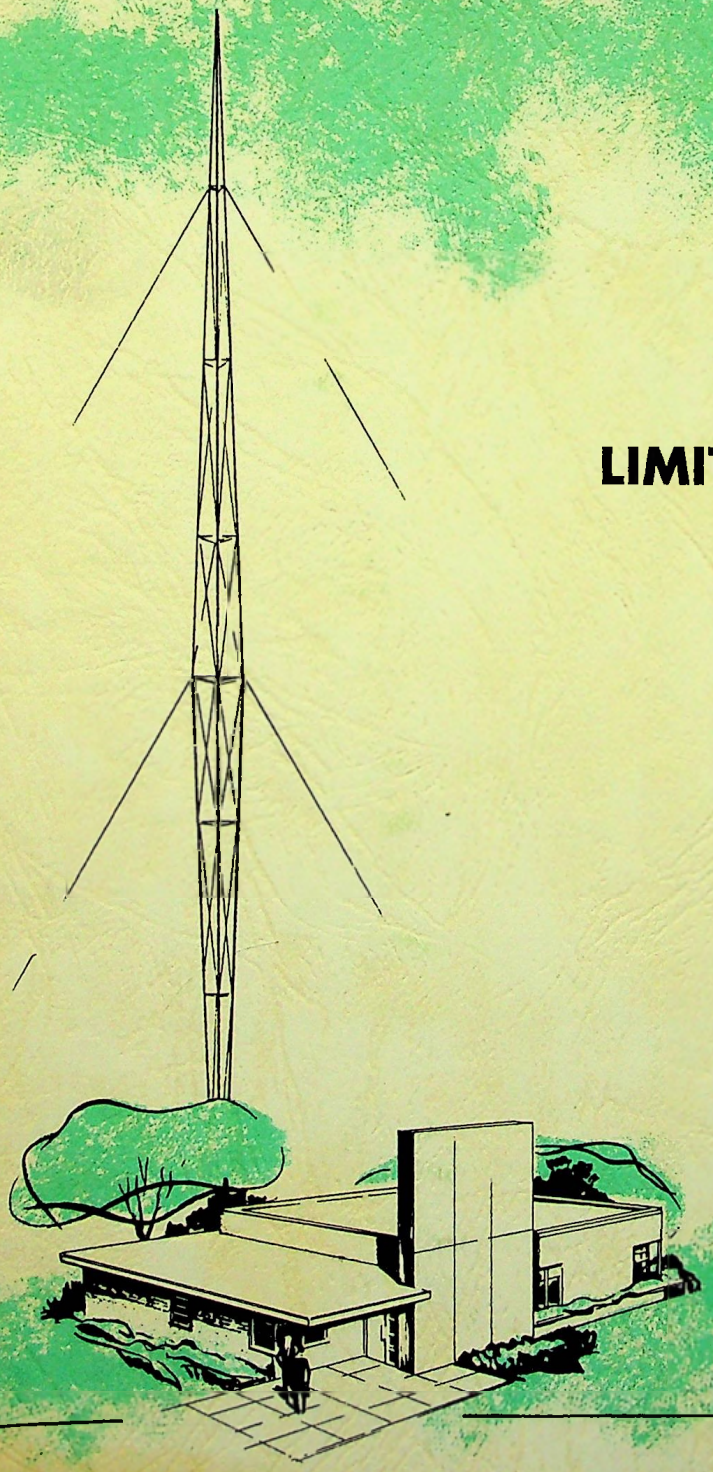
Collins

INSTRUCTION BOOK



LIMITING AMPLIFIER

26J-1

COLLINS RADIO COMPANY

LIMITING AMPLIFIER

26J-1

INSTRUCTION BOOK

15 MAY 1960
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PRINTED IN THE UNITED STATES OF AMERICA

COLLINS®

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The equipment described herein is sold under the following guarantee:

Collins agrees to repair or replace, without charge, any equipment, parts, or accessories which are defective as to design, workmanship or material, and which are returned to Collins at its factory, transportation prepaid, provided

(a) Notice of the claimed defect is given Collins within one (1) year from date of delivery and goods are returned in accordance with Collins' instructions.

(b) Equipment, accessories, tubes, and batteries not manufactured by Collins or from Collins' designs are subject to only such adjustments as Collins may obtain from the supplier thereof.

(c) No equipment or accessory shall be deemed to be defective if, due to exposure or excessive moisture in the atmosphere or otherwise after delivery, it shall fail to operate in a normal or proper manner.

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.

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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 handling of your returned merchandise.

ADDRESS:

Collins Radio Company
Sales Service Department
Cedar Rapids, Iowa

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 sub-assemblies 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
Sales Service Department
Cedar Rapids, Iowa

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 sub-assembly number (where applicable)

