GTEC UPS MODEL:

# SATURN 60 – 100 kVA

## SERVICE MANUAL

www.gtec-power.eu

# Contents

# 2 SOFTWARE OPERATIONS

## 21 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 and/or power modules), 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 fast-on connectors inserted into connector FN1 (Vin) from the B0125 boards for each phase (see Fig. 33 on page 47) and temporarily isolate the hanging fast-on connectors on wiring 0CBSU0040x.
- Close the SWIN and save the log file.

**for DUAL INPUT UPS:**

- Simply close the SWBYP and save the log file.

## 22 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.

## 23 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 range (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

## 24 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 |
|---|---|---|
| 60-80-100kVA | 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

1) Close the SWMB
2) Set the UPS to stand-by using the display
3) Open the SWIN, SWBY (if present) and SWOUT
4) Wait for the display to shut down
5) Open the disconnection switch/fuses for the UPS external battery line

## 3.2 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 the disconnection switch/fuses for the UPS external battery line

## 3.3 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

## 3.4 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

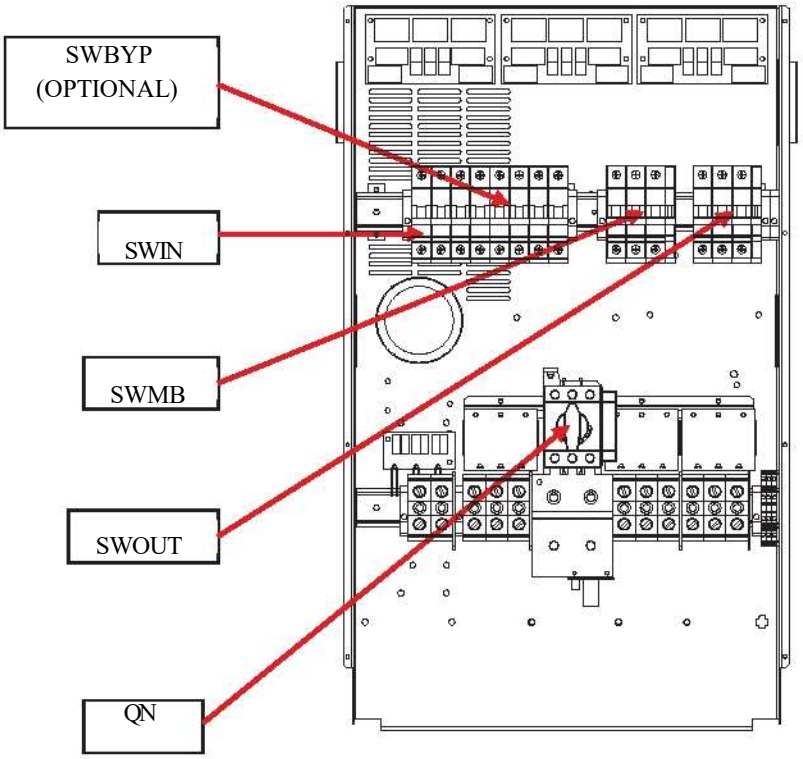
## 3.5 ADDITIONAL SERVICE OPERATIONS

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

# 4 UPS INTERNAL STRUCTURE

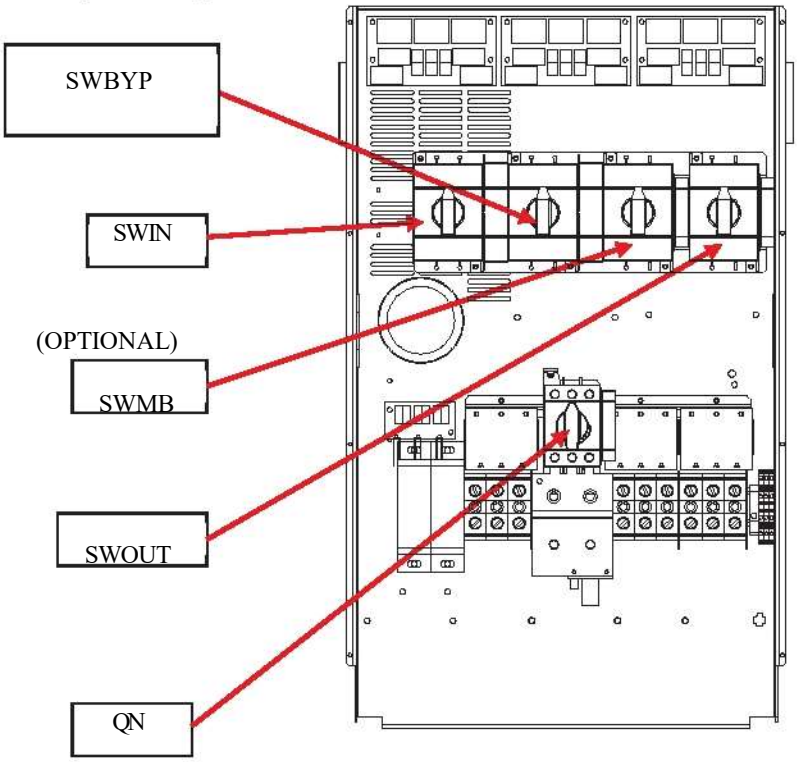
For further details, see the instruction manual:

## 4.1 DISCONNECTION SWITCH POSITIONS




60 – 80K

Fig.1




100K

Fig.2

**NOTE:**

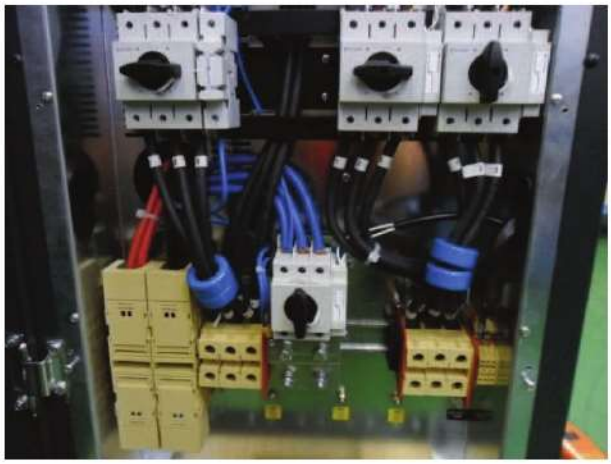
– the auxiliary contact on both SWOUT and SWMB disconnection switches is normally closed (NC) (with the disconnection switch open)

- the auxiliary contact on disconnection switch QN is normally open (NO) (with the disconnection switch open)

model K60**A**… model K80**A**...

model K60**B**… model K80**B**…

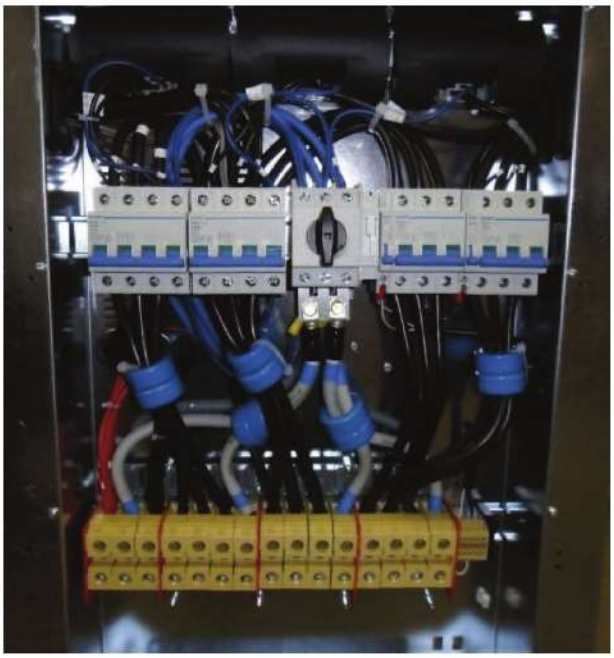
model M10**A**…



model M10**B**…

**Fig.3**

model K60**A**… model K80**A**… with separate BYPASS input



model K60**B**… model K80**B**… with separate BYPASS input

model M10**A**… with separate BYPASS input

model M10**B**… with separate BYPASS input

**Fig.4**

## 42 BOARD /COMPONENT POSITIONS INSIDE THE UPS.

With reference to the following diagrams, there is:

1) BOOST DRIVER board (B0121)
2) BOOST LEM board (B0124)
3) INPUT board (B0125)
4) OUTPUT board (B0126)
5) INVERTER DRIVER board (B0135)
6) INVERTER BUS BARS board (B0137) (B0183 on SATURN60**B**…)
7) PFC BUS BARS board (B0138) (B0183 on SATURN60**B**…)
8) INVERTER LEM board (B0144)
9) AUX PS board (B0102)
10) 10A BATTERY CHARGER board (B0060)
    25A BATTERY CHARGER board (B0084) (OPTIONAL)
11) 24V RELAY board (B0127)
12) CONTROL board (B0122)
13) DSP+uC CONTROL board (B0067)
14) INTERFACE board (B0056)
15) INPUT FILTER board (and BYPASS line) (B0133)
16) OUTPUT FILTER board (B0133)
17) BATTERY CY CAPACITORS board (B0155)
18) CB 20A INTERFACE board (B0132) (OPTIONAL)
19) PARALLEL board (B0085) (OPTIONAL)
20) PHASES CY CAPACITORS board (B0181)
21) N CY CAPACITORS board (B0182)
22) INVERTER INDUCTOR
23) POSITIVE BOOST INDUCTOR
24) NEGATIVE BOOST INDUCTOR
25) INVERTER CAPACITOR (150uF 250VAC)
26) PFC+ CAPACITOR (50uF 250VAC)
27) PFC- CAPACITOR (50uF 250VAC)
28) ELT. POSITIVE CAPACITOR BANK
29) ELT. NEGATIVE CAPACITOR BANK
30) INPUT CAPACITORS (50uF 330VAC)
31) INPUT RELAY
32) OUTPUT RELAY (for 60-80kVA)
33) OUTPUT RELAY (for 100kVA)
40) AUX PS BOARD FAN (80x80, 24Vdc)
41)BATTERY CHARGER BOARD FAN (92x92, 12Vdc)
42) OUTPUT POWER HEATSINK FAN (120x120, 24Vdc)
43) INPUT POWER HEATSINK FAN (120x120, 24Vdc)

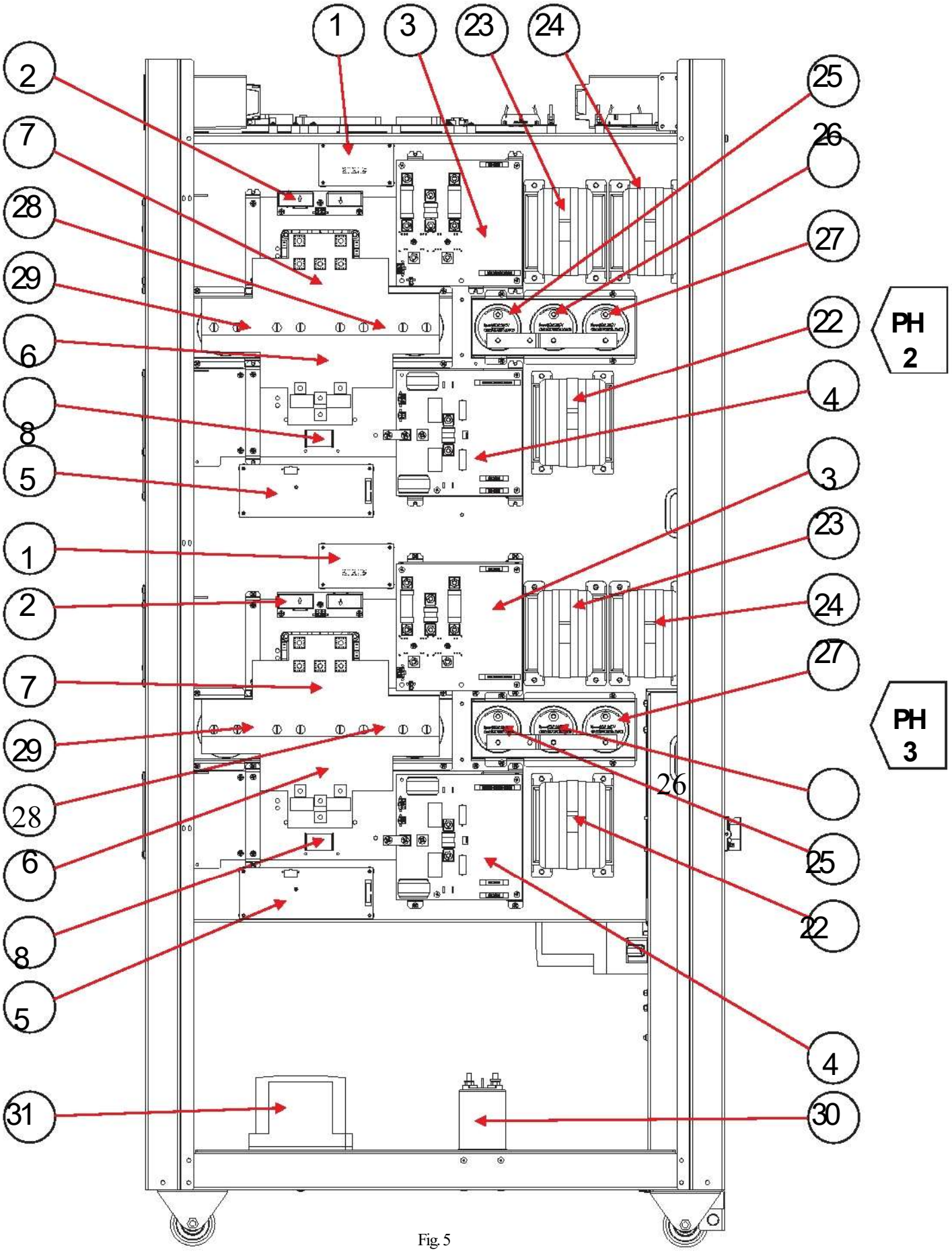

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Fig. 5

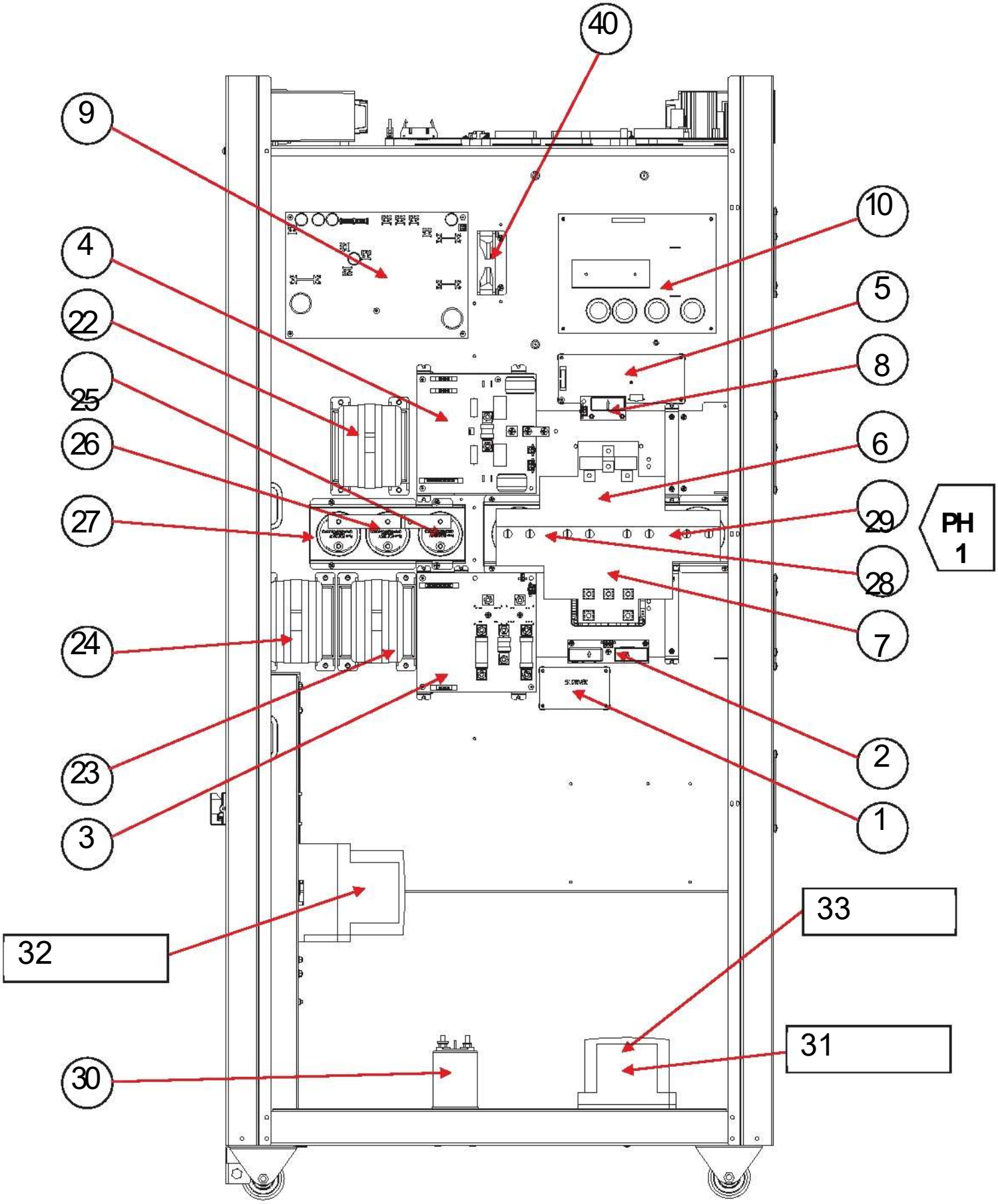



Fig.6

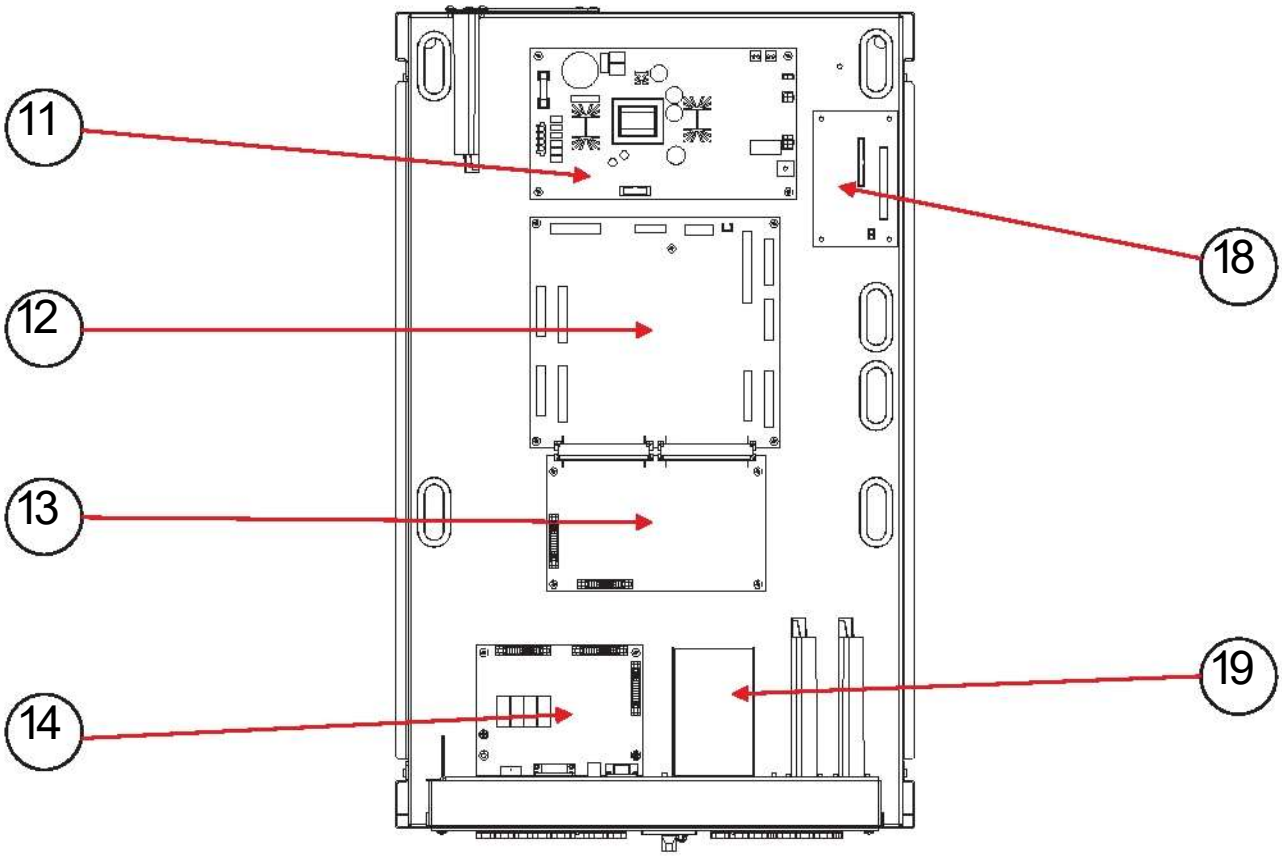



Fig.7

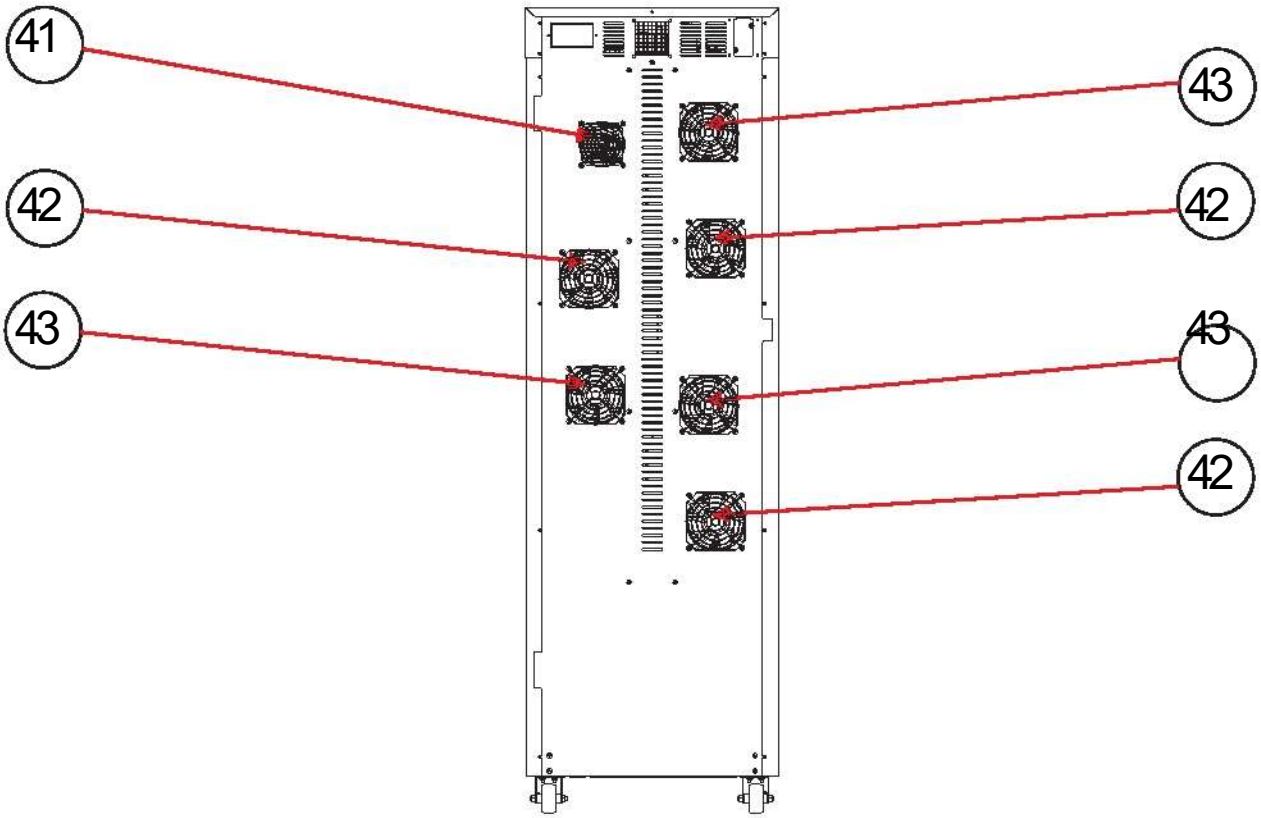
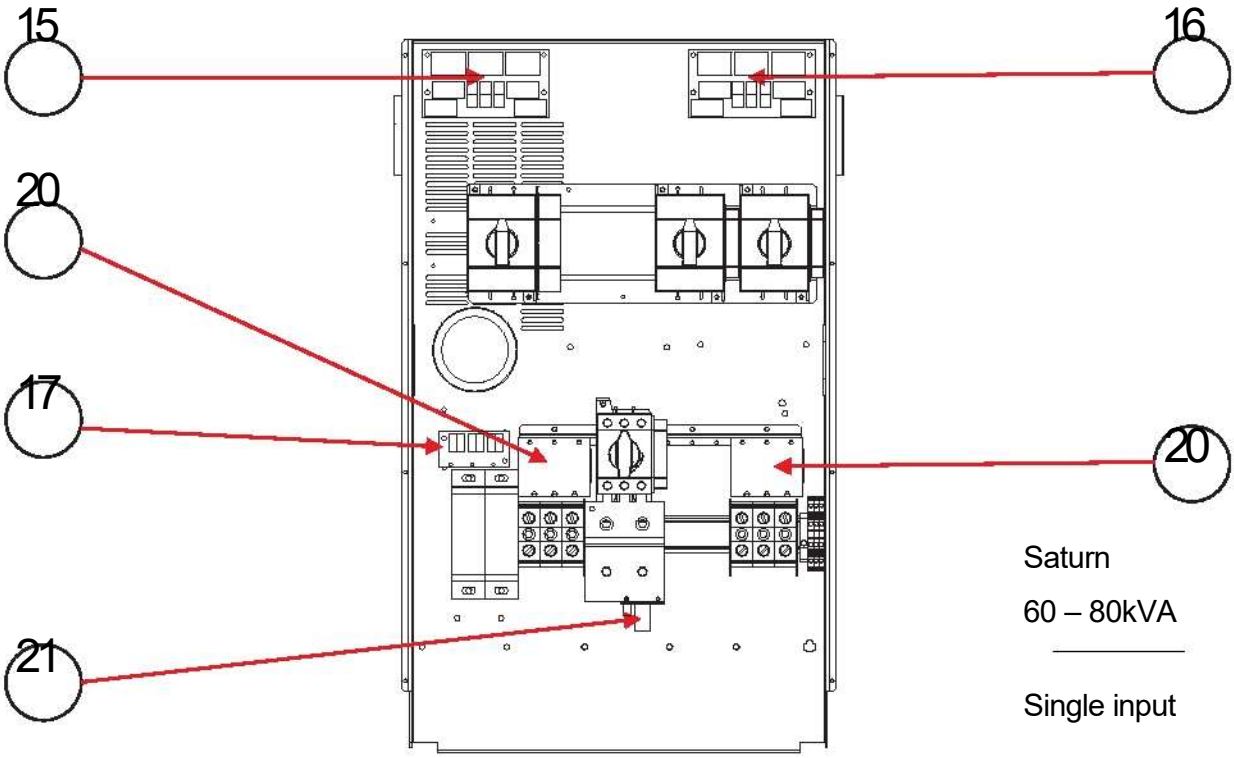



Fig.8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21
Saturn
60 – 80kVA
Single input

