

# INSTRUCTION MANUAL

100 & 200 SERIES  
AUDIO CONSOLES

IM No. 597-1020

BROADCAST ELECTRONICS, INC.



# IMPORTANT INFORMATION

## EQUIPMENT LOST OR DAMAGED IN TRANSIT

When delivering the equipment to you, the truck driver or carrier's agent will present a receipt for your signature. Do not sign it until you have (a) inspected the containers for visible signs of damage and (b) counted the containers and compared with the amount shown on the shipping papers. If a shortage or evidence of damage is noted, insist that notation to that effect be made on the shipping papers before you sign them.

Further, after receiving the equipment, unpack it and inspect thoroughly for concealed damage. If concealed damage is discovered, immediately notify the carrier, confirming the notification in writing, and secure an inspection report. This item should be unpacked and inspected for damage WITHIN 15 DAYS after receipt. Claims for loss or damage will not be honored without proper notification of inspection by the carrier.

## TECHNICAL ASSISTANCE AND REPAIR SERVICE

Technical assistance is available from Broadcast Electronics by letter or prepaid telephone or telegram. Equipment requiring repair or overhaul should be sent by common carrier, prepaid, insured and well protected. Do not mail equipment. We can assume no liability for inbound damage, and necessary repairs become the obligation of the shipper. Prior arrangement is necessary. Contact Customer Service Department for a Return Authorization.

### FOR TECHNICAL ASSISTANCE

Phone (217) 224-9600 Customer Service

## WARRANTY ADJUSTMENT

Broadcast Electronics, Inc. warranty is included in the Terms and Conditions of Sale. In the event of a warranty claim, replacement or repair parts will be supplied F.O.B. factory. At the discretion of Broadcast Electronics, the customer may be required to return the defective part or equipment to Broadcast Electronics, Inc. F.O.B. Quincy, Illinois. Warranty replacements of defective merchandise will be billed to your account. This billing will be cleared by a credit issued upon return of the defective item.

## RETURN, REPAIR AND EXCHANGES

Do not return any merchandise without our written approval and Return Authorization. We will provide special shipping instructions and a code number that will assure proper handling and prompt issuance of credit. Please furnish complete details as to circumstances and reasons when requesting return of merchandise. All returned merchandise must be sent freight prepaid and properly insured by the customer.

## REPLACEMENT PARTS

Replacement and Warranty Parts may be ordered from the address below. Be sure to include equipment model and serial number and part description and part number.

Broadcast Electronics, Inc.  
4100 N. 24th St., P.O. Box 3606  
Quincy, Illinois 62305  
Tel: (217) 224-9600  
Telex: 25-0142  
Cable: BROADCAST

## PROPRIETARY NOTICE

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## MODIFICATIONS

Broadcast Electronics, Inc. reserves the right to modify the design and specifications of the equipment in this manual without notice. Any modifications shall not adversely affect performance of the equipment so modified.

## ADDENDUM

### 100, 200, 3000 SERIES CONSOLES

The 918-3500 (mono) and 918-3501 (stereo) preamp have been revised and updated to 918-3600 (mono) and 918-3601 (stereo). This new preamp offers superior noise, distortion and RF immunity over the 918-3500 (3501).

#### Input Level Selection

The 918-3600 (3601) can be preset via jumper selection to accept low level (mic) or high level (line) signals. See notes 3&4 on drawing number 906-7112. Jumper orientation can be found on drawing number 918-3600. Proper jumper selection must be made prior to operation.

In new consoles, the first two preamps (mixer 1 and 2) have been preset for low level (mic). The remainder are preset for high level (line). To change factory level preset selection, simply change jumpers as noted above.

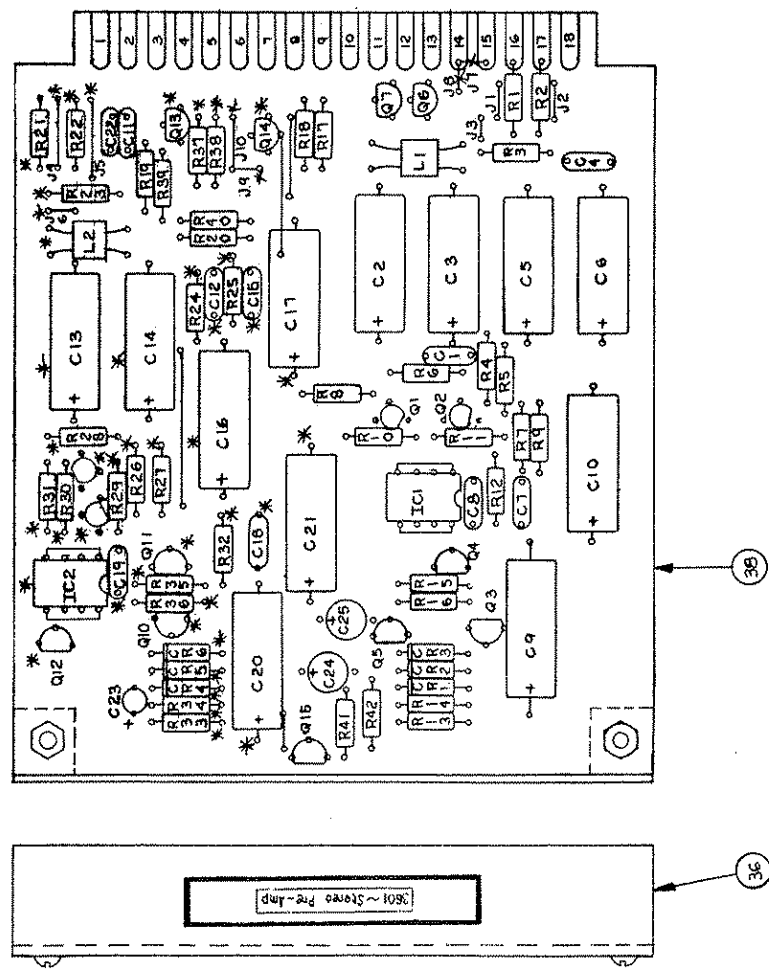
#### Stereo-Mono Selection

##### 918-3601 Stereo Preamps

The 918-3601 stereo preamp can be preset for mono or stereo operation via jumper selection. See notes 5,6 and 7 on drawing number 906-7112. Jumper orientation can be located on drawing number 918-3600.

All 918-3601 stereo preamps shipped from the factory, either in new consoles or for replacement, are preset for stereo operation.

REVISIONS		
REV	DESCRIPTION	DATE
A	ECN # 999	10-19-71



NOTES:  
 1. PART NUMBER 918-3600 - MONO PREAMP  
 918-3601 - STEREO PREAMP  
 2. \* ITEMS ONLY USED WITH 918-3601.  
 3. SEE SCHEMATIC FOR PROPER JUMPER SELECTION.

39	REF	D-906-7112	SCHEMATIC
36	1	518-3600	BLANK PCB 514-3600
37	1	594-3600	LABEL
38	1	486-3500	HANDLE
35	2	421-1100	RIVETS
34			# 32 SOLID ENAMELED WIRE
33			# 22 BUS WIRE
32	2	417-0800	IC SOCKET
31	2	360-0001	FAIR RITE BEAD (L1, L2)
30	2	221-7480	IC OP-AMP 748 (IC1, IC2)
29	4	212-5462	TRANSISTOR 2N5462 (Q6, Q7, Q13, Q14)
28	2	210-5817	TRANSISTOR 2N5817 (Q5, Q12)
27	2	211-5816	TRANSISTOR 2N5816 (Q3, Q10)
26	3	211-3804	TRANSISTOR 2N3804 (Q4, Q11, Q15)
25	4	210-4250	TRANSISTOR 2N4250 (Q1, Q2, Q8, Q9)
24	2	202-0098	DIODE 1N918 (CR3, CR8)
23	4	203-4148	DIODE 1N4148 (CR1, CR2, CR4, CR5)
22	1	063-1083	TANT. CAPACITOR 100mfd 20V (C24)
21	1	064-3373	TANT. CAPACITOR 33mfd 35V (C25)
20	1	064-4763	TANT. CAPACITOR 47mfd 35V (C23)
19	10	014-1084	ELECT. CAP 100mfd 40V (C2, C3, C4, C5, C6, C7, C8, C9, C10, C11, C12, C13, C14, C15, C16, C17)
18	2	014-3274	ELECTROLYTIC CAP. 33mfd 35V (C9, C20)
17	2	031-2243	CAPACITOR .022 mfd 100V (C11, C22)
16	4	001-1014	DISC CAPACITOR 10 pf 500V (C7, C8, C18, C19)
15	4	002-1034	DISC CAPACITOR .001mfd 1KV (C1, C4, C12, C15)
14	1	100-1053	RESISTOR 10K 1/4W (R42)
13	1	100-9143	9100 (R41)
12	4	100-2073	2M (R19, R20, R39, R40)
11			
10	4	100-1823	18K (R15, R16, R33, R36)
9	6	100-4743	4700 (R14, R17, R37, R38)
8	2	100-3943	3900 (R13, R33)
7	2	100-6253	62K (R9, R29)
6	4	100-8253	82K (R10, R11, R30, R31)
5	4	100-3853	39K (R8, R12, R28, R32)
4	4	100-1033	100K (R6, R7, R26, R27)
3	4	100-4733	470K (R4, R5, R24, R25)
2	2	100-1533	150K (R3, R23)
1	4	100-2753	RESISTOR, 27K 1/4W (R1, R2, R21, R22)

LIST OF MATERIAL		
ITEM	QTY	DESCRIPTION
1	4	100-2753
2	2	100-1533
3	4	100-4733
4	4	100-1033
5	4	100-3853
6	4	100-8253
7	2	100-6253
8	2	100-3943
9	6	100-4743
10	4	100-1823
11		
12	4	100-2073
13	1	100-9143
14	1	100-1053
15	4	002-1034
16	4	001-1014
17	2	031-2243
18	2	014-3274
19	10	014-1084
20	1	064-4763
21	1	064-3373
22	1	063-1083
23	4	203-4148
24	2	202-0098
25	4	210-4250
26	3	211-3804
27	2	211-5816
28	2	210-5817
29	4	212-5462
30	2	221-7480
31	2	360-0001
32	2	417-0800
33		
34		
35	2	421-1100
36	1	486-3500
37	1	594-3600
38	1	518-3600
39		

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DATE: 7-12-71

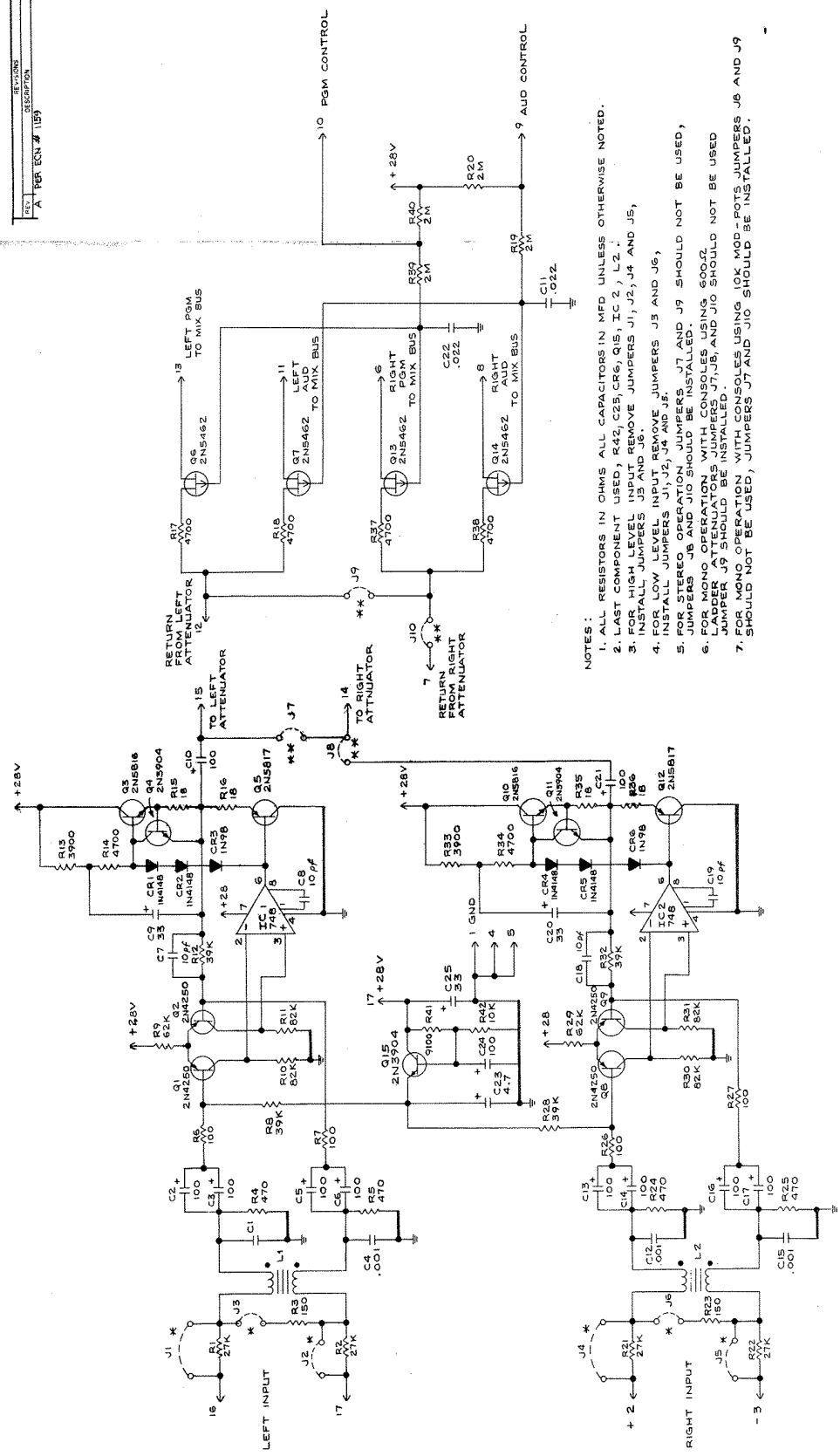
PROJECT: STEREO/MONO PREAMP

REVISION: A

SCALE: 2:1

SHEET 1 OF 1

REV	DESCRIPTION	DATE	APPROVED
A	PER ECU # 189	5-5-68	MM



- NOTES:
1. ALL RESISTORS IN OHMS ALL CAPACITORS IN MFD UNLESS OTHERWISE NOTED.
  2. LAST COMPONENT USED, R42, C25 CR6, Q15, IC 2, L2.
  3. FOR HIGH LEVEL INPUT REMOVE JUMPERS J1, J2, J4 AND J5.
  4. FOR LOW LEVEL INPUT REMOVE JUMPERS J3 AND J6.
  5. FOR STEREO OPERATION JUMPERS J7 AND J9 SHOULD NOT BE USED, JUMPERS J8 AND J10 SHOULD BE INSTALLED.
  6. FOR MONO OPERATION WITH CONSOLES USING 600Ω JUMPER J9 SHOULD BE INSTALLED.
  7. FOR MONO OPERATION WITH CONSOLES USING 10K MOD-POTS JUMPERS J8 AND J9 SHOULD NOT BE USED, JUMPERS J7 AND J10 SHOULD BE INSTALLED.

SEE ASSY. DWGS:  
918-3600 MONO PREAMP (RIGHT CHANNEL OMITTED)  
918-3601 STEREO PREAMP

ITEM	QTY	PART NUMBER	DESCRIPTION	NOTE
LIST OF MATERIAL				
BROADCAST ELECTRONICS INC				
—A FILMMAKERS COMPANY—				
7500 HOLLYWOOD BL				
LOS ANGELES, CALIF 90046				
DATE 1/16/77				
PROJECTED 1/14/77				
TITLE 5-11-11-11				
SUBJECT MONO-STEREO				
FROM 100% 71/2				
TO 100% 71/2				
FALST WIDE				
MATERIAL				
TREATMENT OR FINISH				
D				
SHEET 1 OF 1				

## ADDENDUM

### 100, 200, 3000, 4000 Series Consoles

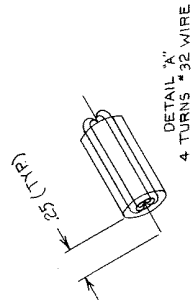
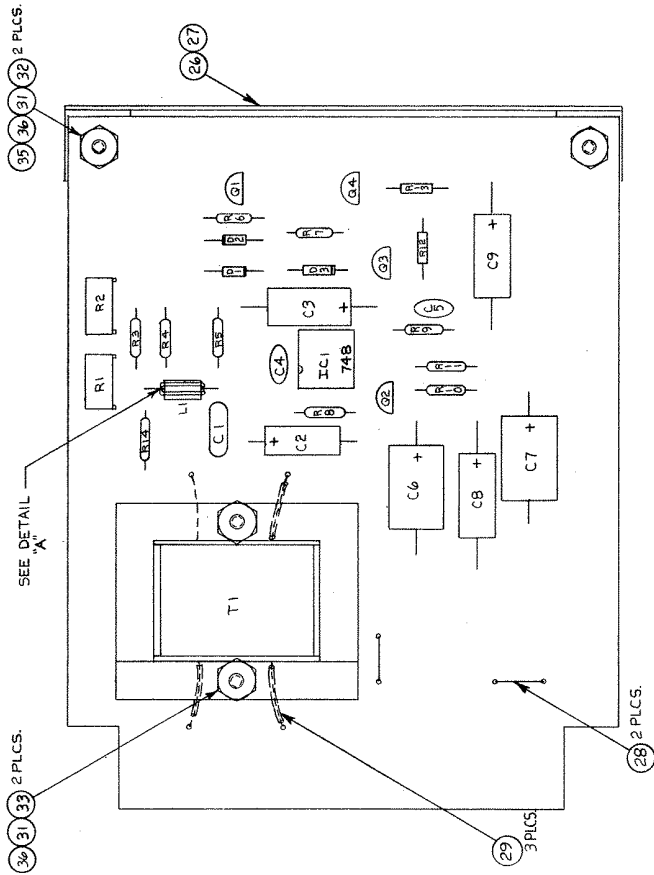
The 918-3502 mono matrix amplifier has been revised and updated to 918-3602.

Signal enters through R1 and R2 which are level balancing controls. L1 and C1 form an RF filter. IC-1 performs the active mixing function, while Q3, Q4 and their associated components provide a low impedance output. T1 provides a balanced output. Q2 supplies a decoupled bias source to IC-1.

Assembly No. 918-3602  
Schematic No. 906-3602



REVISIONS		
REV	DESCRIPTION	DATE
A	PER ECN # 1148	2-15-78
		APPROVED



SEE B/M NO. 918-3602  
LAST USED: C9, R14, D3, Q4, L1, T1, IC1

ITEM	QTY	QTD	PART NUMBER	DESCRIPTION	NOTE
LIST OF MATERIAL					
DRAWN BY: J. HAYDEN					
CHECKED BY: J. HAYDEN					
DATE: 1-12-78					
DECIMAL 2 PL./01 3 PL./005					
FRACTIONAL 1/164					
SHARP EDGES					
FILLET RADIUS					
MATERIAL					
TREATMENT OR FINISH					
BROADCAST ELECTRONICS INC.					
-A FILMWAYS COMPANY-					
TITLE ASS'Y, MONO MATRIX CARD					
C DWS NO. 918-3602					
REV A					
CONSOLES 2/1					
SHEET 1 OF 1					

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## ADDENDUM

### 100, 200, 3000, 4000 SERIES CONSOLES

The 918-3504 Mixer-Line Drive has been updated to 918-3604.

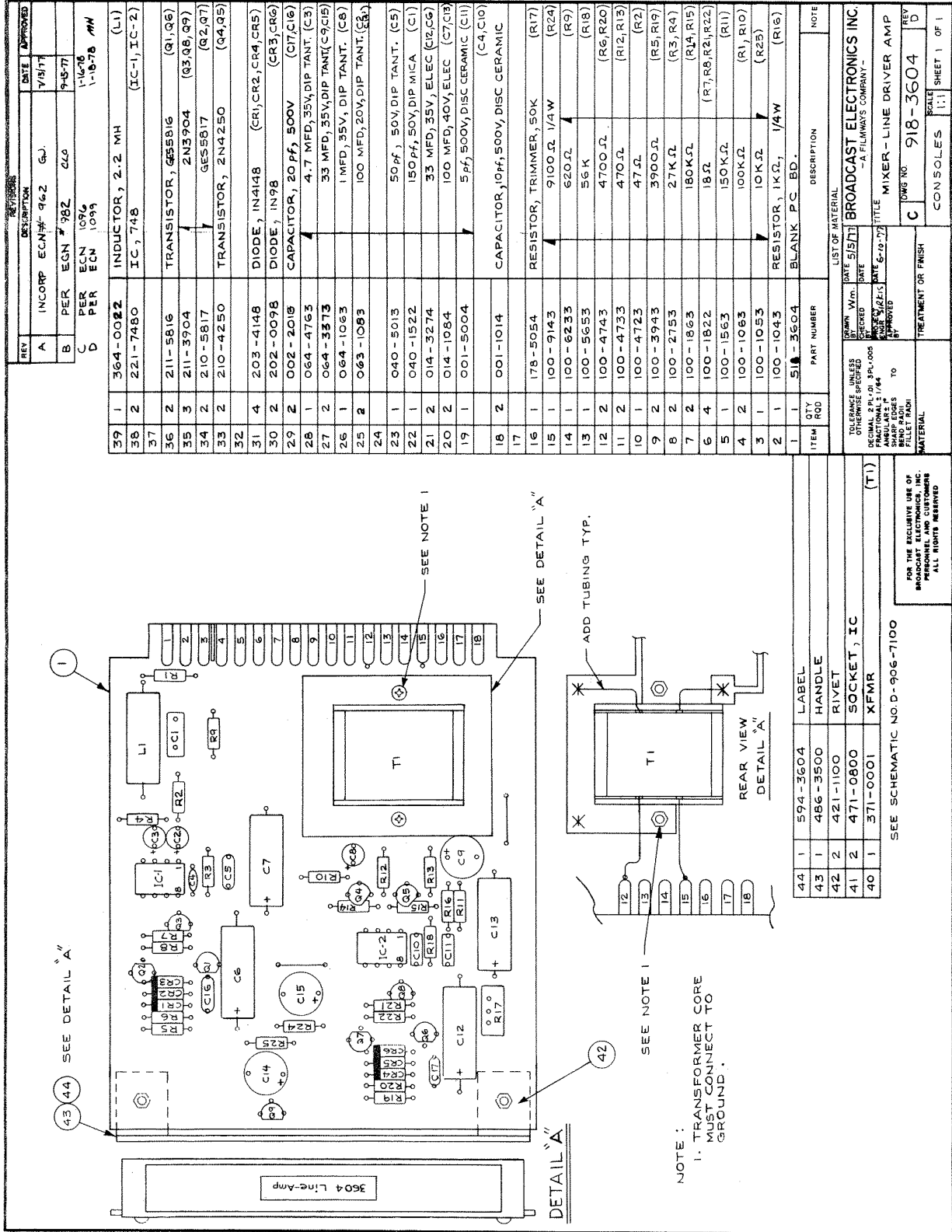
The 918-3604 contains two multiple stage amplifiers and the isolation transformer to supply the console output. In monophonic consoles, two 918-3604's are used to provide the MIX 1 and MIX 2 (Program and Audition) outputs. In stereophonic consoles, four are required to provide the MIX 1 and MIX 2 (Program and Audition) outputs.

Signal from the MIX 1 or MIX 2 (Program and Audition) bus enters on pin 1 and is coupled through C2 to the input of the mixer amplifier composed of IC-1 and Q1-Q2. Choke L1 and capacitor C1 act as a low-pass filter to prevent the appearance of rf in the amplifier's input. Operational amplifier IC-1 supplies 12 dB of gain as determined by R3 and the mix sum resistors in the mixing modules. Output drive is supplied by the complementary pair of Q1 and Q2 which is driven directly by IC-1. Capacitor C6 provides bootstrapping for the output stage. Transistor Q3 provides protection in case of a short circuit on the output.

The output of the mixer amplifier is coupled through C7 to pin 3. Following the master level control the signal is returned to pin 5 for final amplification in the line driver. This three-stage amplifier consists of a differential input stage (Q4-Q5), an operational amplifier (IC-2), and a complementary-symmetry output pair (Q6-Q7). Transistor Q8 provides short circuit protection. This stage can provide up to 40 dB of gain as determined by R16, R18, and variable resistor R17. In conjunction with the master level control, R17 permits matching the gain of two 918-3604's. A signal for use in the monitor circuit is bridged from the primary of T1.

