Metapo Inc.

H 3-Phase Double Conversion Online UPS

10KVA ~ 320KVA

Features and Specifications

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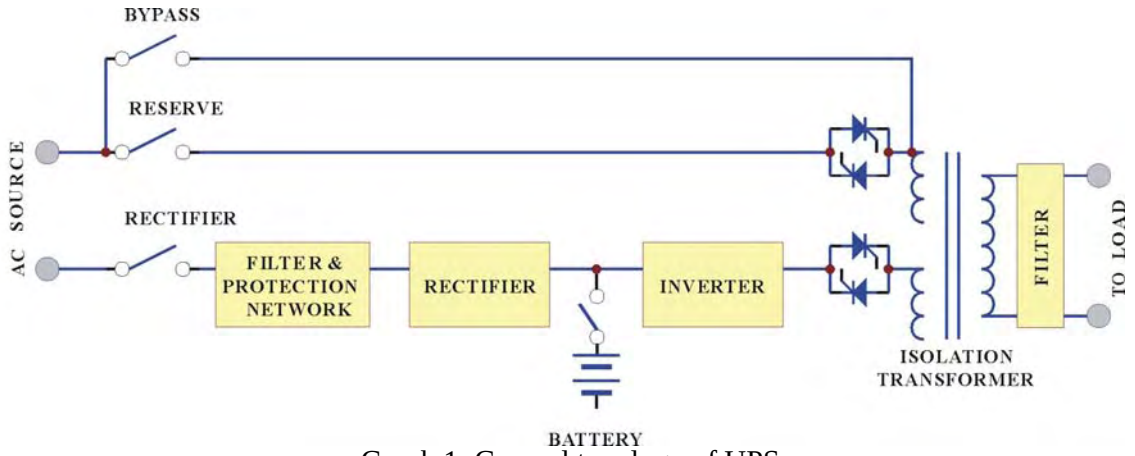
1.0 SYSTEM OVERVIEW

1.1 Construction of the UPS

General Topology：



Graph 1: General topology of UPS

The UPS system is composed of input breakers, input filter & protection network, rectifier, battery bank, inverter, static switch, bypass breaker, isolation transformer and output filter. The basic topology is shown in the diagram above. Under normal AC mode, energy from the AC source is converted to DC power and supplied to the inverter to charge the batteries to its full capacity all the time, ready to support the output load in case of AC source failure.

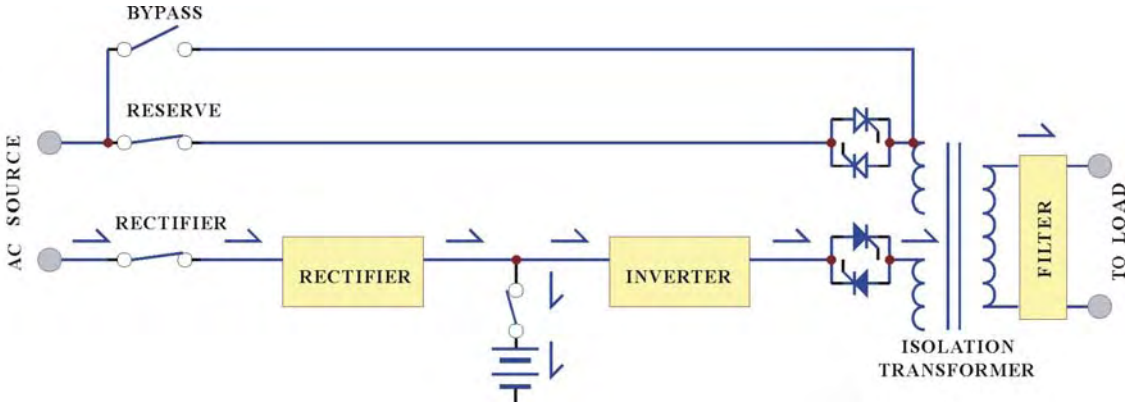
Although the principle and operation of a UPS seems simple and straightforward, the requirement for a reliable and intelligent UPS makes the design and manufacturing of a high power UPS one requiring advanced technology, intelligence, experience and most important, consideration of the user interface. Many years have been spent in designing the most rugged, intelligent and reliable UPS for the market, and a safe and convenient UPS for the user.

Choosing the best and most suitable UPS for a given application can be easy or difficult, depending on the client's knowledge of key parameters. The most obvious specification, output power, depends on the size of the load. Often, an allowance of 50% more power is added to the present load requirement, both for tolerance and for future expansion.

Another important issue is reliability. The prime aim of a UPS is to protect your load. Therefore, the UPS should be much more reliable than the AC source. An unreliable UPS may suffer the problem of frequent break down, even more frequent than AC failure, and the cost of repair may become more than the cost of the unit itself.

Generally, there are four different modes of operation, the NORMAL OPERATION MODE, the BACK-UP (BATTERY) MODE, the RESERVE MODE and the MAINTENANCE BYPASS MODE. These are explained below.

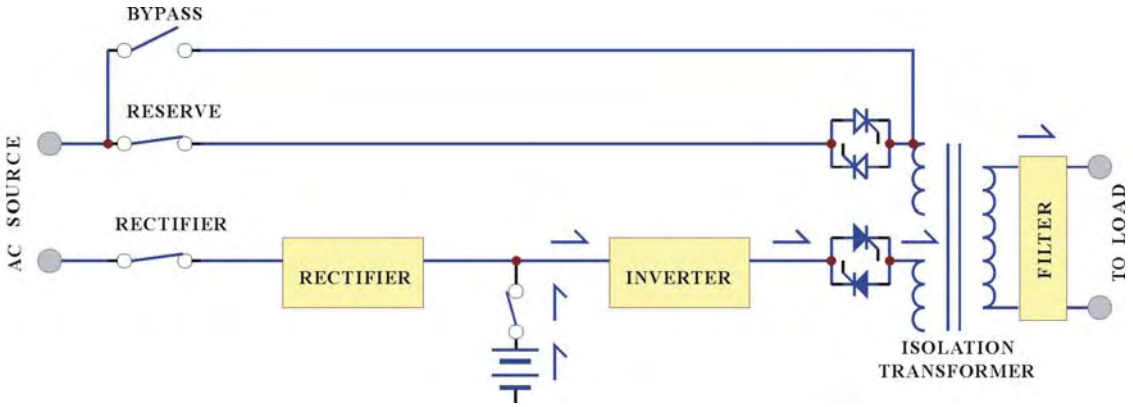
Normal Operation Mode:



Graph 2: Normal operation mode

The rectifier converts the AC input to DC power to supply the inverter and charge the batteries simultaneously. All the fluctuations, surges and spikes of the AC input are removed during AC to DC conversion. Therefore, the AC supplied by the inverter is clean and stable.

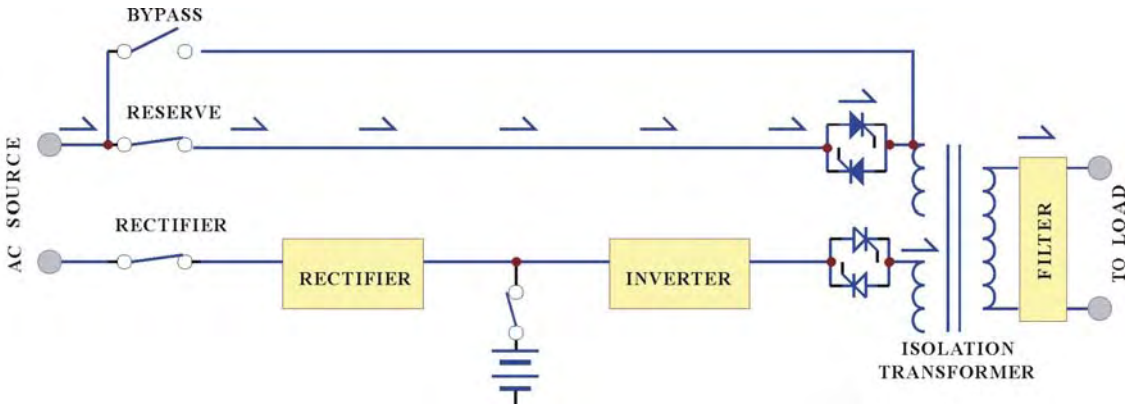
Back-up Mode:



Graph 3: Back-up Mode

Since the batteries are connected directly to the DC bus, when the AC fails, the batteries change immediately from receiver to donor, supplying energy to the inverter instead of receiving energy from the rectifier. The output AC is not interrupted. Therefore, the load connected to the output is protected.

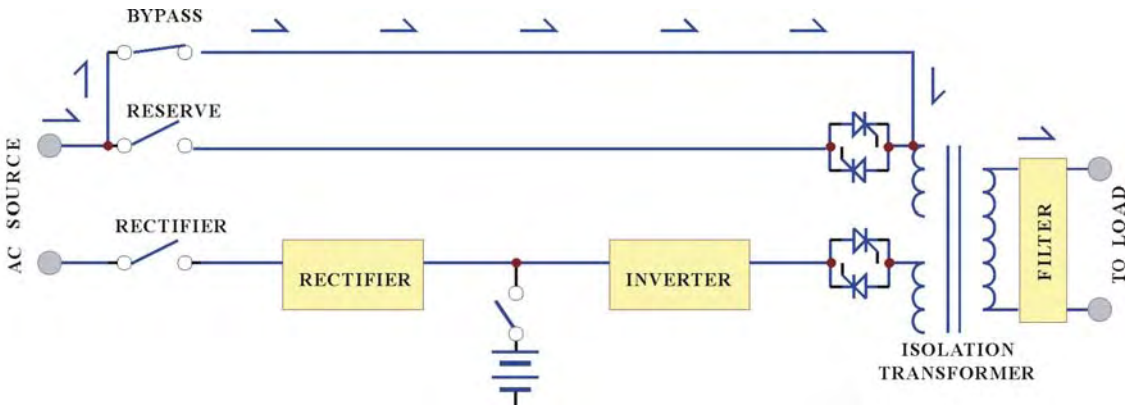
Reserve Mode:



Graph 4: Reserve Mode

When the inverter is in an abnormal condition, such as over temperature, short circuit, abnormal output voltage or overloaded for a period exceeding the inverter's limit, the inverter will automatically shut down in order to protect itself from damage. If the utility power is normal, the static switch shall transfer the load to the reserve source without interruption of AC output.

