GTEC UPS MODEL:

SATURN 30 – 40 kVA

SERVICE MANUAL

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Service Manual SATURN 30-40KVA

Date/Data	Code/ Codice doc.	Rev.	Description / Descrizione
04/10/15	**RM102**	**00**	**Service Manual SATURN 30-40KVA**

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Contents

2 SOFTWARE OPERATIONS

2.1 SAVING THE UPS LOG FILE

This should be performed before any operation is carried out on the UPS.
To save the log file use the GpDownload application provided with the UcomGp software. Please read the instructions for this application for the correct procedure to be followed.

IMPORTANT:
In the event you need to save log files for a UPS that is visibly damaged (i.e. displaying clear damage to the power boards), we recommend you follow the **safety procedure** (in order to avoid the DC capacitor bank pre-loading stage).

With the UPS fully switched off,

for **SINGLE INPUT UPS:**

- remove the cable connected to terminal F_IN from boards B0090, for each phase, and temporarily isolate the cable ends (see Fig. 25 on page 42).
- Close the SWIN and save the log file.

for **DUAL INPUT UPS:**

- Simply close the SWBYP and save the log file.

2.2 CONFIGURING THE UPS

To configure the UPS, use the dedicated UcomGp software. Please read the dedicated manual for this software for instructions about this application and the correct procedure to be followed.

2.3 UcomGp SOFTWARE

UComGP is a package of applications for the advanced analysis of log files and real-time diagnostics for UPS belonging to the Multi Sentry ranges (from 10kVA to 120 kVA).
Communication between PC and UPS, for the applications that require it, takes place via serial communication port RS232.
The package is currently comprised of seven different applications:

- GpDownload - Log Downloader
- GpHistory - Log Analyzer
- GpEvent - Event Analyzer
- GpRealTime - Status Analyzer
- GpDebug - UPS Debugger
- GpCalibrate - UPS Calibrator
- GpConfig - UPS Configuration tool

For further information on the applications listed above please see:

- UCOMGP Manual RM900
- UCOMGP Configuration tool Manual RM901

2.4 UPDATING THE FIRMWARE

In order to update the firmware, the dedicated "**YMSTPRGA (MICRO & DSP PROGRAMMING KIT)**" kit must be used to program the microprocessor and/or DSP. Please see the instructions for this application, attached to the kit.

The firmware to be used is the following:

Firmware	µProcessor	DSP
SATURN 30-40K	FW022-xxxx	FW023-xxxx

3 SWITCHING THE UPS ON/OFF

See the instruction manual before carrying out any operations on the machine.

3.1 SWITCHING OFF THE UPS WHILST DELIVERING POWER TO THE LOAD

In the event of a single UPS follow these steps:

1) Close the SWMB
2) Set the UPS to stand-by using the display
3) Open the SWOUT, SWBATT, SWIN and SWBY (if present)
4) Wait for the display to shut down

In the event of a UPS operating as part of a parallel system follow these steps:

1) Open the SWOUT, SWBATT, SWIN and SWBY (if present)
2) Wait for the display to shut down
3) Disconnect the RJ45 cables from the parallel board (refer to parallel manual

SWITCHING OFF THE UPS WHILST CUTTING OFF THE POWER SUPPLY TO THE LOAD

1) Set the UPS to stand-by using the display
2) Open the SWIN, SWBY (if present) and SWOUT
3) Wait for the display to shut down
4) Open all battery fuses

3.2 RESTARTING THE UPS

1) Close all battery fuses
2) Close the SWIN, SWBY (if present) and SWOUT
3) IMPORTANT: Switch the UPS on by entering and confirming SYSTEM ON using the display
4) If closed, open the SWMB

3.3 STARTING THE UPS FROM THE BATTERY

Important: this type of start-up should only be carried out if mains power is down and ONLY with the SWMB switch open. Start-up with the SWMB closed is only possible on UPS with a separate bypass option and where the bypass line is present.
NOTE: the minimum voltage for battery start-up is 236Vdc (11.8V for monoblock).

1) Close all battery fuses
2) Close the SWIN, SWBY (if present) and SWOUT
3) Press and hold down the "cold start" button
4) Switch the UPS on by entering and confirming SYSTEM ON

3.4 ADDITIONAL SERVICE OPERATIONS

Additional service operations are available using the dedicated UCOMGP software. See the application manual for further details.

4 UPS INTERNAL STRUCTURE

For further details, see the instruction manual

4.1 DISCONNECTION SWITCH POSITIONS

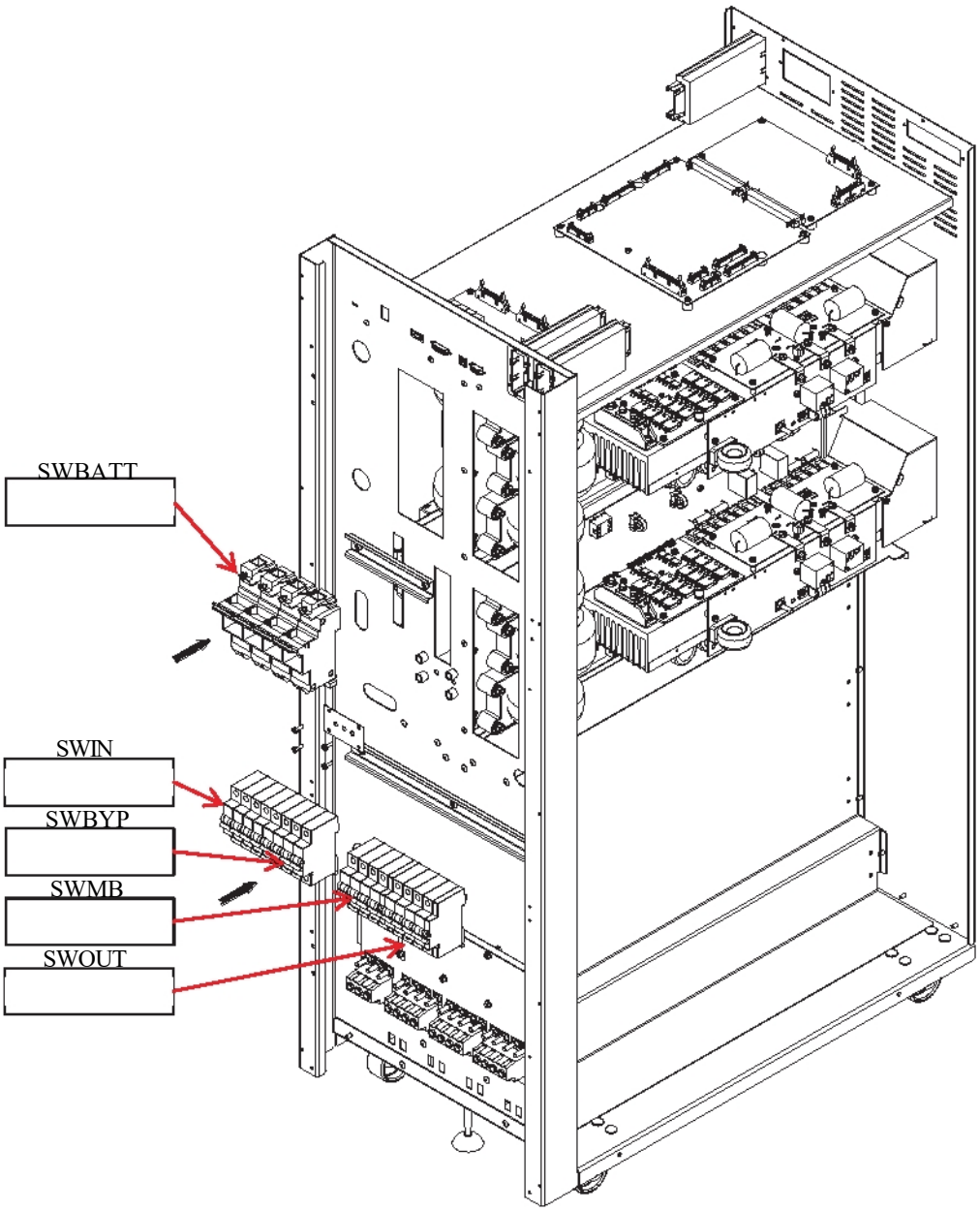


Fig.1

NOTE: the auxiliary contact on both SWOUT and SWMB disconnection switches is normally closed (NC) (with the disconnection switch OPEN).

42 BOARD POSITIONS INSIDE THE UPS.

With reference to the following diagrams, there is:

1) Power assembly (one per phase)
   - For Saturn 30:
     6R_SU0091x120 (IMS) (no longer in manufacture)
     6R_SU0091-05. (NO IMS) (no longer in manufacture)
     6R_SU0091-07. (NO IMS)

   - For Saturn 40:
     6R_SU0091x110 (IMS) (no longer in manufacture)
     6R_SU0091-04. (NO IMS) (no longer in manufacture)
     6R_SU0091-06. (NO IMS)

2) Battery charger board. (B0060-02.)
3) Auxiliary power supplies board. (B0059-01.)
4) Inverter output board. (B0092-01.)
5) Input capacitor filter board (B0109-01.)

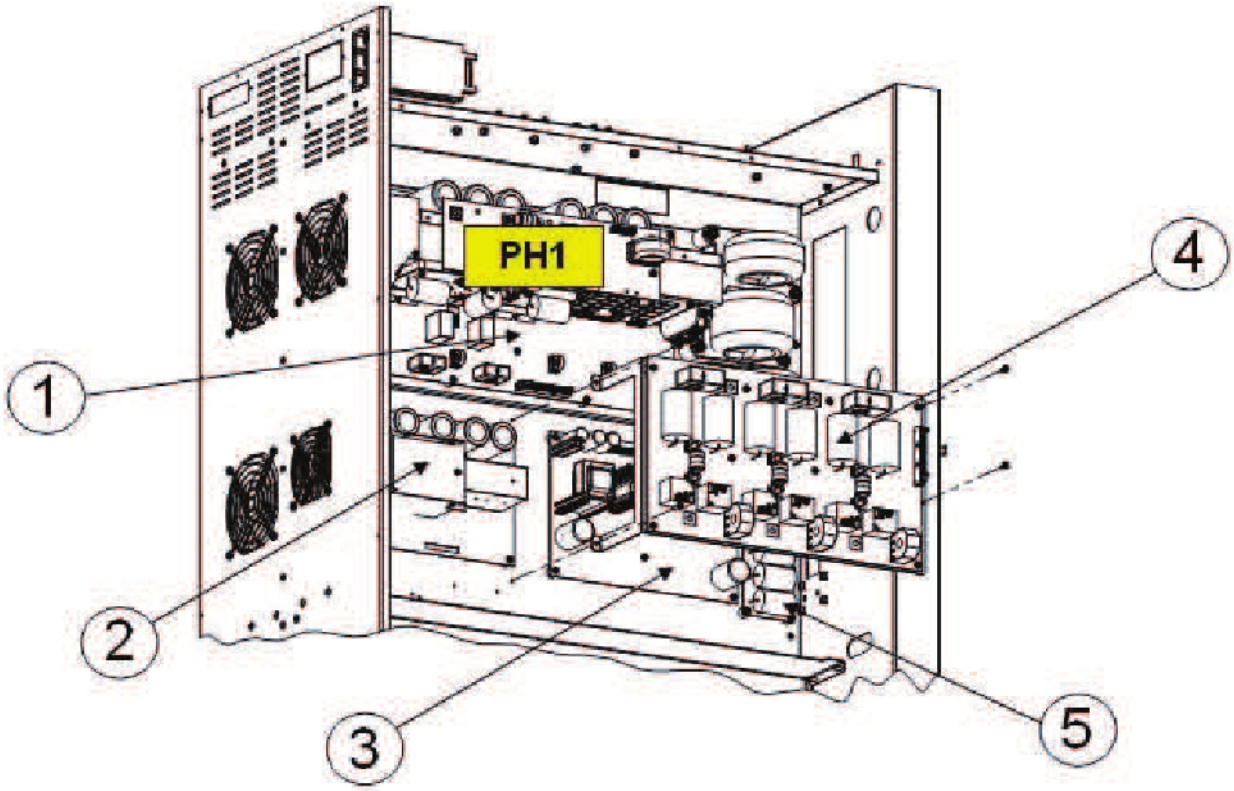


Fig.2

6) Interface board. (B0056-02.)

7) Control board: B0087-02. for Saturn 40 IMS (no longer in manufacture)
B0087-01. for Saturn30 IMS (no longer in manufacture)
B0173-01. for Saturn 30 NO IMS
B0173-02. for Saturn 40 NO IMS

8) DSP+uP control board. (B0067-01.)

9) Terminal board. (B0101-01.)

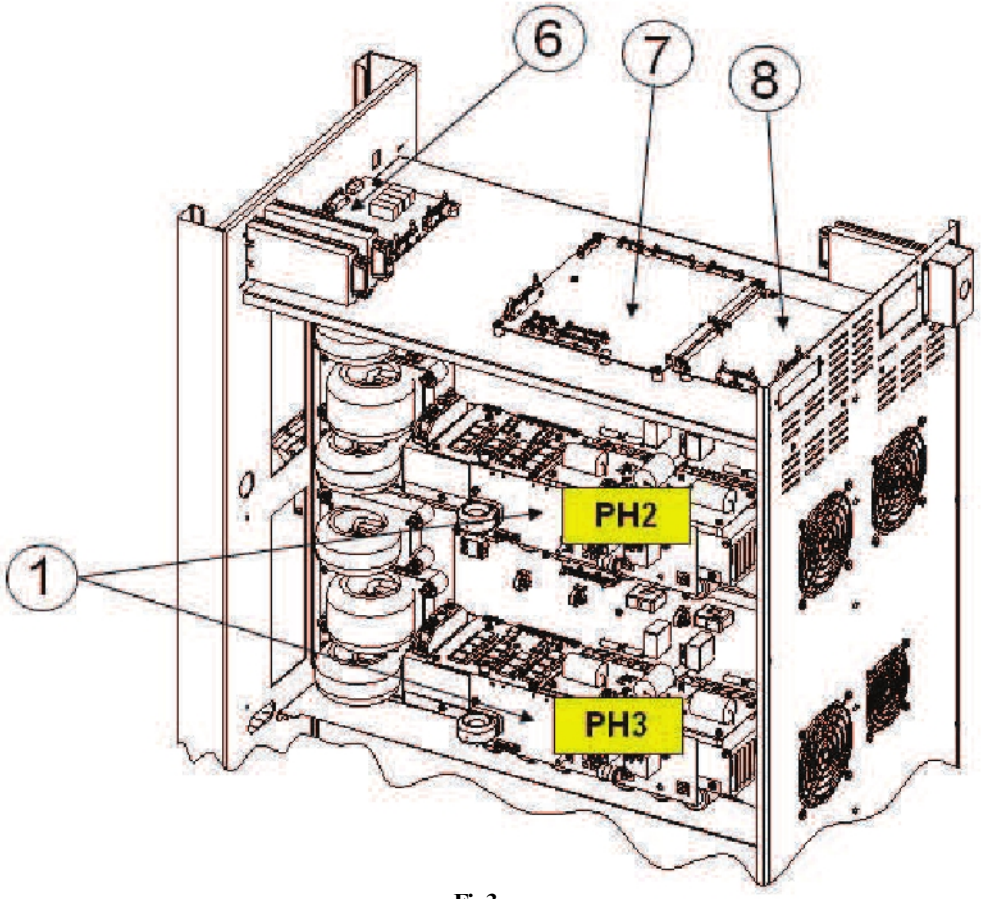


Fig.3

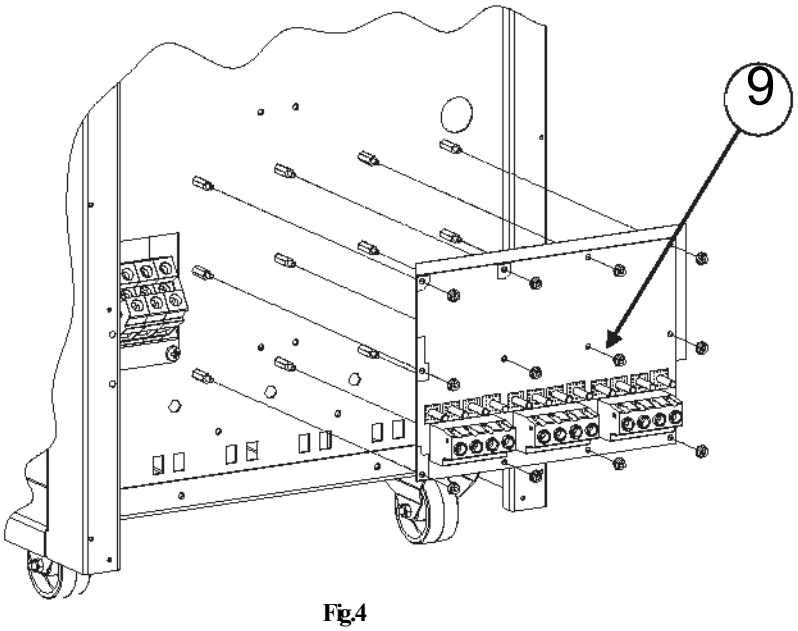
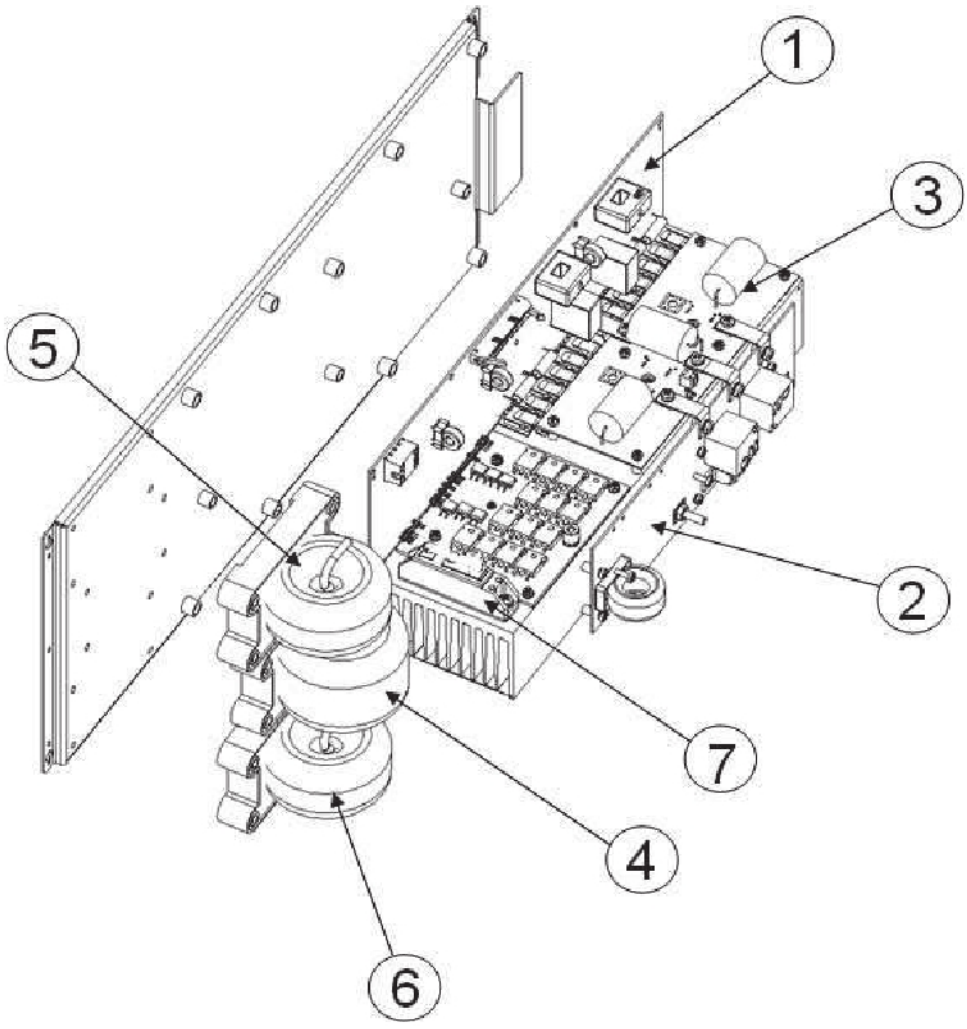


Fig.4

4.3 POWER ASSEMBLY.

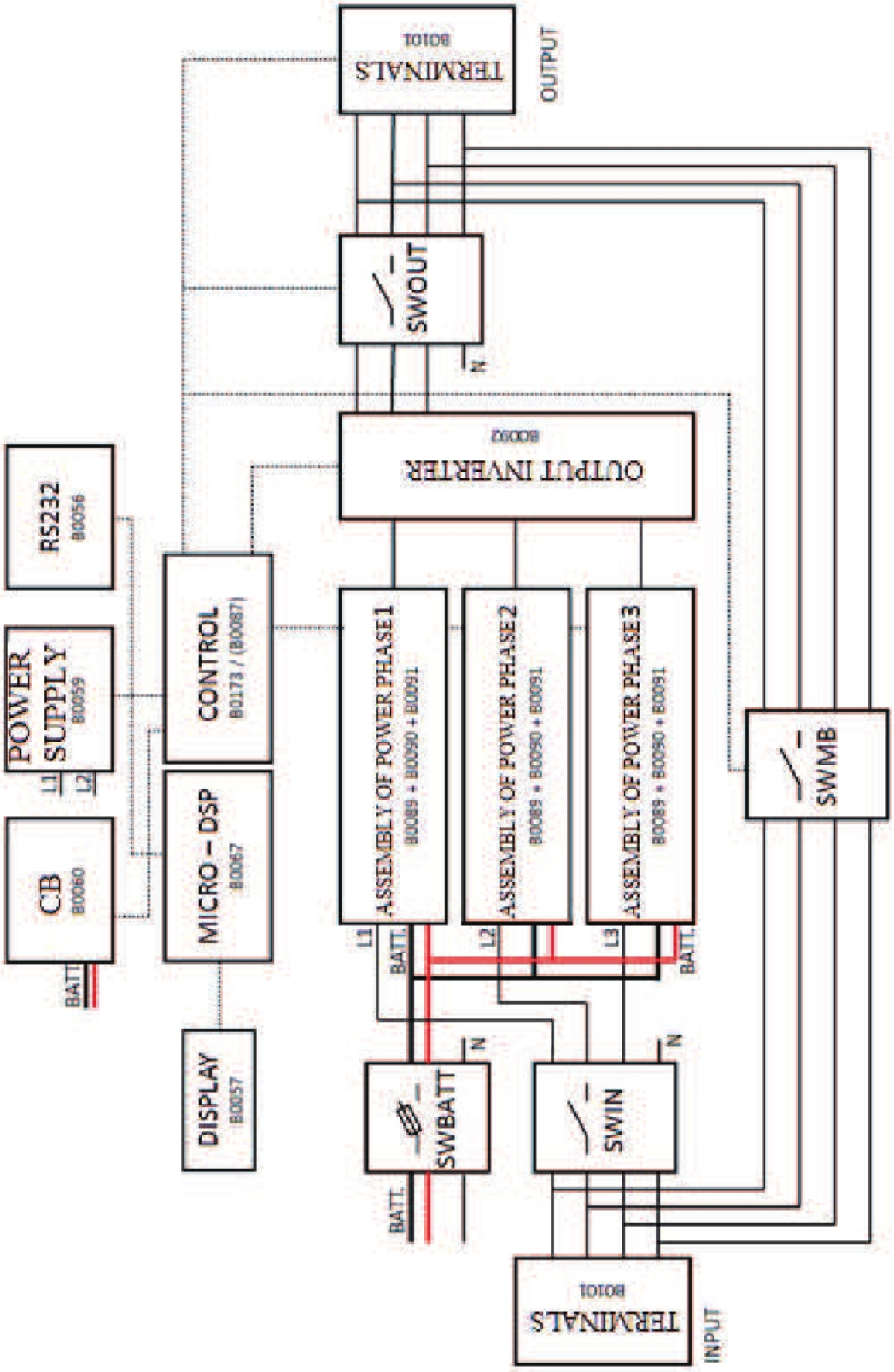
There are three identical power assemblies (one for each phase); these are fitted onto metal trays and each tray is composed of the following elements:

1) Power board B0091; (B0091-01. Saturn 40IMS) (B0091-03 Saturn 30IMS)
   (B0091-04. for Saturn 40 NO IMS) (B0091-05. for Saturn 30 NO IMS)
   (B0091-06. for Saturn 40 NO IMS) (B0091-07. for Saturn 30 NO IMS)
2) Input power board B0090; (B0090-02. Saturn30) (B0090-01. Saturn40)
3) Input capacitor board B0089; (B0089-01. for Saturn 30-40)
4) Inverter inductor
5) Boost inductor positive
6) Boost inductor negative
7) Bypass SCR



Fg.5

4.4 UPS BLOCK DIAGRAM



4.5 SINGLE PHASE BLOCK DIAGRAM

The diagram below shows the basic layout of one phase with the main elements mounted on the boards.

