Contents

Safety Instruction

Safety Message

Danger: Serious human injury or even death may be caused, if this requirement is ignored.
Warning: Human injury or equipment damage may be caused, if this requirement is ignored.
Attention: Equipment damage, loss of data or poor performance may be caused, if this requirement is ignored.
Commissioning Engineer: The engineer who installs or operates the equipment should be well trained in electricity and safety and familiar with the operation, debug, and maintenance of the equipment.

Warning Label

The warning label indicates the possibility of human injury or equipment damage, and advises the proper step to avoid the danger. In this manual, there are three types of warning labels as below.

Labels	Description
 Danger	Serious human injury or even death may be caused, if this requirement is ignored.
 Warning	Human injury or equipment damage may be caused, if this requirement is ignored.
 Attention	Equipment damage, loss of data or poor performance may be caused, if this requirement is ignored.

Safety Instruction

 Danger	✧ Performed only by commissioning engineers. ✧ This UPS is designed for commercial and industrial applications only, and is not intended for any use in life-support devices or system.
 Warning	✧ Read all the warning labels carefully before operation, and follow the instructions.
	✧ When the system is running, do not touch the surface with this label, to avoid any hurt of scald.
	✧ ESD sensitive components inside the UPS, anti-ESD measure should be taken before handling.

Move & Install

 **Danger**	✧ Keep the equipment away from heat source or air outlets. ✧ In case of fire, use dry powder extinguisher only, any liquid extinguisher can result in electric shock.
 **Warning**	✧ Do not start the system if any damage or abnormal parts founded. ✧ Contacting the UPS with wet material or hands may be subject to electric shock.
 **Attention**	✧ Use proper facilities to handle and install the UPS. Shielding shoes, protective clothes and other protective facilities are necessary to avoid injury. ✧ During positioning, keep the UPS way from shock or vibration. ✧ Install the UPS in proper environment, more detail in section 3.3.

Debug & Operate

 **Danger**	✧ Make sure the grounding cable is well connected before connecting the power cables, the grounding cable and neutral cable must be in accordance with the local and national codes practice. ✧ Before moving or re-connecting the cables, make sure to cut off all the input power sources, and wait for at least 10 minutes for internal discharge. Use a multi-meter to measure the voltage on terminals and ensure the voltage is lower than 36V before operation.
 **Attention**	✧ The earth leakage current of load will be carried by RCCB or RCD. ✧ Initial check and inspection should be performed after long time storing of UPS.

Maintenance & Replacement

 **Danger**	✧ All the equipment maintenance and servicing procedures involving internal access need special tools and should be carried out only by trained personnel. The components that can only be accessed by opening the protective cover with tools cannot be maintained by user. ✧ This UPS full complies with “IEC62040-1-1-General and safety requirements for use in operator access area UPS”. Dangerous voltages are present within the battery box. However, the risk of contact with these high voltages is minimized for non-service personnel. Since the component with dangerous voltage can only be touched by opening the protective cover with a tool, the possibility of touching high voltage component is minimized. No risk exists to any personnel when operating the equipment in the normal manner, following the recommended operating procedures in this manual.

Battery Safety

 **Danger**	✧ All the battery maintenance and servicing procedures involving internal access need special tools or keys and should be carried out only by trained personnel. ✧ WHEN CONNECTED TOGETHER, THE BATTERY TERMINAL VOLTAGE WILL EXCEED 400Vdc AND IS POTENTIALLY LEATHAL. ✧ Battery manufacturers supply details of the necessary precautions to be observed when working on, or in the vicinity of, a large bank of battery cells. These precautions should be followed implicitly at all times. Particular attention should be paid to the recommendations concerning local environmental conditions and the provision of protective clothing, first aid and fire-fighting facilities. ✧ Ambient temperature is a major factor in determining the battery capacity and life. The nominal operating temperature of battery is 20°C. Operating above this temperature will reduce the battery life. Periodically change the battery according to the battery user manuals to ensure the back-up time of UPS. ✧ Replace the batteries only with the same type and the same number, or it may cause explosion or poor performance. ✧ When connecting the battery, follow the precautions for high-voltage operation before accepting and using the battery, check the appearance the battery. If the package is damaged, or the battery terminal is dirty, corroded or rusted or the shell is broken, deformed or has leakage, replace it with new product. Otherwise, battery capacity reduction, electric leakage or fire may be caused. ● Before operating the battery, remove the finger ring, watch, necklace, bracelet and any other metal jewelry ● Wear rubber gloves. ● Eye protection should be worn to prevent injury from accidental electrical arcs. ● Only use tools (e.g. wrench) with insulated handles. ● The batteries are very heavy. Please handle and lift the battery with proper method to prevent any human injury or damage to the battery terminal. ● Do not decompose, modify or damage the battery. Otherwise, battery short circuit, leakage or even human injury may be caused. ● The battery contains sulfuric acid. In normal operation, all the sulfuric acid is attached to the separation board and plate in the battery. However, when the battery case is broken, the acid will leak from the battery. Therefore, be

	sure to wear a pair of protective glasses, rubber gloves and skirt when operating the battery. Otherwise, you may become blind if acid enters your eyes and your skin may be damaged by the acid. ● At the end of battery life, the battery may have internal short circuit, drain of electrolytic and erosion of positive/negative plates. If this condition continues, the battery may have temperature out of control, swell or leak. Be sure to replace the battery before these phenomena happen. ● If a battery leaks electrolyte, or is otherwise physically damaged, it must be replaced, stored in a container resistant to sulfuric acid and disposed of in accordance with local regulations. ● If electrolyte comes into contact with the skin, the affected area should be washed immediately with water.

Disposal

 **Warning**	✧ Dispose of used battery according to the local instructions

1. Introduction to UPS Structure and Key components

1.1 Structure

The modular UPS consists of power unit, charger/discharger, STS, Bypass Maintenance Switch and external battery, as is shown in Figure 1-1.

Power unit：

It consists of parallel power modules. Each power module includes Rectifier and Inverter.

Charger/Discharger：

When the UPS is normally powered by the utility, the UPS charges the battery; when there is no utility or abnormal, the battery discharges and the UPS is powered by the battery.

STS： It consists of two paralleled SCR. The load can be powered directly by the utility thro the STS.

Bypass Maintenance Switch： The Bypass Maintenance Switch is used when Maintenance work needs to be done while keep the load on.

External Battery：When the utility is off or being abnormal, the UPS power the load by obtaining energy from the External Battery.