Maintenance Bypass Mode:



Graph 5: Maintenance bypass mode

In case of UPS maintenance or battery replacement, and where the load cannot be interrupted, the user can turn off the inverter, close the bypass breaker and then open the rectifier and reserve breakers. The AC output will not be interrupted during manual bypass transfer procedure. Therefore, the maintenance bypass switch keeps continuously supplying power to the load. Electricity will not exist in UPS except the output transformer, thus ensuring the safety of service personnel.

Generally, the UPS is expected to run 24 Hours a day in normal operation mode once it is installed, except when the utility power fails, under overload conditions, or during maintenance.

Normal operation with batteries connected provides clean, stable, regulated and uninterrupted power to the load, free from any spikes and surges. Therefore, the UPS can be regarded as a perfect AC power source, limited in back-up time, under mains failure, only by the capacity of the batteries.

2.0 TECHNICAL SPECIFICATION

2.1 10KVA ~ 60KVA UPS 3-Phase Input / 3-Phase Output

Table 1: 10 ~60KVA 3-Phase Input / 3-Phase Output Technical specification (1)

KVA	10	20	30	40	50	60
RECTIFIER						
INPUT VOLTAGE	220VΔ / 380VΔ / 460VΔ, 208VY / 380VY / 400VY / 415VY					
INPUT RANGE	+/- 20%V					
INPUT FREQUENCY	50 / 60 Hz +/- 5Hz					
INPUT POWER FACTOR	0.8					
NORMAL INPUT CURRENT(A)	18	36	54	72	90	108
MAXIMUM INPUT CURRENT(A)	24	45	68	90	113	136
POWER WALK IN	0% - 100% : 20 sec					
EFFICIENCY	99%					
VOLTAGE REGULATION	1%					
CURRENT LIMIT(A)	27	54	81	108	135	162
RIPPLE VOLTAGE	0.5%					
BATTERY						
BATTERY TYPE	SEAL LEAD ACID / NiCd					
NO. OF CELLS	174 / 271					
VOLTAGE RANGE	295 – 410VDC / 285-415VDC					
MAXIMUM CHARGE CURRENT (ADC)	5	10	15	20	25	30
BATTERY LOW VOLTAGE	320VDC / 305VDC					
BATTERY LOW STOP VOLTAGE	295VDC / 285VDC					
BOOST CHARGE	402VDC / 415VDC					
FLOAT CHARGE	390VDC / 410VDC					

Table 1: 10 ~60KVA 3-Phase Input / 3-Phase Output Technical specification (2)

KVA		10	20	30	40	50	60
INVERTER							
DC INPUT RANGE		285 – 420VDC					
WAVE FORM		SINUSOID					
OUTPUT VOLTAGE		380 / 400 / 415 VAC 3 Phase 4 Wire					
OUTPUT POWER FACTOR		0.8					
VOLTAGE REGULATION 100% UNBALANCE LOAD		+ / - 1 %					
FREQUENCY LOCK RANGE		45 – 55 Hz / 55 – 65 Hz					
OUTPUT FREQUENCY (FREE RUNNING)		50 / 60 Hz + / - 0.1 Hz					
PHASE SHIFT UNDER 100% UNBALANCE LOAD		120 % + / - 0.5°					
THD (LINEAR LOAD)		< 2 %					
OVERLOAD	<110%	CONTINUOUS					
	110 – 125%	15 min					
	125 – 150%	10 min					
	> 150%	60 sec					
EFFICIENCY (100% LOAD)		93%	93%	93%	93.5%	93.5%	94%
MAXIMUM OUTPUT PEAK CURRENT(A)		43	87	130	174	218	260
STATIC SWITCH							
VOLTAGE RANGE		173 – 277 VAC (LINE TO NEUTRAL)					
FREQUENCY RANGE		45 – 55 Hz / 55 – 65 Hz					
EFFICIENCY		99.5%					
TRANSFER TIME:							
- MAINS -> INVERTER		0 ms					
- INVERTER -> MAINS		0 ms					
OVERLOAD	100%	30 sec					
	300%	1 sec					
ISOLATION WITH OUTPUT		YES					

Table 1: 10 ~60KVA 3-Phase Input / 3-Phase Output Technical specification (3)

KVA	10	20	30	40	50	60
OVERALL CHARACTERISTICS						
OVERALL EFFICIENCY	91%	91%	91%	91.5%	92%	92%
OPERATING ENVIRONMENT:						
- TEMPERATURE	0 – 40℃ (32 – 104℉)					
- HUMIDITY	0% - 90% (NON–CONDENSING)					
- ALTITUDE	<1500 M ABOVE SEA LEVEL					
MAXIMUM HEAT DISSIPATION(KW)	0.65	1.3	1.9	2.6	3	3.5
WEIGHT(Kg) (No Battery)	270	300	400	480	550	680
DIMENSION:						
- HEIGHT(mm)	1600					
- WIDTH(mm)	550					
- DEPTH(mm)	800					
- AUDIBLE NOISE	< 65 dBA (AT 1 m)					
STANDARDS:						
- EN50091-1,-2	YES					
- FCC CLASS A	YES					
PROTECTIONS:						
- SHORT CIRCUIT	RECTIFIER, RESERVE, BYPASS NFB					
- LIGHTNING	MOV					
- EMC FILTER	INPUT & OUTPUT					
- GALVANIC ISOLATION	BETWEEN INPUT & OUTPUT					
DATA DISPLAY BY LCD	YES					
INDICATIONS & ALARMS:						
- LED,LCD,BUZZER	YES					
DRY CONTACT	YES					
BATTERY START	YES					

☆All specifications mentioned above are subject to change without prior notice.

2.2 80KVA ~ 160KVA UPS 3-Phase Input / 3-Phase Output

Table 2: 80~160KVA 3-Phase Input / 3-Phase Output Technical specification (1)

KVA	80	100	120	160
RECTIFIER				
INPUT VOLTAGE	380 / 400 / 415VAC 3 Phase 4 Wire			
INPUT RANGE	307 – 520V			
INPUT FREQUENCY	50 / 60 Hz +/- 7%			
INPUT POWER FACTOR	0.8			
NORMAL INPUT CURRENT(A)	144	180	216	288
MAXIMUM INPUT CURRENT(A)	180	225	270	360
POWER WALK IN	0% - 100% : 20 sec			
EFFICIENCY	99%			
VOLTAGE REGULATION	1%			
CURRENT LIMIT(A)	216	270	324	432
RIPPLE VOLTAGE	0.5%			
BATTERY				
BATTERY TYPE	SEAL LEAD ACID / NiCd			
NO. OF CELLS	174 / 271			
VOLTAGE RANGE	295 – 410VDC / 285-415VDC			
MAXIMUM CHARGE CURRENT (ADC)	40	50	60	80
BATTERY LOW VOLTAGE	320VDC / 305VDC			
BATTERY LOW STOP VOLTAGE	295VDC / 285VDC			
BOOST CHARGE	402VDC / 415VDC			
FLOAT CHARGE	390VDC / 410VDC			

Table 2: 80 ~ 160KVA 3-Phase Input / 3-Phase Output Technical specification(2)

KVA		80	100	120	160
INVERTER					
DC INPUT RANGE		285 – 420VDC			
WAVE FORM		SINUSOID			
OUTPUT VOLTAGE		380 / 400 / 415 VAC 3 Phase 4 Wire			
OUTPUT POWER FACTOR		0.8			
VOLTAGE REGULATION 100% UNBALANCE LOAD		+ / - 1 %			
FREQUENCY LOCK RANGE		45 – 55 Hz / 55 – 65 Hz			
OUTPUT FREQUENCY (FREE RUNNING)		50 / 60 Hz + / - 0.1 Hz			
PHASE SHIFT UNDER 100% UNBALANCE LOAD		120 % + / - 0.5°			
THD (LINEAR LOAD)		< 2 %			
OVERLOAD	<110%	CONTINUOUS			
	110 – 125%	15 min			
	125 – 150%	10min			
	> 150%	60 sec			
EFFICIENCY (100% LOAD)		94.5%	94.5%	95%	95%
MAXIMUM OUTPUT PEAK CURRENT(A)		348	432	520	693

STATIC SWITCH

VOLTAGE RANGE		173 – 277 VAC (LINE TO NEUTRAL)
FREQUENCY RANGE		45 – 55 Hz / 55 – 65 Hz
EFFICIENCY		99.5%
TRANSFER TIME:		
- MAINS -> INVERTER		0 ms
- INVERTER -> MAINS		0 ms
OVERLOAD	100%	30 sec
	300%	1 sec
ISOLATION WITH OUTPUT		YES

Table 2: 80 ~ 160KVA 3-Phase Input / 3-Phase Output Technical specification(3)

KVA	80	100	120	160
OVERALL CHARACTERISTICS				
OVERALL EFFICIENCY	92.5%	92.5%	93%	93%
OPERATING ENVIRONMENT:				
- TEMPERATURE	0 - 40℃ (32 - 104℉)			
- HUMIDITY	0% - 90% (NON–CONDENSING)			
- ALTITUDE	<1500 M ABOVE SEA LEVEL			
MAXIMUM HEAT DISSIPATION(KW)	4.6	5.4	6.5	8.7
WEIGHT(Kg) (No Battery)	820	950	1180	1450
DIMENSION:				
- HEIGHT(mm)	1600			
- WIDTH(mm)	1100			
- DEPTH(mm)	800			
- AUDIBLE NOISE	< 65 dBA (AT 1 m)			
STANDARDS:				
- EN50091-1,-2	YES			
- FCC CLASS A	YES			
PROTECTIONS:				
- SHORT CIRCUIT	RECTIFIER, RESERVE, BYPASS NFB			
- LIGHTNING	MOV			
- EMC FILTER	INPUT & OUTPUT			
- GALVANIC ISOLATION	BETWEEN INPUT & OUTPUT			
DATA DISPLAY BY LCD	YES			
INDICATIONS & ALARMS:				
- LED,LCD,BUZZER	YES			
DRY CONTACT	YES			
BATTERY START	YES			

☆All specifications mentioned above are subject to change without prior notice.

