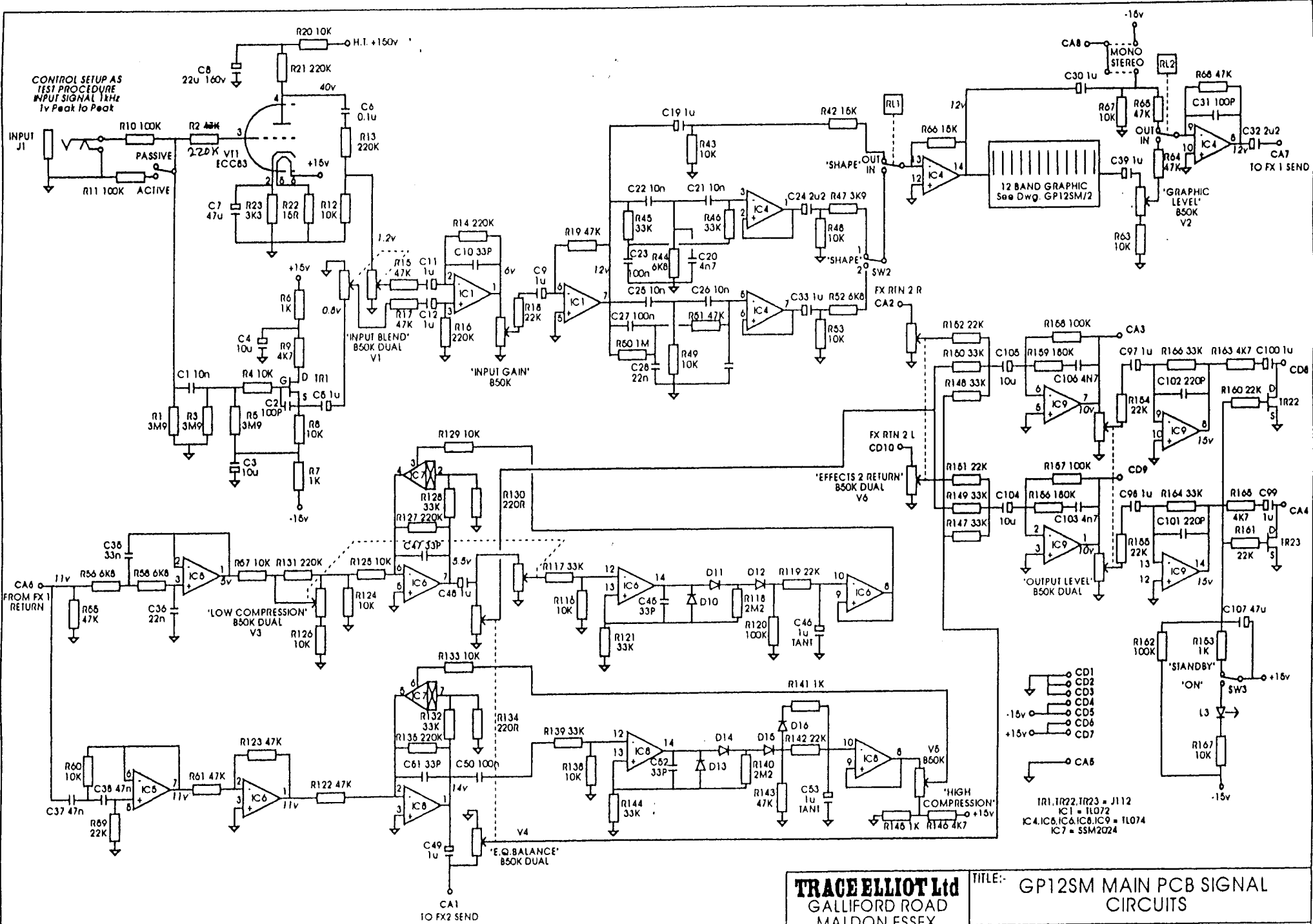


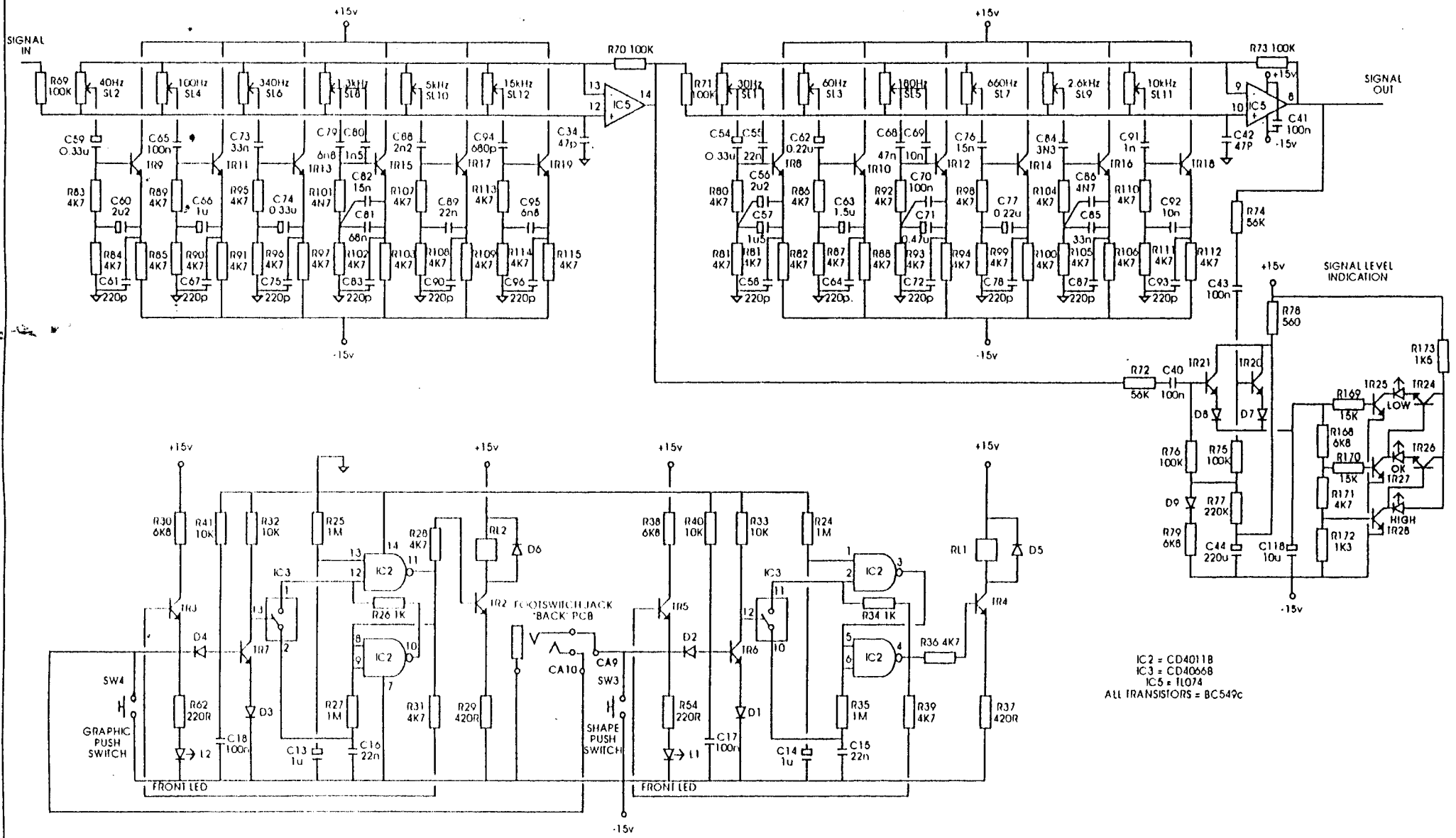
# **TRACE ELLIOT**

## **SERVICE MANUAL**

**DATE :** December 29, 1999  
**Product Code:** T0605/0610  
**Model Number :** GP12SMX 600 WATT

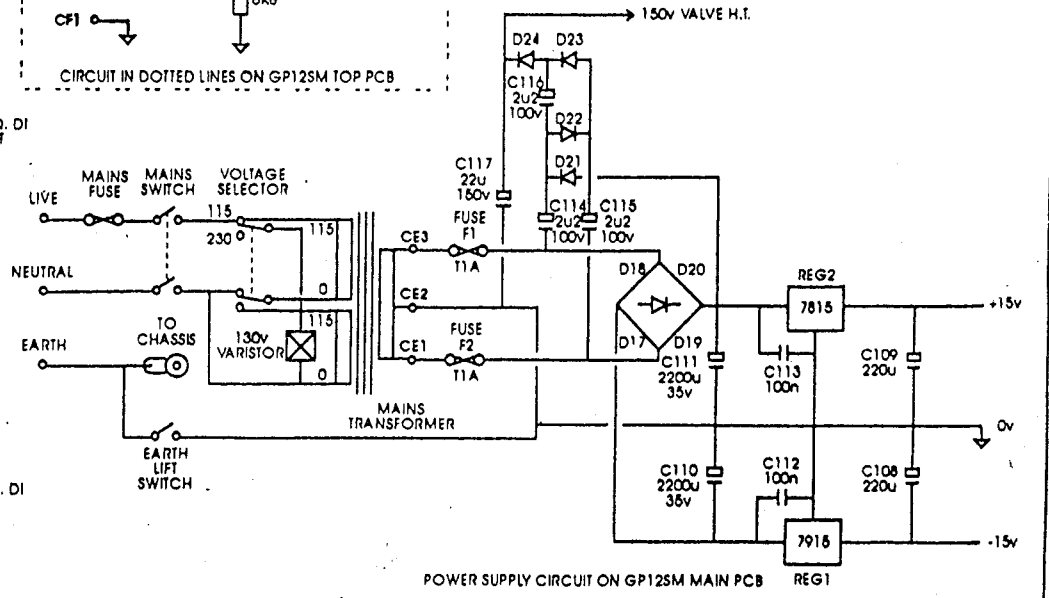
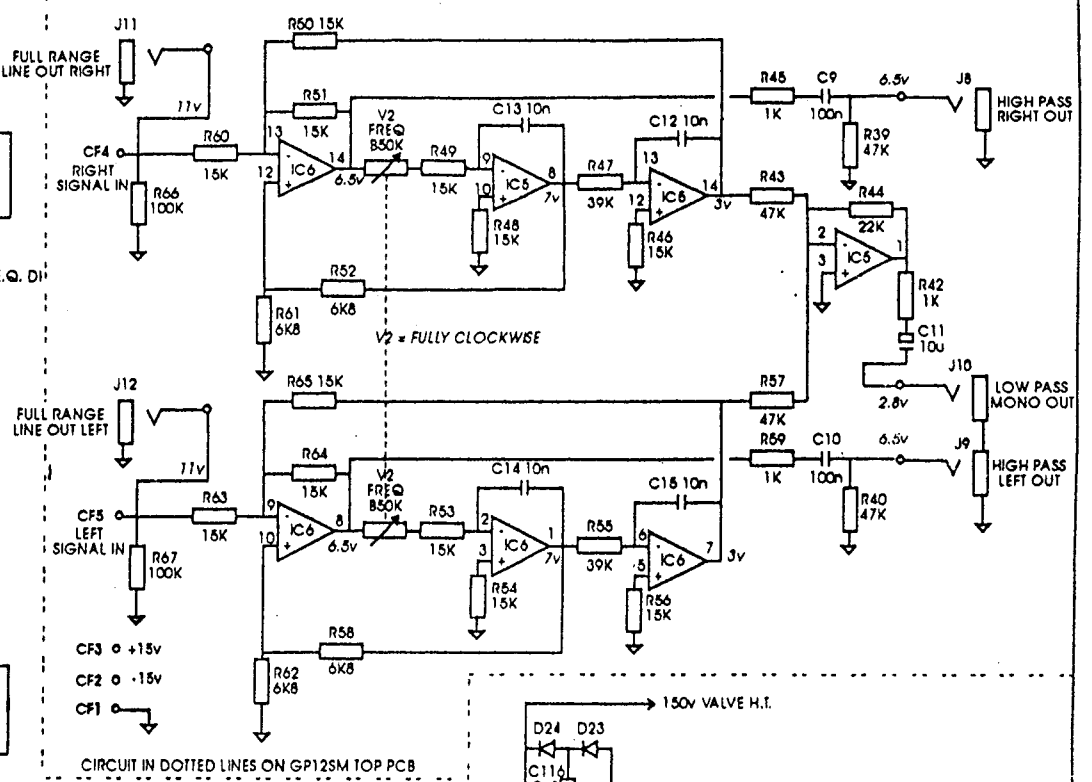