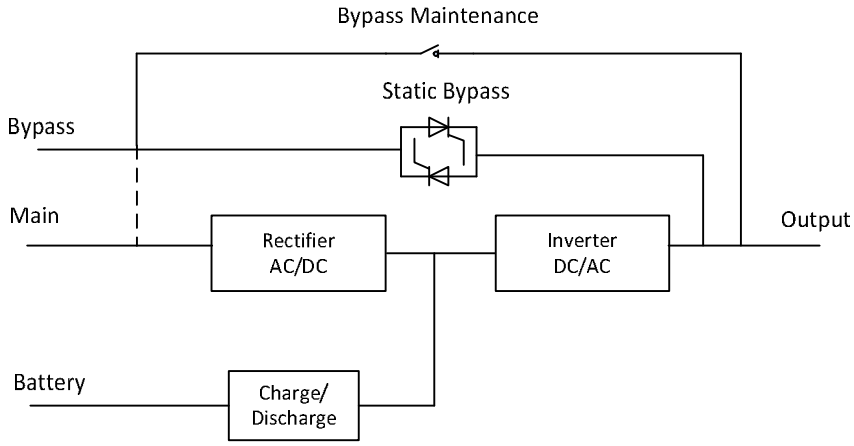


Figure 1-1 UPS Structure

1.2 Topological Diagram

The Topological diagram of the system is shown as Figure 1.2:

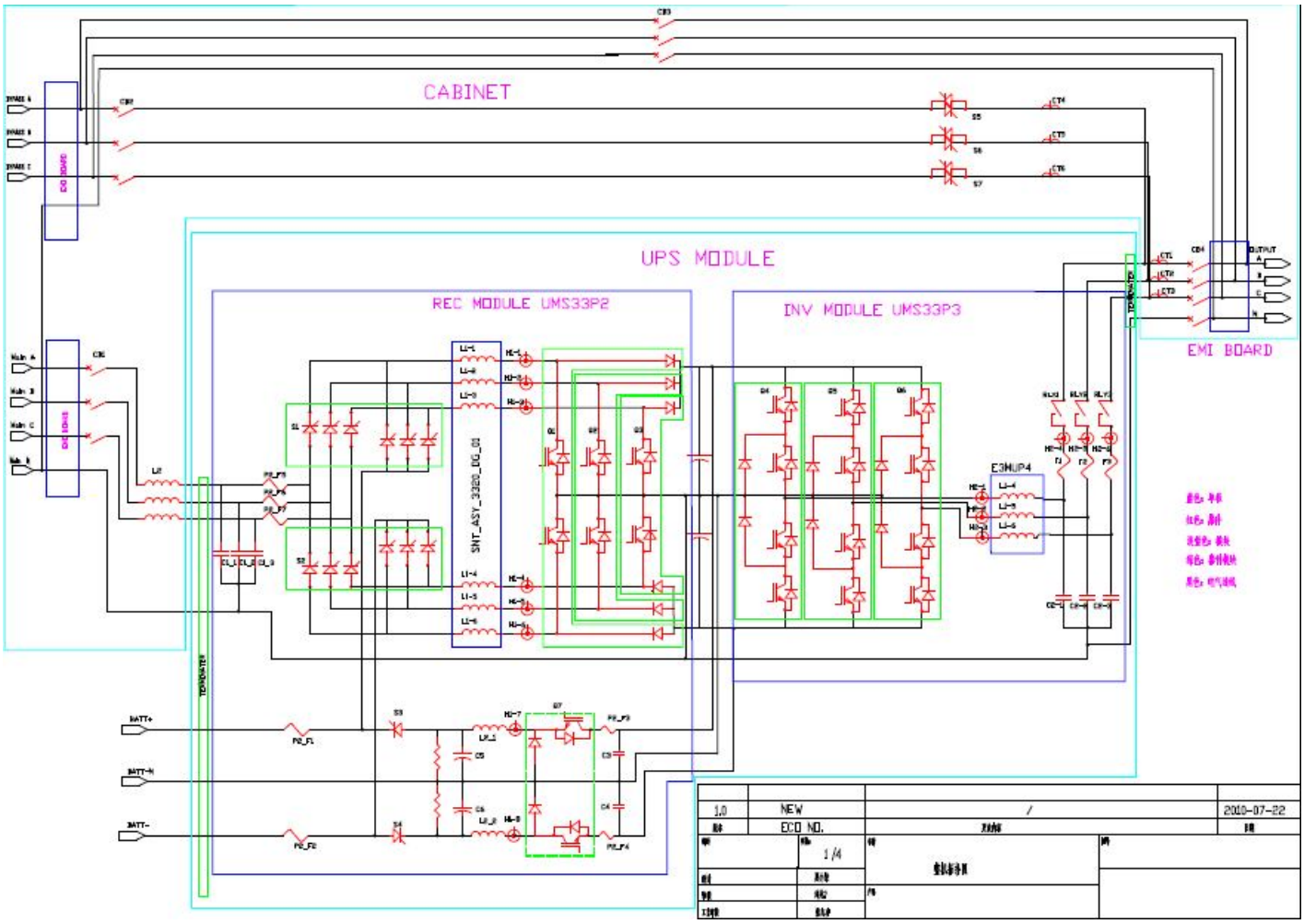


Figure 1.2 Topological diagram of the system

2 Structure of the Cabinet

2.1 Front of the Cabinet

The front contains SPD(Optional), bypass Maintenance switch, LCD, battery cold, bypass& monitoring module, dry contact, power module, SNMP(Optional), Expansion dry contact card, LBS, RS485, RS232, as is shown in Figure 2.1.

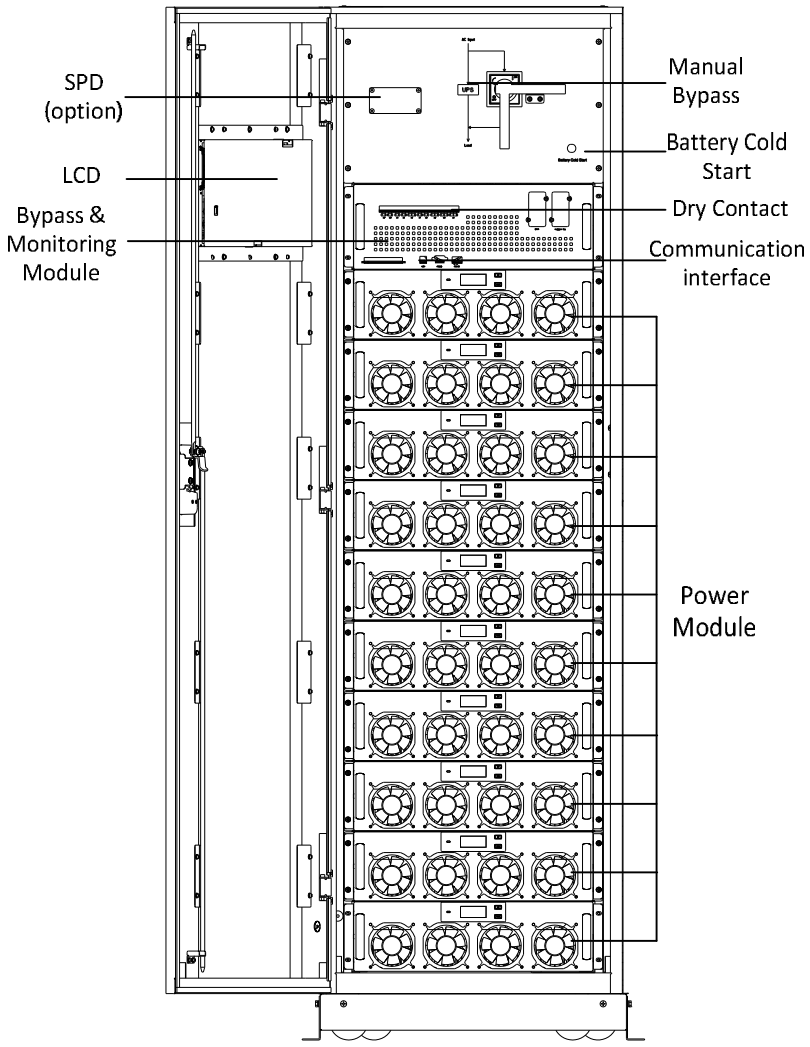


Figure 2.1 Front view

2.2 Back of the Cabinet

It includes Input terminals, Output terminal, battery terminal, and power module connectors, as is shown in Figure 2.2

