COLLINS

instruction book

Collins Radio Company

26J-3 Auto-Level Amplifier

BROADCAST EQUIPMENT GUARANTEE

The equipment described herein is sold under the following guarantee:

a. Except as set forth in paragraph b. of this section, Collins agrees with Buyer to repair or replace, without charge, any properly maintained equipment, parts or accessories which are defective as to design, materials, or workmanship and which are returned in accordance with Collins instructions by Buyer to Collins factory, transportation prepaid, provided:
   1. Notice of a claimed defect in the design, materials or workmanship of the equipment manufactured by Collins is given by Buyer to Collins within five (5) years from date of delivery, with exception of rotating machinery such as blowers, motors, and fans whereby notice must be given by Buyer to Collins within two (2) years from date of delivery.
   2. Notice of a claimed defect in the design, materials or workmanship of the following described Collins manufactured equipment is given by Buyer to Collins within two (2) years from the date of delivery:

20V-3	26U-2	81M	172G-2	216C-2	313T-4	642A-2	820F-1	830D-1	830F-2A
26J-1	42E-7	144A-1	212H-1	313T-1	356H-1	786M-1	A830-2	830E-1	830H-1A
26U-1	42E-8	172G-1	212Z-1	313T-3	564A-1	820E-1	830B-1	830F-1	830N-1A

b. The above guarantee does not extend to other equipment, accessories, tubes, lamps, fuses, and tape heads manufactured by others which are subject to only adjustment as Collins may obtain from the supplier thereof.

c. Collins further guarantees that any radio transmitter described herein will deliver full radio frequency power output at the antenna lead when connected to a suitable load, but such guarantee shall not be construed as a guarantee of any definite coverage or range of said apparatus.

d. The guarantee of this section is void if:
   1. The equipment malfunctions or becomes defective as a result of alterations or repairs by others than Collins or its authorized service center, or
   2. The equipment is exposed to environmental conditions more severe than specified by Collins in equipment manuals.

e. NO OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING WARRANTIES OF MERCHANTABILITY OR FITNESS FOR INTENDED PURPOSE, SHALL BE APPLICABLE TO ANY EQUIPMENT SOLD HEREUNDER.

f. THE FOREGOING SHALL CONSTITUTE THE BUYER'S SOLE RIGHT AND REMEDY UNDER THE AGREEMENTS IN THESE SECTIONS. IN NO EVENT SHALL COLLINS HAVE ANY LIABILITY FOR CONSEQUENTIAL DAMAGES, OR FOR LOSS, DAMAGE OR EXPENSE DIRECTLY OR INDIRECTLY ARISING FROM THE USE OF THE PRODUCTS, OR ANY INABILITY TO USE THEM EITHER SEPARATELY OR IN COMBINATION WITH OTHER EQUIPMENT OR MATERIALS, OR FROM ANY OTHER CAUSE.

g. The guarantees of this section and limitations thereon will also accrue to the benefit of any purchaser of Buyer's F.C.C. license, provided:
   1. Notice of the sale of the F.C.C. license is given by Buyer to Collins in writing within thirty (30) days after the consummation of said sale; and
   2. No greater rights are granted to the purchaser of Buyer's F.C.C. license than are granted herein to Buyer.

How to Return Material or Equipment If, for any reason, you should wish to return material or equipment, whether under the guarantee or otherwise, you should notify us, giving full particulars including the details listed below, insofar as applicable. If the item is thought to be defective, such notice must give full information as to nature of defect and identification (including part number if possible) of part considered defective. (With respect to tubes we suggest that your adjustments can be speeded up if you give notice of defect directly to the tube manufacturer.) Upon receipt of such notice, Collins will promptly advise you respecting the return. Failure to secure our advice prior to the forwarding of the goods or failure to provide full particulars may cause unnecessary delay in the handling of your returned merchandise.

ADDRESS:

Collins Radio Company
Customer Returned Goods, 412-023
1225 North Alma Road
Richardson, Texas 75080

INFORMATION NEEDED:

(A) Type number, name and serial number of equipment
(B) Date of delivery of equipment
(C) Date placed in service
(D) Number of hours of service
(E) Nature of trouble
(F) Cause of trouble if known
(G) Part number (9 or 10 digit number) and name of part thought to be causing trouble
(H) Item or symbol number of same obtained from parts list or schematic
(I) Collins number (and name) of unit subassemblies involved in trouble
(J) Remarks

How to Order Replacement Parts When ordering replacement parts, you should direct your order as indicated below and furnish the following information insofar as applicable. To enable us to give you better replacement service, please be sure to give us complete information.

ADDRESS:

Collins Radio Company
Service Parts, 412-024
1225 North Alma Road
Richardson, Texas 75080

INFORMATION NEEDED:

(A) Quantity required
(B) Collins part number (9 or 10 digit number) and description
(C) Item or symbol number obtained from parts list or schematic
(D) Collins type number, name and serial number of principal equipment
(E) Unit subassembly number (where applicable)

1 December 1967

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15 April 1969

COLLINS

instruction book

26J-3 Auto-Level Amplifier

Collins Radio Company | Dallas, Texas

table of contents

table of contents (cont)

list of illustrations

list of tables

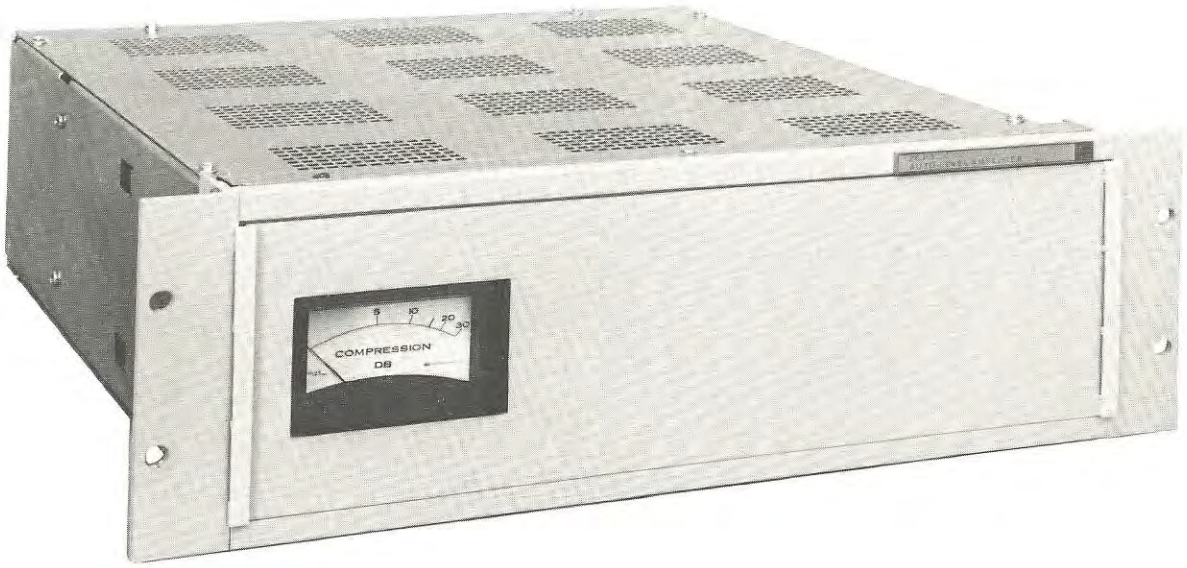

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Figure 1-1. 26J-3 Auto-Level Amplifier.

section 1
general description

1.1 PURPOSE OF INSTRUCTION BOOK

This instruction book contains information for the installation, adjustment, operation, and maintenance of the 26J-3 Auto Level-Amplifier. Refer to figure 1-1.

1.2 PURPOSE OF EQUIPMENT

The auto-level amplifier provides a high degree of automatic gain control for broadcast program material. Use of the 26J-3 results in a higher average modulation level while reducing the chance of transmitter overmodulation.

1.3 PHYSICAL DESCRIPTION

The 26J-3 is housed in a metal case 5-1/4 inches high, 19 inches wide, 15-3/4 inches deep and weighs approximately 15 pounds. A removable front panel covers all operator controls that are mounted on the assembly containing the printed circuit card and power supply. The signal inputs and outputs are located on the rear panel.

1.4 FUNCTIONAL DESCRIPTION

Refer to figure 1-2 for the following discussion. INPUT LEVEL attenuator A1R10 controls the program level to gain control amplifier A1 and the signal presence circuits (SPC). With GAIN CONTROL switch A1S1 in AUTO position, operational amplifier A2 amplifies part of the input signal. A2 also isolates the input circuits from the detector/delay circuits. The detector/delay circuits derive a dc voltage dependent on the audio input amplitude. This dc level is delayed to prevent the Schmitt trigger from changing states because short duration signal losses, such as pauses in speech. The Schmitt trigger out-of-phase outputs, fixed normal gain enable, and autogain enable control the states of gain control switches, Q12 and Q13, in the automatic gain control (agc) circuits.

Under normal conditions, input below threshold, fixed-normal-gain enable turns fixed gain switch Q12 on. Fixed-normal-gain enable, through CR23, disables the agc voltage from the signal detector circuits. Fixed gain adjust R50 sets the agc voltage under these conditions. The signal detector circuits derive an amplitude and time dependent dc voltage from the audio input. Gain control switches Q12 and Q13 determine the amplitude and duration of this agc voltage. During normal programming, switch Q13 is on and Q12 is off. As the input program level changes, the voltage from the signal detector circuit also changes. Agc amplifier Q14, Q15, and Q17 amplifies this voltage, drives the front panel meter, A1M1, and supplies gate bias for Q1.

Mos fet* Q1 operates as a voltage controlled shunt resistance that controls the negative feedback for operational amplifier A1. When weak signals, such as soft music passages are sensed, the agc circuits increase the gain of A1 to maintain its average output level. If a loud passage should occur and return to normal, the agc circuits will immediately decrease the gain of A1, when the amplitude increase is sensed, and slowly return the gain to normal as the input decreases. This permits gain corrections that are not discernable to the average listener.

