SOLAR POWER SYSTEM

SERVICE MANUAL

IGrid SS 3KW Plus

Table of Contents

1. General Information

1.1 Getting start

This manual is for IGridSS3KWPlus It can help service person perform the basic maintenance and repair service.

This manual only focuses on the service section. The basic operation of the Inverter can be get from the user manual, and make sure you had read and understood the user manual before reading this manual.

The manual includes 8 sections:

● **General Information,** this section shows you the general information of the service manual.

● **Electric Specifications,** this section shows you the basic electric specification of the Inverter.

● **Functional block,** this section shows you the major functional block of the Inverter.

● **Working Principle of the Major Functional Block,** this section shows you the working principle of the major functional block.

● **Function explanations for each PCB,** this section explains you all the PCBs of the Inverter system.

● **Interface,** this section shows you the LCD interface.

● **Trouble Shooting,** this section gives you the way to find the problems.

● **Test Step,** this section tells you how to test the Inverter after you repair the unit.

1.2 Important Safety Instructions

⚠ For qualified service person only.

⚠ Before installing and using the inverter, read all instructions and cautionary markings on the inverter and all appropriate sections of this guide.

⚠ DO NOT perform any internal service or adjustment of this product unless the technical person is well trained and experienced. .

⚠ Dangerous voltage exists at several points in this product. To avoid personal injury, don't touch any exposed connections or components while inverter is on.

⚠ Turn off the inverter and switch off the input breaker before removing protective case.

⚠ High voltage may exist at DC capacitors. Before removing the protective case, wait for at least five minutes after turning off the inverter.

 Verify input source (voltage and frequency) is within the maximum range before service.

 Don’t remove the battery or switch off the breaker of battery when the inverter is running, otherwise the inverter may change to error mode.

2. Electric Specifications

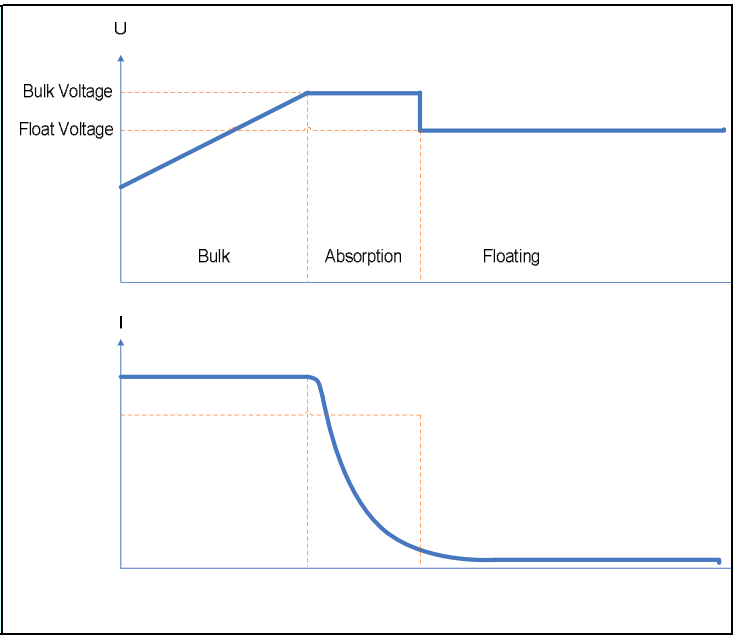
Item	Specification	Comments
AC input data		
AC start voltage	120~140Vac	
Auto restart voltage	194 Vac	Tolerance ±3%
AC input voltage range	184~265 Vac (VDE) 193.6~242Vac(Taibei)	
AC input voltage comeback value	194/255 Vac(VDE) 203.6/232 Vac(Taibei)	
AC input frequency range	47.5 ~ 50.2 Hz (50Hz) 59.3~ 60.5Hz(60Hz)	
AC input frequency comeback value	47.6/50.1 Hz(50Hz) 59.4/60.4Hz(60Hz)	
Max. AC Input current	20Amp	
PV input data		
Max. DC Power	3200W	
Nominal DC voltage	360Vdc	
Max. Input voltage (Maximum PV open voltage)	500Vdc	
System start-up voltage	116V ± 10V	whether PV establish control power
Initial feeding voltage	150V ±5%	
Working voltage range	100(±5%) ~ 500 Vdc (-5%+0%)	Which is the DC voltage range that inverter can feed power to grid
MPPT voltage range	250 ~ 450Vdc	1).Max Pinput=13*Vinput when Vin<250Vdc 2).Max Pinput=30200-60*Vinput when Vin>450Vdc
Shutdown voltage	<70V typical	
Max. DC Input current	13Amp	
Grid Feeding data		
Nominal output voltage	230Vac	Optional：208/220/240 Vac
Nominal output frequency	50/60Hz auto sensing	
Max feeding power	3000W	

Output voltage range	184~265 Vac (VDE) 193.6~242Vac(Taibei)	
Output voltage comeback value	194/255 Vac(VDE) 203.6/232 Vac(Taibei)	
Operational frequency range	47.5 ~ 50.2 Hz (50Hz) 59.3~ 60.5Hz(60Hz)	
Output frequency comeback value	47.6/50.1 Hz(50Hz) 59.4/60.4Hz(60Hz)	
Max output current	13.6A	Under the output voltage is 220VAC
O/P current distortion	<3%	Under utility voltage THD<3%
Power Factor	>0.99	
Battery mode output data		
Nominal output power	3000W	
Wave form	Pure sine wave	
Nominal output voltage	230Vac±1%	Optional：208/220/240 Vac
Nominal output frequency	50 Hz± 0.1Hz	
O/P voltage distortion	<3% for linear load <5% for non- linear load	
O/P DC component	<50mV	
Transient O/P voltage range	230+/-10%	
Transient Time	120ms	
Maximum Conversion Efficiency (DC/AC)	92%	
Overload capability		
Line Mode	> 110%	Overload alarm for 5 min, and then will switch to fault mode. If user decrease the load <100% rating, the overload alarm can release.
	> 150%	Overload alarm for 1 min, and then will switch to fault mode. If user decrease the load <100% rating, the overload alarm can release.
	> 200%	Switch to fault mode immediately
Battery Mode	> 110%	Overload alarm for 1 min, and then will switch to fault mode. If user decrease the load <100% rating, the overload alarm can release.

	> 150%	Overload alarm for 30 sec, and then will switch to fault mode. If user decrease the load <100% rating, the overload alarm can release.
	> 200%	Switch to fault mode immediately
Short circuit		
Line Mode	Fuse	
Battery Mode	Software Detection	Can be re-start 3 cycles before power shutdown. interval time 10s.

