UNINTERRUPTIBLE POWER SYSTEM

SERVICE MANUAL

Galleon Pro 3P1 10K~30KVA Tower Model

REVISION	DESCRIPTION	Date
Rev. 1.0	Formal Release	2015/3/26
Rev.2.0	Some section correction	2016/3/4

CONTENT

1. General Information

1.1 Getting start

This manual is for Galleon 10K(L)~30K(L) tower UPS. It can help service person perform the basic maintenance and repair service.

This manual only focuses on the service section, so you should get the basic operation of the UPS from the user manual, and make sure you had read and understood the user manual before reading the manual.

The manual includes 9 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 UPS.

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

● **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 UPS system.

● **Interface,** this section shows you the LCD interface, including display and setting.

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

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

● **Appendix,** this section shows you the basic waveforms for reference and the basic communication commands.

1.2 Important Safety Instructions

 For qualified service person only.

 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 UPS is on.

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

 AC voltage is always present if the input AC power is still available.

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

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

2. Electric Specifications

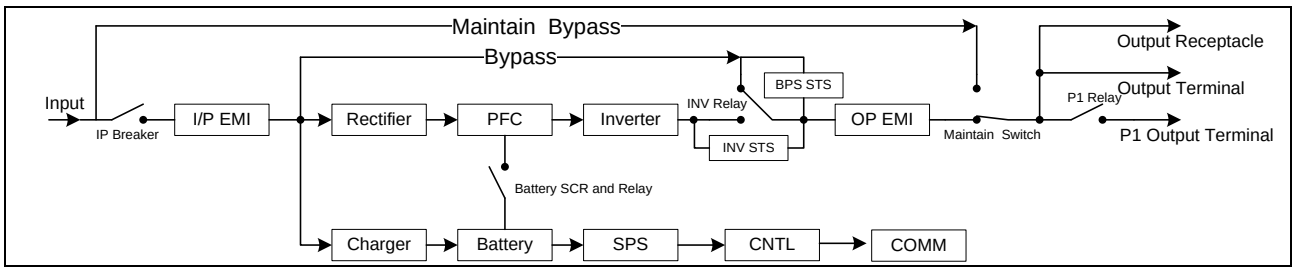
CAPACITY*		10000VA / 9000W		15000VA / 13500W	20000VA / 18000W		30000VA / 27000W	
INPUT								
Voltage Range	Low Line Loss	110 VAC(L-N) ± 3 % at 50% Load 176 VAC(L-N) ± 3 % at 100% Load						
	Low Line Comeback	Low Line Loss Voltage + 10V						
	High Line Loss	300 VAC(L-N) ± 3 %t 50% Load 276 VAC(L-N) ± 3 % at 100% Load						
	High Line Comeback	High Line Loss Voltage - 10V						
Frequency Range		46Hz ~ 54 Hz @ 50Hz system 56Hz ~ 64 Hz @ 60Hz system						
Phase		Three phase with ground						
Power Factor		≧ 0.99 at 100% Load						
OUTPUT								
Output voltage		208/220/230/240VAC						
AC Voltage Regulation		± 1%						
Frequency Range (Synchronized Range)		46Hz ~ 54 Hz @ 50Hz system 56Hz ~ 64 Hz @ 60Hz system						
Frequency Range (Batt. Mode)		50 Hz ± 0.1 Hz or 60Hz ± 0.1 Hz						
Overload	AC mode	100%~110%: 10min 110%~130%: 1min >130% : 1sec						
	Battery mode	100%~110%: 30sec 110%~130%: 10sec >130% : 1sec						
Current Crest Ratio		3:1 max						
Harmonic Distortion		≦ 2 % @ 100% Linear Load; ≦ 5 % @ 100% Non-linear Load						
Transfer Time	Line←→Battery	0 ms						
	Inverter←→Bypass	0 ms						
	Inverter←→ECO	<10 ms						
EFFICIENCY								
AC mode		> 89%		>89%	>89%		>90%	
Battery Mode		> 86%		>88%	>87%		>88%	
BATTERY								
Standard Model	Type & Numbers	12 V /9 Ah x 20		12 V / 9 Ah x 40	12 V / 9 Ah x 40		12 V / 9 Ah x 60	
	Recharge Time	9 hours recover to 90% capacity						
	Charging Current	1.0 A ± 10% (max.)		2.0 A ± 10% (max.)	2.0 A ± 10% (max.)		4.0 A ± 10% (max.)	
	Charging Voltage	13.65V ± 1%						
Long-run Model	Type	Depending on applications						
	Numbers	18 - 20						
	Charging Current	4.0 A ± 10% (max.)		8.0 A ± 10% (max.)	8.0 A ± 10% (max.)		12.0 A ± 10% (max.)	
	Charging Voltage	13.65± 1%						
PHYSICAL								
Model		10K	10KL	15K	15KL	20K	20KL	30K	30 L
Outline	Dimension, D X W X H	592X250X576		815X250X826	592X250X576	815X250X826	592X250X576	815 X300 X 1000	815X250X826
	Net Weight (kgs)	83	28	164	37	164	37	233.5	64
Packaging	Dimension, D X W X H	700X385X815	690X370X670	920X380X1025	700X385X815	920X380X1025	700X385X815	920 X430 X 1205	920X380X1025
	Net Weight (kgs)	90	31	182	44	182	44	250.5	90
ENVIRONMENT								
Operation Temperature		0 ~ 40°C (the battery life will down when > 25°C)						
Operation Humidity		<95 % and non-condensing						
Operation Altitude**		<1000m						
Acoustic Noise Level		Less than 58dB @ 1 Meter			Less than 60dB @ 1 Meter		Less than 65dB @ 1 Meter	
MANAGEMENT								
Smart RS-232 or USB		Supports Windows® 2000/2003/XP/Vista/2008, Windows® 7, Linux, Unix, and MAC						
Optional SNMP		Power management from SNMP manager and web browser						

* Derate capacity to to 90% when the output voltage is adjusted to 208VAC.

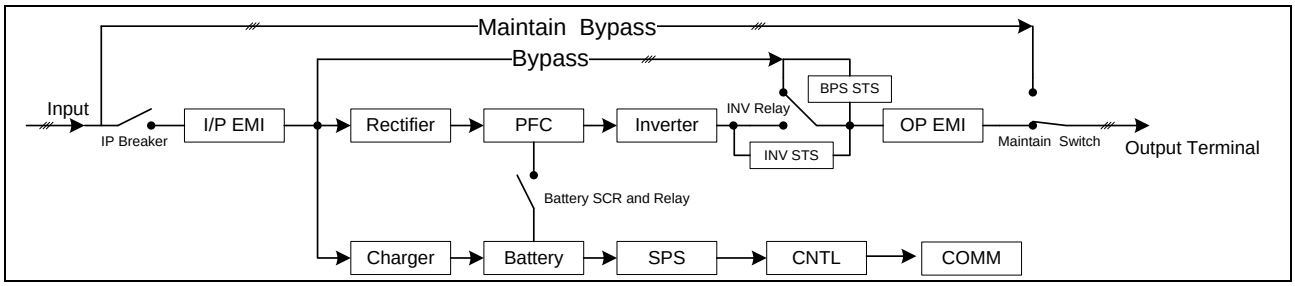
**If the UPS is installed or used in a place where the altitude is above than 1000m, the output power must be derated one percent per 100m.
***Product specifications are subject to change without further notice.

3. Functional Block

As a true online UPS, the product applies a double conversion topology, comprising functional blocks as shown in Figure 3.1



a. Function block Diagram for 10K~20K



b. Function block Diagram for 30K

Figure 3.1 Function block Diagram

The CNTL block controls the action of the UPS system. It detects the voltage and current to control PFC and inverter, also it supplies the protection for the UPS, When the UPS becomes abnormal, in most case, the CNTL can provide basic information indicating the status of the UPS.

The COMM block provides the communication interface for receiving and executing command from users via the panel or other communication protocol, also provides the LCD display task.

The Rectifier and PFC blocks are the input stage of the UPS. The blocks convert AC input power into two stable DC power stored in the BUS capacitor. In the meantime, PFC (Power Factor Correction) will be executed and allows input current tracking the input voltage waveform. Therefore, the input power factor will be corrected to 1 to achieve maximum efficiency and produce lowest power pollution to the utility.

The PFC block in battery mode, also called Booster, is used to convert the low voltage DC power to higher voltage with stable DC power, stored in the BUS capacitor.

The Inverter block is the output stage of the UPS and used to convert DC power from the BUS capacitor to sine waveform output power.

When the utility is within the acceptable range, the UPS will provide power directly from the utility input and the Rectifier and PFC will be executed at the same time. When the utility is outside of the acceptable range, no matter it's because of input voltage or input frequency, the UPS will shut down the Rectifier and PFC functions and turn on the Battery Booster. In case of sudden interruption from input utility, the controller can detect the interruption in very short time. During the short interval of detecting the interruption, the output power will be provided by the power stored in the BUS capacitor. In this way, there is no any interruption on output power.

The charger charges the battery when the utility is normal. The charger converts AC input power to DC

power for recharging the battery. Two types of chargers will be available, one is for the standard model, and the other is for long-run model that connects to external batteries.

The Input and Output EMI section provides EMI filter function. The input and output EMI filters can prevent the UPS 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 UPS system.

The SPS generates DC power supply needed by operation of the circuit of the UPS itself. The Bypass provides a path that utility can power the output directly when the Inverter is not executed. The Maintenance Bypass provides another path that utility can power the output directly when UPS is in maintenance status. The BYP.STS and ECO.STS blocks are two static transfer switches to make sure the UPS has less or no transfer time.

4. Working Principle of the Major Functional Block

4.1 Switch Power Supply

The Switch Power Supply (SPS) supplies DC power for UPS operation. The input source of the SPS is the battery, or the output of the charger.

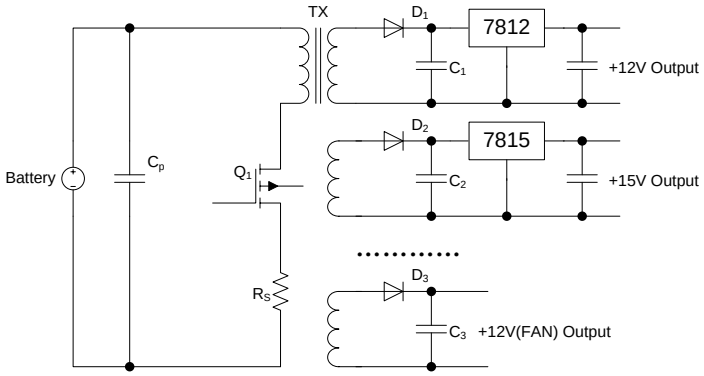


Figure 4.1 Basic circuit of power supply

Figure 4.1 is a flyback converter. When Q1 is on, all rectifier diodes (D1/D2/D3) are on open status and all output capacitors (C1/C2/C3) 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 Q1 is off, primary current will stop and all rectifier diodes (D1/D2/D3) 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, +12V, +5V, +12V(Fan), and HFPW±.

The power of ±15V, +12V, +5V supplies stable voltage to all kinds of ICs and other devices such as HCT. The +12V (Fan) is supplied to fans and relays. The HFPW± supplies a high frequency power for the switch (SCR/IGBT) driver and some other drive boards.

4.2 PFC/Booster

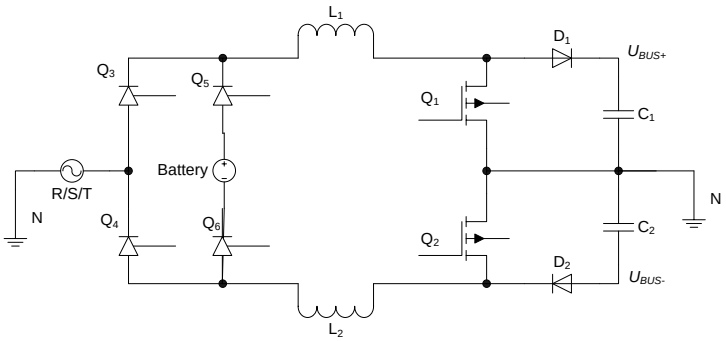


Figure 4.2 PFC/Booster

As shown in the Figure 4.2, when Q1/Q2 is on and D1/D2 is off, the current will increase to store energy in choke(L1/L2). When the Q1/Q2 is off and D1/D2 is on, the choke will release energy. Therefore, we can control the current in chokes (input current) by regulating the time of Q1/Q2 on and off. There are three independent PFC/Booster for each phase.

4.3 Inverter

The input of the half-bridge inverter topology is two DC voltages, and the output is an AC voltage, as shown in the Figure 4.3. When Q1 is on and Q2 is off, the voltage of the bridge midpoint is +BUS. When Q1 is off and Q2 is on, the voltage of the midpoint bridge is –BUS. We can get any voltage waveform between ±BUS voltage from LC filter output by regulating the duty cycle of Q1/Q2, including sine wave form.

The half-bridge inverter requires one snubber circuit to absorb the spike for security of the switches.

The Bypass output power is supplied by R phase, and there is BYP.STS and INV.STS for the transfer time requires.

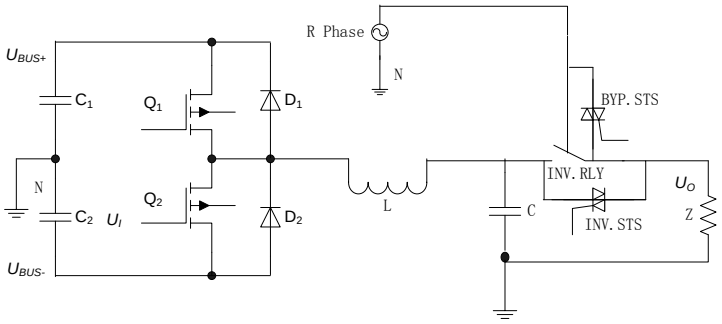


Figure 4.3 Half-bridge inverter

4.4 Charger

The function of charger is to charge and maintain the batteries at fully charged condition. The charger charges the batteries with a constant current at initial stage. At the same time, the battery voltage keeps increasing until reaching the constant charge voltage point. Then, the charge current will decrease accordingly, now it's in second stage. After one hour of constant voltage charging, the charge voltage will change to floating charge voltage, in general, the charger will control the output voltage at a constant level (13.65V±1% per battery) to optimize battery recharge time and prolong the lifetime of batteries without overcharging.

As shown in the Figure 4.4, the battery charger applies same flyback topology as the SPS.

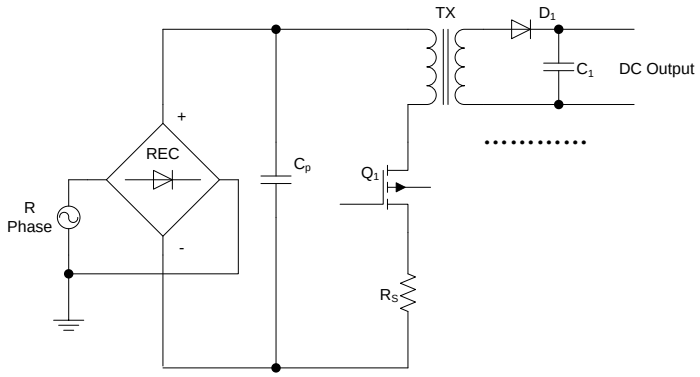


Figure 4.4 Topology of the charger

Note: There are two kinds of chargers for standard model UPS and long-run model UPS. They both apply the same principle, but there is one difference in charger output capacity. For standard model UPS, it's capable of generating 1A current. For long-run model UPS, it has maximum 4A charge current capacity.

4.5 EMI Board

Input EMI board is connected between utility and the input of rectifier. Output EMI board is connected between the output of inverter and output terminal block.

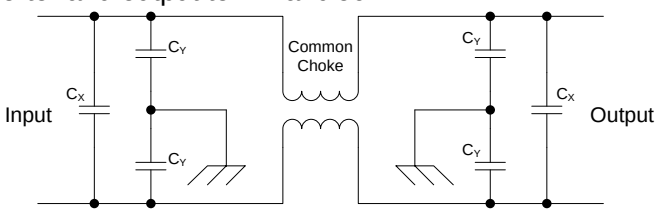


Figure 4.5 Topology of the output EMI

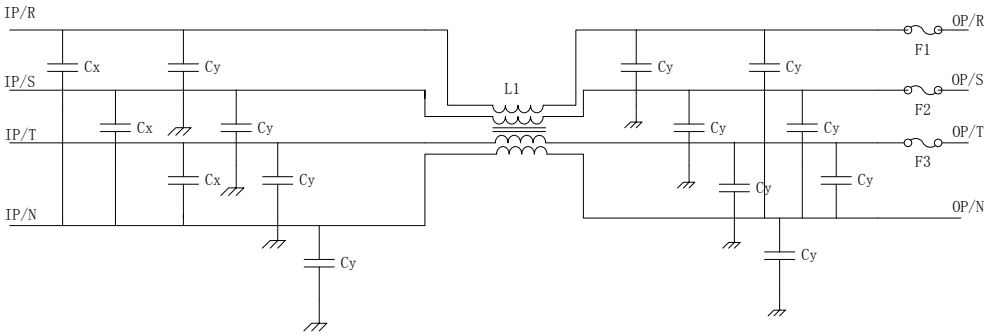


Figure 4.6 Topology of the input EMI

5. Function explanations for each PCB

Table 5.1 PCB information of Galleon 3-1 10~20k

Item	PCB Name		PCB serial number	Quantity	Remark
1	PFC	10k	A301021XXG----------	1	For 10kVA mode, just S(L2)&T(L3) phase PFC
2		15k/20k	A301060XXG----------	1	For 15K/20KVA model
3	INV	10k	A301020XXG----------	1	For 10kVA model, include R(L1) phase PFC
4		15k/20k	A300033XXG----------	1	For 15K/20KVA model
5	CNTL		A301441XXG----------	1	
6	Charger	1A	A300380XXG----------	1	For standard 10K model
7			A300233XXG----------	1	For standard 15K/20K model
8		4A	A300233XXG----------	1	For long run time 10K model
9				2	For long run time 15K/20K model
10	O/P Relay	10k	A300026XXG----------	1	Optional, for 10kVA parallel model
11		15k/20k	A300046XXG----------	1	Optional, for 15k/20KVA parallel model
12	Power Relay	10k	A300027XXG----------	1	For 10kVA model
13		15k/20k	A300047XXG----------	1	For 15k/20kVA model
14	Communication		A300245XXG----------	1	Only one of them installed on UPS
15			A300045XXG----------	1	
16	Parallel		A300059XXG----------	1	Optional, for parallel model
17	Panel		A300006XXG----------	1	
18	EMI	Line I/P	A300077XXG----------	1	For 10KVA model
19			A300034XXG----------	1	For 15k/20KVA model
20		BAT I/P	A301363XXG----------	1	For 15k/20KVA model
21		O/P	A300009XXG----------	1	For 10KVA model
22			A300046XXG----------	1	For 15k/20KVA model
23	MOV		A300048XXG----------	1	

Table 5.2 PCBA information of Galleon 3-1 30k

Item	PCBA Name		PCBA serial number	Quantity	Remark
1	PFC		A301469XXG----------	1	Phase R/S of PFC
2			A301470XXG----------	1	Phase T of PFC
3	INV		A301469XXG----------	1	Inverter 1&2
			A301468XXG----------	1	Inverter 3
4	CNTL		A301374XXG----------	1	PFC control board
			A301376XXG----------	1	INV control board
5	Connector		A300596XXG----------	1	For PFC control board
			A301014XXG----------	1	
6	Charger	4A	A300233XXG----------	1	For standard 30K model

		12A	A300233XXG----------	3	For long run time 30K model
7	O/P Relay		A300043XXG----------	3	Optional,for30Kparallel model
8	Communication		A301375XXG----------	1	
9	Parallel		A300609XXG----------	1	Optional, for parallel model
10	Panel		A300211XXG----------	1	
11	EMI	Line I/P	A300034XXG----------	1	
12		BAT I/P	A300044XXG----------	1	
13		O/P	A300036XXG----------	1	
14	MOV		A300048XXG----------	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 PFC board (Power Factor Correct Board)

The PFC board consists of Rectifier and PFC/Booster

When UPS works in line mode, the Rectifier and PFC will work, It changes the AC power to DC power stored in the BUS capacitor. When works in Battery mode, the PFC will only work as boost to get the higher DC power

5.2 INV board (Inverter Board)

The INV Board includes SPS,STS and Inverter. It supplies the power for the system, and it converts the DC power to a pure sine waveform, in the purpose of less or no transfer time, there are two STS.

