UNINTERRUPTIBLE POWER SYSTEM

SERVICE MANUAL

Galleon 6K / 10KVA PF 0.9 Tower Model

REVISION	DESCRIPTION	Date
Rev. 1.0	First Release	2014/9/12

CONTENT

1. General Information

1.1 Getting start

This manual is for Galleon 6K(L)/10K(L) PF 0.9 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 include 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

MODEL	SPECIFICATION			
	6K	6KL	10K	10KL
Input				
Input Voltage	176～300 VAC @ Full Load			
	110～300 VAC @ Half Load			
Input Frequency	46～54 Hz for 50Hz system			
	56～64 Hz for 60Hz system			
Input Power Factor	≥0.99			
Input THD	<6%			
Generator	Support			
Output				
Output Power (VA/Watt)	6000/5400		10000/9000	
Nominal Output Voltage	208/220/230/240VAC			
Voltage Regulation	±1%			
Output Frequency	Follows Bypass Frequency in Line Mode			
	(50/60±0.1) Hz in Battery Mode			
Voltage Distortion	≤6% @ Full Nonlinear Load			
	≤2% @ Full Linear Load			
Current Crest Ratio	3:1			
Transfer Time	0ms @ Line ←→ Battery			
	0ms @ Inverter ←→ Bypass			
	<10ms @ Inverter ←→ ECO			
Short Circuit Protection	Yes			
Battery				
Nominal Battery Voltage	240 VDC			
Nominal Battery Quantity	20 pcs			
Acceptable Battery Quantity	18~20 pcs			
Type/Capacity	12V/7.2Ah		12V/9Ah	
Backup Time	≥5.1minutes@full load		≥2.8minutes@full load	
Efficiency				
To Line Mode	>89%			
To Battery Mode	>88%			
To ECO Mode	>96%			
Overload Protection				
100%～110%	Alarm and Transfer To Bypass after 10min @ Line mode			
	Alarm and Cut Off Output after 30s @ Battery mode			
110%～130%	Alarm and Transfer To Bypass after 1min @ Line mode			
	Alarm and Cut Off Output after 10s @ Battery mode			
Over 130%	Alarm and Transfer To Bypass after 1s @ Line mode			
	Alarm and Cut Off Output after 1s @ Battery mode			
	Alarm and Cut Off Output after 1min @ Bypass mode			
Auto Retransfer	Yes			

Interface				
RS232	Yes			
USB 1.1	Yes			
EPO	Yes			
Environment				
OperatingTemperature	0 ℃ to 40℃			
Humidity	<95% (No condensing)			
Acoustic Noise	≤55dB		≤58dB	
Standard				
ESD	IEC 61000-4-2 Level 4			
RS	IEC 61000-4-3 Level 3			
EFT	IEC 61000-4-4 Level 4			
Surge	IEC 61000-4-5 Level 4			
Conduction	IEC/EN 62040-2 Category C3			
Radiation				
Safety	IEC62040-1-1			
Drop	ASTM D5276-94			
Vibration	ASTM D4728-87			
Mechanical				
Inlet	Terminal Block			
Outlet	Terminal Block and Receptacle			
Outline Dimension W x H x D (mm^3)	592 X 250 X 576			
- Net Weight (kg)	81	25	83	27
- Packaging Dimension W x H x D (mm^3)	700 X 385 X 815	690 X370 X670	700 X 385 X 815	690 X370 X670
- Gross Weight (kg)	88	28	90	30

3. Functional Block

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

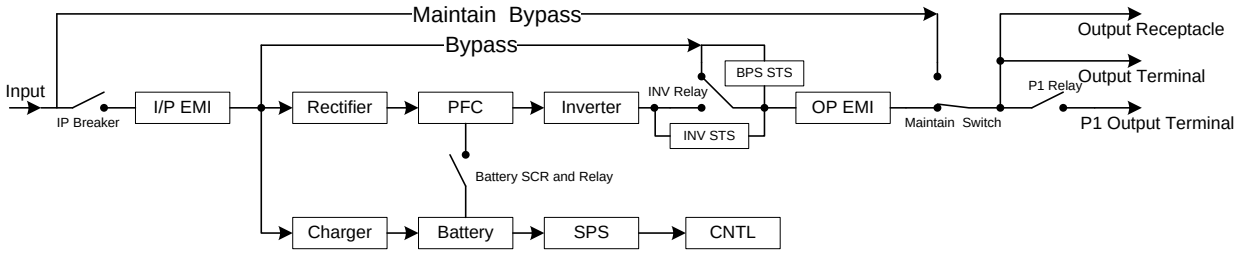


Figure 3.1 Function block Diagram

The CNTL block controls the action of the UPS system. It also provides the communication interface for receiving and executing command from users via the panel or other communication protocol. When the UPS becomes abnormal, in most case, the CNTL can provide basic information indicating the status of the UPS.

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.

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.

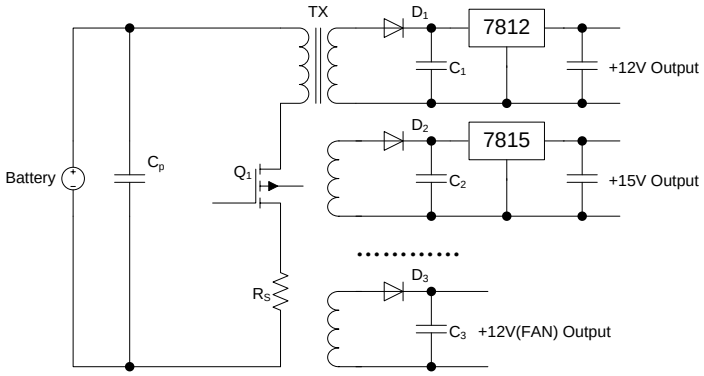


Figure 4.1 Basic circuit of power supply

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

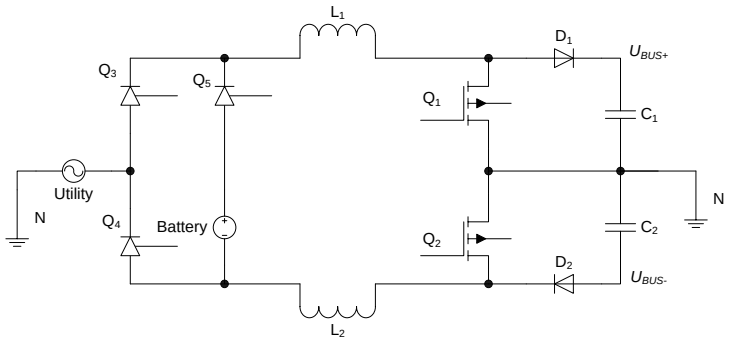


Figure 4.2 PFC/Booster

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.