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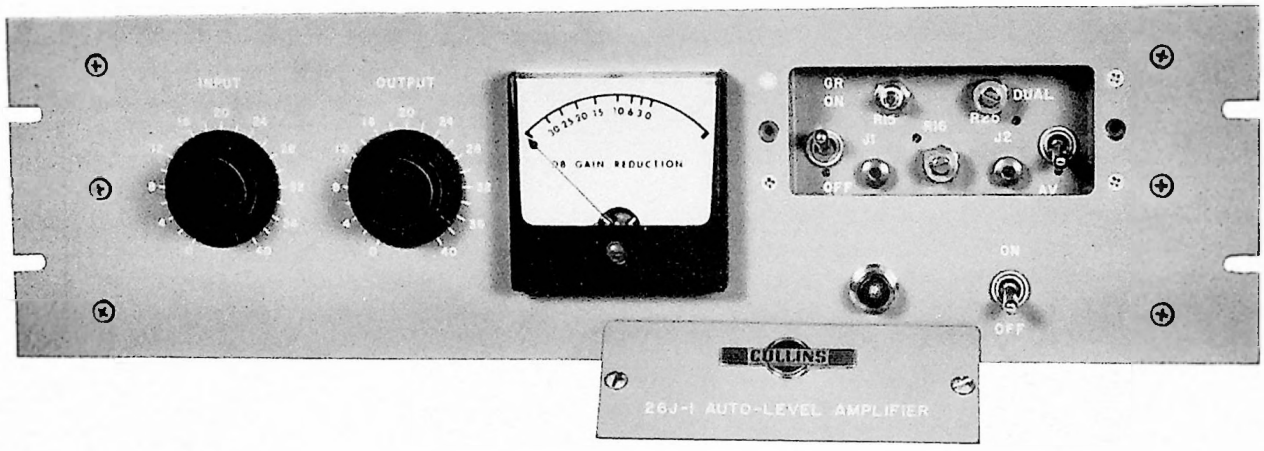


Figure 1. Collins Type 26J-1 Auto-Level Amplifier, Equipment Supplied

TYPE 26J-1 AUTO-LEVEL AMPLIFIER

1. PURPOSE OF EQUIPMENT.

The 26J-1 Auto-Level Amplifier is an automatic average level limiting amplifier, complete with power supply; for broadcast, TV, and microwave audio systems.

2. PHYSICAL DESCRIPTION.

The 26J-1 Auto-Level Amplifier (Figure 1) is a rack mounted module containing two stages of amplification with a bias rectifier. It is 5 1/4 inches high, 19 inches wide, 9 inches deep and weighs approximately 16 pounds.

3. TUBE COMPLEMENT.

Function	Symbol	Tube Type
Input Amplifier	V1	GL 6386
Output Amplifier	V2	6V6
Output Amplifier	V3	6V6
Bias Rectifier	V4	6AL5

4. ELECTRICAL CHARACTERISTICS.

4.1 CONNECTORS. One 7-pin connector, TB1, is located at the rear of the 26J-1 Auto-Level Amplifier. All connections for input and output are made at this connector. Two jacks, J1 and J2, are provided on the front panel for measurement of the threshold voltage.

4.2 POWER REQUIREMENTS. The power requirement for the 26J-1 Auto-Level Amplifier is 115/230 volts, 50/60 cycles, single phase. The unit is shipped wired for 115 volts.

4.3 FREQUENCY RANGE. The frequency range of the 26J-1 Auto-Level Amplifier is 50 to 15,000 cycles per second.

4.4 INPUT IMPEDANCE. The 26J-1 Auto-Level Amplifier is factory wired for 600 ohms unloaded transformer input impedance. This unit may also be wired for 150 ohms input impedance if desired. See figure 8 and paragraph 7.4.

4.5 GAIN. The gain of the 26J-1 Auto-Level Amplifier, with the master gain control (R4) at maximum gain and the output attenuator (AT2) at minimum loss, is 20 db (36 db with the input pad changed from 22 db to 6 db).

4.6 OUTPUT IMPEDANCE. The 26J-1 Auto-Level Amplifier output impedance is 600 ohms unbalanced through a Daven "T" attenuator. Balanced operation can be obtained by a direct transformer connection.

4.7 INPUT LEVEL. The input level of the 26J-1 Auto-Level Amplifier is adjustable from -26 dbm to +30 dbm. NOTE: 0 dbm is equal to 1 milliwatt across 600 ohms.

4.8 OUTPUT LEVEL. The output level of the 26J-1 Auto-Level Amplifier is adjustable from -24 dbm to + 30 dbm, + 14 dbm is nominal.

4.9 FREQUENCY RESPONSE. The frequency response of the 26J-1 Auto-Level Amplifier is $\pm$ 1 db from 50 to 15,000 cps.

4.10 DISTORTION. The distortion of the 26J-1 Auto-Level Amplifier is as follows: 1.5% maximum distortion from 50 to 15,000 cps with no compression and 2% maximum distortion from 50 to 15,000 cps at any level up to 30 db gain reduction (with the threshold control set for a 3/1 compression ratio.

4.11 NOISE LEVEL. The noise level in the output of the 26J-1 Auto-Level Amplifier is -50 dbm with the threshold control set for a 3/1 compression ratio.

4.12 COMPRESSION RATIO. The compression ratio of the 26J-1 Auto Level Amplifier is adjustable from a ratio of 1.6/1 to 5/1. A ratio of 3/1 is optimum over a 30 db range of input levels.

4.13 ATTACK TIME. The attack time for the 26J-1 Auto-Level Amplifier is 11 milliseconds with the switch (S2) set in the DUAL position or 62 milliseconds with the switch (S2) set in the AVERAGE position.

4.14 RELEASE TIME. The release time of the 26J-1 Auto-Level Amplifier is 0.9 seconds for 63% recovery with the switch (S2) set in the DUAL position or 5.2 seconds for 63% recovery with the switch (S2) set in the AVERAGE position.

