

SERVICE MANUAL

Galleon One 1-3KVA models

Version: 00A

Date: Jun 14, 2017

CONTENTS

1. General Information	3
1.1 Getting start	3
1.2 Conventions	3
2. Over view and introduction	4
2.2 UPS range	12
2.3 Topology	12
2.4 Charger features	12
2.5 Battery features	12
2.6 Additional features	12
3. Important Safety Instructions	15
4. Operation and setting	16
4.1 Switch panel	16
4.2 LCD Panel	17
4.3 UPS Setting	20
4.4 Operating Mode Description	25
4.5 Faults Reference Code	26
4.6 Warning indicator	26
4.7 Audible Alarm	26
5. Circuit principle	27
5.1 Functional diagram	27
5.2 Subsystem instruction	27
5.2.1 <i>Charger Sub-System:</i>	28
5.2.2 <i>Auxiliary Power Supply Sub-System:</i>	28
5.2.3 <i>Inverter Sub-System:</i>	29
5.2.4 <i>Output and filter Sub-System:</i>	30
5.2.5 <i>Input Power Factor Correction Sub-System:</i>	30
5.2.6 <i>DC-DC Converter Sub-System:</i>	30
5.2.7 <i>Control board</i>	31
5.2.7.1 <i>REGULATION & CONTROL SUB-SYSTEM:</i>	31
5.2.7.2 <i>PROTECTION SUB-SYSTEM:</i>	31
5.2.7.3 <i>Signaling Sub-System:</i>	32
6. TROUBLE SHOOTING	33

6.1 Trouble Shooting Chart.....	33
6.2 Failure Diagnosis	34
6.2.1 <i>Step to open the case</i>	34
6.2.2 <i>Critical component list</i>	37
APPENDIX I: COMMUNICATION	66
APPENDIX II: : Charger Voltage adjustment.....	68
APPENDIX III: Wiring diagram.....	68
APPENDIX IV: circuit diagram.....	68

1. General Information

1.1 Getting start

If you want to know:

- ? Overview and what special for this UPS, refer to section Introduction.
- ? Replacing Battery Pack, refer to Replacing The Battery Pack.
- ? Open external case refer to Steps to Open the Case.
- ? Electrical function and principle refer to Principle of Operation.
- ? Whether UPS works properly, refer to Alignments.
- ? What happened to the UPS, refer to Trouble Shooting.
- ? Electrical performance, refer to Electrical Spec.

1.2 Conventions

This service manual uses the following conventions to alert you some important information for safe operation and quick working.



Warning: Denotes a procedure or operation, which, if not perform correctly, may result in personal injury. **Be sure not to continue operation until indicated conditions are fully understood and met.**



Caution: Denotes a procedure or operation, which, if not perform correctly, may cause damage to the UPS. **Be sure not to continue operation until indicated conditions are fully understood and met.**



Information and Tips: There are some tips and skills after this symbol. During service operations, these skills are provided by our design engineers which may help you quickly finish your work.

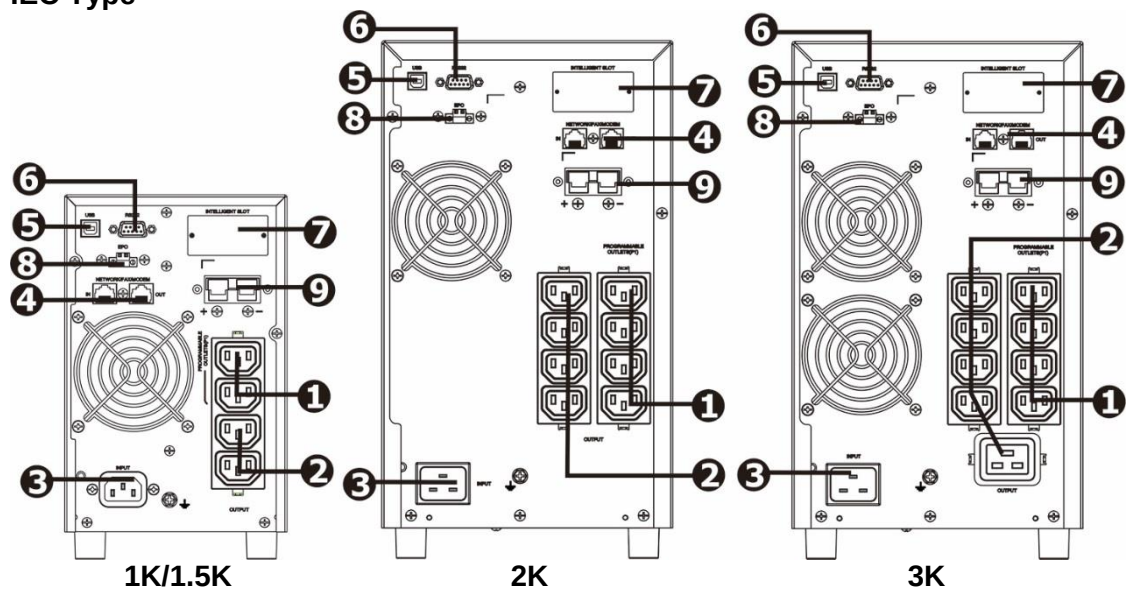
2. Over view and introduction



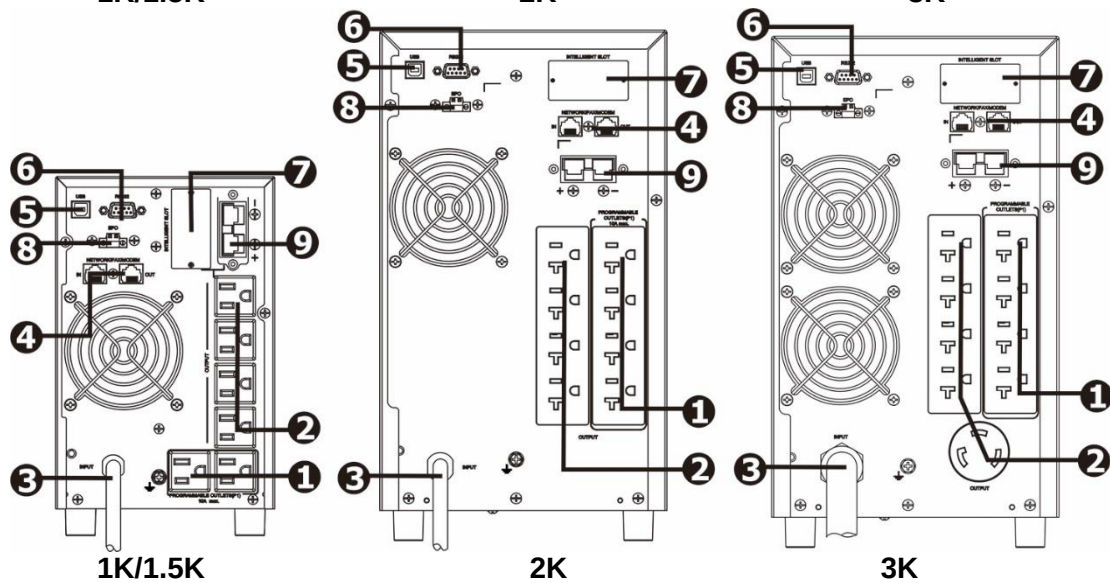
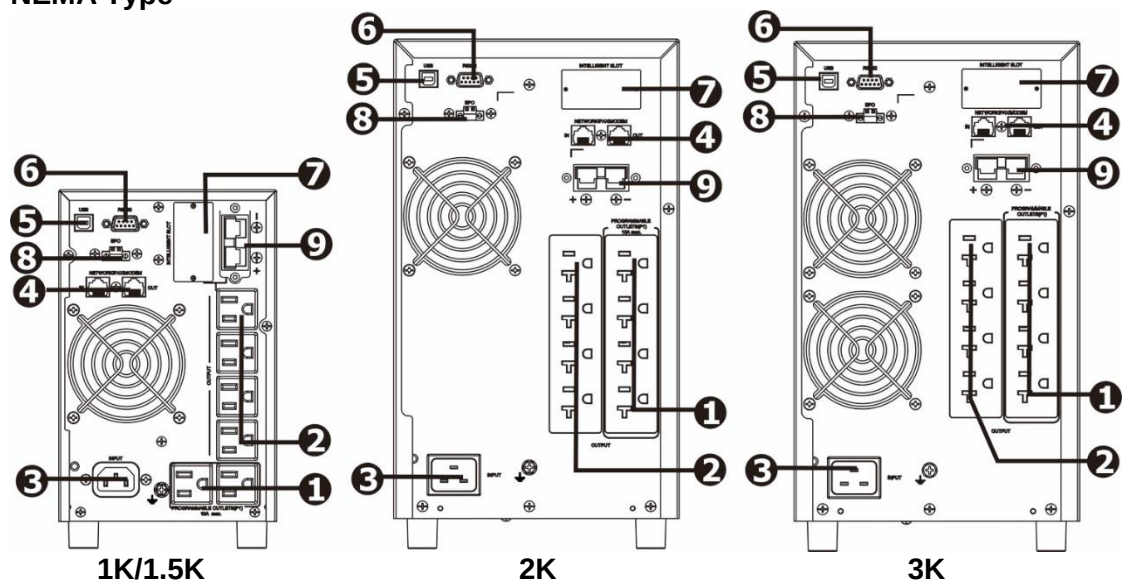
R/T

Tower

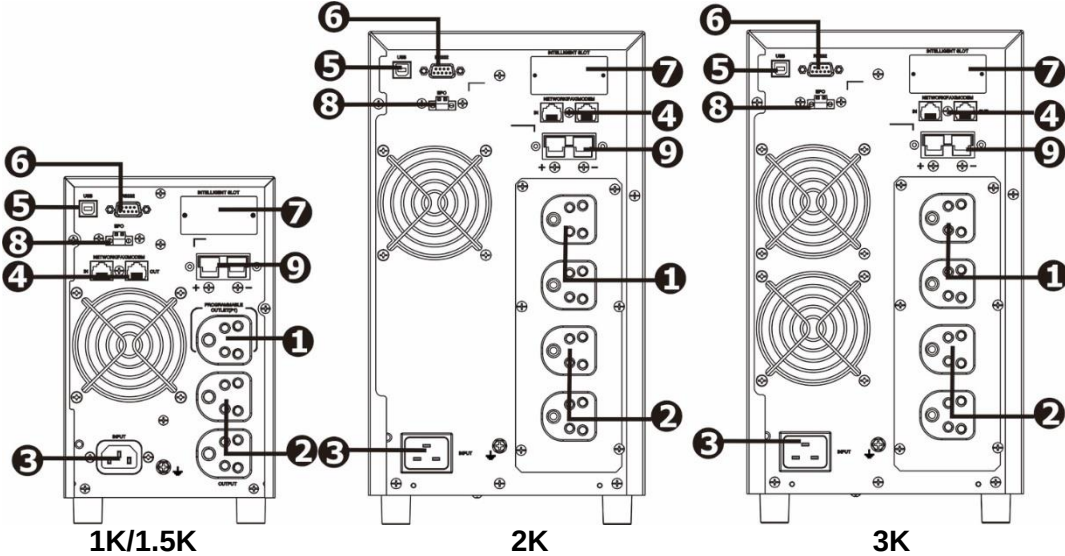
Rear Panel View
Tower Models
IEC Type



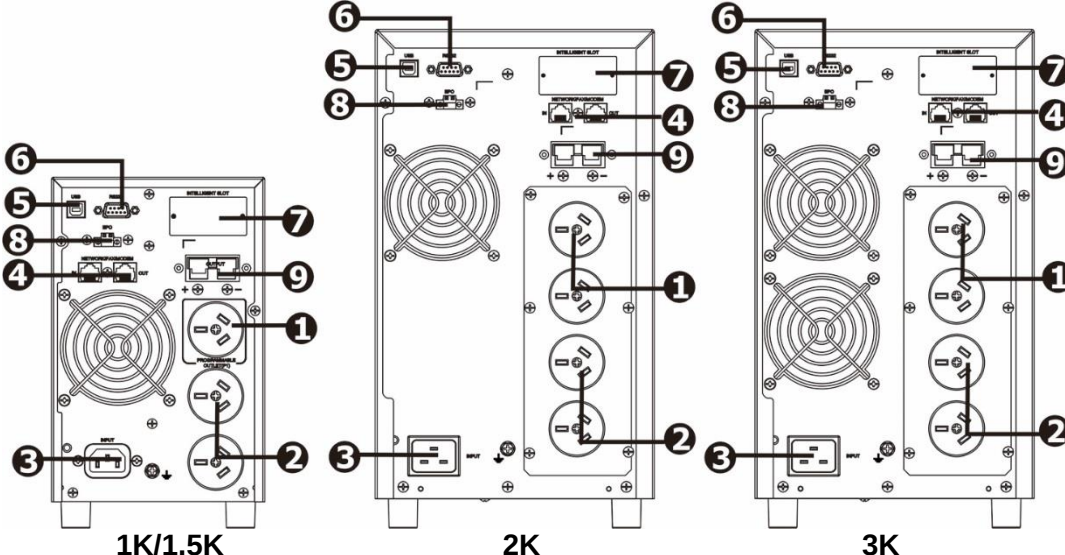
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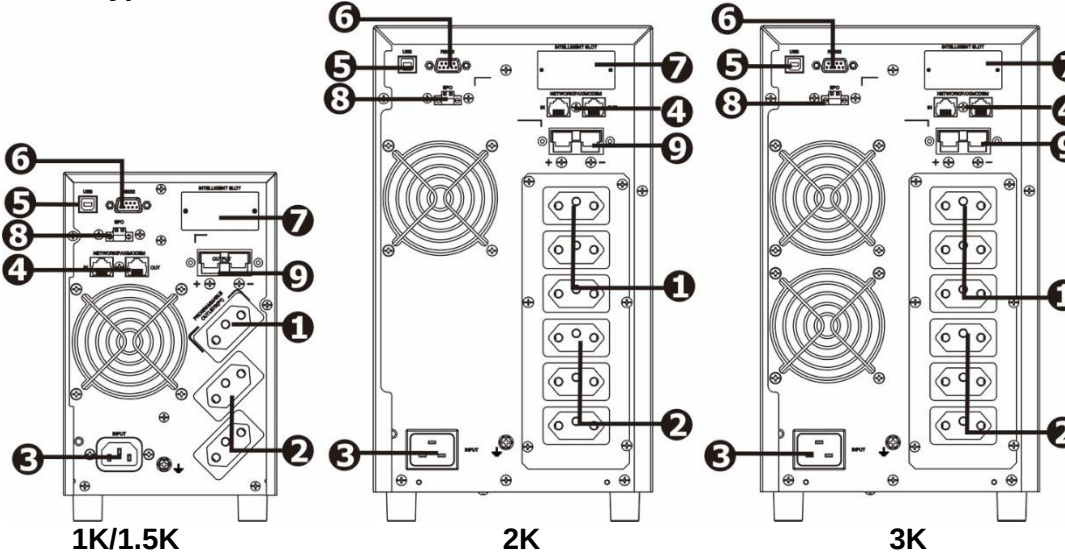
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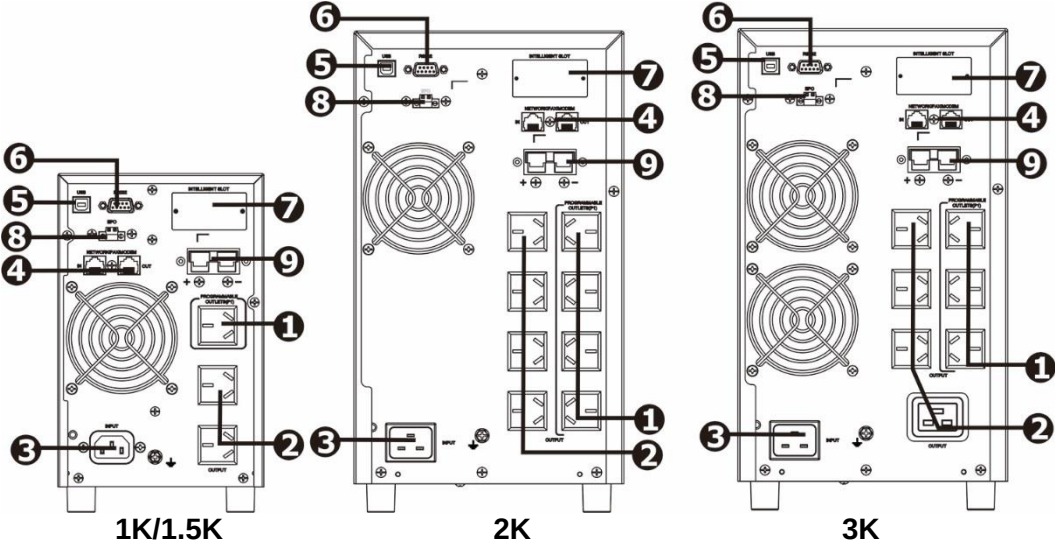
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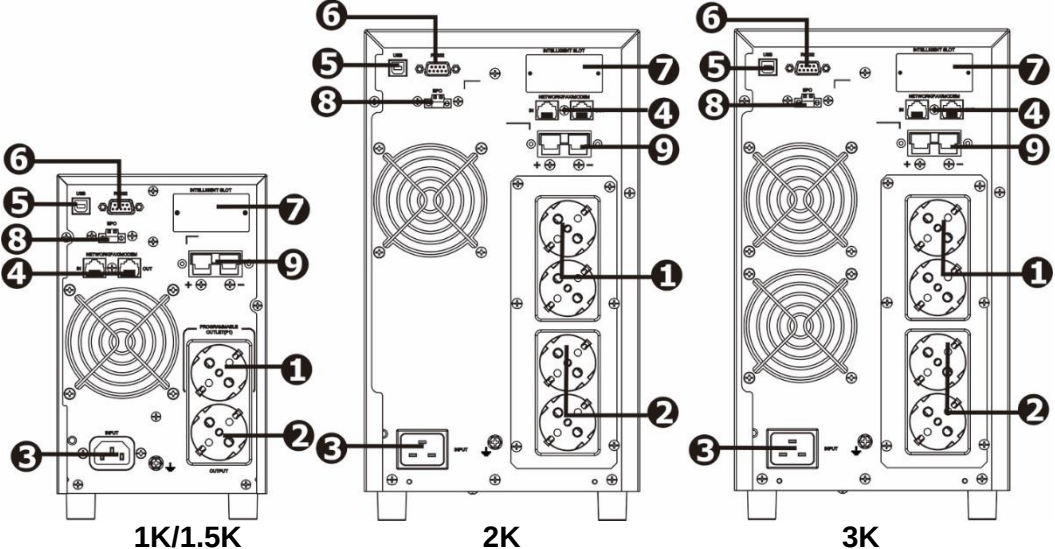
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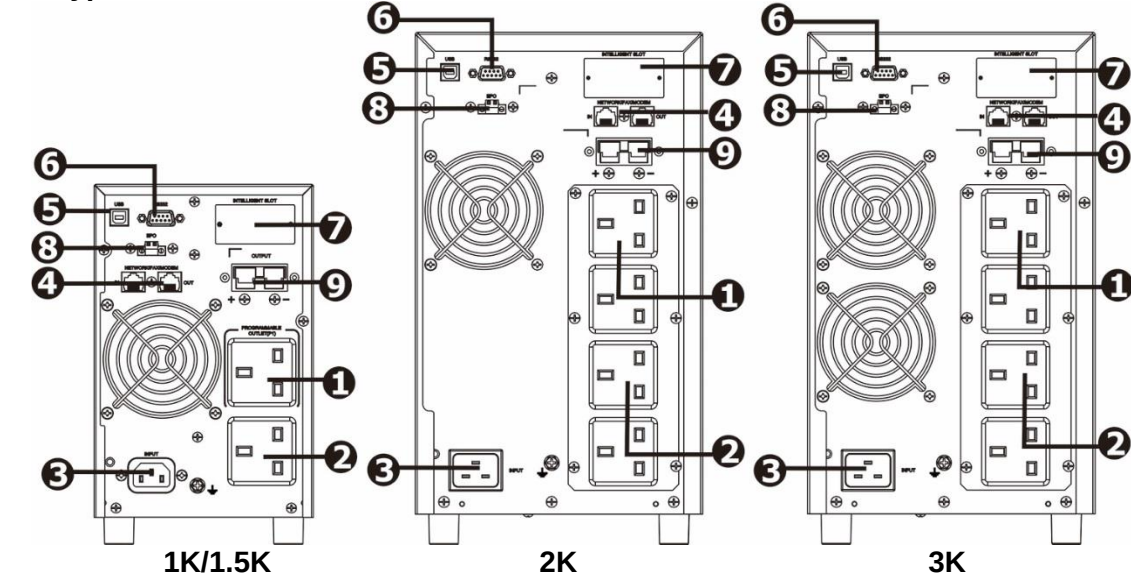
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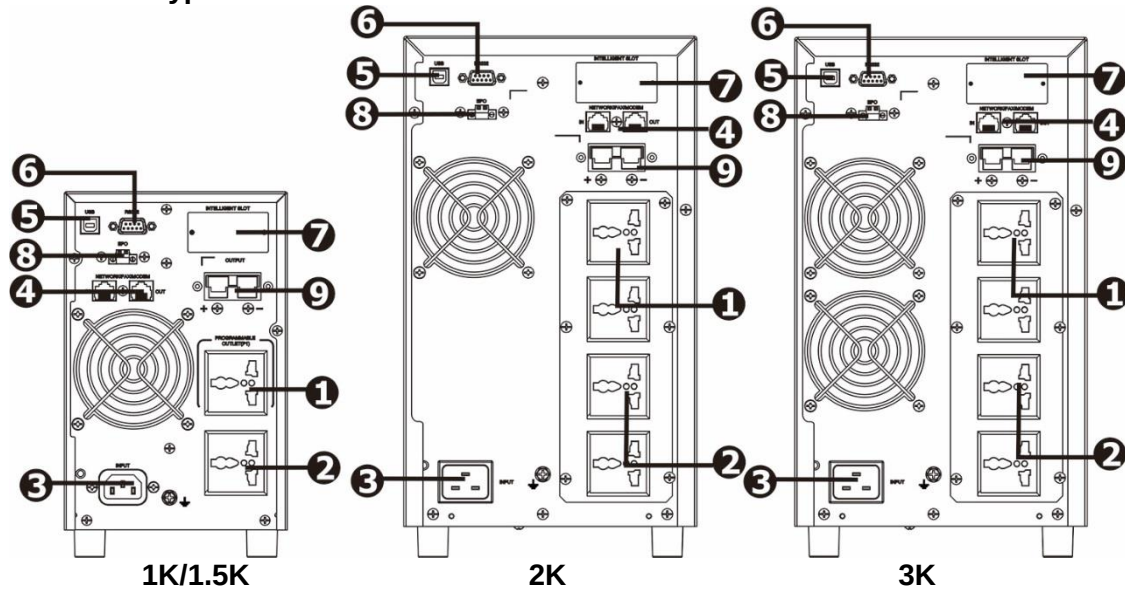
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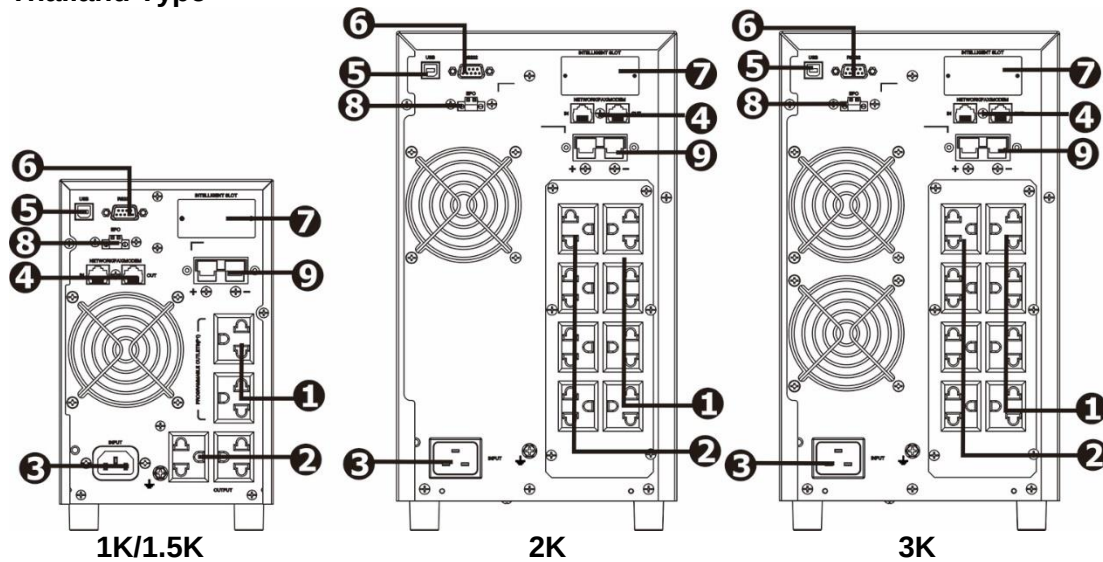
UK Type



Universal Type

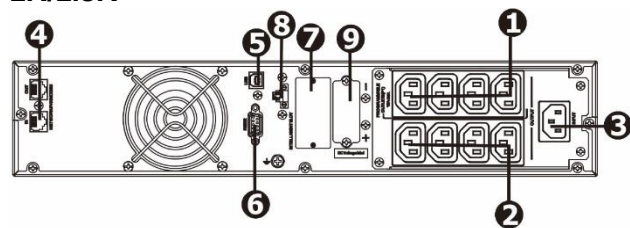


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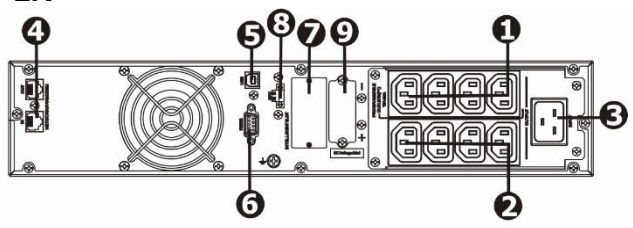