Fig.9

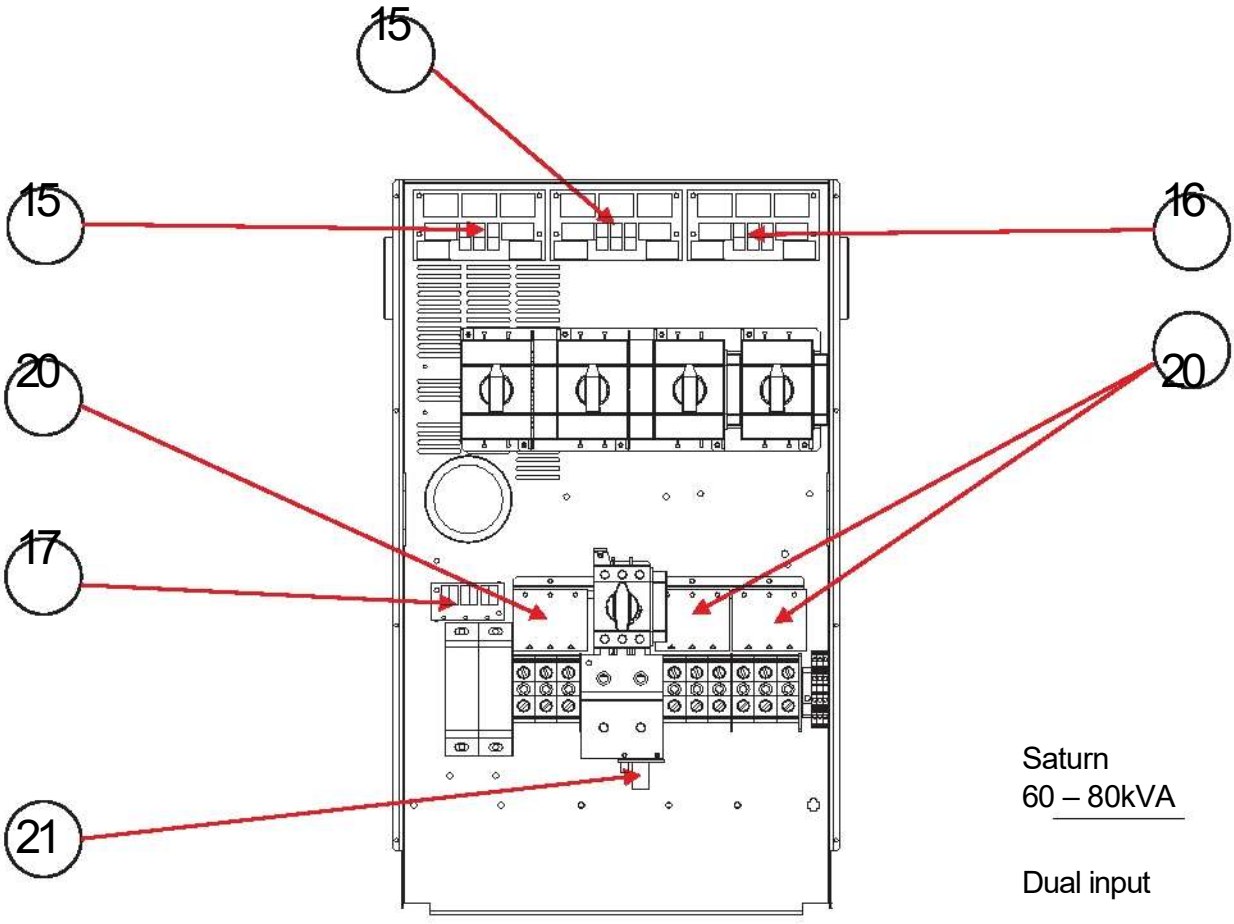

15
15
16
20
20
17
21
Saturn
60 – 80kVA
Dual input

Fig.10

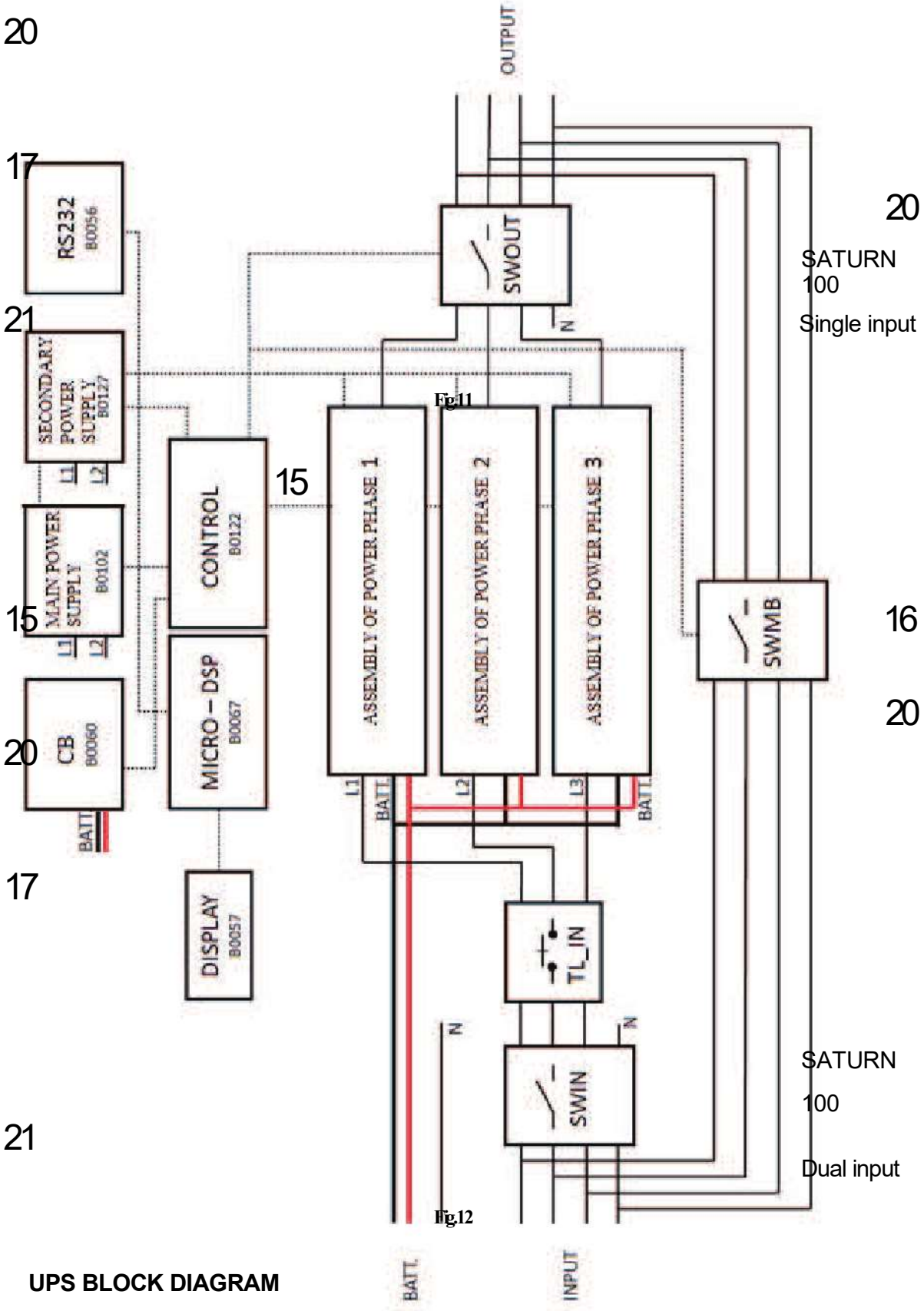



Fig.11

Fig.12

## 4.3 UPS BLOCK DIAGRAM

## 4.4 SINGLE PHASE BLOCK DIAGRAM

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

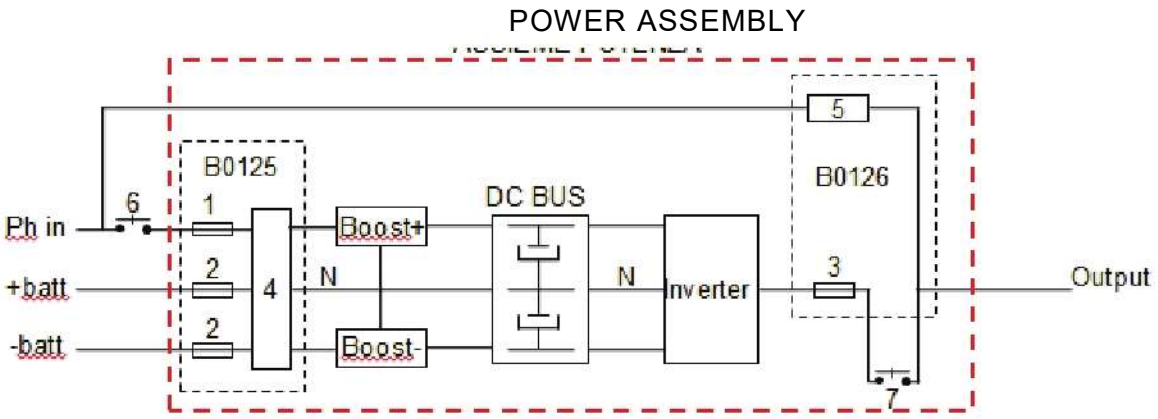



Fig.13

Legend:

| | | |
|---|---|---|
| 1) Input fuses | 60 - 80kVA | 160A FF240V |
| | 100kVA | 180A FF240V |
| 2) Battery fuses | 60 - 80kVA | 80A F500V |
| | 100kVA | 100A F690V |
| 3) Output fuses | 60 - 80kVA | 160A FF240V |
| | 100kVA | 180A FF240V |

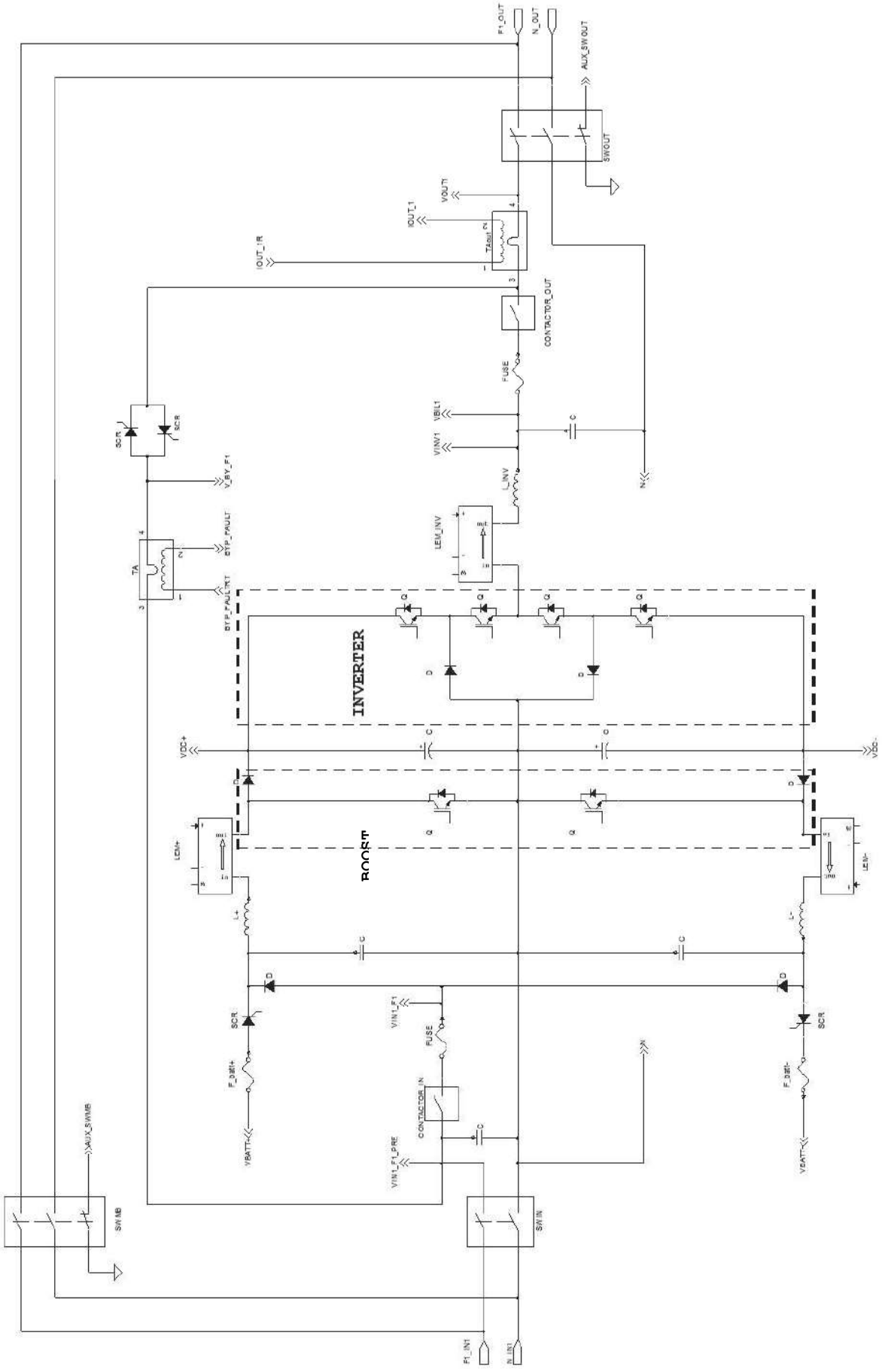
4) Input stage with rectifying diodes and battery SCR in Semitop module

5) Bypass SCR module

6) Input relay

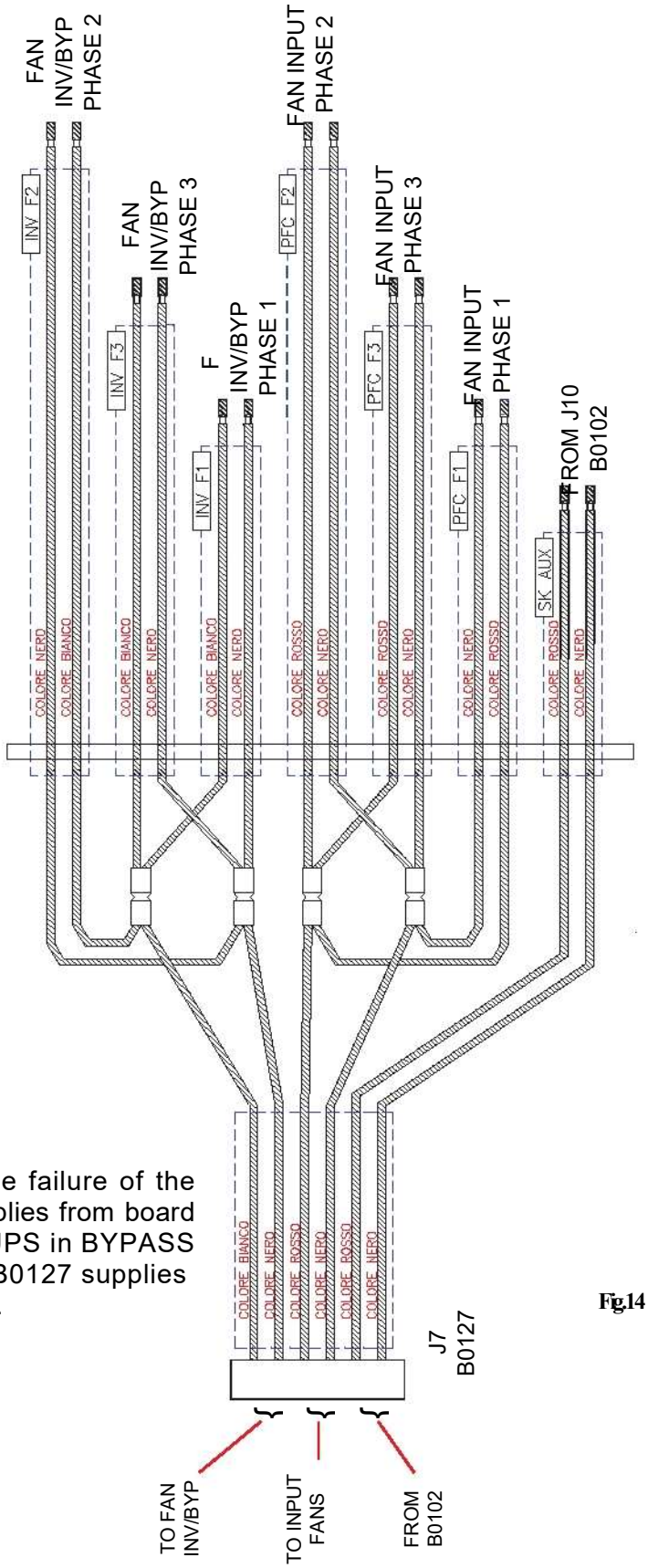
7) Inverter output relay

## 4.5 SINGLE PHASE ELECTRICAL DIAGRAM



## 4.6 FAN POWER SUPPLY CONNECTION

The 24Vdc power supply voltage required for fan operation is generated by auxiliary power supplies board B0102. This power supply is sent to the 24V relay board (B0127) and is distributed from here to the individual fans for each power board. Please refer to the wiring shown in Fig. 14.




**NOTE:**
in the event of the failure of the 24Vdc power supplies from board B0102, with the UPS in BYPASS operating mode, B0127 supplies the output fans only.

**Fg.14**

# 5 AUXILIARY POWER SUPPLY FAILURE (L01)

## 5.1 TESTS

Board B0102 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 B0102 generates different voltages for supplying the different parts of the UPS. We can therefore distinguish between:

- ±15V voltage (for the booster, battery charger, inverter LEM and battery charger fan).
- ±12V voltage (analogue part of control board B0122)
- 24V voltage (for the fans, from a separate circuit that takes up current from the negative capacitor bank)
- 24V voltage (for the bypass fans and relay control, generated by board B0127)
- 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 to the electronics of board RS232 (B0056) and for the battery charger board (B0060).

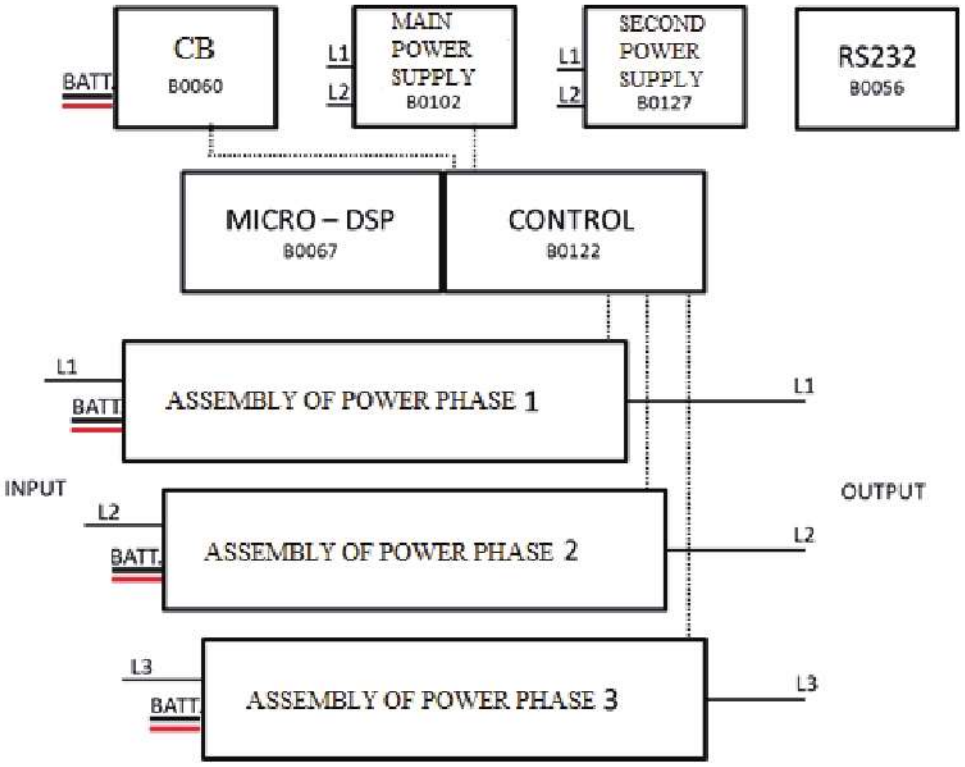
All auxiliary power lines (±15V, ±12V and HF 50KHz) first pass through the control board, and are distributed from here to the various parts of the UPS via flat connection cables.
The HF 100KHz power supply generated by the main power supply unit is distributed to the power boards via the control board (B0122). The battery charger receives the HF 100KHz signal directly from the main power supply unit.

Board RS232 receives this power supply via the following route:

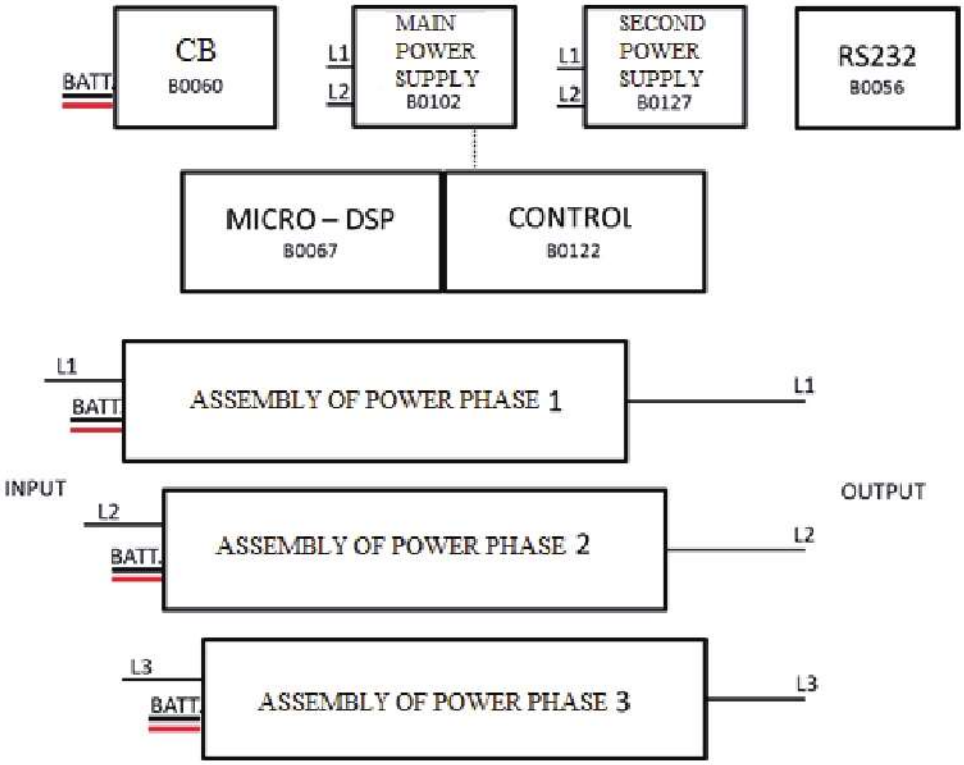
main power supply unit (B0102) → control board (B0122) → micro DSP board (B0067).

