ARCAM

ALPHA AMPLIFIER SERVICE MANUAL

(ALL MODELS)

ARCAM ALPHA AMPLIFIER SERVICE MANUAL

Issue 2 16/10/91 Arcam Drawing No. H04/0001

Alpha amplifier	s/n 0001 - 5580	Alpha Plus	s/n 5581 - 18799
Alpha II	s/n 18800 - 39649	Alpha III	s/n 39650 -

CONTENTS

Unless otherwise stated the circuit description for the various versions of the amplifier are identical but please refer to the appropriate circuit diagrams for the model in question.

Circuit description

[Component numbers for the right hand channel are prefixed by 100; e.g. R103 is equivalent to R3 in the left hand channel. Components common to both channels (e.g. power supply) have the prefix 200.]

Disc input

Alpha and Alpha Plus

The disc input amplifier consists of a dual op-amp selected for low noise (IC201, NE5532), one op-amp for each channel. The RIAA equalization is achieved by feedback round the op-amp, with R3, C4, R4, C5 determining the mid-band frequency response, R2 the gain and C3 the low frequency roll off. The cartridge is loaded by R1 in parallel with C1 and there is an option for a cartridge loading module for additional loading if required (ULM/M). C2 provides R.F. suppression. The output is coupled via C6 to the input selector switch.

Alpha II

The Alpha II has an optional moving coil facility added and the loading module option was removed. The moving coil board, (MCA board available from Arcam), plugs in place of the 8 way plug in the disc stage. The MCA board is based on the moving coil stage of the D60 and D90.2 amplifiers and provides a 21 dB flat response amplifier. It has its own on board +8V regulated supply, provided by Z1, R202, R203, derived from the Alpha's own +15V supply. The required audio signals and supply pass to from the board via the 8 way connector. (See separate MCA circuit diagram).

Alpha III

The moving coil option is not available on the Alpha III and the low frequency roll off was changed by increasing the value of C3 from 10uF to 22uF.

Selector switch

Alpha

The selector switch is a five position switch with an output via R8 to the tape output sockets and an output via R9 to the volume control, RV201. R6 and R7 form a 6dB attenuator for the CD input.

Alpha Plus onwards

The cd input attenuator was reduced t
switching between inputs.

Alpha II and III

The Alpha II was the first Alpha model t
monitoring of 3 head machines. This wa
occurred with certain tape decks on the
removed on the Alpha III and the input se

Line preamp

Alpha, Alpha Plus and Alpha II

The line preamp is a dual op-amp select
per channel. The gain is fixed by R11 ar

Alpha III

On the Alpha III the gain previously provi
the tone control stage.

Tone controls

Alpha, Alpha Plus and Alpha II

The tone control stage consists of one o
Alpha Plus onwards) with frequency ser
RV202. The range of the control is set
frequency at which it operates by C9. T
control is set by the end stop resistors R
by C10. R15 is an isolation resistor to r
controls.

Alpha III

The Alpha III has a direct switch which by
The tone control stage has no gain with
approximately 5dB's at 50Hz and 10KHz.
amp IC202 with half of the op-amp used

Mute circuit and balance control

Alpha

The balance control is RV204 and R18 which feeds via R19 to the power amp. Q1 mute FET which provides a turn on mute. This device is normally "on" i.e. Rds is lov no gate voltage. When power is applied it becomes high resistance via a time con which is determined by R201 and C201. D201 discharges C201 rapidly after the am has been turned off. This ensures that the mute circuit still operates if the ampli turned off and turned on again soon after. The effectiveness of the mute is deterr by the ratio of the "ON" resistance of Q1 to the resistance of R18, R19 and is typ better than 40dB.

Alpha Plus, Alpha II and III

The mute circuit was modified with the addition of 3 components, R204,205 and (and the change of D201 from a diode to a 5V6 zener diode. The circuit works in a s way to the original mute circuit but the extra components are used to monitor the +/ rails and as they drop below a certain value Q201 is turned on, pulling the gates o Q1,101 down to ground and so muting the output. (On the Alpha III Q203 provide same function as Q201 on the earlier units).

Preamp power supply

All models

The pre amp is powered by a regulated +/- 15 volt supply. IC203 and IC204 are t volt regulators and C202-205 are de-coupling capacitors.

Alpha III units with issue 8 pcb's (s/n > 41756), have dropper resistors,R207, R208, with the regulators to reduce the input level to a safe level for the regulators.

Power amplifier

Alpha, Alpha Plus and Alpha II

The input to the power amp is fed to the differential pair Q2 and Q3. Q4 and Q5 p a constant current for the differential pair. The output from the collector of Q2 is fed class A stage, Q8, Q6 and Q7 form a constant current source for Q8. The outpu this stage is fed to the driver transistors Q11, Q12 which drive the complementary transistors Q13 and Q14. Feedback is taken from the output of the power amp vi and R26 (part of the feedback is around the fuse) and is fed back to the second in the differential pair, the base of Q3. The overall gain of the amplifier is set by the r R25 and R26 (in parallel) to R23, with C13 providing a low frequency roll off. C14 high frequency compensation capacitor, necessary to ensure stability of the power The quiescent current in the power amp is set by RV1 and should be adjusted so th

current through Q13 and Q14 is approx. 30mA (7mV across R41) are constrained to operate within their safe operating area by R31,32,33,34,35,36,37,38; C15,16; D1,2; Q9,10. The speake should only ever be replaced with a fuse of the same type. T stability if a capacitive load is put on the output of the amplifier. is fed from R45 and the "switched" speaker outputs are controll socket. D3 and D4 protect against transients from inductive loa major power amplifier faults is provided by the mains fuse.

Alpha III

The power amp signal comes from the first gain stage formed l the input of the differential input. The power amplifier also has a feedback loop to keep the dc voltage at the speaker outputs at 0 very little gain at audio frequencies but an extremely high d.c. ga rating device, BD139, on the Alpha III. New speaker terminal binc the Alpha III and the inductor were replaced with air cored type

Power supply

All models

The power supply comprises a transformer, bridge rectifier and r transformer is a toroidal transformer, (except on original Alpha w which can be wired for either 240V or 120V operation. (220V/1 The mains switch is a two pole type which meets international s mains fuse is a 800mA slow blow (1.25A slow blow for 120v ope only be replaced with a fuse of the same type.