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.

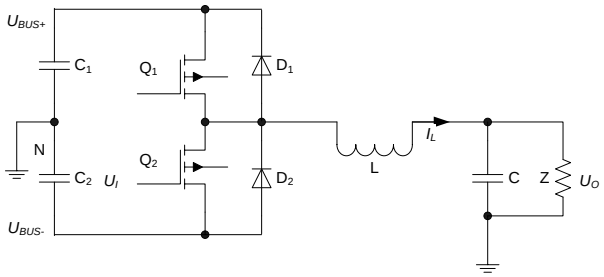


Figure 4.3 Half-bridge inverter

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.

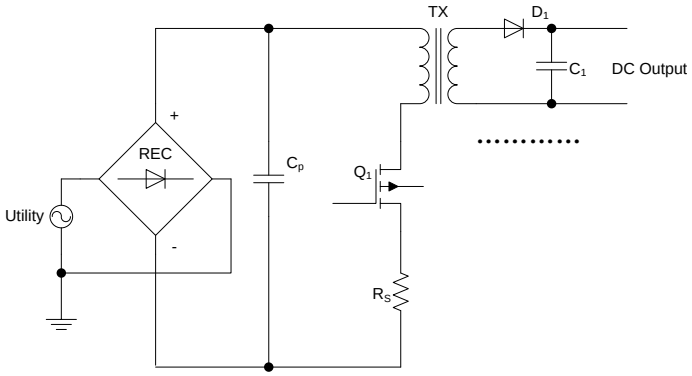


Figure 4.4 Topology of the charger

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.

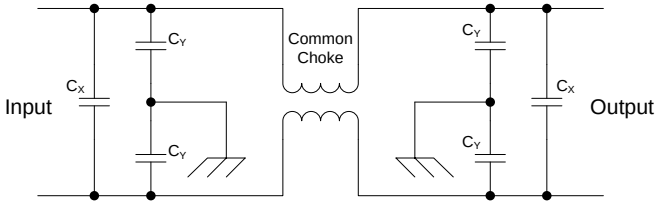


Figure 4.5 Topology of the EMI

5. Function explanations for each PCB

Table 5.1 PCB information of Galleon 6~10k

Item	PCB Name		PCB serial number	Quantity	Remark
1	PSDR	6k	71-300687-XXG	1	For 6kVA model
2		10k	71-300688-XXG	1	For 10kVA model
3	CNTL		71-301333-XXG	1	
4	Charger	1A	71-300040-XXG	1	For standard model
5		4A	71-300233-XXG	1	For long run time model
6	O/P Relay	6k	71-300043-XXG	1	Optional, for 6kVA parallel model
7		10k	71-300026-XXG	1	Optional, for 10kVA parallel model
8	Power Relay	6k	71-300042-XXG	1	For 6kVA model
9		10k	71-300027-XXG	1	For 10kVA model
10	Communication		71-300436-XXG	1	
11	Parallel		71-300059-XXG	1	Optional, for parallel model
12	Panel		71-300006-XXG	1	
13	EMI	I/P	71-300061-XXG	1	
14		O/P	71-300009-XXG	1	
15	MOV		71-301270-XXG	1	

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

5.1 PSDR board (Power Stage Board)

The PSDR board consists of SPS, Rectifier, PFC/Booster, Inverter, and STS.

The PSDR board is the most expensive and biggest PCB in the UPS, and it converts the AC/DC power to a pure sine waveform.

There are many semiconductors and easy-failure components on the board, so it’s required to pay more attention when UPS is abnormal.

5.2 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, the display of the LED/LCD, the sound of the buzzer, the communication with the computer, and other important tasks.

5.3 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.

5.4 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).

5.5 Power Relay board

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

5.6 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.

5.7 Parallel board

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

5.8 Panel board

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

5.9 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.

5.10 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	●	●	●	●
Bypass mode	●	○	○	○
Line mode	○	●	○	○
Battery mode	○	○	●	○
Battery test mode	●	●	●	○
ECO mode	●	●	○	○
CVCF mode	○	●	○	○
Fault mode	○	○	○	●

●: means LED is lighting.

○: means LED is faded.

6.2 LCD Display

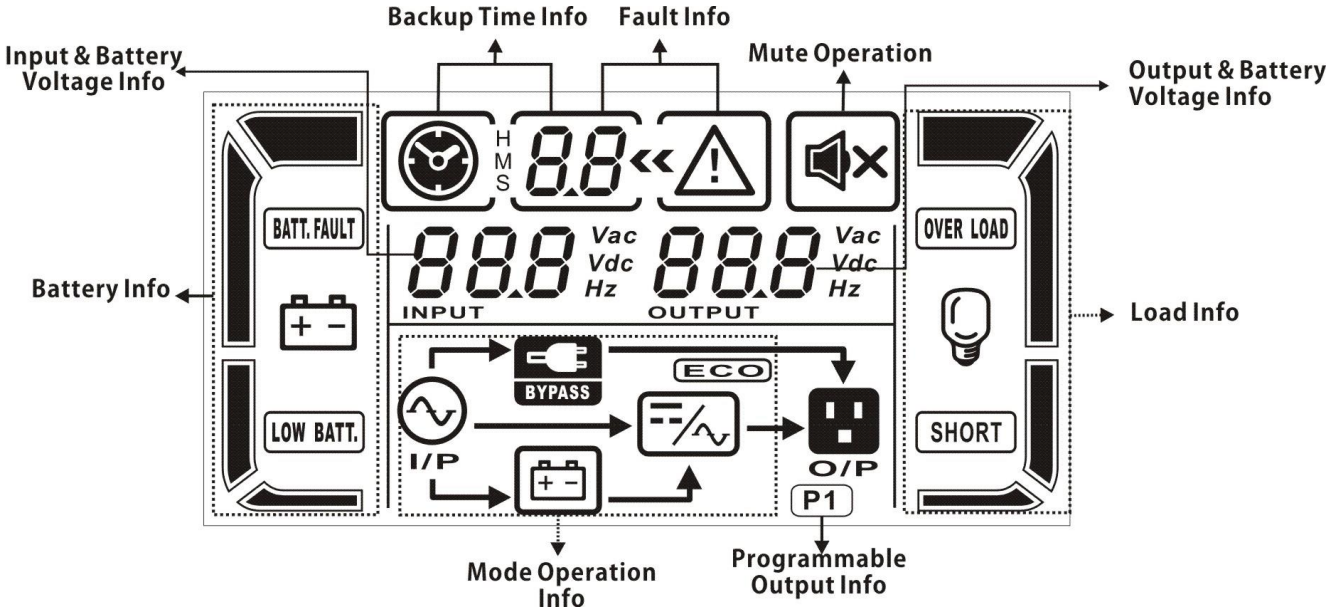
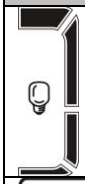
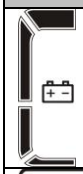


Figure 6.1 LCD Display

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 ● When UPS is in Bypass mode, these two numbers indicating the power capacity; 06 for 6K model and 10 for 10K model.

