

UNINTERRUPTIBLE POWER SYSTEM

SERVICE MANUAL

Arena 3P3&3P1&1P1 6-10KVA RT Model

Rev. 1.0

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1. General information

1.1 Getting start

This manual is for Arena 3/3&3/1&1/1 10K(L) RT UPS. It can help service person perform the basic maintenance and repair service.

This manual only focuses on the service section, so you should get the basic operation of the UPS from the user manual, and make sure you had read and understood the user manual before reading the manual.

The manual include 8 sections, as follows

- General Information, this section show you the general information of the service manual
- Functional Block, this section show you the major functional block of the UPS
- Working Principle of the major Functional Block, this section show you the major functional block
- Function explanations for each PCB, this section show you all the PCBs of the UPS
- Interface, this section show you the LCD interface, include display and setting
- Trouble shooting, this section will give you the way to find the trouble
- Test step ,this section tell you how to test the UPS after you repair the unit
- Electric Specifications, this section show you the basic electric specification of the UPS

1.2 Important safety instructions

WARNING: This chapter contains important safety and operating instructions. Read and keep this manual for future reference.



For qualified service personnel only.



DO NOT performs any internal service or adjustment of this product unless another person is capable of rendering first aid and resuscitation is present.



Dangerous voltage exists at several points in this product. To avoid personal injury, don't touch any exposed connections or components while UPS is on.



Turn off the UPS and switch off the input breaker before removing outside protective cover.



AC voltage is always present if the input AC power is still available.



High voltage may present at DC capacitors. Before opening the outside cover, wait for at least five minutes after turning off the UPS.



Verify input source (voltage and frequency) is within the maximum range before service.

2. Electric Specifications

MODEL	SPECIFICATION			
	1P1 10K(L)	3P1 10K(L)	3P3 10K(L)	2P2 6K(L)
Input				
Input Voltage	176~276 VAC(L-N)@ Full Load			88~155
	110~300 VAC(L-N) @ Half Load			VAC(L-N)
Input Frequency	46~54 Hz for 50Hz system			
	56~64 Hz for 60Hz system			
Input Power Factor	≥ 0.99 @100% R/RCD Load			
	≥ 0.97 @ 50% R/RCD Load			
Input THD(Full Load)	<4%@ Linear load	<5%@ Linear load	<4%@ Linear load	<4%@ Linear load
Generator	Support			
Output				
Output Power (VA/Watt)	10000VA/10000W	10000VA/10000W	10000VA/10000W	6000VA/6000W
Nominal Output Voltage	208/220/230/240VAC(L-N)			100/110/115/120/ 127VAC(L-N)
Voltage Regulation	<1%(balance load)			
	<2% (unbalance load)			
Output Frequency	Follows Bypass Frequency if the bypass is ok(except the convert mode)			
	(50/60±0.1) Hz if bypass is not ok or in convert mode			
Voltage Distortion	≤5% @ Full Nonlinear Load			≤4% for nonlinear load
	≤2% @ Full Linear Load			
Current Crest Ratio	3:1max			
Transfer Time	0ms @ Line ↔ Battery			
	0ms @ Inverter ↔ Bypass			
	<10ms @ Inverter ↔ ECO			
Short Circuit Protection	Yes			
Battery				
Nominal Battery Voltage	+/- 192~240V			+/- 96~120V
Acceptable Battery Quantity (PCS)	(16~20)×12V/pc*2			(8~10)×12V/pc*2
Type/Capacity	12V/9Ah or equivalent			
Backup Time (minutes)	>6.5 mins @ +/- 16 pcs Batteries			>5 mins @ +/- 8 pcs Batteries
	>8.75 mins @ +/- 20 pcs Batteries			>7 mins @ +/- 10 pcs Batteries
Efficiency				
Line Mode	>94%			91

Battery Mode	>91%	90
ECO Mode	>97%	
Overload Protection		
100%~110%	Alarm and Transfer To Bypass after 30min @ Line mode	
	Alarm and Cut Off Output after 3min @ Battery mode	
110%~130%	Alarm and Transfer To Bypass after 5min @ Line mode	
	Alarm and Cut Off Output after 30s @ Battery mode	
130%~150%	Alarm and Transfer To Bypass after 10s @ Line mode	
	Alarm and Cut Off Output after 10s @ Battery mode	
Over 150%	Alarm and Transfer To Bypass after 200ms @ Line mode	
	Alarm and Cut Off Output after 200ms @ Battery mode	
Auto Retransfer	Yes	
Interface		
USB 1.1	Yes	
Intelligent Slot	SNMP card (Optional)	
	RS485 card (To be considered)	
	AS400 card (Optional)	
Dry Contact	5 channel Dry Contact Card (Optional)	
EPO	Yes	
Environment		
Operating Temperature	0 °C to 40°C	
Humidity	<95% (No condensing)	
Acoustic Noise	≤55dB	≤58dB
Standard		
ESD	IEC 61000-4-2 Level 4	
RS	IEC 61000-4-3 Level 3	
EFT	IEC 61000-4-4 Level 4	
Surge	IEC 61000-4-5 Level 4	
Conduction	IEC 62040-2	FCC 47 CFR15, Subpart B
Radiation		
Safety	IEC62040-1-1	
Drop	ASTM D5276-94	
Vibration	ASTM D4728-87	
Mechanical		
Inlet	Terminal Block	
Outlet	Terminal Block and Receptacle	
Outline Dimension W x H x D (mm ³)	635 *418 *132	
- Net Weight (kg)	22	
- Packaging Dimension W x H x D (mm ³)	580*250*870	
- Gross Weight (kg)	25	

3. Functional block

As a true online UPS, the product employ a double conversion topology, comprise following functional blocks, as shown in Figure 3.1.

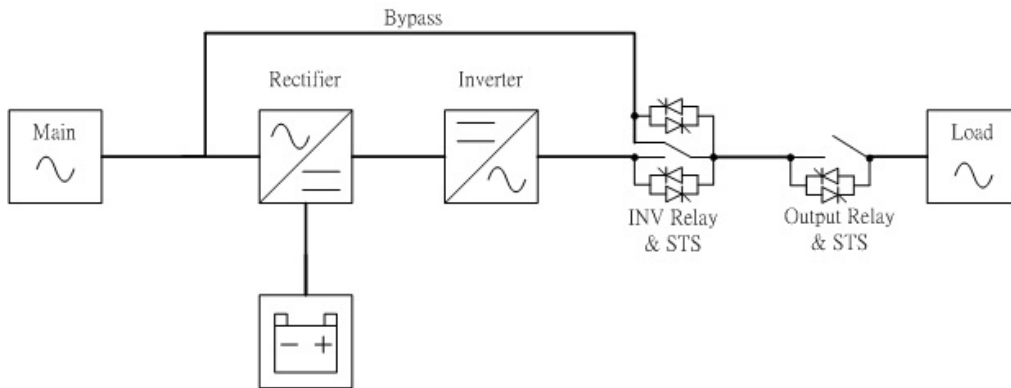


Figure 3.1 function block diagram

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

The Rectifier and PFC blocks are the input stage of the UPS, The blocks converse the AC input power into two stable DC power storing on the BUS capacitor. In means time, PFC(Power Factor Correction) is performed, the input current tracking the input voltage waveform, and the input power factor can be corrected to 1, achieve maximum efficiency and product lowest power pollution to the utility.

The PFC block in battery mode, called also Booster, used to converse the low voltage DC power into higher voltage and more stable DC power, storing on the BUS capacitor also.

The Inverter block is the output stage of the UPS, used to converse the DC power from the BUS capacitor into sine waveform output power.

When the utility is within the tolerance range, the UPS use the utility input, at this time, the Rectifier and PFC work; In case the utility is output tolerance range, due to either the voltage or the frequency, the UPS will stop the Rectifier and PFC working, start the Battery Booster. In case the input utility interrupts suddenly, the controller can detect the interruption in very short time, and in the interval before detecting the interruption, the output power will be maintain by energy stored in the BUS capacitor, there will never be appear interruption on output.

The charger charges the battery when the utility is normal. The charger converse the AC input power into DC power for recharging the battery.

The Input or Output EMI section provides EMI filter function. This section can prevent the UPS being interference by external electronic/magnetic noise which generated by the other electronic system, and it can prevent the noise generated inside the UPS system interference other system too.

The SPS generates DC power supply needed by operation of the circuit of the UPS itself.

The Bypass provides a path that utility can power the output directly when the Inverter didn't work.

4. Working principle of the major functional block

4.1 Switch Power Supply

The switch power supply (SPS) supplies DC power for UPS operation. The input voltage of the SPS is the battery or AC input voltage.

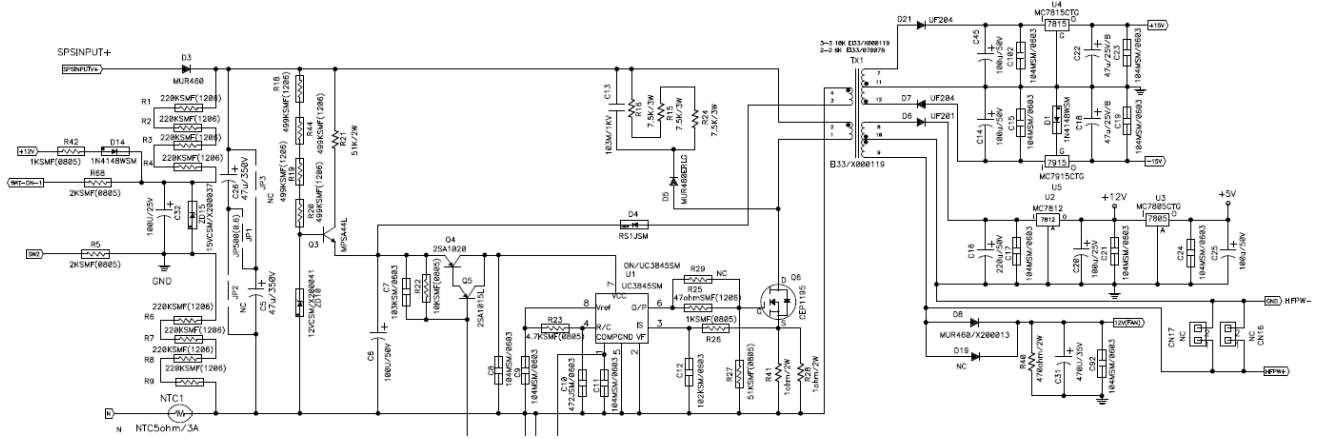


Figure 4.1 basic circuit of power supply

This is the fly-back DC-DC converter, fly-back operation can be easily recognized from the position of the dots on the transformer primary and secondary (these dots show starts of the winds). When Q6 is ON, the dot ends of all winds are negative with respect to their no-dot ends. Output rectifier diodes D6, D7, D8 and D21 are reverse-biased and all the output load currents are supplied from storage filter capacitors C12, C13. The primary coil of the transformer acts as an inductor and stored energy.