5.3 CNTL board (Control Board)

The CNTL board is the core of the UPS system. It controls the actions of the semiconductors and other mechanical switches.

5.4 COMM board (Communication Board)

The COMM board is charged of display of the LED/LCD, the control of the buzzer, the communication with the computer, and other important tasks

5.5 Charger board

There are two kinds of chargers, one is for standard model with 1A charge current and the other is for long-run model with 4A charge current. But you can set the current to 2A or 1A by changing the jumper (JP1, short pin1&pin2 is 2A, short pin2&pin3 is 1A). The charge voltage is controlled by CNTL board, but it can still work without CNTL board. In this case, the output DC voltage is about 246V.

5.6 O/P Relay board

The O/P Relay board should be installed for parallel system. For single system, it must be removed.

The board can disconnect the UPS from the output (parallel system).

5.7 Power Relay board

The Power Relay board can disconnect the P1 from the output.

5.8 Communication board

The Communication board provides RS232/USB interface to the users, and it also provide one EPO port to cut off the output immediately.

5.9 Parallel board

The Parallel board is used for parallel communication when the UPS system is running in parallel mode.

5.10 Panel board

The Panel board provides LED and LCD display to the users.

5.11 EMI board

The EMI board can prevent the UPS from external electronic/magnetic noise generated by other electronic systems, and also prevent other systems from the noise generated inside of the UPS system.

5.12 MOV board

The MOV board can absorb the surge to protect the UPS system.

6. Interface

6.1 LED Display

Table 6.1 LED Display

MODE / LED	Bypass	Line	Battery	Fault
UPS Startup	●	●	●	●
No output	○	○	○	○
Bypass mode	●	○	○	○
Line mode	○	●	○	○
Battery mode	○	○	●	○
Battery test	●	●	●	○
ECO mode	●	●	○	○
CVCF mode	○	●	○	○
Fault mode	○	○	○	●

●: means LED is lighting.

○: means LED is faded.

6.2 LCD Display

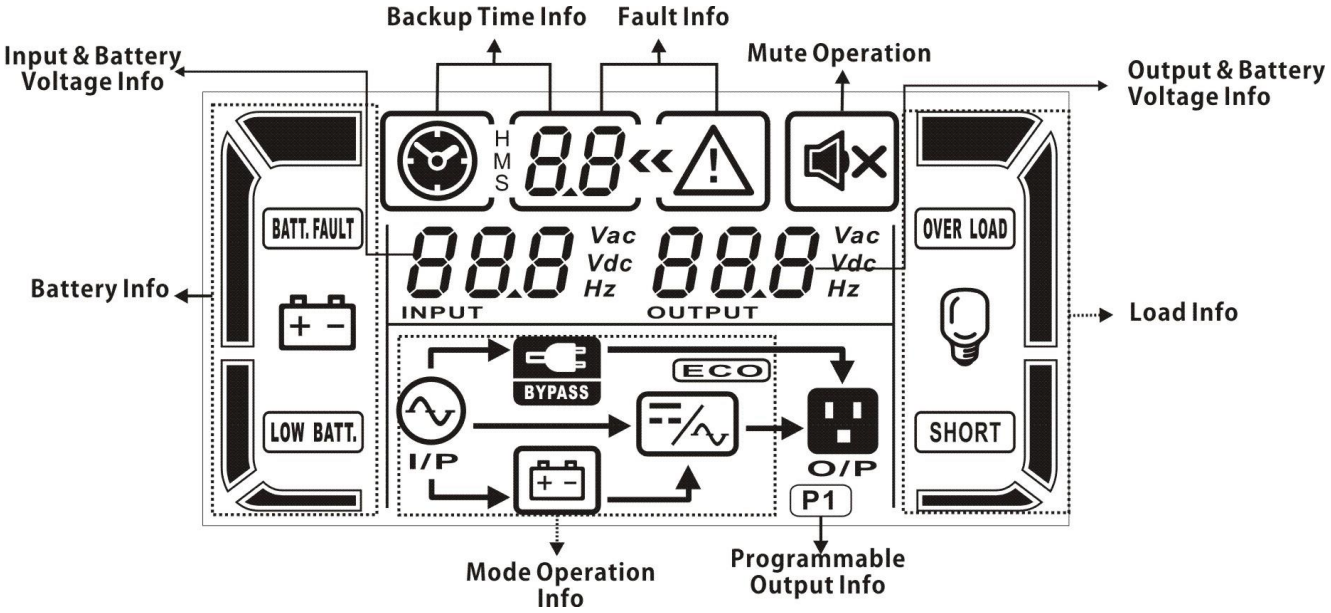
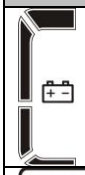


Figure 6.1 LCD Display

6.3 LCD Display Icon

Display	Function
Backup time information	
	Indicates the backup time in pie chart.
	Indicates the backup time in numbers. H: hours, M: minutes, S: seconds
Fault information	

	Indicates that the warning and fault occurs.
	Indicates the fault codes, and the codes are listed in details in section 3-9.
Mute operation	
	Indicates that the UPS alarm is disabled.
Output & Battery voltage information	
	Indicates the output voltage, frequency or battery voltage. Vac: output voltage, Vdc: battery voltage, Hz: frequency
Load information	
	Indicates the load level by 0-25%, 26-50%, 51-75%, and 76-100%.
	Indicates overload.
	Indicates the load or the output is short.
Programmable output information	
	Indicates that the programmable outputs are working.
Mode operation information	
	Indicates the UPS connects to the mains.
	Indicates the battery is working.
	Indicates the bypass circuit is working.
	Indicates the ECO mode is enabled.
	Indicates the Inverter circuit is working.
	Indicates the output is working.
Battery information	
	Indicates the Battery capacity by 0-25%, 26-50%, 51-75%, and 76-100%.
	Indicates the battery is unconnected
	Indicates low battery level and low battery voltage.
Input & Battery voltage information	
	Indicates the input voltage or frequency or battery voltage. Vac: Input voltage, Vdc: battery voltage, Hz: input frequency

7. Trouble Shooting

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

1. Check the UPS status via LED and LCD display, the sound of the buzzer and get the warning or fault code via the RS232 if possible, otherwise 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

Any warning display implies some abnormity happened to the UPS, indicating that some situation that may endanger the reliability of the UPS has occurred, but these situations don't immediately lead to interruption of power supply.

LCD icon (Flashing)	Code	Alarm	Possible cause	Action
⚠ BATT. FAULT	01	1 Beeping / second	Battery disconnected	Check the battery wiring
⚠	07	1 Beeping / second	Battery/Charger voltage too high	Check the output voltage of the battery and the charger
⚠ LOW BATT.	08	1 Beeping / second	Low battery	Check the battery voltage
⚠ OVER LOAD	09	2 Beeping / second	Over load	Check the loads
⚠ EP	0B	1 Beeping / second	EPO plug or cable not connected	Check the EPO plug and EPO cable
⚠	0A	1 Beeping / second	Fan failure	Check the fans
	0D	1 Beeping / second	high internal temperature	Check the loads, ventilation, ambient temperature
⚠	0E	1 Beeping / second	Charger broken or low output voltage	Check the charger
⚠	10	1 Beeping / second	I/P fuse broken	Check the I/P fuse

⚠	02	1 Beeping / second	Input Neutral loss	Check the input wiring
	04	1 Beeping / second	Input phase abnormal	Check the input wiring
	21	1 Beeping / second	Line input status is different in parallel system	Check the R/S/T input
	22	1 Beeping / second	Bypass status is different in parallel system	Check R phase input
	33	1 Beeping / second	Overload 3 times in 30min	Check the loads
	34	1 Beeping / second	Converter current unbalance	Check the converter
	35	1 Beeping / second	Battery fuse broken	Check the Battery fuse
	36	1 Beeping / second	Inverter inter-current unbalance	Check the inverter
	3A	1 Beeping / second	Cover of the maintain switch is open	Check the cover of the maintain switch or 2-pin black/black cable to the CN2 in 16-300076XXG---------- for 10K(CN9 in 16-300033XXG---------- for 20K)
	3B	1 Beeping / second	Phase auto adapt failure	Please check if phase sequence between three phase is correct
	3C	1 Beeping / second	Utility extremely unbalanced	There are huge gap between L1-N and L2-N,or L2-N and L3-N,or L1-N and L3-N Please check input voltage.
	3D	1 Beeping / second	Bypass unstable	Please check if bypass voltage is stable.

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

7.1.2 Trouble shooting for fault codes in LCD display

When the UPS is fault, it will transfer to Fault mode.

7.1.2.1 Fault code for 10k~20k

Code	LCD icon	Fault Event	Description	Action
01	None	BUS soft start failure	When the bus voltage can't reach the setting value in 30s, the fault signal will be displayed.	Check if power components such as IGBT and SCR for the PFC and the utility power SCR are well. Meanwhile, check if the components on the drive circuit are well.
02	None	BUS voltage high	When one of the following conditions occurs, the fault signal will be displayed. 1. +Bus voltage keeps higher than 450V or the –BUS voltage keeps lower than –450V for more than 200ms.	Maybe the PFC board is damaged; Check if power components such as IGBT and SCR for the PFC and the utility power SCR are well. Meanwhile, check if components on the drive circuit are well.
03	None	BUS voltage low	When +Bus voltage keeps lower than 300V or the –BUS voltage keeps higher than -300Vfor more than 200ms, the fault signal will be displayed.	Maybe the PFC board is damaged. Check if power components such as IGBT and SCR for the PFC and the utility power SCR are well. Meanwhile, check if components on the drive circuit are well.
04	None	BUS voltage unbalance	When the difference between the ±Bus voltage absolute value keeps more than 100 for 200ms, the fault signal will be sent.	Maybe the PFC board is damaged. Check if power components such as IGBT and SCR for the PFC and the utility power SCR are well. Meanwhile, check if components on the drive circuit are well.
06	None	Converter over current	.When the current of PFC/Boost is over 30 A(20K:60A), the fault signal will be display	Maybe the PFC board is damaged. Check if power components such as IGBT and SCR for the PFC and the utility power SCR are well. Meanwhile, check if components on the drive circuit are well.
11	None	INV soft start failure	Inverter voltage can't reach the setting value in 40s.	Check the inverter drive circuit.
12	None	INV voltage high	When INV voltage keeps higher than 276V for 400 ms, the fault signal will be displayed.	Check if power components in power INV and on the drive circuit are normal. Check if IGBT protective circuit and some PFC components are normal.
13	None	INV voltage low	When INV voltage keeps lower than 140V for 400 ms, the fault signal will be displayed.	Maybe the INV board is damaged; Check if power components in power INV and on the drive circuit are normal. Check if IGBT protective circuit and some PFC components are normal.
14	SHORT	Output short circuited	When INV output voltage keeps lower than 50V and output current keeps higher than 20A for over 4 periods, the fault signal will be displayed.	Remove all the loads. Turn off the UPS. Check whether the output of UPS and loads are short circuited. Make sure the short circuit is removed, and the UPS has no internal faults before turning on again.
1A	None	Negative power fault	When the output power on the INV terminal is over -800W(20K:-1600W) for 60ms or over -2400W(20K:-4800W) for 20ms, the fault signal will be displayed.	Check if input and output connections are correct. And then check, for 10KVA: if INV relay RY5 or STS(Q13,Q14,Q20,Q31 and their driver circuits) are OK; for 20KVA: if INV relay RY5 and RY6 or STS(Q13, Q14, Q17, Q18,Q19,Q20,Q21,Q22 and their driver circuits) are OK;
21	None	Battery SCR short circuited	When battery voltage is more than 310V for 4s, the fault signal will be displayed.	It is probably the charger or PFC board damaged. Check if the battery SCR(Q21,Q27, Q26, Q49, Q46,Q58). If PFC board is ensured ok after checking, it may indicate there is something wrong with charger output. Check if components for the battery drive signals are normal. Check circuit of the utility

				power SCR part.
24	None	INV relay short circuited	After Bus soft start completes and INV PWM is off, more than 50V INV voltage is detected, the fault signal will be displayed.	Check if INV relay RY5(for 20KVA,check RY5 and RY6) on INV board is OK.
29	None	Battery fuse broken in Battery mode	When this battery voltage is less than 7V, any other battery voltage is higher than 9V The fault signal will be displayed.	Check the Battery fuse is ok
31	None	Parallel cable failure	When the parallel communication between the UPSs is interrupted, the fault signal will be displayed.	Check the parallel cables between the UPSs are normal, and the cable between the parallel board and the control board are normal.
36	None	Current un-sharing	When sharing current is greater than 5A and sharing current is greater than 5*ILoad or the share current less than 5A and greater than the ILoad+4A in UPS parallel system, the fault signal will be displayed.	Check the share current cable are normal, and make sure the output be connected together.
41	None	over temperature	The temperature of sink is over the protection setting.	Check if UPS is overloaded, air vents are blocked, and ambient temperature is over 40℃. After overload or block is removed, please keep UPS cool down for 10 minutes before turning on again. It is not recommended to operate the UPS under over 40°C temperature environment.
43	OVER LOAD	Overload	The load is over the settings for certain time.	Check the loads and remove some non-critical loads. Check whether some loads are failed.
46	None	Incorrect UPS setting	The UPS can not identify the right model.	Check the Model Pin of the Control board is inserted correctly

7.1.2.2 Fault code for 30k

Code	LCD icon	Fault Event	Description	Action
01	None	BUS soft start failure	When the bus voltage can't reach the setting value in 30s, the fault signal will be displayed.	Check if power components such as IGBT and SCR for the PFC and the utility power SCR are well. Meanwhile, check if the components on the drive circuit are well.
02	None	BUS voltage high	When one of the following conditions occurs, the fault signal will be displayed. 1. +Bus voltage keeps higher than 450V or the –BUS voltage keeps lower than –450V for more than 200ms.	Maybe the PFC board is damaged; Check if power components such as IGBT and SCR for the PFC and the utility power SCR are well. Meanwhile, check if components on the drive circuit are well.
03	None	BUS voltage low	When +Bus voltage keeps lower than 300V or the	Maybe the PFC board is damaged. Check if power components such as IGBT

			–BUS voltage keeps higher than -300Vfor more than 200ms, the fault signal will be displayed.	and SCR for the PFC and the utility power SCR are well. Meanwhile, check if components on the drive circuit are well.
04	None	BUS voltage unbalance	When the difference between the ±Bus voltage absolute value keeps more than 100 for 200ms, the fault signal will be sent.	Maybe the PFC board is damaged. Check if power components such as IGBT and SCR for the PFC and the utility power SCR are well. Meanwhile, check if components on the drive circuit are well.
06	None	Converter over current	.When the current of PFC/Boost is over 30 A(20K:60A), the fault signal will be display	Maybe the PFC board is damaged. Check if power components such as IGBT and SCR for the PFC and the utility power SCR are well. Meanwhile, check if components on the drive circuit are well.
11	None	INV soft start failure	Inverter voltage can't reach the setting value in 40s.	Check the inverter drive circuit.
12	None	INV voltage high	When INV voltage keeps higher than 276V for 400 ms, the fault signal will be displayed.	Check if power components in power INV and on the drive circuit are normal. Check if IGBT protective circuit and some PFC components are normal.
13	None	INV voltage low	When INV voltage keeps lower than 140V for 400 ms, the fault signal will be displayed.	Maybe the INV board is damaged; Check if power components in power INV and on the drive circuit are normal. Check if IGBT protective circuit and some PFC components are normal.
14	SHORT	Inverter 1(Line to Neutral)Output short circuit	When INV 1 output voltage keeps lower than 50V and output current keeps higher than 30A(for 10K is 20A)for over 4 periods, the fault signal will be displayed.	Remove all the loads. Turn off the UPS. Check whether the output of UPS and loads are short circuited. Make sure the short circuit is removed, and the UPS has no internal faults before turning on again.
15	SHORT	Inverter 2(Line to Neutral)Output short circuit	When INV 2 output voltage keeps lower than 50V and output current keeps higher than 30A(for 10K is 20A)for over 4 periods, the fault signal will be displayed.	
16	SHORT	Inverter 3(Line to Neutral)Output short circuit	When INV 3 output voltage keeps lower than 50V and output current keeps higher than 30A(for 10K is 20A)for over 4 periods, the fault signal will be displayed.	
1A	None	Inverter 1 output negative power fault	When the output power on the INV 1 terminal is over -3000W(for 10k is -1500W) for more than 20ms or -800W(for 10k is -400W) for more than 100ms, the fault signal will be displayed	Check if input and output connections are correct. And then check if INV relay RY5 or STS(Q13, Q14, Q17,Q18 and their driver circuits) are OK. Also please check if the power feedback load connected to the UPS.

1B		Inverter 2 output negative power fault	When the output power on the INV 2 terminal is over -3000W(for 10k is -1500W) for more than 20ms or -800W(for 10k is -400W) for more than 100ms, the fault signal will be displayed	Check if input and output connections are correct. And then check if INV relay RY5 or STS(Q19, Q20, Q21,Q22 and their driver circuits) are OK. Also please check if the power feedback load connected to the UPS.
1C		Inverter 3 output negative power fault	When the output power on the INV 3 terminal is over -3000W(for 10k is -1500W) for more than 20ms or -800W(for 10k is -400W) for more than 100ms, the fault signal will be displayed	Check if input and output connections are correct. And then check if INV relay RY5 or STS(Q17, Q18, Q19,Q20 and their driver circuits) are OK. Also please check if the power feedback load connected to the UPS.
21	None	Battery SCR short circuited	When battery voltage is more than 310V for 4s, the fault signal will be displayed.	It is probably the charger or PFC board damaged. Check if the battery SCR(Q21,Q27, Q26, Q49, Q46,Q58). If PFC board is ensured ok after checking, it may indicate there is something wrong with charger output. Check if components for the battery drive signals are normal. Check circuit of the utility power SCR part.
24	None	INV relay short circuited	After Bus soft start completes and INV PWM is off, more than 50V INV voltage is detected, the fault signal will be displayed.	Check if INV relay RY5(for 20KVA,check RY5 and RY6) on INV board is OK.
29	None	Battery fuse broken in Battery mode	When this battery voltage is less than 7V, any other battery voltage is higher than 9V The fault signal will be displayed.	Check the Battery fuse is ok
31	None	Parallel cable failure	When the parallel communication between the UPSs is interrupted, the fault signal will be displayed.	Check the parallel cables between the UPSs are normal, and the cable between the parallel board and the control board are normal.
36	None	Current un-sharing	When sharing current is greater than 5A and sharing current is greater than 5*ILoad or the share current less than 5A and greater than the ILoad+4A in UPS parallel system, the fault signal will be displayed.	Check the share current cable are normal, and make sure the output be connected together.

41	None	over temperature	The temperature of sink is over the protection setting.	Check if UPS is overloaded, air vents are blocked, and ambient temperature is over 40℃. After overload or block is removed, please keep UPS cool down for 10 minutes before turning on again. It is not recommended to operate the UPS under over 40°C temperature environment.
42	DSP communication failure	DSP communication Failure	When the communication between the INV control board and the PFC control board is interrupted, the fault signal will be displayed.	Check if the 3-pin blown cable between the INV control board and the PFC control board is normal.
43	OVER LOAD	Overload	The load is over the settings for certain time.	Check the loads and remove some non-critical loads. Check whether some loads are failed.
46	None	Incorrect UPS setting	The UPS can not identify the right model.	Check the Model Pin of the Control board is inserted correctly
47	None	MCU communication Failure	When the communication between the INV control board and the COMM board is interrupted, the fault signal will be displayed.	Check if the cable between the INV control board and the COMM board is normal.
48	None	Two DSP firmware versions are incompatible	When these two DSP firmware versions are incompatible, the fault signal will be displayed	Contact the distributor or service people to replace the control board with compatible version.
49	None	Input and output phases are incpmpatible	When the UPS was set as three phase out, but detect only one phase input (Three phases are the same).	Check the input of the UPS.

