



DESIGNS DEPARTMENT

DESIGNS DEPARTMENT HANDBOOK NO.3.131(73)

AMPLIFIER, MONITORING, HEADPHONE

AM10/9 AND AM10/10

BRITISH BROADCASTING CORPORATION  
ENGINEERING DIVISION

DESIGNS DEPARTMENT HANDBOOK NO.3.131(73)

AMPLIFIER, MONITORING, HEADPHONE

AM10/9 AND AM10/10

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(P. DENBY)  
for Head of Designs Department

Written by:- R.N. Robinson

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DESIGNS DEPARTMENT HANDBOOK NO.3.131(73)

AMPLIFIER, MONITORING, HEADPHONE AM10/9 AND AM10/10

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1. Description

AM10/9

The AM10/9 is a general purpose monitoring amplifier constructed on a small printed circuit card.

The unit has separate outputs suitable for driving high or low impedance headphones. The low impedance output may alternatively be used to drive a small high-sensitivity loudspeaker. Both outputs are fully protected against damage due to incorrect load impedance.

The unit incorporates a voltage regulator suitable for power supply voltages from +20 to +30 volts. Supply voltages down to +12 volts may however be used with correspondingly reduced maximum output levels.

Provision is made within the unit for connection of an external volume control.

AM10/10

The AM10/10 consist an amplifier card AM10/9 mounted in a die-cast metal box. A volume control, and high and low impedance output jacks are mounted on the front of the box. A connector on the rear of the box carries the input and power supply connections.

The AM10/10 supercedes the AM10/5, the specifications of these amplifiers are similar except that the supply voltage has been changed from -50 volts to +24 volts.

The powersupplier PS3/48 is designed for use with the amplifiers AM10/9 and AM10/10. This unit is constructed in a die-cast box similar to the AM10/10 and will supply up to four amplifiers.

2. General Specification

Input level		-20dB to 0dB vol.
Input impedance		20K $\Omega$ balanced
Gain	(low impedance output)	28dB $\pm$ 2dB
Max. output level	( " " " )	+14dB into 8 $\Omega$
Output impedance	( " " " )	<1 $\Omega$ (unbalanced)
Gain	(high impedance output)	38dB $\pm$ 4dB
Max. output level	( " " " )	+22dB into 1K $\Omega$
Output impedance	( " " " )	Approx. 300 $\Omega$ (earth free)
Frequency response	( " " " )	50Hz to 15kHz $\pm$ 1.5dB
Total harmonic distortion	( " " " )	<0.5%

Supply voltage (full output)	+20 to +30 volts
Supply voltage (reduced output)	+12 to +30 volts
Supply current	
Quiescent	Approx. 15mA
Max. output into 8 $\Omega$ load (programme)	Approx. 200mA
Max. output into 8 $\Omega$ load (tone)	Approx. 330mA

### 3. Installation and Operation

#### AM10/9

The amplifier has a single high impedance bridging input and is designed for use with input signal levels of approximately -20dB vol.

The low impedance output is designed to feed low impedance headphones (4 $\Omega$  to 200 $\Omega$ ). Alternatively this output may be used to drive a small budspeaker.

When the load impedance is greater than 200 $\Omega$  a higher output level will be obtained from the high impedance output. Both outputs may be used simultaneously, however in this condition the signal level from the high impedance output may be slightly dependant on the load connected to the low impedance output.

The integrated circuit used in this amplifier is internally protected against damage due to a short circuit at its output. This protection takes the form of both an output current limit and a thermal protection device. The effect of the latter is to reduce the output voltage clipping levels if the device is over-heated. Thus if the amplifier output is short circuited, distortion may be noticed on the output signal until the integrated circuit has returned to its operation temperature (normally within 30 seconds).

The high impedance output is taken from a transformer winding and is earth-free. The low impedance output is capacitor coupled, and unbalanced.