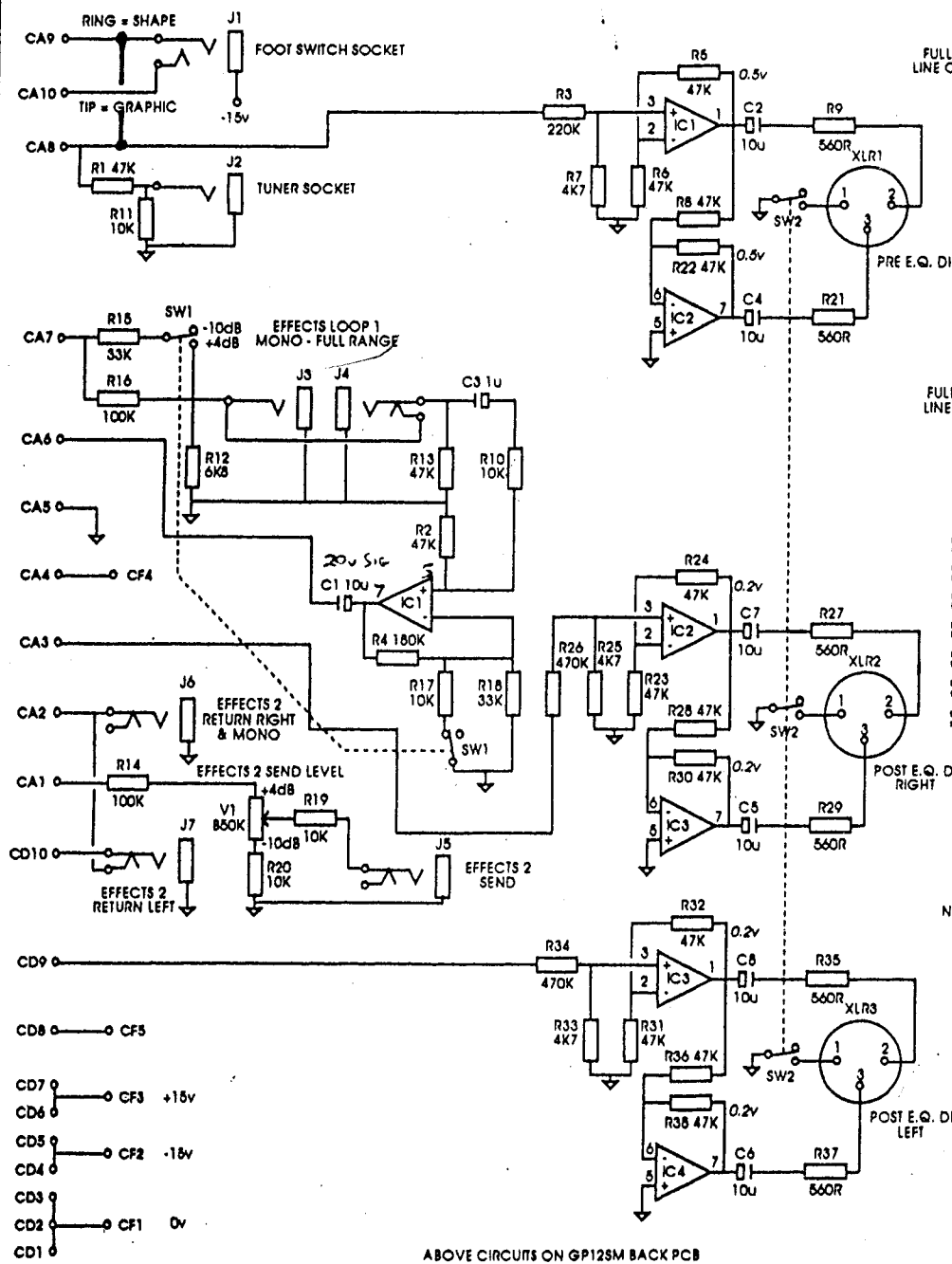
Issued by:  
**Trace Elliot Limited**  
**Blackwater Trading Estate**  
**The Causeway**  
**Maldon**  
**Essex**  
**England**  
**CM4 4GG**





IC2 = CD4011B  
 IC3 = CD4066B  
 IC5 = 1LQ74  
 ALL TRANSISTORS = BC549c

<b>TRACE ELLIOT Ltd</b> GALLIFORD ROAD MALDON, ESSEX, CM9 7XD, ENGLAND	TITLE: GP12SM MAIN, GRAPHIC E.Q. & SWITCHING CIRCUITS		
	DRAWN C. BUITON	DATE 22.9.92	DRG No. GP12SM/2



# **GP12 SMX CIRCUIT DESCRIPTION**

**February 21, 1997**

## **Input**

J1 is the instrument input to the pre-amp.

