SPH10000TL3 BH-UP

Technical Guidance for Customer Service

SPH10000TL3 BH-UP series

Technical guidance for customer service

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Ratify： Zhigang liao

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Ⅰ. SPH10000TL3 BH-UP Series

1.1 Product overview

SPH 4000-10000TL3 BH-UP three-phase on grid machine is an upgrade version of the SPH 4000-10000TL3 BH. Main new functions: The parallel off-grid switching time is less than 10mS, realize uninterrupted power switching of off-grid; Three-phase power can be unbalanced output, can be loaded with single phase; Each phase/sum power control can be set, phase-level power regulation, maximum spontaneous self-use; DC/AC PV has a maximum board of 1.5 times; compatible with ZTE Pineng and ARK-2.5H batteries.

This range includes SPH4000TL3 BH-UP, SPH5000TL3 BH-UP, SPH6000TL3 BH-UP, SPH7000TL3 BH-UP, SPH8000TL3 BH-UP 和 SPH10000TL3 BH-UP, the corresponding ratings (maximum power) are 4000W，5000W, 6000W, 7000W, 8000W and 10000W.

1.2 Product appearance

SPH 4000-10000TL3 BH-UP series product appearance

1.3 Product characteristic

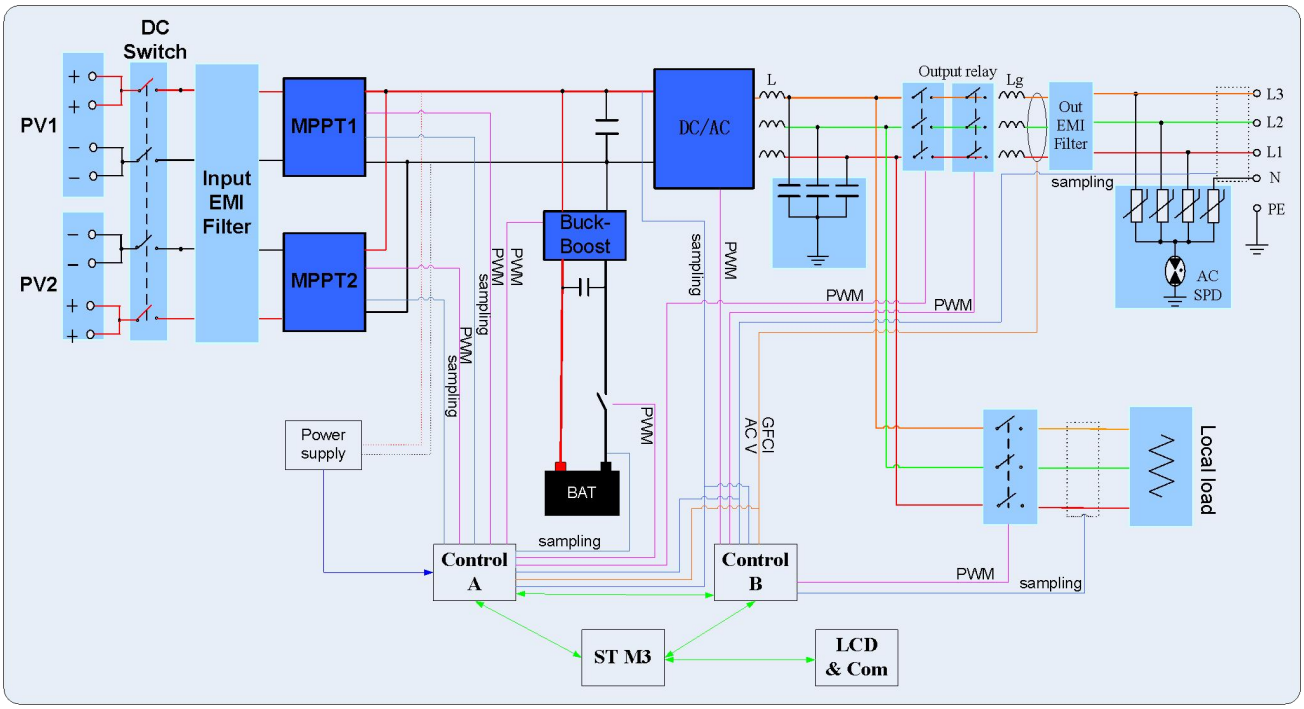
- Human-computer interaction, LCD display, rich man-machine function interface, physical button operation;

- Operation mode, battery first, power grid priority, load priority optional, three time period can be set;
- Battery communication, CAN and RS485 optional;
- Off-grid function and off-grid automatic identification, support for three-phase 100% unbalanced input;
- Intelligent monitoring, WiFi-X/Shinelink/GPRS/APP/Shineserver, support remote setup and upgrade;
- Program upgrade, support USB rapid upgrade; fast response, rapid tracking current and identification, responding to changes in PV energy within 1s.

Ⅱ. Product brief principle and internal structure

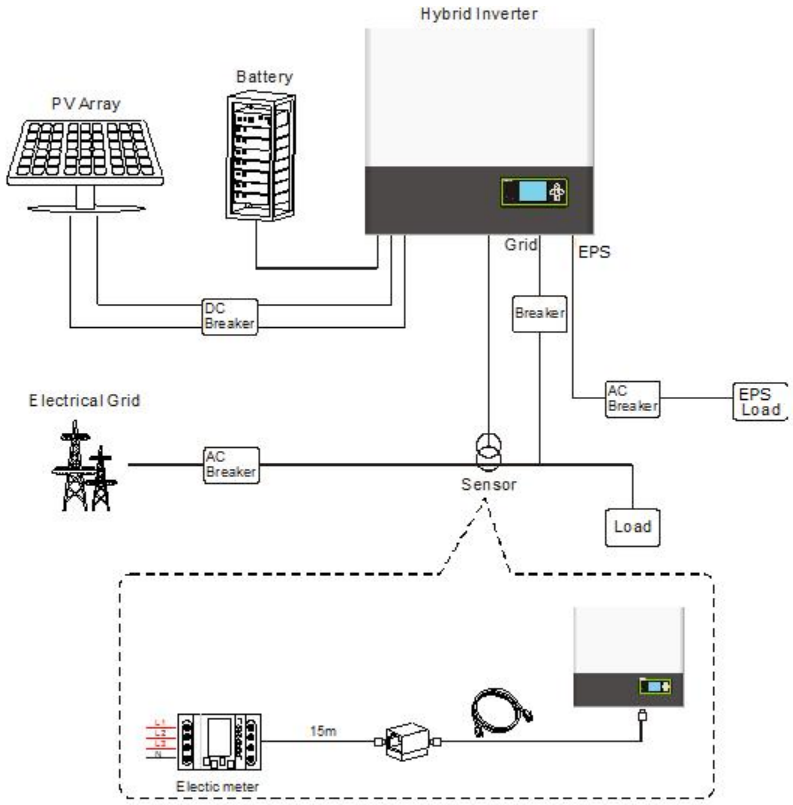
2.1 System principle block diagram

The system principle block diagram is as follows:



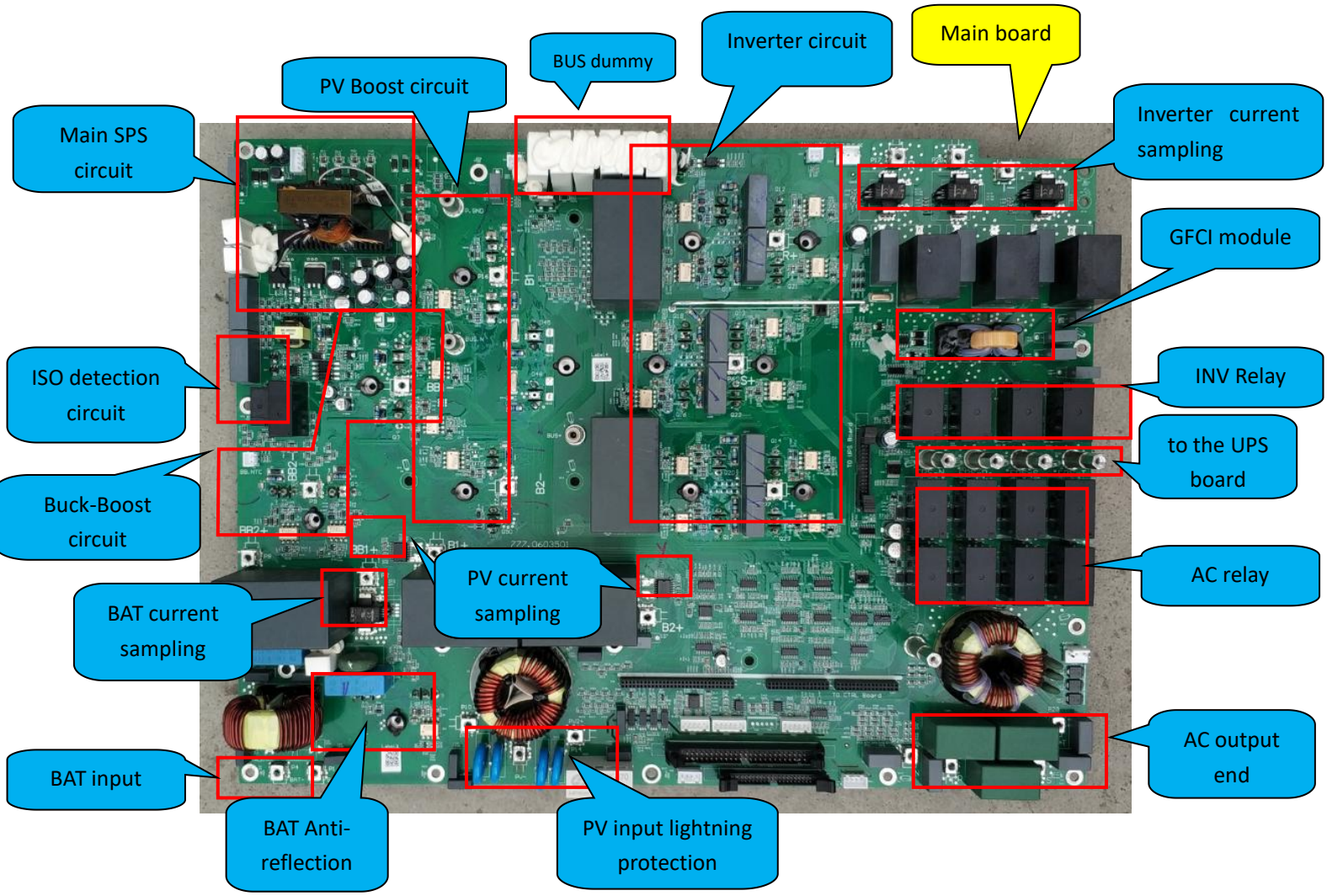
2.1 System block diagram

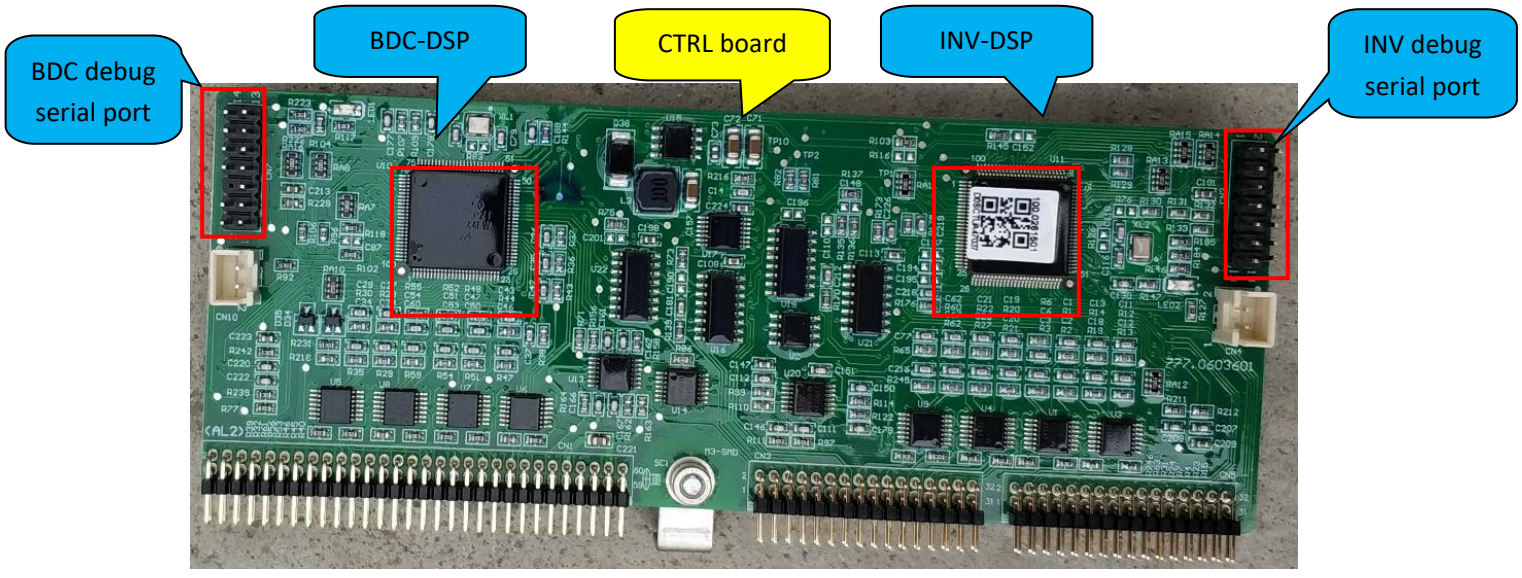
2.2 Schematic diagram of the photovoltaic system

