

## Maintenance Manual for HT33010-15XL/XS



# INVT Power System

Power Solution Specialist

## Safety Instruction

This manual contains important information on safe operation of the UPS. Please carefully read this manual prior to operation. Service personnel should understand all the information on warning and operate according to the instruction.

### **Warning**

Battery is of high hazardous voltage and may cause large short circuit current. The following precautions should be observed before any operations on the battery.

- Wear rubber gloves and boots.
- Remove rings, watches and other metal objects.
- Use tools with insulated handles.
- Do not lay tools or other metal objects on the batteries.
- If the battery is damaged in any way or shows signs of leakage, contact your local representative immediately.
- Do not dispose of batteries in a fire. The batteries may explode.
- Handle, transport and recycle batteries in accordance with local representative.

### **Warning**

Although the UPS has been designed and manufactured to ensure personal safety, improper use can result in electrical shock or fire. To ensure safety, observe the following precautions:

- Turn off and unplug the UPS before cleaning it.
- Clean the UPS with a dry cloth. Do not use liquid or aerosol cleaners.
- Never block or insert any objects into the ventilation holes or other openings of the UPS.
- Do not place the UPS power cord where it might be dangerous.
- Ensure the cable are correctly connected before powering on
- Ensure to place the UPS with enough space for ventilation and access to maintenance
- If there is fire accident, use dry powder extinguisher.

### **Attention:**

**In any case when the UPS needs to be operated with cover being removed, please ensure to turn off the input switch, bypass switch and battery switch to completely shut down the UPS .Wait 10 minutes before operation to avoid high voltage of the bus.**

## 目录

<b>1. Product structure</b> .....	4
<b>1.1 Outlook</b> .....	4
<b>1.2 LCD Panel</b> .....	4
<b>1.3 Inner structure</b> .....	6
<b>2. Topology and Operational principle</b> .....	8
<b>2.1 Topology</b> .....	8
<b>2.2 Operational principle</b> .....	9
<b>3. Components introduction</b> .....	10
<b>3.1 Control board</b> .....	10
<b>3.2 Input board</b> .....	10
<b>3.3 Rectifier board</b> .....	11
<b>3.4 Inverter board</b> .....	12
<b>3.5 Output board</b> .....	12
<b>3.6 Bypass SCR board</b> .....	13
<b>3.7 Input EMI board</b> .....	13
<b>3.8 Battery EMI and lightning protection board</b> .....	14
<b>4. Detection</b> .....	15
<b>4.1 Detection of the fuse</b> .....	15
<b>4.2 Detection of rectifier IGBT</b> .....	16
<b>4.3 Detection of inverter IGBT</b> .....	16
<b>4.4 Output relay detection</b> .....	17
<b>4.5 Resistors detection</b> .....	17
<b>4.5 Drive test</b> .....	19
<b>5. Maintenance</b> .....	20
<b>5.1 Trouble-shooting</b> .....	20
<b>5.2 Common Faults and Maintenance</b> .....	21

# 1. Product structure

## 1.1 Outlook

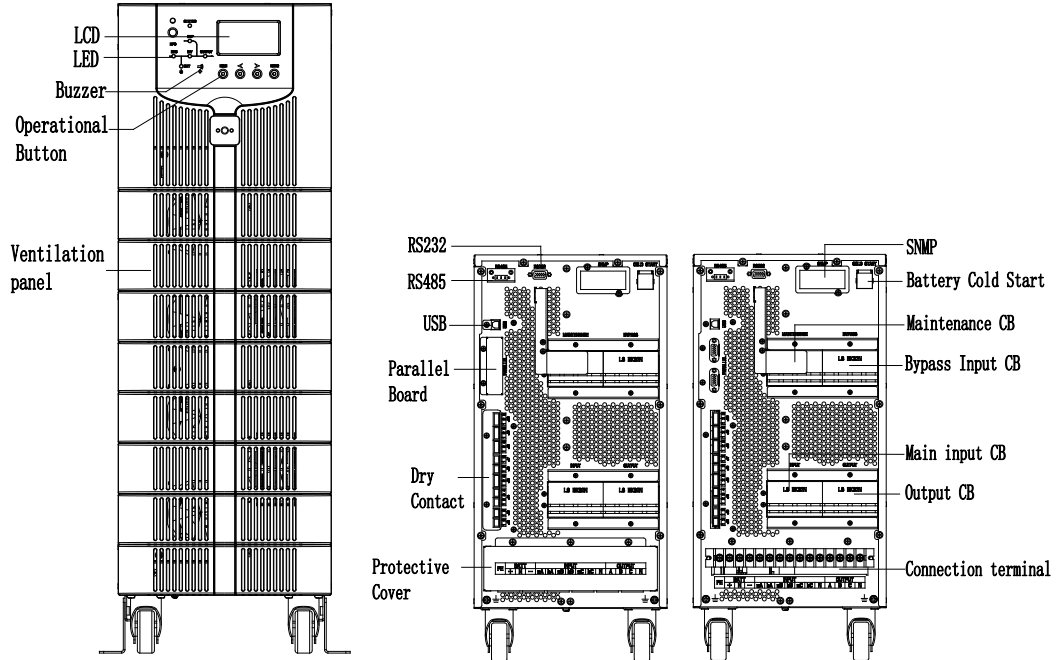


Fig.1-1 10/15kVA System outlook (Long backup type)

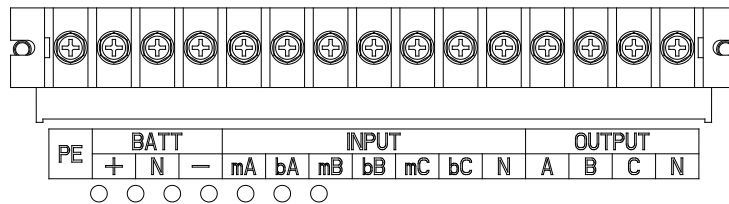


Fig.1-2 connections terminals for 10/15kVA

## 1.2 LCD Panel

The structure of operator control and display panel for cabinet is shown in Fig.1-3.

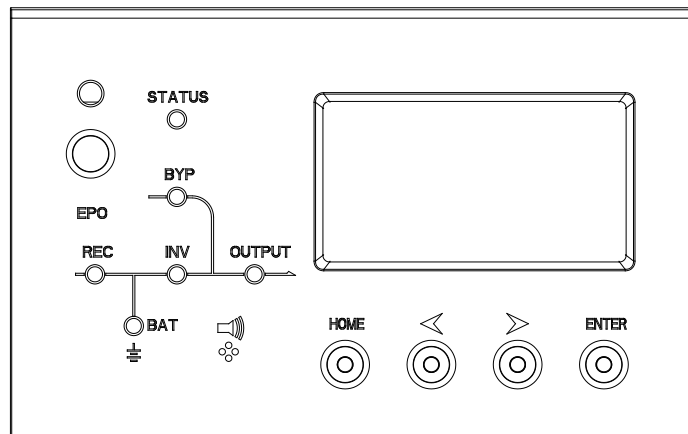


Fig.1-3 Control and display panel for cabinet

The LCD panel for cabinet is divided into three functional areas: LED indicator, control and operation keys and LCD screen.

After the monitoring system starts self-test, the system enters the home page, following the welcome window. The home page is shown in Fig.1-4.

Home page consists of System Information Window, Menu Window and Current Command and Record Menu.

