3~6KVA-220V/230V

Service manual

SERVICE MANUAL	3~5KVA-220V/230V

Table of contents

1. General information

1.1 Getting start

This manual is used as a checking and repairing guide for 3~5KVA-220V/230V model. Before read this manual, it's better to have some electrical or electronic background knowledge. With this guide, you can fix the inverter by yourself firstly.

There are five main parts of this guide:

General information: This part is the basic information of the inverter; you can start to know the inverter from this chapter.

Troubleshooting: This part will tell you how to do when you face a problem.

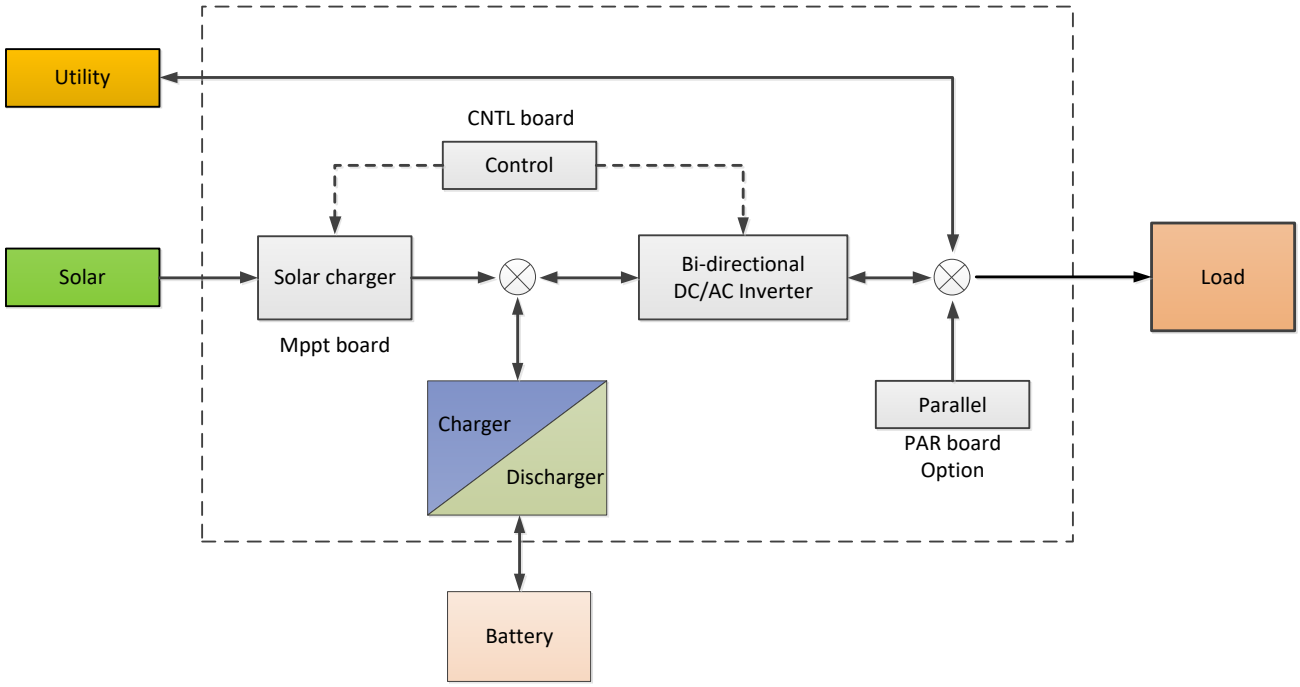
Checking and measuring guide: This part will teach you how to check or repair the inverter by measuring the critical components.

Assembling guide: This part teaches you how to take the board outside and fix the new one.

Cables connection: This part is a reference for cable connection.

1.2 Basic topology introduction

The topology of the inverter shows as below:



Compare with UPS or normal inverter, INVERTER combines a solar charger inside. Solar charger can be a supplement for battery when there is not grid or for saving energy purpose. And with the solar charger, the inverter can have more working modes than UPS. For detail information please refer to our user manual.

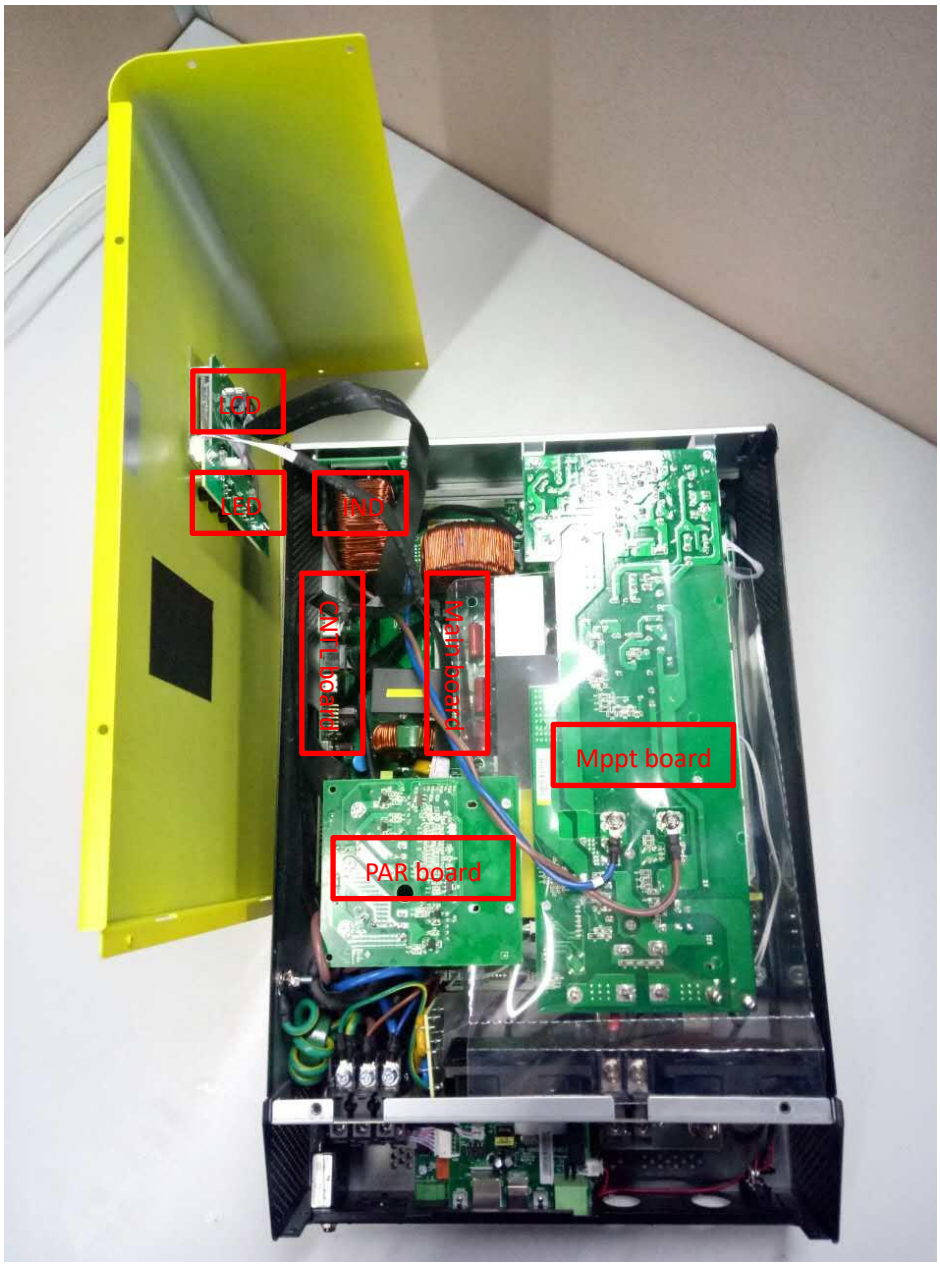
1.3 Inverter family

This service manual includes different models of the inverter, the table as below contains some important parameters with different models.

These models names are only neutral names; please match the real model name of your inverter to the model name in the table by comparing the typical characteristics.

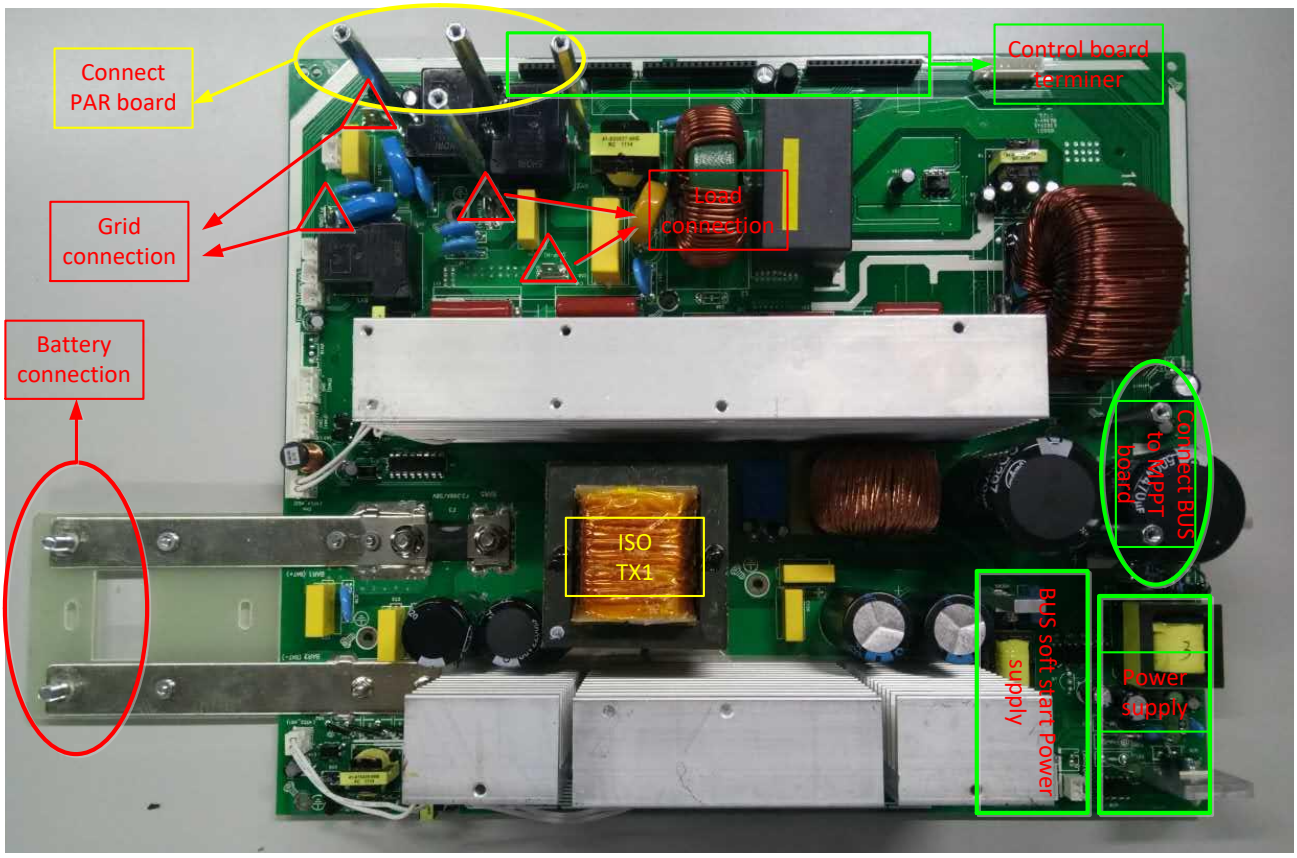
Model name	Power rating	Solar charger type	Solar charger number	Off-grid/Hybrid
Inverter with MPPT 3KVA	3KVA/3KW	MPPT	1	Hybrid
Inverter with MPPT 5KVA	5KVA/5KW	MPPT	1	Off-grid

