GTEC UPS MODEL:

SATURN 125 kVA

SERVICE MANUAL

www.gtec-power.eu

Contents

1 INTRODUCTION

This document aims to provide a simple outline for the maintenance and/or troubleshooting of problems associated with the SATURN 125kVA.

ALL OPERATIONS MUST EXCLUSIVELY BE CARRIED OUT BY QUALIFIED AND TRAINED PERSONNEL.

2 SOFTWARE OPERATIONS

2.1 SAVING THE UPS LOG FILE

This activity 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.

With the UPS fully switched off,

close the SWBYP (in order to avoid the DC capacitor bank pre-loading stage) 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 range (from 10kVA to 200 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
- GpOscilloscope – Oscilloscope 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 "**YMSTPRG.. (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.

To update the version firmware, closing only SWBY and opening SWIN.

The firmware to be used is the following:

Firmware	µProcessor	DSP
SATURN-125kVA	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 FEEDING POWER TO THE LOAD

1) Close the SWMB
2) Set the UPS to stand-by using the display
3) Open the SWIN, SWBY 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 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 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 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

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)

SATURN 125

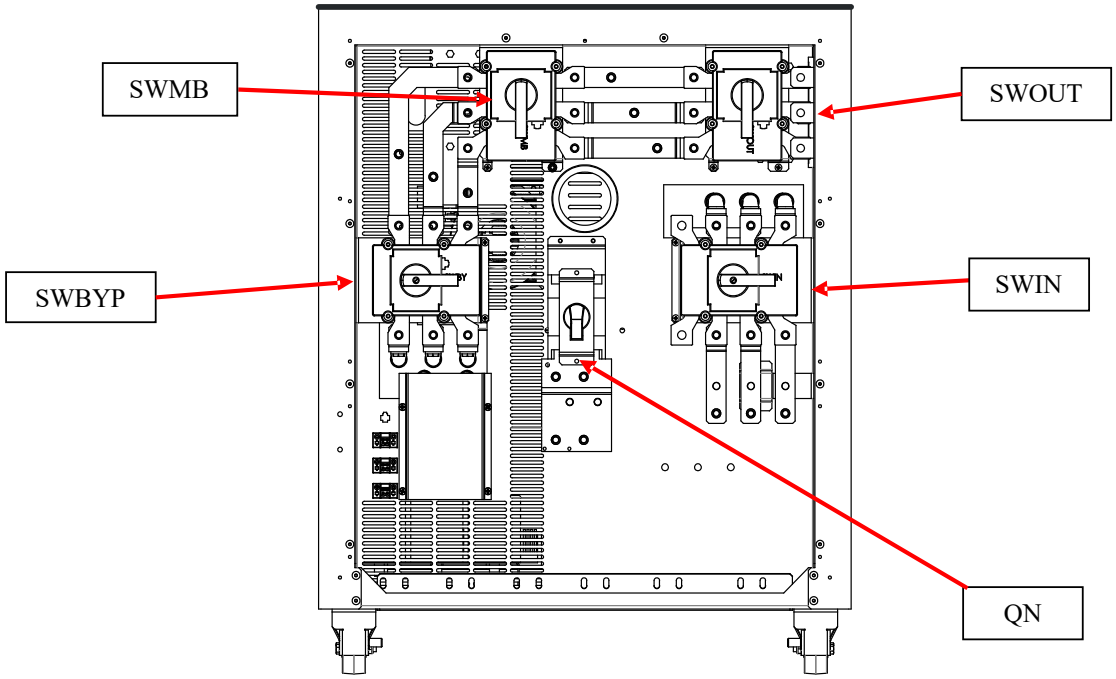

Fig. 1

- **SWMB:** Service Maintence Bypass
- **SWBYP:** Bypass Switch
- **SWIN:** Input Switch
- **SWOUT:** Output Switch
- **QN:** Neutral isolator Switch (Service Personnel Only)

4.2 COMPONENT POSITIONS INSIDE THE UPS.

With reference to the following diagrams, there are:

1) BOOST DRIVER + SIGNAL board (B0209 + B0210)
2) BOOST LEM
3) INPUT board (B0221)
4) OUTPUT board (B0126)
5) INVERTER DRIVER + SIGNAL board (B0215 + B0216)
6) BUS BARS board (B0222)
7) INVERTER LEM
8) AUX PS board (B0102)
9) 25A BATTERY CHARGER board (B0084)
10) 24V RELAY board (B0127)
11) CONTROL board (B0122)
12) DSP + uC CONTROL board (B0067)
13) INTERFACE board (B0056)
14) INPUT FILTER board (B0133)
15) OUTPUT FILTER board (B0133)
16) PARALLEL board (B0085) (OPTIONAL)
17) N CY CAPACITORS board (B0182)
18) INVERTER INDUCTOR
19) POSITIVE BOOST INDUCTOR
20) NEGATIVE BOOST INDUCTOR
21) INVERTER CAPACITOR (200uF 250VAC)
22) PFC+ CAPACITOR (50uF 250VAC)
23) PFC- CAPACITOR (50uF 250VAC)
24) ELT. POSITIVE CAPACITOR BANK
25) ELT. NEGATIVE CAPACITOR BANK
26) INPUT CAPACITORS (50uF 330VAC)
27) INPUT CONTACTOR
28) OUTPUT CONTACTOR
29) AUX PS BOARD FAN (80x80, 24Vdc)
30) BATTERY CHARGER BOARD FAN (92x92, 12Vdc)
31) OUTPUT POWER HEATSINK FAN (120x120, 24Vdc)
32) INPUT POWER HEATSINK FAN (120x120, 24Vdc)

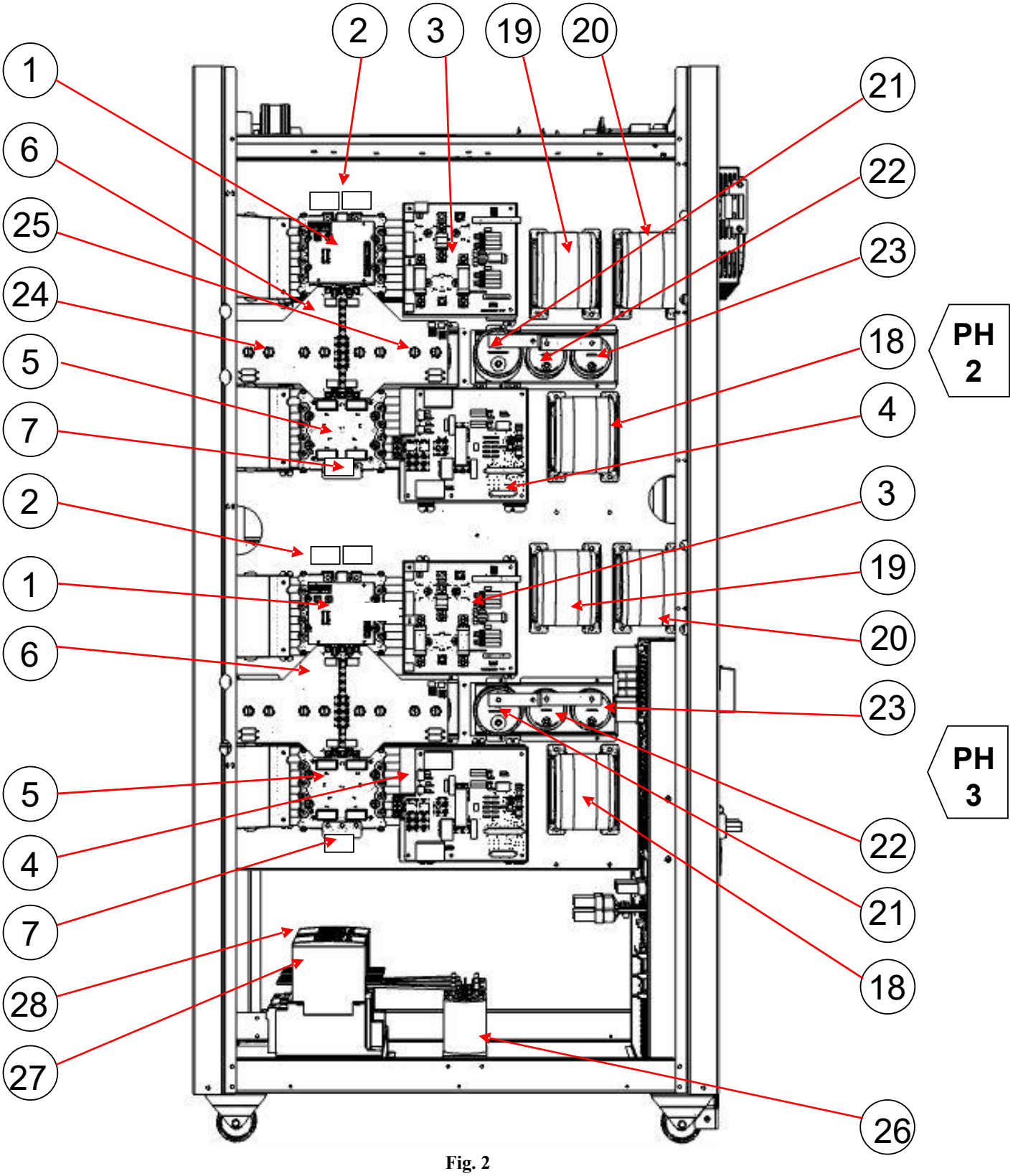
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Fig. 2