When Q6 is OFF, the stored energy in the primary coil is delivered to secondary filter capacitors C18, C20, C22, C25 and C31.

As shown in figure 3.1, this circuit may generate several output voltage, such as +5V, +12V, -12V, +12V(FAN), HFPW+, 3843VCC.

4.2 PFC/Boost circuit

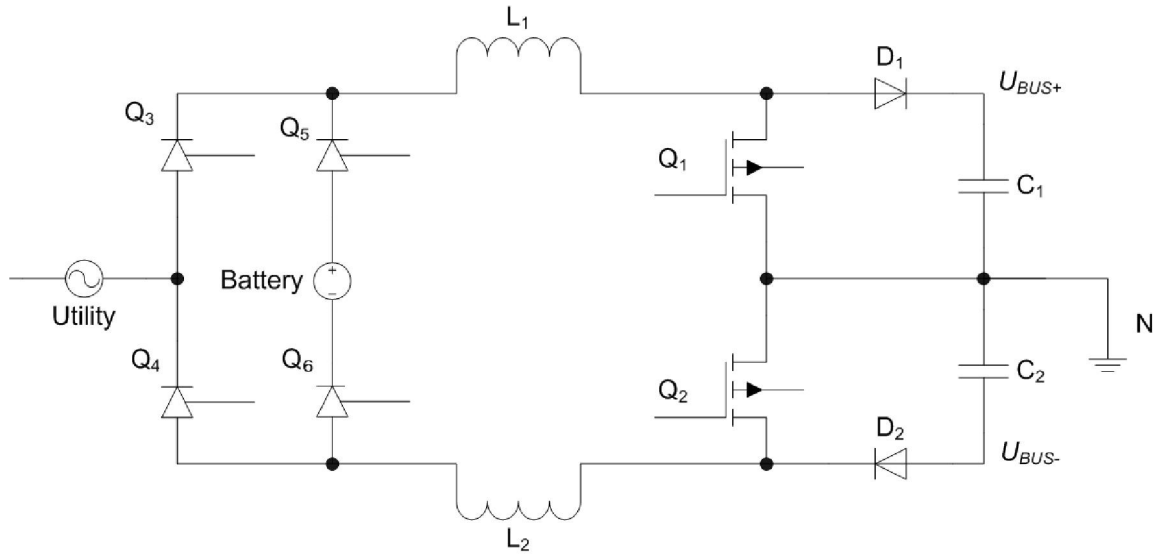


Figure 4.2 Boost circuit topology

As shown in the Figure 4.2, when Q1/Q2 is on, and D1/D2 is off, the choke (L1/L2) will store energy and the current crossing the choke will increase by degrees with time pass. When the Q1/Q2 is off, the choke releases energy and the D1/D2 is on, the current of the choke will be descending with time pass. Therefore, we can control the current waveform of chokes (input current) by regulating the time of Q1/Q2 on and off.

4.3 Inverter circuit

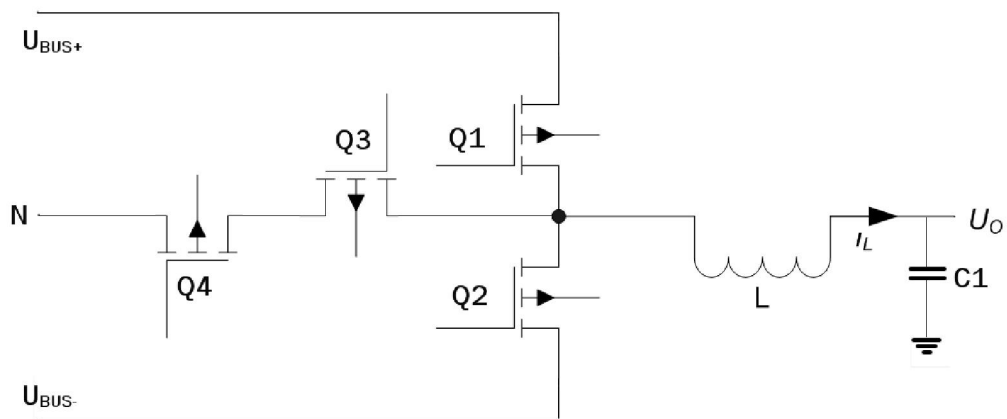


Figure 4.3 “T” three level topology

The topology works as follows. Q1&Q4 and Q2&3 are switched on at alternate half cycles. The junction voltage of Q1 and Q2 is a high frequency rectangular waveform. This rectangular wave through the LC filter will become a standard sine wave.

4.4 Charger

The Charger of utility is to recharge and maintain the batteries at fully charged condition .The charger charges the batteries with a constant current at initial stage, and as battery voltage keep increasing, the charge current decrease accordingly until the charge voltage reached the constant voltage level, and then the charger turn to the floating charge mode.

The charger employed a double forward topology.

Figure 4.4 Buck circuit topology

4.5 EMI Board

Input EMI board is connected between utility and the input of rectifier.

Output EMI board is connected between the output of inverter and output terminal block.

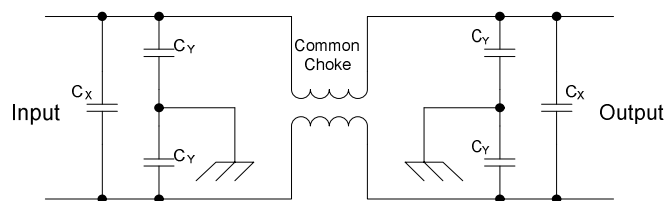


Figure 4.5 Topology of the EMI

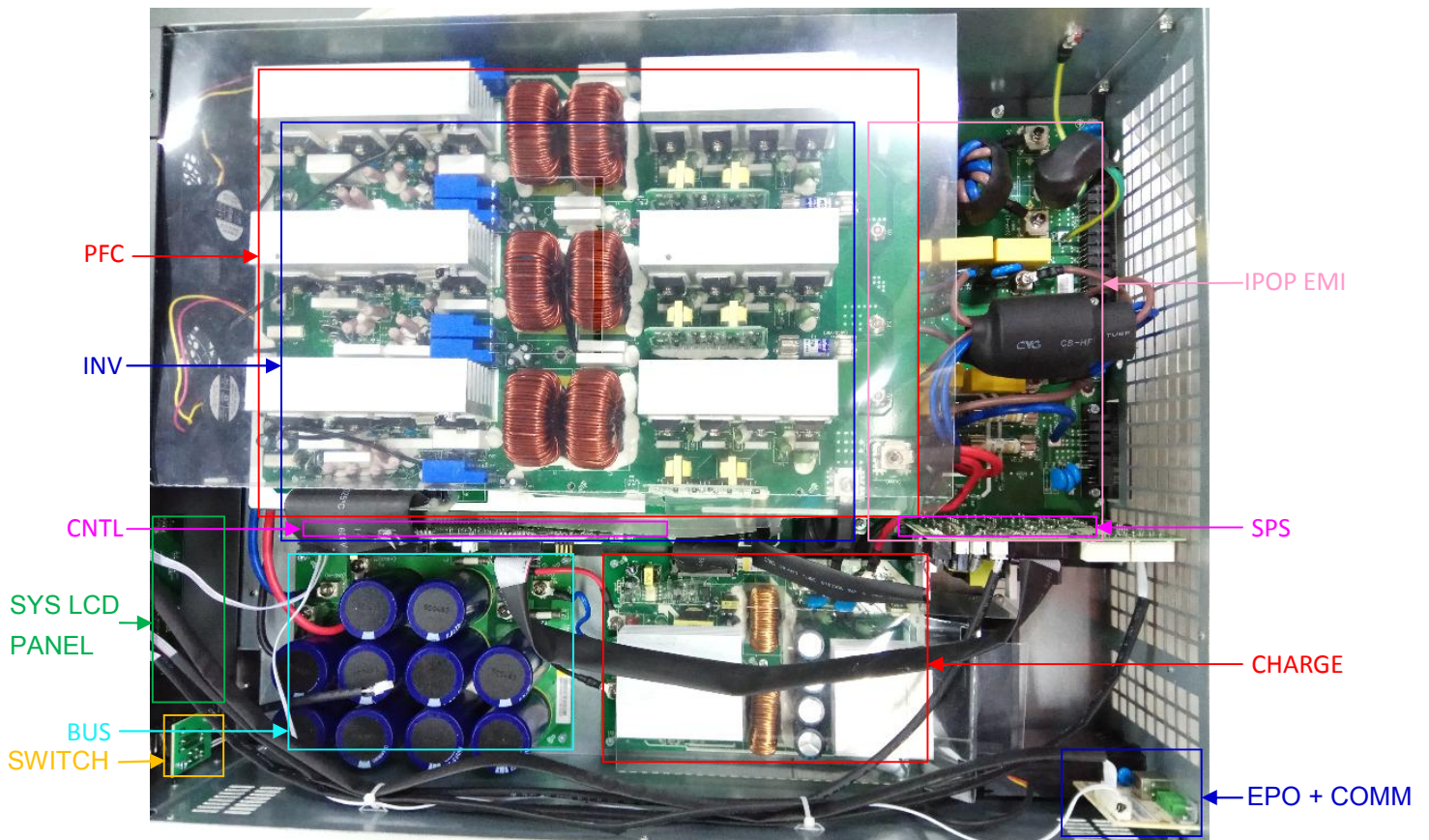
5. Functional explanations for each PCB

Table 5.1 PCB information of Arena 1/1&3/1&3/3 10K(L)

