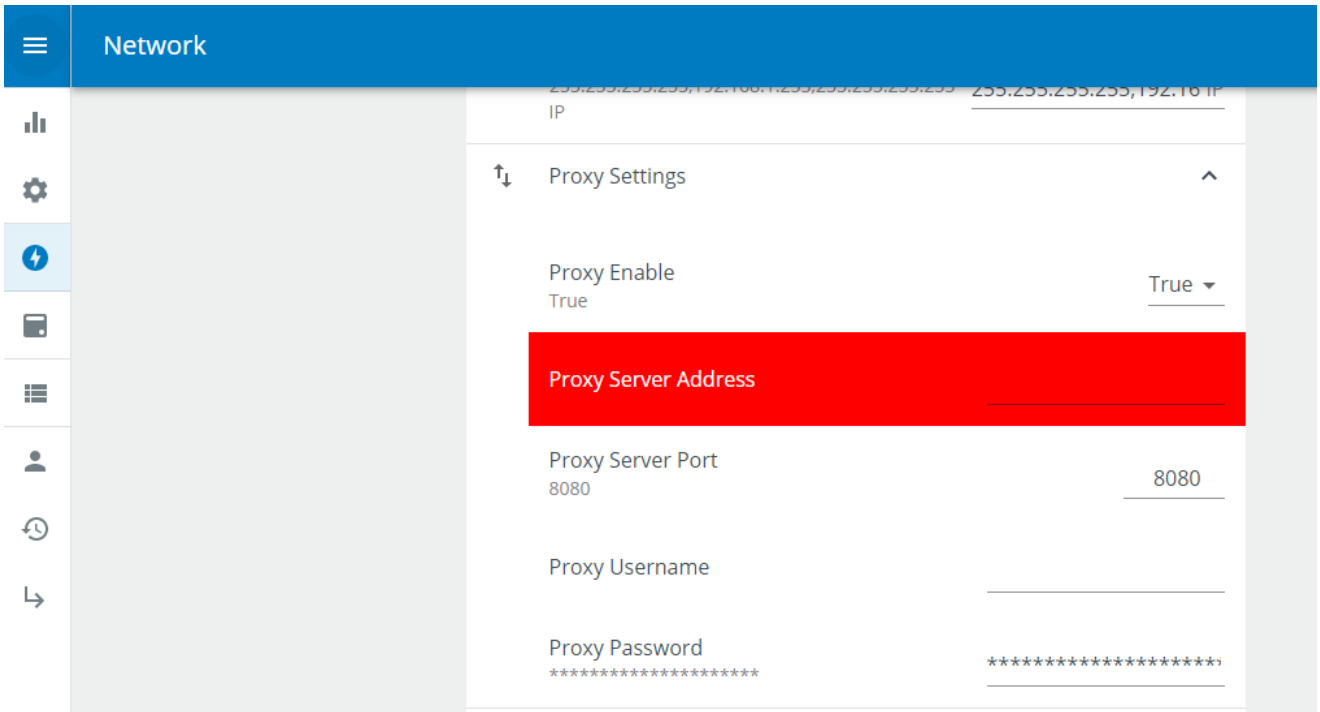
Step3: Use DHCP for device (DHCP by default).



Step4: Make sure device can access the Internet.
The device will access timer server and Azure IoT.
If you can open localweb, that means LAN is ok. Then checkout WAN: ping timeserver

6.3.2 Proxy configures (Disabled proxy by default)

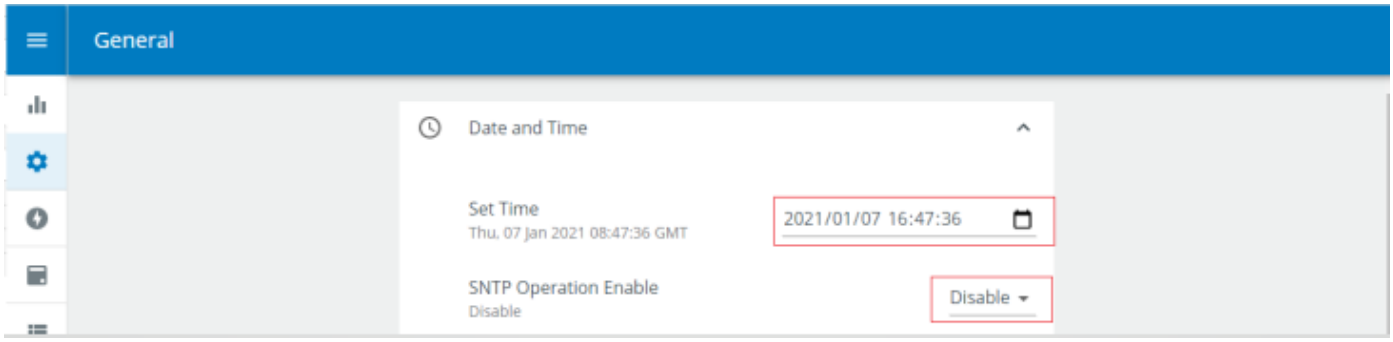
Please check you have set correct “Proxy Server Address”, if your network has no Proxy Server, please disable it.



6.3.3 Time configuration

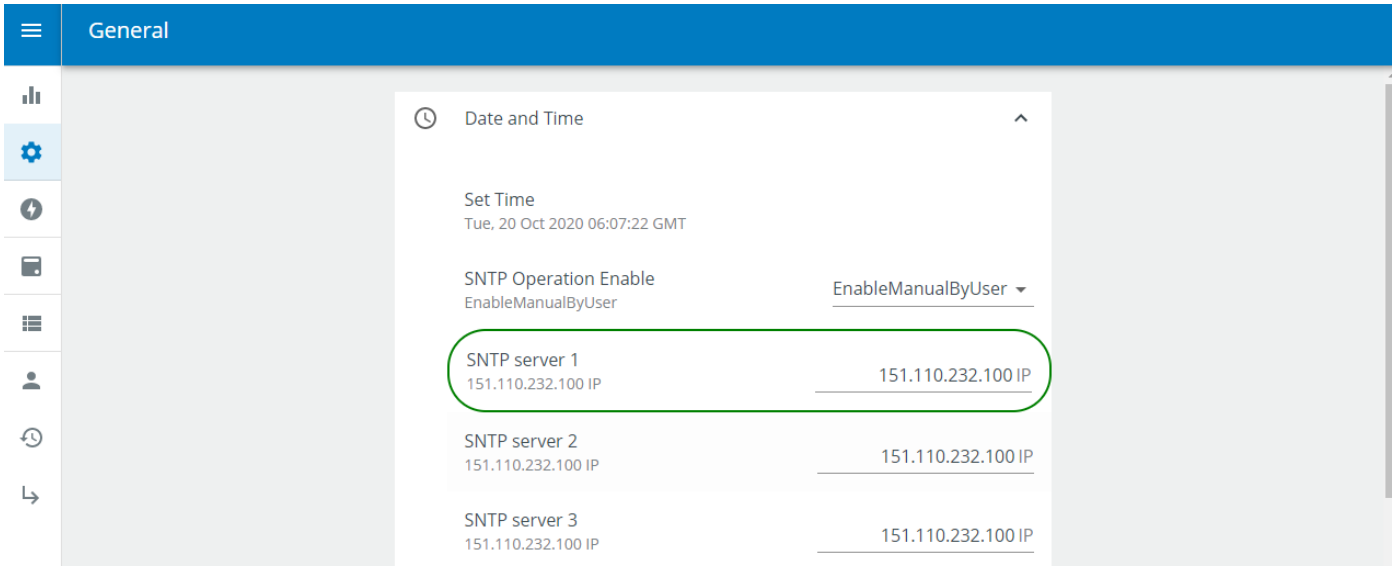
A properly configured time server is a necessary condition for devices to connect to IoT.

1. Manually setting time:



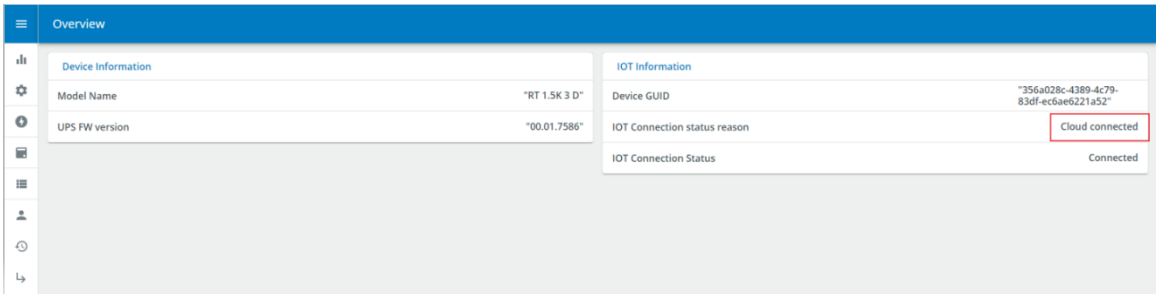
2. Auto get network time.

   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 Location of the faulty function or component

Goal:

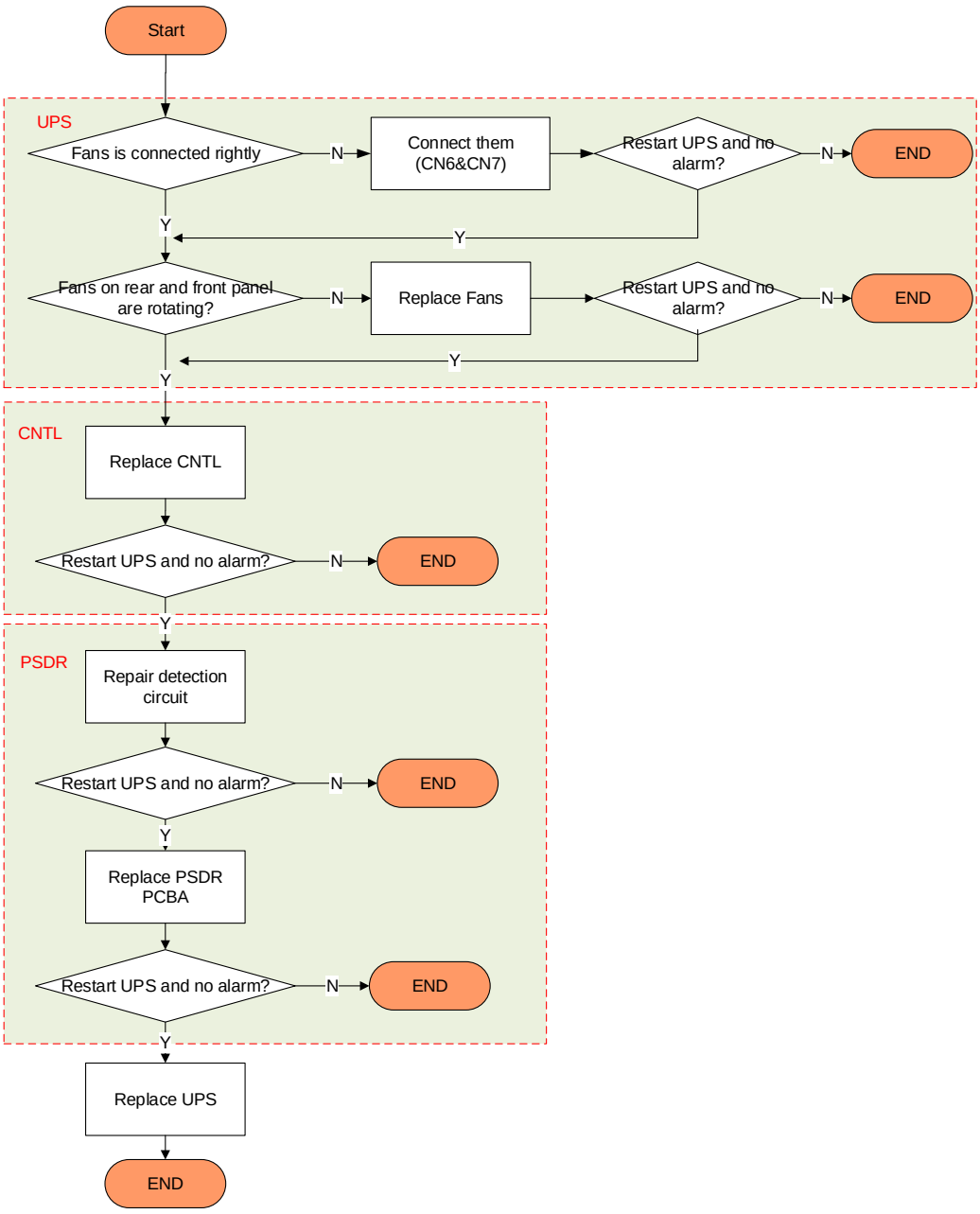
This part of the manual concentrates on the localization of the function(s), or the part(s), which are faulty, from the fault shown on the display (LCD).

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.

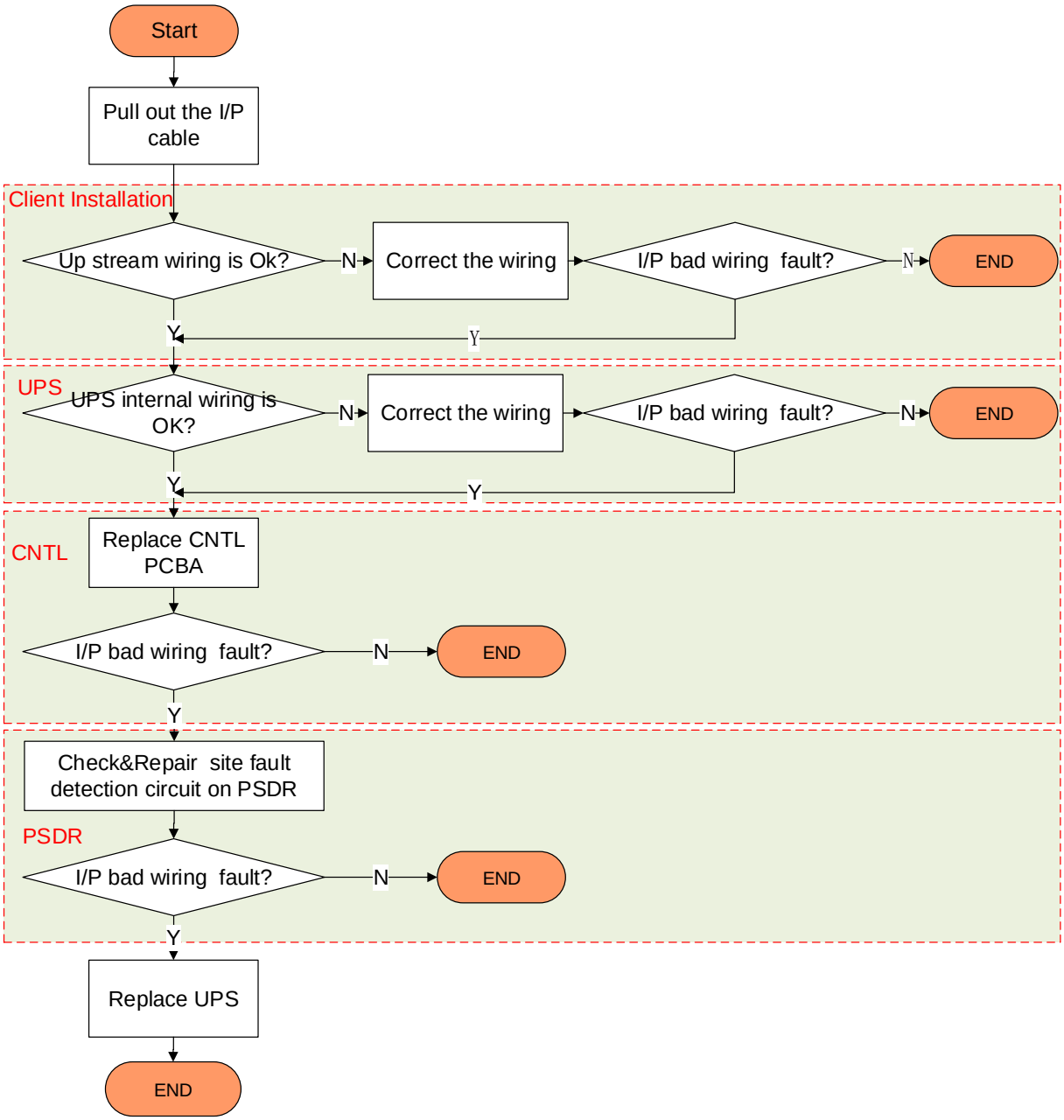
Example : The UPS display indicates a fault on the inverter function.

The process to follow is:

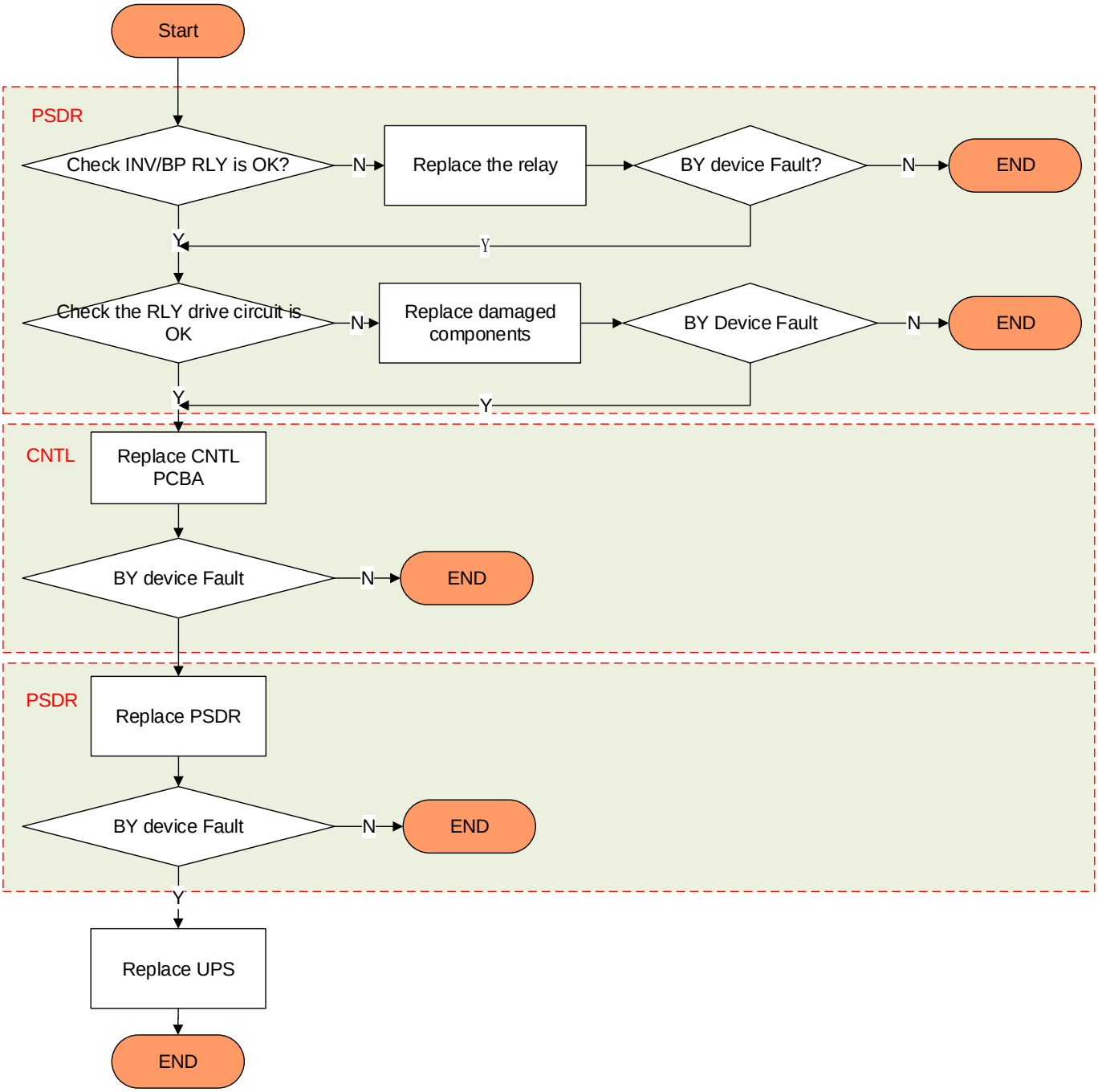
Fault_007, Fan Fault



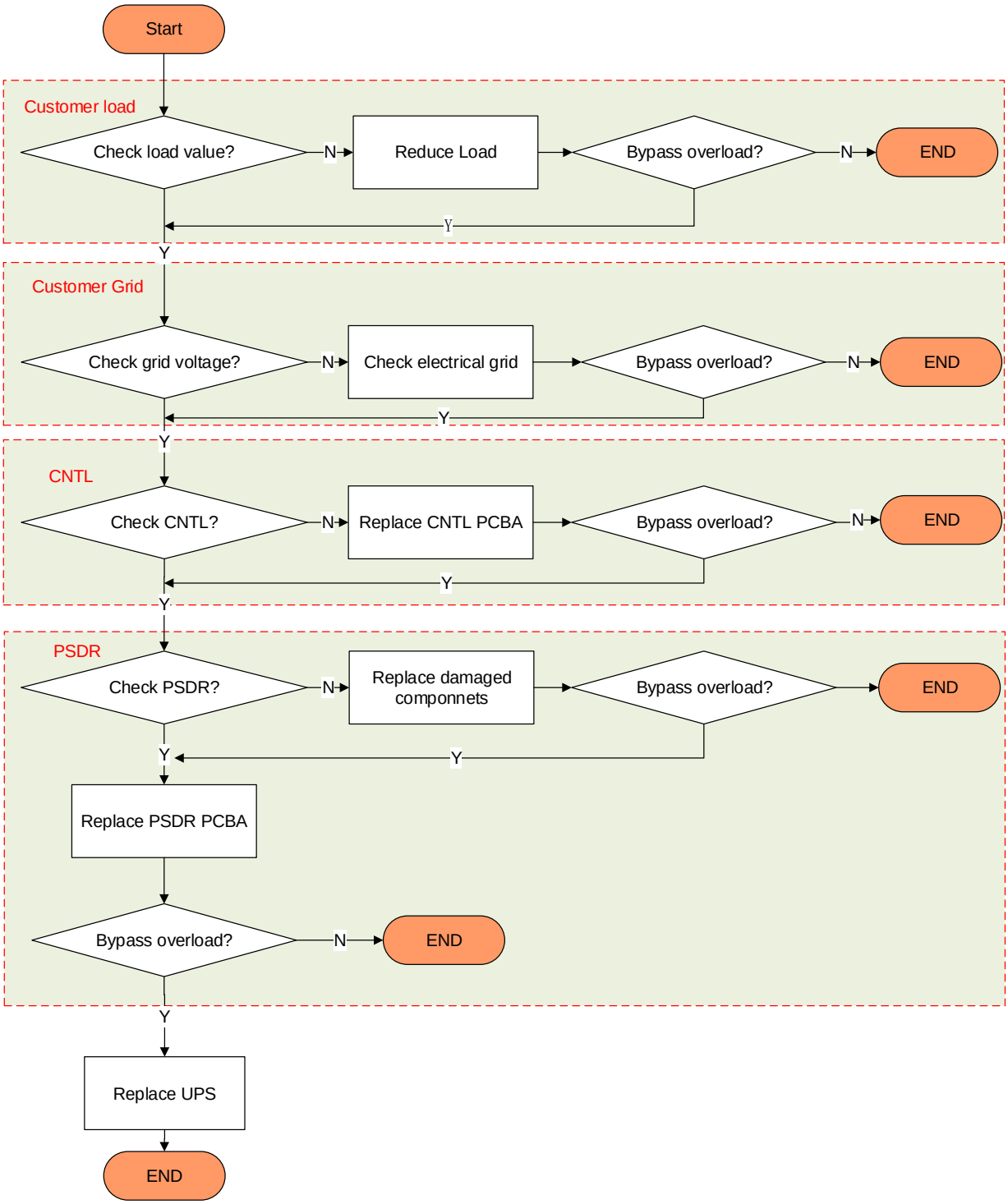
Fault 107:Input bad wiring



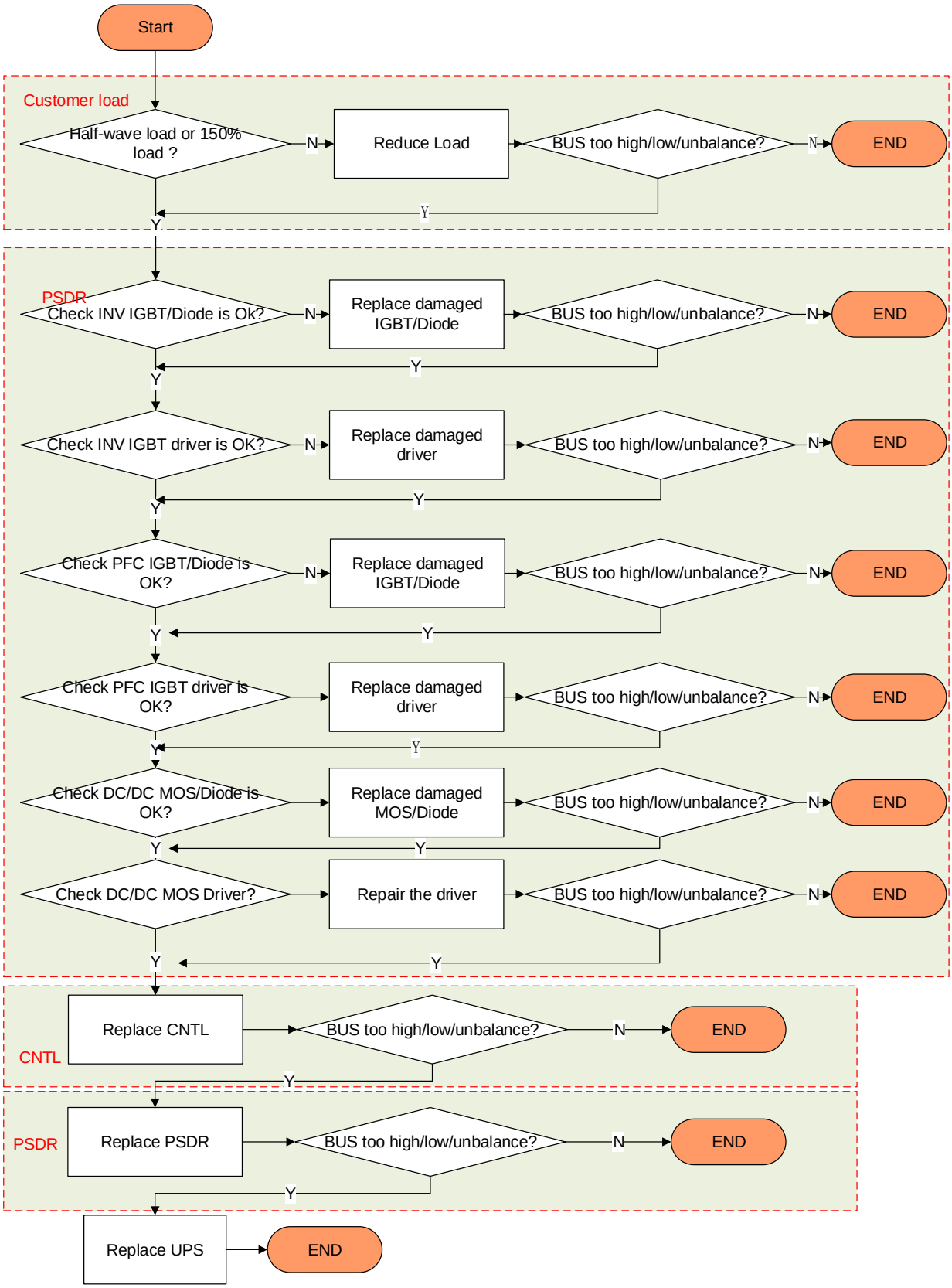
Fault 207, Bypass device fault



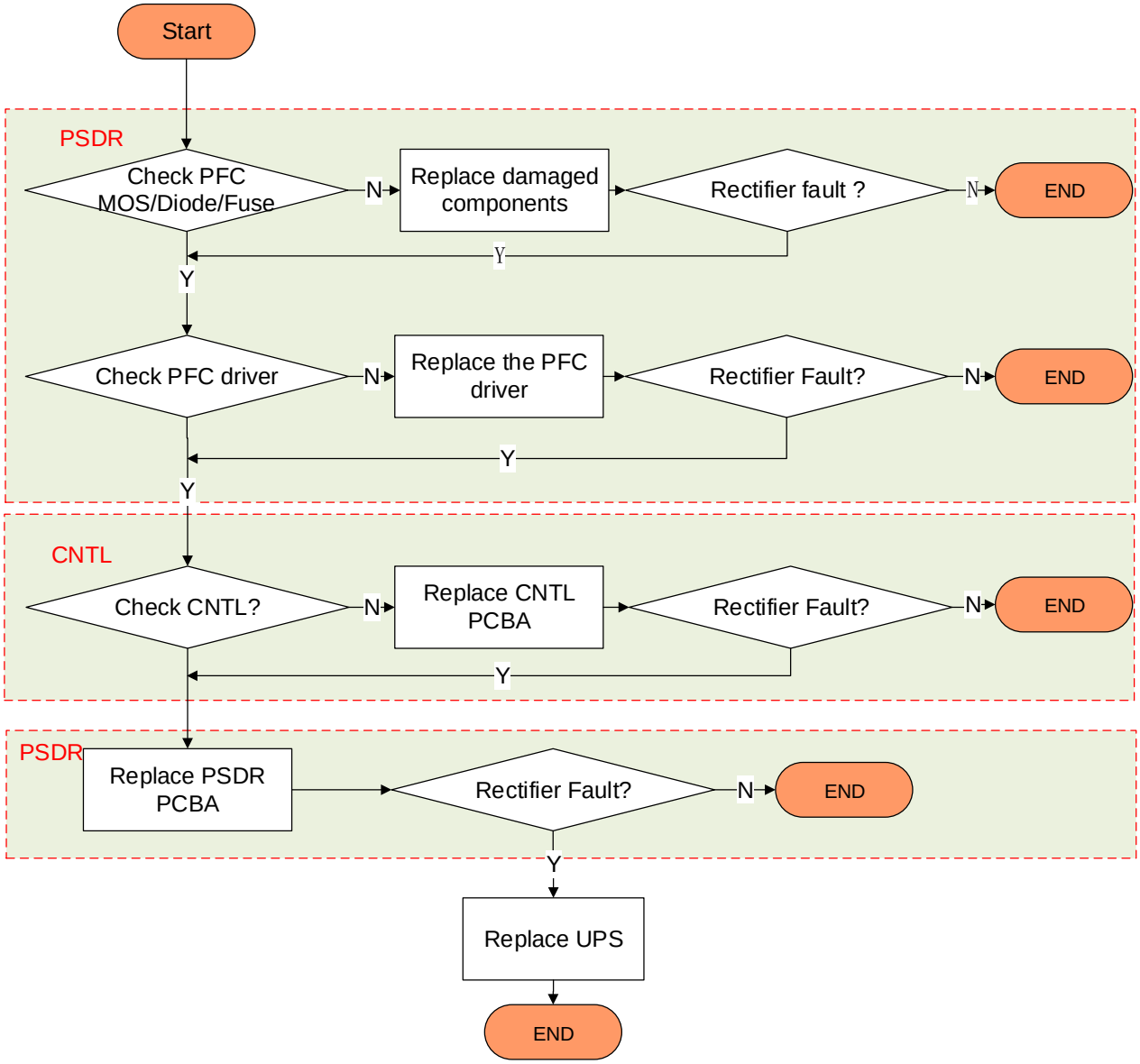
Fault 208: Bypass overload



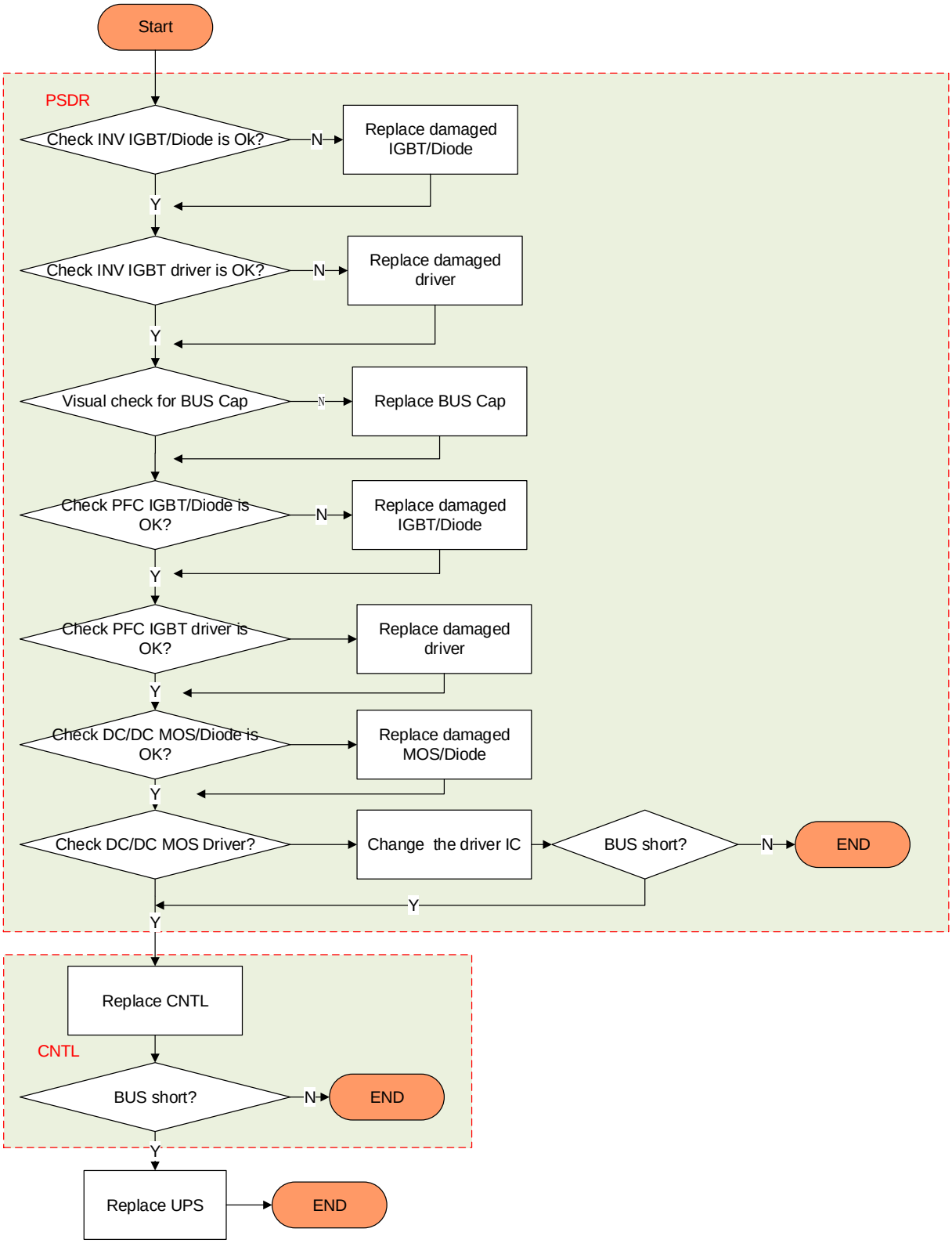
Fault 300/301/302/303/304:DC BUS too high/too low/unbalance