4.15 FRONT PANEL MOUNTING. The following controls are mounted on the front panel:

a. Input Level Control
b. Output Level Control
c. Power on/off Toggle Switch

4.16 SUB CHASSIS CONTROLS. The following sub chassis controls are mounted beneath the removable front plate:

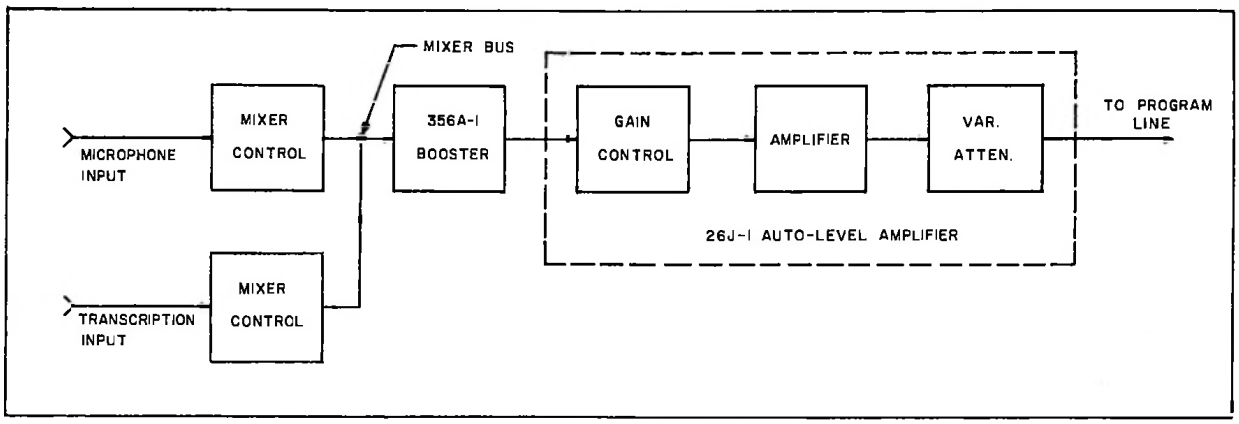


Figure 2. Collins Type 26J-1 Auto-Level Amplifier as Automatic Fader Control, Suggested Arrangement

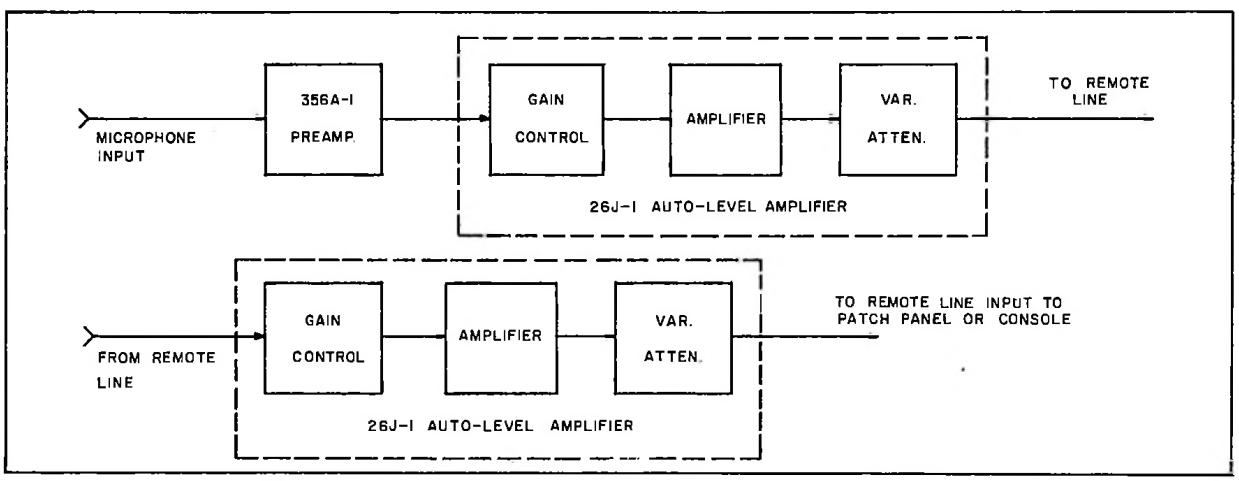


Figure 3. Collins Type 26J-1 Auto-Level Amplifier as Automatic Level Control, Suggested Arrangement

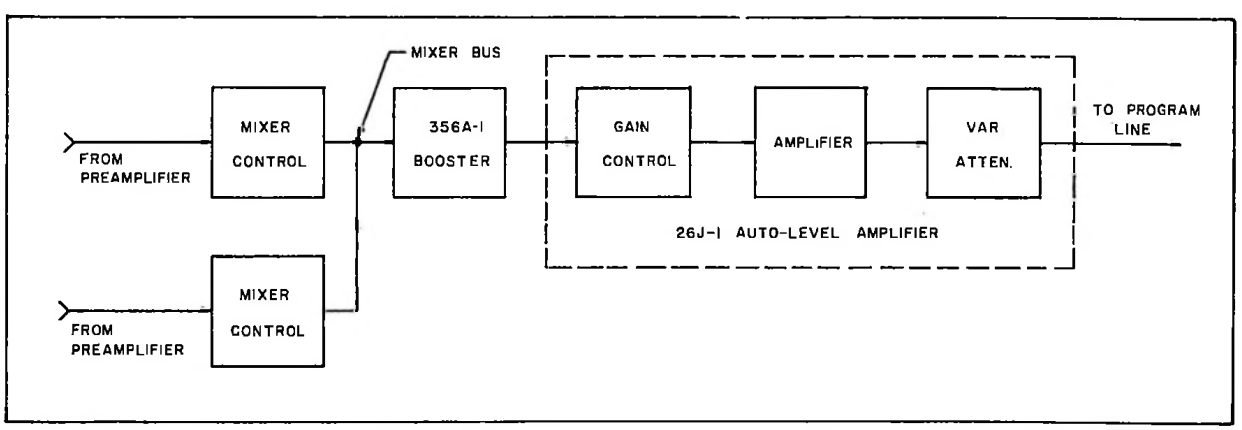


Figure 4. Collins Type 26J-1 Auto-Level Amplifier as Automatic Mixer, Suggested Arrangement

a. Dual/Average Toggle Switch
b. Threshold Voltage Potentiometer
c. Output Balance Potentiometer
d. GR on/off Toggle Switch
e. Meter Calibrate Potentiometer
f. (Test points are also available on this sub chassis)

