

**DATATAPE<sup>®</sup>**

***13-505, 13-505A,  
13-505B AND 13-505C  
AMPLIFIER MOUNTING  
ASSEMBLIES***

**OPERATION AND MAINTENANCE MANUAL**

**INSTRUMENTS DIVISION**

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**BELL & HOWELL**

This manual describes the operation and maintenance procedures for the Types 13-505, 13-505A, 13-505B, and 13-505C Amplifier Mounting Assemblies, with serial numbers 2001 through 3999.

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## SECTION I

### GENERAL DESCRIPTION

#### 1-1. FUNCTION AND USE.

1-2. The 13-505, 13-505A, 13-505B, and the 13-505C Amplifier Mounting Assemblies house all 28 pin, end-connected amplifiers used with Bell & Howell VR-3700B Magnetic Tape Record/Reproduce Systems. Each assembly will handle up to 16 direct or FM record and/or reproduce amplifiers. The mounting assemblies contain +15 vdc and -15 vdc regulators which furnish power to the amplifiers. They also carry all the control signals between the transport and the amplifiers: record control, FM squelch, and nine speed control lines (for switching amplifier components that must change as a function of tape speed), as well as one bias control line for each amplifier.

1-3. The 13-505 mounting assembly and the 13-505A mounting assembly are identical in function and operation, with one exception. The 13-505A assembly has an additional connector, J50 on the rear panel, that is used to connect the amplifiers to a monitoring system. Any differences in setup, operation, or theory between the two mounting assemblies will be identified as being pertinent to one type or the other. The 13-505B and 13-505C mounting assemblies are identical to the 13-505 mounting assembly. The 13-505B and 13-505C assemblies, however, are used only for 28 and 42 channel systems. The 13-505B assembly is used for a reproduce only system.

#### 1-4. EQUIPMENT DESCRIPTION.

1-5. The amplifier mounting assembly occupies 7 inches of vertical space in a RETMA standard 19 inch cabinet. The assembly houses amplifiers that are approximately 5 1/2 by 13 inches in size with the electrical connecting tabs on the rear edge of the 5 1/2 inch dimension. The amplifier cards are positioned vertically in card guides within the mounting assembly. The door of the assembly is hinged at the bottom and swings down out of the way for access to the amplifiers. Pawl latches keep the door closed. On the inside of the door is a label that identifies the amplifier controls and test points.

1-6. Channel positions (seen from the front of the mounting assembly) for a record/reproduce system are numbered from left to right: 8/1 through 14/7 for record, then two spare channels (15 and 16), then 8/1 through 14/7 again for reproduce. When more than 7 channels are used, an additional assembly or assemblies are used, and the channel positions would be numbered to correspond to the total number of channels in both the record and reproduce sections. When either an all record or an all reproduce system is used, then 14 channels would be available in each assembly. In a 42 channel direct record/reproduce system, only the reproduce amplifiers are mounted in the mounting assemblies. The channel numbering would be the same as for an all reproduce system. If a 42 channel FM record/reproduce system is used, an extra cabinet would be required to house the necessary mounting assemblies. All amplifier connectors are wired identically. The corresponding electrical connectors on the rear panels are numbered from right to left.

1-7. Data signal input and output connections are made via two rows of BNC connectors on the rear panels of the mounting assembly. Power and control connections from the transport are made via one 42 pin connector in the center of the lower panel. An additional 20 pin coaxial connector is used only on the 13-505A assembly for monitor connections. Immediately forward of the lower rear panel is the printed circuit board which contains the voltage regulator circuits and the record control, squelch, and speed control line relays.

1-8. TYPICAL PERFORMANCE CHARACTERISTICS.

1-9. The performance characteristics of the amplifier mounting assemblies are listed in table 1-1.

CHARACTERISTIC	TYPICAL PERFORMANCE
Mounting Facilities	16 amplifier modules maximum; direct record, direct reproduce, FM record, FM reproduce in any combination.
Dimensions	Occupies 7 inches of vertical space in standard 19 inch cabinet.
Input/Output Signal Connections	BNC receptacles on rear panel distribute input signals to record amplifiers and output signals from reproduce amplifiers.
Head Signal Connections	BNC receptacles on rear panel distribute signals from record amplifiers to head drivers and signals from reproduce preamplifiers to reproduce amplifiers.
Power Connection	Single 42 pin connector distributes power and control signals to and from amplifiers.
Monitor Connections (13-505A only)	Multipin coaxial receptacle connects amplifiers to external monitoring system.
Voltage Regulator	
Input Power	-20 vdc, 3 amperes (maximum). +20 vdc, 3 amperes (maximum).
Output Power	-15 vdc, 3 amperes (maximum). +15 vdc, 3 amperes (maximum).
Regulation	0.1%.
Ripple Reduction	85% under no load condition.
Controls	Potentiometers for adjusting -15 vdc and +15 vdc outputs.
Indicators	None.
Fuses	None.

Table 1-1. Typical Performance Characteristics, 13-505, 13-505A, 13-505B, and 13-505C Amplifier Mounting Assemblies

## SECTION II

### INSTALLATION

#### 2-1. GENERAL.

2-2. Installation of the 13-505, 13-505A, 13-505B, or the 13-505C Amplifier Mounting Assembly, along with all cabling except the user's signal lines, is usually completed at the factory at the time of manufacture. However, installation or removal in the field is easily accomplished.

#### 2-3. CABINET INSTALLATION OF AMPLIFIER MOUNTING ASSEMBLY.

2-4. The following procedure is used on both types of mounting assembly. It is assumed that the mounting assembly is complete with door and mounting brackets attached. If it is necessary to attach the mounting brackets, the flanges of the brackets must face away from the mounting assembly chassis. The two adjustable rear brackets are identical. Each one is attached to the mounting assembly by two #4-40 screws and washers. The lower mounting hole is 3/4" in from the rear edge and 1" up from the bottom. (Do not confuse this hole with a similar hole 3/8" in from the rear edge.) The second mounting hole is 1" above and in line with the first one. The front mounting brackets are mirror images of each other. They, too, are attached with #4-40 mounting hardware. The mounting holes are 3/8" in from the front edge; the lower one is 1 1/4" up from the bottom; the second hole is 3 1/2" above and in line with the first. The front brackets must be attached with the two smaller holes in the flange downward. There is a notch in the lower corner of each front mounting bracket to preclude interference with the base of the mounting assembly chassis.

2-5. The procedure for installing the amplifier mounting assembly in a RETMA standard 19 inch cabinet is as follows:

- a. Remove the door and hinges from the mounting assembly (see figure 2-1). Loosen the screws attaching the rear mounting brackets.
- b. Maneuver the mounting assembly into the cabinet so that the flanges of the mounting brackets are behind the mounting rail (both front and rear). Adjust the mounting assembly so that all four screw holes in each front bracket are visible through holes in the mounting rail.
- c. Secure the front of the amplifier mounting assembly to the mounting rail with four #8-32 screws and washers (two in each bracket in the large screw holes).
- d. Extend the adjustable rear mounting brackets until they touch the rail and secure with #8-32 mounting hardware.
- e. Tighten the screws that attach the brackets to the amplifier mounting assembly.
- f. Attach a door hinge to one of the front mounting brackets (smaller holes below the bracket assembly screws). Use #6-32 hardware.
- g. Slide the door onto the attached hinge. Slide the second hinge onto the opposite side of the door; then secure this hinge to the other mounting bracket with #6-32 hardware.
- h. Secure the free end of each door lanyard under the upper mounting screw.

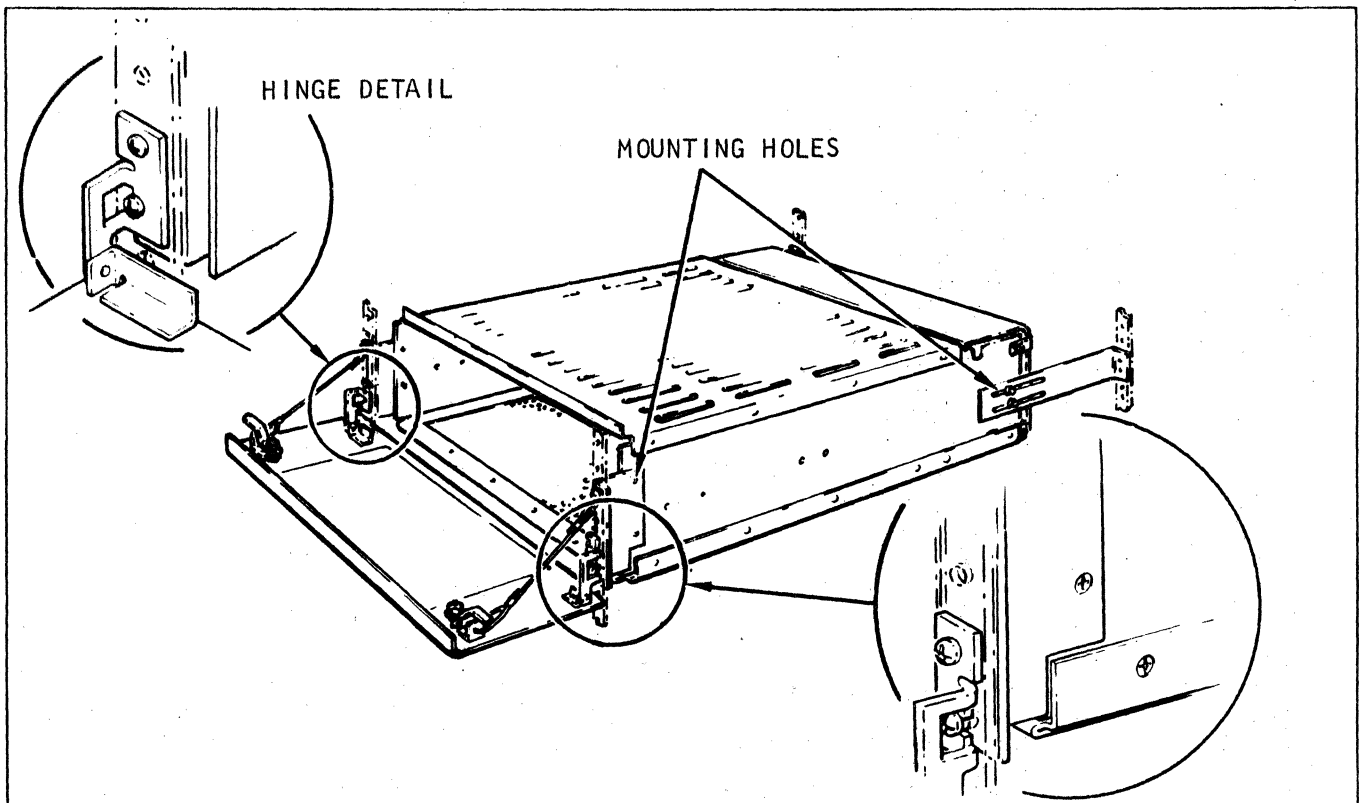


Figure 2-1. Installation, 13-505 Amplifier Mounting Assembly

i. Install the amplifiers and make the necessary electrical connections as described in the following paragraphs.