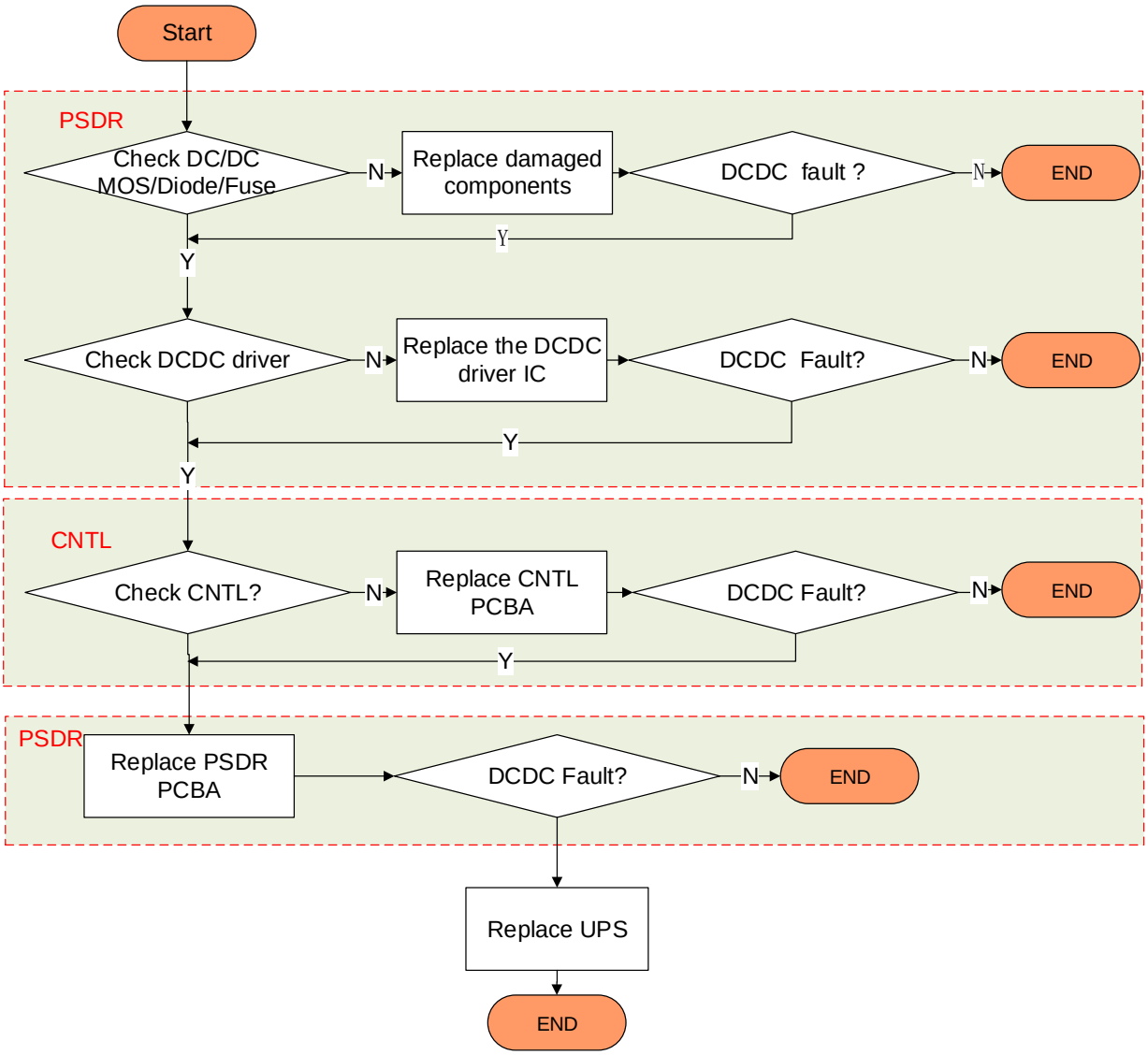
Fault 305:Rectifier Fault



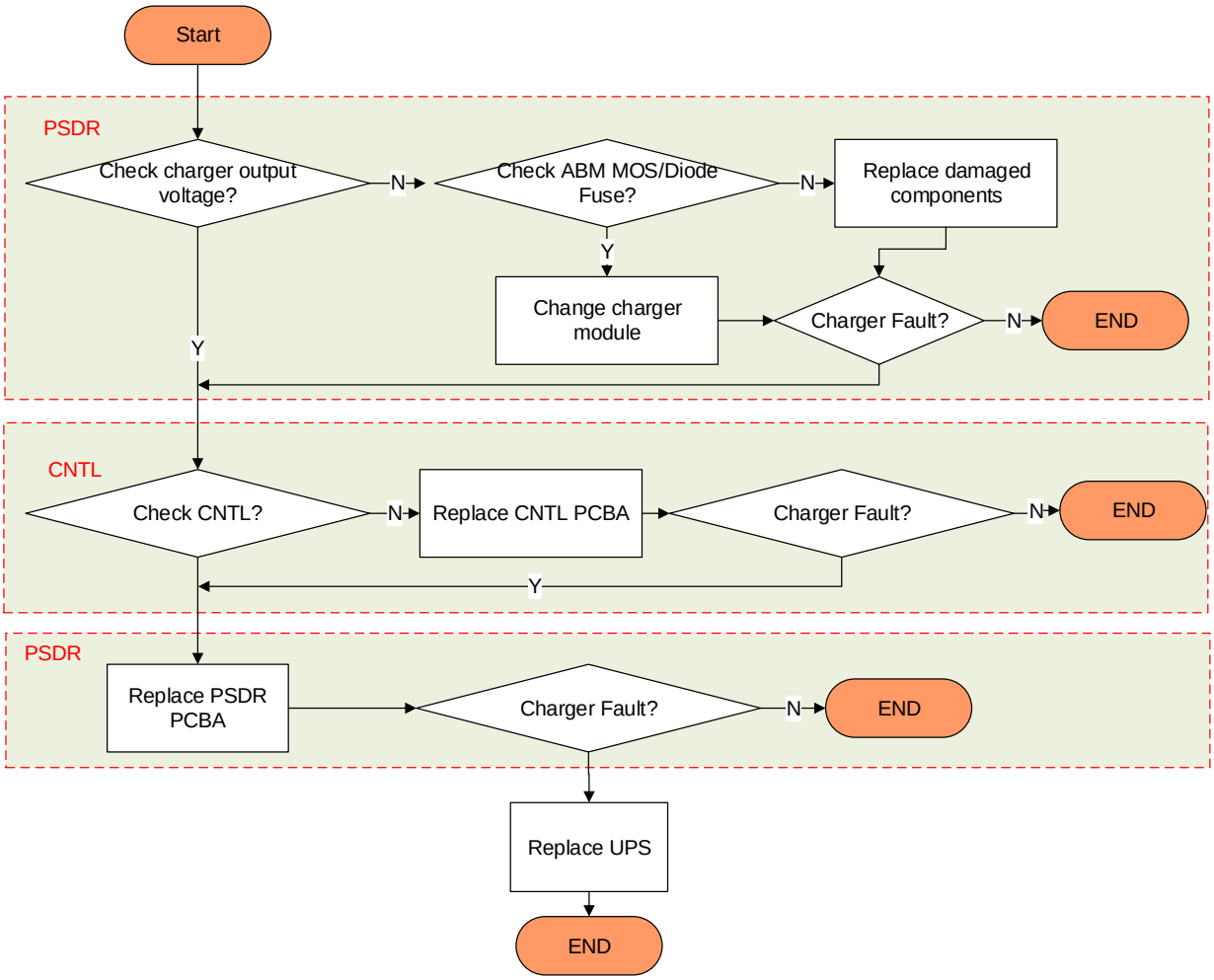
Fault 308: DC BUS short circuit



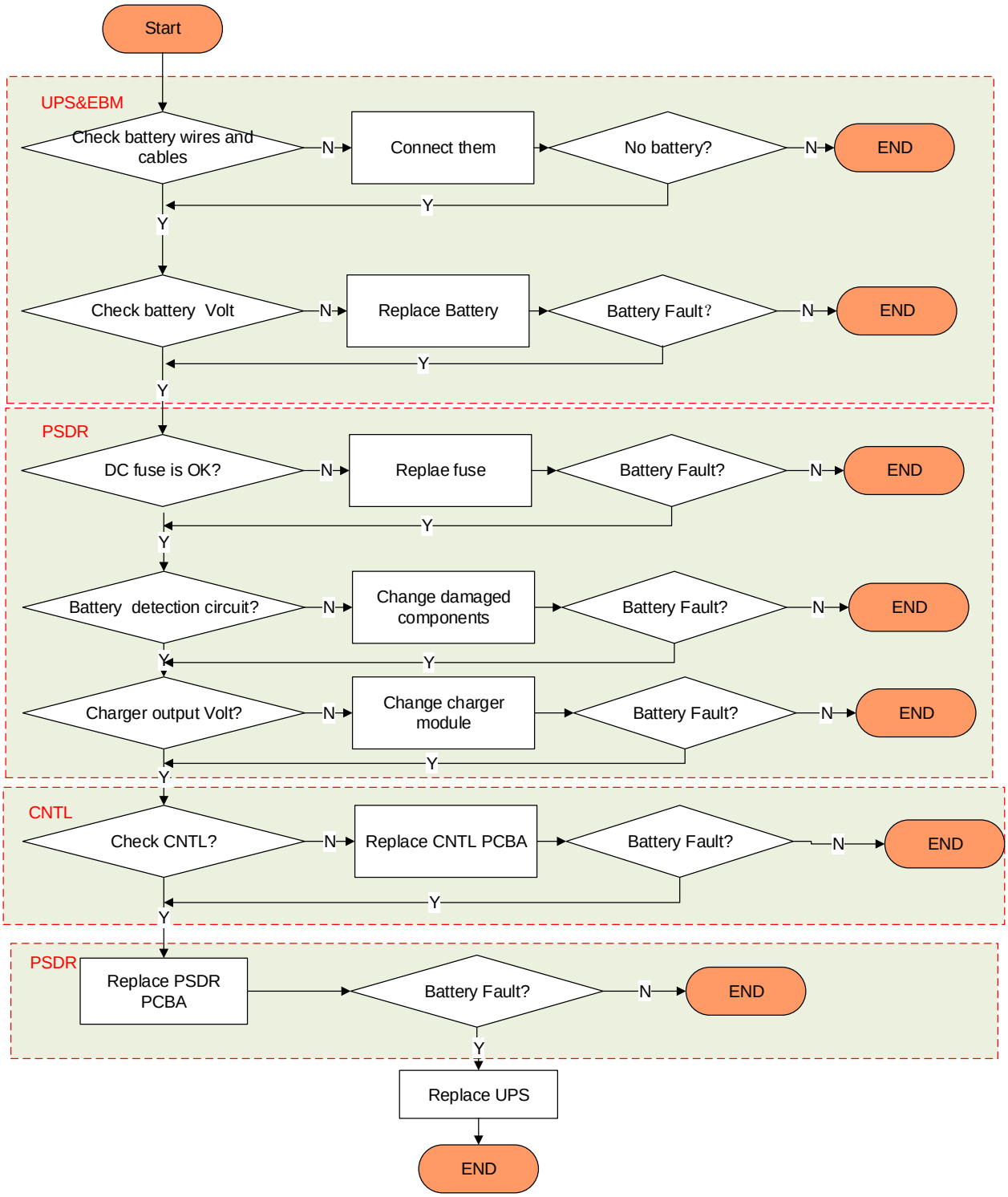
Fault 400: DCDC Fault



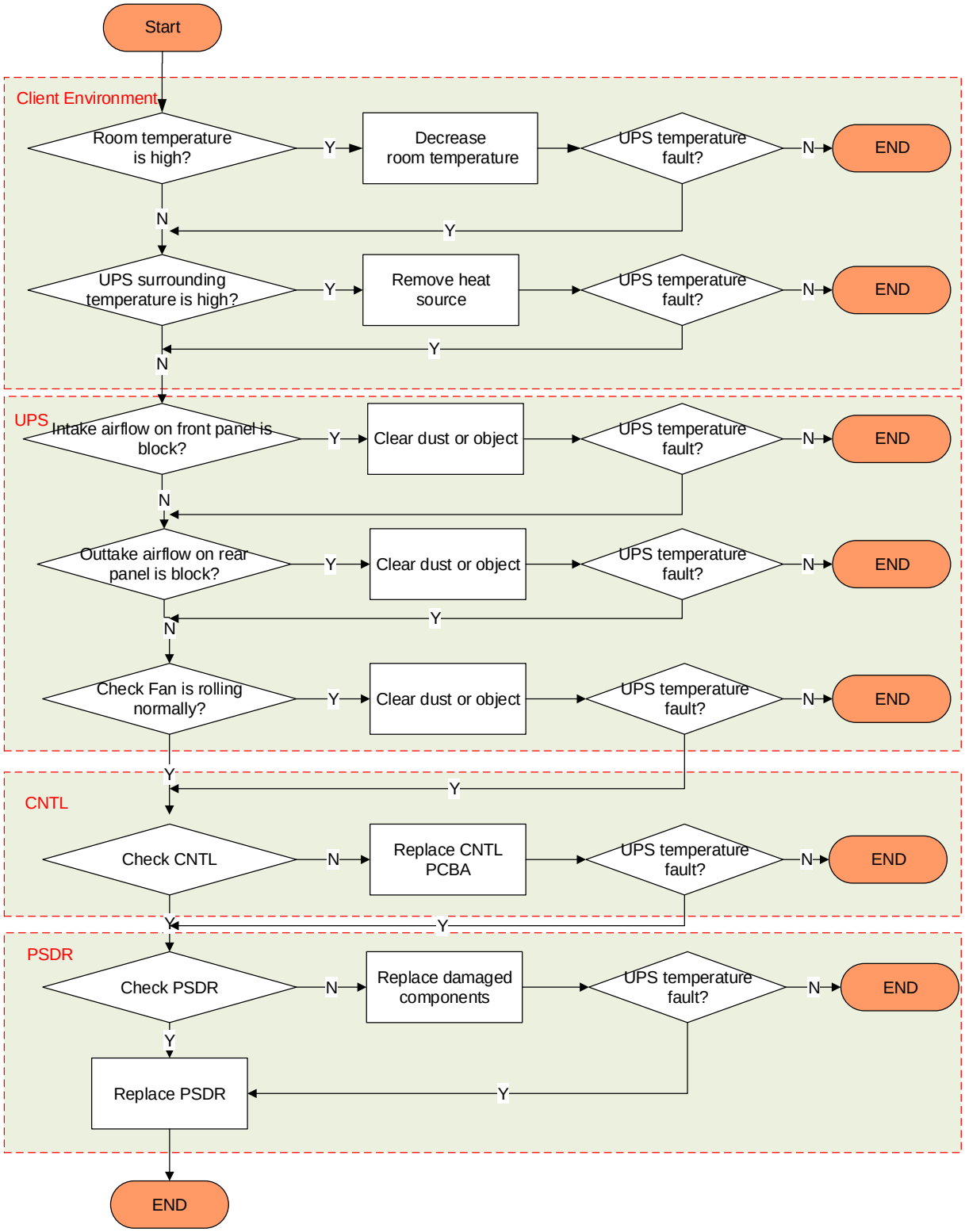
Fault 500/502/503:Charger Fault



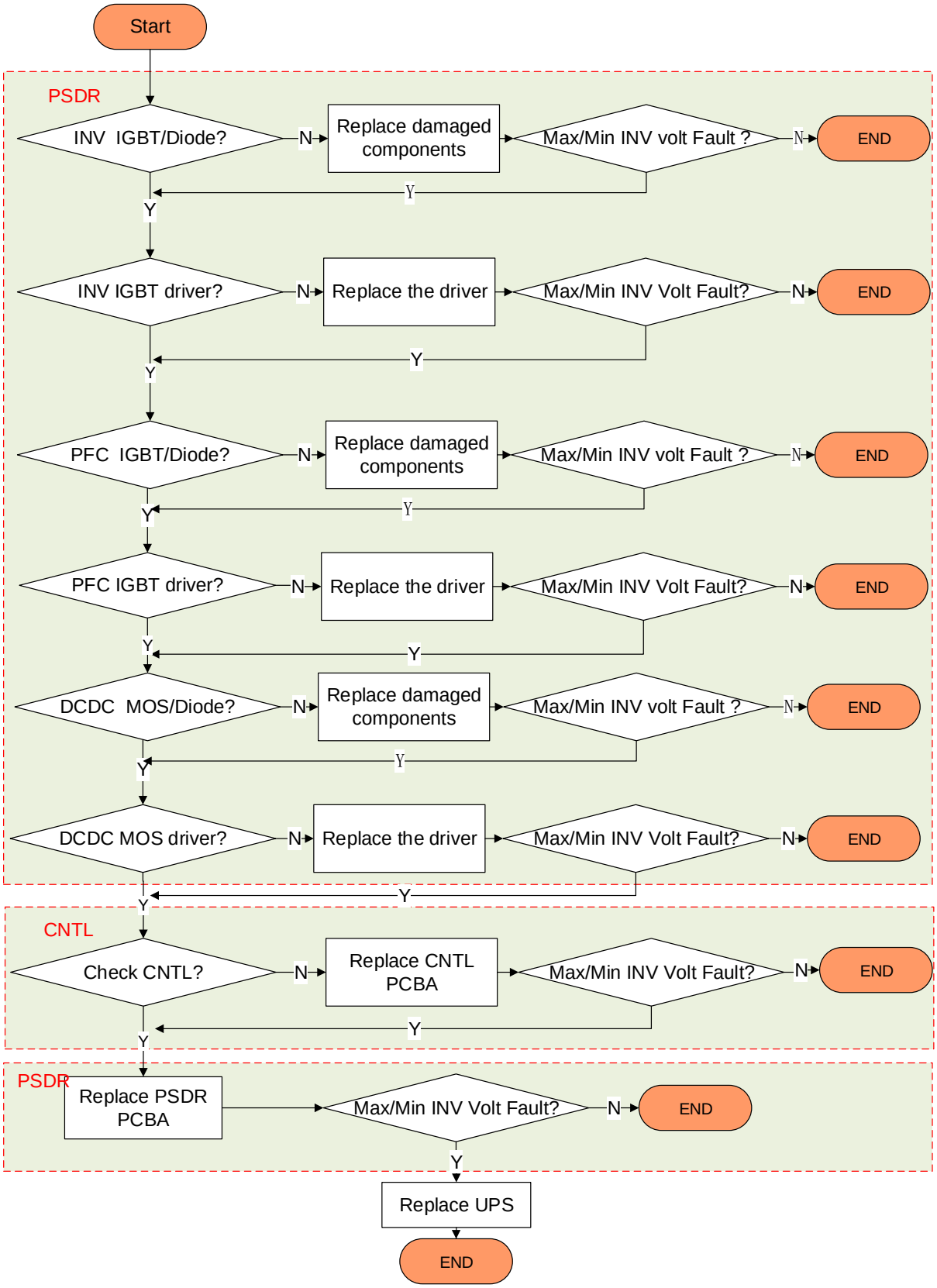
Fault 607:Battery Fault



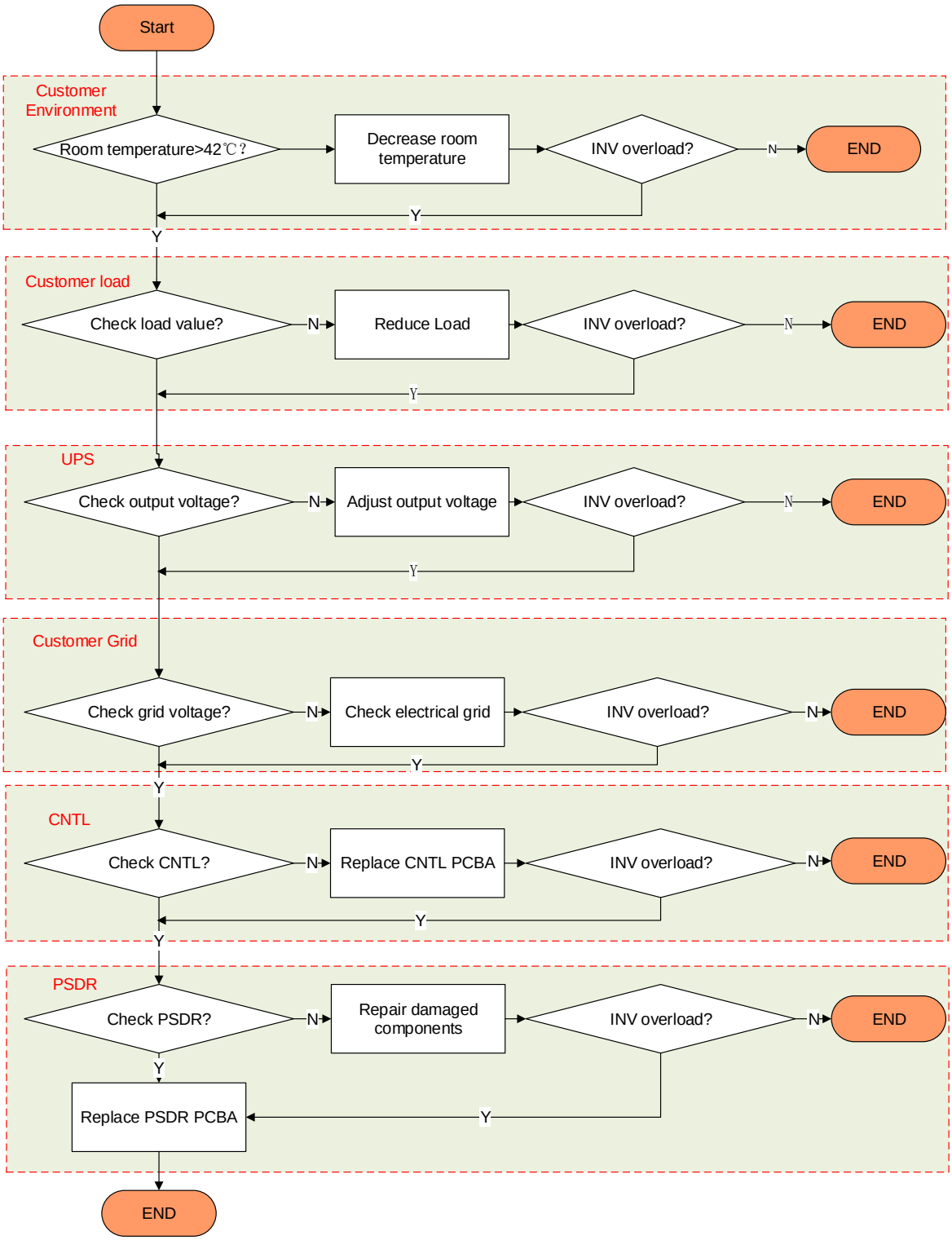
Fault 706: UPS temperature fault



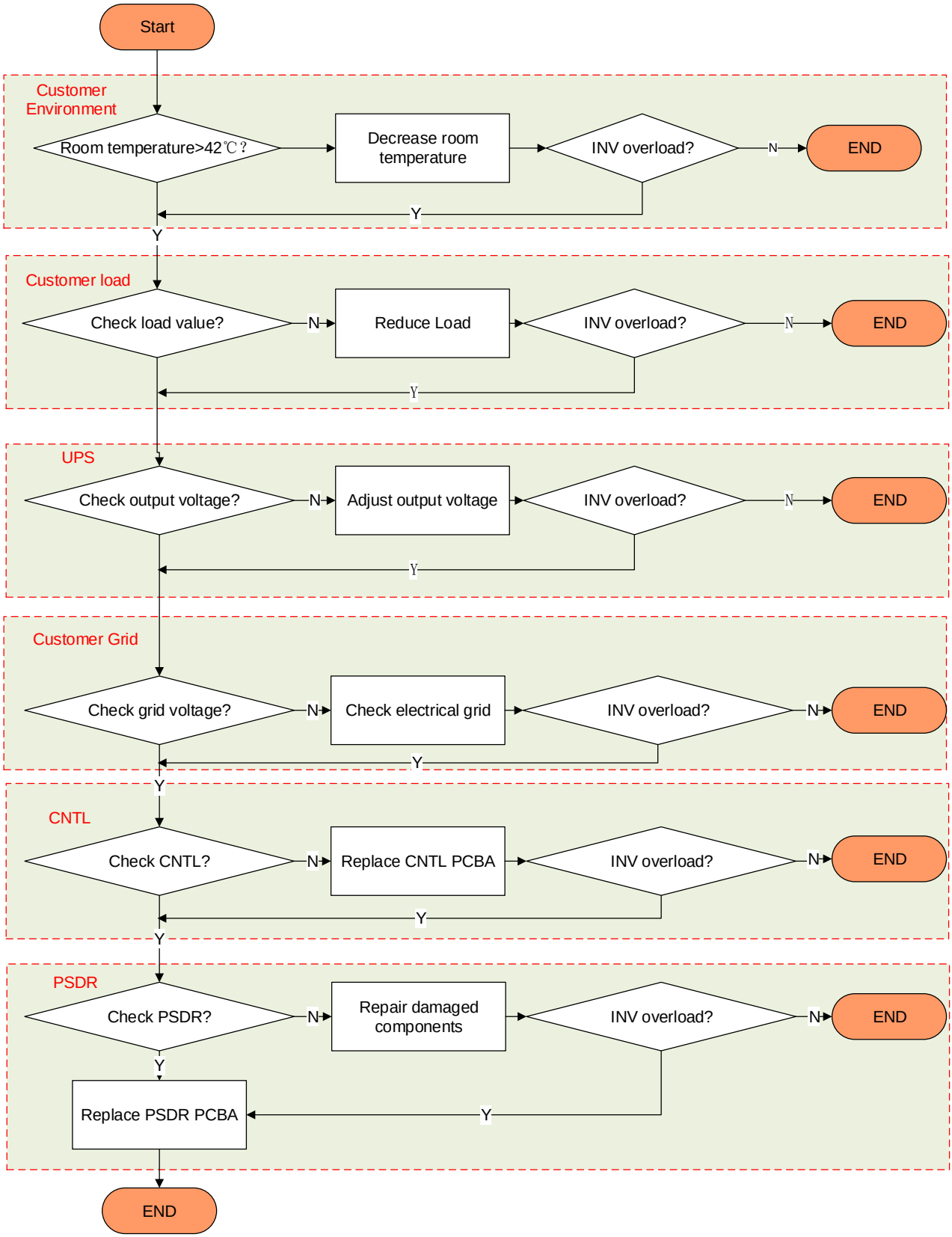
Fault 70C/70D: Max inverter volt/Min inverter volt



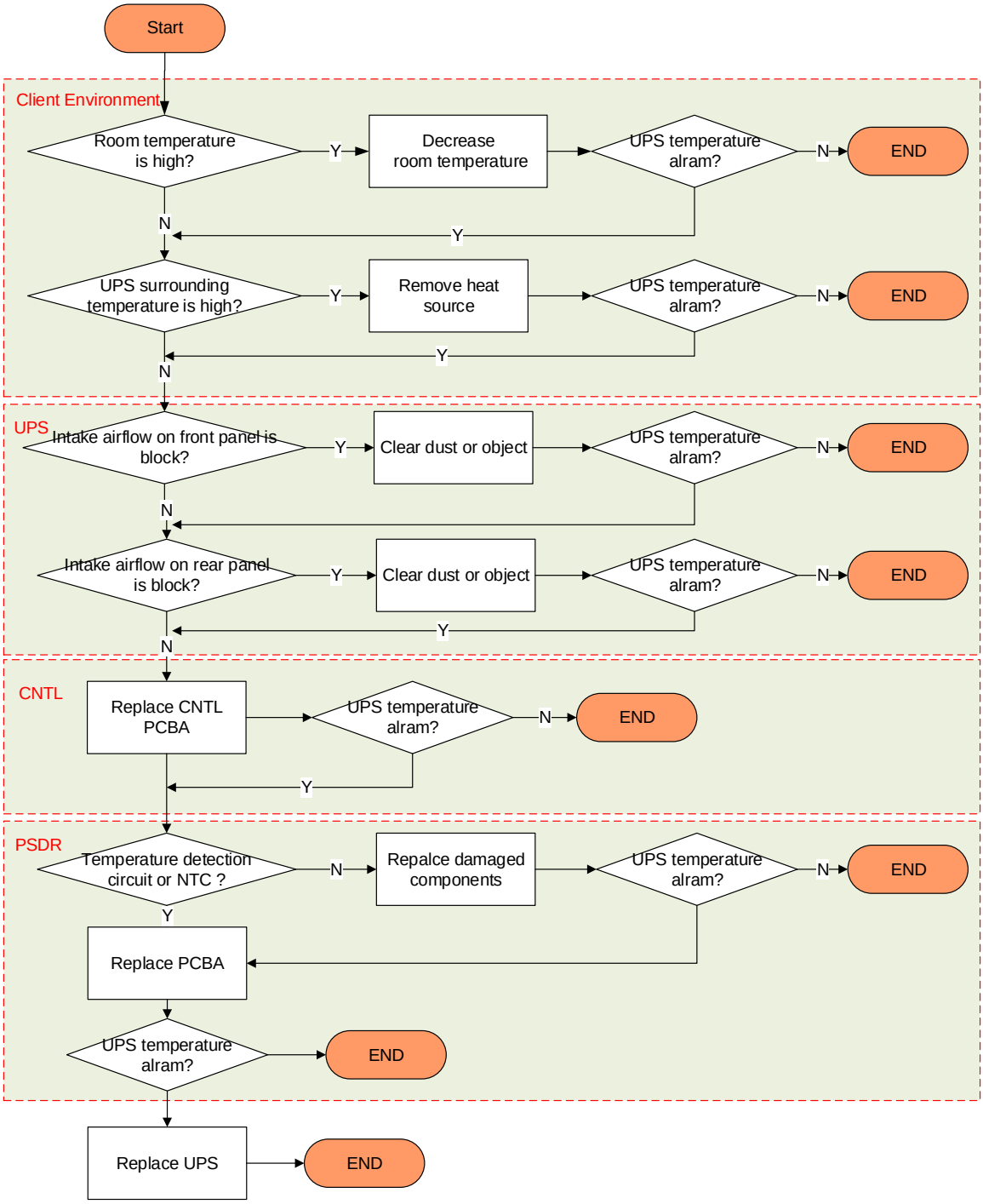
Fault 805:Output short circuit



Fault 808:Inverter overload



Fault 815:Calibration failure



7 Disassembly

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

- Screw by Screw: Indicate the locations of the screws on the frame or on the boards.
- Cables and connectors: identify their connections on the boards.
- Board references and names.