With GAIN CONTROL switch A1S1 in DISABLE position, A1 functions as an input amplifier with no gain control. Buffer amplifiers Q2 and Q3 provide gain and isolation. OUTPUT LEVEL potentiometer A1R11 develops the signal from Q3. Output amplifier transistors Q4 through Q9 provide gain and impedance matching. Transformer T2 may be tapped for 600- or 150-ohm impedance matching.

Solid-state switch Q18 and Q19 provides the agc voltage necessary for paralleling two 26J-3's for stereo operation.

*Metal oxide semiconductor field effect transistor

1.5 TECHNICAL CHARACTERISTICS

Input Level:
15 dbm maximum (with level control maximum cw)
10 dbm (normal operating level)

Input Impedance:
600 ohms ±20% balanced

Compression Range:
30 db minimum (figure 1-3)

Compression Ratio:
15:1 minimum

Attack Time:
5 ms.

Release Time:
7 to 11 ms

Threshold Level:
-20 to -25 db with input level control maximum cw

Frequency Response:
±1 db, 50 to 15,000 Hz

Distortion:
1% maximum with output up to +20 dbm and compression 0 to 30 db

Noise Level:
-50 dbm under average 15-db compression

Output Level:
20 dbm maximum (reference 0 dbm = 1 mw in 600 ohms)

Output Impedance:
600 ohms ±20% balanced or unbalanced
150 ohms ±20% unbalanced

Ambient Temperature Range:
+15° to +40°C

Ambient Humidity Range:
0 to 95% relative humidity

Altitude:
Up to 10,000 feet

Shock and Vibration Condition:
Normal handling and transportation

Power Source:
117 vac ±10%, 50/60 Hz, single-phase, 30 watts maximum

Type of Service:
Continuous

Fuse:
The 26J-3 is equipped with a 1/2 ampere Slo-Blo post-mounted fuse

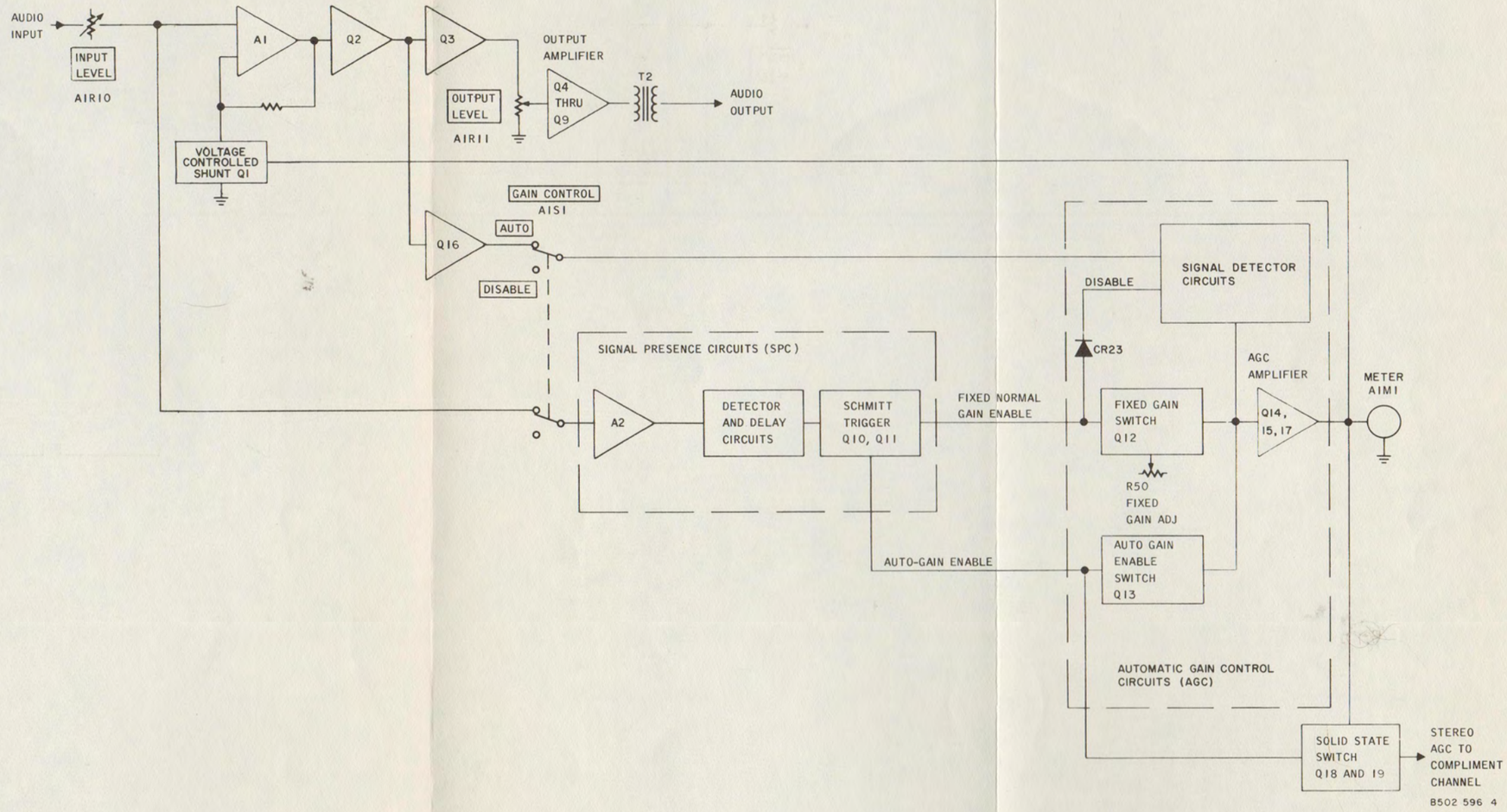

Figure 1-2. 26J-3 Functional Block Diagram.

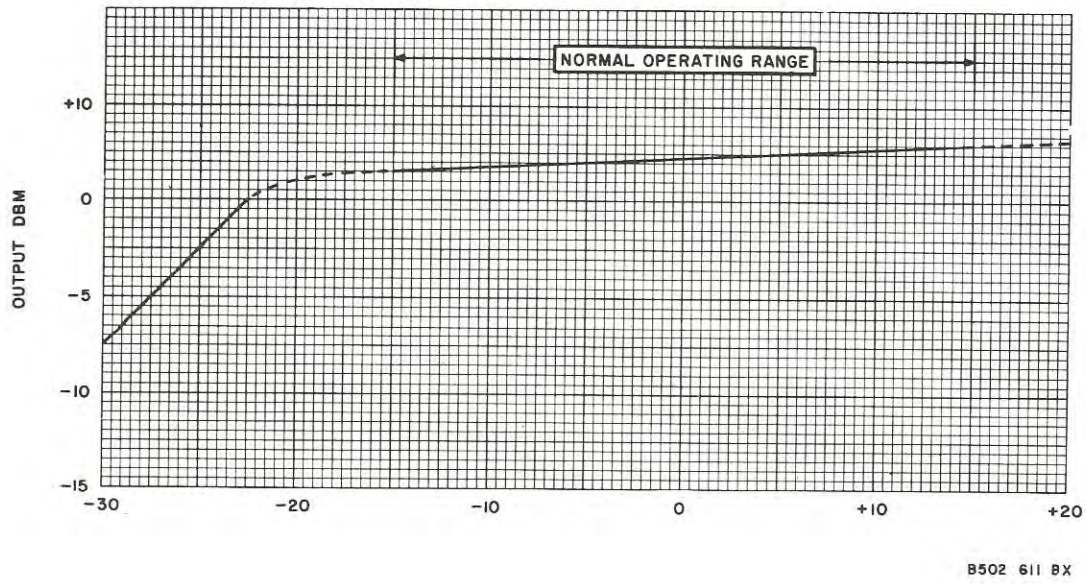

Figure 1-3. Compression Characteristic Curve.

section 2
installation and adjustment

2.1 UNPACKING AND INSPECTING THE EQUIPMENT

Remove all packing material carefully and lift the unit from the package. Check the equipment against the packing slips. Visually inspect the unit for damaged or missing components. Check for proper operation of controls. Any claims for damage should be filed promptly with the transportation agency. If such claims are to be filed, all packing material must be retained.

2.2 INSTALLATION

2.2.1 Mounting

Position the amplifier in a standard 19-inch rack or cabinet and secure.

2.2.2 Connections

Prior to connecting amplifier primary power and external inputs and outputs, set POWER switch to OFF.

Note

Use shielded cable for all input and output lines to reduce the possibility of hum pickups.

2.2.2.1 Audio Input and Output Connections

Connect the audio input and output connections to the terminal block on rear panel of the amplifier (figure 2-1) as listed in table 2-1. For 600-ohm balanced input use terminals 1 and 3. Terminal 2 is a common for use with 600-ohm balanced line. For 600-ohm balanced output, strap terminal 5 to terminal 6 and take output from terminals 4 and 7. For 150-ohm balanced output, strap terminals 4 and 6, also strap terminals 5 and 7, and take output from terminals 4 and 7. Terminal 8 is a ground provided for use with unbalanced lines.

2.2.2.2 Connection for Stereo Operation

The 26J-3 amplifiers may be connected in parallel for stereo operation (figure 2-2). When connected in this manner, the channel with the highest amplitude controls the gain of both amplifiers, thus providing the required dynamic separation.

2.3 ADJUSTMENT PROCEDURES

The following procedures outline the adjustments required for stereo and monaural operation.

2.3.1 Adjustment Procedures for Monaural Operation

a. Adjust INPUT LEVEL and OUTPUT LEVEL controls fully ccw.
b. Set POWER switch to ON.
c. With normal program material fed into the 26J-3, adjust INPUT LEVEL for approximately 15-db compression as indicated by the green marker.
d. Adjust OUTPUT LEVEL for the required line amplitude.

