UNINTERRUPTIBLE POWER SYSTEM

SERVICE MANUAL

Smartbitt SBOL50KTIII-3, SBOL60KTIII-3, SBOL90KTIII-3 Tower Model

1. General Information

1.1 Getting start

This manual is for Smartbitt III 30K(L)~200K(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*		30KVA/30KW	60KVA/60KW	100KVA/100KW	120KVA/120KW	180KVA/180KW	200KVA/200KW
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 %at 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 Neutral					
Power Factor		≧ 0.99 at 100% Load					
OUTPUT							
Output voltage		208/220/230/240VAC(208 will derating to 90%)					
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%: 60min; 110%~125%: 10min; 125%~150%:1min;>150% : immediately					
	Battery mode	100%~110%: 60min; 110%~125%: 10min; 125%~150%:1min;>150% : immediately					
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		> 95.5%					
Battery Mode		> 94.5%					
BATTERY							
Standard Model	Type	12 V /7 Ah	NA				
	Numbers	(16+16)pcs*2string					
	Recharge Time	7hours					
	Charging Current	2.0 A ± 10% (max.)					
	Charging Voltage	13.65V ± 1%					
Long-run Model	Type	Depending on applications					
	Numbers	32 - 40					
	Charging Current	1.0~12.0A ±10% (Adjustable)	1.0~18.0A ±10% (Adjustable)	2.0~36.0A ±10% (Adjustable) Each step 2A		3.0~54.0A ±10% (Adjustable) Each step 3A	
	Charging Voltage	13.65VDC± 1%					
PHYSICAL							
Model		30K	30KL	60KL	100KL	120KL	180KL	200KL
Outline	Dimension, D X W X H	815 x 300 x 1000			979 x 600 x 1600		
	Net Weight (kg)	207	74	74.2	250	309	311
Packaging	Dimension, D X W X H	920 x 430 x 1205			1125 x 665 x 1800		
	Gross Weight (kg)	225	94.5	95	278	362	364
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 65dB @ 1 Meter	Less than 70dB @ 1 Meter	Less than 75dB @ 1 Meter	Less than 75dB @ 1 Meter	Less than 75dB @ 1 Meter	Less than 75dB @ 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

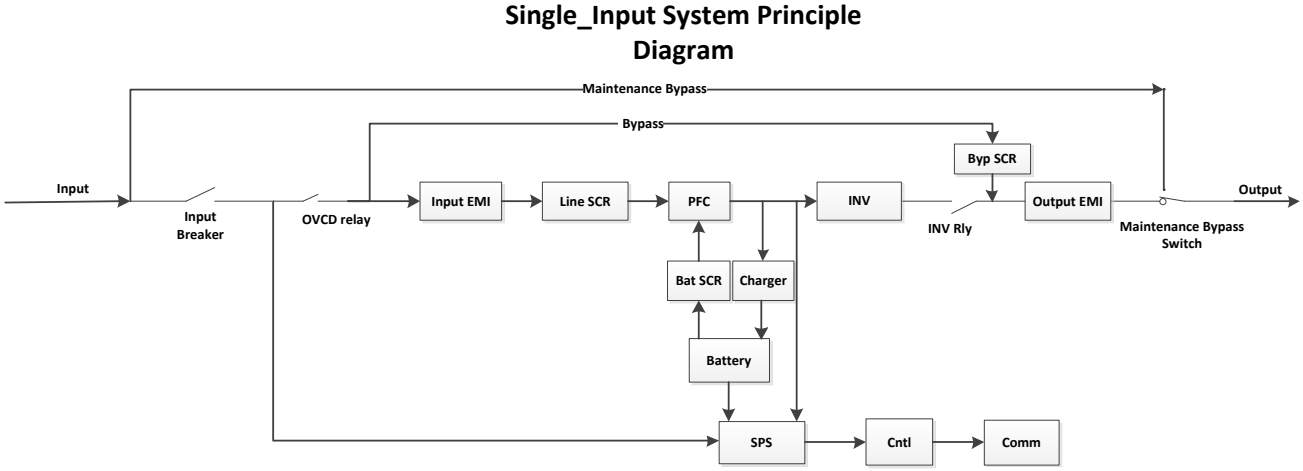


Figure 3.1 Function block Diagram

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 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 DC input power to DC power for recharging the battery. The charger's output current can be setting form 1A to 4A.

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.

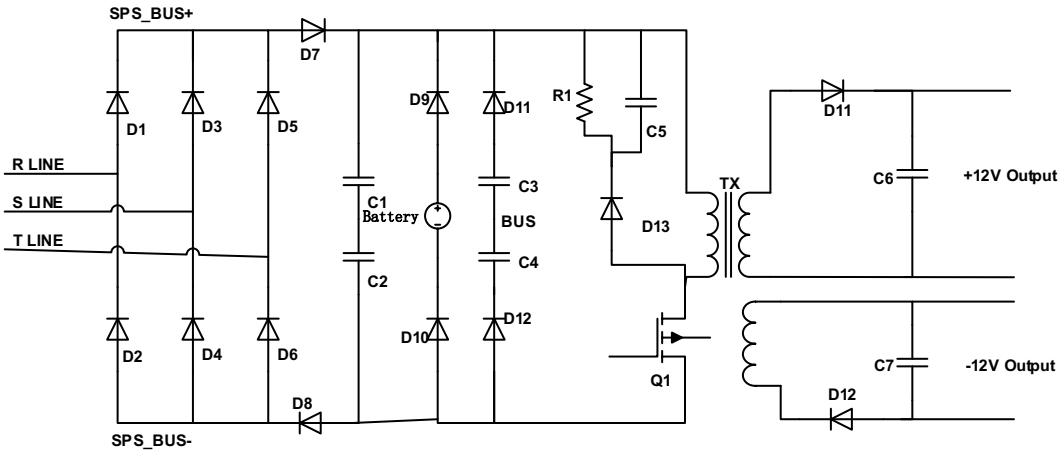


Figure 4.1.1 Basic circuit of power supply for 10K-20K

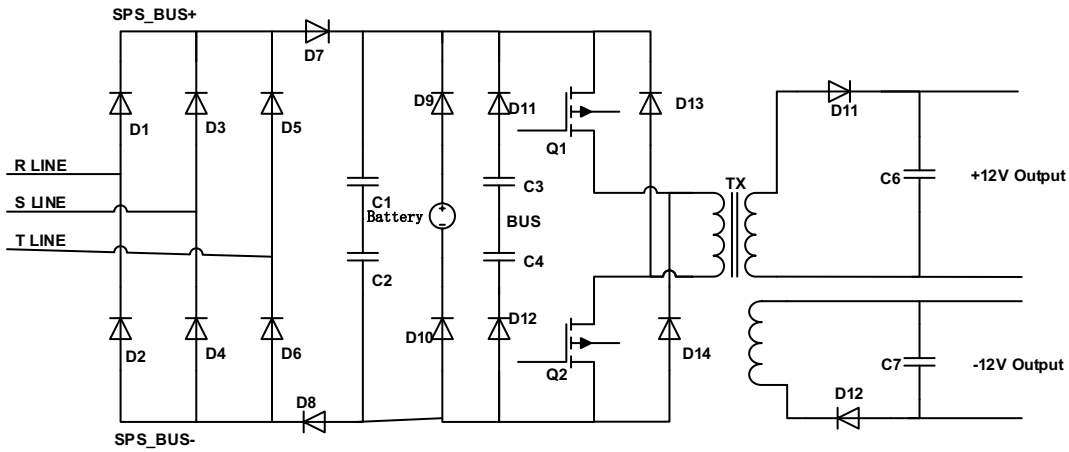


Figure 4.1.2 Basic circuit of power supply for 30K-80K

Figure 4.1.1 is a flyback converter. When Q1 is on, rectifier diodes (D11/D12) are on open status and output capacitors (C6/C7) 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 rectifier diodes (D11/D12) 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 ±12V, +5V, +12V(Fan), and HFPW±.

Figure 4.1.2 is a double tube flyback converter. When Q1 and Q2 are on, rectifier diodes (D11/D12) are on open status and output capacitors (C6/C7) 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 and Q2 are off, primary current will stop and rectifier diodes (D11/D12) 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 ±12V, +5V, +12V(Fan), and HFPW±.

The power of ±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

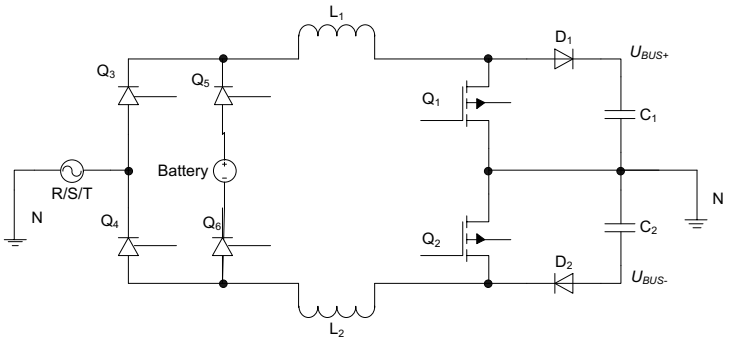


Figure 4.2 PFC/Booster

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 three-level inverter topology is two DC voltages, and the output is an AC voltage, as shown in the Figure 4.3. When Q1 and Q2 are on, Q3 and Q4 are off, the voltage of the middle point bridge is +BUS. When Q1 and Q2 are off, Q3 and Q4 are on, the voltage of the middle point bridge is –BUS. We can get any voltage waveform between ±BUS voltage from LC filter output by regulating the duty cycle of Q1/Q2/Q3/Q4, including sine wave form.

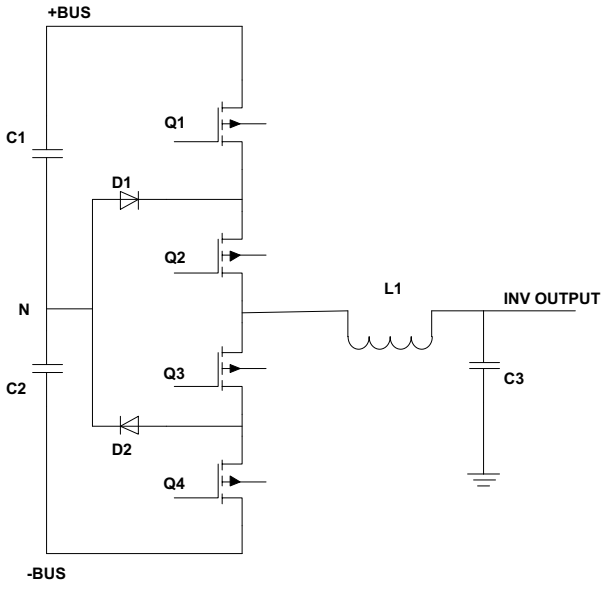


Figure 4.3 three-level inverter

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 buck converter.

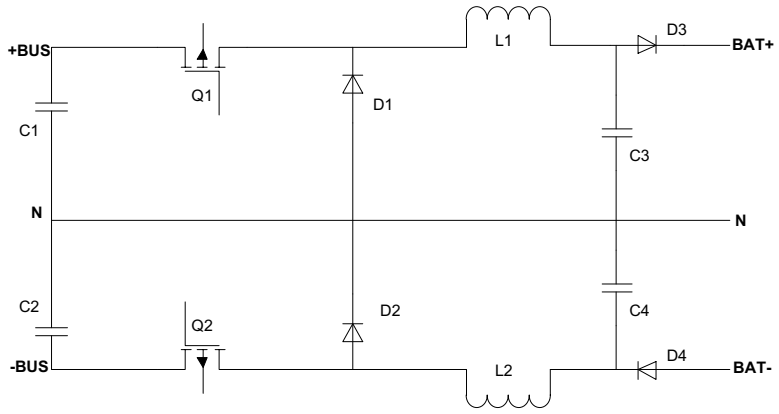


Figure 4.4 Topology of the charger

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.