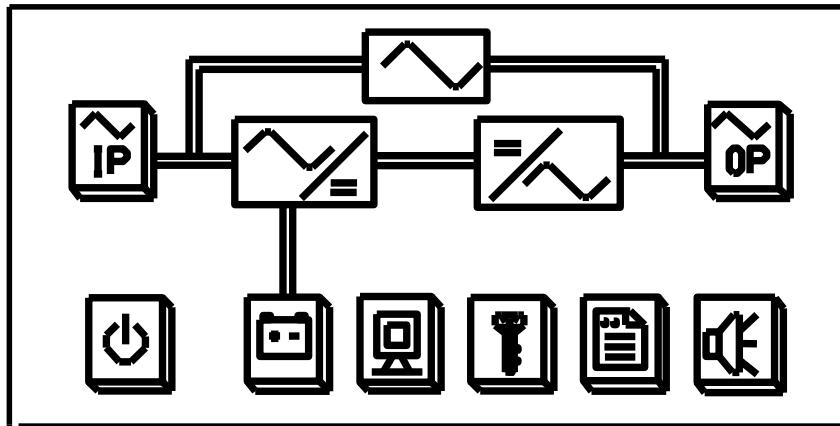


Fig.1-4 Home page

The description of LCD icons is shown in Table 1-1

Table 1-1 Description of LCD Icons

Icon	Description
	Power On/Off button
	Parameters of Main & Bypass Input
	History log
	Function set(Fault Clear, Battery Test, Battery Maintenance, language set, Manual Transfer, etc.), System Configuration(For Service Engineer Only)
	Parameters of Battery, DC bus information, Temperature etc.
	Parameters of Output & Load
	Warning, S-code and System Information(Rated parameters, Version Information)
	Mute on/off
	Page Up & Down

### 1.3 Inner structure

The HT33010XL/XS and the HT33015XL/XS are similar in structure. Consisting of follow parts: control PCB, input PCB, rectifier PCB, bus fuse PCB, inverter PCB, output PCB, bypass PCB, input EMI PCB, battery EMI and lightning protection PCB. The charger is at the input PCB, and the aux power is at the output PCB. The inner structure is shown in Fig.1-5 to Fig.1-7.

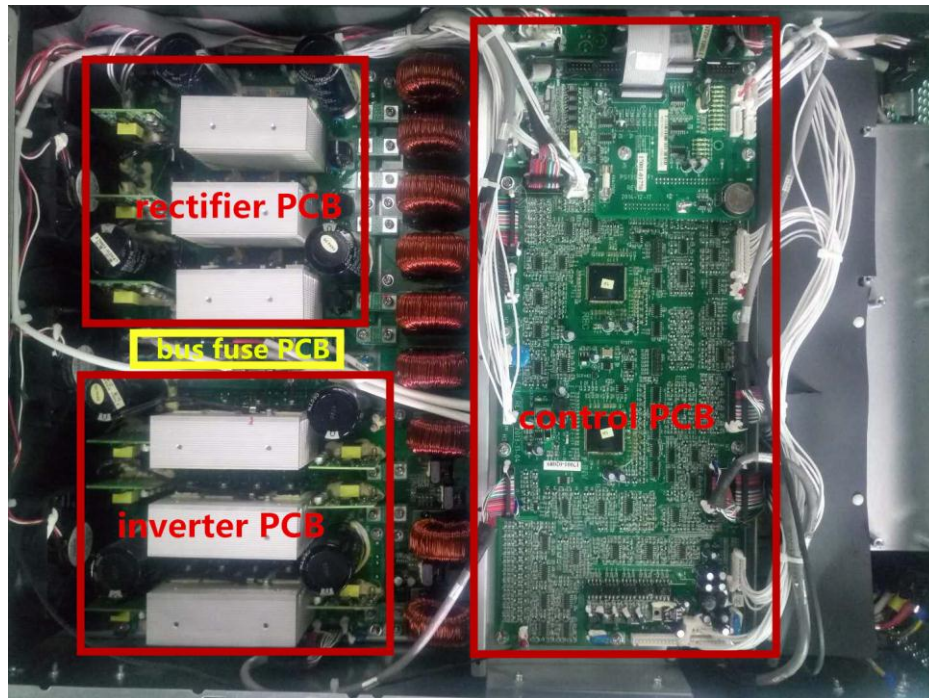


Fig.1-5 Inner structure (a)

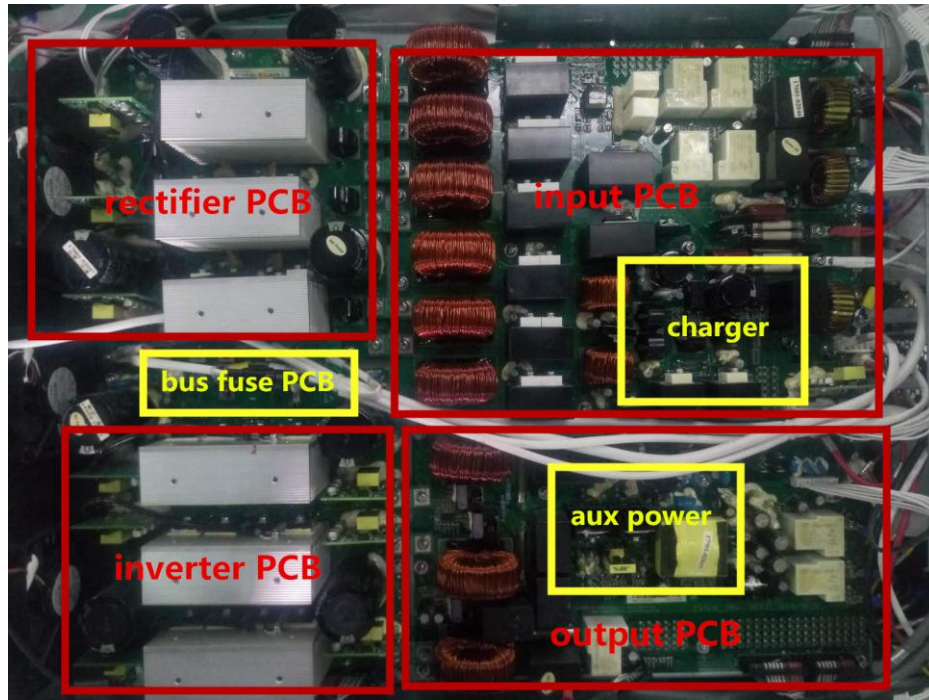


Fig.1-6 Inner structure (b)

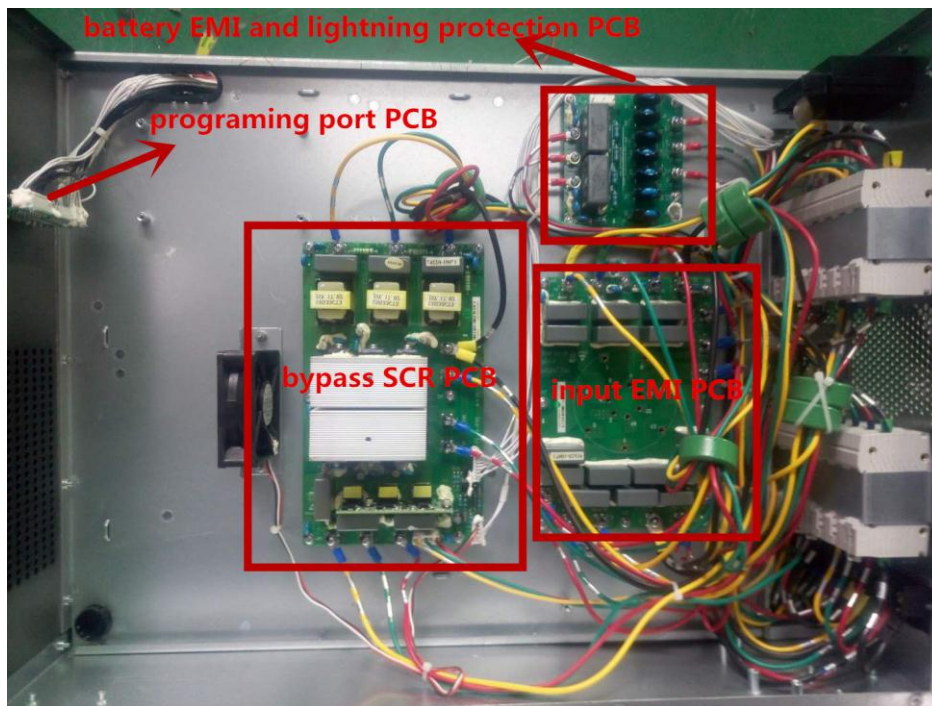


Fig.1-7 Inner structure (c)  
Battery EMI and lightning protection PCB

## 2. Topology and Operational principle

### 2.1 Topology

The topology is shown in Fig.2-1 and Fig.2-2.