RT Models

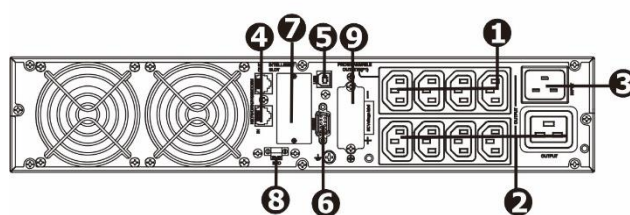
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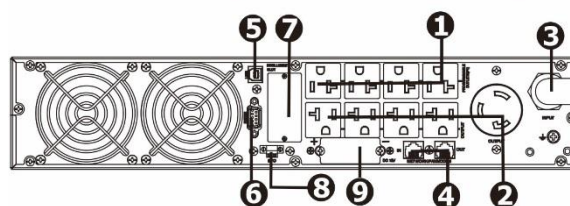
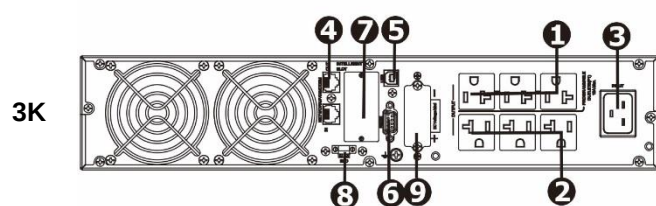
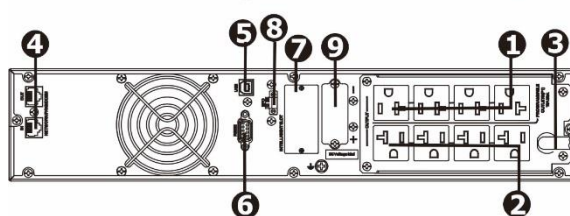
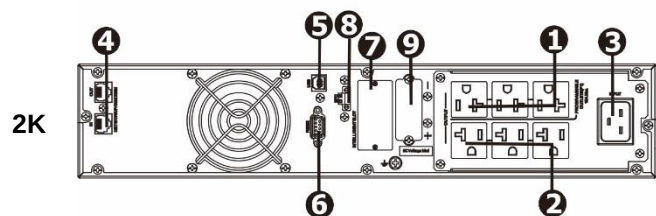
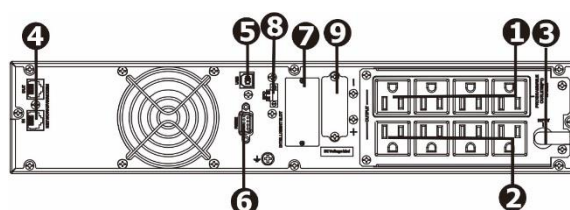
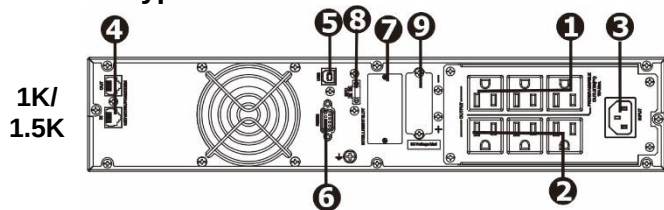
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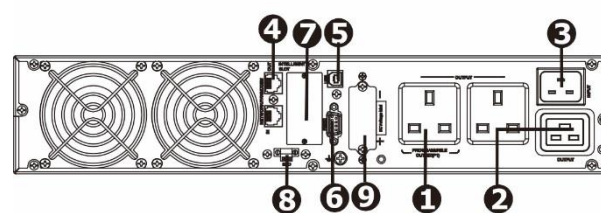
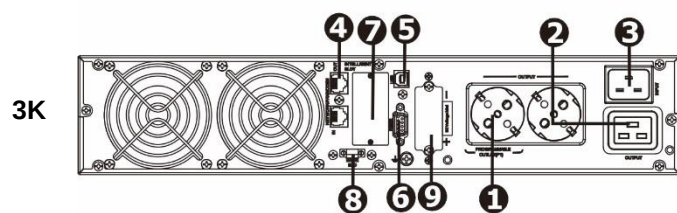
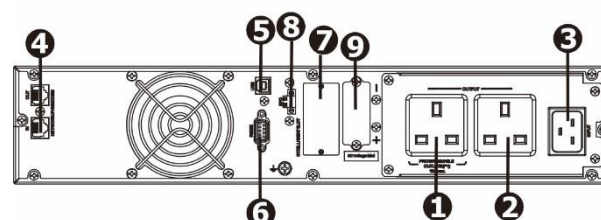
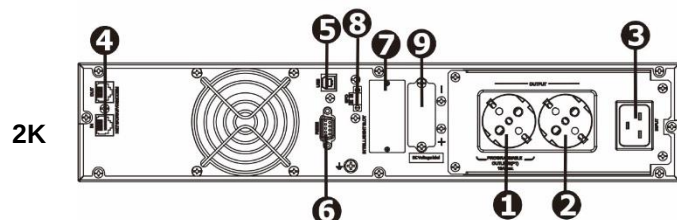
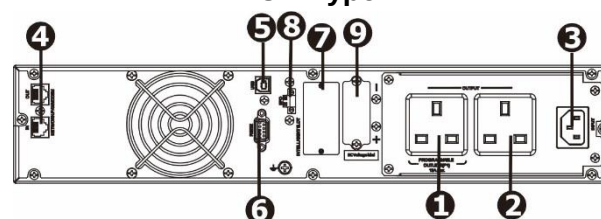
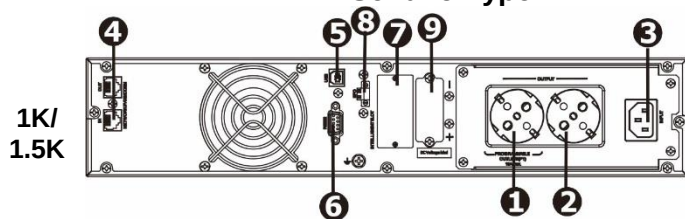
3K



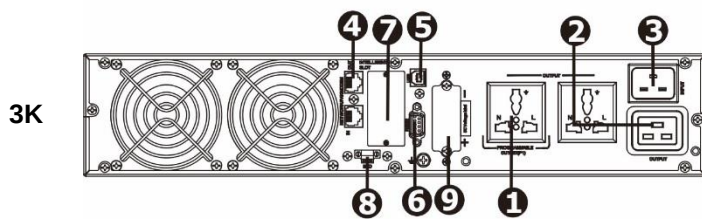
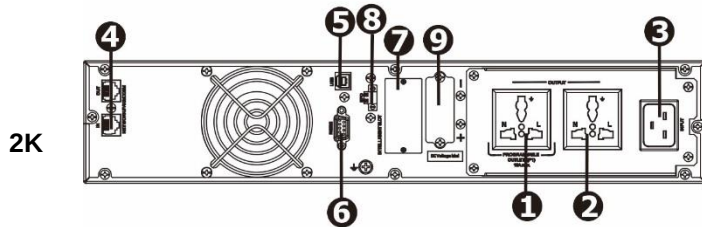
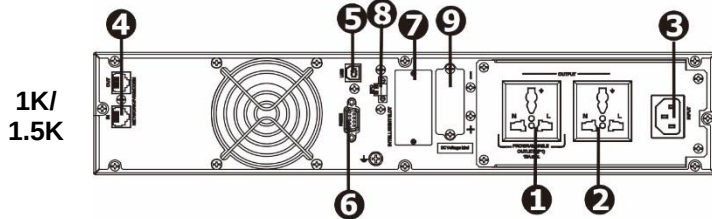
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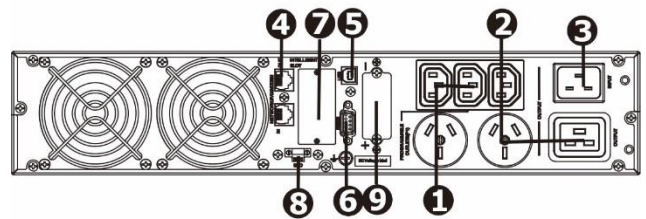
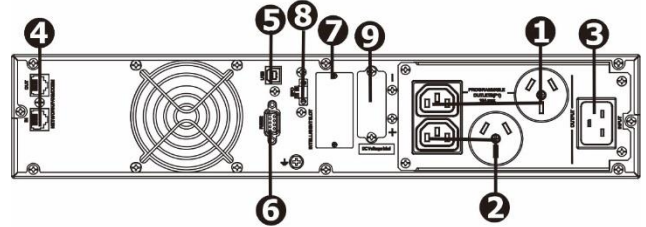
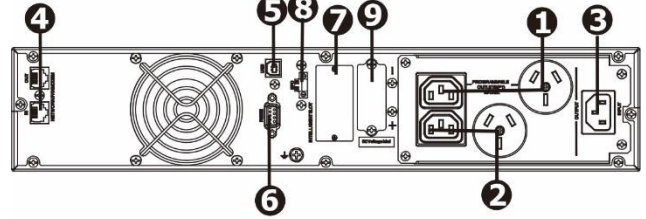
Schuko Type



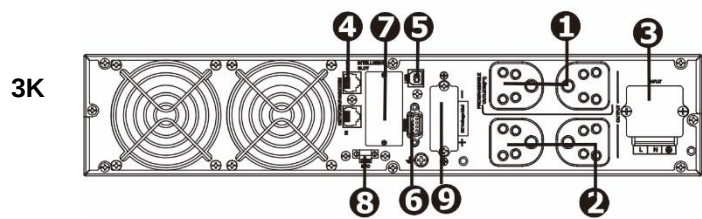
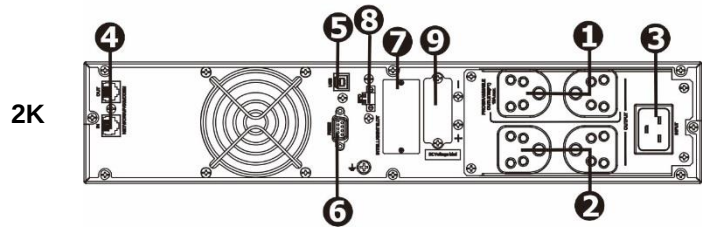
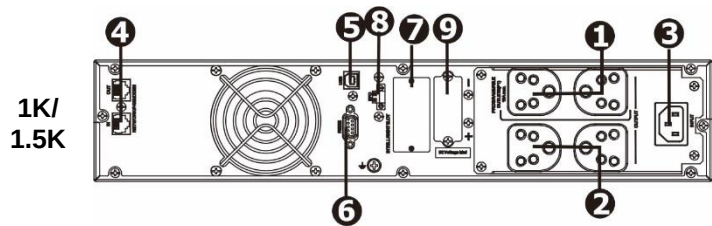
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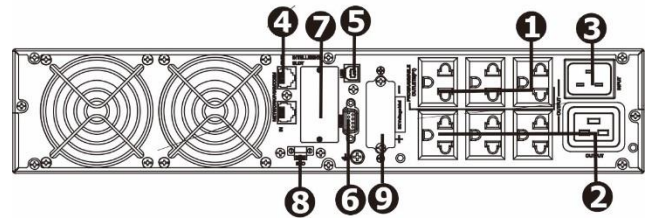
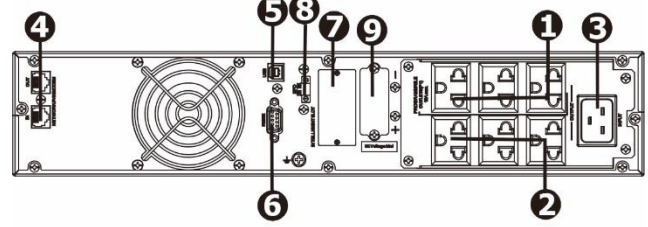
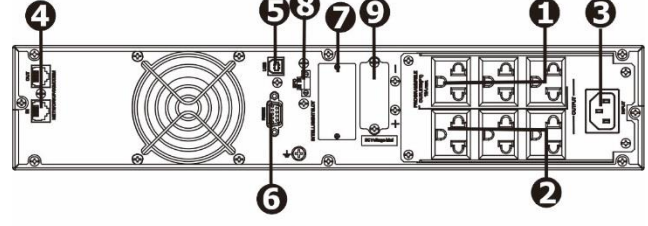
AU Type

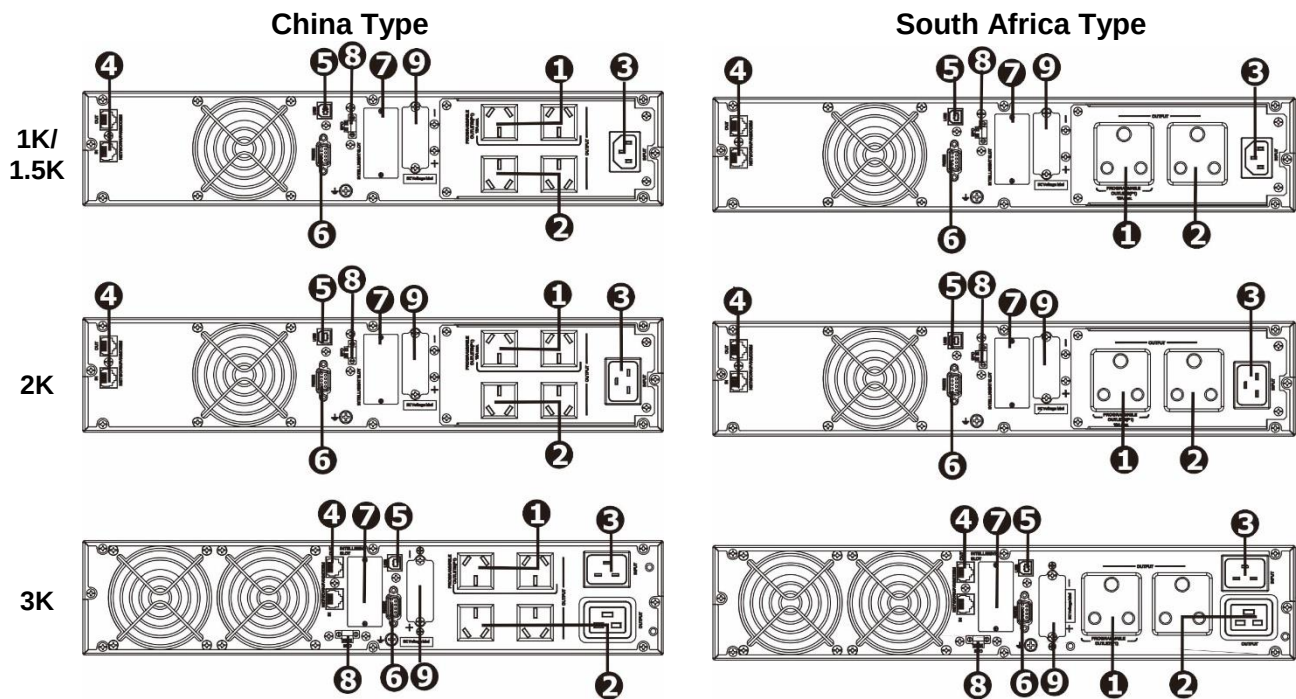


India Type



Thailand Type





1. Programmable outlets: connect to non-critical loads.
2. Output receptacles: connect to mission-critical loads.
3. AC input
4. Network/Fax/Modem surge protection
5. USB communication port
6. RS-232 communication port
7. SNMP intelligent slot
8. Emergency power off function connector (EPO)
9. External battery connection

2.2 UPS range

- ❑ Standard models: 1000/1500/2000/3000VA, 230V (High Voltage)
- ❑ Extend models: 1000/1500/2000/3000VA, 230V (High Voltage)
- ❑ Standard models: 1000/1500/2000/3000VA, 120V (Low Voltage)
- ❑ Extend models: 1000/1500/2000/3000VA, 120V (Low Voltage)

2.3 Topology

- ❑ On line double conversion, without galvanic insulation.
- ❑ Input power factor corrector (PFC).
- ❑ Automatic bypass, allow to transfer the load to the mains in case of overload or internal fault.

2.4 Charger features

- ❑ Charger works even if the UPS is in standby mode.
- ❑ Charger with APFC (Low ripple current).
- ❑ Charging current adaption, maximum up to 16A.
- ❑ Charging current measurement.
- ❑ 3 stage charging management (charging parameter setting available).
- ❑ OVP, OCP, OTP and short-circuit protection.
- ❑ Charger smart control by CPU.\

2.5 Battery features

- ❑ Cold start: the unit can start on battery.
- ❑ Battery deep discharge protection: minimum battery level linked with customer load level.
- ❑ Battery test: at each start-up and then, once every week.
- ❑ Long backup time model with super charger internal the UPS.

2.6 Additional features

- ❑ Nominal voltage: output voltage can be set through the UPS LCD panel (200/208/220/230/240V, 100/110/115/120/127V). Power de rating to be defined.
- ❑ Frequency synchronization: Within 50/60Hz ± 3 Hz by default, the output frequency is synchronized with input mains.
- ❑ Frequency converter: 50Hz to 60Hz converter mode.
- ❑ Automatic restart after short circuit: maximum 3 times and space 30s.
- ❑ Site Wiring Fault (SWF): detection of line and neutral reverse and ground missing.
- ❑ Emergency Power Off (EPO): EPO connector at rear panel allow to turn off the output voltage.
- ❑ Energy saving (ECO): the ECO range can be set through the monitor software or the UPS

LCD panel.

- ❑ Green function: when autonomy, the UPS will shut down automatically when equipment power consumption less than 5%.
- ❑ Programmable Outlet: when autonomy, the programmable outlet power supply time can be set through the monitor software or the UPS LCD panel.
- ❑ High Surge level immunity
- ❑ Smart fan speed control
- ❑ RS232/USB and Slot operation simultaneous.
- ❑ Network protection
- ❑ High over load capacity
- ❑ OVCD functional
- ❑ Dry contact independent port (optional).
- ❑ Real time Clock (Optional)

2.6 Attentions:

For all series of UPS, they are strictly tested and carefully designed. We always do our best to make our products more reliable and safer; this is also the goal of our company. However, due to the lifetime of electrical components and some unpredictable reasons, there will be unavoidable failures of this UPS. If this situation occurs, service of qualified person is needed. This service manual will guide the technicians to repair and adjust a problematic UPS. If the UPS still does not work properly, please contact with us and we will be glad to solve any problems you met.

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

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

This service manual consists of 4 major parts:

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

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

3. Important Safety Instructions



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 before removing outside protective cover.
5. AC voltage is always present if the input AC power is still available.
6. High voltage may present at DC capacitors. Before opening the outside cover, wait for at least five minutes after turning off the UPS.
7. Verify input source (voltage and frequency) before service.



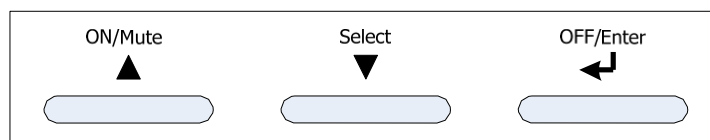
1. **DO NOT** make internal batteries short-circuited.
2. If the battery connectors (P5, P8) are disconnected, be sure to plug in the input power cord and the input power is available before re-connect the battery connectors.
3. After service, verify the polarity of batteries, the tightness of all screws and connectors before restarting the UPS.



After opening the cover, please always check the tightness of all wires, connectors and screws first. Then check if there are any de-colored components inside.

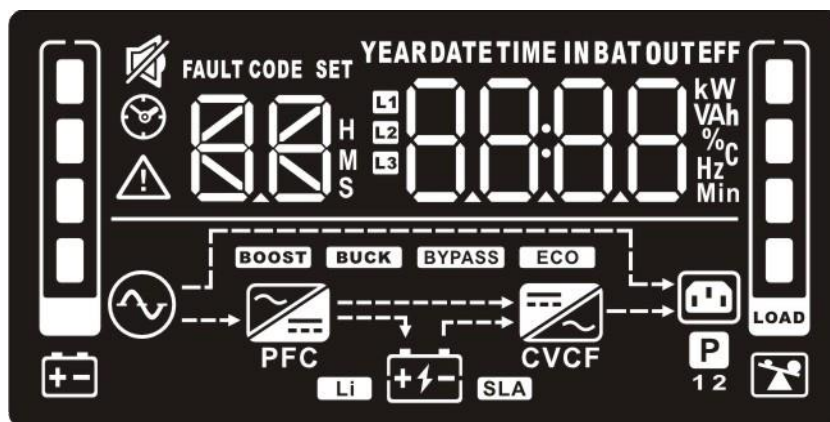
4.Operation and setting

4.1 Switch panel



Button	Function
ON/Mute Button	➤ Turn on the UPS: Press and hold ON/Mute button for at least 2 seconds to turn on the UPS. ➤ Mute the alarm: After the UPS is turned on in battery mode, press and hold this button for at least 2 seconds to disable or enable the alarm system. But it's not applied to the situations when warnings or errors occur. ➤ Up key: Press this button to display previous selection in UPS setting mode. ➤ Switch to UPS self-test mode: Press ON/Mute buttons for 2 seconds to enter UPS self-testing while in AC mode, ECO mode, or converter mode.
OFF/Enter Button	➤ Turn off the UPS: Press and hold this button at least 2 seconds to turn off the UPS. UPS will be in standby mode under power normal or transfer to Bypass mode if the Bypass enable setting by pressing this button. ➤ Confirm selection key: Press this button to confirm selection in UPS setting mode.
Select Button	➤ Switch LCD message: Press this button to change the LCD message for input voltage, input frequency, input current, battery voltage, battery current, battery capacity, ambient temperature, output voltage, output frequency, load current and load percent. ➤ Setting mode: Press and hold this button for 2 seconds to enter UPS setting mode when Standby and Bypass mode. ➤ Down key: Press this button to display next selection in UPS setting mode.
ON/Mute + Select Button	➤ Switch to bypass mode: When the main power is normal, press ON/Mute and Select buttons simultaneously for 2 seconds. Then UPS will enter to bypass mode. This action will be ineffective when the input voltage is out of acceptable range. ➤ Exit setting mode or return to the upper menu: When working in setting mode, press ON/Mute and Select buttons simultaneously for 0.2 seconds to return to the upper menu. If it's already in top menu, press these two buttons at the same time to exit the setting mode.

4.2 LCD Panel



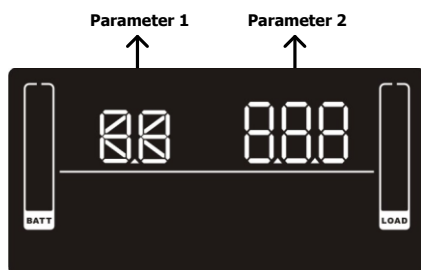
Display	Function
Autonomy time information	
	Indicates the estimated or running autonomy time. H: hours, M: minute, S: second
Configuration and fault information	
	Indicates the configuration items, and the configuration items are listed in details in section UPS Setting.
	Indicates the warning and fault codes, and the codes are listed in details in section Faults Reference Code and Warning indicator.
Mute operation	
	Indicates that the UPS alarm is disabled.
UPS measurement information	
	Indicate the input voltage, input frequency, input current, battery voltage, battery current, battery capacity, ambient temperature, output voltage, output frequency, load current and load percent. k: kilo, W: watt, V: voltage, A: ampere, %: percent, °C: centigrade degree, Hz: frequency
Load information	
	Indicates the load level by 0-24%, 25-49%, 50-74% and 75-100%.
	Indicates overload.
Programmable outlets information	
	Indicates that programmable management outlets are working.
Mode operation information	
	Indicates the UPS connects to the mains.

	Indicates the battery is working.
	Indicates charging status
	Indicates the bypass circuit is working.
	Indicates the ECO mode is enabled.
	Indicates the AC to DC circuit is working.
	Indicates the PFC circuit is working.
	Indicates the inverter circuit is working.
	Indicates the UPS is working in converter mode.
	Indicates the output is working.
Battery information	
	Indicates the battery level by 0-24%, 25-49%, 50-74%, and 75-100%.
	Indicates low battery.

LCD display wordings index

Abbreviation	Display content	Meaning
ENA	ENR	Enable
DIS	di S	Disable
ESC	ESC	Escape
HLS	HLS	High loss
LLS	LLS	Low loss
BP	BP	Battery Packs
AO	AO	Active Open
AC	AC	Active Close
EAT	EAt	Estimated autonomy time
AAT	AAt	Accumulated autonomy time
SD	Sd	Shut down
OK	OK	OK
ON	ON	ON
SB	Sb	Standby
BL	bL	Battery Low
OL	OL	Over Load
OI	O I	Over input current
NC	NC	Battery No Connect
OC	OC	Over Charge
SF	SF	Site wiring fault
EP	EP	EPO
TP	tP	Temperature
CH	CH	Charger
BF	bF	Battery Fault
BY	bY	Bypass Out Range
FU	FU	Bypass frequency unstable
BR	bR	Battery Replacement
EE	EE	EEPROM error

4.3 UPS Setting



There are three parameters to set up the UPS.

Parameter 1: It's for program alternatives. Refer to below table.

Parameter 2 is the setting options or values for each program.