7.1.3 Trouble shooting

Problem	Possible cause	Action
Battery backup time is shorten	Battery not yet been fully charged.	Keep UPS connected to utility power persistently for more than 10 hours to recharge the batteries.
	UPS overload.	Check the loads and remove some non-critical loads.
	Battery aged.	Replace the batteries.
	Charger fails	Replace the charger.
The UPS cannot power on after pressing the button	The button is not pressed and hold long enough	Press the button continuously for more than 0.5s.
	Battery is not connected or battery voltage is too low, or charger fails.	Check the charger and battery.
	UPS failure.	Repair the UPS.

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 Configuration of the Model pin and Battery number on the Control Board

The Model Port (JS2,JS3,JS5,JS6) on the CNTL board (On INV control board—A301376XXG ---------- for 30K unit) the JS should be configured as follows:

Table 7.1 Model Pin Setting List

Model Type	JS2				JS5	JS6
	Pin1&pin2	Pin3&pin4	Pin5&pin6	Pin7&pin8		
10K	1	0	0	0	0	1
10KL	1	0	0	0	0	0
15K	0	1	0	0	0	1
15KL	0	1	0	0	0	0
20K	0	0	1	0	0	1
20kL	0	0	1	0	0	0
30K	0	0	0	1	1	1
30kL	0	0	0	1	1	0

Table 7.2 Battery Number Setting List

Battery Number	JS3			
	Pin1&pin2	Pin3&pin4	Pin5&pin6	Pin7&pin8
18	1	0	0	0
19	0	1	0	0
20	0	0	1	0

Note：“1” indicates that the jumper is connected;

“0”indicates that nothing is connected,

7.2.3 Configuration of the charger current on the charger Board

The Model Port (JP1) on the Charger board should be configured as follows:

Table 7.3 Charger current Setting List

Charger Current(A)	JP1	
	Pin1&pin2	Pin2&pin3
1	0	1
2	1	0
4	0	0

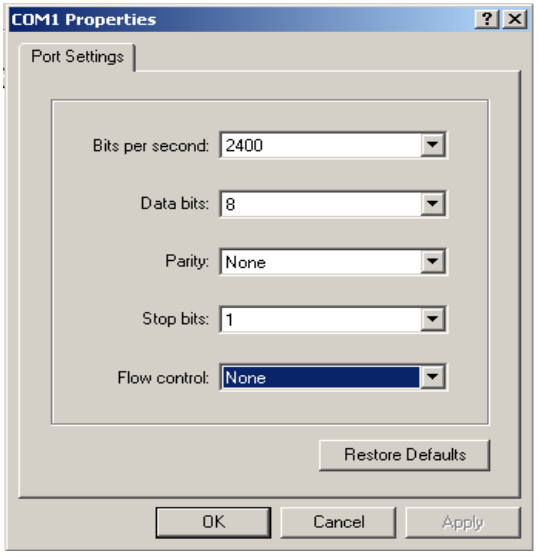
Note：“1” indicates that the jumper is connected;

“0”indicates that nothing is connected

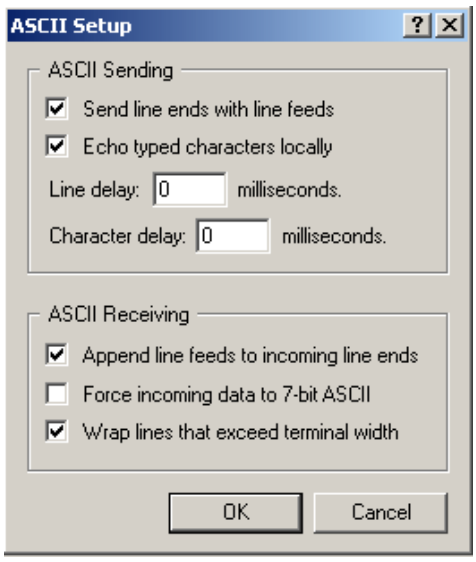
7.2.4 Regulation of the system

Parameter Setting Method:

1. Connect the RS232 port of the UPS to the RS232 port of the computer with RS232 cable. Choose the “Start>>Program>>Accessory>>Communication>>Hyper terminal” and start Hyper terminal application. Set the COM port for “COM1” and the other setting as Figure 7.1.



Communication protocol setting



Display setting

Figure 7.1 Hyper terminal setting

2. After completing the setting, you can type the command in the command area.
3. +BUS voltage regulation: Type “BUSP+/- XX” command (XX is two digits from 00 to 99). Then press the “ENTER” key, and +BUS voltage will rise (drop) about 0.1V.
4. -BUS voltage regulation: Type “BUSN+/- XX” command (XX is two digits from 00 to 99). Then press the “ENTER” key, and -BUS voltage will rise (drop) about 0.1V.
5. INV output voltage regulation: Type “V+/- XX” command (X is two digit from 00 to 99) Then press the “ENTER” key, and output voltage will rise (drop) about 0.2V.
6. INV output voltage setting: Type “VXXX” command (XXX is 208/220/230/240). Then press the “ENTER” key, and INV output voltage will be set to 208V/220V/230V/240V.

Regulation Process for Single UPS

1. BUS voltage regulation: When the UPS run into AC mode, measure ±BUS voltage with the multimeter, and then regulate ±BUS voltages to 370±0.1V by using BUS regulation command. (BUS voltage can be regulated about 0.1V every point by using BUS regulation command).

2. INV output voltage regulation: When the UPS run into the Inverter mode, measure the output voltage with the multimeter, and regulate the output voltage to 230±0.2V by using output voltage regulation command. (INV output voltage can be regulated about 0.2V every point by using output voltage regulation command).

Notes:

1. Make sure the ground of the UPS connects to earth safely during parameter regulation.
2. New assembly UPS must be regulated.
3. UPS which have been replaced CNTL/PFC/INV must be regulated again.
4. All the commands use capital letters.
5. All the above parameter regulation cannot be accumulated.
6. All the regulation will be saved in the flash memory of the CNTL when UPS shutdown with battery connected.

7.2.5 Quick Start

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

Note: Make sure that the capacitor voltage is lower than the safety voltage before disassembling any parts to do checking procedure.

10k R-PFC&INV Section

Circuit Block	Checked components	Component Type	Failure condition
DC FUSE	F4	Fuse	Open
AC FUSE	F2	Fuse	Open
Rectifier	Q17, Q18, Q21	SCR	A-K Short or open
R-PFC	D33, D35, D34, D36	Diode	Short or open
	Q24, Q25	IGBT	C-E short or open
INV	D15, D16, D17, D18	Diode	Short or open
	Q7, Q8, Q9, Q10	IGBT	C-E short or open
STS	Q13, Q14, Q20, Q31	SCR	A-K Short or open
SPS	F6	Fuse	Open
	Q6, Q44	MOSFET	D-S short or open
	D3, D4, D5, D6, D7, D8, D21	Power Diode	Short or open
	U2, U3, U4, U5	Power IC	I-O short or open
	U1	Power Control IC	Vcc short to GND
Others	Q1, Q2, Q11, Q12, Q29, Q30, Q32, Q43	MOSFET	D-S short or open

10k S&T PFC Section

Circuit Block	Checked components	Component Type	Failure condition
DC FUSE	F4,F5,F6,F7,F8	Fuse	Open
AC FUSE	F2,F3	Fuse	Open
Rectifier	Q24,Q25,Q26,Q44,Q45,Q46,Q49,Q58,Q59	SCR	A-K Short or open
PFC	D43,D44,D45,D49, D52, D53,D54,D58	Diode	Short or open
	Q32, Q52,Q43,Q55	IGBT	C-E short or open

15k/20k PFC Section

Circuit Block	Checked components	Component Type	Failure condition
Rectifier	Q17,Q18,Q21,Q27,Q24,Q25,Q26,Q49,Q44,Q45, Q46,Q58	SCR	A-K Short or open
PFC	D33, D35, D34, D36,D45,D43,D49,D44,D54,D52 D53,D58,	Diode	Short or open
	Q22, Q23,Q59,Q60,Q32,Q43,Q61,Q62,Q57,Q52 Q63,Q64	IGBT	C-E short or open

30k PFC Phase R&S Section

Circuit Block	Checked components	Component Type	Failure condition
Rectifier	Q17,Q18,Q24,Q25,Q21,Q26,Q27,Q49	SCR	A-K Short or open
PFC	D33,D35,D43,D45,D34,D36,D44,D49	Diode	Short or open
	Q22,Q23,Q29,Q32,Q37,Q38,Q42,Q43,Q44,Q45, Q46,Q47	IGBT	C-E short or open

30k PFC Phase T Section

Circuit Block	Checked components	Component Type	Failure condition
Rectifier	Q24,Q25,Q26,Q49	SCR	A-K Short or open
PFC	D43,D45,D44,D49	Diode	Short or open
	Q32,Q43,Q44,Q45,Q46,Q47	IGBT	C-E short or open

15k/20k INV Section

Circuit Block	Checked components	Component Type	Failure condition
INV	D17, D18,D34,D32	Diode	Short or open
	Q8,Q9,Q10,Q11,Q45,Q46,Q42,Q43	IGBT	C-E short or open
STS	Q13, Q14, Q17, Q18	BYPASS SCR	G-K short or open (for normal condition , A-K is 0ohm , G-K is around 40 ohm)
	Q19, Q20, Q21, Q22	ECO SCR	G-K short or open or A-K is short (for normal condition , A-K is around 440K ohm , G-K is around 40 ohm)
SPS	F6	Fuse	Open
	Q6, U14,U15	MOSFET	D-S short or open
	D3, D4, D5, D6, D7, D8,D9	Power Diode	Short or open
	U5, U6, U9, U13	Power IC	I-O short or open
	U11	Power Control IC	Vcc short to GND

Others	Q16, Q52, Q12, Q31,Q33,Q30,Q32, Q34 Q3,Q4,Q1,Q2,Q5,Q6	MOSFET	D-S short or open

30K INV 1&2 Section

Circuit Block	Checked components	Component Type	Failure condition
INV	D17, D18,D34,D32	Diode	Short or open
	Q8,Q9,Q10,Q11,Q45,Q46,Q42,Q43	IGBT	C-E short or open
STS	Q13, Q14, Q17, Q18,Q19,Q20,Q21,Q22	SCR	A-K Short or open
SPS	F6	Fuse	Open
	Q6, U14,U15	MOSFET	D-S short or open
	D3, D4, D5, D6, D7, D8,D9	Power Diode	Short or open
	U5, U6, U9, U13	Power IC	I-O short or open
	U11	Power Control IC	Vcc short to GND
Others	Q16, Q52, Q12, Q31,Q33,Q30,Q32, Q34 Q3,Q4,Q1,Q2,Q5,Q6	MOSFET	D-S short or open

30K INV 3 Section

Circuit Block	Checked components	Component Type	Failure condition
INV	D34,D32	Diode	Short or open
	Q9,Q11,Q45,Q46	IGBT	C-E short or open
STS	Q17, Q18,Q19,Q20	SCR	A-K Short or open

15k/20k EMI Section

Circuit Block	Checked components	Component Type	Failure condition
Line I/P EMI	F1,F2,F3,F4,F5,F6	Fuse	Open
BAT I/P EMI	F1,F2,F3,F4,F5,F6,F7,F8,F9,F10,F11,F12	Fuse	Open

30K EMI Section

Circuit Block	Checked components	Component Type	Failure condition
Line I/P EMI	F1,F2,F3,F4,F5,F6	Fuse	Open
BAT I/P EMI	F1,F2,F3,F4,F5,F6,F7,F8,F9,F10,F11,F12	Fuse	Open

1A /4A Charger Section

Circuit Block	Checked components	Component Type	Failure condition
DC FUSE	F2, F3, F4	Fuse	Open
AC FUSE	F1	Fuse	Open
Power Semiconductor	REC1, REC2	Rectifier Bridge	Short or open
	D3, D4, D5, D7, D8	Diode	Short or open
	Q8, Q14	MOSFET	D-S short or open
	U10	Power IC	I-O short or open
Others	Q11	MOSFET	D-S short or open
	Q15, Q16, Q7, Q10	Transistor	C-E short or open
	U1	Power Control IC	Vcc short to GND

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 UPS, you must find all failed components and replace them.

7.2.5.1 Major parameters of Rectifier and PFC section

The most likely problems occur on the Rectifier and PFC section including: open fuse, broken IGBT, broken Diode, broken SCR, and broken IGBT/SCR driver resistor. When checking PFC section, directly check the IGBT with Resistance probe or the Diode Voltage Droop probe with multimeter.

10K S&T PFC Section

Checked components		**Instrument function**	**Reference Value**	**Failed condition**
F2, F3, F4,F5,F6,F7,F8		Resistance	< 0.5 Ω	Open
Q24,Q25, Q44,Q45	(A, K)	Resistance	≈6MΩ	Short
	(G, K)	Resistance	≈33Ω	Short
Q26,Q46,Q49,Q58,Q59	(A, K)	Resistance	≈10MΩ	Short
	(G, K)	Resistance	≈33Ω	Short
R181, R178, R185,R205,R229,R226,R233,R248		Resistance	39Ω	Value change
Q32,Q43,Q52,Q57	(E, C)	Diode Voltage Droop	≈0.38V	Short or open
	(E, G)	Diode Voltage Droop	≈1.4V	Short or open
	(G, E)	Resistance	≈47.5KΩ	Short or open
D30, D31,D60,D61 (need be removed from PCB)		Diode Voltage Droop	≈0.61V	Short or open
R210,R197,R122,R129		Resistance	10Ω	Infinite or value change
R164,R163,R222,R198		Resistance	2.2Ω	
D45,D43,D52,D54		Diode Voltage Droop	≈0.38V	Short or open
D49,D44,D53,D58		Diode Voltage Droop	≈0.38V	Short or open
D68,D69,D62,D67		Diode Voltage Droop	≈0.38V	Short or open
TVS7, TVS8, TVS9, TVS10, TVS11, TVS12 TVS13, TVS14, TVS15, TVS16, TVS17, TVS18		Diode Voltage Droop	≈0.53V	Short or open

15K/20K PFC Section

Checked components		**Instrument function**	**Reference Value**	**Failed condition**
Q17, Q18, Q24,Q25,Q44,Q45	(A, K)	Resistance	≈6MΩ	Short
	(G, K)	Resistance	≈33Ω	Short
Q21,Q27, Q26,Q49, Q46,Q58	(A, K)	Resistance	≈10MΩ	Short
	(G, K)	Resistance	≈33Ω	Short
R102, R105, R116,R158,R181,R178 R185, R205, R226,R229,R233,R248		Resistance	39Ω	Value change
Q22,Q23,Q59,Q60,Q32,Q43, Q61,Q62,Q57,Q52,Q63,Q64	(E, C)	Diode Voltage Droop	≈0.38V	Short or open
	(E, G)	Diode Voltage Droop	≈1.4V	Short or open
	(G, E)	Resistance	≈25.5KΩ	Short or open
R118, R120, R122, R129,R197,R210, R251, R254, R258, R260,R264,R275		Resistance	2.2Ω	Infinite or value change
D33, D35,D43,D45,D52,D54		Diode Voltage Droop	≈0.38V	Short or open
D34, D36,D44,D49,D53,D58		Diode Voltage Droop	≈0.38V	Short or open
D69,D70,D71,D72,D73,D74		Diode Voltage Droop	≈0.38V	Short or open

TVS1, TVS2, TVS3, TVS4, TVS5, TVS6 TVS7, TVS8, TVS9, TVS10, TVS11, TVS12 TVS13, TVS14, TVS15, TVS16, TVS17, TVS18	Diode Voltage Droop	≈0.53V	Short or open

30K PFC Phase R&S Section

Checked components		**Instrument function**	**Reference Value**	**Failed condition**
Q17, Q18, Q24,Q25	(A, K)	Resistance	≈6MΩ	Short
	(G, K)	Resistance	≈33Ω	Short
Q21,Q27, Q26,Q49	(A, K)	Resistance	≈10MΩ	Short
	(G, K)	Resistance	≈33Ω	Short
R103,R111,R116,R158,R178,R181,R185, R205,		Resistance	39Ω	Value change
Q22,Q23,Q29,Q32,Q37,Q38. Q42,Q43,Q44,Q45,Q46,Q47	(E, C)	Diode Voltage Droop	≈0.38V	Short or open
	(E, G)	Diode Voltage Droop	≈1.4V	Short or open
	(G, E)	Resistance	≈17KΩ	Short or open
R118,R120,R182,R190,R196,R197,R198,R206 ,R209,R213,R216,R217		Resistance	10Ω	Infinite or value change
R162,R164,R174,R176,R189,R195,R200,R203 ,R208,R211,R214,R215		Resistance	2.2Ω	
D33, D35,D43,D45		Diode Voltage Droop	≈0.38V	Short or open
D34, D36,D44,D49		Diode Voltage Droop	≈0.38V	Short or open
D69,D70,D71,D72		Diode Voltage Droop	≈0.38V	Short or open
TVS1, TVS2, TVS3, TVS4, TVS5, TVS6 TVS7, TVS8, TVS9, TVS10, TVS11, TVS12		Diode Voltage Droop	≈0.53V	Short or open

30k PFC Phase T Section

Checked components		**Instrument function**	**Reference Value**	**Failed condition**
Q24,Q25	(A, K)	Resistance	≈6MΩ	Short
	(G, K)	Resistance	≈33Ω	Short
Q26,Q49	(A, K)	Resistance	≈10MΩ	Short
	(G, K)	Resistance	≈33Ω	Short
R178,R181,R185, R205		Resistance	39Ω	Value change
Q32, Q43,Q44,Q45,Q46,Q47	(E, C)	Diode Voltage Droop	≈0.38V	Short or open
	(E, G)	Diode Voltage Droop	≈1.4V	Short or open
	(G, E)	Resistance	≈17KΩ	Short or open
R190,R206,R209,R213,R216,R217		Resistance	10Ω	Infinite or value change
R164, R189, R208,R211,R214,R215		Resistance	2.2Ω	
D43,D45		Diode Voltage Droop	≈0.38V	Short or open
D44,D49		Diode Voltage Droop	≈0.38V	Short or open
D71,D72		Diode Voltage Droop	≈0.38V	Short or open
TVS7, TVS8, TVS9, TVS10, TVS11, TVS12		Diode Voltage Droop	≈0.53V	Short or open

Note: If IGBT/SCR is OK, but the parameter is not close to the reference value, it is very possible that

the corresponding driver is damaged, so please try to change the IGBT driver component.

7.2.5.2 Major parameters of Inverter and STS section

The most likely problems occur on the INV section including broken IGBT, broken Diode, broken SCR, damaged IGBT/SCR driver resistor, damaged relative snubber circuit with broken IGBT/SCR, and stuck output relay.