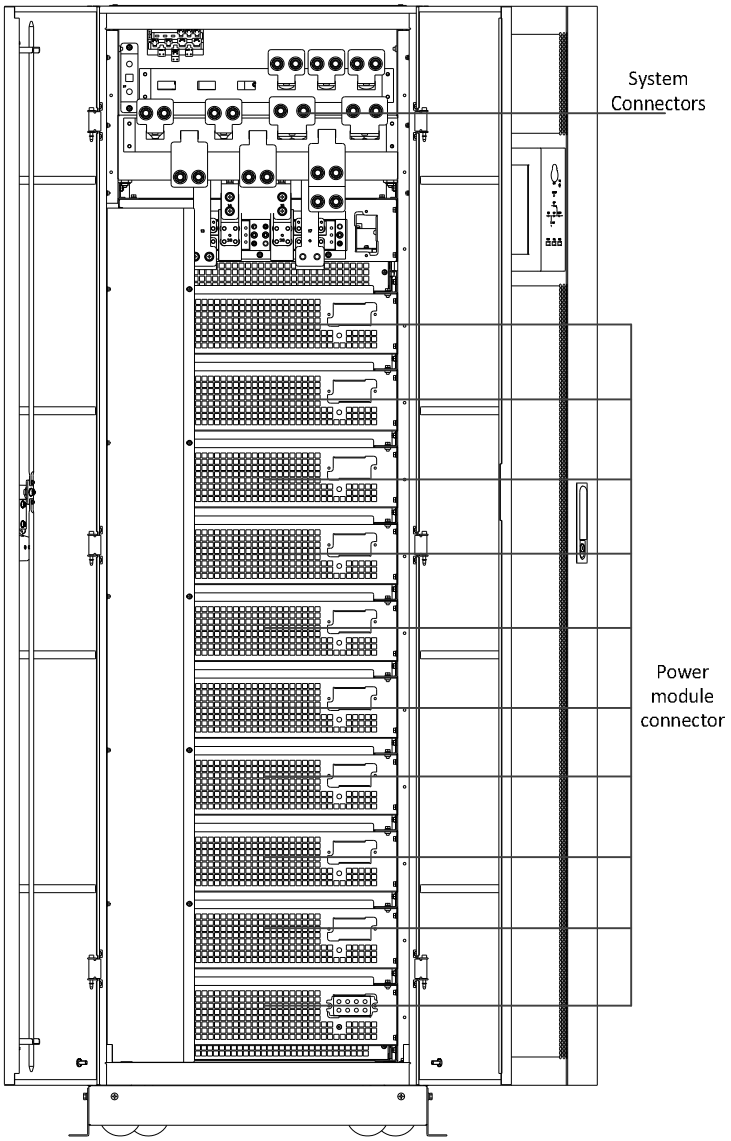


Figure 2.2 Back view

2.3 Top view of the cabinet

It includes the Input EMI and Battery cold board.

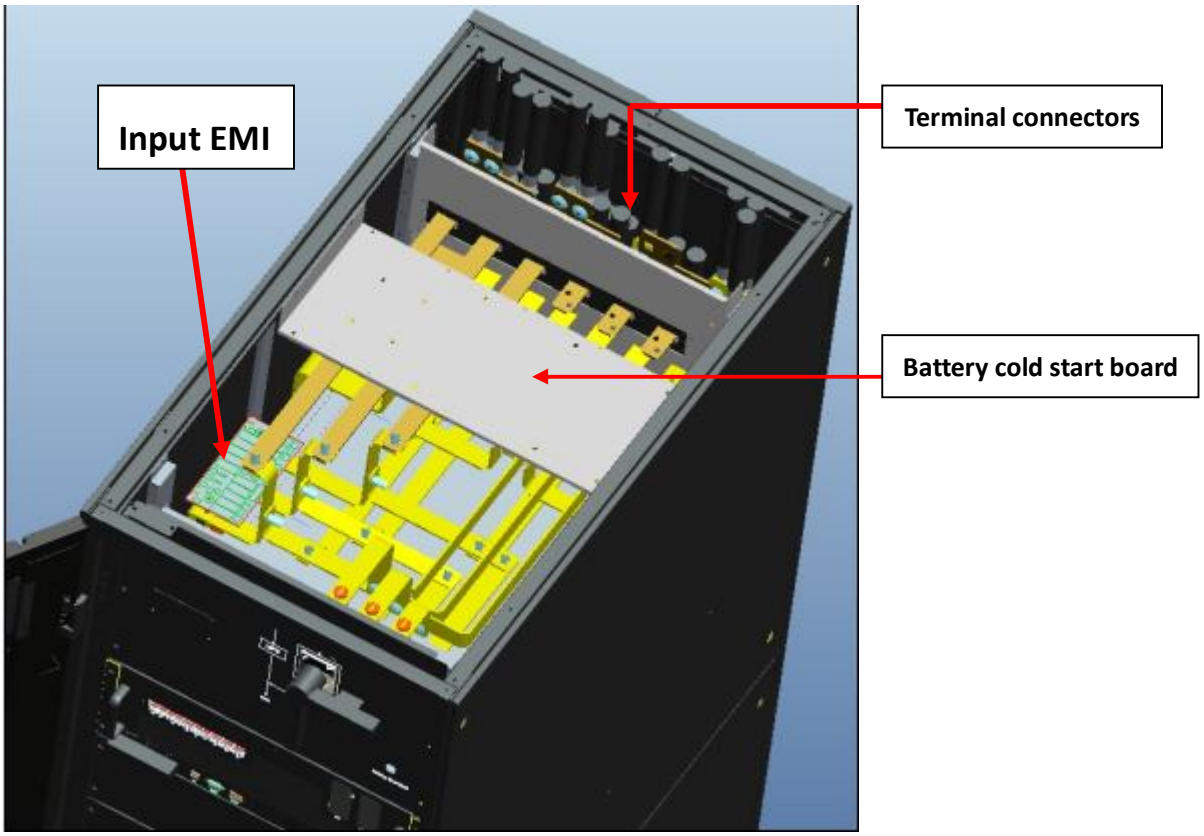


Figure 2.3 Top view

3 Structure of Power Module

3.1 Components

The power module consists of inductance board，charger，power supply board，rectifier board，boost power board, inverter board, EMI board and control board.

3.2 Lower Layer

The lower layer of the power module contains inductance board, power supply and charge board whose locations are shown as Figure 3.1 below.

