

# Maintenance manual

## For HTX33 (20-30K) serial

### Version 1.0

#### Precaution

1. Only qualified engineer can operate
2. Make sure that UPS is shut down completely
3. Make sure that there is no power at input and battery is disconnected
4. After remove the cover, measure the DC bus voltage. Make sure that the voltage is below 30VDC, if not please wait for several minutes
5. Wait for 10 minutes after shutdown UPS completely



Front panel



Rear panel

# Contents

1. PRODUCT INTRODUCTION .....	2 -
2 PANEL INSTRUCTION AND OPERATION .....	4 -
2.1 PANEL INSTRUCTION .....	4 -
2.2 LCD MAIN MENU INSTRUCTION.....	6 -
2.3 OPERATION MODE INSTRUCTION.....	6 -
2.3.1 <i>Normal mode</i> .....	6 -
2.3.2 <i>Battery mode</i> .....	7 -
2.3.3 <i>Parallel mode</i> .....	7 -
3. HARDWARE DETECTION .....	7 -
4 COMMON FAULT LOCATION .....	16 -

# 1. Product Introduction

## 1.1 System Configuration

The Tower UPS is configured by the following part: Rectifier, Charger, Inverter, Static Switch and Manual Bypass Switch. One or several battery strings should be installed to provide backup energy once the utility fails. The UPS structure is shown in Fig. 1-1.

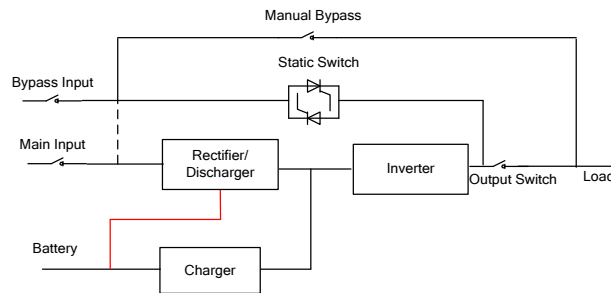


Fig. 1-1 UPS Configuration

## 1.2 UPS Outlook

The UPS outlook is shown as Fig.1-2 to Fig. 1-5.

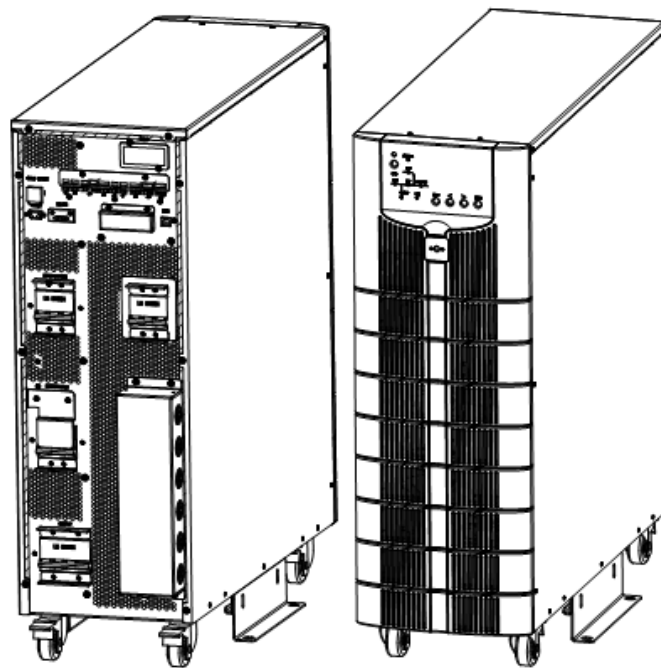


Fig.1-2 20-30KVA System outlook (Long backup type)

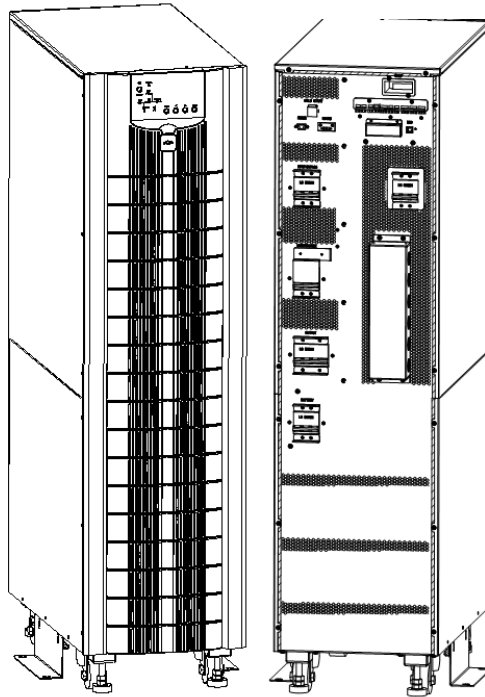


Fig. 1-3 20-30KVA System outlook (Standard backup type)