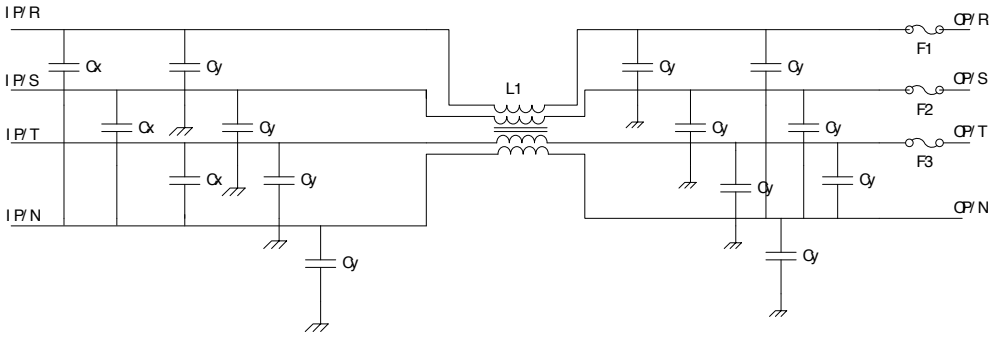


Figure 4.5 Topology of the input/output EMI

■ 5. Picture of the UPS

30k picture

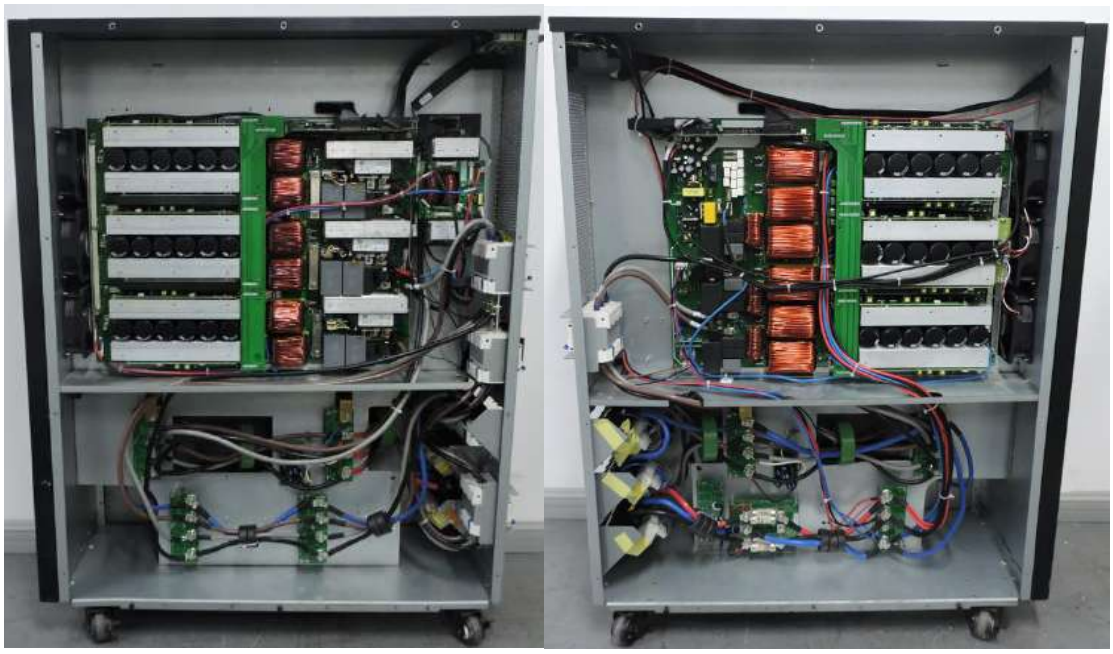
single input

dual input

30k UPS inner picture

60K picture

60K picture



60K unit inner picture

Front panel

Rear panel Left panel

100K~200K picture

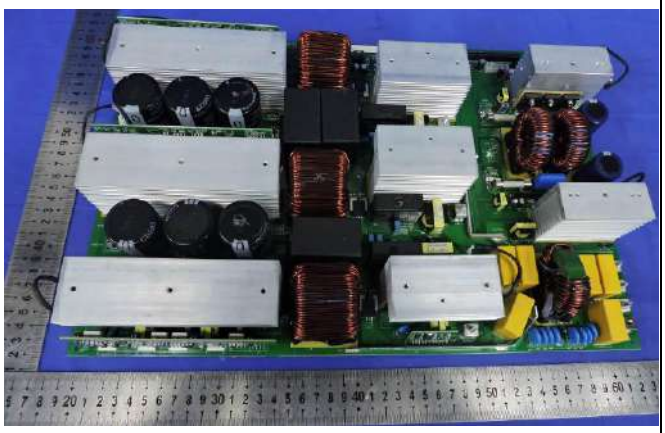
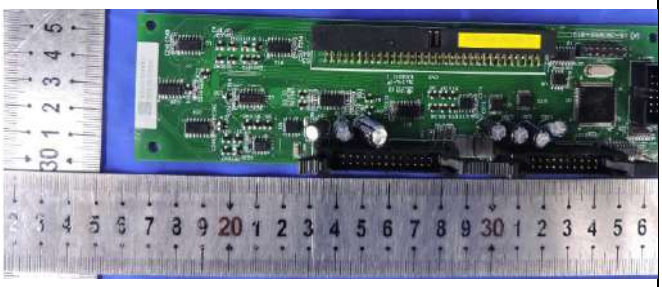
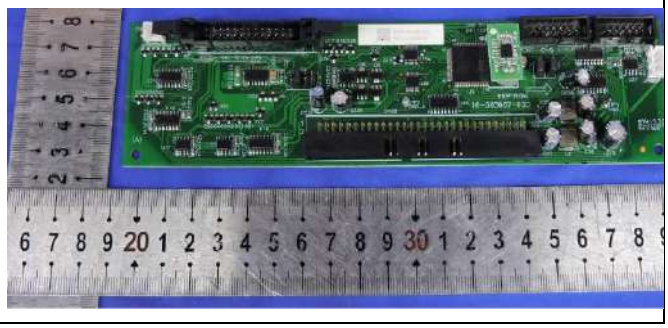
Right side panel

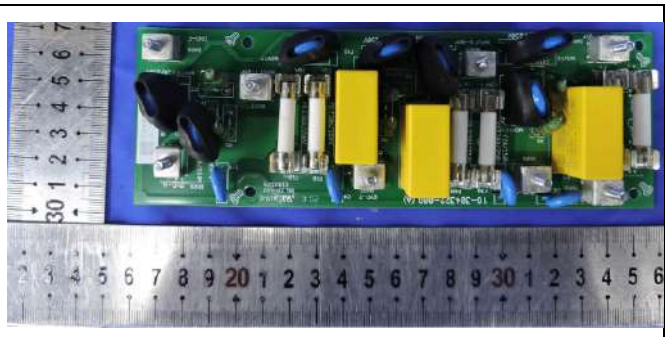
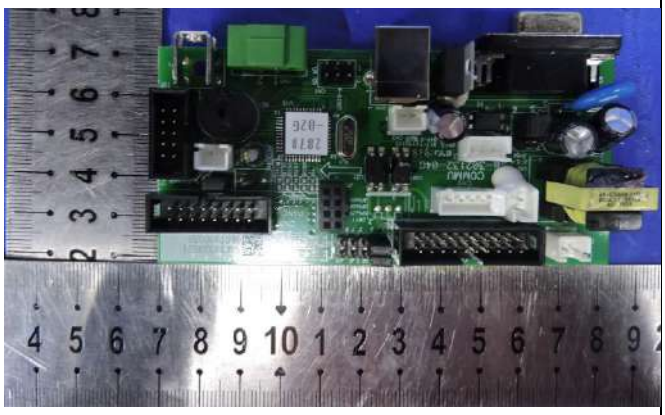
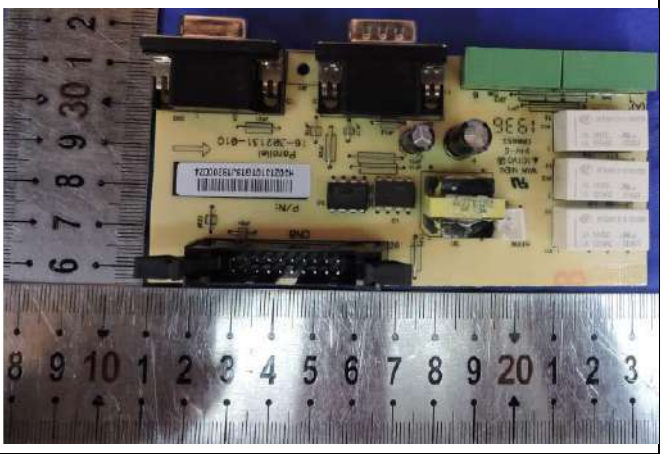
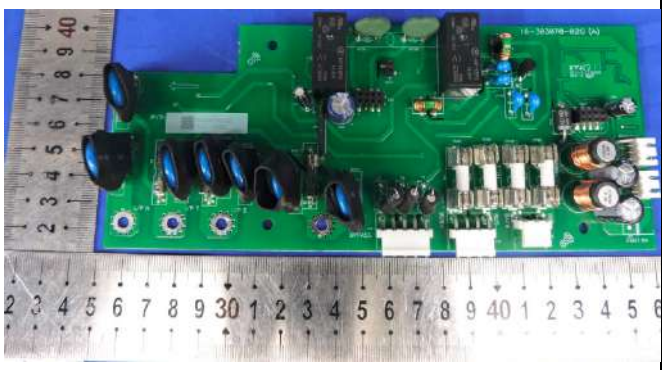
Top side panel

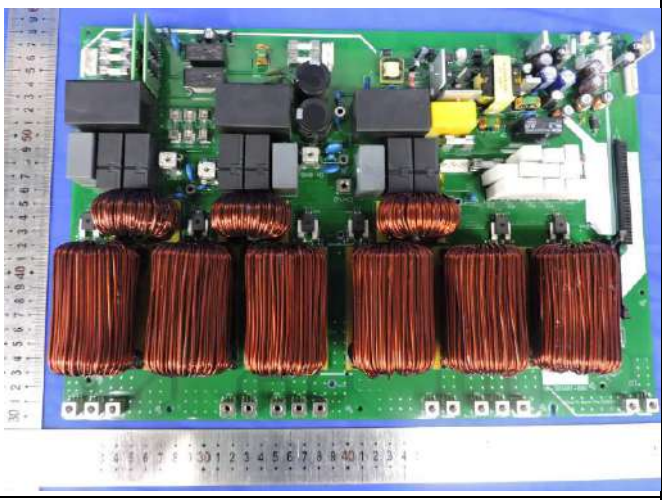
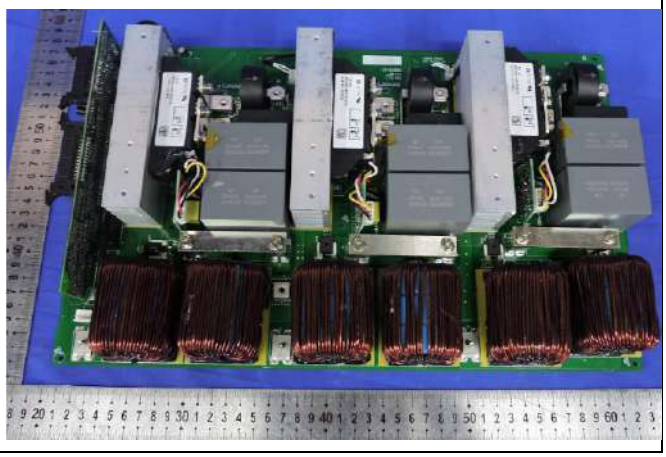
100K~200K picture