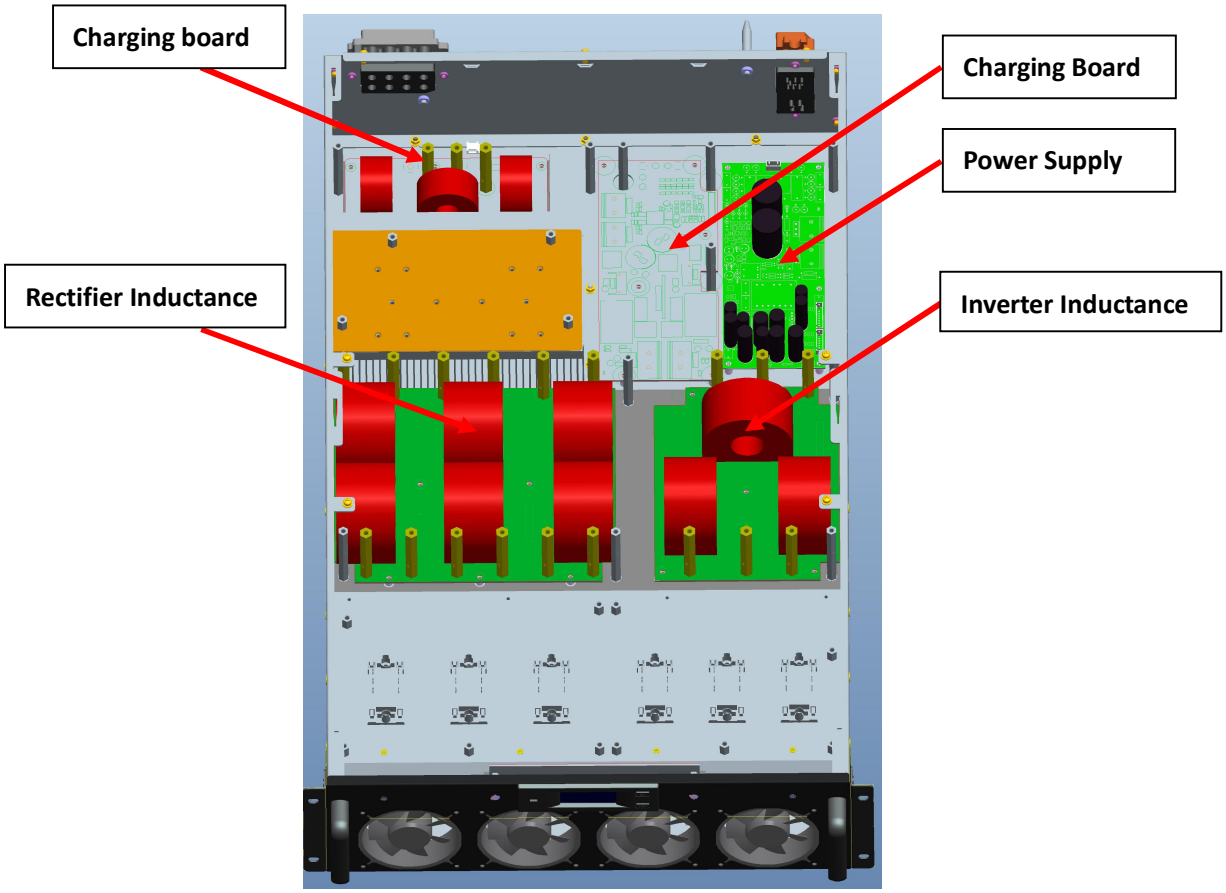


Figure 3.1 Lower Layer of the power module

3.3 Upper Layer

The upper layer of the power module contains input SCR board, rectifier board, inverter board, output board, control board and fan board, as is shown in the Figure 3.2

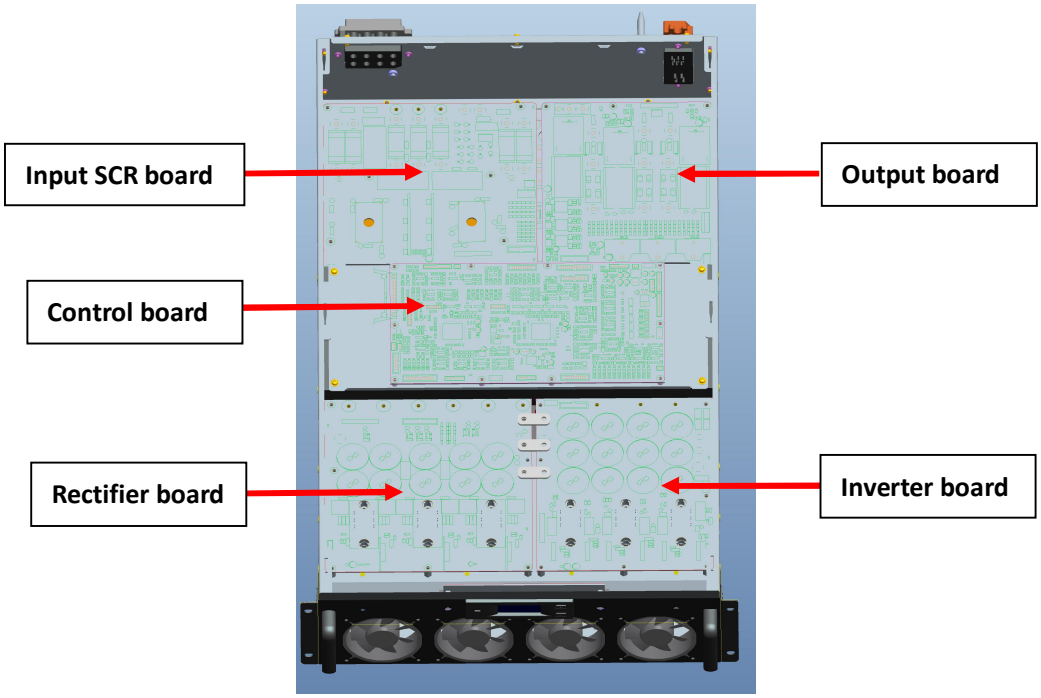


Figure 3.2

3.4 LED panel of the power module

The LED panel of the power module is shown in Figure 3.3.

Figure 3.3 LED panel for power module

3.5 Connection inside the power module

The connection inside the power module is shown in Figure 3.4.