5. CIRCUIT DESCRIPTION.

Figure 8 is a schematic diagram of the 26J-1 Auto-Level Amplifier. Transformer T1 couples the input signal to the grids of the push-pull input stage V1. The output from V1 is coupled to the grids of the push-pull output stage by C3 and C4. The output stage is transformer coupled to the load by T2. The threshold voltage control (R25) adjusts the positive bias applied to the cathodes of the bias rectifier V4. A sample of the output signal from the plates of V2 and V3 is coupled to the bias rectifier cathodes by C7 and C8. When the audio voltage at the plates of the output stage is high enough to overcome the threshold voltage, the bias rectifier V4 conducts. Plate current for V4 develops a negative voltage across R19. This negative voltage is the control voltage for the automatic gain circuit. It is applied to the grid return of the input amplifier V1. An increase in level of the input signal does not produce any limiting action until the threshold voltage is exceeded. When this happens, the gain of the input stage is reduced and the output level remains comparatively constant. When the signal level at the input is again reduced below the threshold voltage, the bias rectifier V4 stops conducting and the bias of the input stage falls back to normal. Attack and release times of the amplifier are determined by the RC time constants in the plate circuit of V4. When S2 is in the DUAL position, C6 is charged by the voltage across R19 and the attack time of the amplifier is determined by the time constant of R17 and C6. When the switch S2 is in the same position and V4 stops conducting, the release time of the circuit is the time necessary for C6 to discharge through R19. When S2 is in the AVERAGE position, R18 is shorted out. This connects C5 in parallel with C6 and the attack time is determined by the RC time constant of R17 and the sum of the capacities of C6 and C5. When V4 stops conducting, the release time of the circuit is the time necessary for C6 and C5 to discharge through R19.

6. APPLICATION.

6.1 GENERAL. The 26J-1 Auto-Level Amplifier may be used as an automatic fader control, as an automatic level control in unattended remote operation, as an automatic mixer, or as a level control in microwave relay systems. Arrangements and adjustments for these uses are described in the following paragraphs.

6.2 THE 26J-1 AUTO-LEVEL AMPLIFIER USED AS AUTOMATIC FADER CONTROL. Refer to figure 2. The 26J-1 Auto-Level Amplifier is generally used in place of the console amplifier. Operate the switch on the 26J-1 Auto-Level Amplifier to DUAL position. Adjust the mixer in the transcription channel until the GR (gain reduction) meter indicates a 2 to 5 db gain reduction. Adjust the mixer in the microphone channel until the microphone signal at the mixer bus is 20 db higher than the transcription signal at the same point. The use of the microphone channel automatically causes the transcription signal to drop 20 db below the microphone signal with an overall output increase of less than 7 db. This 7-db increase may be handled by the peak-limiting amplifier usually employed at the transmitter.

With this type of operation, announcements may be made over the transcription signal without adjustment of the mixers in the microphone or transcription channels. When an announcement is over, the transcription signal automatically returns to its original level.

6.3 THE 26J-1 AUTO-LEVEL AMPLIFIER USED AS AUTOMATIC LEVEL CONTROL IN UNATTENDED REMOTE OPERATION. Figure 3A shows a suggested arrangement for using the 26J-1 Auto-Level Amplifier at a remote location. Figure 3B shows a suggested arrangement for using 26J-1 Auto-Level Amplifier at a studio with input from a remote line.

With average input signal, adjust the input to the 26J-1 Auto-Level Amplifier to produce aproximately 15-db gain reduction.

6.4 THE 26J-1 AUTO-LEVEL AMPLIFIER USED AS AUTOMATIC MIXER. Figure 4 shows a suggested arrangement for using the 26J-1 Auto-Level Amplifier as an automatic mixer. When two signals are present at the mixer bus, the amplifier acts as a master gain control, expander-compressor, or as a straight program amplifier.

6.5 THE 26J-1 AUTO-LEVEL AMPLIFIER USED IN MICROWAVE RELAY SYSTEM. Figure 5 shows a method for using the 26J-1 Auto-Level Amplifier to minimize audio level variations in a microwave relay system.

7. ADJUSTMENTS OR MODIFICATIONS.

7.1 GENERAL. The following paragraphs describe adjustments of threshold voltage for various input and output levels, modification of resistor values for various release times, and input resistor modification to convert the input impedance to 150 ohms.

7.2 THRESHOLD VOLTAGE SETTINGS. Table 1 gives threshold voltage settings for various input and output levels. Optimum operation results when the threshold voltage is set at 24.0 volts for an output level of +14 dbm. If this level is too high, a step attenuator (AT2) is provided to reduce the output level. A potentiometer (R4) controls the input signal level to the first amplifier stage.

