

SERVICE MANUAL

6K To 10K

Uninterruptible Power System

Warning

1. High voltage exists inside UPS. To avoid accidental harm, unqualified service personnel does not open up the DOS shell .
2. You must cut off the connection between the Line and Battery before examine and repair.
3. You shouldn't wear metal conductor such as watches and bracelets in time of examine and repair.
4. You should wear ring when you are taking apart, installing and repairing PCBA ; otherwise CPU, IC, or IGBT components tend to be harmed by static.
5. Examining and Repairing tools must be assured credible and insulative.
6. You'd better to use DC steady power to turn on the machine while limiting the electric current when you are doing total-machine test and PCBA test, avoiding PCBA board to be badly injured.
7. Please pay attention to make double-channels' probe-grounding- line at the same level when you use double-trace oscillograph.

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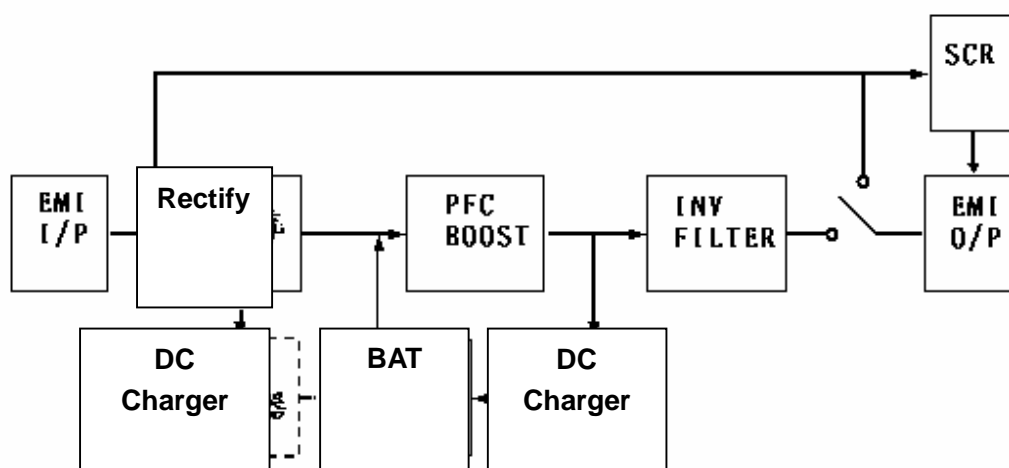
Electrical Standard

Reference data

item	data
+BUS voltage	$345V \pm 2V$
-BUS voltage	$-345V \pm 2V$
+/-BUS voltage absolute value difference	$<3V$
balance voltage (empty load)	$<500mV$
Charger voltage	$274V \pm 0.5\%$ (leave factory specification: $274 \pm 0.5V$)

Please check the machine if the data upwards exceed the rating.

Circuit Chart



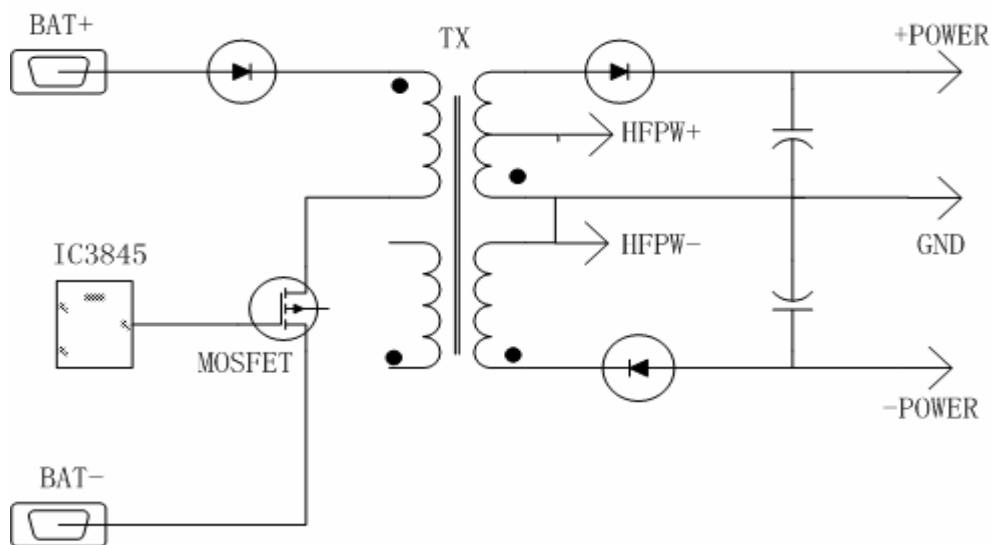
Circuit circle chart (broken line means charger board with the long backup time UPS, real line means charger board with the standard UPS)

Work Principle

1. Work power circuit

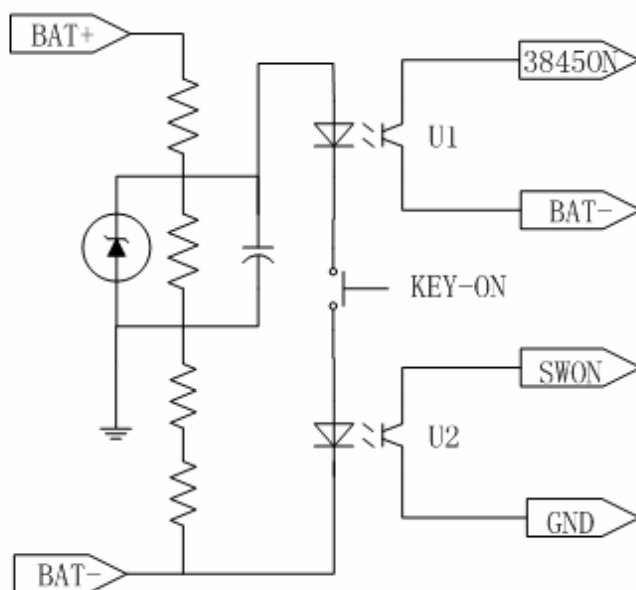
This work power circuit is a frame with isolated return. When you electrify under line mode or turn on UPS under battery mode, IC3845 power will set up, IC3845 starts to work, then will drive the MOSFET to work by export PWM wave. The transformer TX will storage energy when MOSFET is open and it will supply for whole UPS system work power when MOSFET is shut down. This circuit supplies +20V、±15V、+12V、+5V、12V(FAN) power, which provides work power for every component. At the same time, it

also provides high frequency HFPW+/HFPW-, which supplies power to charger board and other drive board.