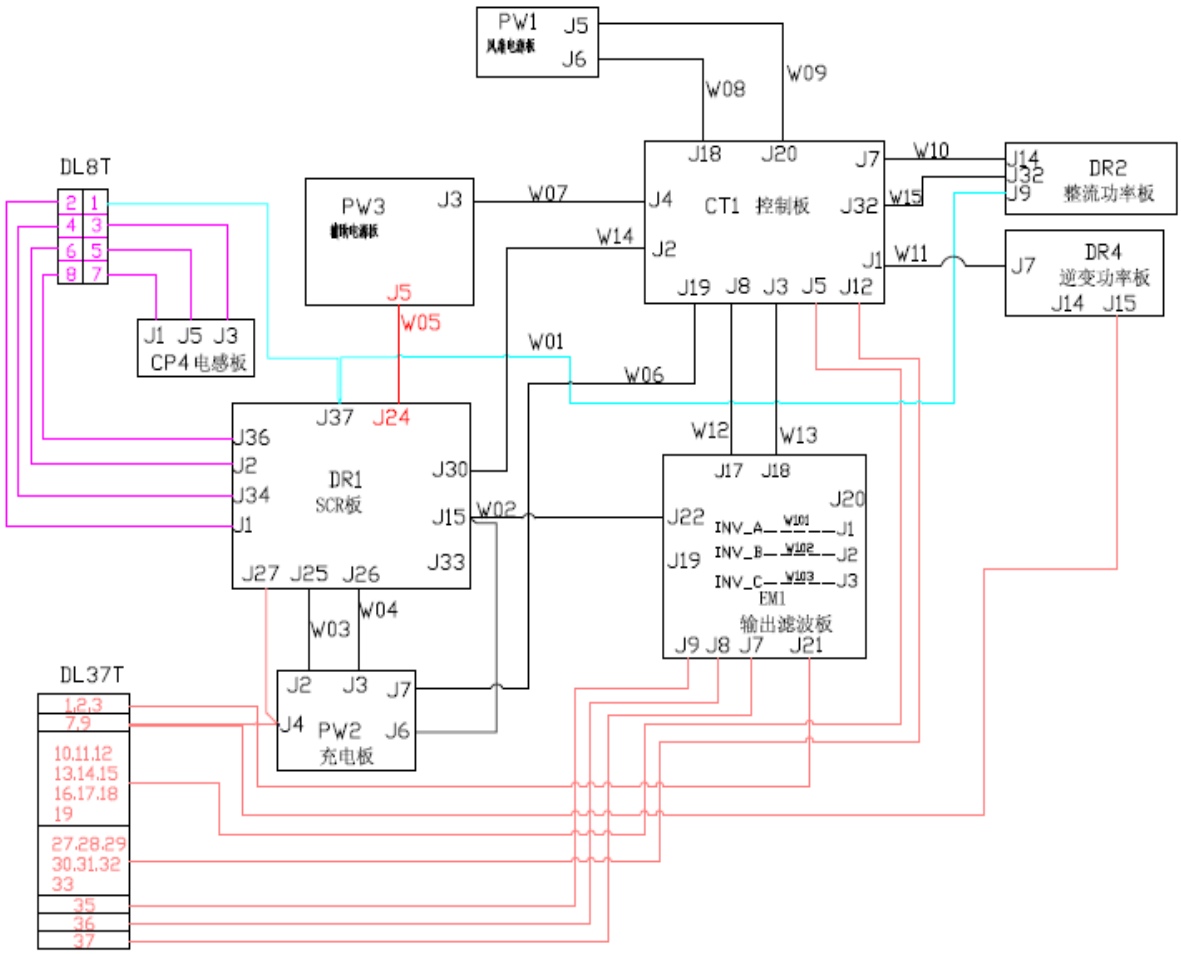


Fig 3.4 Connection inside the power module

4 Power Cable

4.1 The recommended cables

Table 4.1 Cable selection

Contents			150KVA	300KVA
Main Input	Main Input Current		260A	520A
	Cable section （mm^2）	A	95	185
		B	95	185
		C	95	185
		N	95	185
	Output Current		225A	450A
		A	70	150

Output	Cable section （mm^2）	B	70	150
		C	70	150
		N	70	150
Bypass Input （Optional）	Bypass Input Current		225A	450A
	Cable section （mm^2）	A	70	150
		B	70	150
		C	70	150
		N	70	150
Battery Input	Battery Current		300A	600A
	Cable section （mm^2）	+	120	240
		-	120	240
		N	120	240
PE	Cable Section （mm^2）	PE	75	120

Note

The recommended cable section for power cables are only for situations described below：

- Ambient temperature：+30℃.
- AC loss less than 3%，DC loss less than 1%，The length of the AC power cables are no longer than 50 m and the length of the DC power cables are no longer than 30 m.
- Currents listed in the table are based on the 380V system (Line-to-line voltage) .For 400 V system, the currents is 0.95 times and for the 415V system the current is 0.92 times.
- The size of neutral lines should be 1.5~1.7 times the value listed above when the predominant load is non-linear.

5 The test of the key components

5.1 Testing of Rectifying SCR module and its drive

5.1.1 Pin measurement of SCR module

Turn the multimeter to the resistive channel, measure the resistance of pin A-K as 29-2, 20-6, 18-15, 11-10, 35-28, 25-23, the normal value should be around 30Ω;

measure the resistance of pin G-K as 1-2,5-6, 12-15, 9-10, 14-28,24-23, the normal value should be around 1MΩ. The pins of the SCR are defined in Figure 5.1.

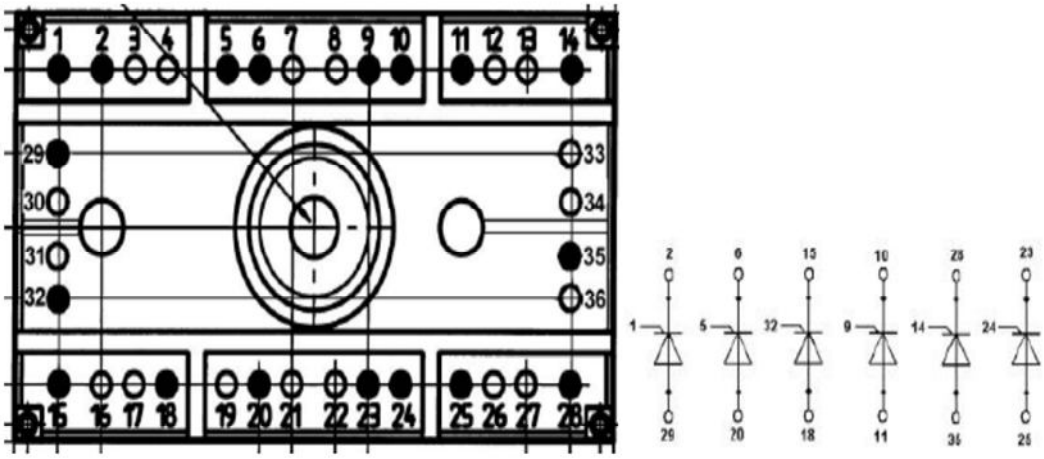


Figure 5.1 Pins definition the SCR module

5.1.2 Drive signal of the SCR pin A-K

The normal drive signal of the pin A-K SCR is shown in Figure 5.2

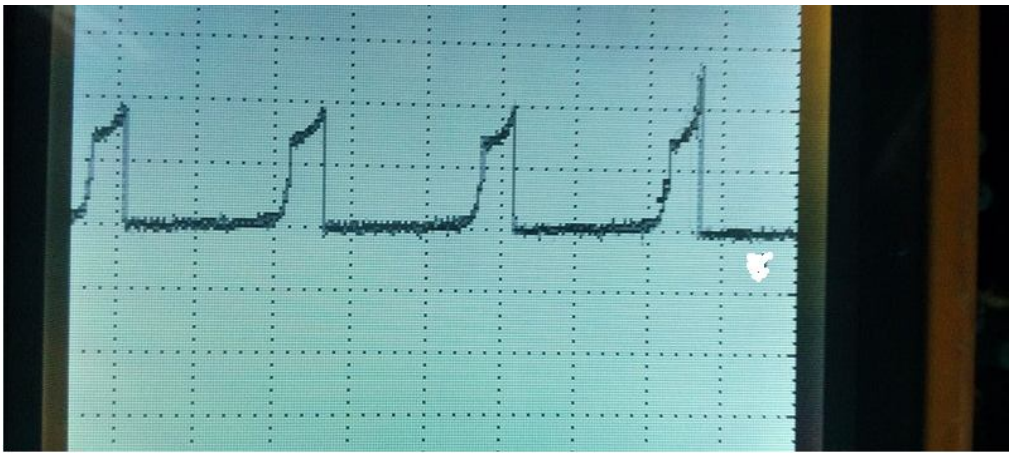


Figure 5.2 Drive signal of the SCR pin A-K

5.2 Rectifier IGBT

5.2.1 The test of the Rectifier IGBT

Turn the multimeter to the diode channel, measure the status of diode (anode to cathode) as 9-5, 3-9, 11-17, 15-11, the normal value should be around 0.4V.
Turn the multimeter to the resistive channel, measure the resistance of pin G-K of the IGBT module as 1-3 and 20-11, the normal value should be around 10KΩ
Turn the multimeter to the diode channel, measure the status of diode of the IGBT

drive board as from D1 to D12, the normal value of each diode should be around 0.8V, as is shown in Figure 5.3.