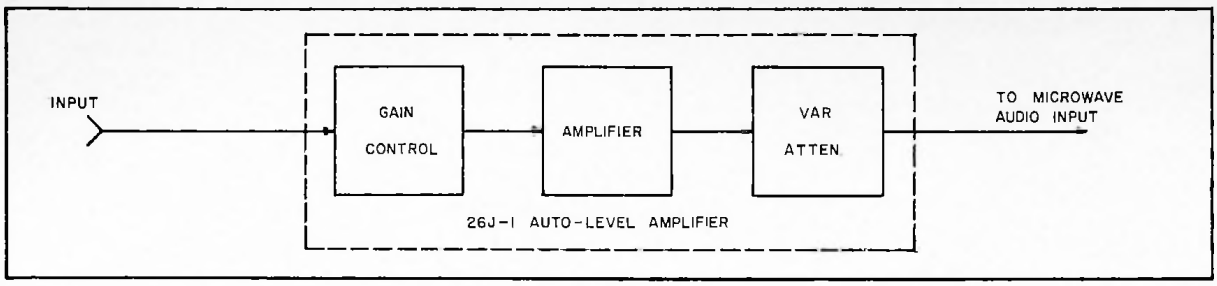


Figure 5. Collins Type 26J-1 Auto-Level Amplifier as Automatic Level Control in Microwave Relay Systems, Suggested Arrangement

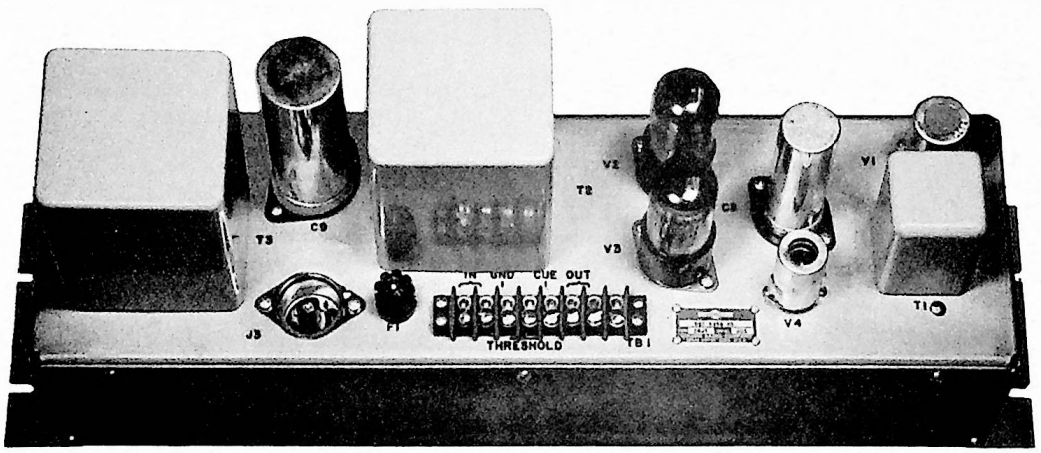


Figure 6. Collins Type 26J-1 Auto-Level Amplifier, Rear View

TABLE 1. THRESHOLD VOLTAGE SETTINGS

Input DBM	Output DBM	Threshold Voltage
-10	+10	15
- 6	+14 *	24
- 2	+18	37
0	+20	47

*Optimum (3/1 compression ratio)

7.3 RELEASE TIME. The release time of the 26J-1 Auto-Level Amplifier is satisfactory for most applications. If some other value of release time is desired, change the values of R19 and R18. Table 2 gives other values of resistance for R19 and R18 with corresponding release times.

TABLE 2. VALUES OF R19 AND R18 AND CORRESPONDING RELEASE TIMES

Megohms		DUAL Position Seconds		AVERAGE Position Seconds
R19	R18	FAST	SLOW	
2.2	10	0.48	12.2	2.7
3.3	3.3	0.73	6.6	4.0
3.3	10	0.73	13.3	4.0
4.3	4.3	0.95	8.6	5.3
4.3	10	0.95	14.3	5.3
5.1	10	1.1	15.1	6.2
6.2	10	1.4	18.2	7.6

7.4 MODIFICATION OF INPUT CIRCUIT FOR 150 OHM INPUT IMPEDANCE. The 26J-1 Auto-Level Amplifier may be modified for 150 ohm input impedance by changing the values of R1, R2, and R3. Table 3 gives the values of resistance for R1, R2, and R3.

TABLE 3. VALUES OF R1, R2, AND R3 FOR 150 OHM INPUT IMPEDANCE

Part	Resistance Ohms (5%, 1/2 W)
R1	100
R2	47
R3	560

8. MAINTENANCE.

Normal maintenance will consist of tube replacement. When replacing V2 and V3, adjust R15 for minimum distortion at 50 cps. As these tubes age, this adjustment may again be made. If excessive distortion occurs, replace V2 and V3. Table 4 gives voltage and resistance measurements for the 26J-1 Auto-Level Amplifier.

9. TABLE OF REPLACEABLE PARTS.

Table 5 gives the description, circuit function, and Collins part number for all replaceable parts in the 26J-1 Auto-Level Amplifier. When replacement of parts is necessary, only parts identical or equivalent to those listed should be used. All parts mounted on the rear of the chassis are identified in Figure 6. All parts mounted within the chassis are identified in Figure 7.

TABLE 4. VOLTAGE AND RESISTANCE MEASUREMENTS FOR THE 26J-1 AUTO-LEVEL AMPLIFIER

Conditions of measurements:

a. Voltage readings are taken with a 20,000 ohms-per-volt meter.

b. Line voltage 115 vac.

c. Resistance readings taken with no power applied.

d. All measurements from terminal to ground. Negative ground for resistance measurements.

e. No audio signal input.

