GTEC UPS MODEL:

AP160N 6/10 kVA

Rack/Tower

SERVICE MANUAL

www.gtec-power.eu

Content

1. General Information of This Document

1.1 Getting Start

This is a service manual for AP160N 6K/10K Rack/Tower, intend to help service personal perform maintenance and repair service.

If you want to know:

? **Functional block of the UPS, and operating principle thereof,** please refer to Construction of the Product.

? **What's wrong with the UPS and How to solve the problem**, please refer to Trouble Shooting.

? **Basic information about the product, install and operation instruction,** you may please refer to USER MANUAL

1.2 Conventions

This service manual uses the following conventions to alert you some important information for safe operation and quick working.

Warning: Denotes a procedure or operation, which, if not perform correctly, may result in personal injury. **Be sure not to continue operation until indicated conditions are fully understood and met**.

Caution: Denotes a procedure or operation, which, if not perform correctly, may cause damage to the UPS. **Be sure not to continue operation until indicated conditions are fully understood and met**.

Information and Tips: There are some tips and skills after this symbol. During service operations, these skills may help you quickly finish your work.

1.3 Important Safety Instructions

1. **For qualified service personnel only.**
2. **DO NOT** performs any internal service or adjustment of this product unless another person is capable of rendering first aid and resuscitation is present.
3. Dangerous voltage exists at several points in this product. To avoid personal injury, don't touch any exposed connections or components while UPS is active.

4. Turn off the UPS and disconnect input power cord before removing outside protective cover.
5. AC voltage is always present if the input AC power is still available.
6. High voltage may present at DC capacitors. Before opening the outside cover, wait for at least five minutes after turning off the UPS. Discharge the remaining energy at DC capacitors with resistor before disassembling the power board.
7. Verify input source (voltage and frequency) is within the maximum range before service.

1. DO NOT short-circuit internal batteries

2. After service, verify the polarity of batteries, fasten all screws and connectors before restarting the UPS

After opening the cover, please always check the tightness of all wires, connectors, and screws first. Then check if there are any de-colored components inside

TO DISCHARGE the energy of charger capacitor, **after disconnect the battery from PSDR/Charger**, you can use a 300Ω/10W resistor contact **BAT (+) terminal** and **BAT (-)** terminal for discharge battery filter capacitor

2 System view

2.1 Outlook

On line UPS as rack installation:

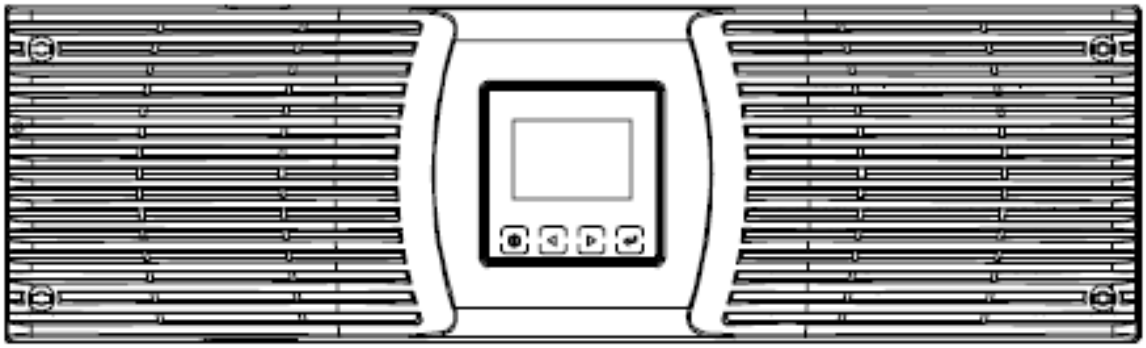


Fig2.1: On Line R/T 6K

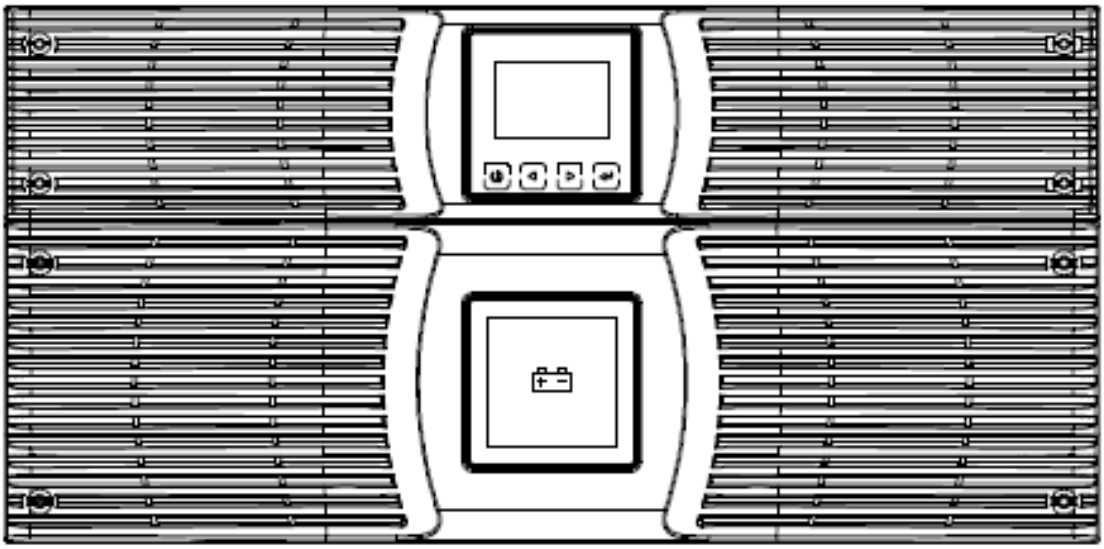


Fig2.2: On Line R/T 10K

On line UPS as Tower installation:

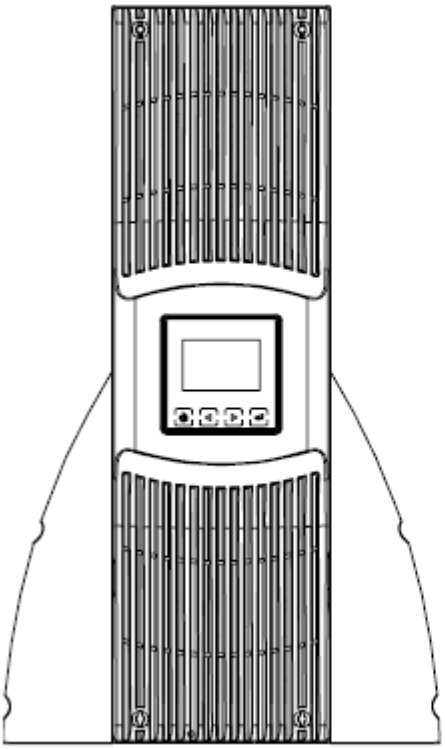


Fig2.3: On line R/T 6K

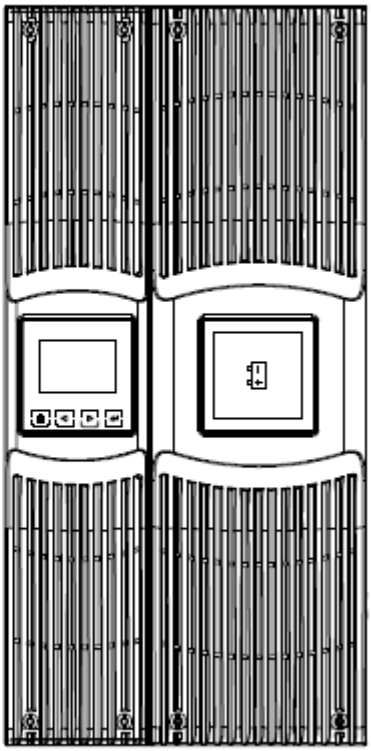


Fig2.4: On line R/T 10K

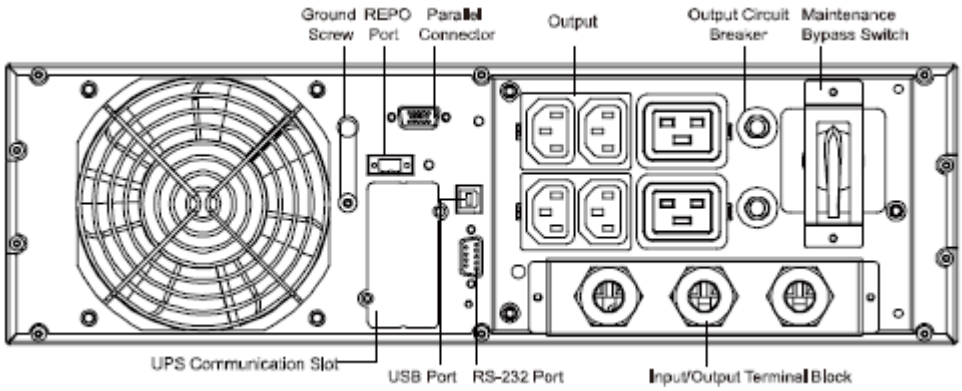


Fig2.5：R/T 6K Rear Panel

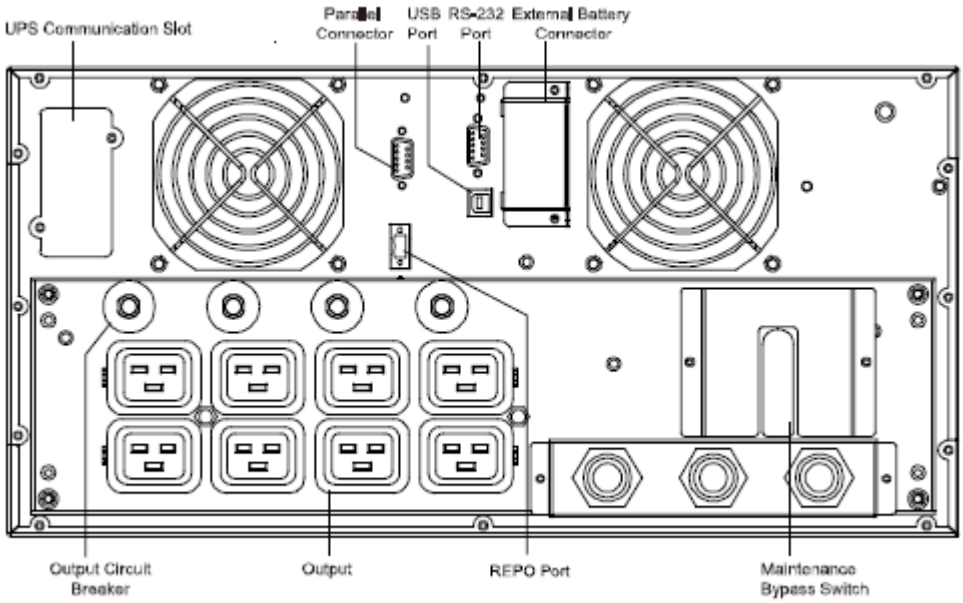


Fig2.6: R/T 10K Rear Panel

2.2 Frame Structure

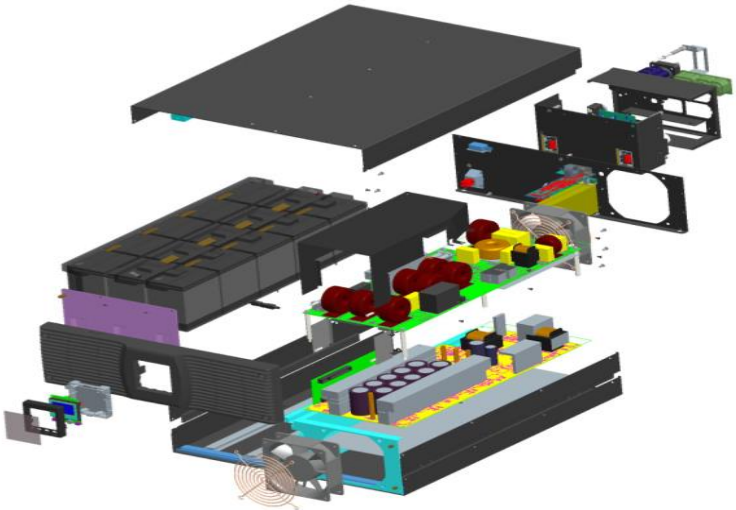


Fig2.7: R/T 6K Frame Structure

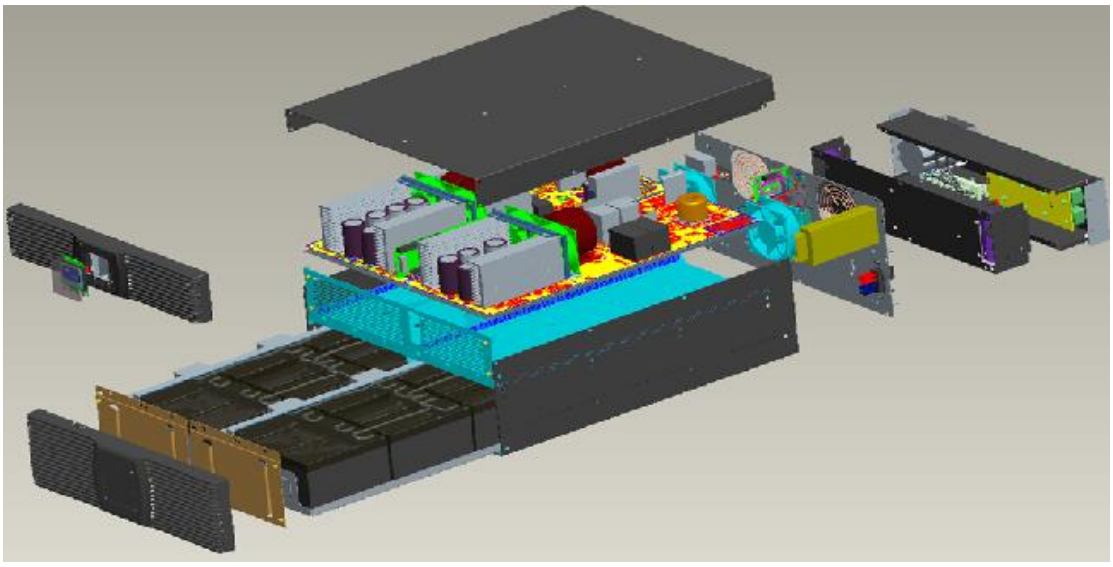


Fig2.8：R/T10K Frame Structure

2.3 Specification

1 Inverter Output			
No.	**Item**	**Specification/Function**	**Standards/Comments**
1.1	Rated Appearance Power	6000/10000VA	
1.2	Maximum Active Power	5400/9000W	
1.3	Power Factor	0.9	
1.5	Load Power Factor Range	0.5~1	For 6-10KVA models
1.6	Output Voltage Rates	208/220/230/240V	
1.7	Voltage Accuracy	±1 %	With Calibration, The minimum calibrating step is 0.1V
1.9	Voltage Distortion THD%	<5%	IEC62040-3 Reference nonlinear load
		<2%	Linear load
1.10	DC Offset	±100 mV	
1.11	Load Crest Ratio	3:1 max	
1.12	Frequency Auto Detection Function	Default: On	Manual setting output Frequency Adopt previous record in overlap freq
1.13	Output Frequency	45 - 55 Hz	Line/Bat mode For 50Hz system, Maximum range synchronize with BPS
		54~66 Hz	Line/Bat mode For 60Hz system, Maximum range synchronize with BPS
		Adjustable	Line mode Defined by user within the maximum range

1.15	Overload Warning	>102% Pn	Pn: Nominal output capacity.
1.16	Overload Warning Comeback	<100% Pn	
1.17	Overload Capability	Line Mode 2mins 102% ~ 130% 30s 130% ~ 150% 100ms >150%	Intelligent overload management Overload endurance has linear relation ship with overload degree. After over load time up, transfer to bypass. Bypass Disable option can be active via software. In this case the bypass will be unavailable and output will be cut off.
		Battery Mode 10s 102% ~ 130% 100ms >130%	Transfer to bypass if bypass is OK, else cut off the output.
1.18	Auto Re-transfer	Default: Yes	The UPS transfer from bypass mode to normal mode after over load disappears. (Recover to 70%) Auto re-transfer function can be disabled via dedicated software.
1.19	Over Load Memory	Default: Yes	Overload time up occurs 3 times in 30min, the UPS will lock on bypass mode and keep alarming. This function can be disabled by software.
1.20	Maximum Voltage deviation responding to resistive load step	±9%	0%->100%->0% R Load
		±6%	20%->100%->20% R Load
1.21	Recovery time after reference Non-linear load step	100ms	IEC 62040-3 reference Non-linear load 0→100%-->0% step loading, output voltage recovery to 90% of nominal voltage
1.22	Transient Response	IEC62040-3 Classification 1	IEC62040-3 Define Test Method: 1. Resistive load step: 20%-100%-20%, counting output voltage by half cycle 2. Reference Non_linear Load step: 33%-->66%-->100%, Counting RCD Load capacitor voltage.
1.23	Output Short-circuit Protection	Yes	1. In INV mode, the inverter will limit the output current by software, and make the protection action according to the setting of SCC (Short-Circuit Clearance) function. 2. In Bypass or ECO mode, output enable until the output fuse or input breaker trip.

1.24	Short-Circuit Clearance Function	Selectable (Default: Enable)	This function can be set via software. 1. Enable: inverter continues output 100% of rating current for 4s, if the output voltage recover to >=50% of the nominal output voltage (RMS), the UPS stay on the original mode (INV mode), otherwise, cut off the output. 2. Disable: inverter limits the current within 100ms, and then fault, cutting off the output.
1.25	Half wave rectifier load capability	Capable of carry half-wave load of 50% of rated capacity	Taking half wave rectifier load, customer should confirm the load capacity of the UPS which displayed in the LCD less than 50% of rated capacity.
2 Parallel operation Capability (Option)			
No.	**Item**	**Specification/Function**	**Standards/Comments**
2.1	Parallel Operation Capability	UP to 2 units	
2.2	Power Unbalance Ratio	<3% @ Pload>80%	$P_R\% = \frac{P_i - P_{AVE}}{P_{AVE}} \times 100\%$ $P_{AVE} = \frac{1}{N} P_{LOAD}$
2.3	Circulation Current under No Load Condition	1A	
2.4	Parallel System Output Power	Derating to 90%	$\sum_{n=1}^{N} P_n \cdot 90\%$
3 Efficiency			
No.	**Item**	**Specification/Function**	**Standards/Comments**
3.1	Efficiency	>92%	6kVA model Line mode, R full load
		>93%	10kVA model Line mode, R full load
		>89%	6K BAT Mode
		>90%	10K BAT Mode
		>96%	6kVA HE Mode
		>97%	10kVA HE Mode
3.2	Efficiency Curve	TBD	Efficiency at difference load level

4 Transfer Time			
No.	**Item**	**Specification/Function**	**Standards/Comments**
4.1	Transfer Time	0ms	Normal Transfer among Line, Battery, Bypass Mode.
		10ms Break-time	Force to Transfer to bypass with Mains2 out of tolerant or without phase lock
		<10ms	HE to battery transfer time
5 Mains Input			
No.	**Item**	**Specification/Function**	**Standards/Comments**
5.1	Input Topology	Single phase Dual input with ground	Bypass can be separated for source to rectifier
5.2	Input Wiring	1 Ph (L1,L2/N)+ PE	L1 for Rectifier, L2 for Bypass
5.3	Nominal Input Voltage	200/208/220/230/240V	
5.4	Nominal Input Current		
5.5	Input Voltage Range	120-276V	1. Derating to 50% @120V input. 2. The range can be set via software.
5.6	Line Low Loss	176V	Full load
		$120\text{V}+k\cdot(\text{Power}\%-50\%)$	$k=\frac{176-120}{100\%-50\%.}$
5.7	Line High Loss	276V	
5.8	Line Low Comeback	Line Low Loss + 10V	
5.9	Line High Comeback	Line High Loss -10V	
5.10	Line Low Turn On	130V	
5.11	Line High Turn On	266V	
5.12	Voltage Detection Tolerance	±3%	
5.13	Input Frequency Range	45Hz– 55 Hz	For 50Hz System
5.14	Freq. Low Loss	45 Hz	
5.15	Freq. Low Comeback	Freq. Low Loss + 0.5 Hz	
5.16	Freq. High Loss	55 Hz	
5.17	Freq. High Comeback	Freq. High Loss - 0.5 Hz	
5.18	Input Frequency Range	54 Hz – 66 Hz	For 60Hz System
5.19	Freq. Low Loss	54 Hz	
5.20	Freq. Low Comeback	Freq. Low Loss + 0.5 Hz	
5.21	Freq. High Loss	66 Hz	
5.22	Freq. High Comeback	Freq. High Loss - 0.5 Hz	