Assembly No. 918-3604  
Schematic No. 906-7100





REV	DESCRIPTION	DATE	APPROVED
A	INCORP ECN # 962 G.L.	7/9/77	
B	PER ECN # 982 C.L.G.	9-5-77	
C	PER ECN 1096	1-16-78	M.H.
D	PER ECN 1099		

39	1	364-0022	INDUCTOR, 2.2 MH	(L1)
38	2	221-7480	IC-1, IC-2	(IC-1, IC-2)
37				
36	2	211-5816	TRANSISTOR, 655816	(Q1, Q6)
35	3	211-3904	2N3904	(Q3, Q8, Q9)
34	2	210-5817	655817	(Q2, Q7)
33	2	210-4250	TRANSISTOR, 2N4250	(Q4, Q5)
32				
31	4	203-4148	DIODE, IN4148	(CR1, CR2, CR4, CR5)
30	2	202-0098	DIODE, IN98	(CR3, CR6)
29	2	002-2018	CAPACITOR, 20 PF, 500V	(C17, C16)
28	1	064-4763	4.7 MFD, 35V, DIP TANT. (C3)	
27	2	064-3373	33 MFD, 35V, DIP TANT. (C9, C15)	
26	1	064-1063	1 MFD, 35V, DIP TANT. (C8)	
25	2	063-1083	100 MFD, 20V, DIP TANT. (C2)	
24				
23	1	040-5013	50 PF, 50V, DIP TANT. (C5)	
22	1	040-1522	150 PF, 50V, DIP MICA (C1)	
21	2	014-3274	33 MFD, 35V, ELEC (C2, C6)	
20	2	014-1084	100 MFD, 40V, ELEC (C7, C13)	
19	1	001-5004	5 PF, 500V, DISC CERAMIC (C11)	(C4, C10)
18	2	001-1014	CAPACITOR, 10 PF, 500V, DISC CERAMIC	
17				
16	1	178-5054	RESISTOR, TRIMMER, 50K	(R17)
15	1	100-9143	9100 OHM 1/4W	(R24)
14	1	100-6233	620 OHM	(R9)
13	1	100-5653	56 K	(R18)
12	2	100-4743	4700 OHM	(R6, R20)
11	2	100-4733	470 OHM	(R12, R13)
10	1	100-4723	47 OHM	(R2)
9	2	100-3943	3900 OHM	(R5, R19)
8	2	100-2753	27 K OHM	(R3, R4)
7	2	100-1863	180 K OHM	(R14, R15)
6	4	100-1822	18 OHM	(R7, R8, R21, R22)
5	1	100-1563	150 K OHM	(R11)
4	2	100-1063	100 K OHM	(R1, R10)
3	1	100-1053	10 K OHM	(R25)
2	1	100-1043	RESISTOR, 1 K OHM, 1/4W	(R16)
1	1	518-3604	BLANK PC BD.	

ITEM	QTY	PART NUMBER	DESCRIPTION	NOTE
1	1	518-3604	BLANK PC BD.	

DATE	BY	DATE	DATE
5/9/77	W.M.	5/9/77	5/9/77
	DESIGNED		DESIGNED
	CHECKED		CHECKED
	APPROVED		APPROVED

BROADCAST ELECTRONICS INC.	
- A FILMWAYS COMPANY -	
TITLE	MIXER - LINE DRIVER AMP
LOW NO	918-3604
REV	D
CONSULES	
SCALE	1:1
SHEET 1 OF 1	

# ADDENDUM

## 100, 200, 3000 SERIES CONSOLES

The 918-3503 Stereo Monitor Amplifier and the 918-~~3603~~<sup>3605</sup> Mono Cue Headphone Amplifier have been revised and updated to 918-3603 and 918-3605 respectively.

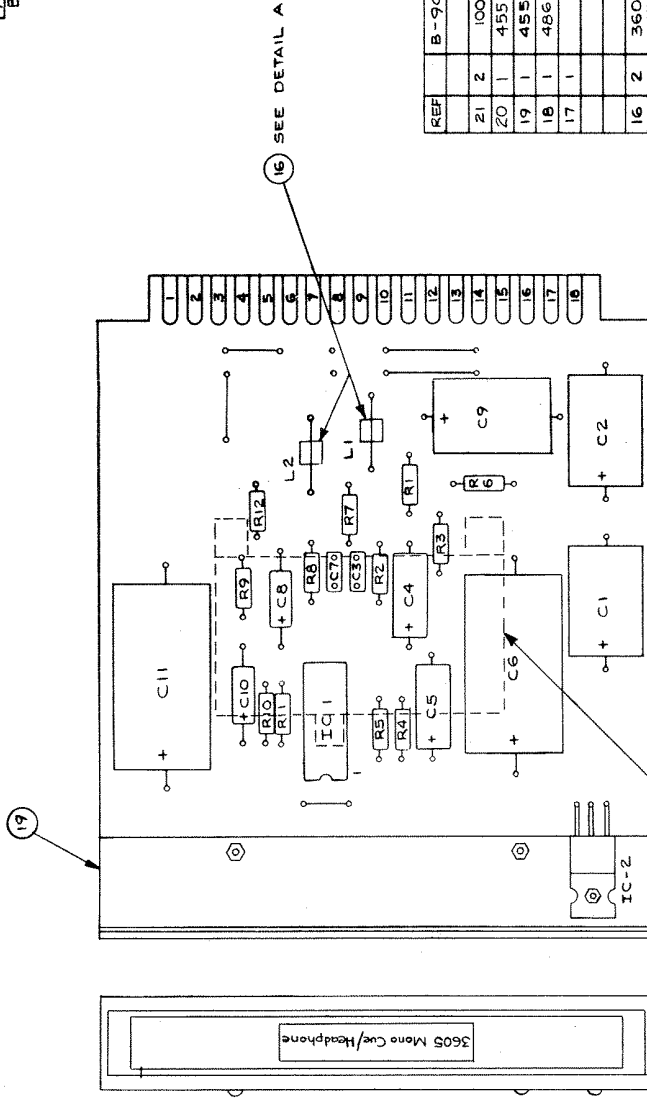
Due to the similarity, they are built on the same blank printed circuit board. Jumper location for input/output terminals is the only difference.

This card contains two identical amplifiers of which one will be explained.

IC-2 is a self-contained 18V regulator providing power to IC-1, a dual power amplifier. Signal is coupled through L1, R1 and C4 to Pin 6 (input) of IC-1. L1, R1 and C3 form a low pass filter to keep rf from the amplifiers input. Pin 1 of IC-1 provides bias current through R3 to Pin 6. Negative feedback components R4, R5 and C5 determine amplifier gain. The output signal is coupled through D.C. blocking capacitor C6.

Assembly No. 918-3603 Stereo Monitor Amp  
Assembly No. 918-3605 Mono Cue Headphone  
Schematic No. 906-7111

REV	DESCRIPTION	DATE	APPROVED
A	PER ECN # 1053	11-30-77	MH
B	PER ECN # 1063	12-6-77	CLG



REF	B-906-7111	SCHEMATIC		
21	2	100-4743 RESISTOR, 4700 1/4 W (R6, R12)		
20	1	455-3603 HEAT SINK		
19	1	455-3509 HEAT SINK		
18	1	486-3509 HANDLE		
17	1	LABEL		
		# 22 BUS WIRE		
		# 32 SOLID ENAMELED WIRE		
16	2	360-0001 FAIR RITE BEAD (L1, L2)		
15	1	227-7818 REGULATOR, 7818 18V (IC-2)		
14	1	222-3780 IC, OP-AMP LM378 DUAL PWR (IC-1)		
13	2	015-1064A CAPACITOR, 1MFD 35V ELEC (C4, C8)		
11	2	040-1022 100 50V DIP MICA (C3, C7)		
10	2	013-1095 1000 MFD 25V ELEC (C6, C11)		
9	2	013-1074 10 MFD 16V ELEC (C5, C10)		
8	3	014-1084 CAPACITOR, 100 MFD 40V ELEC (C1, C2, C9)		
7				
6	2	100-4743 RESISTOR, 4700 1/4W (R6, R12)		
5	2	100-2243 2200 (R4, R10)		
4	4	100-1063 100 K (R3, R9, R5, R11)		
3	2	100-1543 1500 (R2, R8)		
2	2	100-1053 RESISTOR, 10K 1/4W (R1, R7)		
1	1	C-518-3605 BLANK P.C. BOARD		
ITEM	QTY	PART NUMBER	DESCRIPTION	NOTE

LIST OF MATERIAL			
TOLERANCE UNLESS OTHERWISE SPECIFIED FRACTIONAL 1/100 ANGULAR ± P HOLE ± .005 BEND RADII TO PILLET RADII	DOWN	DATE	BY
	CHECKED	DATE	
	APPROVED	DATE	
	BY		
BROADCAST ELECTRONICS INC. - A FILMWAYS COMPANY - MONO CUE/HEADPHONE C DWG NO 918-3605 B C			
TREATMENT OR FINISH		SCALE	
MATERIAL		SHEET 1 OF 1	

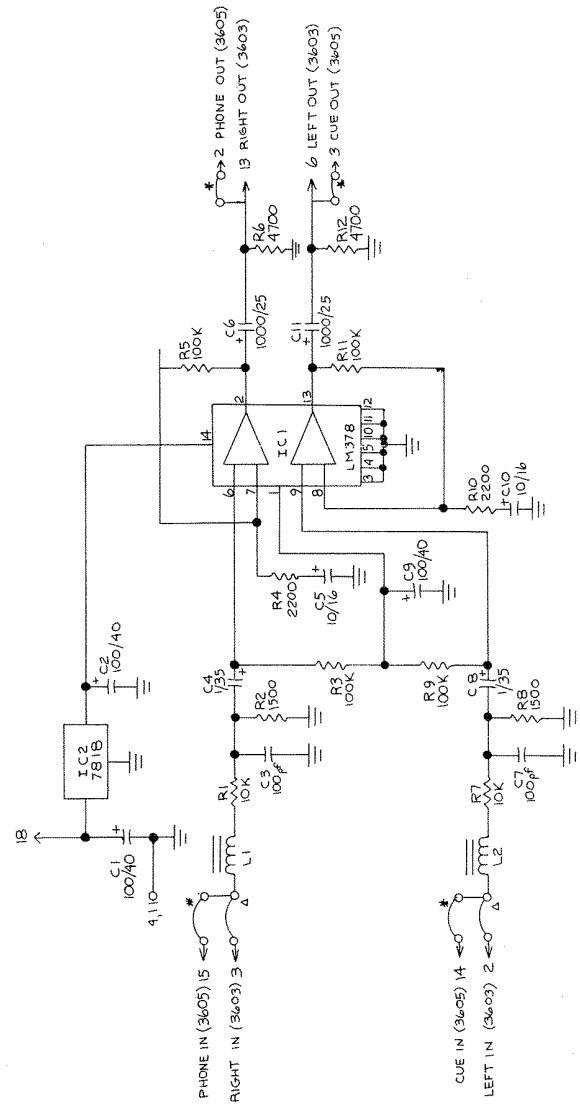
LIST OF MATERIAL			
ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	C-518-3605	BLANK P.C. BOARD
2	2	100-1053	RESISTOR, 10 K 1/4W (R1, R7)
3	2	100-1543	1500 (R2, R8)
4	4	100-1063	100 K (R3, R9, R5, R11)
5	2	100-2243	2200 (R4, R10)
6	2	100-4743	RESISTOR, 4700 1/4W (R6, R12)
7			
8	3	014-1084	CAPACITOR, 100 MFD 40V ELEC (C1, C2, C9)
9	2	013-1074	10 MFD 16V ELEC (C5, C10)
10	2	013-1095	1000 MFD 25V ELEC (C6, C11)
11	2	040-1022	100 50V DIP MICA (C3, C7)
12	2	015-1064A	CAPACITOR, 1MFD 35V ELEC (C4, C8)
13			
14	1	222-3780	IC, OP-AMP LM378 DUAL PWR (IC-1)
15	1	227-7818	REGULATOR, 7818 18V (IC-2)
16	2	360-0001	FAIR RITE BEAD (L1, L2)
			# 32 SOLID ENAMELED WIRE
			# 22 BUS WIRE
17	1		LABEL
18	1		486-3509 HANDLE
19	1		455-3509 HEAT SINK
20	1		455-3603 HEAT SINK
21	2		100-4743 RESISTOR, 4700 1/4 W (R6, R12)

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BROADCAST ELECTRONICS INC.			
- A FILMWAYS COMPANY -			
DATE	DATE	DATE	DATE
11/30/77	11/30/77	11/30/77	11/30/77
PER ECN # 1053	PER ECN # 1053	PER ECN # 1053	PER ECN # 1053
PER ECN # 1063	PER ECN # 1063	PER ECN # 1063	PER ECN # 1063
TITLE			
MONO CUE/HEADPHONE			
CONSOLE NO.	918-3605	REV	3
CONSOLES	211	SHEET	1 OF 1



REV	DESCRIPTION	DATE	APPROVED



NOTES:  
 1. RESISTORS IN OHMS, 1/4W; CAPACITORS IN MICROFARADS UNLESS OTHERWISE NOTED.  
 2. LAST COMPONENTS USED: C11, IC2, L2, R12.  
 3. SEE P.C. BOARD ASSEMBLY NO. 918-3403 AND 918-3405.  
 \* JUMPER FOR 918-3405.  
 Δ JUMPER FOR 918-3403.

ITEM	QTY	ROD	PART NUMBER	DESCRIPTION	NOTE
LIST OF MATERIAL					
BROADCAST ELECTRONICS INC.					
- A FILMWAYS COMPANY -					
TITLE SCHEMATIC - STEREO MONITOR					
8 MONITOR CUE HEADPHONE					
C DWS NO 906-711					
CONSOLE					
SHEET 1 OF 1					

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## ADDENDUM

### 100, 200, 3000 Series Consoles

The 918-3506 stereo cue headphone amplifier has been updated to 918-3606.

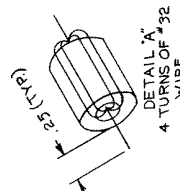
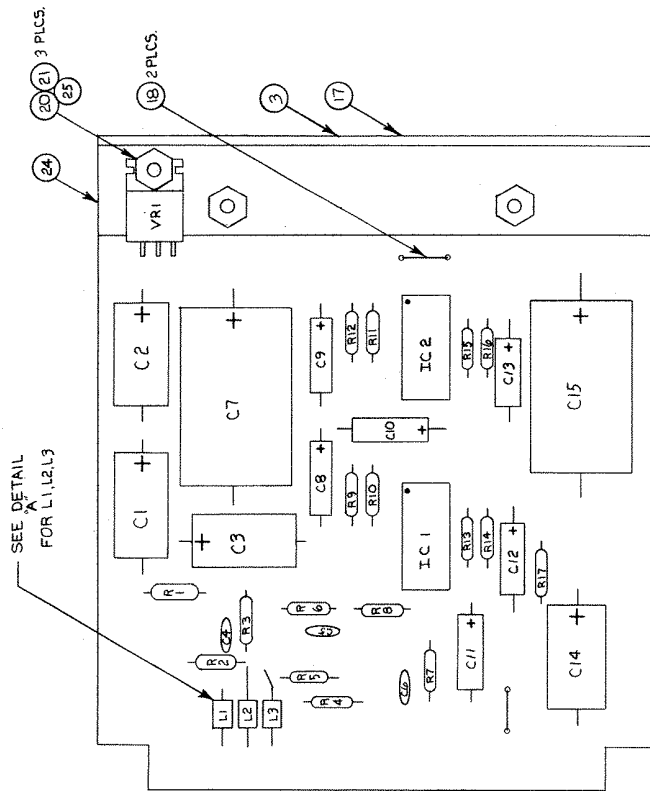
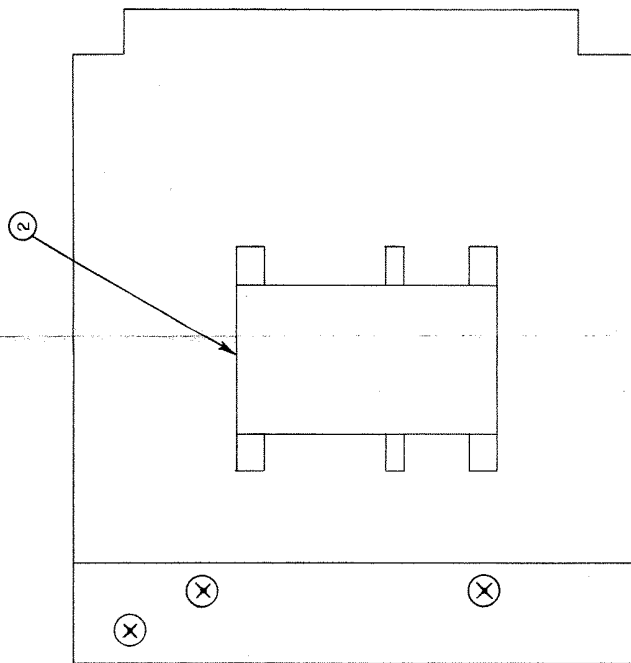
There are three identical sections to this amplifier, therefore, only one will be explained.

Input signal is coupled through L2, R2, C4 and R3, an attenuator and RF filter to the input of IC-2. Gain is set by R11, R12 and C9. Output signal is coupled through C7. Pin 1 of IC-2 provides bias for all amplifiers via R8, R9, and R10. VR-1 supplies 18VDC to IC-1 and IC-2. One-half of IC-1 is not used.

Assembly No. 918-3606  
Schematic No. 906-3606



REVISIONS		
REV	DESCRIPTION	DATE
A	PER ECN #1143	2-25-76
		79H

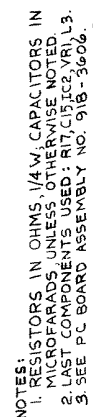


SEE B/M NO. 918-3606  
LAST USED: C15, R17, IC2, VR1, L3.

ITEM	QTY	QDD	PART NUMBER	DESCRIPTION	NOTE
LIST OF MATERIAL					
TOLERANCE UNLESS OTHERWISE SPECIFIED		DATE		DATE	
DECIMAL 2 P.L./D1, 3 P.L./D2		BY: K. ANDERSON		1-12-78	
FRACTIONAL 2 P.L./D1, 3 P.L./D2		CHECKED		DATE	
SHARP EDGES TO		APPROVED		DATE	
BEND RADIUS		BY: K. ANDERSON		DATE	
MATERIAL		TREATMENT OR FINISH		DATE	
				SCALE	
				2/1	
				SHEET 1 OF 1	

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BROADCAST ELECTRONICS INC.	
-A FILMWAYS COMPANY-	
TITLE	
ASSY. STEREOGRAPHIC	
CUE/HEADPHONE AMPLIFIER	
DWG NO. 918-3606	
REV	
C	
CONSOLES	

[illegible]

ITEM	QTY REQD	PART NUMBER	DESCRIPTION	NOTE
LIST OF MATERIAL				
TOLERANCE UNLESS OTHERWISE SPECIFIED		BROADCAST ELECTRONICS INC. - A FILMWAYS COMPANY -		
FRACTIONAL 1/64		TITLE SCHEMATIC STEREOHONIC		
ANGULAR 2 P		C HEADPHONE AMPLIFIER		
HOLE DIA		DWS NO 906-3606		
PILLET RADII		REV		
MATERIAL		C		
TREATMENT OR FINISH		CONSOLES		
		SCALE		
		SHEET 1 OF 1		

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## ADDENDUM

### 100, 200, 3000, 4000 Series Consoles

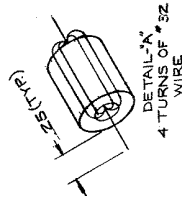
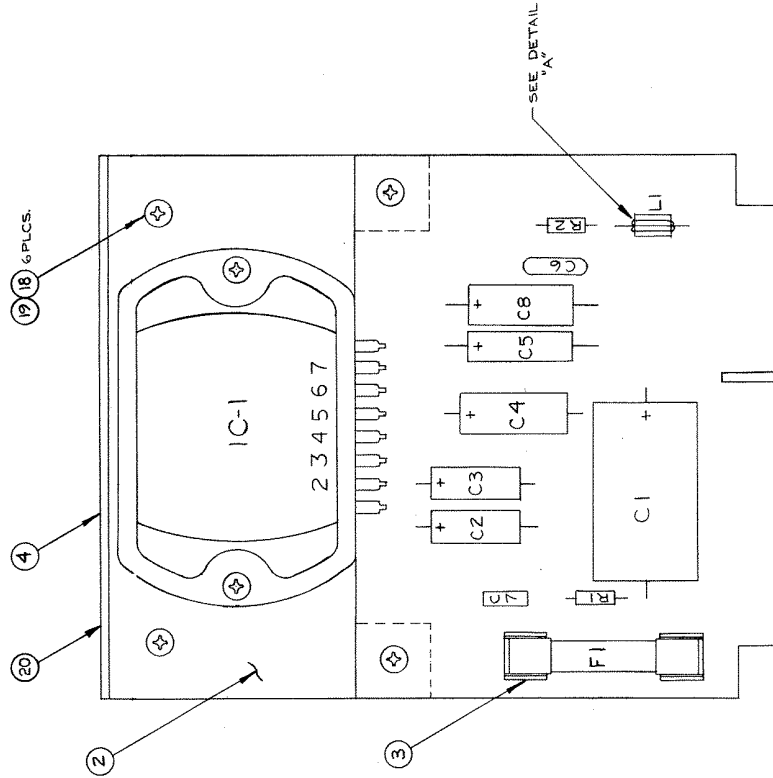
The 918-3509 monitor amplifier has been revised and updated to 918-3609.

This amplifier uses a hybrid audio power amplifier module whose gain is fixed at 30dB. Input signal is coupled to the module via L1, R2 and C6, which form an RF filter. The output is coupled through C1 whose purpose is DC blocking. Capacitor C5 performs bootstrapping for the output stage.

Fuse F1 prevents IC-1 destruction if the amplifier should see a shorted load.

Assembly No. 918-3609  
Schematic No. 906-3609

REV		REVISIONS		DATE		APPROVED	
A		ECN 1196		3/31/78		CLO	



SEE B/M NO. 918-3609

ITEM	QTY	QTY REQ	PART NUMBER	DESCRIPTION	NOTE
LIST OF MATERIAL					
TOLERANCE UNLESS OTHERWISE SPECIFIED					
DECIMAL 2 PLACES 3 PLACES					
FRACTIONAL 1/64 1/32 1/16					
SHARP EDGES TO					
FILLET RADIUS					
MATERIAL					
TREATMENT OR FINISH					
CONSOLES					
SCALE 2/1					
SHEET 1 OF 1					

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# INSTRUCTION MANUAL

## 100 AND 200 SERIES

### MONOPHONIC AND STEREOGRAPHIC

### AUDIO CONSOLES

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# **SECTION 1**

## **INTRODUCTION**

### **1.1      MANUALS**

This manual provides operation, installation, and maintenance information for the SPOTMASTER® 100 and 200 Series audio consoles. There are eight models:

5BEM100	5 mixer dual monophonic
5BES100	5 mixer dual stereophonic
5BEM200	5 mixer dual monophonic
5BES200	5 mixer dual stereophonic
8BEM100	8 mixer dual monophonic
8BES100	8 mixer dual stereophonic
8BEM200	8 mixer dual monophonic
8BES200	8 mixer dual stereophonic

Specifications and comparative information on these models are in Table 1.

### **1.2      FEATURES AND DESCRIPTION**

The SPOTMASTER audio console line provides a complete range of 5 and 8 mixer devices in monophonic and stereophonic configurations. Each console represents an economical yet superior performing console designed to switch and mix multiple audio sources in AM, FM, and TV broadcast installations, CATV systems, recording studios, and other facilities. All of the consoles are designed with features that are most needed to provide operating flexibility, installation simplicity, and service convenience. Components and circuit designs were chosen for performance and reliability.

All amplifiers are mounted on plug-in printed circuit board modules. Integrated circuits are used extensively. The power supply is mounted in the console cabinet.

All preamplifiers are equipped for operation with microphone or line level input signals as selected by slide switches mounted on the preamplifier card. A cue detent position is installed on all mixers, so that input assignments can be made as desired. In stereophonic consoles both the left and right channels are fed to the cue system. The stereophonic consoles are also equipped to accept monophonic or stereophonic inputs to all preamplifiers. This switch selectable capability can be used to feed a mono signal to both the left and right channels.

All consoles are designed for dual channel operation with the audition and program channels identical in operating specifications. (In certain models the audition output amplifier is optional. All wiring is in place, so this capability may be added at a later date.) A third output is available as an option in the stereo models: a monophonic signal derived from the stereophonic program channel.

The switching of signals to the audition or program channel is accomplished electronically with Field Effect Transistors. The FET's provide excellent isolation when off and are protected from RF pick-up.

Built-in amplifier(s) are provided for monitor speakers. Separate outputs are provided for several studios. These outputs are connected through relays which can be activated to mute the speaker when used next to a live microphone. Separate contacts are provided on the relay for controlling a studio "on-the-air" light.

Separate amplifiers are provided to drive a cue speaker and headphones. An internal cue speaker and connections for an external speaker are provided. Both a front panel headphone jack and parallel external connections are incorporated.

For ease in installation and interconnection, most connections are made to screw terminals. All terminals are labeled for quick identification. Since all connections are made inside the cabinet, wiring is protected from dirt, tampering, or accidental damage.

There are eight models of audio consoles in the SPOTMASTER® 100 and 200 Series. Their specifications and comparative features are shown in Table 1.