Fault information	
	Indicates that the warning and fault occurs.
	Indicates the fault codes, and the codes are listed in details in section 7-1.
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 utility.
	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, or listen to the description of end users.
2. Inspect failure board for static checking.
3. Replace failure components.
4. Static checking.
5. Power-on checking.
6. Test after repair.

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

7.1 LCD Panel Display Pattern Definition

7.1.1 Trouble shooting for warning icon in LCD display

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)	Alarm	Possible cause	Action
⚠ LOW BATT.	1 Beeping / second	Low battery	Check the battery voltage
⚠ OVER LOAD	2 Beeping / second	Over load	Check the loads
⚠ BATT. FAULT	1 Beeping / second	Battery disconnected	Check the battery wiring
⚠ 	1 Beeping / second	Battery/Charger voltage too high	Check the output voltage of the battery and the charger
⚠ EP	1 Beeping / second	EPO plug or cable not connected	Check the EPO plug and EPO cable
⚠ 	1 Beeping / second	Fan failure, or high internal temperature	Check the fans, loads, ventilation, ambient temperature
⚠ 	1 Beeping / second	Charger broken or low output voltage	Check the charger
⚠ 	1 Beeping / second	I/P fuse broken	Check the I/P fuse
⚠	1 Beeping / second	Overload 3 times in 30min	Check the loads

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.

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 50 ms. 2. +Bus voltage keeps higher than 430V or the –BUS voltage keeps lower than –430V for more than 1.5s.	Maybe the PSDR 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 230V or the –BUS voltage keeps higher than –230V for more than 200ms, the fault signal will be displayed.	Maybe the PSDR 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 40V for 2 minutes, the fault signal will be sent.	Maybe the PSDR 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.
05	None	BUS short circuited	When bus voltage drops to 32V in a period and the situation occurs for more than two periods, the fault signal will be displayed.	Check all the components on power board.
11	None	INV soft start failure	Inverter voltage can't reach the setting value in 30s.	Check the inverter drive circuit.
12	None	INV voltage high	When INV voltage keeps higher than 276V for 128 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 128 ms, the fault signal will be displayed.	Maybe the PSDR 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 lower than 20A for over 3 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, 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, Q20,Q25 and their driver circuits) are OK.
21	None	Battery SCR short circuited	When battery voltage is more than 310V, the fault signal will be displayed.	It is probably the charger or PSDR board damaged. Check if the battery SCR(Q21)or the battery relay (RY3, RY4) on the PSDR board are well. If PSDR 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 on PSDR board is OK.
35	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		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	None	Internal fault	CPU can not build communication and the control board is damaged.	Replace the CNTL board.
43	OVER LOAD	Overload		Check the loads and remove some non-critical loads. Check whether some loads are failed.

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 Port on the Control Board

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

Table 6.1 Model Port Setting List

Model Type	pin1&pin2	pin3&pin4	Battery Number	pin5&pin6	pin7&pin8
6K	1	1	18	0	0
6KL	1	0	19	1	0
10K	0	1	20	1	1
10KL	0	0			

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

“0”indicates that nothing is connected

For long run model, charger’s part number is 71-300233-xxG (“xx” means the version of charger) normally, the default charging current is 4A for 20 PCS battery configuration, if the batter number is modified to be 18 or 19, for more safety, we strongly recommend the charging current is to be adjusted to be “2A” through the jumper on charger board as per the silk mark on charger PCB (but the actual charging current is between 3A-3.5A).The specific setting contents about how to plug the jumper, please refer the following section of 7.2.3.

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;

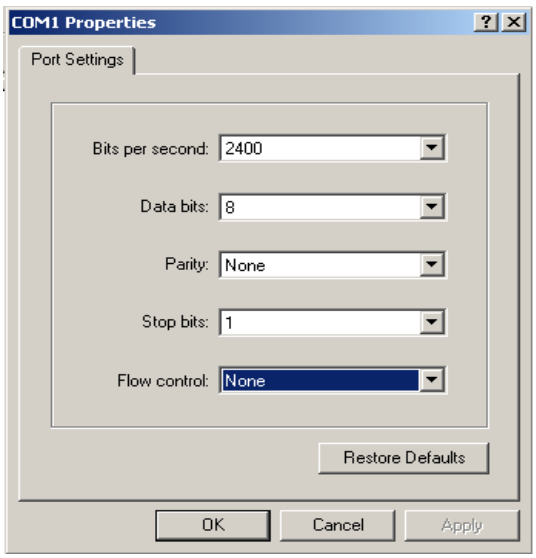
“0”indicates that nothing is connected

7.2.4 Regulation of the system

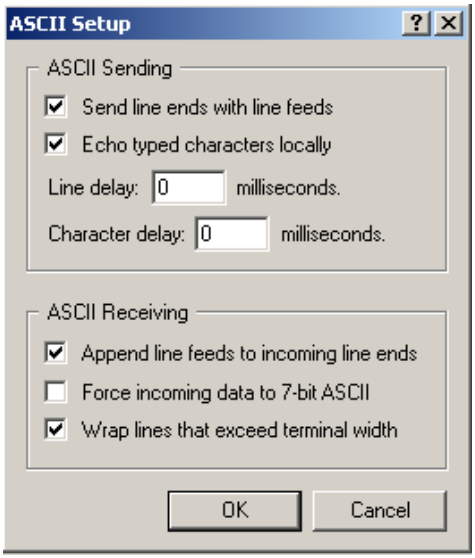
Parameter Setting Method:

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 19). Then press the “ENTER” key, and +BUS voltage will rise (drop) about 0.5V.

4. -BUS voltage regulation: Type “BUSN+/- XX” command (XX is two digits from 00 to 19). Then press the “ENTER” key, and -BUS voltage will rise (drop) about 0.5V.

5. INV output voltage regulation: Type “V+/- X” command (X is a digit from 0 to 6) Then press the “ENTER” key, and output voltage will rise (drop) about 0.8V.