1.4 Overview the inverter

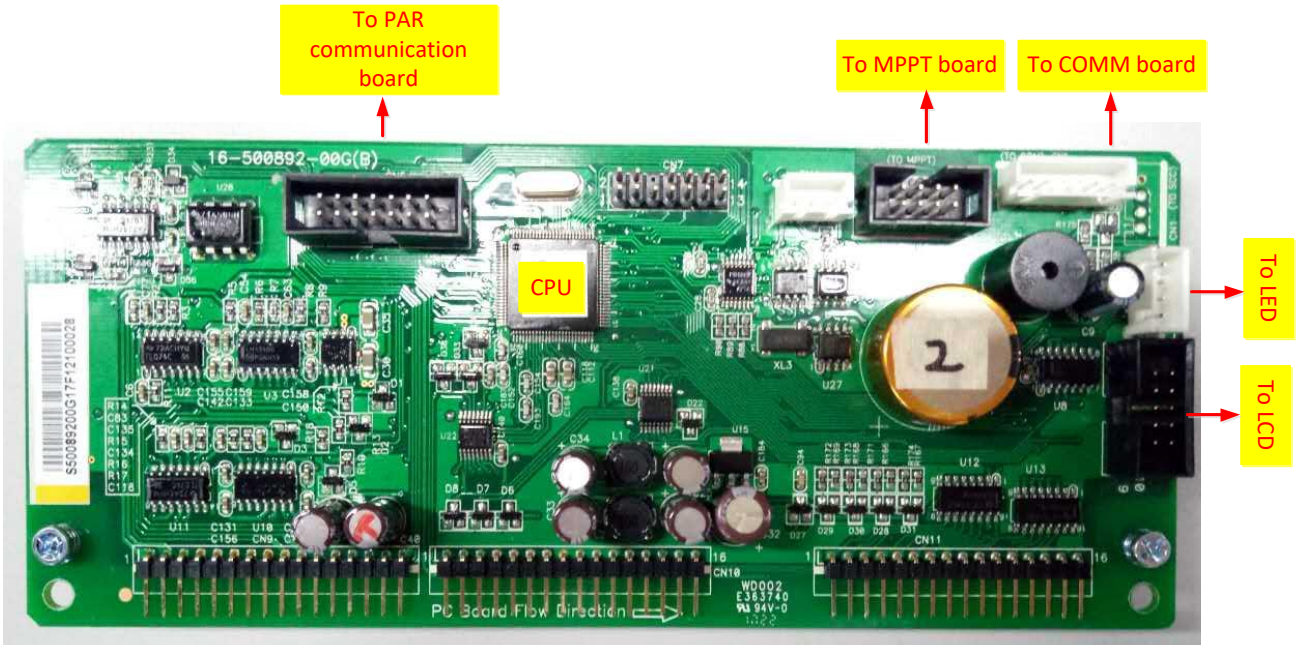


1.5 PCB overview

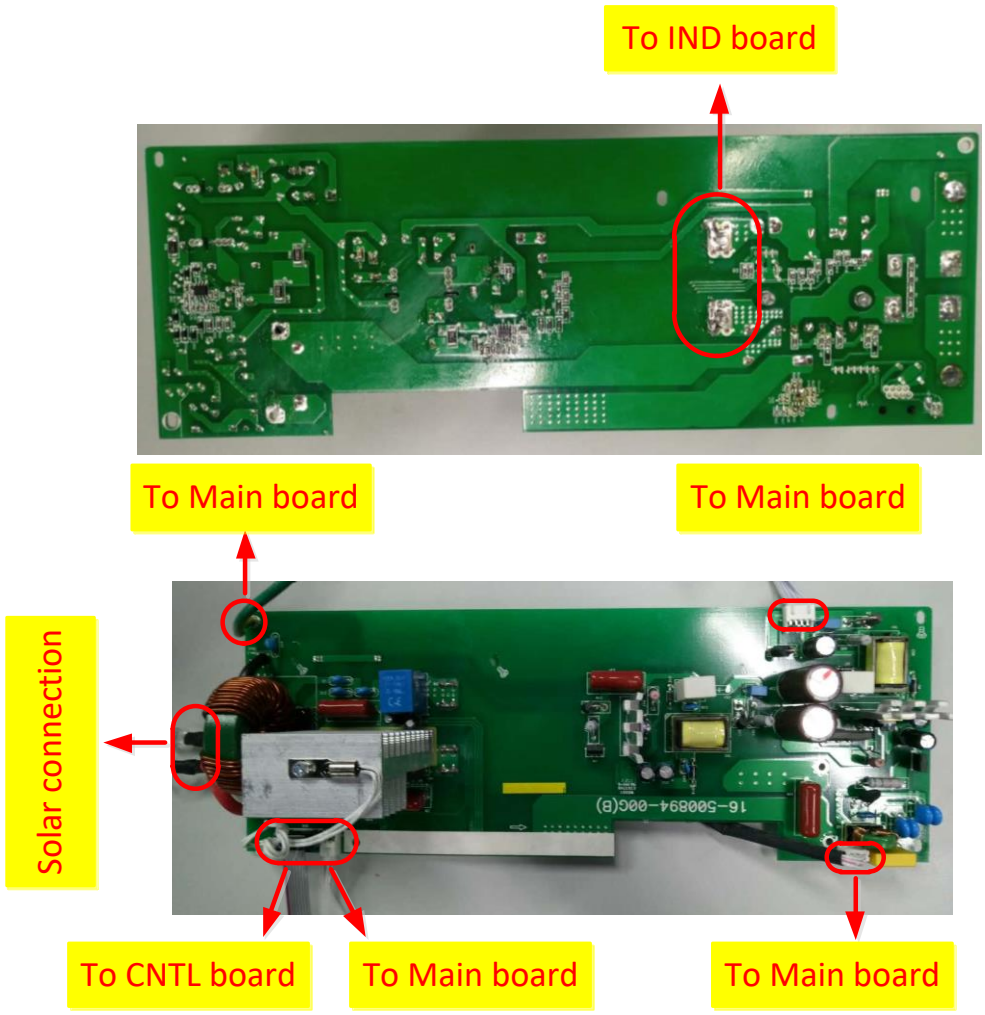
Main board:



Control board:



MPPT board:



2. Troubleshooting

2.1 How to do

When the inverter was faulty, normally there are two main symptoms:

- No display at all;
- Fault code or warning code on the LCD;

When the fault occurred, please help to record the fault information and follow “How to check” of part 2.3 to check the inverter, then feedback the checking result to the service center. It will be very helpful for solving the problem as soon as possible.

2.2 Check the fault information

Please follow the steps as below to find the issues!

Make sure that you can finish all the steps and feedback us the results. Or we may not be able to give you the right solution.

Step 1: Test the battery working mode.

Before turning on the inverter, only connect the battery with the inverter which means no solar input and

grid input. Turn on the switch, the LCD will light up and wait for the battery connecting to load.
If the connection is failed, please record the fault code.

Step 2: Test the grid charging mode.

Before turning on the inverter, only connect the utility and battery with the inverter. Without press any buttons, the LCD will light up. And wait for the utility connecting to battery.
If the connection is failed, please record the fault code.

Step 3: Test the solar charging mode.

Before turning on the inverter, only connect the solar and battery with the inverter. Without press any buttons, the LCD will light up. And wait for the solar connecting to battery.
If the connection is failed, please record the fault code.

2.3 Fault condition

Note:
When open the top cover, please have a look first, are there any obviously damaged parts?
When take the main board out, please have a look around, are there any obviously damaged parts?

2.2.1. Not working at all/ No display

Description	The inverter couldn't startup completely.
Possible reason	1. SPS module damaged. 2. PAR board or control board damaged
How to check	1. Firstly, please measure the resistance between BAT+ and BAT-. If it is not shorted, only connect the inverter with battery, and press "ON" button, could the inverter startup? If not, please check the fan. 2. If the LCD couldn't light up and fan doesn't work, please disconnect all the wires and open the top cover, and then take the main board outside by following part 4. 3. Check the main board by following "3.7" 4. If the fans are working without LCD display, please open the cover, and disconnect the cable between PAR board and main board. Then check the inverter again. You can follow part "3.12" to check PAR board.
How to solve	Repair the main or PAR board or replace it directly.

2.2.2. 01 fault

Description	Fan abnormal.
Possible reason	There was something wrong with fans or the fan driver has something wrong.
How to check	Replace the fans first, if the issue still exist, please check the main board by following "3.11".
How to solve	Replace the fan or repair the main board.

2.2.3. 02 fault

Description	Over temperature.
Possible reason	The NTC is damaged.
How to check	Check the inverter by following “3.10”
How to solve	Replace the NTC and resistors.

2.2.4. 03 fault

Description	Battery voltage is too high.
Possible reason	1. Battery voltage is too high 2. The battery detecting resistors were damaged.
How to check	When the fault happened, please read the battery voltage in the LCD first, and compare with the actual battery voltage. If the battery voltage in the LCD is 120V, the main board may have the problem.
How to solve	Replace the main board.

2.2.5. 04 fault

Description	Battery voltage is too low.
Possible reason	The battery voltage is too low
How to check	When the fault happened, please read the battery voltage in the LCD first, if the voltage is too low, please charge the battery.
How to solve	Please charge the battery until the error is gone.

2.2.6. 05 fault

Description	Output shorted circuit.
Possible reason	The load output is shorted circuit.
How to check	In most scenarios, this error is caused by the load output is shorted circuit. Please disconnect the load, and restart the inverter to check if the error will happen again. If not, please check the load wire connection or the load itself.
How to solve	Check the load if it is too heavy or shorted circuit.

2.2.7. 06 fault

Description	Output voltage abnormal
Possible reason	Surge

How to check	1. Startup the inverter only with battery, will the fault come out again? If not, please provide the situation when will the fault occur? 2. Connect the grid and battery, could the inverter charge the battery? 3. If step 1 and 2 are both not OK, please check the main board by following “3.4”.
How to solve	Replace the main board.

