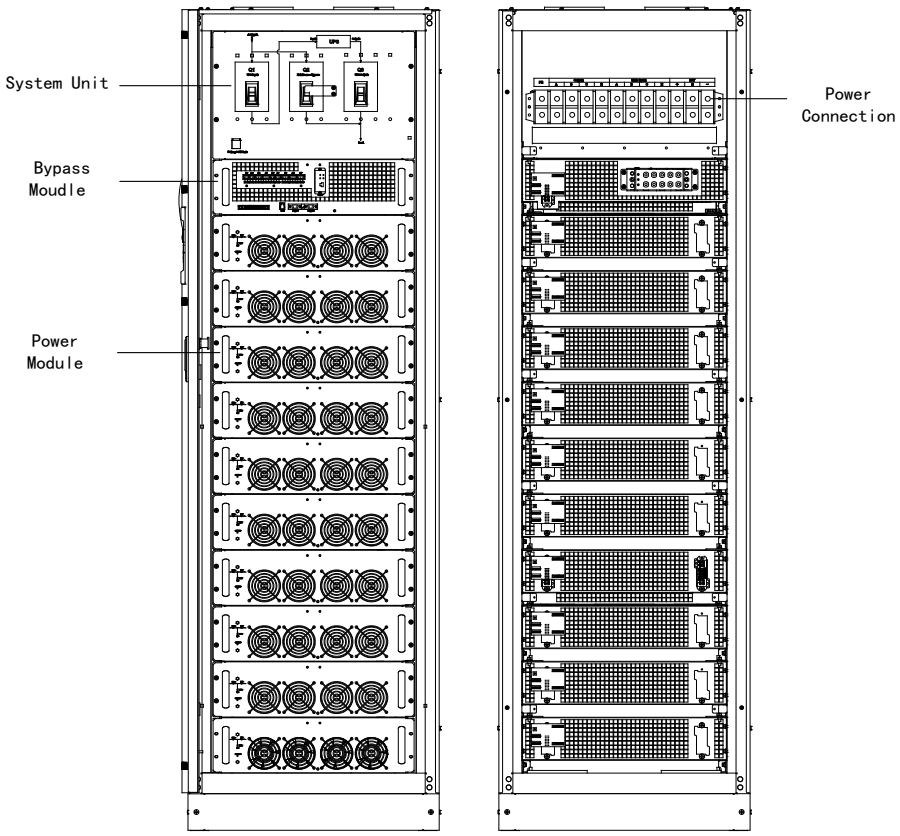
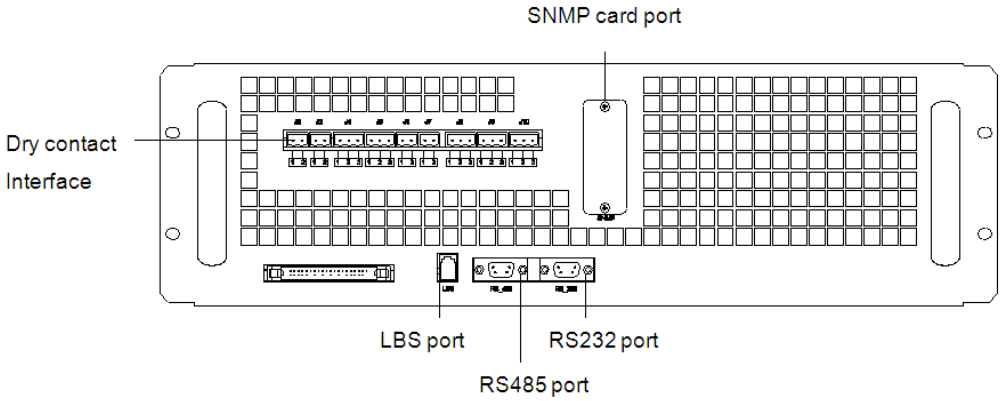
Contents

Preface：

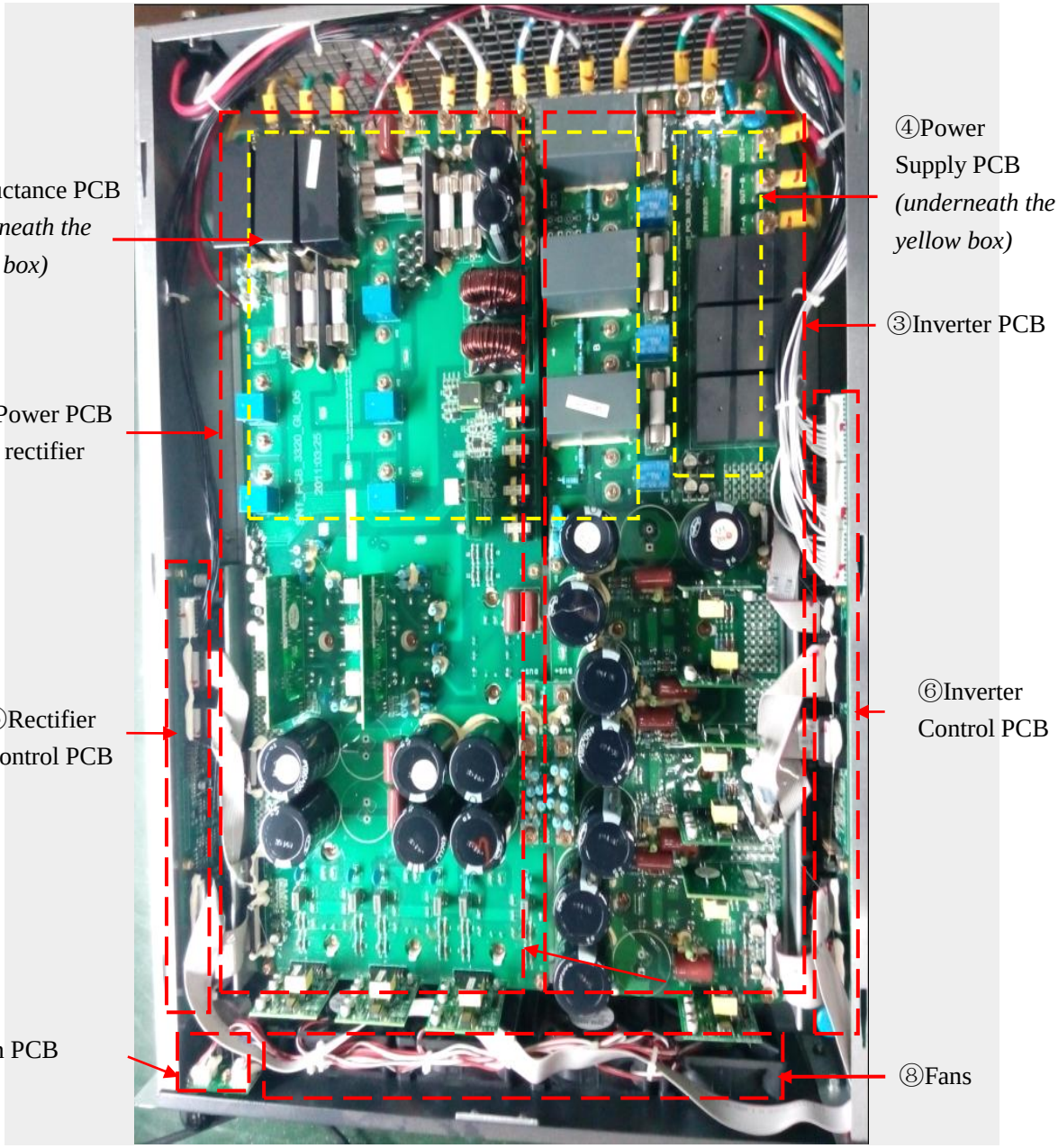
This manual is aim at giving guide to the global after-service center and special maintenance center to improve their theory level and the quality for Maintenance.