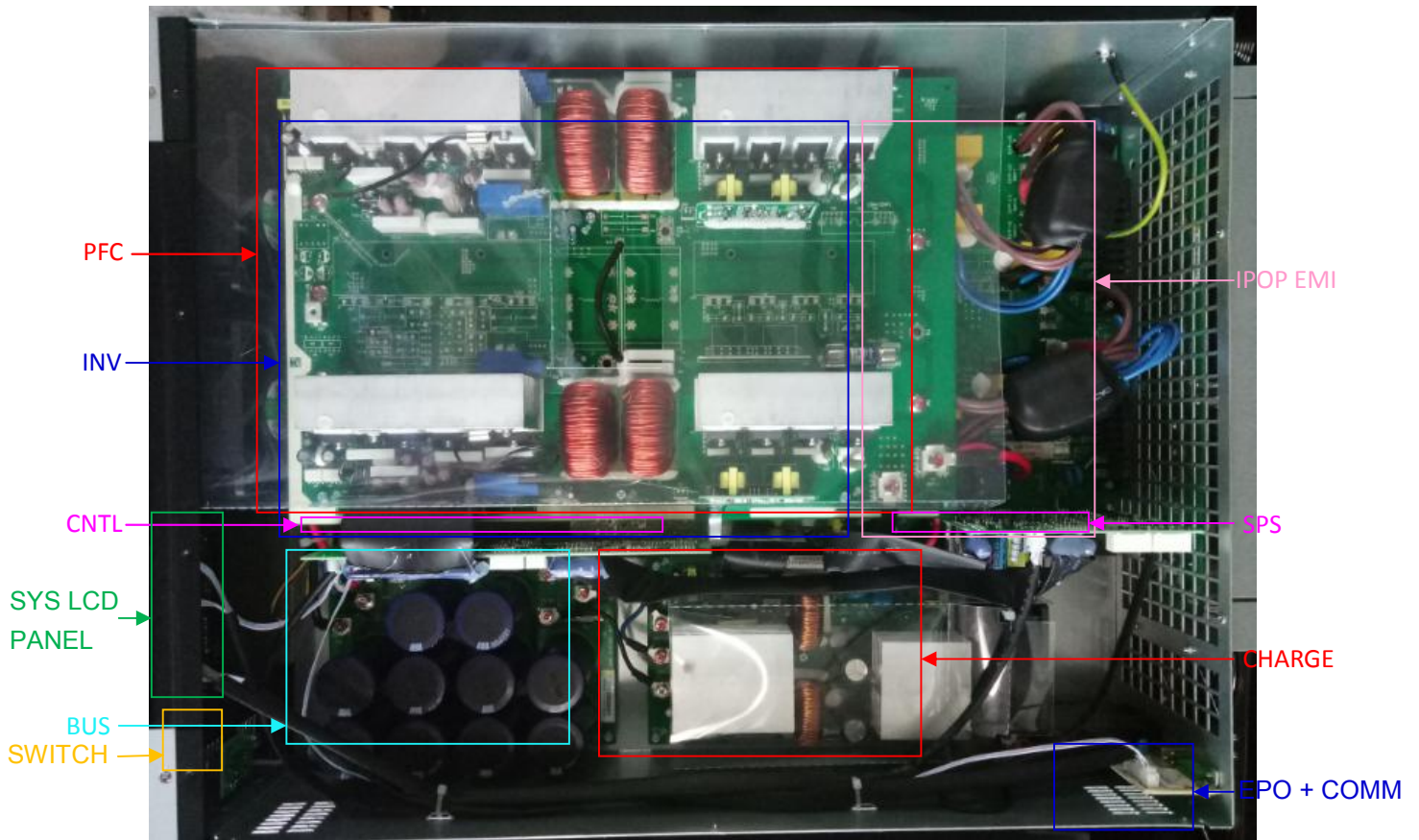
Item	Series name	PCB name	PCB serial number	Quantity	Remark
1	Arena 1/1&3/1 10K(L)	PFC	71-302254-XXG	1	
2		INV	71-302253--XXG	1	
3		Charger	71-302260-XXG	1	
4		CNTL	71-302257-XXG	1	
5		SPS	71-302261-XXG	1	
6		BUS	71-302259-XXG	1	
7		IPOP	71-302252-XXG	1	
8		EPO + COMM	71-302264-XXG	1	
9		SYS LCD PANEL	12-400134- XXG 71-303040-XXG	1	LCD(12-400134- XXG) combine with PCBA (71-303040-XXG)
10		PFC SCR DRIVE	71-302256- XXG	3	
11		Switch	71-302258-XXG	1	
1	Arena 3/3 10K(L)	PFC	71-302254-XXG	1	
2		INV	71-302894-XXG	1	
3		Charger	71-302260-XXG	1	
4		CNTL	71-302896-XXG	1	
5		SPS	71-302261-XXG	1	
6		BUS	71-302259-XXG	1	
7		IPOP	71-302895-XXG	1	
8		EPO + COMM	71-302264-XXG	1	
9		SYS LCD PANEL	12-400134- XXG 71-303040-XXG	1	LCD(12-400134- XXG) combine with PCBA (71-303040-XXG)
10		PFC SCR DRIVE	71-302256- XXG	3	
11		INV SCR DRIVE	71-300785-XXG	9	
12		INV DRIVER	71-302905- XXG	3	
13		Switch	71-302258-XXG	1	

1	Arena 2/2 6K(L)	PFC	71-302898-XXG	1	
2		INV	71-302900-XXG	1	
3		Charger	71-302899-XXG	1	
4		CNTL	71-303212-XXG	1	
5		SPS	71-303125-XXG	1	
6		BUS	71-302936-XXG	1	
7		IPOP	71-302901-XXG	1	
8		EPO + COMM	71-302264-XXG	1	
9		SYS LCD PANEL	12-400134- XXG 71-303040-XXG	1	LCD(12-400134- XXG) combine with PCBA (71-303040-XXG)
10		PFC SCR DRIVE	71-302256/302255- XXG	2	Daughter board on PFC PCBA
11		INV SCR DRIVE	71-300785-XXG	6	Daughter Board on INV PCBA
12		INV DRIVER	71-302905- XXG	2	Daughter Board on INV PCBA
13		Switch	71-302258-XXG	1	

Note: "XXG" in the serial number is the version of the PCB. It may be modified according to releasing version in the future.



Arena 1/1&3/1&3/3-10K(L) structure



Arena 2-2 6K LV structure

5.1 PFC board (Power Factor Correct Board)

The PFC board consists of Rectifier and PFC/Booster.

When UPS works in line mode, the Rectifier and PFC will work, It changes the AC power to DC power stored in the BUS capacitor. When works in Battery mode, the PFC will only work as boost to get the higher DC power.

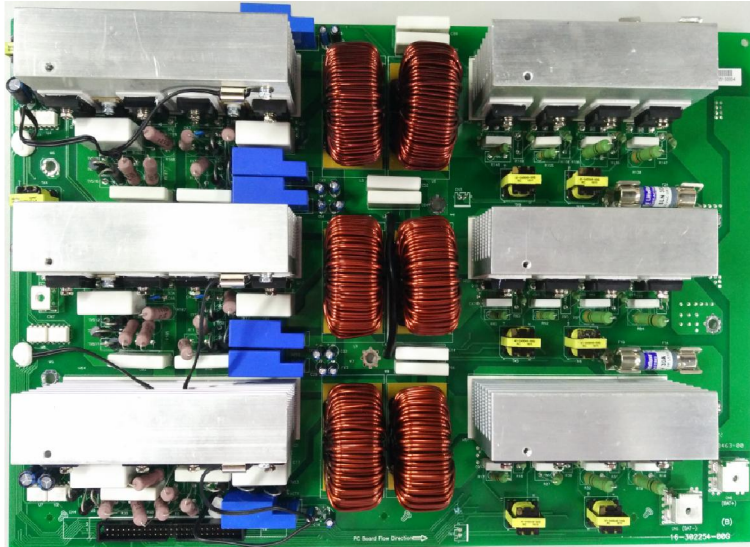


Figure 5.1.1 Arena 1/1&3/1&3/3-10K PFC board

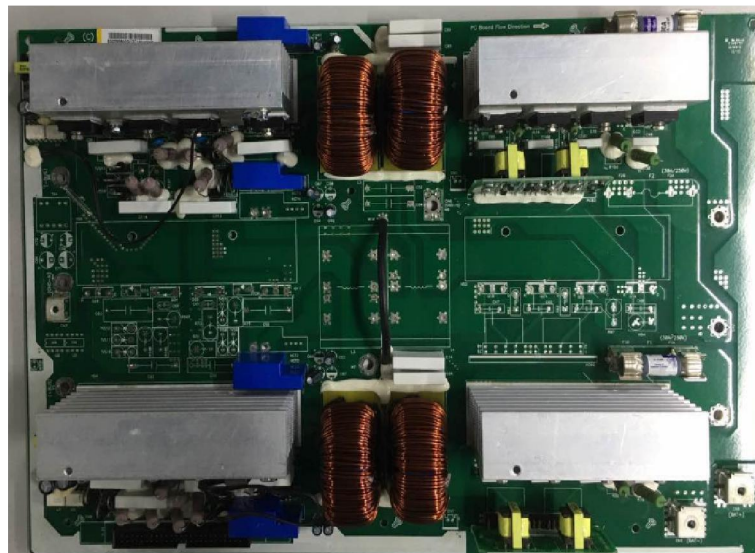


Figure 5.1.2 Arena 2/2-6K PFC board

5.2 INV board (Inverter Board)

The INV Board includes STS and Inverter. It converts the DC power to a pure sine waveform, in the purpose of less or no transfer time.