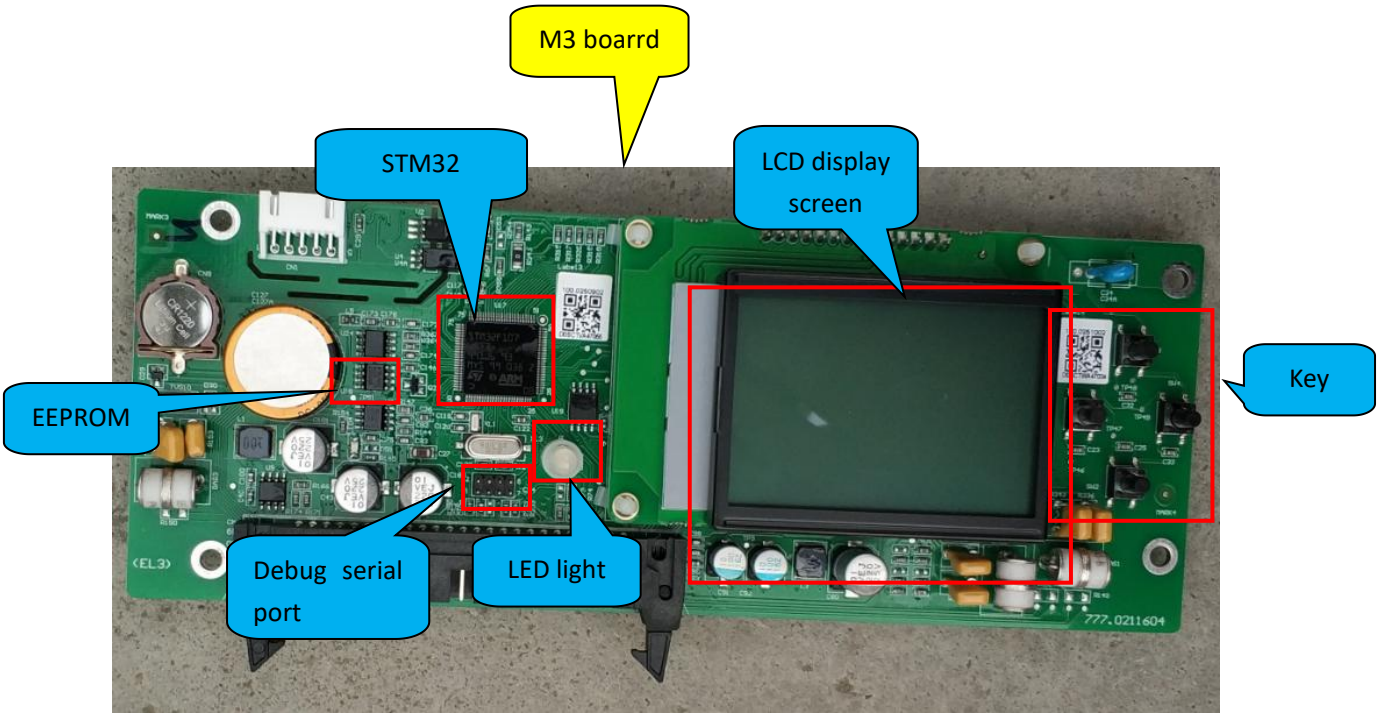


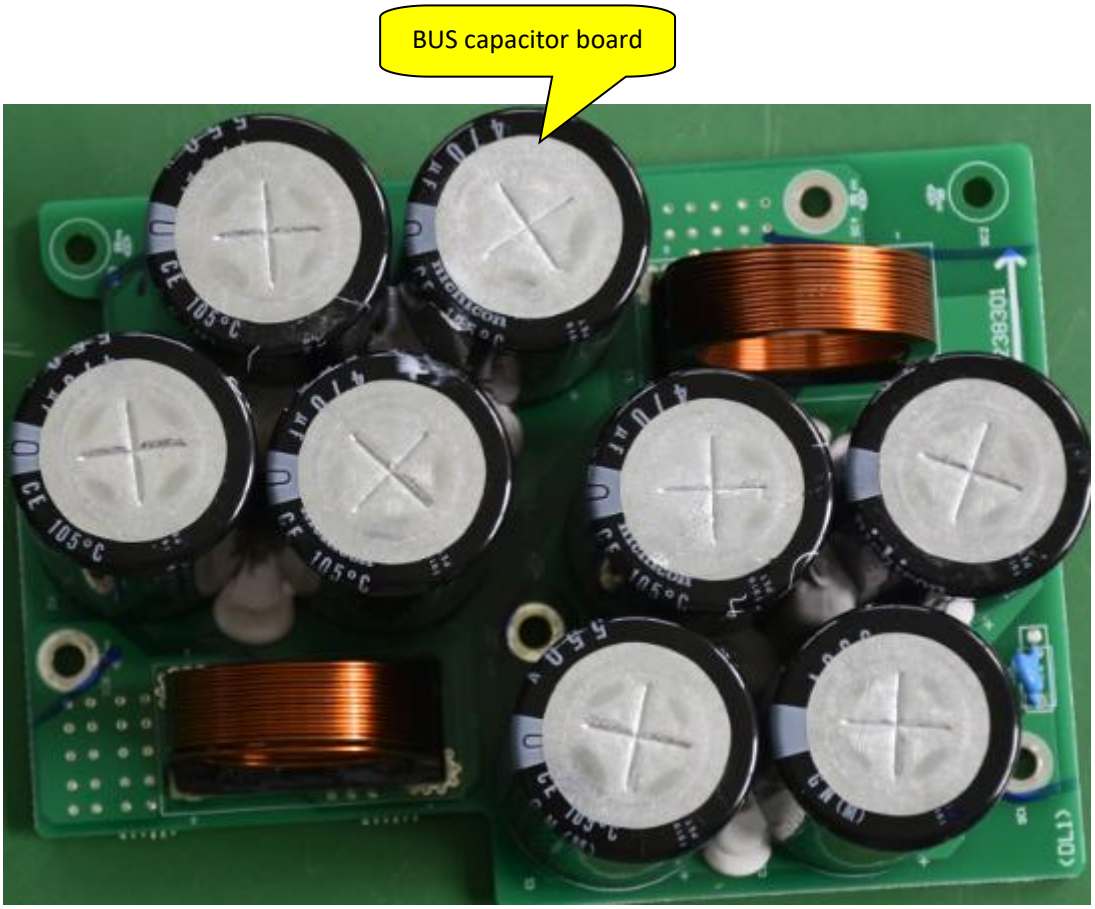
2.2 Schematic diagram of the photovoltaic system

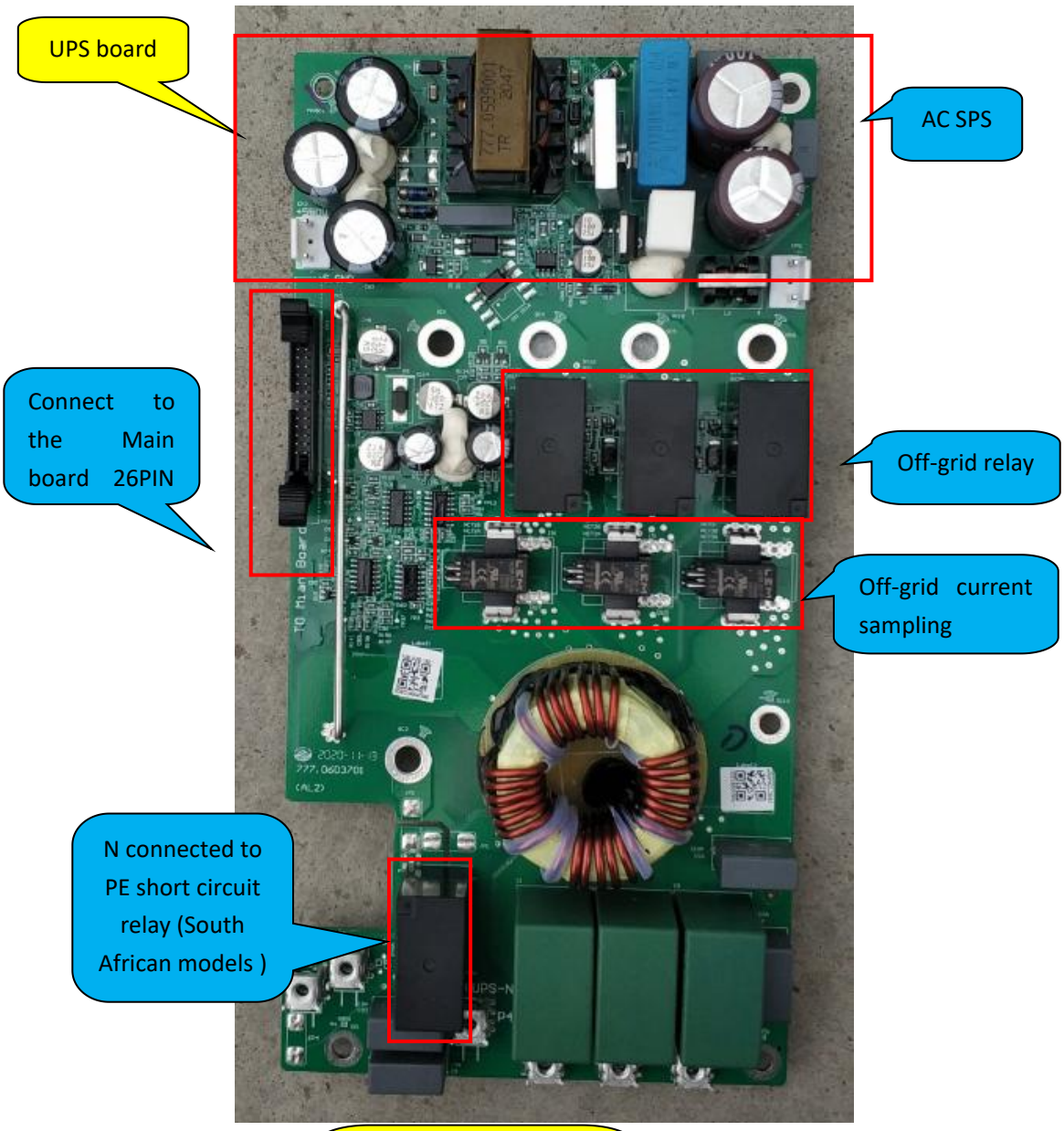
2.3 Product internal architecture diagram

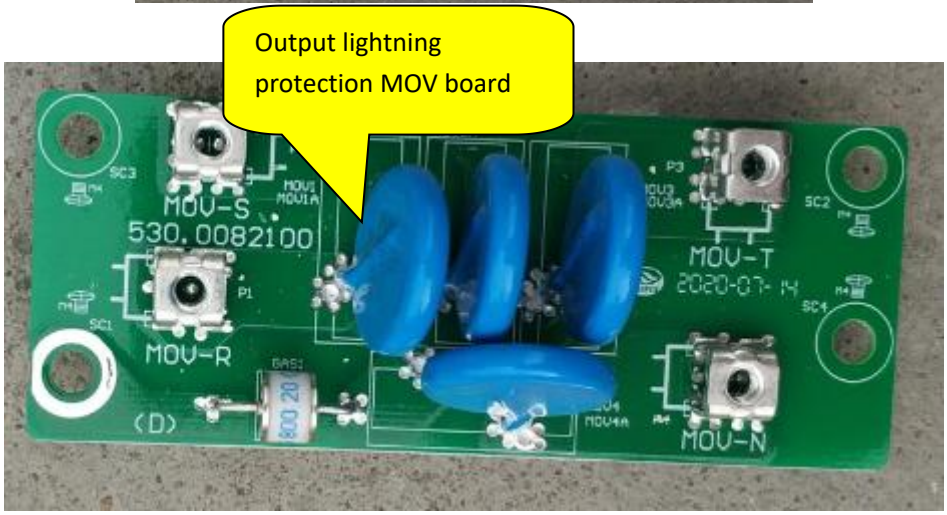




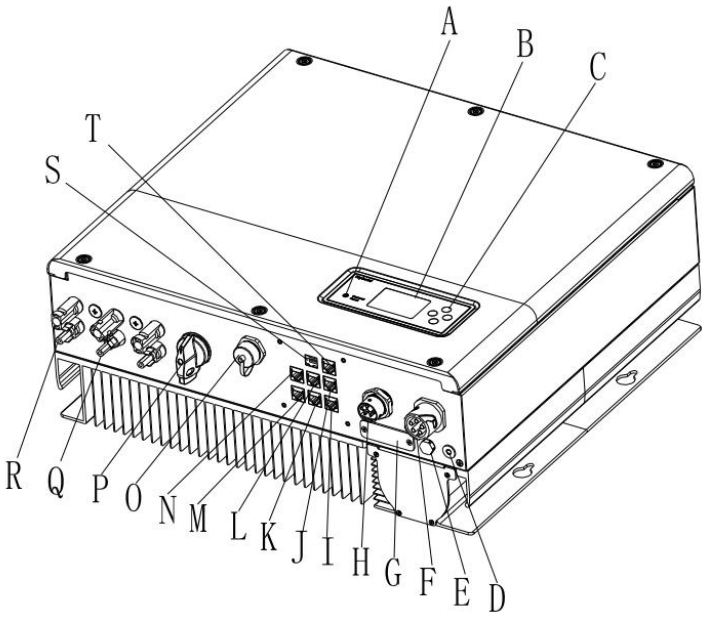

M3 boarrd
STM32
LCD display screen
Key
EEPROM
Debug serial port
LED light


BUS capacitor board


UPS board
AC SPS
Connect to the Main board 26PIN
Off-grid relay
Off-grid current sampling
N connected to PE short circuit relay (South African models)