NOTE: THE MAINS FUSE IS ALWAYS LIVE EVEN WITH THI SWITCH OFF!

D203-D206 form the bridge rectifier and C210,C211 are the capacitors. C208, C209 are high frequency supply de-coul suppresses switching transients. D202 is the power LED and R2(D202. From Alpha II onwards the current limit resistor for the led a second series resistor, R203, and the power led was changec

Alpha III

The Alpha III has a higher voltage power supply, 38V dc, compa with 33V rails, and 10000uF smoothing capacitors per rail instea unit a higher power rating. The transformer is a multi voltage un 240V,220V or 120V by moving 1 wire on the primary winding ar necessary. An third led current limit resistor was added to reduc other two, due to the increased supply voltage.

CHANGE OF MAINS VOLTAGE

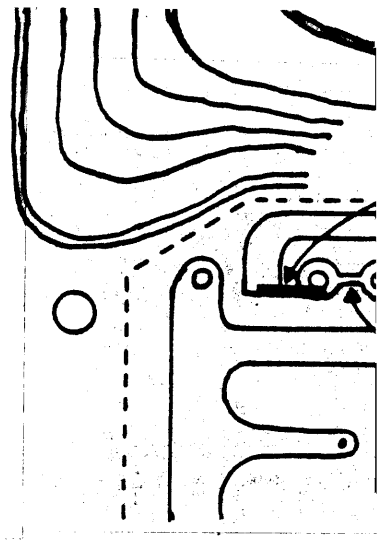
WARNING - The unit must be u
wiring or the mains fuses since th
off.

The frame transformer of the Alp
or 220/110V. Other voltage chan

240V to 120V (220V to 110V) co

1. Disconnect from the mains
2. Remove top and bottom c
3. Fold back or remove the r
4. Cut through the track (mai
   primary windings of the tra
   the remaining conductors.
5. Using 22swg tinned copp
   diagram below.
6. Replace the the mains ins
7. Replace the mains fuse w

120V to 240V (110V to 220V) is

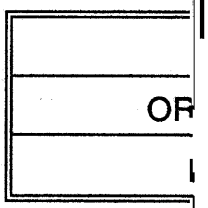


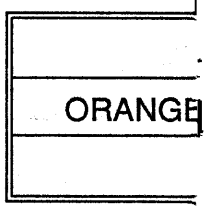
Diagram

CHANGE OF

WARNING -
wiring or the
off.

To convert t
changing the
120V or 220
To convert to
The pcb lege





CHANGE OF MAINS VOLTAGE (ALPHA III)

WARNING - The unit must be unplugged from the mains supply when changing the wiring or the mains fuses since the fuse is at mains potential even with the unit switched off.

The Alpha III has a multi voltage transformer* so the same transformer can be used for 240V, 220V and 120V by moving two of the three wires, (orange, yellow or brown) and changing the fuse rating as necessary. The wire in the bottom left hand corner determines the mains voltage, i.e. orange for 240V, and the other two wires go into the holes marked "Spare Wires". The black wire does not move. The pcb legend is shown below.

240V WIRING (800mA ANTI-SURGE FUSE)

⊠ BROWN SPARE WIRES ⊠ YELLOW	⊠ BLACK
⊠ ORANGE (This wire determines the voltage)	240V ORANGE 220V YELLOW 120V BROWN

220V WIRING (800mA ANTI-SURGE FUSE)

⊠ BROWN SPARE WIRES ⊠ ORANGE	⊠ BLACK
⊠ YELLOW (This wire determines the voltage)	240V ORANGE 220V YELLOW 120V BROWN

120V WIRING (1.25A ANTI-SURGE FUSE)

⊠ YELLOW SPARE WIRES ⊠ ORANGE	⊠ BLACK
⊠ BROWN (This wire determines the voltage)	240V ORANGE 220V YELLOW 120V BROWN

* The first 100 Alpha III's have a 240/120V transformer and do not have the extra yellow wire. To convert these to 220V requires a new transformer.

RESETTING THE QUIESCENT CURRENT

After replacement of components in the power amplifier stages of the Alpha amplifier the quiescent current setting should be checked and adjusted if necessary. The adjustment should be made with no load connected to the amplifier and no signal applied and after the unit has been switched on for about 30 minutes. The voltage should be measured across **one** of the 0.22 ohm emitter resistors and should be set to 8mV for Alpha,Alpha Plus and Alpha II but only to 4.5mV on the Alpha III.

CIRCUIT DIAGRAMS

No.	Title of Circuit
1	Alpha & Alpha Plus Power Amp & Power Supplies
2	Alpha & Alpha Plus Disc, Line & Tone Control Stages
3	Alpha II Power Amp & Power Supplies
4	Alpha II Disc, Line & Tone Control Stages
5	Alpha II Moving Coil Preamp Option Board (MCA)
6	Alpha III Power Supplies
7	Alpha III Disc & Tone Control Stages
8	Alpha III Power Amp

BOARD MODIFIC

ALPHA 3

Issue 6 PCB - THIS IS THE FIRST ISSUE BOA
wrong way round to screening on pcb due to col
laid out.

Issue 7 PCB - Headphone jumper link re-routed

Issue 8 PCB - R207,208 and 206 added to pro
C213, 214 changed from 2n2 to 4n7.

Nov 91 - Issue 8 boards only - R19,119 change
from 820R to 1K8, R20,120 changed from 1K8
47K, 5V6 zener diode and 10uF capacitor adde
now conected to + 38V rail to reduce switch off th

Issue 9 PCB - Incorporating all the modifications

ALPHA III SWITCH-OFF THUMP CURE 03/12/91

Issue 8 boards only (serial numbers 41757 - 43694 approx.)