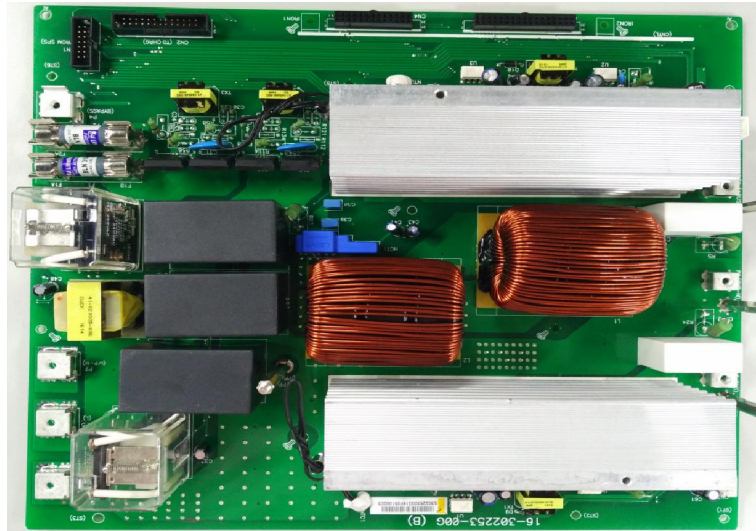


Figure 5.2.1 Arena 1/1&3/1-10K Inverter board

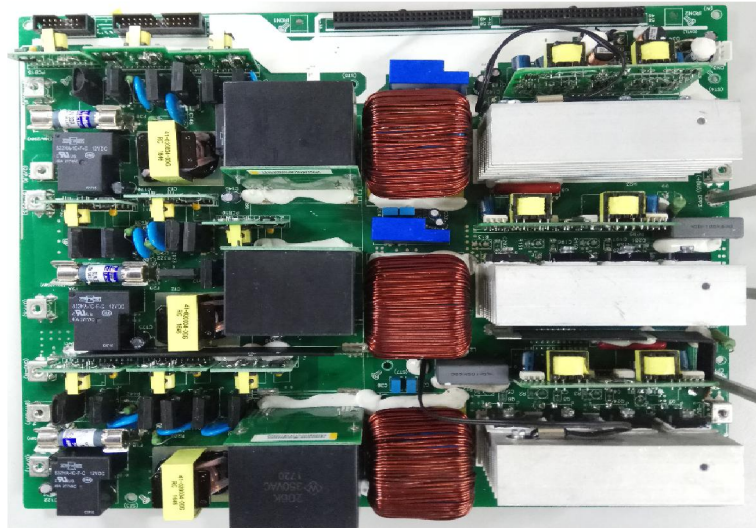


Figure 5.2.2 Arena 3/3-10K Inverter board

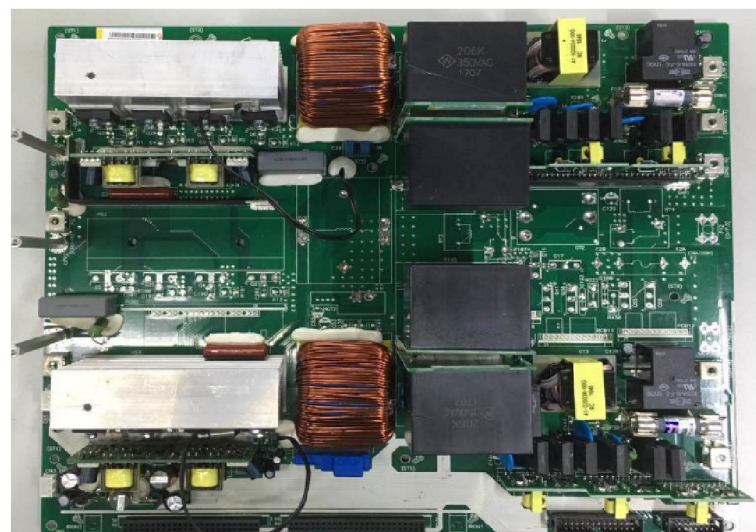


Figure 5.2.3 Arena 2/2-6K Inverter Board

5.3 Charge board

After the UPS is connected to the utility power, the charger will charge the batteries automatically except in Battery mode or during battery test, and the charge current is can be set from 1A~6A via LCD or communication port.

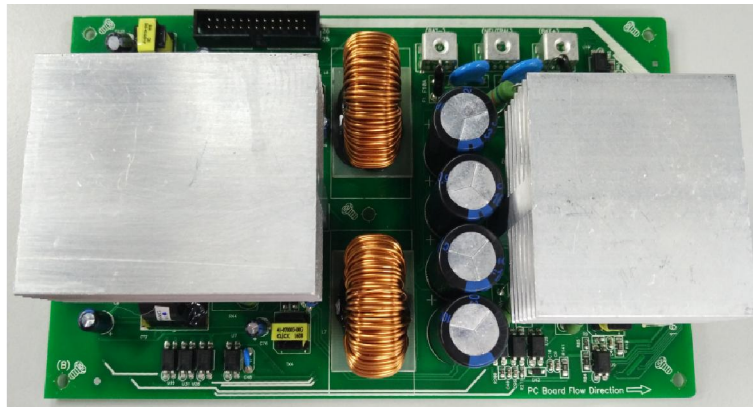


Figure 5.3.1 Arena 1/1&3/1&3/3-10K Charge Board

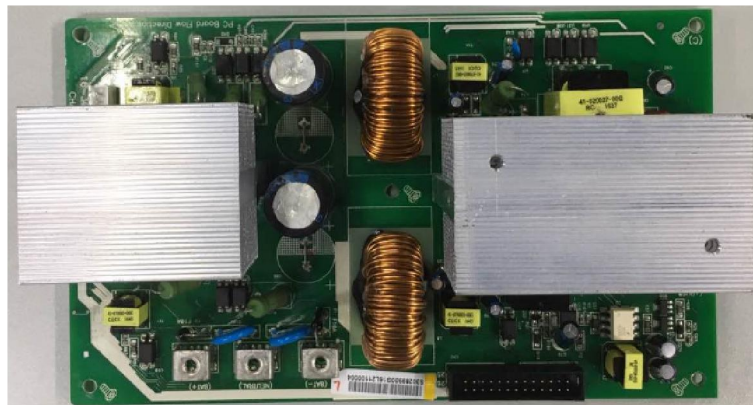


Figure 5.3.2 Arena 2/2-6K Charge Board

5.4 CNTL board (Control board)

The CNTL board is the cerebrum of the UPS system, CNTL board control the action of the semiconductors and other mechanical switches, the display of the LED/LCD, the sound of the buzzer, the communication with the computer, and other important items.

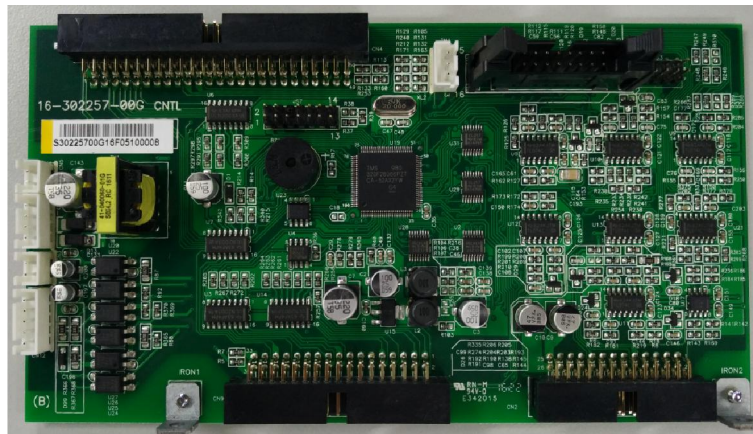


Figure 5.4.1 Arena 1/1&3/1-10K Control board



Figure 5.4.2 Arena 3/3-10K&2/2-6K Control board

5.5 BUS board

The BUS board work as tow stable DC power, storing energy from PFC and passing it to inverter and charger.



Figure 5.5 Bus board

5.6 SPS board (Switch power supply)

The SPS board supplies DC power for the UPS system. The input voltage of the SPS is the battery or AC input voltage.

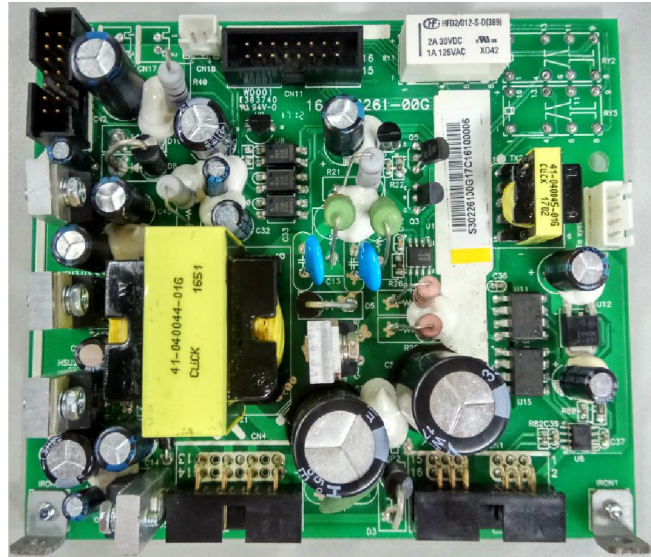


Figure 5.6 SPS board

5.7 IPOP EMI board

The EMI board can prevent the UPS from external electronic/magnetic noise generated by other electronic systems, and also prevent other systems from the noise generated inside of the UPS system.