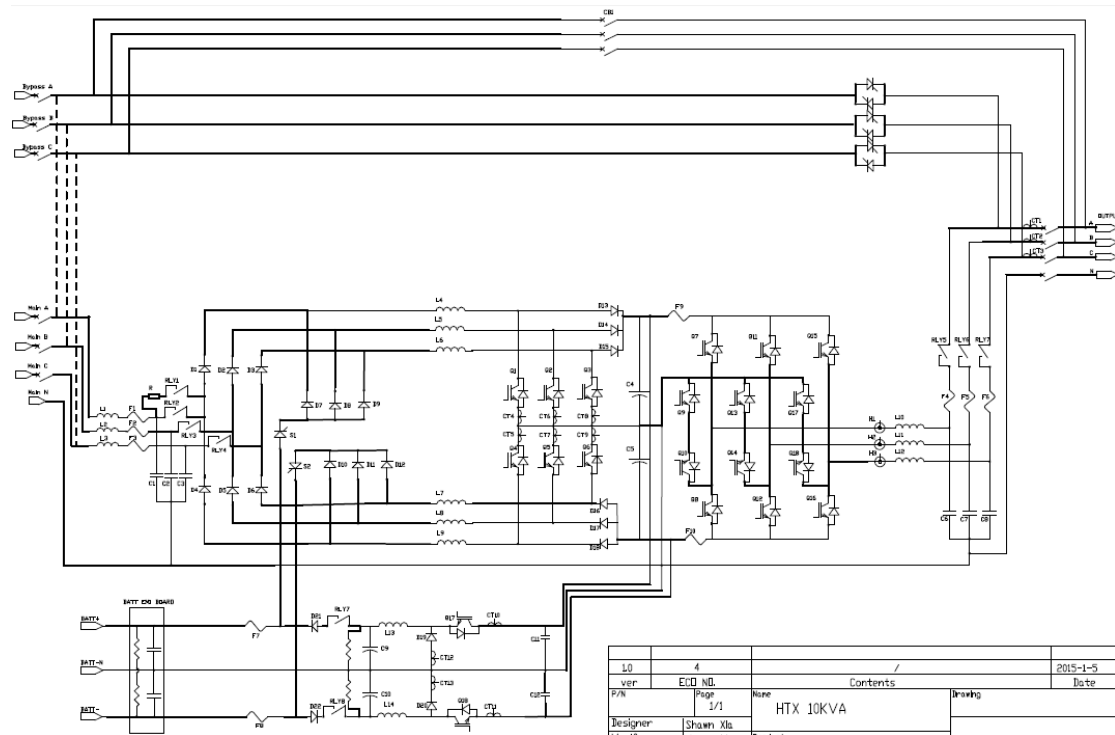


Fig.2-1 HT33010XL Topology

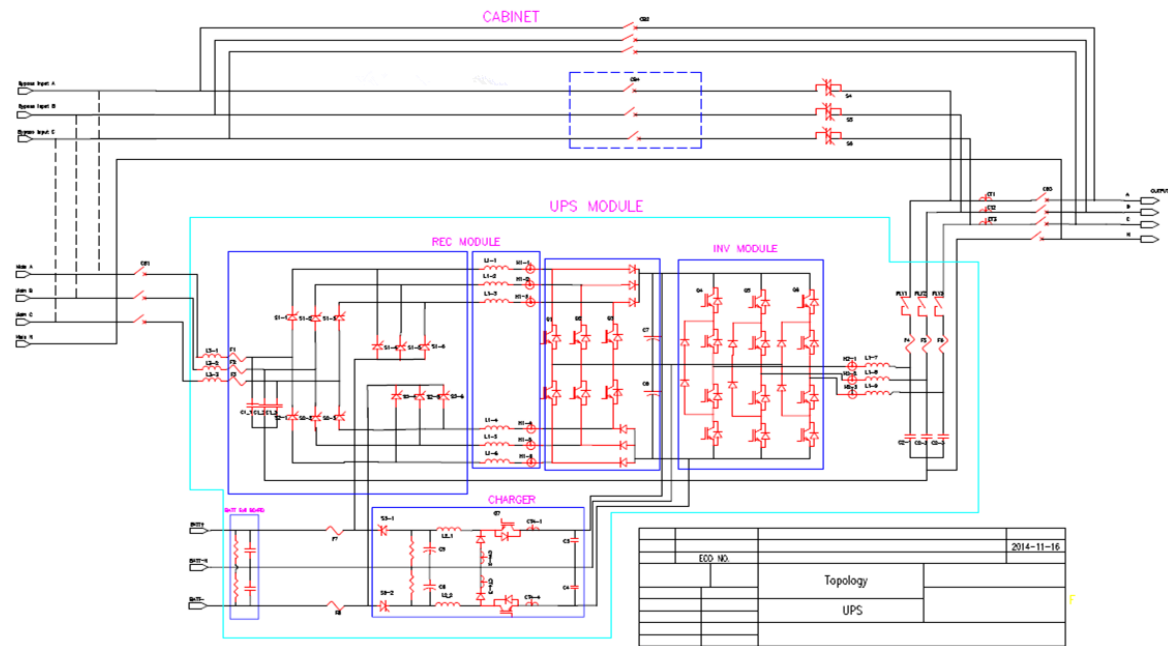


Fig.2-2HT33010XL Topology



## 2.2Operational principle

The input AC sine wave is transferred to DC bus voltage of 400VDC by rectifier with PFC technology. The process is as following: the main AC input is filtered by the LC and rectified by SCR (HT33010XL/XS is rectified by relays and diodes), then the source is boosted to 400VDC by the booster consisting of rectifier IGBT, inductance and capacitors.

For the DC bus voltage ,In one way, the independent charger regulate the DC bus voltage to for the battery charging; For the other way, the DC bus supply the inverter consisting of inverter IGBT, inductance and filter capacitor transfer the DC to AC pure sine wave with the three-level technology.