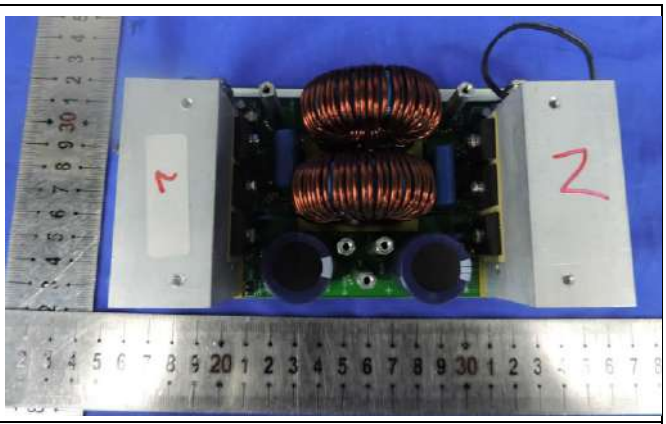
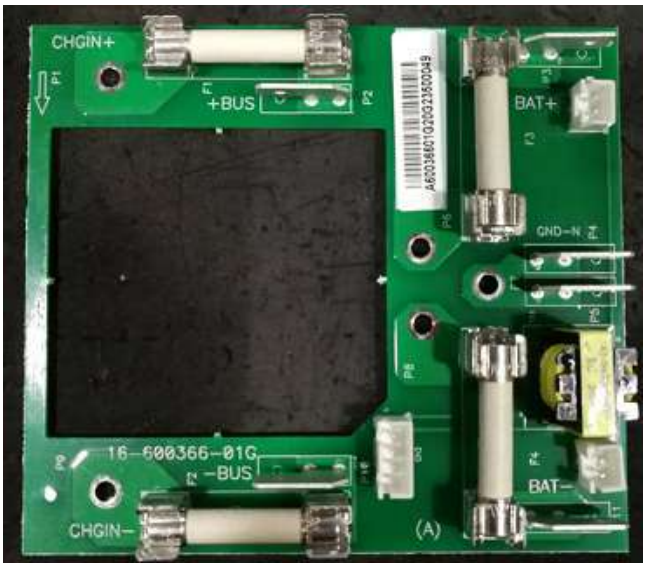
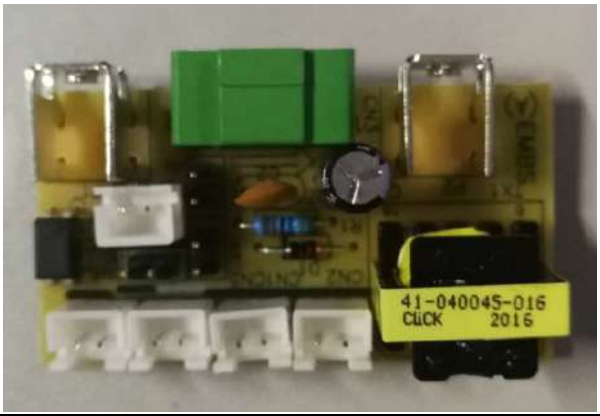
6. Function explanations for each PCB

Table 5.1 PCBA information of Smartbitt 3-3 10~80k

Item	Model	Part number	Function	Picture
1	30K	31-531408-XXG	INV board	
2	30K	31-531407-XXG	PFC board	
3	30K ~ 200K	72-300745-XXG	INV Control board	
4	30K ~ 200K	72-300744-XXG	PFC Control board	

5	30K	71-304525-XXG	Input fuse EMI board	
6	30K Rack	72-300820-XXG(LCD)	Communication board	
	30K 60K Tower	72-300746-XXG(LCD)		
	60K ~ 200K tower	72-300773-XXG(Touch panel)		
7	30K ~ 200K	31-531225-XXG	Parallel board	
8	30K	31-531366-XXG	SPS board	
9	60K ~	31-531025-01G	R PFC board	

	200K	31-531252-XXG	ST PFC board	
10	60K ~ 200K	31-531026-XXG	INV Board	
11	60K ~ 200K	31-531253-XXG	AC IN Board	
12	60K ~ 200K	31-531254-XXG	Bypass board	

13	60K ~ 200K	31-531255-XXG	Charger board	
14	60K ~ 200K	71-600400-XXG	Charger fuse board	
15	30K ~ 200K	71-304252-XXG	SNMP card power supply board	
16	30K ~ 200K	71-300194-XXG	EMBS board	

17	30K ~ 200K	71-303357-XXG (71-304615-00G for advance communication board)	Touch panel power board	

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

7. Interface

7.1 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.

7.2 LCD Display

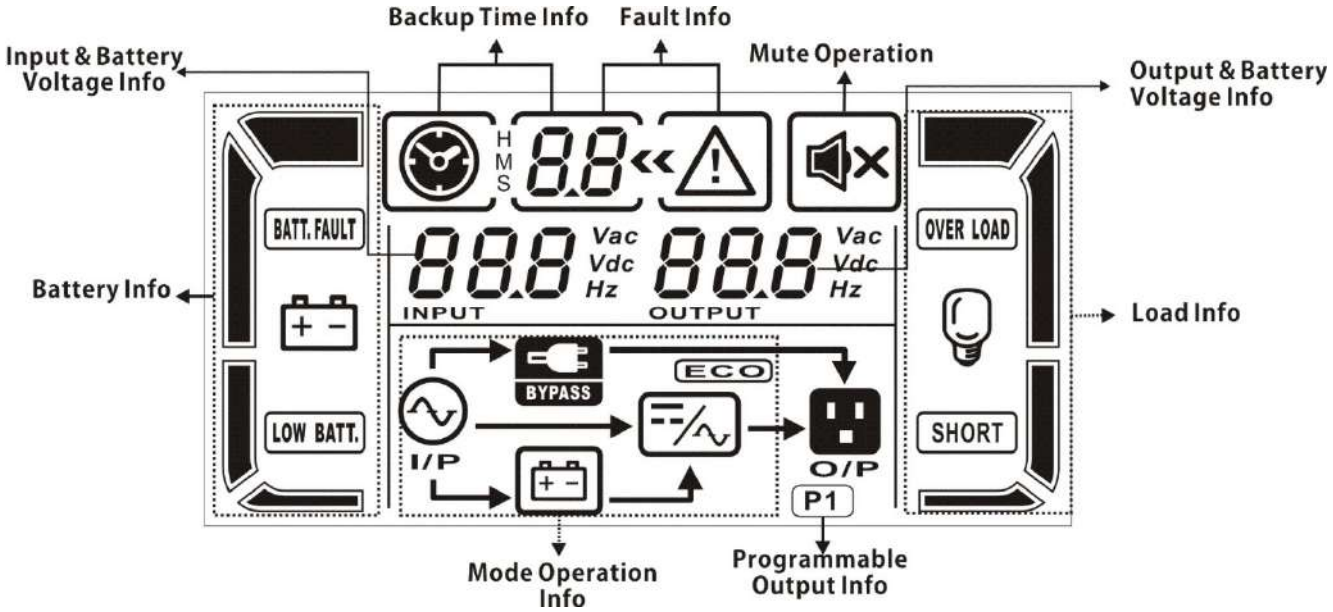
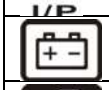
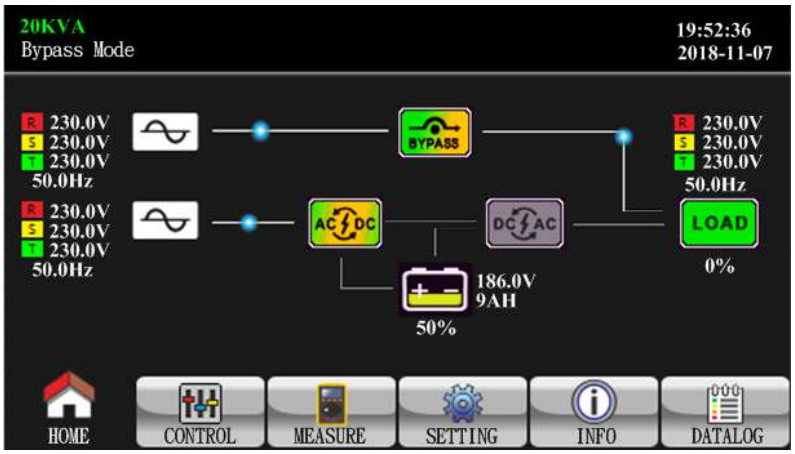


Figure 6.1 LCD Display

7.3 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

7.4 4.3 Inch and 5 inch and 7 inch touch panel display



7.5 4.3 Inch and 5 inch and 7 inch touch panel password

The Primary password is “0000”, this password can set UPS function.

The Factory password is “XXXX”, this password can calibrate the parameter and change all parameter. Only factory and after-sales Service person have this password.

8. 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.

8.1 LCD Panel Display Pattern Definition

8.1.1 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 Open	Check the battery wiring
⚠	02	1 Beeping / second	Input Neutral loss	Check the input N wiring
	04	1 Beeping / second	line phase error	Check the input wires
	05	1 Beeping / second	Bypass phase error	Check the input wires
⚠	07	1 Beeping / second	Battery Over Charge	Check the output voltage of the battery and the charger
⚠ LOW BATT.	08	1 Beeping / second	Battery low	Check the battery voltage
⚠ OVER LOAD	09	2 Beeping / second	Over load warning	Check the loads
⚠	0A	1 Beeping / second	Fan lock warning	Check the fans and wires
⚠ EP	0B	1 Beeping / second	EPO active	Check the EPO plug and EPO cable
⚠	0D	1 Beeping / second	Over temperature	Check the loads, ventilation, ambient temperature
⚠	0E	1 Beeping / second	Charger Fail	Check the charger

	21	1 Beeping / second	Line connect different	Check the R/S/T input
	22	1 Beeping / second	Bypass connect different	Check R phase input
	24	1 Beeping / second	Parallel load different	Check the output cable
	33	1 Beeping / second	Locked in bypass after overload 3 times in 30min	Check the loads
	34	1 Beeping / second	AC Input current unbalance	Check the converter
	36	1 Beeping / second	INV current unbalance	Check the inverter
	38	1 Beeping / second	Battery replace	Replace the battery
	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 CN12 in 16-302132--XXG for 30K~80K
	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.
	3E	1 Beeping / second	Battery Voltage High	Check the battery number setting
	3F	1 Beeping / second	Battery Voltage Unbalance	Check the charger or Battery fuse
	41	1 Beeping / second	Bypass Loss	Check the bypass
	42	1 Beeping / second	ISO over temperature	Check the ISO transformer

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

8.1.2 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~80k

Code	LCD icon	Fault Event	Description	Action
01	None	BUS 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 over	When one of the following conditions occurs, the fault signal will be displayed. +Bus voltage keeps higher or the –BUS voltage keeps lower than normal.	If line mode and battery mode all alarm 02 fault, it is means the PFC part have problem. If line mode alarm 02 fault, but battery mode can work normal, the reason is bypass part circuit have problem. Please check the INV relay and bypass SCR. If 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 under	When +Bus voltage keeps lower or the –BUS voltage keeps higher than normal, 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 unbalance	When the difference between the ±Bus voltage absolute value, 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	PFC over current	When the current of PFC/Boost is over current, 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 start failure	Inverter voltage can't reach the setting value.	Check the inverter drive circuit.
12	None	High inverter voltage	When INV voltage keeps higher than normal, 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 INV components are normal.
13	None	Low Inverter Voltage	When INV voltage keeps Lower than normal, the fault signal will be displayed.	
14	SHORT	Inverter L1 output short	When INV phase L1 output voltage keeps lower and output current keeps higher than normal, 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 L2 output short	When INV phase L2 output voltage keeps lower and output current keeps higher than normal, the fault signal will be	

			displayed.	
16	SHORT	Inverter L3 output short	When INV phase L3 output voltage keeps lower and output current keeps higher than normal, the fault signal will be displayed.	
17	SHORT	Inverter L1L2 output short	When INV phase L1-phase L2(Line to line) voltage keeps lower and output current keeps higher than normal, 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.
18	SHORT	Inverter L2L3 output short	When INV phase L2-phase L3(Line to line) voltage keeps lower and output current keeps higher than normal, the fault signal will be displayed	
19	SHORT	Inverter L3L1 output short	When INV phase L3-phase L1(Line to line) voltage keeps lower and output current keeps higher than normal, the fault signal will be displayed	
1A	None	Inverter L1 negative power fault	When the output power on the INV phase L1 terminal is overpower, 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.
1B	None	Inverter L2 negative power fault	When the output power on the INV phase L2 terminal is over power, the fault signal will be displayed	
1C	None	Inverter L3 negative power fault	When the output power on the INV phase L3 terminal is over power, the fault signal will be displayed	
23	None	Inverter relay open	The inverter voltage detection is normal, but the output voltage difference	Check the INV relay circuited

			form the inverter voltage	
25	None	wiring fault	INV relay and bypass SCR open, but output voltage is higher than normal.	Check the input and output wires
31	None	CAN communication fault	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.
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	None	DSP communication Failure	When the communication between the INV control board and the PFC control board is interrupted, the fault signal will be displayed.	
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.
45	None	Charger Error	The UPS detect the charger current more than 1.5A when power on the UPS	Check the charger HCT
46	None	Model fault	The UPS can not identify the right model.	Check the Model Pin of the Control board is inserted correctly
47	None	DSP and MCU communication Failure	When the communication between the INV control board and the COMM board is interrupted, the fault signal will be displayed.	1, for 30K~80K old version (2016~2019) AC EMI board, maybe the problem is 5V power have problem. It need to replace the AC EMI board. 2, Check if the flat cable between the INV control board and the COMM board is normal.
49	None	Input and output phase sequence is not compatible	Input and output phase sequence different	Check the input and output cable connect status
60	None	Inverter over current fault	Output voltage stable and output current RMS is higher than normal	Check the loads and remove some non-critical loads. Check whether some loads are failed.
61	None	Bypass SCR short	There isn't signal drive the bypass SCR close, but bypass output voltage higher	Check the wire connection make sure the output is not source, check the Bypass SCR circuited
62	None	Bypass SCR open	There is signal drive the bypass SCR close, but bypass output voltage is lower than normal	Check Bypass SCR circuited and the input relay circuited