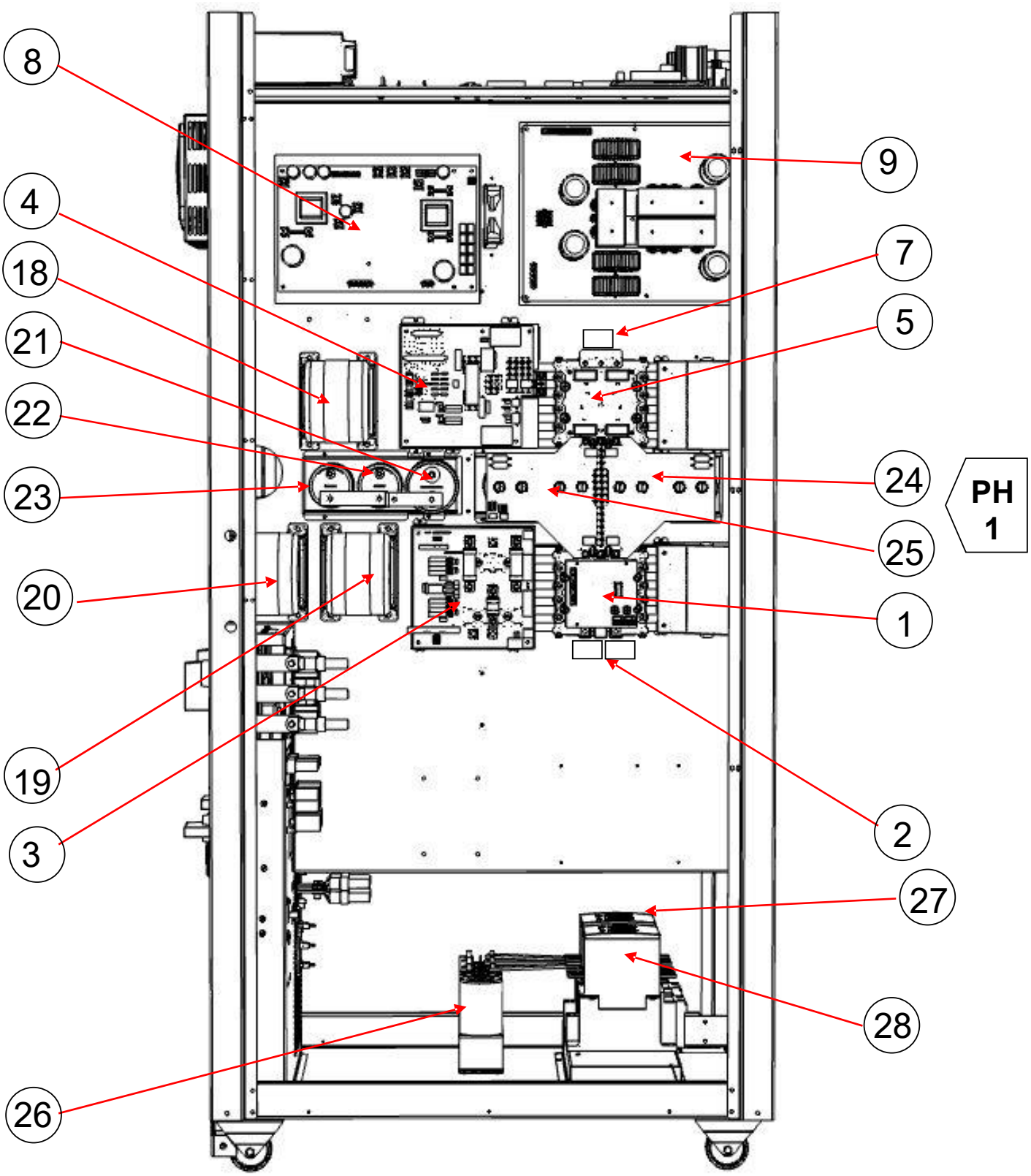


Fig. 3

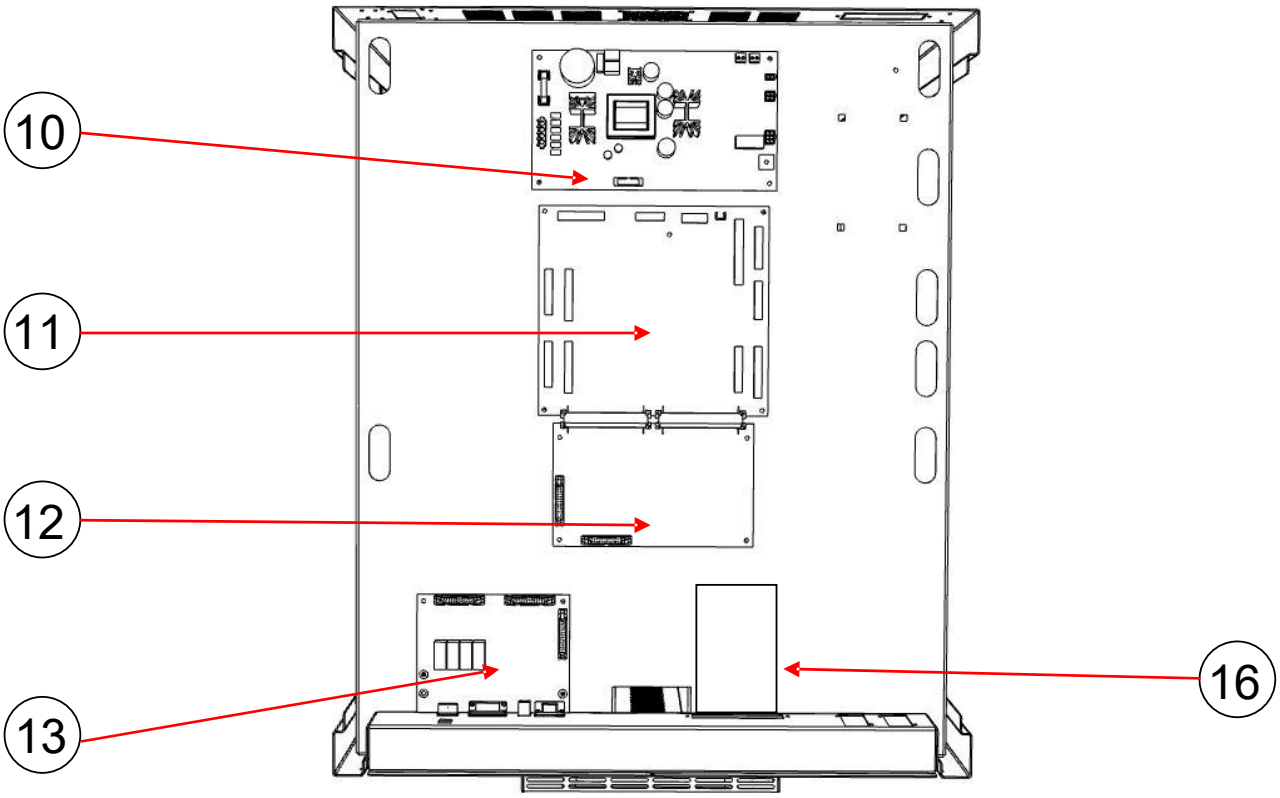


Fig. 4

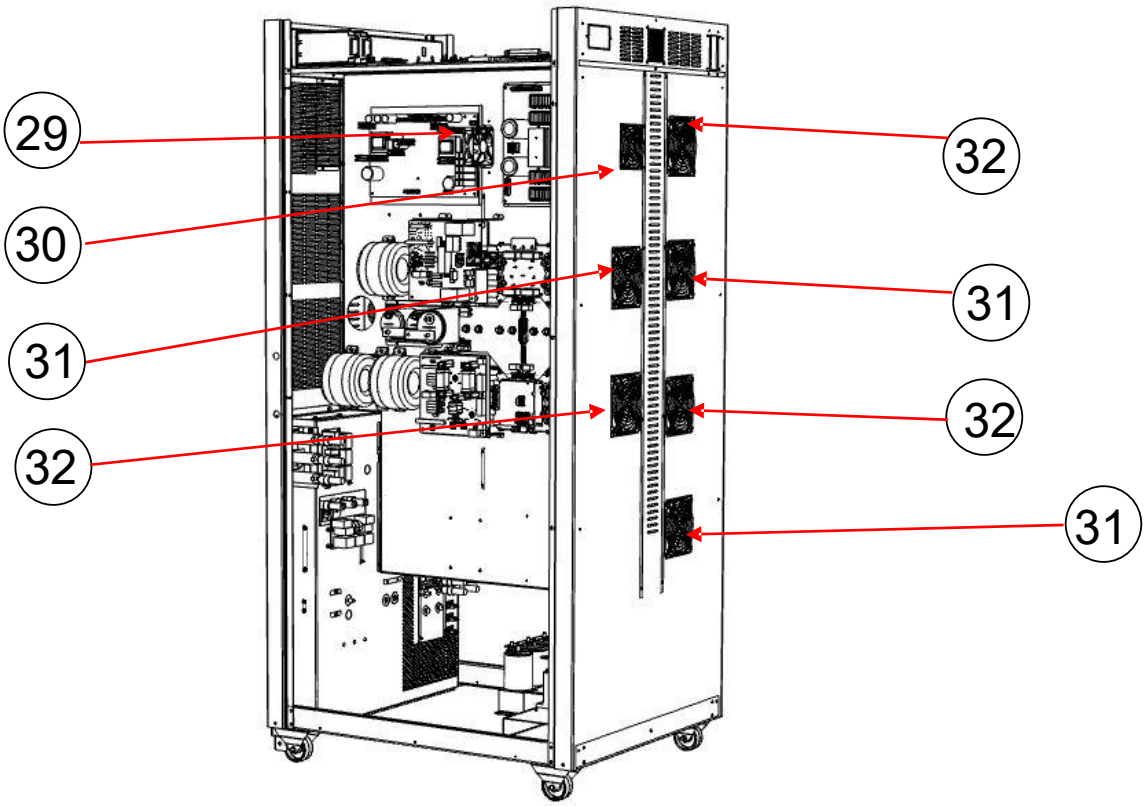


Fig. 5

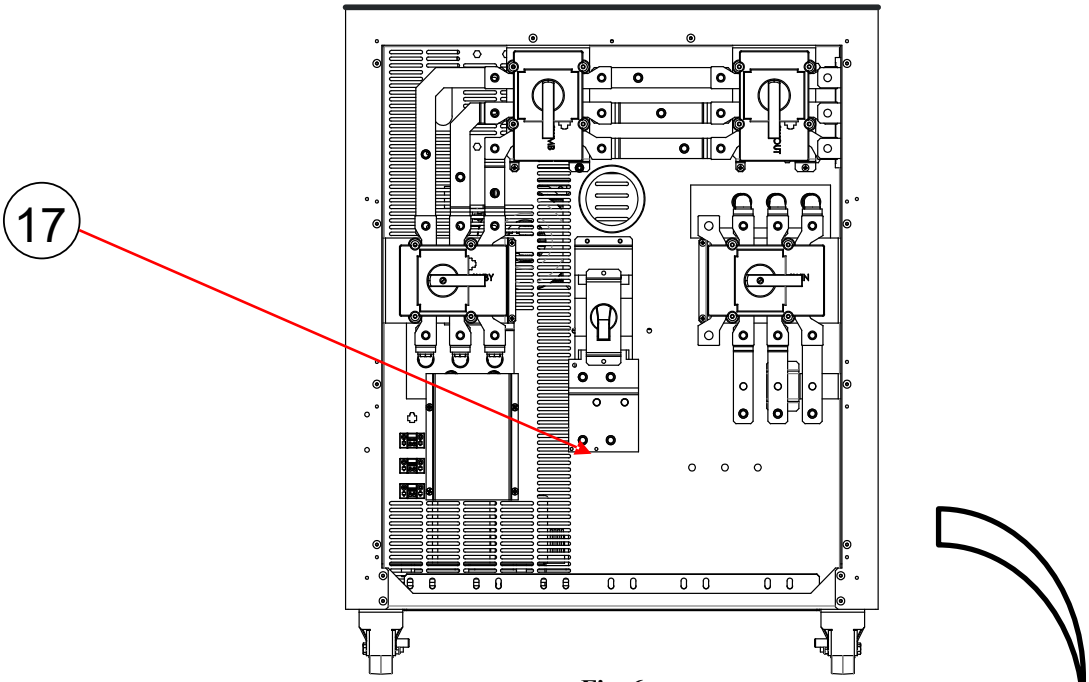


Fig. 6

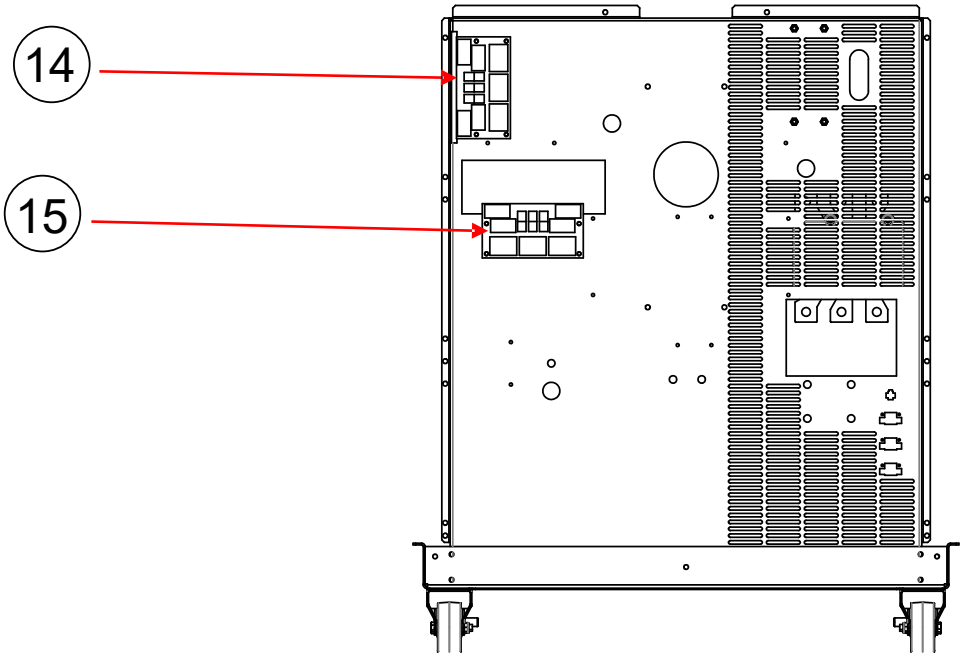


Fig. 7

4.3 UPS BLOCK DIAGRAM

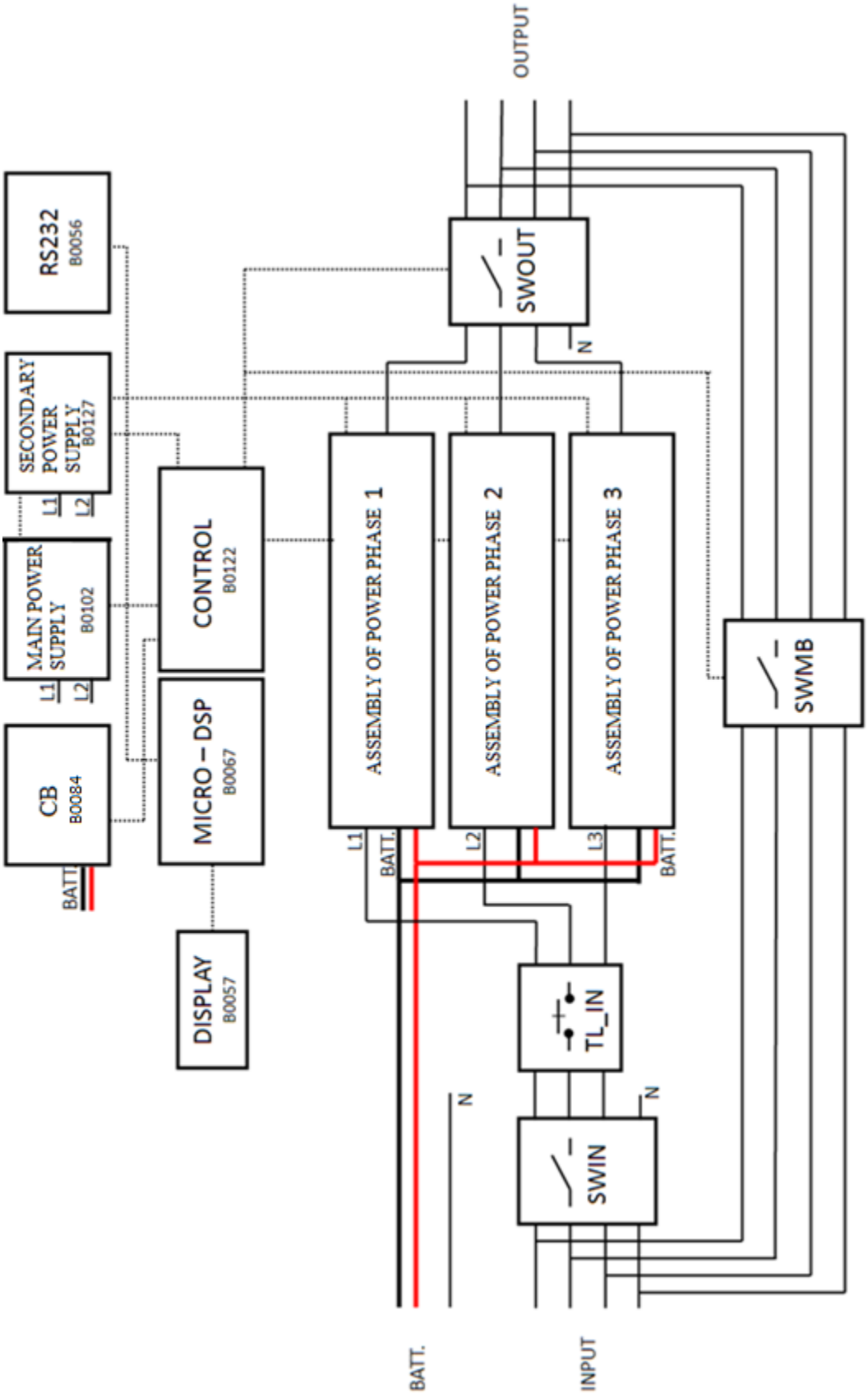


Fig. 8

4.4 SINGLE PHASE BLOCK DIAGRAM

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

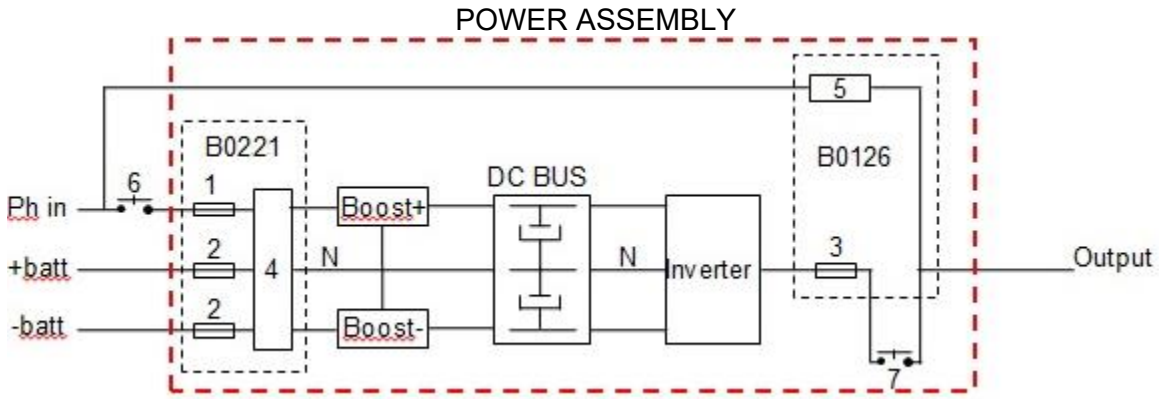


Fig. 9

1) Input fuses 125kVA 2x125A FF240V

2) Battery fuses 125kVA 2x80A F500V

3) Output fuses 125kVA 2x125A 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

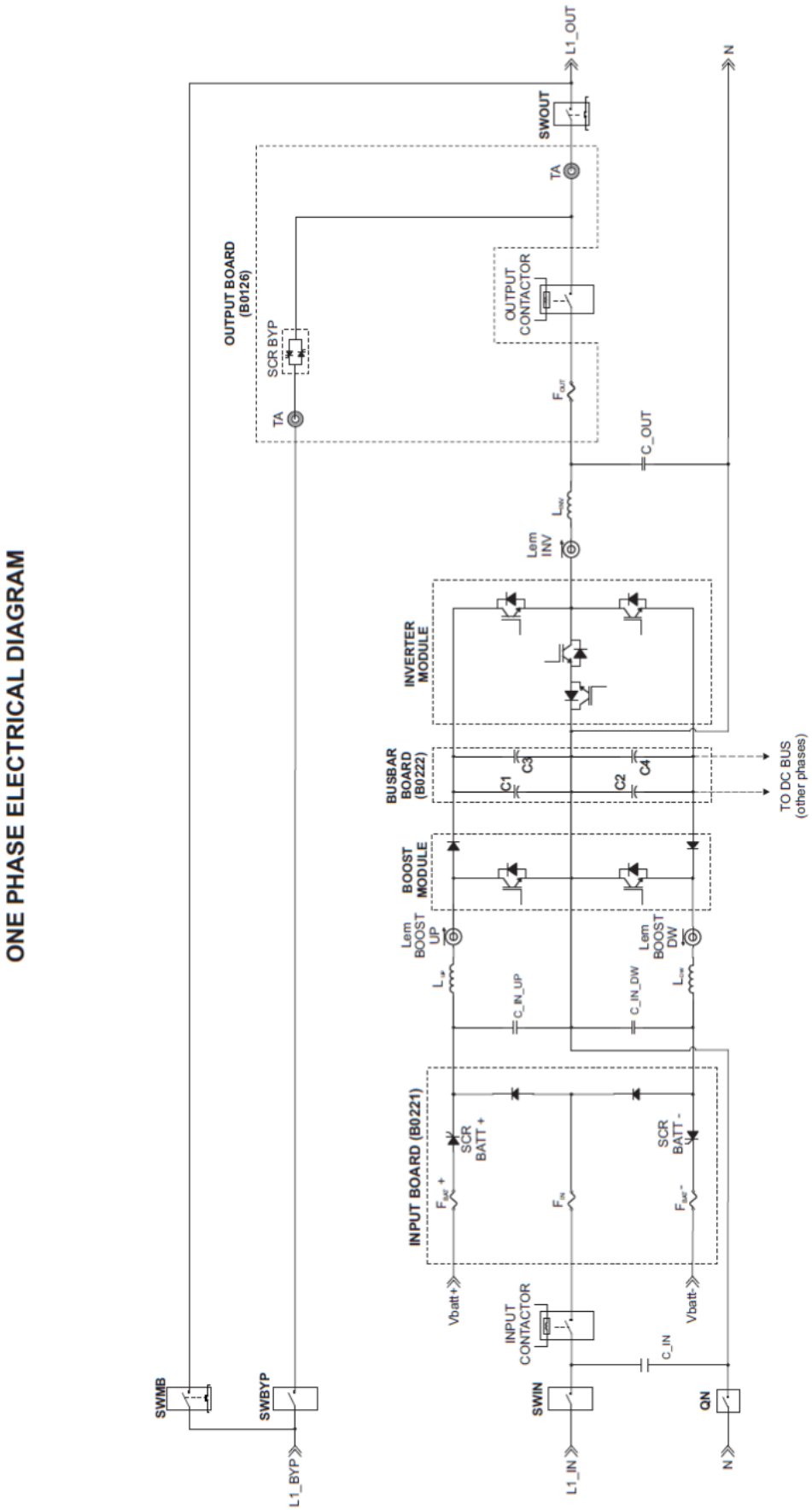


Fig. 10

5 DESCRIPTION OF BOARDS

5.1 INTERFACE BOARD (B0056)

Version:
B0056-02. Interface Card SATURN

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

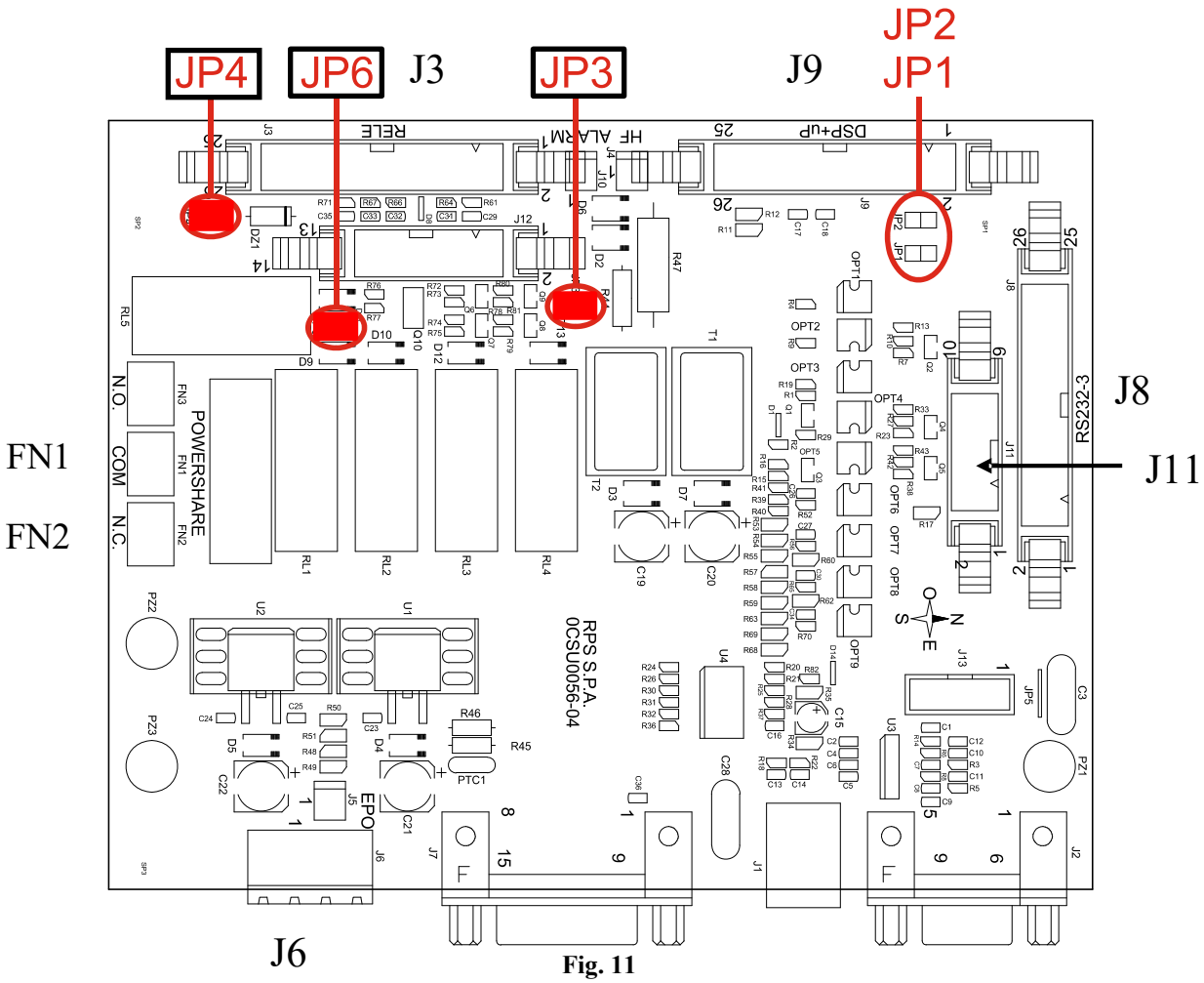


Fig. 11

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 slot 1
J11	Connection to slot 2	To slot 2
FN1-FN2	Energyshare connectors	

5.2 DISPLAY CARD (B0057)

Versions:

B0057-02. Display Card SATURN

The display board contains the following main elements:

1) DL1, 2, 3, 4, 5 and 6 Led indicators
2) SW1, 2, 3, 4 Are selection button

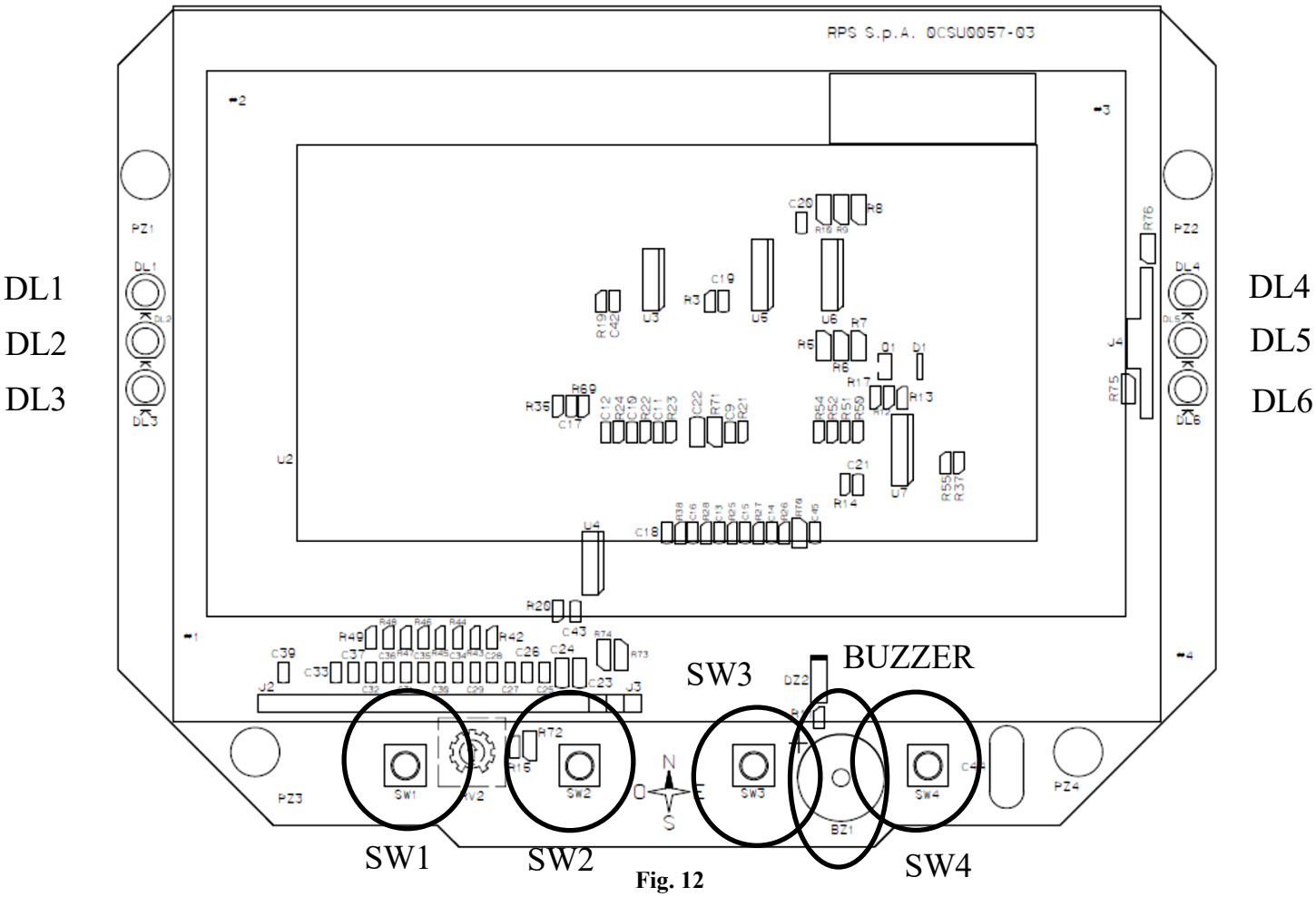


Fig. 12

Led	Description	Note
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	

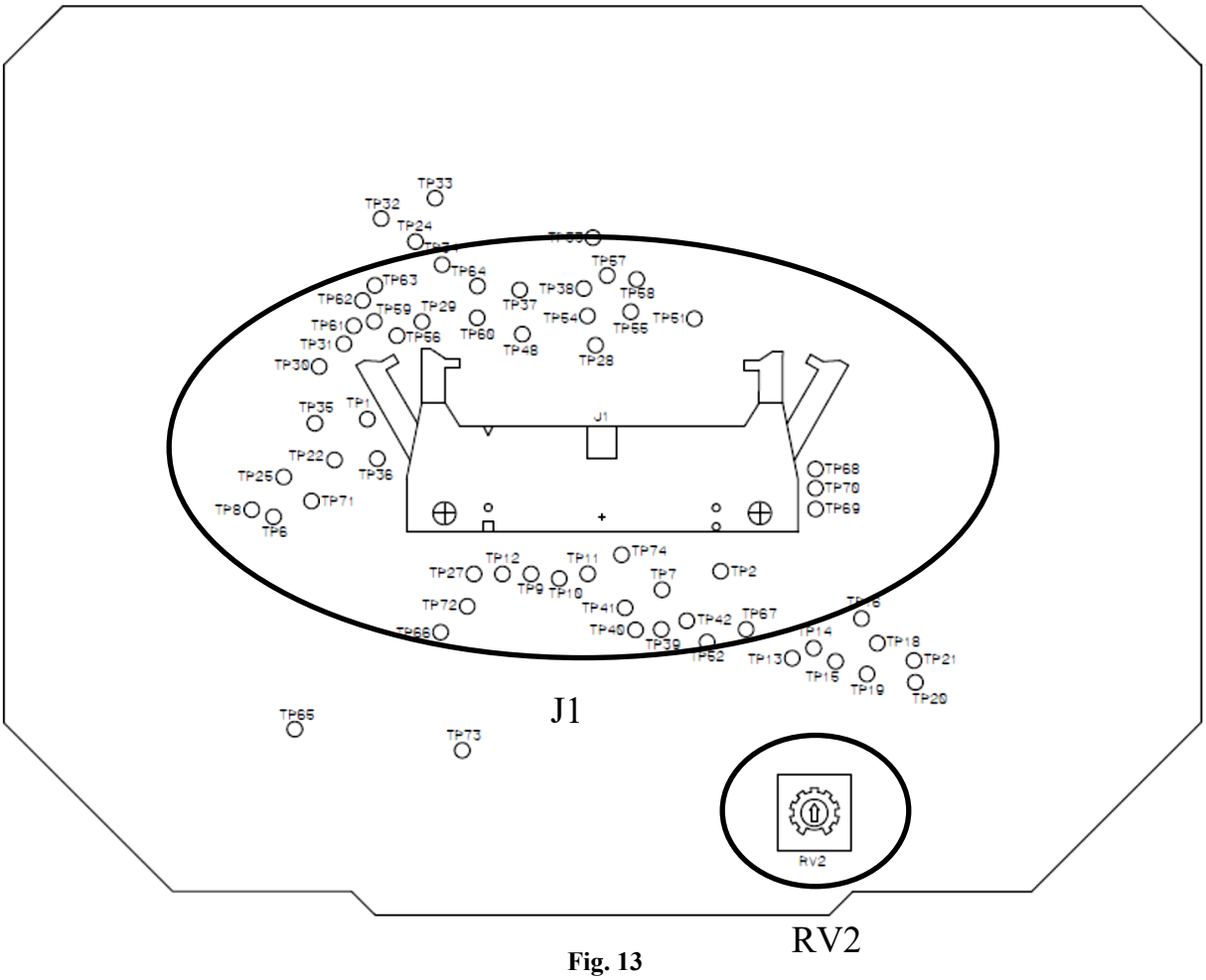


Fig. 13

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.