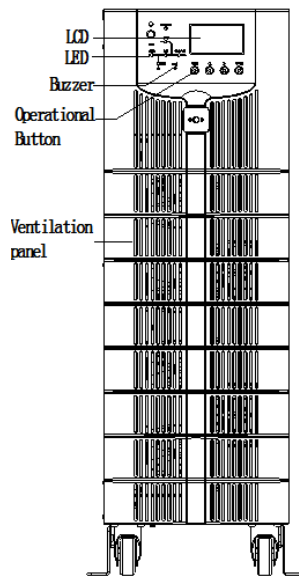


Fig. 1-4 20-30KVA System outlook-Front View

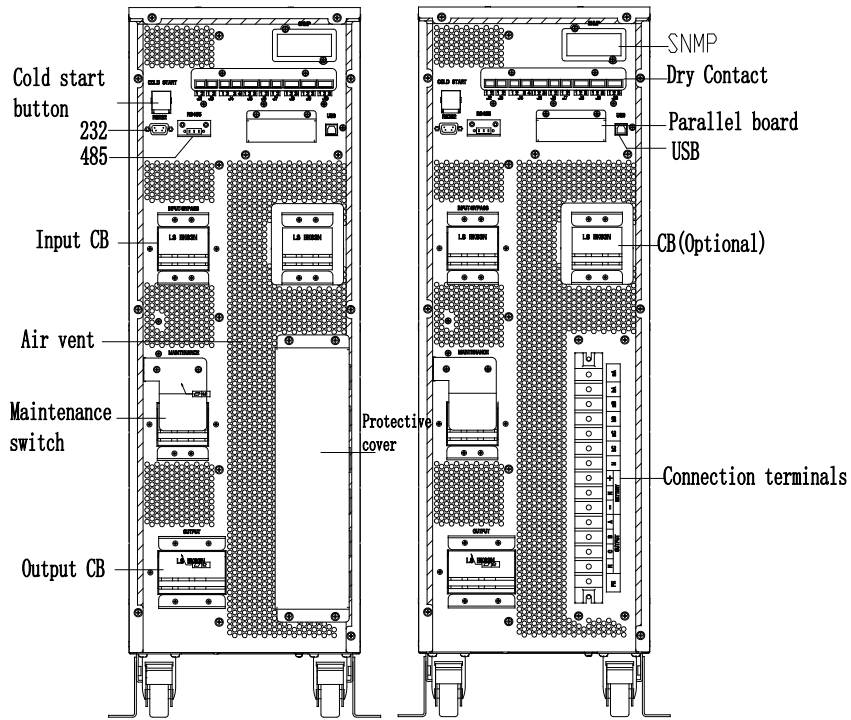


Fig. 1-5 20-30KVA System outlook-Back View

## 2 Panel instruction and operation

Operation of LCD panel is very important for maintenance personnel to quickly master the UPS, this step will greatly improve the efficiency of UPS maintenance.

### 2.1 Panel instruction

Fig2.1 is 33 serial front panels, and the panel is easy to operate UPS.

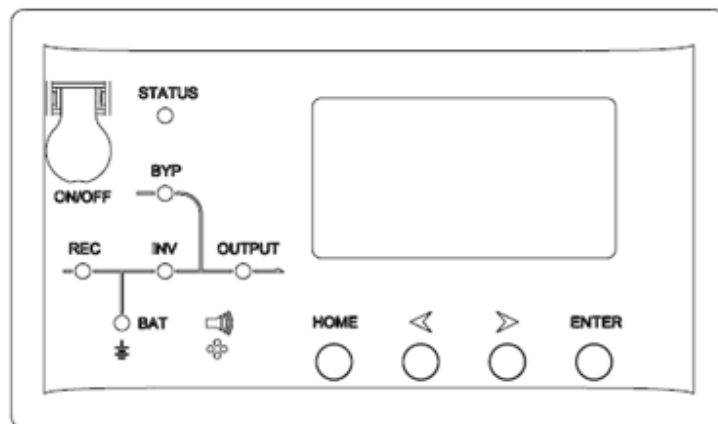


Fig 2.1 Front Panel

Panel instruction:

Controls	Description
ON/OFF	1.Press on/off to start inverter when rectifier is OK <b>NOTE:</b> Not available when inverter is set in automatically start mode 2.Press on/off directly when there is no main input, press again for 3 seconds to start UPS 3. Press on/off for 3 seconds to shutdown inverter when UPS is in normal mode. 4.Press on/off for 3 seconds to shutdown UPS completely when UPS is in battery mode
HOME	Back to main menu
◀ ▶	Left and right
ENTER	Press to choose
Indicators	Description
STATUS	UPS status: green--normal mode, red--UPS is abnormal
REC	Rectifier indicator: green--rectifier is normal, green flicker--rectifier is starting, red--rectifier fault, red flicker--rectifier alarm, dark—rectifier is not working
INV	Inverter indicator: green--inverter is normal, green flicker--inverter is starting or tracking with bypass(ECO), red—inverter fault and load is not on inverter, red flicker—inverter fault and load is on inverter, dark—inverter is not working
BYP	Bypass indicator: green—bypass is normal, dark—UPS is in normal mode and bypass is normal, red—bypass fault, red flicker—bypass alarm
BAT	Battery indicator: green—battery charge, green flicker—battery discharge, dark—battery is connected, red—battery fault, red flicker—battery alarm
OUTPUT	Output indicator: green—output is normal, red—output alarm

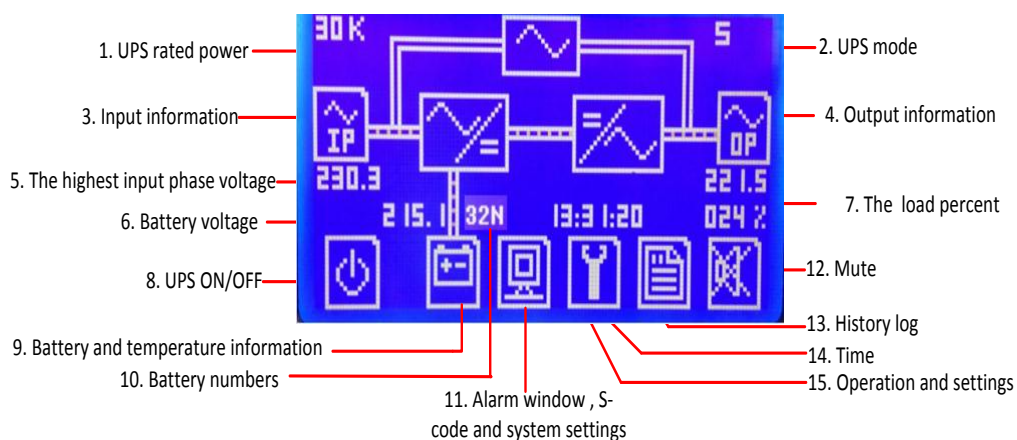









Fig 2.2 LCD Main Menu

## 2.2 LCD main menu instruction

Display	Function	Submenu
	Input information	Main input: voltage, current, frequency, PF
	Battery information	Battery: voltage, discharge current, battery status, battery temperature, capacity
	Output information	Output information:
	Status of UPS	Alarms, S-code, soft version, system information
	Set and function	Set: language, contrast, communication set(SNT, Modbus), Modbus set
	History log	
<b>30K</b>	System parameter	Rated capacity: 10KVA 1 phase in, 1 phase out
<b>230.3</b>	Input voltage	
<b>215.1/32</b>	Battery voltage and battery NO	
<b>221.5 024%</b>	Output voltage and load percent	
<b>P2</b>	System working mode	S--single mode, E--ECO mode, P-parallel mode, 2-the unit ID is 2 in system, the units ID in parallel system should be different
	Mute on, mute off	

## 2.3 Operation Mode Instruction

### 2.3.1 Normal mode

UPS work in normal mode, rectifier indicator(REC)、inverter indicator(INV)、battery indicator(BAT)、output indicator(Output) and status indicator(STATUS) are green, bypass indicator(BYP) is off. UPS inverter feed load, battery in charge.