POWER ASSEMBLY

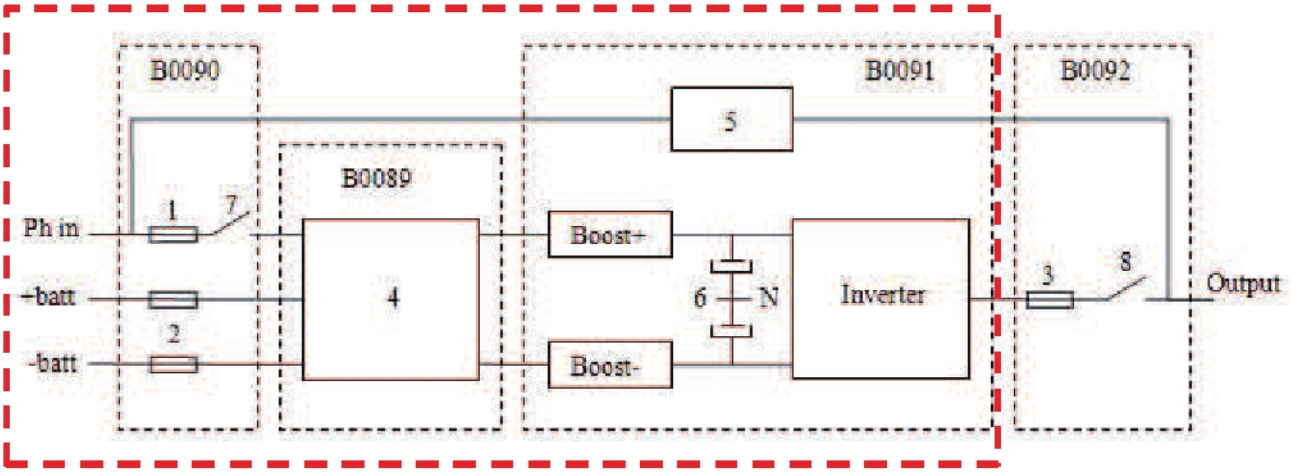


Fig.6

Key:

1) Input fuses	Saturn 30 - 40	125A FF 240V
2) Battery fuses	Saturn 30	16A F 500V (6.3x32)
	Saturn 40	20A F 500V (6.3x32)
3) Output fuses	Saturn 30 - 40	125A FF 240V

4) Input stage with rectifying diodes and battery SCR in Semitop module

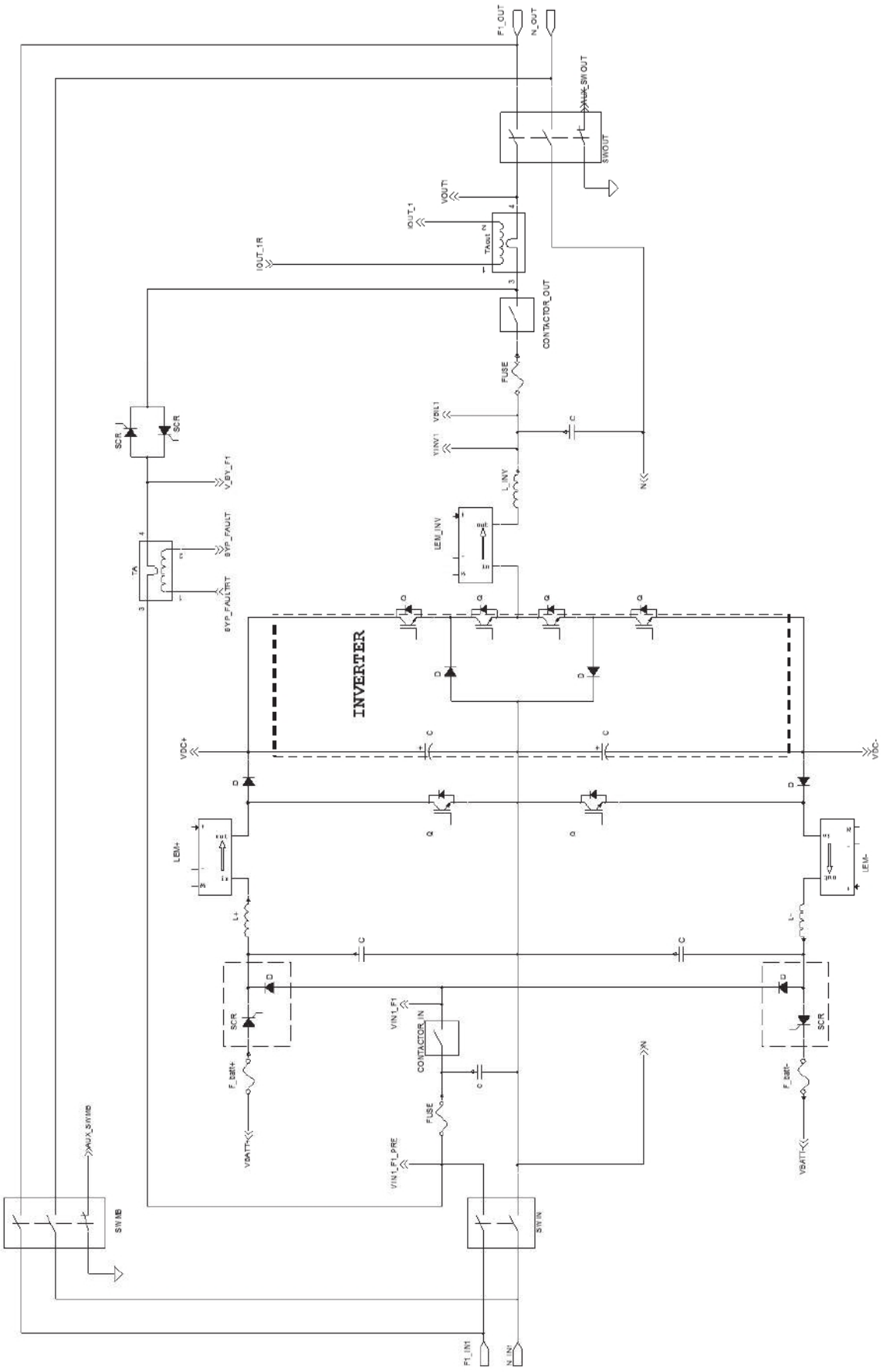
5) Bypass SCR module

6) Electrolytic capacitor bank

7) Input relay

8) Inverter output relay

4.6 SINGLE PHASE ELECTRICAL DIAGRAM



5 AUXILIARY POWER SUPPLY FAILURE (L01)

5.1 TESTS

Board B0059 is supplied from 4 different power sources:

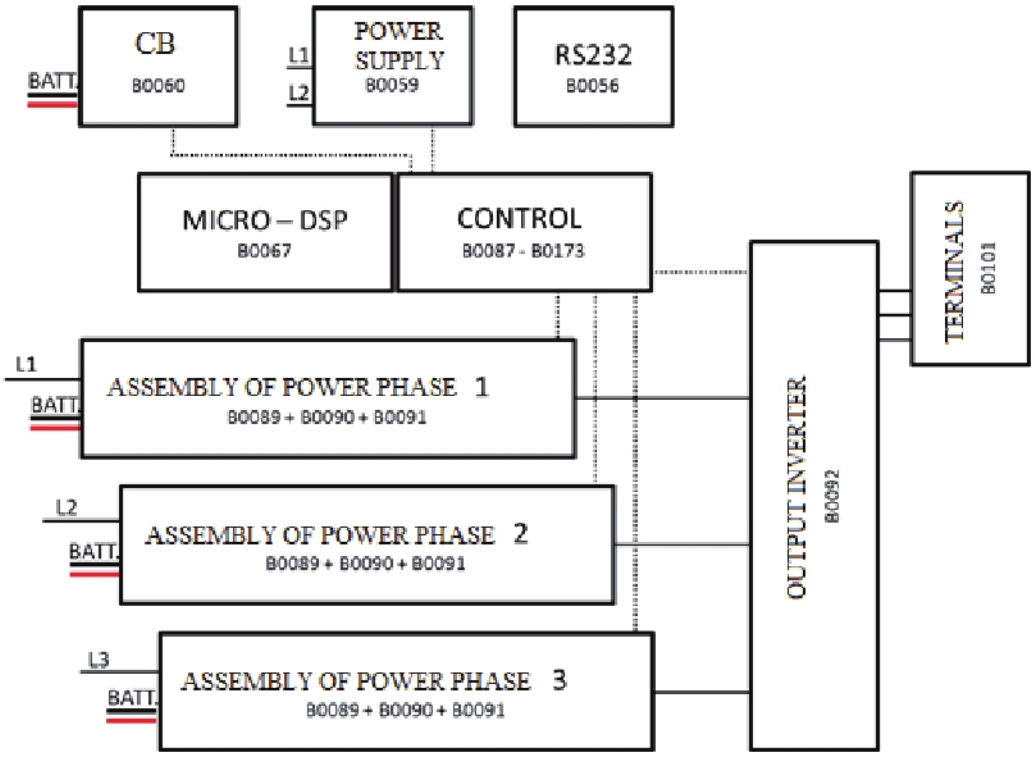
- phase 1 of the input mains power
- phase 2 of the input mains power or the bypass input mains power if the UPS is dual input. (this power source is also used for the redundant power supply of the static bypass).
- direct current from the DC capacitor bank
- battery voltage for battery start

Board B0059 generates different voltages for supplying the different parts of the UPS. We can therefore distinguish between:

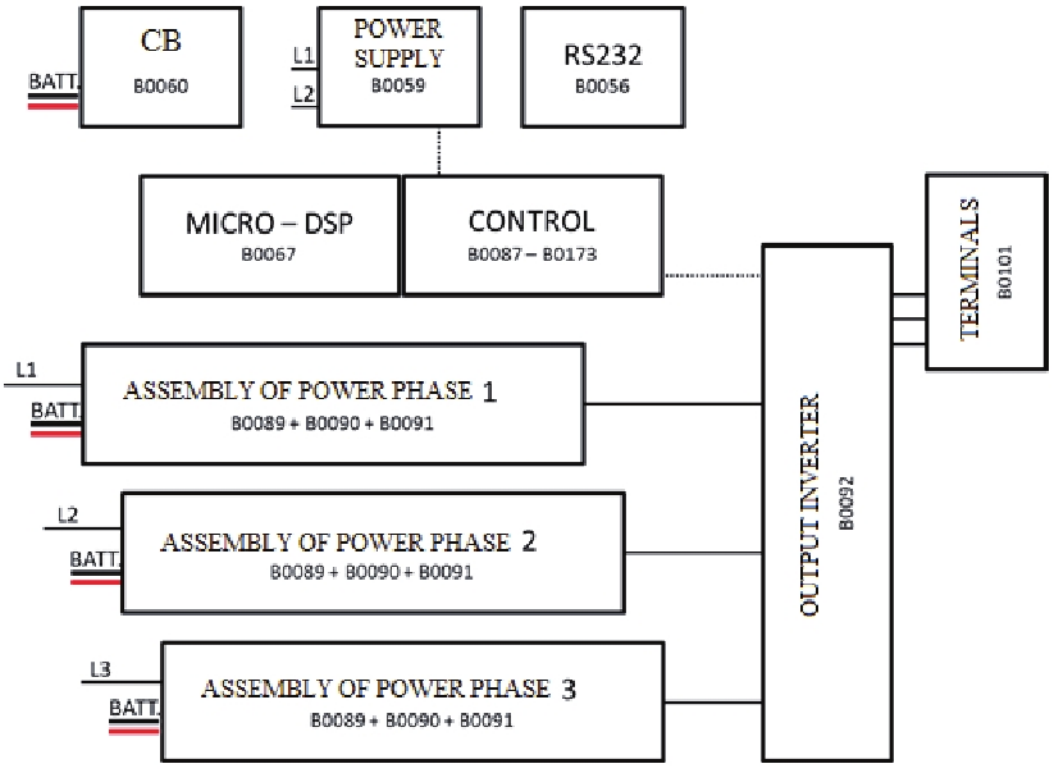
- ±15V voltage (for the booster, battery and inverter LEM)
- ±12V voltage (analogue part of control board B0087 or B0173 and balancing circuit for direct current at inverter output board B0092)
- regulated 24V voltage (for the fans, from a separate circuit that takes up current from the negative capacitor bank)
- HF voltage (27V 50KHz) for the battery SCR (square wave)
- HF voltage (27V 50KHz) for the bypass SCR (square wave)
- HF voltage (27V 100KHz) for the isolated power supplies for the power stages (IGBT booster and inverter), for the power supply of the electronics on board RS232 (B0056) and for the battery charger board (B0060).

In the diagrams below the dotted line shows the route of each single power supply.

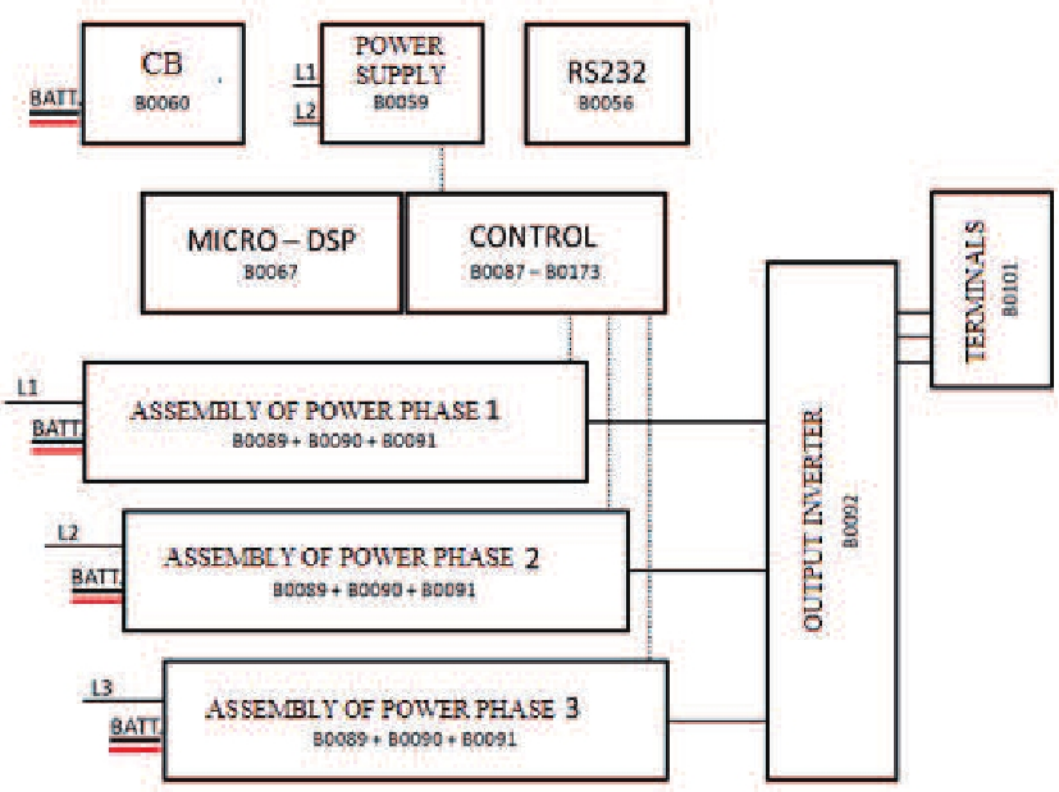
5.2 ±15V - LEM POWER SUPPLY



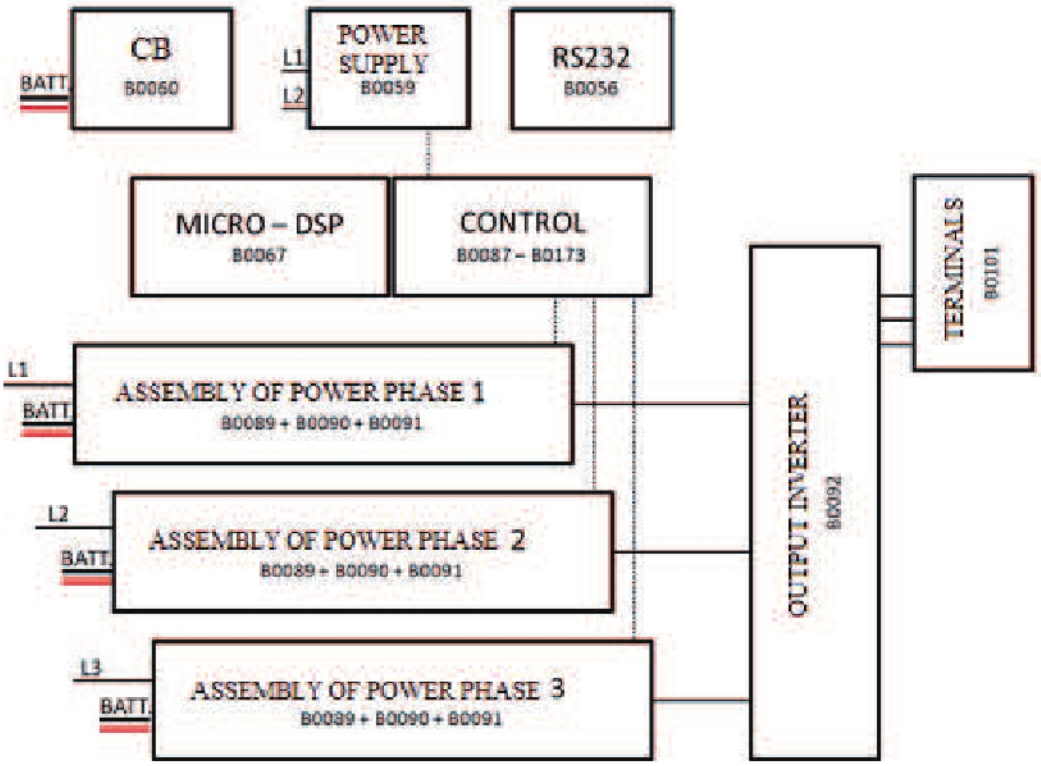
53 12V POWER SUPPLY - ANALOGUE PART OF CONTROL BOARD



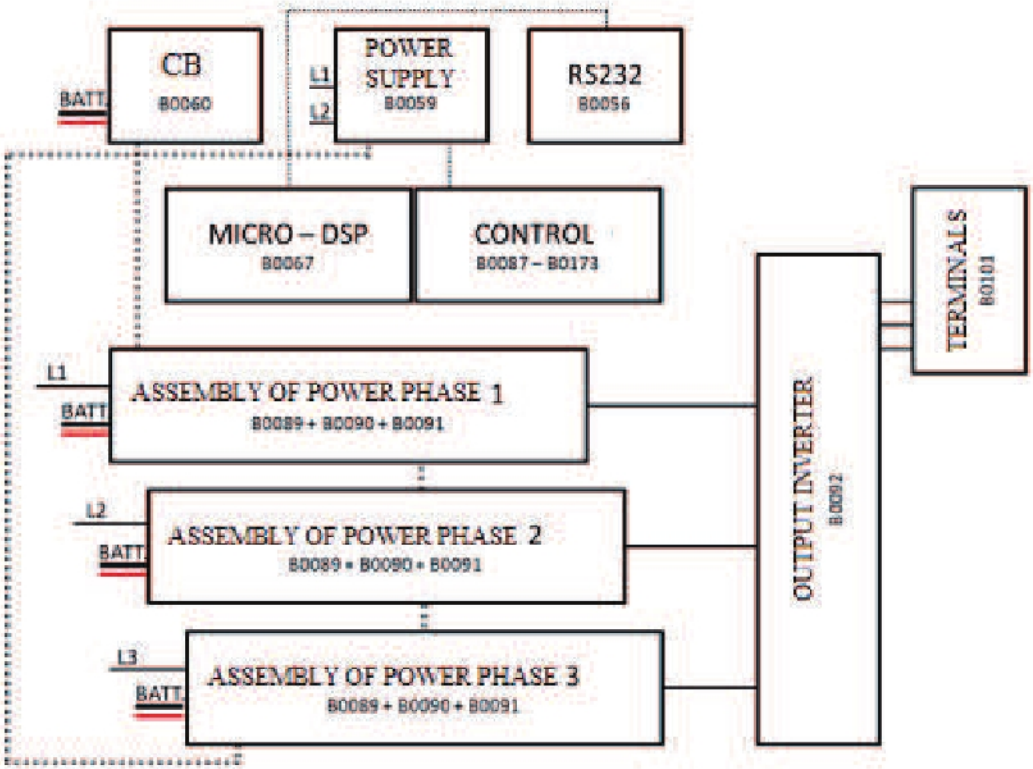
54 24V POWER SUPPLY FOR FANS (regulated)



5.5 HF 50KHz POWER SUPPLY FOR BATTERY AND BYPASS SCR



5.6 HF 100KHz POWER SUPPLY FOR POWER STAGES AND RS232



5.7 OVERVIEW OF AUXILIARY POWER SUPPLIES - OBSERVATIONS.

All auxiliary power lines, **except** the HF line for the power stages, first pass through the control board, and are distributed from here to the various parts of the UPS via flat connection cables.

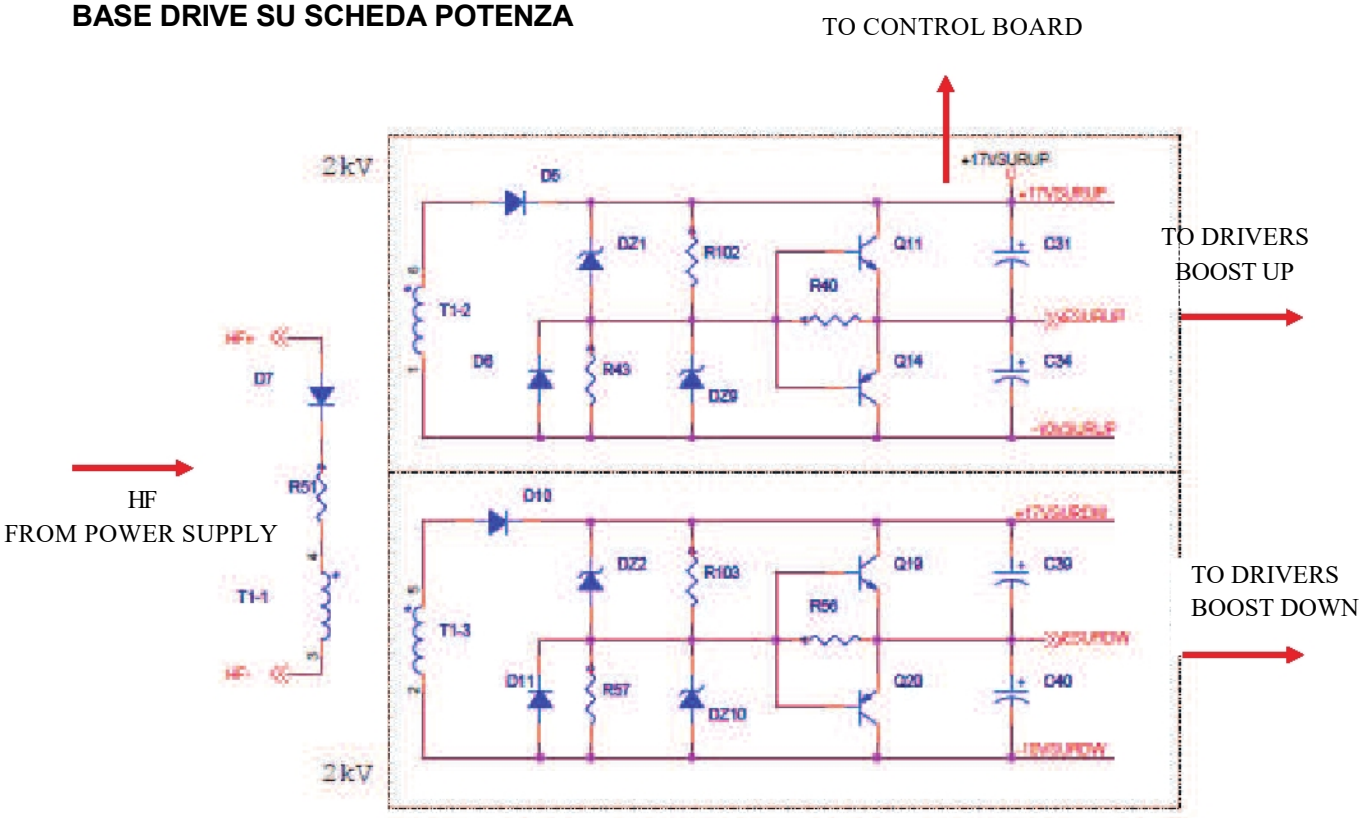
The HF line for the power stages, battery charger and for RS232 deserves particular attention:

This power supply line runs **directly** to the power boards and battery charger over the same plug in connector wiring that carries the 400V direct current without passing through the control board (B0087 or B0173):

- power boards supply the primary circuit of the **base drives** (isolation transformers) whose secondary circuit is connected to the booster and inverter drivers.
- the battery charger supplies the base drive for the buck up and down IGBTs.

Another line of the same power supply leaves the power supply unit and supplies board RS232 (B0056), passing through the control board and DSP micro board (B0067).

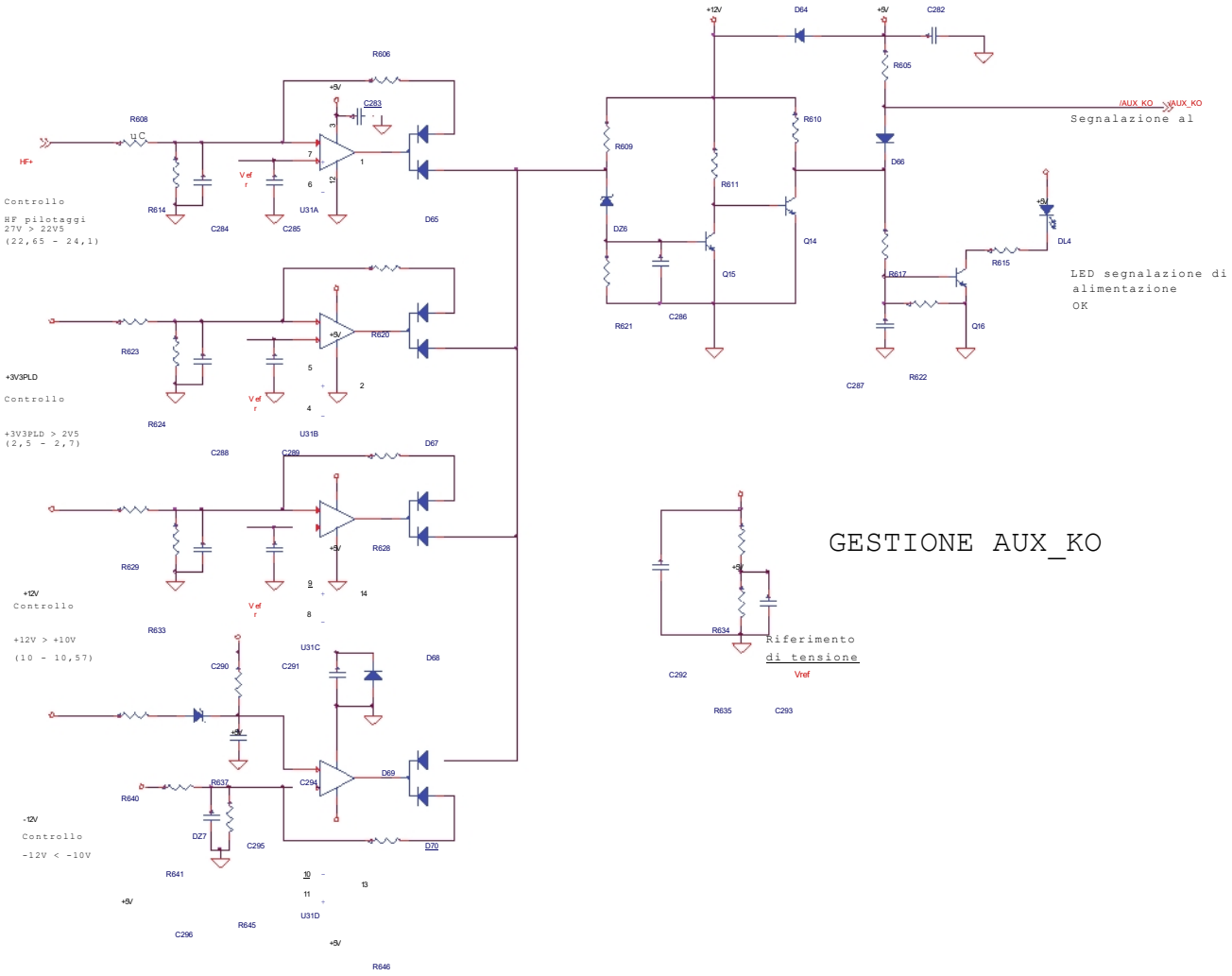
BASE DRIVE SU SCHEDA POTENZA



58 "AUX KO" (L01) DETECTION LOGIC

A logic test is carried out on the control board to check whether the auxiliary power supplies are present and correct. The test is performed:
- on +3V3, +12V, -12V voltages (for the analogue part of the control board);
- on the HF+ 100KHz voltage generated by auxiliary power supply unit board B0059.

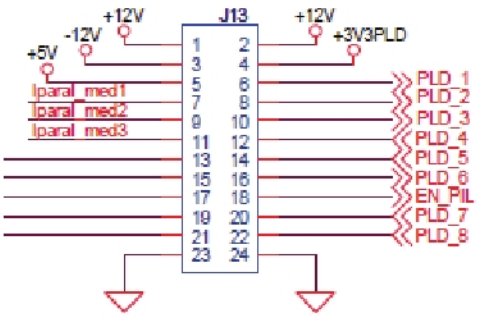
If all the power supplies are correct, the UPS starts up; if the logic AND gives a negative result, the machine stops and displays L01.