2.3 200KVA ~ 320KVA UPS 3-Phase Input / 3-Phase Output

Table 3: 200KVA ~ 320KVA 3-Phase Input / 3-Phase Output Technical specification (1)

KVA	200	240	300	320
RECTIFIER				
INPUT VOLTAGE	380 / 400 / 415VAC 3 Phase 4 Wire			
INPUT RANGE	307 – 520V			
INPUT FREQUENCY	50 / 60 Hz +/- 7%			
INPUT POWER FACTOR	0.8			
NORMAL INPUT CURRENT(A)	350	420	525	560
MAXIMUM INPUT CURRENT(A)	437	525	656	700
POWER WALK IN	15% - 100% : 15 sec			
EFFICIENCY	99%			
VOLTAGE REGULATION	1%			
CURRENT LIMIT(A)	525	630	788	840
RIPPLE VOLTAGE	0.5%			
BATTERY				
BATTERY TYPE	SEAL LEAD ACID / NiCd			
NO. OF CELLS	174 / 271			
VOLTAGE RANGE	295 – 410VDC / 285-415VDC			
MAXIMUM CHARGE CURRENT (ADC)	100	120	150	160
BATTERY LOW VOLTAGE	320VDC / 305VDC			
BATTERY LOW STOP VOLTAGE	295VDC / 285VDC			
BOOST CHARGE	402VDC / 415VDC			
FLOAT CHARGE	390VDC / 410VDC			

Table 3: 200KVA ~ 320KVA 3-Phase Input / 3-Phase Output Technical specification (2)

KVA		200	240	300	320
INVERTER					
DC INPUT RANGE		285 – 420VDC			
WAVE FORM		SINUSOID			
OUTPUT VOLTAGE		380 / 400 / 415 V 3 Phase 4 Wire			
OUTPUT POWER FACTOR		0.8			
VOLTAGE REGULATION 0-100% LOAD		+ / - 1 %			
FREQUENCY LOCK RANGE		45 – 55 Hz / 55 – 65 Hz			
OUTPUT FREQUENCY (FREE RUNNING)		50 / 60 Hz + / - 0.1 Hz			
PHASE DIFFERENCE WITH RESERVE INPUT		120°+ / - 0.5°			
THD (LINEAR LOAD)		< 5 %			
OVERLOAD	<110%	CONTINUOUS			
	110 – 125%	15 min			
	125 – 150%	10 min			
	> 150%	60 sec			
EFFICIENCY(100% LOAD)		95%	95%	95%	95%
MAXIMUM OUTPUT PEAK CURRENT(A)		800	1000	1250	1300

STATIC SWITCH

VOLTAGE RANGE		173 – 277 VAC (LINE TO NEUTRAL)
FREQUENCY RANGE		45 – 55 Hz / 55 – 65 Hz
EFFICIENCY		99.5%
TRANSFER TIME:		
- MAINS -> INVERTER		0 ms
- INVERTER -> MAINS		0 ms
OVERLOAD	100%	30 sec
	300%	1 sec
ISOLATION WITH OUTPUT		YES

Table 3: 200KVA ~ 320KVA 3-Phase Input / 3-Phase Output Technical specification (3)

KVA	200	240	300	320
OVERALL CHARACTERISTICS				
OVERALL EFFICIENCY	93%	93%	93%	93%
OPERATING ENVIRONMENT:				
- TEMPERATURE	0 - 40℃ (32 - 104℉)			
- HUMIDITY	0% - 90% (NON–CONDENSING)			
- ALTITUDE	<1500 M ABOVE SEA LEVEL			
MAXIMUM HEAT DISSIPATION(KW)	11.5	13	16.3	17.4
WEIGHT(Kg) (No Battery)	2500	2700	3000	3100
DIMENSION:				
- HEIGHT(mm)	1600			
- WIDTH(mm)	2200			
- DEPTH(mm)	800			
- AUDIBLE NOISE	< 67 dBA (AT 1 m)			
STANDARDS:				
-EN50091-1，2	YES			
-FCC CLASS A	YES			
PROTECTIONS:				
- SHORT CIRCUIT	RECTIFIER, RESERVE, BYPASS NFB			
- LIGHTNING	MOV			
- EMC FILTER	INPUT & OUTPUT			
- GALVANIC ISOLATION	BETWEEN INPUT & OUTPUT			
DATA DISPLAY BY LCD	YES			
INDICATIONS & ALARMS:				
- LED,LCD,BUZZER	YES			
DRY CONTACT	YES			
BATTERY START	YES			

☆All specifications mentioned above are subject to change without prior notice.

2.4 10KVA ~ 50KVA UPS 3–Phase Input / 1-Phase Output

Table 4: 10KVA ~ 50KVA 3–Phase Input / 1-Phase Output Technical specification (1)

KVA	10	20	30	40	50
RECTIFIER					
INPUT VOLTAGE	220VΔ / 380VΔ / 460VΔ, 208VY / 380VY / 400VY / 415VY				
INPUT RANGE	+/-20%				
INPUT FREQUENCY	50 / 60 Hz +/- 7%				
INPUT POWER FACTOR	0.8				
NORMAL INPUT CURRENT(A)	18	36	54	72	90
MAXIMUM INPUT CURRENT(A)	24	45	68	90	113
POWER WALK IN	0% - 100% : 20 sec				
EFFICIENCY	99%				
VOLTAGE REGULATION	1%				
CURRENT LIMIT(A)	27	54	81	108	135
RIPPLE VOLTAGE	0.5%				
BATTERY					
BATTERY TYPE	SEAL LEAD ACID / NiCd				
NO. OF CELLS	174 / 271				
VOLTAGE RANGE	295 – 410VDC / 285-415VDC				
MAXIMUM CHARGE CURRENT (ADC)	5	10	15	20	25
BATTERY LOW VOLTAGE	320VDC / 305VDC				
BATTERY LOW STOP VOLTAGE	295VDC / 285VDC				
BOOST CHARGE	402VDC / 415VDC				
FLOAT CHARGE	390VDC / 410VDC				

Table 4: 10KVA ~ 50KVA 3–Phase Input / 1-Phase Output Technical specification (2)

KVA		10	20	30	40	50
INVERTER						
DC INPUT RANGE		285 – 420VDC				
WAVE FORM		SINUSOID				
OUTPUT VOLTAGE		220 / 230 / 240 VAC, 1p2w or 1p3w				
OUTPUT POWER FACTOR		0.8				
VOLTAGE REGULATION 0-100% LOAD		+ / - 1 %				
FREQUENCY LOCK RANGE		45 – 55 Hz / 55 – 65 Hz				
OUTPUT FREQUENCY (FREE RUNNING)		50 / 60 Hz + / - 0.1 Hz				
PHASE DIFFERENCE WITH RESERVE INPUT		+ / - 0.5°				
THD (LINEAR LOAD)		< 2 %				
OVERLOAD	<110%	CONTINUOUS				
	110 – 125%	15 min				
	125 – 150%	10 min				
	> 150%	60 sec				
EFFICIENCY (100% LOAD)		93%	93%	93%	93.5%	93.5%
MAXIMUM OUTPUT PEAK CURRENT(A)		130	260	390	520	650

STATIC SWITCH		
VOLTAGE RANGE		173 – 277 VAC (LINE TO NEUTRAL)
FREQUENCY RANGE		45 – 55 Hz / 55 – 65 Hz
EFFICIENCY		99.5%
TRANSFER TIME:		
- MAINS -> INVERTER		0 ms
- INVERTER -> MAINS		0 ms
OVERLOAD	100%	30 sec
	300%	1 sec
ISOLATION WITH OUTPUT		YES

Table 4: 10KVA ~ 50KVA 3–Phase Input / 1-Phase Output Technical specification (3)

KVA	10	20	30	40	50
OVERALL CHARACTERISTICS					
OVERALL EFFICIENCY	91%	91%	91%	91.5%	92%
OPERATING ENVIRONMENT:					
- TEMPERATURE	0 - 40℃ (32 - 104℉)				
- HUMIDITY	0% - 90% (NON–CONDENSING)				
- ALTITUDE	<1500 M ABOVE SEA LEVEL				
MAXIMUM HEAT DISSIPATION(KW)	0.65	1.3	1.9	2.6	3
WEIGHT(Kg) (No Battery)	270	300	400	480	550
DIMENSION:					
- HEIGHT(mm)	1600				
- WIDTH(mm)	550				
- DEPTH(mm)	800				
- AUDIBLE NOISE	< 65 dBA (AT 1 m)				
STANDARDS:					
- EN50091-1,-2	YES				
- FCC CLASS A	YES				
PROTECTIONS:					
- SHORT CIRCUIT	RECTIFIER, RESERVE, BYPASS NFB				
- LIGHTNING	MOV				
- EMC FILTER	INPUT & OUTPUT				
- GALVANIC ISOLATION	BETWEEN INPUT & OUTPUT				
DATA DISPLAY BY LCD	YES				
INDICATIONS & ALARMS:					
- LED,LCD,BUZZER	YES				
DRY CONTACT	YES				
BATTERY START	YES				

☆All specifications mentioned above are subject to change without prior notice.

3.0 FEATURES AND ADVANTAGES

(a) Reliable input protection: Circuit breakers are placed in each individual input loop to ensure power can continue through another loop in case of breaker trip caused by an abnormal condition in either rectifier or load.

(b) Input surge protection: An MOV (surge protector) is added at the input, providing protection to both UPS and the load from any lightning surges, or surges caused by neighboring large loads.

(c) EMI suppression: An EMI filter is added to meet the international EMC limits. Therefore, very low noise is emitted, and no interference is supplied to other equipment connected to the same AC source.