Provision is made in the amplifier for connection of an external volume control (5K $\Omega$  log). If a volume control is not required pins 6 and 7 should be strapped and a 54K $\Omega$  resistor connected between pins 7 and 8.

The amplifier is designed to operate on an unregulated supply between +20V and +30V. If the supply voltage falls below +18V the maximum output level before clipping is reduced. The unit will operate at correspondingly reduced outputs down to +12 volts provided that the supply ripple does not exceed approx. 1V pk-pk.

#### AM10/10

The AM10/10 is essentially an AM10/9 amplifier card mounted in a die-cast metal box. The above notes therefore apply also to the AM10/10 except that in this case the volume control is fitted as part of the unit.

The AM10/10 may be mounted on the underside of a desk using a mounting bracket (see DSK 13900 A3), or used as a portable amplifier.

The low impedance output jacks on the front of the unit is wired for use with stereo low-impedance headphones. On this jack tip and ring are shorted. The output appears between tip and sleeve, or ring and sleeve.

The high impedance jack is conventionally wired with the output between tip and ring.

### WARNING

The chassis of this unit is connected to the negative supply input, this must be securely earthed when the unit is installed. When the AM10/10 is used in conjunction with power supplier PS3/48 the tag on the case of the PS3/48 must be connected to earth before mains is applied. Earthing the PS3/48 will then provide the required earthing of the AM10/10 via the negative supply.

#### 4. Circuit Description

The AM10/9 circuit is shown in D 32706 A3.

The amplifier uses a single integrated circuit: National Semiconductors LM380. The input is applied via a 2:1 step-down transformer and volume control to the inverting input of the LM380. The output of the LM380 is capacitively coupled to the low impedance output and via a step-up transformer to the high impedance output.

The non-inverting input of the LM380 (pin 2) is decoupled earth at high frequencies. Pin 1 of the integrated circuit is an internal decoupling point, this is decoupled to earth to improve the supply ripple rejection.

The series network LS, C5 connected across the output is designed to maintain amplifier stability into any load impedance.

A circuit diagram of the integrated circuit is shown in DSK 15348 A4.

The voltage regulator is a simple emitter follower fed from a zener diode. The main function of the regulator is to ensure that the supply to the LM380 does not exceed its maximum rating of 22V.

#### 5. Maintenance

Typical D.C. voltages measured with an Avometer model 8 are shown on the circuit diagram. The supply voltage to the LM380 is not critical. The voltage at the I.C. output (pin 8) and the decoupling point (pin 1) should be approximately half the supply voltage. The I.C. inputs are internally biased to 0V.

The gain of the I.C. should be  $34\text{dB} \pm 3\text{dB}$ .

#### 6. Manufacturing Information

The AM10/9 and AM10/10 are manufactured in accordance with the following Designs Department Manufacturing Information