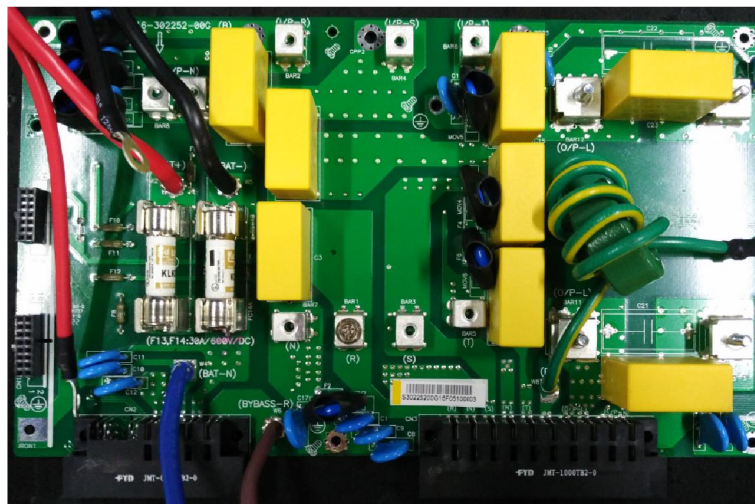


Figure 5.7.1 Arena 1/1&3/1-10K IPOP board

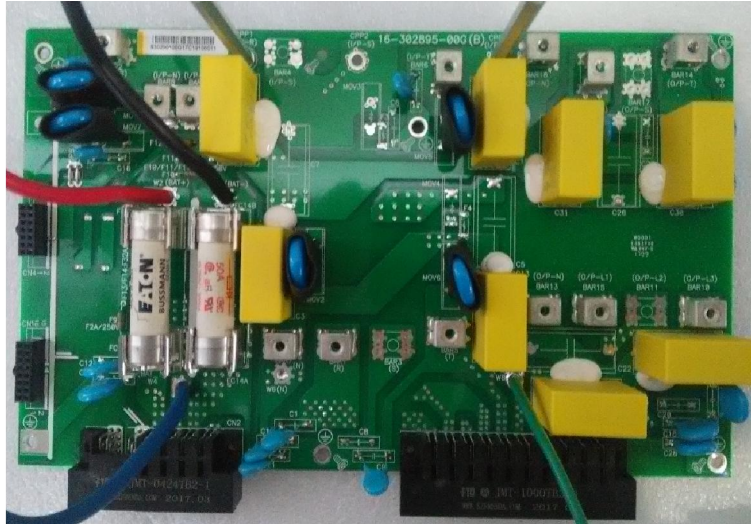


Figure 5.7.2 Arena 3/3-10K IPOP board

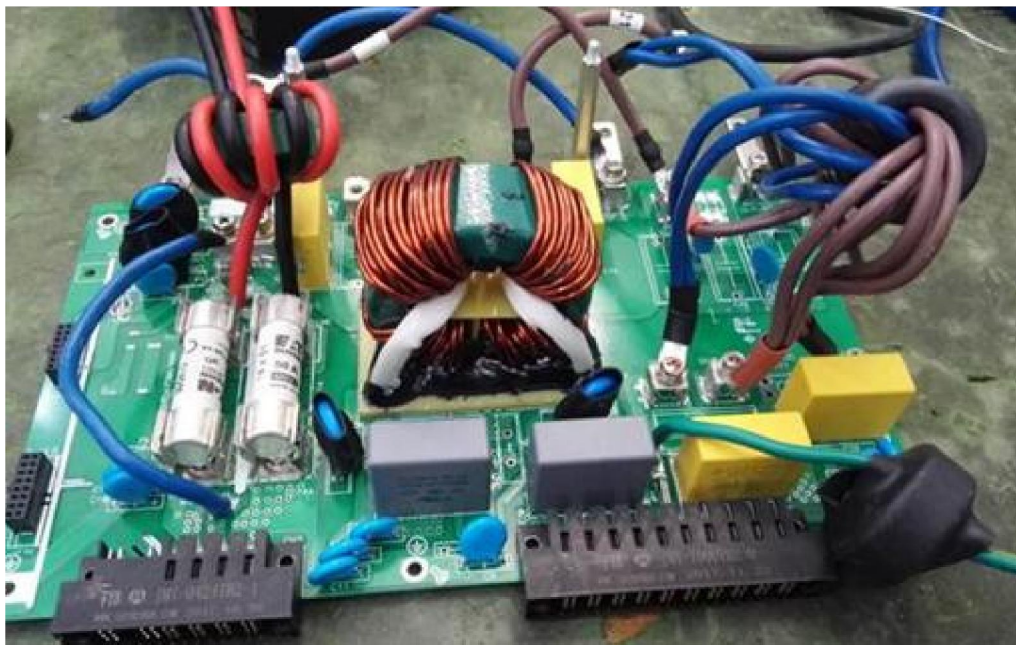


Figure 5.7.3 Arena 2/2-6K IPOP board

5.8 EPO and Communication board

Communication board include EPO and COMM board.

The Communication board provide USB interface to the user, and it also provide one EPO port to cut off the output immediately.

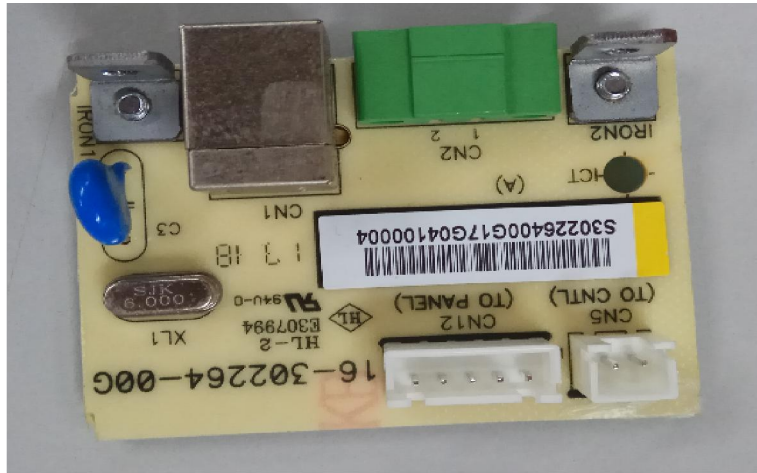


Figure 5.8 Communication board

5.9 SYS LCD Panel board

LCD combine with PCBA, the Panel board provide the LED and LCD display to the user.

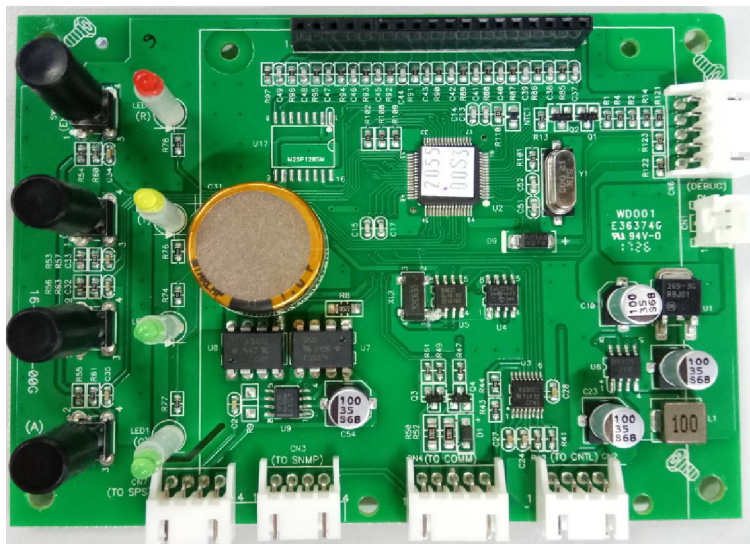


Figure 5.9.1 Panel PCBA



Figure 5.9.2 LCD

5.10 SWITCH board

The AC input disconnect, used for DC start.

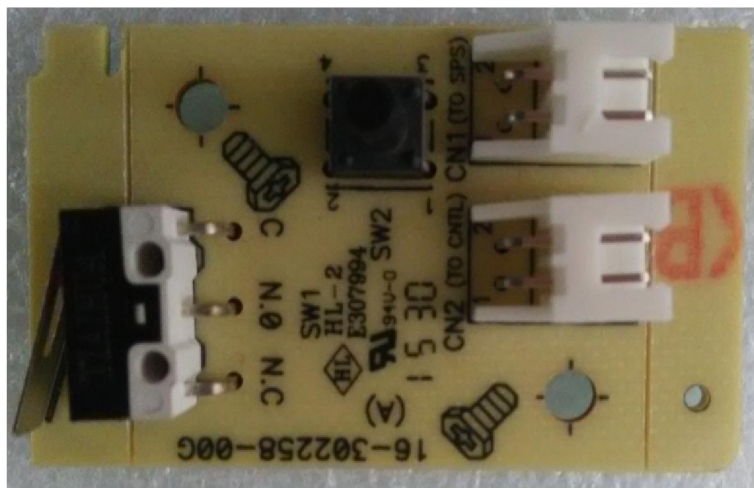


Figure 5.10 Switch board

6. Interface

6.1 Button Operation

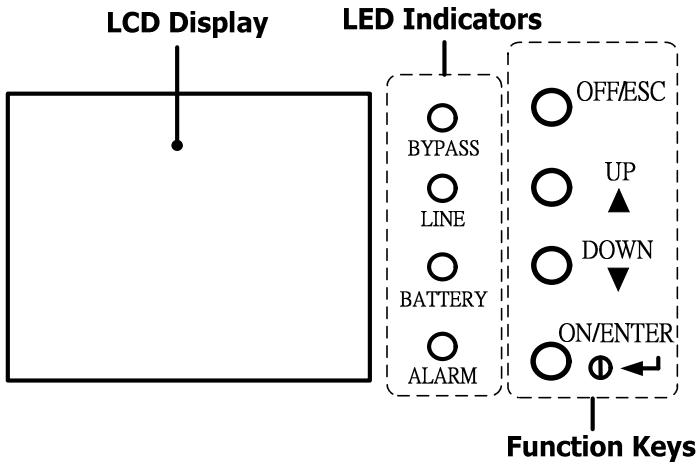


Table 6.1 The function keys for UPS module

Control Key	Description
Battery Starts	<ul style="list-style-type: none"> When the input only connect the battery, press this buttont, awakens the SPS.
ON/ENTER	<ul style="list-style-type: none"> Press this button to turn on the UPS. Or press it to confirm the selection in the menu.
OFF/ESC	<ul style="list-style-type: none"> Press this button to turn off the UPS. Or press it to return to the last menu.
UP	<ul style="list-style-type: none"> Press this button to select the previous item in the menu. Or press this button to jump to previous page in the screen. Or press this button to increase the number in the setting.
DOWN	<ul style="list-style-type: none"> Press this button to select the next item in the menu. Or press this button to jump to next page in the screen. Or press this button to decrease the number in the setting.
UP + DOWN	<ul style="list-style-type: none"> To allow LCD display to rotate 90 automatically, press these two buttons at the same time. This operation is used to configure the UPS in rack or tower display.

6.2 LED display

There are 4 LEDs on front panel to show the UPS working status:

Table 6.2 LED Display in each mode

Mode \ LED	BYPASS	LINE	BATTERY	ALARM
UPS Power On	●	●	●	●
Standby mode	○	○	○	○
Bypass mode	●	○	○	○
Line mode / Converter mode	○	●	○	○
Battery mode	○	○	●	○
Fault mode	○	○	○	●
Battery Test mode	○	●	●	○
ECO mode	●	●	○	○

●: means LED is lighting.

○: means LED is faded.

6.3 LCD Display

6.3.1 LCD Structure

The entire LCD structure is demonstrated as diagram below Figure 1.