### 2.3.2 Battery mode

When utility is abnormal, UPS work in battery mode. When battery voltage is close to EOD voltage, fault alarm will appear. If utility still don't come, UPS will automatic off.

🚫🚫 **Note:** UPS internal still has a high voltage, please do not touch terminals.

### 2.3.3 Parallel mode

#### 1)、 Normal mode

Parallel UPS work in normal mode, UPS inverter provides power supply sharing.

#### 2)、 Battery mode

When utility abnormal, parallel UPS all work in battery mode, UPS inverter provides power supply sharing.

#### 3)、 Bypass mode

Utility directly feed the load, when utility abnormal, the output will have brief interruptible.

#### 4)、 Fault mode

When one UPS in parallel system is fault, the fault UPS will turn off inverter. Meanwhile, if another UPS have enough capacity, it will separately feed the load, if another UPS do not have enough capacity, the double UPS will transform to bypass mode.

## 3. Hardware detection

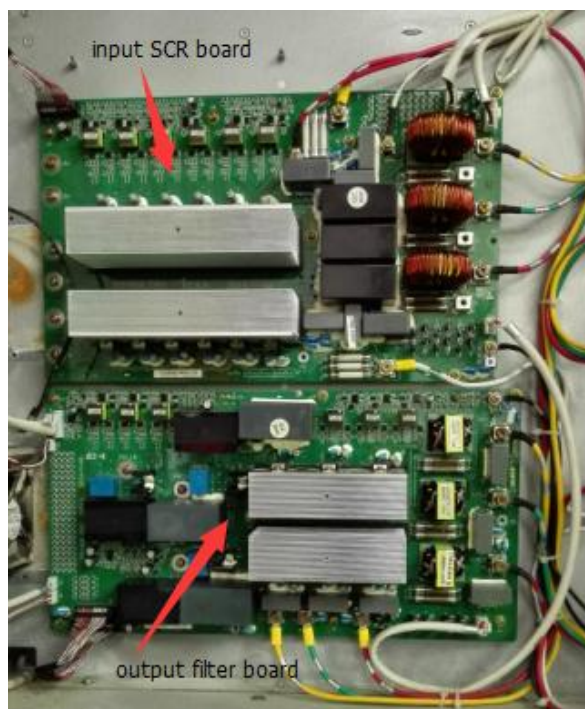


Fig 3-1 Right side



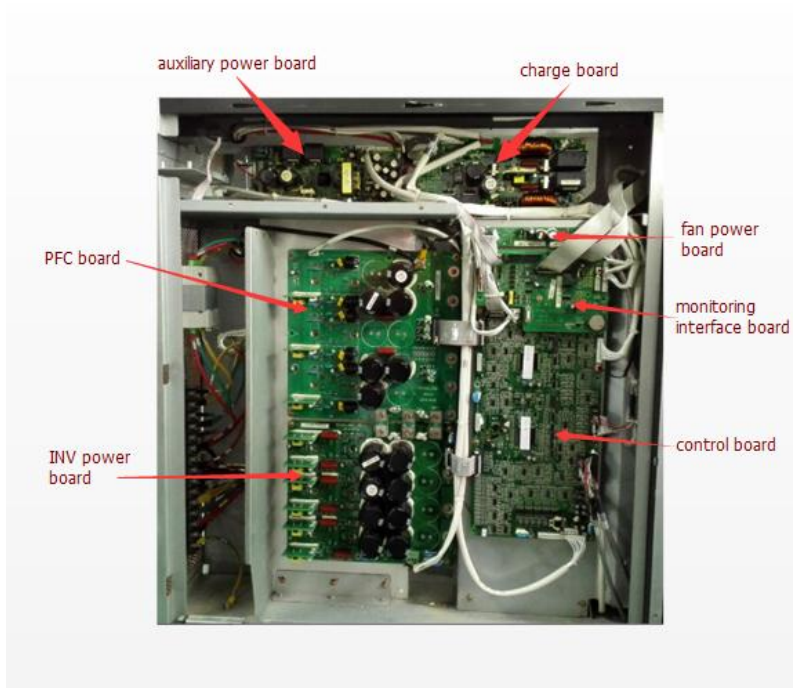


Fig 3-2 Left side

### 3.1 SCR detection



Fig 3-3



Fig 3-4

HT33 (20-30K) series UPS, all SCR use the same detect method. Multi meter use resistance gear, the red pen pick foot 1, black pen for foot 3, resistance between  $17\Omega \sim 70\Omega$  is normal. Red pen pick foot 2, black pen for 1 foot, no short circuit is normal, usually  $K\Omega$  or  $M\Omega$ . As fig We can use oscilloscope to test the SCR driver wave, measure foot 1 and foot 3.