● 01: Output voltage setting

Interface	Setting
The display shows '01' on the left and '230' on the right. Above '01' is the label 'SET' and above '230' is the label 'OUT'. Below '230' is a 'V' symbol. At the bottom center, there is a small icon of a battery and the text 'CVCF'.	Parameter 2: Output voltage For 200/208/220/230/240 VAC models, you may choose the following output voltage: 200: presents output voltage is 200Vac 208: presents output voltage is 208Vac 220: presents output voltage is 220Vac 230: presents output voltage is 230Vac (Default) 240: presents output voltage is 240Vac For 100/110/115/120/127 VAC models, you may choose the following output voltage: 100: presents output voltage is 100Vac 110: presents output voltage is 110Vac 115: presents output voltage is 115Vac 120: presents output voltage is 120Vac (Default) 127: presents output voltage is 127Vac

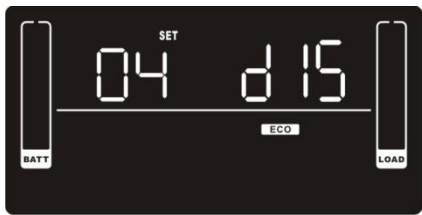
● 02: Frequency Converter enable/disable

Interface	Setting
The display shows '02' on the left and 'd 15' on the right. Above '02' is the label 'SET'. Below 'd 15' is a 'CVCF' label. At the bottom center, there is a small icon of a battery and the text 'CVCF'.	Parameter 2: Enable or disable converter mode. You may choose the following two options: CF ENA: converter mode enable CF DIS: converter mode disable (Default)

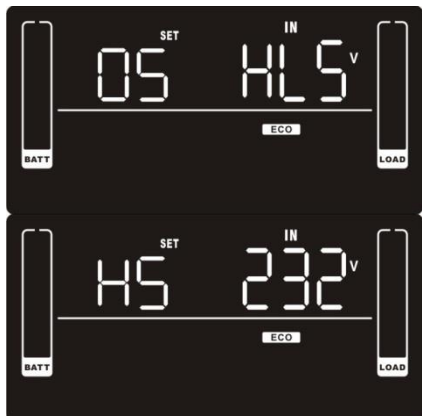
● 03: Output frequency setting

Interface	Setting
The display shows '03' on the left and '500' on the right. Above '03' is the label 'SET' and above '500' is the label 'OUT'. Below '500' is a 'Hz' symbol. At the bottom center, there is a small icon of a battery and the text 'CVCF'.	Parameter 2 : Output frequency setting. You may set the initial frequency on battery mode: BAT 50: presents output frequency is 50Hz BAT 60: presents output frequency is 60Hz If converter mode is enabled, you may choose the following output frequency: CF 50: presents output frequency is 50Hz CF 60: presents output frequency is 60Hz

● 04: ECO enable/disable

Interface	Setting
	Parameter 2: Enable or disable ECO function. You may choose the following two options: ENA: ECO mode enable DIS: ECO mode disable (Default)

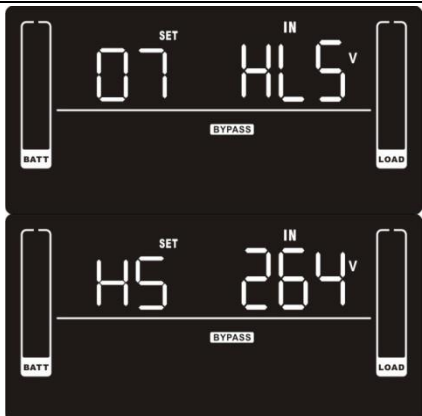
● **05: ECO voltage range setting**

Interface	Setting
	Parameter 2: Set the acceptable high voltage point and low voltage point for ECO mode by pressing Down key or Up key. HLS: High loss voltage in ECO mode in parameter 2. For 200/208/220/230/240 VAC models, the setting range in parameter 3 is from +7V to +24V of the nominal voltage. (Default: +12V) For 100/110/115/120/127 VAC models, the setting range in parameter 3 is from +3V to +12V of the nominal voltage. (Default: +6V) LLS: Low loss voltage in ECO mode in parameter 2. For 200/208/220/230/240 VAC models, the setting range in parameter 3 is from -7V to -24V of the nominal voltage. (Default: -12V) For 100/110/115/120/127 VAC models, the setting voltage in parameter 3 is from -3V to -12V of the nominal voltage. (Default: -6V)

● **06: Bypass enable/disable when UPS is off**

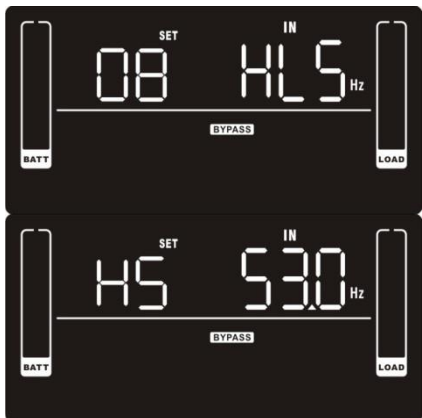
Interface	Setting
	Parameter 2: Enable or disable Bypass function. You may choose the following two options: ENA: Bypass enable DIS: Bypass disable (Default)

● **07: Bypass voltage range setting**

Interface	Setting
	Parameter 2: Set the acceptable high voltage point and acceptable low voltage point for Bypass mode by pressing the Down key or Up key. HLS: Bypass high voltage point For 200/208/220/230/240 VAC models: 230-264: setting the high voltage point in parameter 3 from 230Vac to 264Vac. (Default: 264Vac) For 100/110/115/120/127 VAC models: 120-140: setting the high voltage point in parameter 3 from 120Vac to 140Vac. (Default: 132Vac) LLS: Bypass low voltage point

	For 200/208/220/230/240 VAC models: 170-220: setting the low voltage point in parameter 3 from 170Vac to 220Vac. (Default: 170Vac) For 100/110/115/120/127 VAC models: 85-115: setting the low voltage point in parameter 3 from 85Vac to 115Vac. (Default: 85Vac)
--	--

● **08: Bypass frequency range setting**

Interface	Setting
	Parameter 2: Set the acceptable high frequency point and acceptable low frequency point for Bypass mode by pressing the Down key or Up key. HLS: Bypass high frequency point For 50Hz output frequency models: 51-55Hz: setting the frequency high loss point from 51Hz to 55Hz(Default: 53.0Hz) For 60Hz output frequency models: 61-65Hz: setting the frequency high loss point from 61Hz to 65Hz(Default: 63.0Hz) LIS: Bypass low Frequency point For 50Hz output frequency models: 45-49Hz: setting the frequency low loss point from 45Hz to 49Hz(Default: 47.0Hz) For 60Hz output frequency models: 55-59Hz: setting the frequency low loss point from 55Hz to 59Hz(Default: 57.0Hz)

● **09: Programmable outlets enable/disable**

Interface	Setting
	Parameter 2: Enable or disable programmable outlets. ENA: Programmable outlets enable DIS: Programmable outlets disable (Default)

● **10: Programmable outlets setting**

Interface	Setting
	Parameter 2: Set up backup time limits for programmable outlets. 0-999: setting the backup time limits in minutes from 0-999 for programmable outlets which connect to non-critical devices on battery mode. (Default: 999)

● **11: Autonomy limitation setting**

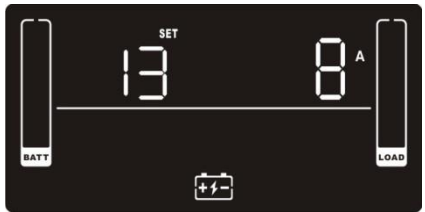
Interface	Setting
-----------	---------

	Parameter 2: Set up backup time on battery mode for general outlets. 0-999: setting the backup time in minutes from 0-999 for general outlets on battery mode. DIS: Disable the autonomy limitation and the backup time will depend on battery capacity. (Default) Note: When setting as "0", the backup time will be only 10 seconds.
---	--

● **12: Battery total AH setting**

Interface	Setting
	Parameter 2: Set up the battery total AH of the UPS. 7-999: setting the battery total capacity from 7-999 in AH. Please set the correct battery total capacity if external battery bank is connected.

● **13: Charger maximum current setting**

Interface	Setting
	Parameter 2: Set up the charger maximum current. 1/2/3/4: setting the charger maximum current 1/2/3/4* in Ampere. (Default: 2A) For Long-run model with 24/36/48VDC 1/2/4/6/8/10/12/14/16: setting the charger maximum current 1/2/4/6/8/10/12/14/16* in Ampere. (Default: 12A) For Long-run model with 72/96VDC 1/2/4/6/8/10/12: setting the charger maximum current 1/2/4/6/8/10/12* in Ampere. (Default: 12A) Note: Please set the appropriate charger current based on battery capacity and brand used.

● **14: Charger Boost voltage setting**

Interface	Setting
	Parameter 2: Set up the charger boost voltage. 2.25-2.40: setting the charger boost voltage from 2.25 V/cell to 2.40V/cell. (Default: 2.36V/cell)

● **15: Charger Float voltage setting**

Interface	Setting
	Parameter 2: Set up the charger float voltage. 2.20-2.33: setting the charger float voltage from 2.20 V/cell to 2.33V/cell. (Default: 2.28V/cell)

● **16: EPO logic setting**

Interface	Setting
-----------	---------

	Parameter 2: Set up the EPO function control logic. AO: Active Open (Default). When AO is selected as EPO logic, it will activate EPO function with Pin 1 and Pin 2 in open status. AC: Active Close. When AC is selected as EPO logic, it will activate EPO function with Pin 1 and Pin 2 in close status. DIS: Disable the EPO function
---	---

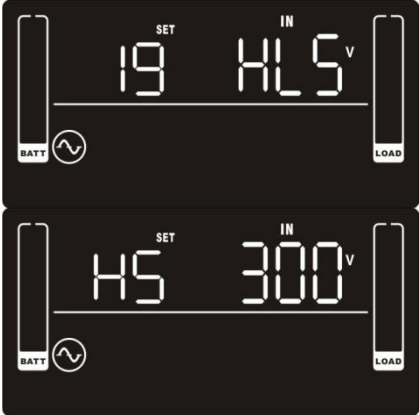
● **17: External output isolation transformer connection**

Interface	Setting
	Parameter 2: Allow or disallow external output isolation transformer connection. ENA: If selected, it's allowed to connect to an external output isolation transformer. DIS: If selected, it's not allowed to connect to external output isolation transformer. (Default)

● **18: Display setting for autonomy time**

Interface	Setting
	Parameter 2: Set up the display setting for autonomy time EAT: If EAT is selected, it will display the remaining autonomy time. (Default) RAT: If RAT is selected, it will show accumulated autonomy time so far.

● **19: Acceptable input voltage range setting**

Interface	Setting
	Parameter 2: Set the acceptable high voltage point and acceptable low voltage point for input voltage range by pressing the Down key or Up key. HLS: Input high voltage point For 200/208/220/230/240 VAC models: 280/290/300: setting the high voltage point in parameter 2. (Default: 300Vac) For 100/110/115/120/127 VAC models: 140/145/150: setting the high voltage point in parameter 2. (Default: 150Vac) LLS: Bypass low voltage point For 200/208/220/230/240 VAC models: 110/120/130/140/150/160: setting the low voltage point in parameter 2. (Default: 110Vac) For 100/110/115/120/127 VAC models: 55/60/65/70/75/80: setting the low voltage point in parameter 2. (Default: 55Vac)

● **00: Exit setting**

Interface	Setting
-----------	---------

	Exit the setting mode.
---	------------------------

4.4 Operating Mode Description

Operating mode	Description	LCD display
Online mode	When the input voltage is within acceptable range, UPS will provide pure and stable AC power to output. The UPS will also charge the battery at online mode.	
ECO mode	Energy saving mode: When the input voltage is within voltage regulation range, UPS will bypass voltage to output for energy saving. The UPS will also charge the battery at ECO mode.	
Frequency Converter mode	When input frequency is within 40 Hz to 70 Hz, the UPS can be set at a constant output frequency, 50 Hz or 60 Hz. The UPS will still charge battery under this mode.	
Battery mode	When the input voltage is beyond the acceptable range or power failure, the UPS will backup power from battery and alarm is sounding every 5 seconds.	
Bypass mode	When input voltage is within acceptable range but UPS is overload, UPS will enter bypass mode or bypass mode can be set by front panel. Alarm is sounding every 10 seconds.	
Standby mode	UPS is powered off and no output supply power, but still can charge batteries.	
Fault mode	When a fault has occurred, the ERROR icon and the fault code will be displayed.	

4.5 Faults Reference Code

Fault event	Fault code	Icon	Fault event	Fault code	Icon
Bus start fail	01	x	Battery voltage too high	27	x
Bus over	02	x	Battery voltage too low	28	x
Bus under	03	x	Charger output short	2A	x
Inverter soft start fail	11	x	Over temperature	41	x
Inverter voltage high	12	x	Overload	43	
Inverter voltage Low	13	x	Charger failure	45	x
Inverter output short	14	x	Over input current	49	x

4.6 Warning indicator

Warning	Icon (flashing)	Code	Alarm
Low Battery		6L	Sounding every 2 seconds
Overload		OL	Sounding every second
Over input current		OI	Sounding 2 beep every 10 seconds
Battery is not connected		NC	Sounding every 2 seconds
Over Charge		OC	Sounding every 2 seconds
Site wiring fault		SF	Sounding every 2 seconds
EPO enable		EP	Sounding every 2 seconds
Over temperature		EP	Sounding every 2 seconds
Charger failure		CH	Sounding every 2 seconds
Battery fault		6F	Sounding every 2 seconds (At this time, UPS is off to remind users something wrong with battery)
Out of bypass range		6Y	Sounding every 2 seconds
Bypass frequency unstable		FU	Sounding every 2 seconds
Battery replacement		6R	Sounding every 2 seconds
EEPROM error		EE	Sounding every 2 seconds

Note 1: When the fault is happened on line mode, the UPS must transfer to bypass mode except Inverter short circuit if the input voltage within the range of bypass mode.

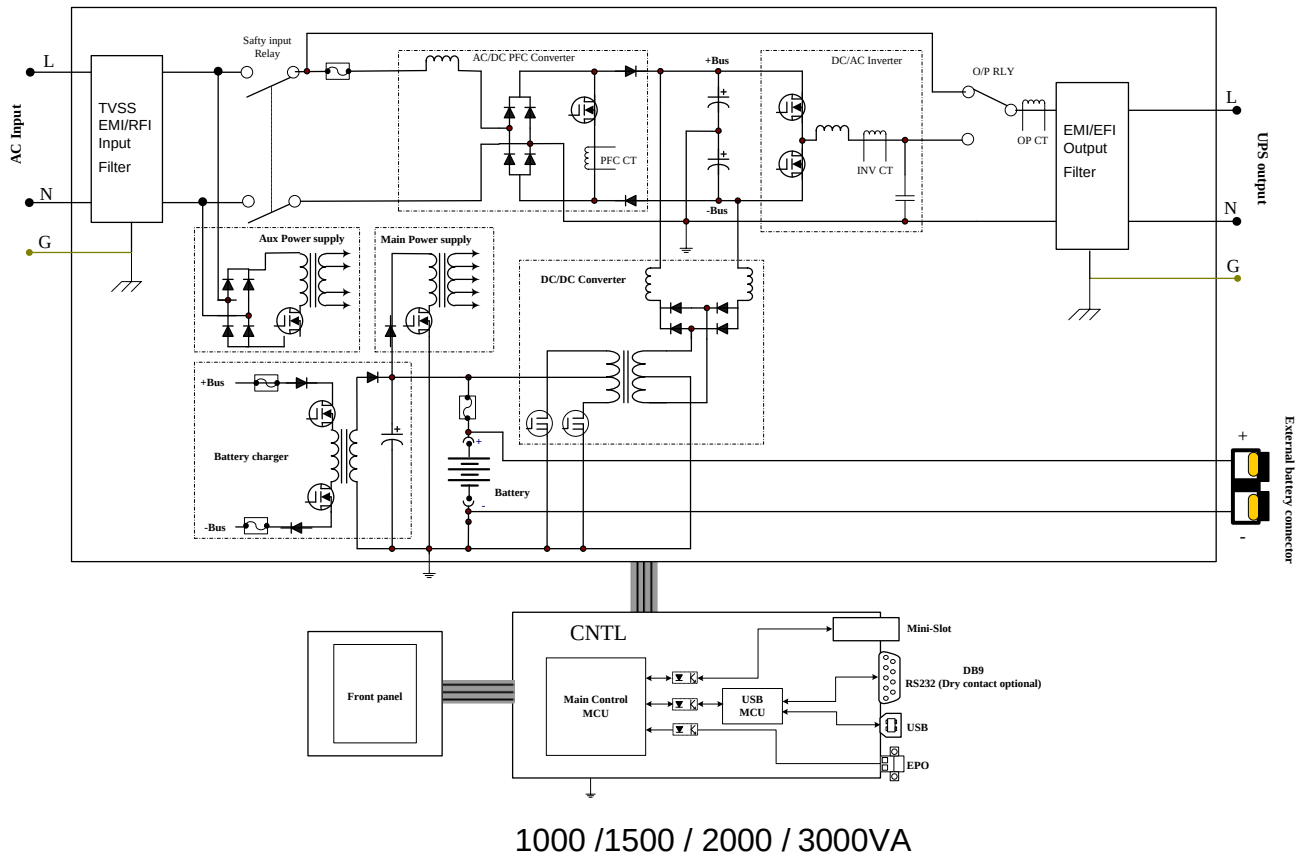
Note 2: If the site fault is happened after the UPS turned on, the UPS can't transfer to on line mode.

4.7 Audible Alarm

Battery Mode	Sounding every 5 seconds
Low Battery	Sounding every 2 seconds
Overload	Sounding every second
Fault	Continuously sounding
Bypass Mode	Sounding every 10 seconds

5.Circuit principle

5.1 Functional diagram



5.2 Subsystem instruction

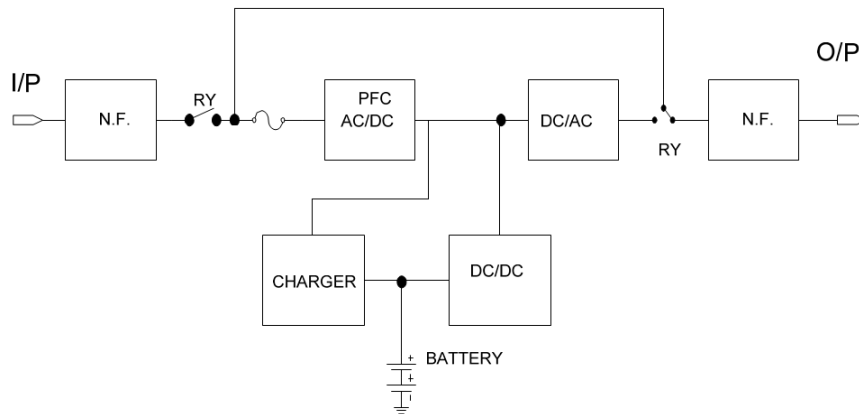
This Galleon One series UPS system contains two major PCB assemblies. They are including:

1. Power board	Contains major parts of (1) Charger, (2) Auxiliary power supply, (3) Power factor correction, (4) DC-DC converter, (5) Inverter, (6) Output filter.
2. Control board	Contains major parts of protection, signaling circuits, regulation and control circuits of inverter

The functional diagram shows how the major circuits are connected and illustrates the overall system functions.

The block diagram shows the UPS at normal operation from left to right. When a protection circuit is triggered or a fault condition occurs, the output supply is transferred immediately from inverter to AC mains by a bypass relay. The operation principle will be explained in later section. Basically, this ON-LINE UPS system utilizes high frequency PWM techniques to achieve high efficient performance. This UPS can deliver a clean, regulated sine-wave output under full load.

The sub-systems are described as below:

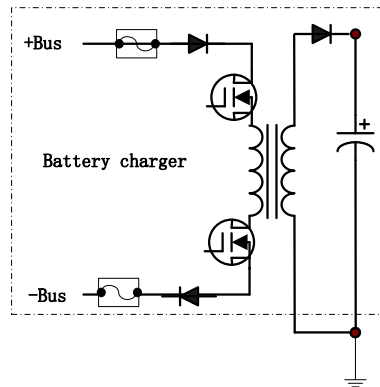


Block Diagram for UPS

As shown in functional diagram, the power stage consists of charger, power factor correction, DC power supply, DC-DC converter, inverter and output filter.

5.2.1 Charger Sub-System:

The purpose of charger is to charge and to maintain the batteries at full charged condition. Refer to circuit diagram, the voltage fly back switching power supply provides a constant DC voltage (13.65Vdc/PCS battery) for batteries. Besides providing constant voltage, the power supply also limits the current flowing into batteries and therefore protects and prolongs the life time of charged batteries.



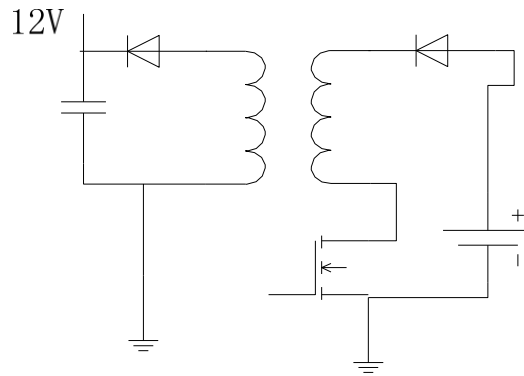
Charger Circuit Diagram

Note: For detail circuit diagram and key waveforms and values, see Annexures-circuit diagram.

5.2.2 Auxiliary Power Supply Sub-System:

The input of the auxiliary power supply is connected to the battery bus, i.e., the output of the charger. The output of auxiliary power supplies provides +12 Vdc for the bias supply of IC's working voltage and the fan(s) voltage. The DC power supply works only when the 12 Vdc regulator supplies Vcc to its control IC. To have proper operation of 12 Vdc regulators, its input

power is controlled by the switch as indicated in circuit diagram.

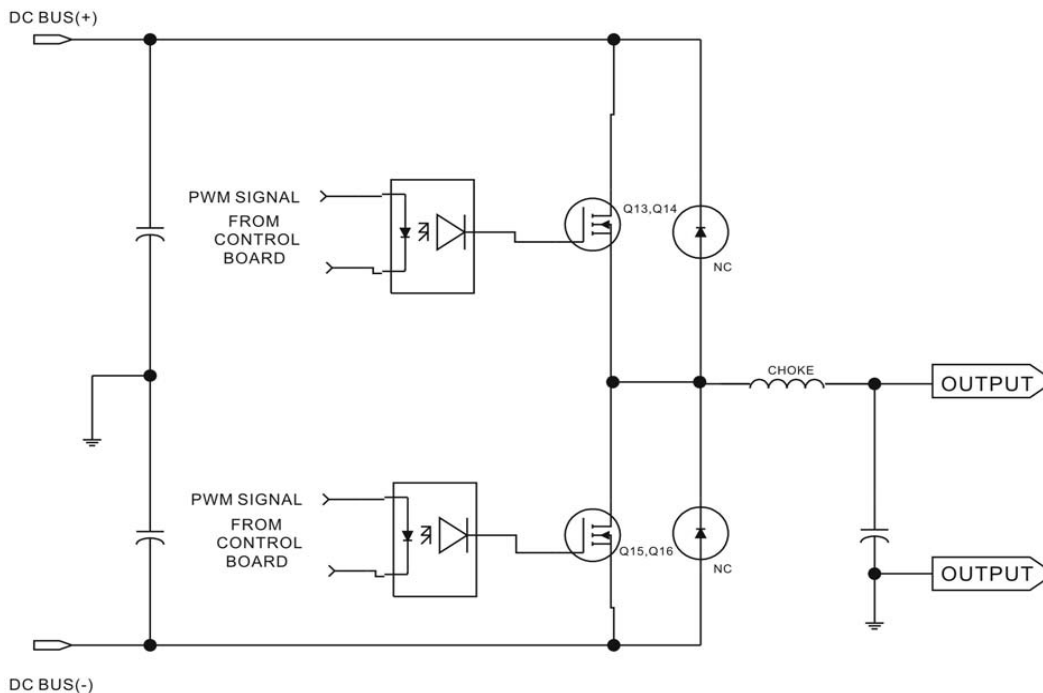


Auxiliary power supply circuit diagram

Note: For detail circuit diagram and key waveforms and values, see Annexures-circuit diagram.

5.2.3 Inverter Sub-System:

The UPS transfers $\pm$ DC bus voltages to the AC output voltage through an inverter of half bridge configuration at normal operation. The schematic diagram of inverter is shown below. To construct a high frequency (20.4 kHz) PWM inverter, the drivers receive switching signals from PWM generation circuit through a pair of photo-couplers to trigger the upper IGBT and the lower IGBT alternately. The output of IGBT's is filtered by an LC circuit to reduce the o/p voltage harmonics distortion.



Schematics for Inverter

Note: For detail circuit diagram and key waveforms and values, see Annexures-circuit diagram.

5.2.4 Output and filter Sub-System:

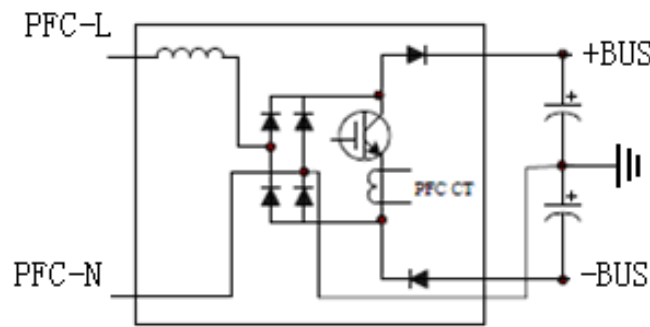
The bypass relay receives signal from control circuit to switch the output of the UPS from bypass to inverter, and vice versa. The output noise filter circuit blocks EMI noise to the loads.

Note: For detail circuit diagram and key waveforms and values, see Annexures-circuit diagram.

5.2.5 Input Power Factor Correction Sub-System:

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

When the input AC power cord is plugged in, the AC relay is activated and the AC power goes through noise filter to the charger and to the line detector. Both DC buses present voltages at about 1.4 times of input RMS voltage. When the "on" switch is pressed, the P.F.C. circuit is enabled and the DC buses are regulated at about $\pm 360\text{Vdc}$.



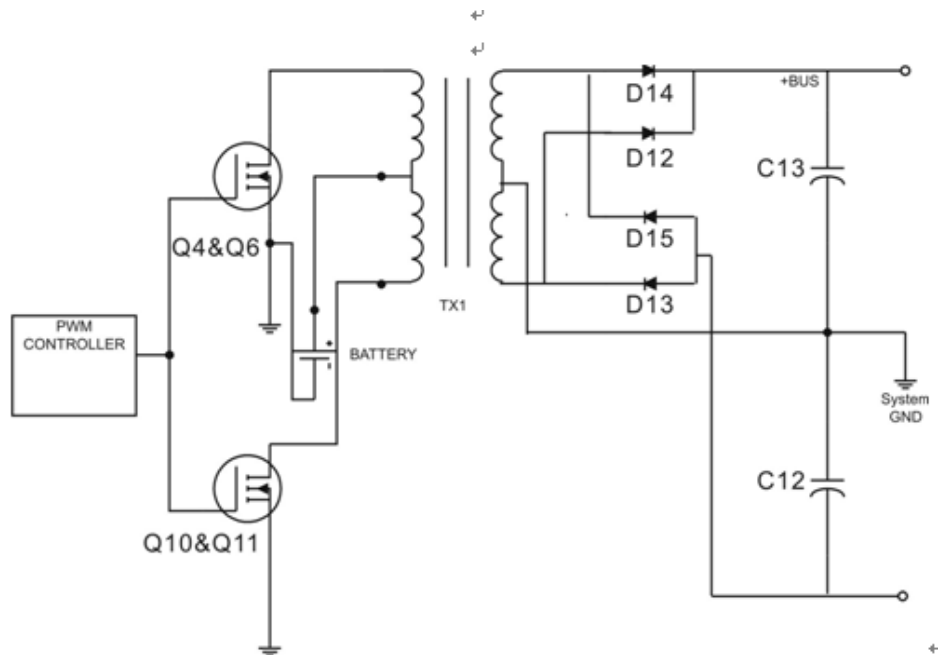
PFC configuration

Note: For detail circuit diagram and key waveforms and values, see Annexures-circuit diagram.

5.2.6 DC-DC Converter Sub-System:

The major function of the UPS is to deliver accurate AC power to the loads connected to it whenever the AC line is correct or fails. In this system, the batteries release the stored energy to supply inverter immediately upon AC line fails.

Refer to circuit diagram, the battery voltage is transformed through a push-pull DC-DC converter to $\pm 360\text{Vdc}$ as DC buses for inverter. When the line fails, the $\pm 360\text{Vdc}$ DC sources are caught up to supply the power needed by the inverter immediately.



DC -DC circuit

Note: For detail circuit diagram and key waveforms and values, see Annexures-circuit diagram.

5.2.7 Control board

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

5.2.7.1 REGULATION & CONTROL SUB-SYSTEM:

This portion can be seen as brain of the UPS. It provides the control pulses to the switching elements which deliver power to the output. The sub-system also regulates the output to ensure that the UPS is delivering constant AC voltage to the loads.

The inverter signal is sensed directly by resistor division. It is compared with a reference signal from sine wave generator. The difference of these two signals (error signal) alter the pulse widths of PWM signals which control the duty cycles of switching elements to regulate the output voltage within specification.