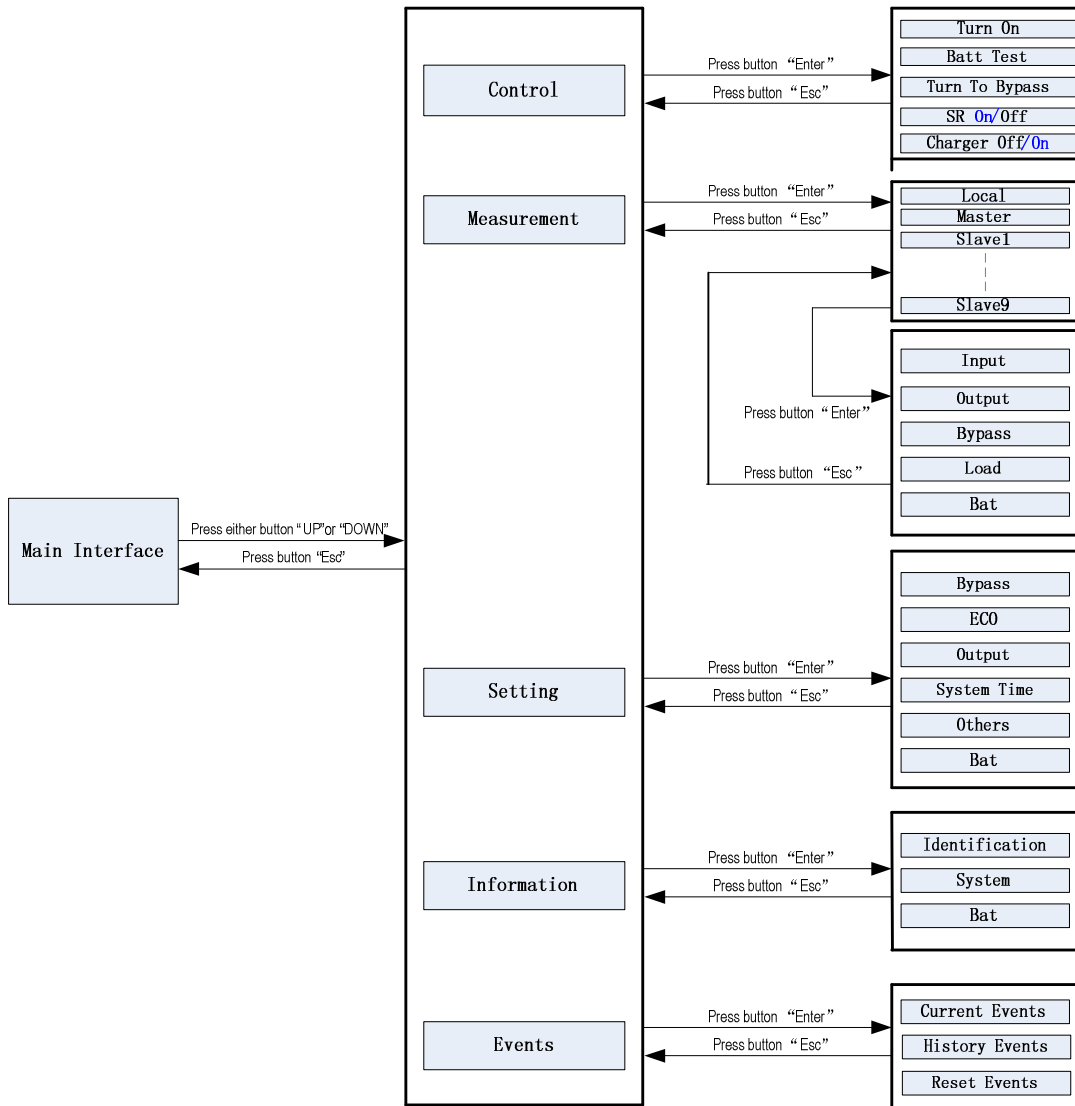
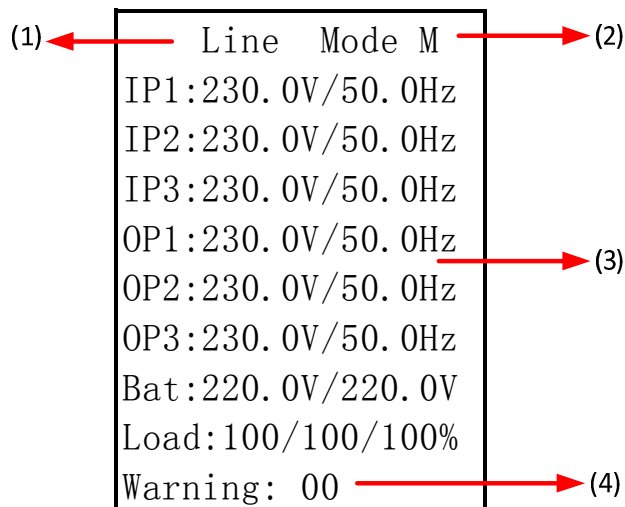


Figure 6.1 LCD Display Structure

6.3.2 Main interface (Home Page)

After initialization, the main screen will display as Figure 2. Main screen is divided into three parts.



- 1) UPS Mode: Current Operation Mode.
- 2) it will display the UPS running status mode and parallel information as refer to below table.

	information
N	New module
M	Master
S<n>	Slave, <n> means the number

- 3) UPS Measurement Data.
- 4) When alarms happen, the warning or fault information will display. When UPS in Battery mode or Battery Test mode, the backup time will display.
- 5) When the front panel is not operated for 2 minutes, the display page will return back to home page;
- 6) Press the "UP" or "DOWN" button to enter the operation menu;
- 7) When it displays home page in LCD, if UPS is in bypass or standby, you could press the "ON/ENTER" button to turn on the UPS to line / converter / ECO / battery mode according to the setting and input status;

7. Trouble Shooting

7.1 Warning status

When Fault LED flashes and the buzzer beeps once every second, it means that there are some problems with UPS. Users can see the warning code from LCD panel and refer to the trouble shooting table to check what problem probably happen.

7.2 Fault mode

- 1) When Fault LED illuminates and the buzzer beeps continuously, it means that there is a fatal error about UPS. Users can get the fault code from LCD panel. Please refer to the trouble shooting table to check what problems probably happen.
- 2) Don't try to turn on the UPS again before the problem is clear. If the problems can't be fixed, please contact the distributor or service people immediately.
- 3) For emergency case, please cut off the connection from utility, external battery, and output

immediately to avoid more risk or danger.

7.3 Trouble shooting table

Most of the fault and warnings need to be released by authorized service personnel. Few of them can be solved by users themselves.

LCD Message	Explanation	Solution
Fault 01:Bus Start Fail	The rectifiers could not start within specified time due to low DC-bus voltage.	Turn off UPS and then restart the UPS. If it fails again, mainly check that the IGBT and SCR etc power components for the PFC and the utility power SCR are well. Meanwhile check that the components on the drive circuit are well.
Fault 02:Bus Over Volt	DC-bus voltage exceeds the maximum voltage.	Mainly check that the IGBT and SCR etc power components for the PFC and the utility power SCR are well. Meanwhile check that the components on the drive circuit are well.
Fault 03:Bus Under Volt	DC-bus voltage is lower than the minimum value.	Mainly check that the IGBT and SCR etc power components for the PFC and the utility power SCR are well. Meanwhile check that the components on the drive circuit are well.
Fault 04:Bus Unbalance	DC-bus voltage is not balanced	Mainly check that the IGBT and SCR etc power components for the PFC and the utility power SCR are well. Meanwhile check that the components on the drive circuit are well.
Fault 05:Bus Volt Vary	DC-bus voltage changes too fast.	Mainly check that the IGBT and SCR etc power components for the PFC and the utility power SCR are well. Meanwhile check that the components on the drive circuit are well.
Fault 06:PFC Over Curr	PFC current is higher than the maximum current.	Mainly check that the IGBT and SCR etc power components for the PFC and the utility power SCR are well. Meanwhile check that the components on the drive circuit are well.
Fault 07:Over Temperature	The temperature in UPS is higher than 85°C. At this time, the UPS is off.	Check if the ambient temperature is over specification.
Fault 08:Batt SCR Short	Battery SCR is short circuited.	Mainly check that the IGBT and SCR etc power components for the PFC and the utility power SCR are well. Meanwhile check that the components on the drive circuit are well.
Fault 11:Inv Start Fail	Inverter voltage cannot reach desired	Turn off UPS and then restart it. If it fails

	voltage within specified time.	again, contact service personnel.
Fault 12:Inv Volt High	Inverter voltage is too high.	Mainly check that the IGBT etc power components are well. Meanwhile check that the components on the drive circuit are well.
Fault 13:Inv Volt Low	Inverter voltage is too low.	Mainly check that the IGBT etc power components are well. Meanwhile check that the components on the drive circuit are well.
Fault 14:Inv Short R	R phase inverter output is short circuited	Mainly check that the R phase IGBT etc power components are well. Meanwhile check that the components on the drive circuit are well.
Fault 15:Inv Short S	S phase inverter output is short circuited	Mainly check that the S phase IGBT etc power components are well. Meanwhile check that the components on the drive circuit are well.
Fault 16:Inv Short T	T phase inverter output is short circuited	Mainly check that the T phase IGBT etc power components are well. Meanwhile check that the components on the drive circuit are well.
Fault 17:Inv Short RS	R-S inverter output is short circuited	Mainly check that the R/S phase IGBT etc power components are well. Meanwhile check that the components on the drive circuit are well.
Fault 18:Inv Short ST	S-T inverter output is short circuited	Mainly check that the S/T phase IGBT etc power components are well. Meanwhile check that the components on the drive circuit are well.
Fault 19:Inv Short TR	T-R inverter output is short circuited	Mainly check that the R/T phase IGBT etc power components are well. Meanwhile check that the components on the drive circuit are well.
Fault 1A:Nega Power R	R phase inverter output negative power is beyond the range.	Check the AC output Voltage, if the actual output voltage and the default voltage difference is bigger.
Fault 1B:Nega Power S	S phase inverter Output Negative Power is beyond the range.	Check the AC output Voltage, if the actual output voltage and the default voltage difference is bigger.
Fault 1C:Nega Power T	T phase inverter Output Negative Power is beyond the range.	Check the AC output Voltage, if the actual output voltage and the default voltage difference is bigger.
Fault 21:Inv STS Open	Inverter relay or STS is open.	Contact service personnel.
Fault 22:Inv STS Short	Inverter relay or STS is short circuited.	Contact service personnel.
Fault 23:Op STS Open	Output relay or STS is open.	Contact service personnel.