1 Components and inner structure

The power module(PM) consists of the following parts: ①Inductance PCB for input filter, output filter and DC booster②Power PCB for rectifier booster, charge and discharge power PCB ③ Inverter PCB ④Power supply PCB ⑤Rectifier Control PCB ⑥Inverter Control PCB⑦ Fan PCB ⑧ Fans



2 Capacity of PM

PM has three type of capacity of 10KVA, 15KVA, 20KVA. There is also Power Unit(PU) of

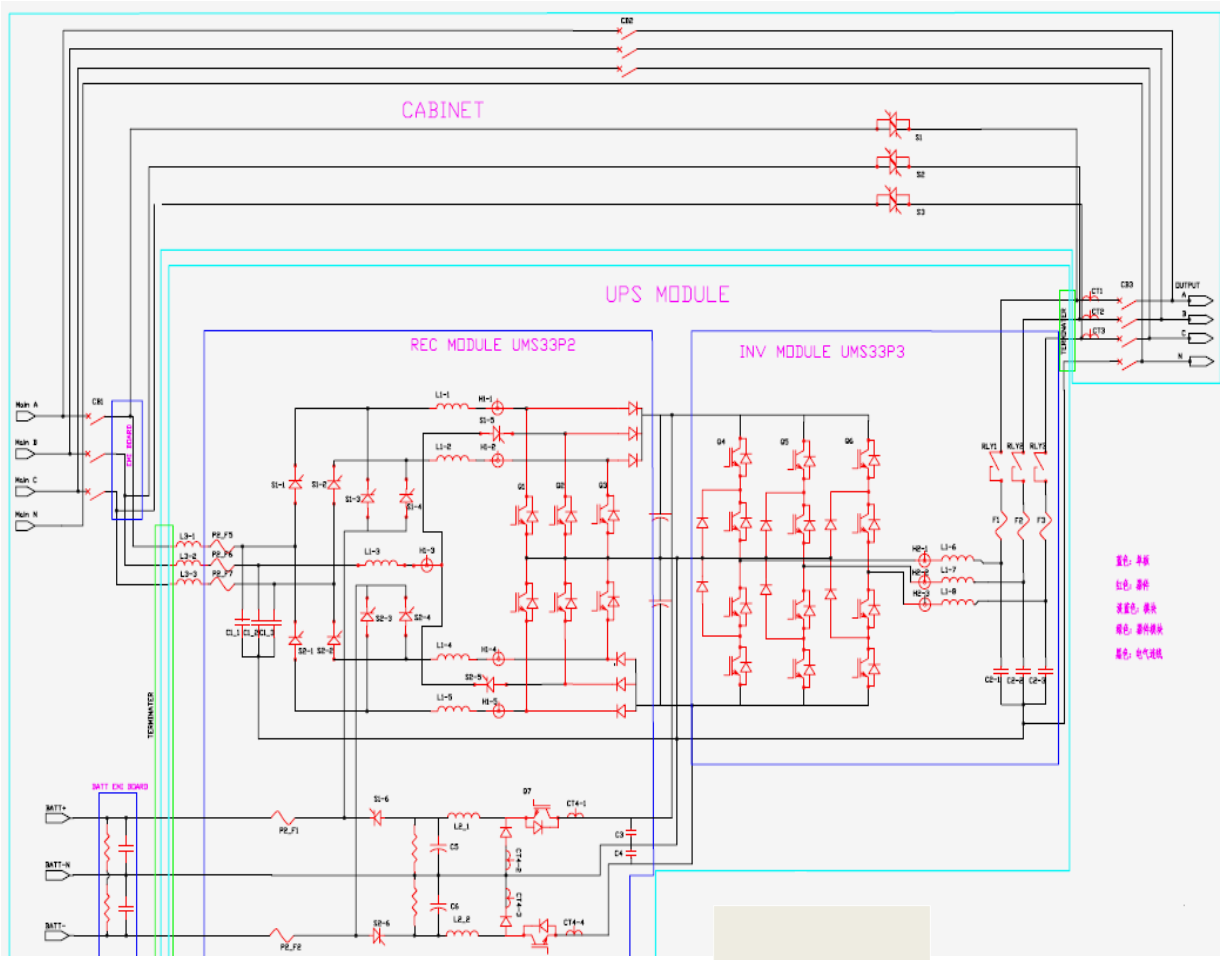
PU-20(20KVA).The PM and PU share the same structure except for its connectors. This manual gives description based on the PM

3 Tools

The tools need to be prepared are as follows: multimeter, oscilloscope, clamp ampere meter, cross –screwdriver, diagonal pliers, tweezers, electric screw driver, dust wiper.

4 Topology and Operational principle

4.1Topology



4. 2 Operational 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 rectifier SCR and 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 to transfer the DC to AC pure sine wave with the three-level technology.

