TRACE ELLIOT LTD

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Product Code :	T1140 / T1145
Model No :	PPA1200 / 600
Technical File No :	TE00035

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CIRCUIT DESCRIPTION
POWER MODULE PA300/500
February 24, 1997

FAN SPEED CONTROL

The voltage to the 48 volt DC fan comes from the +70 volt supply to the PCB. This 70 volts is dropped to a suitable voltage for the fan by TR7 a BD679 darlington transistor working as a series regulator.

Diode D7 is included in series with the output to the fan to allow two power modules to be linked together as in the AH600SM amplifiers. Either module may take control of the fan without affecting the other.

TR7 has a 51 volt zener diode ZD5 in its base to limit the maximum voltage to the fan. C11 is in parallel with ZD5 for smoothing purposes.

The voltage on TR7's base is set by TR6 in series with R30 and R31. The DC conditions around TR6 are set by preset P2, in the potential divider chain of R27, P2 and R28 across the 70 volt supply.
Adjusting P2 will set the fan's minimum speed, this functions as follows:

Increasing the voltage on the wiper of P2 increases the voltage on the base of TR6, this in turn decreases the voltage on TR6's collector, and thus decreases the voltage to the fan viaTR7 causing it to slow down. Zener diode ZD6 is included to prevent the base voltage on TR6 from rising too far causing to fan to completely stop.
The opposite occurs if the voltage on the base of TR6 is decreased, i.e. the fan speeds up.

Thermistor TH1 detects the temperature from the heat sink, this is a NTC (Negative Temperature Coefficient) device i.e. its resistance decreases as its temperature increases . This thermistor is placed directly across the base of TR6, and consequently reduces the preset base voltage supplied via R29 as its temperature increases (and its resistance decreases), speeding up the fan.

Capacitor C12 is included to make sure the fan always starts when the amplifier is switched on. To see how it does this, consider the conditions before switching on when C12 is fully discharged, the unit is then switched on and the 70 volt supply appears.
C12 is at this point still discharged and holds the base voltage to TR6 at or near zero volts, TR6 is not conducting and the voltage on its collector will be +51 volts, the maximum zener diode voltage. The voltage to the fan will also be maximum and the fan will start at maximum speed.
C12 gradually charges up, the base voltage increases and the fan slows down to the minimum speed set by P2.

This minimum speed will also be dependant on the ambient room temperature as this will determine the initial resistance of the thermistor.

SWITCH ON DELAY

The speaker output is switched using a heavy duty 30 amp relay, this is done for two reasons:
Firstly to provide a switch on delay that will not connect the speakers to the output stage until the supplies have reached their full voltage, and become stable.
And secondly to provide a means of electronic thermal output protection.
We have already seen how capacitor C12 holds down the base voltage on TR6 on initial switch on; well it is this same TR6 base voltage that is delayed further by R25 charging up capacitor C10 that provides the delay to the relay circuit.
The relay switching circuit consists or TR8, TR9 and TR10 and their associated resistors.

OUTPUT THERMAL PROTECTION

The thermistor controlled voltage on the base of TR6 is also used as a means of providing output thermal protection.
R32 and R33 form a potential divider with its centre point voltage being fed via R34 to the base TR9, this sets the trip and reset voltages for the relay switching circuit to approximately 1 volt and 1.7 volt respectively.
Switching off the relay itself is done by TR8, in series with a 1k Ohm dropper resistor to give the correct relay voltage.
For the relay to switch cleanly i.e. without chattering etc. TR8 has to be either turned hard on i.e. conducting fully or turned completely off.
This is done with the circuit around TR9 and TR10 with these two transistors forming a schmitt trigger.
A schmitt trigger is a circuit that has an upper and lower threshold on its input, and has an output that changes state instantly as these thresholds are passed.
As already mentioned these thresholds are 1 volt for the relay to drop out, i.e. thermal cutout, and 1.7 volts for the relay to pull in again.
These voltages equate to temperatures of approximately 80 degrees celsius for the relay to trip, and a 10 degree celsius drop in temperature before the relay resets itself again.