5.23	Frequency System Auto Detection Option	Default setting: Yes	Could be DISABLE via dedicated software
5.24	Frequency Detection Tolerance	±0.1 Hz	
5.25	Input Current Distortion THDi%	< 5 %	Test condition: IEC61000-3-4 Nominal input voltage, with nominal load, Battery full charged
5.26	Input Power Factor	≥ 0,99 @100% Nominal Load ≥ 0,98 @50% Nominal Load ≥ 0,95 @25% Nominal Load	
5.27	Inrush Limitation	$8*I_{RMS\_Nom}$	
5.28	Current Protection	Mains input protected by input circuit breaker and Fuse	Breaker need to be added by customer
6 Input AC Source Compatibility			
No.	**Item**	**Specification/Function**	**Standards/Comments**
6.1	Generator Set	1.3 x UPS Rating Power	
6.2	Voltage Variation	IEC 61000-4-11	
6.3	Distorted Mains Input	IEC 61000-4-13	
7 Battery Input			
No.	**Item**	**Specification/Function**	**Standards/Comments**
7.1	Battery Type	VRLA, 12V	
7.2	Nominal Battery Input Voltage	15*12V	6kVA
		20*12V	10kVA
7.3	Battery Capacity	5AH or equivalent	6kVA standard model
		9AH or equivalent	10kVA standard model
7.4	Maximum External battery Capacity	No limitation	
7.5	Backup Time	>7mins	6kVA Model @2.7kW
		>5mins	6kVA Model @4.2kW
		>3mins	6kVA Model @4.8KW
		>2.5mins	6kVA Model @5.4kW
		>7mins	10kVA Model @5kW
		>5.5mins	10kVA Model @7kW
		>4.5mins	10kVA Model @8kW
		>3.5mins	10kVA Model @9kW
7.6	Battery Warning Voltage	11.4V/pc	
7.7	Battery Warning Comeback Voltage	Battery warning voltage + 0.5V	

7.8	Battery Shutdown Voltage	10.5V/pcs	With EXB Automatic variation according to Battery discharge current (Load level).
		10.5V/pcs (0～30% Load)	Standard model. Automatic Variation according to Load level Subject to over current protection and over temperature protection under low battery voltage
		10.2V/pcs (30～70% Load)	
		9.5V/pcs (＞70% Load)	
		Setting voltage >8V/pcs for 6-10KVA (Default OFF)	Deep Discharge Function: The UPS will continue discharge until minimum limitation for maximum backup time, regardless the life time of the battery, but subject to over current protection and over temperature protection under low battery voltage.
7.9	Battery Test	Weekly checking Configurable by software	Battery disconnect detection include
7.10	Maximum Battery Leakage Current	300uA	
8 Battery Charger			
No.	**Item**	**Specification/Function**	**Standards/Comments**
8.1	Battery recharge method	ABM	
8.2	Input Voltage Range	160V~276V	Full output power range
		120V~160V	Charging current derating to 50% @ 120V
8.3	Nominal Recharging Current	1A (± 10%)	6kVA
		1.7A (± 10%)	10kVA
8.4	Recharge Time for internal Bat	<3hours to 90%	After Nominal load discharged
8.5	Rated Charge Voltage	14.4V/pc	Rapid recharge phase
		13.65V/pc	Floating charge phase
8.6	Charge Voltage Accuracy	±1%	
8.7	Temperature compensation	Yes	20mv/pc/ºC No temperature Sensor for battery, refer to ventilation inlet temperature
8.8	Over Charger Protection Threshold	14.7V/pc	Stop charger
9 Bypass			

No.	Item	Specification/Function	Standards/Comments
9.1	Bypass type	STS with Relay	
9.2	Bypass Output Voltage Range	184~264V	Default value
		120~276V	Maximum range can be set by user via dedicated software
9.3	Bypass Output Frequency Range	±10%	Default value
		40~70Hz	Maximum range can be set by user via dedicated software
9.4	Bypass Over Load Capability	Permanent working <130% 1min 130%<180%	
9.5	Bypass Short Circuit Protection	N.F.B	N.F.B is required to be added by end user
9.6	Maintenance Bypass	Yes	Integrated with PDU
10 HE Mode			
No.	**Item**	**Specification/Function**	**Standards/Comments**
10.1	Input voltage range	Rated Voltage ± 5%	Default value
		Rated Voltage ± 10%	Maximum range can be set by user via dedicated software
10.2	Input frequency range	50/60Hz ± 5%	Default value
10.3	Over Load Capability	Same as Bypass	
10.4	Short Circuit Protection	Same as Bypass	
11. Frequency Converter Mode			
11.1	Frequency Converter Mode	Default Disable	Frequency Converter mode can be Enable by the user setting
11.2	Output Frequency	50/60Hz	Select by user
11.3	Output capability	80% Derating	
11.4	Bypass Output	Disable	
11.5	Input Frequency Range	40 Hz – 70 Hz	For Frequency Converter Mode(CVCF Mode)
11.6	Freq. Low Loss	40 Hz	
11.7	Freq. Low Comeback	Freq. Low Loss + 0.5 Hz	
11.8	Freq. High Loss	70 Hz	
11.9	Freq. High Comeback	Freq. High Loss - 0.5 Hz	
12 Display Interface			
No.	**Item**	**Specification/Function**	**Standards/Comments**
LCD Spec			
12.2	MULTI-Language Support	English default	According the requirement

13 Communication Interface			
No.	**Item**	**Specification/Function**	**Standards/Comments**
13.1	RS232	DB-9 Female	Standard configuration
	Protocol	Ptec. Q Protocol	
	Baud rate	9600	
13.2	USB 1.1		Standard configuration (independent SCI port)
14.3	Intelligent Slot	SNMP card	Optional (independent SCI port)
		RS485 card (CMC)	
		AS400 card	
14 Regulatory Standards			
No.	**Item**	**Specification/Function**	**Standards/Comments**
14.1	ESD	IEC 61000-4-2 Level 4	
14.2	RS	IEC 61000-4-3 Level 3	
14.3	EFT	IEC 61000-4-4 Level 4	
14.4	Surge	IEC 61000-4-5 Level 4	
14.5	Conduction	IEC 62040-2 Category C2	
14.6	Radiation	IEC 62040-2 Category C2	
14.7	Safety	Design for TUV, UL IEC 60950-1 IEC 62040-1-1	
14.8	Insulation & Dielectric Rigidity	IEC 62040-1-1 IEC 62040-1-2	
14.9	Leakage Current	IEC 62040-1-1	
14.10	Transportation	ETS 300019-2-2 class2.3	
14.11	Protection	IP20 (static)	
14.12	Other Standard	Design for TUV, UL	
15 Input/Output Connector			
No.	**Item**	**Specification/Function**	**Standards/Comments**
15.1	Inlet	Hard Wire terminal Block	
15.2	Outlet	Hard Wire terminal Block + 2 IEC C19 + 4 IEC C16	Can be customized according to requirement
16 Miscellaneous Function			
No.	**Item**	**Specification/Function**	**Standards/Comments**
16.1	Intelligent Fans Speed control	Yes	Fans speed adjust according to load level and ambient temperature to achieve optimum acoustic noise

16.2	EPO Function	Default setting Enable	System Halt, when EPO switch is active
16.3	Auto restart function	Default Yes	The UPS restarts automatically more than three times in 30mins from BPS mode, it would be locked in BPS mode

3. Construction of the Product

3.1Function Block Diagram

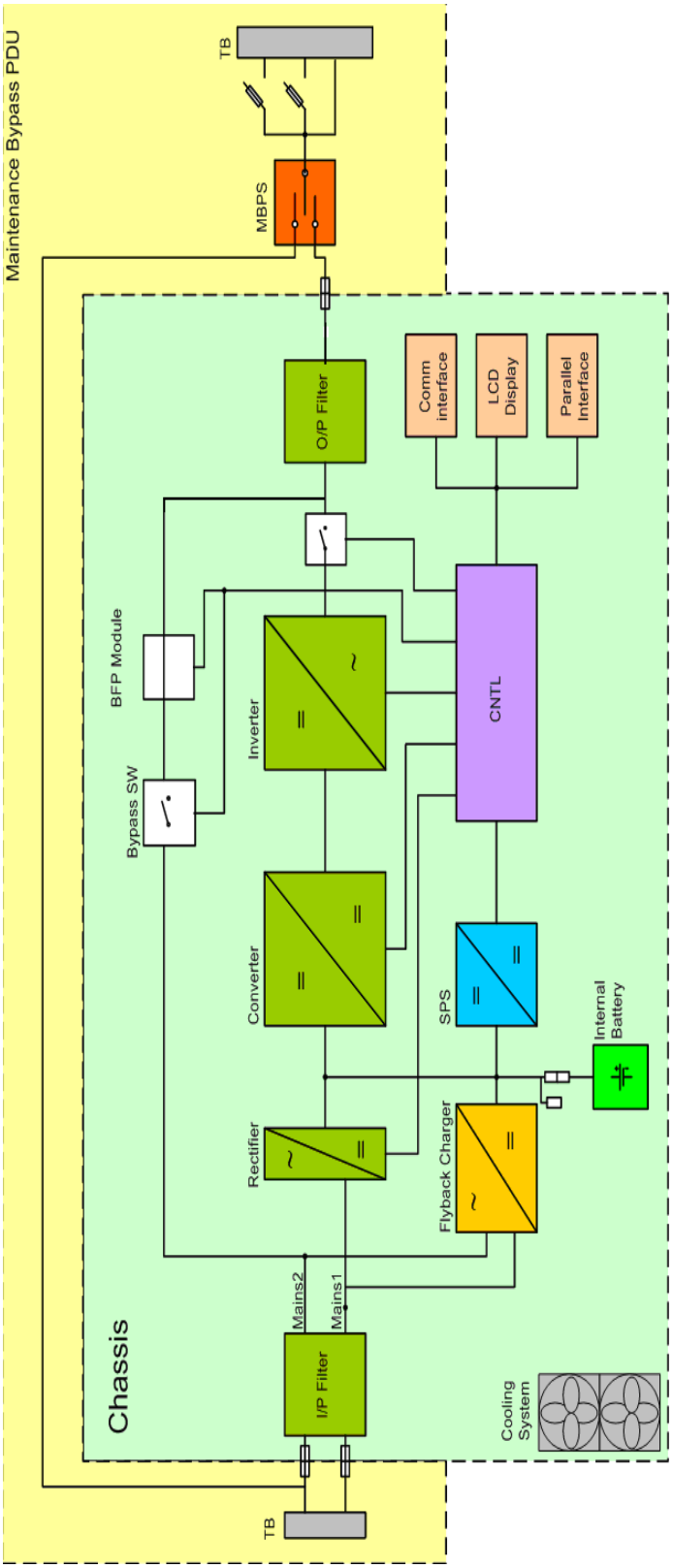


Fig3.1: R/T 6K/10K Function Block Diagram

AP160N 6K/10K Rack/Tower consists of PSDR, PDU, CNTL, Fan, LCD, Parallel card, Communication interface, and so on.