Battery feature

Item	Specification	Comments
Battery		
Nominal DC voltage	48Vdc	
DC start voltage	46 Vdc	
Discharge pre-alarm battery capability	Battery capability<25% or Battery voltage< 44V	
Battery shutdown voltage	42 Vdc	
Leakage current	100uA	
Charger		
Max charging current	25A	The charging current can be set by user. 3 stages： First - max current until 57V, then 57V during until charging current down to 5 Amp, then go to float at 55V.
Absorption charger voltage	57.0 Vdc	
Floating charger voltage	55.0 Vdc	
Battery overcharge protection	60.0 Vdc	

IUoU charging process	

3. Functional Block

As a hybrid photovoltaic inverter, the product utilizes several power sources. Comprising functional blocks as shown in Figure 3.1

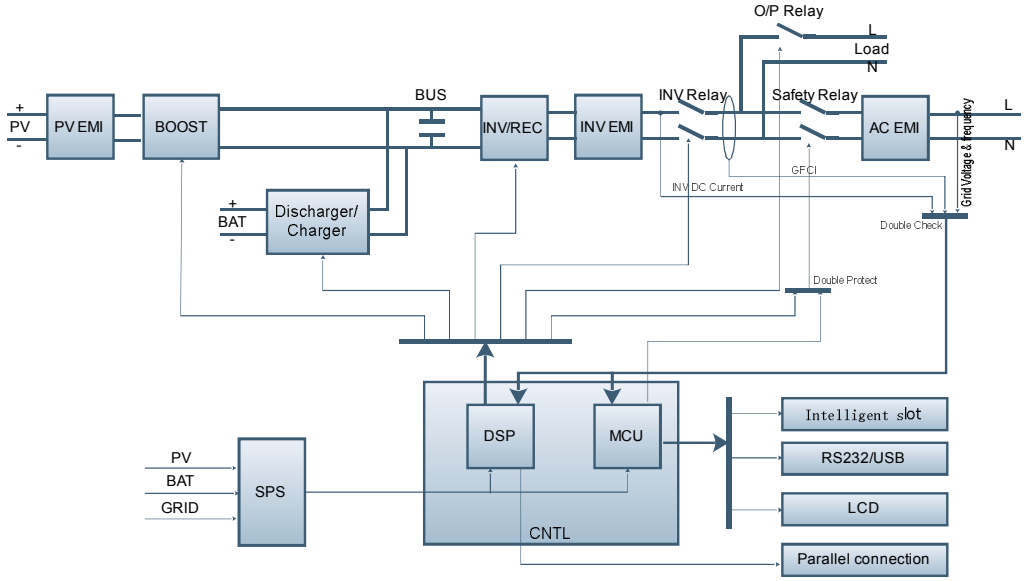


Figure 3.1 Function block Diagram

The CNTL block provides control signals to control the action of the inverter. It also provides the communication interface for receiving and executing commands from users via the panel or other communication protocol. When the inverter becomes abnormal, in most case, the CNTL board can provide basic information indicating the status of the inverter, and the information will be displayed on the LCD. The MCU and the DSP will double check the frequency and voltage of grid, the inverter output DC current, the GFCI signal and disconnect the inverter from the grid if any abnormal signal is generated by turning off the safety relay.

The Input and Output EMI section provides EMI filter function. The input and output EMI filters can prevent the PV Inverter from being interference by external electronic/magnetic noise which is generated by other electronic system and prevent other systems from the noise generated inside the inverter system.

The BOOSTER blocks are the PV input stage of the inverter. The block converts DC input power generated by the Solar panels into DC power stored in the BUS capacitor. In the meantime, BOOSTER will track maximum power point of solar modules by calculating the input power through changing the input voltage.

The INV/REC block is the output stage of the PV Inverter and this block is a bidirectional power flow block. It can convert DC power from the BUS capacitor to AC power to the load or to the grid. It can also convert the AC power from the utility to DC power at the DC BUS and arrive at PFC at the same time. When the maximum power point of PV input is above 370Vdc, the boost will turn off and the PV input current will be sent to the BUS directly. That means the input PV voltage is same as the BUS voltage. At the same time, the INV/REC block controls the BUS voltage and will track maximum power point of solar modules.

The SPS generates DC power supply needed for operation of the circuit of the inverter itself.

The Discharger/Charger block converts battery voltage to high-BUS DC voltage or converts high-BUS DC voltage to low battery voltage. This block uses high frequency isolation technology. The block charges the battery when the efficient power from PV modules or the utility power is generated more than the load needed. On the contrary, the block will discharge the battery power to the DC BUS.

The switch block is controlled by the CNTL block and used to control if the inverter is connected to grid or not and the load is on or off.

The COMMUNICATION and Intelligent slot block are used to communicate with the computer to maintain or setup the system, and it can be used to detect what happened when the PV inverter is abnormal.

4. Working Principle of the Major Functional Block

4.1 Switch Power Supply

The Switch Power Supply (SPS) supplies DC power for Inverter operation including +5V,+12V,-12V and +15V.

The SPS consists 3 parts: the battery SPS, the grid SPS and main SPS. The battery SPS generates a DC voltage at about 120Vdc(BATSPS) and the grid SPS generates a DC voltage about 150Vdc(ACSPS). The input source of the main SPS can be any of the DC BUS voltage, the output of the battery SPS or the output of the grid SPS. Because the PV input can power to the DC BUS through a diode, any of 3 inverter power sources: PV, grid, battery is good, the main SPS works and supplies the DC power +5V,+12V,-12V and +15V.