Tube		Pin Number								
		1	2	3	4	5	6	7	8	9
V1 (6386)	DC V.	20-50	1.2	0	57	0	57	0	1.2	20-50
	AC V.	3.0	0	0	0	0	0	0	0	3.0
	Ohms	2.7K	200	3.8 meg	55K	Inf	55K	3.8 meg	200	2.7K
V2 (6V6)	DC V.	0	20-50	290	300	0	0	20-50	18	
	AC V.	0	3.0	0	0	0	0	3.0	0	
	Ohms	Inf	2.7K	26K	26K	510K	510K	2.7K	230	
V3 (6V6)	DC V.	0	20-50	290	300	0	290	20-50	18	
	AC V.	0	3.0	0	0	0	0	3.0	0	
	Ohms	Inf	2.7K	26K	26K	510K	26K	2.7K	230	
V4 (6AL5)	DC V.	22	0	20-50	20-50	22	0	0		
	AC V.	0	0	3.0	0	0	0	0		
	Ohms	510K	3.8 meg	2.7K	2.7K	510K	0	3.8 meg		

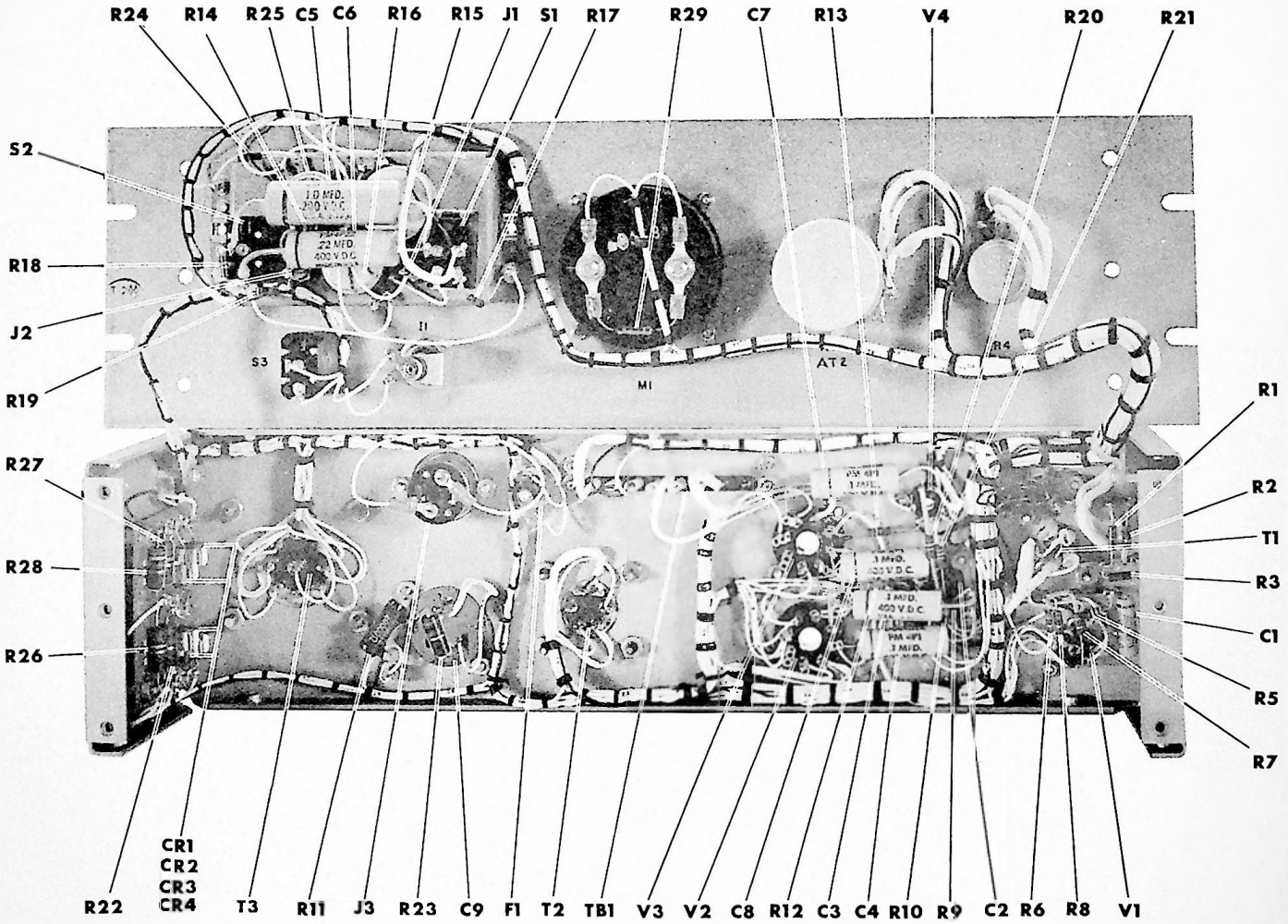


Figure 7. Collins Type 26J-1 Auto-Level Amplifier, Front Panel Open View

TABLE 5. TABLE OF REPLACEABLE PARTS FOR THE 26J-1 AUTO-LEVEL AMPLIFIER

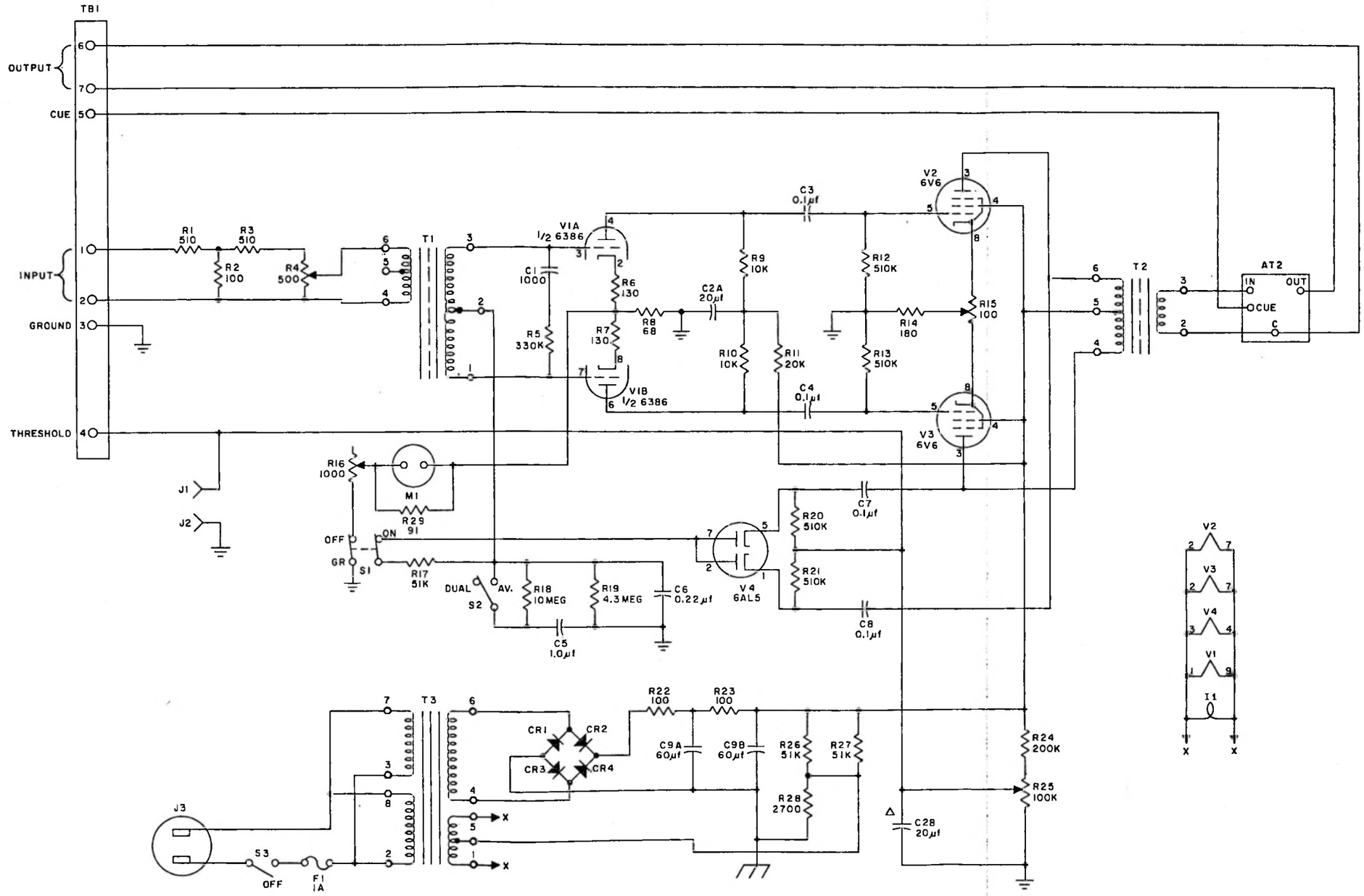
ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NUMBER
AT1		Not Used	
AT2	Output level control	ATTENUATOR: 600/60 ohm 2 db step, 20 steps	378 0373 00
C1	Frequency compensation	CAPACITOR: paper, .001 mf, 600 vdcw	933 0417 00
C2 (A&B)	Decoupling	CAPACITOR: electrolytic; 20-20 mf, 400 vdcw	183 1485 00
C3	Coupling	CAPACITOR: paper, 0.1 mf, 400 vdcw	933 0415 00
C4	Coupling	SAME as C3	933 0415 00