5 Main components and definition of the pins

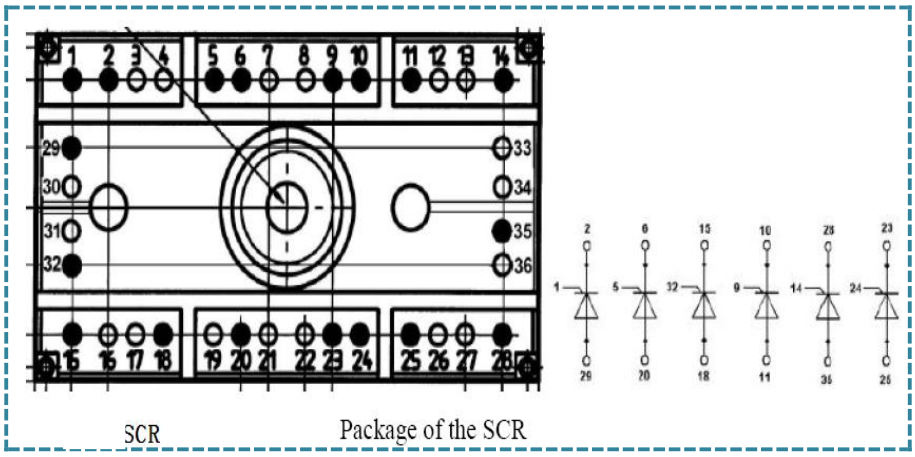


Figure 5-1 Pins of Rectifier SCR

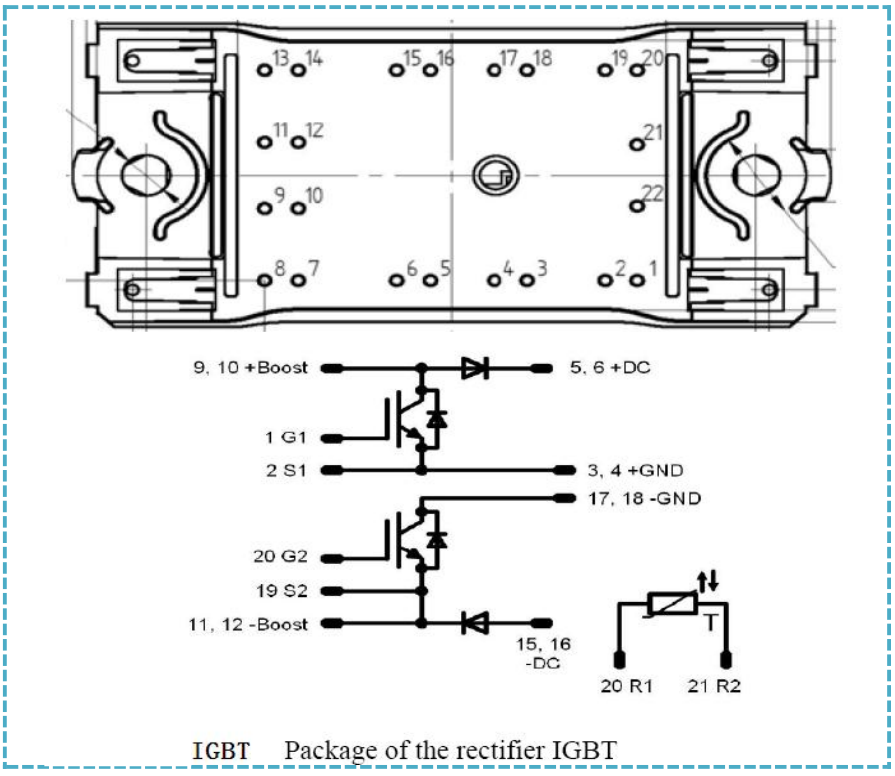


Figure 5-2 Pins of rectifier IGBT

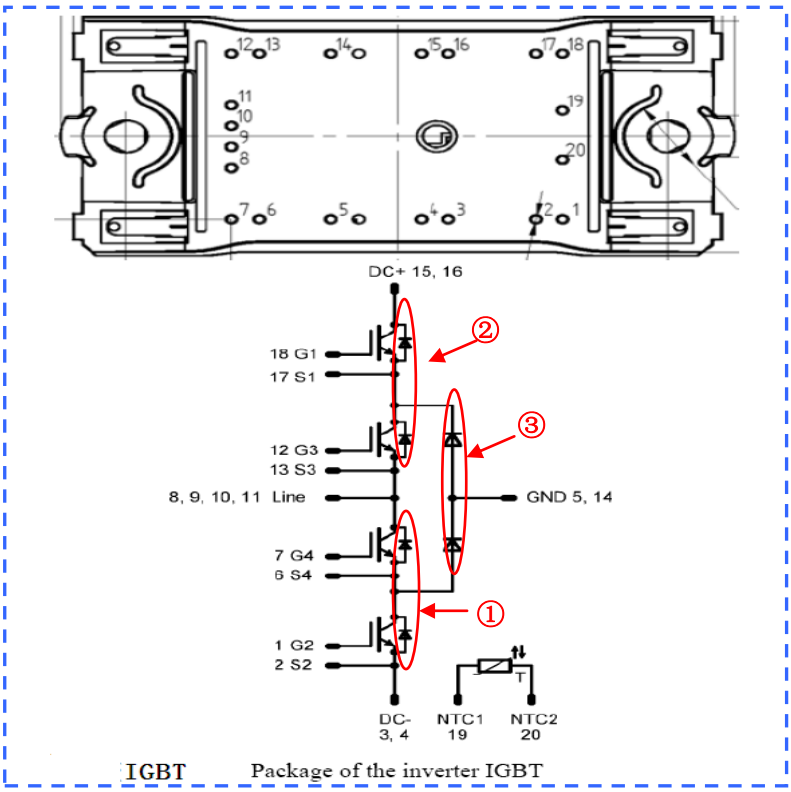


Figure 5-3 Pins of Inverter IGBT

6 Detection

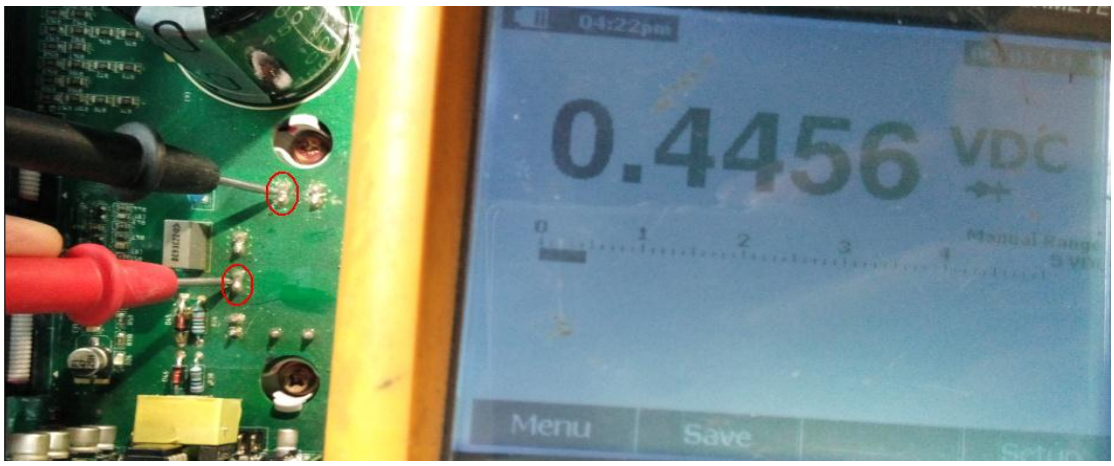
6.1 Detection of Rectifier SCR

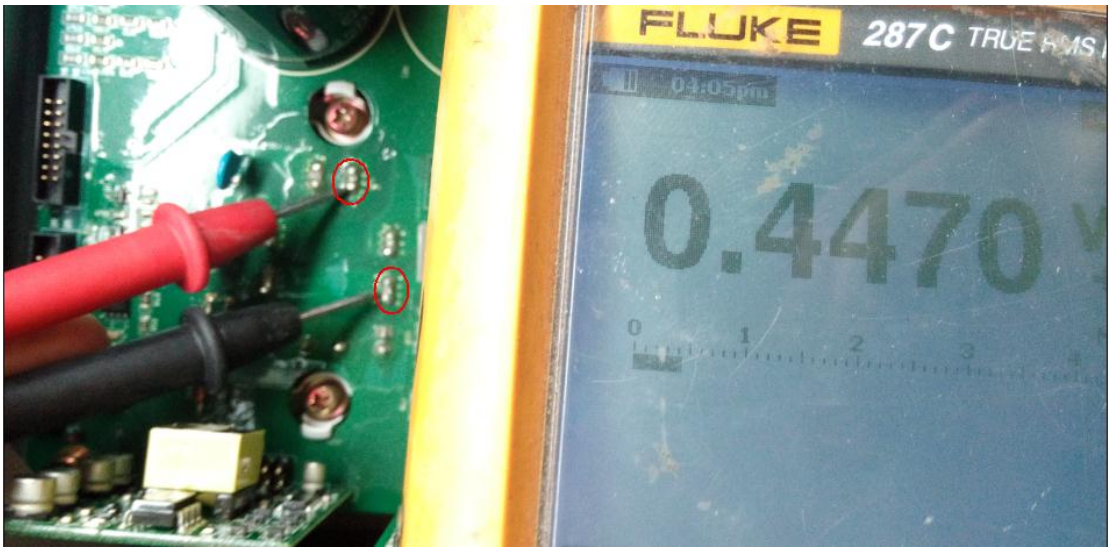
Test the resistance for pins of 1&2, 5 & 6, 9&10, 23&24, 15&32 and 14&28(pins for gate and cathode, see