Work power circuit

2. Boot-strap circuit



Boot-strap circuit

Press the LCD Select Down-key with ON/OFF control key to turn on UPS, U1、U2 are active ; U1's connection set up the work power, U2's connection send out SW-ON signal. SWSTUTS on signal which is produced by resistance's separate voltage then supply to CPU, when CPU receives this high level signal, UPS will be turned on.

Press the LCD Select Down-key with Up-key to turn off UPS, CPU will send out SHUTDOWN high level signal under battery mode, which will make S.D and SW-ON signal be low signal through a reverse implement of control board, UPS will stop working

by lowering work power. If UPS work under line mode, PSDR board's work power will still exist, but turn to bypass mode.

If UPS work under line INV mode, press the LCD Select Up-key with ON/OFF control key longer than 3secs, UPS will turn to battery maintenance state, then normal LED light, warning LED light and fault LED light will work circularly, 10secs later UPS will turn back to line INV mode.

In period of battery maintenance, UPS will turn to INV mode if line is break off; It will return to line INV mode if the connection between battery and UPS is cut off; press the LCD Select Up-key with ON/OFF control key longer than 3sec again, UPS will turn back to line INV state.

Press the LCD Select Up-key with ON/OFF control key longer than 3secs when UPS working in battery state, the buzzer will stop alarming, and will come back to alarm with one alarm/4sec when press the two keys again.

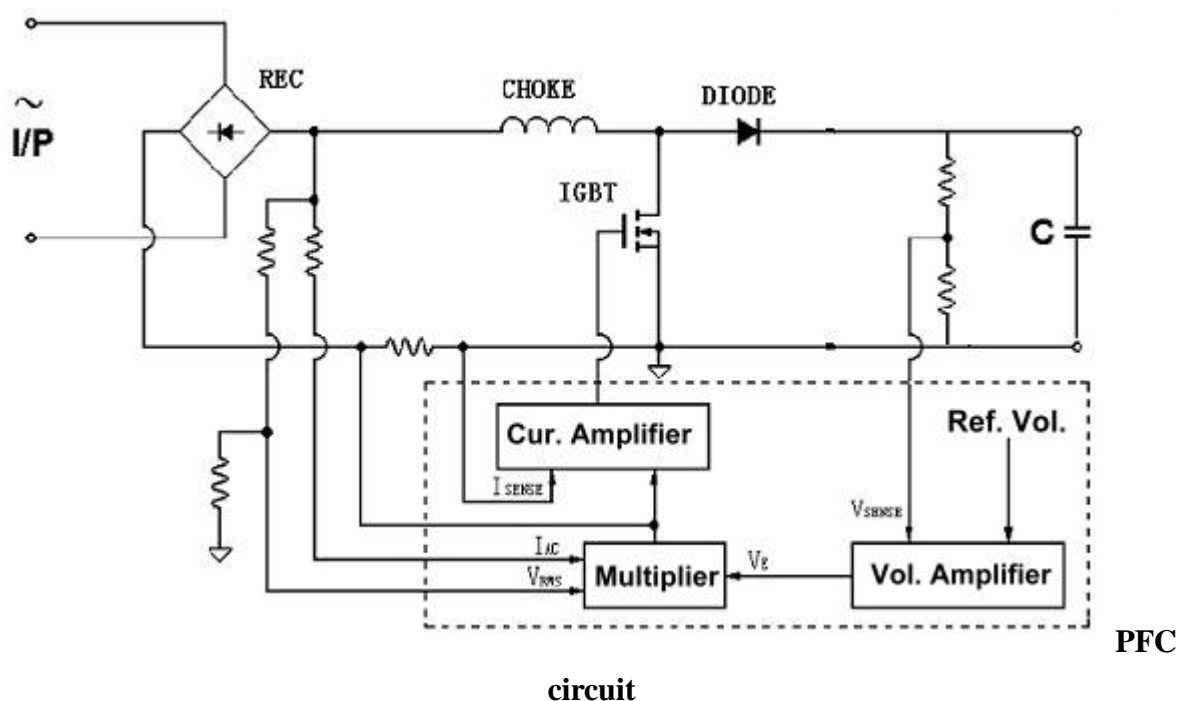
3. PFC/boost circuit

PFC: Power Factor Correction

Only when positive pole voltage higher than cathode voltage, diode can lead, so diode current wave presents high tme characteristic through line commutate, such current wave not only has lots of low frequency wave, but also will reduce UPS input power factor.

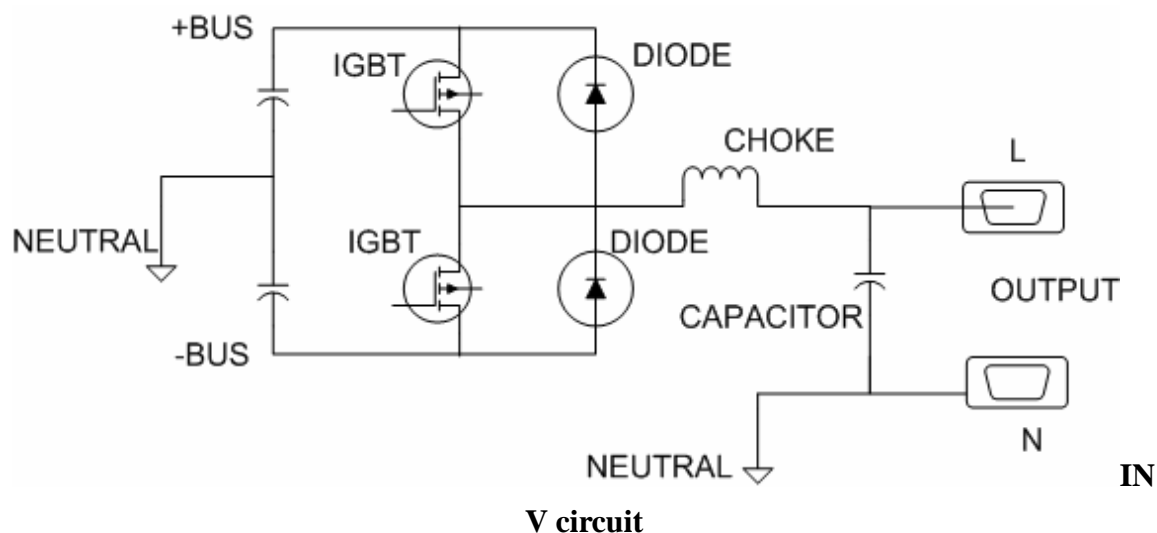
Add one stair DC/DC PFC after commuting; you can correct current for sine wave by change switch, which will make input power factor close to 1.

