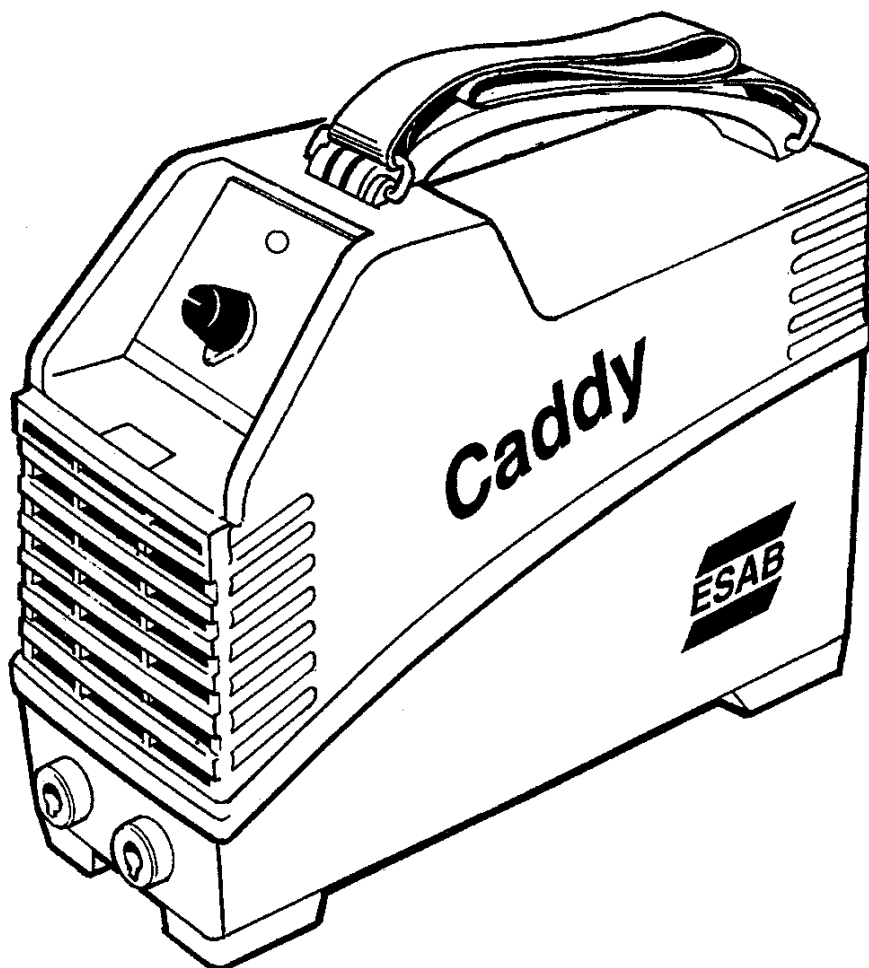




***LHQ 150***

***LTV 150***

***Caddy 150, Caddy Tig 150***



**Service Manual**

0700 150 018 0002

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**1) GUARANTEE CONDITIONS.**

To specify the present warranty conditions , we remind that the damages

- a) resulting from attempts by personnel not allowed to install, repair or service the products
- b) resulting from improper use or connection to incompatible equipment
- c) in products that have been modified or integrated with other products when such modification or integration can be the cause of the failure are not repair under warrantly.

## 2) PURPOSE OF THE MANUAL

The purpose of this manual is to provide authorised technical servicing centres the information required for repairing LHQ150/LTV150.

To avoid serious damage to people and things, this manual must be used strictly by qualified technicians.

What is involved in a repair job?: identifying the faulty part - as this part is included in the list of available spare parts - and replacing it according to the procedures described below.

If an electronic card is faulty, repair entails replacing the card and not replacing the faulty electronic component on the card itself.

If trouble cannot be solved by observing the procedures in the manual, the machine must be sent back.

We suggest two diagnosis procedures on two levels: at the first level, simple initial action instruments/tools are used, at the second level, more sophisticated instruments/tools are used.

By taking into account the training level of its technicians and its available instruments, each service centre can decide whether to use the first or second procedure.

The order of the subjects in this manual is based on a logic that gradually provides the repair technician with knowledge of the machine. We therefore advise you to follow the suggested order, by starting at the beginning.

## 3) MACHINE TECHNICAL SPECIFICATIONS .

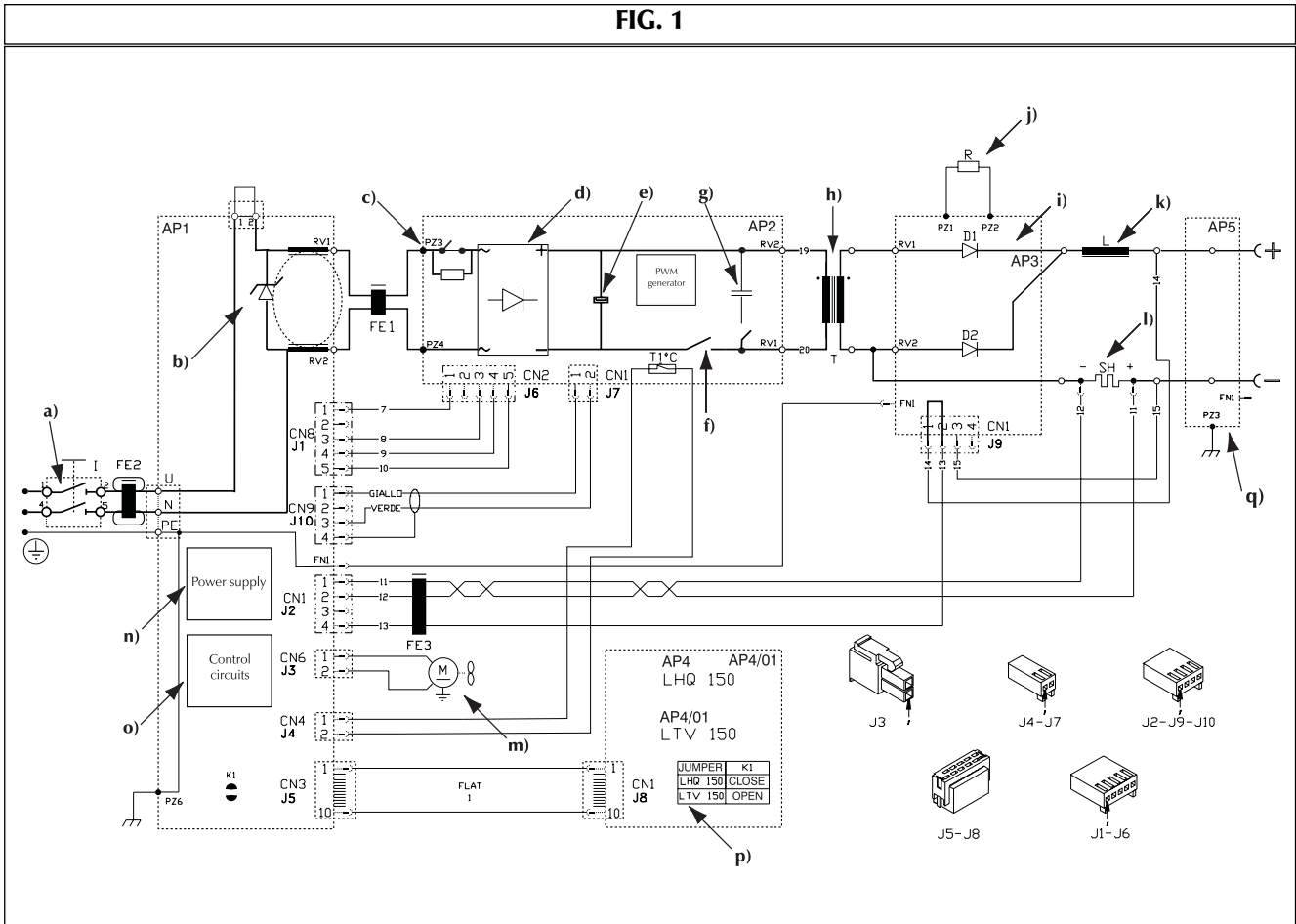
### Caddy 150 - LHQ 150

|                      |                |
|----------------------|----------------|
| Performance:         |                |
| at 25% duty cycle    | 150 A/26 V     |
| at 35% duty cycle    | 140 A/25,6 V   |
| at 60% duty cycle    | 110 A/24,4 V   |
| at 100% duty cycle   | 100 A/24 V     |
| Setting range        | 5-150 A        |
| Open circuit voltage | 62 V           |
| Mains supply:        |                |
| voltage              | 230 V AC       |
| frequency            | 50/60 Hz       |
| fuse                 | 16 A*          |
| mains cable , area   | 3x1,5 mm2**    |
| Enclosure class      | IP 23          |
| Application class    | <b>S</b>       |
| Dimensions LxWxH     | 375x145x280 mm |
| Weight               | 5,5 Kg         |

### Caddy TIG 150 - LTV 150

|                      |                |
|----------------------|----------------|
| Performance:         |                |
| at 25% duty cycle    | 150 A/26 V     |
| at 35% duty cycle    | 140 A/25,6 V   |
| at 60% duty cycle    | 110 A/24,4 V   |
| at 100% duty cycle   | 100 A/24 V     |
| Setting range        | 5-150 A        |
| Open circuit voltage | 62 V           |
| Mains supply:        |                |
| voltage              | 230 V AC       |
| frequency            | 50/60 Hz       |
| fuse                 | 16 A*          |
| mains cable , area   | 3x1,5 mm2**    |
| Enclosure class      | IP 23          |
| Application class    | <b>S</b>       |
| Dimensions LxWxH     | 375x145x280 mm |
| Weight               | 5,5 Kg         |

FIG. 1



**4) DESCRIPTION OF MACHINE PARTS.** (see fig. 1)

The equipment consists of the following circuit parts:

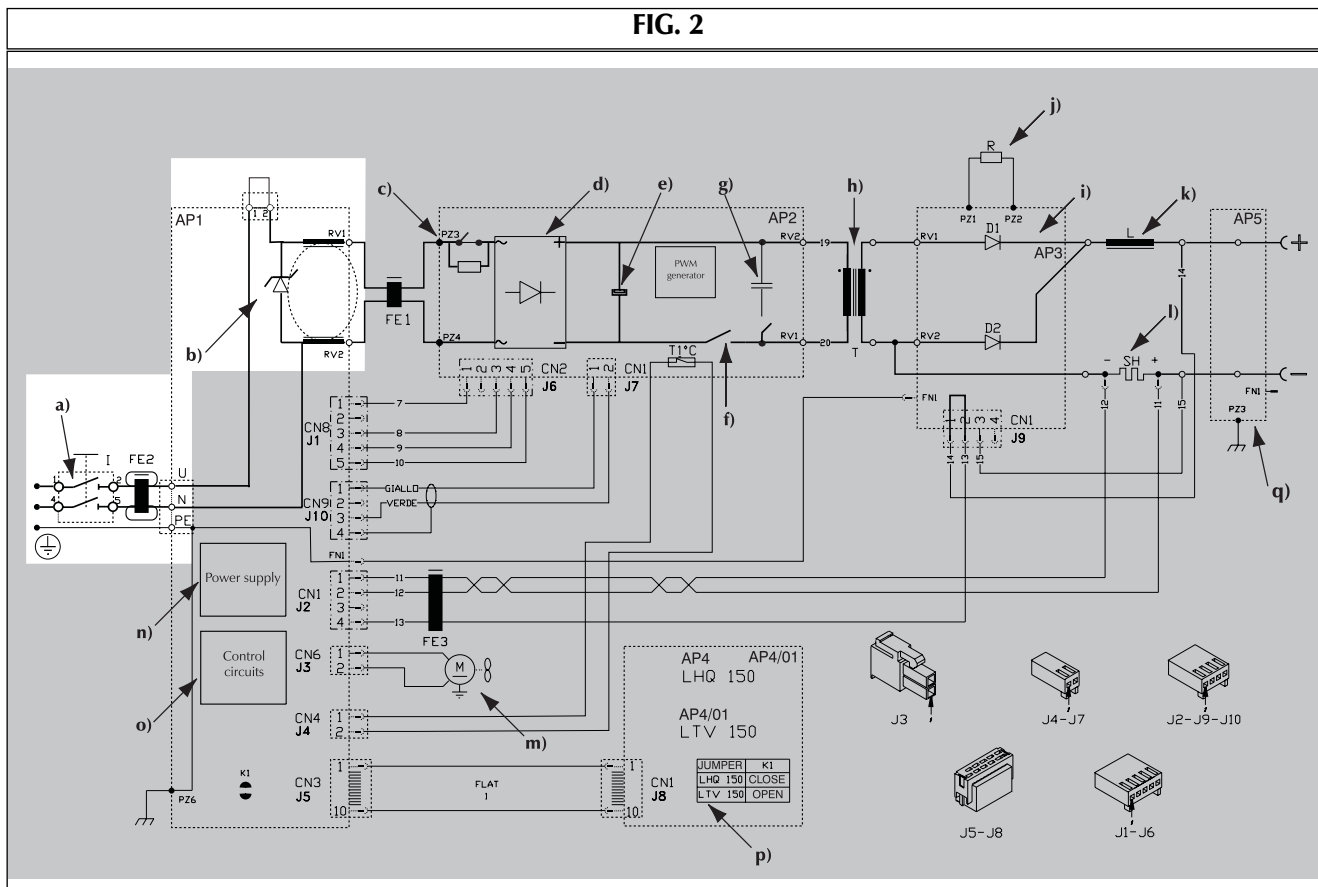
- a) Master switch
- b) input filter for suppressing radio noise and protecting against mains over-voltage.
- c) resistors for pre-loading levelling capacitors and by-pass relays for the resistors.
- d) rectifier bridge
- e) levelling capacitors
- f) power inverter with over-temperature detection device.
- g) clamp circuit (over-voltage limiter)
- h) power transformer
- i) rectifier circuit and current free-flow diode
- j) load resistor

- k) levelling inductance
- l) current transducer (shunt)
- m) fan
- n) power circuits feeding control/adjustment circuits
- o) current control circuits
- p) control circuits (front panel)
- q) output filter for suppressing radio noise

Some of these parts are independent, while others are housed inside the following electronic cards:

- A) Card AP1
  - B) Card AP2
  - C) Card AP3
  - D) Card AP4 (for LHV 150) or AP4/01 (for LTV 150)
  - E) Card AP5
- as illustrated below.

FIG. 2



## 5) DESCRIPTION OF MACHINE OPERATION.

Power is initially converted from AC to DC by the rectifier bridge at input, and is then converted from DC to AC by an inverter providing AC frequency of 100kHz. Power is then transferred via an isolating transformer to the output circuits and is subjected to a final AC to DC conversion by the output rectifier .

More details:

**5.1)** Master switch (a) - input filter for suppressing radio noise and protecting against power line over-voltage (b). (see fig. 2)

The power cable takes the supply voltage and the ground protection to card AP1.

Only one phase of the supply voltage is switched by switch (a) which is outside the card and connected to it by two appropriate bump contacts.



**IMPORTANT !:** When accessing parts inside the machine, remember that turning off the switch will not prevent the danger of electric shocks. We therefore advise you to remove the power plug and wait for about a minute before attempting any job.

When the switch is turned on, input voltage is applied to the power line over-voltage suppression circuit (b) - which consists of a varistor (see note) - and is then filtered by the radio noise suppression circuit (b) (see note).

The card also makes the grounding connection between the yellow-green conductor coming from the power cable and the cables coming from card AP3 .

**NOTE :** If the electrical component know as a varistor is placed between the two power supply phases, when an instantaneous voltage in excess of 275 V appears on its terminals, the varistor very rapidly becomes conductive, absorbing a current peak which is sufficient to limit the said over-voltage and it thus protects the other parts of the machine.

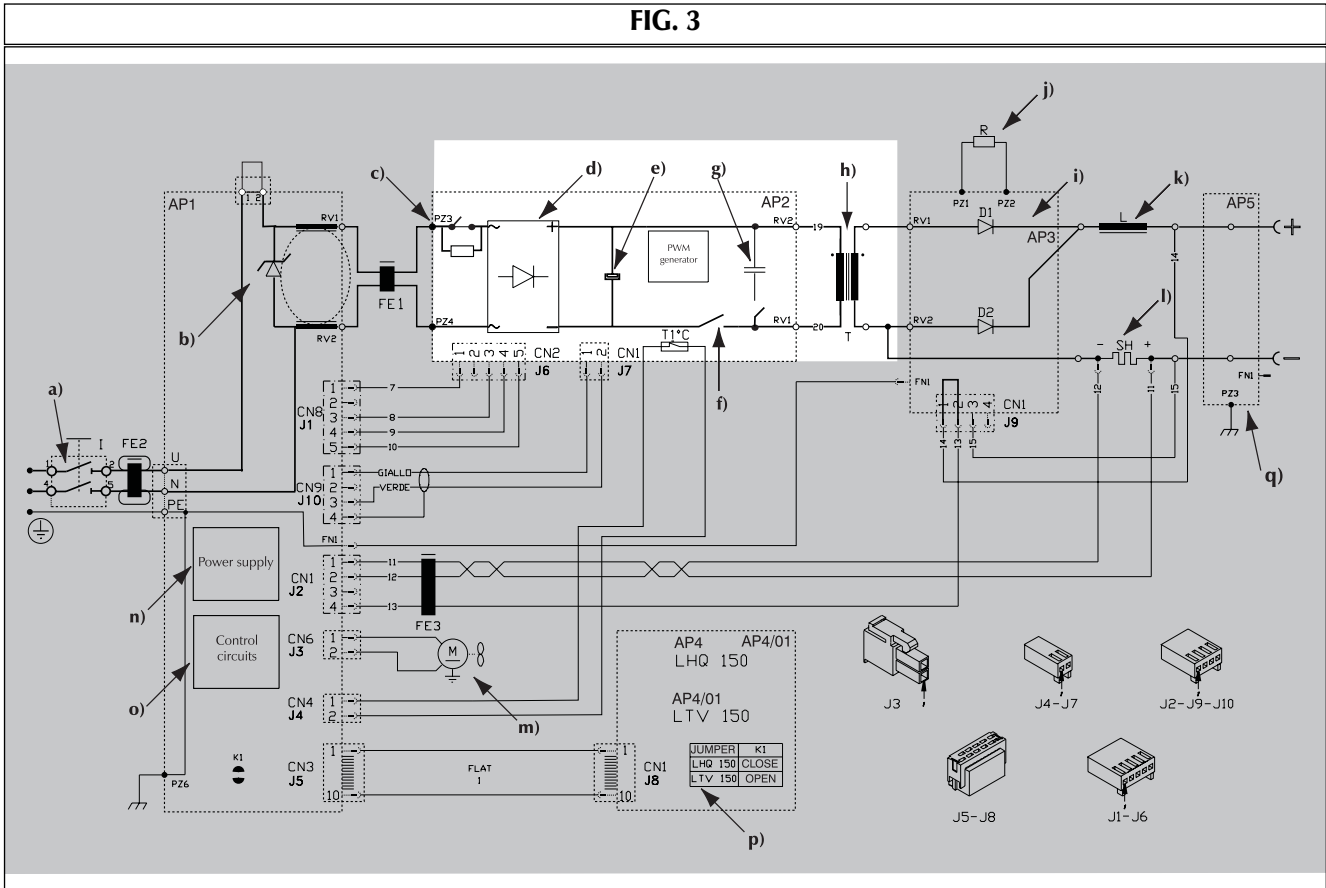
This process has no destructive effect on the component if the energy generated by the voltage peak is low, as in the case of atmospheric lightning strikes. If, however, over-voltage is high and prolonged, the varistor cannot dissipate this high energy and blows.

This happens if, for example, the machine is connected in error to 400 Vac mains voltage, or following over-voltage caused by non stabilised power units of inadequate capacity.

**NOTE :** The radio noise suppression circuit has two purposes: to keep the machine's radio frequency emissions within limits specified by standards and to ensure the equipment's immunity against the same type of problems caused by any electronic devices connected to the same power supply source.

The filter consists of a network of capacitors, some of which are grounded, and a toroidal inductor.

FIG. 3



**5.2)** resistors for pre-loading levelling capacitors and by-pass relays for the resistors (c) - rectifier bridge (d) - levelling capacitors (e) - power inverter with over-temperature detection device (f) - clamp circuit (over-voltage limiter) (g) - power transformer (h). (see fig. 3)

Power supply voltage reaches card AP2 via two small cables, and at this point, is applied to the rectifier bridge (d) - levelling capacitors (e) by means of a soft start circuit (c) consisting of a pair of power resistors in series with each other and installed in parallel with respect to the contacts of a relay. (see note)  
The by-pass relay is powered on 24 Vdc supplied by card AP1.

Rectified, filtered voltage is supplied to the power inverter section (f), fitted on the card itself, and also to the control circuits power supply section installed on card AP1.

The inverter has a forward structure with eight power mosfets in parallel soldered directly on card AP2 and secured with screws to the aluminium radiator.

Power up control for the mosfets is effected with PWM (Pulse Width Modulation) technique at a frequency of about 100 kHz. The control circuit is fitted on card AP2, receiving 18Vdc power from AP1.

The radiator is cooled by a fan (m) powered by card AP1 at 15 Vdc. Air flows from the machine's rear grille (air intake) toward the front grille (air outlet).

If, due to interruption of ventilating air or a heavy duty machine cycle, radiator temperature exceeds the permissible limit, the thermal device on the radiator sends a signal to the control logic which then shuts down the inverter and signals the fault to the front panel.

