COLLINS

instruction book

Cedar Rapids Division | Collins Radio Company, Cedar Rapids, Iowa

212Z-1
Remote Amplifier

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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 two (2) years 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.

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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

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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)

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212Z-1
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Cedar Rapids Division | Collins Radio Company, Cedar Rapids, Iowa
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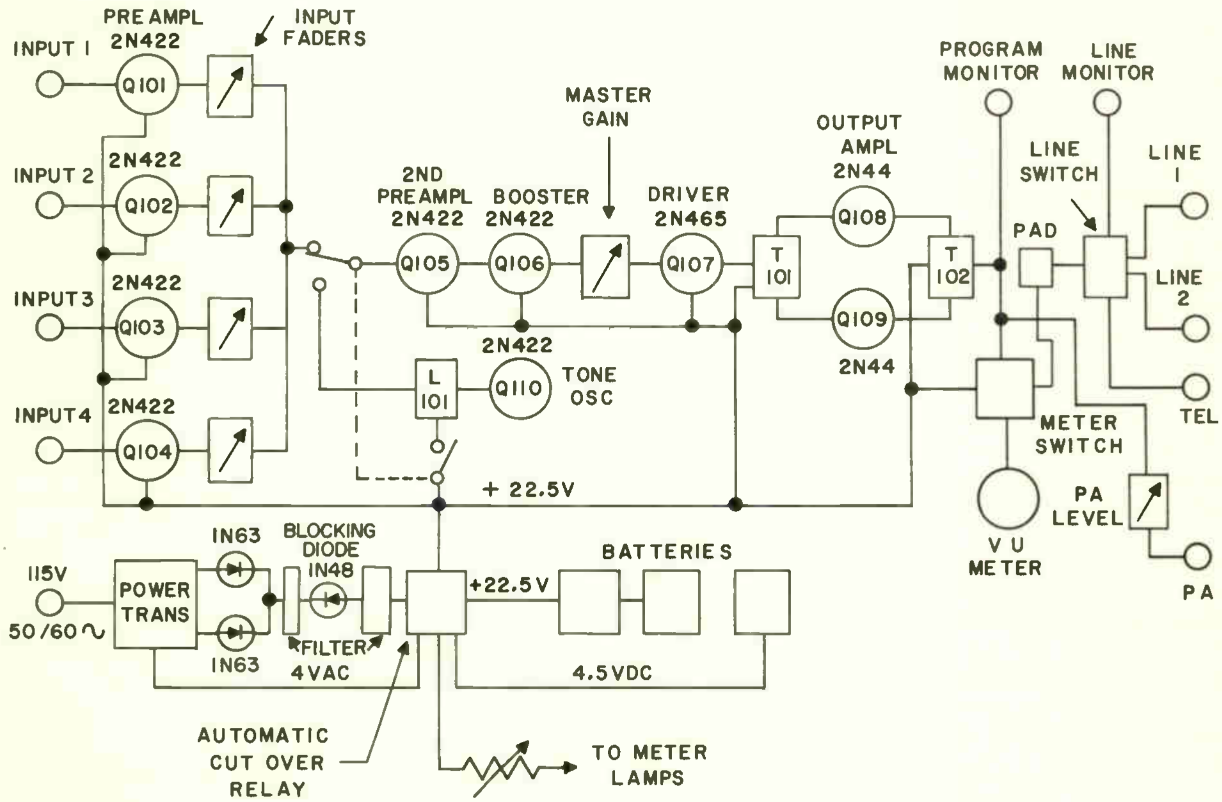


Figure 1-1. 212Z-1 Remote Amplifier in Carrying Case and 212Z-1 Block Diagram

section 1

general description

1.1 General.

This instruction book has been compiled as a guide to the proper installation, adjustment, operation, and maintenance of the transistorized Collins 212Z-1 Remote Amplifier, see figure 1-1.

The Collins 212Z-1 Remote Amplifier greatly simplifies the problem of on-the-spot broadcasts. The amplifier is built into a small carrying case, is light in weight, and can be easily carried by one person. The 212Z-1 includes four input channels with individual controls, a master control, a-c power supply, and a battery power supply built into a single compact unit. The batteries are switched automatically into operation whenever the a-c power source fails. Two output circuits are provided, one for program and one for telephone. If the program line fails, a twist of the OUTPUT line control will reverse the lines and the program will be fed into the line previously used for telephone. The receptacles for the microphone, terminals for the lines, and the receptacle for the a-c power cord plug are accessible from the rear of the amplifier. Program monitor, line monitor, and multiple jacks are mounted on the right-hand end of the unit.

The fader controls are of the low impedance ladder type to give low insertion loss. The master gain control is also a low impedance ladder type. All controls have an attenuation of 2 db per step. A range switch and meter switch connect a standard vu meter to the proper circuit for measuring the output level in vu or the battery voltages. A 400-cps tone oscillator is provided to aid in setting up line level.

The carrying case is similar in size and features to the more popular portable typewriter cases. The amplifier can be removed entirely from the case or, more conveniently, it can be left in the case and just the lid of the case removed. All of the controls, plugs, and terminals are perfectly accessible with just the lid removed. Whenever the lid of the case is closed, an interlock switch is actuated to disconnect the B source from the transistors. This is only a safety feature to prevent accidentally discharging the B batteries in event the POWER switch is inadvertently left on.

An additional feature of the 212Z-1 is the MULTIPLE connection jack which can be used to patch 212Z-1 Remote Amplifiers together to provide more input channels. Four input channels (and input controls) are gained for each 212Z-1 connected, then they are all fed through the master gain control on the 212Z-1 to which the output line is connected.

The use of transistors throughout provides a power saving in the order of 15-1 over previous models, in addition to the savings in weight and space.

1.2 Reference Data.

Dimensions	14 in. x 15-1/2 in. x 6-1/2 in. (including case).
Weight.	22 lb (with batteries and case).
Frequency response .	±1.5 db 50 to 15,000 cps.
Input impedance . . .	30 to 600 ohms.
Gain	90 db.
Output impedance . .	Normally 600 ohms, 150 ohms on special order.
Distortion	1.5 percent max at +5 dbm.
Equivalent noise level at the input	Less than -115 dbm.
Power output	+1 uv (+11 dbm) normal, +6 vu (+16 dbm) emergency.
Power source	115 volts a-c, 50 to 60 cps or self-contained batteries (two 22-1/2-volt "B" and 4.5-volt meter illuminating).
Input connectors, Cannon	Use Cannon XL-3-13N plugs. Other connectors available on special order.

1.3 Transistor and Diode Complement.

QUANTITY	TYPE	FUNCTION
4	2N422	Channel amplifiers
1	2N422	Input amplifier
1	2N422	Interstage amplifier
1	2N465	Driver amplifier
2	2N44	Output amplifier
1	2N422	Tone oscillator
1	1N48	Blocking diode
2	1N63	Rectifiers

1.4 Fuse Complement.

QUANTITY	TYPE	FUNCTION
1	1/16 amp 3AG	F101, power line fuse
1	1/16 amp 3AG	Spare F101

1.5 Battery Complement.

QUANTITY	COLLINS PART NUMBER	MFR TYPE NUMBER	FUNCTION
1	015-0519-00	National Carbon Company 726	4.5 V Meter Lamp
2	015-0520-00	National Carbon Company 763	22.5 V B Supply

section 2

installation

2.1 Unpacking.

All the equipment supplied with the 212Z-1 unit is shipped in one carton. Remove all packing material and carefully lift the unit out of the carton. Open the carrying case and remove the lid. Set the lid aside, then turn the unit over on its front panel upon a piece of soft, nonscratch material. Remove the bottom of the case and the bottom plate from the inverted unit by removing the four screws that are visible from the bottom. Inspect the unit for loose screws or bolts. Be certain all controls, such as switches, dials, etc., work properly. All claims for damages should be filed promptly with the transportation company. If a claim for damages is to be filed, the original packing case and material must be preserved.

2.2 Preparing the Amplifier for Operation.

It is suggested that the procedure described below be followed in detail when the amplifier is put into operation for the first time:

a. Remove the case lid and set it aside.
b. Turn the unit over on a piece of soft, nonscratch material and remove the bottom part of the case and the bottom plate by removing the four screws that are visible.
c. Install the batteries. To install the B batteries, lift the battery hold-downs to one side, determine the correct polarity (printed on the hold-down), remove the battery connector nuts, insert the battery, place the hold-down in place so that the battery terminals penetrate the connector straps, engage the hold-down wing bolts and tighten, then screw the battery connector nuts upon the battery terminals tightly. To install the meter-light battery, pull the hold-down to one side, look at the battery plug to determine which is the best way to insert the battery (plug is polarized by having one pin larger), insert the battery, place the hold-down over the battery, engage the wing bolts and tighten, then plug the battery connector plug into the battery. Refer to figure 7-1.
d. Replace the bottom cover and bottom of case.
e. Remove the power cord from the inside of the carrying case and plug it into the receptacle at the rear of the unit but do not connect it to the power line.
f. Insert microphones into J101 (microphone input no. 1) and J102 (microphone input no. 2). (Check the connections of the microphone plugs before insertion to be sure that they agree with the schematic, figure 7-5.)
g. Plug a headset into PROGRAM MONITOR jack, J105. (See figure 2-1.)
h. Turn all the faders and MASTER gain to off.
i. Turn the POWER switch to ON.
j. Turn the VU METER switch to BAT. Meter should read in the vicinity of 0, preferably in the red portion of the scale.
k. Turn METER LIGHT switch S106 to ON. Rotate METER DIM control R144 over its range and observe change of light intensity.
l. Plug power cord into source of 115 V 50/60 cps current. The unit should automatically switch to a-c operation as indicated by glowing of the A-C OPERATION pilot light. To check this, press INTERLOCK switch S105, and see if the unit remains operative. If the unit does not operate with the interlock switch pressed, check for open circuit between secondary of T103 and K101.
m. Set TONE switch to OFF, OUTPUT switch to 0, and VU METER to HIGH.

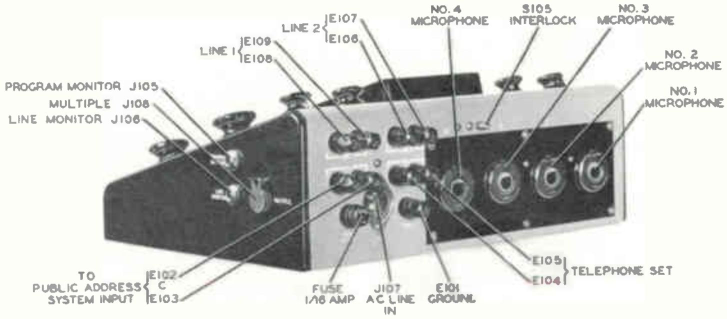


Figure 2-1. 212Z-1 Remote Amplifier, Connections

n. Advance fader no. 1 to half scale.

o. Talk into microphone no. 1 and advance MASTER gain control while listening into headset. (Adjust HEADSET LEVEL control.)

p. Return fader no. 1 to 0 and advance fader no. 2. Talk into microphone no. 2 while listening into headset.

q. Return fader no. 2 to 0; plug microphones into channels no. 3 and no. 4.

r. Repeat steps n through p with microphones and faders no. 3 and no. 4.

s. Return faders and MASTER gain to 0, place TONE switch in ON position, place OUTPUT switch in the LINE 1 position, and plug the headset into the LINE MONITOR jack.

t. Advance the MASTER gain control and listen for 400-cps tone in headset.

u. Reduce MASTER gain and change VU METER switch to NORMAL position. Advance MASTER gain until 0 shows on the meter.

v. Change OUTPUT switch to LINE 2 position.

w. Remove headset cord tips from plug and attach them to LINE 2 binding posts. Tone should be heard.

x. Change OUTPUT switch to LINE 1 and attach headset cord tips to LINE 1 posts. Tone should be heard.

y. Attach headset cord tips to PA posts (E102 and E103). Adjust R155.

z. Jumper LINE 1 terminals to LINE 2 terminals and connect headset cord tips to TEL posts. Switch OUTPUT to LINE 1. Tone should be heard. Change OUTPUT switch to LINE 2. Tone should be heard.

aa. Remove a-c cord from receptacle. Amplifier should remain in operation on battery power.

ab. If the amplifier appears normal, remove jumper wires from LINE 1 and LINE 2 posts and replace headset tips in phone plug.

