



instruction book

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

212F-2

Broadcast Console

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- (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:

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- (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)



instruction book

212F-2 Broadcast Console

This manual includes:

SP-180 Broadcast Console 212F-2 523-0755437

TD-323 Preamplifier 356A-1 520-5446000

TD-324 Program/Monitor Amplifier 356B-1 520-5447000

TD-325 Limiter Amplifier 356E-1 520-5448000

TD-326 Cue Amplifier 356Q-1 523-0034000

TD-327 Relay Unit 274K-2 523-0036000

TD-328 Power Supply 409X-2 523-0035000

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BROADCAST CONSOLE 212F-2

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1961

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UNIT INSTRUCTIONS

| TD No. | Title |
|--------|----------------------------------|
| 323 | Preamplifier 356A-1 |
| 324 | Program/Monitor Amplifier 356B-1 |
| 325 | Limiter Amplifier 356E-1 |
| 326 | Cue Amplifier 356Q-1 |
| 327 | Relay Unit 274K-2 |
| 328 | Power Supply 409X-2 |

SECTION I GENERAL DESCRIPTION

1.1 PURPOSE OF INSTRUCTION BOOK.

This instruction book is a guide for installing, adjusting, operating, and maintaining Broadcast Console 212F-2.

1.2 PURPOSE OF EQUIPMENT.

Broadcast Console 212F-2 furnishes facilities for simultaneously mixing six of 17 possible inputs for broadcasting or auditioning. The console may be used in high-fidelity AM, FM, or TV installations.

1.3 DESCRIPTION OF MAJOR COMPONENTS.

1.3.1 BROADCAST CONSOLE 212F-2.

Broadcast Console 212F-2, shown in figure 1-1, may be adapted to meet individual station requirements by inserting various plug-in modules in the console. The 212F-2 has provisions for seven preamplifiers, one program output amplifier or a limiter amplifier, one monitor output amplifier, one cue amplifier, one relay unit for controlling studio speakers and warning lights, and one internal power supply.

All controls on the front panel of the 212F-2 are clearly identified to ensure ease of operation. An illuminated vu meter is located on the front panel. The front panel and top of the console are hinged to allow access to all internal parts and plug-in

modules. The console may be serviced from the front allowing the cabinet to be placed almost flush against a wall or window. Slots in the bottom, back, and top of the console provide cooling by convection.

Modification kits are available for adding a cue speaker and volume control in the console and adapting the vu meter for gain-reduction use when a limiter amplifier is used as the program amplifier.

1.3.2 PREAMPLIFIER 356A-1.

Preamplifier 356A-1 is used for low-level amplification and as a booster amplifier. This plug-in module contains two amplifier stages that provide an over-all gain of 40 db. The amplifier input impedance may be wired for either 30, 150, 250, or 600 ohms. The output impedance may be either 150 or 600 ohms. Refer to paragraph 1.5.

1.3.3 PROGRAM/MONITOR AMPLIFIER 356B-1.

Program/Monitor Amplifier 356B-1 is used as an output amplifier for the program and monitor circuits. Its gain is either 56 or 68 db, depending on the position of a toggle switch on the amplifier chassis. The input and output impedances of this amplifier module may be wired for either 150 or 600 ohms. Refer to paragraph 1.5.

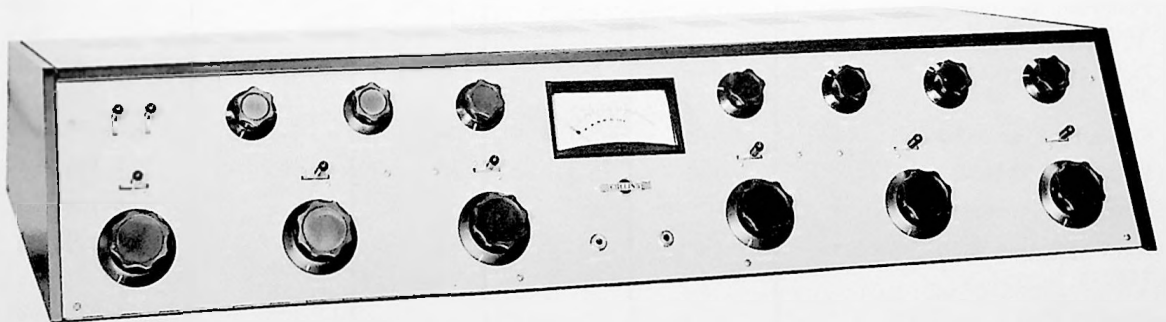


Figure 1-1. Broadcast Console 212F-2

1.3.4 LIMITER AMPLIFIER 356E-1.

Limiter Amplifier 356E-1 is a compression-type or peak-limiting amplifier. This plug-in module contains two amplifier stages, with an over-all gain of 54 db, and a bias rectifier. The compression ratio of the amplifier is adjustable from 1.6:1 to 5:1. A choice of either 11 milliseconds attack time and 0.9 second release time or 62 milliseconds attack time and 5.2 seconds release time for 63 percent recovery is provided. Refer to paragraph 1.5.

1.3.5 CUE AMPLIFIER 356Q-1.

Cue Amplifier 356Q-1 is a two-stage amplifier module with an over-all gain of 55 db. This amplifier is used to drive a speaker for cue operation. Refer to paragraph 1.5.

1.3.6 RELAY UNIT 274K-2.

Relay Unit 274K-2 controls the application of audio power to studio speakers and a-c power to studio warning lights. The four 12-volt relays in the module are mounted on rubber to minimize noise. Silicon diodes across the relay coils minimize arcing and radio interference. Refer to paragraph 1.5.

1.3.7 POWER SUPPLY 409X-2.

Power Supply 409X-2 is a plug-in power supply that furnishes power for filaments, plate circuits, and relays in Broadcast Console 212F-2. Silicon rectifiers are used in the high-voltage circuits to eliminate

the heat associated with vacuum-tube rectifiers and to ensure long life. The outputs of the 409X-2 are 250 to 300 volts d-c (adjustable) at 250 ma, 6.3 volts a-c at 6 amperes, and 12 volts at one ampere. Refer to paragraph 1.5.

1.3.8 JUMPER PLUG.

When mixing facilities are desired for a program source that has a self-contained preamplifier, a jumper plug may be inserted into the jack normally used for Preamplifier 356A-1.

1.3.9 AMPLIFIER TEST CABLE.

The amplifier test cable is a 35-inch long cable with a 12-pin plug on one end and a 12-pin jack on the other. This cable permits operation of an amplifier module while it is out of the console for testing or maintenance.

1.4 BASIC EQUIPMENT.

Equipment that is available for use with Broadcast Console 212F-2 is listed in table 1-1. The type and quantity of subassemblies supplied will depend on individual station requirements.

1.5 SUBASSEMBLY INSTRUCTION BOOKS.

Applicable subassembly instruction books are listed in table 1-2. These unit instructions are supplied following section VII of this system instructions.

TABLE 1-1. BROADCAST CONSOLE 212F-2, EQUIPMENT AVAILABLE

| ITEM | OVER-ALL DIMENSIONS (inches) | | | WEIGHT (lb) | COLLINS PART NUMBER |
|-------------------------------------|---------------------------------|---------|--------|----------------|------------------------|
| | H | W | D | | |
| Broadcast Console 212F-2 | 8-1/8 | 41-1/16 | 21-1/8 | 67 | 522-2608-00 |
| Preamplifier 356A-1 | 4-5/8 | 2-1/8 | 9-1/2 | 2-1/2 | 522-0389-005 |
| Program/Monitor Amplifier 356B-1 | 5-3/4 | 2-3/4 | 9-1/2 | 4-3/4 | 522-0390-005 |
| Limiter Amplifier 356E-1 | 5-5/16 | 3 | 9-1/2 | 4-3/4 | 522-0394-004 |
| Cue Amplifier 356Q-1 | 4-5/8 | 2-1/8 | 9-1/2 | 2-1/4 | 522-1607-00 |
| Relay Unit 274K-2 | 5-1/2 | 2-1/2 | 9 | 25 | 522-1606-00 |
| Power Supply 409X-2 | 6 | 8 | 9 | 25 | 522-1691-00 |
| Rack Mounting Shelf 499G-1 | 8-23/32 | 19 | 14 | 11 | 522-0774-00 |
| Jumper Plug | | | | 1/2 | 541-6459-002 |
| Amplifier Test Cable | | | | 1 | 541-6473-003 |
| Gain Reduction Modification Kit | | | | | 548-8232-00 |
| Cue Modification Kit | | | | | 548-8233-00 |

TABLE 1-2. SUBASSEMBLY INSTRUCTION BOOKS

| PUBLICATION | COLLINS PART NUMBER |
|----------------------------------|------------------------|
| Preamplifier 356A-1 | 520-5446-00 |
| Program/Monitor Amplifier 356B-1 | 520-5447-00 |
| Limiter Amplifier 356E-1 | 520-5448-00 |
| Cue Amplifier 356Q-1 | 523-0034-00 |
| Relay Unit 374K-2 | 523-0036-00 |
| Power Supply 409X-2 | 523-0035-00 |

1.6 EQUIPMENT SPECIFICATIONS.

1.6.1 PHYSICAL.

Size 41-1/16 inches wide, 21-1/8 inches deep at base,
8-1/8 inches high at front, 6-5/8 inches high at back.

Weight 67 pounds (basic cabinet less modules).

1.6.2 ELECTRICAL.

Maximum number of channels 5 low-level inputs, 1 remote network input, 1 pro-
gram channel, 1 monitor channel, and 1 cue channel
when provided with:

- 7 - Preamplifiers 356A-1
- 1 - Amplifier 356B-1 or Limiter
Amplifier 356E-1 (and gain reduction kit)
- 1 - Program/Monitor Amplifier 356B-1
- 1 - Relay Unit 274K-2
- 1 - Cue Amplifier 356Q-1 (and cue kit)
- 1 - Power Supply 409X-2

Input impedance Low level - 30/150/250/160 ohms, balanced or
unbalanced*.
Remote lines - 50/150/250/60 ohms*.

Output impedance Program line - 150/600 ohms*.
Monitor line - 60 ohms.

Gain Low-level input to program line at least 100 db.
Remote-line input to program line at least 53 db.

Output level. Program line - +18 dbm (50 mw).

Response. ±1.5 db, 50-15,00 cps at program line.

Distortion Less than 1 percent at +18 dbm program-line output;
less than 3 percent at +39 dbm monitor-amplifier
output.

Noise At least 68 db below +18 dbm program output with
-50 dbm low-level input. (Equivalent input noise
level -118 dbm or less.)

Power source. 115 or 230 volts a-c ±10 percent, 50/60 cps, single
phase*.

*Shipped wired for 150-ohm low-level inputs, 600-ohm remote line input and program line output, and 115-volt power source.

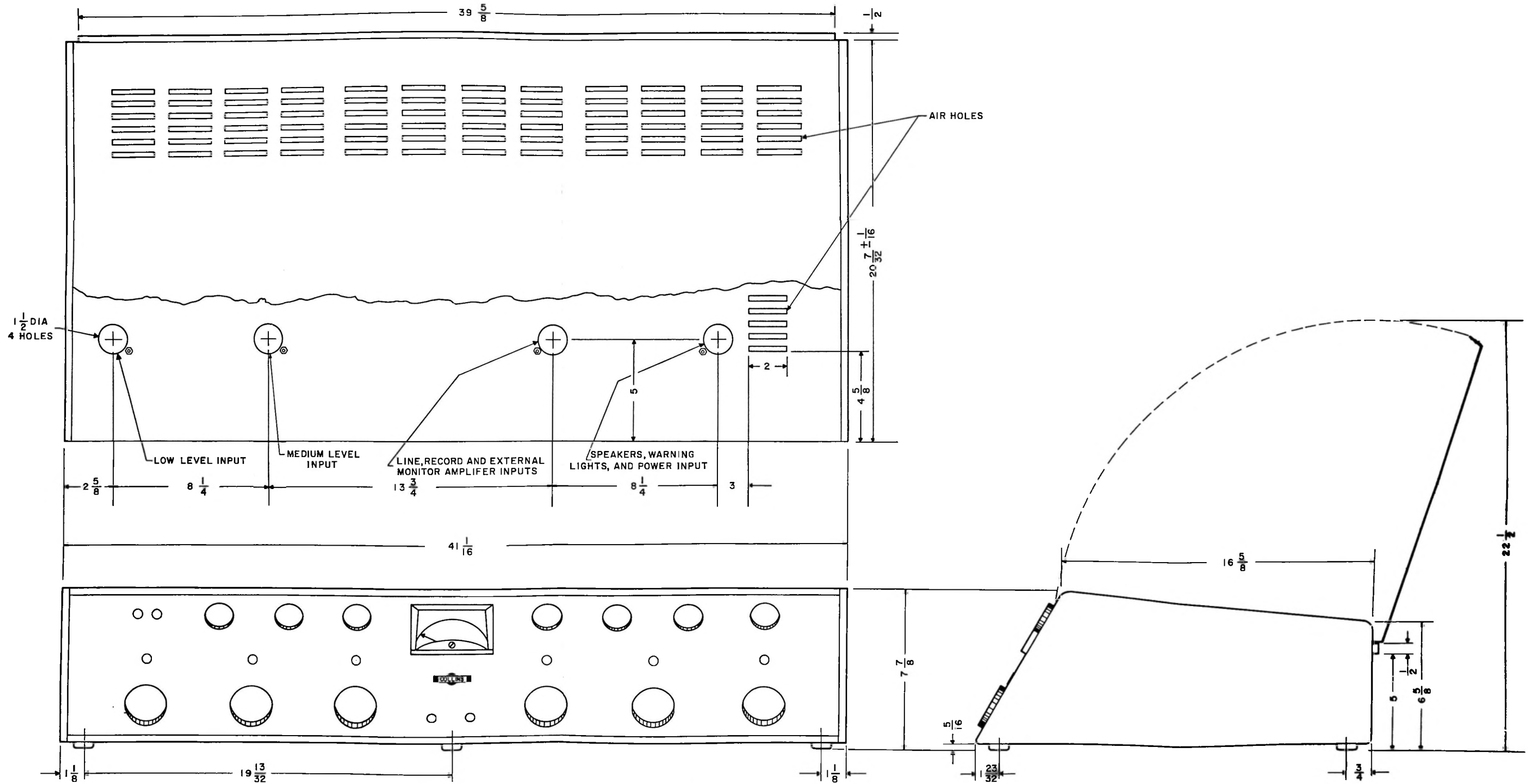


Figure 2-1. Broadcast Console 212F-2, Outline and Mounting Dimensions

SECTION II INSTALLATION

2.1 UNPACKING AND INSPECTING.

Remove all packing material, and carefully lift the units from the crates. Check the equipment against the packing slips. Visually inspect the units for any apparent damage and for missing components. Check for proper operation of controls. Promptly file any damage claims with the transportation agency. If such claims are to be filed, keep all packing material.

2.2 INSTALLATION PROCEDURE.

2.2.1 EQUIPMENT LOCATION.

The location of the console in an individual station will depend on the arrangement of studio and control room facilities. Carefully plan the placement of the console and wiring before starting any installation work. Keep low-level microphone leads separated from high-level audio leads. Keep all audio leads separated from power and control wiring.

Broadcast Console 212F-2 may be placed within 1/2 inch of a window, wall, or other vertical surface. Outline and mounting dimensions for the 212F-2 are given in figure 2-1.

2.2.2 EQUIPMENT MOUNTING PROCEDURE.

a. Lift the top panel and swing the front panel forward. Remove the three wing nuts that secure the terminal strip cover, and remove the cover. Note the four 1-1/2-inch-diameter holes that are in the console base plate for the entry of external wiring. These holes are located directly in front of the long terminal strip, TB1.

b. If the console is to be bolted down, drill additional holes in the console base plate as necessary. Leave the rubber feet on the bottom of the console in place for spacers.

c. After the 212F-2 is mounted, insert the plug-in units into the console in their proper jacks. Follow the steps in the following paragraph.

2.2.3 INSTALLATION OF PLUG-IN UNITS.

NOTE

To remove an amplifier module, lift its rear edge clear of the retaining rail, and push toward the rear of the cabinet to unplug.

a. Rewire the two 356A-1 Preamplifiers that are used as booster amplifiers (J7 and J10) as follows.

Move the lead that is connected to terminal 4 of transformer T201 in the 356A-1 to terminal 5 of T201. This reconnection changes the input impedance of the preamplifier from 150 ohms to 250 ohms.

b. Insert these two rewired amplifiers into jacks J7 and J10 in the 212F-2. Refer to figure 2-2 for the location of all jacks in the console.

c. Insert 356A-1 Preamplifiers or jumper plugs into J1 through J5. The number of preamplifiers or jumper plugs is determined by the number and types of inputs that are to be used. If a mixer input is used that does not require a preamplifier (such as a turntable or tape playback unit with self-contained preamplifiers), use a jumper plug in place of Preamplifier 356A-1. Figure 2-3 is a schematic diagram of the jumper plug.

d. Insert a Program/Monitor Amplifier 356B-1 into J8. Set the toggle switch on the top of the amplifier module to LOW. (Limiter Amplifier 356E-1 may be used in place of Program/Monitor Amplifier 356B-1 in this jack. Refer to paragraph 2.3.3.)

e. Insert a Program/Monitor Amplifier 356B-1 into J11. Set the toggle switch on the top of this amplifier module to HIGH.

f. Insert Relay Unit 274K-2 into J12. Plug the connector on the pendant cable from the relay unit into J13 on the console.

g. Mount Power Supply 409X-2 on the console base plate. Plug J14, the connector on the console pendant cable, into the jack on the top of the power supply.

h. If a Cue Amplifier 356Q-1 is to be used, plug this module into J9. Refer to paragraph 2.3.4. If a headset or external cueing amplifier is to be used, insert a jumper plug in J9.

2.2.4 INSTALLATION WIRING.

All connections to Broadcast Console 212F-2 are made to screw-type terminals on terminal board TB1. TB1 is the terminal strip located on the base plate of the console. Table 2-1 lists the line connections and their respective terminal numbers on TB1.

Keep all low-level audio input lines separate from the power and control wires. All wiring should be done with twisted shielded pairs, preferably insulated, with the shield grounded at only one end. Audio lines should be a #20 or #22 AWG twisted shielded pair. Studio warning light connections should be made with a #16 AWG twisted shielded pair. Filament leads should be #12 AWG twisted pair. The input line shields should be grounded at the four 1/4-inch ground studs and lugs next to the holes in the cabinet base that the input lines pass through.

