

DATATAPE[®]

***13-540A RECORD HEAD
DRIVER AMPLIFIER***

***13-505-4 RECORD HEAD
DRIVER AMPLIFIER HOUSING***

OPERATION AND MAINTENANCE MANUAL

INSTRUMENTS DIVISION

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 **BELL & HOWELL**

This manual describes the operation and maintenance procedures for the Type 13-540A Record Head Driver Amplifier, with serial numbers 3001 through 4999, and the associated Type 13-505-4 Record Head Driver Amplifier Housing.

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SECTION I
GENERAL DESCRIPTION

1-1. GENERAL.

1-2. This manual describes the 13-540A Record Head Driver Amplifier modules and the 13-505-4 Record Head Driver Amplifier Housing.

1-3. EQUIPMENT DESCRIPTION.

1-4. 13-540A RECORD HEAD DRIVER AMPLIFIER. The function of the record head driver is to combine the data signal from the record amplifier with the bias from the bias buffer amplifier and feed the combined signal to the record head. Four identical amplifier circuits are contained on one circuit board. Thus, in a 14-channel system, four circuit boards are used which results in 16 available channels. Fourteen of the channels are normally used for data; the remaining two are available for voice annotation and are designated Voice A and Voice B. Channel designations are shown in Section II, figure 2-2. All power and control connections and monitor and signal output connections to the record heads are made via the module connector when the module is installed in the amplifier housing. The signal inputs from the record amplifiers are made at individual BNC connectors on the end of the module. These are accessible when the module is installed (see figure 1-1).

1-5. 13-505-4 RECORD HEAD DRIVER AMPLIFIER HOUSING. The amplifier housing is mounted above and to the right of the capstan motor on the rear of the transport baseplate. It is designed to hold four 13-540A Record Head Driver Amplifier modules and one 13-544-2 Bias Buffer and Reference Amplifier module. The module connectors, J1 through J5, are mounted on the rear of and inside the housing, and provide power and signal distribution for the plug-in modules. The first four positions are for the record head driver amplifier modules; the fifth is for the bias buffer and reference amplifier. The cable from the rear of the housing connects the output signals to the record heads; its connector is designated J6. Connector J7, on the lower right corner of the housing, is for connection to a monitor system. This makes it possible to monitor both the bias signal, at the output of the bias buffer amplifier, and the composite record signal, at the output of the record head driver amplifier. The location of the amplifier housing is shown in figure 1-1.

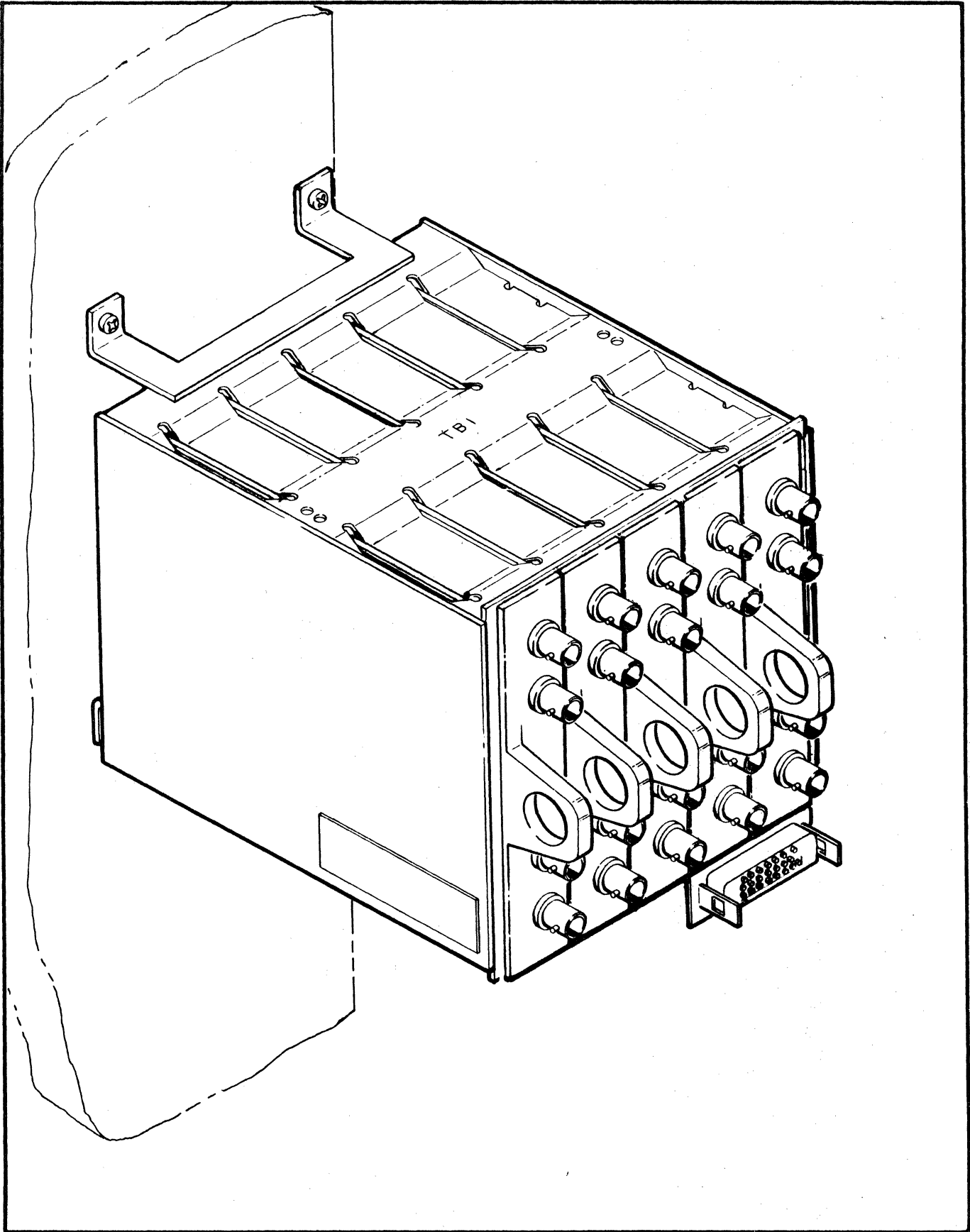


Figure 1-1. 13-505-4 Record Head Driver Amplifier Housing with 13-540A Record Head Driver Amplifier and 13-544-2 Bias Buffer and Reference Amplifier Installed

SECTION II

INSTALLATION

2-1. GENERAL.

2-2. The 13-505-4 Housing with all wiring and cabling completed is normally mounted on the tape transport at the factory.

2-3. INSTALLATION OF AMPLIFIER MODULES.

2-4. Up to four record head driver amplifier modules can be installed in each 13-505-4 Housing. Each module plugs into the appropriate housing connector, J1 through J4, located in the back of the housing. The modules slide in place using guide slots in the top and bottom of the housing and mount in the vertical position. The last slot on the right side of the housing is the mounting location for the 13-544-2 Bias Buffer and Reference Amplifier module. Figure 2-1 shows an inside view of the housing with location of housing connectors.

2-5. ELECTRICAL CONNECTIONS.

2-6. On the 13-540A Record Head Driver Amplifier, all electrical connections except the data inputs are made when the module is installed in the housing and the housing is connected to the remainder of the system. The data signal inputs should be connected according to the channel designations shown in figure 2-2.