NOTE

If any circuit involving a transistor appears dead, remove the back of the unit, gain access to the transistors, and carefully remove and reinsert the transistor. Be sure the power is off when removing or inserting transistors. This procedure breaks down any thin film of oxidation that may have formed between the transistor pin and socket prong.

2.3 Permanent Installation.

The 212Z-1 can be used as an economical, permanently installed studio console. In this application, it is likely that the carrying case would be entirely removed. To do this, remove the lid, turn the unit face downward upon some nonscratch material, and remove the four screws that hold the bottom of the case and the bottom of the unit in place. Set the bottom of the case aside and using the screws just removed, fasten the bottom of the unit back in place. Rubber feet can be added, if necessary.

2.4 Multiple Input.

If four microphone channels are not enough, another 212Z-1 can be added by connecting the two 212Z-1 units together at the MULTIPLE jacks with a patch cord. In this type operation, the MASTER gain control of the unit connected to the audio lines should be used to control both units, and the MASTER gain of the other unit should be turned to OFF. This setup would give eight input channels and faders all controlled by the one MASTER gain control. Both units would have to be connected to the 115 V power source and energized.

2.5 Input Power Change.

When received, the 212Z-1 is connected for 115-volt, 50- to 60-cps operation. If 230-volt, 60-cps input power is used with the 212Z-1, connect the input power transformer as shown in figure 2-2B. Figure 2-2A shows the 212Z-1 connected for 115-volt, 50- to 60-cps operation.

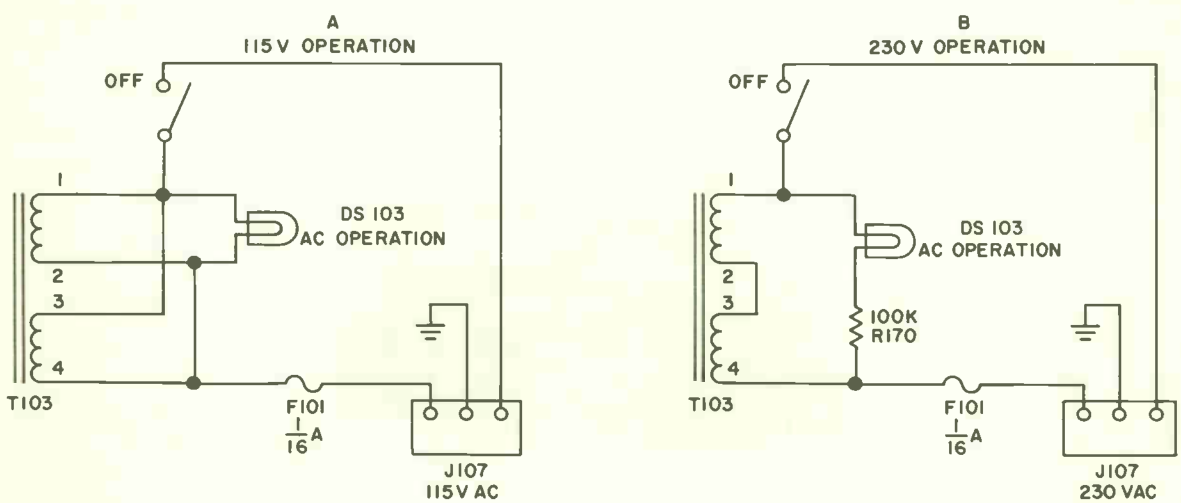


Figure 2-2. 115V/230V Input Power Change, Schematic Diagram

section 3

operation

3.1 Setting Up for Remote Operation.

3.1.1 CONNECTIONS. Refer to figure 2-1.

a. If two lines are available, connect the program line to LINE 1 terminals at the rear of the unit. Connect the talk-back line to LINE 2 terminals and the telephone headset to the TEL terminals.

b. Plug the microphones into the microphone receptacles at the rear of the unit.

c. Plug headset into PROGRAM MONITOR jack at the side of the unit.

d. If a public address system is to be used in conjunction with the 212Z-1, connect it to the PA terminals at the rear of the unit, after first setting the PA LEVEL control in the extreme CCW position. This is a 500-ohm connection. E102 is ground side.

e. Connect an external ground to the GRD terminal at the rear of the unit, if hum troubles are encountered.

f. If headphones are provided for a guest announcer or for program director, plug them into LINE MONITOR jack at the side of the unit.

g. Plug the power cord into the power receptacle at the rear of the unit and connect it to a 115 V 50/60 cps receptacle.

3.1.2 PREBROADCAST ADJUSTMENTS.

3.1.2.1 SETTING LINE LEVEL. (See figure 3-1.)

a. Turn all microphone fader and MASTER gain controls to OFF.

b. Throw POWER switch to ON.

c. Turn OUTPUT control to LINE 1.

d. Turn VU METER control to NORMAL.

e. Turn TONE switch to ON.

f. Advance MASTER gain control until the meter indicates 0 on the scale.

g. Communicate with the studio via the telephone handset to confirm line level. If only one line is being used, see paragraph 3.2.3 for alternate talk-back method.

h. Turn TONE control to OFF.

i. Talk into a microphone and advance its associated fader control while observing the VU METER. Advance the fader until the peaks of the voice tones produce approximately 0 indication on the meter scale.

NOTE

After the line level has been set once, the ideal range in which to operate the fader controls is between 20 and 32, and the ideal range in which to operate the MASTER gain control is around position 16. An attempt should be made to adjust the controls to reach these ranges, but any setting will do, so long as there is sufficient range for adjustment.

j. Adjust HEADSET LEVEL control.

k. Contact the studio via the telephone handset for confirmation of line level and quality of transmission.

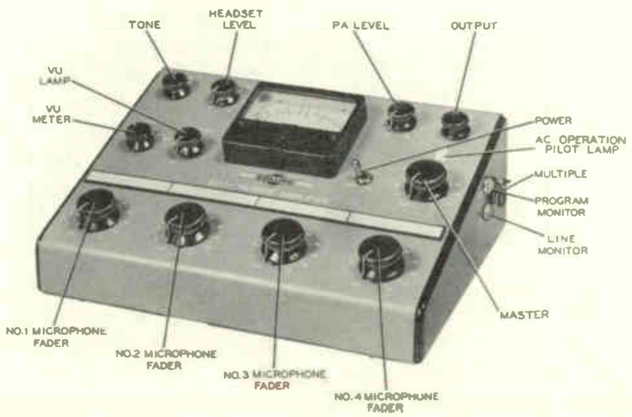


Figure 3-1. 212Z-1 Remote Amplifier, Controls

If only one line is being used, see paragraph 3.2.3 for alternate talk-back method.

l. Repeat the above procedure for any other microphone and channels being used on the job.

m. Return the microphone faders to OFF and await the program cue on the telephone handset.

3.2 Operating Procedures.

3.2.1 BROADCAST PROGRAM.

a. Condition the equipment for braodcasting as indicated in paragraph 3.1.

b. Operate the equipment in the usual fashion according to good station practices.

c. If a public address system is being used, orient the microphones to prevent acoustical feedback and make the public address compatible with the broadcast pickup.

3.2.2 PUBLIC ADDRESS OPERATION.

a. After the line level has been established, turn the OUTPUT control to 0. This cuts the program to the line but allows the audio to drive the PA input.

b. Advance the PA LEVEL control until a workable signal is delivered to the public address system.

c. Use the gain control of the public address system to control the gain of the system; however, in an emergency, the PA LEVEL control can be used.

d. Return the OUTPUT switch to LINE.

3.2.3 TALK BACK WITH ONE-LINE OPERATION.

a. If only one telephone line is being used, talk back to studio previous to broadcast can be accomplished with just the one line, by switching to LINE 2 position of the OUTPUT control and using the handset. If a handset is not available:

b. Set MASTER gain at position 16.

c. Plug headset into LINE MONITOR jack.

d. Set the OUTPUT control to LINE 1.

e. Advance the fader control associated with microphone being used, and talk to the studio.

f. The answer from the studio can be received with the OUTPUT control as is (in LINE 1 position), or it can be set to 0 for the answer.

3.2.4 EMERGENCY SWITCH TO LINE 2. Should LINE 1 go dead or develop trouble of any nature, the program can be immediately switched to LINE 2 (providing this line is suitable).

Turn the OUTPUT control to LINE 2 position. This will connect the program to LINE 2 and at the same time, will connect the telephone handset to LINE 1 and the LINE MONITOR jack. All program monitoring will have to be done at the PROGRAM MONITOR jack. Talk back can be had by switching the OUTPUT control to 0. This, of course, is going out on the program line and provision must be made first at the studio to prevent it from being aired.

3.2.5 EMERGENCY SWITCH TO BATTERY OPERATION. Should the a-c power source fail for any reason, such as power failure, blown fuse, or power plug accidentally removed, the amplifier will be automatically switched to battery operation utilizing self-contained batteries, and the A-C OPERATION pilot lamp will go out. Should this occur, it is wise to determine the fault and correct it as soon as possible to conserve battery power; however, a fresh set of batteries should last through a period of 75 hours. A spare fuse should always be carried in the clip provided on the lid of the carrying case. See paragraph 5.5 of section 5 of this book for fuse replacement instructions.

To check whether the unit has returned to a-c operation, check to see that the A-C OPERATION pilot lamp is glowing, then press the INTERLOCK switch at the rear of the unit and if the operation has not switched back to a-c operation, there will be an interruption in the program audio.

3.3 Description of Operating Controls.

3.3.1 FADERS. The faders (four in number) control the output of the individual microphones. These should be set to give good range of adjustment; somewhere in the range of 20 to 32 on the panel scale is ideal. Set all faders not in use at OFF.

3.3.2 MASTER GAIN CONTROL. The MASTER gain control controls the over-all program level. Set to give a good range of adjustment; somewhere near position 16 on the panel scale is ideal.

3.3.3 TONE. In the ON position, the TONE control turns on the tone oscillator and connects it for use in setting up line level previous to broadcast.

3.3.4 HEADSET LEVEL. The HEADSET LEVEL control adjusts the level of audio delivered to the PROGRAM MONITOR jack.

3.3.5 PA LEVEL. This control adjusts the audio output to the public address system (if used).

3.3.6 OUTPUT SWITCH. (Refer to figure 4-1.) The OUTPUT selector switch in LINE 1 position connects the audio to LINE 1 and connects the TEL (telephone) circuit to LINE 2. In the LINE 2 position, the OUTPUT selector switch connects the audio to LINE 2 and connects the TEL (telephone) circuit to LINE 1. In the 0 position, a load resistor is connected across the program audio and the audio is disconnected from both lines, but the telephone circuit is connected to LINE 2.