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

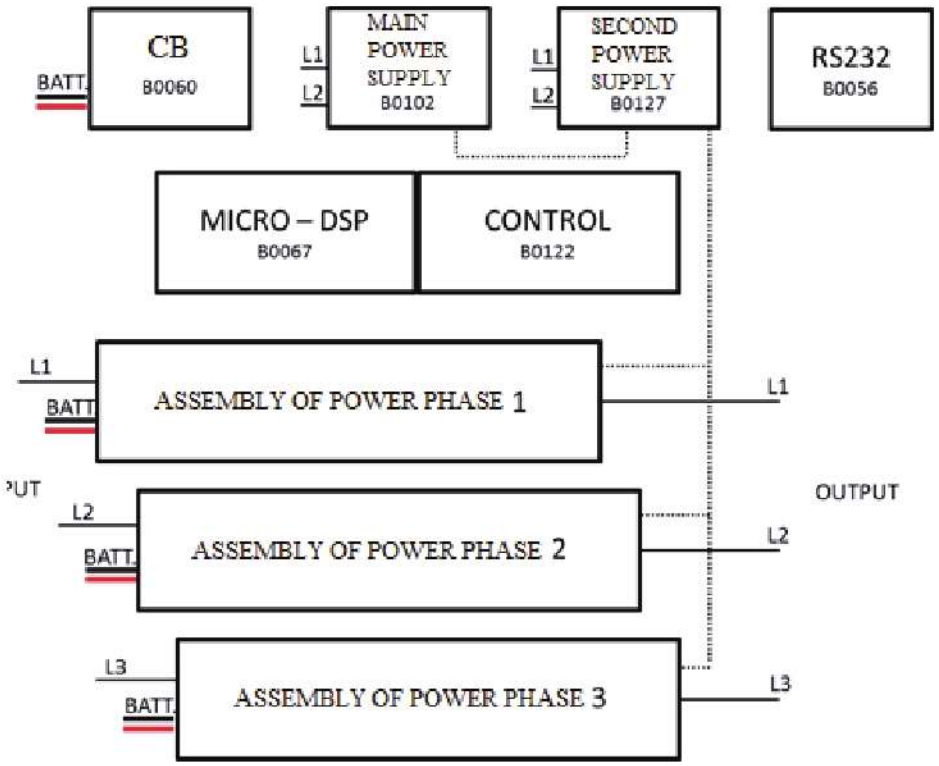
## 52 15V - LEM POWER SUPPLY




## 53 12V POWER SUPPLY - ANALOGUE PART OF CONTROL BOARD

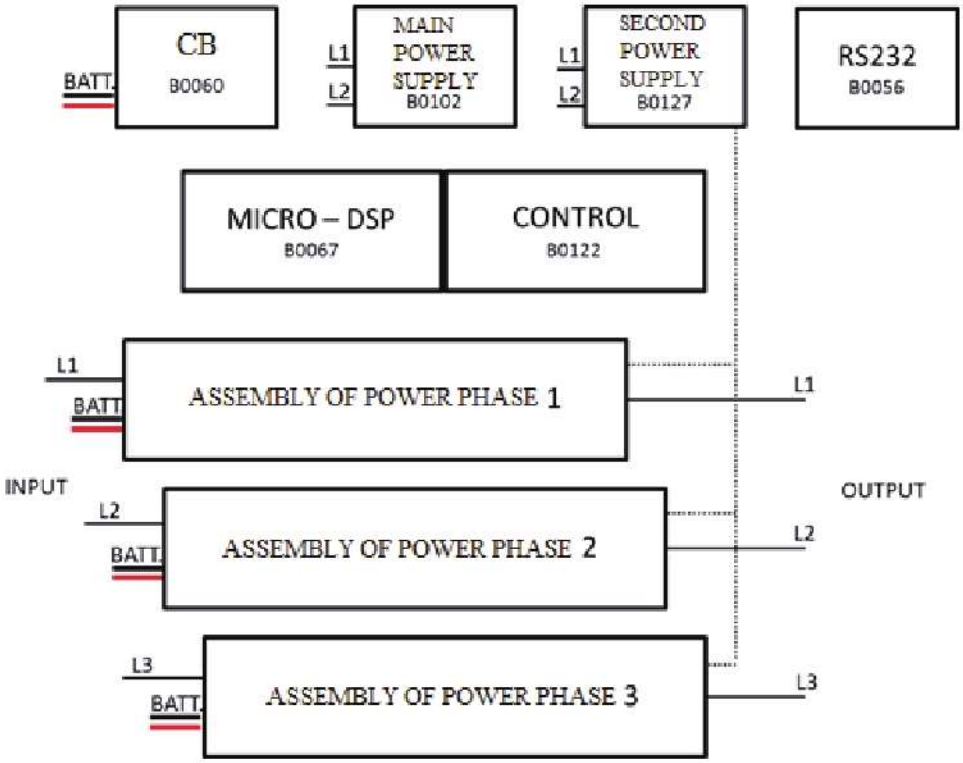


## 54 24V POWER SUPPLY FOR FANS (regulated)

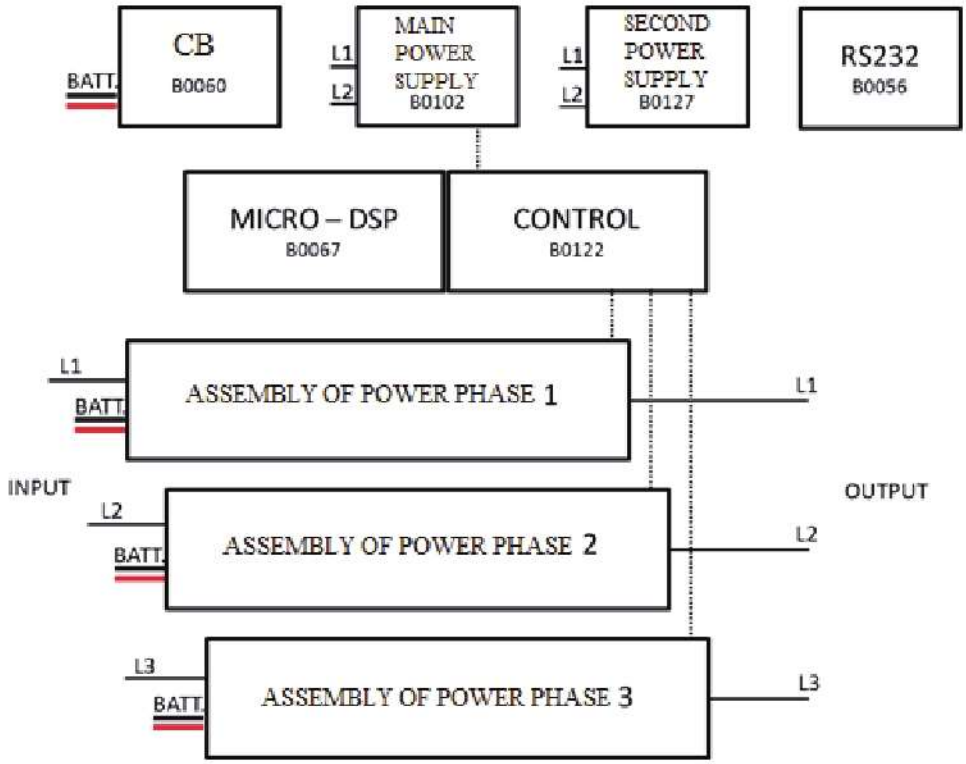



## 55 24V EMERGENCY POWER SUPPLY FOR FANS (fault B0102)

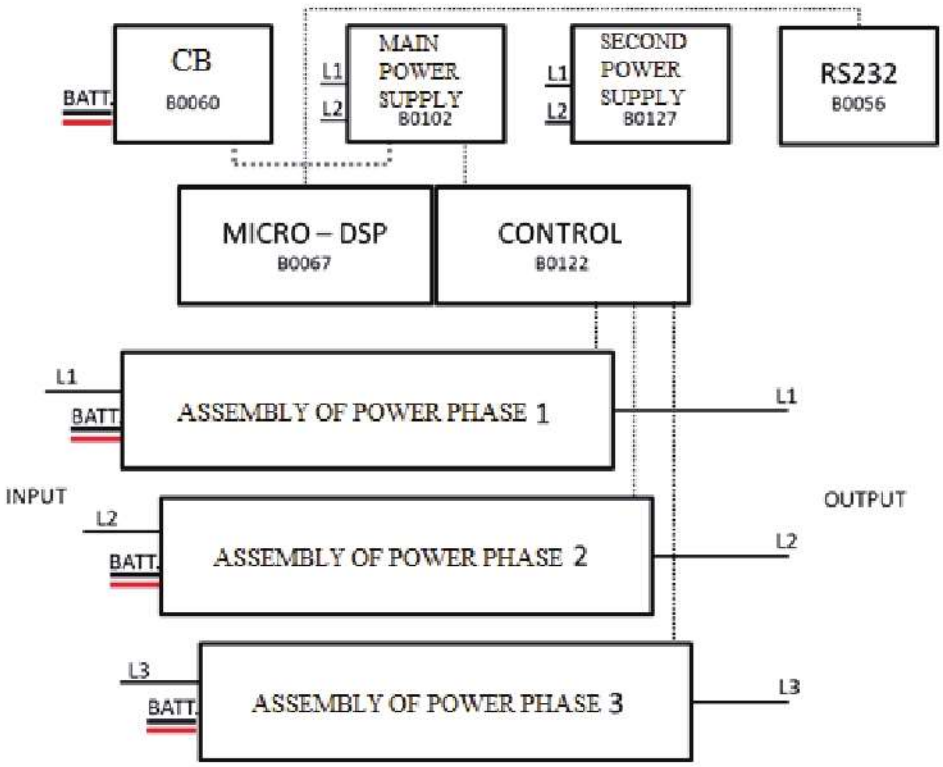
**NOTE:** only the output dissipator fans are supplied.



## 5.6 HF 50KHz POWER SUPPLY FOR BATTERY AND BYPASS SCR



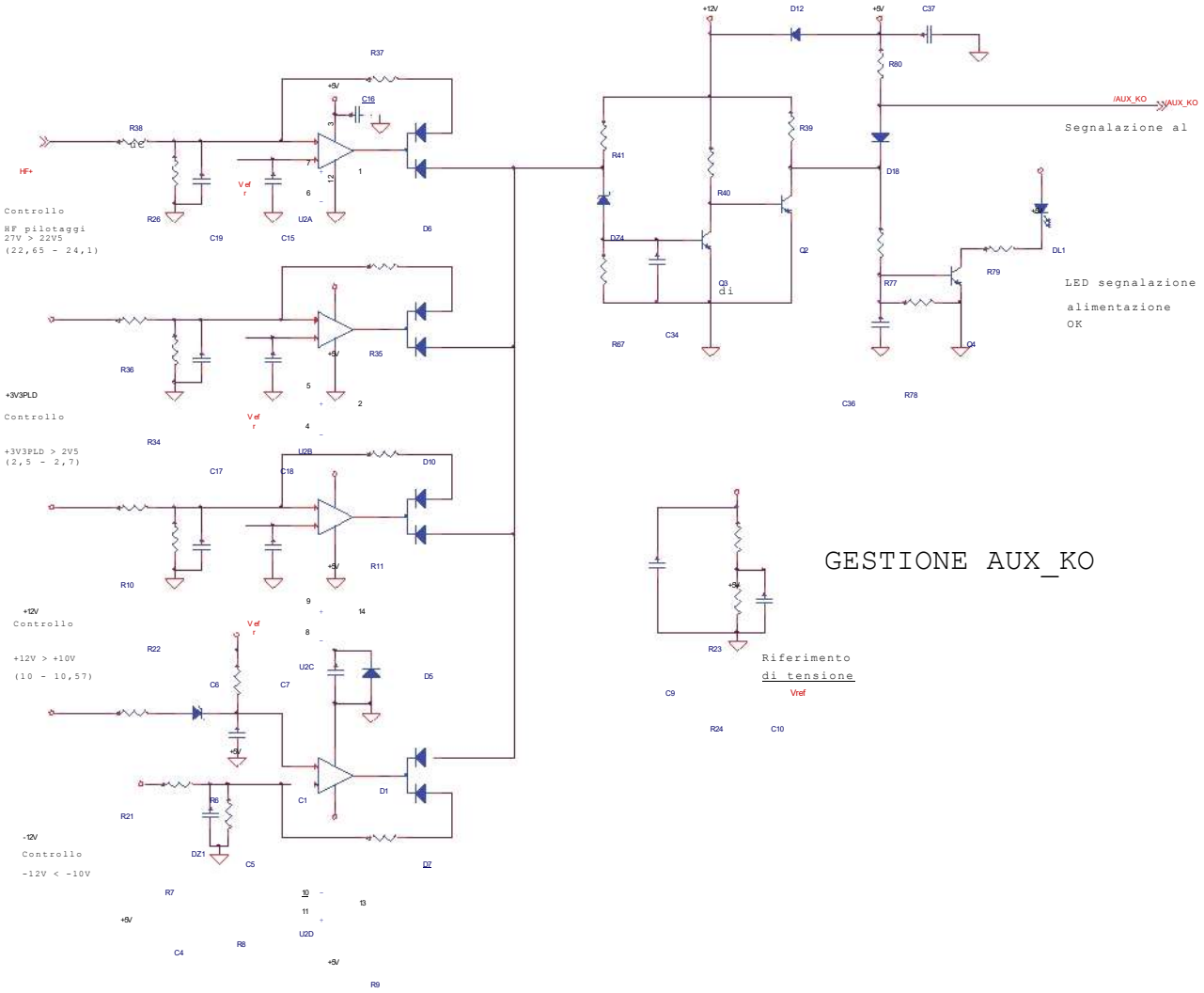

## 5.7 HF 100KHz POWER SUPPLY FOR POWER STAGES AND RS232



## 5.8 "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 HF+ 100KHz voltages drawn from Aux. power supplies board B0102.

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.

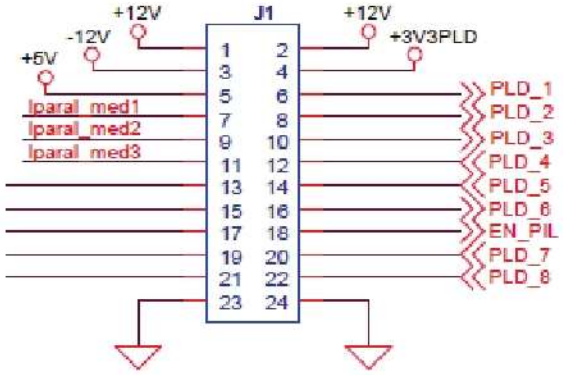


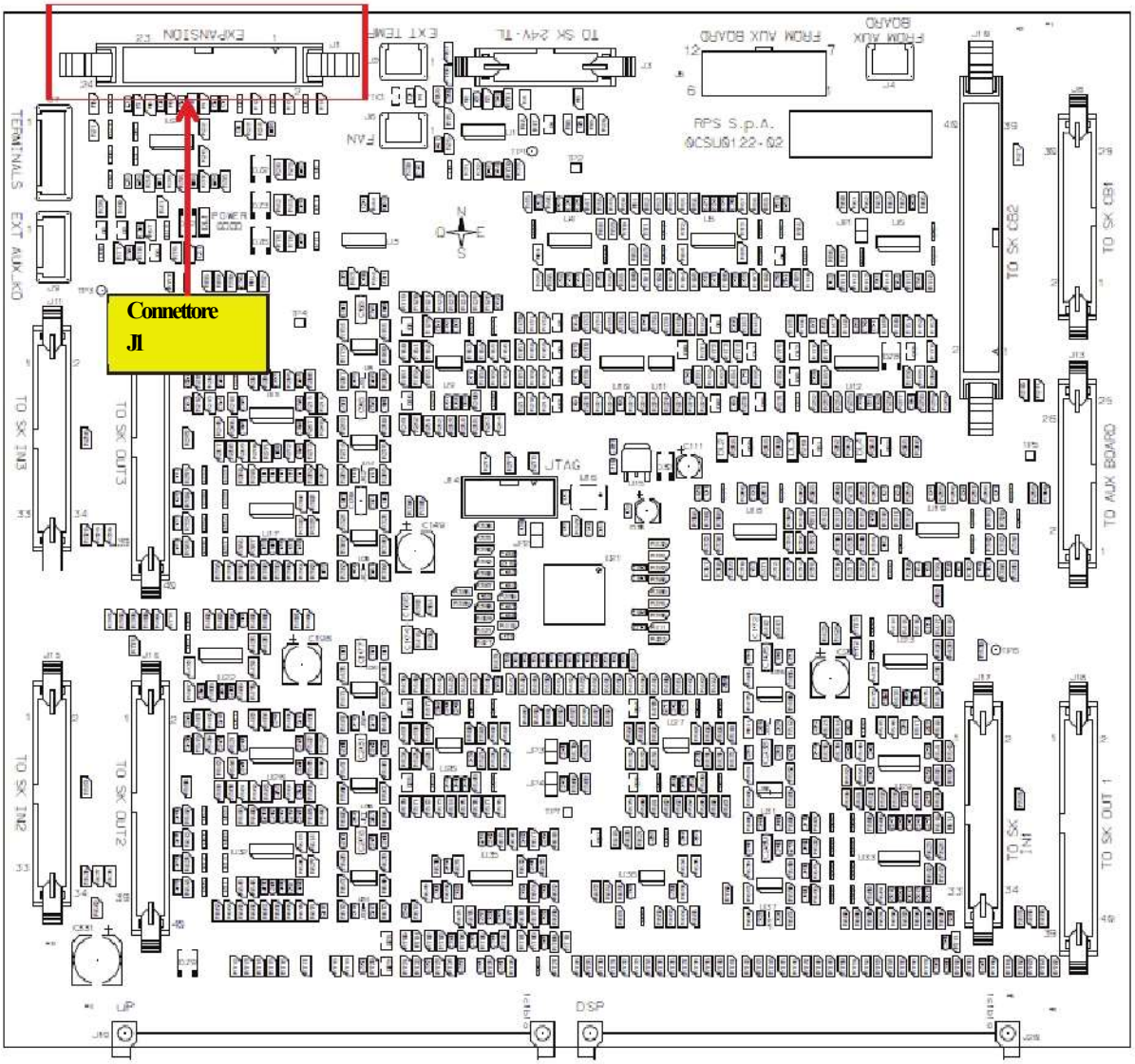

The difficulty in resolving this kind of fault lies in identifying the cause of the problem. In particular it is necessary to understand why the control logic of board B0122 has failed (the failure is not necessarily due to an incorrect voltage supplied by the power supply).

## 59 CHECK AUX VOLTAGE (L01)

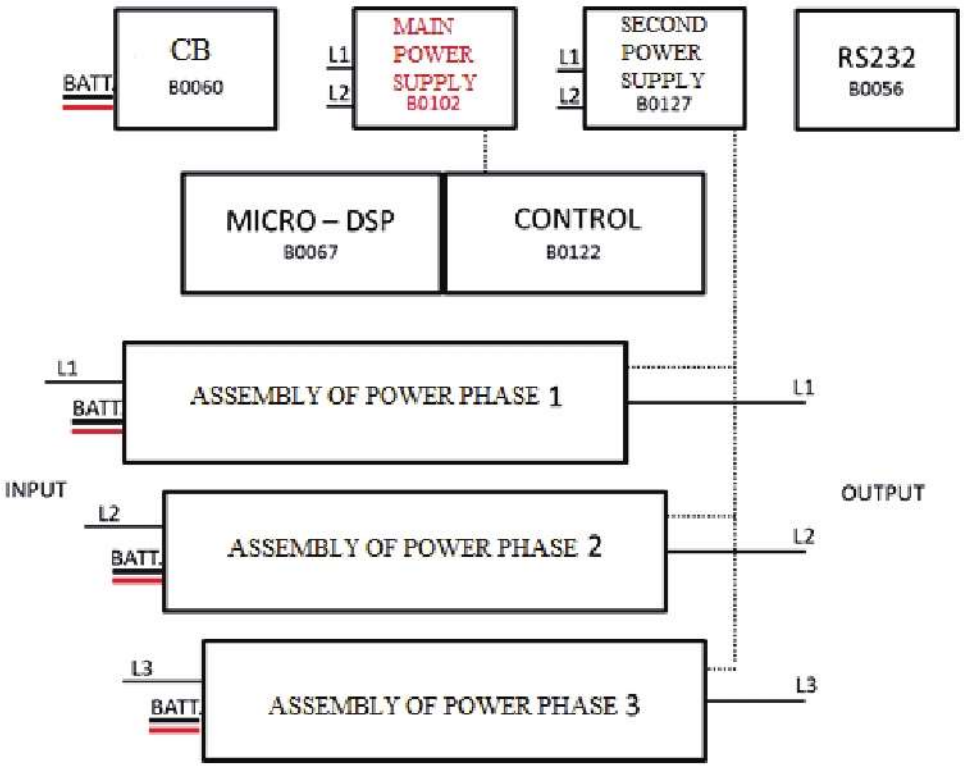
To understand the problem about the L01 alarm, is necessary to check the voltage/s not present. So, is possible to measure, on control board B00122, these points (with UPS in standby mode):

On connector J1 on board B00122 between pins
1 & 23 → +12V
3 & 23 → -12V
4 & 23 → +3,3V
5 & 23 → +5V



## 5.10 MAIN POWER SUPPLY UNIT FAILURE

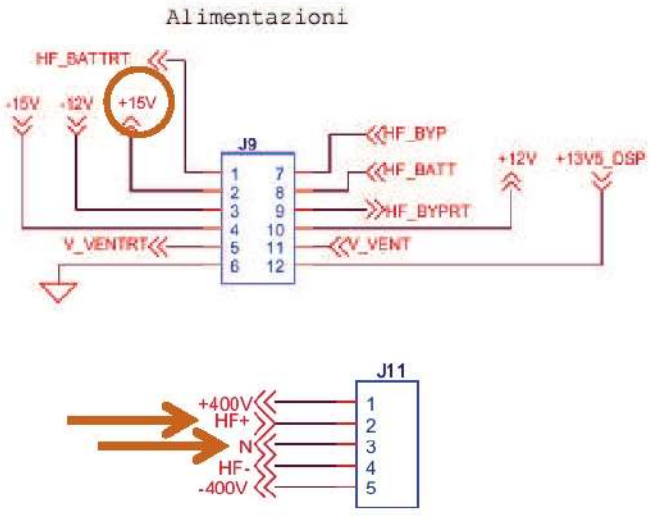



**OBSERVATIONS**

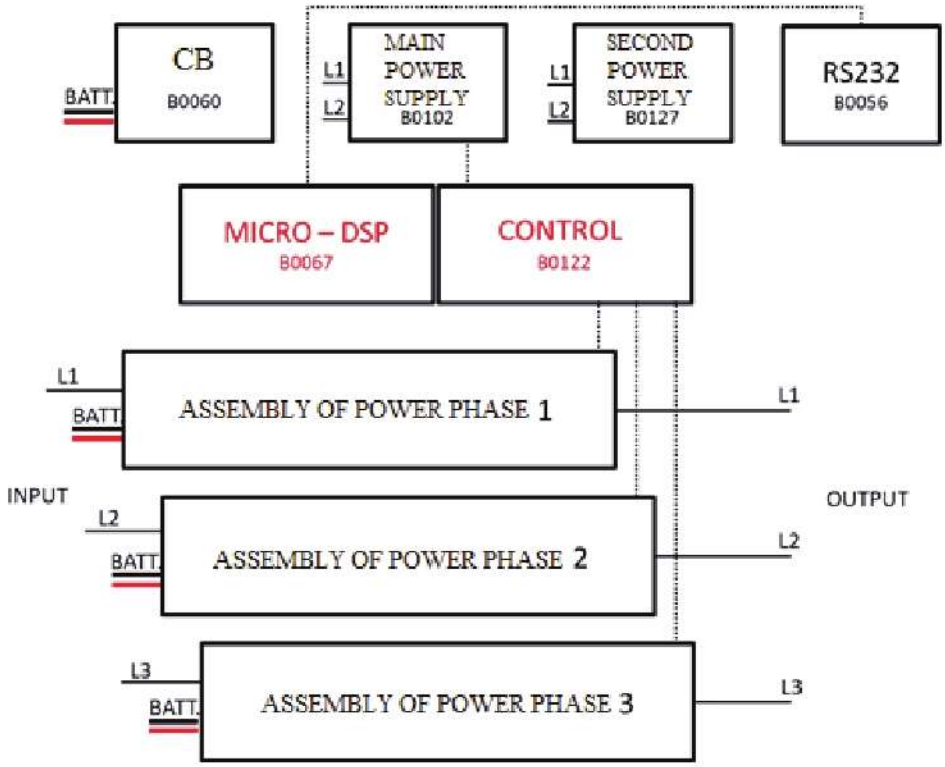
If the auxiliary power supply unit ceases to provide the correct power supply (i.e. the 12V or HF supplies), the logic board stops the UPS and displays error L01.

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 B0102 by disconnecting connector J9 (**with the UPS completely switched off**) and leaving J11 connected. Close the SWIN and check for the presence of power supply voltages and, if possible, the presence of the HF+ supply (measuring between HF+ and N with the tester in DC mode the reading should be approx. 27V).
In the event of missing or incorrect power supplies, replace board B0102.

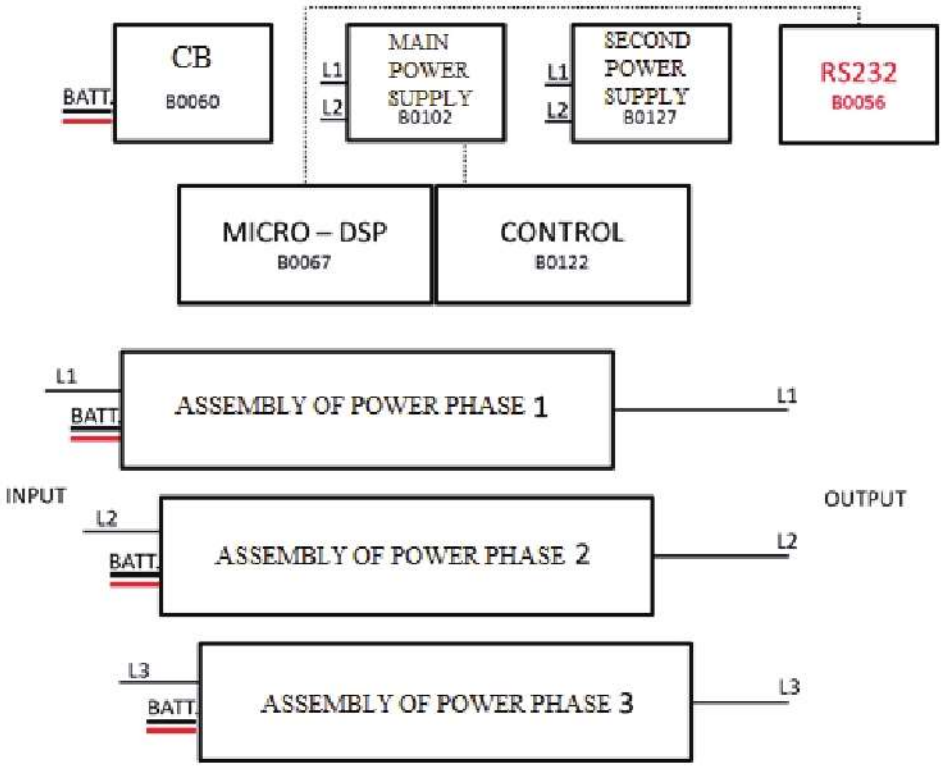


## 5.11 MICRO DSP / CONTROL BOARD FAILURE




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.

## 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 FAN FAILURE

The presence of a blocked fan or a fan with a short circuit winding may damage fuse F1 on the main power supply unit board (B0102). After replacing the damaged fan, check and if necessary replace fuse F1.

# 6 COMPONENT TEST FOLLOWING A FAILURE

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

1) Open all disconnecting switches on the UPS.
2) **IMPORTANT:** completely disconnect the UPS from any power supply, including any external 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 BOOST MODULE TEST

Based on the layout of Fig. 15 and pin layout of Fig. 16 use a multimeter to check the condition of the boost modules. Specifically check that the diodes are neither open nor short circuited by measuring the direct bias voltage.

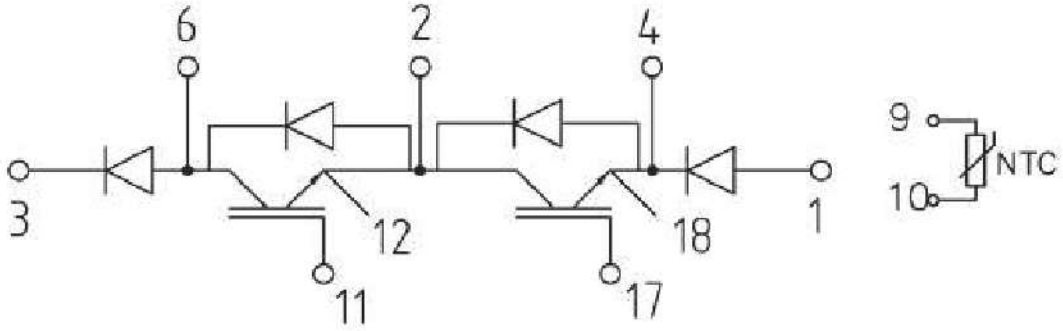



Fig.15

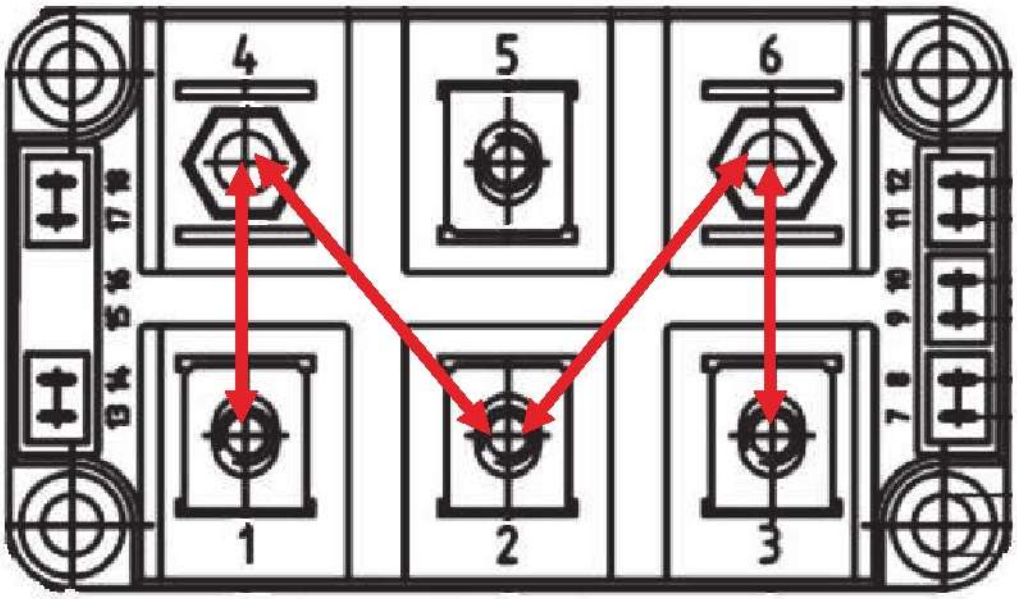



Fig.16

In the event of damage detected following checks on the BOOST module, replace the module and associated driver board (included in the igbt spare part kit).

## 62 INVERTER MODULE TEST

Based on the layout of Fig. 17 and pin layout of Fig. 18 use a multimeter to check the condition of the inverter modules. Specifically check that the diodes are neither open nor short circuited by measuring the direct bias voltage (valid for 60-A, 80 and100 KVA).