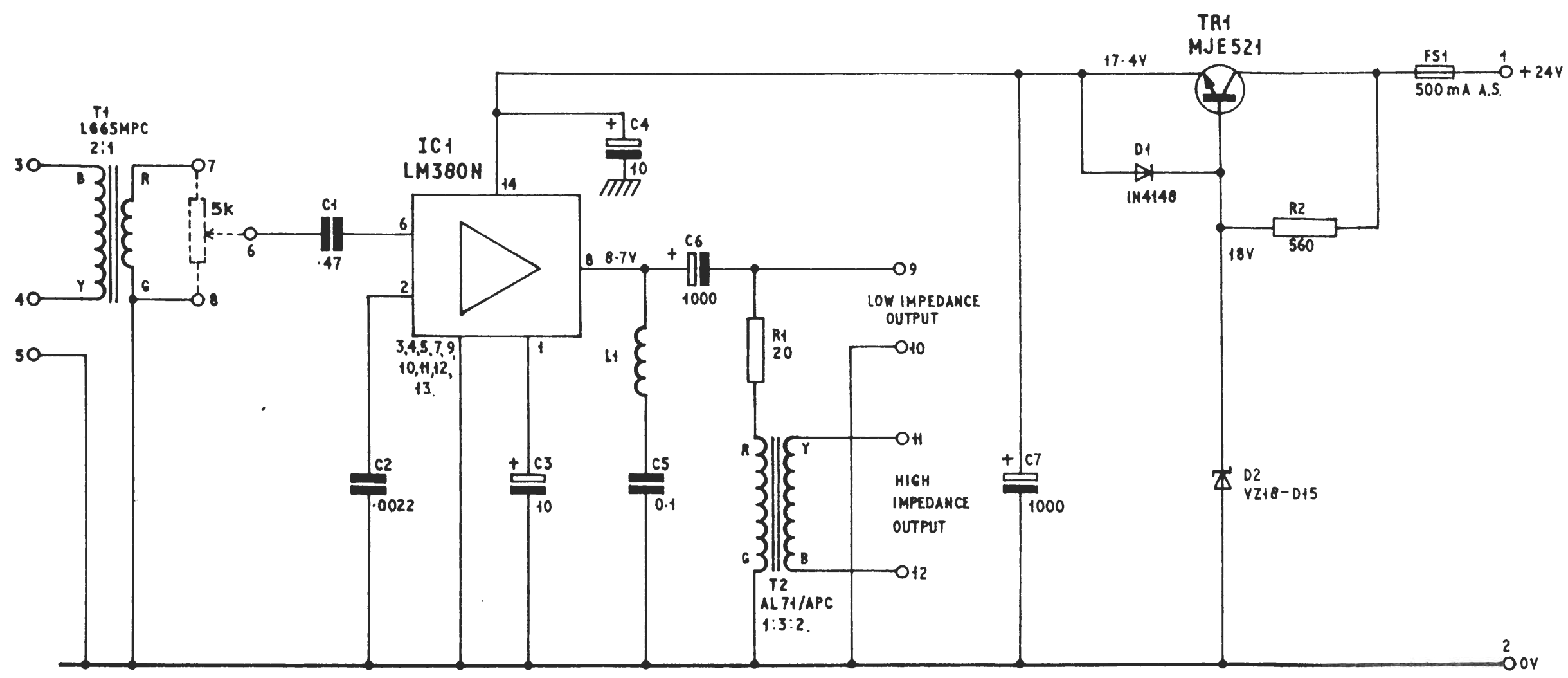
AM10/9	3.562(73)
AM10/10	3.560(73)

N.B. Both sets of information are required for manufacture of AM10/10.

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D3270  
AM10/9 (AMPLIFIER MONITORING HEADPHONE) CIRCUIT

CHANGE
4-12-72
SPEC. ADDED.
U.W.
H.J.M. 26-1-73

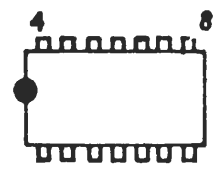


transistor terminations  
view on top



MJE 521

IC terminations  
view on top



1 LM380N 7

5KΩ VARIABLE RESISTOR  
SHOWN IS EXTERNAL TO BOARD.

CHANGE  
4-12-72  
SPEC. & EMB. LOAN  
\* WITH NOTE ADDED  
V.L.W.  
H.J.M. 26-1-73

NOTE:  
\* DENOTES ITEMS SUPPLIED ON EMBODIMENT LOAN TO  
THE CONTRACTOR BY THE B.B.C. FREE OF CHARGE.