1. Change R20,120 from 1K8 to 2K2
2. Change R49,149 from 100K to 47K (metal film)
3. Change R50,150 from 820R to 1K8 (metal film)
4. Change R19,119 from 820R to 56R

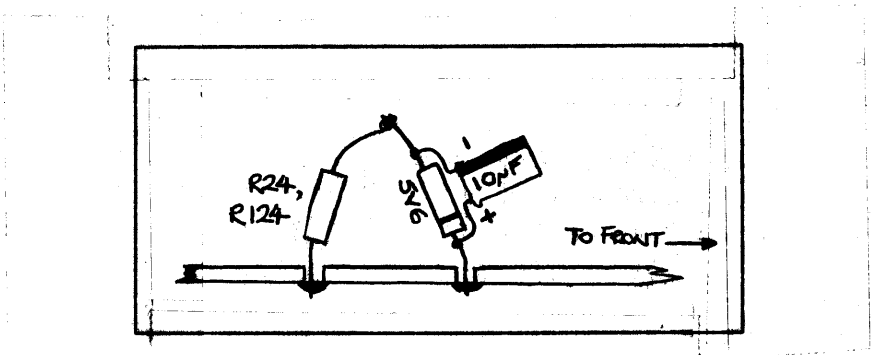
5. Connect the power led to the positive rail as described below.

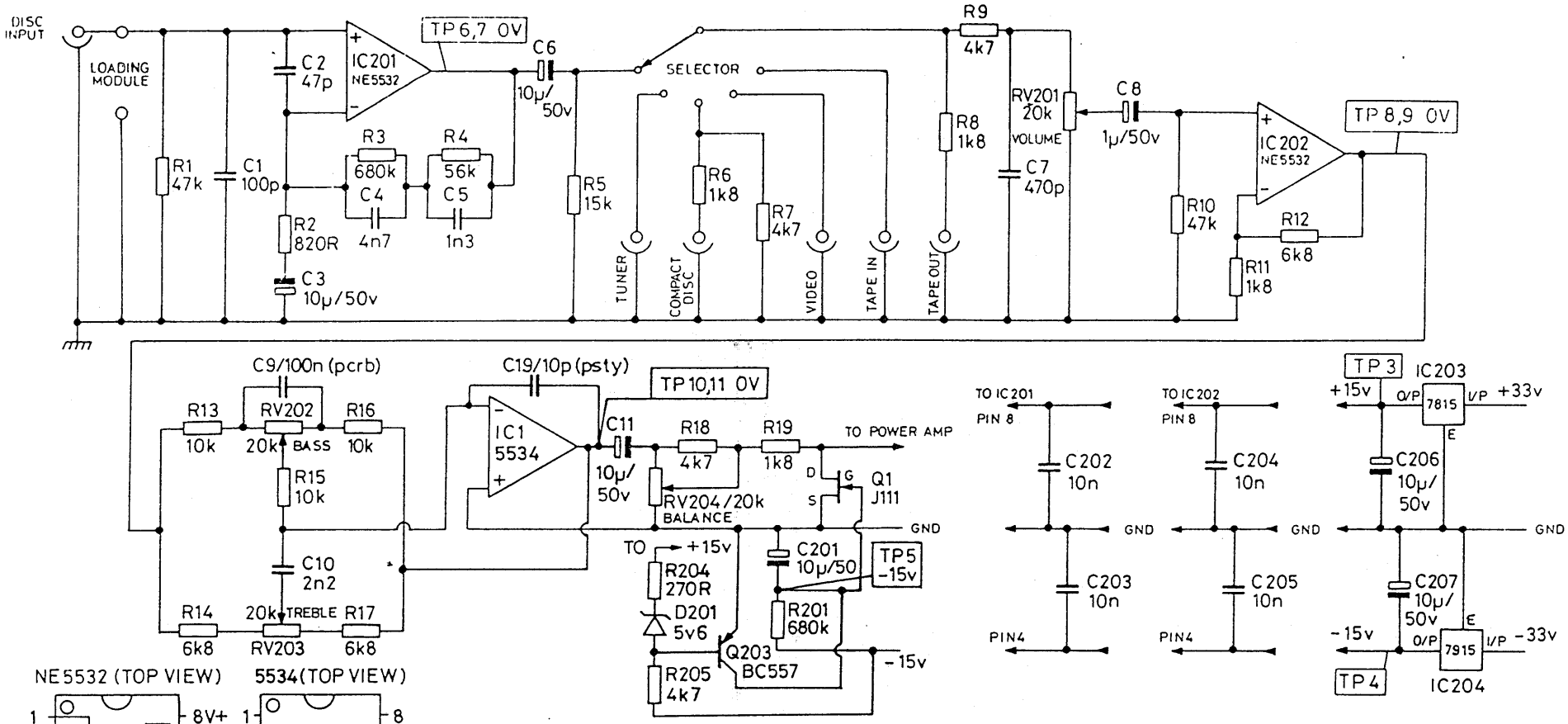
Reverse the black and red wires to the power led.
Unsolder the leg of R206 nearest to link LK20. Solder this leg to the nearest leg of R127.

6. Desolder the end of resistors R24,124 nearest to the front panel and pull these ends of the resistors up out of the pcb.
Solder a 5V6 zener diode in series with the resistor and a 10uF capacitor in parallel with the zener diode as shown below.
N.B. It may be easier to solder the zener/capacitor assembly together before fitting into the board.

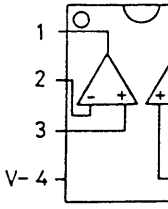
These modifications should virtually eliminate all switch off noise on the Alpha III.

This modification can be retrofitted to any issue of board less than issue 8 except there is no R206 on earlier issues. When modifiying early boards read R202 for R206.

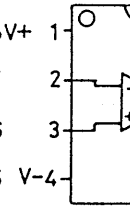




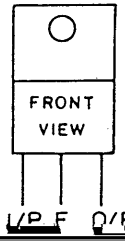
NE5532 (TOP VIEW)



5534 (TOP VIEW)



7815



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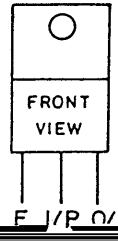


J111

A&R Cambridge Ltd	TITLE: ARCAM ALPHA DISC AND LINE INPUTS, TONE CONTROLS, MUTE & PREAMP POWER SUPPLIES
DRAWN WITH REFERENCE TO BS 308	
PROJECTION THIRD ANGLE	DRG. TYPE
ALL DIMENSIONS MILLIMETRES UNLESS OTHERWISE STATED	PART NO.
TOLERANCES UNLESS OTHERWISE STATED	ORIGINAL SCALE
MATERIAL	
FINISH	