The passive / active switch connects R10 to R11 and acts as a potential divider to effectively half the amplitude of the input signal sent to the valve and FET input stages.

## **Valve Input Stage**

This uses half a twin triode valve ( ECC83 / 12AX7 ) and has a voltage gain of around 40. R12 and R13 form a potential divider to bring the voltage down to about 1.2 volts, which is sent to one half of the 'Input Blend' pot.

## **FET Input Stage**

The FET is configured as a common drain or source follower circuit to provide a low impedance output to feed the 'Input Blend' pot.

## **Input Blend and Input Gain**

This is a dual gang potentiometer which is used as a balance control between the valve and FET input stages. As these two stages are out of phase, IC1, which is configured as a differential amplifier, mixes these two signals as well as amplifying them to around 6 volts.

## **Mid Pre-Shape**

Pre-Shape 1 is determined by the first op-amp stage in IC4 and discrete components C20 to C23 and R44 to R46.

Pre-Shape 2 is determined by the second op-amp stage in IC4 and discrete components C25 to C28 and R49 to R51.

Each pre-shape is selected with SW2.

RL1 is used to switch between 'straight' and 'pre-shape' sounds.

## **Graphic Section**

The graphic equalisation section is configured around IC5.

The graphic is split into two halves with each covering six frequency bands.

After the graphic section the signal is sent to effects loop one, ( except on mono versions - AH300SMX / RAH300SMX and all SMX combos ) and then into the dual compressor section.

## **Dual Compressor Section**

First of all the signal is split, one half goes through a low pass filter, while the other goes through a high pass filter.

Each signal then goes into separate compression circuits whose ratios are set by V3 and V5 for low and high respectively.

The 'High Compression' signal is then sent to effects loop 2, while the 'EQ Balance' pot sets the balance between the two compression stages to be sent to the output stage of the pre-amp.

IC's 5,6,7 and 8 with their associated components make up the compression section, including filtering.

### **Output Stage**

The signals from the dual gang 'EQ Balance' pot and from the effects return are mixed and amplified by the four op-amp stages in IC9. The output level being set by another dual gang pot.

A FET is connected between the output signals and ground, when this is switched on, by SW3, the drain is effectively at the same voltage as the source thereby shorting the output to ground for 'Standby' mode.

### **Signal Level Indication**

TR21 and TR20 are fed from two points in the graphic section of the pre-amp, these then develop a DC voltage across C118 feeding the potential dividing network R168, R171 and R172.

As the DC voltage rises the corresponding LED's will be switched on.

### **Graphic and Pre-Shape Switching**

This is all performed by IC2 ( 4011 Quad 2 input nand gate ), IC3 ( 4066 analogue switch ) and relays 1 and 2, as well as the associated discrete components.

### **Pre-Amp Supply Regulation**

The mains transformer for each unit in the SMX range, regardless of size, has a low current 18-0-18 volt secondary tapping, as well as the main higher current power board tapping.

The centre of this tapping is connected to the 0 volt rail on the pre-amp, while the other two are fed firstly through F1 and F2 before being connected to a bridge rectifier to give full wave rectification. This is then filtered by C110 and C111 and then regulated by REG 1 ( 7815 ) and REG 2 ( 7915 ).

This then provides the +15, 0 and -15 volt rails which are used in the majority of the pre-amp.

The 150 volt HT supply for the valve is generated by the circuit consisting of D21 to D24 and C114 to C117.

This is a simple voltage quadruplar circuit that derives 150 volts from the 18-0-18 volt AC supply.

# PARTS LIST FOR GP12SM FRONT BOARD

Description	Part Code	Qty	Where Used
RESISTORS			
15K ¼WATT	72-RM15K	2	R169 R170
1K ¼WATT	72-RM1K	2	R174 R176
1K3 ¼WATT	72-RM1K3	1	R172
1K5 ½WATT	72-RM1K5-.5W	1	R173
4K7 ¼WATT	72-RM4K7	1	R171
6K8 ¼WATT	72-RM6K8	1	R168
430R 2.5 WATT	72-RWW430R-2.5W	2	R175 R177
CAPACITORS			
10µF 35V AXIAL	72-C10-35VEA	1	C118
SEMI-CONDUCTORS			
GREEN LED	72-LED-GRN-REC	1	G
RED LED	72-LED-RED-TEG	1	O
YELLOW LED	72-LED-YEL-REC	1	Y
BC549C TRANSISTOR	72-TBC549C	5	TR24-28
OTHERS			
BULB	73-FLUOR-TUBE	2	A
SLIDER	73-SLIDER-B100KC	12	SL1-12
10 WAY LINK	72-LK-10W150TEG	2	2
PLASTIC SPACER	71-SPA-LED-TEG2	3	G,O,Y