2.2.8. 08 fault

Description	Bus voltage is too high
Possible reason	Surge
How to check	Restart the inverter, will the fault repeat? If the error 08 is happened only sometimes, it may be caused by the surge from the grid input.
How to solve	We have modified the firmware to improve this case, please update the firmware to check if it will solve this case.

2.2.9. 09 fault

Description	Bus soft start fails.
Possible reason	DC-DC or INV module was damaged.
How to check	Check the main board by following “3.1~3.4”;
How to solve	Repair the main board or replace it directly.

2.2.10. 10 fault

Description	PV current is over.
Possible reason	MPPT board is damaged.
How to check	Check the MPPT board by following “3.5”;
How to solve	Repair the MPPT board or replace it directly.

2.2.11. 11 fault

Description	PV voltage is over.
Possible reason	MPPT board is damaged, or the cable from the control board to MPPT board is loosen.
How to check	Check the MPPT board by following “3.5”, check the cables connection.
How to solve	Repair the MPPT board or replace it directly.

2.2.12. 12 fault

Description	Charging current is over.
Possible reason	The charging components may have the problem.
How to check	Check the main board by following “3.2~3.3”;
How to solve	Repair the main board or replace it directly.

2.2.13. 51 fault

Description	Over current
Possible reason	Surge
How to check	Please restart the inverter, will the error eliminate? If the error is gone, it means the error was caused by the surge from the grid sometimes. The inverter protects by itself. If the error still persists, the problem is from the main board.
How to solve	Repair the main board or replace it directly.

2.2.14. 52 fault

Description	BUS voltage is under.
Possible reason	DC-DC module was damaged.
How to check	Check the main board by following “3.1~3.4”;
How to solve	Repair the main board or replace it directly.

2.2.15. 53 fault

Description	Inverter soft start failed.
Possible reason	Surge
How to check	1. Startup the inverter only with battery, will the fault come out again? If not, please provide the situation when will the fault occur? 2. Connect the grid and battery, could the inverter charge the battery? 3. If step 1 and 2 are both not OK, please check the main board by following “3.4”.
How to solve	Replace the main board.

2.2.16. 55 fault

Description	The dc component of the output voltage is over the limitation.
Possible reason	The half waveform load will cause the unbalance of the sinewave, if the DC

	component of the output sinewave is too high, it will harm the inverter. The inverter needs to protect itself by cutting off the output.
How to check	Please check if the load is the hair drier or similar load.
How to solve	If the load is hair drier, please use no more than 1KW.

2.2.17. 56 fault

Description	Battery couldn't be detected.
Possible reason	Wire connection or fuse was burnt.
How to check	1. Check the wire connection, the priority of the battery cable; 2. Check the main board by following "3.1".
How to solve	Repair the main board or replace it directly.

2.2.18. 57 fault

Description	Current sensor is abnormal.
Possible reason	The control board or main board was damaged.
How to check	Check the control board by following "3.9".
How to solve	Replace the control board or main board.

2.2.19. 58 fault

Description	Output voltage is too low.
Possible reason	The load is too heavy
How to check	1. Startup the inverter only with battery, will the fault come out again? If not, please provide the situation when will the fault occur? 2. Connect the grid and battery, could the inverter charge the battery? 3. If step 1 and 2 are both not OK, please check the main board by following "3.1.2, 3.2.1 and 3.4.1".
How to solve	Replace the main board.

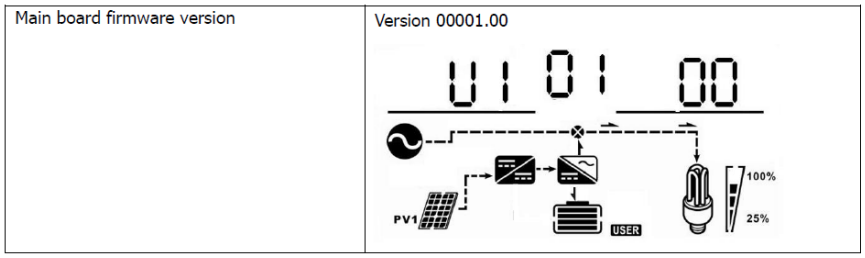
2.2.20. 60 fault

Description	Power feedback protection
Possible reason	Wrong connection of the parallel system
How to check	Please check if only one inverter is showed "HS", and other inverters show "SL"
How to solve	Please set each inverter to "PAL"

2.2.21. 60 fault

Description	Power feedback protection
Possible reason	Wrong connection of the parallel system
How to check	Please check if only one inverter is showed “HS”, and other inverters show “SL”
How to solve	Please set each inverter to “PAL”

2.2.22. 71 fault

Description	Firmware version inconsistent
Possible reason	The firmware version of each inverter is different.
How to check	Please check firmware version in the LCD display: 
How to solve	Update the firmware

2.2.23. 72 fault

Description	Current sensor is abnormal.
Possible reason	The control board was damaged.
How to check	Check the control board by following “3.9”.
How to solve	Replace the control board.

2.2.24. 80/81/82 fault

Description	Parallel function fault
Possible reason	Parallel communication board is not working.
How to check	Please exchange the parallel communication board with other inverter to verify the problem.
How to solve	Replace the parallel communication board.

2.2.25. 83 fault

Description	Battery voltage detected different
Possible reason	The system didn’t share the same battery bank.

How to check	Please use the same battery for all inverters. If the error still persists, please check the battery voltage of each inverter in the LCD display.
How to solve	If the battery voltage has the difference with the real one, please calibrate.

2.2.26. 84 fault

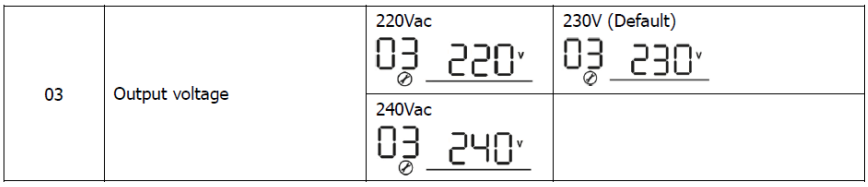
Description	AC input voltage and frequency detected different
Possible reason	The system didn't use the same AC input source.
How to check	Please check the input voltage and frequency in the LCD display.
How to solve	Use the same input source.

2.2.27. 85 fault

Description	Current unbalance between the inverters when working in parallel mode.
Possible reason	Most situations were due to the inappropriate wire connection
How to check	Please help to check the AC input and output, the cables of two inverters should be the same size and same length, and they should connect together to the distributor. And please also check the connectors, have they been screwed tightly?
How to solve	Modify the wire connection.

2.2.28. 86 fault

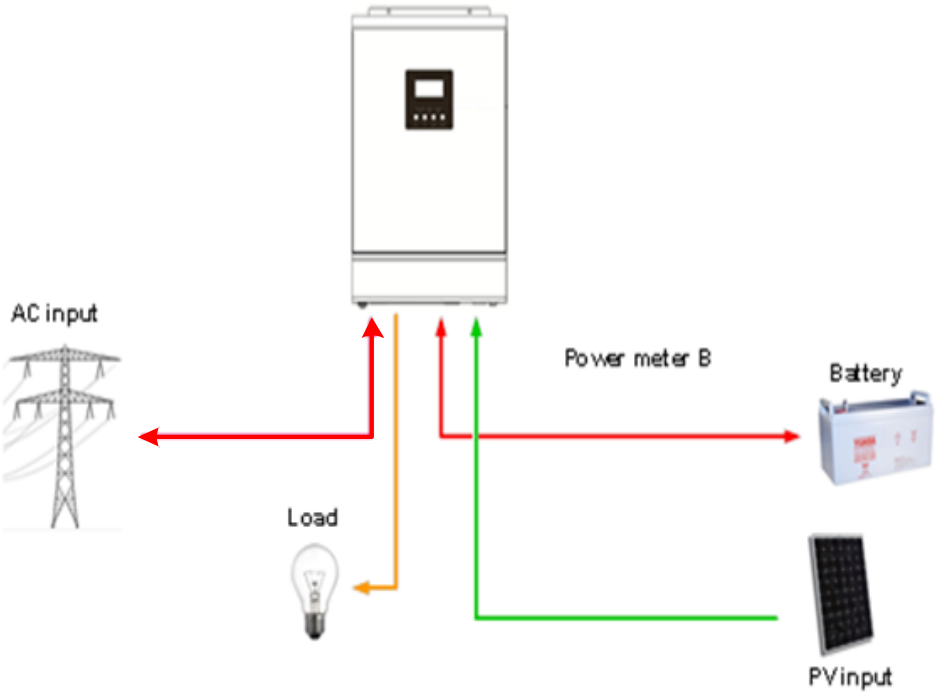
Description	AC output mode setting is different
Possible reason	The setting of program #03 is different with each inverter.
How to check	Please check the setting below of each inverter.
How to solve	The setting should be the same of each inverter.



2.4 Test step

After replacing all defected components, testing steps can be used to confirm the repair result and the reliability of the Inverter.

Set up the testing system as below:

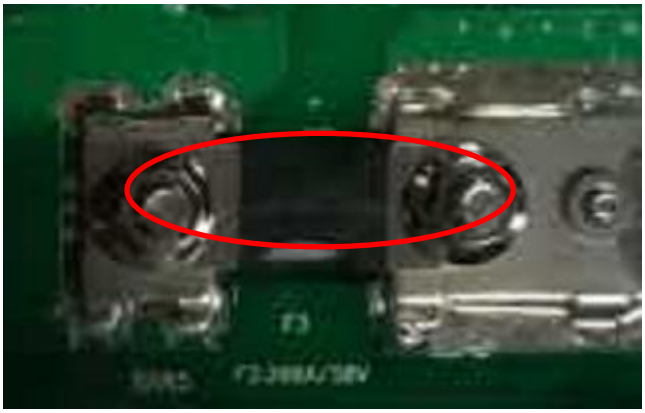


3. Checking and measuring guide

3.1 Check the battery side components

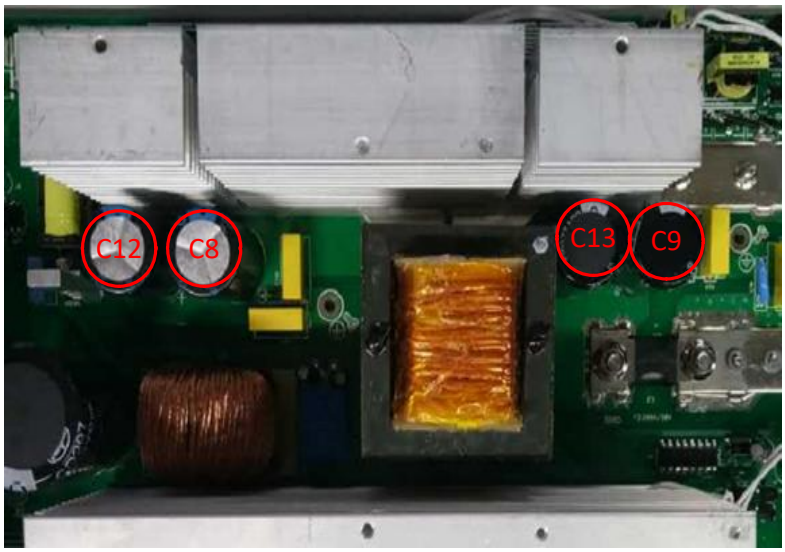
Fuse and capacitors

F3



Parts	Attribute	Reference values	Failure status
F3	Resistor	0 ohm	Open

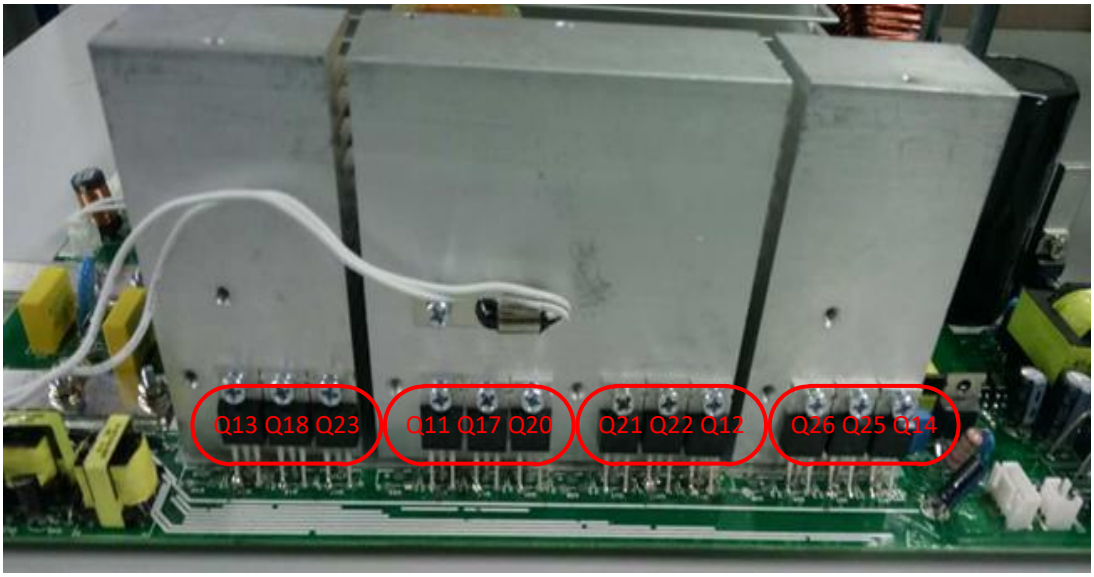
C9/C13/C8/C12



If the capacitors explode as below, they need to be replaced.

Power devices

DC/DC MOSFET: Q13/Q18/Q23 & Q11/Q17/Q20 & Q21/Q22/Q12 & Q26/Q25/Q14



Parts	Attribute	Reference values	Failure status
All:	Resistor[1]	GS: 11.7K GD: 250K	Short or explosion

		DS: 0.55M	
	Diode	SD: 0.43V DS: OL	

Note1: When you use the multimeter to measure the resistor of the transistor, because of the capacitor in the circuit, it will cause the changing of the values when you measure the DS and GD. So we recommend you measure the diode forward voltage of SD, and the resistor of GS. These two values can reflect the situation of the transistor more correctly.

Note: If one or more of them were damaged, please replace all of them.

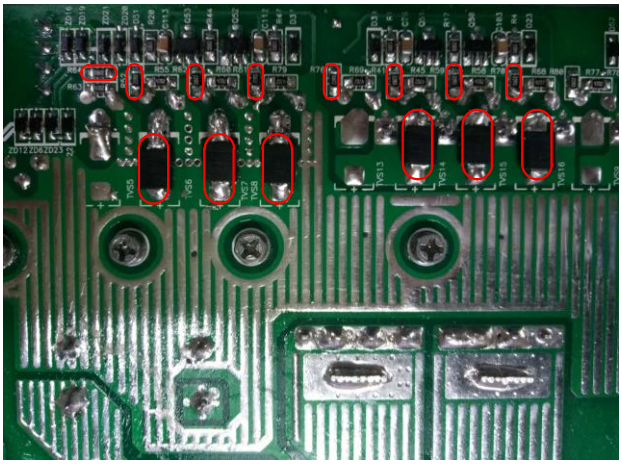
3.1.1. Drivers (This part is only used for repair checking)

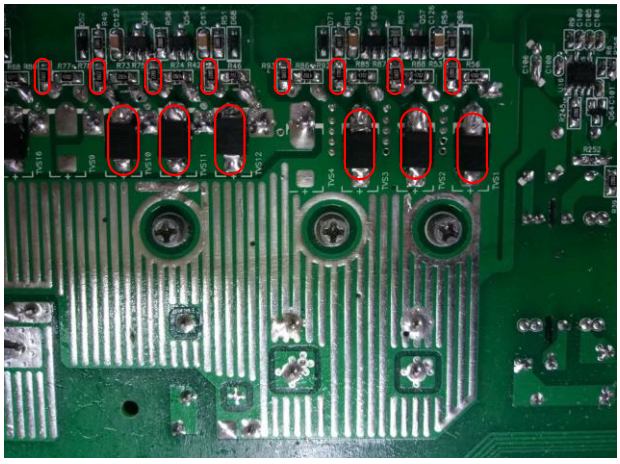
Note: Drivers usually need to be checked when users want to repair the boards. Because when power devices were damaged, the high voltage will rush to driver circuit through the gates of power devices.

The reference of the resistors list as below:

R41/R59/R70/R76/R80/R78/R75/R42/R52/R62/R81/R64/R93/R92/R87/R53

TVS1/ TVS2/ TVS3/ TVS4/ TVS6/ TVS7/ TVS8/ TVS10/ TVS11/ TVS12/ TVS14/ TVS15/ TVS16

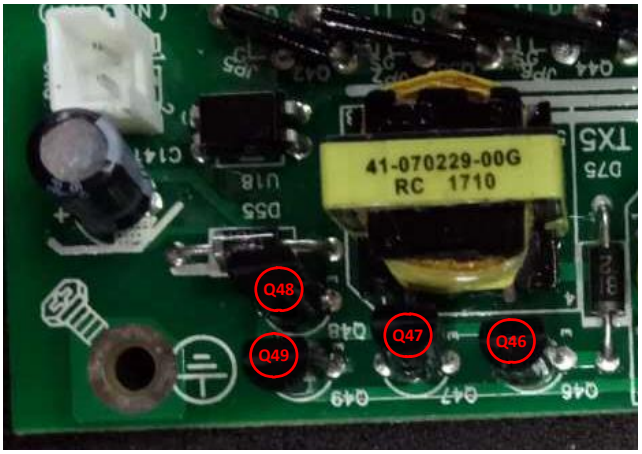


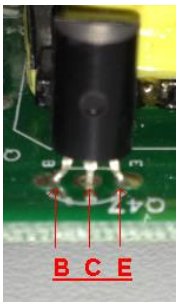


Use multimeter to measure each resistor, find the burnt resistors and replace them; don't need to replace them all.

Parts	Attribute	Reference values	Failure status
All: 22ohm	Resistor	22 ohm	Open or other values
TVS1-16	Diode	+ To - : 0.42V	Short or explosion

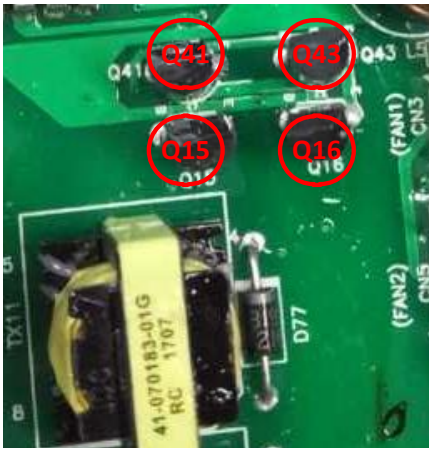
If the resistors need to be replaced, please also check the driver transistors and control IC.





The Q46and Q48 are 11-300012-00G (TR 2A 50V NPN TO-92)

The Q47and Q49 are 11-300005-00G (TR 2A 50V PNP TO-92NL)

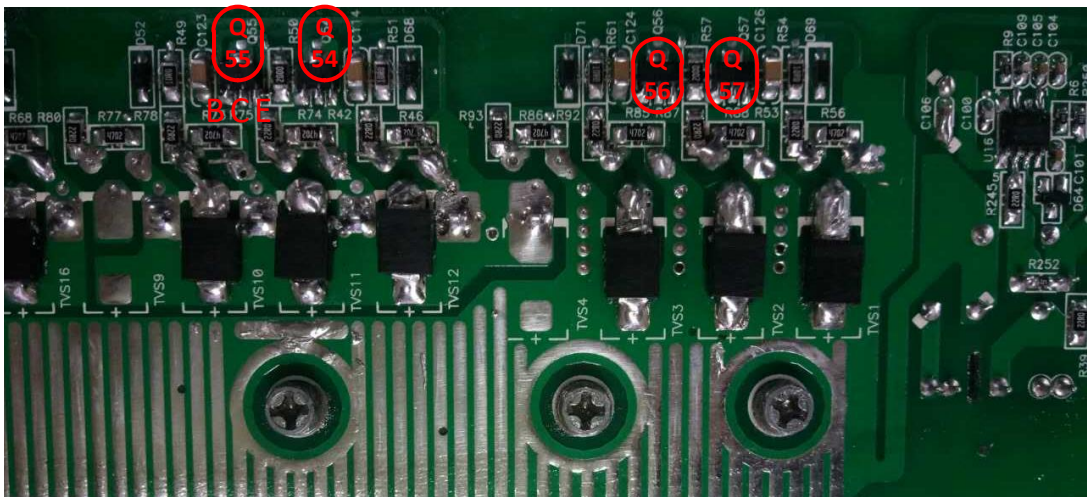


The Q41and Q43 are 11-300012-00G (TR 2A 50V NPN TO-92)

The Q15and Q16 are 11-300005-00G (TR 2A 50V PNP TO-92NL)