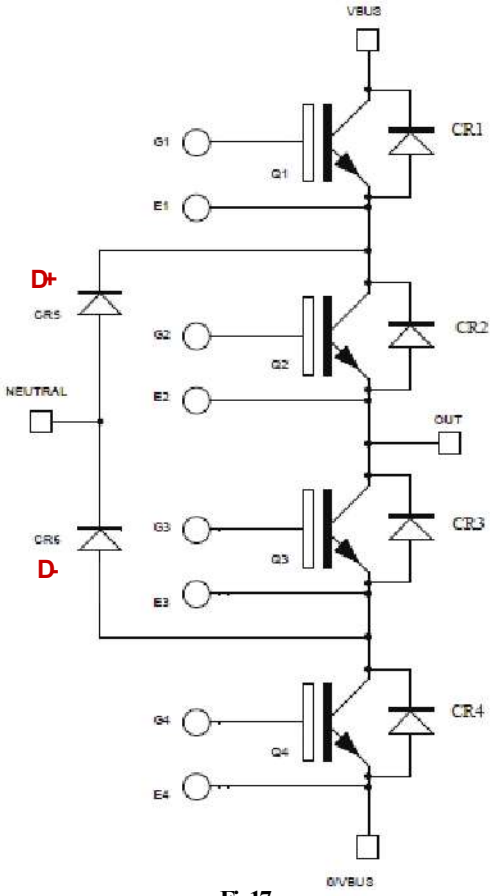



Fig.17

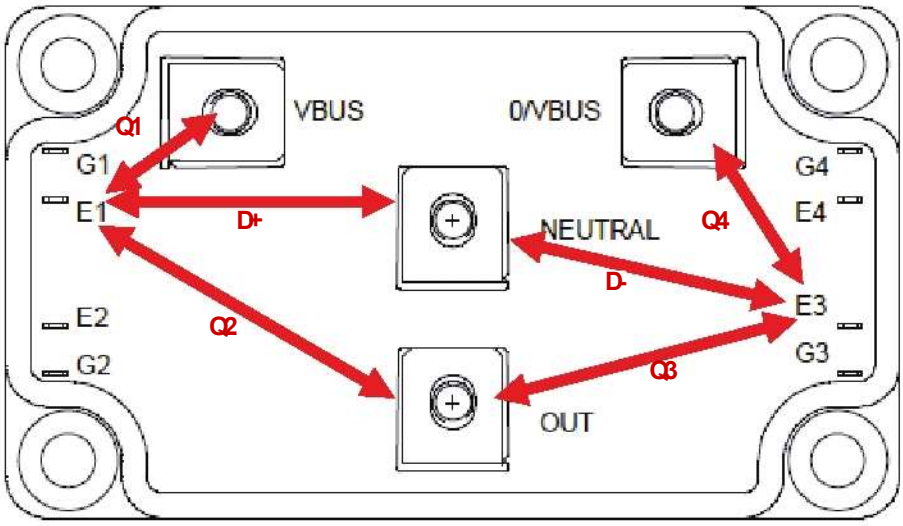
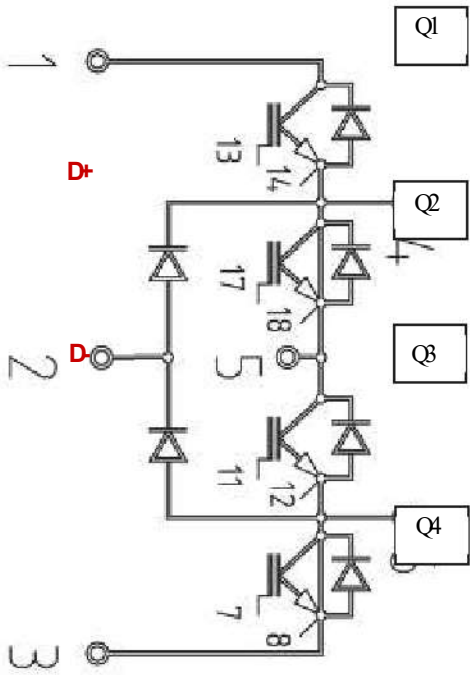
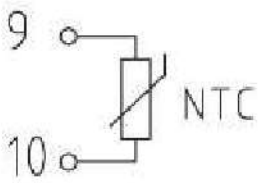



Fig.18

In the event of damage detected following checks on the INVERTER module test, replace the module and associated driver board (included in the IGBT spare part kit).

For SATURN 60B, use the layout shown below



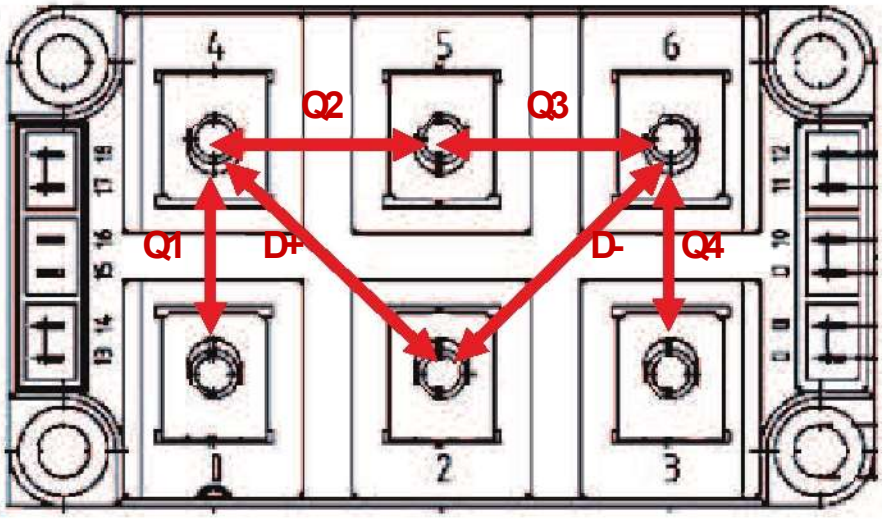




Fig.19

## 63 SEMITOP MODULE TEST

In the event of the failure of the PFC module and/or INVERTER, in addition to replacing the faulty components (IGBT modules, boards, etc.), the condition of the rectifier bridges on the other two phases should also be checked using a multimeter.
The component in question is the input stage with rectifier diodes and battery SCR in the Semitop module on board B0125 (2 modules on each board).
Specifically, use the layout and pin layout given below to check that the two SCR are not short-circuited between the anode and cathode and that the two diodes are neither open nor short circuited, measuring the direct bias voltage.


Fig.20

If one of these components is faulty the affected input board must also be replaced.

## 64 CABLE CONNECTIONS TEST (LINK FAIL)

If necessary, use a multimeter set to ohmmeter mode to check the following on board B0122:

- resistance within the range of 0-15 between test points TP1 and TP6
- resistance within the range of 1-2k between test points TP6 and TP7

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 B0122, TEST POINT POSITIONS**

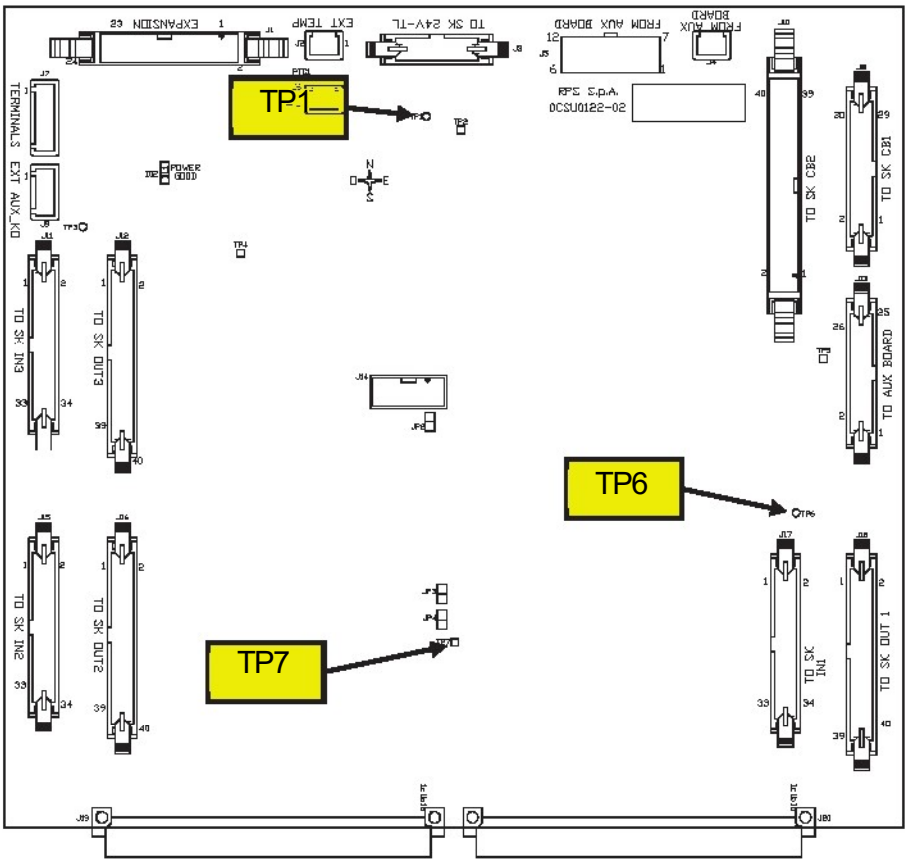



Fig.21

# 7 DESCRIPTION OF BOARDS

## 7.1 INTERFACE BOARD (B0056)

Versions:
B0056-02. Interface Card SATURN10-120

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

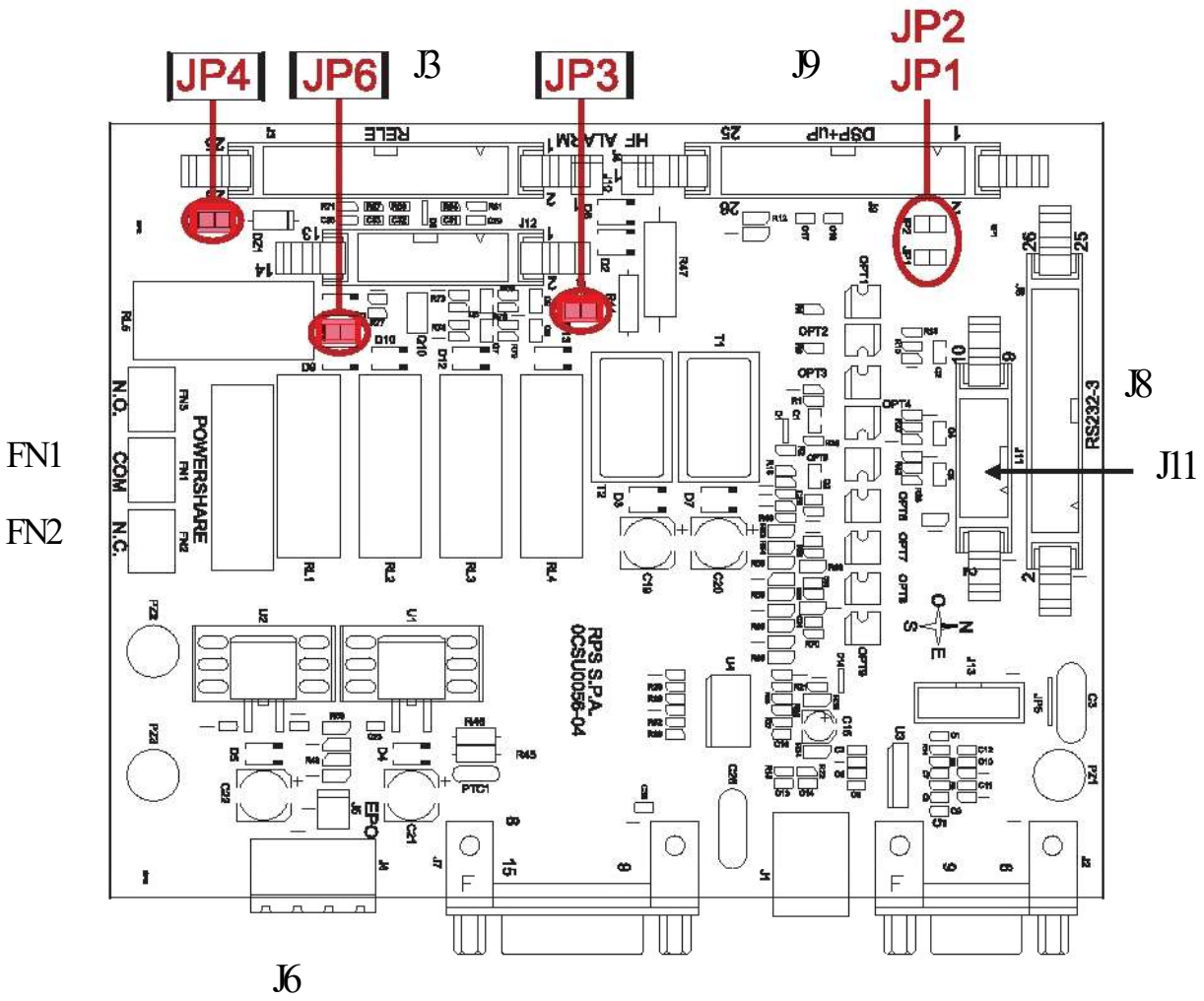



Fig.22

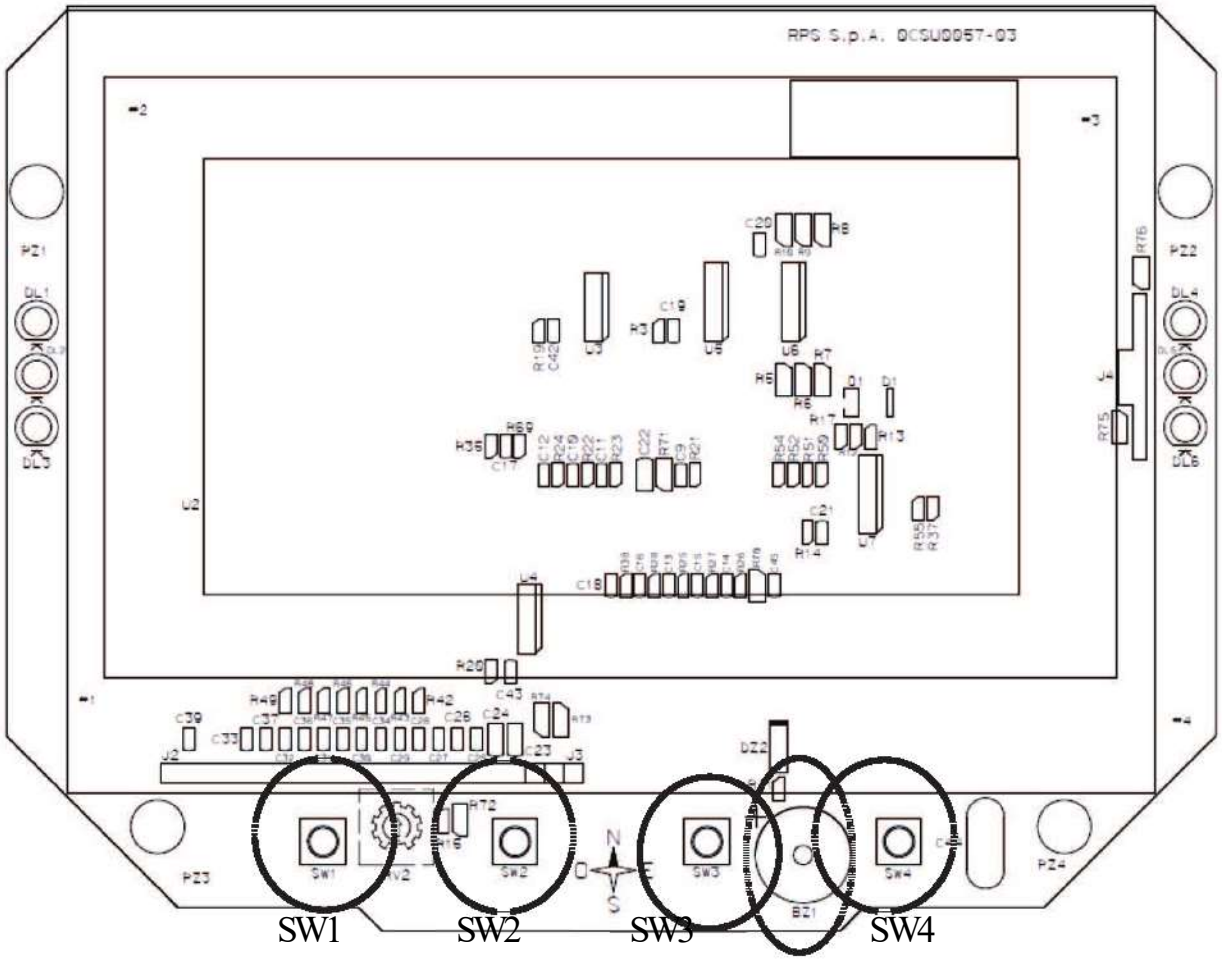
| Connector | Description | Notes |
|---|---|---|
| J3 | Flat connection from relay board | From aux relay slot |
| J6 | EPO connector | |
| J8 | Flat connection from DSP-uP board | From B0067 |
| J9 | Flat connection from DSP-uP board | From B0067 and slot1 |
| J11 | Connection to slot 2 | To slot 2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

## 72 DISPLAY CARD (B0057)

Versions:
B0057-02. Display Card SATURN - Neutral Version

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




| | | |
|---|---|---|
| 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 | |
| | | |

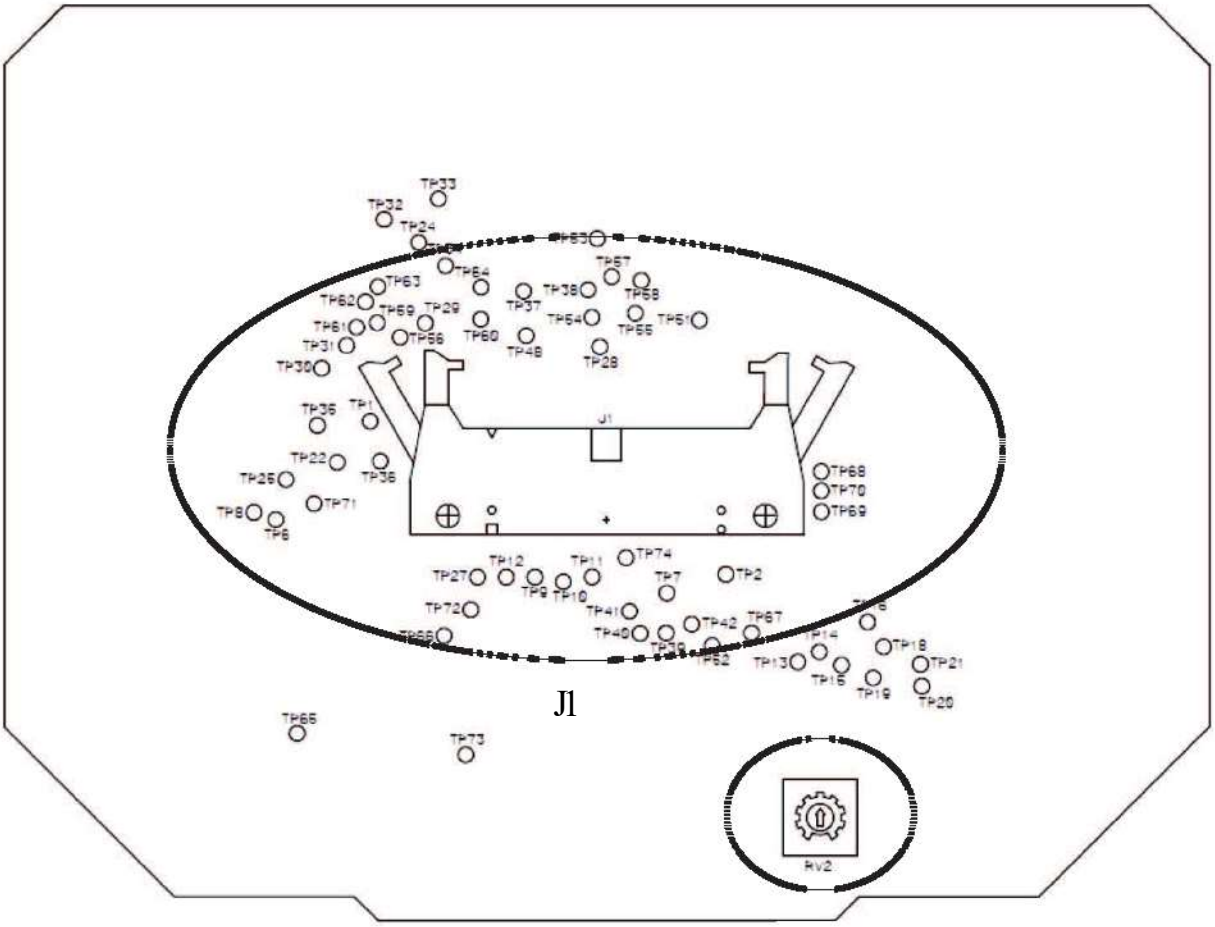



Fig.24 RV2

| Connector | Description | Note |
|---|---|---|
| J1 | Flat connection to uC+DSP board | To B0067 |
| RV2 | Trimmer to regulate the contrast on display | |

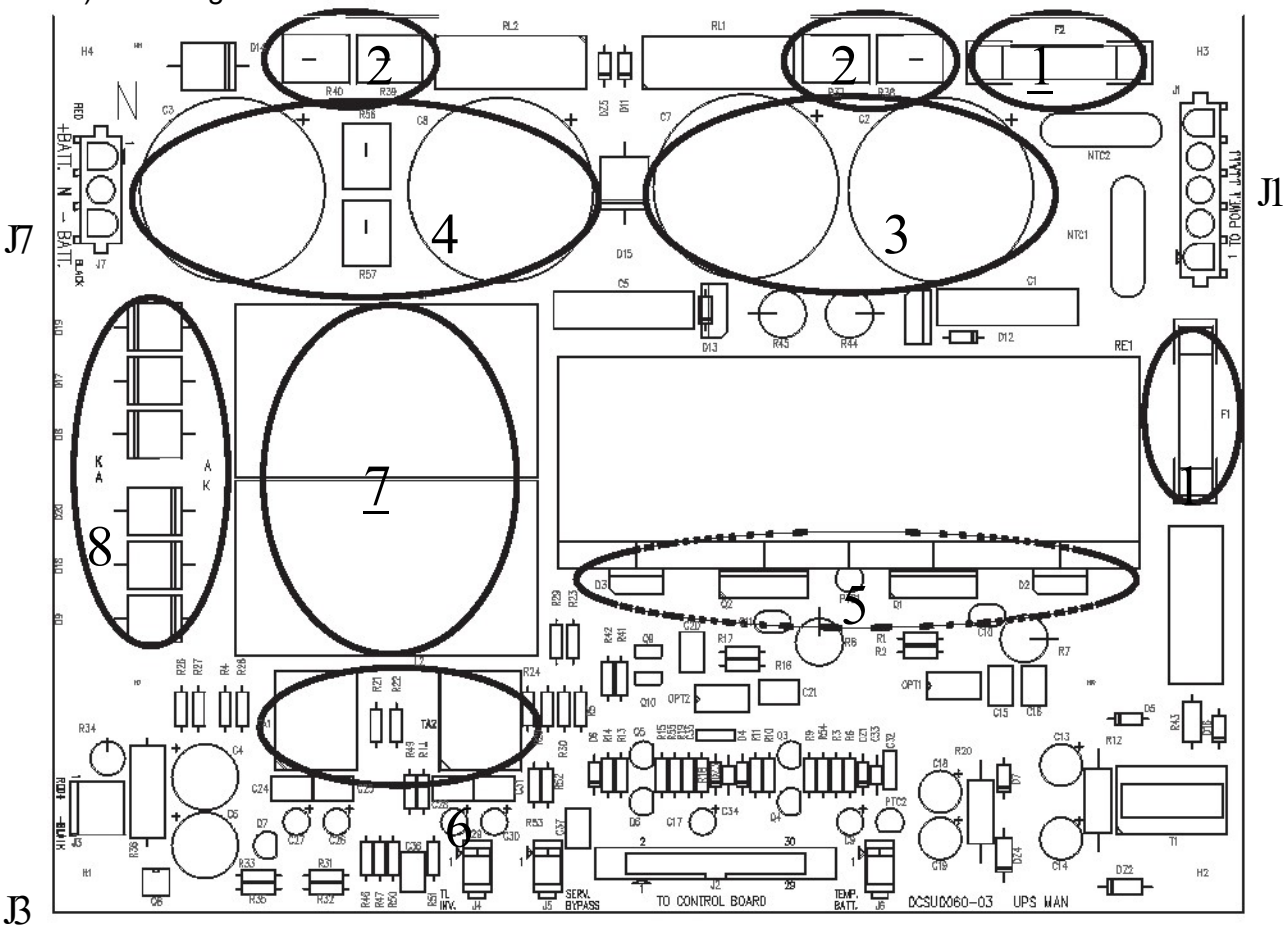
ATTENTION: It is important when starting the UPS in a very cold environment to allow the display time to warm up before adjusting the contrast via RV2.