#### 2-6. AMPLIFIER CIRCUIT CARD INSTALLATION AND REMOVAL.

2-7. To install an amplifier card in the mounting assembly, insert it into the upper and lower guides of the assembly, pin end first and with component side of the board to the right. Slide the card in the guides toward the rear until it stops against the connector. Check that the card is correctly aligned with the connector, then push the card in firmly until it is completely seated in the connector.

2-8. A card extractor is attached to the upper front edge of the circuit board to facilitate removal of the card from the amplifier mounting assembly. Lift up on the card extractor to pull the card out of the connector, then slide the card out of the guides.

#### 2-9. ELECTRICAL CONNECTIONS.

2-10. All electrical connections are made at the rear panels of the amplifier mounting assembly (see figure 7-1). The power and control cable (part number 471632, figure 6-4) is connected to receptacle J49 and is used for all assemblies except the 13-505B. For the 13-505B mounting assembly, power and control cable with part number 471631 is used. Either cable connects the amplifier mounting assembly to the tape transport and the record head driver amplifier housing. Refer to the system manual for specific cabling instructions.



2-11. The internal system cabling (outputs from record amplifiers and inputs to reproduce amplifiers) is connected to receptacles J33 through J48, the lower row of BNC connectors. The user's signal lines (inputs to record amplifiers and outputs from reproduce amplifiers) are connected to receptacles J17 through J32, the upper row of BNC connectors, as indicated by the placarding on the mounting assembly.

**Note**

The amplifier mounting assembly can accommodate 16 amplifier cards and thus has 16 amplifier slots and 16 sets of input and output connectors. The amplifier slots for channels 15 and 16 are located in the center of the mounting assembly. However, in the usual 7, 14, 28, or 42 channel system, the two center slots, and the corresponding input and output connectors (J31 and J32, and J47 and J48) on the rear panels, are not used.

2-12. In the typical system configuration, the record and reproduce amplifiers for seven channels are housed in one amplifier mounting assembly. This is true for 7, 14, 28, and 42 channel systems. (In a 14 channel system, the record and reproduce amplifiers for channels 1 through 7 are housed in one mounting assembly, and the record and reproduce amplifiers for channels 8 through 14 are housed in a second mounting assembly.) Four mounting assemblies are required for a 28 channel system. The record amplifiers are mounted on the left side of the assembly, the reproduce amplifiers on the right. Thus, the record amplifier input cables must be connected to receptacles J24 through J30 and the reproduce output cables to receptacles J17 through J23.

2-13. The amplifiers are numbered from left to right as viewed from the front of the mounting assembly. The connectors on the rear panel are numbered from right to left, with the exception of channels 15 and 16 (connectors J31, J32 and J47, J48) which are in the center.



## SECTION III

## OPERATION

## 3-1. GENERAL.

3-2. The amplifier mounting assembly is a functional part of a record/reproduce system. Except for the installation and removal of amplifiers, any operation involving the mounting assembly is initiated and controlled by some other component within the system.

## 3-3. CONTROLS AND INDICATORS.

3-4. The mounting assembly has no operating controls or indicators as such. There are two potentiometers, R6 and R16, that are used to set the +15 vdc and -15 vdc outputs of the voltage regulator. Under normal operating conditions, these controls will not require adjustment. The potentiometers are accessible when the lower connector plate on the rear panel is removed. Complete procedures for adjusting the voltage regulator are covered in the calibration and maintenance section of this manual.

## 3-5. DOOR LATCHES.

3-6. Pawl latches are used on the door of the amplifier mounting assembly. When the latch handle is rotated, the latch pawl slips behind the cabinet mounting rail to hold the door closed. To release the pawl latches, raise the handles and rotate them 90° (clockwise on the left side, counterclockwise on the right). To refasten the latches, close the door, rotate the latches back 90°, and lower the latch handles.

**Note**

Check that the door lanyards do not get caught when closing the door.



## SECTION IV

## THEORY OF OPERATION

## 4-1. GENERAL.

4-2. The basic function of the amplifier mounting assembly is to house the amplifiers used to record and reproduce data in the VR-3700B Magnetic Tape System. Up to 16 amplifier cards can be housed in one assembly.

4-3. For these reasons, when looking at the front of the mounting assembly, the channels are numbered from left to right: 8/1 through 14/7, 15, 16, and 8/1 through 14/7. The connectors on the rear panel are similarly numbered, only from right to left. Channels 15 and 16 provide for isolation between two groups of seven amplifiers. This is especially helpful when record and reproduce amplifiers are housed in the same mounting assembly or when a mixture of direct and FM amplifiers are housed in one assembly.

4-4. The amplifier mounting assembly is basically a steel box with the receptacles and wiring necessary to make and maintain the required electrical connections. Circuit card guides are attached to the inside of the base and cover to guide the amplifier circuit cards to the correct amplifier connector, maintain physical separation between circuit cards, and to help hold them upright when they are installed. About 3/4 of the way back in the mounting assembly is the amplifier connector panel to which are attached the 16 printed circuit card connectors, J1 through J16. At the rear of the mounting assembly are two more connector panels. These panels contain the 16 BNC connectors, J17 through J32, for the user's data signal connections; 16 more BNC connectors, J33 through J48, for system data signal connections; and one 42 pin connector, J49, which carries all control and power lines to and from the transport. On the forward side of the lower connector panel is mounted a printed circuit card which contains control relays K1A through K11A and the +15 vdc and -15 vdc power regulator circuits. This lower connector panel is removable for access to the circuit board and the mounting assembly wiring.

## 4-5. INPUT AND OUTPUT CONNECTIONS.

4-6. The input and output lines run directly from the amplifier connector panel to two rows of BNC connectors on the rear panels. There are two BNC connectors for each channel. The upper connector is wired to pins 1 (signal) and 2 (ground) of the amplifier connector. This is the input to a record amplifier or the output from a reproduce amplifier. It is to this receptacle that the user connects his input or output line. The lower connector is wired to pins 27 (ground) and 28 (signal) of the amplifier connector. This is the output from a record amplifier or the input to a reproduce amplifier. Connection to this receptacle is part of the system cabling and is usually done at the factory when the system is being assembled.

## 4-7. MONITOR CONNECTOR (13-505A ONLY).

4-8. A 20 pin coaxial connector, J50, is mounted on the lower connector panel of the 13-505A Amplifier Mounting Assembly. This receptacle connects the amplifiers to an external monitoring system. Each pin of the connector is wired to pins 14 (signal) and 15 (ground) of the amplifier module connectors. The relationship of the module connectors, J1 through J16, to the pins of the monitor connector, J50, is shown in table 4-1.

MODULE CONNECTOR	MONITOR CONNECTOR PIN
J1	A
J2	B
J3	C
J4	D
J5	E
J6	F
J7	J
J8	K
J9	L
J10	M
J11	N
J12	P
J13	R
J14	S
J15	H
J16	T

NOTE: Pins U, V, W, and X of connector J50 are not used.

Table 4-1. Monitor Connector Pin Designations

## 4-9. VOLTAGE REGULATION.

4-10. The amplifier mounting assembly also houses two similar voltage regulators which take +20 vdc and -20 vdc power furnished by the transport power supply and regulate it to the steady +15 vdc and -15 vdc required by the amplifiers. Power comes from the transport via connector J49, pins P (+20 v), S (-20 v), and R (ground). The +15 vdc is wired to pin 24 of each amplifier connector; the -15 vdc is wired to pin 25; pin 23 is the power ground. In this discussion, the +15 vdc regulator is described. The differences between it and the -15 vdc regulator are mentioned where appropriate. Refer to the block diagrams, figures 4-1 and 4-2, and the amplifier mounting assembly schematic, figure 7-3.

4-11. Regulation depends on the impedance of the series regulating transistor. As the output voltage tends to go up, the impedance is increased, and the regulator output voltage goes down; as the output voltage tends to go down, the series regulator impedance decreases and the regulator output voltage goes up. The bias on the series regulating transistor is varied in proportion to changes in the output voltage of the regulator, maintaining the output voltage within very close tolerances. To accomplish this, a differential amplifier compares a sample of the regulator output voltage to a reference voltage. The error correction voltage from the differential amplifier is then fed to a current amplifier which, in turn, varies the bias on the series regulating transistor in proportion to the error correction signal.

4-12. +15 VDC REGULATOR. Refer to figure 4-1. The +15 vdc regulator is made up of transistors Q1 through Q5, zener diode VR1, diodes CR1 through CR5, and other associated components. The comparison amplifier, Q4 and Q5, is a typical differential amplifier. The