5.3 uC + DSP BOARD (B0067)

Version:
B0067-01. DSP+µC Control Card for SATURN 125

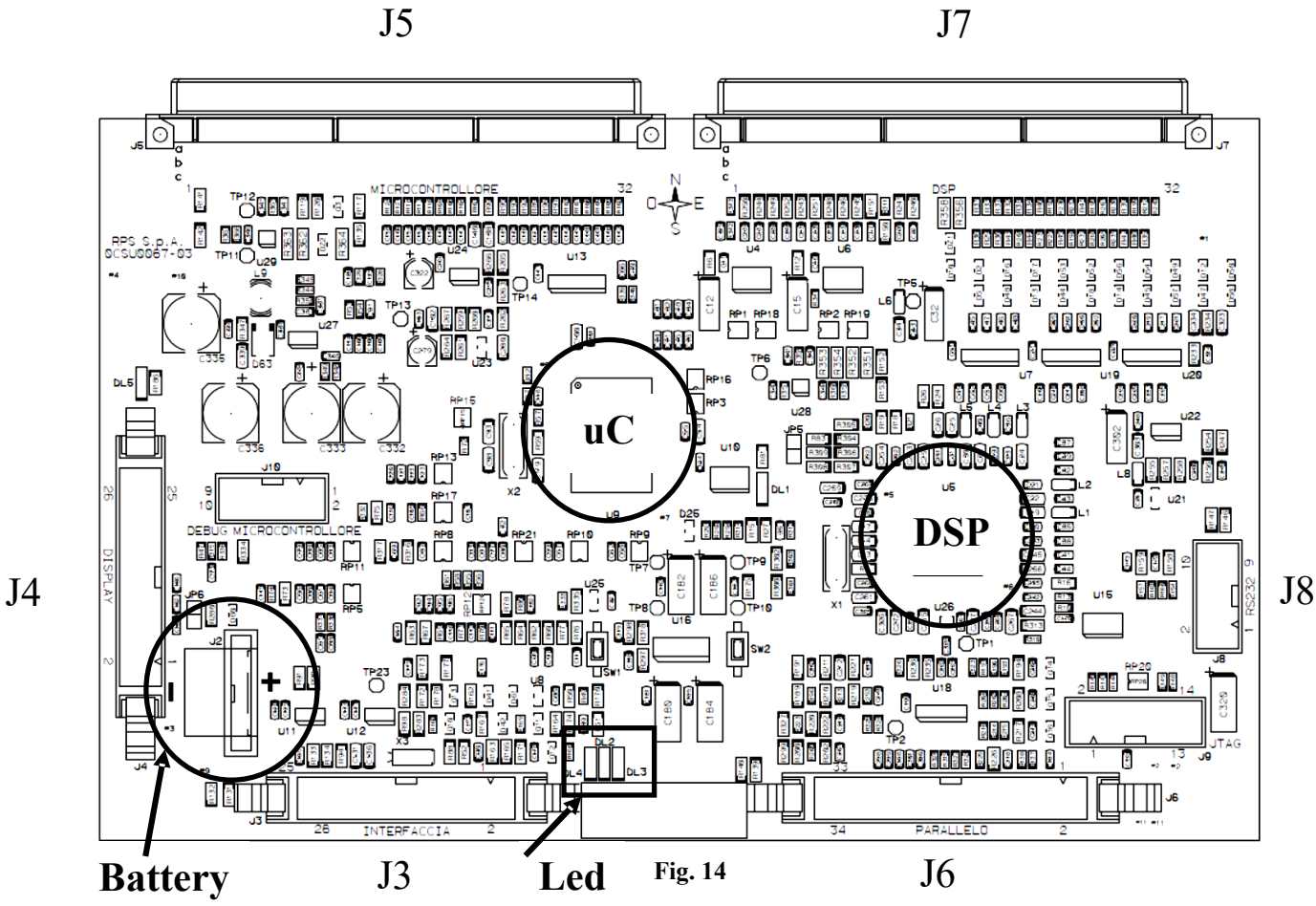


Fig. 14

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	Meaning
DL1 (RED)	Reset DSP
DL2 (RED)	Reset uC
DL3 (GREEN)	+5V and +1,9V present
DL4 (GREEN)	+3,3V present

5.4 BATTERY CHARGER BOARD (B0084)

Version:
B0084-02. Battery Ch. 25A Card SATURN 125-160-200.

The battery charger board is composed by two buck converters and by battery pre-charge. The main elements of the B0084 board are:

1) 2 output fuses - 10mmX38 32 A 500V
2) 2 input fuses - 6.3mmX32 25A 500V
3) pre-charge resistors from the battery (6 x 22Ω 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 inductors
11) R59 = fuse resistor 1,2Ω 500mW

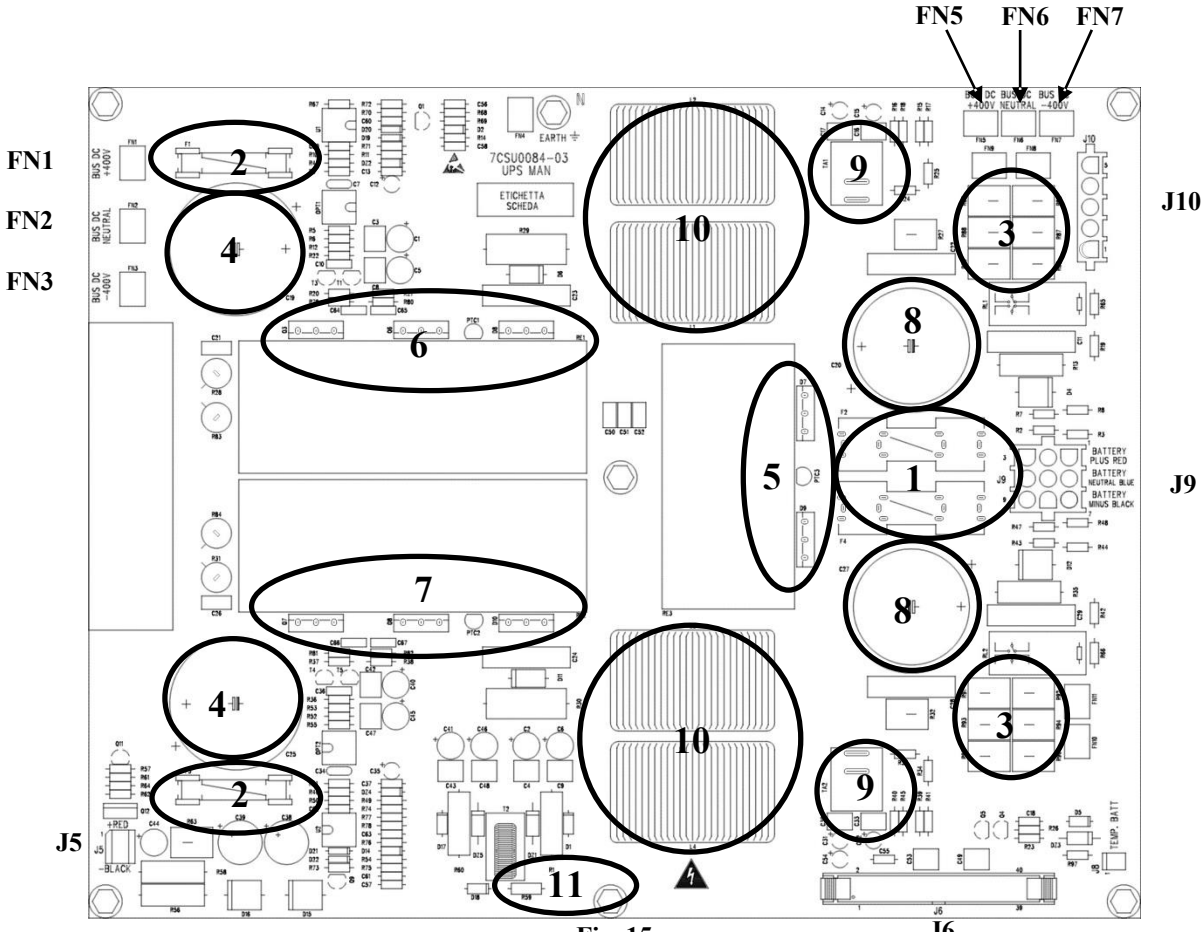


Fig. 15

Connections of battery charger

Connector	Description	Note
J5	Fan connector	
J9	Battery charger board output connection	Connected to battery bar +/-/N
J6	Flat connected to control board	To J10 B0122
J10	Battery charger board input connection	Connected to dc bar +400/-400/N

Pinout connectors:

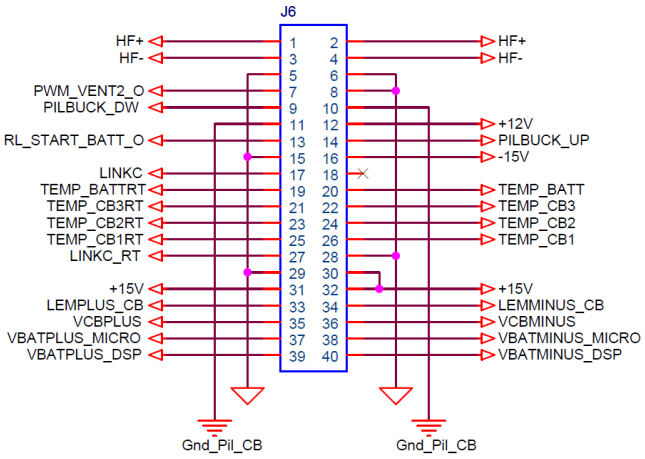


Fig. 16

5.5 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
6) R5 = fuse resistor 6,8Ω 500mW

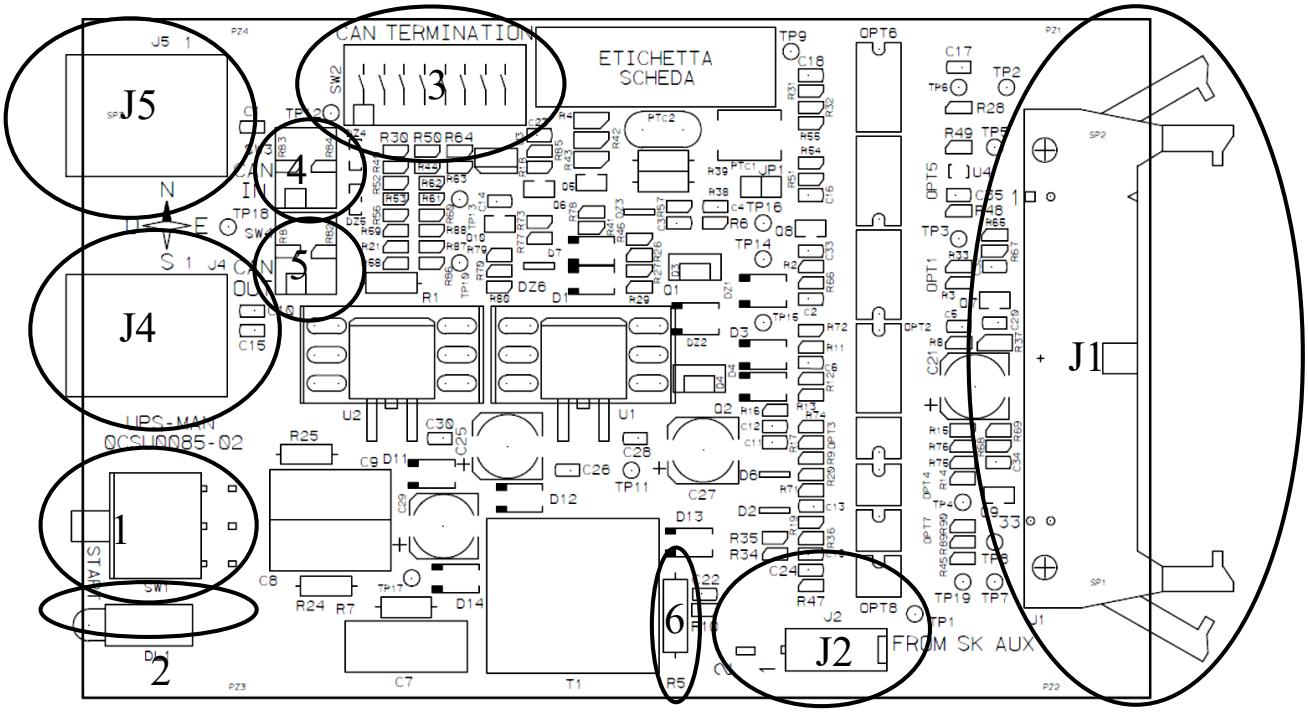


Fig. 17

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 other B0085 (UPS in parallel)
J5	Input communication line RJ45- IN	From other B0085 (UPS in parallel)

5.6 AUXILIARY POWER SUPPLIES BOARD (B0102)

Version:
B0102-02. Main Aux Supply Card SATURN 60-125

The auxiliary power supplies board contains the following 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)

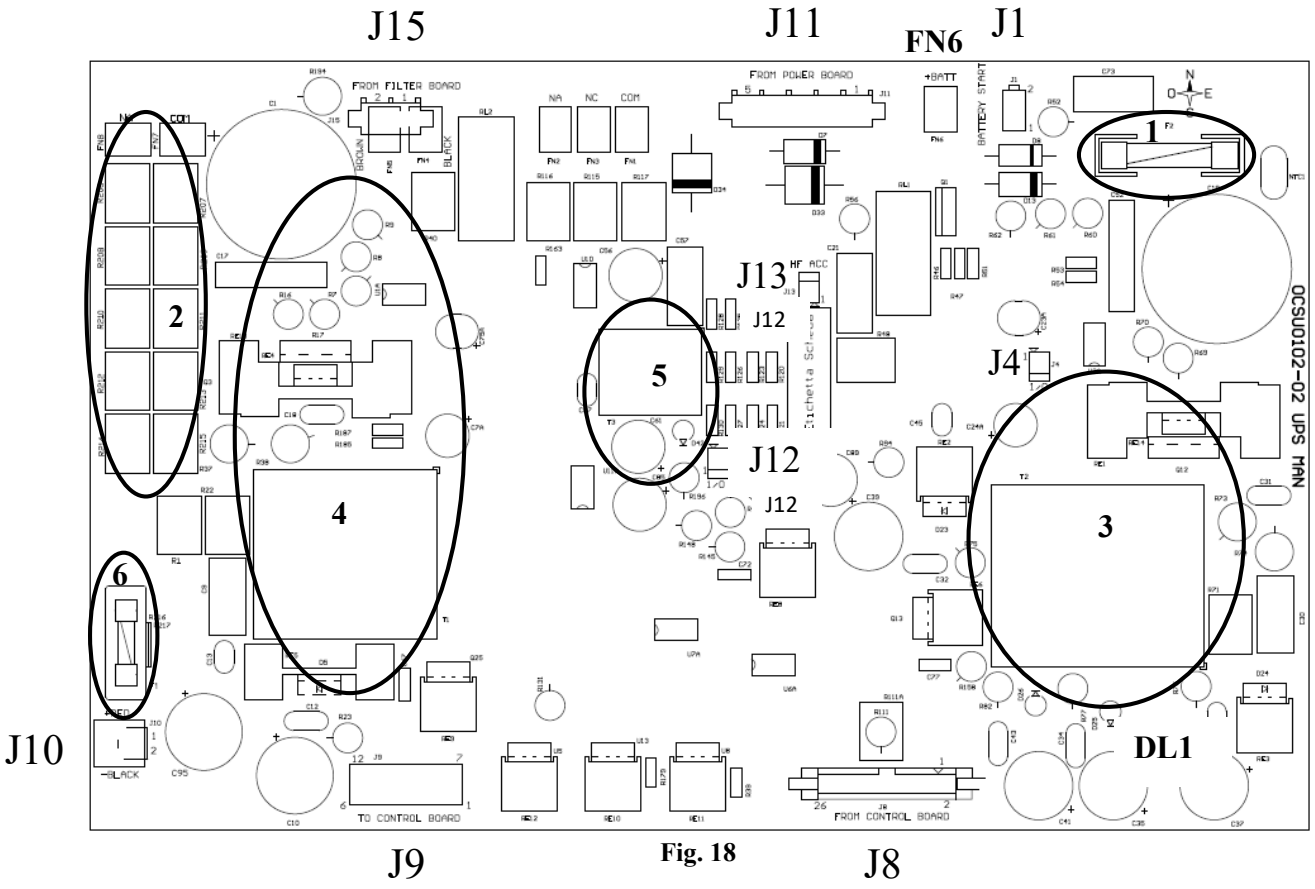


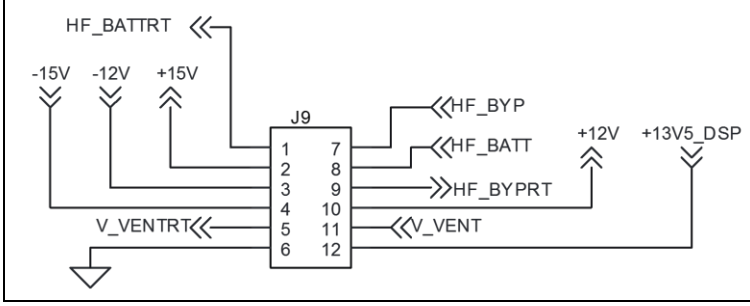
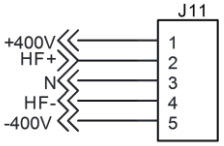
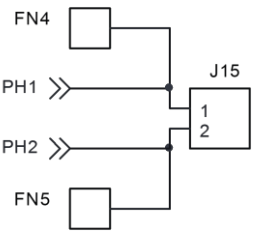
Fig. 18

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

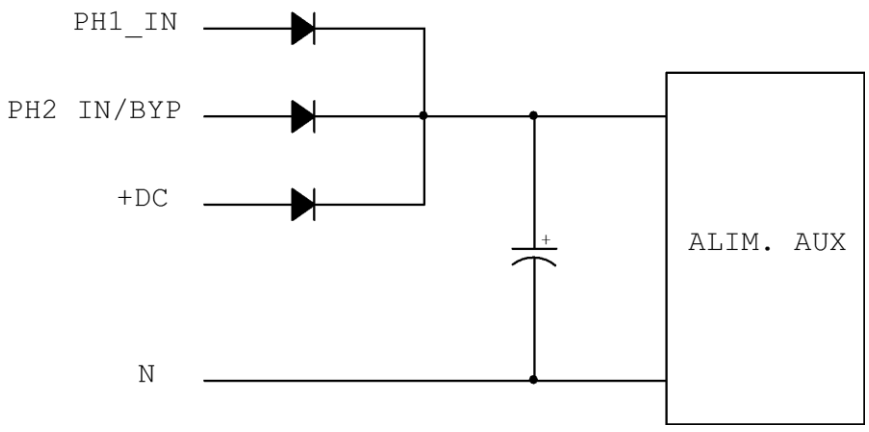
Connector	Description	Notes
J10	Fan power supply connector	
J11	DC BUS, HF connector	
J12	Connector for 1/0	
J13	HF connector	
J15	Connector for mains power supply	pin1 → from C_IN (PH1) pin2 → from C_IN (PH2) (with single input UPS) pin2 → from PH2 SWBYP (with dual input UPS)
FN6	+batt connector for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

LEDs	Description	Notes
DL1	Aux power good LED	

Connector pin layout:

J9	J11	J15
		

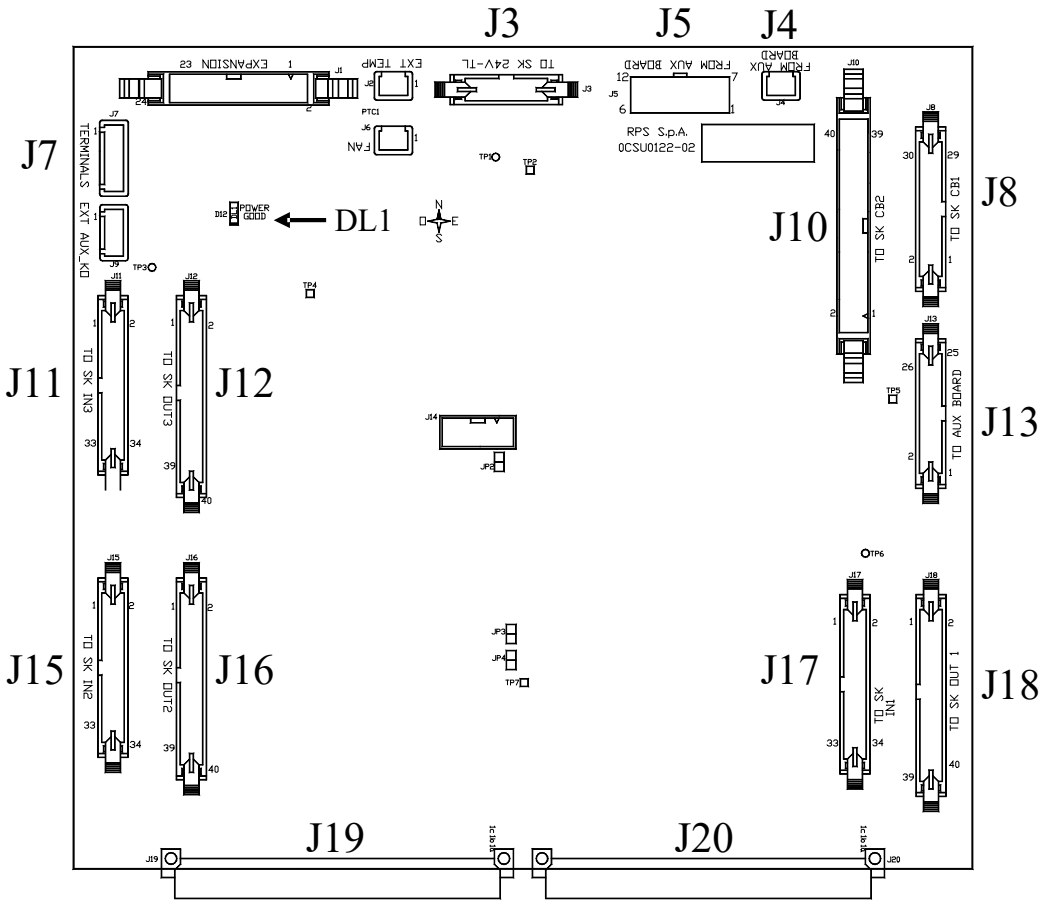
Power supply diagram:



5.7 CONTROL BOARD (B0122)

Version:
B0122-04. Signal Control Card SATURN 125

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	
J10	Flat connection to Battery Charger board	From B0084
J11, J15, J17	Flat connections to input boards	From B0221
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	

5.8 OUTPUT BOARD (B0126)

Version:
B0126-03. Output Card SATURN 125

The output board contains the following main elements:

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

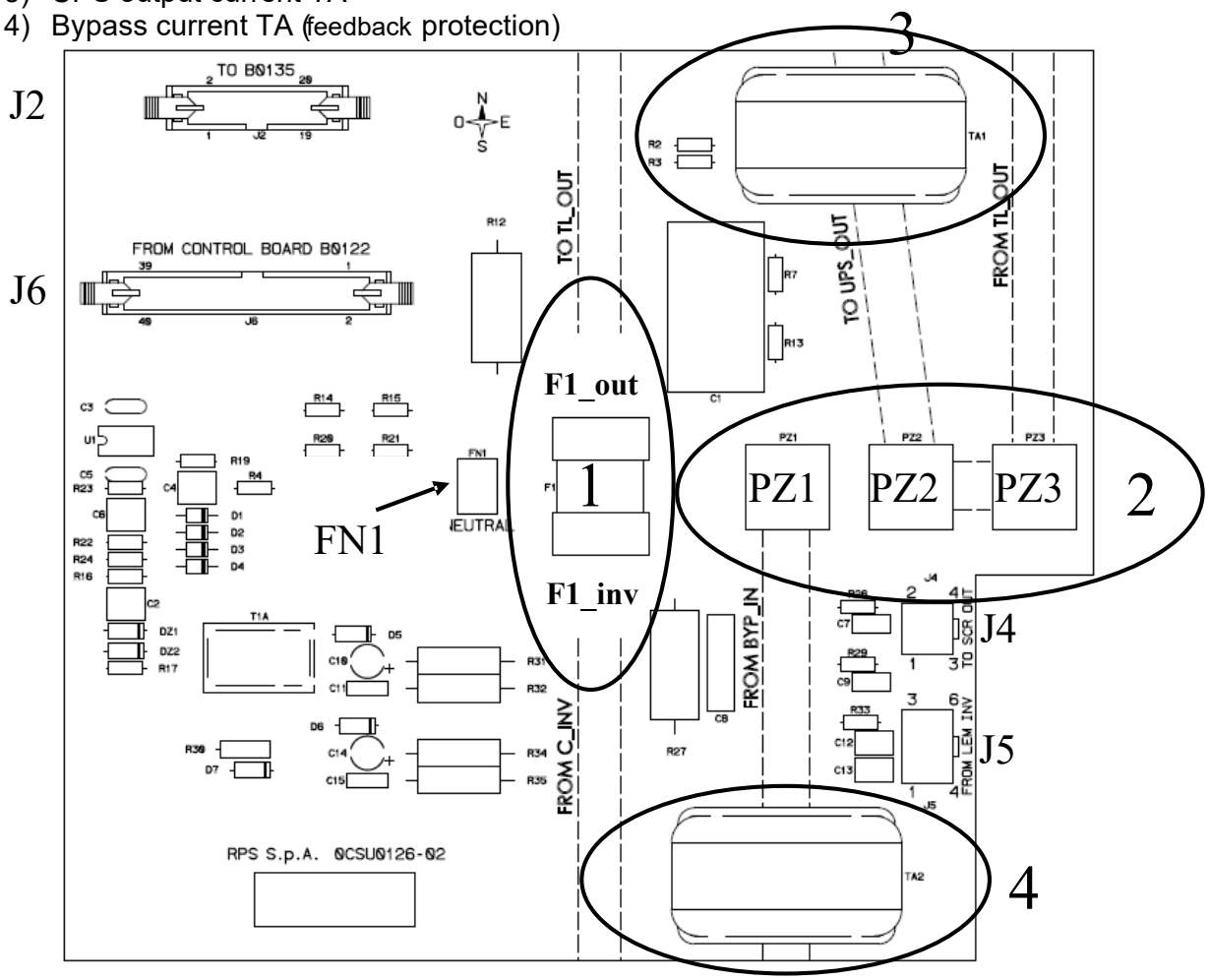


Fig. 20

Connector	Description	Notes
J2	Flat connection from inverter driver board	From B0210
J4	Connection towards Bypass SCR	
J5	Connection from inverter LEM board	To LEM inverter
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	

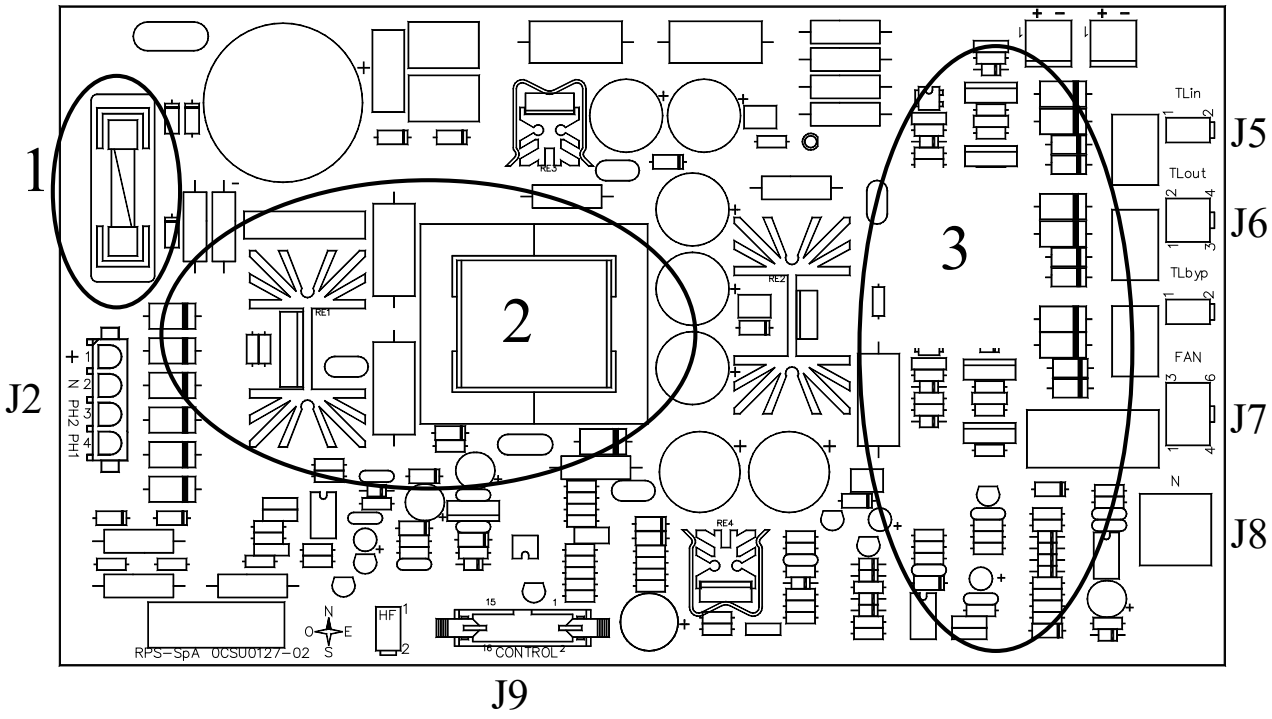
Connector	Description	Notes
PZ2	Terminal for cable from SWOUT disconnection switch	
PZ3	Terminal for cable from output relay (Lx)	

5.9 24V RELAY BOARD (B0127)

Version:
B0127-02. Aux 24V Power Supply Card SATURN 125

The relay board contains of the following main elements:

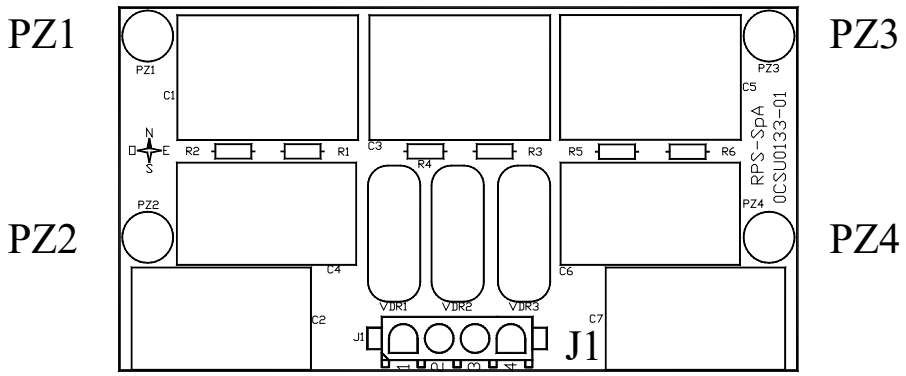
1) Input fuse.
2) Power supply unit.
3) Relay control



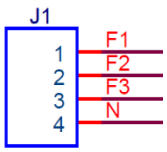
J7	Fan connection, power supplies board	From B0102
J8	Connection towards neutral bar	
J9	Flat connection from control board	From B0122

5.10 FILTER BOARD (B0133)

Version:
B0133-06. Filter Card SATURN 125



PZ2	Connection towards GND (fastening turret)	
PZ3	Connection towards GND (fastening turret)	
PZ4	Connection towards GND (fastening turret)	



5.11 NEUTRAL CY CAPACITORS BOARD (B0182)

Versions:
B0182-01. Filter Card CY N SATURN 60-100 B

The layout of the board connectors is given below.

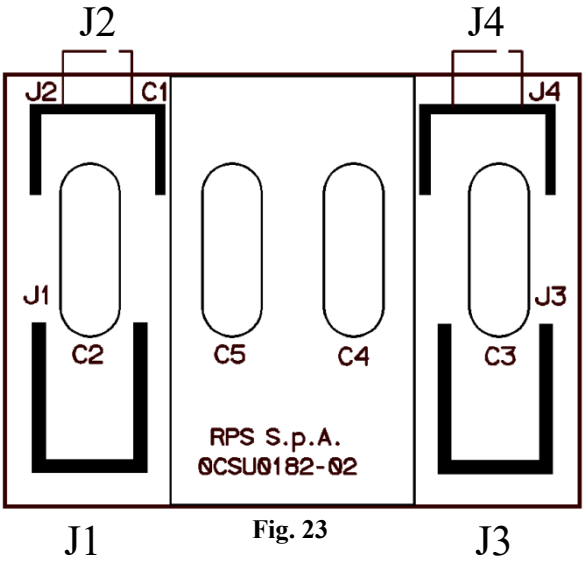


Fig. 23

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

5.12 BOOST DRIVER BOARD (B0209)

Version:
B0209-02. Driver Boost Board SATURN 125-160

Note: This is not listed as spare part because it comes together with the BOOST IGBT MODULE.

The driver boost board is connected at the signal board B0210 through the pinstrip connectors.

Inside the board there are:
1) driver and electronic desat circuit for boost up
2) driver and electronic desat circuit for boost down

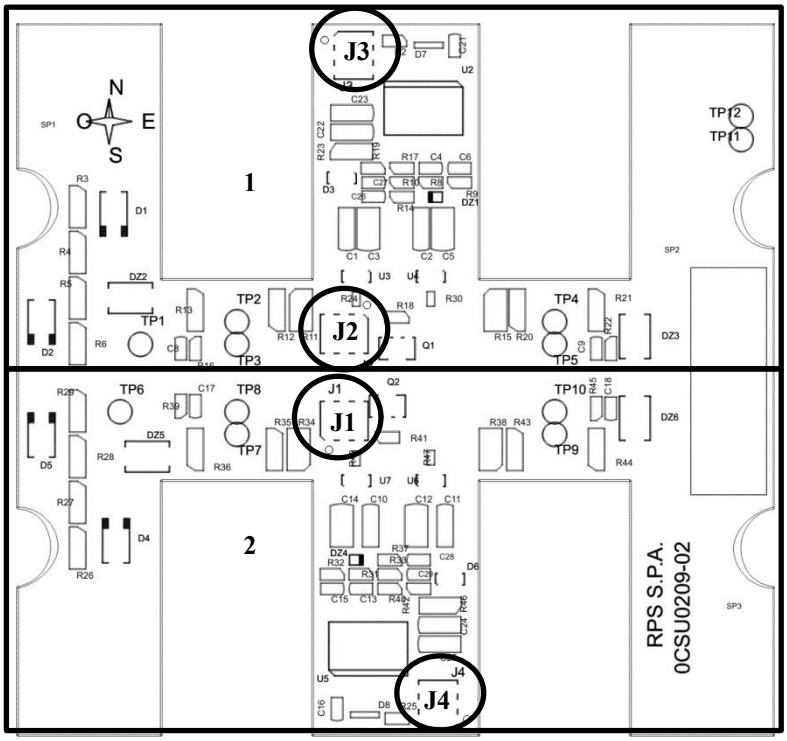
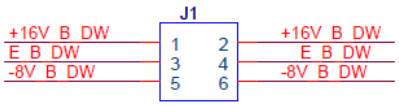
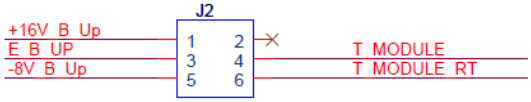


Fig. 24

Connectors on B0209 board:

Connector	Description	Note
J1	Power supply Boost DW	 Connected to J8 B0210
J2	Power supply Boost UP + module IGBT temperature	 Connected to J14 B0210
J3	Signals and Power supply at Boost UP optoisolator	Connected to J10 B0210
J4	Signals and Power supply at Boost DW optoisolator	Connected to J13 B0210

5.13 BOOST BOARD (B0210)

Version:
B0210-01. Boost Signal Card SATURN 125-160-200

Inside the board there are:

1) R18 = fuse resistor 1,2Ω 500mW
2) buffer to drive the boost IGBT
3) electronic circuit for HF power supply
4) electronic circuit to indicate boost up / down fault
5) resistors of measure the booster currents
6) electronic circuit to measure in module temperature

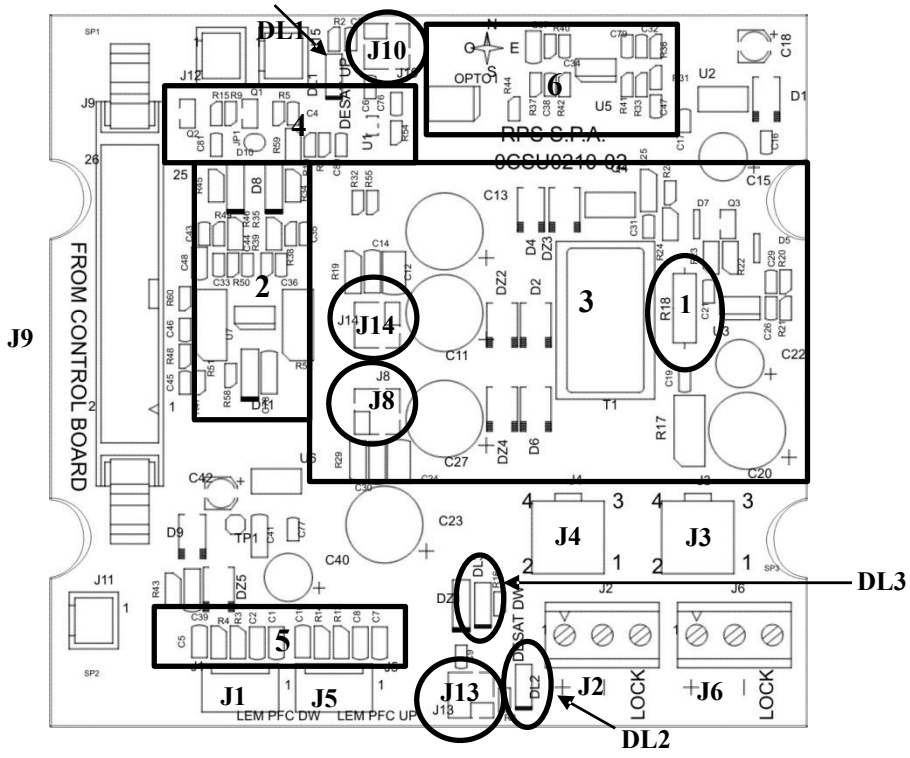
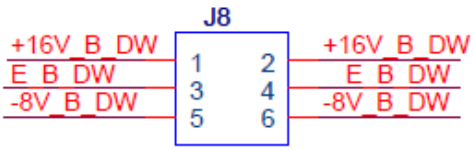
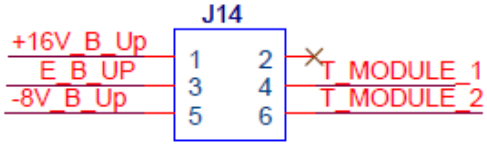


Fig. 25

Connector	Description	Note
J1	Connection to power supplies and LEM boost DW signal	From LEM boost DW
J5	Connection to power supplies and LEM boost UP signal	From LEM boost UP
J9	Flat connector for signal to control board (PH1,PH2,PH3) through input board B0221	To J3 B0221 (PH1)
		To J3 B0221 (PH2)
		To J3 B0221 (PH3)

Connectors on B0209 board:

Connector	Description	Note
J8	Boost DW power supplies	 Connected to J1 B0209
J14	Boost UP power supply + module temperature	 Connected to J2 B0209
J10	Signals and Power supply at Boost UP optoisolator	Connected to J3 B0209
J13	Signals and Power supply at Boost DW optoisolator	Connected to J4 B0209

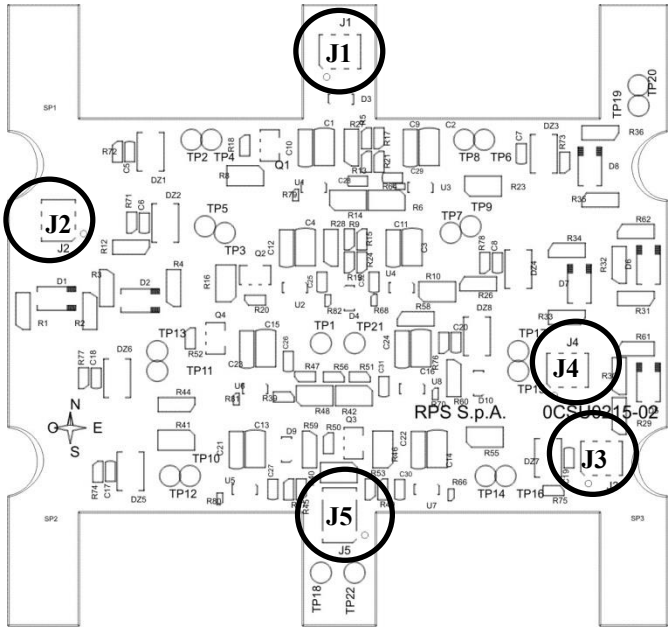
Led indications:

LED	Descrizione	Note
DL1 (RED)	Indication for Boost UP DESAT	On if DESAT has triggered on Boost UP
DL2 (RED)	Indication for Boost DW DESAT	On if DESAT has triggered on Boost DW
DL3 (GREEN)	Signals for HF	On if the +24HF is present

5.14 INVERTER DRIVER BOARD (B0215)

Version:
B0215-02. Driver inverter Board SATURN 125-160

Note: This is not listed as spare part because it comes together with the INVERTER IGBT MODULE.
The inverter driver board is connected to signal inverter board B0215 through the pin strip connectors, highlighted in the figure below, necessary to drive the 4 IGBTs:



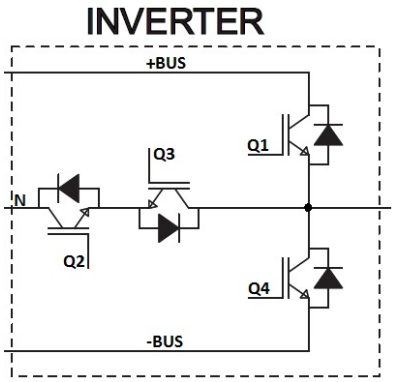
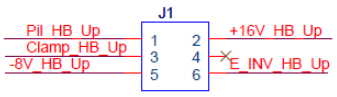
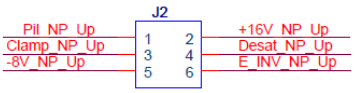
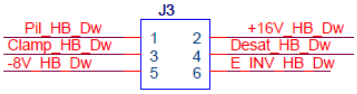
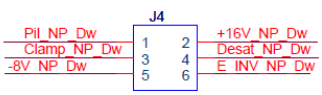


Fig. 26

Connectors on the B0215 board:

Connector	Description	Note
J1	Power Supplies Q1 (IGBT HB_Up inverter)	 Connected to J10 B0216
J2	Power Supplies Q2 (IGBT NP_Up inverter)	 Connected to J11 B0216
J3	Power Supplies Q4 (IGBT HB_Dw inverter)	 Connected to J13 B0216
J4	Power Supplies Q3 (IGBT NP_Dw inverter)	 Connected to J12 B0216
J5	DESAT (IGBT HB_Up inverter) and module temperature	Connected to J9 B0216

5.15 INVERTER BOARD (B0216)

Version:
B0216-02. Inverter Signal Card SATURN 125

In the board there are:

1) R26 = fuse resistor 1,2Ω 500mW
2) R35 = fuse resistor 1,2Ω 500mW
3) buffer to drive 4 inverter IGBTs
4) HF for IGBT
5) electronic circuit to measure in module temperature
6) resistive divider to decrease the output voltage
7) electronic circuit to measure the unbalance output voltage