Fault 24:Op STS Short	Output relay or STS is short circuited.	Contact service personnel.
Fault 25:Wiring Fail	The wiring is wrong.	Cut off input power, connect to power turn on again.
Fault 26:Bat Fuse Open	Battery fuse is broken.	Replace the battery Fuse.
Fault 27:Charge Short	The battery is short circuited.	Contact service personnel.
Fault 31:Para Comm Fail	The communication between UPS modules is interrupted.	Contact service personnel.
Fault 32:Host Line Fail	The host line between UPS modules fails.	Contact service personnel.
Fault 33:OP Curr Unbal	The load share line between UPS modules fails.	Contact service personnel.
Fault 34:Ver Incompat	The firmware version between UPS modules is incompatible.	Contact service personnel.
Fault 41:DSP Comm Fail	The internal communication in UPS module is interrupted.	Contact service personnel.
Fault 42:Over load	Heavy overload causes UPS fault.	Reduce some load.
Fault 43:Charger Fail	Battery polarity is connected reversely or charger voltage is abnormal.	Contact service personnel.
Fault 44:Model Fault	UPS model is not able to identify.	Contact service personnel.
Fault 45:Mcu Comm Fail	As stated.	Contact service personnel.
Fault 46:CT Satiation	Load current sensor is abnormal.	Contact service personnel.
Fault 47:Fan Fault	The two fans are stuck or broken.	Make sure fans work well when UPS is working.
Warning 01:BatLow	Battery voltage is low.	Charge the battery when the mains is normal.
Warning 02:BatOpen	Battery is not connected.	<ol style="list-style-type: none"> 1. Check battery breaker status. 2. Check if the battery connection is well connected. 3. Check the setting of Nominal Battery voltage. 4. Contact service personnel if necessary
Warning 03:BatPhaseLoss	The voltage between positive and negative battery is different.	Check the battery connection.
Warning 04:LineIpNLoss	Neutral loss	Check if the Neutral connection is well and contact service personnel.
Warning 05:LinePhaseError	As stated.	Check if the Mains phase sequence is correct and contact service personnel.
Warning 06:LineVoltError	As stated.	Check if the input wiring is correct or contact service personnel
Warning 07:LinePhaseFail	As stated.	Check if the input wiring is correct or contact service personnel
Warning 08:OverCharge	Battery voltage is too high.	Check the setting of Nominal Battery voltage and contact service personnel.
Warning 09:ChgFail	Battery voltage is detected as low level. However, the charge is able to work.	Contact service personnel.

Warning 0A:OverTemp	The temperature in UPS is higher than 75°C. At this time, the UPS is still running.	Check if the ambient temperature is over specification. Or contact service personnel.
Warning 0B:PFCCurUnbal	PFC current is unbalance.	Contact service personnel
Warning 0C:FanError	Fan error.	Check if the fan is blocked or contact service personnel.
Warning 0D:LineFuseOpen	Fuse is broken.	Turn off UPS and replace a good one with the broken one. If UPS fails again after you do this, contact the service personnel.
Warning 0E:IICEepromFail	EEPROM operation error	Contact service personnel.
Warning 11:BypassIpNLoss	Neutral loss.	Check if the Neutral connection is well and contact service personnel.
Warning 12:BpsPhaseError	Bypass phase error.	Check if the Bypass phase sequence is correct and contact service personnel.
Warning 13:BpsVoltError	Bypass voltage error.	Check the wiring or contact service personnel
Warning 14:BpsPhaseFail	As stated.	Contact service personnel
Warning 15:OverLoad	In line mode, the connected devices are demanding more power than the UPS can supply.	Reduce some load and check output Load-Capacity in specification.
Warning 16:OverLoadLock	The connected devices are demanding more power than the UPS can supply. UPS will transfer to bypass mode from line mode.	Reduce some load and check output Load-Capacity in specification.
Warning 17:EpoActive	Check the EPO connector.	Check if the connector is loose when EPO acts abnormally.
Warning 18:MaintainOpen	The UPS is in maintenance mode.	Check if the 2-pin plate is not connected to EMBS connector on the back panel of communication module when it acts abnormally.
Warning 19:LineDiff	Each module gets different line voltage when they are in parallel.	Contact service personnel.
Warning 1A:BypassDiff	Each module gets different bypass voltage when they are in parallel.	Contact service personnel.
Warning 1B:InvCurUnbal	As stated.	Contact service personnel.
Warning 1C:BpsUnstable	UPS switches between bypass mode and standby mode five times in 30 minutes due to abnormal utility.	Contact service personnel.
Warning 1D:RedundancyFail	As stated.	Check if redundancy setting is correct or not. Then, contact service personnel.
Warning! Battery Age Alert	Battery life is expired.	Check if the battery has been used over its service age. Or contact service personnel.
Warning! Dry Contact Input	As stated.	Remove the node

Alarm 1		
Warning! Dry Contact Input Alarm 2	As stated.	Remove the node
Warning! Control Module SPS 1 Fault	As stated.	Contact service personnel.
Warning! Control Module SPS 2 Fault	As stated.	Contact service personnel.

Trouble shooting in else cases

Problem	Possible cause	Action
Battery discharging time diminishes	Battery not yet been fully charged.	Keep UPS connected to utility power persistently for more than 10 hours to recharge the batteries.
	UPS overload.	Check the loads and remove some non-critical loads.
	Battery aged.	Replace the batteries.
	Charger failed	Replace the charger.
The UPS cannot power on after pressing the button	The button is pressed too briefly.	Press the button continuously for more than 0.5s.
	Battery is not connected or battery voltage is too low,	Check the battery.
	UPS failure.	Repair the UPS.

7.4 Failure Shooting

In this section, some debug skills are listed to help you finding the failure components and problems as soon as possible. Before continuing the following steps listed, we suggest that you should read problem shooting chart in previous section then check the components listed in section 7.2.4 to find out which block is failure.

Basic Instruments and tools:

- 1、 One computer with RS232 port and one standard RS232 cable;
- 2、 Wire cutters and clamps;
- 3、 One electric soldering iron;
- 4、 One multimeter;
- 5、 One oscilloscope(voltage and current probe needed);
- 6、 Diagonal pliers, snipe nose pliers, cross screwdrivers (150mm/75mm length), straight screwdrivers (75mm length) and PVC insulating tapes etc;
- 7、 Make-self tools include: Balance voltage test equipments, current limiting resistors, tubes and clamp terminals with different specifications;

Parameter Setting Method:

1. Connect the RS232 port of the UPS to the RS232 port of the computer with RS232 cable. Choose the "Start/Program/Accessory/Communication/Hyper terminal" and start Hyper terminal application. Set the COM port for "COM1" and the other setting as Figure 7.1.

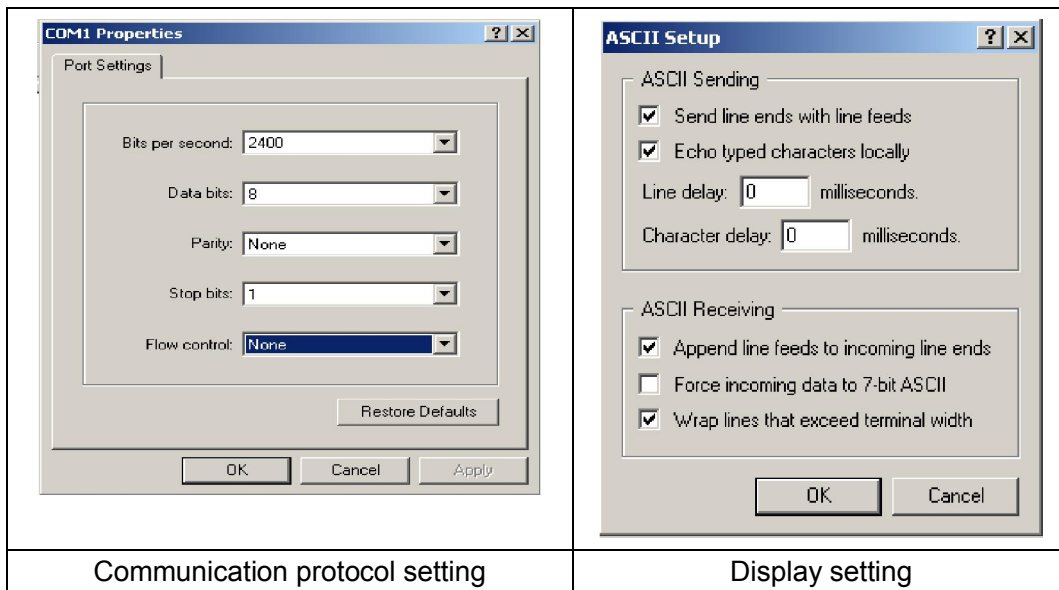


Figure 7.1 Hyper terminal setting

2. After you finished the setting, you can type the command in the command area.
3. +BUS voltage regulation: Type “BUSP+/- XX” command (XX is two digits from 00 to 19), then press the “ENTER” key, +BUS voltage will rise (drop) a little step.
4. -BUS voltage regulation: Type “BUSN+/- XX” command (XX is two digits from 00 to 19), then press the “ENTER” key, -BUS voltage will rise (drop) a little step.
5. INV output voltage regulation: Type “V+/- X” command (X is a digit from 0 to 6), then press the “ENTER” key, output voltage will rise (drop) a little step.
6. INV output voltage setting: Type “VXXX” command (XXX is 208/220/230/240), then press the “ENTER” key, INV output voltage will be set to 208V/220V/230V/240V.
7. charger current setting: Type “XXX” command CHGC XX (XX is from 0 to 6), then press the “ENTER” key, Charger current will be set to 1A~6A

Regulation Process for Single UPS:

1. BUS voltage regulation: When the UPS run into AC mode, measures \pm BUS voltage with the multimeter, and then regulate the \pm BUS voltages to $370\pm 0.5V$ by using BUS regulation command. (BUS voltage can be regulated about 0.5V every point by using BUS regulation command).
2. INV output voltage regulation: When the UPS run into the Inverter mode, measure the output voltage with the multimeter, then regulate the output voltage to $230\pm 0.5V$ by using output voltage regulation command. (INV output voltage can be regulated about 0.8V every point by using output voltage regulation command).

Notes:

1. Be sure the ground of the UPS connect earth safely while parameter regulation.
2. The new assembly UPS must be regulated.
3. The UPS who have been replaced CNTL/PSDR must be regulated again.
4. All the commands use capital letters.
5. All the above parameter regulation cannot be accumulated.
6. All the regulation will be saved in the Flash of the CNTL when UPS shutdown with battery connected.

7.5 Quick start

Before any detail check of UPS, please check the components listed in the following table. This action could help you find problem quickly and make following debug procedures go smoothly.