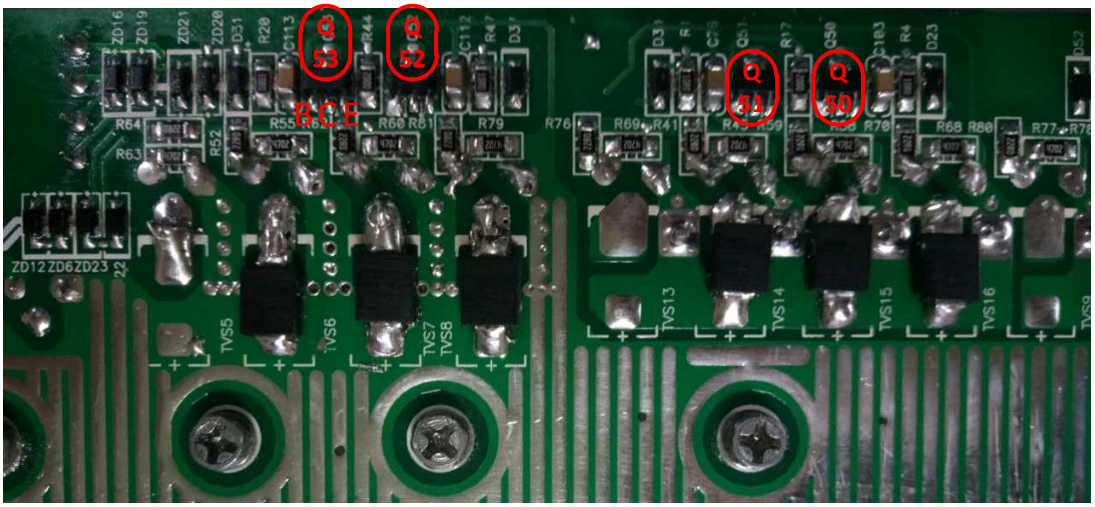
Parts	Attribute	Reference values	Failure status
Q46/Q48/Q41/Q43	Resistor	BE: 434.2k BC: 429.3k CE: 19.52k	Short or explosion
	Diode	BE: 0.656V BC: 0.655V CE: 1.3V	
Q47/Q49/Q15/Q16	Resistor	BE: 433.5k BC: 432.1k CE: 8.1k	Short or explosion
	Diode	BE: 0.656V	

		BC: 1.741V CE: 0.2V	



The Q54and Q56 are 11-400011-00G (TR 2A 50V NPN SOT-89)

The Q55and Q57 are 11-400010-00G (TR 3A 50V PNP SOT-89)

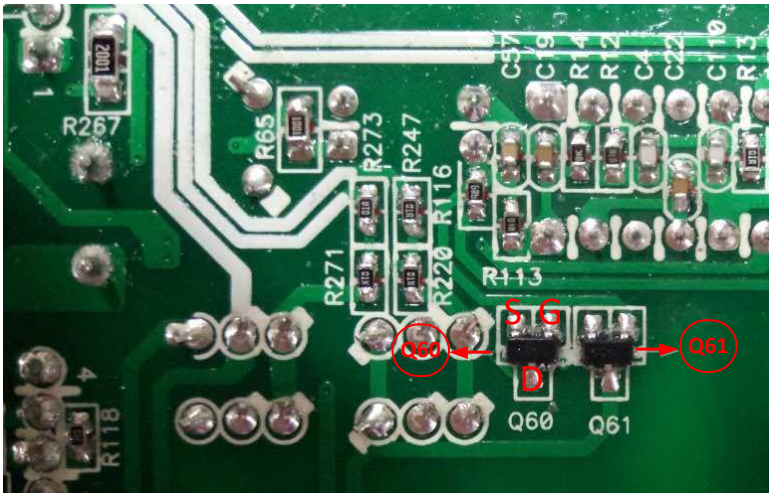


The Q51and Q52 are 11-400011-00G (TR 2A 50V NPN SOT-89)

The Q50and Q53 are 11-400010-00G (TR 3A 50V PNP SOT-89)

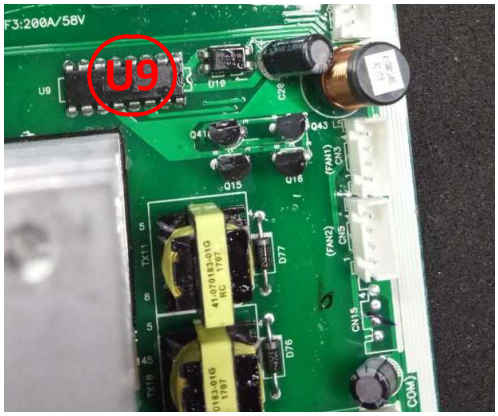
Parts	Attribute	Reference values	Failure status
Q54/Q56/Q51/Q52	Resistor	BE: 12k BC: 263.5K CE: OL	Short or explosion
	Diode	BE: 0.632V BC: 0.631V CE: OL	

Q55/Q57/Q50/Q53	Resistor	BE: 12k BC: OL CE: 277.3k	Short or explosion
	Diode	BE: 0.632V BC: OL CE: 1.107V	



The Q60 and Q61 are 11-420007-00G (MOSFET 5.8A 30V SOT-23)

Parts	Attribute	Reference values	Failure status
Q60/Q61	Resistor	GS: 4.185k GD: 12.08k DS: 90k	Short or explosion
	Diode	SD: 0.207V DS: 1.389V	

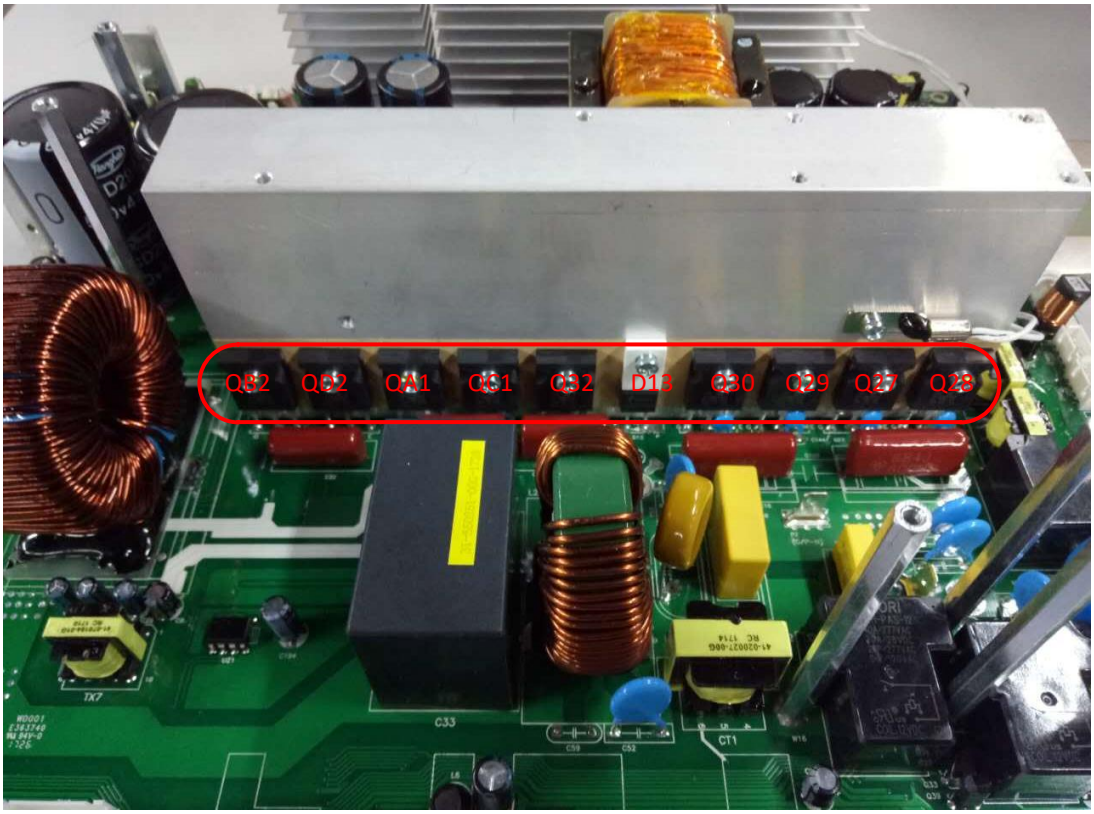


Parts	Attribute	Reference values	Failure status
U9	Resistor	Pin13TOPin12:100~300k Pin11TOPin12: 438k Pin14 TO PIN12: 438k	Short or explosion
Note: If you are not sure about these components, we recommend you replacing them all.			

3.2 Check the bus side components

Power devices

DC/DC IGBT: Q30/Q29/Q27/Q28



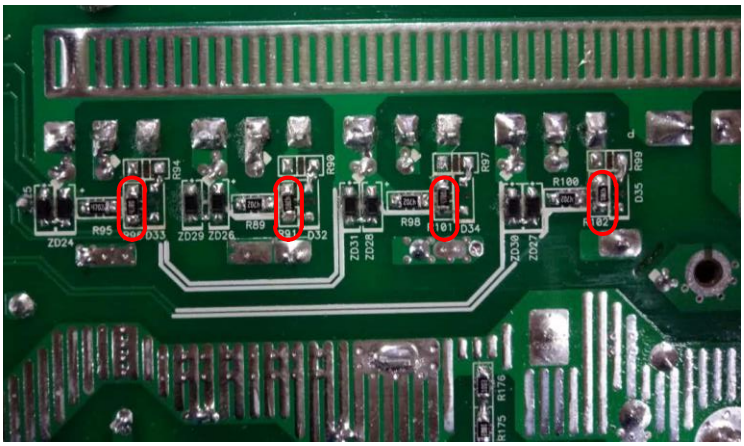
Parts	Attribute	Reference values	Failure status
Q27/Q28/Q29/Q30	Resistor[1]	GE: 47.8 ohm GC: 196.3k CE:400-500K	Short or explosion
	Diode	EC: 0.39V CE: OL	

Note1: When you use the multimeter to measure the resistor of the transistor, because of the capacitor in the circuit, it will cause the changing of the values when you measure the CE and GE. So we recommend you measure the diode forward voltage of EC, and the resistor of GE. These two values can reflect the situation of the transistor more correctly.

Note: If one or more of them were damaged, please replace all of them.

Drivers (This part is only used for repair checking)

Meanwhile, we also need to check the driver tubes of these power tubes.