3.2 PSDR

PSDR consists of rectifier, Boost, Inverter, charger, SPS, I/P EMI and O/P EMI, and so on. Their topologies are showed below.

- On line double conversion, without galvanic insulation.
- Dual input, accept separated bypass source
- Double Boost rectifier with Power Factor Correction (PFC) for all models.
- I type 3 Level inverter
- Charger by Fly-back for 6K, charger by Forward-Flyback for 10K
- Internal automatic bypass

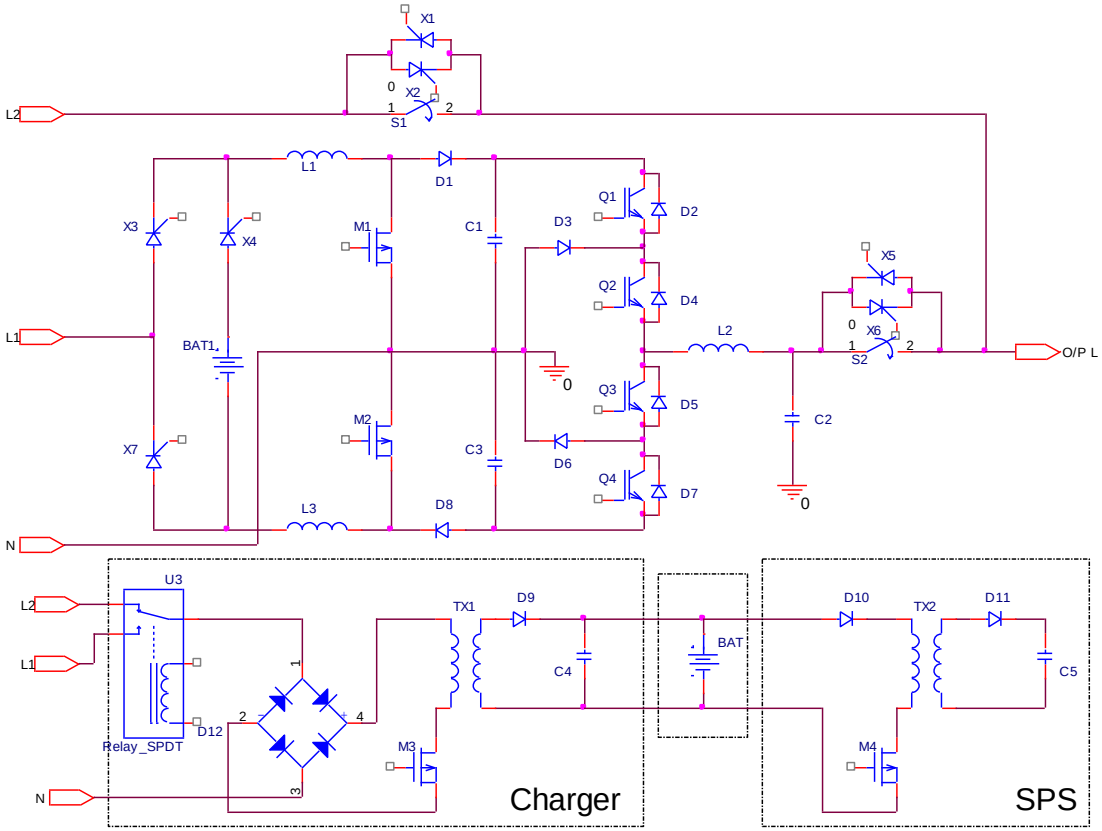


Fig3.2：R/T 6K Power Topology

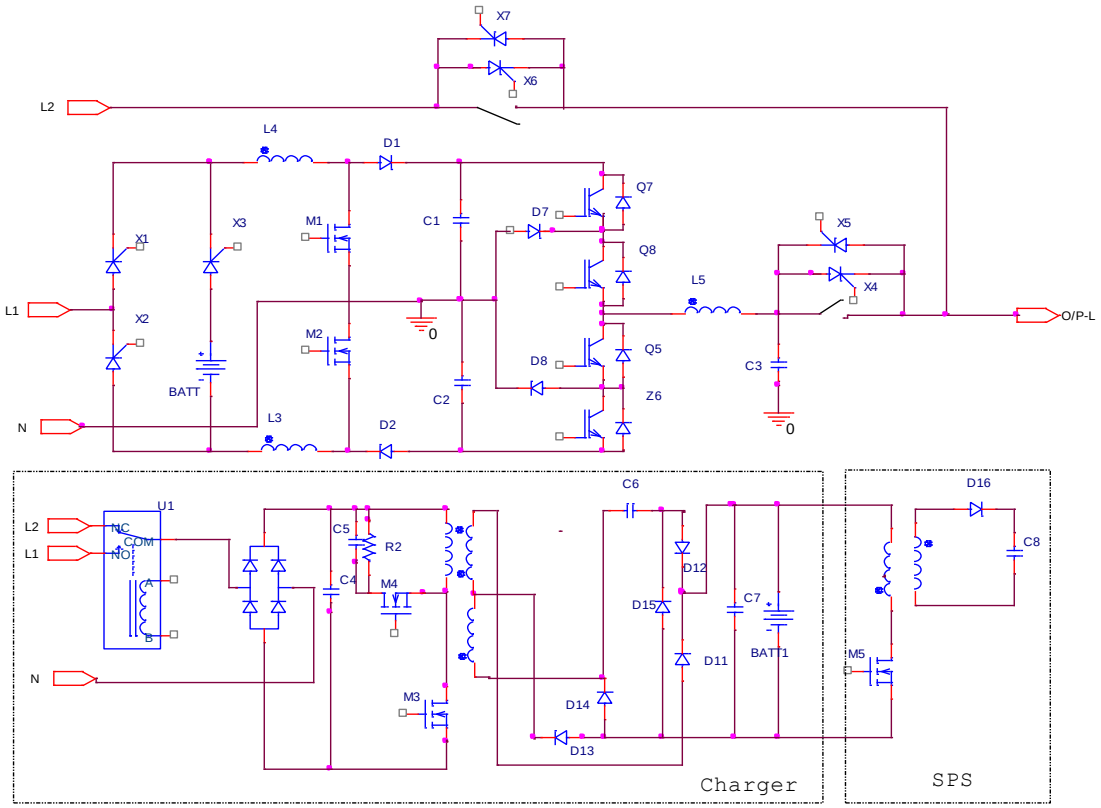


Fig3.3：R/T 10K Power Topology

3.2.1 Rectifier and power factor correction

In line mode, the input AC power is rectifier by input SCR. Then the DSP controller makes the input current and voltage in phase and therefore achieves a high input power factor.

3.2.2 Booster

In case the AC mains interrupt or out of tolerance range, UPS transfer to battery mode. BOOST converter boosts the DC power from the battery to maintain the DC-BUS voltage. The converter works to boost bus voltage to 350~370Vdc.

3.2.3 Inverter sub-system

The UPS transfers +/- DC bus voltages to the AC output voltage through an inverter of three-level inverter circuit. At normal operation, to construct a high frequency (19.2KHz) PWM inverter, the drivers receive switching signals from CPU PWM generation circuit through an IGBT Drive Board to trigger the upper IGBT and the lower IGBT alternately. The output of IGBT is filtered by a LC circuit to reduce the output voltage harmonic distortion.

3.2.4 Charger board

The input of the charger is connected to mains 1 or mains 2. The charge voltage for 6K is 204.75VDC and charge current is 1A. The charge voltage for 10K is 273V and charge current is 1.7A.

3.2.5 SPS

The system power supply offers power for ups system. The input of SPS is battery or the charger output. SPS offers +5Vdc, +12Vdc, ±15Vdc，high frequency and low level AC signal(H.F power), Fan drive voltage.

3.2.6 EMI board

All EMI chokes are integrated on PSDR board, input EMI choke is located between input and PFC, output EMI choke is located between output and terminal block.

3.3 Control board

The Control Board (CNTL) is can be regards the brains of the UPS, in charge of signal detecting, measurement, processing, timing control, inverter operating control, protection, communication. CNTL is composed of following major circuits as following.

(1) CPU Central Processor Unit, DSP Motorola 8356
(2) Signal conditioning circuit
(3) Regulation & Protection circuit
(4) Output buffering circuit
(5) Communication interface

Due to the high level integration, the control board is not desired to maintenance or repair out of manufacture factory. There are two methods to identify the status of global controller. The first one is to test with test fixture; the second is to test the global controller on a PSDR that has been verified OK.

3.4 Parallel board (Option)

The Parallel Board (PARL) is used for parallel communication when the UPS system is running in parallel mode.

3.5Communication interface

The communication interface provides a means for using computer to manage the UPS, on the rear panel of the UPS, a standard RS232 port and a USB port and an intelligent slot are provided.

With dedicated software, output voltage, frequency can be set via the RS232 port or USB port. And status of the UPS can be monitor.

The intelligent slot can accept SMNP, AS400, and for more flexible application solution.

3.6 REPO

The Remote Emergence Power Off interface provides an emergence power off function. When the REPO function is enabled, once the EPO port is pulled out, the UPS would shut off the output and enter into EPO mode, and the UPS would not respond anything command unless the port is plugged back.

4 Trouble Shooting

When UPS is alarm or fault, please refer the following service procedure.

1. Check the UPS status by LCD panel display, or listen to the end user description
2. Identify the failure part/boards with the help of failure identify flowchart.
3. Observe the failure board, Static checking
4. Replace the failure components
5. Static checking
6. Power up checking
7. Test after repair.

Following section will help service person to solve the most problems.

4.1 LCD panel display and Diagnoses

4.1.1 LCD operation

The UPS has a four-button graphical LCD with dual color backlight. Standard backlight is used to light up the display with white text and a blue background. When the UPS has a critical alarm or fault, the backlight changes the text dark amber and the background to amber.