As following chart, when IGBT is open, DIODE is closed, Inductance CHOKE will store up energy and its current will increase by degrees; when IGBT is closed, inductance will release its energy, DIODE is open, and inductance current will decrease by degrees. So we can control inductance current wave by adjusting IGBT open and closed time.



The correction of power factor is accomplished by DSP, broken line frame shows sketch map of DSP dealing with PFC. Firstly, hardware frame sends out sampling signal to DSP, and then DSP output a set of pulse signal to drive IGBT's on or off. The purpose of power factor correction (P.F.C.) circuit is to make the input current and voltage in phase, therefore achieve a high input power factor near to 1.

4. Inverter Circuit



The PFC/BOOST circuit converters $+$, $-$ DC BUS (absolute value is $345V \pm 5V$) voltage for the input of inverter circuit of half bridge configuration. The PWM signal, which is produced by control board, will drive INV IGBT to lead alternately through IGBT driver. The output of IGBT is filtered by a LC circuit to reduce the o/p voltage harmonics distortion and produces sine wave.

5. Bypass And Inverter Circuit

UPS is changed between bypass and inverter mode through inverter relay and bypass SCR.

Bypass mode: Line arrives at UPS output port through input air switch, bypass switch, inverter relay often- closed point and load sense transformer.

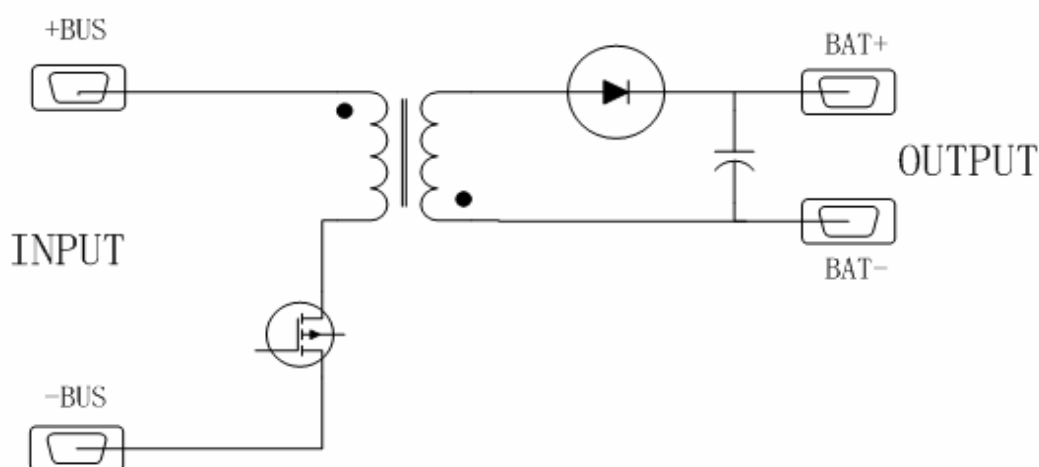
Inverter mode: Inverter output arrives at UPS output port through filter inductance, inverter relay, inverter relay often-closed end (this point is closed at inverter mode) and load sense transformer.

If inverter faults, bypass SCR will be droved and open at once, so can realize conversion between inverter and bypass with no interrupt.

6. Charger circuit (only for standard UPS)

Standard UPS has one DC charger board, input comes from BUS voltage, the max output current is 2A. Standard UPS charger is a model isolated return transformer.

The basal circuit model of isolated return transformer

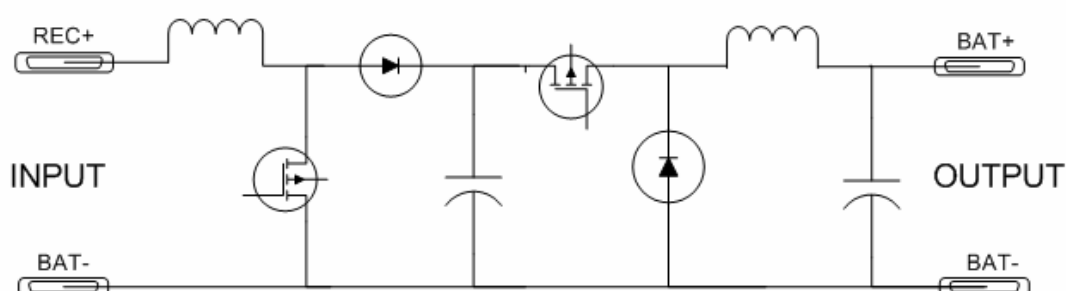


Standard UPS charger circuit

Standard UPS charger work principle: IC3845 outputs a series of rectangular wave with PWM adjustment, drives transformer elementary to get a AC pulse, induces accessory to produce two lines of pulse in-phase, controls MOSFET open or close, work mode according to the isolated return transformer forward.

Charger characteristic: it can be on-off. When under line mode, charger begins to work and charge for battery; when under battery mode, charger stop working.