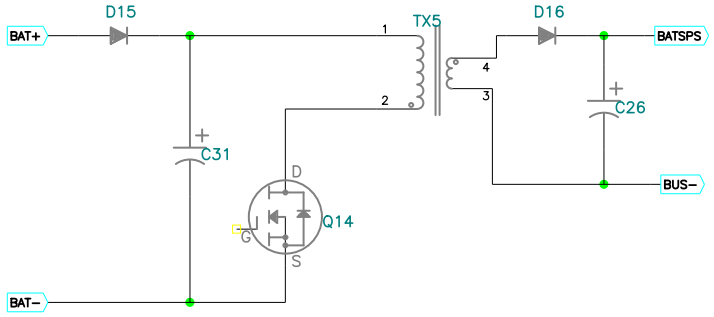


Figure 4.1 Basic circuit of battery SPS

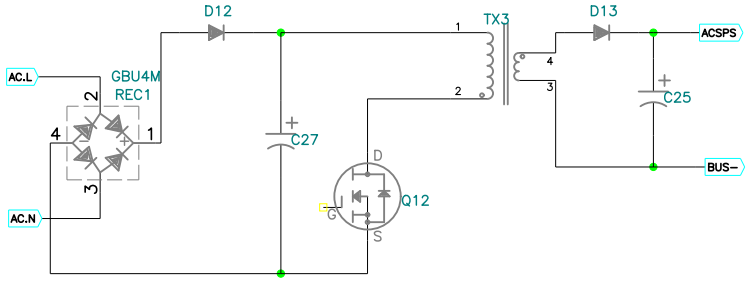


Figure 4.2 Basic circuit of grid SPS

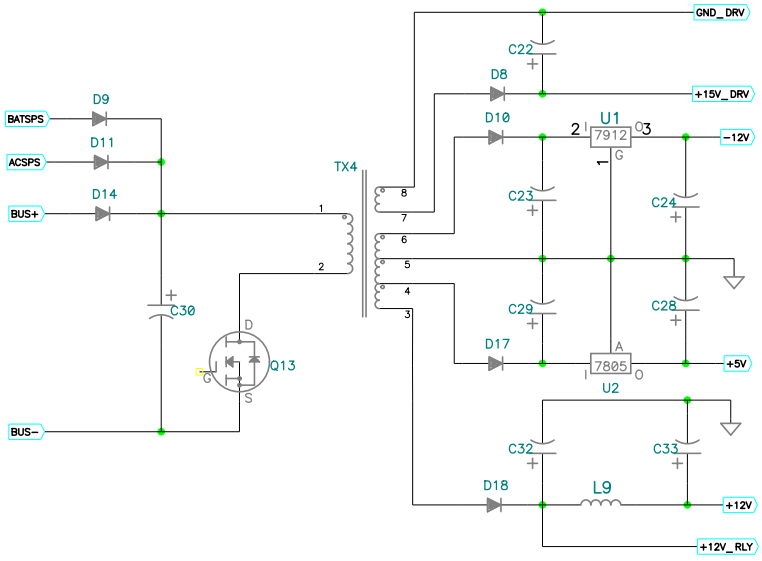


Figure 4.3 Basic circuit of main SPS

Figure 4.1, Figure 4.2 and Figure 4.3 are the basic circuits of battery SPS, grid SPS and

main SPS. They are all flyback converter. However, the grid SPS includes a rectifier to convert grid AC voltage to a DC voltage but the main SPS is multiple output circuits. Taking main SPS to explain the operation of flyback converter as a example. When Q13 is on, all rectifier diodes are on “open” status and all output capacitors supply currents to the load. The primary coil of the transformer will become a pure inductor and the primary current will linearly increase to store energy in the coil. When Q13 is off, primary current will stop and all rectifier diodes will turn to “close” status. It will release the stored energy from the primary coil of the transformer to the secondary coil to supply loads. At the same time, it will charge output capacitors including+15V_DRV, ±12V, +5V.

The +15V_DRV, ±12V, +5V power supplies stable voltage to all kinds of ICs and other devices such as HCT. The +12V_RLY is supplied to fans and relays.

4.2 Boost circuit

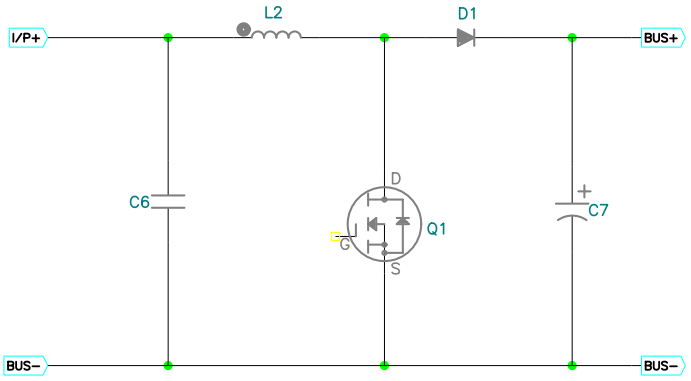


Figure 4.4 Boost circuit

As shown in the Figure 4.4, when Q1 is on, the current will increase to store energy in choke(L2) and capacitor C7 will supply power to the load. When the Q1 is off, the choke will release energy to BUS. Therefore, we can control the current in chokes (input current) by regulating the time of Q1 on and off. In this way, we can control the input PV voltage by regulating the cycle of the Q1 and executive MPPT function.

4.3 Inverter

The input of the full bridge inverter topology is DC voltage, the DC BUS, and the output is an AC voltage, as shown in the Figure 4.5. When Q3 and Q4 are on while Q2 and Q5 are off, the voltage of the bridge midpoint is +BUS. When Q3 and Q4 are off and Q2 and Q5 are on, the voltage of the midpoint bridge is –BUS. We can get any voltage waveform between +BUS and –BUS voltage and any frequency from π filter output by regulating the cycle of Q2/Q3/ Q4/Q5, including sine wave form.

L5,C10,C11,C12 consists of a inverter filter to eliminate the EMI of the power to load.

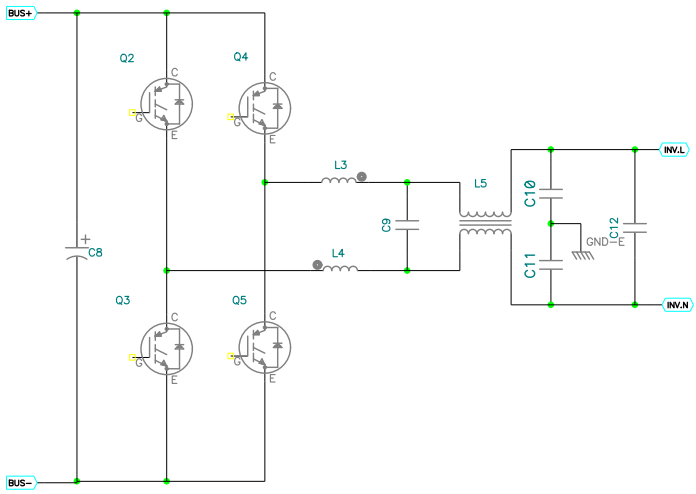


Figure 4.5 bridge inverter

4.4 Charger/Discharger

The function of charger is to charge and maintain the batteries at fully charged condition. When the battery is working in charging mode, the control board will enable the charge control circuit and disable the discharge control circuit. As showed in figure 4.6, the charge control circuit provides PWM waves to regulate the cycle of Q8/Q9/Q10/Q11 on and off in this mode. The control board will disable the charge control circuit and enable the discharge control circuit when the battery is working in discharging mode. In this mode, the discharge control board will provides PWM waves to regulate the cycle of Q6/Q7 on and off. In this way, the BUS voltage can be controlled by the control board, and the output DC voltage will be filtered by L7 and C19. Then, we can get relatively stable BUS voltage.