ITEM No.	Zo. OFF.	SEE PAGE	DESCRIPTION	CCT REF.	BBC REF. OR DRG. No.
<u>DRAWING NUMBERS</u>					
			CIRCUIT D32706 A3		
			PARTS LIST D32707 A4		
			ASSEMBLY D32708 A3		
			DETAIL D32709 A4		
			P.B. WIRING D32710 A3		
			P.B. COMP. LOC. D32711 A4		
			P.B. DRILLING D32712 A4		
<u>FURTHER INFORMATION REQUIRED FOR MANUFACTURE</u>					
			UNIT ASSEMBLY INFORMATION EA 10484		
			WIRING INFORMATION EA 10140		
			HEAT SINK D32396 A4 - CP		
SPEC: EP/AM10/9					
1	1	*	PRINTED BOARD WIRING		D32710 A3, D32711 A4, D32712 A4.
2					
3					
4					
<u>CAPACITOR</u>					
5	1	*	0022 $\mu$ F 500V	C2	1-20615-288
6	1	*	0.1 $\mu$ F	C5	1-20614-406
7	1	*	0.47 $\mu$ F 100V	C1	1-21034-425
8	1	*	10 $\mu$ F 20V	C3	1-21124-458
9	1	*	10 $\mu$ F 20V	C4	"
10					
11					
12					
<u>CAPACITOR ELECTROLYTIC</u>					
13	1	*	1000 $\mu$ F 25V	C6	1-20724-535
14	1	*	1000 $\mu$ F 25V	C7	"
15					
16					
17					
18	1	*	FUSE 500 mA ANTI-SURGE	FS1	1-22420-161
19					
20					
21					
22	1	*	FUSE HOLDER		1-22251-110
23	1	*	HEAT SINK		D32396 A4 - CP
24					
25					
26	1	*	INDUCTOR	L1	D32709 A4
27					
28					
29					
<u>INTERGRATED CIRCUITS</u>					
30	1	*	LM380N. NATIONAL SEMICOMPS.	IC1	

disclosed to a third party in any form without the written permission of the Corporation.

AM10/9  
AMPLIFIER MONITORING HEADPHONE  
PARTS LIST

DRN. D.C.  
TPD.  
CKD R.N.R.  
APPD *[Signature]*

DESIGNS DEPARTMENT.  
**D32707 A4**  
SHEET 1 OF 2



AM10/9 PARTS LIST.

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CHANGE				DESCRIPTION	C/C'T REF.	BBC REF. OR DRG. No.
ITEM No.	No. OFF.	SEE NOTE				
31						
32						
33						
				<u>RESISTORS METAL FILM ± 2% 0.4W</u>		
34	1	*	20 Ω		R1	1-26877-138
35	1	*	560 Ω		R2	1-26877-354
36						
37						
38						
				<u>DIODE</u>		
39	1	*	1N4148 MULLARD		D1	
40						
41						
42						
				<u>DIODE ZENER</u>		
43	1	*	VZ18-D15		D2	
44						
45						
46						
				<u>SCREWS</u>		
						<u>FOR FIXING ITEMS</u>
47	2		6BA CH.HD. X 5/16" LG. STL. Zn PL.	23		
48	1		6BA CH.HD. X 1/2" LG. STL. Zn PL.	56		
49						
50						
51						
				<u>TAG</u>		
52	12	*	VERO ELECTRONICS 11034			
53						
54	1	*	LABEL BLICK TYPE N° 8 GREEN			
55						
				<u>TRANSISTOR</u>		
56	1	*	MJE 521 MOTOROLA		TR1	
57						
58						
59						
				<u>TRANSFORMER</u>		
60	1	*	LG/65 MPC		T1	ED TC/LG/65M
61	1	*	AL/71 APC		T2	ED TC/AL/71A
62						
63						
64						
				<u>NUTS, HEX FULL</u>		
65	3		6BA M.S. Zn PL.	23, 56		
66						
67						
68						
				<u>WASHERS PLAIN (SMALL)</u>		
69	3		6BA STL. Zn PL.	23, 56		
70						
71	A/R		SLEEVING. INSULATING 1mm I.D. RED.			ED / 3002
72						
73	1		CARTON, CARDBOARD.			SPEC: ED / AM10/9.