7. Charger circuit (only for long backup time UPS)

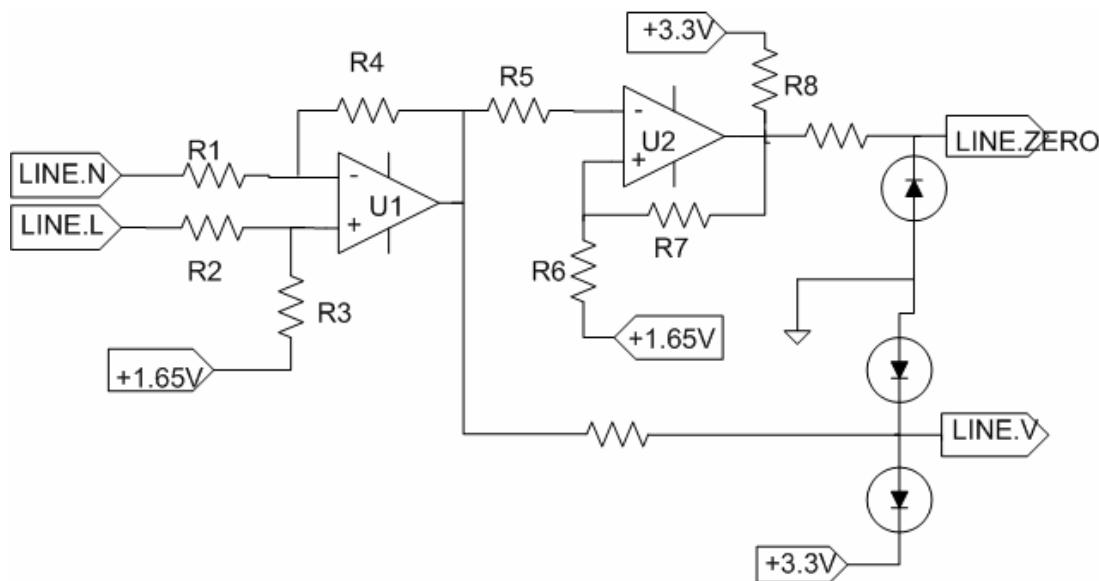


Long backup time UPS charger circuit

The work frame of long backup time UPS charger circuit is a BOOST-BUCK frame; its input voltage, which comes from line commutating, firstly through a BOOST circuit, secondly through a BUCK circuit, afterward output for battery charging; when output voltage higher than input voltage, BOOST circuit begins to work; when output voltage less than input voltage, BOOST circuit doesn't work, BUCK circuit begins to work; so UPS can accomplish charging work under any mode.

8. Control circuit

Line sense circuit



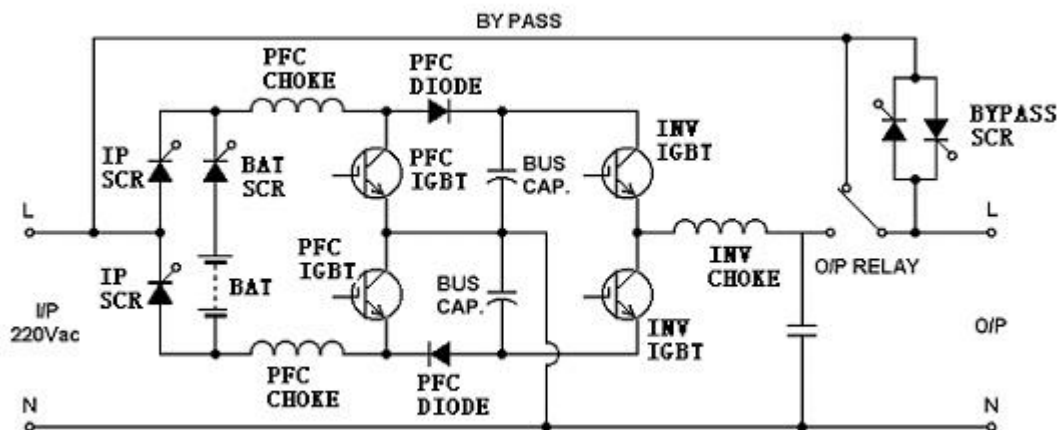
Line sense circuit

Work principle:

Systemic signal samplings all adopt different module input mode, in this way can restrain common module interferential signals effectively, advance anti-jamming ability of sampling signals; when line input, firstly through a attenuation circuitry, up to value which DSP can accept. This extent signal can send to DSP directly; afterward through a compared implement, so we can get frequency of line.

PCB function instructions

1. PSDR Board (POWER STAGE DRIVER)



PSDR board frame circuit

PSDR includes power part, work power part; normal input/output voltage of PSDR are all 220V/50Hz, work process includes RECTIFIER, BOOSTCIRCUIT and INVERTER.

RECTIFIER: used for commuting input line to DC;

BOOST CIRCUIT: used for changing commuted voltage into steady 345VBUS voltage, at the same time, put up PFC to get higher power factor;

INVERTER: DC BUS voltage, through half bridge frame, changed into AC and produces steady AC output through LC low filter.

Work power part supplies 20V, $\pm 15V$, 12V, 5V, HFPW power for the whole UPS, at the same time, supplies power for fan.

2. CNTL board

CNTL board adopts DUAL MCU design, including one 2406A and one MR32; 2406A adopts DSP technique, used to control system normal running, samples and controls needed correlative signal; MR32 is used to control conversion under any mode, protect UPS and load under abnormal status; at the same time, MR32 takes charge for communication with PC.

3. Parallel board

Parallel board is made up of a series of communicational circuits; mostly used to accomplish signal communication with other UPS.

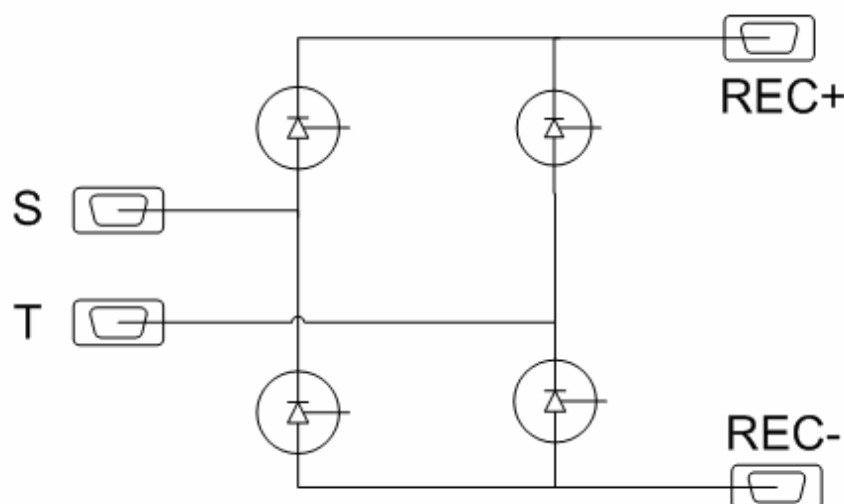
4. Charger board(long backup time UPS)

This charger board is designed for long backup time UPS, supplies charging ability for its outside battery; its input comes from line commuting voltage, output mode is three-sect; firstly, it charges UPS keeping steady current of 4.2A; it is changed to invariable voltage charging until battery voltage arrives about 270V; finally put up float charging until battery is full.

5. Charger board (standard UPS)

This charger board is designed for standard UPS, supply moderate charging current for standard UPS; its input comes from BUS voltage, starting charging current is 2A.

6. Commuting board(only for three phase input UPS)



Commuting board frame chart

Commuting board circuitry is mostly composed of commuting circuitry and protection circuitry; its four SCR pipes make up S、T phase 's commuting bridge, its input port is connected with S、T phase line , output port is connected with commuting circuit on PSDR board. At the same time, its protective circuit can also supply high and low voltage protection.