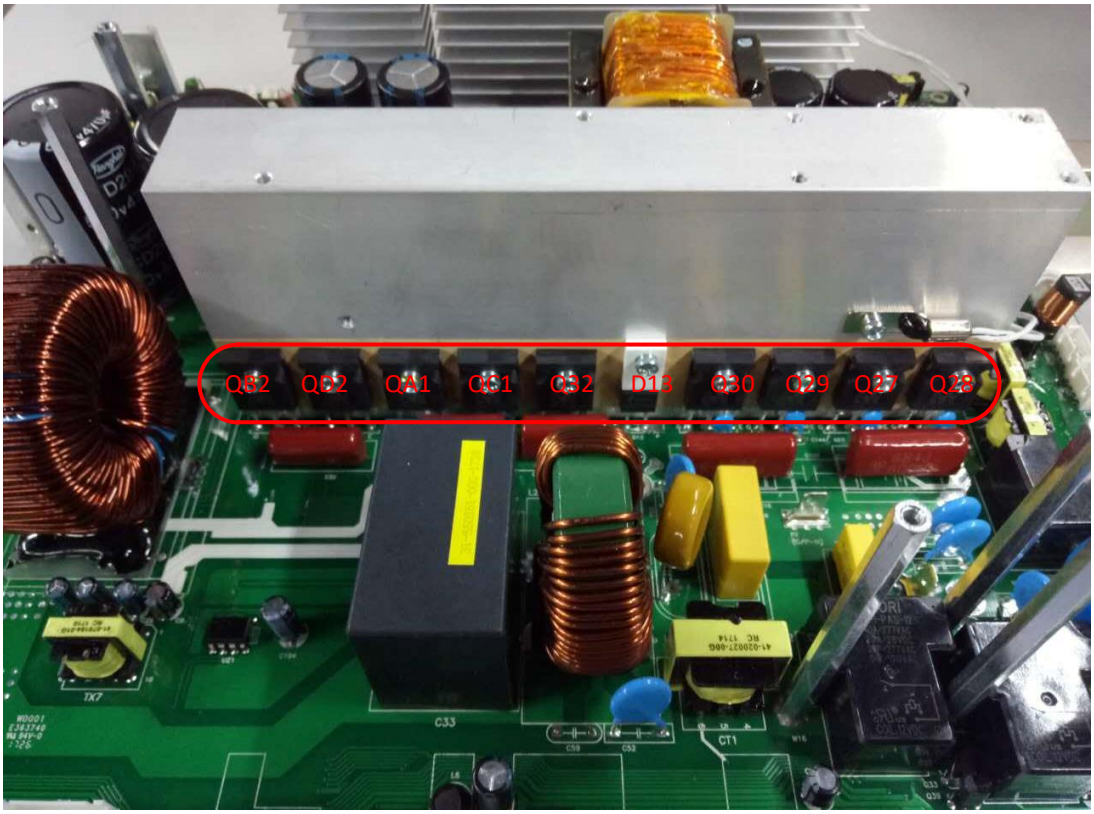


Parts	Attribute	Reference values	Failure status
R91/R102/R96/R101	Resistor	47 ohm	Open or other values
Note2: When test the diode; please remove the R90/R99/R94/R97 from the board, or the test result is not right.			

3.3 Check the buck circuit

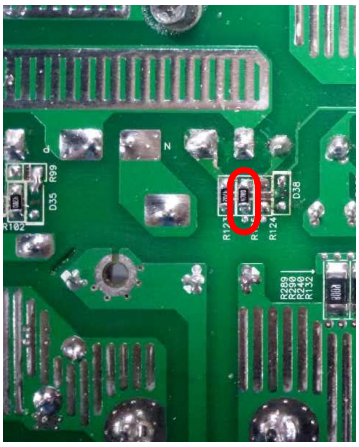
Power devices

BUCK MOSFET and Diode: Q32 / D13



Parts	Attribute	Reference values	Failure status
Q32	Resistor	GE: 22.7 K GC: 259K CE: 10-20M	Short or explosion
	Diode	SD or CE: 0.406V DS or EC: OL	
D13	Resistor	+ to -: 26.2K - to +: OL	
	Diode	+ to -: 0.39V - to +: OL	

Drivers (This part is only used for repair checking)

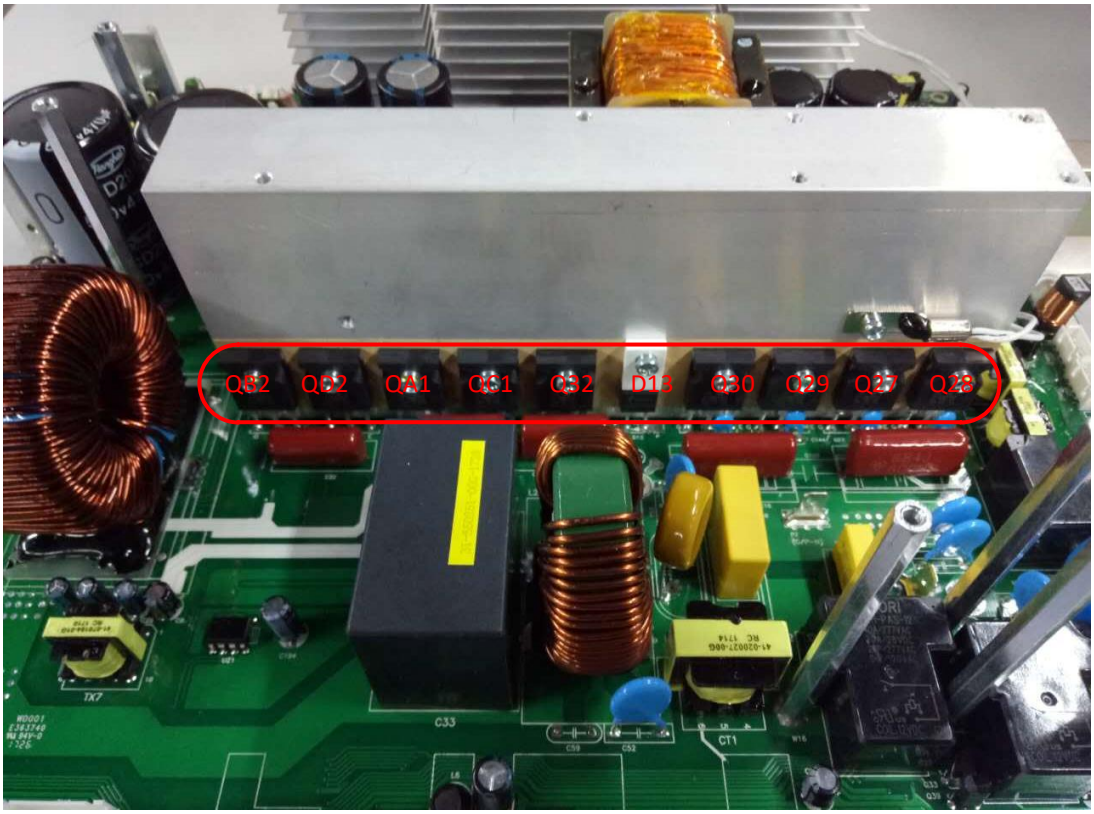


Parts	Attribute	Reference values	Failure status
R125	Resistor	47 ohm	Open or other values
Note: When test the diode; please remove the R124 from the board, ortherwise the test result is not right.			

3.4 Check the INV full bridge

Power devices

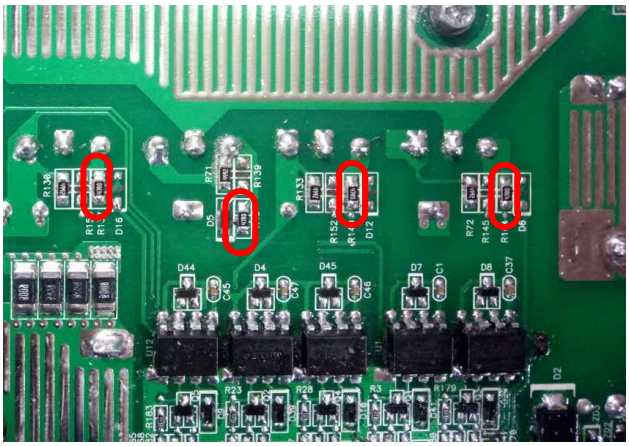
INV IGBT: QB2/QD2/QA1/QC1



Parts	Attribute	Reference values	Failure status
QB2/QD2/QA1/QC1	Resistor	GE: 23.3K GC: 250k CE: 38M	Short or explosion
	Diode	EC: 0.4V CE: OL	

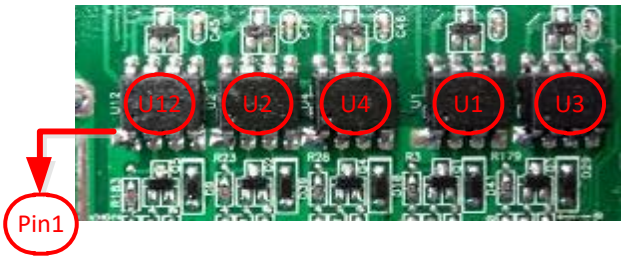
Note1: If one or more of them were damaged, please replace all of them.

Drivers



Parts	Attribute	Reference values	Failure status
R144/R48/R140/R137	Resistor	47 ohm	Open or other values

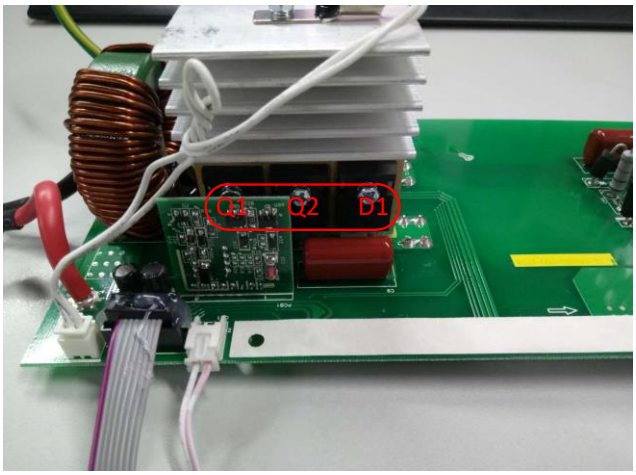
Optocoupler: U12/U2/U4/U1/U3

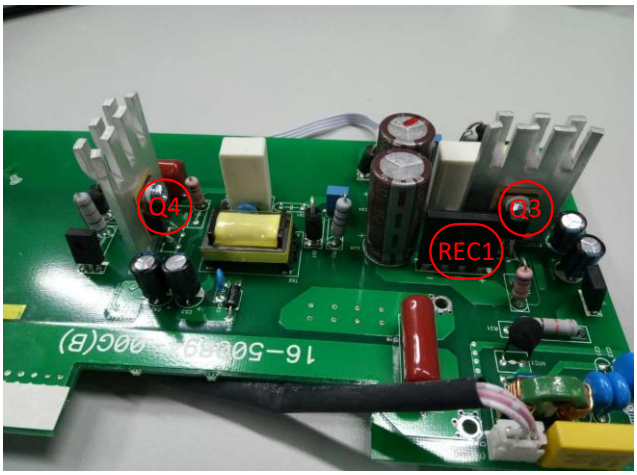


Parts	Attribute	Reference values	Failure status
U1/U2/U3/U4/U12	Resistor	PIN8 TO PIN5: 0.922M PIN7 TO PIN5: 0.953M	Short or explosion