2-7. Check the position of the bias trap jumpers on the circuit board. The jumpers should normally be installed from terminals EA to EC. However, when the 13-540A is used in FM channels at 120 inches per second with IRIG Wideband Group II or Bell & Howell Wideband Group III electronics, the jumper connections must be from terminals EA to EB.

2-8. The 13-505-4 Housing is cabled as shown in the housing wiring diagram, figure 7-2. Terminal board TB1 carries all the power and bias control connections from the transport and record amplifier mounting assembly. Connectors J1 through J5 are the module connectors for the record head driver amplifiers and the bias buffer and reference amplifier. Connector J6 carries the signals from the head drivers to the record heads. Connector J7 is the monitor connector.

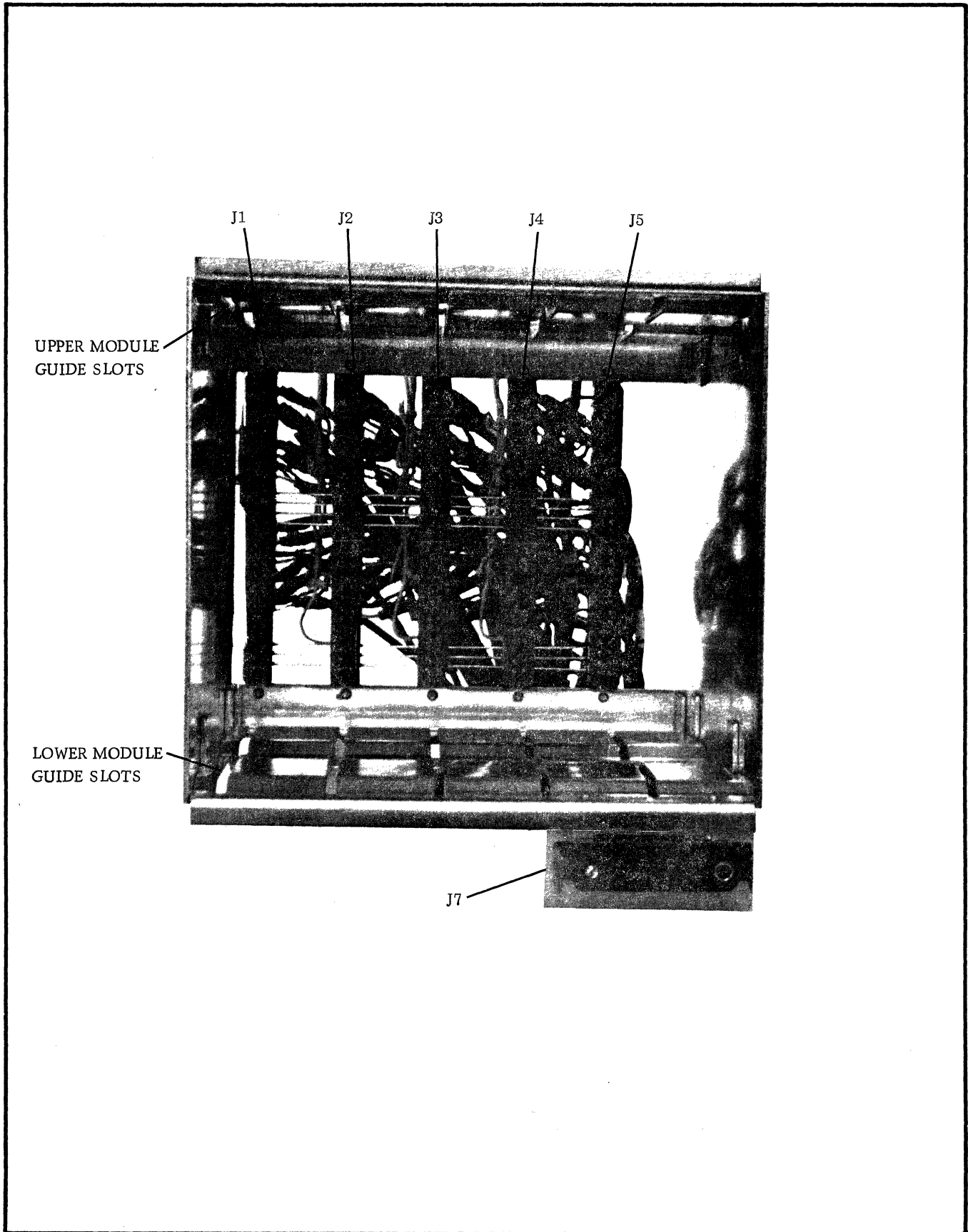


Figure 2-1. Interior View, 13-505-4 Record Head Driver Amplifier Housing

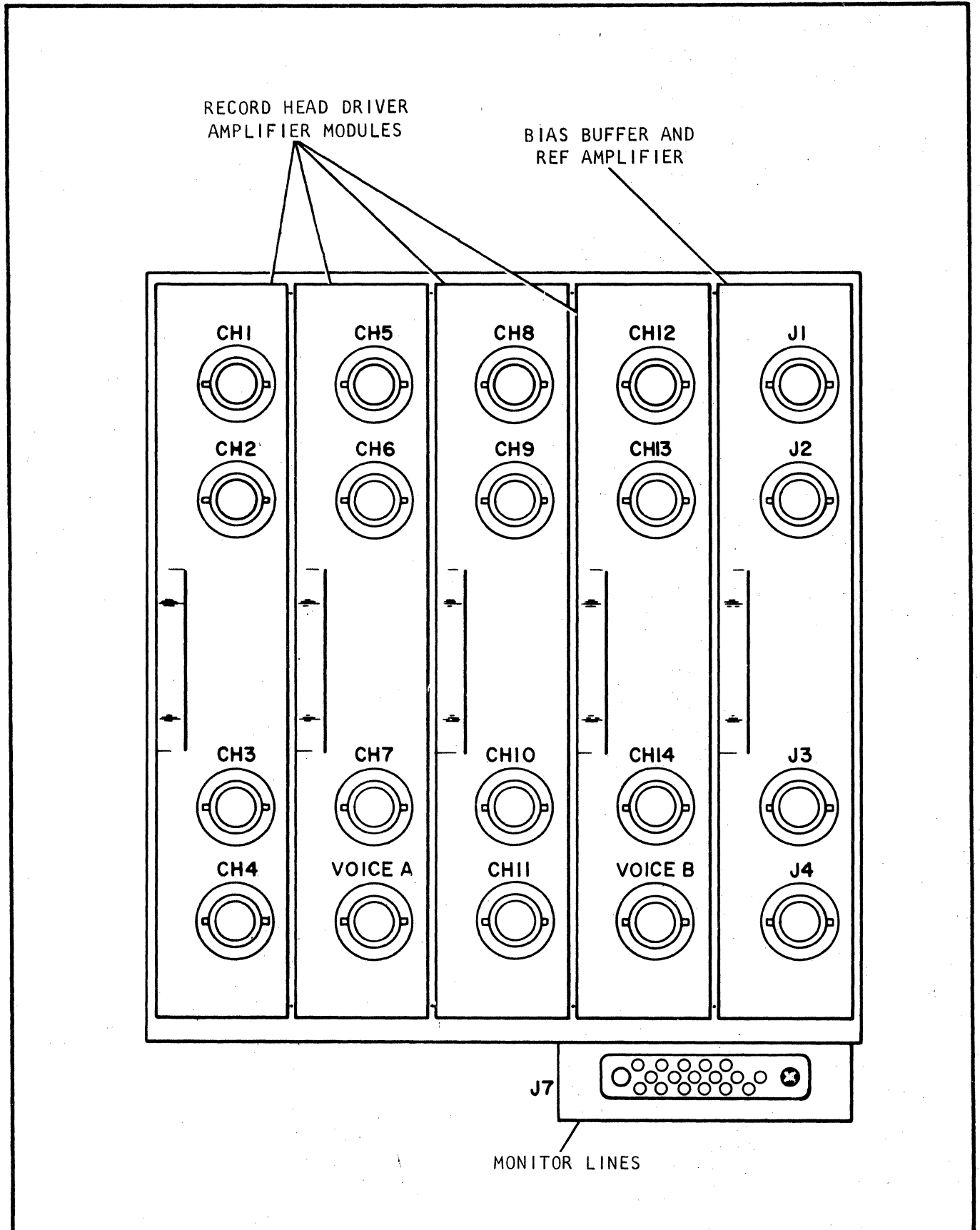


Figure 2-2. Channel Designations, Record Head Driver Amplifiers

SECTION III
OPERATION

3-1. GENERAL.

3-2. The housing and modules are energized when the system is turned on. There are no controls or indicators for these components; therefore, in operating the system, there are no adjustments or operating procedures necessary.

SECTION IV
THEORY OF OPERATION

4-1. GENERAL.

4-2. This section describes the theory of operation of the Type 13-540A Record Head Driver Amplifier.

4-3. CIRCUIT DESCRIPTION.

4-4. Each 13-540A assembly includes four identical channels. Each channel has a data signal and bias frequency input. The data signal is derived from a direct or FM record amplifier located in an amplifier mounting assembly beneath the transport. The bias input originates in the transport and is routed through a Type 13-544-2 Bias Buffer and Reference Amplifier located in the fifth slot of the Type 13-505-4 Record Head Driver Amplifier Housing.

4-5. Figure 7-1 is the schematic diagram for the Type 13-540A Record Head Driver Amplifier.

4-6. BIAS LIMITING AMPLIFIER. The bias frequency is applied to pin 12 of the head driver board and coupled through capacitor C6 to terminal 1 of integrated circuit U1, which is an RCA CA3028 linear amplifier. The amplifier limits the bias to prevent any incoming amplitude variation from reaching the record head. The limited bias output is taken from terminal 6 of U1 and coupled through capacitor C9 to the buffer amplifier stage. Figure 4-1 shows the internal circuitry of U1.

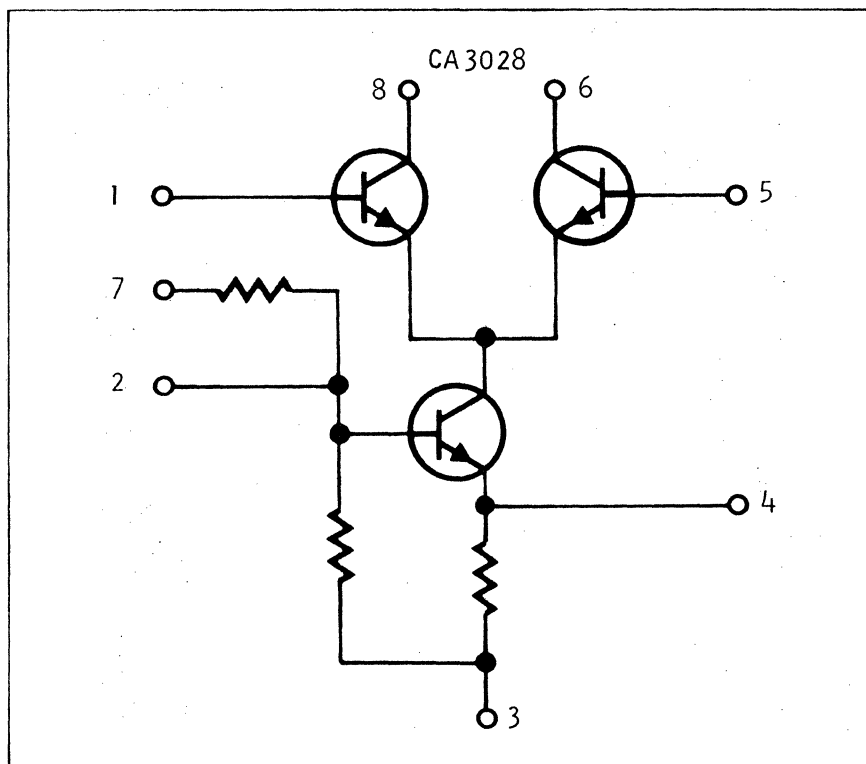


Figure 4-1. Schematic, Limiter Amplifier