figure 5-1) for SCR with multimeter of resistor channel. The normal value should be 23Ω～30Ω, as is shown in the Figure 6-1.

Figure 6-1 Normal resistance of the rectifier SCR

6.2 Detection of rectifier IGBT

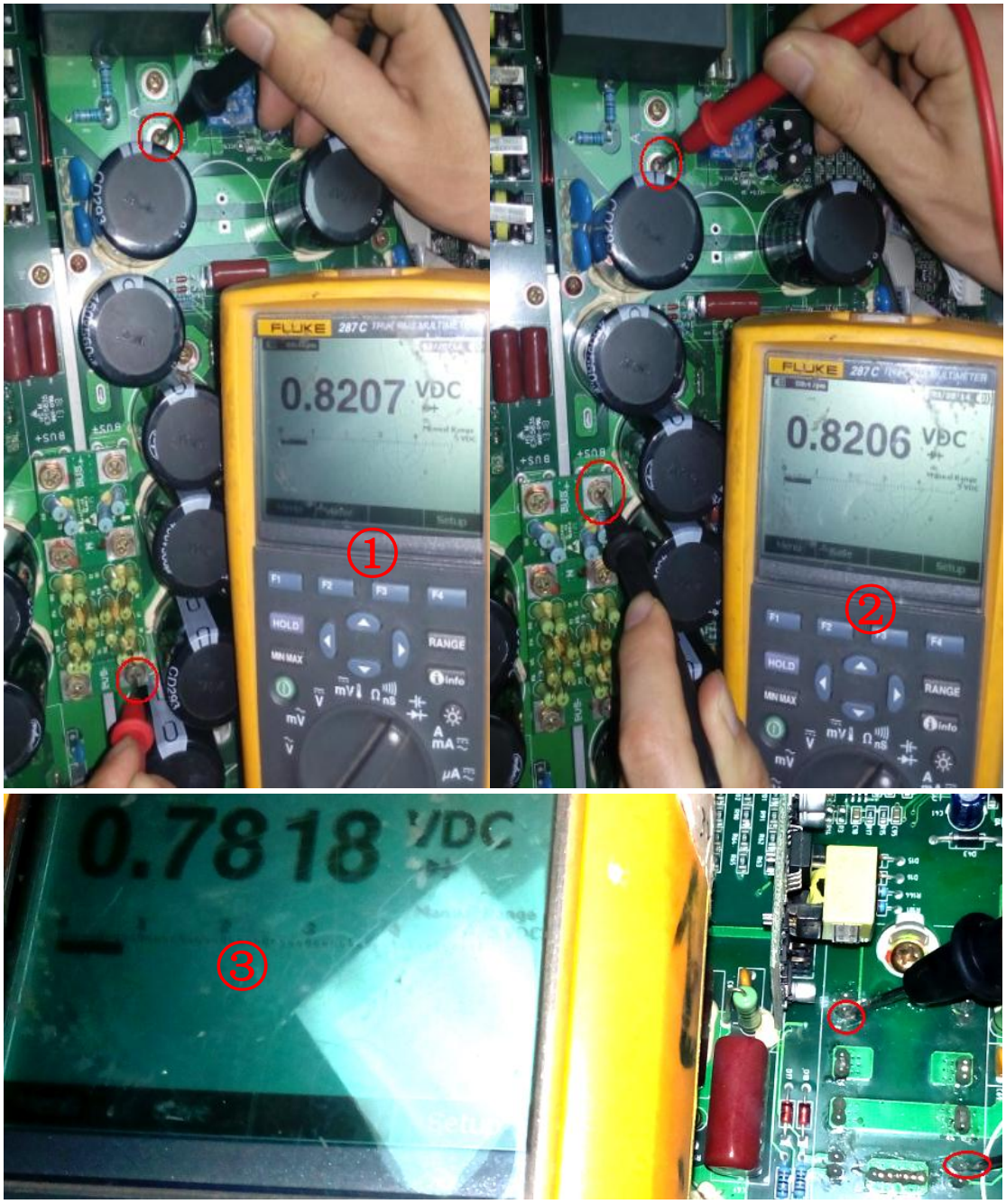
Switch the multimeter to Diode Chanel and test the voltage drop of the 4 Diodes of the Rectifier IGBT(shown in figure 5-2), the normal value should be 0.35V～0.45V. The following figures show the procedures of testing Phase A of rectifier IGBT.