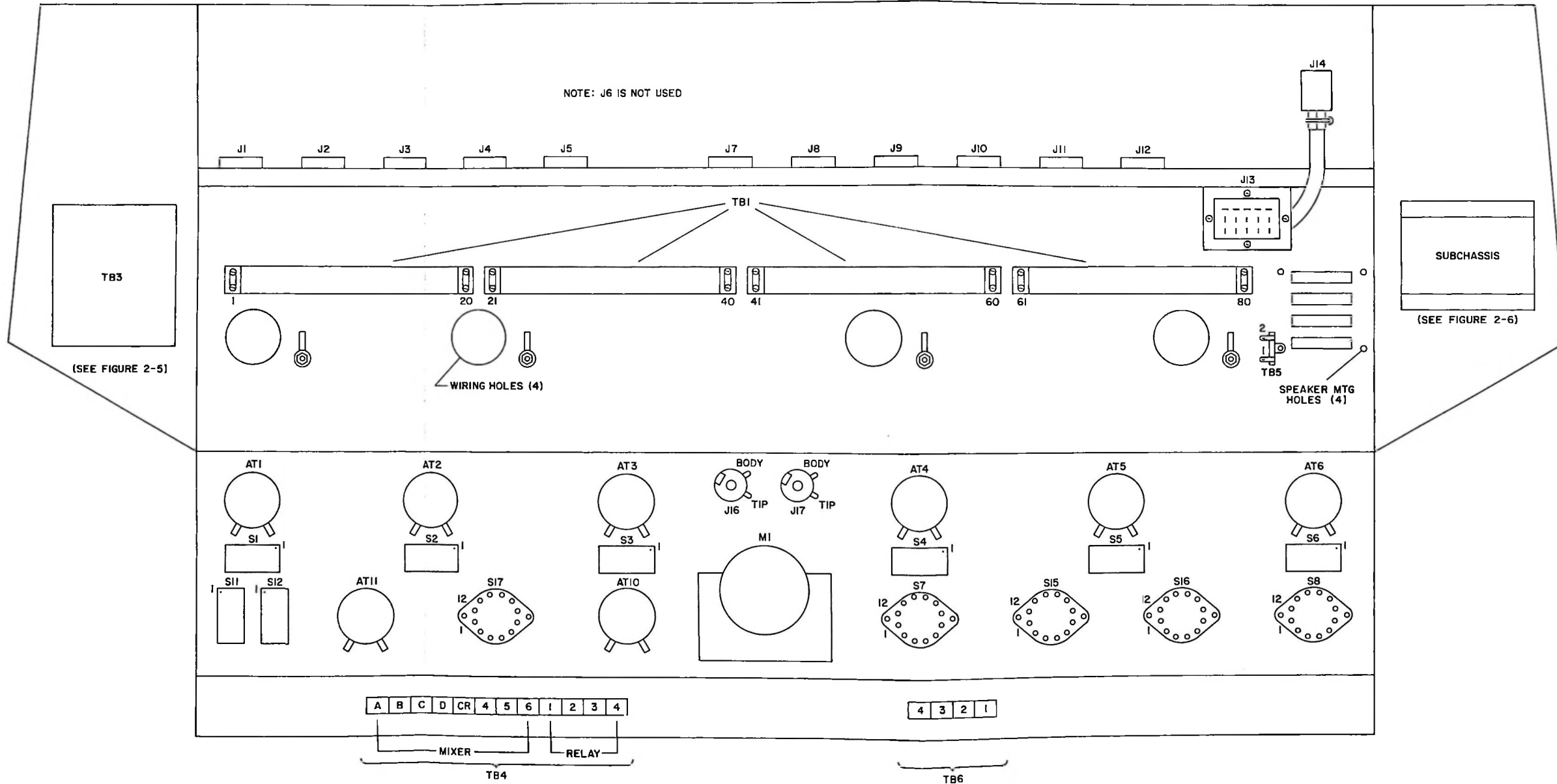


Figure 2-2. Component Location Guide

2.2.5 STUDIO MONITOR SPEAKER MUTING AND WARNING LIGHT CONTROL WIRING.

Control wiring for muting studio speakers and operating studio warning lights is done on terminal board TB4, located on the top left rear of the front panel.

Refer to figure 2-2 for the location of TB4. This figure also shows the designation of the mixer inputs and relays connected to the terminals of TB4.

Wiring consists of connecting insulated jumper wires between terminals on TB4 that are connected to the speaker muting, warning-light relays, and the mixer audition/program switches. If, for example, speaker 3 is to be muted and ON AIR warning light 3 is to operate when either microphone input A or C is used, terminals MIXER A and C on TB4 should be jumpered to terminal RELAY 3.

If cue speaker LS1 is installed in the console, it will be muted whenever the control room microphone is used. If this interlock feature is not desired, jumper contacts 14 and 20 on switch S3. A jack may be placed in the cue speaker line so that the speaker will be muted when headphones are plugged into the jack.

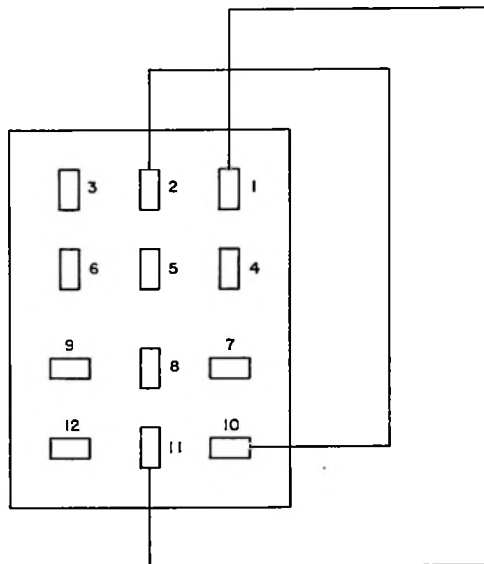


Figure 2-3. Jumper Plug, Schematic Diagram

TABLE 2-1. CONNECTIONS TO TERMINAL STRIP TB1

| TB1 TERMINALS | LINE | TB1 TERMINALS | LINE |
|---------------|-------------------------|---------------|--|
| 1 | Spare | 41 and 42 | Program line |
| 2 and 3 | Low-level input A | 43 and 44 | Record output |
| 4 and 5 | Low-level input B | 45 and 46 | External monitor input* |
| 6 and 7 | Low-level input C | 47 and 54 | Spare |
| 8 and 9 | Low-level input D | 55 and 56 | Speaker no. 1 |
| 10 and 11 | Control room mike input | 57 and 58 | Speaker no. 2** |
| 12 and 13 | Auxiliary input | 59 and 60 | Speaker no. 3 |
| 14 and 15 | Auxiliary input | 61 and 62 | Speaker no. 4 |
| 16 and 17 | Spare | 63 and 64 | Spares |
| 18 and 19 | Remote input 1 | 65 and 66 | ON AIR no. 1 |
| 20 | Ground | 65 and 67 | OFF AIR no. 1 |
| 21 and 22 | Remote input 2 | 68 and 69 | ON AIR no. 2 |
| 23 and 24 | Remote input 3 | 68 and 70 | OFF AIR no. 2 |
| 25 and 26 | Remote input 4 | 71 and 72 | ON AIR no. 3 |
| 27 and 28 | Remote input 5 | 71 and 73 | OFF AIR no. 3 |
| 29 and 30 | Remote input 6 | 74 and 75 | ON AIR no. 4 |
| 31 and 32 | Remote input 7 | 74 and 76 | OFF AIR no. 4 |
| 33 and 34 | Remote input 8 | 77 and 78 | 115/230 volts a-c for 409X-2 |
| 35 and 36 | Remote input 9 | | 115 volts a-c for studio ON AIR-OFF AIR lights. |
| 37 and 38 | Remote input 10 | 79 and 80 | |
| 39 and 40 | Spare | | |

NOTES

*Terminal 45 is common (ground).

**If speakers are not used, connect 600-ohm, 10-watt resistors across speaker terminals on terminal board.

2.2.6 ADJUSTMENT OF POWER SUPPLY 409X-2.

When all plug-in units are in place in the console, installation wiring has been completed and a-c input power is applied to the console, adjust screwdriver adjustment R401, on top of Power Supply 409X-2, until the voltage between test points J1- and J2+ on top of the power supply is 300 volts d-c. J1- is connected to B-, J2+ to the B+ output.

2.3 MODIFICATIONS.

2.3.1 AMPLIFIER INPUT AND OUTPUT IMPEDANCE SELECTION.

Preamplifier 356A-1 is shipped from the factory wired for an input impedance of 150 ohms. The input impedance of this preamplifier may be rewired for inputs of 30, 250, or 600 ohms. Refer to the unit instructions for Preamplifier 356A-1, TD-323, figure 4, for rewiring instructions.

The two 356A-1 Preamplifiers that are used as program and audition booster amplifiers should be rewired for a 250-ohm input as instructed in paragraph 2.2.3.a.

The unit instructions for the various amplifier modules used in Broadcast Console 212F-2 also give instructions for rewiring the modules for different output impedances.

2.3.2 VU METER CALIBRATION.

Refer to figure 2-4, a simplified schematic diagram of program-line and meter attenuator pads.

Broadcast Console 212F-2 is supplied with a 10-db meter pad. This will calibrate the vu meter so that

it will indicate a 0-vu peak when the program-line output is +8 vu. If a program-line level of other than +8 vu is used, the meter pad must be modified to recalibrate the vu meter.

Table 2-2 lists the value of meter pad resistors for various values of program-line levels in vu. If modifications are to be made, install the new resistors on terminal board TB3, located on the left inside end of the console cabinet. Refer to figure 2-5 for proper placement of resistors.

NOTE

Table 2-2 lists calculated values for pad resistors. The nearest standard resistance value may be substituted without seriously affecting pad attenuation.

CAUTION

The vu meter will indicate proper levels only when the signal on the program line is a complex wave, like speech or music. Such a complex wave has occasional high peaks, but the average (0 vu) level of the wave is usually about 10 db less than the peak level. When a sine-wave input is used for testing, the sine-wave magnitude is adjusted to the same level as the complex-wave peaks. Therefore, the vu meter would indicate +10 vu with such a sine-wave input. Since the meter scale goes only to +3 vu, the meter should be disabled during sine-wave tests by disconnecting one of the meter leads.

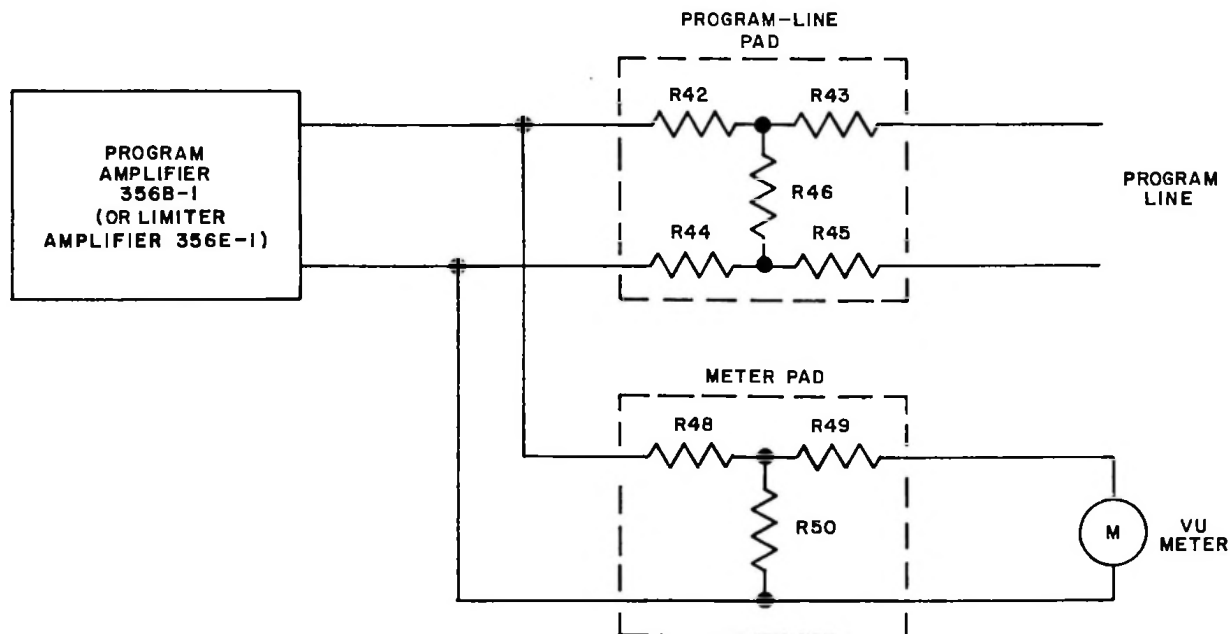


Figure 2-4. Program-Line and Meter Pad Identification

2.3.3 GAIN REDUCTION KIT.

2.3.3.1 PURPOSE. The gain reduction kit is composed of a meter switch, a meter-calibrating variable resistor, and associated mounting hardware. When Limiter Amplifier 356E-1 is used as the program output amplifier, this kit provides a means for monitoring the amplifier gain reduction on the front panel meter.

2.3.3.2 INSTALLATION.

a. Remove the small subchassis from the right inside end of the console cabinet by removing four hexhead screws.

b. Refer to figure 2-6. Unsolder the two blue wires from terminal board TB8, and remove TB8 from the subchassis.

c. Mount the 1K variable resistor, R47, in the hole just below the one where TB8 was formerly mounted. Use the 3/8-inch lock washer and 3/8-inch hexnut to mount R47.

d. Solder the two blue wires, unsoldered earlier from TB8, to the input terminal and tap terminal of R47.

e. Mount the switch supplied in the kit to the GR-VU switch bracket. Use two 4-40 x 1/4 screws, no. 4 lock washers, and 4-40 hexnuts.

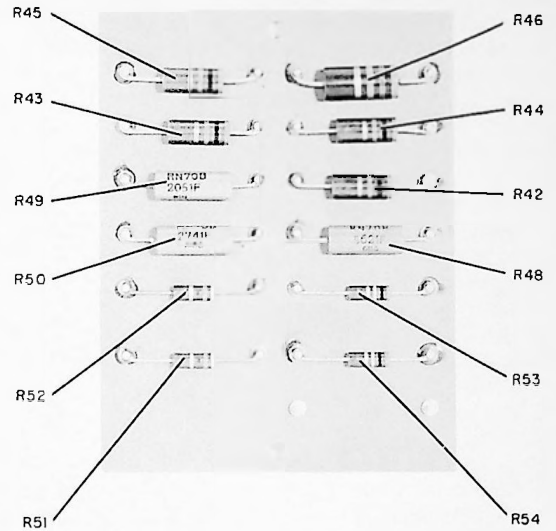


Figure 2-5. Terminal Board TB3

TABLE 2-2. METER PAD RESISTOR VALUES

| PROGRAM-LINE* LEVEL (vu) | METER PAD RESISTORS (ohms) | | |
|--------------------------------|-------------------------------|------|--------|
| | R48 | R49 | R50 |
| -2 | 3600 | 0 | Open |
| -1 | 3824 | 224 | 33,801 |
| 0 | 4047 | 447 | 16,788 |
| +1 | 4267 | 667 | 11,070 |
| +2 | 4483 | 883 | 8177 |
| +3 | 4693 | 1093 | 5221 |
| +4 | 4896 | 1296 | 5221 |
| +5 | 5092 | 1492 | 4352 |
| +6 | 5279 | 1679 | 3690 |
| +7 | 5457 | 1857 | 3166 |
| +8** | 5626 | 2026 | 2741 |
| +9 | 5785 | 2185 | 2388 |
| +10 | 5934 | 2334 | 2091 |
| +11 | 6073 | 2473 | 1838 |
| +12 | 6203 | 2603 | 1621 |

*Program-line level is correct only if program-line pad is 6 db.

**Broadcast Console 212F-2 shipped with resistors for this output level.

f. Unsolder all connections to terminal board TB6, located at the right inside of the front panel. Remove TB6 from the panel by removing one screw.

g. Mount the switch bracket, switch up, in the same place where TB6 was formerly mounted. Mount the solder lug supplied in the kit under the nut at the GR (left) end of the bracket. Use two 4-40 x 5/16 flat-head screws, no. 4 lock washers, and 4-40 hexnuts to mount the bracket and solder lug.

h. The following steps contain instructions for re-soldering the wires, unsoldered earlier from TB6, to the switch terminals. Switch terminal location is given as viewed from the front of the switch bracket.

i. Use an ohmmeter to determine which of the two black wires that were connected to TB6 goes to the vu meter. Solder this wire to the top center terminal.

j. Solder the other black wire to the top right terminal.

k. Solder the green wire to the bottom right terminal.

l. Solder the white wire to the bottom center terminal.

m. Solder the blue wire to the top left terminal.

n. Solder one end of a short insulated jumper wire to the bottom left terminal. Solder the other end of the jumper, and the two cable shields, to the solder lug.

This completes the installation of the gain reduction kit.

2.3.3.3 ADJUSTMENT. The following procedure will adjust Limiter Amplifier 356E-1 for a compression ratio of 3:1 with a threshold of -44 dbm. This means that all inputs to the amplifier below -44 dbm will be amplified uniformly with a gain of 54 db. When the inputs are above -44 dbm, the amplifier output will increase only 1 db when the input increases 3 db. If, for example, the amplifier input increases

from -44 dbm (threshold) to -14 dbm (30-db increase), the output increases from 10 dbm to 20 dbm (10-db increase). This is an amplifier gain reduction of 20 db. When the GR-VU switch is in the GR position, the front panel meter will indicate the amplifier gain reduction in db.

Refer to the unit instructions for Limiter Amplifier 356E-1, TD-325, for information about the operation of the amplifier module.

a. Plug Limiter Amplifier 356E-1 into J8.

b. Adjust Power Supply 409X-2 as instructed in paragraph 2.2.6.

c. Set the GR-VU switch to GR.

d. Note the setting of the MASTER attenuator. Then turn this control fully counterclockwise.

e. Adjust R47 for an indication of 0 db gain reduction on the gain reduction scale of the front panel meter.

f. Adjust the screwdriver adjustment on the top of Limiter Amplifier 356E-1, R612, for 23.5 volts between the two test jacks on the top of the 356E-1. The yellow jack is +; the black jack is -.

g. Allow a 30-minute warmup period; then repeat step f.

h. Return the MASTER attenuator to its original position.

i. Set the toggle switch on the top of Limiter Amplifier 356E-1 to AVERAGE.

The limiter amplifier and gain reduction meter scale are now ready to use.

2.3.4 CUE KIT.

2.3.4.1 PURPOSE. The cue kit is composed of a loudspeaker, a volume control for the speaker, and

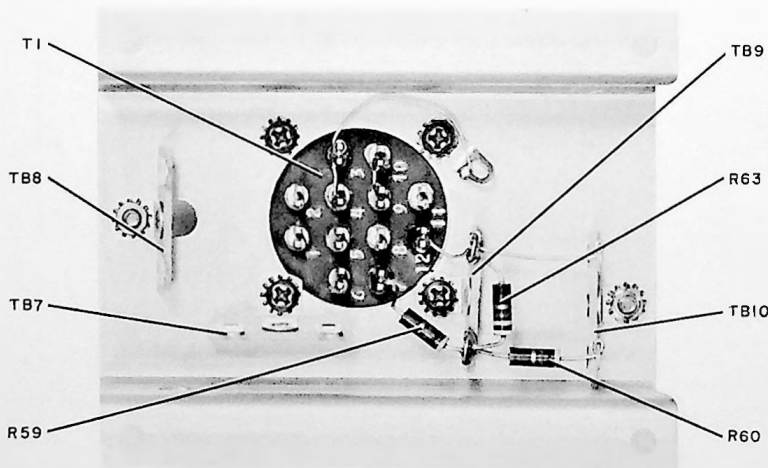


Figure 2-6. Broadcast Console 212F-2, Subchassis

associated mounting hardware. The cue speaker is connected to the cue amplifier output to provide a means of monitoring the cue outputs of MIXER 4 and MIXER 5.