The operating voltage of the inverter's power mosfets is limited by a clamp circuit (g) consisting of an auxiliary mosfet of the same type as the eight other mosfets above. This mosfet is secured by a screw on the aluminium radiator, but is electrically isolated from the radiator by insulating tape of low thermal resistance.

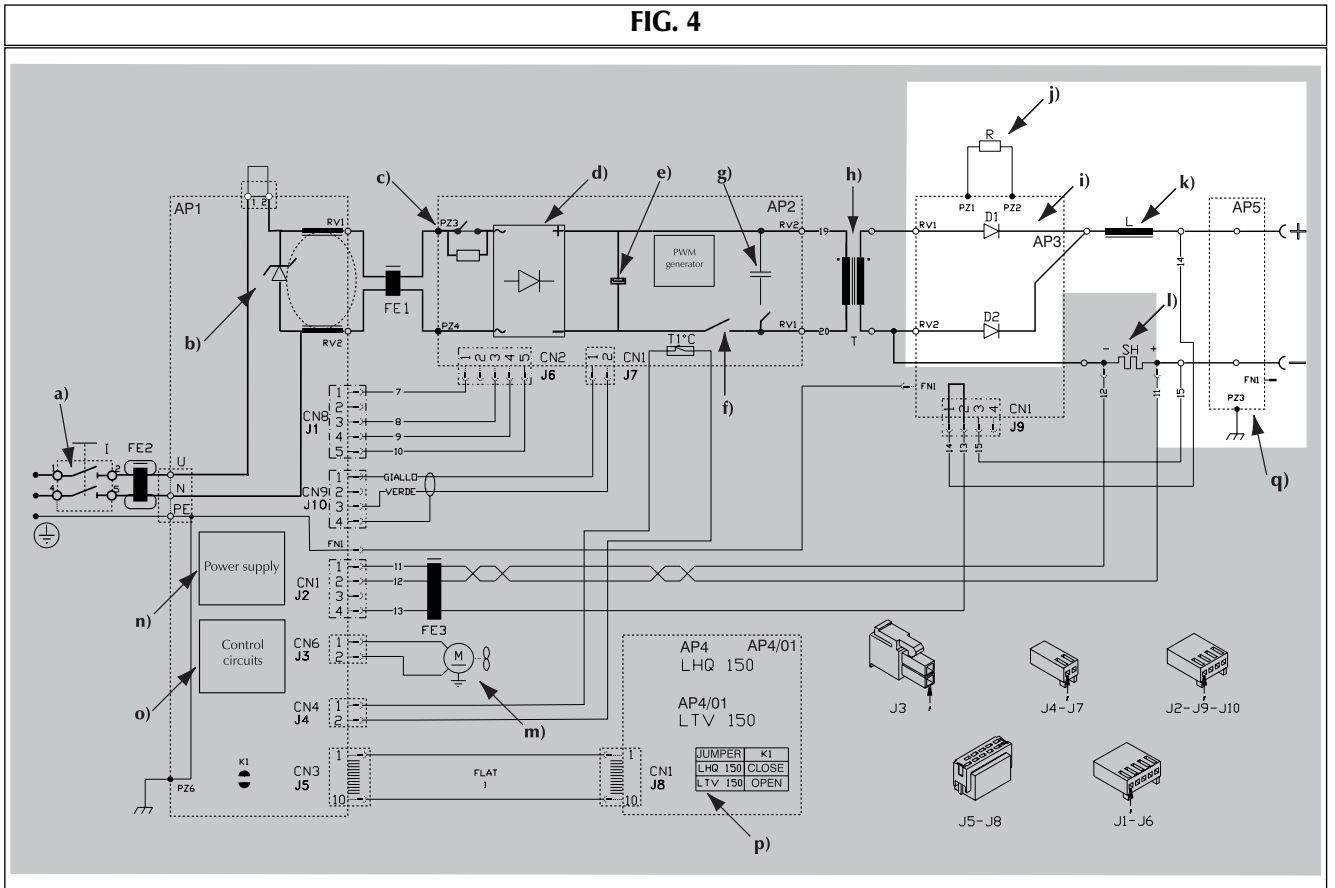
The power transformer, constructed with planar technology and also cooled by an adjacent radiator, is connected by two small cables to card AP2.



**IMPORTANT: When replacing card AP2, remember that the order of securing the cables to the card is extremely important.**

**NOTE :** The purpose of the soft-start circuit is to limit absorption of current from the mains as soon as the machine is powered up. In fact, in the absence of this circuit, at power up, the filter capacitors would be charged instantly. Vice versa, a control circuit installed on card AP2, by commanding closure of the by-pass relay with a few seconds delay, enables the capacitors to be charged slowly through the two resistors.

FIG. 4



**5.3)** rectifying circuit and free wheeling diode (I) - load resistor (j) - levelling inductance (k) - output filter for suppressing radio noise (q). (see fig. 4)

The output of the power transformer is connected to the two rectifier diodes and to the two free wheeling diodes (I) soldered onto card AP3 and secured by screws to the aluminium radiator. The latter diodes together with the current levelling inductance (k), ensure continuity of current at output.

Electrical connection between the diodes and the levelling inductance is directly via the radiator, on which all cathodes and diodes are fitted.

A 220 Ohm power resistor is also fitted to the radiator, and supplies a minimum output load even when the machine is running load free.

Similarly to the inverter, the radiator is located along the flow of cooling air generated by the fan.

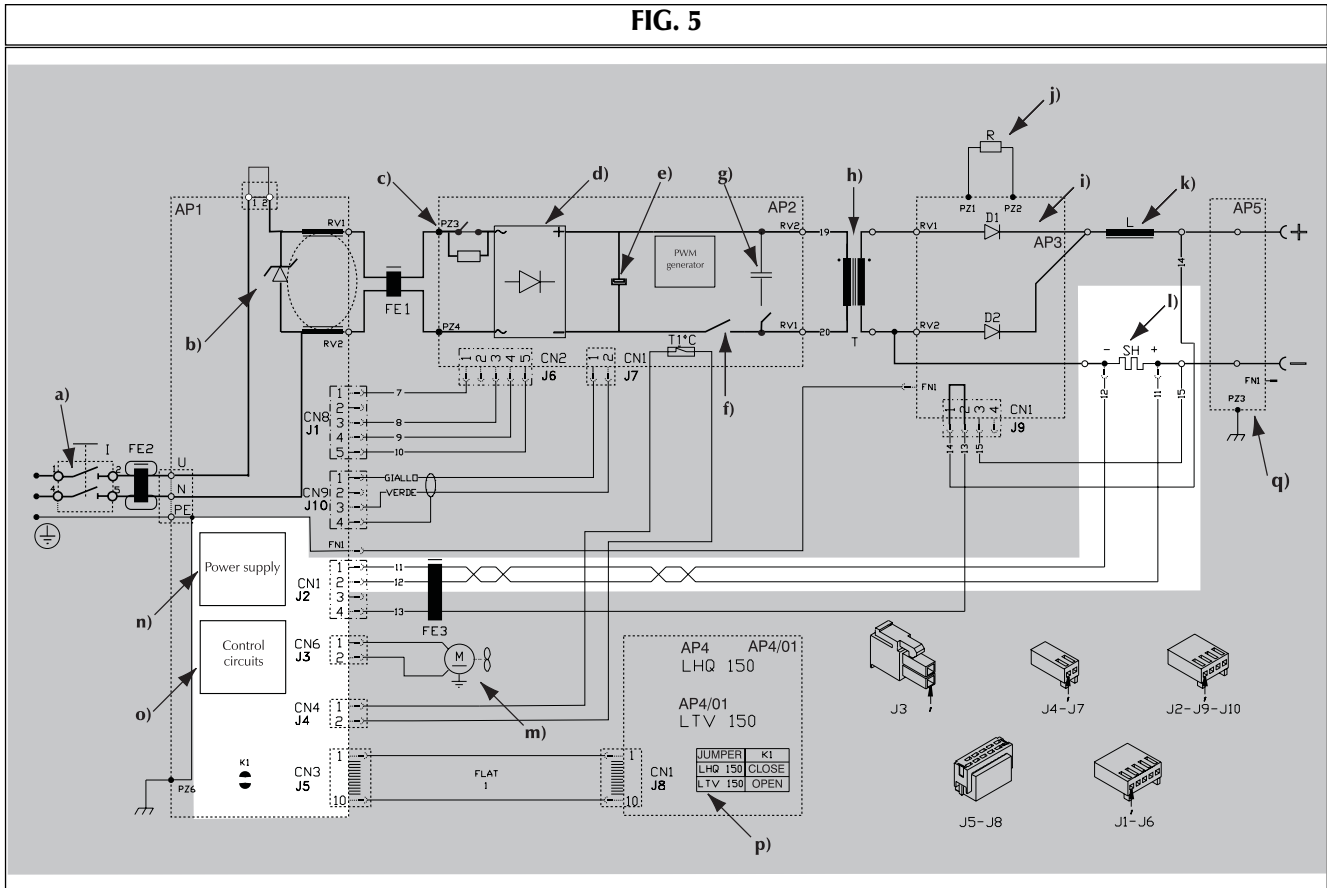
There is no temperature detection device on the radiator because protection is, in any event, assured by the inverter's thermal protection.

A small capacitive filter connected to the ground circuit is also fitted on card AP3 .

The output filter (q), housed inside card AP5, has the purpose to keep the machine's radio frequency emission within limits specified by standard.

It consists of a network of resistors and capacitors some of which are grounded.

FIG. 5



**5.4) Current transducer (shunt) (l) - power circuits for command/control circuits (n) - current control circuits (o). (see fig. 5)**

The equipment is essentially a direct current generator that can be set by a potentiometer on the front panel. To effect this function, delivered current is measured by a current transducer (or shunt), consisting of a constantan foil suitable gauged which is connected at one end to the secondary winding of the power transformer and, at the other, to the machine output.

The control circuit on card AP1 instantly compares the value of requested and delivered current and sends the control signal to the inverter modulator installed on card AP2.

This control circuit also measures the machine's output current to provide the following functions:

- **in MMA :**

- increase of current when welding is started (hotstart); the following relation applies:  
supplied current = requested current + 80% of the same
- increase of current if the electrode is short-circuited on the piece during welding (anti-freeze); the following relation applies :  
supplied current = requested current + 30% of the same
- fold-back if, in spite of anti-freeze the short-circuit of the electrode on the piece continues for a few tenths of a second; the following relation applies:  
supplied current limited to a few amperes

- **in TIG (TOUCH START) :**

- current limited at lift start; the following relation applies  
supplied current = 10 A

Furthermore, due to safety standard problems, output voltage is restricted to 62 Vdc, if measured according to the relevant standards, but is limited to 55-56 Vdc if measured with an ordinary multimeter applied directly on the machine's output terminals. By using switching point K1 of card AP1, the value of load free output voltage can be lowered further to below 50 Vdc if called for by special national or sector standards.

All the machine's electronic circuits are powered by voltages produced by a switching power supply unit fitted on card AP1. The following voltages are generated:

- **with respect to GND reference potential**

- +12Vdc for electronic circuits of card AP1
- -12Vdc for electronic circuits of card AP1
- +15Vdc to power the fan

- **with respect to reference potential GND\_PWR**

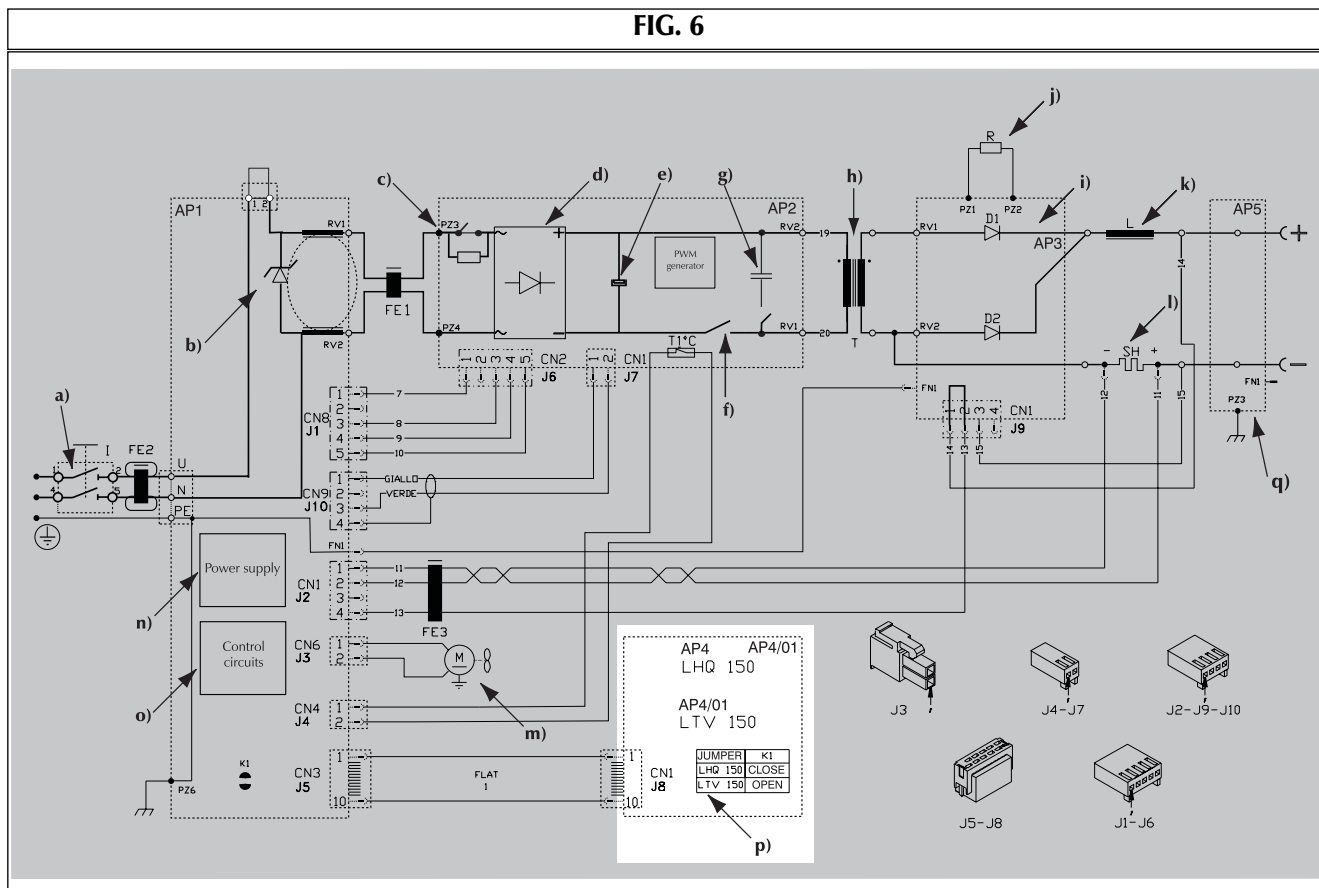
- +18Vdc for electronic circuits of card AP2
- +24Vdc to power the relay of card AP2

GND is equipotential with respect to the shunt terminal, whereas GND\_PWR coincides with the output of the rectifier bridge (d).

The voltages listed above are generated in card AP1 commencing with the rectified input voltage of 325Vdc (= 230V X V2) supplied by the rectifier bridge (d) on card AP2.



FIG. 6



**5.5) Control circuits ( front panel ) (p). (see fig. 6)**

These circuits, which are contained in card AP4 fitted at the rear of the machine front panel, enable the following:

- setting of welding current by means of the potentiometer
- selection of function mode MMA / TIG (LIFT)

When the selector switch is in MMA (right) position, load free voltage is available on the machine terminals when it is powered, and further, the hot-start, anti-freeze, and fold-back functions are all enabled.

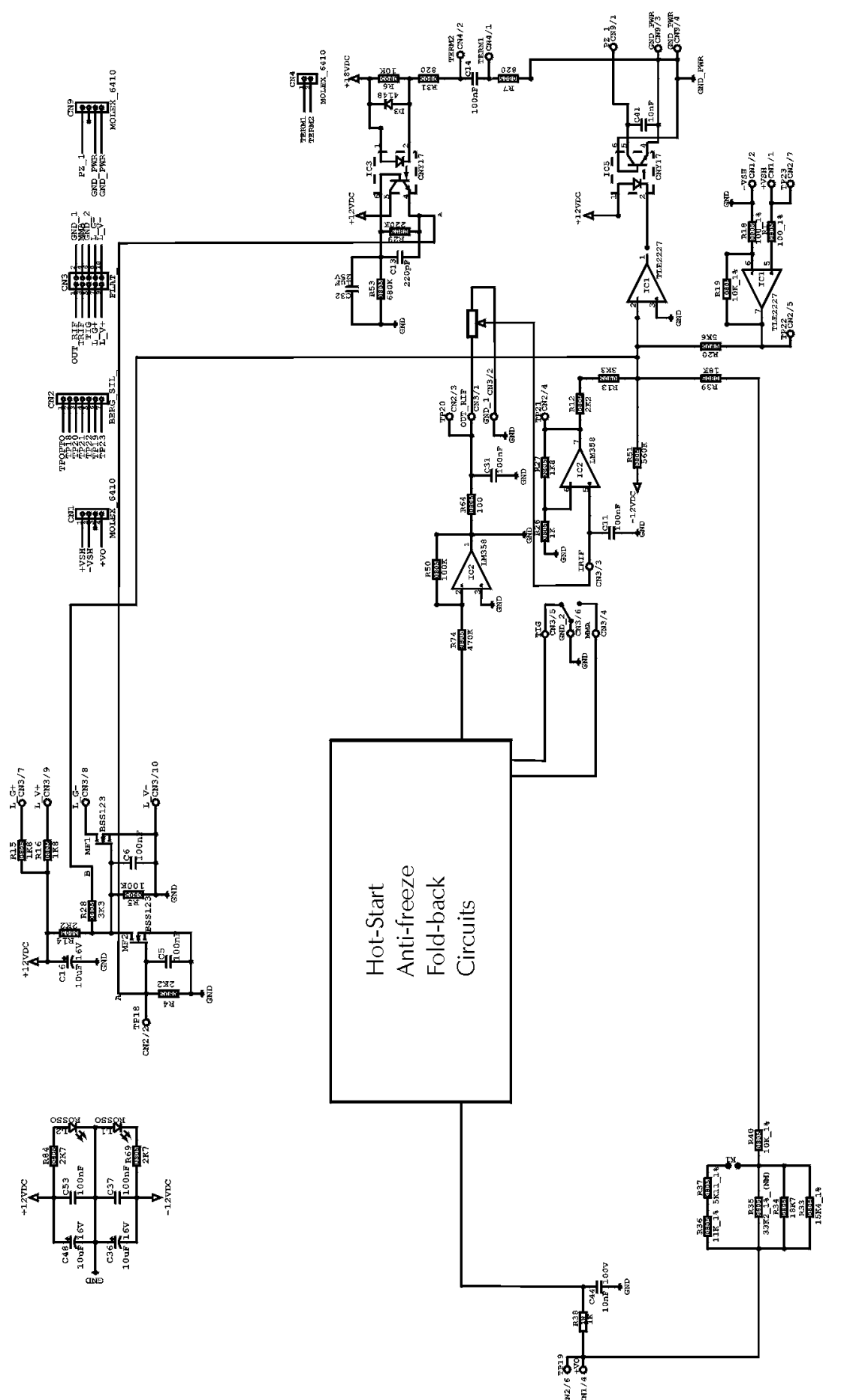
When the selector switch is in TIG (left) position, open circuit voltage is on when the machine is powered and, furthermore, current is limited to 10 A while the electrode is short-circuited and until it is raised.

We shall talk about the LED on the panel later on.

Moreover, two potentiometers for setting delivered current are fitted on card AP4, but can be accessed only when the machine is open. We shall discuss these later on.