2.3.2 Adjustment Procedures for Stereo Operation

a. Connect equipment as shown in figure 2-2 with the exception of AGC A.
b. With both INPUT LEVEL controls maximum cw, apply a 1-kHz signal to amplifier A. Increase the input level until the compression meter reaches 15 db.
c. Adjust the amplifier output level for the desired line level.
d. Connect another signal source to amplifier B and adjust the frequency to approximately 1 kHz.
e. Increase the input level to amplifier B to 0 dbm and observe output A. If output A decreases in level, its associated compression meter will also read completely down scale. To correct this, adjust R70 of amplifier B (figure 7-1) ccw until amplifier A output returns to its previous setting. If amplifier A remains unaffected with a 0-dbm

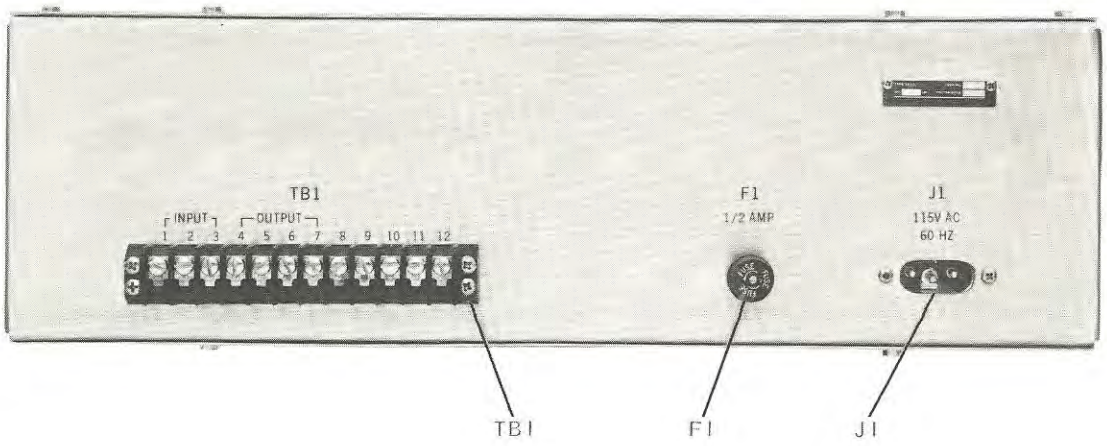

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Figure 2-1. Rear Panel Connections.

Table 2-1. Connections.

SIGNAL NOMENCLATURE	TERMINAL NUMBER
Audio input, 600-ohm balanced	1 and 3
Audio input, common for 600 ohms	2
Audio output, (paragraph 2.2.2.1)	4, 5, 6, 7
Ground	8
Connections for stereo operation (figure 2-2)	9, 10
Aux audio input	11

input to amplifier B, readjust R70 of amplifier B slowly cw until the output of amplifier A just begins to decrease.

f. Remove AGC B and connect AGC A.

g. Increase the input level to amplifier B until the compression meter reads 15 db.

h. Adjust amplifier B output for the desired line level.

i. Increase the input level to amplifier A to 0 dbm and observe output B. If output B decreases in level, its associated compression meter will also read completely down scale. To correct this, adjust R70 of amplifier A ccw until amplifier B output returns to its previous setting. If amplifier B remains unaffected with a 0-dbm input to amplifier A, adjust R70 of amplifier A slowly ccw until amplifier A output returns to its previous setting.

j. Connect AGC B.

k. Decrease both INPUT LEVEL controls and increase both input signal levels to their normal values.

l. Increase both INPUT LEVEL controls slowly until both read approximately 15-db compression and the outputs of both amplifiers are equal. The OUTPUT LEVEL controls should not be used to equalize the output levels. This will cause a permanent change in channel levels.

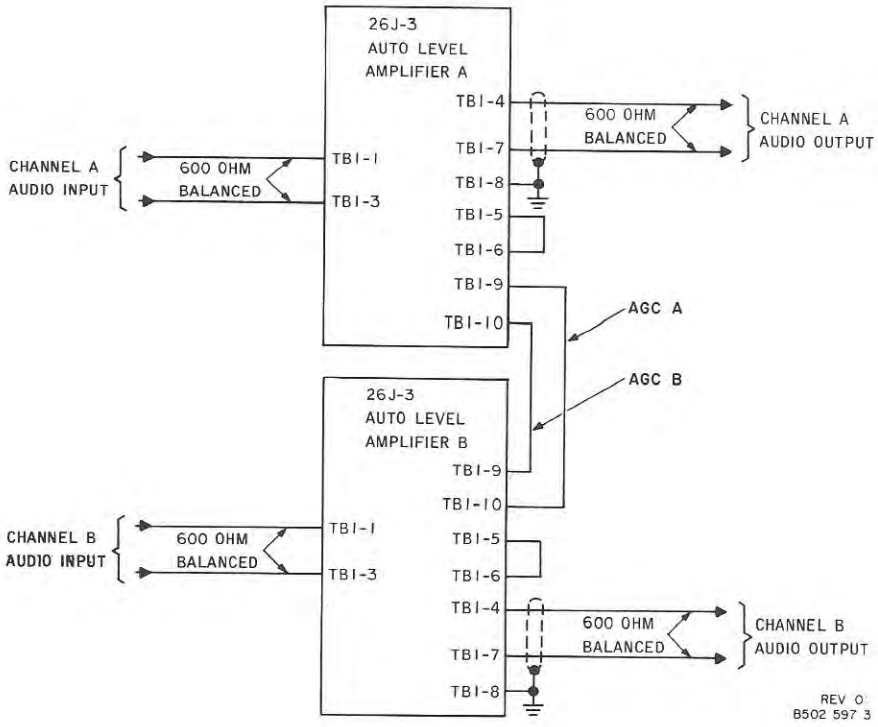

Figure 2-2. Connection for Stereo Operation.

section 3
operation

3.1 PANEL CONTROLS AND INDICATORS

This section locates, illustrates, and describes the function of each front panel control (figure 3-1 and table 3-1).

3.2 OPERATING PROCEDURES

Under normal conditions the 26J-3 should not require any adjustment. If the input or output conditions/requirements change, refer to paragraph 2.3 for adjustment procedures.

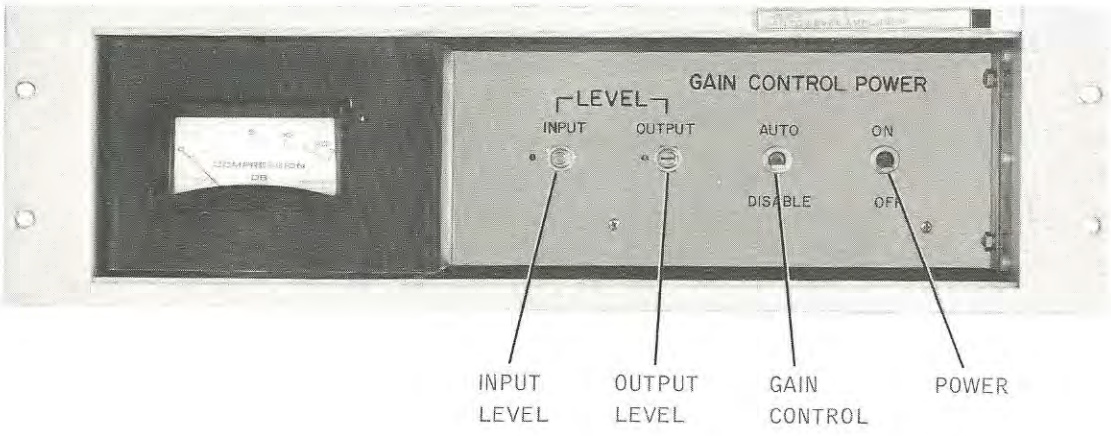

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Figure 3-1. Panel Controls and Indicators.

Table 3-1. Controls and Indicators.

NAME	PANEL MARKING	FUNCTION
Power switch	POWER ON/OFF	Turns amplifier on and off.
Compression on/off	GAIN CONTROL AUTO/ DISABLE	Removes gain control and allows the 26J-3 to function as a straight audio amplifier.
Input level control	INPUT LEVEL	Controls the amount of audio to the gain control circuits.
Output level control	OUTPUT LEVEL	Controls the audio output of the 26J-3.
Panel meter	None	Indicates the compression level of the input signal.

section 4
principles of operation

4.1 GENERAL

The 26J-3 is an automatic level-controlling amplifier for use in audio applications where a high degree of gain control is desired. Two units may be paralled for stereo operation. The 26J-3 controls the program level with two time controls: one control responds to level changes of several seconds duration, and the other responds only to short duration (several hundred milliseconds) changes.

4.2 AMPLIFIER PRINCIPLES OF OPERATION

The following paragraphs are keyed to the schematic diagram (figure 7-1).

4.2.1 Input Circuits

INPUT LEVEL attenuator controls the audio level across the primary winding of impedance-matching transformer T3. The secondary of T3 couples the input to the gain controlling amplifier A1. With GAIN CONTROL switch A1S1 in the DISABLE position, amplifier A1 functions as an input amplifier with no gain control. Transistors Q2 and Q3 buffer the output of A1 and the signal is developed across OUTPUT LEVEL potentiometer A1R11.

4.2.2 Output Amplifier

The output amplifier (Q4 through Q9) functions the same regardless of the position of GAIN CONTROL switch A1S1. Transistors Q4 and Q5 amplify the signal tapped off A1R11. Transistors Q6 through Q9 form a complementary emitter-follower output stage that is loaded into a transformer with dual 150-ohm secondaries. The output may be connected as a 150-ohm or 600-ohm source with a maximum power output of 20 dbm.

4.2.3 Level Control Circuits

With GAIN CONTROL switch A1S1 in the AUTO position part of the input signal is tapped off the secondary center tap of T3 and amplifier by A2. Diode CR16 places the output of A2 on a -12 volt pedestal and CR17 detects the positive peaks. The parallel combination of R14 and C20 develops the detected signal. This Rc time constant provides a small delay to prevent the Schmitt trigger (Q10, Q11) from changing states during brief signal losses, such as pauses in speech. Under no-signal conditions (input below threshold) Q10 is off and Q11 is on. Diode CR23 disables the entire detector network for signal levels below threshold. The two out-of-phase Schmitt trigger outputs control the states of fet switches Q12 and Q13. Under normal conditions, Q10 being off keeps Q12 on, placing R48 in the discharge circuit of C21. When the Schmitt trigger changes states, Q12 turns off and Q13 turns on, placing R54 in the discharge path of C21.