This permits the reassembly of the UPS and at the same time prevents any errors of inverted wiring, which could cause the product to be failed again during switch on.

Example

Be careful when unscrewing

7.1 RT Disassembly

1K/1KS/1,5K/1,5KS RT

Step1: Press the buckles on the both sides of front panel to remove the front panel.

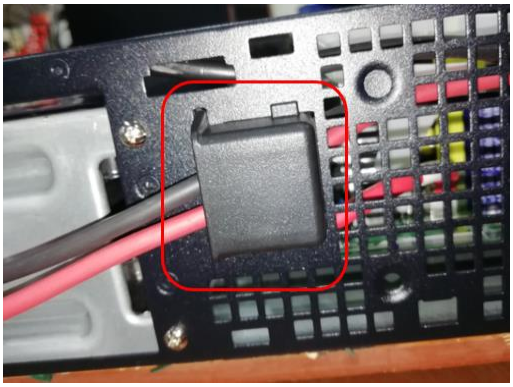
Step2: Press the button to disconnect the connector from UPS to battery pack (only for 1K/1,5K).

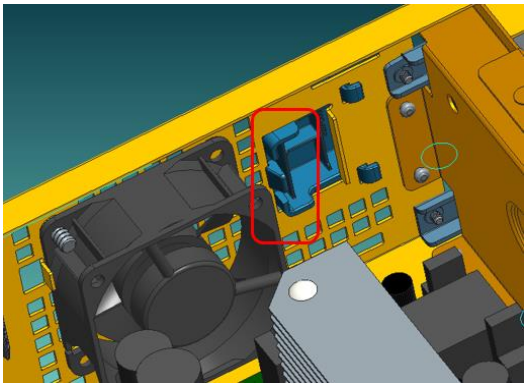
Step3: Remove 3 screws, take off battery door, and then pull out battery pack (only for 1K/1,5K).

Step4: Remove the 4 screws on the top cover, then remove the top cover toward rear panel side.

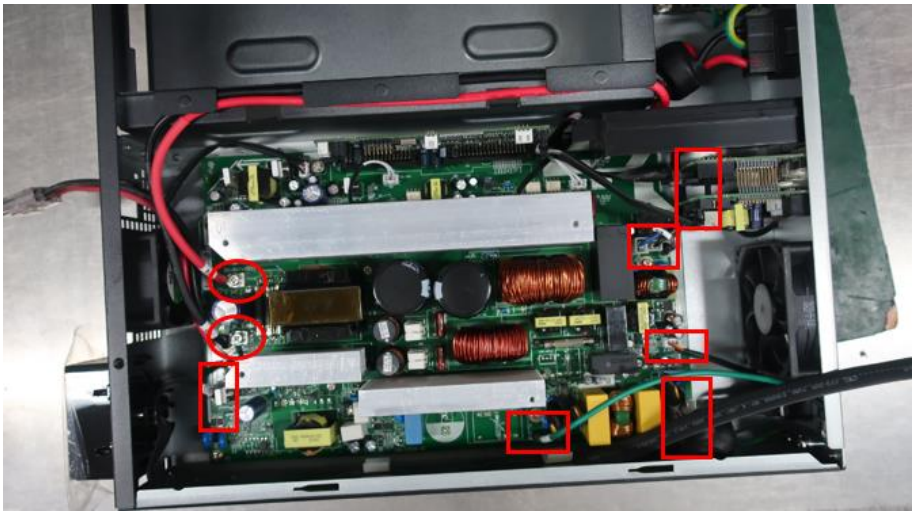
Step5: Disconnect LCD cable, remove 4 plastic rivet, remove ins paper.

Step6: Press the inner buckle of plastic cable holder to remove it from chassis (only for 1K/1,5K).



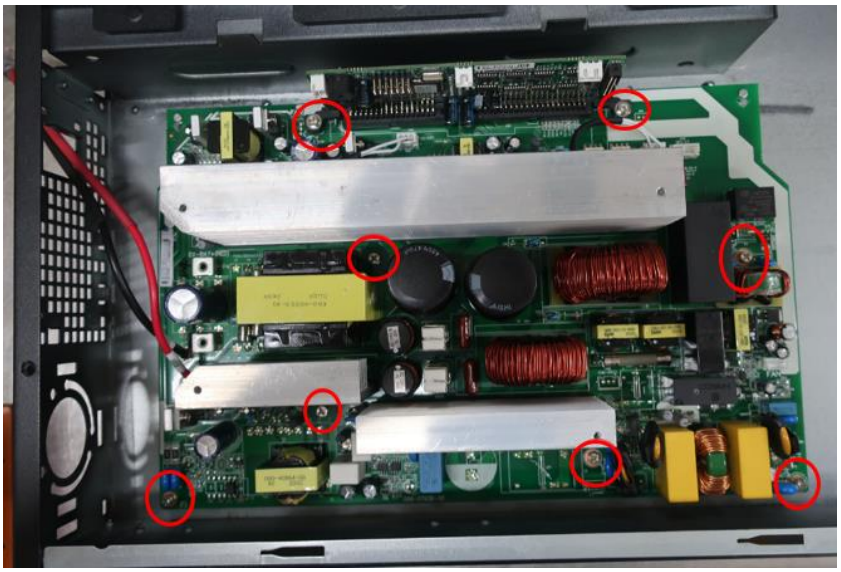


Step7: Remove 2 screws, disconnect the connectors from PSDR to rear panel.

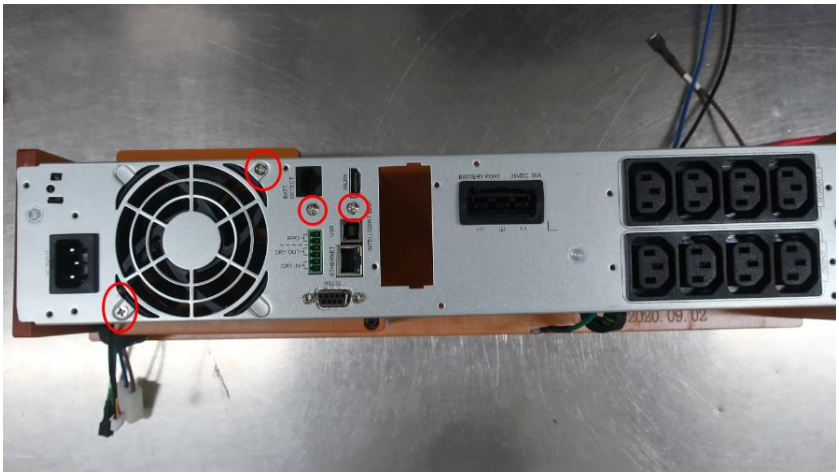


Step8: Remove 5 screws, take off rear panel.

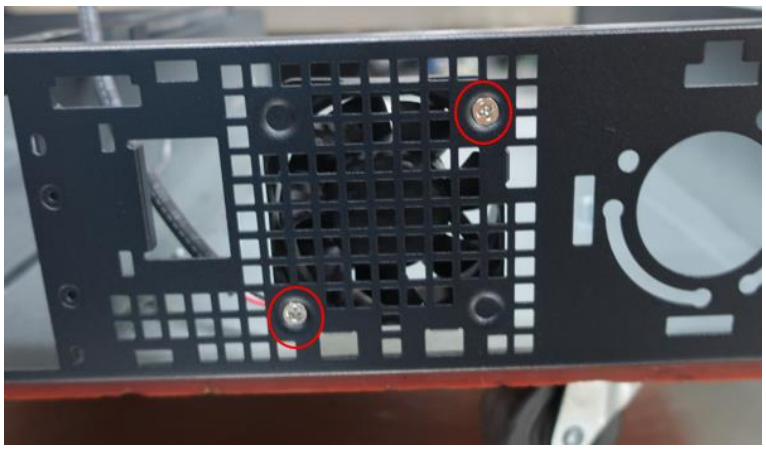
Step9: Remove 8 screws, take off PSDR.



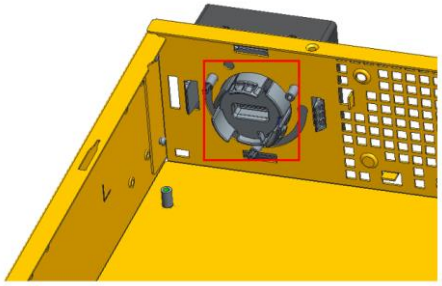
Step10: Remove 4 screws, take off fan & CNTL board.



Step11: Remove 2 screws, take off fan (only for 1,5K/1,5KS).



Step12: Press the buckles of LCD box to remove LCD box from chassis. Use a flat-blade screwdriver to pry open the 4 positions of the red circle, and then open the LCD box. Remove the LCD cables , take off LCD PSDR.



2K/3K/ RT

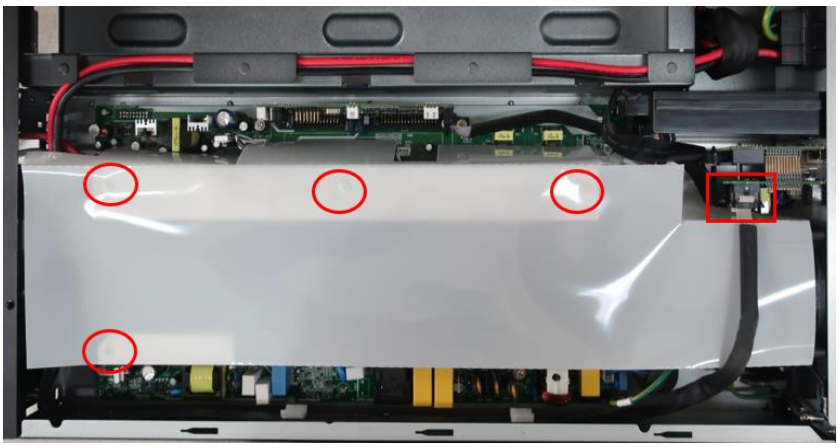
Step1: Press the buckles on the both sides of front panel to remove the front panel.

Step2: Press the button to disconnect the connector from UPS to battery pack.

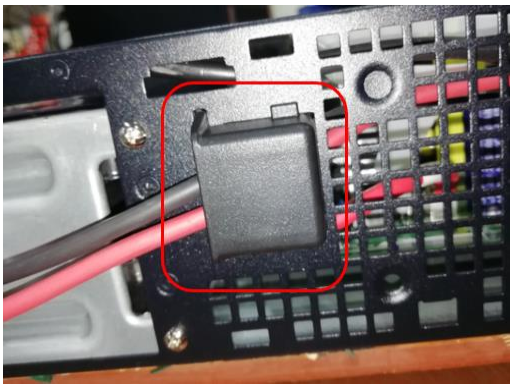
Step3: Remove 3 screws, take off battery door, and then pull out battery pack.

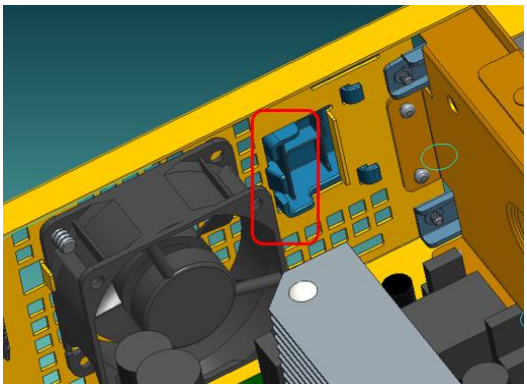
Step4: Remove the 4 screws on the top cover, then remove the top cover toward rear panel side.

Step5: Disconnect LCD cable, remove 4 plastic rivet, remove ins paper.

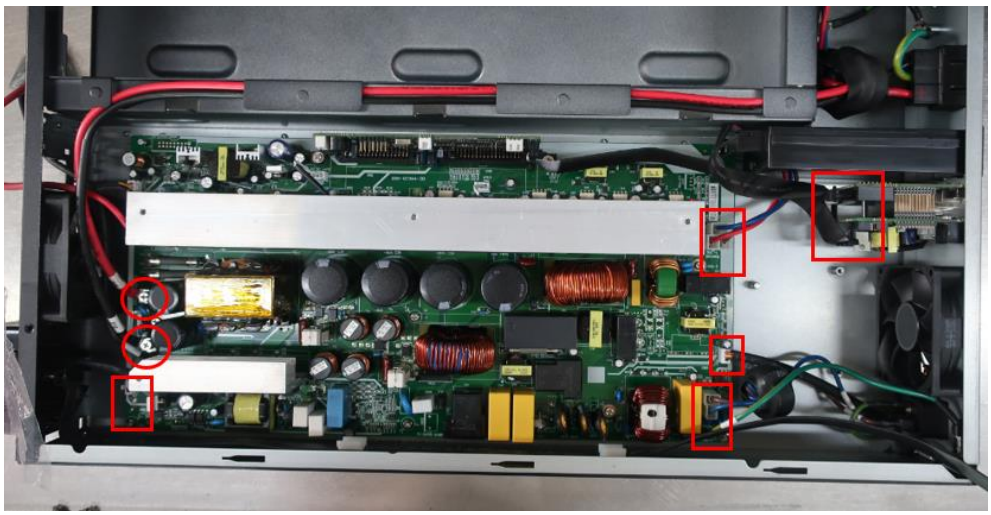


Step6: Press the inner buckle of plastic cable holder to remove it from chassis .



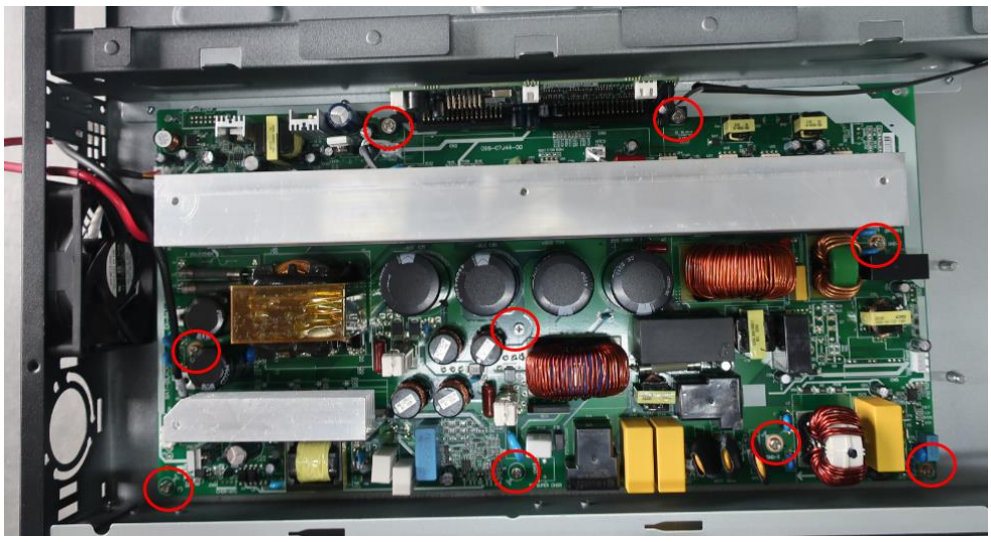


Step7: Remove 2 screws, disconnect the connectors from PSDR to rear panel.

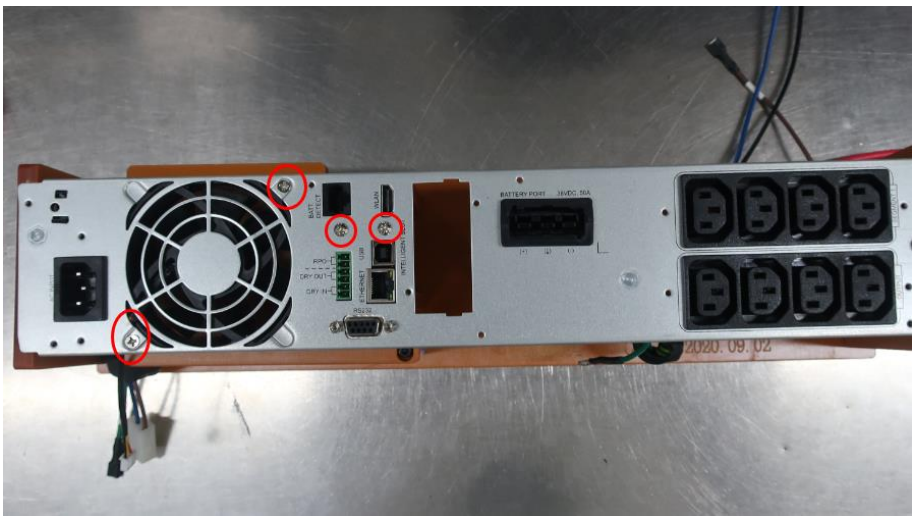


Step8: Remove 5 screws, take off rear panel.

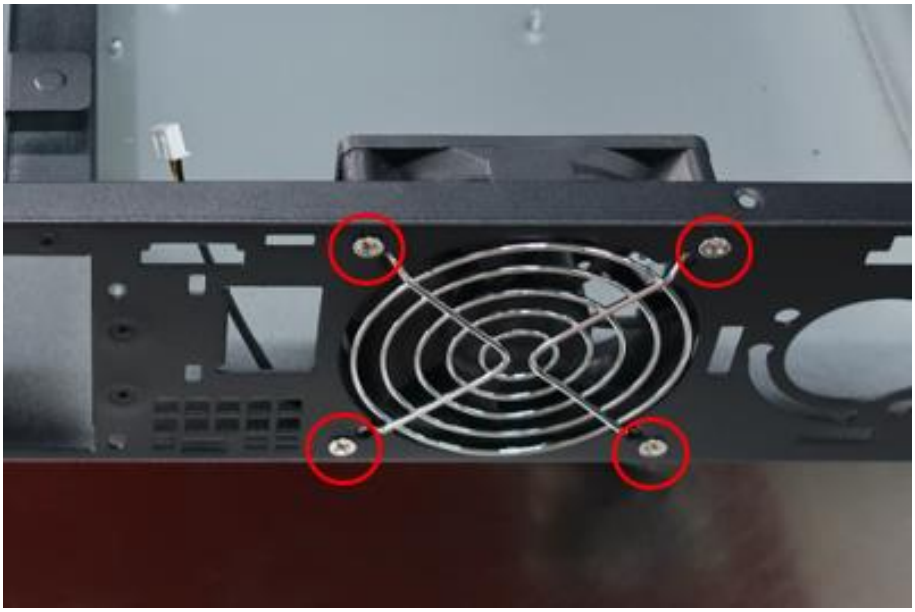
Step9: Remove 9 screws, take off PSDR.