3.3.7 VU METER CONTROL AND METER. The VU METER is a standard vu meter with a type A scale. In the NORMAL position of the selector switch, the output of the amplifier is connected through the pad to the OUTPUT switch and 0 on the meter indicates a line level of +1 VU. In the HIGH position, the output of the amplifier is connected directly to the OUTPUT switch. Zero on the meter indicates a line level of +6 VU. In the BAT position of the VU METER switch, the meter is used to indicate B voltage. Plus 1.0 to 0.5 on the meter indicates normal voltage.

3.3.8 VU LAMP. This control adjusts the degree of illumination afforded by the meter lamp.

3.3.9 POWER SWITCH. This toggle switch turns the power on in both battery operation and in a-c operation.

3.3.10 LINE MONITOR JACK. This jack is permanently connected to LINE 1. Whenever the OUTPUT control is set at LINE 1, this jack can be used to monitor the program as it appears on the line. This jack is also useful in energizing a second set of headsets for guest or program director.

3.3.11 PROGRAM MONITOR. This jack is intended for use in monitoring the program by the announcer or operator.

3.3.12 MULTIPLE JACK. This jack is used to patch two or more 212Z-1 amplifiers together so that more microphone inputs and faders can be utilized.

3.3.13 A-C OPERATION PILOT LAMP. This lamp is connected across the primary of the power transformer and indicates that the a-c power is reaching the transformer.

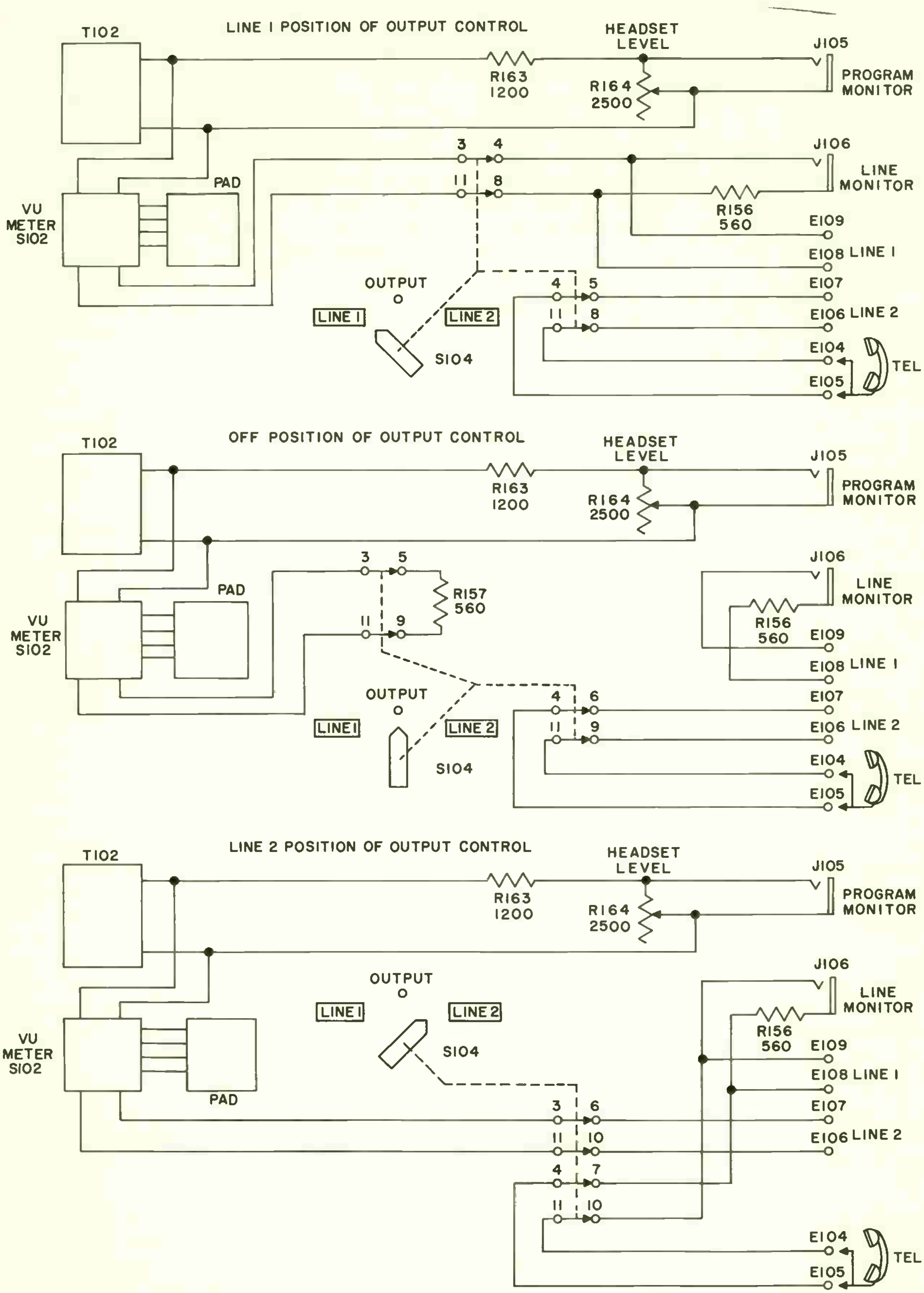


Figure 4-1. Output Circuits, Simplified Schematic

section 4

principles of operation

4.1 Mechanical Details.

The case of the 212Z-1 is constructed along horizontal lines rather than vertical lines. The control panel is the surface and slopes gently from the rear toward the front. Aluminum, or aluminum alloys, are used for panel, cabinet, and constructional parts. A parts layout is printed upon the inside of the bottom plate.

The controls are symmetrically arranged around the output meter. The mixing controls have a blank identification strip above them which can be filled in to suit the requirements. The strip is removed easily and inverted, allowing preset marking to be made on one side. The cover of the carrying case is hinged to the case bottom by means of a special hinge that allows the cover to be removed.

4.2 Electrical Details.

4.2.1 GENERAL. Semiunitized-type construction is employed in the 212Z-1 Remote Amplifier. Printed circuits are employed where advantageous. A signal entering the 212Z-1 receives amplification from five audio stages. The input stage consists of four completely separate input stages, each with its own transistor and fader. In addition, there is a tone oscillator, an a-c power supply, and a battery power supply. See the block diagram, figure 1-1. PNP-type transistors are used throughout the audio amplifier portion of this unit.

4.2.2 AUDIO AMPLIFIER. (See figure 7-5.) Each fader for the four input channels has its own transistor channel amplifier stage preceding it. No input transformers are employed, the low impedance input characteristic of the 2N422 transistors being suitable for coupling to microphones of 30- to 600-ohm impedance. The input coupling capacitors are of 50-uf value (as are all other interstage coupling capacitors). A-c negative feedback is obtained by tapping down on the emitter-region series resistance with the bypass capacitor (C102, in the case of Q101). The feedback occurs across the unbypassed portion (R103 for Q101). The output of the individual channel amplifier is coupled into its associated ladder-type fader. After passing through 1100-ohm build-out resistors, the outputs of the faders are combined and passed through TONE selector switch S101 and coupling capacitor C113 to the base connection of Q105, the input amplifier transistor.

A-c negative feedback similar to that used on the channel amplifiers is employed on Q105. The output of Q105 is coupled to interstage amplifier Q106, a 2N422 transistor, through capacitor C116.

In addition to feedback in the emitter series resistor, Q106 employs further feedback in the nature of a 33K resistor, R130, connected from the collector connection to the base connection. The output of Q106 is coupled to MASTER gain control AT105 through capacitor C118.

MASTER gain control AT105 is a ladder-type fader similar to those used for the channel faders. The input to AT105 is bridged by MULTIPLE jack J108.

MULTIPLE jack J108 is provided so that additional 212Z-1 Remote Amplifiers can be patched (through their MULTIPLE jacks) to the 212Z-1 to gain more input channels and faders. All of the additional input channels are then routed through the one MASTER gain control.

The output of the MASTER gain control is coupled to driver transistor Q107 through coupling capacitor C119. Q107 has a-c negative feedback applied to the emitter similar to that of Q105, except that different values of resistance are used to obtain a higher value of feedback.

The output of Q107 is coupled to the output amplifier by means of a transformer, T101. Transformer T101 has an impedance ratio of 40 to 1 primary to 1/2 secondary.

Two type 2N44 transistors are employed in the output amplifier in a push-pull arrangement. Each transistor employs negative feedback from its collector to its base through a 47K resistor. The output of this stage employs a transformer, T102.

One winding of output transformer T102 provides a 500-ohm impedance output for exciting an auxiliary public address system. R155, a potentiometer, provides a means of setting the maximum audio level obtainable from this winding. The other winding on T102 provides audio at 600-ohm impedance for the program lines and the program monitor jack. Program monitor jack J105 is connected to this winding through isolation resistor R163 and HEADSET LEVEL control R164. The program audio connects to VU METER switch S102. With the VU METER switch set to OFF, NORMAL, or BAT, the program audio is connected through a 3-db pad consisting of R158, R159, R160, R161, and R162 to OUTPUT selector switch S104. With the VU METER switch set at HIGH, the program audio is connected directly to OUTPUT selector switch S104.

OUTPUT selector switch S104 in LINE 1 position (refer to figure 4-1), connects the audio to LINE 1 and connects the TEL (telephone) binding posts E104-E105 to LINE 2. In LINE 2 position, the OUTPUT selector switch connects the audio to LINE 2 and connects the TEL binding posts to LINE 1. In the 0 position of the OUTPUT switch, a load resistor, R157, is connected across the program audio and the audio is disconnected from both lines, but the TEL binding posts are connected to LINE 2. The LINE MONITOR jack, J106, is always bridged across the LINE 1 output binding posts.

4.2.3 VU METER. The VU meter is a rectifier-type Simpson 142 VU meter. This instrument conforms to the standards adopted by the major networks and reads directly in volume units (on steady tone numerically equal to db above a 1-mw reference level). In the NORMAL position of the selector switch, the output of the amplifier is connected through a pad to the OUTPUT switch, and 0 on the meter indicates a line level of +1 VU. In the HIGH position, the output of the amplifier is connected directly to the OUTPUT switch. Zero on the meter indicates a line level of +6 VU. In the BAT position of the VU METER switch, the meter is used to indicate B voltage. Plus 1.0 to 0.5 on the meter indicates normal voltage.

4.2.4 TONE OSCILLATOR. Line levels are most easily set up by means of a steady audio tone, therefore the 212Z-1 includes a built-in tone oscillator as a standard feature. This tone oscillator employs a type 2N422 transistor, Q110, in a 400-cps audio circuit. When the TONE switch is placed in the ON position, the channel faders and amplifiers are disconnected from input transistor Q105 and the output of the tone oscillator is connected in their place. At the same time, B voltage is applied to tone oscillator Q110 and oscillation results.