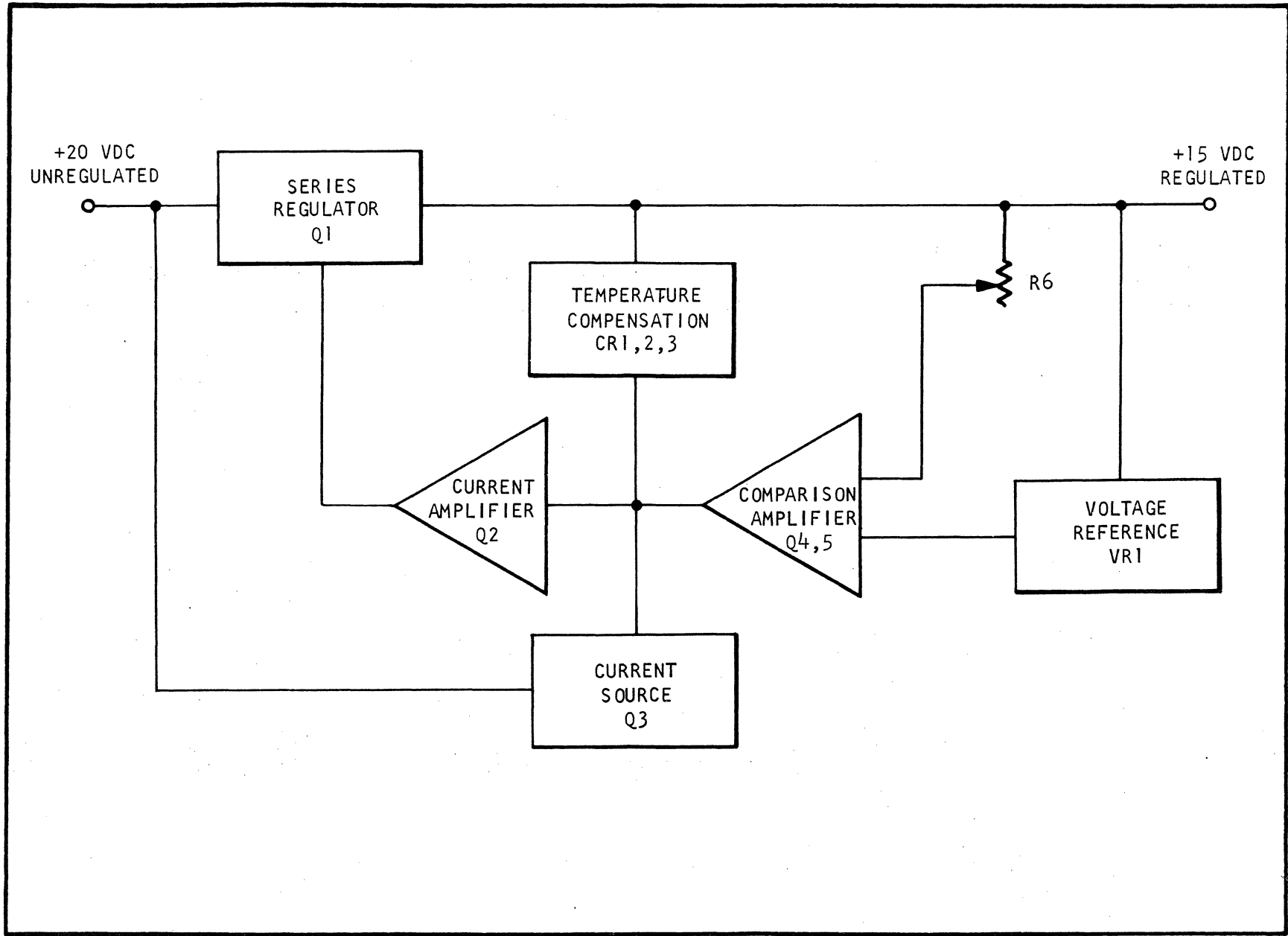


Figure 4-1. Block Diagram, +15 vdc Regulator, 13-505 Amplifier Mounting Assembly

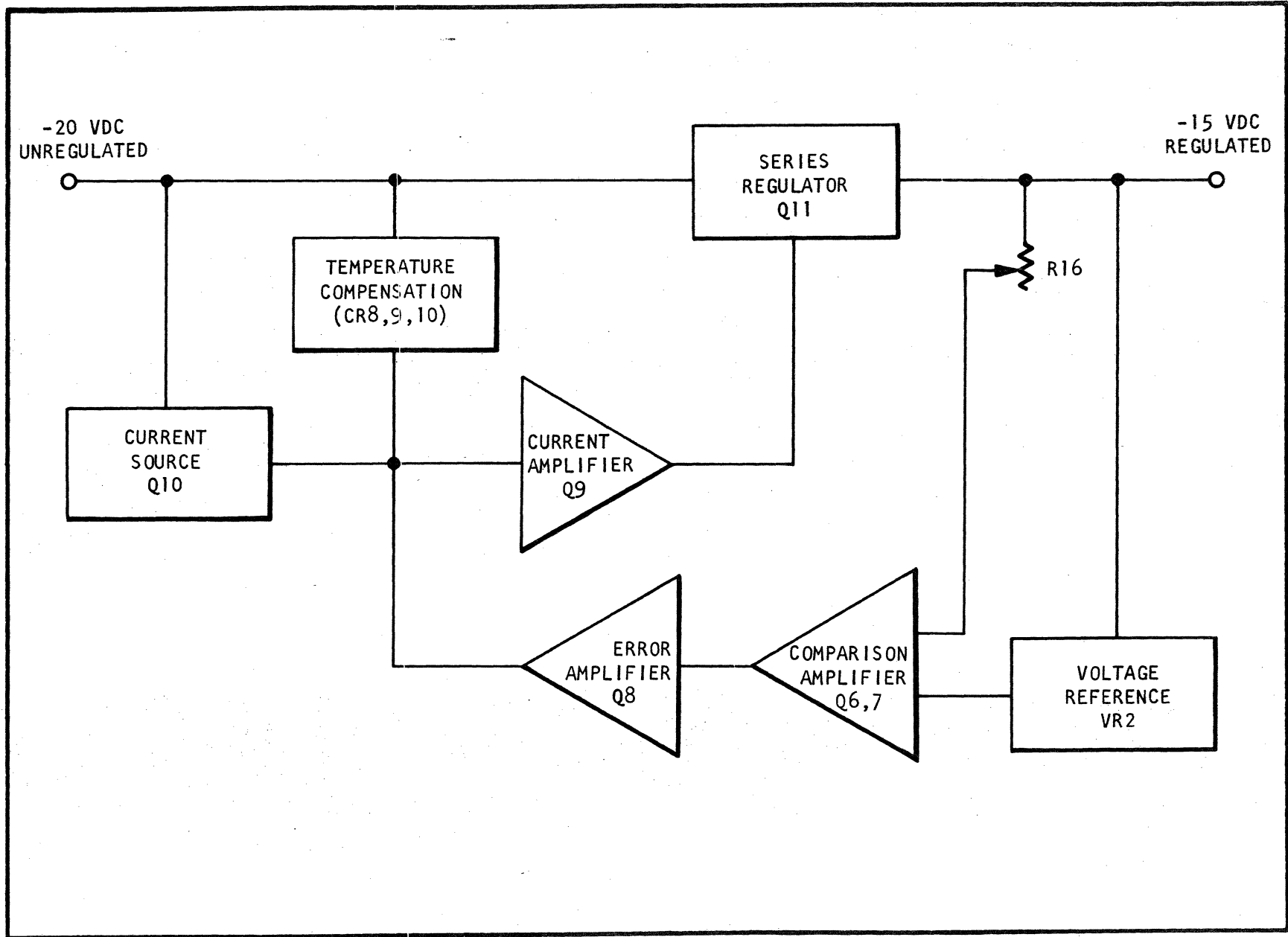


Figure 4-2. Block Diagram, -15 vdc Regulator, 13-505 Amplifier Mounting Assembly



voltage reference is determined by zener diode VR1 and is applied to the base of Q5. The output voltage sample is taken from a voltage divider made up of resistors R2 and R5 and potentiometer R6. The voltage sample is applied to the base of Q4 in the comparison amplifier. The output of the comparison amplifier is connected to the base of the current amplifier, Q2.

4-13. Transistor Q3 is a constant current source which drives current amplifier Q2, which in turn controls the bias on series regulator Q1. Changes in the output of the regulator due to temperature are compensated for by diodes CR1, CR2, and CR3.

4-14. -15 VDC REGULATOR. Refer to figure 4-2. The -15 vdc regulator is made up of transistors Q6 through Q11, zener diode VR2, diodes CR6 through CR12, and other associated components. The comparison amplifier, Q6 and Q7, is a typical differential amplifier. The voltage reference is determined by zener diode VR2 and is applied to the base of Q7. The output voltage sample is taken from a voltage divider made up of resistors R9 and R13 and potentiometer R16. The voltage sample is applied to the base of Q6 in the comparison amplifier. The output of the comparison amplifier is connected to the emitter of Q8, the error amplifier.

4-15. Error amplifier Q8 works in conjunction with the current source, Q10, to drive the current amplifier, Q9, which in turn controls the bias on the series regulator, Q11. Changes in the output of the regulator due to temperature are compensated for by diodes CR8, CR9, and CR10.

4-16. CONTROL LINES.

4-17. Several control lines run, via the mounting assembly, between the transport and the amplifiers. The 16 bias control lines (one line for each channel) run directly from pin 26 of each amplifier connector to pins CC, DD, EE, FF, HH, JJ, KK, LL, MM, NN, PP, RR, SS, TT, UU, and VV of connector J49.

4-18. The remaining control lines have a relay in the circuit. In all cases, a -28 vdc control signal from the transport energizes the relay which then feeds a +15 vdc control signal to the amplifier circuit concerned. There are 9 speed lines, one for each transport tape speed. The line energized depends on the setting of the transport tape speed switch. For example, if the tape speed switch is set at 240 ips, -28 vdc is applied to pin A of connector J49 (ground return is pin L). Relay K1A is energized and the normally open contacts of K1A1 and K1A2, wired in parallel, feed +15 vdc to pin 4 of each amplifier connector. The normally closed contacts of all the relays are tied to the power ground bus which runs between pin 23 of all the amplifier connectors and pin R of connector J49. A similar sequence is followed on the remaining speed control lines: pins B through K of connector J49, relays K2A through K9A, and pins 5 through 12 of the amplifier connectors, respectively, for tape speeds of 120 ips through 15/16 ips.

4-19. The record control and FM squelch control lines operate in a similar manner. When the transport is operating in the record mode or when the record/test switch on the transport is set to TEST, -28 vdc is applied to pin M of connector J49, the record control bus. Relay K10A is energized and the normally open contacts of K10A1 and K10A2, wired in parallel, feed +15 vdc to pin 16 of each amplifier connector. This is the +15 volt record signal. Likewise, when power is on, except when the transport is operating in the record or run (playback) modes, -28 vdc is applied to pin N of connector J49, the FM squelch bus. Relay K11A is energized and the normally open contacts of relay K11A1 and K11A2, wired in parallel, feed +15 vdc to pin 17 of each amplifier connector.

4-20. In addition to the basic amplifier power and the control lines, a +5 vdc line runs via connector J49, pins T (+5 v) and U (ground), directly from the transport to each amplifier connector, pins 21 (+5 v) and 22 (ground). This voltage is used in the FM record amplifier.

4-21. Some amplifiers carry separate ground buses for input signal, output signal, and power. All amplifier ground lines, except pin 22, are tied together at the amplifier connector panel in the mounting assembly.

SECTION V  
CALIBRATION AND MAINTENANCE

5-1. GENERAL.

5-2. This section contains preventive maintenance procedures, alignment procedures, and the troubleshooting and repair instructions for the 13-505, 13-505A, 13-505B, and 13-505C Amplifier Mounting Assemblies. Also contained in this section is information pertaining to field and factory repair service.

5-3. PREVENTIVE MAINTENANCE.

5-4. Preventive maintenance consists of general cleaning and periodic visual inspection.

5-5. GENERAL CLEANING. Accumulation of dust, dirt, grit, and/or grease in the amplifier mounting assembly and on both the voltage regulator circuit card and on the amplifier modules should be guarded against by periodic inspection and cleaning. This will prevent foreign matter from clinging to the circuit cards and causing unwanted short circuits, and from clogging the air vents in the mounting assembly. The period of cleaning depends on the particular operating environment and should be determined by visual inspection.

5-6. VISUAL INSPECTION. Every six months, under normal laboratory conditions, visually inspect the electrical components of the mounting assembly and the power regulator for signs of defects or deterioration, loose connections, insecurity of mounting, and general cleanliness. Repair or replace, as necessary, any defective electrical components or connections.

5-7. VOLTAGE REGULATOR ADJUSTMENT PROCEDURES.

5-8. To check the output of the voltage regulator, proceed as follows:

a. Before turning on system power, insert the amplifier extender card into an unused amplifier slot. The extender card is part number 471755-1 and is supplied with each amplifier mounting assembly.

b. Turn on system power.

c. To check +15 vdc  $\pm 0.1$ , connect a dc voltmeter (Hewlett-Packard Type 3439 Digital Voltmeter, or equivalent) between pin 24 (+15 vdc) and pin 23 (+15 vdc ground).

d. To check -15 vdc  $\pm 0.1$ , connect the voltmeter between pin 25 (-15 vdc) and pin 23 ( $\pm 15$  vdc ground).

**Note**

The +5 vdc power used by the FM record amplifier can be checked between pins 21 (+5 vdc) and 22 (+5 vdc ground). This voltage cannot be adjusted at the amplifier mounting assembly. For further information, refer to the tape transport manual.