Rik Daniels  
February 24, 1997

## PARTS LIST FOR GP12SM MAIN PCB

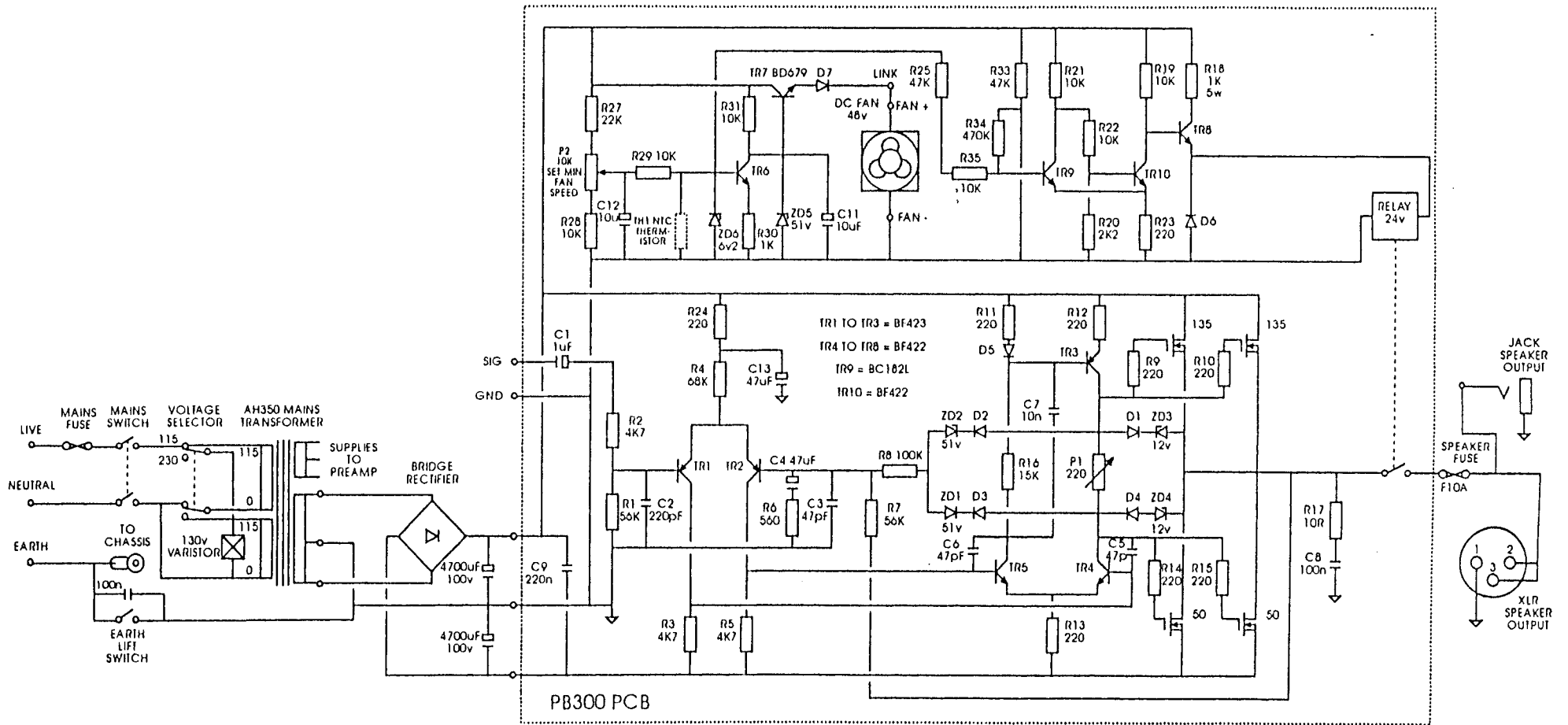
Description	Part Code	Qty	Where Used
RESISTORS			
3M9 ¼Watt	72-RM3M9	3	R1 R3 R5
47K ¼Watt	72-RM47K	11	R15 R17 R51 R55 R61 R64 R65 R68 R122 R123 R143
10K ¼Watt	72-RM10K	23	R4 R8 R12 R20 R32 R33 R40 R41 R43 R48 R49 R53 R57 R60 R63 R67 R116 R124 R125 R126 R129 R133 R138
1K ¼Watt	72-RM1K	7	R6 R7 R26 R34 R141 R145 R153
4K7 ¼Watt	72-RM4K7	44	R9 R28 R31 R36 R39 R80-115 R146 R163 R165
100K ¼Watt	72-RM100K	13	R10 R11 R69 R70 R71 R73 R75 R76 R120 R157 R158 R162 R19
220K ¼Watt	72-RM220K	9	R13 R14 R16 R21 R77 R127 R131 R135 R2
22K ¼Watt	72-RM22K	10	R18 R59 R119 R142 R151 R152 R154 R155 R160 R161
3K3 ¼Watt	72-RM3K3	1	R23
3K8 ¼Watt	72-RM3K8	8	R30 R38 R44 R52 R56 R58 R79 R167
1M ¼Watt	72-RM1M	5	R24 R25 R27 R35 R50
15K ¼Watt	72-RM15K	2	R42 R66
33K ¼Watt	72-RM33K	14	R45 R46 R117 R121 R128 R132 R139 R144 R148 R149 R150 R164 R166 R147
56K ¼Watt	72-RM56K	2	R72 R74
2M2 ¼Watt	72-RM2M2	2	R118 R140
180K ¼Watt	72-RM180K	2	R156 R159
15R ¼Watt	72-RM15R	1	R22
470R 1 Watt	72-RM470R-1WATT	2	R29 R37
220R ¼Watt	72-RM220R	6	R54 R62 R130 R134 R136 R137
560R ¼Watt	72-RM560R	1	R78
3K9 ¼Watt	72-RM3K9	1	R47
LINKS	72-RCZERO	56	
CAPACITORS			



