

EA99 Series UPS Manual



30 ~ 120kVA

Section I: EA99 Product System Overview	4
1.1 Introduction	4
1.1.1 Separate bypass input	5
1.1.2 Static transfer switch	5
1.1.3 Battery switch	6
1.1.4 Redundant control power board	6
1.2 Running mode	6
1.2.1 Normal mode	7
1.2.2 Battery mode	7
1.2.3 Bypass mode	8
1.2.4 Maintenance mode (manual bypass)	8
1.2.5 Economic (ECO) mode (only applicable for the single machine system)	9
1.2.6 Parallel redundant mode (system multiplication)	10
1.2.7 Hot backup mode	10
1.2.8 Frequency converter mode	11
1.3.1 EA99 Series UPS performance features	11
1.3.2 Product specific parameters	12
1.3.3 Detailed instruction of function features	14
1.3.4 Similar modularization design and fully front maintenance	29
1.3.5 Options	31
Section II Installation of Single Machine System	31
2.1 Introduction	31
2.2 Initial test	32
2.3 Siting	32
2.3.1 UPS room	32
2.3.2 External battery room	32
2.3.3 Storage	33
2.4 Position	33
2.4.1 Transportation of cabinet	33
2.4.2 Operation space	34
2.4.3 Front operation	34
2.4.4 Final position	34
2.4.5 Anchor installation	34
2.4.6 Incoming mode	34
2.5 External protection device	35
2.5.1 Rectification and bypass input	35
2.5.2 External battery	35
2.6 Power cable	35
2.7 Control cable and communication	38
2.7.1 Features of the monitoring panel	38
2.8.1 Interface of the input dry contact	38
2.8.2 BCB switch interface of the external battery	39
2.8.3 Input interface of emergency power off	39
2.8.4 Temperature detection interface of the external battery	40
2.8.5 Serial port RS232-1 and RS232-2	40
2.8.6 SNMP card interface	40
Section III: Installation of Battery	41
3.1 Introduction	41
3.2 Safety	41
3.3 Battery cabinet	42
3.3.1 Introduction	42
3.3.2 Environmental temperature	42

3.3.3 Outline dimension	43
3.3.4 Weight	43
3.3.5 Features of switch.....	43
3.3.6 Temperature pickup of battery	43
3.3.7 Transportation of battery cupboard.....	43
3.3.8 Cable incoming.....	44
3.3.9 Structural map of battery cupboard	44
3.4 Power cable of battery	45
3.4.1 Installation of battery	45
3.4.2 Battery connection	45
3.5 Battery control	46
Section IV Installation of Parallel System.....	46
4.1 UPS single machine of parallel system	46
4.2 Hot backup system	48
Section V: Installation Diagram.....	49
5.1 External structure	49
5.2 Internal view.....	50
5.3 Instruction of connection terminal	53
Section VI: Operation Procedure	53
Start-up procedure (access to inverted supply mode)	53
6.2 Start-up procedure (access to economic mode).....	55
6.3 Operational procedure of battery maintenance mode	55
6.4 Operational procedures of maintenance bypass (UPS power off procedure)	56
6.5 Procedures of power off (completely turn off UPS and load).....	56
6.6 Procedures of emergency power off (EPO).....	57
6.7 Certain UPS reset procedures after fault alarm.....	57
6.8 Automatic start-up	58
6.9 Language select	58
6.10 Alter the current date and time.....	58
6.11 Controlling password	58
Section VII: Operational & Controlling Display Panel	58
7.1 Introduction.....	58
7.1.1 Simulation state diagram.....	60
7.1.2 Sound alarm (buzzer)	61
7.1.3 Functional operation key	61
7.1.4 LCD and menu key	61
7.1.5 Detailed menu description	63
7.2 List of displayed events of liquid crystal panel	66

Section I: EA99 Product System Overview

1.1 Introduction

EA99 is a high-performance and fully digital UPS utilizing the double DSP control technology with the power factor correction function. Its performance indexes reach the leading level of the industry and the power grade contains 30-120 KVA. EA99 UPS is connected between the commercial power and the important load to supply the high-quality power to the load. It adopts the high-frequency double conversion pulse width modulation (PWM) and fully digital control technology, the output voltage is not influenced by the change and interference of the input voltage and frequency of the utility.

As shown in diagram 1, the utility is inputted from CB1, the rectifier converts the utility to DC and supplies power to the DC/DC bi-directional battery converter (charge the battery at any time) and the inverter. The inverter converts the DC power to AC power to supply the load. When the utility is interrupted, the battery supplies the back-up power to the load through the bi-directional battery converter and inverter. When the inverter is in fault or overload time is up, the external bypass supplies power to the load through the input switch CB2 and static bypass. In addition, for the maintenance and repair of the UPS, UPS will supply the power to the load through the internal maintenance bypass. When the UPS is in normal mode, all switches are closed except the maintenance bypass switch.

Note: and are the external battery and circuit breaker

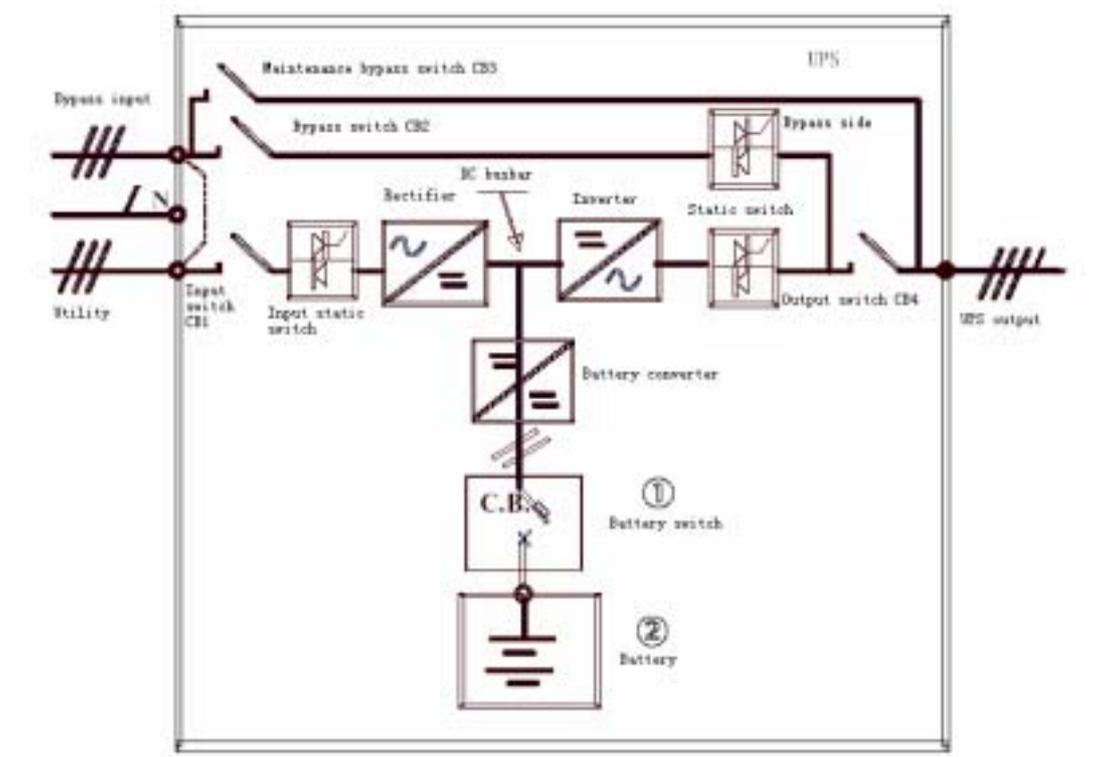


Diagram 1, frame of the single machine system

1.1.1 Separate bypass input

Diagram 1 describes the single machine frame of the EA99 UPS with the “Separate Bypass Power Supply” (bypass is inputted through independent utility). In the separate bypass allocation, static bypass and repair bypass adopt a single bypass power supply together and connect with the special bypass power supply through a single power switch. If bypass power supply is not available, connect the bypass and the rectifier input power terminal together.

1.1.2 Static transfer switch

The “Static Switch” in the diagram 1 contains the electronic control switching circuit and it can connect the load to the inverter output or to the bypass power supply through the static bypass.

Inverter supplies the power to the load under the normal condition; but the load is automatically switched to the static bypass power supply under the conditions of overloading or the inverter fault.

Under the normal operation, inverter output and the static bypass power supply should be synchronous to realize the uninterrupted transfer of the inverter and the static

bypass power supply. The synchronous of the inverter output and the static bypass power supply can be realized through the inverter control circuit. When the frequency of the static bypass power supply is within the allowed synchronizing range, the inverter control circuit always makes the inverter output frequency track the frequency of the static bypass power supply.

UPS also supports the manual control maintenance bypass. When shut the UPS and implement the daily maintenance and repair, UPS can supply the power to the important load through maintenance bypass.

1.1.3 Battery switch

The external battery is connected to the UPS through the switch inside the battery cabinet. If there is no battery cabinet, install the battery switch near to the assembled battery. The battery switch can be closed manually and it owns an under-voltage trip coil. When the fault is detected, UPS control circuit will trigger the coil and the switch will trip. In addition, the switch also supports the magnetism tripping function to realize the overloading protection.

1.1.4 Redundant control power board

UPS is equipped with two control power boards to mutual backup. The two power boards can obtain the input power from the AC utility input and DC bus. When one of the power supplies or one control power board is failed, UPS LCD panel will display the fault message and the UPS system is still in normal operation. This function supports the higher reliability to the system.

1.2 Running mode

EA99 UPS is online and double conversion UPS system, the running modes are as follows:

- Normal mode
- Battery mode
- Bypass mode
- Maintenance mode
- Economic (ECO) mode
- Parallel redundant mode
- Hot backup mode

- Frequency converter mode

1.2.1 Normal mode

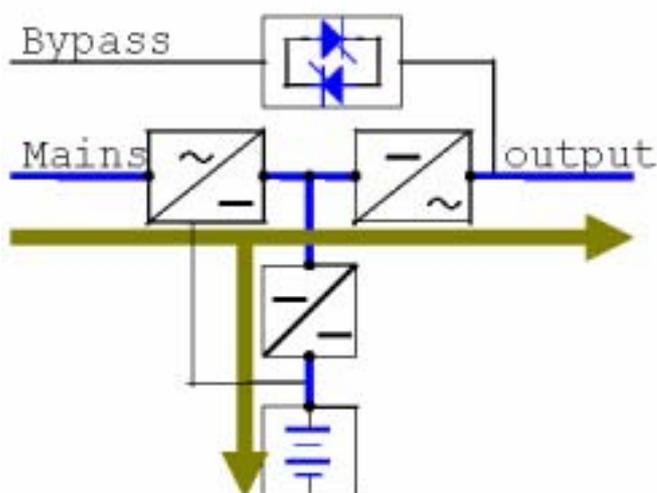


Diagram 2 Current diagram of the inversion mode

The utility supplies the AC power supply to the UPS rectifier; the rectifier supplies the DC power supply to the inverter; and the inverter supplies the uninterrupted AC power to the load. At the same time, the rectifier supplies the floating charge voltage or boost charge voltage to the battery through the charger.

1.2.2 Battery mode

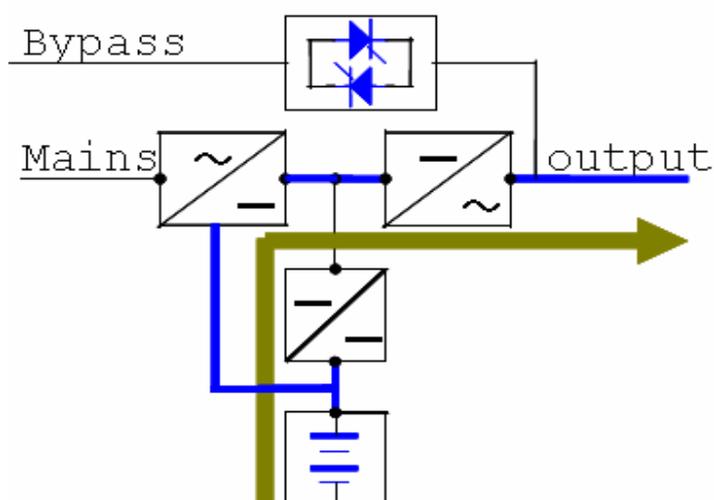


Diagram 3 Current diagram of the battery mode

Battery mode is such a running mode that the battery supplies the back-up power to the load through the inverter. When the utility is off, the system automatically switches to the battery mode and the load is not interrupted. When the utility recovers, the system automatically switches back to the normal mode and the load power supply is not interrupted without any manual intervention.

1.2.3 Bypass mode

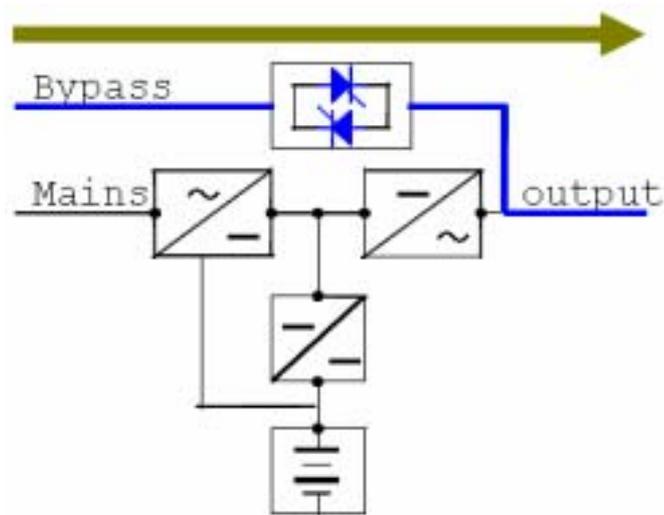


Diagram 4 Current diagram of the bypass mode

Under the normal mode, if the inverter is out of order, overloading or closed manually, the static transfer switch will convert the load to the bypass power supply side from the inverter side and the load power supply is not interrupted. If the inverter and the bypass is asynchronous at that time and the static switch converts the load to the bypass power supply side from the inverter side, but the load power supply will be interrupted for a short time. The function can avoid the general circulation resulted from the parallel of the asynchronous power supply. The interruption interval of the load power supply can be set, generally it is smaller than $3/4$ cycle. For example, the frequency is 50Hz and the interruption interval is smaller than 15ms; the frequency is 60Hz and the interruption interval is smaller than 12.5ms.

1.2.4 Maintenance mode (manual bypass)

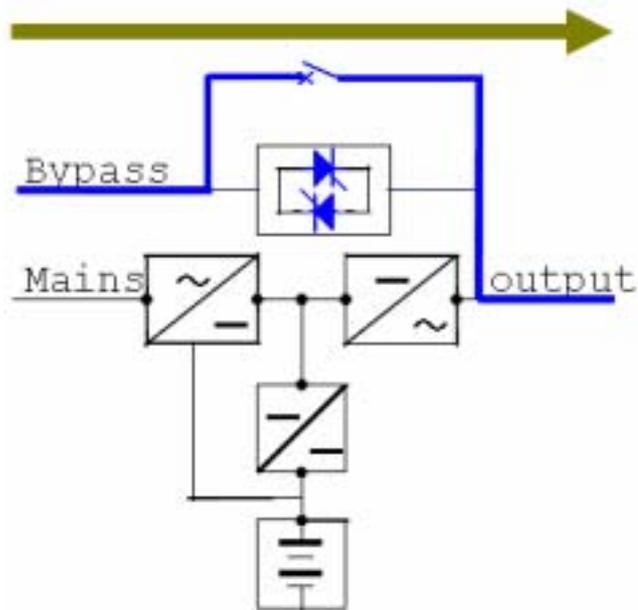


Diagram 5 Current diagram of the repair bypass mode

If the UPS needs maintenance or repair, convert the load to the maintenance bypass through the manual bypass switch and the load power supply is not interrupted. The manual bypass switch is equipped inside the UPS and the capacity meets the requirement of the single machine total load capacity.

1.2.5 Economic (ECO) mode (only applicable for the single machine system)

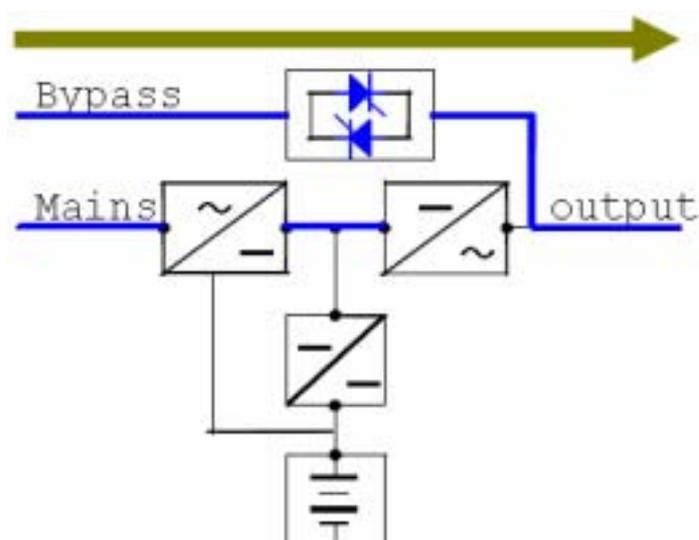


Diagram 6 Current diagram of the ECO mode

If the economic mode is applied, the double transformation is forbidden under most of the conditions to realize the energy-saving. When run in the form of the economic mode, bypass supplies the power to the load. When the bypass power supply is within the range of normal frequency and voltage, the load power is supplied by the bypass; when the bypass power supply exceeds the range, the system will convert to the inverter output and the load power supply will be interrupted. The interruption interval is smaller than 3/4 cycle. For example, the frequency is 50Hz and the interruption interval is smaller than 15ms; the frequency is 60Hz and the interruption interval is smaller than 12.5ms.