10K R-PFC&INV Section

Checked components		**Instrument function**	**Reference Value**	**Failed Condition**
F2, F4		Resistance	< 0.5 Ω	Open
Q17, Q18,		(A, K)	Resistance	≈6MΩ
		(G, K)	Resistance	≈33Ω
Q19		(A, K)	Resistance	≈10MΩ
		(G, K)	Resistance	≈33Ω
R103, R111, R116		Resistance	39Ω	Value change
Q24, Q25		(E, C)	Diode Voltage Droop	≈0.38V
		(E, G)	Diode Voltage Droop	≈1.4V
		(G, E)	Resistance	≈47.5KΩ
D29, D30 (need be removed from PCB)		Diode Voltage Droop	≈0.61V	Short or open
R122, R126		Resistance	10Ω	Infinite or value change
R159, R163		Resistance	2.2Ω	
D33, D35		Diode Voltage Droop	≈0.38V	Short or open
D34, D36		Diode Voltage Droop	≈0.38V	Short or open
D49, D50		Diode Voltage Droop	≈0.38V	Short or open
TVS1, TVS2, TVS3, TVS4, TVS5, TVS6		Diode Voltage Droop	≈0.53V	Short or open
Q7, Q8, Q9, Q10	(E, C)	Diode Voltage Droop	≈0.38V	Short or open
	(E, G)	Diode Voltage Droop	≈1.4V	Short or open
	(G, E)	Resistance	25.5KΩ	Short or open
D22, D23, D24, D25 (need be removed from PCB)		Diode Voltage Droop	≈0.61V	Short or open
R45, R46, R52, R53		Resistance	22Ω for 40N120 IGBT 10Ω for 40B120U IGBT	Infinite or value change
R47, R48, R54, R55		Resistance	62Ω for 40N120 IGBT 36Ω for 40B120U IGBT	Infinite or value change
D15, D16		Diode Voltage Droop	≈0.38V	Short or open Not install when use 40N120 IGBT
D17, D18		Diode Voltage Droop	≈0.38V	Short or open
Q13, Q14	(A, K)	Resistance	≈0(Short by the INV.RLY)	---
	(G, K)	Resistance	≈33Ω	Short
Q20, Q31	(A, K)	Resistance	≈6MΩ	Short
	(G, K)	Resistance	≈33Ω	Short

15K/20K INV Section

Checked components		**Instrument function**	**Reference Value**	**Failed Condition**
Q9, Q10,Q11,Q12,	(E, C)	Diode Voltage Droop	≈0.38V	Short or open

Q42,Q43,Q45,Q46	(E, G)	Diode Voltage Droop	≈1.4V	Short or open
	(G, E)	Resistance	25.5KΩ	Short or open
D22, D23, D24, D25 D26,.D27,.D28,.D31 (need be removed from PCB)		Diode Voltage Droop	≈0.61V	Short or open
R45, R46, R52, R53, R131,R137,R124,R127		Resistance	22Ω	Infinite or value change
R47, R48, R54, R55 R125,R130,R123,R129		Resistance	62Ω	Infinite or value change
D17, D18,D32,D34		Diode Voltage Droop	≈0.38V	Short or open
Q13, Q14,Q17,Q18	(A, K)	Resistance	≈0(Short by the INV.RLY)	----
	(G, K)	Resistance	≈33Ω	Short
Q19,Q20,Q21,Q22	(A, K)	Resistance	≈6MΩ	Short
	(G, K)	Resistance	≈33Ω	Short

30K INV Section

Checked components		**Instrument function**	**Reference Value**	**Failed Condition**
Q9, Q10,Q11,Q12, Q42,Q43,Q45,Q46	(E, C)	Diode Voltage Droop	≈0.38V	Short or open
	(E, G)	Diode Voltage Droop	≈1.4V	Short or open
	(G, E)	Resistance	25.5KΩ	Short or open
D22, D23, D24, D25 D26,.D27,.D28,.D31 (need be removed from PCB)		Diode Voltage Droop	≈0.61V	Short or open
R45, R46, R52, R53, R131,R137,R124,R127		Resistance	22Ω	Infinite or value change
R47, R48, R54, R55 R125,R130,R123,R129		Resistance	62Ω	Infinite or value change
D17, D18,D32,D34		Diode Voltage Droop	≈0.38V	Short or open
Q13, Q14,Q17,Q18	(A, K)	Resistance	≈0(Short by the INV.RLY)	----
	(G, K)	Resistance	≈33Ω	Short
Q19,Q20,Q21,Q22	(A, K)	Resistance	≈6MΩ	Short
	(G, K)	Resistance	≈33Ω	Short

Note: If IGBT/SCR is OK, but the parameter is not close to the reference value, it is very possible that the corresponding driver is damaged, so please try to change the IGBT driver component.

7.2.5.3 Major parameters of SPS section

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

10K SPS Section

Checked components		**Instrument function**	**Reference Value**	**Failed Condition**
F6		Resistance	< 0.5 Ω	Open
Q6	(S, D)	Diode Voltage Droop	≈0.53V	Short or open
	(S, G)	Diode Voltage Droop	≈0.68V	Short or open
	(G, S)	Resistance	≈47.5KΩ	Short or open

R25		Resistance	≈47Ω	Infinite or value change
D3, D4, D5, D6, D7, D8, D21		Diode Voltage Droop	≈0.53V	Short or open
Q44	(D, S)	Resistance	≈282KΩ	Short
	(G, S)	Resistance	≈1KΩ	Short
U2, U3, U4, U5		Diode Voltage Droop	≈0.6V	Short
U1		Resistance	≈76.4KΩ	Short

15K/20K SPS Section

Checked components		**Instrument function**	**Reference Value**	**Failed Condition**
F6		Resistance	< 0.5 Ω	Open
Q6	(S, D)	Diode Voltage Droop	≈0.53V	Short or open
	(S, G)	Diode Voltage Droop	≈0.68V	Short or open
	(G, S)	Resistance	≈47.5KΩ	Short or open
R25		Resistance	≈47Ω	Infinite or value change
D4, D5, D6, D7, D8, D9		Diode Voltage Droop	≈0.53V	Short or open
U14,U15	(D, S)	Resistance	≈282KΩ	Short
	(G, S)	Resistance	≈500Ω	Short
U5, U6, U9, U13		Diode Voltage Droop	≈0.6V	Short
U11		Resistance	≈76.4KΩ	Short

30K SPS Section

Checked components		**Instrument function**	**Reference Value**	**Failed Condition**
F6		Resistance	< 0.5 Ω	Open
Q6	(S, D)	Diode Voltage Droop	≈0.53V	Short or open
	(S, G)	Diode Voltage Droop	≈0.68V	Short or open
	(G, S)	Resistance	≈47.5KΩ	Short or open
R25		Resistance	≈47Ω	Infinite or value change
D4, D5, D6, D7, D8, D9		Diode Voltage Droop	≈0.53V	Short or open
U14,U15	(D, S)	Resistance	≈282KΩ	Short
	(G, S)	Resistance	≈500Ω	Short
U5, U6, U9, U13		Diode Voltage Droop	≈0.6V	Short
U11		Resistance	≈76.4KΩ	Short

7.2.5.4 Major parameters of 1A Charger

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

Checked components		**Instrument function**	**Reference Value**	**Failed condition**
F1.F2.F3.F4		Resistance	<0.5Ω	Open
Q14	(S, D)	Diode Voltage Droop	≈0.46V	Short or open
	(G, S)	Diode Voltage Droop	≈1.7V	Short or open
	(S, G)	Diode Voltage Droop	≈1.05V	Short or open
	(G, D)	Diode Voltage Droop	≈2.1V	Short or open
	(G, S)	Resistance	≈47KΩ	Short or open
R87		Resistance	≈3Ω	Infinite or value change

D11 (need be removed from PCB)		Diode Voltage Droop	≈0.61V	Short or open
Q8	(S, D)	Diode Voltage Droop	≈0.43V	Short or open
	(G, S)	Diode Voltage Droop	≈0.67V	Short or open
	(S, G)	Diode Voltage Droop	≈1.0V	
	(G, D)	Diode Voltage Droop	≈1.1V	
	(G, S)	Resistance	≈10KΩ	Short or open
REC1, REC2	(+,~)	Diode Voltage Droop	≈0.54V	Short or open
	(~,-)	Diode Voltage Droop	≈0.54V	Short or open
D3, D4, D5, D7, D8		Diode	≈0.3~0.5V	Short or open
Q15, Q16, Q7, Q10	(C, E)	Diode Voltage Droop	≈1.0V	Short or open
	(B, E)	Diode Voltage Droop	≈0.67V	Short or open
Q11	(S, D)	Diode Voltage Droop	≈0.67V	Short or open
	(S, G)	Diode Voltage Droop	≈0.7V	Short or open
U1	(Vcc, GND)	Resistance	≈82 KΩ	Short

7.2.5.5 Major parameters of 4A Charger

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

Checked components		**Instrument function**	**Reference Value**	**Failed condition**
F1.F2.F3.F4		Resistance	<0.5Ω	Open
Q13, Q14	(S, D)	Diode Voltage Droop	≈0.46V	Short or open
	(G, S)	Diode Voltage Droop	≈1.7V	Short or open
	(S, G)	Diode Voltage Droop	≈1.05V	Short or open
	(G, D)	Diode Voltage Droop	≈2.1V	Short or open
	(G, S)	Resistance	≈23.5KΩ	Short or open
R85, R87		Resistance	≈3Ω	Infinite or value change
D10, D11 (need be removed from PCB)		Diode Voltage Droop	≈0.61V	Short or open
Q8	(S, D)	Diode Voltage Droop	≈0.43V	Short or open
	(G, S)	Diode Voltage Droop	≈0.67V	Short or open
	(S, G)	Diode Voltage Droop	≈1.0V	
	(G, D)	Diode Voltage Droop	≈1.1V	
	(G, S)	Resistance	≈10KΩ	Short or open
REC1, REC2	(+,~)	Diode Voltage Droop	≈0.52V	Short or open
	(~,-)	Diode Voltage Droop	≈0.52V	Short or open
D3, D4, D5, D7, D8		Diode	≈0.3~0.5V	Short or open
Q15, Q16, Q7, Q10	(C, E)	Diode Voltage Droop	≈1.0V	Short or open
	(B, E)	Diode Voltage Droop	≈0.67V	Short or open
Q11	(S, D)	Diode Voltage Droop	≈0.67V	Short or open
	(S, G)	Diode Voltage Droop	≈0.7V	Short or open
U1	(Vcc, GND)	Resistance	≈82 KΩ	Short

8. How To Start UPS Safely After Repairing or Replacing PSDR Board

When the PCBA board is reinstalled after repairing or replacing a new one, it is more secure for UPS that input source, no matter DC source or Ac source, has some protection function such as current limitation or power limitation in case the board is damaged again if it still has some potential defects. Here, to lower this risk, we utilize internal charger(please make sure the output current jumper is configured with 4A for 4A-charger, and for 1A charger its version should be equal or higher than A30004002G----------), which has power limitation function, to simulate DC source to start UPS, referring the following SOP, if everything is fine and almost same with the following specific data, then the board repaired or replaced is fine, otherwise, please recheck it according to some suggestion we provide as below .

8.1 Start 10K(L) and 20K(L) unit safely

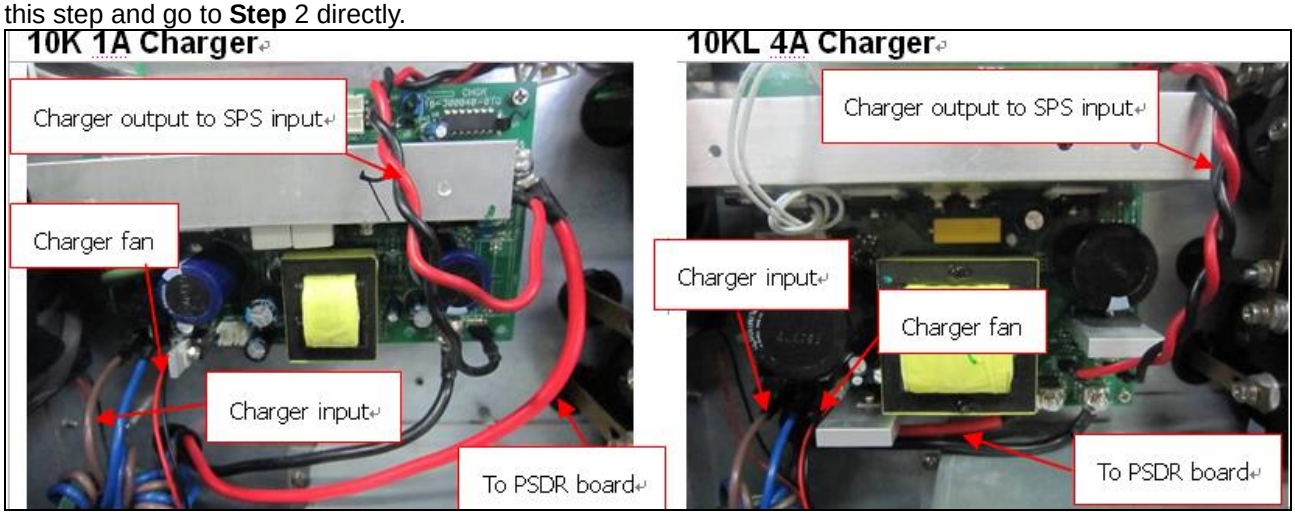
Notes:

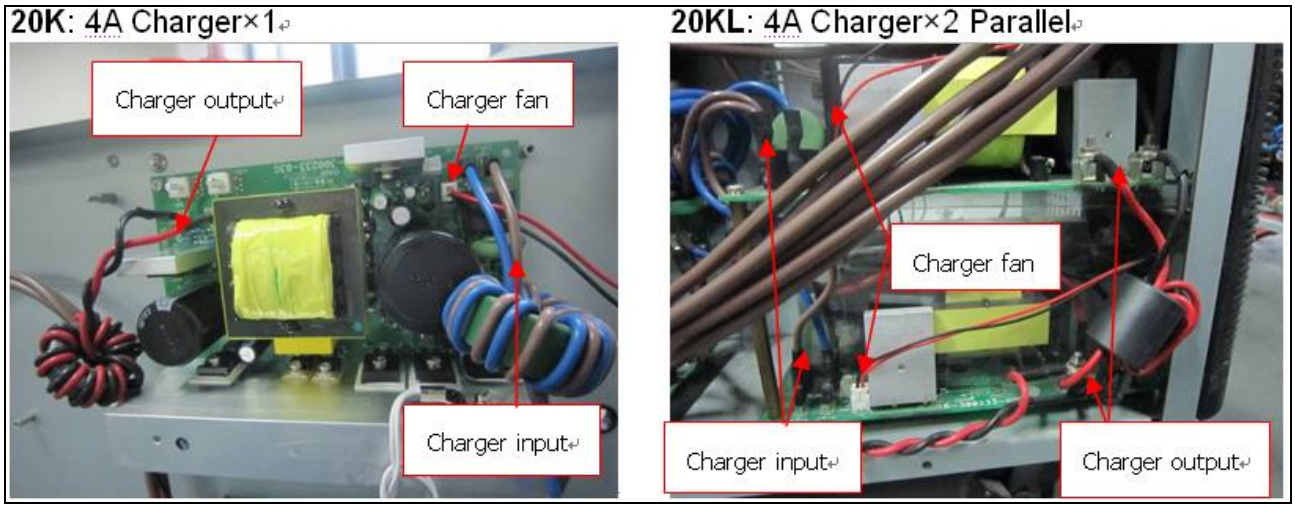
This operating SOP is made base on 10K standard model and 20KL long run model, As Galleon 10K and 10KL almost have the same frame structure and cabinet, so for 10KL long run model, please refer this 10K standard model operating SOP. By the same token, for 20K standard model, please refer 20KL long run model operating SOP also.

Before starting any operation, please disconnect battery input no matter for standard or long run model due to its potential electricity risk.

Section 1: Install and test Charger to make sure charger could work fine, here, charger's function is equal to battery.

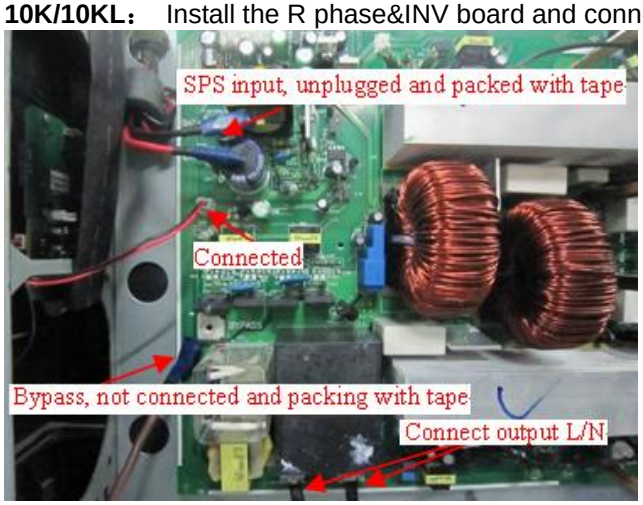
Step1: Install charger and connect wires. If charger has been installed in cabinet originally, please ignore this step and go to **Step** 2 directly.



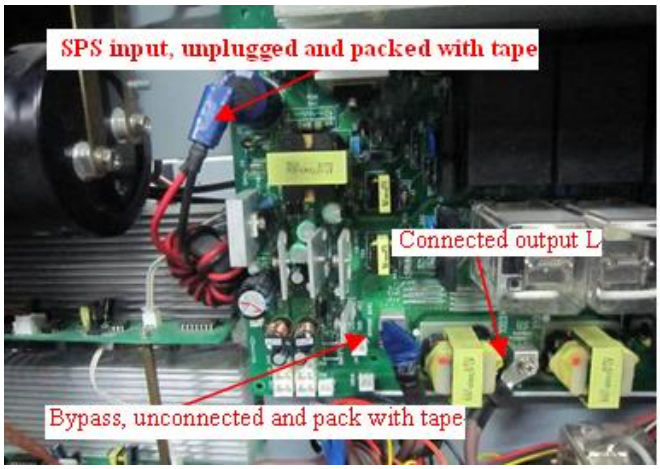


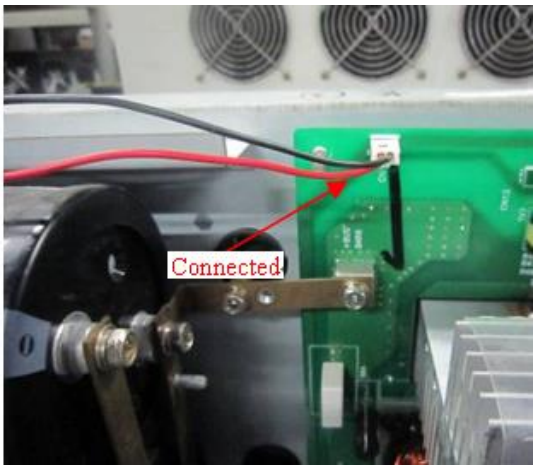
Step2: Install PSDR board repaired or completely new spare part and connect related wires, although some wires are not necessary for charger testing here, but doing it at this section for later section testing:

10K/10KL： Install the R phase&INV board and connect some cables



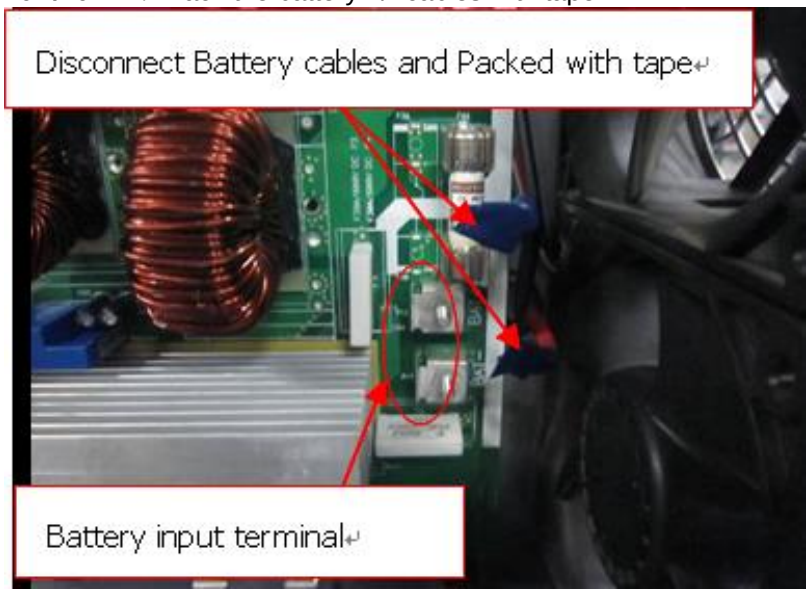
20K/20KL： Install the INV board



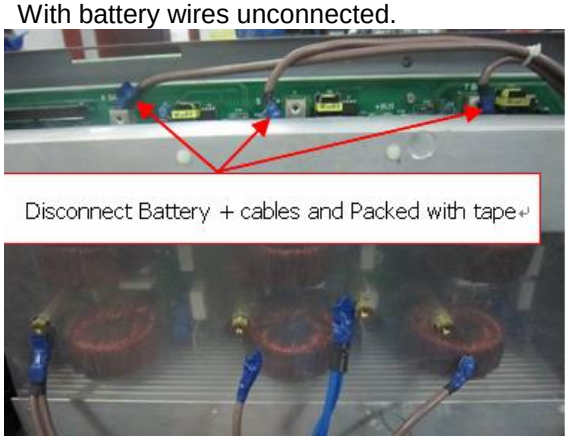


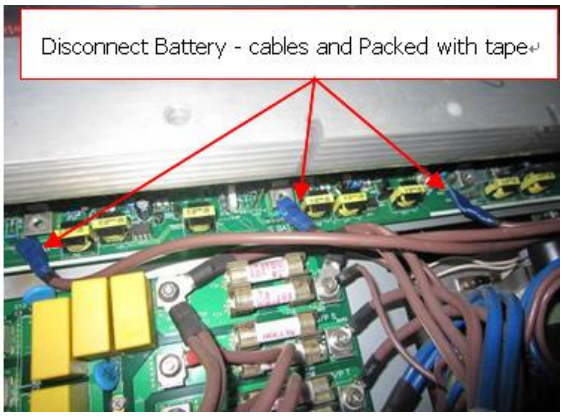
Step3: Disconnect battery wire with PSDR board, pack the battery +/- cables with tape.