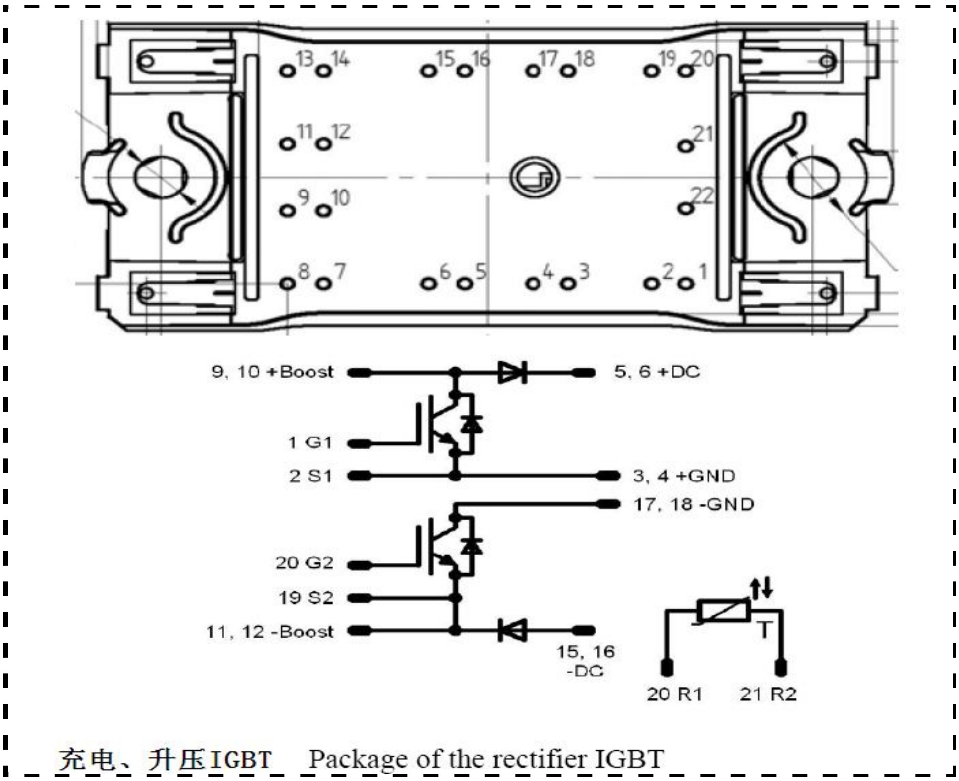


Figure 5.3 Rectifier IGBT pin test

5.2.2 Drive signal of Rectifier IGBT modules

Test the G-K pin of IGBT modules with multimeter, the normal wave should be as follows, as is shown in Figure 5.4.

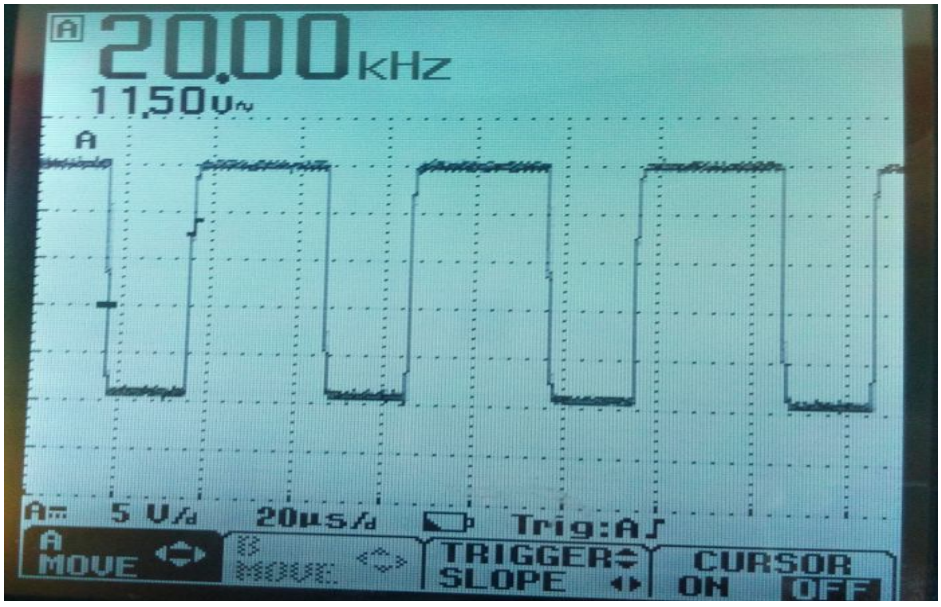


Figure 5.4 Normal drive signal wave for IGBT

5.3 Inverter IGBT

5.3.1 Test of Inverter IGBT

The definition and measurement are shown as Figure 5.5.

Turn the multimeter to the Diode Channel，measure the status of diode (anode to cathode) as 17-15, 8-17, 6-8, 3-6, 5-17, 6-5 ,the normal value should be around 0.4V.

Turn the multimeter to the resistive channel, measure the resistance of pin G-K of the IGBT module as 18-17, 12-13, 7-6 and 1-2, the normal value should be around 10K Ω

Turn the multimeter to the diode channel, measure the status of diode of the IGBT drive board (Located in the Inverter Board) as from D8 to D31, the normal value of each diode should be around 0.8V, as is shown in Figure 5.3.

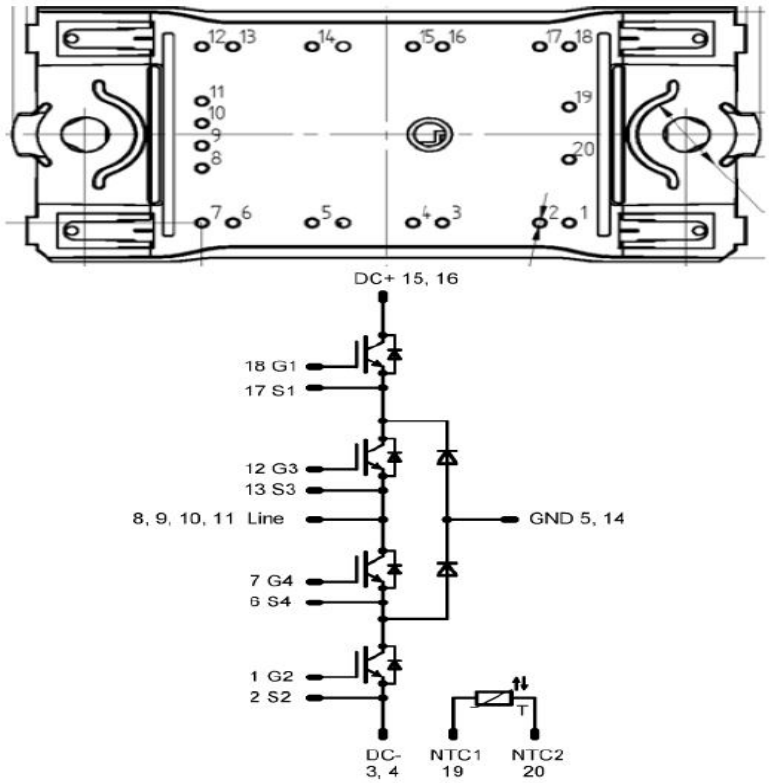
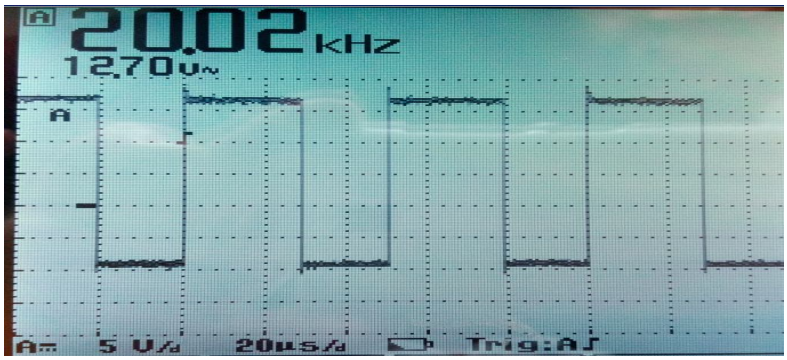