2.3.4.2 INSTALLATION.

a. Remove the small subchassis from the right inside end of the console cabinet by removing four hexhead screws.

b. Refer to figure 2-6. Unsolder the blue and orange wires from terminal board TB7, and remove TB7 from the subchassis.

c. Mount the 50K potentiometer, R58, in the hole on the side of the subchassis. Use the 1/4-inch lock washer and 1/4-inch nut to mount R58.

d. Solder the orange wire, unsoldered earlier from TB7, to the input terminal of R58.

e. Solder the blue wire to the tap terminal of R58.

f. Connect an insulated jumper wire from the common terminal of R58 to the grounded solder lug next to terminal board TB9.

g. Remove the screw, mounting terminal board TB5, that is in one of the four speaker mounting holes. Mount the speaker, LS1, above the speaker opening in the base plate at the right end of terminal board TB1. Replace the screw removed earlier, and TB5, when the speaker is installed. Use the three 6 x 1/4 self-taping screws, supplied in the kit, in the other three holes.

h. Unsolder the blue wire from terminal 1 of TB5. Resolder this wire to one of the terminals of speaker LS1.

i. Connect an insulated jumper wire from the other speaker terminal to terminal 2 of TB5.

This completes the installation of the cue kit.

2.3.4.3 ADJUSTMENT. Adjust potentiometer R58 for the desired cue-speaker volume.

SECTION III OPERATION

3.1 CONTROL FUNCTIONS.

3.1.1 MIXERS AND ASSOCIATED CONTROLS.

Refer to figure 3-1. The six meter controls are located near the lower edge of the front panel of Broadcast Console 212F-2. They are identified as MIXER 1 through MIXER 6. These mixer controls are variable attenuators that adjust the level of the preamplifier outputs and remote/network inputs. The mixer outputs are connected to either the program bus or audition bus. The particular connection is determined by the position of the audition/program switch located directly above each mixer. When this three-position lever switch is in the left (A) position, the mixer output is connected to the audition bus; when it is in the right (P) position, the output is connected to the program bus. When the switch is in its center position, the mixer output is disconnected from both buses.

The function of each mixer is as follows:

a. MIXER 1 and MIXER 2 each control the input from one of two microphones. The particular microphone input to either of these mixers is selected by two microphone selector switches. These two lever

switches are located at the upper left corner of the front panel. The left switch, identified as MIXER 1, selects one of two microphone inputs for MIXER 1. The right switch performs the same function for MIXER 2. If these three-position switches are in the center position, neither microphone input is connected to the mixer.

b. MIXER 3 controls the input of a control room microphone.

c. MIXER 4 and MIXER 5 control separate auxiliary inputs. These two mixers have cue positions. When the mixer controls are turned fully counterclockwise, the mixer input is connected to a cue amplifier and speaker. These mixers may be used for inputs where cueing is desired, such as turntables or tape playback units. A modification kit is available for installing a cue speaker and volume control in the console cabinet.

d. MIXER 6 controls one of 10 remote line or network inputs. The desired remote input is connected to this mixer through the two remote LINE selector switches. These two switches are the first and fourth switches in the group of four switches located at the upper right of the front panel. The two middle switches in this group, the remote function selector switches, identified as LINE 1-5 and LINE 6-10, connect the selected remote line to either (1) the input of MIXER 6, (2) the monitor

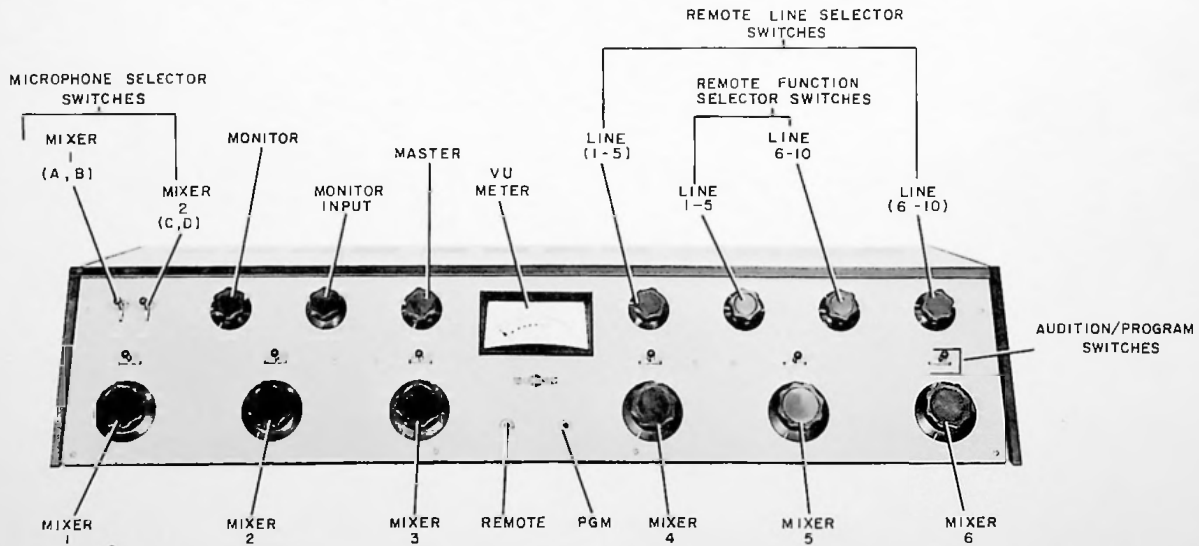


Figure 3-1. Control Locations

output for remote cuing, or (3) the REMOTE phone jack, located under the vu meter, for remote monitoring.

3.1.2 MONITOR CONTROLS.

The MONITOR INPUT control at the upper left of the front panel connects one of three inputs to the monitor amplifier and speakers. In the AUD position, the amplifier input is connected to the audition bus. In the PGM position, it is connected to the program output. In the EXT position, it is connected to an external input that is to be monitored.

The MONITOR level control, at the left of the MONITOR INPUT control, controls the volume of the monitor output.

3.1.3 PROGRAM CONTROLS.

The MASTER level control, at the right of the MONITOR INPUT control, controls the over-all level of the program-line output. The program output may be monitored at the PGM phone jack under the vu meter.

3.1.4 VU METER.

The vu (volume unit) meter in the top center of the front panel visually indicates the level of the program-line output. The output level should be adjusted with the mixer controls and MASTER level control so that the vu meter indicates 0 vu during peaks in the output signal.

3.2 OPERATING PROCEDURES.

3.2.1 LOCAL PROGRAM ON THE AIR.

To put a local program on the air, perform the following procedure:

- a. Select the desired microphone input, if one is used, with the microphone selector switches.
- b. Set the MONITOR INPUT control to PGM.
- c. Set the MASTER level control to 24.
- d. Set appropriate audition/program switches to P.
- e. Turn up corresponding mixer controls for desired level as indicated by the vu meter.
- f. Adjust the MONITOR level control for desired monitor output level.

3.2.2 AUDITION.

To audition program material, perform the following procedure:

- a. Select the microphone input that is to be auditioned, if applicable, with the microphone selector switches.
- b. Set MONITOR INPUT control to AUD.
- c. Set appropriate audition/program switches to A.
- d. Turn up corresponding mixer controls for desired listening level.
- e. Adjust MONITOR level control for desired output level.

3.2.3 REMOTE PROGRAM ON THE AIR.

To place one of the remote line inputs on the air, perform the following procedure:

- a. Set MONITOR INPUT control to PGM.
- b. Set MASTER level control to 24.
- c. Select desired remote line input with the remote line selector switches.
- d. Set the appropriate remote line function selector switch to MIX.
- e. Set MIXER 6 audition/program switch to P.
- f. Turn up MIXER 6 control to proper level as indicated by the vu meter.
- g. Adjust the MONITOR level control for desired volume.

3.2.4 REMOTE CUING.

To send a program-line cue to the remote operator and then switch the remote program to the program line, perform the steps in paragraph 3.2.3 with the following exception. Instead of setting the appropriate remote line function selector switch to MIX as in step d of paragraph 3.2.3, set it to CUE. Then when the cue is sent, turn this switch to MIX. This will put the remote line on the air.

3.2.5 REMOTE TALK-BACK.

If the control room operator wants to talk to the remote operator while a local program is on the air, perform the following procedure:

- a. Set MONITOR INPUT control to AUD.
- b. Set MIXER 3 audition/program switch to A.
- c. Select the desired remote line input with the remote line selector switches.
- d. Set MIXER 6 audition/program switch to A.
- e. To talk to the remote operator from the control room, set the appropriate remote line function selector switch to CUE.
- f. To listen to the remote operator on the control room speaker, set the remote line function selector switch to MIX. To listen on headphones, plug the phones into the REMOTE phone jack, which is located under the vu meter, and set the remote function selector switch to MON.

3.2.6 RECORD OPERATION.

To record a program from a remote or network line while a local program is on the air, perform the following steps:

- a. Connect a tape recorder input to terminals 43 and 44 of TB1.

NOTE

Disconnect the recorder from these terminals when the recorder is not being used.

- b. Select the desired microphone or remote line input with the proper selector switches.
- c. Set appropriate audition/program switches to A.
- d. Turn up the corresponding mixer controls for proper recorder input level.

SECTION IV PRINCIPLES OF OPERATION

4.1 GENERAL.

Refer to figure 4-1, a functional diagram of Broadcast Console 212F-2. The following paragraphs contain descriptions of various circuits in the console.

4.2 CONSOLE INPUTS.

There are connections for 17 inputs to the 212F-2: seven low-level inputs, and 10 remote line or network inputs.

Five of the low-level microphone inputs are fed to three 356A-1 Preamplifiers that are wired for 150-ohm inputs. The input impedances of these input preamplifiers may be changed by making connections as directed in the Unit Instructions for Preamplifier 356A-1, TD-323.

Two of the low-level inputs are auxiliary inputs that may or may not require 356A-1 Preamplifiers. If an input source is used that contains a preamplifier, such as a turntable or a tape playback unit, a jumper plug should be inserted in the console in place of the preamplifier.

The 10 remote line or network inputs require no preamplifier. The preamplifier and line outputs are fed to the console mixers.

4.3 MIXER CIRCUITS.

Refer to figure 4-2, a simplified schematic diagram of mixer circuits in Broadcast Console 212F-2. The 212F-2 contains six mixers that can simultaneously control six of the 17 inputs. Each mixer is a variable attenuator with a minimum attenuation of 12-1/2 db.

Three of the six mixers control low-level microphone inputs. The inputs of two of these three mixers are connected to lever switches that select one of two microphone inputs. The input of the third mixer is from a control room microphone.

Two mixers control low-level auxiliary inputs. These mixers have cue positions; when the mixer control is turned full counterclockwise, the mixer output is connected to a cue amplifier and speaker. These two mixers are useful for inputs from turntables or tape playback units, where cuing is desirable. A modification kit is available for installing a cue speaker and associated level control in the console cabinet.

One mixer controls a remote line or network input. Any one of 10 remote line inputs may be selected with

rotary switches. The output of these rotary switches are connected to other rotary switches that connect the selected remote line either (1) through a 10-db pad to the mixer, (2) through a 20-db pad to a phone jack for remote monitoring, or (3) to a monitor amplifier output for remote cuing.

The output of each of the six mixers is connected to a three-position lever switch that can (1) connect the mixer output to the program bus, (2) connect the mixer output to the audition bus, or (3) disconnect the mixer output from both buses.

4.4 PROGRAM CIRCUITS.

Refer to figure 4-3, a simplified schematic diagram of program circuits in Broadcast Console 212F-2.

The program bus is connected to the input of a 356A-1 booster amplifier which has a gain of 40 db. The amplifier output is fed through the MASTER attenuator to the 356B-1 program amplifier which has a gain of 56 db. The program amplifier has four parallel outputs: (1) through a 6-db pad to the program line, (2) through a 10-db pad to vu meter M1, (3) through a 30-db pad to PGM phone jack J17, and (4) through a 24-db pad to MONITOR INPUT switch S17.

4.5 MONITOR CIRCUITS.

Refer to figure 4-4, a simplified schematic diagram of monitor circuits in Broadcast Console 212F-2.

The audition bus is connected to the input of a 356A-1 booster amplifier which has a gain of 40 db. The amplifier output is fed to (1) the record output and (2) the MONITOR INPUT switch, S17. This switch connects either an external input, the program-line output, or the audition booster amplifier output to the 356B-1 monitor amplifier which has a gain of 68 db. The monitor amplifier output is fed through the relays in Relay Unit 274K-2 to the four studio monitor speakers or through a 30-db pad to a remote line for remote cuing.

4.6 STUDIO MONITOR SPEAKER AND WARNING-LIGHT CONTROL CIRCUITS.

Refer to figure 4-5, a simplified schematic diagram of the studio monitor speaker and warning-light control circuits.

Four terminals of the six audition/program switches are connected to 12 volts d-c from Power Supply 409X-2. When these switches are in either the A or P positions, this 12-volt d-c is connected to a terminal on terminal board TB4. Any of these terminals may be connected to any of the relays in Relay Unit 274K-2 to mute studio speakers and operate ON AIR-OFF AIR warning lights.