1.2.6 Parallel redundant mode (system multiplication)

In order to improve the system capacity and /or reliability, set several UPS single machines as the direct parallel and the parallel operation control logic inside each UPS single machine ensure that all single machines automatically share the load evenly. The parallel operation system can be formed by 6 single machines at most.

1.2.7 Hot backup mode

It is a 1 + 1 redundant mode to improve the availability and reliability of the system. Two UPS are connected in the form of the hot backup mode: UPS1 connects with the important load and UPS 2 connects with the UPS1 bypass. Other system input connects with the users' power distribution. The output of UPS1 and UPS2 is synchronous to ensure that the load power supply is not interrupted when the load is switching between UPS1 and UPS2. The mode not only ensures that the UPS meets the power supply

requirement of any special load, but also supports the requirement of bypass constant-voltage and constant-frequency. In addition, the UPS1 can be set as the alternate run of the normal mode and bypass mode to realize that the two UPS supply the power to the load alternately. The alternate run interval can be set by the user and the setting range is 1 ~ 4,320 hours (180 days).

1.2.8 Frequency converter mode

The UPS can be set as the frequency converter mode to supply 50Hz or 60Hz stable output frequency. The input frequency range is 40Hz ~ 70Hz. Under this mode, the static bypass is non-effective and the battery selection can be determined according to whether require the battery mode to run.

1.3 EA99 Series product features

1.3.1 EA99 Series UPS performance features

- Three phase input and output to support the power system of 380/400/415V, 50/60Hz.
- Pure online double conversion to support the optimal power supply quality
- Applicable for all kinds of load and possess high overload capacity
- Double DSP fully digital control to realize the full digitalization of the IGBT rectification, inversion, charge and discharge converter.
- For the latest IGBT rectification technology, the input power factor is up to 0.99; features low harmonic current, green environmental protection, high efficiency and energy-saving.
- Digital circulation technology with the small circulation and the parallel reliability is high
- Super wide input voltage anti-interference range to adjust to the rugged power system environment
- Intellectualized battery management to prolong the service life of the battery
- Self-diagnostic function; abundant and perfect fault protection function; possess 10000 historic records to be inquired
- Fully positive maintenance and install the equipment near to the wall to save the equipment room space
- Cooling fan redundant design of the power module to improve the system reliability.
- Similar modular design and the site maintenance is convenient and rapid

- Ultralong mean time between failure (MTBF) (> 200,000h)
- Short mean time to repair (MTTR) (< 0.5 h)
- Huge LCD interface display and friendly human-machine interface
- Two routing modes of top incoming and bottom incoming
- Whether equip the output transformer can be selected
- Options: Main path reverse protection, bypass reverse protection, battery leakage protection, battery cold start and lightning protection components

1.3.2 Product specific parameters

Figure 1: Performance parameters

Capacity		30 , 40 , 50,60 , 80 , 90,100 , 120kVA
Main input	Input voltage	380V/400V/415 (line voltage)
	Input mode	Three-phase four-wire
	Power factor	>0.99
	Total Harmonic Distortion, Harmonic current	<3%
	Voltage range	132/228V~277/480V 176/304V~~277/480V, full load operation 132/228V~176/304, the load capacity linear derates between 100%~70%
Frequency range	40~70HZ	
Bypass input	Input voltage	380V/400V/415 (line voltage)
	Input voltage range	+20%~-50%
	Input mode	Three-phase four-wire
	Frequency range	40~70HZ (can be set)
Output	Steady state voltage precision (balanced load)	±0.5%
	Dynamic voltage transient	±2% (0~100% load variation)
	Voltage distortion THDU (linear load)	THD<0.5% (phase voltage)

	Voltage distortion THDU (non-linear load)	THD<3% (phase voltage)
	Power factor	0.8 (lagging)
	Frequency tracking range	50Hz±3Hz
	Frequency precision (battery inversion)	±0.01%
	Three-phase separation	120±0.5°
	Frequency tracking rate	Adjustable between 0.5Hz/s and 5Hz/s
	Inverter overload capacity	105% load, run for a long time 110% load, convert to bypass output after 1hour 125% load, convert to bypass output after 10min 150% load, convert to bypass output after 1min > 150% load, convert to bypass output after 200ms Load between 105% ~ 150%, close the inverter according to the overload curve
	Bypass overload capacity	150% load, run for a long time 150%<load< 180%, insist on 1 min load>1000%, insist on 100ms
	Normal switching time	0
System	Overall working efficiency	the maximum is 93% ECO mode is 98%
	Display	LCD+LED
	EMI	IEC62040-2

	EMS	IEC61000-4-2(ESD) IEC61000-4-3(RS) IEC6100-4-4(EFT) IEC6100-4-5(Surge)
	Noise (1m)	<58dB
	Insulation resistance	>2M(500VDC)
	Insulation strength	(Input and output ground) 2820Vdc; leakage current is lower than 3.5mA, 1min without flashover
	Surge protection	Meet the installation location requirement of IEC60664-1, that is, the ability of bearing 1.2/50us+8/20us combination wave is not lower than 6KV/3KA
	Protection degree	IP20
Battery number		38~42 cells of 12V battery (standard 40 cells)
Installation	Connection mode	Top and bottom incoming and outgoing

1.3.3 Detailed instruction of function features

1.3.3.1 Rectifier

(1) Power factor correction

Rectifier possesses the power factor correction function. Under the condition of output full load, the input power factor is larger than 0.99 and the input current THD is smaller than 3%.



Diagram 7: Input voltage and current waveform

Figure 2: Input THDI and PFC

60kVA input THDi and PF with 380V rating voltage		
	100% linear	100% nonlinear
THDi_A (%)	1.690	2.728
THDi_B (%)	1.472	2.082
THDi_C (%)	1.814	2.244
PF_A	0.9999	0.9999
PF_B	0.9999	0.9999
PF_C	0.9999	0.9999

(2) DC busbar soft start-up

Rectifier can realize the soft start-up of the direct current busbar voltage to ensure that no impact current to the busbar capacitance.

(3) Protection and alarm of rectifier

Main input abnormal

If any phase voltage of input is lower than 132V or higher than 277V, the rectifier will be closed, UPS will switch to the battery mode and the LCD will display the alarm messages.

Input frequency abnormal

If the input frequency exceeds the range of 40~70Hz, the alarm single of the input frequency abnormality will be reported, the rectifier will be closed, UPS will switch to the battery mode and the LCD will display the alarm messages.

Phase sequence reverse protection function of the main input

If the input phase sequence reverse is detected before the starting of the rectifier soft start, the rectifier will not start and the LCD will display the alarm messages.

DC busbar low voltage and over-voltage protection

Software protection point: When the voltage of the positive busbar or negative busbar is lower than 340V, UPS will switch to the battery mode. If the voltage of the positive busbar or negative busbar is lower than 300V or higher than 440V, the rectifier will be closed.

Hardware protection point: When the voltage of the positive busbar or negative busbar is higher than 460V, the rectifier, inverter and battery converter will be closed. If the bypass is within the protection range, the load will switch to the bypass power supply.

The LCD will display the alarm messages.

Pulse by pulse current limitation

If the rectifier current is larger than 3 times of the peak value of the rated input current, the rectifier will undergo wave chasing and current limiting.

Heatsink over- temperature protection

Each IGBT temperature is monitored. If the IGBT base plate temperature is higher than 90 ± 5 , the rectifier will be closed and the LCD will display the alarm messages.

Over- temperature protection of the input inductance

If the input inductance temperature is higher than 160 ± 5 , the rectifier will be closed and the UPS will switch to the bypass mode. The LCD will display the alarm messages.

Soft start fault

When the soft start finishes and the voltage of the positive busbar or negative busbar is still lower than 150V, soft start fault alarm will be reported.

Input over current protection

If the input current of the rectifier is larger than 4~6 times of the IMAX current limit (effective value), the rectifier will switch to the battery mode to supply the power. The LCD will display the alarm messages.

1.3.3.2 Battery converter

(1) Charger

When the rectifier is running, the battery converter intelligently charges to the battery under the normal commercial power.

The conversion of the constant-current charge, constant voltage charge and float charge can be realized automatically and smoothly.

The battery type includes the valve-regulated lead acid battery, nickel-cadmium battery and wet battery.

(2) Discharger

When the rectifier is closed or under the condition of the input over current, the battery converter will supply the power to inverter.

(3) Protection and alarm

Battery over-voltage protection

Software protection: If the battery voltage is higher than $N*14.5V$, the battery converter will be closed.

Hardware protection: If the battery voltage is higher than $N*15.0V$, the battery converter will be closed.

N: Assembled battery number, 12V for each assembly.

Battery discharge interruption (EOD) protection

If the battery voltage is lower than EOD shutdown point, the battery converter will be closed. The EOD shutdown point is the single battery's voltage.

Wave chasing and current limiting protection of battery discharge

If the battery converter current is higher than 2~2.5 times of the rated discharge current, the battery converter will undergo wave chasing and current limiting.

Battery capacity and backup time alarm

The panel will always display the battery capacity and backup time and report the alarm before EOD.

Inductance over-temperature protection of the battery converter

If the inductance temperature of the battery converter is higher than 160 ± 5 , the battery converter will be closed.

Battery access reverse alarm

If the positive and negative poles of the battery are accessed reversely, the alarm will be reported and the battery converter will be closed. The LCD will display the alarm message.

Short circuit protection of IGBT bridge arm of the battery converter

If the IGBT bridge arm of battery converter is shorted (IGBT over current) , the battery converter will be closed immediately.

Charger fault alarm

Under the charging mode, if the output voltage of the battery converter is not accordance with the set value and the difference value which exceeds 10% of the set voltage reaches to 5 min, the battery charger will be closed and the panel will display the alarm of the “Charger Fault”.

1.3.3.3 Balancer circuit

(1) Function

The balanced current can generate the direct current to compensate the voltage imbalance between the positive and negative busbar. The power of the balanced circuit can reach to more than 20% of the system rated power.

(2) Protection and alarm

Balancer circuit over current

If the balanced circuit appears the phenomenon of the direct current IGBT bridge arm, the balanced circuit will be closed immediately.

Voltage imbalance of the DC busbar

If the voltage difference between the positive and negative busbar exceeds 70V, the alarm of “Balancer Circuit Fault” will be reported.

(3) Pulse by pulse current limitation protection of balancer current

If the balancer current is higher than 2~2.5 times of the rated balancer current, the balancer current will be protected pulse by pulse.

(4) Over-temperature protection of the balancer circuit

The balancer circuit IGBT temperature is monitored. If the IGBT base plate temperature is higher than 90 degree, the rectifier will be closed.

1.3.3.4 Inverter and bypass

(1) The inverter possesses super overload capacity:

105% load, run for long time

110% load, transfer to the bypass output after 1 hour;

125% load, transfer to the bypass output after 10 min;

150% load, transfer to the bypass output after 1 min;

Load > 150%, transfer to the bypass output after 200ms

Load is between 105% ~ 150%, the inverter will be closed according to the overload curve.

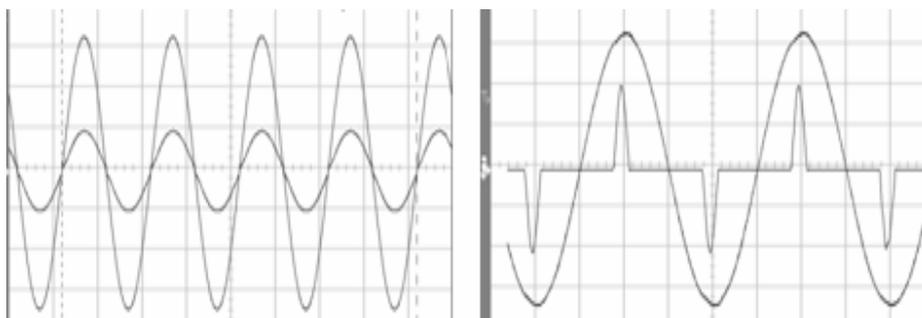


Diagram 10: Voltage and current waveform of the inverter with the resistance load and rectification load

(3) Bypass setpoint

A. Transfer range

The definition of the transfer range is to realize the determination of uninterrupted and interrupted switch of the inversion and bypass which include the voltage amplitude range and frequency range. When the bypass voltage amplitude or frequency exceeds the range, the bypass will be considered to exceed the transfer range.

The voltage amplitude range is fixed in the -20%, +15% deviation range of the rated voltage. The frequency range sees the following definition.

B. Bypass tracking range

When the bypass is within the tracking range, the inverter is in the synchronous state with the bypass. It includes the voltage amplitude tracking range and frequency tracking range. When the bypass voltage amplitude or frequency exceeds the tracking range, the bypass exceeds the tracking range.

User can set the bypass tracking range like the following protection range. The frequency tracking range can be continuously set from $\pm 0.5\text{Hz}$ to $\pm 5\text{Hz}$ of the rated frequency and the default value is $\pm 3\text{Hz}$.

(4) Bypass protection range

Protection range means the bypass is in the available mode and when the bypass is in this state, the bypass will not supply power at any time. It includes the amplitude protection range and frequency protection range. When the bypass voltage amplitude or the frequency exceeds the protection range, the bypass exceeds the protection range.

The bypass protection range included an upper limit and a lower limit. The upper

limit is +10%, +15% and +20% and the default value is +15%. The lower limit is -10%, -20%, -30% and -40% and the default value is -20%. The frequency protection range is $\pm 10\%$ and $\pm 20\%$ and the default value is $\pm 10\%$.

(5) Function

A. On/off control of the inverter

The inverter can be started through manual operation of user, using keyboard to eliminate the fault or automatic startup when the commercial power recovers. Inverter can be closed through manual operation of user or automatic close when the system is out of order. Some serious fault will close the inverter permanently till the system disconnects, such as, the static switch fault.

B. Output transfer logic

The transfer logic of the system automatically chooses the mode for each switch. The transfer logic determines the transfer mode combining the bypass state, inverter state and fault information. If the inverter is in the synchronous state with the bypass, the phase difference between the inverter and bypass is smaller than 5 degrees.

C. Economic mode (ECO)

The economic run mode is only effective to the single machine. Under the mode, the load is supplied the power from the bypass and the inverter is in the hot backup state. It will realize the higher system efficiency. The efficiency of the UPS single machine is higher than 97~98% under this mode.

D. Parallel running

The maximum parallel number of this series UPS includes six machines. The flexible and reliable operation logic ensures the high reliability and load stability of the parallel system. The parallel logic can coordinate the operation of all inverters in the parallel system.

(6) Protection and alarm

Fault protection of the bypass thyristor

If a bypass static switch has a short circuit and the inverter is in the running state, the inverter will be closed immediately and the LCD will display the alarm. UPS will switch to the bypass power supply permanently till the system disconnects.

Fault protection of the inverted thyristor

If the load is supplied power by the bypass and the system detects that the inverter static switch has a short circuit, the switch from the bypass to the inversion will be forbade and the alarm will report it till the system disconnects.

Phase sequence reverse protection of the bypass

If the bypass phase sequence is reverse, the system will consider that the bypass is in the over protection state and the load cannot be supplied power by the bypass at any time. The fault alarm always exists till the system disconnects.

Over-temperature protection of the inverter heatsink

Each IGBT is monitored and if the inverter IGBT base plate temperature exceeds 90 ± 5 , the inverter will be closed and the load switches to the bypass power supply. After the IGBT temperature drops, the system will automatically transfer to the main power supply. The LCD will display the alarm message.

Over-temperature fault of the output inductance

If the output inductance temperature exceeds 160 ± 5 , the inverter will be closed and the load will transfer to bypass power supply. After the inductance temperature drops, the system will automatically transfer to the main power supply. The LCD will display the alarm message.

Inverter fault protection

After the inverter starts for some time and if the inverter output voltage still exceeds the CBEMA curve, it is considered that the inverter fault appears, the inverter will be closed and the LCD will display the alarm message. The UPS will switch to the bypass power supply and return to the main path power supply after using keyboard to eliminate the fault.

Current pulse by pulse protection of IGBT bridge arm of the inverter

If a phase of the inverter IGBT bridge arm is shorted (IGBT over current) , the inverter will be closed immediately and the LCD will display the alarm message.

Error in operation

When the inverter is running and the repair bypass is closed, the inverter will be closed immediately and the UPS will switch to the bypass power supply. The alarm will report the error in operation of the user.

When the repair bypass is closed, the inverter will not respond to the manual startup

order.

If the system connects with the power and there is no output voltage after 5 minutes, the system will determine the error in operation of the user and automatically close the rectifier.

Over-voltage or low-voltage fault of the DC busbar

If any busbar voltage is higher than 470V or lower than 330V and persists for some time, the inverter will be closed and the UPS will switch to the bypass power supply.

Overload transfer of the inverter

Under the overloading condition of the inverter, the UPS will transfer to the bypass power supply from the inversion power supply after the specified duration. After transferring, the inverter is in the hot backup state. The system will transfer to the normal mode automatically after the overload disappears. The transfer is limited in five times every hour and the LCD will display the alarm message.

Current pulse by pulse limitation of the inverter

When the inverter current is larger than 2~3 times of the peak value of the rated output current, the inverter current will be protected pulse by pulse. When the output is short circuited, the protection will be triggered.

Fan fault detection

The fault of each fan of the UPS can be detected. If a fan is out of order (coil open), then the fan fault will be reported. According to the number of the fault alarm red light displayed in the veneer, check in the corresponding diagram 27 in the appendix and the fan fault location can be confirmed.

