

**5KVA-120V/208V/240V**

## **Service manual**

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## 1. General information

### 1.1 Getting start

This manual is used as a checking and repairing guide for **5KVA-120V/208V/240V** 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.

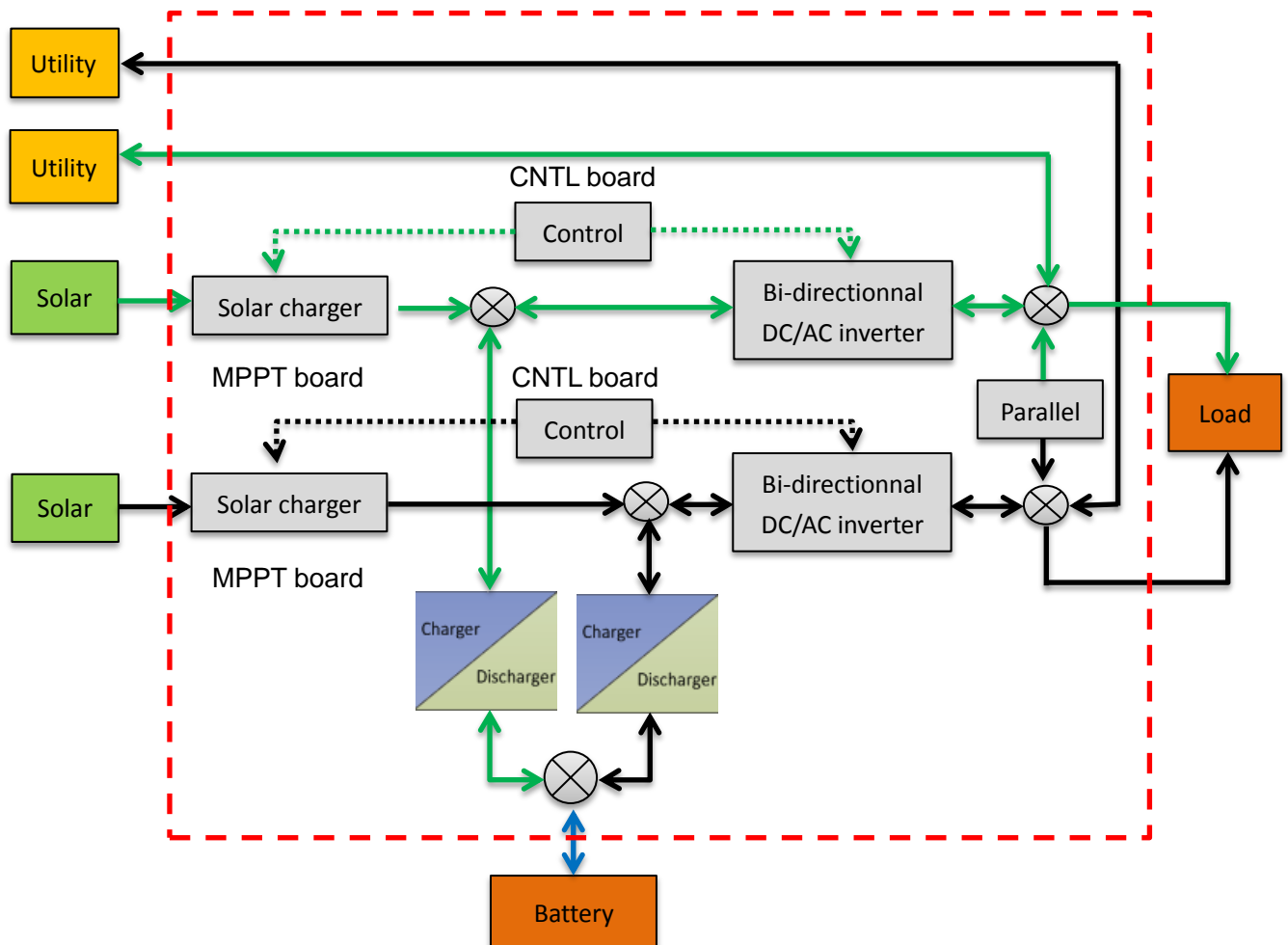
**Checking and measuring guide:** This part will teach you how to check or repair the inverter by measuring the critical components.

**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.

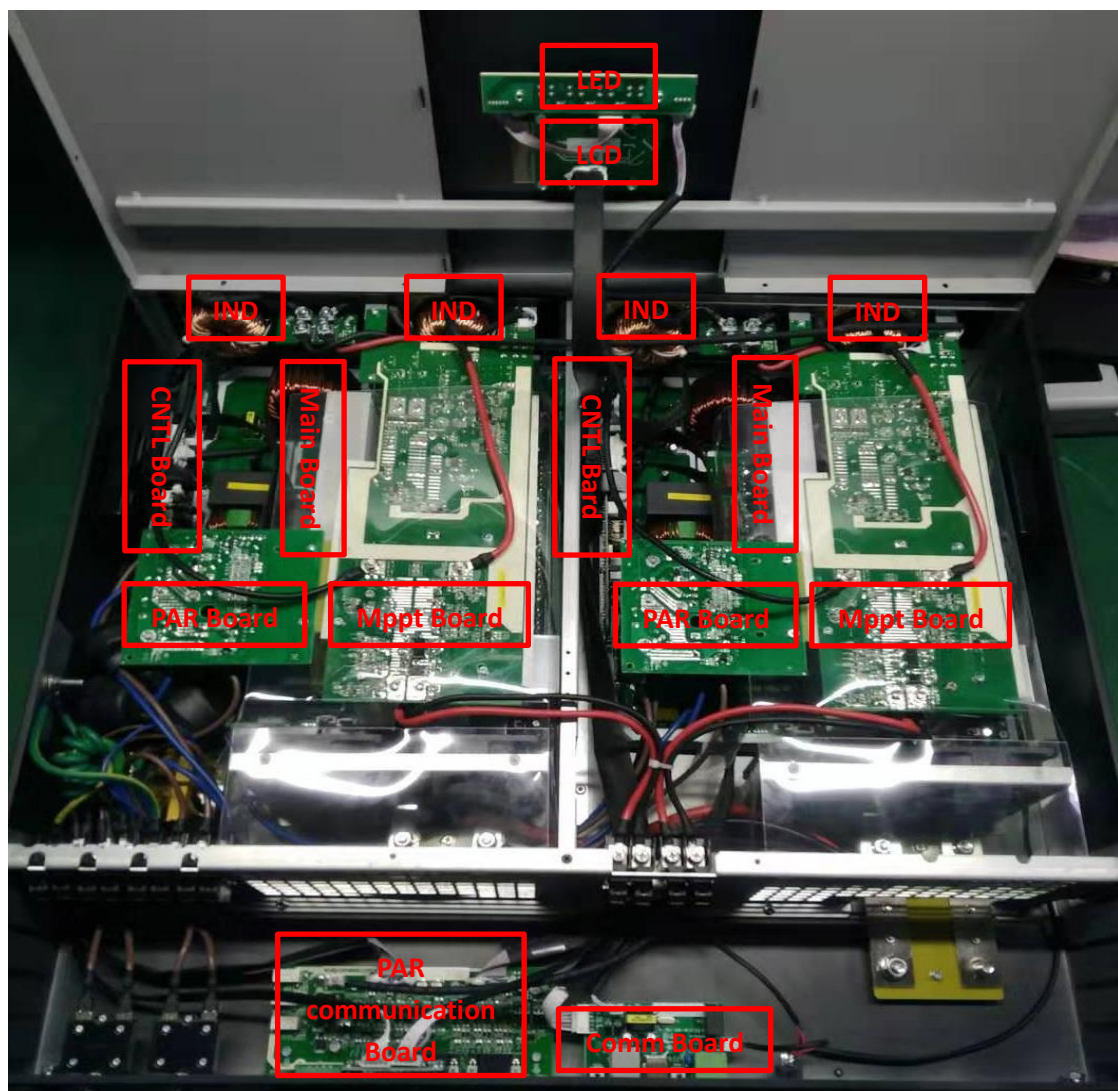
### 1.3 Inverter family

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.