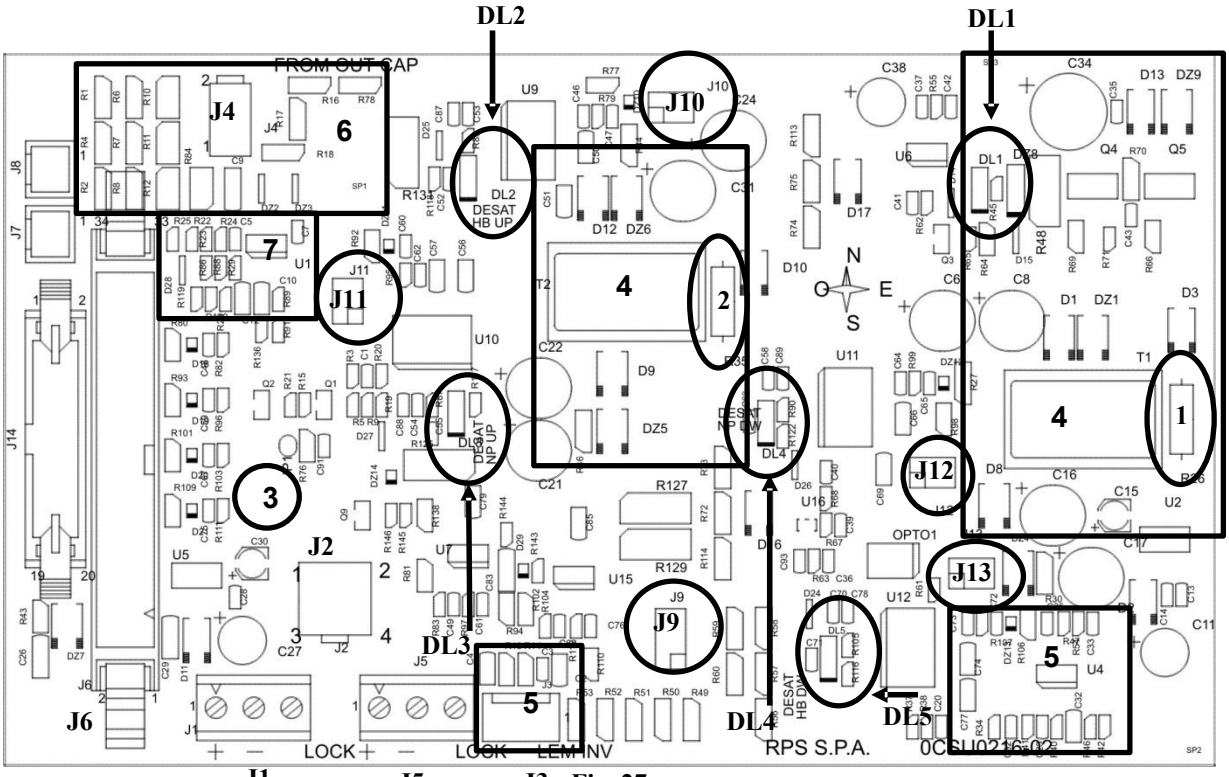
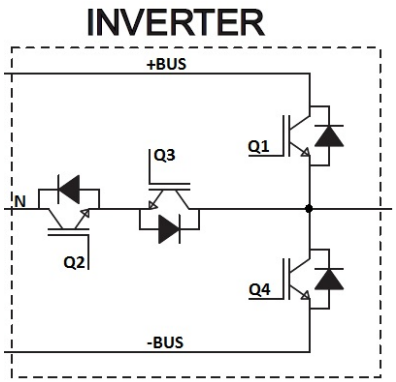
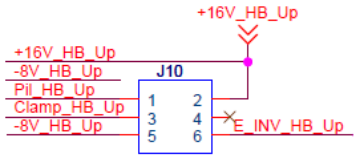
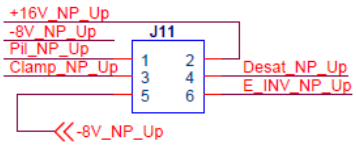
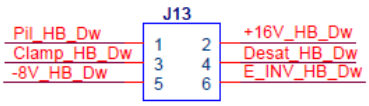
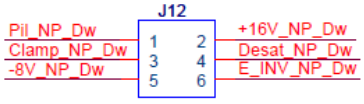


Fig. 27

Connector	Description	Note
J1	Connector for primary fan (A)	+ LOCK on power supply
J2	Connector to fed the fans from signal boost board	From J4 B0210
J3	Connector to fed the LEM inverter	Unused
J4	Connector for the output voltage measure	
J5	Connector for secondary fan (B)	+ LOCK on power supply
J14	Connector for signal flat connected to output board (PH1,PH2,PH3)	To J2 B0126

Connections from B0216 board:



Connector	Description	Note
J10	Power Supplies Q1 (IGBT HB_Up inverter)	 Connected to J1 B0215
J11	Power Supplies Q2 (IGBT NB_Up inverter)	 Connected to J2 B0215
J13	Power Supplies Q4 (IGBT HB_Dw inverter)	 Connected to J3 B0215
J12	Power Supplies Q3 (IGBT NP_Dw inverter)	 Connected to J4 B0215
J9	DESAT (IGBT HB_Up inverter) and module temperature	Connected to J5 B0215

LED indication:

LED	Description	Note
DL1 (GREEN)	Indications for HF	On if the signal +24HF is present
DL2 (RED)	DESAT Q1 inverter indication	On if DESAT has triggered on Q1
DL3 (RED)	DESAT Q2 inverter indication	On if DESAT has triggered on Q2
DL4 (RED)	DESAT Q3 inverter indication	On if DESAT has triggered on Q3
DL5 (RED)	DESAT Q4 inverter indication	On if DESAT has triggered on Q4

5.16 INPUT BOARD (B0221)

Version:
B0221-01. Input Card SATURN 125

In the board there are:

1) Input fuse
2) Battery fuses
3) HF for SCR
4) Fuse resistor

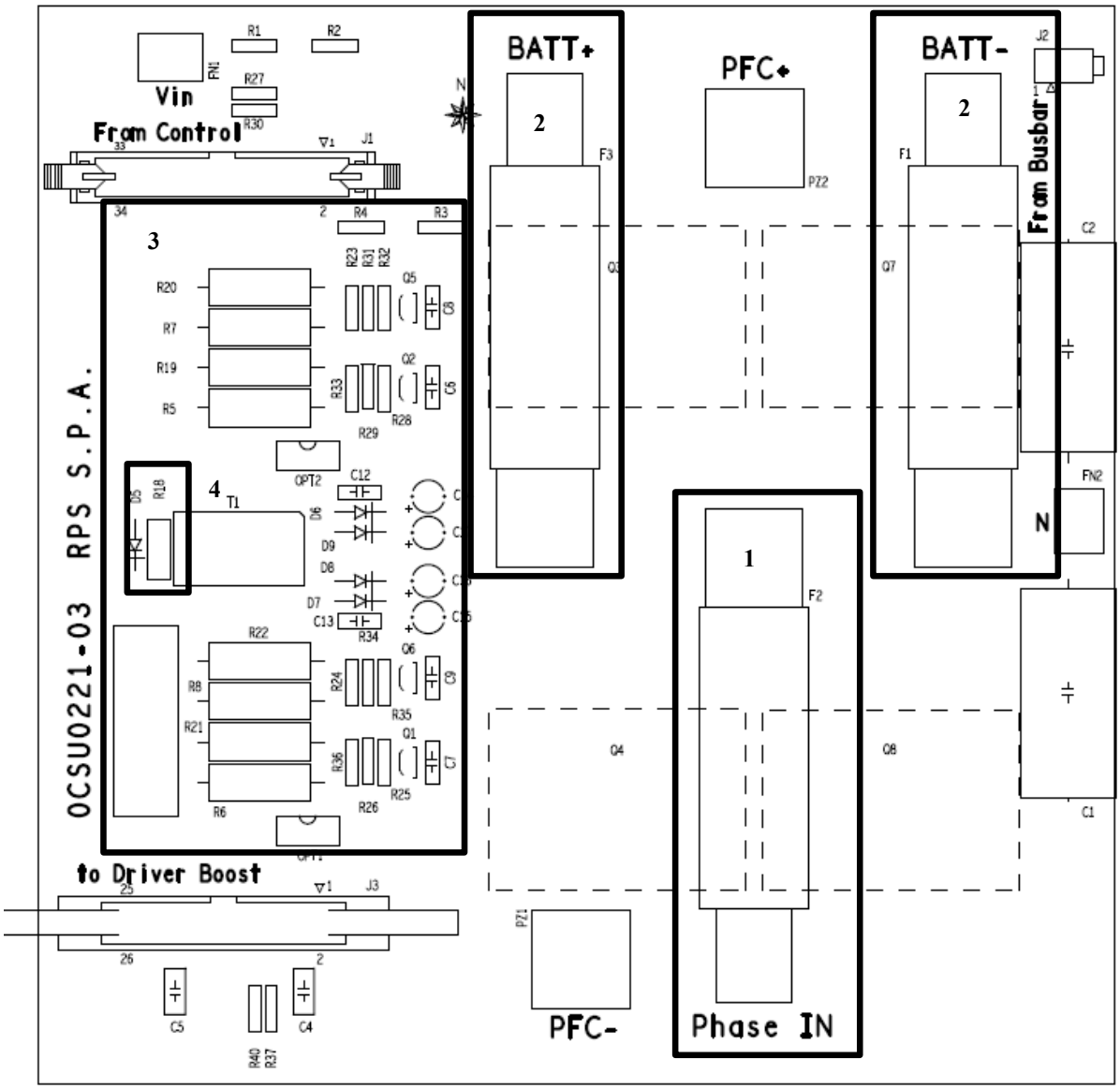
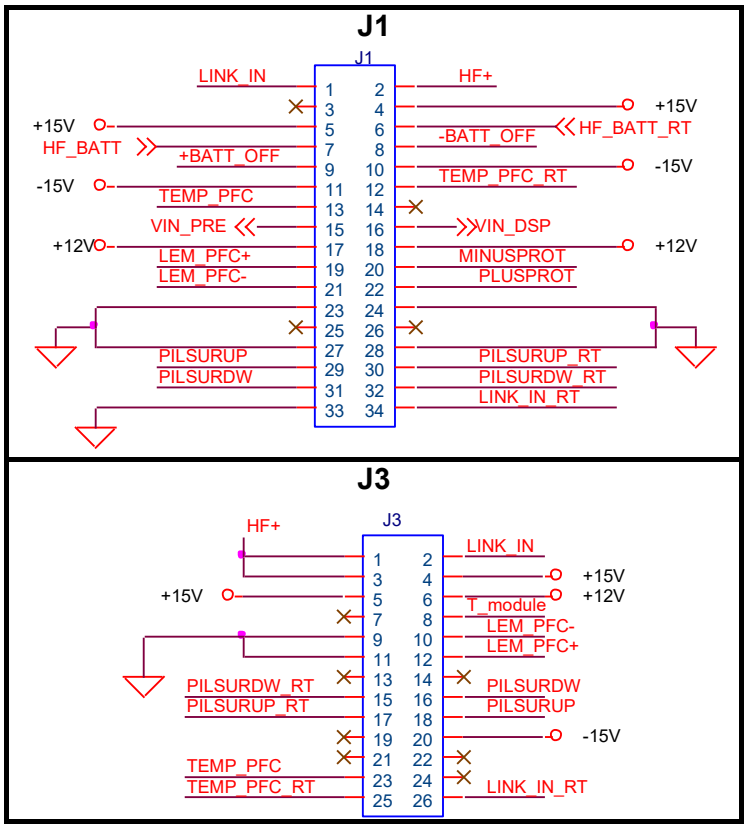


Fig. 28

Connector	Description	Note
J1	Flat connector for measures and HF signal	From J17 control board B0122
J3	Flat connector to drive the module booster IGBT	To J9 booster signal board B0210
PZ1	Connection for booster down	To booster capacitor down
PZ2	Connection for booster up	To booster capacitor up
FN1		From input capacitor
FN2		From neutral bar


J1
J1
LINK_IN
HF+
+15V
+15V
HF_BATT
HF_BATT_RT
+BATT_OFF
-BATT_OFF
-15V
TEMP_PFC_RT
-15V
TEMP_PFC
VIN_PRE
VIN_DSP
+12V
+12V
LEM_PFC+
MINUSPROT
LEM_PFC-
PLUSPROT
PILSURUP
PILSURUP_RT
PILSURDW
PILSURDW_RT
LINK_IN_RT
J3
J3
HF+
LINK_IN
+15V
+15V
+12V
T_module
LEM_PFC-
LEM_PFC+
PILSURDW_RT
PILSURUP_RT
PILSURDW
PILSURUP
-15V
TEMP_PFC
TEMP_PFC_RT
LINK_IN_RT

5.17 BUSBAR BOARD (B0222)

Version:
B0222-01. DC Capacitors Card SATURN 125

In the board there are:

1) 2 dc capacitor for positive BUS
2) 2 dc capacitor for negative BUS
3) Bus voltage reading for overvoltage protection (only PH2)

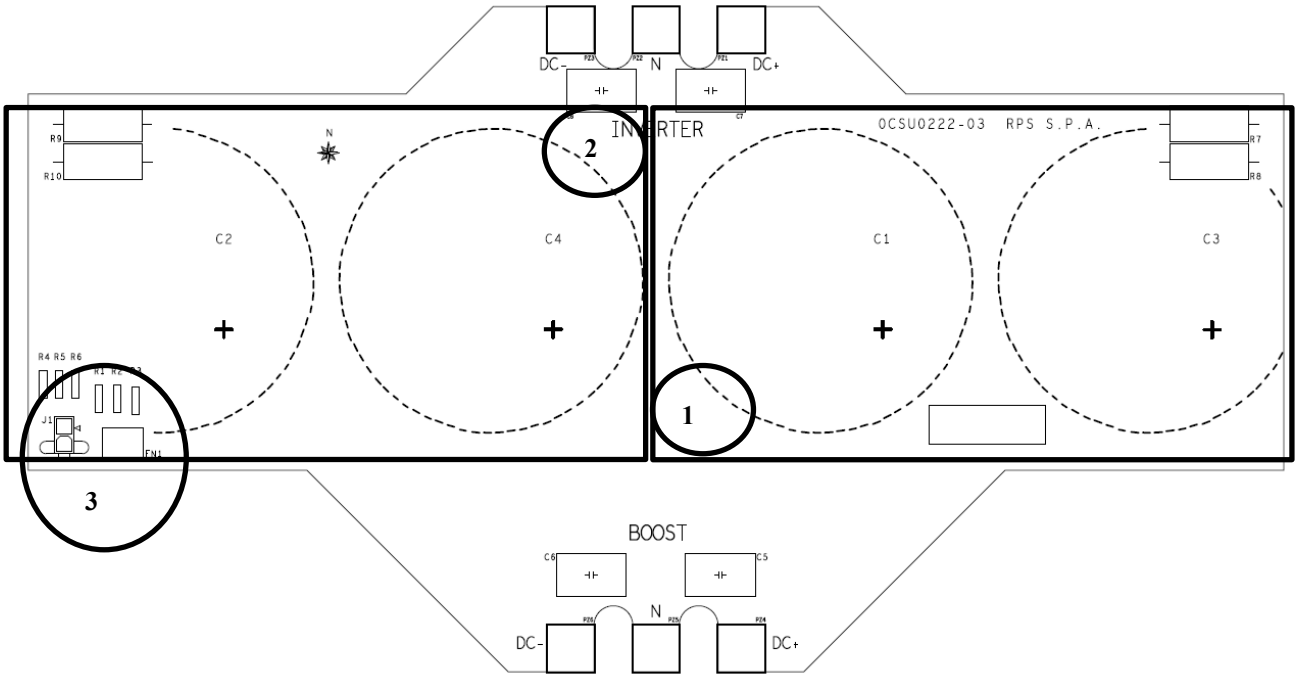


Fig. 29

Connector	Description	Note
PZ1		To inverter module DC+
PZ2		To inverter module Neutral
PZ3		To inverter module DC-
PZ4		From booster module DC+
PZ5		From booster module Neutral
PZ6		From booster module DC-
J1		Voltage reading for overvoltage bus protection (only PH2)
FN1		Vbus+ wire for overvoltage protection (only PH2)

6 AUXILIARY POWER SUPPLY

6.1 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 (B0084).

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.

6.2 15V – LEM POWER SUPPLY

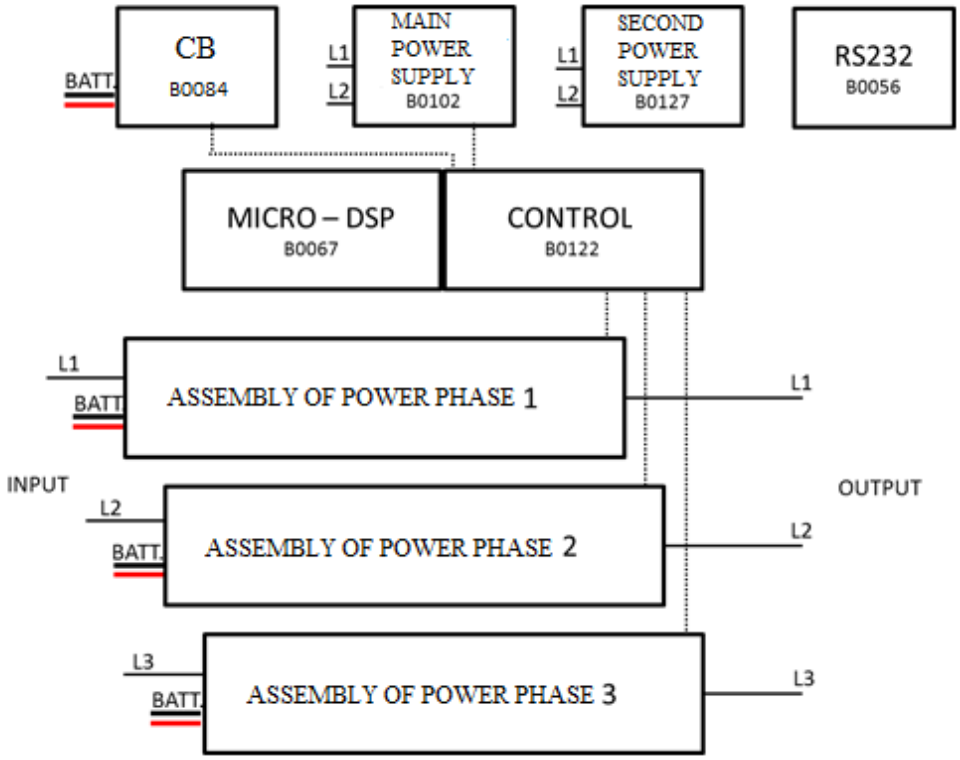


Fig. 30

6.3 12V POWER SUPPLY – ANALOGUE PART OF CONTROL BOARD

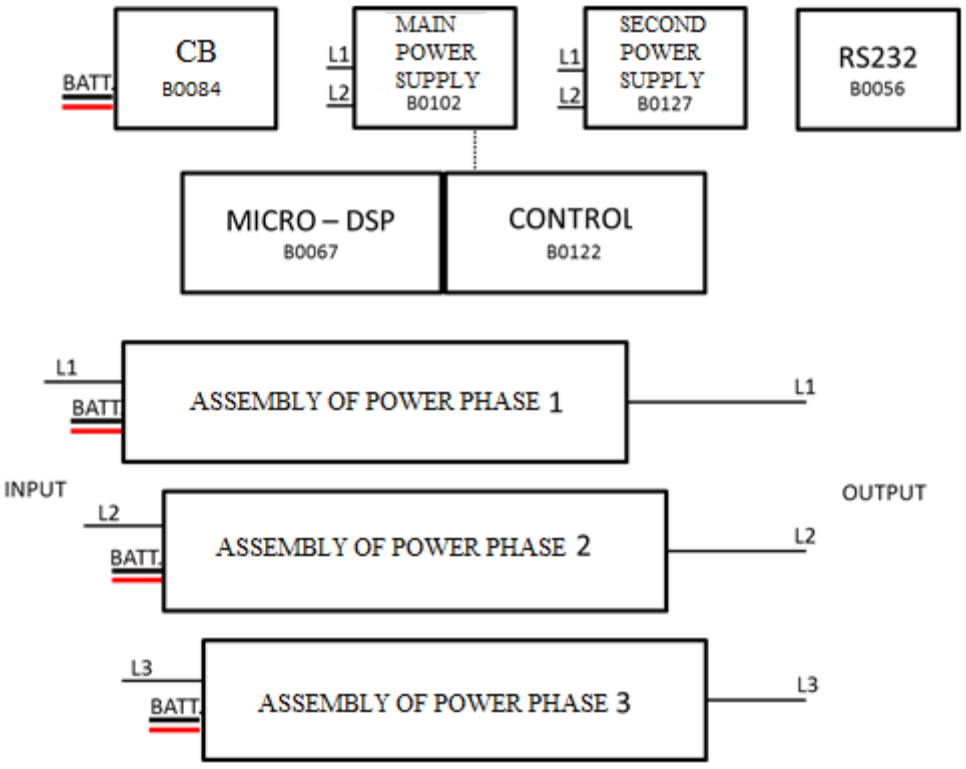


Fig. 31

6.4 24V POWER SUPPLY FOR FANS (regulated)

