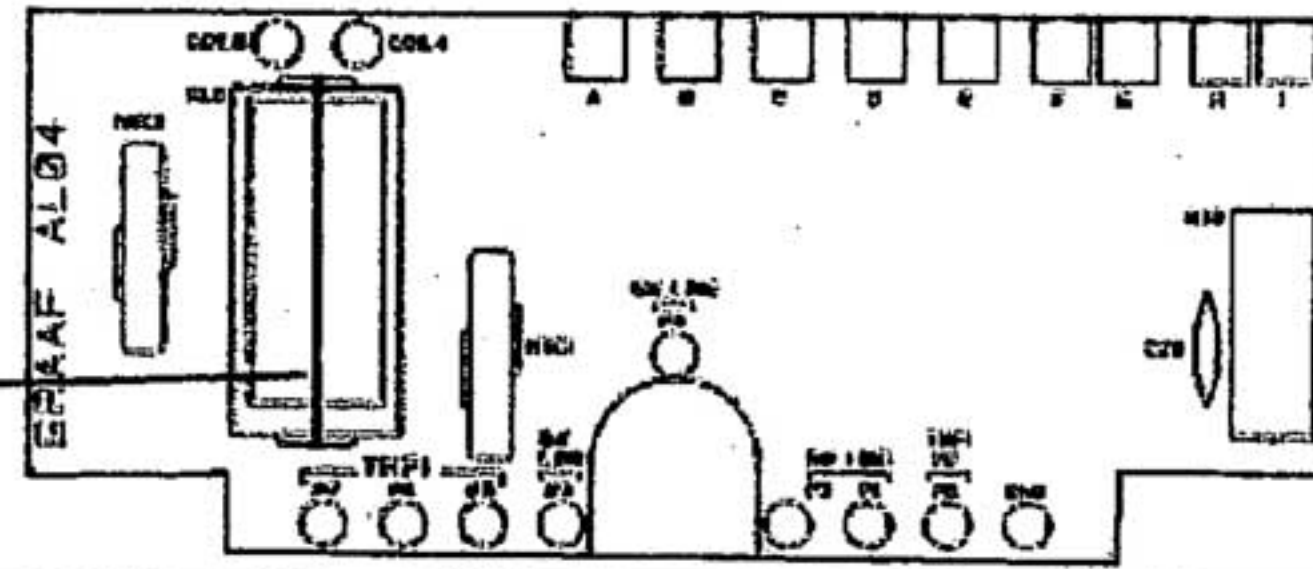


SERVICE MANUAL
GM 200

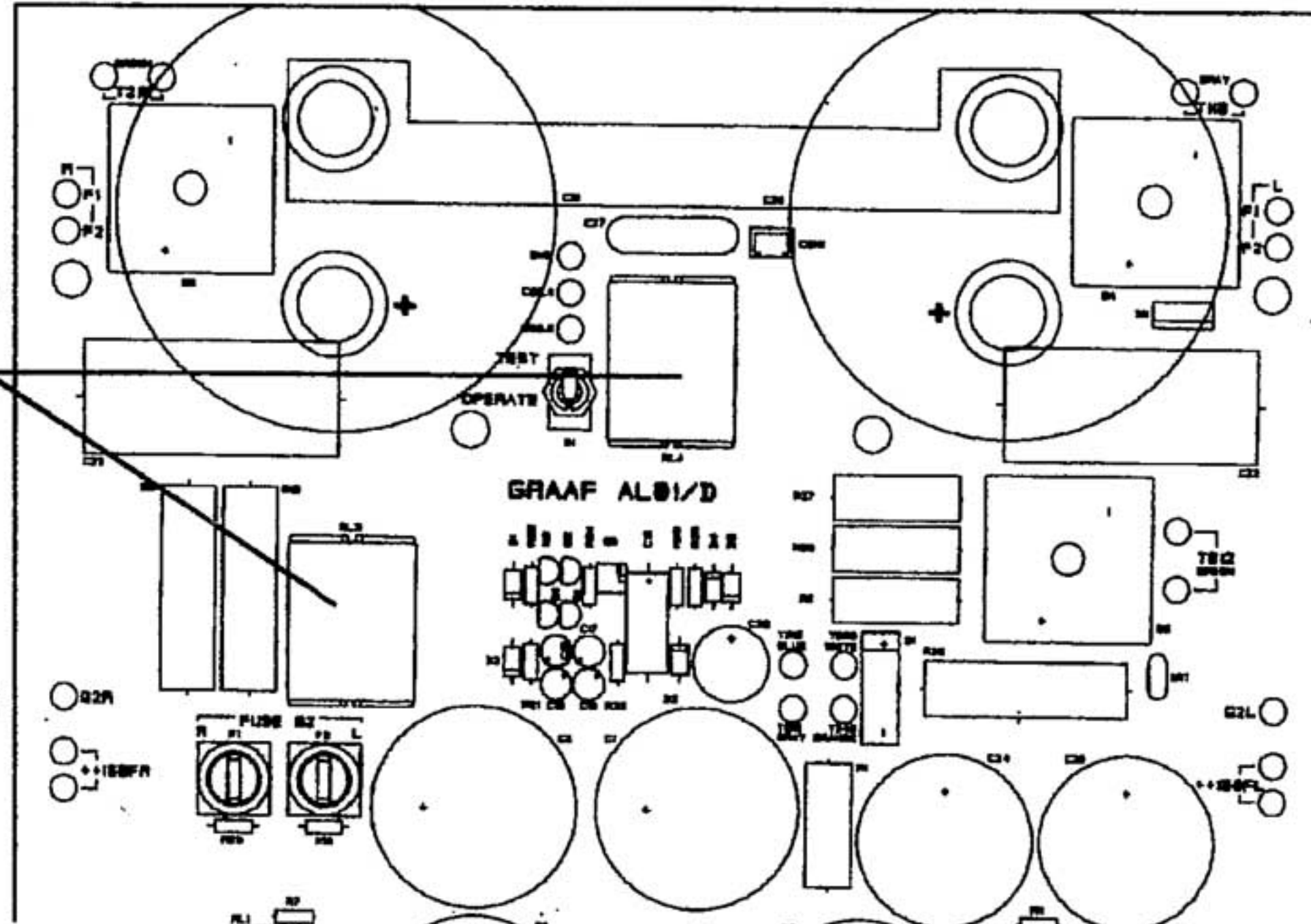
GM 200 TECHNICAL INFORMATION

The GM 200 has a complex circuit provided with different protection systems, but it's studied in such a way that the regulations, the settings and the electronic components replacement can be carried out in the easiest way possible.

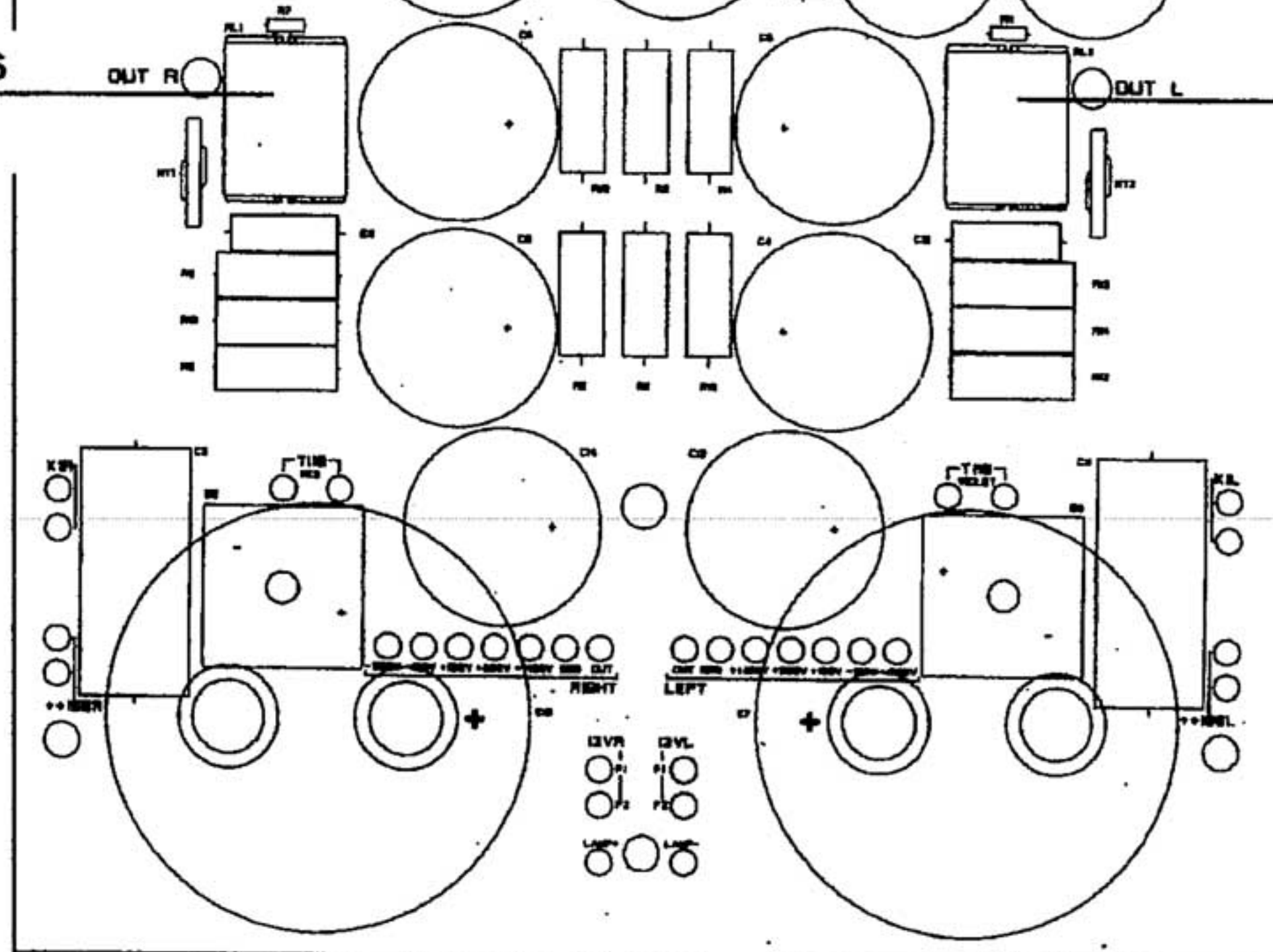
Protection with relays for the current limitation during the starting phase.