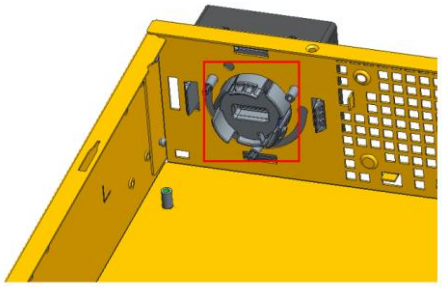
Step10: Remove 4 screws, take off fan & CNTL board.



Step11: Remove 4 screws, take off fan.



Step12: Press the buckles of LCD box to remove LCD box from chassis. Use a flat-blade screwdriver to pry open the 4 positions of the red circle, and then open the LCD box. Remove the LCD cables , take off LCD PSDR.

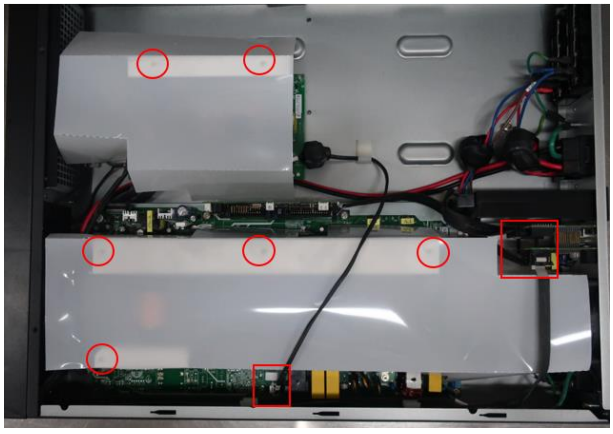


2KS/3KS/ RT

Step1: Press the buckles on the both sides of front panel to remove the front panel.

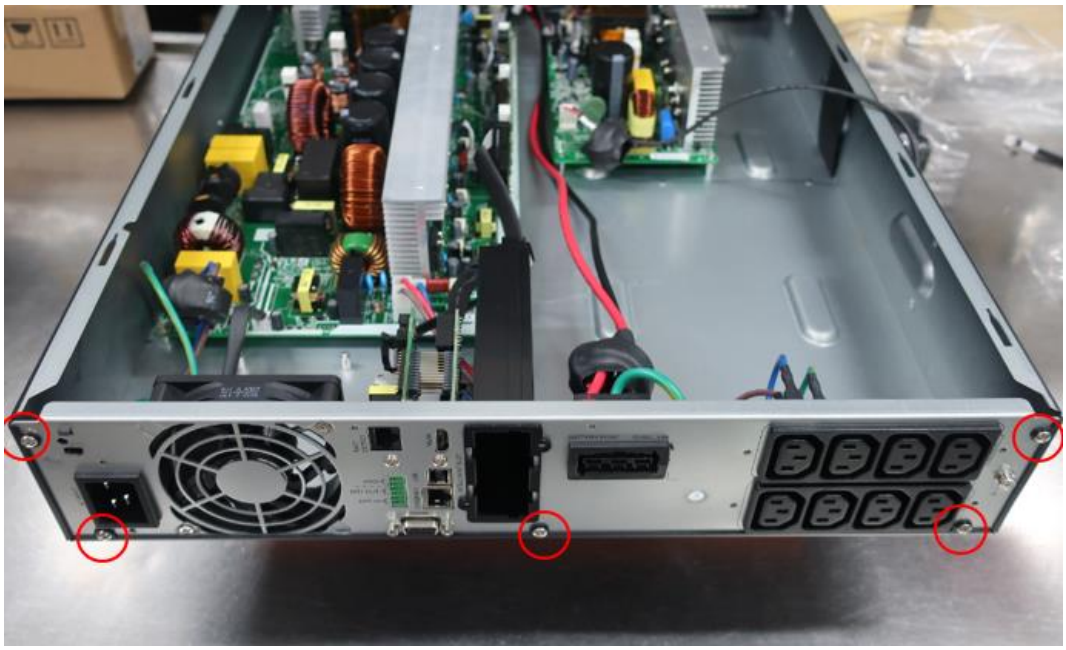
Step2: Remove the 4 screws on the top cover, then remove the top cover toward rear panel side.

Step3: Disconnect LCD cable, remove 6 plastic rivet, remove ins papers.

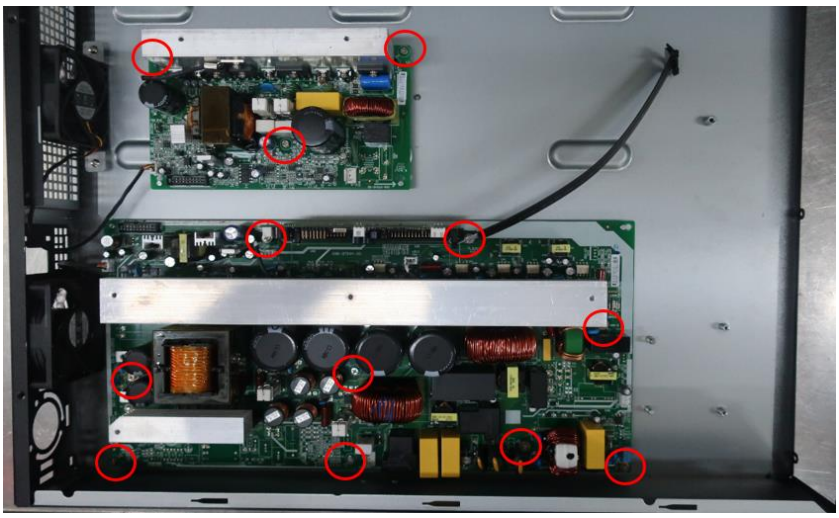


Step4: Remove 2 screws, disconnect the connectors from PSDR to rear panel.

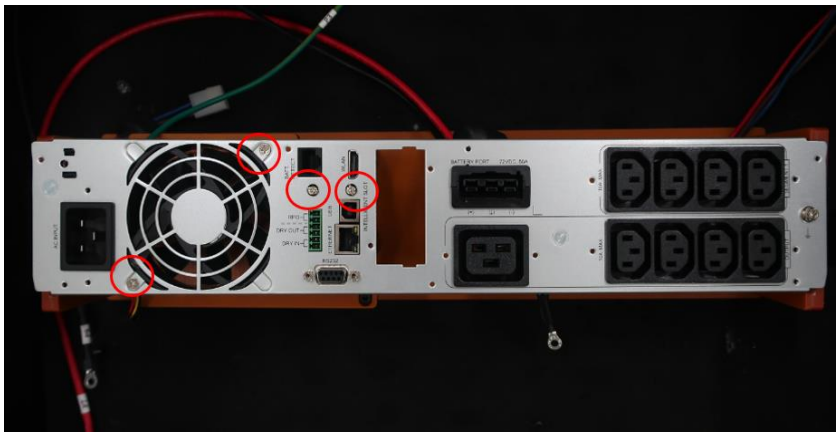
Step5: Remove 5 screws, take off rear panel.



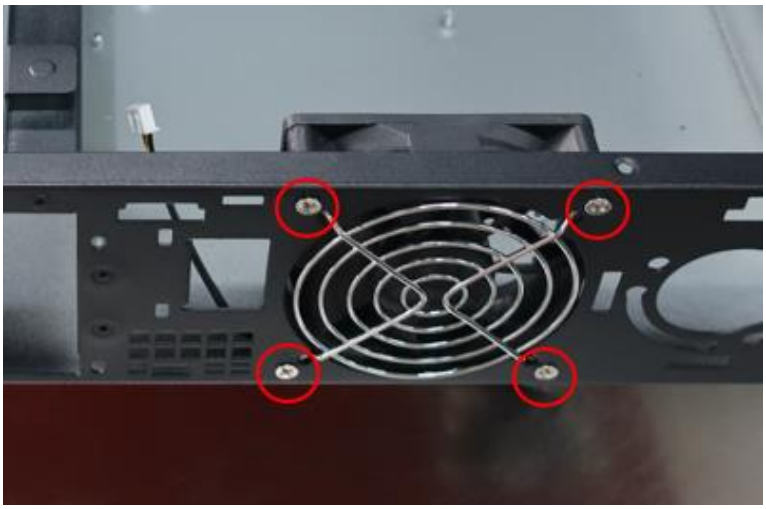
Step6: Remove 12 screws, take off PSDR & Charge board.



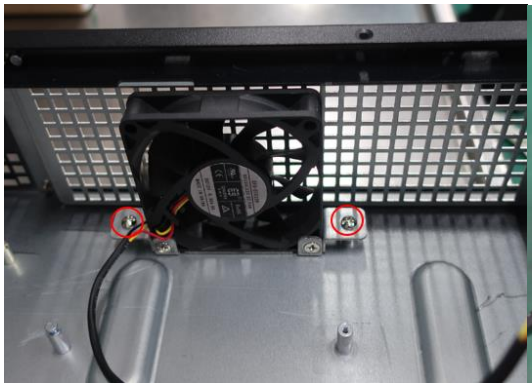
Step7: Remove 4 screws, take off fan & CNTL board.



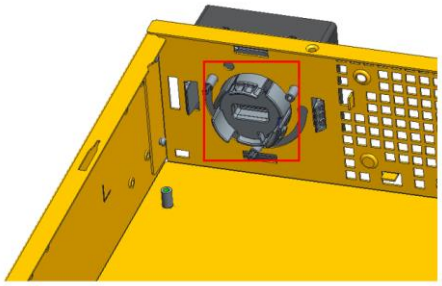
Step8: Remove 4 screws, take off fan.



Step9: Remove 4 screws, take off fan.



Step10: Press the buckles of LCD box to remove LCD box from chassis. Use a flat-blade screwdriver to pry open the 4 positions of the red circle, and then open the LCD box. Remove the LCD cables , take off LCD PSDR.



<u>36V/72V EBM</u>

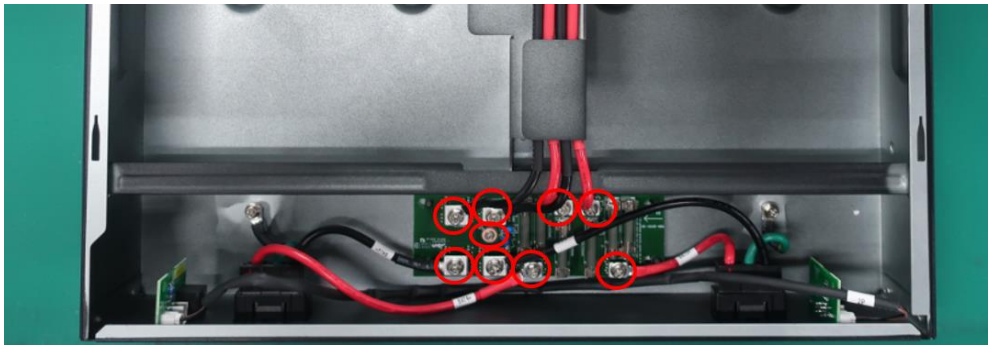
Step1: Press the buckles on the both sides of front panel to remove the front panel.

Step2: Press the button to disconnect the connector from UPS to battery pack.

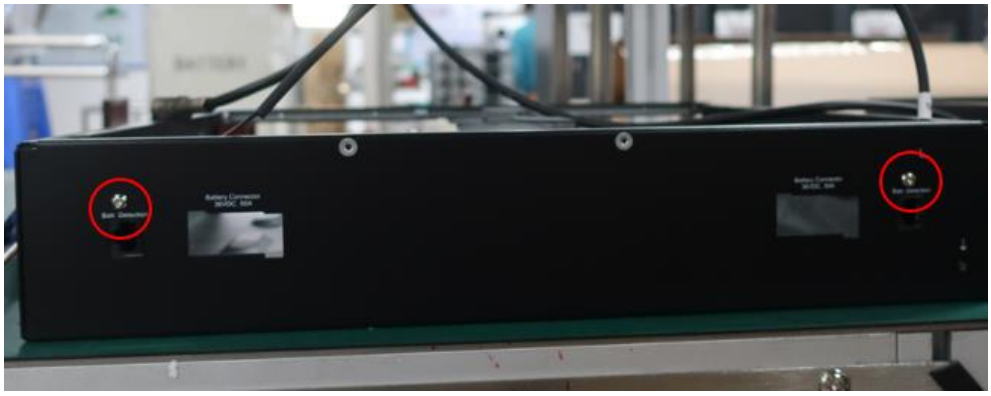
Step3: Remove 4 screws, take off battery door, and then pull out battery pack.

Step4: Remove the 4 screws on the top cover, then remove the top cover toward rear panel side.

Step5: Remove 9 screws, take off fuse board.



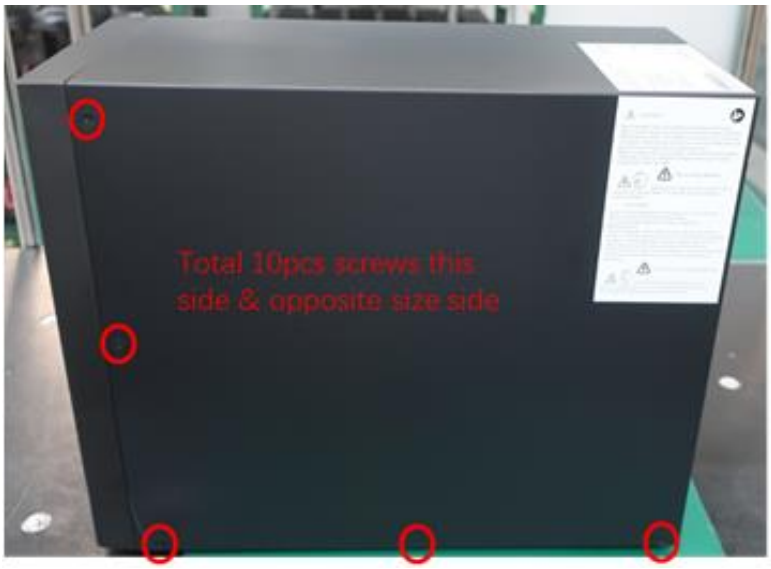
Step6: Remove 2 screws, take off detection board.



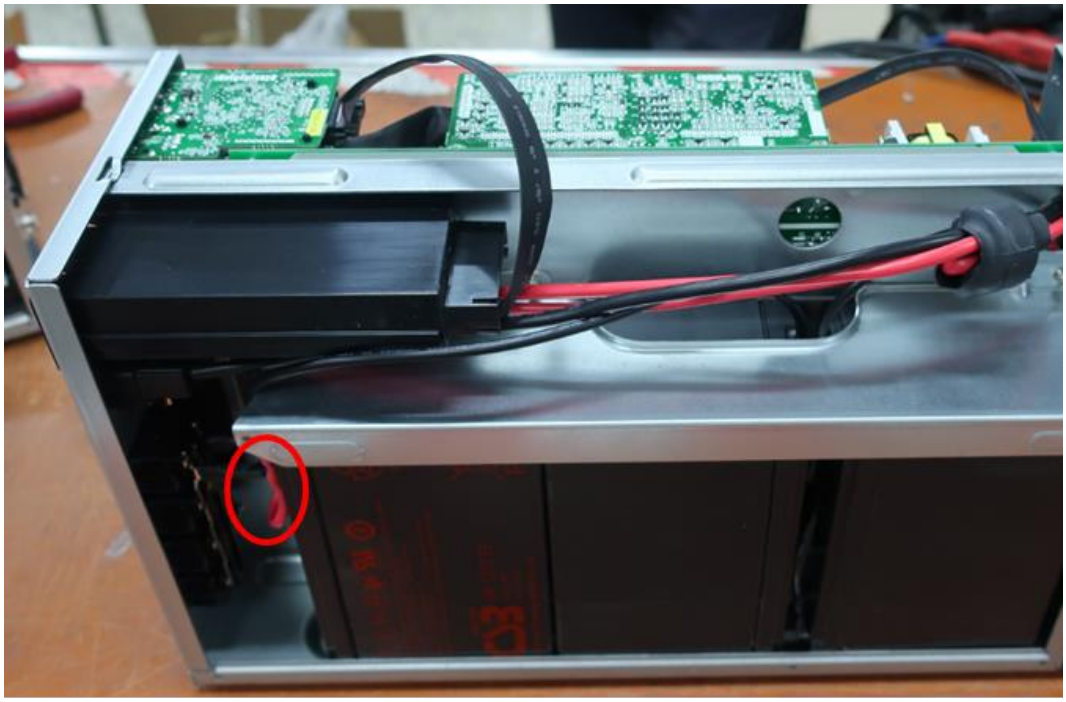
7.2 Tower Disassembly

1K/1KS/1,5K/1,5KS Tower

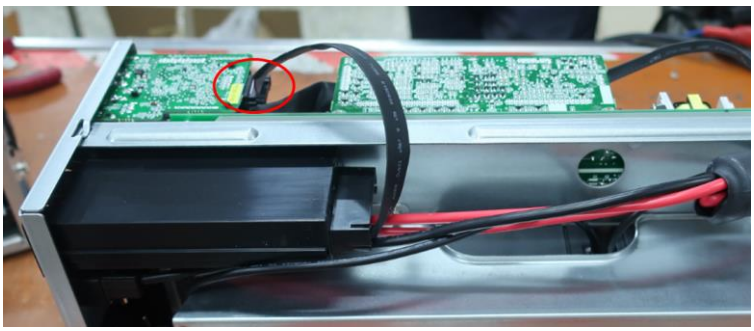
Step1: Remove the screws in left/right side and rear side, push back and lift up the top cover.



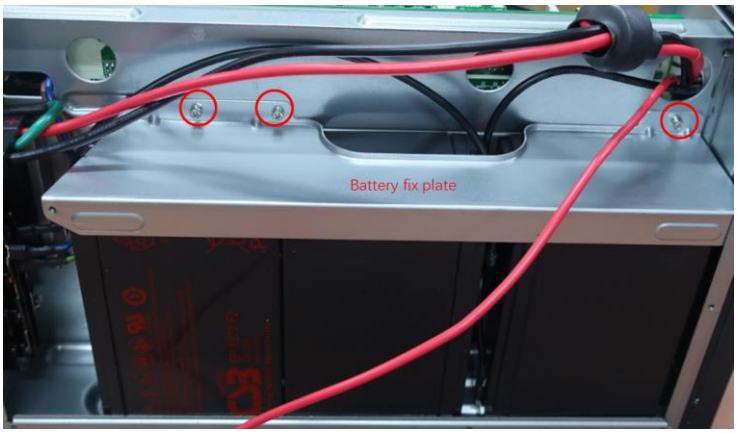
Step2: Disconnect the internal battery & tape the wire terminal.(only for 1K/1,5K)



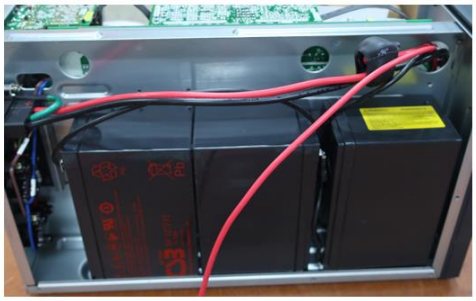
Step3: Disconnect the cable on COMM board that connect with Slot Card.



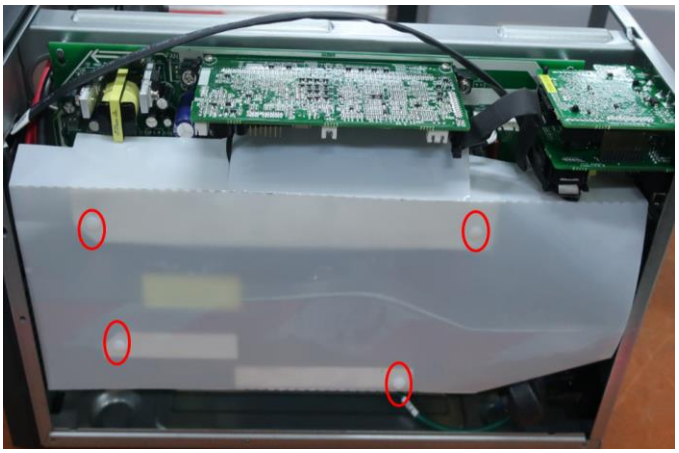
Step4: Remove the screws and remove the batter fix plate. (only for 1K/1,5K)



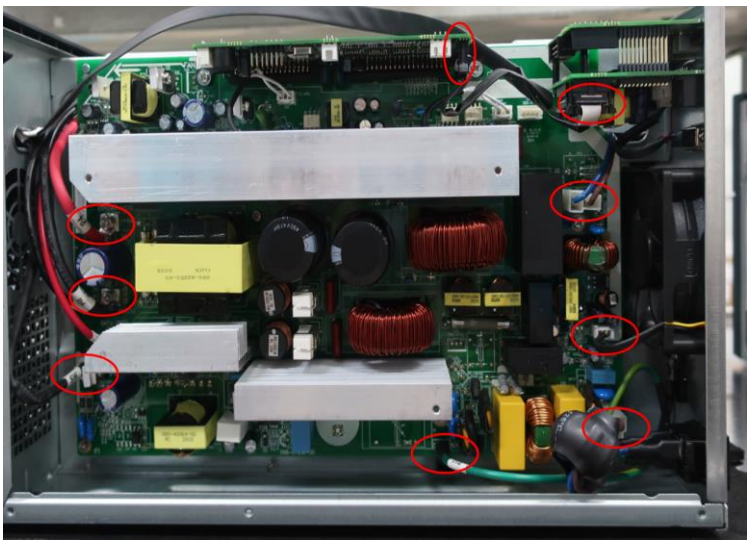
Step5: Remove the batteries and cables. (only for 1K/1,5K)



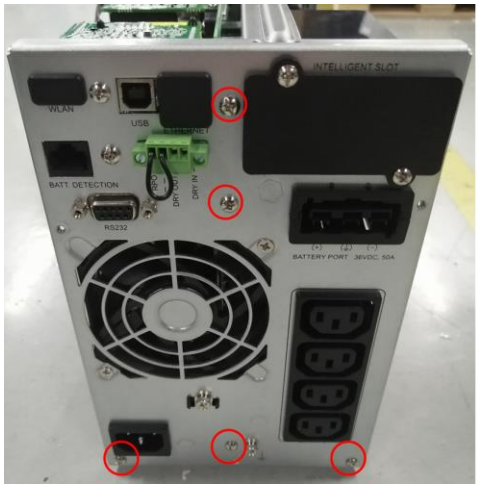
Step6: Remove the plastic screws for air channel paper and remove the air channel paper.