4.2.5 POWER SUPPLY. The 212Z-1 includes two power supplies, an a-c power supply and a battery power supply. The a-c power supply consists of power transformer T103, diode rectifiers CR101 and CR102 (both are type 1N63), and a filter. The filter is a combination RC and LC filter with very high values of C. The positive side of the power supply is grounded and the negative side is high. The a-c-to-battery changeover relay coil is connected across the a-c power supply output so that whenever the coil is excited, the relay connects the a-c power supply output to the amplifier. Whenever the coil is not excited either through a-c line failure, blown fuse, power supply failure, or through lack of a-c line facilities, the relay will connect the battery power supply to the amplifier. CR103, a 1N48 diode, is used as a blocking diode to accelerate automatic changeover on a-c power failure by preventing the discharge of the large filter capacitors through K101. The relay also switches the meter lights from a transformer winding to a dry battery whenever the a-c source fails. The meter lights are adjustable by rheostat R144 and may be turned off by S105. They are interlocked by POWER switch S103, but not by the case interlock, S105. The meter light battery is a 4.5-volt, C type battery.

Two 22-1/2-volt B batteries are connected in parallel to supply the battery source of B power. They are connected only under the following condition: no a-c line excitation, carrying case open, and POWER switch on.

section 5

maintenance

5.1 General.

Because the amplifier stages in this unit employ transistors in place of vacuum tubes, slightly different techniques are necessary in maintenance procedures. The impedances and resistances encountered are of much lower values than those encountered in vacuum tube amplifiers, therefore a few ohms discrepancy can make a big difference in the performance of the transistor-equipped unit. Likewise, the coupling capacitors and filter capacitors are of larger values and, in general, are of the electrolytic type. This means that when measuring resistances, an instrument very accurate in the low-resistance ranges must be used, and when measuring the value of the capacitors, an instrument very accurate in the high ranges must be used. Also, the polarity of the capacitors must be observed when taking resistance measurements.

To further complicate the picture, transistors have a low value of forward resistance and a high, but measurable, value of backward resistance. More satisfactory results are obtained if the transistors are removed or disconnected from the circuit when "bugging" individual circuit components.

Figure 5-4, the gain chart, is useful in diagnosing troubles.

5.2 Test Equipment.

The following test equipment is known to function satisfactorily and is recommended for use in testing the 212Z-1 equipment.

TABLE 5-1. LIST OF TEST EQUIPMENT

FUNCTION	TEST EQUIPMENT
Resistance measurements	BECO Impedance Bridge Model 250-C1
Voltage measurements (d-c)	Simpson Model 269 Meter
Voltage measurements (a-c)	Hewlett-Packard Model 400D AC-VTVM
Capacity measurements	BECO Impedance Bridge Model 250-C1
Audio output meter	Daven Power Output Meter Type OP-182
Audio signal generator	Hewlett-Packard Model 200CD Wide-Band Oscillator
Distortion	Hewlett-Packard Model 330D Distortion Analyzer
Oscilloscope	Dumont 208-B
Attenuation network	Daven T-693-R with various impedance pads

5.3 Transistor Replacement.

The transistors are mounted on the printed circuit boards. Remove the four screws holding the board containing the defective transistor and carefully turn the transistor over.

The transistors in this equipment are of the same general construction, especially insofar as the connection leads are concerned. The connection leads on a new transistor must be pruned to 1/4-inch length in order to fit the sockets properly. When replacing the transistors, see that the prongs are not bent, then align them with the holes in the socket and carefully press the transistor into position. Be sure the prongs do not bend.

CAUTION

The transistors should not be inserted into or withdrawn from the socket with the power on, because high transient currents may cause permanent damage to the transistor.

5.4 Resistance and Voltage Measurements. (Refer to figures 5-1, 5-2, and 5-3.)

5.4.1 GENERAL. Inspect the leads and test probes of the test equipment to be used. There must be no high resistance in these leads and the test probes must be clean and sharp. When using test probes, take measurements at points on the printed circuit where there is a large build-up of solder to prevent damaging any of the interconnecting printed wiring. Remember to observe polarity when checking with an ohmmeter any circuit across which there is an electrolytic capacitor.

Resistance measurements are made with the power plug pulled from the supply line and the battery plugs pulled from the batteries.

A chart of resistance measurements is not included in this book because of the use of high-capacity electrolytic capacitors in the filter and audio coupling circuits. In any circuit that includes an electrolytic capacitor, the charging time to charge the capacitor when the ohmmeter is attached makes a duplication of readings impossible. If resistance measurements are taken, take them directly across the component in question. Resistance values of resistors are given on the schematic diagram.

CAUTION

When making resistance measurements or at any other time, never reverse the polarity across any elements of a transistor to that existing in the normal operating circuit. Likewise, never apply more voltage to the transistor than that appearing in the normal circuit from which it was taken. Be sure that the circuit from which a transistor is extracted or into which it is being inserted has no voltage applied.

5.5 Fuse.

One fuse, F101, is used in this equipment. It is connected in the 115-volt supply line circuit only. The fuse is contained within the fuse post on the rear of the unit. To replace the fuse, press the cap of the holder and rotate it in the direction indicated on the cap. Pull the cap with the fuse attached from the holder. Pull the fuse from the cap and replace with a 1/16-amp, 3AG-type fuse. (A spare fuse is located in a clip on the carrying case.) Return the fuse and cap to the holder.

5.6 Component Parts Replacement.

5.6.1 GENERAL. In manufacturing the printed circuit assemblies, the "wires" are first copper plated on the insulation board, then the component parts are mounted on the board, then the bottom of the board is dipped into a pot of hot solder. All of the components are soldered at once and, at the same time, a coating of solder is deposited on the copper "wires." The leads of the resistors and condensers, after they come through the mounting holes, are slightly flattened and bent over and cannot safely be withdrawn from the same side of the board. The main problem with any printed circuit assembly when replacing parts is to prevent dislodging the copper "wires" from the board and causing an open circuit in the wiring. This copper "wire" can be disturbed by two means. One way is by applying too much heat, the other way is by accidentally pushing the copper away from the board when shoving the leads of the resistors or capacitor through the holes of the board. Extreme care is the only answer to either problem. The special tools listed below will make it easier to perform the soldering operations without damaging the wiring.

5.6.2 SPECIAL TOOLS.

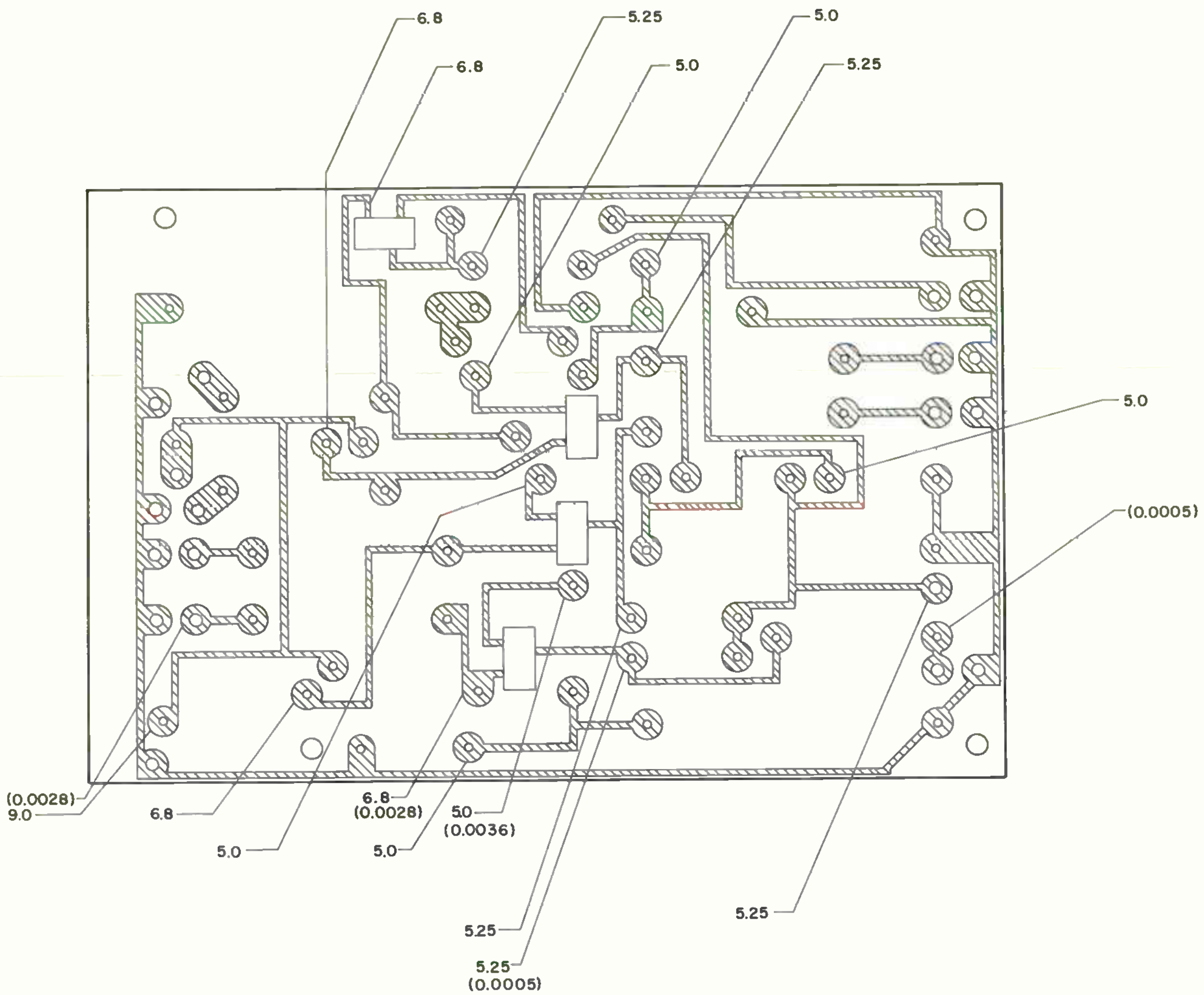
5.6.2.1 SOLDERING IRON. Select a soldering iron with a removable tip and of no more than 40 watts capacity. Flatten and dress the tip to a size of 3/16 inch across. With a file or saw, cut a 1/32-inch wide slot in the center of the tip, then put a slight bend in the tip close to the end. This tip will be used to hold the copper down around a hole through which a resistor or capacitor lead is being thrust (and melt the solder at the same time).

5.6.2.2 PIN-NOSED PLIERS. Pin- (or needle-) nosed pliers are used to grasp the protruding resistor or capacitor leads.

5.6.3 PROCEDURE. To remove a resistor or capacitor, cut the leads close to the ends of the component, then straighten them so that they protrude straight upward from the board. Using the soldering iron with the notched tip, quickly melt the solder at the solder spots and grasp the ends of the leads in the melted solder with pin-nosed pliers. Gently withdraw the leads through the board. To replace a resistor or capacitor, bend the leads so that they will exactly fit the spacing of the holes into which they are mounted. Prune the leads so that there will be only about 1/8-inch excess lead length. Carefully file the end of each lead to produce a point. Enter one lead into the mounting board and press the soldering iron against the associated soldering spot. When the tip of the lead comes through, allow it to come through the notch in the iron and press the iron firmly against the board. This will prevent the copper-plated wiring from coming loose from the board. Enter the other lead in its hole and repeat the process. Trim the excess lead.

CAUTION

If unreasonable resistance is met at any time when the lead is being thrust through the board into the melted solder, do not force the lead on through, because to do so may cause the copper "wiring" to be lifted from the board. The copper "wiring" can be lifted also if too much heat is applied during a soldering operation. Use only the minimum amount of heat and do the job quickly.