Protection with relays: during the starting phase it works as a current limiting system; during the test phase it reduces the filaments and G2 tension.



Protection with relays Channel B right



Protection with relays Channel A left

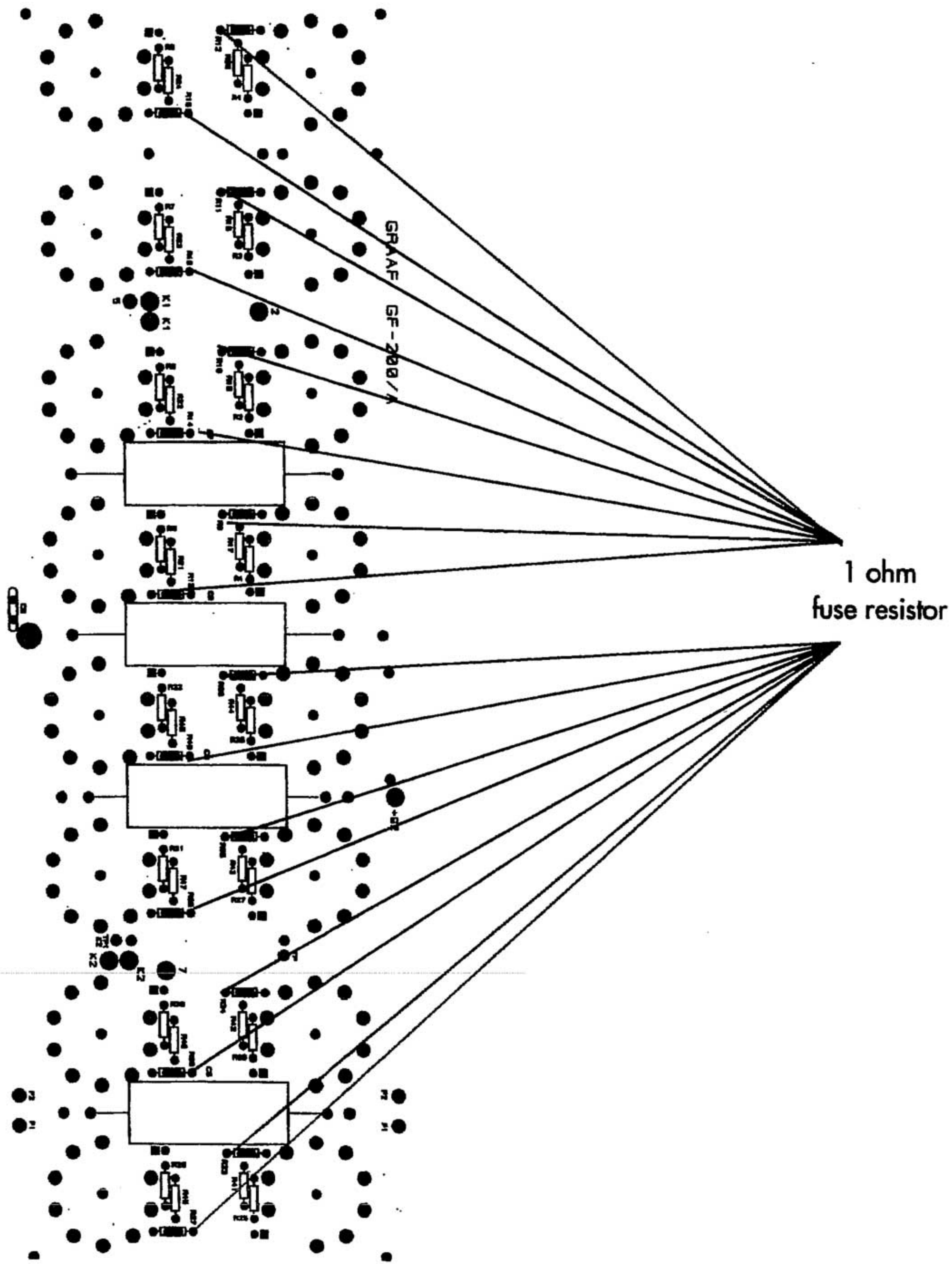
PROTECTION SYSTEMS

1 - PROTECTION WITH RELAYS ON THE POWER SUPPLY CIRCUIT BOARD (PROTECTION OF THE ELECTRICAL CIRCUIT AND THE SPEAKERS)

During the GM 200 starting phase, the unit is equipped with two limiting systems: one works as a current limiting system (it limits the current impulse required by the AC line during the starting phase) and the other one works on the speakers protection system.

The first limiting system works on the PL 504 power tubes filaments improving their lifetime and making the set up of the amplifier easier; it also works on the primary windings of the transformer through two NTC used as current limiters.

The second one switches the loudspeakers off if troubles occur. During the normal on state of the amplifier these systems are deactivated by a timed relay circuit.



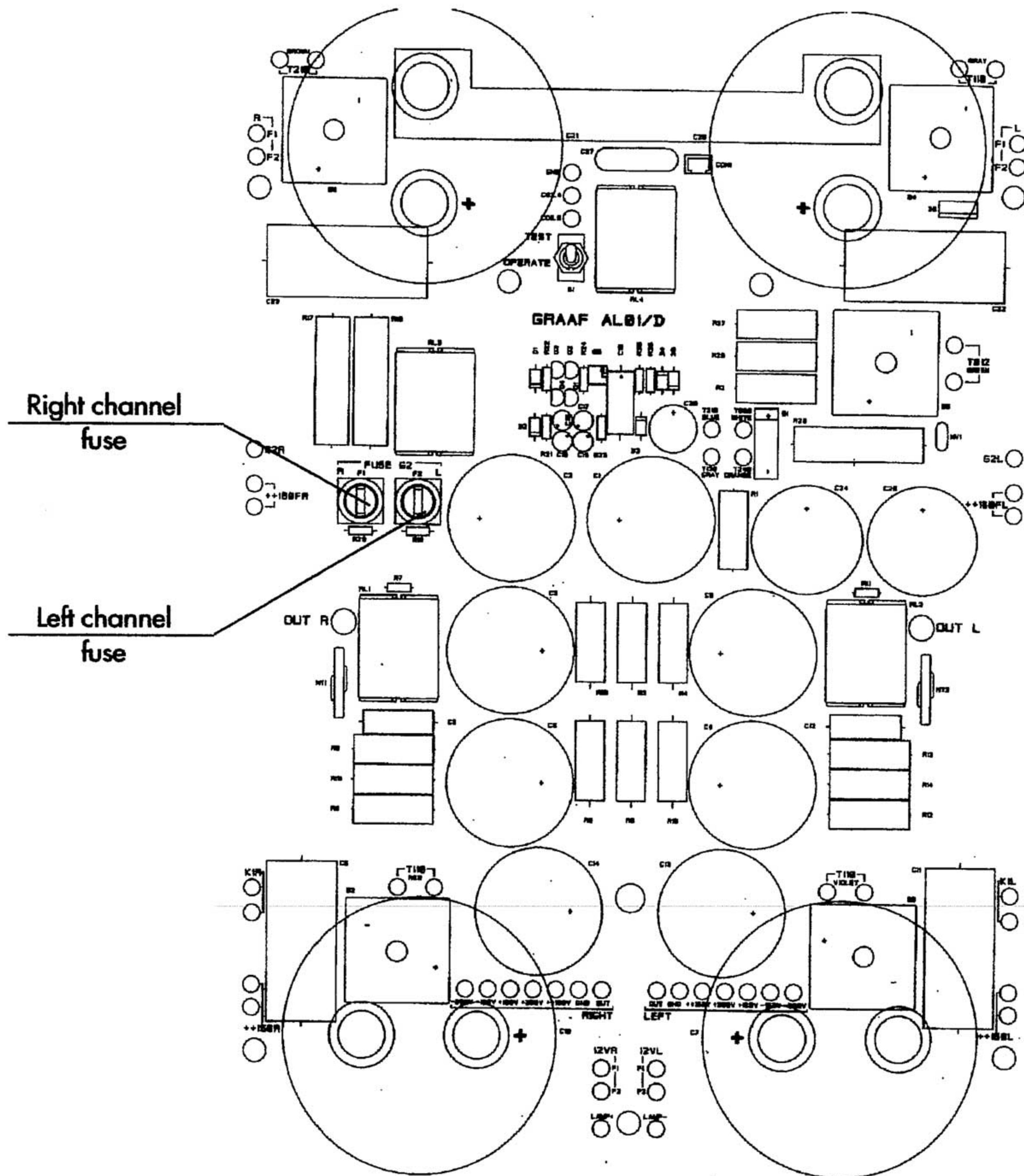
2 - PROTECTION WITH FUSE RESISTORS ON THE OUTPUT PC BOARD (PROTECTION OF THE POWER TUBES)