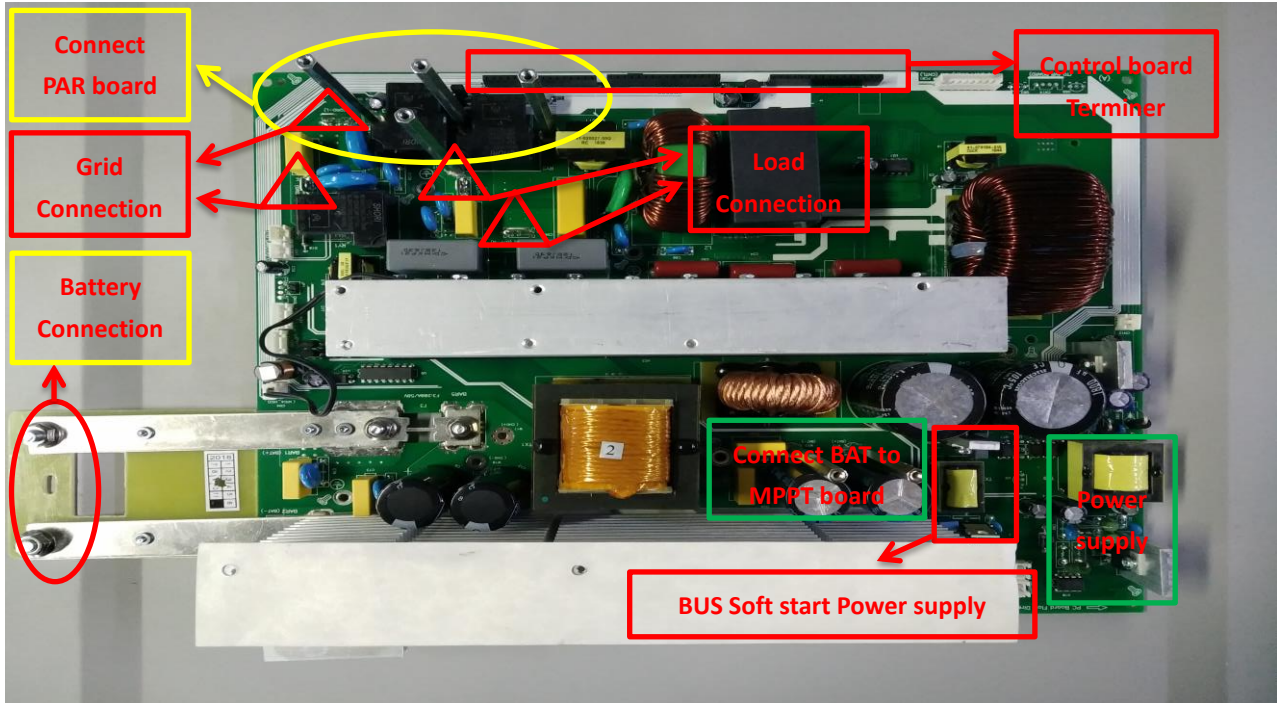
Model name	Power rating	Solar charger type	Solar charger number	Off-grid/Hybrid
Inverter with MPPT 3KVA	3KVA/3KW	MPPT	2	Off-grid

### 1.4 Overview the inverter

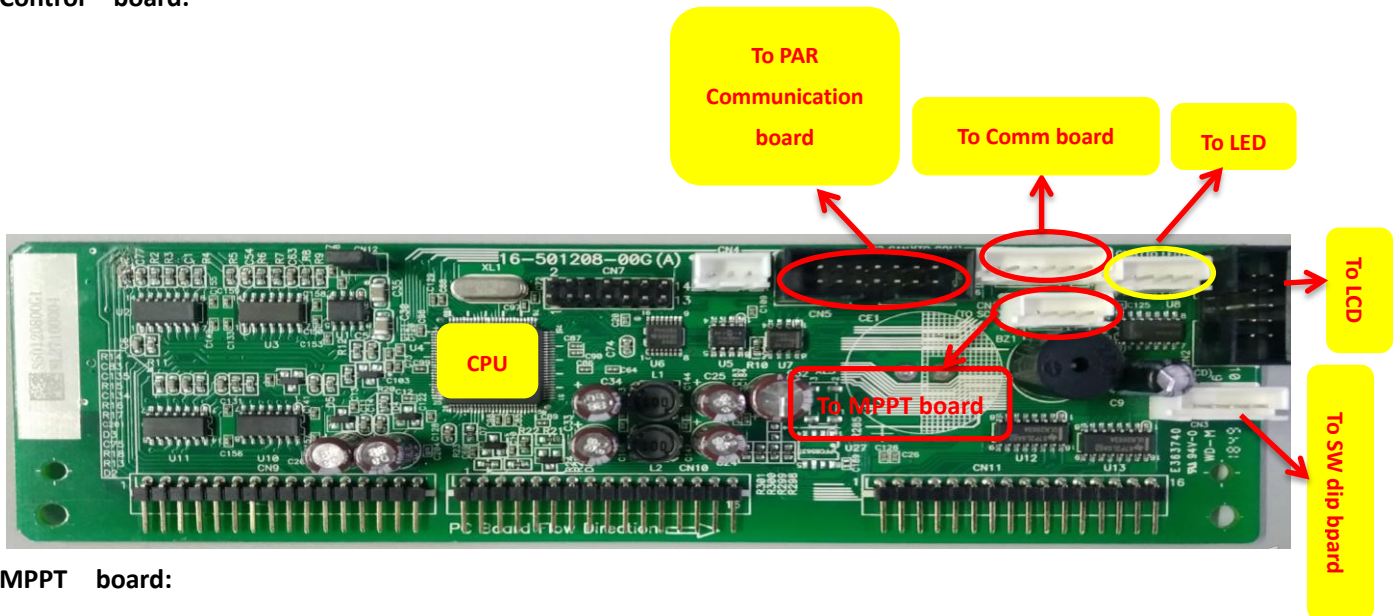


### 1.5 PCB overview

Main board:

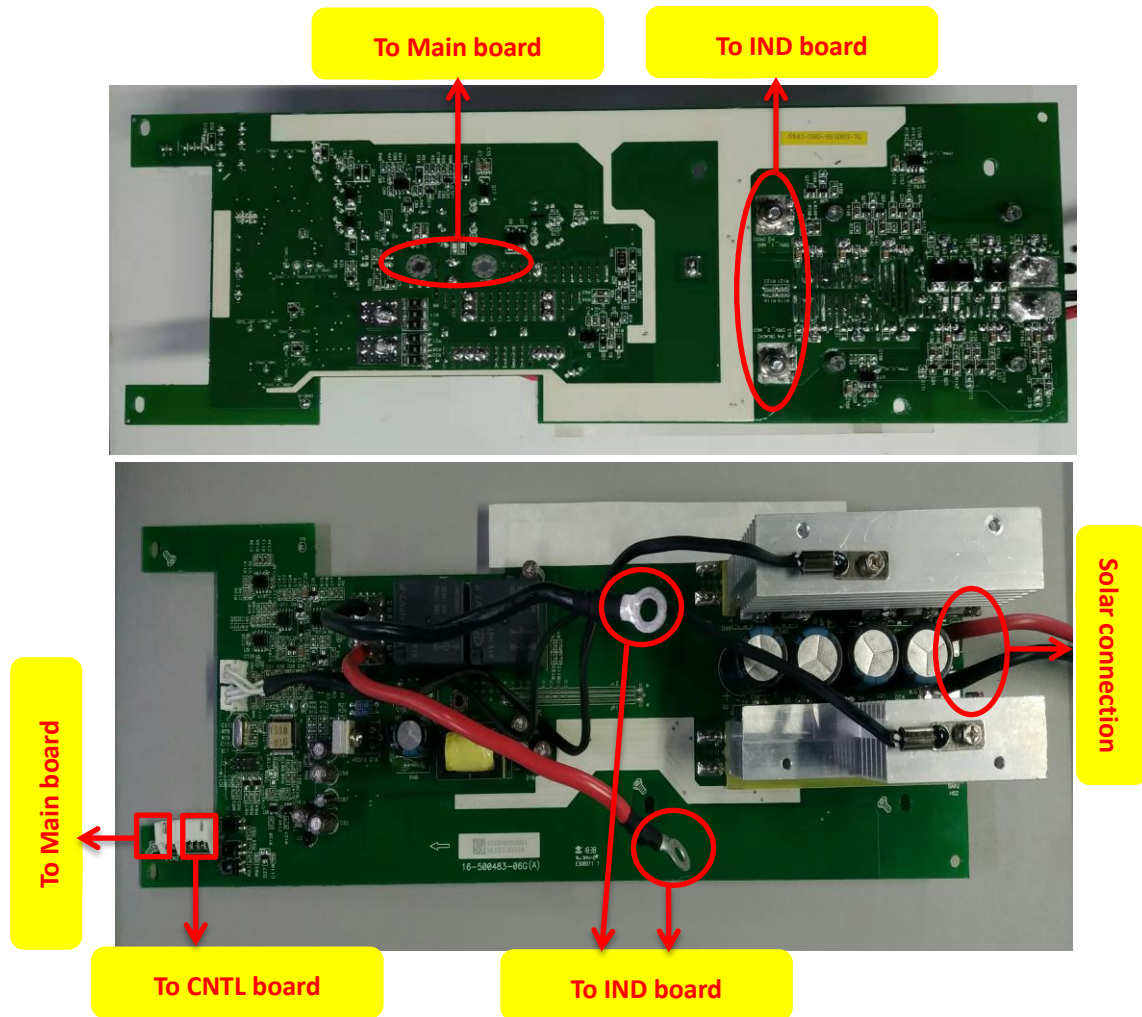


Control board:



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.
How to check	1. Firstly, please measure the resistor 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.
How to solve	Replace the main board.

### 2.2.2. 09 fault

Description	Bus soft start fails.
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.