**TABLE 1. SPECIFICATIONS AND COMPARATIVE FEATURES**

MODEL	5BEM-100	5BES-100	5BEM-200	5BES-200	8BEM-100	8BES-100	8BEM-200	8BES-200
MONO/STEREO	MONO	STEREO	MONO	STEREO	MONO	STEREO	MONO	STEREO
NUMBER MIXERS	5 MIXERS				8 MIXERS			
MIXER TYPE	SEALED (STEP**)	STEREO SEALED (STEP**)	STEP LADDER	STEREO STEP LADDER	SEALED (STEP**)	STEREO SEALED (STEP**)	STEP LADDER	STEREO STEP LADDER
NUMBER INPUTS	10 INPUTS				16 INPUTS			
TYPE INPUTS	MICROPHONE OR LINE; SWITCH SELECTABLE							
	MONO	MONO OR STEREO	MONO	MONO OR STEREO	MONO	MONO OR STEREO	MONO	MONO OR STEREO
LINE INPUTS	BALANCED BRIDGING (36K), -20 dBm NOMINAL, +10 dBm MAXIMUM							
MIC INPUT	150 OHMS, BALANCED, -65 dBm NOMINAL, -38 dBm MAXIMUM; 92 dB MAXIMUM GAIN							
OUTPUTS	PGM-AUD	PGM (AUD,* MONO)*	PGM-AUD	PGM AUD, MONO	PGM-AUD	PGM (AUD,* MONO)*	PGM-AUD	PGM (AUD, MONO)*
	600 OHM XFMR +8 dBm, +18 dBm MAX							
FREQUENCY RESPONSE	±0.50 dBm 20 Hz TO 20 kHz @ +8 dBm OUTPUT							
DISTORTION	0.5% @ +18 dBm							
NOISE	65 dB (UNWEIGHTED) BELOW +8 dBm OUTPUT WITH -50 dBm INPUT							
MONITOR (SPEAKER)	8W	4W (2W/CHAN)	8W	16W (8W/CHAIN)	8W	4W (2W/CHAN)	8W	16W (8W/CHAIN)
CUE	.5W INTERNAL SPEAKER PROVIDED, TERMINALS FOR EXTERNAL SPEAKER							
HEADPHONES	.5W FRONT PANEL JACK FOR LOW OR HIGH IMPEDANCE HEADPHONES							
MUTING RELAY W/CONTACTS FOR ON AIR LIGHTS	1 (2ND OPT)*	1 (2ND OPT)*	3		1 (2ND OPT)*	1 (2ND OPT)*	3	
VU METERS	1 PGM 1 AUD	2 PGM	1 PGM 1 AUD	2 PGM OR AUD	1 PGM 1 AUD	2 PGM	1 PGM 1 AUD	2 PGM OR AUD

\*PLUG-IN OPTIONS  
\*\*OPTION

### **1.3      WARRANTY**

Broadcast Electronics products are guaranteed to be free from defects in workmanship and material for a period of one year after shipping date when subjected to normal usage or service. All warranties are void, (a) If equipment has been altered or repaired by others without Broadcast Electronics' specific prior authorization, or (b) If equipment is operated under environmental conditions or circumstances other than those specifically described in Broadcast Electronics literature or instruction manuals.





## **SECTION 2**

### **INSTALLATION**

#### **2.1 INSTALLATION PROCEDURES**

The installation of a SPOTMASTER® audio console requires four steps:

1. Determine the physical location of the console in relation to other associated equipment. Specifically, requirements for operator convenience, cable access and proper electrical interconnection must be considered. General information on planning the console installation is contained in paragraph 2.2 below. Representative studios are shown in the block diagrams in Figures 1A and 1B.
2. Mount the console. All SPOTMASTER audio consoles are intended for desk top mounting. All connections are made inside the cabinet. Cable access is provided through cut-outs located in the bottom of the cabinet. If mounted flush on a table top, matching openings are required in the table top beneath the console.
3. Make the electrical interconnections as described individually for the different types of connections in paragraphs 2.3 through 2.7. The internal arrangements of the consoles are shown in Figures 4 through 11.
4. Finally perform these adjustments and checks: check the input level switches on each mixer preamplifier for proper sensitivity as explained in 2.3.1. In stereo consoles, check the mono/stereo switch on each preamplifier for proper setting as explained in 2.3.2. Check all input wiring for proper connection of balanced or unbalanced inputs as explained in 2.3.3. Check the muting relays for proper operation as required in 2.6.5. In 200 series consoles, be sure that jumpers required for other than standard muting relay control are installed if desired. If an external cue speaker is installed, be certain the internal speaker is disconnected as required in 2.6.2. If an external headphone jack or low impedance headphones (mono consoles only) are used, be certain the precautions described in 3.7 are observed. Perform the level setting procedure outlined in 2.8.1. If required in stereo consoles, perform the monophonic balance adjustment and level balances procedures set forth in 2.8.2 and 2.8.3. If the console is NOT operated at a +8 dBm output level, calibrate the VU meter(s) as explained in 2.8.4. If desired a specifications test may be performed as confirmation of proper console installation and operation. The results can be compared to the original factory results shown on the test sheet supplied with each unit. Proper conditions for these tests are indicated in 5.2.

## **2.2 INSTALLATION, PLANNING AND TECHNIQUES**

### **2.2.1 Assignment of Inputs and Outputs**

Refer to the representative studio installations shown in block diagram form in Figures 1A and 1B.

Electrically, the most important consideration in assigning the mixer inputs is the level of the source signal. Both inputs to a mixer must be the same level class (microphone or line level). Since the two muting relays in 100 series consoles are activated by mixers 1 and 2, microphones operated in a studio with a monitor speaker must be connected to these mixers. In 200 series consoles the three muting relays may be controlled by any mixer. (See paragraph 2.6.5.)

Additionally, in stereo consoles, the inputs may be monophonic or stereophonic. But both inputs to a mixer must be either mono or stereo; one cannot be mono with the other stereo. Notice mixer 7 in Figure 1B.

Operationally input sources used simultaneously (mixed), cross faded, or used in a rapid sequence should all be on separate mixers. Conversely, two inputs rarely used in conjunction with each other may be assigned to the same mixer.

The output lines are identical in performance so that these may be used as required. However, in the 5BES100 and 8BES100 models, the optional audition channel is not provided with a VU meter. It is best used as a recording output or with external metering provided.

### **2.2.2 Wiring**

Audio connections to the console should be made with shielded cable such as Belden 8441, Belden 8451, Alpha 2400, etc. Separate as much as possible cables carrying different signal levels. Separate microphone cables from high level cabling and all inputs from speaker connections.

Similarly, run audio and power cables as far apart as is possible. Use the appropriate type wiring for power cables ("zip cord", twisted pair, etc.). If practical, wire power connections with a shielded cable to prevent coupling to audio cables.

### **2.2.3 Grounding**

The most important consideration in ensuring good noise performance of the installation is the grounding and shielding of the various interconnections.

First, it is necessary to achieve a good ground for the console itself. This should be a central earth ground. If possible, connect to the transmitter RF ground. Alternately, connect to a power line earth ground or earth-grounded plumbing. The console ground should be connected with a braided grounding strap (such as Alpha 1235 or Belden 8657) or solid copper ground strap.

Secondly, the grounding of the signal shields must be executed so as to avoid ground loops (unintended signal paths through shields and grounds). To prevent ground loops, shields are grounded at only one end of the cable. Generally, this is done at the console. However, it may be best to ground the shield at the source equipment or in between the console and the source.

Particular care must be exercised to avoid unintended grounds at patch panels, through external switching arrangements, through uninsulated (case grounded) jacks on associated equipment, or from grounded racks and cabinets.

## 2.2.4 Terminations

Proper load or termination for transformer coupled equipment is necessary for proper frequency response and level. The program outputs of SPOTMASTER® consoles must have a 600 ohm termination. This may be installed at the console or externally. Proper termination should be provided for other transformer coupled equipment connected to the console.

## 2.3 MIXER INPUTS

### 2.3.1 Input Level Sensitivity

Any mixer will accept either low level (microphone) or high level inputs. This is determined by the setting of the HI/LO switch(es) on the preamplifier cards located in the console cabinet. One preamplifier is included for each mixer beginning with mixer 1 to the left as viewed from the front of the console. Refer to the specifications in Table 1 for the input sensitivities of your particular console.

#### NOTE

*While a mixer may be set for either high or low level inputs, both inputs (A or B) to that mixer must be either high or low level.*

### 2.3.2 Monophonic and Stereophonic Inputs

Any mixer in stereo consoles will accept either monophonic or stereophonic inputs as determined by the setting of the MONO-STEREO switch on each preamplifier card. When set to MONO, a signal connected to the LEFT input will also be fed to the right channel. In the MONO position, the RIGHT input is not connected.

#### NOTE

*When a mixer is set for a monophonic input, both inputs (A and B) must be mono sources.*

### 2.3.3 Input Wiring

#### BALANCED INPUTS

Connect the high side to the  $\pm$  terminal and the low side to the COM terminal. Connect the shield to the GND terminal.

#### UNBALANCED INPUTS

Connect the high side to the  $\pm$  terminal. Connect the low side (shield) to the GND terminal. Connect the COM and GND terminals.

## 2.4 Console Program Outputs

Identical program and audition channel outputs are provided in the 5BEM100, 8BEM100, 5BEM200, 8BEM200, and 8BES200 consoles. The audition output is optional in the 5BES100 and 8BES100 consoles.



Additionally, a mono sum output derived from the left and right program signals is standard in the 5BES200 and 8BES200 consoles. This mono output is optional in the 5BES100, 8BES100, 5BES200 and 8BES200 consoles.

These outputs are transformer coupled, balanced with an impedance of 600 ohms. Connect the high side to the  $\pm$  terminal, the low side to the COM terminal, and the shield to the GND terminal. A 600 ohm termination should be provided for proper level and frequency response.

## **2.5 EXTERNAL MONITOR INPUT**

This input to the monitor amplifier is intended to accept the output from a modulation monitor or other auxiliary audio monitor source. It is unbalanced with an impedance of approximately 10,000 ohms. The input level should be adjusted with an external pad so that the monitor level remains constant when switching from audition or program monitor feed to the external input.

## **2.6 SPEAKER, HEADPHONE, AND MUTING RELAY CONNECTIONS**

### **2.6.1 Speaker Connections**

Outputs for monitor speakers are provided for the control room (console location) and various studios. These speaker outputs are connected through the muting relays for operation with live microphones. The control room speaker is controlled by relay K1, studio A by K2, etc.

The monitor circuitry is designed to drive 8 ohm speakers. For multiple speaker installations use 16 ohm speakers or matching transformers to maintain an overall impedance above 4 ohms. Refer to the specifications (Table 1) for power available in the various model consoles.

#### **NOTE**

*To avoid damage to the monitor amplifier, DO NOT EXCEED the power capabilities of the amplifier. DO NOT operate the amplifier into speaker loads below 4 ohms.*

### **2.6.2 External Cue Speaker**

An internal cue speaker is provided; however, an external cue speaker may be connected if desired. This should be a high efficiency device of 8 or 16 ohms impedance. When an external cue speaker is connected, disconnect the internal speaker. In 200 series consoles remove the jumper on the power supply board next to the K1 muting relay.

The external cue speaker will be muted by relay K1.

### **2.6.3 Muting Relay Contacts**

The solder terminals on the power supply board give access to the normally open contacts of the muting relays to control studio "on-the-air" lights. These contacts are rated at 1 amp resistive at 125 VAC. These contacts can be used to activate an external relay to actually switch the lamps.

## **2.6.4 External Headphones Connection and Front Panel Head Phone Jacks**

Terminals are provided to connect an external headphone jack should this be more convenient than the front panel jack.

### **NOTE**

*Refer to section 3.7 for use of low impedance headphones or use of both the front panel jack and the external connection.*

## **2.6.5 Muting Relay Control**

### **100 SERIES CONSOLES**

The 100 Series consoles have provisions for two muting relays: one is standard and the second is a plug-in option.

All 100 series consoles come wired for activation of relay K1 (control room), when the mixer 1, audition/program switch is in either the audition or program position. The studio A relay (K2) is similarly controlled by mixer 2. Each relay can be controlled by only one mixer (the relay is activated by breaking a connection to ground). If it is necessary to change the muting as wired at the factory, see the "100-Series Console Muting" diagram (Figure 12).

### **200 SERIES CONSOLES**

All 200 series consoles are equipped with 3 muting relays. As wired at the factory, the control room relay (K1) is activated when the mixer 1 audition/program switch is in the program position. The studio A (K2) and studio B (K3) relays are similarly controlled by mixers 2 and 3 respectively.

This control designation may be changed. Refer to the console schematic diagram (Figures 15 and 16). Wiring is provided so that the muting may be controlled by any of the mixers.

## **2.7 AC POWER**

All SPOTMASTER® audio consoles are equipped with three-wire grounded AC line cords. This should be connected to a single phase, 117 VAC, 50/60 Hz power source. (Models for operation from 220 VAC, 50/60 Hz, are optionally available.)

The console AC power switch and fuse are located inside the cabinet on the right hand side.

## **2.8 ELECTRONIC ADJUSTMENTS**

### **2.8.1 Level Setting**

Refer to the chassis layout diagrams in Figures 4 through 11.

All SPOTMASTER consoles are designed to operate at an output level of +8 dBm. The VU meter(s) are calibrated to read 0 VU (100) with an output of +8 dBm. The level adjustments described here may be performed using the console VU meter as reference. Use a 1 KHz sine wave signal or any program signal with a consistent level as a test signal.

Set the front panel master gain control to the 1 o'clock position.

Switch each input source to the program or audition channel in turn. Adjust the front panel mixer for +8 dBm output. If the mixer is only set at 9 o'clock or 8 o'clock, install a pad on the input. Ideally, the mixer should be operated in the 12 o'clock to 3 o'clock range for best performance.

The front panel master control may be adjusted slightly if required.

## **2.8.2 Level Balance**

The level balance trimmers on the 918-3504 Mixer Line Driver Amplifiers are not used to set the output level but to balance the left to right output levels in stereophonic consoles or to match the audition to program outputs in monophonic consoles.

### **NOTE**

*These controls need not be adjusted in monophonic consoles unless the audition and program outputs are used to feed the same line. For this reason the procedure for stereo consoles is described below.*

The level balance adjustment must be performed with an external VU meter connected to the output and proper 600 ohm termination provided to the output. The level adjustments described in 2.8.1 above should first be performed.

Feed a sine wave signal to any mixer's right input. Observe the output level. Feed the same signal to the same mixer's left input. Adjust the left or right balance trimmer to match the two output levels. With the signal still connected to the left channel input, place the preamplifier mono/stereo switch to MONO. The output level will decrease 3 dB, but the two output levels should remain identical. If not, repeat the left and right balance adjustments.

## **2.8.3 Balance Adjustment of Monophonic Output**

### **NOTE**

*This adjustment is required only in stereophonic consoles equipped with the 918-3502 mono mixdown module.*

The trimmers on the 918-3502 module are used to adjust the input signals so that the left and right channel signals are mixed 50%/50% in the monophonic output. This adjustment is performed after the level adjustments described in 2.8.1 and 2.8.2 above.

This adjustment requires an external VU meter connected to the mono output. This output must be terminated with 600 ohms.

Feed a sine wave signal to the right input of any mixer. Place that mixer in the program channel and adjust the mixer for 0 VU (+8 dBm output) on the console VU meter. Adjust the right trimmer on the 918-3502 for a mono output on the external meter of +5 dBm. Connect the same signal to the left input of the same mixer and perform the adjustment with the left trimmer on the 918-3502.

**NOTE**

*When inputs are present from both the left and right channels,  
the mono output will be +8 dBm.*

**2.8.4 VU Meter Calibration**

The console VU meters are calibrated at the factory to indicate 0 VU (100) when the output is +8 dBm. If the console is operated at a different output level, the VU meters may be re-calibrated if the meter rectifier circuit is equipped with calibration trimmers. Refer to Figure 30. Meters so equipped can be adjusted to zero with output levels between +3 dBm and +11 dBm.

Connect an external meter to the output and provide 600 ohm termination to the output. Adjust the output to the desired level as indicated on the external meter. Adjust the calibration trimmer on the VU-1 Meter Rectifier circuit so that the console VU meter reads 0 VU (100).

## **SECTION 3**

### **OPERATION**

#### **3.1 GENERAL OPERATION**

The SPOTMASTER® audio consoles combine several audio sources at various levels into a single source. For convenience in operation, several subsidiary systems are included.

A cue circuit allows preview of a source before mixing. The two separate channels, audition and program, make the console two units in one. Each mixer may control more than one input, although not simultaneously. Built-in amplifiers allow speaker or headphone monitoring of the two mixing circuits and the cue systems. The controls are explained below.

#### **3.2 INPUT SELECTION**

Two separate input sources may be connected to each mixer. Two pushbutton switches labeled A and B are provided for each mixer. The desired input is fed to the mixer by depressing the A or B switch for that mixer.

#### **3.3 CHANNEL SELECTION**

Any mixer may be operated into either of the two console outputs: program or audition. This is determined by the setting of the three position switch immediately above the mixer. In the audition (A) position the signal from either the A or B input is fed through the mixer to the audition output only. In the program (P) position the input selected is fed through the mixer to the program output only. In the center position the input signal is off and is fed to neither the audition nor program position.

#### **3.4 LEVEL CONTROL**

The mixers are used in two ways to control level: to keep each input at approximately the same volume or to combine the signal from two (or more) inputs in a desired relationship. The VU meters and the monitor circuits are provided as an aid in determining the proper levels or volumes. The mixer or mixers for active sources are adjusted so that the VU meter reads 100 (0 VU) on peaks. When mixing two or more inputs the mixers are adjusted to yield the desired sound while maintaining a VU meter reading which peaks to 100 (0 VU). The level is increased by rotating the mixer clockwise and decreased by rotating the mixer counter-clockwise.

#### **NOTE**

*The master level controls provided for the audition and program outputs SHOULD NOT BE USED in normal operation.*

### **3.5 VU METERS**

In the 5BEM100, 8BEM100, 5BEM200 and 8BEM200 consoles, separate VU meters are provided for the audition and program channels. In the 5BES200 and 8BES200 consoles separate VU meters are provided for the left and right channels. These two meters may monitor either the program or audition channel as determined by the setting of the VU meter switch.

In the 5BES100 and 8BES100 VU meters are provided for the left program and right program channels only.

### **3.6 CUE SYSTEM**

The cue system is provided for previewing or monitoring sources prior to mixing. An input is connected to the cue system by depressing its input selector switch (A or B) and rotating its mixer into the cue detent (click stop) at the extreme counter-clockwise position of the mixer.

An internal amplifier and speaker are provided for monitoring the cue system. The volume of the cue speaker is determined by the setting of the CUE LEVEL control. The cue speaker is muted by the control room muting relay.

The cue system may also be monitored by headphones plugged into the front panel jack by depressing the CUE switch above the headphones level control.

### **3.7 HEADPHONES**

The front panel headphone jack is designed to accept a wide variety of headsets including low impedance stereo headphones. In monophonic consoles only one channel of the stereo headphones will be active.

Low impedance stereo headphones can be modified for use with mono consoles in several ways. The headphone plug can be rewired so that the left and right channels are in series (isolate wire(s) originally connected to the sleeve of the plug, and move the ring connection to the sleeve). If the channels are paralleled (tip and ring shorted), a 4 ohm resistor (2W) must be added in series with the headphones. The series resistance method must be used if the front panel headphone jack and internal barrier-strip headphone outputs are used simultaneously. **AT NO TIME SHOULD A LOAD OF LOWER RESISTANCE THAN 8 OHMS BE USED WITH THE HEADPHONE AMPLIFIER.**

The headphones may be connected to either the program, audition, or cue outputs by depressing the appropriate switch above the headphones level control. The headset volume is determined by the setting of this level control.

The headphone jack is never muted.

### **3.8 MONITOR SPEAKERS**

An internal amplifier is provided to drive a control room speaker as well as separate speakers in several studios. These speakers may be muted for use with live microphones.

The speakers may monitor either the program output, audition output, or an external signal by depressing the appropriate switch located above the front panel monitor level control.

The volume of all speakers connected to the various monitor outputs is determined by the setting of the monitor level control.

## **SECTION 4**

### **ELECTRONIC THEORY OF OPERATION**

#### **4.1 GENERAL SYSTEM DESCRIPTION**

Refer to the block diagrams in Figures 2 (monophonic) and 3 (stereophonic). Separate in depth circuit descriptions for the monophonic and stereophonic consoles are included in paragraphs 4.2 and 4.3 below.

In all consoles two inputs may be connected to operate through each mixer. One of these is selected by the input switches. This signal is fed through the input level switch to a preamplifier stage. The level switch properly sets the gain of the preamplification stage for microphone or other input.

The output of the preamplifier is connected to an adjustable level control or mixer. In stereophonic models the signal is connected through a mono/stereo switch which allows a monophonic input source to be fed to both the left and right mixing busses.

The output of the mixer is connected through the FET switching to either the audition or program bus. The signals from all the mixers are combined on the bus and fed to a line amplifier. The output of this final amplification stage is coupled through an output transformer. A VU meter is connected after the transformer to measure the signal level on that output.

In stereophonic consoles a third output is available. This mono mixdown (or matrix) signal is combined left and right channels of the (stereophonic) program output. These two signals are taken from the output of the two program channel line amplifiers. These are combined, amplified, and coupled through an output transformer.

A preview (cue) circuit is built into each console. Signal is taken from each mixer to feed the cue bus. In stereophonic models, both left and right channel signals are combined into a monophonic composite signal so that the entire stereo signal is previewed. When a mixer is connected to the cue bus its signal is disconnected from the normal mixing circuitry.

The cue bus feeds the headphone selector switch and the cue amplifier. The amplifier is connected through a muting relay to an internal speaker and terminals for an external speaker.

Signal from the output of the audition and program line amplifiers is connected to the headphone and monitor selector switches. A third position accepts the external input to the monitor. The third position of the headphone switch is connected to the cue bus.

The outputs of the selector switches are fed to separate power amplifiers. The monitor circuit provides sufficient power to drive several speakers. The outputs to these speakers are connected through the muting relays so that the speakers can be shut off by energizing a particular relay. Several relays are provided so that speakers can be muted in one studio without muting all other speakers. Each relay is also equipped with contacts to turn on an "on-the-air" light. The headphone

circuit provides power to drive a headset. This amplifier is connected to the front panel jack and parallel terminals for external connection.

Low voltage DC (V+) is provided to all the printed circuit modules by the power supply.

## **4.2 MONOPHONIC SYSTEM DESCRIPTION**

Refer to the schematic diagrams in Figures 13 and 15. These drawings function as combined schematic, wiring, and block diagrams. The physical arrangement of the electronic modules is shown in Figures 4, 6, 8 and 10. Operation of the circuits on individual printed circuit modules is described in detail in the following sections.

### **4.2.1 Audition and Program Channels**

Terminals are provided to connect two input sources to each mixer. Signal passes from the input terminals on the sub-chassis inside the cabinet to the front panel selector switches. Here either the A or B source is connected to the preamplifier. The signal enters the 918-3500 preamplifier, passes through the level sensitivity pad, and enters the preamplifier.

Following amplification, signal is taken from the 918-3500 to the front panel mixer. In 100 series consoles this is a sealed composition potentiometer designed for several million operations. In 200 series models, a ladder attenuator (Daven or equivalent) with 20 steps of 2 dB attenuation per step is used. These may be opened and cleaned. In both 100 and 200 series consoles, a cue switch is installed on all mixers to route signal to the cue system instead of the attenuator (see below).

From the mixer the signal is returned to the 918-3500 preamplifier to the FET switching, which is controlled by the front panel audition/program switch. Following the FET's, separate outputs are taken from the 918-3500 to the audition and program buses.

The program outputs of all the 918-3500 preamplifiers are bussed together and presented to the input of a 918-3504 Mixer Line Driver amplifier module. The mixed signal is amplified, passed to the front panel program master gain control, and returned to the 918-3504. The signal enters the final amplification stage through a level trim potentiometer. This amplifier is directly coupled to the 600 ohm/600 ohm output transformer. A feed to the monitor selector switch is bridged off of the amplifier output (see below).

After the output transformer, the line level signal leaves the 918-3504 module and is connected to the program output terminal strips. At the output of the 918-3504 signal for the program VU meter is bridged from the line signal. This is connected to the VU-1 rectifier module mounted on the rear of the VU meter.

The audition channel is identical in operation to the program channel. The audition outputs of all the 918-3500 preamplifiers are bussed together and presented to a separate 918-3504 driver amplifier. The amplified signal passes through the audition master gain control and is returned to the 918-3504 for final amplification. Following this the audition monitor feed is bridged off of the output. The line signal is passed through the output transformer to the audition output terminals. The audition channel VU meter is bridged from the line signal and delivered to the VU-1 rectifier mounted on the audition VU meter.



#### **4.2.2 Cue Circuitry**

The outputs of all the cue switches (on the front panel mixers) are bussed together to feed the headphone selector switch (see below) and the cue speaker amplifier.

Signal from the cue bus is taken to the front panel cue level control. From there the signal enters the cue speaker amplifier on the 918-3505 module. Following amplification the cue signal leaves this module for the power supply board (918-3507 or 918-4001) where the control room muting relay is mounted.

The cue output is routed through a set of normally closed contacts on K1. After the relay, the signal is split. A connection is made directly to the external cue speaker screw terminals on the sub-chassis. A separate connection is made through an exposed jumper on the power supply board to the internal cue speaker. If an external cue speaker is connected, this jumper should be removed to disconnect the built-in speaker.

#### **4.2.3 Monitor Circuitry**

The monitor outputs of the audition and program channel 918-3504 mixer Line Amplifier modules are connected to separate sections of the monitor selector switch on the front panel. A third position is provided on this switch for connection of an "off-the-air" or other external feed; this is connected directly from its input terminals on the sub-chassis to the selector switch.

The output of the selector switch is taken through the front panel monitor level control to the 918-3509 monitor amplifier module. Following amplification, signal is routed to the muting relays on the power supply board. There the signal is split and fed through normally closed contacts. The monitor output from each relay is taken to separate terminals on the sub-chassis barrier strips.

The monitor busses from the audition and program Mixer Line Amplifiers are also connected to separate sections of the front panel headphone selector switch. A third position on this switch is connected to the cue bus. From the selector switch the signal passes through the front panel headphone level control to the headphone amplifier. This amplifier is mounted on the same module as the cue amplifier: the 918-3505 Cue/Headphone Amplifier. Following amplification the signal leaves the printed circuit module. The signal is connected to the front panel headphone jack and to terminals on the sub-chassis. An external headphone jack may be connected to these terminals.