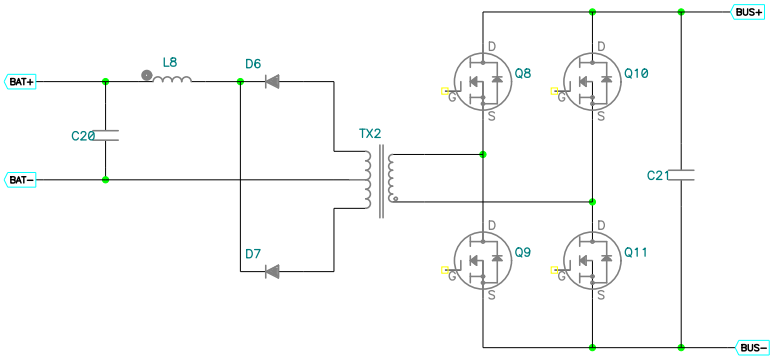


Figure 4.6charge circuit

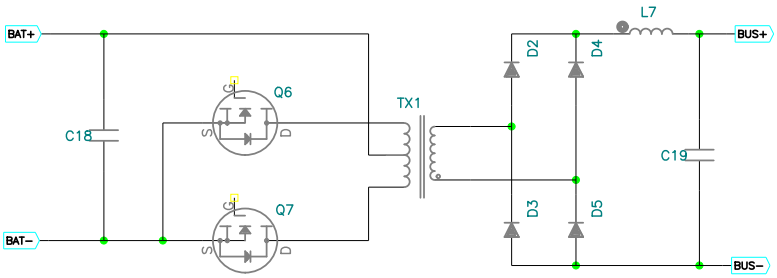


Figure 4.7 discharge circuit

4.5 EMI Board

Input EMI board is connected between solar panel and the input of BOOSTER. Output

EMI board is connected between the output of inverter and output terminal SWITCH block.

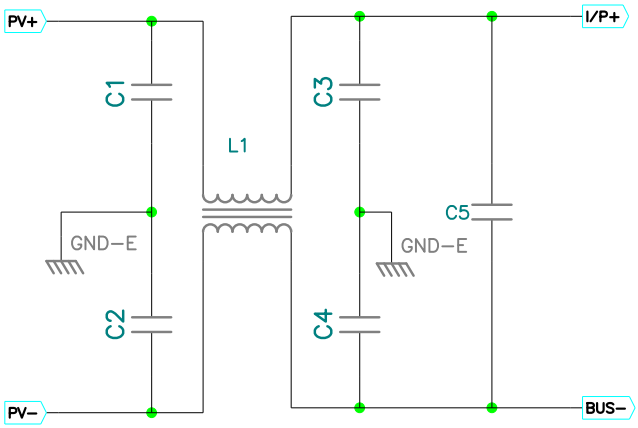


Figure 4.8 Topology of the EMI

5. Function explanations for each PCB

Table 5.1 PCB information of InfiniSolar 3KW

Item	PCB Name	PCB serial number	Quantity
1	CNTL	71-500083-XXG	1
2	MAIN	71-500086-XXG	1
3	BAT	71-600021-XXG	1
4	COM	71-000072-XXG	1
5	PANEL	12-400030-XXG	1
6	CHG CNTL	71-000074-XXG	1
7	DISCHG CNTL	71-000076-XXG	1
8	SPS	71-500007-XXG	1

Note: "XX" in the serial number is the version of the PCB. It may be modified according to releasing version in the future.

5.1 MAIN board

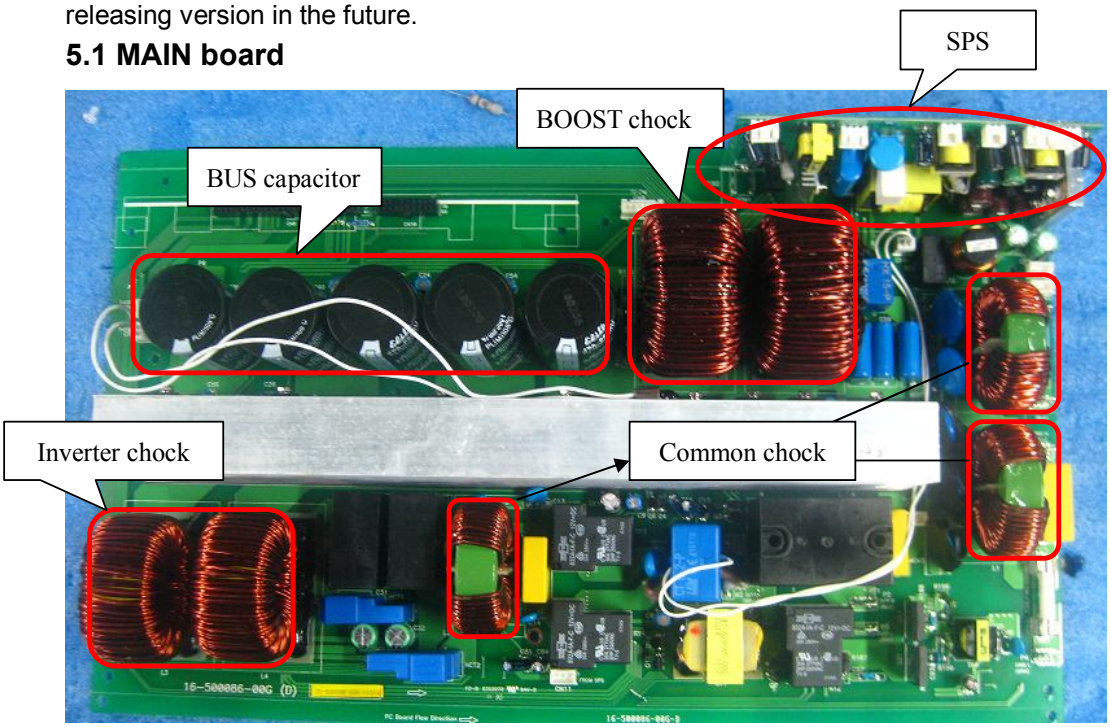


Figure 5.1 picture of MAIN board

The MAIN board consists of inverter circuit, Boost circuit, relay blocks, BUS capacitors, detection circuit and some other filter inductors and capacitors. Although the input of the MAIN board is unstable DC, the output is relatively stable. And the Boost circuit will trace the MPP.