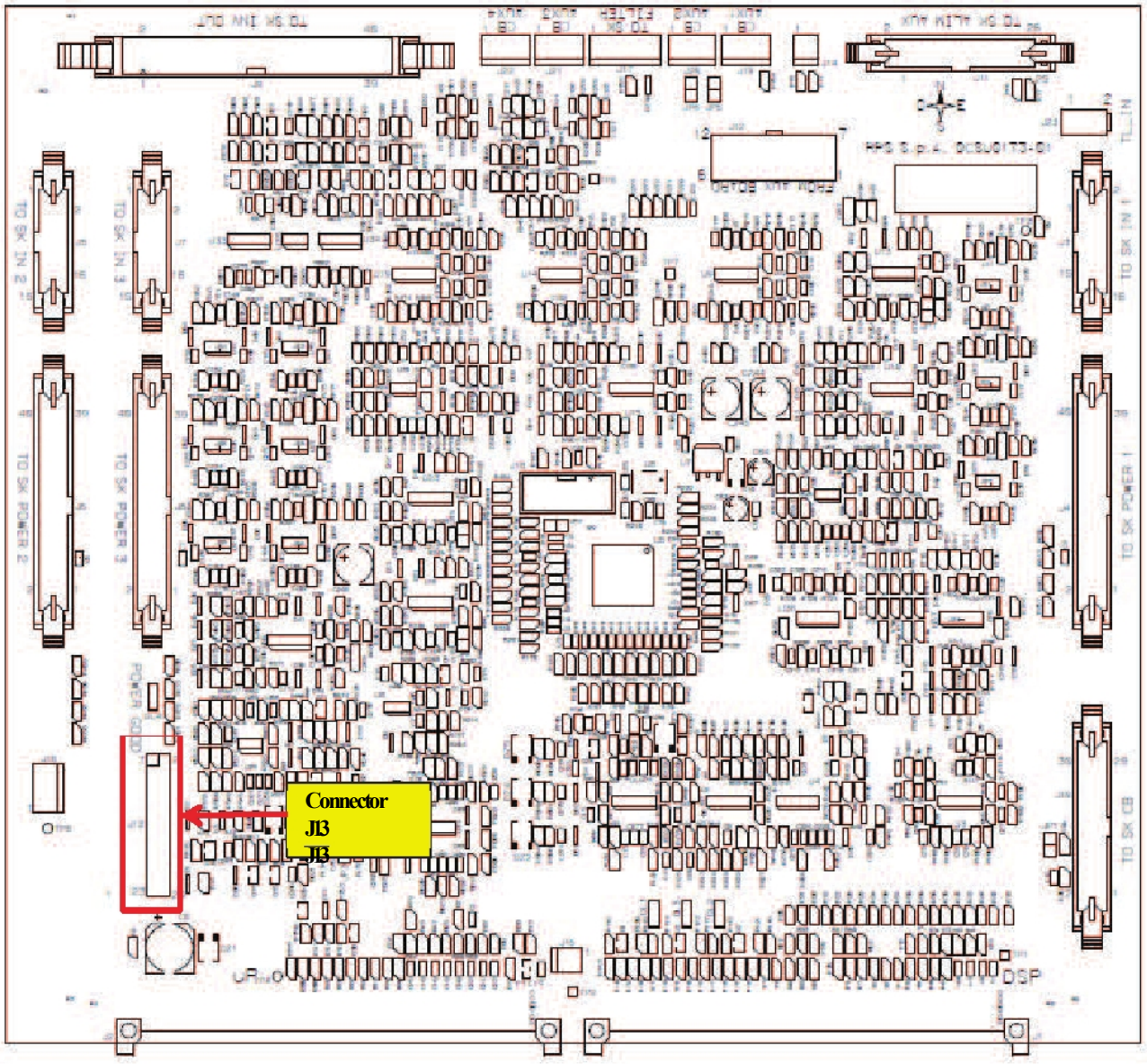
The difficulty in resolving this kind of fault lies in identifying the cause of the problem. In particular it is necessary to understand why the control logic of board B0173 has failed (the failure is not necessarily due to an incorrect voltage supplied by the power supply).

59 CHECK AUX VOLTAGE (L01)

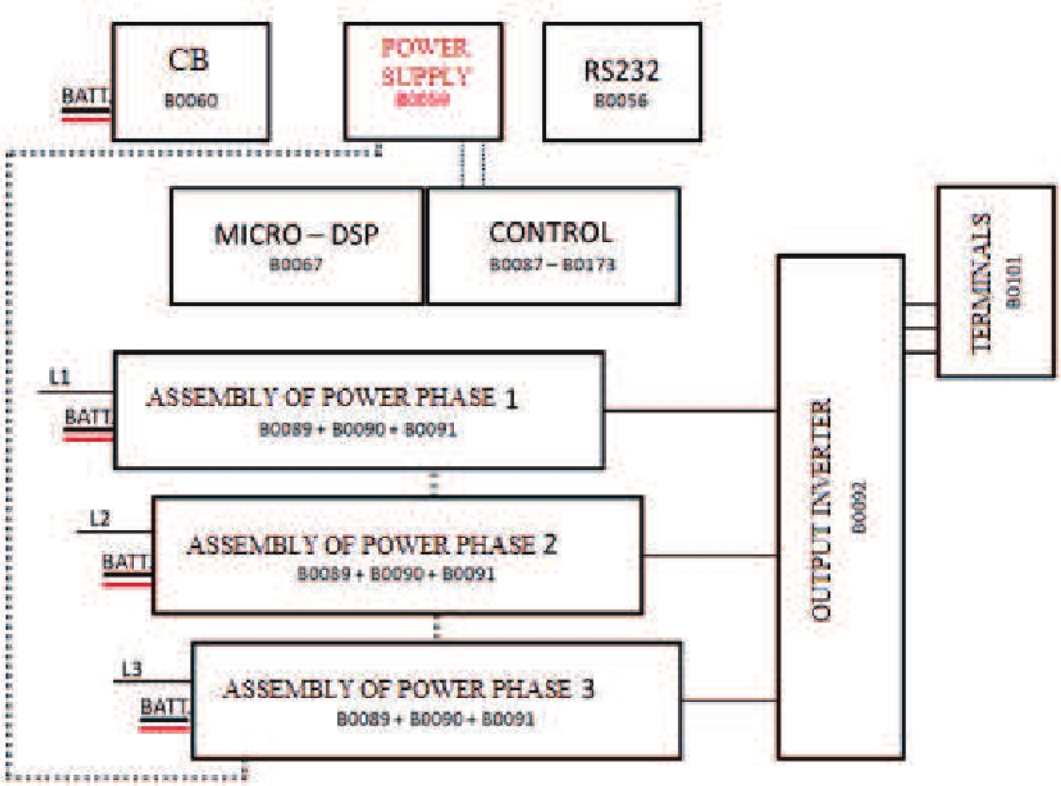
To understand the problem about the L01 alarm, is necessary to check the voltage/s not present. So, is possible to measure, on control board B00173, these points (with UPS in standby mode):



On connector J13 on board B00173 between pins
1 & 23 → +12V
3 & 23 → -12V
4 & 23 → +3,3V
5 & 23 → +5V



5.10 POWER SUPPLY UNIT FAULT

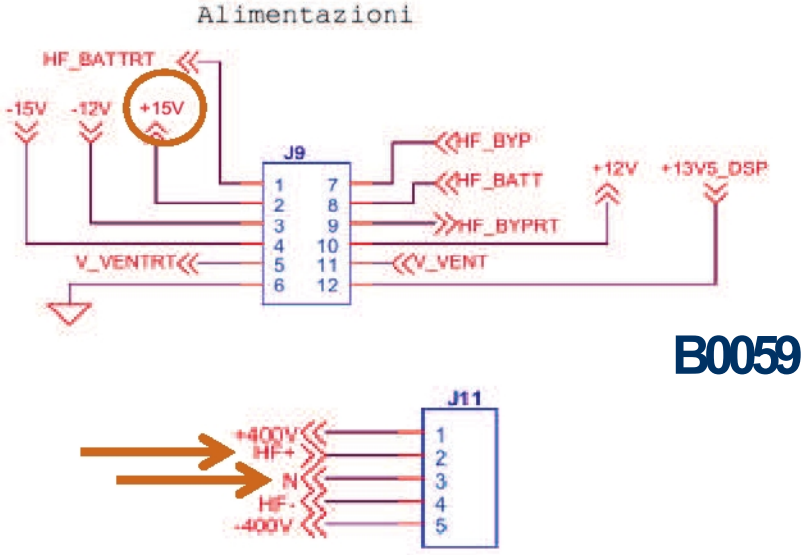


OBSERVATIONS

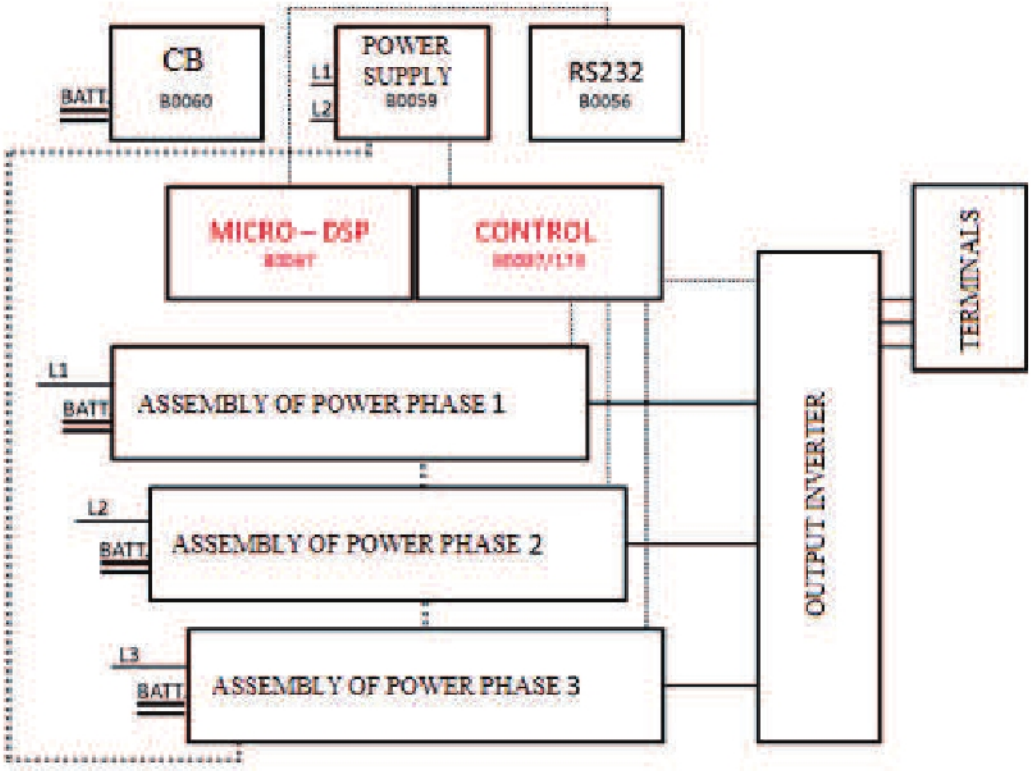
If the auxiliary power supply unit ceases to provide the correct power supply (i.e. the 12V or HF supplies), the logic board stops the UPS and displays error L01.

In the most serious cases the machine may not switch on if the voltage supplied from the power supply unit is insufficient to activate the logic board.

The presence of power supply voltages can be checked directly at board B0059 by disconnecting connector J9 (**with the UPS completely switched off**) and leaving J11 connected and closing the SWIN. Check for the presence of power supply voltages and, if possible, the presence of the HF+ supply (measuring between HF+ and N with the multimeter in DC mode, the reading should be approx. 27V).
In the event of missing or incorrect power supplies, replace board B0059.



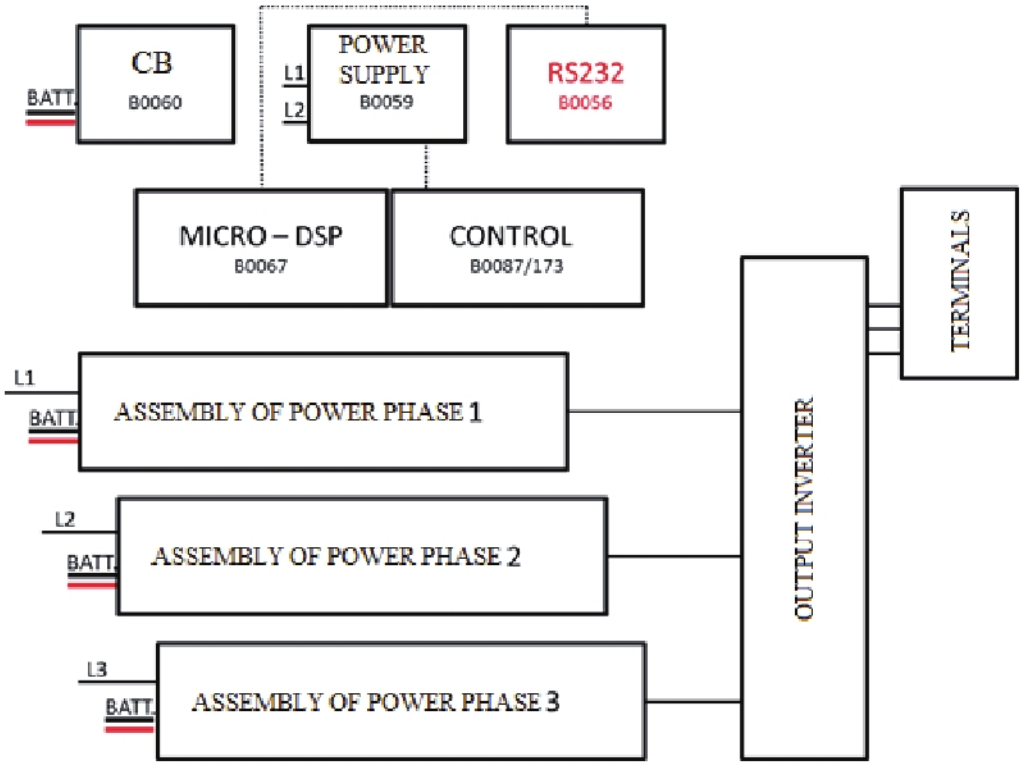
5.11 MICRO DSP / CONTROL BOARD FAILURE



It is possible that a fault at the logic boards, which affects an integrated circuit, may produce error L01 due to an error in the auxiliary power supplies test.

In addition, it is possible that the failure of particular components could lead to the absorption of a strong current at the 100KHz HF power supply circuit and damage the fuse resistors on the power boards (see following section 6.2). It is therefore necessary to continue with the fault analysis using the checks detailed in the following chapter 6.2. It is also possible that the fault impacts the power supply unit board as well, causing the protections to blow (see section 5.9 on power supply unit failure).

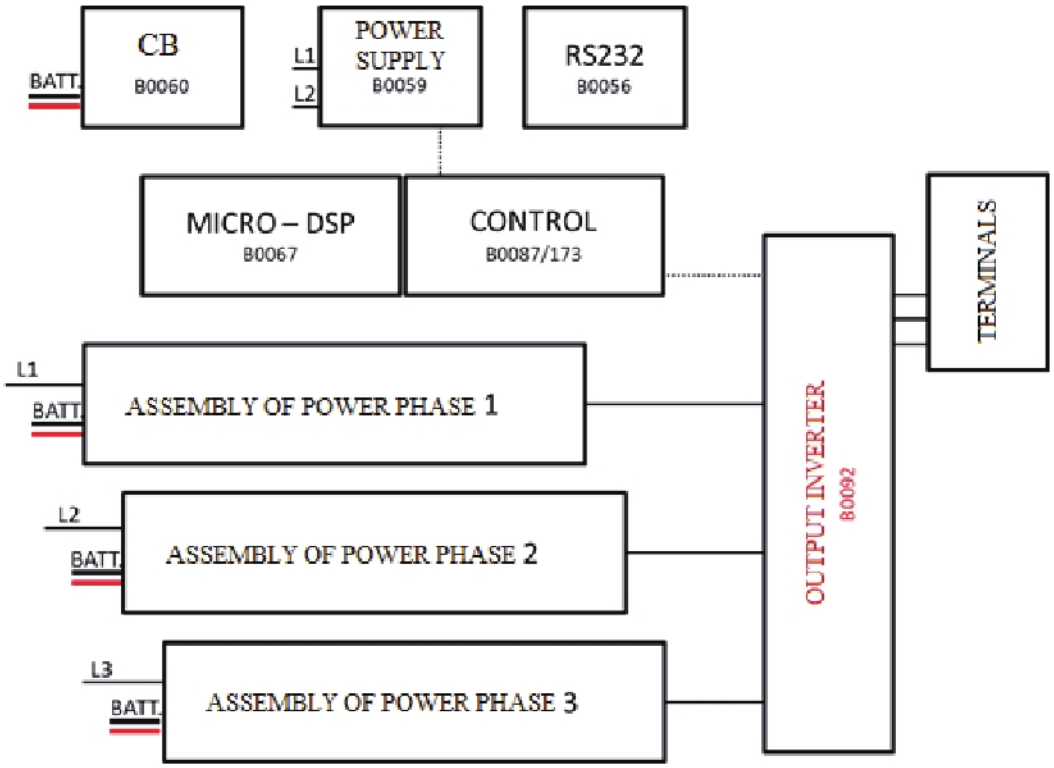
5.12 BOARD RS232 FAILURE



The failure of a component of board RS232 (supplied by a HF line directly through the control board and DSP micro board) could cause error L01. Often, in the event of the failure of this board, the UPS also signals that the EPO is disconnected, or that a remote command is present (in reality this is a false command generated by the fault).

A serious fault may also damage the power supply unit, which should, if necessary, be replaced after replacing board RS232.

5.13 INVERTER OUTPUT BOARD FAILURE



A short circuited current sensor (LEM) at the inverter output board may absorb too much current and may also damage the control board and flat connection cable.
The LEM are supplied at ±15V and the power supply line is quite robust, so much so that the control board can sometimes overheat near the connector that leads to the inverter output. A similar result may arise due to a failure at the direct current output balancing circuit (supplied at 12V). In this case the two boards and connection cable should be replaced.

Following a failure at the power supply board or strong interference in the input mains power (i.e. the disconnection of the neutral), the 0 fuse resistor that connects the UPS logic to GND may blow. In this case, there is no actual problem at the auxiliary power supplies; however, the logic is no longer working correctly and typically displays error L01 (i.e. the result of the first check that the UPS carries out upon start-up). The problem can be resolved by changing the fuse resistor or replacing the inverter output board. This resistor is R59 on board B0092.

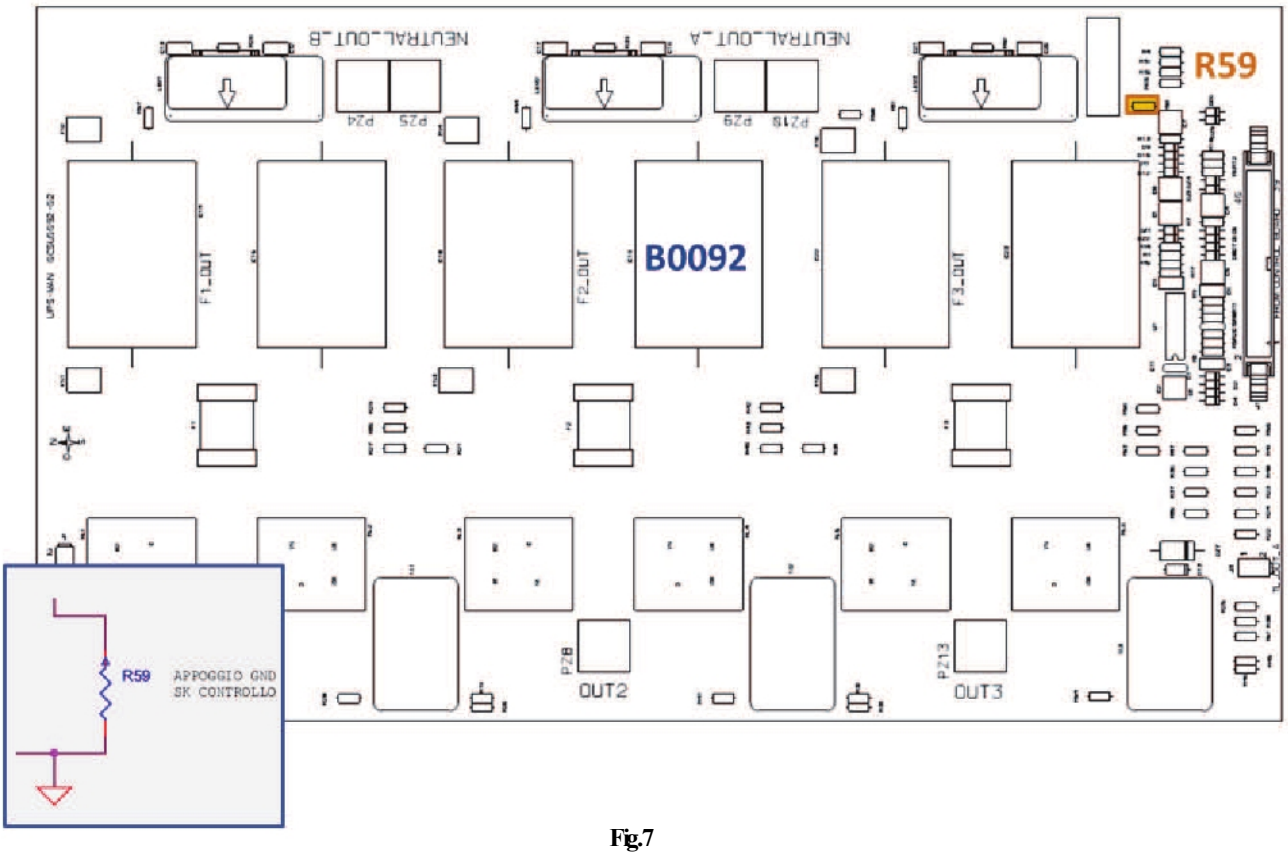


Fig.7

5.14 FAN FAILURE

The presence of a blocked fan or a fan with a short circuit winding may damage the power supply unit board. It may occur that after replacing the power supply unit board, it fails once again because the fault at the fan persists. It is therefore advisable to note that a dual failure of the power supply unit board may be caused by a faulty fan.

A short circuit at one of the fans may also lead to the overheating of the tracks on the control board, in the same way as described for a failure at the inverter output LEM.

6 COMPONENT TESTS FOLLOWING THE FAILURE OF THE POWER ASSEMBLY

Following visible damage inside the UPS that requires the replacement of a power assembly, it is also necessary to check the status of all the other power boards (even if they appear not to be damaged).

1) Open all disconnecting switches. **IMPORTANT:** it is very important that all battery disconnecting switches are open. Disconnect any internal batteries.
2) **IMPORTANT:** completely disconnect the UPS from any power supply, including any battery boxes, other UPS in parallel or other power sources. Make sure there is no voltage present.
3) Discharge the DC capacitor bank and wait 10-15 minutes for the voltage in the bank to reach a level close to 0V.

6.1 TESTS FOR INPUT POWER BOARD (B0090)

Always check:

1) the status of the mains input fuses (F3).
2) the status of the positive branch battery fuses (F1-F2) and negative branch battery fuses (F4-F5) (see Fig. 25 on page 42).
3) use a multimeter to check that the contacts of relays RL1 and RL2 are not short circuited (between NO and COM; see Fig. 8).

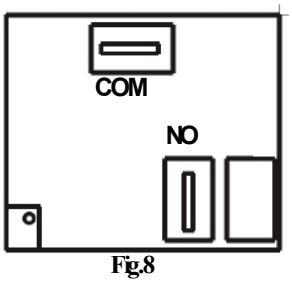


Fig.8

The fuses should be replaced if they are damaged and the additional tests described in the next section should be carried out.

If the relay contacts are short circuited, board B0090 must be replaced.

62 TESTS FOR POWER BOARD (B0091) AND INPUT CAPACITOR BOARD (B0089).

1) Disconnect the hanging wires from connectors J2 and J3 on the B0091 boards for all phases; see Fig. 9 and disconnect the cable from connector F_INV or L_INV based on the power assembly version).

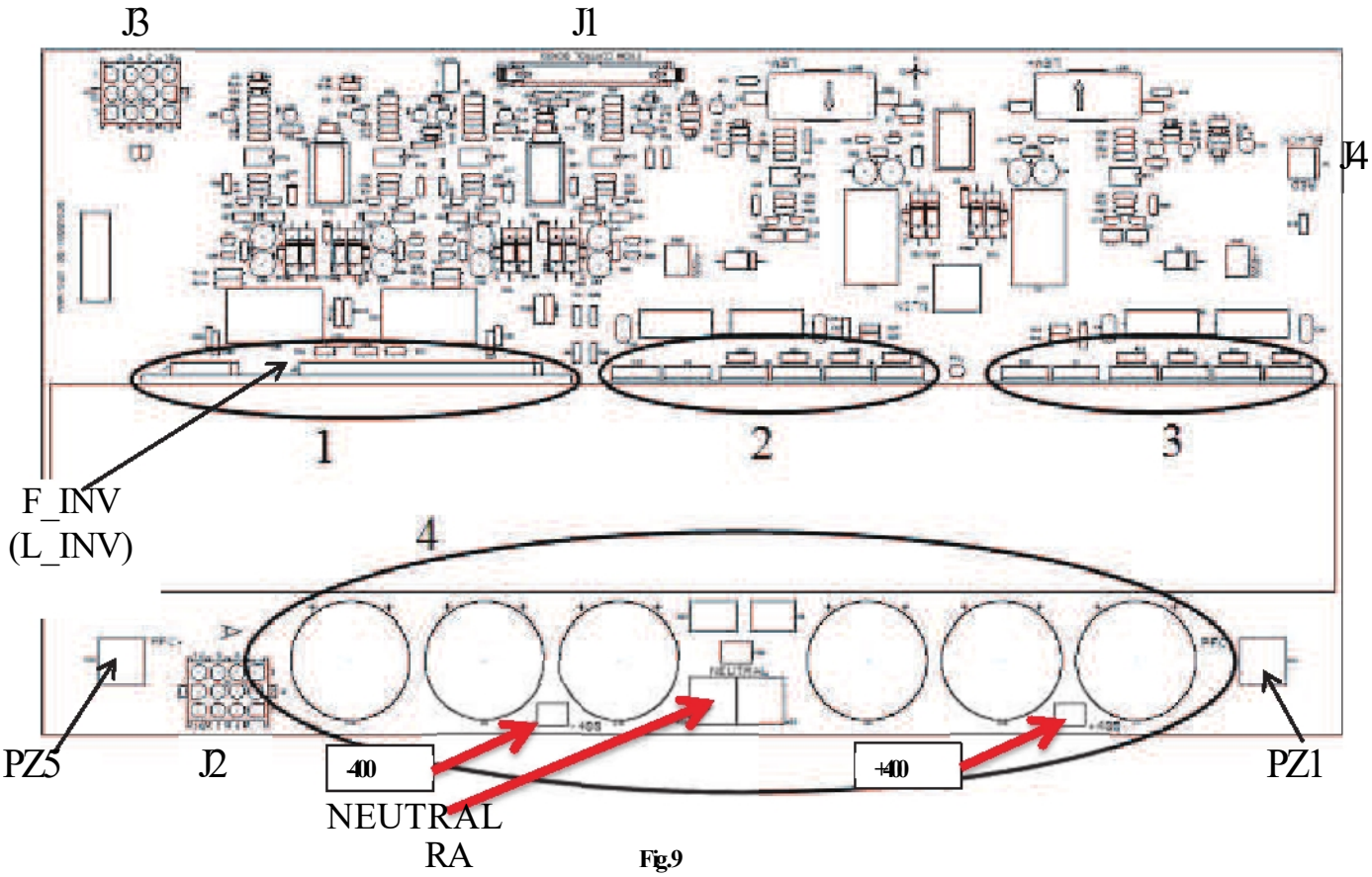


Fig.9

2) using a multimeter set to ohmmeter, check that there are no short circuits between NEUTRAL - (+400) and NEUTRAL - (-400); see Fig. 9.

3) Using a multimeter set to diode test, check that the semitop modules (B0089) are OK (test diodes D1, D2, D3, D4). In the event that a diode or several diodes are short circuited, replace B0089. Refer to Fig. 10. In the event that a diode or the SCR is short circuited, replace B0089.

Fig.10

4) Test the inverter and booster:

- in diode test mode, measure between J3-PIN6 and PFC+ & J3-PIN6 and PFC-
- in diode test mode, measure between J3-PIN3 and PFC+ & J3-PIN12 and PFC-
- in diode test mode, measure between LINV (or FINV) and J3-PIN3 & LINV (or FINV) and J3-PIN12

Check that each pair of measurements returns a similar value and that no short circuits are present Fig. 11). If this is not the case, the assembly is faulty and must be replaced.