Asynchrony of the inverter

If the inverter cannot be synchronous with the bypass, the alarm message will be reported.

Not current-sharing of the parallel system

If the non-equalized current degree of a single machine in the parallel system exceeds 30%, the alarm message will be reported.

1.3.3.5 Auxiliary power supply

The auxiliary power supply adopts 1+1 redundant mode. Each auxiliary power supply can supply power to all control circuit independently. When one auxiliary power

supply is out of order, another auxiliary power supply will continue to supply power. UPS will run normally and the LCD will display the alarm message.

1.3.3.6 Monitoring

(1) LCD display



Diagram 11: LCD panel

The following parameters should be displayed in the LCD screen. All displayed electrical quantity should be refreshed for one time every five seconds. The difference between the displayed value and the actual value should be lower than 2%.

- Main input

Three-phase main input phase voltage

Three-phase main input current

Three-phase main input frequency

Three-phase input power factor

- Bypass input

Three-phase bypass input phase voltage

Three-phase bypass input current

Bypass input frequency

- UPS output

Three-phase output phase voltage

Three-phase output current

Three-phase power factor

Three-phase output frequency

- Load information

Three-phase load percentage

Three-phase output active power, apparent power and reactive power

Load power factor

- Battery

Battery voltage

Battery current

Forecasting of the battery backup time

Battery temperature

Battery capacity

- Parallel load

Three-phase total apparent power

Three-phase total active power

Three-phase total reactive power

- Record of the historical event

When the fault appears, the record of the historical event should be updated immediately.

10000 historical events can be recorded at most.

- Menu language

Two languages: Chinese and English

- Setting information

Date format

Date and time

Address

Contact

Com1 baud rate

Com2 baud rate

Com3 baud rate

Contact telephone number

- Control interface

Start the self-checking of the battery maintenance

Start the self-checking of the system

Stop testing

(2) LED display

The power flow direction of the system is displayed by five bicolor LED.

- Rectifier/charger
- battery
- Bypass
- Inverter
- Load

The green of the LED means the corresponding circuit works normally and the red of the LED means the corresponding circuit works abnormally. The extinguishing of the LED means the corresponding circuit is closed and the twinkling of the LED means the corresponding circuit is in the standby mode. The red LED is used for the fault alarm.

(3) Key

There are nine keys in the panel which include five menu keys, inverter start-up key, inverter close key, urgent-off key, fault silencing key and fault clearing key.

The four menu keys can be used for choosing the menu screen displayed by the LCD.

Inverter start-up key is used for starting the inverter.

Inverter close key is used for closing the inverter.

Emergency power off key is used for the rapid shutdown in the urgent situation. The shutdown includes closing the rectifier, inverter, bypass and the battery converter.

Fault clearing key is used for clearing the fault lock mode.

Silencing key is used for closing the alarm sound of the buzzer.

(4) External interface

Support the abundant input and output signal of the dry contact:

It includes the access signal of the generator, UPS fault alarm output signal, on-off state

signal of the external battery and on-off drive signal of the external battery.

Measure module can monitor the environmental temperature and battery temperature together.

A. Signal interface connects with the battery cabinet

Battery temperature interface can connect the temperature pickup of the battery (option) with the UPS internal control unit. The temperature of the battery cabinet can be got through this interface and displayed in the LCD and the temperature compensation can be implemented. The difference of the battery temperature should be smaller than ± 3 .

B. RS-232 signal

Equip the RS-232 COM1 and COM2 to use for the local communication.

C. Smart card

Modbus, SNMP and other pending cards

Each EA99 UPS possesses the expand communication interface and communication interface card to connect with each kind of network. It can realize the computer centralized control of the UPS and the monitor of the UPS running state.

* Compositive SNMP interface

The circuit board is installed inside the UPS host to directly connect the UPS with all Ethernets through the TCP/IP agreement. Then, each computer in the network can manage the UPS through the network.

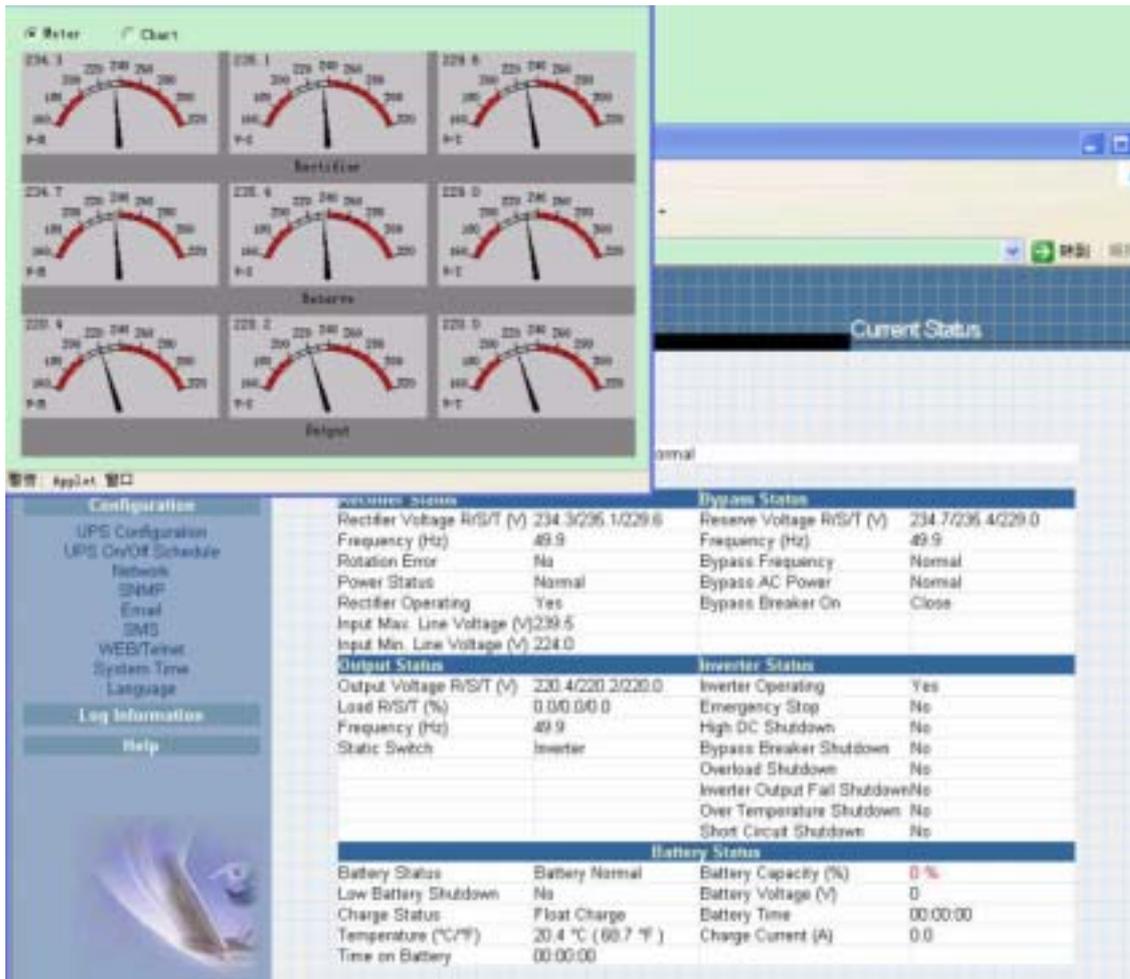


Diagram 12: Remote monitoring interface

1.3.3.7 Battery management

UPS possesses the intelligentized battery management function and supports the valve regulated lead acid battery, nickel-cadmium battery and wet battery.

(1) Basic function

Constant current average charging

The charging current can be set in the upper limit value of the charging power.

Constant voltage average charging

Set the charging voltage according to the battery type.

For the valve regulated lead acid battery, the maximum charging voltage is smaller than 2.4V.

Float charge

Float charging voltage value can be set according to the battery type.

For the valve regulated lead acid battery, the float charging voltage is between 2.2V and 2.3V.

Float charge temperature compensation (optional)

The temperature compensation coefficient can be set according to the battery type.

Interruption protection of the battery discharge

If the battery discharge voltage is lower than the protection point, the battery converter will be closed.

(2) Advanced function

Battery self-maintenance

Select the battery self-maintenance order through the panel display and the key and the system will automatically switch to the battery mode to test the battery discharge, and then automatically switch back to the main path mode.

Battery capacity forecasting

For the valve regulated lead acid battery, if the battery has been completely discharged and the battery capacity curve will be recorded. If the battery has never been completely discharged, start the battery capacity forecasting through the manual set to discharge the battery to the EOD point. If the curve is not gained through discharging, then default the typical curve of the valve regulated lead acid battery.

After the battery starts to discharge, the battery surplus capacity should be displayed. The nickel-cadmium battery and the wet battery adopt the typical capacity curve.

Backup time forecasting

Implement backup time forecasting according to the current load. Under 25 environmental temperature, the forecasting difference of the new valve regulated lead acid battery through studying is smaller than 10%.

Short backup time alarm

During the time before the interruption of the battery discharge, low forecasting alarm of the battery voltage should be reported.

1.3.4 Similar modularization design and fully front maintenance

The structure design considers the operability of the on-site maintenance in detail and adopts the advanced front maintenance design idea to realize the similar

modularization design of each function block in the UPS according to the function. The installation and maintenance is very convenient.



Diagram 13: Material object photo of the internal door

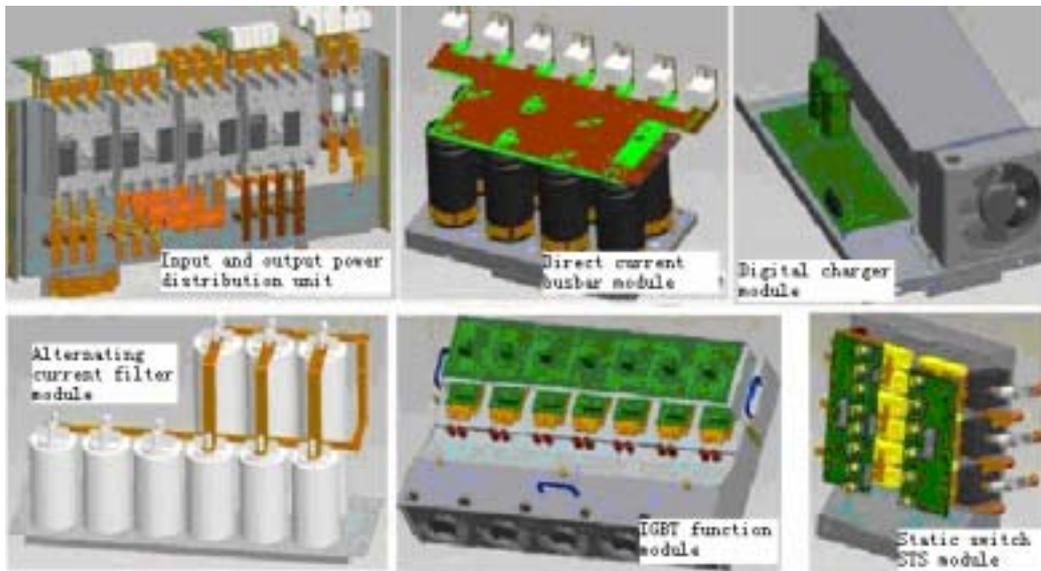


Diagram 14: Internal similar module design

1.3.5 Options

(1) An internal main and bypass backfeed protection device can be installed as an option.

(2) Battery cold start option

Support the function of direct battery start under the condition of without the input.

(3) Battery leakage protection option

Detect and eliminate the battery earthing fault to ensure the reliable running of the system.

The monitoring leakage current range: 30 ~ 3000mA.

(4) Lightning protection option

Section II Installation of Single Machine System

2.1 Introduction

This section introduces the necessary UPS requirements of the UPS siting and routing.

Because each site possesses its particularity, this section does not introduce the detailed installation steps but support the instructional general installation steps and methods to the installation personnel. The installation personnel should handle according to the specific situation of the site.

Notes:

- Connect the UPS with the power after the agreement of the commissioning engineer.
- The UPS installation should be implemented by the qualified engineer according to the description of this section. All other equipment are not referred in this manual will be accompanied by its detailed mechanical and electrical installation data when shipping.
- The standard EAST EA99 UPS system can connect with the three-phase four-wire (earthing) system TN , TT and IT alternating current power distribution network and support the transformer optional parts of transferring three-wire to four-wire. If it used for the IT alternating current power distribution network, a four-grade circuit breaker should be equipped to the input referring to the relevant IT system standard.
- Be careful to the installation of the battery. When connect the battery, the voltage of the battery terminal will exceed 400Vdc which possess mortal danger. Please wear

the eyes protecting cap to avoid the damage of the eyes from the accidental electric arc. Take off the ring, watch and other metal adornment. Use the tool with the insulated handle and wear the rubber glove. If the electrolyte of the battery leaks or the battery is damaged, change the battery and put it in vessel with the sulphuric acid resistance. Handle it according to the local regulation. If the skin touches the electrolyte, wash with water immediately.

2.2 Initial test

Implement the following inspection before installing the UPS:

- 1 . Visual inspect whether the transportation damage exists in the UPS and the internal and external of the battery. If it is damaged, report to the carrier immediately.
- 2 . Check up the product label and confirm the correctness of the equipment. The equipment label is fixed behind the door of the equipment and the UPS model, capacity and main parameters are marked in the label.

2.3 Siting

2.3.1 UPS room

EA99 series UPS supports the forced cooling through the internal fan. The cold blast enters the UPS internal from the front and bottom air grid of the UPS cabinet. The hot blast is exhausted from the top air grid of the UPS. Please do not block the ventilation hole (air grid). If necessary, install the indoor exhaust fan to avoid the increase of the room temperature or choose the precision air-conditioning of the machine room.

Note: UPS is only applicable for installing in the concrete or other noninflammable installation surface.

2.3.2 External battery room

The environmental temperature of the battery should be kept constant. The environmental temperature is the main factor of influencing the battery capacity and the service life. Standard working temperature of the battery is 20 ~ 25 . Run in the environmental temperature which is higher than the range will shorten the service life of the battery and run in the environmental temperature which is lower than the range will decrease the battery capacity. Usually, the allowed environmental temperature by the battery is between 15 ~ 25 . Keep the battery far away from the heat source and ventilation opening. Install the battery switch near to the battery and ensure the shortest

routing distance between the battery and the UPS. Support the battery switch control plate and use together with the battery switch. The control plate should be installed near to the battery switch and connected with the UPS control system.

2.3.3 Storage

If do not install the UPS immediately, store it indoor to avoid the over-wetting or over-temperature environment.

2.4 Position

Four casters are installed in the bottom of the UPS cabinet to convenient to the position and short transportation of the equipment. UPS also supports the ground screw to prevent the equipment from slipping after the final position.

The position selection of the UPS should ensure:

- Convenient connection;
- Enough operation space;
- Good ventilation to meet the radiating requirement;
- Without the aggressive gas in the surround;
- Without over-wetting and heat source
- Non-dirty environment
- Meet the fire-fighting requirement;
- The optimal working environmental temperature is +20 to +20 , that is, the temperature range of the battery's maximum efficiency.

The equipment is the steel frame structure surrounded by the demountable panel and its top and lateral panels are fixed with the screw. After opening the UPS door, the power supply terminal, auxiliary terminal board and power supply operation switch can be touched. Front door of the UPS is designed with the operation control panel to support the display of the basic running state and alarm message. The air inlet is installed in the front and bottom of the UPS cabinet and the air outlet is in the top of the UPS cabinet.

2.4.1 Transportation of cabinet

The hoisting equipment used for transporting the UPS cabinet should possess the enough hoisting capacity. The caster is installed in the UPS and prevent it from slipping when open the bolt from the carrying tray. Ensure the enough manpower and hoisting

equipment to remove the carrying tray.

Ensure that the weight of the UPS is within the hoisting capacity range of the hoisting equipment. The weight of the UPS sees figure 17. Adopt the fork-lift truck or other similar hoisting equipment to transport the UPS and short distance transportation adopts its casters.

Note: Since the battery is installed inside the battery cupboard, be careful to the transportation. The distance of this transportation should be controlled in shortest.

2.4.2 Operation space

Since there is no air grid in the side and back of the EA99 series UPS, the special space requirement is not required to its side and back.

In order to fix the power supply terminal inside the UPS conveniently in the daily running, keep enough space in the front of the UPS except meeting the local regulation. After opening the UPS door completely, people should pass through freely. Keep 700 mm space between the top of the UPS and the ceiling to ensure the smooth exhaust in the top of the UPS.

2.4.3 Front operation

Because of the device layout of the UPS, the maintenance, diagnosis and repair of the UPS can be implemented in the front completely to decrease the space requirement of the side and back.

2.4.4 Final position

Four casters are installed in the bottom of the UPS cabinet to convenient to the moving and position of the equipment. After the final position of the UPS, ensure that other ground screws have been set to fix the UPS stably.

2.4.5 Anchor installation

The installation diagram in the section V marks the size and position of the anchor installation holes in the UPS base and the equipment can be fixed in the ground utilizing the holes. If install the UPS in the raised flooring, design a proper support frame to bear the weight of the UPS.

2.4.6 Incoming mode

EA99 series UPS and the battery cupboard can adopt two incoming modes of top and bottom incoming.

If adopt the bottom incoming, uncover the rubber grommet in the bottom of the equipment when connect and the incoming hole can be watched.

If adopt the top incoming, dismantle the shield sheet in the left of the cabinet top and the top incoming line channel can be watched.

2.5 External protection device

Install the circuit breaker and other protection devices in the alternating current power input location of the external UPS system. This section supports the general guidance to the qualified installation engineer. The qualified installation engineer should learn about the local regulated connection relevant knowledge of the installation equipment.