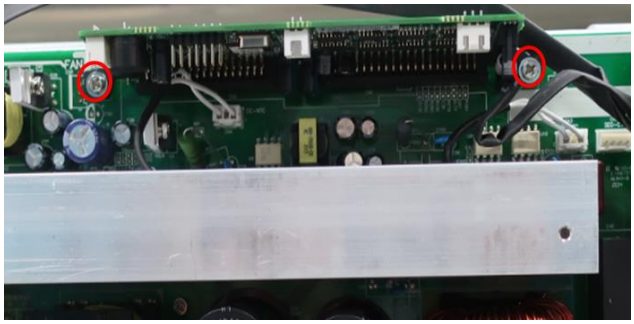
Step7: Remove all cables on PSDR board and COMM board indicated below.



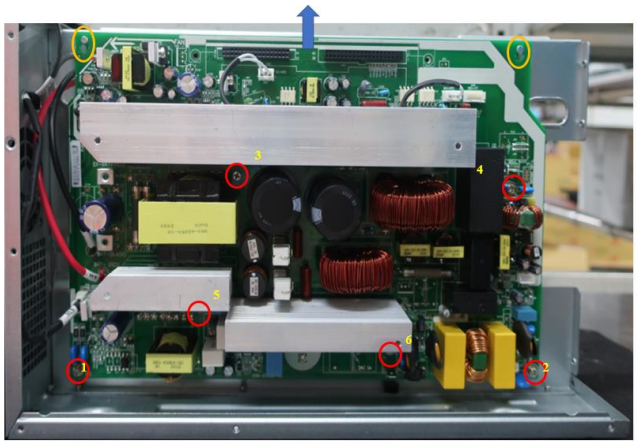
Step8: Remove the screws for rear panel and remove the rear panel.



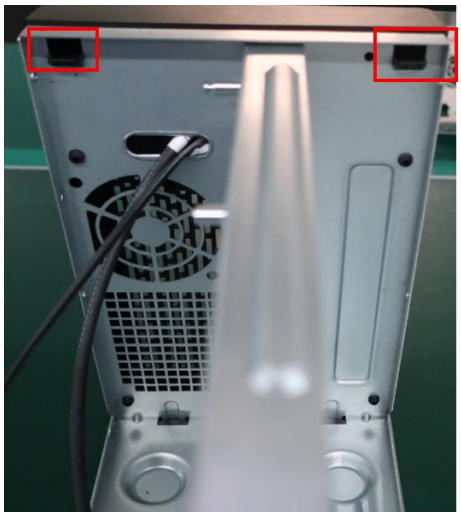
Step9: Remove the screws for CNTL board and unplug CNTL board.



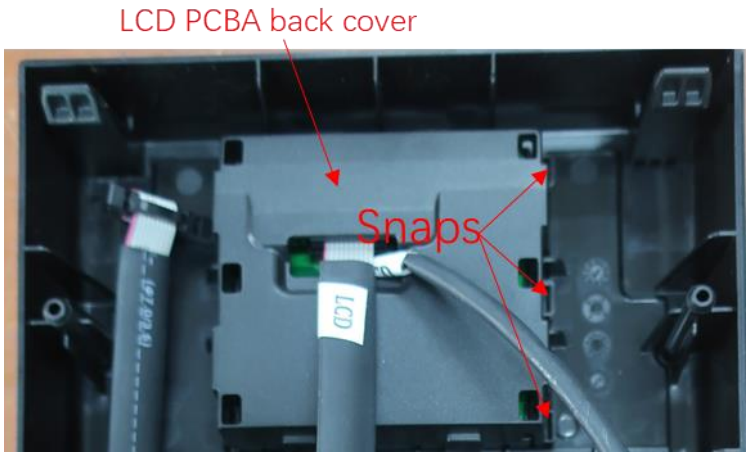
Step10: Remove all the screws for PSDR board and pull the board upward to release from the standoff mark as yellow.



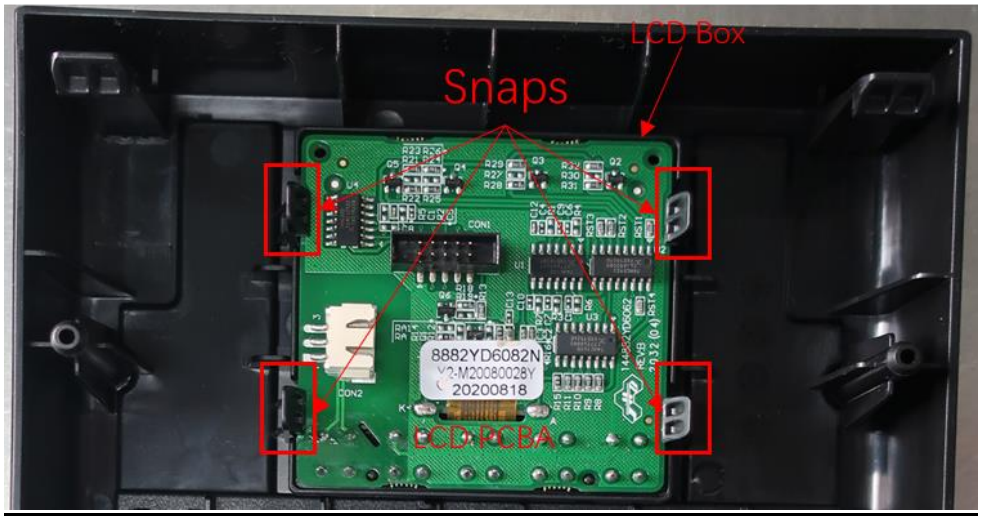
Step11: Release the snaps and remove the front panel assembly.



Step12: Release the snaps and remove the LCD PCBA back cover.



Step13: Release the snaps and take off the LCD PCBA& LCD BOX.

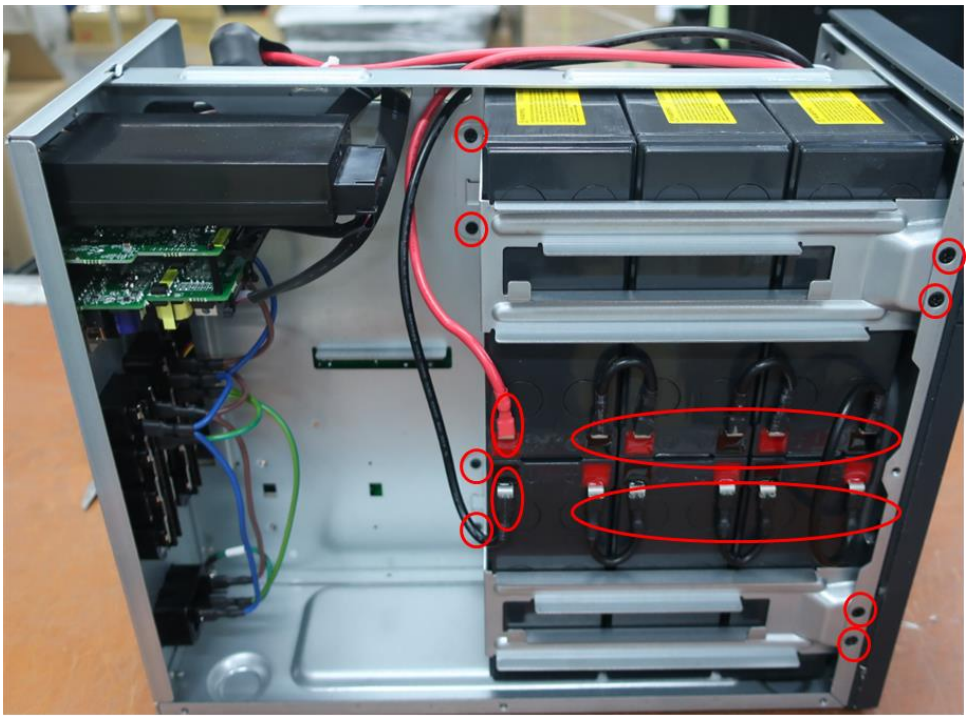


Step14: Release the screws and take off the fan.

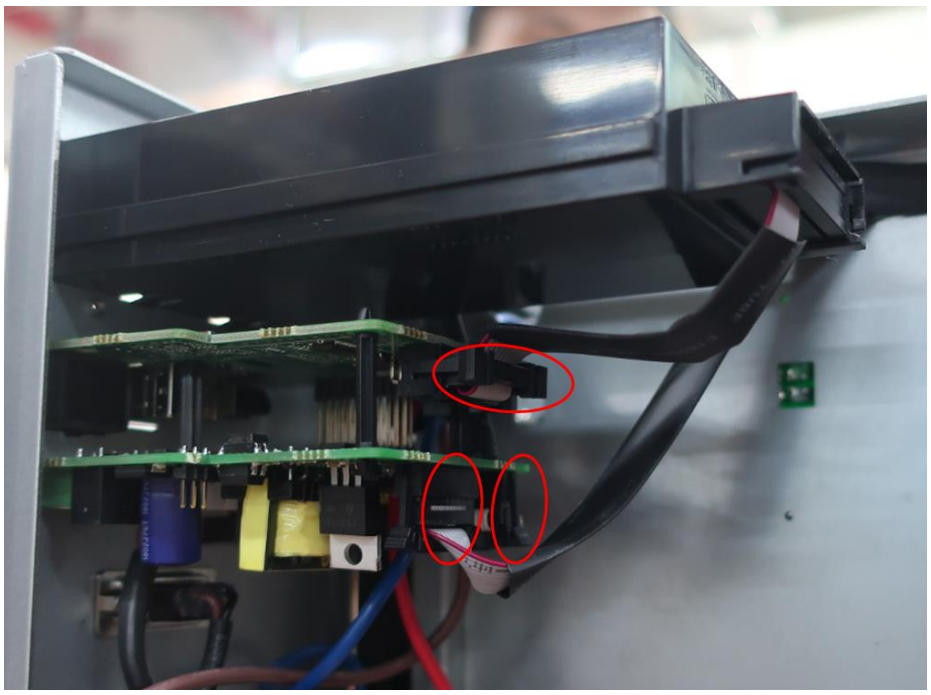
2K/2KS/3K/3KS Tower

Step1: Remove the screws in left/right side and rear side, push back and lift up the top cover.

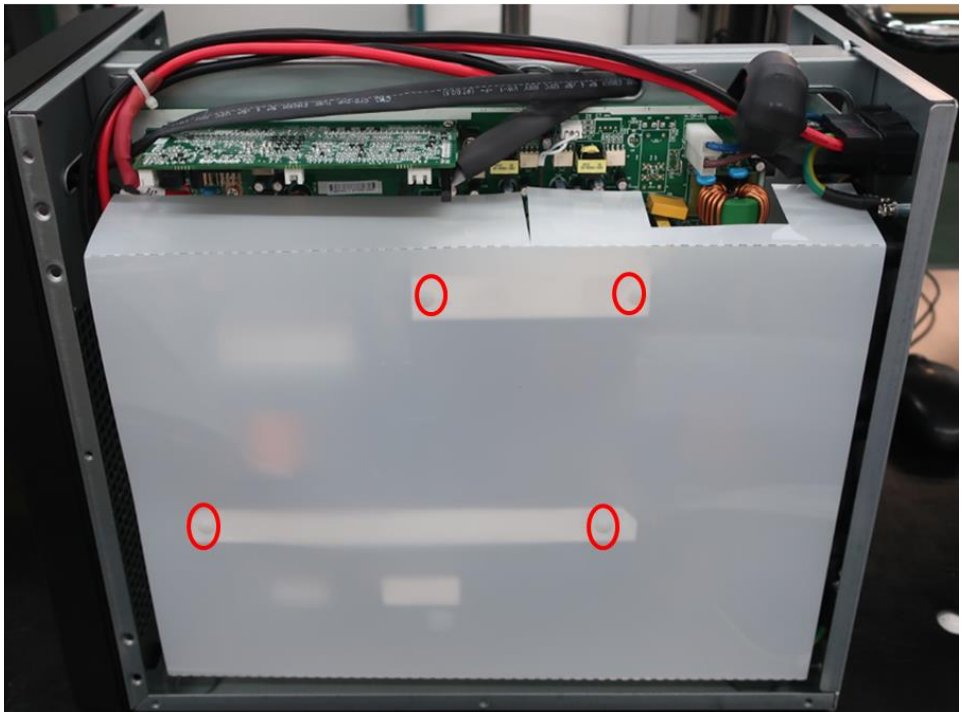
Step2: Disconnect All the internal battery, remove the screws for battery fix plate & remove the batteries.(only for 2K/3K)



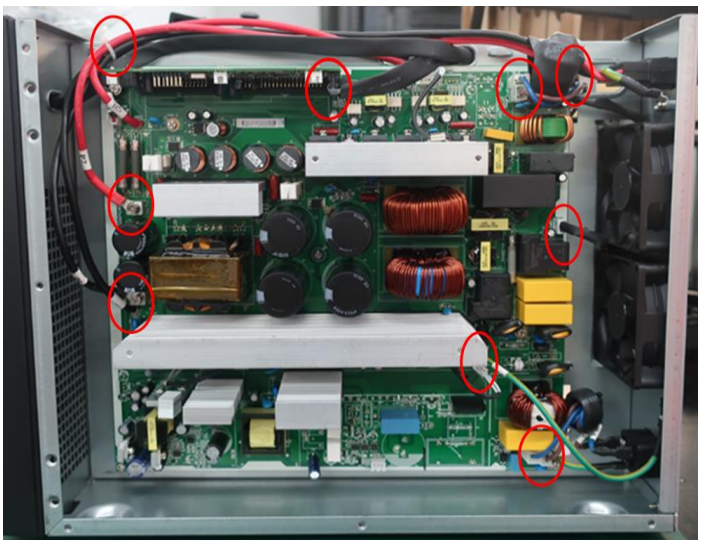
Step3: Disconnect the cable on COMM board that connect with Slot Card, LCD & control board.



Step4: Remove the plastic screws for air channel paper and remove the air channel paper.

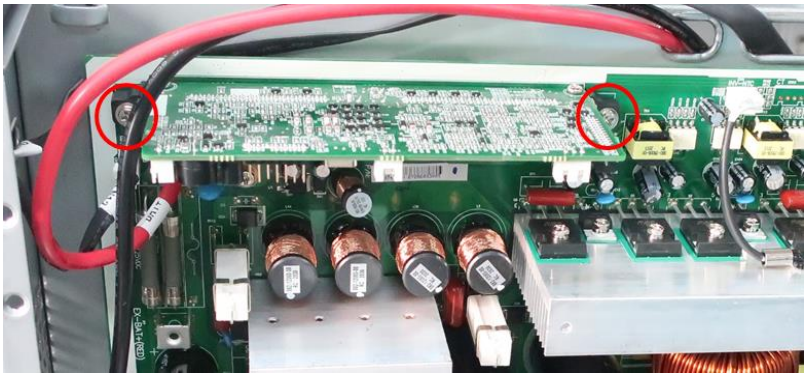


Step5: Remove all cables on PSDR board and COMM board indicated below.

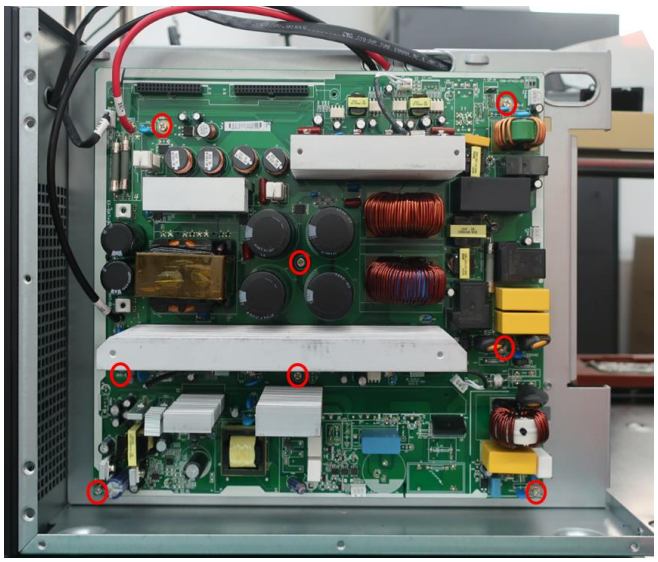


Step6: Remove the screws for rear panel and remove the rear panel.

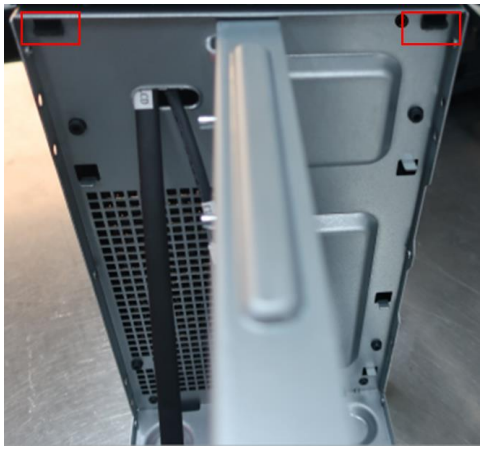
Step7: Remove the screws for CNTL board and unplug CNTL board.



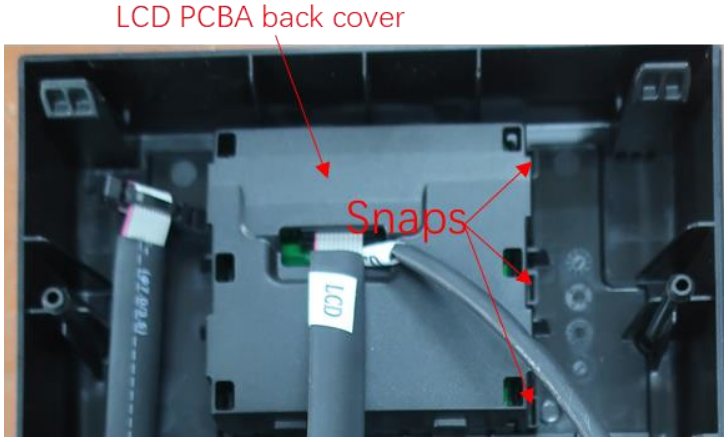
Step8: Remove all the screws for PSDR board and take off the Board



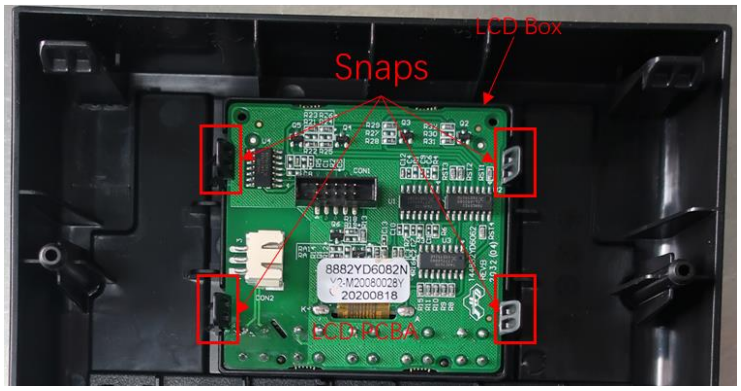
Step9: Release the snaps and remove the front panel assembly.



Step10: Release the snaps and remove the LCD PCBA back cover.