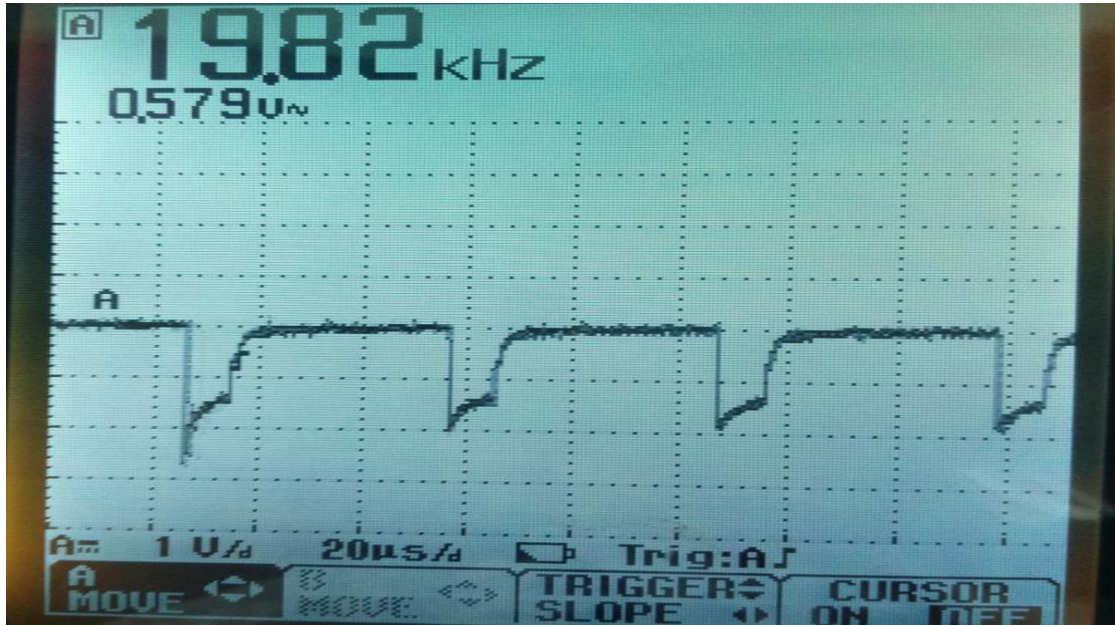


Fig 3-5 SCR drive wave

### 3.2 REC power board IGBT detection



Fig 3-6



Fig 3-7

There are three IGBT modules in the rectifier board; for each IGBT module, there are 2 units in it. We simply test 4 inner diodes. The diagram for the IGBT module is shown in the Fig 3-8

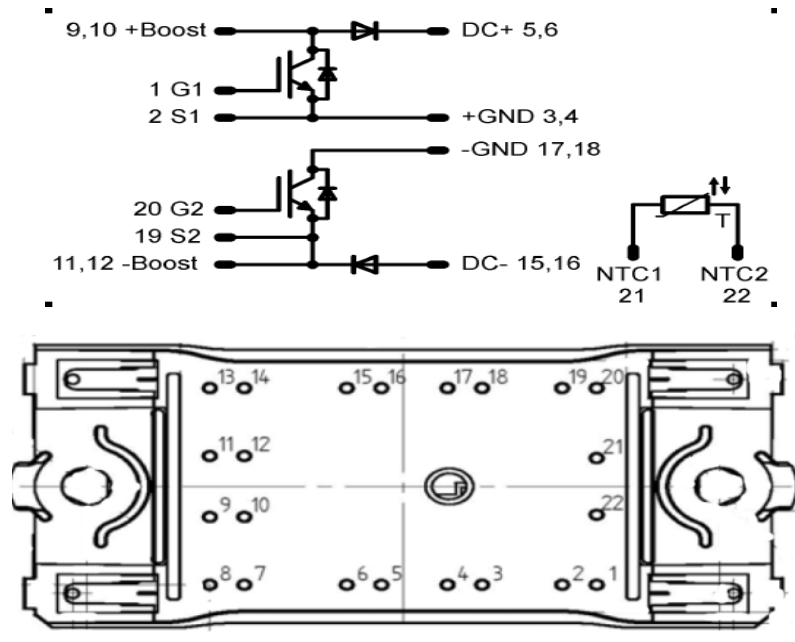


Fig 3-8 Diagram for the IGBT module

If all the measured diode voltages are between 0.37V and 0.5V, then the IGBT is OK. Please make sure the probes are well touched to the pin, for there is conformal coating on the surface of the pins. IGBT simplify measurement is shown in the following table and Fig 3-9