2.5.1 Rectification and bypass input

Install the proper over-current protection device in the commercial power input distribution and consider the current capacity of the power cable and overload capacity requirement of the system when installing (see figure 3).

It generally suggests using the thermal-magnetic breaker of tripping curve C (normal) in Figure 3(when the current is 125%).

Separate bypass: If the system adopts the separate bypass, respectively install the protection device of the bypass input in the input commercial power distribution location.

Note: Rectifier and the bypass input power supply should use the same neutral line.

Note: For the IT power system, install four-grade protection device in the external input distribution and external output distribution of the UPS.

2.5.2 External battery

Equip with the direct current compatible circuit breaker to supply the over-current protection of the UPS and its battery.

2.6 Power cable

Design the external connection cable according to the description of this section and the local connection regulation and considering the environment condition (temperature and physical support media). The maximum stable alternating current and the direct current of each model:

Figure 3: Input & output rated current of each capacity model

UPS	Rated current (A)
-----	-------------------

rated power (kVA)	Input current of the full load and full charge of the battery			Output current of full load			Discharge current of the minimum battery voltage (400Vdc)
	380	400	415	380	400	415	
30	50	48	46	46	44	42	67
40	67	64	61	61	58	56	89
50	83	79	76	76	72	70	112
60	100	95	92	91	86	83	134
80	133	126	122	121	115	111	179
90	150	143	137	137	130	125	201
100	167	159	153	152	144	139	232
120	200	190	183	182	173	167	268

Link

After the complete position of the equipment, link the power wire referring to the connection diagram in the section V and according to the following steps:

- 1 .Completely cut all input distribution switches and the internal power switches the UPS. Stick the warning mark in these switches to avoid other people to operate them.
- 2 . Open the UPS door and take down the under part protection cover, and the copper bar of the connection power cable can be watched.
- 3 . Connect the protection ground and other necessary earthing cable to the earthing copper bar of the bottom in the UPS power supply equipment. All UPS cabinets should be connected with the user's earthing.

Note: The connection of the ground wire and the midline should accord the local and the state relevant regulation.

Mark and connect the input cable choosing one of the following two steps and according to the installation type:

Public input connection

- 4 . For the bypass and rectification using the same circuit of the commercial power input, connect the alternating current input cable to the UPS input terminal (main path A-B-C,

input N) and the tightening torque is 5 Nm (M6 bolt) or 13 Nm (M8 bolt) . Ensure the correctness of the phase sequence.

Separate bypass connection

5 . For the bypass and rectification using two circuits of the commercial power input, connect the rectification input cable to the rectifier input terminal (main path A-B-C) and connect the bypass power supply input cable with the bypass input (bypass A-B-C) terminal. The tightening torque is 5 Nm (M6 bolt) or 13 Nm (M8 bolt) . Ensure the correctness of the phase sequence.

Note: For the system of the bypass and rectification input using two circuits of the commercial power input, dismantle the short ribbon wire between the bypass and the rectification input. Connect the midline of the bypass input and main path input together.

Frequency converter mode

6.If adopt the frequency conversion device, connect the alternating current input cable to the rectifier input terminal (main path A-B-C) and the tightening torque is 5 Nm (M6 bolt) , 13 Nm (M8 bolt) or 26Nm (M10 bolt). Ensure the correctness of the phase sequence and tighten the connection terminal. Do not connect the alternating current bypass power supply cable with the bypass input terminal.

Note: For the running mode of the frequency converter, dismantle the short ribbon wire between the bypass and the rectifier input terminal.

System output connection

7.Connect the system output cable between the UPS output terminal (output A-B-C- N) and the important load. If the load is not ready to accept the power when the commissioning engineer comes to the site, properly handle the terminal safe insulation of the system output cable.

External battery connection

8.Connect the battery cable between the (+\ -)battery terminal of the UPS and the battery switch. Pay attention to the polarity of the battery cable.

Note: For the connection of the cable between the battery terminal and the battery switch, firstly connect from the switch terminal.

9 . Reinstall all protection cover.

2.7 Control cable and communication

2.7.1 Features of the monitoring panel

According to the specific requirement of the site, auxiliary connection is required for UPS realizing the function of management of the battery system (including the external battery switch and temperature pickup of the battery), communication of personal computer, warning signal to the external device or remote emergency power off. These functions are realized through the monitoring panel in the back of the UPS front door and the monitoring panel supports the following interfaces:

1. Emergency power off control (EPO)
2. Input interface of the environment parameter
3. User communication interface (used for the parameter set and the users' background monitor)
4. Intellislot™ smart card interface
5. Modem interface
6. Battery temperature detection interface

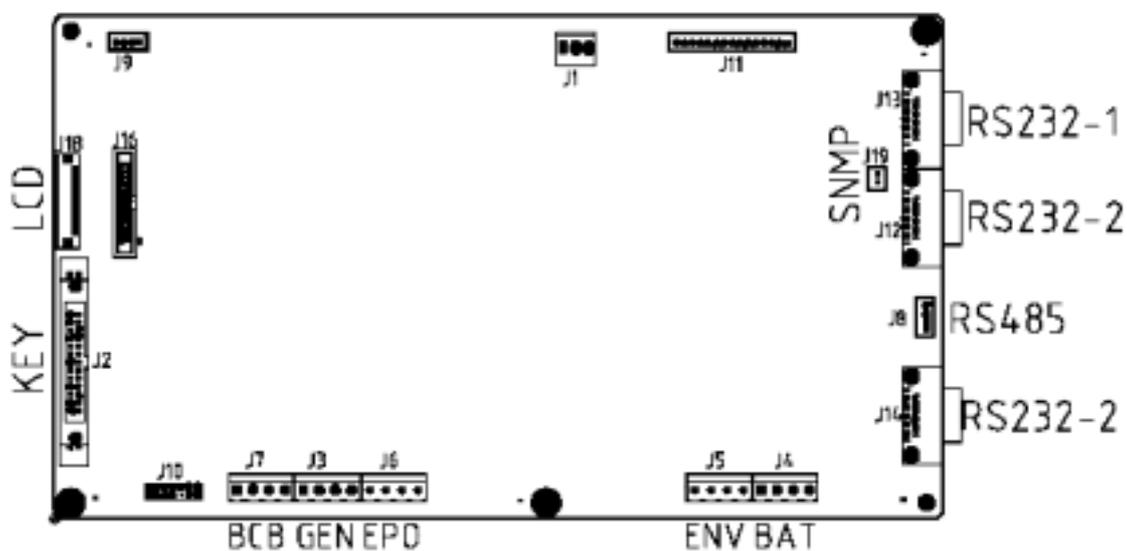


Diagram 15: Schematic diagram of the monitoring panel interface

2.8 Dry contact

UPS supports the input and output dry contact.

2.8.1 Interface of the input dry contact

For the external signal of the zero-voltage (dry contact) contact connected by the

phoenix terminal and the input dry contact terminal, the signal is effective when these contacts short connect with the terminal ' s leftmost + 12V through the software set.

Note: All auxiliary cables should be the double insulation twisted cable and the sectional area is 0.5 ~ 1.5mm² when the longest connection distance is 25 ~ 50m.

2.8.2 BCB switch interface of the external battery

Figure 4: Air switch interface description of the external battery

Position	Name	Description
J7.1	DRY	BCB driving signal- output (normal open)
J7.2	FB	BCB contact status- input (normal open)
J7.3	GND	Power ground
J7.4	OL	BCB online-input (normal open): The pin is effective after accessing the interface signal of the BCB

2.8.3 Input interface of emergency power off

UPS supports the emergency power off (EPO) function. It is realized through the EPO press-button in the UPS control panel or the remote contact supported by the user. EPO press-button is protected by the articulated plastic cover.

See in diagram 15, the J6 interface is the remote EPO input interface and the short circuit of base pin 3 and 4 of J6 or the cut of base pin 2 and 1 will activate the emergency power off.

If the external emergency power off function should be allocated, base pin 1 and 2 or base pin 3 and 4 of J6 reserve the terminal to the function. The external emergency power off device should be connected with the normal opened or normal closed remote power off switch of the two terminals through adopting the shielded cable. If not use the function, cut the base pin 3 and 4 of J6 or short connect the base pin 1 and 2 of J6.

Figure 5: Description of the remote EPO interface

Position	Name	Significance
J6.1	EPO_NC	Activate EPO when cut with J6.2
J6.2	EPO_NC	Activate EPO when cut with J6.1
J6.3	EPO_NC	Activate EPO when short connect with J6.4
J6.4	EPO_NC	Activate EPO when short connect with J6.3

Note: UPS emergency power off movement will close the rectifier, inverter and static bypass, but it does not cut the UPS input commercial power from inside. If it needs to cut the power of the UPS completely, cut the superior input switch when activate the EPO.

The base pin 1 and 2 of the EPO normal closed contact J6 in the monitoring panel has been short connected when shipping. All auxiliary cables should be the double insulation twisted cable and the sectional area is $0.5 \sim 1.5\text{mm}^2$ when the longest connection distance is 25 ~ 50m.

2.8.4 Temperature detection interface of the external battery

J4 port is the TMP-2 battery temperature pickup interface. Temperature pickup of the battery is usually connected with the external battery cupboard.

J4 base pin 1 : + 12V (temperature pickup power supply)

J4 base pin 2 : Unused

J4 base pin 3: BAT-T (battery temperature signal)

J4 base pin 4 : GND

2.8.5 Serial port RS232-1 and RS232-2

RS232-1 supplies the serial data to use as the interface of the background monitoring software.

RS232-2 supplies the serial data to use as debugging and maintenance interface of the authorized debugging and maintenance personnel and the switching of the SNMP card.

2.8.6 SNMP card interface

EA99 UPS supplies the communication interface of the SNMP card to install the communication option SNMP card (optional) on site.

Section III: Installation of Battery

3.1 Introduction

UPS assembled battery is connected by several batteries in series to provide the rated DC input voltage for UPS inverter. The required battery backup time (duration of load power supply when the utility is interrupted) is restricted by the ampere hours of battery. So it needs to connect several batteries in parallel sometimes.

The provided battery cupboard has the following forms:

- 1 . Complete set containing battery cupboard, battery and protection components;
- 2 . Only contain battery cupboard and protection components - no battery;
- 3 . Only contain battery - no battery and switch

It may need to disconnect the battery and UPS when maintain or repair the equipment.

The switch of the battery can be disconnected or closed manually. The switch off control can be realized through the under-voltage coil of battery switch or release.

3.2 Safety

The operation of the battery of EA99UPS system shall be particularly careful, because the voltage of the battery is deadly when connect all the single batteries. With regards to safety, the external battery shall be installed in the cabinet with lock or special designed battery chamber to separate from the personnel (except for the qualified engineer)

Note: The note related to the use and maintenance of battery is instructed in the battery manual provided by the manufacturer. The note relevant to battery safety mainly includes the necessary events in the installation and designing process; it may be adjusted according to the local situation.

Warning:

The user cannot operate the parts that needed the tools to open behind the protection lap, only the qualified personnel is permitted to open this type of protection lap. Besides, please disconnect the internal battery before operating the isolation terminals used for connecting external battery.

The following safety notes shall be paid attention when use battery:

- 1 . There is the electric shock when use battery. Large short circuit current can cause fire

danger.

- 2 . The voltage of the assembled batteries is 480Vdc with deadly danger, so please comply with the safety notes of high voltage operation.
- 3 . Only the qualified personnel can install and maintain the battery.
- 4 . Wear the eye shield to avoid the accidental injury of arc.
- 5 . Take down the ring, watch, necklace, bracelet and other medal ornaments.
- 6 . Use the tools with insulated handle.
- 7 . Wear the rubber glove and apron when use battery.
- 8 . The leaked or damaged battery shall be put in the sulfate resistant container, and it shall be disposed as scrap according to local regulations.
- 9 . Immediately clean the skin if it contacts the electrolyte.
- 10 . Scrap disposal of the battery shall comply with the local environment laws.
- 11 . The quantity of new battery and old one shall be the same when replace the battery.

3.3 Battery cabinet

3.3.1 Introduction

This battery cupboard can be used together with other machine cabinets, so that it can contain more batteries to provide the system longer backup support time.

If there are two or more battery cupboards, which shall be installed side by side and mutually connected. Besides, it suggests connecting the batteries in the general output end in series after paralleling the air switch output end of battery cupboards.

3.3.2 Environmental temperature

Valve control lead accumulator is very sensitive to temperature, so the valve control battery shall be used within the temperature of 15 ~ 25 . When the temperature is below 25 , the environmental temperature increases 1 , the battery capacity will increase 1%. Therefore, use the battery above the temperature of 25 will shorten its service life.

If the battery and UPS are installed in one room, the maximum design environmental protection shall be determined by the battery, not UPS. That is to say, if use the valve control battery, the indoor temperature shall be within 15 ~ 25 , not 0 ~ 40 (it is

the regulated working temperature range of main equipment). The temperature is allowed the deviation in a short time on the premise that the average temperature doesn't exceed 25 .

3.3.3 Outline dimension

The outline dimension of the battery cupboard is indicated in Figure 8. The door of the battery cupboard shall be completely open the needed space when plan its position to facilitate the installation and taking off the battery.

3.3.4 Weight

The sole weight of the battery cupboard is 200kg. The weight of battery cupboard shall include the weight of battery and cable when design the battery installation. It suggests not installing the battery cupboard on the elevated floor, this is very important.

3.3.5 Features of switch

Generally, the external battery cupboard connected with UPS of this model is protected by the standard battery switch (provided with state contact but without under voltage trip coil). If UPS has no automatic interrupted internal contactor, install a switch control panel to the battery switch and a under voltage coil to control the disconnection of external battery.

3.3.6 Temperature pickup of battery

The temperature plate of the battery can be installed in the highest temperature position of battery cupboard (generally at the top), and it is connected directly with UPS control system. If use the control panel of the battery switch, connect UPS control system through the control panel of battery switch. This function can regulate the float charge voltage of battery to make it inversely proportional to battery cupboard/room temperature, so that the battery in the high temperature environment is not over charge.

3.3.7 Transportation of battery cupboard

The weight of the battery cupboard shall be guaranteed in the range of load-carrying ability of the lifting equipment. The forklift or other similar equipment shall be used for transporting the battery cupboard.

Note: Transporting the battery in the battery cabinet shall be particularly careful, and the distance shall be controlled the shortest. Moreover, the battery cabinet must be

guaranteed no slope. The battery and battery cabinet must be separated for long-distance transportation.

The battery cabinet shall be firmly fixed with the foot screw after final location.

3.3.8 Cable incoming

The incoming of battery is from top and bottom. When the incoming is from bottom, take off the bottom shielding piece of the equipment, and you can see the incoming hole. When the incoming is from the top, take off the shielding piece of the equipment, and you can see the bottom incoming hole.

3.3.9 Structural map of battery cupboard

The detailed structure of battery cupboard is as follows:

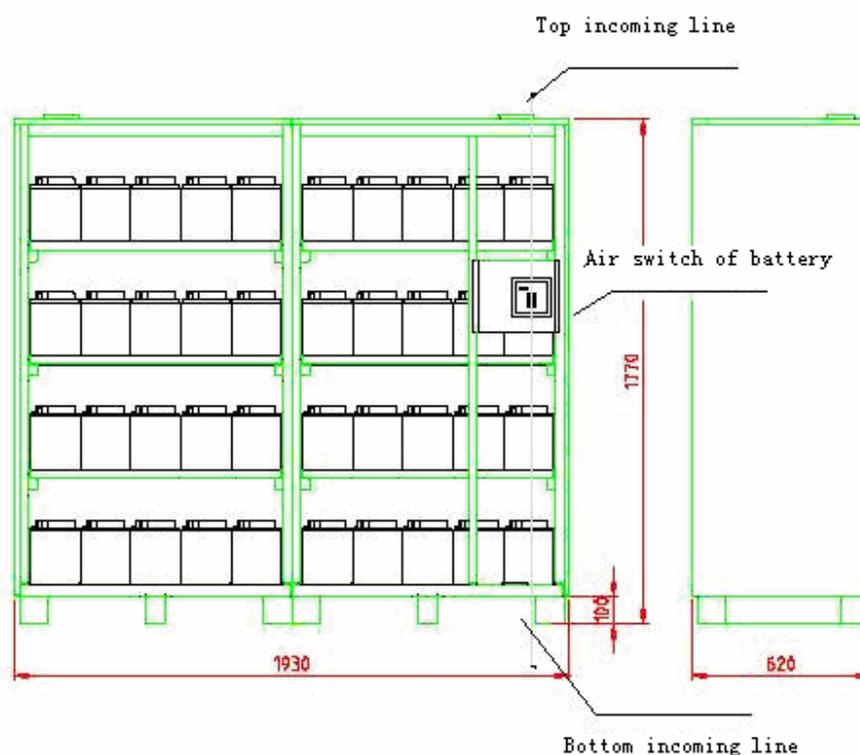


Diagram 16: Structure of battery cabinet

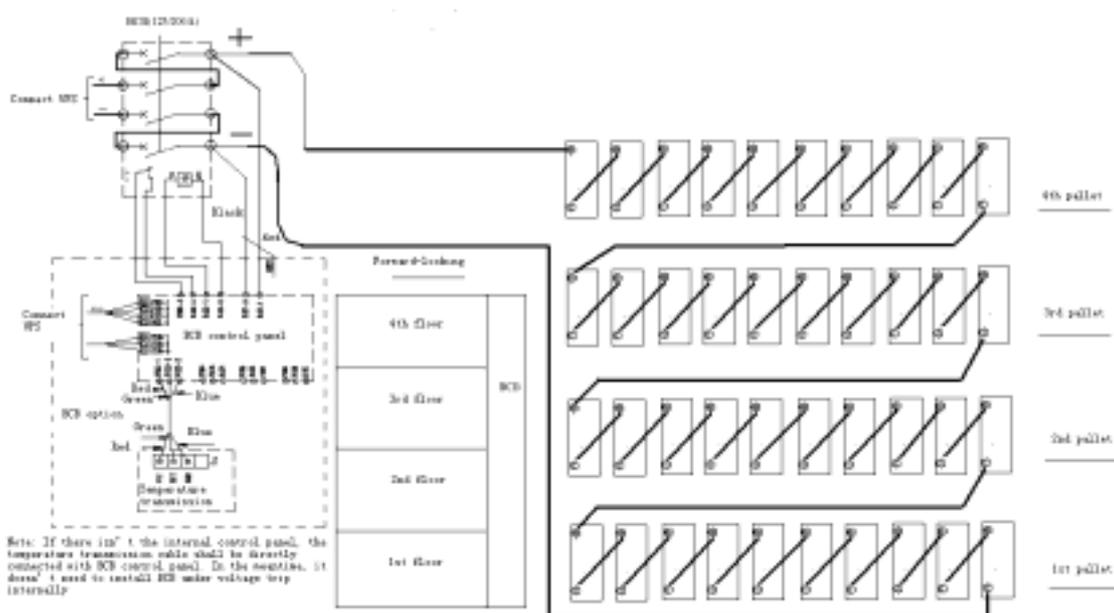


Diagram 17: Battery connection

3.4 Power cable of battery

3.4.1 Installation of battery

- 1 . Generally, the space between the vertical surface and the sides shall be at least 10 mm, which can make the surrounding air freely flow.
- 2 . There shall be a certain space between battery top and the above barricade to facilitate the monitoring and maintenance of battery.
- 3 . The battery shall be installed from the bottom to the top to avoid the top-heaviness.
- 4 . There shall be retained more than 1 meter's space around the battery cupboard, which can facilitate the maintenance and air flow.