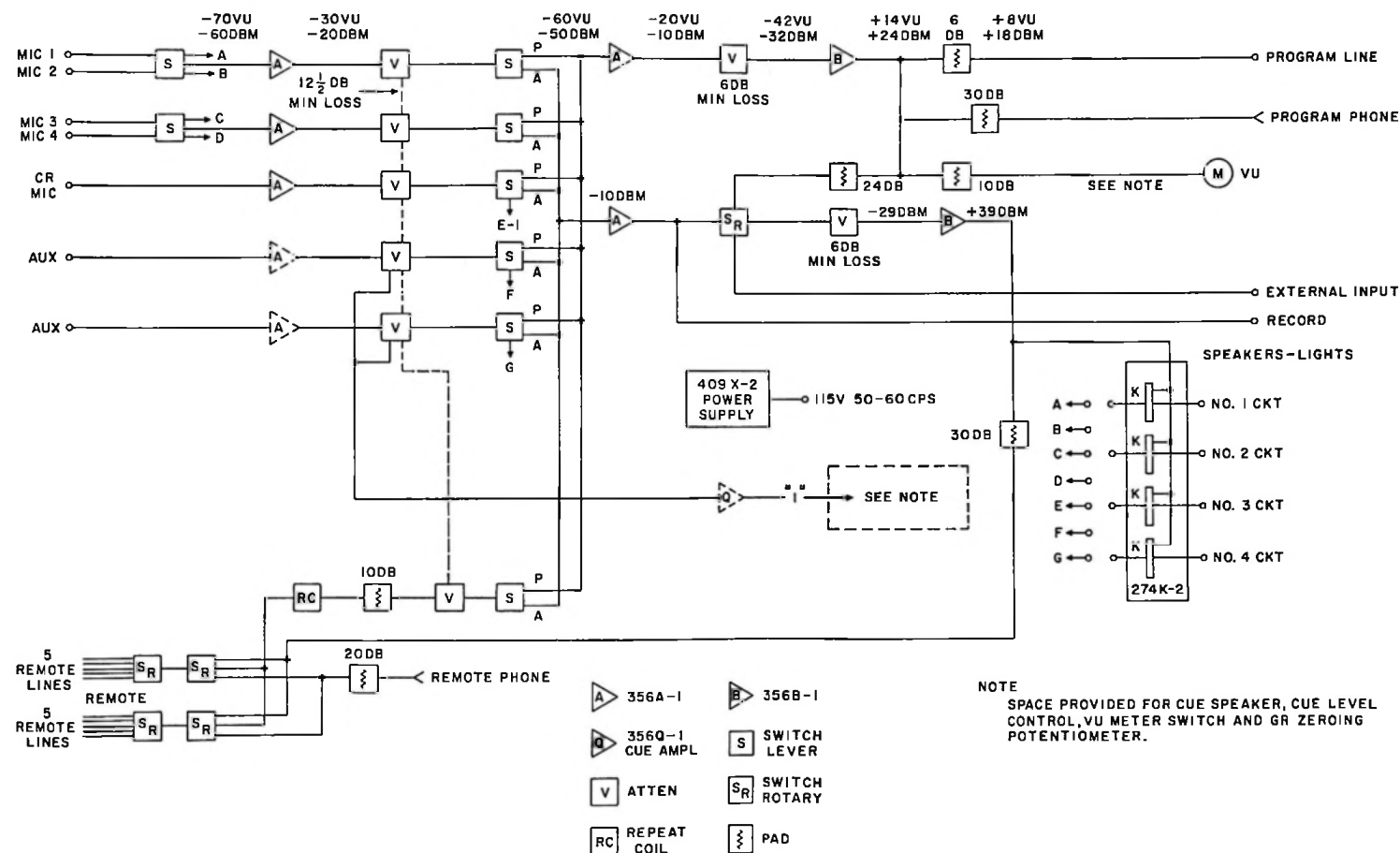


Figure 4-1. Broadcast Console 212F-2, Functional Diagram

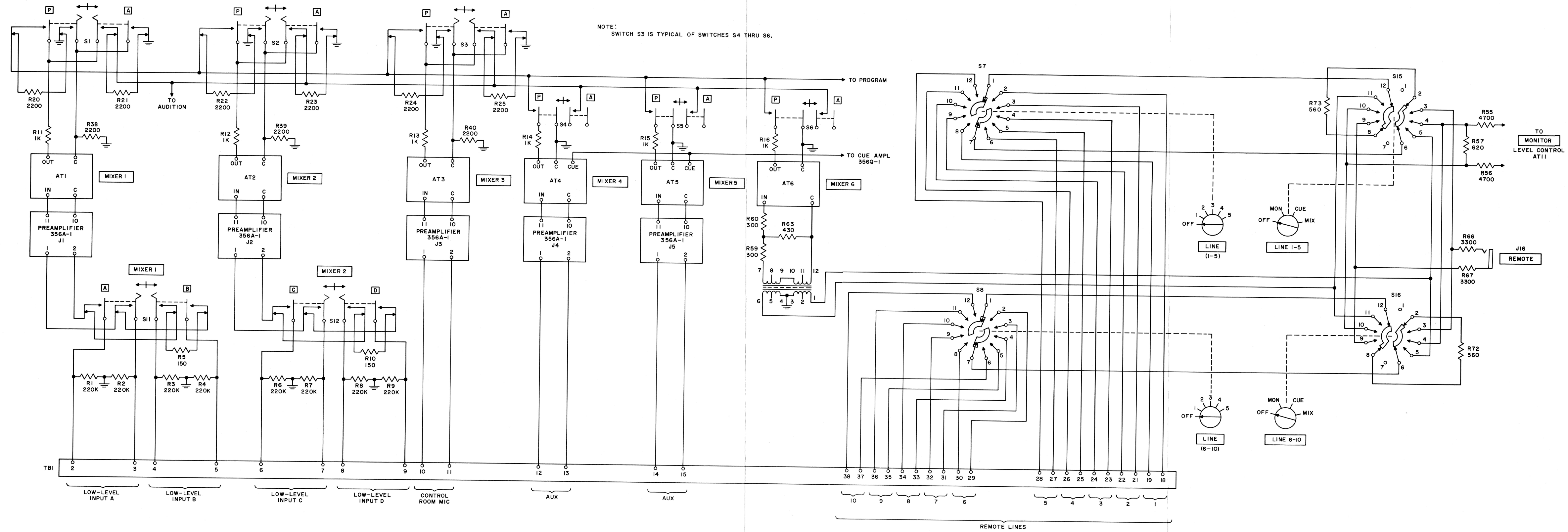


Figure 4-2. Mixer Circuits, Simplified Schematic Diagram

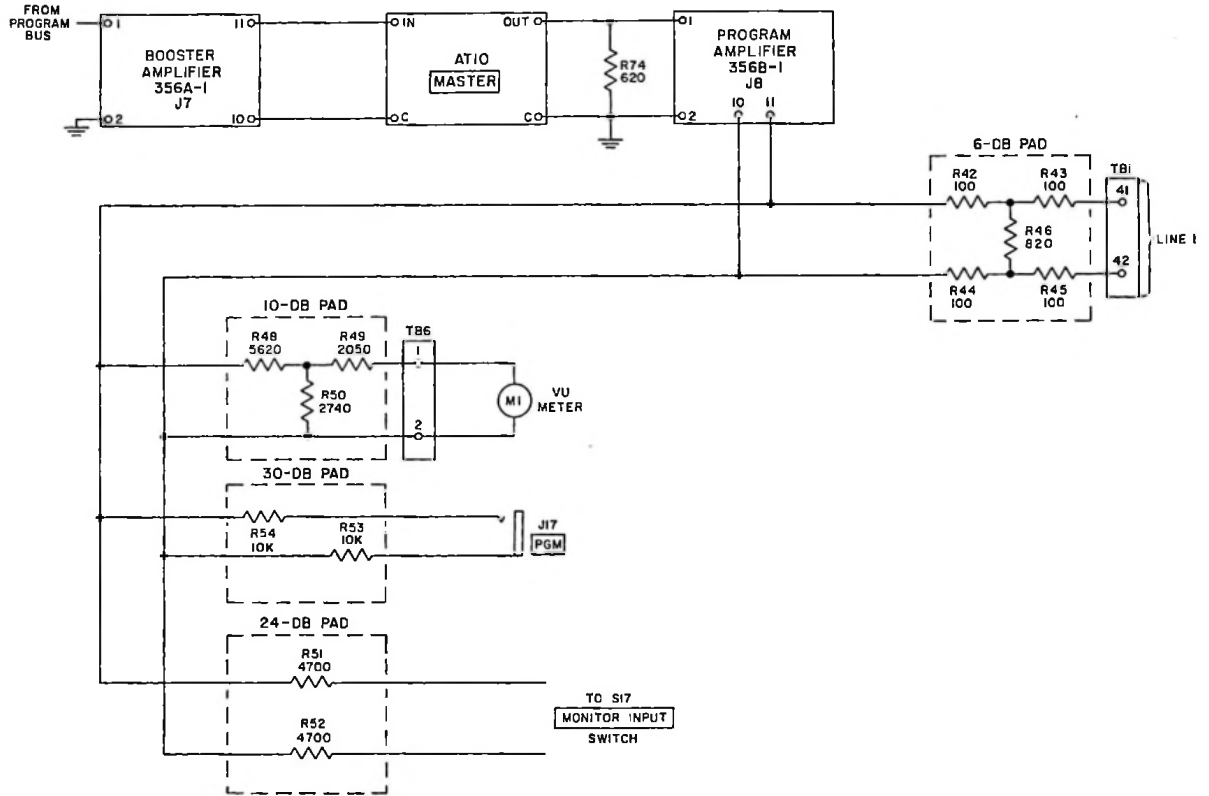


Figure 4-3. Program Circuits, Simplified Schematic Diagram

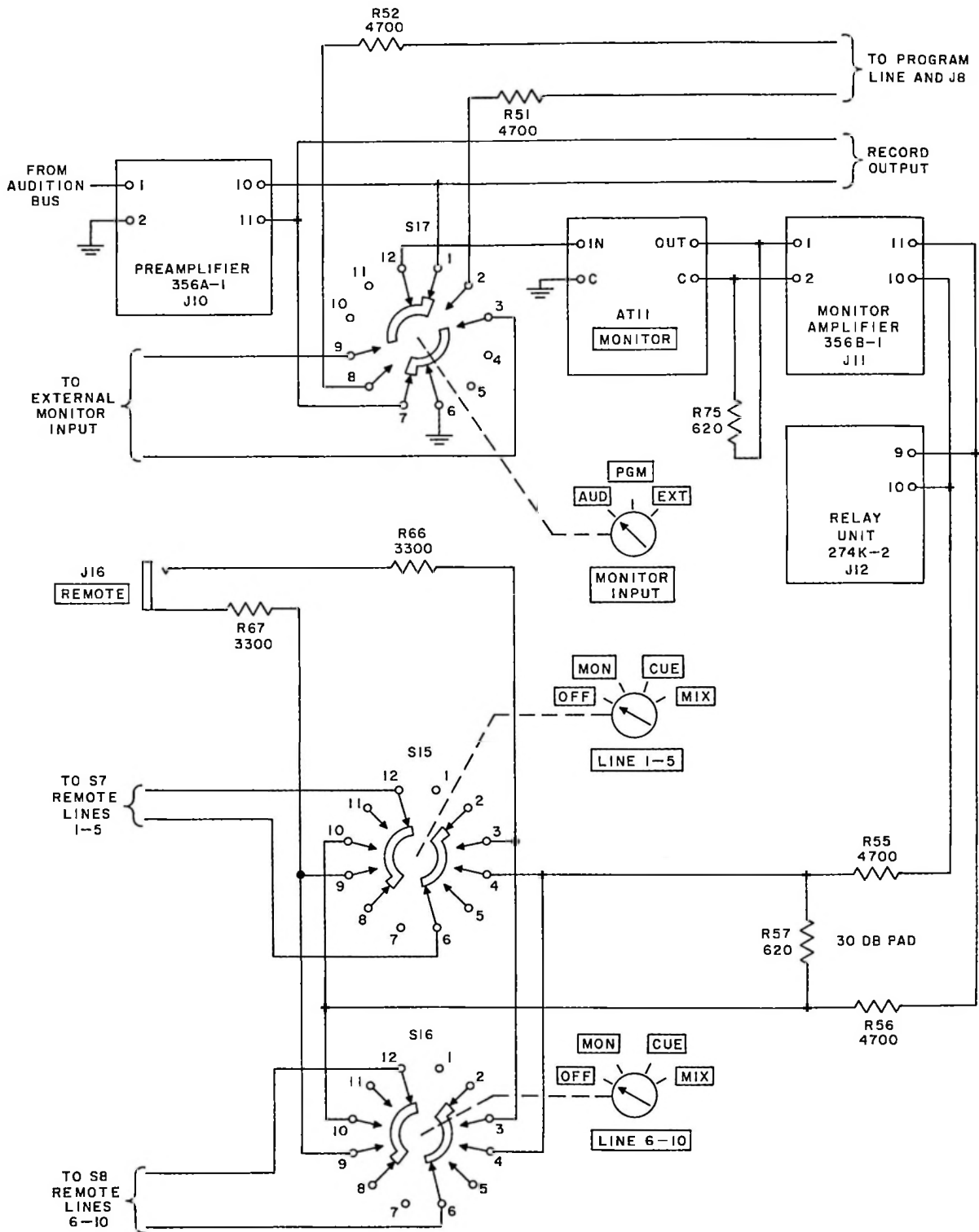
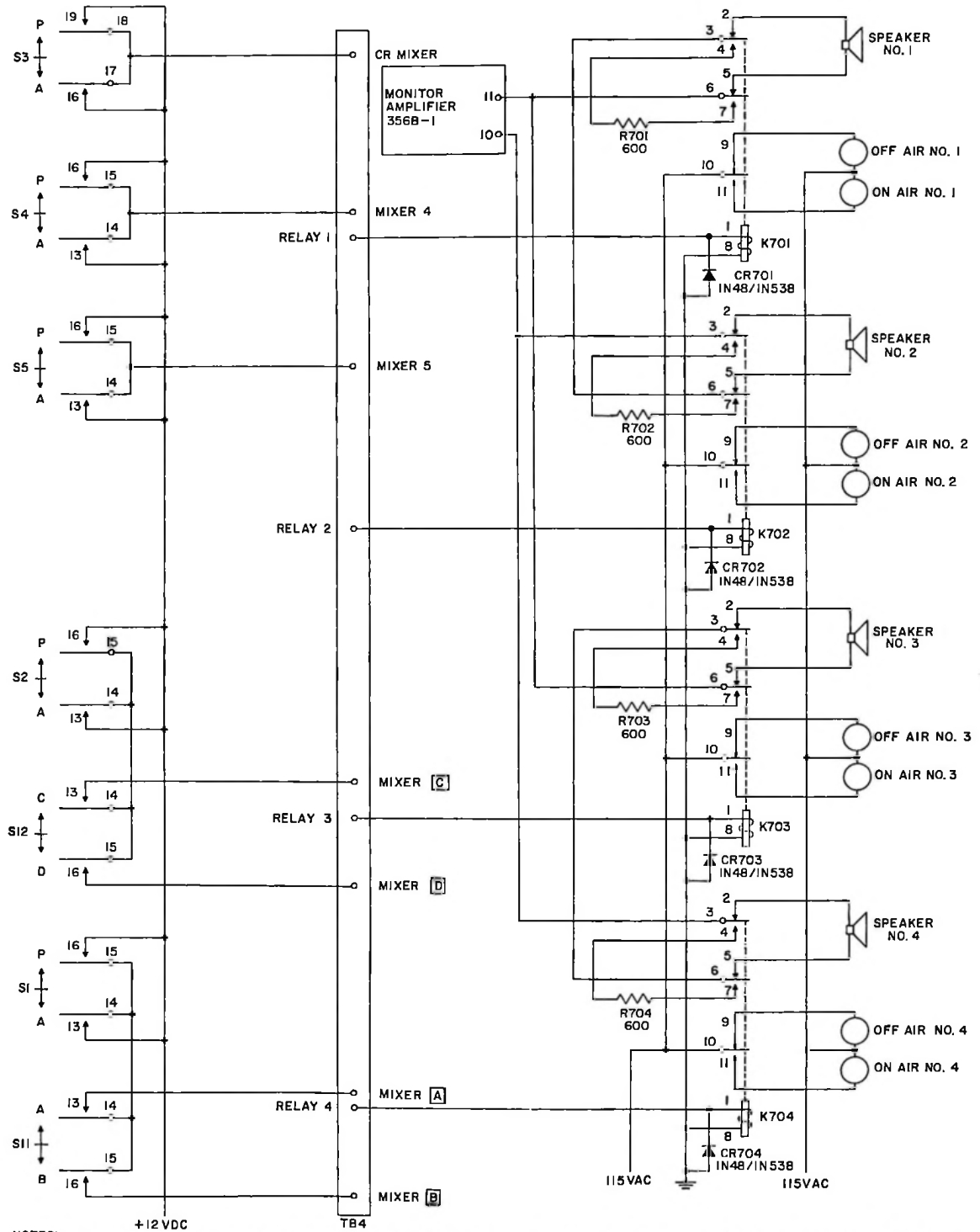


Figure 4-4. Monitor Circuits, Simplified Schematic Diagram



NOTES:
 1. A JUMPER MUST BE PLACED FROM CR MIXER TO RELAY 1 ON TB4 WHEN SPEAKER NO. 1 IS LOCATED IN THE CONTROL ROOM. ADDITIONAL JUMPERS MUST BE PLACED BETWEEN RELAYS 2,3,4 AND THE ASSOCIATED MIXER WHEN THERE IS A SPEAKER IN A STUDIO WITH A MICROPHONE.
 2. IF MORE THAN ONE MICROPHONE IS USED IN A SPECIFIC LOCATION, THE SWITCH CONTACTS FOR EACH SHOULD BE PARALLELED AND JUMPED ON TB4 SO THAT EITHER MICROPHONE WILL OPERATE THE ASSOCIATED RELAY.

Figure 4-5. Studio Monitor Speaker and Warning-Light Control Circuits, Simplified Schematic Diagram

SECTION V MAINTENANCE

5.1 PERIODIC INSPECTION AND PREVENTIVE MAINTENANCE.

5.1.1 ATTENUATORS.

Clean all attenuators in Broadcast Console 212F-2 occasionally to avoid noisy operation. Perform the following cleaning procedure:

- a. Remove the attenuator dust cover.
- b. Wipe each contact and contact arm with a lint-free cloth that is saturated with trichloroethylene.
- c. Apply a thin film of contact lubricant, such as Daven oil or equivalent.
- d. Replace and secure dust cover.

5.1.2 LEVER SWITCHES.

Clean the lever-switch contacts occasionally with a burnishing tool. Be careful not to bend any of the leaf springs while burnishing the contacts.

5.1.3 WIRING.

Check all wiring for loose connections and frayed insulation. Make certain that all terminal strip screws are tight.

5.2 TROUBLE SHOOTING.

5.2.1 GENERAL.

An amplifier module test cable is available for use with the 212F-2. When one of the plug-in amplifier

modules is plugged into the test cable connector and the cable is plugged into the console, the amplifier module can operate outside the console, and may be turned upside down for testing and maintenance.

NOTE

To remove an amplifier module, lift the rear edge of the module clear of the retaining rail, and push toward the rear to unplug.

Refer to the unit instructions for the individual module for trouble-shooting and maintenance procedures for that module. All module unit instructions are supplied following section VII of this system instructions.

5.2.2 REPLACEMENT OF METER LAMPS.

The two meter lamps are located inside the front panel of the 212F-2. Both lamps are mounted on a bracket that is accessible when the front panel is tilted forward.

5.2.3 EXCESSIVE DISTORTION.

If excessive distortion occurs, it may be due to an unbalanced condition in the push-pull output stage of Program/Monitor Amplifier 356B-1. To correct this condition, replace tubes V303 and V304 in the 356B-1 module.

SECTION VI PARTS LIST

| ITEM | DESCRIPTION | COLLINS PART NUMBER |
|--------------------------|---|---------------------|
| BROADCAST CONSOLE 212F-2 | | 522-2608-00 |
| AT1 | ATTENUATOR, VARIABLE: resistive type, 600/1200 ohms nom impedance, 20 steps, 2 db per step, 1-27/32 in. dia, 2-23/32 in. lg; Daven Co. part no. 5406 | 378-0368-00 |
| AT2 | ATTENUATOR, VARIABLE: same as AT1 | 378-0368-00 |
| AT3 | ATTENUATOR, VARIABLE: same as AT1 | 378-0368-00 |
| AT4 | ATTENUATOR, VARIABLE: resistive type, 600/1200 ohms impedance, 20 steps attenuation in infinity, 1-27/32 in. dia, 2-23/32 in. lg; Daven Co. part no. 5405-1 | 378-0367-00 |
| AT5 | ATTENUATOR, VARIABLE: same as AT4 | 378-0367-00 |
| AT6 | ATTENUATOR, VARIABLE: same as AT1 | 378-0368-00 |
| AT7 | NOT USED | |
| thru | | |
| AT9 | | |
| AT10 | ATTENUATOR, VARIABLE: resistive type, 600/600 ohms impedance 20 steps, 2 db each except last step, last step infinity; Daven Co. part no. 5407-3 | 378-0530-00 |
| AT11 | ATTENUATOR, VARIABLE: same as AT10 | 378-0530-00 |
| C1 | CAPACITOR, FIXED, CERAMIC: 10,000 uuf, ±20%, 500 v dc | 913-1188-00 |
| DS1 | LAMP, INCANDESCENT: miniature bayonet base; T-3-1/4 clear bulb; 6.3 v, 0.150 amp, C-2R filament; General Electric Co. part no. 47 | 262-3240-00 |
| DS2 | LAMP, INCANDESCENT: same as DS1 | 262-3240-00 |
| H1 | CLAMP, LOOP: aluminum; insulated; accommodates 3/4 in. dia material; Tinnerman Products part no. A3044-6-92 | 139-0030-00 |
| H2 | CLAMP, LOOP: nylon; 0.380 in. w, 0.045 in. thk material; Burndy Engineering Co., Inc. part no. HP-6N | 150-1543-00 |
| H3 | BUMPER, RUBBER: black synthetic; 75 durometer hardness rating; 23/32 in. od, 11/64 in. id, 15/32 in. h overall; LaVelle Rubber Co. p/n 747-R | 200-5010-00 |
| H4 | CLAMP, LOOP: nylon; 1/16 in. to 1-3/4 in. dia material accommodated; Thomas & Betts Co. part no. TY-5 | 436-1026-00 |
| H5 | CHAIN, WELDLESS: steel; single loop, 0.018 in. thk stock, approx 27 links per ft | 015-0325-00 |
| J1 | CONNECTOR, RECEPTACLE, ELECTRICAL: 12 contacts; 1 mating end; plastic dielectric; 1-1/4 in. lg, 1-1/2 in. approx w, 1/2 in. h | 366-2120-00 |
| J2 | CONNECTOR, RECEPTACLE, ELECTRICAL: same as J1 | 366-2120-00 |
| thru | | |
| J5 | | |
| J6 | NOT USED | |
| J7 | CONNECTOR, RECEPTACLE, ELECTRICAL: same as J1 | 366-2120-00 |
| thru | | |
| J12 | | |
| J13 | CONNECTOR, RECEPTACLE, ELECTRICAL; 15 female contacts, chassis mtg, 3/4 in. by 1-5/8 in. by 1-21/32 in. overall; Howard B. Jones part no. S-315-AB-W.I. | 366-2150-00 |
| J14 | CONNECTOR, PLUG, ELECTRICAL: 12 contacts; 1 mating end; low loss plastic dielectric; 1-1/4 in. lg, 15/16 in. w, 1-3/16 in. h; Howard B. Jones Co. part no. S-312-CCT-W.I. | 366-8120-00 |
| J15 | NOT USED | |
| J16 | JACK, TELEPHONE: spring leaf contact, J1-1A; 1-5/16 in. lg, 15/16 in. w, 3/4 in. h; Switchcraft, Inc. part no. 2J-1182 | 358-1080-00 |
| J17 | JACK, TELEPHONE: same as J16 | 358-1080-00 |
| M1 | METER, AUDIO LEVEL: db; top scale -20 thru 0, black, and +1 to +3 red markings cw; bottom scale 0 thru 100 and db gain reduction scale, black; phenolic case, 4 in. by 5 in. rectangular, flush panel mtg | 456-0053-00 |
| O1 | KNOB: set screw type; black phenolic body w/ aluminum insert; 1.500 in. dia by 0.843 in. thk excluding skirt | 544-0791-003 |
| O2 | KNOB: same as O1 | 544-0791-00 |
| thru | | |
| O7 | | |
| O8 | KNOB: set screw type; octagonal shape; black phenolic body w/ aluminum insert; 2.078 in. dia by 0.859 in. thk excl skirt | 544-0794-00 |