(d) Ruggedness: The rectifier employs phase control technology to regulate the DC bus voltage. This is the most efficient method to charge the batteries. The SCR used are inherently rugged. Additionally, a large inductor is added at the input to avoid deforming the AC source waveform.

(e) High frequency design: The inverter uses high frequency, high efficiency IGBT, PWM methodology to convert the DC power to AC power. Therefore, the number of components is fewer, reliability is improved, and the size and weight of UPS is reduced, performance is improved, and acoustic noise is minimized.

(f) True Galvanic isolation: An isolation transformer is placed at the output. This can solve the problem of poor input grounding, can allow a different ground between input and output, can avoid the annoying problem of ground leakage current, and can be tied to any potential provided on site. The AC output is isolated under every mode of operation. Additionally, the user gets the bonus of attenuation of common mode noise from the output isolation transformer.

(g) Plug & Play Modular design: The power circuit is separated into several modules plugged into slots in the UPS, which are easy to pull out, permitting quick maintenance and easier trouble shooting.

(h) Cold start function: the UPS can be started without an AC source, that is, can be started with battery power only. This is possible because current limit circuitry is added, preventing the problem of large inrush current blowing the battery fuse and damaging the DC capacitors when batteries are connected to an empty DC bus (before the DC bus is energized).

(i) Multi-CPU design: Several CPUs are employed in the control circuit, and critical functions are designed with parallel redundancy to improve reliability.

Therefore, in case of one CPU failure, the other CPUs keep the UPS operational, and the output AC is not affected.

(j) Protection against misuse: The UPS is designed with breaker on/off sensor, power supply sensor, etc. Therefore, any operational mistake made by the user causes no harm to the UPS.

(k) Accepts wide input range: The UPS is designed to accept a wide input range, so that it can work effectively under an unstable AC source. All of the input components used are specifically selected to handle extreme high voltage and high current.

(l) Operating environment: Each component of the UPS is chosen with large safety margin to accommodate extreme environments, such as temperature, humidity, altitude, shock or contamination.

(m) Intelligent charger: The UPS will automatically recharge (boost charge) the batteries every time the batteries are depleted to a voltage level equal to 2V/Cell. Thus, the batteries can be restored to full capacity as soon as possible, and made ready for the next back-up requirement. In order to keep the batteries in the best condition, the UPS will boost charge the batteries for several hours (selectable) automatically every month. To avoid over charging the batteries, boost charge will stop when the ambient temperature is over 35^{o}C (95^{o}F).

(n) Intelligent battery test: The batteries are tested after every boost (initiated by battery discharge or by the monthly boost charge cycle). This is done without interrupting the operation of the rectifier, preventing the risk of output AC failure in case of a bad battery. The user is informed of the battery condition, so that action can be taken before the full capacity of the batteries is needed.

(o) Huge charging power: The charging power is selectable (Lo/Me/Hi) according to Ah rating of the batteries, and can charge up battery banks providing more than 8Hrs back-up time without adding an extra charger.

(p) MTBF of fans are extended: Fans used to cool the UPS, are designed to slow down under light load, so that the life expectancy of the fans is extended beyond the normal.

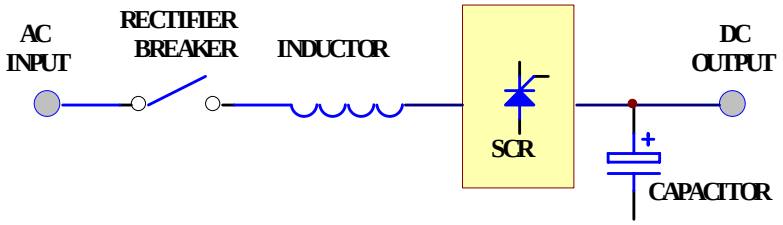
(q) Redundant power supply: A supplemental power supply is added to provide redundancy for supplying power to the static switch, so that there will be AC output no matter what happens to the UPS.

(r) Variety of accessory (options): With built-in intelligent communication

interface as well as output ports of RS-232, RS-485, and dry contacts, there are several options are hence available such as remote control panel, 3 phases software for PC monitoring, auto dialing module, battery monitoring module, 3 phases SNMP card, and emergent power off (EPO) switch. Please refer to the chapter 7 of options for details**.**

Rectifier

The main function of a rectifier is to convert the AC input to DC power, and supply it to the inverter. The inverter then converts the DC power to AC power for the load. The UPS use the DC power to charge the batteries as well, which is the most efficient method of charging.

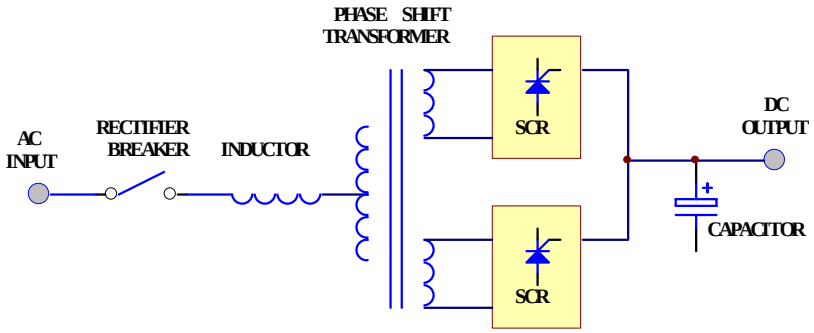


6-PULSE FULL CONTROL RECTIFIER

Graph 6: 6 pulse full control rectifier

■ UPSs in the sizes 10KVA to 80KVA use 6-pulse fully controlled rectification. An inductor is added before the rectifier to improve the power factor, smooth the current waveform and eliminate the harmonic current. The control circuit regulates the DC bus within 1%. Soft walk-in circuitry (approximately 20sec.) and current limit circuitry is used to prevent over current or instantaneous surge current.

■ Extra under-voltage and over-voltage protections are added to improve reliability and to shutdown the rectifier in case of abnormal conditions. The DC bus is adjustable to fit different types of batteries. The power component used in the rectifier is specially selected to handle extreme high voltage and high current. The rectifier is designed to operate under a wide range of AC input, from 177 to 300VAC, to operate under the poor power conditions found in some areas.



12-PULSE FULL CONTROL RECTIFIER

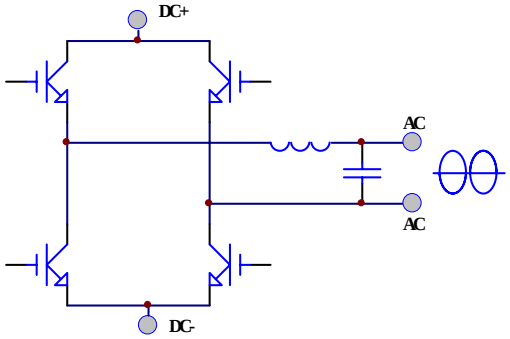
Graph 7: 12 Pulse full control rectifier

■ In order to further improve the power factor and reduce harmonic current drawn by the rectifier, UPS at 100KVA and above, use the 12-pulse full controlled rectifier. The total current harmonic current can be reduced to around 15%, and power factor improved to over 0.8. A phase shift transformer is added to achieve this performance. The input inductor is retained also to obtain the best result. Although this results in higher cost, the unit is much more reliable and rugged. Users do not need to increase the input breaker and cable sizes, since input KVA and harmonic current drawn is minimized, fulfilling the worldwide energy saving requirements.

■ The harmonic current can be further lowered by adding harmonic filters (factory installation available). The total harmonic current can be reduced to approximately 9%.

■ Another alternative method to reduce the harmonic current (especially for very large KVA UPS) is to employ 18-pulse full controlled rectifier (available as an option). The total harmonic current can be reduced to approximately 7%.

Inverter

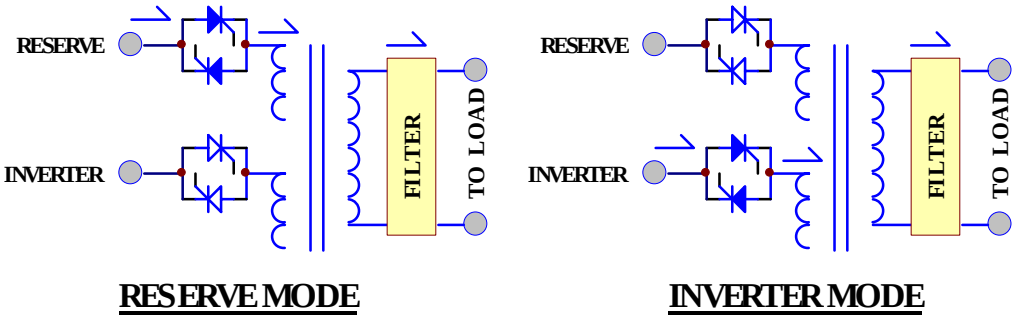


Graph 8: IGBT Inverter

- The inverter is composed of IGBT, inductor, capacitor, snubber, control circuitry and protection circuitry. The inverter converts the DC power from the DC bus to AC power to supply the output load. The UPS uses IGBT technology which switches at frequencies beyond the audible range, therefore producing no audible noise.
- The UPS uses voltage regulation circuitry to limit the voltage variation within 1%. Special compensation circuitry is added to eliminate the output distortion. Every component is oversized to accept the wide DC input range (from 285 to 420VDC), so that the output waveform remains sinusoidal throughout the range. With the aid of dynamic feedback loop the inverter will keep a sine waveform even under non-linear load.
- An independent inverter is used for each phase. Although it is more expensive, each inverter has its independent feedback, so that the voltage is unaffected when load is added to the adjacent phase, producing excellent voltage regulation under 100% unbalanced load.
- The IGBT is operated in its optimal condition to obtain best efficiency, so as to minimize the power cost of the user.

■ Usually, the most frequent failures of the UPS occur at the inverter. Therefore, we have added redundant protection circuitry to protect the inverter. A strong snubber is added to suppress the spikes and noise, oversized, high quality components are used throughout, semi-conductor fuses are provided, and ventilation is maximized. The result of this design is a more rugged, reliable and high efficient inverter. At the same time, the inverter can sustain overload and high peak current drawn by the load. Additionally, a longer MTBF is achieved.