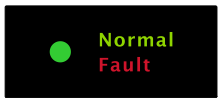

Output lightning protection MOV board
MOV-S
530.0082100
MOV-R
MOV-T
MOV-N

2.4 Product appearance overview:

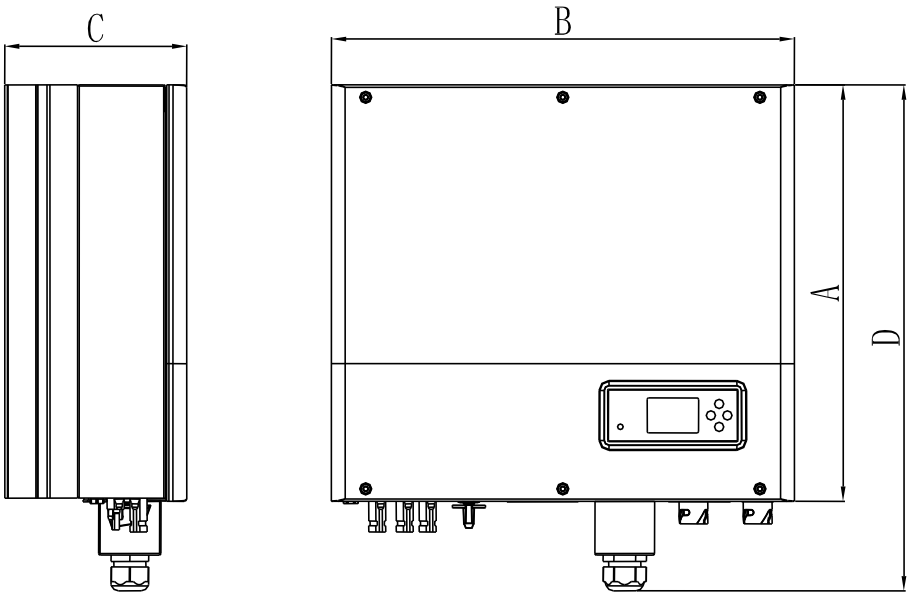


Position	Description
A	LED of status display
B	LCD screen
C	Function button
D	Ground point
E	Breathable valve
F	UPS output(off grid connection)
G	RSD(do not open except by Professional staff)
H	AC Grid (on grid connection)
I	Rs485 communication interface(Reserved)
J	Rs485 communication interface of meter2(Reserved)
K	NTC: Lead-acid temperature sensor terminal
L	Rj45 interface of DRMs(used only in Australia)
M	Rs485 communication interface of meter1
N	CAN communication interface of Lithium battery
O	USB interface
P	PV switch
Q	PV input
R	Battery terminal
S	Dry contact
T	Rs485 communication interface of meter2(Reserved)

Identification on the inverter：

Identification	Description	Instruction	
	Function button	Switch over the display information, and set system parameters.	
	All-in-one machine status identification	The green light is always bright.	Normal operation
		The red light is always bright.	Fault
		The green light flashing	Alarm
		The red light flashing	Software burning

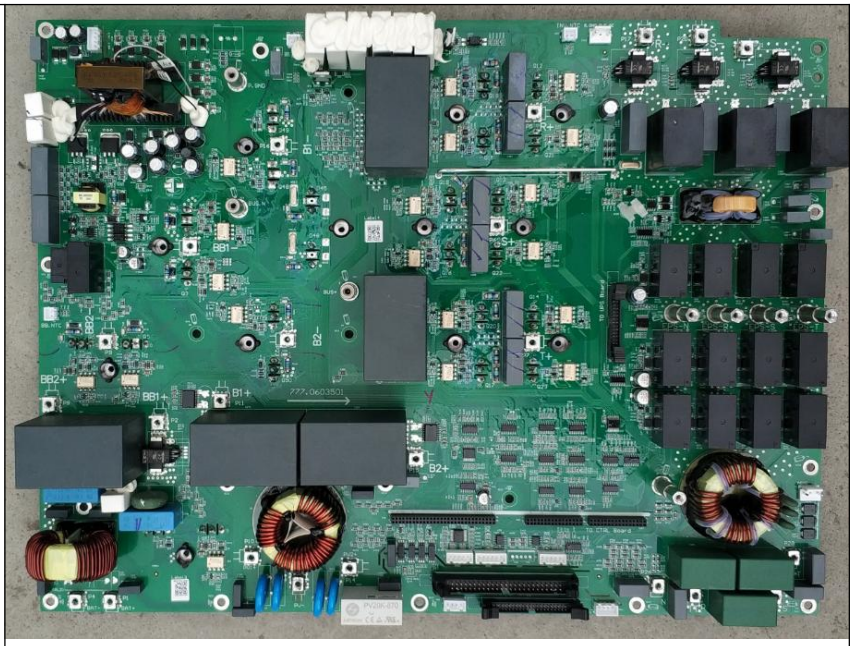
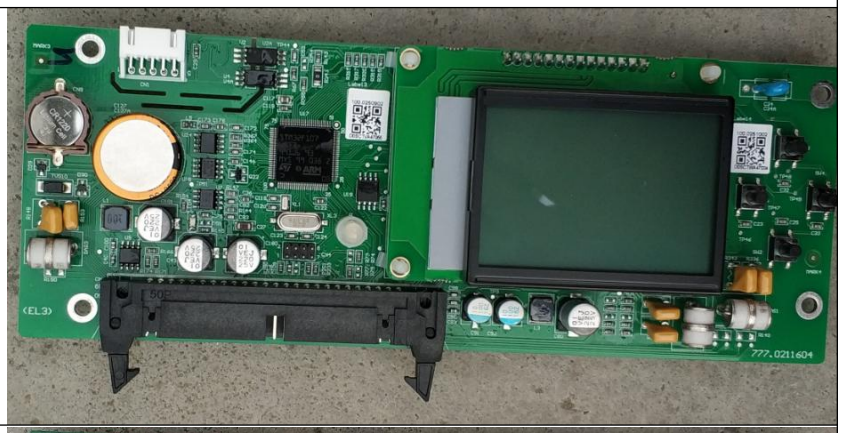
Dimensions：

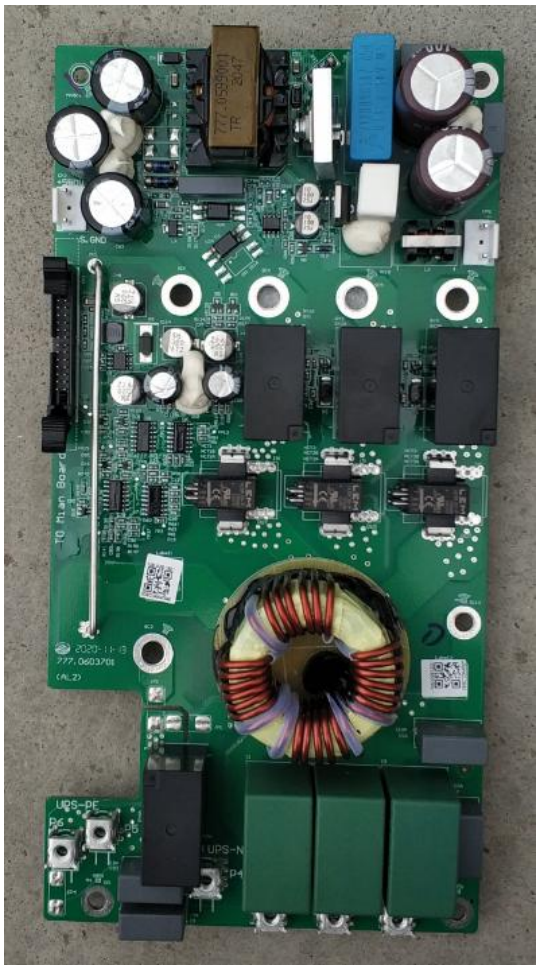


Size and weight：

Model	A(mm)	B(mm)	C(mm)	Weight(kg)
Growatt SPH TL3 BH-UP	453	505	198	30

2.5 Introduction of each board function

Main function of main board: Bidirectional DC transformation, battery inverter, auxiliary power supply, inverter, current-voltage sampling, temperature sampling,ISO detection, GFCI, co-model filtering.	
Main function of M3 board: LED,LCD display, communication, DRMS, human-computer interaction.	
Main function of control board： DSP control,OCP protecion	

Main fucntion of UPS: AC SPS,UPS function implementation,off-grid voltage and current sampling	

Ⅲ. Error code interpretation

3.3 Interpretation of the error code and the alarm code

3.3.1 Error code

Error code	LED display	Fault name	Troubleshoot
405	Error 405	Relay fault	1:Restart inverter 2:Check that the relay is stuck.
407	Error 407	Auto test failure	1:Restart inverter
411	Error 411	Communication fault	1:After shutdown,Check communication board wiring.
418	Error 418	DSP and COM firmware	1:Check the firmware

		version not match	version; 2:If error message still exist, update the circuit board.
Bus Unbalance	Bus Unbalance	Bus voltage unbalance	1:Restart inverter 2:If the fault information remains, measure the ± BUS voltage
PV Isolation Low	PV Isolation Low	Panel insulation impedance low	1:Check the panel housing for reliable grounding after shutdown.
PV Voltage High!	PV Voltage High	Voltage abnormal	1:Disconnect the DC switch immediately and confirm the voltage.
Model Set Fault	Model Set Fault	Initialization mode exception	1:Reset mode
OP Short Fault	OP Short Fault	Off-grid short circuit	1.Restart the inverter 2.Check the off-grid output terminals
Residual I High	Residual I High	Leakage current too high	1:Restart inverter 2:Check that the machine ground wire is normal.
NTC Open	NTC Open	Temperature abnormal	1.Check if the temperature sampling module is properly connected after shutdown.

3.3.2 Warning code

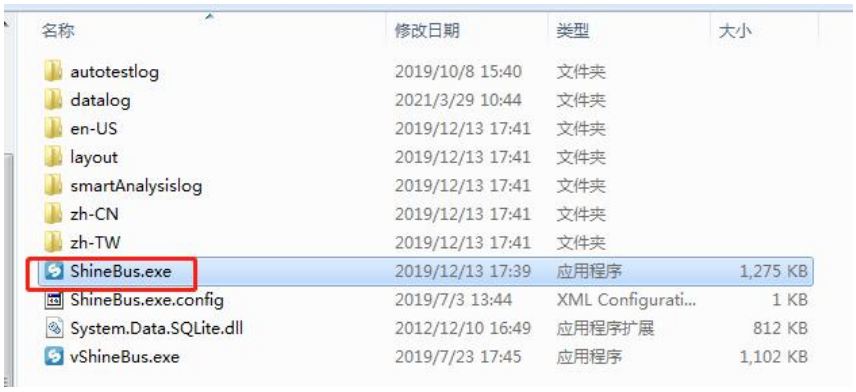
Error code	LED display	Fault name	Troubleshoot
Warning 401	Warning 401	Meter communication abnormal	1:Check the wiring of the meter after shutdown.
EPS Volt Low	EPS Volt Low	Off-grid output voltage too low	1: Restart inverter 2: Check the off-grid output terminals
Bat Voltage High	Bat Voltage High	Battery voltage high	1：Check that the battery voltage is within the specification range. 2：Check that the battery is well connected.
			1：Check that the

Bat Voltage Low	Bat Voltage Low	Barrtert voltage too low	battery voltage is within the specification range. 2：Check that the battery is well connected.
Battery reversed	Battery reversed	Battery reversed	1:Check if the battery is reversed.
No AC Connection	No AC Connection	No utility connection	1.Confirm that the grid is not lost.
Output High DCI	Output High DCI	The DC component bias is abnormal	1.Restart inverter
AC V Outrange	AC V Outrange	Utility voltage out of range	1.Check whether the AC voltage is within the specification range of the standard voltage.
AC F Outrange	AC F Outrange	Utility frequency out of range	1.Check that the frequency is within the range.
BMS Error：xxxx	BMS Error：xxxx	Battery management system information abnormal	1.Restart inverter 2.Check the lithium battery INDICATOR for errors.
BMS Warning:xxxx	BMS Warning:xxxx	Battery management system information abnormal	1.Restart inverter 2.Check the lithium battery INDICATOR for errors.
BMS COM Fault	BMS COM Fault	Battery communication failure	1.Check if the lithium battery is turned on. 2.Check whether the connection between the lithium battery and the inverter is normal.

IV . ShineBus monitoring software use instruction, USB update software and other monitoring instruction

4.1 Shinebus software and RS485 driver installation

Note: ShineBus is generally only available to customers, facilitating customer service to help customers set machine related parameters.

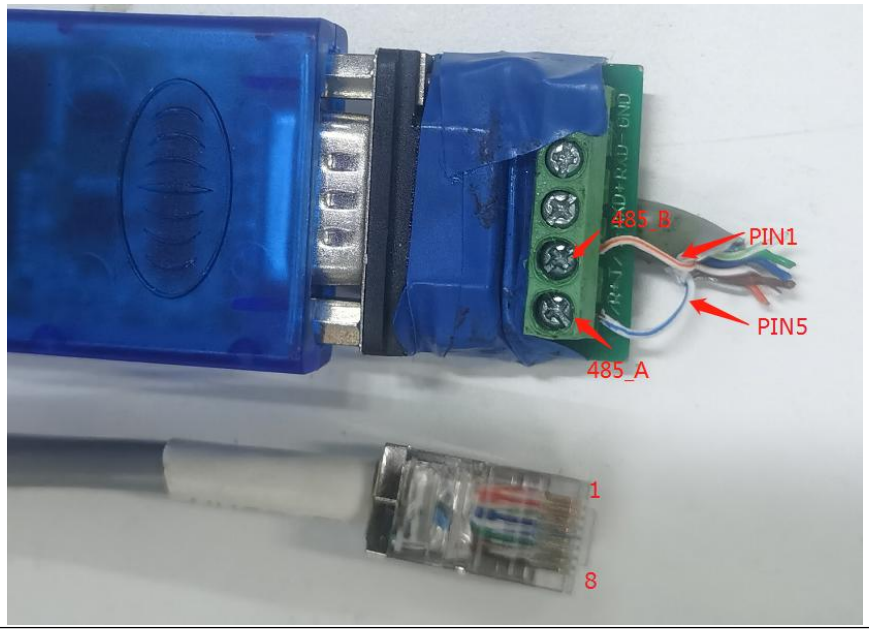
1.First, you need to install the RS485 driver, and find the USB to RS485 driver software installation.	
2.Then find "SPH TL3-shineBus.exe"in the folder and open it directly.	
For easy to use next time, you can create shortcuts to shinebus .exe on the desktop.	