Serial numbers 5581→

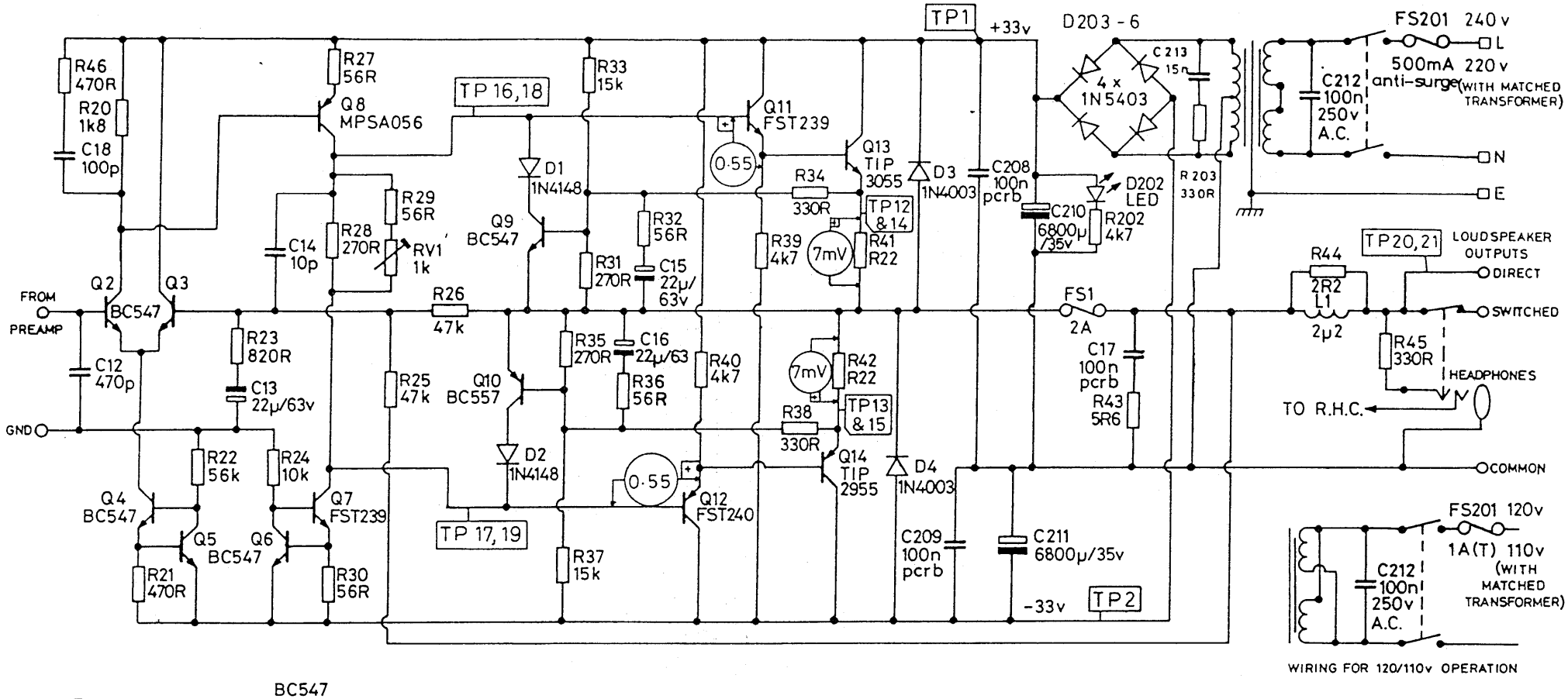
R6 - 1k8
C9 - 100n polycarbonate
C19 - 10p polystyrene added
IC1 - NE5534

} ALPHA + UPGRADE

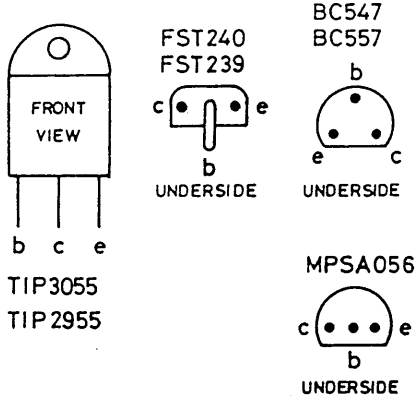
Revised Mute Circuit (additional)
R204 - 270R
R205 - 4k7
D201 - 5v6 Zener
Q203 - BC557

ISSUE	DATE	INITIALS	CHANGE

DRAWN BY	CHECKED BY	APPROVED BY
a. c. H.		
DATE 17/10/84	DATE	DATE



WIRING FOR 120/110v OPERATION



A&R Cambridge Ltd	TITLE ARCAM ALPHA POWER AMPLIFIER CIRCUIT AND POWER SUPPLIES
DRAWN WITH REFERENCE TO BS 308	
PROJECTION THIRD ANGLE	DRG. TYPE
ALL DIMENSIONS MILLIMETRES UNLESS OTHERWISE STATED	PART NO.
	ORIGINAL SCALE
TOLERANCES UNLESS OTHERWISE STATED	
MATERIAL	
FINISH	

SERIAL NUMBERS 5581 →
C208, 209, 17 - 100n polycarbonate
FS201 - 500mA anti-surge - ALPHA + upgrade
R46 - 470R } additional
C18 - 100p

ISSUE	DATE	INITIALS	CHANGE
2	12/3/85	W.A.C.	C213 & R203 added. Serial no. 490 onwards.