| ITEM | DESCRIPTION | COLLINS PART NUMBER |
|------|--|---------------------|
| O9 | KNOB: same as O8 | 544-0794-00 |
| thru | | |
| O13 | | |
| R1 | RESISTOR, FIXED, COMPOSITION: 0.22 megohm, ±10%, 1/2 w | 745-1450-00 |
| R2 | RESISTOR, FIXED, COMPOSITION: same as R1 | 745-1450-00 |
| thru | | |
| R4 | | |
| R5 | RESISTOR, FIXED, COMPOSITION: 150 ohms, ±10%, 1/2 w | 745-1317-00 |
| R6 | RESISTOR, FIXED, COMPOSITION: same as R1 | 745-1450-00 |
| thru | | |
| R9 | | |
| R10 | RESISTOR, FIXED, COMPOSITION: same as R5 | 745-1317-00 |
| R11 | RESISTOR, FIXED, COMPOSITION: 1000 ohms, ±10%, 1/2 w | 745-1352-00 |
| R12 | RESISTOR, FIXED, COMPOSITION: same as R11 | 745-1352-00 |
| thru | | |
| R16 | | |
| R17 | NOT USED | |
| thru | | |
| R19 | | |
| R20 | RESISTOR, FIXED, COMPOSITION: 2200 ohms, ±10%, 1/2 w | 745-1366-00 |
| R21 | RESISTOR, FIXED, COMPOSITION: same as R20 | 745-1366-00 |
| thru | | |
| R31 | | |
| R32 | NOT USED | |
| thru | | |
| R37 | | |
| R38 | RESISTOR, FIXED, COMPOSITION: same as R20 | 745-1366-00 |
| thru | | |
| R40 | | |
| R41 | NOT USED | |
| R42 | RESISTOR, FIXED, COMPOSITION: 100 ohms, ±5%, 1 w | 745-3309-00 |
| R43 | RESISTOR, FIXED, COMPOSITION: same as R42 | 745-3309-00 |
| thru | | |
| R45 | | |
| R46 | RESISTOR, FIXED, COMPOSITION: 820 ohms, ±5%, 2 w | 745-5648-00 |
| R47 | NOT USED | |
| R48 | RESISTOR, FIXED, FILM: 5620 ohms, ±1%, 1/2 w | 705-7632-00 |
| R49 | RESISTOR, FIXED, FILM: 2050 ohms, ±1%, 1/2 w | 705-7611-00 |
| R50 | RESISTOR, FIXED, FILM: 2740 ohms, ±1%, 1/2 w | 705-7617-00 |
| R51 | RESISTOR, FIXED, COMPOSITION: 4700 ohms, ±10%, 1/2 w | 745-1380-00 |
| R52 | RESISTOR, FIXED, COMPOSITION: same as R51 | 745-1380-00 |
| R53 | RESISTOR, FIXED, COMPOSITION: 10,000 ohms, ±10%, 1/2 w | 745-1394-00 |
| R54 | RESISTOR, FIXED, COMPOSITION: same as R53 | 745-1394-00 |
| R55 | RESISTOR, FIXED, COMPOSITION: 4700 ohms, ±5%, 1/2 w | 745-1379-00 |
| R56 | RESISTOR, FIXED, COMPOSITION: same as R55 | 745-1379-00 |
| R57 | RESISTOR, FIXED, COMPOSITION: 620 ohms, ±5%, 1/2 w | 745-1343-00 |
| R58 | NOT USED | |
| R59 | RESISTOR, FIXED, COMPOSITION: 300 ohms, ±5%, 1/2 w | 745-1329-00 |
| R60 | RESISTOR, FIXED, COMPOSITION: same as R59 | 745-1329-00 |
| R61 | NOT USED | |
| R62 | NOT USED | |
| R63 | RESISTOR, FIXED, COMPOSITION: 430 ohms, ±5%, 1/2 w | 745-1336-00 |
| R64 | NOT USED | |
| R65 | NOT USED | |
| R66 | RESISTOR, FIXED, COMPOSITION: 3300 ohms, ±10%, 1/2 w | 745-1373-00 |
| R67 | RESISTOR, FIXED, COMPOSITION: same as R66 | 745-1373-00 |
| R68 | NOT USED | |
| R69 | RESISTOR, FIXED, COMPOSITION: 10 ohms, ±10%, 2 w | 745-5568-00 |
| R70 | NOT USED | |
| R71 | NOT USED | |
| R72 | RESISTOR, FIXED, COMPOSITION: 560 ohms, ±10%, 1 w | 745-3342-00 |
| R73 | RESISTOR, FIXED, COMPOSITION: same as R72 | 745-3342-00 |
| R74 | RESISTOR, FIXED, COMPOSITION: same as R57 | 745-1343-00 |
| R75 | RESISTOR, FIXED, COMPOSITION: same as R57 | 745-1343-00 |

| ITEM | DESCRIPTION | COLLINS PART NUMBER |
|---------------------|--|---------------------|
| S1 | SWITCH, LEVER: 3 positions; upper, left 2D right 1A; lower, left 2D, right 1A, 3 amps, 110 v ac noninductive | 375-0175-00 |
| S2 | SWITCH, LEVER: same as S1 | 375-0175-00 |
| S3 | SWITCH, LEVER: 3 positions; upper, left 2D right 1C, 1A; lower, left 2D, right 1C, 1A; 3 amps, 110 v ac, noninductive | 375-0177-00 |
| S4 | SWITCH, LEVER: same as S1 | 375-0175-00 |
| S5 | SWITCH, LEVER: same as S1 | 375-0175-00 |
| S6 | SWITCH, LEVER: 3 positions; upper, left 2D lower left 2D; 3 amps, 110 v ac noninductive | 375-0176-00 |
| S7 | SWITCH, ROTARY: 1 section; 2 moving, and 12 fixed contacts, 2 pole, 5 throws; 28 v dc at 2 amps, 110 v ac at 1 amp | 259-1507-00 |
| S8 | SWITCH, ROTARY: same as S7 | 259-1507-00 |
| S9 | NOT USED | |
| S10 | NOT USED | |
| S11 | SWITCH, LEVER: same as S1 | 375-0175-00 |
| S12 | SWITCH, LEVER: same as S1 | 375-0175-00 |
| S13 | NOT USED | |
| S14 | NOT USED | |
| S15 | SWITCH, ROTARY: 1 section, 2 moving, 10 fixed and 2 dummy contacts, 2 poles, 3 throw; 28 v dc at 2 amps, 110 v ac at 1 amp | 259-1121-00 |
| S16 | SWITCH, ROTARY: same as S15 | 259-1121-00 |
| S17 | SWITCH, ROTARY: 1 section, 2 moving, 8 fixed contacts, 2 poles, 2 throws; 28 v dc at 2 amps, 110 v ac at 1 amp | 259-1138-00 |
| TI | TRANSFORMER, AUDIO FREQUENCY: line type, primary impedance 600 ohms connected; tapped at 250 ohms, 150 ohms, 62.5 ohms; secondary impedance 600 ohms connected, tapped at 250 ohms, 150 ohms, 62.5 ohms, direct current zero; metal encased; solder lug type terminals; 1-5/8 in. by 1-5/8 in. by 2-3/8 in.; Audio Development part no. 122A | 667-0440-00 |
| TB1 | TERMINAL STRIP: molded bakelite barrier strip, 20 terminals, 7-7/8 in. lg by 7/8 in. w. 0.656 in. thk; Howard B. Jones part no. 353-11-20-001 | 367-0131-00 |
| TB2 | TERMINAL BOARD: phenolic, 1/16 in. thk, 3/8 in. w by 1-1/8 in. lg overall excluding terminals; Cinch Mfg. Corp part no. 18A18697 | 306-0168-00 |
| TB3 | CONSOLE SUBASSEMBLY: incs terminal board, 3/32 in. by 3-3/8 in. by 4-5/16 in., 12 resistors and wire | 545-5981-003 |
| TB4 | TERMINAL BOARD: plastic; 1/16 in. thk; 4-7/16 in. lg, 9/16 in. w; 12 brass solder lug type terminals; Howard B. Jones part no. 2012 | 367-0905-00 |
| TB5 | TERMINAL BOARD: phenolic; 1-1/8 in. by 3/8 in. w, 1/16 in. thk; Cinch Mfg. Co. part no. 18A18697 | 306-0168-00 |
| TB6 | TERMINAL BOARD: bakelite strip, 1-1/2 in. lg, 3/8 in. w, 1/16 in. thk; 3 wiring lugs and 1 mtg lg spaced 3/8 in. between centers; Cinch Mfg. Corp. part no. 1534-A | 306-2240-00 |
| TB7 thru TB10 | TERMINAL BOARD: same as TB5 | 306-0168-00 |
| XDS1 | LAMPHOLDER: single contact, bayonet base with bracket mounting | 262-0297-00 |
| XDS2 | LAMPHOLDER: same as XDS1 | 262-0297-00 |
| COMMERCIAL HARDWARE | | |
| | WASHER, SHOULDERED: fiber, 0.625 in. od, 0.032 in. thk; Iten Fibre Co. part no. 302-1600-00 | 302-1600-00 |
| | WASHER, FLAT: stainless steel; 0.312 in. dia; 0.032 in. thk | 310-0046-00 |
| | WASHER, LOCK: CRES; 0.194 in. id, 0.323 in. od, 0.040 in. thk | 310-0073-00 |
| | WASHER, LOCK: CRES; 0.141 in. id, 0.253 in. od, 0.031 in. thk | 310-0282-00 |
| | WASHER, LOCK: CRES; 0.255 in. id, 0.493 in. od, by 0.062 in. thk | 310-0288-00 |
| | WASHER, FLAT: CRES; 0.147 in. id, 0.375 in. od, by 0.031 in. thk | 310-6360-00 |
| | STUD, CONTINUOUS THREAD: stainless steel; 8-32 NC-2 thd, 1-1/2 in. lg | 312-0083-00 |
| | MACHINE SCREW, NUT: stainless steel; 8-32 thd, 11/32 in. lg by 1/8 in. thk | 313-0017-00 |
| | NUT, PLAIN, HEXAGON: CRES; 6-32 thd, 1/4 in. hex, 3/32 in. thk | 313-0045-00 |
| | NUT, PLAIN, HEXAGON: brass; 3/8-32 thd, 9/16 in. w across flats, 3/32 in. thk overall | 313-0062-00 |
| | NUT, PLAIN, HEXAGON: CRES; 3/8-32 thd, 0.562 in. w across flats, 0.093 in. h overall; Pheoll Mfg. Co. part no. 313-0064-00 | 313-0064-00 |

| ITEM | DESCRIPTION | COLLINS PART NUMBER |
|---------------------------------|---|---------------------|
| | NUT, PLAIN, HEXAGON: CRES; 4-40 NC-2 thd; 3/16 in. across flats, 1/16 in. thk | 313-0132-00 |
| | NUT, PLAIN, HEXAGON: brass; 1/4-20 thd, 7/16 in. w across flats, 3/16 h overall; Pheoll Mfg. Co. part no. 313-0148-00 | 313-0148-00 |
| | SCREW, TAPPING, THREAD FORMING: Phillips bending head; steel; screw size 6; head 0.270 in. dia by 0.097 in. h; thd 1/4 in. lg | 330-0735-00 |
| | SCREW, TAPPING, THREAD FORMING: Phillips countersunk flat head; steel; screw size 6; 0.137 in. basic dia, 3/8 in. lg | 330-1056-00 |
| | SCREW, TAPPING, THREAD FORMING: steel; 0.187 in. dia of head, 0.053 in. h of head, 32 thd per in., 1/8 in. lg; Parker-Kalon Division of General American Transportation Corp. part no. 5522-2 | 330-1551-00 |
| | SCREW, TAPPING, THREAD FORMING: steel; screw size 6, 32 threads per in.; 1/4 in. lg | 330-2545-00 |
| | SCREW, TAPPING, THREAD FORMING: steel; screw size 6, 32 threads per in.; 3/8 in. lg | 330-2551-00 |
| | NUT, PLAIN, WING: brass; 6-32 thd, 21/32 in. wing spread, 11/32 in. wing height, 9/64 in. between wings, 5/16 in. body dia, 0.138 in. dia; Pheoll Mfg Co. part no. 334-0040-00 | 334-0040-00 |
| | SETSCREW: CRES; multiple spline, 8-32 NC-3 thd, 6 flutes, 3/16 in. lg, oval point, 0.164 in. od | 335-0041-00 |
| | SCREW, MACHINE: stainless steel; 4-40 NC-2A thd, flat countersunk head, 0.375 in. lg | 342-0046-00 |
| | SCREW, MACHINE: stainless steel; 6-32 NC-2A thd, flat countersunk head, 5/16 in. lg | 342-0061-00 |
| | SCREW, MACHINE: steel; 6-32 NC-2A thd, flat countersunk head, 3/4 in. lg | 342-0066-00 |
| | SCREW, MACHINE: stainless steel; 6-32 NC-2A thd, Phillips flat head, 7/32 in. lg | 342-0624-00 |
| | SCREW, MACHINE: stainless steel; 8-32 NC-2A thd, Phillips flat head, 3/4 in. lg | 342-1733-00 |
| | SCREW, MACHINE: CRES; Phillips recessed pan head, 6-32 NC-2A thd, 1/4 in. lg | 343-0167-00 |
| | SCREW, MACHINE: CRES; Phillips recessed pan head, 6-32 NC-2A thd, 5/16 in. lg | 343-0168-00 |
| | SCREW, MACHINE: CRES; Phillips recessed pan head, 6-32 NC-2A thd, 3/8 in. lg | 343-0169-00 |
| | SCREW, MACHINE: CRES; Phillips pan head, 6-32 NC-2A thd, 1/2 in. lg | 343-0171-00 |
| | SCREW, MACHINE: brass, 1/4-20 UNC-2A thd; Phillips recessed pan head, 0.750 in. lg | 343-0368-00 |
| | SCREW, MACHINE: brass; 3-48 NC-2A thd, pan head, 1/4 in. lg | 343-0384-00 |
| | WASHER, LOCK: stainless steel; flat external teeth, 0.317 in. od, 0.150 in. id, 0.020 in. thk | 373-8020-00 |
| GAIN REDUCTION MODIFICATION KIT | | 548-8232-00 |
| R47 | RESISTOR, VARIABLE: composition; 1000 ohms, ±20%, 0.3 w | 376-0203-00 |
| S18 | SWITCH, SLIDE: dpdt; 0.5 amps at 125 v ac, dc; | 250-2597-00 |
| | NUT, PLAIN, HEXAGON: CRES; 4-40 NC-2, 3/16 in. w across flats, 1/16 in. thk | 313-0132-00 |
| | WASHER, LOCK: stainless steel, 0.115 in. id, 0.212 in. od, 0.025 in. thk | 310-0279-00 |
| | SCREW, MACHINE: CRES; 4-40 NC-2A thd, Phillips recessed flat head, 5/16 in. lg | 342-0045-00 |
| | SCREW, MACHINE: CRES; Phillips recessed pan head, 4-40 NC-2A thd, 1/4 in. lg | 343-0133-00 |
| | NUT, PLAIN, HEXAGON: stainless steel, single chamfer, 3/8-22 thd, 9/16 in. w | 313-0064-00 |
| | WASHER, LOCK: stainless steel; internal teeth, 0.391 in. id, 0.507 in. od, 0.022 in. thk | 373-0085-00 |
| CUE MODIFICATION KIT | | 548-8233-00 |
| R58 | RESISTOR, VARIABLE: composition; 50.000 ohms, ±30%, 1/4 w | 376-7204-00 |
| LS1 | LOUDSPEAKER, PERMANENT MAGNET: 3 to 4 ohms max voice-coil impedance; 3 w nominal input; 3 in. sq | 271-0217-00 |
| | SCREW, TAPPING, THREAD FORMING: Phillips binding head; steel; screw size 6; head 0.270 in. dia by 0.097 in. h; thread 1/4 in. lg | 330-0735-00 |
| | NUT, PLAIN, HEXAGON: brass, nickel plated; 1/4-32 NEF-2B thd; 0.3125 in. hex by 0.125 in. thk | 334-0257-00 |
| | NUT, PLAIN, HEXAGON: brass, nickel plated; 1/4-32 NEF-2B thd; 0.3125 in. hex by 0.125 in. thk | 334-0271-00 |