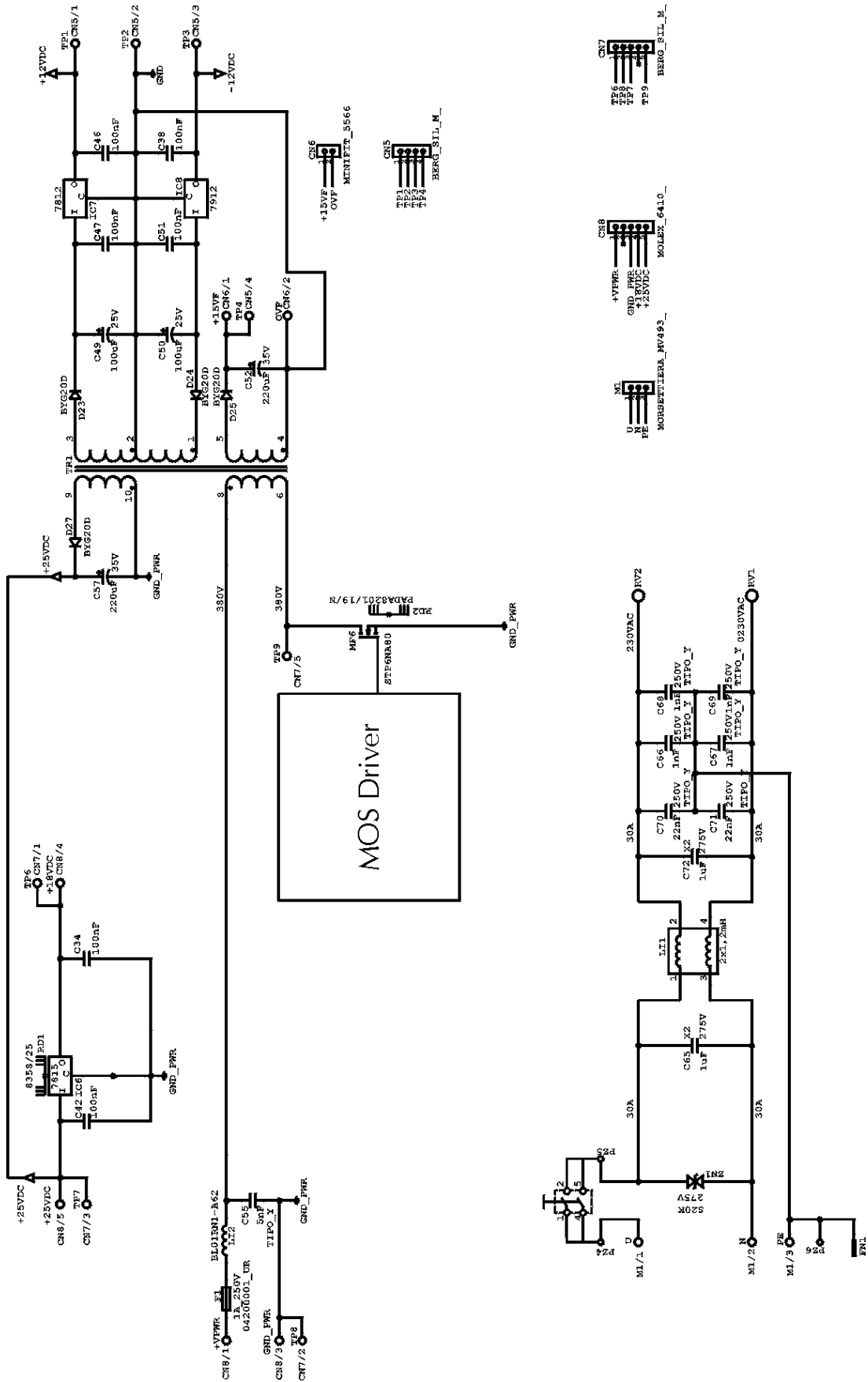
**NOTE:** the difference between card AP4 and AP4/01 is explained in section 12.

# Card AP1 side A (FIG. 7A)

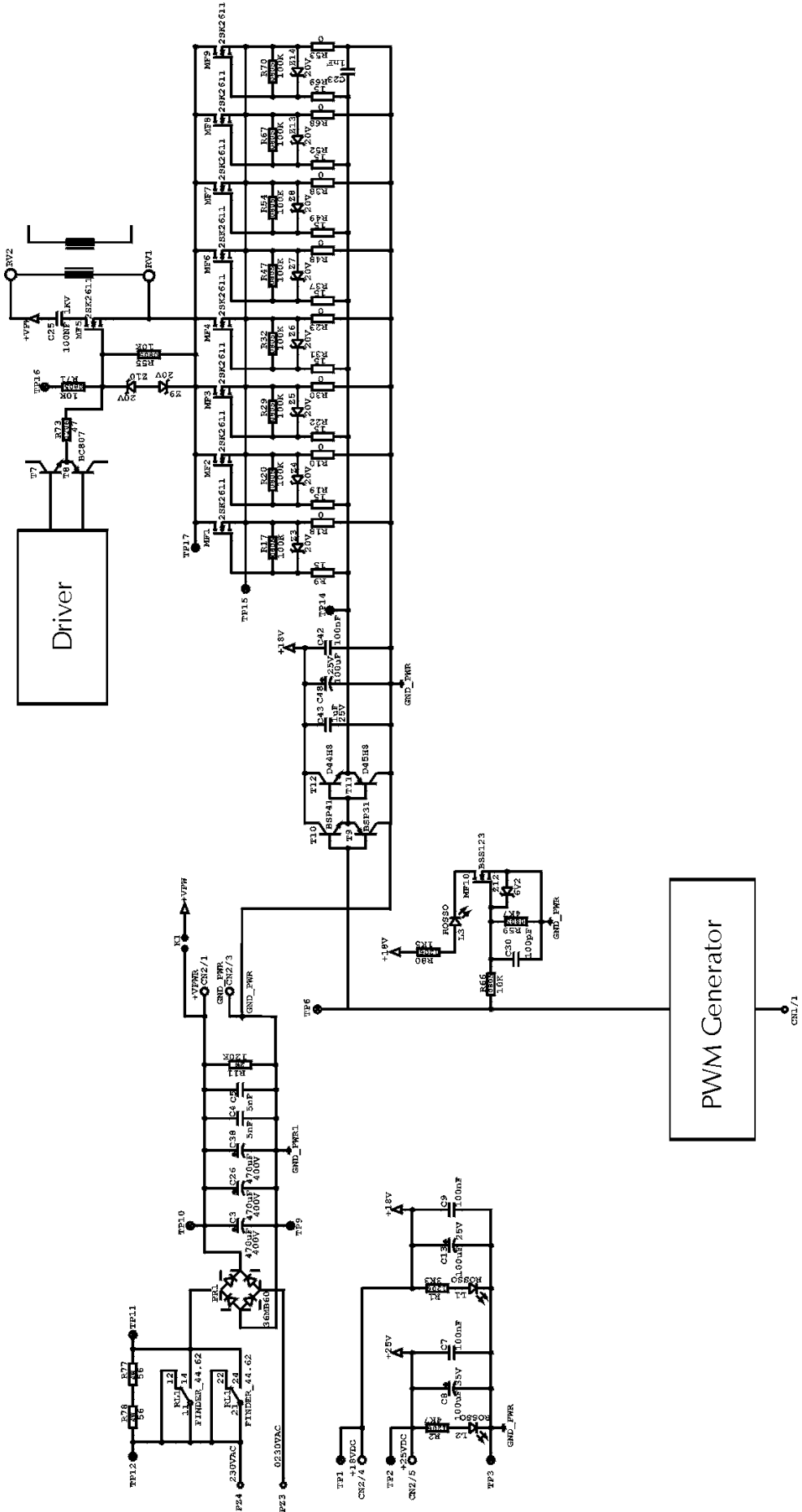


Hot-Start  
Anti-freeze  
Fold-back  
Circuits

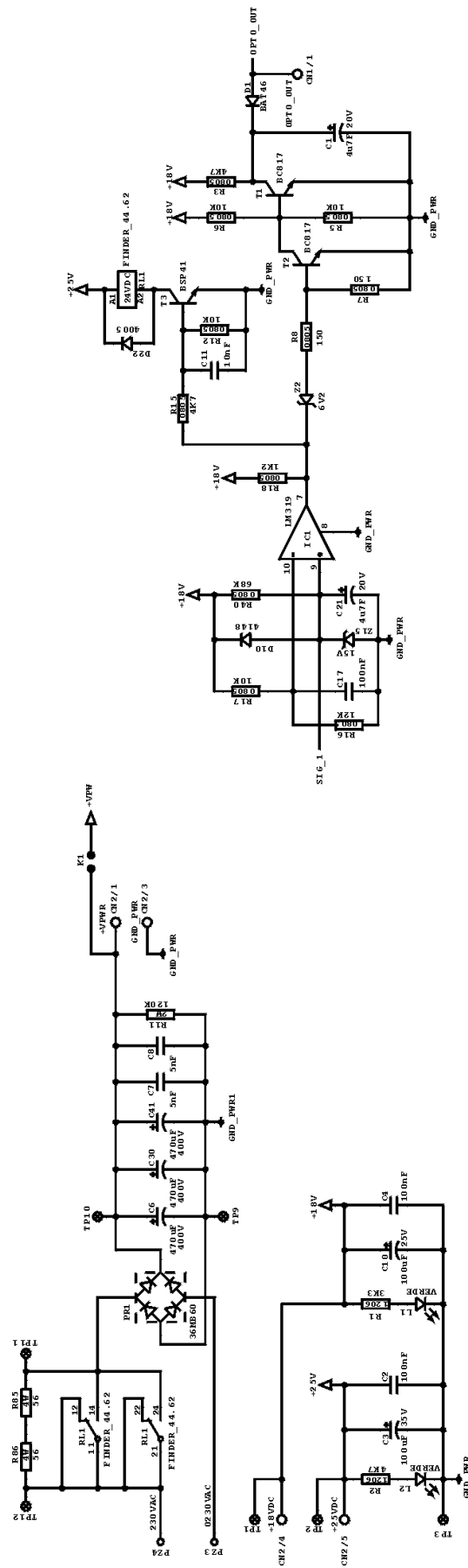
### Card AP1 side B (FIG. 7B)



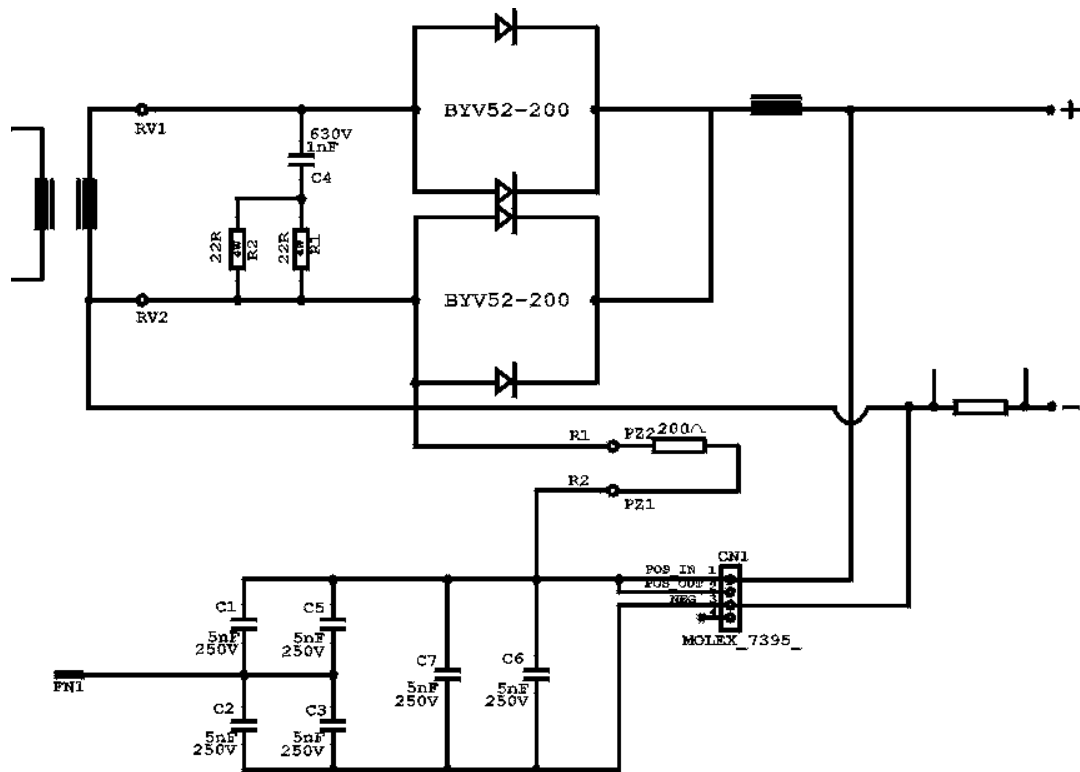
Card AP2 (FIG. 8)



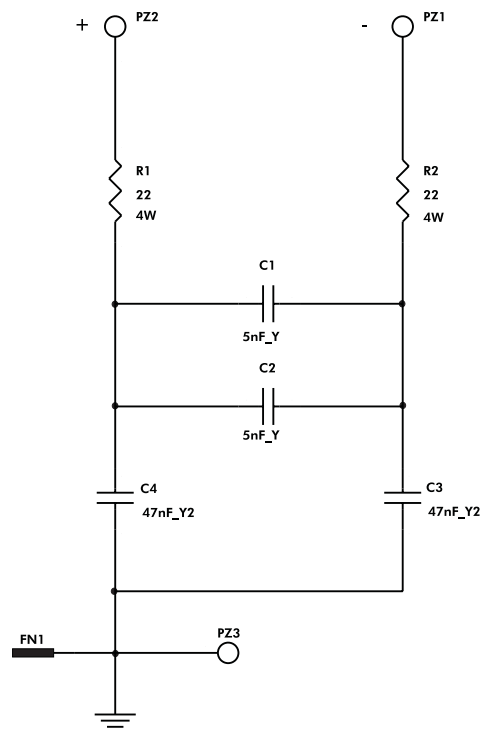
# Card AP2 side A (FIG. 8A)



Card AP3 (FIG. 9A)



Card AP5 (FIG. 9B)



Card AP4 or AP4/01 (FIG. 10)

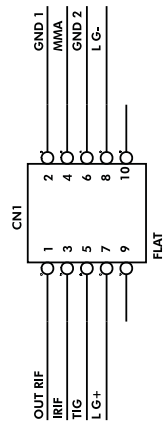
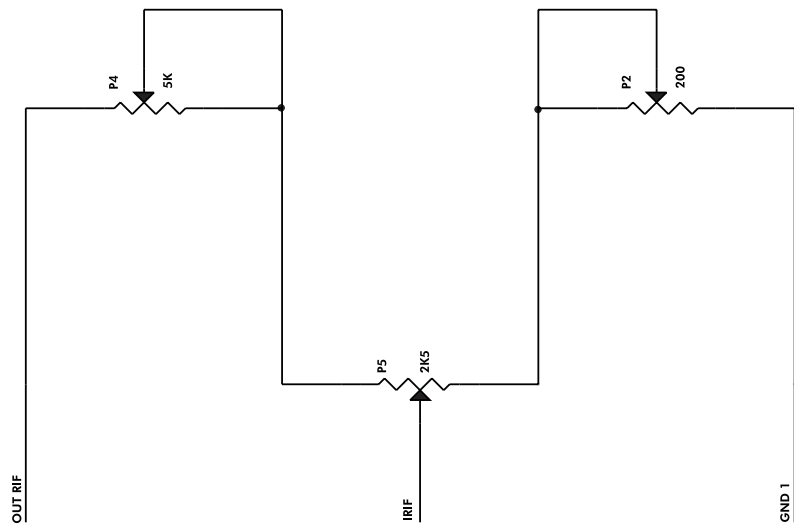
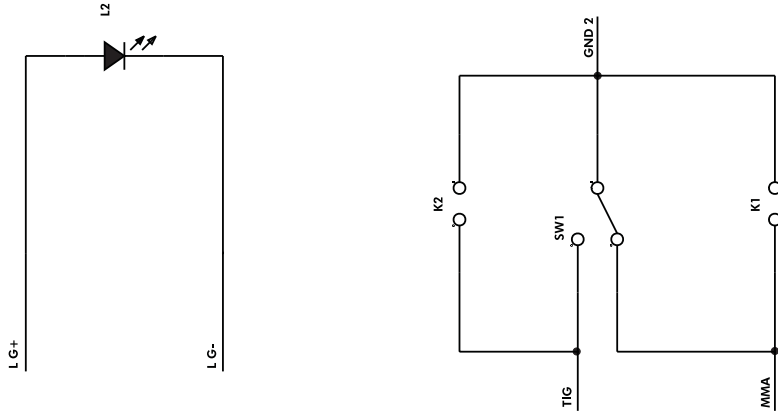
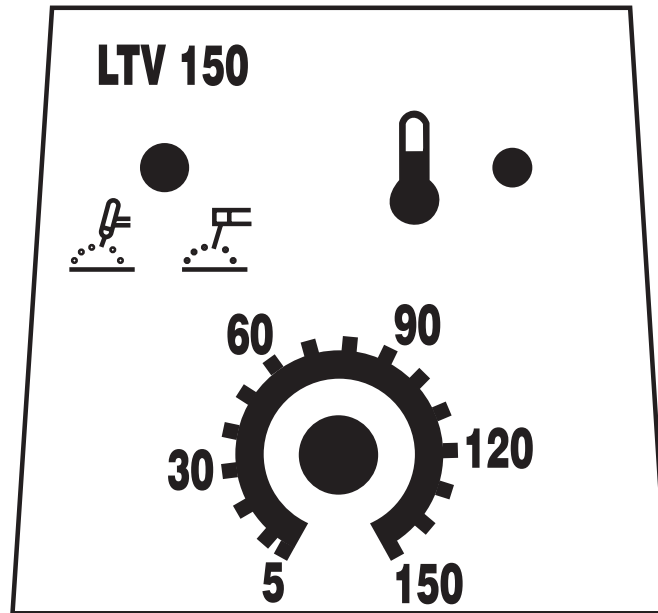


FIG. 11



## 6) DESCRIPTION OF DIAGNOSTIC INDICATIONS.

The equipment has LEDs with diagnostic functions on both front panel and on electronic cards.

### 6.1) External diagnostic indications. (see fig. 11)

There is a LED on the front panel:

| Position | Colour | Status under normal conditions | Meaning                              |
|----------|--------|--------------------------------|--------------------------------------|
| L1       | YELLOW | OFF                            | Thermal protection device NOT active |

Further explanations of the above:

- **YELLOW LED:** This LED is off when the machine is operating normally. It goes on to report inverter overtemperature, followed by interruption of power supply by the machine.

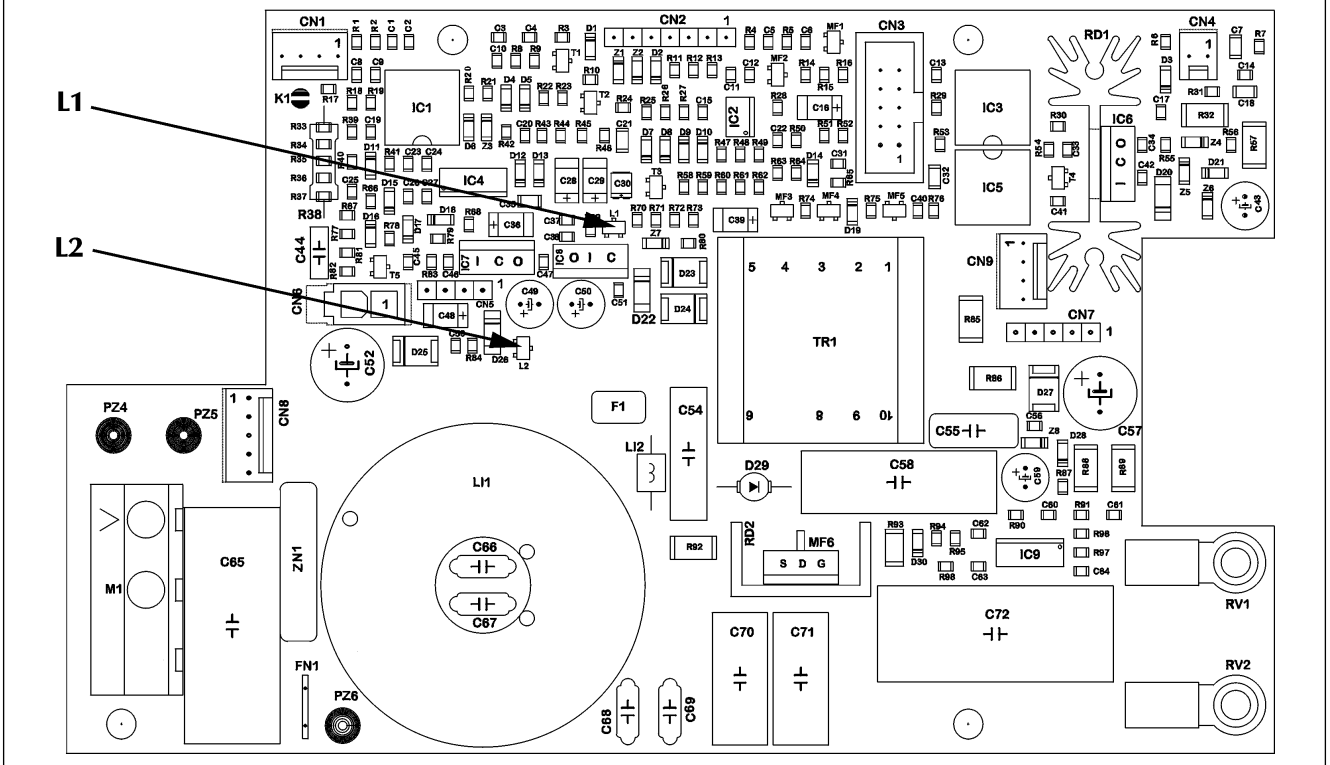
Therefore **if** the LED is on

**then either** the machine has exceeded work cycle limits  
**or** the fan is not operating  
**or** air flow is obstructed from the outside



## Card AP1 (FIG. 12)

### Position LED



### 6.2) Internal diagnostic indications.

- Card AP1 . (see fig. 12)

There are two LEDs:

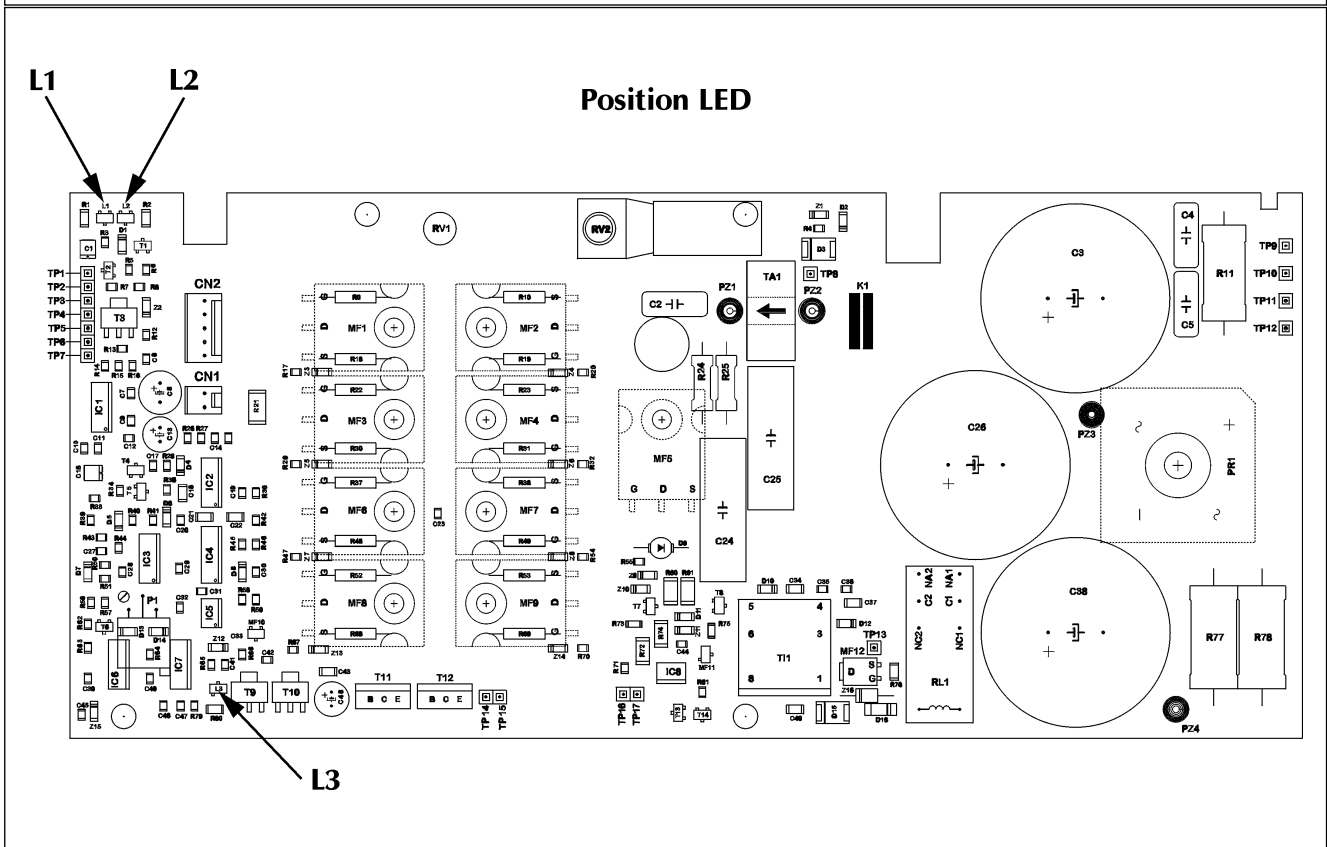
| Position | Status under normal conditions | Meaning                 |
|----------|--------------------------------|-------------------------|
| L1       | ON                             | -12Vdc power ON on Card |
| L2       | ON                             | +12Vdc power ON on Card |

Further explanations of the above:

• L1 : **If** OFF  
**then** there is a malfunction in the power circuit of Card AP1 or there is a short circuit on Card AP2

L2 : **If** OFF  
**then** there is a malfunction in the power circuit of Card AP1 or there is a short circuit on Card AP2

Card AP2 (FIG. 13)



- Card AP2 . (see fig. 13)  
There are three LEDs:

| Position | Status under normal conditions | Meaning                 |
|----------|--------------------------------|-------------------------|
| L1       | ON                             | +18dc power ON on Card  |
| L2       | ON                             | +25Vdc power ON on Card |
| L3       | See explanation                | Modulation level of PWM |

- L3 : The luminosity of this LED is not fixed but is in proportion to the width of the inverter's PWM modulation. Therefore, its luminosity is:

minimum when supplied power is low  
maximum when supplied power is high

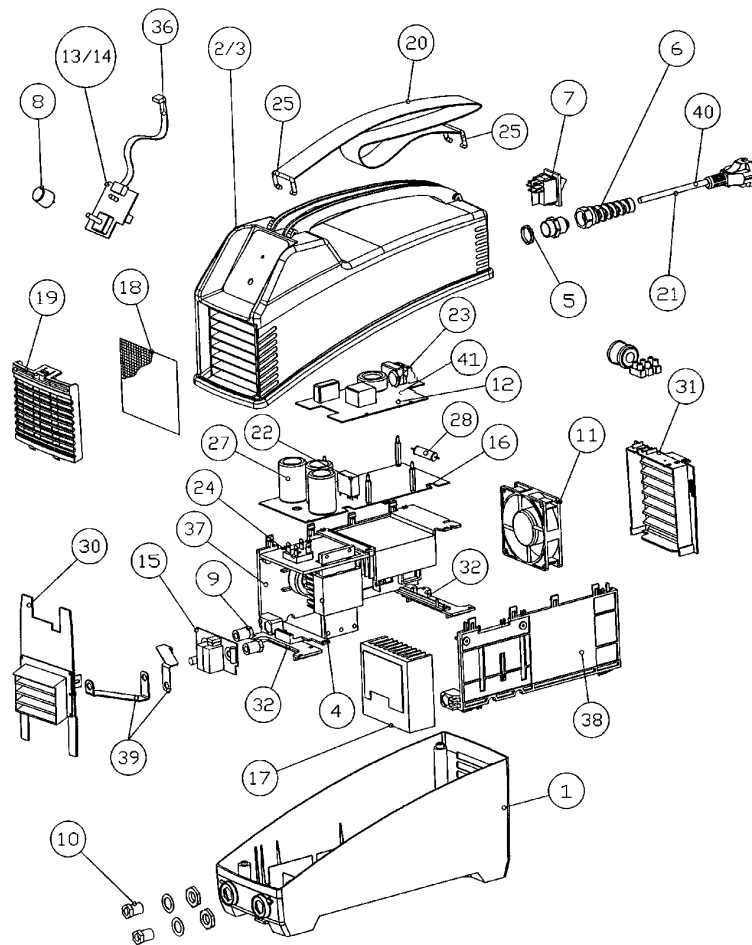
However, note the following special cases:

- machine running load free: medium luminosity (due to load free voltage at machine output)
- in the absence of the control signal coming from the circuits controlling the current of card AP1 (yellow-green shielded 2-pole cable): maximum luminosity.

Further explanations of the above:

- L1 : If it is OFF  
 then there is **either** a malfunction in the power circuit of Card AP1  
**or** there is an electrical connection problem on small cables n. 8 and n. 9.  
**or** there is a short circuit on Card AP2
- L2 : If it is OFF  
 then there is **either** a malfunction in the power circuit of Card AP1  
**or** there is an electrical connection problem on small cables n. 8 and n. 10.  
**or** there is a short circuit on Card AP2

**TAB. 01**



**Caddy 150 (LHQ) and Caddy Tig 150 (LTV)**

| Pos. | Description                         | Item number  |
|------|-------------------------------------|--------------|
| 1    | COVER (Lower part)                  | 0700 150 001 |
| 2    | COVER WITH LHQ PLATE (Upper part)   | 0700 150 002 |
| 3    | COVER WITH LTV PLATE (Upper part)   | 0700 150 003 |
| 4    | INVERTER TRANSFORMER WITH HEAT SINK | 0700 150 004 |
| 5    | NUT                                 | 0212 602 208 |
| 6    | CABLE BUSH                          | 0193 307 104 |
| 7    | MAIN SWITCH                         | 0193 317 001 |
| 8    | KNOB                                | 0321 475 881 |
| 9    | CONNECTOR                           | 0700 150 005 |
| 10   | CONNECTOR                           | 0366 306 881 |
| 11   | FAN                                 | 0700 150 006 |
| 12   | INPUT AND LOGIC MMA PC-BOARD        | 0700 150 007 |
| 13   | FRONT PC-BOARD, LHQ 150             | 0700 150 008 |
| 14   | FRONT PC-BOARD, LTV 150             | 0700 150 009 |
| 15   | OUTPUT FILTER PC-BOARD              | 0700 150 010 |
| 16   | POWER PC-BOARD KIT                  | 0700 150 011 |
| 17   | SECONDARY RECTIFIER KIT             | 0700 150 012 |
| 18   | FILTER                              | 0456 574 001 |
| 19   | FRONT GRATING                       | 0456 541 001 |
| 20   | STRAP                               | 0468 208 001 |
| 21   | MAINS CABLE                         | 0456 192 881 |
| 22   | REPLACEMENT OF RELAY ON 15,18,012   | 0700 150 013 |
| 23   | REPLACEMENT OF VARISTOR             | 0700 150 014 |
| 24   | REPLACEMENT OF RECTIFIER DIODE      | 0700 150 015 |
| 25   | CLAMP FOR CARRYNG STRAP             | 0700 150 016 |
| 27   | CAPACITOR                           | 0700 150 021 |
| 28   | RESISTOR 2x56 Ohm 5W                | 0700 150 022 |
| 30   | INNER FRONT GRID                    | 0700 150 025 |

|    |                                 |              |
|----|---------------------------------|--------------|
| 31 | REAR GRID                       | 0700 150 019 |
| 32 | MONOBLOC FRONT AND REAR SUPPORT | 0700 150 020 |
| 33 | THERMIC WIRING                  | 0700 150 023 |
| 34 | FUSE SMD 250V 1A                | 0700 150 024 |
| 36 | FLAT CABLE LINK SCH 243-2842    | 0700 150 027 |
| 37 | RIGHT PLASTIC PANEL             | 0700 150 028 |
| 38 | LEFT PLASTIC PANEL              | 0700 150 029 |
| 39 | COPPER BAR NEGATIVE/POSITIVE    | 0700 150 030 |
| 40 | MAINS CABLE (NEW TYPE)          | 0700 150 031 |
| 41 | INPUT AND LOGIC MMA PC-BOARD    | 0700 150 032 |

**7) SPARE PARTS LIST**

**NOTE :**

Item number 0700 150 011 (n.16) includes:

- Card AP2 complete with power mosfets and rectifier diode bridge already soldered on the printed circuit in order to facilitate replacement.
- insulating tape to be inserted between the clamp mosfets and radiator - this is useful if the tape on the radiator is damaged. Power mosfets cannot be supplied separately, but the rectifier diode bridge can. (0700 150 015)

Item number 0700 150 012 (n.17) includes:

- Card AP3 complete with power diodes pre-soldered on the printed circuit, but without the load resistor, in order to facilitate the replacement procedure.

## 8) WARNINGS, PRECAUTIONS, GENERAL INFORMATION ON EXECUTING REPAIRS.

Repairs may be executed by qualified personnel only.

Before attempting any repairs, we advise you to read and understand the information in this manual, especially in regard to safety recommendations.

Do not carry out any repair unless another person is present who can provide help in case of an accident.

To repair equipment, access is necessary to the internal parts of the machine, and to obtain this, some protective panels have to be removed. Therefore, some extra precautions are necessary, over and above those applying to normal use of the machine for welding, in order to prevent any damaged caused by contact with:

- Live parts
- moving parts
- parts at high temperature

- Live parts:



**IMPORTANT !:** When accessing parts inside the machine, remember that turning off the switch will not prevent the danger of electric shocks. We therefore advise you to remove the plug and wait for about a minute before attempting any job.

Further, as capacitors charged with high voltage may be present, wait about a minute before working on the internal parts.



**IMPORTANT !:** When taking measurements, remember that the measuring instruments themselves can become live and, therefore, do not touch their metal parts.

- Moving parts:



**IMPORTANT !:** Keep your hands well away from the fan when the machine is connected to the power supply. Make sure that the power plug is removed and that the fan is idle before replacing it.

- Parts at high temperature:



**IMPORTANT !:** When you have to handle internal parts of the machine, remember that some could be at high temperature. In particular, do not touch cooling radiators.

## 9) DIAGNOSTICS AND REPAIR INSTRUMENTS AND TOOLS.

### 9.1) Diagnostics instruments and tools

#### 9.1.1) Level 1

You will need the following:

- a multimeter with the following scales:
  - Ohm : from 0 to a few Mohm
  - Diode test
  - Direct voltages (Vdc): from mVdc to 500 Vdc
  - Alternate voltages (Vac): from 10 Vac to 500 Vac

**NOTE :** We recommend you to use an instrument with an automatic scale, because, if the machine faulty, in theory, the level of the electrical value to be measured cannot be foreseen.

- a shunt of 150 A @ 60 mV.

**NOTE :** Remember that other values may be equally suitable, but you will sacrifice accuracy at larger capacities, whereas on low capacities, rapid measuring is necessary to prevent the shunt overheating.

#### 9.1.2) Level 2

In addition to the instruments and tools recommended at the previous point, you will also need the following:

- an oscilloscope with the following characteristics :
  - two channels
  - 100MHz of passband
  - time base up to 200ms, and ROLL option for the trigger
- a probe with the following characteristics :
  - attenuation of 100: 1
  - insulating voltage to ground of at least 600Vrms.



**IMPORTANT !:** Any connection to the ground, whether direct or through the metal frame of the oscilloscope must be eliminated. However, we advise you to make a ground connection for the oscilloscope through an in-series capacitor-resistor circuit, where  $C = 10 \text{ nF}$ ,  $1600 \text{ V}$ ,  $R = 220\text{Kohm}$   $1\text{W}$ .

**TABLE 02**

| Normalised loads |                  |            |
|------------------|------------------|------------|
| Load n.          | Resistance (Ohm) | Power (KW) |
| 1)               | 8.8              | 0.22       |
| 2)               | 8.8              | 0.22       |
| 3)               | 4.4              | 0.44       |
| 4)               | 1.76             | 1.1        |
| 5)               | 0.88             | 2.2        |
| 6)               | 0.44             | 4.4        |
| 7)               | 0.44             | 4.4        |
| 8)               | 0.22             | 8.8        |
| 9)               | 0.22             | 8.8        |
| 10)              | 0.148            | 13.1       |

**NOTE :** When designing an electrical panel containing loads for testing welding equipments, there must be a facility for inputting several loads (as listed in the table) *in parallel* by means of switches.

In the remainder of this manual, we shall use *the symbol* + for inputting two loads *in parallel* (e.g. 3 + 8 means inputting normalised loads 3 and 8 in parallel).

### 9.2) Static load

The repair procedure includes static load tests. If this is not possible, the test can be run welding but this is more difficult.



**IMPORTANT!:** On static load, in order to prevent tripping either the anti-freeze function, overheating protection, or saturation at generator output, load value must be adapted according to the supplied current.

For the equipment, with reference to the normalised loads (see TABLE 02), loads 3 and 8 are required selected, depending on current, according to the following diagram:

| Current (A) | Load n. |
|-------------|---------|
| 5           | 3       |
| 50          | 8       |
| 100         | 8       |
| 140         | 8+3     |

### 9.3) Repair tools

- full set of fork wrenches
- full set of pipe wrenches for hexagon nuts
- full set of screwdrivers for single-slot screws
- full set of screwdrivers for cross-slot screws
- a torque cross-slotted screwdriver for M3 screws with facility for setting tightness torque in the range 1 to 2 Nxm 0.1 with precision of 0.1 Nxm.
- a pair of crimping pliers for insulated terminals (blue, red and yellow)
- a pair of pliers for AMP contacts.
- a pair of pincers and nippers suitable for electronic components.
- a bigger pair of nippers for cutting small gauge steel sheet.
- a soldering iron for electronic components with minimum capacity of 50 W.
- an unwelding station - off-the shelf unwelding tracee may be used instead.

## 10) DIAGNOSIS PROCEDURE .

### 10.1) General information

The diagnosis procedure is according to this logic: starting off from a known situation, you are asked to perform a set of successive operations, while checking that the machine responds correctly at each stage.

### 10.2) Agreements

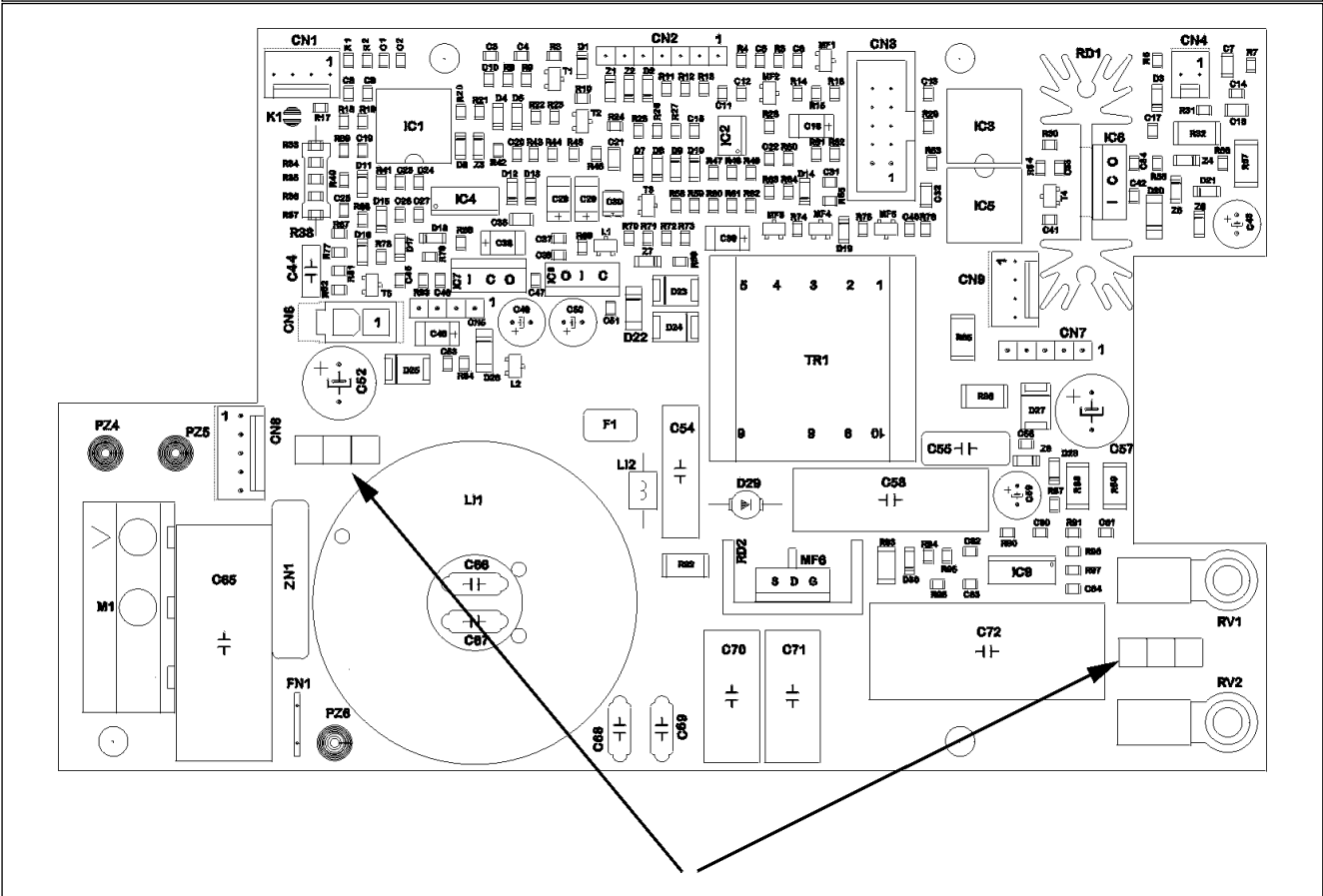
Unless otherwise specified, when you are requested to take a measurement between a pair of terminals - e.g. a-aa - this means that the red prod (or the oscilloscope probe) is placed on the left-hand terminal (on a in this example), while the black prod (or the ground cable of the oscilloscope) is positioned on the right-hand one (on aa in this example).

The pins of the connector are identified by the name of the connector itself followed by a slash character and by the number of the pin; e.g. CN 1/2 identifies the pin 2 of the connector CN1.