DRAWN BY	CHECKED BY	APPROVED BY
a. C. H.		
DATE 11/10/84	DATE	DATE

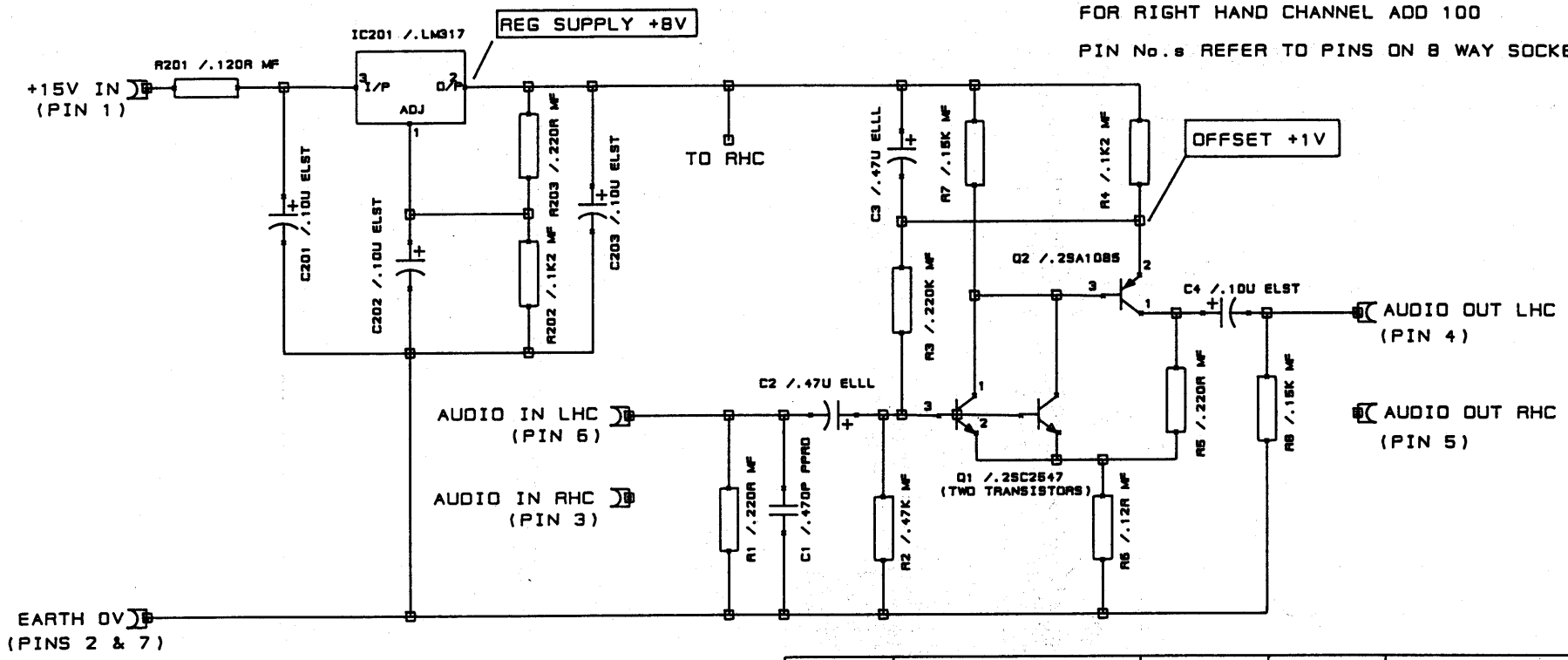
SHEET OF | DRAWING NUMBER

MCA MOVING COIL BOARD

LEFT HAND CHANNEL ONLY SHOWN

FOR RIGHT HAND CHANNEL ADD 100

PIN No.s REFER TO PINS ON 8 WAY SOCKET



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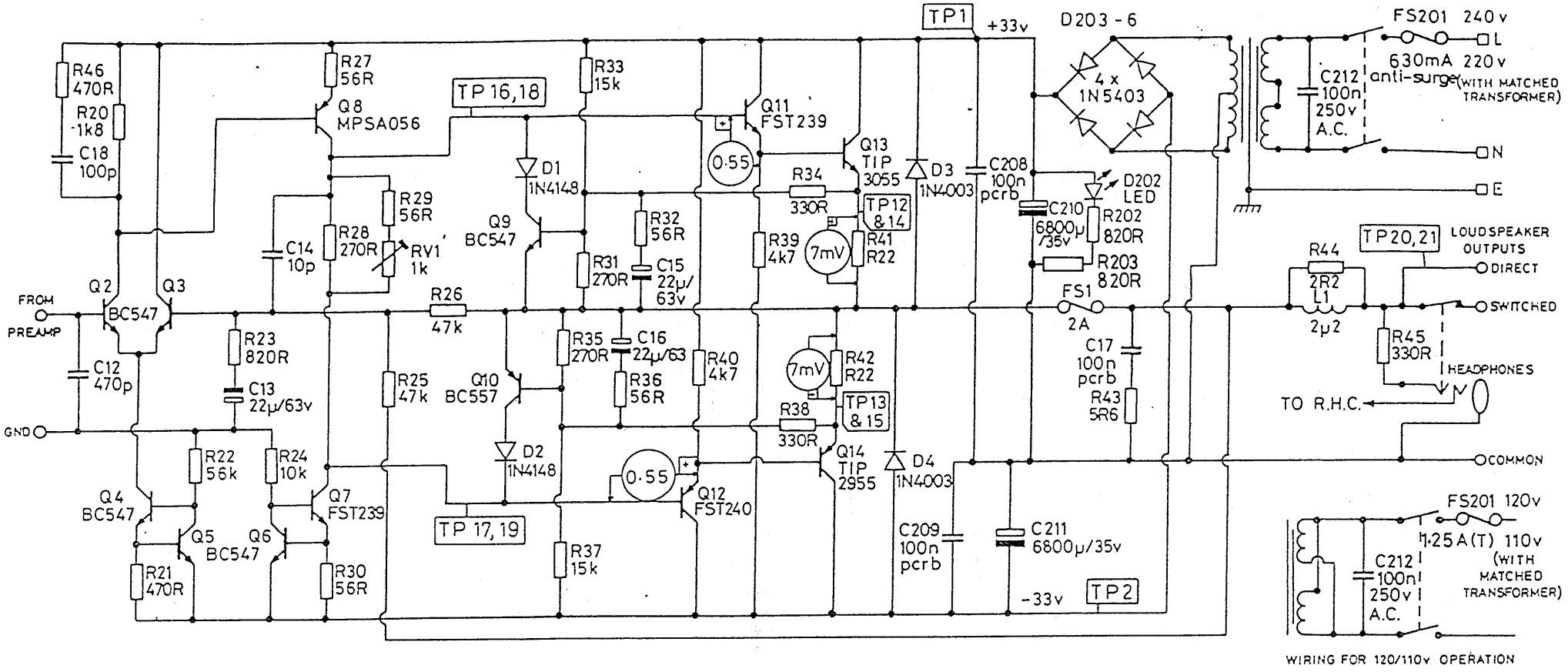
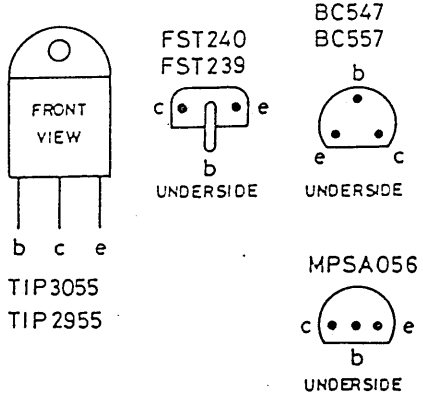
SHT. 1	OF. 1	DRG NO. C02/0058		
SERVICE MANUAL DRW NO. H04/		SHT.	OF	
ARCAM. A & R CAMBRIDGE LTD, CB5 9PB				