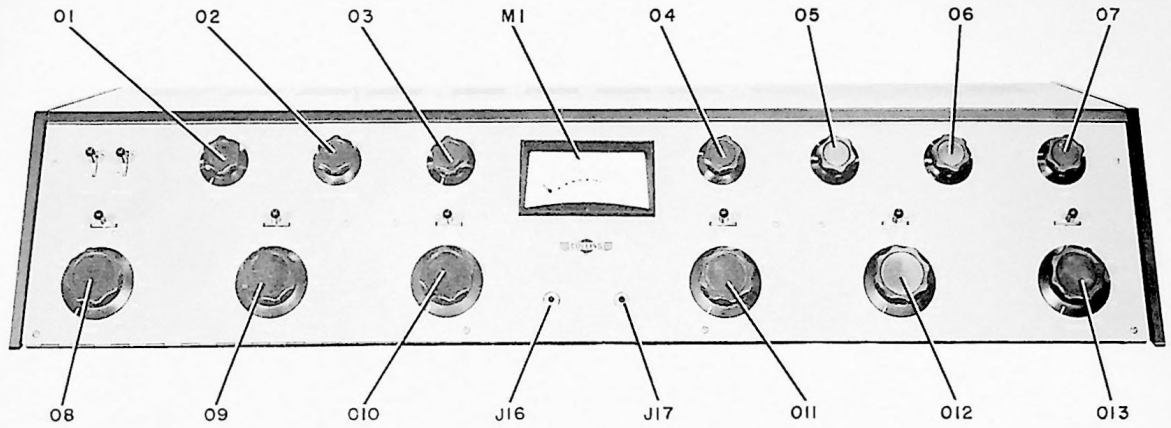


Figure 6-1. Broadcast Console 212F-2, Front Panel

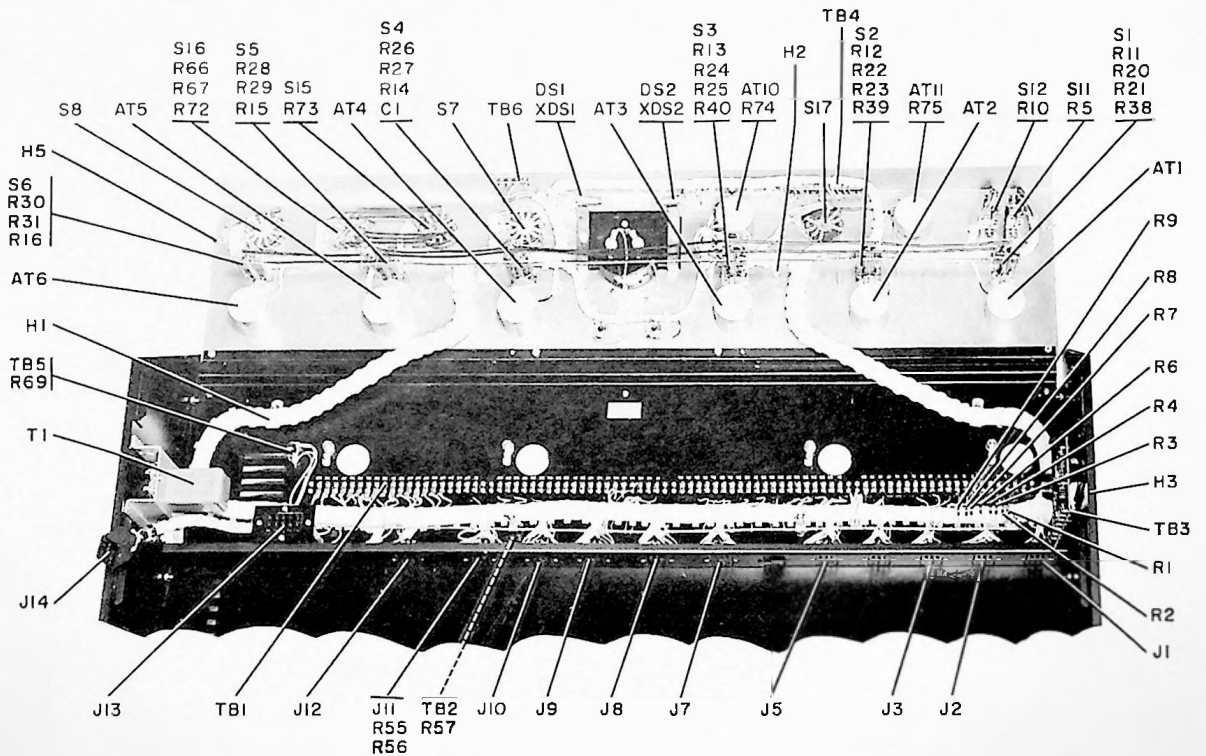


Figure 6-2. Broadcast Console 212F-2, Top View with Front Panel and Top Open

SECTION VII ILLUSTRATIONS

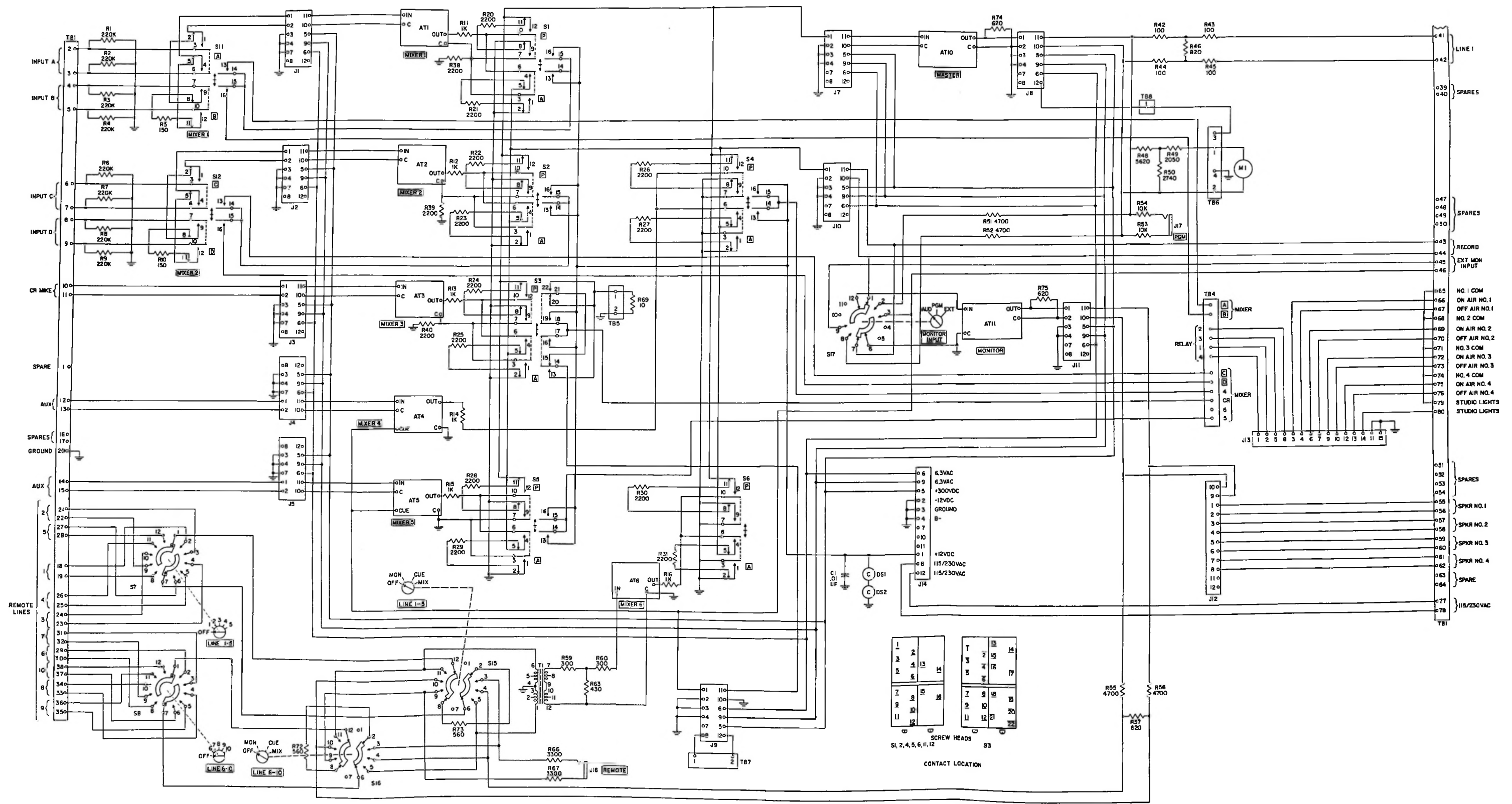


Figure 7-1. Broadcast Console 212F-2, Schematic Diagram

356A-1 Preamplifier

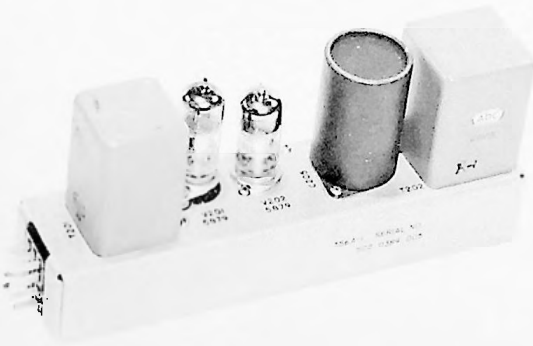


unit instructions

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

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FD-323
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C99-40-P.

Figure 1. Preamplifier, 356A-1 Equipment Supplied

1.1 PURPOSE OF EQUIPMENT.

Preamplifier 356A-1 is intended for use as a pre-amplifier or booster with broadcast studio equipment such as Broadcast Console 212F-1 or 212G-1. It may be used in high-fidelity AM, FM, and TV broadcast service or program control in audio systems.

1.2 PHYSICAL DESCRIPTION.

Preamplifier 356A-1 (figure 1) is a plug-in module containing the necessary circuitry for two stages of amplification. The 356A-1 is 4-5/8 inches high,

2-1/8 inches wide, and 9-1/2 inches long and weighs approximately 2.5 pounds.

1.3 TUBE COMPLEMENT.

| Function | Symbol | Tube Type |
|------------------|--------|-----------|
| Input amplifier | V201 | 5879 |
| Output amplifier | V202 | 5879 |

1.4 ELECTRICAL CHARACTERISTICS.

1.4.1 CONNECTORS. One 12-pin connector, P201, is located at the front end of the chassis. All connections to the 356A-1 are made at this connector.

1.4.2 POWER REQUIREMENTS. Power requirements for the 356A-1 are as follows: 250 - 300 volts d-c filtered at 6.5 - 7.5 ma and 6.3 volts a-c or d-c at 0.3 amperes.

1.4.3 FREQUENCY RANGE. The frequency range of the 356A-1 is 50 to 15,000 cycles per second.

1.4.4 INPUT IMPEDANCE. The 356A-1 is factory wired for 150 ohms unloaded transformer input impedance. Choice of 30, 150, 250, or 600 ohm impedance connections is available at the input transformer. See figure 4.

NOTE

If 250-ohm balanced input to the 356A-1 is desired, connect a 2700-ohm resistor from transformer T201 terminal 2 to ground and a 2700-ohm resistor from terminal 5 to ground. Disconnect the wire from terminal 4 and connect it to terminal 5. Disconnect terminal 3. If 30-ohm balanced input is desired, connect a 270-ohm resistor from terminal 4 to ground and connect a 270-ohm resistor from terminal 5 to ground. Disconnect the wire from terminal 2 and connect it to terminal 5. Disconnect terminal 3.

1.4.5 GAIN. When the 356A-1 is used in preamplifier service, a -60 dbm (nominal) input from a commercial microphone produces a -20 dbm output. When used as a booster with input connected for 600 ohms impedance, a -22 dbm input signal produces an output of +18 dbm which is maximum rated output power. Gain through the preamplifier is 40 db.

1.4.6 OUTPUT IMPEDANCE. The output of the 356A-1 may be connected for either 150 or 600 ohms output impedance (balanced or unbalanced). It is factory connected for 600 ohms output impedance. For information on terminal connection for 150 ohms output impedance, see figure 4, note 2.

1.4.7 FREQUENCY RESPONSE. The frequency response of the 356A-1 is ± 1 db from 50 to 15,000 cps at $\pm 0.5\%$ maximum distortion.

1.4.8 NOISE LEVEL. The equivalent input noise level of the preamplifier is -118 dbm. When the 356A-1 is used with Power Supply 409X-1 or 409X-2, the filaments are maintained at approximately +30 volts d-c above ground. This positive bias minimizes a-c noise in the preamplifier.

2.1 CIRCUIT DESCRIPTION.

Figure 4 is a schematic diagram of Preamplifier 356A-1. Input to the preamplifier is coupled by transformer T201 to the grid of V201. The input amplifier (V201) is a pentode-connected type 5879. Its output is resistance-capacitance coupled to the grid of a triode-connected type 5879 (V202). Output from V202 is taken from the secondary winding of transformer T202. A third winding of T202 supplies inverse feed-back voltage to the cathode of the input amplifier. All connections to the amplifier are made at P201.

3.1 MAINTENANCE.

Normal maintenance will consist of tube replacement. Table 1 gives voltage and resistance measurements for Preamplifier 356A-1.

4.1 TABLE OF REPLACEABLE PARTS.

Table 2 gives the description, circuit function, and Collins part number for all replaceable parts in the 356A-1. When replacement of parts is necessary, only parts identical or equivalent to those listed should be used. All parts above the chassis are identified in figure 2. All parts under the chassis are identified in figure 3.

TABLE 1. VOLTAGE AND RESISTANCE MEASUREMENTS FOR PREAMPLIFIER 356A-1

Conditions of Measurement:

- a. Voltage readings are taken with power applied as in normal operation.
- b. Line voltage 115 volts a-c. Plate supply voltage adjusted to +300 volts.
- c. Resistance readings are taken with no power applied.
- d. All measurements from terminal to ground.
- e. Voltage measurements made with a 20,000 ohms-per-volt meter.

| TUBE | | PIN NUMBER | | | | | | | | |
|----------------|------|------------|---|------|-------|-------|---|-----|------|------|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| V201 (5879) | V DC | 0 | 0 | 1.9 | 20-50 | 20-50 | 0 | 46 | 82 | 1.9 |
| | V AC | 0 | 0 | 0 | 3.0 | 3.0 | 0 | 0 | 0 | 0 |
| | Ohms | 6K | 0 | 2300 | 2800 | 2800 | 0 | 37K | 200K | 2300 |
| V202 (5879) | V DC | 0 | 0 | 5.7 | 40 | 40 | 0 | 210 | 210 | 210 |
| | V AC | 0 | 0 | 0 | 3.0 | 3.0 | 0 | 0 | 0 | 0 |
| | Ohms | 2.2 meg | 0 | 900 | 2800 | 2800 | 0 | 40K | 40K | 40K |

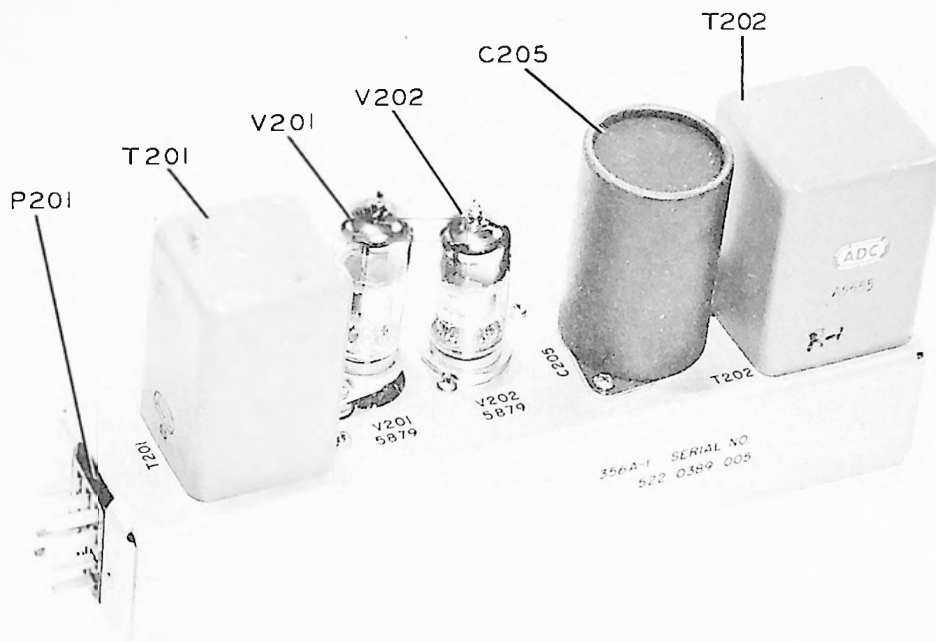


Figure 2. Preamplifier, 356A-1 Top View

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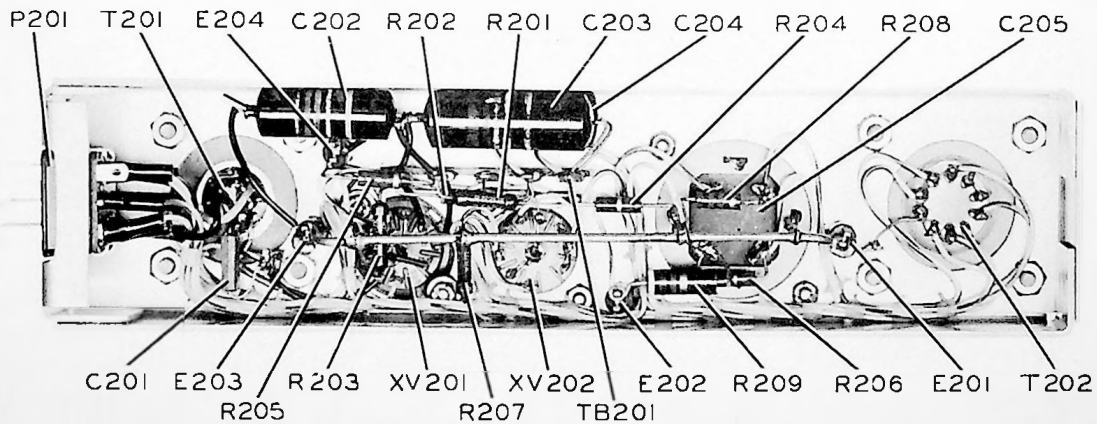


Figure 3. Preamplifier, 356A-1 Bottom View

C99-31-P.

PARTS LIST

| ITEM | DESCRIPTION | COLLINS PART NUMBER |
|------|--|------------------------|
| C201 | NOT USED | |
| C202 | CAPACITOR: paper, 0.047 uf $\pm 10\%$, 400 vdcw | 931-0295-00 |
| C203 | CAPACITOR: paper, 0.1 uf $\pm 10\%$, 400 vdcw | 931-0299-00 |
| C204 | Same as C203 | 931-0299-00 |
| C205 | CAPACITOR: dry electrolytic, quadruple section; sections 1 and 2, 20 uf, 450 vdcw $+250\%$ -10% tolerance; section 3 and 4, 50 uf, 50 vdcw $+250\%$ -10% tolerance | 183-1260-00 |
| E201 | TERMINAL, stud: melamine body, brass term tinned, brass base, cadmium plated; hex | 306-0233-00 |
| E202 | Same as E201 | 306-0233-00 |
| E203 | Same as E201 | 306-0233-00 |
| E204 | TERMINAL, stud: melamine body, terminal brass hot tin dipped, base brass cadmium plated | 306-0234-00 |
| P201 | CONNECTOR, plug: 12 rectangular male contacts | 365-2120-00 |
| R201 | RESISTOR: comp, 0.16 megohms $\pm 5\%$, 1/2 w | 745-1445-00 |
| R202 | RESISTOR: comp, 0.10 megohms $\pm 10\%$, 1/2 w | 745-1436-00 |
| R203 | RESISTOR: comp, 51,000 ohms $\pm 5\%$, 1/2 w | 745-1424-00 |
| R204 | RESISTOR: comp, 2.2 megohm $\pm 10\%$, 1/2 w | 745-1492-00 |
| R205 | RESISTOR: comp, 5.6 megohm $\pm 10\%$, 1/2 w | 745-1510-00 |
| R206 | RESISTOR: comp, 30,000 ohms $\pm 5\%$, 1/2 w | 745-1413-00 |
| R207 | RESISTOR: comp, 910 ohms $\pm 5\%$, 1/2 w | 745-1350-00 |
| R208 | RESISTOR: comp, 2,200 ohms $\pm 10\%$, 1/2 w | 745-1366-00 |

| ITEM | DESCRIPTION | COLLINS PART NUMBER |
|-------|---|------------------------|
| R209 | RESISTOR: comp, 910 ohms $\pm 5\%$, 1 w | 745-3392-00 |
| R210 | RESISTOR: comp, 270 ohms $\pm 10\%$, 1/2 w (separate) in cloth bag | 745-1328-00 |
| R211 | Same as R210 | 745-1328-00 |
| R212 | RESISTOR: comp, 2700 ohms $\pm 10\%$, 1/2 w (separate) in cloth bag | 745-1370-00 |
| R213 | Same as R212 | 745-1370-00 |
| T201 | TRANSFORMER, AF: input type; 600 ohms; primary impedance; secondary 50,000 ohms | 667-0435-00 |
| T202 | TRANSFORMER, AF: output type; primary 16,500 ohms, 6 ma dc; secondary impedance 600 ohms when series connected; 150 ohms when parallel connected; transformer contains a feedback winding | 667-0436-00 |
| TB201 | BOARD, TERMINAL: phenolic PBG; 5 solder lug terminals | 306-0550-00 |
| V201 | TUBE, electron: miscellaneous type, pentode 5879 | 257-0104-00 |
| V202 | Same as V201 | 257-0104-00 |
| XV201 | SOCKET, tube: 9 contact miniature | 220-1274-00 |
| XV202 | SOCKET, tube: 9 contact miniature | 220-1274-00 |