5.2.7.2 PROTECTION SUB-SYSTEM:

The UPS provides the following protection circuits:

5.2.7.2.1 Overload protection

The load detector senses the load current. I.e. the inverter current, and sends the signal by two paths. In battery mode, the UPS will go to failure mode if overload condition happened. The panel will indicate the fault condition. There are two kinds of protection in our UPS:

- a. **Overload Protection:** The UPS collects the continuous overload signals through CPU

switch the bypass relay. If the output load is lower than 110% of rated load (VA, or Wattage) the UPS keeps running on inverter running and warning. If the output load is between 110% and 130% of rated load (VA, or Wattage) the UPS transfers to bypass after 5mins(ambient temperature<40°C). If the output load is between 130% and 140% of rated load (VA, or Wattage) the UPS transfers to bypass after 30secs. If the output load is higher than 140% of rated load, the UPS transfers to bypass after 1.5s immediately.

- b. **Cycle by Cycle Current Limit:** When output loads sink a high surge current for a short time, a high inverter current is detected and the inverter switches, i.e. the IGBT's, are turned off pulse by pulse to protect themselves from thermal runaway. The output relay stays at inverter output position unless a continuous overload is detected or an abnormal inverter operation occurs.

5.2.7.2.2 *Battery over or under shut down*

Upon the battery voltage declines to battery-under/over level, the UPS will warning and the LCD will display the fault code, then shut down.

In case of the battery voltage is high voltage, the UPS will warning and the LCD will display the fault code.

5.2.7.2.3 *Inverter output abnormal protection*

The inverter failure signal shuts down the inverter immediately, makes the buzzer a continuous alarm, and the LCD displays the fault code.

"The failure signal latches itself unless SW off or battery is empty".

5.2.7.2.4 *Over temperature protection*

The thermal switch detects the temperature of PSDR heat sink. The thermal switch is electrically connected to the CPU. An opened thermal switch is thought as temperature failure by the UPS. The LCD will display the fault code.

5.2.7.2.5 *Bus over/under/unbalance-voltage protection*

To protect any BUS over/under/unbalance -voltage condition especially for the half-bridge load. The LCD will display the fault code.

5.2.7.3 **Signaling Sub-System:**

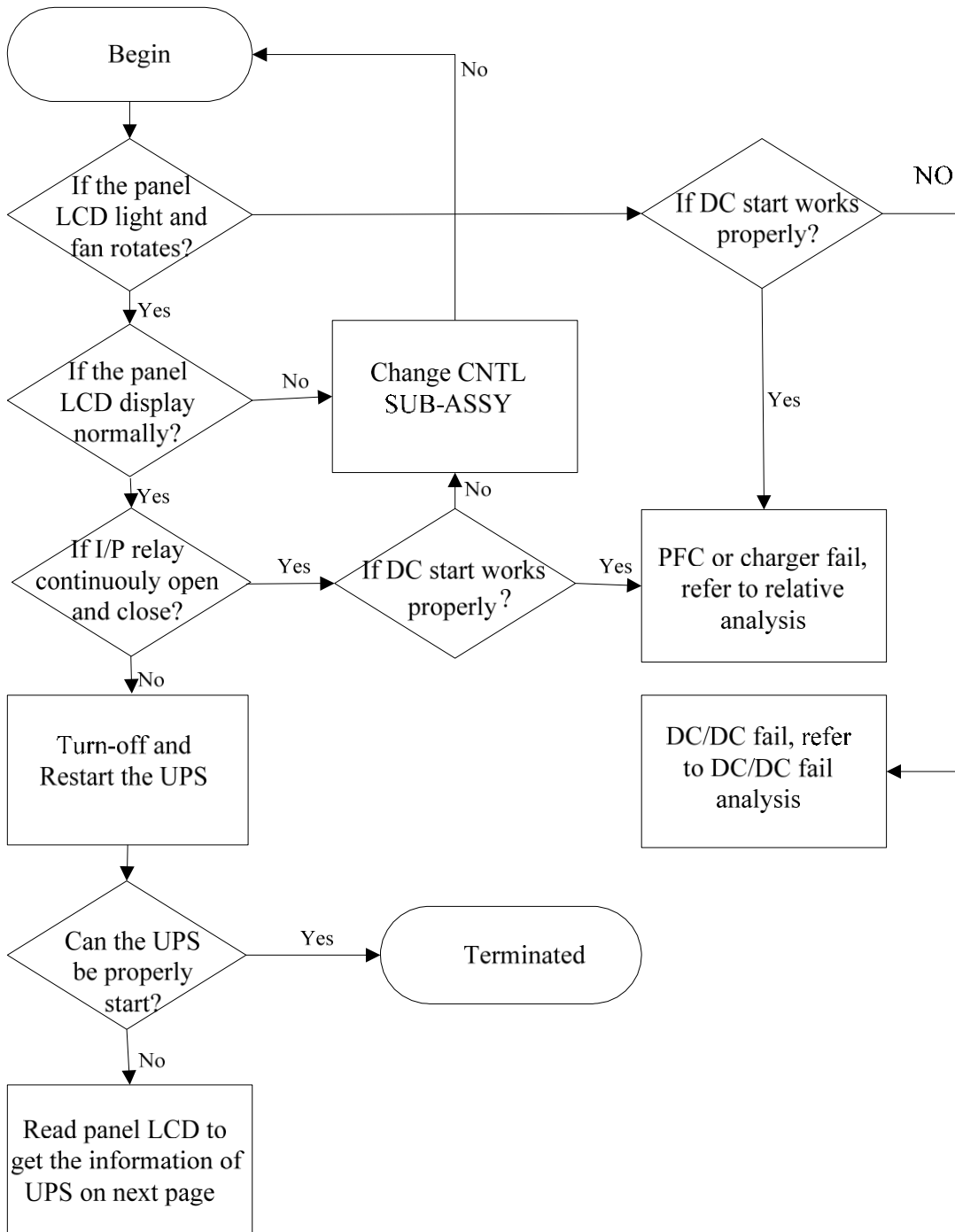
When the AC line is unable to supply, the batteries release energy inside to supply the inverter immediately. At the same time, the buzzer beeps every 5 seconds.

Upon the batteries are discharged to battery-low level, the battery-low signal is activated and the buzzer beeps every 2 second.

6. TROUBLE SHOOTING

Due to careful design and strict tests of our products, fail of UPS seldom occurs. However, once they do fail in some situations, please check them according to **Trouble Shooting Chart** that will help you solve the most problems on UPS.

6.1 Trouble Shooting Chart

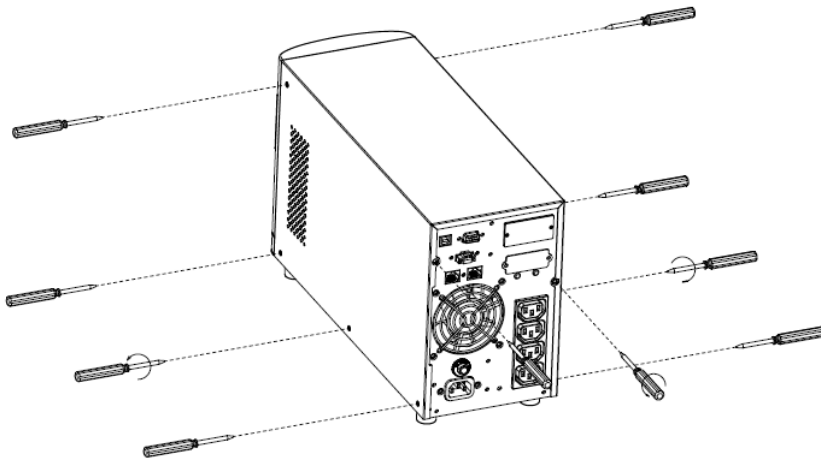


6.2 Failure Diagnosis

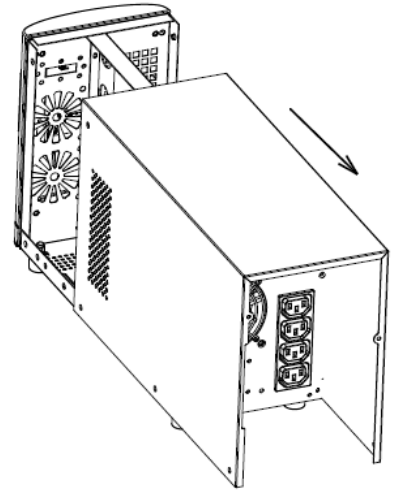
6.2.1 Step to open the case (Tower)

Small case (For 2~4Batterys)

Step1:

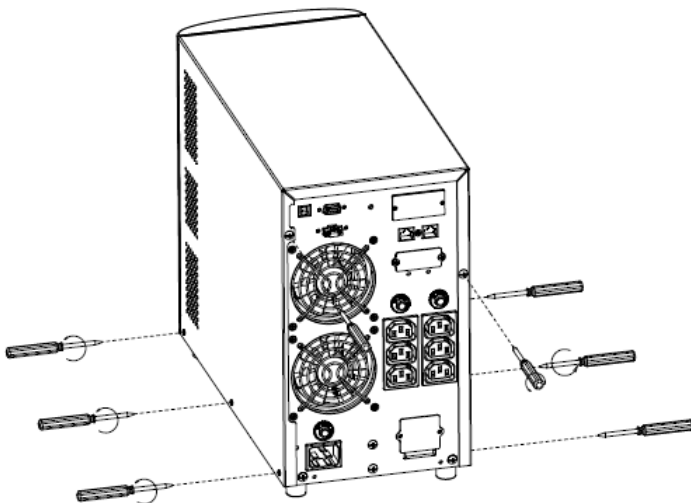


Step2:

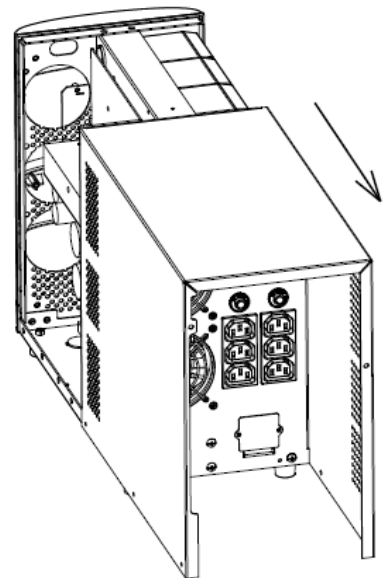


Big case (For 6~8Batterys)

Step1:

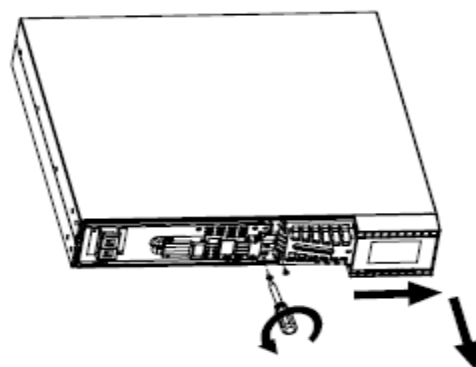
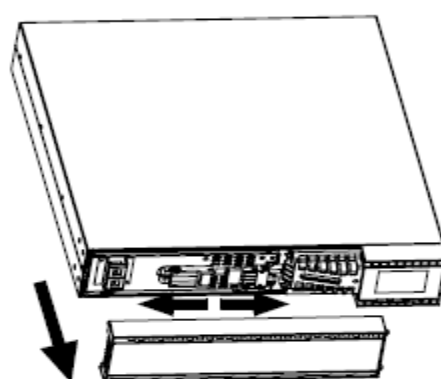
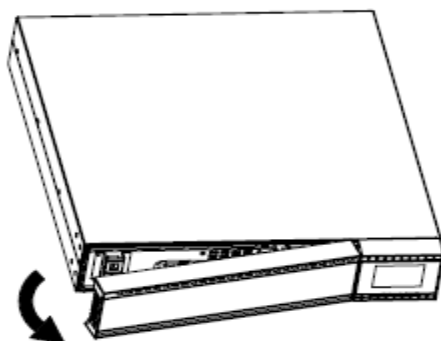


Step2:

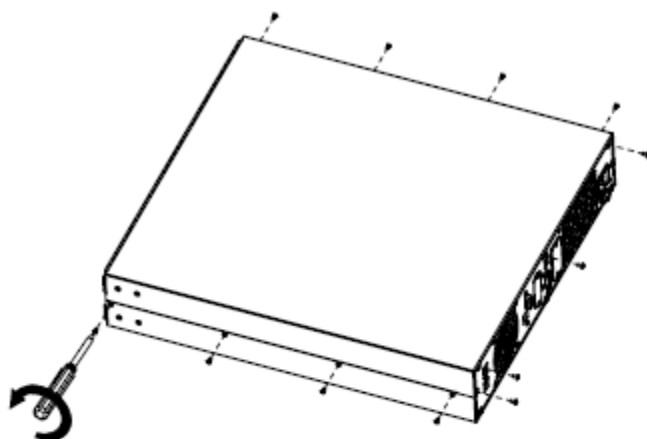


(R/T)

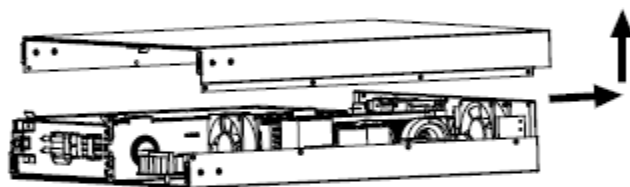
STEP1



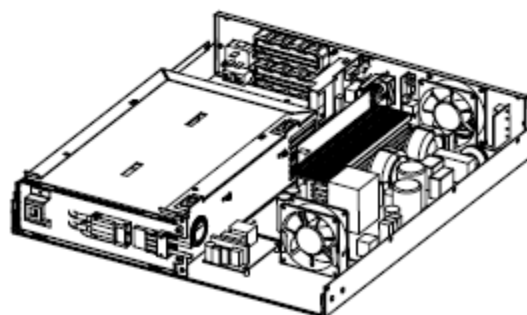
STEP2



STEP3



STEP4



6.2.2 Critical component list

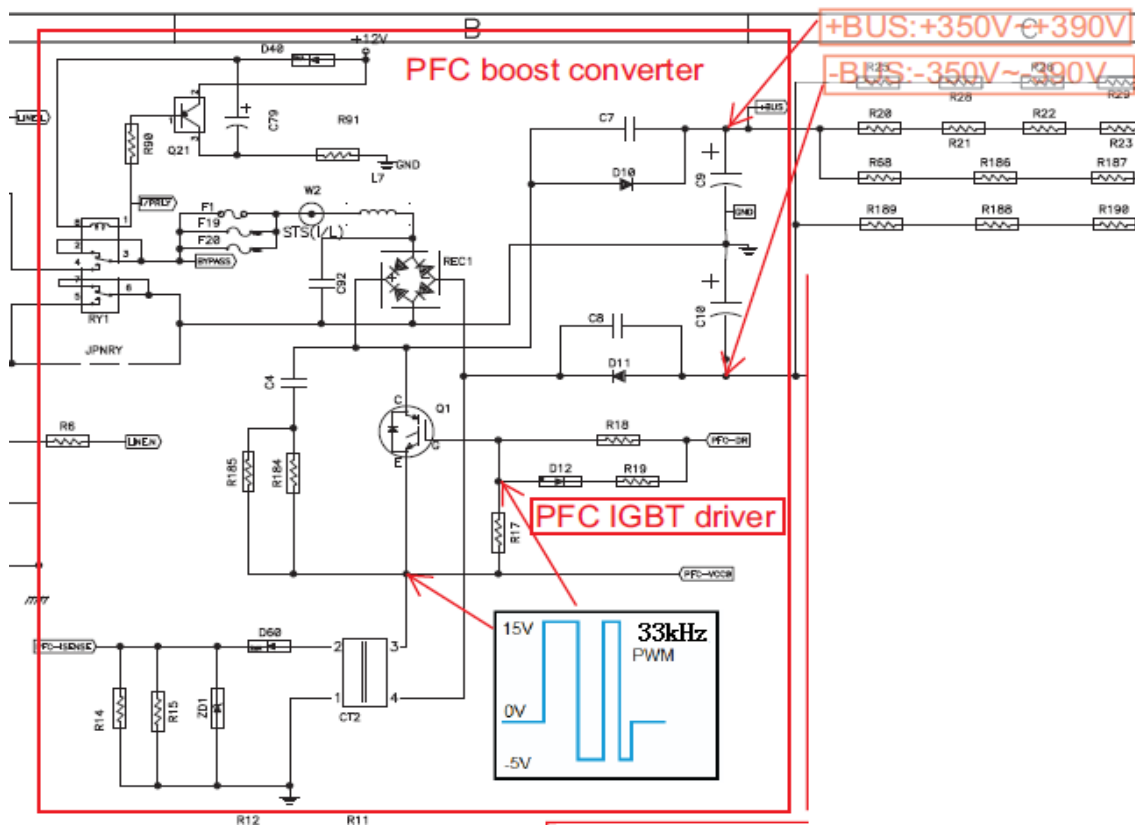
(use multi-meter to check the value)

1. Overview:

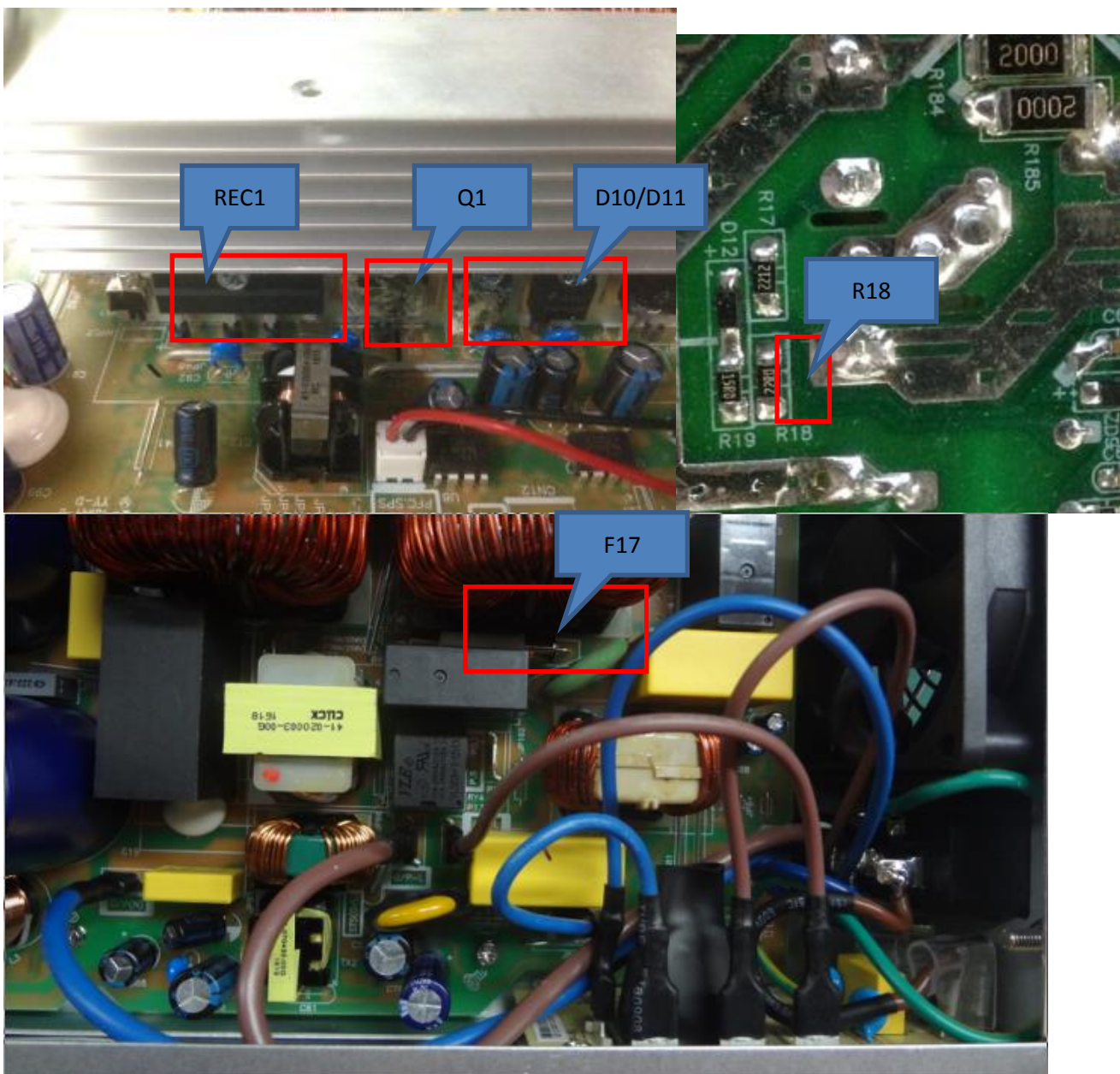
Circuit Block	Components to be checked	Fail condition
Power board	Fuse	open
	Diode	short or open
	MOSFET	G-D-S short or open
	IGBT	G-C-E short or open
Control board	5V voltage regulator (78M05)	Input and output short
	MCU	I/O port breakdown
Charger	Fuse	open
	Diode	short or open
	MOSFET	G-D-S short or open

2. P.F.C.:

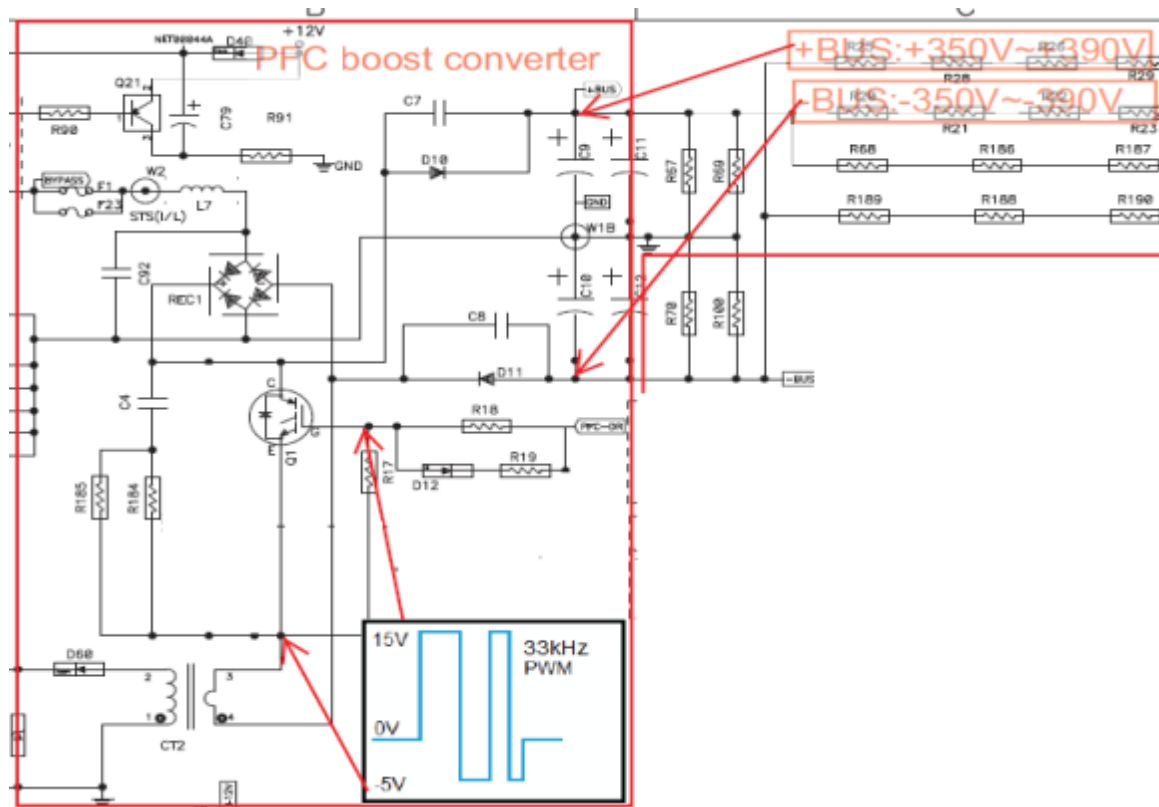
---1~2K (PCB: 16-302286-XXG&16-302287-XXG)



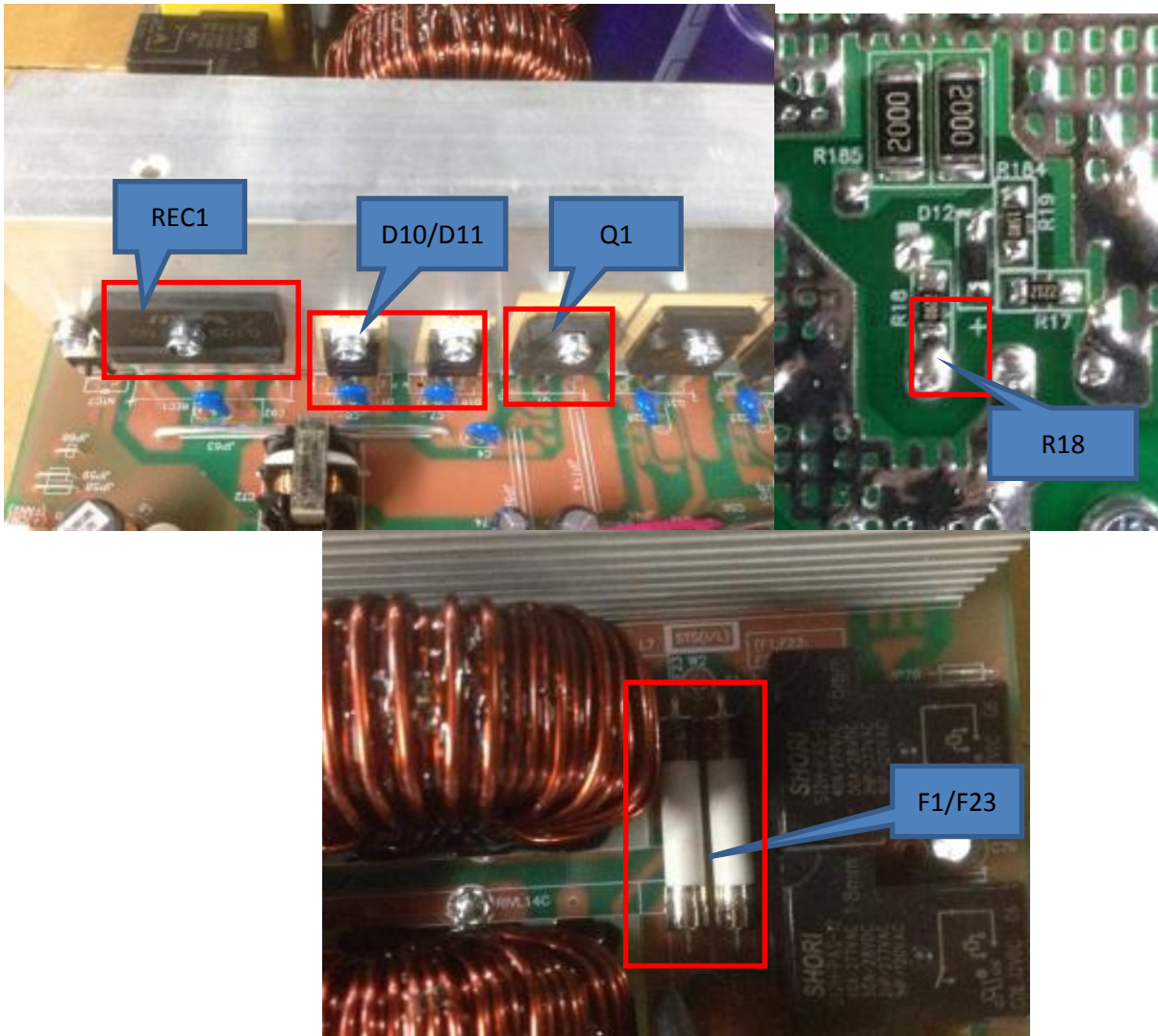
Step	Checked components	Instrument function	Reference Value	Failed condition
1	IGBT Q1 (E,C) (G,E; C,E)	Diode Diode	~0.48 Open	Short or open Short
2	Rectifier REC1	Diode	~0.53	Short or open
3	Fuse F17	Resistance	0 ohm	Open
4	Diode D10,D11	Diode	~0.41	Short or open
5	Resistor R18	Resistance	~22 ohm	>25 ohm or Open