### 3. Components introduction

#### 3.1 Control board

The detailed introduction of control board is shown in Fig.3-1

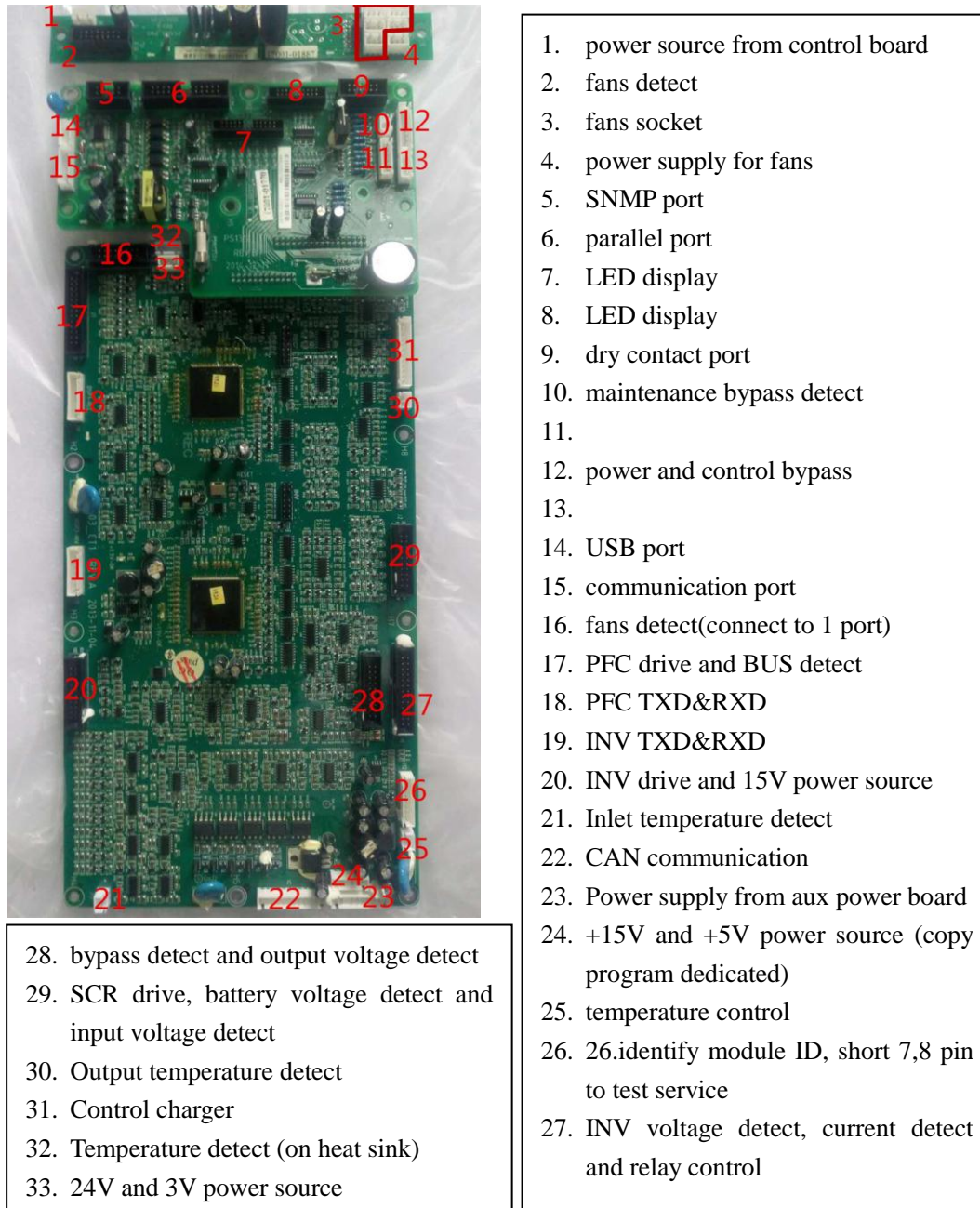


Fig.3-1 control board introduction

#### 3.2 Input board

The detailed introduction of input board is shown in Fig.3-2

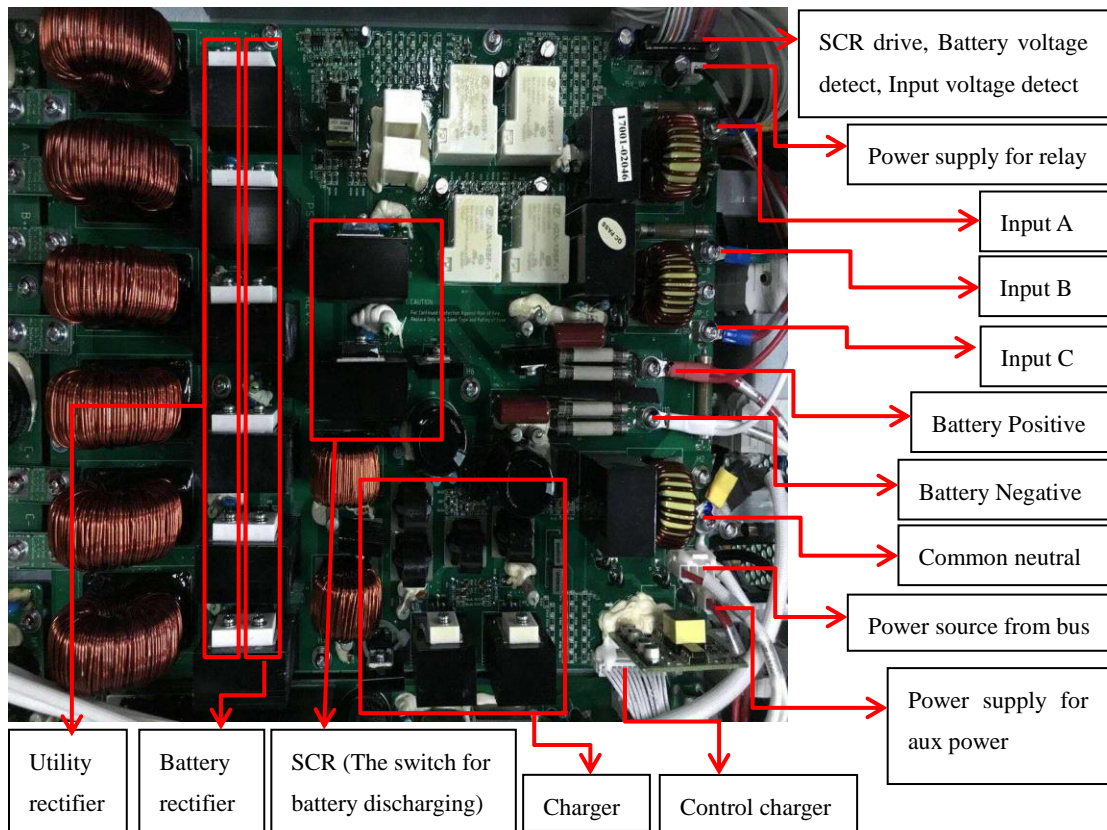


Fig.3-2 input board introduction

### 3.3 Rectifier board

The detailed introduction of rectifier board is shown in Fig.3-3

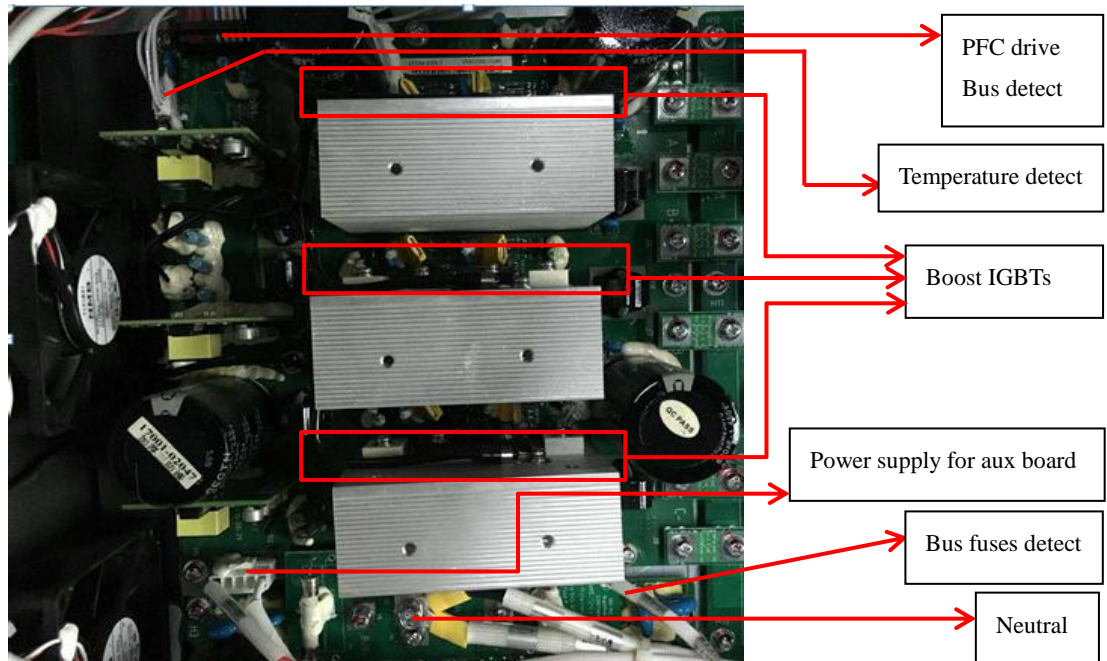


Fig.3-3 rectifier board introduction

### 3.4 Inverter board

The detailed introduction of inverter board is shown in Fig.3-4

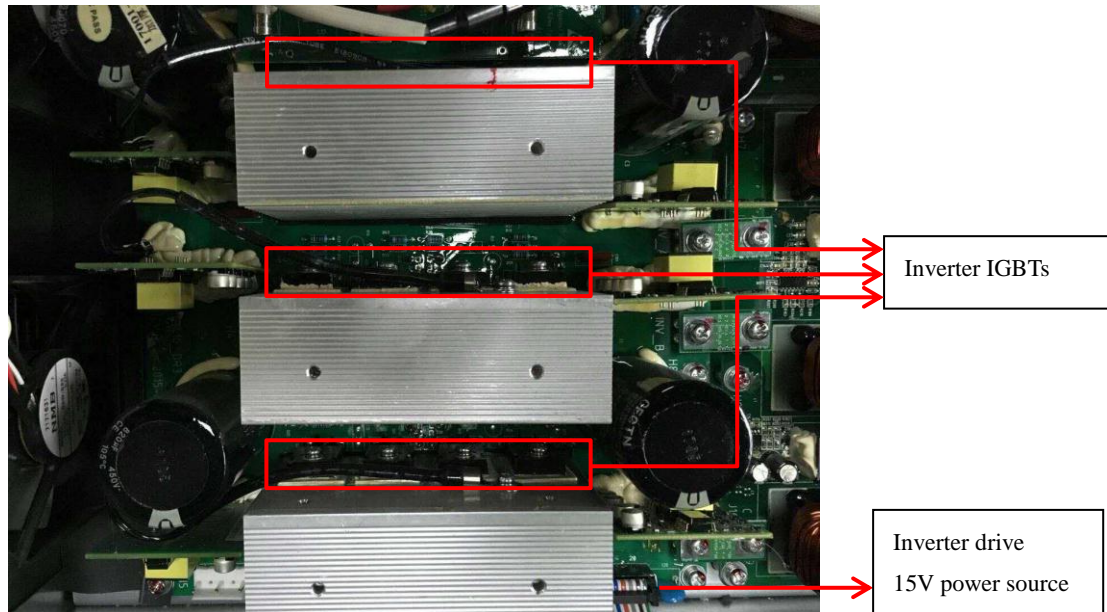


Fig.3-4 Inverter board introduction

### 3.5 Output board

The detailed introduction of output board is shown in Fig.3-5