In the soldering part of the output circuit board there are 1 ohm fuse resistors, connected in series to the cathodes of the PL 504 power tubes. These resistors, in case of a tube trouble, break themselves. In this case a led diode, placed on the upper part of the circuit near the PL 504 socket, is placed in on state (lighting). If one of these leds remains on, it's better to switch the amplifier off and replace the fuse resistor with one of the same value.

Once you have checked the tube functionality you can switch the amplifier on again: the led diode will be off.

In case the same resistor breaks again, replace the tube and the resistor. If the trouble happens many times, you have to check the bias and, if necessary, carry out the bias setting.

In case the problem doesn't disappear please contact Graaf company in Italy.



3 - PROTECTION WITH FUSES ON THE POWER SUPPLY CIRCUIT BOARD (PROTECTION OF THE OUTPUT CIRCUIT).

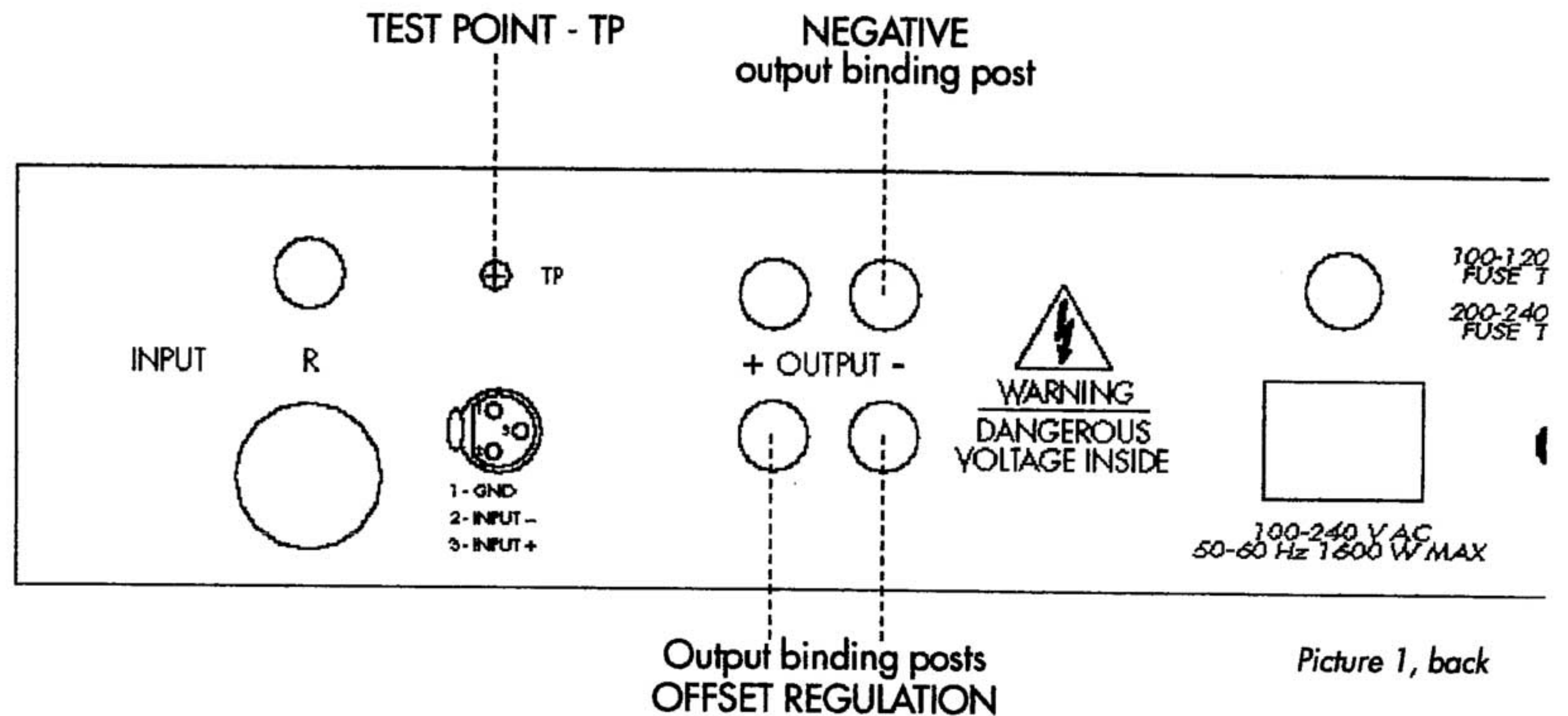
On the power supply circuit there are two F 1,6A fuses in series to the G2. These fuses break in case of excessive current absorption of the power tubes or in case of problems in the amplifier. If one of these fuses breaks, you have to replace it with one of the same value and check the amplifier functionality.

In case the fuse breaks again, remove the fuses from both channels. Fill in the GM 200 reparation technical chart with the broken channel specifications and send it to Graaf company in Italy. The fuse protection enables the protection with relais.

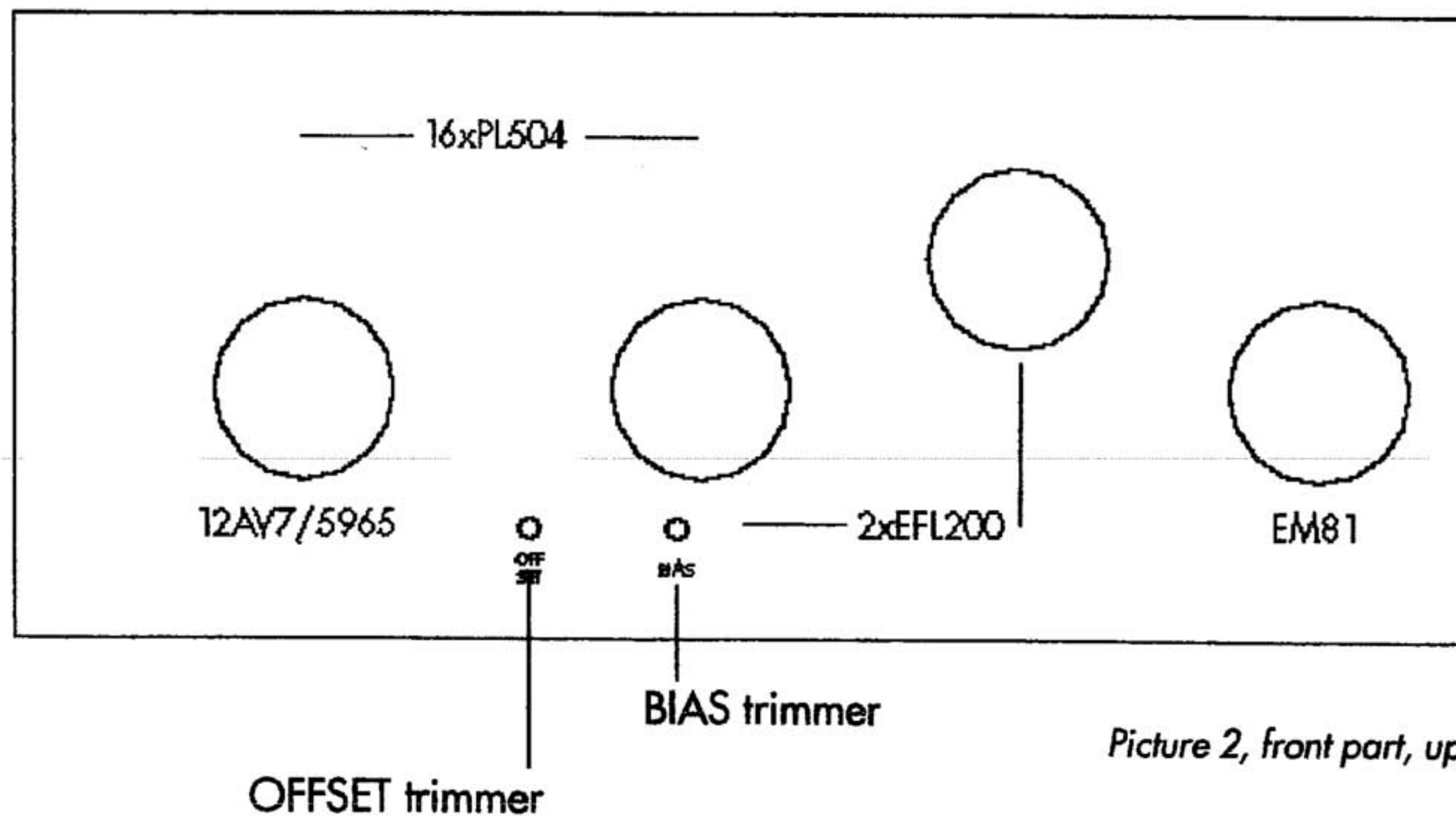
IMPORTANT: In order to obtain the best performances the amplifier must have the same voltage of the country where the unit is working. To check if the GM 200 has been correctly set, follow the indications of the voltage selection table and check the connection between the transformer wires and the AL04 power supply circuit board.