#### **4.2.4 Muting Relays and Control**

The muting relays are provided to shut off any speakers and to turn on a warning ("on-the-air") light in a studio with a live microphone. Speaker connections are made through normally closed contacts which open when the relay is energized. The warning light (external and not supplied with the console) is connected through the normally open contacts which close when the relay is energized.

The relays and the relay driver circuits are located on the power supply board 918-3507 or 918-4001). The relays are controlled by the front panel audition/program switches. In the 100 series consoles, the relay is energized by removing the ground from the mute control bus (Figure 12). In the 200 series consoles, the relay is energized by supplying a ground to the mute control bus. (The schematic diagram shows the standard relay control designation. These may be changed, however, as explained in paragraph 2.6.5 above.)

#### **4.2.5 Power Supply**

All consoles are equipped with a three conductor, NEMA standard, grounded line cord. The high side of the AC line is connected through the fuse to the primary of the power transformer. The low side of the AC line is connected through the switch to the transformer primary. The ground line is connected to the transformer frame and chassis at the point where the station ground terminal is located.

The secondary of the power transformer is connected to the full wave bridge rectifier located on the chassis. The 100 series consoles are equipped with the 918-3507 board. The 200 series consoles are equipped with the 918-4001 board. The power supply furnishes rectified and filtered DC only.

### **4.3 STEREOPHONIC SYSTEM DESCRIPTION**

Refer to the schematic diagrams in Figures 14 and 16. These drawings function as combined schematic, wiring, and block diagrams. The physical arrangement of the electronic modules is shown in Figures 5, 7, 9 and 11. The operation of the modules is described in detail in following sections.

#### **4.3.1 Audition and Program Channels**

Terminals are provided to connect two stereo input sources to each mixer. Signal passes from the input terminals on the sub-chassis inside the cabinet to the front panel selector switches. Here either the A or B source is connected to the preamplifier. The left and right channel signals enter the 918-3501, pass through the separate level sensitivity pads, and enter separate preamplifiers.

The output of the right channel preamplifier is connected to the stereo/mono switch on the 918-3501 module. When the switch is in the mono position, the output of the right channel preamplifier is disconnected; the left channel preamplifier output is connected to both the left and right channels. In the stereo position, the two channels remain separate.

Following amplification, the two stereophonic signals are taken from the 918-3501 module to the front panel mixer. In 100 series consoles this is a dual, concentric, sealed composition potentiometer designed for several million operations. In 200 series models, a dual, concentric, ladder attenuator (Daven or equivalent) with 20 steps of 2 dB attenuation per step is used. These may be opened and cleaned. In both 100 and 200 series consoles, cue switches are installed on both the left and right channel stages of the mixer to route both these signals to the (mono) cue system instead of the mixer. This unique cue feature is installed on all mixers.

From the mixer the stereo signal is returned to the 918-3501 preamplifier to the FET switching which is controlled by the front panel audition/program switch. Following the FET's, separate outputs are taken from the 918-3501 to left and right audition and program busses.

The left program outputs of the 918-3501 preamplifiers are bussed together and presented to the input of a 918-3504 mixer Line Driver Amplifier Module. The right program outputs are similarly bussed to a second 918-3504 module. In the 918-3504 the signal is amplified, passes to the front panel program master gain control, and returns to the 918-3504. For convenience, the left and right channel master level controls are mounted on a single control shaft.

The signal enters the final amplification stage on the 918-3504 through a level trimming potentiometer. This amplifier is directly coupled to the 600 ohm/600 ohm output transformers. A feed to the monitor selector switch is bridged off of the amplifier output (see below).

After the output transformer, the line level signal leaves the 918-3504 module and is connected to the left or right program output terminal strip. At the output of the 918-3504 signal for the program VU meter and mono matrix output are bridged from the line signal.

In the 100 series consoles the program VU meter signals are connected directly to separate VU-1 rectifier circuits mounted on the rear of the left and right VU meters. In 200 series consoles the VU meter signals are connected to the meter rectifier circuits through a front panel selector switch so that either the audition or program output channel may be metered.

The left and right program outputs for the mono matrix are connected directly to separate inputs on the 918-3502 mono mixdown module. The signals enter through separate level balancing potentiometers, are combined, and amplified. The amplified monophonic signal is coupled through a 600 ohm/600 ohm output transformer and taken from the 918-3502 to the mono program output terminals. No metering is provided for this derived monophonic output, since it is taken from the primaries of the left and right line output transformers. The level into the 918-3502 is controlled by the program master level control. The program VU meters give a true indication of the input level to the 918-3502.

The audition channel is nearly identical in operation to the program channel. The left and right audition outputs of all the 918-3501 preamplifiers are presented to separate 918-3504 driver amplifiers. The amplified signals pass through the dual audition master gain control and are returned to the 918-3504 modules for final amplification. Following this the audition monitor feeds (left and right) are bridged from the output. The line signal is passed through the output transformers to the audition left and right output terminals. No provision is made for a monophonic signal derived from the audition channel. In 100 series consoles no metering is provided for the audition channel. In 200 series models a meter connection is bridged from the line signal and delivered to the VU meter selector switch.

#### **4.3.2 Cue Circuitry**

The outputs from the left and right cue switches (on the front panel mixers) are combined into a single cue bus to feed the headphone selector switch (see below) and the cue speaker amplifier.

Signal from the cue bus is taken to the front panel cue level control. From there the signal enters the cue speaker amplifier on the 918-3506 module. Following amplification the cue signal leaves this module for the power supply board (918-3507 or 918-4001) where the control room muting relay is mounted.

The cue output is routed through a set of normally closed contacts on K1. From the relay the signal is split. A connection is made directly to the external cue speaker screw terminals on the sub-chassis. A separate connection is made through an exposed jumper on the power supply board to the internal cue speaker. When an external speaker is connected, this jumper should be removed to disconnect the built-in speaker.

#### **4.3.3 Monitor Circuitry**

The monitor outputs from the left and right audition and program channel 918-3504 Mixer Line Amplifier modules are connected to separate sections of the monitor selector switch on the front panel. A third position is provided for connection of a stereo "off-the-air" or other external feed; this is connected directly from its input terminals on the sub-chassis to the selector switch.

The left and right outputs of this switch are taken through the dual front panel monitor level control to the monitor amplifiers. In 100 series models a single dual amplifier module, the 918-3503, is used. In 200 series consoles two single channel amplifiers, two 918-3509 modules, are used. Following amplification, the signals are routed to the muting relays on the power supply board. There the signals are split and fed through normally closed contacts. The left and right monitor outputs from each relay are taken to separate terminals on the sub-chassis barrier strips.

The left and right audition and program monitor buses from the Mixer Line Amplifiers are also connected to separate sections of the front panel headphone selector switch. A third position is connected to the monophonic cue bus. From the selector switch the signals pass through the dual front panel headphone level control to the headphone amplifier. This dual channel amplifier is mounted on the same module as the cue amplifier: the 918-3506 Cue/Headphone Amplifier. Following amplification the stereo signal leaves the printed circuit module. The signal is connected to both the front panel stereo headphone jack and to terminals on the sub-chassis. An external jack may be connected to these terminals.

#### **4.3.4 Muting Relays and Control**

The muting relay system in the 100 and 200 series stereophonic consoles is identical to the system described for monophonic consoles in section 4.2.4 above.

#### **4.3.5 Power Supply**

The power supply in stereophonic consoles is identical to that described for the monophonic consoles in section 4.2.5 above.

### **4.4 918-3500 MONOPHONIC PREAMPLIFIER**

Refer to Figure 17 and 18.

Figure 17 shows the original version of the 918-3500 card. Figure 18 shows the present configuration. These may be distinguished by the mounting of the input sensitivity switches: on the bracket in the original; on the printed circuit board just below the bracket in the later version. Circuit operation of the two is identical; the two versions are direct replacements and may be intermixed in the same console.

The 918-3500 is an integrated circuit monophonic amplifier with Field Effect Transistors installed on the output for signal routing. The 918-3500 provides the initial gain stage and performs the signal switching to the audition or program buses. An input pad is installed at the input so that the amplifier will accept microphone (−65 dBm) or line (−20 dBm) sources. Either of the two ranges is selected by a slide switch.

A balanced signal enters the board on terminals 16 and 17 to the input pad controlled by switch S2. This pad (resistors R13, R14, R15, and R16) provides approximately 46 dB attenuation to the signal when S2 is open. Similarly, with S2 open, the pad provides a high impedance to the input source. With S2 closed, a low impedance is provided with little attenuation.

The COM signal from pin 17 is coupled through C8 and R18 to the inverting input (2) of IC-2. The  $\pm$  from pin 16 is coupled through C7 and R17 to the non-inverting input (3) of IC-2. To provide proper gain and signal phasing when operated with an unbalanced input, the COM must be grounded to pin 1 (the input ground which also appears on the console input barrier strip).

Amplification is provided by IC-2, a 709 operational amplifier in an 8 pin plastic dual in-line package. This device is a wideband, high gain block. In this high level mode it is operated with a gain of approximately 16 dB. The gain is determined by R20, R18, R14 and the impedance of the input. Set for a low level input source, the overall gain is increased to approximately 55 dB as determined by R20, R18 and the impedance of the input.

Supply voltage for the board enters on pin 8. Voltage for IC-2 is connected through R33 and C14 to IC pin 7. This network decouples the amplifier stage from the main supply. Bias to the non-inverting input is supplied through R19 from the voltage divider R11, R12.

Following amplification, the output of IC-2 is coupled through R21 and C11. Resistor R21 prevents loading of the IC output. The signal leaves the board on pin 4 which is connected to the front panel attenuator (mixer). After the attenuator, the signal is returned to the board at pin 7 and presented to FET's Q3 and Q4 through R23. These FET's are used as analog switches and when conducting they pass the signal through R22 and R24 to the program and audition buses through board pins 13 and 11.

Control for FET's is the front panel audition/program switch. This switch supplies a ground to the gate to turn on the FET to feed the preamplifier output to either the audition or program line amplifier. The FET's are held in the non-conducting state by R26 or R27 when the ground is not applied to the gate. When shut off, the FET provides 70 dB or better isolation.

The 918-3500 preamplifier is RF protected by the use of ferrite beads on the leads of the input capacitors and the gates of the FET's.

#### **4.5 918-3501 STEREOPHONIC PREAMPLIFIER**

Refer to Figures 19 and 20.

Figure 19 shows the original version of the 918-3501 module. Figure 20 shows the present configuration. These may be distinguished by the mounting of the slide switches: on the bracket in the original; on the printed circuit board just below the bracket in the later. Circuit operation of the two is nearly identical; they are direct replacements and may be intermixed in the same console.

The 918-3501 is identical to the 918-3500 described above except that separate circuits are installed for the left and right channels. In addition, the stereo/mono switch S3 is added. In the mono- phonic (Mono) position the left input is fed to both the left and right attenuators. The right input is not used.

#### **4.6 918-3502 MONO MIXDOWN MODULE**

Refer to Figure 21.

The 918-3502 is used in the stereophonic consoles to mix the left and right channel signals and to amplify this composite (MATRIX) signal sufficiently to drive a 600 ohm line at +8 dBm (+18 dBm peak). This is accomplished with a mixing network, an integrated circuit amplifier, and a 600 ohm output transformer.

The left and right signals enter the board on pins 3 and 1 from the left and right program channels of the console. The two signals are combined in the mixer R1, R2, R3, R4, R5 and R6. Potentiometers R3 and R6 allow level adjustment to properly balance the summed signal.

After mixing the signal is coupled through C2 to the non-inverting input of IC-1. The NE540 is an AB class audio amplifier used here to provide a gain of approximately 45 dB. The gain and bandwidth are determined by the feedback network between pins 7 and 4.

The DC supply voltage is connected to IC-1 at pin 10. Bias is supplied from the voltage divider R7 and R8, through R9. Bias decoupling is provided by C1.

The output is coupled through C6 to the output transformer T1.

#### **4.7 918-3503 STEREO MONITOR (POWER) AMPLIFIER**

Refer to Figure 22.

The 918-3503 is a stereophonic power amplifier used in the 100 series consoles to drive monitor speakers. Two separate integrated circuit amplifiers for the left and right channels are built on the printed circuit board. Since these circuits are identical, the left channel amplifier is described; component designations in parenthesis are for the right channel.

Signal enters the board at pin 2 (3) through the bridging pad R1, R2, (R3, R4). This signal is derived from the front panel monitor selector switch. The signal is coupled through C1 (C6) to the non-inverting input of IC-1 (IC-2). This device is an LM-380 audio power amplifier in a 14 pin DIP plastic case.

The amplified output is coupled through C4 (C9) to board pin 6 (13). (From the 918-3503 module the signal is routed through the muting relays to the console barrier strips.) The LM-380 is designed to operate into a load of 8 ohms and can be damaged from excessive power dissipation if operated into less than 4 ohms. If operated into 4 ohms, a moderate volume should be used to prolong the units' life.

The RC network R5, C3 (R6, C8) prevents high frequency oscillation. Power for the board enters on pin 18 is regulated down to 18 V by Q1 and CR1 and is connected to the IC pin 14.

#### **4.8 918-3504 MIXER LINE DRIVER AMPLIFIER**

Refer to Figure 23.

The 918-3504 provides the final amplification in the console. Its output is a 600 ohm, balanced, signal at a nominal +8 dBm (+18 dBm peak). The circuit is monophonic, so two modules are required to provide left and right outputs in stereophonic consoles. The 918-3504 is used in both the program and audition channels.

Signal enters the board from the audition or program bus at pin 1 and is coupled through C1 to the inverting input of IC-1. This is a type 741C operational amplifier. Its gain is approximately 15 dB as determined by R2 and the sum resistors located on the 3500 preamp cards.

Power for IC-1 is taken from board pin 18 through dropping resistor R3 to IC pin 1. Bias is supplied to the non-inverting input (pin 5) from the voltage divider R5, R6 through R4. Decoupling is provided by C4, C5.

The output of IC-1 is coupled through C3 to board pin 3. The signal is taken to the front panel master level control and then returned to board pin 5 and the balance control R9. This control allows trimming the gain to the exact desired level. It is particularly useful in matching the left and right outputs (separate 918-3504 modules) in stereo consoles.

From R9, signal is coupled through C6 to the non-inverting input of IC-2. The networks R10, C7, R11, C8 and C9 determine the gain and bandwidth. On the 918-3504, the gain is set at 38 dB.

The output of IC-2 is coupled through C10 to the 600 ohm output transformer, T1. The output is also bridged off through R12 to board terminal 17 as an input to the console monitor system and the MONO MATRIX card in stereo consoles.

#### **4.9 918-3505 MONOPHONIC CUE/HEADPHONE AMPLIFIER**

Refer to Figure 24.

The 918-3505 module contains separate power amplifiers to drive the cue system speaker and the headphone circuit in monophonic consoles. In both instances the integrated circuit LM-380 power amplifier is employed.

The two amplifier circuits are identical in operation. The input signal is AC coupled to the non-inverting input. The LM-380 provides a maximum 34 dB gain and an output designed to drive an 8 ohm load. The RC circuit to ground from the IC output (pin 8) prevents high frequency oscillation of the amplifier.

18 VDC for the two amplifiers is supplied through Q1 and zener diode CR1 which acts as a voltage regulator.

The bracket assembly acts as a heat sink for the regulator transistor (Q1). Much of the foil on the printed circuit board acts as a heat sink for the LM-380 integrated circuits.

#### **4.10 918-3506 STEREOPHONIC CUE/HEADPHONE AMPLIFIER**

Refer to Figure 25.

The 918-2506 module contains a monophonic amplifier to drive the cue speaker and a stereophonic amplifier to power the headphone jack.

The cue speaker amplifier consists of a single LM-380N integrated circuit (IC-1) which operates identically to the circuit on the 918-3505 module described above.

The headphone amplifier is dual channel power amplifier LM-377 integrated circuit (IC-2). The LM-377 is in essence two LM-380 amplifiers in a single 14 pin DIP plastic package. Bias for the two amplifiers is provided internally. Additionally the LM-377 includes internal current limiting and thermal protection. Separation between the two channels is 75 dB or better.

The input signals are AC coupled to the non-inverting inputs (pins 14 and 15). The two outputs are taken from pins 2 and 13. The gain is controlled by feedback resistors R12, R11 and R13, R8.

18 VDC is supplied through the voltage regulator Q1 and CR1. The bias for the amplifiers of IC-2 is supplied from R9 and R10. Pin 1 is the internal bias source.

The bracket assembly provides a heatsink for regulator Q1. The integrated circuits use foil on the printed circuit boards as heatsink.

#### **4.11 918-3507 POWER SUPPLY**

The 918-3507 printed circuit board mounts the low voltage power supply and muting relays and their control circuits. The power transformer is mounted in the cabinet adjacent to the 918-3507. Low voltage AC from the power transformer is rectified by the full wave bridge rectifier mounted on the chassis. C1, C2 and R1 provide filtration. Additional filtration and regulation is provided by circuitry on the individual amplifier modules.

Control circuits for two muting relays are built on the 918-3507. The relays are controlled by the audition/program switches: K1 by mixer 1 and K2 by mixer 2. In the center (OFF) position a ground is supplied to the base of Q1 (Q2 so it is non-conducting. When the switch is placed in either the program or audition position the ground is removed. The relay driver Q1 (Q2) is forward biased and conducts. Voltage is supplied to the coil of K1 (K2) to activate the relay. The normally closed contacts open to shut off the speaker outputs. The normally open contacts close to activate any "on-air" lights connected.

#### **4.12 918-3508 CUE/HEADPHONE AMPLIFIER**

Refer to Figure 27.

The 918-3508 is built in four versions for monophonic or stereophonic consoles. The 918-3508-1 and 918-3508-3 used in monophonic units contain separate power amplifiers to drive the cue speaker and the headphone jack. The 918-3508-2 and 918-3508-4 for stereo units contain three amplifiers: two for the left and right channels of the headphone jack and a third for the cue speaker.

Circuit operation is similar to that described above for the 918-3505 module except that resistor R11 is installed in the voltage regulator circuit in place of the zener diode. In the 918-3508-1 and 918-3508-2 used in the 100 series consoles, the voltage regulator circuit R10, R11, and Q1 is not used. The positive DC is applied directly to the filtration and decoupling circuit.

#### **NOTE**

*In consoles manufactured after August, 1974, the 918-3505 is used in place of the 918-3508-1 and 918-3508-3; the 918-3506 replaces the 918-3508-2 and 918-3508-4. This change was made to facilitate differentiating the mono and stereo cue/headphone amplifiers.*



#### **4.13 918-3509 MONITOR (POWER) AMPLIFIER**

Refer to Figure 28.

The 918-3509 is a power amplifier designed to drive 8 ohm monitor speakers. It consists of an integrated circuit power amplifier with a complementary symmetry output driver pair. The 918-3509 is a single channel amplifier; two modules are used to provide a stereo monitor output.

The input signal from the monitor selector switch enters the board on pin 1. It is coupled through C1 to the non-inverting input of IC-1. Its output is directly coupled to Q1 and Q2 which provide output drive for a speaker through C7.

The NE-540 is specifically designed to operate in conjunction with transistor output stages. Gain is set to 27 dB by R4, C3 and R7, C6. The IC is designed with internal power limiting. Overall circuit power limiting is achieved with R5, R6, R8 and R9. Current limiting is provided by R10 and R11.

#### **4.14 918-4001 POWER SUPPLY**

Refer to Figure 29.

The 918-4001 contains the low voltage power supply, three muting relays, and the muting relay control circuits.

Low voltage AC is supplied to the full wave bridge rectifier from the secondary of the power transformer mounted on the sub-chassis adjacent to the 918-4001. Filtration is provided by R1, C1, and C2. Additional filtration and regulation is provided as required on the amplifiers.

The three separate muting relay circuits are identical in operation. Control is exercised by the audition/program switches above the mixers. As shipped from the factory, mixer 1 controls relay K1, mixer 2 — K2, and mixer 3 — K3. However, circuitry is provided on all mixers so that any of the relays may be controlled by any mixer audition/program key by installation of the proper connections. Activating the relay disconnects the speaker lines connected through the normally closed contacts. The normally open contacts close.

The relay is energized by supplying a ground to shut-off the sub-driver (Q1, Q3 or Q5) to allow the driver transistor (Q2, Q4, or Q6) to conduct. When the ground is removed, the sub-driver conducts to shut off the driver transistor. As long as the sub-driver is in conduction, the driver transistor and the relay are held off.

#### **4.15 VU-1 VU METER RECTIFIER**

Refer to Figure 30.

The VU-1 contains the rectifier circuit for the VU meter. The T pad (R1, R2, R3) provides calibration so that the meter reads 0 VU (100) when the output is +8 dBm.

## **SECTION 5**

### **MAINTENANCE**

#### **5.1 CLEANING**

##### **A. PUSHBUTTON SWITCHES**

These switches are self-wiping and should not require cleaning.

##### **B. LEVER SWITCHES**

These may be cleaned, if required, with either a burnishing tool or an aerosol spray contact cleaner.

##### **C. STEP ATTENUATORS**

The mixers in the 200 series consoles can be opened and the steps cleaned with isopropyl alcohol or an aerosol spray contact cleaner.

##### **NOTE**

*Do not use an abrasive cleaner or burnishing tool on the step attenuators.*

##### **D. PRINTED CIRCUIT BOARDS AND CARD EDGE CONNECTORS**

The card edge connectors do not require cleaning. Should intermittent contact between the connector and the printed circuit board occur, polish the fingers on the board with a soft pencil eraser. The life of the card edge connectors can be prolonged by minimizing the removal and re-insertion of printed circuit modules.

#### **5.2 CONSOLE SPECIFICATION MEASUREMENTS**

As a check on continued proper operation of the console, the user may wish to periodically perform a specifications test. The results can be compared to the original factory results shown on the test sheet supplied with each unit.

These specification tests are performed at the factory with a  $-50$  dBm signal supplied to a low level input. The gain controls are adjusted to yield a  $+8$  dBm output. Active inputs and outputs are terminated with the proper load. When measuring the noise figure, the input signal should be disconnected and replaced by a 150 ohm resistor.

### 5.3 TROUBLE SHOOTING

#### NOTE

*AC power must be turned off when printed circuit boards are removed or replaced.*

In determining the cause of a fault in the console it is necessary to isolate it to a particular section or electronic module. Begin by determining that the main power supply is functioning (VU meter lamps burning, muting relays operational, or by actual voltage check). Second check signal presence in the audition, program, and cue channels. Thirdly, interchange printed circuit modules to determine if the fault is caused by a particular module.

#### NOTE

*The 918-3500 monophonic preamplifier may be installed in stereophonic consoles without harm. It will provide a left channel signal only. Similarly the 918-3501 stereophonic preamplifier may be installed in monophonic consoles without damage. The left channel only is used.*

Fourth, if the fault occurs with more than one module check wiring continuity within the console.

The major faults which occur on the printed circuit modules are failure of the integrated circuits or shorting of capacitors. Test the IC by measuring the DC voltage present on the IC input and output pins (with a 20,000 ohms/volt VOM). This should be one half the DC voltage present at the IC's DC supply voltage input pin (V+). With the power off test all capacitors for shorting or reversed polarity.

#### NOTE

*The optional 277-3000 extender card is helpful in raising a module above the level of other modules when performing these measurements.*

### 5.4 COMPONENT REPLACEMENT ON PRINTED CIRCUIT BOARDS

Great care should be exercised when working on printed circuit boards, since excessive heat may cause the foil to peel off. The Broadcast Electronics warranty on printed circuit boards is void if boards are damaged by improper handling.

Broadcast Electronics maintains a complete inventory of parts (e.g., resistors, transistors, etc.) as well as complete board assemblies. Order by Broadcast Electronics part number.

When replacing components on a printed circuit board use a small soldering iron (60 watts maximum) with a small tip. Use a de-soldering aid to remove excess solder. Protect the board contacts with masking tape and mount gently in a small vise.

Touch the iron to the connection to be unsoldered. When heated, quickly remove the iron and remove the excess solder. Be careful that no solder splatters onto the board. Unbend the

leads with a small pair of needle nose pliers and remove the component.

#### NOTE

*When replacing multi-pin components (integrated circuitry, connectors, etc.) de-solder all the pins before attempting to remove the component. It is virtually impossible to heat all the pins simultaneously.*

Check the mounting holes in the board to be sure they are clear of solder and open before mounting the replacement. Put the leads through the holes and trim the leads to about 1/8 inch. Bend the leads over so they touch only the foil strips the leads are to be soldered to.

Touch the iron to the leads and let the solder flow onto the foil. Always use a fine rosin core solder such as No. 20 gauge. Check for "bridges" of solder between adjacent foil strips.

Clean the flux off the connection with alcohol. Solder flux left on the printed circuit board may cause noise in the circuit. If the contacts were covered with masking tape, clean them also with alcohol.