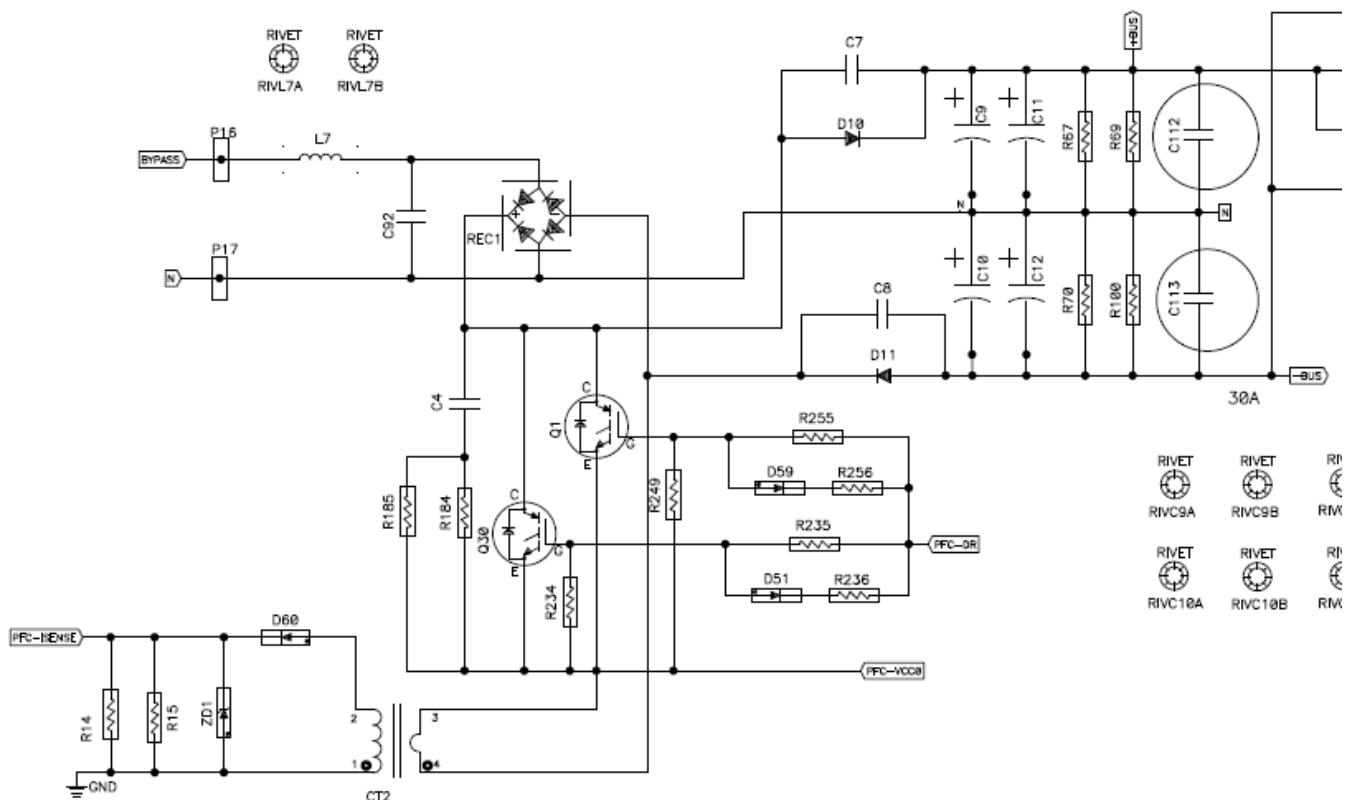
---3K (PCB: 16-302288-XXG)



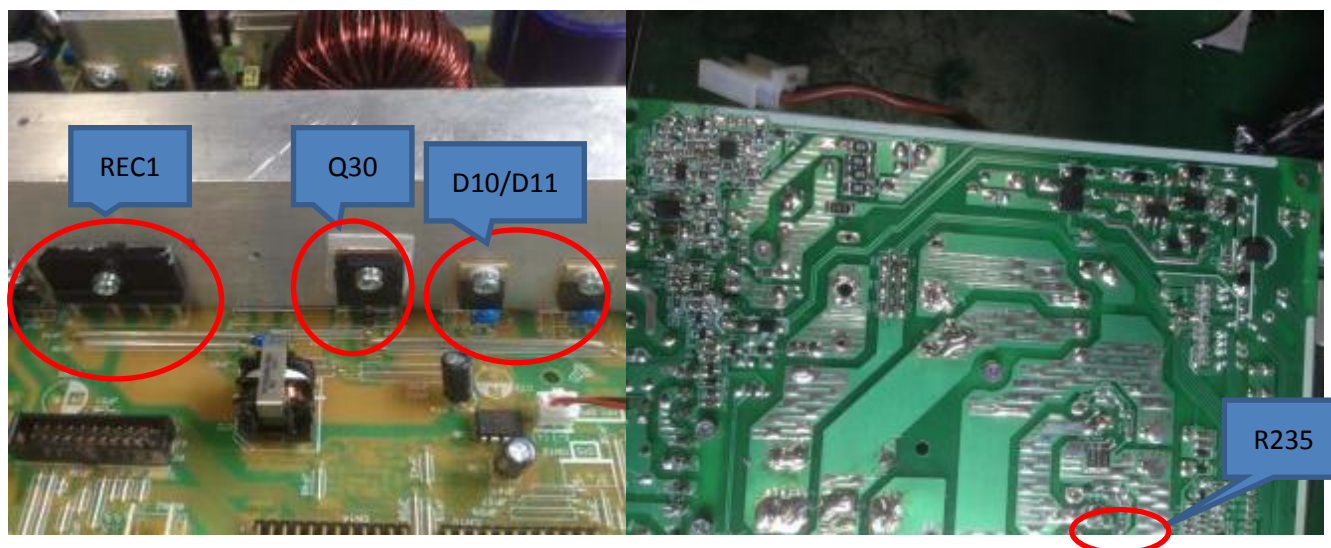
Step	Checked components	Instrument function	Reference Value	Failed condition
1	IGBT Q1 (E,C) (G,E; C,E)	Diode Diode	~0.48 Open	Short or open Short
2	Rectifier REC1	Diode	~0.47	Short or open
3	Fuse F1 F23	Resistance	0 ohm	Open
4	Diode D10,D11	Diode	~0.41	Short or open
5	Resistor R18	Resistance	~22 ohm	>25 ohm or Open



---3K (PCB: 16-302479-XXG)

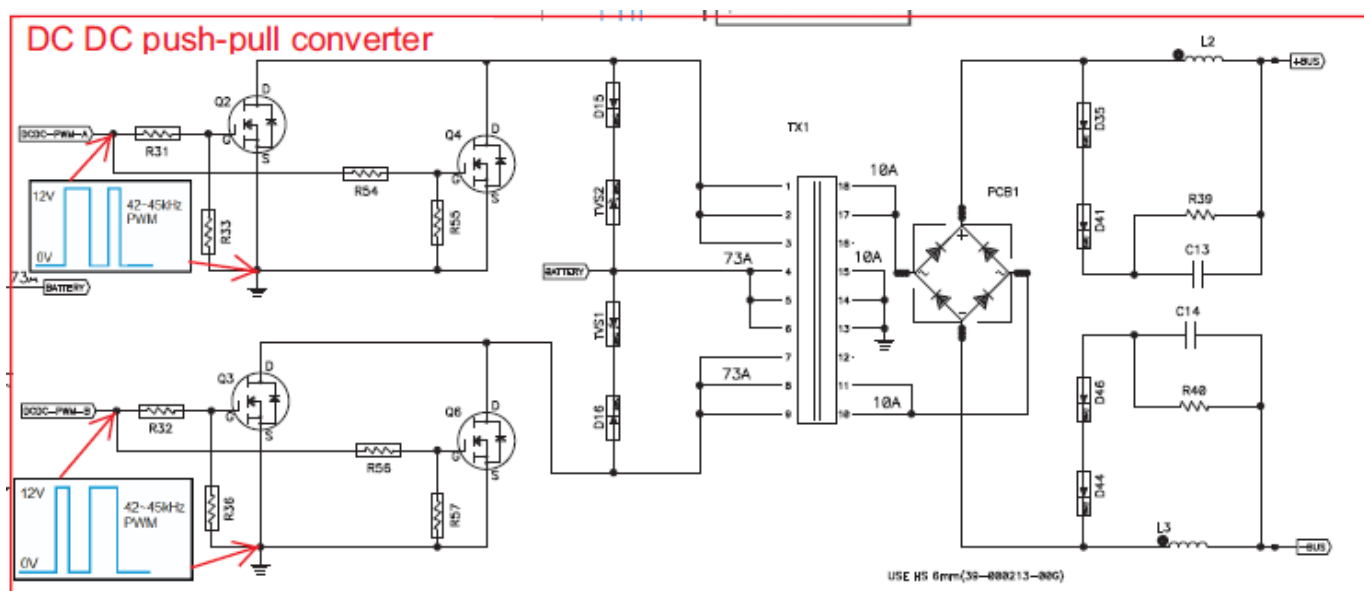


Step	Checked components	Instrument function	Reference Value	Failed condition
1	IGBT Q1 Q30 (E,C) (G,E; C,E)	Diode Diode	~0.48 Open	Short or open Short
2	Rectifier REC1	Diode	~0.47	Short or open
3	Fuse F1 F2(On I/O board 16-302467-00G)	Resistance	0 ohm	Open
4	Diode D10,D11	Diode	~0.41	Short or open
5	Resistor R235 R255	Resistance	~22 ohm	>25 ohm or Open



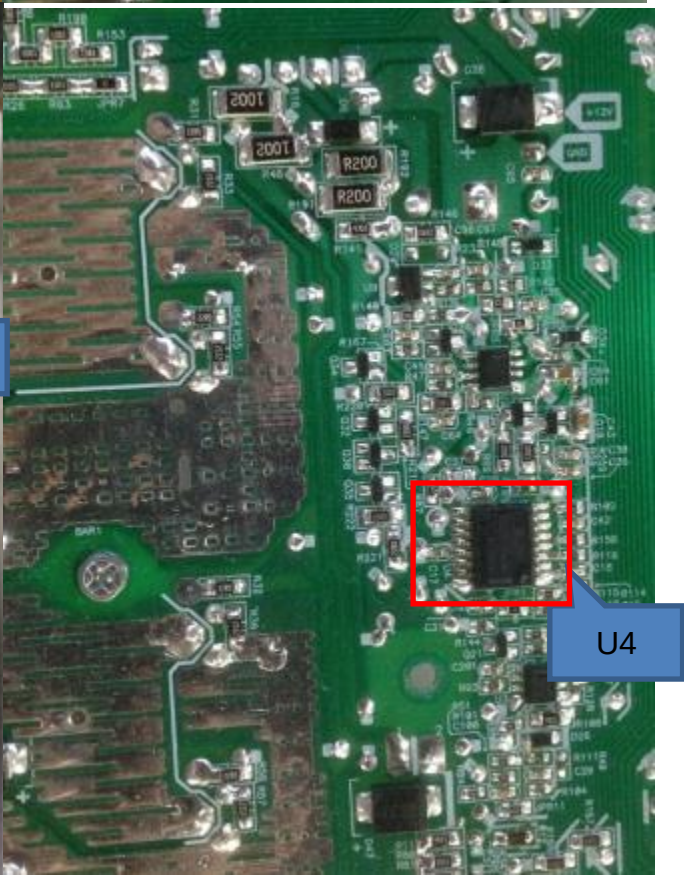
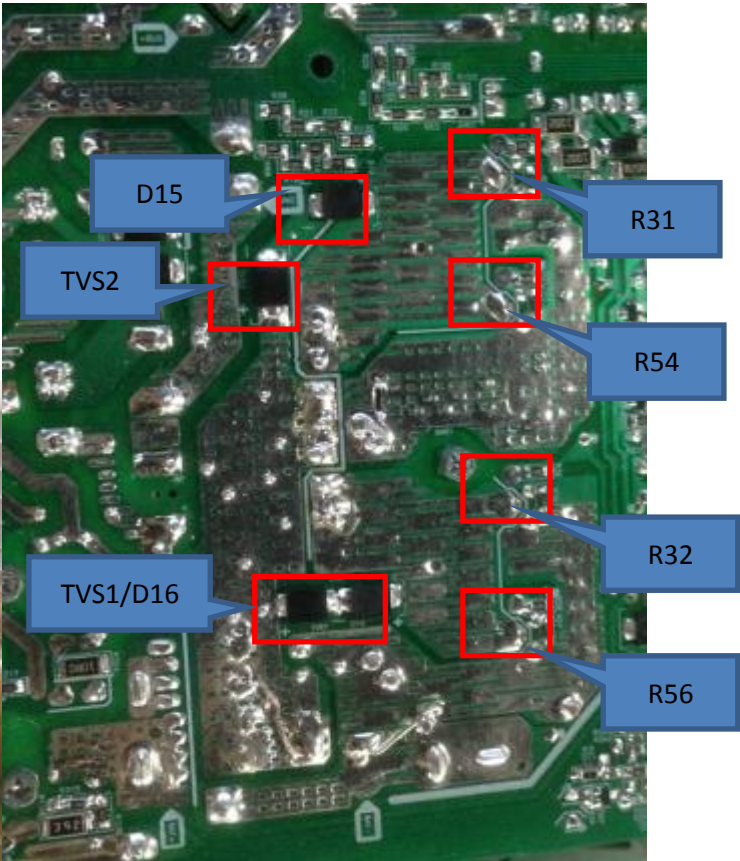
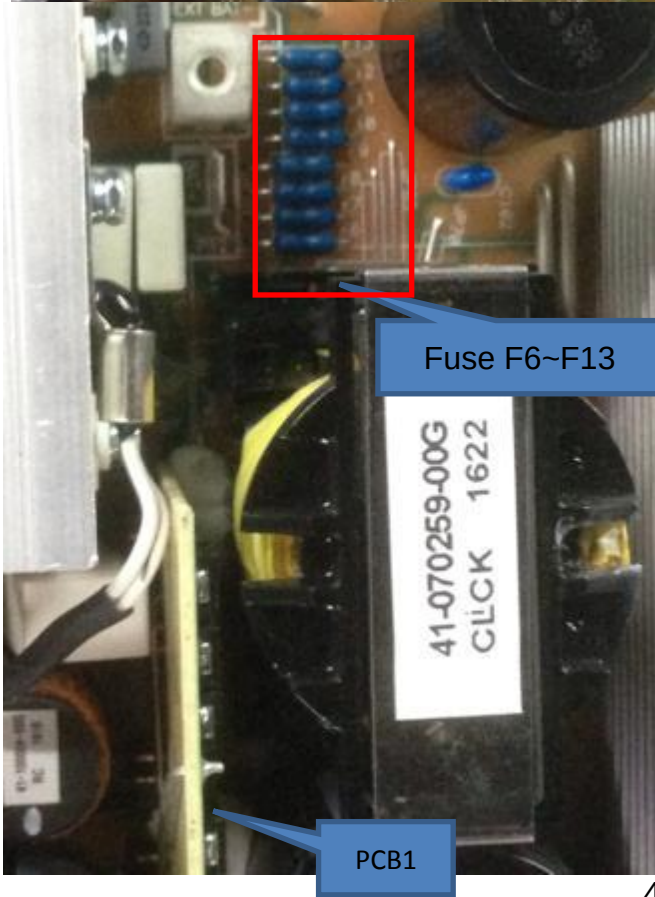
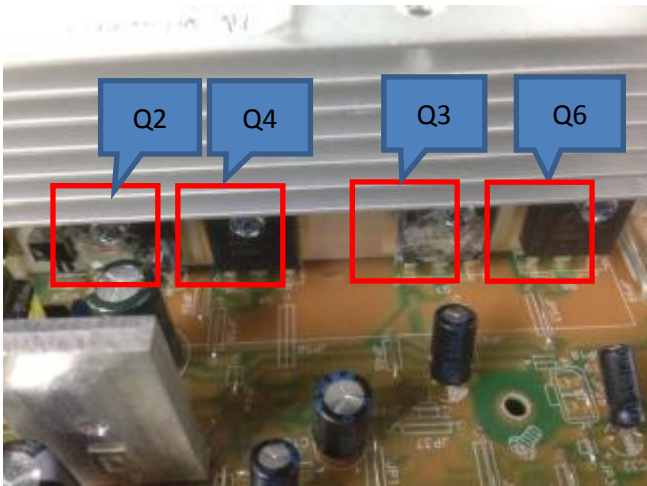
3.DC-DC CONVERTER:

---1~2K (PCB: 16-302286-XXG&16-302287-XXG)

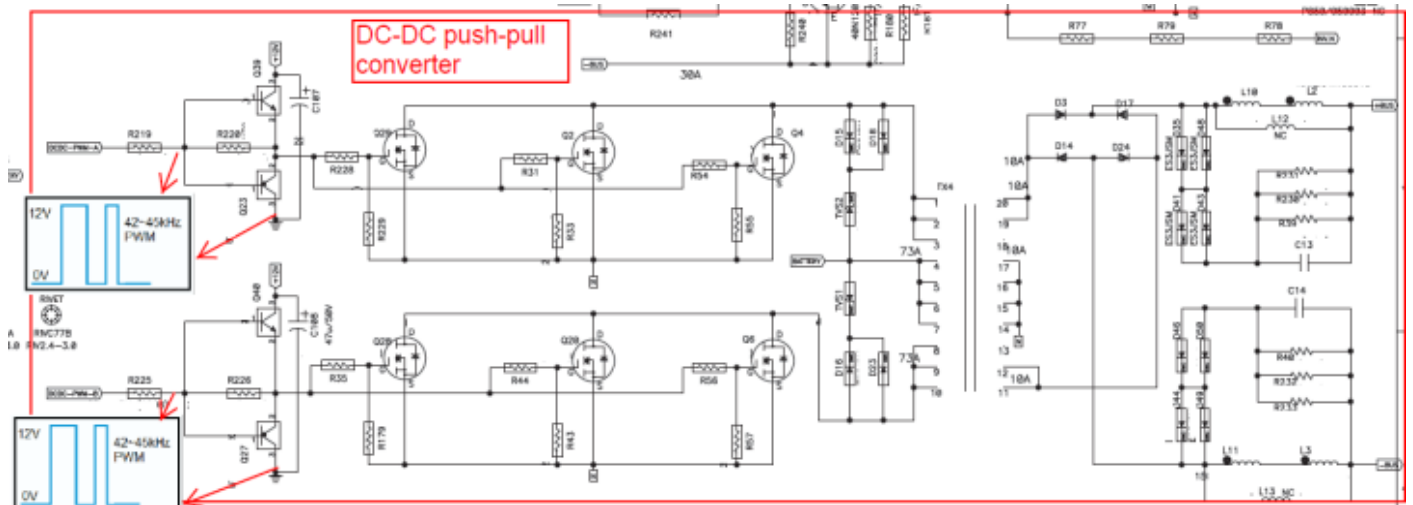


Step	Checked components	Instrument function	Reference Value	Failed condition
1	MOSFET Q2,Q3,Q4,Q6 S,D D,S; G,S; G,D	Diode Diode	~0.46 >0.6	Short Short or <0.6
2	Fuse F6~F13	Resistance	0 ohm	Open
3	Diode D15, D16, TVS1, TVS2, D35, D41, D44, D46, PCB1	Diode	~0.42	Short or open

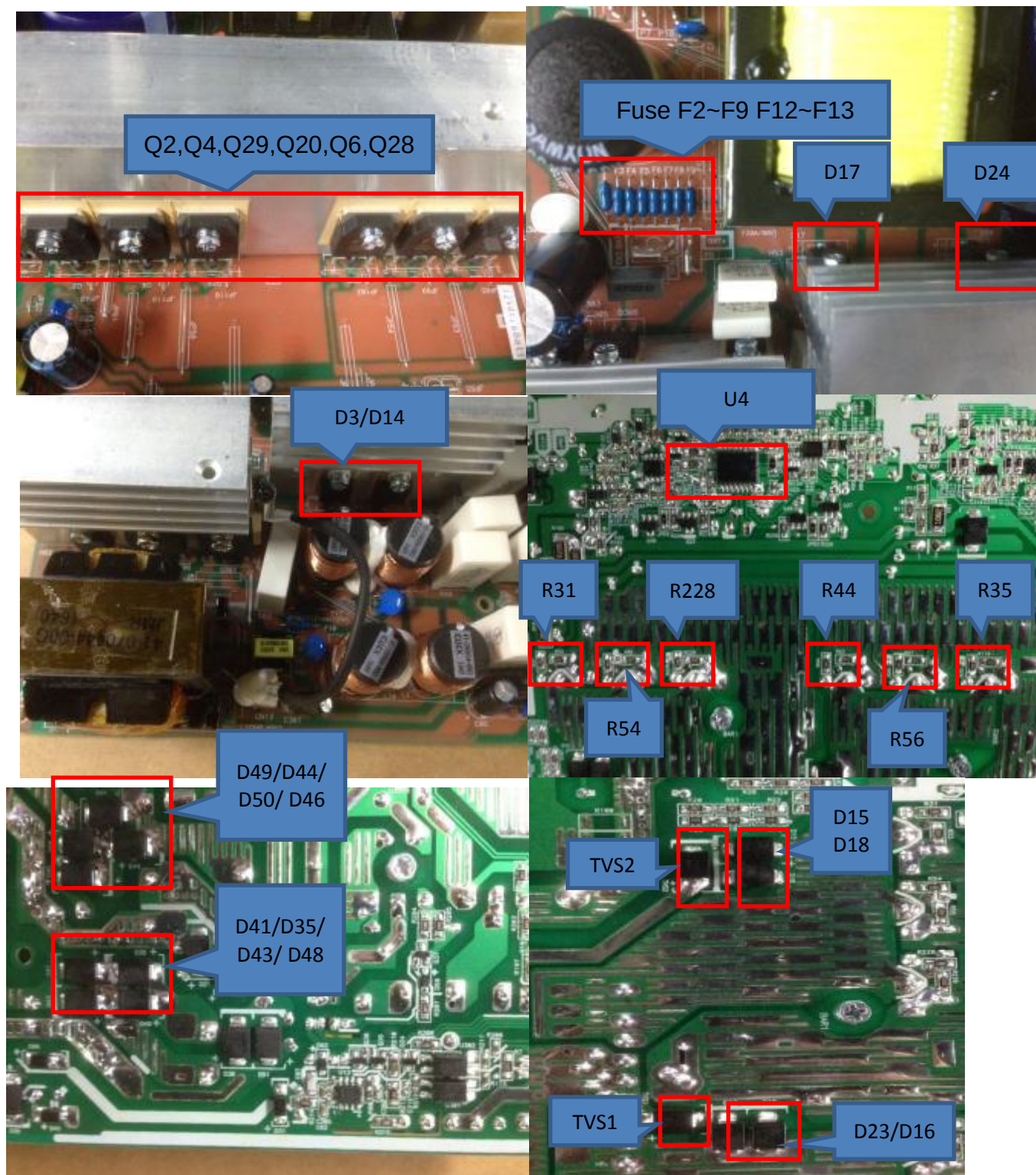
4	Resistor R31, R32, R54, R56	Resistance	~22 ohm	>25 ohm or Open
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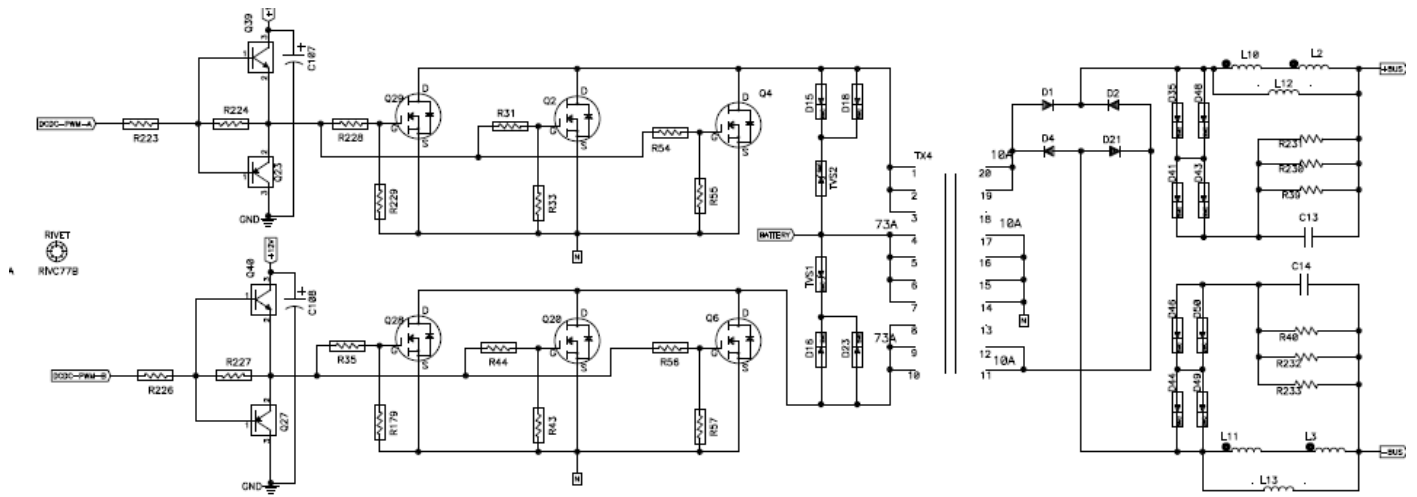
---3K (PCB: 16-302288-XXG)