5.2 CNTL board

Figure 5.2 picture of CNTL board

The CNTL board is the core of the Inverter system. It controls the actions of the semiconductors and other mechanical switches, LCD display, buzzer alarm, communication with the computer, and other important tasks. The inverter is controlled by two CPUs, DSP and MCU. The master controller is the DPS. Its main function is to control power and safety independence. The slave controller is the MCU. Its main function is to control the safety with DSP, LCD display and communication.

5.3 BAT board

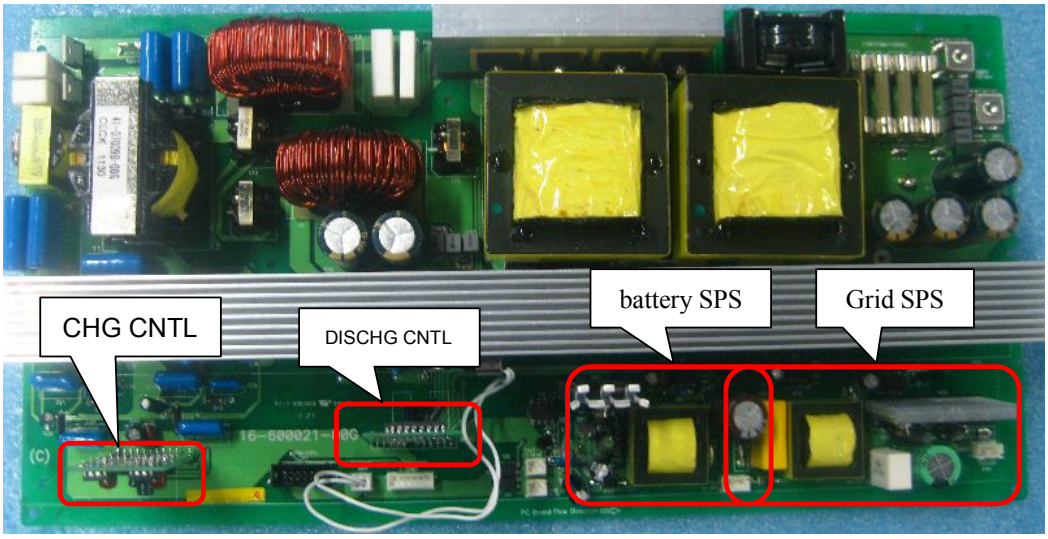
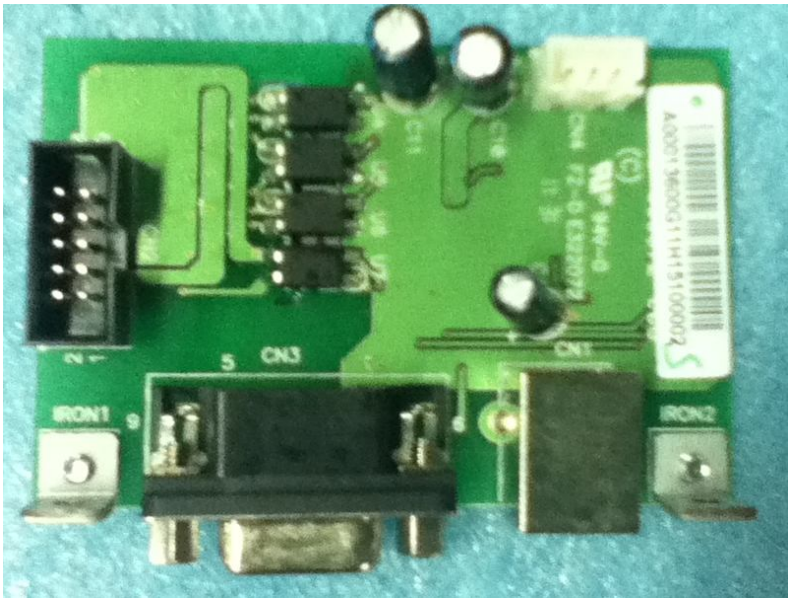


Figure 5.3 picture of BAT board

The BAT board will charge the battery or discharge the battery base on the signal from CNTL board, CHG CNTL board and DISCHG CNTL board. And it can provide the SPS board with DC source to avoid the input loss of the SPS board along with loss of BUS voltage.

5.4 COM board

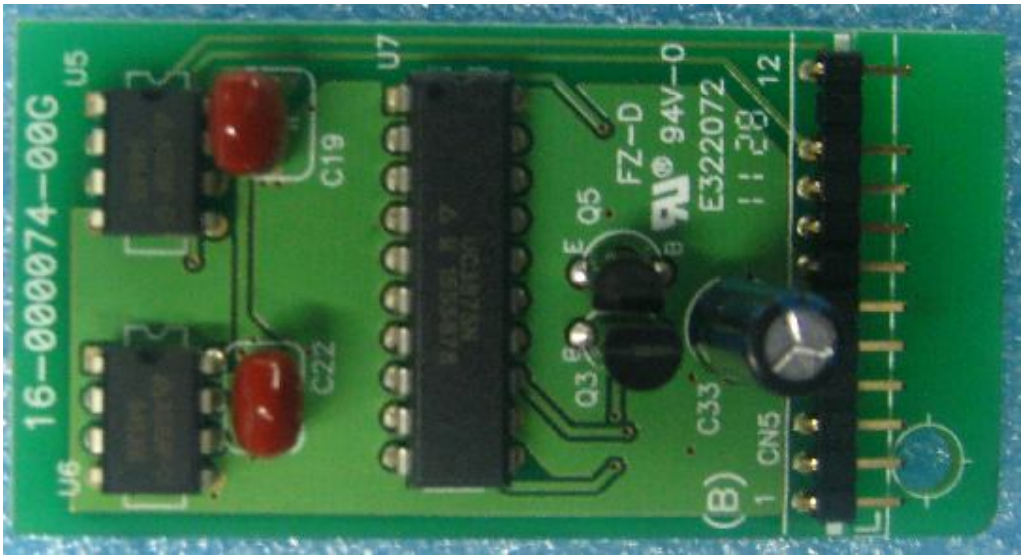


The COM board provides RS232 and USB interface to the users.