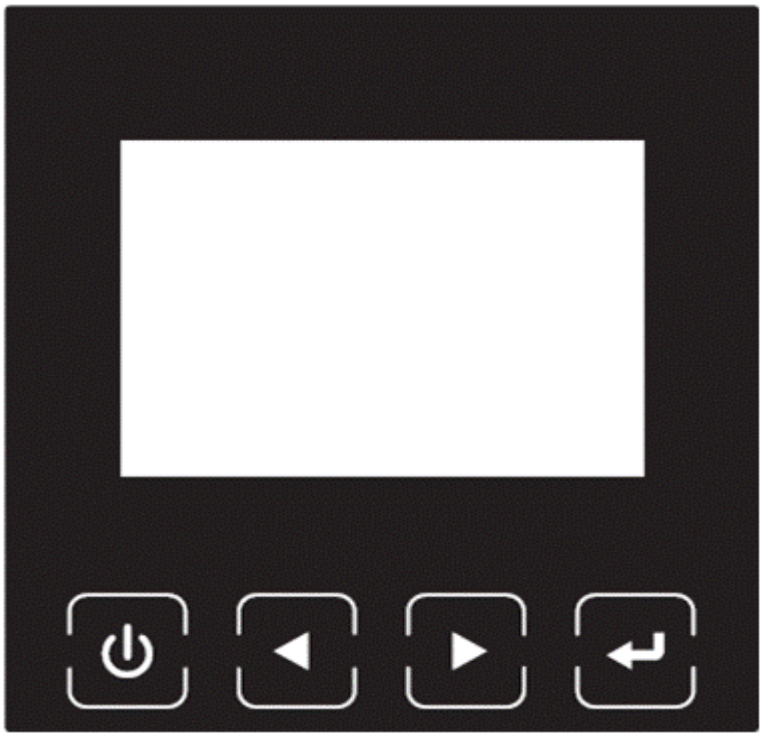


Fig 4.1: RT 6K/10K LCD Panel

Control Button	Sequence	Function
	Press for more than 3 seconds	ON/OFF UPS
	Press for less than one second	Scroll back or up to the previous menu
	Press for more than one second	Return/exit back one menu layer without initiating a command or changing a setting
	Press for more than one second	Scroll forward or down to the next menu option
	Press for less than one second	Select the setting being edited
	Press for longer than one second	Save the setting being edited

Table 4.1: Control Button Functions

4.1.2 Alarm & Fault Code and Diagnosis

If UPS is alarm or fault, please refer the following alarm and fault code, and other information.

Table 4.2: Alarm & Fault Code and Diagnosis

Alarm or Condition	Possible cause	Action
On Maintenance Bypass Alarm Code: 72	UPS was manually commanded to switch to bypass and will remain in bypass until commanded out of bypass	1. Check the maintain switch cover is close. 2. Check CNTL- COM wiring is ok.
Remote Emergency Power Off Alarm Code: 71	The external contacts in the rear of the UPS are configured for REPO operation and they have been activated.	1. Pull the EPO connector out. 2. Check and replace the EPO board, check wiring in the UPS. 3. Check and replace the communication board. 4. Replace the control board.
Site Wiring Problem Alarm Code: 04	Site Fault detection is supported on all models anytime there is a Grounding Neutral connection. Alarm triggers when the difference between ground and neutral voltage is > 15v.	1.Check all input wires 2.Check site fault circuit
Back feed Alarm Code: 93	UPS has a unexpected bypass current on battery mode	1.Transfer to maintenance bypass 2.Check the bypass SCR.
Batteries disconnected Alarm Code: 11	Battery voltage is lower than the batteries disconnected level defined for this UPS. This may be due to a blown fuse, intermittent battery connection or battery cable being disconnected.	Verify that all batteries are properly connected.
Battery low Alarm Code: 12	The UPS is in Battery mode and the battery is running low	This warning is approximate, and the actual time to shutdown may vary significantly. Depending on the UPS load and number of Extended Battery Modules(EBMs), the “Battery Low” warning may occur before the batteries reach 25% capacity

Service Battery Alarm Code: 13	A faulted battery string has been detected and as a result the battery charger has been disabled until it is replaced	1. Check all battery. 2. Replace batteries.
Overload warning Alarm Code: 41	Output is overload.	1. Check the loads and remove some non-critical loads. 2. Check whether some loads are failed. 3. Check the detective circuit on the PSDR board.
Inverter Overload Warning Alarm Code: 42	UPS has transferred to bypass or fault mode because of overload in inverter mode	1. Check if the load is overload 2. Check if INV board is ok
Bypass Overload Fault Alarm Code: 43	UPS has cut off the output and transferred to fault mode because of overload in bypass mode or HE mode.	1. Check if the load is overload 2. Check the output load detecting circuit.
Output Short Circuit Alarm Code: 31	Indicates that the UPS has detected abnormally low impedance placed on its output and considers it a short circuit	1. Check if the load is short circuit. 2. Check the output part of the UPS. 3. Check the INV part on the PSDR board.
Fan Locked Alarm Code: 84	Indicates that the fan could not work normally.	1. Check if the fan is running normally. 2. Check the fan driver circuit on the PSDR board. 3. Replace the fans.
Heatsink temperature high Alarm Code: 81	Indicates that the temperature of heatsink is too high, UPS will get over temperature fault soon.	1. Check if ambient temperature is over 40℃. 2. Check the NTC and the thermal detecting circuit on the PSDR board. 3. If the air vents are blocked
Ambient Temperature High Alarm Code: 82	Indicates that the ambient temperature is higher than the operation temperature on specification	1. Check if ambient temperature is over 45℃. 2. Check the NTC and the thermal detecting circuit on the PSDR board.
BUS Over Voltage Alarm Code: 21	Indicates that the UPS get BUS over voltage fault because of positive BUS.	1. Check input voltage is normal 2. Check if the load is inductive or too large. 3. Check the PFC board is ok.
BUS Under Voltage Alarm Code: 22	Indicates that the UPS get BUS under voltage fault	1. Check if input fuse is ok 2. Check if the load is inductive or too large. 3. Check if the PFC board is ok.
BUS Voltage Unbalance Alarm Code: 23	Indicates that the positive BUS voltage and negative BUS voltage are too lopsided to fault	1. Check if the PFC board is ok 2. Check if the INV board is ok.

BUS Short Alarm Code: 24	Indicates that the BUS voltage decrease very fast	Check the INV, PFC part on the PSDR board.
BUS Softstart Fail Alarm Code: 25	Indicates that the BUS could not soft start successfully	1. Check if input is ok 2. Check if input fuse is ok 3. Check if PFC board is ok
Inverter Over Voltage Alarm Code: 32	Indicates that the UPS get invert over voltage fault	1.Check if the load is too large 2.Check the INV board 3. Check the detecting circuit on the INV board
Inverter Under Voltage Alarm Code: 33	Indicates that the UPS get inverter under voltage fault	1.Check if the load is too large 2.Check the INV board 3. Check the detecting circuit on the INV board
Inverter softstart fail Alarm Code: 34	Indicates that the inverter could not soft start successfully	1.Check if bypass frequency is ok 2.Check if INV board is ok
Charger Fail Alarm Code: 15	Indicates that the UPS has confirmed the charger has failed	Check if charger is ok
Charger Over Voltage Alarm Code: 16	Indicates that the battery voltage is too high	1. Check battery number and voltage. 2. Check if charger is ok.
Fatal eeprom Fault Alarm Code: A3	Indicates that the UPS could not read eeprom successfully	Reset the error status
Negative power Fault Alarm Code: E1	In parallel system，power of UPS is negative	Check output voltage and WATT
Parallel cable loss Alarm Code: E2	In parallel system，parallel cable disconnect	check parallel cable
Parallel system battery status Alarm Code: E6	UPS1 connect battery，UPS2 without battery	Check battery connect status
Line input different Alarm Code: E7	Parallel system，UPS1 line ok，UPS2 line loss	Check the line input
Bypass input different Alarm Code: E8	Parallel system，UPS1 bypass ok，UPS2 Bypass loss	Check bypass input
Power strategy different Alarm Code: E9	Parallel system，UPS OP mode（normal ，converter，HE）different	Check UPS OP mode, Keep OP mode be the same
Rate power different Alarm Code: EA	Parallel system rate power different	Rate power different，not allow turn on UPS. Check rate power

HE in parallel Alarm Code: EB	Parallel system，OP mode set as HE	HE not allow in parallel system，check OP mode

4.1.3Trouble Shooting In Else Cases

Table 4.3: Trouble shooting in else cases

Problem	Possible cause	Action
The UPS cannot be turned on after pressing the button	The button is pressed too briefly.	Press the button continuously for more than 3 second.
	Battery is not connected or battery voltage is too low, or Charger failed.	Check the charger and battery.
	SPS failed	Check SPS
No indication, no warning tone even though system is connected to mains power supply	No input voltage	Check building wiring socket outlet and input cable.
	Charger failed	Check the charger and battery.
	SPS failed	Check SPS
Communication fails	Communication circuit fails; Power supply fails;	1. Check the power supply on the PSDR board. 2. Check and replace the RS232 board. 3. Replace the control board.