3.4.2 Battery connection

- 1 .When the battery cupboard is installed on the elevated floor, the power cable of battery and the battery switch-controlled cable can enter UPS cabinet from the bottom. If UPS is installed adjacently to the battery cupboard on the solid floor, these cables can pass through the machine cabinet through the underside incoming hole of battery cupboard.
- 2 . Generally, it suggests connecting the cables between the same-layer batteries first, and then connecting the cables between the layers, finally connecting the battery switch and

battery terminals.

3 . Install the insulating cover to the terminals after connecting the battery terminals.

4 . Connect the switch end first when connect the battery terminal and cables between the battery switches.

3.5 Battery control

The battery switch is controlled by the control panel, which is in the battery switch box. If the battery is the rack-mounted installation, the control panel of the battery switch shall be near the switch. The control panel controls the trip coil of the switch, and provides the access for the auxiliary contact of the switch to transmit the status signal of switch to UPS control logic. Besides, the control panel of the battery switch is connected with UPS through the auxiliary terminal J7 of monitor board behind the cabinet door of UPS.

Temperature pickup cable of battery (option) is connected among the auxiliary terminal J4 of USP monitor board, control penal of battery switch and batteries. The connection cable of BCB must has the protective ground wire or barrier, and it is wired separately with the power cable (use double insulated cable); when the longest connection distance is between 25 and 50m, the section area is generally between 0.5 and 1mm². The shielded wire is connected with the protective ground wire of the battery cupboard or battery switch (not UPS).

Section IV Installation of Parallel System

The installation of parallel machine shall comply with the installation procedures of the single machine system and the requirements of this section.

4.1 UPS single machine of parallel system

Put the single machine side by side and install these machines according to Diagram 29.

It suggests using external bypass cabinet to facilitate the maintenance and system testing.

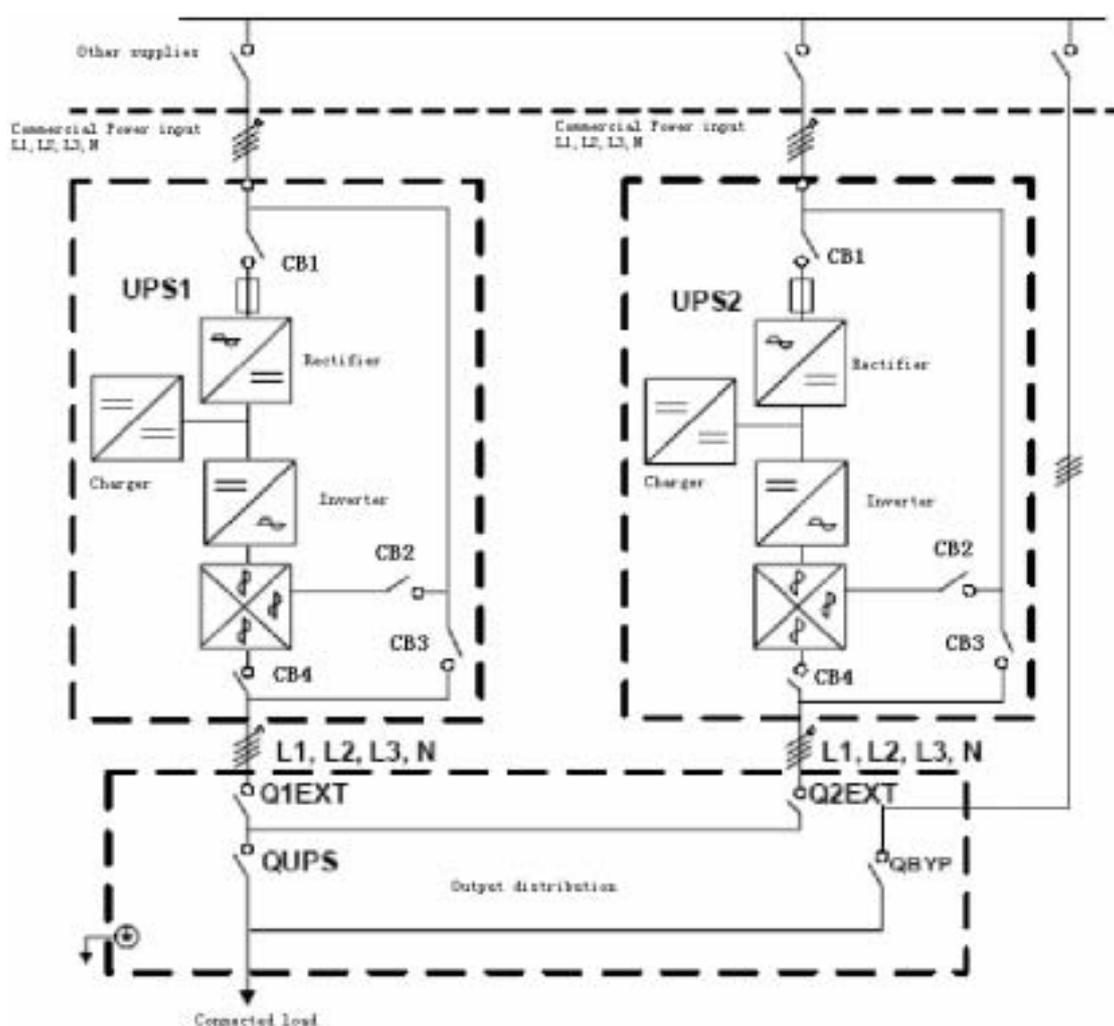


Diagram 18: Typical 1+N system principle

Note: The internal maintaining bypass switch CB3 must be taken off when the load exceeds the capacity of single machine.

All the single machines must be connected with double insulated shielding parallel controlled cable of 30m (longest).

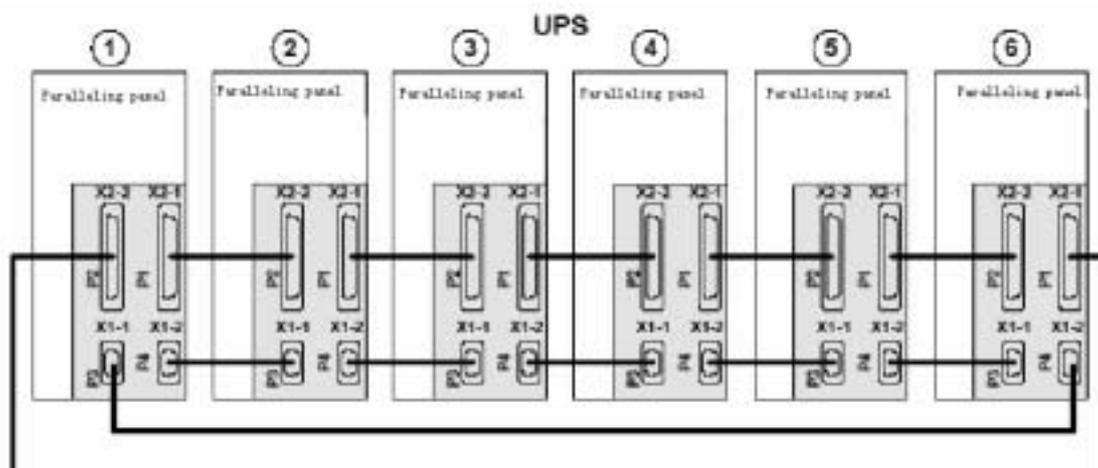


Diagram 19: Schematic diagram of parallel signal cable's connection

4.2 Hot backup system

Put the single machine side by side and connect these machines according to the following instruction.

The hot backup system is connected in series by two UPS single machines with same capacity, and one is the host (subordinate UPS), another is slave (superior UPS). Besides, the host and slave are determined by the connection of power cable and setting of allocation software. Normally, the host and slave are operated of inverted supply mode, the output of the superior UPS single machine (slave) provides the power supply for the bypass input of another UPS single machine (subordinate UPS, host). The output of the subordinate UPS (host) is connected with the important load, and has the output synchronization with superior UPS (slave). When the inverter of UPS connected with the load has fault, the converter of the superior UPS (slave) will supply the load through the bypass of subordinate UPS (host). Moreover, the system can be set to make the subordinate UPS (host) run alternatively with inverted supply and bypass modes, so that the two UPS can provide the power supply for the load through alternative operation.

Note: As for the hot backup system, the first thing is to start up the host.

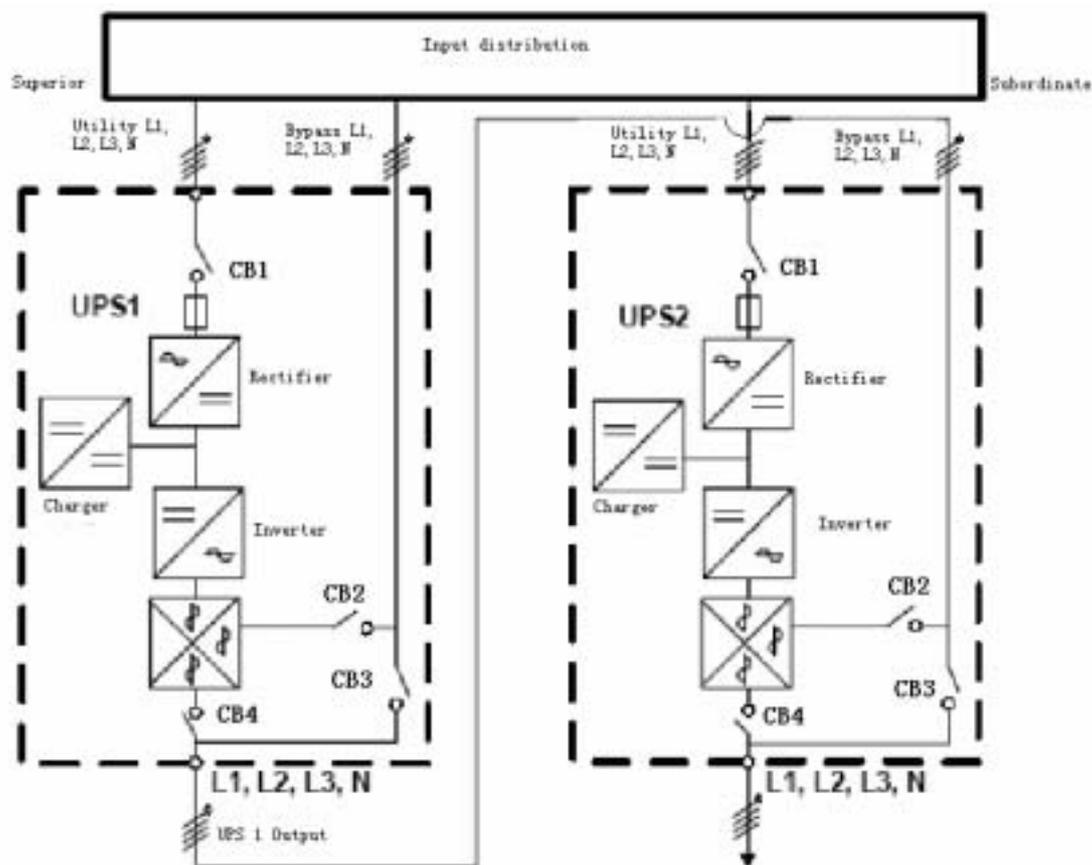


Diagram 20: Schematic diagram of hot backup parallel machine (host and slave)

The wiring of power cable is similar to single system machine, the difference is to connect the output of superior UPS with the bypass input of the subordinate UPS in the hot backup system, and the subordinate UPS supplies the load through its inverter or bypass. Besides, the input power supply of the bypass and main path must use the same neutral wire input terminal.