- 5-9. If the voltage regulator outputs require adjustment, use the following procedure:
- a. Turn off system power.
  - b. Remove the ten screws that secure the lower connector panel to the rear of the mounting assembly chassis. (Remove signal cables as necessary for access.)
  - c. Pull the connector panel out until the two voltage adjusting potentiometers R6 and R16, at the right side of the printed circuit board, are accessible (see figure 7-1).
  - d. Check that the extender card is installed in an unused amplifier slot and turn on system power.
  - e. Monitor the +15 vdc power between pins 24 and 23 and adjust potentiometer R6 to obtain +15 vdc output.
  - f. Monitor the -15 vdc power between pins 25 and 23 and adjust potentiometer R16 to obtain -15 vdc output.

**Note**

If desired, the voltage can be monitored across the output capacitor of each section of the regulator. Refer to figure 7-1 and measure the voltage across C1 for +15 vdc; across C2 for -15 vdc.

- g. Turn off power. Disconnect the test equipment, secure the connector panel to the assembly chassis, and replace any signal lines removed in step b.

5-10. TROUBLESHOOTING.

5-11. Before attempting the repair of any unit suspected of a malfunction, check to make sure the symptom of defect is not caused by associated equipment. This can be done by substituting a known good unit for the suspected unit or by making continuity checks from unit to unit. If such a check eliminates the associated equipment as a source of trouble, check the input power and visually inspect the unit. Visual inspection will eliminate the possibility of obviously damaged components such as broken wires, burned resistors, or transistors that are not fully seated in their sockets, as a source of trouble. If visual inspection does not expose the malfunction, refer to table 5-1 for a list of typical voltage readings observable at the emitter, base, and collector of each transistor stage. The bracketed components in this table, e.g. (E28), indicate the circuit component or components which are common to the specified transistor element.

5-12. The best troubleshooting tool is complete familiarity with the equipment and a thorough understanding of the theory of operation as given in Section IV of this manual. A complete schematic of the amplifier mounting assembly is supplied in Section VII of this manual. System cabling is described in the System manual and schematics for the rest of the system components are found in the individual component manuals.

TRANSISTOR	EMITTER	BASE	COLLECTOR
Q1	(E28) +15.0 v	(E26) +15.6 v	(E24) +20 v
Q2	(E26) +15.6 v	(CR3-A) +16.2 v	(E24) +20 v
Q3	(R1) +19.4 v	(R8/CR5) +18.8 v	(CR3-A) +16.2 v
Q4	(R7) +8.4 v	(R2/R5) +9.0 v	(CR3-A) +16.2 v
Q5	(R7) +8.4 v	(R4/VR1) +9.0 v	(R3) +13.0 v
Q6	(R17) -6.6 v	(R9/R13) -6.0 v	(R12) -0.6 v
Q7	(R17) -6.6 v	(R11/VR2) -6.0 v	(R10) -3.0 v
Q8	(R12) -0.6 v	(R15/CR7) -1.2 v	(R14) -18.8 v
Q9	(E29) -19.4 v	(R14/CR8) -18.8 v	(R17/VR2) -15.0 v
Q10	(E18) -19.4 v	(R15/CR11) -18.8 v	(R14) -18.8 v
Q11	(E31) -20.0 v	(E29) -19.4 v	(E30) -15.0 v

**CONDITIONS OF MEASUREMENT:**

1. Supply Voltage: -20 vdc at J49-S; +20 vdc at J49-P; J49-R ground.
2. Output Voltage: Adjust for -15 vdc at collector of Q11, +15 vdc at emitter of Q1 (see text).
3. Reference Schematic: Figure 7-3.
4. Measurements were taken using a Hewlett-Packard Type 3439 Digital Voltmeter with a Type 3442 Plug-in.

Table 5-1. Typical Voltage Measurements: Voltage Regulator, Amplifier Mounting Assemblies

5-13. REPAIR.

5-14. Repair should be attempted only by electronics technicians and personnel experienced in printed wiring techniques. Recommended repair is limited to the replacement of defective wiring and components, and to the adjustment of controls. When removing and replacing defective components, be careful not to burn or damage surrounding circuit parts or wires. Be sure replacement parts are known to be good and of the correct type and value. When installing a new part, place it in the exact position of the replaced part, and, after replacement, inspect for evidence of cold solder joints, solder splashes, and insecurity of mounting. Any new wiring should be the same type, the same insulation color, and the same length, as the wiring being replaced.

5-15. FIELD SERVICE.

5-16. 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.

5-17. FACTORY REPAIR SERVICE.

5-18. 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 13-505, 13-505A, 13-505B, and the 13-505C Amplifier Mounting Assemblies 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 through 6-6.

#### 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
02288	Allied Control Company, Incorporated Plantsville, Connecticut
02735	RCA Corporation Solid State Division Somerville, New Jersey
03508	General Electric Company Semiconductor Products Department Syracuse, New York
04713	Motorola Semiconductor Products, Incorporated Phoenix, Arizona
06540	Amatom Electronic Hardware Division Mite Corporation New Rochelle, New York
24546	Corning Glass Works Bradford, Pennsylvania
30684	Industrial Products Company Philadelphia, Pennsylvania
31433	Union Carbide Corporation Materials Systems Division, Components Department Greenville, South Carolina
56289	Sprague Electric Company North Adams, Massachusetts
71002	Birnbach Company, Incorporated New York, New York
80294	Bourns, Incorporated Riverside, California
81312	Winchester Electronics Division Litton Industries, Incorporated Oakville, Connecticut
84256	Avdel, Incorporated Burbank, California

Table 6-1. List of Manufacturers (Sheet 1 of 2)



CODE	MANUFACTURER
91836	Kings Electronic Company, Incorporated Tuckahoe, New York
94222	Southco, Incorporated Lester, Pennsylvania
95238	Continental Connector Corporation Woodside, New York
96906	Military Standards

Table 6-1. List of Manufacturers (Sheet 2 of 2)

Table 6-2. Parts Lists for the 13-505, 13-505A, 13-505B, and 13-505C Amplifier Mounting Assemblies (Sheet 1 of 5)

ITEM NO.	B&H PART NO.	DESCRIPTION	QTY				FIG./INDEX OR REF SYM	MFR CODE	MFR OR MIL PART NO.
			BASIC	-1	-2	-3			
1	471912	13-505 Ampl Mtg Assy	1	-	-	-	6-1		
2	471912-1	13-505A Ampl Mtg Assy	-	1	-	-	6-1		
3	471912-2	13-505B Ampl Mtg Assy	-	-	1	-	6-1		
4	471912-3	13-505C Ampl Mtg Assy	-	-	-	1	6-1		
5	471580	Universal Chassis Kit	1	1	1	1	(Separate parts list, table 6-3)		
6	471872	Conn, rcpt, elec	16	16	16	16	J1 thru J16	95238	K600-128-28XA
7	471930-3	Cap, 100 $\mu$ f +75 -10%, 16 v	6	6	6	6	C3 thru C8	56289	500D107G016DC7
8	471908	Door Assy, chassis	1	1	1	1	6-1/9		
9	471578	Door, chassis	1	1	1	1			
10	248363-1	Fastener, pawl	2	2	2	2		94222	62-10-202-10
11	472165	Legend, ampl controls	1	1	1	1			
12	475167	Lanyard, door	2	2	2	2	6-1/1	84256	LT1504
13	475136-1	Hinge, door (right side)	1	1	1	1	6-1/2		
14	475136-2	Hinge, door (left side)	1	1	1	1	6-1/3		
15	471579-1	Bracket, angle (right side)	1	1	1	1	6-1/4		
16	471579-2	Bracket, angle (left side)	1	1	1	1	6-1/5		
17	471286	Bracket, angle	2	2	2	2	6-1/6		
18	70072-101	Screw, soc hd, #4-40 x 1/4	6	6	6	6	6-1/11	96906	MS16997-9
19	472160	Bracket Assy, connector	1	1	1	1	6-1/7		
20	471581	Bracket, elec, conn	1	1	1	1			
21	126732-31	Connector, BNC	16	16	16	16	J17 thru J32	91836	KC-79-46
22	472161	Plate Assy, elec cable conn	1	-	1	1	6-1/8, 6-2		
23	472161-1	Plate Assy, elec cable conn	-	1	-	-	6-1/8, 6-2		
24	471915	Plate, elec cable conn	1	1	1	1	6-2/1		

Table 6-2. Parts Lists for the 13-505, 13-505A, 13-505B, and 13-505C Amplifier Mounting Assemblies (Sheet 2 of 5)

ITEM NO.	B&H PART NO.	DESCRIPTION	QTY BASIC	QTY			FIG./INDEX OR REF SYM	MFR CODE	MFR OR MIL PART NO.
				-1	-2	-3			
1	126732-31	Connector, BNC	16	16	16	16	J33 thru J48	91836	KC-79-46
2	7127-2	Terminal, lug	16	16	16	16	6-2/9	71002	4
3	472127-0001	Connector Body, rept	-	1	-	-	6-2/14, J50	00779	200346-2
4	472127-0004	Catch, clamping	-	2	-	-	6-2/15	00779	201673-1
5	472127-0006	Pin, guide, center	-	1	-	-	6-2/16	00779	200389-4
6	472127-0007	Socket, guide, center	-	1	-	-	6-2/17	00779	200390-4
7	472128-2	Contact, elec, socket	-	20	-	-	6-2/18	00779	1-331950-9
8	472128-3	Contact, elec, ferrule	-	16	-	-	6-2/19	00779	1-332056-0
9	126716-174	Cable, RG/U	-	A/R	-	-		30684	RG/U-174
10	204877-8	Connector, 42 contacts, pin	1	1	1	1	6-2/10, J49	81312	XAC-42P-F2016
11	204902-3	Contact, pin, 20 AWG	29	29	29	29	6-2/12	81312	100-1020P
12	204902-2	Contact, pin, 16 AWG	4	4	4	4	6-2/11	81312	100-1016P
13	472421	Plate, insulator	1	1	1	1	6-2/2		
14	247804-0001	Socket, power transistor	2	2	2	2	6-2/3	04713	PTS-1
15	248422-0010	Insulator, transistor mtg	4	4	4	4	6-2/5	04713	43B51547F02
16	248422-0001	Insulator, transistor mtg	2	2	2	2	6-2/4	04713	14B52600F10
17	246014-3	Transistor, NPN	2	2	2	2	Q1, 11	04713	2N3055
18	157117-1643	Screw, tapping, thread-forming	4	4	4	4	6-2/6	96906	MS24621-18
19	249641-29	Post, elec-mech	4	4	4	4	6-2/7	06540	8082-SS-0256-7
20	249641-28	Post, elec-mech	7	7	7	7	6-2/8	06540	8086-SS-0256-7
21	472122-1	Voltage Regulator Assy	1	1	1	1	6-2/13, 6-3		
22	472122	Printed Wiring Bd	1	1	1	1	6-3/1		
23	471922-6802	Res, 68Ω ±2%, 1/4 w	1	1	1	1	R1	24546	C4-680G
24	471922-4312	Res, 430Ω ±2%, 1/4 w	4	4	4	4	R2, 7, 9, 17	24546	C4-431G