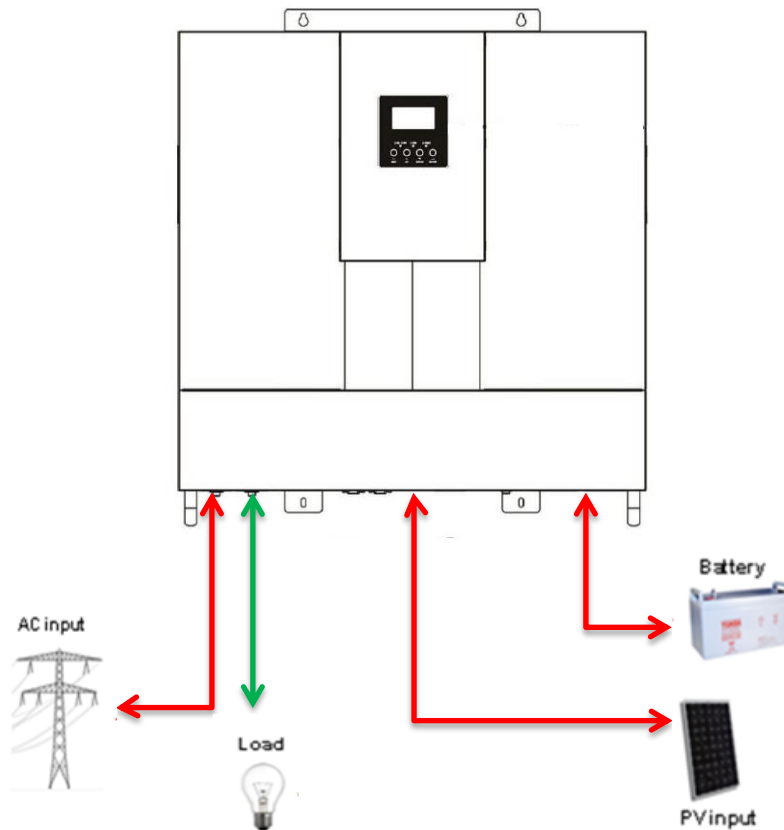
### 2.2.3. 56 fault

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.

### 2.4 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:



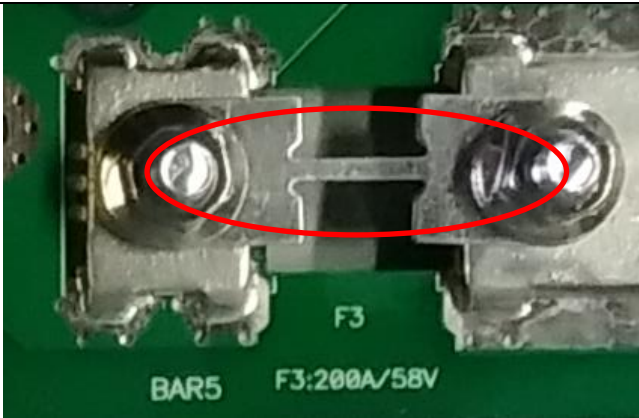
## 3. Checking and measuring guide

### 3.1 Check the battery side components

Fuse and capacitors

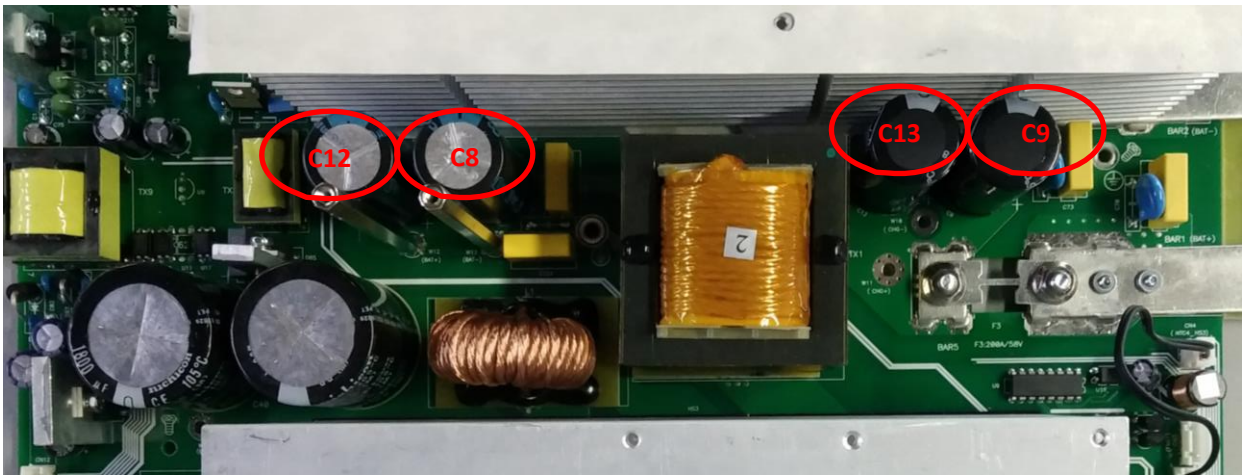
F3





Parts	Attribute	Reference values	Failure status
F3	Resistor	0 ohm	Open

C9/C13/C8/C12

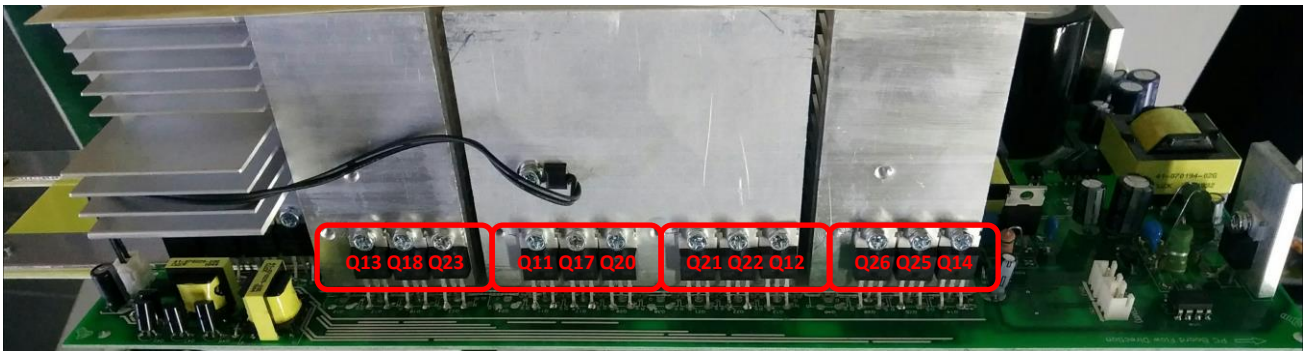


If the capacitors explode as below, they need to be replaced.



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 <sup>1</sup>	GS: 11.7K GD: 220K-230K DS: 250K	Short or explosion
	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.

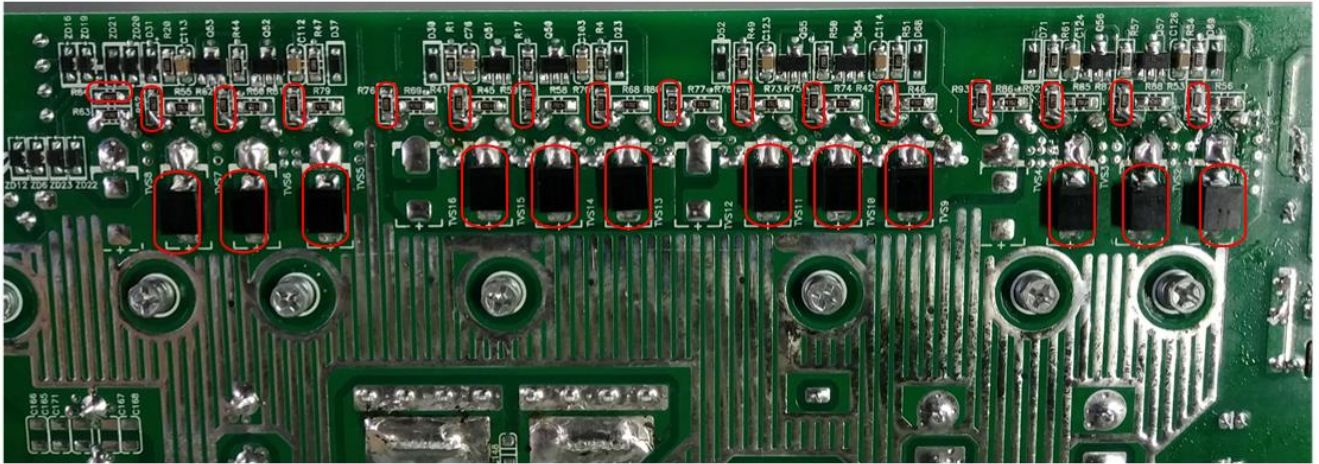
The reference of the resistors list as below:

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

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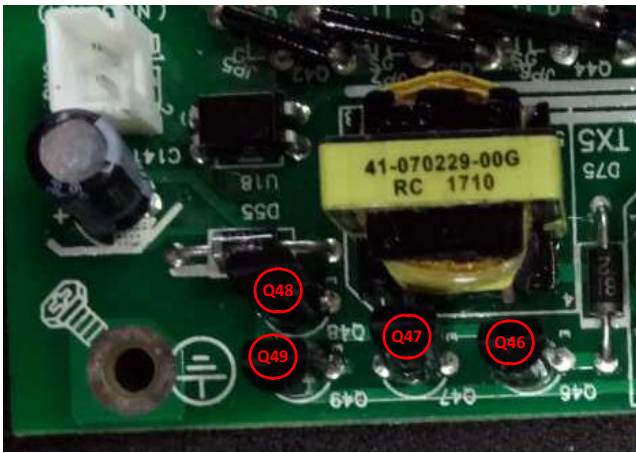
**5KVA-120V/208V/240V**



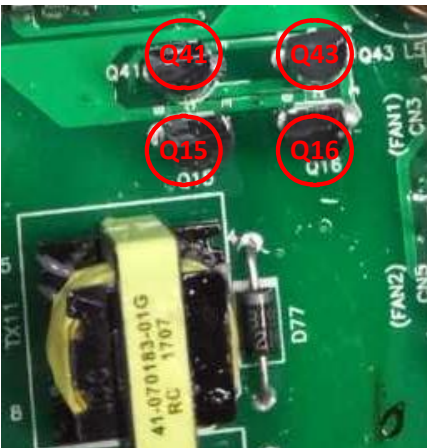
Use multimeter to measure each resistor, find the burnt resistors and replace them; don't need to replace them all.