NOTES:
1. AC VOLTAGES WITH PARENTHESIS, DC VOLTAGES WITHOUT PARENTHESIS.
2. ALL DC VOLTAGES NEGATIVE WITH RESPECT TO GROUND.
3. DC VOLTAGES MEASURED WITH SIMPSON MODEL 269 METER. 100,000 OHMS PER VOLT INPUT IMPEDANCE.
4. AC VOLTAGES MEASURED WITH HEWELETT-PACKARD MODEL 400D VTVM WITH AN INPUT SIGNAL LEVEL OF -60DBM AND AN OUTPUT LEVEL OF +5DBM.

Figure 5-1. Voltage Measurements, Preamplifier Board

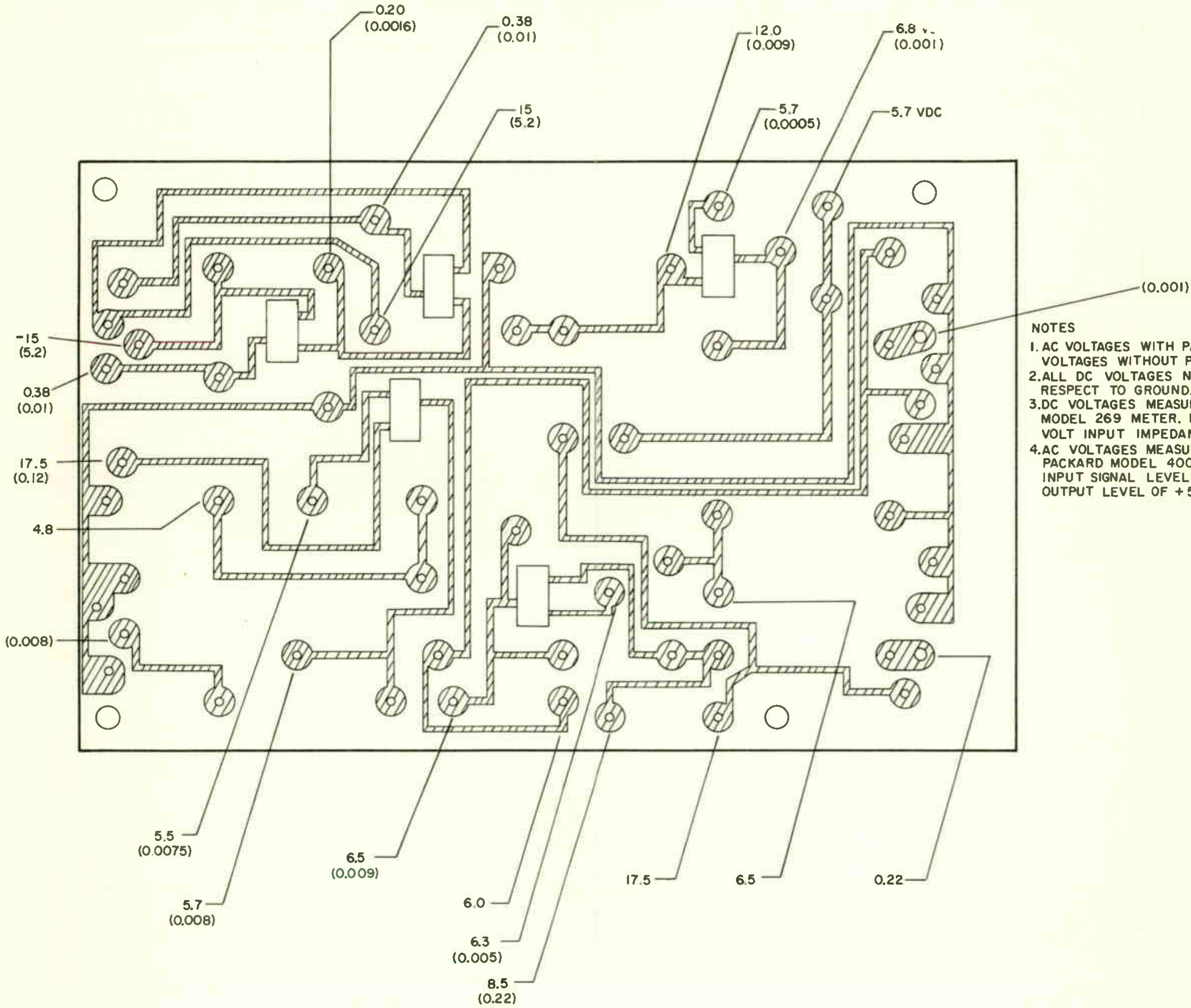
5.7 Servicing Transistor Circuits.

5.7.1 GENERAL. The servicing procedures and test equipments that have been used in the past with other types of electronic gear, for the most part, may be used with transistor circuits. The cases where special precautions must be used are listed below. If the equipment under test contains transistors, even though they may not be in the circuits under test, the precautions should be observed because of the possibility of accidentally cotacting a transistor circuit.

5.7.2 TEST EQUIPMENT. The damage to transistors by test equipment is usually the result of accidentally applying too much current or voltage to the transistor elements. The following are common sources of damage from test equipment.

5.7.2.1 TRANSFORMERLESS POWER SUPPLIES. One source of such current is from the power line when test gear with transformerless power supply is used. This type of test gear can be used by employing an isolation transformer in the power line.

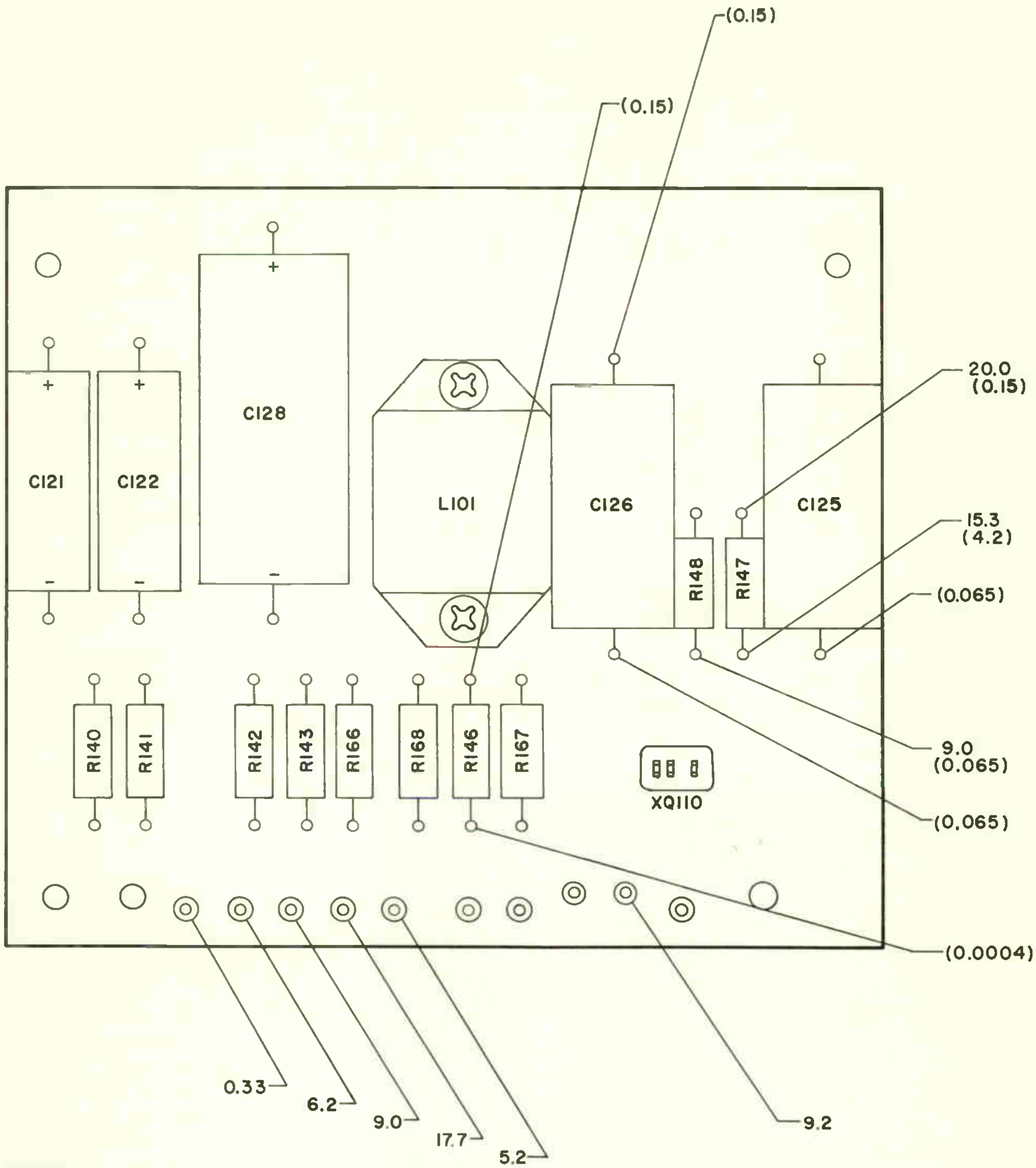
5.7.2.2 LINE FILTER. It is still possible to damage transistors from line current, even though the test gear has a power transformer in the power supply, if the test gear is equipped with a line filter. This



NOTES

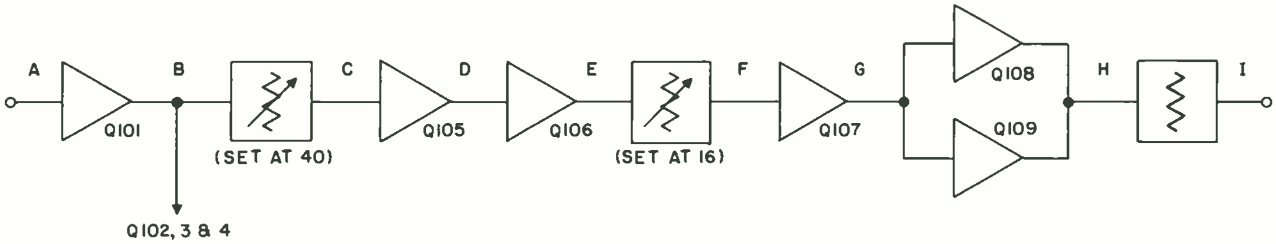
1. AC VOLTAGES WITH PARENTHESIS, DC VOLTAGES WITHOUT PARENTHESIS.
2. ALL DC VOLTAGES NEGATIVE WITH RESPECT TO GROUND.
3. DC VOLTAGES MEASURED WITH SIMPSON MODEL 269 METER. 100,000 OHMS PER VOLT INPUT IMPEDANCE.
4. AC VOLTAGES MEASURED WITH HEWELETT-PACKARD MODEL 400D VTVM WITH AN INPUT SIGNAL LEVEL OF 60 DBM AND AN OUTPUT LEVEL OF +5 DBM

Figure 5-2. Voltage Measurements, Amplifier Board



NOTES:
1. AC VOLTAGES WITH PARENTHESIS, DC VOLTAGES WITHOUT PARENTHESIS.
2. ALL DC VOLTAGES NEGATIVE WITH RESPECT TO GROUND.
3. DC VOLTAGES MEASURED WITH SIMPSON MODEL 269 METER. 100,000 OHMS PER VOLT INPUT IMPEDANCE.
4. AC VOLTAGES MEASURED WITH HEWELETT-PACKARD MODEL 400D VTVM WITH AN INPUT SIGNAL LEVEL OF -60DBM AND AN OUTPUT LEVEL OF +5DBM.