Red probe	Black probe
1	3
5	4
3	2
4	6

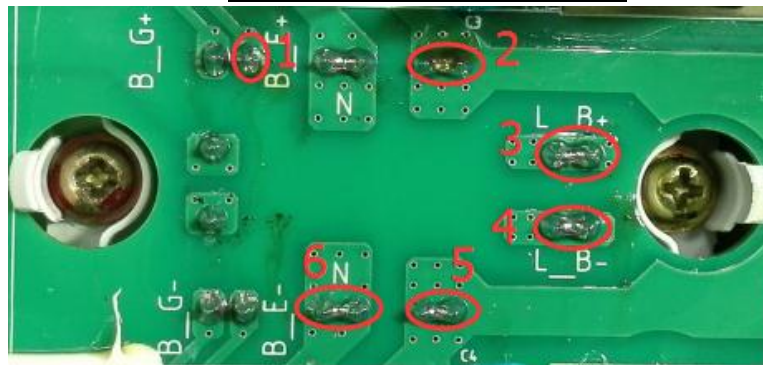


Fig 3-9 IGBT simplify measurement

We can use oscilloscope to test the REC driver wave

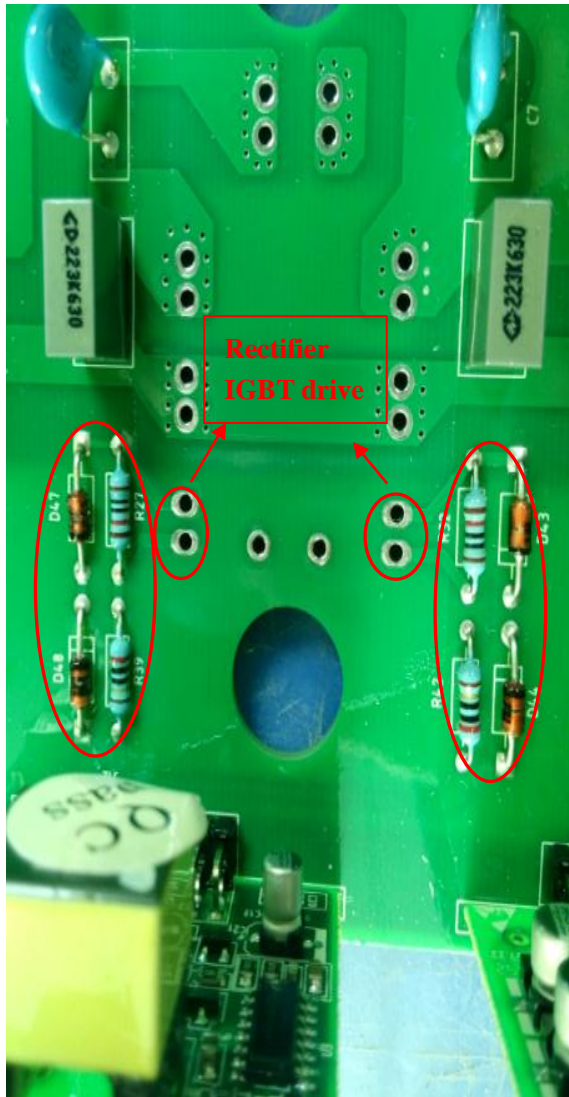


Fig 3-10 REC drive test

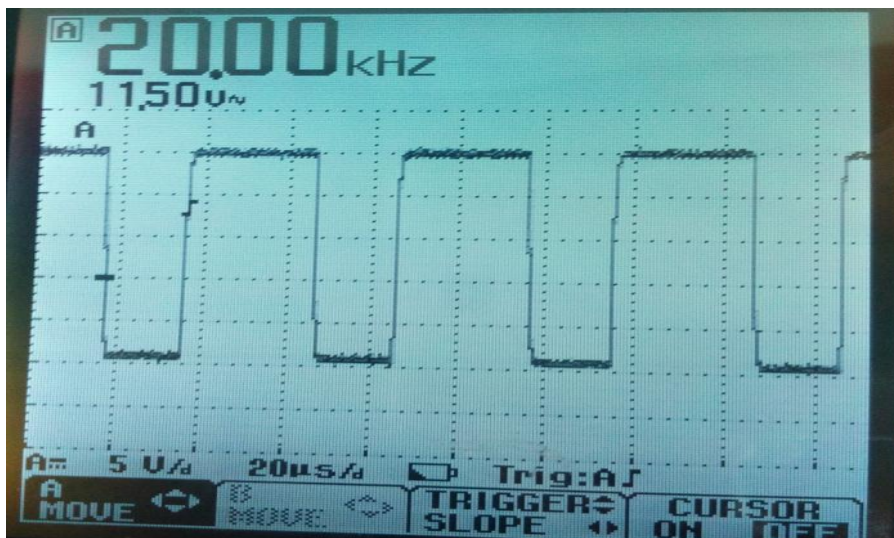


Fig 3-11 REC drive wave

### 3.3 INV power board IGBT detection



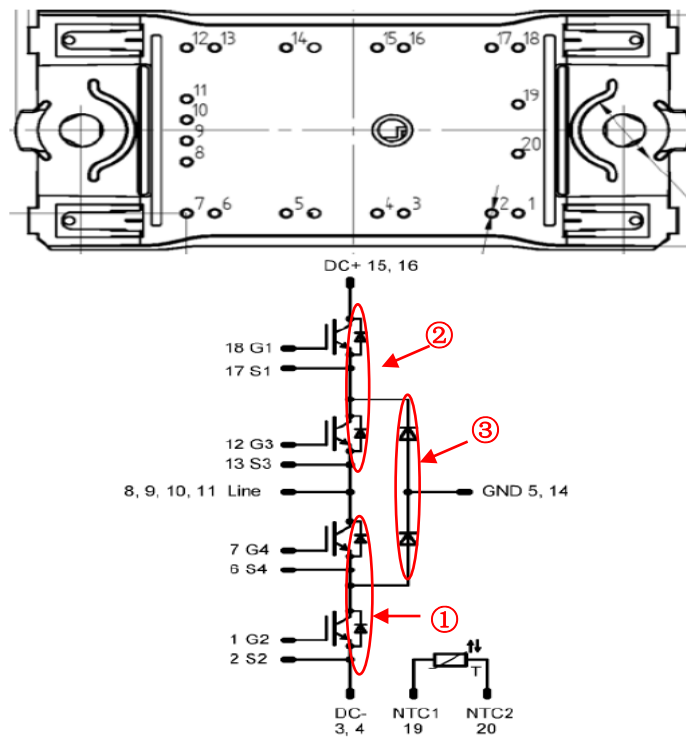
Fig 3-12



Fig 3-13

Steps	Red pin	Black pin
①	BUS-	1
②	BUS-	2
③	BUS-	3
④	BUS+	1
⑤	BUS+	2
⑥	BUS+	3

Fig 3-14 Inverter IGBT quick test method



IGBT Package of the inverter IGBT

Fig 3-15 Pins of Inverter IGBT

We can use oscilloscope to test the INV driver wave

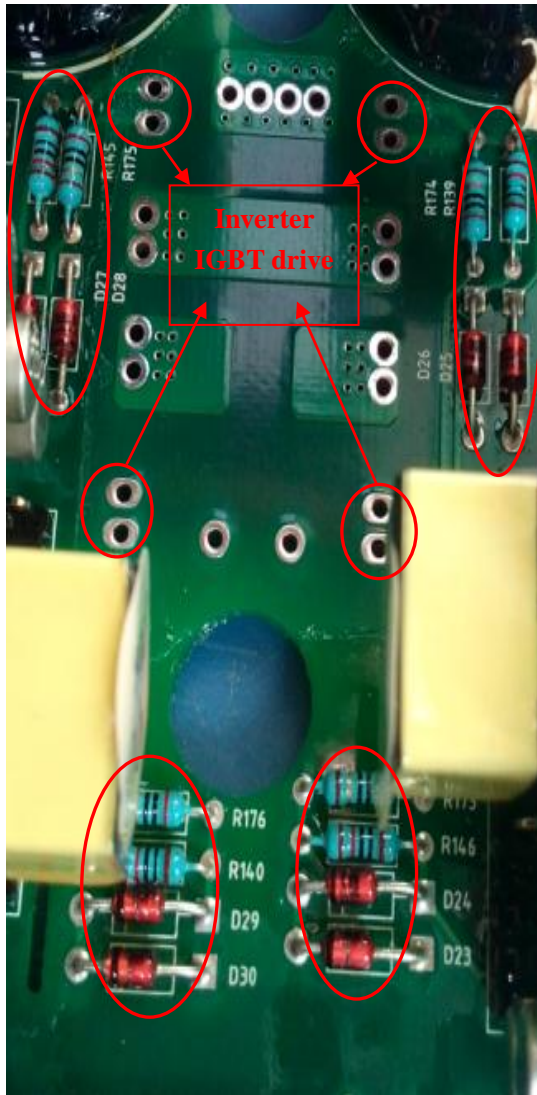


Fig 3-16 inverter drive test

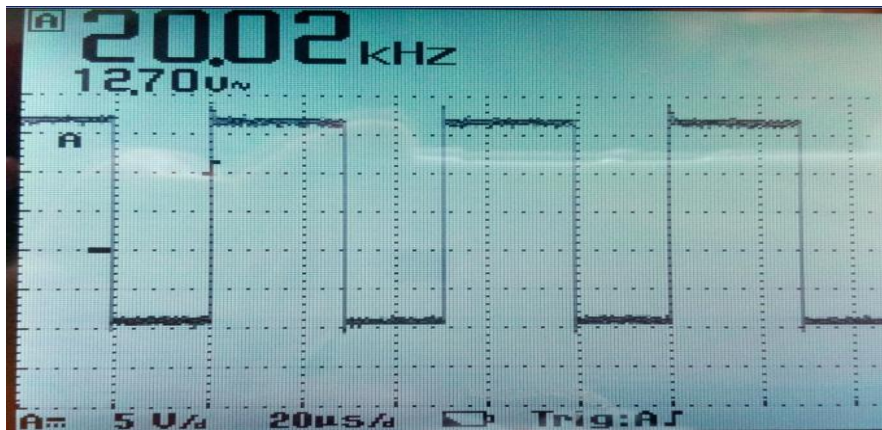


Fig 3-17 INV drive wave

### 3.4 Test tooling

#### Note:

- a) This manual only for trained engineer
- b) If you test driver in the unit, only need the DC supply
- c) When test the driver, please turn off the utility and battery.

#### List:

- d) 2 diode
- e) 17001-01322 power supply board(SMPS) 1pcs;
- f) 17001-02089 HTX33 control board 1pcs;
- g) 17001-01983 rectifier power board (HTX20KVA) 1pcs;
- h) 17001-01982 inverter power board (HTX20KVA) 1pcs;
- i) 17001-01881 rectifier power board (HTX30KVA) 1pcs;
- j) 17001-02546 inverter power board (HTX30KVA) 1pcs;

#### 3.4.1 Prepare 2 diode (Parameters: 1000V/3A) for AC to DC, as shown in Fig 3-18.

**Note:** For driver testing, the DC voltage range can be 90V~350V.

If utility is 110VAC, you can use full wave Rectifier, as is shown in Fig 3-19.