4.2. Failure Diagnosis

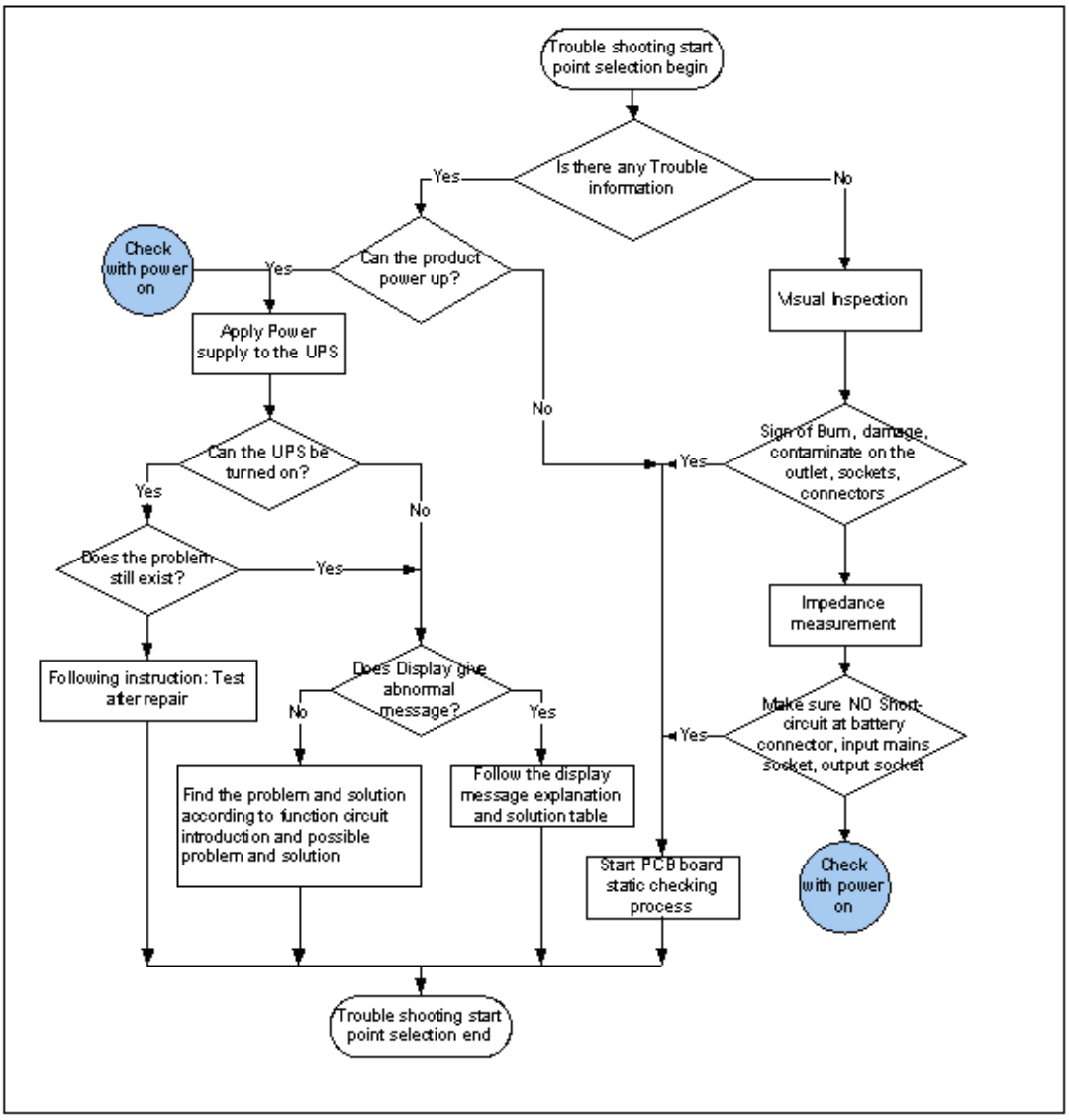


Fig4.2 General Guidance to start a trouble shooting process

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 ***Quick Start*** to find out which block is out of order, in order to shorten the service time.

For the reason of safety, please follow safety instruction to begin your work

High Voltage Danger: Some components contain residue charge and remain dangerous high voltage even if the external power supply is cut of, operator should follow following instruction strictly avoid risk of electrical shock.

1. Unplug the power cord from the utility.
2. Open outside case shown in the beginning of this manual
3. Remove connectors from battery, for long backup time model, unplug battery cabinet connector to UPS.

4.Discharge energy in BUS CAPACITORS, and BATTERY CAPACITORS
5.Disassemble cable from connectors, if required.
6.Disassemble PCB if required.

Before starting service, some tools are necessary, at least: A DMM (Digital Multifunction Meter) meter, screwdrivers and discharge resistor (300Ω/10W recommended). A DC power supply with current limiting (over current protection) function (180VDC/3A at least) is recommended for fast and safe diagnosis.

TO DISCHARGE the energy of battery capacitor, **after disconnect the battery from PSDR/Charger**, you can use a 300Ω/10W resistor contact **BAT (+) terminal** and **BAT (-)** terminal for discharge battery filter capacitor

If the module is damaged, it is not recommended to change components on the module, just replace the whole module.

DO NOT power up UPS with the mains unless you are sure that you have replaced all defective components.

4.3 Quick Check

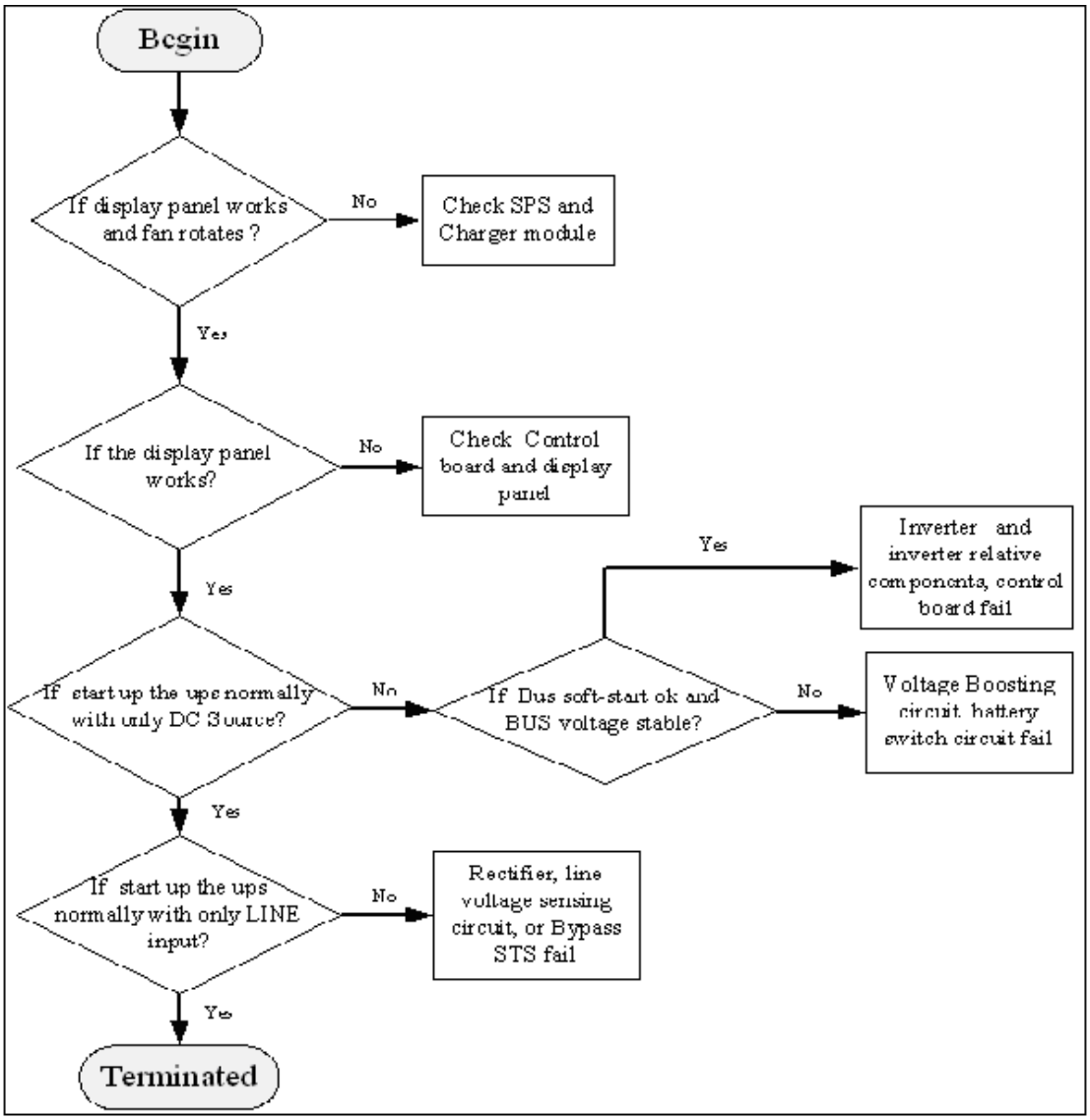


Fig4.3: Quick Check Process

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. You can find the location of these key components from the picture which is attached at the end of this file.

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

> ⚠ If the fuse is open, replacing fuse only **DOES NOT** mean you have solved the problem. In most case, open of fuse is caused by other failure of components; therefore, before restart that UPS, you must find the real failure components and replace them!

4.3.1 SCR

Table4.3: R/T 6K SCR

Item	Checked components		DVM Function	Reference Value	Fail Condition
1	F3, F7, F1, F2		Ω	0Ω	open
2	Q1 Q2 Q3	(A, K)	Ω	≈1MΩ	short
		(G, K)	Ω	≈40Ω	short

Table4.4: R/T 10K SCR

Item	Checked components		DVM Function	Reference Value	Fail Condition
1	F2,F4		Ω	0Ω	open
2	Q3 Q6 Q1	(A, K)	Ω	≈1MΩ	short
		(G, K)	Ω	≈40Ω	short

If fail condition stated in item 1 or 2 occurs, it is very possible that the corresponding PFC part is damaged, so please check try to check PFC circuits.

4.3.2 PFC

Table4.5: R/T 6K PFC

Item	Checked components		DVM Function	Reference Value	Fail Condition
1	Q28, Q32、Q34	(E, C)	Ω	≈1MΩ	short or open
		(G, E)	Ω	15.8kΩ	short or open
2	Q29, Q30、Q36	(E, C)	Ω	≈200kΩ	short or open
		(G, E)	Ω	15.8kΩ	short or open
3	D9, D13		DIODE	≈0.35V	0V
4	R123, R124, R180, R163、R185、R164		Ω	20Ω	open

Table4.6: R/T 10K PFC

Item	Checked components		DVM Function	Reference Value	Fail Condition
1	Q31,Q28, Q32,Q34	(E, C)	Ω	≈1MΩ	Short or open
		(G, E)	Ω	≈11.85kΩ	short or open
2	Q21, Q29,Q30,Q36	(E, C)	Ω	≈100kΩ	Short
		(G, E)	Ω	≈11.85kΩ	short or open
3	D9, D13		DIODE	≈0.35V	0V
4	R122,R123,R180,R185, R186,R163,R162,R164		Ω	20Ω	open

If fail condition stated in item 1 or 2 or 4 occurs, it is very possible that the corresponding IGBT driver circuit is damaged, so please check try to change the IGBT driver circuit and

the connection of components.

4.3.4 INV

Table4.7: R/T 6K INV

Item	Checked components		DVM Function	Reference Value	Fail Condition
1	Q16, Q18, Q24,Q25	(E, C)	Ω	≈1MΩ	Short or Open
		(G, E)	Ω	47.5kΩ	Short or Open
2	D10, D15		DIODE	≈0.36V	0V
3	R82, R84, R89, R92		Ω	20Ω	open

Table4.8: R/T 10K INV

Item	Checked components		DVM Function	Reference Value	Fail Condition
1	Q16, Q17, Q18,Q20, Q25,Q27,Q24,Q26	(E, C)	Ω	≈1.5MΩ	Short or open
		(G, E)	Ω	≈23.75kΩ	short or open
2	D10, D15		DIODE	≈0.36V	0V
3	R158,R118,R152,R151 R153,R159,R160,R161		Ω	30Ω	open

If fail condition stated in item 1 or 3 occurs, it is very possible that the corresponding IGBT driver circuit is damaged, so please check try to change the IGBT driver circuit and the connection of components.