4-7. BIAS CONTROL CIRCUIT. The bias amplitude is controlled by a potentiometer in the Type 13-542 Direct Record Amplifier which supplies a dc bias control voltage ranging from 0 volts in the counterclockwise position to -15 volts in the clockwise position. The bias control voltage is connected through resistor R1 to the base of current source transistor Q2. The collector of Q2 is connected to terminal 7 of the CA3028 amplifier. As the bias level control is rotated in a clockwise direction, the collector current of Q2 increases, which increases the drive current from the amplifier and the bias level at the record head. Diode CR1 provides temperature compensation. Capacitor C15 prevents any bias from coupling back through the control line.

4-8. BIAS RELAY CIRCUIT. When the bias level control in the direct record amplifier is advanced from the counterclockwise position, the dc voltage at terminal 2 of the integrated circuit amplifier becomes more positive and turns on switching transistor Q1. The collector current of Q1 energizes relay K1 and connects the bias output amplifier to the record head. When the 13-540A is used in an FM system (no bias required), the FM record amplifier provides a ground to the bias control line to deenergize relay K1.

4-9. BIAS BUFFER AMPLIFIER. The output of the limiting amplifier is coupled through capacitor C9 to the base of buffer transistor Q3. Diode CR4 provides temperature compensation, while diode CR5 provides clamping to prevent saturation in transistor Q3. The bias signal from the collector of Q3 is coupled through capacitor C10 to the output amplifier circuit.

4-10. BIAS OUTPUT AMPLIFIER. The output of the bias buffer amplifier is connected to the base of transistor Q4. Transistor Q4 provides the power gain necessary to drive the record head. Gain stabilization is provided by negative feedback through capacitor C16. Capacitors C12 and C13, together with inductor L6, form a pi-network to properly match the record head impedance and to suppress harmonics of the bias frequency. Further harmonic suppression is provided by capacitor C14 and inductor L7, which are series resonant at the 8 MHz bias frequency. The bias signal is routed through normally open contacts of relay K1 before it is linearly mixed with the data signal at the output terminal.

4-11. DATA SIGNAL PATH AND MIXER. The data signal is connected to the 13-540A through a BNC connector on the front of the assembly. Two bias traps prevent the 8 MHz bias signal from coupling back from the mixer to the record amplifier. A parallel resonant circuit consisting of capacitor C3 and inductor L4, together with a series resonant circuit consisting of capacitor C5 and inductor L3, are used. The data signal is linearly mixed with the bias signal at the output terminal. The record head winding is connected between the output high terminal and the output low terminal, where it is routed to ground through a 10 ohm resistor, R18. A monitor output connection may be used to measure the voltage across R18 and determine the record head current. The monitor connections are routed to connector J7 on the Type 13-505-4 Record Head Driver Amplifier Housing.