10K/10KL ： Pack the battery +/- cables with tape



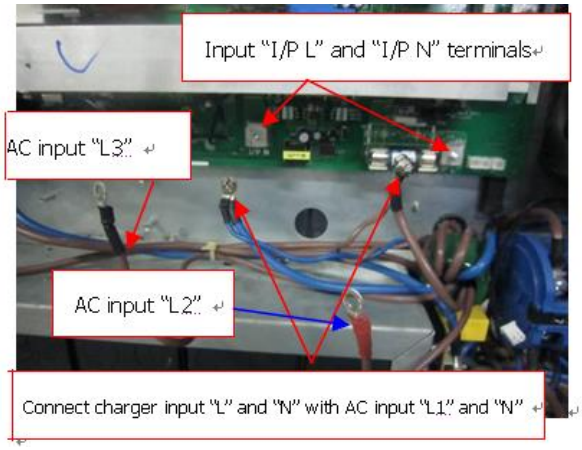
20K/20KL：Install the PFC board
With battery wires unconnected.

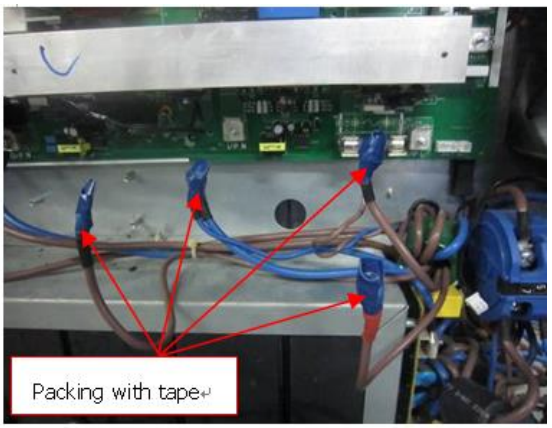




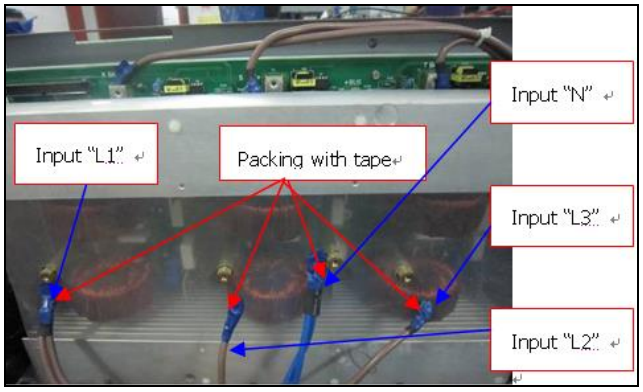
Step4: Disconnect utility input with PSDR, but connect charger input with utility L1/ N outside PSDR board and pack with tape in case of electricity risk as below;

10K/10KL



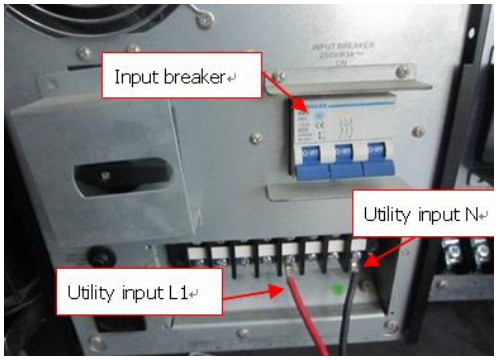


20K/20KL

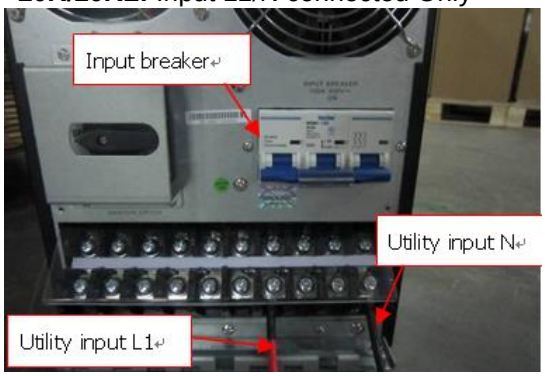


Step5: Check charger output voltage

10K/10KL： Input L1/N connected Only

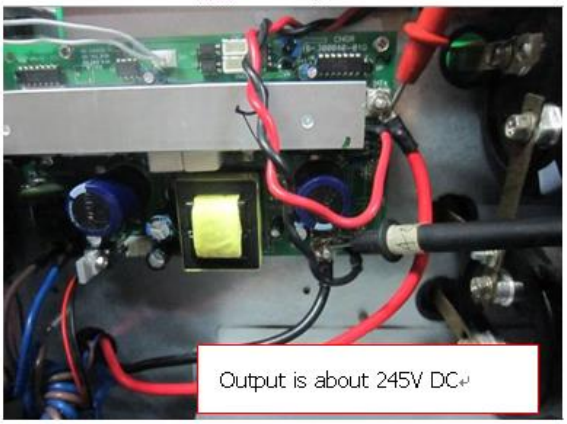


20K/20KL: Input L1/N connected Only

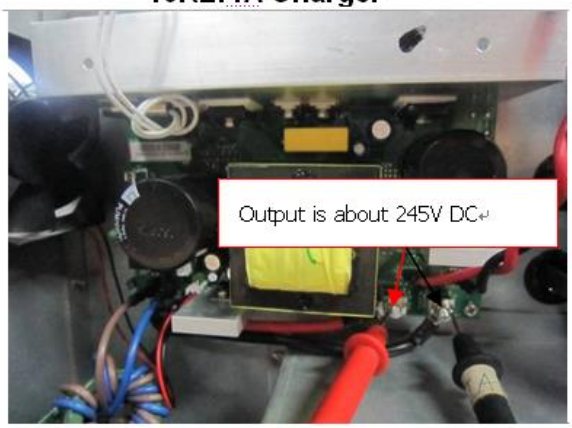


Step6: If normal, Charger fan rotates and charger's output voltage is about 245V DC. If not, please check the charger

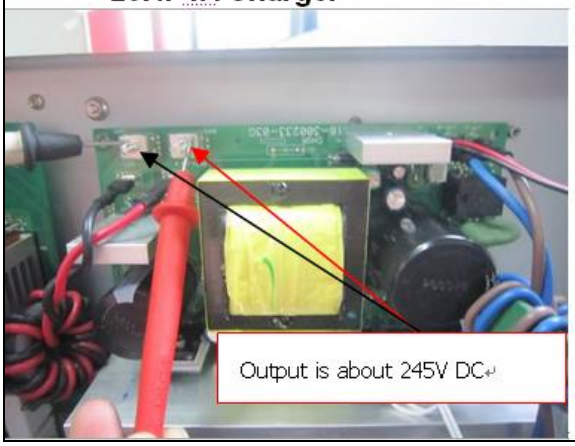
10K：1A Charger



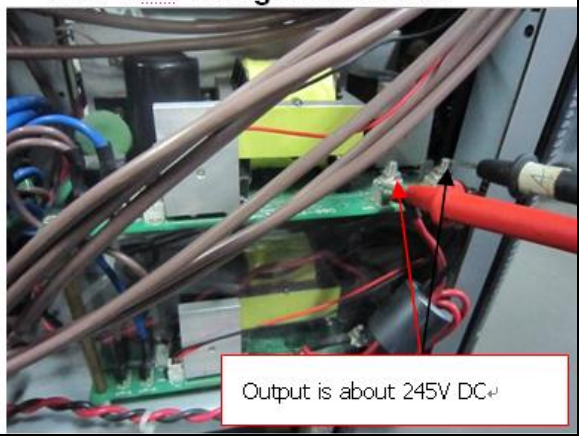
10KL:4A Charger



20K: 4A Charger



20KL: 4A Charger×2 Parallel

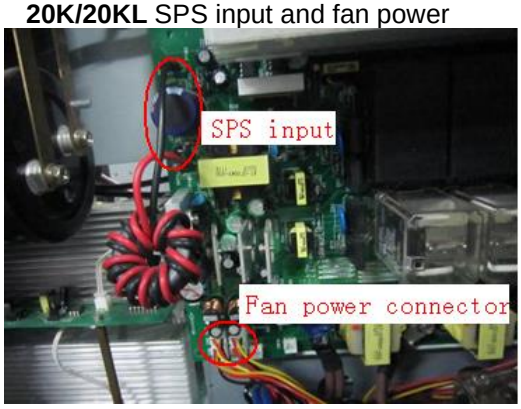


Section 2：SPS checking: It is very important for control board, please test SPS as the following procedure:

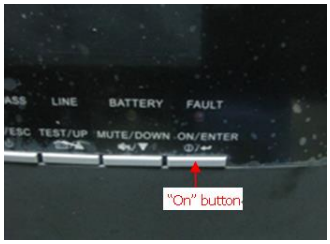
1. Turning off input breaker, connecting charger output to SPS input and plugged fan power wires into The corresponding terminal, then Turning on input breaker, Check if the SPS input is about 245V DC, if not, please check the SPS input cable.

10K/10KL SPS input and fan power

20K/20KL SPS input and fan power

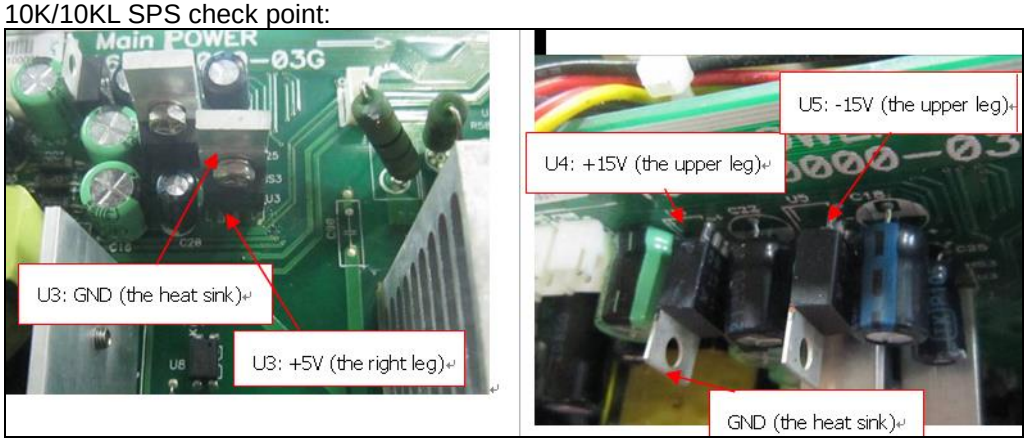


2. Press “ON” Button to start SPS

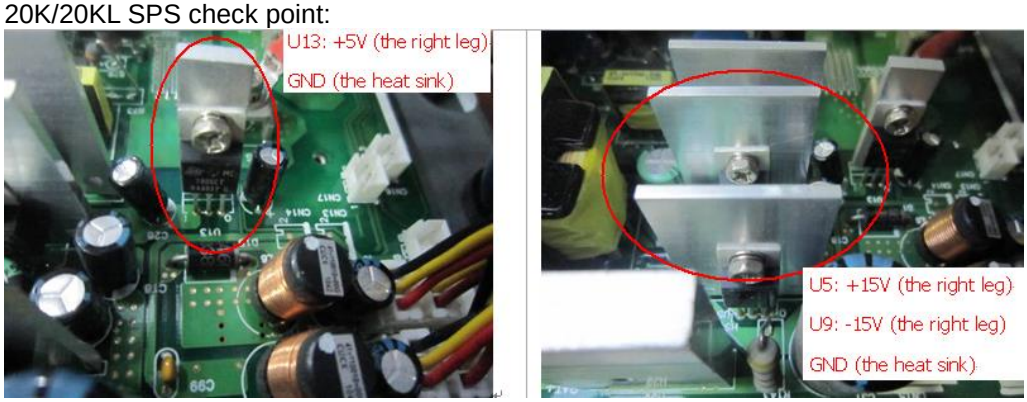


3. When SPS is started, the Fans wouldn’t rotate because the fan power needs a signal to drive from control board but control board was not installed in this step. **To confirm whether the SPS is normal or not， please check if the following voltage is right: for 10K/10KL, U4 output should be +15V DC, U5 output should be -15V DC, U3 output should be +5V; for 20K/20KL, U5 output should be +15V DC, U9 output should be -15V DC, U13 output should be + 5V.** If not, SPS part is abnormal, please check and repair it.

10K/10KL SPS check point:



20K/20KL SPS check point:



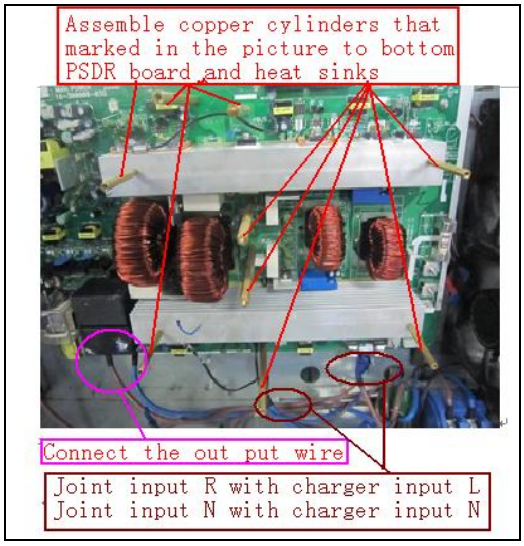
Section 3：Turn on the UPS in battery mode to check if DC-DC BOOST and INVERTER can work normally, here we use the charger inside the UPS as a DC source. This will more safe because the charger will limit it output.

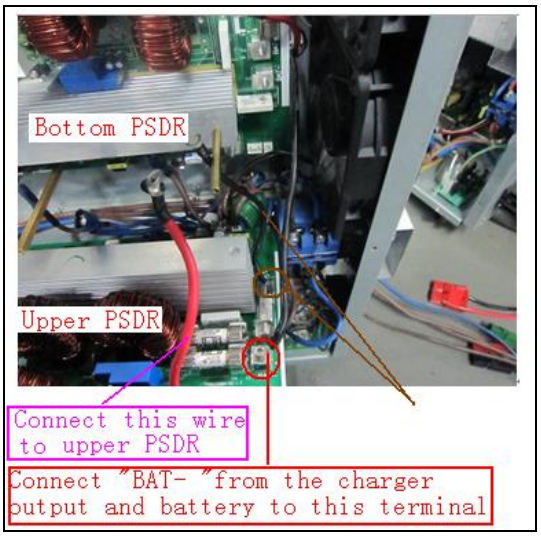
1. Turn off input breaker.
2. For 10k/10KL, Install the upper PSDR board; for 20k/20KL, please skip this step.
3. Install control board, communication board and connect related wires, **please make sure all signal cables are connected in right way.**
4. **Please do not plug that three pins control wire first which connects control board with charger board, otherwise the control board will shutdown charger and UPS can not start up.**
5. **For 10k standard model, due to the fact that 1A charger could provide very limited power, around 240W,so please unplug the power wires of fans for PSDR board to make sure ups could be started up successfully**. **For 10KL/20K/20KL, it is unnecessary to unplug the fan power in this step.**
6. Turn on input breaker, Press “ON” button for less than 0.5s, the LCD will be lit , confirm if the battery voltage displaying on LCD is same as actual value(between 240-245V DC). If everything above is ok, press the “ON” button for more than 0.5s and starting UPS.
7. Please measure BUS voltage and output voltage as below picture, if everything is same with the showing result, then UPS succeed in starting and is running in battery mode.

Step1: (For 10K/10kL only) Install the upper PFC board （S and T phase PFC）

Install the upper PFC board and connect some wires (battery input and output wire) and some cable to PSDR board, keep the AC input wiree unconnected, but join input L with charger inputL, join input N with charger input N.

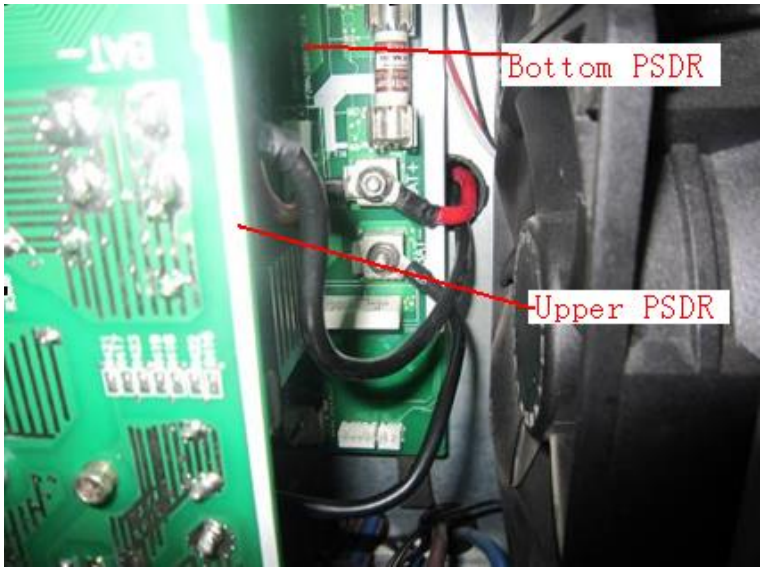
10K/10KL

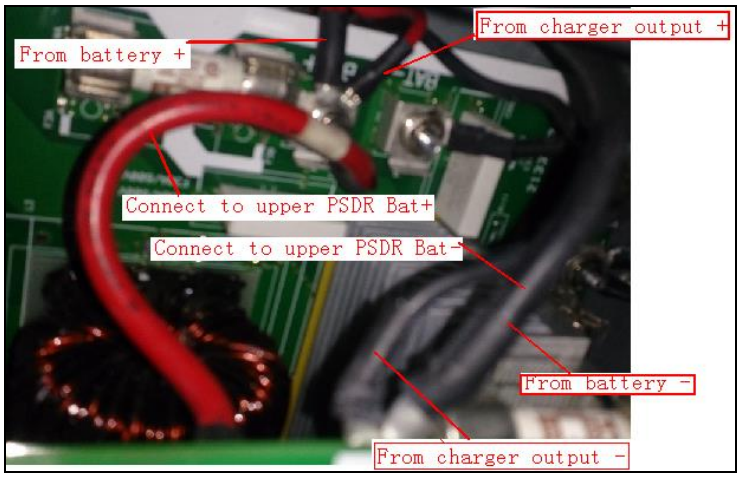




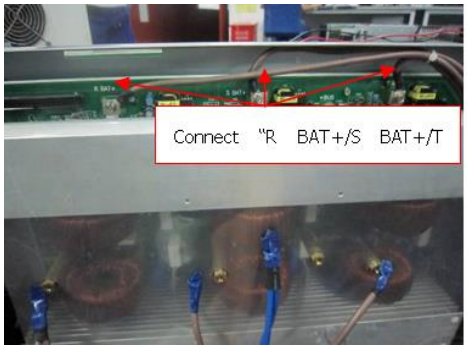
Step2: Screw battery input cables to PSDR board