ARCAM
A&R Cambridge Limited

TITLE: ALPHA II AMPLIFIER
P.S.U. & POWER AMP' CIRCUIT

DRAWN WITH REFERENCE TO BS 308

PROJECTION THIRD ANGLE

DRG. TYPE: CCT DIA'

PART NO.

ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE STATED

ORIGINAL SCALE

TOLERANCES UNLESS OTHERWISE STATED

MATERIAL

FINISH

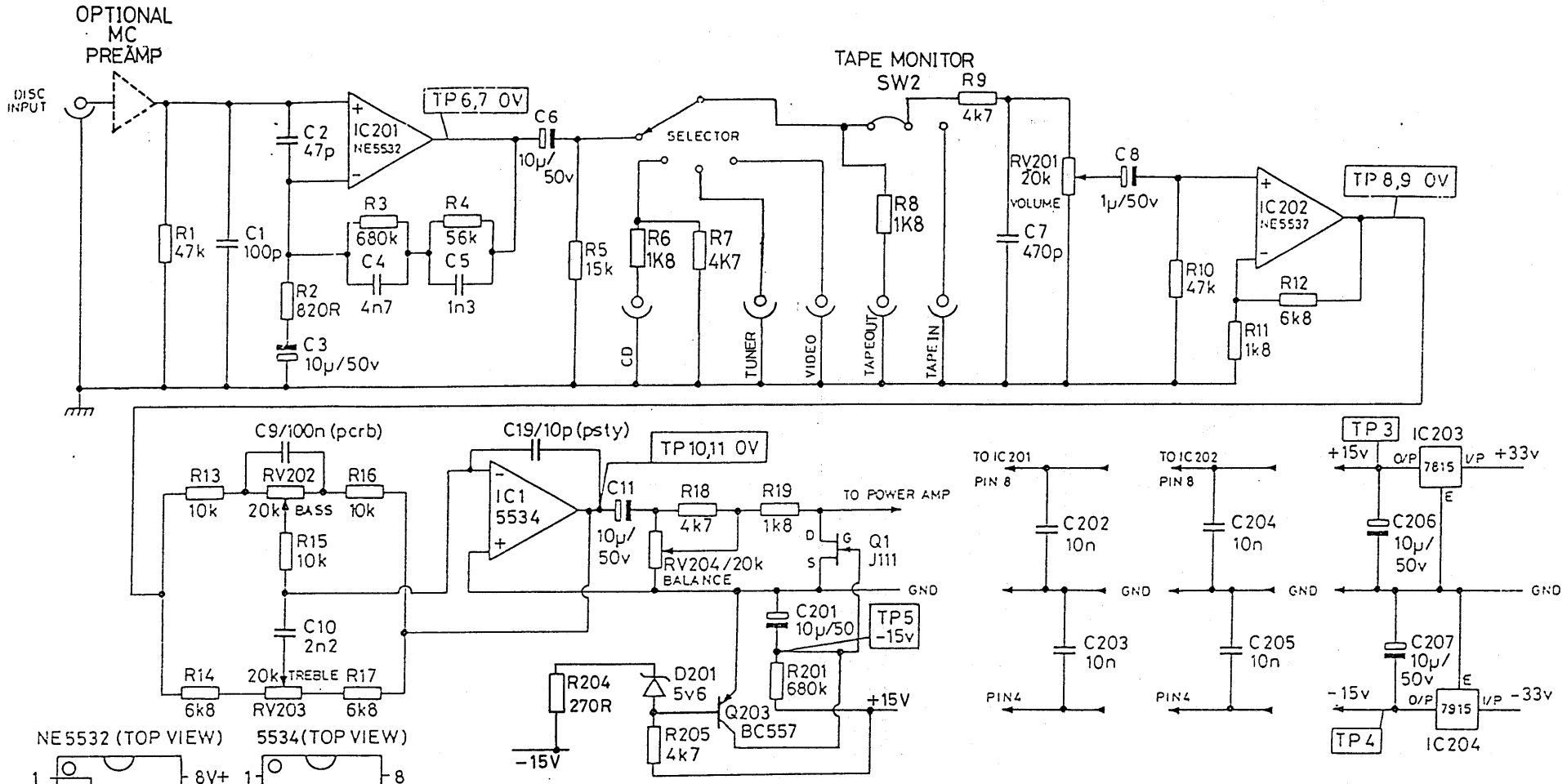
ISSUE	DATE	INITIALS	CHANGE	ECN NO
2	24·1·91	B.C.		91004

DRAWN BY P. NEWTON | CHECKED BY | APPROVED BY

DATE 11·10·84 | DATE | DATE

SHEET 1 OF 2

DRAWING NUMBER C02/0018



ARCAM
A&R Cambridge Limited

DRAWN WITH REFERENCE TO BS 308

PROJECTION THIRD ANGLE

ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE STATED

TOLERANCES UNLESS OTHERWISE STATED

MATERIAL

FINISH

TITLE

ALPHA II AMPLIFIER

DISC & LINE INPUTS, TONE CONTROLS, MUTE & PRE-AMP P.S.U.'s

DRG. TYPE CCT DIA'

PART NO.