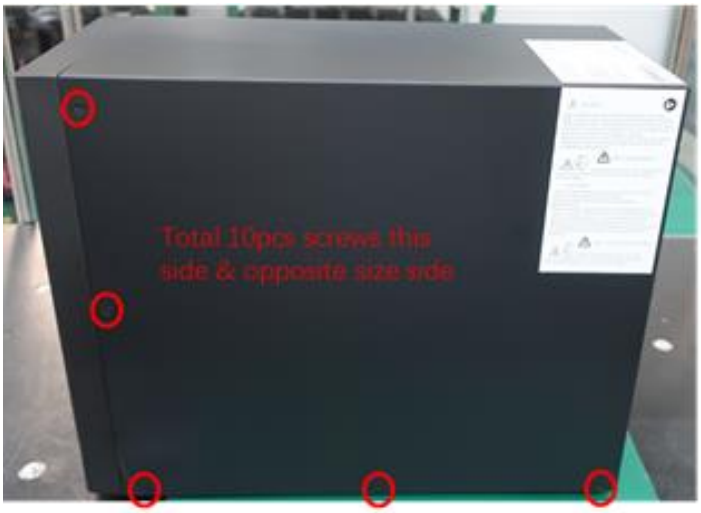


Step11: Release the snaps and take off the LCD PCBA& LCD BOX.

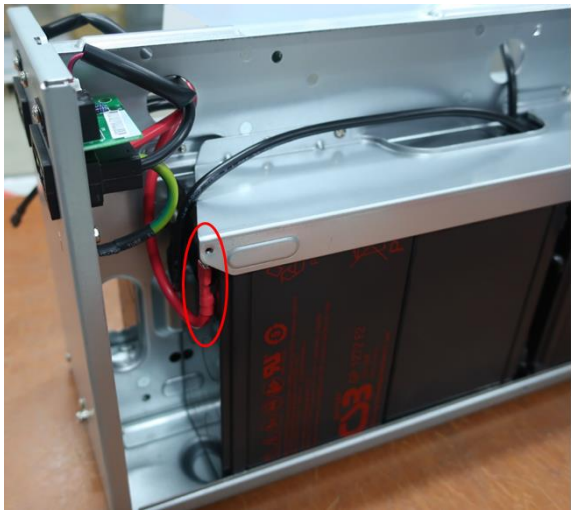


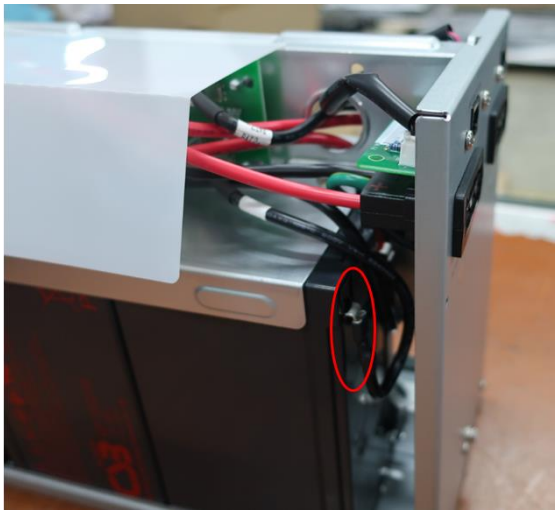
Tower 36V EBM 2 strings

Step1: Remove the screws in left/right side and rear side, push back and lift up the top cover.



Step2: Disconnect the indicated internal battery & tape the wire terminal both left & right side.

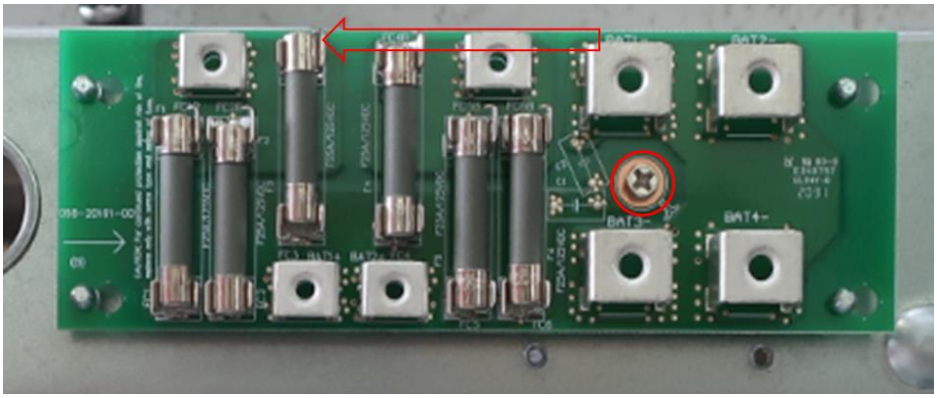




Step3: Life up the mylar to make the fuse board exposed.

Step4: Remove all the cables on the fuse board and tape the wire terminals

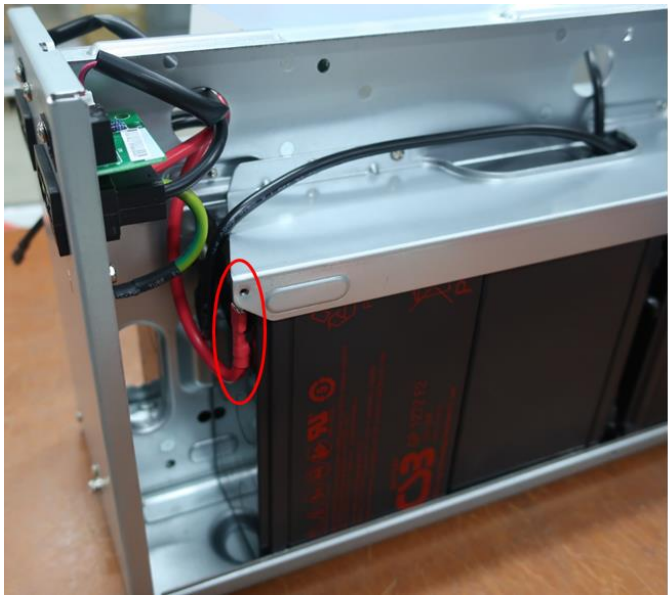
Step5: Remove the Screw for the fuse board & slip left to remove it.



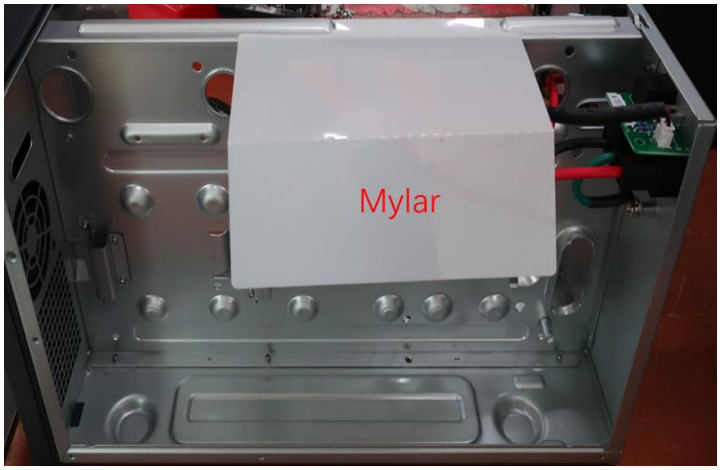
<u>Tower 36V EBM 1 string</u>

Step1: Remove the screws in left/right side and rear side, push back and lift up the top cover.

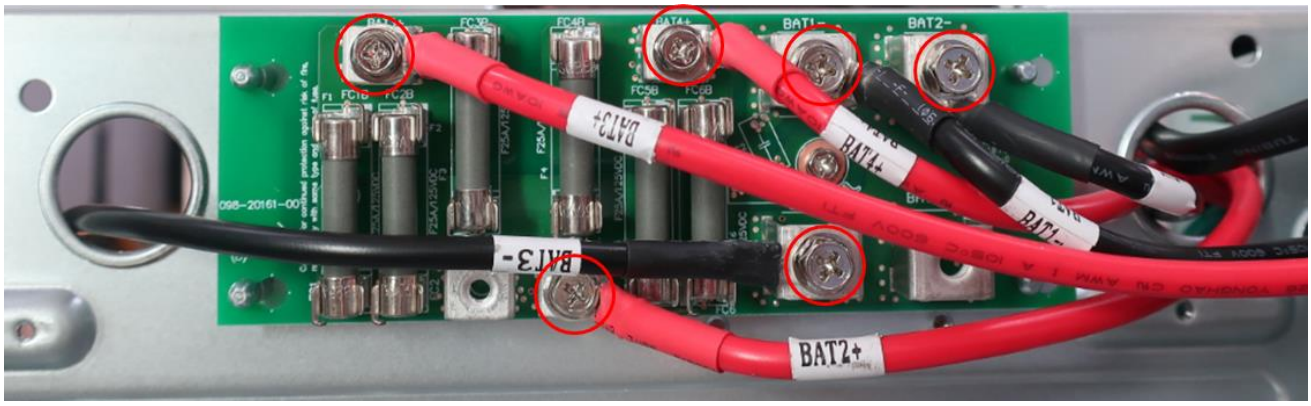
Step2: Disconnect the indicated internal battery & tape the wire terminal.



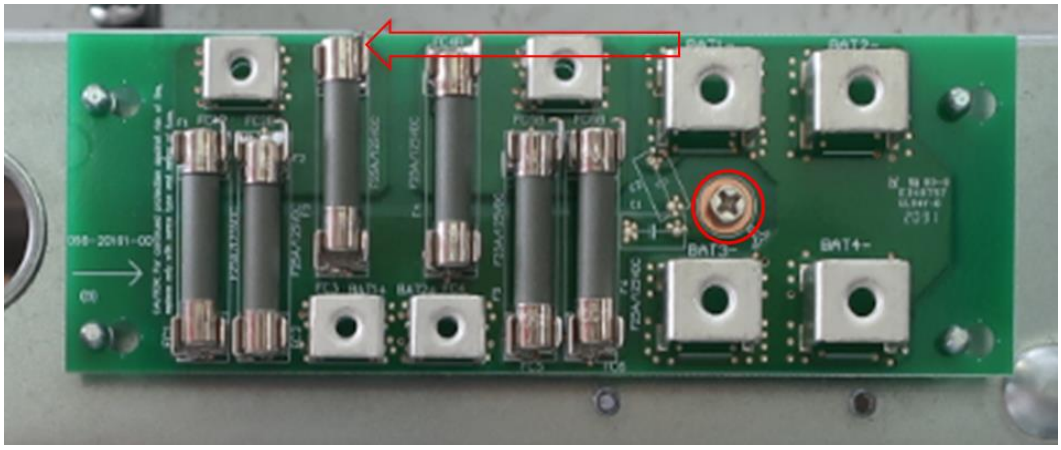
Step3: Life up the mylar to make the fuse board exposed.



Step4: Remove all the cables on the fuse board and tape the wire terminals.

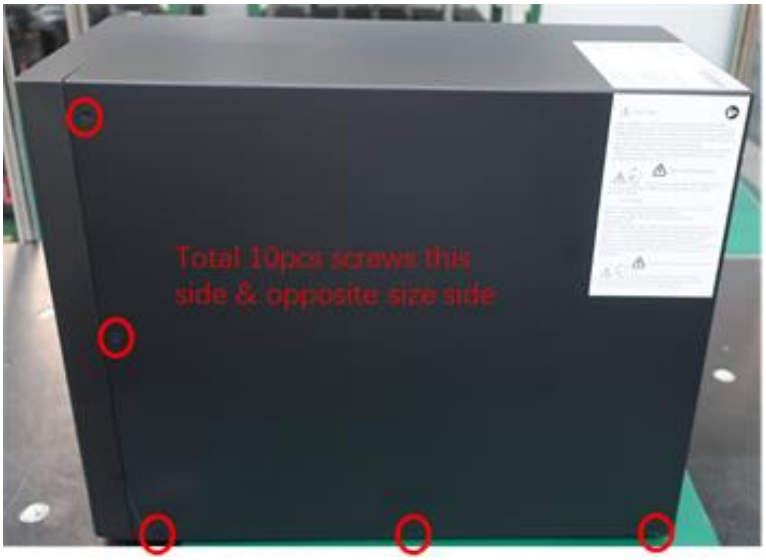


Step5: Remove the Screw for the fuse board & slip left to remove it.

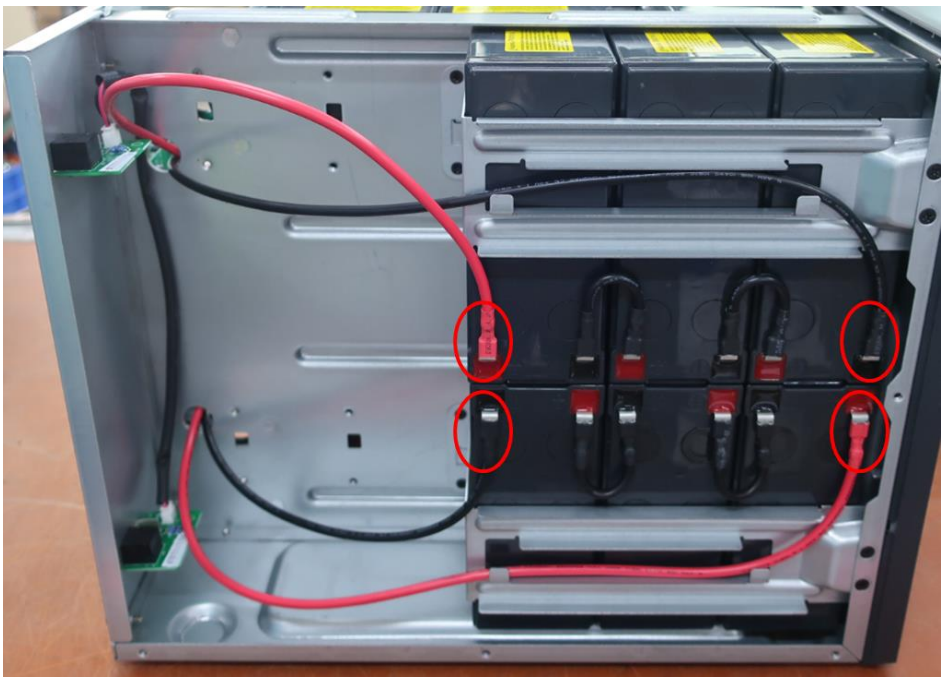


Tower 72V EBM 2 strings

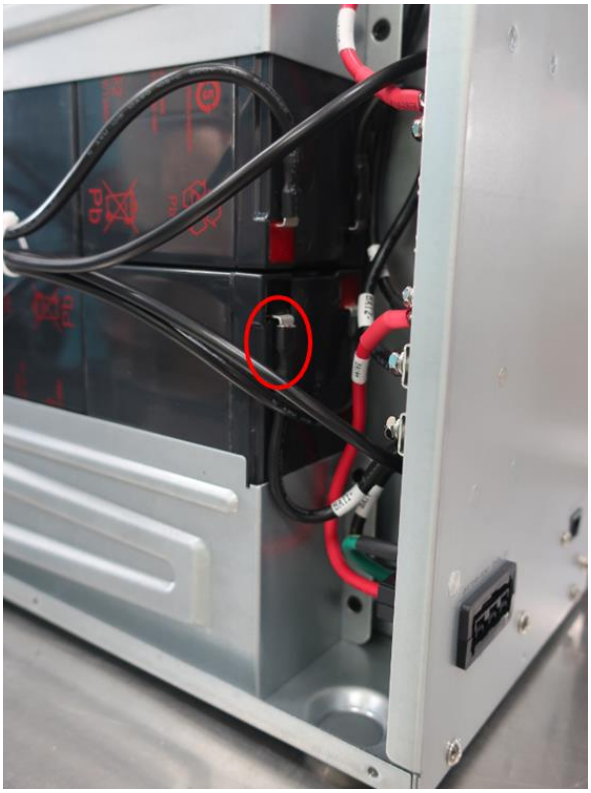
Step1: Remove the screws in left/right side and rear side, push back and lift up the top cover.



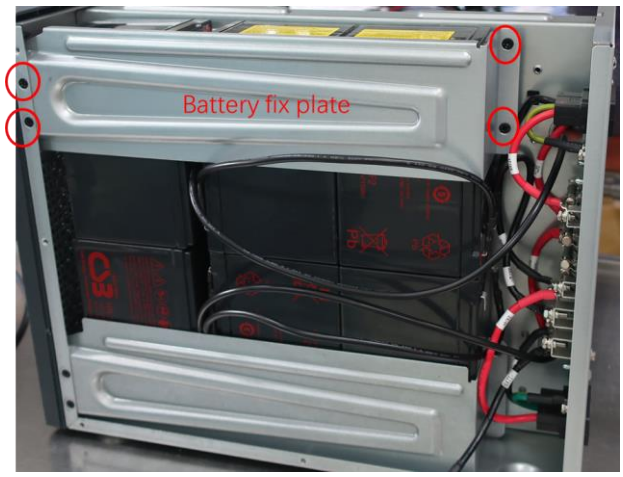
Step2: Disconnect the indicated internal battery & tape the wire terminal.



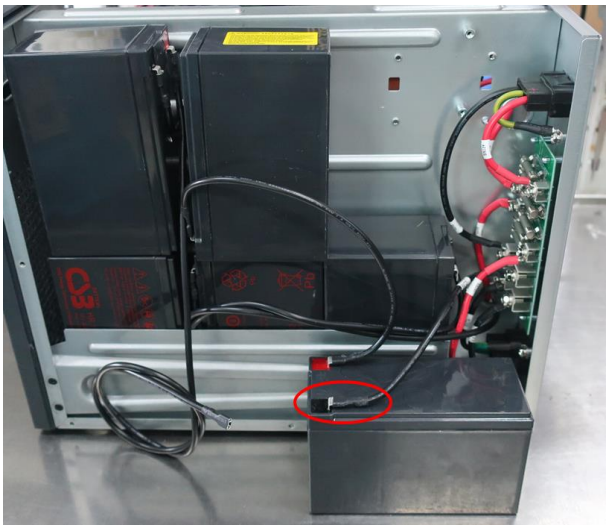
Step3: Disconnect the indicated internal battery & tape the wire terminal the other side.



Step4: Remove the screws and take off the battery fix plate.

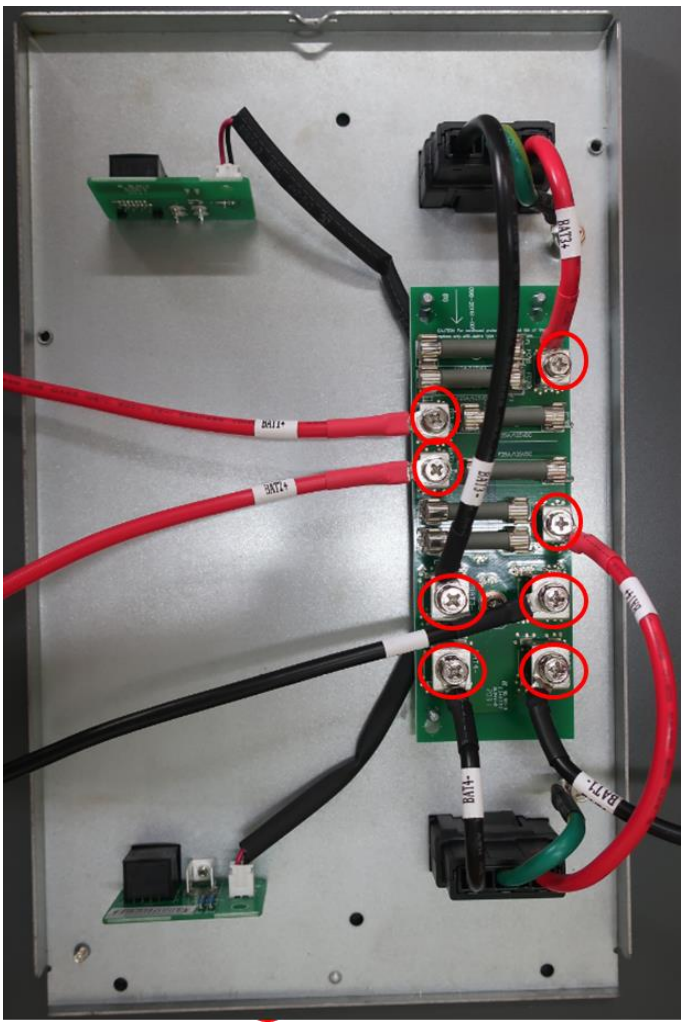


Step5: Take the battery down and disconnect the indicated battery, tape the wire terminal & remove the top battery.

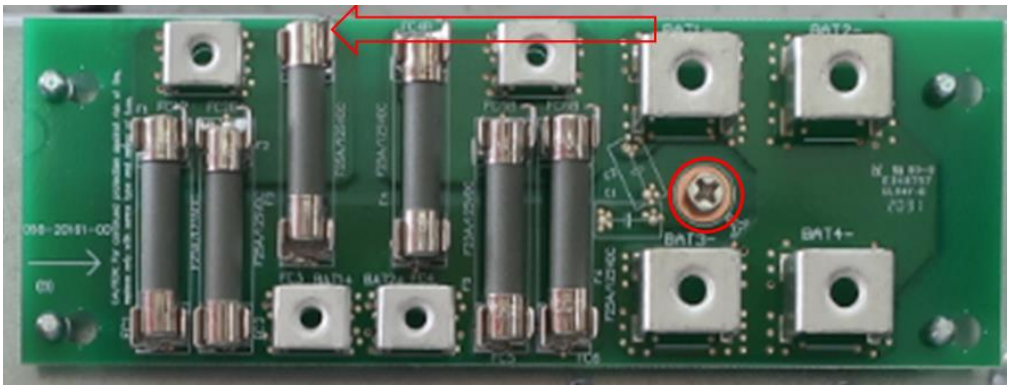


Step6: Remove the screws and remove the rear panel.