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 360±0.5V by using BUS regulation command. (BUS voltage can be regulated about 0.5V 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 220±0.5V by using output voltage regulation command. (INV output voltage can be regulated about 0.8V 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/PSDR 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 PSDR Section

Circuit Block	Checked components	Component Type	Failure condition
DC FUSE	F3, F4	Fuse	Open
AC FUSE	F1, F2	Fuse	Open
Rectifier	Q17, Q18, Q21	SCR	A-K Short or open
PFC	D33, D35, D34, D36	Diode	Short or open
	Q22, Q23, Q24, Q25, Q26, Q27	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

6k PSDR Section

Circuit Block	**Checked components**	**Component Type**	**Failure condition**
DC FUSE	F3	Fuse	Open
AC FUSE	F2	Fuse	Open
Rectifier	Q17, Q18, Q21	SCR	A-K Short or open
PFC	D33, D35, D34, D36	Diode	Short or open
	Q22, Q23	IGBT	C-E short or open
INV	D15, D16, D17, D18	Diode	Short or open
	Q7, Q9	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	Q2, Q11, Q12, Q29, Q30, Q32, Q43	MOSFET	D-S short or 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.

Checked components		**Instrument function**	**Reference Value**	**Failed condition**
F1, F2, F3, F4		Resistance	< 0.5 Ω	Open
Q17, Q18,	(A, K)	Resistance	≈6MΩ	Short

	(G, K)	Resistance	≈33Ω	Short
Q19	(A, K)	Resistance	≈10MΩ	Short
	(G, K)	Resistance	≈33Ω	Short
R103, R111, R116		Resistance	39Ω	Value change
Q22, Q23, Q24, Q25, Q26, Q27	(E, C)	Diode Voltage Droop	≈0.38V	Short or open
	(E, G)	Diode Voltage Droop	≈1.4V	Short or open
	(G, E)	Resistance	≈51KΩ for 6k ≈17KΩ for 10k	Short or open
D27, D28, D29, D30, D31, D32 (need be removed from PCB)		Diode Voltage Droop	≈0.61V	Short or open
R118, R120, R122, R126, R124, R129		Resistance	10Ω	Infinite or value change
R161, R162, R159, R163, R160, R164		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

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.

Checked components		**Instrument function**	**Reference Value**	**Failed Condition**
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	51KΩ for 6k 25.5KΩ for 10k	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	10Ω	Infinite or value change
R47, R48, R54, R55		Resistance	36Ω	Infinite or value change
D15, D16		Diode Voltage Droop	≈0.38V	Short or open
D17, D18		Diode Voltage Droop	≈0.38V	Short or open
Q13, Q14	(A, K)	Resistance	≈0	----
	(G, K)	Resistance	≈33Ω	Short
Q20, Q31	(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.

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

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

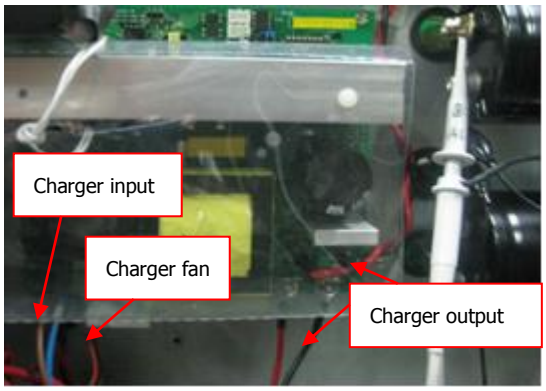
8. How To Start UPS Safely After Repairing or Replacing PSDR Board

When the PSDR 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 PSDR 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 71-300040-02G), 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 PSDR repaired or replaced is fine, otherwise, please recheck it according to some suggestion we provide as below .

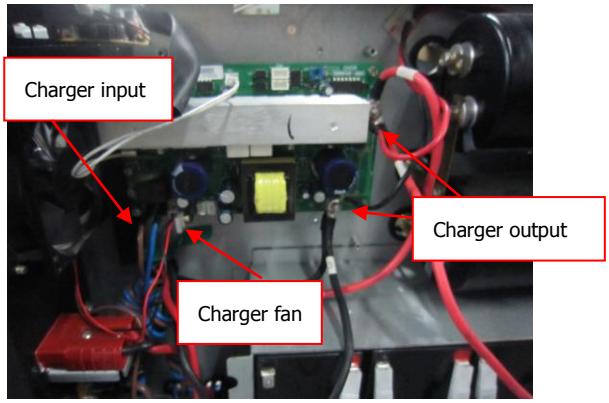
Notes:
This operating SOP is made base on 6KL, the main difference between 6KL and 6K standard model is explained at the photo below. As Galleon 6K and 10K almost have the same frame structure and cabinet, so for 10KL and 10K standard model, please also refer this SOP.
Before starting any operation, 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.

Step 1: Install charger and connect wires. If charger has been installed in cabinet originally, please ignore this step and go to **Step** 2 directly.

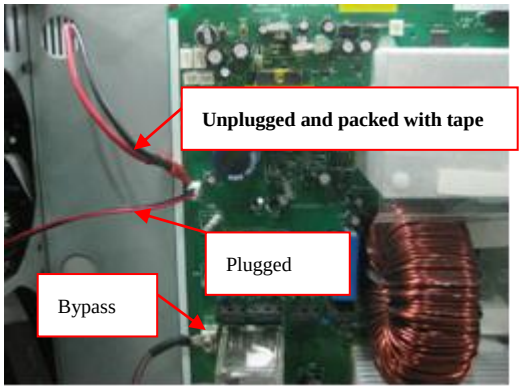


4A charger

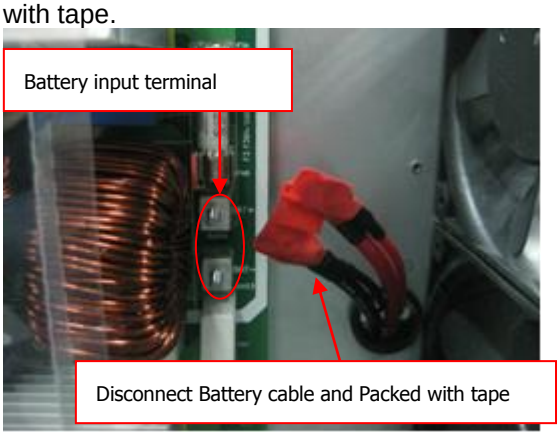


1A charger

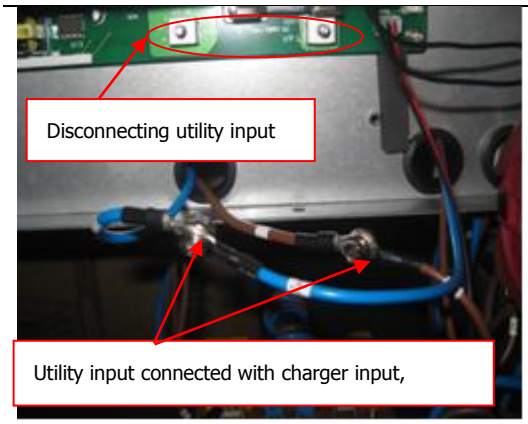
Step 2: Install PSDR board repaired or completely new spare part and connect related wires, although some wires are not necessary for charger testing here, but doing it at this section is in order to be easy for later section testing