7. EMI board

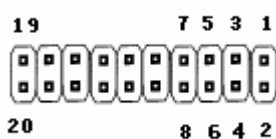
EMI board includes input EMI board and output EMI board, can flit miscellaneous wave on input and output line, consequently, can achieve to purify power supply wave.

MODEL port setting

MODEL port (JP01) setting for using 01 edition CNTL board as follows:

Note: 1 shows inserting jumper, 0 shows not inserting jumper, other pins not listing show not inserting jumper.

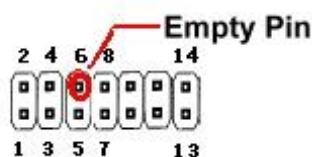
	pin9andpin10	pin11andpin12	pin13andpin14	pin19andpin20
6K	0	0	0	1
6KL	0	0	0	0
10K	1	0	0	1
10KL	1	0	0	0



01edition CNTL board JP01

MODEL port (JP01) setting for using 02 edition or higher edition CNTL board as follows:

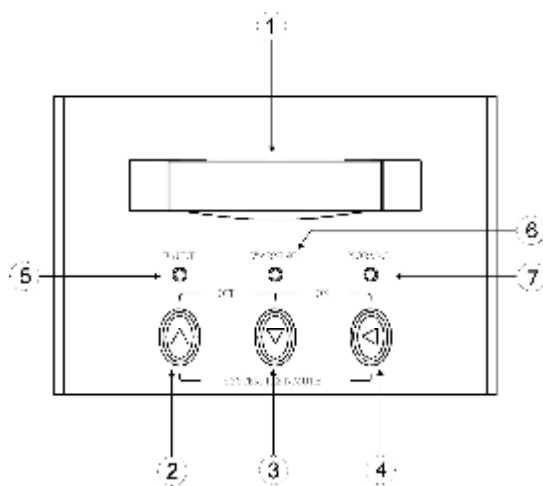
	pin1andpin12	pin9andpin10	pin7andpin8	pin1andpin2
6K	0	0	0	1
6KL	0	0	0	0
10K	1	0	0	1
10KL	1	0	0	0



02 edition CNTL board JP01

Note: the definition of 01 edition CNTL board JP01 and 02 edition CNTL board JP01 is opposite, take care when you are inserting jumper.

Panel state and meanings

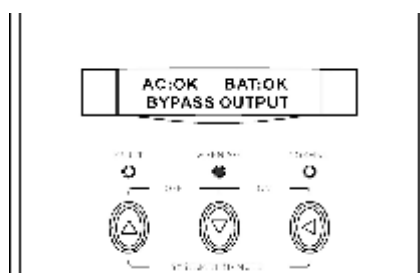


Display	Function
LCD Display(1)	This indicates the UPS operation information, including UPS status, input/output voltage, input/output frequency, battery voltage, output load, inside temperature, history events and so on.
Fault LED (5)	This red LED indicates the UPS is in fault condition because of inverter abnormal or over-temperature or DC_BUS fault.
Warning	This yellow LED indicates the UPS is in the status of overload,

LED (6)	bypass and battery back-up.								
Normal LED (7)	This green LED indicates the UPS is operating normally.								
	<table border="1"> <thead> <tr> <th>Switch</th> <th>Function</th> </tr> </thead> <tbody> <tr> <td>ON/OFF CONTROL KEY(4)</td> <td>When this key is pressed with the LCD Select Down-key simultaneously for 3 seconds, the UPS will be switched on. Besides, in the mode of battery back-up, press both of this key and LCD Select Up-key at the same time to disable the beeps; in line INV mode, press both of this key and LCD Select Up-key at the same time to test for 10 seconds.</td> </tr> <tr> <td>Select Up-key(2)</td> <td>It is pressed to select upward the UPS status on LCD Display. When this key is pressed with the LCD Select Down-key simultaneously for 3 seconds, the UPS will be switched off.</td> </tr> <tr> <td>Select Down-key(3)</td> <td>It is pressed to select downward the UPS status on LCD Display.</td> </tr> </tbody> </table>	Switch	Function	ON/OFF CONTROL KEY(4)	When this key is pressed with the LCD Select Down-key simultaneously for 3 seconds, the UPS will be switched on. Besides, in the mode of battery back-up, press both of this key and LCD Select Up-key at the same time to disable the beeps; in line INV mode, press both of this key and LCD Select Up-key at the same time to test for 10 seconds.	Select Up-key(2)	It is pressed to select upward the UPS status on LCD Display. When this key is pressed with the LCD Select Down-key simultaneously for 3 seconds, the UPS will be switched off.	Select Down-key(3)	It is pressed to select downward the UPS status on LCD Display.
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Clients' Problems Analyze and Settle On the Spot

I *Output Overload*



Cause1: line inverter mode 105% ~ 130% overload, turn to bypass after 10 mins;

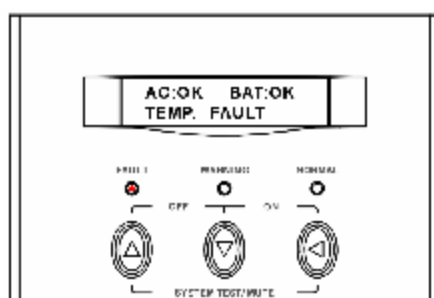
Cause2: bypass mode 130% load, cut off output after 1 min , give an alarm

Cause3: battery mode 105% ~ 130% load, give an alarm after 10 seconds and cut off output.

Cause4: battery mode more than 130% load, alarm immediately and cut off output.

Strategy: unload unimportant load to 90% below; if UPS have been fault ,you should turn UPS into inverter mode.

I *Over-temperature*



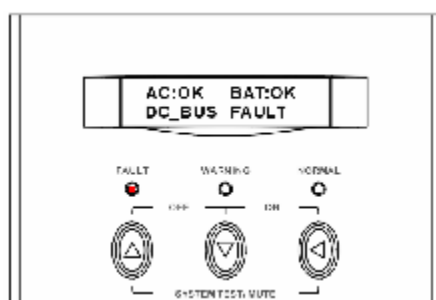
Cause1: PSDR PCB radiator's temperature higher than 75℃

Cause2: FAN signal abnormality

Strategy1: If temperature is assuredly too high inside the case, please unload redundant load and suggest user install an air-condition in UPS room; if sense is fault, maybe CNTL board estimates falsely, or NTC on PSDR board fault.