4.2 Shinebus wiring connection

Prepare the USB to RS485 cable shown in the figure.The USB head is directly connected to the COMPUTER USB port.

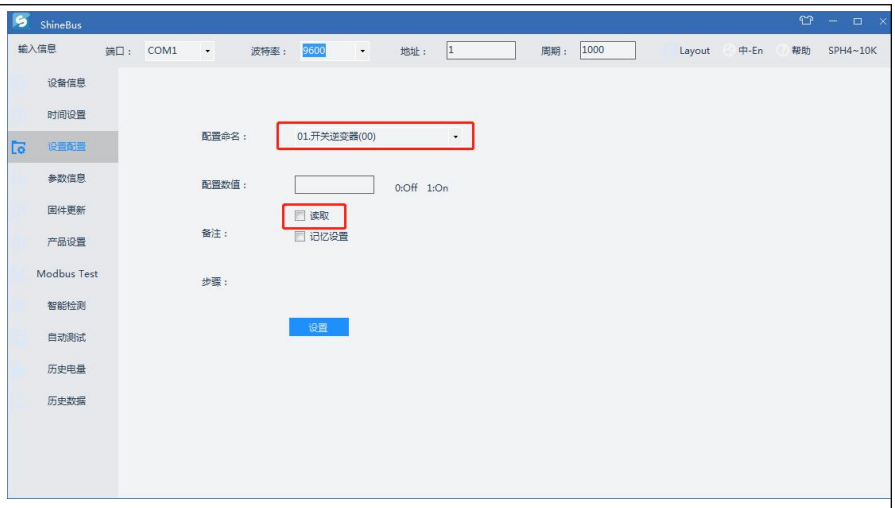
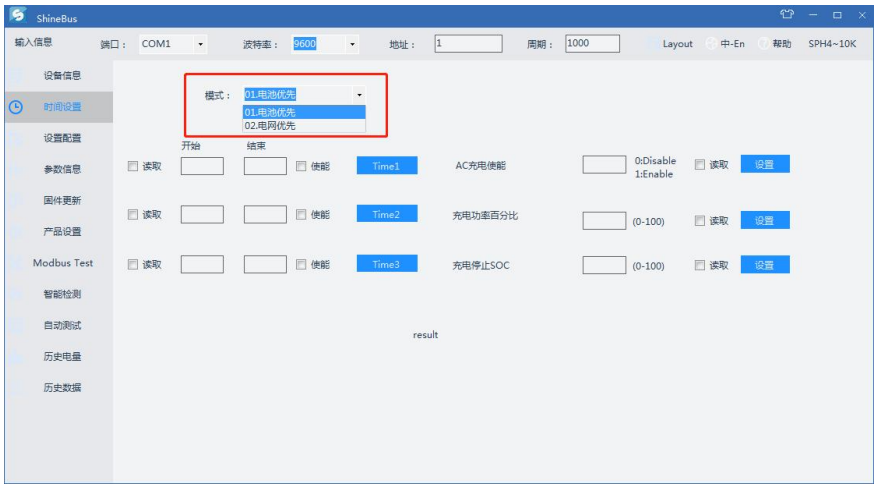
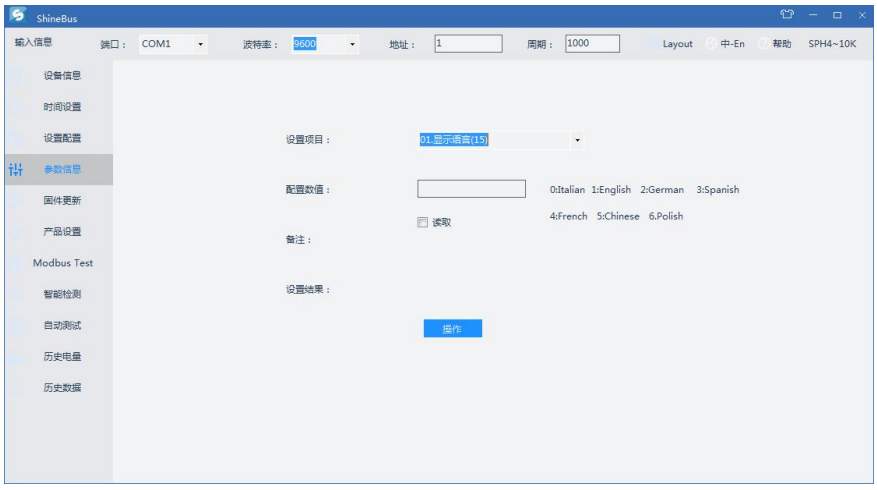
The RS485 head is connected to the network cable through the adapter board and connected to the RS485-3 interface on the machine side.

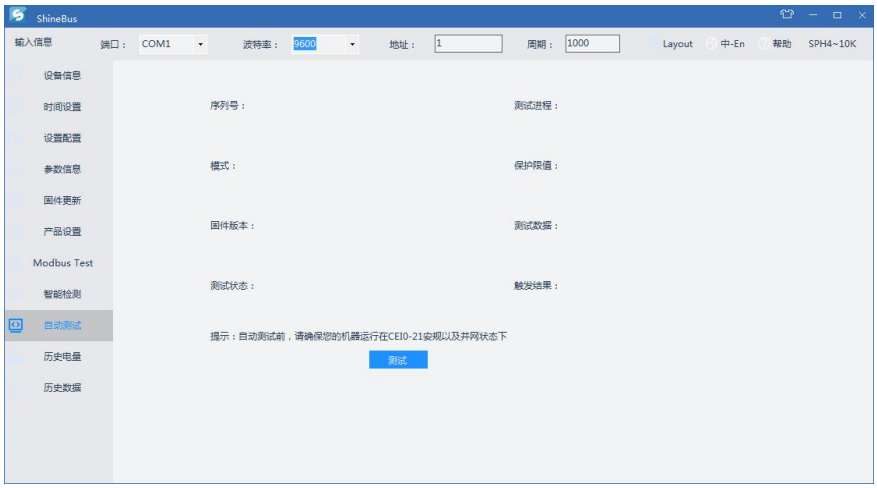
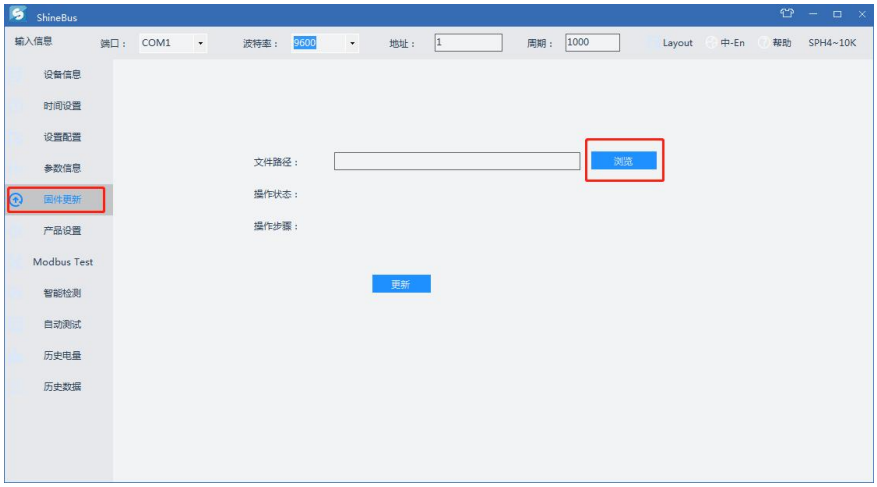
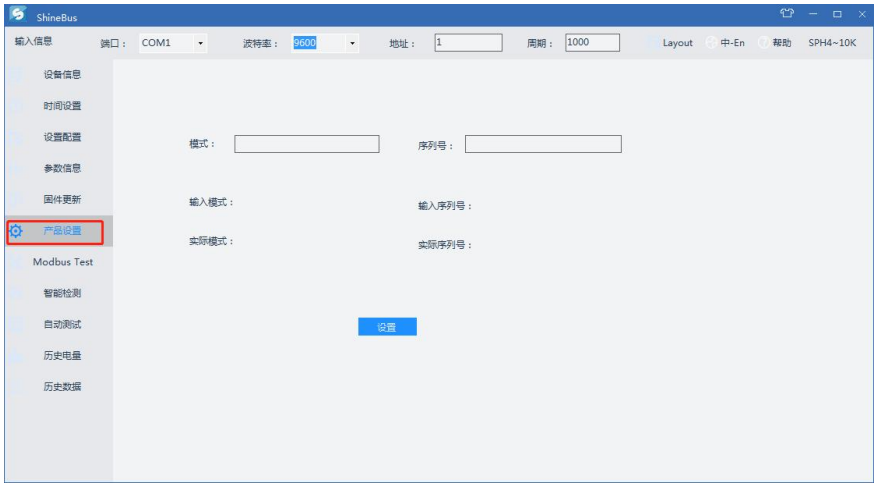
RS485 connected to crystal head: Connect the PIN1 of the crystal head to 485_B and the PIN5 to 485_A.



4.3 Shinebus software operation

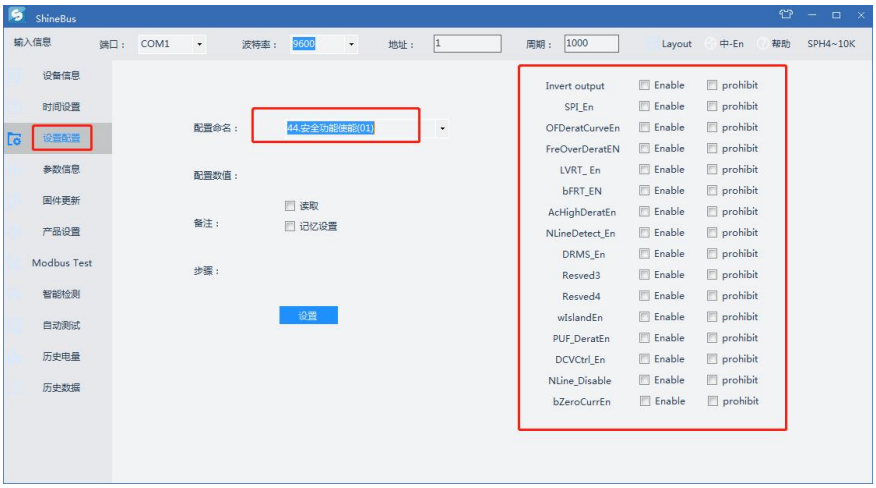
Input information Relevant settings performed before the Shinebus reads the data, as shown in the figure, select the "SPH4-10K"option , select the correct com port, adjust the language as needed, and click Start:	
Device information As shown in the figure： ①system information ②status information (include operation mode and error prompt) ③AC side information ④PV side information ⑤BAT information ⑥Off-grid information ⑦Power information	

Set the configuration Commonly used settings can be set, such as: Switch, active load rate,check “read”,and click “Settings”to read. If you don’t need it,set the value directly. Please do not set it up without any need.	
Timing settings It is divided into battery priority period and power grid priority period, corresponding to Bat First and Grid First, and the default is Load First when not set. Enable time, power percentage, battery charge and discharge SOC can be set at different priorities.	
Parameter information The basic information of the machine and some safty rules can be set. Please don’t set arbitrarily if you have no need.	