BIAS

For the bias general regulation, place the black plug of a voltmeter in range mV-DC on the negative output binding post of the unit and the red plug on the test point (TP)



Picture 1, back



Picture 2, front part, up

placed between the input pin (INPUT) and the output binding posts, as shown in picture 1.

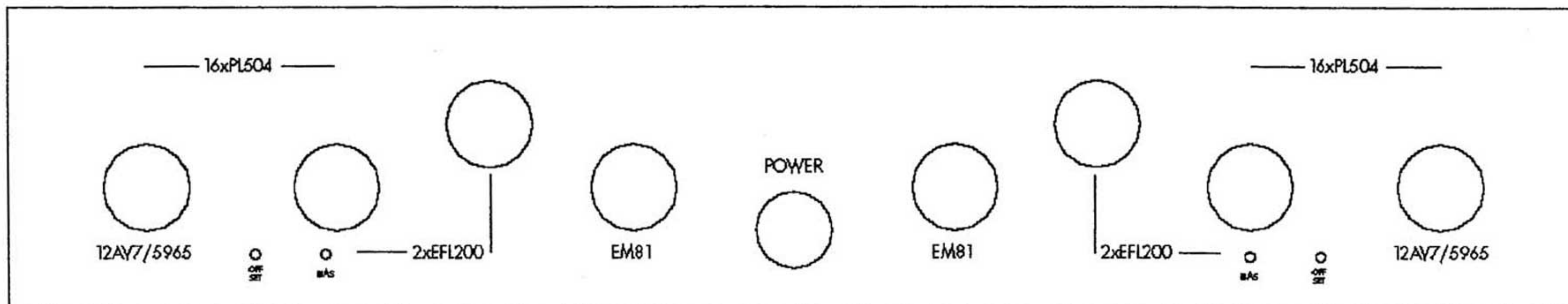
In order to obtain a correct setting, regulate the bias trimmer, placed on the front panel (see picture 2), until you obtain a measure varying from 75mV to 80mV (corresponding to 750/800 mA).

Repeat the operation on the other channel.

OFFSET

Connect a voltmeter in mV range on the output binding posts of the unit (see picture 1).

Regulate the offset trimmer, placed on the front panel (see picture 2) until you obtain a measure inferior +/- 30 mV, near to 0. Repeat the operation on the other channel.



TUBES REPLACEMENT

The following operations must be performed upon replacing tubes:

12BZ7 - No additional reset required.

5965 - Reset the offset only.

EFL 200/6Y9 - Reset the bias and offset.

EM81 / 6DA5 - Place a signal generator at 1000Hz in the XLR or RCA input. Place a AC voltmeter in the binding posts and regulate the signal generator in order to obtain 40V RMS on the binding posts.

For each tube regulate the internal trimmer placed below the

EM81/6DA5: the indication should be parallel.

P.S. This setting operation must be carried out when the amplifier is not connected to the load (loudspeakers).

PL 504

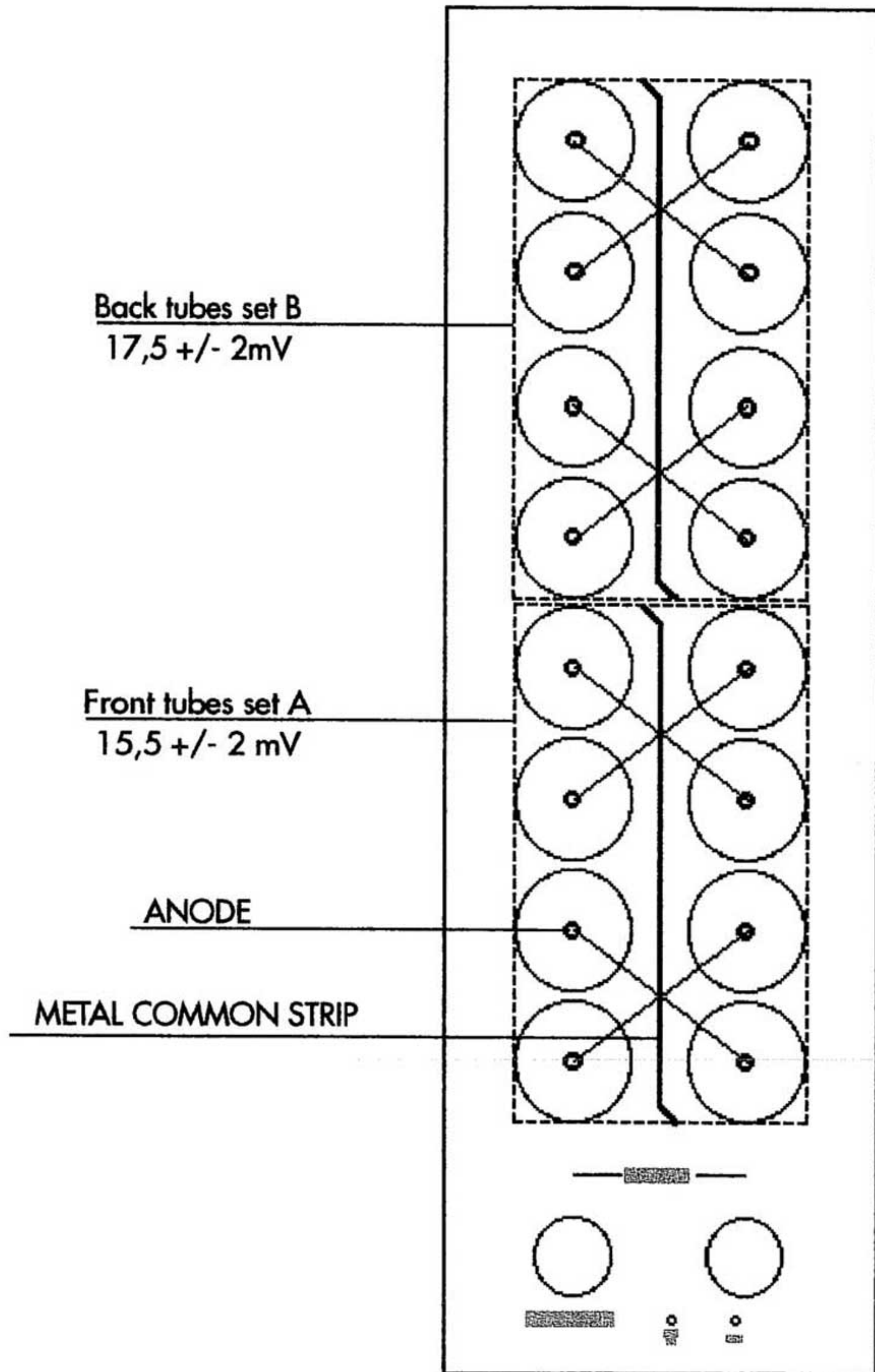
COLOR CODE: All PL 405's are matched by color code which is marked on the bottom of each tube. Tubes should be ordered through Graaf by this color code and indicating the serial number of the amplifier.