63	None	Inverter L1 waveform abnormal	the voltage difference between the inverter reference and inverter sample is greater than normal	Check the load is not overload and no surge load ,Check the Inverter circuited
64	None	Inverter L2 waveform abnormal	the voltage difference between the inverter reference and inverter sample is greater than normal	
65	None	Inverter L3 waveform abnormal	the voltage difference between the inverter reference and inverter sample is greater than normal	
67	None	Bypass output short (L-N)	Bypass O/P voltage drop too fast and O/P current more than normal	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.
68	None	Bypass output line short (L-L)	Each of line current more than normal, but line plus line current lower than normal	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.
69	None	Inverter Relay short circuited	There isn't signal drive the Inverter Relay close, but inverter output voltage over normal	Check the Inverter Relay circuited
6C	None	BUS voltage vary fast	BUS voltage drop too fast in Inverter mode.	Remove all the loads. Turn off the UPS. Check whether the output of UPS and loads are short circuited.
6D	None	Current detect error	Inverter current and share current and output current sample deviation more than normal	Check the current sample circuited on the bypass board.
6E	None	SPS Power fault	SPS 12V power lower than normal	Check the SPS circuited
6F	None	Battery connect reverse	Battery polarity reverse	Check the battery connect polarity
71	None	L1 PFC IGBT over current fault	The unit have detected IGBT fault signal from the drive board	Check the IGBT drive signal and PFC IGBT circuited
72	None	L2 PFC IGBT over current fault	The unit have detected IGBT fault signal from the drive board	
73	None	L3 PFC IGBT over current fault	The unit have detected IGBT fault signal from the drive board	

74	None	L1 INV IGBT over current fault	The unit have detected IGBT fault signal from the drive board	Check the IGBT drive signal and INV IGBT circuited
75	None	L2 INV IGBT over current fault	The unit have detected IGBT fault signal from the drive board	
76	None	L3 INV IGBT over current fault	The unit have detected IGBT fault signal from the drive board	
77	None	ISO transformer over temperature	Output ISO transformer or Auto transformer over temperature	Check the output load and Transformer Fan
78	None	LCD and MCU communication failure	Touch panel and MCU communication failure	Check the flat cable between the LCD and MCU

8.1.3 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.

8.2 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.

8.2.1 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;

8.2.2 Configuration of the Model pin on the Control Board

The Model Port (JS4, JS5，JS6) on the CNTL board (71-303067-XXG) and the JS should be configured as follows:

Table 7.1 Model Pin Setting List

Model Type	JS6				JS5	JS4
	Pin1&pin2	Pin3&pin4	Pin5&pin6	Pin7&pin8		
30K	0	0	1	0	0	0
30KL	0	0	1	0	1	0
60K	0	1	0	0	0	1
60KL	0	1	0	0	1	1
100KL	1	0	0	0	1	1
120KL	0	1	0	0	1	1
180KL	0	1	0	0	1	1
200KL	0	0	1	0	1	1

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

“0”indicates that nothing is connected,

For long run model, The 30KL’s charge board on the INV board （71-304125-XXG）。The 30KL’s default charging current is 4A for battery configuration.

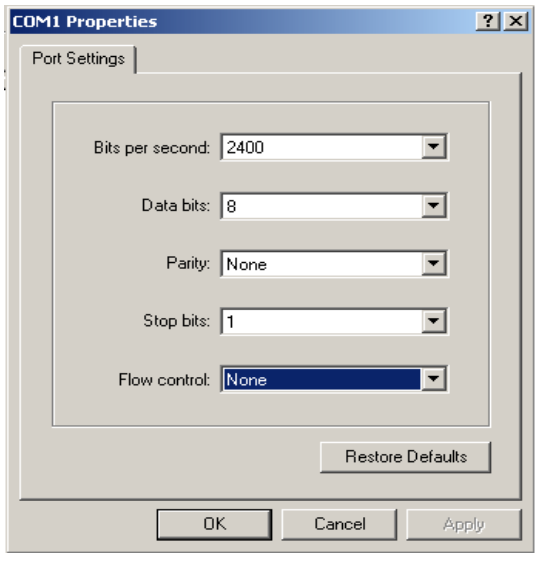
For standard mode, The 30K’s charge board on the INV board （71-304125-XXG）。The 30K’s default charging current is 2A for battery configuration.

For long run model, charger’s part number is 71-303981-03G-XXG (“xx” means the version of charger) normally, the 60KL’s default charging current is 8A for battery configuration, and the 100KL/120KL’s default charging current is 16A for battery configuration,and the 180KL/200KL’s default charging current is 24A for battery configuration.

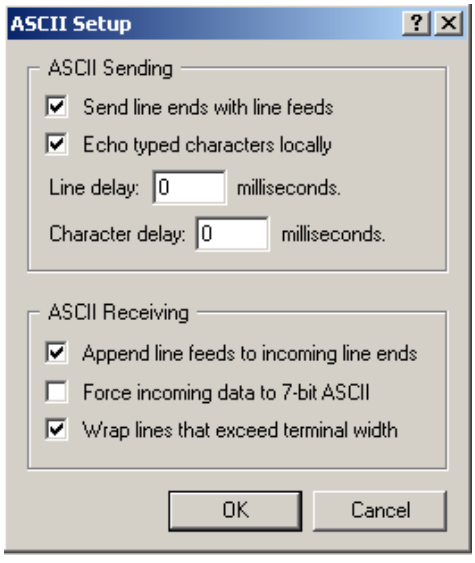
8.2.3 Regulation of the system

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.

8.2.4 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.

30K SPS Section

Circuit Block	Checked components	Component Type	Failure condition
SPS	F1,F2,F3, F4, F5, F6, F9, F10, F11, F12	Fuse	Open
	D1,D2,D3,D4,D5,D6,D7,D8,D9,D10,D11,D12,D13,D14,D16,D17,D18,D19,D20,D21,D22,D23,D24,D27,D32,D35,D25, D26	Power Diode	Short or open

30K PFC Section

Circuit Block	Checked components	Component Type	Failure condition
OVCD relay drive	Q11, Q12	MOSFET	D-S short or open
SPS	Q15,Q16	MOSFET	D-S short or open
	D11,D21,D5,D6,D7,D74,D75	Power Diode	Short or open
	U5	Power IC	I-O short or open
	U1	Power Control IC	Vcc short to GND
	U4	Power 5v IC	Vcc short to GND
Rectifier	UC1, UC2, UC3, UC4, UC5, UC6, UC7, UC8,	SCR	A-K Short or open

	UC9, UC10, UC11 ,UC12		
PFC	D9,D10,D19,D20,D29,D30	Diode	Short or open
	Q1,Q2, Q5,Q6, Q9,Q10	IGBT	C-E short or open

30K INV Section

Circuit Block	Checked components	Component Type	Failure condition
STS	Q40,Q17,Q43,Q21,Q23,Q45, Q30,Q32,Q33,Q41,Q44,Q46	SCR	A-K Short or open
INV	D38,D41,D40,D47,D58,D57	Diode	Short or open
	Q13,Q14,Q15,Q16,Q22,Q18,Q20,Q19,Q25,Q26,Q27,Q28	IGBT	C-E short or open
DC FUSE	F1,F2, F3, F4,F5,F6,F7,F8	Fuse	Open
Power Semiconductor	Q1,Q2	MOSFET	D-S short or open
	D3,D4,D1,D9	Diode	Short or open
	U4,U9	Power Control IC	Vcc short to GND

30K BAT FUSE Section

Circuit Block	Checked components	Component Type	Failure condition
BAT I/P Fuse	F1,F2,F3,F4,F5,F6	Fuse	Open

8.2.4.1 30K Major parameters of Rectifier and PFC and SPS 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.

30K PFC Section

Checked components		Instrument function	Reference Value	Failed condition
UC1,UC2,UC3,UC4,UC5, UC6,UC7,UC8UC9, UC10,UC11,UC12	(A, K)	Resistance	infinite	Short
	(G, K)	Resistance	≈20Ω	Short
R9,R10,R24,R25,R61,R62,R76,R77,R111,R112, R126,R127		Resistance	≈33Ω	Value change
Q1,Q2, Q5,Q6, Q9,Q10	(E, C)	Diode Voltage Droop	≈0.38V	Short or open
	(E, G)	Diode Voltage Droop	≈1.0V	Short or open
	(G, E)	Resistance	≈50KΩ	Short or open
R26,R27,R78,R79, R128,R129		Resistance	≈10Ω	Short or open
D9,D10,D19,D20,D29,D30		Diode Voltage Droop	≈0.372V	Short or open
Q16	(S, D)	Diode Voltage Droop	≈0.506V	Short or open
	(S, G)	Diode Voltage Droop	≈0.339V	Short or open
	(G, S)	Resistance	≈15KΩ	Short or open
U14,U11		Diode Voltage Droop	≈0.509V	Short or open
D75		Diode Voltage Droop	≈0.29V	Short or open
D74		Diode Voltage Droop	≈0.35V	Short or open
Q11,Q12	(S, D)	Diode Voltage Droop	≈0.31V	Short or open
	(S, G)	Diode Voltage Droop	infinite	Short or open
	(G, S)	Resistance	≈20KΩ	Short or open

8.2.4.2 30K Major parameters of Bypass and INV and 12A Charger section。

Checked components		Instrument function	Reference Value	Failed condition
Q40,Q17,Q43,Q21,Q23,Q45, Q30,Q32,Q33,Q41,Q44,Q46	(A, K)	Resistance	≈44MΩ	Short or open
	(G, K)	Resistance	≈17Ω	Short or open
R29,R201,R211,R39,R233,R40,R451,R453,R321,R66,R454,R457		Resistance	≈33Ω	Short or open
Q13,Q14,Q15,Q16,Q22,Q18,Q20,Q19,Q25, Q26,Q27,Q28	(E, C)	Diode Voltage Droop	≈0.38V	
	(E, G)	Diode Voltage Droop	≈1.0V	
	(G, E)	Resistance	≈50KΩ	
R155,R158,R188,R328,R195,R198		Resistance	≈10Ω	Short or open
R196,R197,R328,R178,R156,R157		Resistance	≈33Ω	Short or open
R366,R365,R362,R361,R358,R357		Resistance	≈22Ω	
D33,D34,D37,D39,D44,D45		Diode Voltage Droop	≈0.056V	
D58,D38,D40,D57,D41,D47		Diode Voltage Droop	≈0.368V	Short or open
F1,F2, F3, F4,F5,F6,F7,F8		Resistance	<0.5Ω	Open
Q1,Q2	(S, D)	Diode Voltage Droop	≈0.393V	Short or open
	(G, S)	Diode Voltage Droop	≈1.399V	Short or open
	(G, D)	Diode Voltage Droop	≈1.777V	Short or open
	(G, S)	Resistance	≈10KΩ	Short or open
D3,D4,		Diode Voltage Droop	≈0.375V	Short or open
UC1 UC2	(A, K)	Resistance	≈1.3MΩ	Short or open
	(G, K)	Resistance	≈23Ω	Short or open

8.2.4.3 30K Major parameters of SPS section。

30K SPS Section

Checked components	Instrument function	Reference Value	Failed Condition
F4, F5, F6, F9, F10, F11, F12	Resistance	< 0.5 Ω	Open
D13,D14,D16,D17,D18,D19,D20, D21,D22,D23,D24,D27	Diode Voltage Droop	≈0.59V	Short or open
D32,D35,D25,D26	Diode Voltage Droop	≈0.425V	Short or open