## PARTS LIST FOR GP12SM BACK

Description	Part Code	Qty	Where Used
RESISTORS			
ZERO OHM LINK	72-RCZERO	9	
100K ¼WATT	72-RM100K	2	R14 R16
10K ¼WATT	72-RM10K	5	R10 R11 R17 R19 R20
180K ¼WATT	72-RM180K	1	R4
220K ¼WATT	72-RM220K	1	R3
22K ¼WATT	72-RM22K	3	R68 R69 R70
33K ¼WATT	72-RM33K	2	R15 R18
470K ¼WATT	72-RM470K	2	R26 R34
47K ¼WATT	72-RM47K	14	R1 R2 R5 R6 R13 R23 R24 R22 R28 R30 R31 R32 R36 R38
4K7 ¼WATT	72-RM4K7	3	R7 R25 R33
560R ¼WATT	72-RM560R	6	R9 R21 R27 R29 R35 R37
6K8 ¼WATT	72-RM6K8	1	R12
CAPACITORS			
1µF 63V RADIAL	72-C1-63VER	1	C3
10µF 63V RADIAL	72-C10-63VER	7	C1 C2 C4 C5 C6 C7 C8
POTS & SWITCHES			
50K PCB MOUNT POT	73-POT-50KB	1	V1
LATCHING SWITCH	73-SWT-F2UEE	2	SW1 SW2
SEMI-CONDUCTORS			
J112 FET	72-FET-J-112	3	TR1-3
TL072 OP-AMP	72-IC-TL072	4	IC1-4
SOCKETS			
XLR SOCKET	73-XLR-PCB-M	3	XLR1-3
10 WAY 100MM LINK	72-LK-10W100TEG	1	CA
10 WAY 300MM LINK	72-LK-10W300TEG	1	CD
JACK SOCKET	72-SKT-JCKBBBG	1	J1
JACK SOCKET	73-JCKBNBG	6	J2-7

**Rik Daniels**  
**February 26, 1997**



**TRACE ELLIOT Ltd**  
 GALLIFORD ROAD  
 MALDON, ESSEX,  
 CM9 7XD, ENGLAND

TITLE:- AH350 OUTPUT STAGE  
 CIRCUIT DIAGRAM

DRAWN C. BUTTON

DATE 28.10.92

ORG No AH350/1

## 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**

# **CIRCUIT DESCRIPTION**

## **POWER MODULE PB300/500**

**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 via TR7 causing it to slow down. Zener diode ZD6 is included to prevent the base voltage on TR6 from rising too far causing the 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 of 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.

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 ).

# MUTE OUTPUT IN STANDBY MODE

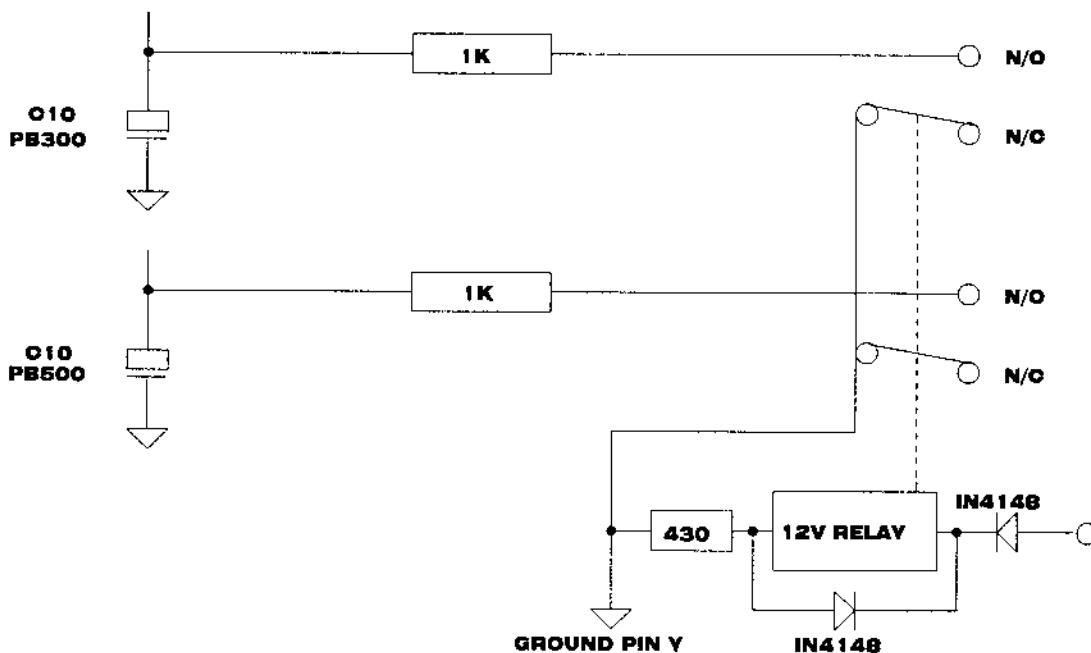
February 25, 1997

Due to loud disturbing noises when the AH600SMX is switched off in Bi-Amp mode, Trace Elliot have added a small circuit to mute the outputs in standby mode thus allowing for silent turn-off.

The circuit on a 30mm x 25mm PCB, is mounted using a plastic spacer and M3 x 16mm bolt in the hole next to regulator 1 on the GP12SM main PCB.