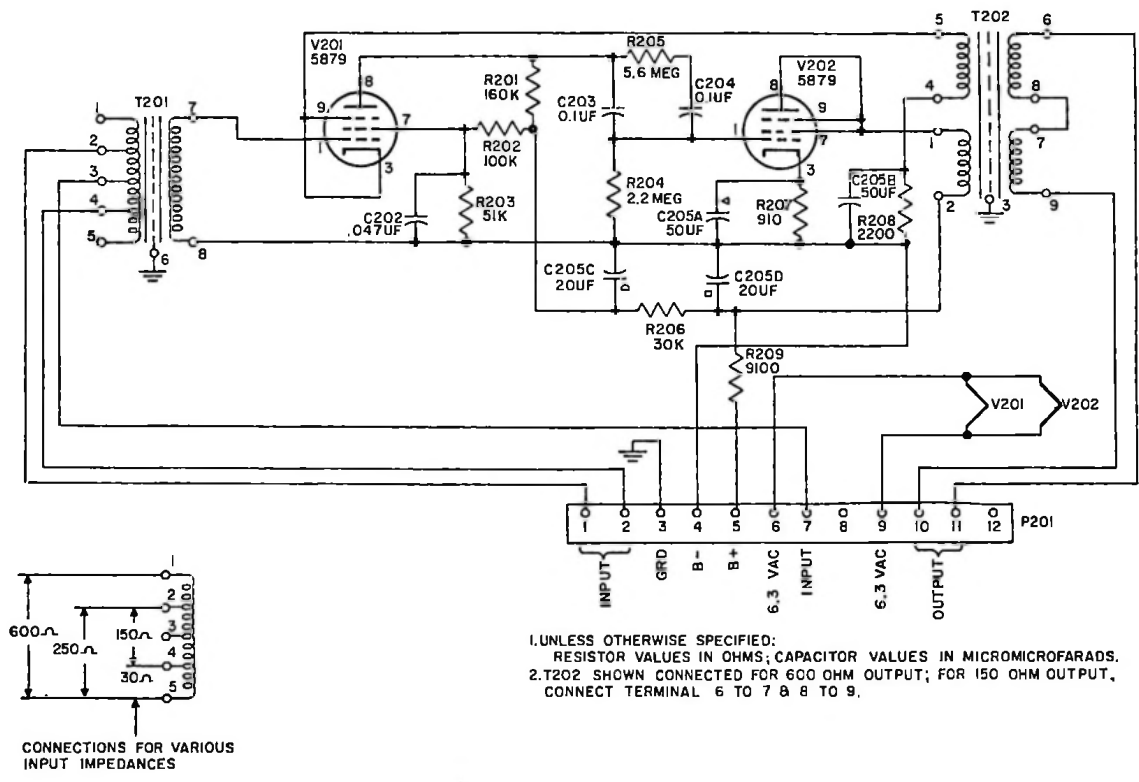


Figure 4. Preamplifier 356A-1, Schematic Diagram

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UNIT INSTRUCTIONS

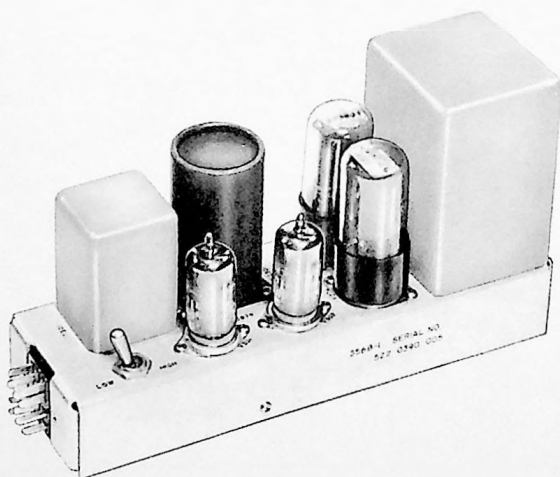
TD-324
4th EDITION, 15 SEPTEMBER 1961
520-5447-00

PROGRAM/MONITOR AMPLIFIER 356B-1

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1956, 1960, 1961

CEDAR RAPIDS, IOWA, U.S.A.

PRINTED IN THE UNITED STATES OF AMERICA



5342301

Figure 1. Program/Monitor Amplifier 356B-1,
Equipment Supplied

1.1 PURPOSE OF EQUIPMENT.

Program/Monitor Amplifier 356B-1 is intended for use as a program or monitor amplifier with broadcast studio equipment such as Broadcast Console 212F-1, 212F-2, or 212G-1. It may be used in high-fidelity

AM, FM, and TV broadcast service or program control in audio systems.

1.2 PHYSICAL DESCRIPTION.

Program/Monitor Amplifier 356B-1 (figure 1) is a plug-in module containing necessary circuitry for three stages of amplification. The 356B-1 is 5-3/4 inches high, 2-3/4 inches wide, and 9-1/2 inches long and weighs approximately 4-3/4 pounds.

1.3 TUBE COMPLEMENT.

| Function | Symbol | Tube Type |
|------------------|--------|-----------|
| Input amplifier | V301 | 5879 |
| Phase inverter | V302 | 5879 |
| Output amplifier | V303 | 6V6 |
| Output amplifier | V304 | 6V6 |

1.4 ELECTRICAL CHARACTERISTICS.

1.4.1 CONNECTORS. One 12-pin connector, P301, is located at the front end of the chassis. All connections to the 356B-1 are made at this connector.

1.4.2 POWER REQUIREMENTS. Power requirements for the 356B-1 are as follows: 250 - 300 volts

d-c at 63 - 88 ma and 6.3 volts a-c or d-c at 1.2 amperes.

1.4.3 FREQUENCY RANGE. The frequency range of the 356B-1 is 50 to 15,000 cycles per second.

1.4.4 INPUT IMPEDANCE. The 356B-1 is factory wired for 600 ohms unloaded transformer input impedance. It may be rewired for 150 ohms input impedance if desired. See figure 4.

1.4.5 GAIN. When the HI-LOW gain switch on the top of the amplifier chassis is in the HI position the amplifier has 68-db gain. When the gain switch is in the LOW position, the gain is 56 db.

1.4.6 OUTPUT IMPEDANCE. The 356B-1 is factory wired for 600 ohms output impedance. It may be rewired for 150 ohms output impedance. See figure 4.

1.4.7 FREQUENCY RESPONSE. The frequency response of the 356B-1 is ± 1 db from 50 to 15,000 cps.

1.4.8 DISTORTION. The distortion in the output of the 356B-1 is 0.5% maximum at +30 dbm (one watt) output and 3% maximum at +39 dbm (8 watts) output.

1.4.9 NOISE LEVEL. The equivalent input noise level of the amplifier is -116 dbm.

2.1 CIRCUIT DESCRIPTION.

Figure 4 is a schematic diagram of Program/Monitor Amplifier 356B-1. Input signal is coupled by transformer T301 to the grid of the input amplifier V301. The input amplifier is a pentode-connected type 5879. Its output is resistance-capacitance coupled to the phase inverter V302. The phase inverter is a triode-connected type 5879. Output from the phase inverter is RC coupled to the grids of two type 6V6 tubes (V303 and V304) in push-pull. Output from the amplifier is coupled to the load by transformer T302. Inverse feedback is taken from a third winding of T302 and applied to the cathode of V301.

3.1 MAINTENANCE.

Normal maintenance will consist of tube replacement. Table 1 gives voltage and resistance measurements for Program/Monitor Amplifier 356B-1. If excessive distortion occurs, replace V303 and V304.

4.1 TABLE OF REPLACEABLE PARTS.

Table 2 gives the description, circuit function, and Collins part number for all replaceable parts in Program/Monitor Amplifier 356B-1. When replacement of parts is necessary, only parts identical or equivalent to those listed should be used. All parts on top of the chassis are identified in figure 2. All parts mounted beneath the chassis are identified in figure 3.

TABLE 1. VOLTAGE AND RESISTANCE MEASUREMENTS FOR THE 356B-1 PROGRAM/MONITOR AMPLIFIER

Conditions of measurement:

- a. Voltage readings are taken with a 20,000 ohms-per-volt meter.
- b. Line voltage 115 v a-c. Plate voltage adjusted to +300 volts.
- c. Resistance readings taken with no power applied.
- d. All measurements from terminal to ground.

| TUBE | | PIN NUMBER | | | | | | | | |
|----------------|------|------------|-------|------|-------|-------|-----|-------|------|------|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| V301 (5879) | V DC | 0 | 0 | 1.4 | 20-50 | 20-50 | 0 | 54 | 141 | 1.4 |
| | V AC | 0 | 0 | 0 | 3.0 | 3.0 | 0 | 0 | 0 | 0 |
| | Ohms | 6K | 0 | 1400 | 2800 | 2800 | 0 | 27K | 120K | 1400 |
| V302 (5879) | V DC | 24 | 0 | 50 | 20-50 | 20-50 | 0 | 170 | 170 | 170 |
| | V AC | 0 | 0 | 0 | 3.0 | 3.0 | 0 | 0 | 0 | 0 |
| | Ohms | 1 meg | 0 | 23K | 2800 | 2800 | 0 | 55K | 55K | 55K |
| V303 (6V6) | V DC | 0 | 20-50 | 290 | 300 | 0 | 0 | 20-50 | 18 | |
| | V AC | 0 | 3.0 | 0 | 0 | 0 | 0 | 3.0 | 0 | |
| | Ohms | 0 | 2800 | 24K | 23K | 560K | Inf | 2800 | 470 | |
| V304 (6V6) | V DC | 0 | 20-50 | 290 | 300 | 0 | 0 | 20-50 | 18 | |
| | V AC | 0 | 3.0 | 0 | 0 | 0 | 0 | 3.0 | 0 | |
| | Ohms | 0 | 2800 | 24K | 23K | 560K | Inf | 2800 | 470 | |

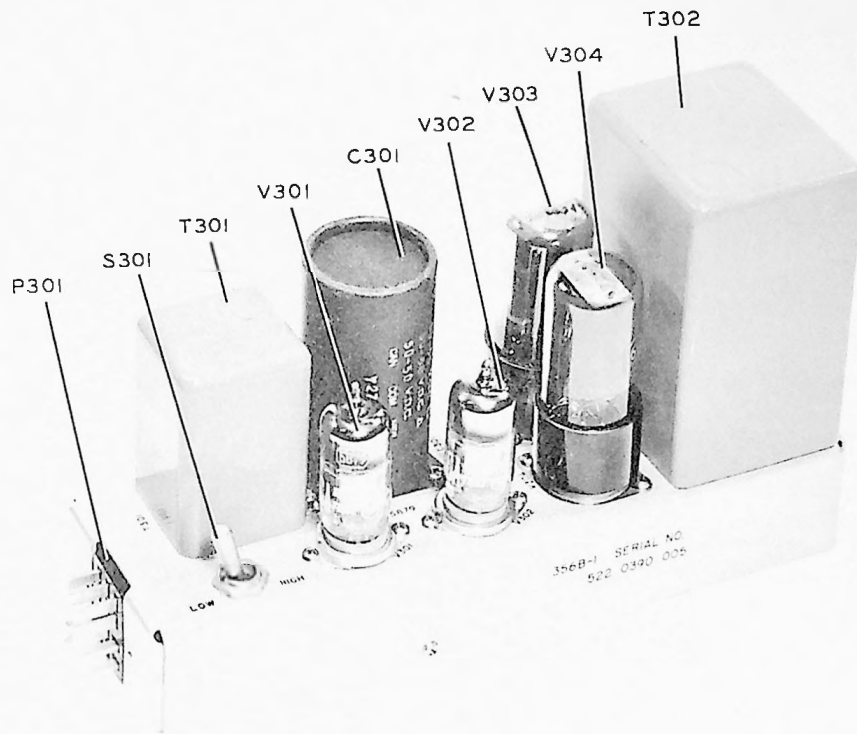


Figure 2. Program/Monitor, Amplifier, 356B-1, Top View

C99-32-P.

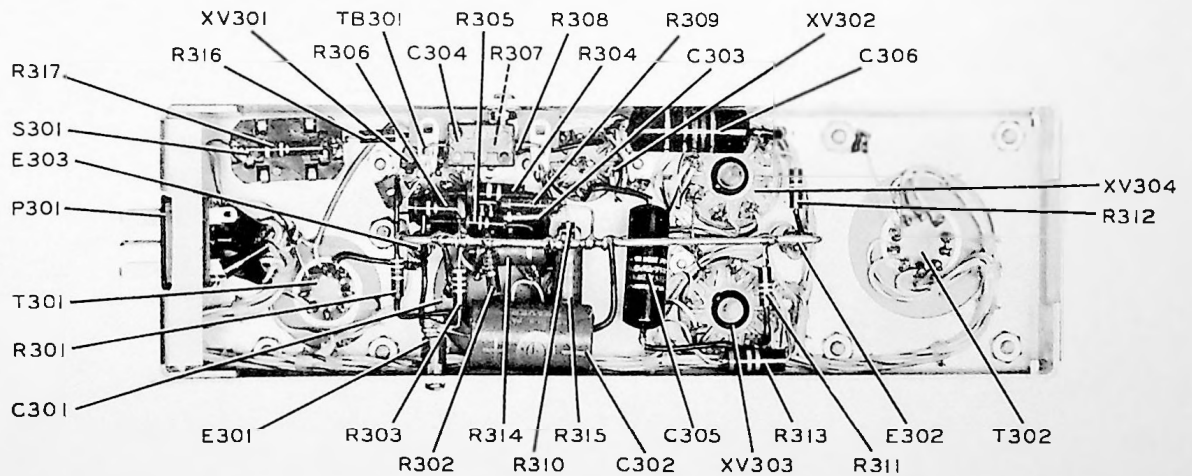


Figure 3. Program/Monitor Amplifier, 356B-1, Bottom View

C99-33-P.

PARTS LIST

| ITEM | DESCRIPTION | COLLINS PART NUMBER |
|--|--|---|
| C301, C301A, C301B, C301C, C301D C302 | CAPACITOR: dry electrolytic, quadruple sections, section No. 1, 40 uf, 450 V dc, section No. 2, 50 uf 50 V dc, section No. 3, 50 uf, 50 V dc, section No. 4, 50 uf V dc capacity tolerance -10%+250% each section CAPACITOR: electrolytic, 4 uf -15%+100%, 250 vdcw | 183-1261-00 183-1209-00 |
| C303 C304 C305 C306 | CAPACITOR: paper, 0.047 uf ±10%, 400 vdcw CAPACITOR: mica, 82 uuf ±10%, 500 vdcw SAME as C303 SAME as C303 | 931-0295-00 935-0170-00 931-0295-00 931-0295-00 |
| E301 E302 | TERMINAL: stud, melamine body, brass term thinned, brass base, cadmium plated, hex TERMINAL: stud, melamine body, terminal, brass hot tin dipped, base brass, cadmium plated, hex | 306-0233-00 306-0234-00 |
| E303 P301 | SAME as E302 CONNECTOR: plug, 12 rectangular male contacts | 306-0234-00 365-2120-00 |
| R301 R302 R303 R304 R305 R306 R307 R308 R309 R310 R311 | RESISTOR: comp, 330 ohms ±10%, 1/2 w RESISTOR: comp, 1100 ohms ±5%, 1/2 w RESISTOR: comp, 33,000 ohms ±10%, 1/2 w RESISTOR: comp, 0.10 megohm ±10%, 1/2 w RESISTOR: comp, 0.10 megohm ±10%, 1 w RESISTOR: comp, 0.20 megohm ±5%, 1/2 w RESISTOR: comp, 1.0 megohm ±10%, 1/2 w RESISTOR: comp, 2000 ohms ±5%, 1/2 w RESISTOR: comp, 22,000 ohms ±5%, 1/2 w RESISTOR: comp, 24,000 ohms ±5%, 1/2 w RESISTOR: comp, 0.56 megohm ±10%, 1/2 w | 745-1331-00 745-1354-00 745-1415-00 745-1436-00 745-3436-00 745-1448-00 745-1478-00 745-1364-00 745-1407-00 745-1410-00 745-1468-00 |

| ITEM | DESCRIPTION | COLLINS PART NUMBER |
|--|--|--|
| R312 R313 R314 R315 R316 R317 S301 | SAME as R311 RESISTOR: comp, 15,000 ohms ±10%, 1 w RESISTOR: comp, 510 ohms ±5%, 2 w SAME as R314 RESISTOR: comp, 9,100 ohms ±5%, 1/2 w RESISTOR: comp, 91,000 ohms ±5%, 1/2 w SWITCH: toggle, spst, 30 V dc 20 amps in locking position | 745-1468-00 745-3401-00 745-5640-00 745-5640-00 745-1392-00 745-1434-00 266-3072-00 |
| T301 T302 | TRANSFORMER AF: input type, 600 ohms primary impedance; secondary 50,000 ohms TRANSFORMER, AF: output type; primary 9,000 ohms, secondary impedance 600 ohms when series connected; 150 ohms when parallel connected; transformer contains a feedback winding | 667-0435-00 667-0437-00 |
| TB301 | BOARD, TERMINAL: component mtg; four solder lug terminals; terminals 3/8 in. between centers; brown bakelite board | 306-2230-00 |
| V301 V302 V303 V304 XV301 XV302 XV303 XV304 | TUBE: electron, pentode, 5879 SAME as V301 TUBE: electron, tetrode amplifier, 6Y6GT SAME as V303 SOCKET: tube, 9 miniature contacts SAME as XV301 SOCKET: tube, 8 prong octal SAME as XV303 | 257-0104-00 257-0104-00 255-0021-00 255-0021-00 220-1274-00 220-1274-00 220-1005-00 220-1005-00 |

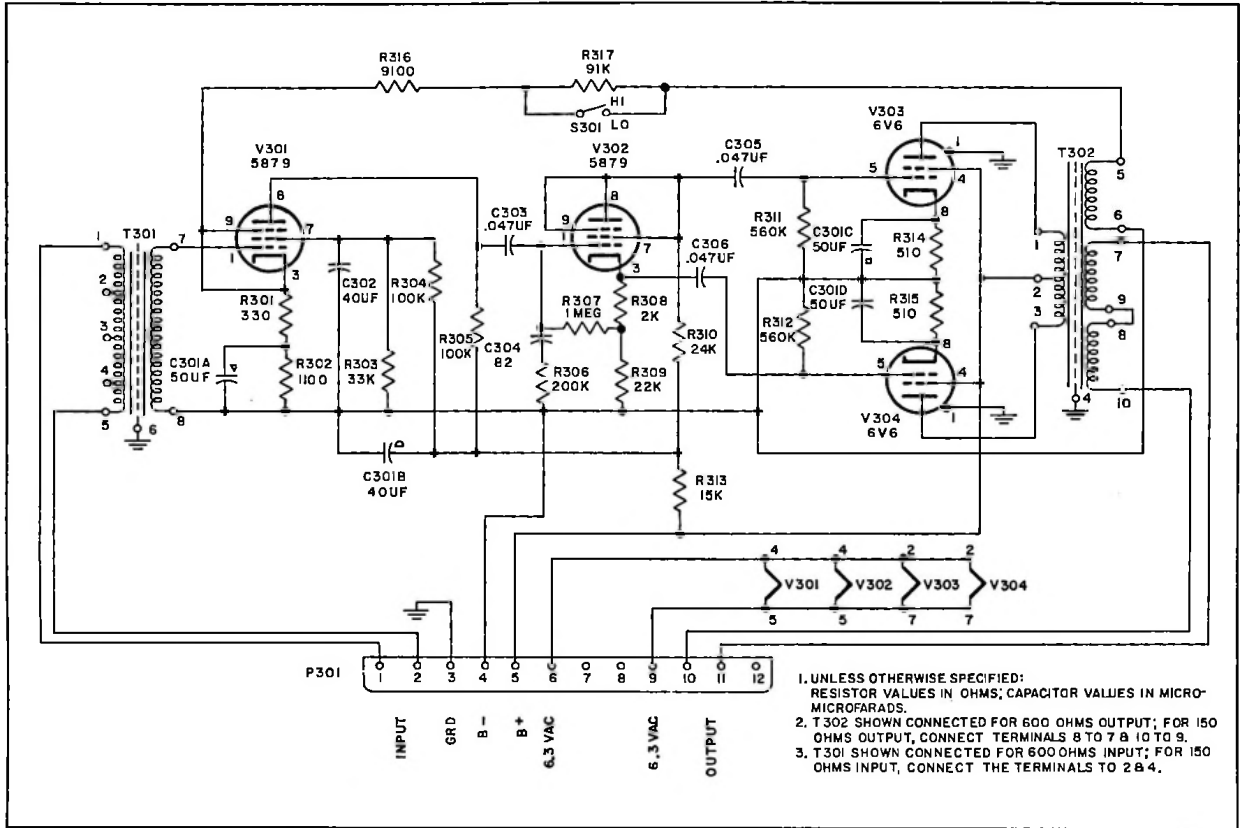


Figure 4. Program/Monitor Amplifier, 356B-1, Schematic Diagram

C99-09-3

LIMITER AMPLIFIER

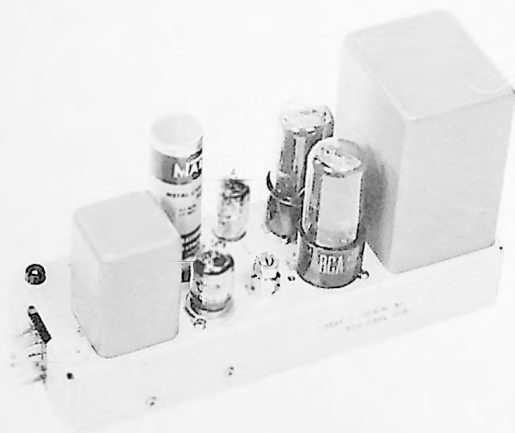
356E-1

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COLLINS



C99-23-P.