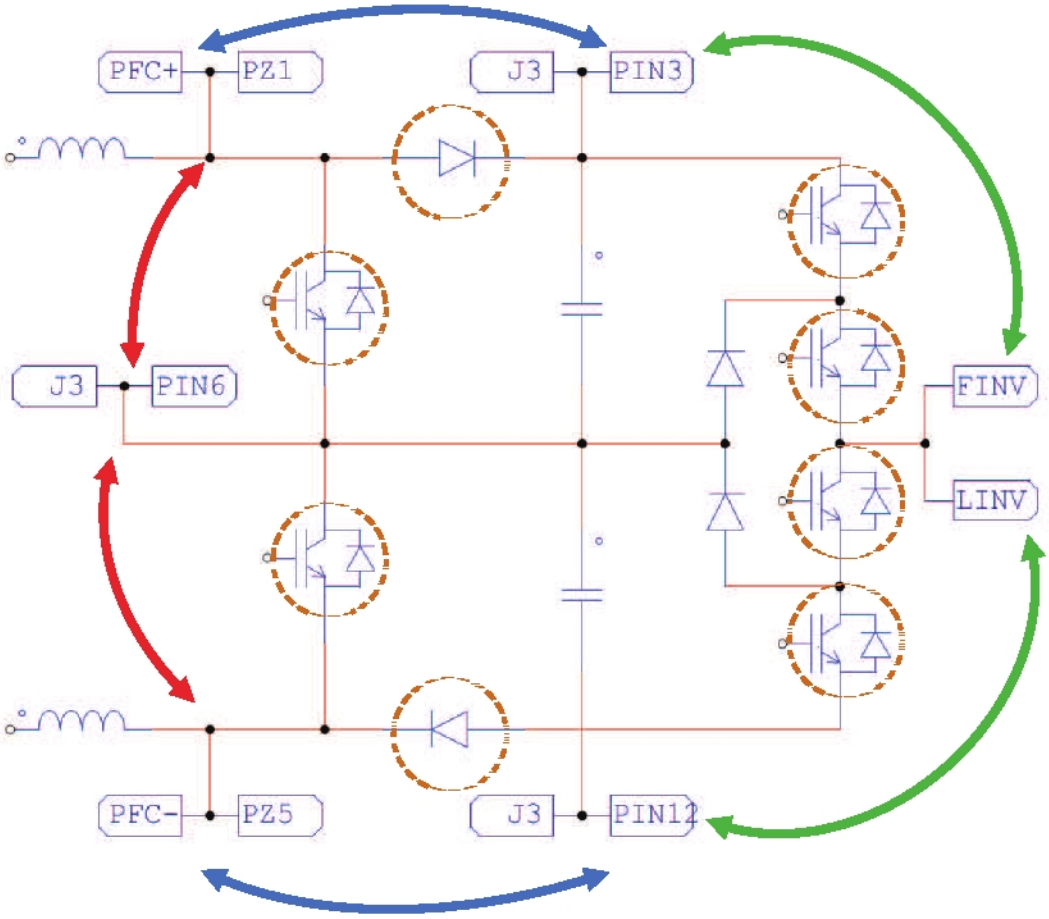


Fig.11

Connector J3 on board B0091

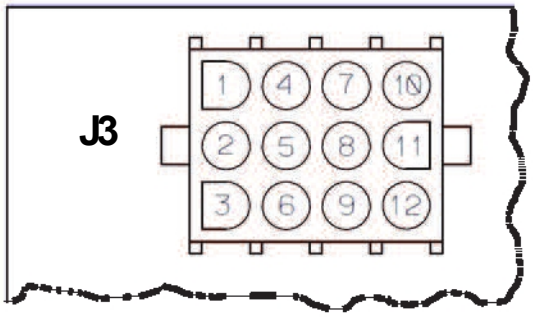


Fig.12

5) Fuse resistor test

It is possible that an IGBT module on a power assembly fails and absorbs too much current from the auxiliary power supply, causing a fuse resistor (R51 -1.2) to blow on a power assembly (board B0091).

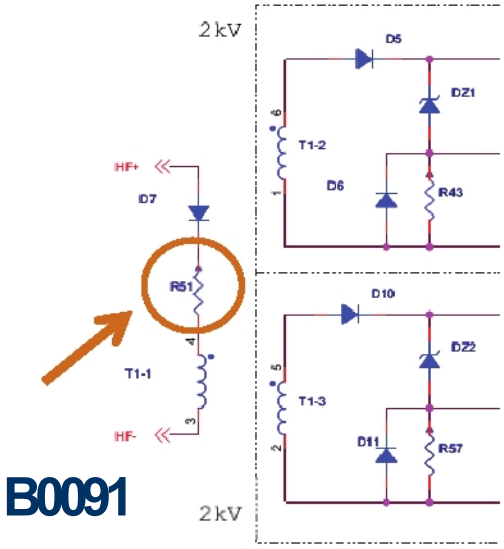


Fig.13

Resistor R51 is located on the primary circuit of the base drive that distributes power to the IGBTs for the positive and negative booster (Fig. 14).

The same board also houses two resistors on the base drives for the power supply to the positive and negative inverter stage (R72 and R88 - 1.2 each) highlighted in Fig. 14.

30-40KVA POWER ASSEMBLY

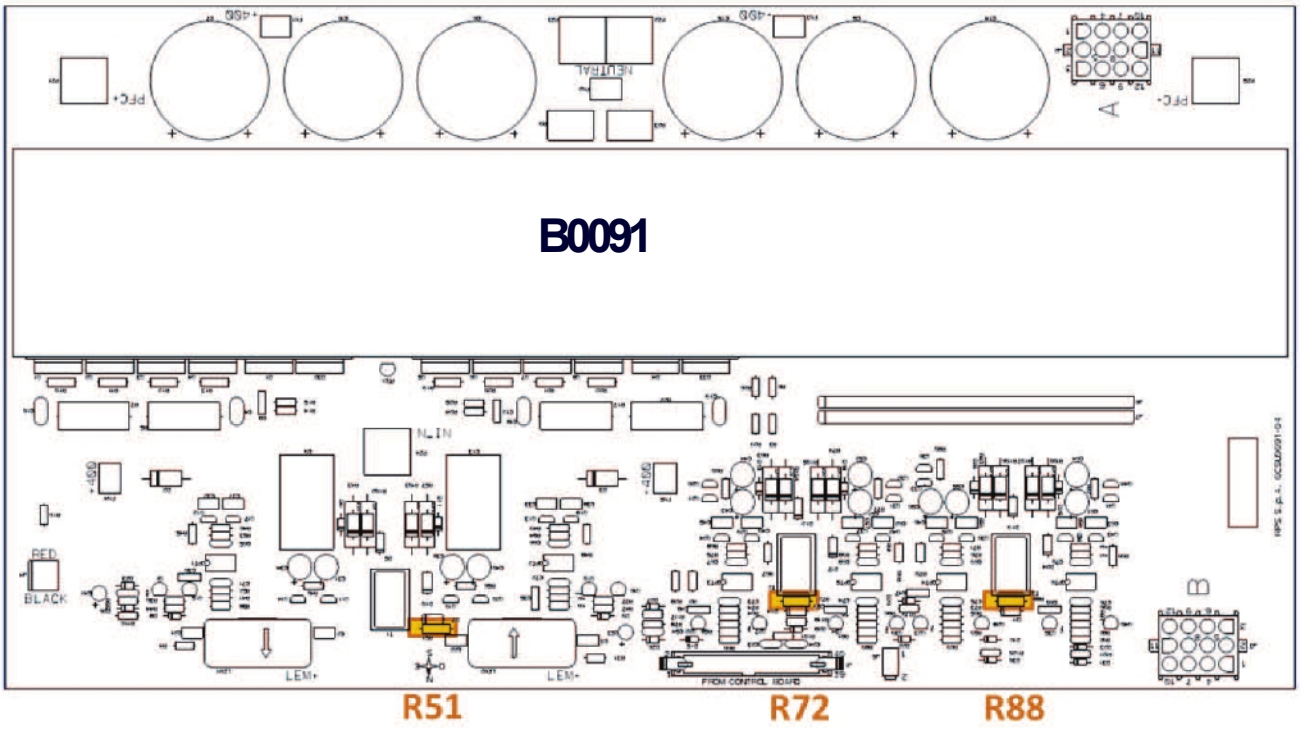


Fig. 14

The fuse resistors described above may blow following the failure of a power module, or due to a short circuit between the pins of the plugin connectors that carry the 400V direct current, or due to a fault at the power supply unit.

Once the resistors on all three phases have been checked, the following conclusions can be reached:

1. only one assembly has a problem at the fuse resistors. Replace the power assembly affected by the fault.

2. all three power assemblies have a fault at the fuse resistors. The fuses blowing may have been caused by a fault in the power supply unit (if this has not already been replaced it is advisable to replace it as a precautionary measure) or by a fault in the logic boards.

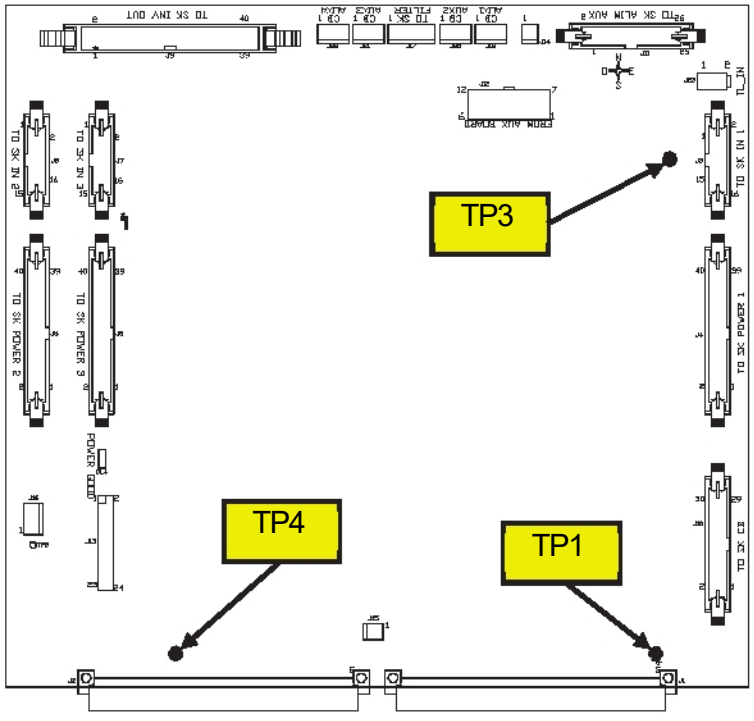
63 CABLE CONNECTIONS TEST (LINK FAIL)

If necessary, use a multimeter set to ohmmeter to check the following on board B0173 (B0087):

- resistance within the range of **1-15** between test points TP3 and TP4
- resistance within the range of **1-2**k between test points TP3 and TP1

If the tests give a positive result it means that the flat cables have been connected correctly. If this is not the case, check the correct insertion of the flat cables into the respective holders on the CS.

BOARD B0173 (B0087), TEST POINT POSITIONS



Fg.15

7 DESCRIPTION OF BOARDS

7.1 INTERFACE BOARD (B0056)

Versions:
B0056-02. Interface Card Saturn / Saturn 10-120

NOTE : on UPS without accessories JP3, JP4, JP6 must be closed and JP1, JP2 must be open.

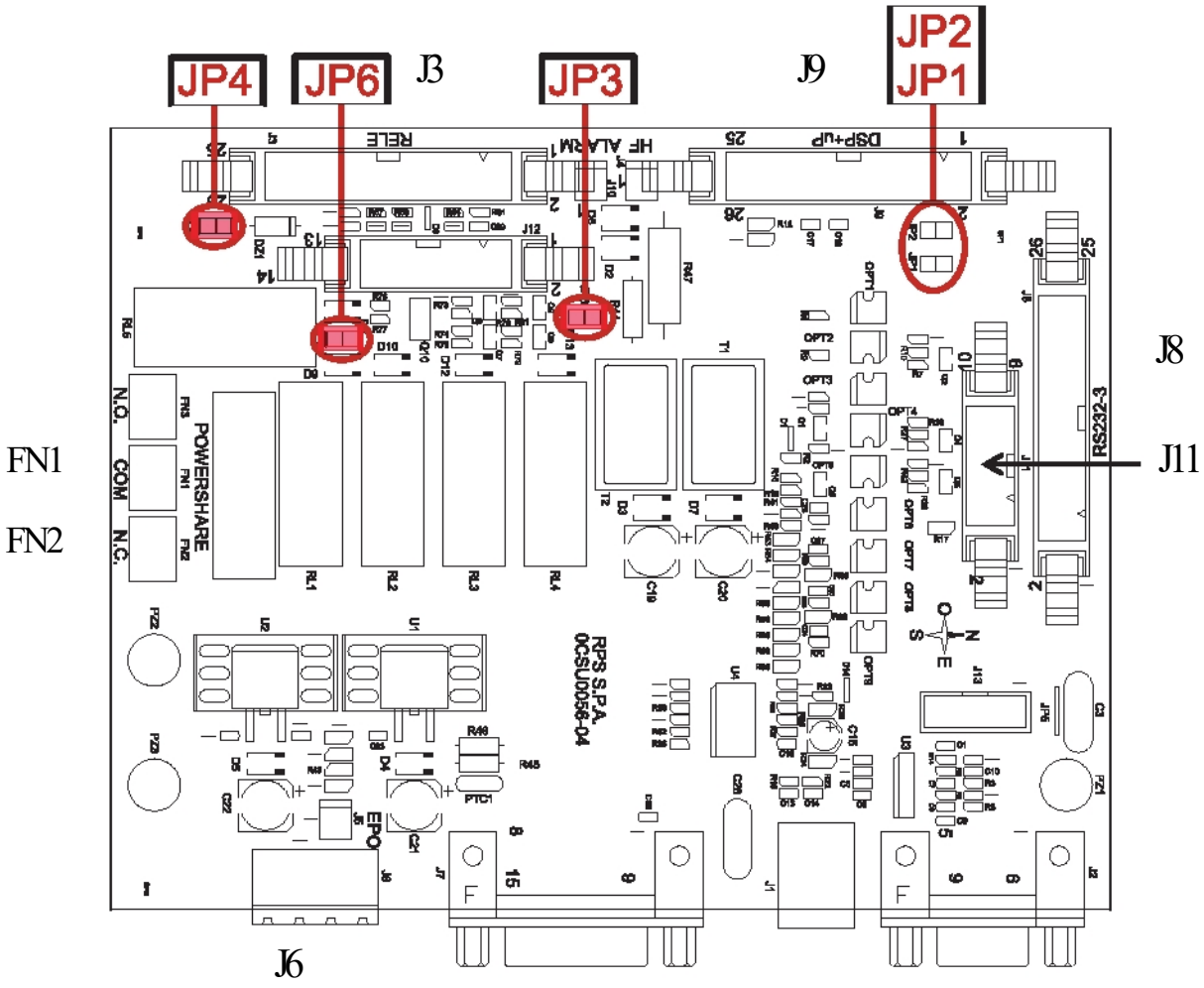


Fig.16

Connector	Description	Notes
J3	Flat connection from relay board	From aux relay slot
J6	EPO connector	
J8	Flat connection from DSP-uP board	From B0067
J9	Flat connection from DSP-uP board	From B0067 and slot1
J11	Flat connection to slot 2	To slot 2
FN1-FN2	Powershare connectors	

72 DISPLAY BOARD (B0057)

Versions:
B0057-02. Display Card Saturn

The display board is made up of the following main elements:

1) DL1, 2, 3, 4, 5 and 6 Led indicator
2) SW1, 2, 3, 4 Are selection buttoms

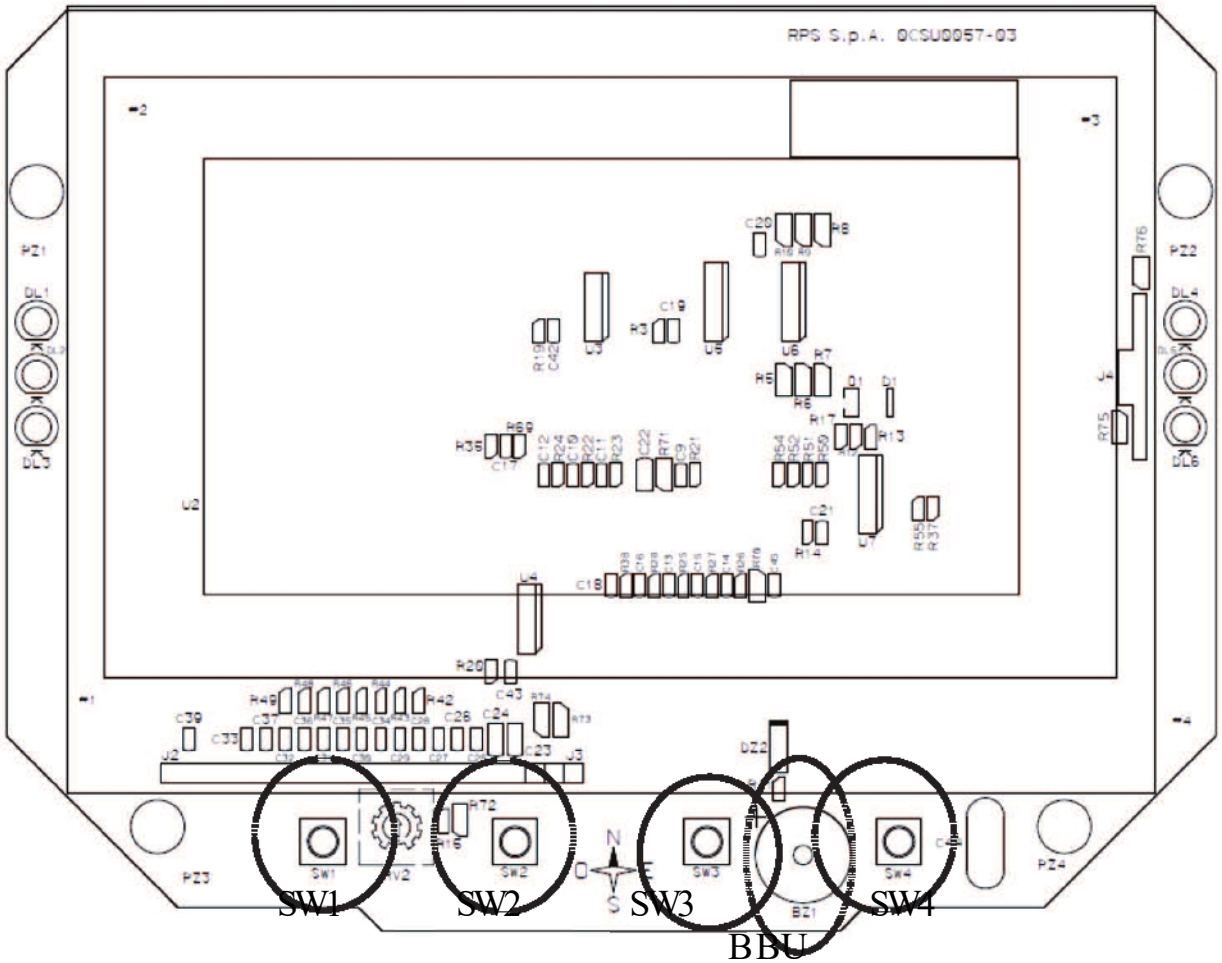


Fig.17

Led	Description	Notes
DL1	Mains operation LED	
DL2	Battery operation LED	
DL3	Load on bypass LED	
DL4	Standby/alarm LED	
DL5	Replace batteries LED	
DL6	ECO mode LED	

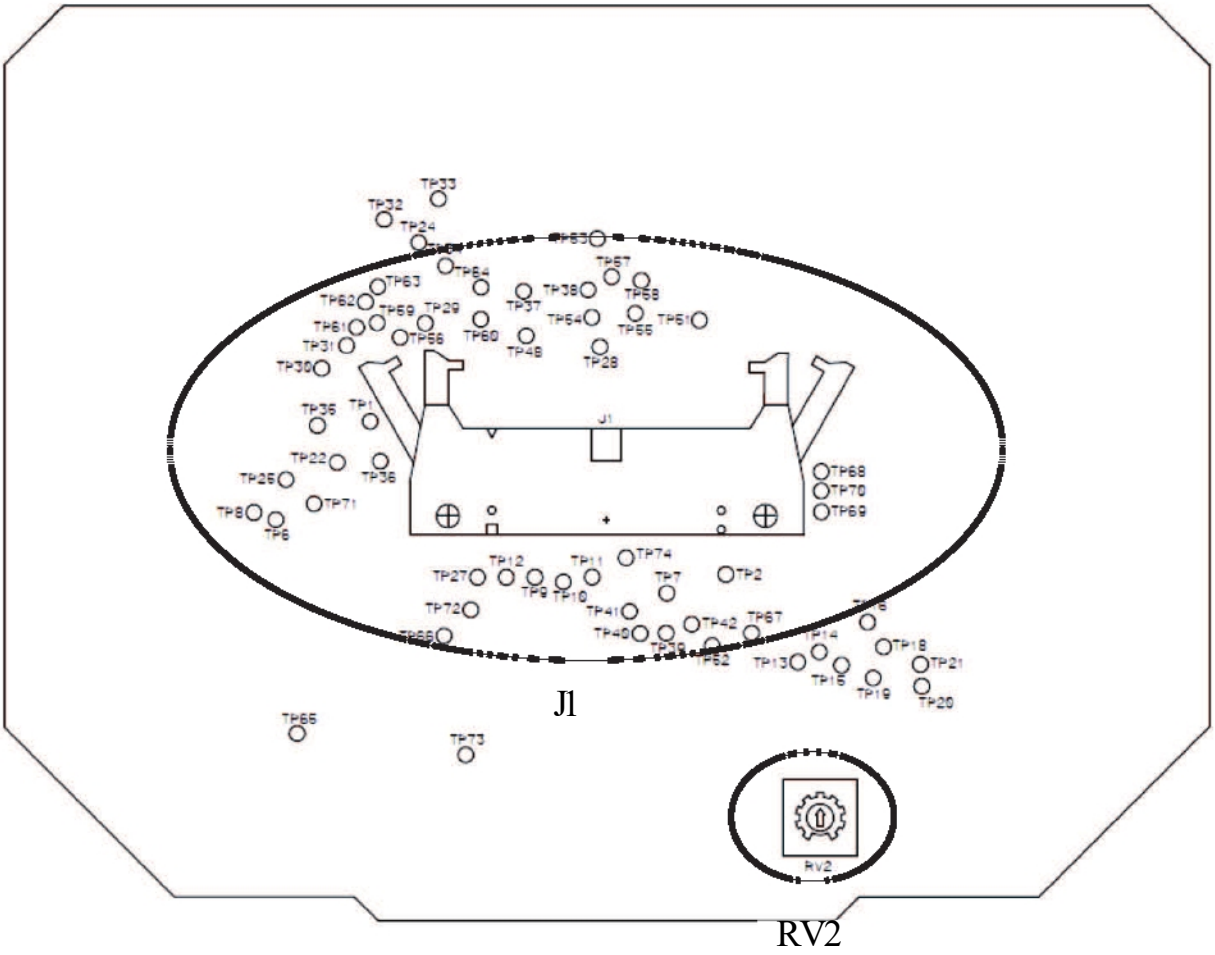


Fig.18

Connector	Description	Notes
J1	Flat connection to uC+DSP board	to B0067
RV2	Trimmer to regulate the contrast on display	

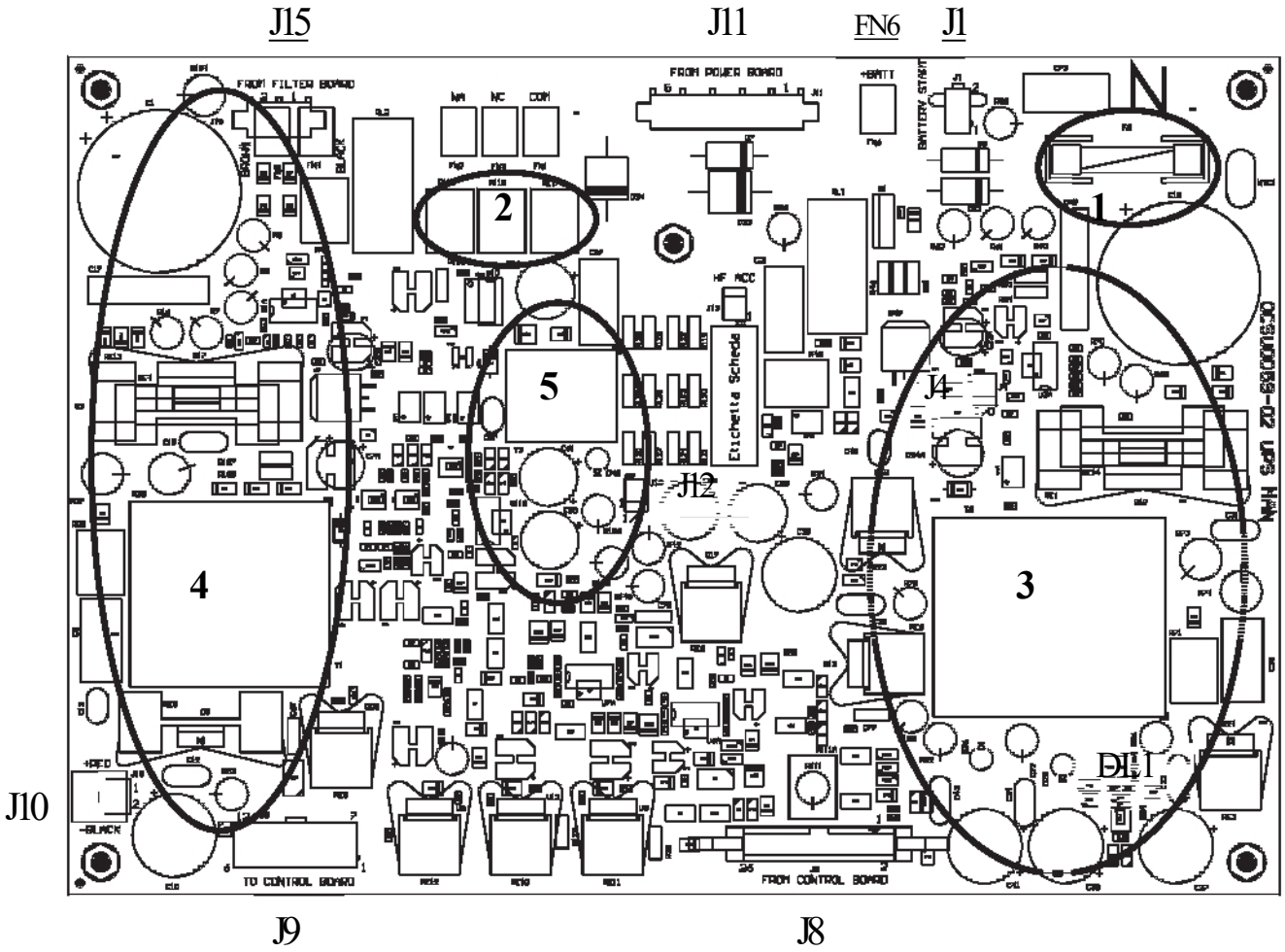
ATTENTION: It is important when starting the UPS in a very cold environment to allow the display time to warm up before adjusting the contrast via RV2.