Strategy2: Check whether fan runs normally, if OK, check fan detective circuitry.

I DC Bus Fault



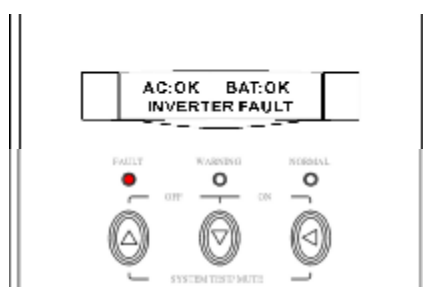
Cause1: +Bus voltage lasts higher than 450V or - Bus voltage lasts lower than -450V for 80 ms.

Cause2: +Bus and - Bus absolute value difference lasts more than 40V for 2 minutes.

Cause3: PFC IGBT fault.

Strategy: Maybe PSDR board fault; mostly check whether PFC part on PSDR board and such power components as IGBT、SCR on line commutating part are fault, at the same time , check whether components of driving circuitry are fault.

I Inverter Fault



Cause1: inverter voltage lasts higher than 276V or lower than 140 V for 128 ms

Cause2: inverter output voltage<50V, output current >10A for more than 60ms.

Cause3: inverter relay short.

Strategy1: Maybe PSDR board fault; check whether power components on PSDR INVERTER part and on driving circuitry are abnormal; at the same time, check whether protecting circuitry of IGBT and PFC components are OK.

Strategy2: Check whether load switch of user jumps, and find out equipment power and

input current's characteristic of user.

Strategy3: Check whether inverter bypass short.

I、repair tools

1. One computer with serial interface, and installing "RS24" debug software, one normal RS232 serial wire;
2. Suitcase or toolbox;
3. Wire cutters and shelve cutters;
4. Equalizer, current limit resistance, electric iron, sleeve, shelve ports with different spec;
5. Multimeter, oscillograph (or amperemeter);
6. Other tools in common use: tilted cutters, pipe cutter, cross screwdriver, small single screwdriver, electrical adhesive plaster and so on ;
7. Correlative semi-manufactured goods and correlative materiel with badness phenomenon.

II、Notes:

1. Make sure that cut off the connection between line and battery when you examine and repair UPS.
2. When maintenance switch at "UPS" place, the ends on the platform and UPS box inside are all electriferous.
3. When maintenance switch at "UPS" place, the ends on the platform are all electriferous, the three-phase front line inside UPS box are all unelectriferous, but nought line is still connected with electrical net, so make insulative disposal through binding up nought line with insulating plaster. When you are serving inside UPS box, (1)if want to maintain at once, please release BUS voltage with releasing resistance. (2)if no releasing resistance, please wait for 5mins, serve UPS until BUS voltage less than 10V; if you don't follow two items above, you are in danger of getting an electric shock .
4. Make sure line input and battery input are natural first before boot-strap when you have examined and repaired UPS.
5. Make sure that +BUS and -BUS voltage can achieve standard value after boot-strap.

VI、PCB examine and repair

A. Charger board

(A-1). charger board (standard UPS) :

Item	Checked components	DVM function	Reference Value	Fail Condition
1	F901, F902, F903, F904, F905, F906,	W	0W	open
2	Q907, Q908,	(S, D)	≈1.7MW	short
		(G, S)	32W	short or open
3	D901, D902, D903	DIODE	≈0.4V	0V
4	Q909	(A, K)	≈20MW	short
		(G, K)	≈42W	short

(A-2). Charger board (long backup time UPS) :

Item	Checked components	DVM function	Reference Value	Fail Condition
1	F1	Ω	0Ω	open
2	Q301 Q105	(E,C)	≈1MΩ	short
		(G,E)	10kΩ	short or open
3	D303	DIODE	≈0.4V	0V
4	R315	Ω	10Ω	open
5	R319	Ω	1kΩ	open
6	D106	DIODE	≈0.4V	0V
7	R112, R159	Ω	10Ω	open
8	Q04	(A,K)	≈1MΩ	short
		(G,K)	≈12Ω	short
9	R320, R321, R322, R340, R339, R341	Ω	≈0.5/6 Ω	open

B. PSDR board

(B-1). Rectifier part:

Item	Checked components	DVM Function	Reference Value	Fail Condition
1	F301, F302	W	0W	open

2	Q301	(A, K)	W	≈1.4MW	short
	Q302	(G, K)	W	≈10W	short

(B-2). Voltage increase part:

Item	Checked components		DVM Function	Reference Value	Fail Condition
1	Q306, Q308、 Q310 Q307, Q309、 Q311	(E, C)	W	≈800kW	short
		(G, E)	W	15.8kW	short or open
2	D308, D310		DIODE	≈0.35V	0V
3	R325, R331, R334, R342、 R337、 R328		W	10W	open
4	R390, R388, R389、 R393、 R392、 R391		W	2.2W	open
4	D302, D304, D306, D303、 D305、 D307		DIODE	≈12Ω	open

(B-3). Battery voltage increase part:

Item	Checked components		DVM Function	Reference Value	Fail Condition
1	F303、 F304		W	0W	open
2	Q305	(A, K)	W	≈2.5MW	short
		(G, K)	W	≈10W	short

(B-4). Inverter part:

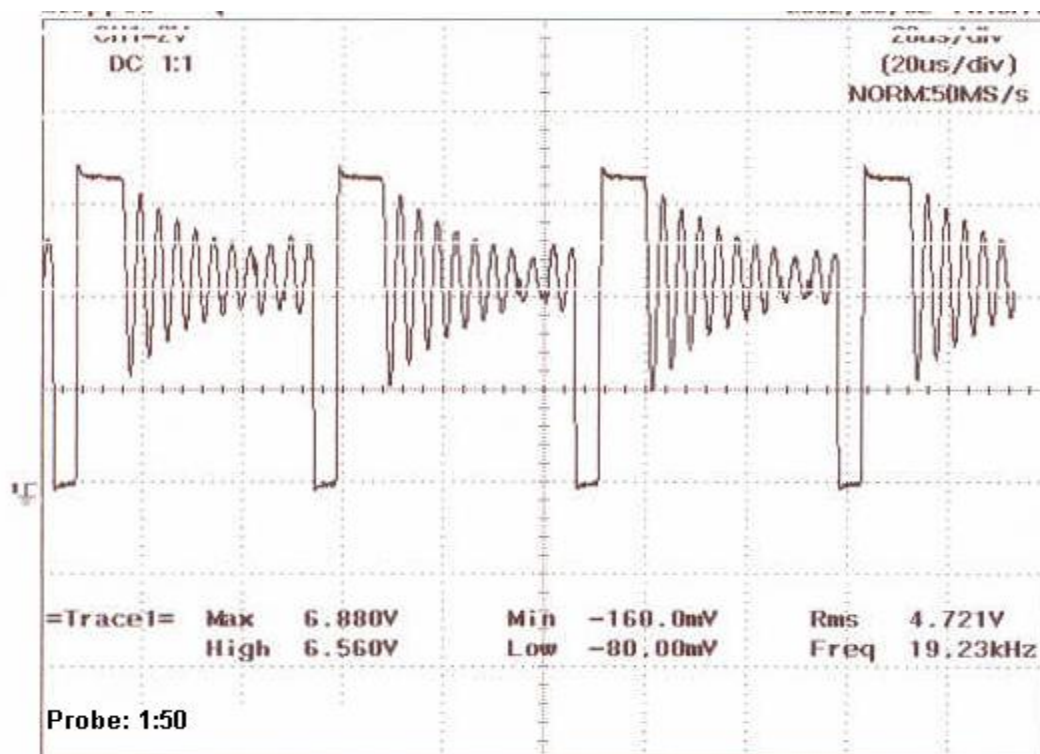
Item	Checked components		DVM Function	Reference Value	Fail Condition
1	Q201, Q202, Q203, Q204	(E, C)	W	≈100kW	short
		(G, E)	W	23.5kW	short or open
2	D201, D202, D203.D204		DIODE	≈0.36V	0V
3	R201, R202, R208, R209		W	10W	open
4	R203, R204, R210 R211		W	36W	open
5	D210, D211, D212.D213		DIODE	46Ω	open

C. IP SCR board

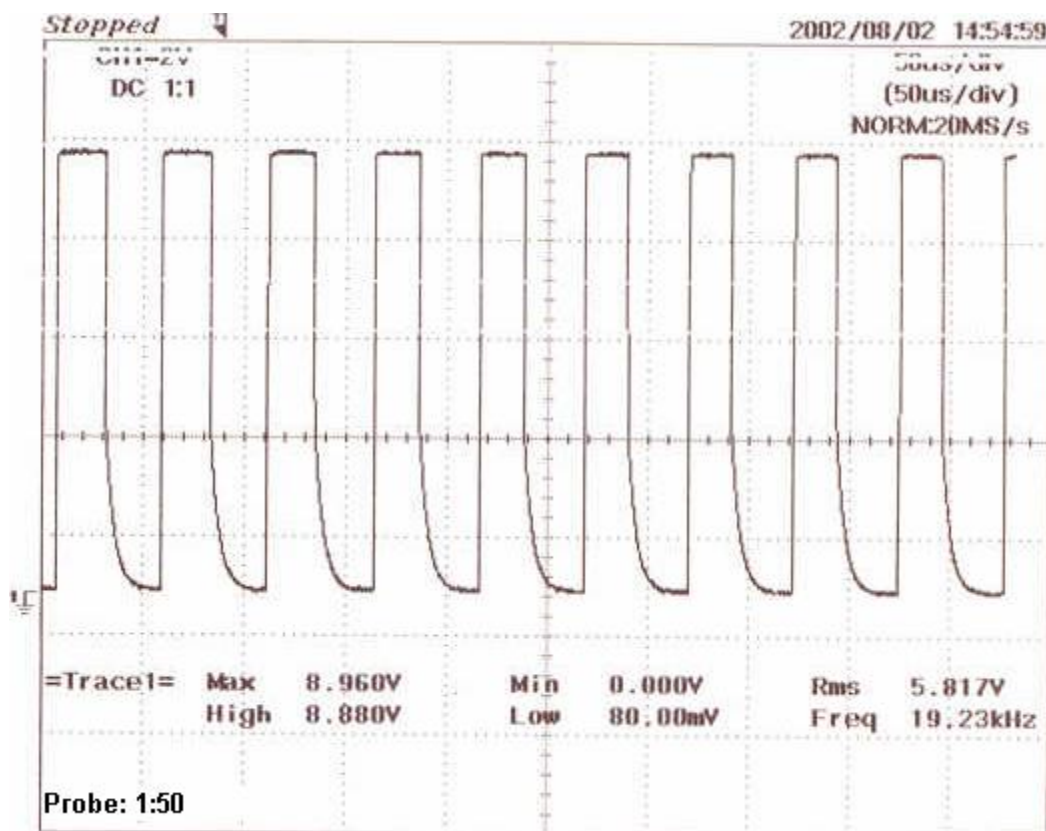
Item	Checked components		DVM Function	Reference Value	Fail Condition
------	--------------------	--	--------------	-----------------	----------------

1	F1, F2		W	0W	open
2	Q3, Q4, Q5, Q6	(A, K)	W	$\approx 2.5\text{MW}$	short
		(G, K)	W	$\approx 10\text{W}$	short

Voltage wave



Empty load, PFC IGBT C, E pole's voltage wave(V_{CE})

IGBT G, E pole's drive voltage wave (V_{GE})INV IGBT C, E pole's voltage wave (V_{CE})

Parallel Redundancy Maintenance

This UPS system has parallel redundancy function. If the user wants to parallel up the UPS, please follow the process of connecting new UPS. On the other hand, if the load is decreased or UPS is damaged, the user needs disconnect the UPS, please follow the process of disconnecting parallel systems.