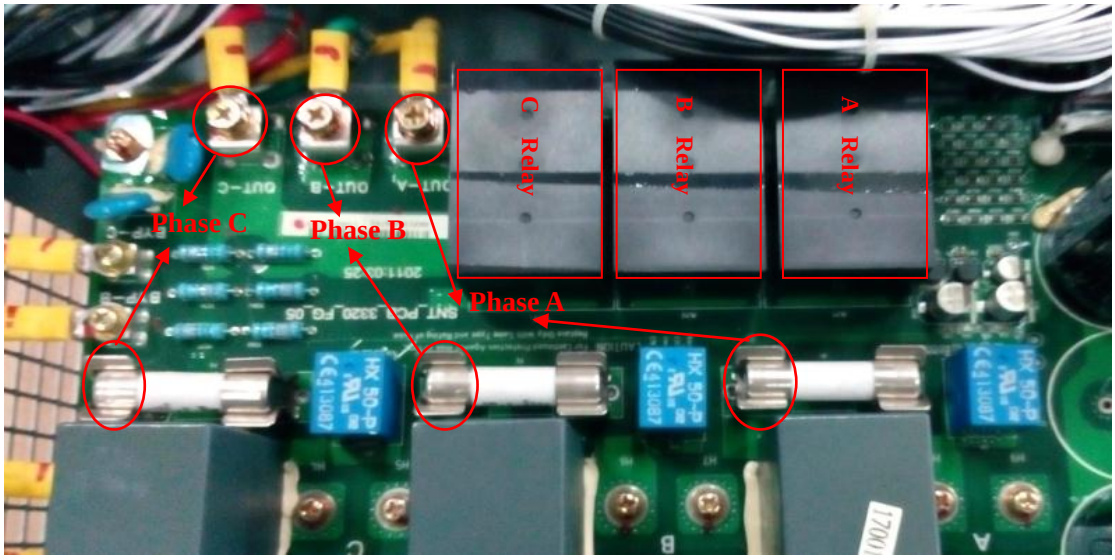
6.3 Detection of inverter IGBT

Switch the multimeter to Diode Chanel and test the voltage drop of the 6 Diodes of the inverter IGBT, the normal value should be 0.35V～0.45V for each one and voltage drop of 0.7V～0.9V for two in series(shown in figure 5-3). The following figures show the procedures of testing Phase A of inverter IGBT.



6.4 Output relay detection

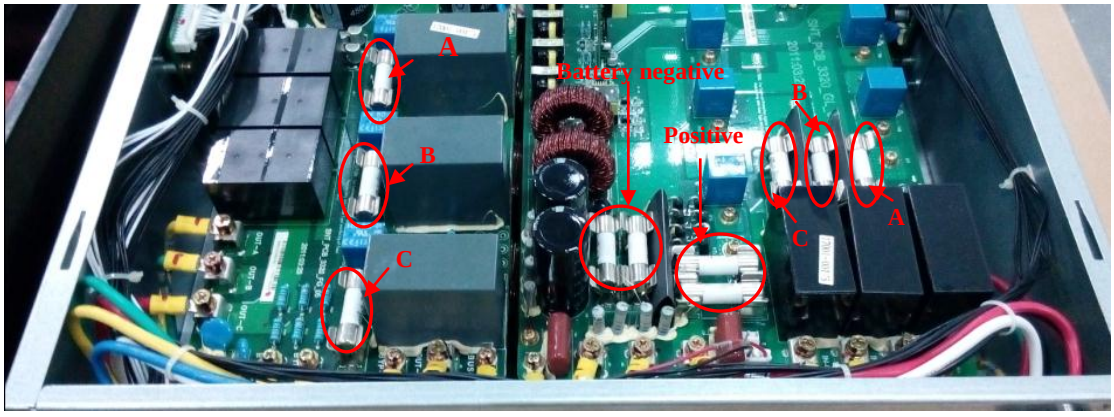
Test the resistance of the terminals of the relays， as shown in the following figure with red marks. When the resistance is infinite, the relays should be OK; When the resistance are under several ohm relay , the relays should get shorted.



6.5 Detection of the fuse

Test the resistance of the terminals of the fuses. When the resistance is less than 1ohm;When the resistance is infinite, the fuses should be blown out.

The following figure shows the fuses to be detected and their definitions of PM20.



7 Trouble-shooting for power modules

Steps：

① Exam the connectors terminals at the back of the power module if they are out of shape, burnt or drawn in.

② Open the cover to check visually whether the circuit paths are burnt, broken or have bumps on copper foils. To exams whether the components are burnt or have bumps(such

as input or output capacitors) ;

③ Exam the fuses of input and output;

④ Detect rectifier SCR,IGBT of rectifier and inverter, as is shown in chapter 7

⑤ Exam the relay of the output；

⑥ Record the fault information on the cabinet.

8 Faults and Maintenance

8.1 Common Faults for Power Module

The common faults are as following：Rectifier failure, inverter failure , utility abnormal, no display with powering on, faults in inverter communication, faults in fans, output overload, overload time-out, output shorted. The faults occur at the following moments: powering on, soft-starting, transferring between inverter and bypass inverter, no-load running for a while, load changing, power module paralleling.

The following contents give detailed information for each fault.

8.2 Rectifier failure

Take out the power module and exam the following:

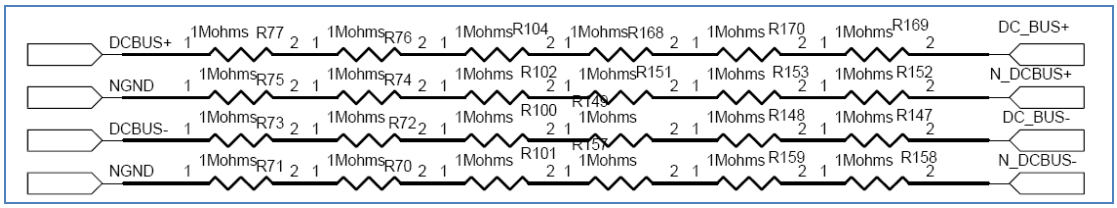
(1)Check if the input fuses, rectifier SCR, rectifier IGBT are OK.

(2)Check if the sampling resistors for bus voltages are OK (pull out the W301 when doing the checking).

After the above are done, follow the steps below:

Check if the information for bus voltage on the rectifier side through the screen are normal(around ±360V)are OK；After the above is done， the Rectifier should be changed.

The following figure shows the sampling resistors for bus voltages on the rectifier side.



8.3 Inverter failure

Take out the power module and exam the following:

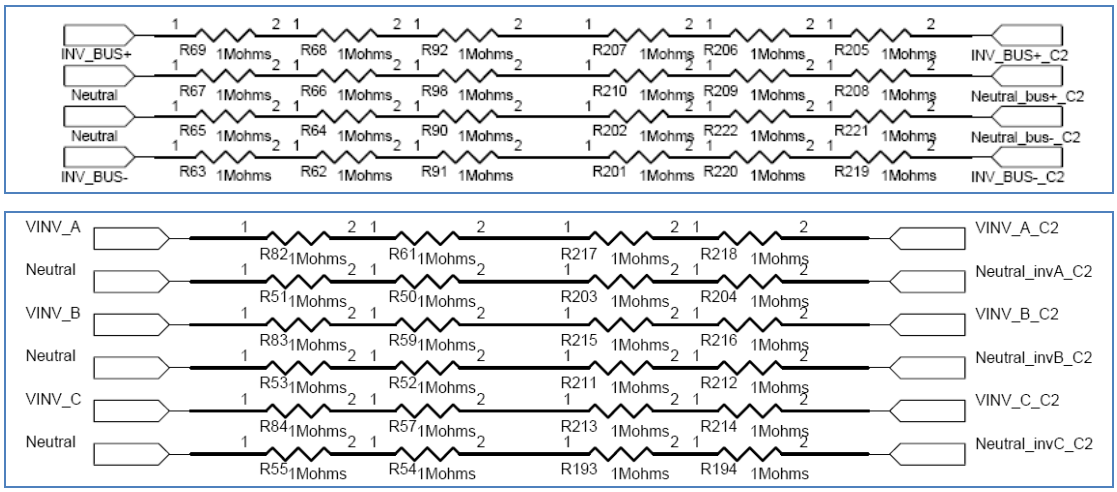
(1) Check if the output fuses, Relays, inverter IGBT are OK.