Table 6-2. Parts Lists for the 13-505, 13-505A, 13-505B, and 13-505C Amplifier Mounting Assemblies (Sheet 3 of 5)

ITEM NO.	B&H PART NO.	DESCRIPTION	QTY BASIC	QTY			FIG./INDEX OR REF SYM	MFR CODE	MFR OR MIL PART NO.
				-1	-2	-3			
1	471922-3012	Res, 300Ω ±2%, 1/4 w	2	2	2	2	R3,10	24546	C4-301G
2	471922-7512	Res, 750Ω ±2%, 1/4 w	2	2	2	2	R4,11	24546	C4-751G
3	471922-5612	Res, 560Ω ±2%, 1/4 w	2	2	2	2	R5,13	24546	C4-561G
4	471922-2422	Res, 2.4K ±2%, 1/4 w	2	2	2	2	R8,15	24546	C4-242G
5	471922-3902	Res, 39Ω ±2%, 1/4 w	1	1	1	1	R12	24546	C4-390G
6	471922-1022	Res, 1K ±2%, 1/4 w	1	1	1	1	R14	24546	C4-102G
7	471922-1012	Res, 100Ω ±2%, 1/4 w	1	1	1	1	R18	24546	C4-101G
8	378771-5	Res, var, 200Ω ±10%, 1 w	2	2	2	2	R6,16	80294	3059Y-1-201
9	251304-2	Cap, 1000 μf +75 -10%, 25 vdc	2	2	2	2	C1,2	56289	39D108G025GL4
10	246954	Diode	12	12	12	12	CR1 thru CR12	03508	1N4154
11	372295-2	Diode	11	11	11	11	CR13 thru CR23	04713	1N4003
12	246819-7	Diode, zener, 9 v	2	2	2	2	VR1,2	04713	1N937
13	246014-2	Transistor, NPN	2	2	2	2	Q2,9	02735	2N3054
14	471925	Transistor, PNP	2	2	2	2	Q3,8	04713	2N2905
15	471927	Transistor, NPN	5	5	5	5	Q4 thru Q7,10	04713	2N2219
16	199951	Relay, 4PDT, 24 vdc	11	11	11	11	K1A thru K11A	02288	T-154X-368
17	197593-1	Socket, relay	11	11	11	11	6-3/2	02288	30055-4
18	9916-22	Wire, elec, 22 AWG	A/R	A/R	A/R	A/R	6-3/3		
19	205908	Plate, identification	1	1	1	1	6-1/10		
20	472132-1	Cable Assy, spec prp, elec	7	7	-	-			

Table 6-2. Parts Lists for the 13-505, 13-505A, 13-505B, and 13-505C Amplifier Mounting Assemblies (Sheet 4 of 5)

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	BASIC	-1				-2	-3
1	126716-174							A/R	A/R	-	-		30684	RG/U-174
2	126732-54							2	2	-	-		91836	KC-59-152
3	200710-1							2	2	-	-			
4	472132-7							7	7	-	-			
5	126716-174							A/R	A/R	-	-		30684	RG/U-174
6	126732-54							2	2	-	-		91836	KC-59-152
7	200710-1							2	2	-	-			
8	477969-1							-	-	-	7			
9	126716-174							-	-	-	A/R		30684	RG/U-174
10	367066							-	-	-	1			
11	126732-54							-	-	-	1			
12	200710-1							-	-	-	1			
13	477969-2							-	-	14	7			
14	126716-174							-	-	A/R	A/R		30684	RG/U-174
15	367066							-	-	1	1			
16	126732-54							-	-	1	1			
17	200710-1							-	-	1	1			
18	471632							1	1	-	1	6-4		
19	204877-6							1	1	-	1	6-4/1, P49	81312	XAC-42-S-C1306
20	204902-5							8	8	-	8	6-4/4	81312	100-1016S
21	204902-6							25	25	-	25	6-4/11	81312	100-1020S
22	204876-5							1	1	-	1	6-4/2, P303/ P304, P307/ P308	81312	XAC-26-P-C1306

Table 6-2. Parts Lists for the 13-505, 13-505A, 13-505B, and 13-505C Amplifier Mounting Assemblies (Sheet 5 of 5)

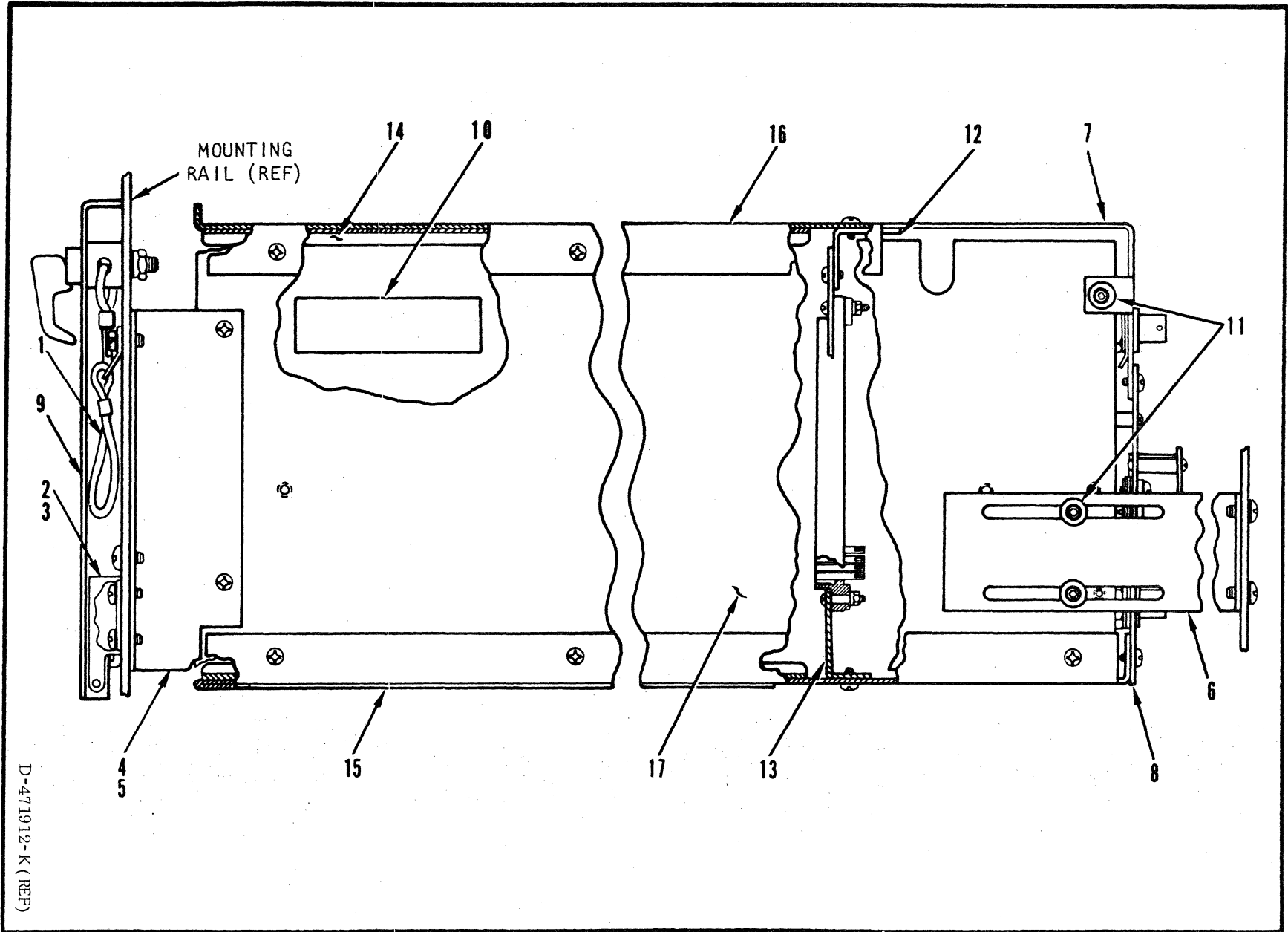
ITEM NO.	B&H PART NO.	DESCRIPTION	QTY	FIG./INDEX OR REF SYM	MFR CODE	MFR OR MIL PART NO.	QTY		
							BASIC	-1	-2
1	204902-2	Contact, pin, 16 AWG	8	8	-	8	6-4/3	81312	100-1016P
2	204902-3	Contact, pin, 20 AWG	9	9	-	9	6-4/12	81312	100-1020P
3	19362	Insul Slvg, elec	A/R	A/R	-	A/R	6-4/7		
4	200710	Band, mkr, blank	2	2	-	2	6-4/8		
5	156071-1	Terminal, lug, insul	16	16	-	16	6-4/9	00779	324608
6	8793	Band, marker	A/R	A/R	-	A/R	6-4/10		
7	471876-2299	Wire, elec, 22 AWG	A/R	A/R	-	A/R	6-4/5		
8	471876-1899	Wire, elec, 18 AWG	A/R	A/R	-	A/R	6-4/6		
9	471876-1699	Wire, elec, 16 AWG	A/R	A/R	-	A/R	6-4/13		
10	471631	Cable Assy	-	-	1	-	6-5		
11	204877-6	Connector, 42 contacts	-	-	1	-	6-5/1, P49		
12	204902-5	Contact, socket, 16 AWG	-	-	8	-	6-5/4	81312	100-1016S
13	204902-6	Contact, socket, 20 AWG	-	-	9	-	6-5/9	81312	100-1020S
14	204876-5	Connector, 26 contacts	-	-	1	-	6-5/2, P303/ P304, P307/ P308	81312	XAC-26-P C1306
15	204902-2	Contact, pin, 16 AWG	-	-	8	-	6-5/3	81312	100-1016P
16	204902-3	Contact, pin, 20 AWG	-	-	9	-	6-5/10	81312	100-1020P
17	19362-A/R	Insul Slvg, elec	-	-	A/R	-	6-5/7		
18	200710-A/R	Band, mkr, blank	-	-	2	-	6-5/8		
19	471876-2299	Wire, elec, 22 AWG	-	-	A/R	-	6-5/5		
20	471876-1899	Wire, elec, 18 AWG	-	-	A/R	-	6-5/6		
21	471876-1699	Wire, elec, 16 AWG	-	-	A/R	-	6-5/11		

Table 6-3. Parts list for the 471580 Universal Chassis Kit.