73 AUXILIARY POWER SUPPLIES BOARD (B0059)

Versions:
B0059-01. Aux power supply card Saturn 10-40 (for all sizes)

The auxiliary power supplies board is made up of the following main elements:

1) fuse (code 0602020066_6.3x32 2A 500V GF)
2) DC Bus pre-charge from mains
3) main power supply unit
4) fan power supply unit
5) redundant bypass power supply unit



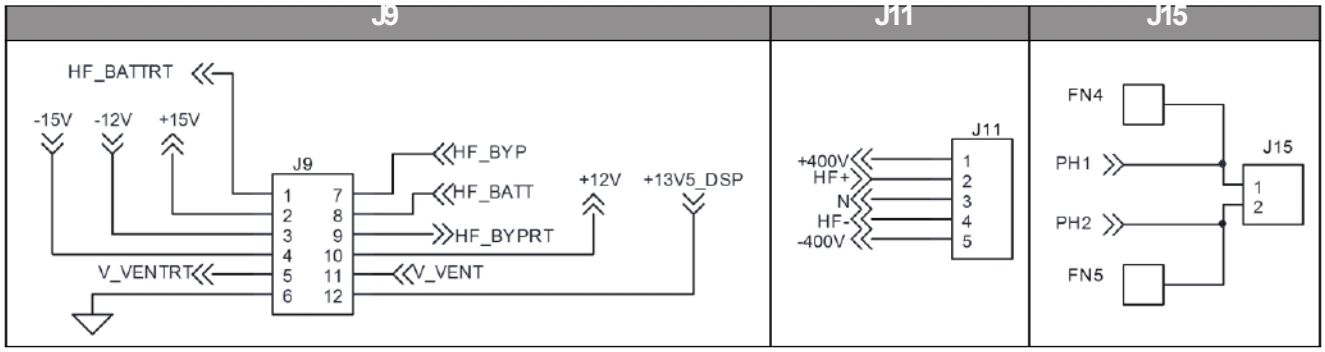
Fg.19

Connector	Description	Notes
J1	Vbat connector for battery start-up	
J4	Connector for I/0	Put jumper
J8	Flat connector from control board	From B0087 or B0173
J9	Connector for power supplies to control board	From B0087 or B0173

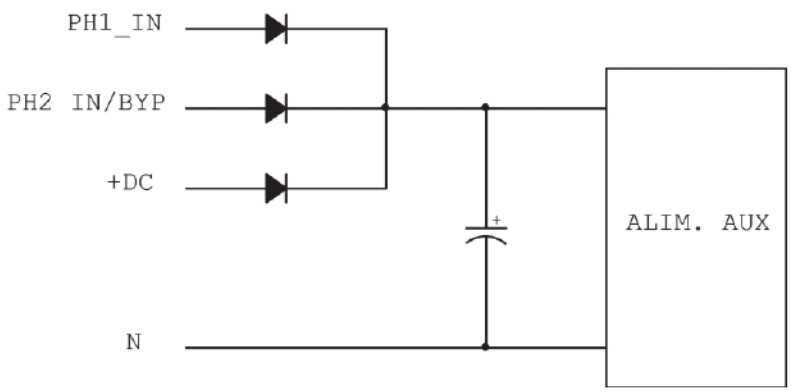
Connector	Description	Notes
J10	Fan power supply connector	
J11	DC BUS, HF connector	From B0091 phase 3
J12	Connector for I/0	
J15	Connector for mains power supply	pin1 Æ from FN2 B0109 pin2 Æ from FN6 B0109 (with single input UPS) pin2 Æ from PH2 SWBY (with dual input UPS)
FN6	+batt connector for battery start-up	

LEDs	Description	
DL1	Aux ON warning LED	

Connector pin layout:



Power supply diagram:



7.4 BATTERY CHARGER BOARD (B0060)

Versions:
B0060-02. Battery Charger Card 10A Saturn 30-100 (for all sizes)

The battery charger board is made up of the following main elements:

1) 2 fuses 6.3X32 - 16A 500V rapid
2) DC Bus pre-charge resistors from battery (4 x 22 10W)
3) input capacitors
4) output capacitors
5) dual buck + heaksink temperature sensor
6) current sensors
7) buck inductances
8) blocking diodes

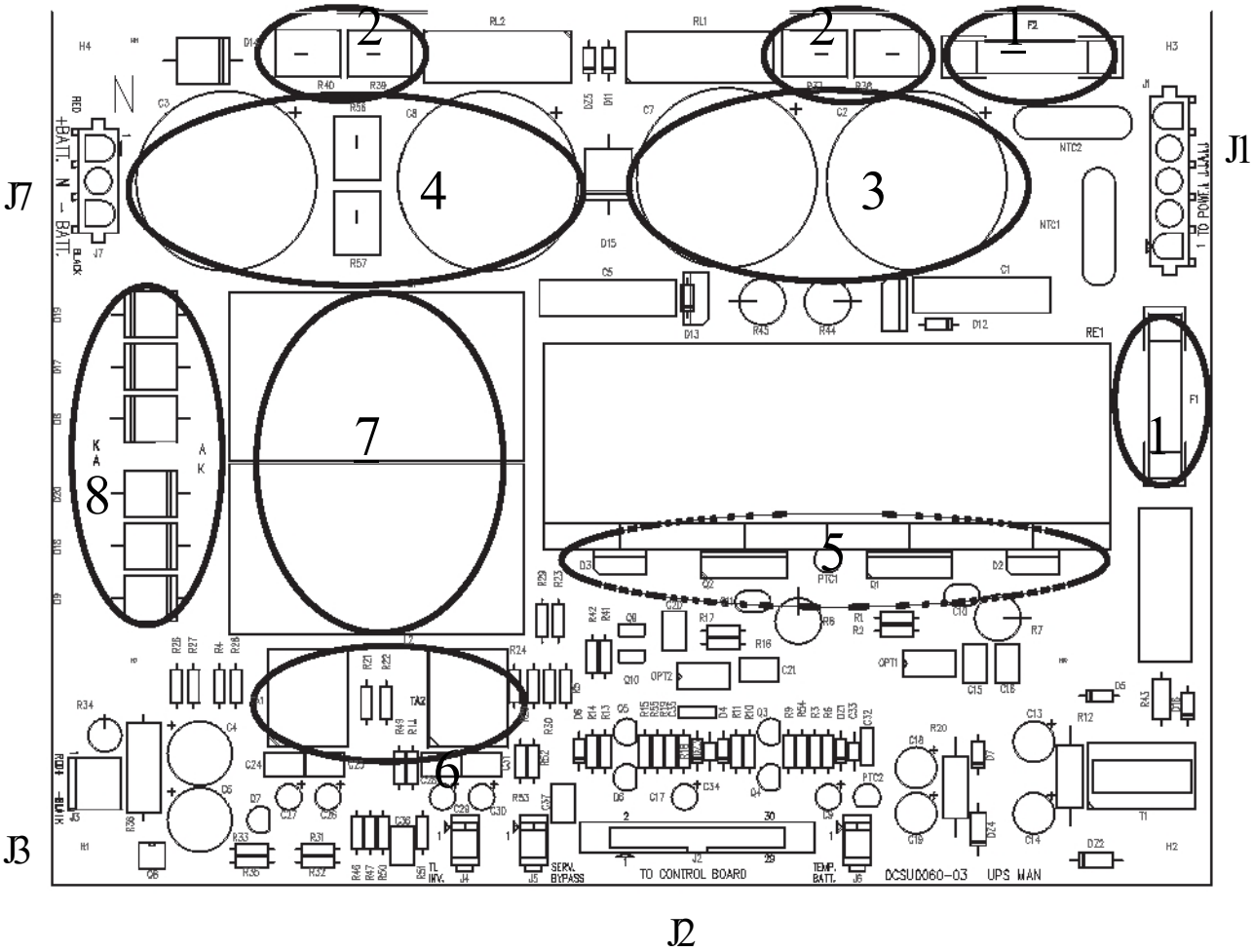
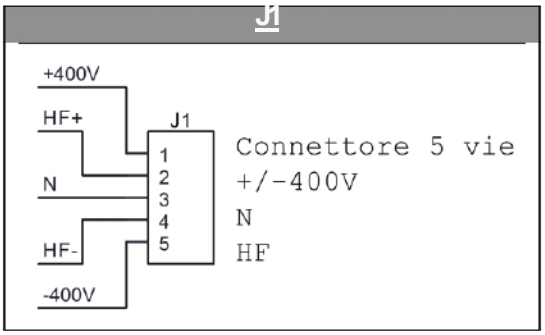
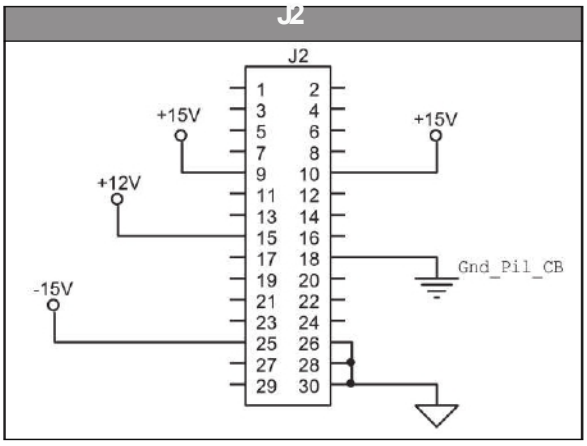


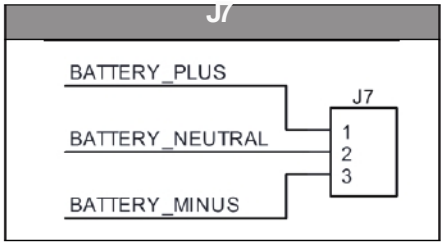
Fig.20

J1	Battery charger input connector	From B0091 phase 1
J2	Flat connection from control board	From B0087 or B0173
J3	Fan power supply connector	
J7	Battery charger output connector	

Connector pin layout:







7.5 uC + DSP BOARD (B0067)

Version:
B0067-01. DSP+µC Control Card for SATURN 30-40

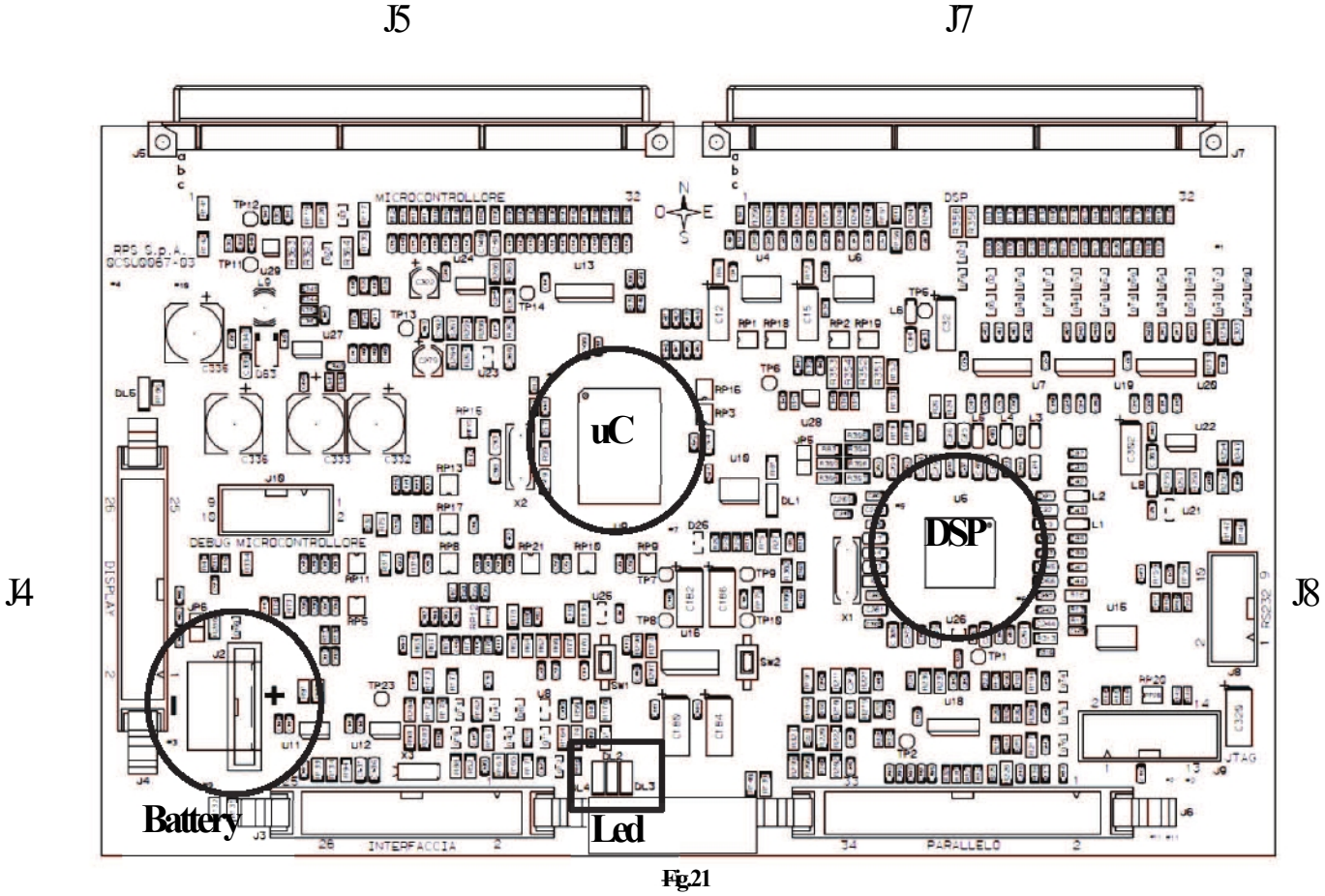


Fig.21

Connettore	Descrizione	Note
J3	Flat connections to interface boards for SLOT 1	To B0056 and SLOT 1
J4	Flat connections to display boards	From B0057
J5	connector uC to control board	To B0173 or B0087
J6	connector uC to parallel board	
J7	connector DSP to control board	To B0173 or B0087
J8	Flat connections to interface boards for SLOT 2	To B0056 and SLOT 2

Test point	Voltage present
Between TP11 and TP12	+5V
Between TP7 and TP8	+1,9V
Between TP9 and TP10	+3,3V
Between TP14 and TP10	+2,3V
Between TP5 and TP6	+3,3V
Between TP13 and TP10	+4,6V

Led turns on	Means
DL1	Present +5V
DL2	Reset uC
DL3	Present +1,9V

7.6 PARALLEL BOARD (B0085)

Version:
B0085-01. Parallel Card SATURN (for each UPS)

The parallel board is made of these elements:

1) SW1 to select the "Start" or "Continue" mode
2) Yellow led indicates that SW1 is in "Start" position
   Green led indicates that the parallel board is powered
3) SW2 to select the terminating resistor
4) SW3 the input communication line is opened or closed
5) SW4 the output communication line is opened or closed

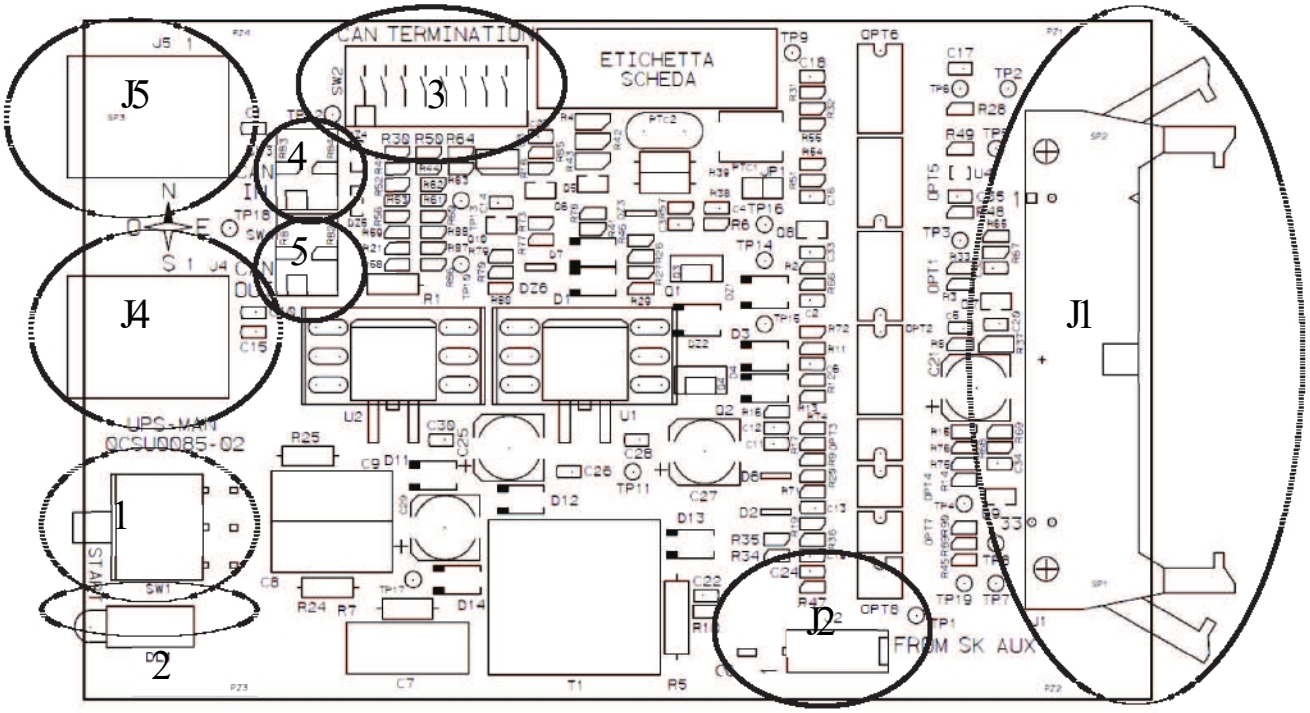


Fig.22

Connector	Description	Notes
J1	Flat connection to uC+DSP board	To B0067
J2	Connection to auxiliary board	To B0059
J4	Output communication line RJ45- OUT	To B0085
J5	Input communication line RJ45- IN	To B0085

7.7 CONTROL BOARD (B0087) [replaced by B0173]

Versions:
B0087-01. Signal Control Card Saturn 30
B0087-02. Signal Control Card Saturn 40

NOTE : B0087 only for power boards with IMS module

The layout of the control board connectors is given below.

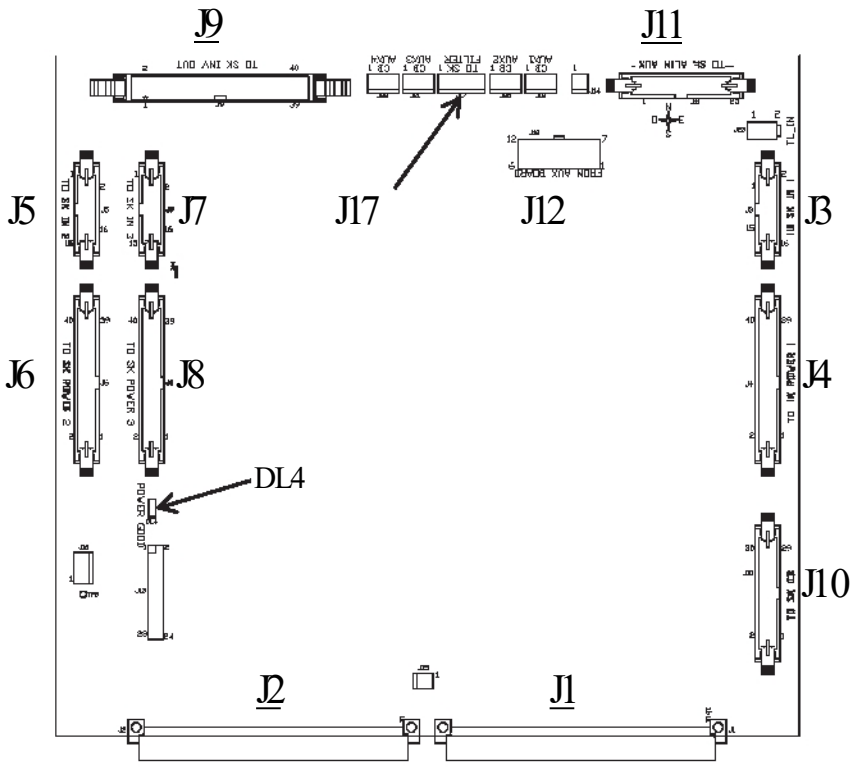


Fig.23

Connector	Description	Notes
J1	Signals for DSP-uP board	From B0067
J2	Signals for DSP-uP board	From B0067
J3, J5, J7	Flat connections to input boards	From B0090
J4, J6, J8	Flat connections to power boards	From B0091
J9	Flat connection to output board	From B0092
J10	Flat connection to CB board	From B0060
J11	Flat connection to aux. power supplies board	From B0059
J12	Connection to aux. power supplies board	From B0059
J17	Connections from terminal board	From B0101

LEDs	Description	Notes
DL4	POWER GOOD LED	

78 INPUT CAPACITOR BOARD (B0089)

Versions:
B0089-01. Input Capacitor Card Saturn 30-40 (identical for all sizes)

The input capacitor board is made up of the following main elements:

1) Semitop module positive branch (input diode and battery SCR)
2) Semitop module negative branch (input diode and battery SCR)
3) Positive clamp diode
4) Negative clamp diode

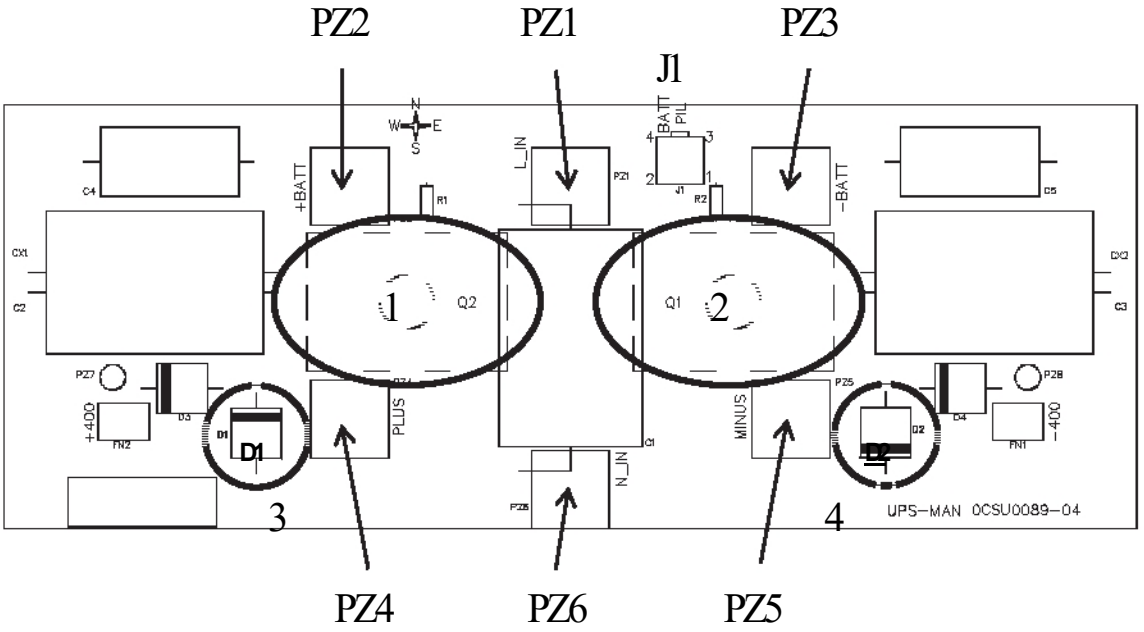
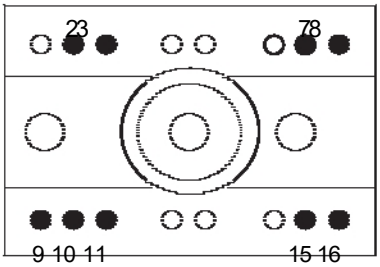
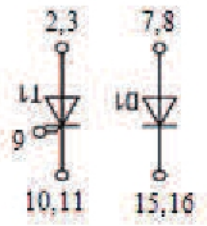


Fig.24

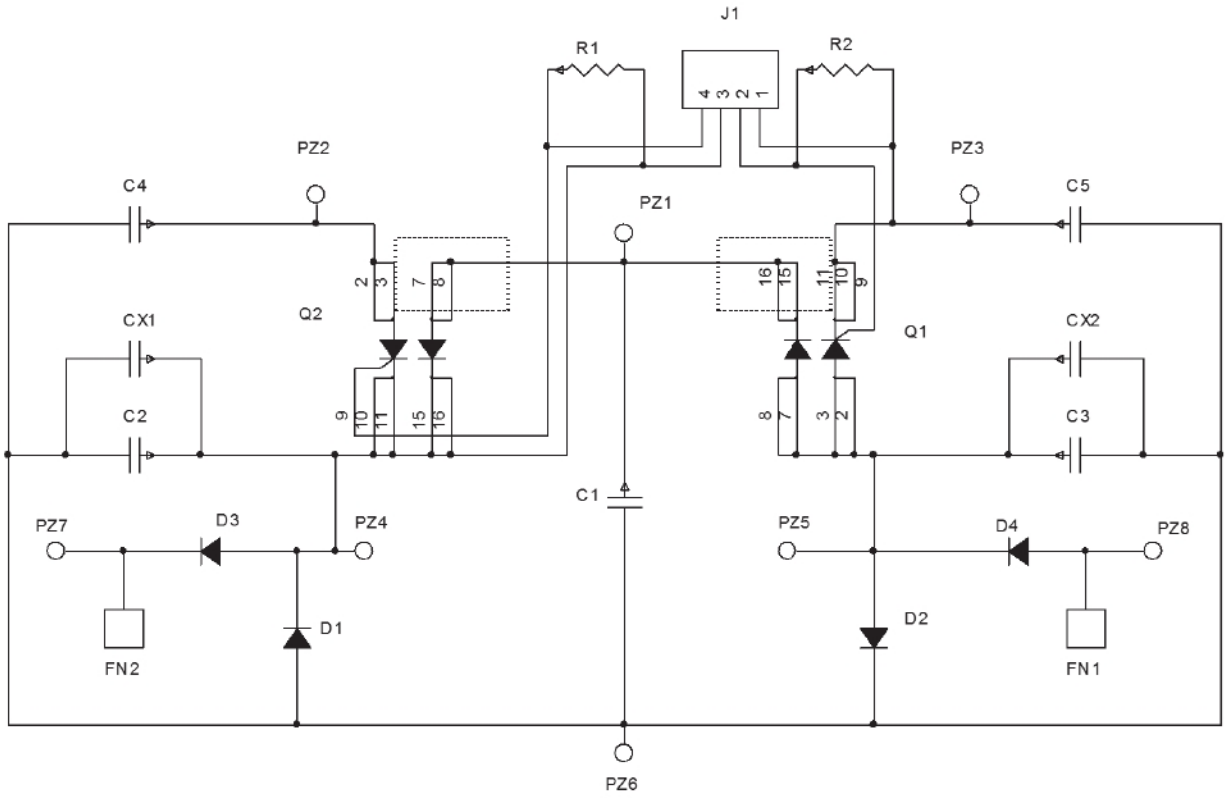
Connector	Description	Notes
J1	Battery SCR control signal connector	
PZ1	L_IN bar	From B0090
PZ2	+BATT bar	From B0090
PZ3	-BATT bar	From B0090
PZ4	Positive boost coil terminal	
PZ5	Negative boost coil terminal	
PZ6	N_IN bar	From B0091

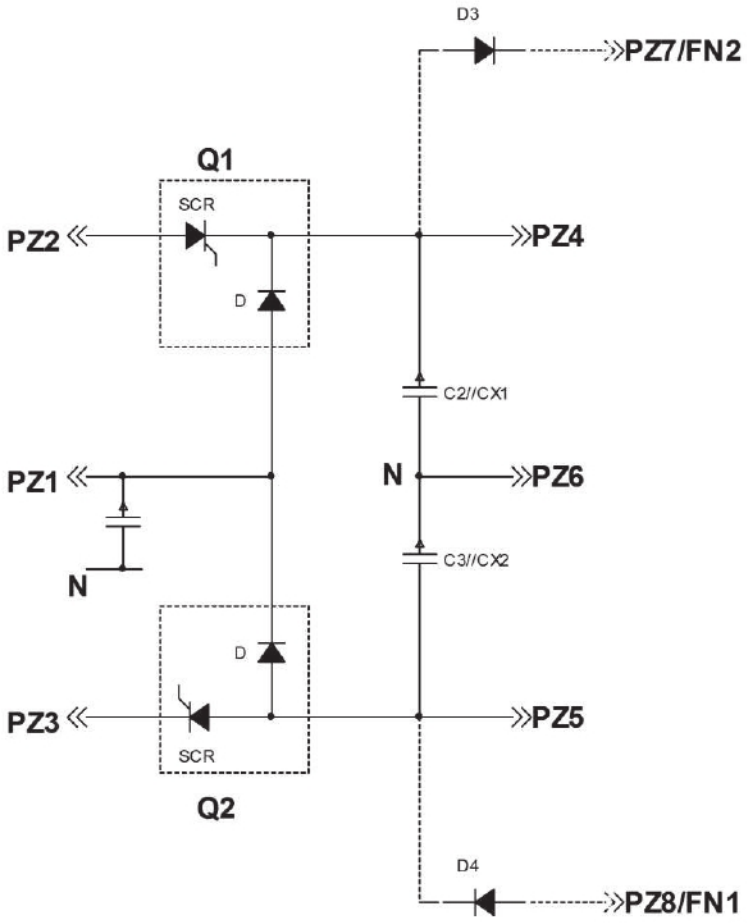
Semitop module.