4-12. The two bias traps in the data input line must be bypassed when used in an FM channel at 120 inches per second with IRIG Wideband Group II or Bell & Howell Wideband Group III electronics. (The reactance of the bias traps introduces phase non-linearity at high carrier frequencies.) The bias traps are bypassed when a jumper connection is made from terminals EA to EB, instead of from EA to EC.

SECTION V
CALIBRATION AND MAINTENANCE

5-1. GENERAL.

5-2. This section of the manual is presented in three parts: preventive maintenance, calibration, and troubleshooting and corrective maintenance.

5-3. PREVENTIVE MAINTENANCE.

5-4. The record head driver amplifier housing assembly should be inspected and cleaned at six month intervals to prevent accumulation of dirt, grit, and/or grease. However, the interval between inspections may be increased, as determined by the particular operating environment. Remove all modules and inspect printed circuit boards for breaks or loose connections. When cleaning boards, use a soft brush, low pressure air, or a suitable solvent, such as Freon TF. Clean all connectors with a clean rag and solvent. Use care during handling to prevent damage to printed circuitry.

5-5. CALIBRATION.

5-6. There are no calibration procedures necessary for the components covered by this manual.

5-7. TROUBLESHOOTING AND CORRECTIVE MAINTENANCE.

5-8. Before attempting the repair of a unit suspected of malfunction, first, visually inspect the unit for obvious damage such as burned resistors, improper connections, or poor seating of connectors. Next, verify that the symptom is not caused by an associated component such as the power supply or an amplifier.

5-9. The following test equipment is required for troubleshooting the record head driver amplifiers. The circuit extender card listed below is also shown in figure 7-3.

Oscilloscope, Tektronix Type 545B/1A1, or equivalent.

VOM, Triplet 630, or equivalent.

Circuit extender card, Bell & Howell part number 472155-1.

5-10. Monitor lines for bias current and head current terminate at J7 which is mounted externally on the record head driver housing. The pins of connector J7 may be used as test points for checking the output of the bias buffer amplifier and the output of each record head driver amplifier. See table 5-1 for pin identification of J7.

5-11. RECORD HEAD DRIVER AMPLIFIER. A detailed schematic diagram is shown in figure 7-1. After it has been determined that a malfunction exists in one of the record head driver amplifier channels, an extender board must be used to make the printed circuitry accessible. Check the signal input to the suspected channel with the oscilloscope. Compare this with an input from a channel that is known to be operating correctly. If the input is correct, it will be necessary to trace the signal through the suspected module.

CONNECTOR PIN	MONITOR FUNCTION
A	Channel 1
B	Channel 2
C	Channel 3
D	Channel 4
E	Channel 5
F	Channel 6
J	Channel 7
H	Channel V _A
K	Channel 8
L	Channel 9
M	Channel 10
N	Channel 11
P	Channel 12
R	Channel 13
S	Channel 14
T	Channel V _B
U	Bias
V	Spare
W	Spare
X	Spare

Table 5-1. Monitor Points, Connector J7

5-12. REPAIR. Repair of the unit should be attempted only by personnel experienced in printed wiring techniques. It is recommended that repair be limited to replacement of defective parts. When removing and replacing defective parts, care should be exercised so as not to damage contiguous parts of the circuit board itself. Replacement parts must be of the correct type and value, as listed in the parts list in Section VI of this manual. When installing a new part, place it in the exact position of the replaced part. After replacement, carefully inspect the circuit board for evidence of cold solder joints, solder splashes, and insecurity of mounting. If the equipment is repaired, the amplifiers should be checked.

5-13. PARTS IDENTIFICATION. Components covered in this manual are illustrated in Section VI, showing locations and part designations. The parts list in Section VI itemizes the component parts in the assembly and provides a Bell & Howell part number for each.

5-14. FIELD REPAIR SERVICE.

5-15. Regular scheduled maintenance service is available from the Bell & Howell Instruments Division Sales and Service Office on a contract basis. If immediate service is required, it may be obtained on an emergency basis. Every effort is made to furnish the needed repair as soon as possible. For a complete description of Bell & Howell's maintenance service plans and their costs, contact the Instruments Division Sales and Service Office.

5-16. FACTORY REPAIR SERVICE.

5-17. If desired, instruments (or major assemblies) may be returned to the factory for repair. When an instrument or assembly is returned:

a. Indicate the symptom of defect. State as completely as possible, both on an instrument tag and on the order form, the nature of the problem encountered. Too much information is far better than too little. If the trouble is intermittent, please be specific in describing the instrument's performance history.

b. Give special instructions. If any changes in the instrument or assembly have been made, and it is desired to retain the modified form, please indicate this specifically.

c. State the desired invoicing procedure. In the first correspondence, indicate whether repair work may begin immediately with billing in accordance with the standard pricing system or whether Bell & Howell should secure prior approval of the price before proceeding with the repair. The price will be the same in both cases, but any delay will be minimized by permission to start work immediately. The order acknowledgment copy will, of course, always show the price.

d. Pack securely and label. Proper packaging saves money. The small amount of extra care and time it takes to cushion a part or instrument properly may prevent costly damage while in transit. Make certain that the address is both legible and complete; failure to do so often results in needless delay. Address all shipments and correspondence to:

Bell & Howell
Instruments Division
360 Sierra Madre Villa
Pasadena, California 91109
Attention: Repair Department

e. Show return address on repair correspondence. Please indicate clearly the exact address to which the equipment should be returned after repair is completed. All shipping costs will be borne by the owner of the equipment, not by Bell & Howell.

SECTION VI

PARTS LISTS

6-1. GENERAL.

6-2. Appropriate parts lists and illustrations for the 13-540A Record Head Driver Amplifier and associated components covered by this manual follow the instructions given below. The parts lists include the Bell & Howell Instruments Division part number, description, figure and index and/or schematic reference symbol, and where applicable, the manufacturer's or military part number for each component. Manufacturers are identified in the parts lists by code number in accordance with the Federal Supply Code for Manufacturers, Cataloging Handbook H4-2, and as listed in table 6-1. The components are illustrated in figures 6-1 and 6-2.

6-3. ORDERING REPLACEMENT PARTS.

6-4. Parts should be ordered through the nearest Bell & Howell Instruments Division Sales and Service Office. Price and delivery information on parts or complete instruments may be obtained there also. To assist in making this contact, a list of Sales and Service Offices is included in the front of this manual. Bell & Howell recommends that whenever possible, and particularly when an instrument is used in a critical application, the user maintain a minimum stock of spare parts. Instruments Division has specialized personnel ready to assist the user in making a selection of spares at any time. The same personnel are also ready and able to prepare or quote on the preparation of illustrated parts breakdowns (IPB's), provisioning parts breakdowns (PPB's), and other parts documentation that might be required.

6-5. When ordering parts, the following information should always be supplied to the field office engineers:

- a. A description of the part or assembly, obtained from the parts list.
- b. The Bell & Howell part or assembly number, also on the parts list, or on the component itself.
- c. The figure and index, and/or reference symbol, given on the applicable diagram and on the parts list.
- d. The part or type number of the major assembly, shown on the instrument nameplate.
- e. The production serial number, also on the nameplate.
- f. The Bell & Howell register number applying to the complete system or order.