AM10/9 PRINTED BOARD COMPONENT LOCATION

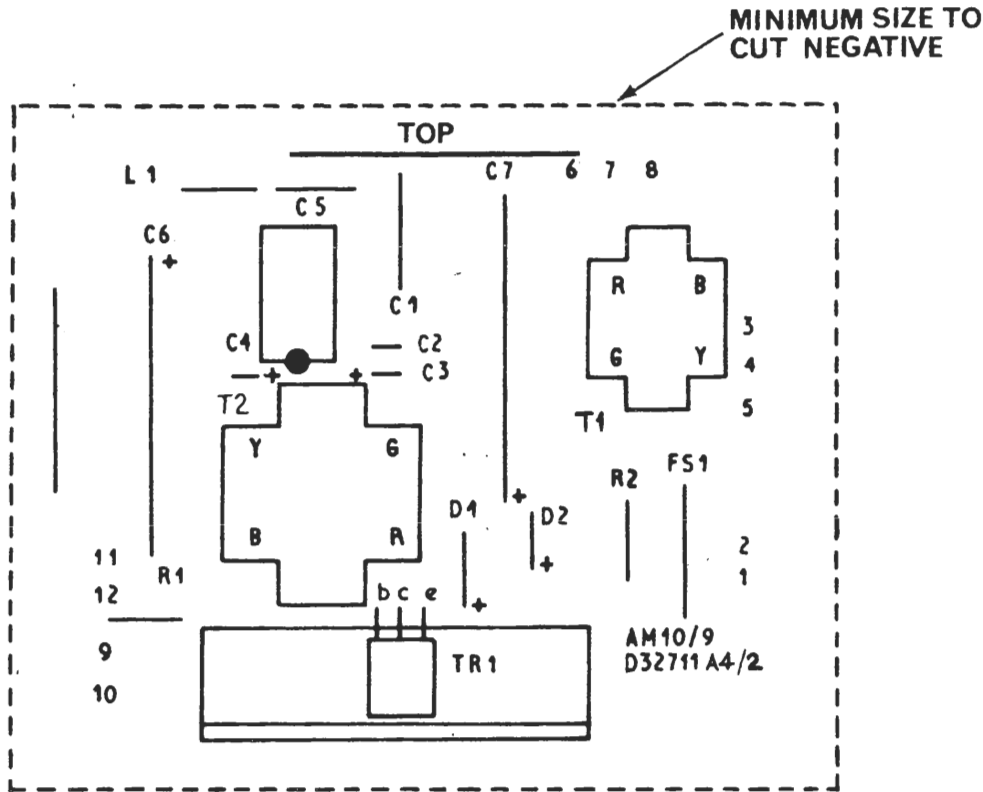
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3BC  
M161A4