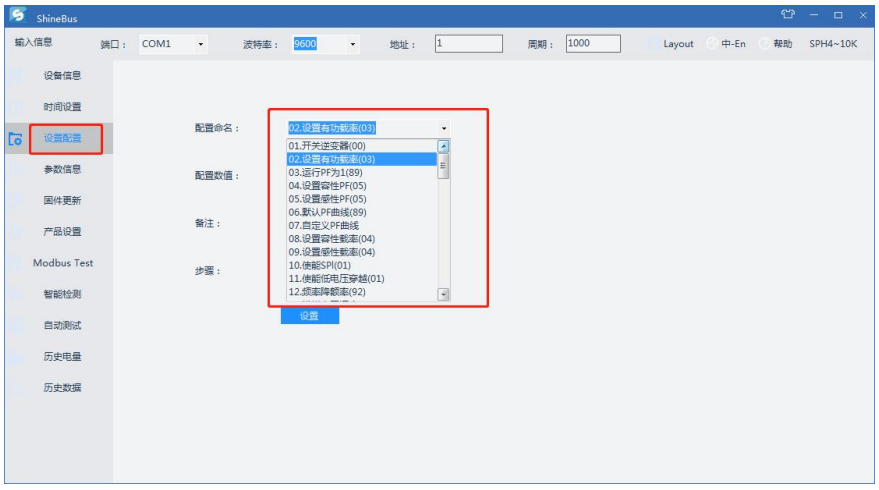
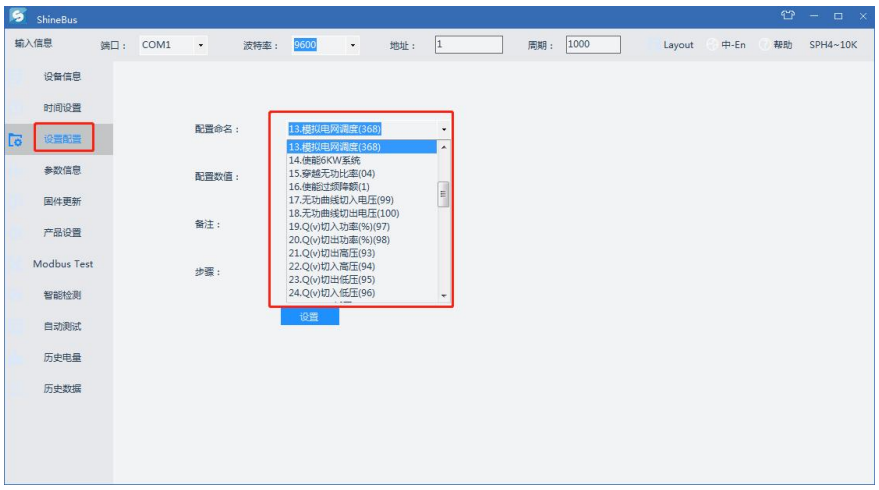
Automatic testing Auto test with ShineBus host computer,test results can be printed after testing.	
Firmware update If you need to upgrade the firmware through Shinebus, select the corresponding file and click update to burn it.	
Product settings To set the product Model and serial number, you must first click to read the information on the “Device information”page before setting up the product.	

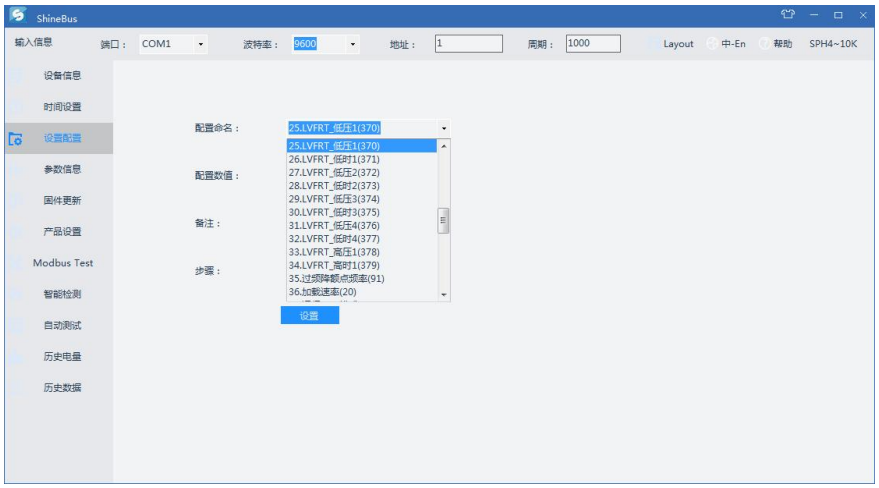
4.4 Description of some parameter settings

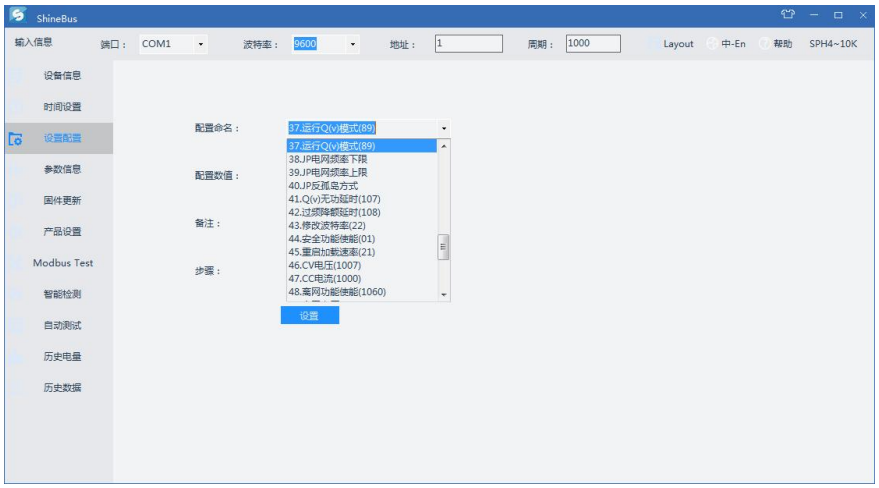
Security function enabling

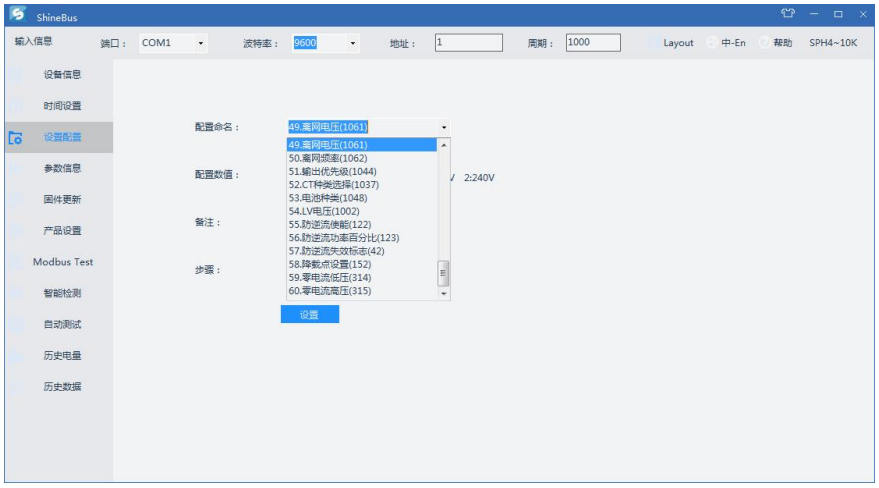
Shinebus can set security features, including anti-reverse current, N-line enable, DRMS and other functions.	

Additional setting instructions

As shown in the figure, Parameters set by Shinebus：	 


ShineBus
输入信息
端口：
COM1
波特率：
9600
地址：
1
周期：
1000
Layout
中-En
帮助
SPH4~10K
设备信息
时间设置
设置配置
参数信息
固件更新
产品设置
Modbus Test
智能检测
自动测试
历史电量
历史数据
配置命名：
25.LVFRT_低压1(370)
配置数值：
备注：
步骤：
25.LVFRT_低压1(370)
26.LVFRT_低时1(371)
27.LVFRT_低压2(372)
28.LVFRT_低时2(373)
29.LVFRT_低压3(374)
30.LVFRT_低时3(375)
31.LVFRT_低压4(376)
32.LVFRT_低时4(377)
33.LVFRT_高压1(378)
34.LVFRT_高时1(379)
35.过频降载点频率(91)
36.加载速率(20)
设置


ShineBus
输入信息
端口：
COM1
波特率：
9600
地址：
1
周期：
1000
Layout
中-En
帮助
SPH4~10K
设备信息
时间设置
设置配置
参数信息
固件更新
产品设置
Modbus Test
智能检测
自动测试
历史电量
历史数据
配置命名：
37.运行Q(v)模式(89)
配置数值：
备注：
步骤：
37.运行Q(v)模式(89)
38.JP电网频率下限
39.JP电网频率上限
40.JP反孤岛方式
41.Q(v)无功延时(107)
42.过频降载延时(108)
43.修改波特率(22)
44.全功能使能(01)
45.重启加载速率(21)
46.CV电压(1007)
47.CC电流(1000)
48.离网功能使能(1060)
设置


ShineBus
输入信息
端口：
COM1
波特率：
9600
地址：
1
周期：
1000
Layout
中-En
帮助
SPH4~10K
设备信息
时间设置
设置配置
参数信息
固件更新
产品设置
Modbus Test
智能检测
自动测试
历史电量
历史数据
配置命名：
49.离网电压(1061)
配置数值：
备注：
步骤：
V 2:240V
49.离网电压(1061)
50.离网频率(1062)
51.输出优先级(1044)
52.CT种类选择(1037)
53.电池种类(1048)
54.LV电压(1002)
55.防逆流使能(122)
56.防逆流功率百分比(123)
57.防逆流失效标志(42)
58.降载点设置(152)
59.零电流低压(314)
60.零电流高压(315)
设置

Parameters set remotely: Almost all the parameters can be set remotely by Shinebus.	 1. Enter the password: the date of the day(e.g. 20210430) ②Register: It can be read after setting parameter through Shinebus (such as 01.switch inverter（00）),that is 00. ③Value: According to Shinebus setting (e.g. Shutdown inverter is：0)

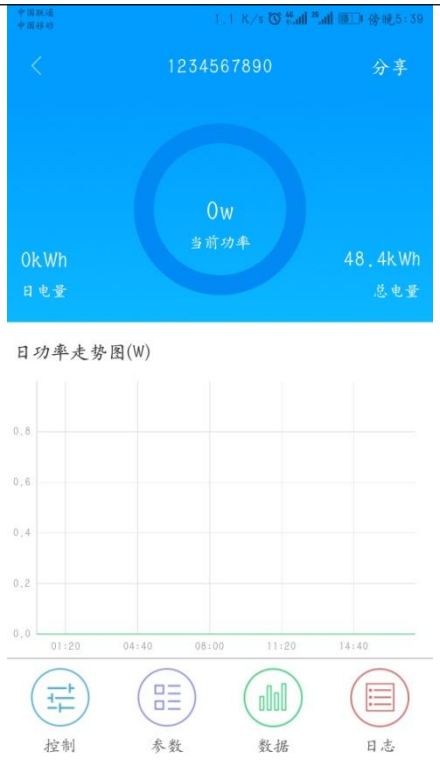
4.5 USB update software, USB to WIFI, GPRS, RS232 to WIFI, GPRS and remote monitor APP related operations

USB to WIFI、GPRS both can be used for remote monitoring and remote settings, and some relevant information can be viewed on the remote monitoring app.

Only few simple operations are opened on the remote monitoring (client) , basically some main information display.

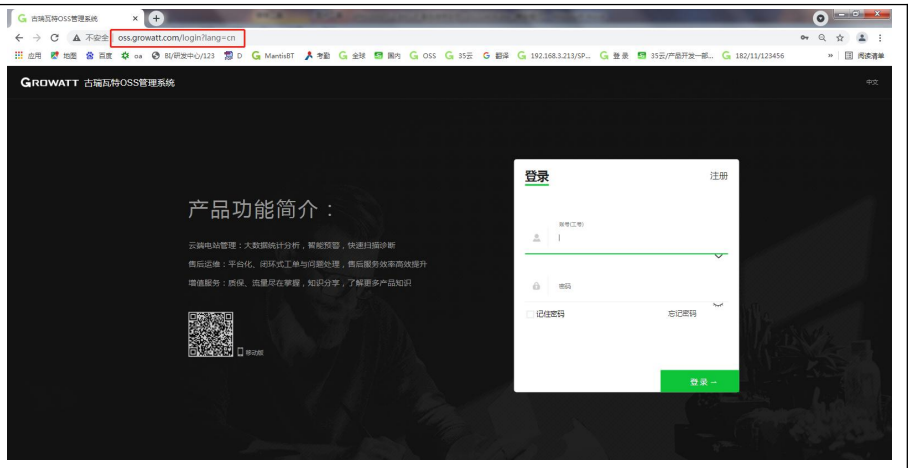
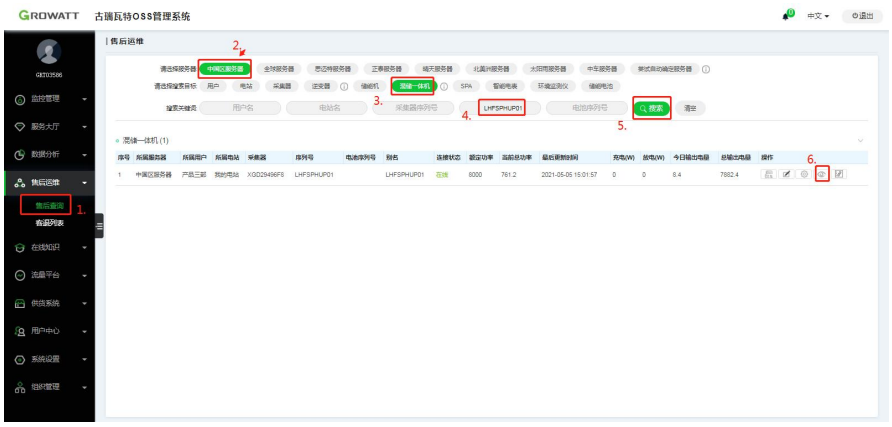
U disk update code	SPH10000TL3 BH-UP series inverter supports U disk quick update code function, precautions and operation steps are as follows **Note 1: 1. TXT file name can not be arbitrarily modified, and it can only be BCONFIG, do not need to create a new folder, files can be**