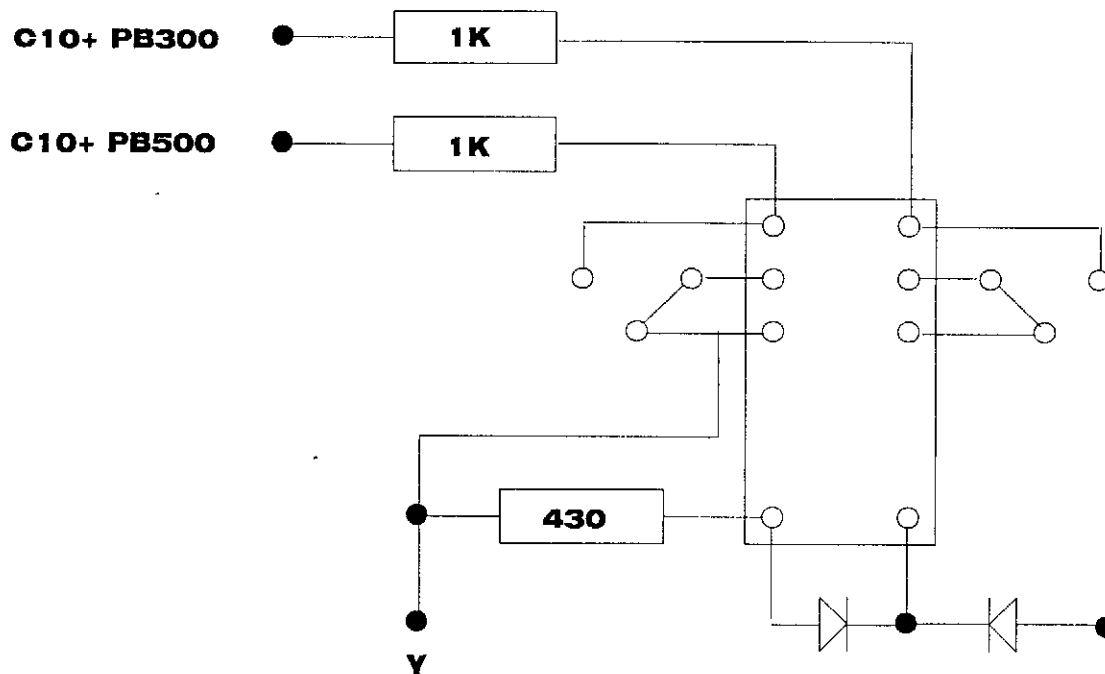
Four wires are then soldered to various parts of the amplifier. The board is basically a relay to switch the output relays off when the unit is in standby.

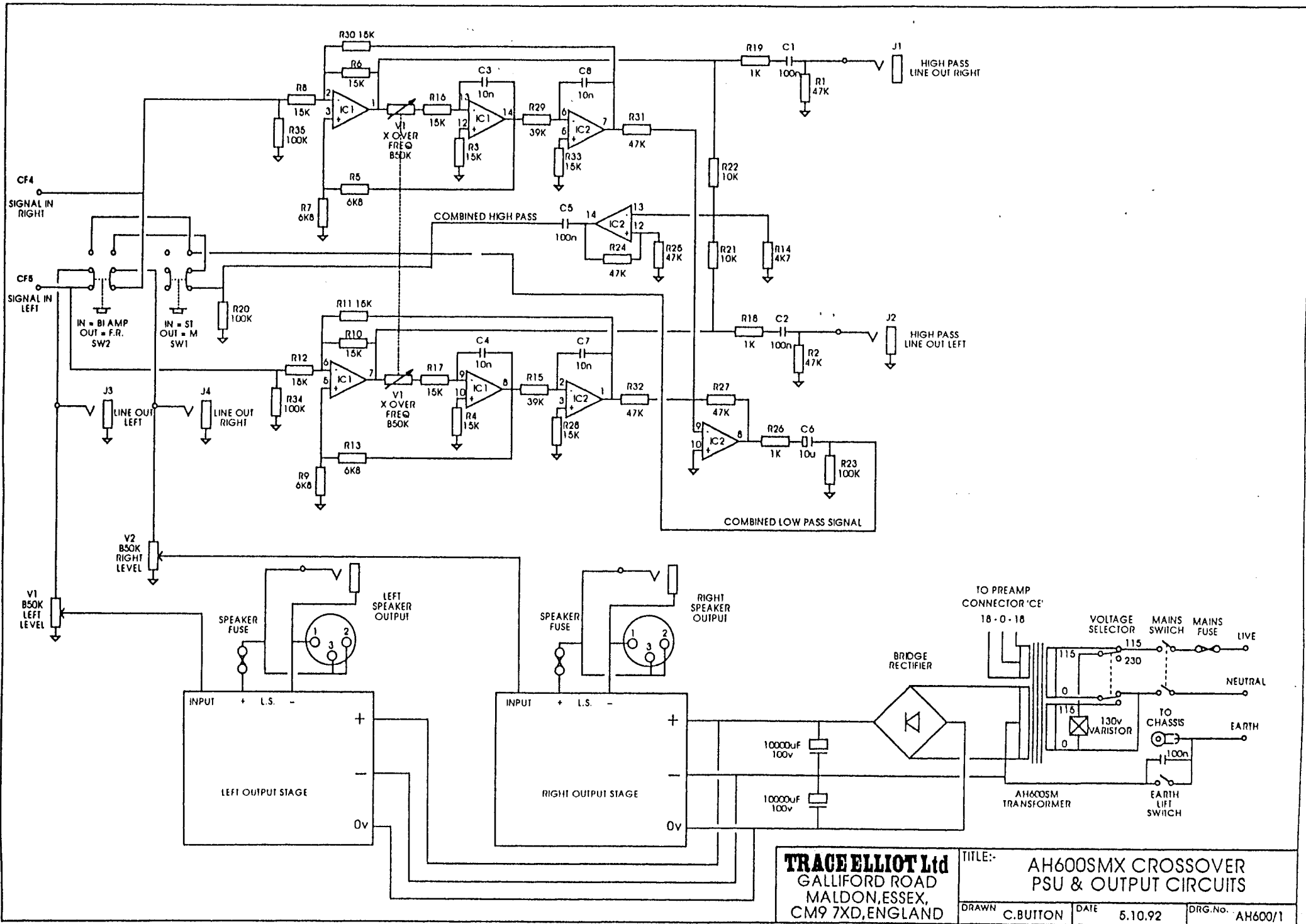
1. Wire marked SBY goes to the front top contacts on the standby switch ( either contact will do as they are linked ).
2. Wire marked Y goes to test point Y which is a ground point which is a ground point between the regulators.
3. Two wires marked "C10+" go to the positive side of the C10 on both output boards. This is found above the relay next to R35 on both boards.  
Solder the wires to the back of the boards; the +VE side of C10 is the bottom leg on both.