Parts	Attribute	Reference values	Failure status
All: 22ohm	Resistor	22 ohm	Open or other values
TVS1-16	Diode	+ To - : 0.43V	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: 431.6k BC: 425.8k CE: 15.95k	Short or explosion
	Diode	BE: 0.652V BC: 0.650V CE: 2.176V	
Q47/Q49/Q15/Q16	Resistor	BE: 430.2k BC: 436.7k CE: 8.51k	Short or explosion
	Diode	BE: 0.651V	

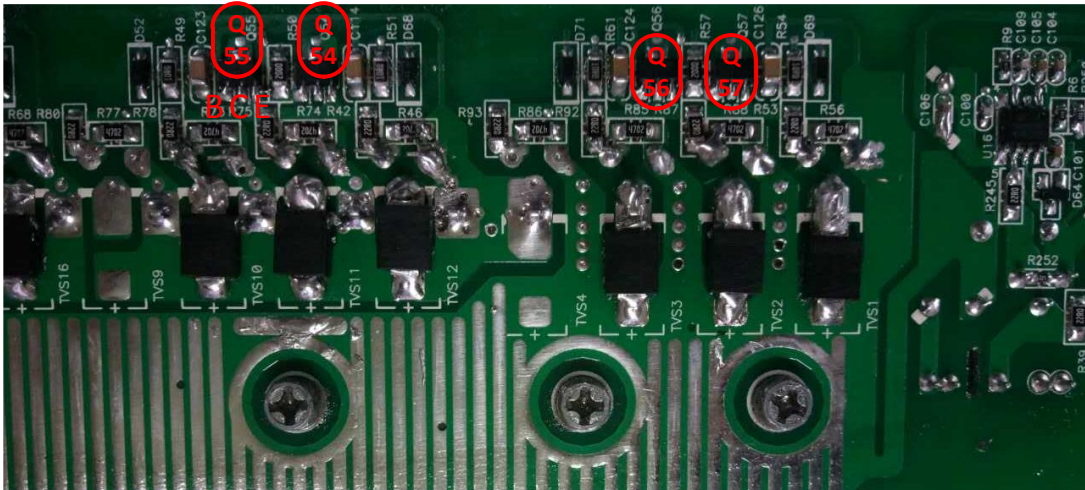


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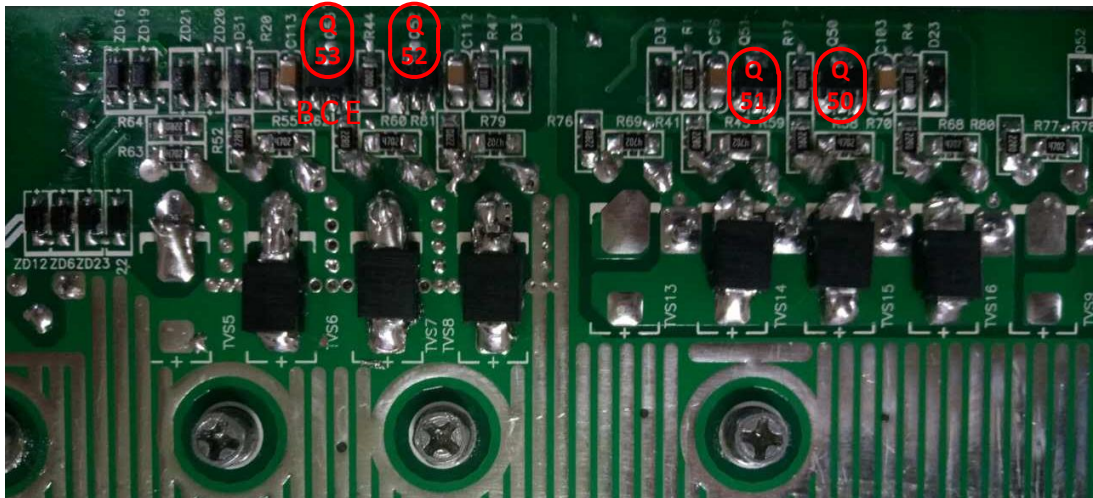
BC: 2.516V

CE: 0.21V



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)

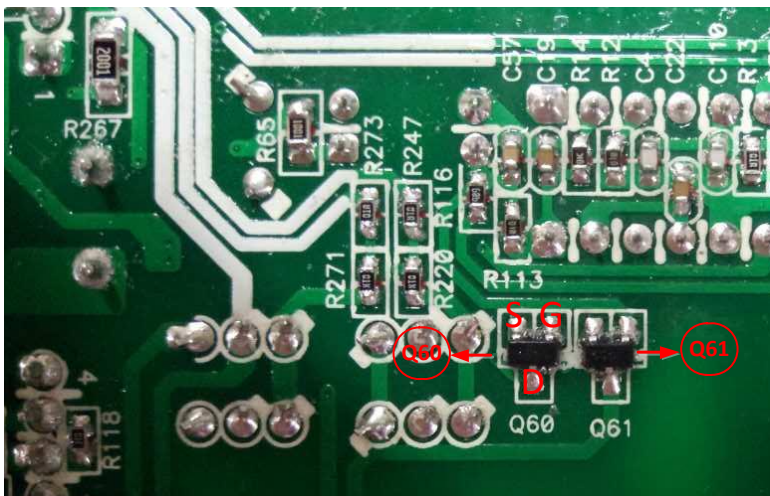
The Q50and Q53 are 11-400010-00G (TR 3A 50V PNP SOT-89)

Parts	Attribute	Reference values	Failure status
Q54/Q56/Q51/Q52	Resistor	BE: 12k BC: 267.8K CE: OL	Short or explosion
	Diode	BE: 0.629V BC: 0.628V CE: OL	

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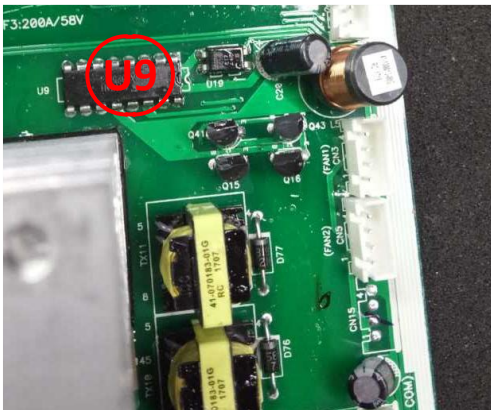
5KVA-120V/208V/240V

Q55/Q57/Q50/Q53	Resistor	BE: 12k BC: OL CE: 281.2k	Short or explosion
	Diode	BE:0.627V 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: 4.138k GD: 12.78k DS: 101k	Short or explosion
	Diode	SD: 0.207V DS: 2.205V	