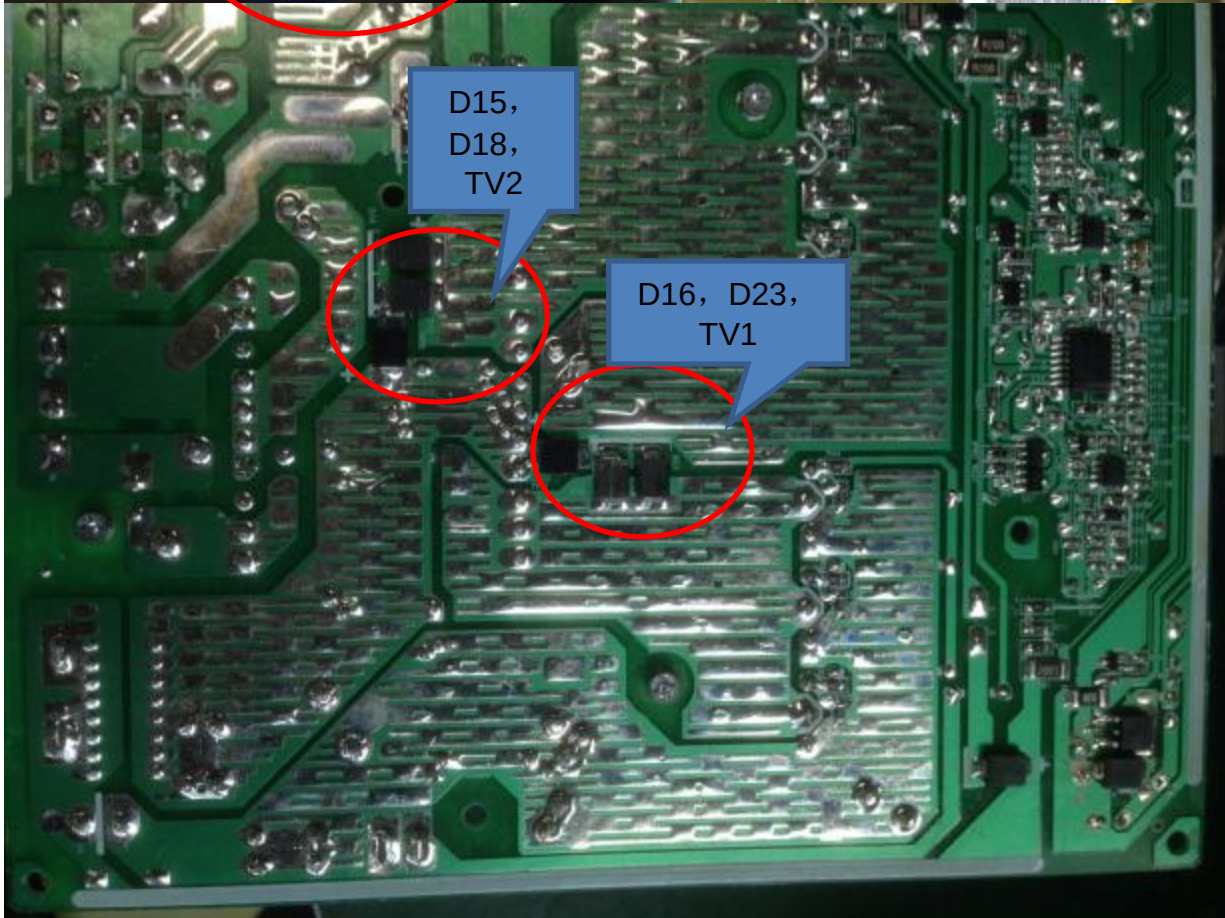
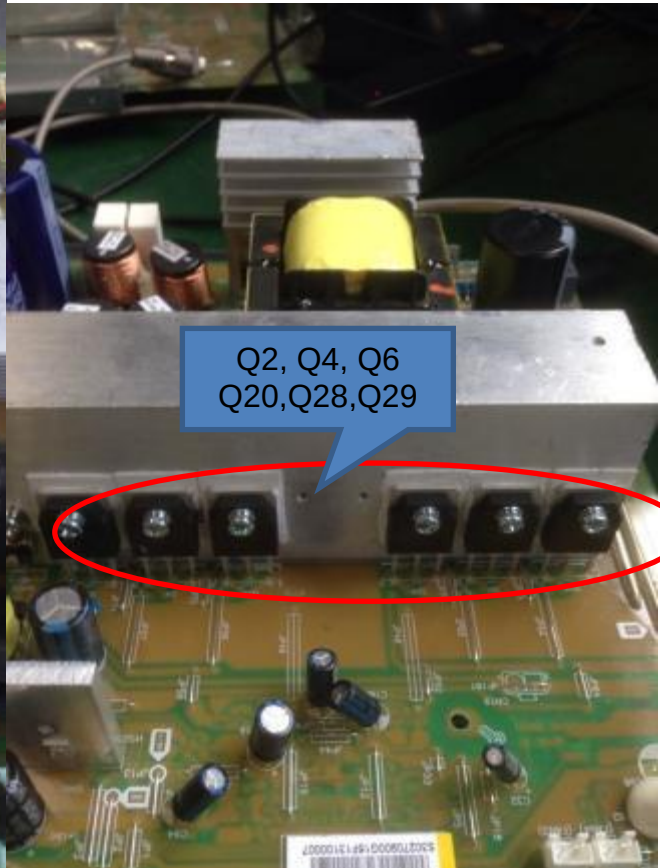
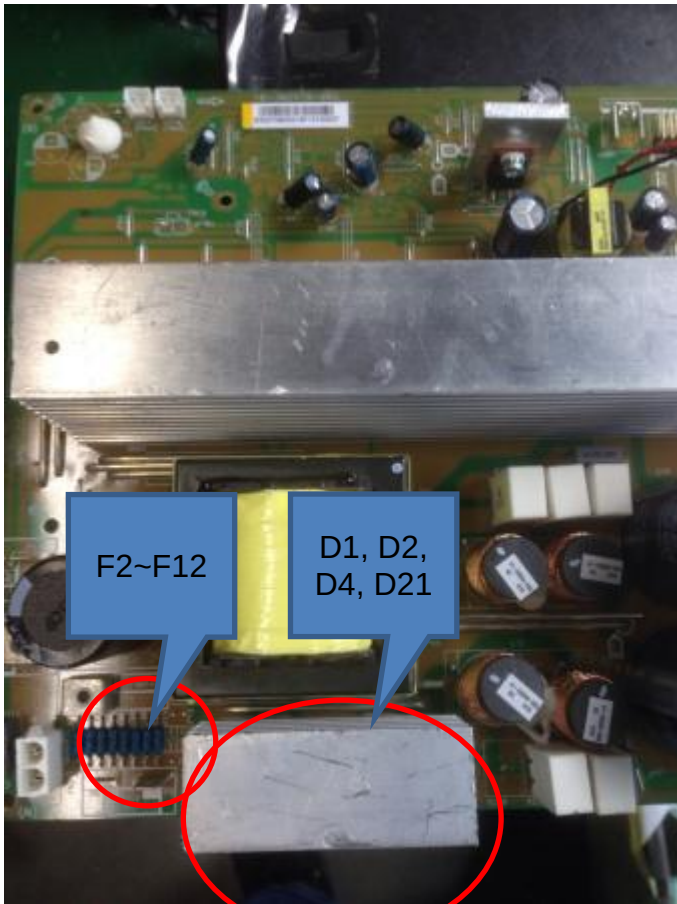
Step	Checked components	Instrument function	Reference Value	Failed condition
1	MOSFET Q2, Q4, Q6 Q20,Q28,Q29 S,D D,S; G,S; G,D	Diode Diode	~0.46 >0.6	Short Short or <0.6
2	Fuse F2~F9 F12~F13	Resistance	0 ohm	Open
3	Diode D3, D14, D17, D24, D35, D41, D43, D48, D44, D46, D49, D50, D15,D18,D16,D23, TVS1,TVS2	Diode	~0.42	Short or open
4	Resistor R31, R35, R44, R54,R56,R228	Resistance	~22 ohm	>25 ohm or Open



---3K (PCB: 16-302479-XXG)

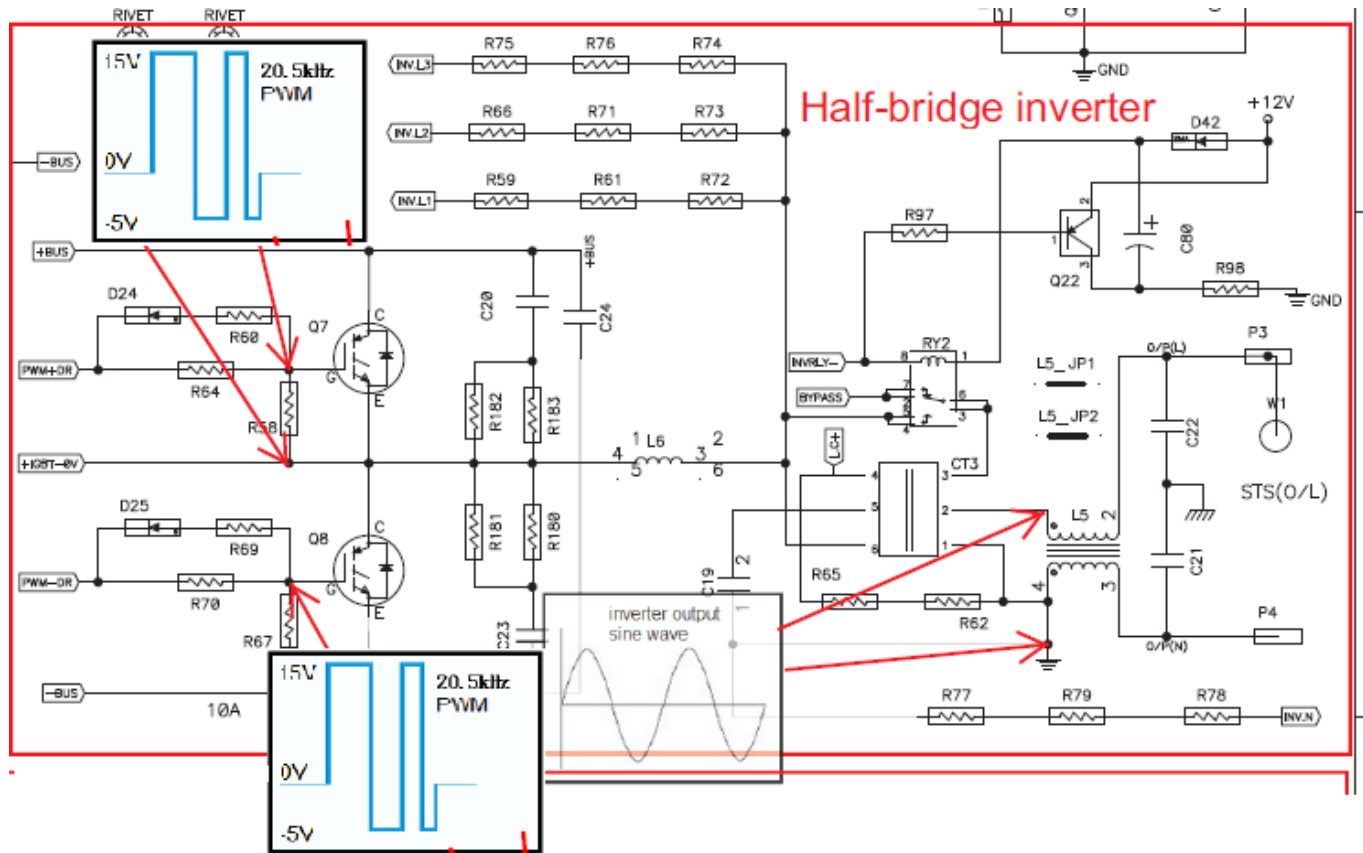


Step	Checked components	Instrument function	Reference Value	Failed condition
1	MOSFET Q2, Q4, Q6 Q20,Q28,Q29 S,D D,S; G,S; G,D	Diode Diode	~0.46 >0.6	Short Short or <0.6
2	Fuse F2~F12	Resistance	0 ohm	Open
3	Diode D1, D2, D4, D21, D35, D41, D43, D48, D44, D46, D49, D50 D15,D18,D16,D23, TVS1,TVS2	Diode	~0.42	Short or open
4	Resistor R31, R35, R44, R54,R56,R228	Resistance	~22 ohm	>25 ohm or Open

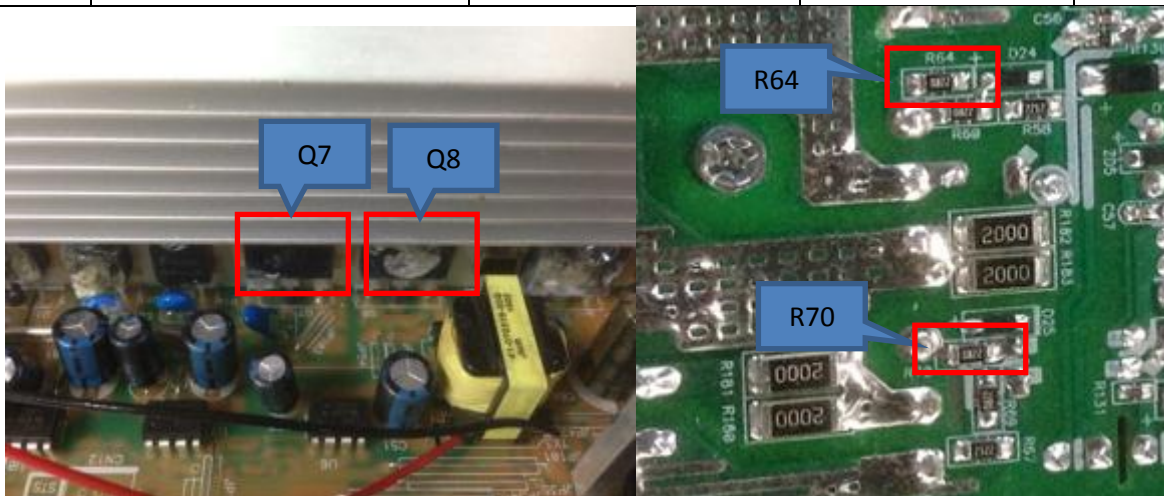


4, DC/AC INVERTER:

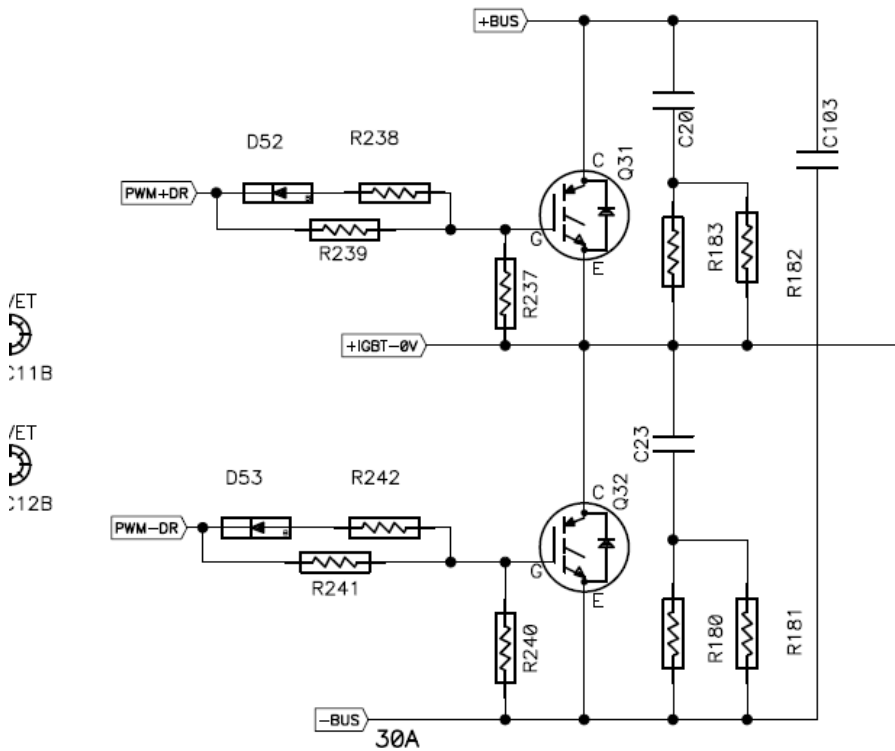
---1~2K (PCB: 16-302286-XXG&16-302287-XXG)



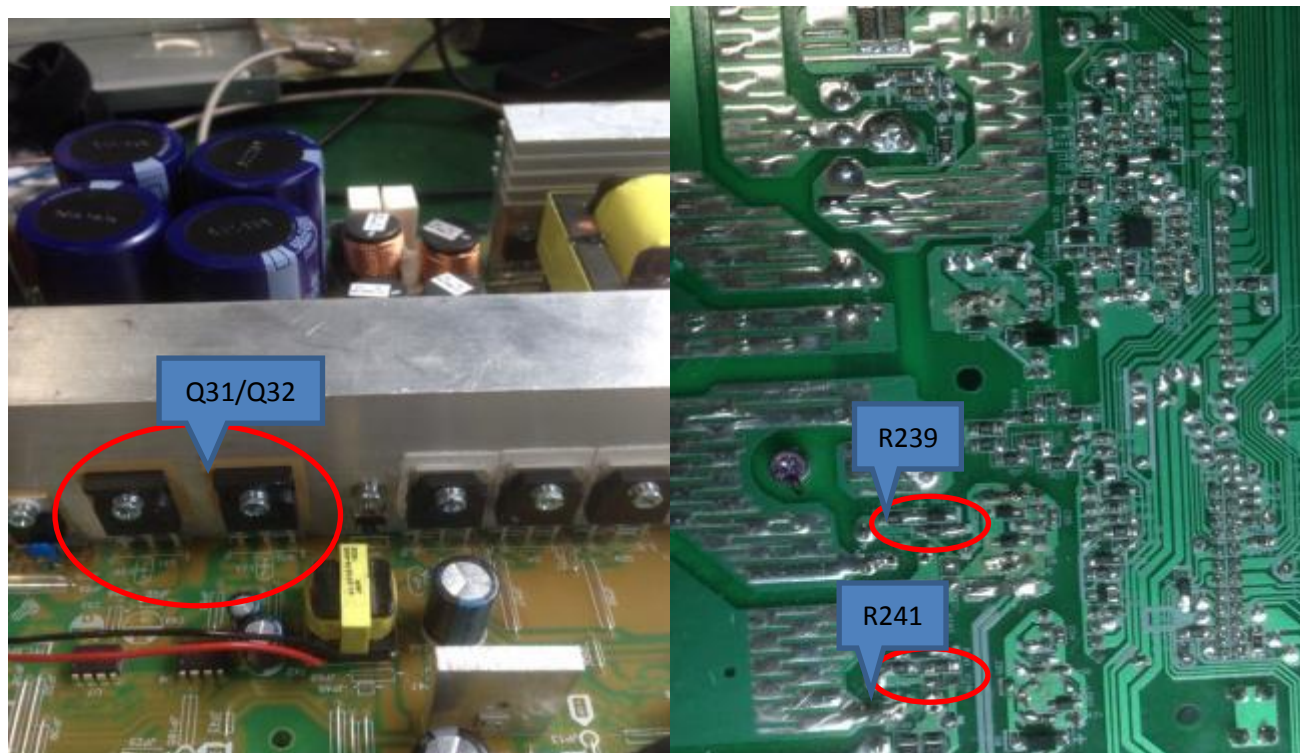
Step	Checked components	Instrument function	Reference Value	Failed condition
1	IGBT Q7, Q8 (E,C) (G,E; C,E)	Diode Diode	~0.47 Open	Short or open Short
2	Resistor R64, R70	Resistance	~22 ohm	>25 ohm or Open



---3K (PCB: 16-302479-XXG)

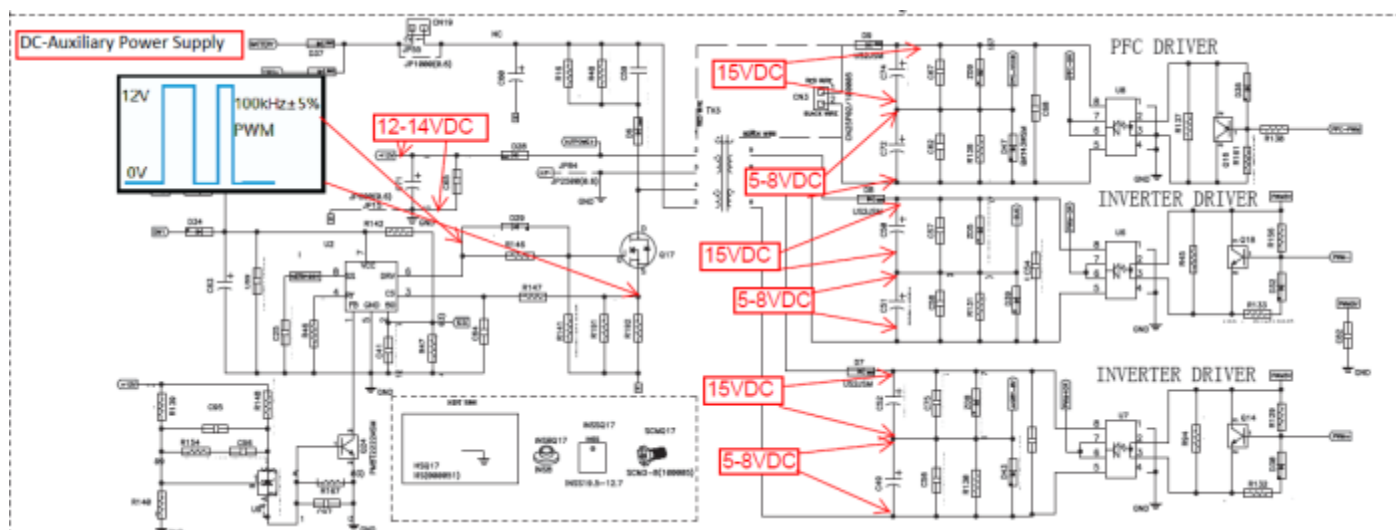


Step	Checked components	Instrument function	Reference Value	Failed condition
1	IGBT Q31, Q32 (E,C) (G,E; C,E)	Diode Diode	~0.44 Open	Short or open Short
2	Resistor R239, R241	Resistance	~22 ohm	>25 ohm or Open



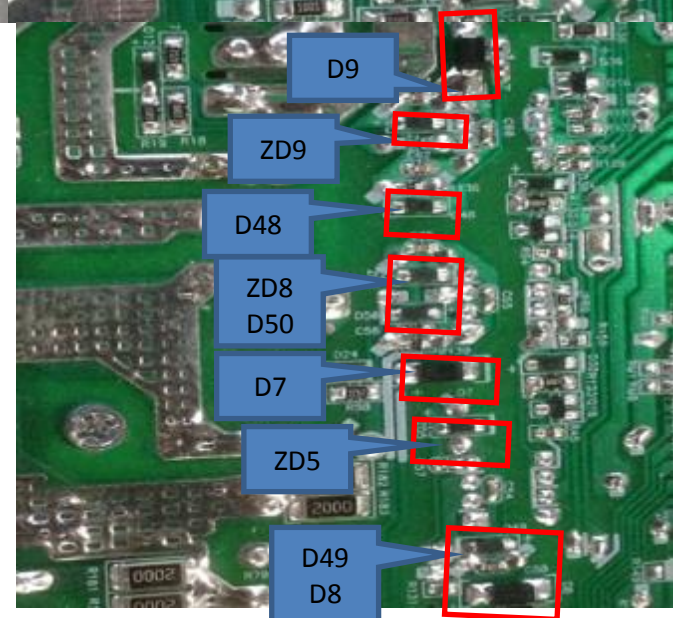
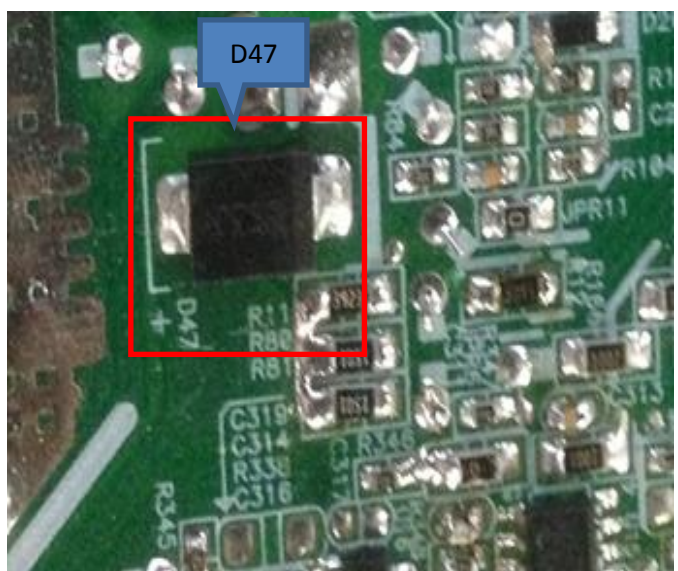
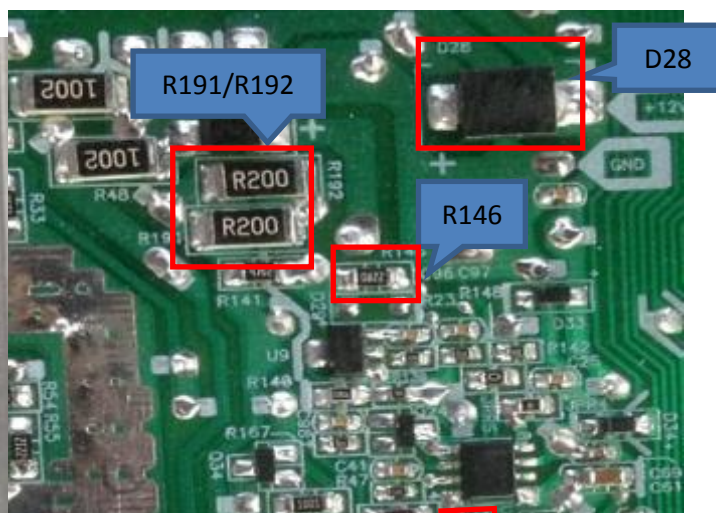
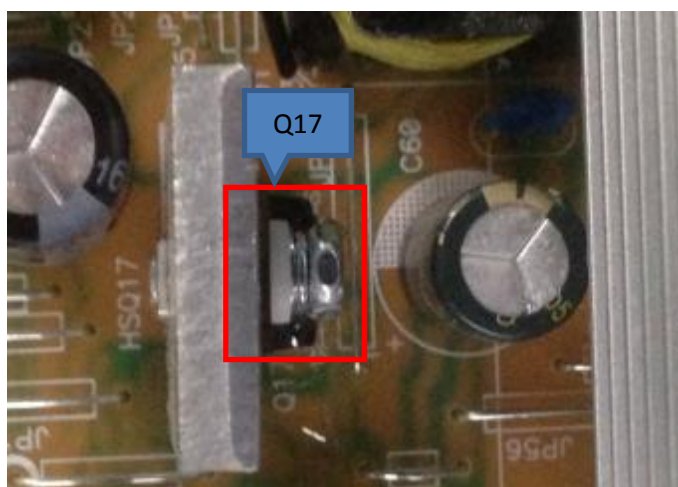
5, DC POWER SUPPLY:

---1~2K (PCB: 16-302286-XXG&16-302287-XXG)

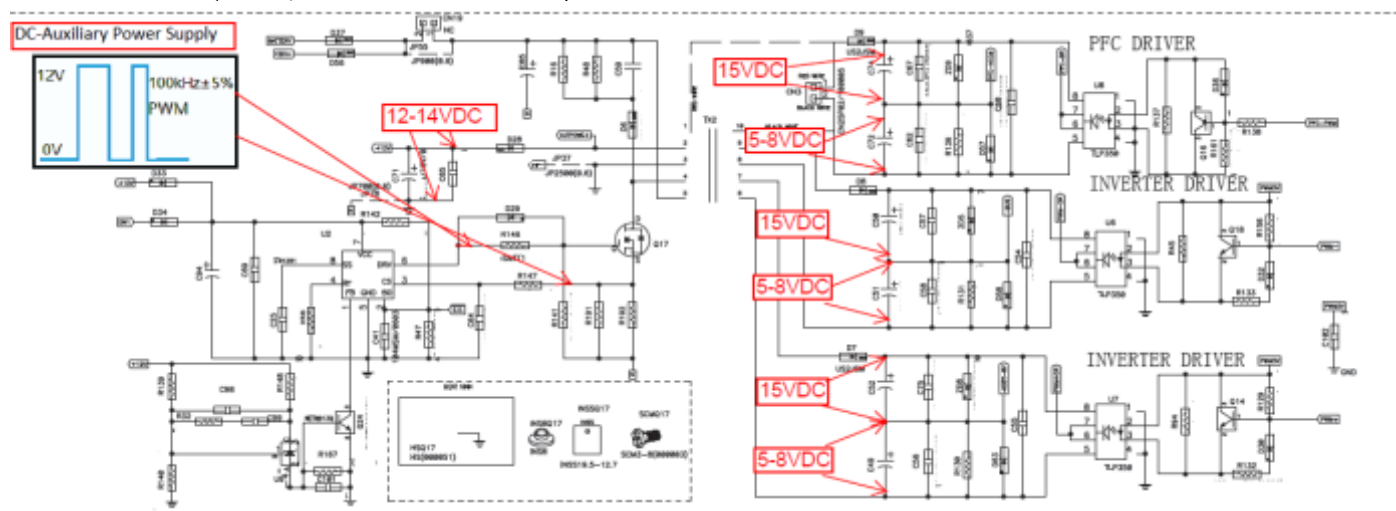


Step	Checked components	Instrument function	Reference Value	Failed condition
1	MOSFET Q17 S,D D,S; G,S; G,D	Diode Diode	~0.53 >0.6	Short Short or <0.6
2	Diode D47, D28	Diode	~0.34	Short or open
3	Resistor R191, R192	Resistance	~0.2	>1 ohm

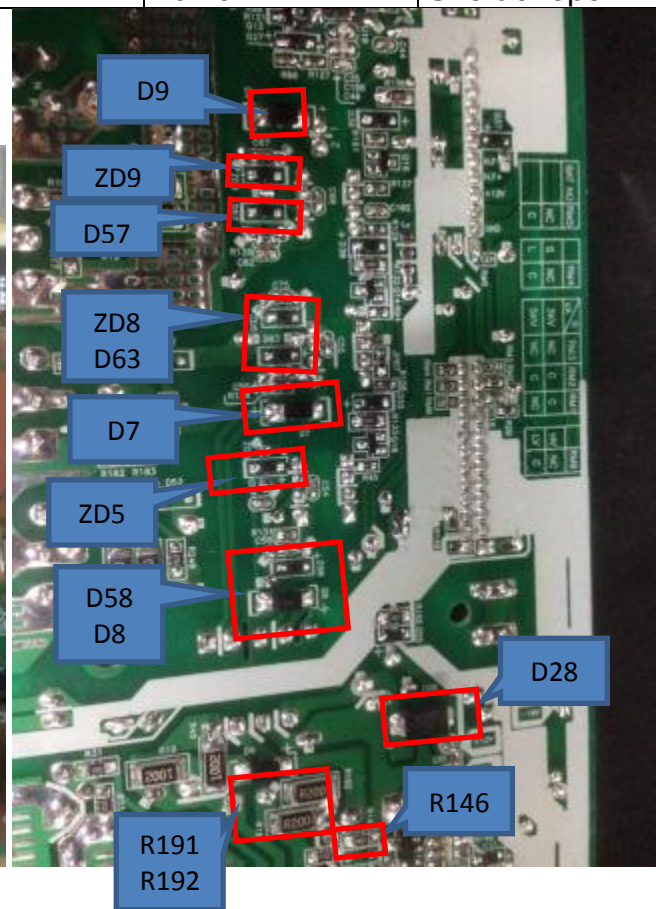
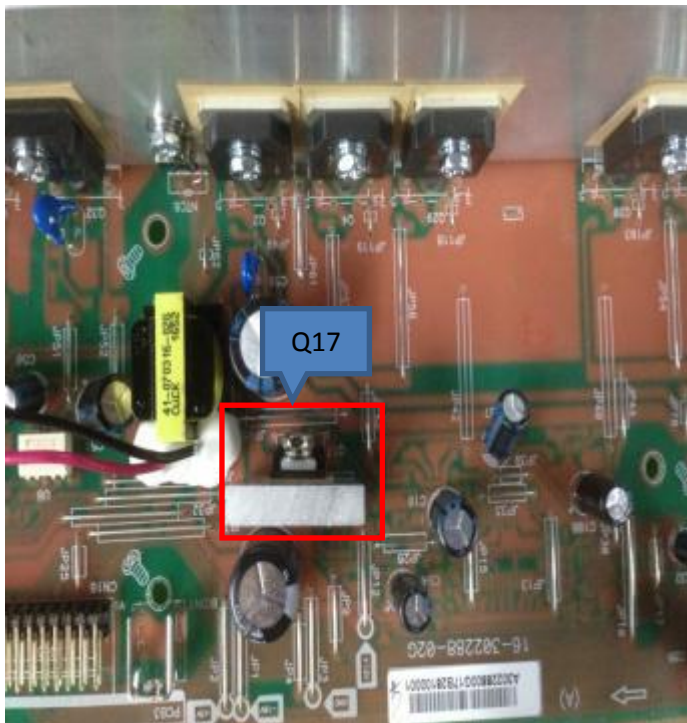
4	Resistor R146	Resistance	~22 ohm	>15ohm
5	Diode D7, D8, D9	Diode	~0.49	Short or open



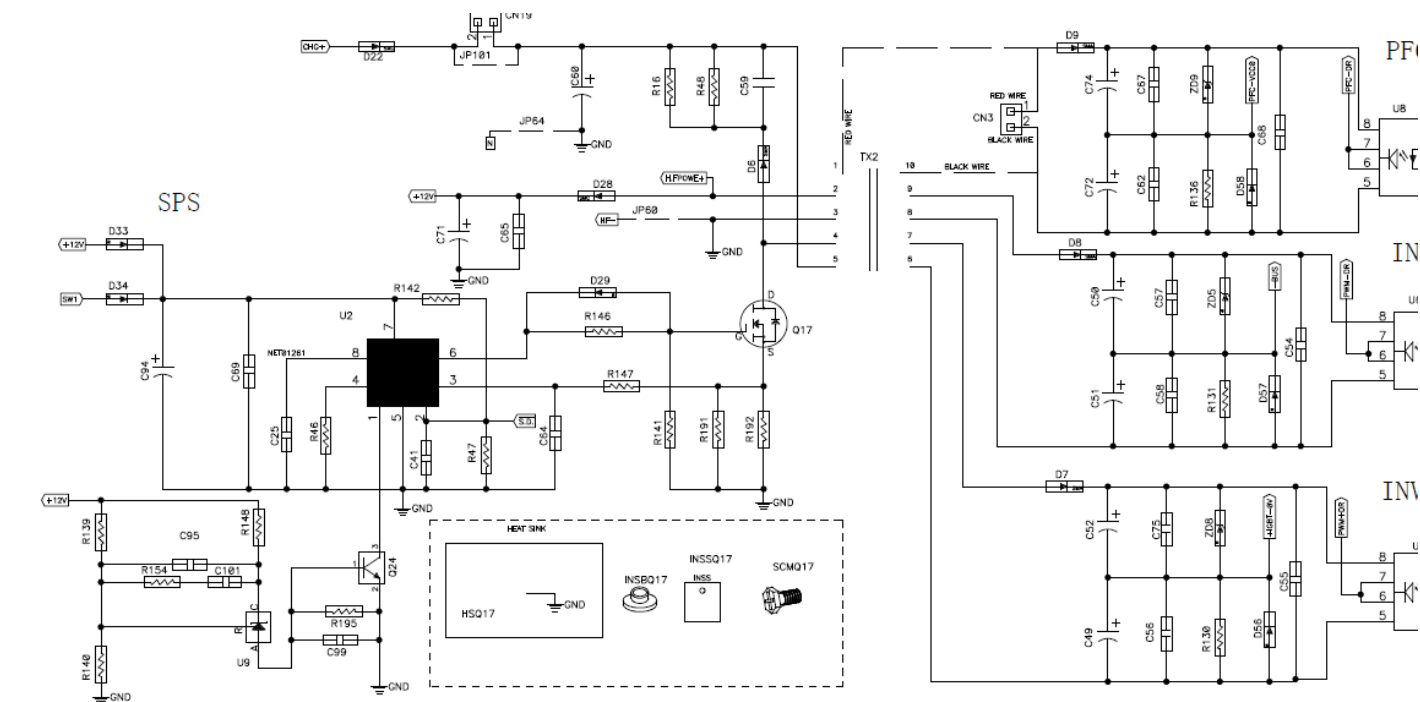
---3K tower (PCB: 16-302288-XXG)



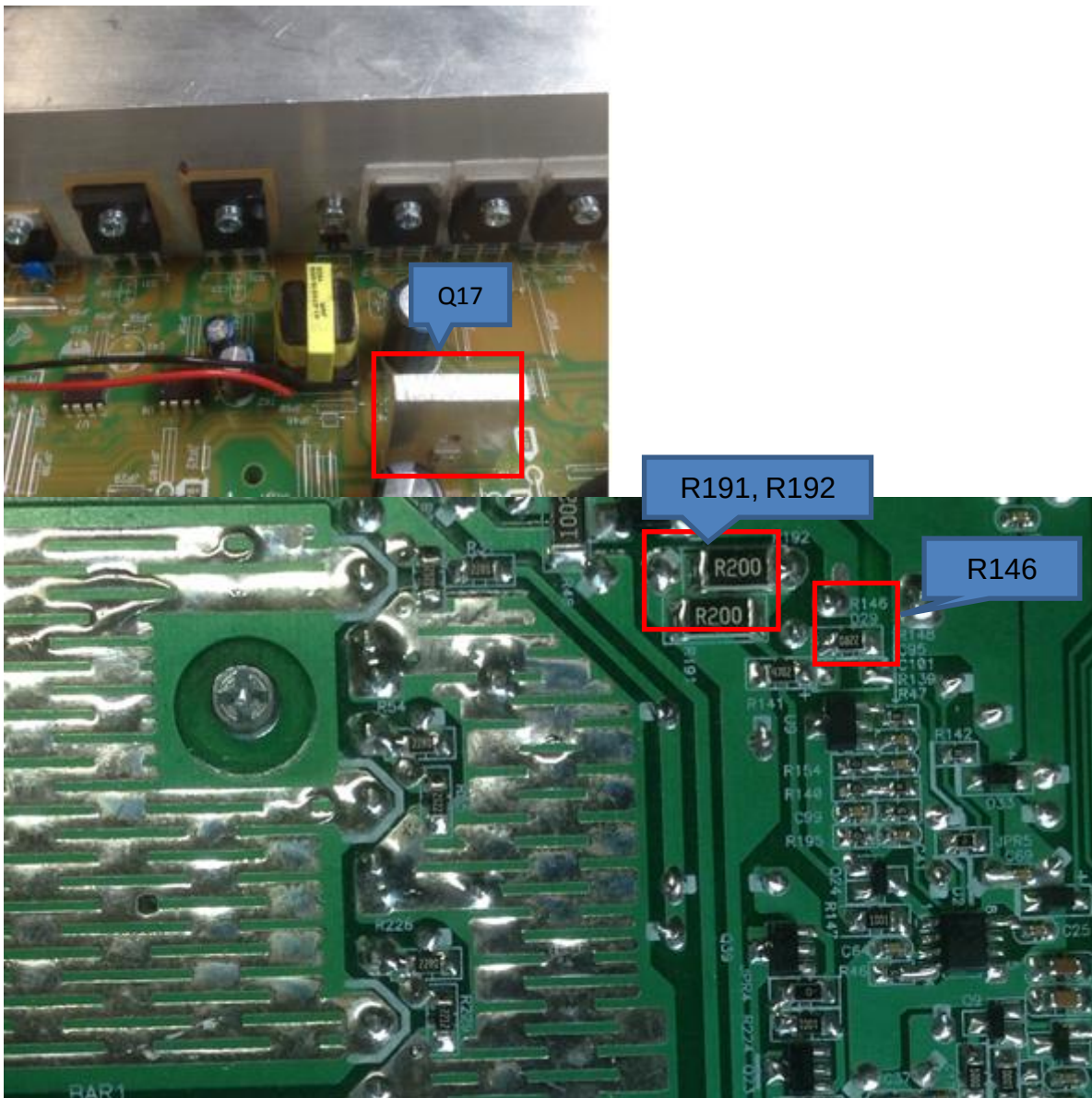
Step	Checked components	Instrument function	Reference Value	Failed condition
1	MOSFET Q17 S,D D,S; G,S; G,D	Diode	~0.53 >0.6	Short Short or <0.6
2	Diode D28, D56,ZD5,ZD8,ZD9,D57,D 58,D63	Diode	~0.34	Short or open
3	Resistor R191, R192	Resistance	~0.2	>1 ohm
4	Resistor R146	Resistance	~22ohm	>15ohm
5	Diode D7, D8, D9	Diode	~0.49	Short or open



---3K (PCB: 16-302479-XXG)



Step	Checked components	Instrument function	Reference Value	Failed condition
1	MOSFET Q17 S,D D,S; G,S; G,D	Diode Diode	~0.53 >0.6	Short Short or <0.6
2	Diode D22, D28	Diode	~0.34	Short or open
3	Resistor R191, R192	Resistance	~0.2	>1 ohm
4	Resistor R146	Resistance	~22ohm	>15ohm
5	Diode D7, D8, D9	Diode	~0.49	Short or open



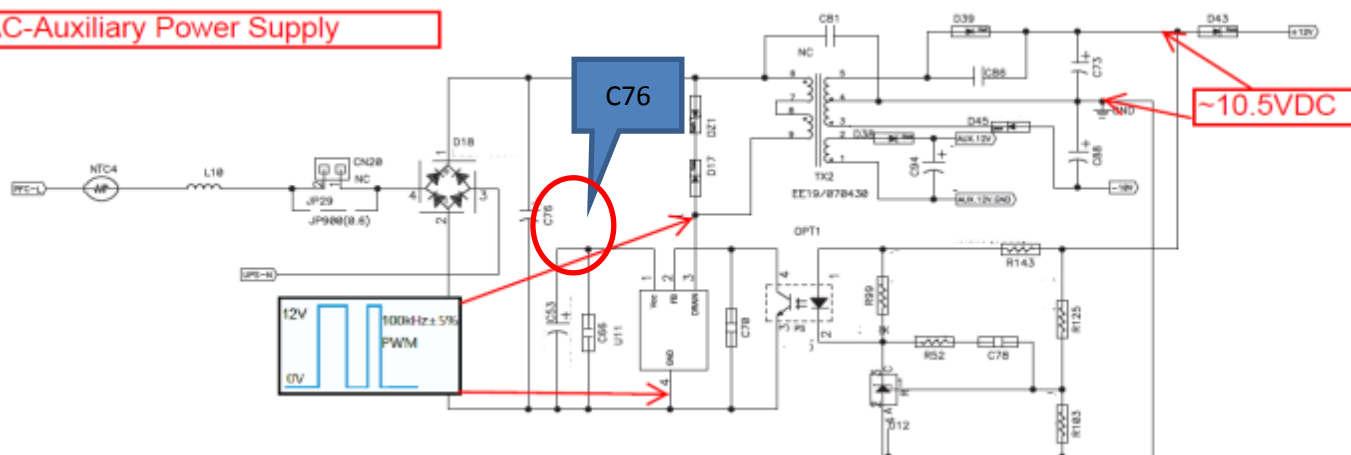
6,AC-Auxiliary Power Supply:

Remark:

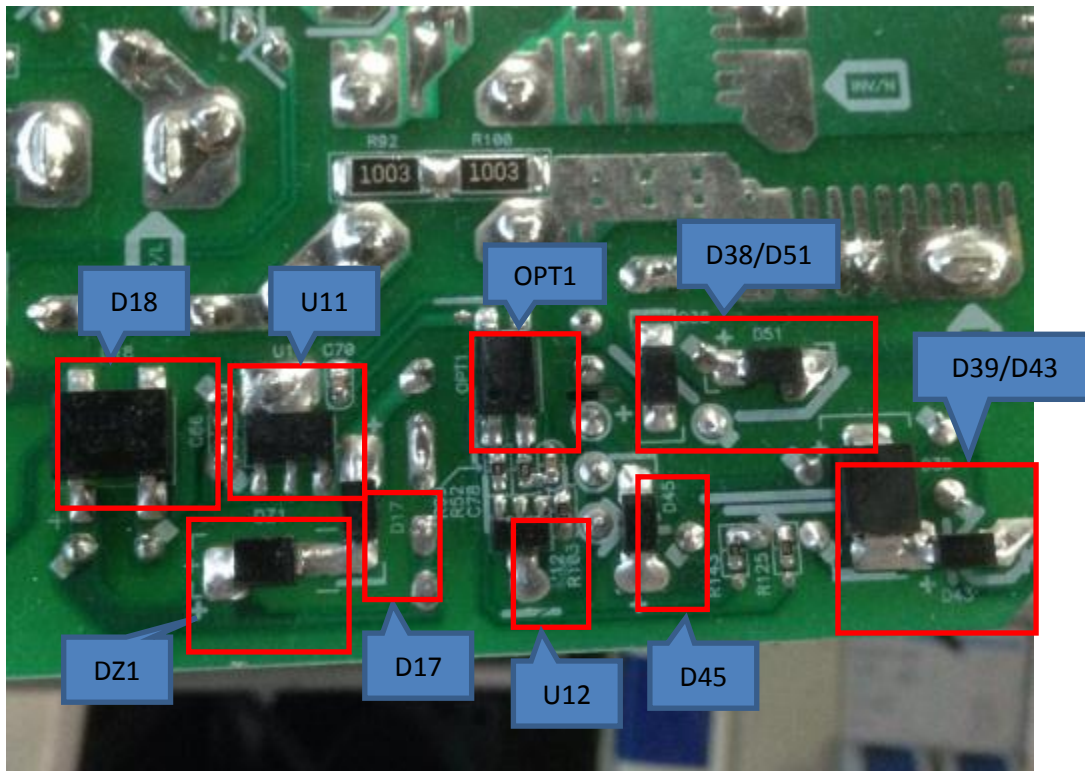
If U11 fails, you should check if the C76 Soldering is cracked or not. If the soldering is cracked, it will damage the control IC(U11).

---1~2K (PCB: 16-302286-XXG&16-302287-XXG&16-302663-XXG&16-302664-XXG)

AC-Auxiliary Power Supply

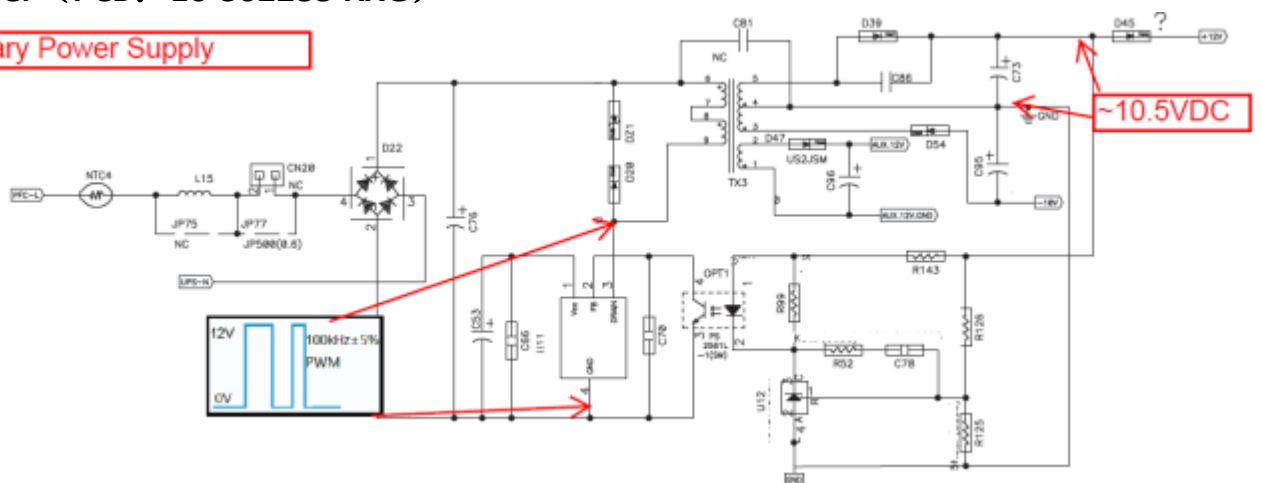


Step	Checked components	Instrument function	Reference Value	Failed condition
1	MOSFET U11 2-4 1-4, 3-4	Diode Diode	~0.52 >0.7	Short Short or open
2	Diode D18 D17,DZ1,D43,D51,D38,D45 D39	Diode Diode Diode	~0.55 ~0.48 ~0.43	Short or open Short or open Short or open
3	PHOTOTRANSISTOR OTP1 1-2 3-4	Diode Diode	~0.7 ~0.9	Short or open Short or open
4	Diode U12 2-3	Diode	~0.6	Short or open



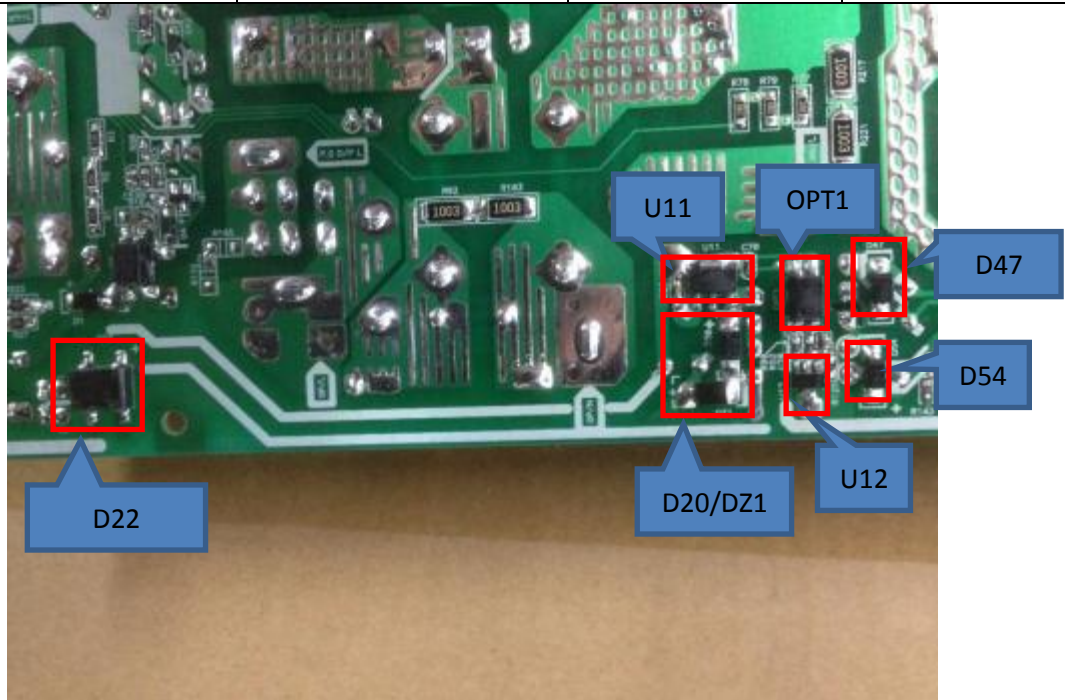
---3K tower (PCB: 16-302288-XXG)

AC-Auxiliary Power Supply

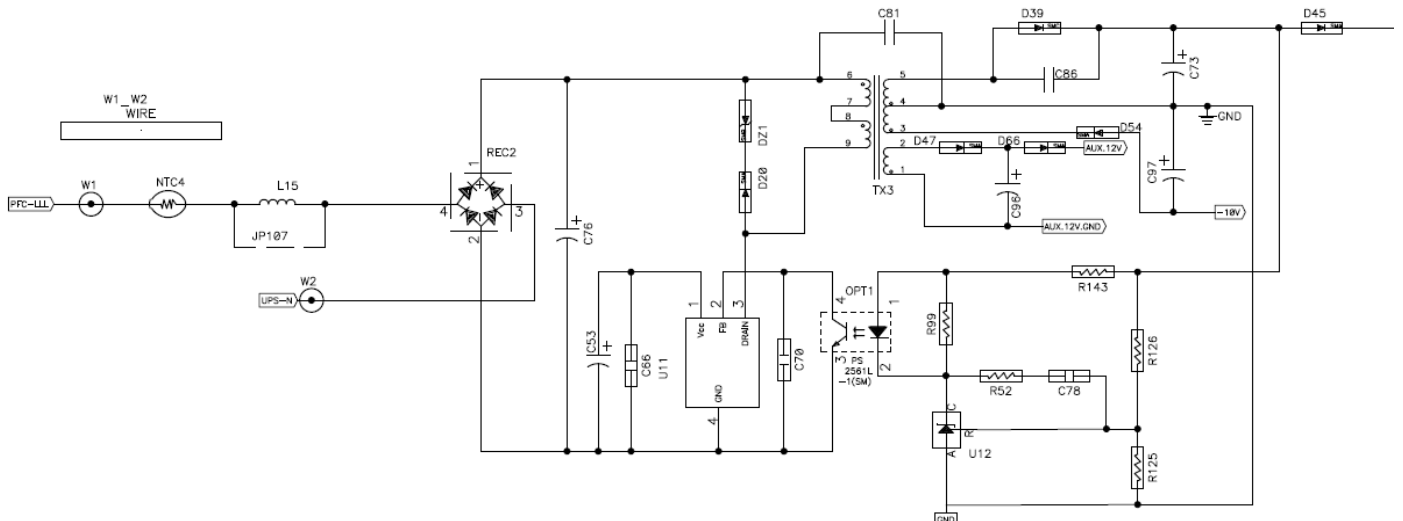


Step	Checked components	Instrument function	Reference Value	Failed condition
1	MOSFET U11			
	2-4	Diode	~0.52	Short
	1-4, 3-4	Diode	>0.7	Short or open
2	Diode D22	Diode	~0.55	Short or open
	Diode D20,DZ1,D47,D54,D66,D45	Diode	~0.48	Short or open
	Diode D39	Diode	~0.43	Short or open