Under normal signal level conditions, Q13 is on and Q12 is off. The parallel combination of R54 and C21 establish the controlling time constant for the agc level. The parallel combination of R48 and C21 establish the agc time constant for signal levels below threshold. The time constant of C21 and R48 is a great deal longer than the combination of C21 and R51 even though the reverse is true of their Rc products, because the voltage across R48, when it is active, is always less than the voltage across R54 when Q13 is on. Variable resistor R50 determines the agc voltage that establishes the compression level of 15 db when the signal level is below threshold.

With switch A1S1 in the AUTO position, the signal is ac coupled to detector diodes CR20 and CR22. Under normal conditions, diode CR21 is reverse biased because of the bias established by R60, R63, R61, and R64. The signal detected by CR20 determines the dc voltage stored at the gate of Q15 by C21 and R54. Normal audio program material amplitude changes are within the rate and dynamic range of the time constant established by C21 and R54. A quiet passage 8 to 10 db below normal level will allow the detected voltage stored across C22 and R54 to decay enough to forward bias CR21. The voltage stored at the gate of Q15 will decrease rapidly because

of the rapid discharging of C21. This increases the gain of A1 until the signal level at CR20 and CR22 once again reverse biases CR21.

Q15, a jfet* used for high-input impedance, buffers the dc output from the signal detector circuits. Q14 provides level shifting while Q17 an emitter follower provides impedance matching. The dc output from Q17 is the agc voltage used for level control. When a gain correction (reduction) is necessary the agc voltage increases in the positive direction. This positive going dc voltage tends to reverse bias mos fet Q1 increasing the shunt resistance to ground. This increase of resistance allows more negative feedback to terminal 2 of A1, which results in reduced gain. The dc voltage from Q17 also drives the front panel meter which indicates the relative level of compression.

4.2.4 Power Supply

The 26J-3 contains a built in 117-vac power supply. The power supply is a conventional dual full-wave, Rc filtered supply. Zener diodes provide voltage regulation. CR5 regulates the +20 vdc supply while CR6 and CR7 regulate the positive and negative 12 vdc supplies.

*Junction field effect transistor

section 5
maintenance

5.1 GENERAL

The following paragraphs contain maintenance procedures for the 26J-3 Auto-Level Amplifier. Maintenance personnel should become familiar with the principles of operation before attempting to service the 26J-3.

5.2 PREVENTIVE MAINTENANCE

Many electronic equipment malfunctions are caused by accumulated dirt or corrosion. Inspect the equipment at regular intervals, depending upon environmental conditions. Remove the 26J-3 from its enclosure and use a soft brush and low-pressure air hose or vacuum cleaner to remove dirt and lint. The low-pressure air supplied should be dry and oil-free. Inspect all metal parts for rust, corrosion, and general deterioration. Check wiring and components for signs of overheating, and the power connector and terminal strip on the rear of the unit for broken or loose pins and terminals. Check all operating controls for smoothness of operation. In addition, check all connections and tighten any nuts, bolts, or screws that are loose.

5.3 SPARE PARTS

Spare parts may be ordered from the following address:

Collins Radio Company
Service Parts, 412-024
1225 North Alma Road
Richardson, Texas 75080

5.4 RECOMMENDED TEST EQUIPMENT

The test equipment recommended for the trouble analysis and adjustment procedures of the 26J-3 is listed in table 5-1. Test equipment having characteristics equivalent to those listed may be used.

5.5 TROUBLE ANALYSIS

Before starting troubleshooting, be sure that the amplifier is actually defective. Check the input and output connections and operation of controls. A little time spent here could save a lot of trouble.

Trouble analysis procedures for the 26J-3 consist of isolating the trouble to a stage, and then making resistance and/or voltage measurements until the trouble source is found. Test points are assigned in various locations to aid the technician in this trouble isolation.

Refer to table 5-2 for the troubleshooting procedure. The voltages given are typical and do not represent absolute values. Different amplifiers may contain voltages that vary slightly from the values given with no loss in performance.

5.5.1 Preliminary Adjustments

Perform the following steps to prepare the amplifier for troubleshooting:

a. Connect the amplifier and test equipment as shown in figure 5-1.
b. Adjust the audio oscillator for a 1-kHz, -10 dbm output.
c. Position amplifier controls as shown below:

1.	POWER ON/OFF	ON
2.	INPUT LEVEL	Fully cw
3.	OUTPUT LEVEL	Fully cw
4.	GAIN CONTROL	DISABLE

Table 5-1. Recommended Test Equipment.

EQUIPMENT	MANUFACTURER AND TYPE
Wide range oscillator	HP-200CD
Attenuator set	HP-350B
Distortion analyzer	HP-331A
Ac vtvm	HP-400L
Vtvm	HP-410B

Table 5-2. Troubleshooting Procedure.

STEP	TEST EQUIPMENT USED	LOCATION OF TEST	INDICATION	NOTES
1	HP-400L	TB1-4 and TB1-7 (ground)	+20 dbm	If this indication is correct, continue to step 10. If incorrect, continue to step 2.
2	HP-410B	Cathode CR5	+20 vdc	
3	HP-410B	Cathode CR6	+12 vdc	
4	HP-410B	Anode CR7	-12 vdc	
5	HP-410B	Anode CR24	-3.6 vdc	
6	HP-400L	T3 - pin 6	.7 v rms	
7	HP-400L	Base Q2	.1 v rms	
8	HP-400L	Base Q4	.2 v rms	
9	HP-400L	T2 - pin 1	1.65 v rms	
10				Place GAIN CONTROL in AUTO position.
11	HP-400L	Emitter Q16	1.38 v rms	
12	HP-400L	Pin 6 A2	11.5 v rms	
13	HP-410B	Gate Q15	-1.08 vdc	
14	HP-410B	Base Q17	-2.0 vdc	
15	HP-410B	Collector Q10	-7.0 vdc	
16	HP-410B	Collector Q11	-7.0 vdc	

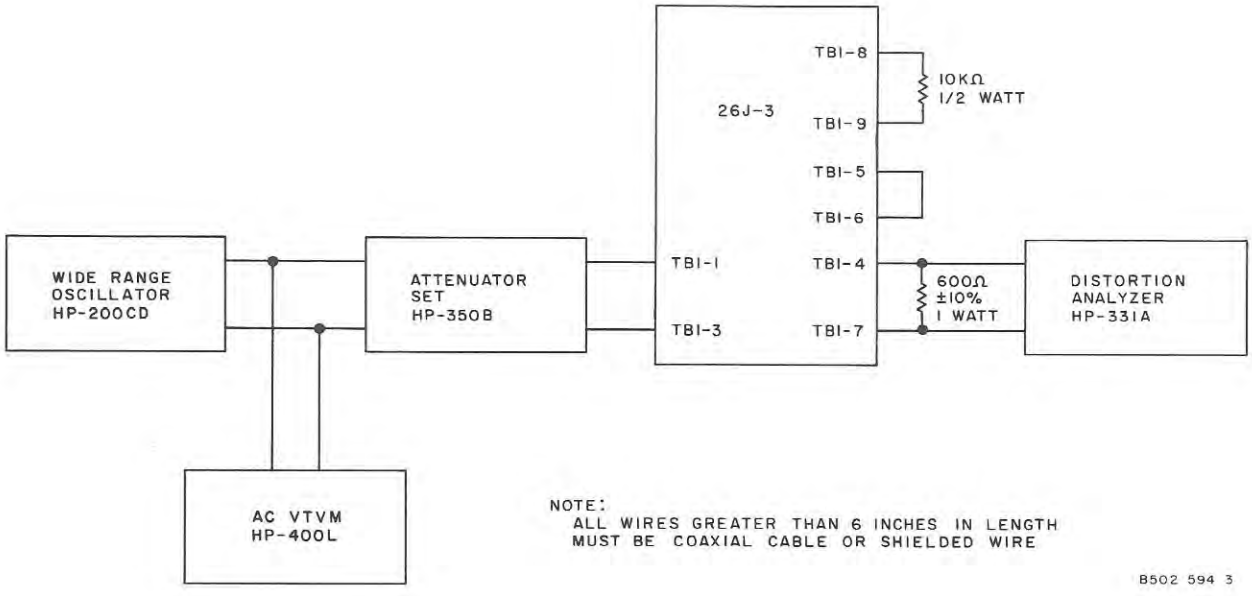


Figure 5-1. Test Equipment Setups.

5.5.2 Troubleshooting Procedure

Using the schematic diagram (figure 5-1) and parts location guide (figure 6-3) perform the measurements listed in table 5-2. Once the trouble is located to a stage, use the HP-410B as an ohmmeter to locate the defective component. After a repair is made, check the amplifier in operation before attempting any recalibration. In most cases replacement of a defective component will not necessitate recalibration.

5.6 REPAIR OF PLANAR PROCESS BOARDS WITH PLATED THRU HOLES

Caution

Exercise extreme care during component replacement to avoid damage to the circuit board. Heat applied for more than 5 seconds may cause the plated thru holes to become loose or broken and severely damage the board. Do not attempt to repair a damaged board. Return it to the factory for repair.

a. Replace components with accessible leads (resistors, capacitors, etc.) in accordance with the following procedure.
   1. Cut the component lead beyond the bend (nearest the board). Make sure the cut lead is straight.
   2. Remove all burrs by rounding or squeezing the lead with the long-nosed pliers.
   3. Apply heat (5 seconds, maximum) to the lead on the backside of the board and remove the molten solder with a solder sipper (Collins part number 024-0676-010).
   4. Allow the board to cool completely between heatings and repeat step 3. as necessary.
   5. Carefully break the lead loose from the hole, and gently remove the cold lead. If necessary, slightly heat the lead from the component side of the board while carefully removing the lead from the bottom.
   6. Carefully insert the lead of the replacement component into the hole. Be sure the lead is straight.
   7. Apply heat to the lead on the backside of the board (5 seconds, maximum) and allow fresh solder to flow into the hole. Cut off any excess lead. Do not bend the lead.

b. Replace components without accessible leads (transistors, relays, board-mounted potentiometers, etc.) in accordance with the following procedure.
   1. Apply heat (5 seconds, maximum) to the component lead on the backside of the board and remove the molten solder with a solder sipper.
   2. Allow the board to cool completely between heatings and repeat step 1. as necessary.
   3. Use long-nosed pliers to gently straighten the lead, if it is bent. The lead must be as straight as possible.
   4. If possible, cut the lead and remove all burrs by rounding or squeezing the lead with the long-nosed pliers.
   5. Repeat steps 1. and 2. until the lead can be carefully broken loose from the hole.
   6. Slowly and very gently remove the component from the board.
   7. Carefully insert the replacement component. Be sure the lead is straight.
   8. Apply heat to the lead on the backside of the board (5 seconds, maximum) and allow fresh solder to flow into the hole. Cut off any excess lead. Do not bend the lead.