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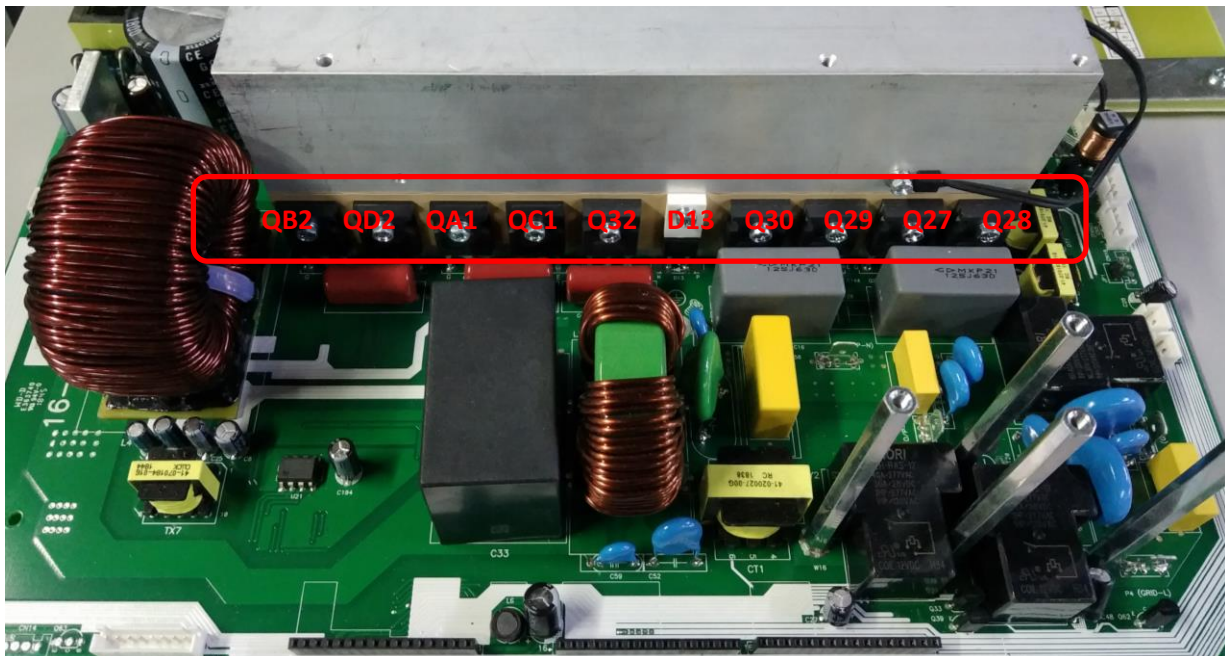
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Parts	Attribute	Reference values	Failure status
U9	Resistor	Pin13TOPin12:100~300k Pin11TOPin12: 438k Pin14 TO PIN12: 438k	Short or explosion
<b>Note:</b> If you are not sure about these components, we recommend you replacing them all.			

## 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 <sup>1</sup>	GE: 47.8 ohm GC: 170k CE: 1.7M	Short or explosion
	Diode	EC: 0.357V 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.

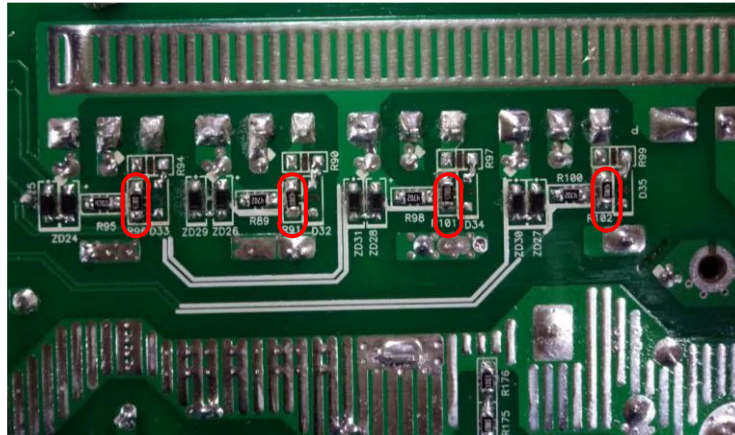
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**Note:** If one or more of them were damaged, please replace all of them.

## Drivers (This part is only used for repair checking)

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



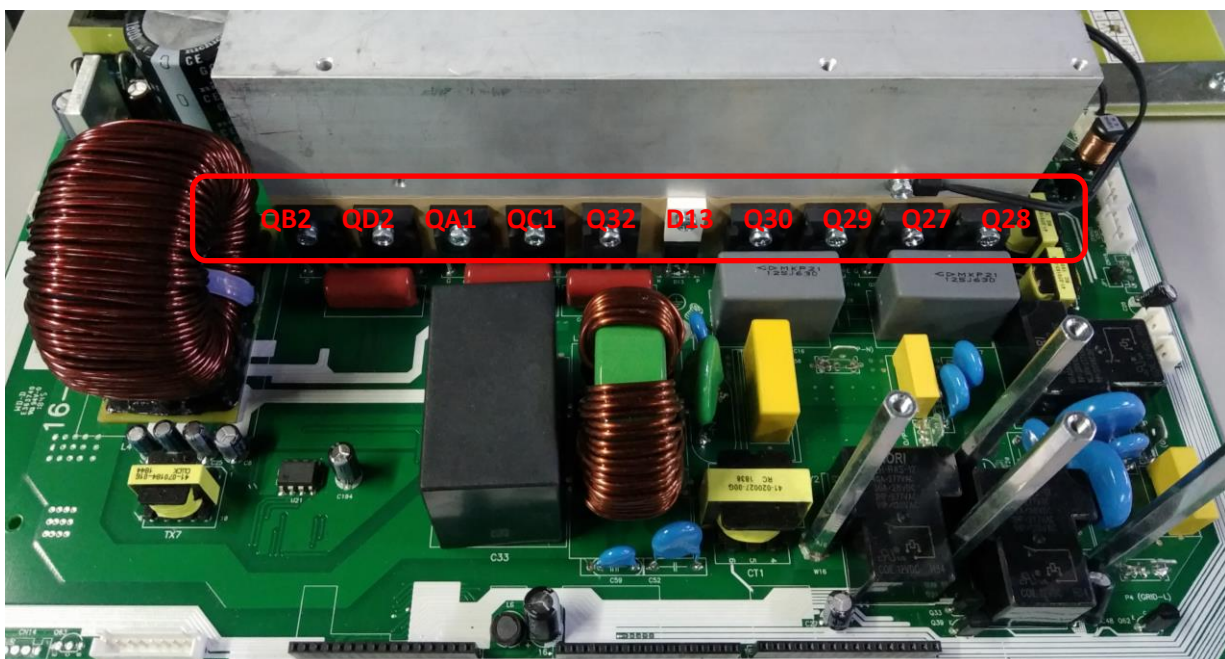
Parts	Attribute	Reference values	Failure status
R91/R102/R96/R101	Resistor	47 ohm	Open or other values

**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

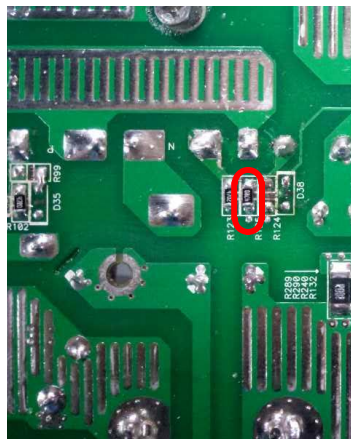


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Parts	Attribute	Reference values	Failure status
Q32	Resistor	GS: 22.4 K GD: 230K CS: 1.46M	Short or explosion
	Diode	SD or CE: 0.375V DS or EC: OL	
D13	Resistor	+ to -: 185.6K - to +: OL	
	Diode	+ to -: 0.38V - to +: OL	

**Drivers (This part is only used for repair checking)**



Parts	Attribute	Reference values	Failure status
R125	Resistor	47 ohm	Open or other values

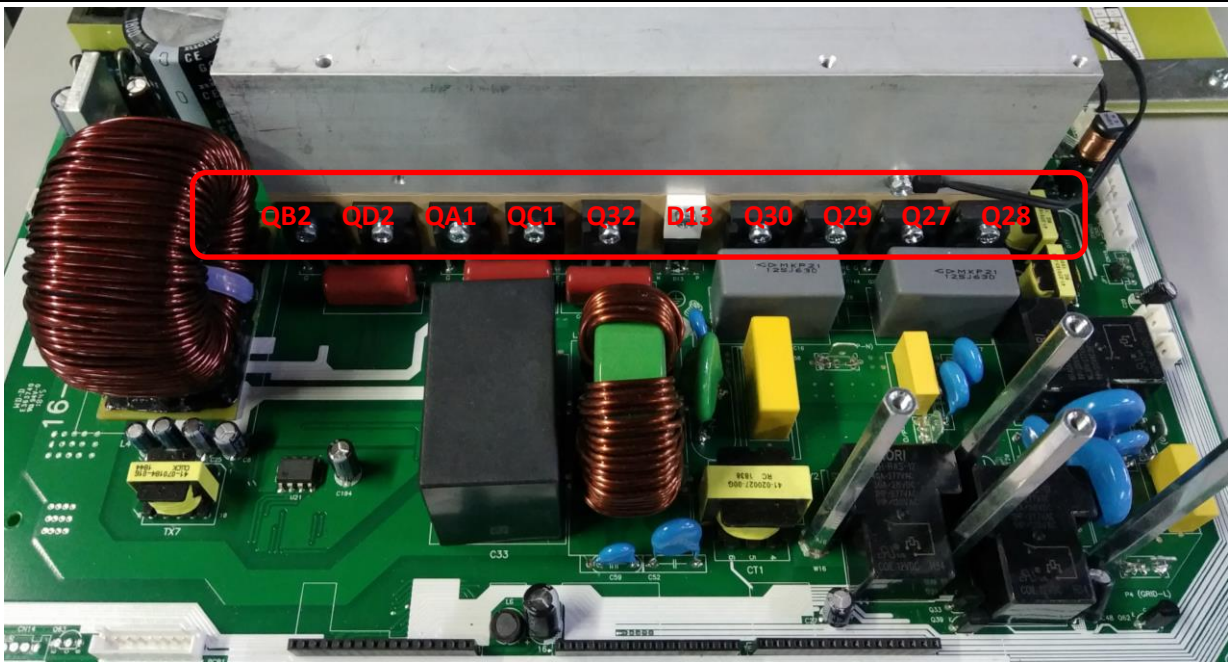
**Note:** When test the diode; please remove the R124 from the board, otherwise the test result is not right.