**TABLE 2. REPLACEMENT PARTS**

Description	BE Number	Note
Monophonic Preamplifier Module	918-3500	5
Stereophonic Preamplifier Module	918-3501	4
Mono Mixdown Module	918-3502	4
Stereo Amplifier Module	918-3503	2, 4
Mixer Line Driver Amplifier Module	918-3504	
Mono Cue/Headphone Amplifier Module	918-3505	5
Stereo Cue/Headphone Amplifier Module	918-3506	4
Power Supply, 100 Series	918-3507	2
Monitor Amplifier Module	918-3509	1
Power Supply, 200 Series	918-4001	3
VU Meter Rectifier Module	918-0001	1
Printed Circuit Board Test Extender Card	918-3000	
VU Meter	319-1003	
Lamps for VU Meter	321-1828	
Power Transformer, 117 VAC, 50/60 Hz	376-0007	
Power Transformer, 220 VAC, 50/60 Hz	376-0002	
600 ohm/600 ohm Audio Output Transformer	371-0001	
Cue Speaker	414-0001	
Muting Relay	271-0007	
Lever Switch (Audition/Program)	343-3001	2
Lever Switch (Audition/Program)	343-3003	3
Pushbutton Switch (Input, A, B)	343-1401	4
Pushbutton Switch (Input A, B)	343-1201	5
Pushbutton Switch (Monitor & Headphones)	343-1202	
Knob, Mixer	482-0001	
Knob, (Monitor, Cue, Headphone, Master Level Controls)	482-0002	
Mixer, Step Attenuator, Mono	194-6032B	3, 5

**TABLE 2. REPLACEMENT PARTS (Cont.)**

Description		BE Number	Note
	Mixer, Step Attenuator, Stereo	194-6032A	3, 4
	Mixer, Sealed Potentiometer, Mono	193-1053B	2, 5
	Mixer, Sealed Potentiometer, Stereo	193-1053A	2, 4
	Master Level Control, Mono	192-1053B	5
	Master Level Control, Stereo	192-1053A	4
	Cue Level Control	192-1053B	
	Monitor, Headphone Level Control, Mono	192-1053B	5
	Monitor, Headphone Level Control, Stereo	192-1053A	4
	End Panel, RH, 100 Series	474-0001-2	2
	End Panel, LH, 100 Series	474-0002-1	2
	End Panel, RH, 200 Series	474-0002-2	3
	End Panel, LH, 200 Series	474-0002-1	3
	Chain for Front Panel		
	Line Cord	681-1723	
	Fuseholder	415-2012	
	3AG 2 Amp Fuse (117 VAC, 50/60 Hz)	334-0200	
	3AG ½ Amp Fuse (220 VAC, 50/60 Hz)	330-0050	
	Headphone Jack	417-0311	
	Power Switch	348-8280	
141-1003	NE709 Integrated Circuit	221-7091	
141-1001	NE540L Integrated Circuit	222-5400	
141-1004	LM741CP Integrated Circuit	221-7410	
141-1002	LM380 Integrated Circuit	222-3800	
140-5462	2N5462 FET	212-5462	
140-6121	2N6121 Transistor	219-6121	
140-6124	2N6124 Transistor	218-0032	
136-4004	1N4004 Diode	203-4004	
136-0060	1N60 Diode	202-0098	
	LM377 Integrated Circuit	222-3770	
	2N3904 Transistor	211-3904	
	18 V, 1W, Zener Diode	200-0018	

**Notes:**

1. Refer to Table 3, for use in the various models.
2. 100 Series Consoles
3. 200 Series Consoles
4. Stereo Consoles Only
5. Mono Consoles Only

**TABLE 3. PRINTED CIRCUIT BOARD COMPLEMENT**

BOARD/MODEL	5BEM100	5BES100	5BEM200	5BES200	8BEM100	8BES100	8BEM200	8BES200
277-3500 Mono Pre-Amp	5	—	5	—	8	—	8	—
277-3501 Stereo PreAmp	—	5	—	5	—	8	—	8
277-3502 Mono Mix	—	1 - Opt.	—	1 - Opt.	—	1 - Opt.	—	1 - Opt.
277-3503 2W Stereo Amp	—	1	—	—	—	1	—	—
277-3504 Line Driver Amp								
PGM Channel	1	2 - Std.	1	2	1	2 - Std.	1	2
AUD Channel	1	2 - Opt.	1	2	1	2 - Opt.	1	2
277-3505 Mono Cue and Headphone Amp	1	—	1	—	1	—	1	—
277-3506 Stereo Cue and Headphone Amp	—	1	—	1	—	1	—	1
277-3507 Power Supply	1	1	—	—	1	1	—	—
277-3508* Cue/Headphone Amp	*	*	*	*	*	*	*	*
277-3508-1	1	—	—	—	1	—	—	—
277-3508-2	—	1	—	—	—	1	—	—
277-3508-3	—	—	1	—	—	—	1	—
277-3508-4	—	—	—	1	—	—	—	1
277-3509 Monitor Amp	1	—	1	2	1	—	1	2
277-4001 Power Supply	—	—	1	1	—	—	1	1
VU Meter	2	2	2	2	2	2	2	2

\*These modules are installed in consoles manufactured prior to August, 1974. After that date the designations were changed for simplicity. 277-3508-1 and 277-3508-3 became 277-3505. 277-3508-2 and 277-3508-4 became 277-3506.

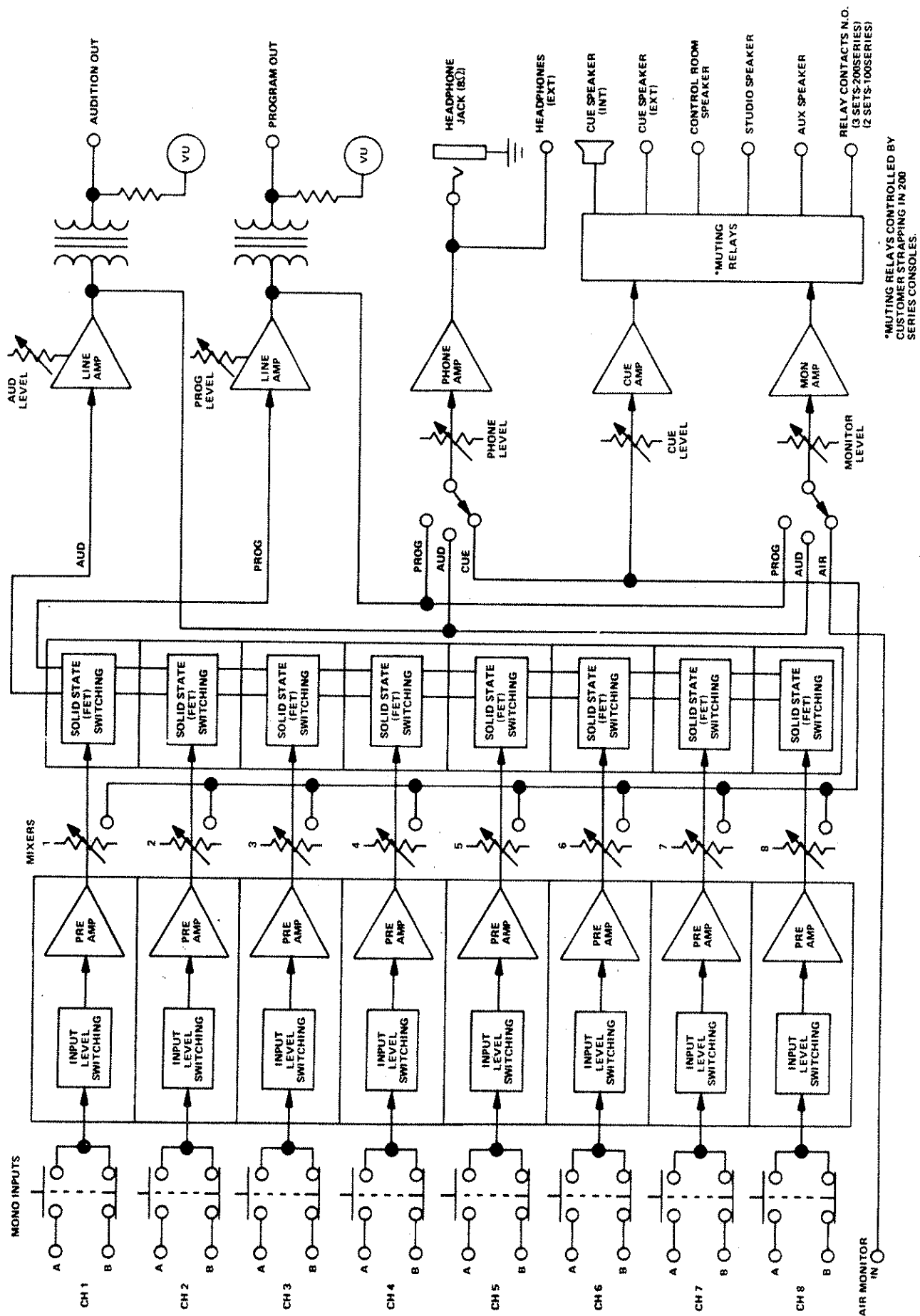


Figure 2. Monophonic Consoles Block Diagram

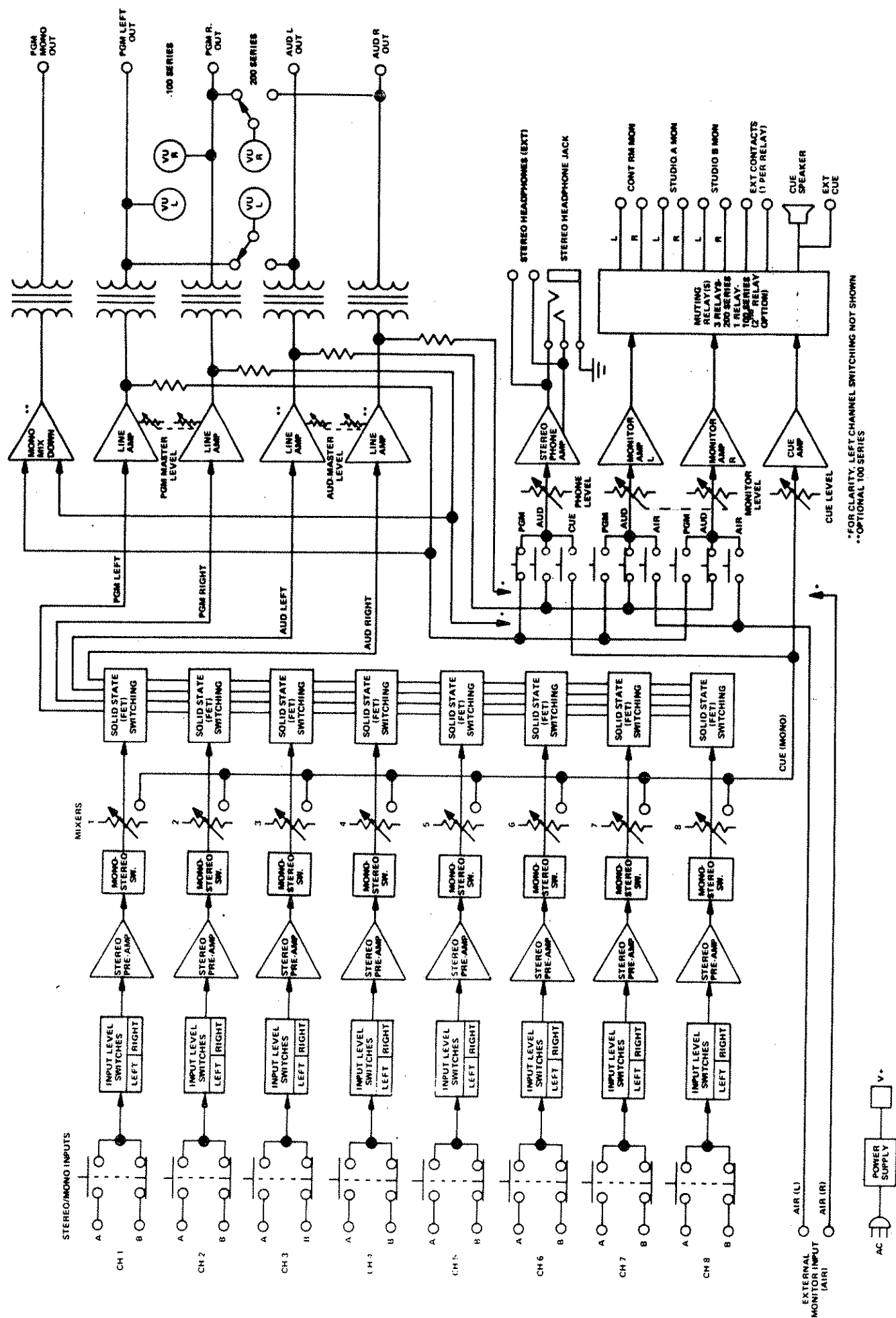


Figure 3. Stereophonic Consoles Block Diagram





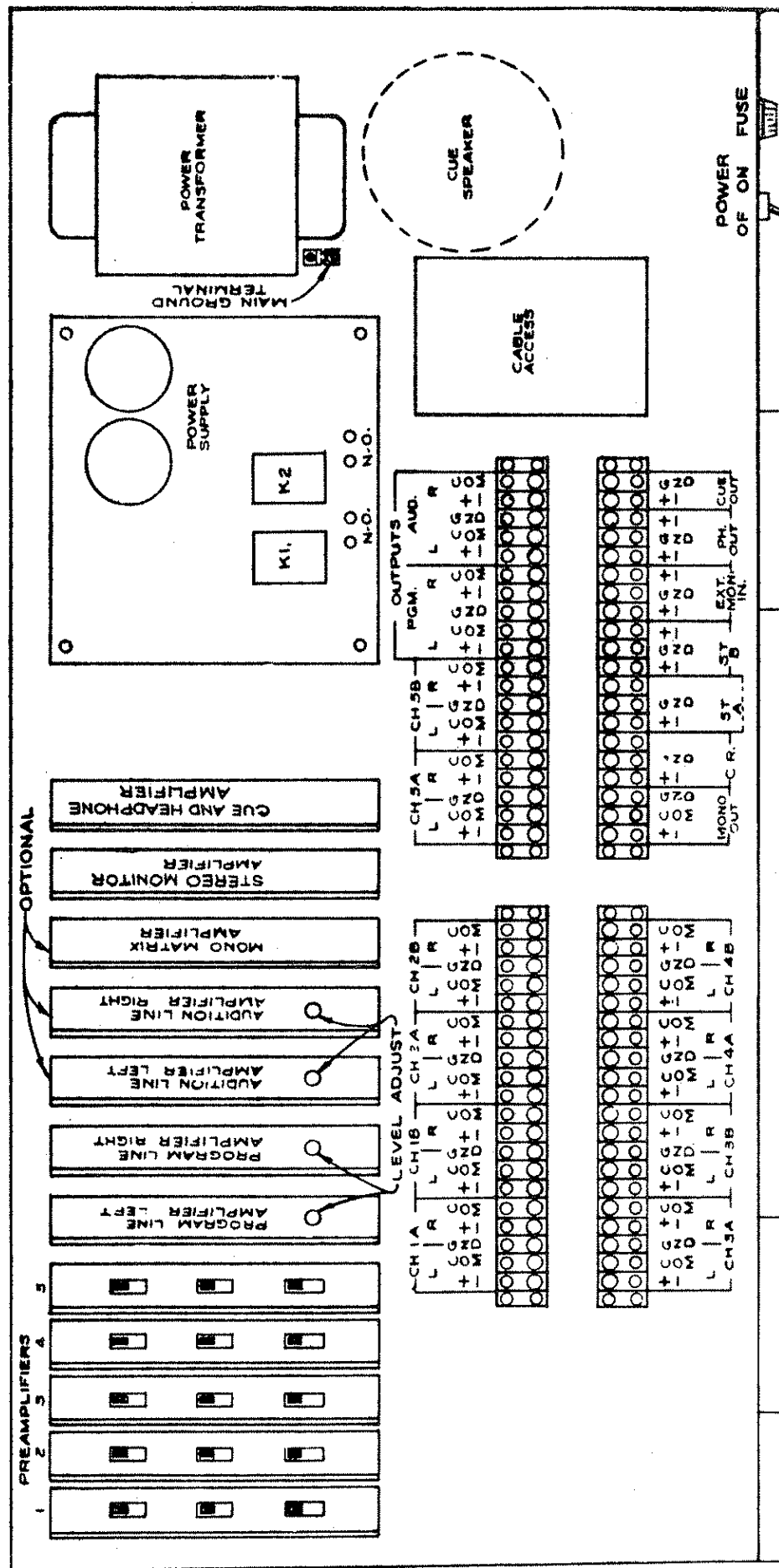
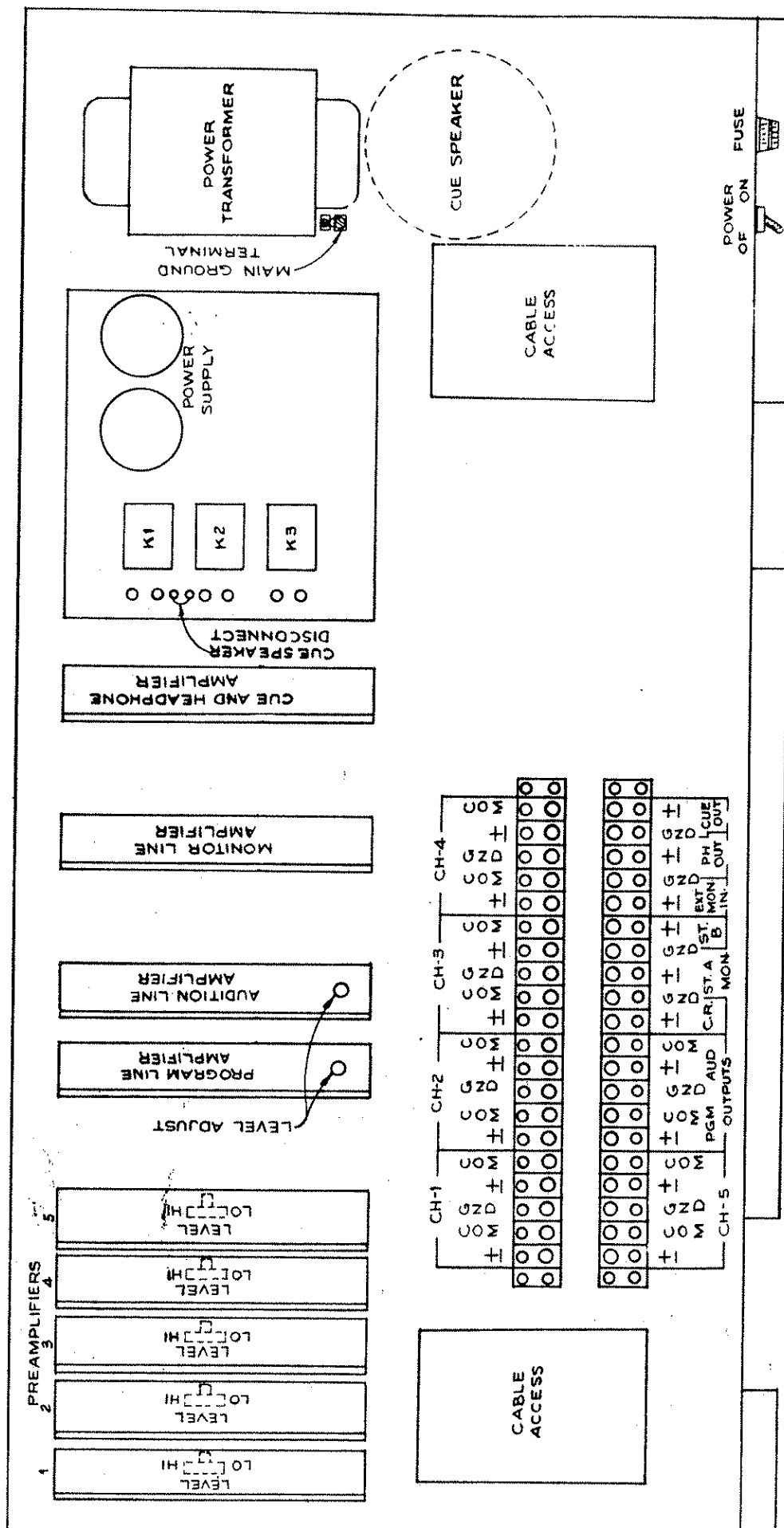


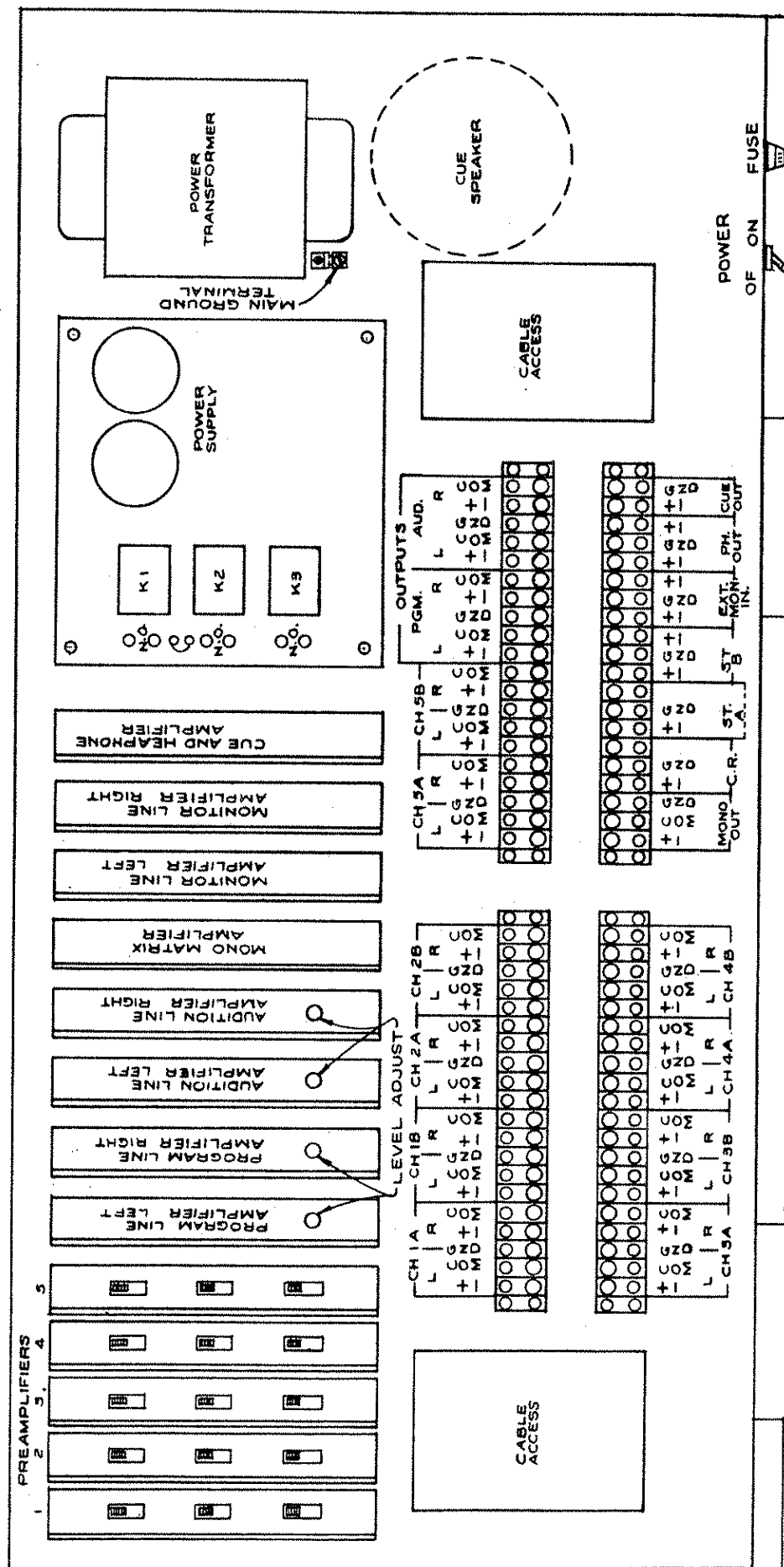
Figure 5. 5BES100 Console Chassis  
B838-0520



NOTE:

1. PRINTED CIRCUIT MODULES INSERT WITH COMPONENTS TO THE RIGHT AS CONSOLES IS VIEWED FROM THE FRONT.

Figure 6. 5BEM200 Console Chassis  
B838-0511

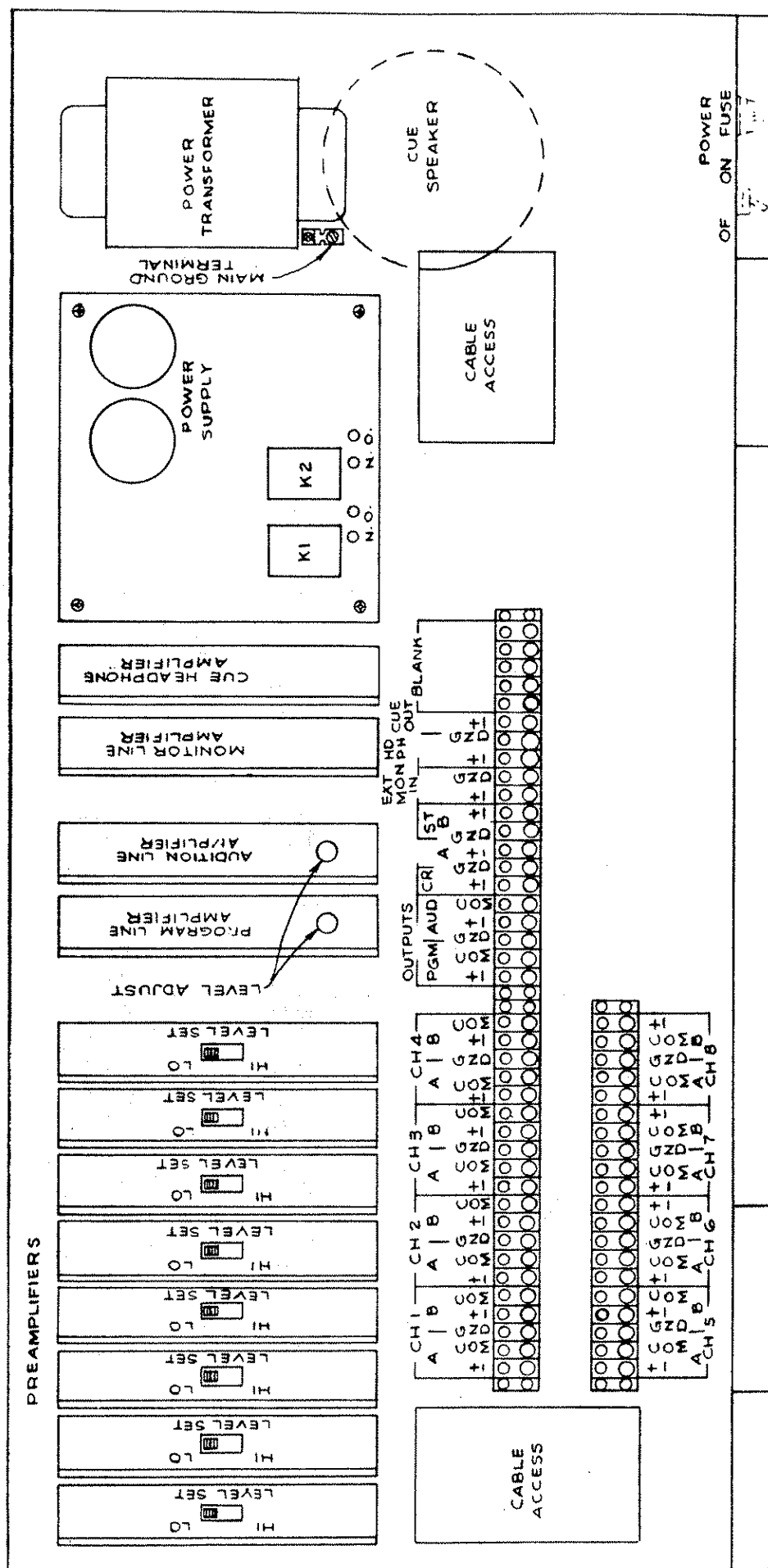


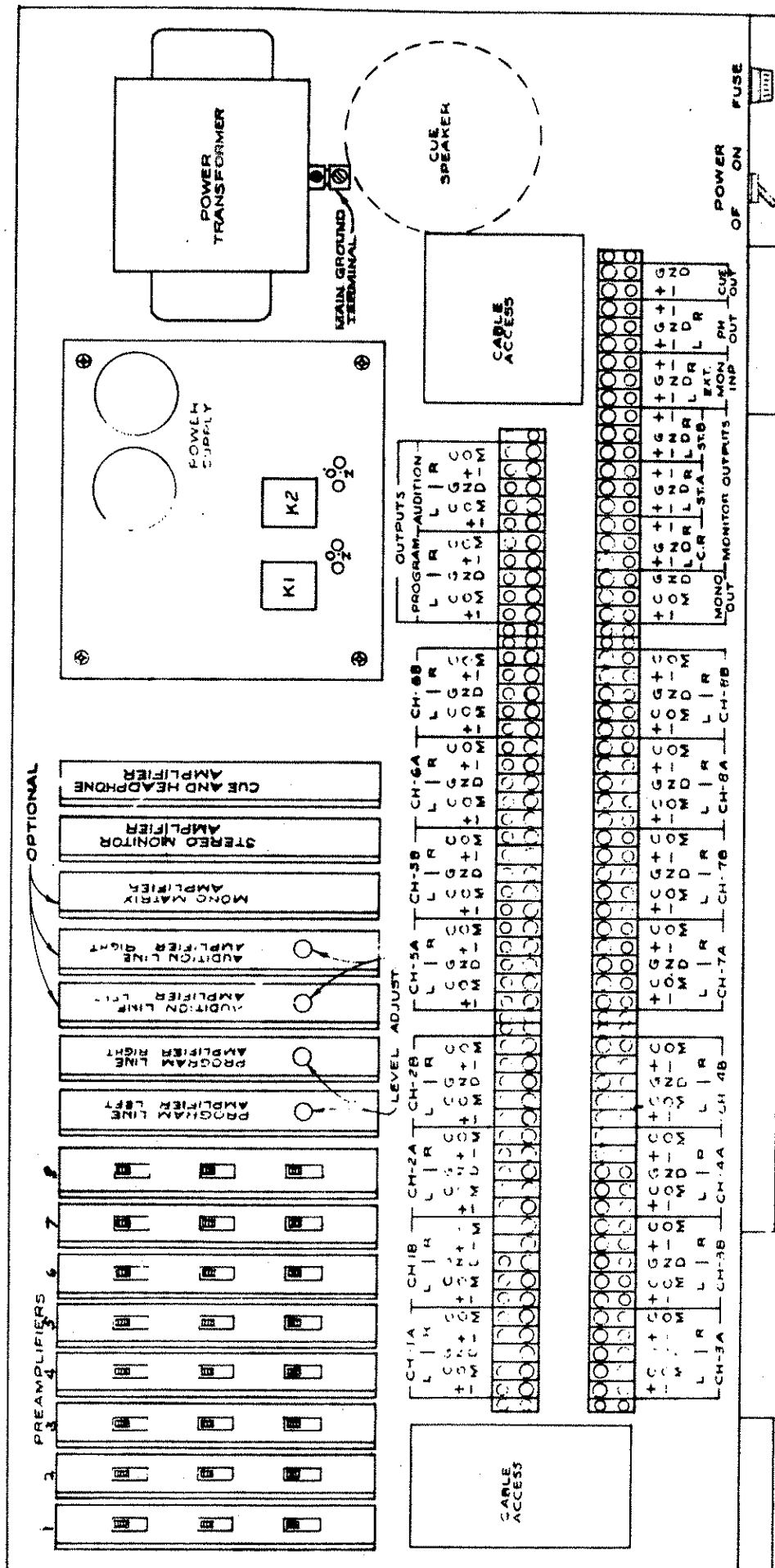
TOP VIEW

NOTE:

1. PRINTED CIRCUIT MODULES INSERT WITH COMPONENTS TO THE RIGHT AS CONSOLE IS VIEWED FROM THE FRONT.

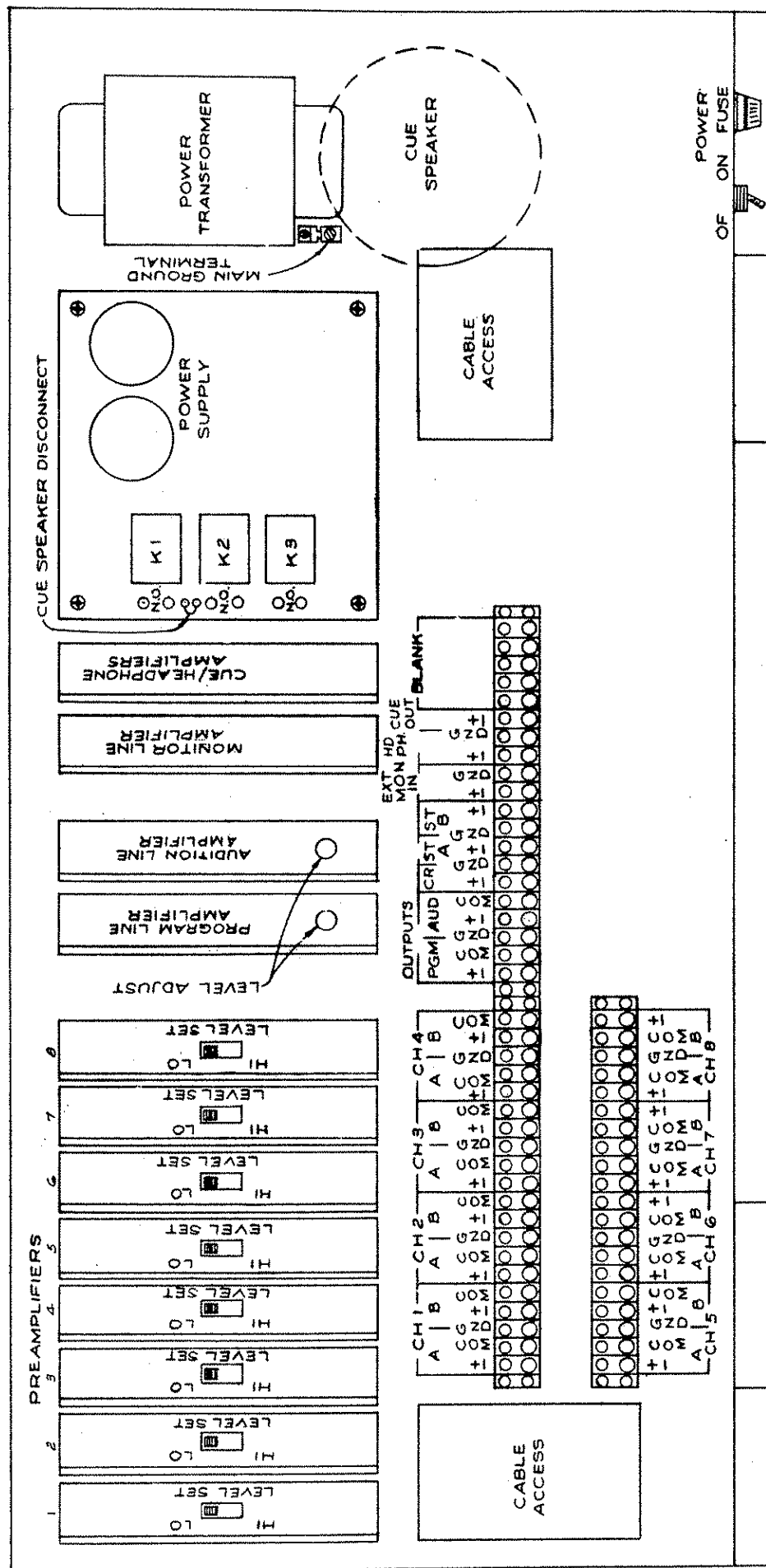
Figure 7. 5BES200 Console Chassis  
B838-0521





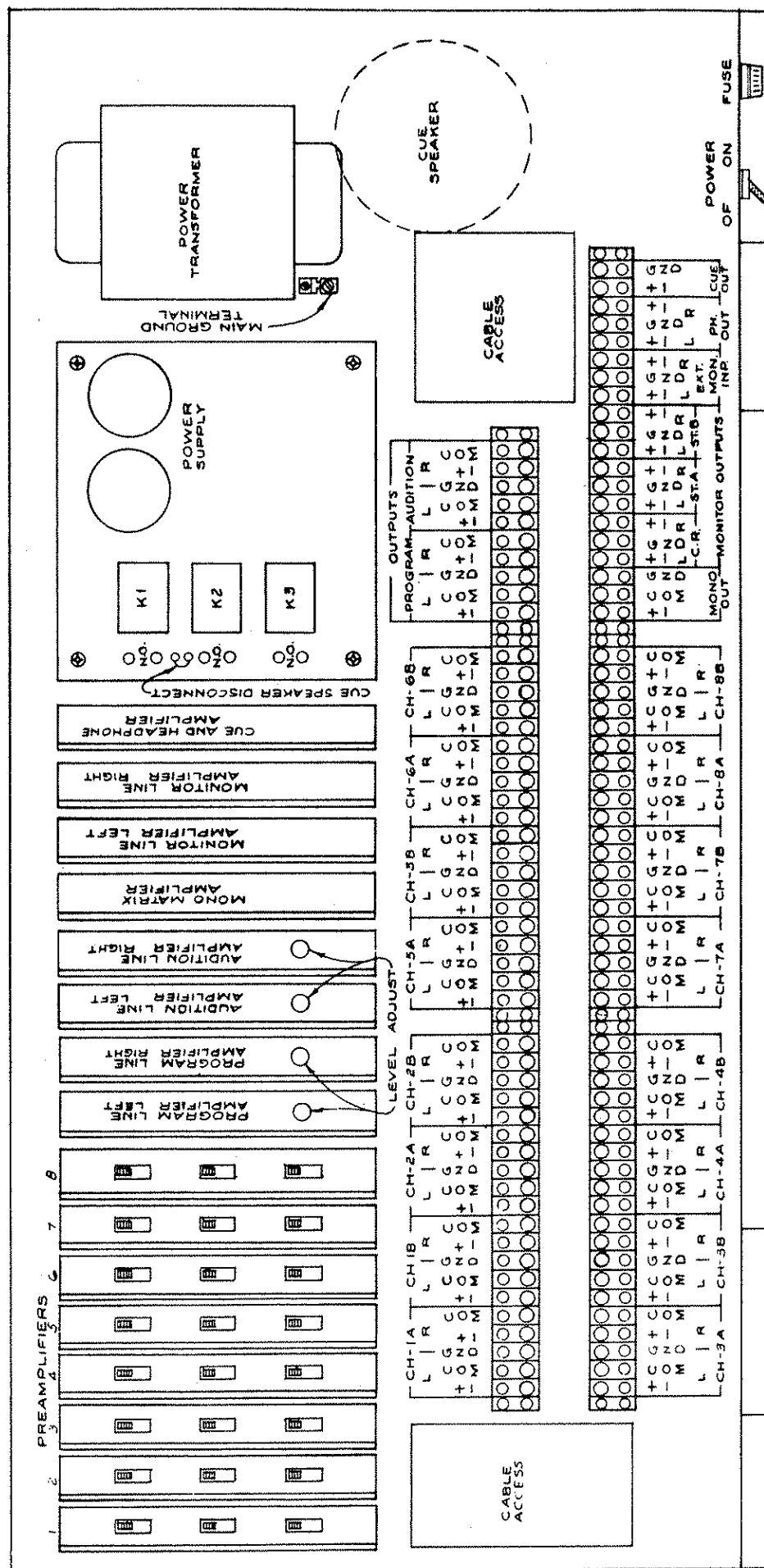
TOP VIEW

Figure 9. 8 BES100 Console Chassis  
B838-0820



NOTE:  
1. PRINTED CIRCUIT MODULES INSERT WITH COMPONENTS TO THE RIGHT AS CONSOLE IS VIEWED FROM THE FRONT.