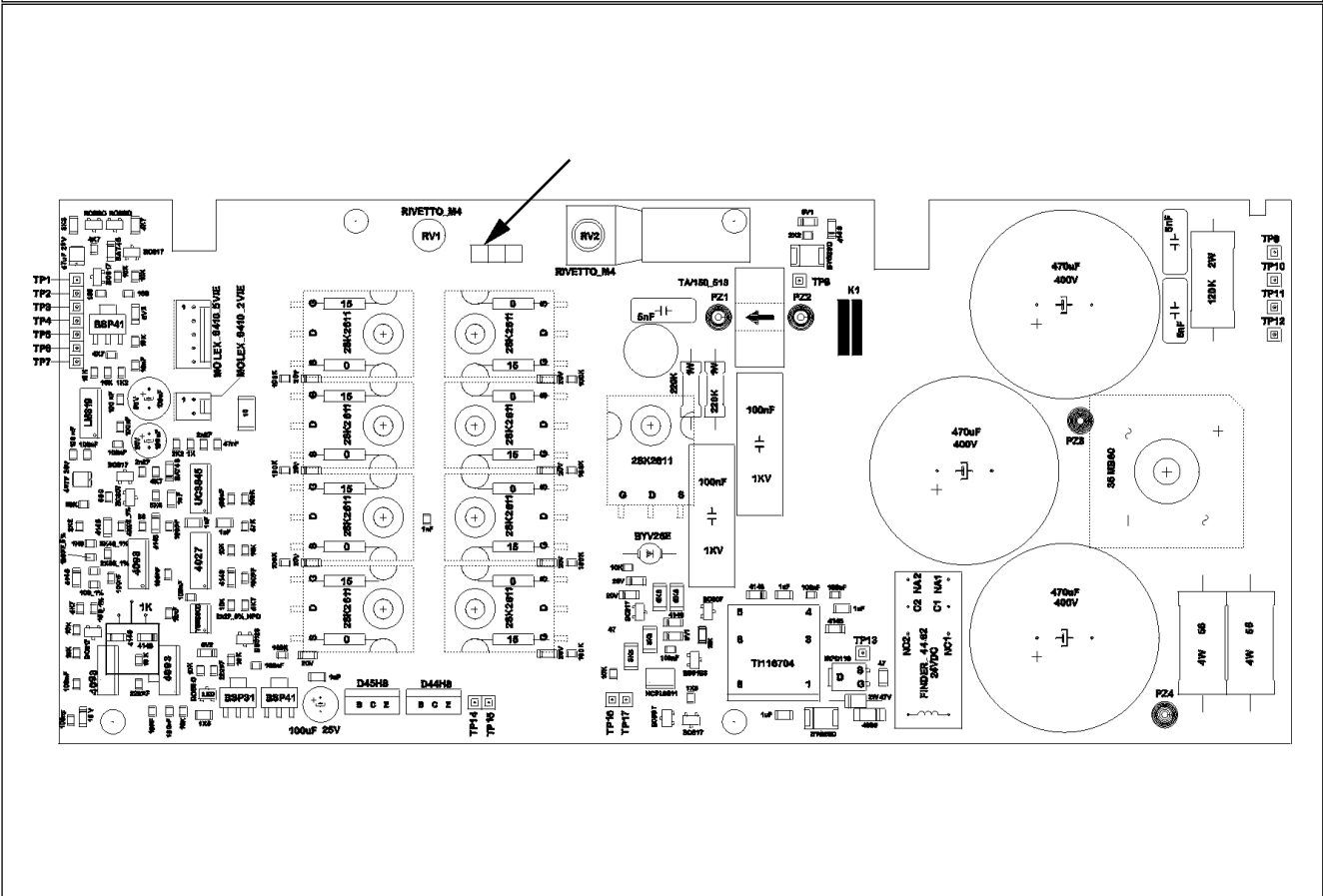


**IMPORTANT !:** Electronic cards may be modified following improvements to the product. This may cause some small differences in the diagnostic procedure according to version. You can trace the card version by reading the number on the card, which is indicated in the areas shown in the following figures. (see fig. 14-15)

Card AP1 (FIG. 14)



Card AP2 (FIG. 15)



---

### 10.3) Diagnostic stages (see fig. 16-17-18-19-20)

#### (level 1 e 2)

Stage 1 : Remove the upper cover from the machine and also the plastic bottom.  
Machine disconnected from the mains.

#### Checks :

Look for any signs of burning on cards or cables.

**yes** : go on ; **no** : run the following checks:

- varistor on Card AP1 in good condition

**yes** : go on ; **no** : replace varistor

- levelling capacitors good and no sign of electrical discharge between container and Card AP2

**yes** : go on ; **no** : replace levelling capacitors

- tracks on printed circuits and other components good

**yes** : go on ; **no** : replace damaged Card

Using a multimeter set at the diode test, check between the points of Card AP2 :

a-aa ed aa-a = circuit open

**yes** : go on ; **no** : execute *check procedure for diode bridge and power inverter*.

b-bb = circuit open (wait a few seconds for the capacitors to charge)

**yes** : go on ; **no** : execute *check procedure for diode bridge and power inverter*.

Using a multimeter set at OHms, check between points:

c-cc = 220 Ohm

cc-c = 170 Ohm

**yes** : go on ; **no** : execute *check procedure for power diodes of secondary winding*.

Stage 2 : Machine connected to mains.  
Current potentiometer at approximately 100 A.  
Turn on master switch.

#### Checks :

Check status of following LEDs:

LED L1 Card AP1 = ON

**yes** : go on ; **no** : execute *check procedure for power supplies*

LED L2 Card AP1 = ON

**yes** : go on ; **no** : execute *check procedure for power supplies*

LED L1 Card AP2 = ON

**yes** : go on ; **no** : execute *check procedure for power supplies*

LED L2 Card AP2 = ON

**yes** : go on ; **no** : execute *check procedure for power supplies*

Visually check if the contacts of the by-pass relay of the pre-loading resistors close with a 5 second delay compared to closure of master switch.

**yes** : go on ; **no** : replace Card AP2

Check efficiency of fan (is air flowing from rear to front of machine).

**yes** : go on ; **no** : remove connection to fan at CN6 of Card AP1 and check:

CN6/1-CN6/2 = approximately 17.5Vdc (following note)

**yes** : replace fan; **no** : execute *check procedure for power supplies*

**NOTE** : value 17.5 Vdc, which refers to connector CN6 when disconnected (load free value), becomes 15 Vdc when connector CN6 is connected (on load value).

Using a multimeter set at Vdc, check between points:

b-bb = 325Vdc @ 230Vac (=Vin X  $\sqrt{2}$ )

**yes** : go on ; **no** : execute *check procedure for diode bridge and power inverter*.

---

Using a multimeter set at Vdc, check between points:

c-cc = 55-56Vdc

**yes** : go on ; **no** : execute *check procedure for diode bridge and power inverter and the check procedure for power diodes of the secondary winding*.

Stage 3 : Set a request for 100A with the potentiometer of the front panel.  
Select MMA mode and apply load 8.

Checks :

With the shunt on the ground cable and using a multimeter set at mVdc, measure the supplied current:

I = 100 A

**yes** : go on ; **no** : execute *check procedure for current control circuits*.



---

### Check procedure for diode bridge and power inverter.

#### (level 1 e 2)

Stage 1 : Disconnect machine from mains.  
Remove the upper cover of the machine

Checks :

Using a multimeter set at the diode test, check between points :

|       |   |                    |
|-------|---|--------------------|
| a-b   | = | approximately 0.4V |
| aa-b  | = | approximately 0.4V |
| b-a   | = | OPEN               |
| b-aa  | = | OPEN               |
| bb-a  | = | approximately 0.4V |
| bb-aa | = | approximately 0.4V |
| a-bb  | = | OPEN               |
| aa-bb | = | OPEN               |

**yes** : go on ; **no** : replace bridge or part 0700 150 011  
(according to outcome of checks in the following stages)

Stage 2 : Conditions of preceding state.  
Remove Card AP1 from machine

Checks :

Visual check : any traces of burning on the power mosfets

**yes** : go on ; **no** : replace part 0700 150 011

Visual check : any traces of burning on components of Card AP2

**yes** : go on ; **no** : replace part 0700 150 011

Using a multimeter set at the diode test, check between points of Card AP2 :

|            |   |                    |
|------------|---|--------------------|
| D-S di MF8 | = | OPEN               |
| S-D di MF8 | = | approximately 0.4V |
| D-S di MF5 | = | OPEN               |
| S-D di MF5 | = | approximately 0.4V |

Using a multimeter set at OHm, check between points of Card AP2 :

G-S of MF from MF1 to MF4 = 12kOhm  
and from MF6 to MF8

G-S of MF5 = 10 kOhm

**yes** : go on ; **no** : replace part 0700 150 011 or go on to stage 3 ( for **level 2** only)

#### (level 2)

Stage 3 : Re-fit Card AP1 on the machine taking care to make all connections.  
Reconnect machine to mains.  
Close master switch.

Checks : Using an oscilloscope set to:

|             |   |           |
|-------------|---|-----------|
| Time scale  | = | 2 us/div  |
| Width scale | = | 100 V/div |

Measure between points of Card AP2 :

TP17 - bb of = oscillogram n.1 (following note )

**yes** : go on ; **no** : replace part 0700 150 011

**NOTE** : After the machine has been running load free for a few minutes, the signal indicated in oscillogram n. 1 becomes identical to oscillogram n. 2, due to heating of the load resistor (j).

---

***Check procedure of power diodes of secondary winding.***

**(level 1 e 2)**

Stage 1 : Disconnect machine from mains.  
Remove the upper cover of the machine  
Remove the plastic bottom of the machine

Checks :

Using a multimeter set at OHm, check between points:

c-cc = 220 Ohm

cc-c = 170 Ohm

**yes** : go on ; **no** : replace part 0700 150 012.

Stage 2 : Remove part 0700 150 012 of the machine (the 220 Ohm resistor is not part of this article and, therefore, should not be removed)

Checks :

Using a multimeter set at the diode test, check between points of Card AP3 :

A1-K from D1 to D4 = approximately 0.3-0.4

K-A1 from D1 to D4 = OPEN

**yes** : go on ; **no** : replace part 0700 150 012.

---

## Check procedure for power supplies

### (level 1 e 2)

Stage 1 : Connect machine to the mains.  
Close master switch

#### Checks :

Using a multimeter set at Vac, check between points of Card AP1 :  
U-N (input terminals) = 230 Vac  
**yes** : go on ; **no** : after disconnecting the machine from the mains, check :  
- is the plug fitted correctly to the power cable  
**yes** : go on ; **no** : fit the plug correctly  
- is the power cable continuous  
**yes** : go on ; **no** : replace power cable  
- are cables secured correctly on the terminal board  
**yes** : go on ; **no** : fit cables correctly on the terminal board

Stage 2 : Re-connect the machine to the mains.  
Close the master switch

#### Checks :

Using a multimeter set at Vac, check between points of Card AP1 :  
RV1-RV2 (rivets) = 230 Vac  
**yes** : go on ; **no** : after disconnecting the machine from the mains, but with the master switch closed, using a multimeter set at Ohm check:  
- U-RV2 = 0 (track continuity)  
**yes** : go on ; **no** : replace Card AP1  
- N-RV1 = 0 (track continuity)  
**yes** : go on ; **no** : replace Card AP1  
- no track damaged on AP1  
**yes** : go on ; **no** : replace Card AP1

Stage 3 : Reconnect the machine to the mains  
Close the master switch

#### Checks :

Using a multimeter set at Vdc, check between points of Card AP1 :  
CN8/1-CN8/3 = 325Vdc  $230 \times \sqrt{2}$   
**yes** : go on ; **no** : after disconnecting the machine from the mains:  
- Check continuity of small cables n.7 and n.8  
**yes** : go on ; **no** : restore continuity  
- run procedure for checking diode bridge and power inverter.

Stage 4 : Reconnect the machine to the mains  
Fit the power supplies by-pass connector (SEE instrument/tools for carrying out diagnostics and repair)  
Close the master switch

#### Checks :

Check the following on card AP1 :

| Position | Status under normal conditions | Meaning                 |
|----------|--------------------------------|-------------------------|
| L1       | ON                             | -12Vdc power ON on Card |
| L2       | ON                             | +12Vdc Power ON on Card |

**yes** : go on ; **no** : after disconnecting the machine from the mains, replace Card AP1 .

Stage 5 : Re-connect the machine to the mains  
Replace the power supplies by-pass connector with the machine's standard connector.  
Close the master switch

Checks :

Check the following on Card AP1:

| Position | Status under normal conditions | Meaning                 |
|----------|--------------------------------|-------------------------|
| L1       | ON                             | -12Vdc power ON on Card |
| L2       | ON                             | +12Vdc Power ON on Card |

**yes** : go on ; **no** : after disconnecting the machine from the mains, replace part 0700 150 011 .

Stage 6 : Reconnect the machine to the mains  
Close the master switch

Checks :

Using a multimeter set at Vdc, check between points of Card AP2 :

- CN2/5-CN2/3 = 25Vdc

- CN2/4-CN2/3 = 18Vdc

**yes** : go on ; **no** : after disconnecting the machine from the mains, check continuity of small cables n.8,9 and 10

**yes** : go on ; **no** : restore continuity

Stage 7 : Reconnect the machine to the mains  
Close the master switch

Check the following on Card AP2:

| Position | Status under normal conditions | Meaning                 |
|----------|--------------------------------|-------------------------|
| L1       | ON                             | +18Vdc power ON on Card |
| L2       | ON                             | +25Vdc Power ON on Card |

**yes** : go on ; **no** : after disconnecting the machine from the mains, replace part 0700 150 011 .

### Check procedure for current control circuits

#### (level 1 e 2)

Stage 1 : Machine disconnected from mains

Checks : (Only on LTV150)

Using a multimeter set at Ohm, check between points of Card AP4 :

|        | Selector in TIG mode | Selector in MMA mode |
|--------|----------------------|----------------------|
| B - 0  | 28 kOhm              | 0                    |
| BB - 0 | 0                    | 6 kOhm               |

**yes** : go on ; **no** : replace flat connector and/or plastic front panel

Stage 2 : Machine connected to mains

When machine has cooled down (idle for ten minutes)

Close the master switch

Checks :

Check status of yellow LED on front panel :

| Colour | Normal status | Meaning                              |
|--------|---------------|--------------------------------------|
| YELLOW | OFF           | Thermal protection device NOT active |

**yes** : go on ; **no** : check

- if CN4 fitted correctly on Card AP1, and, using a multimeter set at Vdc, measure between terminals CN4 = 0V

**yes** : go on ; **no** : fit CN4 correctly

- using a multimeter set to Vdc, measure between indicated points of Card AP4 :

A - 0 = approximately 12V

**yes** : go on ; **no** : replace Card AP1

#### (level 1)

Stage 3 : Machine connected to mains.

Disconnect connector CN1 of Card AP2

Close the master switch

Checks :

Check status of following LED on Card AP2 :

| Position | Status             | Meaning                  |
|----------|--------------------|--------------------------|
| L3       | ON<br>bright light | Maximum modulation (PWM) |

**yes** : go on ; **no** : after disconnecting the machine from the mains, replace part 0700 150 011 .

#### (level 2)

Stage 3 : Machine connected to mains.

Disconnect connector CN1 from Card AP2

Close the master switch

Checks :

With the oscilloscope set to:

Time scale = 2 us/div

Width scale = 5 V/div

Measure Card AP2 :

TP5 - bb = oscillogram n.3

**yes** : go on ; **no** : after disconnecting the machine from the mains, replace part 0700 150 011 .

**NOTE** : If the previous test was positive, the status of the LED on Card AP2 is as follows:

| Position | Status             | Meaning                  |
|----------|--------------------|--------------------------|
| L3       | ON<br>bright light | Maximum modulation (PWM) |

**(level 1 and 2)**

Stage 4 : As at stage 3 .

Checks :

Using a multimeter set at Vdc, check between points of Card AP1 :

CN1/4-CN1/2 = 70 Vdc (=voltage between points c-cc in the figure )

**yes** : go on ; **no** : after disconnecting the machine from the mains, check continuity of connections:

- n.14 (terminal + , CN1 Card AP3)
- n.13 (CN1 Card AP3 , CN1 Card AP1)
- n.12 (shunt , CN1 Card AP1)

Stage 5 : Reconnect connector CN1 to Card AP2

Machine connected to mains

Close the master switch

Checks :

Using a multimeter set at Vdc, check between points of Card AP1 :

CN1/4-CN1/2 = 55-56 Vdc (= voltage between points c-cc)

**yes** : go on ; **no** : after disconnecting the machine from the mains, check continuity of connection between CN9 Card AP1 and

CN1 Card AP2

**yes** : replace Card AP1 ; **no** : restore connection

**(level 1)**

Stage 6 : Machine connected to mains

Close the master switch

Input the load, setting incrementing current from minimum to maximum

(Important: in the static load test, the load must be adapted to the different currents).

Checks :

Check status of the following LED on Card AP2 :

| Position | Status                               | Meaning          |
|----------|--------------------------------------|------------------|
| L3       | ON at low light for low currents.    | Modulation (PWM) |
|          | ON at bright light for high currents |                  |

**yes** : go on ; **no** : after disconnecting the machine from the mains, check continuity of connections:

- n.11 (shunt , CN1/1 Card AP1)

**yes** : go on; **no** : restore connection

While machine is delivering current, using a multimeter set at Vdc, measure between the following points of Card AP1 :

- CN2/3 - dd = - 5.7 Vdc

- CN2/5 - dd = from 200 mVdc to 7.2 Vdc

(for incrementing values set on the potentiometer)

**yes** : go on ; **no** : replace plastic front panel

**NOTE** : If a measuring instrument is fitted on point CN2/5, this causes supplied current to vary by a few amperes.

**(level 2)**

Stage 6 : Machine connected to mains.

Close the master switch

Input the load, setting incrementing current from minimum to maximum

(Important: in the static load test, the load must be adapted to the different currents)

Checks :

Using an oscilloscope set to :

Time scale = 2 us/div  
Width scale = 5 V/div

Measure the following on Card AP2 :

TP5 - bb = PWM widths increase (from oscillogram n.4 to oscillogram n.5) as current requested via the panel potentiometer increases .

**yes** : go on ; **no** : after disconnecting the machine from the mains, check continuity of connection:

- n.11 (shunt , CN1 Card AP1)

**yes** : go on ; **no** : restore connection

While machine is delivering current, using a multimeter set at Vdc, measure between the following points of Card AP1 :

- CN2/3 - dd = - 5.7 Vdc  
- CN2/5 - dd = from 200 mVdc to 7.2 Vdc

(for increasing values set on the potentiometer)

**yes** : go on ; **no** : replace plastic front panel

**NOTE** : If a measuring instrument is fitted on point CN2/5, this causes supplied current to vary by a few amperes.

**NOTE** : If the preceding test was positive, the status of LED on Card AP2 is as follows:

| Position | Status                               | Meaning          |
|----------|--------------------------------------|------------------|
| L3       | ON at low light for low currents     | Modulation (PWM) |
|          | ON at bright light for high currents |                  |

(from stage 7 onwards, for **level 2** only)

Stage 7 : (Only on LTV150)

Machine connected to mains

Selector on front panel in TIG status

Close the master switch

Set a request for 80A on the potentiometer of the front panel, short circuit the electrode on the piece, and then lift it to fire the arc.

Checks :

Using an oscilloscope set to :

TRIGGER = ROLL  
Time scale = 200 ms/div  
Width scale = 2 V/div

Measurement on Card AP1 :

CN2/3 - dd = oscillogram n.6 (establishes the instants before and after arc firing)

CN2/5 - dd = oscillogram n.7 (establishes the instants before and after arc firing)

**yes** : go on ; **no** : replace Card AP1

Stage 8 : (On LTV150, selector on front panel in MMA mode)

Set a request for 80A on the potentiometer of the front panel. Fire the arc.