CHANGE

4-12-72

AM10/9 PRINTED BOARD COMPONENT LOCATION



CHARACTERS AND LINES TO BE PRINTED IN WHITE  
PRINTED WIRING ON REVERSE SIDE OF BOARD IS D32710 A3

SCALE 1-1

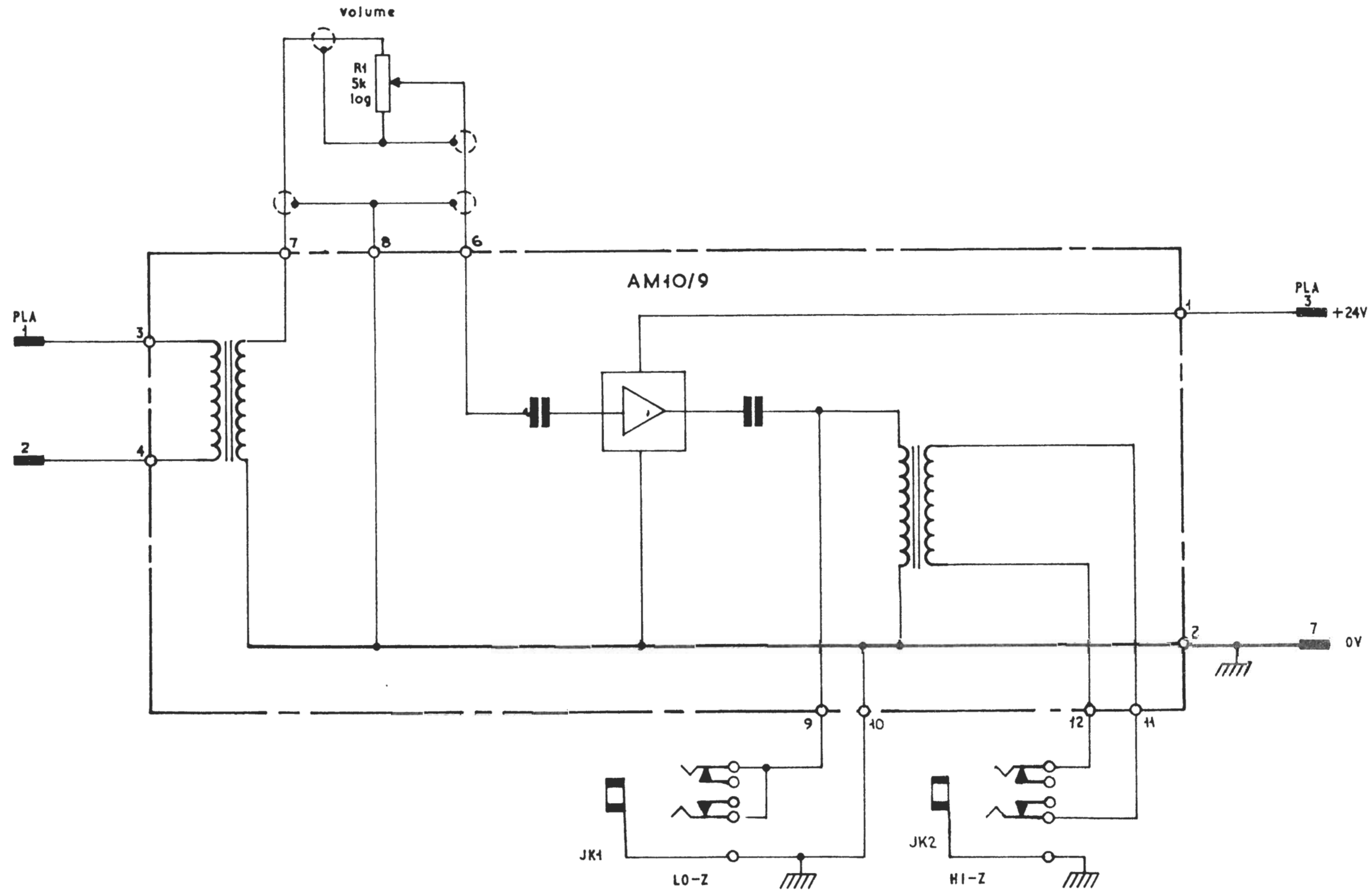
DRN	
TCD	PJ
CKD	R N A
APPD	

D32711 A4

DESIGNS DEPT

AM10/10 (AMPLIFIER MONITORING HEADPHONE) CIRCUIT.