5.7 ADJUSTMENT PROCEDURES

Note

The following procedure tells how to change or adjust R50, R65, R68, and R69. These adjustments have been made at the factory to optimize the performance of the amplifier. Under no circumstances should the following adjustments be made without first determining that the trouble is positively caused by one of these adjustments. Indiscriminate adjustment or adjustment without the test equipment recommended will result in serious loss of equipment performance.

5.7.1 Initial Adjustments

Place the panel controls in the following positions:

a. INPUT LEVEL - fully ccw
b. OUTPUT LEVEL - fully ccw
c. GAIN CONTROL - AUTO

5.7.2 Initial Setup

a. Connect the test equipment as shown in figure 5-1. Set POWER ON/OFF to the ON position.
b. Adjust the oscillator frequency to 1-kHz.

c. With the attenuator set at 0 db, adjust the oscillator output to +15 dbm as indicated on the ac vtvm.
d. Adjust the INPUT LEVEL control R10 to the maximum cw position.

5.7.3 Distortion Alignment

Adjust the OUTPUT LEVEL control, R11, of the 26J-3 for 18 to 20 dbm at the output. Adjust R69 for minimum distortion. Readjust the attenuator to 30 db.

5.7.4 Meter Alignment

a. Adjust R68 so that the meter on the 26J-3 is approximately 10% full scale.

Note

If, prior to this adjustment, the meter is reading completely down scale adjust R68 cw for 10% of full scale. If the meter is reading full scale R68 must be rotated ccw for 10% of full scale.

b. Adjust R65 fully cw and readjust R68 for 0 db reading on the meter.
c. Adjust R65 fully ccw. Adjust the attenuator to 0 db. Adjust R65 cw for full scale reading of 30 db.

5.7.5 Nominal Gain Adjustment

Adjust the attenuator to 15 db. Adjust OUTPUT LEVEL control R11 to give an output level of +10 dbm. Place GAIN CONTROL switch S1 in the DISABLE position. Adjust R50 so that the output level returns to +10 dbm.

Note

Due to the extremely long time constants involved in this setting, the adjustment time may be minimized by temporarily placing a 1 kilohm resistor in parallel with R48.

Return the GAIN CONTROL switch to the AUTO position after adjustment is completed.

section 6
parts list

6.1 GENERAL

This section contains a list of all replaceable electrical, electronic, and critical mechanical parts for the 26J-3 Auto-Level Amplifier.

The manufacturers' codes appearing in the Mfr Code column of the parts list are listed in numerical order at the end of the parts list. The code list provides the manufacturer's name and address as shown in the Federal Supply Code for Manufacturers' Handbook H4-1. Manufacturers not listed in Handbook H4-1 are assigned a 5-letter code and appear first in the code list.

6.2 LIST OF EQUIPMENT

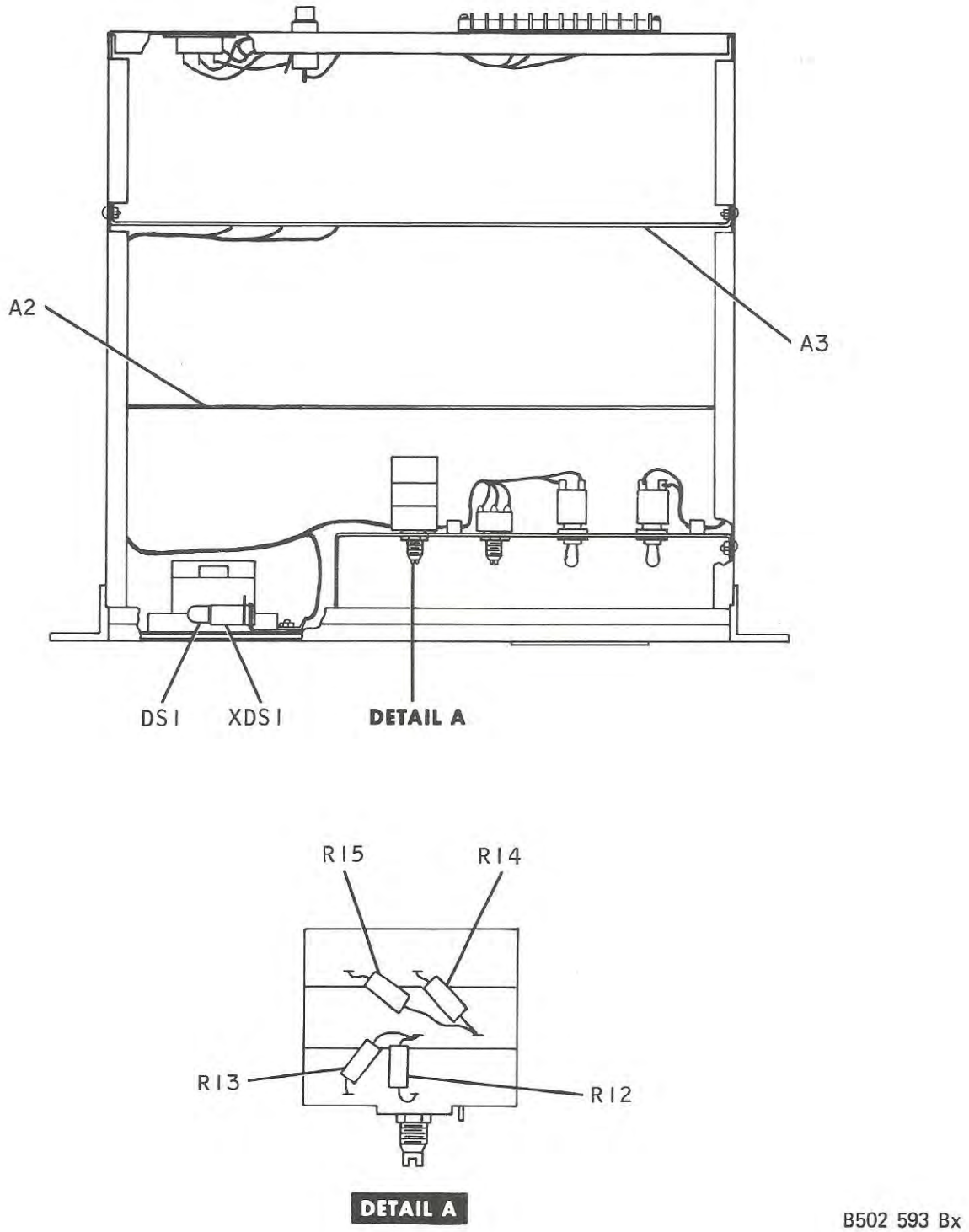
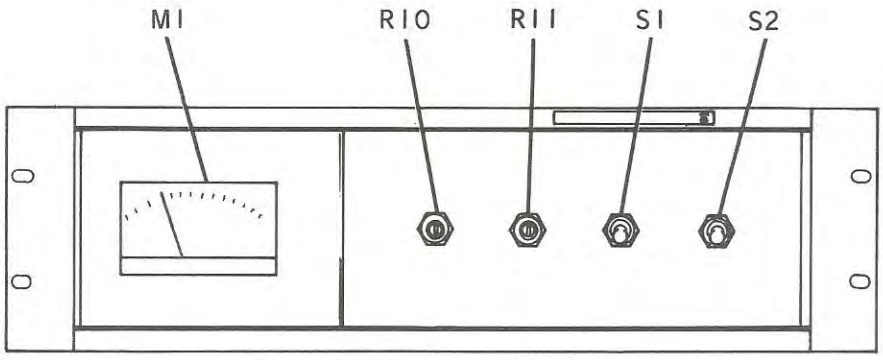
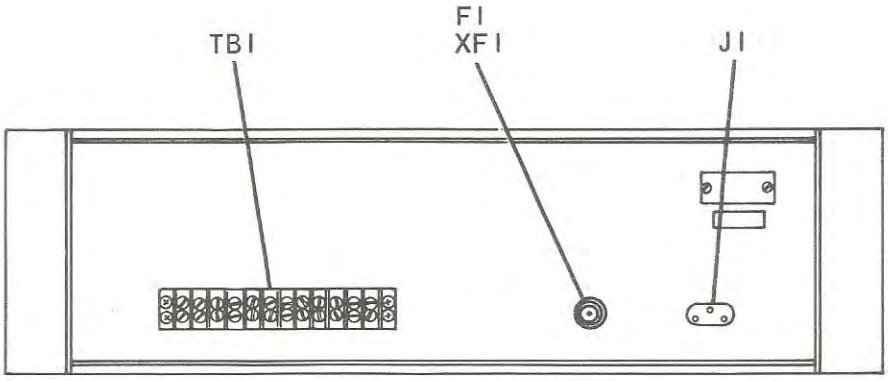


Figure 6-1. 26J-3 Auto-Level Amplifier (Sheet 1 of 2).