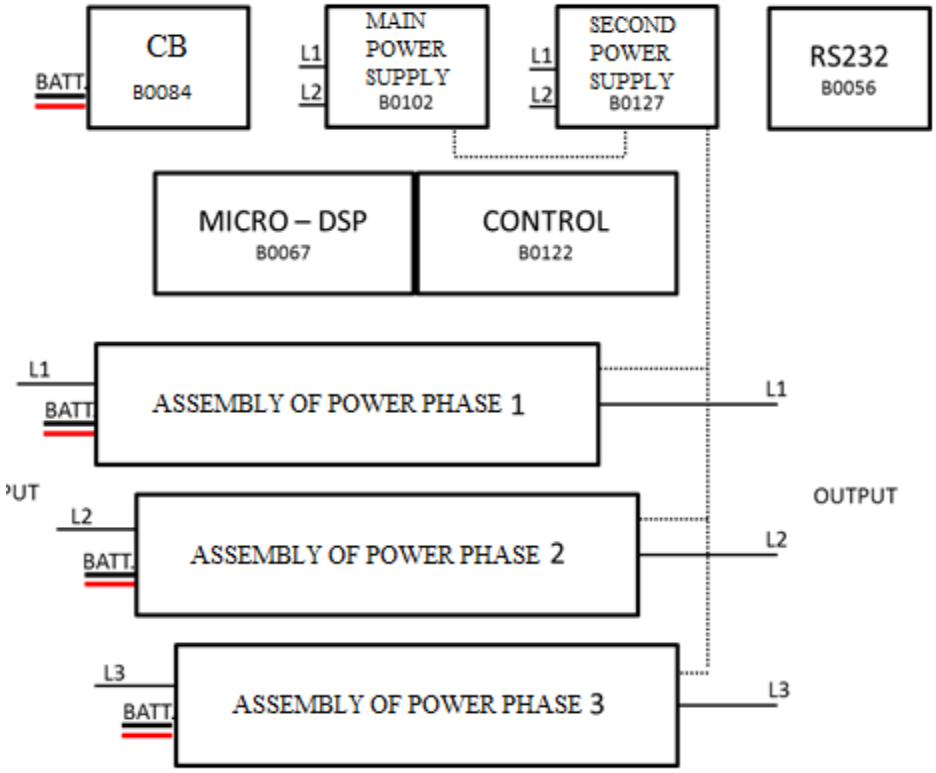
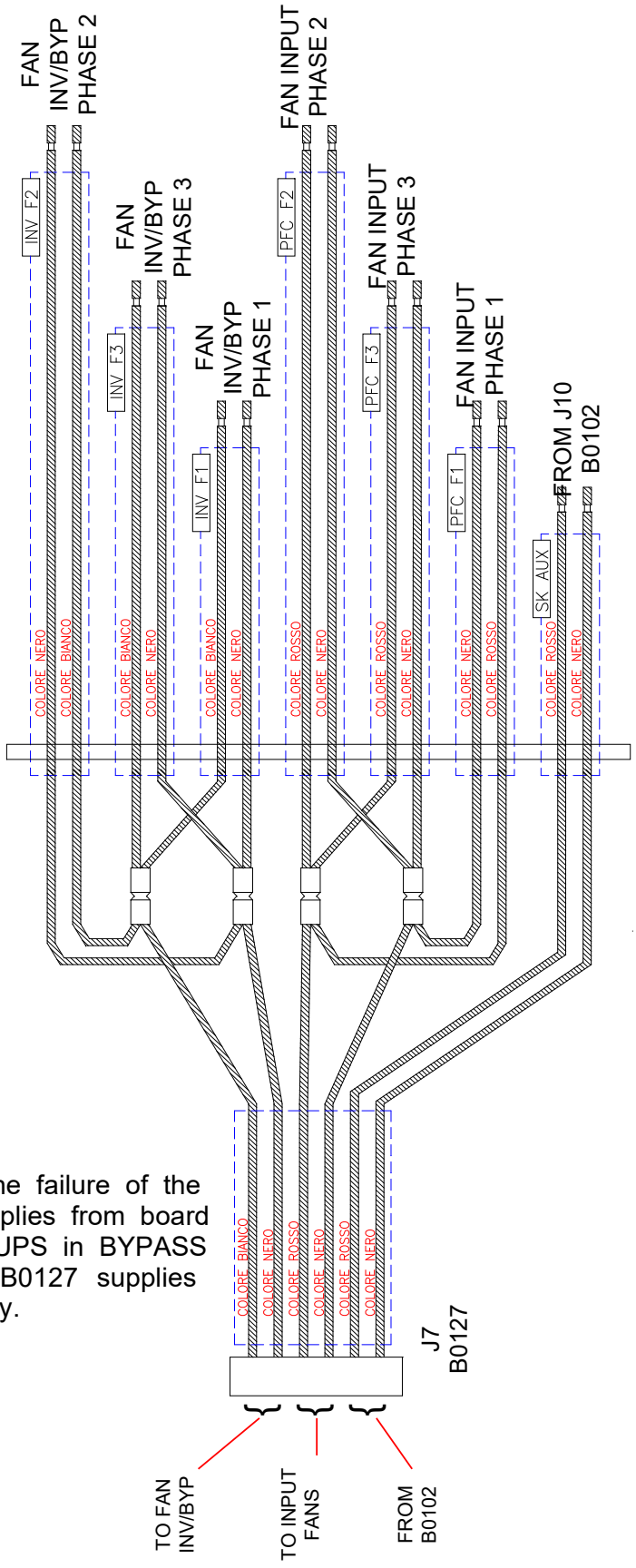


Fig. 32

6.4.1 FAN POWER SUPPLY CONNECTION

The 24Vdc power
supplies board B01(
from here to the indi



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.

Fig. 33

6.5 24V EMERGENCY POWER SUPPLY FOR FANS (fault B0102)

NOTE: only the output heatsink fans are supplied.

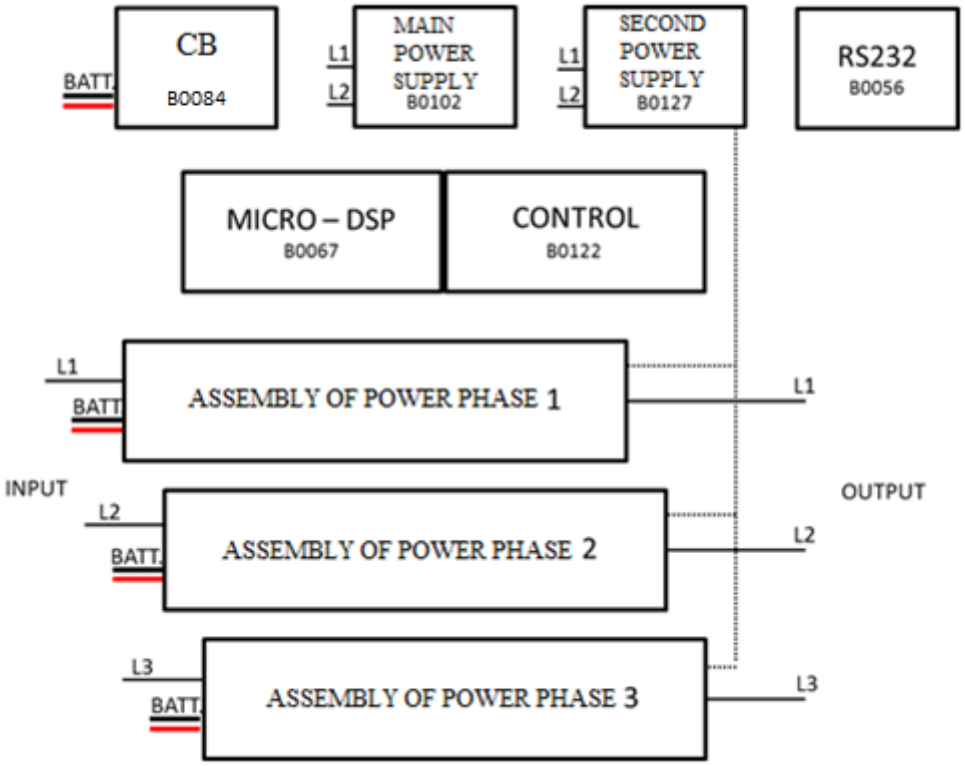


Fig. 34

6.6 HF 50KHz POWER SUPPLY FOR BATTERY AND BYPASS SCR

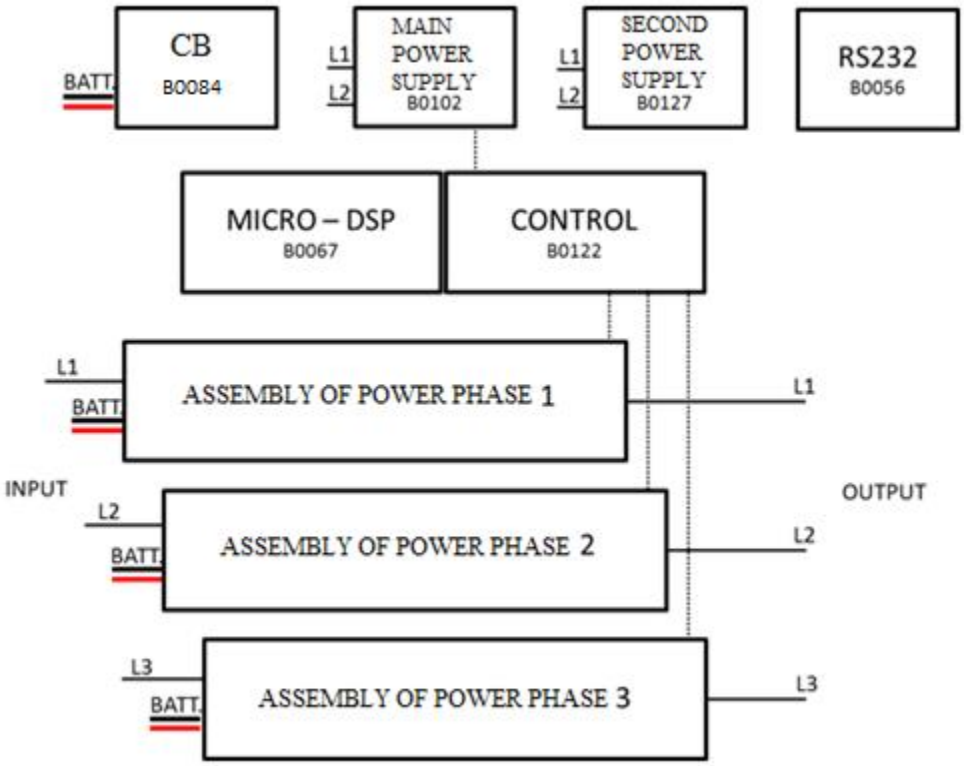


Fig. 35

6.7 HF 100KHz POWER SUPPLY FOR POWER STAGES AND RS232

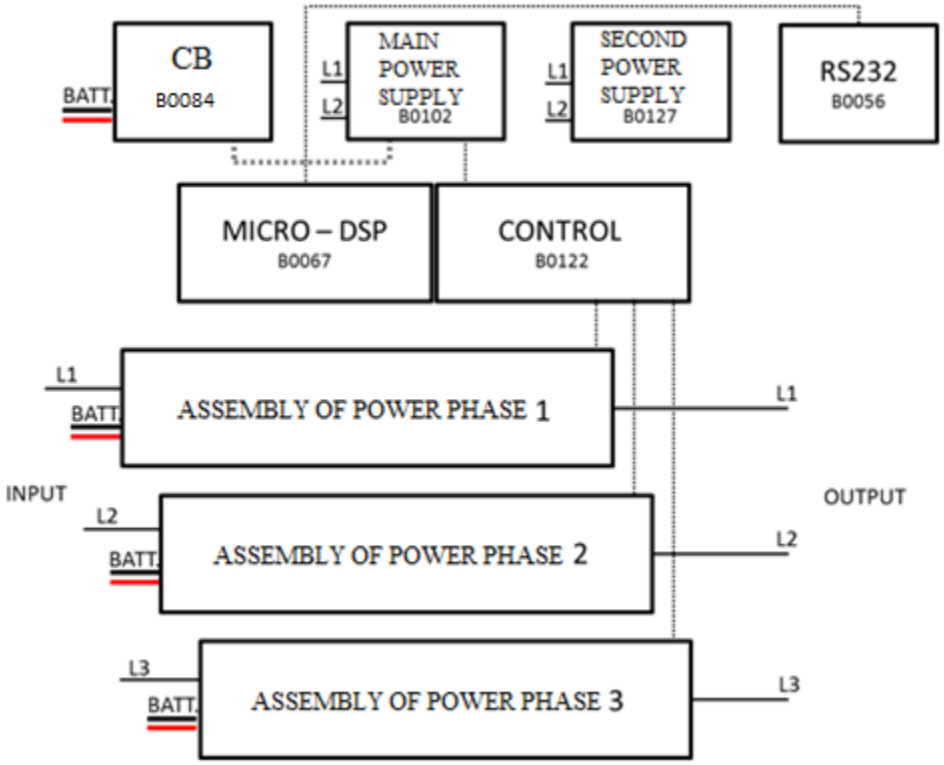


Fig. 36

7 LOCK FOR POWER SUPPLY FAILURE

7.1 “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.

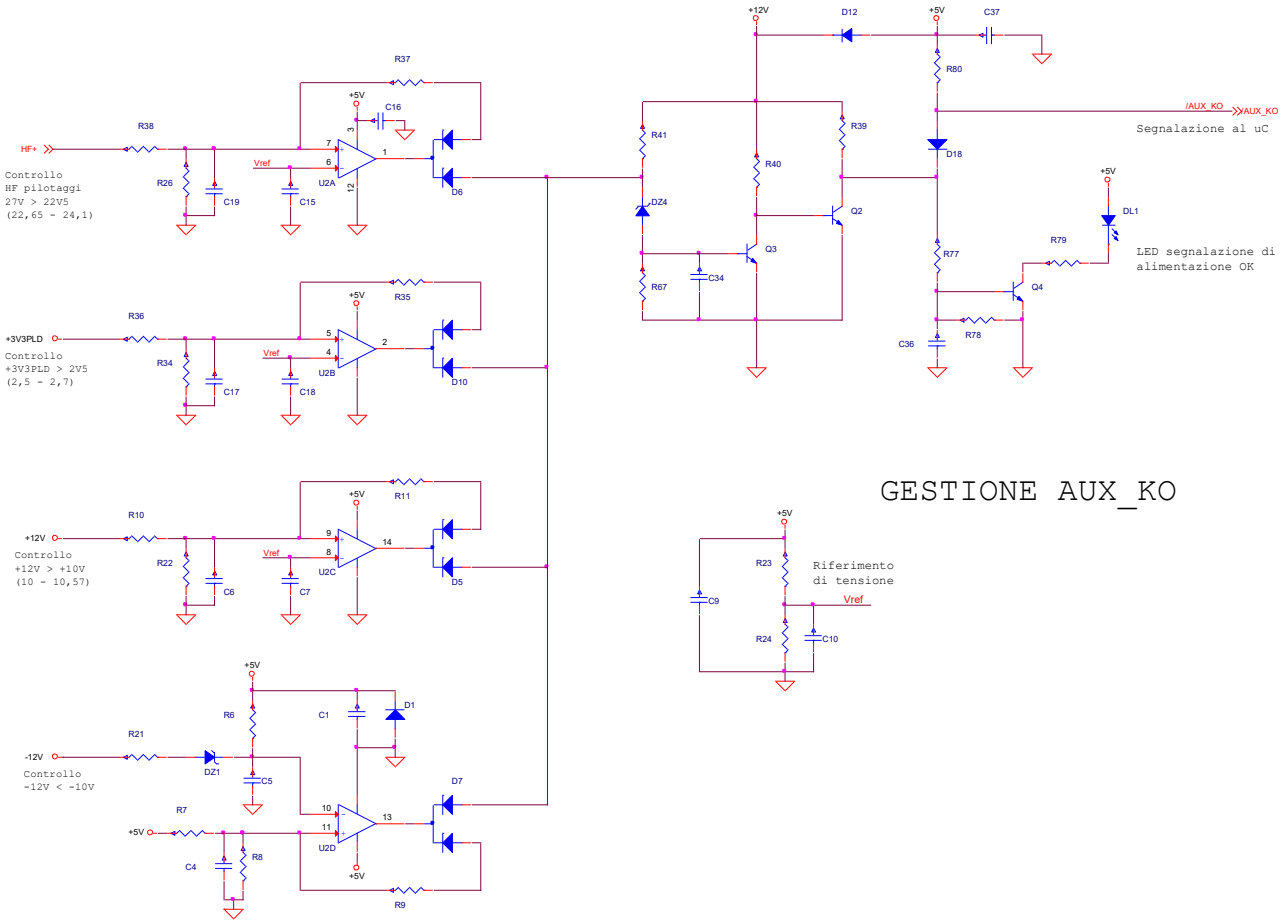


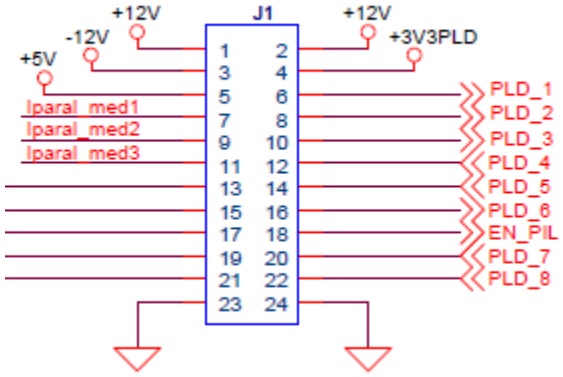
Fig. 37

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).

7.2 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



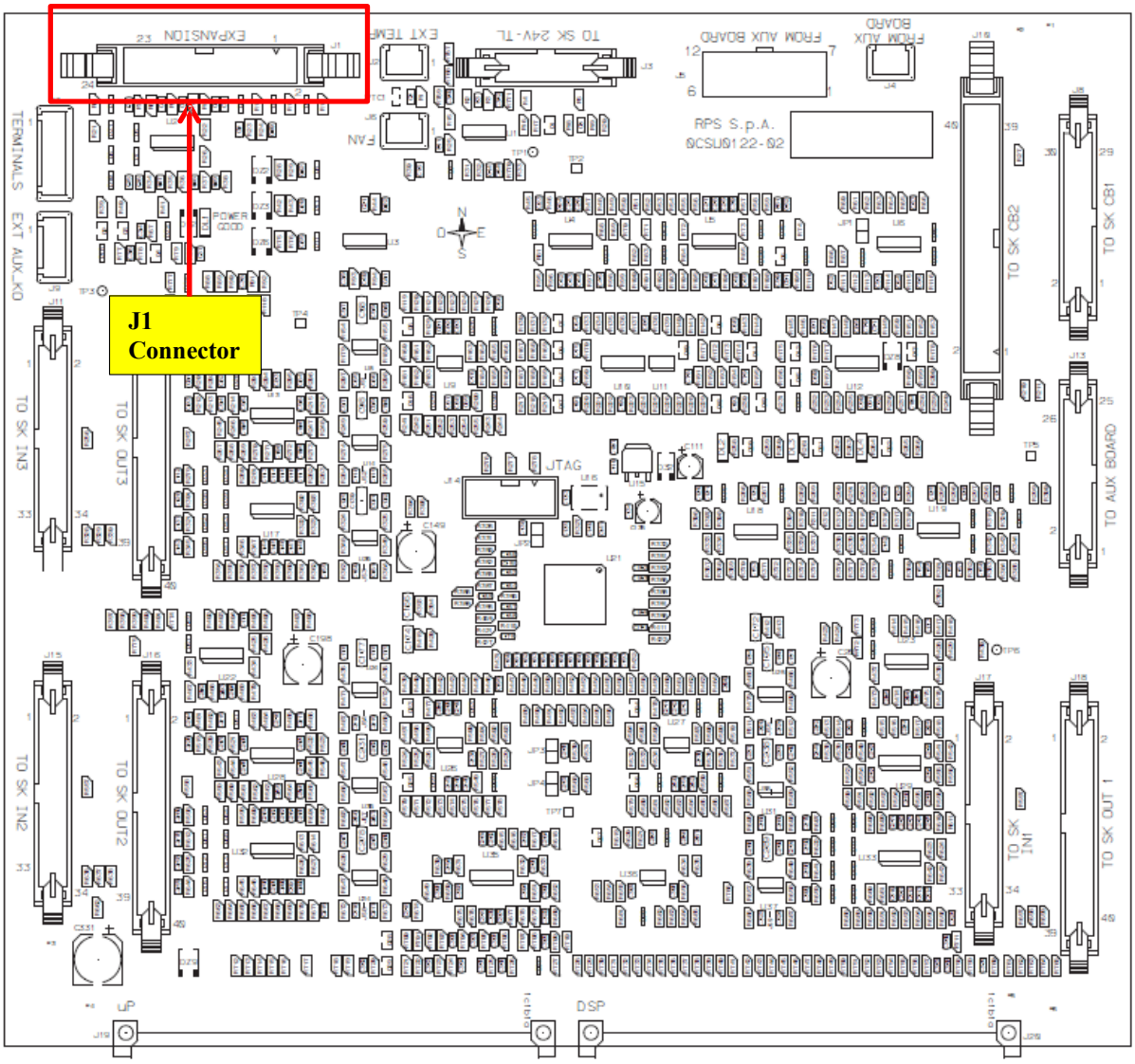


Fig. 38

7.3 MAIN POWER SUPPLY UNIT FAILURE

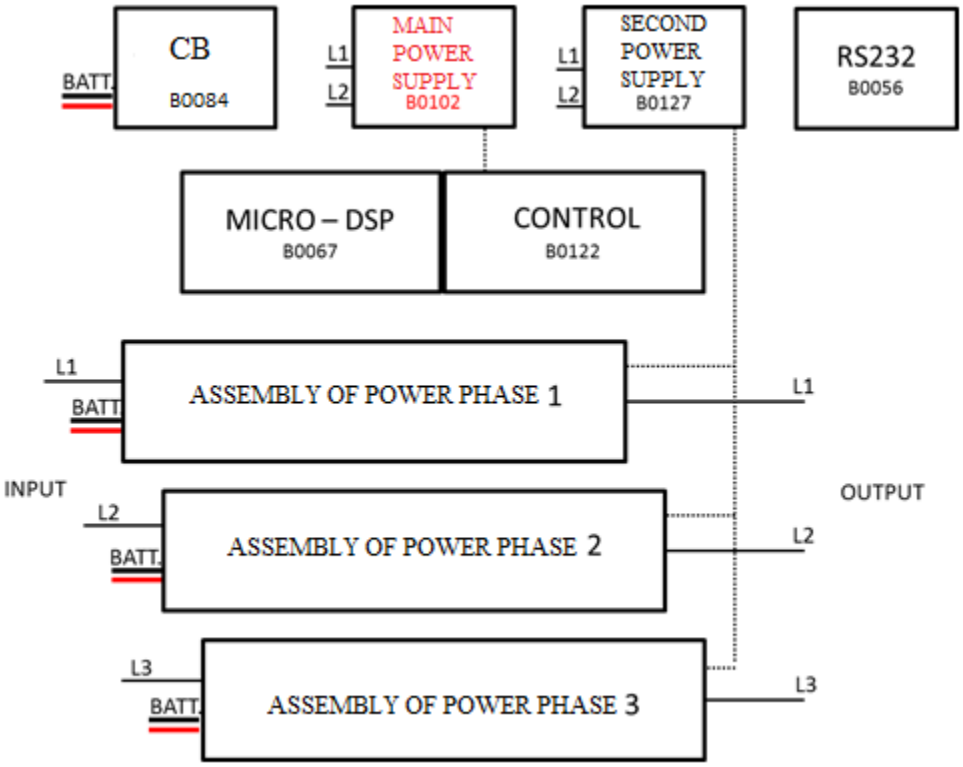


Fig. 39

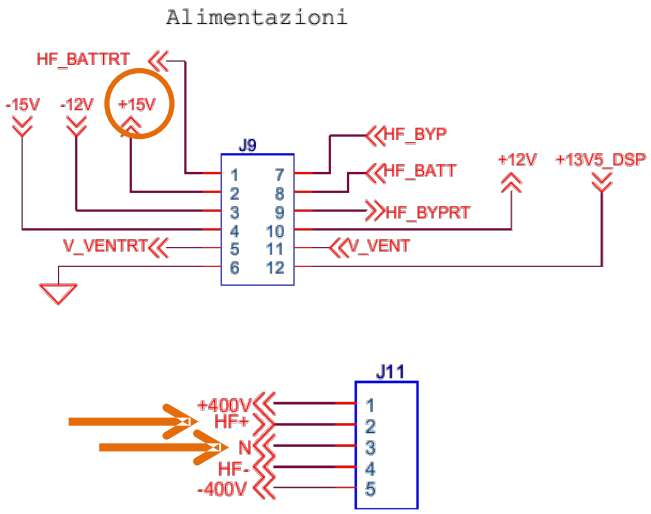
OBSERVATIONS

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.