Figure 10. 8BEM200 Console Chassis  
B838-0811



**Figure 11. 8BES200 Console Chassis  
B838-0821**



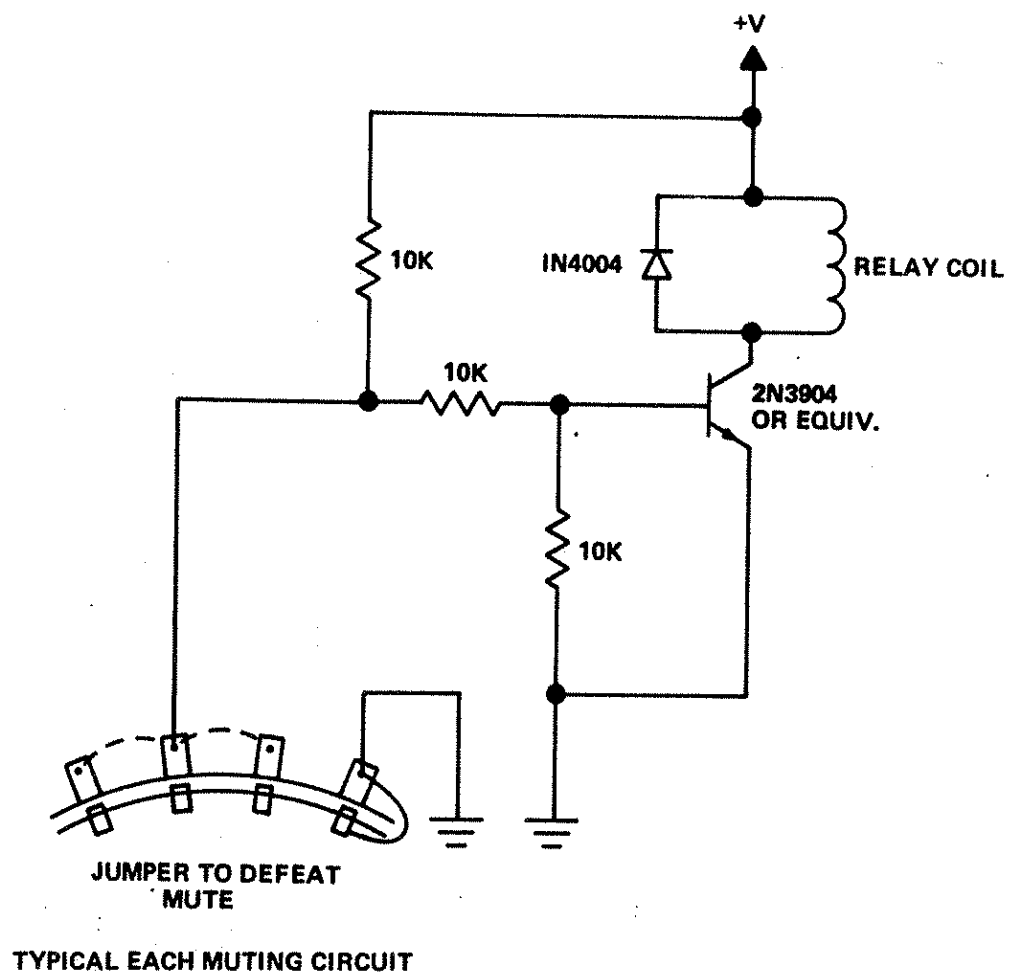


Figure 12. 100 Series Console Muting Diagram

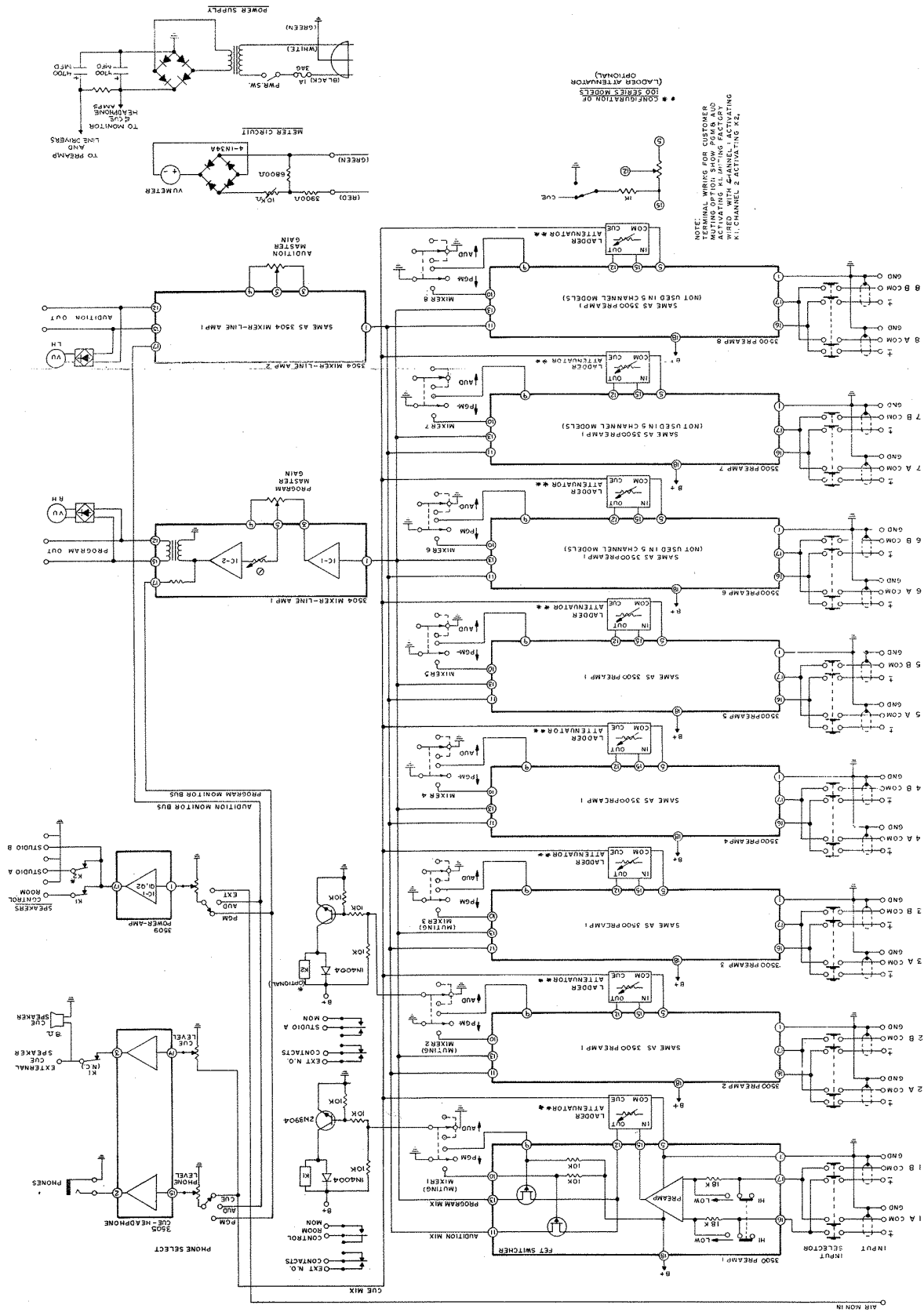


Figure 13. 5BEM100, 8BEM100 Schematic Diagram  
 D838-0510 REV B

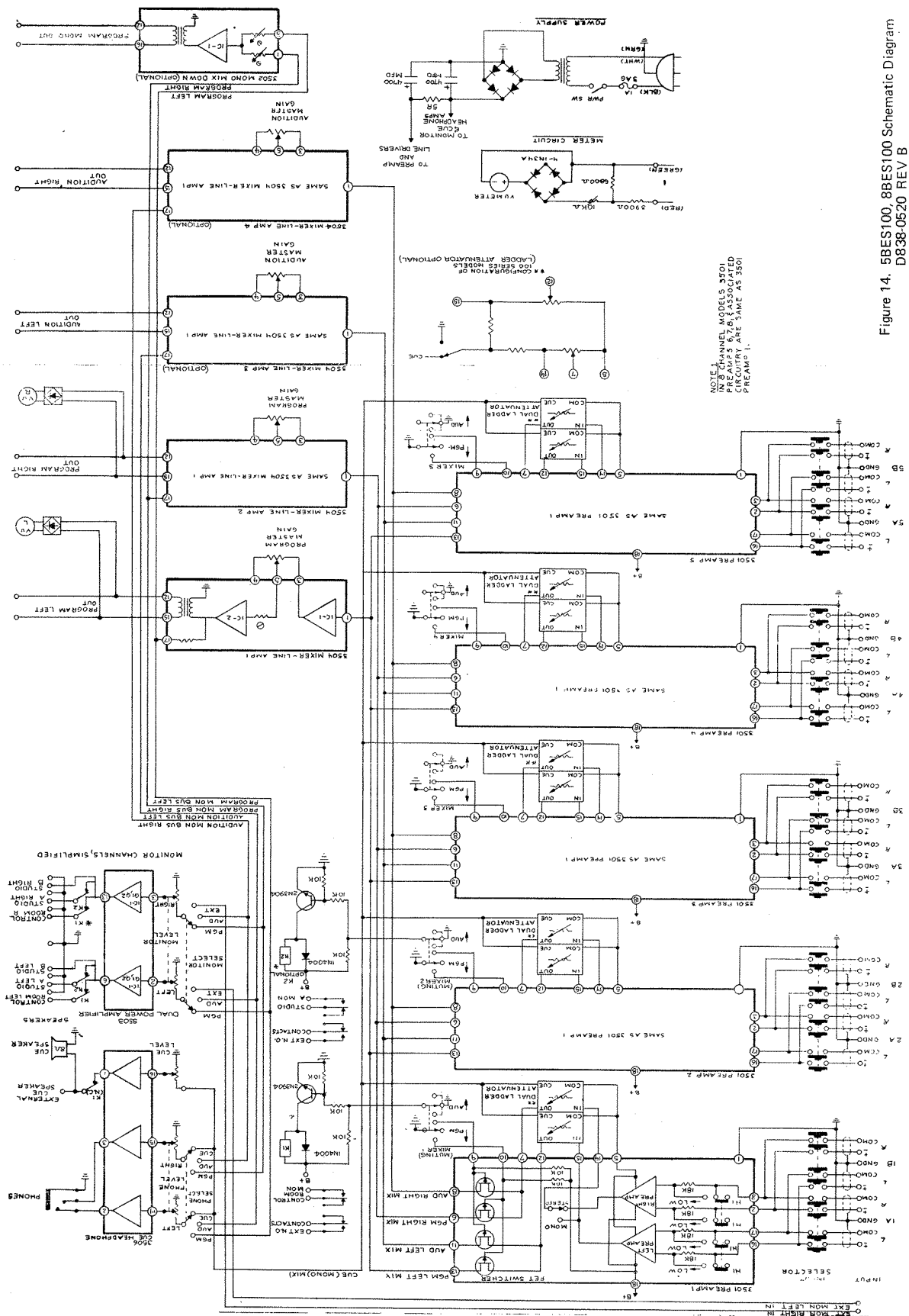


Figure 14. 5BES100, 8BES100 Schematic Diagram  
D838.0520 REV B

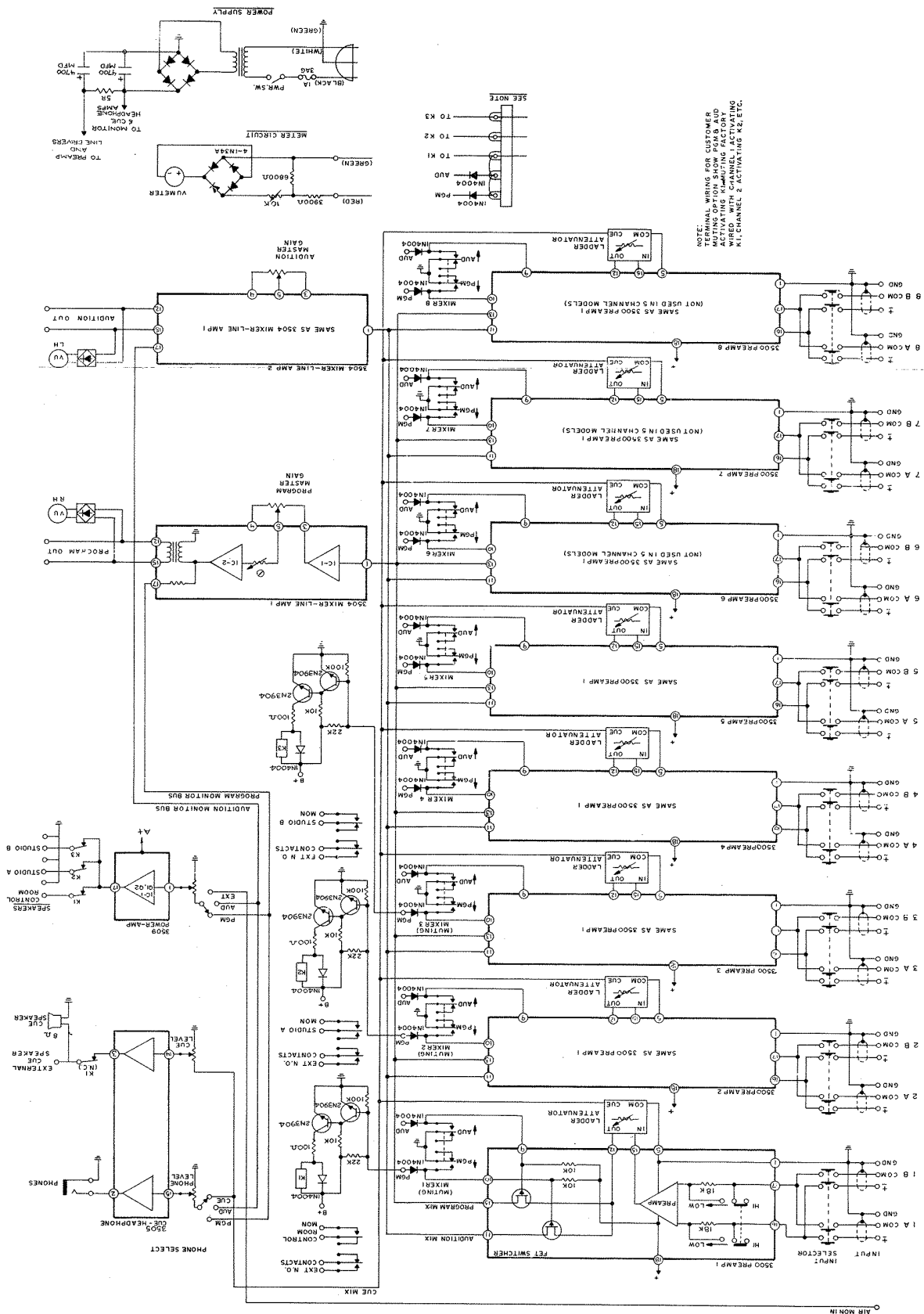
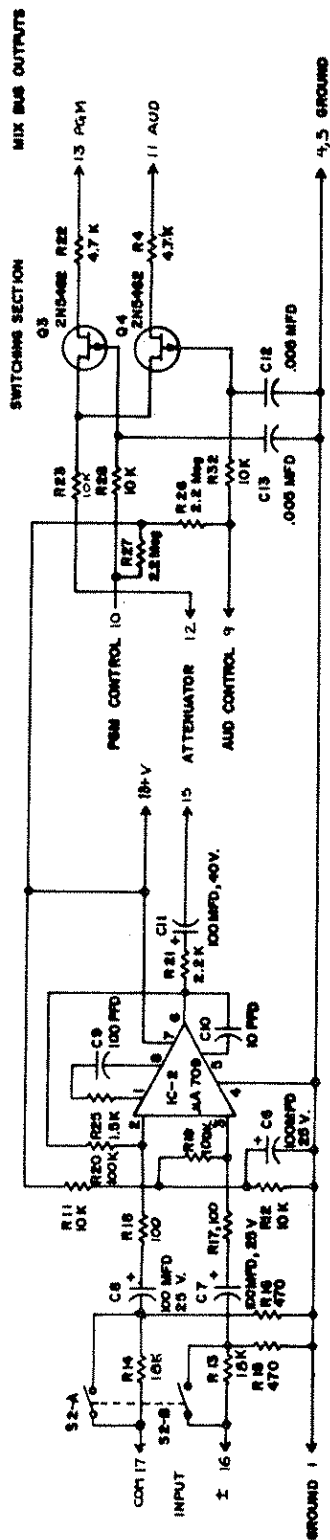


Figure 15. 8BEM200, 8BEM200S Schematic Diagram  
D838-0511 REV B





NOTE:  
1. LAST COMPONENTS USED: IC-2, R22, C25, C26, C27, C28

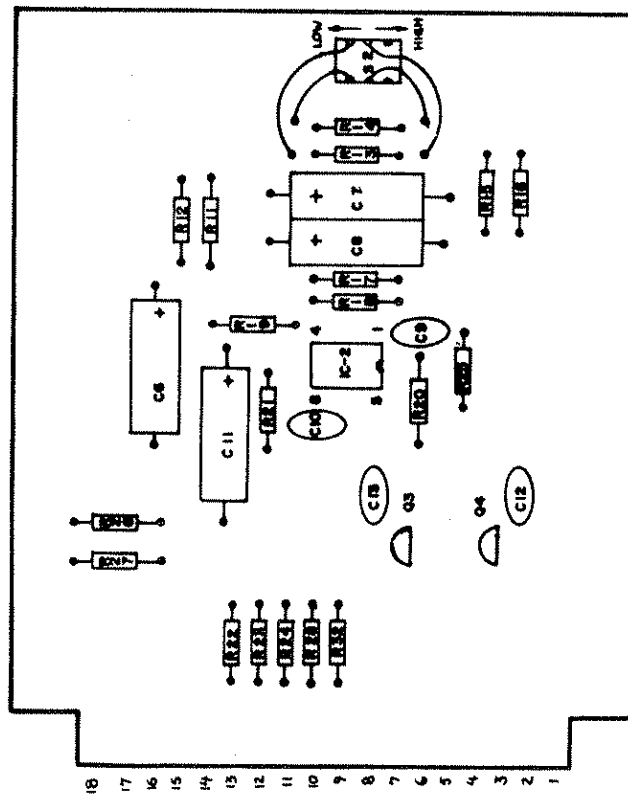
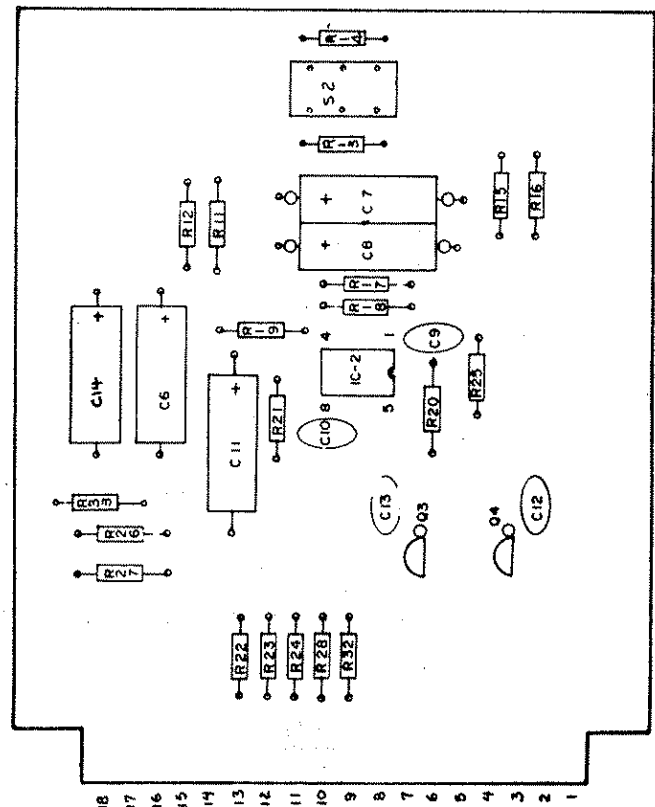
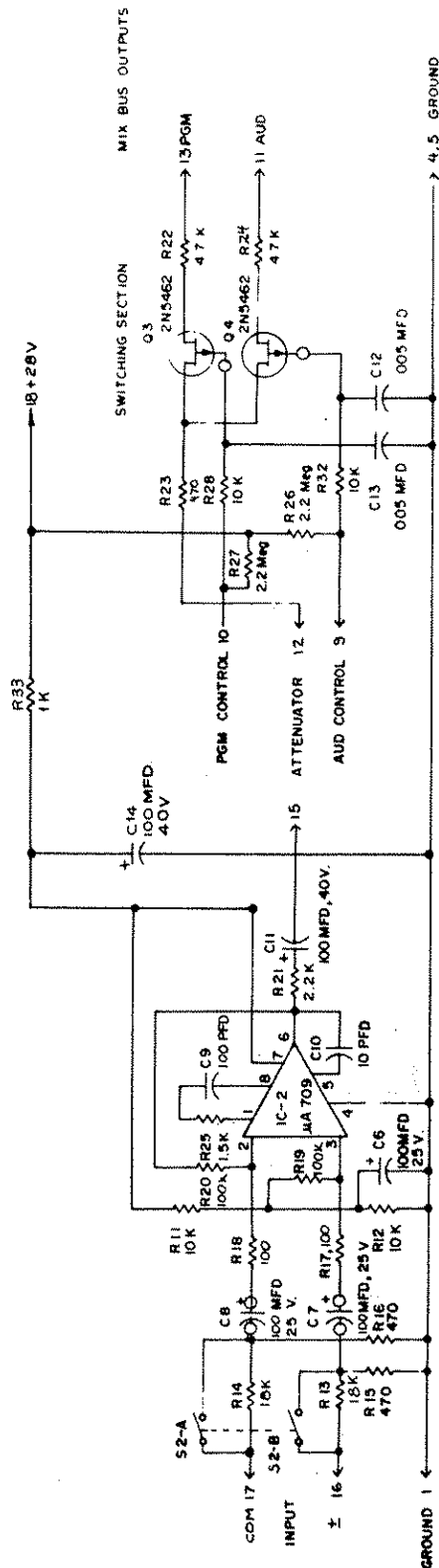


Figure 17. 918-3500 REV A Monophonic Preamplifier Assembly (Prior to 6/74)



NOTE:

1. LAST COMPONENTS USED: IC-2, R33, C14, Q4, S3
2. FERRITE BEADS INSTALLED ON GATE LEADS OF FETS (Q3-Q4) AND ON INPUT CAPACITORS (C7-C8)
3. BEADS SHOWN:

Figure 18. Monophonic Preamplifier Assembly (After 6/74)  
918-3500 REV A (8/774)

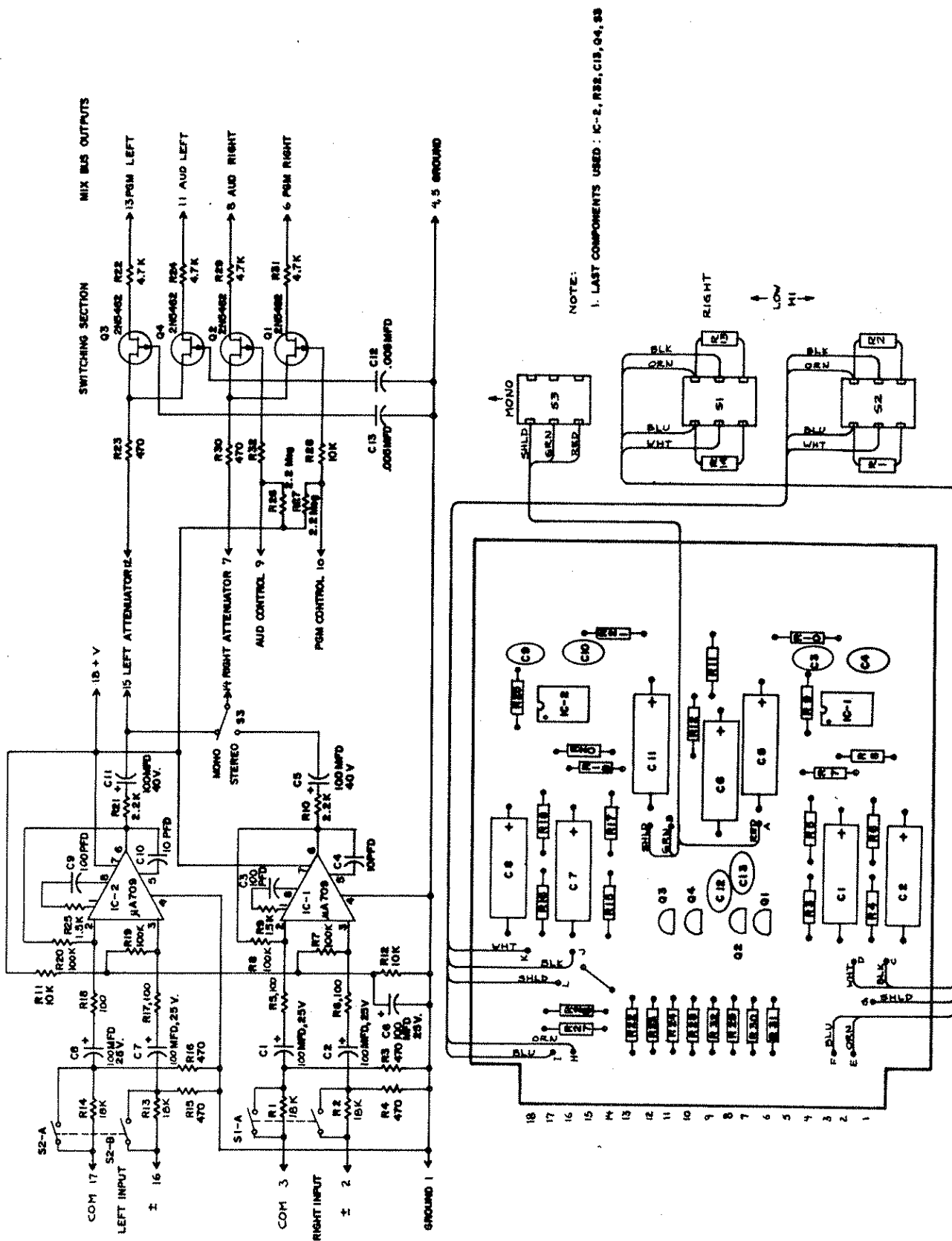
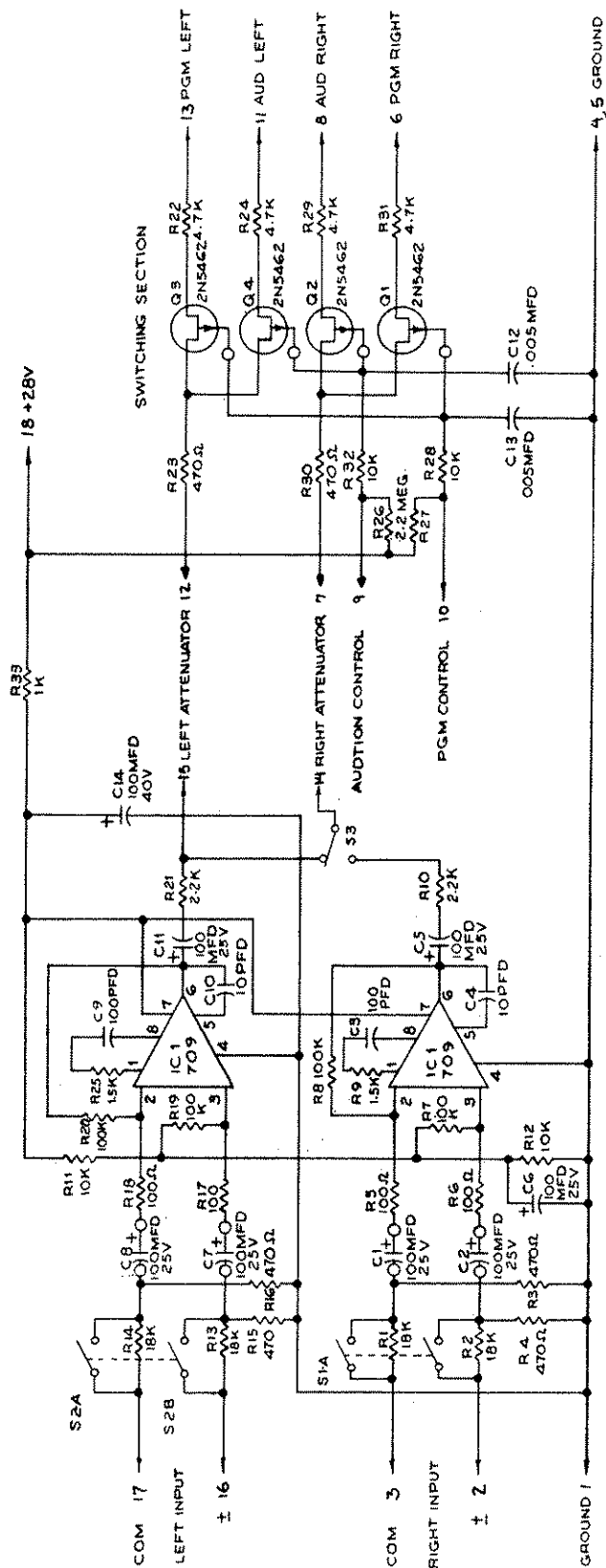


Figure 19. 918-3501 REV A Stereophonic Preamplifier Assembly (Prior to 8/74)





# NOTES:

1. LAST COMPONENTS USED IC-2, R33, C14, Q4 AND S3
2. FERRITE BEADS INSTALLED ON GATE LEADS OF FETs (Q1-Q4) AND ON INPUT CAPACITORS (C1, C2, C7, AND C8).
3. BEADS SHOWN: —○—

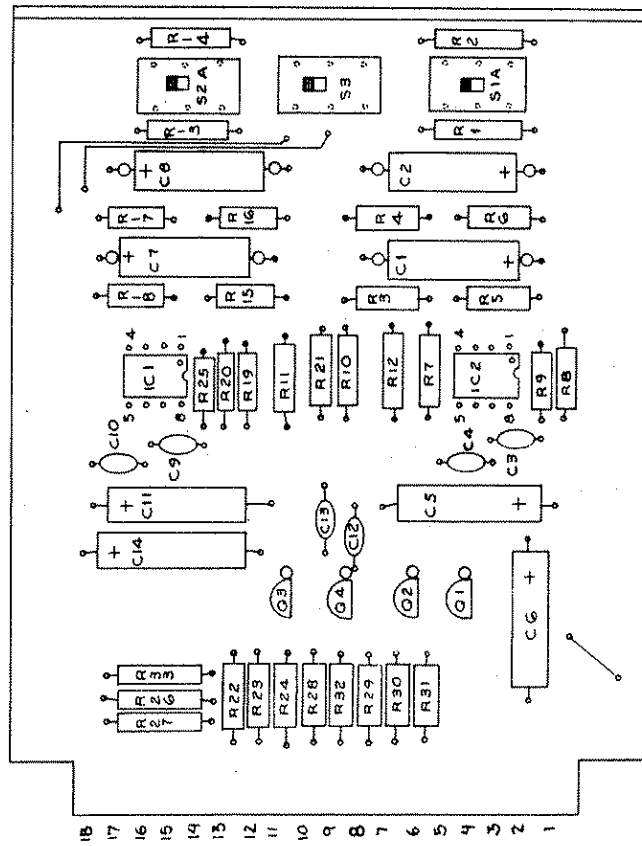
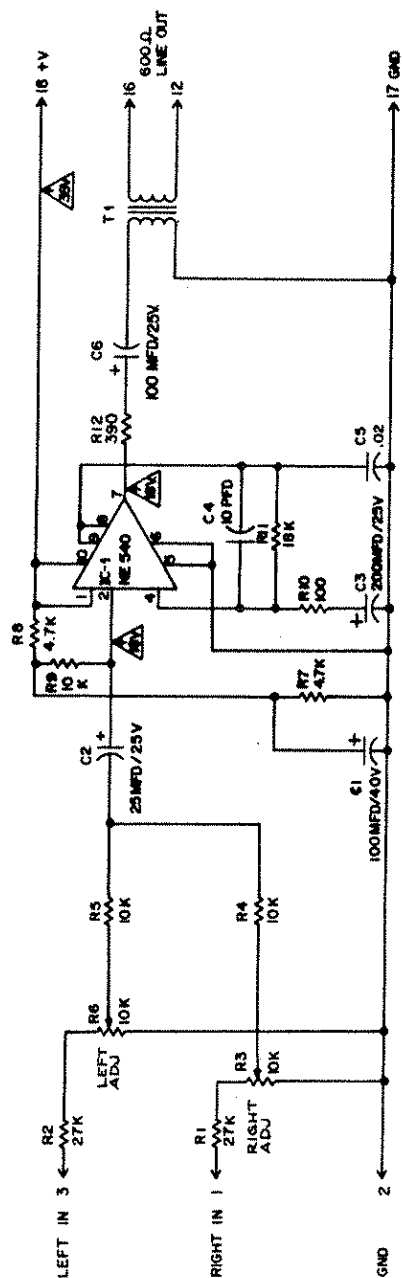


Figure 20. Stereophonic Preamplifier Assembly (After 8/74) 918-3501 REV A



NOTE:  
 1. NE-540 HEAT-SINKED.  
 2. LAST COMPONENTS USED: IC-1, R12, C6, T1.

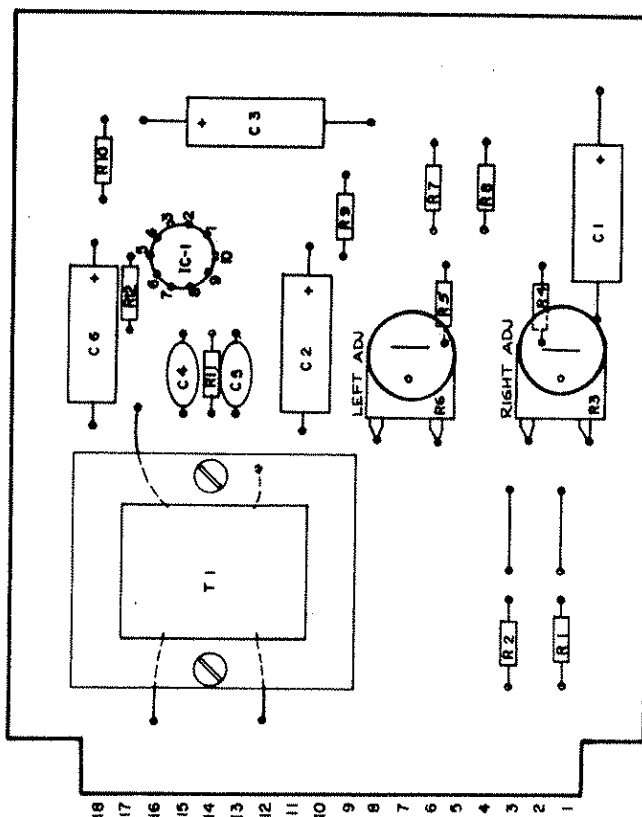
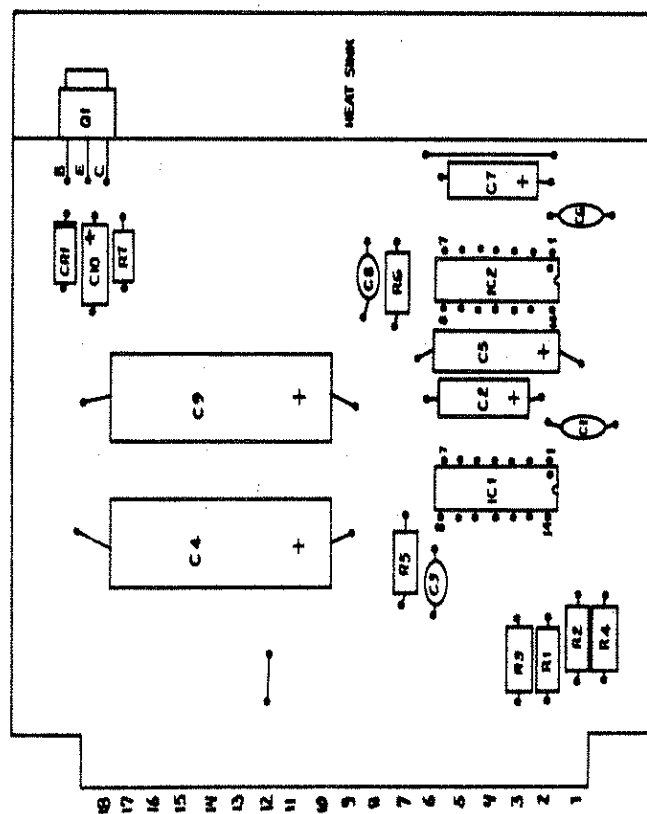


Figure 21. Mono Mixdown Module Assembly 918-3502 REV A



1. LAST COMPONENTS USED: R7, C10  
Q1, IC2
2. Q1 IS HEAT SINKED TO TOP BOARD  
BRACKET USE INSULATING WASHER  
AND SILICON GREASE.