3.5 Check the MPPT board

Power devices

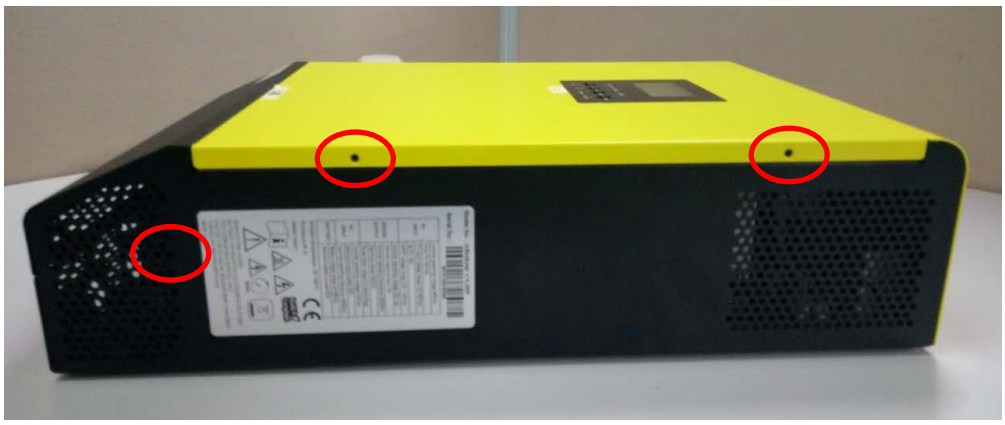


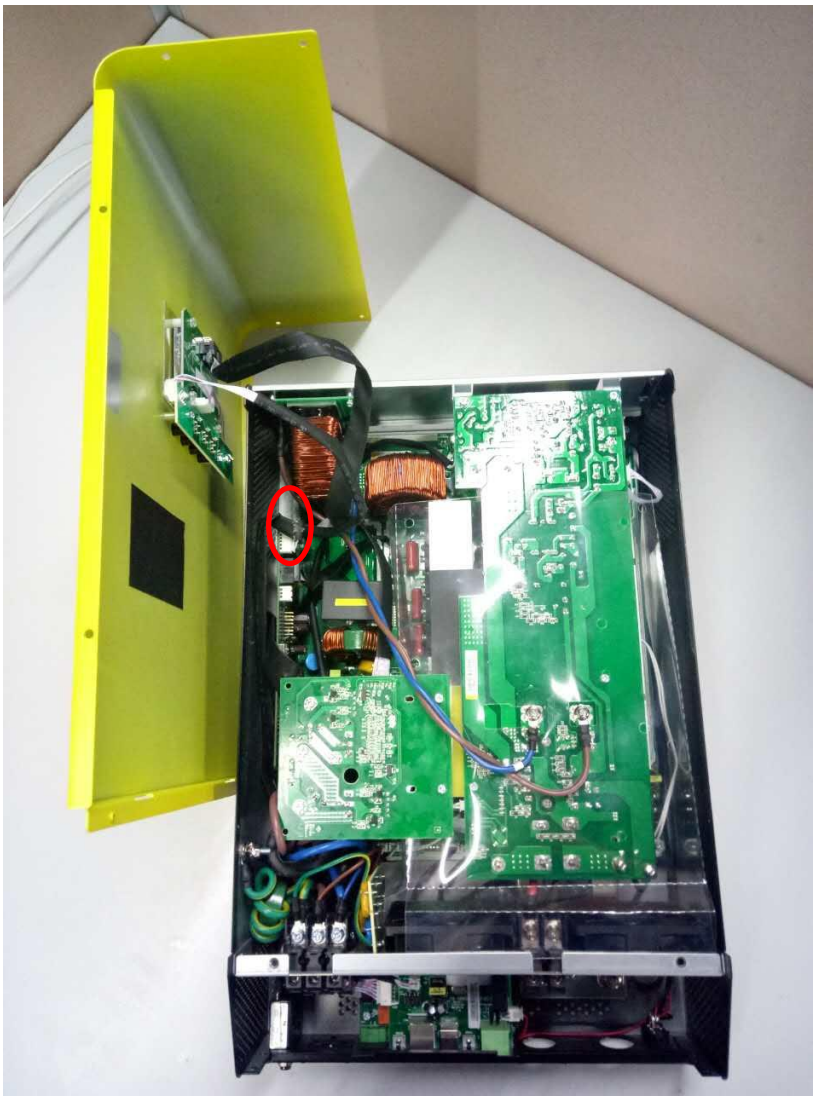


Parts	Attribute	Reference values	Failure status
Q1, Q2,	Resistor	GS: 25k GD: 218K DS: OL	Short or explosion
	Diode	SD: 0.381V DS: OL	
D1	Resistor	+ to -: 202.8k - to +: OL	Short or explosion
	Diode	+ to -: 0.389V - to +: OL	
REC1	Resistor	+ to -: 303.7k - to +: 0.7M	Short or explosion
	Diode	+ to -: 0.535V - to +: OL	
Q4、Q3	Resistor	GS: 20K-40K GD: 300K-400K DS: OL	Short or explosion
	Diode	SD: 0.532V DS: OL	

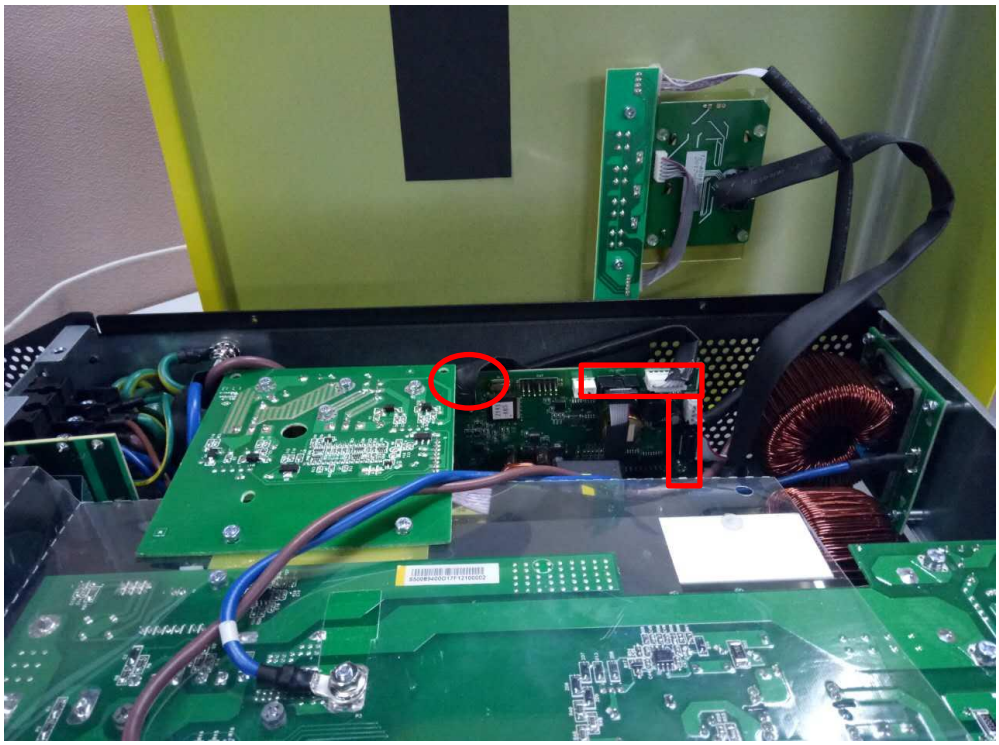
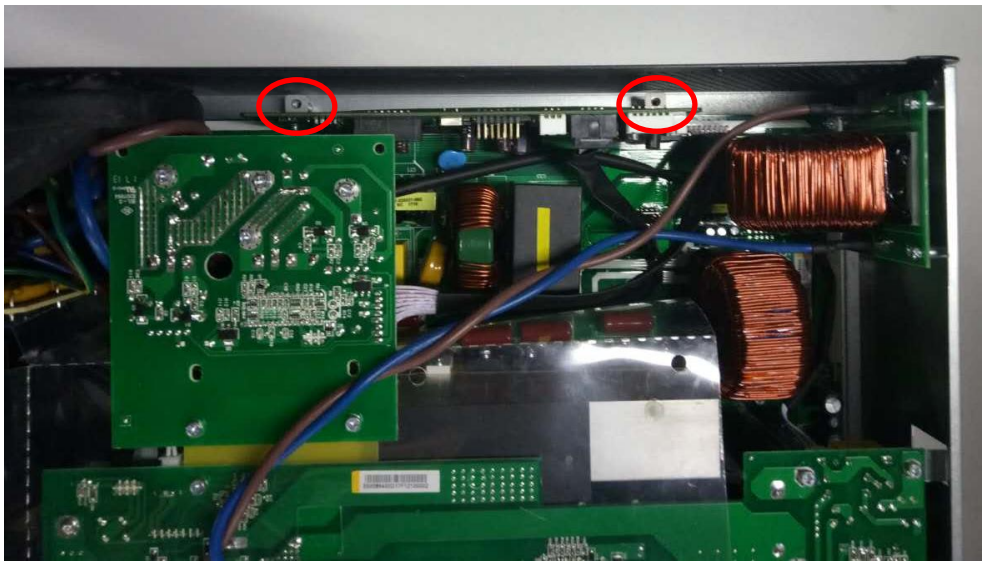
4. Disassembling guide

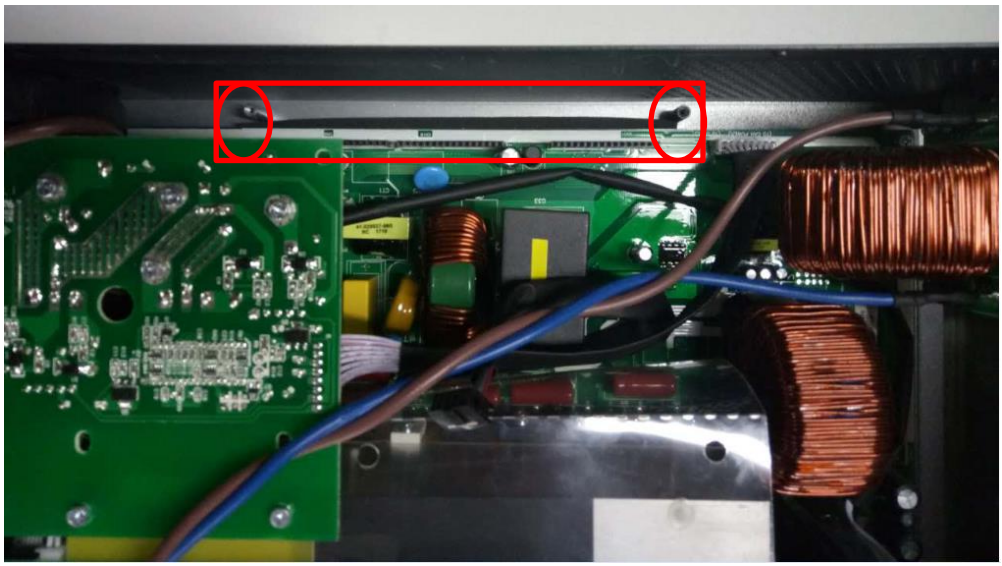
4.1 Open the case

Remove screws on the top cover	  

Open the top cover carefully, for there are two cables connected with LCD display.	