## 73 BATTERY CHARGER BOARD (B0060)

Versions:
B0060-02. Battery Charger 10A Card 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



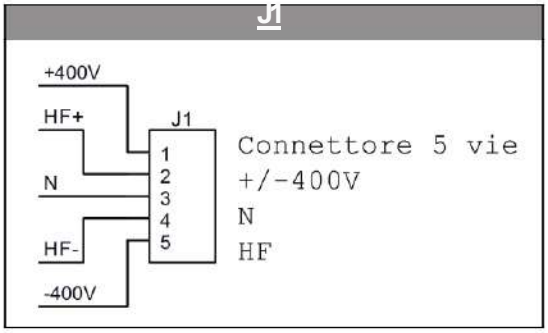

J2

Fig.25

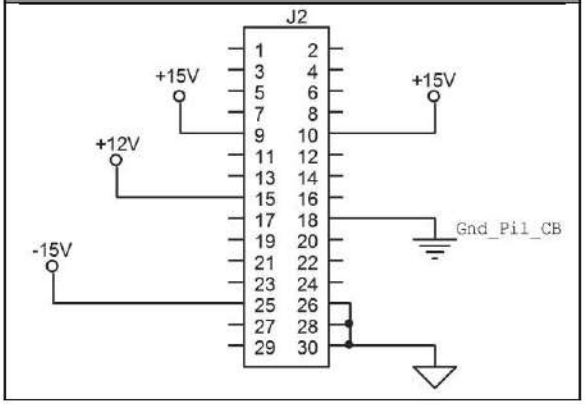
| Connector | Description | Notes |
|---|---|---|
| J1 | Battery charger input connector | |
| J2 | Flat connection from control board | From B0122 |
| J3 | Fan power supply connector +12Vdc* | |
| J7 | Battery charger output connector | |

Connector pin layout:

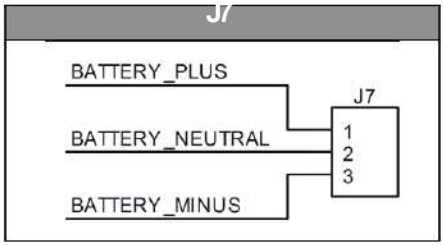
J1




J2




J7



## 7.4 uC + DSP BOARD (B0067)

Version:
B0067-01. DSP+µC Control Card for SATURN 60-100

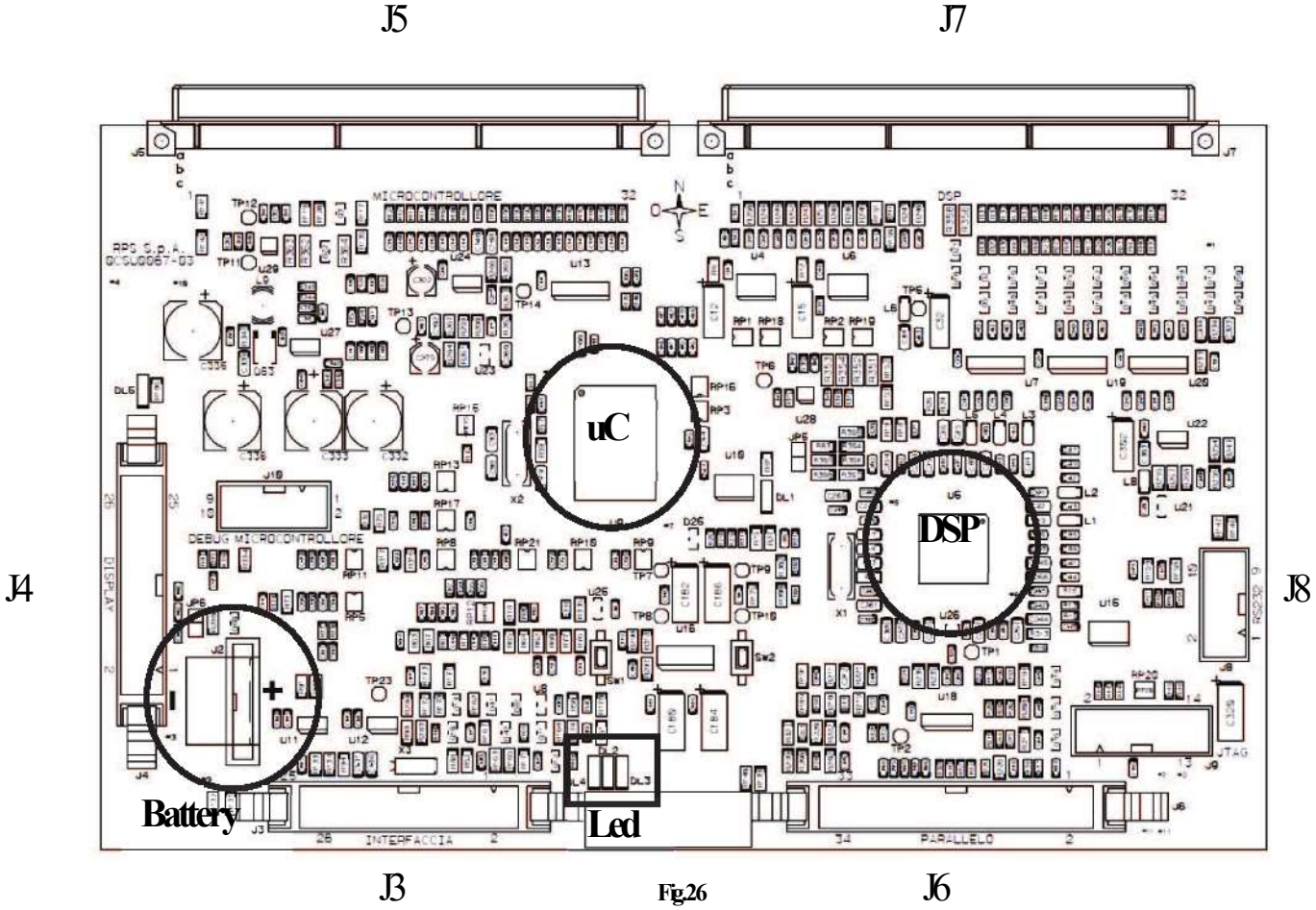



Fig.26

| Connector | Description | Notes |
|---|---|---|
| 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 B0122 |
| J6 | Connector uC to parallel board | |
| J7 | Connector DSP to control board | To B0122 |
| 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 | +5V present |
| DL2 | Reset uC |
| DL3 | +1,9V present |

## 75 BATTERY CHARGER BOARD (B0084) (OPTIONAL)

Versions:
B0084-01. Battery Charger 25A Card SATURN 100-120

NOTE: See manual 0MNMSTER3… (for option YMSTER3A 480V 20A 60-100kVA)

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

1) 2 output fuses 10mmX38 - 32 A 500V
2) 2 input fuses 6.3mmX32 - 25A 500V
3) preload resistors from battery (6 x 22 10W)
4) input capacitors
5) Battery Charger output diodes
6) positive buck + heatsink temperature sensor
7) negative buck + heatsink temperature sensor
8) output capacitors
9) current sensors
10) buck inductances

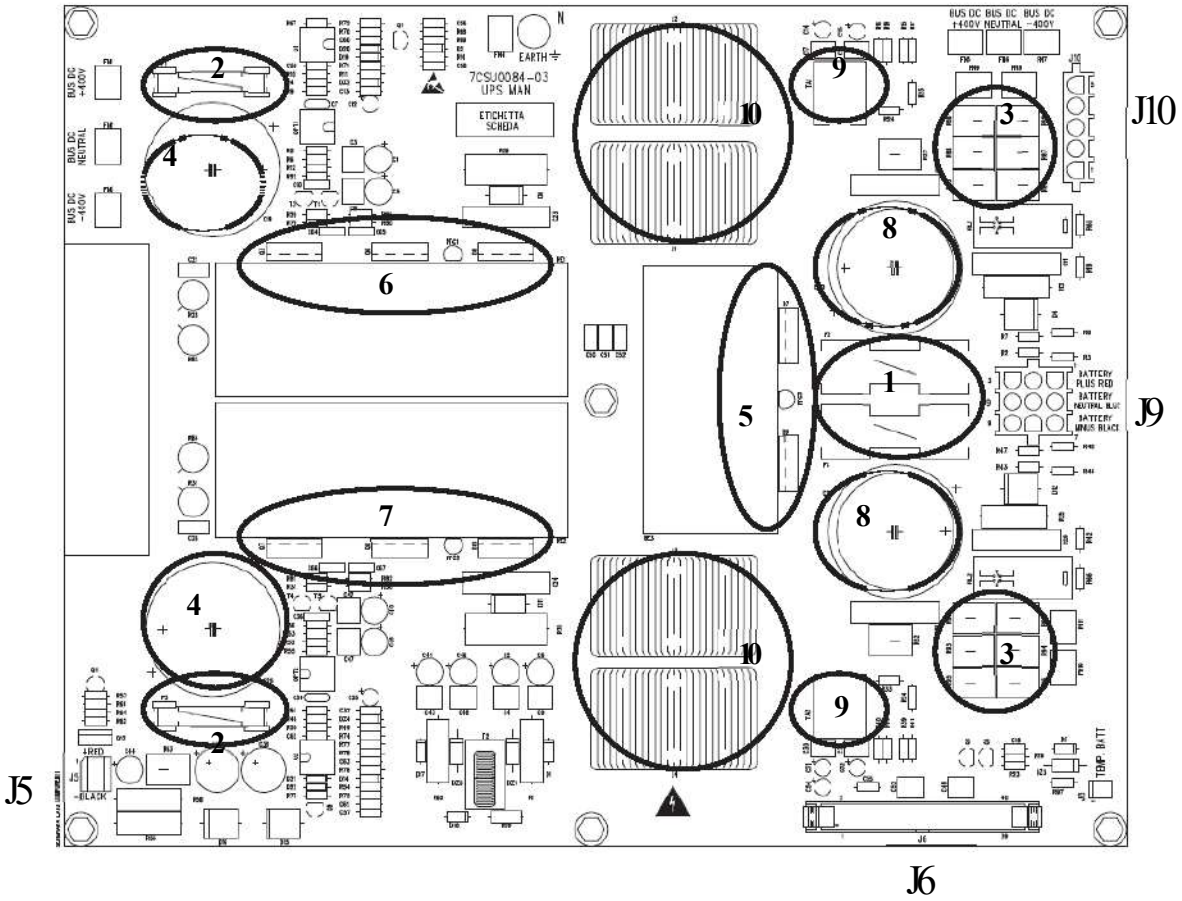



Fig.27

| Connector | Description | Notes |
|---|---|---|
| J5 | Battery charger input connector | |
| J6 | Flat connection from control board | From B0122 |
| J9 | Fan power supply connector | |
| J10 | Battery charger output connector | |

## 7.6 PARALLEL BOARD (B0085)

Version:
B0085-01. Parallel Card SATURN (for all sizes)

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

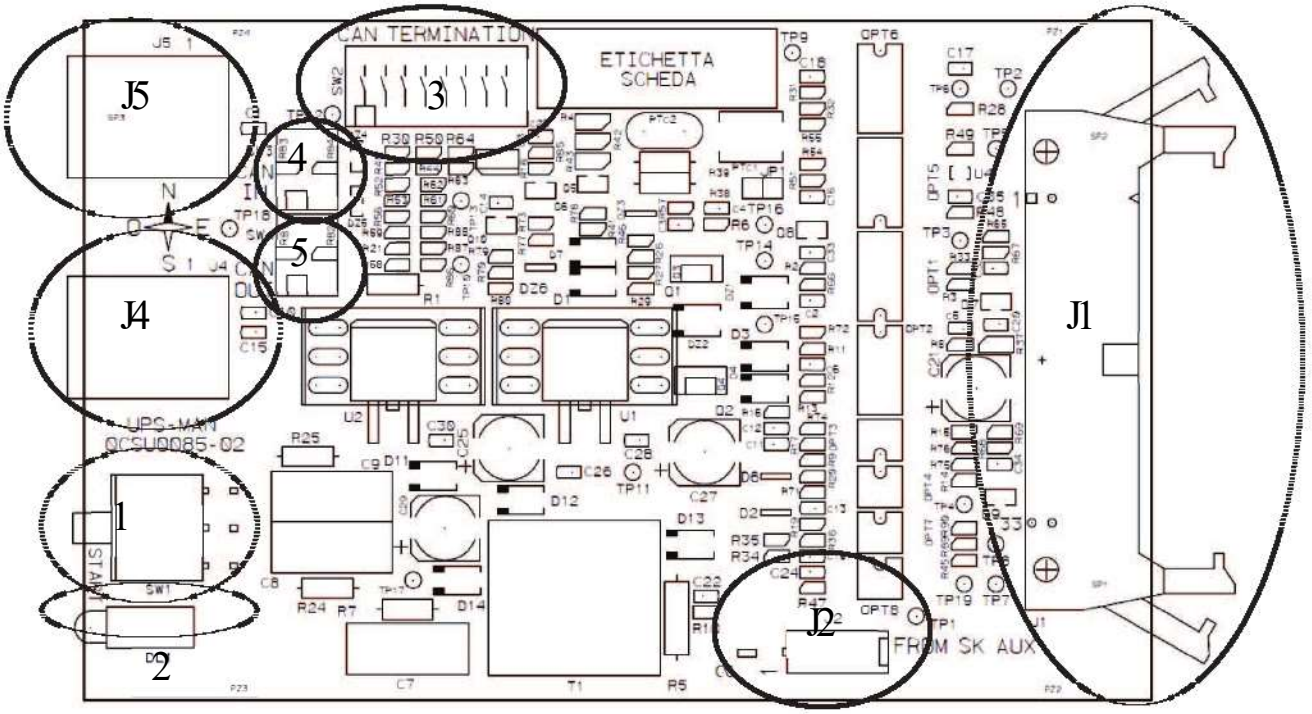



Fig.28

| Connector | Description | Note |
|---|---|---|
| J1 | Flat connection to uC+DSP board | To B0067 |
| J2 | Connection to auxiliary board | To B0102 |
| J4 | Output communication line RJ45- OUT | To B0085 |
| J5 | Input communication line RJ45- IN | To B0085 |

## 7.7 AUXILIARY POWER SUPPLIES BOARD (B0102)

Versions:
B0102-02. Aux power supply card SATURN 60-100 (for all sizes)

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

1) fuse 6.3x32 - 2A 500V GF (F2)
2) DC Bus pre-charge from mains
3) power supply unit +27, +15, +12_relay, -18V
4) fan power supply unit
5) redundant bypass power supply unit
6) Fan power supply unit output fuse 8A 250V 5X20 delayed (F1)

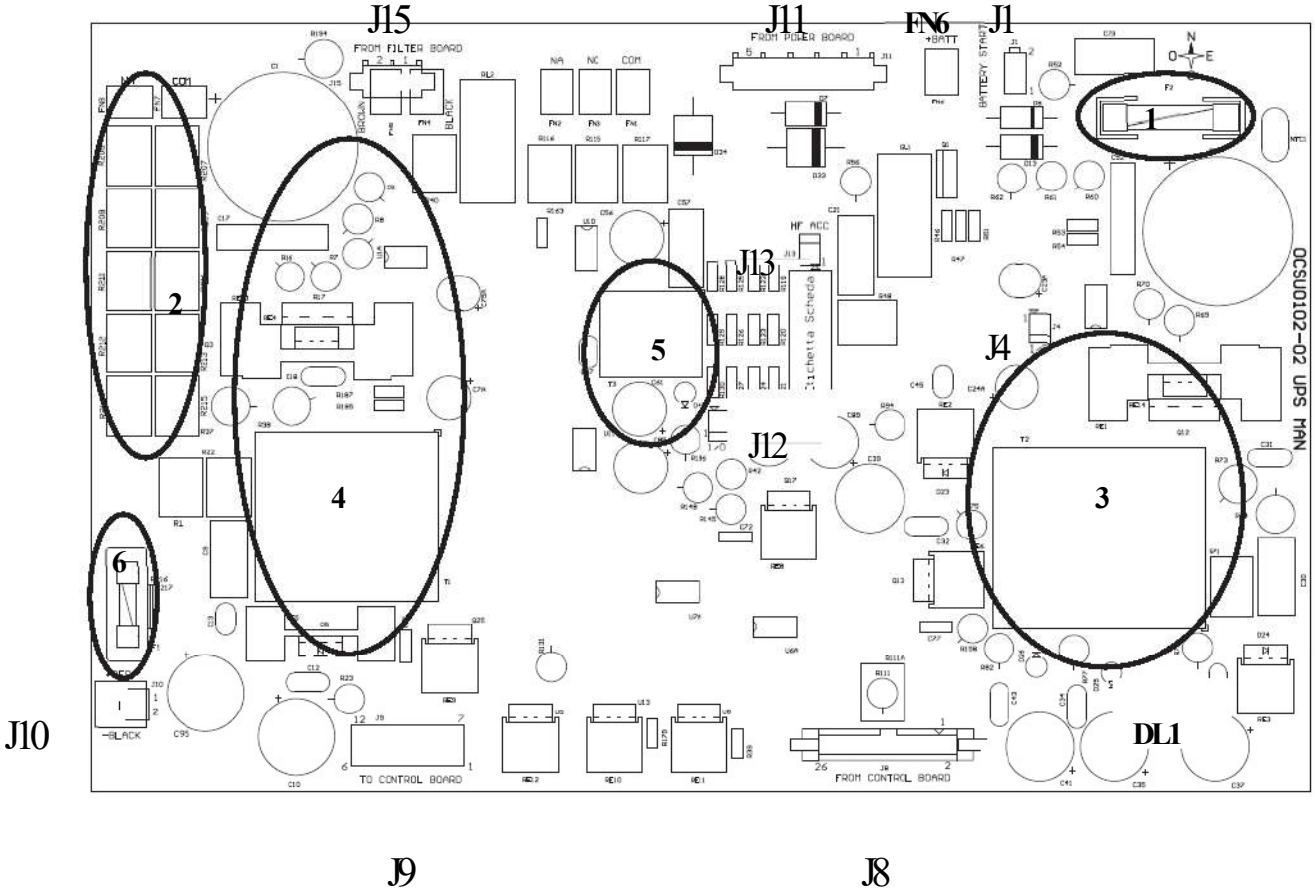


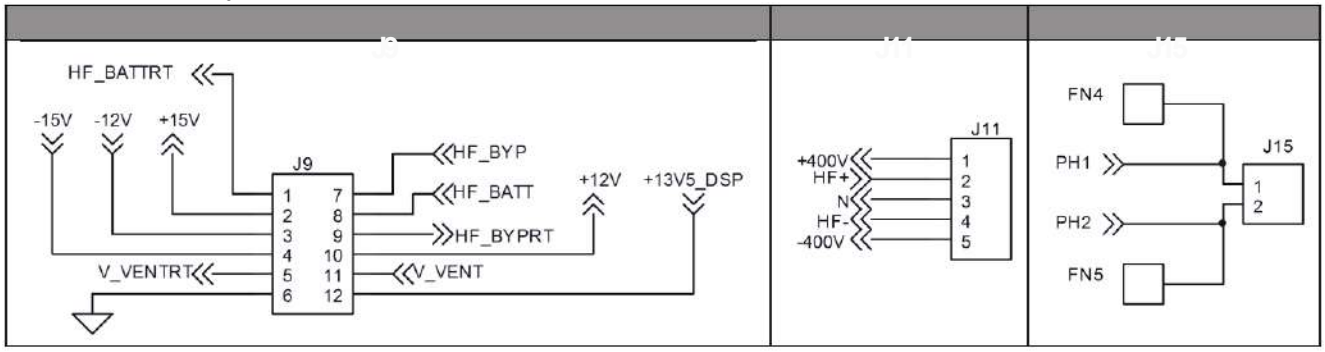

Fig.29

| Connector | Description | Notes |
|---|---|---|
| J1 | Vbat connector for battery start-up | |
| J4 | Connector for 1/0 | Put jumper |
| J8 | Flat connector from control board | From B0122 |
| J9 | Connector for power supplies to control board | to B0122 |

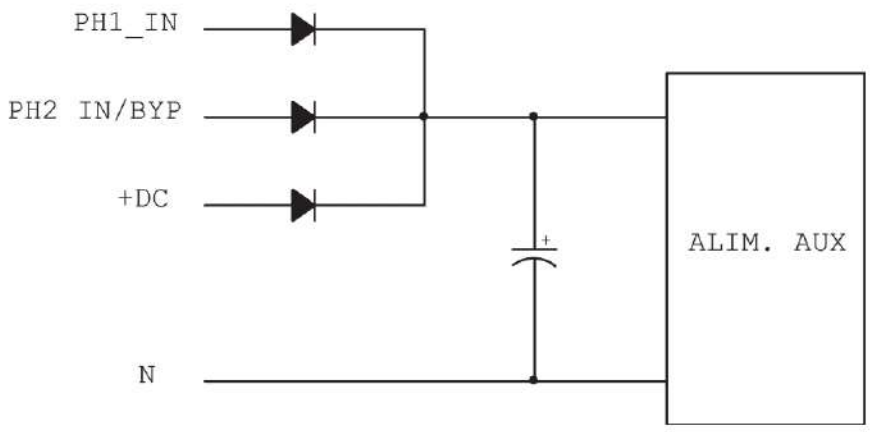
| Connector | Description | Notes |
|---|---|---|
| J10 | Fan power supply connector | |
| J11 | DC BUS, HF connector | |
| J12 | Connector for 1/0 | |
| J13 | HF connector | |
| J15 | Connector for mains power supply | pin1 Æ from C_IN (PH1)<br>pin2 Æ from C_IN (PH2) (with single input UPS)<br>pin2 Æ from PH2 SWBYP (with dual input UPS) |
| FN6 | +batt connector for battery start-up | |

| LEDs | Description | Notes |
|---|---|---|
| DL1 | Aux power good LED | |

Connector pin layout:




Power supply diagram:



## 78 BOOST DRIVER BOARD (B0121)

Versions:
B0121-01. Boost driver Card SATURN 60-80-100

The layout of the boost driver board connectors is given below.

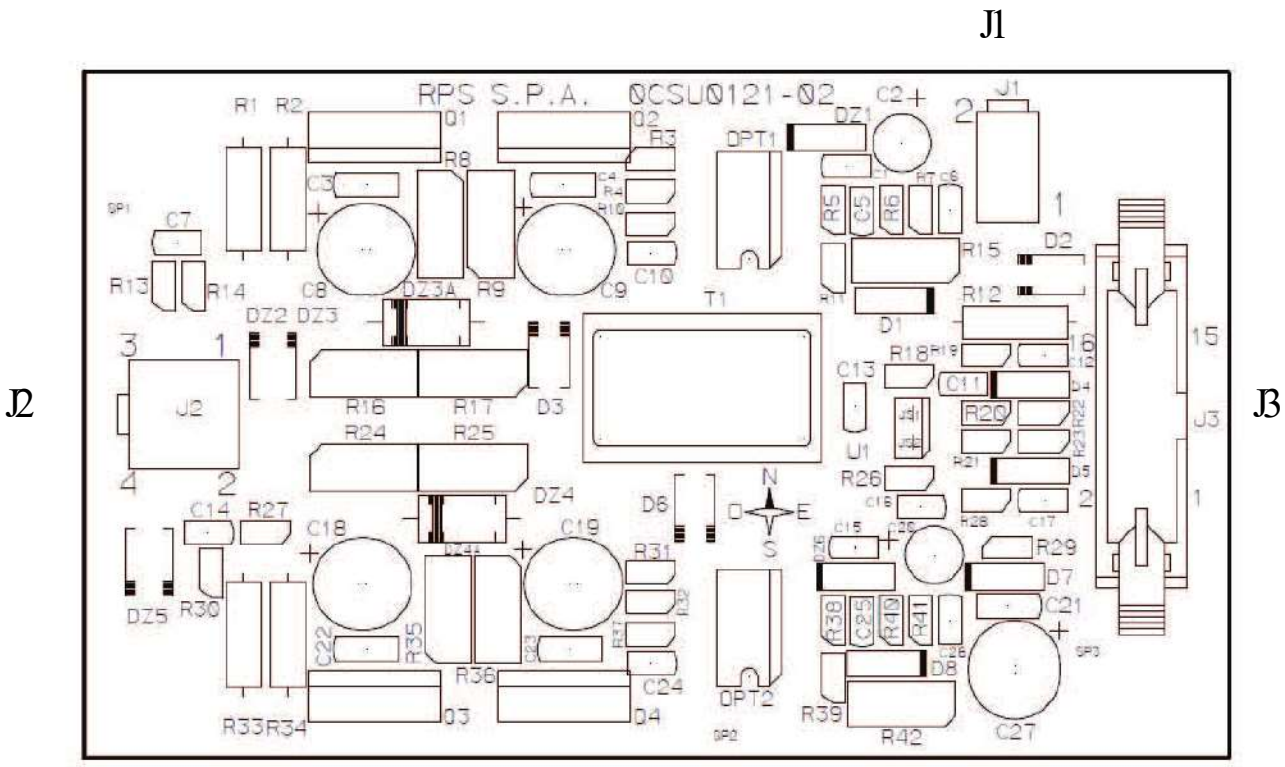


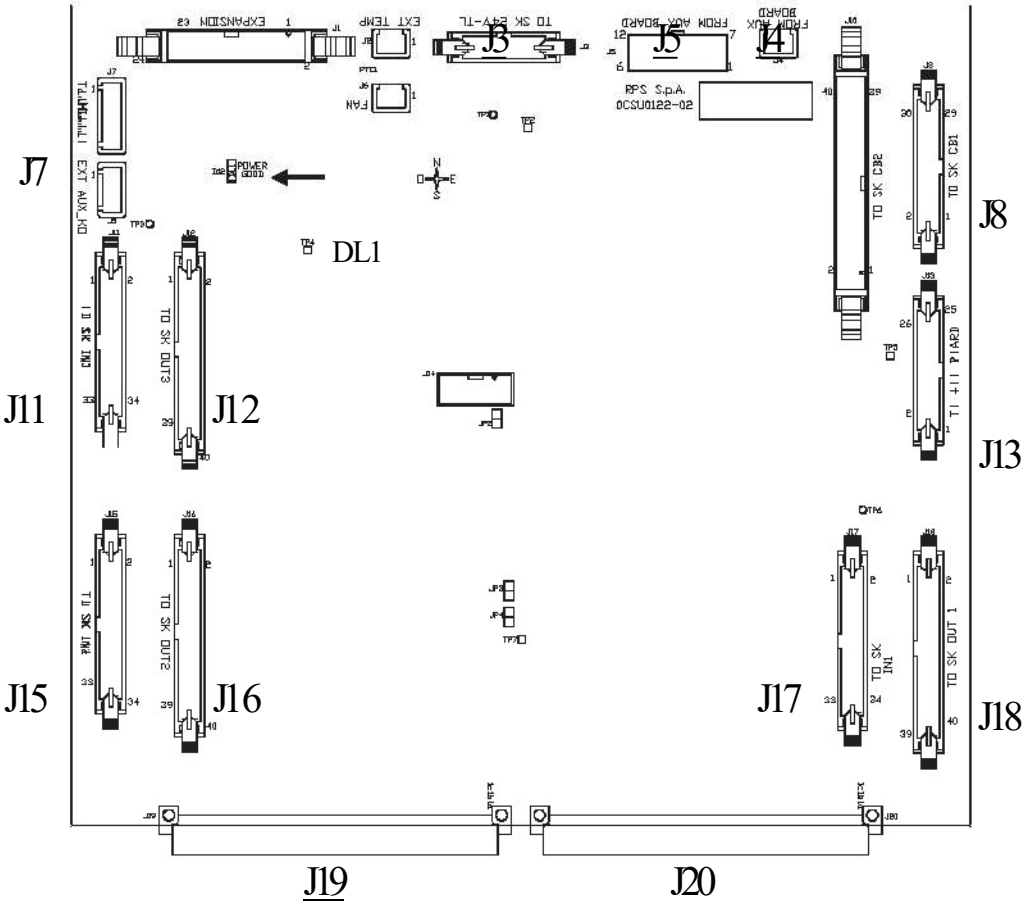

Fig.30

| Connector | Description | Notes |
|---|---|---|
| J1 | Temperature sensor connection | |
| J2 | Connection towards boost module | |
| J3 | Flat connection from input board | From B0125 |

## 79 CONTROL BOARD (B0122)

Versions:
B0122-01. Signal Control Card SATURN 80 (for SATURN 80) B0122-02. Signal Control Card SATURN 60 (for SATURN 60)
B0122-03. Signal Control Card SATURN 100 (for SATURN 100)

The layout of the control board connectors is given below.




| Connector | Description | Notes |
|---|---|---|
| J3 | Flat connection to relay board 24V | From B0127 |
| J4, J5 | Connections to aux. power supply board | From B0102 |
| J7 | Connections to disconnection switch aux contacts | |
| J8 | Flat connection to Battery Charger board | From B0060 |
| J11, J15, J17 | Flat connections to input boards | From B0125 |
| J12, J16, J18 | Flat connections to output boards | From B0126 |
| J13 | Flat connection to aux. power supplies board | From B0102 |
| J19 | Signals for DSP-uP board | From B0067 |
| J20 | Signals for DSP-uP board | From B0067 |

| LEDs | Description | Notes |
|---|---|---|
| | | |

DL1 Power good LED

## 7.10 LEM BOOST BOARD (B0124)

Versions:
B0124-01. LEM Boost Card SATURN 80-100
B0124-02. LEM Boost Card SATURN 60

J1

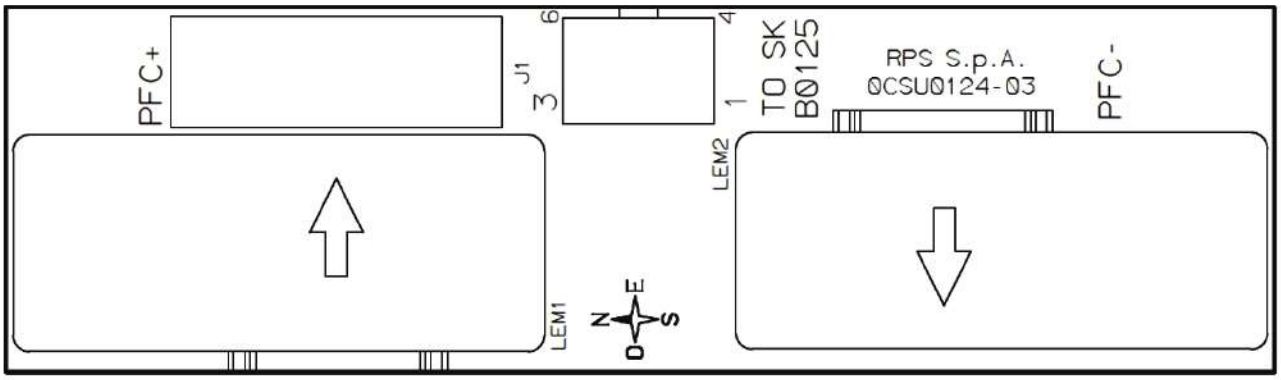



Fig.32

| Connettore | Descrizione | Note |
|---|---|---|
| J1 | Connections to input board | To B0125 |

## 7.11 INPUT BOARD (B0125)

Versions:
B0125-01. input Card SATURN 60-80
B0125-02. input Card SATURN 100

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

1) Positive pole battery fuse F3.
2) Negative pole battery fuse F1.
3) Mains fuse F2.
4) Semitop modules with rectifier diodes and battery SCR (Q3 and Q4).