Figure 5.5 Definition of the pin

5.3.2 The drive signal wave

The drive signal wave is as following, as shown in Figure 5.6.



5.6 Drive signal wave

5.4 IGBT Drive Circuit

5.5 Drive Circuit for Rectifier IGBT

Take the Rectifier IGBT of Phase A for example. Test the status of diode D3 and D8 (or the same position for Rectifier IGBT of Phase B and C), the normal value should be 0.45-0.8V; test the resistance of R7 and R3 (or the same position for Rectifier IGBT of Phase B and C). The schematic diagram is shown in Figure 5.8

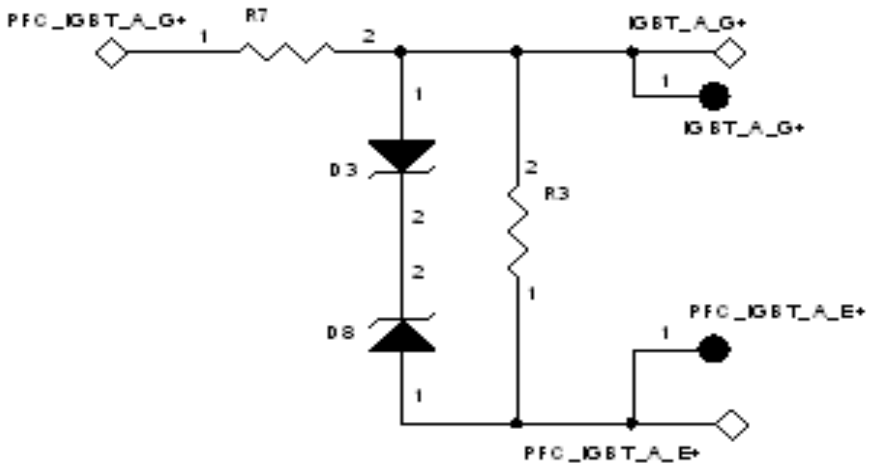


Figure 5.8 Schematic diagram for the Rectifier IGBT

5.6 Drive Circuit for Inverter IGBT

Take the Inverter IGBT of Phase A for example. Test the status of diode D25 and D26 (or the same position for Rectifier IGBT of Phase B and C), the normal value should be 0.45-0.8V; test the resistance of R7 and R3(or the same position for

Rectifier IGBT of Phase B and C). The schematic diagram is shown in Figure 5.9:

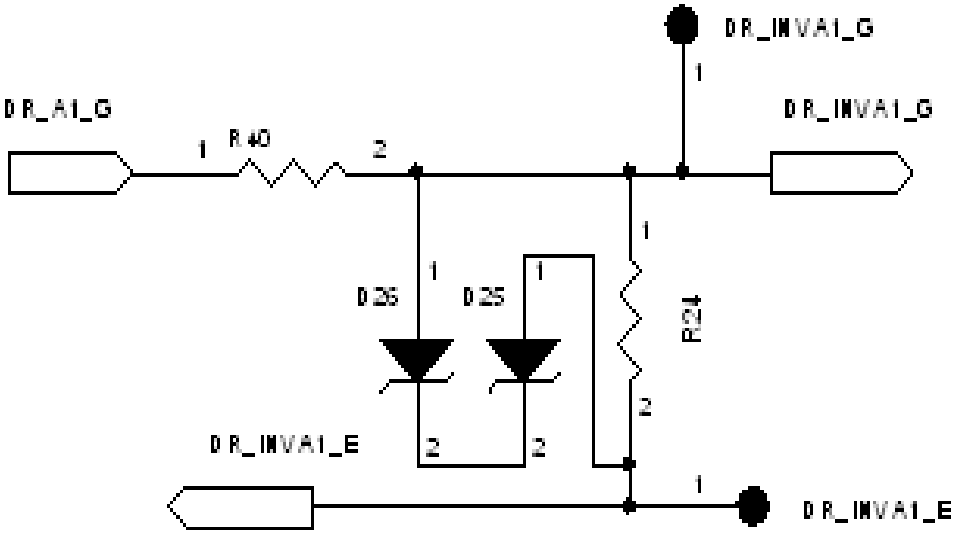


Figure 5.9

5.7 Fuse and Relay

6 Introductions to S-Code

Please refer to the document of S-code trouble shooting

7 Trouble shooting for Cabinet

7.1 Configuration in the Cabinet

Series number	PCB	PCB Name	Description
1	Cabinet LCD	LCD for the cabinet	Displaying the system information
2	PCB_PS1203_KY1	Keyboard	For view the information
3	PCB_PS1203_EM2	Input EMI board	Filter for utility
4	PCB_3320_FR	Battery EMI board	Filter for battery
5	PCB_3320_QD	Battery cold start board	The system can start up by the Battery cold start PCB, when there is no utility
6	PCB_PS1203_TF1	Power module transferring board	For the communication between the power modules
7	PCB_PS1203_TF2	Transfer board	Transferring board
8	PCB_PS1203_TF4	LBS and Parallel board	Used for LBS when needed or for cabinet paralleling

7.2 Configuration in the Bypass Module

Series	PCB	PCB Name	Description

number			
1	PCB_PS1203_PW3	Power supply board	Supplying power for the control unit
2	PCB_PS1203_MN1	Monitoring board	For monitoring and bypass control unit
3	PCB_PS1203_TF3	Dry contact board	Dry contact function
4	PCB_ 3320_CQ	Bypass SCR drive board	Bypass SCR drive

7.3 The signal connection in bypass，

The signal cable connection in bypass is shown in Figure7.1.