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	471580	Universal Chassis Kit						1			
2	471129	Base, universal chassis						1	6-1/15		
3	471284	Cover, universal chassis						1	6-1/16		
4	379019	Guide, universal chassis						4	6-1/14		
5	471288	Plate, universal chassis, side						2	6-1/17		
6	379014	Bracket, angle						1	6-1/12		
7	379015	Bracket, elec, edge connector						1	6-1/13		

Table 6-4. Parts List for the 471755-1 Circuit Extender Card

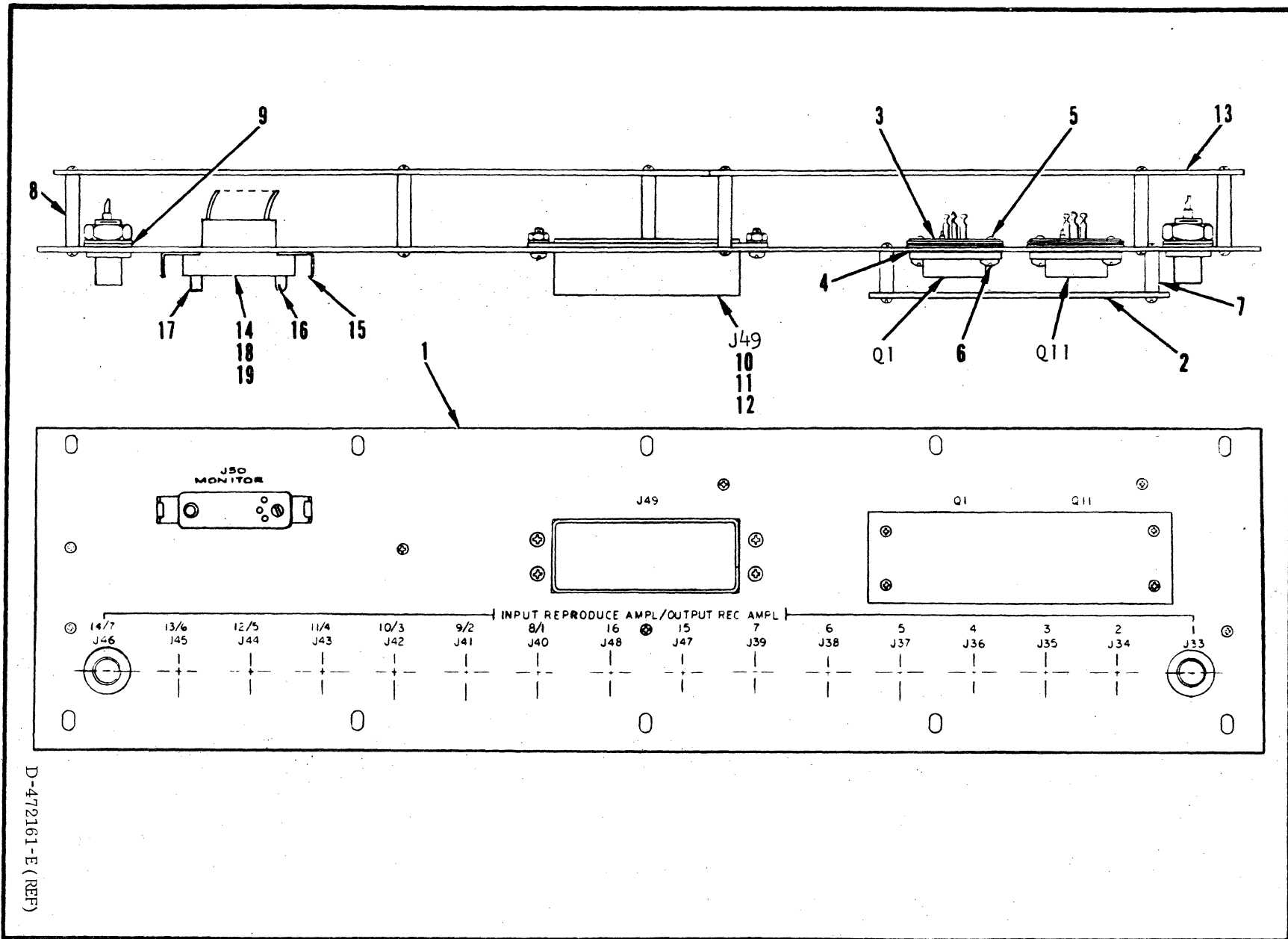
ITEM NO.	B&H PART NO.	DESCRIPTION						QTY	FIG./INDEX OR REF SYM	MFR CODE	MFR OR MIL PART NO.
		0	1	2	3	4	5				
1	471755-1	Circuit Extender Card						1	6-6		
2	471755	Printed Wiring Board						1	6-6/1		
3	471890	Support, extender card						1	6-6/2		
4	471889	Bracket, elec edge conn						2	6-6/3		
5	471478-2299	Wire, elec, 22 AWG						A/R	6-6/4		
6	471349	Shield, prtd wiring bd						1	6-6/5		
7	471872	Connector, receptacle, elec						1	J1	95238	K600-128-28XA
8	471930-5	Cap, 50 $\mu$ f +75 -10%, 25 vdc						3	C1, 2, 3	56289	500D506G025CC7



D-471912-K (REF)

Figure 6-1. 13-505 Amplifier Mounting Assembly





D-472161-E (REF)

Figure 6-2. Connector Plate Assembly

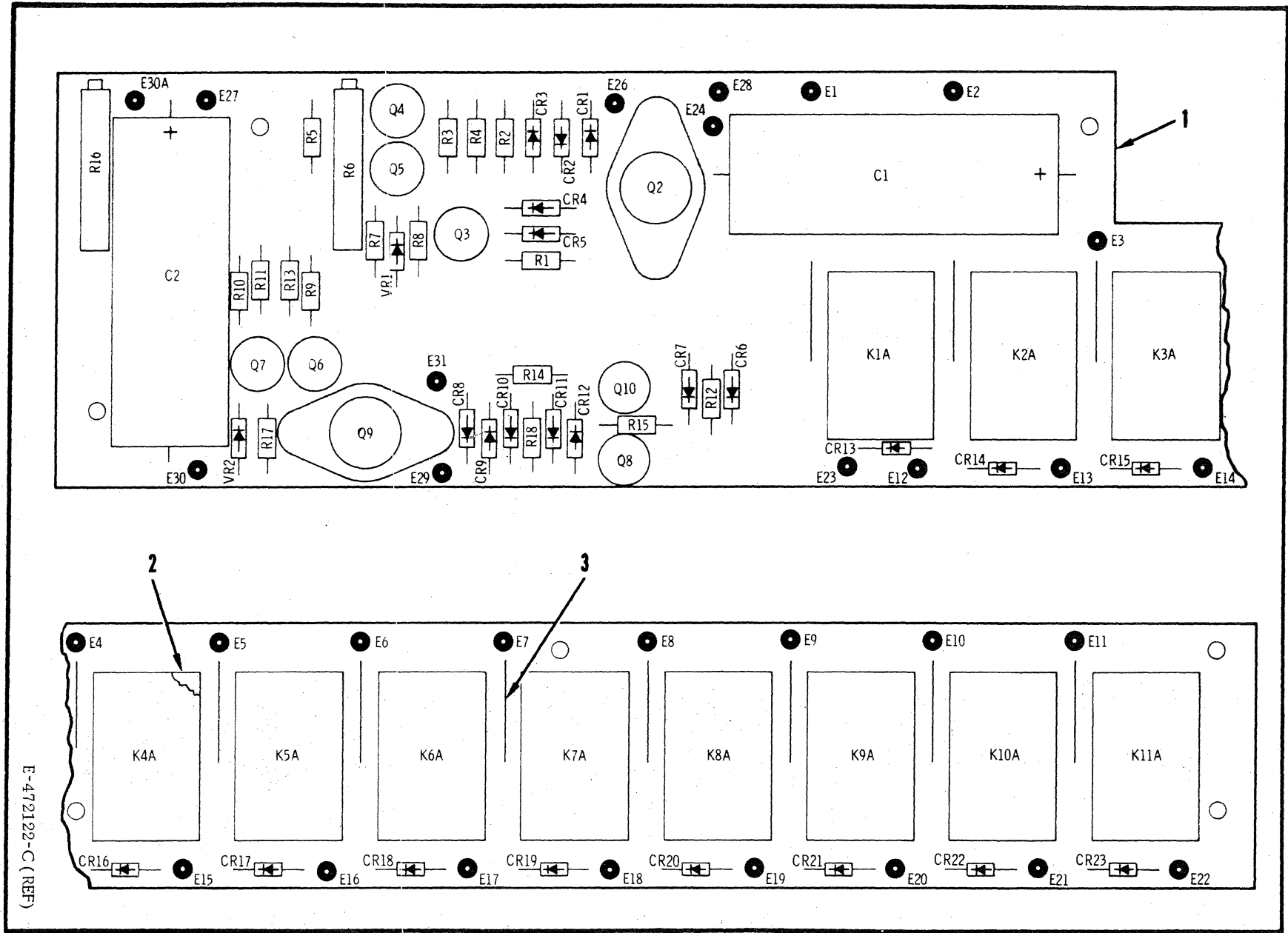


Figure 6-3. Voltage Regulator, 13-505 Amplifier Mounting Assembly

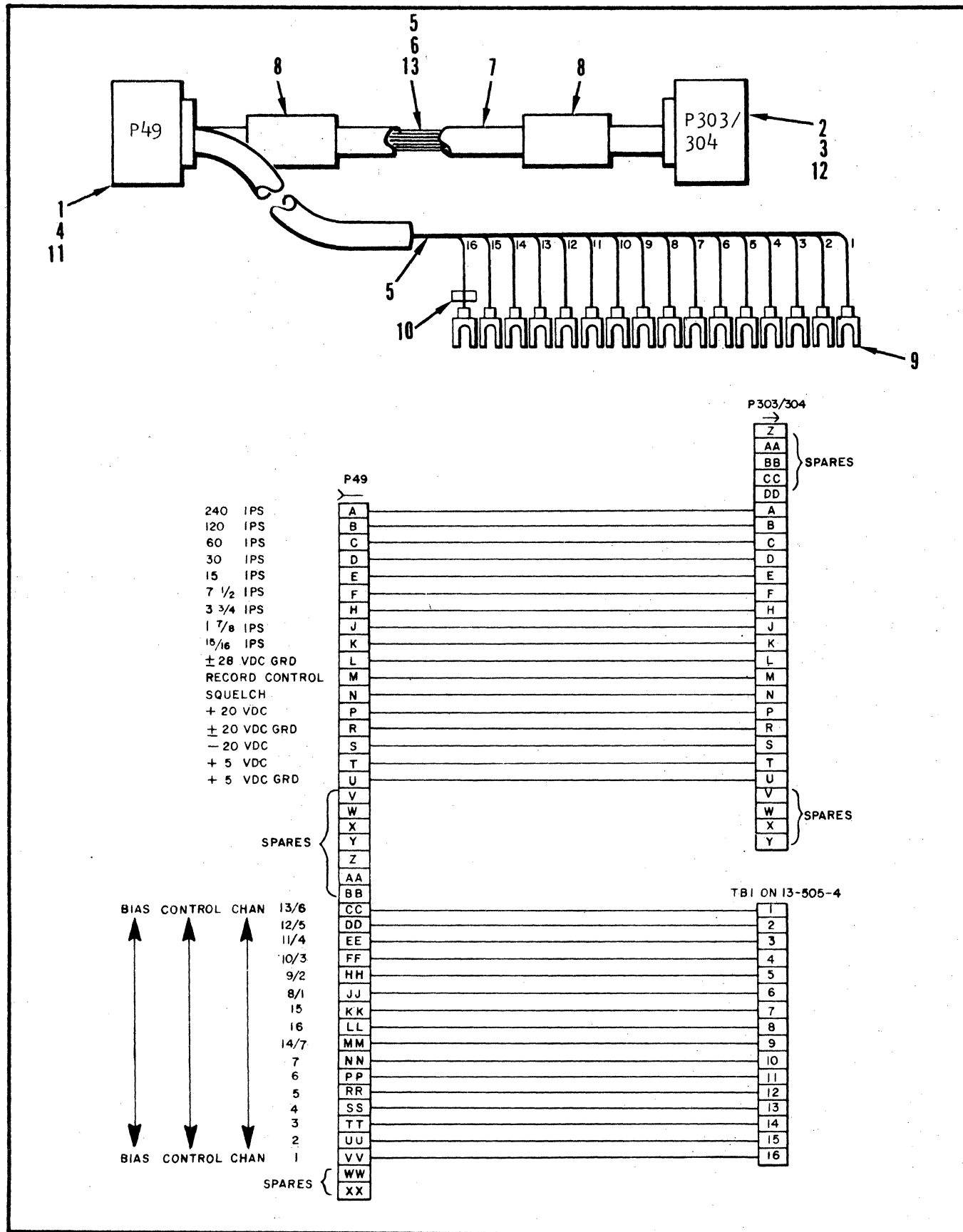


Figure 6-4. Cable Number 471632, 13-505, 13-505A, and 13-505C Amplifier Mounting Assembly to Tape Transport and Record Head Driver Amplifier Housing