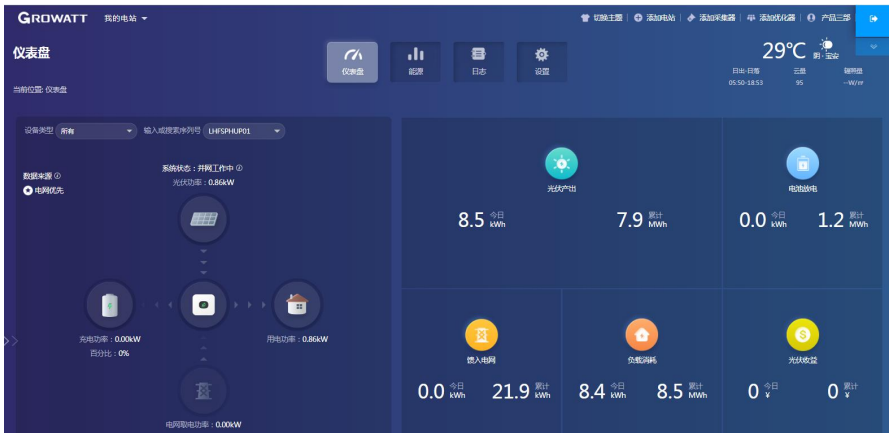
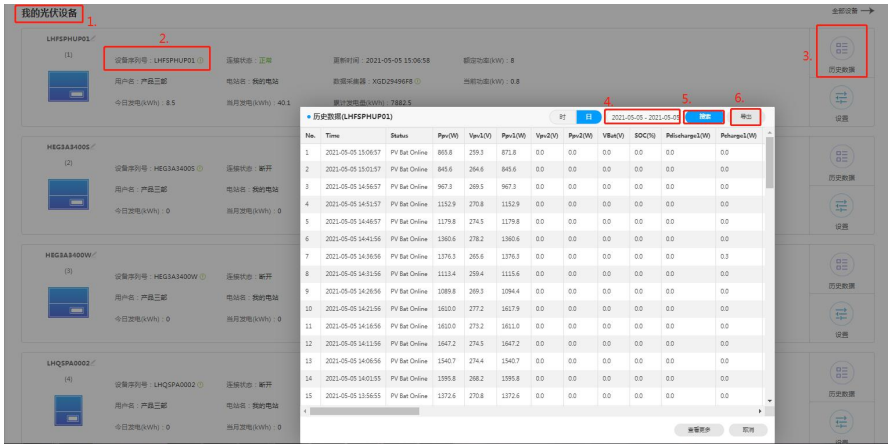
	copied directly to the root directory of the U disk. Step 1: Copy the code to the U disk; Step 2: Create a new TXT profile, named BCONFIG Step 3, write the configuration file content: update 1. SPH4-10k_DC_AC_28067_Vxxx.hex(exactly consistent with the code file name to be updated) 2. SPH4-10k_DC_DC_28067_Vxxx.hex(exactly consistent with the code file name to be updated) 3.SPH4~10K_ST_M3_Vxxx.bin(exactly consistent with the code file name to be updated) **Note 2: When update three codes at the same time, the bin file can only be placed last;** **The following configuration is not allowed:** update 1. SPH4~10K_ST_M3_Vxxx.bin 2. SPH4-10k_DC_DC_28067_Vxxx.hex 3. SPH4-10k_DC_AC_28067_Vxxx.hex **Note 3: If only one code is updated, the previous serial number needs to be changed to 1, For example, you only need to update the SPH4~10K_ST_M3_Vxxx.bin, and the configuration file is as follows:** update 1. SPH4~10K_ST_M3_Vxxx.bin

USB to WIFI monitoring operation interface Generation Power Income You can choose the inverter in my device.	
After selecting my device, you can view the current power, daily power generation and total power generation of the current equipment. You can also select the corresponding function in the panel below.	

After selecting control function, some corresponding inverter parameters can be set.	
In the log, you can view the corresponding alarm information.	

4.6 Monitoring data reading faults and alarms

As shown on the right is our monitoring login interface, Log on to the website http://oss.growatt.com/login?lang=en Log in according to the user's name and password. You can download mobile app in this interface and set language.	
After logging in, as shown in the figure, click the after-sales inquiry, select the server of the device, hybrid inverter, enter its serial number, click "Search", and you can find the corresponding inverter. Click "" to view the relevant information.	

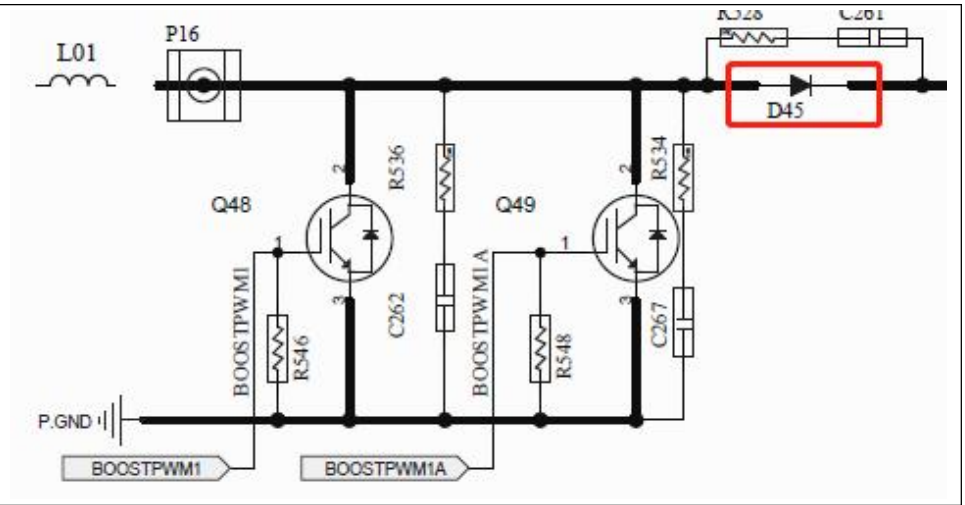
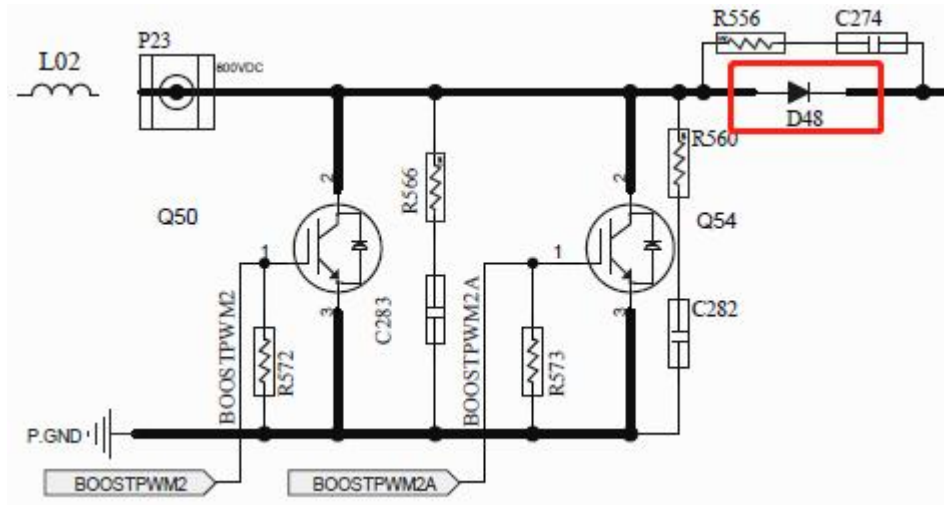
Go to the dashboard and view the relevant information.	
Follow the steps in the figure to export the monitoring data in the format: XLS.	

V. The IGBT measurements of the BOOST、BUCK-BOOST and INV (Multimeter measurement)

5.1 The IGBT measurements of the BOOST

In the whole machine and the single board measurement judgment basis are the same. The voltage drop of the diode is mainly measured, and if the voltage drop of the diode is (0.3V---0.7V), it is OK. If the voltage drop is 0V, it is breakdown, and if it is infinity, it is open. The following measurements are measured in a normal OK module.

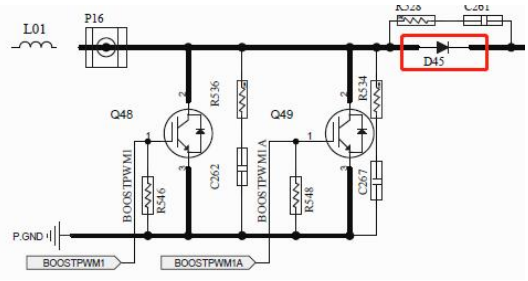
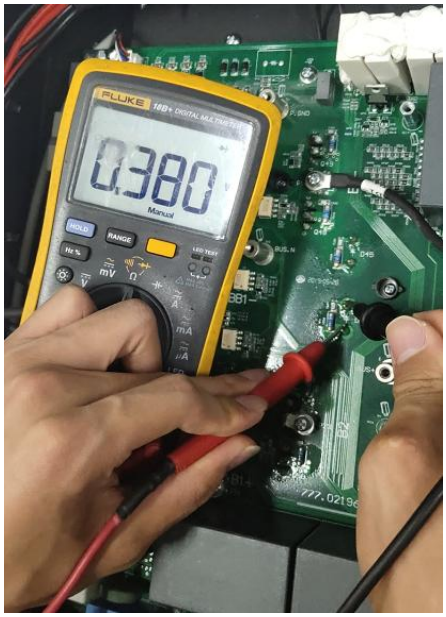
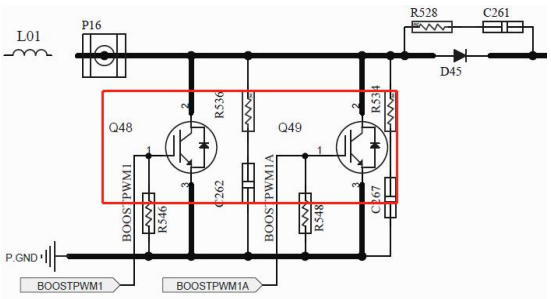
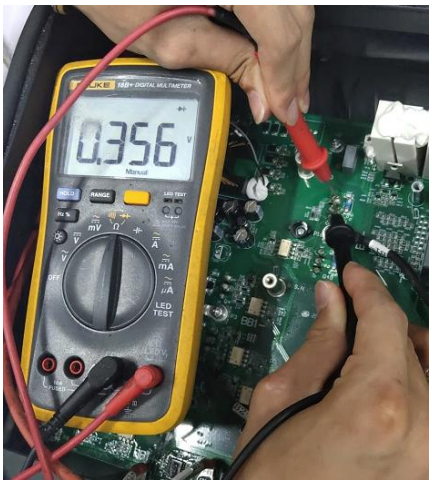
5.1.1 Measurement schematic

BOOST IGBT There are two IGBT circuit. Each boost circuit has a boost IGBT and boost diode. The figure shows A circuit.	
The figure shows B circuit	

5.1.2Actual measurement

Measurement on the whole machine can be determined on the first stage whether the BOOST IGBT is damaged, to avoid the trouble of disassembling the machine, if the whole machine measurement is OK but the problem still exists, it can be removed before the measurement on the single board again. The following is the location of the actual measurement point corresponding to the schematic diagram (taking the A circuit as an example)

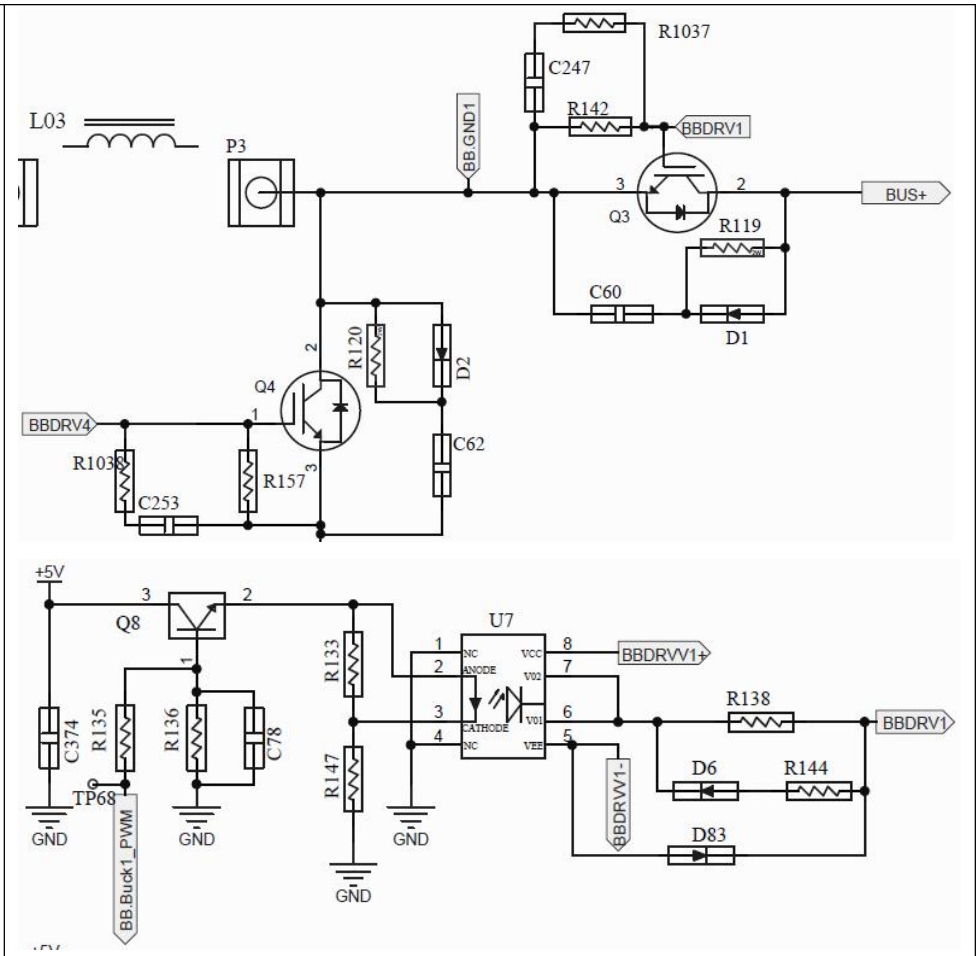
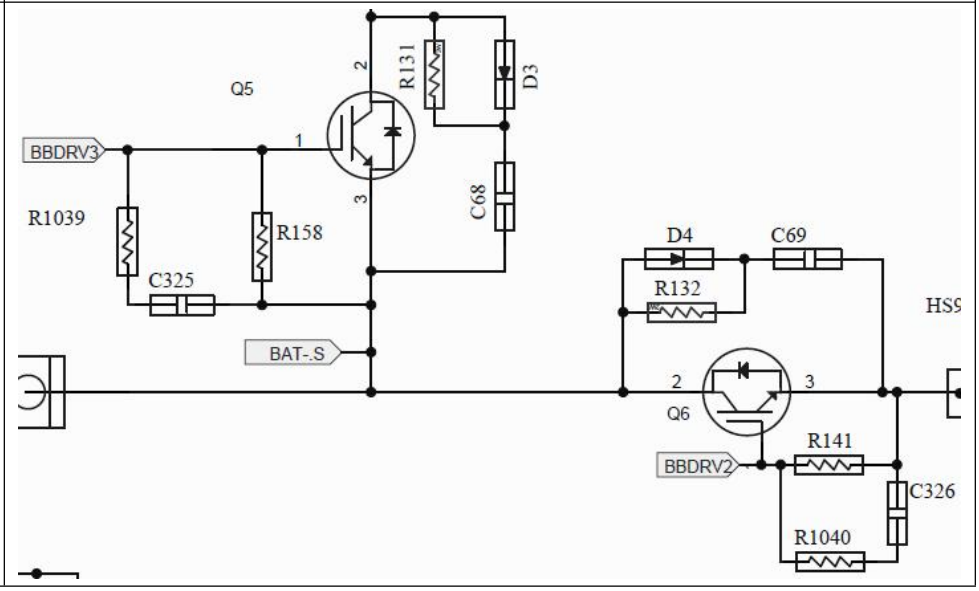
	Schematic corresponding point	Machine measurement point