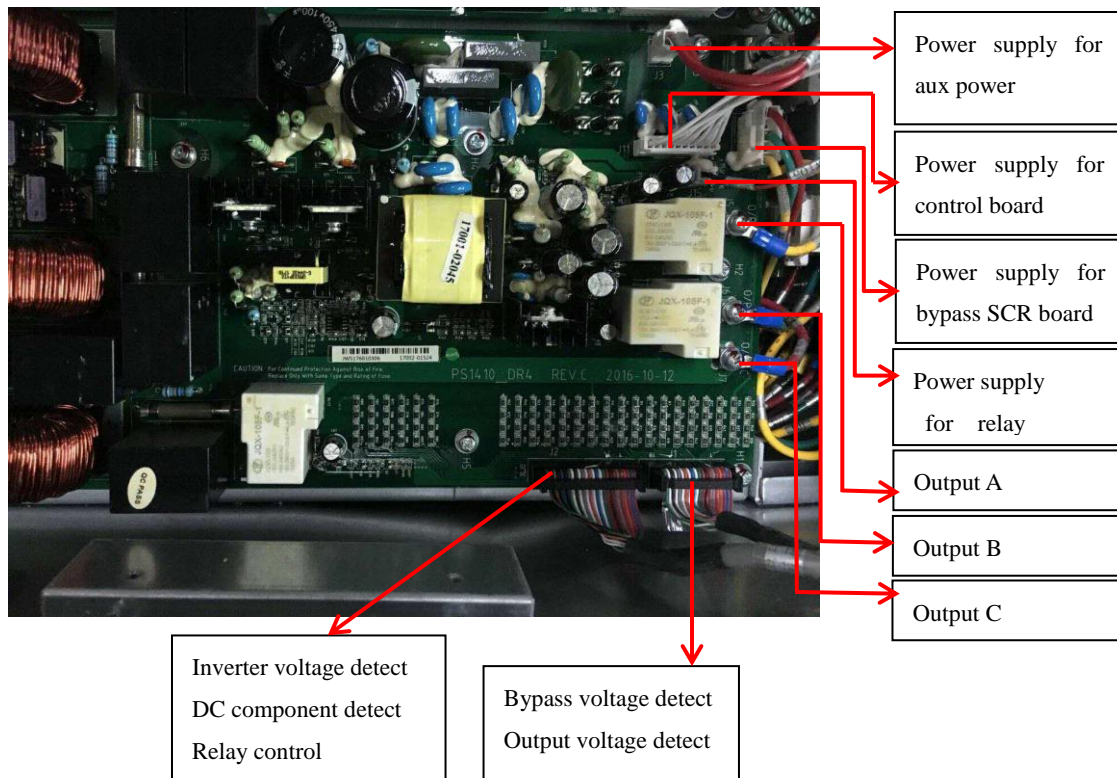


Fig.3-5 Output board introduction

### 3.6 Bypass SCR board

The detailed introduction of bypass SCR board is shown in Fig.3-6

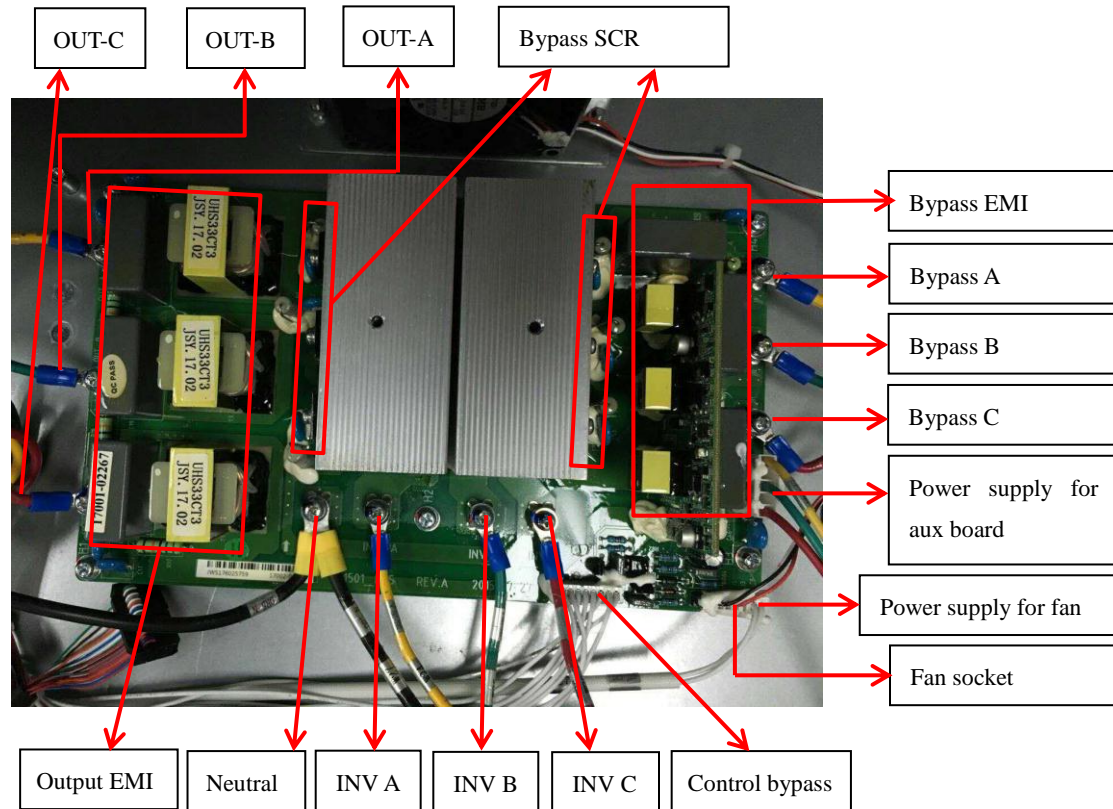


Fig.3-6 Bypass SCR board introduction

### 3.7 Input EMI board

The detailed introduction of input EMI board is shown in Fig.3-7

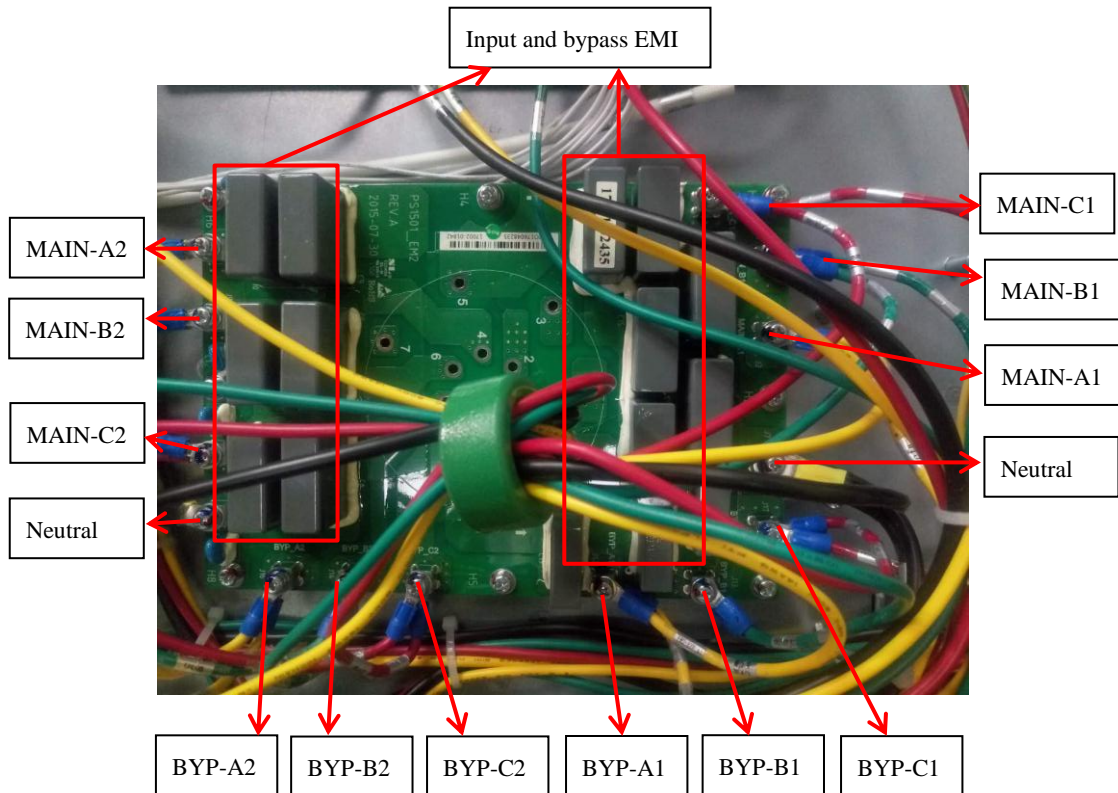


Fig.3-7 Input EMI board introduction

### 3.8 Battery EMI and lightning protection board

The detailed introduction of Battery EMI and lightning protection board board is shown in Fig.2-8

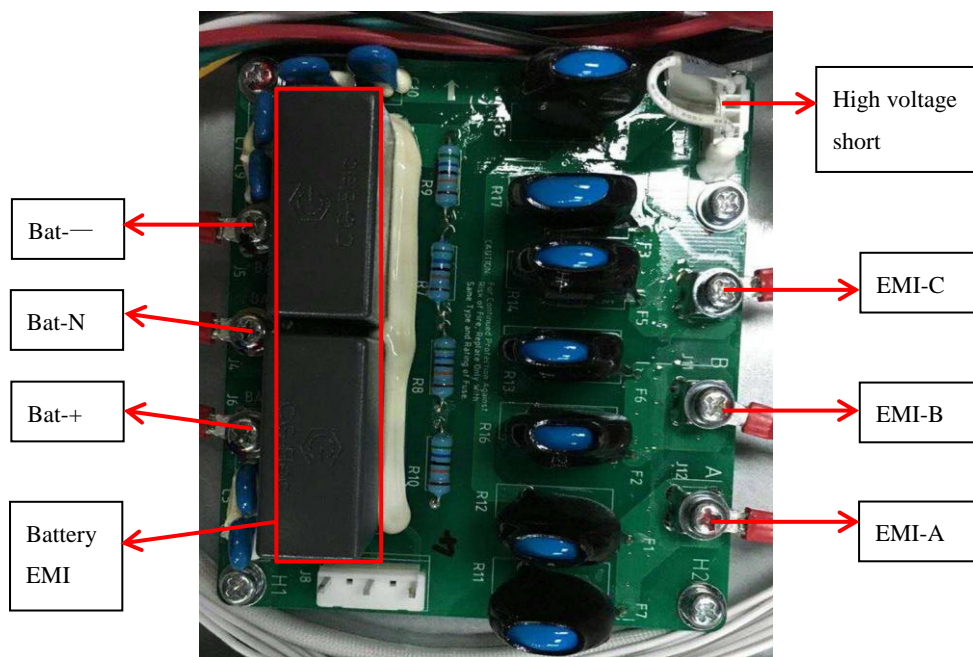


Fig.3-8 Input EMI board introduction