60-200K AC EMI Section

Circuit Block	Checked components	Component Type	Failure condition
Back feed drive	Q3, Q9	MOSFET	D-S short or open
SPS	F1,F2,F3,F4, F5, F6,F7,F8, F9, F10, F11, F12	Fuse	Open
	Q1,Q2,U9,U21	MOSFET	D-S short or open
	D6,D13, D14, D7,D8,D10,D11,D12,	Power Diode	Short or open
	U1,U11,U3	Power IC	I-O short or open
	U4	Power Control IC	Vcc short to GND

60-200K INPUT LINE FUSE Section

Circuit Block	Checked components	Component Type	Failure condition

Line I/P FUSE	F1,F2,F3,F4,F5,F6,	Fuse	Open

60-200K BAT FUSE Section

Circuit Block	Checked components	Component Type	Failure condition
BAT I/P Fuse	F1,F2,F3,F4	Fuse	Open

18A Charger Section

Circuit Block	Checked components	Component Type	Failure condition
DC FUSE	F1,F2, F3, F4	Fuse	Open
MOSFET	Q1,Q2	MOSFET	D-S short or open
SCR	UC1,UC2	SCR	Short
D	D3,D4	D	Short

60-200K PFC Section

Circuit Block	Checked components	Component Type	Failure condition
SCR	UC1, UC2,UC3,UC4,UC5,UC6,UC7,UC8	SCR	A-K Short or open
D	D1,D2,D3,D4	D	Short
IGBT	Q1,Q2,Q3,Q4,Q5,Q6	IGBT	C-E Short

60-200K INV Section

Circuit Block	Checked components	Component Type	Failure condition
D	D1,D2,D5,D6,D7,D8,D9,D10	D	Short
IGBT	Q1,Q2,Q3,Q4,Q5,Q6,Q7,Q8,Q9,Q10,Q11,Q12	IGBT	C-E Short

60-200K BYPASS Section

Circuit Block	Checked components	Component Type	Failure condition
SCR	SCR1,SCR2,SCR3	SCR	Short or Open
RLY	RLY10,RLY11,RLY12	RELAY	Short or Open
INV FUSE	F1,F2,F3	FUSE	Open

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

8.2.4.4 30-200K Major parameters of Rectifier and PFC and SPS 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.

30K PFC Section

Checked components		Instrument function	Reference Value	Failed condition
UC1,UC2,UC3,UC4,UC5, UC6,UC7,UC8UC9, UC10,UC11,UC12	(A, K)	Resistance	infinite	Short
	(G, K)	Resistance	≈20Ω	Short

R5,R6,R7,R8,R9,R10,R24,R25,R61,R62,R76,R77,R111,R112, R126,R127		Resistance	≈33Ω	Value change
Q1,Q2, Q5,Q6, Q9,Q10	(E, C)	Diode Voltage Droop	≈0.38V	Short or open
	(E, G)	Diode Voltage Droop	≈1.0V	Short or open
	(G, E)	Resistance	≈50KΩ	Short or open
R26,R27,R78,R79, R128,R129		Resistance	≈10Ω	Short or open
D9,D10,D19,D20,D29,D30		Diode Voltage Droop	≈0.372V	Short or open
Q1,Q2,Q3,Q4,Q5,Q6, Q13	(S, D)	Diode Voltage Droop	≈0.443V	Short or open
	(S, G)	Diode Voltage Droop	≈0.691V	Short or open
	(G, S)	Resistance	≈20KΩ	Short or open
Q14	(S, D)	Diode Voltage Droop	≈0.443V	Short or open
	(S, G)	Diode Voltage Droop	≈0.309V	Short or open
	(G, S)	Resistance	≈51KΩ	Short or open
D1,D2,D3,D4,D41,D44		Diode Voltage Droop	≈0.44V	Short or open
D75		Diode Voltage Droop	≈0.29V	Short or open
D74		Diode Voltage Droop	≈0.35V	Short or open
Q11,Q12	(S, D)	Diode Voltage Droop	≈0.31V	Short or open
	(S, G)	Diode Voltage Droop	infinite	Short or open
	(G, S)	Resistance	≈20KΩ	Short or open

60-200K PFC Section

Checked components		**Instrument function**	**Reference Value**	**Failed condition**
UC1,UC2,UC3,UC4,UC5,UC6,UC7,UC8	(A, K)	Resistance	infinite	Short
	(G, K)	Resistance	≈20Ω	Short
R5,R6,R7,R8,R9,R10		Resistance	≈33Ω	Value change
Q1,Q2,Q3,Q4,Q5,Q6	(E, C)	Diode Voltage Droop	≈0.38V	Short or open
	(E, G)	Diode Voltage Droop	≈1.0V	Short or open
	(G, E)	Resistance	≈50KΩ	Short or open
D1,D2,D3,D4		Diode Voltage Droop	≈0.372V	Short or open

8.2.4.5 30-200K Major parameters of Bypass and INV and Charger section。

30K Bypass and INV and Charger section

Checked components		**Instrument function**	**Reference Value**	**Failed condition**
Q40,Q17,Q43,Q21,Q23,	(A, K)	Resistance	≈6MΩ	Short or open

Q45	(G, K)	Resistance	≈17Ω	Short or open
R29,R201,R211,R39,R233,R40		Resistance	≈33Ω	Short or open
Q13,Q14,Q15,Q16,Q22,Q18,Q20,Q19,Q25, Q26,Q27,Q28	(E, C)	Diode Voltage Droop	≈0.38V	
	(E, G)	Diode Voltage Droop	≈1.0V	
	(G, E)	Resistance	≈50KΩ	
R155,R158,R188,R328,R195,R198		Resistance	≈10Ω	Short or open
R196,R197,R328,R178,R156,R157		Resistance	≈33Ω	Short or open
R366,R365,R362,R361,R358,R357		Resistance	≈22Ω	
D33,D34,D37,D39,D44,D45		Diode Voltage Droop	≈0.056V	
D58,D38,D40,D57,D41,D47		Diode Voltage Droop	≈0.368V	Short or open
F1,F2, F3, F4,F5,F6,F7,F8		Resistance	<0.5Ω	Open
Q1,Q2	(S, D)	Diode Voltage Droop	≈0.521V	Short or open
	(G, S)	Diode Voltage Droop	≈2.288V	Short or open
	(G, D)	Diode Voltage Droop	≈2.45V	Short or open
	(G, S)	Resistance	≈10KΩ	Short or open
D3,D4,		Diode Voltage Droop	≈0.375V	Short or open
D1,D9		Diode Voltage Droop	≈0.415V	Short or open

60-200K INV Section

Checked components		**Instrument function**	**Reference Value**	**Failed condition**
Q1,Q2,Q3,Q4,Q5,Q6,Q7,Q8 ,Q9,Q10,Q11,Q12	(E, C)	Diode Voltage Droop	≈0.38V	Short or open
	(E, G)	Diode Voltage Droop	≈1.0V	Short or open
	(G, E)	Resistance	≈50KΩ	Short or open
D1,D2,D3,D4		Diode Voltage Droop	≈0.372V	Short or open

60-200K BYPASS Section

Checked components		**Instrument function**	**Reference Value**	**Failed condition**
SCR1,SCR2,SCR3	(A, K)	Resistance	≈6MΩ	Short or open
RLY10,RLY11,RLY12		Resistance	< 0.5 Ω	Short or open
F1,F2,F3		Resistance	< 0.5 Ω	open

60-200K CHARGER Section

Checked components		**Instrument function**	**Reference Value**	**Failed condition**
Q1,Q2	(S, D)	Diode Voltage Droop	≈0.521V	Short or open
	(G, S)	Diode Voltage Droop	≈2.288V	Short or open
	(G, D)	Diode Voltage Droop	≈2.45V	Short or open
	(G, S)	Resistance	≈10KΩ	Short or open
UC1,UC2	(A, K)	Resistance	≈6MΩ	Short or open
F1,F2, F3, F4		Resistance	< 0.5 Ω	open

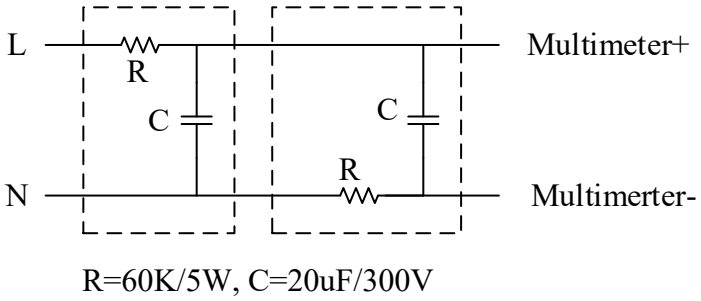
8.2.4.6 30-200K Major parameters of SPS section。

30-200K SPS Section

Checked components	Instrument function	Reference Value	Failed Condition
F1,F2,F3,F4, F5, F6, F9, F10, F11, F12	Resistance	< 0.5 Ω	Open
D6,D13,D14,D7,D8,D10,D11,D12,D16,D17,D18,D19,D20, D21,D22,D23,D24,D27	Diode Voltage Droop	≈0.59V	Short or open
D32,D35,D25,D26	Diode Voltage Droop	≈0.425V	Short or open

8.2.5 Output DC offset value test method

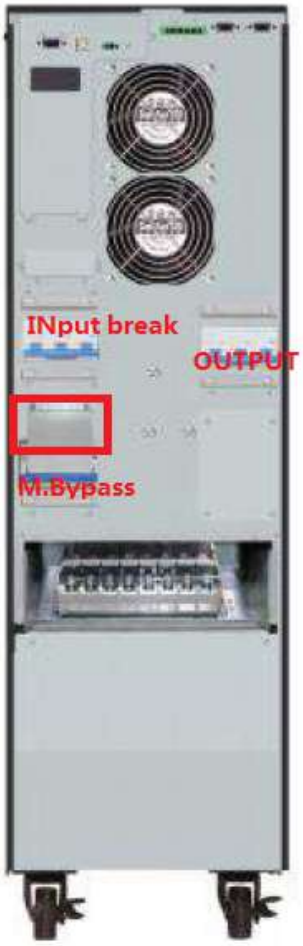
RC filter for test inverter offset (DC balance), check -50mV<output DC value < +50mV



R=60K/5W, C=20uF/300V

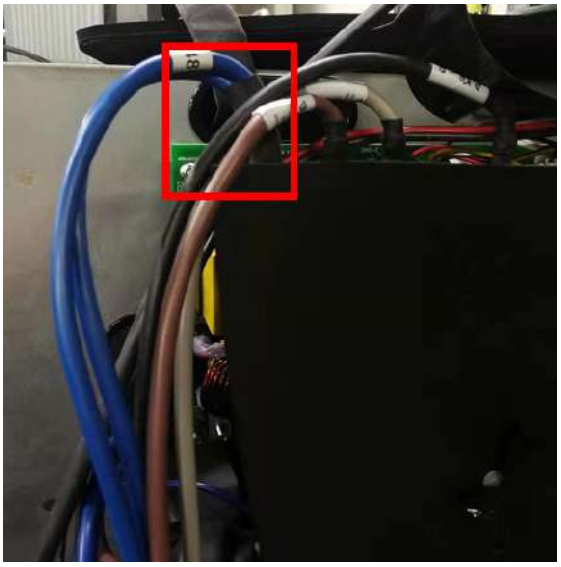
9 How To Transfer the UPS from Online mode to Maintain Bypass mode

9.1 HV30KL/LV15KL mode transfer to Maintain Bypass mode



HV30KL/LV15KL Single Input Mode

HV30KL/LV15KL Dual Input Mode



Input Neutral on the SPS board

Below is the step transfer to Maintain bypass mode:

1, if the UPS work in online mode, please turn off the UPS to bypass mode.

2, Removing the cover of the Maintain bypass, then the UPS will force transfer to bypass mode and the warning 3A will alarm.

3, Close the Maintain bypass switch.

4, Turn off the Input Breaker and output breaker. If your UPS is Dual Input mode, please also turn off the bypass breaker.

5, Disconnect the Input Neutral which locked on the SPS board.

HV60KL/LV30KL Dual Input Mode

Below is the step transfer to Maintain bypass mode:

1, if the UPS work in online mode, please turn off the UPS to bypass mode.

2, Removing the cover of the Maintain bypass, then the UPS will force transfer to bypass mode and the warning 3A will alarm.

3, Close the Maintain bypass switch.

4, Turn off the Input Breaker and output breaker. If your UPS is Dual Input mode, please also turn off the bypass breaker.

5, Disconnect the Input Neutral which locked on the SPS board.