## Check the INV full bridge

### Power devices

INV IGBT: QB2/QD2/QA1/QC1

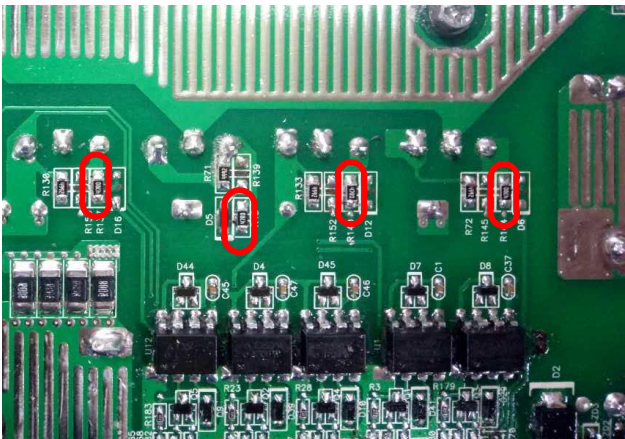




Parts	Attribute	Reference values	Failure status
QB2/QD2/QA1/QC1	Resistor	GE: 22.9K GC: 250k CE: 1.5M	Short or explosion
	Diode	EC: 0.4V CE: OL	

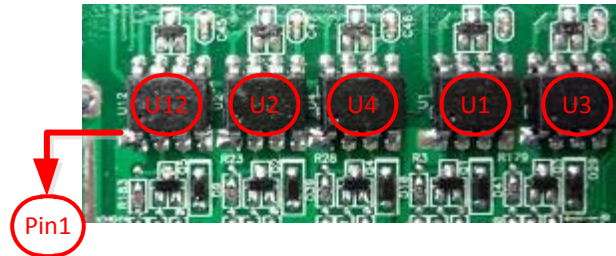
Note1: If one or more of them were damaged, please replace all of them.

Drivers



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

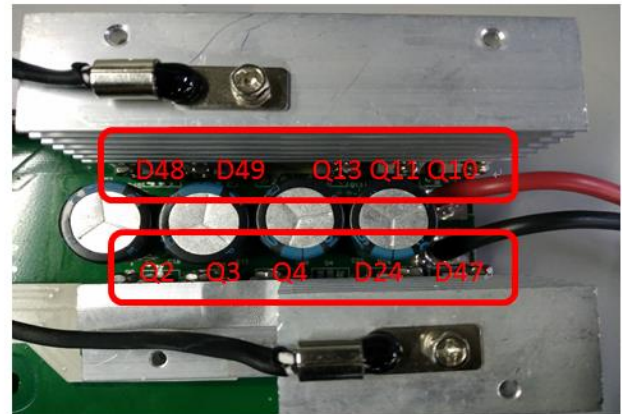
Optocoupler: U12/U2/U4/U1/U3



Parts	Attribute	Reference values	Failure status
U1/U2/U3/U4/U12	Resistor	PIN8 TO PIN5: <b>0.948M</b> PIN7 TO PIN5: <b>0.980M</b>	Short or explosion

### 3.4 Check the MPPT board

#### Power devices



Parts	Attribute	Reference values	Failure status
<b>Q2,Q3,Q4,Q10,Q11,Q13</b>	Resistor	GS: <b>5k</b> GD: <b>36K</b> DS: OL	Short or explosion
	Diode	SD: <b>0.445V</b> DS: OL	
<b>D24,D47,D48,D49</b>	Resistor	+ to -: <b>0.86k</b> - to +: OL	Short or explosion
	Diode	+ to -: <b>0.144V</b> - to +: OL	
<b>Q16</b>	Resistor	GS: <b>46.8K</b>	Short or explosion

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		GD: 404K DS: OL	
	Diode	SD: 0.534V DS: OL	

## 4. Disassembling guide

### 4.1 Open the case

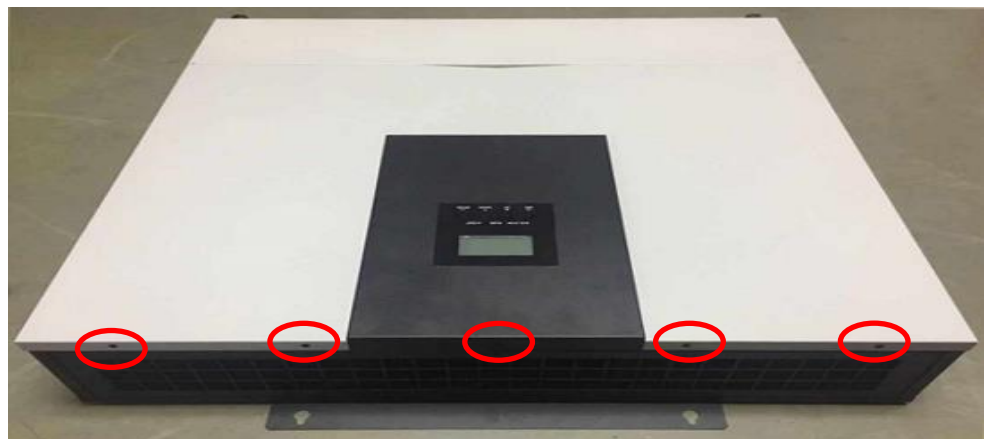
Remove screws on the top cover



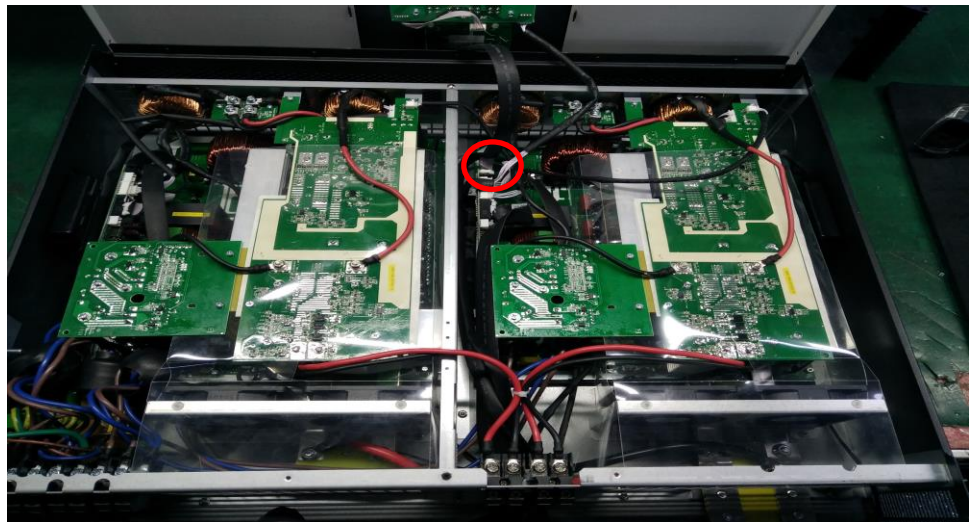


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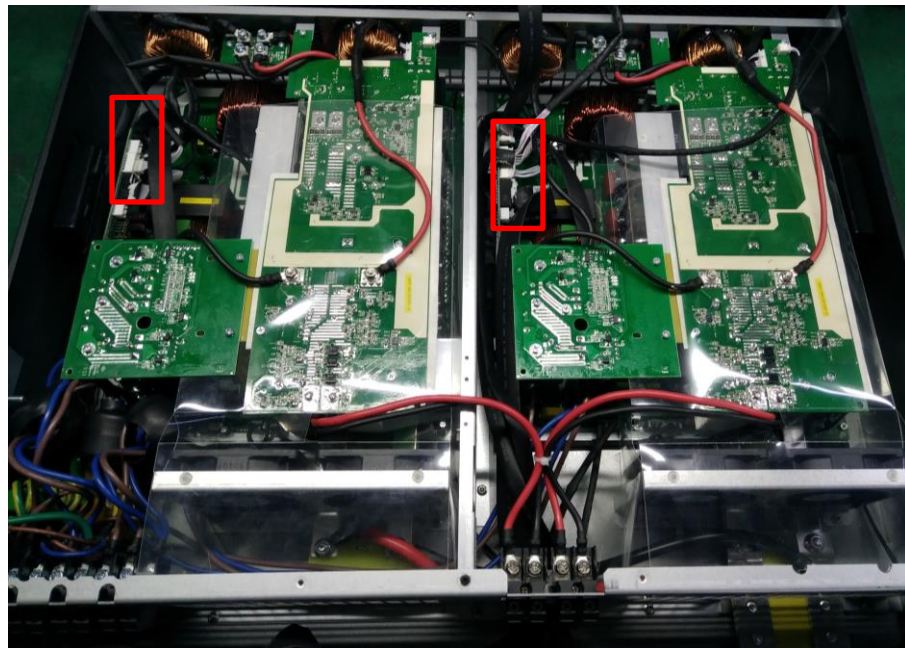


Open the top cover carefully, for there are two cables connected with LCD display.