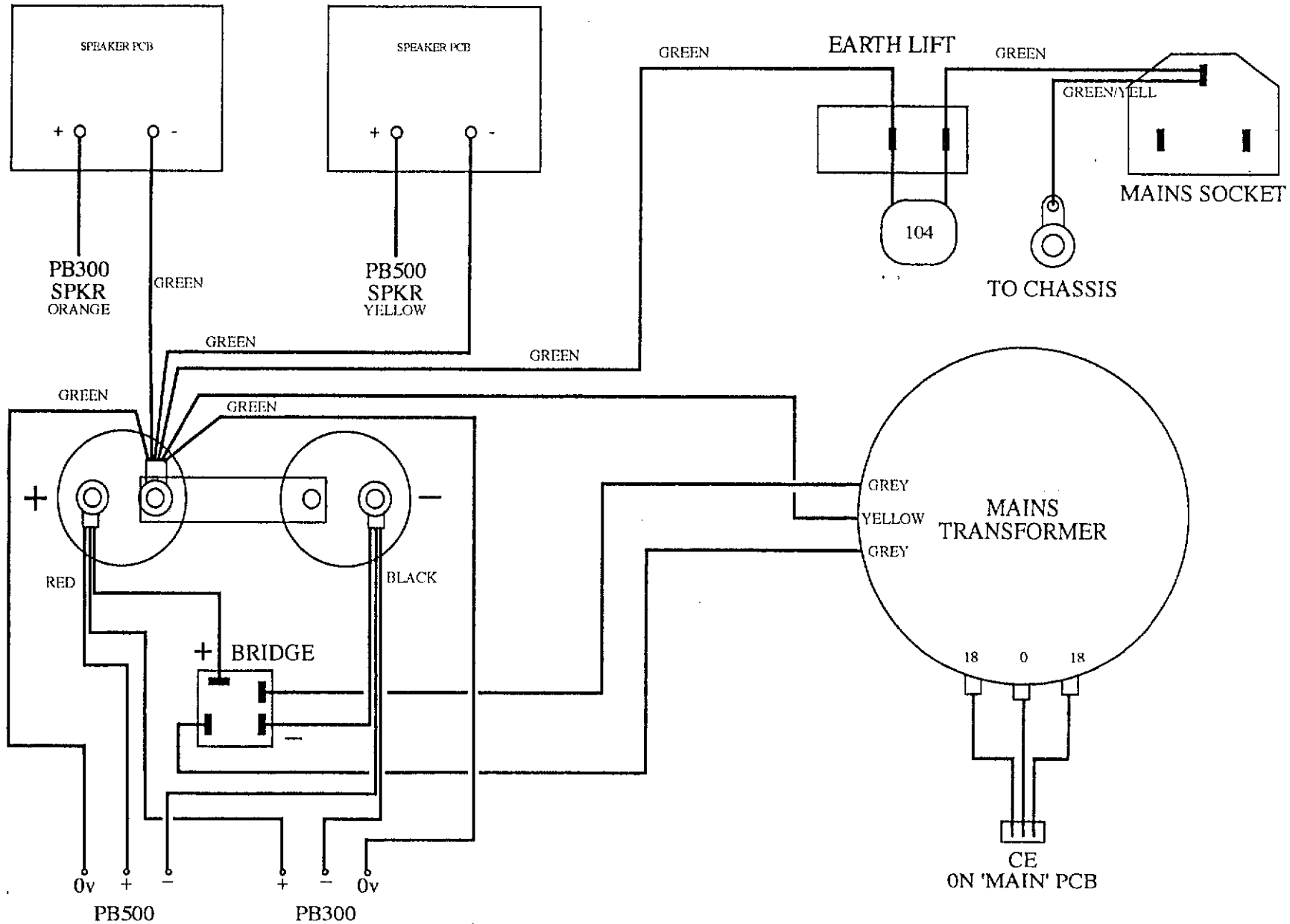


# PHYSICAL VIEW





# AH600 SUPPLY & EARTH WIRING



FOR AH350 - WIRING REMAINS THE SAME  
EXCEPT THERE IS NO PB500 PCB

# PARTS LIST FOR AH600SM CROSSOVER PCB

Description	Part Code	Qty	Where Used
<b>RESISTORS</b>			
ZERO OHM LINK	72-RC-ZERO	9	
100K ¼ WATT	72-RM100K	4	R20 R23 R34 R35
10K ¼ WATT	72-RM10K	2	R21 R22
15K ¼ WATT	72-RM15K	11	R3 R4 R6 R10 R11 R12 R16 R17 R28 R30 R33
1K ¼ WATT	72-RM1K	3	R18 R19 R26
39K ¼ WATT	72-RM39K	2	R15 R29
47K ¼ WATT	72-RM47K	7	R1 R2 R24 R25 R27 R31 R32
4K7 ¼ WATT	72-RM4K7	1	R14
6K8 ¼ WATT	72-RM6K8	3	R7 R8 R13
<b>CAPACITORS</b>			
10µF 63V RADIAL	72-C10-63VER	1	C6
100nF 100V MYLAR	72-C100N-100VE	3	C1 C2 C5
10nF 100V MYLAR	72-C10N-100VE	4	C3 C4 C7 C8
<b>POTS &amp; SWITCHES</b>			
DUAL GANG 50K POT	73-POT-50K-DG	1	V1
50K PCB MOUNT	73-POT-50KB	2	V2 V3
LATCHING SWITCH	73-SWT-F2UEE	2	SW1 SW2
<b>SOCKETS</b>			
5 WAY 150MM LINK	72-LK-10W150L	1	CF
JACK SOCKET	72-SKT-JCKBNBG	4	J1 J2 J3 J4
2 WAY TERMINAL	73-TERM-PCB-2WAY	2	LEFT & RIGHT
<b>SEMI-CONDUCTORS</b>			
TL074 OP-AMP	72-IC-TL074	2	IC1 IC2

Rik Daniels  
February 26, 1997