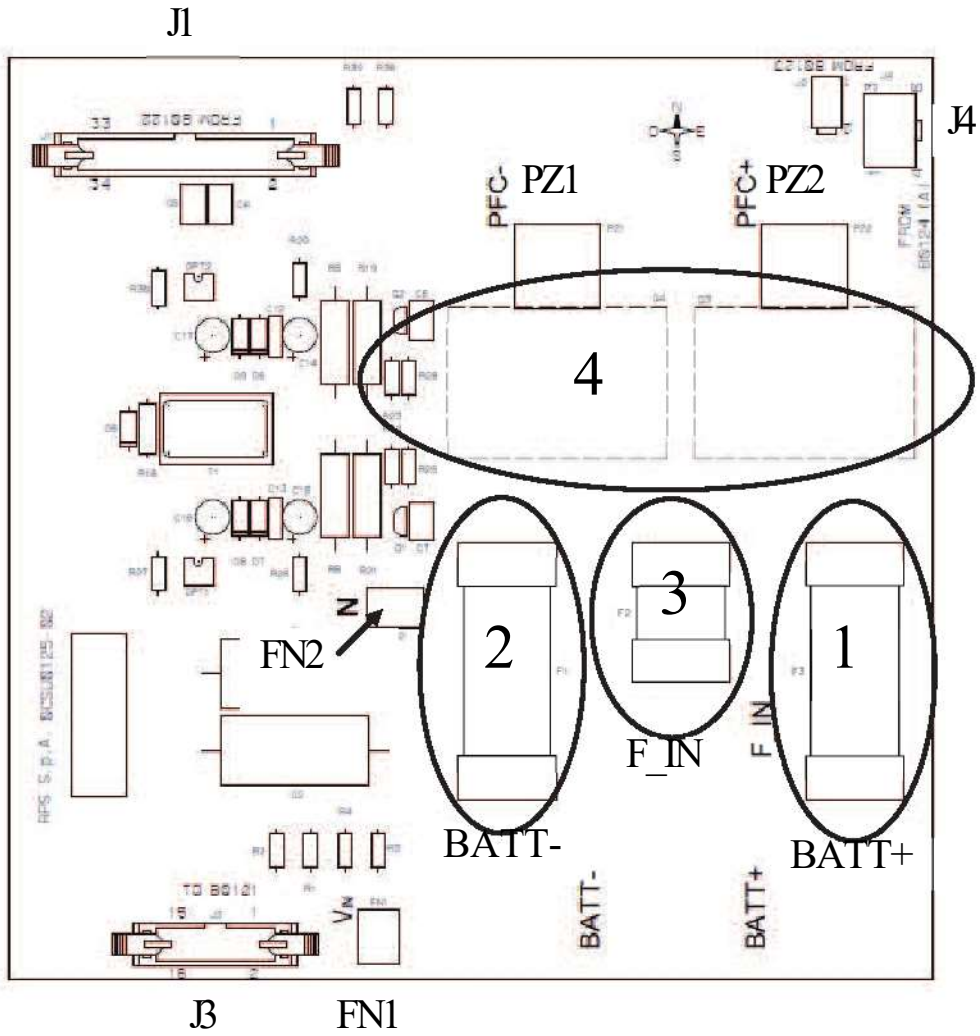


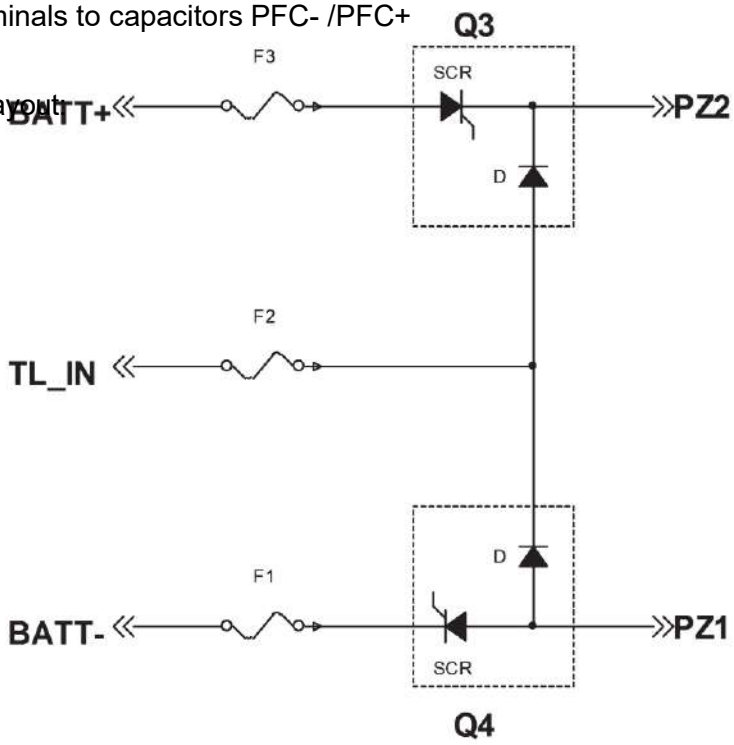

Fig.33

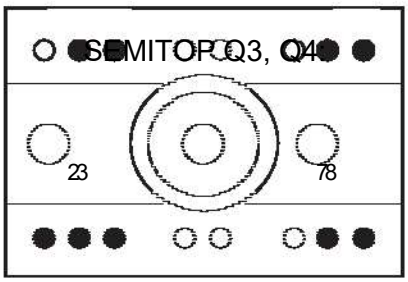
| Connector | Description | Notes |
|---|---|---|
| J1 | Flat connection from control board | From B0122 |
| J3 | Flat connection from boost driver board | From B0121 |
| J4 | Connection to boost LEM board | From B0124 |
| FN1 | Connection to input capacitors | |
| FN2 | Connection to neutral bar | |
| F_IN | Input phase terminal | |
| | | |
| | | |

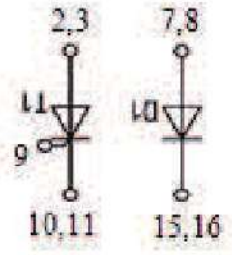
BATT+/BATT- +batt. / -batt. terminals

PZ1/PZ2 Terminals to capacitors PFC- /PFC+

Board B0125 layout




9 10 11 15 16

## 7.12 OUTPUT BOARD (B0126)

Versions:
B0126-01. Output Card SATURN 60-80
B0126-02. Output Card SATURN 100

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

1) Output fuse.
2) BYPASS SCR module
3) UPS output current TA
4) Bypass current TA (feedback protection)

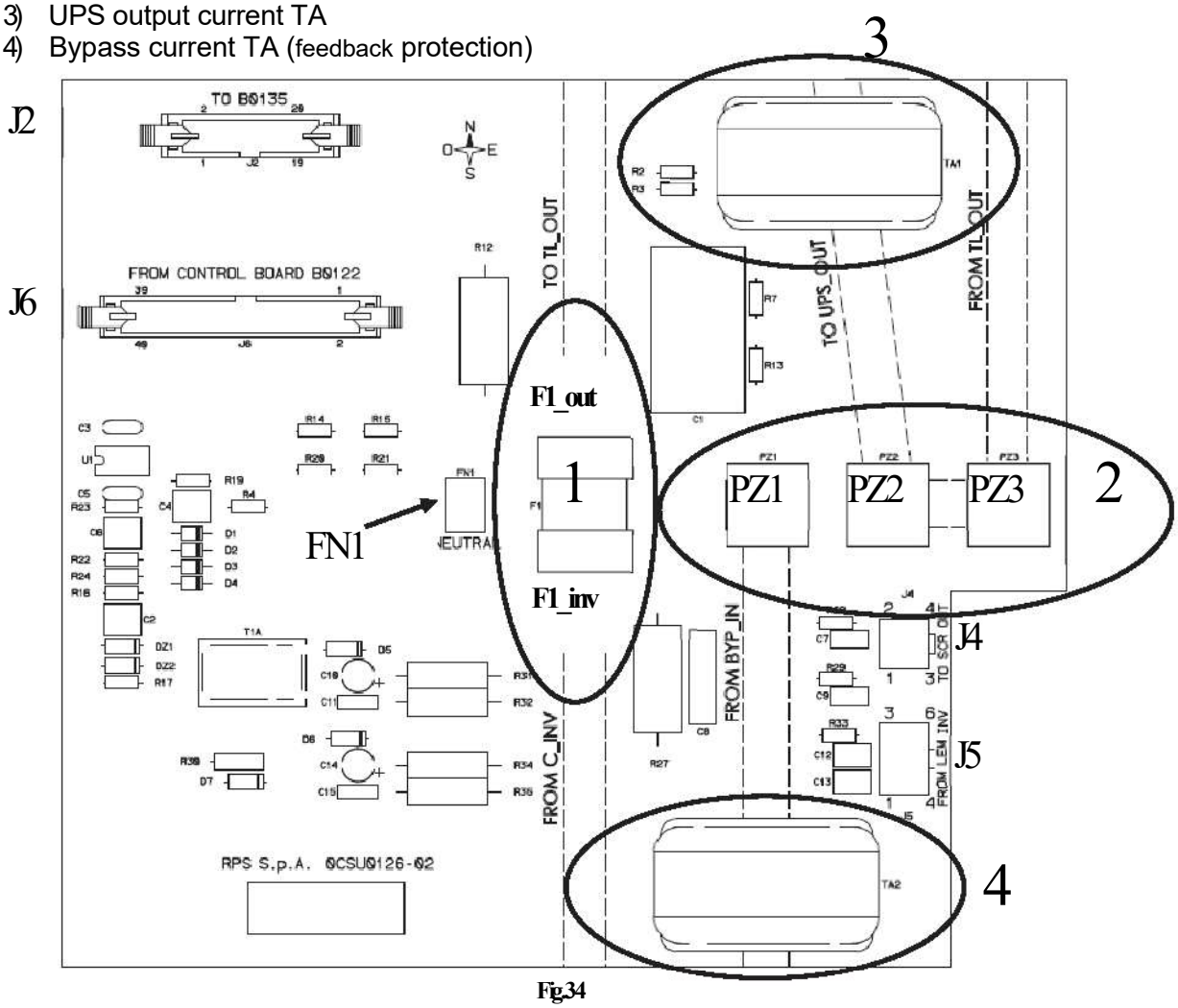



Fig.34

| Connector | Description | Notes |
|---|---|---|
| J2 | Flat connection from inverter driver board | From B0135 |
| J4 | Connection towards Bypass SCR | |
| J5 | Connection from inverter LEM board | From B0144 |
| J6 | Flat connection from control board | From B0122 |
| FN1 | Connection to neutral bar | |
| F1_inv | Terminal for cable from inverter filter capacitor | |
| F1_out | Terminal for cable from output relay (Tx) | |
| PZ1 | Terminal for cable from SWBYP disconnection switch | |

| Connector | Description | Notes |
|---|---|---|
| PZ2 | Terminal for cable from SWOUT disconnection switch | |
| PZ3 | Terminal for cable from output relay (Lx) | |

## 7.13 24V RELAY BOARD (B0127)

Versions:
B0127-01. 24V contactors Card SATURN 60-80
B0127-02. 24V contactors Card SATURN 100

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

1) Input fuse.
2) Power supply unit.
3) Relay control.

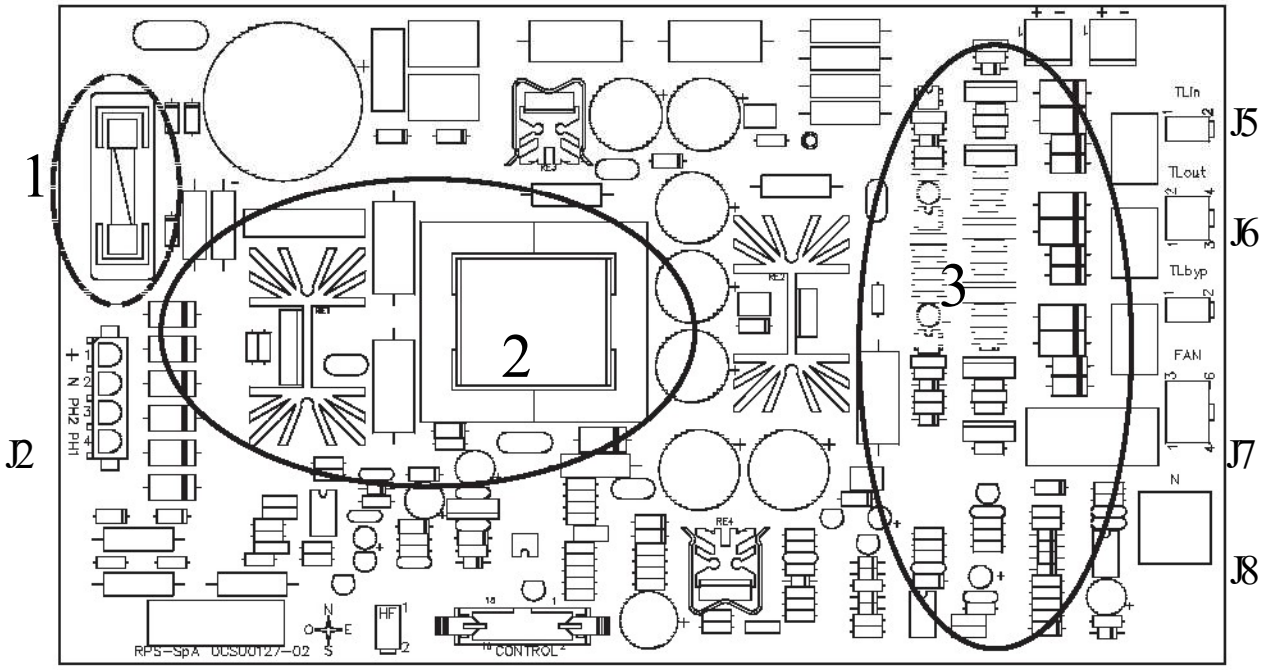



Fig.35

| Connector | Description | Notes |
|---|---|---|
| J2 | Connector DC, PH1, PH2 | |
| J5 | Connection towards input relay coil | |
| J6 | Connection towards output relay coil | |
| J7 | Fan connection, power supplies board, | From B0102 |
| J8 | Connection towards neutral bar | |
| J9 | Flat connection from control board | From B0122 |

## 7.14 CB 20A ADAPTOR BOARD (B0132) (OPTIONAL)

Versions:
B0132-01. Adapter CB 20A card SATURN 60-100 (for all sizes)

The layout of the board connectors is given below

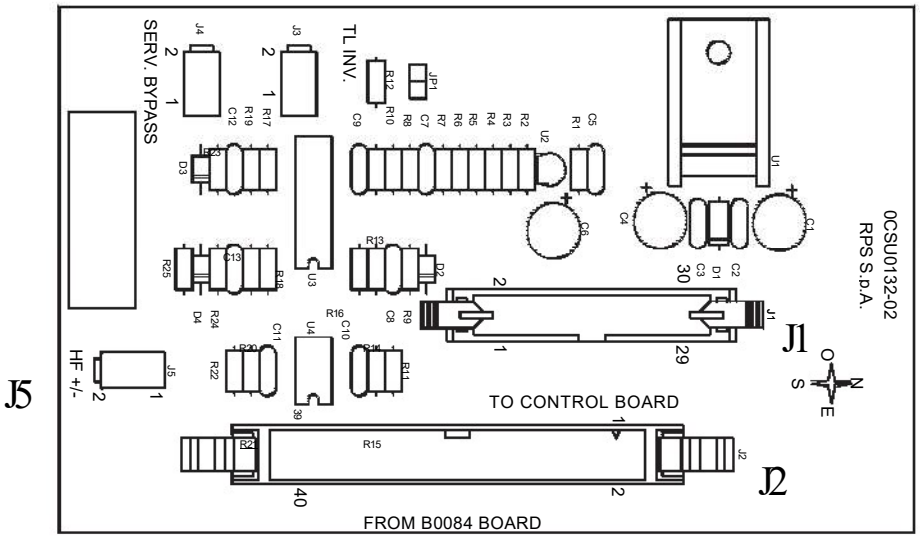



**Fig.36**

| Connector | Description | Notes |
|---|---|---|
| J1 | Flat connection from control board | From B0122 |
| J2 | Flat connection from board CB 20A | From B0084 |
| J5 | Connection towards power supplies board (HF) | From B0102 |

## 7.15 FILTER BOARD (B0133)

Versions:
B0133-03. Replaced by B0133-01. Filter Input Card SATURN 60-100

B0133-02. Filter Output Card SATURN 60-100 (replaced by B0133-04.)
B0133-04. Filter Output Card SATURN 60-100

The layout of the board connectors is given below

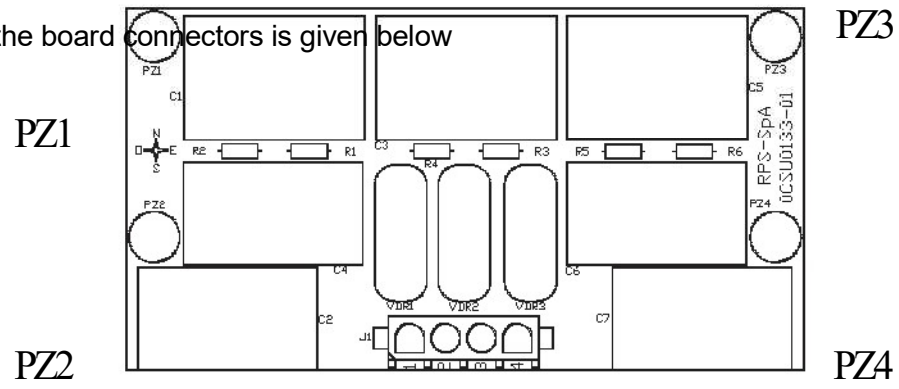



Fig.37

| Connector | Description | Notes |
|---|---|---|
| J1 | Connector PH1, PH2, PH3, N input or output | |
| PZ1 | Connection towards GND (fastening turret) | |
| PZ2 | Connection towards GND (fastening turret) | |
| PZ3 | Connection towards GND (fastening turret) | |
| PZ4 | Connection towards GND (fastening turret) | |

## 7.16 INVERTER DRIVER BOARD (B0135)

Versions:
B0135-01. Driver Inverter Card SATURN 60-100
B0135-02. Driver Inverter Card SATURN 60B

The layout of the inverter driver board connectors is given below.

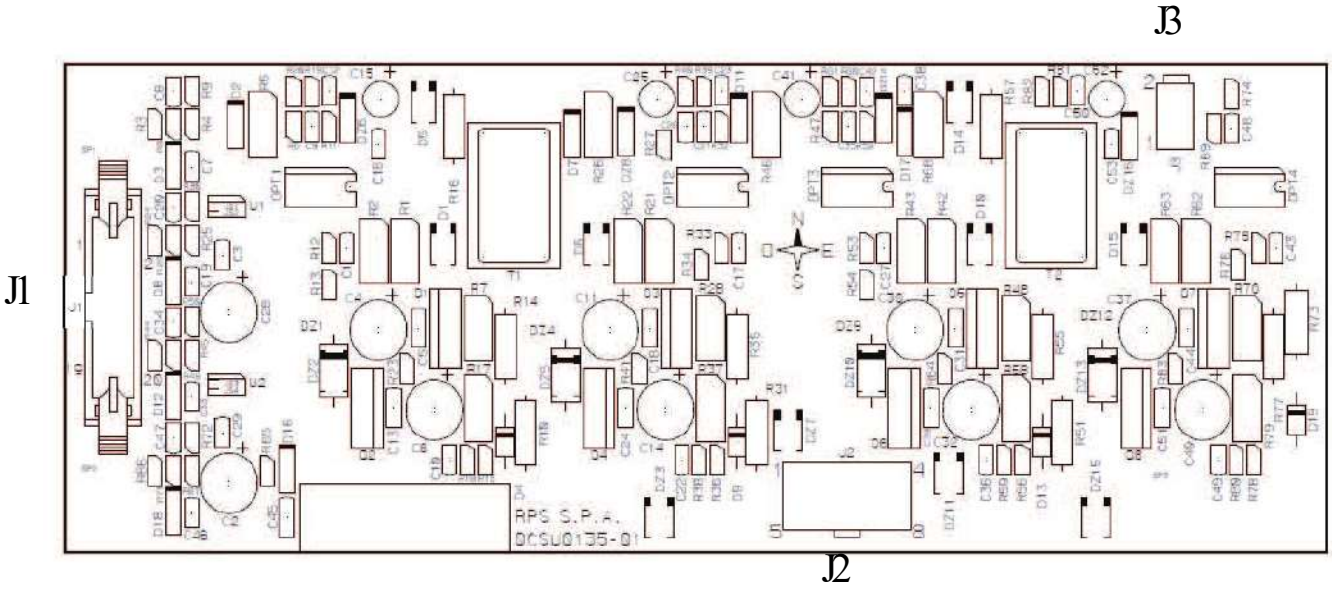



Fig.38

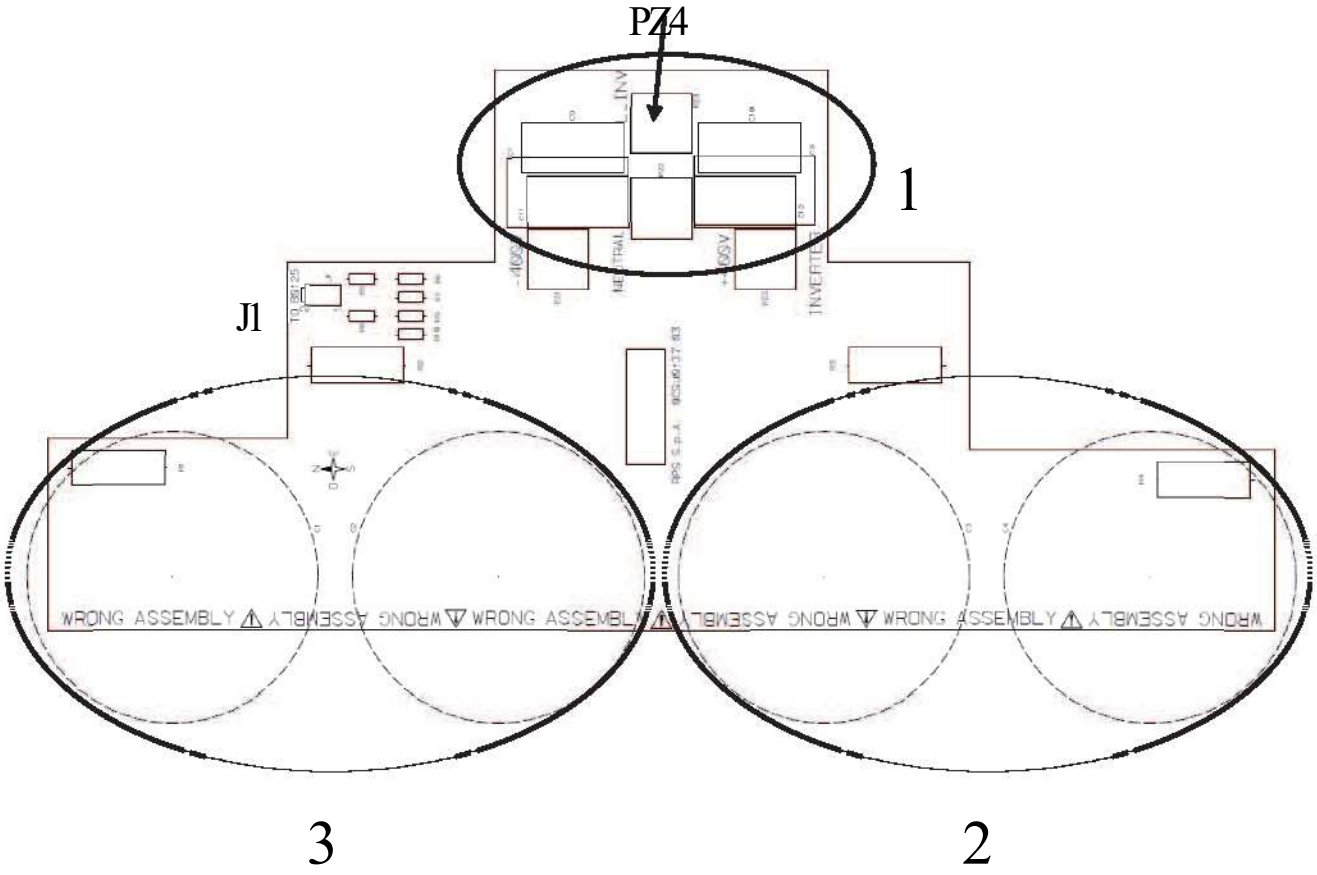
| Connector | Description | Notes |
|---|---|---|
| J1 | Flat connection from control board | From B0126 |
| J2 | Connection to inverter module | |
| J3 | Temperature sensor connection | |

## 7.17 INVERTER BUS BARS BOARD (B0137) (NOTE: for SATURN60A and **NOT** SATURN60B)

Versions:
B0137-01. inverter Card SATURN 60-80
B0137-02. inverter Card SATURN 100

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

1) Inverter module
2) Electrolytic positive capacitor bank
3) Electrolytic negative capacitor bank




Fg.39

| Connector | Description | Notes |
|---|---|---|
| J1 | Connection from input board (phase 2 only) | From B0125 |
| PZ4 | Inverter coil cable terminal | |

**7.18 PFC BUS BARS BOARD (B0138)** (NOTE: for SATURN60A and NOT SATURN60B)

Versions:
B0138-01. PFC Card SATURN 60-80-100

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

1) BOOST module
2) Electrolytic positive capacitor bank
3) Electrolytic negative capacitor bank

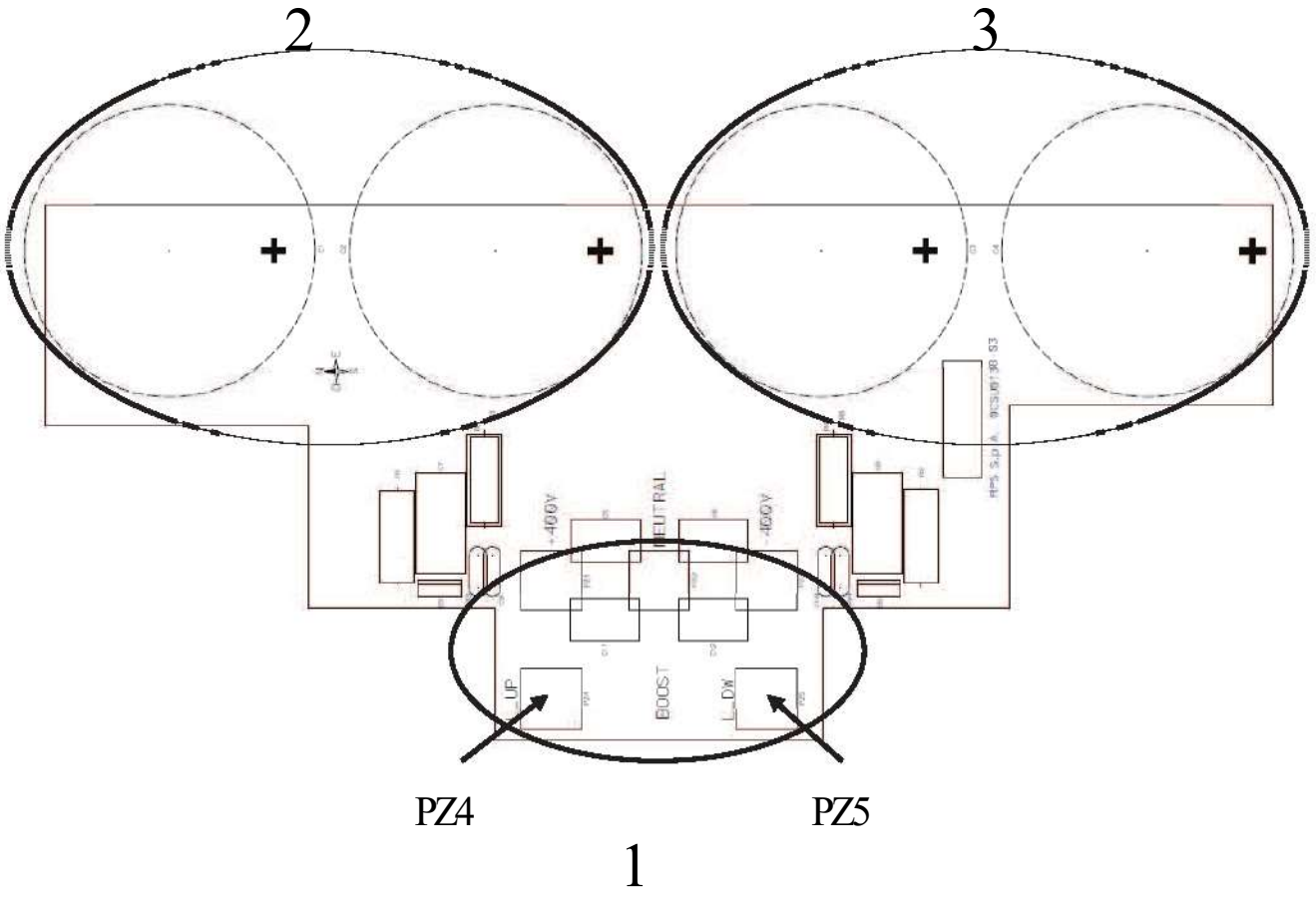



Fig.40

| Connector | Description | Notes |
|---|---|---|
| PZ4 | Boost coil cable terminal UP | |
| PZ5 | Boost coil cable terminal DW | |