1 - If a single PL 504 is replaced with one of the same color it is not necessary to carry out the bias and offset settings.

2 - Upon replacing several PL 504's with tubes of the same color, to test for maximum performance you are encouraged to carry out the bias and offset operations.

3 - In case you replace an entire set of PL 504's (the set color is not important) you have to carry out the bias and offset operations.

In case a filament in the tube goes out, the tubes in line (8) will turn off without causing any damages to the amplifier.



CHECKING PROCEDURE OF THE OUTPUT TUBES ANODE CURRENT

How to measure the tube current to check the unit.

After replacing one or more PL504 power tubes, check that the anode current of the new tube is the same as the others. In order to carry out the measure it's necessary to use a voltmeter in range mV-DC with the positive plug on the metal common strip connection of the tube plates and the negative plug on the tube anode. The measure obtained should be 15,5 mV +/- 2 mV for the set A and 17,5 mV +/- 2mV for the set B.

REPAIRING PROCEDURE

In order to make the GM 200 repair easier, you must fill in the reparation technical chart that you will find in the next page and send it by fax to Graaf company in Italy.

Our technicians will immediately analyse the problem and send back the right procedure for the solution of your trouble.

WHEN THE AMPLIFIER IS IN OFF STATE YOU MUST:

- 1 - Turn the amplifier upside down.
- 2 - Remove the two fuses from the AL01/D power supply circuit board and put the switch, placed on this circuit board, in TEST position.

SWITCH THE AMPLIFIER ON:

- 3 - The luminosity of the gain and driver tubes must be normal, while the power section tubes luminosity must hardly be visible because the test position reduces the filaments voltage of these tubes of the 50%.
- 4 - Take a digital voltmeter in range Volt DC.
- 5 - Place the voltmeter negative plug in the negative output binding post.
- 6 - Fill in the reparation technical chart with the values of the measures obtained on the tube sockets.

After the repair, place the switch of the AL01/D circuit board in OPERATE position and carry out the bias and offset checking operations.

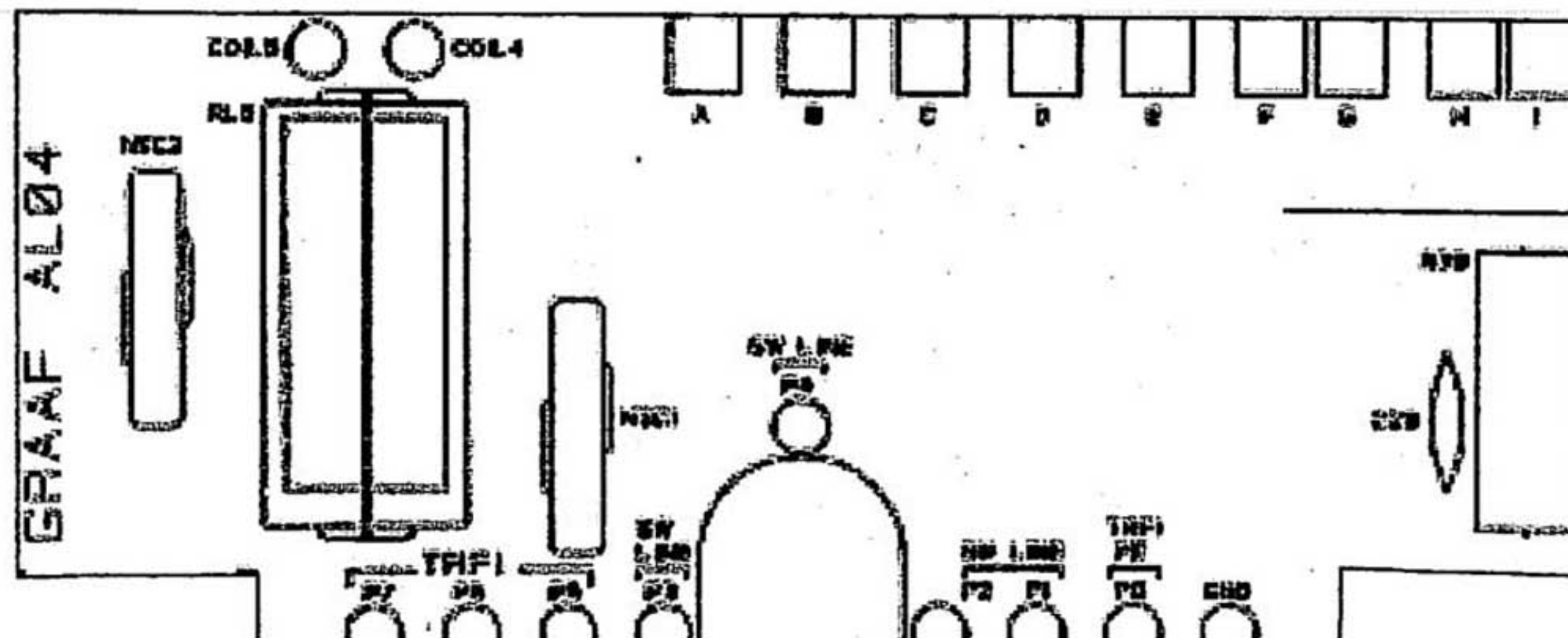
GM 200 REPARATION TECHNICAL CHART (REF. TO ONE CHANNEL)

TUBES \ PIN		1	2	3	4	5	6	7	8	9	10
V1	5965 12AV7										
V2	EFL 200 6Y9										
V3	EFL 200 6Y9										
PV1-8	PL504 27GB5										
PV9-16	PL504 27GB5										
V4	6DA5 EM81										