Static Switch



Graph 9: Static Switch

■ The static switch is composed of two pairs of SCRs, connected back-to-back. The switch can transfer the load from reserve to inverter or from inverter to reserve without losing power at the output. Therefore, it is a very important portion of a UPS.

■ Detection circuitry is added to the control circuit to achieve zero dead time transfer. Extra detection logic is employed to control when the static switch should transfer. For example, when output is short circuited, under normal mode operation, the UPS detects the short circuit and stops the inverter. The static switch will not transfer power to the reserve circuit, which might damage the reserve breaker. In case of an overload, the UPS will stop the inverter after a period the inverter can endure, and then transfer the load to the reserve circuit, since the overload capability of the static switch is higher than the inverter.

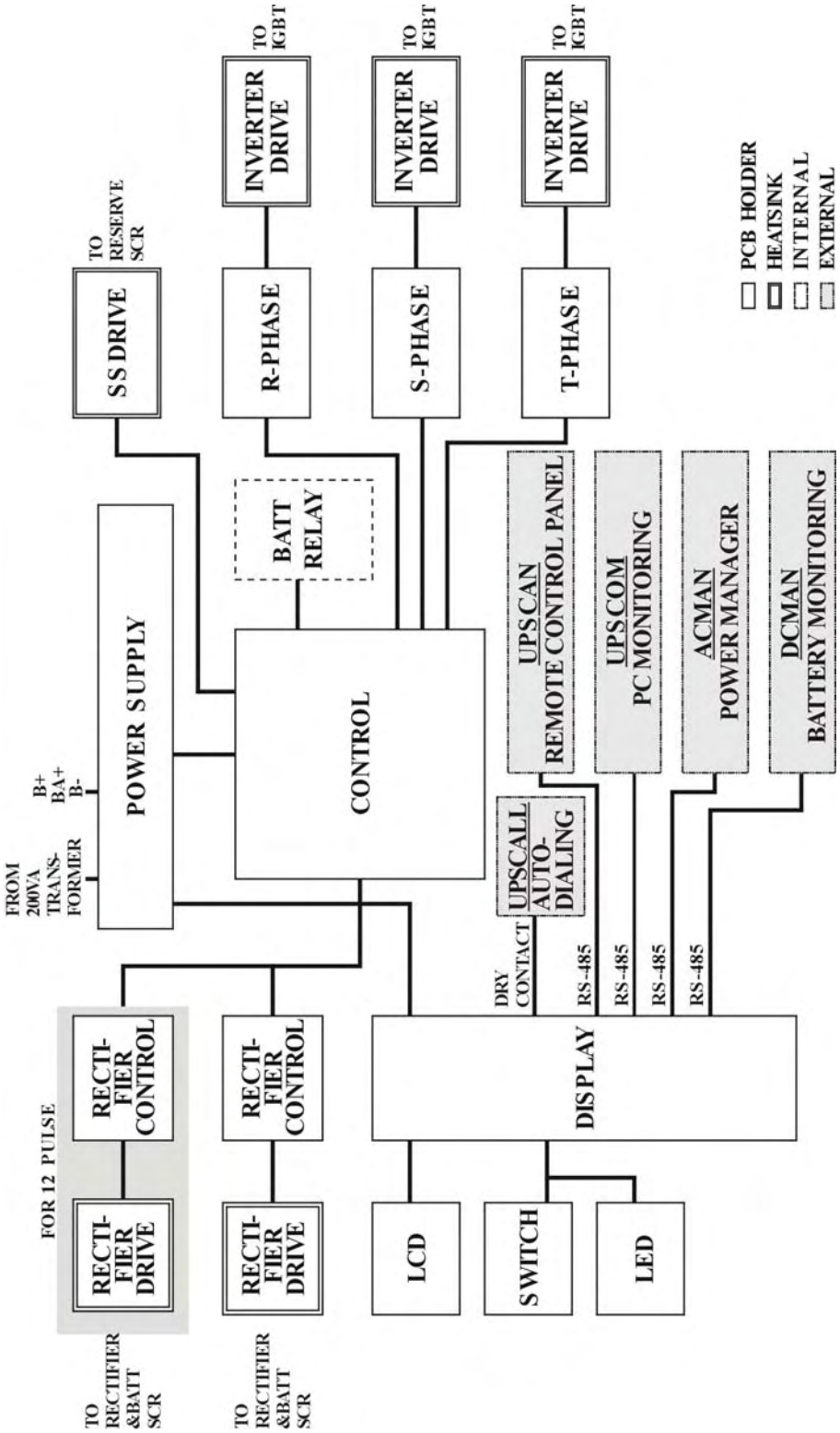
■ The transfer action is determined according to the reserve-input voltage and frequency to protect supplying incorrect power to the load. Finally, there is a double check by the CPU as to whether the transfer is successful or not.

Maintenance Bypass Switch

Unlike other UPS, the maintenance bypass switch is already installed inside the UPS for convenience. It should be open under normal operation, and only closed during maintenance. For the sake of safety of maintenance personnel, all power supplies inside the UPS should be disconnected before touching any parts inside the UPS. Thus, the maintenance bypass switch is a necessity to maintain AC power at the output and yet keep maintenance personnel safe at the same time. If the bypass breaker is closed under normal operation, the inverter will stop and the load will be automatically transferred to reserve to prevent the inverter connecting directly to the AC source. Of course, you cannot switch on the inverter as long as the maintenance bypass breaker is closed.

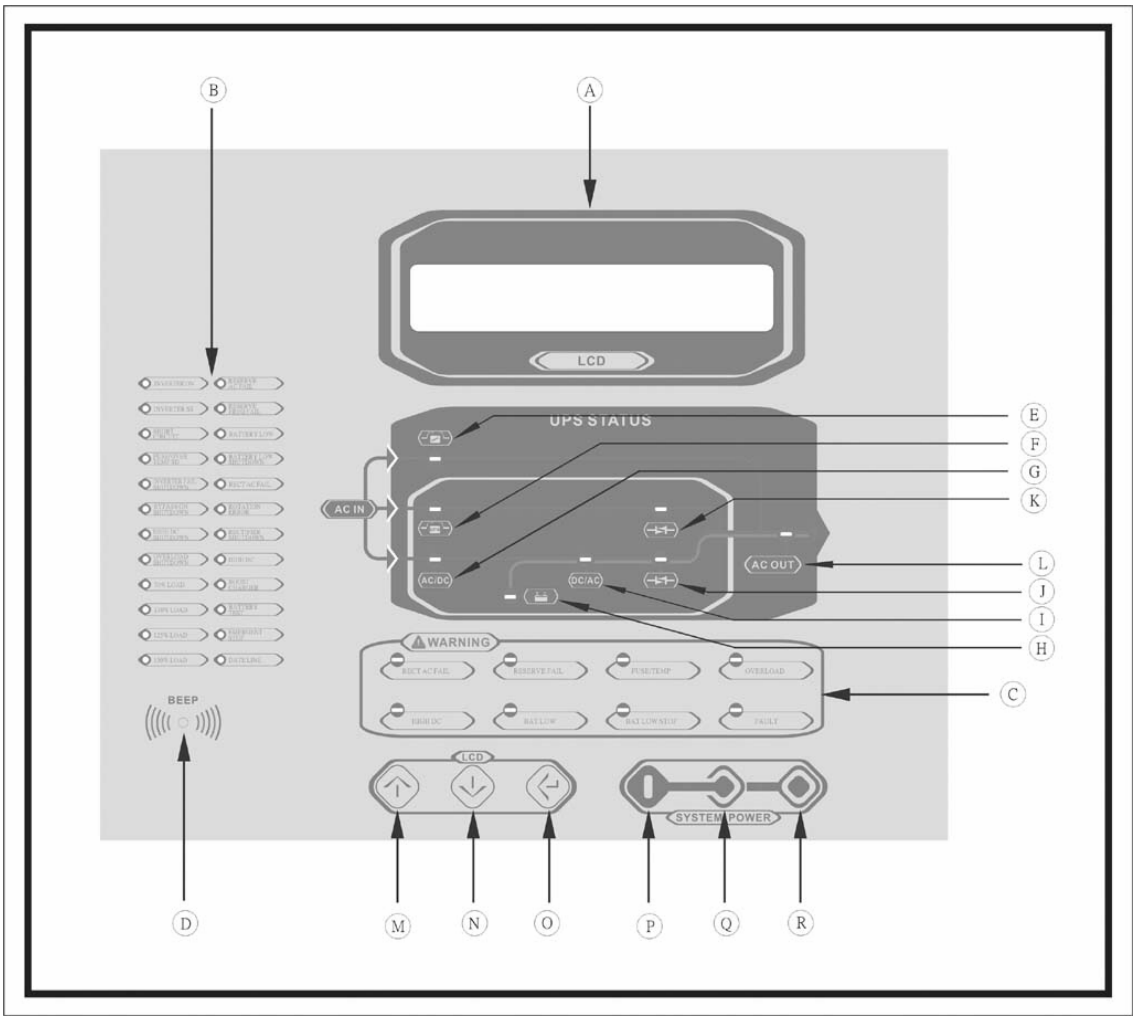
To properly use the maintenance bypass breaker, switch off the inverter first. The static switch will automatically transfer the load to reserve without dead time. Then one can close the maintenance bypass breaker, then open the reserve breaker, so that the load gets power from the output without interruption.

INTER-PCB DIAGRAM



Graph 10: Inter-PCB diagram

Front Panel



Graph 11: Front Panel

The front panel is located at the front of the PCB holder. It gathers the real time information of the UPS and shows them clearly to the user. It also provides switches for controlling and setting the UPS. Through this panel, the UPS can be not only a stand alone machine supplying the load, but also closely monitored by the user. Each part of the panel is explained below.

A: LCD display: Real time status, data or historical events are displayed on the LCD. The UPS parameters, real time clock, inverter, and buzzer also can be set through this LCD. The LCD is back-lighted by LEDs to provide a sharp display. In order to lengthen the LED's life time, the LED are automatically shut off 3 minutes

after no key is activated, but will light up again when one of the up/down/enter key is pushed.