OUTPUT CIRCUIT

The output circuit is a MOS-FET type arrangement.
This uses two BUZ900 MOS-FET transistors and two complimentary BUZ905 MOS-FETS.
In the case of the PPA 1200 the MOS-FET's will be of the double dye type and will produce almost double the output level.

The speakers are driven from the common sources of these four devices connected together, the +VE supply being connected to the drain of the BUZ900 and the -VE supply connected to the drain of the BUZ905 device.
C8 and R17 form a Zobel network to damp out and prevent any high frequency spurious oscillation (MHz range).

TEST PROCEDURE PA300/500

February 25, 1997

The AH300 and AH500 PCB's will be tested in their finished state i.e. a complete module fitted to the heatsink with its four output devices.

1. Check that the MOS-FET's are in their correct positions before applying any power to the PCB.

2. Adjust preset P1 to its centre position and apply low power to the PCB to determine if the output stage is functioning.
   This should be done by injecting a 1kHz sine wave into the input and checking with an oscilloscope connecting to the common connection of ZD3 and ZD4. This is because on a low supply, the relay will not pull in and consequently the speaker output will not be connected.
   This test should be done with no output load.

3. If a clean symetrical sine wave with no crossover distortion is seen in test 2, then connect the PCB to its full positive and negative supplies.
   Connect a test 48 volt fan to the PCB as well.

4. When switching on the supplies make sure a delay period or 4 or 5 seconds elapses before the relay pulls in.

5. Before checking the output into a load (as this will cause the temperature of the heatsink to rise) it is necessary to adjust the fan minimum speed.
   Assuming the room temperature to be between 20 and 25 degrees celsius, adjust preset P2 to make sure this varies the speed of the fan.
   Now adjust this to a suitable Slow Run speed for the fan. (This will need to be reset on final test of the finished unit again anyway, so this set up is merely to determine that it is functioning correctly).
   Make sure the thermistor is sitting down close to the heatsink.

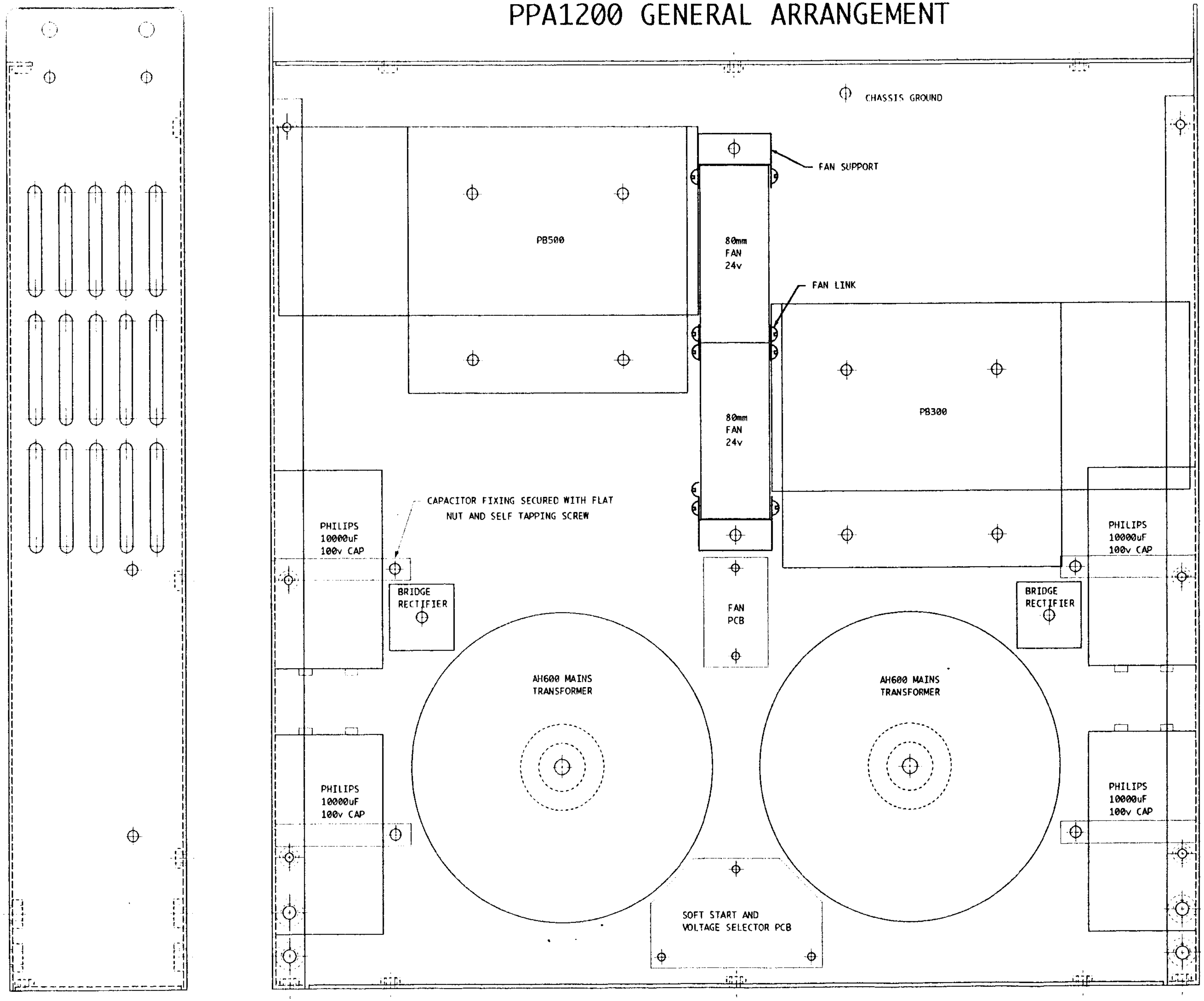
6. Check the maximum output power of the module on a clean sine wave at 1kHz into a 4 ohm load, also check for a clean symetrical sine wave from 30Hz up to 20kHz.