Connect new UPS as Parallel Redundancy Function:

- 1) Before connecting new UPS, the user should prepare input and output wire, and parallel cable.
- 2) Input & output breaker on the Power Panel for the new UPS should be turned off. Follow the instruction of terminal block and connect with the appropriate input or output wire and battery. In the meanwhile, please remove the jumper between JP1 and JP2.
- 3) Switch the operating UPS to bypass mode. After that, please take off the maintenance cover and turn the switch from 'UPS' to 'BPS'. Then turn off the input breakers on the rear panel of each UPS.
- 4) If the operating UPS is running in single mode, the user must remove the jumper on JP1 and JP2 of the UPS terminal block.
- 5) Take off the cover of parallel port of the new UPS, then using a parallel cable to connect the slot in the parallel port of the new UPS. After finish this step, please screw up the cover of the parallel port.
- 6) Switch on the battery breaker of the new UPS and switch on the input breaker on the "Power Panel"; measuring the difference between the Line(L) connector of new UPS and the Line(L) connector of Parallel System. If the difference is less than 1 Volt, the user switches on the output breaker for the load.
- 7) Take off the cover of parallel port that the UPS has already transferred to the bypass mode; then using a parallel cable to connect the slot of the parallel port of the other UPS. After finish this step, please screw up the cover of the parallel port again.
- 8) After recover the maintenance cover, close the input breaker of each UPS on its rear panel. When all the systems have transferred to the bypass mode, the user can switch on all the Parallel Systems; and then make sure that all the UPS transfer to Inverter mode at the same time. After that, check the voltage between JP1 and JP2 of each UPS if they are all under 1Vac.
- 9) Please check the voltage difference between all JP2 on the UPS terminal blocks; the voltage should be less than 5 Volt. The average voltage rate is 2 Volt.
- 10) Turn off all UPS systems to let them switch to bypass mode, then please take off the maintenance cover and turn the switch from 'BPS' to 'UPS'. Also screw up all of the

maintenance covers.

11) Turn on all of the UPS to let them switch to Inverter (Normal) mode.

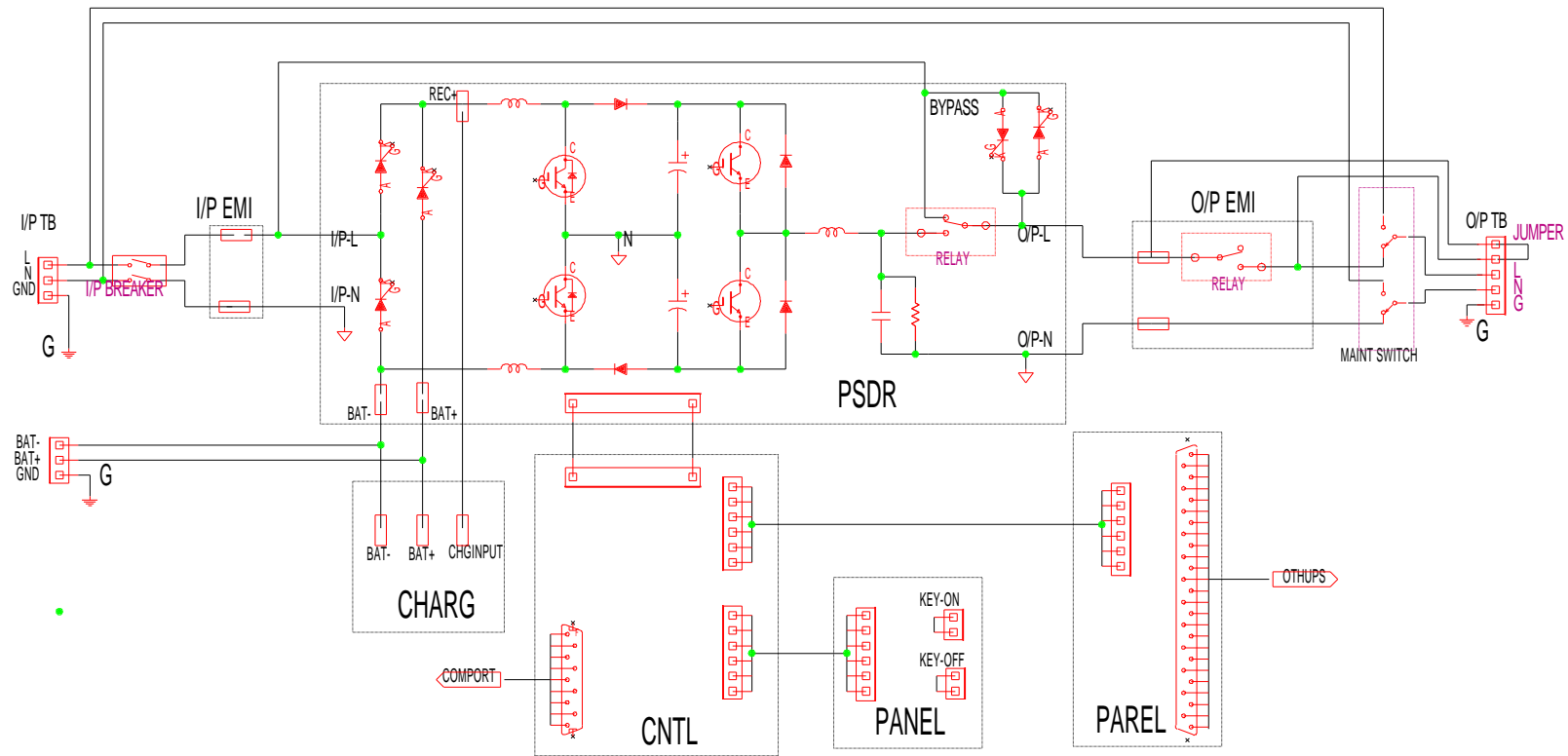
Note: If the state of UPS is abnormal in step 8&9, please follow the operation process of disconnecting UPS.

Operation process of disconnecting UPS:

- 1) If the user wants to disconnect an UPS, please press LCD Select Down-key with Select Up-key longer than 3 seconds twice, the UPS output will be turned off.
- 2) Turn off the input breaker and battery breaker of the UPS and turn off the input breaker on the "Power Panel".
- 3) Turn off other UPS systems to let them switch to bypass mode, please take off the maintenance cover and turn the switch from 'UPS' to 'BPS'. Then turn off all UPS input breakers.
- 4) After disconnecting the UPS, if the rest UPS is running in single mode, you must connect JP1 and JP2 of the output terminal.
- 5) Take off the cover of parallel port and parallel cable from the other UPS. Then screw up the cover of parallel port again.
- 6) Close the input breaker of the rest of UPS on its rear panel and wait them transfer to bypass mode, then turn the maintenance switch from "BPS" and to "UPS". Also screws up the maintenance cover; Turn on all of the UPS to let them switch to Inverter (Normal) mode.
- 7) Please connect JP1 and JP2 of the terminal block for the UPS which has disconnected.

Parallel System Warning:

- 1) When parallel systems run into inverter mode, please make sure that all UPS maintain switches at the same place as a position for "UPS" or "BPS".
- 2) Please make sure the power of UPS is "OFF" before parallel systems have been transferred to inverter mode.
- 3) During the system is in parallel, please do not operate any maintenance switch of the other UPS.



UPS frame chart