BOOST A circuit boost diode		
BOOST A circuit IGBT		

5.2The IGBT measurements of the BUCK-BOOST

In the whole machine and the single board measurement and judgment basis are the same. The pressure drop of the diode is mainly measured, if in the diode pressure drop range (0.3V---0.7V) is OK. If the voltage drop is 0V, it is breakdown, if it is infinity, it is open. The following measurements are measured in a normal OK module.

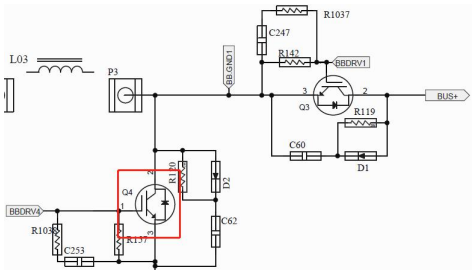
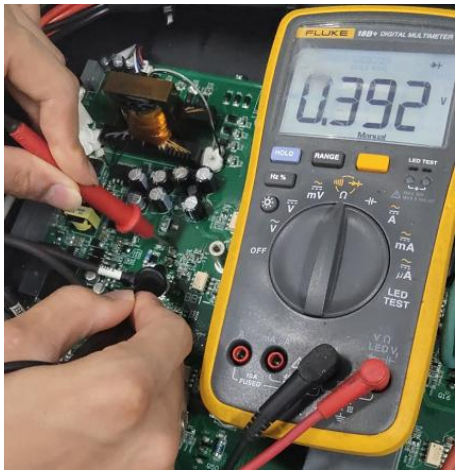
5.2.1 Schematic of measurement

The BUCK-BOOST IGBT has two path, each has a BUCK tube and a BOOST tube.The figure shows the A-way main power circuit and its driving circuit.	
The picture shows the “circuit B” main power circuit	

5.1.2Actual measurement

Whether the BUCK-BOOST IGBT is Damaged can initially be judged on the machine to avoid the hassle of disassembling the machine. If the whole machine measures OK but the problem still exists, it can be measured again on the single plate after disassembling.

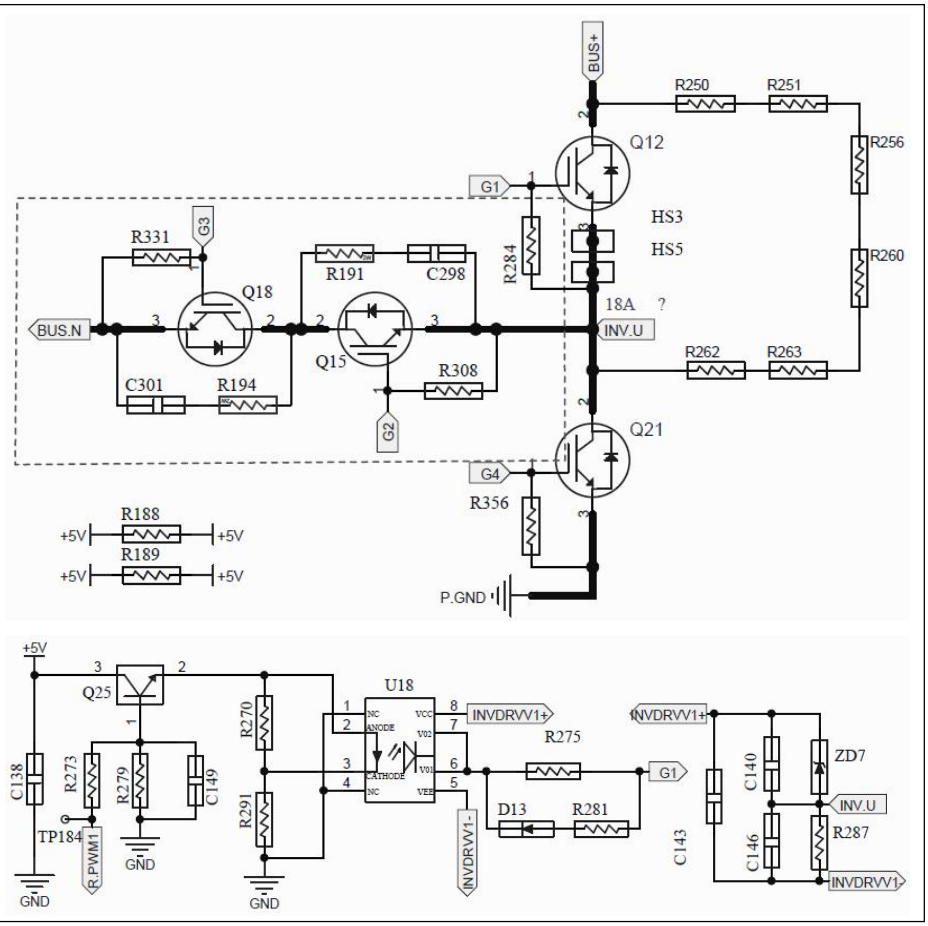
The following are the positions of the actual measurement points corresponding to the schematic diagram (take Route A as an example)：

	Schematic corresponding point	Machine measurement point
BUCK-BOOST A path IGBT Q4		

5.3 The IGBT measurement of the INV

In the whole machine and the single board measurement and judgment basis are the same. The pressure drop of the diode is mainly measured, if in the diode pressure drop range (0.3V---0.7V) is OK. If the voltage drop is 0V, it is breakdown, if it is infinity, it is open. The following measurements are measured in a normal OK module.

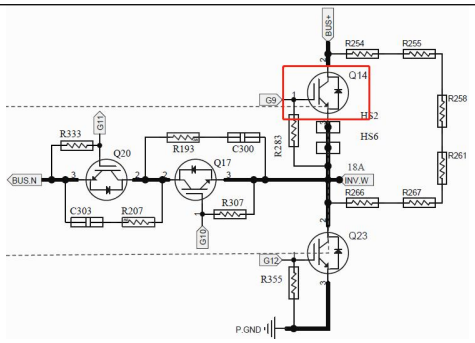
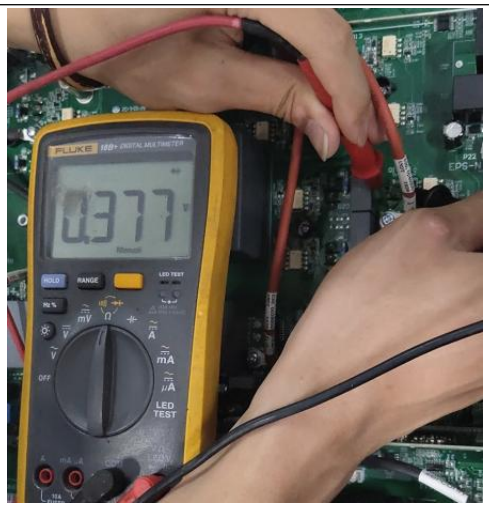
5.2.1 Measurement schematic diagram

IGBT main power circuit and drive schematic of INV. The four IGBT in the three phase circuit are the same.Take one of the roads as a reference.	

5.2.2 Actual measurement

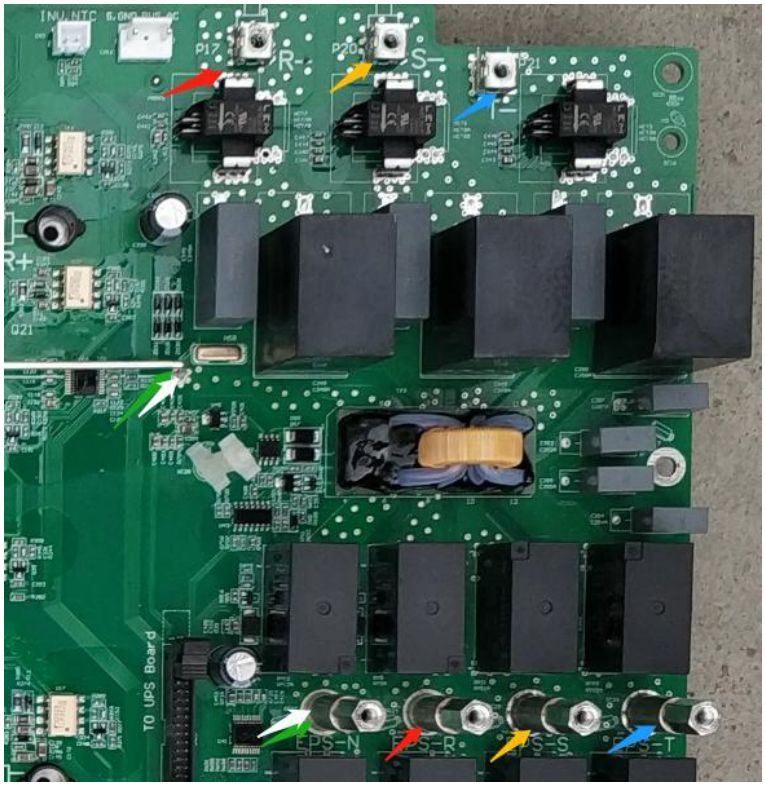
Whether the inverter IGBT is normal can be measured on the whole machine, and whether the INV IGBT is damaged can be judged first. If the whole machine measures OK but the problem still exists, it can be measured again on the single panel after disassembling.The following are the measurement points and the schematic corresponding points:

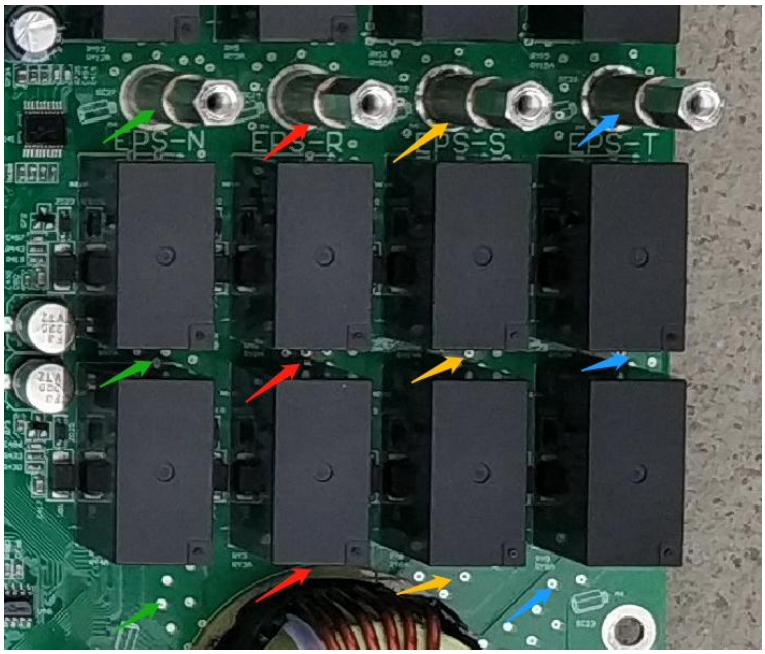
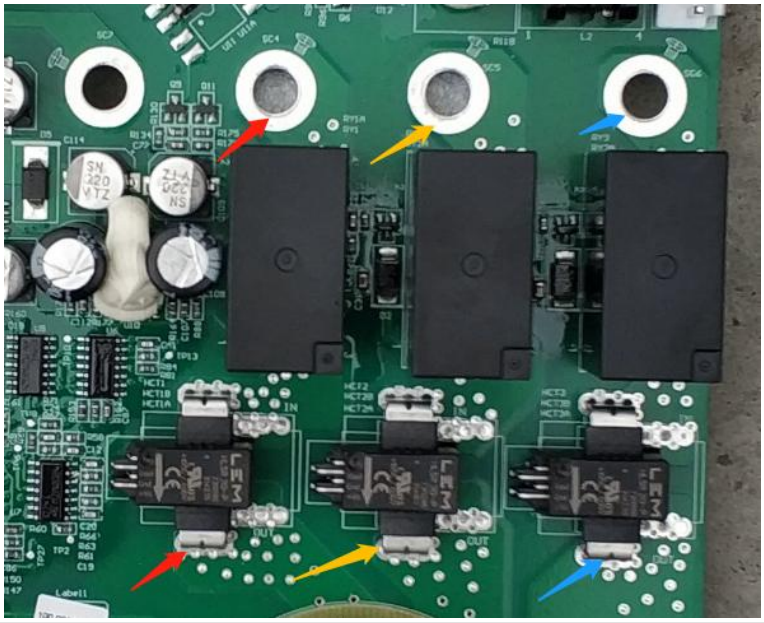
	Schematic corresponding point	Machine measurement point