(2) Check if the sampling resistors for bus voltages and inverter output in inverter PCB are OK (Pull out the W313 when doing the checking).

After the above are done, follow the steps below:

Check if the information for Output voltage, current of the power modules through the LCD screen are normal(around ±360V)are OK; After the above is done, the Rectifier should be changed.

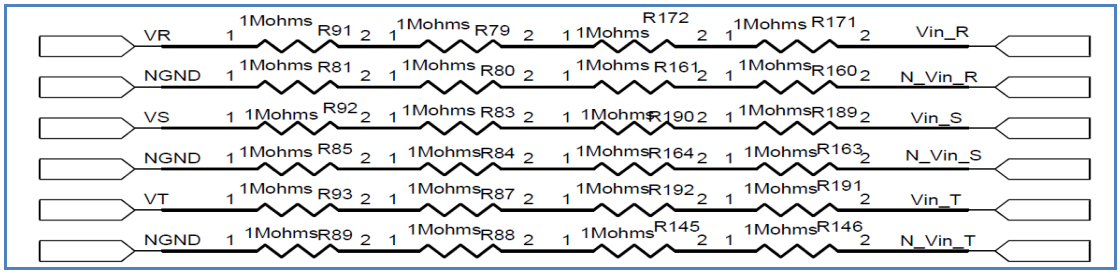
The following figure shows the sampling resistors for bus voltages on the inverter side.



8.4 Utility abnormal

Check if the input fuse and the sampling resistor is OK. Check if the sampling resistor for main input are OK (Pull out the cable W301 connected to the control board).

The following figure shows the sampling resistors for input sides.



8.5 Power on without displaying on the screen

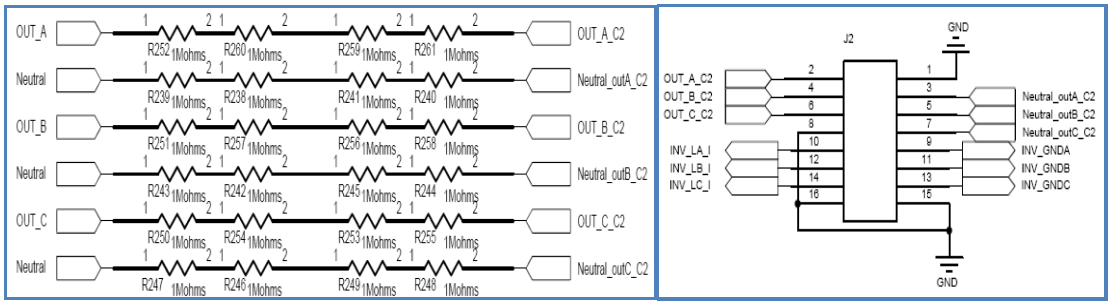
Test if the power supply board is OK. Check if the LED indicators of +1.9V and +3.3V on the rectifier and inverter control board are OK .If the above are OK, firstly replace the inverter control board to try. Replace the cables of W307 and rectifier control board.

8.6 Fans fault

Check if the 4 fans in the power module are working normally. Replace the cable W305, rectifier control board and fan PCB one by one to locate the problem.

8.7 Output overload or overload time out

Check information of the faulty power module for output current, load rate on the LCD screen, if the information is abnormal, check the sample resistors for output (Put out the cable W311 when checking). The following figure show the sample resistors for output.



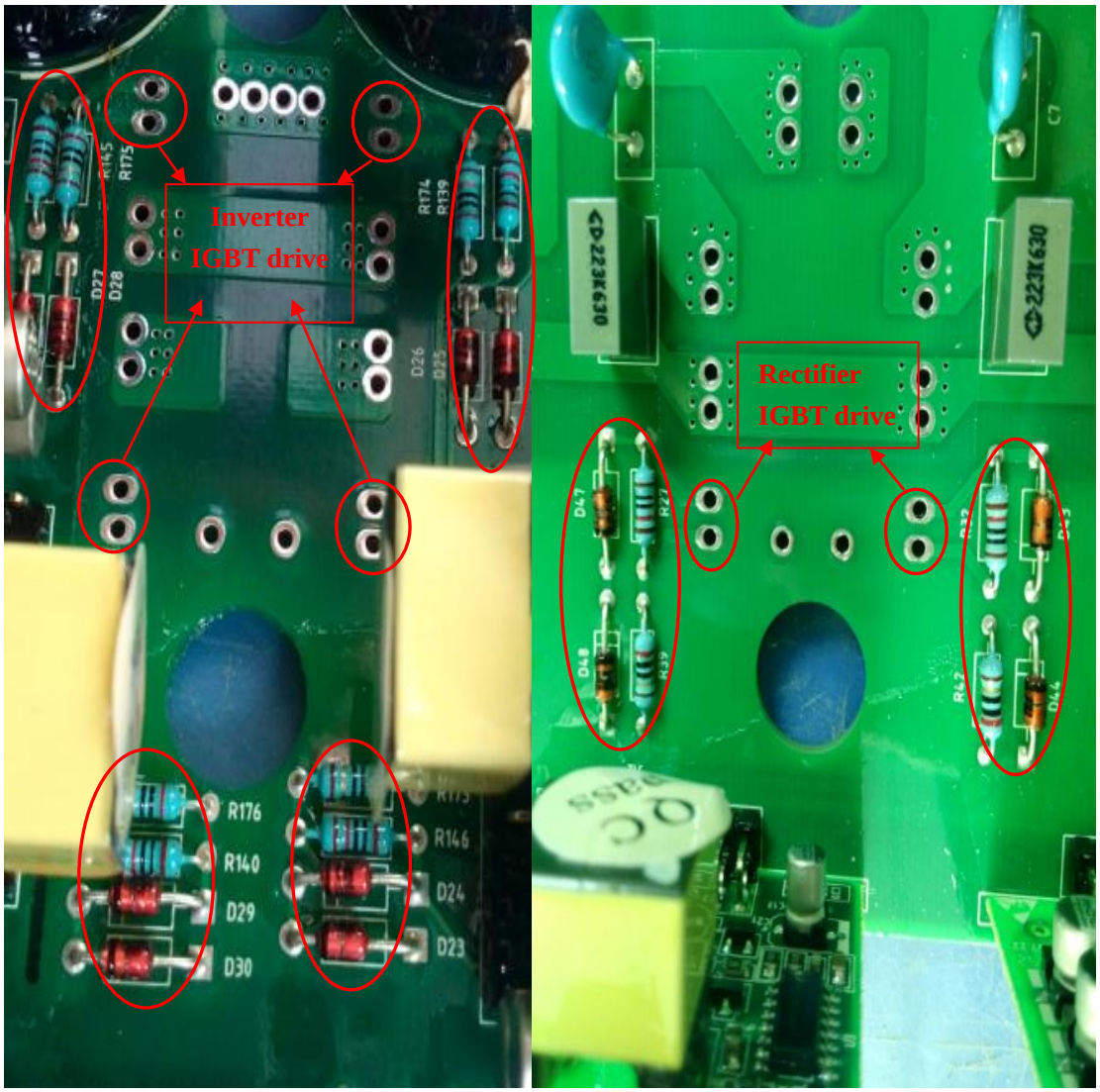
8.8 Output shorted

Firstly check if load , external circuit and wiring terminal are shorted. If not, please check if the output relays of the power module are shorted .