Checks :

Using an oscilloscope set to :

TRIGGER = ROLL  
Time scale = 200 ms/div  
Width scale = 2 V/div

Measure the following on Card AP1 :

CN2/3 - dd = oscillogram n.8 (establishes the instants before and after arc firing)

CN2/5 - dd = oscillogram n.9 (establishes the instants before and after arc firing)

**yes** : go on ; **no** : replace Card AP1

---

Stage 9 : (On LTV150, selector on front panel in MMA mode)

Set a request for 80A on the potentiometer of the front panel, fire the arc and, when fired, maintain the electrode short-circuited to the piece

Checks :

Using an oscilloscope se to :

|             |   |         |
|-------------|---|---------|
| TRIGGER     | = | ROLL    |
| Time scale  | = | 200 ms  |
| Width scale | = | 2 V/div |

Measure the following on Card AP1 :

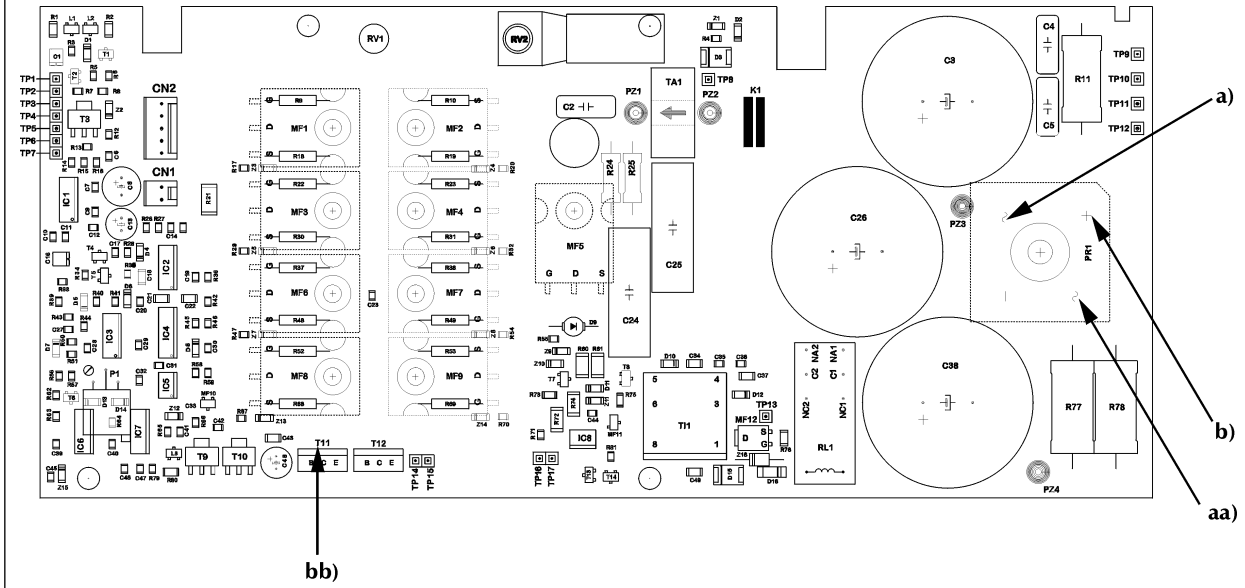
CN2/3 - dd = oscillogram n.10 (establishes the instants before and after arc firing)

CN2/5 - dd = oscillogram n.11 (establishes the instants before and after arc firing)

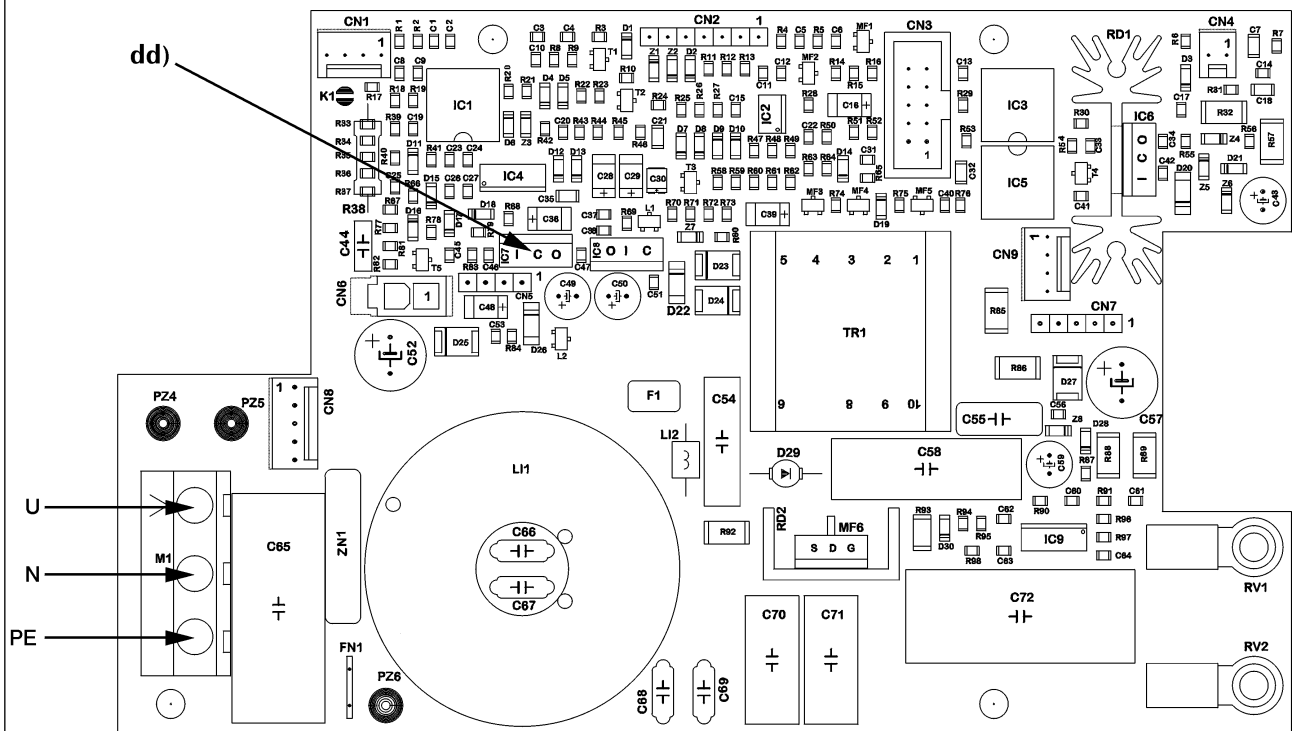
**yes** : go on ; **no** : replace Card AP1



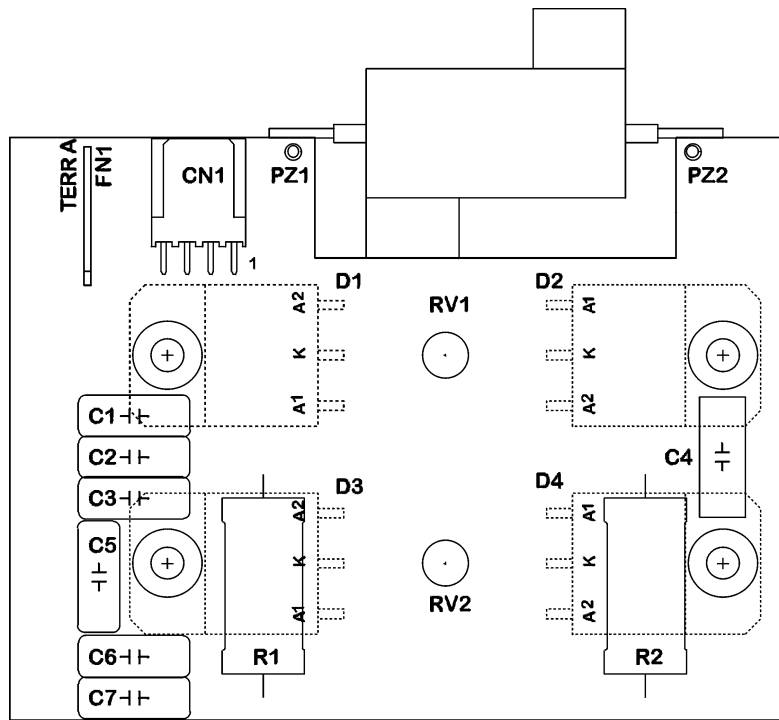
Card AP2 (FIG. 16)



Card AP1 (FIG. 17)

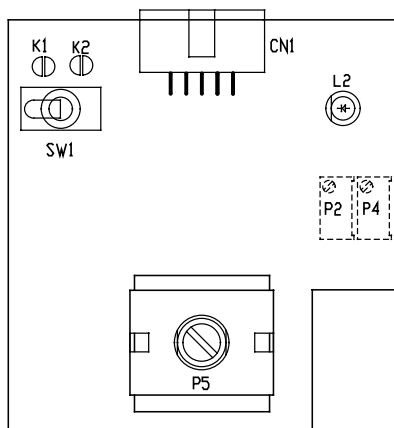


Card AP3 (FIG. 18)



Card AP4 or AP4/01 (FIG. 19)

(components side view)



(soldering side view)

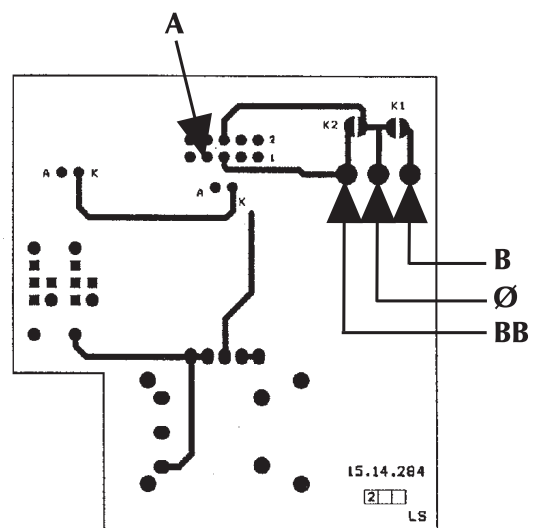
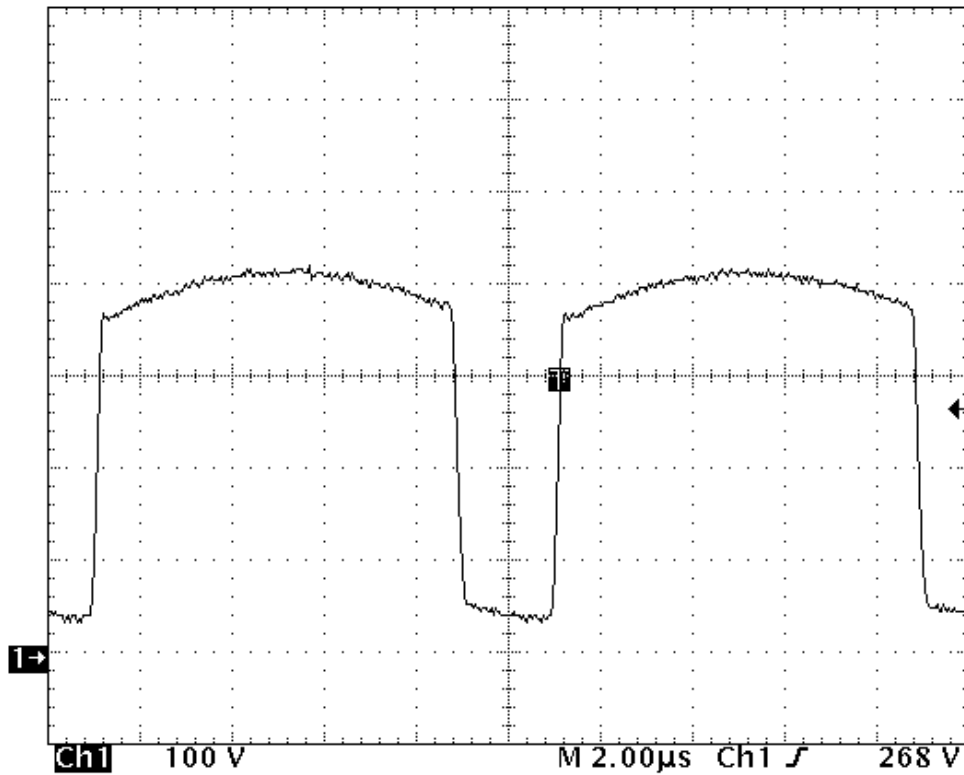