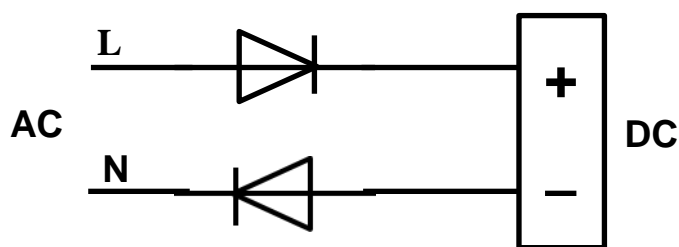


Fig3-18 half wave Rectifier

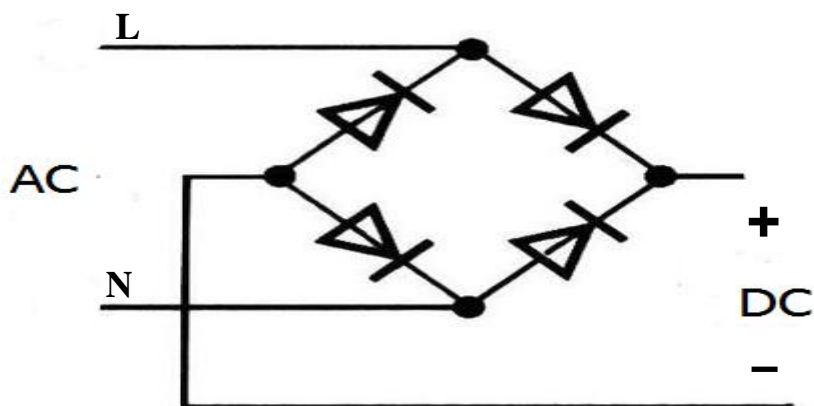


Fig3-19 full wave Rectifier

3.4.2 Service mode for 3 phase UPS. PCB code: 17001-00746, same DC input, as is shown in Fig 3-20.

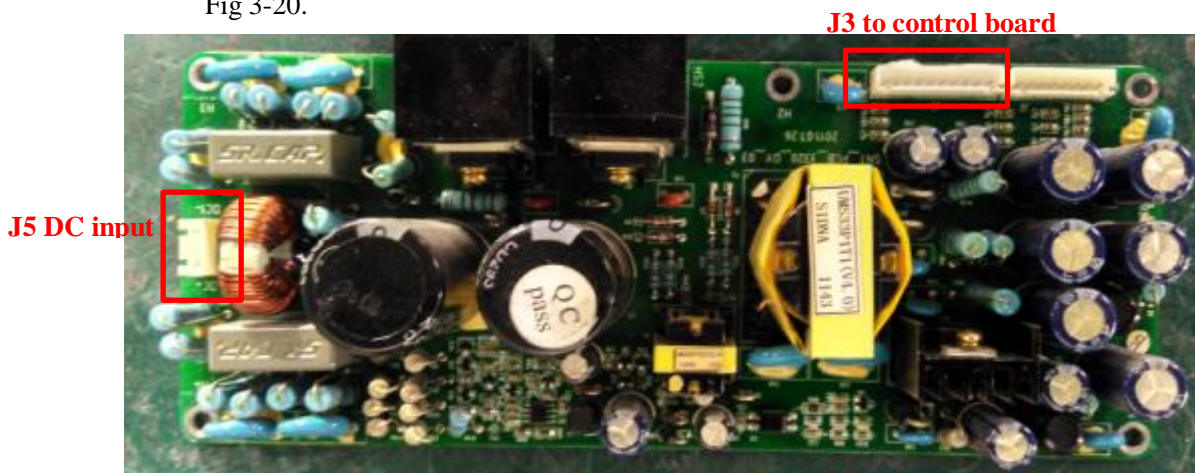


Fig 3-20 SMPS

3.4.3 Make the service jumper (J30) is shorted circuit, as is shown in Fig 3-21.

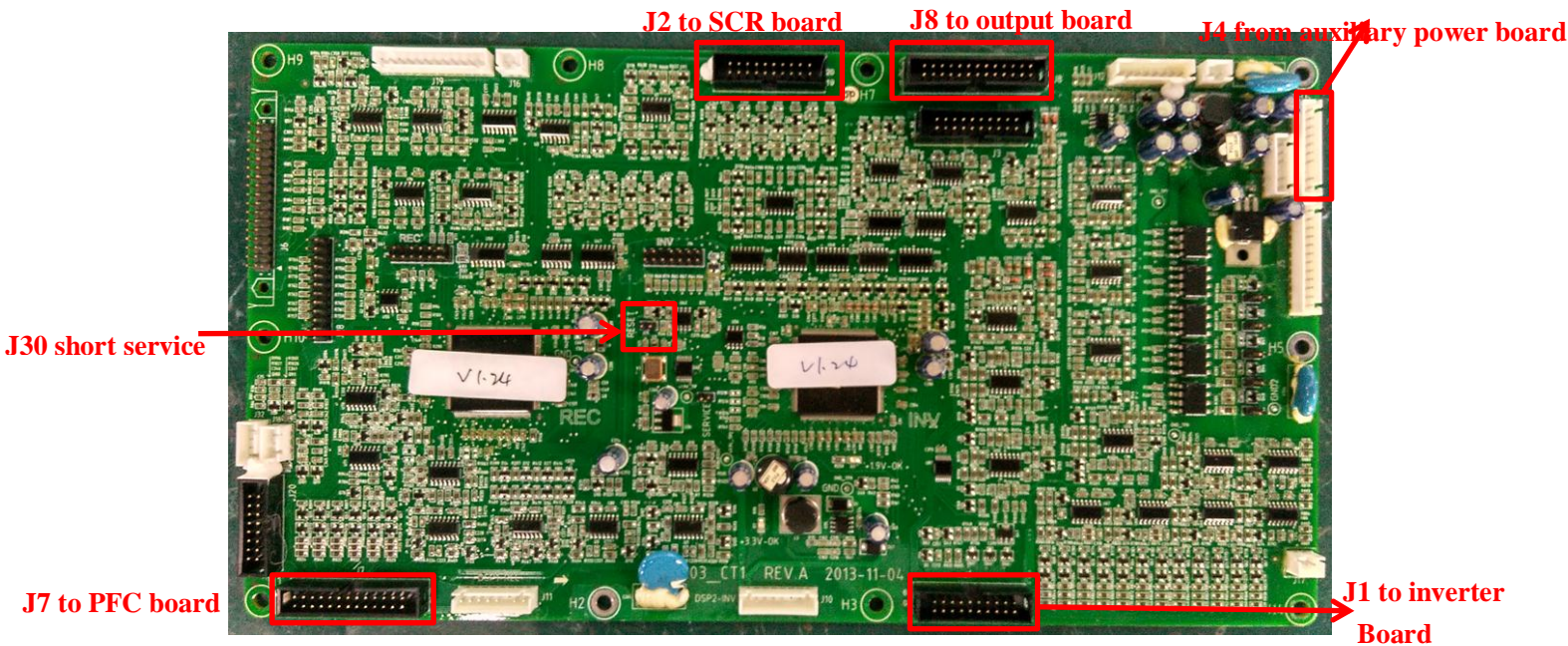


Fig 3-21 Control board



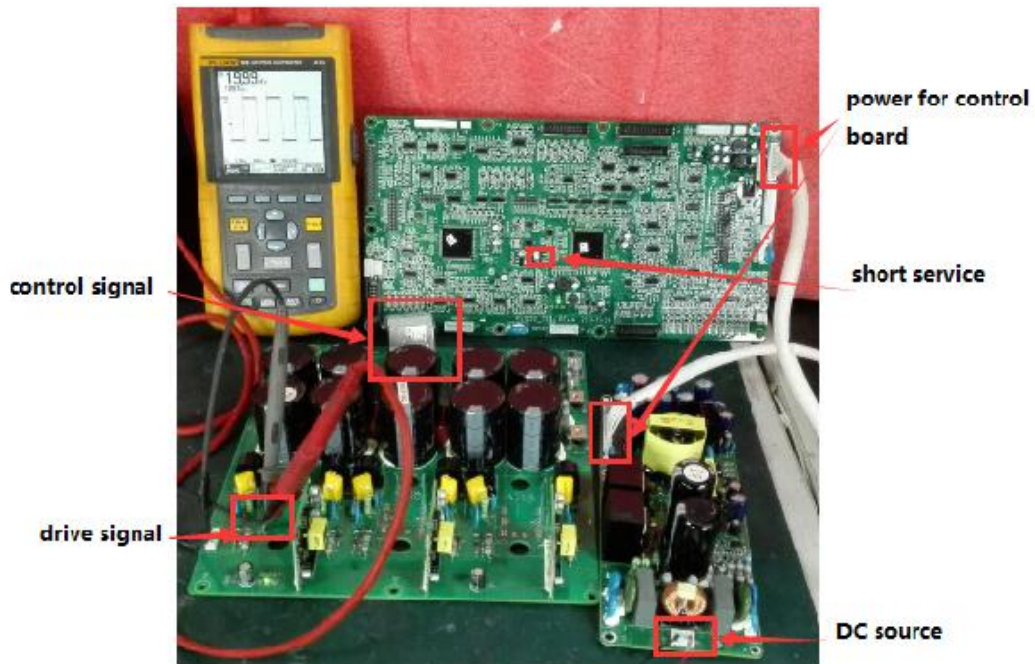


Fig 3-22 tooling

1. Give a DC source arrange 90V-350V to the auxiliary power board;
2. Give control board a power from the auxiliary;
3. Use cable to connect control board and REC power board , INV power board or SCR board;
4. Short service pin of the control board;
5. Turn on the switch, we can use oscilloscope to measure the drive wave.

## 4 Common fault location

When UPS shows alarm, we first need find the fault part. The history log, LED status and current alarm will help us analyze the failure.

When turn on UPS, rectifier PCB will work (REC led is green flashing), then inverter PCB will work (INV led is green flashing).