CODE	MANUFACTURER
00779	Amp, Incorporated Harrisburg, Pennsylvania
03508	General Electric Company Semiconductor Products Department Syracuse, New York
04713	Motorola Semiconductor Products, Incorporated Phoenix, Arizona
14028	Bell & Howell Instruments Division Pasadena, California
24546	Corning Glass Works Bradford, Pennsylvania
56289	Sprague Electric Company North Adams, Massachusetts
72136	Electro Motive Manufacturing Company, Incorporated Willimantic, Connecticut
76493	J. W. Miller Company Compton, California
78488	Stackpole Carbon Company St. Marys, Pennsylvania
81312	Litton Industries, Incorporated Winchester Electronics Division Oakville, Connecticut
83330	Herman H. Smith, Incorporated Brooklyn, New York
86684	Radio Corporation of America Electronic Components Harrison, New Jersey
92528	H. B. Fuller Company St. Paul, Minnesota
95238	Continental Connector Corporation Woodside, New York
96918	Kings Electronic Company, Incorporated Microwave Division Tuckahoe, New York

Table 6-1. List of Manufacturers

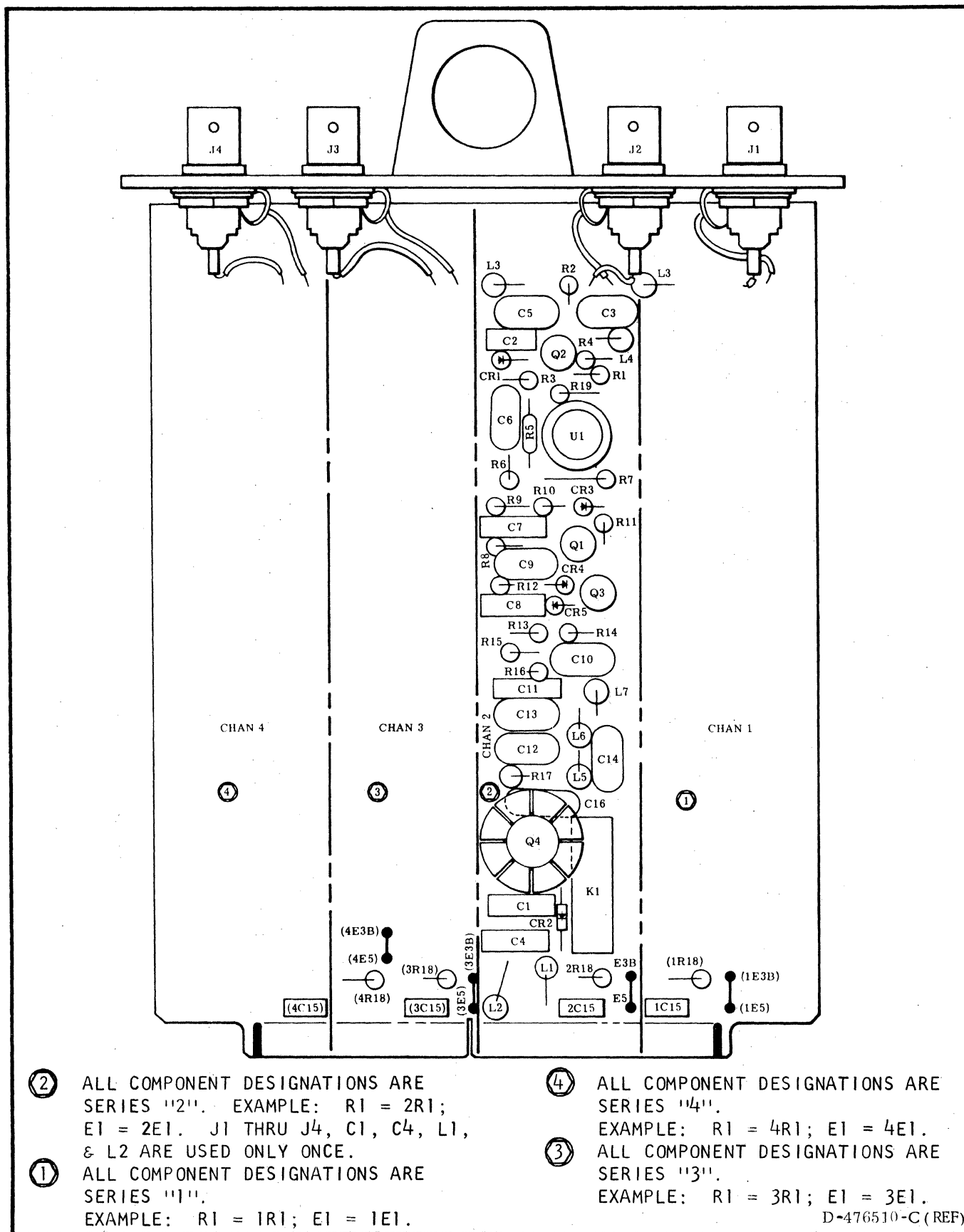


Figure 6-1. 13-540A Record Head Driver Amplifier

Table 6-2. Parts List for the 13-540A Record Head Driver Amplifier (Sheet 1 of 2)

ITEM NO.	B&H PART NO.	DESCRIPTION						QTY	FIG./INDEX OR REF SYM	MFR CODE	MFR OR MIL PART NO.
		0	1	2	3	4	5				
1	476510-0001	Record Head Driver Amplifier						1	6-1		
2	476510	Printed Wiring Board						1	6-1/1		
3	471922-1032	Res, 10K $\pm 2\%$, 1/4 w						8	R1,12	24546	C4-103G
4	471922-1512	Res, 150 Ω $\pm 2\%$, 1/4 w						4	R2	24546	C4-151G
5	471922-1022	Res, 1K $\pm 2\%$, 1/4 w						16	R3,6,7,8	24546	C4-102G
6	471922-6812	Res, 680 Ω $\pm 2\%$, 1/4 w						4	R4	24546	C4-681G
7	471922-8222	Res, 8.2K $\pm 2\%$, 1/4 w						4	R5	24546	C4-822G
8	471922-6822	Res, 6.8K $\pm 2\%$, 1/4 w						8	R9,10	24546	C4-682G
9	471922-5122	Res, 5.1K $\pm 2\%$, 1/4 w						4	R11	24546	C4-512G
10	471922-1012	Res, 100 Ω $\pm 2\%$, 1/4 w						4	R13	24546	C4-101G
11	471922-2002	Res, 20 Ω $\pm 2\%$, 1/4 w						4	R14	24546	C4-200G
12	471922-5112	Res, 510 Ω $\pm 2\%$, 1/4 w						8	R15,16	24546	C4-511G
13	7138-4795	Res, 4.7 Ω $\pm 5\%$, 1/2 w						4	R17	78488	RC20GF4R7J
14	471922-1002	Res, 10 Ω $\pm 2\%$, 1/4 w						4	R18	24546	C4-100G
15	471922-2232	Res, 22K $\pm 2\%$, 1/4 w						4	R19	24546	C4-223G
16	202790-0017	Cap, 0.05 μ f +80 -20%, 100 vdc						2	C1,4	56289	55C23A4
17	202790-0018	Cap, 0.01 μ f +80 -20%, 100 vdc						4	C2,15	56289	C023B101F1032
18	70094-0008	Cap, 18 pf $\pm 5\%$, 500 vdc						12	C3,5,14	72136	DM15C180J0 500WV5CR
19	70094-3046	Cap, 510 pf $\pm 10\%$, 500 vdc						8	C6,9	72136	DM15F511K0 500WV5CR
20	202790-0017	Cap, 0.05 μ f +80 -20%, 100 vdc						12	C7,8,11	56289	55C23A4
21	70094-0045	Cap, 500 pf $\pm 5\%$, 500 vdc						4	C10	72136	DM15F501J0 500WV5CR
22	70094-0042	Cap, 390 pf $\pm 5\%$, 500 vdc						4	C12	72136	DM15F391J0 500WV5CR