7. Check that the fan speeds up as the module gets hotter, this will determine that the thermistor and speed control circuit is working correctly.

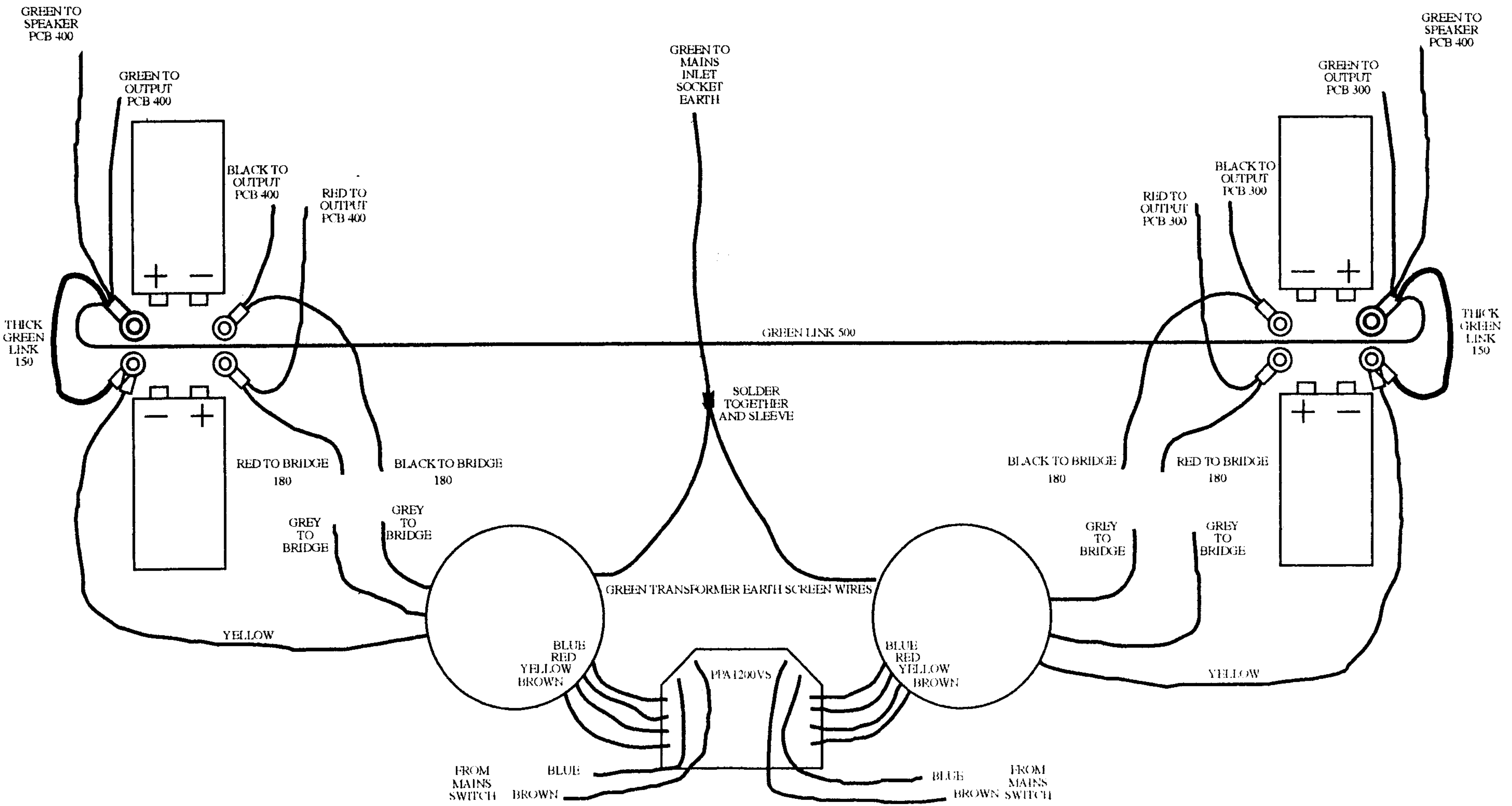
8. To test the Output Thermal Overload trip, use a soldering iron and heat up the thermistor to make sure that it will actually trip out and disconnect the speaker from the output. This is best done with a signal through the unit so that it is easy to see when it trips. Remove the soldering iron once it has tripped and make sure the relay resets within a short time.