Step4: Remove all the cables on the fuse board and tape the wire terminals



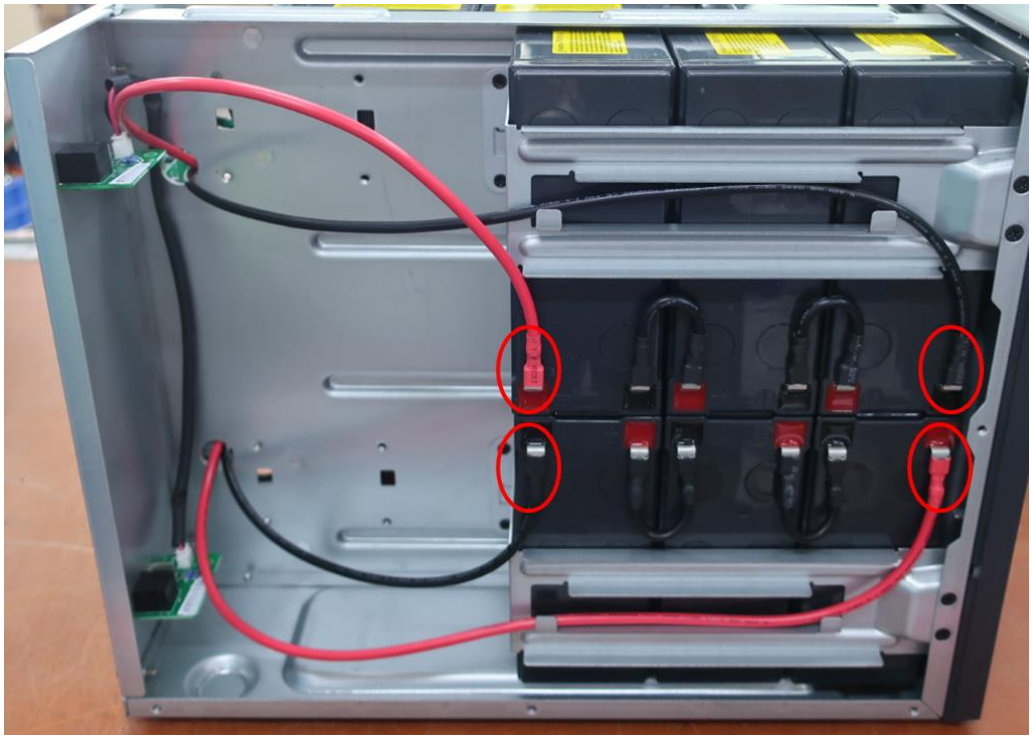
Step5: Remove the Screw for the fuse board & slip left to remove it.



Tower 72V EBM 1 strings

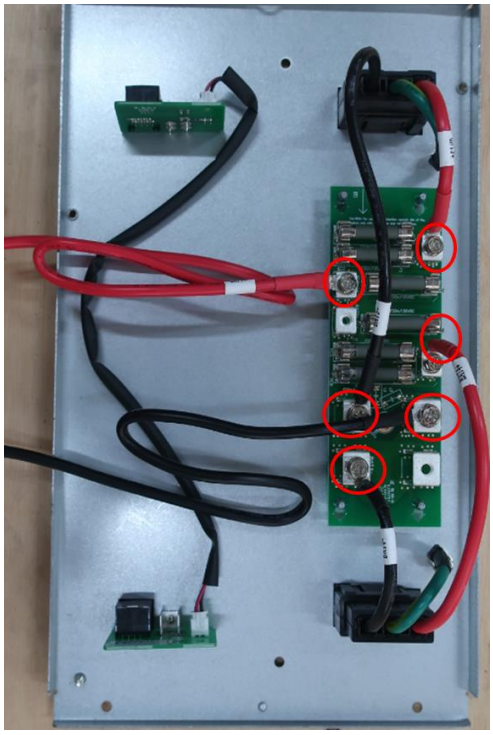
Step1: Remove the screws in left/right side and rear side, push back and lift up the top cover.

Step2: Disconnect the indicated internal battery & tape the wire terminal.

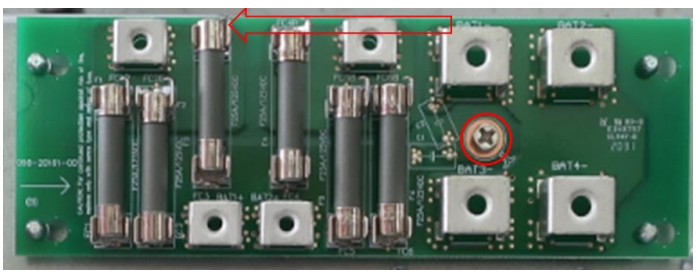


Step6: Remove the screws and remove the rear panel.

Step4: Remove all the cables on the fuse board and tape the wire terminals



Step5: Remove the Screw for the fuse board & slip left to remove it.



8 Component level Tests by function and by board

Goal: Find 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*	*PN*	*Fail condition*
PSDR board for RT/Tower ：1K(S)/1,5K(S)			
I/P Fuse	*1K(S)/1,5K(S): F1*	*Fuse: 102-01734*	*Open*
BAT Fuse	*1K: F6, F7*	*Fuse: 102-01708*	*Open*
	1,5K: F6, F7, F8		
Charger fuse	*1K/1,5K: F9(A)*	*Fuse: 102-00210*	*Open*
	1KS/1,5KS: F9	*Fuse: 102-23212*	
PSDR board for RT 2K(S)/3K(S)			
I/P Fuse	*2K(S): F1*	*Fuse: 102-01734*	*Open*
	3K(S): F1	*Fuse: 102-00647*	
BAT Fuse	*2K: F2, F3*	*Fuse: 102-00498*	*Open*
	3K: F2, F3, F4		
Charger fuse	*2K/3K: F9*	*Fuse: 102-00213*	*Open*
Super CHARGER board for RT 2KS/3KS			
Charger fuse	*2KS/3KS: F1*	*Fuse: 102-23212*	*Open*
PSDR board for Tower 2K(S)/3K(S)			
I/P Fuse	*2K(S): F1*	*Fuse: 102-01734*	*Open*
	3K(S): F1	*Fuse: 102-00647*	
BAT Fuse	*2K: F3, F5*	*Fuse: 102-00498*	*Open*
	3K: F3, F4, F5		
Charger fuse	*2K/3K: F2*	*Fuse: 102-00213*	*Open*
	2KS/3KS: F6	*Fuse: 102-23212*	
EBM			
Fuse board	*F1, F2, F3, F4, F5, F6*	*Fuse:102-23187*	*Open*

Table 8.1 Fuse list in UPS

If the fuse is open, replacing fuse only **DOES NOT** mean you have solved the problem. In most cases, fuse open is caused by other failure of components. Therefore, before restarting the UPS, please must find the real failed components and replace them!

AC/DC Converter Analysis

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

Checked components	***Instrument function***	***Reference Value***	***PN***	***Failed condition***
PSDR board for RT/Tower ：1K(S)/1,5K(S)				
1K(S)/1,5K(S): Q8	*Diode Voltage Drop (E→C)*	*About 0,4V*	*IGBT: 088-30585*	*Short or open*
	(C→E) Diode Voltage Droop	*/*		*Short*
1K(S)/1,5K(S): D1, D6	*Diode Voltage Drop*	*About 0,4V*	*Diode: 086-04451*	*Short or open*
1K(S): REC1 *1,5K(S): REC1*	*Diode Voltage Drop*	*About 0,5V* *About 0,5V*	*Diode: 086-02537* *Diode: 086-02225*	*Short or open*
PSDR board for RT/Tower: 2K(S)/3K(S)				
2K(S): Q41 *3K(S): Q41, Q42*	*Diode Voltage Drop (E→C)*	*About 0,4V*	*IGBT: 088-30585*	*Short or open*
	(C→E) Diode Voltage Droop	*/*		*Short*
2K(S)/3K(S): D8, D9	*Diode Voltage Drop*	*About 0,4V*	*Diode: 086-00847MA*	*Short or open*
2K(S): REC4A *3K(S): REC4*	*Diode Voltage Drop*	*About 0,5V* *About 0,6V*	*Diode: 086-02537* *Diode:086-04420*	*Short or open*

Table 8.2 Critical components of AC/DC

DC/AC Inverter Analysis

Checked components	***Instrument function***	***Reference Value***	***Type***	***Failed condition***
PSDR board for RT/Tower ：1K(S)/1,5K(S)				
1K(S): Q22, Q24	*Diode Voltage Drop (E→C)*	*About 0,4V*	*IGBT: 088-30592*	*Short or open*
	(C→E) Diode Voltage Droop	*/*		*Short*
1,5K(S): Q22, Q24	*Diode Voltage Drop (E→C)*	*About 0,4V*	*IGBT: 088-30357*	*Short or open*
	(C→E) Diode Voltage Droop	*/*		*Short*
PSDR board for RT/Tower: 2K(S)/3K(S)				
2K(S): Q1, Q2, Q5, Q8	*Diode Voltage Drop (E→C)*	*About 0,4V*	*IGBT: 088-30585*	*Short or open*
	(C→E) Diode	*/*		*Short*

Checked components	Instrument function	Reference Value	Type	Failed condition
	Voltage Droop			
3K(S): Q1, Q2, Q5, Q8	Diode Voltage Drop (E→C)	About 0,4V	IGBT: 088-30563	Short or open
	(C→E) Diode Voltage Droop	/		Short
2K(S): D2, D5	Diode Voltage Drop	About 0,35V	Diode: 086-02321	Short or open
3K(S): D2, D5	Diode Voltage Drop	About 0,35V	Diode: 086-00847MA	Short or open

Table 8.3 Critical components of DC/AC

SPS Analysis

Checked components	Instrument function	Reference Value	Type	Failed condition
PSDR board for RT/Tower ：1K(S)/1,5K(S)				
1K(S): Q29	Diode Voltage Drop (S→D)	About 0,4V	MOS: 088-21428	Short or open
	(D→S) Diode Voltage Droop	/		Short
1K(S)/1,5K(S): D35	Diode Voltage Drop	About 0,4V	Diode: 086-00482	Short or open
1K(S)/1,5K(S): D42	Diode Voltage Drop	About 0,4V	Diode: 086-14001	Short or open
1K(S)/1,5K(S): D42	Diode Voltage Drop	About 0,4V	Diode: 086-14001	Short or open
1K(S)/1,5K(S): D65	Diode Voltage Drop	About 0,4V	Diode: 086-14105	Short or open
1K(S)/1,5K(S): U4	Diode Voltage Drop	/	IC:084-00660	Short
PSDR board for RT/Tower: 2K(S)/3K(S)				
2K(S)/3K(S): Q44	Diode Voltage Drop (S→D)	About 0,4V	MOS: 088-22768	Short or open
	(D→S) Diode Voltage Droop	/		Short

Checked components	Instrument function	Reference Value	Type	Failed condition
2K(S)/3K(S): D30	Diode Voltage Drop	About 0,4V	Diode: 086-00849	Short or open
2K(S)/3K(S): D38	Diode Voltage Drop	About 0,4V	Diode: 086-14001	Short or open
2K(S)/3K(S): D39	Diode Voltage Drop	About 0,4V	Diode: 086-14001	Short or open
2K(S)/3K(S): D57	Diode Voltage Drop	About 0,4V	Diode: 086-14105	Short or open
2K(S)/3K(S): U7	Diode Voltage Drop	/	IC:084-00660	Short

Table 8.3 Critical components of SPS

Charger Analysis

1,5A Charger

Checked components	Instrument function	Reference Value	Type	Failed condition
PSDR board for RT/Tower ：1K(S)/1,5K(S)				
1K/1,5K: Q33	Diode Voltage Drop (E→C)	About 0,45V	MOS: 088-29049	Short or open
	(C→E) Diode Voltage Droop	/		Short
1K/1,5K: REC3	Diode Voltage Drop	About 0,4V	Diode: 086-00268	Short or open
1K/1,5K: D50	Diode Voltage Drop	About 0,4V	Diode: 086-04451	Short or open
1K/1,5K: D54	Diode Voltage Drop	About 0,4V	Diode: 086-01938	Short or open
1K/1,5K: Q23	Diode Voltage Drop (E→C)	About 0,45V	MOS: 088-22766	Short or open
	(C→E) Diode Voltage Droop	/		Short
1K/1,5K: D53	Diode Voltage Drop	About 0,4V	Diode: 086-00240	Short or open
PSDR board for RT: 2K/3K				
2K/3K:Q30	Diode Voltage Drop (E→C)	About 0,45V	MOS: 088-29049	Short or open
	(C→E) Diode Voltage Droop	/		Short
2K/3K:REC6	Diode Voltage Drop	About 0,4V	Diode: 086-00268	Short or open

Checked components	Instrument function	Reference Value	Type	Failed condition
2K/3K:D48	Diode Voltage Drop	About 0,4V	Diode: 086-00041	Short or open
2K/3K:D44	Diode Voltage Drop	About 0,4V	Diode: 086-01938	Short or open
2K/3K: Q12	Diode Voltage Drop (E→C)	About 0,45V	MOS: 088-22767	Short or open
	(C→E) Diode Voltage Droop	/		Short
2K/3K: D45	Diode Voltage Drop	About 0,4V	Diode: 086-00849	Short or open
PSDR board for Tower: 2K/3K				
2K/3K:Q52	Diode Voltage Drop (E→C)	About 0,45V	MOS: 088-29049	Short or open
	(C→E) Diode Voltage Droop	/		Short
2K/3K:REC1	Diode Voltage Drop	About 0,4V	Diode: 086-00268	Short or open
2K/3K:D65	Diode Voltage Drop	About 0,4V	Diode: 086-00041	Short or open
2K/3K:D76A	Diode Voltage Drop	About 0,4V	Diode: 086-01938	Short or open
2K/3K: Q12	Diode Voltage Drop (E→C)	About 0,45V	MOS: 088-22767	Short or open
	(C→E) Diode Voltage Droop	/		Short
2K/3K: D64	Diode Voltage Drop	About 0,4V	Diode: 086-00849	Short or open

Table 8.5 Critical components of 1,5A charger

8A Charger

Checked components	Instrument function	Reference Value	Type	Failed condition
PSDR board for RT/Tower ：1K(S)/1,5K(S)				
1KS/1,5KS: Q33	Diode Voltage Drop (E→C)	About 0,45V	MOS: 088-29049	Short or open
	(C→E) Diode Voltage Droop	/		Short
1KS/1,5KS: Q30	Diode Voltage Drop (E→C)	About 0,45V	MOS: 088-29014	Short or open

Checked components	*Instrument function*	*Reference Value*	*Type*	*Failed condition*
	(C→E) Diode Voltage Droop	*/*		*Short*
1KS/1,5KS: REC3, REC2	*Diode Voltage Drop*	*About 0,4V*	*Diode: 086-00268*	*Short or open*
1KS/1,5KS: D68	*Diode Voltage Drop*	*About 0,4V*	*Diode: 086-04451*	*Short or open*
1KS/1,5KS: D54	*Diode Voltage Drop*	*About 0,4V*	*Diode: 086-01938*	*Short or open*
1KS/1,5KS: D50	*Diode Voltage Drop*	*About 0,4V*	*Diode: 086-00415*	*Short or open*
1KS/1,5KS: Q23	*Diode Voltage Drop (E→C)*	*About 0,45V*	*MOS: 088-22766*	*Short or open*
	(C→E) Diode Voltage Droop	*/*		*Short*
1KS/1,5KS: D53	*Diode Voltage Drop*	*About 0,4V*	*Diode: 086-00240*	*Short or open*
Super CHARGER board for RT: 2KS/3KS				
2KS/3KS:Q2, Q4	*Diode Voltage Drop (E→C)*	*About 0,45V*	*MOS: 088-29049*	*Short or open*
	(C→E) Diode Voltage Droop	*/*		*Short*
2SK/3KS:REC1, REC2	*Diode Voltage Drop*	*About 0,4V*	*Diode: 086-00268*	*Short or open*
2KS/3KS:D6	*Diode Voltage Drop*	*About 0,4V*	*Diode: 086-00847MA*	*Short or open*
2KS/3KS:D2	*Diode Voltage Drop*	*About 0,4V*	*Diode: 086-00648*	*Short or open*
2KS/3KS:Q15A	*Diode Voltage Drop (E→C)*	*About 0,45V*	*MOS:088-20043*	*Short or open*
	(C→E) Diode Voltage Droop	*/*		*Short*
2KS/3KS:D16	*Diode Voltage Drop*	*About 0,4V*	*Diode: 086-02321*	*Short or open*
2KS/3KS: Q10	*Diode Voltage Drop (E→C)*	*About 0,45V*	*MOS: 088-22767*	*Short or open*
	(C→E) Diode Voltage Droop	*/*		*Short*
2KS/3KS: D14	*Diode Voltage Drop*	*About 0,4V*	*Diode: 086-00240*	*Short or open*

Checked components	Instrument function	Reference Value	Type	Failed condition
PSDR board for Tower: 2KS/3KS				
2KS/3KS:Q52, Q54	Diode Voltage Drop (E→C)	About 0,45V	MOS: 088-29049	Short or open
	(C→E) Diode Voltage Droop	/		Short
2SK/3KS:REC1, REC2	Diode Voltage Drop	About 0,4V	Diode: 086-00268	Short or open
2KS/3KS:D65	Diode Voltage Drop	About 0,4V	Diode: 086-00847MA	Short or open
2KS/3KS:D76	Diode Voltage Drop	About 0,4V	Diode: 086-00648	Short or open
2KS/3KS:Q7	Diode Voltage Drop (E→C)	About 0,45V	MOS:088-20043	Short or open
	(C→E) Diode Voltage Droop	/		Short
2KS/3KS:D14	Diode Voltage Drop	About 0,4V	Diode: 086-02321	Short or open
2KS/3KS: Q12	Diode Voltage Drop (E→C)	About 0,45V	MOS: 088-22767	Short or open
	(C→E) Diode Voltage Droop	/		Short
2KS/3KS: D64	Diode Voltage Drop	About 0,4V	Diode: 086-00240	Short or open

Table 8.6 Critical components of 8A charger

DC/DC Converter Analysis

Checked components	Instrument function	Reference Value	PN	Failed condition
PSDR board for RT/Tower ：1K(S)/1,5K(S)				
1K(S): Q1, Q18, Q13, Q14	Diode Voltage Drop (E→C)	About 0,4V	MOS: 088-21427	Short or open
1,5K(S): Q1, Q9 Q10, Q18, Q13, Q14	(C→E) Diode Voltage Droop	/		Short
1K(S)/1,5K(S): D13, D14, D18, D19	Diode Voltage Drop	About 0,4V	Diode: 086-02538	Short or open
PSDR board for RT/Tower: 2K(S)/3K(S)				
2K(S): Q18, Q19, Q25, Q26	Diode Voltage Drop (E→C)	About 0,4V	MOS: 088-20077	Short or open
3K(S): Q18, Q19 Q22, Q23, Q25, Q26	(C→E) Diode Voltage Droop	/		Short

Checked components	*Instrument function*	*Reference Value*	*PN*	*Failed condition*
2K(S)/3K(S): D13, D15, D18, D19	*Diode Voltage Drop*	*About 0,4V*	*Diode: 086-02538*	*Short or open*

Table 8.7 Critical components of DCDC

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.

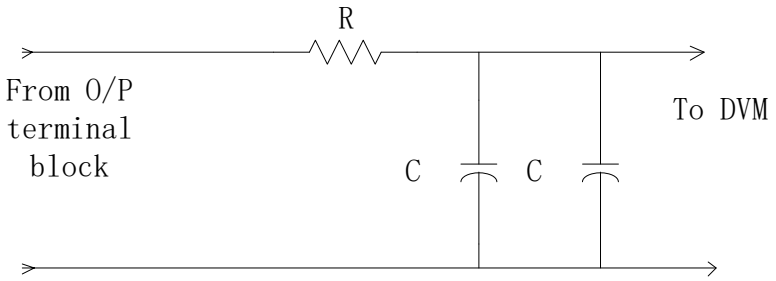
   Note: It is suggested to use DC power which has current limit function as the battery power. It can protect the UPS in case there is still some failure part. The limit current should be 3A.
6. Turn on the UPS. And then check the voltage and UPS status. If turn on failed, please check the fault code.
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.
10. If every step is ok and the parameter configuration is same as the one before repairing, the maintenance/ repair work is completed..

During the maintenance/repair, some voltages below may be measured,

TEST ITEM	TEST POINT	EXPECTED RESULT
O/P voltage	RT1K(S)/1,5K(S): P10 and P7 Tower1K(S)/1,5K(S): P10 and P8 RT2K(S)/3K(S): P1 and P4 Tower2K(S)/3K(S): P1 and P4	230Vac (or 220Vac, etc according to the setting)
O/P DC offset	RT1K(S)/1,5K(S): P10 and P7 Tower1K(S)/1,5K(S): P10 and P8 RT2K(S)/3K(S): P1 and P4 Tower2K(S)/3K(S): P1 and P4	100mV max.

Table 8.6 Voltage list maybe measured

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



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