9 IGBT replacement and drive test

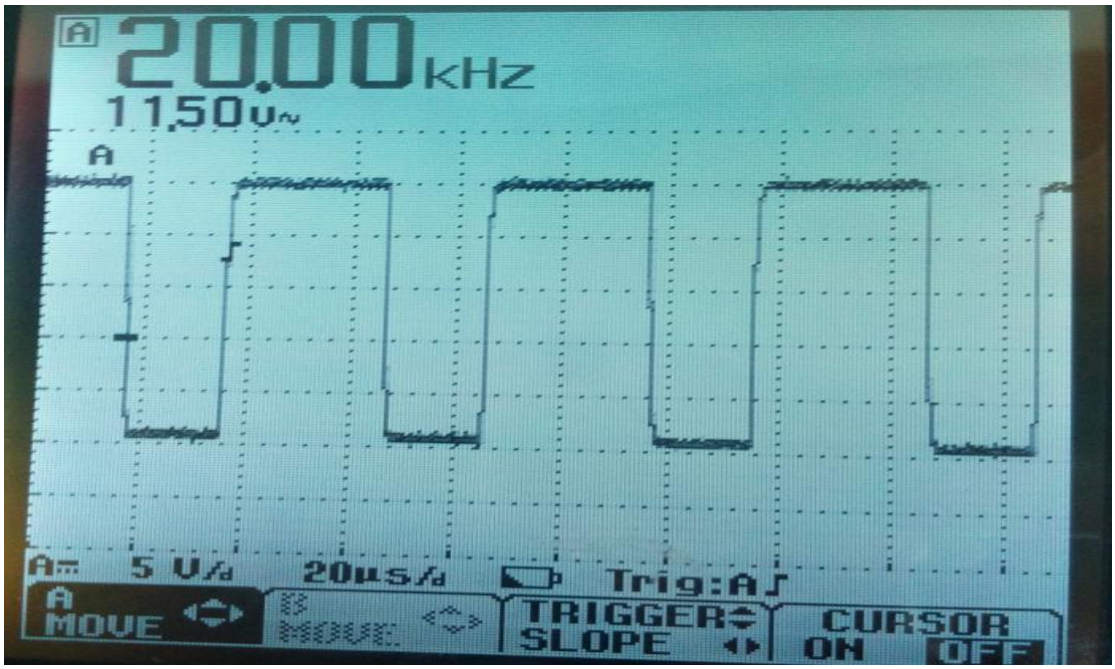
9.1 Dismantle IGBT

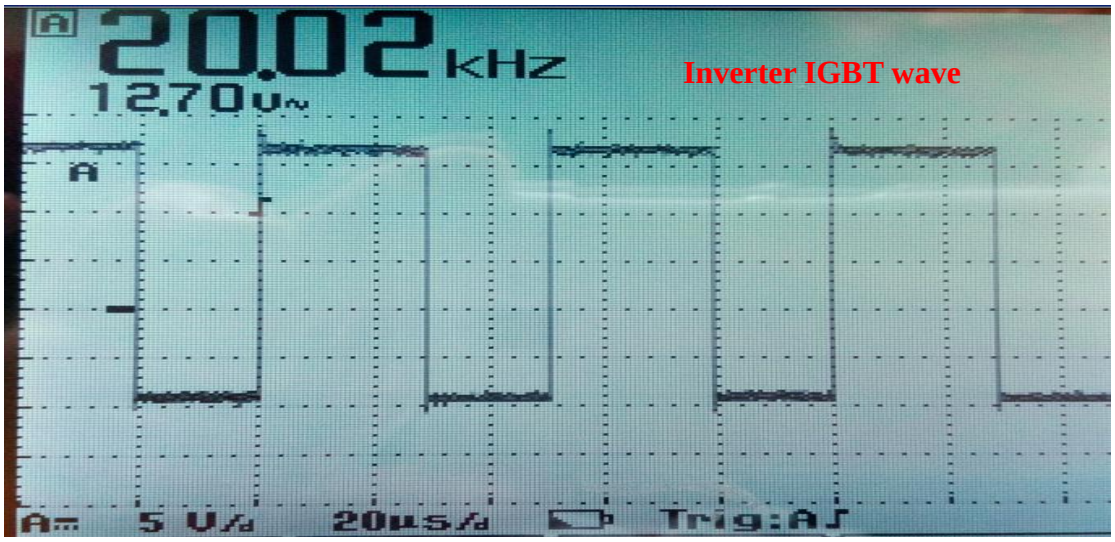
Take out the broken SCR and IGBT with diagonal pliers and iron and clean the tin of the pin holes with suction gun. The normal range should be : drive resistance(20 Ω) , diode(0.65V−0. 73V), bleeder resistor(10K Ω), as is shown in the following figures.



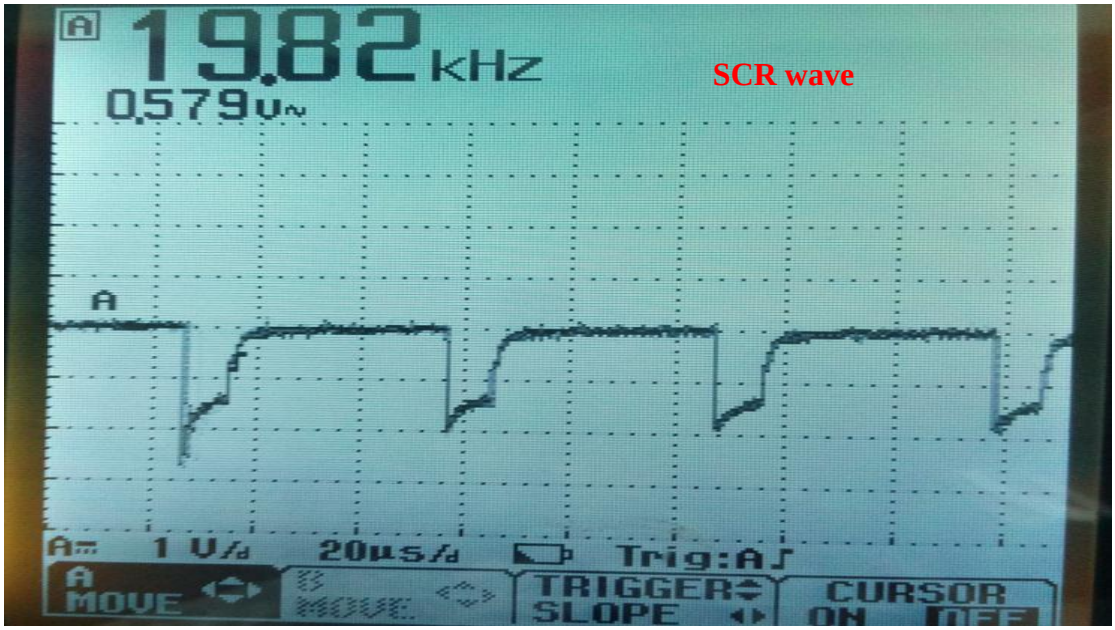
9.2 Drive test

When powering on the control board, test the drive signals of the IGBT(test pins are shown as figure above). The signal wave should be as the following figures.