Table 6-2. Parts List for the 13-540A Record Head Driver Amplifier (Sheet 2 of 2)

ITEM NO.	B&H PART NO.	DESCRIPTION						QTY	FIG./INDEX OR REF SYM	MFR • CODE	MFR OR MIL PART NO.
		0	1	2	3	4	5				
1	70094-0040							4	C13	72136	DM15F331J0 500WV5CR
2	70094-0007							4	C16	72136	DM15C150J0 500WV5CR
3	246954							20	CR1, 2, 3, 4, 5	03508	1N4154
4	471472							4	Q1	04713	2N3947
5	471931							8	Q2, 3	04713	2N3251
6	476426							4	Q4	04713	2N3553
7	212457-0001							4	K1		
8	472466-0021							2	L1, 2	76493	9250-104
9	472466-0005							12	L3, 4, 7	76493	9250-223
10	472466-0021							4	L5	76493	9250-104
11	212358-1117							4	L6		
12	378773							4	U1	86684	CA3028
13	471727							1	6-1/2		
14	128253-0007							4	J1, 2, 3, 4	96918	KC79-46
15	250995							4			
16	247002							4			
17	202088							4			
18	377372-0003							12			
19	377373-0001							4			

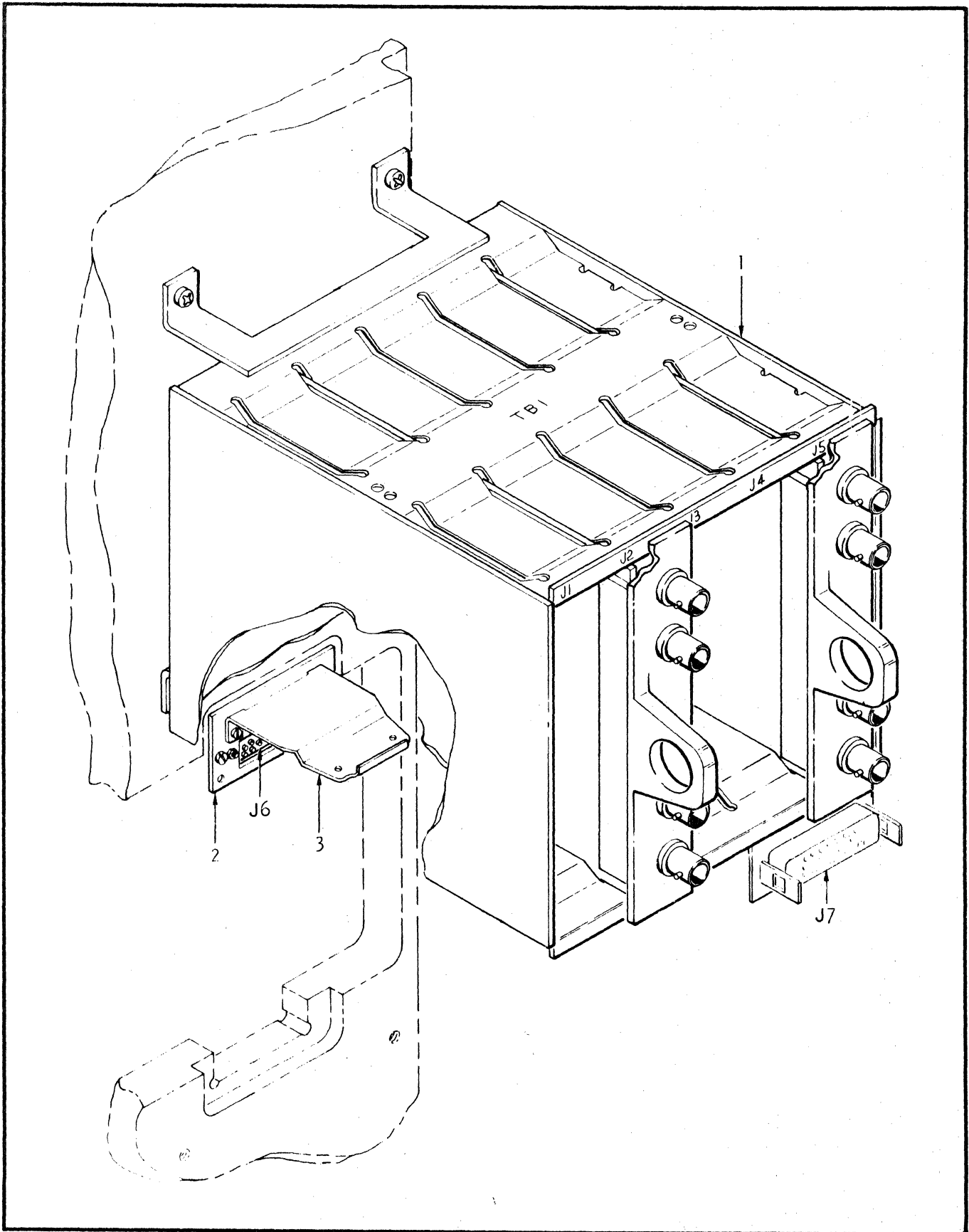


Figure 6-2. 13-505-4 Record Head Driver Amplifier Housing

Table 6-3. Parts List for the 13-505-4 Record Head Driver Amplifier Housing (Sheet 1 of 2)

ITEM NO.	B&H PART NO.	DESCRIPTION					QTY	FIG./INDEX OR REF SYM	MFR CODE	MFR OR MIL PART NO.
		0	1	2	3	4				
1	472121	Housing, record head driver amplifier					1	6-2		
2	379037	Chassis, electrical equipment					1	6-2/1		
3	471872	Connector, receptacle, elec					5	J1 thru 5	95238	K600-128-28XA
4	371763-1901	Terminal Bd, barrier type					1	TB1	83330	410-19
5	371979	Bracket, connector mounting					1	6-2/2		
6	372889-0001	Connector					1	J6	81312	SRE-44PN
7	202790-0018	Cap, 0.01 μ f +80 -20%, 100 vdc					2	C1,2	56289	C023B101F1032
8	471876-1899	Wire, elec, 18 AWG					A/R			
9	471876-2299	Wire, elec, 22 AWG					A/R			
10	156071-0001	Lug, terminal, insulated					19		00779	324608
11	126716-0174	Cable, RG174/U					A/R			
12	9916-0018	Wire, elec, solid					A/R			
13	475211	Label, channel identification					1			
14	475213	Spacer					1			
15	17484-0117	Resiweld					A/R		92528	7004
16	472127-0009	Clamp, strain relief, short					1	6-2/3	00779	201237-1
17	472152-0002	Cable, power, electrical -20 vdc					1			
18	474635	Polarizing, key, conn					10		95238	602-23 Type K
19	472127-0001	Connector, body, recpt, elec					1	J7	00779	200346-2
20	472128-0002	Contact, elec, socket					20	J7	00779	51565-1
21	472128-0003	Contact, elec, ferrule					17	J7	00779	1-332056-0
22	472127-0004	Catch, clamping					2	J7	00779	201673-1
23	472127-0006	Pin, guide, center					1	J7	00779	200389-4
24	472127-0007	Socket, guide, center					1	J7	00779	200390-4