It would be extremely time consuming to check that each module tripped and reset at the specified temperatures, so the above test although seeming rather crude will generally have to be sufficient.
With the occasional module being subject to a full temperature check only.

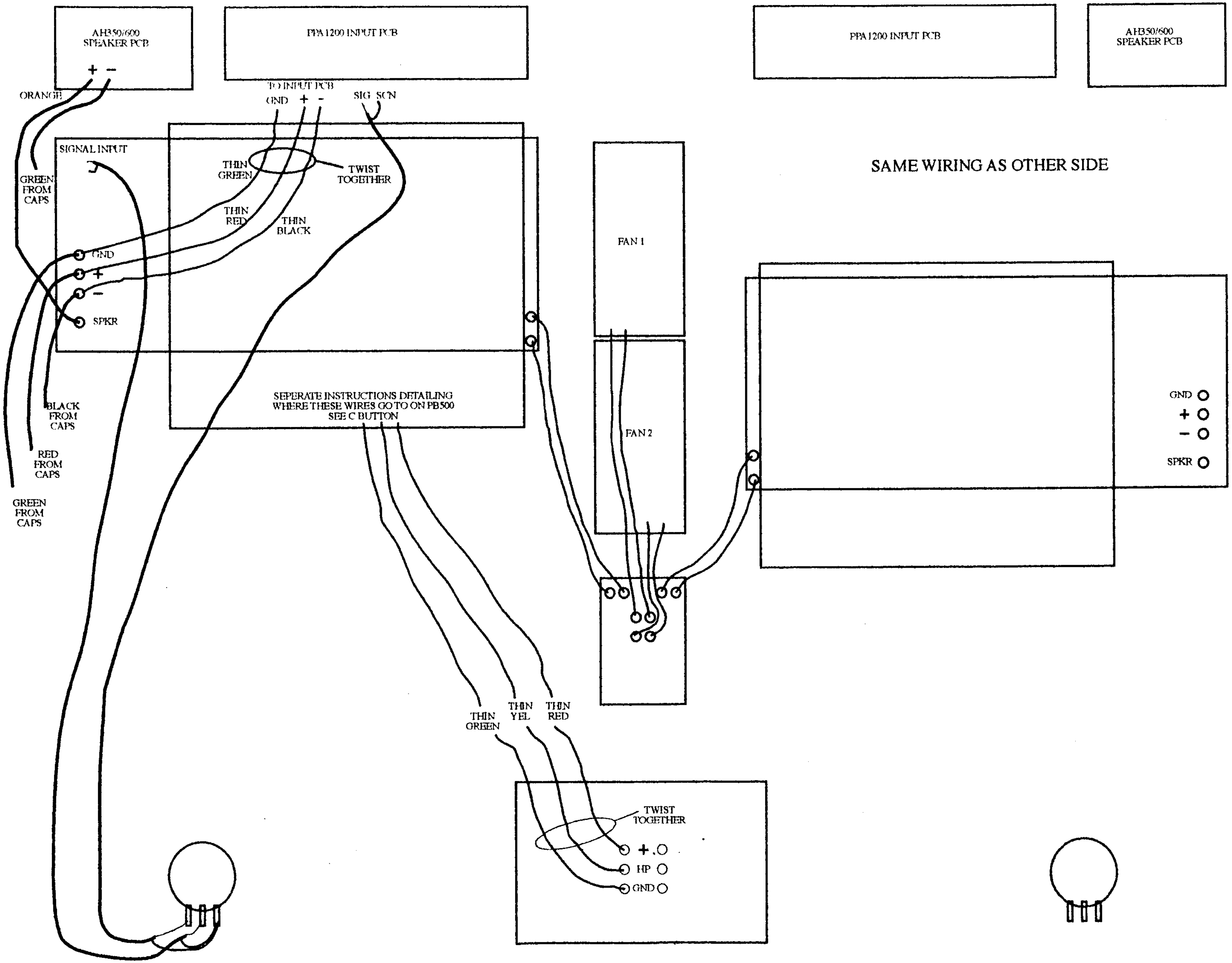
PPA1200 GENERAL ARRANGEMENT



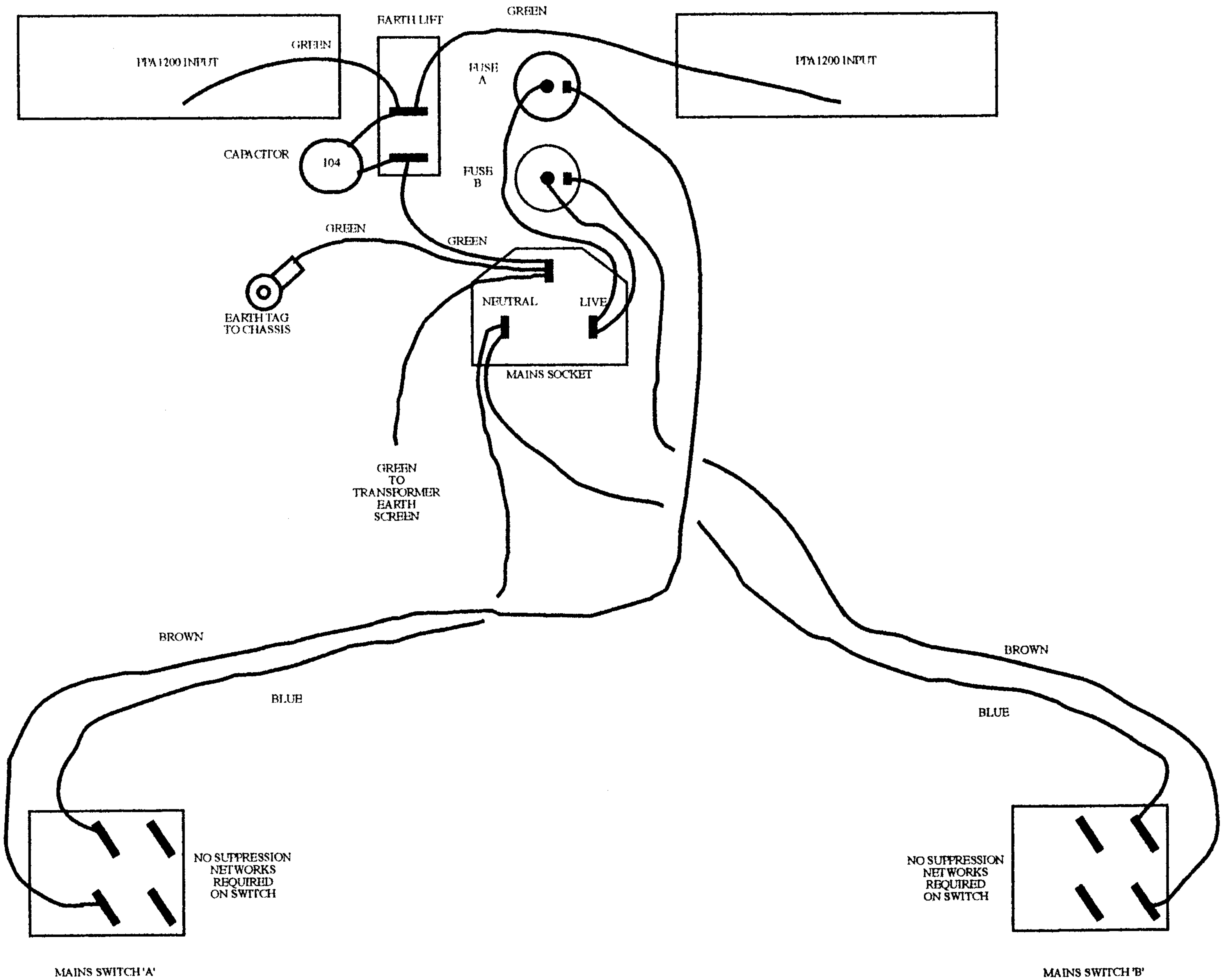
PPA600 & PPA 1200 INTERNAL POWER WIRING

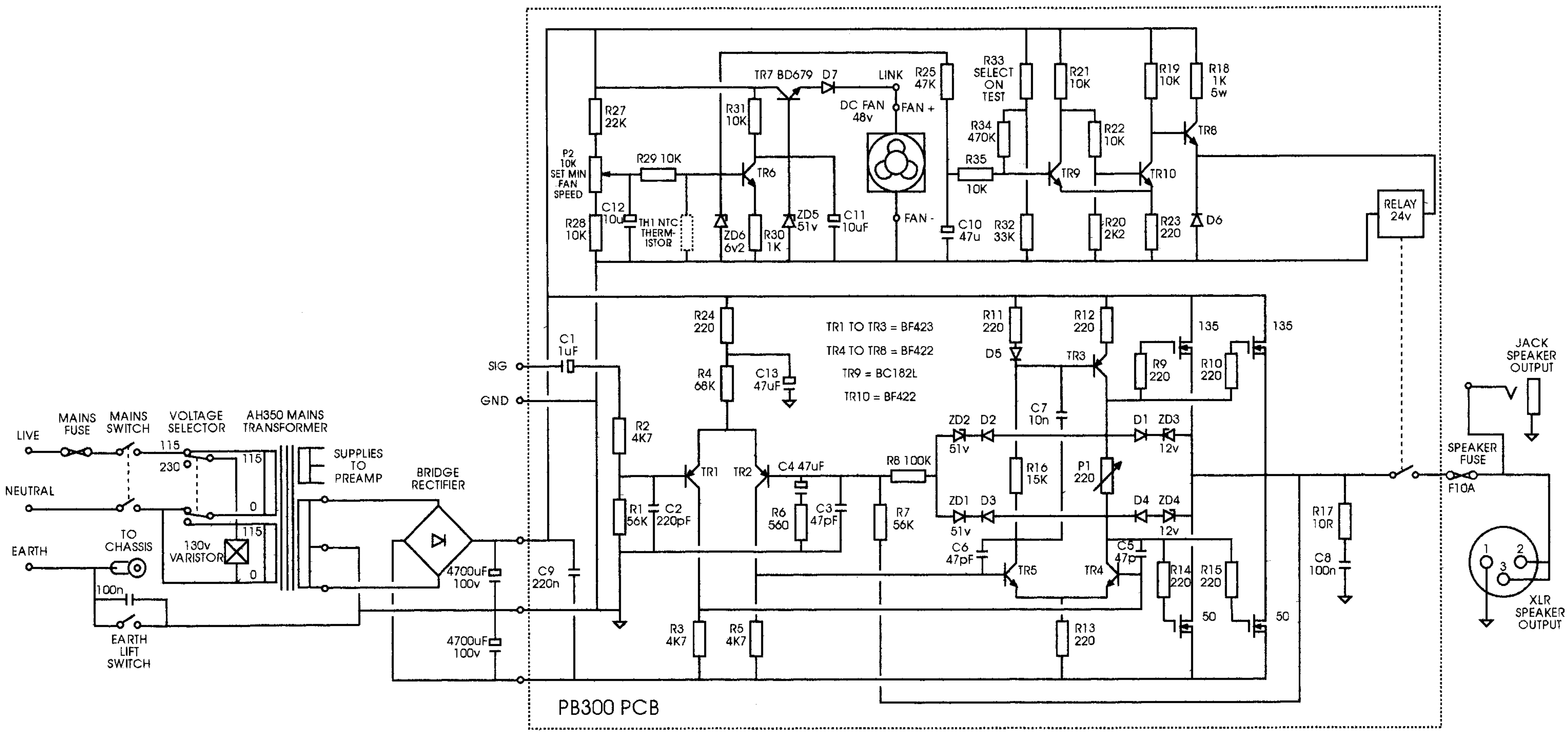