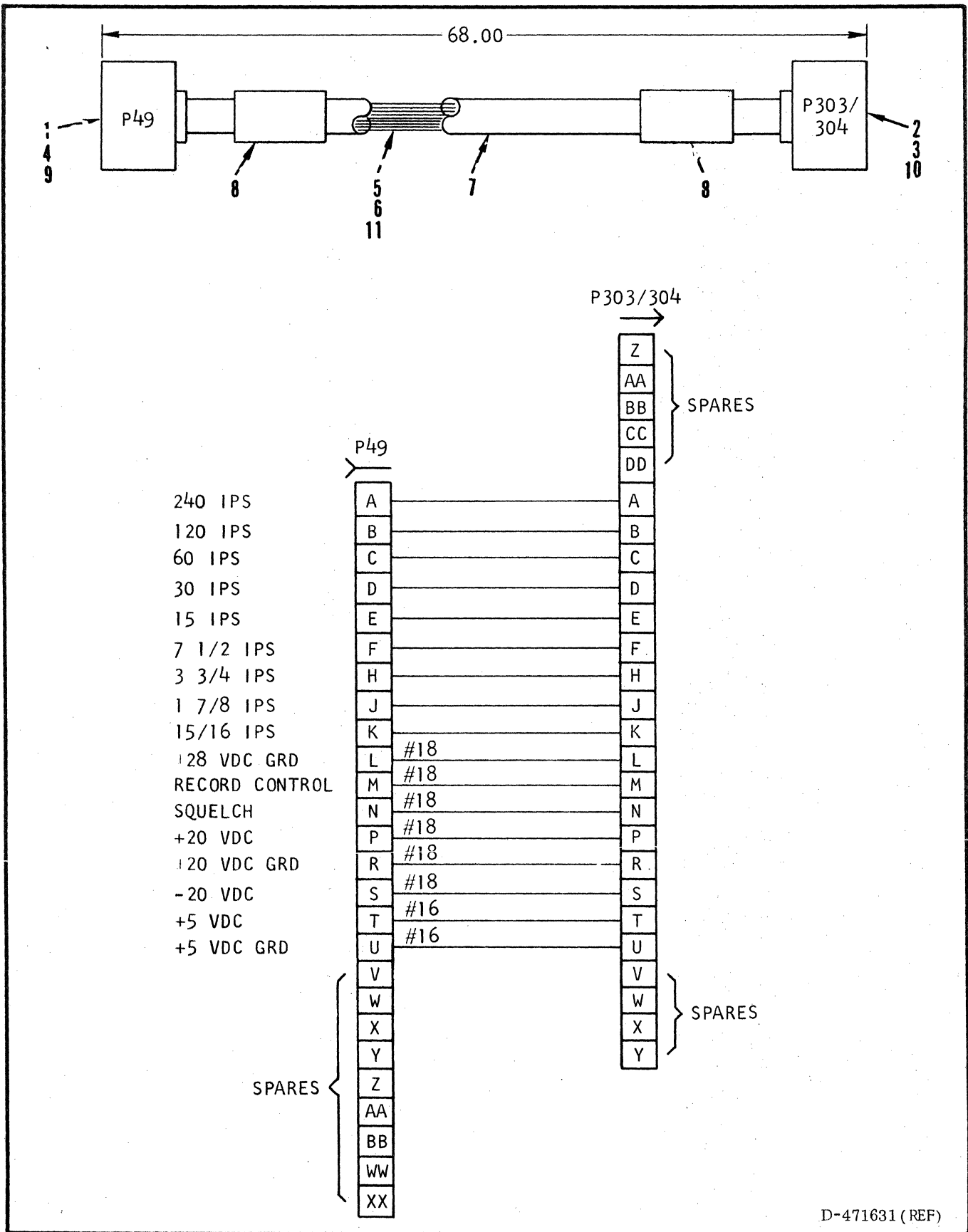


Figure 6-5. Cable Number 471631, 13-505B Amplifier Mounting Assembly to Tape Transport

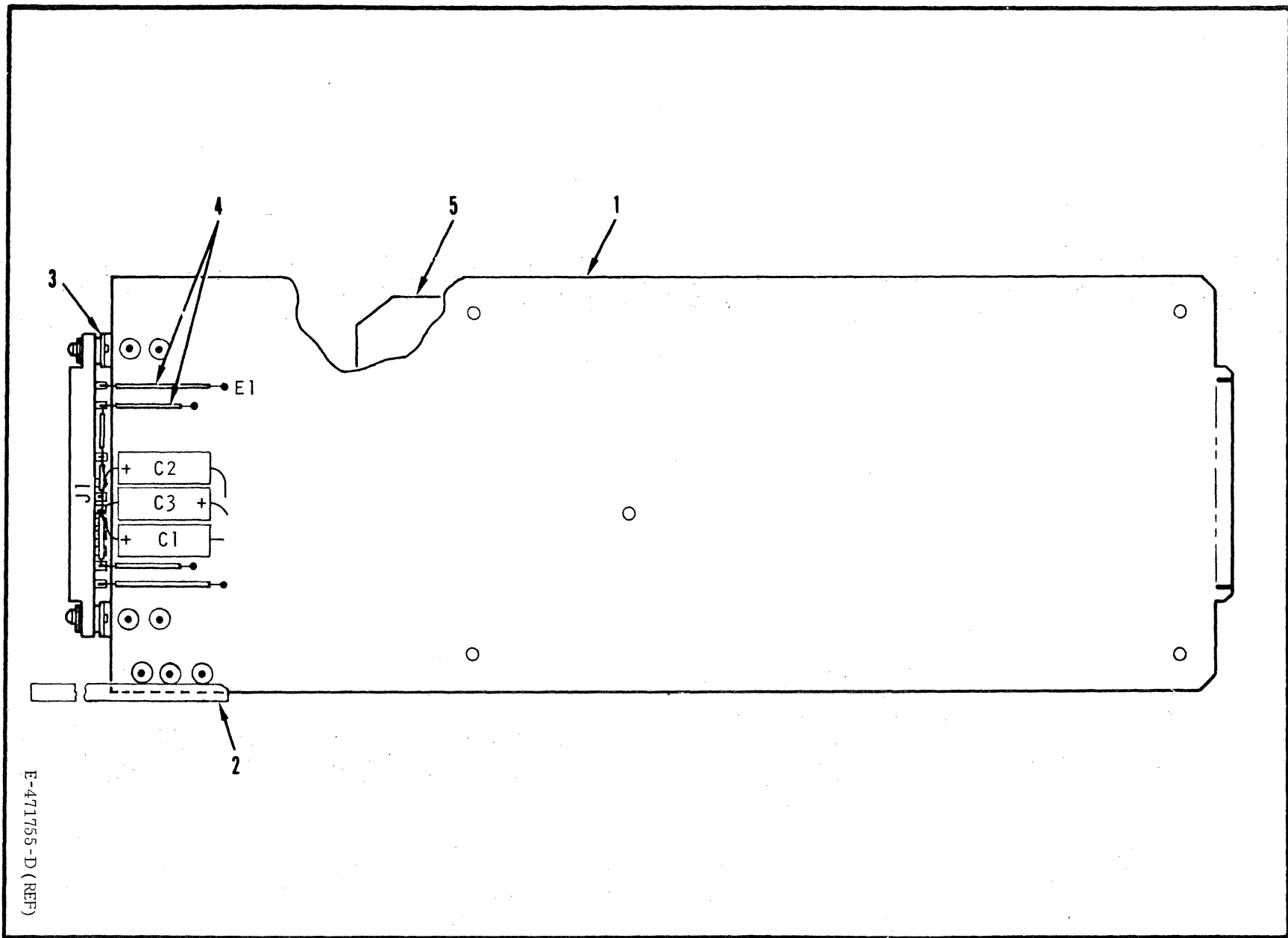


Figure 6-6. Circuit Extender Card



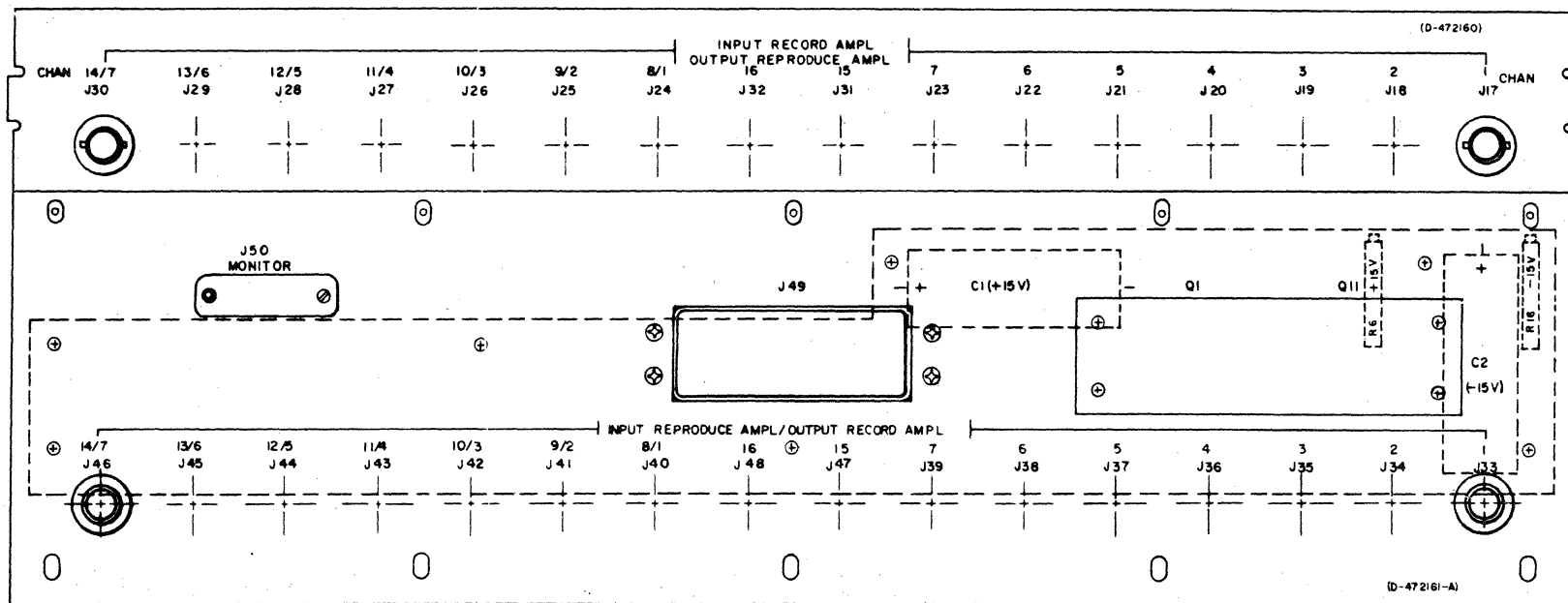
SECTION VII  
DRAWINGS AND SCHEMATICS

7-1. GENERAL.