CHANGE
4-12-72



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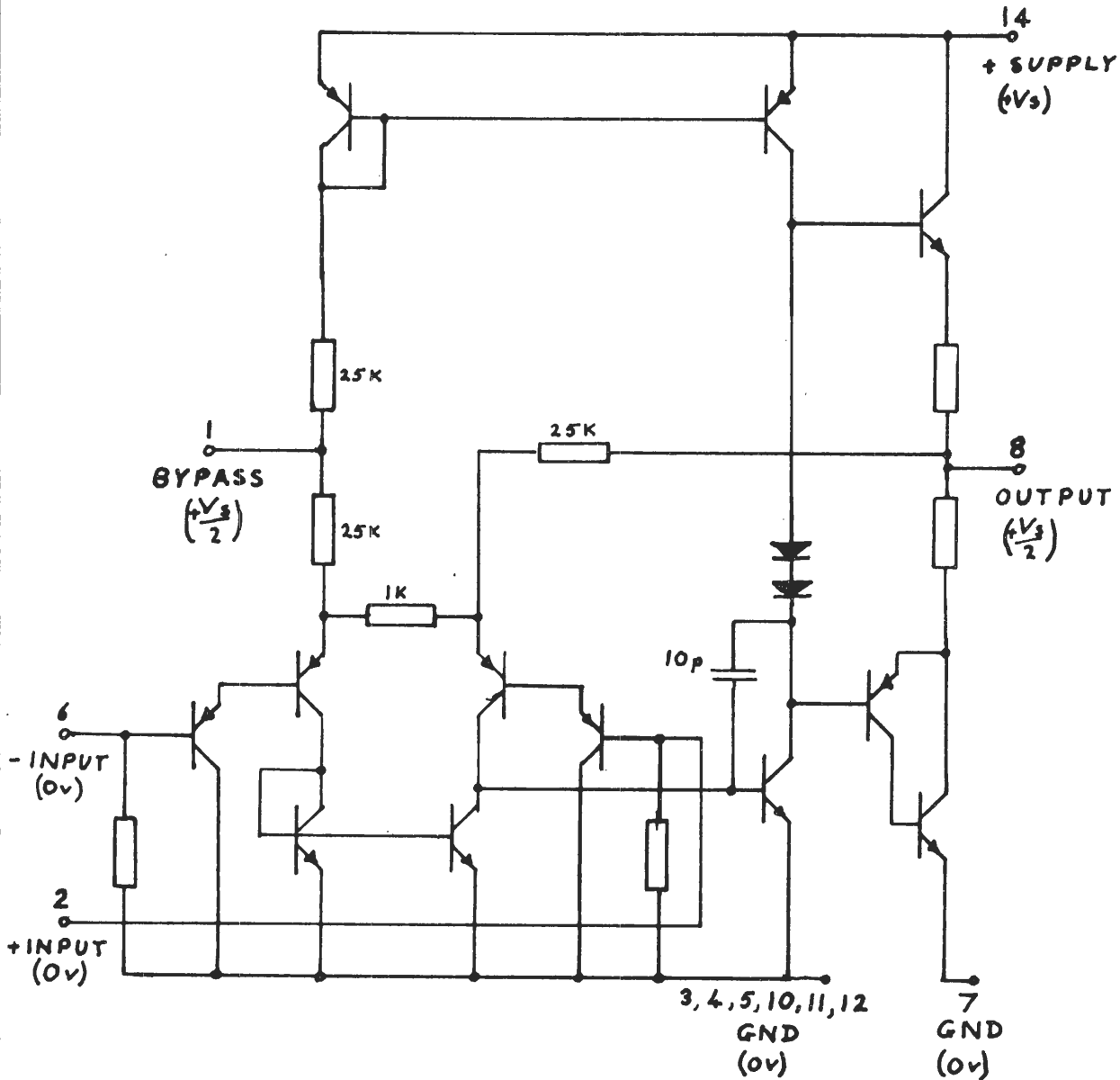
BBC  
DS/A3

AM10/10 (AMPLIFIER MONITORING HEADPHONE) CIRCUIT

DRN		DESIGNS DEPARTMENT
TCD.	D.C.	D33220 A3
CKD.	R.N.R.	
APPD.		

CHANGE

15-5-73



TYPICAL VOLTAGES SHOWN IN BRACKETS

LM380 CIRCUIT

DRN.  
TCD.  
CKD.  
APPD.

*RMP*

DSK15348 A4