3	PHOTOTRANSISTOR OTP1 1-2 3-4	Diode Diode	~0.7 ~0.9	Short or open Short or open
4	Diode U12 2-3	Diode	~0.6	Short or open

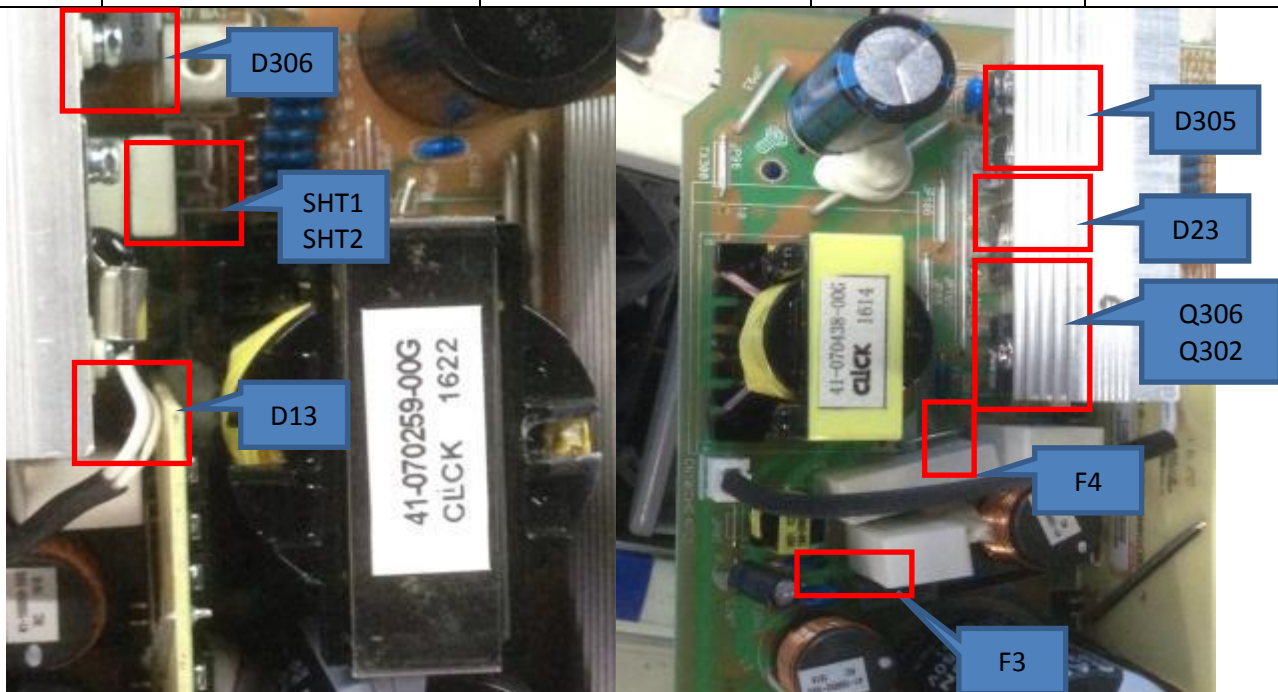


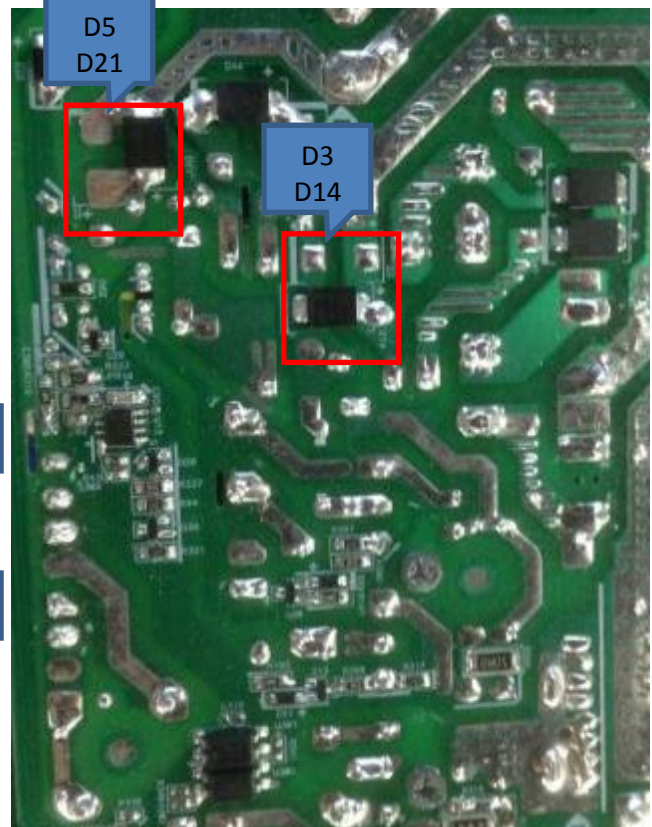
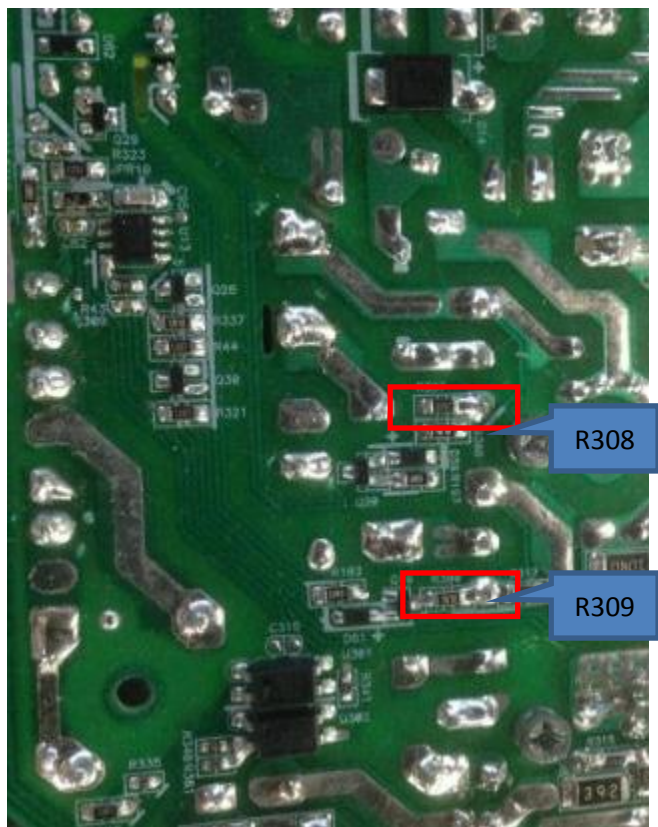
---3K RACK (PCB: 16-302479-XXG)



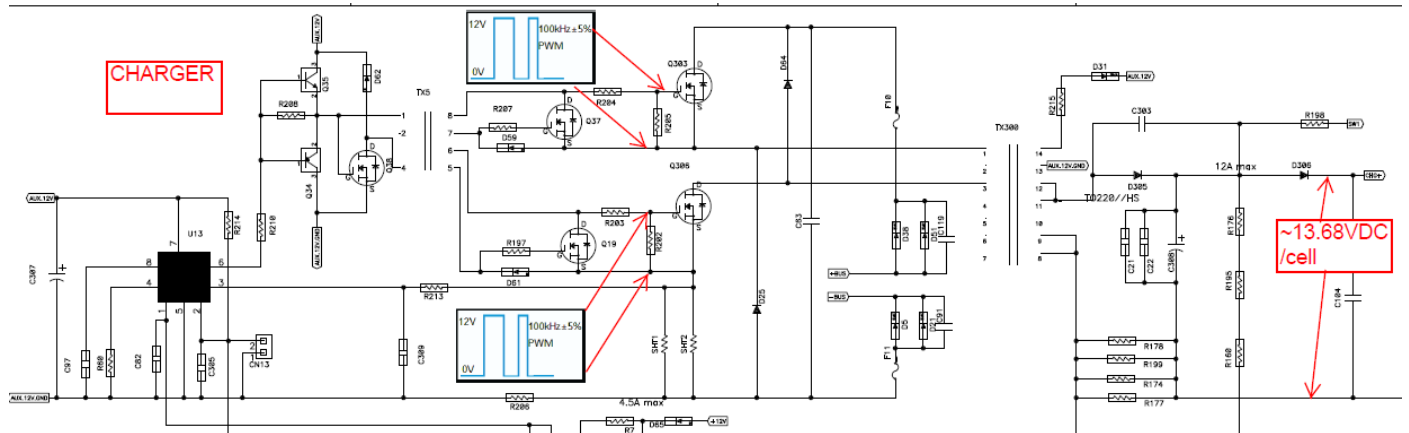
Step	Checked components	Instrument function	Reference Value	Failed condition
1	MOSFET U11 2-4 1-4, 3-4	Diode Diode	~0.52 >0.7	Short Short or open
2	Diode D22 D20,DZ1,D47,D54,D66,D45	Diode Diode	~0.55 ~0.48	Short or open Short or open

	S,D	Diode	~0.49	Short
	D,S; G,S; G,D	Diode	>0.6	Short or <0.6
2	Fuse F3,F4	Resistance	0 ohm	Open
3	Diode			
	D305	Diode	~0.39	Short or open
	D306	Diode	~0.43	Short or open
	D13 D23	Diode	~0.43	Short or open
	D3 D14 D5 D21	Diode	~0.43	Short or open
4	Resistor SHT1,SHT2 R174,R177,R178,R179	Resistance	~0.1	>1 ohm
5	Resistor R308 R309	Resistance	~4.7 ohm	>40ohm



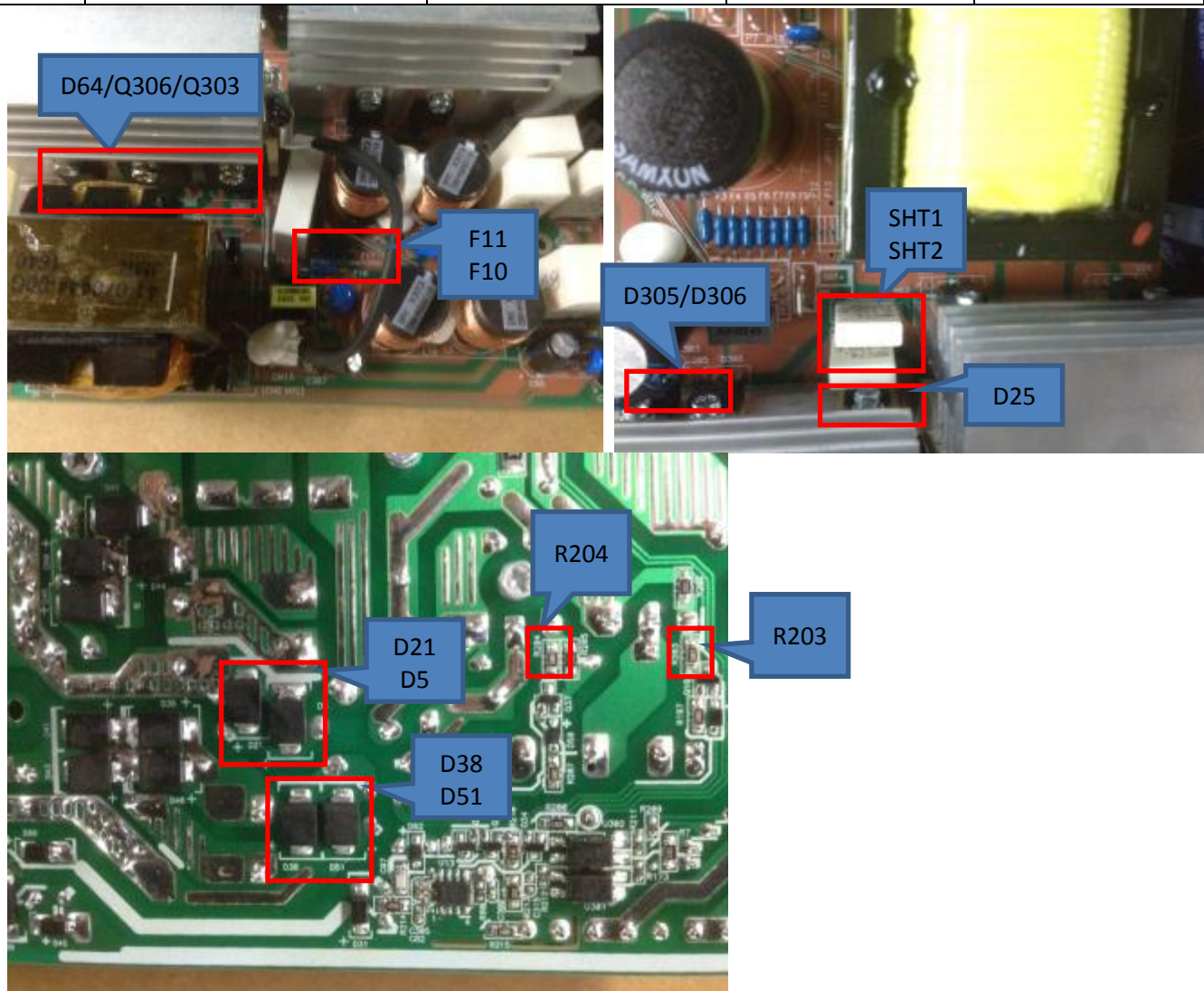


---3K (PCB: 16-302288-XXG)

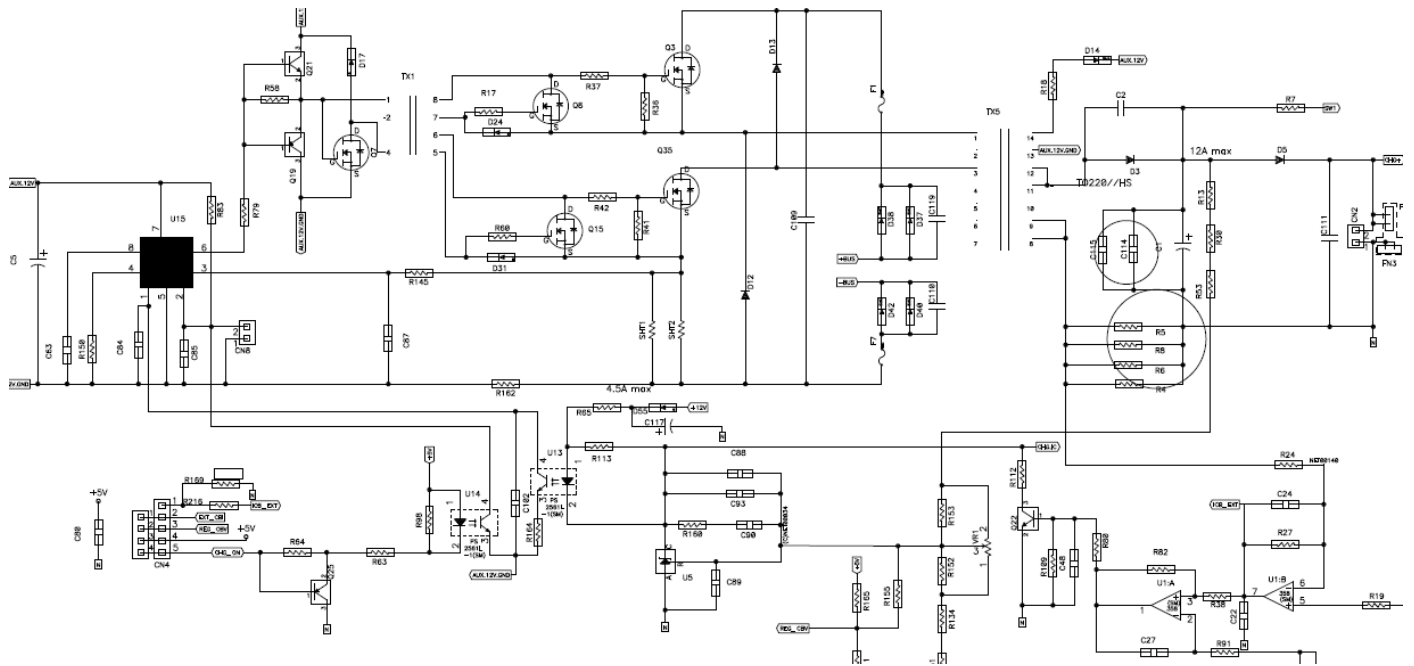


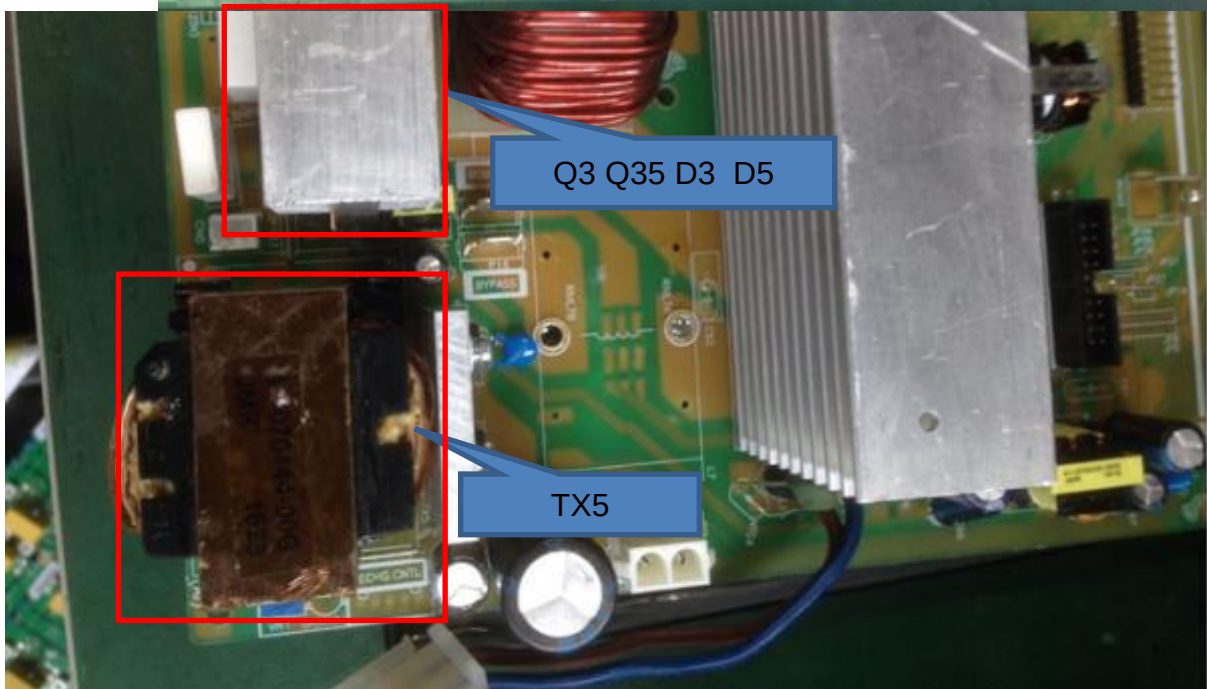
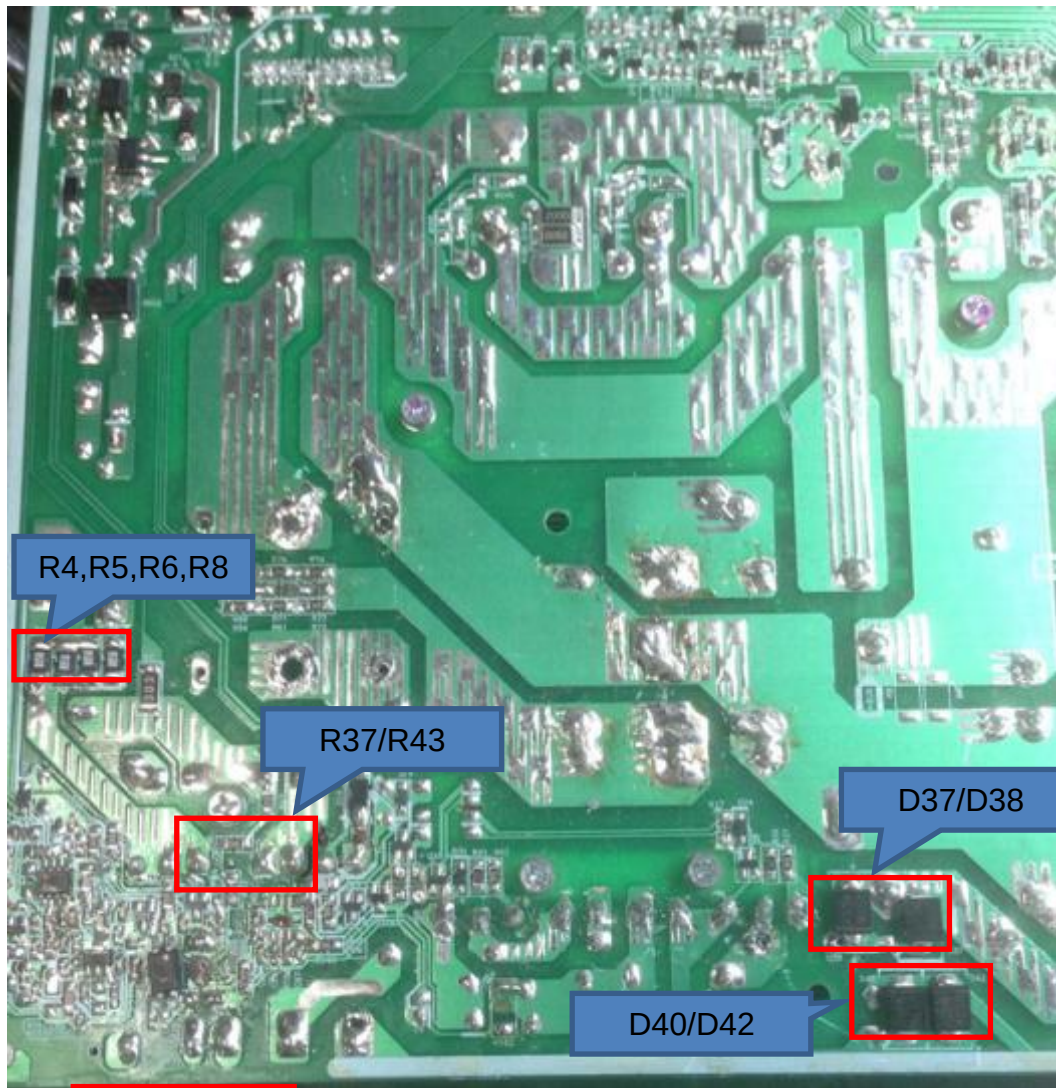
Step	Checked components	Instrument function	Reference Value	Failed condition
1	MOSFET Q303 Q306 S,D D,S; G,S; G,D	Diode Diode	~0.49 >0.6	Short Short or <0.6
2	Fuse F10 F11	Resistance	0 ohm	Open
3	Diode D305 D306	Diode Diode	~0.39 ~0.43	Short or open Short or open

	D25 D64	Diode	~0.43	Short or open
	D5,D21,D38,D51	Diode	~0.43	Short or open
4	Resistor SHT1,SHT2 R174,R177,R178,R179	Resistance	~0.1	>1 ohm
5	Resistor R203 R204	Resistance	~4.7 ohm	>30ohm



---3K (PCB: 16-302479-XXG)





After you have replaced all defect components on power stage (PSDR), connect with control board. Supply appropriate DC voltage 3Amp (limited current) with DC power via BAT+ and BAT-, then turn on the switch on panel, you will see "current limit" on the DC power supply for about 2 seconds (If not, there are some defective components you have not found).

When everything seems good, turn off the switch on panel and remove DC power supply. Plug in the power cord and supply UPS with the mains. Test the output voltage of charger is OK or not. The fan will also active. If there is no problem in charger, connect the batteries via BAT+ and BAT-. Finally, turn on the switch on panel again and follow the maintenance circuit diagram to check the voltage on DC bus, output voltage, or other signals.

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

APPENDIX I: COMMUNICATION

1. RS232 PORT

The RS232 provides proprietary command sequence for the computer to monitor the line and UPS status and to control the UPS. The data format is listed as following:

BAUD RATE.....: 2400 bps

DATA LENGTH.....: 8 bits

STOP BIT.....: 1 bit

PARITY.....: NONE

The interface configuration is indicated in figure VI-1 and the pin assignment and description are listed in the following table.

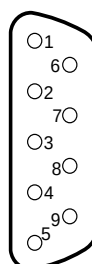


Figure VI-1 9 pins female D-type connector

PIN #	Description	I/O type
1,4,6,7,8,9	not connected	
3	UPS RS232 receiver Rx from computer.	input
2	UPS RS232 transmitter to computer	output
5	GND	

Note that, the computer will control information exchange by a query followed by <cr> (Character Return). UPS will respond with information followed by a <cr> or action. All the information is provided in ASCII format.

2. USB PORT

The USB is compatible to USB2.0 specification, and implemented for customized HID and self-powered device. The customized HID bi-directionally transfers the UPS protocol from USB to serial communication so that the monitor software can support the 2 communication ports (USB & RS232) with

less effort.

The USB connector is "B" receptacles, seeing the following figure VI-2. The signal definition of USB interface is listed following table.

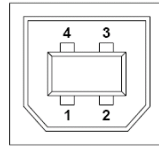
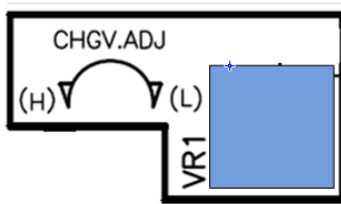


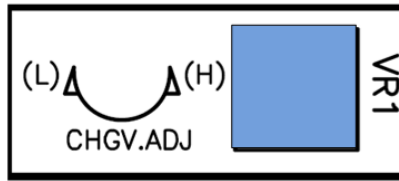
Figure VI-2 USB "B" receptacles

PIN#	SIGNAL
1	VBUS
2	D-
3	D+
4	GND

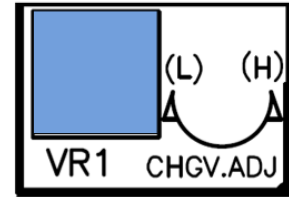
APPENDIX II: : Charger Voltage adjustment



16-302286-XXG
16-302287-XXG



16-302288-XXG



16-302479-XXG

Charging Voltage can be adjusted by VR1 On main board,
Adjustment VR1 on clockwise direction , can reduce charging voltage, and vice versa

APPENDIX III: Wiring diagram

See attachments Annexures.rar

APPENDIX IV: circuit diagram

See attachments Annexures.rar



Annexures.rar