5.5 PANEL board

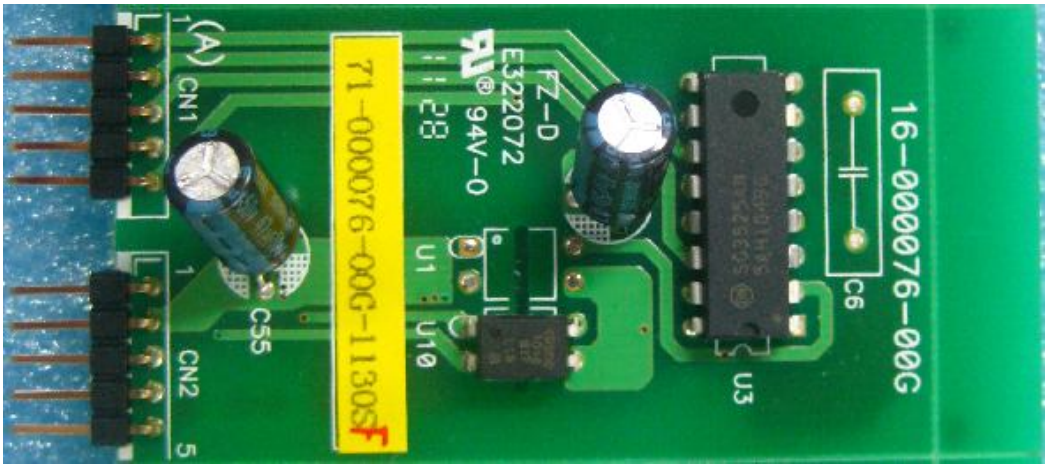
The PANEL board is used to provide LCD interface.

5.6 CHG CNTL board



It provides PWM waves to control the charging MOSFET when the battery is in charging mode.

5.7 DISCHG CNTL board



It provides PWM waves to control the charging MOSFET when the battery is in discharging mode.

5.8 SPS board

The Switch Power Supply (SPS) supplies DC power for Inverter operation including +5V, +12V, -12V and +15V. The input source of the SPS is from BUS voltage, the output of the battery SPS, or the output of the grid SPS.

6. Interface

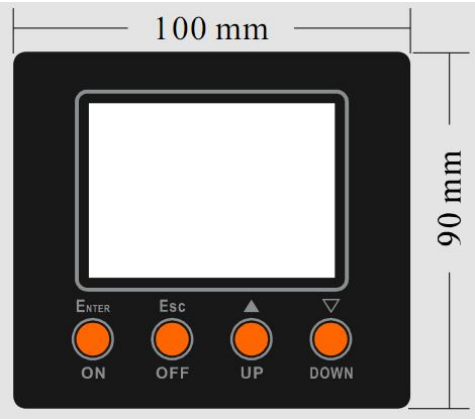


Figure 6.1 picture of the LCD panel

This display is operated by four buttons.

NOTICE: There is a battery inside of control board. It's recommended to replace the battery every 5 years.

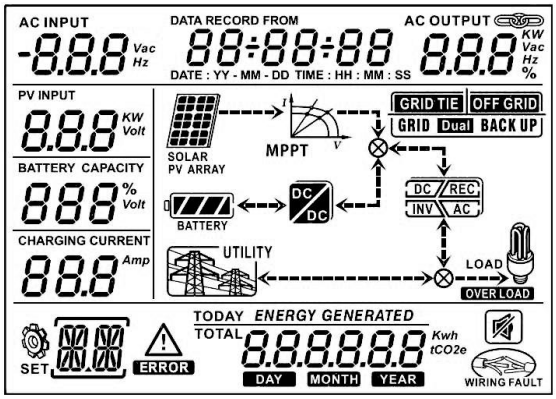
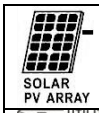
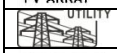
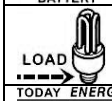


Figure 6.1 the display picture of LCD

Table 6.1 LCD Information Define

Display	Function
AC INPUT 8.8.8 Vac	Indicates AC input voltage or frequency. Vac: voltage, Hz: frequency
AC OUTPUT 8.8.8 KW Vac Hz %	Indicates AC output power, voltage, frequency, or Load percentage. KW: power, Vac: Voltage, Hz: frequency, %: Load percentage
PV INPUT 8.8.8 KW Volt	Indicates PV input voltage or power. Volt: voltage, KW: power
BATTERY CAPACITY 888 % Volt	Indicates battery voltage or percentage. Volt: voltage, %: percentage
CHARGING CURRENT 88.8 Amp	Indicates charging current to battery.
⚠	Indicates that the warning occurs.
ERROR	Indicates that the fault occurs.
88	Indicates fault code in fault mode or WR for warning situation.
DATA RECORD FROM 88:88:88 DATE : YY - MM - DD TIME : HH : MM : SS	Indicates date and time, or the date and time you set for querying energy generated.

	Indicates solar panels.
	Indicates grid.
	Indicates battery.
	Indicates load.
	Indicates energy generated.

7. Trouble Shooting

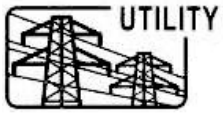
This section describes how to find the troubles when Inverter is abnormal. We suggest you to follow the service procedure below:

1. Check the Inverter status via LCD display, the sound of the buzzer, or listen to the description of end users.
2. Inspect failure board for static checking.
3. Replace failure components.
4. Static checking.
5. Power-on checking.
6. Test after repair.

Following section will help service person to solve the most problems.

7.1 LCD Panel Display Pattern Definition

7.1.1 Trouble shooting for warning icon in LCD display

LCD icon (Flashing)	Means	Possible cause	Action
	PV module disconnect	PV voltage is lower than 100V.	1. Waiting for sunlight to generate sufficient power. 2. Check if PV cables are connected correctly and firmly.
	Line loss Islanding detect	Grid is detected out of range.	1. Grid is not connected. 2. Check if grid cables are connected correctly and firmly. 3. Check grid usability.
	Low battery	Battery is not detected or low battery	1. Make sure battery wires are connected well. 2. Check if the battery is good.
	Over load	The load is out of supported capacity the Inverter can support.	1. Remove some non-critical loads.
	Initial fail	The CPU is disturbed.	1. Restart the inverter. 2. Reset to the factory settings.

Note: When the Inverter alarms, the Inverter is still working on the original mode.