ORIGINAL SCALE

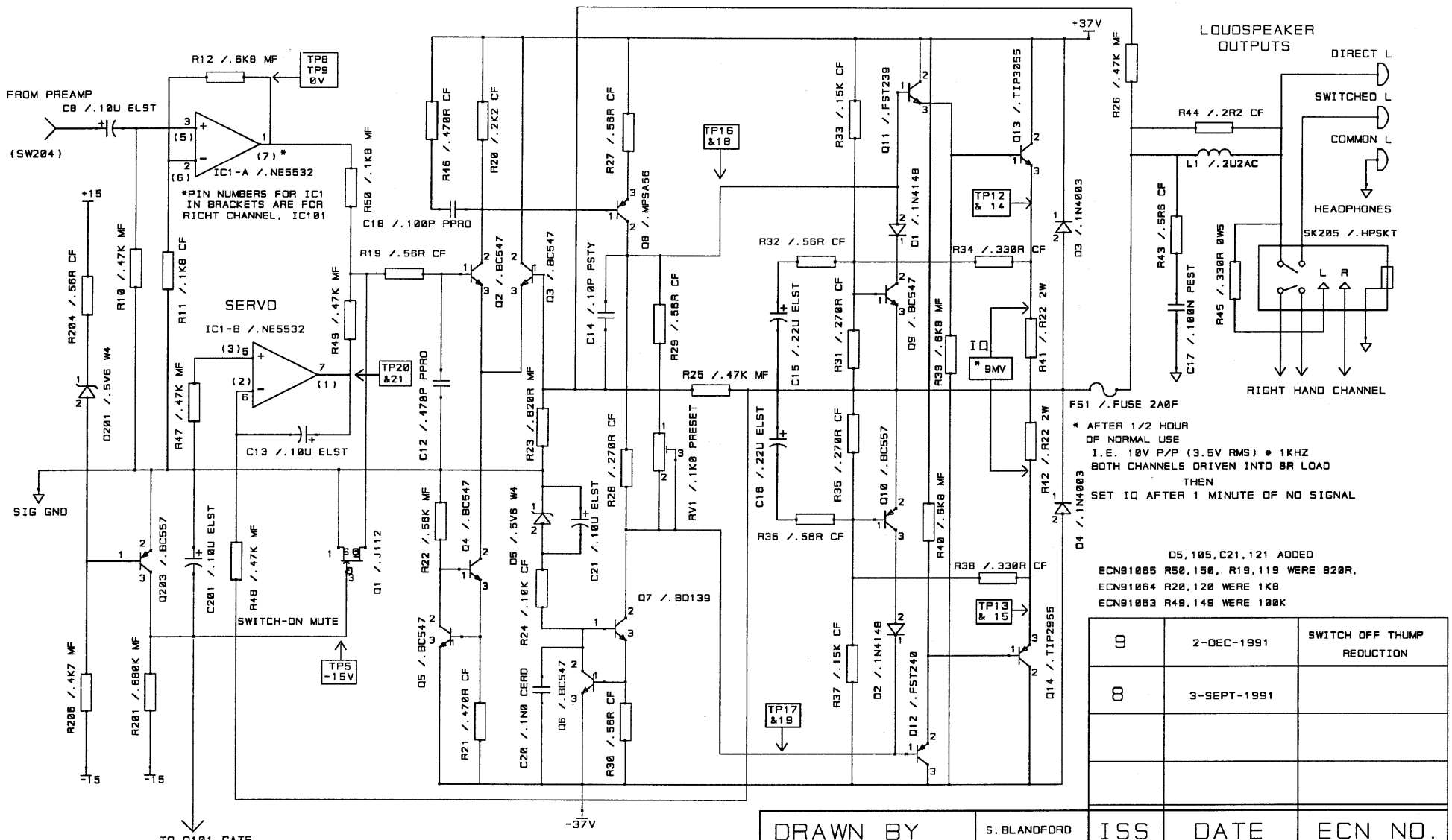
ISSUE	DATE	INITIALS	CHANGE	ECN NO.
2	24·1·91	B.C.		91004