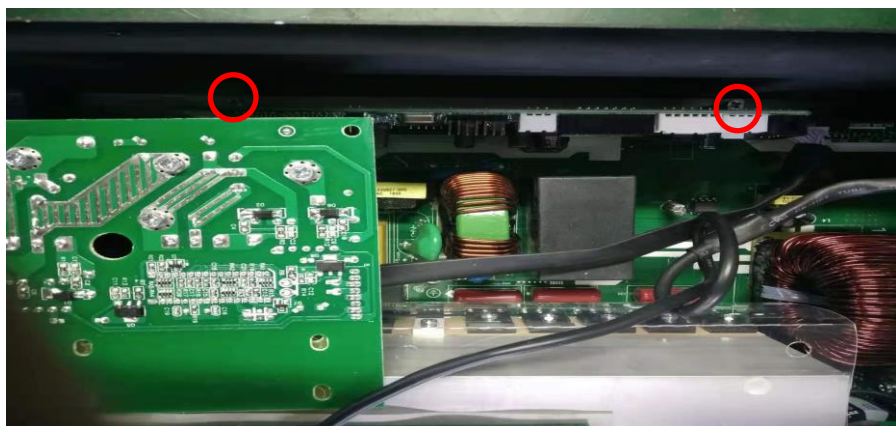
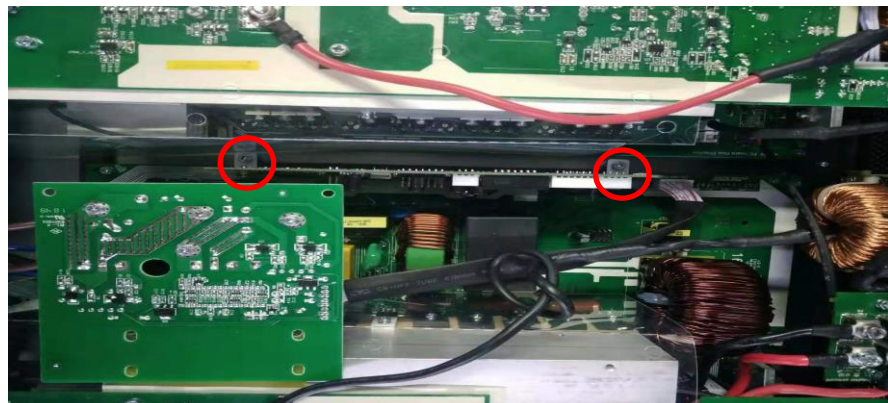


### 4.2 Remove the control board

Remove the cables  
on the control board.

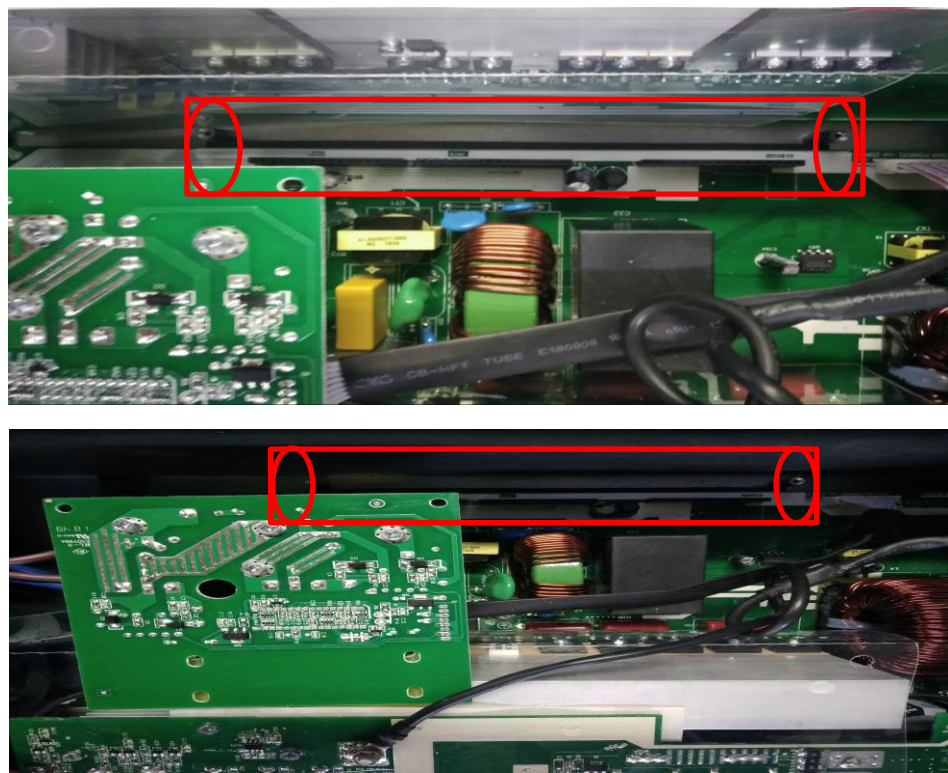


Remove the fixing  
screws.





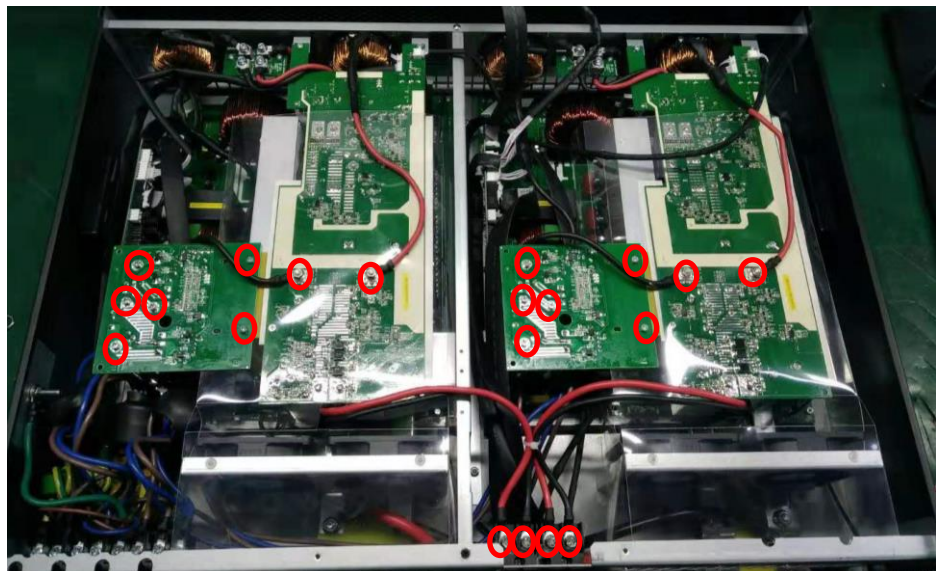
Take out the control board.



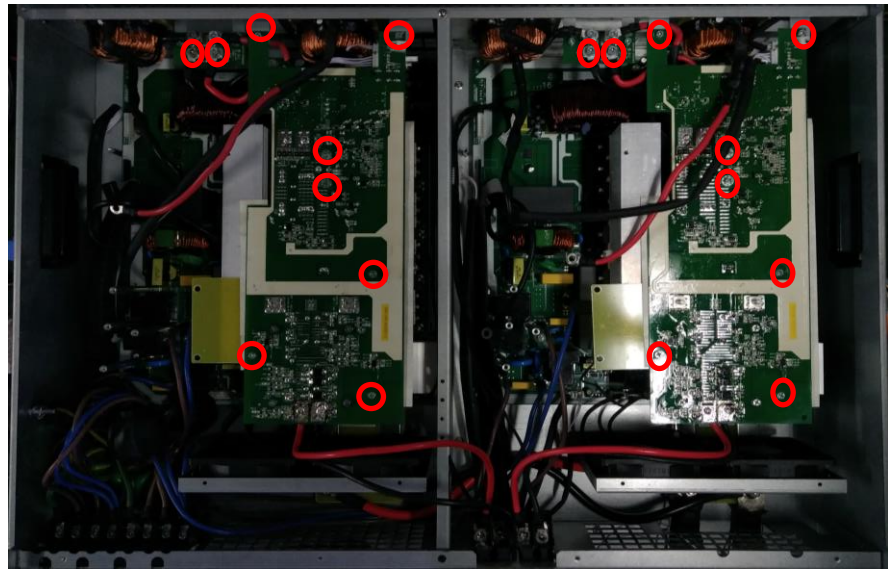
**Note:** When you put the new control board on the main board, please make sure that the connection is correct and tighten. Don't forget to put the screws and cables back.