Figure 5-3. Voltage Measurements, Oscillator Board



LOCATION	VOLTAGE	LEVEL IN DBM
A		−60
B	.0045	$-47\frac{1}{2}$
C	.0019	$-59\frac{1}{4}$
D	.016	−35
E	.038	−3.15
F	.0155	−41.1
G	.025	−16.5
H	.5	+13.0
I	2.45	+10.

NOTES:

1. GAIN MEASURED AS FOLLOWS:
   600 OHMS 1000 CPS INPUT, INPUT FADER AT 40, MASTER AT 16.
2. ZERO DBM = 1 MW ACROSS 600 OHMS.

Figure 5-4. 212Z-1 Gain Chart

filter may act like a voltage divider and apply 55 volts a-c to the transistor. To eliminate trouble from this situation, connect a ground wire from the chassis of the test gear to the chassis of the equipment under test before any other connections are made.

5.7.2.3 LOW SENSITIVITY MULTIMETERS. Another source of transistor damage is a multimeter that requires excessive current for adequate indications. Multimeters that have sensitivities of less than 5000 ohms per volt should not be used. A multimeter with lower sensitivity will draw too much current through many types of transistors and damage them. Use of 20,000 ohms-per-volt meters or vacuum tube voltmeters is recommended. Check the ohmmeter circuits (even those in vtvms) on all scales with an external, low resistance milliammeter in series with the ohmmeter leads. If the ohmmeter draws more than one milliampere on any range, this range cannot be used safely on small transistors.

5.7.2.4 POWER SUPPLY. Always use fresh batteries of the proper value for the equipment under test in test power supplies. Never use battery eliminators because the regulation of these devices is poor at the current values drawn by transistor circuits. Be certain about identification of polarity before attaching the battery to the equipment under test; polarity reversal may damage the transistor.

5.7.3 ELECTRIC SOLDERING IRONS. The following are possible sources of transistor damage from soldering irons.

5.7.3.1 LEAKAGE CURRENT. Electric soldering irons may damage transistors through leakage current. To check a soldering iron for leakage current, connect an a-c voltmeter between the tip of the iron and a ground connection (water pipe or line ground), allow the iron to heat up, then check for a-c voltage with the meter. Reverse the plug in the a-c receptacle and again check for voltage. If there is any indication on the meter, isolate the iron from the line with a transformer. The iron may be used without the isolation transformer if the iron is plugged in and brought to temperature, then unplugged for the soldering operation. It is also possible to use a ground wire between the tip of the iron and the chassis of the equipment being repaired to prevent damage from leakage current.

5.7.3.2 IRON SIZE. Light duty soldering irons of 20 to 25 watts capacity are adequate for transistor work and should be used. If it is necessary to use a heavier duty iron, wrap a piece of about number 10 copper wire around the tip of the iron and make it extend beyond the tip of the iron. Tin the end of the piece of copper wire and use it as the soldering tip.

5.7.4 SERVICING PRACTICES.

5.7.4.1 HEAT SINK WHEN SOLDERING. When installing or removing a soldered-in transistor, grasp the lead to which heat is being applied, between the solder joint and the transistor, with long-nosed pliers to bleed off some of the heat that conducts into the transistor from the soldering iron. Make sure the wires being soldered to transistor terminals are properly pretinned so that the connection can be made quickly. Excessive heat will permanently damage a transistor.

5.7.4.2 REMOVAL OF TRANSISTORS FROM OPERATING CIRCUITS. Never remove a plug-in transistor or replace same when the supply voltage is turned on. Transients thus produced may damage the transistor or others remaining in the circuit. If a transistor is to be evaluated in an external test circuit, be sure that no more voltage is applied to the transistor than is normally used in the circuit from which it came.

5.7.4.3 PLUG-IN TRANSISTORS. When servicing equipment that uses plug-in transistors, it is good practice to remove the transistors from their sockets and reinsert them to break down any film of corrosion or dirt that may have formed.

5.7.4.4 RESISTANCE MEASUREMENTS IN TRANSISTOR CIRCUITS. When measuring resistances of circuits containing transistors or mineral diodes, remember that these components are polarity and voltage conscious; therefore, follow the directions of the notes given on the resistance tables or drawings to be sure that the correct polarity and range is applied to the circuit from the ohmmeter. Any capacitors used in transistor circuits are usually of large values (especially in audio, servo, or power circuits) and it takes time to charge these capacitors when an ohmmeter is connected to a circuit in which they appear; thus, any reading obtained is subject to error if the capacitor is not allowed time to fully charge. In some cases, it may be best to isolate the components in question and individually measure them.

5.7.4.5 POWER TRANSISTOR HEAT SINKS. In some cases, power transistors are mounted on heat sinks that are designed to carry heat away from then and in some power circuits, the transistor must also be insulated from ground. This insulating is done by means of insulating washers made of fiber and mica. When replacing transistors of this nature, be sure that the insulating washers are replaced in proper order. Before installing the mica washers, treat them with a film of silicone fluid, Collins part number 005-0273-00, or equivalent. This treatment helps in the transfer of heat. After the transistor is mounted and before making any connections to it, check from the case to ground with an ohmmeter to see that the insulation is effective.

5.7.4.6 TEST PRODS. Test prods should be clean and sharp. Because many of the resistors used in transistorized equipments are of low values, when checking resistance values any additional resistance produced by a dirty test prod will make a good resistor appear to be out of tolerance. In miniaturized equipment the clearance between socket terminals, wires, and other components is usually very small. Because of this, it is easy to cause accidental short circuits with a test prod using a long, exposed needle in the end. Short circuits can be very destructive to transistors, therefore it is a good practice to cover all of the exposed tip of the test prod, except about 1/8 inch, with plastic tape or other insulation.

5.7.5 TROUBLE SHOOTING. The usual troubleshooting practices apply to transistors. Be sure the test equipment and tools meet the requirements outlined in the above paragraphs. It is recommended that transistor testers be used to evaluate the transistor.

5.7.5.1 OHMMETER TEST OF TRANSISTORS. If a transistor tester is not available, a good ohmmeter may be used for testing. Be sure the ohmmeter meets the requirements as set forth in the paragraph on test equipment, above. To check a PNP transistor, connect the positive lead of the ohmmeter to the base and the negative lead to the emitter. (The red lead is not necessarily the positive lead on all ohmmeters.) Generally, a resistance reading of 50,000 ohms or more should be obtained. Connect the negative lead to the collector; again a reading of 50,000 ohms or more should be obtained. Reconnect the circuit with the negative lead of the ohmmeter to the base. With the positive lead connected to the emitter, a value of resistance in the order of 500 ohms or less should be obtained. Likewise, with the positive lead connected to the collector, a value of 500 ohms or less should be obtained. Similar tests made on an NPN transistor produce results as follows: With the negative ohmmeter lead connected to the base, the value of resistance between the base and the emitter and between the base and the collector should be high. With the positive lead of the ohmmeter connected to the base, the value of resistance between the base and the emitter and between the base and collector should be low. If the readings do not check out as indicated, the transistor probably is defective and should be replaced.

CAUTION

If a defective transistor is found, make sure that the circuit is in good operating order before inserting the replacement transistor. If a short circuit exists in the circuit, plugging in another transistor will most likely result in another burned out transistor. Do not depend upon fuses to protect transistors.

Make sure that the bias resistors in series with the various transistor elements are correct. The transistor is very sensitive to improper bias voltages; therefore, a short or open circuit in the bias resistors may damage the transistor. For this reason, do not troubleshoot by shorting various points in the circuit to ground and listening for clicks.

section 6

parts list

ITEM	DESCRIPTION	COLLINS PART NUMBER
AT101	ATTENUATOR, variable: ladder network, 3000 ohms input, 1500 ohm output, 2 db each step, 30 steps	378-0366-00
AT102	Same as AT101	378-0366-00
AT103	Same as AT101	378-0366-00
AT104	Same as AT101	378-0366-00
AT105	Same as AT101	378-0366-00
BT101	4.5 V portable	015-0519-00
BT102	22.5 V portable	015-0520-00
BT103	Same as BT102	015-0520-00
C101	CAPACITOR: aluminum electrolytic, 50 uf -15% +100%; 10 vdcw, aluminum case	183-1157-00
C102	CAPACITOR: aluminum electrolytic, 250 uf -15% +100%, 10 vdcw, aluminum	183-1207-00
C103	CAPACITOR: aluminum electrolytic, 50 uf -15% +100%, 12 vdcw, aluminum case	183-1159-00
C104	Same as C101	183-1157-00
C105	Same as C102	183-1207-00
C106	Same as C103	183-1159-00
C107	Same as C101	183-1157-00
C108	Same as C102	183-1207-00
C109	Same as C103	183-1159-00
C110	Same as C101	183-1157-00
C111	Same as C102	183-1207-00
C112	Same as C103	183-1159-00
C113	Same as C101	183-1157-00
C114	NOT USED	
C115	Same as C102	183-1207-00
C116	CAPACITOR: aluminum electrolytic, 50 uf -15% +100%, 25 vdcw, aluminum case	183-1158-00
C117	Same as C102	183-1207-00
C118	Same as C116	183-1158-00
C119	Same as C101	183-1157-00
C120	Same as C102	183-1207-00
C121	CAPACITOR: aluminum electrolytic, 115 uf -15% +100%, 25 vdcw aluminum case	183-1160-00
C122	Same as C121	183-1160-00
C123	CAPACITOR: aluminum electrolytic, 500 uf -15% +100%	183-1208-00
C124	Same as C123	183-1208-00
C125	CAPACITOR: paper, 0.47 uf, ±20%; 100 vdcw	931-2507-00
C126	Same as C125	931-2507-00
C127	Same as C123	183-1208-00
C128	CAPACITOR: fixed electrolytic 250 uf -15% +100%, 10 vdcw	183-1207-00
C129	CAPACITOR: Same as C116	183-1158-00
C130	CAPACITOR: paper .022 uf ±20%, 300 vdcw	931-4524-00
CR101	CRYSTAL UNIT, rectifying: germanium crystal, terminal mtd	353-0029-00
CR102	Same as CR101	353-0029-00
CR103	SEMICONDUCTOR DEVICE DIODE: germanium, type 1N48; peak inv. volts, 85 v, peak rect. current 150 ma; 0.225 in. dia by 2-3/4 in. lg approx overall	353-0027-00
E101	POST, BINDING: black phenolic cap, plain finish, with screw action, not knurled, removable cap	372-1061-00
E102	Same as E101	372-1061-00
E103	Same as E101	372-1061-00
E104	Same as E101	372-1061-00
E105	Same as E101	372-1061-00
E106	Same as E101	372-1061-00
E107	Same as E101	372-1061-00
E108	Same as E101	372-1061-00
E109	Same as E101	372-1061-00
E110	INSULATOR, standoff: brass terminal, molded melamine body	306-0234-00
E111	Same as E110	306-0234-00
E112	Same as E110	306-0234-00
E113	Same as E110	306-0234-00
E114	Same as E110	306-0234-00
E115	Same as E110	306-0234-00
E116	Same as E110	306-0234-00
E117	Same as E110	306-0234-00
E118	Same as E110	306-0234-00
E119	Same as E110	306-0234-00
E120	Same as E110	306-0234-00
E121	Same as E110	306-0234-00
E122	Same as E110	306-0234-00
F101	FUSE, cartridge: 1/16 amp, slow-blow glass body, ferrule terminal	264-4220-00
I101	LAMP: 2 V 0.06 amp; miniature bayonet base	262-0043-00
I102	LAMP: Same as I101	262-0043-00
I103	Light, pilot: Neon, 100,000 ohms limiting resistor built-in	262-0090-00
J101	CONNECTOR, receptacle: 3 contacts, plastic	370-2018-00
J102	Same as J101	370-2018-00
J103	Same as J101	370-2018-00
J104	Same as J101	370-2018-00
J105	JACK, telephone: for 2-conductor plug	358-1080-00
J106	Same as J105	358-1080-00
J107	CONNECTOR, receptacle: 2 rectangular male nonpolarized contacts, straight	368-3700-00
J108	Same as J105	358-1080-00
K101	RELAY, armature: contact arrangement 2C, contact rating 3 amp, 150 w a-c, noninductive	970-1822-00
L101	REACTOR, audio: 0.8 hv inductance, 75 ohms ±15%, d-c resistance 500 v rms test, steel case, terminal mtd	668-0196-00
L102	REACTOR: filter choke, 2.0 hy inductance, 35 ma d-c current, 80 to 105 ohm d-c resistance at 25°C, 500 v rms test, open frame	668-0197-00
L103	COIL, RADIO FREQUENCY: universal wound 3 ti, 72 t each section, #36 AWG wire, 220 uh, 100 ma	240-0198-00
M101	METER, audio: interior illumination, two 2.0 v 0.06 amp lamps in series, scale -20 to 0 thru +3, figures -20 thru 0 black, +1 thru +3 red	456-0017-00
P101	CONNECTOR, plug: 2 plugs accommodated, 2 contacts, male	372-1578-00
Q101	TRANSISTOR: germanium: 0.250 in. lg, 0.360 in. w; 2N422	352-0079-00
Q102	Same as Q101	352-0079-00
Q103	Same as Q101	352-0079-00
Q104	Same as Q101	352-0079-00
Q105	Same as Q101	352-0079-00
Q106	Same as Q101	352-0079-00
Q107	TRANSISTOR: germanium: 0.250 in. lg, 0.360 in. w; wire lead; 2N465	352-0080-00
Q108	TRANSISTOR: germanium: 0.282 in. lg, 0.440 in. w; wire lead; 2N44	352-0004-00
Q109	Same as Q108	352-0004-00
Q110	Same as Q101	352-0079-00
R101	RESISTOR: comp, 0.10 megohm ±10%; 1/2 w	745-1436-00
R102	RESISTOR: comp, 1000 ohms, ±10%; 1/2 w	745-1352-00
R103	RESISTOR: comp, 100 ohms, ±10%, 1/2 w	745-1310-00
R104	RESISTOR: film, 7500 ohms, ±1%; 1/2 w	705-2152-00
R105	RESISTOR: film, 3570 ohms, ±1%; 1/2 w	705-2144-00
R106	RESISTOR: film, 1100 ohms, ±1%; 1/2 w	705-2132-00
R107	Same as R101	745-1436-00
R108	Same as R102	745-1352-00
R109	Same as R103	745-1310-00
R110	Same as R104	705-2152-00
R111	Same as R105	705-2144-00
R112	Same as R106	705-2132-00
R113	Same as R101	745-1436-00
R114	Same as R102	745-1352-00
R115	Same as R103	745-1310-00