C5	Part of attack-and-release time circuit	CAPACITOR: paper, 1.0 mf, 200 vdcw	933 0414 00
C6	Part of attack-and-release time circuit	CAPACITOR: paper, .22 mf, 400 vdcw	933 0416 00
C7	Coupling	SAME as C3	933 0415 00
C8	Coupling	SAME as C3	933 0415 00
C9 (A&B)	Part of power supply filter	CAPACITOR: electrolytic; 60-60 mf, 450 vdcw	183 1486 00
CR1	Power supply rectifier	DIODE: rectifier, G.E. type IN1490	353 1659 00
CR2	Power supply rectifier	SAME as CR1	353 1659 00
CR3	Power supply rectifier	SAME as CR1	353 1659 00
CR4	Power supply rectifier	SAME as CR1	353 1659 00
F1	Input power fuse	FUSE: 3AG, 1A	264 4050 00
I1	Power indicator lamp	LAMP: 6.3 vac	262 3220 00
J1	Threshold voltage test point	CONNECTOR: comb, jack	360 0255 00
J2	Threshold voltage test point	CONNECTOR: comb, jack	360 0256 00
J3	115 vac	CONNECTOR: power	368 0004 00
M1	Gain reduction meter	METER: 3 inch, 0-1 ma dc	458 0586 00
R1	Input attenuator series resistor	RESISTOR: comp, 510 ohms, ± 5%, 1/2 w	745 1340 00
R2	Input attenuator shunt resistor	RESISTOR: comp, 100 ohms, ± 5%, 1/2 w	745 1309 00
R3	Input attenuator series resistor	SAME as R1	745 1340 00
R4	Signal voltage adjust	POTENTIOMETER: 500 ohm, 2 w	380 0194 00