FIG. 20



Oscillogram 1

Tek Run: 25.0MS/s Sample

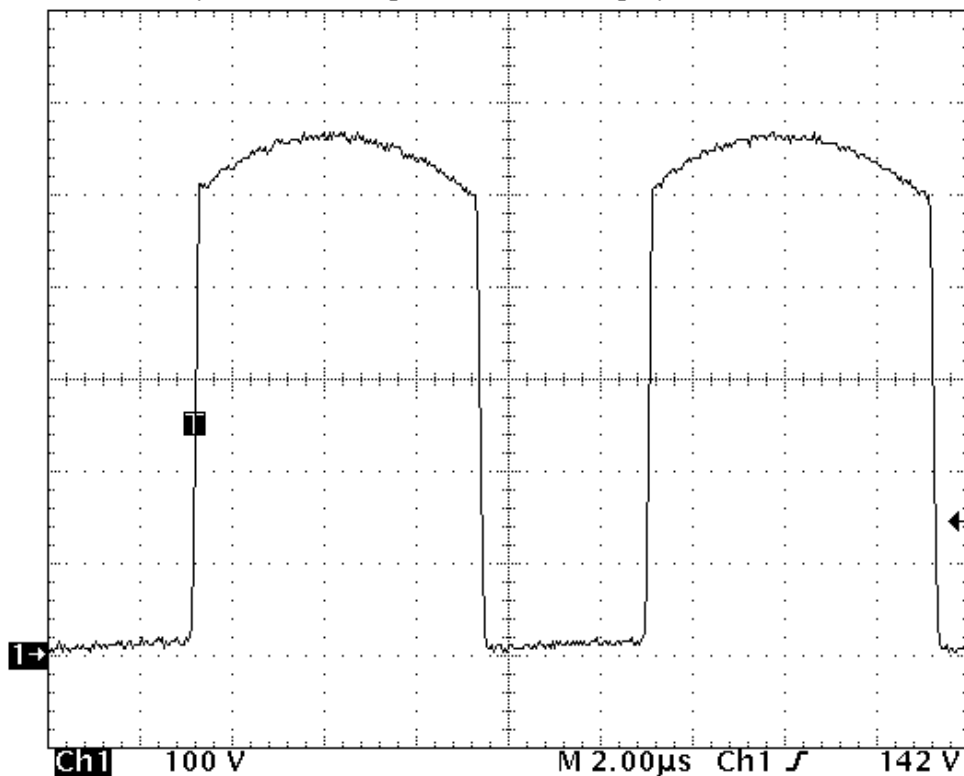


C1 Freq  
99.920kHz

6 Apr 1999  
16:27:38

Oscillogram 2

Tek Run: 25.0MS/s Sample



C1 Freq  
101.398kHz

C1 -Duty  
37.5 %

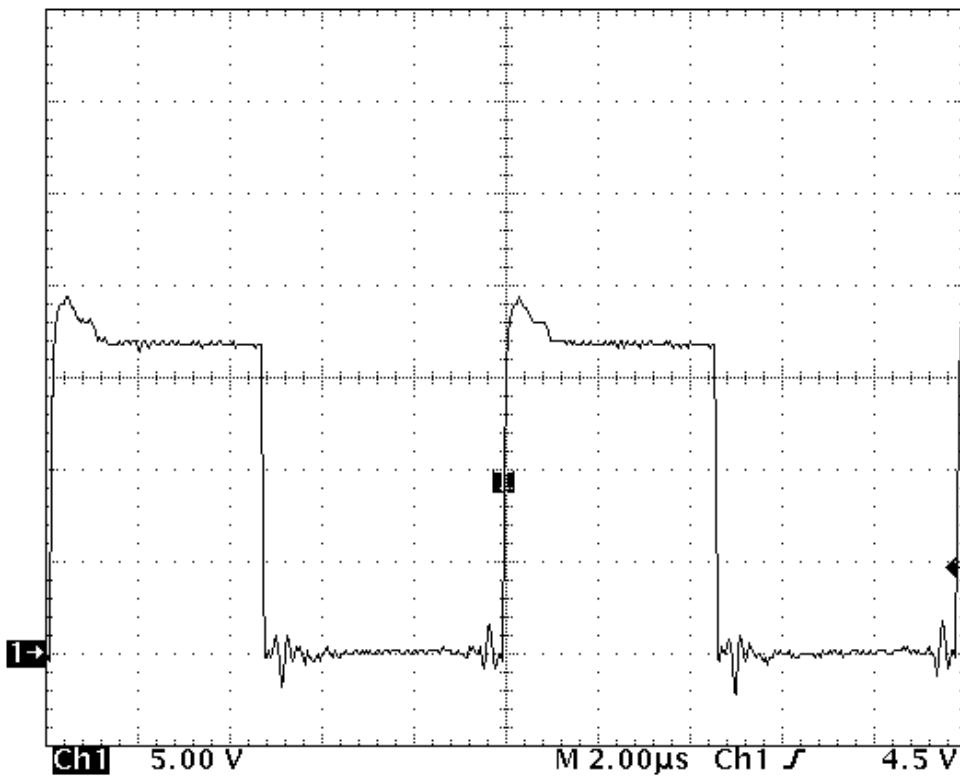
C1 High  
558 V

28 Apr 1999  
16:40:29

Oscillogram 3

Tek Run: 25.0MS/s

Sample



C1 Freq  
101.595kHz

C1 -Duty  
53.3 %

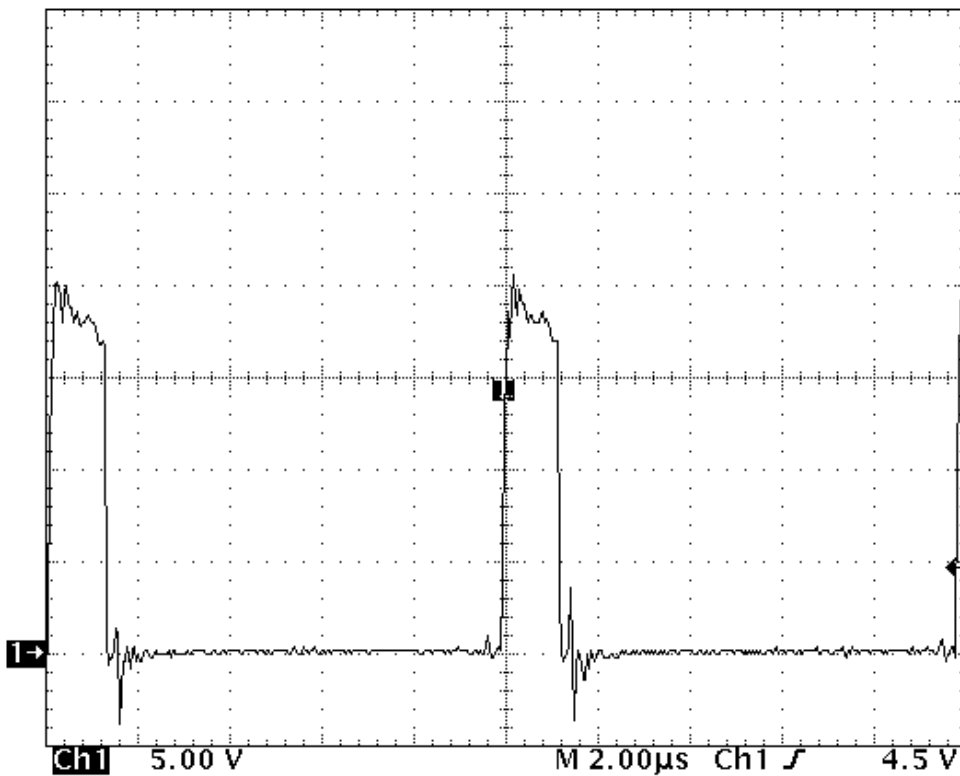
C1 High  
16.7 V

28 Apr 1999  
17:03:55

Oscillogram 4

Tek Run: 25.0MS/s

Sample



C1 Freq  
101.465kHz

C1 -Duty  
87.8 %

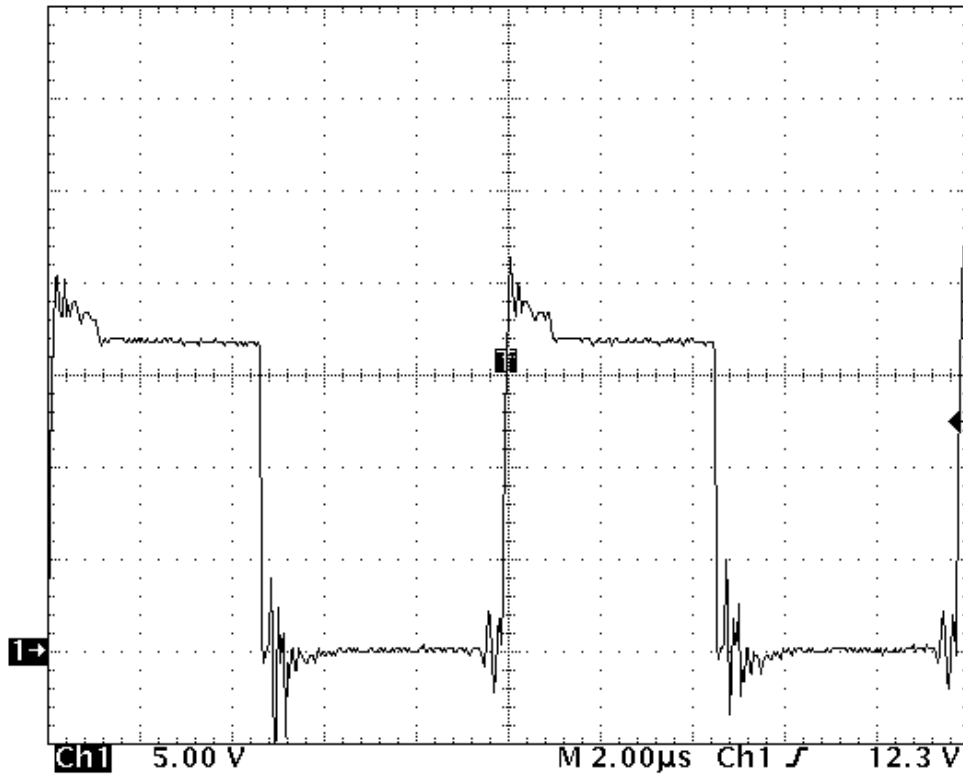
C1 High  
17.9 V

28 Apr 1999  
17:17:29

Oscillogram 5

Tek **Stop:** 25.0MS/s

142 Acqs



C1 Freq  
101.485kHz

C1 -Duty  
53.4 %

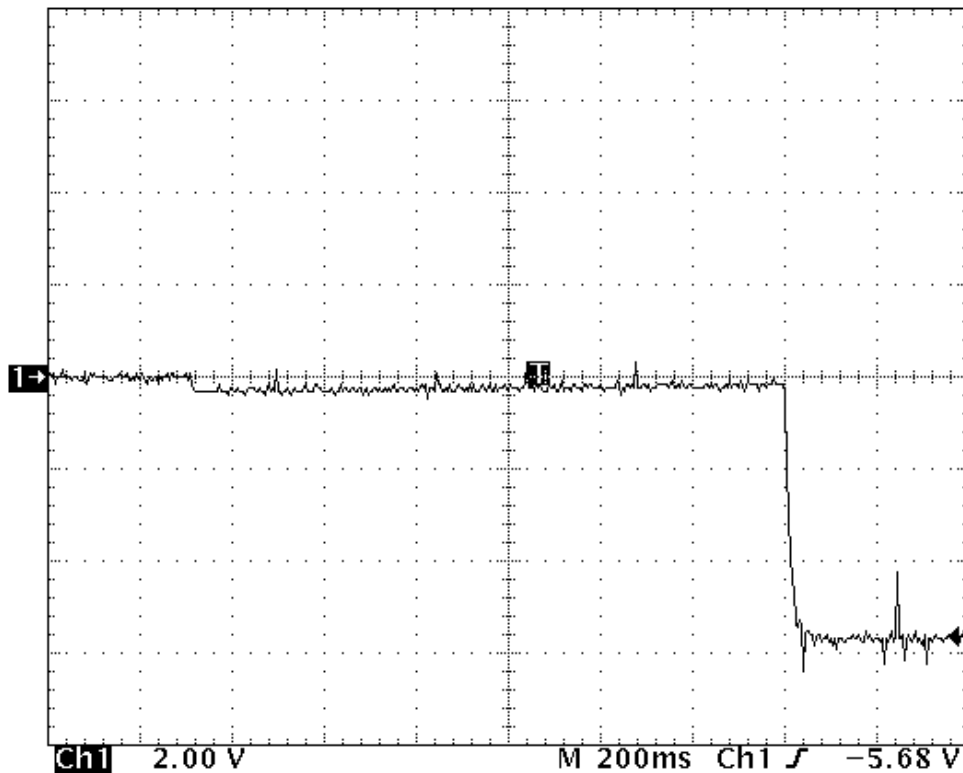
C1 High  
16.7 V

28 Apr 1999  
17:25:23

Oscillogram 6

Tek **Stop:** 250 S/s

1 Acqs

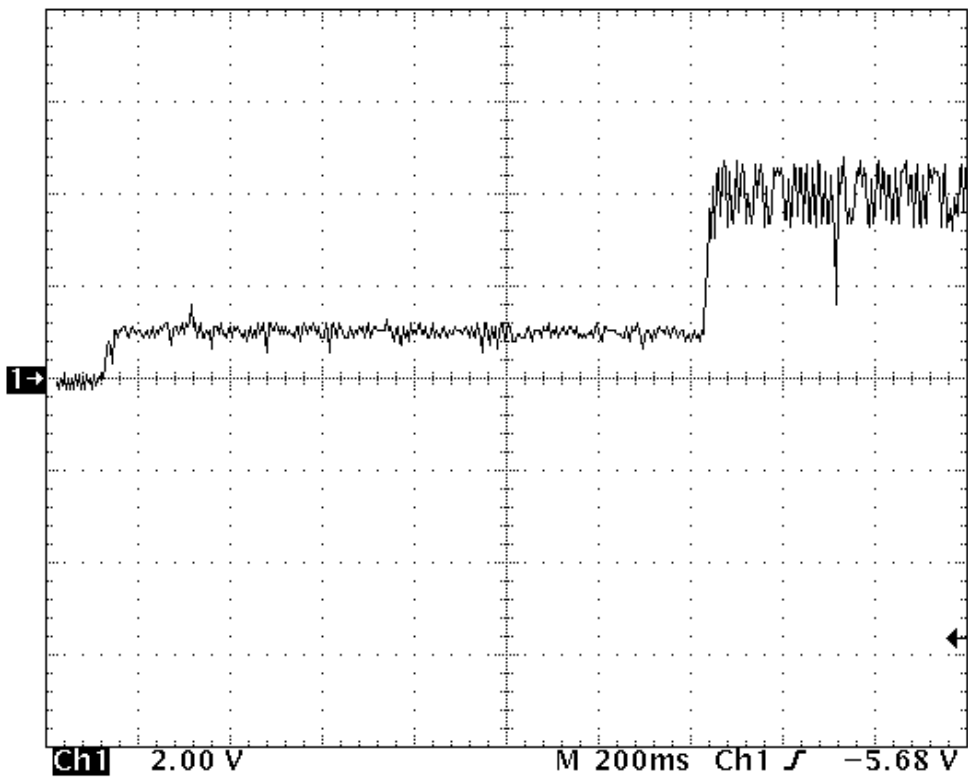


28 Apr 1999  
18:03:08

Oscillogram 7

Tek **Stop:** 250 S/s

1 Acqs

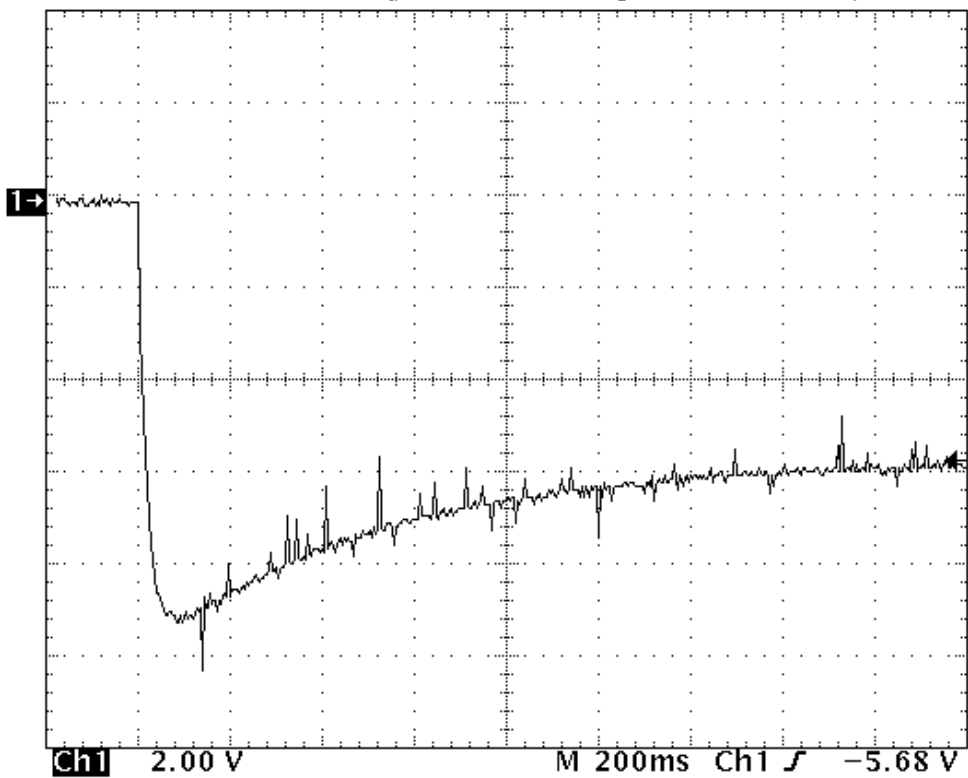


28 Apr 1999  
18:09:19

Oscillogram 8

Tek **Stop:** 250 S/s

1 Acqs

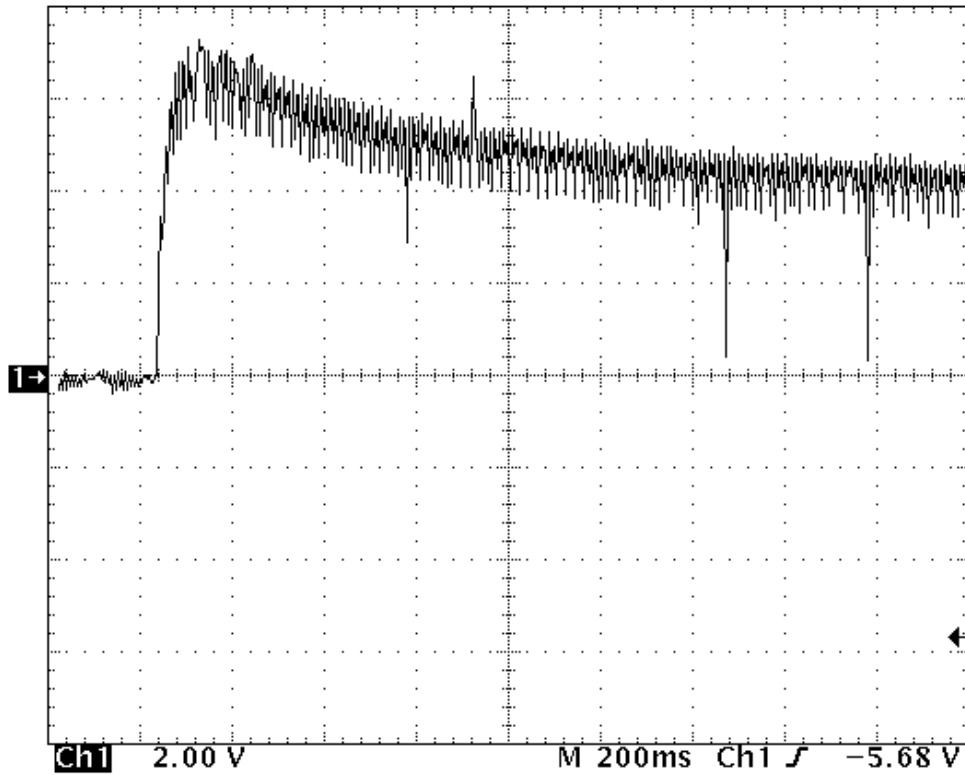


28 Apr 1999  
18:10:34

Oscillogram 9

Tek **Stop:** 250 S/s

1 Acqs

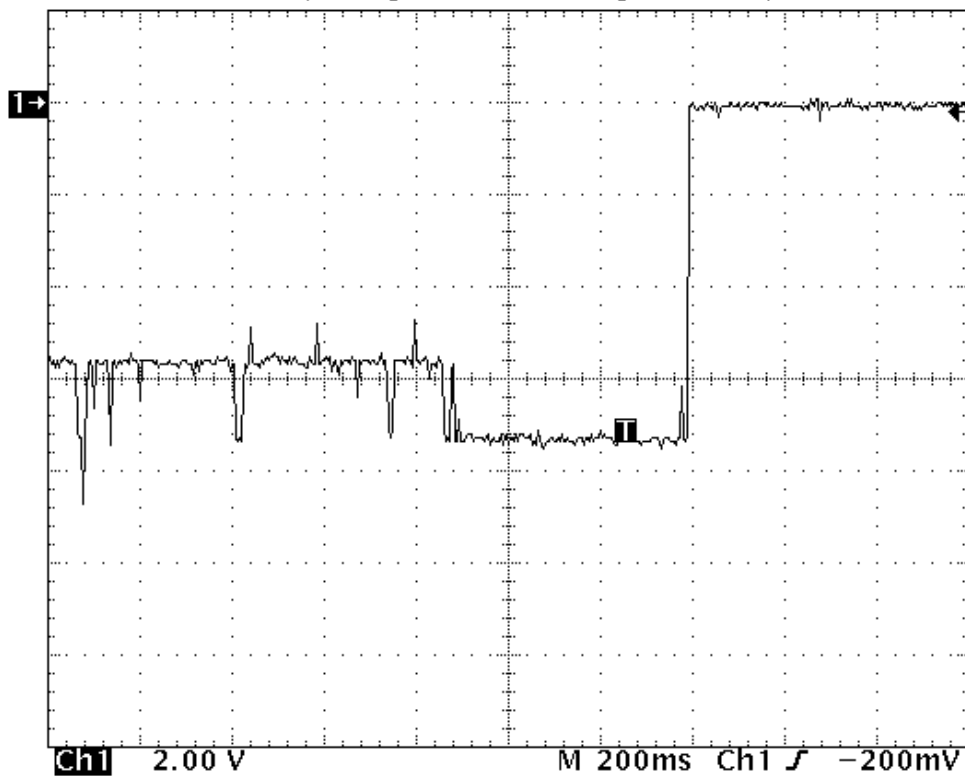


28 Apr 1999  
18:11:10

Oscillogram 10

Tek **Stop:** 250 S/s

1 Acqs



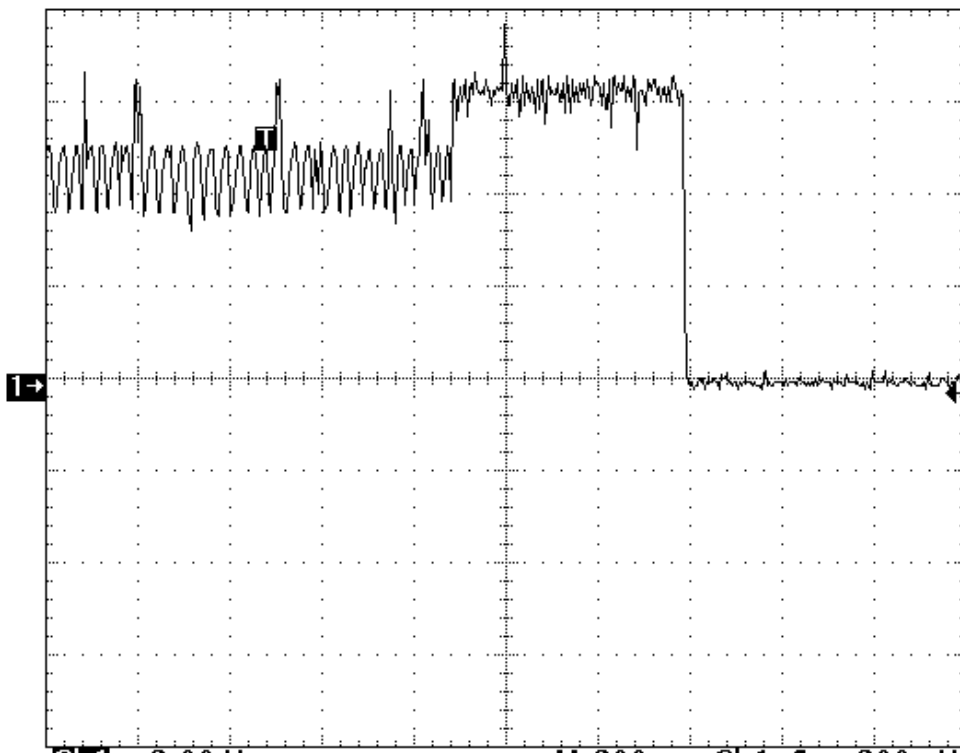
29 Apr 1999  
10:17:07



Oscillogram 11

Tek **Stop:** 250 S/s

1 Acqs



ch1

2.00 V

M 200ms

Ch1

-200mV

29 Apr 1999

10:18:35

## 11) PARTS DISMANTLING AND RE-INSTALLATION PROCEDURE . (see fig. 21-22-23-24-25)

### 11.1 Top casing (2-3).

- Remove the four screws corresponding to the four supporting feet of the lower cover (1).
- Grip the handle and lift the top casing as far as the cables allow.
- Disconnect the flat connection cable between AP1 and AP4.
- Unscrew the cable bush (6) and slide a section of the mains cable (21) inside the machine.
- Unscrew the screws fastening the mains cable (21) to the terminal block and remove the cable.
- Take the switch (7) out, pressing down the two springs on the upper edge and/or the two on the lower edge.
- After raising the safety triggers of the switch fast-on connections by means of a screwdriver, take the fast-on connections out using a pair of pliers and remove the switch (7).

To refit, carry out these jobs in reverse order.



**IMPORTANT ! : The yellow-green wire of the mains cable must be fixed to the terminal PE; the other two cables can be connected to the other two terminals in any way.**

### 11.2) Lower casing (1)

Disassembly can be performed only after removing the top casing (2-3).

- Disconnect the three cables from the terminal (see point M in the figure) on the top board AP1.
- Raise the plastic grille fitted between the fan and the rear of the cover and unscrew the two screws near the fan (11) fastening the inverter block to the lower casing.
- Unscrew the two screws fastening the copper output bars to the + and - connectors (10) of the machine.
- Unscrew the two screws located near the output filter board (15) fastening the inverter block to the lower casing.
- Raise the inverter block.
- Remove the + and - output connectors (10) from the lower casing .

To refit, carry out these jobs in reverse order.

### 11.3) Switch

Disassembly is performed according to the procedure already described in 11.1.

To re-fit, just insert the switch in the appropriate slot and make sure the springs are correctly connected.

### 11.4) Power cable

Disassembly is performed according to the procedure already described in 11.1.

### 11.5) Top board AP1 (12)

Disassembly can be performed only with the top casing raised.

- Remove the following from the Card :
  - all plug connections
  - connection of mains cable to terminal (see point M in the figure) of top board AP1
  - connection to switch (to switch terminals)
  - connection of the two cables to columns RV1 and RV2 of power board AP2 (see point B in the figure)
- Disconnect the cable connecting to CN1 (SEE point A in the figure) from power board AP2 below .
- Withdraw the card from the four securing columns, pressing the securing nibs located on the ends of the columns.

To re-fit:

- Install the card, making sure that the nibs at the column ends secure the card, as they come out of their seats.
- Fit all electrical connections.



**IMPORTANT ! : The yellow-green cable must be secured to terminal PE, whereas any connection is acceptable for the other two cables.**

### 11.6) Power board AP2 (16)

Disassembly can be performed only with the top board AP1 already removed and with connectors CN1 and CN2 of power board AP2 already disconnected.

- Release terminals RV1 and RV2 of power board AP2 (SEE point B in the figure) and remove the ten securing screws of the power mosfets and diode bridge (SEE point C in the figure).



**IMPORTANT ! : Identify the connecting order, on columns RV1 and RV2 of the cables coming from the power transformer (see point B in the figure).**

- Remove the eight securing nibs along the edges of the card.
- Remove the Card
- Remove the template securing insulating material, located on the radiator (included in the initial production batches)
- check if the special insulating tape at MF5 on the radiator shows signs of burning, perforation or tearing . If it does, the tape must be replaced (this article is supplied together with AP2).
- Clean the radiator carefully and apply a uniform but not excessive layer of thermal paste on the surface of the mosfets and rectifier diode bridge.
- Position power board AP2 (without template) using as reference notch D in the figure.
- Secure power mosfets and rectifier bridge (SEE point 8 in the figure) using the torque screwdriver set to 0.9 - 1.1 Nxm .
- Mack the electrical connections.



**IMPORTANT ! : Observe the connecting order, on columns RV1 and RV2, of the cables coming from the power transformer (see point B in the figure).**

### 11.7) Rectifier diode bridge (on power board AP2) (24)

You can dismantle with board AP1 already removed.

- Cut one terminal of the component at a time, by inserting a pair of nippers in the slit (measuring a few millimetres) between the component and the printed circuit.
- Clear the printed circuit from remaining parts of the terminal .
- Clean the radiator carefully and spread a uniform, but not excessive, layer of thermal paste on the surface of the component.
- Secure the component on the radiator with a torque set to 0.9 - 1.1 Nxm .
- Fit the PCB, securing it as described in 11.6.
- solder the terminals of the components without over-using the tip of the welder on the component terminals.

### 11.8) Capacitors 400V (on power board AP2) (27)

These can be dismantled with power board AP2 already removed.

Fitting/dismantling does not call for any special measures.



**IMPORTANT ! : Fit the component with correct polarity, by comparing the indications on the component housing with those on the fitting lay-out of power board AP2 .**

### 11.9) Relay (on power board AP2) (22)

This can be dismantled with power board AP2 already removed.

Fitting/dismantling does not call for any special measures.

### 11.10) Resistor 56 Ohm (on power board AP2) (28)

Fitting/dismantling does not call for any special measures.

### 11.11) Varistor (on top board AP1) (23)

This can be dismantled with top board AP1 already removed, after checking the condition of the tracks, of the other electronic components and of the component securing holes.

Fitting/dismantling does not call for any special measures.

### 11.12) Fan (11)

Disassembly can be performed only after removing the top casing (2/3) and lower casing (1).

- Disconnect connector CN6 from the top board AP1.
- Remove the plastic element at point E in the figure by unscrewing the two fastening screws.
- Remove the plastic element below the fan by bringing together the side fastening triggers.
- Draw apart the side panels (F in the figure) sufficiently to allow you to withdraw the fan from the lower part of the machine.

To re-fit, perform these jobs in reverse order.

### 11.13) Secondary rectifier board AP3 (17)

Disassembly can be performed only with the top casing and lower casing already removed.

- Disconnect plug CN1 of Card AP3 and the yellow-green wire.
- Unweld the 220 Ohm resistance terminals with the unwelding station.
- Unscrew the screws securing the two copper bars on the power transformer and shunt (SEE point G in the figure).
- Unscrew the nut (point H in the figure) and fully remove the copper bar connected to it.
- Unscrew the nut (point I in the figure) and fully remove the copper bar connected to it.
- Take off the securing screws from the four power components and remove the secondary rectifier board AP3.
- Clean the radiator carefully and apply a uniform but not excessive layer of thermal paste on the surfaces of the four diodes.
- Position the secondary rectifier board AP3 matching up the securing holes of the components with those of the radiator.
- Secure the four diodes, using a torque screwdriver set at 0.9 - 1.1 Nxm .

The dismantling operations are executed in reverse order as follows:

- securing the end of the copper bars on Card AP3
- securing the other ends of the said copper bars on the power transformer and shunt
- re-weld the terminals of the 220 Ohm resistor.
- re-connect the connector and the yellow-green cable.

### 11.14) Connector (10)

Disassembly can be performed only with the lower casing removed.

- Unscrew the securing bolt of the socket and withdraw the connector from the front.

To re-fit, perform these jobs in reverse order.

### 11.15) Power transformer (4)

Disassembly can be performed only with the top and lower casing already removed.

- Remove the outer copper bar after unscrewing the nut fixing it to the secondary rectifier board (see point H in the figure) and the bolt fixing it to one of the power transformer terminals (see point G in the figure).
- Unscrew the nut fixing the inner copper bar to the secondary rectifier board (see point I in the figure) and the bolt fixing it to one of the power transformer terminals (see point G in the figure).
- Remove the shunt after unscrewing the screw fixing it to the connector (9) and the bolt fixing it to the copper bar.
- Free the power transformer terminals from terminals RV1 and RV2 on the power board AP2 (see point B in the figure).



**IMPORTANT ! : Identify the order in which the cables from the power transformer are fixed (see point B in the figure) on columns RV1 and RV2.**

- Split the two plastic elements at the side locking the transformer and take it out.

To refit, carry out these jobs in reverse order.



**IMPORTANT ! : Observe the connection order of the cables from the power transformer (see point B in the figure) to the columns RV1 and RV2.**

### 11.16) Output filter board AP5 (15)

Disassembly can be performed only with the top casing raised.