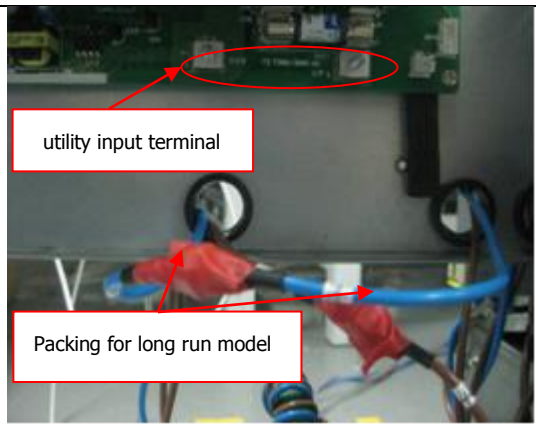
Step 3: To be convenient to operate battery cable, **first ,please do not install the ventilation paper between FANs and PSDR board, and disconnect battery connection (red and black cable) with PSDR board,** pack the battery +/- cables with tape.



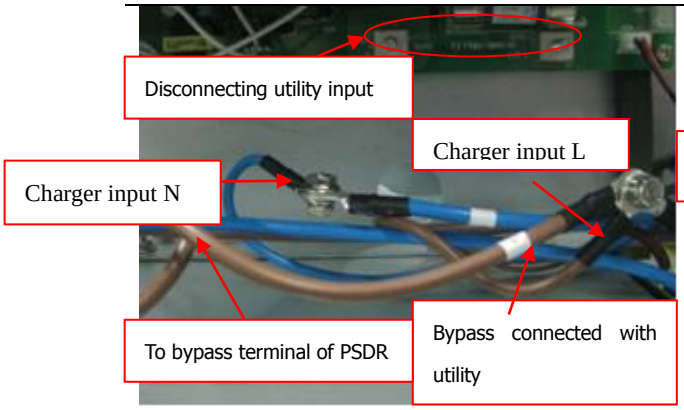
Step 4: For long run model, disconnect utility input with PSDR, but connect charger input with utility L/ N outside PSDR board and pack tape in case of electricity risk as below; for standard model, beside the same connection like long run model, there is also one bypass cable need to be connected with utility L
Although connecting bypass cable is not necessary for charger testing here ,but doing it at this section will be convenient for later.



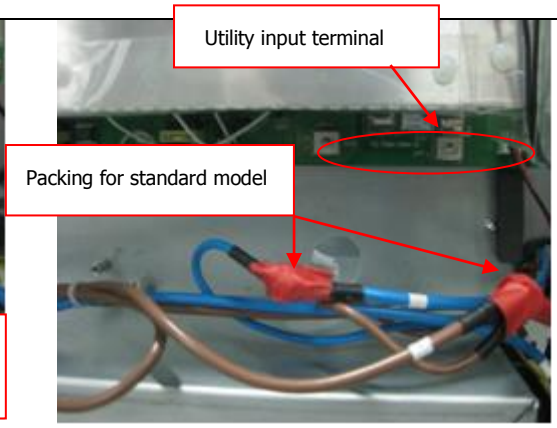
Long run model



Packed with tape for long run model



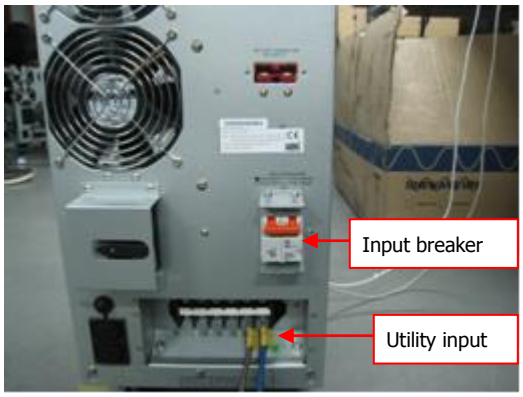
Standard model

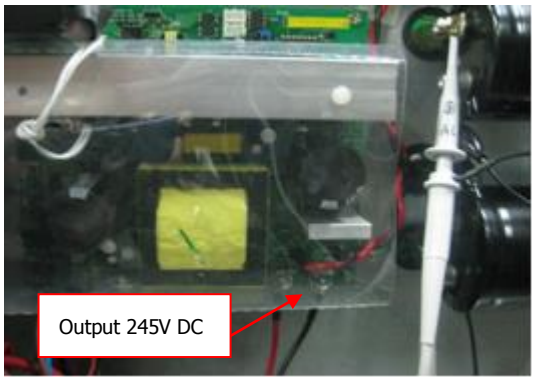


Packed with tape for standard model

Step 5: Turn on input breaker

Step 6: If normal, Charger fan rotates and charger's output voltage is about 245V DC no matter for standard or long run module. If not, please check the charger.

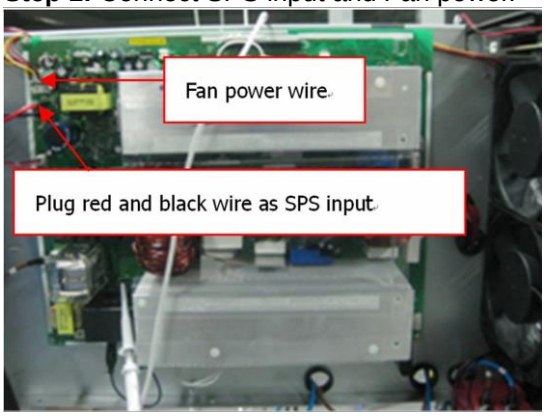




Section 2：To make sure all of supplement power supply are fine, it is very important for control board, please test SPS as the following procedure:

1. Turning off input breaker, connecting charger output with SPS input and two pieces of fan power wire Turning on input breaker, Check if the input of SPS is about 245V DC, if not, please check if the SPS input cable is plugged tight
2. **Please do not insert control board at this section, otherwise the control board might be damaged if SPS is abnormal**
3. Press “ON” Button to start SPS
4. Confirm if following voltage is right: U4 output is +15V DC, U5 output is -15V DC, U3 output is +5V. If not，SPS part is abnormal, please check and repair it.
   Note: The Fans will not rotate because the control board has been unplugged.