Board B0089 layout.





79 INPUT POWER BOARD (B0090)

Versions:
B0090-02. Input Power Card Saturn 30 (16A battery fuses)
B0090-01. Input Power Card Saturn 40 (20A battery fuses)

The input power board is made up of the following main elements:

1) Input relay.
2) Positive pole battery fuses. (code 0602010035__6.3x32 16A 500V F for 30kVA)
(code 0602010036__6.3x32 20A 500V F for 40kVA)
3) Negative pole battery fuses. (code 0602010035__6.3x32 16A 500V F for 30kVA)
(code 0602010036__6.3x32 20A 500V F for 40kVA)
4) Mains fuses. (code 0602010053__125A 240V FF)
5) BATTERY SCR control
6) BYPASS SCR control

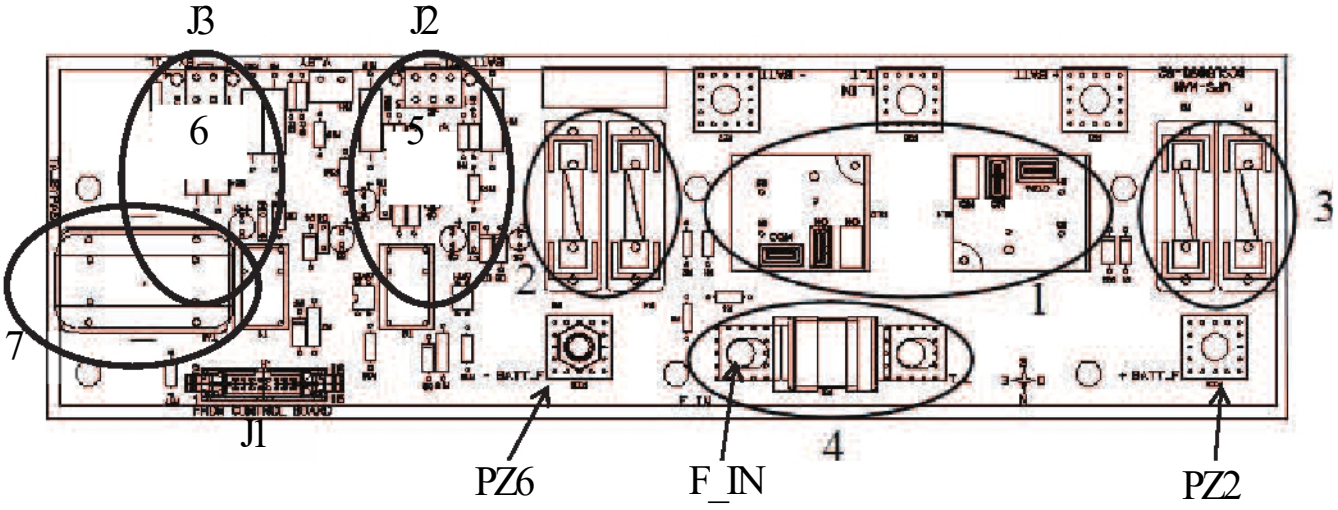


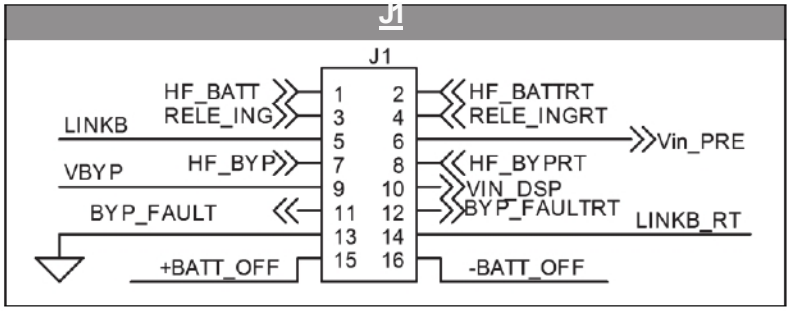
Fig.25

7) Sensor for BACKFEED PROTECTION (BYPASS FAULT)

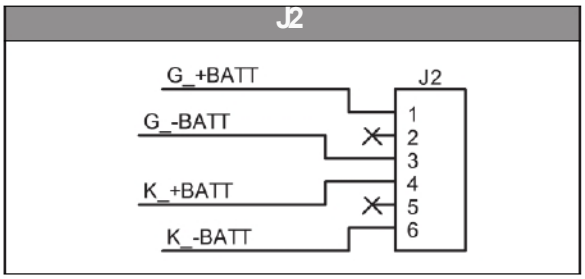
Connector	Description	Notes
J1	Flat connection from control board	From B0087 or B0173
J2	Battery SCR control signal connector	
J3	SCR BYP control signal connector	
PZ2	+batt. terminal	
PZ6	-batt. terminal	
F_IN	Input phase terminal	

Connector pin layout:

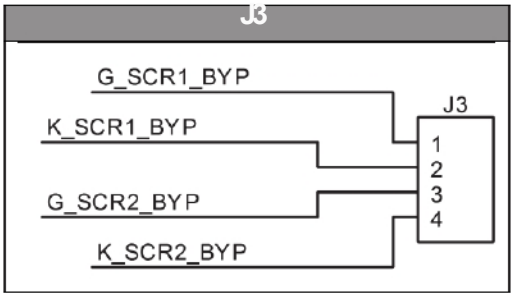
J1



J2



J3



7.10 POWER BOARD (B0091)

Versions:

B0091-01. Power Phase Assembly 40K	IMS (for 40K)
B0091-03. Power Phase Assembly 30K	IMS (for 30K)
B0091-04. Power Phase Assembly 40K	NO IMS (for 40K*)
B0091-05. Power Phase Assembly 30K	NO IMS (for 30K*) NO
B0091-06. Power Phase Assembly 40K	IMS (for 40K*) NO IMS
B0091-07. Power Phase Assembly 30K	(for 30K*)

(*) = cannot be used with B0087, only with B0173.

The power board is made up of the following main elements:

1) Inverter (IMS module or Vincotech module)
2) Negative booster
3) Positive booster
4) Electrolytic capacitor bank

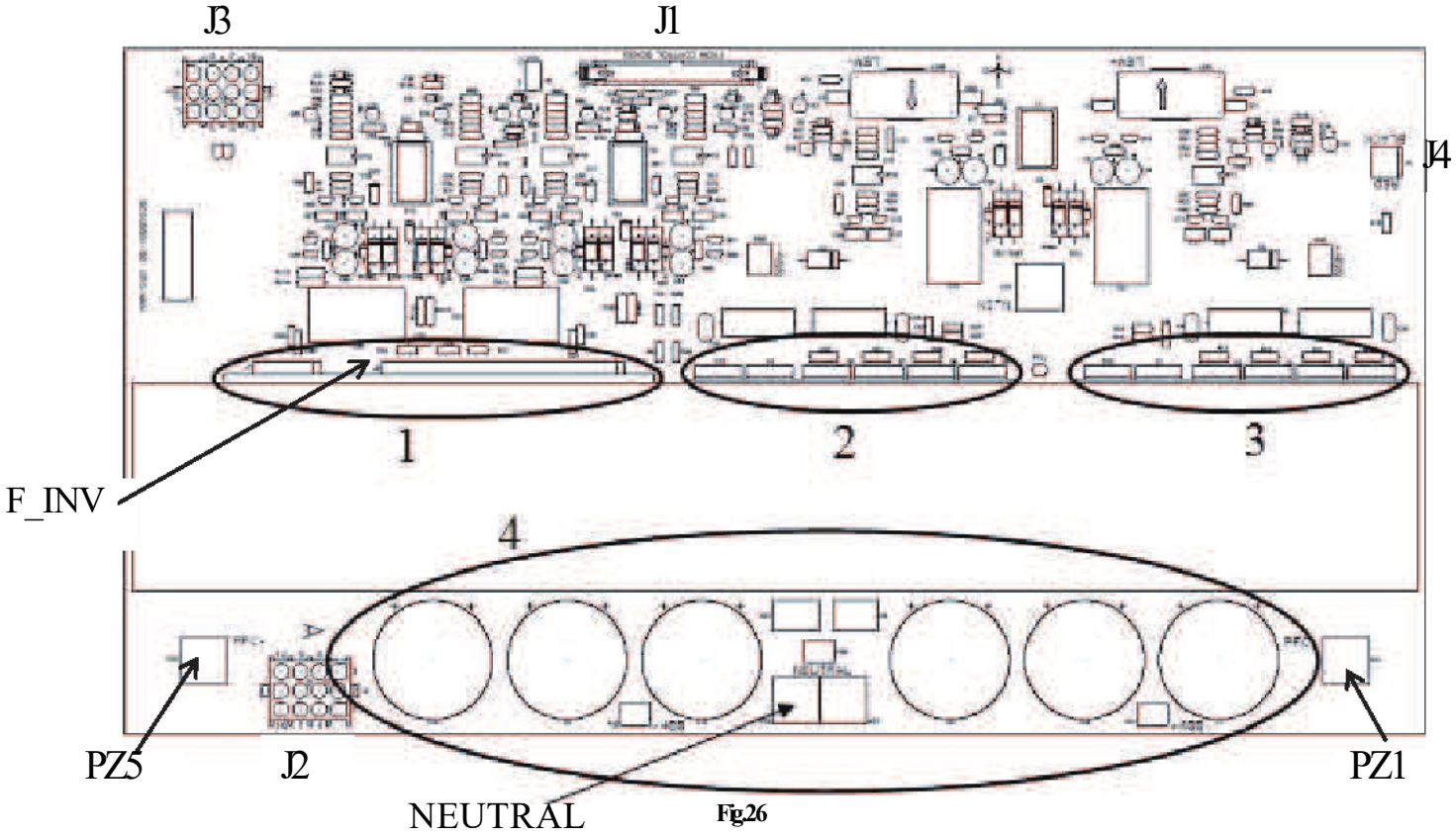
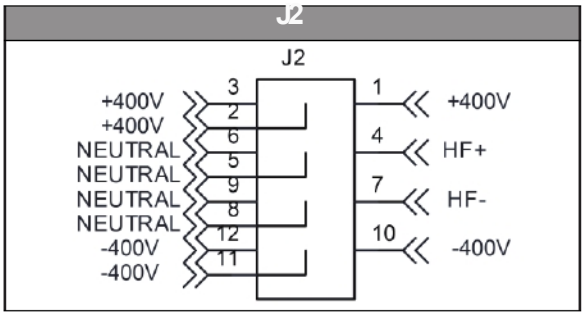


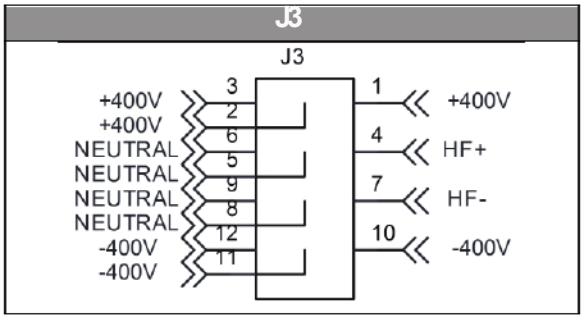
Fig.26

Connector	Description	Notes
J1	Flat connection from control board	From B0087 or B0173
J2-J3	DC BUS, HF connectors	
J4	Fan power supply connector	

Connector	Description	Notes
PZ1	Positive boost coil terminal	
PZ5	Negative boost coil terminal	
F_INV	Inverter coil terminal	
NEUTRAL	Neutral terminals	

Connector pin layout:





7.11 INVERTER OUTPUT BOARD (B0092)

Versions:

B0092-01. Output Inverter Card Saturn 30K

B0092-02. Output Inverter Card Saturn 40K

Single spare part: 6R_B0092-02. Output Inverter Card Saturn 30-40K

The inverter output board is made up of the following main elements:

1) Output fuse - phase 1. (code 0602010053__125A 240V FF)
2) Output fuse - phase 2. (code 0602010053__125A 240V FF)
3) Output fuse - phase 3. (code 0602010053__125A 240V FF)
4) Output relay

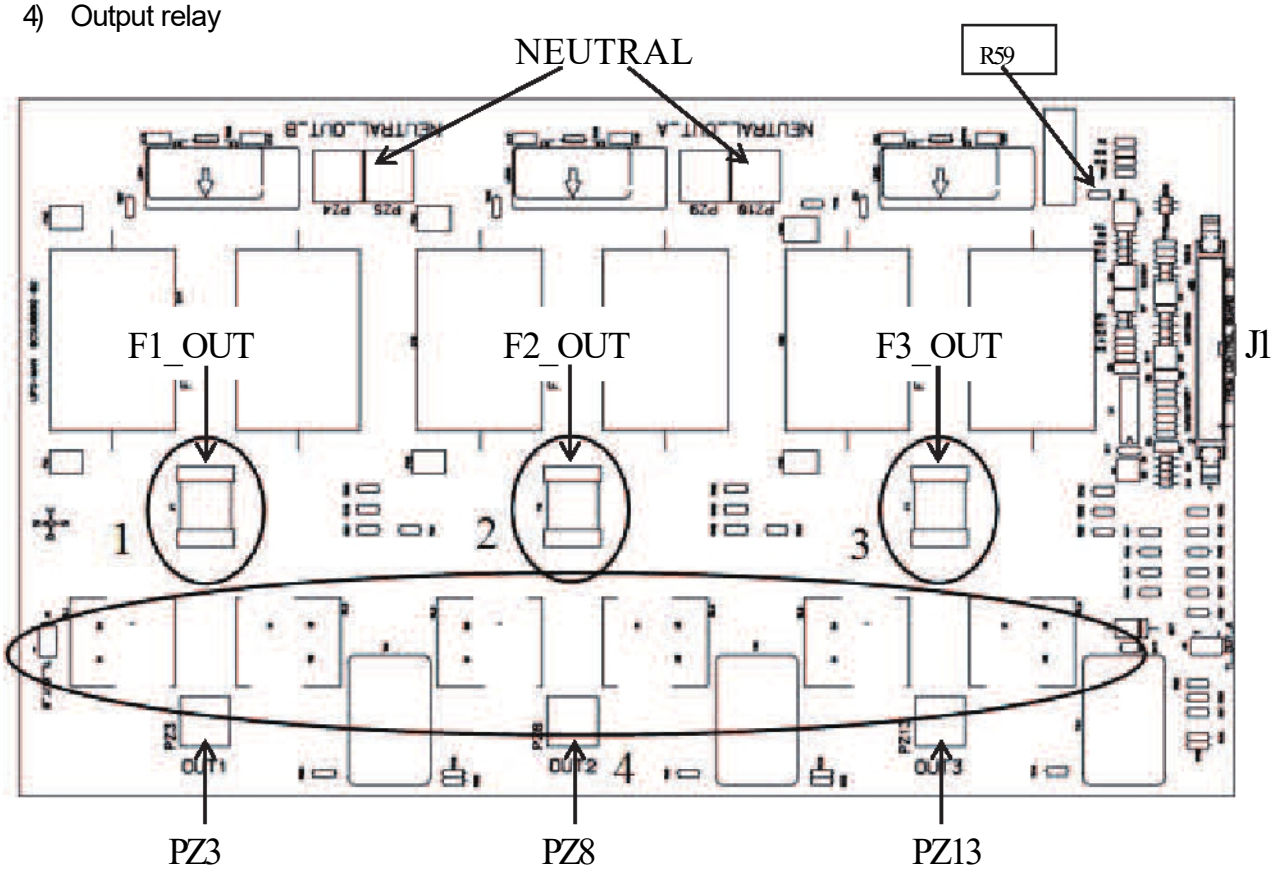


Fig.27

Connector	Description	Notes
J1	Flat connection from control board	From B0087 or B0173
F1_OUT	Inverter coil terminal phase 1	
F2_OUT	Inverter coil terminal phase 2	
F3_OUT	Inverter coil terminal phase 3	
PZ3	UPS output terminal phase 1	
PZ8	UPS output terminal phase 2	
PZ13	UPS output terminal phase 3	
NEUTRAL	Neutral terminals	

7.12 TERMINAL BOARD (B0101)

Versions:
B0101-01. Terminal Card Saturn 30-40K (for standard UPS)
B0101-02. Terminal Card Saturn 30-40K (for dual input standard UPS)

The terminal board is made up of the following main elements:

1) input / bypass / output terminals
2) Input / bypass /output VDR
3) Battery connection

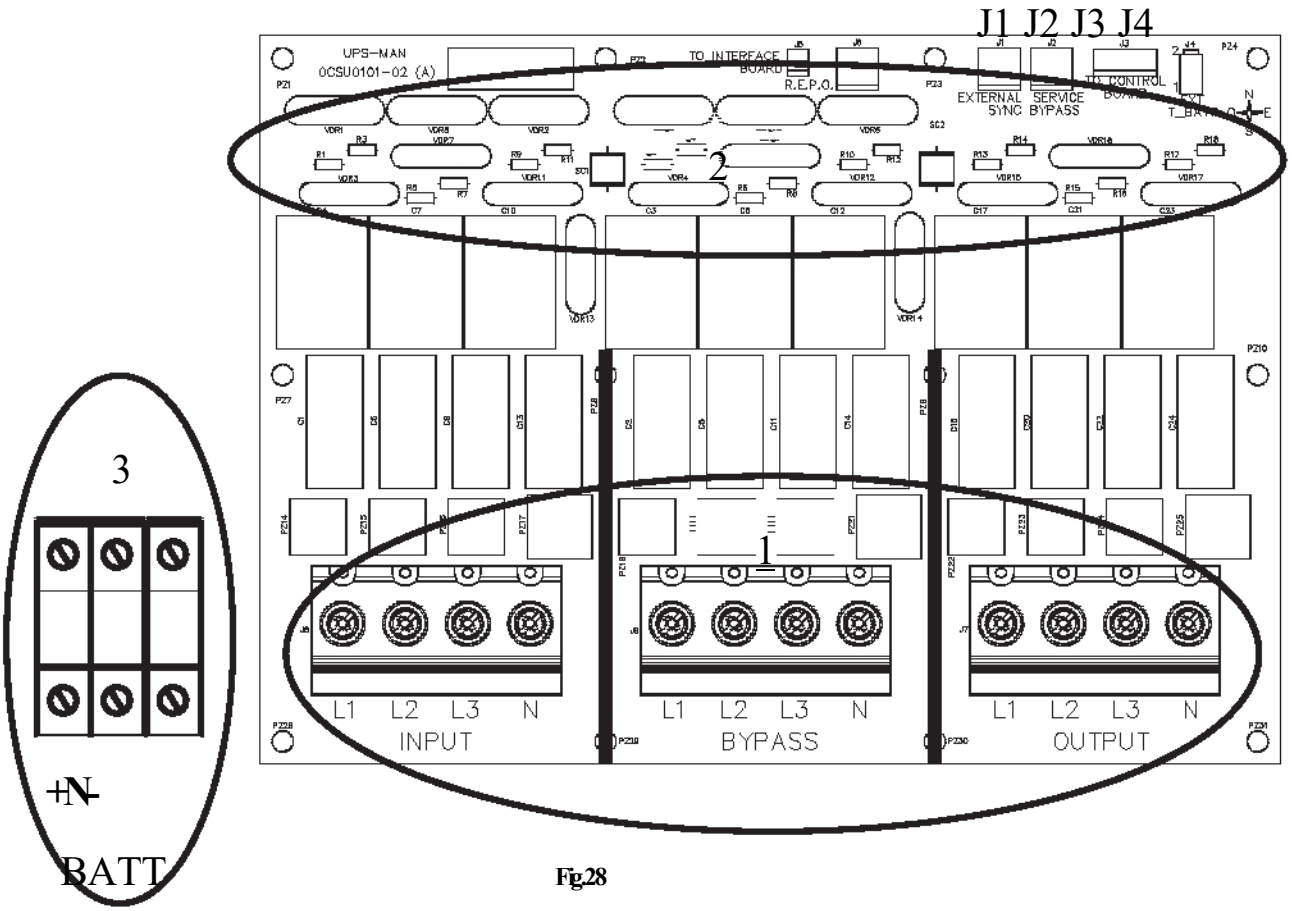


Fig.28

Connector	Description	Notes
J1	External BYP sync connector	
J2	Connector for external aux. SWMB	
J3	Connection from control board	From B0173 or B0087
J4	Connector for external B.box temp. sensor	Conn. for hardware key

7.13 INPUT CAPACITOR FILTER BOARD (B0109)

Versions:
B0109-01. Input Filter Card Saturn 30-40K (identical for all sizes)

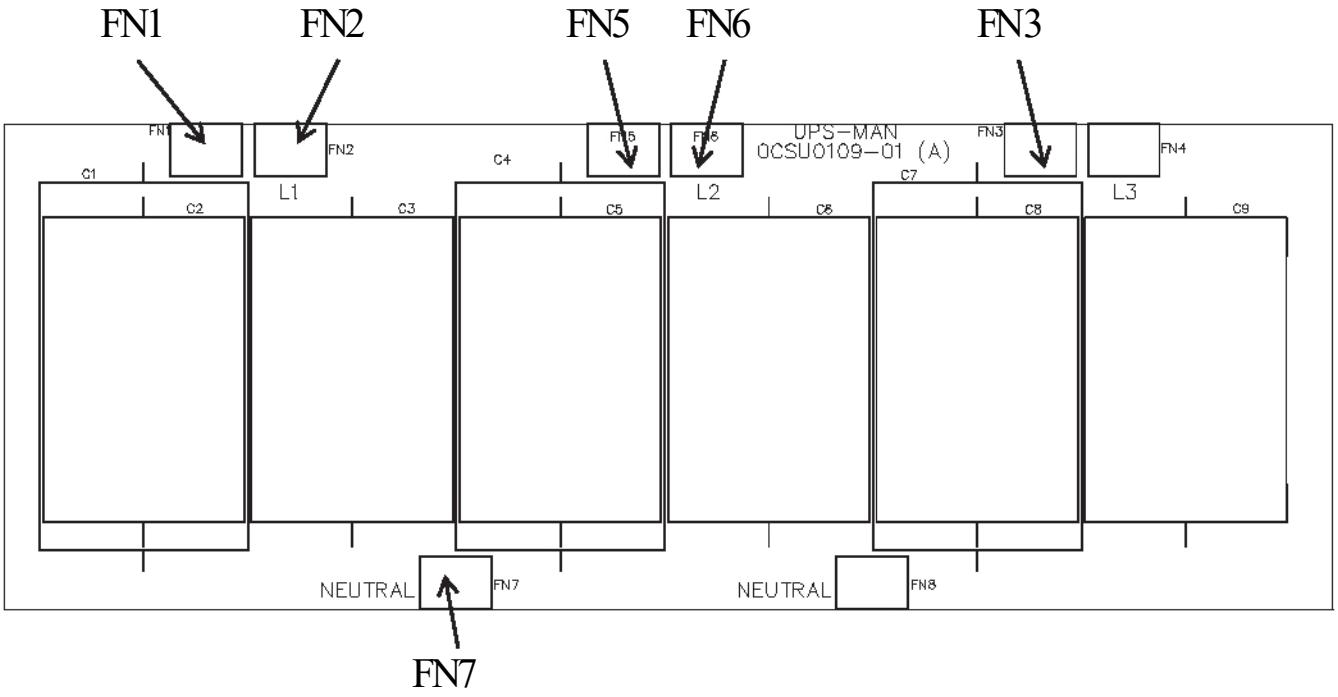


Fig.29

Connector	Description	Notes
FN1	PH1 input connector	From SWIN
FN2	PH1 input connector	From B0059
FN3	PH3 input connector	From SWIN
FN5	PH2 input connector	From SWIN
FN6	PH2 input connector	From B0059 (standard UPS only)
FN7	N input connector	From SWIN

7.14 BATTERY CY CAPACITORS (B0155)

Versions:
B0155-05. Filter Card CY BATT Saturn 30-40K

The layout of the board connectors is given below.

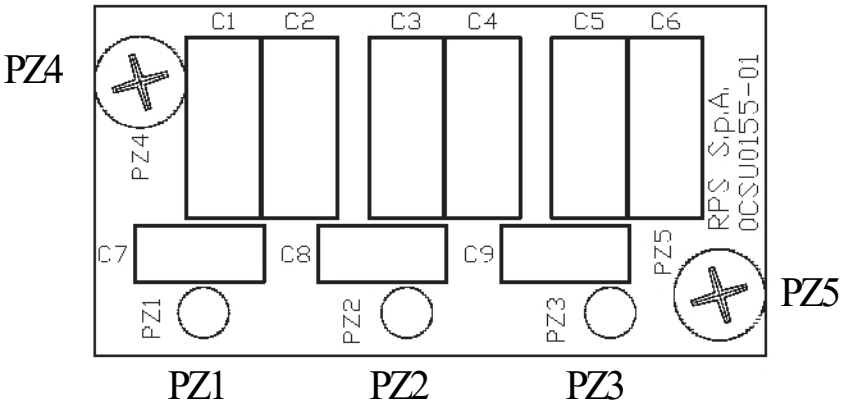


Fig.30

Connector	Description	Notes
PZ1	Connection to BATTERY POSITIVE	
PZ2	Connection to BATTERY NEUTRAL	
PZ3	Connection to BATTERY NEGATIVE	
PZ4	Connection to GND (fastening turret)	
PZ5	Connection to GND (fastening turret)	

7.15 CONTROL BOARD (B0173)

Versions:
B0173-01. Signal Control Card Saturn 30K
B0173-02. Signal Control Card Saturn 40K

NOTE : B0173 for power boards with IMS or Vincotech inverter module.

The layout of the control board connectors is given below.