Section V: Installation Diagram

5.1 External structure

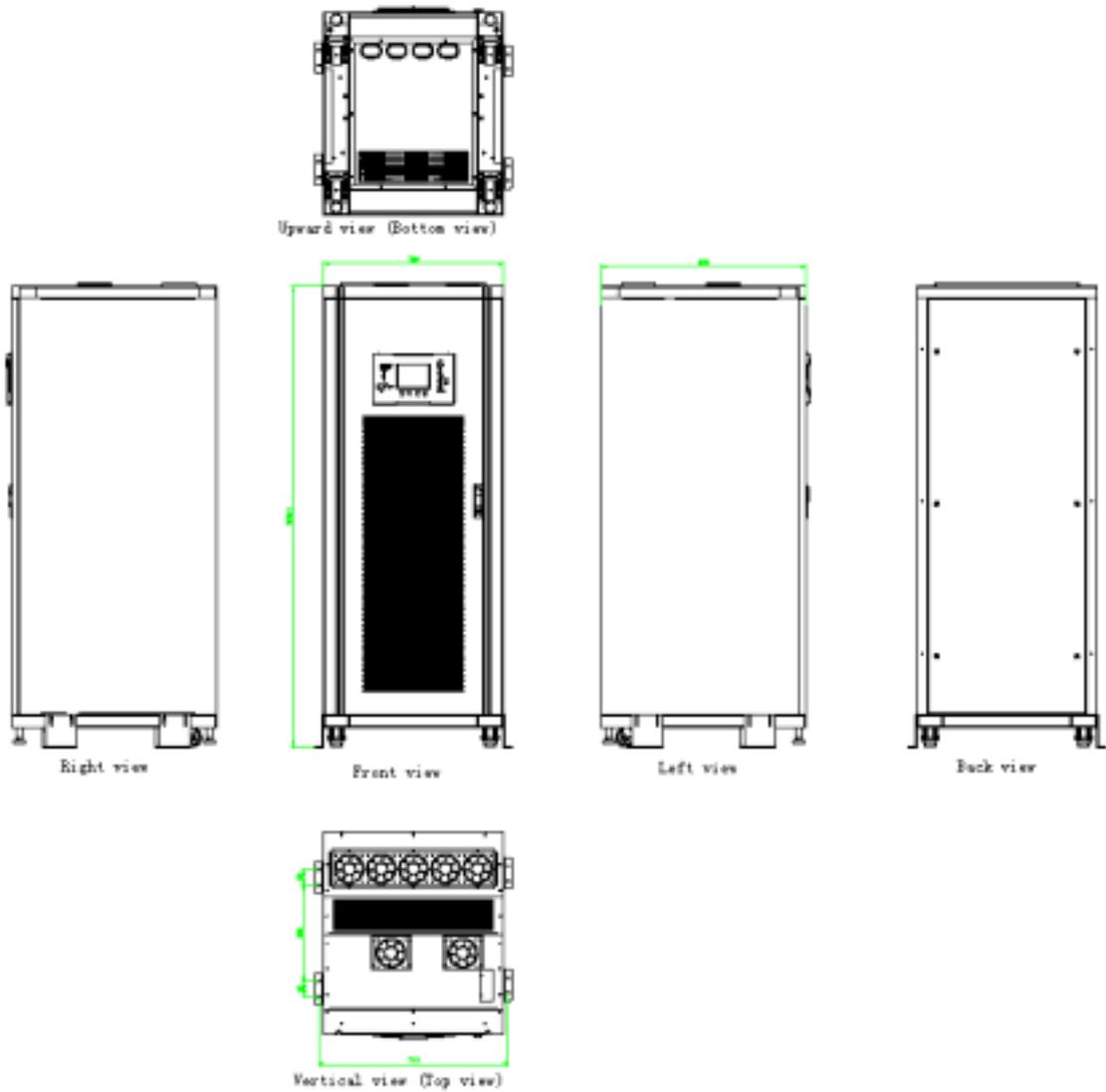


Diagram 21: External view of overall machine

5.2 Internal view

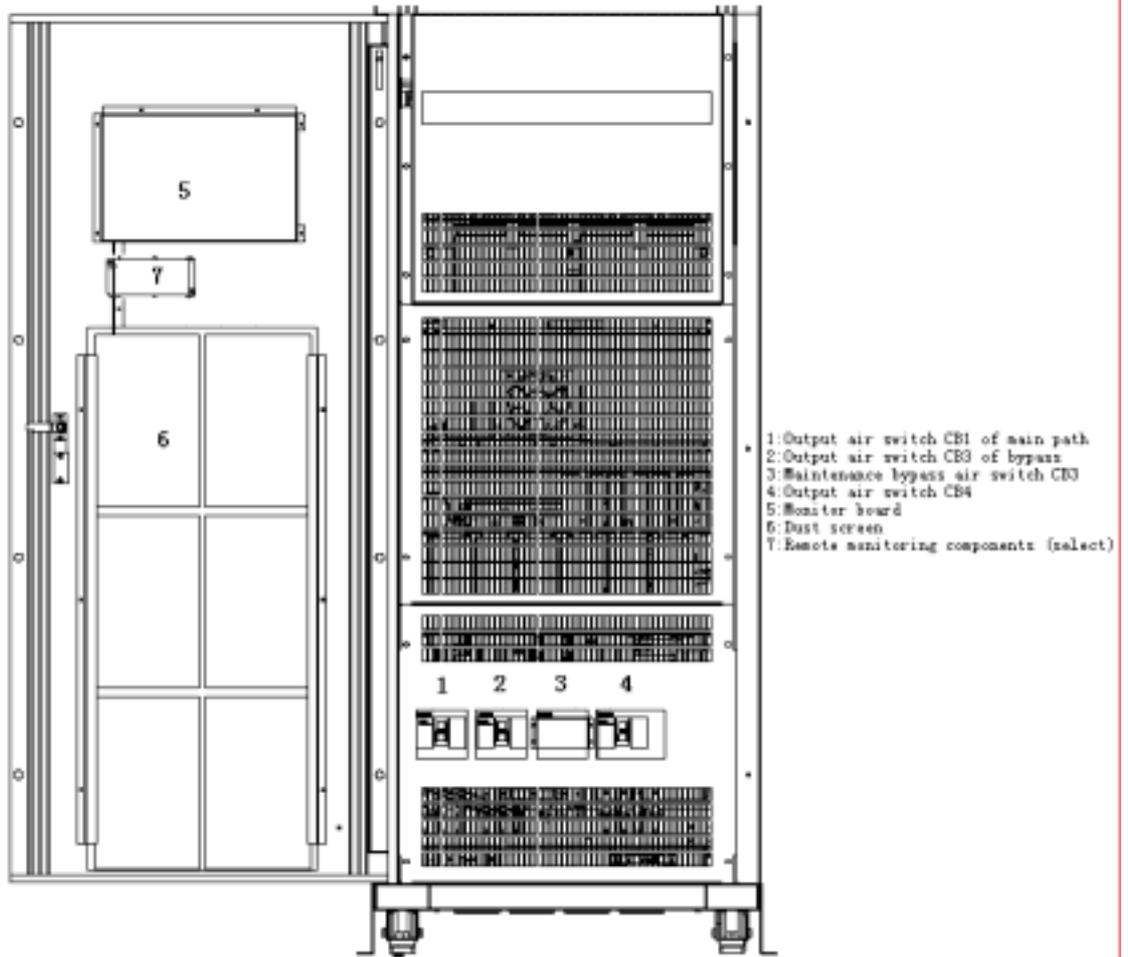


Diagram 22: Schematic diagram of internal door

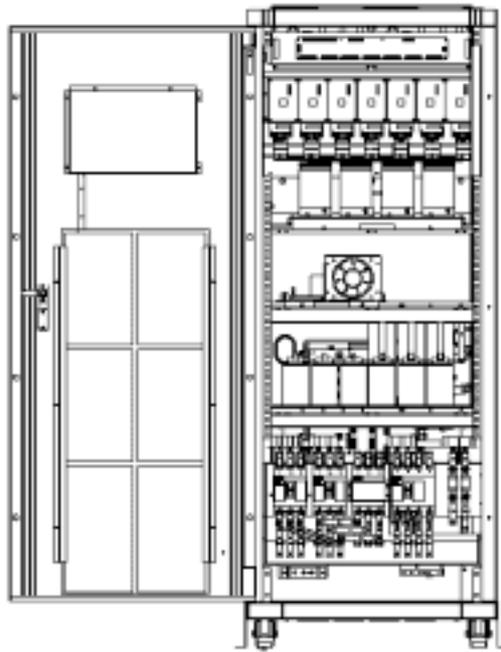


Diagram 23: Internal structure-1

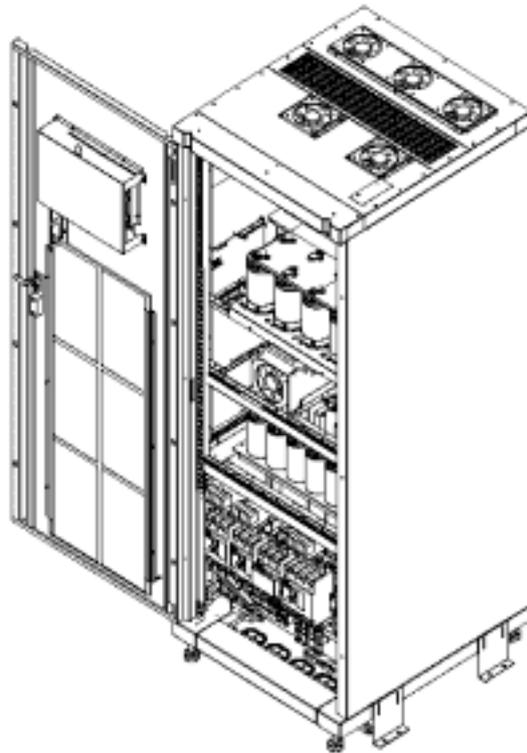


Diagram 24: Internal structure-2

5.3 Instruction of connection terminal

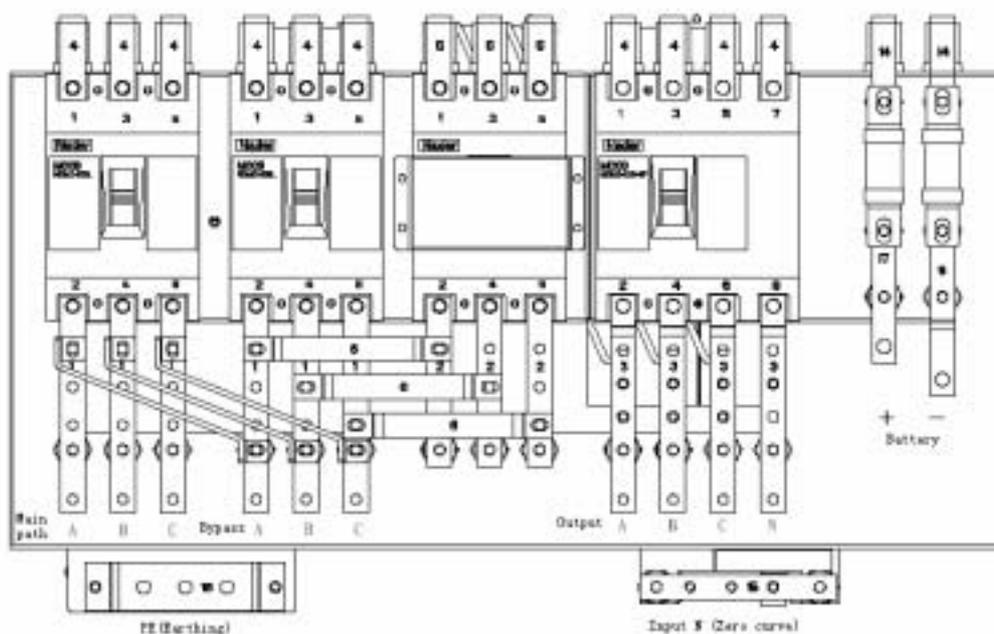


Diagram 25: Schematic diagram of input & output connection terminal

Section VI: Operation Procedure

After installing and debugging of the authorized maintenance engineer, UPS can be run according to the mode of Section II. This Section describes the operation procedures in various running modes for the operator, including the start-up procedures of UPS, the operation procedure to shift the load to bypass and the power-off procedures of UPS.

Note 1: Please see the user's operational key and LED display related to the operation procedure in Section VII.

Note 2: Please see all the power supply switches in UPS cabinet (visible when open the front door of cabinet, with lock) in Diagram 25

Start-up procedure (access to inverted supply mode)

This procedure is used for starting up on the premise that UPS is disconnected completely, it means that UPS don't supply the load or supplies the load through the maintenance bypass switch. Here supposes that the UPS is installed and debugged by the engineer, and

the external power supply switch is closed.

As for the parallel system, operate one step for each single machine, and then continue the next procedure.

Warning:

- The procedure will make the output terminal of UPS electrify with commercial power voltage.
 - If required, disconnect the subordinate load connection and stick on the warning signs on the position of connection.
 - The user cannot operate the parts that needed the tools to open behind the protection lap.
 - Only the qualified personnel are permitted to open this type of protection lap.
- 1 . Open the door of UPS and you can see the operational switch of power supply.
 - 2 . Close the bypass input switch CB2 and the output switch CB4 of UPS, and LCD display begins to run at this moment. After starting up UPS, it begins to supply the bypass first, and the fan of overall machine begins to run. At this time, the bypass indicator and load indicator is light. The state of LED indicator is as follows:

Figure 7: LED display of bypass supply

LED No.	LED Name	State
BYP	Bypass indicator	Green
OUTPUT	Output indicator	Green
BAT	Battery indicator	Red
STATUS	Alarm indicator	Amber/red

1. Close the external battery switch, which locates near the inside battery cupboard (If use the battery cupboard) or battery carrier (if use battery carrier). When the system detects the existence of battery, the red battery indicator goes out. Look for the battery data in the display field of liquid crystal panel to check whether the voltage display of the battery is correct, and check the current record that whether the battery is alarmed connection reversely. If in this situation, please disconnect the machine to check whether the positive and negative poles are connected reversely.
4. Close the rectified input switch CB1. When starting up the rectifier, the indicator

twinkles with green color. About 30 seconds later, the rectifier begins to run, and the indicator turns light normally.

- 5、 Continuously turn on and off according to the panel INV ON (inverted start-up) for 2 seconds. Start up the inverter, and when the voltage frequency of the inverter and bypass is synchronous, the indicator of the inverter is light. After starting-up the inverter, UPS shifts from bypass supply to inverter supply. At this moment, the bypass indicator goes out, and the indicator of the inverter turns green normally.
- 6、 When the system detects that the rectifier runs normally, the battery is installed and the battery charger begins to run, at this moment, when you look for the battery data in the liquid crystal display field, it will show the detailed data of charging current.
- 7、 Check and confirm that there is no alarm information at the top right corner of LED display screen, and UPS runs with inverted mode, and LED display state is as follows:

Figure 8: Panel LED indicator

LED No.	LED Name	State
REC	Indicator of rectifier	Green
BAT	Indicator of battery	Light out
BYP	Indicator of bypass	Light out
INV	Indicator of inverter	Green
OUTPUT	Output indicator	Green
STATUS	Alarm indicator	Light out

6.2 Start-up procedure (access to economic mode)

It only adapts to the single system that is set the economic mode by the debugging engineer. After finishing the operational procedure described in 6.1, you shall confirm that the bypass indicator of the panel is green (indicating that the load is supplied by the bypass commercial power). At this moment, UPS is in ECO running mode.

6.3 Operational procedure of battery maintenance mode

Select the command window of battery maintenance on the front panel LCD of UPS. UPS will shift to the battery supply mode. Before the alarming of battery voltage, the system can automatically shift to the main path supply mode. The system can

automatically record the discharge curve of battery in this process. After testing, the system can automatically update the battery data and actual capacity of the backup time (display when the commercial power is faulted) needed by the calculation (compared with the new battery, the percentage of battery capacity is displayed at the inverted supply mode).

6.4 Operational procedures of maintenance bypass (UPS power off procedure)

The following procedures indicate that the load is shifted from UPS supply protection state to directly connect with AC input bypass power supply through the maintenance bypass switch.

- 1 . Press INVERTER OFF key on the front panel of UPS, the UPS inverter is turned off, and UPS supplies the load through static bypass. At this moment, the indicator of the inverter (INV) goes out; the overall alarm indicator (STATUS) is light.
- 2 . As for the single system and “1+1” redundant parallel system, close the internal maintenance bypass switch Q3 and any other external maintenance bypass switches (in case).
- 3 . As for “1+1” redundant parallel system and “1+1” capacity parallel system, the external maintenance shall be closed. (When the load of capacity-expanded parallel machine is more than the capacity of single machine, it is forbidden to use the single machine to maintain the bypass; otherwise, there will be power down).
- 4 . Now, the maintenance bypass power supply is in parallel with the UPS static switch power supply. The display window will display the relevant operations (including closing the maintenance bypass etc.)
- 5 . Press the relevant emergency power off (EPO) key on the front panel of UPS single machine, and disconnect the input air switch of main path manually, bypass air switch and external battery air switch, this moment, UPS turns to maintenance bypass supply, and the liquid crystal panel of UPS system is power down.

This moment, the shift operation from UPS to maintenance bypass is completed; the load is supplied directly by the maintenance bypass.

Note: The load is supplied directly by the maintenance bypass at this time and UPS is power off. The load equipment has no abnormal protection of AC power supply.

6.5 Procedures of power off (completely turn off UPS and load)

It shall comply with this procedure when completely shut down UPS and disconnect the load. The power supply and breaker shall be disconnected and UPS don't supply for the load. As for the parallel system, operate one step to each single machine, and then continue the next procedure.

- 1 . Press the emergency power off (EPO) key on the front panel of UPS, which will turn off the rectifier and inverter. Disconnect the static switch and battery to interrupt the load.
- 2 . Open the door of UPS and you can see the operating switch of power supply.
- 3 . Disconnect the input switch CB1 of rectifier, output air switch CB4 and bypass input air switch CB2, and then disconnect the external battery air switch.
- 4 . Make sure to disconnect the maintenance bypass switch CB3.
- 5 . As the internal power supply depended on the commercial power is turned off, the LED indicators on the panel go out and LCD display turns off.
- 6 . To completely disconnect UPS, the external commercial power distribution switch (there are two switches for the separate bypass system using independent power input of rectifier and bypass) and the external output switch must be disconnected and stuck on the warning signs.

6.6 Procedures of emergency power off (EPO)

The emergency power off (EPO) switch is used in the emergent situation (such as fire and flood, etc.) to turn off UPS. The system will turn off the rectifier and inverter, and immediately cut off the load supply (including the inverted and bypass output). Moreover, the battery stops charging or discharging.

If there is still the commercial power input to UPS, the control circuit of UPS is still electrified, but the UPS output is turned off. If it needs to completely shift the commercial power supply of UPS, the external input switch of commercial power shall be disconnected.

First, it needs to completely disconnect UPS, it is to disconnect the input switch manually, and then UPS can exit the emergent power off situation.

6.7 Certain UPS reset procedures after fault alarm

When some reasons cause the power-off of UPS (The rectifier or inverter has overheat

and overload leading power off, the busbar has overvoltage, the battery has overvoltage and is shifted too many times, etc.), after adopting measures by the alarm information suggested in the display screen to clear the fault, the following UPS reset procedures shall be implemented to make UPS work normally.

After confirming that the fault is cleared and without the remote EPO signal, please implement the following procedures:

- 1 . Press FAULT CLEAR key to make the system exit the emergency power off state.

The rectifier starts up automatically.

- 2 . Press the right INVERTER ON key behind the control panel for over 2 seconds. The inverter begins to supply the power.

Note: After the overheated signal disappears for 5 minutes and the overheated fault is cleared, the rectifier starts up automatically.

6.8 Automatic start-up

When the commercial power is interrupted, UPS supplies the load through the battery system, until the battery discharge reaches to the end-of discharge voltage (EOD), UPS stops the output. When the commercial power recovers, UPS can start up automatically and resume the output supply.

6.9 Language select

LCD menu and data have both English and Chinese display. The setting can be selected through the menu of panel.

6.10 Alter the current date and time

The setting can be selected through the menu of panel.

6.11 Controlling password

The system provides the password protection to restrict certain operations of the operator, and the default password is “88888888”. The operator can perform UPS and test operations of battery only approved by the password.

Section VII: Operational & Controlling Display Panel

7.1 Introduction

The operational display panel of UPS is on the front panel. Through which, UPS can be operated and controlled to inquire the parameters, UPS & battery states and events &

alarm information. This panel can be divided into three parts by its functions, including simulation state diagram, LCD display & menu key and control & operational key.

Simulation state diagram LCD display & menu key Control & operational key



Diagram 25: UPS control and display panel

Figure 9: Components description of UPS operational & display panel

Silk screen	Function	Key	Function
REC	Indicator of rectifier (input AC to DC)	EPO	Emergency power off (EPO) switch
BAT	Battery indicator (backup DC power supply)	INV ON	Start-up switch of inverter
BYP	Bypass input indicator	INV OFF	Turn-off switch of inverter
INV	Indicator of inverter (DC to AC)	FAULT CLEAR	Fault reset switch
OUTPUT	Load indicator (AC output)	SILENCE ON/OFF	Alarm silence switch

STATUS	UPS state and alarm indicator	F1, F2, F3, F4	LCD menu key
ALARM	Sound alarm (buzzer)		

7.1.1 Simulation state diagram

The simulation state diagram provides the LED indicator, which displays the work paths and current work state of UPS.