ITEM	DESCRIPTION	COLLINS PART NUMBER
R116	Same as R104	705-2152-00
R117	Same as R105	705-2144-00
R118	Same as R106	705-2132-00
R119	Same as R101	745-1436-00
R120	Same as R102	745-1352-00
R121	Same as R103	745-1310-00
R122	Same as R104	705-2152-00
R123	Same as R105	705-2144-00
R124	Same as R106	705-2132-00
R125	RESISTOR: comp, 10,000 ohms ±10%; 1/2 w	745-1394-00
R126	RESISTOR: comp, 47 ohms ±10%; 1/2 w	745-1296-00
R127	Same as R104	705-2152-00
R128	Same as R104	705-2152-00
R129	Same as R125	745-1394-00
R130	RESISTOR: comp, 33,000 ohms, ±10%; 1/2 w	745-1415-00
R131	Same as R126	745-1296-00
R132	Same as R104	705-2152-00
R133	Same as R125	745-1394-00
R134	RESISTOR: comp, 4700 ohms, ±10%; 1/2 w	745-1380-00
R135	RESISTOR: comp, 1000 ohms, ±5%; 1/2 w	745-1351-00
R136	RESISTOR: comp, 150 ohms, ±10%; 1/2 w	745-1317-00
R137	RESISTOR: comp, 47,000 ohms, ±10%; 1/2 w	745-1422-00
R138	RESISTOR: comp, 1.0 megohm, ±20%; 1/2 w	745-1279-00
R139	Same as R139	745-1422-00
R140	RESISTOR: comp, 120 ohms, ±10%; 1/2 w	745-1314-00
R141	Same as R134	745-1380-00
R142	RESISTOR: comp, 2200 ohms, ±10%; 1/2 w	745-1366-00
R143	Same as R142	745-1366-00
R144	RESISTOR: WW, 75 ohms, ±10%; 2 w	750-8166-00
R145	RESISTOR: comp, 0.13 megohm, ±5%; 1/2 w	745-1441-00
R146	RESISTOR: comp, 0.22 megohm, ±10%; 1/2 w	745-1450-00
R147	Same as R101	745-1436-00
R148	RESISTOR: comp, 0.18 megohm, ±10%; 1/2 w	745-1447-00
R149	RESISTOR: comp, 3600 ohms, ±5%; 1/2 w	745-1375-00
R150	NOT USED	
R151	NOT USED	
R152	RESISTOR: comp, 3900 ohms, ±5%; 1/2 w	745-1376-00
R153	RESISTOR: comp, 16,000 ohms, ±5%; 1/2 w	745-1403-00
R154	RESISTOR: comp, 430 ohms, ±5%; 1/2 w	745-1336-00
R155	RESISTOR: comp, 500 ohms, ±20%; 1 w	380-2031-00
R156	RESISTOR: comp, 560 ohms, ±10%; 1/2 w	745-1342-00
R157	Same as R156	745-1342-00
R158	Same as R126	745-1296-00
R159	Same as R126	745-1296-00
R160	RESISTOR: comp, 1800 ohms, ±10%; 1/2 w	745-1363-00
R161	Same as R126	745-1296-00
R162	Same as R126	745-1296-00
R163	RESISTOR: comp, 1200 ohms, ±5%; 1/2 w	745-1355-00
R164	RESISTOR, variable: comp, 2,500 ohms, ±20%; 2 w	380-0645-00
R165	RESISTOR: comp, 180 ohms, ±10% 1 w	745-3321-00
R166	RESISTOR: comp, 18,000 ohms, ±5%; 1/2 w	745-1404-00
R167	RESISTOR: comp, 8200 ohms, ±5%; 1/2 w	745-1390-00

ITEM	DESCRIPTION	COLLINS PART NUMBER
R168	RESISTOR: comp, 270 ohms, ±10%; 1/2 w	745-1328-00
R169	RESISTOR: comp, 330 ohms, ±10%; 1/2 w	745-1331-00
S101	SWITCH, ROTARY: 1 section, 2 position 3 circuit, 3 pole, phenolic	259-0737-00
S102	SWITCH, ROTARY: 3 section, 4 position 4 circuit, 7 pole, phenolic	259-0858-00
S103	SWITCH, TOGGLE: 3 pole, single throw	260-2274-00
S104	SWITCH, ROTARY: 2 section, 3 position 4 circuit, 4 pole, phenolic	259-0735-00
S105	SWITCH, INTERLOCK: spdt; 10 amp, 125 or 250 v a-c, phenolic and metal body; momentary action w/6-32 NC-2 tapped hole 5/16 in. deep in end of shaft	266-0013-00
S106	SWITCH, part of R144: spst, actuated to the ON position at the start of clockwise rotation	750-8166-00
T101	TRANSFORMER, AUDIO: input type; pri 5000 ohms, sec. 500 ohm over-all impedance, C T, 5 ma primary, 5 ma secondary, 500 rms test voltage	667-0194-00
T102	TRANSFORMER, AUDIO: output type, pri no. 1, 12,000 ohm over-all impedance CT, sec. no. 1, 300 ohms, sec. no. 2, 300 ohms, sec. no. 3, 500 ohms; 500 rms test voltage, pri 20 ma, sec. 0	667-0195-00
T103	TRANSFORMER, POWER: primary 115v each section or 230 v over-all, sec. no. 1, 65 V ±3%; CT, 0.065 amp, pri no. 2, 4 V ±3%, 0.060 amp, 1000 rms test voltage, pri 500 rms test voltage each	662-0193-00
TB101	OSCILLATOR, subassembly: consists of 10 resistors, 5 capacitors, 1 socket transistor, 1 reactor mtg on board	541-3231-003
TB102	AMPLIFIER, subassembly: consists of 7 capacitors, 15 resistors, 5 socket transistors mtd on a board	541-3234-003
TB103	PREAMPLIFIER, subassembly: consists of 12 capacitors, 16 resistors, 4 socket transistors mtd on a board	541-3237-003
W101	CABLE ASSY, POWER ELECTRICAL: 3 conductors, #18 AWG rubber insulation, 125 v a-c, 8 ft lg	426-54-26-00
W102	ADAPTER, POWER: 3 wire to 2 wire	386-0110-00
XF	HOLDER, fuse: extractor post type, for single 3AG cartridge fuse; black bakelite	265-1019-00
XQ101	SOCKET, tube: snap in, 3 contact transistor	220-1248-00
XQ102	Same as XQ101	220-1248-00
XQ103	Same as XQ101	220-1248-00
XQ104	Same as XQ101	220-1248-00
XQ105	Same as XQ101	220-1248-00
XQ106	Same as XQ101	220-1248-00
XQ107	Same as XQ101	220-1248-00
XQ108	Same as XQ101	220-1248-00
XQ109	Same as XQ101	220-1248-00
XQ110	Same as XQ101	220-1248-00