If REC led turn red, it maybe rectifier PCB is fault;

If INV led turn red, it maybe inverter PCB is fault;

Please refer to the table:

UPS events	Description
Fault Clear	Manually clear fault
Generator Input	Generator is connected and a signal is sent to the UPS.
Utility Abnormal	Utility (Grid) is abnormal. Mains voltage or frequency exceeds the upper or lower limit and results in rectifier shutdown. Check the input phase voltage of rectifier.

Bypass Sequence Error	Bypass voltage Sequence is reverse. Check if input power cables are connected correctly.
Bypass Module Over Load	Bypass current is over the limitation. If bypass current is under 135% of the rated current. The UPS alarms but has no action.
Bypass Over Load Tout	The bypass overload status continues and the overload times out.
Byp Freq Over Track	This alarm is triggered by an inverter software routine when the frequency of bypass voltage exceeds the limit. The alarm will automatically reset if the bypass voltage becomes normal.
	First check if relevant alarm exists, such as “bypass circuit breaker open”, “Byp Sequence Err” and “Ip Neutral Lost”. If there is any relevant alarm, first clear this alarm.
	1. Then check and confirm if the bypass frequency displayed on the LCD are within the setting range. Note that the rated frequency are respectively specified by “Output Frequency”.
	2. If the displayed voltage is abnormal, measure the actual bypass frequency. If the measurement is abnormal, check the external bypass power supply. If the alarm occurs frequently, use the configuration software to increase the bypass high limit set point according to the user’s suggestions
Exceed Tx Times Lmt	The load is on bypass because the output overload transfer and re-transfer is fixed to the set times during the current hour. The system can recover automatically and will transfer back to the inverter with 1 hour
Output Short Circuit	Output shorted Circuit.
	Fist check and confirm if loads have something wrong.
	Then check and confirm if there is something wrong with terminals, sockets or some other power distribution unit.
	If the fault is solved, press “Fault Clear” to restart UPS.
Battery EOD	Inverter turned off due to low battery voltage. Check the mains power failure status and recover the mains power in time

Battery Test	System transfer to battery mode for 20 seconds to check if batteries are normal
Battery Test OK	Battery Test OK
Battery Maintenance	System transfer to battery mode until to be 1.1*EOD voltage to maintenance battery string
Battery Maintenance OK	Battery maintenance succeed
Module Exit	Power Module is pulled out from system.
Rectifier Fail	The rectifier is fault and results in rectifier shutdown and battery discharging.
Inverter Fail	The inverter output voltage is abnormal and the load transfers to bypass.
Rectifier Over Temp.	The temperature of the rectifier IGBTs is too high to keep rectifier running. This alarm is triggered by the signal from the temperature monitoring device mounted in the rectifier IGBTs. The UPS recovers automatically after the over temperature signal disappears.
	If over temperature exists, check:
	1. Whether the ambient temperature is too high.
	2. Whether the ventilation channel is blocked.
	3. Whether fan fault happens.
	4. Whether the input voltage is too low.
Fan Fail	At least one fan fails in the UPS.
Output Over load	This alarm appears when the load rises above 100% of nominal rating. The alarm automatically resets once the overload condition is removed.
	1. Check which phase has overload through the load (%) displayed in LCD so as to confirm if this alarm is true.
	2. If this alarm is true, measure the actual output current to confirm if the displayed value is correct.
	Disconnect non-critical load. In parallel system, this alarm will be triggered if the load is severely imbalanced.
Inverter Overload Tout	The UPS overload status continues and the overload times out.
	Note:
	The highest loaded phase will indicate overload

		<p>timing-out first.</p> <p>When the timer is active, then the alarm “unit over load” should also be active as the load is above nominal.</p> <p>When the time has expired, the inverter Switch is opened and the load transferred to bypass.</p> <p>If the load decreases to lower than 95%, after 2 minutes, the system will transfer back to inverter mode. Check the load (%) displayed in LCD so as to confirm if this alarm is true. If LCD displays that overload happens, then check the actual load and confirm if the UPS has over load before alarm happens.</p>
Inverter Temp.	Over	<p>Inverter IGBT Over Temperature.</p> <p>The temperature of the inverter heat sink is too high to keep inverter running. This alarm is triggered by the signal from the temperature monitoring device mounted in the inverter IGBTs. The UPS recovers automatically after the over temperature signal disappears.</p> <p>If over temperature exists, check:</p> <p>Whether the ambient temperature is too high.</p> <p>Whether the ventilation channel is blocked.</p> <p>Whether fan fault happens.</p> <p>Whether inverter overload time is out.</p>
Manual Byp	Transfer	Transfer to bypass manually
Esc Bypass	Manual	Escape from “transfer to bypass manually” command. If UPS has been transferred to bypass manually, this command enable UPS to transfer to inverter.
Battery Volt Low		Battery Voltage is Low. Before the end of discharging, battery voltage is low warning should occur. After this pre-warning, battery should have the capacity for 3 minutes discharging with full load.
Input Neutral Lost		The mains neutral wire is lost or not detected. For 3 phases UPS, it’s recommended that user use a 3-poles breaker or switch between input power and UPS.
Manual Shutdown		The rectifier and inverter are manually shutdown, and there’s on bypass output.
Manual Charge	Boost	Manually force the Charger work in boost charge mode.

Manual Charge	Float	Manually force the charger work in float charge mode.
EOD Sys Inhibited		System is inhibited to supply after the battery is EOD (end of discharging)
Battery Test Fail		Battery Test Fail. Check if UPS is normal and battery voltage is over 90% of float voltage.
Battery Maintenance Fail		Check
		If UPS is normal and not any alarms
		If the battery voltage is over 90% of float voltage
		If load is over 25%
Ambient Temp	Over	Ambient temperature is over the limit of UPS. Air conditioners are required to regulate ambient temperature.
Input Unbalance	Curr	The difference of input current between every two phases is over 40% of rated current.
		Please check if rectifier's fuses, diode, IGBT or PFC diodes are broken.
DC Bus Over Volt		Voltage of DC bus capacitors is over limitation. UPS shutdown rectifier and inverter.
Relay Connect Fail		Inverter relays are opened and cannot work or fuses are broken.
Relay Short Circuit		Inverter relays are shorted and cannot be released.