PPA1200 ADDITIONAL INTERNAL WIRING



PPA600/1200 MAINS & EARTH WIRING





TRACE ELLIOT Ltd
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TITLE:- AH350 OUTPUT STAGE CIRCUIT DIAGRAM

DRAWN	DATE	DRG.No.
C.BUTTON	28.10.92	AH350/1

PARTS LIST FOR PPA1200 / 600
SOFT START / FAN / INPUT & DISPLAY PCB'S

Description	Part Code	Qty	Where Used
C42-PCB-PPA-FAN			
220R 6 WATT RESISTOR	72-RWW220R-6W	2	R1 R2
C42-PCB-PPA-SOFT			
NTC THERMISTOR	72-THERMISTOR-2	2	SS1 SS2
ZERO OHM LINK	72-RC-ZERO	4	VOLTAGE DEPENDANT
C42-PCB-PPA-INPT			
10K ¼ WATT	72-RM10K	4	R3-6
10K 1 WATT	72-RM10K-1 WATT	2	R1 R2
33K ¼ WATT	72-RM33K	1	R7
4.7μF 35V TANT	72-C4.7-35VT	3	C1 C2 C3
TL061 OP-AMP	72-IC-TL061	1	IC1
15V ZENER DIODE	72-D-BZX55C15V	2	ZD1 ZD2
STEREO JACK SOCKET	72-SKT-JCKBBBG	2	J1 J2
MALE XLR	73-XLR-PCB-M	1	XLR2
FEMALE XLR	73-XLR-PCB-F	1	XLR1
WIRE WRAP PINS	73-TERM-PIN	3	LINK
C12-PCB-RA30-LED			
5MM SPACER	71-SPA-5MM	8	L1-4
10μF 63V RADIAL	72-C10-63VER	2	C2
100N 100V MYLAR	72-C100N-100VE	2	C1
IN4148 DIODE	72-D-IN4148	2	D1
GREEN LED	72-LED-GREEN	4	L3 L4
RED LED	72-LED-RED	2	L1
YELLOW LED	72-LED-YELLOW	2	L2
2K2 PRESET POT	72-PRESET-2K2	2	R10
10K ½ WATT	72-RC10K-.5W	6	R2 R3 R4
4K7 ½ WATT	72-RC-4K7-.5W	2	R1
10K ¼ WATT	72-RM10K	4	R5 R8
22K ¼ WATT	72-RM22K	2	R7
2K2 ¼ WATT	72-RM2K2	2	R9
47K ¼ WATT	72-RM47K	2	R11
6K8 ¼ WATT	72-RM6K8	2	R6
BF422 TRANSISTOR	72-TBF422	8	T1-4