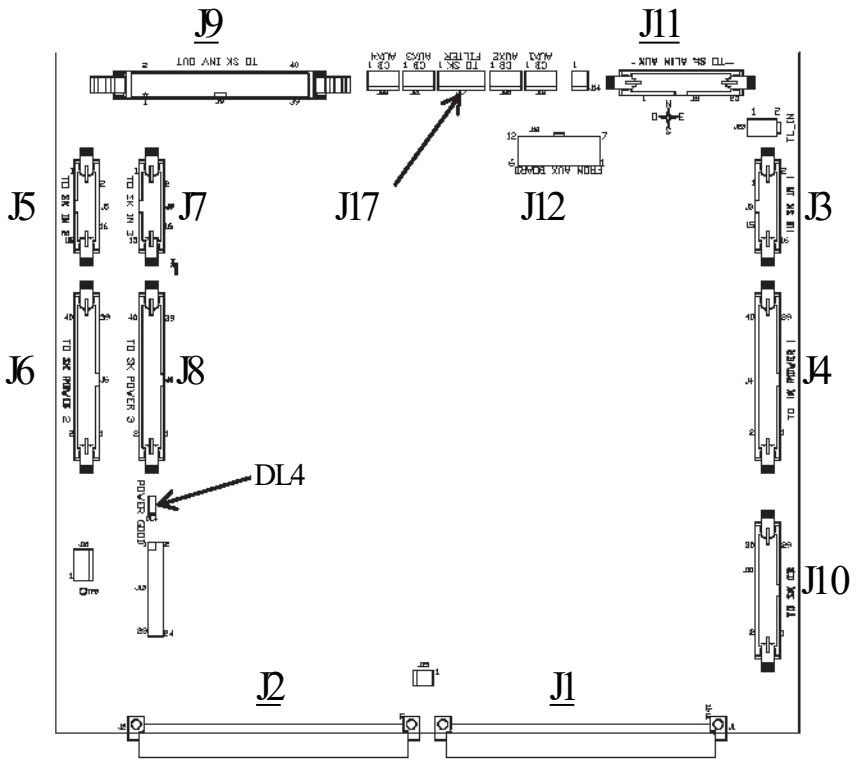


Fig.31

Connector	Description	Notes
J1	Signals for DSP-uP board	From B0067
J2	Signals for DSP-uP board	From B0067
J3, J5, J7	Flat connections to input boards	From B0090
J4, J6, J8	Flat connections to power boards	From B0091
J9	Flat connection to output board	From B0092
J10	Flat connection to CB board	From B0060
J11	Flat connection to aux. power supplies board	From B0059
J12	Connection to aux. power supplies board	From B0059
J17	Connections from terminal board	From B0101

LEDs	Description	Notes
DL4	Power good LED	

7.16 TERMINAL BOARD (B0190)

Versions:
B0190-01. Terminal Card Saturn 30-40K (for standard UPS without battery connections)
B0190-02. Terminal Card SBY Saturn 30-40K (for dual input UPS without battery connections)

The terminal board is made up of the following main elements:

1. input / bypass / output terminals
2. Input / bypass /output VDR

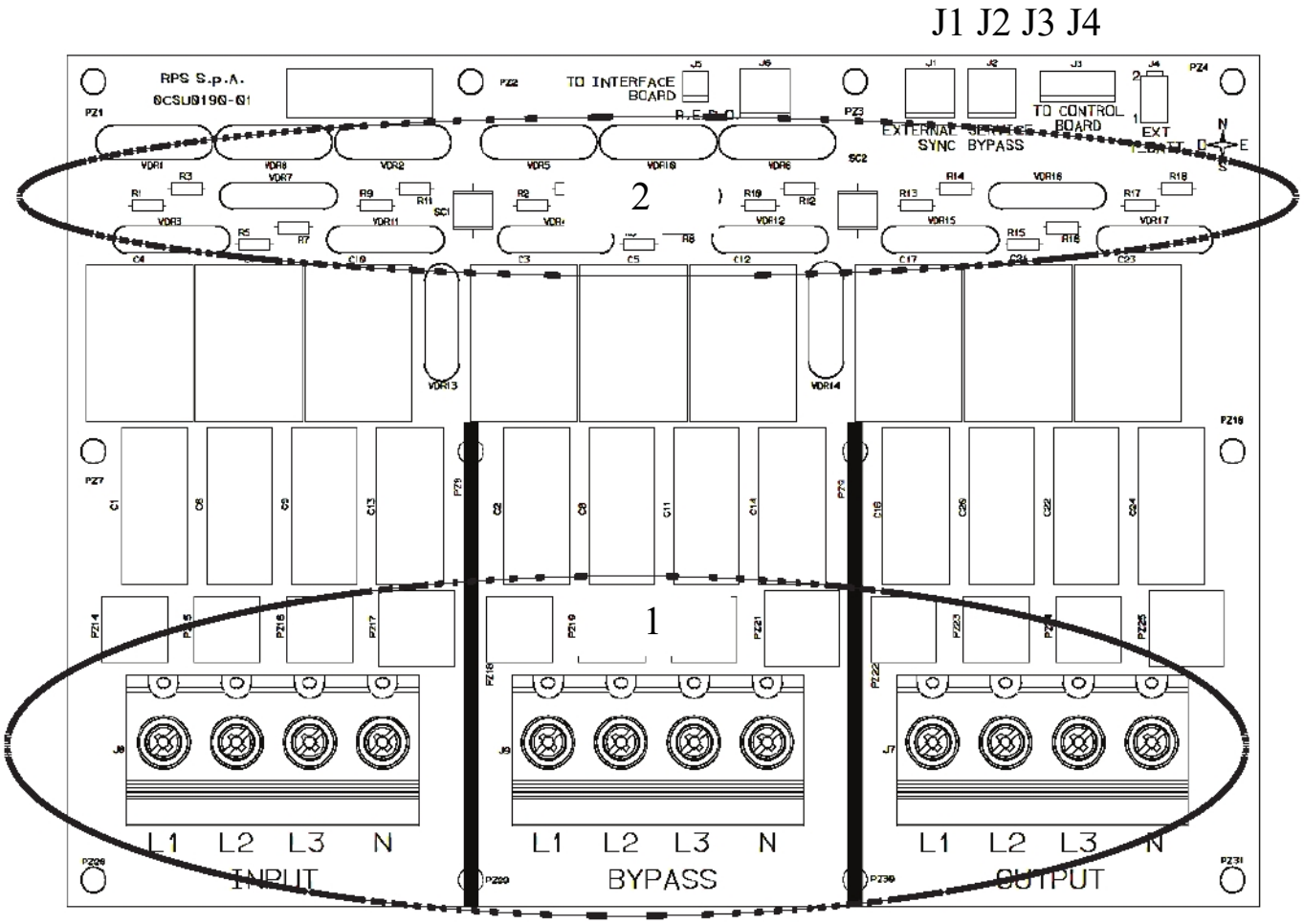


Fig.32

Connector	Description	Notes
J1	External BYP sync connector	
J2	Connector for external aux. SWMB	
J3	Connection from control board	From B0173 or B0087
J4	Connector for external B.box temp. sensor	Conn. for hardware key

7.17 TERMINAL BOARD (B0191)

B0191-01. Terminal Card BAT Saturn 30-40K (battery connections only)

The battery terminal board is made up of the following elements::

1. Battery connection
2. CY Capacitors

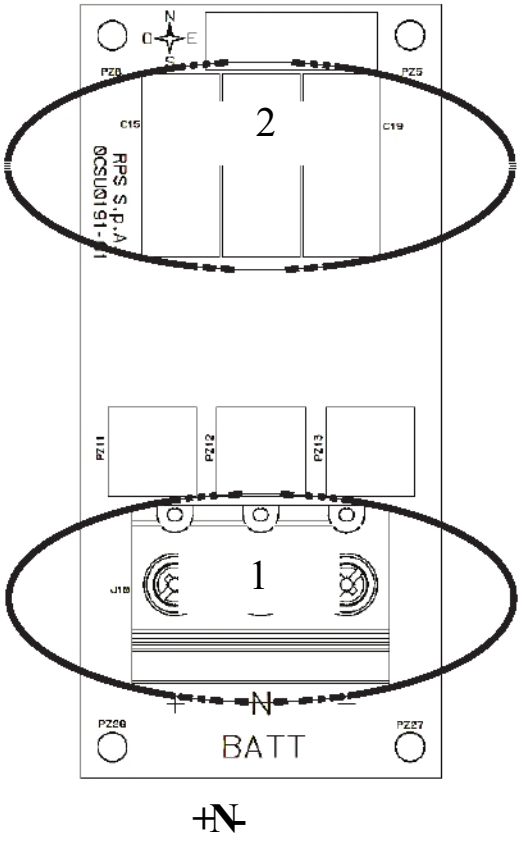


Fig.33

8 SERVICE OPERATIONS ON THE UPS

8.1 HOW TO OPEN THE UPS

Open the door and remove it, sliding the pins out of the dedicated hinges (see note on Fig.2)
To access the terminal area, first ensure the UPS is completely isolated from the mains and battery sources. Remove the lower front panel by removing all the screws.
To access the internal boards, remove the wrap-around by removing screws 1; see Fig. 34. Half unscrew screws 2. Then unscrew the remaining screws and release the wrap-around cover. If necessary, repeat the operation for the opposite wrap-around side cover.
To remove the top cover unscrew screws 3; see Fig. 34 .

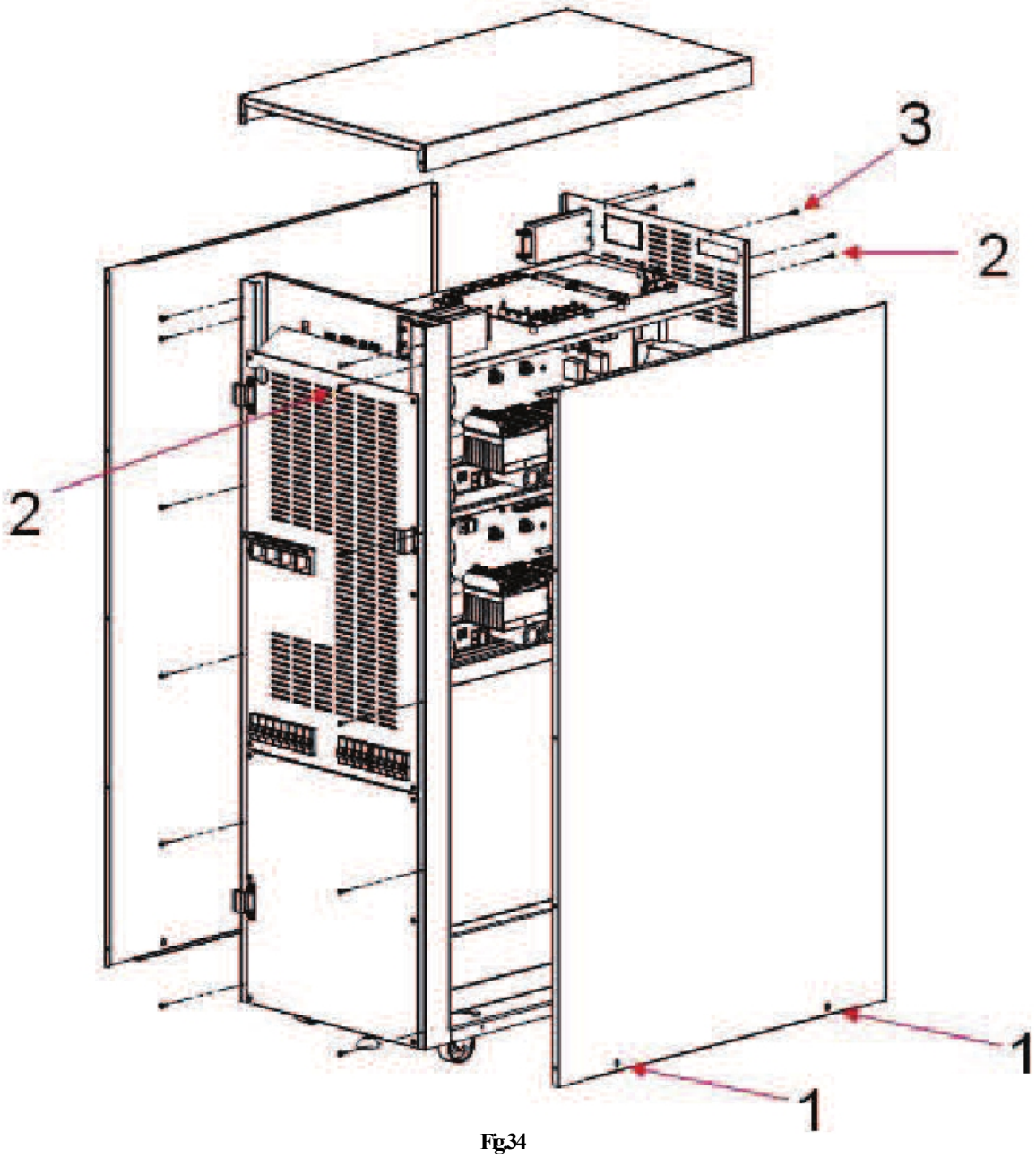
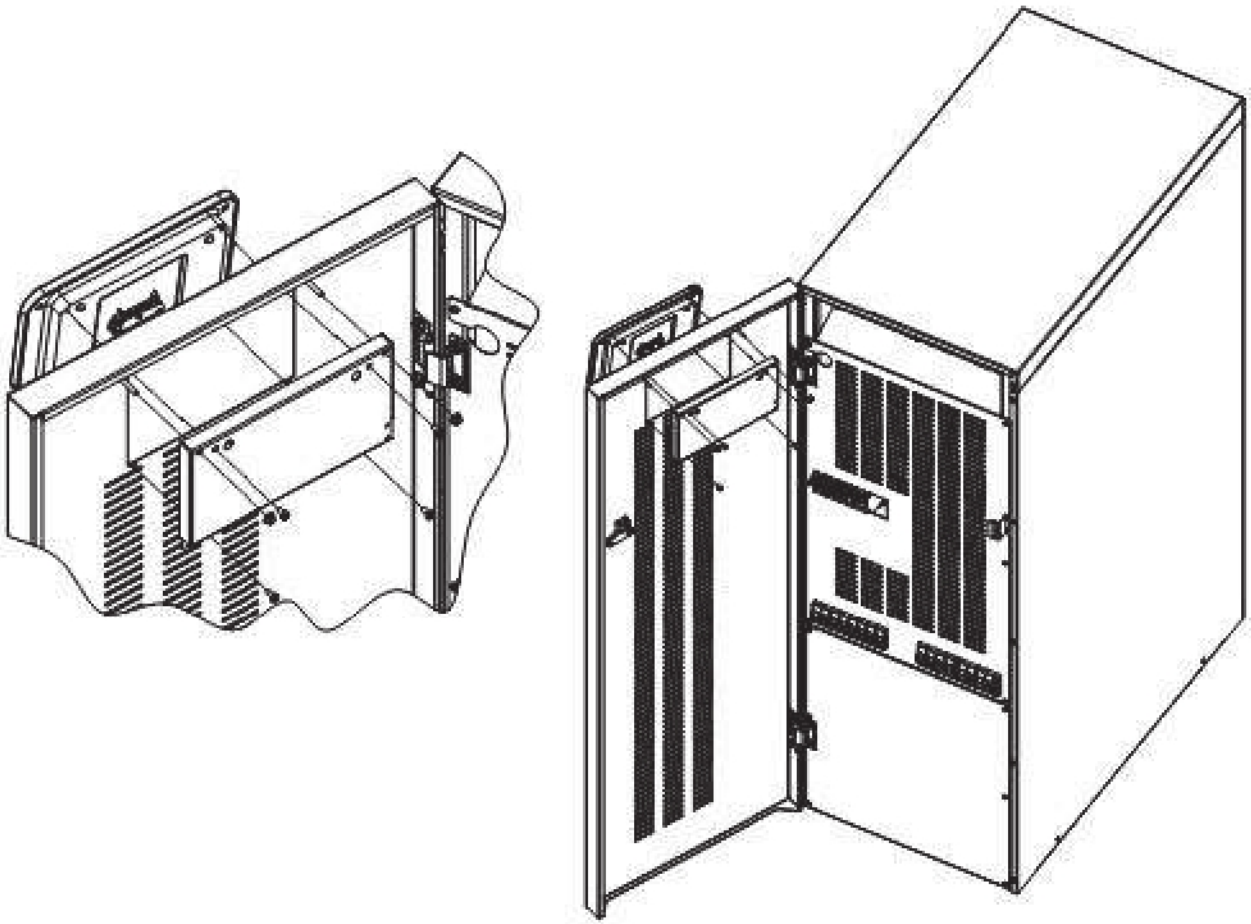


Fig.34

IMPORTANT: in order to remove the left wrap-around cover and top cover first release the door from the pins, taking care not to pull the display flat cable. If necessary, slide out the cable and remove the display with the UPS fully switched off.

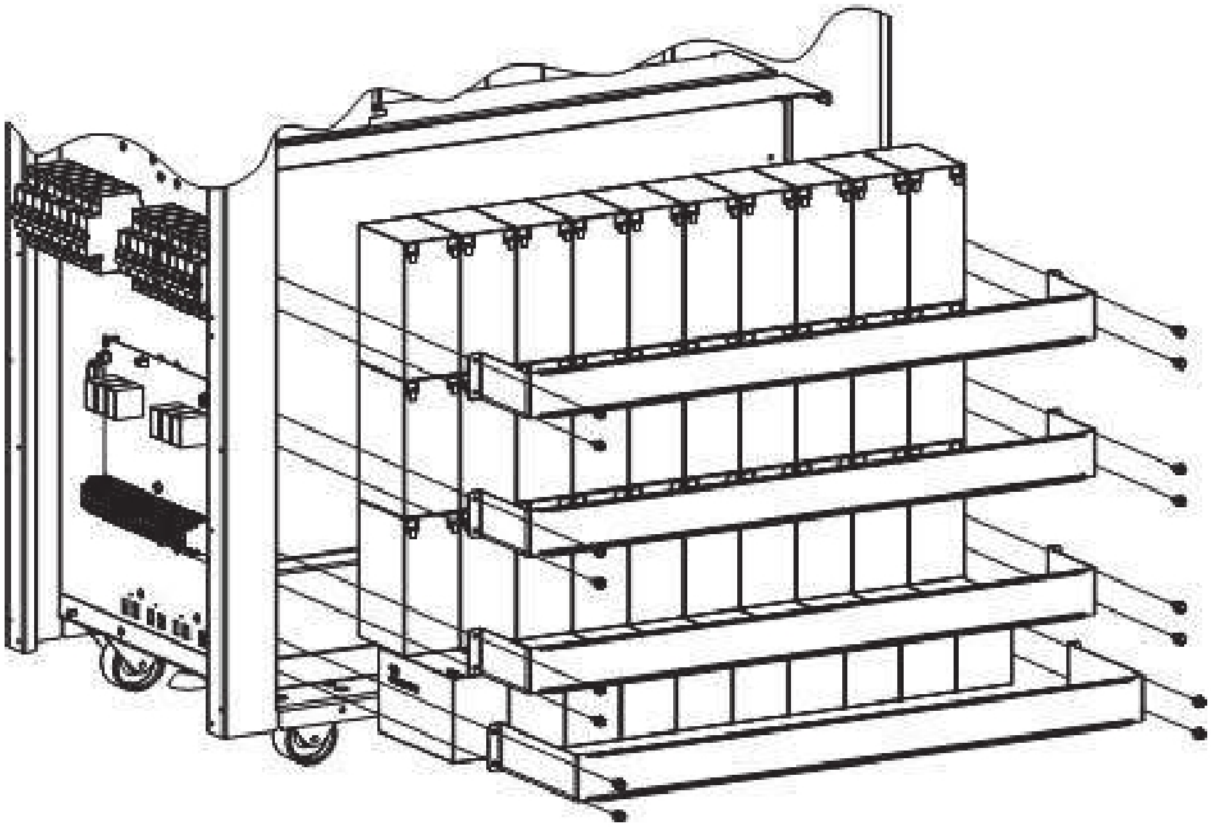


Fg.35

82 REPLACING THE INTERNAL BATTERIES

The batteries are fitted in the lower part of the UPS and are accessible after removing the side wrap-around covers. The layout of the batteries is shown in the diagram below: the wiring connections between the batteries are also shown.
IMPORTANT: take the necessary safety precautions before working on the batteries and follow these instructions:

1) open all the battery fuse holders, making sure that the UPS is supplied from the mains. If the UPS is in battery operation mode, restore mains power before carrying out any operation
2) close the SWMB and completely switch off the UPS (open SWIN and SWOUT)
3) remove the side wrap-around covers
4) replace the batteries, as per the wiring shown in the diagram
5) refit the wrap-around covers
6) close the SWIN, SWOUT and the battery fuse holders, position the 1/0 button on 1 (if present) and switch on the UPS
7) on the display, check that the UPS recognises the batteries and perform a battery test
8) open the SWMB



Fg.36

For further information refer to manual code 0MNU112NP.

Battery compartment **POSITIVE:**

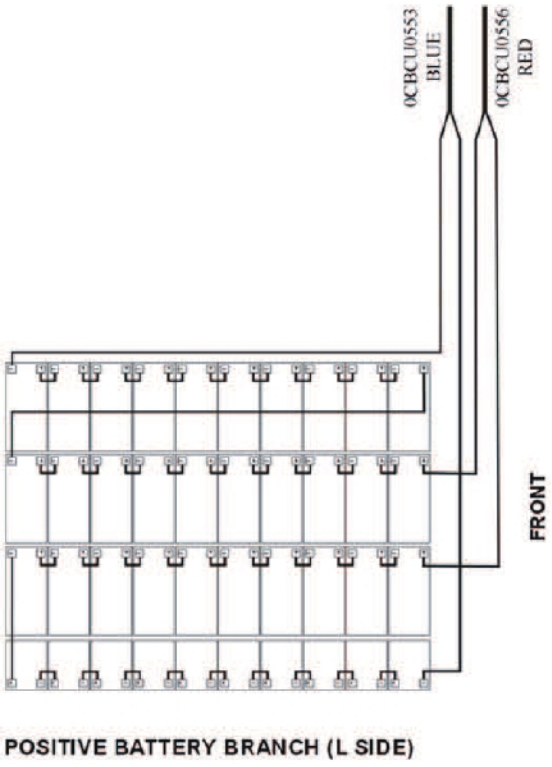


Fig.37

Battery compartment **NEGATIVE:**

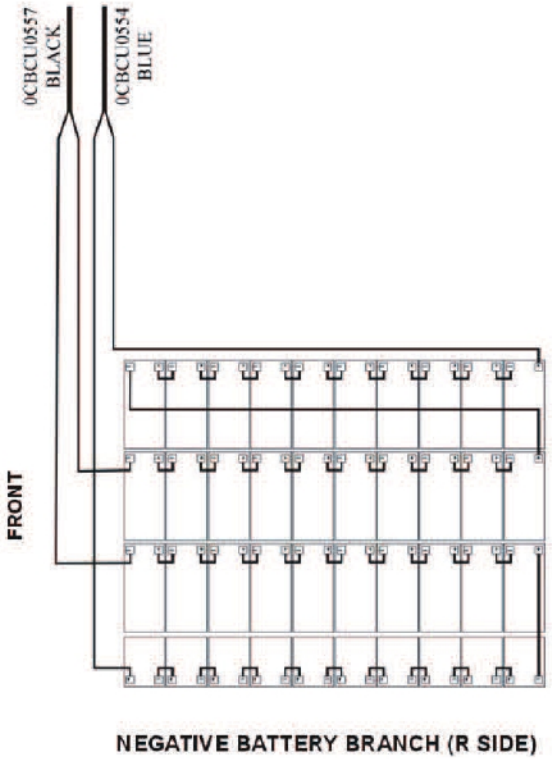


Fig.38

8.3 REPLACING THE FANS

This operation can only be performed with the machine switched off and with the input/output and battery disconnection switches open.

1) remove the ducts from the heatsinks:

a) remove the fastening screws

power boards: n°1 screw per duct

battery charger board: n°3 screws per duct

refer to the diagrams below for screw positions

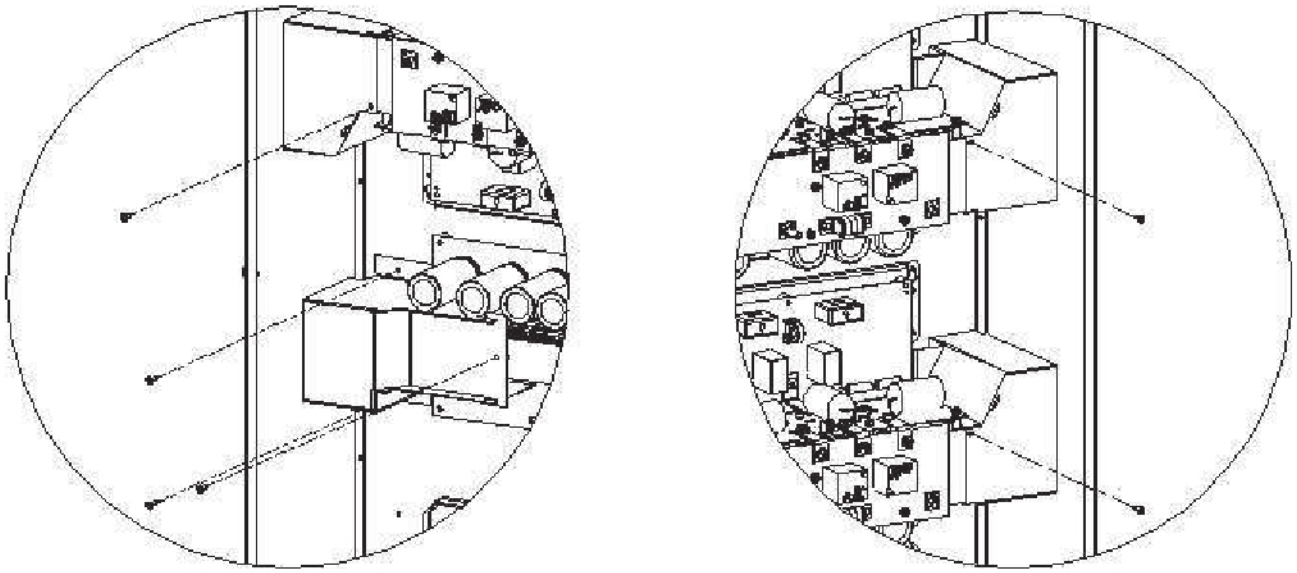


Fig.39

b) remove the ducts, taking care not to damage the fastening tabs

2) disconnect the fans from the respective boards, removing the red and black cables from the terminals

3) remove the protection grilles and free the fans, referring to diagram Fig. 40 for fastening screw positions

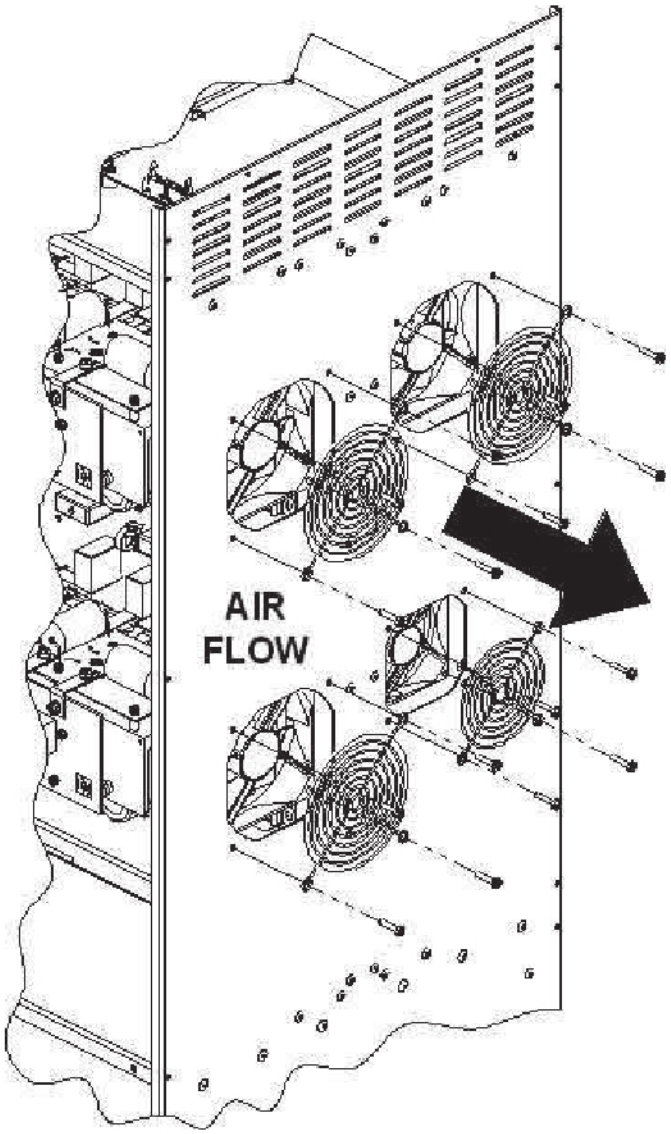


Fig.40

To fit the new fans follow the instructions for removal in reverse.