4.2 Remove the control board

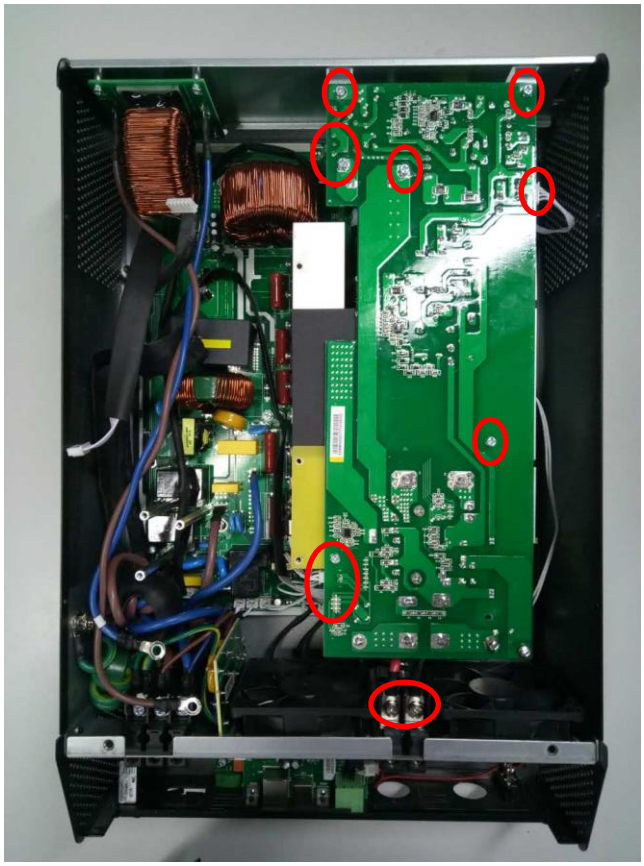
Remove the cables on the control board.	
Remove the fixing screws.	

Take out the control board.	

Note: When you put the new control board on the main board, please make sure that the connection is correct and tighten. Don't forget to put the screws and cables back.

4.3 Remove the fan paper and the SCR board and the MPPT board.

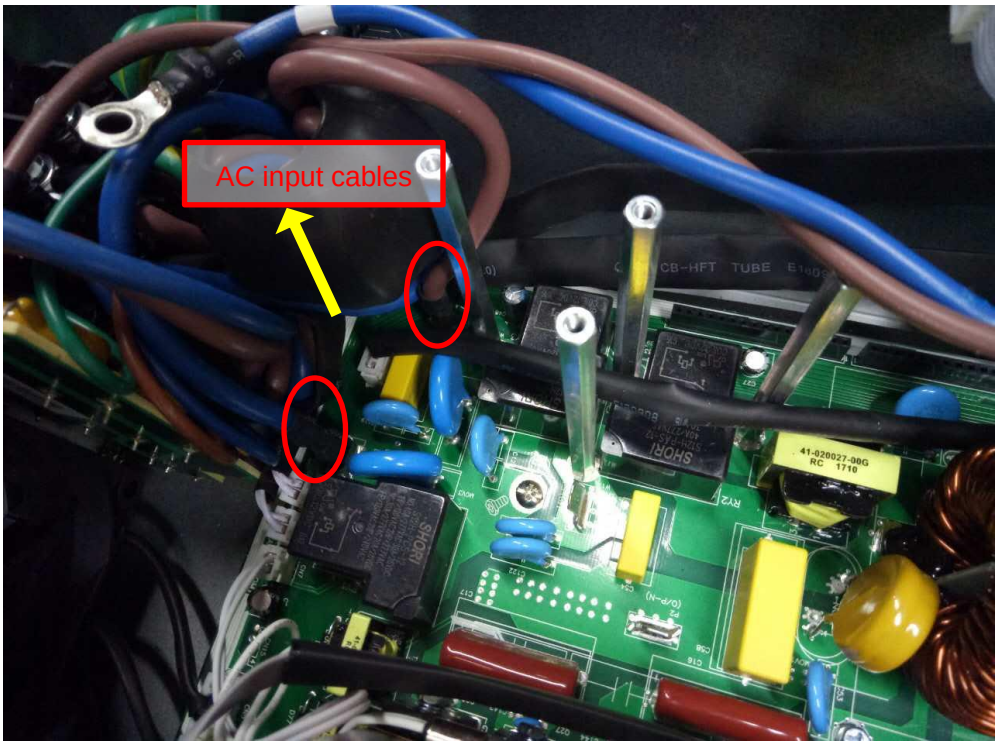
1. Take the plastic screws out. 2. Take two nuts out. 3. Take six screws out. 4. you can take the SCR board and the fan paper off.	

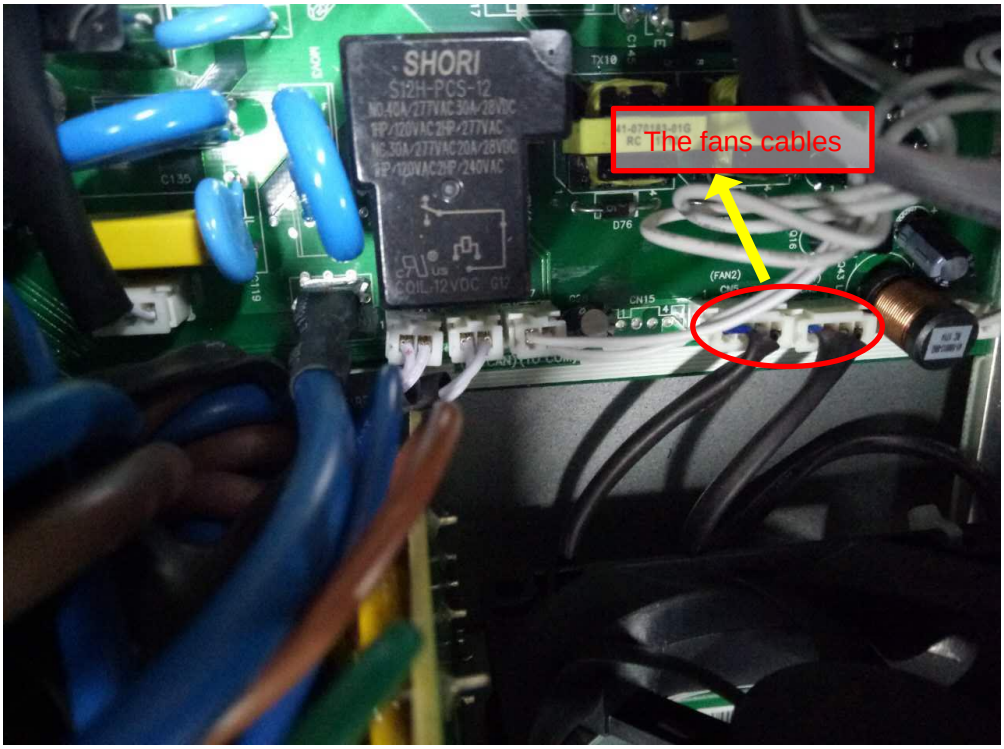
Remove the screws and the signal cables of the MPPT board , and you can take the MPPT board paper off.	

4.4 Remove the main board.

Note: Before replace the main board, please follow 4.2 ~ 4.4, remove the control board, MPPT board, and fans first.

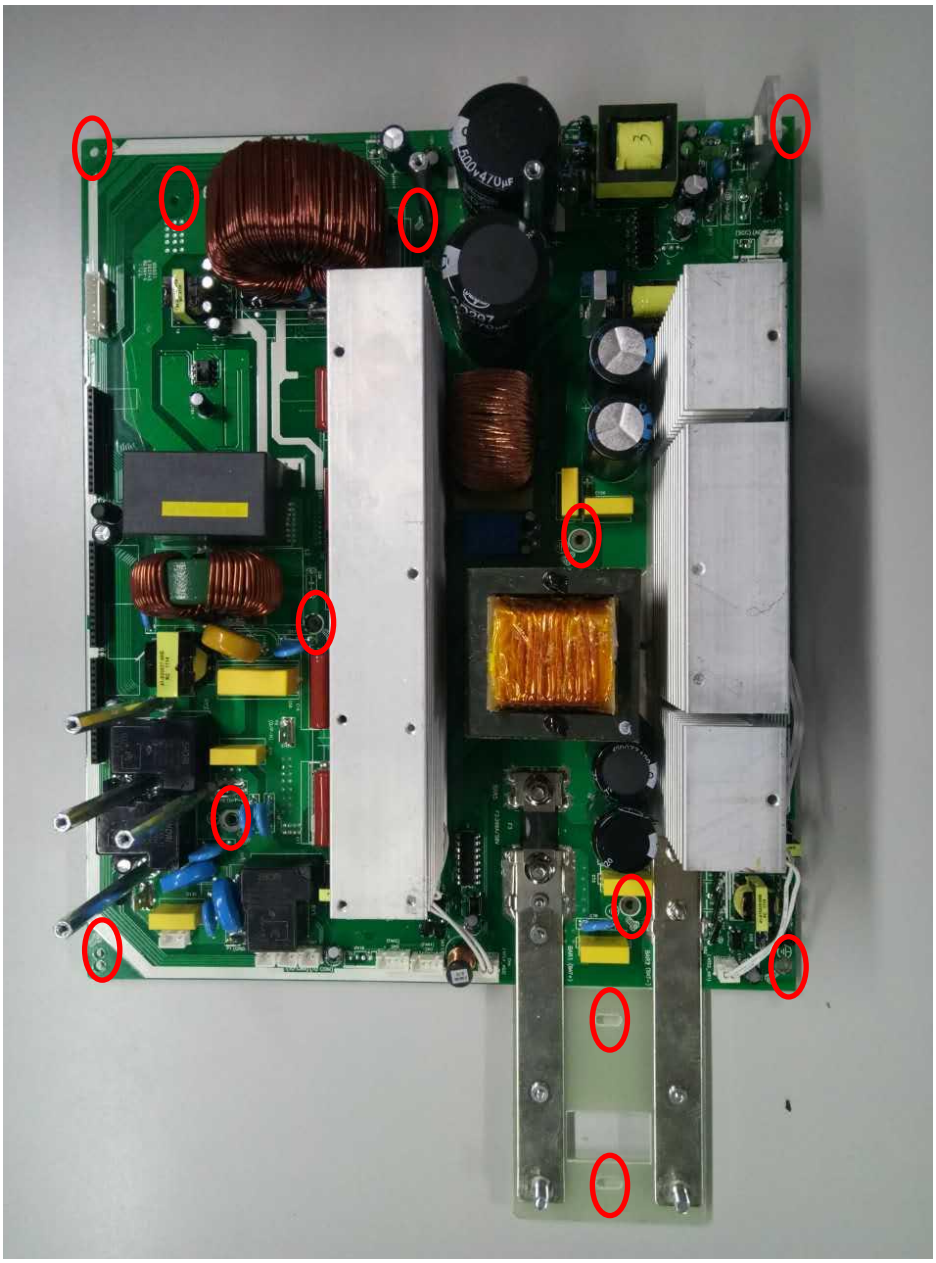
Remove the power cables of AC output and input.
Brown cable is line; blue cable is neutral.
Do not make the wrong polarity.



Remove the fans cables.	

Remove the screws and the signal cables on the main board. And then you can take the main board out.

Note: There are nine screws to fix the main board.



5. Cables connection

MPPT Model