## 7.19 LEM INVERTER BOARD (B0144)

Versions:

B0144-01. LEM inverter Card 80-100
B0144-02. LEM inverter Card 60

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

1) Current transducer
2) Power supply connector and output current measure

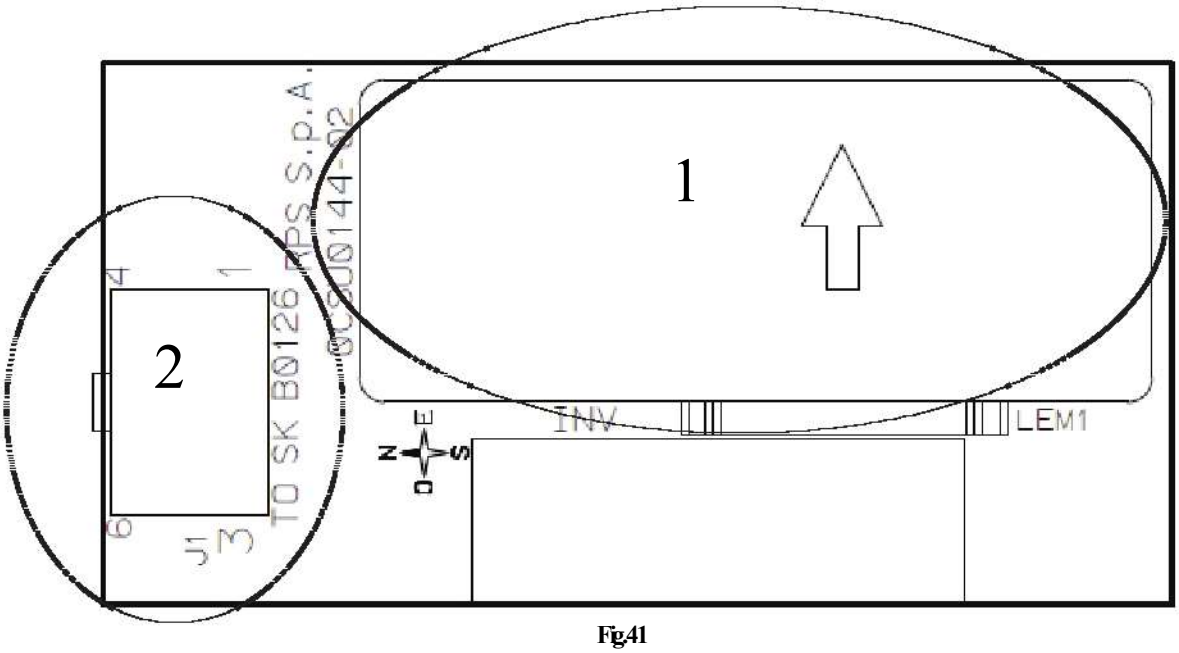



Fig.41

| Connector | Description | Notes |
|---|---|---|
| J1 | Connection to output board | A B0126 |

## 7.20 BATTERY CY CAPACITORS BOARD (B0155)

Versions:
B0155-02. BATTERY CY Capacitor Card SATURN 100
B0155-03. BATTERY CY Capacitor Card SATURN 60B-80B
B0155-04. BATTERY CY Capacitor Card SATURN 100B

The layout of the board connectors is given below.

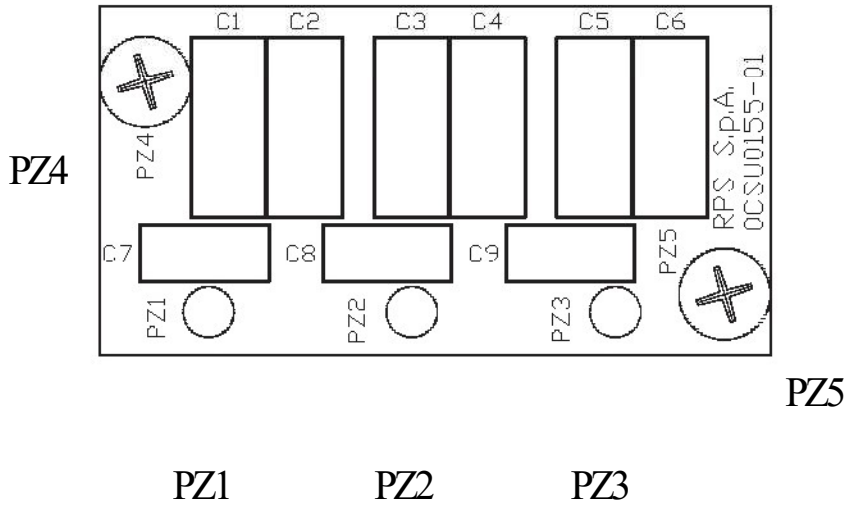



**Fig.42**

| Connector | Description | Notes |
|---|---|---|
| PZ1 | Not used. | |
| PZ2 | Connection to BATTERY POSITIVE | |
| PZ3 | Connection to BATTERY NEGATIVE | |
| PZ4 | Connection to GND (fastening stud) | |
| PZ5 | Connection to GND (fastening stud) | |

## 7.21 NEUTRAL CY CAPACITORS BOARD (B0156)

Versions:
B0156-01. N CY Capacitor Card SATURN 100

The layout of the board connectors is given below.

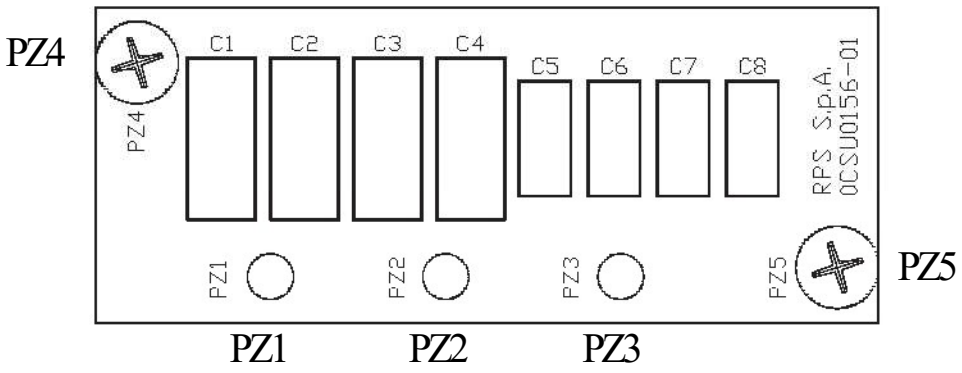



**Fig.43**

| Connector | Description | Notes |
|---|---|---|
| PZ1 | Connection to N (QN) | |
| PZ2 | Connection to N (QN) | |
| PZ3 | Connection to N (QN) | |
| PZ4 | Connection to GND (fastening stud) | |
| PZ5 | Connection to GND (fastening stud) | |

## 7.22 PFC/INV. BUS BARS BOARD (B0180)

Versions:
B0180-01. Capacitor Elect. x4 Card SATURN60 B

NOTE : the following configurations of electrolytic capacitors can be installed:
- 2+2 3300uF - 1+1 6800uF

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

1) Inverter module
2) Electrolytic positive capacitor bank
3) Electrolytic negative capacitor bank
4) BOOST module

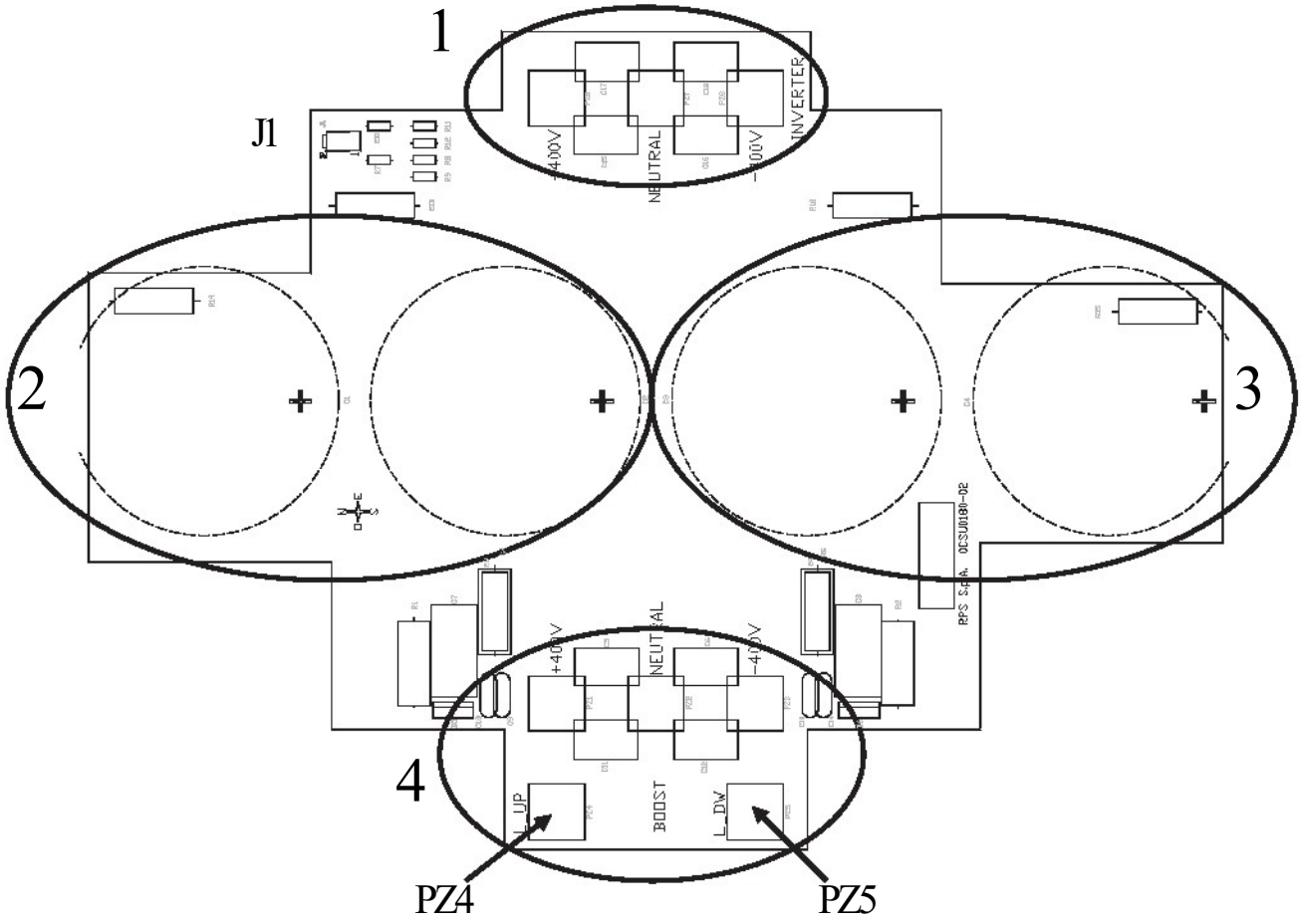



Fig.44

| Connector | Description | Notes |
|---|---|---|
| J1 | Connection from input board (phase 2 only) | From B0125 |
| PZ4 | Boost coil cable terminal UP | |
| PZ5 | Boost coil cable terminal DW | |

## 7.23 CY CAPACITOR BOARD FOR INPUT, OUTPUT AND BYPASS PHASES (B0181)

Versions:
B0181-01. Filter Card CY IN/OUT/BY SATURN 60-100

The layout of the board connectors is given below.

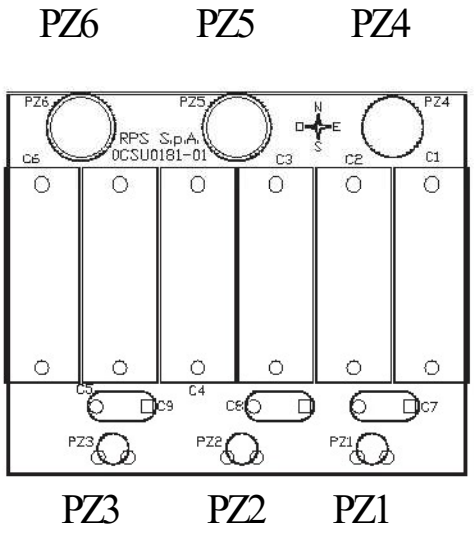



Fig.45

| Connector | Description | Notes |
|---|---|---|
| PZ1 | Connection to PH3 | |
| PZ2 | Connection to PH2 | |
| PZ3 | Connection toPH1 | |
| PZ4 | Connection to GND (fastening screw) | |
| PZ5 | Connection to GND (fastening screw) | |
| PZ6 | Connection to GND (fastening screw) | |

## 7.24 NEUTRAL CY CAPACITORS BOARD (B0182)

Versions:
B0182-01. N CY Capacitor card 60B-80B-100B

The layout of the board connectors is given below.

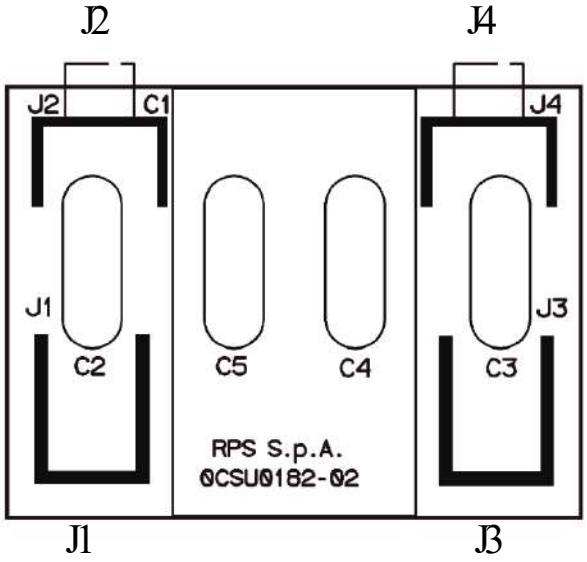



Fig.46

| Connector | Description | Notes |
|---|---|---|
| J1 | Connection to N (fastening screw) | |
| J2 | Contact to GND | |
| J3 | Connection to N (fastening screw) | |
| J4 | Contact to GND | |

## 7.25 PFC/INV. BUS BARS BOARD (B0183)

Versions:
B0183-01. Capacitor Elect. x2 Card SATURN60 B

NOTE : only the configuration with electrolytic capacitors may be installed:
- 1+1 6800uF

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

1) Inverter module
2) Electrolytic positive capacitor bank
3) Electrolytic negative capacitor bank
4) BOOST module

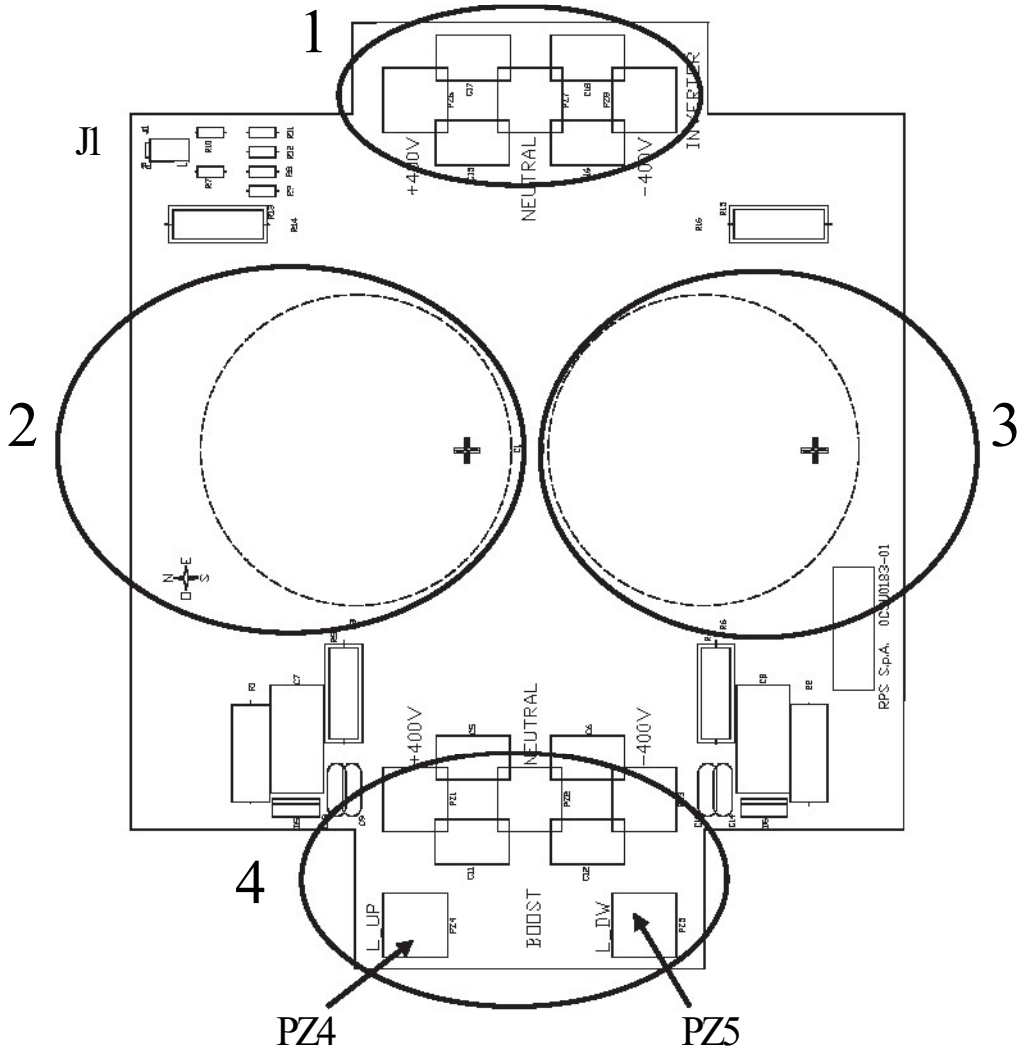



Fig.47

| Connector | Description | Notes |
|---|---|---|
| J1 | Connection from input board (phase 2 only) | From B0125 |
| PZ4 | Boost coil cable terminal UP | |
| PZ5 | Boost coil cable terminal DW | |

# 8 SERVICE OPERATIONS ON THE UPS

## 8.1 HOW TO OPEN THE UPS

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 covers by removing screws 1; see Fig. 48.
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. 48 .

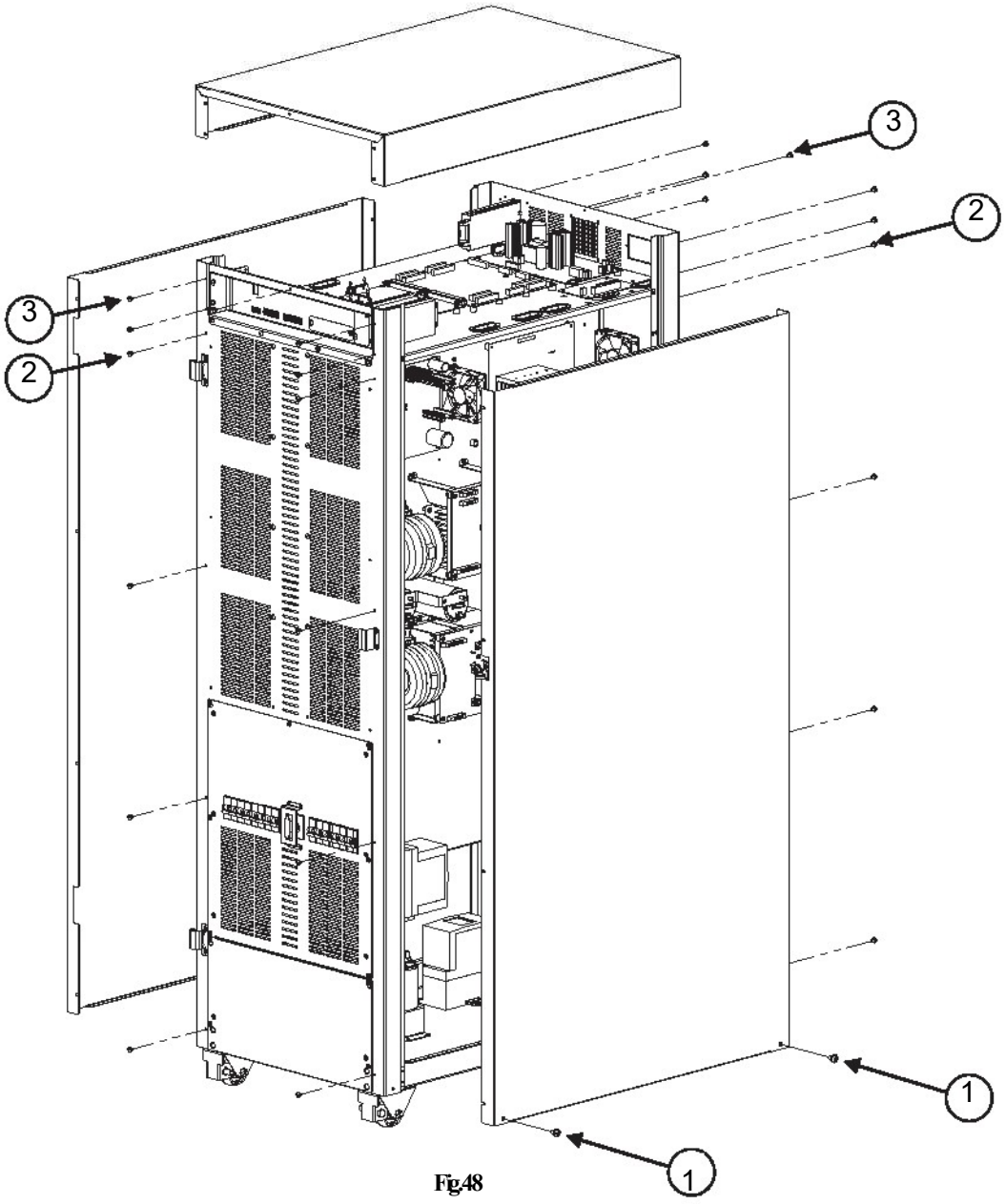



Fig.48

## 82 REPLACING THE FANS

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

1) remove the ducts from the heatsinks:

a) remove the fastening screws

PFC/inverter heatsinks: n°2 screws per duct

battery charger board: n°3 screws per duct

refer to the diagrams below for screw positions

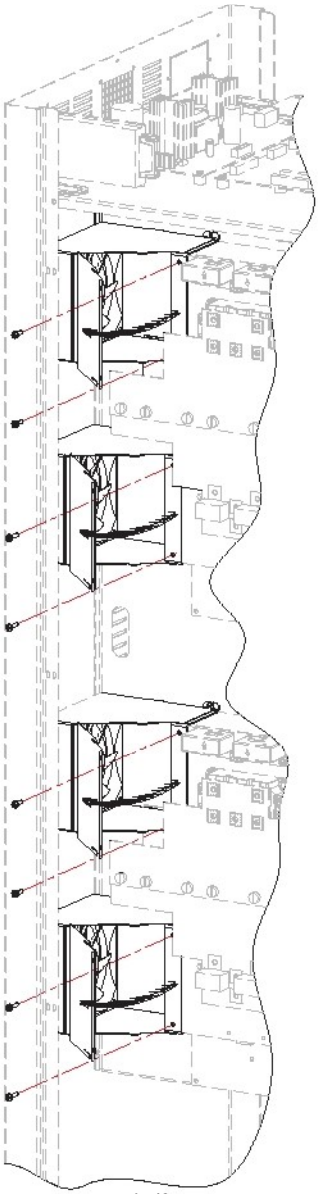


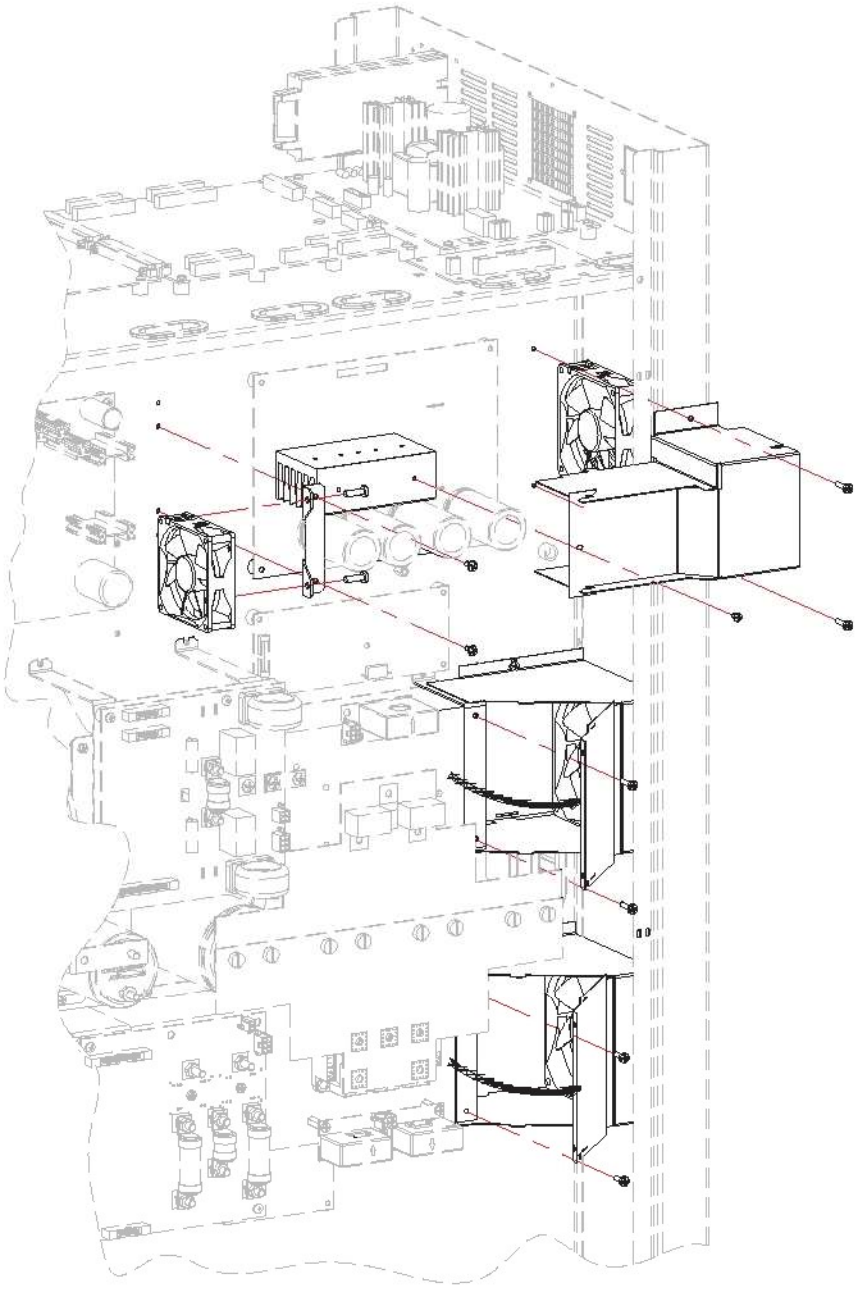
Fig.49

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

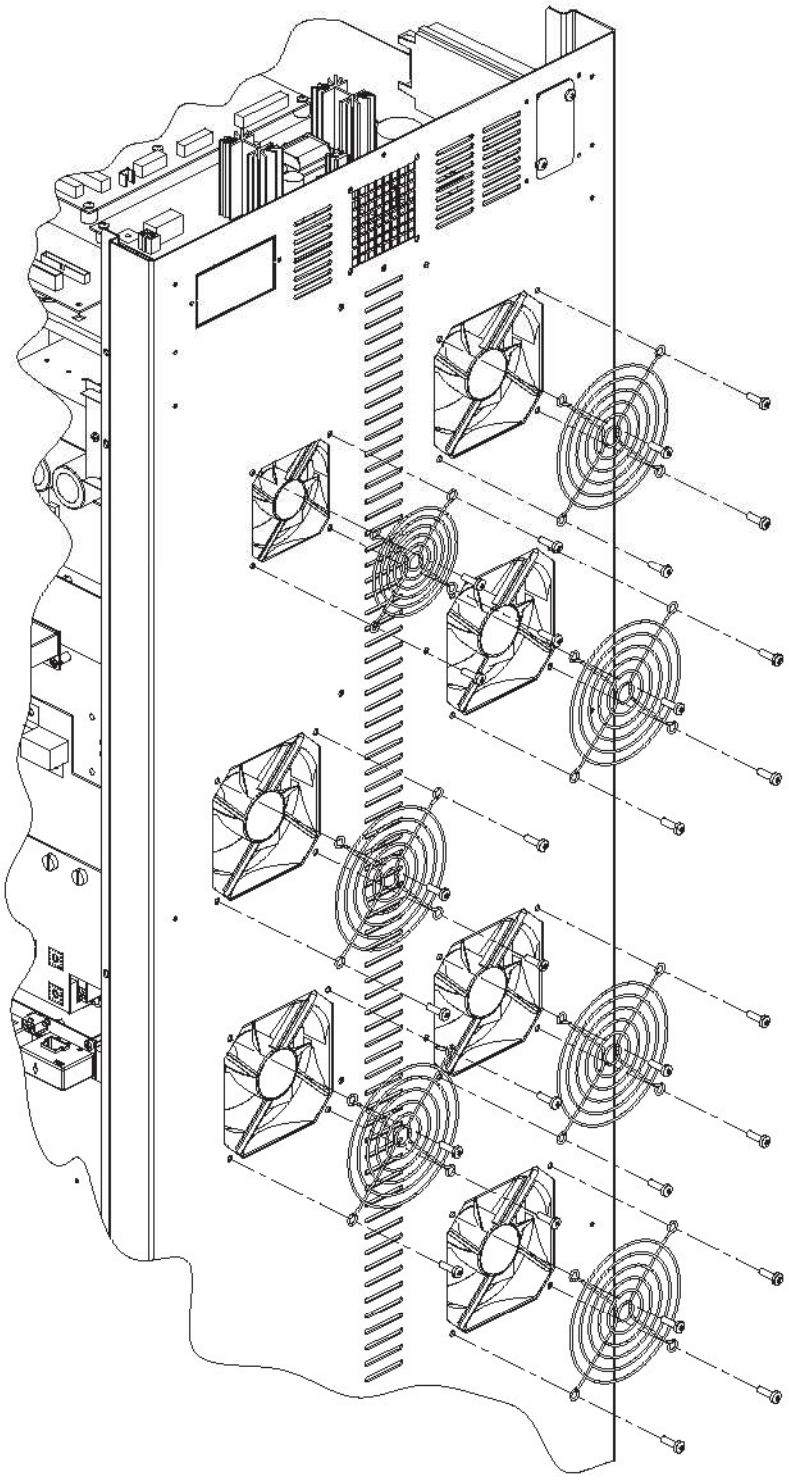
2) disconnect the fans, removing the red and black cables from the terminals

3) remove the protection grilles and free the fans, referring to Fig. 50 and

4) Fig. 51 for the positions of fastening screws



**Fg.50**



**Fg.51**

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

## 8.3 REPLACING THE INPUT FILTERSBOARD (B0133-01.)

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

1) Open all disconnecting switches. **IMPORTANT:** it is very important that the batteries are disconnected.
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) Detach the hanging cable connection
4) Remove the fastening screws from the board
5) Replace the board. **IMPORTANT:** the new INPUT FILTERS board must have code B0133-**01** (SATURN 60-80) or B0133-**03** (SATURN 100);
   (**DO NOT use board** B0133-04. (or B0133-02.); See Fig. 52.
6) Secure the board to the casing by tightening the fastening screws

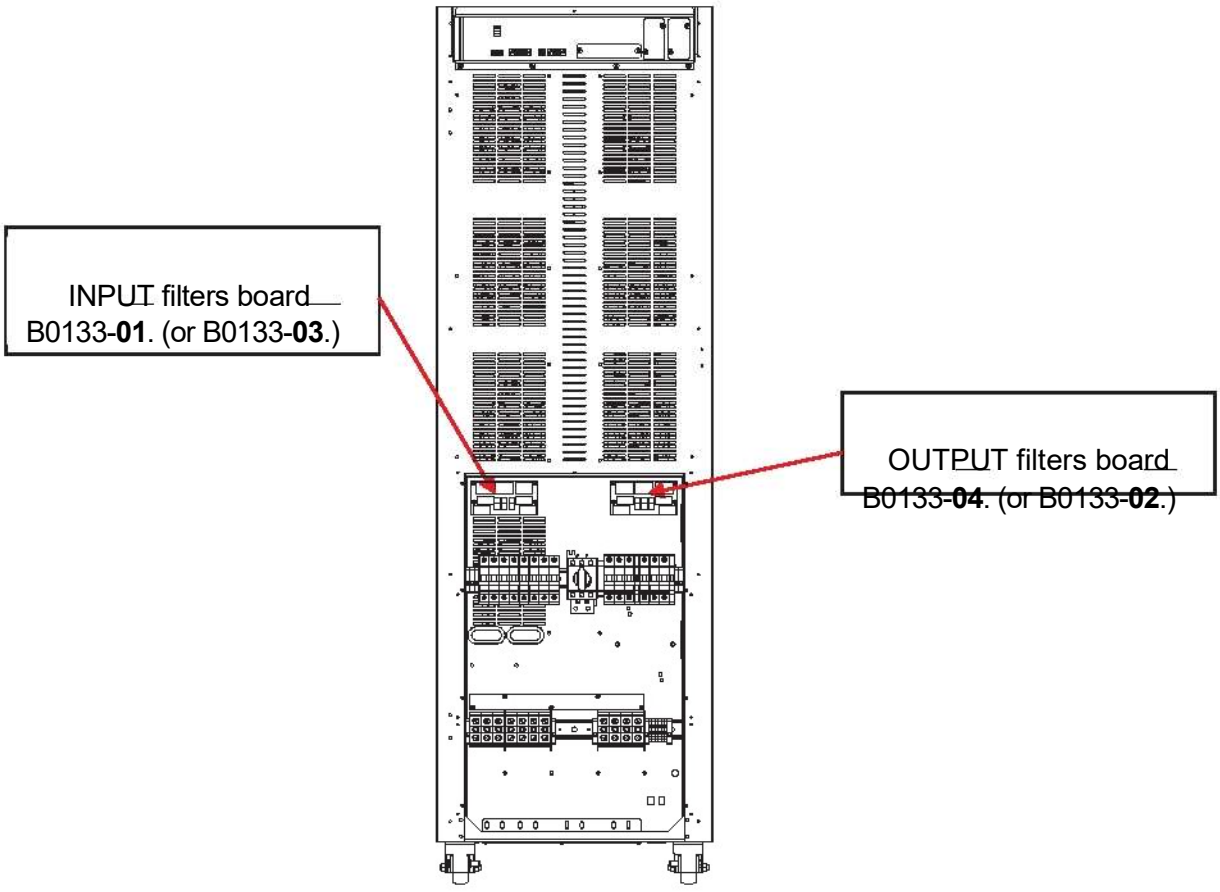



Fig.52

## 8.4 REPLACING THE OUTPUT FILTERS BOARD (B0133-02.)

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

1) Open all disconnecting switches. **IMPORTANT:** it is very important that the batteries are disconnected.
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) Detach the hanging cable connection
4) Remove the fastening screws from the board
5) Replace the board. IMPORTANT: the new OUPUT FILTERS board must have code B0133-
   04. (or B0133-02.);
   (**DO NOT use board** B0133-**01**. (or B0133-**03**.)); See Fig. 52.
6) Secure the board to the casing by tightening the fastening screws

## 8.5 REPLACING THE HEATSINK TEMPERATURE SENSOR WIRING

Each power assembly requires n°2 sensors with code 0CBCU0535: one for the Boost module and one for the Inverter module.

**REPLACING THE BOOST MODULE PTC:**

1) Remove the MiniFit connector for the faulty sensor from connector J1 on board B0121.
2) Remove the PTC from the BOOST heatsink (inserted into hole A; see Fig. 53).
3) Insert the MiniFit connector for the new wiring into connector J1 on board B0121.
4) Fill hole B (see Fig. 53) on the BOOST heatsink with Dowcorning 744RTV SEALANT
   WHITE silicon and slide the end of the wiring with the temperature sensor in as far as it will go. Note: use only the specified sealant.
5) Let the adhesive dry, keeping the sensor in position.

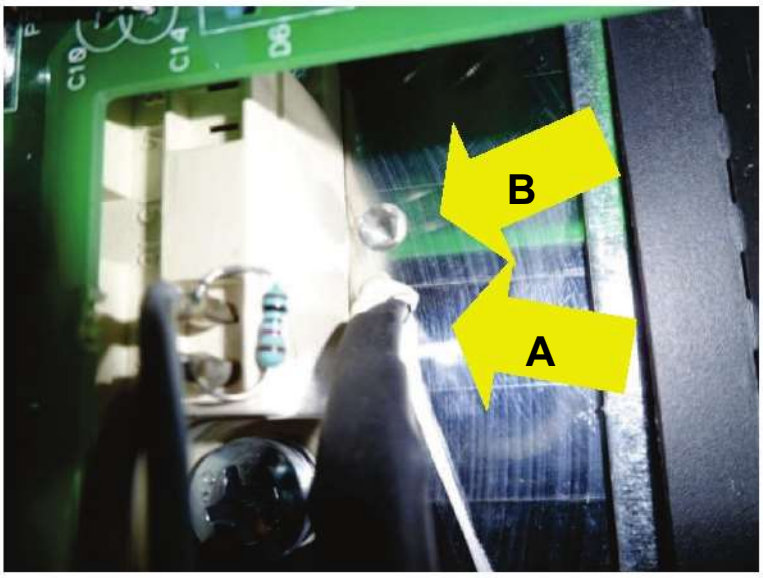



Fig.53

**REPLACING THE INVERTER MODULE PTC:**

1) Remove the MiniFit connector for the faulty sensor from connector J3 on board B0135.
2) Remove the PTC from the INVERTER heatsink (inserted into hole A; see Fig. 54).
3) Insert the MiniFit connector for the new wiring into connector J3 on board B0135.
4) Fill hole B (see Fig. 54) on the INVERTER heatsink with Dowcorning 744RTV SEALANT

   WHITE silicon and slide the end of the wiring with the temperature sensor in as far as it will go. Note: use only the specified sealant.

5) Let the adhesive dry, keeping the sensor in position.

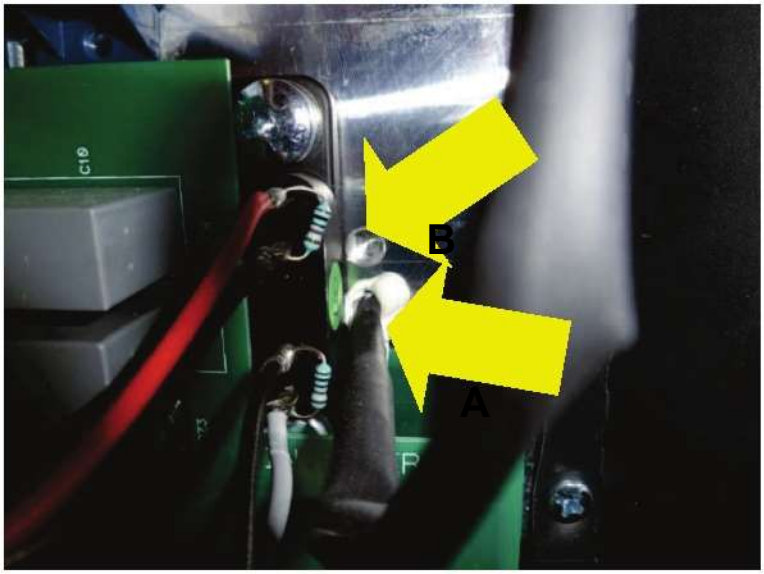
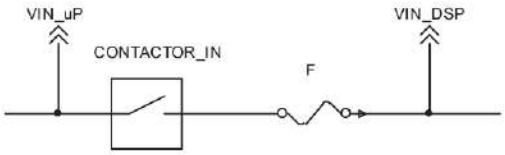



Fig.54

# 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 B0125 is intact.
With the machine still off, check that there is no short circuit between the input relay contacts.

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 |
|---|---|---|---|---|---|
| | TL_IN | T1 | T2 | T3 | |
| | B0125 | FN1 | FN1 | FN1 | |
| | B0125 | R1 | R1 | R1 | 150 kR |
| -> | B0125 | R2 | R2 | R2 | 150 kR |
| | B0125 | J1-15 | J1-15 | J1-15 | |
| | Flat Cable | \| | \| | \| | |
| | B0122 | J17-15 | J15-15 | J11-15 | |
| -> | B0122 | R597 | R557 | R256 | 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 F2 | After | After | After | |
| | B0125 | F2 (side Q3,Q4) | F2 (side Q3,Q4) | F2 (side Q3,Q4) | |
| | B0125 | R3 | R3 | R3 | 150 kR |
| -> | B0125 | R4 | R4 | R4 | 150 kR |
| | B0125 | J1-16 | J1-16 | J1-16 | |
| | Flat Cable | \| | \| | \| | |
| | B0122 | J17-16 | J15-16 | J11-16 | |
| -> | B0122 | R745 | R743 | R747 | 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 PZ1 on board B0126 (output board).
To check for the presence of voltage, with the UPS switched on, measure between neutral and PZ1 on board B0126.
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:

| | Fuse | Phase 1 Before | Phase 2 Before | Phase 3 Before | Notes |
|---|---|---|---|---|---|
| | B0126 | PZ1 | PZ1 | PZ1 | |
| | B0126 | R21 | R21 | R21 | 150 kR |
| -> | B0126 | R20 | R20 | R20 | 150 kR |
| | B0126 | J6-18 | J6-18 | J6-18 | |
| | Flat Cable | \| | \| | \| | |
| | B0122 | J18-18 | J16-18 | J12-18 | |
| -> | B0122 | R199 | R558 | R257 | – |

(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 | \| | \| | |
| | B0122 | J8-5 | J8-6 | |
| -> | B0122 | R706 | R674 | 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 | \| | \| | |
| | B0122 | J8-7 | J8-8 | |
| -> | B0122 | R711 | R760 | 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 fuse F1 (C_INV side) on board B0126 (output board).
This reading is used to check the inverter and check the status of the out relay and inverter 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 fuse (C_INV side).

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 |
|---|---|---|---|---|---|
| | B0126 | F1 (C_INV side) | F1 (C_INV side) | F1 (C_INV side) | fuses |
| | B0126 | R9 | R9 | R9 | 150 kR |
| -> | B0126 | R8 | R8 | R8 | 100 kR |
| | B0126 | J6-37 | J6-37 | J6-37 | |
| | Flat Cable | \| | \| | \| | |
| | B0122 | J18-37 | J16-37 | J12-37 | |
| -> | B0122 | R699 | R638 | R330 | 49.9 kR |

(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 PZ2 or PZ3 on board B0126 (output board). This reading is used to calculate the output power (combined with the Iout reading) and to check the status of the out relay and inverter fuses (combined with the inverter voltage reading).

To check for the presence of voltage, with the UPS switched on, measure between neutral and slots PZ2 or PZ3.

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 |
|---|---|---|---|---|---|
| | B0126 | PZ2-PZ3 | PZ2-PZ3 | PZ2-PZ3 | |
| | B0126 | R15 | R15 | R15 | 150 kR |
| -> | B0126 | R14 | R14 | R14 | 150 kR |
| | B0126 | J6-38 | J6-38 | J6-38 | |
| | Flat Cable | \| | \| | \| | |
| | B0122 | J18-38 | J16-38 | J12-38 | |
| -> | B0122 | R757 | R753 | R755 | 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 B0126 (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 B0126 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 phase 1 | input diodes blown | B0125 | Check for blown diodes and fuses. If necessary replace board B0125 |
| F04 | Input fuse blown phase 2 | | | |
| F05 | Input fuse blown phase 3 | | | |
| F06 | Phase 1 relay contact does not open | Input relay contacts blocked | | Check relay. If necessary also check board B0127 |
| F07 | Phase 2 relay contact does not open | | | |
| F08 | Phase 3 relay contact does not open | | | |
| F09 | Positive branch capacitor preload failed | Short circuit in inverter and/or PFC stages | B0137 B0138 | Replace the affected boards |
| | | Control logic faulty | B0067 B0122 | |
| F10 | Negative branch capacitor preload failed | Input relay out of tolerance values | | Check that Vin < 250V |

| | | | | |
|---|---|---|---|---|
| F11 | Boost stage fault | PFC stage short circuit | B0125<br>B0138 | Replace the affected boards |
| | | Control logic faulty | B0067<br>B0122 | |
| 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 | B0137 | Replace the affected boards |
| F15 | Sinusoid Phase 2 inverter distorted | Control logic faulty | B0067<br>B0122 | |
| F16 | Sinusoid Phase 3 inverter distorted | Phase-Phase short circuit | | Check for SC between phases |
| F17 | Inverter stage faulty | Inverter stage blown | B0137 | Replace the affected boards |
| | | Control logic faulty | B0067<br>B0122 | |
| F19 | Positive 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 |
| F20 | Negative battery overvoltage | | | |
| F23 | Overload at output | Excessive load | | Reduce the load |
| | | Wrong UPS size following control board replacement | | Set the correct size |
| | | Output power reading faulty | B0126<br>B0067<br>B0122 | Replace the affected boards |
| | | Error in output voltage setting | | Set the correct output voltage |

| | | | | |
|---|---|---|---|---|
| F26 | Phase 1 output relay blocked (does not open) | Failure in relay control circuit | B0067<br>B0122<br>B0127 | Replace the affected boards |
| F27 | Phase 1 output relay blocked (does not open) | Relay with damaged contacts | | Replace the relay |
| F28 | Phase 1 output relay blocked (does not open) | | | |
| F29 | Phase 1 output fuse blown or output relay blocked (does not close) | Failure in relay control circuit | B0067<br>B0122<br>B0127 | Replace the affected boards |
| F30 | Phase 1 output fuse blown or output relay blocked (does not close) | Output fuse blown | B0126 | Replace blown output fuse |
| F31 | Phase 1 output fuse blown or output relay blocked (does not close) | Relay with damaged contacts | | Replace the relay |
| 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<br>B0067<br>B0122 | |
| F34 | heatsink overheated | Cooling fans faulty | B0102 | • Check for SC at fans Æ replace fans<br>• Check R194 on board B0102,<br>• check voltage at connector J10, check fan power supply link Æ replace board B0102 |
| | | Temperature readings faulty | B0067<br>B0122 | Check the interconnections between the affected boards, if necessary replace the boards |
| | | Temperature sensor faulty | | Check temperature sensors |

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|---|---|---|---|---|
| F37 | Battery charger overheated | CB cooling fan faulty | B0060 | • Check that the fitted fan is correct (12V) Æ replace fan<br>• Check for SC at the fan Æ replace fan<br>• Check voltage at connector Fx Æ replace board B0060 |
| | | Incorrect duct installation | B0060 | Check that the duct secured to board B0060 is correctly installed |
| | | Temperature readings faulty | B0060<br>B0067<br>B0122 | Check the interconnections between the affected boards, if necessary replace the boards |
| | | Temperature sensor faulty | B0060 | replace board B0060 |
| F42<br>F43<br>F44 | BOOST 1 battery fuses blown<br>BOOST 2 battery fuses blown<br>BOOST 3 battery fuses blown | Battery SCR blown | B0125 | 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 B0102 | B0102 | Check that LED DL1 is lit on B0102 Æ if it is not lit check connections and/or replace board. |
| 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<br>L04<br>L05 | Phase 1 input fuse blown<br>Phase 2 input fuse blown<br>Phase 3 input fuse blown | input diode blown | B0125<br>B0138 | Check if diode is blown Æ replace the fuse. Check Boost module |
| 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 | B0125 | Check the battery boost fuses and battery SCR |
| | | Control logic faulty | B0067<br>B0122 | Check the connections between the boards and if necessary replace them |
| | | No mains power with the batteries disconnected | | Check the battery box connection and/or battery box fuses |
| L09 | Undervoltage at negative BOOST stage | Boost stage blown | B0138 | Check PFC module and if necessary replace it |
| | | Inverter stage blown | B0137 | Check inverter module and if necessary replace it |
| L10 | Static bypass switch faulty | Bypass SCR blown | B0126 | Check bypass SCR and if necessary replace it |

| | | | | |
|---|---|---|---|---|
| L11<br>L12<br>L13 | Bypass output blocked L1<br>Bypass output blocked L2<br>Bypass output blocked L3 | | | |
| L14<br>L15<br>L16 | Overvoltage at phase 1 inverter<br>Overvoltage at phase 2 inverter<br>Overvoltage at phase 3 inverter | Inverter output capacitor faulty | | Check the inverter output capacitor and if necessary replace it |
| | | Inverter operating logic faulty | B0067<br>B0122 | Replace the affected boards |
| L17<br>L18<br>L19 | Undervoltage at Phase 1 inverter<br>Undervoltage at Phase 2 inverter<br>Undervoltage at Phase 3 inverter | Phase-Phase short circuit | | Check for SC between the output phases |
| | | Control logic faulty | B0067<br>B0122 | Check the connections between the boards and/or replace the specified boards |
| L20 | DC voltage at inverter output or Phase 1 inverter sinusoid distorted | Inverter blown | B0137 | Check the inverter module for blown components Æ replace module if necessary |
| L21 | DC voltage at inverter output or Phase 2 inverter sinusoid distorted | Control logic faulty | B0067<br>B0122 | Check the connections between the boards and/or replace the specified boards |
| L22 | DC voltage at inverter output or Phase 3 inverter sinusoid distorted | Phase-Phase short circuit | | Check for the presence of SC at the output |
| L23 | Overload at Phase 1 output | Excessive load | | Reduce the load |
| L24 | Overload at Phase 2 output | Wrong UPS size following control board replacement | | Set the correct size |
| | | Output power reading faulty | B0067<br>B0122<br>B0126 | Replace the affected boards |
| L25 | Overload at Phase 3 output | Error in output voltage setting | | Set the correct output voltage |

| | | | | |
|---|---|---|---|---|
| L26<br>L27<br>L28 | Short circuit at Phase 1 output<br>Short circuit at Phase 2 output<br>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 | B0102 | • Check for SC at fans Æ replace fans<br>• Check R194 on board B0102, check voltage at connector J10, check fan power supply link Æ replace board B0102 |
| L35 | Phase 2 heatsink overheated | Temperature readings faulty | B0060<br>B0067<br>B0122 | Check the interconnections between the affected boards, if necessary replace the boards. |
| L36 | Phase 3 heatsink overheated | Temperature sensor faulty | | Check temperature sensors and replace them if necessary; see page69 |
| L37 | Battery charger overheated | CB cooling fan faulty | B0060 | • Check that the fitted fan is correct (12V) Æ replace fan<br>• Check for SC at the fan Æ replace fan<br>• 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<br>B0067<br>B0122 | Check the interconnections between the affected boards, if necessary replace the boards |
| | | Temperature sensor faulty | B0060 | Replace board B060 |

| | | | | |
|---|---|---|---|---|
| L38<br><br>L39<br><br>L40 | Phase 1 heatsink temperature sensor faulty<br><br>Phase 2 heatsink temperature sensor faulty<br><br>Phase heatsink temperature sensor faulty | Temperature readings faulty | B0067<br>B0122 | Check the interconnections between the affected boards, if necessary replace the boards |
| | | Temperature sensor faulty | | Check temperature sensors |
| L41 | Battery charger temperature sensor faulty | Temperature readings faulty | B0060<br>B0067<br>B0122 | Check the interconnections between the affected boards, if necessary replace the boards |
| | | Temperature sensor faulty | B0060 | Replace board B060 |
| L42<br><br>L43<br><br>L44 | BOOST 1 battery fuses blown<br><br>BOOST 2 battery fuses blown<br><br>BOOST 3 battery fuses blown | Battery SCR blown | B0125 | Check battery SCR (semitop) |

# 12 APPENDIX

## 12.1 LIST OF USEFUL DOCUMENTS

- Programming manual 0MNU073NP... (UPS PROGRAMMING KIT)
- Alarm code manual SATURN RM021 Rev..-

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- UcomGp instruction manual RM900 Rev..
- UcomGp Configurator RM901 Rev..

## 12.2 LIST OF BOARDS

| board | description | quantity for ups |
|---|---|---|
| B0056 | Interface Card | 1 |
| B0057 | Display Card | 1 |
| B0060 | Battery Charger 10A Card | 1 |
| B0067 | DSP+µC Control Card | 1 |
| B0084 | Battery Charger 25A Card | 1 |
| B0085 | Parallel Card | 1 |
| B0102 | Main Aux Power Supply Card | 1 |
| B0121 | Driver Boost Card | 3 |
| B0122 | Signal Control Card | 1 |
| B0124 | LEM Boost Card | 3 |
| B0125 | Input Card | 3 |
| B0126 | Output Card | 3 |
| B0127 | Aux 24V Power Supply Card | 1 |
| B0132 | Adapter CB 20A card | 1 |
| B0133-01. / B0133-03. | Filter Intput Card | 1 |
| B0133-02. / B0133-04. | Filter Output Card | 1 |
| B0135 | Driver Inverter Card | 3 |
| B0137 | Inverter Card | 3 |
| B0138 | PFC Card | 3 |
| B0144 | LEM inverter Card | 3 |
| B0155 | Cond. CY BATTERY Card | 1 |
| B0156 | Cond. CY N Card | 1 |
| B0180 | Capacitor Elect. x4 Card | 3 |
| B0181 | Filter Card CY IN/OUT/BY | 3 |
| B0182 | Filter Card CY N | 1 |
| B0183 | Capacitor Elect. x2 Card | 3 |