## 4. Detection

### 4.1 Detection of the fuse

Detect the resistance of the fuses. If the resistance is less than 1ohm, it means the fuses work well. If the resistance is infinite or no value, the fuses should be damaged. The fuses to be detected and their definitions are shown in Fig.4-1 to Fig.4-3.

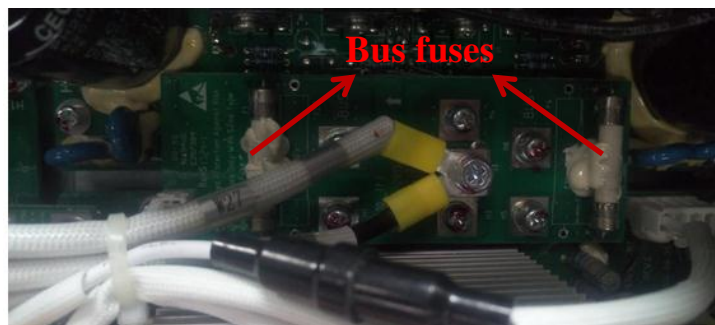


Fig.4-1 BUS fuses

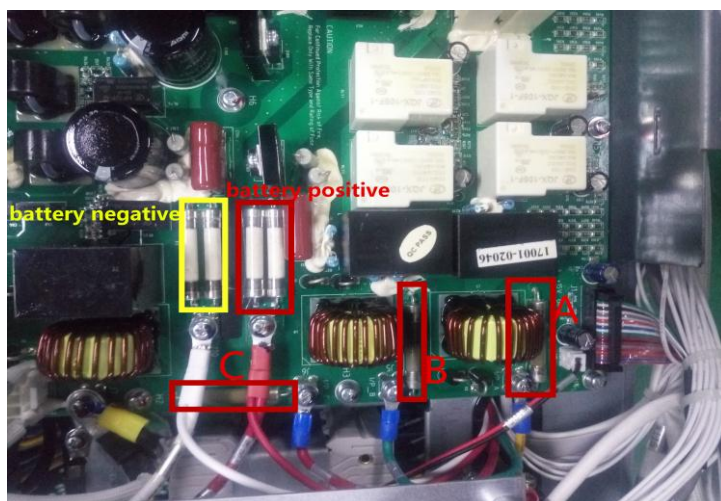


Fig.4-2 Input fuses and battery fuses

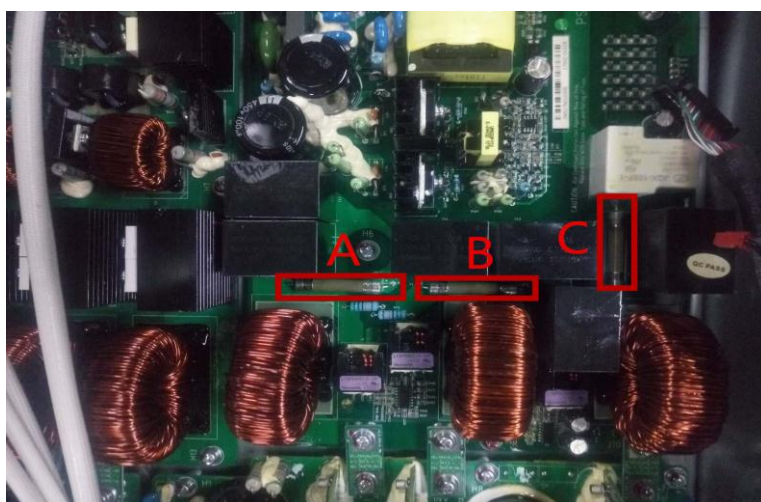


Fig.4-3 Output fuses

## 4.2 Detection of rectifier IGBT

Switch the multimeter to Diode Channel and test the voltage drop of the rectifier IGBT (shown in figure 5-2), the normal value should be  $0.35V \sim 0.45V$ . The procedures of testing rectifier IGBT of phase A are shown in Fig.4-4 and Fig.4-5.