7.1.2 Trouble shooting for fault codes in LCD display

Code	Fault Event	Action
01	Bus over voltage	1. Disconnect ALL PV(+), PV(-) and Grid 2. Wait for few seconds 3. After the LCD switches off, reconnect and check again 4. If the message still remains, the inverter may damage. Please refer to section 7.2.2.
02	Bus under voltage	
03	Bus soft start time out	
04	Inverter soft start time out	
05	Inverter over current	
07	Relay fault	
08	DC current sensor fail	
10	Power down	
11	PV input short	
14	Inverter DC current over	
16	GFCI sensor fail	
06	Over temperature	1. The internal temperature is higher than specified normal value 2. Find a way to reduce the ambient temperature. 3. Or move the inverter to a cooler environment. 4. if the measures above are useless, check the temperature sensor and the related circuit.
09	PV high voltage	1. Check if the open PV voltage is greater than or close to 500VDC 2. If PV voltage is less than 500VDC and the problem still occurs, please refer to section 7.2.2
12	GFCI over	1. The ground current is too high 2. Disconnect from PV modules and check the grounding connection of AC utility 3. After the problem is solved, re-plug the PV panel and check the inverter status.
13	PV isolation low	Check the impedance between PV (+) & PV (-) to the ground. The impedance must be greater than 1MΩ
15	Line value consistent fail between MCU & DSP	1. Disconnect PV(+) , PV(-) from the input, restart the inverter. 2. If it does not work, please replace the CNTL board.
17	Connect fail between MCU & DSP	
18	Communication fail between MCU & DSP	
19	Ground loss	Make sure the inverter connected to the ground
20	Discharge fail	Check the discharge circuit, examine the control signal.
21	Discharge Soft Time Out	

22	Battery over charge	1.Check the connection between battery and Inverter. 2.restart the Inverter. 3.Make sure that don't break the connection between the battery and Inverter while the charging current is high.
23	Over load	Remove the load, ensure that the load is less than the maximum VA the Inverter can support. Then restart the Inverter.
24	Battery open	1. Ensure that the connection of the battery is well. 2. If the message still remains, check the battery detect circuit.
25	Inverter over current for long time	restart the Inverter.
26	Inverter short	Jump to 7.2.2

7.2 Repair

In this section, some debug skills are listed to help you finding the failed components and problems as soon as possible. Before proceeding the following steps, we strongly suggest to read previous section for trouble shooting first. Then check the components listed in section 7.2.4 to find out which block fails.

7.2.1 Basic Instruments and tools

1、One computer with RS232 port and one standard RS232 cable;
2、Wire cutters and clamps;
3、One electric soldering iron;
4、One multimeter;
5、One oscilloscope(voltage and current probe needed);
6、Diagonal pliers, snipe nose pliers, cross screwdrivers (150mm/75mm length), flat screwdrivers (75mm length) and PVC insulating tapes etc;
7、Make-self tools including Balance voltage test equipments, current limiting resistors, tubes and clamp terminals with different specifications;

7.2.2 Quick Start

Before any detail check for Inverter, please check the components listed in the following table. This action could help you find problem quickly and make debug procedures more smoothly.

Note: Make sure that the capacitor voltage is lower than the safety voltage before disassembling any parts of the Inverter for rechecking procedure.

Circuit Block	**Checked components**	**Component Type**	**Failure condition**
Booster	D17,D18, D19, D20	Diode	Short or open

	Q13, Q14	MOSFET	D-S short or open
	U7	Photo coupler	Input and output short or open
	R136,R144,R143,R130,R129,R141,R145,R139,R137 ,R125,R126,R138,	Resistance	Short or open
INV	D3, D4, D5, D6, D7, D8, D12, D13, D15, D16	Diode	Short or open
	R42, R43,R48, R54, R56, R60, R193, R194, R182, R210, R208, R209, R78, R83, R87, R95, R49, R55, R57, R61, R77, R82, R86, R94, R59, R157, R177, R179,R88,R180,R193,R182,R157,R177,R208,R209, R179,R180	Resistance	Short or open
	Q10,Q2,Q16,Q8	Diode	Short or open
	U1,U2,U3,U4	Photo coupler	Input and output short or open
	QA1, QA2, QB1, QB2, QC1, QC2, QD1, QD2	IGBT	C-E short or open
MAIN SPS	Q2	MOSFET	D-S short or open
	D1, D7, D6, D3, D2, D8,D9,D20	Power Diode	Short or open
	U4	Optocoupler	Input and output short or open
	U3	Control IC	Power Pin and o/p pin short
	R7, R11	Resistance	Short or open
AC EMI	F1, F2, F3, F4	Fuse	Open

Note: If the fuse is in “open” status, don’t replace the fuse only. In most of cases, open fuse is caused by other failed components. Therefore, before restarting the Inverter, you must find all failed components and replace them.

Note: Ensure all the failed components have been replaced, then supply the low voltage and check the control signal. Only when the control signal is OK, you can start the Inverter.

Note: If all power components function well, and all cables are connected correclty, but the inverter still can’t start up, we suggest you to replace a new CNTL board.

7.2.2.1 Major parameters of Booster section

The most likely problems occur on the Booster section including: broken IGBT, broken Diode, and broken IGBT driver resistor. When checking Booster section, directly check the MOSFET with Resistance probe or the Diode Voltage Droop probe with multimeter.

Checked components		**Instrument function**	**Reference Value**	**Failed condition**
Q13, Q14	(G, S)	Resistance	≈25kΩ	Short
	(S, D)	Diode Voltage Droop	≈0.5V	Short or open
D15, D16,D17,D19		Diode Voltage Droop	≈0.4V	Short or open
D18, D20(need to be removed from PCB)		Diode Voltage Droop	≈0.6V	Short or open
U7	Pin6,7-Pin5	Resistance	≈25kΩ	Short or open
	Pin2-Pin3	Diode Voltage Droop	≈1.4V	Short or open
R129, R141		Resistance	≈100Ω	Infinite or value change
R130, R143		Resistance	≈2.2Ω	
R136,R144		Resistance	≈510Ω	

Note: If IGBT or RESISTOR is damaged, it means that the Optocoupler may also be damaged extremely. So replace it at the same time.

7.2.2.2 Major parameters of Inverter section

The most likely problems occur on the INV section including broken IGBT, broken Diode, damaged IGBT driver resistor, damaged relative optical coupler.