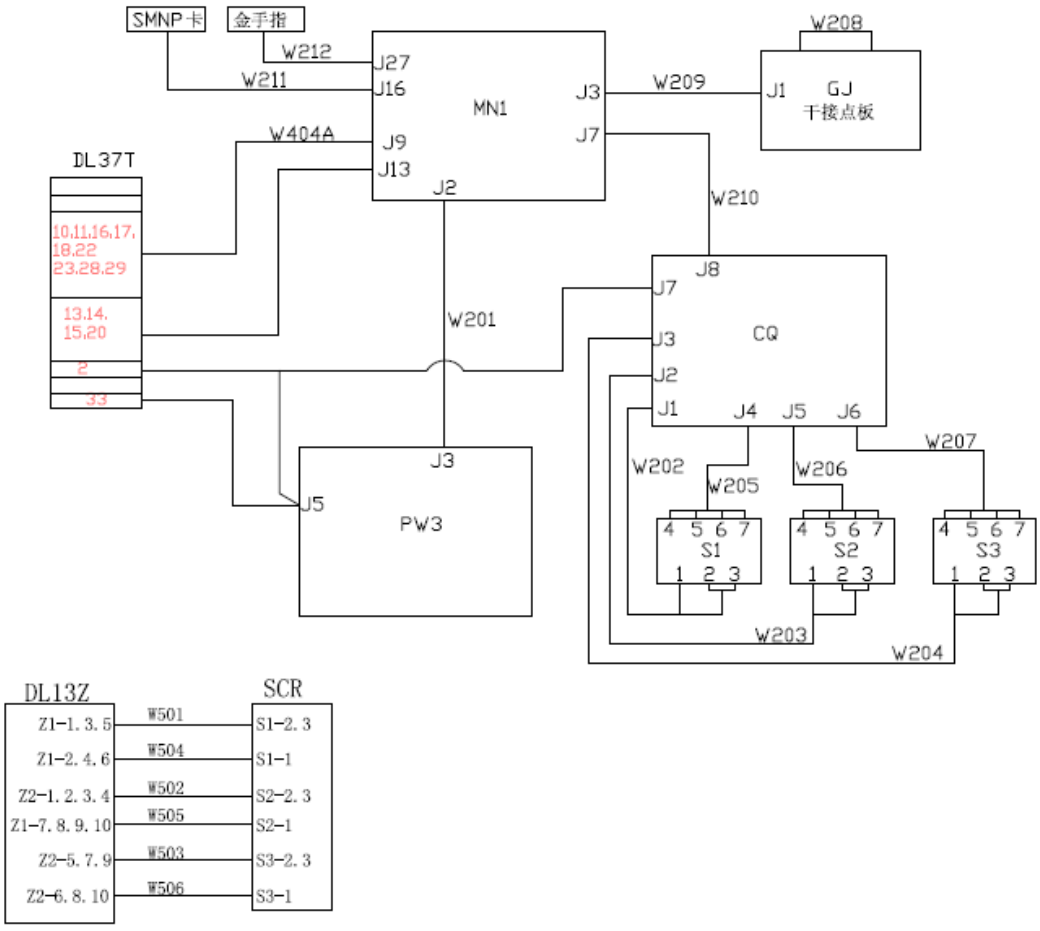


Figure 7.1 signal cable connection

7.4 Trouble shooting for bypass fans

Bypass fan fault

Cause：

1）the abnormity of detect circuit

2）failure of bypass fans

Method：

1）Observe if the fans are running normal，if the fans are running in normal speed with warning of 'Byp Fan Fail' This should be the problem for abnormity of detect circuit .

2）detect the bypass fan power supply

3）Check if the fans are blocked

4）Bypass fan is broken

Bypass Voltage Abnormal

Cause：

1）Bypass voltage is not within the setting range

2）The detection voltage of the bypass is abnormal.

Method：

1）Reset the bypass voltage range according to the load

2）Adjust to main input voltage

3）Change the voltage sampling components

Cause:

The bypass voltage detect failure

Method：

Check the fuse of the detection circuit for bypass voltage

Exceed Tx Times Lmt

Cause：

The transfer time between bypass and inverter exceed 5 times

Method：

1）Clear fault：Operate 

→ 

2）Restart the system

Ip Neutral Lost

Cause：

Input neutral disconnected

Method：

1）Check if the input Neutral is correctly and well connected

2）Check if input ATS are 4 poles (If the ATS is 4 pole , there will be shortly disconnection of neutral when the ATS transfer from one source to the other)

Parallel Fault

Cause：

The parallel cables are not well connected or disconnected

Method:

Connected the parallel cables or change to a normal one

8 Trouble shooting for Power Module

8.1 Configuration of the power module

Series number	PCB	PCB Name	Description
1	Power Module LCD	Power Module LCD	Display information of the power module
2	PCB_PS1203_DR1	Input SCR board	Input SCR
3	PCB_PS1203_DR2	Rectifier board	Rectifier board for battery and Utility
4	PCB_PS1203_DR4	Inverter board	Inverse the DC to AC
5	PCB_PS1203_EM1	Output EMI board	EMI for output
6	PCB_PS1203_CP2	Rectifier Inductance board	Rectifier Inductance
7	PCB_PS1203_CP3	Inverter Inductance board	Inverter Inductance
8	PCB_PS1203_CP4	Input inductance board	Input inductance
9	PCB_PS1203_PW1	Power supply for fans	LED display and supply power for fans
10	PCB_PS1203_PW2	Charging board	Charging the battery
11	PCB_PS1203_PW3	Power supply board	Supply power for control unit
12	PCB_PS1203_CT1	Control board	Monitoring and control of power module

Faults of Rectifier

Cause：1）Input fuse blown

2） Over temperature of the rectifier

3）Bus over voltage

4）Unbalanced the input current and soft start fails

Method：

1）Check the fuse

2）Check if the ambient temperature is too high, if so, improve the environment

3）Check the type of the load and contact with the manufacture

4）Check whether the input is OK

Invert protected

Cause：1）Inverter over-temperature

2）Failure of inverter IGBT

3）Faults of Inverter output relay

Method：

1）Check if the ambient temperature is too high, if so, improve the environment

2）Change the IGBT or the Inverter board

3）Ensure if the relay has arc discharge, if so, please change the relay

If not, change the IGBT drive or the inverter board

4）If all the procedures above cannot get the problem done , please change the control board.

Utility abnormal and bypass frequency over track

Cause：

1）The utility voltage exceed the input voltage range

2）The utility frequency exceed the input frequency range

3）The input fuse blown

4）UPS input break open

Method：

1）Check if the utility voltage is Ok

2）Check if the input frequency is OK

3）Change the input fuse

4）Close the input breaker

Input Phase A, B and C Over Current

cause：

1）Rectifier IGBT broken

2）Drive board of Rectifier IGBT broken or wrong displaying of input voltage

Method：

1）Check if the rectifier IGBT is broken，change the IGBT, if broken

2）Change the IGBT drive board and adjust the input voltage

Inversed input polarity

Cause：

Input inversed polarity among phase A, B and C or between the Phase and N

Method：

Change the Phase A,B and C to the right position

2）Change the Phase and B to right position

3）if the UPS is connected to the generator, check if the phase is connected inversely

Output shorted

Cause：

1) The load is shorted

2) The output of UPS shorted

Method：

1）Shut down the UPS and open the output CB, turn on the UPS again to see if the UPS is running normally, if so, please check if the load is shorted

2）Check if the output of the UPS is shorted, if so, please check the wiring.

3）Clear Faults on Control Panel or restart

Failure of battery test

Cause：

1）Battery disconnected

2）Battery capacity less than 30%

Method：

1）Connect the battery

2）Charge the battery

Failure of battery Maintenance

Cause：

1）The battery capacity is low

2）The cables are not well connected

Method：

1）Charge the battery to enough capacity

2）Exam the connection of the cables