**5-30**

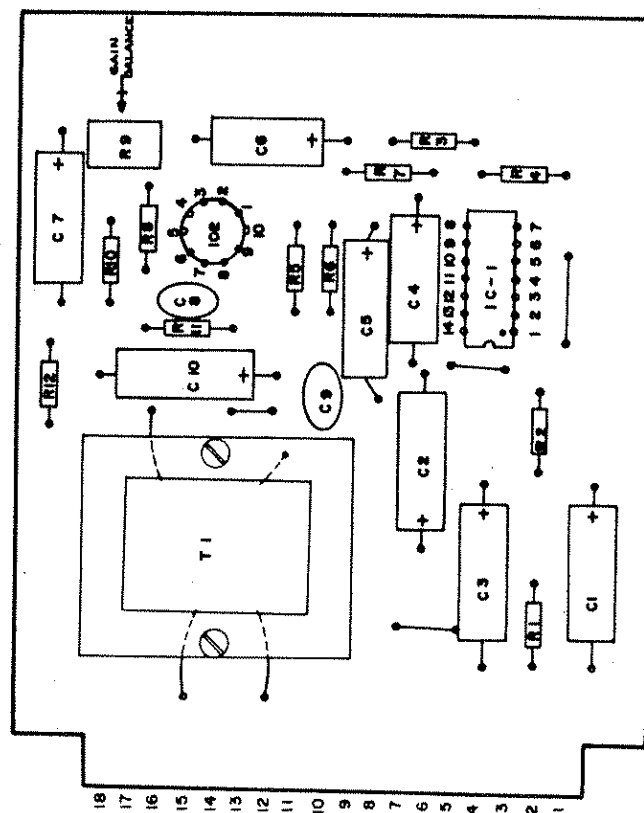
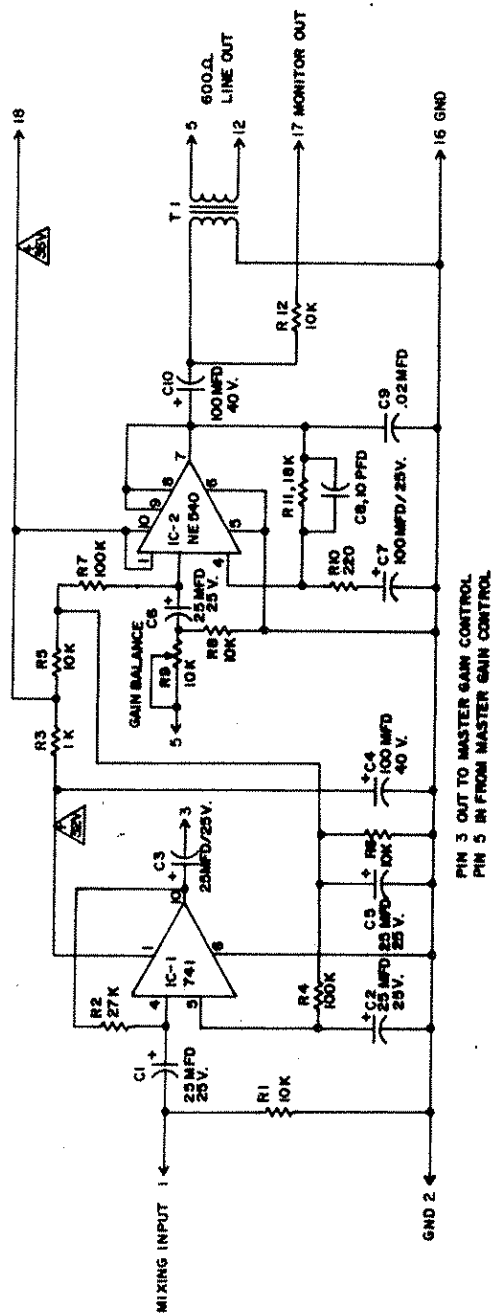
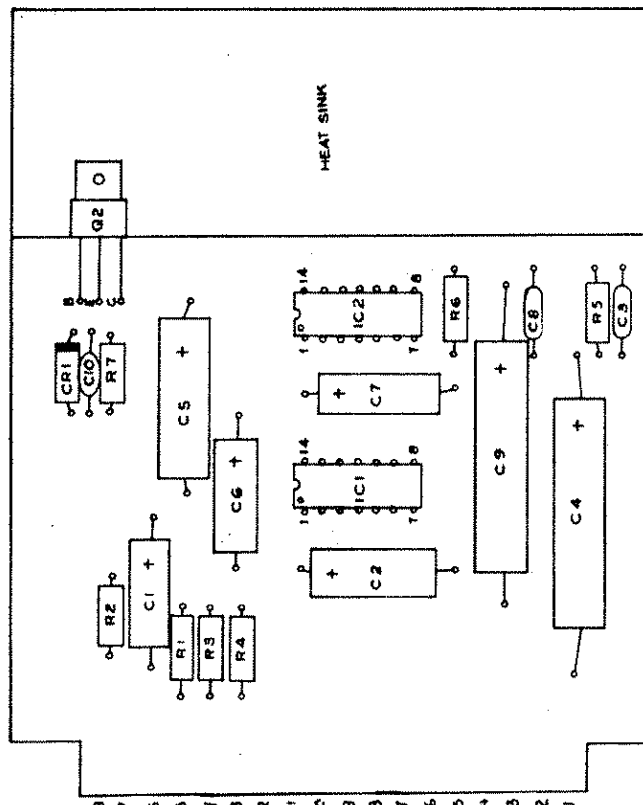
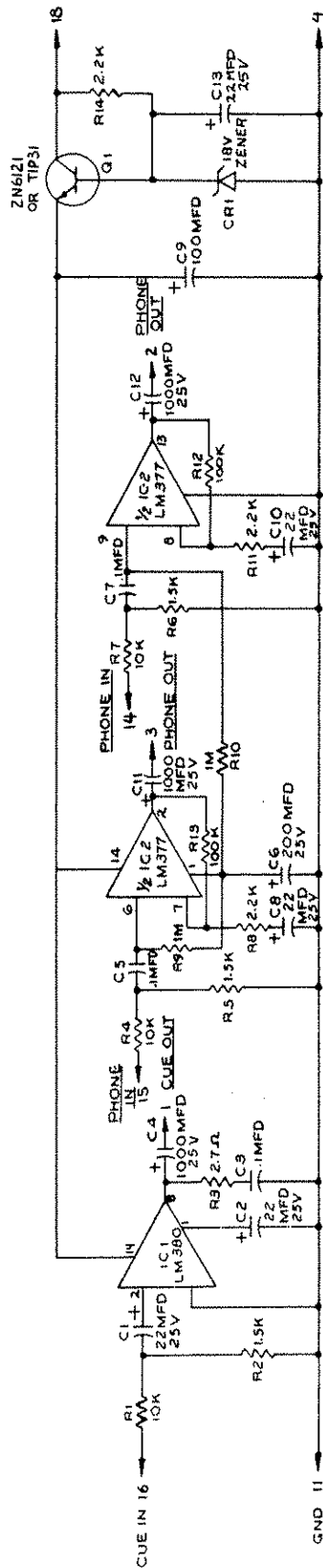


Figure 23. Mixer Line Driver Amplifier Assembly 918-3504 REV A



1. PINS 3, 4, 5, 6, 7, 9, 10, 11, 12 AND 13 SOLDER DIRECTLY TO GROUND FOIL AND ACT AS HEAT SINK. POWER OUTPUT LIMITED TO 1 WATT PER SQ. IN. OF 2 OZ. COPPER ON 1/16 IN. EPOXY BOARD, AT 25°C.
2. Q1 = 2N6121 OR TIP-31A, IS HEAT SUNKED TO TOP BOARD BRACKET. USE INSULATING WASHER AND SILTONE GREASE.
3. LAST COMPONENTS USED: IC2, C10, R7, Q1 & CRI

5-32



- NOTES:
1. PINS 3, 4, 5, 10, 11 AND 12 SOLDER DIRECTLY TO GROUND FOIL AND ACT AS HEAT SINK. POWER OUTPUT LIMITED TO 1 WATT PER SQ. IN. OF 2 OZ. COPPER ON 1/16 IN. EPOXY BOARD AT 25°C.
  2. Q1=2N6121 OR TIP-31A, IS HEAT SINKED TO TOP BOARD BRACKET. USE INSULATING WASHER AND SILICONE GREASE.
  3. LAST COMPONENTS USED: IC1, C10, R7, Q1 AND CR1.

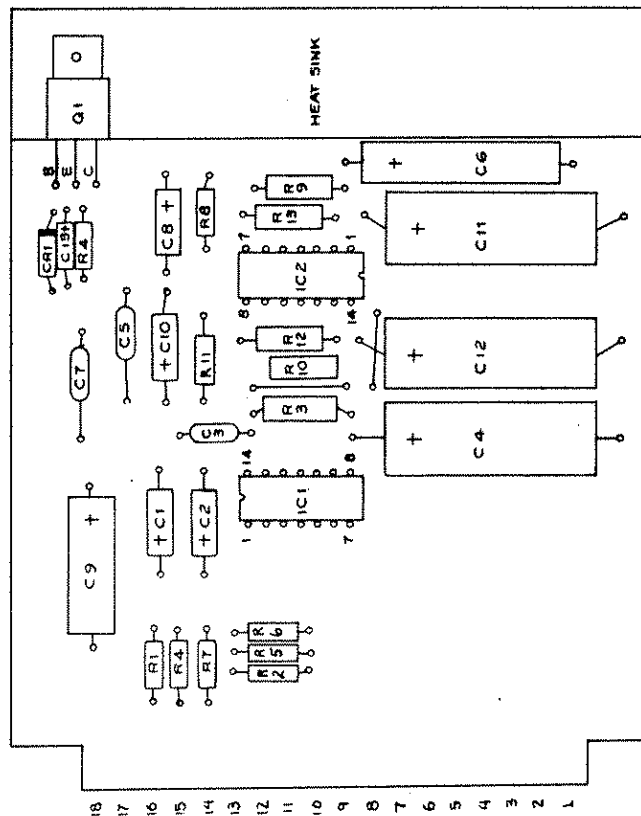
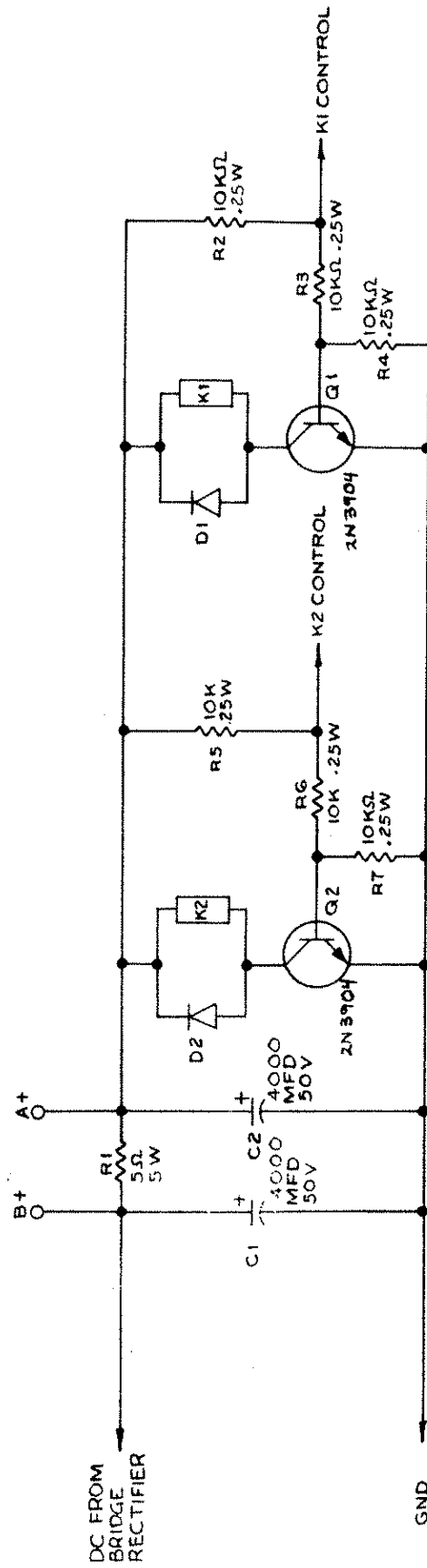
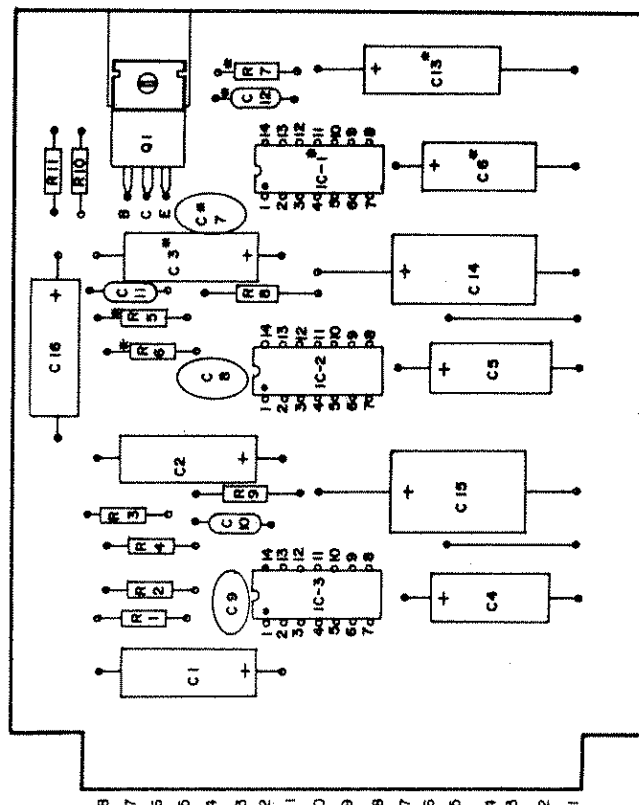


Figure 25. Stereophonic Cue/Headphone Amplifier Assembly 918-3506 REV A



- NOTE:
1. ALL DIODES = 1N4004
  2. B+ TO ALL POWER AMPLIFIERS AND LAMPS
  3. A+ TO ALL PREAMPS AND DRIVER AMPS

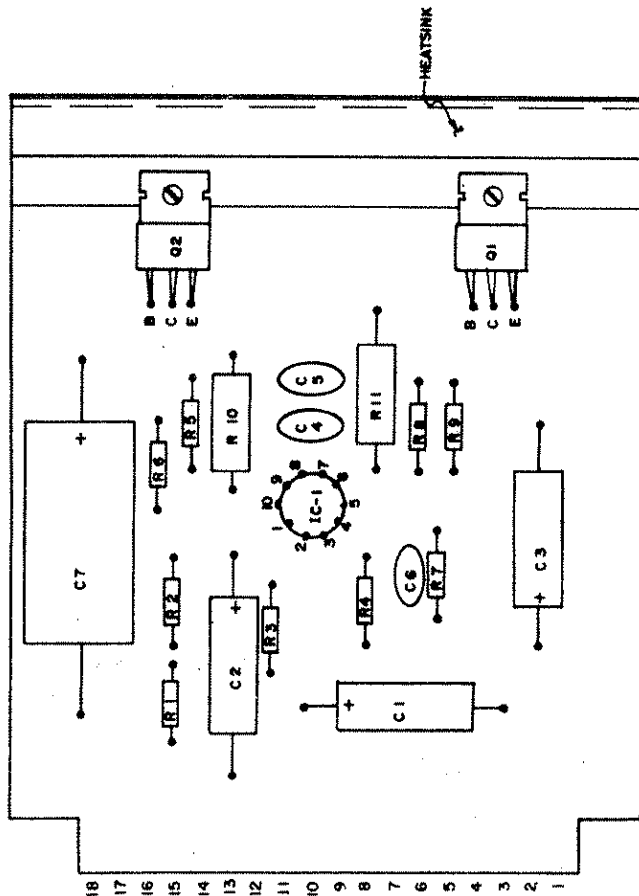
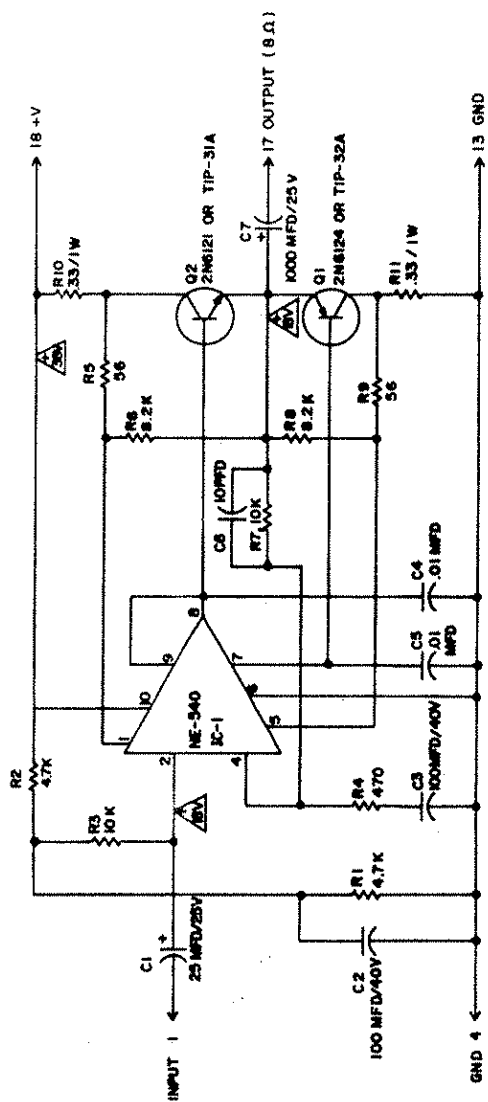
Figure 26. Power Supply Assembly 918-3507 REV B



\* NOT USED IN MONO CONSOLES. IC-3 (PIN 5 IN, PIN 16 OUT) BECOMES CUE AMP. IC-2 (PIN 4 IN, PIN 17 OUT) REMAINS HEADPHONE AMP.

5-35

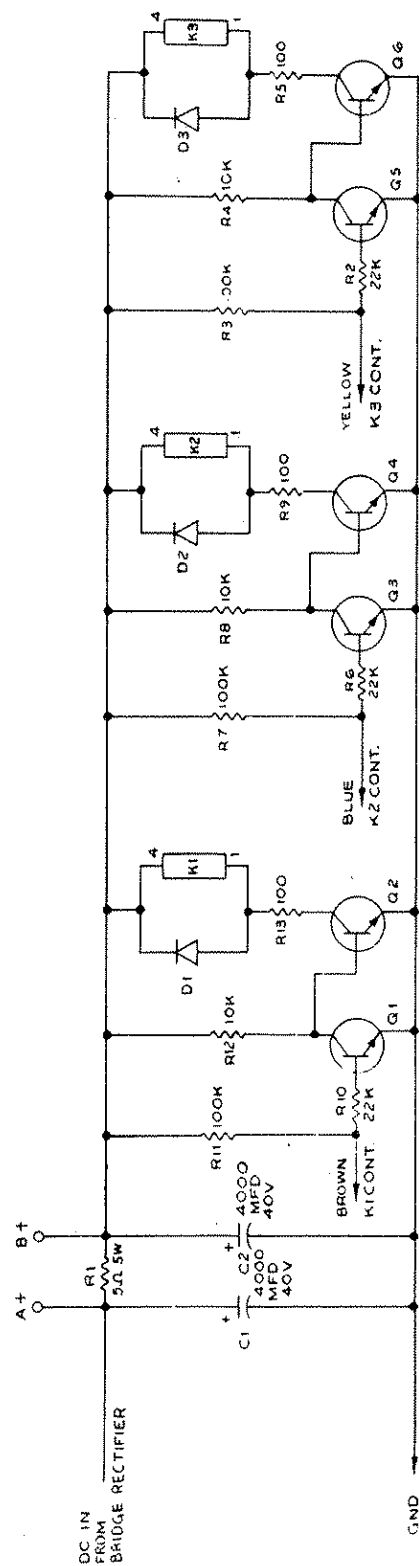




# NOTES:

1. NE-540 HAS CLIP-ON HEAT SINK.
2. OUT TRANSISTORS HEAT-SINKED BY CARD TOP BRACKET WITH REINFORCING BAR. USE INSULATING WASHERS AND SILICONE GREASE.
3. LAST COMPONENT USED: IC-1, C7, R11, Q2

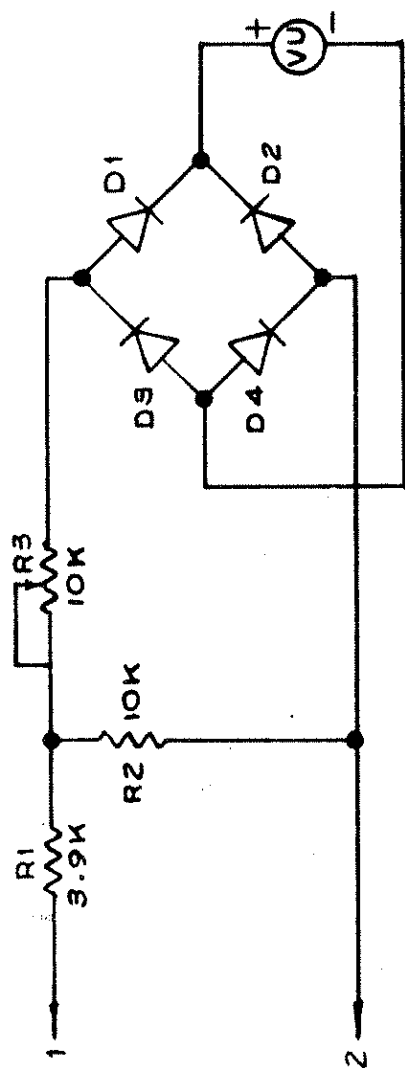
Figure 28. Monitor (Power) Amplifier Assembly 918-3509 REV A



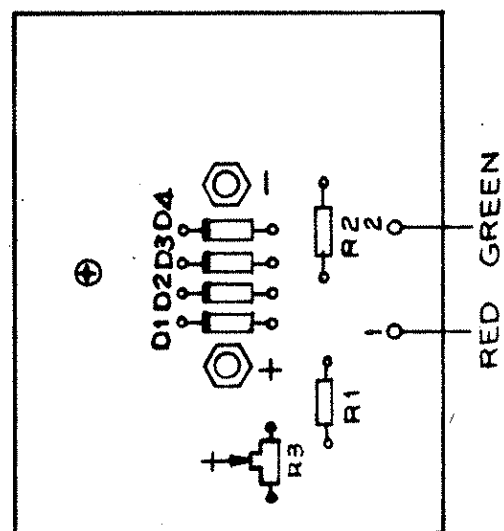
NOTE:

1. ALL DIODES IN4004
2. ALL TRANSISTORS 2N3904
3. ALL RELAYS 700.G/28V 4PDT
4. A+ TO ALL POWER AMPLIFIERS AND LAMPS
5. B+ TO ALL PREAMPS AND DRIVER AMPS

Figure 29. Power Supply Assembly 918-4001 REV B



NOTE:  
1. ALL DIODES IN98 OR EQUIVALENT



BROADCAST ELECTRONICS, INC. A FILMWAYS COMPANY
METER RECTIFIER CARD VU-1
A DWG.NO.: A-918-0001

Figure 30. VU-1 VU Meter Rectifier Assembly 918-0001

## PRODUCT WARRANTY

LIMITED ONE YEAR

While this warranty gives you specific legal rights, which terminate one (1) year (6 months on turntable motors) from the date of shipment, you may also have other rights which vary from state to state.

Broadcast Electronics, Inc. ("BE"), 4100 North 24th Street, P. O. Box 3606, Quincy, Illinois 62305, hereby warrants cartridge machines, consoles, transmitters and other new Equipment manufactured by BE against any defects in material or workmanship at the time of delivery thereof, that develop under normal use within a period of one (1) year (6 months for turntable motors) from the date of shipment. Other manufacturers' Equipment, if any, shall carry only such manufacturers' standard warranty. This warranty extends to the original user and any subsequent purchaser during the warranty period. BE's sole responsibility with respect to any Equipment or parts not conforming to this warranty is to replace such equipment or parts upon the return thereof F.O.B. BE's factory or authorized repair depot within the period aforesaid.

In the event of replacement pursuant to the foregoing warranty, only the unexpired portion of the warranty from the time of the original purchase will remain in effect for any such replacement. However, the warranty period will be extended for the length of time that the original user is without the services of the Equipment due to its being serviced pursuant to this warranty. The terms of the foregoing warranty shall be null and void if the Equipment has been altered or repaired without specific written authorization of BE, or if Equipment is operated under environmental conditions or circumstances other than those specifically described in BE's product literature or instruction manual which accompany the Equipment purchased. BE shall not be liable for any expense of any nature whatsoever incurred by the original user without prior written consent of BE.

BE shall not be liable to the original user for any and all incidental or consequential damages for breach of either expressed or implied warranties. However, some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you. All express and implied warranties shall terminate at the conclusion of the period set forth herein.

Except as set forth herein, and except as to title, there are no warranties, or any affirmations of fact or promises by BE, with reference to the Equipment, or to merchantability, fitness for a particular application, signal coverage, infringement, or otherwise, which extend beyond the description of the Equipment in BE's product literature or instruction manual which accompany the Equipment. Any card which is enclosed with the Equipment will be used by BE for survey purposes only.

**BROADCAST ELECTRONICS, INC.**  
4100 North 24th Street, P. O. Box 3606, Quincy, Illinois 62305