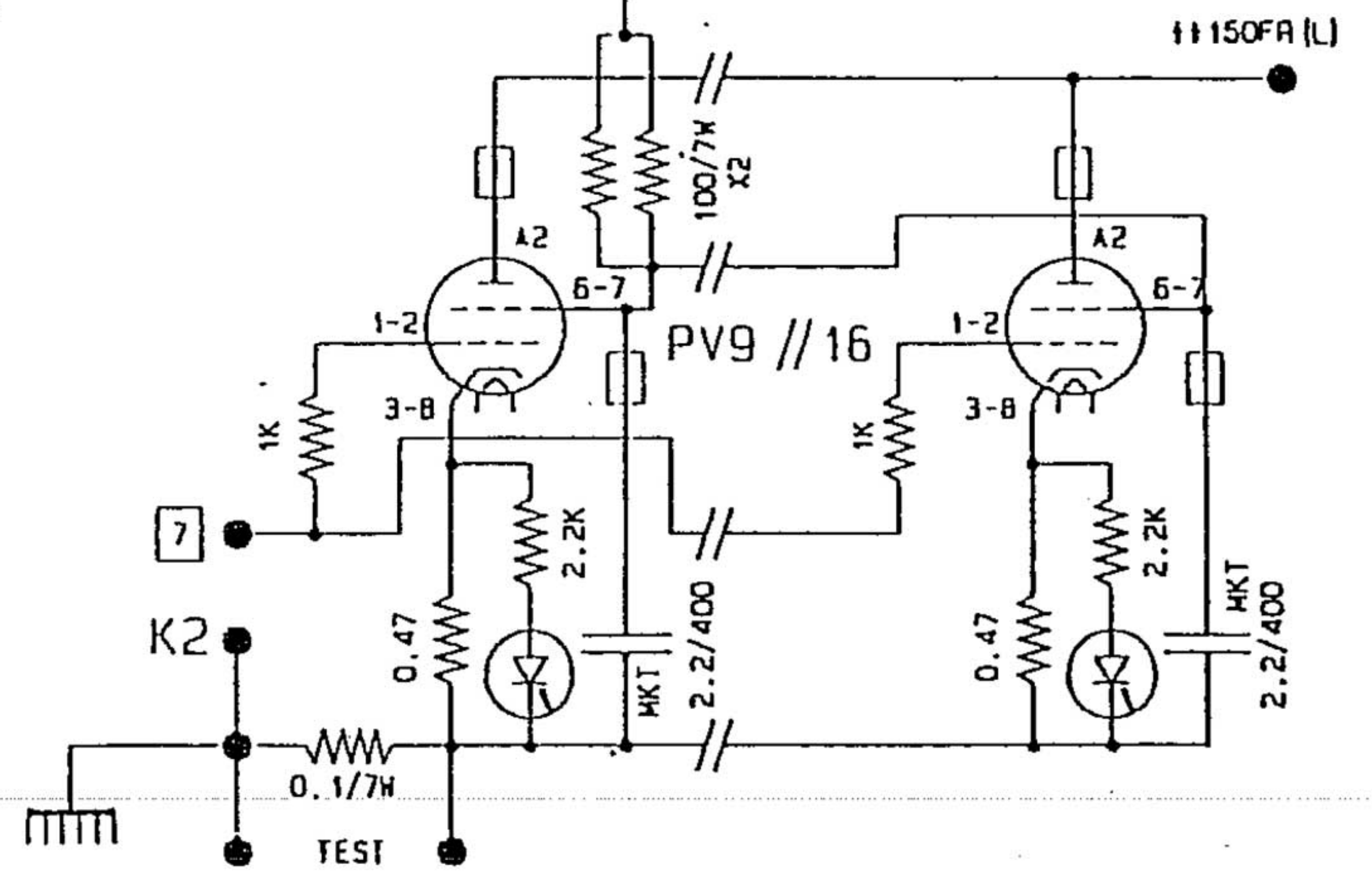
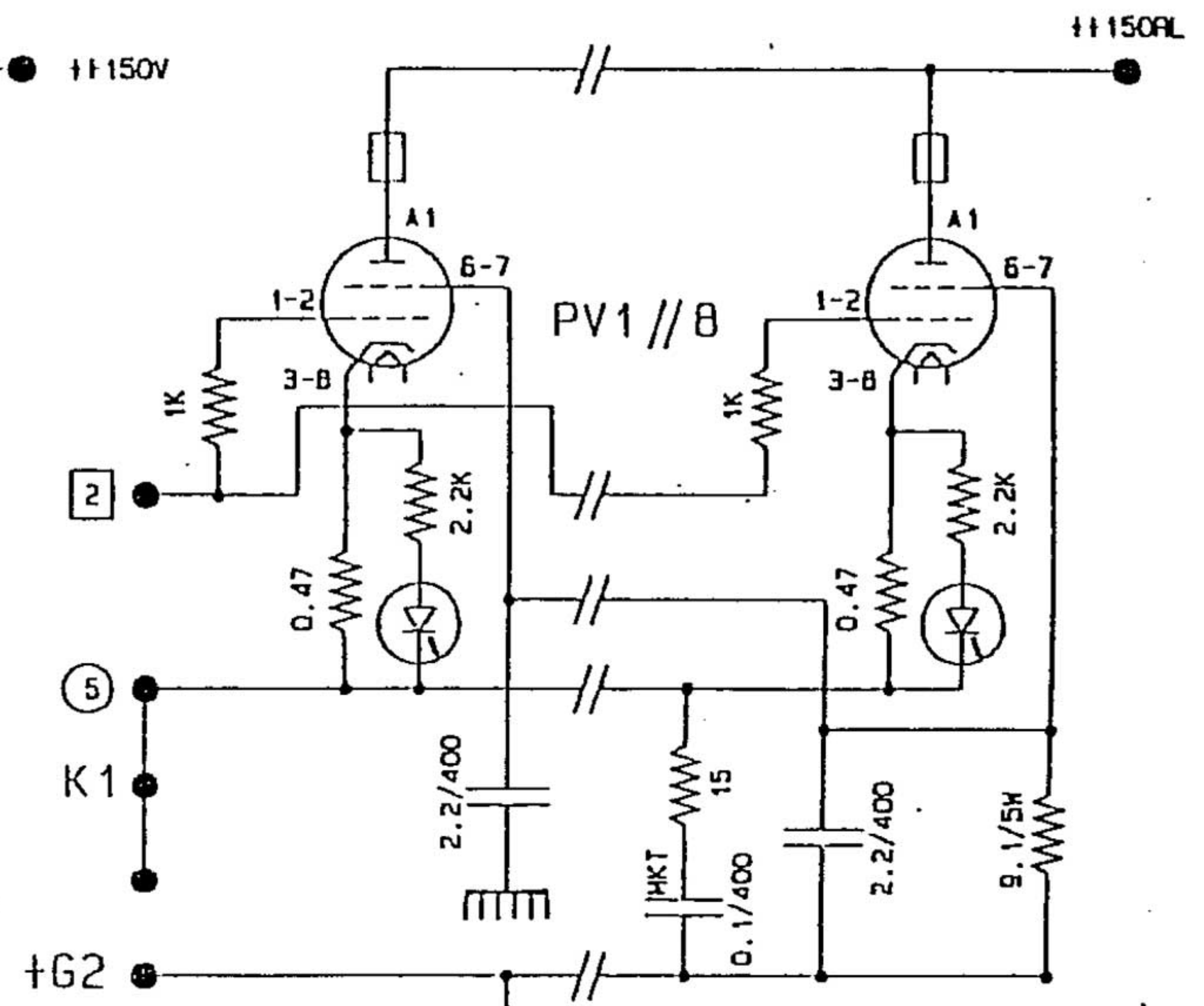