Checked components		**Instrument function**	**Reference Value**	**Failed Condition**
QA1, QA2, QB1, QB2, QC1, QC2, QD1, QD2	(E, C)	Diode Voltage Droop	≈0.4V	Short or open
	(G, E)	Resistance	≈50 kΩ	Short or open
D5, D6, D7, D8, D12, D13, D15, D16 (need be removed from PCB)		Diode Voltage Droop	≈0.6V	Short or open
D3,D4		Diode Voltage Droop	≈0.6V	Short or open
U1,U2,U3,U4	Pin6,7-Pin5	Resistance	≈50kΩ	Short or open
	Pin2-Pin3	Diode Voltage Droop	≈1.4V	Short or open
R48, R56, R78, R87, R49, R57, R77, R86,		Resistance	≈47Ω	Infinite or value change
R42,R43,R54, R55, R60, R61, R83, R82, R95, R94		Resistance	≈10Ω	Infinite or value change
R105, R107		Resistance	≈0Ω	Infinite or value change
R193,R157 ,R208,R179		Resistance	≈100Ω	Short or open
R182, R177,R209,R180		Resistance	≈220Ω	Short or open

Q10,Q2,Q16,Q8	(B,E)	Diode Voltage Droop	≈0.6V	Short or open
	(B,C)	Diode Voltage Droop	≈0.6V	Short or open

Note: 1. If MOS or RESISTOR is damaged, it means that the Optocoupler (U1&U2&U3&U4) may also be damaged extremely. So replace it at the same time.

2.Make sure the voltage of capacitor C22,C24 is less than 0.1Vdc when test QA1, QA2, QB1, QB2, QC1, QC2, QD1, QD2.

7.2.2.3 Major parameters of main SPS section

The most likely problems occur on the SPS section including broken MOSFET, broken Diode, damaged sense resistor, damaged relative driver resistor with broken MOSFET.

Checked components		**Instrument function**	**Reference Value**	**Failed Condition**
Q2	(S, D)	Diode Voltage Droop	≈0.5V	Short or open
	(G, S)	Resistance	≈47kΩ	Short or open
R11		Resistance	≈0.5Ω	Infinite or value change
R7		Resistance	≈100Ω	Infinite or value change
D1, D7, D6, D3, D2, D20		Diode Voltage Droop	≈0.45V	Short or open
U3	Power Pin(Pin7-Pin5)	Resistance	≈230KΩ	Vcc short to GND
	o/p Pin(Pin6-Pin5)	Resistance	≈47kΩ	Short or open
U4	Pin1-Pin2	Diode Voltage Droop	≈1.0V	Short or open
	Pin3-Pin4	Resistance	≈440kΩ	Short or open

7.2.2.4 Major parameters of DISCHARGE section

The most likely problems occur on the DISCHARGE section including broken MOSFET, broken Diode, damaged relative driver resistor with broken MOSFET, broken fuse.

Checked components		**Instrument function**	**Reference Value**	**Failed Condition**
Q1,Q2,Q3,Q4,Q5, Q6,Q7,Q8,Q9,Q10	(S, D)	Diode Voltage Droop	≈0.5V	Short or open
	(G, S)	Resistance	≈4.7kΩ	Short or open
R1,R2,R3,R4,R6,R7,R8,R14,R15,R16 R17,R19,R20,R21		Resistance	≈10Ω	Infinite or value change
D1,D3(need be removed from PCB)		Diode Voltage Droop	≈0.6V	Short or open
U1,U2	Power Pin(Pin4,5-Pin2,7)	Resistance	>10KΩ	Vcc short to GND
	o/p Pin(Pin3-Pin2,7)	Resistance	≈10kΩ	Short or open
F1,F2,F3,F4		Resistance	≈0Ω	open

7.2.2.5 Major parameters of CHARGE section

The most likely problems occur on the CHARGE section including broken MOSFET, broken Diode, damaged relative driver resistor and driver IC with broken MOSFET.

Checked components		**Instrument function**	**Reference Value**	**Failed Condition**
Q11,Q12,Q13,Q14	(S, D)	Diode Voltage Droop	≈0.5V	Short or open
	(G, S)	Resistance	≈4.7kΩ	Short or open
R39,R40,R41,R42,R49,R50,R52,R53 R101,R102		Resistance	≈10Ω	Short or open
D14,D15,D17,D18(need be removed from PCB)		Diode Voltage Droop	≈0.6V	Short or open
D13,D19		Diode Voltage Droop	≈0.6V	Short or open
D16,D20,D22,D23		Diode Voltage Droop	≈0.4V	Short or open
U3,U4	Power Pin(Pin11-Pin15)	Resistance	≈500kΩ	Vdd short to GND
	Power Pin(Pin7-Pin6)	Resistance	≈300kΩ	VB short to VS
	Power Pin(Pin3-Pin2)	Resistance	≈500kΩ	Vcc short to COM
	O/P Pin(Pin1-Pin2)	Resistance	≈4.7kΩ	Short or open
	O/P Pin(Pin8-Pin6)	Resistance	≈4.7kΩ	Short or open

8. Test Step

After replacing all defected components, testing steps can be adopted to verify the repair result and the reliability of the Inverter.

1. Install all of boards/cable/ connector.
2. Check if wires are connected correctly.
3. Apply DC Power from power source with limited current (prefer 1A) to the PV terminal.
4. After turning on the DC Power(200Vdc), the LCD will light up. If not, please check the input voltage of the inverter. If the voltage is not equal to the DC power voltage, please check the PV input connection. If the voltage is equal to the DC power voltage, please repair main SPS again and restart the test step from step 1.
5. After turning off the DC Power, connect the utility to the grid terminal. The LCD will light up. If not, please check if the AC SPS's input voltage is equal to the utility voltage. If the voltage is not equal to the utility voltage, please check power connection from grid to the inverter and AC connection from INV board to the BAT board. If there is no other mistake, repair grid SPS again and restart test step from step 1.
6. Disconnect the utility, connect the battery and press the ON button for a short time(less than 1s). The LCD will light up. If not, please check if the battery SPS's input voltage is equal to the battery voltage. If not, please check the battery connection and battery fuse. If there is no other mistake, repair BAT SPS again and restart from step 1.
7. Turn on the PV simulator and battery breaker, the inverter will charge the battery from the PV simulator. If not, please repair the boost or the charger of the inverter. And then, restart from step 1.
8. Turn off the PV simulator and turn on the battery breaker. Press the ON button for a while until the beep sounds. Then, the inverter will provide AC power to the load. If not, please repair the discharger of the inverter. And then, restart test step from step 1.
9. Turn on the PV simulator (voltage should be less than 350Vdc) and grid breaker. The inverter will feed power to the grid. If not, please repair the boost of the inverter. Then, restart test step from step 1.
10. Turn on all power sources of PV power, battery, and grid. Then, the inverter will normally operate.