8.4 REPLACING THE TERMINAL BOARD

It may be necessary to replace the terminal board if it has been damaged by the VDR blowing, or due to the deterioration of a connector. Proceed as follows to replace the terminal board:

1) Open all disconnecting switches. **IMPORTANT:** it is very important that all battery disconnecting switches are open. Disconnect any internal batteries.
2) **IMPORTANT:** completely disconnect the UPS from any power supply, including any battery boxes, other UPS in parallel or other power sources. Make sure there is no voltage present in the board.
3) Using a section of electrical cable, place one end of the wire in contact with the UPS casing (GND) and with the other end touch all the screws on each terminal (INPUT, OUTPUT and BYPASS if present) in order to fully discharge the filter capacitors on the board.
4) Remove the fastening screws from board B0101
5) Remove all hanging cable connections
6) Disconnect all cables connected to the back by adjusting the brass M6 screws
7) Replace the board and reconnect all the cables to the back, tightening the brass M6 screws
8) Secure the board to the casing by tightening the fastening screws

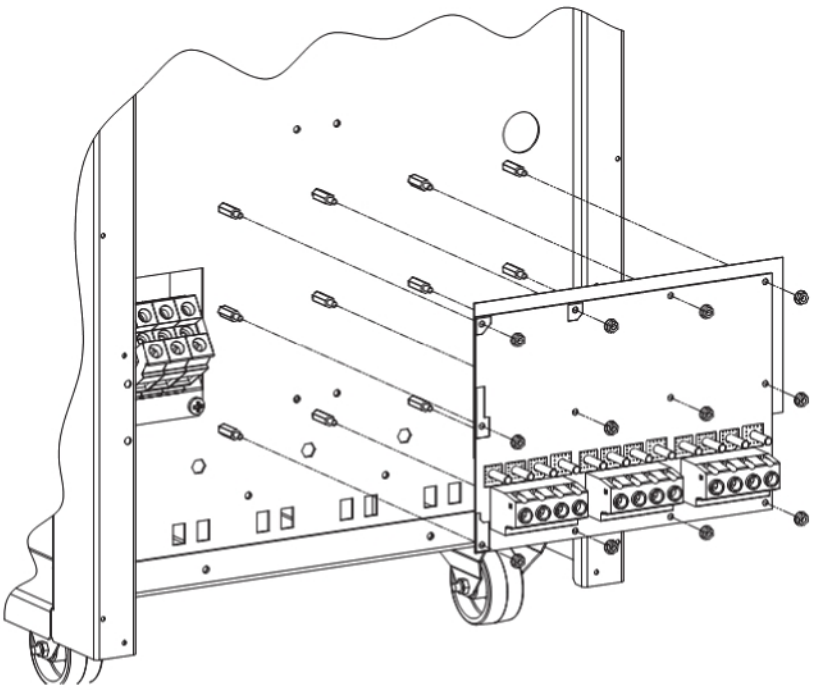


Fig.41

8.5 REPLACING A POWER ASSEMBLY

Once a faulty power assembly has been identified it should be replaced. Proceed as follows to replace a power assembly:

1) Open all disconnecting switches. **IMPORTANT:** it is very important that all battery disconnecting switches are open. Disconnect any internal batteries.
2) **IMPORTANT:** completely disconnect the UPS from any power supply, including any battery boxes, other UPS in parallel or other power sources. Make sure there is no voltage present.
3) Discharge the DC capacitor bank and wait 10-15 minutes for the voltage in the bank to reach a level close to 0V.
4) Disconnect all flat connectors (B0090-B0091).
5) Disconnect the fan wires connected to B0091.
6) Disconnect the cables connected to NEUTRAL from B0091.
7) Disconnect the phase cable connected to B0090.
8) Disconnect the batt. cables (pos./neg.) connected to B0090.
9) Disconnect the cables connected to the BYP SCR module.
10) Disconnect the cable connected to the inverter coil.
11) Loosen the two upper screws securing the power assembly tray without removing them.; B in picture
12) Remove the remaining screws; A in picture
13) Release the faulty assembly tray and replace it with a working assembly.
14) Replace the fastening screws and reconnect the cables, following the instructions for removal in reverse.

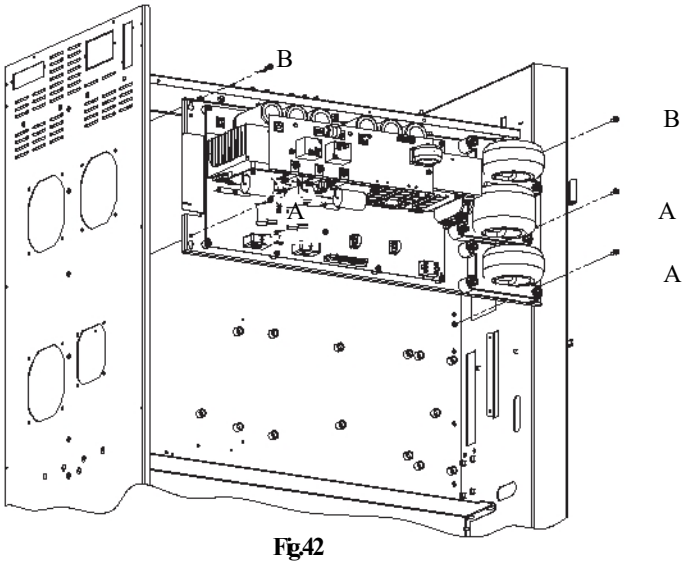


Fig.42

8.6 REPLACING THE BYPASS SCR.

In the event of BYPASS SCR failure, remove the damaged module and replace it with the correct spare part based on the UPS power level.
Before reassembly, cover the aluminium part on the back of the module and the part of the heatsink it will be fitted to with a thin layer of thermally conductive paste. The paste must be spread uniformly on both surfaces.

Please remember that it is essential to completely cover the surface without applying too thick a layer of paste (<100µm in total).

Place the SCR module onto the heatsink (see Fig. 43) and pressing onto it, move it in several directions to make sure that the paste is uniformly distributed between the module and heatsink.
Refit the SCR module onto the heatsink using the previously removed screws.
Remove any excess paste from the edges of the module.

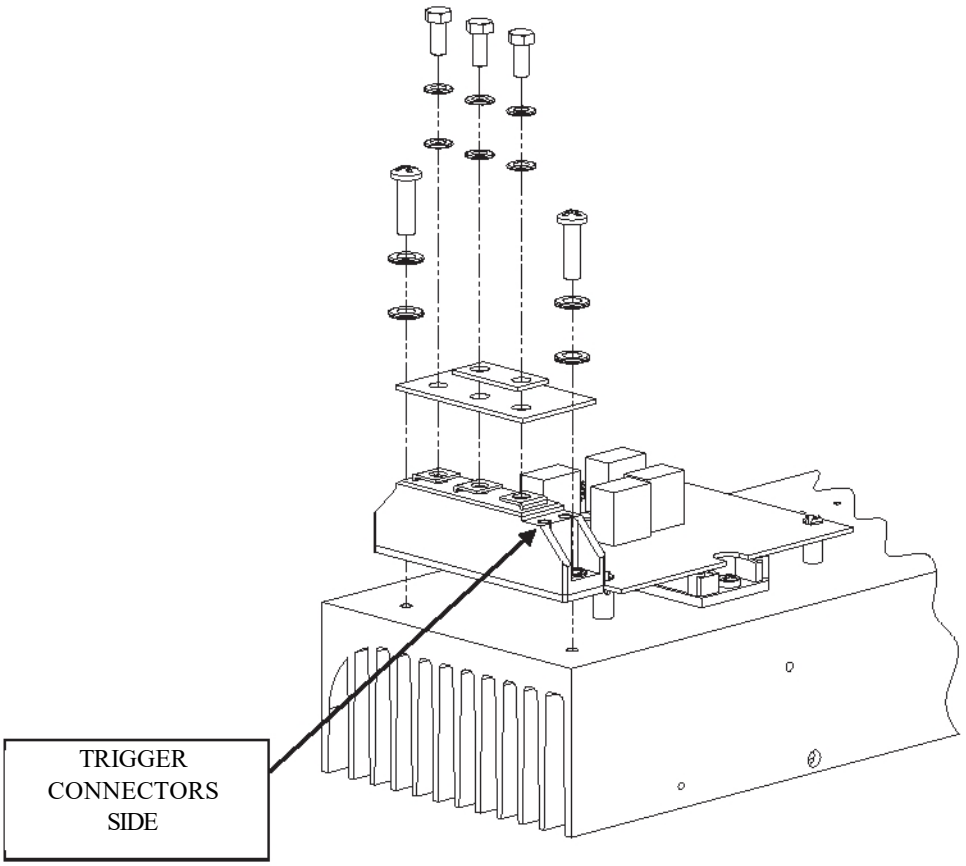
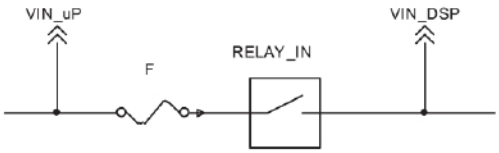


Fig. 43

9 MAP OF MAIN READINGS

The following section provides useful indications for troubleshooting problems with the UPS.

9.1 INPUT VOLTAGES



Input voltages are measured both by the µC and DSP; the measurement points are however different: the µC measures the voltage upstream of the input fuse and input contact, whilst the DSP measures it downstream from them.
The VIN_uP reading on the display is shown as PH-N whilst the VIN_DSP reading on the display is shown as PH-PH (this is only visible with the input relay closed, during start-up the reading is therefore only available at the end of the pre-loading stage).
With the machine switched off, use a multimeter to check that the input fuse on board B0090 is intact.
With the machine still off, check that there is no short circuit between the fast-on connectors for RL1 (RL2) on board B0090 (input power board).
Test to check the continuity of the µC signal (this test should be carried out with the UPS switched off, not supplied and with the battery disconnected); with a multimeter set to ohmmeter mode, check the continuity between the following points:

		Phase 1	Phase 2	Phase 3	Notes
	Fuse 125A	Before	Before	Before	
	B0090	F_IN	F_IN	F_IN	
	B0090	R4	R4	R4	150 kR
->	B0090	R3	R3	R3	150 kR
	B0090	J1-6	J1-6	J1-6	
	Flat Cable	‖	‖	‖	
	B0173 (B0087)	J3-6	J5-6	J7-6	
->	B0173 (B0087)	R53 (R425)	R54 (R428)	R55 (R429)	1.37 kR

(Position the probes between the two points marked with "->" to test the continuity of the flat cables)

Test to check the continuity of the DSP signal (this test should be carried out with the UPS switched off, not supplied and with the battery disconnected); with a multimeter set to ohmmeter mode, check the continuity between the following points:

		Phase 1	Phase 2	Phase 3	Notes
	Fuse 125A	After	After	After	
	B0090	PZ5	PZ5	PZ5	
	B0090	R1	R1	R1	150 kR
->	B0090	R2	R2	R2	150 kR
	B0090	J1-10	J1-10	J1-10	
	Flat Cable	‖	‖	‖	
	B0173 (B0087)	J3-10	J5-10	J7-10	
->	B0173 (B0087)	R75 (R449)	R76 (R450)	R77 (R451)	887 R

(Position the probes between the two points marked with "->" to test the continuity of the flat cables)

92 BYPASS VOLTAGES

Bypass voltage readings are measured by the µC only. The reading point is exactly next to FN1 on board B0090 (input power board).
To check for the presence of voltage, with the UPS switched on, measure between neutral and FN1 on board B0090.
This reading is needed to synchronise the inverter and to enable or disable the bypass.

Test to check the continuity of the µC signal (this test should be carried out with the UPS switched off, not supplied and with the battery disconnected); with a multimeter set to ohmmeter mode, check the continuity between the following points:

		Phase 1	Phase 2	Phase 3	Notes
	Fuse 125A	Before	Before	Before	
	B0090	FN1	FN1	FN1	
	B0090	R18	R18	R18	150 kR
->	B0090	R17	R17	R17	150 kR
	B0090	J1-9	J1-9	J1-9	
	Flat Cable	||	||	||	
	B0173 (B0087)	J3-9	J5-9	J7-9	
->	B0173 (B0087)	R20 (R394)	R51 (R426)	R52 (R427)	150R / 1.37kR / 1.37kR

(Position the probes between the two points marked with "->" to test the continuity of the flat cables)

93 BATTERY VOLTAGES

The battery voltage readings, measured by the µC and the DSP, are taken at the output of board B0060 (battery charger board);
The reading shown on the display is that taken by the µC; this reading is used for regulating the battery charger, the batteries present test, the battery charge status and the "battery over voltage" alarm.
The reading taken by the DSP is only used for internal regulation.

Test to check the continuity of the µC signal (this test should be carried out with the UPS switched off, not supplied and with the battery disconnected); with a multimeter set to ohmmeter mode, check the continuity between the following points:

		DC +	DC -	Notes
	B0060	J7-1	J7-3	
	B0060	R29	R27	2 MR
->	B0060	R30	R28	2 MR
	B0060	J2-5	J2-6	
	Flat Cable	||	||	
	B0173 (B0087)	J10-5	J10-6	
->	B0173 (B0087)	R36 (R410)	R49 (R423)	57.6 kR

(Position the probes between the two points marked with "->" to test the continuity of the flat cables)

Test to check the continuity of the DSP signal (this test should be carried out with the UPS switched off, not supplied and with the battery disconnected); with a multimeter set to ohmmeter mode, check the continuity between the following points:

		DC +	DC -	Notes
	B0060	J7-1	J7-3	
	B0060	R23	R26	2 MR
->	B0060	R5	R4	2 MR
	B0060	J2-7	J2-8	
	Flat Cable	||	||	
	B0173 (B0087)	J10-7	J10-8	
->	B0173 (B0087)	R35 (R409)	R48 (R422)	40.2 kR

(Position the probes between the two points marked with "->" to test the continuity of the flat cables)

9.4 INVERTER VOLTAGES

The inverter voltage readings are taken by the DSP. The reading point is exactly next to the inverter filter capacitors on board B0092 (inverter output board). This reading is used to check the inverter and check the status of the inverter relays and fuses (combined with the output voltage reading).

To check for the presence of voltage, with the UPS switched on, place the probes between neutral and the head of the inverter output fuse.

Test to check signal continuity (this test should be carried out with the UPS switched off, not supplied and with the battery disconnected); with a multimeter set to ohmmeter mode, check the continuity between the following points:

		Phase 1	Phase 2	Phase 3	Notes
	B0092	F1	F2	F3	fuses
	B0092	R30	R43	R56	150 kR
->	B0092	R24	R37	R50	150 kR
	B0092	J1-33	J1-35	J1-37	
	Flat Cable	||	||	||	
	B0173 (B0087)	J9-33	J9-35	J9-37	
->	B0173	R88	R89	R90	0R
(->)	B0173 (B0087)	R91 (R469)	R92 (R470)	R93 (R471)	887 R

(Position the probes between the two points marked with "->" to test the continuity of the flat cables)

9.5 OUTPUT VOLTAGES

The output voltage readings are taken by the DSP only. The reading point is exactly next to points OUT1, OUT2 and OUT3 on board B0092 (inverter output board). This reading is used to calculate the output power (combined with the Iout reading) and to check the status of the inverter relays and fuses (combined with the inverter voltage reading).

To check for the presence of voltage, with the UPS switched on, place one probe on neutral and the other on the three sectors PZ3, PZ8, PZ13 (respectively for phase 1, phase 2, phase 3).

Test to check signal continuity (this test should be carried out with the UPS switched off, not supplied and with the battery disconnected); with a multimeter set to ohmmeter mode, check the continuity between the following points:

		Phase 1	Phase 2	Phase 3	Notes
	B0092	PZ3	PZ8	PZ13	
	B0092	R28	R41	R54	150 kR
->	B0092	R25	R38	R51	150 kR
	B0092	J1-10	J1-12	J1-14	
	Flat Cable	||	||	||	
	B0173 (B0087)	J9-10	J9-12	J9-14	
->	B0173 (B0087)	R70 (R437)	R71 (R438)	R72 (R439)	301 KR

(Position the probes between the two points marked with "->" to test the continuity of the flat cables)

9.6 OUTPUT CURRENTS

The output current readings are taken by the DSP only. The reading is taken by the TA at the output of each single phase on board B0092 (inverter output board). The TA reads the output current, i.e. that distributed by the inverter with the UPS on line or that distributed by the bypass with UPS in bypass mode. The TA is situated on the cables that connect B0092 to the SWOUT. This reading is used to calculate the output power (combined with the Vout reading).

10 STATUS / ALARM CODES

For information on the meanings of status/alarm codes refer to the document:
code RM021 Rev..-XX "STATUS/ALARM CODES"

11 TROUBLESHOOTING TABLES

The UPS is able to check and display its status and any faults and/or failures that may occur during operation on the display panel. In the event of a problem, the UPS reports the event by displaying the type of alarm and alarm code on the display panel.

11.1 TROUBLESHOOTING 'FAULT' TYPE PROBLEMS

The tables below provide useful information for troubleshooting problems connected with 'fault' type alarm codes. The table does not cover all possible UPS failure causes, the information contained here should be considered as a suggestion of the possible causes of problems and how they might be resolved.

Alarm code	Description	Possible cause	Boards affected	Corrective actions
F01	Internal communication error	Programming board inserted into communication slots	B0096	Remove the programming board from the slot
		Communications interface board faulty.	B0056	Replace board B0056
		Board B0067 faulty	B0067	Replace board B0067
F02	Incorrect cyclic direction of phases	Input phases connection error		Check input phases connection
F03	Input fuse blown or phase 1 relay not closed	input diodes or relay blown	B0089	Check for blown diodes, fuses and relays. If necessary replace board B0089 and/or B0059
F04	Input fuse blown or phase 2 relay not closed			
F05	Input fuse blown or phase 3 relay not closed			
F06	Phase 1 input relay does not open	Input relay blocked	B0089	Check relays. If necessary replace board B0089
F07	Phase 2 input relay does not open			
F08	Phase 3 input relay does not open			
F09	Positive branch capacitor preload failed	Short circuit in inverter and/or PFC stages	B0089 B0090 B0091	Replace the affected boards
		Preload diodes faulty	B0059	
F10	Negative branch capacitor preload failed	Control logic faulty	B0067 B0087 B0173	
		Input relay out of tolerance values		Check that Vin < 250V

F11	Boost stage fault	PFC stage short circuit	B0089 B0090 B0091	Replace the affected boards
		Control logic faulty	B0067 B0087 B0173	
F12	Incorrect cyclic direction of bypass phases	Connection error in bypass power supply		Check bypass power supply connection
F14	Sinusoid Phase 1 inverter distorted	Inverter stage short circuit	B0089 B0090 B0091	Replace the affected boards
F15	Sinusoid Phase 2 inverter distorted	Control logic faulty	B0067 B0087 B0173	Replace the affected boards Check for SC between phases
F16	Sinusoid Phase 3 inverter distorted	Phase-Phase short circuit		
F17	Inverter stage faulty	Inverter stage blown Control logic faulty	B0091 B0067 B0087 B0173	Replace the affected boards
F19 F20	Positive battery overvoltage Negative battery overvoltage	Batteries disconnected		UPS operation with the batteries disconnected may lead to an overvoltage at the battery charger output. Shut down and restart the UPS and reconnect the batteries. If the UPS is set up for operation without batteries (freq. conv) the CB is automatically disabled
F23	Overload at output	Excessive load		Reduce the load
		Wrong UPS size following control board replacement		Set the correct size
		Output power reading faulty	B0092 B0067 B0087 B0173	Replace the affected boards
		Error in output voltage setting		Set the correct output voltage

F26 F27 F28	Phase 1 output relay blocked (does not open) Phase 2 output relay blocked (does not open) Phase 3 output relay blocked (does not open)	Failure in relay control circuit	B0092 B0067 B0087 B0173	Replace the affected boards
F29	Phase 1 output fuse blown or output relay blocked (does not close)	Failure in relay control circuit	B0092 B0067 B0087 B0173	Replace the affected boards
F30 F31	Phase 2 output fuse blown or output relay blocked (does not close) Phase 3 output fuse blown or output relay blocked (does not close)	Output fuse blown		Replace blown output fuse
F32	Battery charger stage faulty	Output voltage from CB is missing in one of the two battery branches	B0060	Check the flat cable connections and if necessary replace the affected boards
		CB control and feedback signals faulty	B0060 B0067 B0087 B0173	
F34	heatsink overheated	Cooling fans faulty	B0059	• Check for SC at fans → replace fans • Check R194 on board B0059, check voltage at connector J10, check fan power supply link →replace board B0059
		Temperature readings faulty	B0087 B0173 B0067 B0090 B0091	Check the interconnections between the affected boards, if necessary replace the boards
		Temperature sensor faulty	B0091	

F37	Battery charger overheated	CB cooling fan faulty	B0060	•Check that the fitted fan is correct (12V) →replace fan •Check for SC at the fan → replace fan •Check voltage at connector J3 → replace board B0060
		Incorrect duct installation	B0060	Check that the duct secured to board B0060 is correctly installed
		Temperature readings faulty	B0060 B0067 B0087 B0173	Check the interconnections between the affected boards, if necessary replace the boards
		Temperature sensor faulty	B0060	replace board B0060
F42 F43 F44	BOOST 1 battery fuses blown BOOST 2 battery fuses blown BOOST 3 battery fuses blown	Battery SCR blown	B0089	Check battery SCR (semitop)

11.2 TROUBLESHOOTING 'LOCK' TYPE PROBLEMS

The tables below provide useful information for troubleshooting problems connected with 'lock' type alarm codes. The table does not cover all possible UPS failure causes, the information contained here should be considered as a suggestion of the possible causes of problems and how they might be resolved.

Code	Description	Possible cause	Boards affected	Corrective action
L01	Incorrect auxiliary power supply	Aux power supplies missing B0059	B0059 B0087 B0173	Check that LED DL1 is lit on B0059 Æ if it is not lit check connections and/or replace board. Detailed description of L01 ch. 5 (see page 14)
L02	One or more internal cables disconnected	Flat cables not connected or partially connected	All boards with flat cables	Check the connections of the UPS flat cables
L03 L04 L05	Phase 1 input fuse blown Phase 2 input fuse blown Phase 3 input fuse blown	input diode blown	B0089 B0090	Check if diode is blown Æ replace the fuse. Check Boost and if necessary replace board B0089
L06	Overvoltage at positive BOOST stage	Any unidirectional loads connected at output		Check for the presence of unidirectional loads at the output
		Output short circuit		Check for the presence of short circuits at the output
L07	Overvoltage at negative BOOST stage	Inverter stage short circuit		Check inverter stage
L08	Undervoltage at positive BOOST stage	The UPS does not have battery operation	B0089	Check the battery boost fuses and battery SCR
		Control logic faulty	B0067 B0087 B0173	Check the connections between the boards and if necessary replace them
L09	Undervoltage at negative BOOST stage	No mains power with the batteries disconnected		Check the battery box connection and/or battery box fuses
		Boost stage blown	B0091	replace board B0091
		Inverter stage blown		
L10	Static bypass switch faulty	Bypass SCR blown	B0091	Check bypass SCR and if necessary replace it

L11 L12 L13	Bypass output blocked L1 Bypass output blocked L2 Bypass output blocked L3			
L14 L15 L16	Overvoltage at phase 1 inverter Overvoltage at phase 2 inverter Overvoltage at phase 3 inverter	Inverter output capacitor faulty	B0092	Check the inverter output capacitor and if necessary replace board B0092
		Inverter operating logic faulty	B0067 B0087 B0173	Replace the affected boards
L17 L18 L19	Undervoltage at Phase 1 inverter Undervoltage at Phase 2 inverter Undervoltage at Phase 3 inverter	Phase-Phase short circuit		Check for SC between the output phases
		Control logic faulty	B0067 B0087	Check the connections between the boards and/or replace the specified boards
L20 L21 L22	DC voltage at inverter output or Phase 1 inverter sinusoid distorted DC voltage at inverter output or Phase 2 inverter sinusoid distorted DC voltage at inverter output or Phase 3 inverter sinusoid distorted	Inverter blown	B0091	Check for blown IGBT on inverter side Æ if necessary replace board B0091
		Control logic faulty	B0067 B0087 B0173	Check the connections between the boards and/or replace the specified boards
		Phase-Phase short circuit		Check for the presence of SC at the output
L23 L24 L25	Overload at Phase 1 output Overload at Phase 2 output Overload at Phase 3 output	Excessive load		Reduce the load
		Wrong UPS size following control board replacement		Set the correct size
		Output power reading faulty	B0092 B0067 B0087 B0173	Replace the affected boards
		Error in output voltage setting		Set the correct output voltage

L26 L27 L28	Short circuit at Phase 1 output Short circuit at Phase 2 output Short circuit at Phase 3 output	Short circuit at neutral phase output		Check for the presence of SC between the phases and neutral at the output
L34	Phase 1 heatsink overheated	Cooling fans faulty	B0059	• Check for SC at fans Æ replace fans • Check R194 on board B0059, check voltage at connector J10, check fan power supply link Æ replace board B0059
L35	Phase 2 heatsink overheated	Temperature readings faulty	B0067 B0087 B0173 B0090 B0091	Check the interconnections between the affected boards, if necessary replace the boards.
L36	Phase 3 heatsink overheated	Temperature sensor faulty	B0091	
L37	Battery charger overheated	CB cooling fan faulty	B0060	• Check that the fitted fan is correct (12V) Æ replace fan • Check for SC at the fan Æ replace fan • Check voltage at connector J3 Æ replace board B0060
		Incorrect duct installation	B0060	Check that the duct secured to board B0060 is correctly installed
		Temperature readings faulty	B0060 B0067 B0087 B0173	Check the interconnections between the affected boards, if necessary replace the boards
		Temperature sensor faulty	B0060	Replace board B060

L38 L39 L40	Phase 1 heatsink temperature sensor faulty Phase 2 heatsink temperature sensor faulty Phase 3 heatsink temperature sensor faulty	Temperature readings faulty	B0067 B0087 B0173	Check the interconnections between the affected boards, if necessary replace the boards
		Temperature sensor faulty	B0091	Replace board B0091
L41	Battery charger temperature sensor faulty	Temperature readings faulty	B0060 B0067 B0087 B0173	Check the interconnections between the affected boards, if necessary replace the boards
		Temperature sensor faulty	B0060	Replace board B060
L42 L43 L44	BOOST 1 battery fuses blown BOOST 2 battery fuses blown BOOST 3 battery fuses blown	Battery SCR blown	B0089	Check battery SCR (semitop)

12 APPENDIX

12.1 LIST OF USEFUL DOCUMENTS

- User Manual
- UPS installation manual
- Battery installation manual
- Wiring diagram: Saturn 30K
  Saturn 40K
- Programming manual 0MNU073NP... (UPS PROGRAMMING KIT)
- Alarm code manual RM021 Rev..-XX
- UcomGp instruction manual RM900 Rev..
- UcomGp Configuration tool RM901 Rev..

12.2 LIST OF BOARDS

board	description	quantity for ups
B0056	Interface Card	1
B0057	Display Card	1
B0059	Aux Power Supply Card	1
B0060	Battery Charger	1
B0067	DSP+µC Control Card	1
B0076	IMS inverter	3
B0085	Parallel Card	1
B0087	Signal Control Card (old)	1
B0089	Input Capacitor Card	3
B0090	Input Power Card	3
B0091	Power Phase Assembly	3
B0092	Output Inverter Card	1
B0101	Terminal Card	1
B0109	Input Filter Card	1
B0155	Filter Card CY BATT	1
B0173	Signal Control Card PLD	1
B0190	Terminal Card	1
B0191	Terminal Card BATT	1