TABLE 5. TABLE OF REPLACEABLE PARTS FOR THE 26J-1 AUTO-LEVEL AMPLIFIER (Cont)

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NUMBER
R5	Frequency compensation	RESISTOR: comp, 0.330 megohm ± 5%, 1/2 w	745 1456 00
R6	Cathode bias for V1-A	RESISTOR: comp, 130 ohm, ± 5%, 1/2 w	745 1315 00
R7	Cathode bias for V1-B	SAME as R6	745 1315 00
R8	Cathode bias for V1	RESISTOR: comp, 68 ohm, ± 5%, 1/2 w	745 1302 00
R9	Plate load for V1-A	RESISTOR: comp, 10,000 ohms, ± 5%, 1/2 w	745 1393 00
R10	Plate load for V1-B	SAME as R9	745 1393 00
R11	Decoupling	RESISTOR: WW, 20,000 ohms, ± 5%, 5 w	710 3061 00
R12	Grid load for V2	RESISTOR: comp, 0.510 megohm, ± 5%, 1/2 w	745 1466 00
R13	Grid load for V3	SAME as R12	745 1466 00
R14	Cathode bias	RESISTOR: comp, 180 ohm, ± 5%, 2 w	745 5620 00
R15	V2, V3 cathode balance	POTENTIOMETER: WW, 100 ohm, 2 w	377 0307 00
R16	Meter reading adjust	POTENTIOMETER: comp, 1000 ohm, 2 w	380 0335 00
R17	Part of attack-and-release time circuit	RESISTOR: comp, 51,000 ohms, ± 5%, 1/2 w	745 1424 00
R18	Part of attack-and-release time circuit	RESISTOR: comp, 10 megohm, ± 5%, 1/2 w	745 1519 00
R19	Part of attack-and-release time circuit	RESISTOR: comp, 4.3 megohm, ± 5%, 1/2 w	745 1504 00
R20	Diode bias	SAME as R12	745 1466 00
R21	Diode bias	SAME as R12	745 1466 00
R22	Part of power supply filter	RESISTOR: comp, 100 ohm, ± 5%, 2 w	745 5609 00
R23	Part of power supply filter	SAME as R22	745 5609 00
R24	Decoupling	RESISTOR: Comp, 0.200 megohm, ± 5%, 1/2 w	745 1448 00
R25	Threshold voltage adjust	POTENTIOMETER: comp, 0.100 megohm, 2 w	380 0334 00
R26	Filament bias	RESISTOR: comp, 51,000 ohms ± 5%, 2 w	754 5724 00
R27	Filament bias	SAME as R26	745 5724 00
R28	Filament bias	RESISTOR: comp, 2,700 ohms, ± 5%, 2 w	745 5669 00
R29	Meter shunt	RESISTOR: comp, 91 ohm, ± 1%, 1/2 w	705 2106 00
S1	Meter limiter on/off switch	SWITCH: toggle: dpst	266 0099 00

TABLE 5. TABLE OF REPLACEABLE PARTS FOR THE 26J-1 AUTO-LEVEL AMPLIFIER (Cont)

ITEM	CIRCUIT FUNCTION	DESCRIPTION	COLLINS PART NUMBER
S2	Attack time control switch	SWITCH: toggle: spst	260 0529 00
S3	Power switch	SAME as S2	266 0100 00
TB1		BARRIER STRIP: 8 terminal	367 0016 00
T1	Input transformer	TRANSFORMER, AF: input type; primary 600 ohms, secondary 60,000 ohms, CT connected	667 0519 00
T2	Output transformer	TRANSFORMER, AF: output type; primary 9,000 ohms, CT connected, secondary 600 ohms	667 0518 00
T3	Power transformer	TRANSFORMER: power type; primary 115 or 230 vac, secondary (1) 6.3 vac @ 1.8 amps, CT connected, secondary (2) 320 vac @ 100 ma	662 0517 00
TS1		TUBE SHIELD	141 0102 00
TS4		TUBE SHIELD	141 0111 00
V1	Input amplifier	TUBE: vacuum, twin-triode GL 6386	253 0015 00
V2	Output amplifier	TUBE: vacuum, beam power, 6V6 GT	255 0090 00
V3	Output amplifier	SAME as V2	255 0090 00
V4	Diode limiter	TUBE: vacuum, twin-diode 6AL5	257 0018 00
XF1		SOCKET: fuse, 3AG	265 1023 00
XI1		SOCKET: lamp	262 1031 00
XV1		SOCKET: tube, 9 contact miniature	220 1062 00
XV2		SOCKET: tube, 8 prong octal	220 1059 00
XV3		SAME as XV2	220 1059 00
XV4		SOCKET: tube, 7 contact miniature	220 1034 00
--	Input and output power level dials	KNOB: 1-3/4 inch skirt	235 0021 00



NOTES

1. UNLESS OTHERWISE SPECIFIED, RESISTOR VALUES ARE IN OHMS, CAPACITOR VALUES ARE IN MICROMICROFARADS.

FIGURE 8. COLLINS TYPE 26J-1 AUTO-LEVEL AMPLIFIER, SCHEMATIC DIAGRAM

COLLINS®

COLLINS RADIO COMPANY