Note: Verify connection between GND and NEUTRAL using multimeter. Put one probe on TP2 (GND) of B0122 and the other on J8 (Neutral) of B0127.

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.



7.4 MICRO DSP / CONTROL BOARD FAILURE

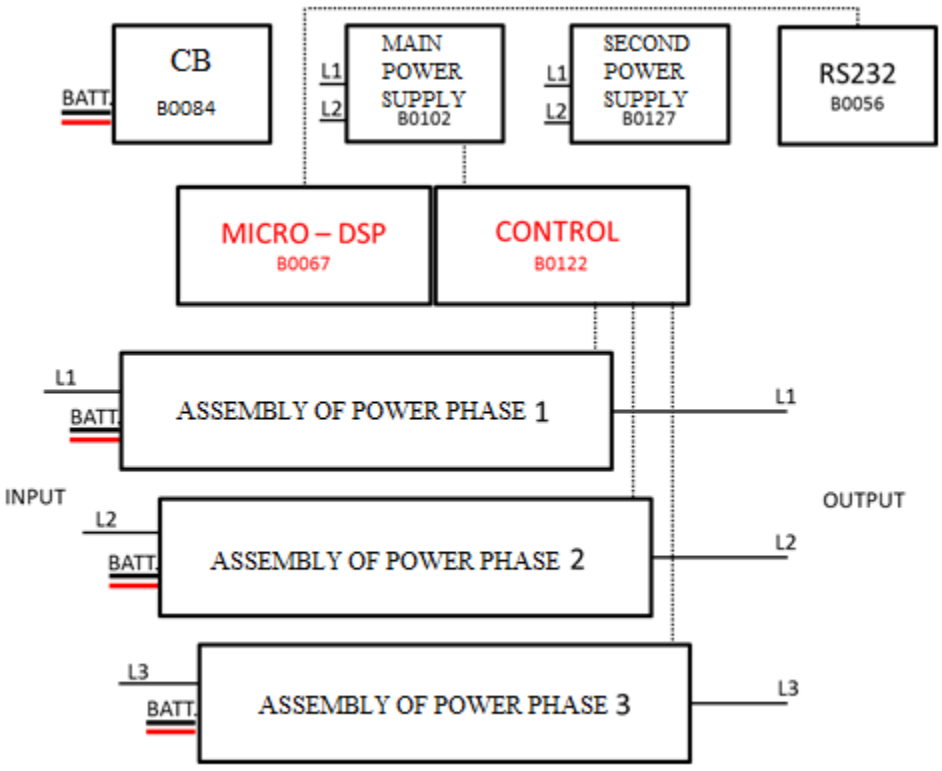


Fig. 40

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 monitoring.

7.5 BOARD RS232 FAILURE

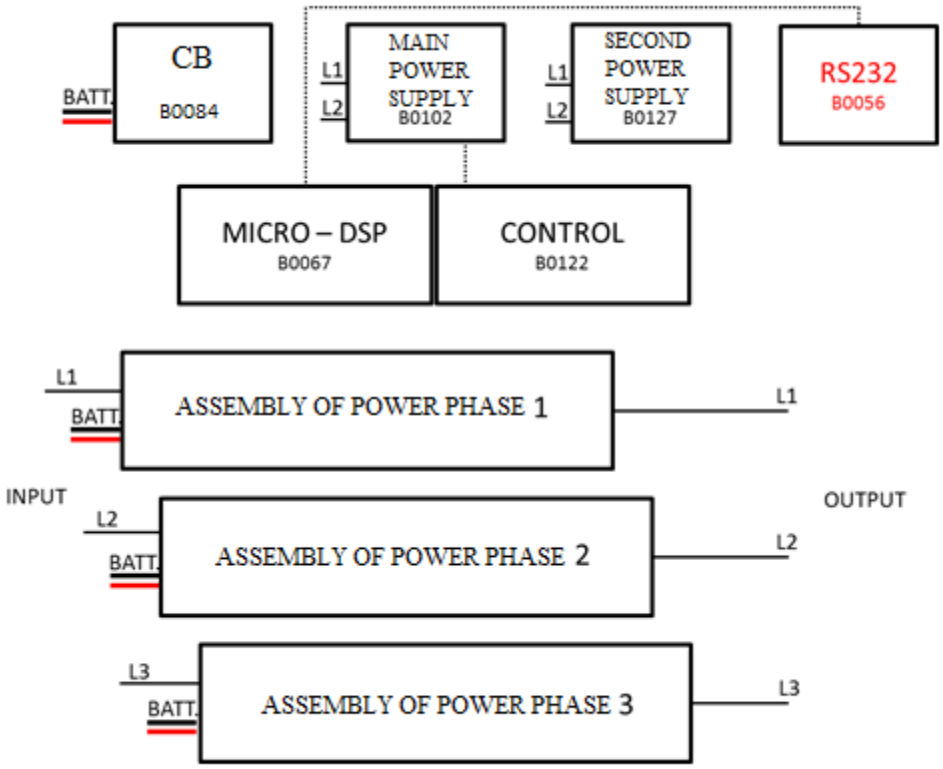


Fig. 41

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.

7.6 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.

8 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.

8.1 BOOST MODULE TEST

Based on the layout of following pictures (module and pins layout), 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.

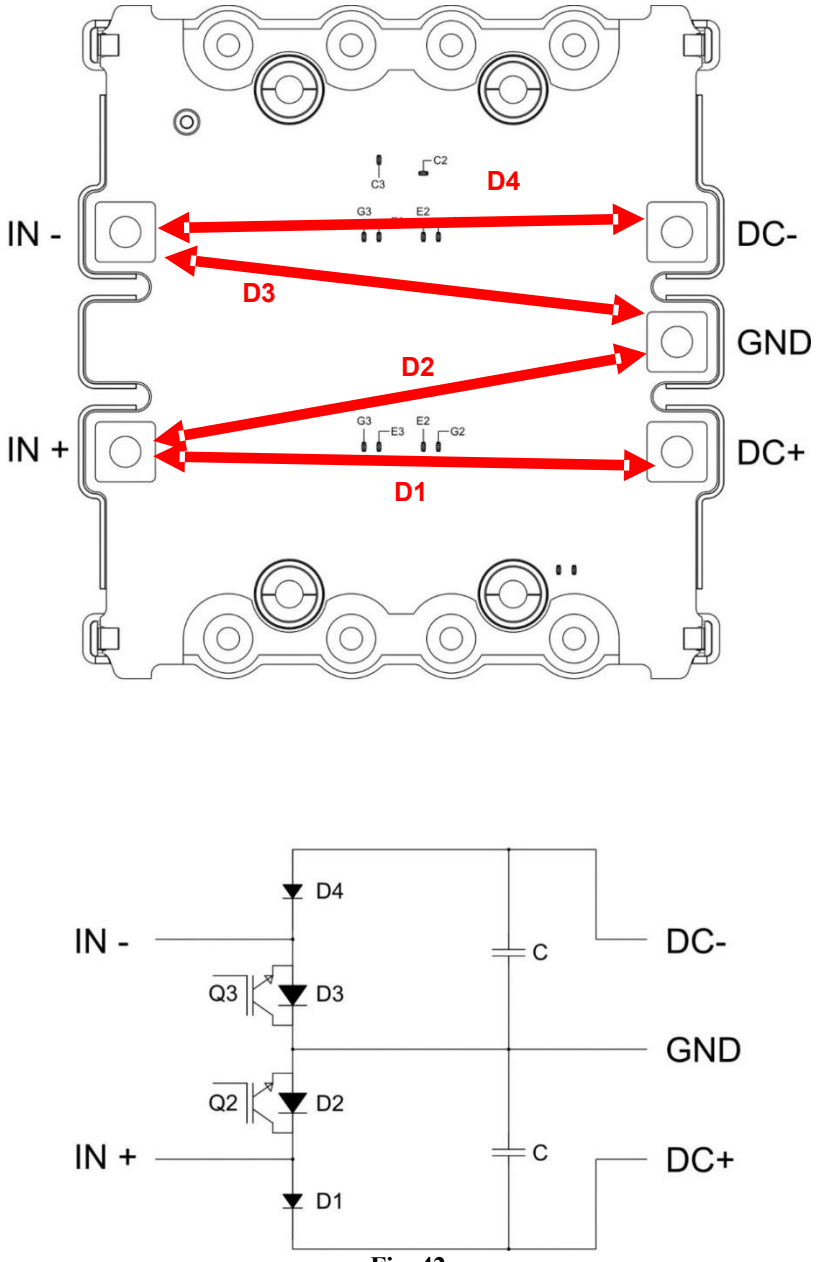


Fig. 42

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).

8.2 INVERTER MODULE TEST

Based on the layout of following pictures (module and pins layout), 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.

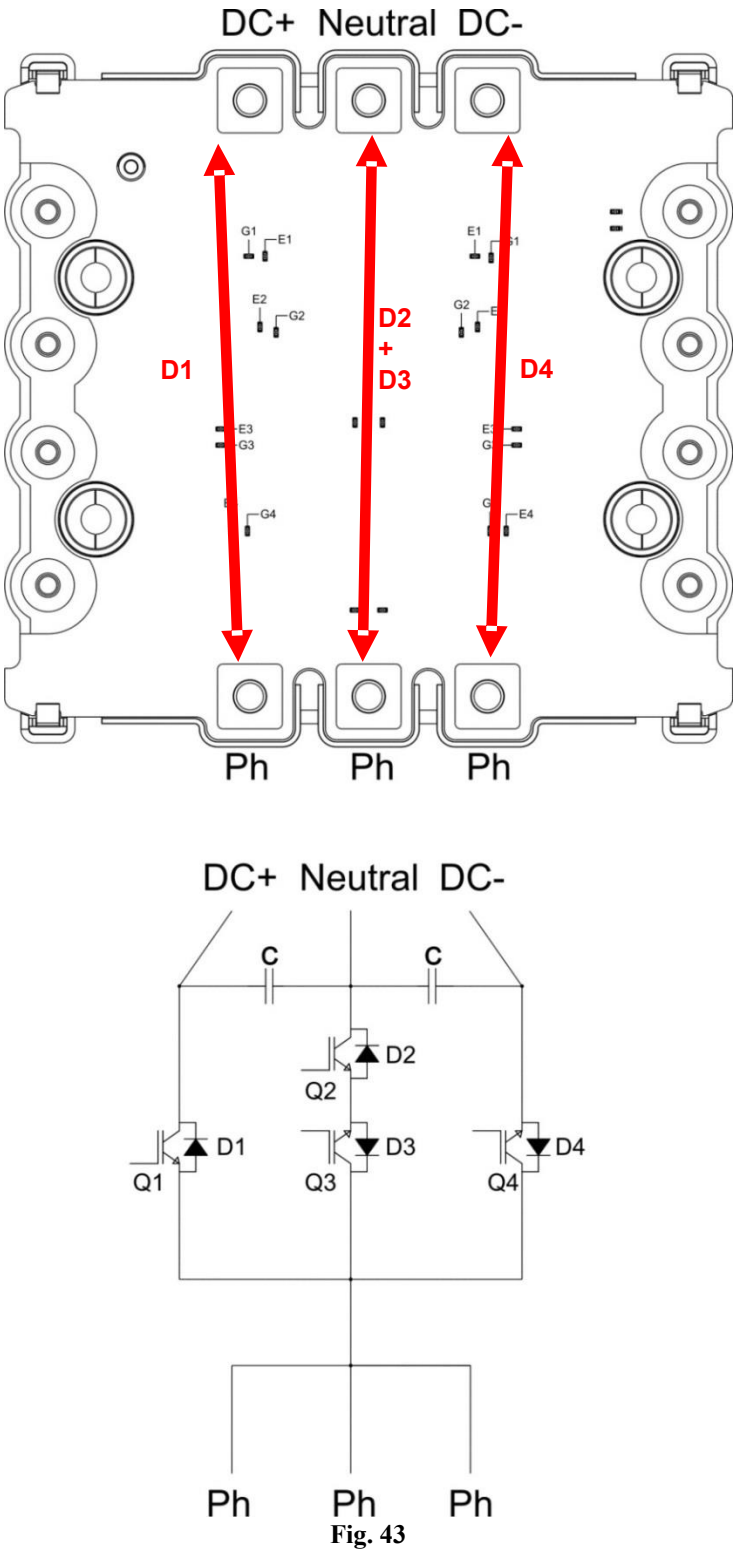


Fig. 43

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).

8.3 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.
This component is the input stage with rectifier diodes and battery SCR in the Semitop module on board B0221 (4 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.

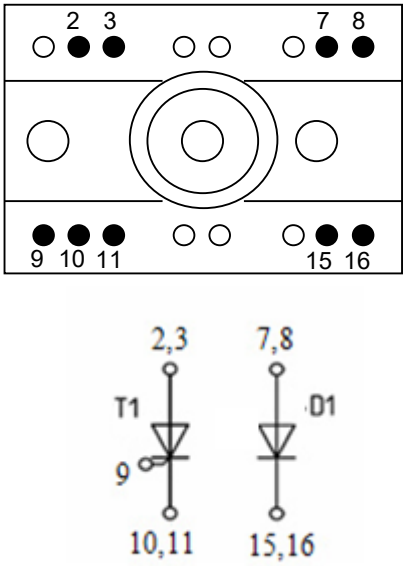


Fig. 44

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

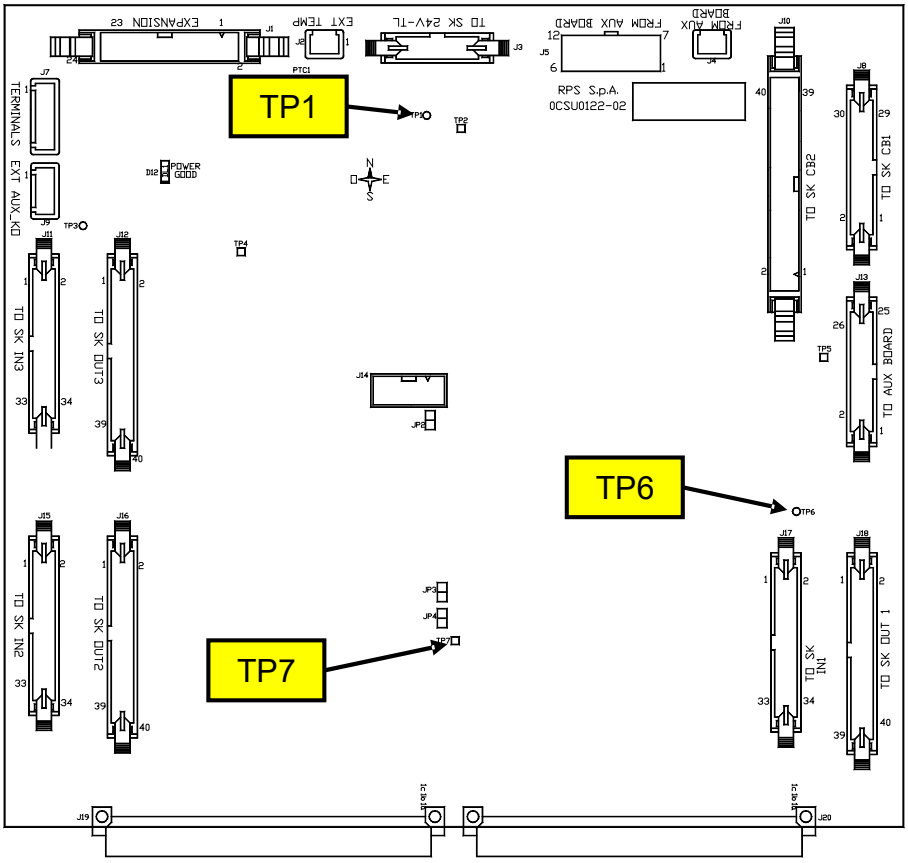
8.4 CABLE CONNECTIONS TEST (LINK FAIL L02)

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

- Resistance within the range of 0-15Ω between test points TP1 and TP6
- Resistance within the range of 1-2kΩ 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.

If Link signal is correctly closed, with UPS in standby, there must be 4.5V between TP6 and TP7 and also between TP1 and TP7.



9 SERVICE OPERATIONS ON THE UPS

9.1 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 8 screws; see Fig. 46. 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 4 screws; see Fig. 46 .

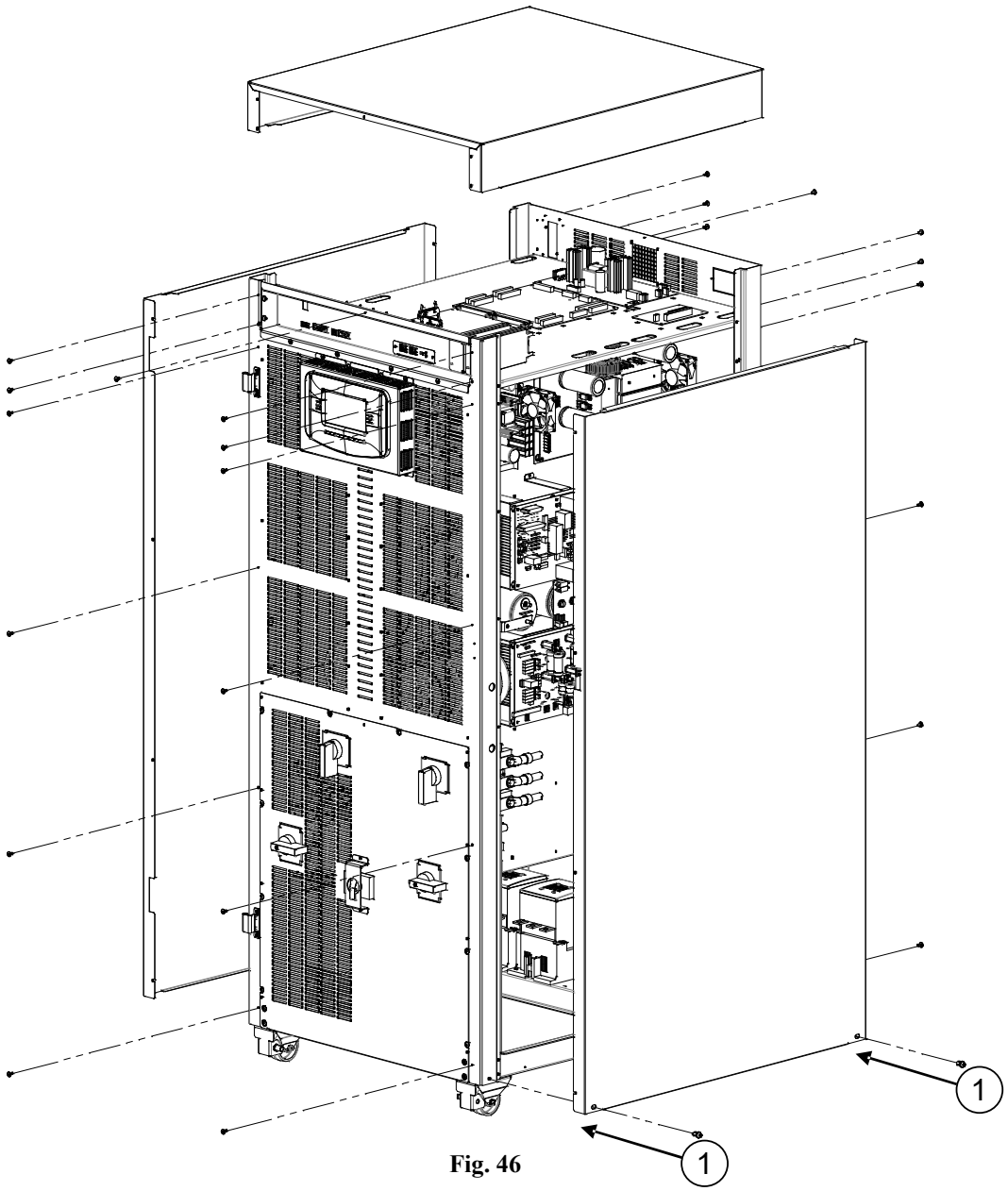


Fig. 46

9.2 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

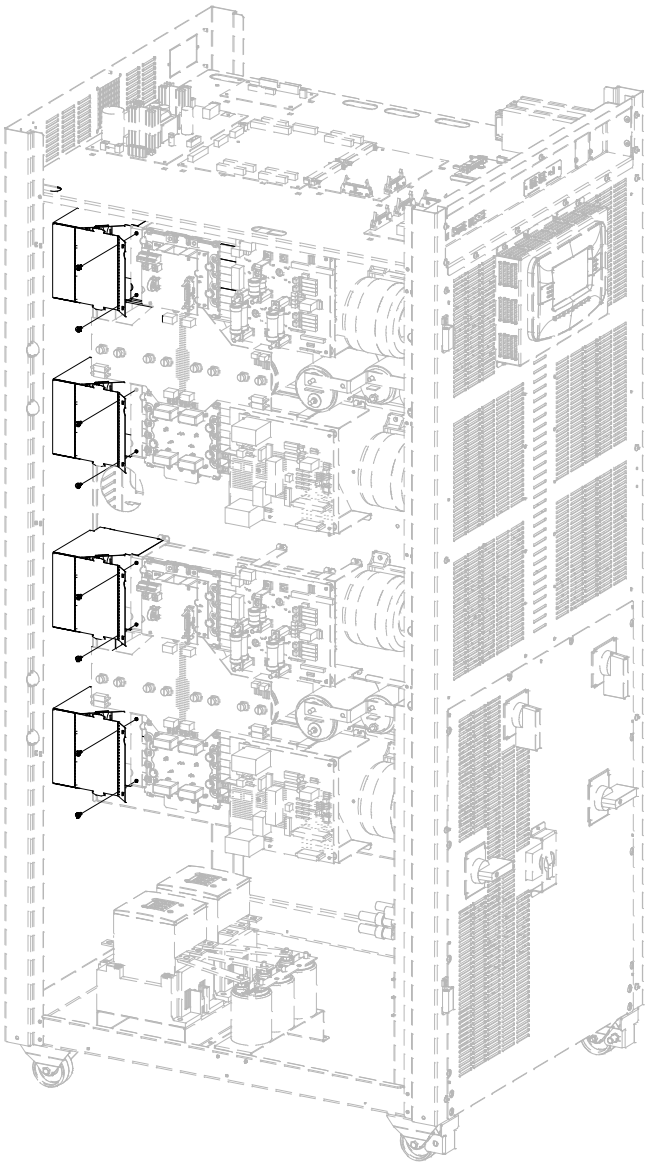


Fig. 47

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. 48 and Fig. 49 for the positions of fastening screws