Inverter IGBT wave

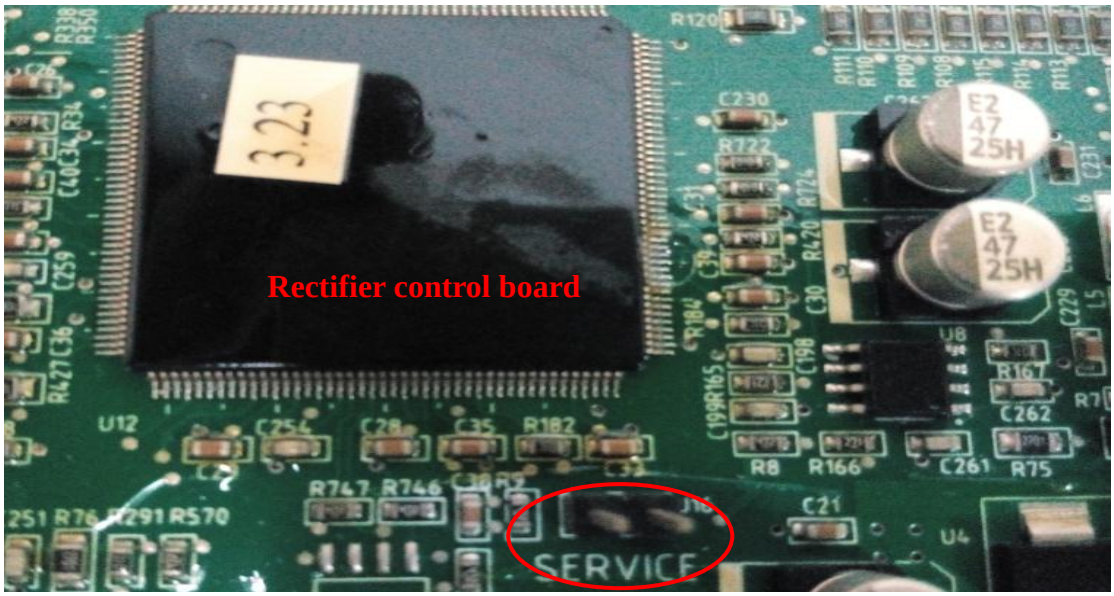


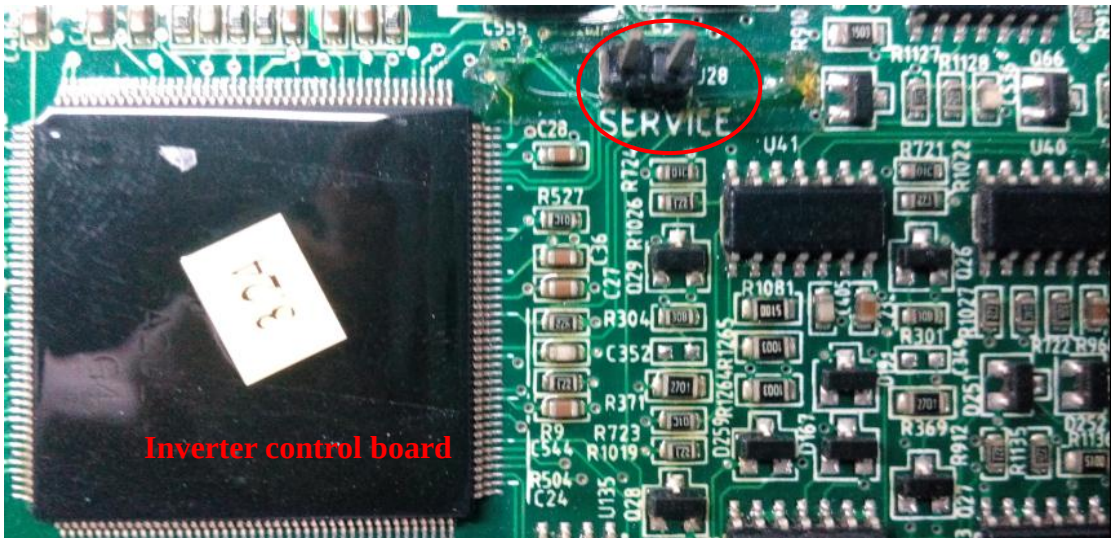
SCR wave

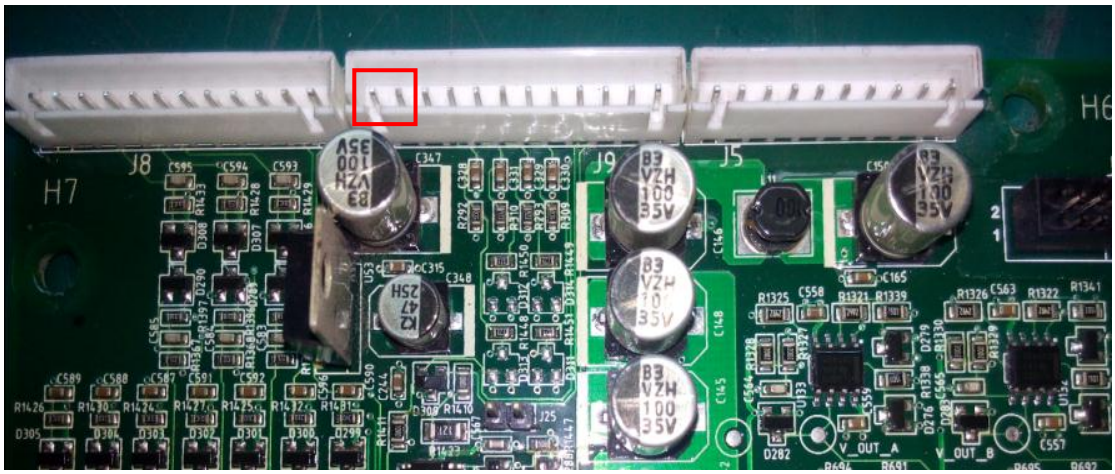
Note: For the drive test, make sure the version for rectifier should be higher than V3.023 and for inverter should be higher than V3.024

Short the SERVICE for Rectifier control boards

And short the SERVICE and EPO for Inverter control boards, as shown in the following figures






H7
J8
J9
J5
H6
V_OUT_A
V_OUT_B