DRAWN BY P.NEWTON | CHECKED BY | APPROVED BY

DATE 11·10·84 | DATE | DATE

SHEET 2 OF 2

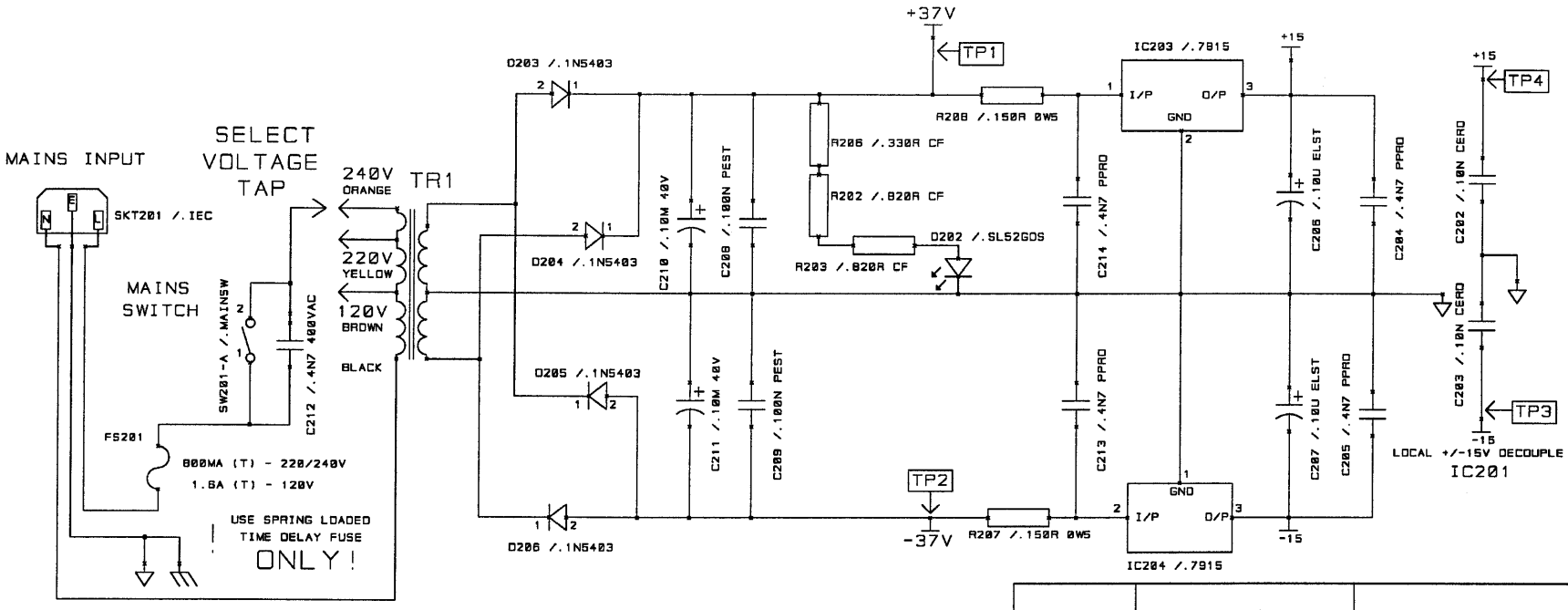
DRAWING NUMBER C02/0018



9	2-DEC-1991	SWITCH OFF THUMP REDUCTION	
8	3-SEPT-1991		

DRAWN BY	S.BLANDFORD	ISS	DATE	ECN NO.
DATE DRAWN	3-SEPT-1991	TITLE	ALPHA AMP3 POWER AMP	
SHT. 3	OF. 3	DRG NO.	H04/0001	
ARCAM. A & R CAMBRIDGE LTD, CB5 9PB				

DRAWING DATE 15/1/92

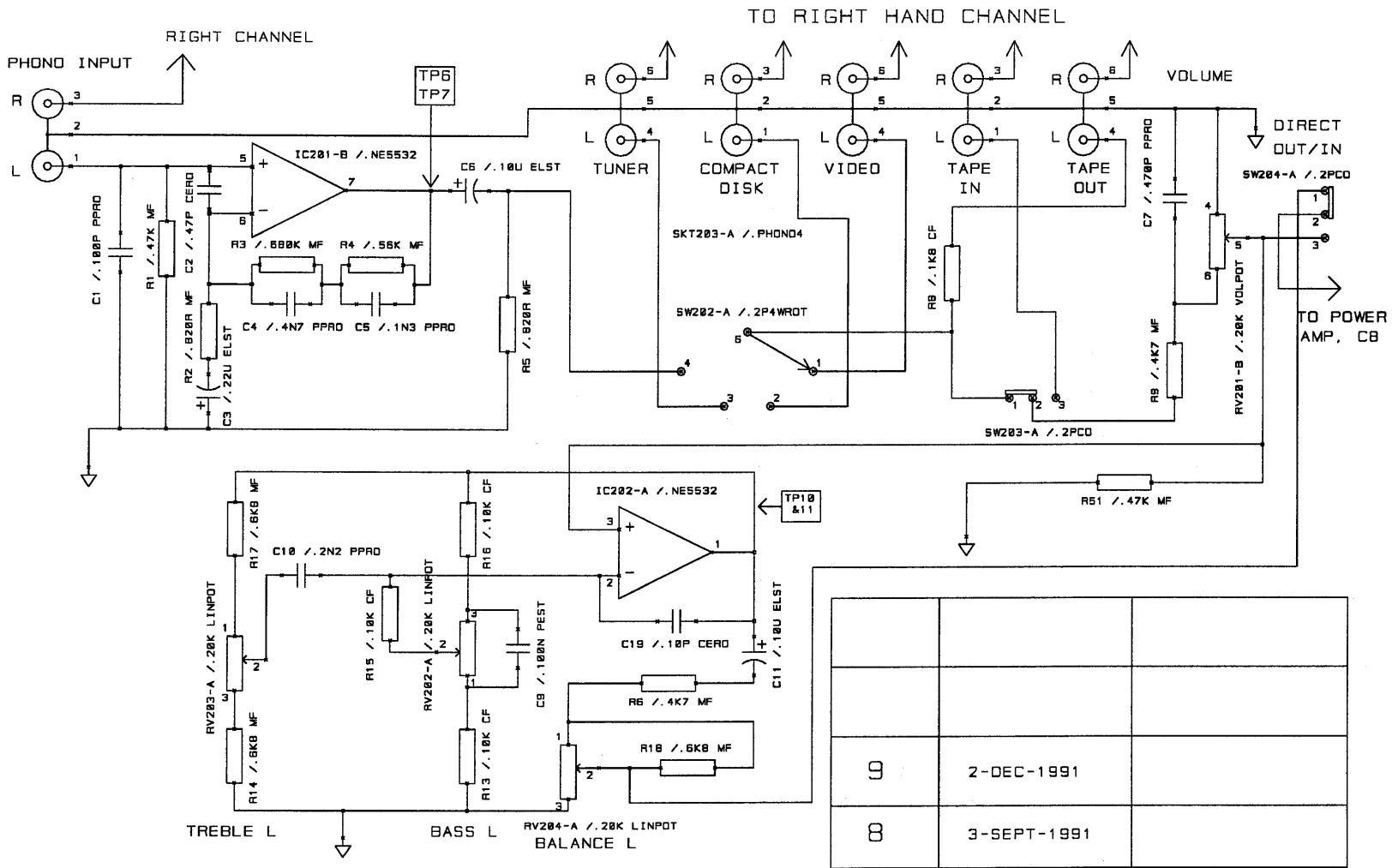


9	2-DEC-1991	
8	3-SEPT-1991	R206, R207, R208 ADDED C213, C214 CHANGED FROM 2N2

LED WAS POWERED FROM -VE SUPPLY

DRAWN BY	S.BLANDFORD	ISS	DATE	ECN NO.
DATE DRAWN	3-SEPT-1991	TITLE ALPHA AMP 3 POWER SUPPLY		
SHT. 1	OF.3	DRG NO. H04/0001		
ARCAM. A & R CAMBRIDGE LTD, CB5 9PB				

DRAWING DATE 15/1/92



9	2-DEC-1991	
8	3-SEPT-1991	

DRAWN BY	S.BLANDFORD	ISS	DATE	ECN NO.
DATE DRAWN	3-SEPT-1991	TITLE	ALPHA AMP 3 PRE-AMP	
SHT. 2	OF.3	DRG NO.	H04/0001	
ARCAM. A & R CAMBRIDGE LTD, CB5 9PB				

DRAWING DATE 15/1/92