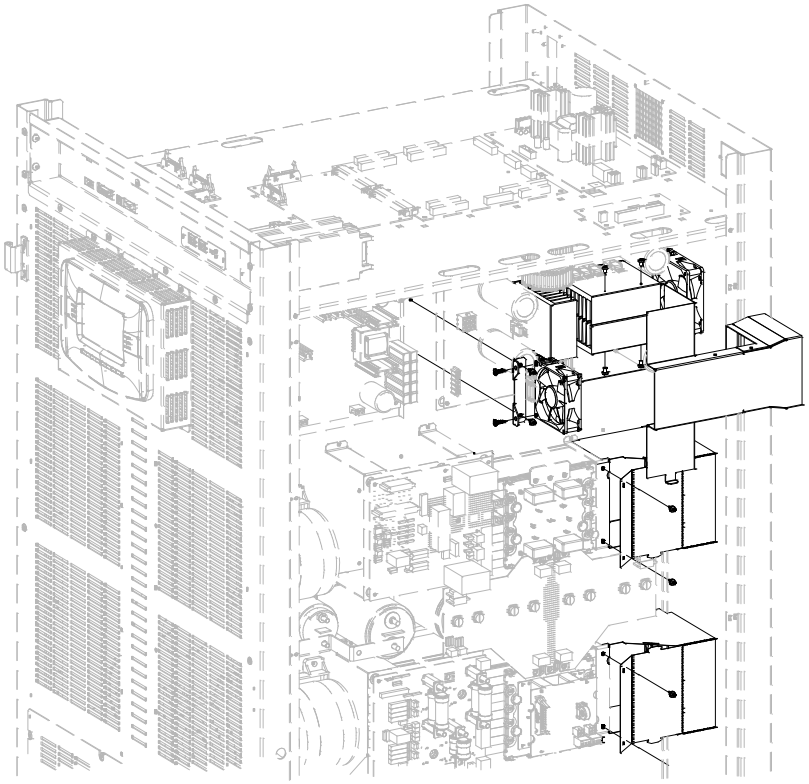


Fig. 48

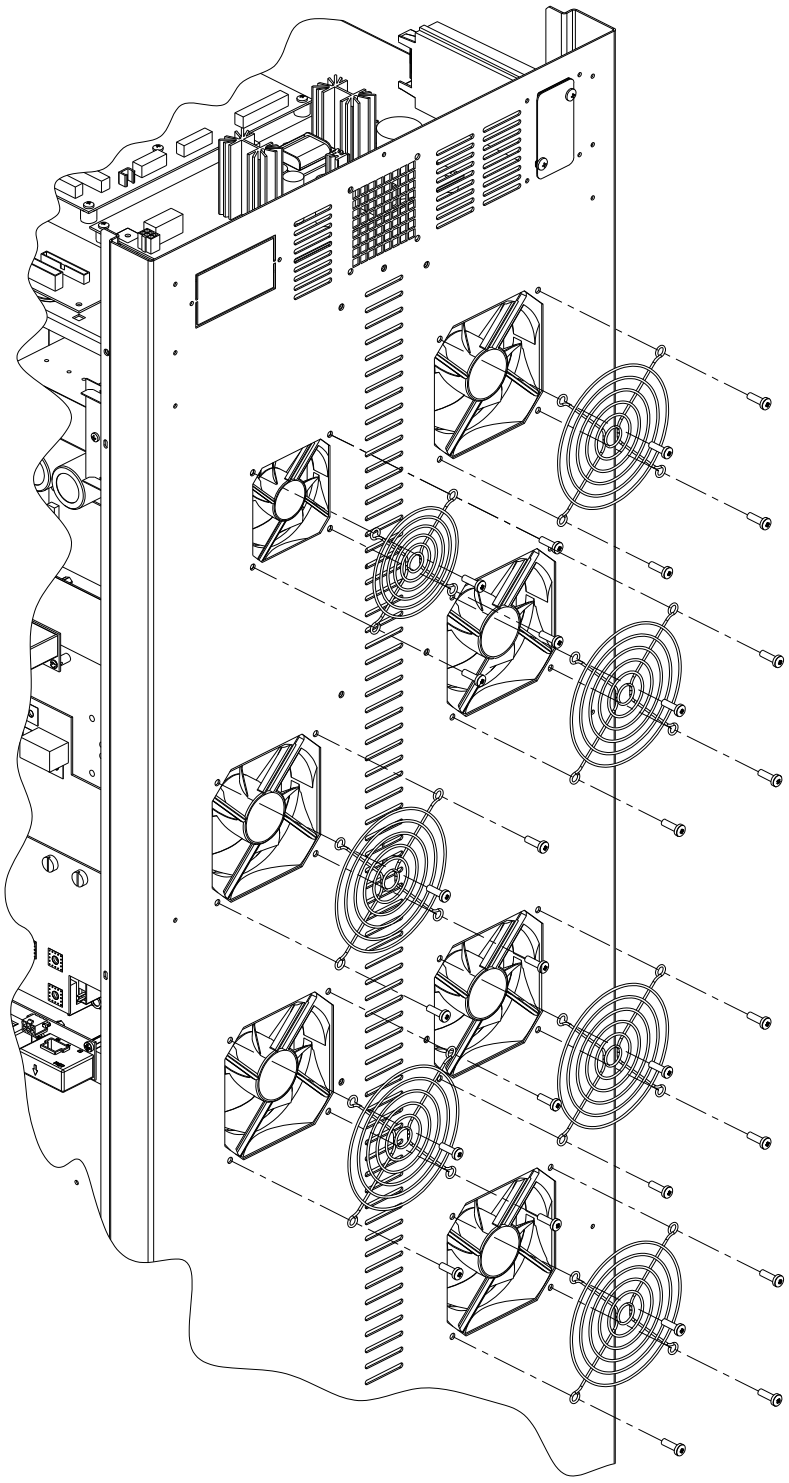


Fig. 49

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

9.3 REPLACING THE INPUT FILTERSBOARD (B0133-06.)

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-**06** (SATURN 125);
6) Secure the board to the casing by tightening the fastening screws

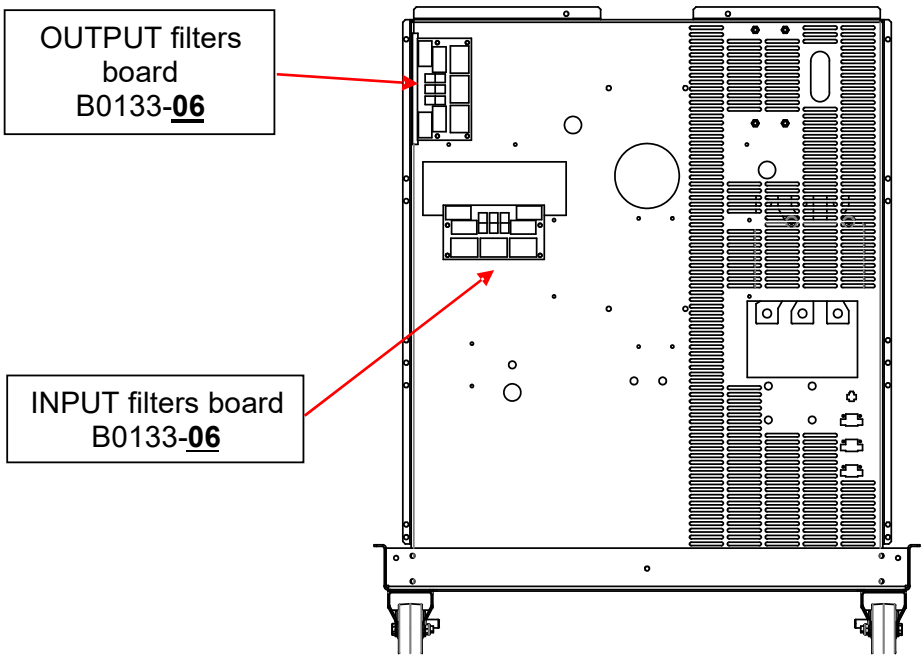
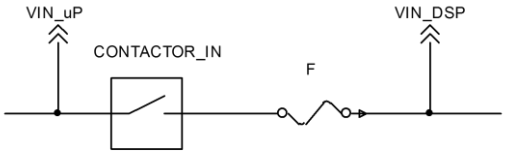


Fig. 50

10 MAP OF MAIN READINGS

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

10.1 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 B0221 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	
	B0221	FN1	FN1	FN1	
	B0221	R1	R1	R1	150 kOhm
->	B0221	R2	R2	R2	150 kOhm
	B0221	J1-15	J1-15	J1-15	
	Flat Cable	||	||	||	
	B0221	J17-15	J15-15	J11-15	
->	B0221	R597	R557	R256	1.37 kOhm

(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	
	B0221	F2 (side Q3,Q7)	F2 (side Q3,Q7)	F2 (side Q3,Q7)	
	B0221	R3	R3	R3	150 kOhm
->	B0221	R4	R4	R4	150 kOhm
	B0221	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)

10.2 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:

		Phase 1	Phase 2	Phase 3	Notes
	Fuse	Before	Before	Before	
	B0126	PZ1	PZ1	PZ1	
	B0126	R21	R21	R21	150 kOhm
->	B0126	R20	R20	R20	150 kOhm
	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)

10.3 BATTERY VOLTAGES

The battery voltage readings, measured by the µC and the DSP, are taken at the output of board B0084 (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
	B0084	J9(pin 1-2-3)	J9(pin 7-8-9)	
	B0084	R7	R43	249 kOhm
->	B0084	R8	R44	249 kOhm
	B0084	J6(pin 37)	J6(pin 38)	
	Flat Cable	||	||	
	B0122	J10(pin 37)	J10(pin 38)	
->	B0122	R706	R674	7.15 kOhm

(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
	B0084	J9(pin 1-2-3)	J9(pin 7-8-9)	
	B0084	R2	R47	249 kOhm
->	B0084	R3	R48	249 kOhm
	B0084	J6(pin 39)	J6(pin 40)	
	Flat Cable	||	||	
	B0122	J10(pin 39)	J10(pin 40)	
->	B0122	R711	R760	7.15 kOhm

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

10.4 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)	
	B0126	R9	R9	R9	150 kOhm
->	B0126	R8	R8	R8	100 kOhm
	B0126	J6-37	J6-37	J6-37	
	Flat Cable	||	||	||	
	B0122	J18-37	J16-37	J12-37	
->	B0122	R699	R638	R330	49.9 kOhm

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

10.5 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 kOhm
->	B0126	R14	R14	R14	150 kOhm
	B0126	J6-38	J6-38	J6-38	
	Flat Cable	||	||	||	
	B0122	J18-38	J16-38	J12-38	
->	B0122	R757	R753	R755	887 R

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

10.6 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).

11 STATUS / ALARM CODES

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

12 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.

12.1 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 Self-trigger or breakage of input SCR	B0221	Check for blown diodes and fuses. If necessary replace board B0221 Check whether SCR is broken → replace SCR and fuse. Check Boost diode and replace module if necessary
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 contactor. 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 precharge failed	Short circuit in inverter and/or PFC stages	B0210 B0209	Check boost power module. Replace the affected boards
		Pre-charge diodes faulty	B0102	
		Control logic faulty	B0067 B0122	

F10	Negative branch capacitor precharge failed			
		Input relay voltage out of tolerance values		Check that Vin < 250V
F11	Boost stage fault	PFC stage short circuit	B0221 B0210 B0209	Check IGBT modules → Replace the affected boards
		Control logic faulty	B0067 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	B0215 B0216	Check inverter power module. Replace the affected boards
F15	Sinusoid Phase 2 inverter distorted	Control logic faulty	B0067 B0122	
F16	Sinusoid Phase 3 inverter distorted	Phase-Phase short circuit		Check for short circuit between phases
F17	Inverter stage faulty	Inverter stage blown	B0215 B0216	Check inverter power module. Replace the affected boards
		Control logic faulty	B0067 B0122	
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 battery charger is automatically disabled
F23	Overload at output	Excessive load		Reduce the load
		Output power reading faulty	B0126 B0067 B0122	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	B0067 B0122 B0127	Replace the affected boards
		Contactor with damaged contacts		Replace the Contactor
F29 F30 F31	Phase 1 output fuse blown or output relay blocked (does not close) Phase 2 output fuse blown or output relay blocked (does not close) Phase 3 output fuse blown or output relay blocked (does not close)	Failure in relay control circuit	B0067 B0122 B0127	Replace the affected boards
		Output fuse blown	B0126	Replace blown output fuse
		Contactor with damaged contacts		Replace the Contactor
F32	Battery charger stage faulty	Output voltage from battery charger is missing in one of the two battery branches	B0084	Check the flat cable connections and if necessary replace the affected boards
		battery charger control and feedback signals faulty	B0084 B0067 B0122	
F33	Battery Measures Error	Difference of >5V between uP/DSP readings	B0084 B0067 B0122	Check the flat cable connections and if necessary replace the affected boards
F34	Heatsink overheated	Cooling fans faulty	B0102	Check for short circuit at fans → replace fans Verify DC voltage Check R194 on board B0102, check voltage at connector J10, check fan power supply link → replace board B0102
		Temperature readings faulty	B0067 B0122	Check the interconnections between the affected boards, if necessary replace the boards

		Temperature sensor faulty		Check temperature sensors. Check PinStrip connections on Power module.
F37	Battery charger overheated	Battery charger cooling fan faulty	B0084	Check that the fitted fan is correct (12V) → replace fan Check for short circuit at the fan → replace fan Check voltage at connector Fx → replace board B0084
		Incorrect duct installation	B0084	Check that the duct secured to board B0084 is correctly installed
		Temperature readings faulty	B0084 B0067 B0122	Check the interconnections between the affected boards, if necessary replace the boards
		Temperature sensor faulty	B0084	Perform sensor resistance measurement on the board: PTC1, PTC2, PTC3. If the sensor is OK, res = 1 KOHM → replace B0084 board
F39	VDC BUS MEASURES ERROR	BUS DC measure difference uP/DSP >20V	B0102 B0067 B0122	Check the interconnections between the affected boards, if necessary replace the boards
F42 F43 F44	BOOST 1 battery fuses blown BOOST 2 battery fuses blown BOOST 3 battery fuses blown	Battery SCR blown	B0221	Check battery SCR (semitop)
F45	Parallel link Open	Single point parallel link failure	B0085	Check the interconnections between the affected boards, if necessary replace the boards
F46	PARAL. R_BYP- LINE FAULT	Bypass call Request not confirmed in HW		
F47	PARAL. SYNC. LINE FAULT	Frequency message different to the HW frequency		

12.2 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 → 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 L04 L05	Phase 1 input fuse blown Phase 2 input fuse blown Phase 3 input fuse blown	Input diode blown. Self-trigger or breakage of input SCR	B0221 B0209 B0210	Check if diode is blown → replace the fuse. Check Boost module. Check whether SCR is broken → replace SCR and fuse.
L06 L07	Overvoltage at positive BOOST stage Overvoltage at negative 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
		Inverter stage short circuit		Check inverter stage
L08 L09	Undervoltage at positive BOOST stage Undervoltage at negative BOOST stage	The UPS cannot work in battery mode	B0221	Check the battery boost fuses and battery SCR
		Control logic faulty	B0067 B0122	Check the connections between the boards and if necessary replace them
		No mains power and the batteries are disconnected		Check the battery box connection and/or battery box fuses
		Boost stage blown	B0209 B0210	Check PFC module and if necessary replace it
		Inverter stage blown	B0215 B0216	Check inverter module and if necessary replace it
L10	Static bypass switch faulty	Bypass SCR in short circuit	B0126	Check bypass SCR and if necessary replace it

L11 L12 L13	Bypass output blocked L1 Bypass output blocked L2 Bypass output blocked L3	Bypass SCR cannot be closed	B0126 B0102 B0122	Check bypass SCR and if necessary replace it.
L14 L15 L16	Overvoltage at phase 1 inverter Overvoltage at phase 2 inverter Overvoltage at phase 3 inverter	Inverter output capacitor faulty		Check the inverter output capacitor and if necessary replace it
		Inverter operating logic faulty	B0067 B0122	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 short circuit between the output phases
		Control logic faulty	B0067 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	B0126	Check the inverter module for blown components → replace module if necessary
L21	DC voltage at inverter output or Phase 2 inverter sinusoid distorted	Control logic faulty	B0067 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 short circuit at the output
L23	Overload at Phase 1 output	Excessive load		Reduce the load
L24	Overload at Phase 2 output	Output power reading faulty	B0067 B0122 B0126	Replace the affected boards
L25	Overload at Phase 3 output	Error in output voltage setting		Set the correct output voltage
L26	Short circuit at Phase 1 output	Short circuit at neutral phase		Check for the presence of short circuit between the phases and

L27 L28	Short circuit at Phase 2 output Short circuit at Phase 3 output	output		neutral at the output
L32	PARAL. SYNC. ERROR	HW Sync. Frequency differ from message for 5 cycles	B0085	Occurs only on Slave. Replace the board.
L33	PARAL. SYNC. LINE FAULT	Physical Loss of HW sync. signal	B0085	Occurs only on Slave. Replace the board.
L34	Phase 1 heatsink overheated	Cooling fans faulty	B0102	Check for short circuit at fans → replace fans Check R194 on board B0102, check voltage at connector J10, check fan power supply link → replace board B0102
L35	Phase 2 heatsink overheated	Temperature readings faulty	B0084 B0067 B0122	Check the interconnections between the affected boards, if necessary replace the boards.
L36	Phase 3 heatsink overheated	Temperature sensor faulty	B0216 B0210	Check pin strip connectors (J14 on board B0210 or J9 on board B0216)
L37	Battery charger overheated	Battery charger cooling fan faulty	B0084	Check that the fitted fan is correct (12V) → replace fan Check for short circuit at the fan → replace fan Check voltage at connector J3 → replace board B0084
		Incorrect duct installation	B0084	Check that the duct secured to board B0084 is correctly installed
		Temperature readings faulty	B0084 B0067 B0122	Check the interconnections between the affected boards, if necessary replace the boards
		Temperature sensor faulty	B0084	Perform sensor resistance measurement on the board: PTC1, PTC2, PTC3. If the sensor is OK, res = 1 KOHM → replace B0084 board

L38 L39 L40	Phase 1 heatsink temperature sensor faulty Phase 2 heatsink temperature sensor faulty Phase heatsink temperature sensor faulty	Temperature readings faulty	B0067 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	B0084 B0067 B0122	Check the interconnections between the affected boards, if necessary replace the boards
		Temperature sensor faulty	B0084	Perform sensor resistance measurement on the board: PTC1, PTC2, PTC3. If the sensor is OK, res = 1 KOHM → replace B0084 board
L42 L43 L44	BOOST 1 battery fuses blown BOOST 2 battery fuses blown BOOST 3 battery fuses blown	Battery SCR blown	B0221	Check battery SCR (semitop)
L45	PARALLEL BUS DIVISION	Communication bus interrupted in a parallel system (two points)	B0085	Check the interconnections between the affected boards, if necessary replace the boards
L46	PARAL. COMMUNICAT. FAULT	Communication bus anomaly in a parallel system		
L47	PARALLEL BOARD FAULT	Parallel board anomaly		

13 APPENDIX

13.1 LIST OF USEFUL DOCUMENTS

- User Manual
- UPS installation manual
- Wiring diagram:
- Programming manual MAN PROGRAMMING KIT 2L
- Alarm code manual RM021 Rev..
- UcomGp instruction manual RM900
- UcomGp Configurator RM901
- SparePartList

13.2 LIST OF BOARDS

Board	SPL Description	Quantity for Ups
B0056-02	Interface Card SATURN	1
B0057-02	Display Card SATURN (NEUTRAL version)	1
B0067-01	DSP+µC Control Card for SATURN 125	1
B0084-02	Batt Ch. 25A Card SATURN 125-160-200	1
B0085-01	Parallel Card (Included in: Parallel KIT)	(1)
B0102-02	Main AuxSupply Card SATURN 60-125	1
B0122-04	Signal Control Card SATUN 125	1
B0126-03	Output Card SATURN 125	3
B0127-02	Aux 24V Power Supply Card SATURN 100	1
B0133-06	Filter Card SATURN 125	2
B0182-01	Filter Card CY N SATURN 60-100 B	
B0209-02	Boost Driver Card (Included in: IGBT Boost & Driver kit SATURN 125-160)	(3)
B0210-01	Boost Signal card SATURN 125-160-200	3
B0215-02	Inverter Driver Card (Included in:IGBT Inverter & Driver kit SATURN 125)	(3)
B0216-02	Inverter Signal Card SATURN 125	3
B0221-01	Input Card SATURN 125	3
B0222-01	DC Capacitors Card SATURN 125	3