Step 1: Connect SPS input and Fan power.



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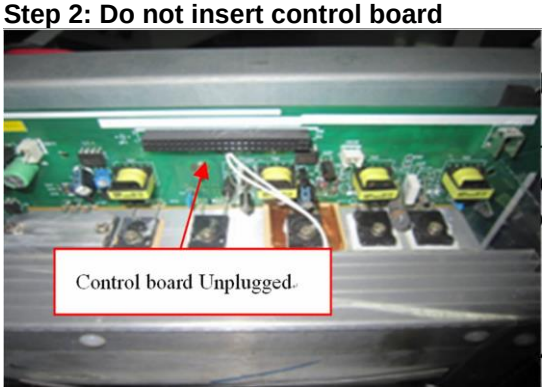
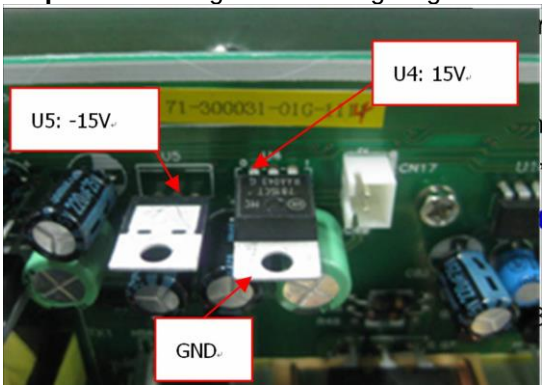
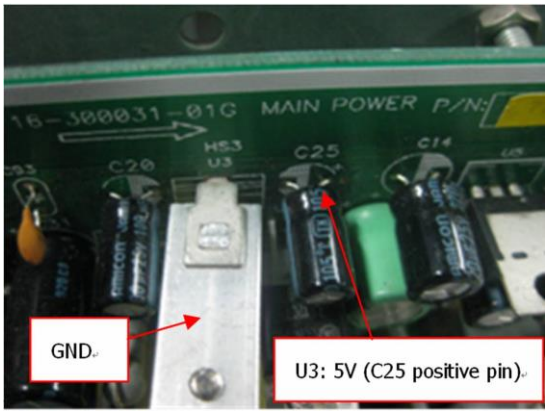
Step 2: Do not insert control board



Step 3: Press “ON” button to start SPS

Step 4: Measuring critical voltage signal as below

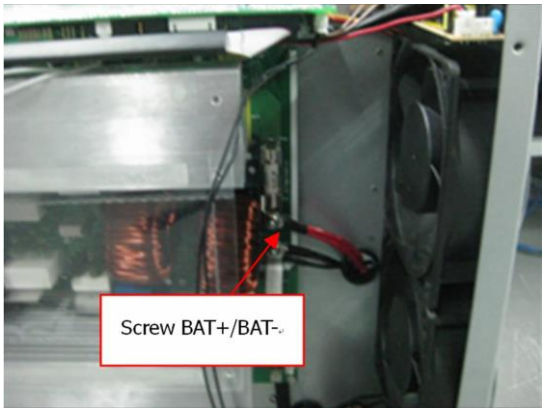




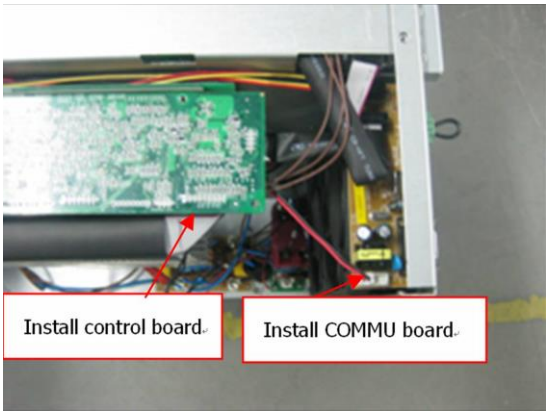
Section 3： Turn on the UPS in battery mode to check if DC-DC BOOST and INVERTER can work fine

1. Turn off input breaker and connect the battery cable back to PSDR
2. Install control board, communication board and connect related wires, **please make sure all signal cables are connected in right way.**
3. **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.**
4. **For 6K/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 6KL/10KL, it is unnecessary to unplug the fan power and can go to next step directly.**
5. 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 with actual value (between 240-245V DC). If everything above is ok. Press the “ON” button for more than 0.5s and starting UPS.
6. Please measure BUS voltage and INV voltage as below picture, if everything is same with the showing result, then UPS succeed in starting and is running in battery mode.

Step 1: Screw battery input cables to PSDR board

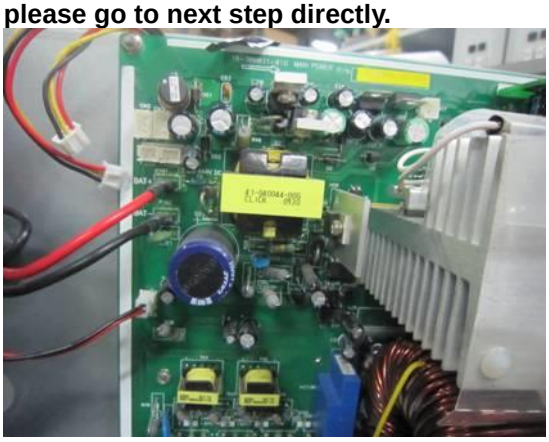


Step 2: Install control board and communication board

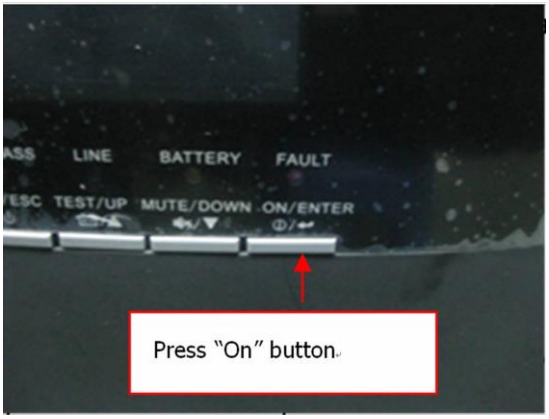


Step 3：Do not connect this three pins cable which is from control board to charger board

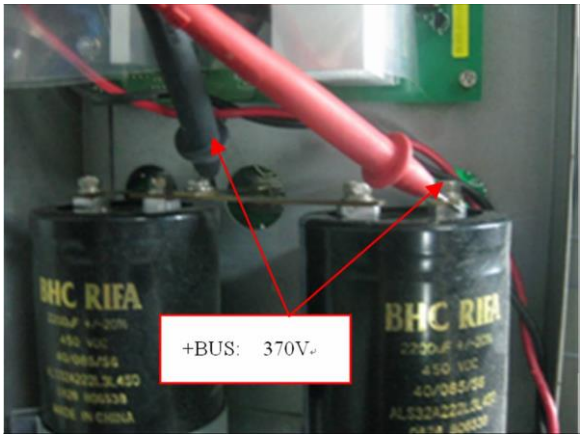
Step 4：For 6K/10K with 1A charger inside, please disconnect fan power wire before opening UPS in battery mode,because the power of the charger is only around 240W,it can’t supply enough power for UPS starup if fans are still there consuming certain power.
For 6KL/10KL,it is no need to do this and please go to next step directly.