State description of rectifier indicator (REC)

Green normal	The rectifier runs normally
Green twinkle	The commercial power is normal, but the rectifier doesn't run
Red normal	The rectifier has fault
Light out	The rectifier doesn't run and the commercial power is abnormal

State description of battery indicator (BAT)

Green normal	The battery provides the load supply
Green twinkle	Alarm the end of discharge of battery
Red normal	The battery is abnormal (the battery is fault, no battery or the battery is connected reversely) or the converter of the battery is abnormal (with fault, over current or overheating)
Light out	The battery and the converter are normal and the battery is charging

State description of bypass indicator (BYP)

Green normal	The bypass provides the load supply
Red normal	The bypass power supply is abnormal or exceeds the normal range, or the static bypass switch is faulted
Light out	The bypass is normal

State description of inverter indicator (INV)

Green normal	The inverter provides the load supply
Green twinkle	The inverter is started synchronously or in the backup state (ECO mode)
Red normal	The inverter has fault
Light out	The inverter doesn't run

State description of load indicator (OUTPUT)

Green normal	UPS has output and is normal
Red normal	UPS has output but is overloaded
Light out	UPS has no output

State description of state indicator (ALARM)

Green normal	It runs normally
Yellow normal	UPS is alarming (such as : AC fault)
Red normal	UPS has fault (such as: The fuse or hardware has fault)

7.1.2 Sound alarm (buzzer)

UPS has two types of sound alarm in the running process:

Sound alarm description of buzzer

Once alarm	You will hear this sound when press any functional operation key
Continuous alarm	You will hear this sound when UPS has fault (such as: The fuse or hardware has fault)

7.1.3 Functional operation key

Emergency power off (EPO) switch	Used for cutting off the load supply. Turn off the rectifier, inverter, static bypass and battery
Turn on the switch of inverter (INV ON)	Used for starting up the inverter
Turn off the switch of inverter (INV OFF)	Used for turning off the inverter
Fault reset switch (FAULT CLEAR)	Clear the fault
Alarm silence switch (SILENCE ON/OFF)	When alarming, press this key to remove the sound. Press this key again to restart the buzzer

7.1.4 LCD and menu key

LCD displays friendly interface and provides lattice graphical display of 320 x 240. It can display the alarm information at real-time and provide 10, 000 historical alarm records for the users to inquire, which offers the reliable basis to fault diagnosis.

The user can perform the operational order through LCD display interface to conveniently browse the input, output, load and battery parameters, so that they can acquire the current UPS state and alarm information. Besides, LCD can display the version information of the software of converter, inverter and internal monitor board.

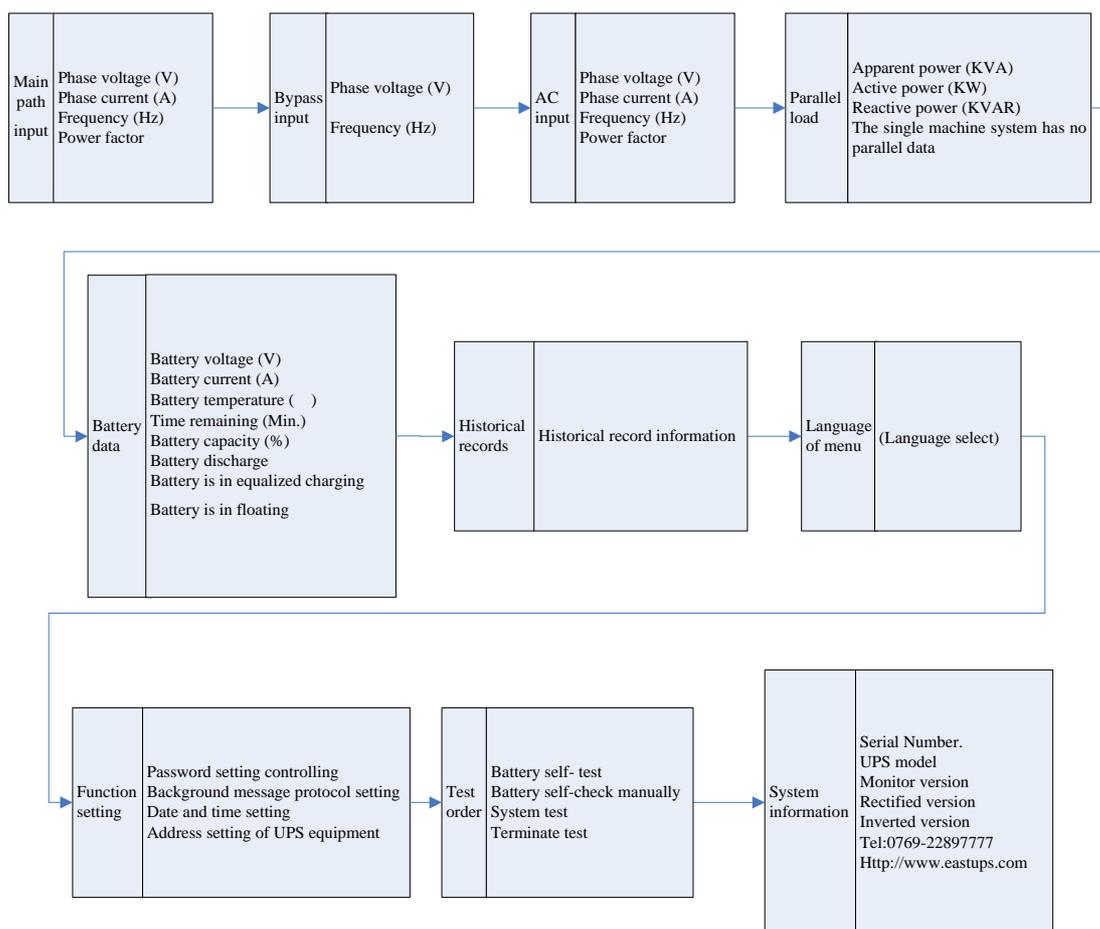
There are five menu key, and the function description is as follows:

Figure 10: description of menu icon meaning

Key	F1	F2	F3	F4
Function 1	 Window shift	 Left shift	 Right shift	 OK
Function 2	ESC Exit	 Up	 Down	

Tree-structure diagram of menu displayed in LCD is as follows:

Figure 11: Events list displayed in panel



7.1.5 Detailed menu description

Information window of UPS system: Display the basic information of UPS, including the current time, date, UPS name and its allocation & state. The information of this window doesn't need the user to operate; the detailed explanation is as Figure 12:

Figure 12: Items description of UPS system information window

Displayed content	Meaning
EA9960	Name of UPS series
(Allocation) single machine on-line, single machine ECO, hot backup host, hot backup	Single machine on-line: Double exchange single machine system Single machine ECO: The UPS setting is single machine system, running with economic mode.

slave, parallel machine (1/6)	Hot backup host: Host of 1+1 hot backup system Hot backup slave: Slave of 1+1 hot backup system Parallel machine (1/6): No. 1 single machine of parallel machine composed by 6 single machines (maximum)
Jan. 9, 2009	Current date (format: year-month-day)
15:26	Current time (format: 24 hours, hour: minute)

Use up and down key to select the menu window and data window.

Figure 13: UPS menu window and data window

Name of menu	Item of menu	Meaning
Main path input	Phase voltage (V)	Phase voltage
	Phase current (A)	Phase current
	Frequency (Hz)	Frequency
	Power factor	Power factor
Bypass input	Phase voltage (V)	Phase voltage
	Frequency (Hz)	Frequency
AC input	Phase voltage (V)	Phase voltage
	Phase current (A)	Phase current
	Frequency (Hz)	Frequency
	Power factor	Power factor
Local load	Apparent power (kVA)	Sout: Apparent power
	Active power (kW)	Pout: Active power
	Reactive power (kVAR)	Qout: Reactive power
	Load percentage (%)	Load (UPS rating load percentage indication)
Local load	Apparent power (kVA)	Sout: Apparent power
	Active power (kW)	Pout: Active power

	Reactive power (kVAR)	Qout: Reactive power
	The single machine system has no parallel data	When UPS is set in single machine mode, there is only local load, no system load.
Battery data	Battery voltage (V)	Busbar voltage of battery
	Battery current (A)	Busbar current of battery
	Battery temperature ()	Internal battery temperature
	Time remaining (Min.)	Remaining backup time of battery
	Battery capacity (%)	Compared with the percentage of new battery's capacity
	Battery discharge	The battery is discharging
	Battery is in equalized charging	The battery is in equalized charging state
	Battery is in floating charging	The battery is in floating charging state
	The battery is not connected	The battery is not connected
Historical record	Historical record information	Display the historical records
Language of menu	(language select)	Provide two LCD languages
Function setting	Control password setting	The user can alter the controlling password
	Background message protocol setting	Provide two background message protocols
	Date and time setting	Set the date and time
	Address setting of UPS equipment	Adaptive to RS485 mode

Test order	Battery self-check manually	
	Battery maintain manually	Manually maintain the battery to carry out part charging to get the probable data of battery capacity. The load must be within the range of 20% ~ 80%.
	System test	It is the self-test of UPS
	Terminate test	Manually terminate the battery manual self-check, manual maintenance or system test
System information	UPS model	Provide the information of UPS model, for example: 220V-50Hz
	Monitor version	Provide the version No. information of monitor software
	Rectified version	Provide the version No. information of rectified software
	Inverted version	Provide version No. information of inverted software

Current record window:

The window records the events that cause the current running mode of UPS, and the solved transient situation is not recorded.

Use F1, up and down key to browse the events.

Please see the complete historical records in the historical record window in menu and data window.

Please see the list of UPS events displayed in the front panel of UPS in figure 14.

7.2List of displayed events of liquid crystal panel

Figure 14: List of displayed events

UPS events	Explanation
Load On UPS, Set	UPS is in the inverted supply mode
Load On Bypass, Set	UPS is in the bypass mode

No Output, Set	UPS is power off and the output is disconnected
Load On Other, Set	The adjacent machine supplies
Battery Charge Stop, Set	The charge is idle
Battery Self Test, Set	Battery state (self-checking)
Battery Boost Charge, Set	Battery state (equalized charging)
Battery Float Charge Set	Battery state (floating charging)
Battery Discharging, Set	Battery state(discharging)
Rectifier Off, Set	The rectifier is idle
Rectifier SoftStarting, Set	The rectifier is soft-starting
Rectifier Normal, Set	The rectifier works normally
Input CB1 Closed, Set	The input power switch of AC commercial power is closed
Input CB1 Open, Set	The input power switch of AC commercial power disconnects
Inverter On Allowed, Set	Allow to start-up
Inverter On Forbidden, Set	Forbid to start-up
Battery CB Closed, Set	The battery contactor is closed
Battery CB Open, Set	The battery contactor is disconnected
Battery Connected, Set	The battery is connected
No Battery, Set	Inspect the battery and its connection
Output CB4 Closed, Set	UPS output power switch is closed
Output CB4 Open, Set	UPS output power switch is disconnected
Bypass Available, Set	The bypass can supply power
Bypass Unavailable, Set	The bypass can't supply power
Inverter Off, Set	The inverter is idle
Inverter SoftStarting, Set	The inverter is soft-starting
Inverter Normal, Set	The inverter works normally
Inverter Unavailable, Set	The inverter can't supply power
Inverter Not Online, Set	The inverter doesn't supply power
Inverter Online, Set	The inverter is supplying power

Maintenance CB3 Closed, Set	The maintenance bypass power switch is closed
Maintenance CB3 Open, Set	The maintenance bypass power switch is disconnected
Bypass CB2 Closed, Set	The input power supply of AC bypass is closed
Bypass CB2 Open, Set	The input power switch of AC bypass is closed
Emergency Power Off, Set	Emergency power off: Directly press EPO key on the panel or receive the external emergency power off order
System Service Mode, Set	The system is maintaining
System Service Mode, Clear	
Capacity Not enough, Set	The start-up capacity is insufficient
Capacity Not enough, Clear	The start-up capacity is normal
Overload No Transform, Set	The parallel system can shift from bypass to inverted output on premise that the overall load must be less than the capacity of single machine (the load power supply is interrupted)
Overload No Transform, Clear	The shift can be interrupted
Generator Input, Set	Receive the access signal of oil engine. The united supply mode can be started up according to the setting of UPS.
No Generator, Clear	
Battery CB Trip, Set	Drive the battery BCB to trip
Battery CB Trip, Clear	
BCB Box Connect, Set	The battery BCB has been accessed
No BCB Box, Set	There is no battery BCB
BCB Closed, Set	Battery switch state (close)
BCB Open, Set	Battery switch state (disconnect)
Inverter Asynchronous, Set	When the difference of phase angle for the phase

	<p>voltage of inverter and bypass is more than 6 degree, the software program of the inverter will trigger the alarm. The set value of amplitude is the rating $\pm 10\%$. When the alarm condition is eliminated, the alarm can resume automatically.</p> <p>First check if there is “bypass ultra-tracking” or “bypass ultra-protection” alarm. If there is, first eliminate the alarm. 2. Check if the voltage waveform of the bypass is normal. If the voltage waveform distortion is serious, ask the user to confirm and seek for solutions.</p>
Inverter Asynchronous, Clear	The inverter runs synchronous
Utility Fail, Set	The commercial power has fault
Utility Fail, Clear	The commercial power is normal
Rectifier Fault, Set	The rectifier has fault
Rectifier Fault, Clear	The rectifier is normal
Inverter Fault, Set	The output voltage of inverter is out of the limit, the load transfers to bypass.
Inverter Fault, Clear	The inverter is normal
Bypass Fail, Set	The bypass has fault
Bypass Fail, Clear	The bypass is normal.
Battery Voltage Abnormal, Set	The voltage of accumulator has fault
Battery Voltage Abnormal, Clear	The voltage of accumulator is normal
Voltage input A Low, Set	Phase A input voltage is low.
Voltage input A high, Set	Phase A input voltage is high
Voltage input A Abnormal, Clear	Phase A input voltage is normal
Voltage input B Low, Set	Phase B input voltage is low
Voltage input B high, Set	Phase B input voltage is high

Voltage input B Abnormal, Clear	Phase B input voltage is normal
Voltage input C Low, Set	Phase C input voltage is low
Voltage input C high, Set	Phase C input voltage is high
Voltage input C Abnormal, Clear	Phase C input voltage is normal
Input A OverCurrent, Set	Phase A input current is excessive
Input A OverCurrent, Clear	Phase A input current is normal
Input B OverCurrent, Set	Phase B input current is excessive
Input B OverCurrent, Clear	Phase B input current is normal
Input C OverCurrent, Set	Phase C input current is excessive
Input C OverCurrent, Clear	Phase C input current is normal
Voltage Output A Low, Set	Phase A output voltage is low
Voltage Output A high, Set	Phase A output voltage is high
Voltage Output A Abnormal, Clear	Phase A output voltage is normal
Voltage Output B Low, Set	Phase B output voltage is low
Voltage Output B high, Set	Phase B output voltage is high
Voltage Output B Abnormal, Clear	Phase B output voltage is normal
Voltage Output C Low, Set	Phase C output voltages is low
Voltage Output C high, Set	Phase C output voltage is high
Voltage Output C Abnormal, Clear	Phase C output voltage is normal
Output A OverCurrent, Set	Phase A output current is excessive
Output A OverCurrent, Clear	Phase A output current is normal
Output B OverCurrent, Set	Phase B output current is excessive

Output B OverCurrent, Clear	Phase B output current is normal
Output C OverCurrent, Set	Phase C output current is excessive
Output C OverCurrent, Clear	Phase C output current is normal
Voltage Bus Low, Set	DC voltage is low
Voltage Bus High, Set	DC voltage is high
Voltage Bus Abnormity, Set	DC voltage is normal
Output Frequency Low, Set	The output frequency is low
Output Frequency High, Set	The output frequency is high
Output Frequency Abnormity, Clear	The output frequency is normal
Voltage input Abnormal, Set	The voltage of commercial power is abnormal
Voltage input Abnormal, Clear	The voltage of commercial power is normal
Input Frequency Abnormal, Set	The frequency of commercial power is abnormal
Input Frequency Abnormal, Clear	The frequency of commercial power is normal
Input Reverse Sequence, Set	The phase sequence of main path is reverse
Input Reverse Sequence, Clear	The phase sequence of main path is normal
Soft-start Fail, Set	The rectifier can't start up because the voltage of DC busbar is low
Soft-start Fail, Clear	The input soft-start is normal
Rectification IGBT OverCurrent, Set	The rectification IGBT current is excessive
Rectification IGBT OverCurrent, Clear	The rectification IGBT current is normal
Rectification inductance Over Temperature, Set	The input filter inductance of the rectifier is overheated. Turn off the rectifier, the battery discharges

Rectification inductance Over Temperature, Clear	The input inductance has normal temperature
Rectification Over Temperature, Set	The rectifier has high temperature
Rectification Over Temperature, Clear	The rectifier has normal temperature
Bus OverVoltage, Set	The voltage of DC busbar is too high, which causes turning off of the rectifier, inverter and battery converter. Check whether the rectifier side has fault or not. If there is no fault, check whether there is overheat or not. After eliminating the fault, restart the inverter.
Bus OverVoltage, Clear	The voltage of the busbar is normal
Fan Fault, Set	At least one cooling fan has fault
Fan Fault, Clear	The fan is normal
Input Backfeed, Set	Main path reverse protection
Input Backfeed, Clear	
Balance Unit Fail, Set	The voltage difference of positive and negative busbar is more than 50v, which exceeds the DC bias compensation capacity of inverter. The inverter is turned off, the load transfers to bypass
Balance Unit Fail, Clear	The balanced circuit is normal
Voltage Bus Low, Off, Set	The voltage of DC busbar causes the power off of inverter. The load is shifted to bypass
Voltage Bus Low, Off, Clear	The busbar voltage is normal
Battery Reverse, Set	Reconnect the battery and check the connection
Battery Reverse, Clear	The battery connection is correct
Battery Leakage, Set	Battery leakage protection
Battery Leakage, Clear	
Cold Start Fail, Set	The battery cold start fails