T-Phase inverter Tube Q14		

VI. Output relay adhesion measurement

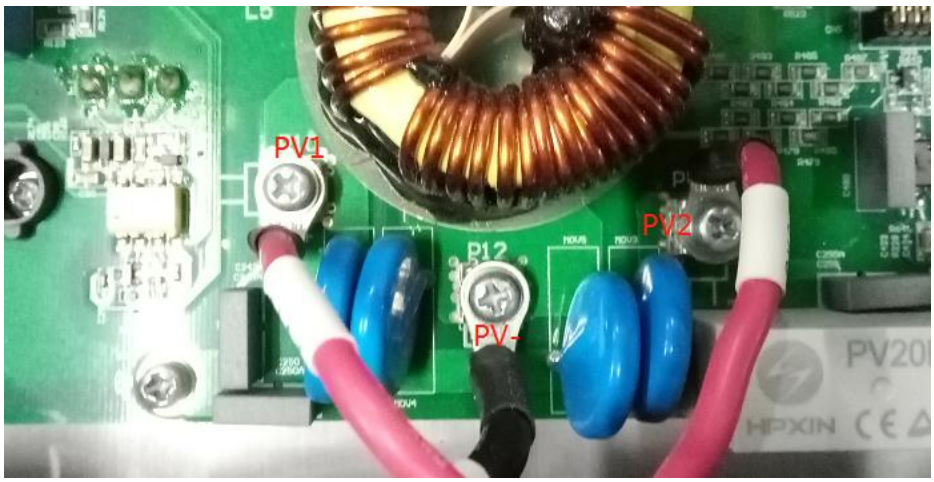
Output relay adhesion measurement points are shown in the figure below:

Inverter-side relay measuring point selects the short circuit gear of the multimeter. Measure both end of the relay pointed out by arrow, and if there is a beep sound of “drops”, it means that the relay is stuck.	

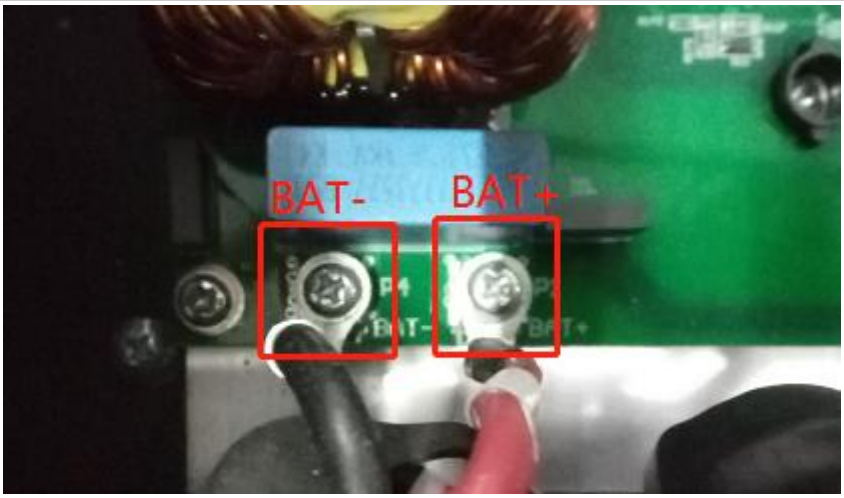
Power grid side relay measuring point selects the short circuit gear of the multimeter. Measure both end of the relay pointed out by arrow, and if there is a beep sound of “drops”, it means that the relay is stuck.	
Off-grid side relay measuring point selects the short circuit gear of the multimeter. Measure both end of the relay pointed out by arrow, and if there is a beep sound of “drops”, it means that the relay is stuck.	

Ⅶ. PV voltage, AC voltage and BUS voltage measurement

7.1 PV voltage measurement

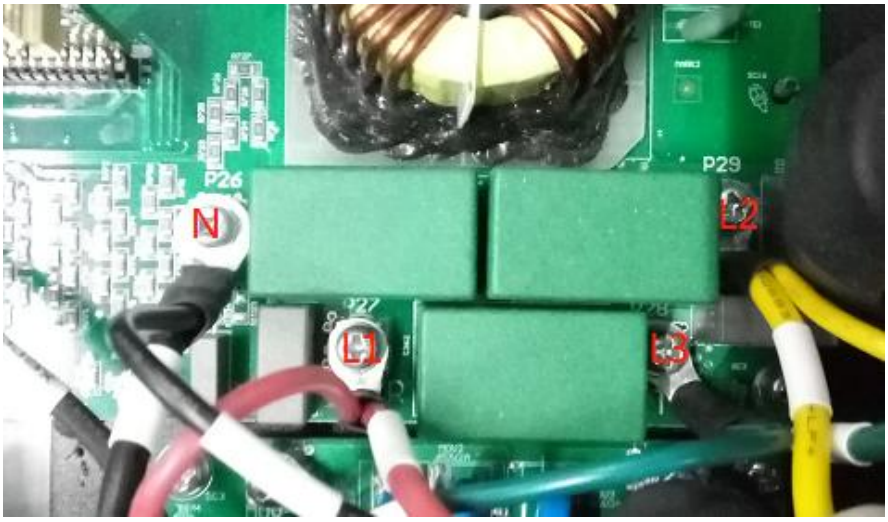
As shown in the figure: A test point for PV voltage measurement inside the machine PV-The interiors are paralleled. For example: to measure the voltage of PV1 road, use the multimeter to adjust to the DC voltage gear, the black pen is connected to PV-, and red pen is connected to the PV1 point screw. PV2 voltage measurement is the same.	

7.2 BAT voltage

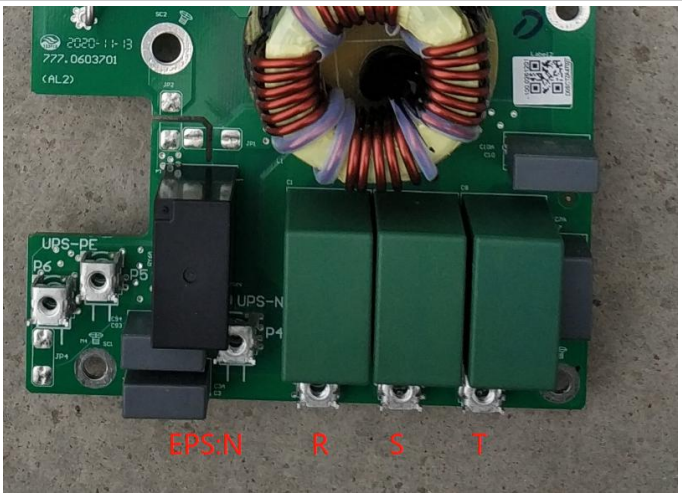
As shown in the figure: Test point for BAT voltage measurements inside the machine.	

7.3 AC voltage

AC voltage measurement:

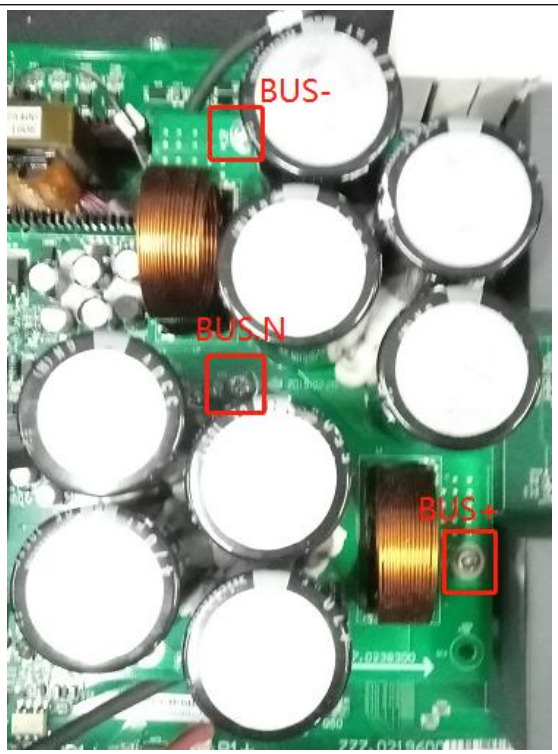
Test point for AC voltage measurements inside the machine Use a multimeter to adjust to the AC voltage gear, the black meter pen is connected to N, and the red meter pen is connected to the L point of the screw (you can also directly measure the line voltage between the L lines)	

7.4 EPS voltage

As shown in the figure: Test point for EPS voltage measurement inside the machine, use a multimeter to adjust to the AC voltage gear, the black pen is connected to N, the red pen is connected to the L point of the crew. (You can also directly measure the line voltage between the L lines.)	

7.5BUS voltage measurement

The voltage measurement points of BUS capacitor are shown below:

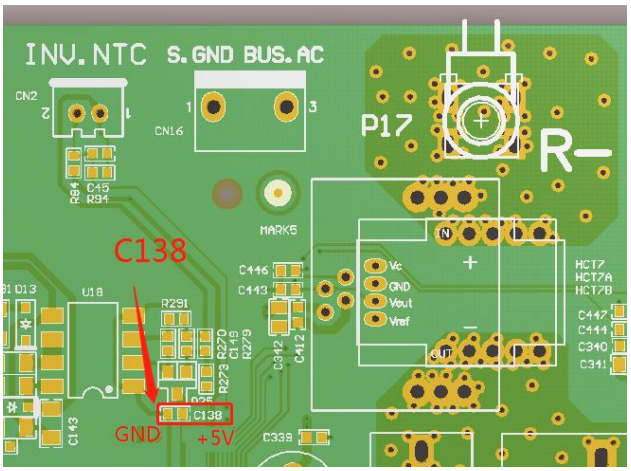
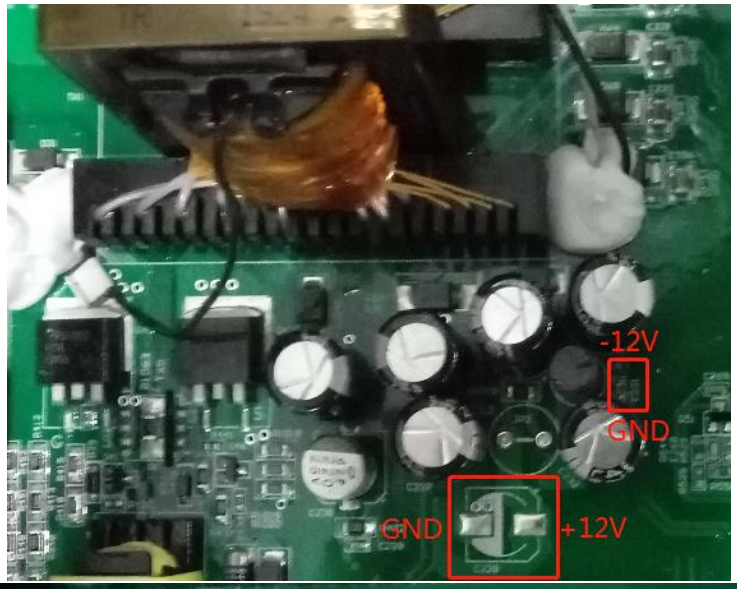
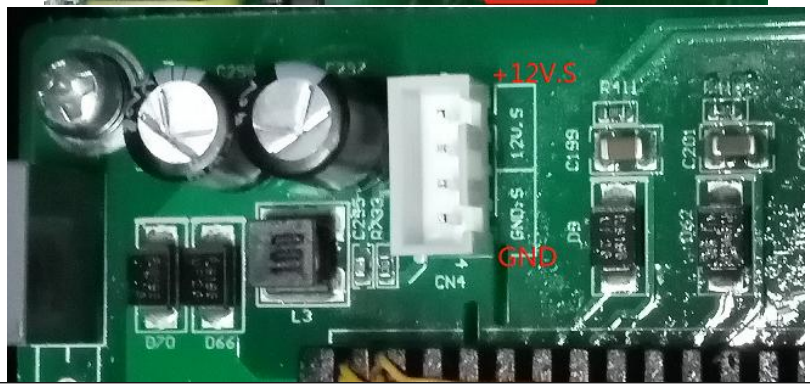
As shown in the figure, at the BUS voltage measurement point, the BUS voltage is DC voltage, and the DC gear is selected when the multimeter measures. The three crews on the capacitor board, corresponding to the ± BUS and BUS midpoint. The BUS voltage and the half BUS voltage can be measured.	

7.6 AC SPS output voltage measurement

When measuring the AC SPS output voltage, it must be tested on the whole machine. As is shown in the following figure:

AC SPS on the UPS board, input voltage measurement point: CN2, voltage about 220V (acceptable range 176V-390V) Output voltage measurement point: CN3, voltage about 576V±20V	

7.7 SPS output voltage measurement

When measuring SPS output voltage, it must be tested on the whole machine. AS is shown in the figure:

SPS output voltage measurement point: +5V：C138 +12V.S：CN4 +12V：C228 -12V：C231