FRONT VIEW

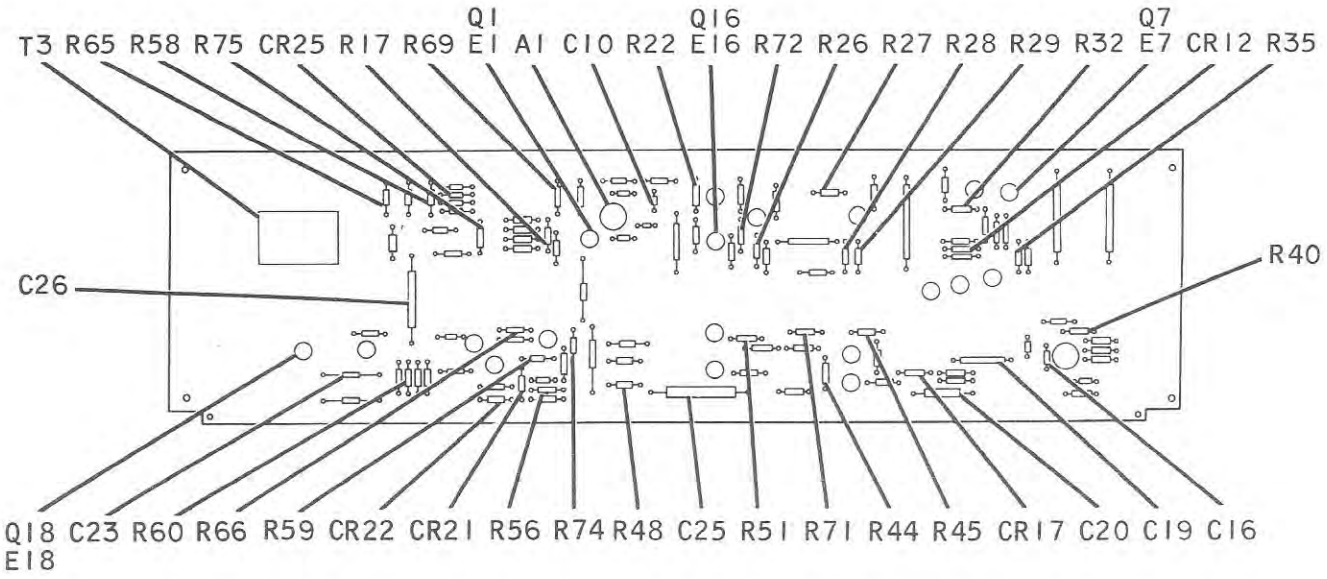


REAR VIEW

B502 591 Bx

Figure 6-1. 26J-3 Auto-Level Amplifier (Sheet 2 of 2).

SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR CODE	COLLINS PART NUMBER
	26J-3 AUTO-LEVEL AMPLIFIER			758-5776-001
A1	NOT USED			
A2	PRINTED CIRCUIT BOARD SEE BREAKDOWN ON PAGE 6-5			786-1262-001
A3	POWER SUPPLY ASSEMBLY SEE BREAKDOWN ON PAGE 6-11			786-2719-001
DS1	LAMP, INCANDESCENT 0.04 AMP CURRENT RATING	MS25231-1819	96906	262-1863-000
F1	FUSE, CARTRIDGE 1/2 AMP CURRENT RATING	MDL1-2	71400	264-0293-000
J1	CONNECTOR, RECEPTACLE 3 CONTACTS	1061-1	87930	368-0207-000
M1	METER, AMP 0 TO 500 AMP METER RANGE	37-6032-0000	80145	458-0379-010
R1 THROUGH R9	NOT USED			
R10	RESISTOR, VARIABLE 600 OHMS, 15% TOL, 1 WATT	SP0-76-1987	76055	383-0069-010
R11	RESISTOR, VARIABLE 1K OHMS, 30% TOL, 1/4 WATT	LS9407	71450	376-4505-000
R12	RESISTOR, FXD, COMPOSITION 300 OHMS, 5% TOL, 1/2 WATT	RC20GF301J	81349	745-1329-000
R13	SAME AS R12			
R14	SAME AS R12			
R15	SAME AS R12			
S1	SWITCH, TOGGLE DPDT CONTACT ARRANGEMENT	83054WA	04009	266-5170-000
S2	SWITCH, TOGGLE DPST CONTACT ARRANGEMENT	83053SF	04009	266-5171-000
TB1	TERMINAL BOARD 12 TERMINALS	MS12142Y	71785	367-1652-120
XDS1	LAMPHOLDER BAYONET TYPE BASE	LH22	81349	262-0913-000
XF1	FUSEHOLDER 30 AMP CURRENT RATING	HKP-H	71400	265-1171-000



B502 595 Bx

Figure 6-2. Printed Circuit Board (Sheet 1 of 3).

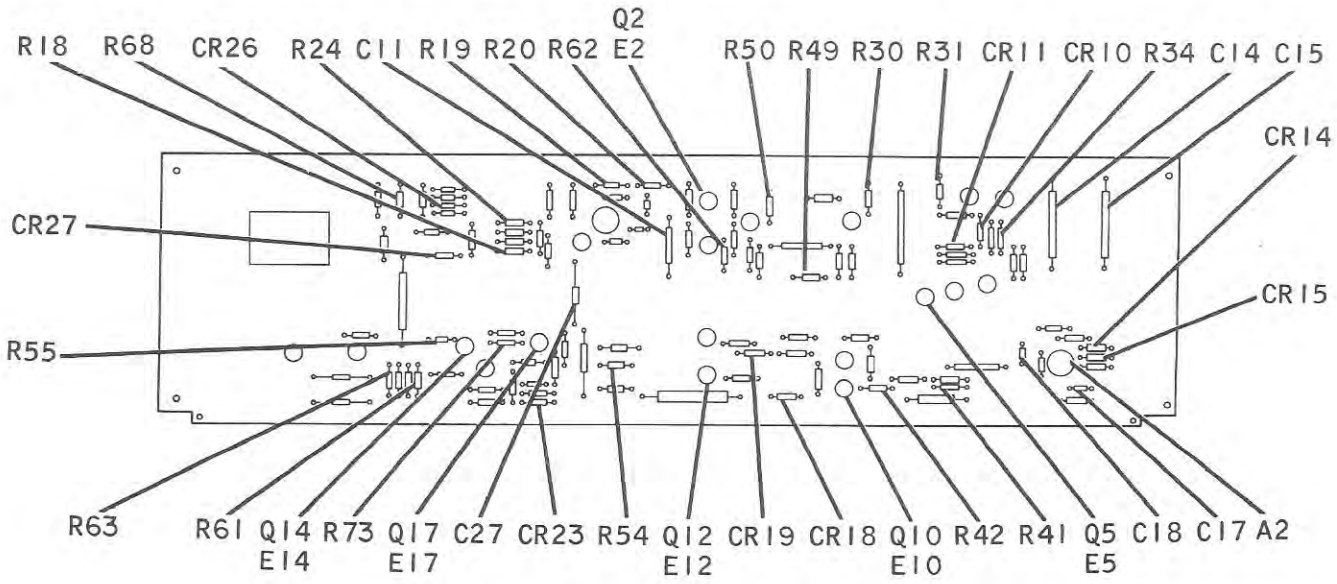


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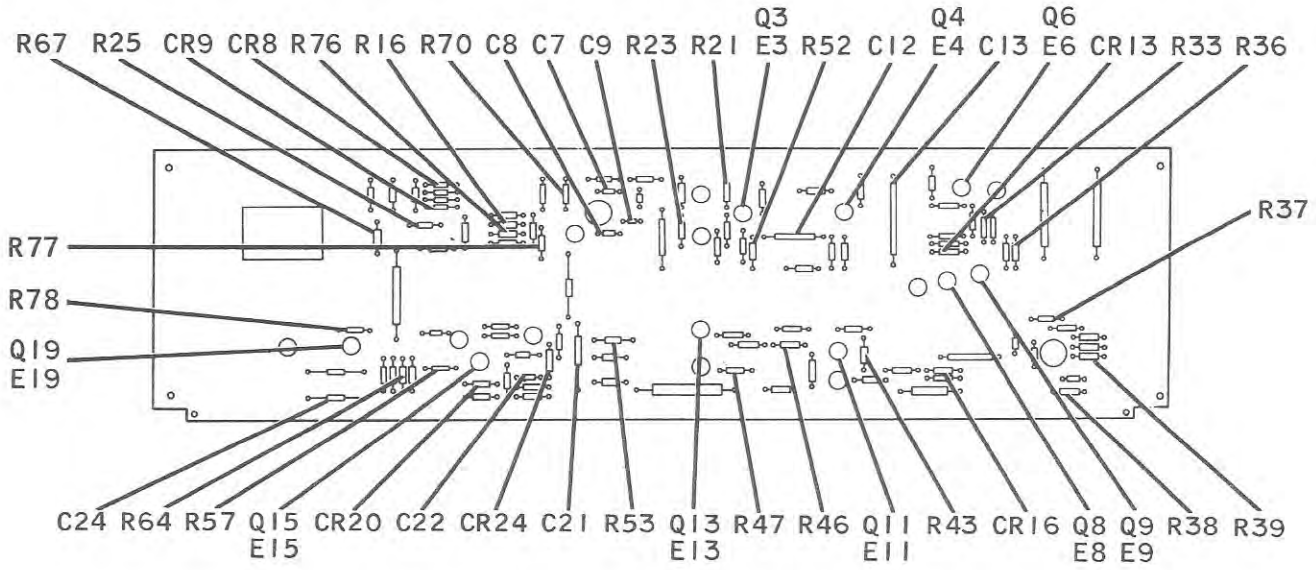
Figure 6-2. Printed Circuit Board (Sheet 2 of 3).



B502 595 Bx

Figure 6-2. Printed Circuit Board (Sheet 3 of 3).

SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR CODE	COLLINS PART NUMBER
	PRINTED CIRCUIT BOARD			786-1262-001
A1	AMPLIFIER, OPERATIONAL	U5B770939X	07263	351-7140-010
A2	SAME AS A1			
C1 THROUGH C6	NOT USED			
C7	CAPACITOR, FXD, MICA 560 UUF, 5% TOL, 500 VDCW	CM06FD561J03	81349	912-2983-000
C8	CAPACITOR, FXD, CERAMIC 0.1 UF, 20% TOL, 100 VDCW	5C067104X0101B3	56289	913-4240-050
C9	CAPACITOR, FXD, MICA 22 UUF, 5% TOL, 1500 VDCW	CM05ED220J03	81349	912-2768-000
C10	CAPACITOR, FXD, MICA 47 UUF, 5% TOL, 1500 VDCW	CM05ED470J03	81349	912-2792-000
C11	CAPACITOR, FXD, ELECTROLYTIC 100 UF, PLUS 75% MINUS 10%, 6 VDCW	D29329	56289	183-1168-000
C12	CAPACITOR, FXD, ELECTROLYTIC 15 UF, PLUS 75% MINUS 10%, 25 VDCW	D31549	56289	183-1164-000
C13	CAPACITOR, FXD, ALUMINUM 640 UF, PLUS 50% MINUS 10%, 16 VDCW	C437ARE640	73445	183-2355-080
C14	CAPACITOR, FXD, ALUMINUM 400 UF, PLUS 50% MINUS 10%, 40 VDCW	C437ARG400	73445	183-2355-160
C15	SAME AS C14			
C16	SAME AS C8			
C17	SAME AS C7			
C18	SAME AS C9			
C19	CAPACITOR, FXD, ELECTROLYTIC 8 UF, PLUS 75% MINUS 10%, 25 VDCW	D31582	56289	183-1167-000
C20	SAME AS C19			
C21	CAPACITOR, FXD, ELECTROLYTIC 68 UF, 20% TOL, 30 VDCW	CL65CH680MP3	81349	184-8670-000
C22	CAPACITOR, FXD, CERAMIC 1 UF, PLUS 80% MINUS 20%, 25 VDCW	5C13A	56289	913-3810-000
C23	CAPACITOR, FXD, ELECTROLYTIC 4.7 UF, 20% TOL, 50 VDCW	CSR13G475ML	81349	184-9084-560
C24	SAME AS C23			
C25	CAPACITOR, FXD, ALUMINUM 640 UF, PLUS 50% MINUS 10%, 6.4 VDCW	C437ARC640	73445	183-2355-010
C26	SAME AS C14			
C27	CAPACITOR, FXD, ALUMINUM 40 UF, PLUS 50% MINUS 10%, 16 VDCW	C426ARE40	73445	183-2354-140
CR1 THROUGH CR7	NOT USED			
CR8	SEMICONDUCTOR DEVICE, DIODE	1N276	81349	353-2020-000
CR9	SAME AS CR8			
CR10	SEMICONDUCTOR DEVICE, DIODE	1N483B	07688	353-2652-000
CR11 THROUGH CR23	SAME AS CR10			
CR24	SEMICONDUCTOR DEVICE, DIODE	1N747	07688	353-2701-000
CR25	SAME AS CR10			
CR26	SAME AS CR10			
CR27	SAME AS CR10			
E1	INSULATOR, TRANSISTOR PAD	A10044DAP	07047	352-9889-000
E2 THROUGH E12	SAME AS E1			
E13	INSULATOR, TRANSISTOR PAD	7717-130DAP	13103	352-9552-580

SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR CODE	COLLINS PART NUMBER
E14 THROUGH E17	SAME AS E13			
E18	HEAT SINK	TR101E1	14953	352-9977-000
E19	SAME AS E18			
Q1	TRANSISTOR	2N4353	07688	352-0751-010
Q2	TRANSISTOR	2N3567	07688	352-0629-010
Q3	SAME AS Q2			
Q4	TRANSISTOR	2N3638	07688	352-0636-010
Q5	SAME AS Q2			
Q6	SAME AS Q2			
Q7	TRANSISTOR	2N2218	07688	352-0433-000
Q8	SAME AS Q4			
Q9	TRANSISTOR	2N904	07688	352-0610-030
Q10	SAME AS Q2			
Q11	SAME AS Q2			
Q12	TRANSISTOR	2N4416	07688	352-0756-010
Q13	SAME AS Q12			
Q14	TRANSISTOR	2N4121	07688	352-0743-010
Q15	SAME AS Q12			
Q16	SAME AS Q4			
Q17	SAME AS Q2			
Q18	SAME AS Q12			
Q19	SAME AS Q2			
R1 THROUGH R15	NOT USED			
R16	RESISTOR, FXD, COMPOSITION 2200 OHMS, 10% TOL, 1/4 WATT	RC07GF222K	81349	745-0761-000
R17	RESISTOR, FXD, COMPOSITION 150K OHMS, 10% TOL, 1/4 WATT	RC07GF154K	81349	745-0827-000
R18	RESISTOR, FXD, COMPOSITION 1K OHMS, 10% TOL, 1/4 WATT	RC07GF102K	81349	745-0749-000
R19	RESISTOR, FXD, COMPOSITION 1500 OHMS, 10% TOL, 1/4 WATT	RC07GF152K	81349	745-0755-000
R20	RESISTOR, FXD, COMPOSITION 47K OHMS, 10% TOL, 1/4 WATT	RC07GF473K	81349	745-0809-000
R21	RESISTOR, FXD, COMPOSITION 4700 OHMS, 10% TOL, 1/4 WATT	RC07GF472K	81349	745-0773-000
R22	RESISTOR, FXD, COMPOSITION 470 OHMS, 10% TOL, 1/4 WATT	RC07GF471K	81349	745-0737-000
R23	SAME AS R21			
R24	RESISTOR, FXD, COMPOSITION 390K OHMS, 10% TOL, 1/4 WATT	RC07GF394K	81349	745-0842-000
R25	RESISTOR, FXD, COMPOSITION 10K OHMS, 10% TOL, 1/4 WATT	RC07GF103K	81349	745-0785-000
R26	RESISTOR, FXD, COMPOSITION 3300 OHMS, 10% TOL, 1/4 WATT	RC07GF332K	81349	745-0767-000
R27	RESISTOR, FXD, COMPOSITION 56K OHMS, 10% TOL, 1/4 WATT	RC07GF563K	81349	745-0812-000
R28	RESISTOR, FXD, COMPOSITION 39K OHMS, 10% TOL, 1/4 WATT	RC07GF393K	81349	745-0806-000
R29	RESISTOR, FXD, COMPOSITION 12K OHMS, 10% TOL, 1/4 WATT	RC07GF123K	81349	745-0788-000
R30	SAME AS R18			
R31	SAME AS R16			
R32	RESISTOR, FXD, COMPOSITION 10 OHMS, 10% TOL, 1/4 WATT	RC07GF100K	81349	745-0677-000
R33	SAME AS R29			
R34	SAME AS R32			
R35	SAME AS R32			
R36	RESISTOR, FXD, COMPOSITION 15 OHMS, 10% TOL, 1/4 WATT	RC07GF150K	81349	745-0683-000
R37	SAME AS R25			
R38	SAME AS R19			
R39	SAME AS R18			
R40	RESISTOR, FXD, COMPOSITION 220K OHMS, 10% TOL, 1/4 WATT	RC07GF224K	81349	745-0833-000
R41	RESISTOR, FXD, COMPOSITION 18K OHMS, 10% TOL, 1/4 WATT	RC07GF183K	81349	745-0794-000

SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR CODE	COLLINS PART NUMBER
R42	RESISTOR, FXD, COMPOSITION 5600 OHMS, 10% TOL, 1/4 WATT	RC07GF562K	81349	745-0776-000
R43	SAME AS R25			
R44	RESISTOR, FXD, COMPOSITION 100K OHMS, 10% TOL, 1/4 WATT	RC07GF104K	81349	745-0821-000
R45	SAME AS R25			
R46	SAME AS R18			
R47	SAME AS R44			
R48	RESISTOR, FXD, COMPOSITION 1 MEGOHM, 10% TOL, 1/4 WATT	RC07GF105K	81349	745-0857-000
R49	RESISTOR, FXD, COMPOSITION 1800 OHMS, 10% TOL, 1/4 WATT	RC07GF182K	81349	745-0758-000
R50	RESISTOR, VARIABLE 2K OHMS, 10% TOL, 3/4 WATT	77PR2K	73138	382-0012-080
R51	SAME AS R44			
R52	SAME AS R26			
R53	RESISTOR, FXD, COMPOSITION 390 OHMS, 10% TOL, 1/2 WATT	RC20GF391K	81349	745-1335-000
R54	RESISTOR, FXD, COMPOSITION 5.6 MEGOHMS, 10% TOL, 1/4 WATT	RC07GF565K	81349	745-0884-000
R55	SAME AS R42			
R56	SAME AS R21			
R57	RESISTOR, FXD, COMPOSITION 3900 OHMS, 10% TOL, 1/4 WATT	RC07GF392K	81349	745-0770-000
R58	SAME AS R18			
R59	RESISTOR, FXD, COMPOSITION 680K OHMS, 10% TOL, 1/4 WATT	RC07GF684K	81349	745-0851-000
R60	RESISTOR, FXD, COMPOSITION 82K OHMS, 10% TOL, 1/4 WATT	RC07GF823J	81349	745-0817-000
R61	RESISTOR, FXD COMPOSITION 100K OHMS, 5% TOL, 1/4 WATT	RC07GF104J	81349	745-0820-000
R62	SAME AS R19			
R63	RESISTOR, FXD, COMPOSITION 22K OHMS, 5% TOL, 1/4 WATT	RC07GF223J	81349	745-0796-000
R64	RESISTOR, FXD, COMPOSITION 12K OHMS, 5% TOL, 1/4 WATT	RC07GF113J	81349	745-0787-000
R65	RESISTOR, VARIABLE 5K OHMS, 10% TOL, 3/4 WATT	77PR5K	73138	382-0012-090
R66	SAME AS R18			
R67	SAME AS R19			
R68	RESISTOR, VARIABLE 1K OHMS, 10% TOL, 3/4 WATT	77PR1K	73138	382-0012-070
R69	RESISTOR, VARIABLE 10K OHMS, 10% TOL, 3/4 WATT	77PR10K	73138	382-0012-100
R70	RESISTOR, VARIABLE 100K OHMS, 20% TOL, 3/4 WATT	77PR100K	73138	382-0012-140
R71	SAME AS R44			
R72	RESISTOR, FXD, COMPOSITION 100 OHMS, 10% TOL, 1/4 WATT	RC07GF101K	81349	745-0713-000
R73	SAME AS R72			
R74	SAME AS R18			
R75	SAME AS R18			
R76	SAME AS R25			
R77	SAME AS R25			
R78	SAME AS R21			
T3	TRANSFORMER, AUDIO FREQUENCY 500 VRMS, 60 HZ	124A31	11700	667-0187-020