9.3 HV120KL~200KLmode transfer to Maintain Bypass mode

Below is the step transfer to Maintain bypass mode:

1, if the UPS work in online mode, please turn off the UPS to bypass mode.

2, Removing the cover of the Maintain bypass, then the UPS will force transfer to bypass mode and the warning 3A will alarm.

3, Close the Maintain bypass switch.

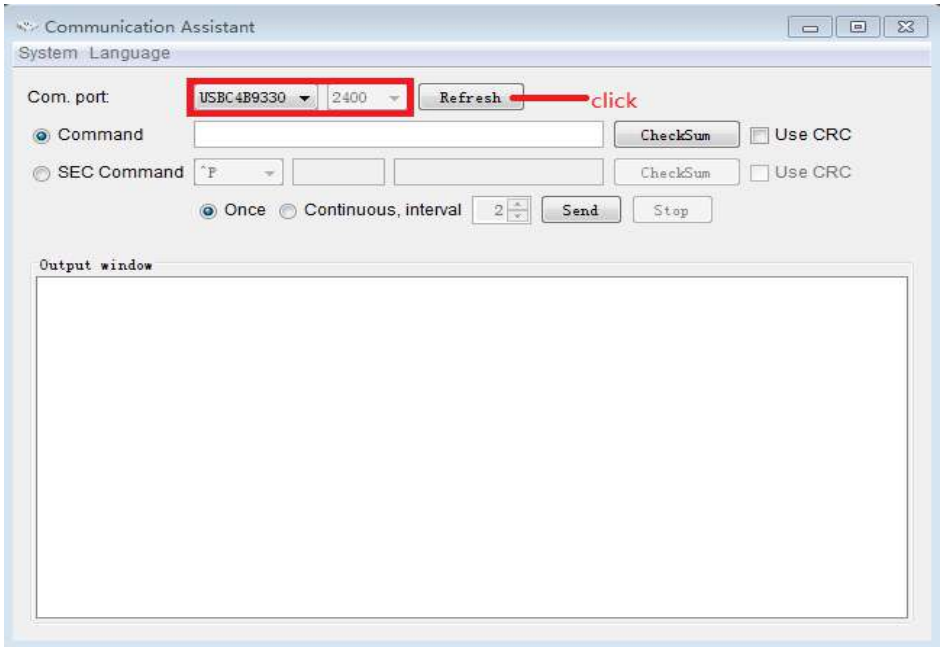
4, Turn off the Input Breaker and output breaker. If your UPS is Dual Input mode, please also turn off the bypass breaker.

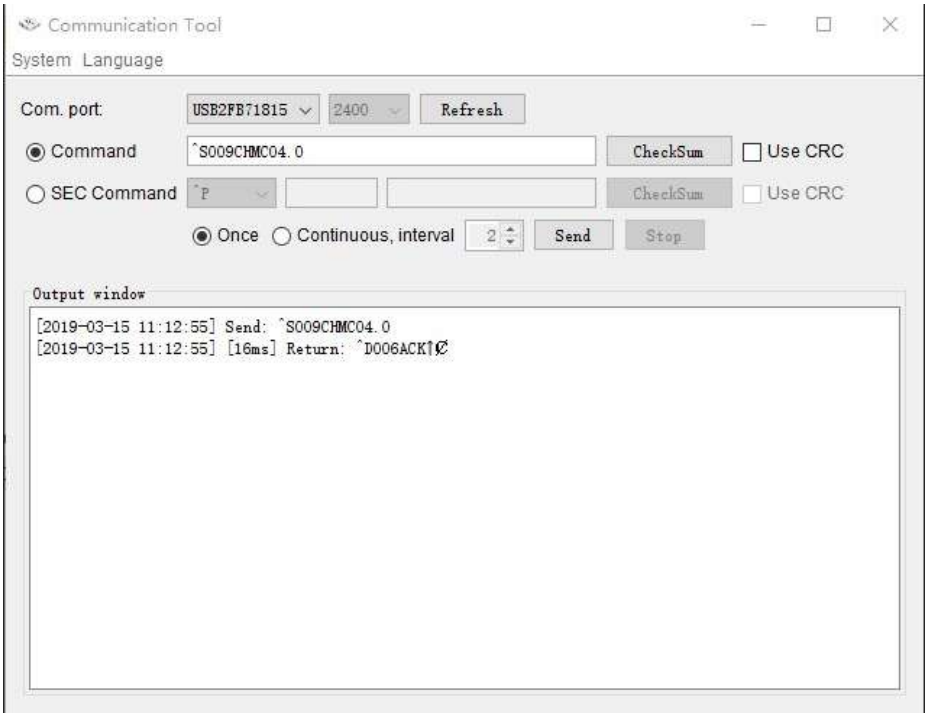
10 How to set the parameter

10.1 How to set the charger current

10.1.1 PF0.9 unit with standard LCD set charger current

Power on the unit with battery, but don't start up the unit. Then send the command.





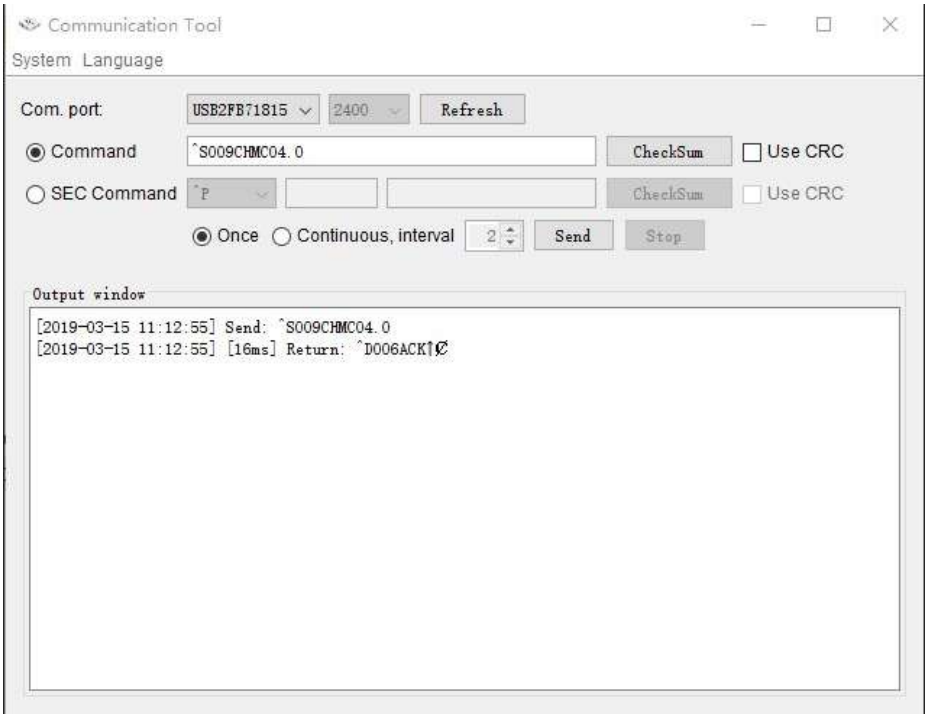
Noted1: Enter the "^S009CHMC04.0" command and click "Send". UPS will return "^D006ACK" when it accept. （The parameter settings will be saved only when UPS shuts down normally with battery connection.）

Noted2: The range of charger current is from 1A to 4A for one charger board.(The

command is ^S009CHMC01.0 to ^S009CHMC4.0)

10.1.2 PF1.0 unit with standard LCD set charger current

Power on the unit with battery, but don't start up the unit. Then send the command.



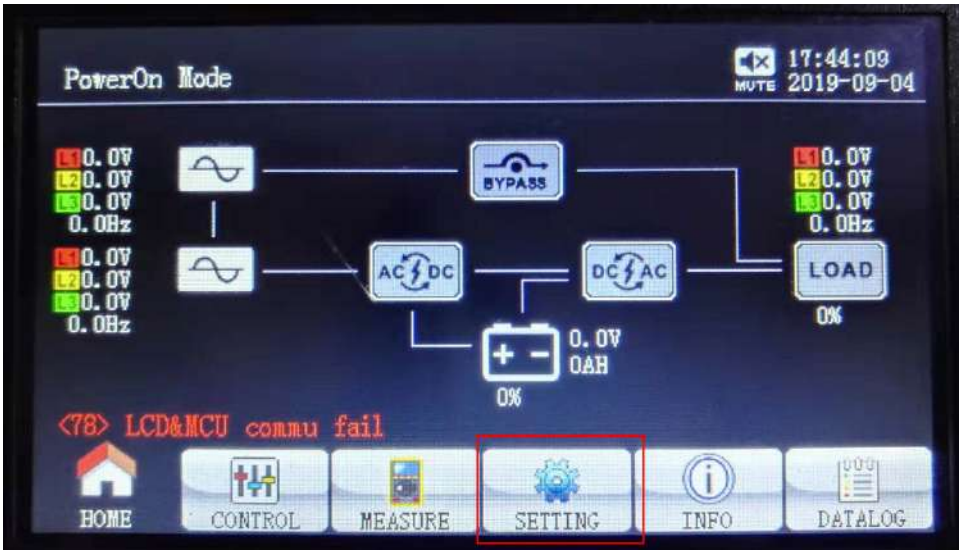
Noted1: Enter the "^S009CHMC04.0" command and click "Send". UPS will return "^D006ACK" when it accept. （The parameter settings will be saved only when UPS shuts down normally with battery connection.）

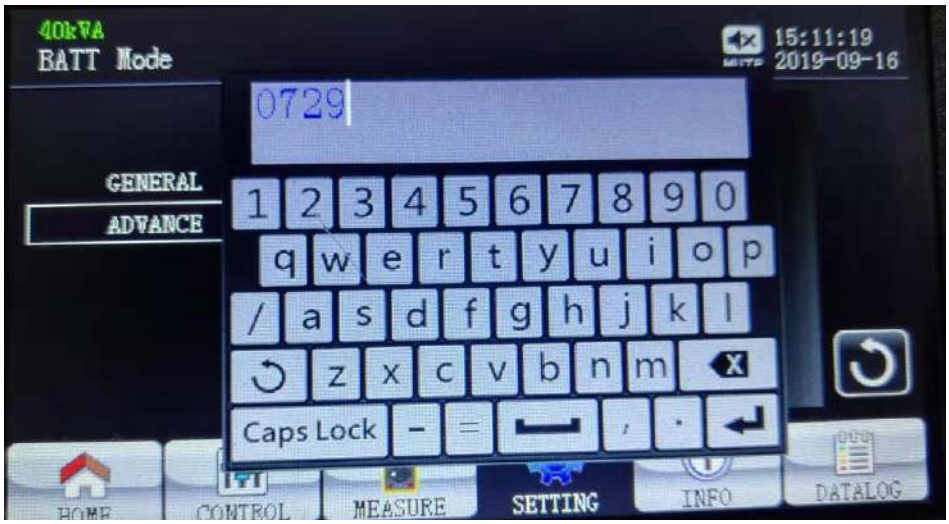
Noted2: The range of charger current is from 1A to 12A for one charger board.(The command is ^S009CHMC01.0 to ^S009CHMC12.0)

Noted3: the newest 40K and 80K unit each charger board is 16A, so for 40K can set to maximum 16A charger current and 80K can set to maximum 32A charger current.

10.1.3 PF1.0 unit with touch panel set charger current

Power on the unit with battery, but don't start up the unit. Then send the command.





This parameter setting is will be saved only when UPS shuts down normally with battery connection.

10.2 Dynamic Password Description

Dynamic Password to secure UPS setting changed from non-authorized personnel

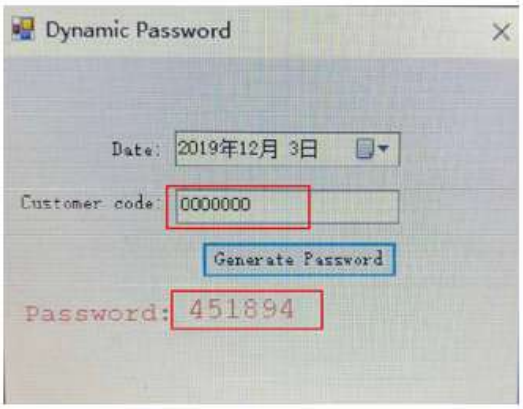
With several simple steps on our password tool, UPS can be protected by dynamic password function. A random one-time password is given on daily basis to secure UPS from non-authorized set-up.