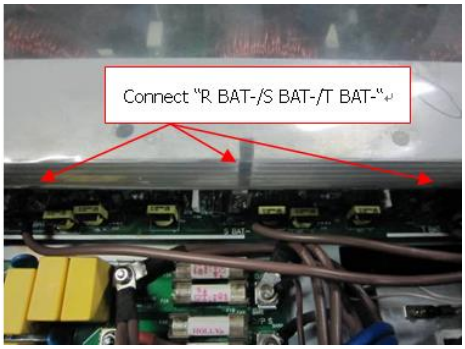
10K/10KL





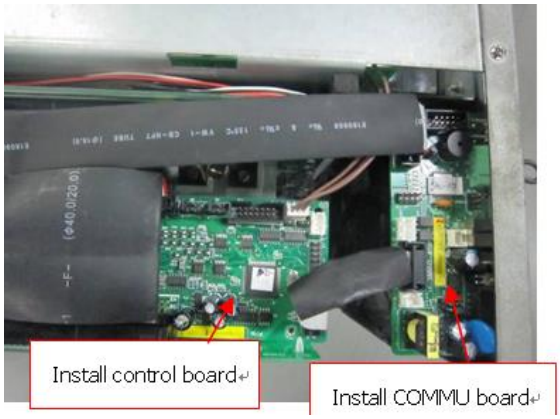
20K/20KL

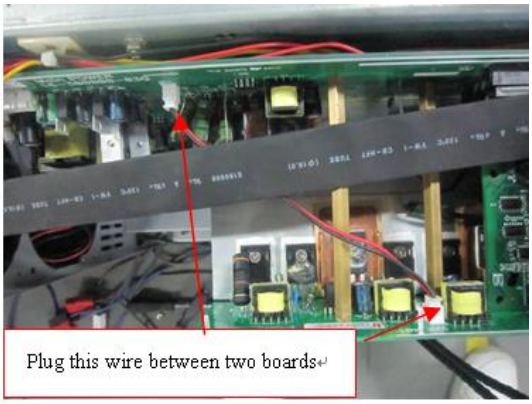




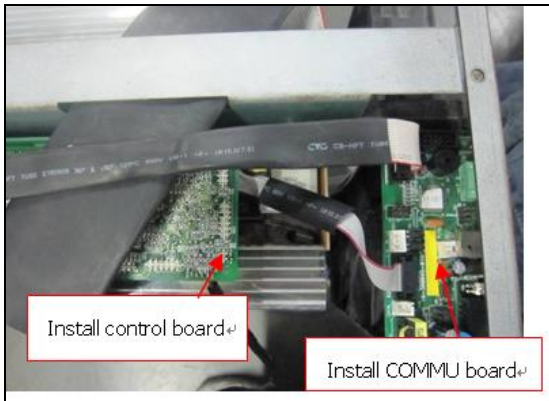
Step3: Install control board and communication board

10K/10KL





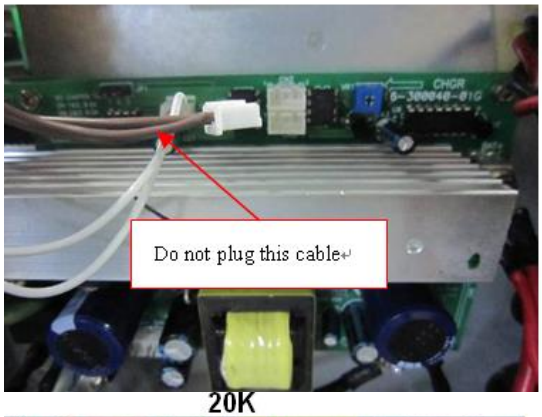
20K/20KL



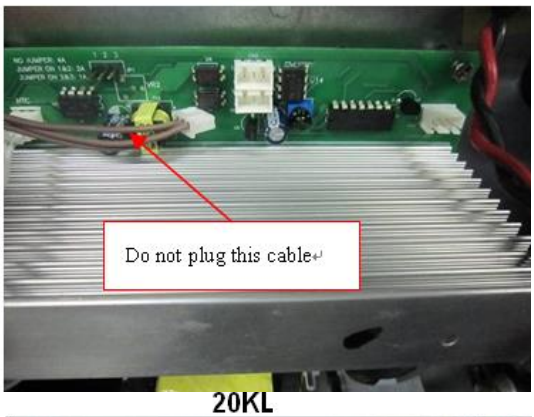
Plugged this 2pin wires which from Micro switch into "CN9" of INV board

Step4：Do not connect this three pins cable which is from control board to charger board

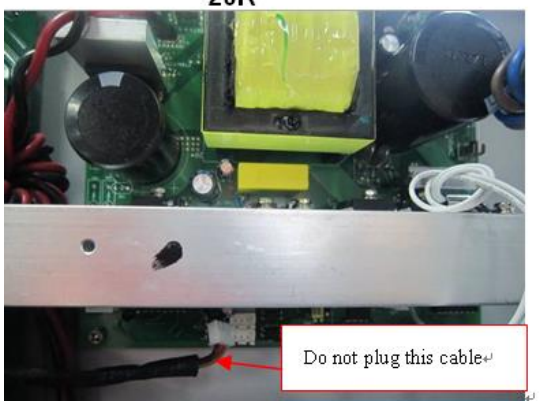
10K：1A Charger



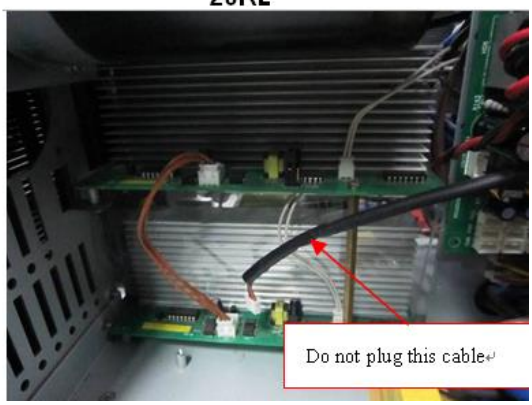
10KL: 4A Charger



20K

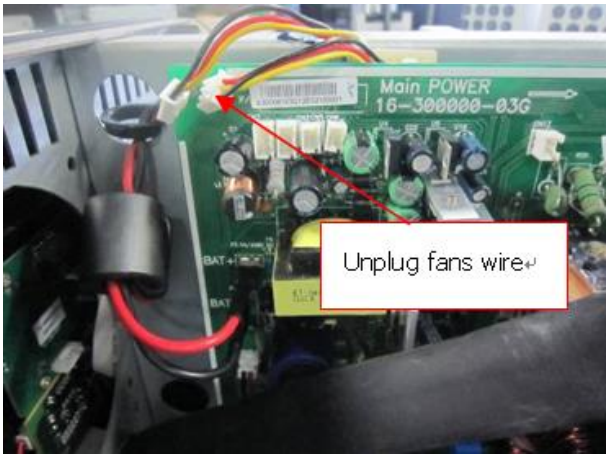


20KL



Step5： Unplug the fans power wires for 10K standard module with 1A charger inside; but for 10KL/20K/20KL, please ignore this step and goto step6 directly

For 10K standard model, as the 1A charger only can provide about 240w power, so you should unplug fans power wire to make sure ups could be started up successfully. If 10K standard model is still installed with 4A charger inside, then you don't need to removw the fan power.



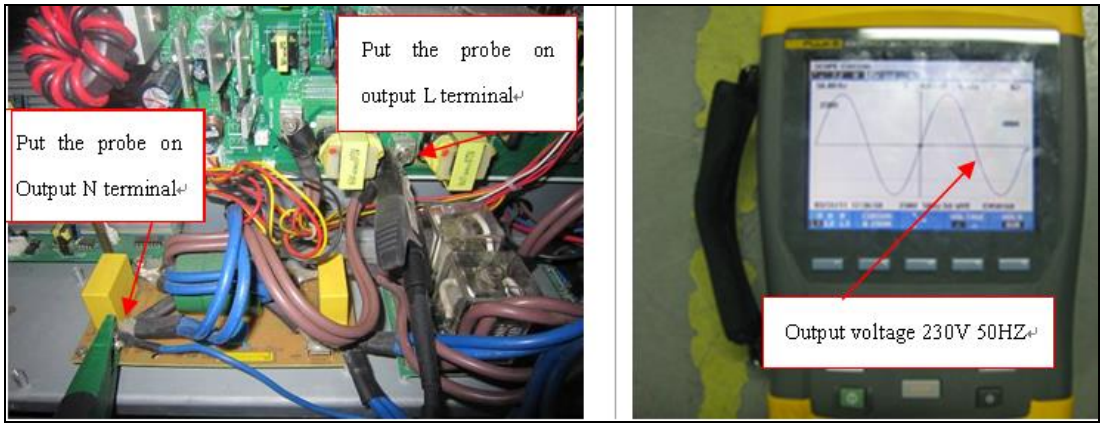
Step6: Turn on input breaker and turn on the UPS, the UPS will work in battery mode, if it normal.

Step7： Verify +/- BUS voltage on the bus capacitors or bus capacitor board, for 230V output, the BUS voltage should be 370V DC，otherwise please check detection circuit of BUS voltage on PSDR

Step 8： Check the output voltage, if the voltage is not 230V, please check detection circuit of INV voltage on PSDR.

10K/10KL

20K/20KL

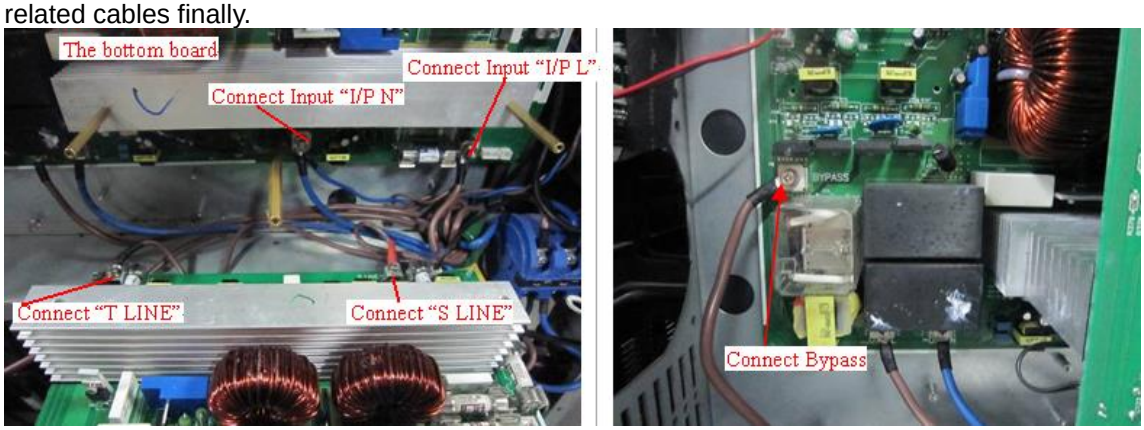


Section 4：Turn on the UPS in line mode to check if RECTIFIER can work fine.

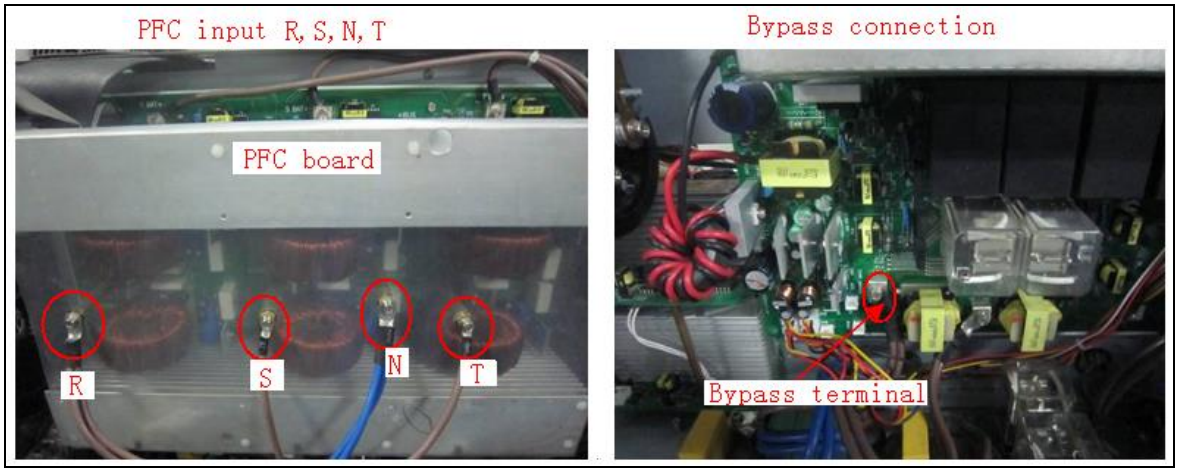
1. Turn off the UPS and turn off input breaker. **Connect AC input cable back to terminal on PSDR**
2. **Plug that three pins control wire from control board to charger board shown as below photos.**
3. Turn on input breaker, then press “ON” button for more than 0.5s, the UPS is starting in line mode. Measuring and checking BUS voltage, output voltage as same as above **Section 3.**

Step1: Connect back input input wire to PFC (rectifer section)

10K/10KL In this step, you have to disassemble the upper PSDR board (before you disassemble the upper PSDR board, please discharge +/-BUS voltage first) to screw input “I/P” and “I/N” of the bottom PSDR board and screw “S LINE” and “T LINE” of the upper PSDR board. Then, re-assemble the upper PSDR board and the control board and the communication board, and connecting related cables finally.

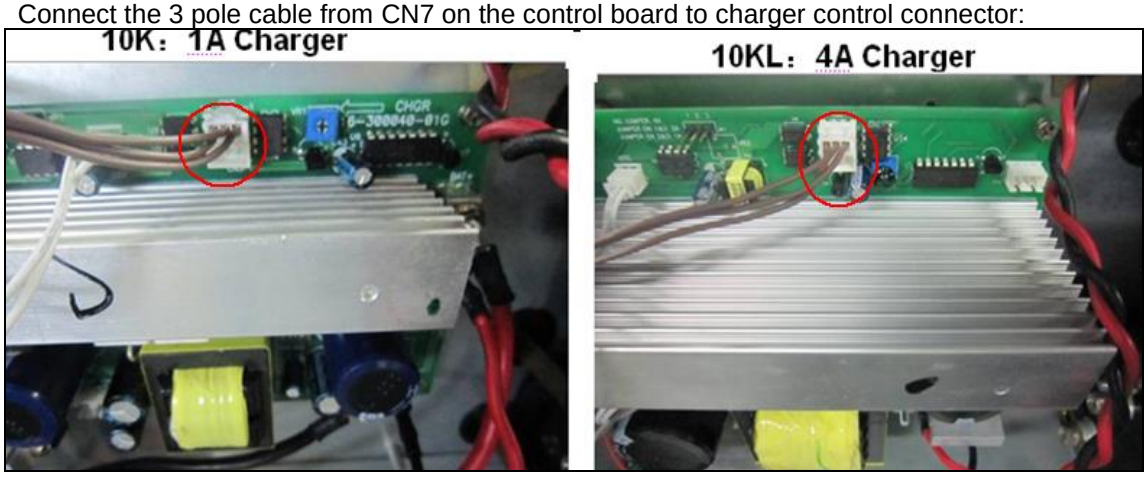


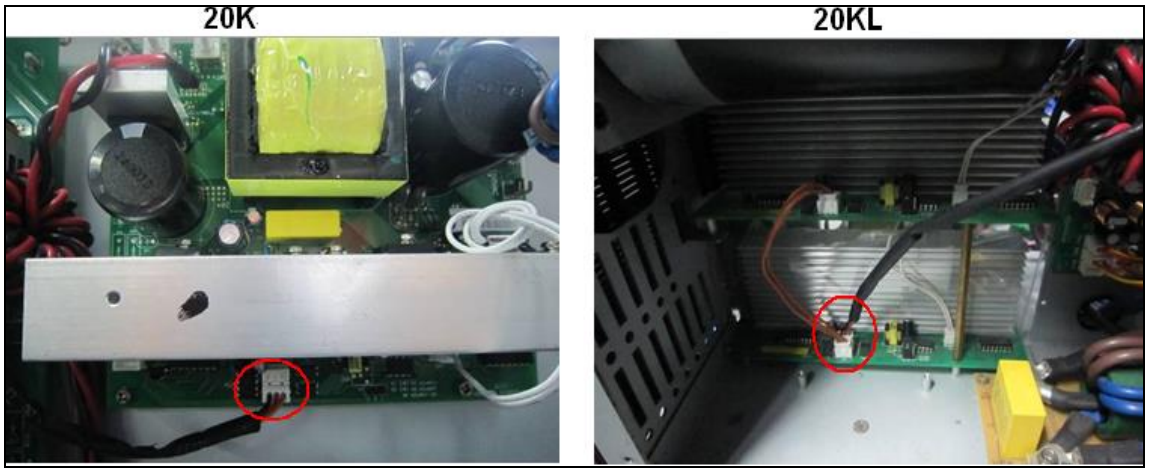
20K/20KL



Step 2: Connect charger control cable

Connect the 3 pole cable from CN7 on the control board to charger control connector:





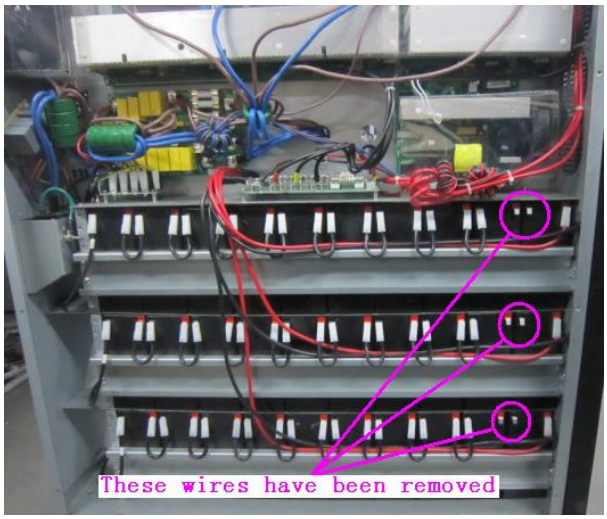
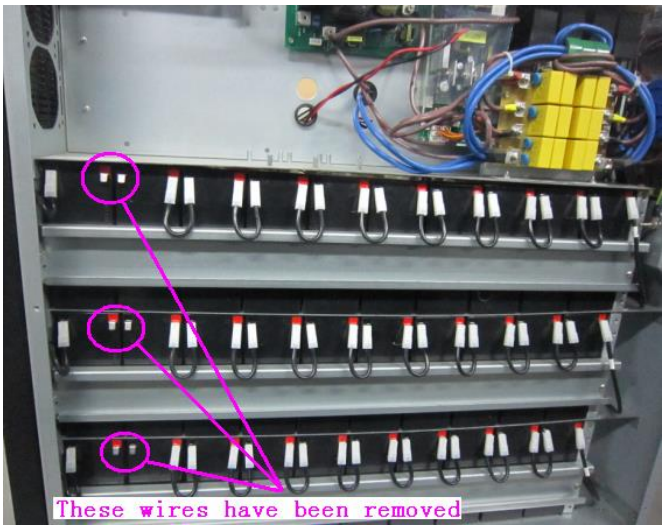
Step 3: Connect all input wires.

Step 4： Turn on input breaker and turn on the UPS by press ON button, check whether the UPS can work normally in on line mode

If UPS passed all above testing, that means all the parts are fine, then please connect the battery back to UPS, install related ventilation paper, put cover back finally, whole testing is over by now.