4.3.5 CHARGER

Table4.9: R/T 6K Charger

Item	Checked components		DVM function	Reference Value	Fail Condition
1	F2, F3		Ω	0Ω	open
2	Q614 Q602	(D,S)	Ω	≈MΩ	Short or open
		(G,S)	Ω	23.5kΩ	short or open
3	BD602		DIODE	≈0.47V	0V
4	Q615	(D, S)	Ω	335kΩ	open
		(G, S)	Ω	48kΩ	short or open
5	R668, R670		Ω	10Ω	open
6	R640 , R619		Ω	47Ω	open
7	D651, D626		DIODE	≈0.47V	0V

Table4.10: R/T 10k Charger

Item	Checked components		DVM function	Reference Value	Fail Condition
1	F1,F3		Ω	0Ω	open
2	Q35	(D,S)	Ω	≈MΩ	Short or open
		(G,S)	Ω	10kΩ	short or open
3	Q17	(D,S)	Ω	≈MΩ	short or open
		(G,S)	Ω	10kΩ	short or open
4	D40,D29,D36,D38, D37,D26		DIODE	≈0.36V	0V
5	Q43	(D, S)	Ω	≈MΩ	Short or Open
		(G, S)	Ω	10kΩ	Short or open
8	D5		DIODE	≈0.36V	0V

4.3.6 SPS

Table4.11： R/T 6k SPS

Item	Checked components		DVM function	Reference Value	Fail Condition
1	F1		Ω	0Ω	open
2	Q1	(D,S)	Ω	≈MΩ	short or open
		(G,S)	Ω	49.9K	short or open
3	D32/D28/D1/ D27/D5		DIODE	≈0.47V	0V

Table4.12： R/T 10k SPS

Item	Checked components		DVM function	Reference Value	Fail Condition
1	F1		Ω	0Ω	open
2	Q1	(D,S)	Ω	≈MΩ	Short or open
		(G,S)	Ω	47.5K	Short or open
3	D7,D5,D2,D9,D8		DIODE	≈0.47V	0V

4.4 Test and Finish

After replace all defected components on power stage (PSDR), following test the steps can be adopted to verify the repair result and the reliability of the UPS.

1. Connect all of boards, cable, and connector right to place.
2. Check the Wiring.
3. Apply DC Power from power source with current limitation function to the BAT terminal on the PSDR, the voltage of the DC power should be 180V/5Amp (limited current) for UPS.
4. Press the ON-switch on front panel for 3 seconds, then UPS should be DC started, If

UPS does not start successfully. Please try diagnosing procedure again.

5. If UPS does not start up for several trying or DC power supply is on current-limit state continuously, there must be some defected components exists. Please follow trouble-shooting chart to debug again.
6. Stop the UPS; apply AC mains to the UPS module. Try on the UPS. If fail you may have start one new round of trouble shooting
7. Check the output voltage waveform and DC-offset voltage, at no-load and full load condition.
8. In most case result of step7, 8 can represent whether product in normal condition, If possible, however, for more reliability, perform quick check follow procedure shows in table would help in know the UPS situation in detail.
9. If possible, does a burn-in test on repaired UPS before return it to customer, the longer and the better.
10. If every step is ok, Congratulation, you have finish the maintenance/ repair work.

Table4.13: Test point

TEST	TEST POINT	TEST AND ADJUSTMENT SEQUENCE	EXPECTED RESULT
DC(+) BUS	RT6K: C78/C84/C85/C91/C108	Connect DVM (DC) to test points and connect UPS to the main, then press “on” switch.	208V and 220V output: 350±3Vdc on line mode and battery mode 230V output:360±3Vdc on line mode and battery mode 240V output: 370±3Vdc on line mode and battery mode
	RT 10K: P8 and P7		
DC(-) BUS	RT 6K: C81/C82/C83/C90/C109	Connect DVM (DC) to test points and connect UPS to the main, then press “on” switch.	208V and 220V output: -350±3Vdc on line mode and battery mode 230V output:-360±3Vdc on line mode and battery mode 240V output: -370±3Vdc on line mode and battery mode
	RT10K: P9 and P7		
CHARGER	RT 6k: CN8	Connect DVM (DC) to test points and connect UPS to the mains (25℃ ambient).	Floating voltage: RT 6K: 204.75V RT10K:273V
	RT 10K: CN3(Pin1,pin5)		
O/P Voltage	O/P socket	Keep Ups on, and connect DCM to output socket	220Vac (or 230Vac, etc according to the setting)
O/P Voltage Balance	O/P socket	Keep Ups on, and connect the tool as figure	±100mVdc

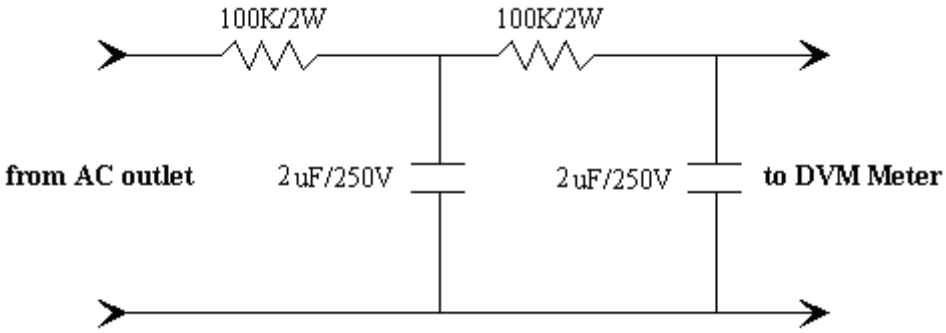


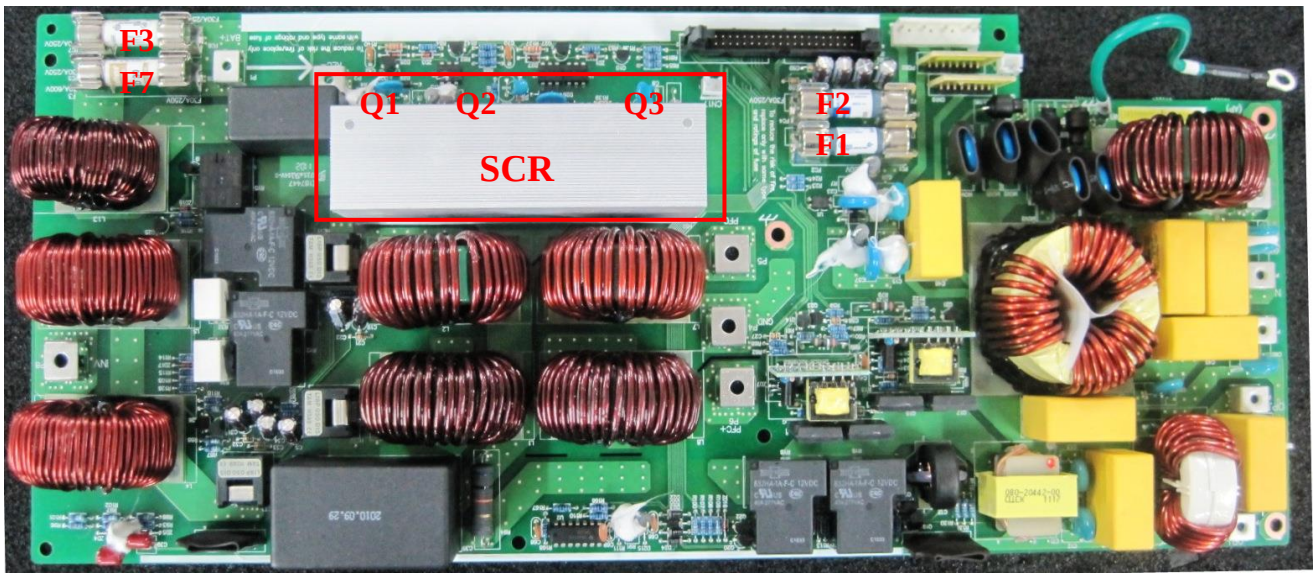
Fig4.4: Circuit for test output balance

APPENDIX 1—SPARE PART LIST

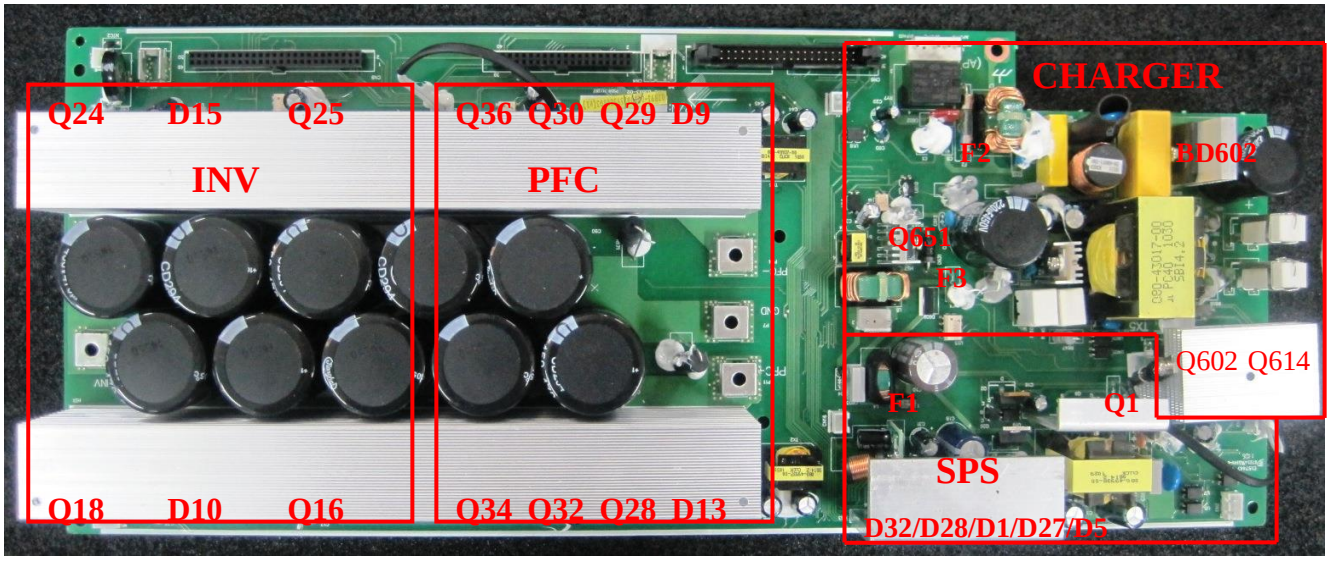
Model	Name Of Board	Part No.
6K	PSDR Top-Board	710-03892-xx
	PSDR Bottom-Board	710-03893-xx
	Control Board	712-83412-xx
	Communication Board	710-03886-xx
	EPO Board	710-12061-xx
	LCD Display Panel	126-00148-xx
10K	PSDR PFC-Board	710-03917-xx
	PSDR INV-Board	710-03918-xx
	Control Board	712-83412-xx
	Communication Board	710-03886-xx
	EPO Board	710-12061-xx
	LCD Display Panel	126-00148-xx