B: Status LEDs: 24 LEDs, representing all of the important information of the UPS, provide the most up to date information to the user. Therefore these LEDs are especially important when abnormal conditions occur. The 24 information items are as shown below:

INVERTER ON – inverter is running.

INVERTER SS – inverter static switch conducts while the reserve static switch is opened.

SHORT CIRCUIT – UPS output is in short circuit state.

FUSE/OVER TEMP SD – inverter shutdown due to either fuse broken or over temperature condition.

INVERTER FAIL SHUTDOWN – inverter shutdown due to inverter output voltage too low.

BYPASS ON SHUTDOWN – inverter shutdown due to bypass breaker being closed while the inverter is running.

HIGH DC SHUTDOWN – inverter shutdown due to overly high DC bus voltage condition while the inverter is running.

OVERLOAD SHUTDOWN – inverter shutdown due to overload of the inverter for a period over that which the inverter can endure; will restart 7 seconds after overload removed.

70% LOAD – load connected to the output is at or over 70% of the UPS rating.

110% LOAD – load connected to the output is over 110% of the UPS rating.

125% LOAD – load connected to the output is over 125% of the UPS rating.

150% LOAD – load connected to the output is over 150% of the UPS rating.

RESERVE AC FAIL – reserve AC magnitude is out of range.

RESERVE FREQ FAIL – reserve frequency is out of range.

BATTERY LOW – DC bus (or battery) is lower than 320VDC, low battery shutdown is approaching.

BATTERY LOW SHUTDOWN – inverter shutdown due to DC bus (or battery) lower than 295VDC (lower than the acceptable DC voltage of the inverter).

RECT AC FAIL – rectifier AC magnitude is out of range.

ROTATION ERROR – rectifier AC phase rotation is incorrect.

RECTIFIER SHUTDOWN – rectifier shutdown due to DC bus too high (over 445VDC), will automatically restart 30 seconds after abnormal situation has been cleared.

HIGH DC – DC voltage over 430VDC and the bus voltage will be limited at this voltage.

BOOST CHARGE – the batteries are being boost charged by the rectifier.

BATTERY TEST – batteries are being tested.

EMERGENCY STOP – inverter shutdown due to emergency stop switch pushed.

DATA LINE – blinks when data is transmitted to or received from the communication port.

C: Warning LEDs: When abnormal condition happens, these LEDs will light to warn the user according to the cause of the faulty condition. Therefore all these LEDs should be extinguished under normal condition. These LEDs are as shown below:

RECT AC FAIL – rectifier AC input is abnormal either due to AC magnitude out of the range or phase rotation error, rectifier shutdown.

RESERVE FAIL – reserve AC input is abnormal either due to AC magnitude out of range or frequency out of range.

FUSE/TEMP –Inverter fuse is blown or over temperature condition exists.

OVERLOAD – output is overloaded by over 110%, 125% or 150%.

HIGH DC – the LED will light as long as the DC voltage is over 430VDC.

BAT LOW – the LED will light as long as the DC voltage is lower than 320VDC.

BAT LOW STOP – the LED will light as long as the DC voltage is lower than 295VDC, inverter cannot start.

FAULT – the inverter is shutdown due to abnormal conditions such as overload, short circuit, high DC, fuse over temperature, bypass breaker on or emergency stop.

Since these LEDs are located behind the transparent window, the user can see them clearly without opening the door.

D: Audible (buzzer) alarm: The user should not be expected to watch the UPS all the time. Therefore, when abnormal conditions occur, an audible sound should be emitted to warn the user to check the status of the UPS. The alarm buzzer will beep under any one of the following conditions:

INVERTER IS OVERLOADED-

>110%, beep once / 3 seconds

>125%, beep once / second

>150%, beep twice / second

BACK- UP

>320VDC, beep once / 3 seconds

<320VDC, beep twice / second

<295VDC, no beeping

INVERTER IS SHORT CIRCUITED - beep continuously

FUSE BROKEN - beep continuously

HEAT SINK OVER TEMPERATURE - beep continuously

HIGH DC SHUTDOWN - beep continuously

BYPASS ON STOP - beep continuously

EMERGENCY STOP – (emergency power off) beep continuously

The buzzer will also beep once every time the inverter is switched on or off to acknowledge to the user that his key is valid and accepted.

E. Bypass LED: This LED will light when the maintenance bypass breaker is closed. When the maintenance bypass breaker is closed, the inverter cannot be switched on and will stop immediately even when inverter is already running.

F. Reserve LED: This LED will light when the reserve breaker is closed, and there is AC power supply present at the reserve terminal.

G. Rectifier LED: This LED will light when the rectifier is operating normally, meaning the rectifier Mains are within the range specified, the rotation sequence of three phases is correct, the rectifier breaker is closed, and no high DC voltage is on the bus.

H. Back-up LED: This LED will light when the UPS is in back-up mode. This is also as the indicator for battery test result. If the battery test does not pass, this

LED will flash even if the UPS is not in back-up mode, to prompt the user to change the batteries.

I. Inverter LED: This LED will light when the inverter is switched on, indicating whether the inverter is running or not.

J. Inverter SS LED: This LED will light when the inverter static switch is turned on and the reserve static switch is turned off, i.e., the load is supplied from the inverter. Usually this LED will light 7 seconds after the inverter is switched on.

K. Reserve SS LED: This LED will light when the reserve static switch is turned on and the inverter static switch is turned off, i.e., the load is supplied from the reserve. Since the reserve static switch and inverter static switch will never both turn on simultaneously, the Inverter SS LED and the Reserve SS LED should never both be lit simultaneously.

L. Output LED: This LED will light when there is AC power present at the output terminal. This is an important indication to the user at to whether AC is available at the output or not.

M. Up key: This is a LCD control key. It is for moving the cursor one item upward when items are being selected or for changing the number/character forward when data or parameter of the UPS is being set.

N. Down key: This is a LCD control key. It is for moving the cursor one item downward when items are being selected or for changing the number/ character backward when data or parameter of the UPS is being set.

O. Enter key: This is a LCD control key. It is for changing backward to the previous page, and also for confirming the number/character /item is selected.

P. Inverter on switch: This is an inverter control switch. When this key is pushed with the control key simultaneously, the inverter will be switched on.

Q. Inverter control switch: This is an inverter control switch. When this key is pushed with the inverter on key simultaneously, the inverter will be switched on. Similarly, when this key is pushed with the inverter off key simultaneously, the inverter will be switched off. Thus, this key is a guard for mistaken key strokes.

R. Inverter off switch: This is an inverter control switch. When this key is pushed with the control key simultaneously, the inverter will be switched off.

4.0 INSTALLATION

4.1 Site & Environment Considerations

The main function of the UPS is to provide a safe, clean independent electrical supply to the load so that it is free from any random variations, disturbances or interruptions of the utility Mains. The UPS also provides a constant power supply which is perfectly regulated in both voltage and frequency. And when the Mains are not available, the UPS can provide optimal back-up time depending on the battery bank capacity connected to it.

Usually the life expectancy of the UPS is 5 to 10 years (batteries are not included, because life expectancy of batteries depend on the type of battery, the temperature and humidity of the environment in which it is installed, and the type of charger that is applied to the battery). Therefore optimal life expectancy of the UPS can be achieved by careful consideration of the site and environment.

The following precautions and recommendations should be checked in considering the site and environment of the UPS:

(a) The UPS should be located in a place with adequate ventilation (refer to the specification of the heat dissipation of the UPS). If the UPS is installed indoors, care must be taken in insuring the evacuation of heat from a closed room.

(b) Adequate space (at least 1M) should be allowed to open the door, unobstructed by other objects, for operation or maintenance. Adequate space (at least 1M) should be allowed at the top of the UPS, because heat dissipation is ventilated through the top openings.

(c) Do not put any objects on the top of the UPS that may obstruct ventilation. Do not locate the UPS near any heat source, machinery which produce metallic dust or powder, or any facility that will produce corrosive substances or vapor.

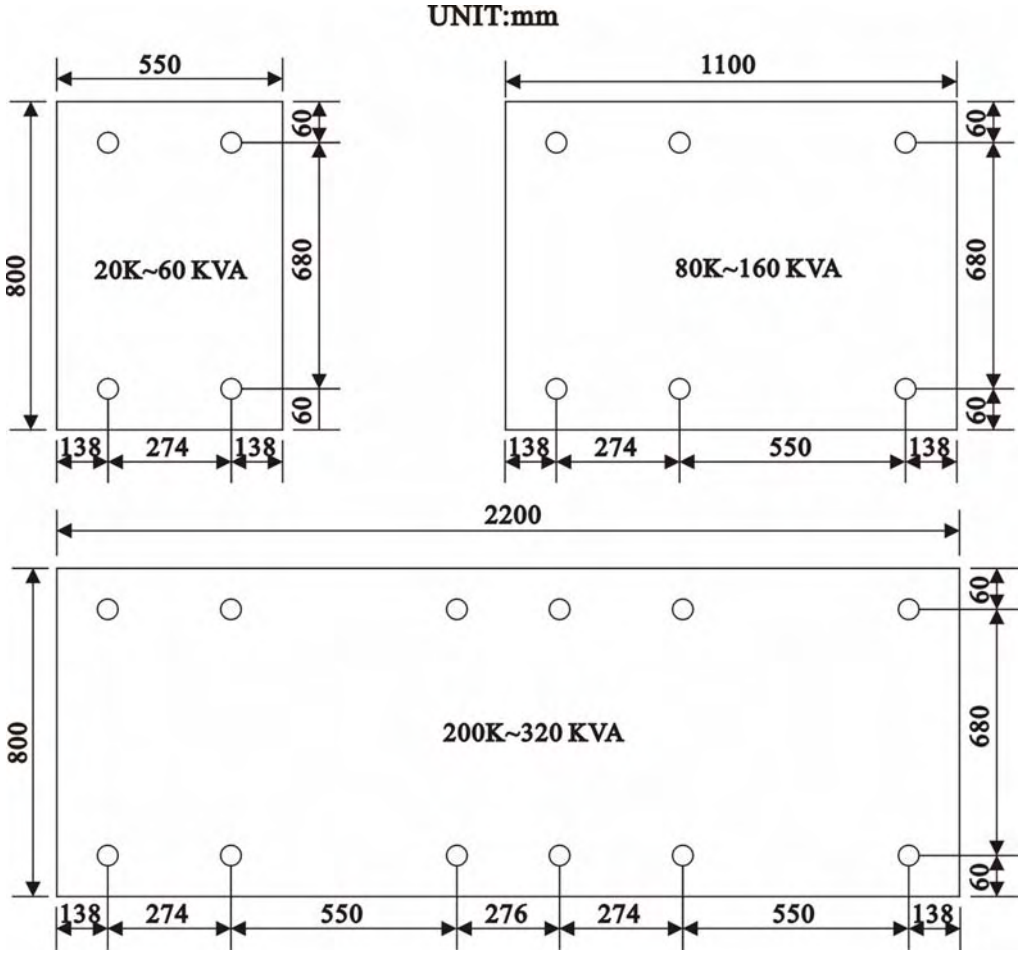
(d) Protect the UPS from accidental damage from fire extinguishing (sprinkler) systems. Protect the UPS from abnormal conditions with a dedicated cutoff from the incoming power.