Cold Start Fail, Clear	
Charger Over Voltage, Set	The voltage of the charger has too high voltage
Charger Over Voltage, Clear	The voltage of the charger is normal
Battery Over Temperature, Set	The temperature of the battery is too high
Battery Over Temperature, Clear	The temperature of the battery is normal
Charger Fault, Set	The charger is faulted
Charger Fault, Clear	The charger is normal
Battery Voltage Low, Set	The voltage of the battery is low
Battery Voltage Low, Clear	The voltage of the battery is normal
End Off Discharge, Set	When the battery discharge reaches to the terminate voltage, the inverter is turned off.
End Off Discharge, Clear	The discharge is ended
Rectification Communication Fail, Set	The rectification message is faulted
Rectification Communication Fail, Clear	The rectification message is normal
Bypass Reverse Sequence, Set	The phase sequence of the bypass is reversed. In the normal situation, phase B lags 120 degree compared to phase A, phase C lags 120 degree to phase B. Check if the phase sequence of the bypass power is right. Correct it if it's wrong.
Bypass Reverse Sequence, Clear	The phase sequence of the bypass is correct.
Bypass Voltage Abnormity, Set	The bypass voltage is abnormal
Bypass Voltage Abnormity, Clear	The bypass voltage is normal
Bypass STS Fail, Set	At least one static switch at the side of bypass disconnects or has short circuit. The fault is locked

	up until disconnection
Bypass STS Fail, Clear	The bypass thyristor is normal
Bypass OverLoad, Set	The bypass has overload
Bypass OverLoad, Clear	
Bypass OverLoad Timeout, Set	The bypass overload has time delay
Bypass OverLoad Timeout, Clear	
Bypass Trace Unable, Set	<p>When the voltage amplitude or frequency exceeds the normal range, the software program of the inverter will trigger the alarm. The set value of amplitude is the rating $\pm 10\%$. When the bypass voltage recovers, the alarm can resume automatically.</p> <p>1. First check and confirm that the displayed bypass voltage and frequency on the panel are within the setting range; the rated voltage and frequency are respectively appointed by “output voltage” and “output frequency”. 2. If the displayed voltage is abnormal, measure the actual bypass voltage and frequency. If there is fault, check the external power supply.</p>
Bypass Trace Unable, Clear	
Bypass Backfeed, Set	<p>When the voltage amplitude or frequency is too high, the software program of the inverter will trigger the alarm. The set value of amplitude is the rating $\pm 10\%$. When the bypass voltage recovers, the alarm can resume automatically. Firstly, check if there is the relevant alarm, such as “disconnection of bypass air switch”, “phase</p>

	<p>sequence of bypass is reversed” and “input lacking fail-save”. If there is the relevant alarm, eliminate the alarm first, and then check and confirm that the displayed bypass voltage and frequency are within the setting range; the rated voltage and frequency are respectively appointed by “class setting of output voltage” and “class setting of output frequency”. If the displayed voltage is abnormal, measure the actual bypass voltage and frequency. If there is the abnormality, check the external bypass power supply. If the alarm is frequent, the allocation software can be used for properly promoting the set point of upper limit according to the user’s opinion.</p>
Bypass Backfeed, Clear	
Load Impact Transfer, Set	<p>Load impact causes the system shifting to bypass, UPS can resume automatically. Start up the load in sequence to reduce the load impact of inverter.</p>
Load Impact Transfer, Clear	
Inverter Overload Timeout, Set	<p>UPS is overloaded and exceeds the allowed overtime.</p> <p>Note 1: The highest load phase first displays the load’s overtime; Note 2: when the load exceeds the rated value, report “local output overload”; Note 3: when it exceeds the overloaded time, the static switch at the side of the inverter is disconnected, the load is shifted to bypass; the load is turned off and restarts after 10 minutes. Note 4: After the load reduces below 95 % for 5 minutes, the system shifts to inverter mode. Refer to the load percentage displayed on LCD panel to confirm the reality of</p>

	the alarm. If LCD is overloaded, check the actual load to confirm that UPS is overloaded or not before alarming.
Inverter Overload Timeout, Clear	
Bypass Abnormal Off, Set	The bypass and inverted voltage are abnormal. The load supply is disconnected
Bypass Abnormal Off, Clear	
Auxiliary Power Off, Set	Ups can run but the control power supply is abnormal or there is no one
Auxiliary Power Off, Clear	The auxiliary power supply is normal
Auxiliary Power Fail, Set	The auxiliary power supply is faulted
Auxiliary Power Fail, Clear	The auxiliary power supply is normal
System Transfer Require, Set	All the single machines of the parallel system are shifted to the bypass supply mode at the same time. The passively shifted to bypass of the UPS single machine and LCD can display the alarm information
System Transfer Require, Clear	
Transfer Times Out, Set	The shift frequency of overload in the first one hour exceeds the setting value, which causes the load stay at the bypass supply state. UPS can automatically resume in one hour and shift to the inverted supply state.
Transfer Times Out, Clear	The shift frequency of this hour is restricted
Battery Contact Fail, Set	The battery contactor or the switch don't response to the control signal
Battery Contact Fail, Clear	The battery contactor is normal
Input Fuse Fail, Set	The internal AC input fuse of the rectifier has fault.

	The rectifier is turned off, the battery discharges.
Input Fuse Fail, Clear	The input fuse is normal
Bypass OverCurrent, Set	The bypass current exceeds 135% of the rated value. UPS only alarms without action
Bypass OverCurrent, Clear	
Inverter inductance Over Temperature, Set	The output filter inductance of the inverter is overheated. The inverter is turned off, the load transfers to bypass
Inverter inductance Over Temperature, Clear	The temperature of the inverter inductance is normal
Inverter Over Temperature, Set	The temperature of the inverter is too high
Inverter Over Temperature, Clear	The temperature of the inverter is normal
Inverter IGBT OverCurrent, Set	The pulse width modulated module of the inverter has overcurrent
Inverter IGBT OverCurrent, Clear	The inverted IGBT is normal
Output Fuse Fail, Set	At least one output fuse of the inverter is disconnected. The inverter is turned off, the load transfers to bypass
Output Fuse Fail, Clear	The output fuse is normal
Unit Over Load, Set	It alarms when the load exceeds 105% of the rated value. The alarm will automatically resume after eliminating the load state. 1. Confirm which phase is overloaded by referring to the load percentage displayed on LCD panel to confirm the reality of the alarm. 2. If the alarm is real, measure the actual output current to confirm the correctness of displayed value. Disconnect the unimportant load.

	The imbalance of the load in parallel system can also cause the alarm
Unit Over Load, Clear	The local output is not overloaded
Inverter STS Fail, Set	At least one static switch of the inverter is disconnected or has short circuit. The fault is locked up until disconnection
Inverter STS Fail, Clear	The inverted thyristor is normal
Inverter Communication Fail, Set	The inverted communication is faulted
Inverter Communication Fail, Clear	The inverted communication is normal
Manual On Fail, Set	The manual start-up of the inverter fails, because of the invalid operation (the maintenance bypass switch is closed), the DC busbar or rectifier doesn't prepare well
Manual On Fail, Clear	
Parallel Connection Fail, Set	The parallel cable has wrong connection. Press FAULT CLEAR key to reset the fault, then press INVERTER ON to restart the inverter
Parallel Connection Fail, Clear	The parallel wire connects well
Parallel Sharing Fail, Set	The UPS single machine of the parallel system can't has load sharing
Parallel Sharing Fail, Clear	
Operation Invalid, Set	When there is error operation, trigger this event
Operation Invalid, Clear	The user operates well
Output Shorted, Set	The output is short circuited
Output Shorted, Clear	
Fault Clear, Set	Press FAULT CLEAR key (fault reset) on the panel
Manual Inverter On, Set	Manually start up the inverter through the key of

	the front panel
Manual Inverter Off, Set	Manually turn off the inverter through the key of the front panel
Output Inhibitted, Set	UPS output is forbidden (test model)
Output Allow, Set	Allow the inverted output
Battery Self Test, Set	Self-check of battery
Battery Test OK, Set	Successful manual self-check of battery
Battery Test Fail, Set	The manual self-check of the battery is failed
Battery Maintenance Test, Set	Manual maintenance of battery
Battery Maintenance OK, Set	The manual maintenance of battery is successful
Battery Maintenance Fail, Set	The manual maintenance of the battery is failed
System Test, Set	System test
System Test OK, Set	Successful system test
System Test Fail, Set	Failed system test
Stop Testing, Set	Stop the ongoing manual self-check, maintenance or system test;
Clear Hislog, Set	Historical records deleting

Appendix: Product specification

The design of the product complies with the following standards:

Figure 15: European and international standard

Item	Standard
General safety requirements of UPS operational area	EN 50091-1-1/IEC 62040-1-1/AS 62040-1-1
EMC Requirements of UPS	EN 50091-2/IEC 62040-2/AS 62040-2 (Class A)
UPS property confirmation method and test requirements	EN 50091-3/IEC 62040-3/AS 62040-3 (VFI SS 111)

The environmental features of the product are as follows:

Figure 16: Environmental features

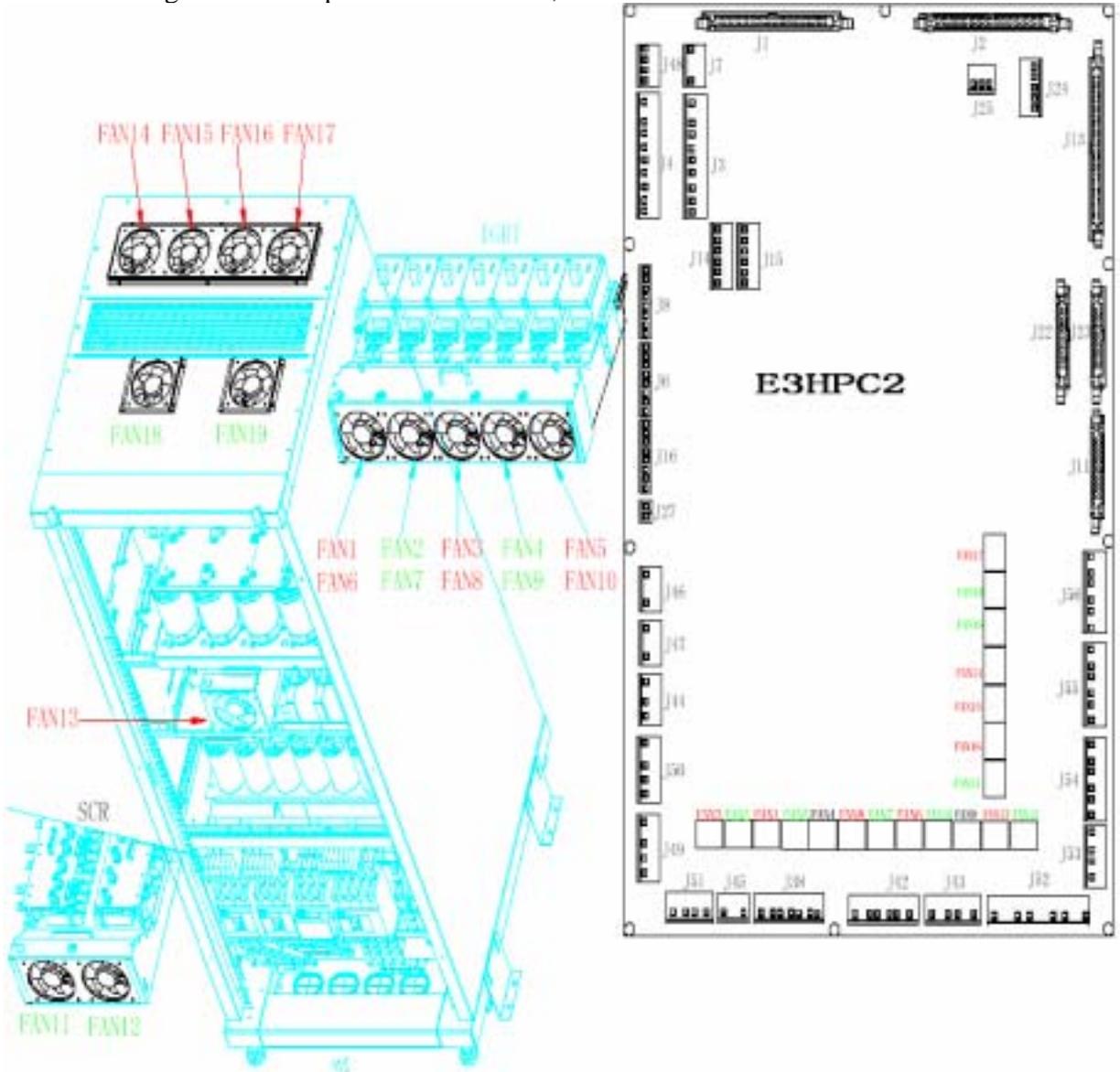
Rated power: kVA	Unit	30	40	50	60	80	90	100	120
Noises within 1 meter	dBA	55	55	62	62	62	64	65	65
Sea level height	m	3000m The power reduces 1% when it increases 100m within 3000~8000m							
Relative humidity	—	0~95%, no condensation							
Operating temperature		0~40 note: The service life of the battery will be shorten half when it increases 10 above 20							
UPS storing-transp ortation temperature		-20~70							

The mechanical features of the product are as follows:

Figure 17: Mechanical features of UPS

Rated power kVA	Unit	30	40	50	60	80	90	100	120	
Mechanical dimension W×D×H	mm	700×800×1820					1000×800×1880			
Weight (no battery)	kg	300	320	340	360	400	550	570	600	

Schematic diagram of fan's position of EA9960,EA9980



Schematic diagram of fan's position of EA9930,EA9940,EA9950

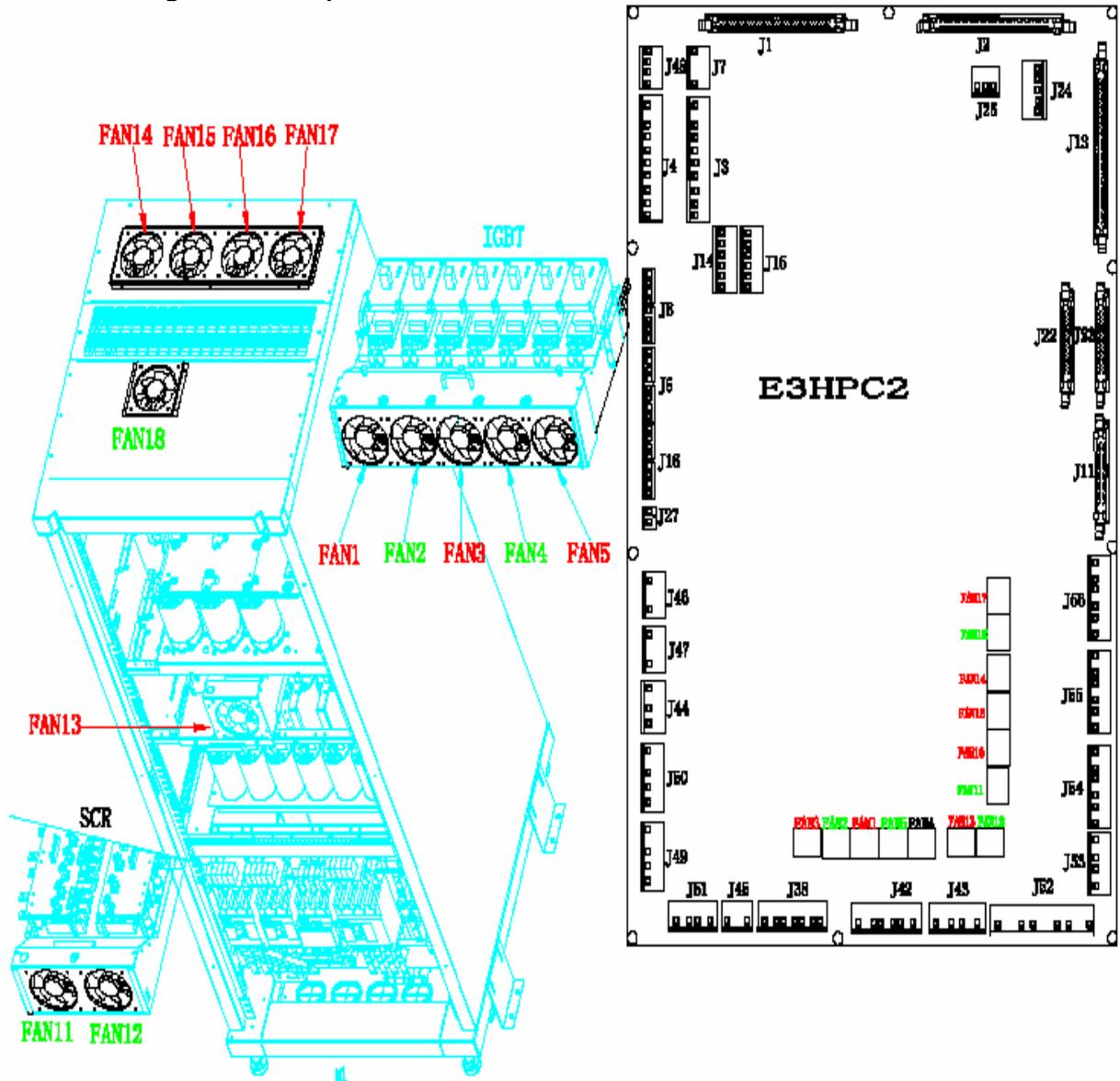


Diagram 27: Schematic diagram of fan's position