7-2. This section contains the schematic diagram and other pertinent drawings for the 13-505 Amplifier Mounting Assembly.

7-3. Figure 7-1 is a composite drawing showing the layout of the electrical connectors on the rear panels. Shown in dotted lines are the outlines of the power regulator and control relay circuit board and the voltage control potentiometers, R6 and R16.

7-4. Figure 7-2 is the schematic diagram for the circuit extender card. Figure 7-3 is the schematic diagram for the complete amplifier mounting assembly.



D-472160 (REF)  
D-472161 (REF)

Figure 7-1. Connector Layout and Voltage Controls, 13-505 Amplifier Mounting Assembly



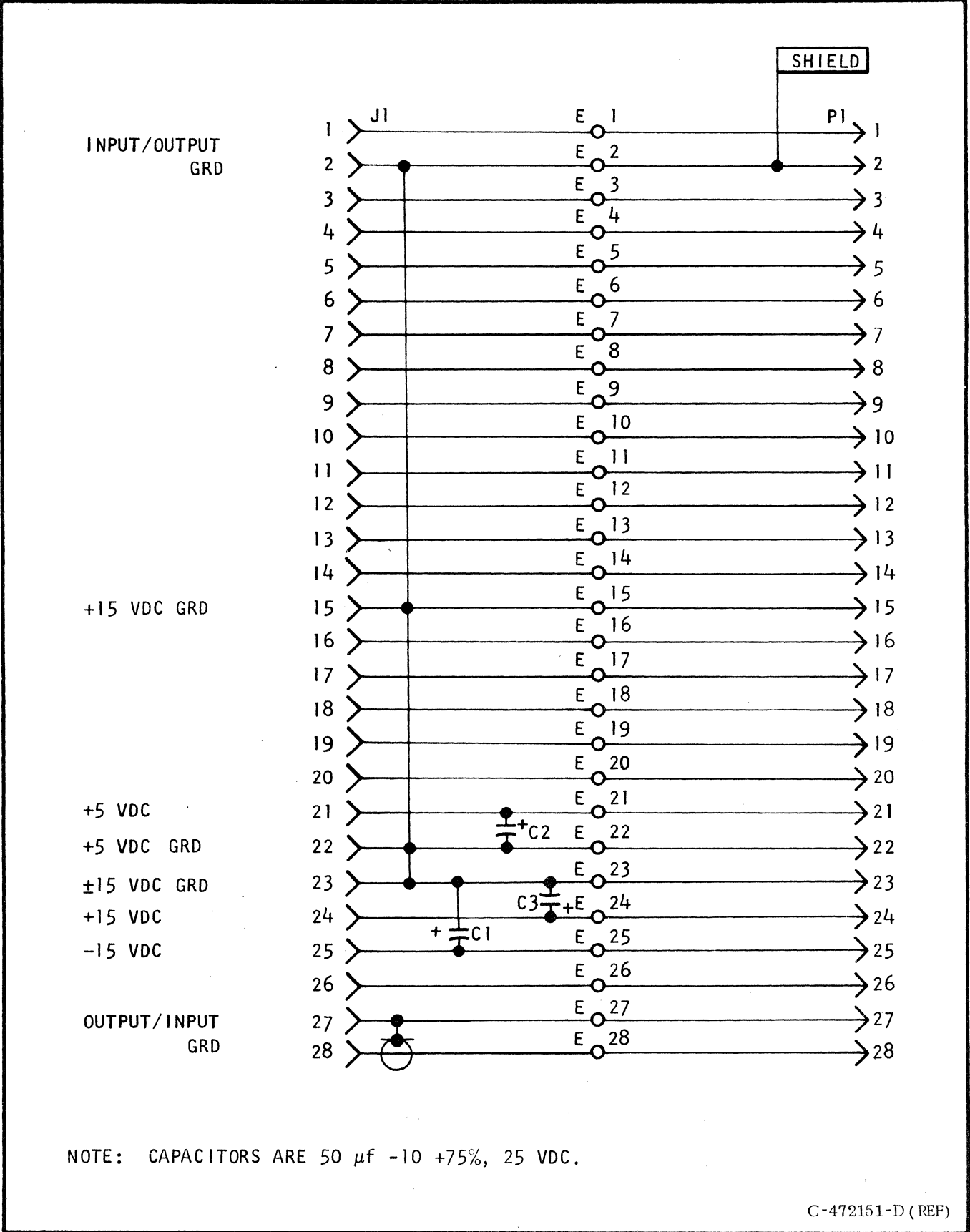
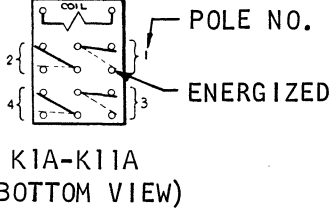
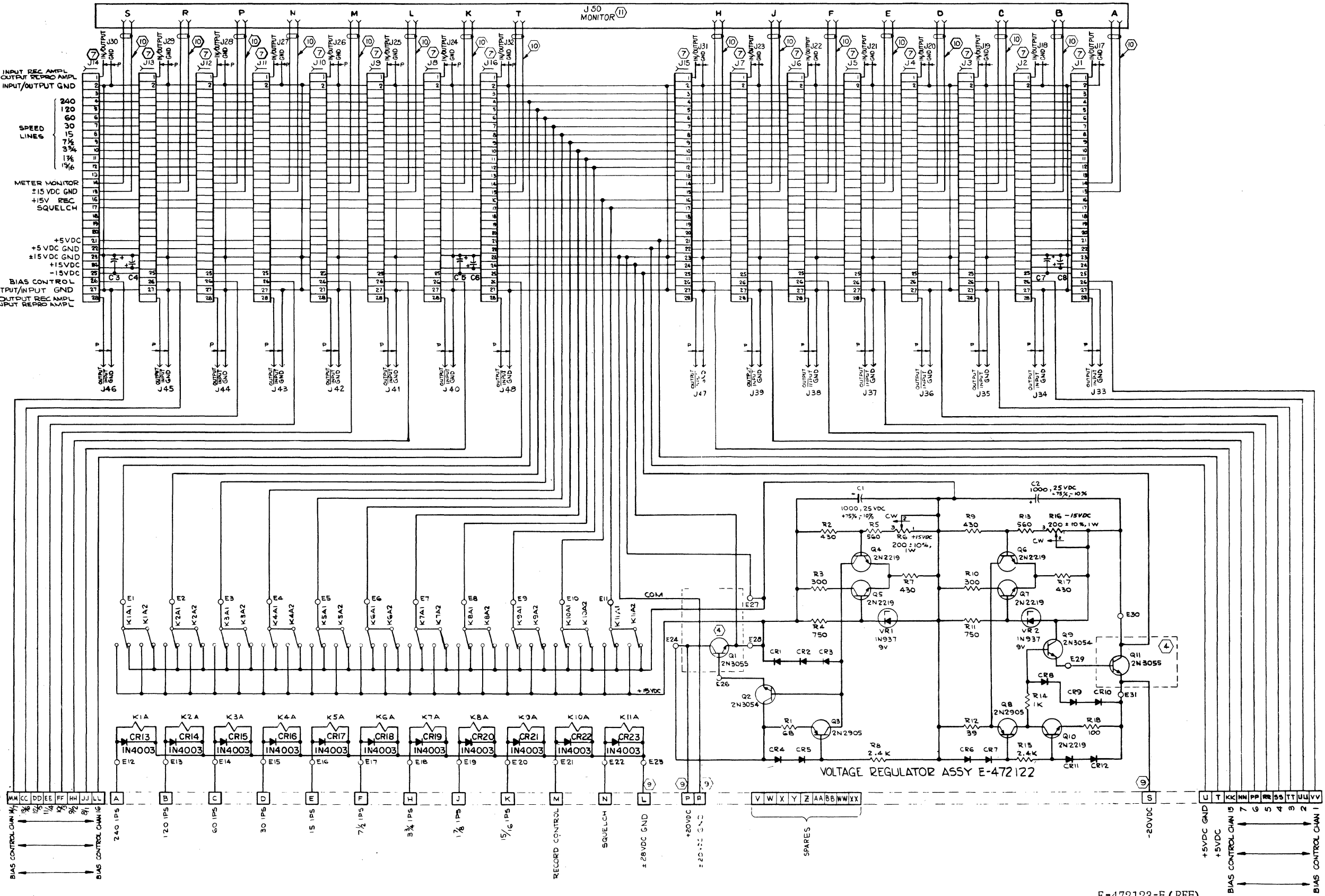


Figure 7-2. Schematic, Circuit Extender Card



LAST COMPONENT DESIGNATIONS USED	
R18, C8, CR23, VR2, Q11, J50, K11A, E31	



- ① J50 USED WITH P/L 471912-1 CONFIGURATION ONLY.
- ⑩ RG174/U CABLE.
- ⑨ STRANDED SOLID COLOR (APPROX AWG SIZE #18).
- 8. ALL WIRES STRANDED SOLID COLOR (APPROX AWG SIZE #22).
- ⑦ BUS NUMBER CONTACTS TO LETTER CONTACTS WITH #18 AWG BUS WIRE EACH CONNECTOR J1 THRU J16, SOLDERING OF WIRE TO LETTER CONTACTS OPTIONAL.
- 6. INPUT & OUTPUT LEGENDS REFER TO AMPLIFIER INPUT & OUTPUT, NOT TO SYSTEM INPUTS OR OUTPUTS.
- 5.
- ④ Q1 & Q11 ARE LOCATED ON REAR PANEL OF CHASSIS.
- 3. ALL DIODES ARE 1N4154.
- 2. CAPACITOR VALUES ARE IN  $\mu$ f.
- 1. ALL RESISTOR VALUES ARE IN OHMS  $\pm 2\%$ , 1/4 W.

NOTES: UNLESS OTHERWISE SPECIFIED.

E-472123-F (REF)

Figure 7-3. Schematic, 13-505 Amplifier Mounting Assembly