(e) It is necessary to guarantee the temperature and humidity values of the site into which the UPS will be installed. These should be within the range allowed by the specification. The UPS is capable of continuous normal operation within a temperature range of 0℃(32℉) to 40℃(104℉). For optimal performance and reliability, and to prolong UPS's lifetime, it is recommended to keep the

environment temperature below 25℃, and humidity below 80%.

(f) If the UPS is installed outdoors, avoid direct exposure of the UPS to the sunlight, wind, and rain. Avoid any exposure to sand or dust.

(g) The floor loading capacity should be high enough to endure the weight of the UPS. The UPS is mounted on four right-angled steel angles. Insert corresponding bolts and nut2 (dia.1/2") into the floor for securing the UPS on the floor when it is located in an area where earthquakes is possible, or where motion may occur, e.g. vehicle mounted. Layout dimensions, in millimeters, are shown below.



Graph 12: UPS installation

(h) Walls, ceilings, and floors near the UPS should be preferably constructed of non-combustible materials. A portable fire extinguisher should be accessible nearby in case of hazard.

(i) Avoid accumulating combustible materials of any sort in or around the UPS

system. The floor area surrounding the UPS should be kept clean so that foreign materials are not sucked into the unit, thus causing a short circuit and damage to the system.

(j) Access to the UPS room should be limited to a minimum number of operation and maintenance personnel only. The doors should be kept locked and the keys should be confined to authorized personnel only.

(k) Personnel who operate or maintain the UPS system should be proficient in normal and emergency operational procedures. New personnel should be trained and qualified prior to operating the equipment.

(l) Although the UPS has passed International EMC tests, it is recommended that the UPS not be installed near any equipment that is susceptible to electro-magnetic interference, such as computer systems, monitors, radios, etc.

(m) It is preferable to place the UPS near to the source rather than near to the load.

4.2 Unpacking

Carefully unpack the UPS, and then carefully locate the UPS onto the site which has selected, with all the points in section 3.1 kept in mind.

The UPS has had detailed production and QC testing of all the electrical and mechanical characteristics prior to shipment from the factory. Therefore, the UPS should be in proper condition upon receipt. Once received, the UPS should be first checked visually to determine if any physical damage has occurred during transportation.

Then check to insure that all the accessories/options (match with your purchase order) have been included.

- DOOR KEY
- THIS INSTRUCTION MANUAL
- BATTERY FUSE (FOR BATTERY CABINET ONLY)
- SPARE SCREWS FOR COVER PLATE
- SPARE SCREWS FOR CONNECTION TERMINALS etc.

Lastly, check to insure that the specification of the UPS is identical to the specification of your order. The key items in the specification you must check are:

- RATED POWER OF THE UPS,
- INPUT VOLTAGE & FREQUENCY

- OUTPUT VOLTAGE & FREQUENCY
- NO. OF OUTPUT PHASES (1Φ OR 3Φ)
- BATTERY VOLTAGE OR CELL NO.

Also check to insure that the necessary documentation is attached:

- GUARANTEE CARD
- AGENT/SERVICE CENTER INFORMATION

4.3 Cable Selection

The following tables list typical information concerning the KVA of the UPS versus the size and rating of the cables. Inadequate cable size or over sized breakers will incur risk of fire or damage of insulation. Therefore, please use the following tables to determine the input circuit breaker rating and the size of cable for input, output and battery connections. These data are for reference; final decisions should be made in accordance with the local electrical codes.

Table 5: Breaker rating for input

KVA	INPUT	Imax(A)	NFB(A)
10	230/400V 3Φ	24	30
20	230/400V 3Φ	50	50
30	230/400V 3Φ	73	75
40	230/400V 3Φ	98	100
50	230/400V 3Φ	122	125
60	230/400V 3Φ	147	150
80	230/400V 3Φ	172	175
100	230/400V 3Φ	215	225
120	230/400V 3Φ	258	300
160	230/400V 3Φ	344	350
240	230/400V 3Φ	500	500
320	230/400V 3Φ	700	700

Table 6: Cable size for input

KVA	INPUT	In(A)	R/S/T(mm^2)	N(mm^2)
10	230/400V 3Φ	18	6	8
20	230/400V 3Φ	36	8	14
30	230/400V 3Φ	54	14	22
40	230/400V 3Φ	72	22	30
50	230/400V 3Φ	90	30	38
60	230/400V 3Φ	108	38	50
80	230/400V 3Φ	144	50	80
100	230/400V 3Φ	180	80	100
120	230/400V 3Φ	216	100	125
160	230/400V 3Φ	288	60*2	80*2
240	230/400V 3Φ	416	100*2	125*2
320	230/400V 3Φ	554	150*2	200*2

Table 7: Cable size for output

KVA	OUTPUT	In(A)	R/S/T(mm^2)	N(mm^2)
10	230/400V 3Φ	15	6	8
20	230/400V 3Φ	29	8	14
30	230/400V 3Φ	46	14	22
40	230/400V 3Φ	58	22	30
50	230/400V 3Φ	72	30	38
60	230/400V 3Φ	91	38	60
80	230/400V 3Φ	116	60	80
100	230/400V 3Φ	144	80	100
120	230/400V 3Φ	182	100	125
160	230/400V 3Φ	232	60*2	80*2
240	230/400V 3Φ	348	100*2	125*2
320	230/400V 3Φ	463	125*2	150*2
10	230V 1Φ	45	14	22
20	230V 1Φ	91	38	60
30	230V 1Φ	130	60	80
40	230V 1Φ	182	100	125
50	230V 1Φ	217	150	60*2

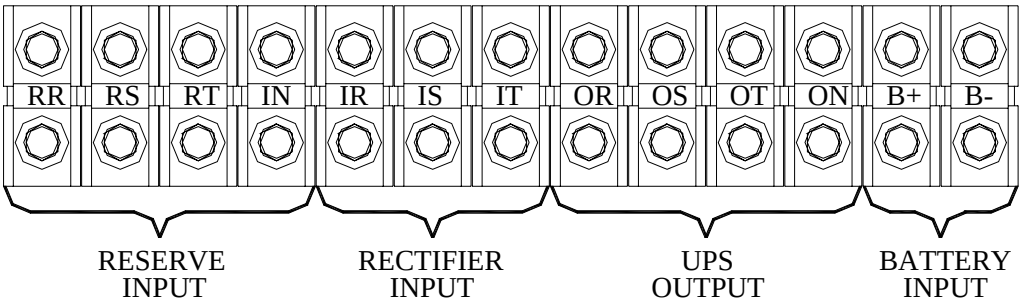
Table 8: Fuse rating & cable size for battery

KVA	Imax(A)	FUSE(A)	CABLE(mm^2)
10	30	35	14
20	60	63	22
30	90	100	38
40	120	125	38
50	150	160	50
60	180	200	80
80	240	125*2	38*2
100	300	160*2	50*2
120	360	200*2	80*2
160	480	200*2	80*2
240	720	200*4	80*4
320	960	200*4	80*4

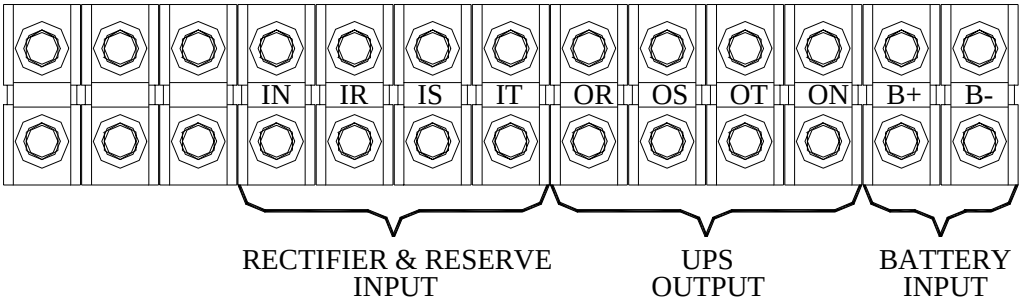
☆ THE BATTERY VOLTAGE IS 295 – 410V

4.4 Terminal Connection

Although different sizes of UPS may have slightly different cable connection terminal blocks, all UPS connection terminal alignments falls into one of the following types:



3 PHASE INPUT / 3 PHASE OUTPUT TERMINAL WITH TWO SOURCE

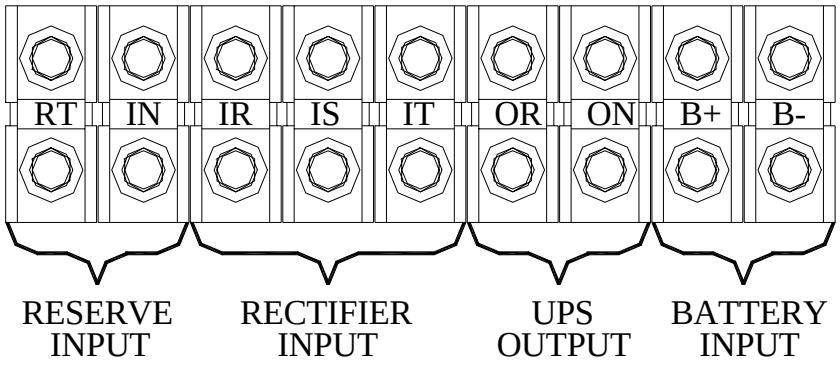


3 PHASE INPUT / 3 PHASE OUTPUT TERMINAL WITH SINGLE SOURCE

Graph 13: Terminal connection

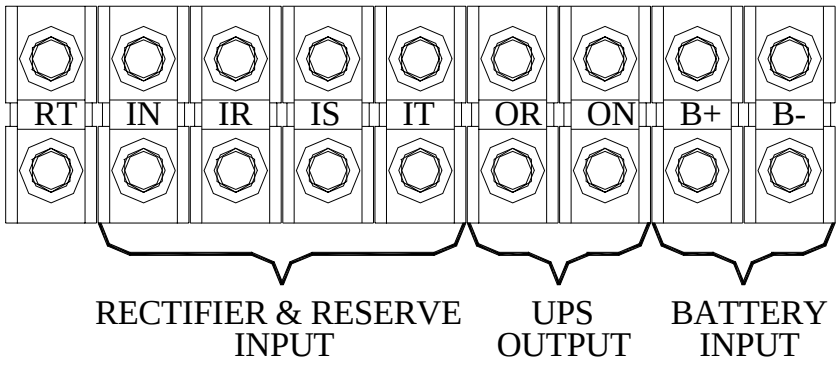
☆☆☆ Three extra terminals are installed for convenience of changing the unit to separate reserve input.

For single phase output UPS, the current is very much larger in single phase terminal, therefore the terminal looks bigger than it is needed.



3 PHASE INPUT / 1 PHASE OUTPUT

TERMINAL WITH TWO SOURCE



3 PHASE INPUT / 1 PHASE OUTPUT

TERMINAL WITH SINGLE SOURCE

Graph 13: Terminal connection

☆☆☆ Extra empty terminals are installed for convenience of changing the unit to separate reserve input.

5.0 TROUBLESHOOTING

Followings are some abnormal situations frequently asked and common solution is offered for trouble-shooting.

Table 9: Troubleshooting table (1)

Abnormal	Description & Checkpoint	Solution
(1) AC input is correct, but rectifier does not operate and RECT AC FAIL LED lights up.	The rectifier breaker is not switch on.	Switch on the rectifier breaker.
	The input voltage is not correct (out of the normal range).	Connect the right AC source.
	The phase sequence of AC input is incorrect, input rotation error, and the LCD will display warning message “RECT PHASE ERROR” in the STATUS/WARN menu (MAIN menu → SELECT menu → STATUS/WARN menu). ROTATION ERROR LED on left side of the front panel will also light.	Correct the R.S.T. phase sequence. Generally, to exchange any two phases connection can solve this problem.
	If the abnormality cannot be corrected when the solution actions have been taken.	Refer to PCB LED Detecting Guide and check the 3C PCB.
(2) The UPS shuts down under AC mains failure.	The battery fuse (breaker/holder/dis-connector) has not been closed.	Close the battery fuse breaker/holder/dis-connector.
(3) No power supply for UPS control circuit and LCD cannot display.	The reserve breaker has not been closed (switched on).	Close the reserve breaker.
	3B PCB has problem.	Refer to PCB LED Detecting Guide and check the 3B PCB.

Table 9: Troubleshooting table (2)

Abnormal	Description & Checkpoint	Solution
(4) The voltage difference between NEUTRAL and GROUND has become abnormally high.	There is external wiring error of R.S.T phase and N. G., instead of UPS unit itself.	Correct the external wiring system.
(5) The inverter cannot start up.	Other than INVERTER SS LED in left side of the front panel, other LEDs still illuminate.	Do trouble shooting according to the LED instruction.
	Switch on the inverter before DC bus has been established completely. Normally, it takes around 30 seconds to establish the DC BUS once the reserve and rectifier breakers are closed.	Refer to the switch on procedure. Close the reserve and rectifier breakers and wait around 30 seconds or directly use batteries to establish the DC bus.
	Bypass breaker has been closed (switched on).	Open the bypass breaker.
	The output is overloaded. The LCD will display warning message ‘ XXX% OVERLOAD’ in the STATUS/WARN menu (MAIN menu → SELECT menu → STATUS/WARN menu). XXX% OVERLOAD LED on left side of the front panel and OVERLOAD LED on right side will also light.	Decrease the load to below the UPS’s rated power.
	In P&P modules1, the temperature sensor sockets on 3G PCB and hest sink are not connected properly. WARNINGLED of FUSE/TEMP still illuminates but LED in 3G PCB doesn’t, indicating DC BUS may be over 240VDC.	Take out the P&P modules and connect them properly.

Table 9: Troubleshooting table (3)

Abnormal	Description & Checkpoint	Solution
(6) Fans do not work while UPS is on.	The fuses positioned behind PCB holder have been blown or are not installed properly.	Replace the fuses or install them properly.
	Abnormal voltage output in R phase.	Refer to PCB LED Detecting Guide and check the 3T PCB of R phase.
(7) The rectifier shunt down and HIGH DC LED is lit.	Voltage limit function failure in the 3B, which contributes to the DC voltage, goes over 430V.	Refer to PCB LED Detecting Guide and check the 3B PCB.
	3C PCB has problem.	Refer to PCB LED Detecting Guide and check the 3C PCB.
(8) Abnormal voltage in reserve.	RESERVE AC FAIL LED lights up. LCD menu also displays the abnormal voltage in reserve. (REAL TIME DATA menu → RESERVE DATA menu).	Check the reserve wiring and connect with the correct source.
	Fuse has blown in 3A PCB	Replace the fuse.
	If the abnormality cannot be corrected after the solution actions have been taken.	Refer to PCB LED Detecting Guide and check the 3A PCB.
(9) Abnormal frequency in reserve.	RESERVE FREQ FAIL LED lights up. LCD menu also displays the abnormal voltage in reserve. (REAL TIME DATA menu → RESERVE DATA menu).	Check the reserve wiring and connect with the correct source.
	Fuse has blown in 3A PCB	Replace the fuse.
	If the abnormal cannot be corrected after the solution actions have been taken.	Refer to PCB LED Detecting Guide and check the 3A PCB.

Table 9: Troubleshooting table (4)

Abnormal	Description & Checkpoint	Solution
(10) The inverter shuts down during operation, while the FAULT LED lights and buzzer beeps continuously.	Bypass breaker has been closed (switched on).	Open the bypass breaker. The inverter will restore running automatically.
	The output is short-circuited, including the load itself.	Clear the short circuit at the output, then switch off the inverter. Secondly, switch on once more to restart the inverter.
	The output is overloaded. The LCD will display warning message ‘ XXX% OVERLOAD’ in the STATUS/WARN menu (MAIN menu → SELECT menu → STATUS/WARN menu). XXX% OVERLOAD LED on left side of the front panel and OVERLOAD LED on right side will also light.	Decrease the load to under the UPS’s rated power. Then the inverter will restore running automatically.
	Heat Sink is over temperature. WARNING LED of FUSE/TEMP still illuminates.	Decrease the load to under the UPS’s rated power, then switch off the inverter. Secondly, switch on once more to restart the inverter.
	IBGT-protect fuse has blown in P&P module1 or IGBT damage.	Take out the P&P module and replace fuse or IGBT.
	When in battery back-up mode, the inverter shuts down due to battery low (lower than 295VDC).	Within 30 minutes, the inverter will restore running automatically once the AC main is back.
	The Emergency Switch has been triggered.	Switch off the inverter first then on once more to restart the inverter.

Table 9: Troubleshooting table (5)

Abnormal	Description & Checkpoint	Solution
(11) Transferring failure between reserve and inverter.	DC BUS voltage becomes abnormal during transferring. DCV value can be read in LCD menu.	Take out the P&P module 2 and make sure the SCR drive connection is OK.
	3P PCB has problem.	Refer to PCB LED Detecting Guide. Take out the P&P module 2 and check the 3P PCB.
	LED A4(OTF) in the 3A PCB lights.	Refer to PCB LED Detecting Guide and check the 3G PCB.
	In P&P modules, the temperature sensor sockets on 3G/3P PCB and hest sink are not connected properly. WARNING LED of FUSE/TEMP still illuminates.	Take out the P&P module and connect them properly.
	Phase sequence error of output transformer.	Change the transformer wiring.
	If the abnormal cannot be improved as the aforesaid solution action has been taken.	Refer to PCB LED Detecting Guide and check the 3G and 3P PCB.
(12) Phase lack when AC output.	The mimic output LED in the front panel blinks.	Make sure the signal sockets in 3T PCB are connected properly.
	Fuse has blown in 3T PCB	Replace the fuse.
	If the abnormal cannot be corrected after the solution actions have been taken.	Refer to PCB LED Detecting Guide and check the 3T PCB.
(13) The mimic battery LED in the front panel blinks.	Batteries become worn out or damaged.	Replace batteries.

Table 9: Troubleshooting table (6)

Abnormal	Description & Checkpoint	Solution
(14) All LED in the front panel light up.	CPU inserting error in 3A or 3R PCB	Insert the CPU into correct socket.
(15) Communication interface is not working properly.	Communication cables are connected improperly.	Correct the wiring.
	Communication software is not installed successfully.	Reinstall the software.
	Communication port setup error.	Correct the setup.
	CPU inserting error in 3R PCB.	Insert the CPU into right socket.
	If the abnormal cannot be corrected after the solution actions have been taken.	Refer to PCB LED Detecting Guide and check the 3R PCB.
(16) The inverter has been turned on but no action of inverter.	The inverter switches of ▮ & ◂▸ are not pressed simultaneously.	Try to press these two buttons simultaneously
	PCB Connection is not good.	Refer to PCB LED Detecting Guide and check the connection of 3W PCB.