Note: Make sure that the capacitor voltage is lower than the safety voltage before disassembling any parts before any checking operation

Arena 1/1&3/1&3/3-10K(L) PFC(71-302254-XXG)Section

Circuit Block	Checked components	Component Type	Failure condition
Rectifier	Q4,Q5,Q7,Q8,Q18,Q19,Q21,Q22,Q32,Q33, Q34,Q35	SCR	A-K Short or open
PFC	D7, D8, D15, D16,D25,D26,D33,D34,D43,D44 D51,D52,	Diode	Short or open
	Q3, Q9,Q17,Q23 ,Q31,Q36.	IGBT	C-E short or open
Others	F1, F2, F3.	Fuse	Open

Arena 1/1&3/1-10K(L) INV(71-302253-XXG) Section

Circuit Block	Checked components	Component Type	Failure condition
INV	Q1, Q2, Q3, Q4, Q5, Q6.	IGBT	C-E short or open
O/P.STS	Q21, Q24	SCR	A-K Short or open
ECO.STS	Q15, Q16	SCR	A-K Short or open
Bypass.STS	Q7, Q8	SCR	A-K Short or open
Others	F1, F2	Fuse	Open
	RY1, RY2	Relay	

Arena 3/3-10K(L) INV(71-302894-XXG) Section

Circuit Block	Checked components	Component Type	Failure condition
INV	Q2, Q3, Q4, Q5, Q6, Q21, Q24, Q25, Q26, Q27 Q28, Q29.	IGBT	C-E short or open
ECO.STS	Q30, Q31, Q36, Q41, Q44, Q51.	SCR	A-K Short or open
Bypass.STS	Q7, Q8 , Q11, Q17, Q43, Q46.	SCR	A-K Short or open
O/P.STS	Q54, Q55, Q57, Q58, Q60, Q62.	SCR	A-K Short or open
Others	F1, F2 , F3.	Fuse	open
	RY1, RY2, RY3, RY4, RY5, RY6.	Relay	

Arena 1/1&3/1-10K(L) CHARGER (71-302260-XXG) Section

Circuit Block	Checked components	Component Type	Failure condition
Power Semiconductor	Q31, Q35.	Mosfet	D-S short or open
	Q32, Q36.	SCR	A-K Short or open
	D14, D16, D21, D22.	Diode	Short or open
Others	F1, F2	DC Fuse	Open
	U16, U37.	IC	Vcc short to GND

Arena 1/1&3/1&3/3-10K(L) SPS (71-302261-XXG) Section

Circuit Block	Checked components	Component Type	Failure condition
Power Semiconductor	Q6	Mosfet	D-S short or open
	D3, D5, D6, D7, D8, D21	Power Diode	Short or open
	U12	Power IC	Short or open
	U2, U3, U4, U5.	Power Control IC	I-O Short or open
Others	NTC1	Current-limiting resistance	Open
	U1, U6.	IC	Vcc short to GND

Arena 1/1&3/1-10K(L) IPOPOP EMI(71-302252-XXG) Section

Circuit Block	Checked components	Component Type	Failure condition
Power	D5, D6, D7, D8, D9, D10, D11, D12, D13, D14, D15, D16, D17, D18, D19, D20, D21, D22, D23.	Rectifier Diode	Short or open
Line I/P EMI	F1, F2, F3, F4, F5, F6, F7, F10, F11, F12.	Fuse	Open
BAT I/P EMI	F9, F13, F14.	Fuse	Open
Lightning protection device	MOV1, MOV2, MOV3, MOV4, MOV5, MOV6, MOV7	MOV	Open

Arena 3/3-10K(L) IPOPOP EMI(71-302895-XXG) Section

Circuit Block	Checked components	Component Type	Failure condition
Power	D1, D2, D3, D4, D5, D6, D7, D8, D9, D10, D11, D12, D13, D14, D15, D16, D17, D18, D19, D20, D21, D22, D23.	Rectifier Diode	Short or open
Line I/P EMI	F1, F2, F3, F4, F5, F6, F7, F10, F11, F12.	Fuse	Open
BAT I/P EMI	F9, F13, F14.	Fuse	Open
Lightning protection device	MOV1, MOV2, MOV3, MOV4, MOV5, MOV6, MOV7	MOV	Open

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

7.3.1 Core parameters of PFC section

The most likely problems occur on the PFC section includes: the Fuse open, the IGBT broken, the Diode broken, the SCR broken.

Checked components	Instrument function	Reference Value	Failed condition
F1, F2, F3.	Resistance	<0.5Ω	Open
Q4,Q5,Q7,Q8,Q18,Q19,Q21, Q22,Q32,Q33,Q34,Q35	(A, K)	Resistance	>100MΩ
	(G, K)	Resistance	≈22Ω
Q3, Q9, Q17, Q23, Q31,Q36.	(E, C)	Diode Voltage Droop	≈0.7V~1.3V
	(E, G)	Diode Voltage Droop	≈2.59V
	(G, E)	Resistance	≈51KΩ for 10kVA
D7, D16, D25, D34, D43, D52	Diode Voltage Droop	≈0.368V	Short or open
D8, D15, D26, D33, D44, D51	Diode Voltage Droop	≈0.389V	Short or open

7.3.2 Core parameters of INV section

The most likely problems occur on the PFC section includes: the Fuse open, the IGBT broken, the Diode broken, the SCR broken.

7.3.2.1 Arena 1/1&3/1-10K(L) INV(71-302253-XXG) Section

Checked components		Instrument function	Reference Value	Failed condition
F1, F2.		Resistance	<0.5Ω	Open
Q7, Q8(RY2 disconnect to 12V drive voltage)	(A, K)	Resistance	<0.5Ω	A-K Short or open
	(G, K)	Resistance	≈12Ω	Short or open
Q7, Q8(RY2 connect to 12V drive voltage)	(A, K)	Resistance	>4MΩ	A-K Short or open
	(G, K)	Resistance	≈12Ω	Short or open
Q15, Q16	(A, K)	Resistance	>4MΩ	A-K Short or open
	(G, K)	Resistance	≈12Ω	Short or open
Q21, Q24	(A, K)	Resistance	>4MΩ	A-K Short or open
	(G, K)	Resistance	≈12Ω	Short or open
Q1, Q2, Q5, Q6	(E, C)	Diode Voltage Droop	≈0.36V	Short or open
	(E, G)	Diode Voltage Droop	≈2.77V	Short or open
	(G, E)	Resistance	≈24.8KΩ	Short or open
Q3, Q4	(E, C)	Diode Voltage Droop	≈0.38V	
	(E, G)	Diode Voltage Droop	≈2.89V	
	(G, E)	Resistance	≈49.9KΩ	

7.3.2.2 Arena 3/3-10K(L) INV(71-302894-XXG) Section

Checked components		Instrument function	Reference Value	Failed condition
F1, F2, F3.		Resistance	<0.5Ω	Open
Q7, Q8, Q11, Q17, Q43, Q46. (RY1,RY3,RY5 connect to 12V drive voltage)	(A, K)	Resistance	>4MΩ	A-K Short or open
	(G, K)	Resistance	14~30Ω	Short or open
Q7, Q8, Q11, Q17, Q43, Q46. (RY1,RY3,RY5 disconnect to 12V drive voltage)	(A, K)	Resistance	0.5Ω	A-K Short or open
	(G, K)	Resistance	14~30Ω	Short or open
Q30, Q31, Q36, Q41, Q44, Q51. (RY1,RY3,RY5 connect to 12V drive voltage)	(A, K)	Resistance	0.5Ω	A-K Short or open
	(G, K)	Resistance	14~30Ω	Short or open
Q30, Q31, Q36, Q41, Q44, Q51. (RY1,RY3,RY5 disconnect to 12V drive voltage)	(A, K)	Resistance	>4MΩ	A-K Short or open
	(G, K)	Resistance	14~30Ω	Short or open
Q54, Q55, Q57, Q58, Q60, Q62. (RY2,RY4,RY6 connect to 12V drive voltage)	(A, K)	Resistance	0.5Ω	A-K Short or open
	(G, K)	Resistance	14~30Ω	Short or open
Q54, Q55, Q57, Q58, Q60, Q62. (RY2,RY4,RY6 disconnect to 12V drive voltage)	(A, K)	Resistance	>4MΩ	A-K Short or open
	(G, K)	Resistance	14~30Ω	Short or open
Q2, Q3, Q4, Q5, Q6, Q21, Q24,	(E, C)	Diode Voltage Droop	≈0.38V	Short or open

Q25, Q26, Q27, Q28, Q29	(E, G)	Diode Voltage Droop	≈2.88V	Short or open
	(G, E)	Resistance	≈51KΩ	Short or open

7.3.3 Core parameters of Charge

The most likely problems occur on the Charger section includes: the fuse broken, the MOSFET broken, the Diode broken, the SCR broken.

Checked components		Instrument function	Reference Value	Failed condition
Q31, Q35.	(S, D)	Diode Voltage Droop	≈0.4V	Short or open
	(D, S)	Resistance	≈180KΩ	Short or open
	(G, S)	Resistance	≈10KΩ	Short or open
Q32, Q36.	(A, K)	Resistance	≈400MΩ	A-K Short or open
	(G, K)	Resistance	22Ω	Short or open
D14, D16, D21, D22.		Diode Voltage Droop (6kVA)	≈0.38V	Short or open
F1, F2		Resistance	< 0.5 Ω	Open

8 Test Step

After replace all defected components, following test the steps can be adopted to verify the repair result and the reliability of the UPS.

1. Install all of boards/cable/connector.
2. Check the wiring.
3. Apply DC Power from power source with current limitation function to the battery terminal.
4. Press the "Battery start" button, awakens the SPS, the LCD will be lit and the Fan will rotates, If not, please check the input voltage of the SPS, if the voltage is the DC source output voltage, please repair the SPS again.
5. According to the sequence press the "ON/ENTER"→"UP or DOWN"→"ON/ENTER" button, then UPS should be DC started, If UPS does not start successfully, please repair the INV, PFC again.
6. If UPS does not start up for several trying or DC source is on current-limit state continuously, there must be some defected components exists. Please follow trouble-shooting chart to debug again.
7. Turn off the UPS, connect AC power to the UPS, turn on the UPS, if fail you may have start one new round of trouble shooting.
8. Check and adjust charge voltage.
9. Check the output voltage waveform and DC-offset voltage, at no-load and full load condition.