Table 6-3. Parts List for the 13-505-4 Record Head Driver Amplifier Housing (Sheet 2 of 2)

ITEM NO.	B&H PART NO.	DESCRIPTION						QTY	FIG./INDEX OR REF SYM	MFR CODE	MFR OR MIL PART NO.
		0	1	2	3	4	5				
1	472127-0005							1	(J7)	00779	201844-1
2	474653							1	(J7)		

SECTION VII
DRAWINGS AND SCHEMATICS

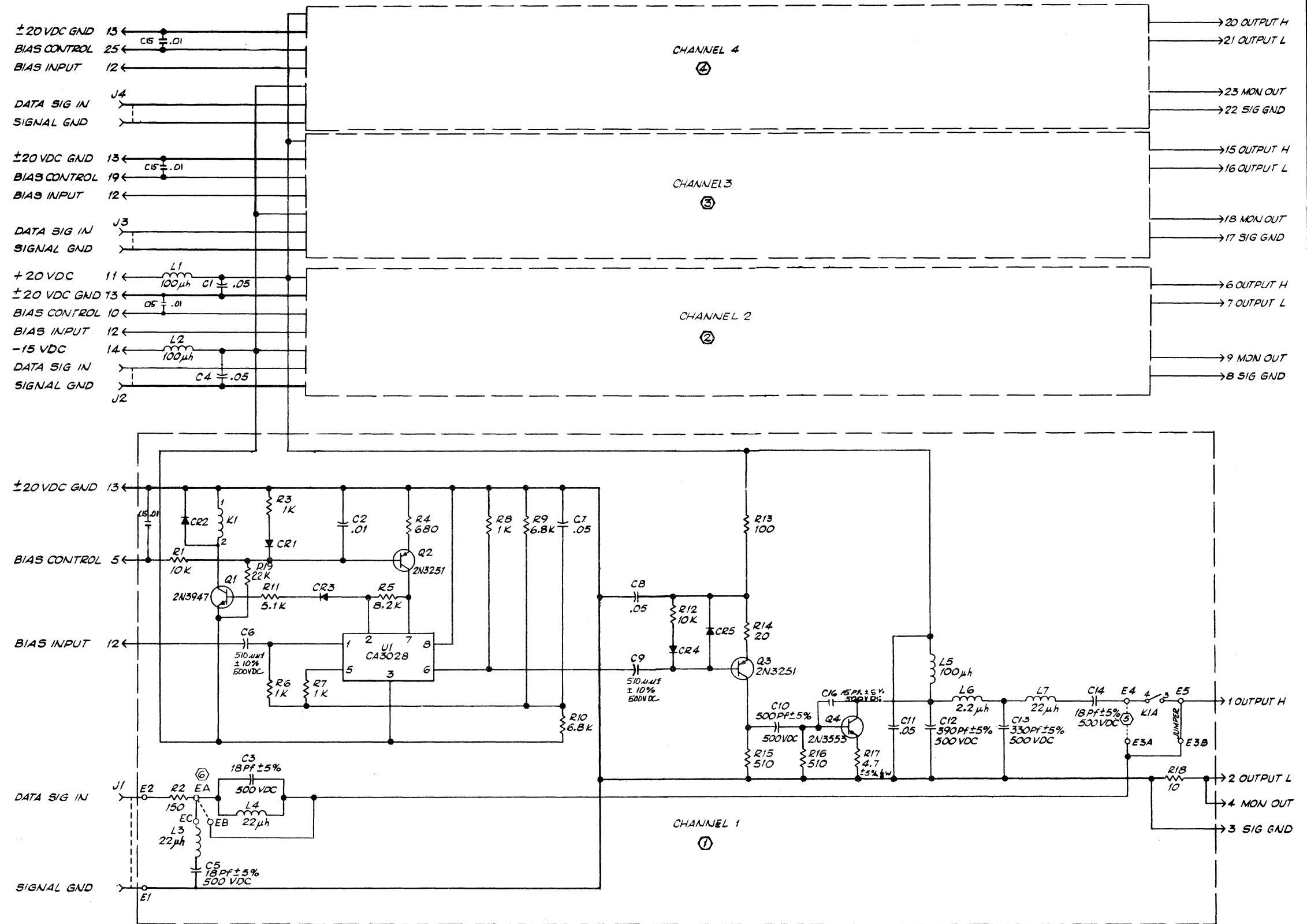
7-1. GENERAL.

7-2. This section contains a schematic diagram for the 13-540A Record Head Driver Amplifier, a wiring diagram for the 13-505-4 Record Head Driver Amplifier Housing, and a diagram for the circuit extender card.

- ⑥ JUMPER TABULATION:
BASIC DIRECT JUMPER: EA TO EC.
FM JUMPER: EA TO EB (NEEDED FOR
500 & 600 kHz FM).
- ⑤ JUMPER PROVISION FOR SELECTIVE
RECORD, SHOWN FOR REF ONLY.
- 4. ALL SCHEMATIC DESIGNATIONS SERIES
ARE TABULATED ①, ②, ③, ④.
- 3. ALL CAPACITORS ARE IN μf +80 -20%,
100 VDC.
- 2. ALL DIODES ARE 1N4154.
- 1. ALL RESISTORS ARE IN OHMS $\pm 2\%$,
1/4 W.