1. Use our password tool on assigned computer and make registration with customer code to get a "hash code"

2. Sending "hash code" to us, a registration key will be given to complete the registration.

With several steps of simple procedure, UPS can be protected by dynamic password function. A random one-time password is given on daily basis to secure UPS from non-authorized set-up.

3. Turn on the password tool in the assigned computer, you will get an one-time random password in each day you want to change UPS settings.



4. On UPS, click SETTING page >> ADVANCE, enter dynamic password to do UPS setting changes.

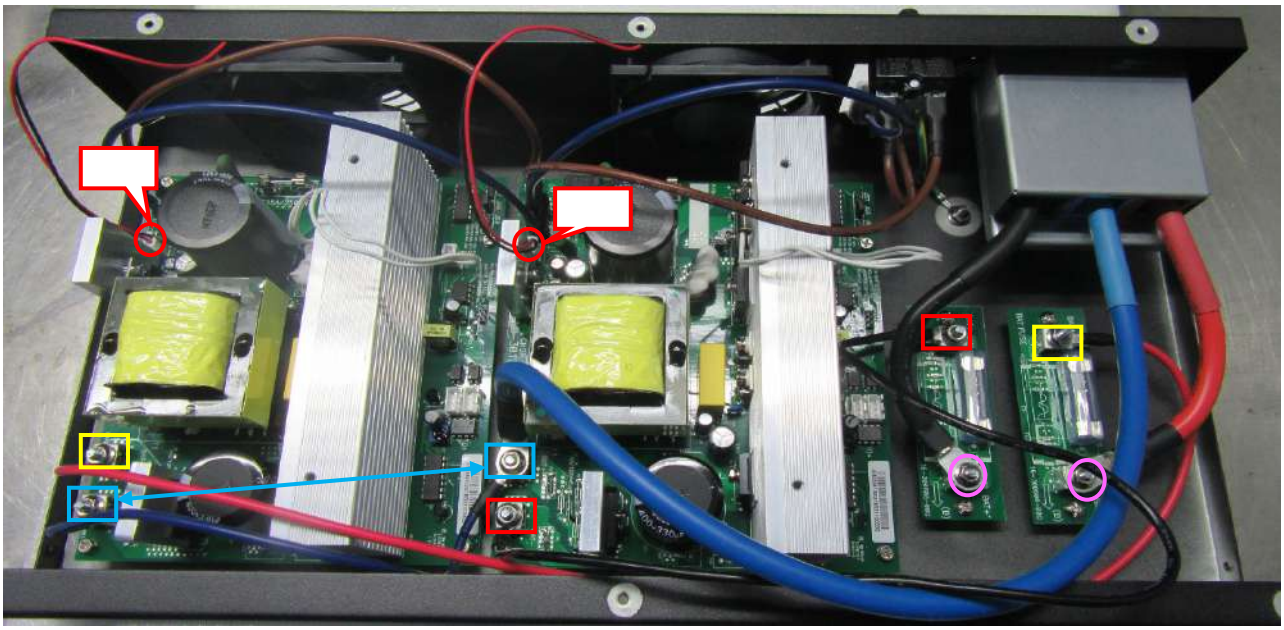
11 How to Start Up UPS Safely After Repairing or Replacing Main Board

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 suggested you use our DC source,which has power limitation function, to simulate DC source to start UPS, 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 .

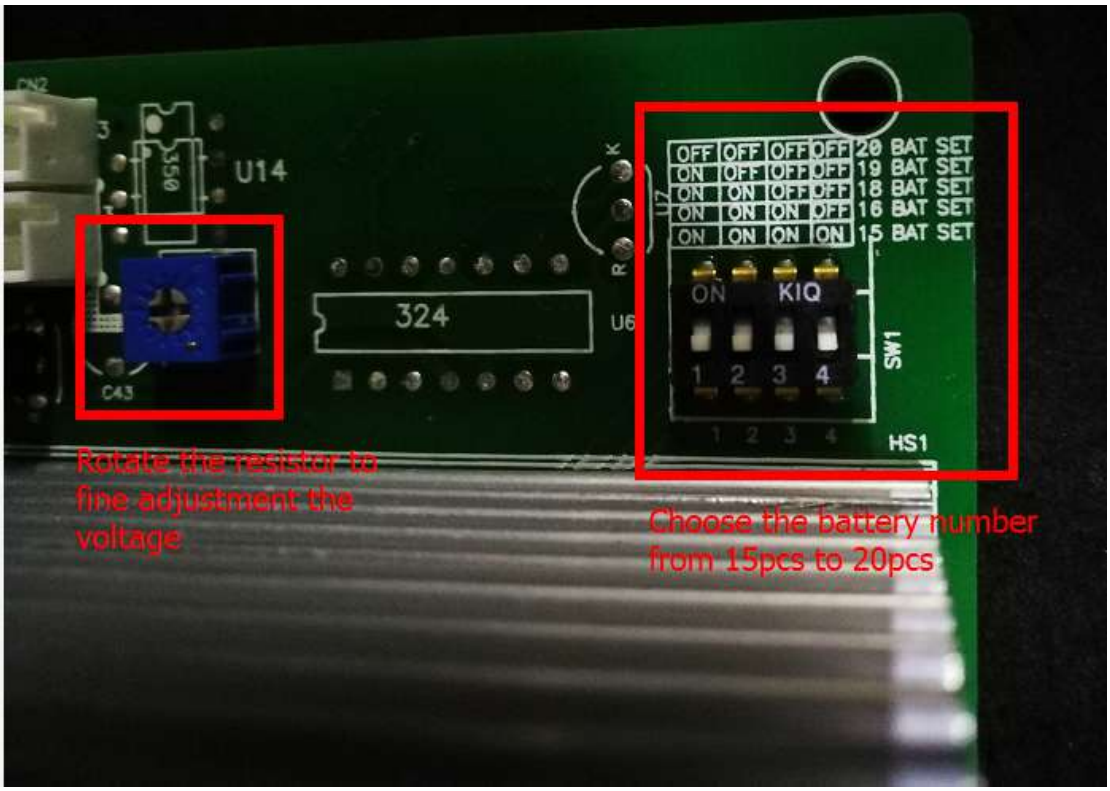
11.1 What is the DC Source?

The Smartbitt SBOL series Unit DC Source is made up by two chargers, you can use it as Smartbitt 33 Battery external charger, and it also can use as DC Source to self-test the Smartbitt 33 Unit.

Picture 1: the charger input and out terminal picture



Picture 2: the charger inner picture



Picture3: the charger output voltage adjustment picture

11.2 How to set the UPS's parameter before self-test the Smartbitt SBOL Unit?

a, if your unit's battery number is ±16pcs(16+16 for HV unit), you also need to set the DC Source battery number to ±16pcs(16+16). If your battery number is ±20pcs, you also need to set the DC Source battery number to ±20pcs.

b, if your unit's battery number is ±8pcs(8+8 for LV unit), you need to send the command(^S010SOUTTYPE0) to set the unit from LV to HV, then the battery number will change to ±16pcs(16+16 as HV unit). after you self-test unit ok, please send the command(^S010SOUTTYPE1) to set the unit from HV to LV. Then your unit's battery number will change to ±8pcs(8+8 for LV unit)

c, if your unit's battery number is ±10pcs(10+10 for LV unit), you need to send the command(^S010SOUTTYPE0) to set the unit from LV to HV, then the battery number will change to ±20pcs(20+20 as HV unit). after you self-test unit ok, please send the command(^S010SOUTTYPE1) to set the unit from HV to LV. Then your unit's battery number will change to ±10pcs(10+10 for LV unit)

d, Battery pcs setting(default value:16+16)

When you receive a new communication board as a spare board, or you want to change the battery Pcs, please send command :

^S007SETBAT and ^S010SBATPCS16 for "+192V / -192V" battery pack

^S007SETBAT and ^S010SBATPCS18 for "+216V / -216V" battery pack

^S007SETBAT and ^S010SBATPCS19 for "+228V / -228V" battery pack

^S007SETBAT and ^S010SBATPCS20 for "+240V / -240V" battery pack

If your UPS is one of LV 15K-40K module, please set the Out-type setting following the step2-(2) firstly, then please send command:

^S007SETBAT and ^S010SBATPCS16 for "+96V / -96V" battery pack

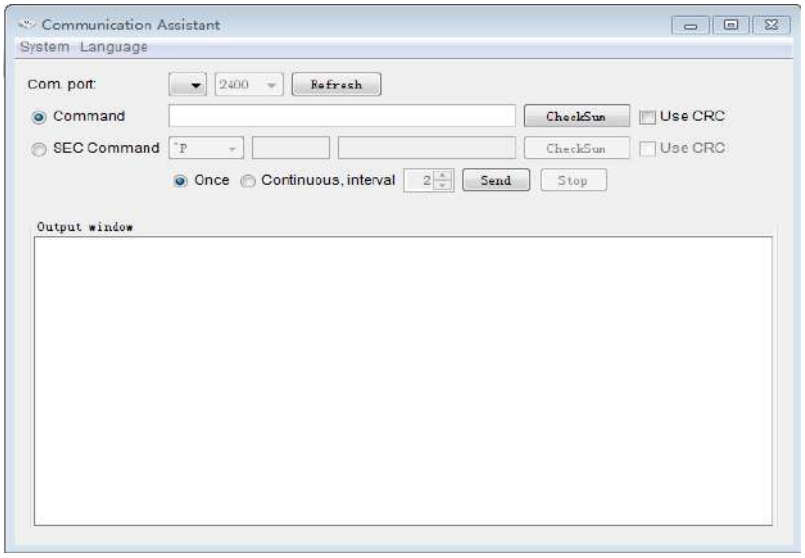
^S007SETBAT and ^S010SBATPCS18 for "+108V / -108V" battery pack

^S007SETBAT and ^S010SBATPCS20 for "+120V / -120V" battery pack

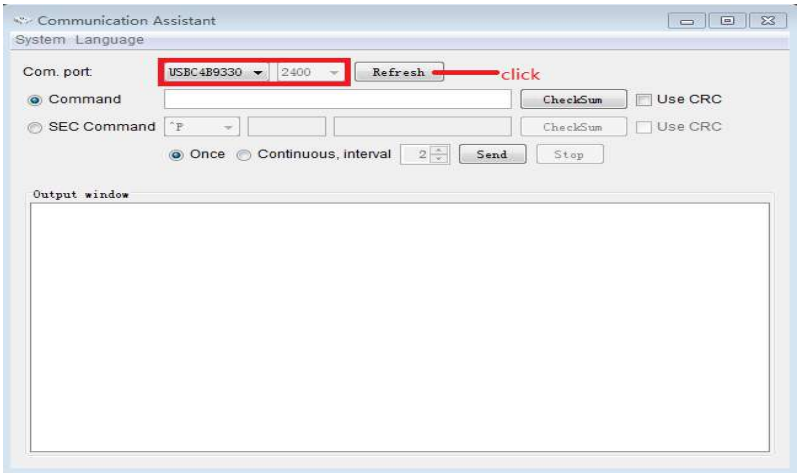
This command will be effective and you should turn off UPS with battery connected to save the change.