8.2 Start 30K(L) unit safely

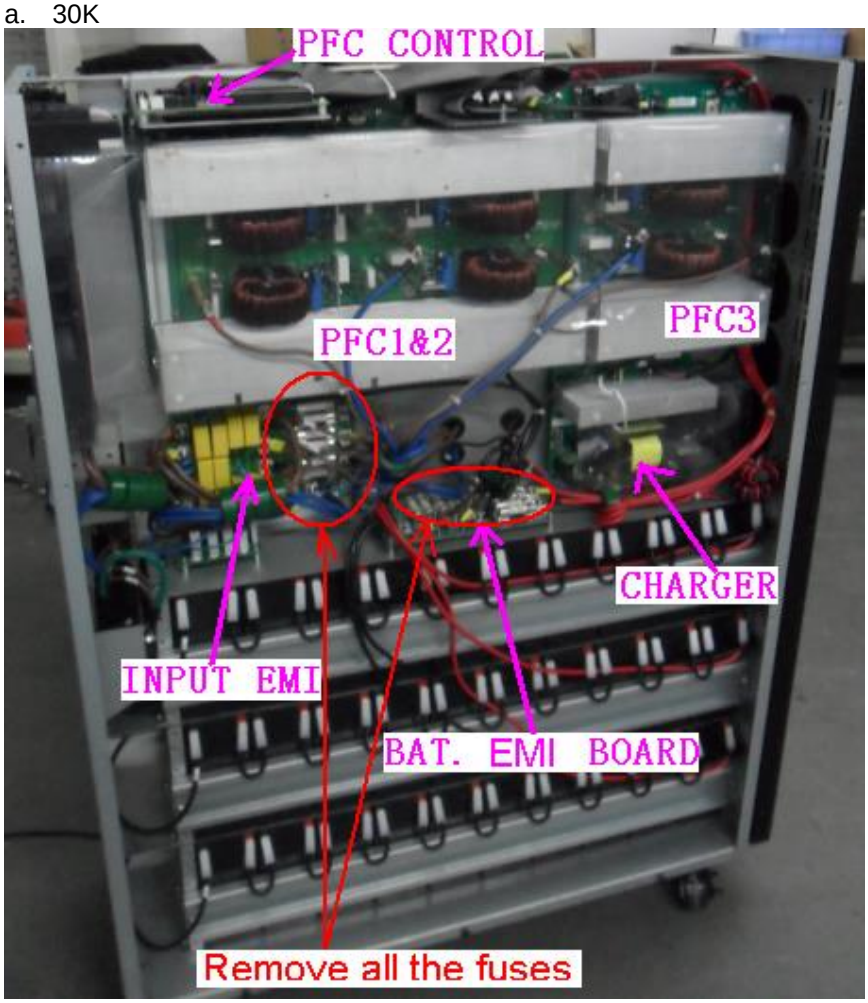
Before starting any operation, please disconnect battery input no matter for standard or long run model due to its potential electricity risk. The following pictures showing how to disconnect inside batteries for 30K unit.

Left view	Right view
	

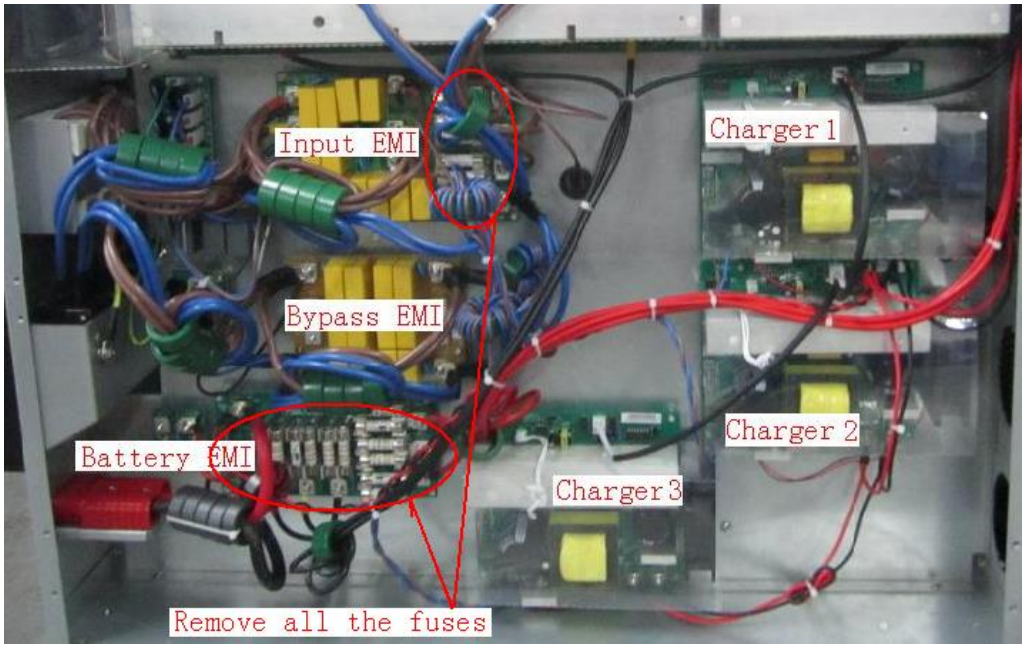
8.2.1 Test Chargers to make sure they could work fine.

Step1: Remove all the fuses on the input EMI board and battery EMI board:+

a. 30K

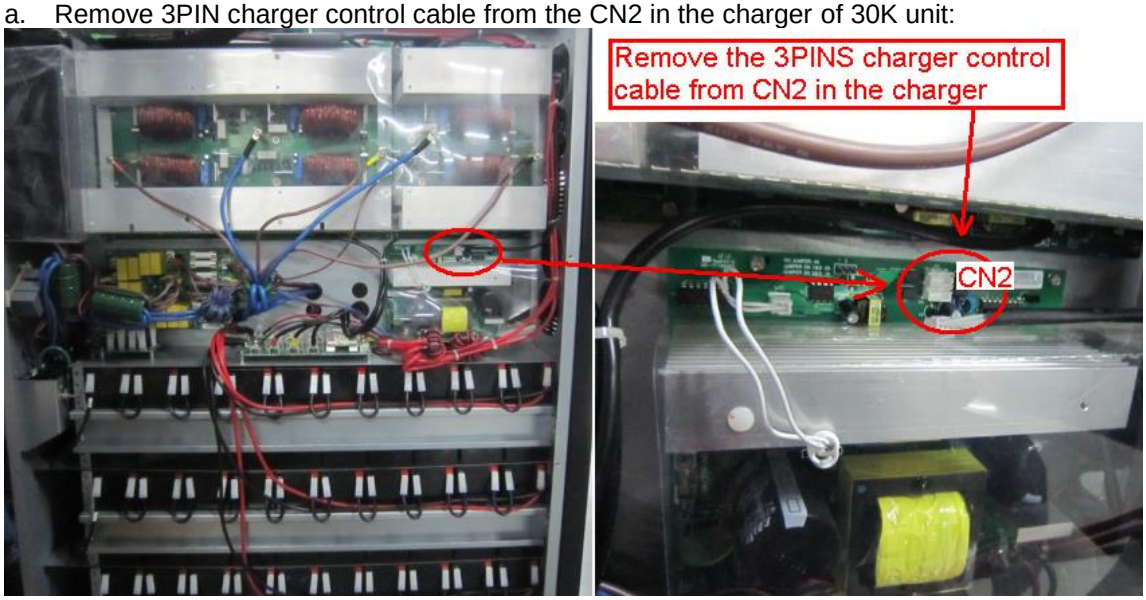


b. 30KL

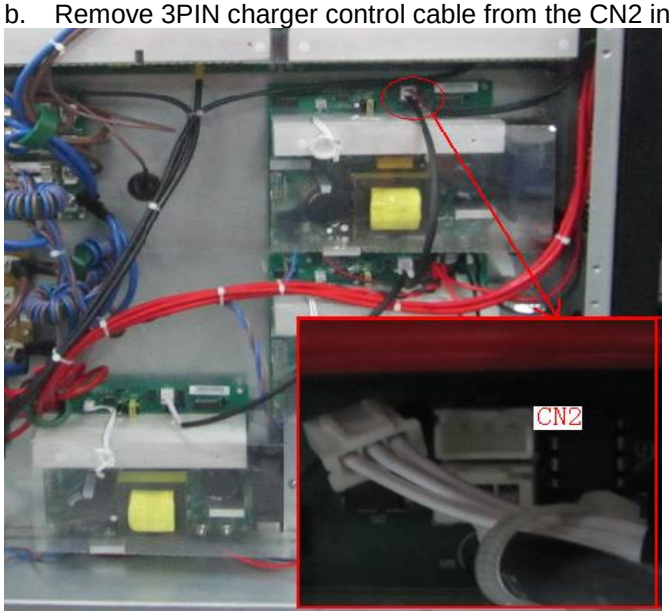


Step2: Remove 3PIN charger control cable.

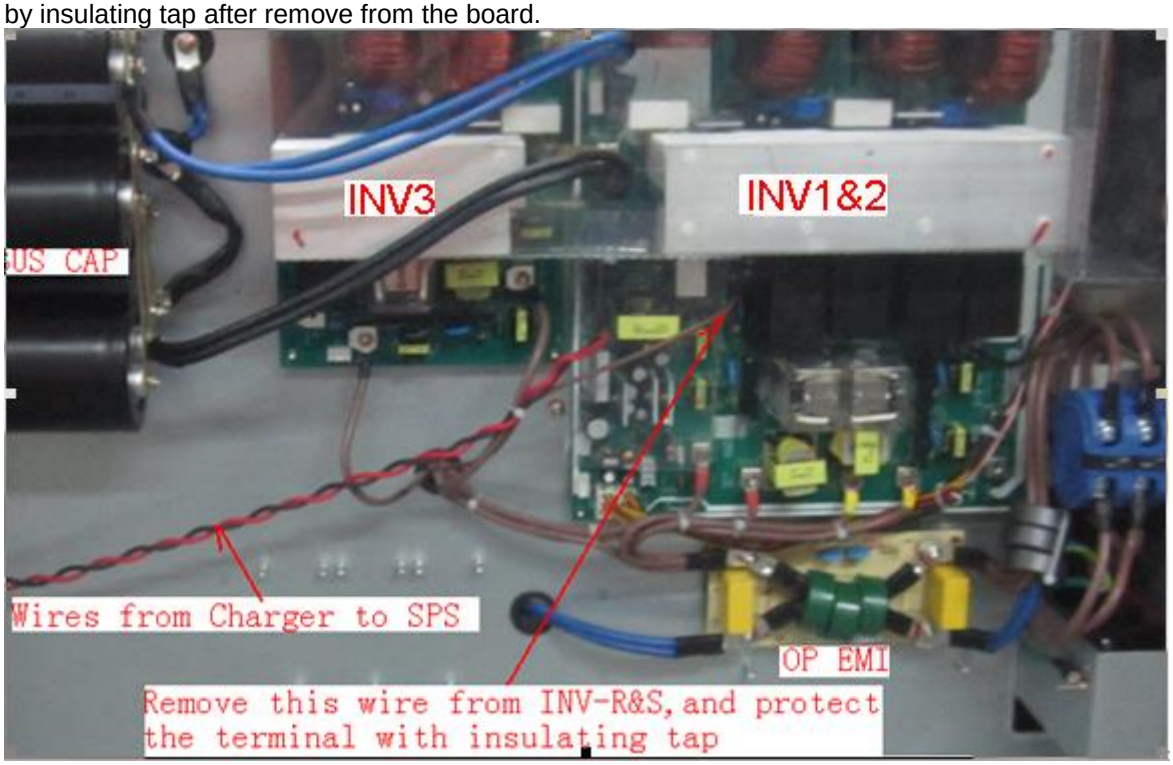
a. Remove 3PIN charger control cable from the CN2 in the charger of 30K unit:



b. Remove 3PIN charger control cable from the CN2 in charger1 of 30KL unit:

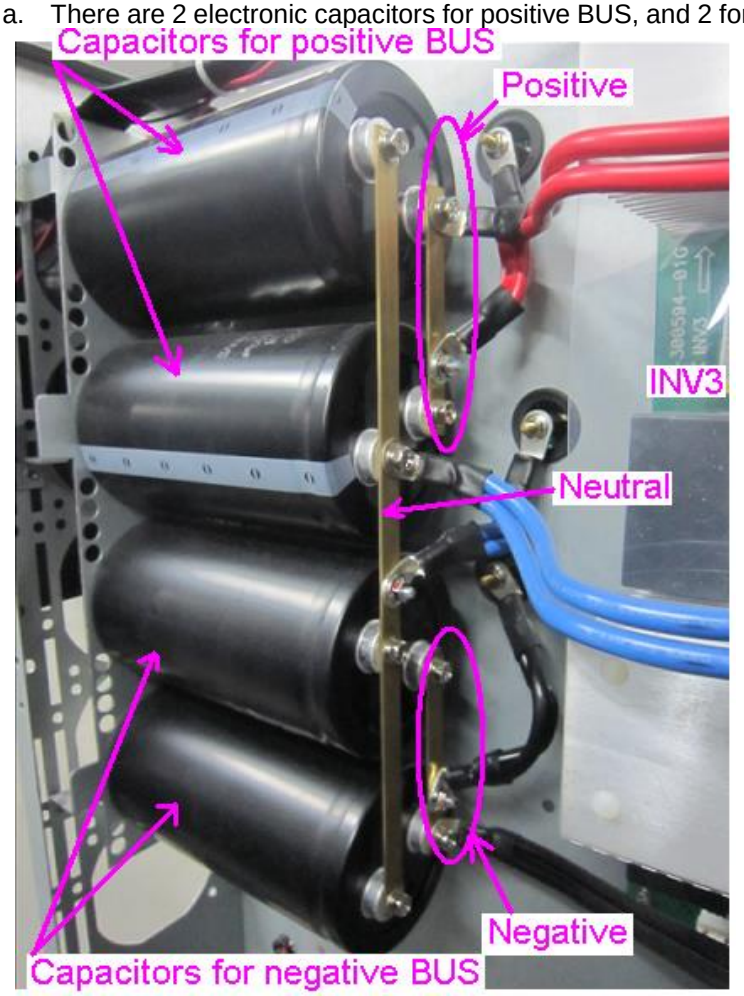


Step3: Remove the wire that connect to P103 on INV-R&S board, becareful the terminal should be protected by insulating tap after remove from the board.

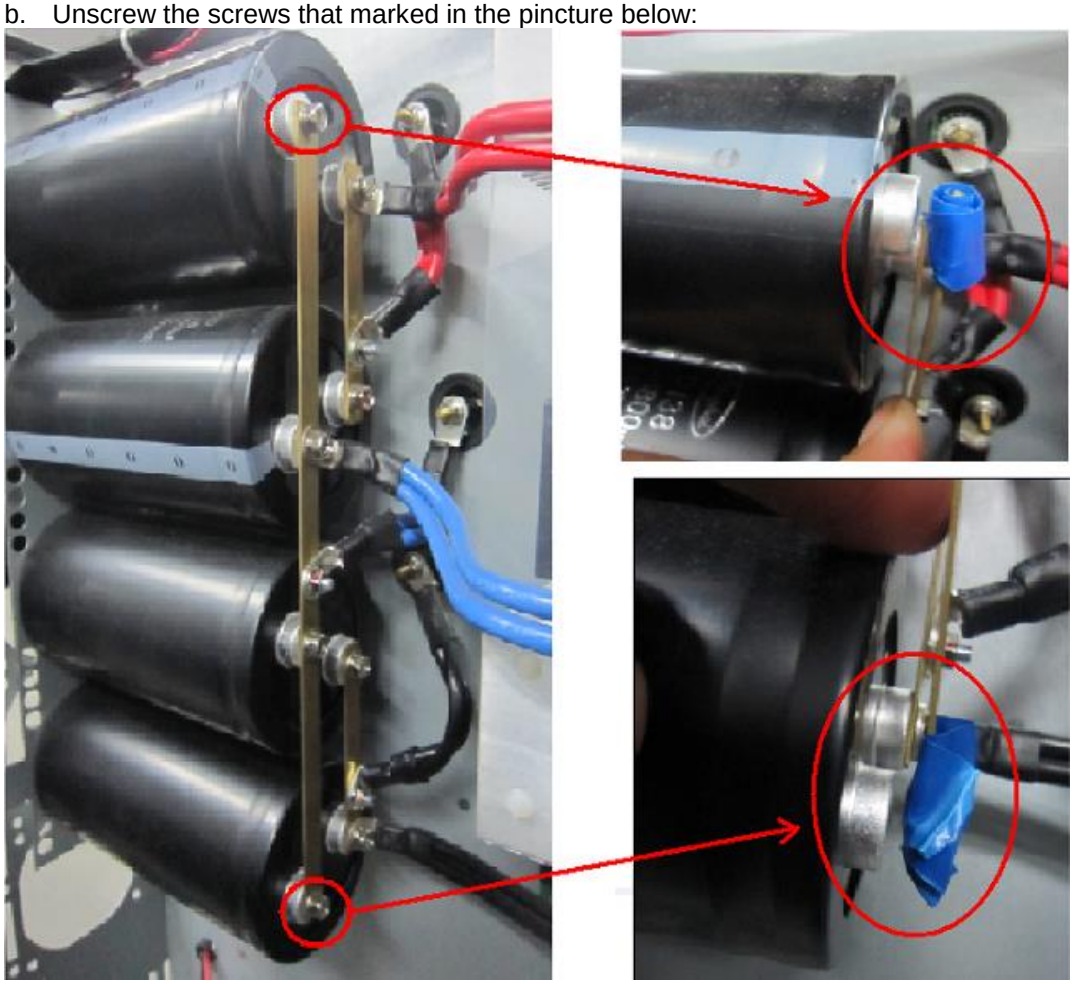


Step4: For 30K unit, there are 4 electronic capacitors, 2 for positive BUS, and 2 for negative BUS; but one 4 A charger can not offer enough energy for these capacitors, so we need to change the BUS capacitors connection to start the unit with a 4A charger. **Before the modify, be sure the voltage of the capacitors dischaged completely.**

a. There are 2 electronic capacitors for positive BUS, and 2 for negtive BUS, please refer the picture below:

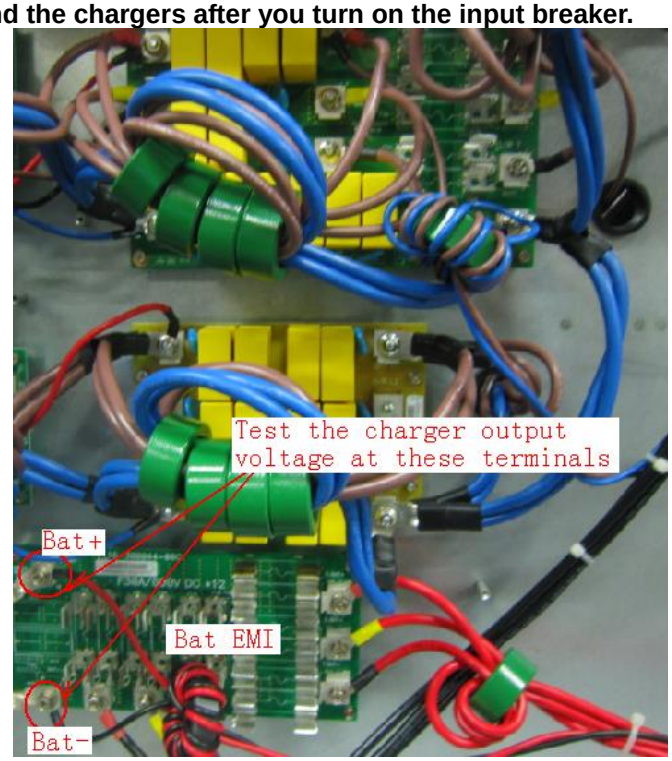


b. Unscrew the screws that marked in the pincture below:



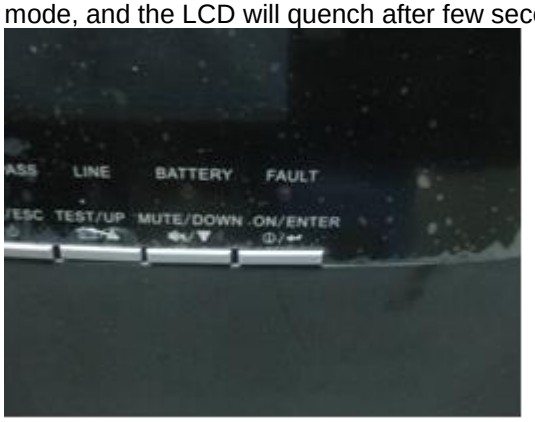
Then protect the two ends of the copper bar for neutral with insulating tape (or other insulating material) to disconnect the capacitor with the neutral completely, then we will get two electronic capacitors for BUS, one for positive, the other for negative.