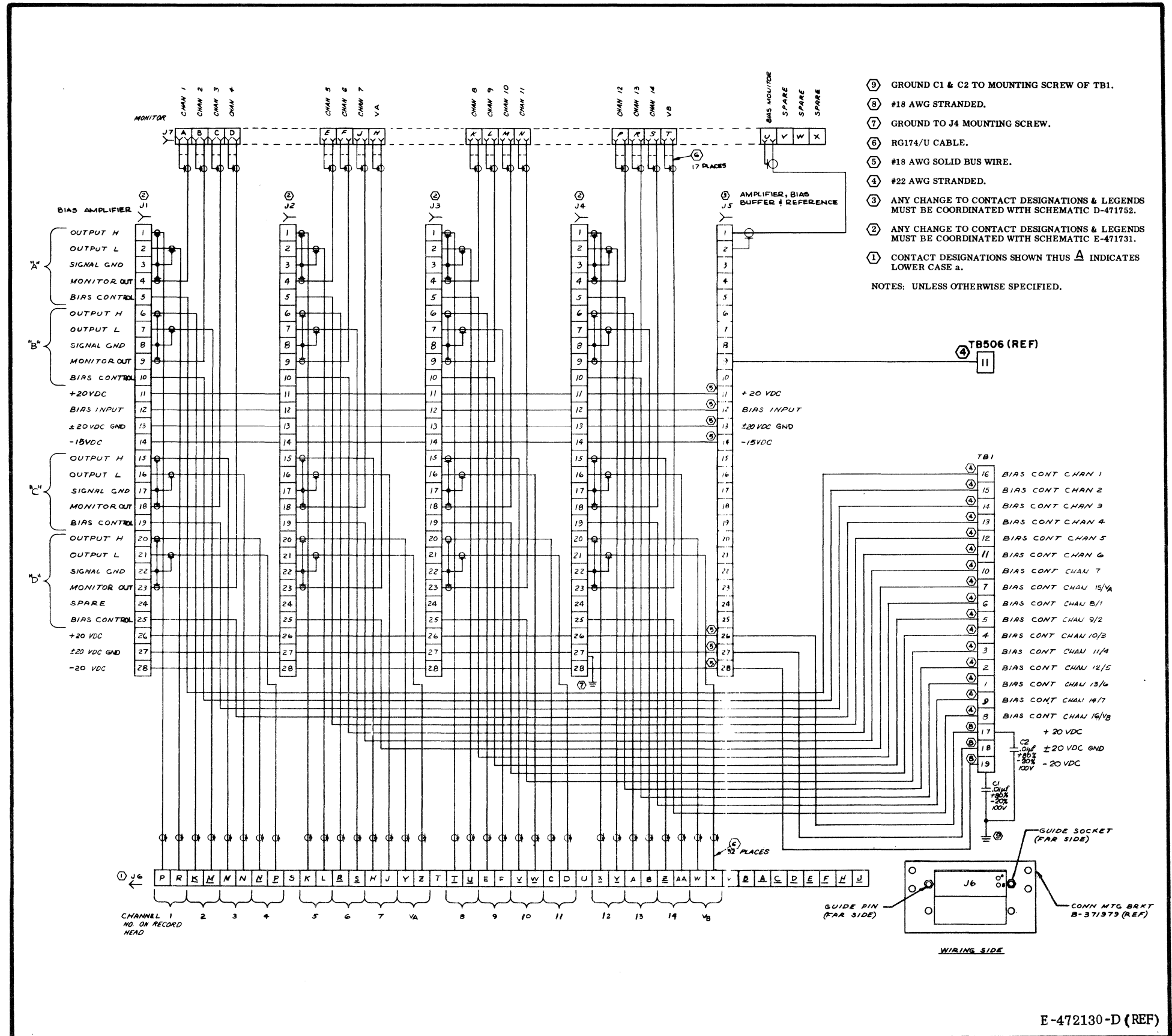
NOTES: UNLESS OTHERWISE SPECIFIED.

- ④ ALL SCHEMATIC DESIGNATIONS ARE
SERIES "4".
EXAMPLE: R1 = 4R1; E1 = 4E1.
- ③ ALL SCHEMATIC DESIGNATIONS ARE
SERIES "3".
EXAMPLE: R1 = 3R1; E1 = 3E1.
- ② ALL SCHEMATIC DESIGNATIONS ARE
SERIES "2".
EXAMPLE: R1 = 2R1; E1 = 2E1.
J1 THRU J4, C1, C4, L1, & L2 ARE
USED ONLY ONCE.
- ① ALL SCHEMATIC DESIGNATIONS ARE
SERIES "1".
EXAMPLE: R1 = 1R1; E1 = 1E1.



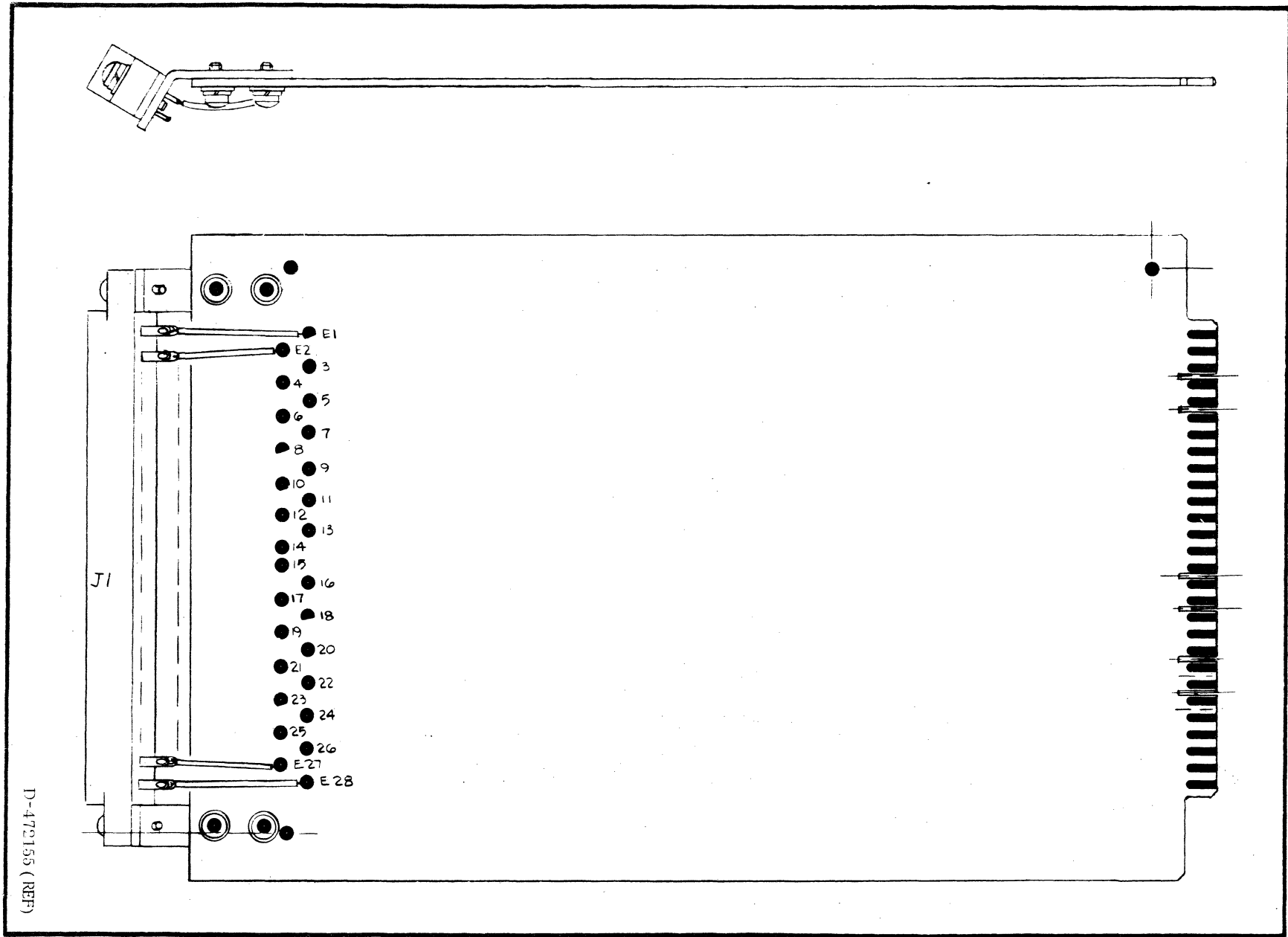
E-476511-C (REF)

Figure 7-1. Schematic, 13-540A Record Head Driver Amplifier 7-3/7-4



E-472130-D (REF)

Figure 7-2. Wiring Diagram, 13-505-4 Record Head Driver Amplifier Housing 7-5/7-6



D-472155 (REF)

Figure 7-2. Circuit Extender Card