section 7
illustrations

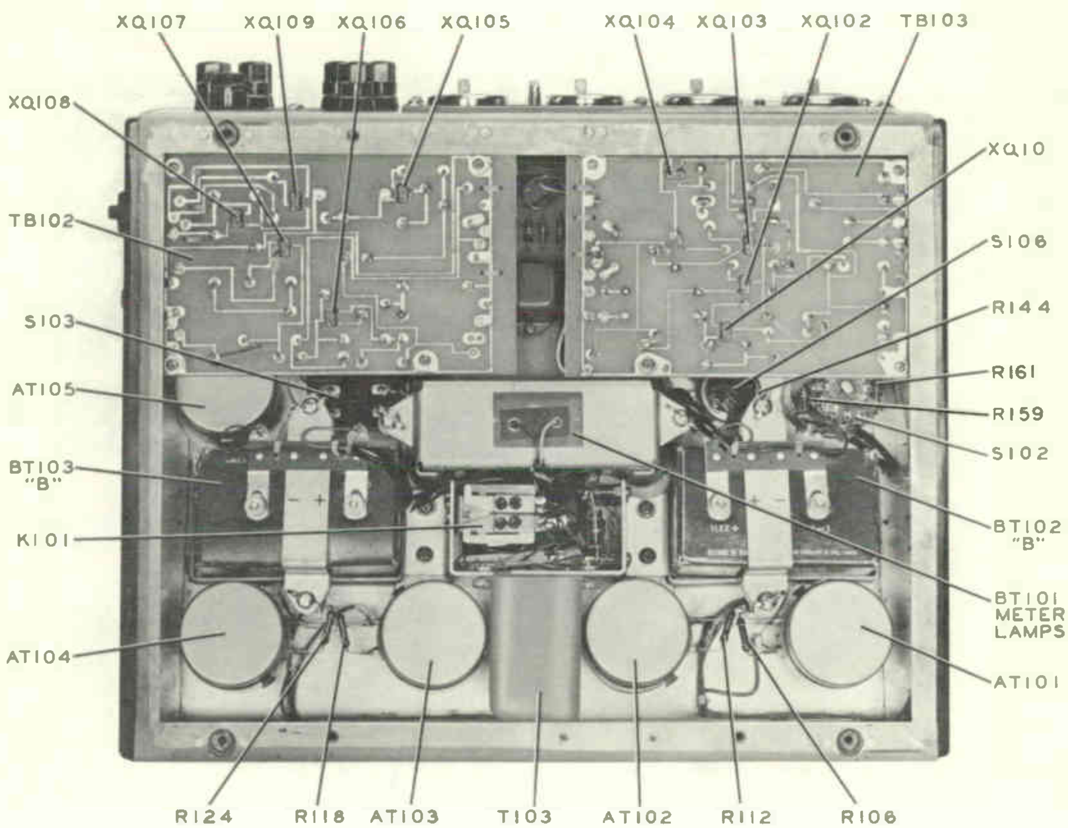


Figure 7-1. 212Z-1 Remote Amplifier, Bottom View

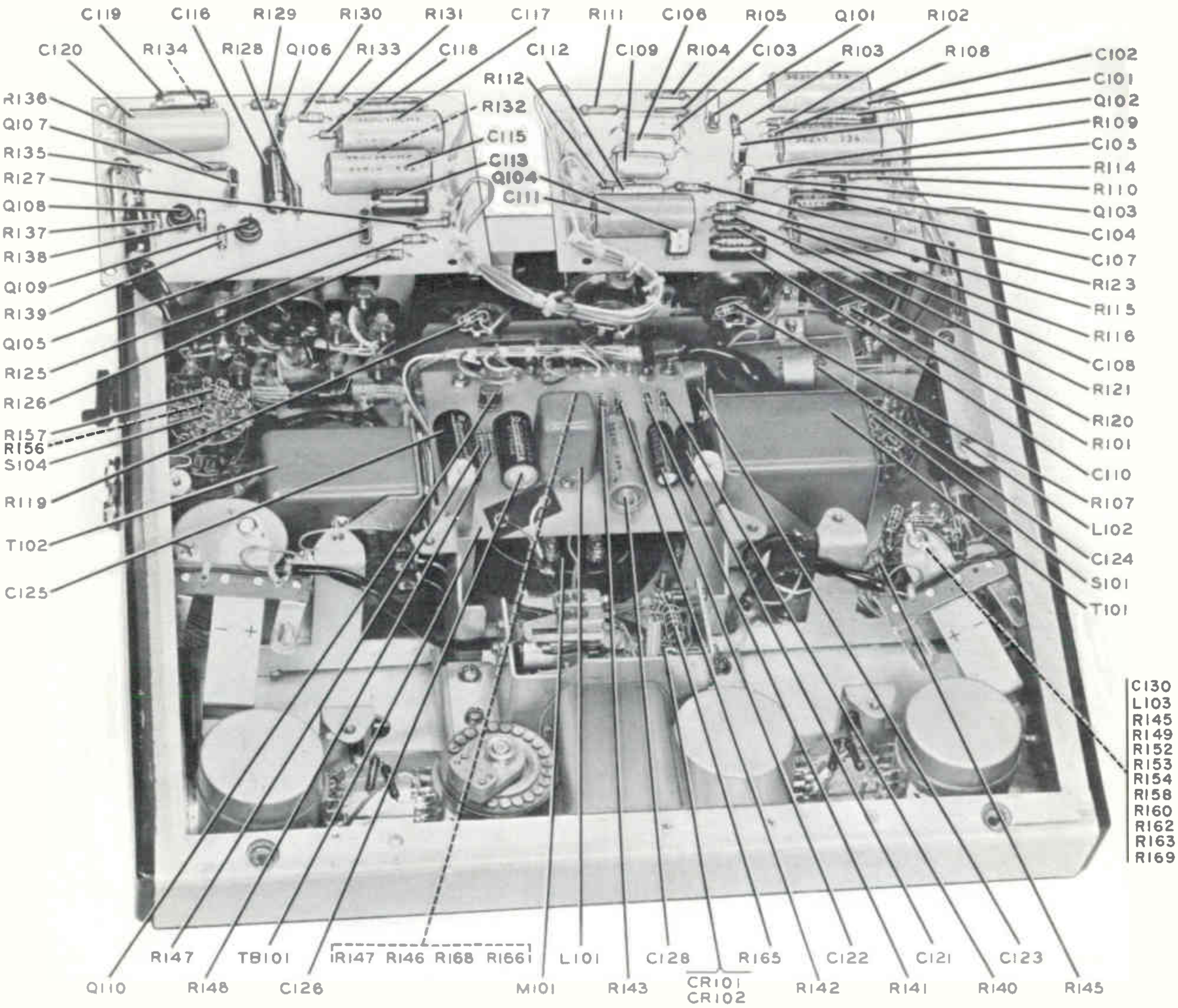


Figure 7-2. 212Z-1 Remote Amplifier, Bottom Open, Boards Removed

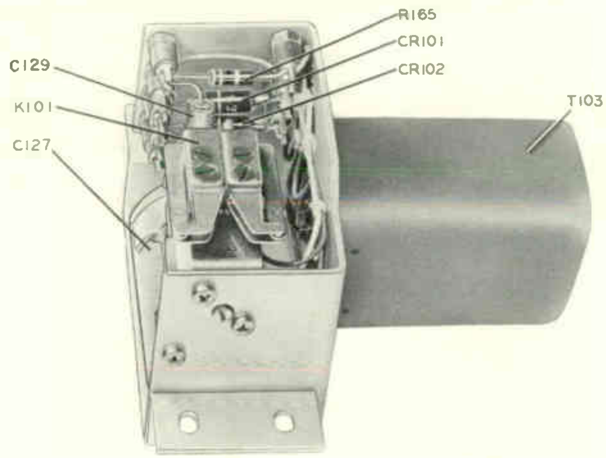


Figure 7-3. Power Supply, Top Open View

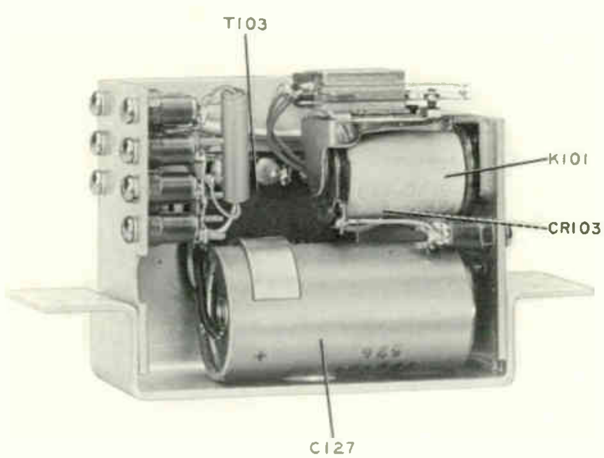


Figure 7-4. Power Supply, Side Open View

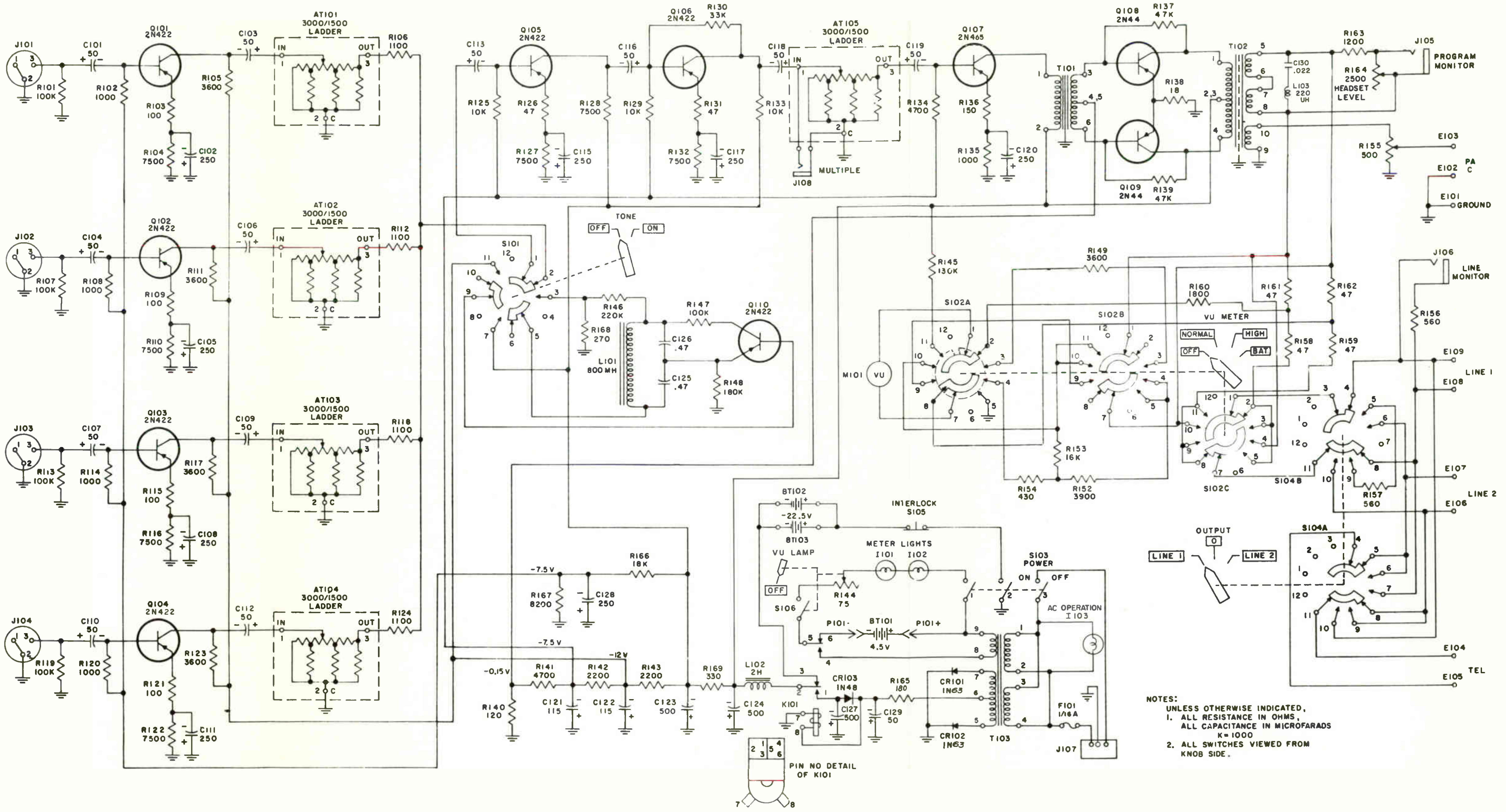


Figure 7-5. 212Z-1 Remote Amplifier, Complete Schematic

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