C12-PCB-SMX-SPKR			
FUSE HOLDER	72-FUS-HLD-PCB	1	NO LEGEND
MONO JACK SOCKET	72-SKT-JCKBNBG	1	NO LEGEND
MALE XLR	73-XLR-PCB-M	1	NO LEGEND

Rik Daniels
March 27, 1997

PARTS LIST FOR PA300L / 500R

Description	Part Code	Qty	Where Used
RESISTORS			
100K ¼ WATT	72-RM100K	1	R8
10K ¼ WATT	72-RM10K	5	R22 R28 R29 R31 R35
15K ¼ WATT	72-RM15K	2	R33 R16
1K ¼ WATT	72-RM1K	1	R30
220R ¼ WATT	72-RM220R	9	R9-15 R23 R24
22K ¼ WATT	72-RM22K	1	R27
2K2 ¼ WATT	72-RM2K2	1	R20
33K ¼ WATT	72-RM33K	1	R32
470K ¼ WATT	72-RM470K	1	R34
47K ¼ WATT	72-RM47K	1	R25
560R ¼ WATT	72-RM560R	1	R6
56K ¼ WATT	72-RM56K	2	R7
68K ¼ WATT	72-RM68K	1	R4
10R 2.5 WATT	72-RWW10R-2.5W	1	R17
1K 6 WATT	72-RWW1K-6W	1	R18
4K7 ¼ WATT	72-RM4K7	3	R2 R3 R5
10K ½ WATT	72-RC10K-.5W	2	R19 R21
CAPACITORS			
0.22μF 250V POLY	72-C0.22-250VP	1	C9
1.5μF 35V TANT	72-C1.5-35VT	1	C1
10μF 63V RADIAL	72-C10-63VER	2	C11 C12
100nF 250V POLY	72-C100N-250VP	1	C8
220pF 100V CER/DISC	72-C220P-100VCD2	1	C2
10nF 100V MYLAR	72-C10N-100VE	1	C7
47μF 16V RADIAL	72-C47-16VER	1	C10
47μF 63V RADIAL	72-C47-63VER	2	C4 C13
47pF 100V CER/DISC	72-C47P-100VCD	3	C3 C5 C6
SEMI-CONDUCTORS			
12V ZENER DIODE	72-D-BZX55C12V	2	ZD3 ZD4
6.2V ZENER DIODE	72-D-BZX556V2	1	ZD6
51V ZENER DIODE	72-D-BZX55C51V	3	ZD5 ZD1 ZD2
IN4002 DIODE	72-D-IN4002	2	D6 D7
IN4148 DIODE	72-D-IN4148	5	D1-5
* BUZ900 MOS-FET	* 72-MOS-BUZ900	2	NEAREST RELAY
* BUZ905 MOS-FET	* 72-MOS-BUZ905	2	NEAREST D7
BC182L TRANSISTOR	72-TBC182L	1	TR9
BD679 DARLINGTON	72-TBD679	1	TR7
BF422 TRANSISTOR	72-TBF422	5	TR4-8 TR10

BF423 TRANSISTOR	72-TBF423	3	TR1-3
OTHERS			
10K PRESET POT	72-PRESET-10K	1	P2
220R PRESET POT	72-PRESET-220R	1	P1
NTC THERMISTOR	72-TH-KED472CY	1	TH1
30 AMP RELAY	73-RELAY-176590	1	RL1
MAIN HEATSINK	71-HS-300/500	1	UNDER MOS-FETS
BD679 HEATSINK	71-HS-TEG	1	TR7
MOS-FET FITTINGS	72-MOS-BUSH-WHT	8	UNDER HEATSINK
MOS-FET FITTINGS	72-MOS-KOOL-PAD	4	UNDER MOS-FETS

* THE PPA 1200 POWER UNITS ARE FITTED WITH DOUBLE DYE MOSFETS.
THE PART NUMBERS FOR THESE ARE THE SAME BUT HAVE THE LETTER ' D ' ON THE END.

Rik Daniels
February 24, 1997