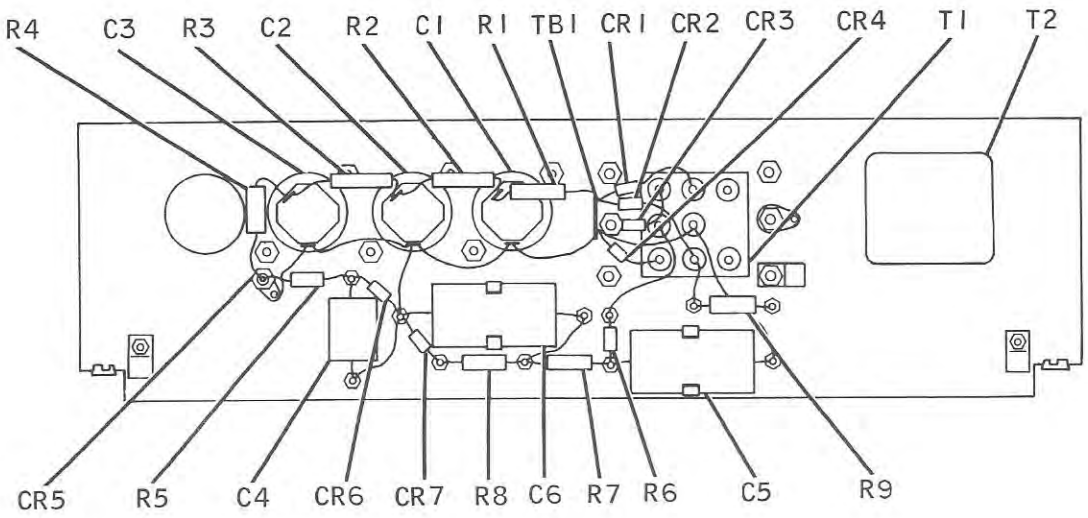


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Figure 6-3. Power Supply Assembly.

SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR CODE	COLLINS PART NUMBER
	POWER SUPPLY ASSEMBLY			786-2719-001
C1	CAPACITOR, FXD, ELECTROLYTIC 1000 UF, PLUS 100% MINUS 10%, 50 VDCW	D33643	56289	183-1403-000
C2	SAME AS C1			
C3	SAME AS C1			
C4	CAPACITOR, FXD, ALUMINUM 1000 UF, PLUS 50% MINUS 10%, 16 VDCW	C437ARE1000	73445	183-2355-090
C5	CAPACITOR, FXD, ELECTROLYTIC 500 UF, PLUS 100% MINUS 10%, 5 VDCW	DEE500-5	56289	183-1309-000
C6	SAME AS C5			
CR1	SEMICONDUCTOR DEVICE, DIODE	1N4003	07688	353-6442-030
CR2	SAME AS CR1			
CR3	SAME AS CR1			
CR4	SAME AS CR1			
CR5	SEMICONDUCTOR DEVICE, DIODE	1N2984B	07688	353-1365-000
CR6	SEMICONDUCTOR DEVICE, DIODE	1N963B	07688	353-3174-000
CR7	SEMICONDUCTOR DEVICE, DIODE	1N3022B	07688	353-3127-000
R1	RESISTOR, FXD, WIRE WOUND 10 OHMS, 10% TOL, 5 WATTS	PW5-10R0-10	07716	710-9106-000
R2	RESISTOR, FXD, WIRE WOUND 20 OHMS, 10% TOL, 7 WATTS	PW7-20-10PCT	07716	710-9003-000
R3	SAME AS R2			
R4	SAME AS R1			
R5	RESISTOR, FXD, COMPOSITION 680 OHMS, 10% TOL, 7 WATTS	RC20GF681K	81349	745-1345-000
R6	RESISTOR, FXD, COMPOSITION 10 OHMS, 10% TOL, 2 WATTS	RC42GF100J	81349	745-5568-000
R7	RESISTOR, FXD, COMPOSITION 68 OHMS, 10% TOL, 2 WATTS	RC42GF680K	81349	745-5603-000
R8	SAME AS R7			
R9	RESISTOR, FXD, COMPOSITION 1200 OHMS, 10% TOL, 2 WATTS	RC42GF122K	81349	745-5656-000
T1	TRANSFORMER, PWR, STEP-DOWN 800 VRMS, 50 TO 60 HZ	36659	73386	662-0048-000
T2	TRANSFORMER, AUDIO FREQUENCY 15 MA. 20 HZ TO 15 KHZ	A17088	70674	667-0197-010
TB1	TERMINAL STRIP 2 TERMINALS	1513-A	71785	306-2220-000

SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR CODE	COLLINS PART NUMBER
	MANUFACTURERS CODES			
CODE	MANUFACTURER			
04009	ARROW-HART AND HEGEMAN ELECTRIC CO HARTFORD, CONN. 06106			
07047	ROSS MILTON CO SOUTHAMPTON, PA. 18966			
07263	FAIRCHILD CAMERA AND INSTRUMENT CORP SEMICONDUCTOR DIVISION MOUNTAIN VIEW, CALIF			
07688	JOINT ELECTRON DEVICE ENGINEERING COUNCIL WASHINGTON, D.C.			
07716	I R C INC BURLINGTON, IOWA 52601			
11700	J B ELECTRONIC TRANSFORMERS INC CHICAGO, ILL. 60647			
13103	THERMALLOY CO DALLAS, TEX 75247			
14953	INLAND ELECTRONIC PRODUCTS CORP PASADENA, CALIF.			
56289	SPRAGUE ELECTRIC CO NORTH ADAMS, MASS 01247			
70674	A D C PRODUCTS INC MINNEAPOLIS, MINN. 55426			
71400	BUSSMANN MFG DIVISION OF MCGRAW-EDISON CO ST LOUIS, MO. 63017			
71450	CTS CORP ELKHART, IND. 46514			
71785	CINCH MFG CO AND HOWARD B JONES DIV CHICAGO, ILL. 60624			
73138	HELIPOT DIVISION OF BECKMAN INSTRUMENTS INC FULLERTON, CALIF. 92634			
73386	FREED TRANSFORMER CO INC BROOKLYN, N.Y. 11227			
73445	AMPEREX ELECTRONIC CORP HICKSVILLE, LONG ISLAND, N.Y. 11801			
76055	MALLORY CONTROLS DIV OF MALLORY P R AND CO INC FRANKFORT, IND.			
80145	A P I INSTRUMENTS CO CHESTERLAND, OHIO 44026			
81349	MILITARY SPECIFICATIONS			
87930	TONER MFG CORP PROVIDENCE, R.I. 02903			
96906	MILITARY SPECIFICATIONS			

section 7
illustrations

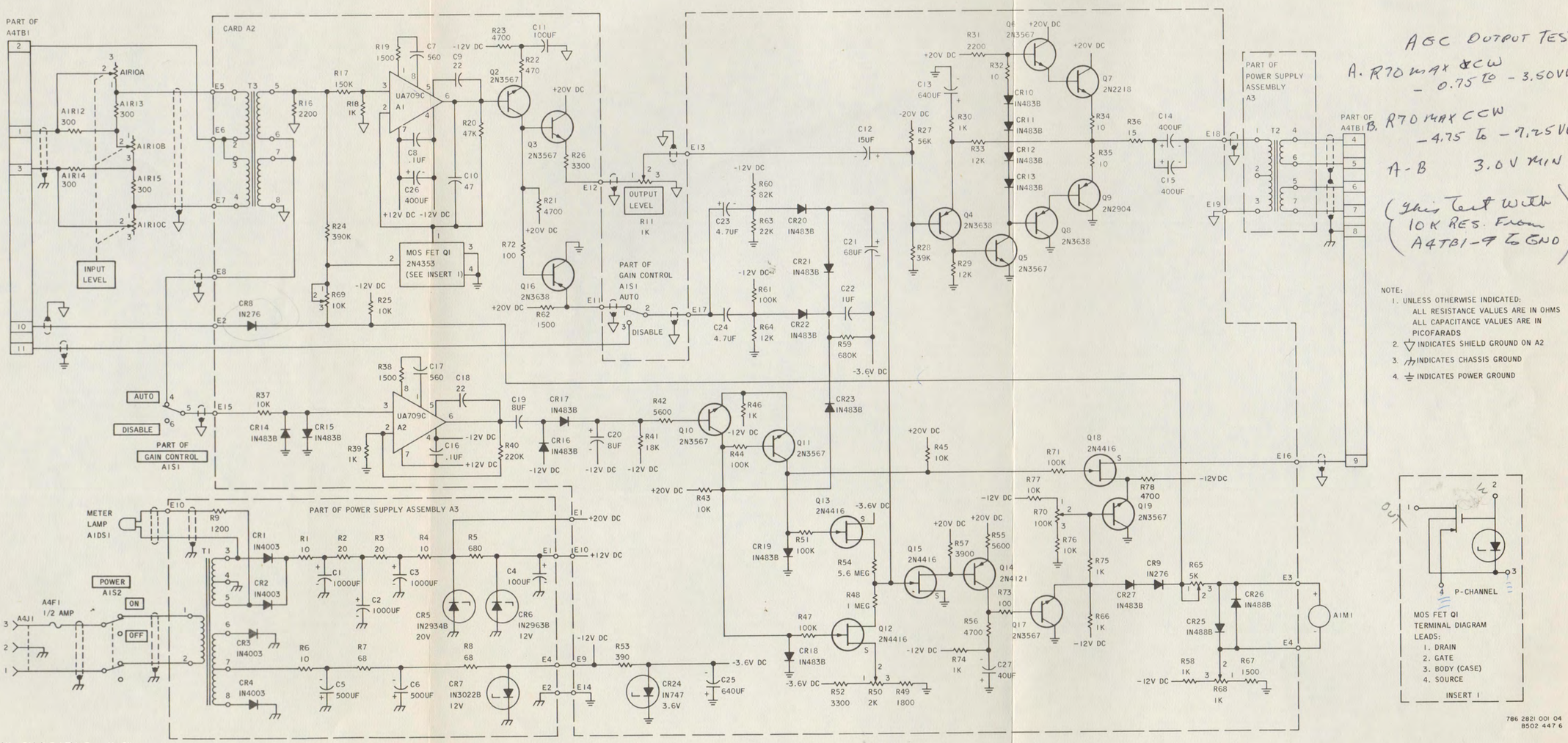

Figure 7-1. Schematic Diagram.