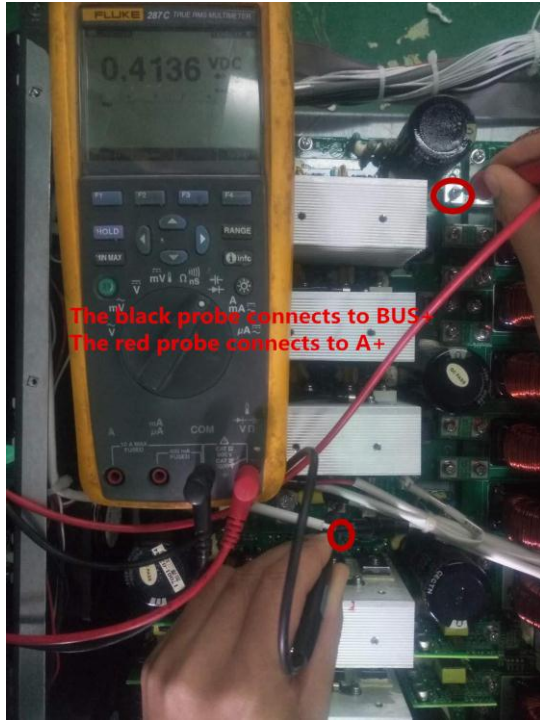


Fig.4-4 rectifier IGBTs detect (a)



Fig.4-5 rectifier IGBTs detect (b)

## 4.3 Detection of inverter IGBT

Switch the multimeter to Diode Channel and test the voltage drop of the inverter IGBT (shown in figure 5-2), the normal value should be  $0.35V \sim 0.45V$ . The procedures of testing inverter IGBT of phase A are shown in Fig.4-6 and Fig.4-7.



Fig.4-6 inverter IGBTs detect (a)



Fig.4-7 inverter IGBTs detect (b)



## 4.4 Output relay detection

Check the resistance of the relay between the input terminal and the fuse, as shown in Fig.4-8 following figure with red marks. If the resistance is infinite or no value, the relays should be OK. If the values are under several ohm, the relays should get shorted.

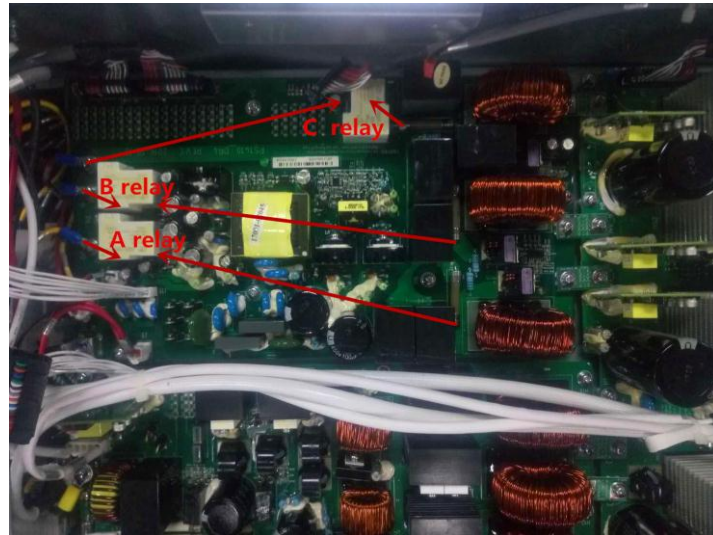


Fig.4-8 output relays

## 4.5 Resistors detection

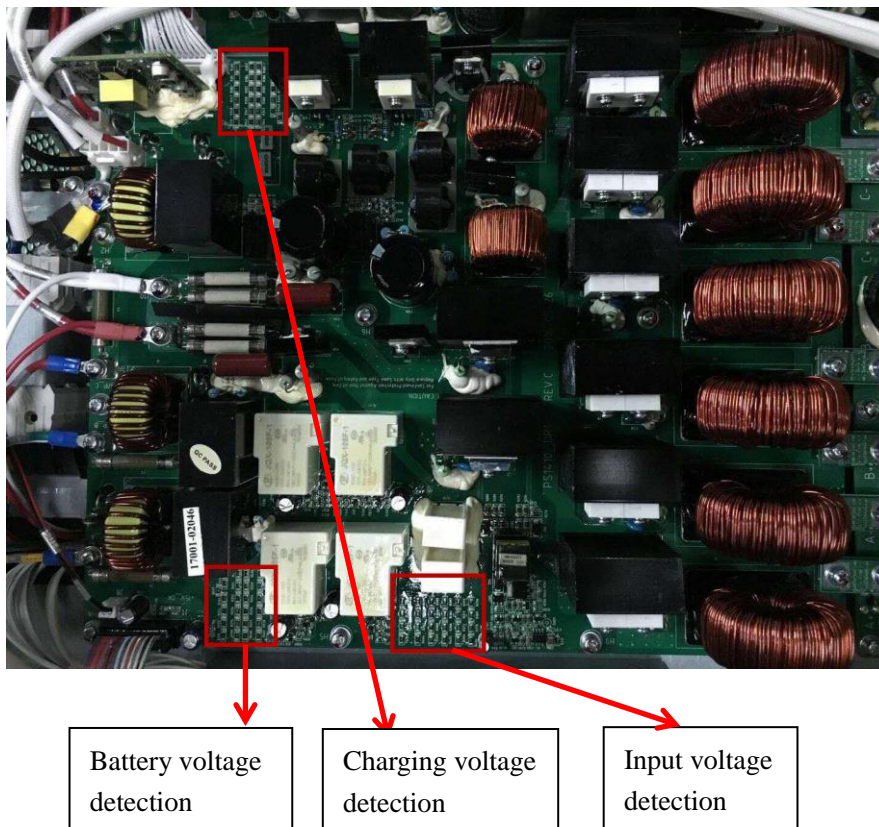


Fig.4-9 detection resistors (a)

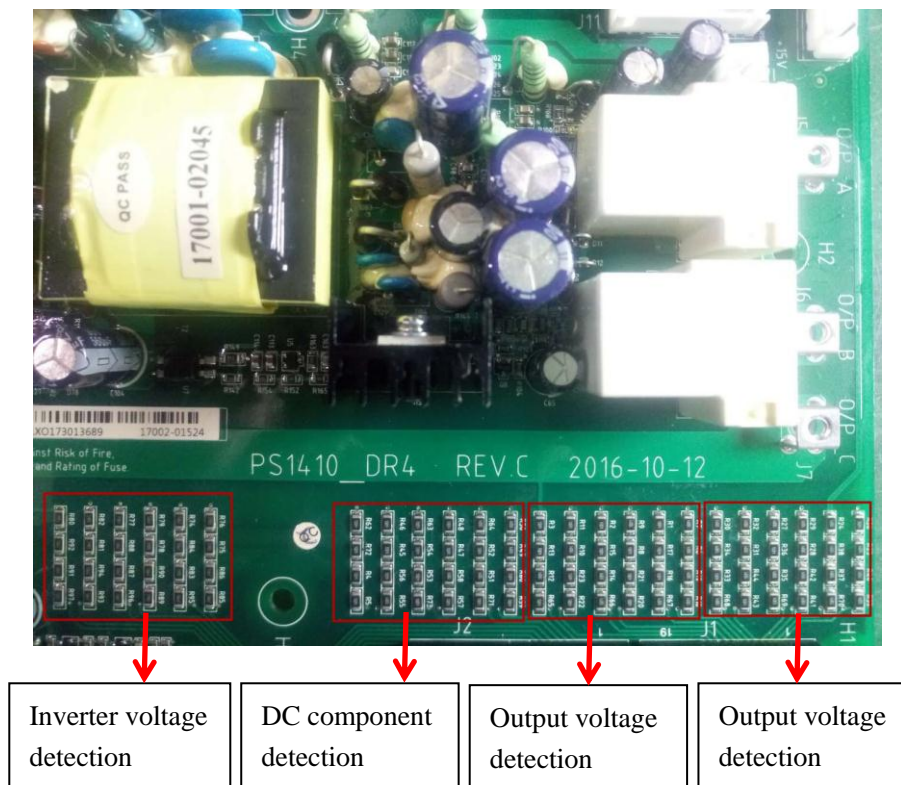


Fig.4-10 detection resistors (b)