- Remove the copper bar connected to the + output of the machine after unscrewing the screw fastening it to the + output of the machine and the screw fixing it to the output filter board AP5.
- Unscrew the screw fastening the output filter board to the copper bar connected to the - output of the machine.
- Cut off the connection between the yellow-green earth cable from the top board AP1 and the cable from the output filter board AP5.

To refit, carry out these jobs in reverse order.



**IMPORTANT ! :Remember to restore the connection between the yellow-green wire of the output filter board AP5 and the wire from the top board AP1.**

### 11.17) Front board AP4 - AP4/01 (13-14)

Disassembly can be performed only with the top casing raised.

- Remove the knob cap to access the knob fixing nut.
- Unscrew the nut and remove the knob to access the potentiometer fixing nut.
- Unscrew the potentiometer fixing nut.

To refit, carry out these jobs in reverse order.

### 11.18) Knob (8)

To disassemble, follow the procedure already described in point 11.17.

### 11.19) Strap (20)

- Take out the two pins corresponding to the two belt fixing points at the front and rear of the handle.
- Push hard to release the belt clamps (25) from their housing.

FIG. 21 - AP1

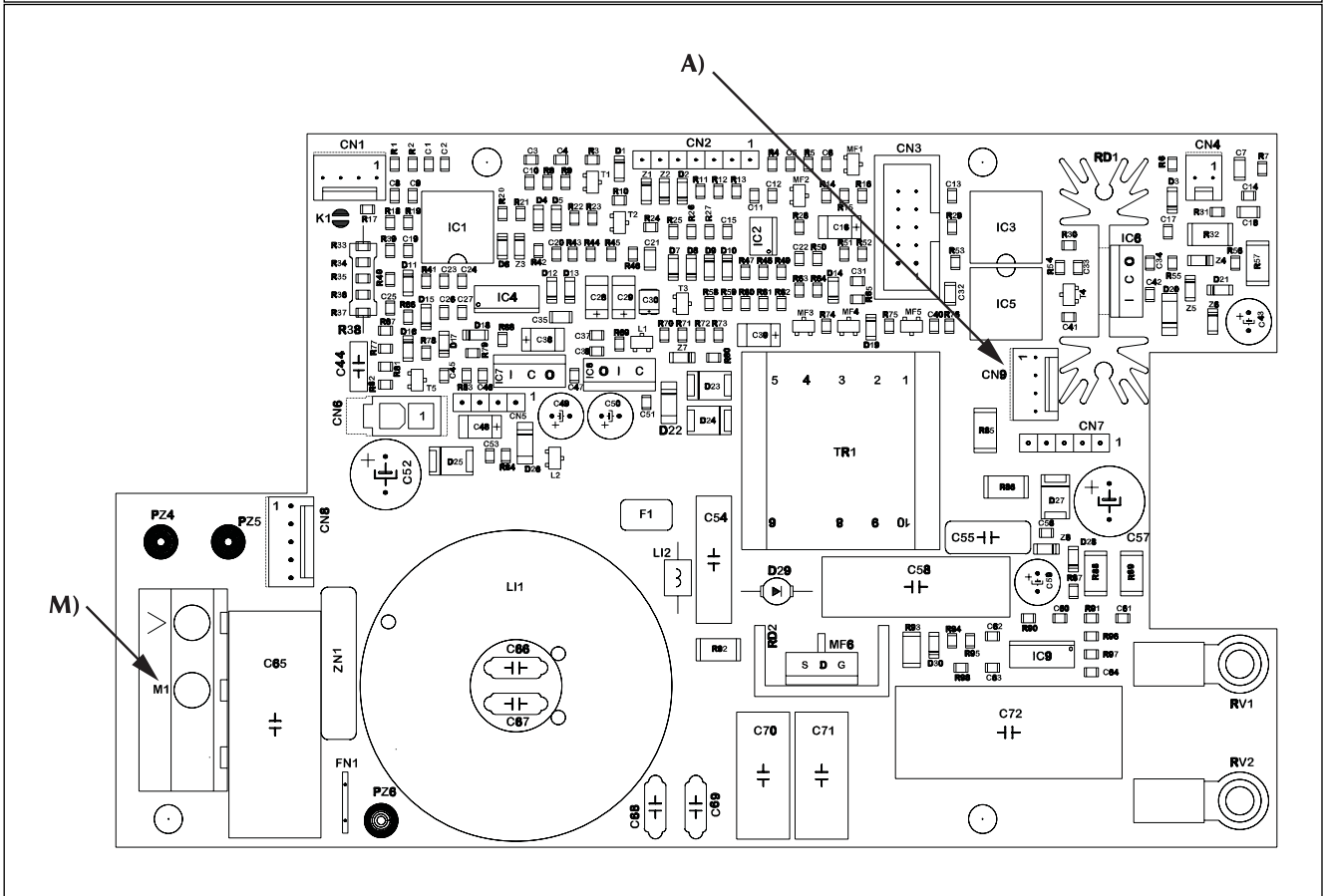
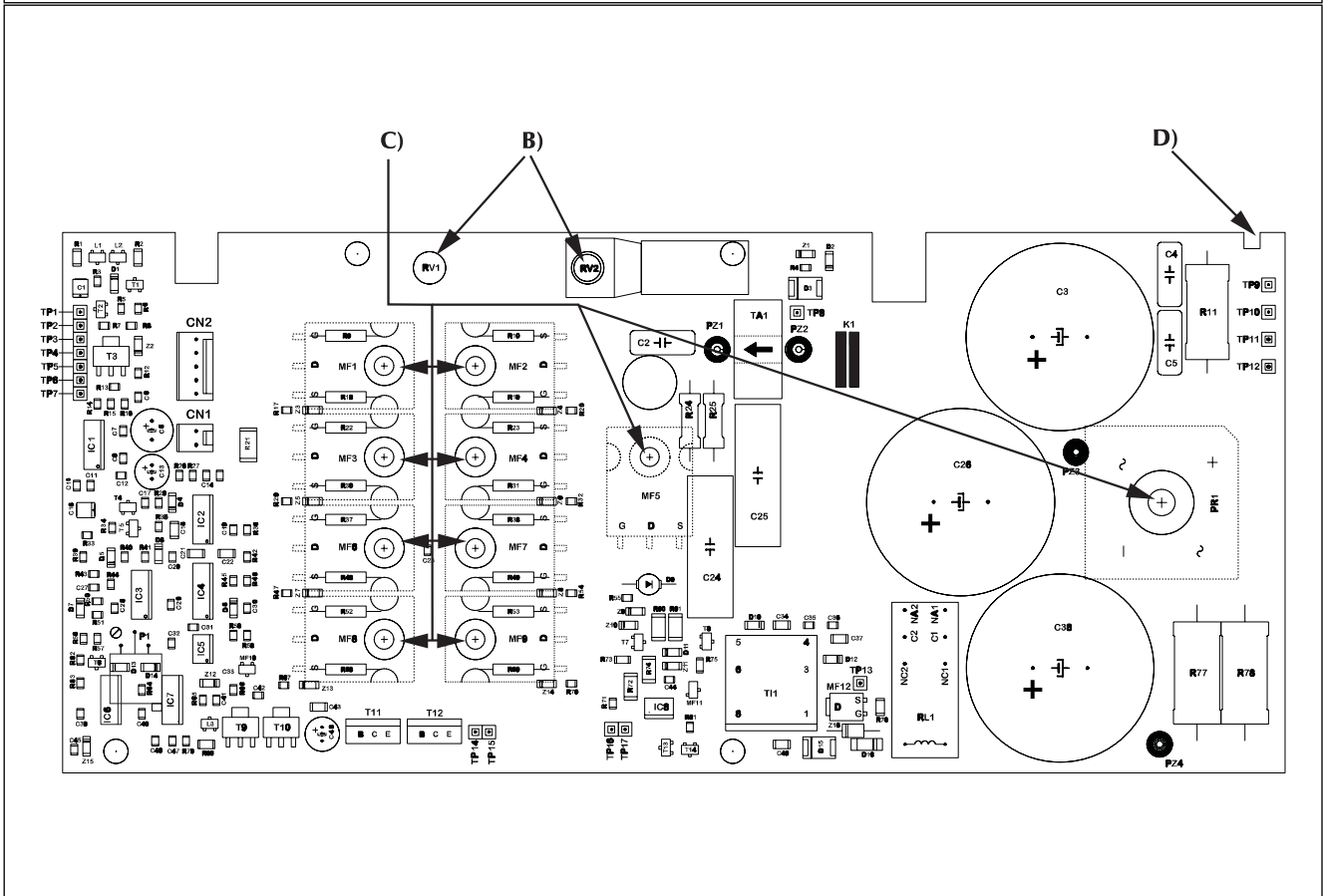


FIG. 22 - AP2



**FIG. 23**

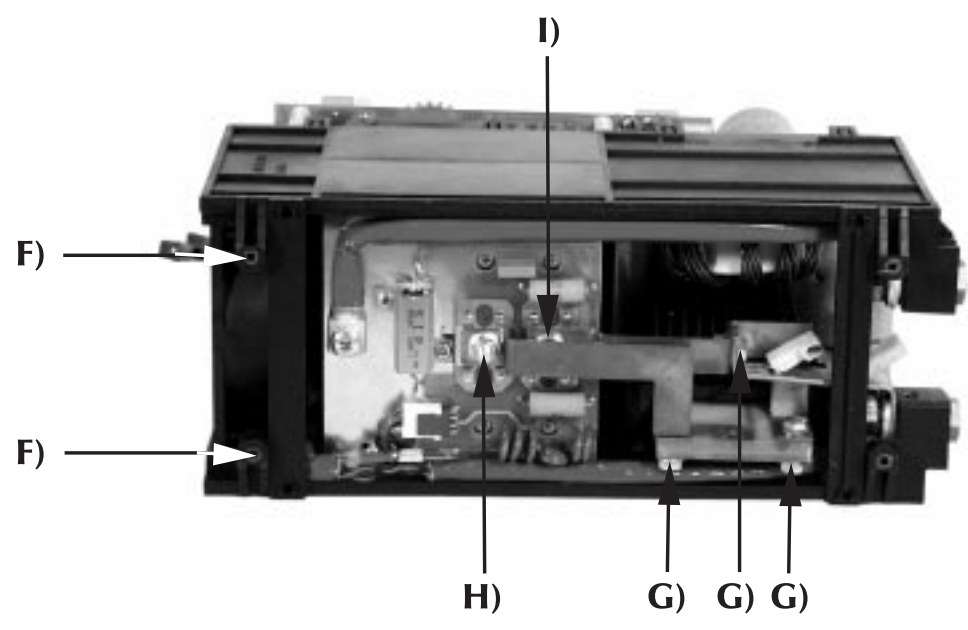


FIG. 24

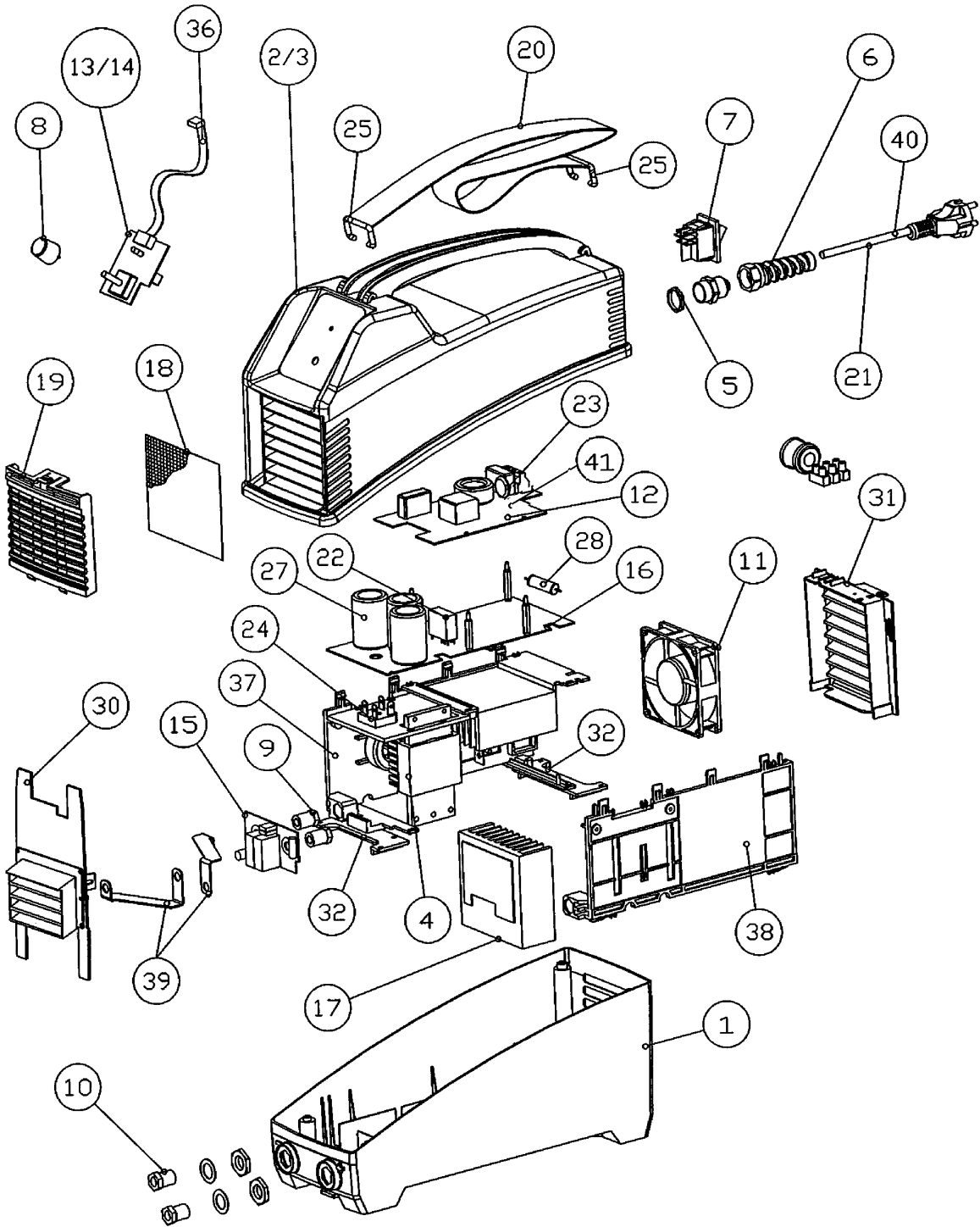
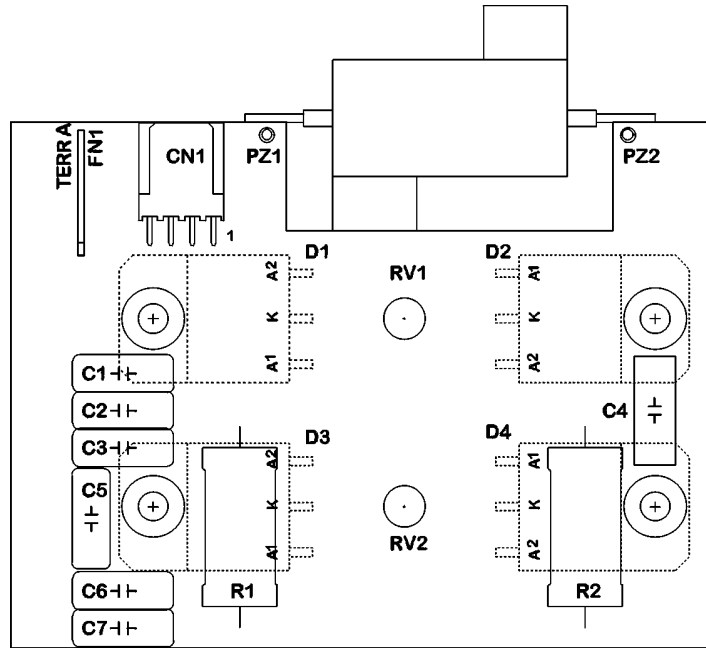


FIG. 25 - AP3



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## 12) OPERATING TESTS AND SETTINGS.

(see fig. 26-27)

Preliminary conditions:

- fit the shunt on the ground cable.
- select scale mVdc on the multimeter
- select the load depending on the current

### 12.1) Measurement and setting of minimum current.

Set to 5A with the potentiometer on the front panel and check that this is the value read by the multimeter. Any fine adjustments of the value can be effected with potentiometer P2 on Card AP4 on the front panel.

### 12.2) Measurement and setting of maximum current.

Set to 150A with the potentiometer on the front panel and check that this is the value read by the multimeter. Any fine adjustments of the value can be effected with potentiometer P4 on Card AP4 on the front panel.



**IMPORTANT ! : When you have executed a setting (e.g. of minimum current), make sure that the other setting (maximum current) is constantly maintained at the set value. A couple of checks are usually enough to consider setting completed.**

### 12.3) Measuring load free voltage

Place a multimeter between the machine's output terminals when it is not supplying current (load free), and measure a value of 55-56Vdc .

**NOTE :** The voltage value measured previously differs from the value on the data-plate, because relevant standards specify a different measuring procedure.

If bump K1 of Card AP1 (SEE figure) is short-circuited, output voltage is 49-50Vdc .

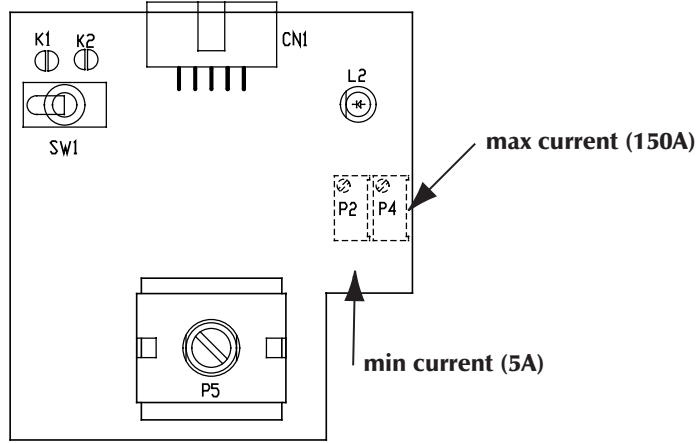
### 12.4) Setting of K1 and K2 (on card AP4)

For LHQ 150 (the card AP4 does not have the MMA/TIG selection switch mounted) K1 = CLOSE - K2 = OPEN.

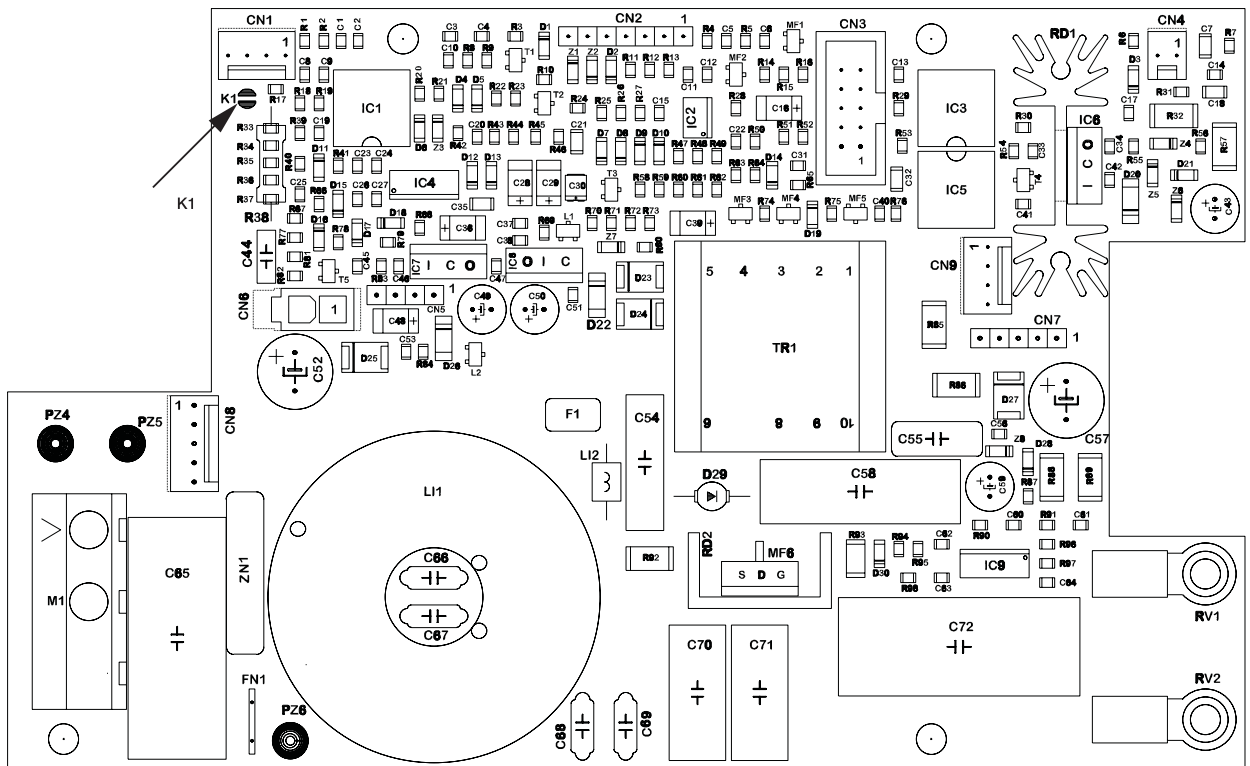
For LTV 150 (the card AP4/01 has the MMA/TIG selection switch mounted) K1 = OPEN - K2 = OPEN.



Card AP4 or AP4/01 (FIG. 26)



Card AP1 (FIG. 27)



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