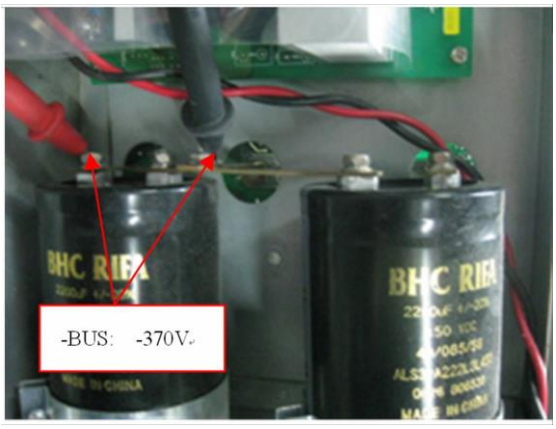


Step 5：Turn on the UPS.

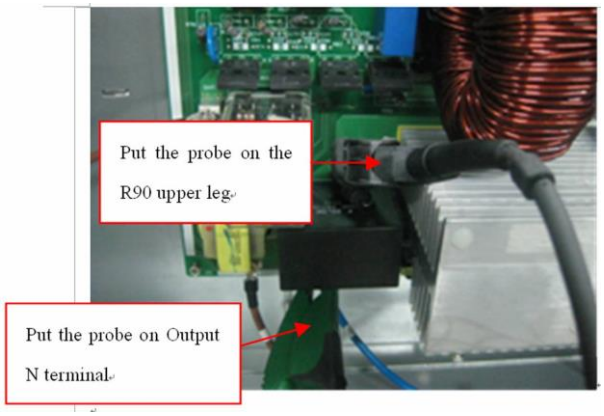


Step 6： Measuring +/- BUS voltage, for 230V output, if BUS voltage is not 370V，please check detection circuit of BUS voltage on PSDR





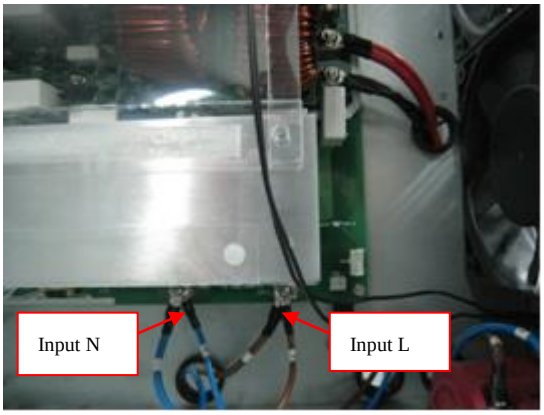
Step 7：Measuring INV voltage, customer can see INV softstart process by measuring this point with oscilloscope if available, if the voltage is not 230V, please check detection circuit of INV voltage on PSDR; **if the frequency is not 50HZ, please check if bypass cable is locked from input EMI board to PSDR.**



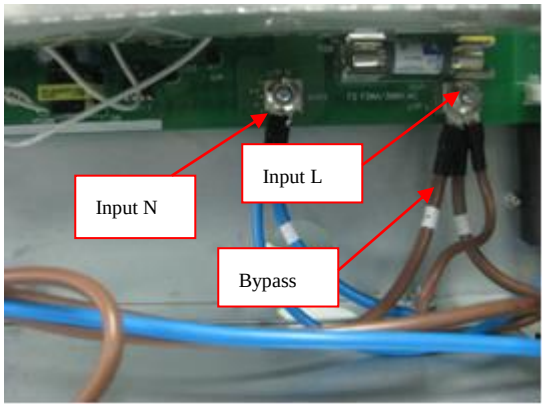
Section 4：Turn on the UPS in line mode to check if RECTIFIER can work fine.

1. Turn off the UPS in battery mode and turn off input breaker. Connect utility input and bypass 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, INV voltage as same as above **Section 3.**

Step 1: Connect back input L, N and BYPASS cable(only for standard model) to PSDR.

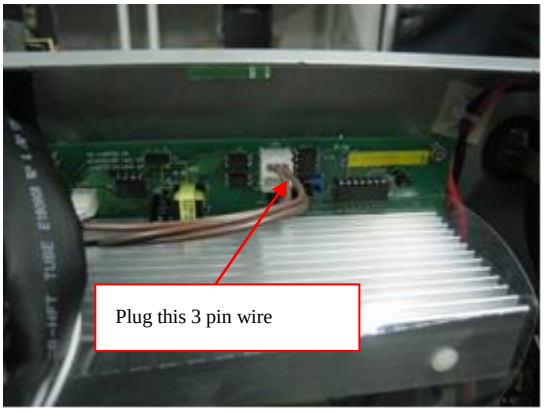


Long run model

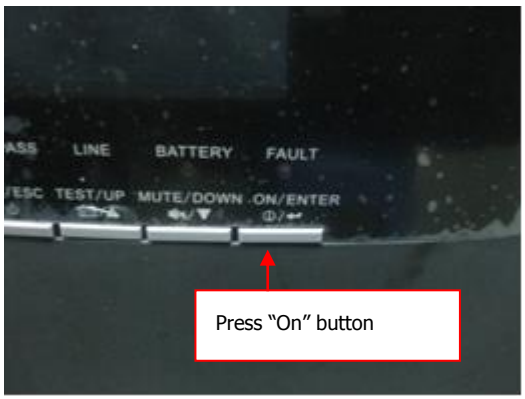


Standard model

Step 2: Plug this 3 pins control wire to charger board.



Step 3 : Turn on the UPS.



Section 5: If UPS passes all of above testing, that means the PSDR can work fine, then please connect the battery back to UPS, install related ventilation paper, put cover back finally, whole testing is over by now.

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.