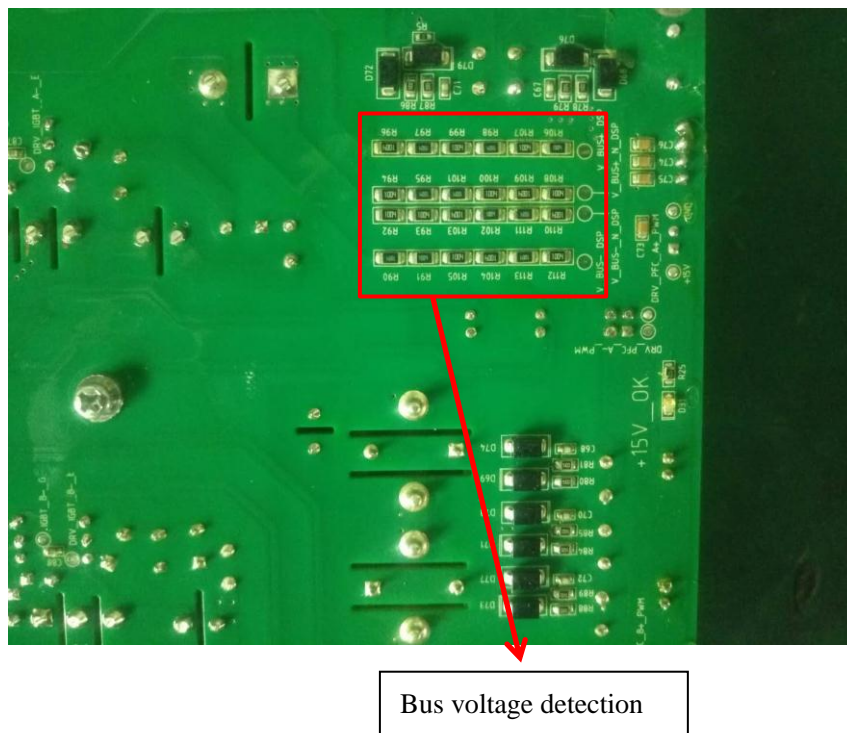


Fig.4-11 detection resistors (c)

### 4.5 Drive test

For the drive test, firstly short the SERVICE, as shown in Fig.4-12. And then power on the control board and connect to the power board, as shown in Fig.4-13.



Fig.4-12 short SERVICE

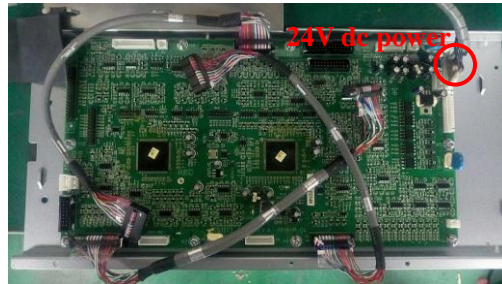


Fig.4-13 power for control board

The signal wave of rectifier SCR is shown in Fig.4-14. There are 12 SCRs, as shown in Fig.4-15.



Fig.4-14 the signal wave of SCR

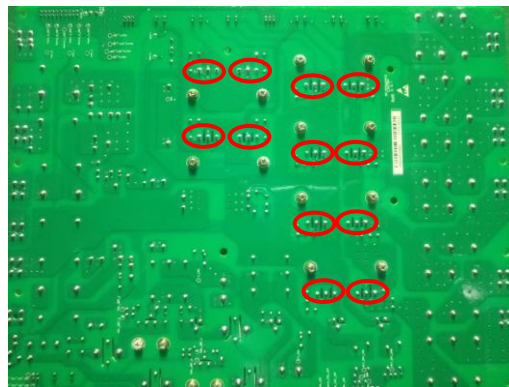


Fig.4-14 SCR distribution

The signal wave of boost IGBT is shown in Fig.4-16. There are 6 IGBTs, as shown in Fig.4-17.



Fig.4-15 the signal wave of boost IGBT

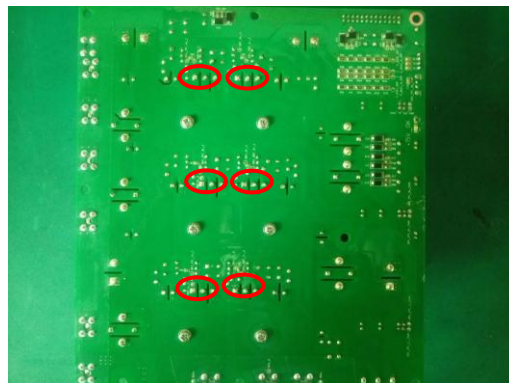


Fig.4-14 boost IGBT distribution

The signal wave of inverter IGBT is shown in Fig.4-16. There are 12 IGBTs, as shown in Fig.4-17.

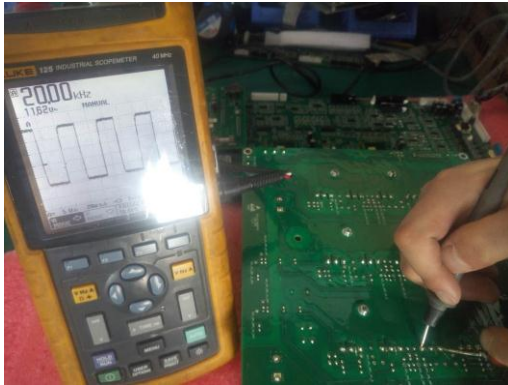


Fig.4-15 the signal wave of inverter IGBT

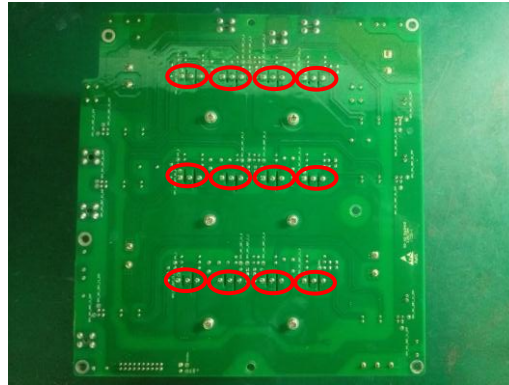


Fig.4-14 inverter IGBT distribution

## 5. Maintenance

### 5.1 Trouble-shooting

When the ups fault, please do the following preparations and contact to our after service engineer.

1. Record the type and the serial number of ups.
2. Notice the status of LEDs on the front panel and check the present alarm.
3. Download the history log and S-CODE (notice: please select the correct type of ups).
4. Check the input and output cable and breaker.
5. Check whether there are any visible damage marks inside the machine.
6. The description of fault.

## 5.2 Common Faults and Maintenance

The common faults and solution is shown in Table.5-1.

Table 5-1 common faults and maintenance

<b>Common faults</b>	<b>Solution and Maintenance</b>
Input Grid Neutral Lost	Put on the output breaker, and turn on the ups again.
Utility Abnormal	Check the whether the input power is normal, then check whether the input fuses are work well. If the fuses are broken, replace the input board.
Rectifier Soft Start Fail	Replace the input board.
Rectifier Fail	Replace the rectifier board.
Inverter Protect	Replace the inverter board and bus fuses board
Inverter Fail	Replace the inverter board
INV IGBT Driver Block	Replace the inverter board and bus fuses board
Output short and output overload	Check the loads firstly, if the loads have no problem, replace the output board
Relays connection lost	Replace the output board.
Fans fail	Replace the fans