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

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



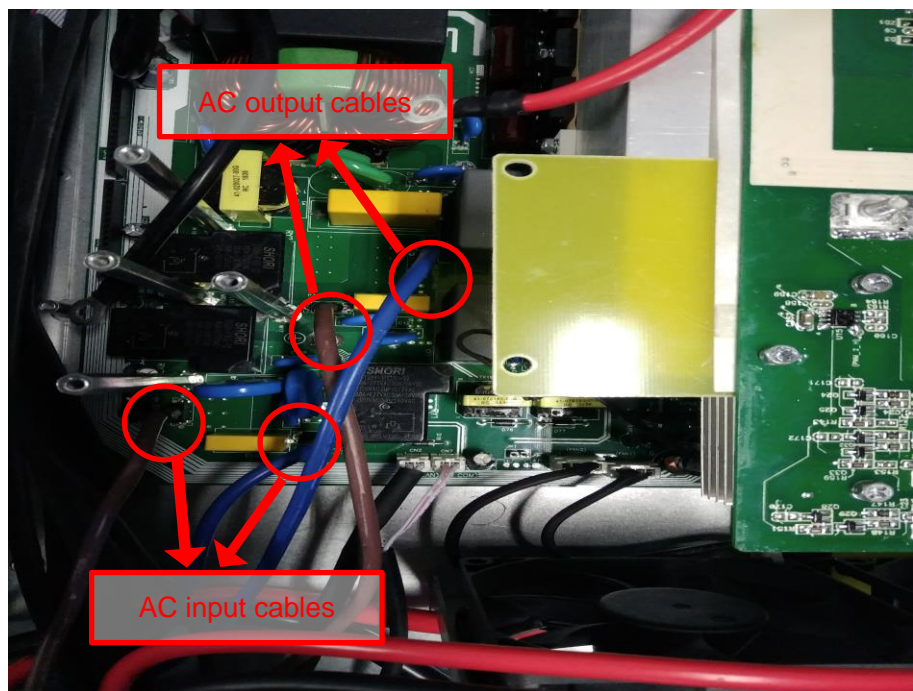
Remove the screws and the signal cables of the MPPT board , and you can take the MPPT board paper off.



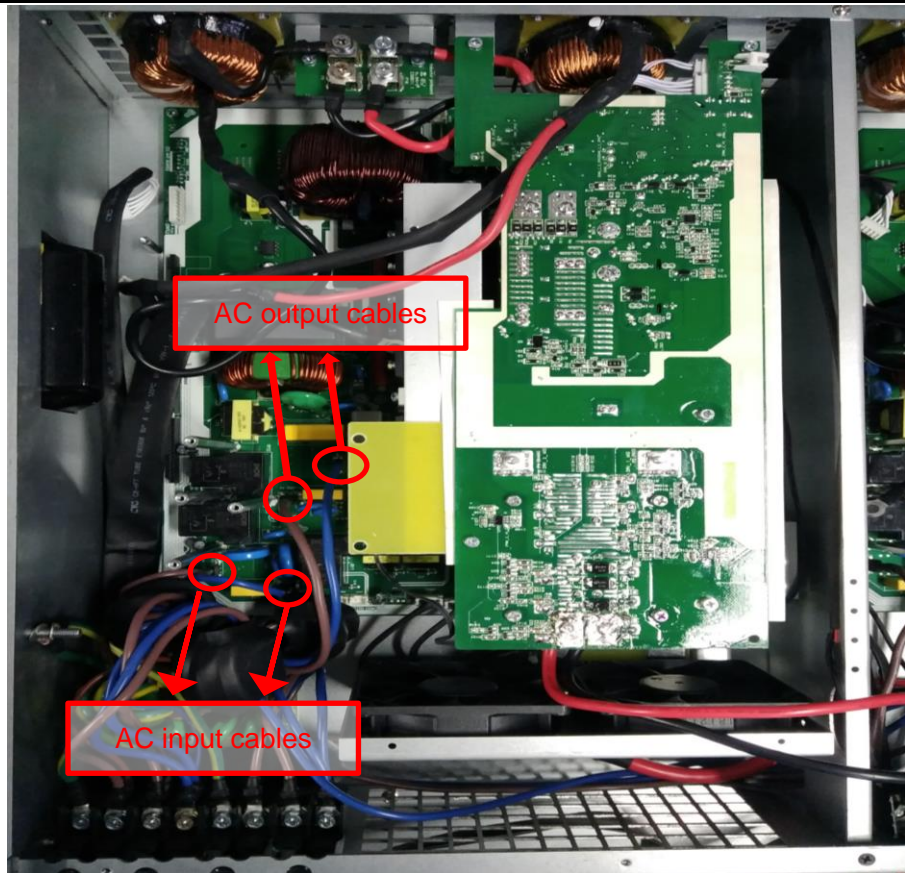
#### 4.4 Remove the main board.

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

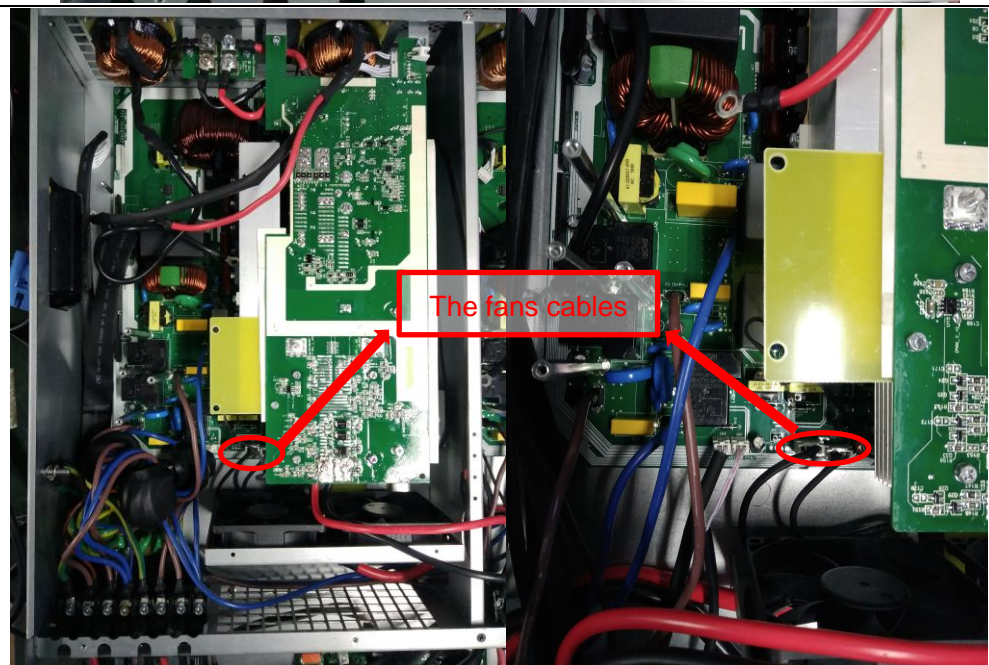
Remove the power cables of AC output and input.  
Brown cable is line;  
blue cable is neutral.  
Do not make the wrong polarity.







Remove the fans cables.



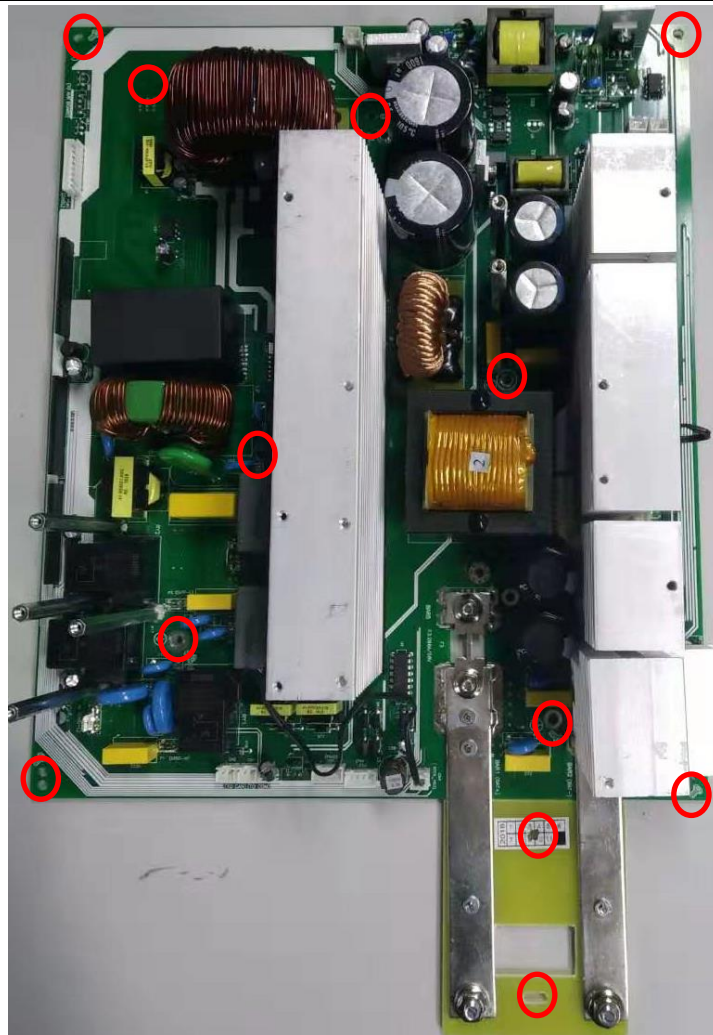
Remove the screws and the signal cables on the main board. And then you can take the main

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board out.

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





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