Note: If the original battery pack is "+240V/-240V" (Or"+120V/-120V"), and you want to change to "+192V/-192V" (Or"+96V / -96V"), it is strongly recommended that set the battery pcs to "16" and save this change firstly, then change the battery pack to "+192/-192" secondly. Because we set the rule that when UPS occurs warning code "01", it's not able to save the change. So if you change the battery pack firstly, UPS maybe occur warning code "01", it will not able to save the change and it will be dangerous for that charging voltage does not match the actual battery Pcs.

e, For example, we use the USB cable to send the battery pcs setting command.
Open the communication Tool and you will see the following interface

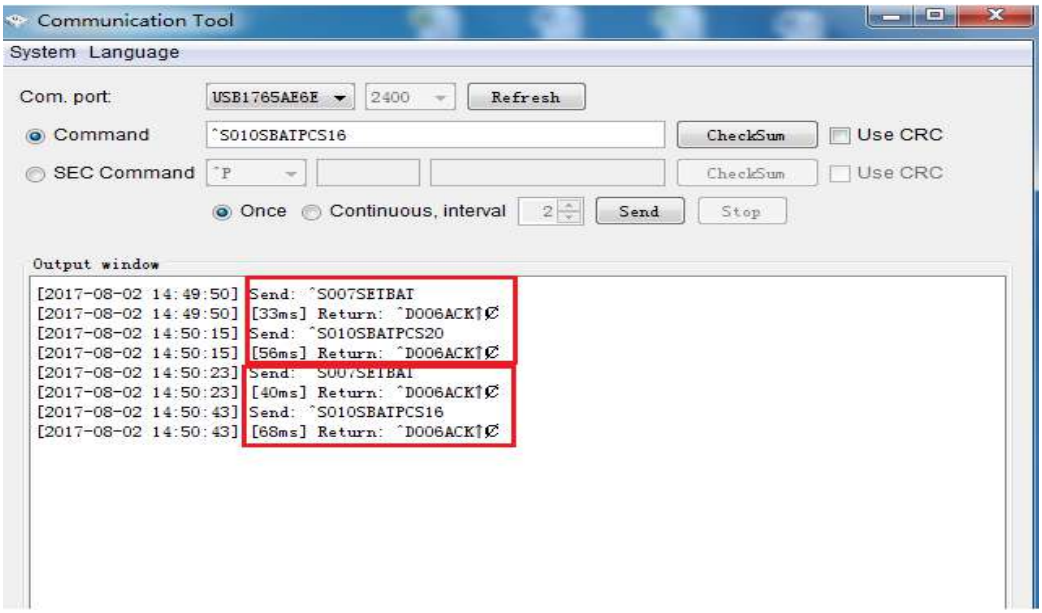


Click the "Refresh", you will see "USB…" and "2400" at the appropriate location.



Enter the "^S007SETBAT" command and click "Send". When it return "D006ACK…", this setting is successful. Enter"^S010SBATPCS16"and click "Send" to set the battery pcs. When it return "D006ACK…", this setting is successful. Or enter the "^S007SETBAT" command and "^S010SBATPCS20".

Noted1: if the UPS return "D006NAK…", it is means your setting is not successful.
Noted2: if you have set the parameter successful, you also need to turn off the input mains and let UPS into standby mode with battery until UPS Shutdown automatic, don't turn off the battery before the UPS Shutdown, because the UPS is saving your new parameter to the system.



11.3 Start 10K/15K/20K(L) /30K(L)/40K(L)/60K(L)/80K(L) unit safely with standard LCD

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

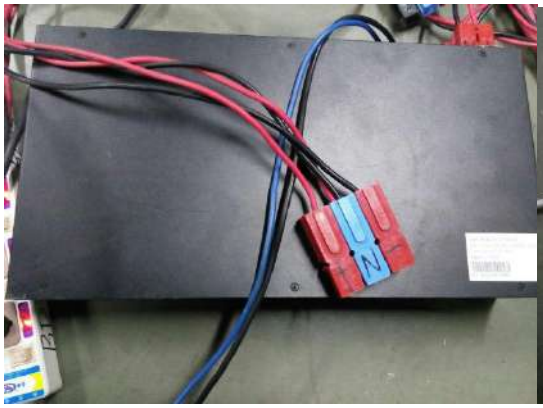


Figure 8.3.1

Figure 8.3.2

Step1: Connect the DC Source output to the battery connect(figure 8.3.3), Start the DC Source (figure 8.3.2)

Step2: Press "ON" Button to start the UPS, then the UPS will enter into the standby mode (figure8.3.4).

Figure 8.3.3 **Figure 8.3.4**

Step3: Press the “UP” Button and the “DOWN” Button at the same time, and you will enter into a set interface. Press the “UP” Button or “DOWN” Button until you can see the interface likes figure8.3.5. Press the “ON” button and set the self-checking program form disable status to enable status likes figure8.3.6. then, Press the “UP” Button and the “DOWN” Button at the same time, you will exit to the set interface and enter into the self-checking program interface. And the UPS will start to self-checking until shutdown.

Note1: The first time you set the self-checking program to enable status, and the UPS will shutdown immediately and don’t enter into the self-checking interface, because the current beyond the scope of DC source. Don’t worry, this is a protection measures for our DC Source. Please repeat the step2 and step3 again. Good luck for you!

Note2: If the self-checking program stop in a interface long time, please record the self-checking step and disconnect the DC Source, then release the BUS cap energy with a high power resistance. Please repair the PCBA again and check the wire connection, until find the question.

Figure 8.3.5 **Figure 8.3.6**

Step4: Press the “ON” Button and the UPS enter into the standby mode, then press the “ON” Button 1s again and the UPS will enter into the Battery mode. Good, please press the “OFF” Button until the UPS shutdown and disconnect the DC Source.

10.4 Start 10K/15K/20K(L) /30K(L)/40K(L)/60K(L)/80K(L) unit safely with Touch panel screen

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

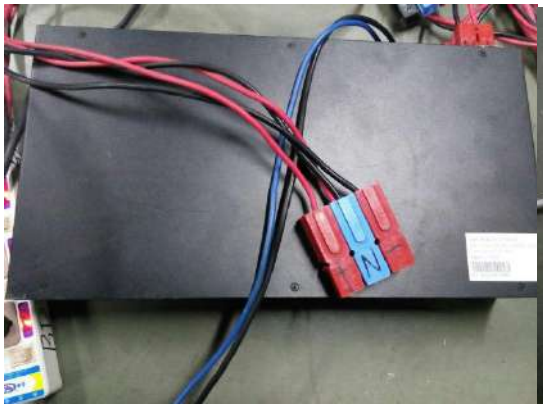
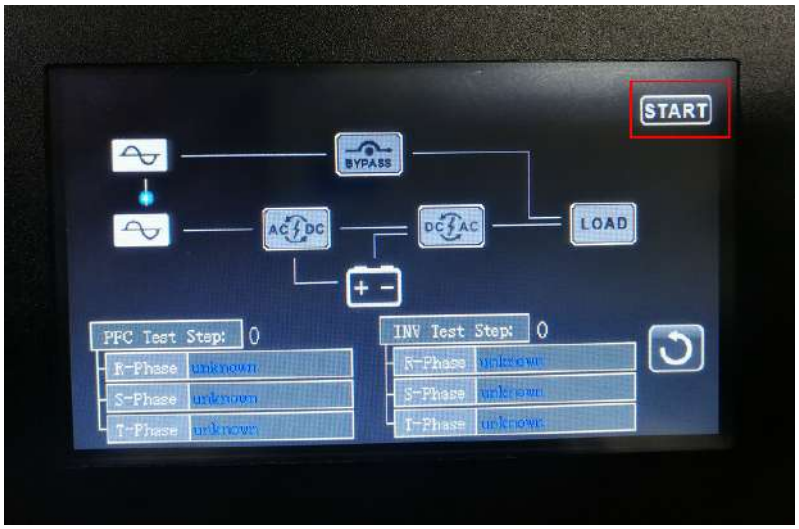


Figure 8.3.7 **Figure 8.3.8**

Refer above the standard LCD self-test step, for touch panel UPS self-test, it is need to press the “POWER ON” button to start up the SPS, then you can refer below picture to do the self-test step.

Setting→advance→password “0729”→UPS self-test→Start



11.5 Process of self-checking program

PFC 1	Check the Battery voltage detect circuit
PFC 2	Check the BUS voltage detect circuit
PFC 3	Check the PFC IGBT Drive circuit
PFC 4	Check the Battery SCR circuit
PFC 5	Check the Line SCR circuit
PFC 6	Check the BUS voltage detect circuit again
PFC 7	Check the Line input relay
PFC 8	Check the Bypass SCR circuit
PFC 9	Check the Line Voltage detect circuit
PFC 10	Check the PFC Current detect circuit
PFC 11	Check the BUS voltage and Battery Voltage again
INV 1	Check the INV Voltage detect circuit
INV 2	Check the INV Current detevt circuit
INV 3	Check the Output Voltage detect circuit
INV 4	Check the Bypass Voltage detect circuit
INV 5	Check the Bypass SCR circuit again
INV 6	Check the Line backfeed relay circuit
INV 7	Stop the self-checking or enter into next phase self-checking

12. Appendix

12.1 Basic communication command

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

12.1.1 ^P005Q3GS<0x0d>

^P005Q3GS<0x0d> means to request general status parameters of the system. The command format is:

Computer: ^P005Q3GS<0x0d>

UPS:

^D113AA,BBB.B,CCC.C,DDD.D,EE.E,FFF.F,GGG.G,HHH.H,II.I,JJJ.J,KKK.K,LLL.L,MMM.M,NNN.N,OOO.O,PPP.P,QQQ.Q,RRR.R,SSS,b9b8b7b6b5b4b3b2b1b0a0<CRC H><CRC L><0x0d>

Data	Description	Notes
AA	UPS Work mode	UPS work mode
BBB.B	Line Voltage R	B is an Integer number 0 to 9. The units is V.
CCC.C	Line Voltage S	C is an Integer number 0 to 9. The units is V.
DDD.D	Line Voltage T	D is an Integer number 0 to 9. The units is V.
EE.E	Line frequency	E is an Integer number 0 to 9. The units is Hz.
FFF.F	Output Voltage R	F is an Integer number 0 to 9. The units is V.
GGG.G	Output Voltage S	G is an Integer number 0 to 9. The units is V.
HHH.H	Output Voltage T	H is an Integer number 0 to 9. The units is V.
II.I	Output Frequency	I is an Integer number 0 to 9. The units is Hz.
JJJ.J	Output Current R	J is an Integer number from 0 to 9. The units is A.
KKK.K	Output Current S	K is an Integer number from 0 to 9. The units is A.
LLL.L	Output Current T	L is an Integer number from 0 to 9. The units is A.
MMM.M	Load Percent R	M is Maximum of W% or VA%. VA% is a percent of power. W% is a percent of maximum active power.
NNN.N	Load Percent S	N is Maximum of W% or VA%. VA% is a percent of power. W% is a percent of maximum active power.
OOO.O	Load Percent T	T is Maximum of W% or VA%. VA% is a percent of power. W% is a percent of maximum active power.
PPP.P	Total Load Percent	P is Maximum of W% or VA%. VA% is a percent of power. W% is a percent of maximum active power.
QQQ.Q	Battery voltage P	Q is an Integer number 0 to 9. The units is V.
RRR.R	Battery voltage N	R is an Integer number 0 to 9. The units is V.
SSS	Max temperature	S is an integer ranging from 0 to 9. The units is °C
b9b8	Ups type (	
b7	Utility Fail	
b6	Battery Low	

b5	Bypass mode	
b4	UPS Failed	
b3	EPO active	
b2	Test in Progress	
b1	Shutdown Active	
b0	mute status (bat silence)	
a0	battery test ok	

12.1.2 ^C010BUSPV+NNN<0x0d>

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

Computer: ^C010BUSPV+NNN<0x0d>

UPS: (ACK or (NAK*

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

Voltage adjustment step: <nnn>. n=000, 011……, 999.

For example:

Computer: ^C010BUSPV -001 <0x0d>

UPS: (ACK

Meanings: Positive BUS voltage will decrease about 0.1%.

12. 1.3 ^C010BUSNV+NNN<0x0d>

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

Computer: ^C010BUSNV+NNN<0x0d>

UPS: (ACK or (NAK*

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

Voltage adjustment step: <nnn>. n=000, 001……, 999.

For example:

Computer: ^C010BUSNV+001 <0x0d>

UPS: (ACK

Meanings: Negative BUS voltage will increase about 0.1%.

12. 1.4 ^C010BATPV+NNN<0x0d>

This command is to adjust the positive 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: ^C010BATPV+007<0x0d>

UPS: (ACK or (NAK*

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

Voltage adjustment step: <nnn>. n=000, 001……, 999.

For example:

Computer: ^C010BATPV-001<0x0d>

UPS: (ACK

Meanings: Battery sampling voltage will decrease about 0.1%.

12. 1.5 ^C010BATNV+NNN<0x0d>

This command is to adjust the negative 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: ^C010BATNV+NNN<0x0d>

UPS: (ACK or (NAK*

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

Voltage adjustment step: <nnn>. n=000, 001……, 999.

For example:

Computer: ^C010BATNV-001<0x0d>

UPS: (ACK

Meanings: Battery sampling voltage will decrease about 0.1%.

12.1.6 ^P004QWS<0x0d>

^P004QWS<0x0d> means to request the current warning of the UPS. The command format is:

Computer: ^P004QWS<0x0d>

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: ^P004QWS<0x0d>

UPS: (10000000000000000000000000000000000000000000000000000000000000000

Meanings: The battery of UPS disconnected.