APPENDIX 2—Component location and PCBA Picture

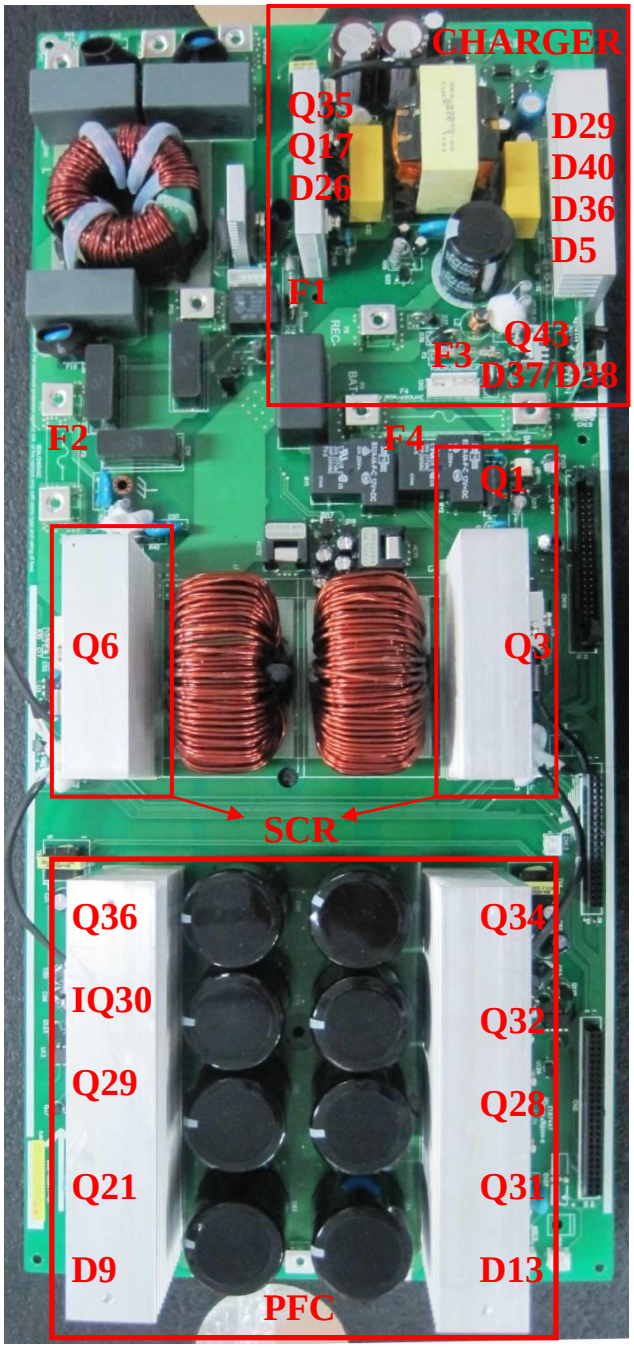
R/T 6K TOP BOARD (710-03892)



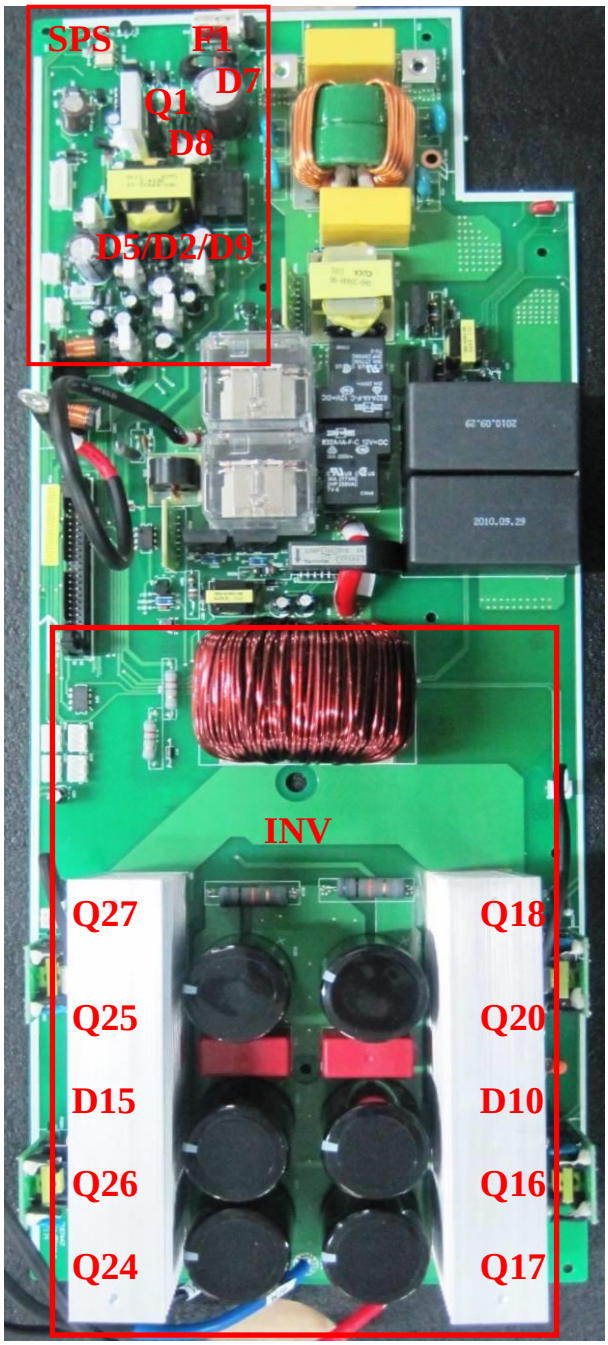
R/T 6K BOTTOM BOARD (710-03893)



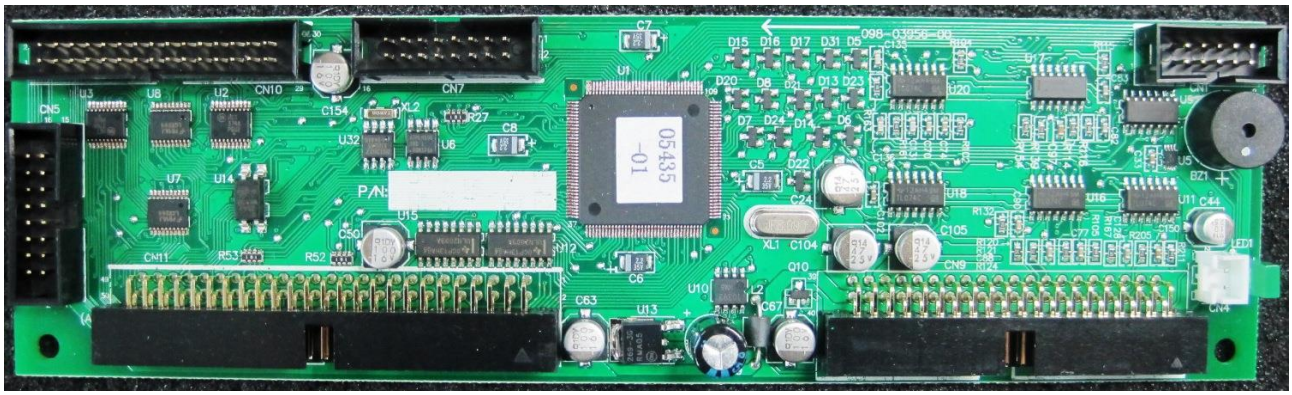
R/T 10K PFC BOARD (710-03917)



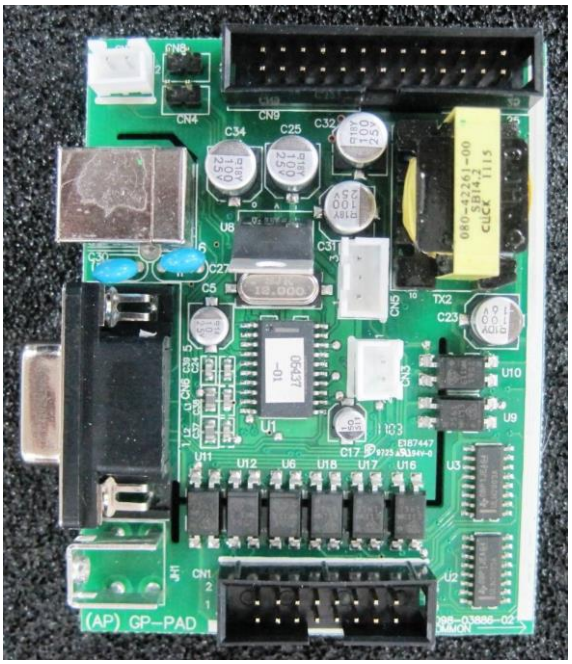
R/T 10K INV BOARD (710-03918)



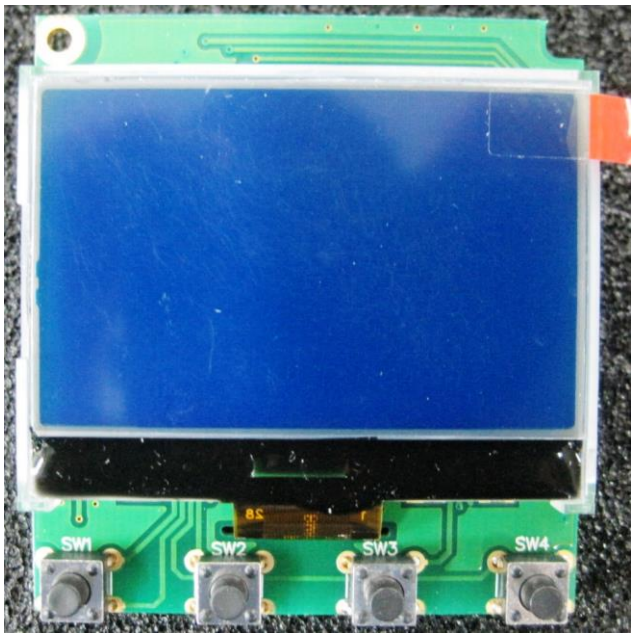
CONTROL BOARD (712-83412)



COMMUNICATION BOARD (710-03886)



DISPLAY PANEL （126-00148）



REPO BOARD （710-12061）