Step5: Test the charger: supply the charger with turn on the input breaker(With the utility power connected, the bypass breaker must be kept at OFF), and then test the charger ouput voltage at the terminals on the battery EMI board, the voltage is about 245V DC,Otherwise,please check the chargers. **Becareful the electricity on the Input EMI board and the chargers after you turn on the input breaker.**



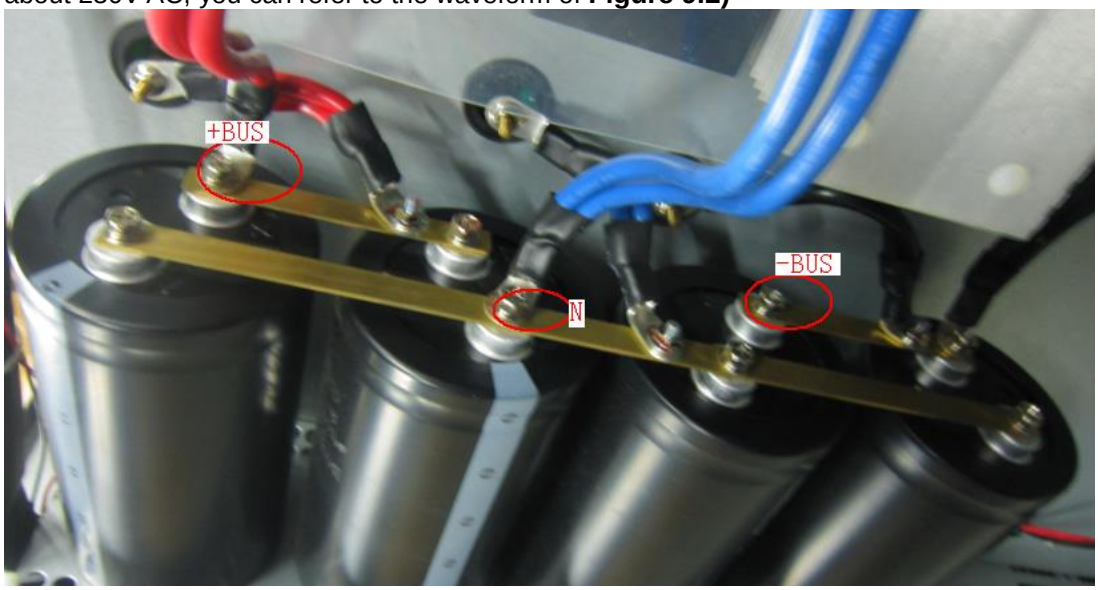
8.2.2 Turn on the UPS with DC source (the charger work as a current limitation DC source)

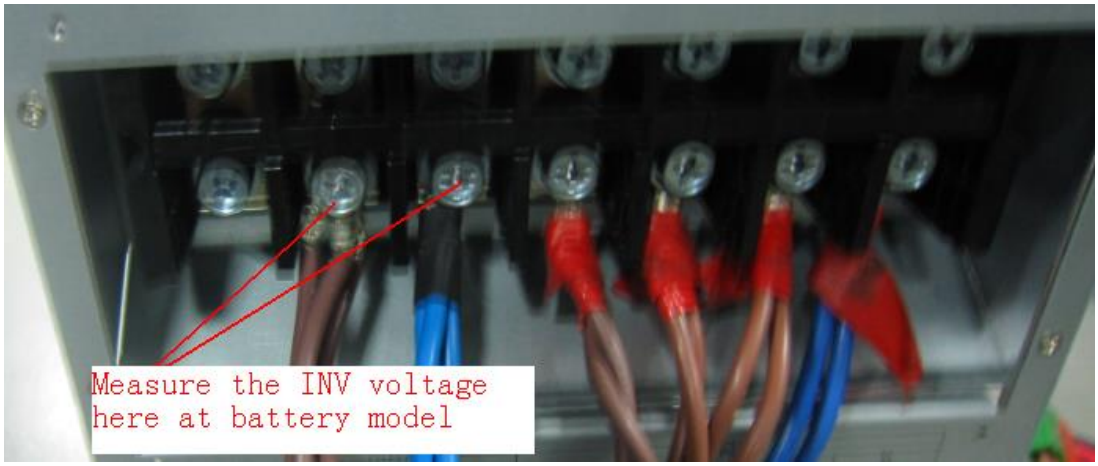
Step1: Check the SPS:Press the ON button on the keyboard of the UPS after check the ouput voltage of the charger according 8.2.1, then you will see the LCD lighted,and the fan of the UPS working, UPS will enter to power on mode, otherwise please check the SPS on INV 1&2. After initialization UPS will enter to No Output mode, and the LCD will quench after few seconds.



Step2: Turn off the input breaker, wait a few seconds, then put the battery fuses（KLKD-30） back to the battery EMI board. Turn on the input breaker.

Step3: Press the “ON” button to set up the power supply for the UPS, UPS will enter to power on mode. After initialization UPS will enter to No Output mode, then Press and hold the “ON” button for 0.5s to turn on the UPS, and the buzzer will beep once. A few seconds later, the UPS will be turned on and enter to Battery mode.(You can measure the BUS voltage at the BUS capacitances terminal and the inverter voltage at the out put terminal, the voltage between +BUS and N, N and –BUS is about 370V DC, the inverter voltage is about 230V AC, you can refer to the waveform of **Figure 9.2)**





8.2.3 Turn on the UPS with utility power

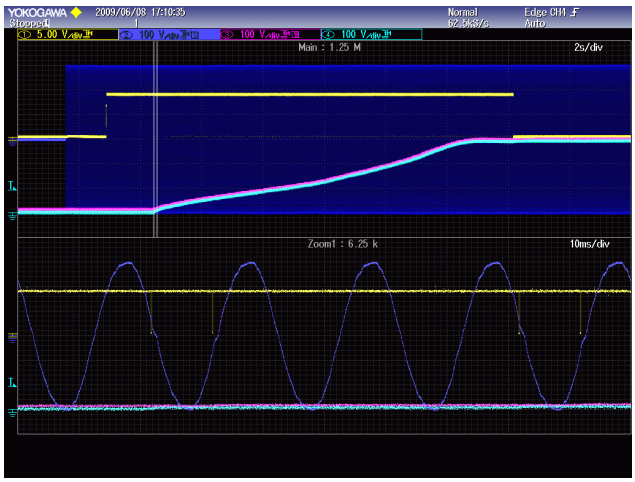
Step1: Shut down the UPS by press **OFF** on the keyboard ,open the input breaker. Wait until the voltage of the bus capacitors below 10VDC, assemble the fuses (HC10AR30)back to the input EMI board, connect the wire that removed at **step3** of 8.2.1 to P103 on INVR&S board,connect the 3PIN cable back to CN2 on charger1. For 30K unit, assemble the neutral cooper bar back to the capacitors terminals.
Step2: Close the input breaker and bypass breaker, turn on the unit by press **ON** on the Keyboard.

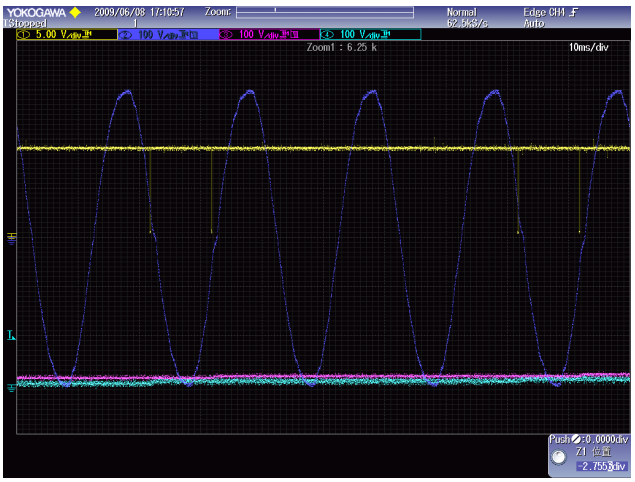
Step3: If UPS passed all of above testing, that means the UPS can work fine, please connect the batteries back to UPS, put cover back finally.

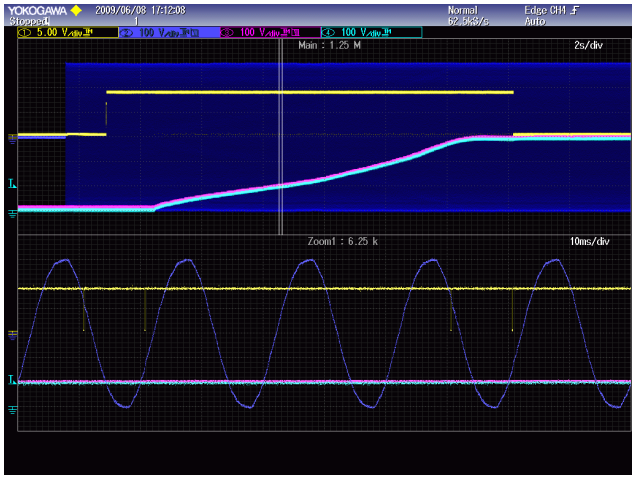
9. Appendix

9.1 Reference Waveform

. Below are some waveform charts to show normal UPS operation. It's a very useful reference to verify the test result in section 8.

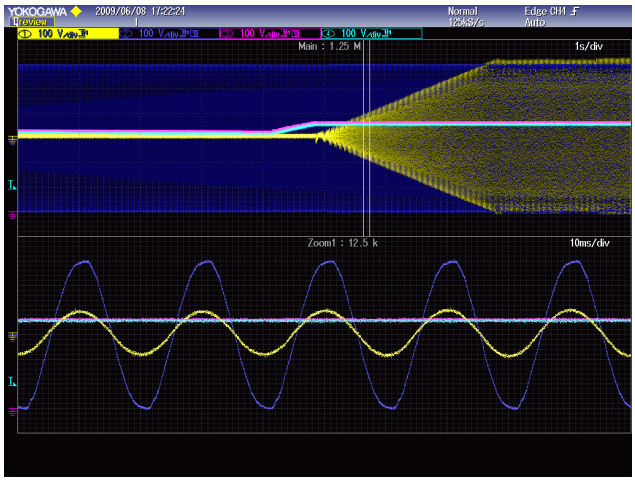


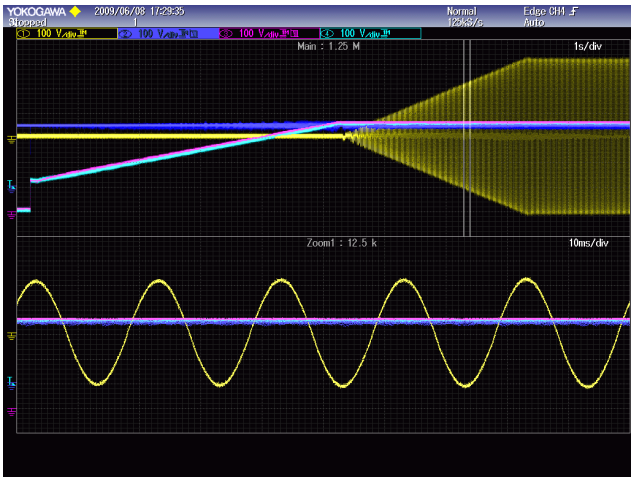




CH1: IP SCR driver
CH2: IP voltage
CH3: -BUS voltage
CH4: +BUS voltage

Figure 9.1 Switch on the input breaker without turn on





CH1: INV voltage CH2: IP voltage CH3: -BUS voltage CH4: +BUS voltage	CH1: INV voltage CH2: Battery voltage CH3: -BUS voltage CH4: +BUS voltage
AC mode (transfer from Bypass mode)	Battery mode

Figure 9.2 Turn on the UPS

	
CH1: IP voltage CH3: V_{GE}-(PFC PWM-) CH4: V_{GE}+(PFC PWM+)	CH1: INV voltage CH2: Battery voltage CH3: V_{GE}-(PFC PWM-) CH4: V_{GE}+(PFC PWM+)
AC mode	Battery mode

Figure 9.3 PFC PWM

	
	CH1: INV voltage CH2: IP voltage CH3: V_{GE}-(INV PWM-) CH4: V_{GE}+(INV PWM+)

Figure 9.4 INV PWM

9.2 Basic communication command

In this section, we will show you some basic communication commands that will help you debug or regulate the UPS system.

9.2.1 QGS

QGS means to request general status parameters of the system. The command format is:

Computer: QGS<Enter>

UPS: (MMM.M HH.H LLL.L NN.N QQQ.Q DDD KKK.K VVV.V SSS.S XXX.X TTT.T $b_{11}b_{10}b_9b_8b_7b_6b_5b_4b_3b_2b_1b_0$

Data	Description	Notes
(	Start byte	
MMM.M	Input voltage	M is an Integer number 0 to 9. The units is V.
HH.H	Input frequency	H is an Integer number 0 to 9. The units is Hz.
LLL.L	Output voltage	L is an Integer number 0 to 9. The units is V.
NN.N	Output frequency	N is an Integer number from 0 to 9. The units is Hz.
QQQ.Q	Output current	Q is an Integer number from 0 to 9. The units is A.
DDD	Output load percent	DDD is Maximum of W% or VA%. VA% is a percent of power. W% is a percent of maximum active power.
KKK.K	Positive BUS voltage	K is an Integer ranging from 0 to 9. The units is V.
VVV.V	Negative BUS voltage	V is an Integer ranging from 0 to 9. The units is V.
SSS.S	P Battery voltage	S is an Integer ranging from 0 to 9. The units is V.
XXX.X	N Battery voltage	X is an Integer ranging from 0 to 9. The units is V.
TTT.T	Max Temperature of the detecting pointers	T is an integer ranging from 0 to 9. The units is °C
$b_{11}b_{10}b_9b_8b_7b_6b_5b_4b_3b_2b_1b_0$	Ups status	b_{11},b_{10}: 00: standby; 01: line-interactive; 10: on-line. B_9: Utility Fail B_8: Battery Low B_7: Bypass/Boost Active B_6: UPS Failure B_5: EPO B_4: Test in Progress B_3: Shutdown Active B_2: bat silence b_1: Bat test fail b_0: Bat test OK

Example:

Computer: QGS<Enter>

UPS: (225.2 50.0 220.0 50.0 027.0 073 360.8 359.9 241.0 ---.- 045.0 100011000000

Meanings:

I/P voltage = 225.2V.

I/P frequency = 50.0Hz

O/P voltage = 220.0V

O/P frequency = 50.0Hz.

O/P current = 27.0A

O/P load = 73%

Positive BUS voltage = 360.8V

Negative BUS voltage = 359.9V

P Battery voltage = 241.0V.

N Battery voltage is ---.-V. It means it is a single battery-type UPS. The negative battery voltage does not exist.

Temperature = 45.0 degrees of centigrade.

On-line mode, Utility OK, Bypass Active, UPS failure.

9.2.2 V<n>

This command is to set the nominal output voltage. The format is:

Computer: V<n><Enter>

UPS: (ACK or (NAK*

*: If UPS accepts this command, responds ACK. Otherwise, responds NAK

Output Voltage: <n>. n is 208,220,230,240.

Default status: Nominal output voltage 220V. (It can be set only in bypass mode)

For example:

Computer: V230<Enter>

UPS: (ACK

Meanings: set output nominal voltage to 230V.

9.2.3 V±<n>

This command is to adjust the nominal output voltage. The format is:

Computer: V±<n><Enter>

UPS: (ACK or (NAK*

*: If UPS accepts this command, responds ACK. Otherwise, responds NAK

Voltage adjust step: <n>. n=00, 01……, 99.

For example:

Computer: V+01<Enter>

UPS: (ACK

Meanings: Output voltage will increase about 0.1V.

9.2.4 BUSP±<n>

This command is to adjust the positive BUS voltage, the format is:

Computer: BUSP±<n><Enter>

UPS: (ACK or (NAK*

*: If UPS accepts this command, responds ACK. Otherwise, responds NAK

Voltage adjustment step: <n>. n=00, 01……, 99.

For example:

Computer: BUSP-01<Enter>

UPS: (ACK

Meanings: Positive BUS voltage will decrease about 0.1V.

9. 2.5 BUSN±<n>

This command is to adjust the negative BUS voltage, the format is:

Computer: BUSN±<n><Enter>

UPS: (ACK or (NAK*

*: If UPS accepts this command, responds ACK. Otherwise, responds NAK

Voltage adjustment step: <n>. n=00, 01……, 99.

For example:

Computer: BUSN+02<Enter>

UPS: (ACK

Meanings: Negative BUS voltage will increase about 0.1V.

9. 2.6 VB±<n>

This command is to adjust the battery voltage sampling value. You can adjust the parameter to the sampling voltage displayed on LCD and the real battery voltage. The format is:

Computer: VB±<n><Enter>

UPS: (ACK or (NAK*

*: If UPS accepts this command, responds ACK. Otherwise, responds NAK

Voltage adjustment step: <n>. n=00, 01……, 99.

For example:

Computer: VB-01<Enter>

UPS: (ACK

Meanings: Battery sampling voltage will decrease about 0.1V.

9.2.7 QVFW

QVFW means to request the version of the firmware. The command format is:

Computer: QVFW<Enter>

UPS: (VERFW: NNNNN.NN

<N> is a HEX number from 0...9 or A…F.

Example:

Computer: QVFW<Enter>

UPS: (VERFW: 00123.01

Meanings: 00123 is the firmware series number and 01 is the version.

9.2.8 QWS

QWS means to request the current warning of the UPS. The command format is:

Computer: QWS<Enter>

UPS: (a0a1……a62a63<cr>

a0,…,a63 is the warning status. If the warning is happened, the relevant bit will set 1, else the

relevant bit will set 0.

Bit	Warning
a0	Battery disconnected
a1	Input Neutral loss
a2	*Reserved*
a3	Input phase abnormal
a4	*Reserved*
a5	*Reserved*
a6	Battery over charge
a7	Low battery
a8	Overload
a9	Fan failure
a10	EPO active
a11	*Reserved*
a12	Over temperature
a13	Charger failure
a14	*Reserved*
a15	L1 IP fuse broken
a16-a49	*Reserved*
a50	Locked in bypass after overload 3 times in 30min
a51	Converter current unbalance
a52	Battery fuse broken
a53	Inverter inter-current unbalance
a54-a56	*Reserved*
a57	Cover of maintain switch is open

Example:

Computer: QWS<Enter>

UPS: (10000000000000000000000000000000000000000000000000000000000000000

Meanings: The battery of UPS disconnected.

9.2.9 QFS

QFS means to request the latest fault occurred of the UPS. The command format is:

Computer: QFS<Enter>

If no UPS fail occurred:

UPS: (OK<cr>

If UPS fail occurred:

UPS: (KK PPP.P FF.F OOO.O EE.E LLL CCC.C HHH.H NNN.N BBB.B TTT.T b7b6b5b4b3b2b1b0<cr>

Data	**Description**	**Notes**
(	Start byte	
KK	Fault code	K is a hexadecimal number 0 to F. The code please reference to 7.1.2
PPP.P	Input voltage when fail	P is an Integer number 0 to 9. The units is V.
FF.F	Input frequency when fail	F is an Integer number 0 to 9. The units is Hz.
OOO.O	Inverter voltage when fail	O is an Integer number from 0 to 9. The units is V.

EE.E	Output Frequency when fail	Q is an Integer number from 0 to 9. The units is Hz.
LLL	Output load percent when fail	LLL is Maximum of W% or VA%. VA% is a percent of power. W% is a percent of maximum active power.
CCC.C	Output current when fail	C is an Integer ranging from 0 to 9. The units is A.
HHH.H	Positive BUS voltage when fail	H is an Integer ranging from 0 to 9. The units is V.
NNN.N	Negative BUS voltage when fail	N is an Integer ranging from 0 to 9. The units is V.
BBB.B	Battery voltage	B is an Integer ranging from 0 to 9. The units is V.
TTT.T	Max Temperature of the detecting pointers	T is an integer ranging from 0 to 9. The units is °C
b7b6b5b4b3b2b1b0	Ups status	b7: DC to DC is on b6: AC to DC is on b5: Inverter is on b4: Reserved（always 0） b3: Reserved（always 0） b2: output relay is on b1: Reserved（always 0） b0: Reserved（always 0）

Example:

Computer: QWS<Enter>

UPS: (01 208.3 50.0 000.0 0.0 000 000.0 300.0 290.0 245.5 028.0 01000000<cr>

Meanings: The fault is BUS soft start failure，and when fail, the UPS status is:

Input voltage is 208.3V.

Input frequency is 50.0HZ.

Output voltage is 0V.

Output frequency is 0HZ

Load percent is 0%

Output current is 0A

Positive Bus voltage is 300.0V

Negative Bus voltage is 290.0V

Battery voltage is 245.5V.

Temperature is 28.0℃

The AC to DC is on, inverter is off, output relay is off.