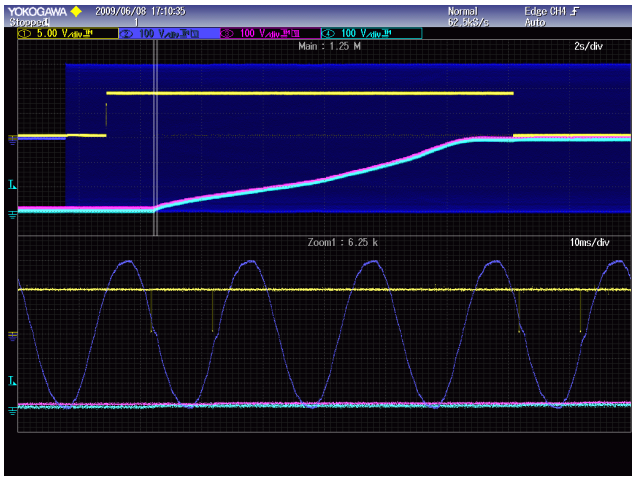
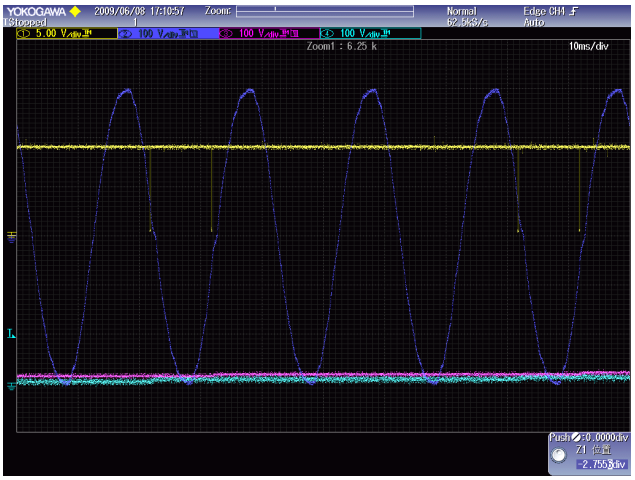
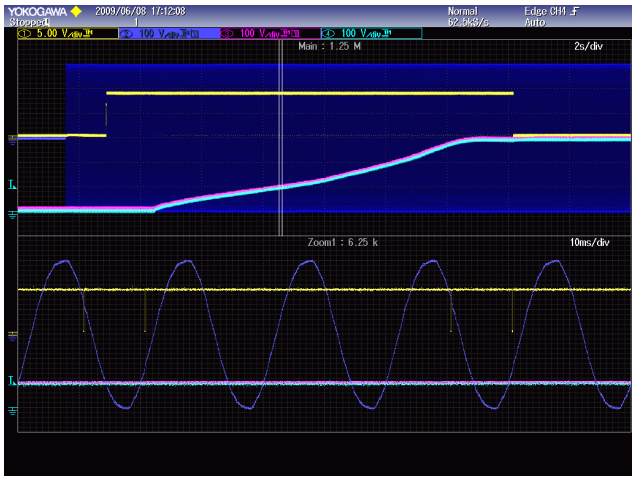
<table>
<tr><td>  </td><td>  </td></tr>
<tr><td>  </td><td>CH1: IP SCR driver
CH2: IP voltage
CH3: -BUS voltage
CH4: +BUS voltage</td></tr>
</table>

Figure 9.1 Switch on the input breaker without turn on

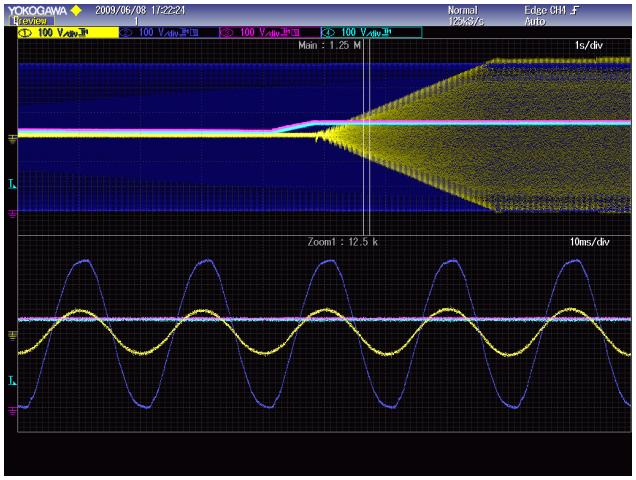
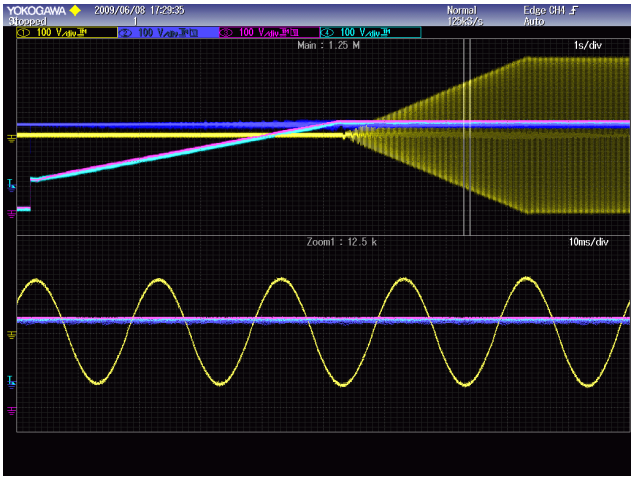
<table>
<tr><td>  </td><td>  </td></tr>
<tr><td>CH1: INV voltage
CH2: IP voltage
CH3: -BUS voltage
CH4: +BUS voltage</td><td>CH1: INV voltage
CH2: Battery voltage
CH3: -BUS voltage
CH4: +BUS voltage</td></tr>
<tr><td>AC mode (transfer from Bypass mode)</td><td>Battery mode</td></tr>
</table>

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=0, 1……, 6.

For example:

Computer: V+1<Enter>

UPS: (ACK

Meanings: Output voltage will increase about 0.8 Volt.

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……, 19.

For example:

Computer: BUSP-01<Enter>

UPS: (ACK

Meanings: Positive BUS voltage will decrease about 0.5 Volt.

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……, 19.

For example:

Computer: BUSN+02<Enter>

UPS: (ACK

Meanings: Negative BUS voltage will increase about 1 Volt.

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……, 19.

For example:

Computer: VB-01<Enter>

UPS: (ACK

Meanings: Battery sampling voltage will decrease about 0.3 Volt.

9.2.7 QVFW

QVFM 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	Reserved
a2	Reserved
a3	Reserved
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
a54-a55	Reserved
a56	Cover of maintain switch is open
a57-a63	Reserved

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: input relay is on 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.