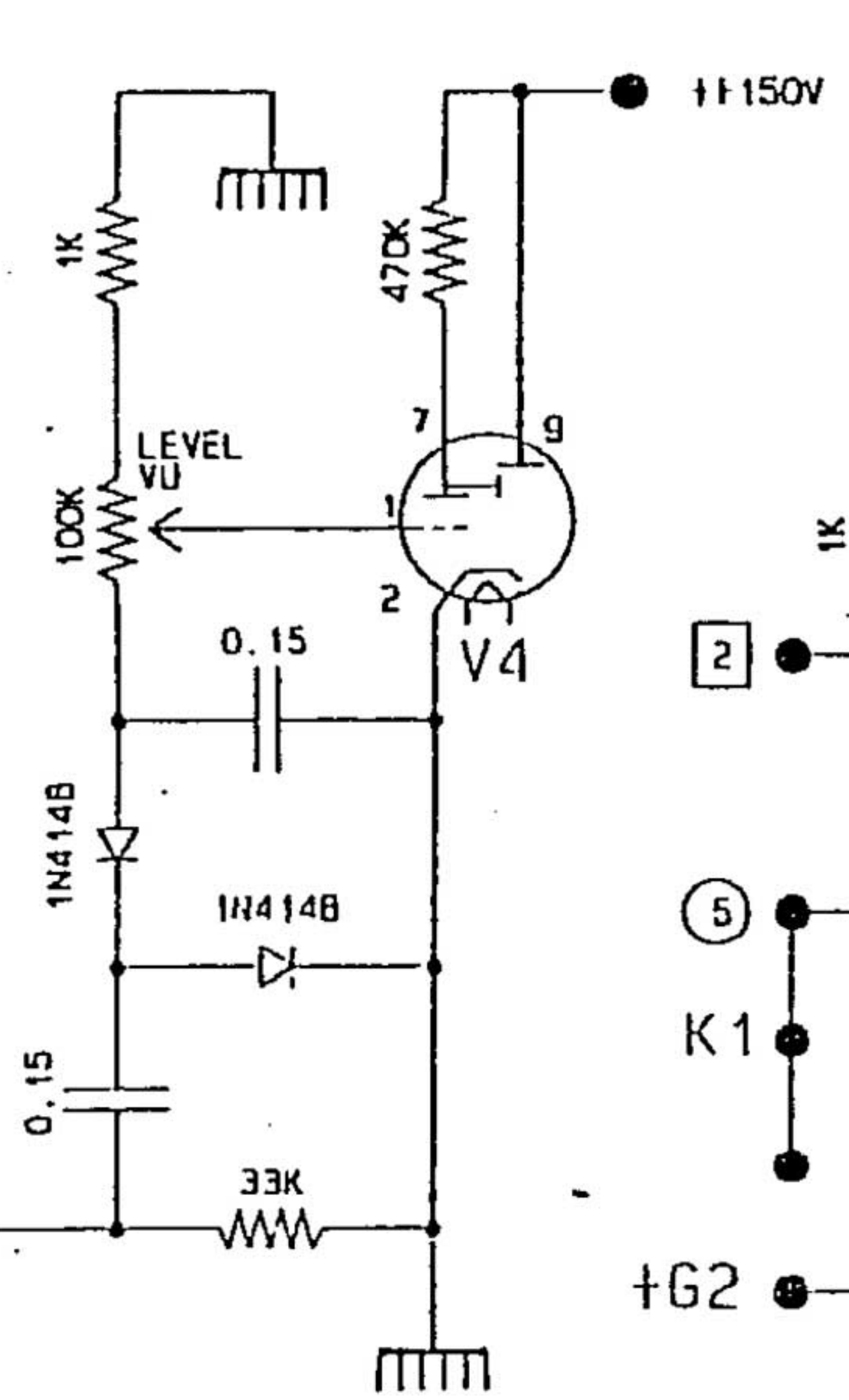
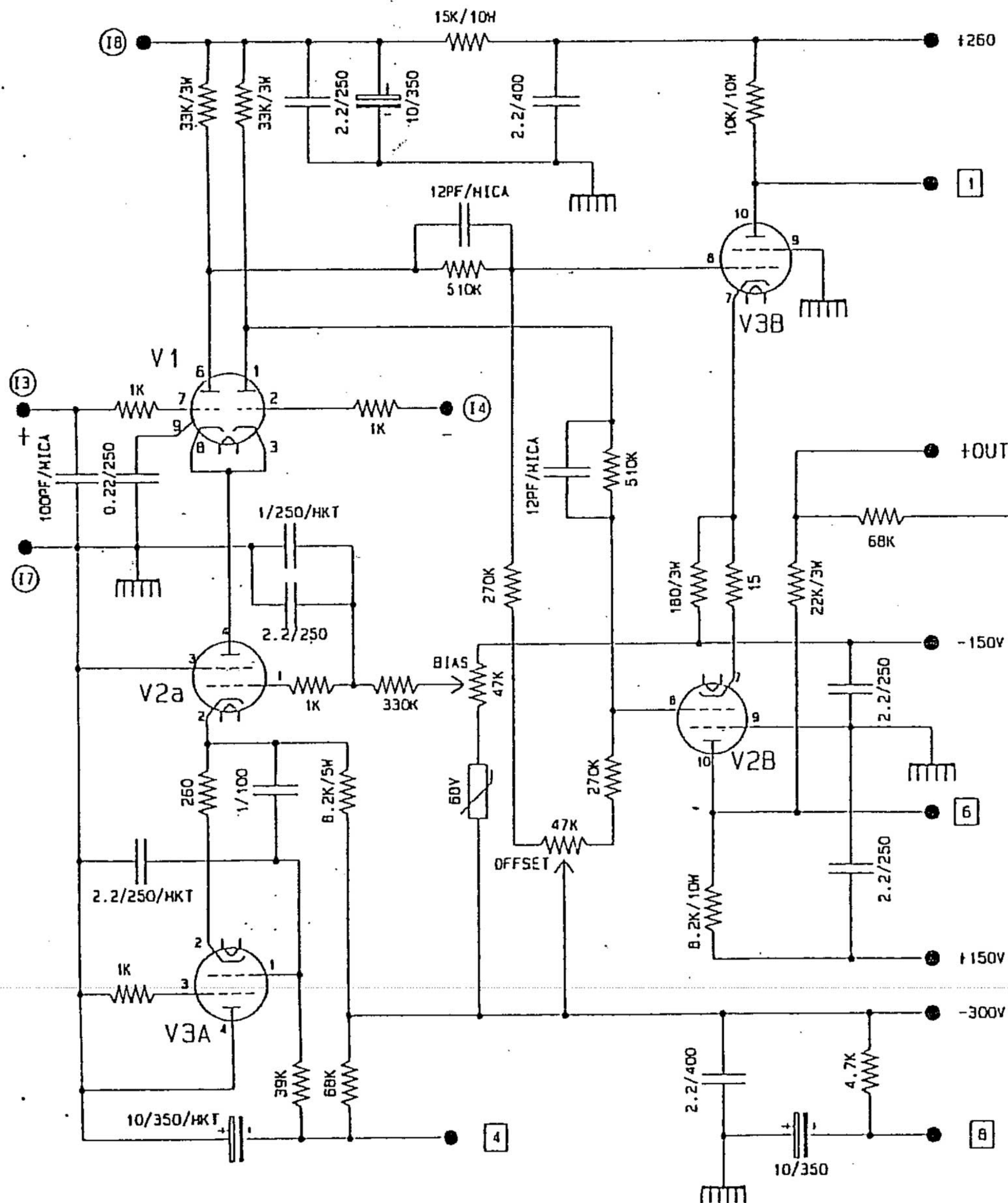
NOTES:

VOLTAGE SELECTION TABLE

VOLTAGE	BLUE	RED	YELLOW	BLACK	GREY	GREEN	WHITE	VOLTAGE
105	G	A	B	D	H	C	I	105
110	A	G	B	D	C	H	I	110
120	A	B	G	D	C	I	H	120
210	E	A	B	F	H	C	I	210
215	A	E	B	F	H	C	I	215
220	A	E	B	F	C	H	I	220
225	A	B	E	F	H	C	I	225
230	A	E	B	F	C	I	H	230
240	A	B	E	F	C	I	H	240

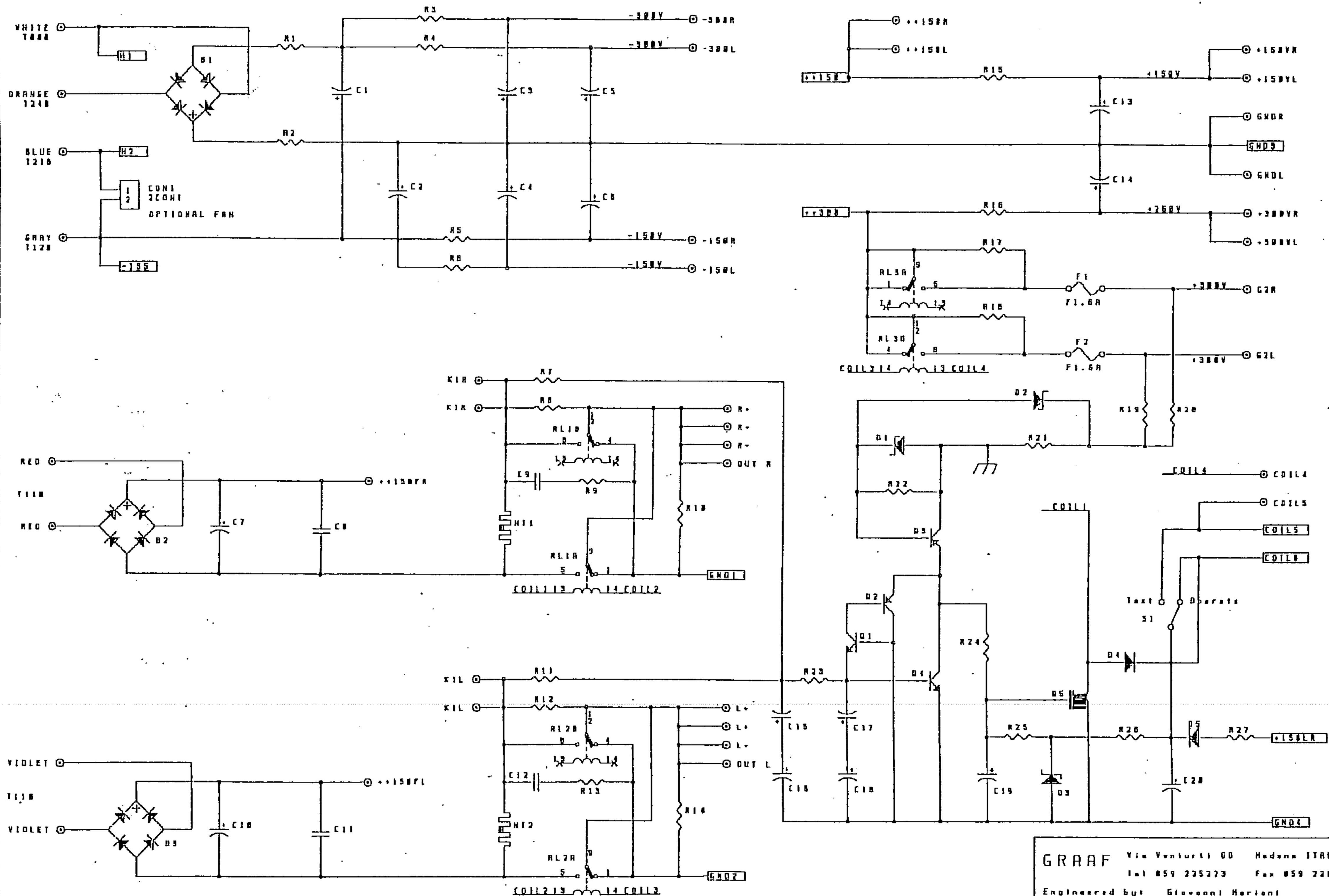


**AL04 POWER SUPPLY
CIRCUIT BOARD**



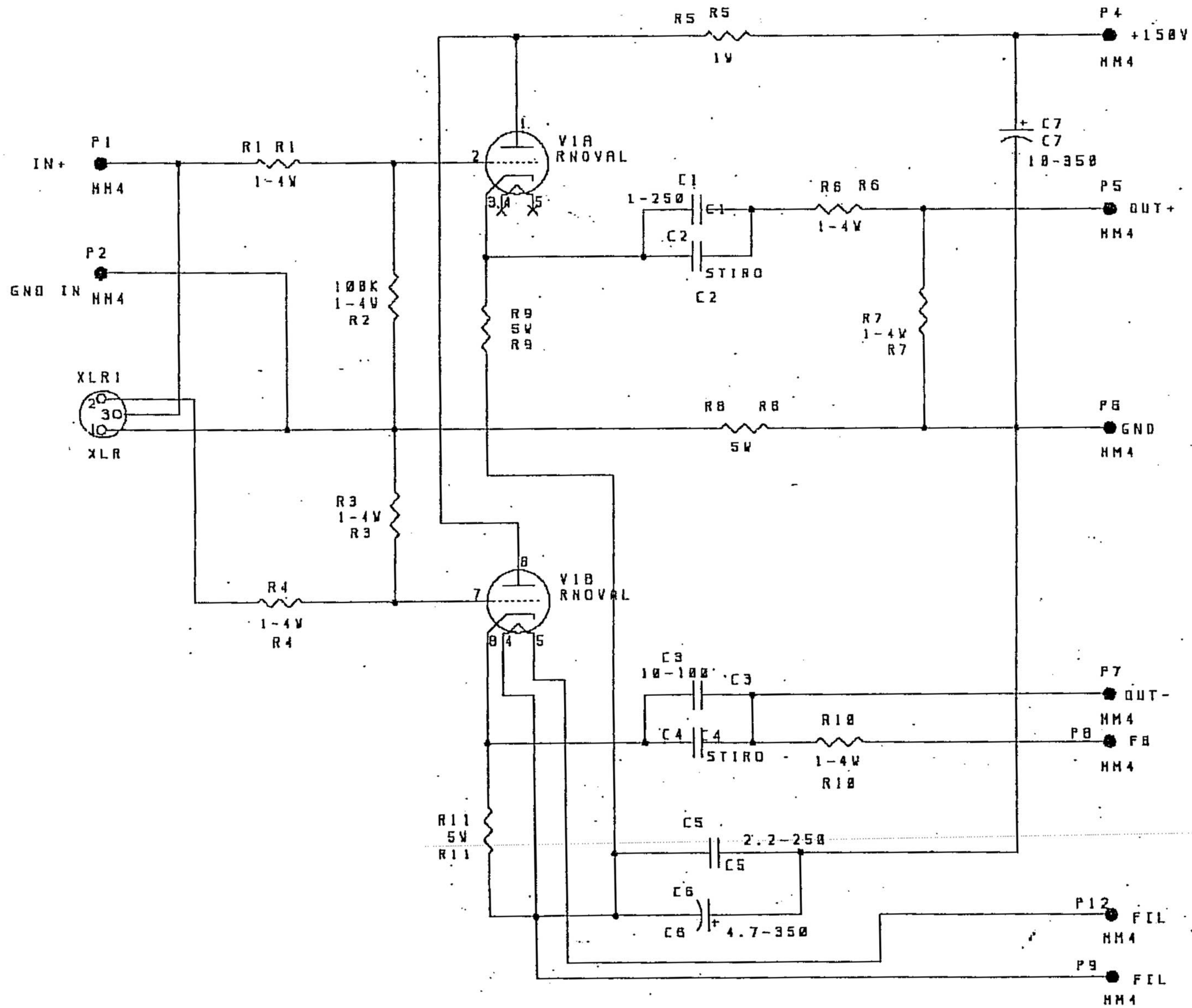
NOTES: PV1-16 = PL504 - 27GB5
 V1 = 12AV7 - 5965
 V2 & V3 = EFL200
 V4 = EHB1

GRAAF		DATE:	16/01/1994
		MADE BY:	GRAAF
PROJECT:	64200 POWER AMPLIFIER	ENGINEERED BY:	G. HARIANI
FILE:	64200	DRAWN BY:	BAGNOLI M.



GRAAF Via Venturii 6B Madama ITALY
 Tel 059 225223 Fax 059 228014
 Engineered by Giovanni Heroni
 Title: POWER SUPPLY File name: GH28B
 Size Document Number REY
 R3 GH28B D
 Date: May 21, 1997 Sheet 3 of 3

LINK
 1GH28B-1.SCH



GRRAF		
Size	Document Number	REV
A		
Date: December 24, 1996 Sheet		1 of 1

Components List GM 200

PR 01- 02

R 01 1K
R 02 33K 3W
R 03 33K 3W
R 04 1K
R 05 511K
R 06 274K
R 07 511K
R 08 332K
R 09 38K3
R 10 8K 5W
R 11 68K1
R 12 274K
R 13 10K 10W
R 14 180R 3W
R 15 10R 2W
R 16 33K 3W
R 17 8K2 10W
R 18 4K75
R 19 100K
R 20 1K
R 21 470K
R 22 8K2 10W
R 23 1K
R 24 1K

C 01 100 pF
C 02 0,22uF 250V
C 03 1 uF 250V
C 04 1uF 100V
C 05 2,2 uF 250V
C 06 10 uF 350V
C 07 12 pF
C 08 12 pF
C 09 2,2 uF 250V
C 10 2,2 uF 250V
C 11 2,2 uF 400V
C 12 10 uF 350V
C 13 0,15 uF 100V
C 14 0,15 uF 100V
C 15 2,2 uF 250V
C 16 10 uF 350V
C 17 2,2 uF 400V
C 18 2,2 uF 250V

P 01 50K
P 02 50K
P 03 100K

MV 01 ~~68V~~ 56
D 01 1N4148
D 02 1N4148
V 1 5965
V 2-3 EFL200 6Y9
V 4 6DA5 EM81

GF 200 A

R 1 - 8 1K
R 9 - 16 1R
R 17 - 24 2K2
R 25 - 32 1K
R 33 - 40 1R
R 41 - 48 2K2
R 49 18R 5W
R 50 9R 5W
R 51 100R 10W
R 52 R10 7W
R 53 100R 10W

C 1 0,1 uF 400V
C 5 2,2 uF 400V
C 6 2,2 uF 400V
C 7 2,2 uF 400V
C 8 680pF CER
C 9 2,2 uF 400V

LD 1 - 16 LED ø 5 ROSSI
V 1 - 16 PL504 27GB5

Components List GM 200

AL 01/D

R 1 2R7 5W
R 2 2R7 5W
R 3 2K2 5W
R 4 2K2 5W
R 5 470R 5W
R 6 470R 5W
R 7 100K
R 8 1K 3W
R 9 9R 5W
R 10 510R 5W
R 11 100K
R 12 1K 3W
R 13 9R 5W
R 14 510R 5W
R 15 180R 3W
R 16 180R 3W
R 17 1K 7W
R 18 1K 7W
R 19 121K
R 20 121K
R 21 56K
R 22 100K
R 23 10K
R 24 154R
R 25 1M
R 26 274K
R 27 220R 5W
R 28 0R33 7W
R 29 12K 5W

C 1 470 uF 450V EL
C 2 470 uF 450V EL
C 3 470 uF 450V EL
C 4 470 uF 450V EL
C 5 470 uF 450V EL
C 6 470 uF 450V EL
C 7 6800 uF 160V EL
C 8 5 uF 200V
C 9 0,1 uF 4000
C 10 6800 uF 160V EL
C 11 5 uF 200V
C 12 0,1 uF 400V
C 13 470 uF 450V EL
C 14 470 uF 450V EL
C 15 10 uF 50V EL

C 16 10uF 50V EL
C 17 10uF 50V EL
C 18 10uF 50V EL
C 19 47 uF 20V Tan.
c 20 22uF 250V EL
C 21 10000uF 160V EL
C 22 5uF 200V
C 23 5uF 200V
C 24 15000uF 25V EL
C 25 15000uF 25V EL
C 26 3300uF 350V EL
C 27 4700pF 400V Cer.

NTC 1 5R
NTC 2 5R
MOV 1 82V

B 1 KBL 08
B 2 SB256W
B 3 SB256W
B 4 SB256W
B 5 SB256W
B 6 SB256W

D 1 6,2V 1W
D 2 100V 1W
D 3 6,2V 1W
D 4 1N4007
D 5 1N4007
D 6 BYW29

Q 1 BC 547B
Q 2 BC 307B
Q 3 BC 307B
Q 4 BC 547B
Q 5 IRFD 210

RL 1 RELE 24V
RL 2 RELE 24V
RL 3 RELE 24V
RL 4 RELE 24V

CON.1 2 PIN

F 1 1,6A 250V
F 2 1,6A 250V

AL 04

R 30 2R7 5W

C 28 47 nF cer.

NTC 1 2R5
NTC 2 2R5

RL 5 RELE 24V FEME

VDE 1 VDE LINE

INPUT BALANCE

R 1 1K
R 2 100K
R 3 100K
R 4 1K
R 5 1K5
R 6 1K
R 7 100K
R 8 2R7 5W
R 9 24K 5W
R 10 100K
R 11 24K 5W

C 1 2,2uF 250V PHC
C 2 10nF 160v Stiroflex
C 3 10uF 100V MWR
C 4 10nF 160V Stiroflex
C 5 0,1 uF 400V MWR
C 6 4,7 uF 350V EL.
C 7 10uF 350V EL.
C 8 50nF 50V Cer.
C 9 0,22 uF 400V MKT
C 10 0,22 uF 400V MKT

V 1 12BZ7