Figure 1. Limiter Amplifier, 356E-1,
Equipment Supplied

1.1 PURPOSE OF EQUIPMENT.

Limiter Amplifier 356E-1 is an automatic average level or peak-limiting amplifier for broadcast, TV, and microwave audio systems.

1.2 PHYSICAL DESCRIPTION.

Limiter Amplifier 356A-1 (figure 1) is a plug-in module containing two stages of amplification with a

bias rectifier. It is 5-5/16 inches high, 3 inches wide, and 9-1/2 inches long and weighs 4.75 pounds.

1.3 TUBE COMPLEMENT.

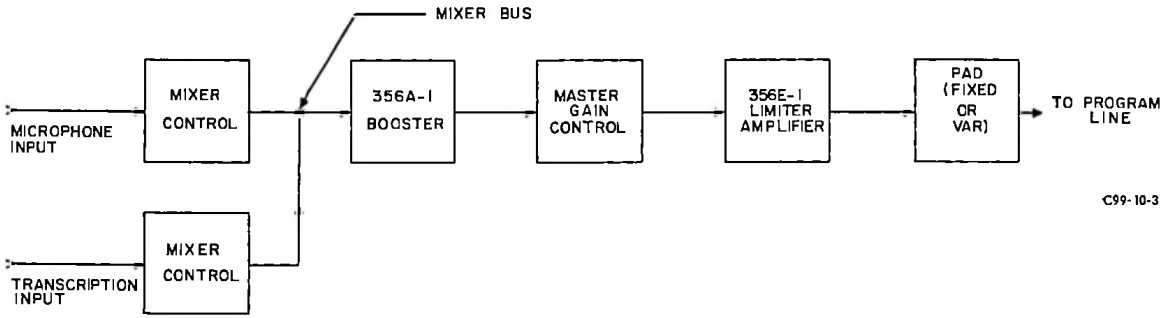
| Function | Symbol | Tube Type |
|------------------|--------|-----------|
| Input amplifier | V601 | GL6386 |
| Output amplifier | V602 | 6V6 |
| Output amplifier | V603 | 6V6 |
| Bias rectifier | V604 | 6AL5 |

1.4 ELECTRICAL CHARACTERISTICS.

1.4.1 CONNECTORS. One 12-pin connector, P601, is located at the front end of the chassis. All connections for input, output, and power are made at this connector. Two jacks, J601 and J602, are provided at the front corners of the chassis top for measurement of threshold voltage.

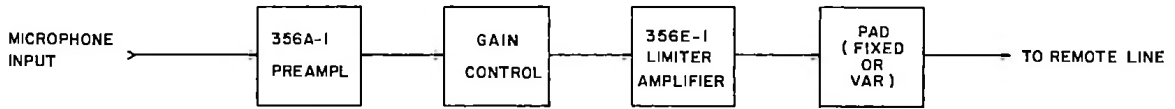
1.4.2 POWER REQUIREMENTS. Power requirements for the 356E-1 are as follows: 300 volts d-c at 77 milliamperes and 6.3 volts a-c at 1.55 amperes.

1.4.3 FREQUENCY RANGE. The frequency range of the 356E-1 is 50 to 15,000 cycles per second.

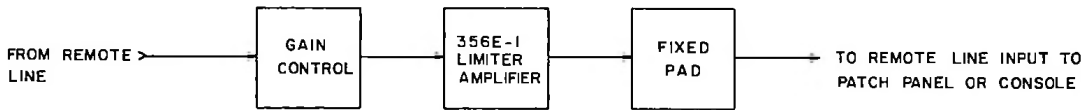


C99-10-3

Figure 2. Collins Type 356E-1 Limiter Amplifier as Automatic Fader Control, Suggested Arrangement



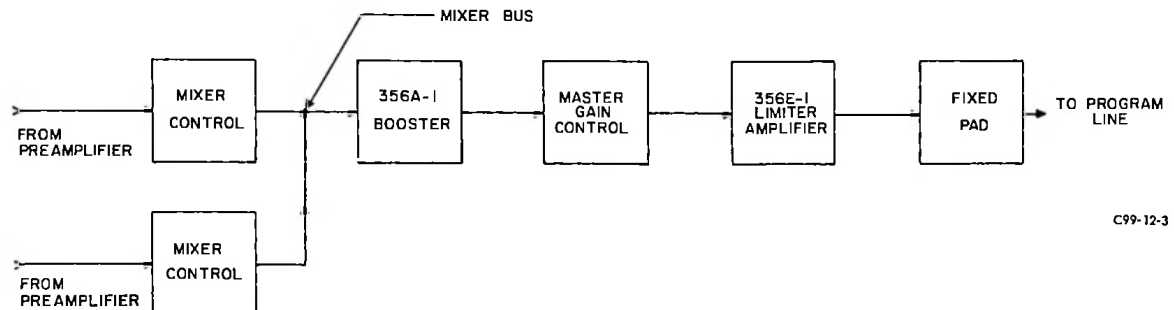
A. 356E-1 LIMITER AMPLIFIER LOCATED REMOTELY



B. 356E-1 LIMITER AMPLIFIER FED FROM REMOTE LINE

C99-13-3

Figure 3. Collins Type 356E-1 Limiter Amplifier as Automatic Level Control, Suggested Arrangement



C99-12-3

Figure 4. Collins Type 356E-1 Limiter Amplifier as Automatic Mixer, Suggested Arrangement

1.4.4 INPUT IMPEDANCE. Limiter Amplifier 356E-1 is factory wired for 600 ohms unloaded transformer input impedance. It may be rewired for 150 ohms input impedance if desired. See figure 11.

1.4.5 GAIN. The gain of the 356E-1 is 54 db.

1.4.6 OUTPUT IMPEDANCE. The 356E-1 is factory wired for 600 ohms output impedance. It may be rewired for 150 ohms output impedance if desired. See figure 11.

1.4.7 FREQUENCY RESPONSE. The frequency response of the 356E-1 is ± 1 db from 50 to 15,000 cps.

1.4.8 DISTORTION. The distortion of the 356E-1 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 threshold set at +20 dbm output).

1.4.9 NOISE LEVEL. The noise level in the output of the 356E-1 is -50 dbm with threshold control set for +20 dbm output.

1.4.10 COMPRESSION RATIO. The compression ratio of the 356E-1 is adjustable from a ratio of 1.6/1 to a ratio of 5/1. A ratio of 3/1 is optimum over a 30-db range of input levels.

1.4.11 ATTACK TIME. The attack time of the 356E-1 is 11 milliseconds with the switch set in DUAL position or 62 milliseconds with the switch set in AVERAGE position.

1.4.12 RELEASE TIME. The release time of Limiter Amplifier 356E-1 is 0.9 seconds for 63% recovery with the switch set in the DUAL position, or 5.2 seconds for 63% recovery with the switch set in the AVERAGE position.

2.1 CIRCUIT DESCRIPTION.

Figure 11 is a schematic diagram of Limiter Amplifier 356E-1. Transformer T601 couples input signal to the grids of the push-pull input stage V601. Output from V601 is coupled to the grids of the push-pull output stage by C602 and C603. The output stage is transformer coupled to the load by T602. The threshold voltage control (R612) adjusts the positive bias applied to the cathodes of the bias rectifier V604. A sample of the output signal from the plates of V602 and V603 is coupled to the bias rectifier cathodes by C605 and C606. When the audio voltage at the plates of the output stage is high enough to overcome the threshold voltage, the bias rectifier V604 conducts. Plate current for V604 develops a negative voltage across R616. This negative voltage is the control voltage for the automatic gain circuit. It is applied to the grid return of the input amplifier V601. 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 V604 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 V604. When S601 is in DUAL position, C607 is charged by the voltage across R616 and the attack time of the amplifier is determined by the time constant of R615 and C607. When the switch, S601, is in the same position and V604 stops conducting, the release time of the circuit is the time necessary for C607 to discharge through R616. When S601 is in AVERAGE position, R617 is shorted out. This connects C608 in parallel with C607 and the attack time is determined by the RC time constant of R615 and the sum of the capacities of C607 and C608. When V604 stops conducting, the release time of the circuit is the time necessary for C607 and C608 to discharge through R616.

2.2 APPLICATION.

2.2.1 GENERAL. The 356E-1 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.

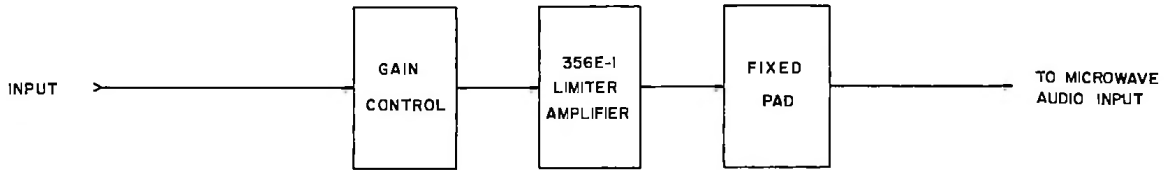
2.2.2 THE 356E-1 USED AS AUTOMATIC FADER CONTROL. Refer to figure 2. The 356E-1 is plugged into J108 of the 212F-1 Broadcast Console. Operate the switch on the 356E-1 to DUAL position. Adjust the mixer in the transcription channel until the GR meter indicates a 2 to 5 db gain reduction. Adjust the mixer 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.

2.2.3 THE 356E-1 USED AS AUTOMATIC LEVEL CONTROL IN UNATTENDED REMOTE OPERATION. Figure 3A shows a suggested arrangement for using Limiter Amplifier 356E-1 at a remote location. Figure 3B shows a suggested arrangement for using the 356E-1 at a studio with input from a remote line.

With an average input signal, adjust the input to the 356E-1 to produce approximately 15-db gain reduction.

2.2.4 THE 356E-1 USED AS AUTOMATIC MIXER. Figure 4 shows a suggested arrangement for using the 356E-1 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.



C99-11-3

Figure 5. Collins Type 356E-1 Limiter Amplifier as Automatic Level Control in Microwave Relay Systems, Suggested Arrangement

2.2.5 THE 356E-1 USED IN MICROWAVE RELAY SYSTEM. Figure 5 shows a suggested arrangement for using the 356E-1 to minimize audio level variations in a microwave relay system.

2.3 ADJUSTMENTS OR MODIFICATIONS.

2.3.1 GENERAL. The following paragraphs describe adjustments of threshold voltage for various input and output levels, modification of resistor values for various release times, and modification of meter and switching circuits to provide for monitoring the amount of gain reduction.

2.3.2 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 23.5 volts for an output level of +20 dbm. If this level is too high, a fixed pad may be inserted in the output line. For selection of resistor values for selected values of attenuation, refer to figure 6.

TABLE 1. THRESHOLD VOLTAGE SETTINGS

| Input DBM | Output DBM | Threshold Voltage |
|-----------|------------|-------------------|
| -44 | +10 | 7.5 |
| -40 | +14 | 12.0 |
| -36 | +18 | 19.5 |
| *-34 | *+20 | *23.5 |
| -32 | +22 | 29.0 |
| -28 | +26 | 45.0 |
| -24 | +30 | 69.0 |
| *Optimum | | |

2.3.3 RELEASE TIME. The release time of the 356E-1 is satisfactory for most applications. If some other

| LOSS IN DB | R1 IN OHMS | R2 IN OHMS | R1 IN OHMS | R2 IN OHMS |
|------------|------------|------------|------------|------------|
| 0 | 0 | OPEN | 0 | OPEN |
| 3 | 103 | 1703 | 51.3 | 1703 |
| 6 | 199 | 803 | 98 | 803 |
| 10 | 312 | 422 | 156 | 422 |
| 15 | 419 | 220 | 209 | 220 |
| 20 | 490 | 121 | 245 | 121 |

C99-18-3

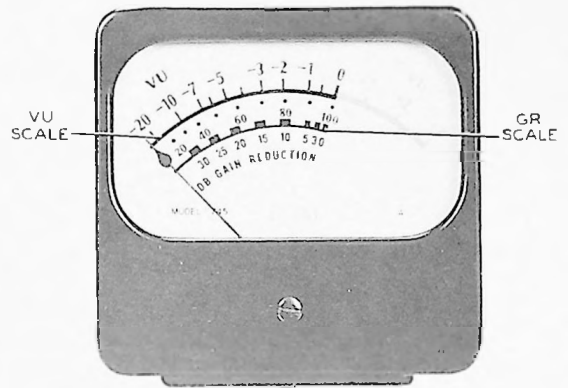
Figure 6. Resistor Values for 600-Ohm Fixed Pads

value of release time is desired, change the values of R616 and R617. Table 2 gives other values of resistance for R616 and R617 with corresponding release times.

TABLE 2. VALUES OF R616 AND R617 AND CORRESPONDING RELEASE TIMES

| Megohms | | DUAL Position Seconds | | AVERAGE Position Seconds |
|---------|------|-----------------------|------|--------------------------|
| R616 | R617 | 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 |

2.3.4 MODIFICATION OF VU METER AND SWITCHING CIRCUITS TO READ GAIN REDUCTION.



C99-26-P.

Figure 7. Vu Meter With GR Scale Decal Applied

Procedures for application of the GR-scale decal (supplied with the 356E-1) and for modification of switching circuits are outlined in the following steps:

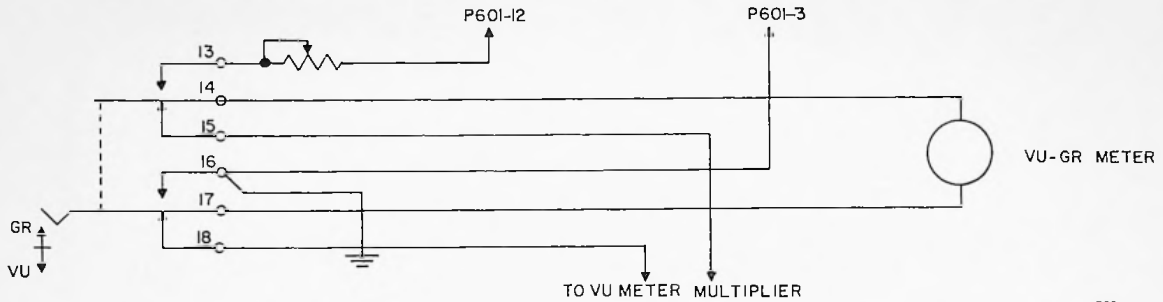
- a. Remove the front of the vu meter.
- b. Prepare the decal for application according to printed instructions on the decal.

TABLE 3. VOLTAGE AND RESISTANCE MEASUREMENTS FOR THE 356E-1 LIMITER AMPLIFIER

Conditions of measurements:

- a. Voltage readings are taken with a 20,000 ohms-per-volt meter.
- b. Line voltage 115 v a-c. Plate voltage adjusted to +300 volts d-c.
- c. Resistance readings taken with no power applied and amplifier disconnected from power supply.
- d. All measurements from terminal to B-.

| Tube | | Pin Number | | | | | | | | |
|----------------|------|------------|---------|---------|-------|------|-----|---------|-----|-------|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| V601 (6386) | V DC | 20-50 | 1.2 | -0.2 | 67 | 0 | 67 | -0.2 | 1.2 | 20-50 |
| | V AC | 3.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3.0 |
| | Ohms | Inf | 200 | 3.8 meg | 300K | Inf | 55K | 3.8 meg | 200 | Inf |
| V602 (6V6) | V DC | 0 | 20-50 | 290 | 300 | 0 | 0 | 20-50 | 18 | |
| | V AC | 0 | 3.0 | 0 | 0 | 0 | 0 | 3.0 | 0 | |
| | Ohms | Inf | Inf | 300K | 300K | 510K | Inf | Inf | 230 | |
| V603 (6V6) | V DC | 0 | 20-50 | 290 | 300 | 0 | 0 | 20-50 | 18 | |
| | V AC | 0 | 3.0 | 0 | 0 | 0 | 0 | 3.0 | 0 | |
| | Ohms | Inf | Inf | 300K | 300K | 510K | Inf | Inf | 230 | |
| V604 (6AL5) | V DC | 0 | 0 | 20-50 | 20-50 | 0 | 0 | 0 | | |
| | V AC | 0 | 0 | 3.0 | 3.0 | 0 | 0 | 0 | | |
| | Ohms | 510K | 3.8 meg | Inf | Inf | 510K | Inf | 3.8 meg | | |



C99-14-2

Figure 8. Vu Meter and GR Switch Connections, Schematic Diagram

c. Apply the decal to the VU meter scale with the plain black line of the decal directly over the black line on the meter scale and with the zero of the decal aligned with the zero of the meter scale. See figure 7.

d. Replace the front of the VU meter.

e. If VU-GR switching is desired, refer to figure 8 for wiring connections.

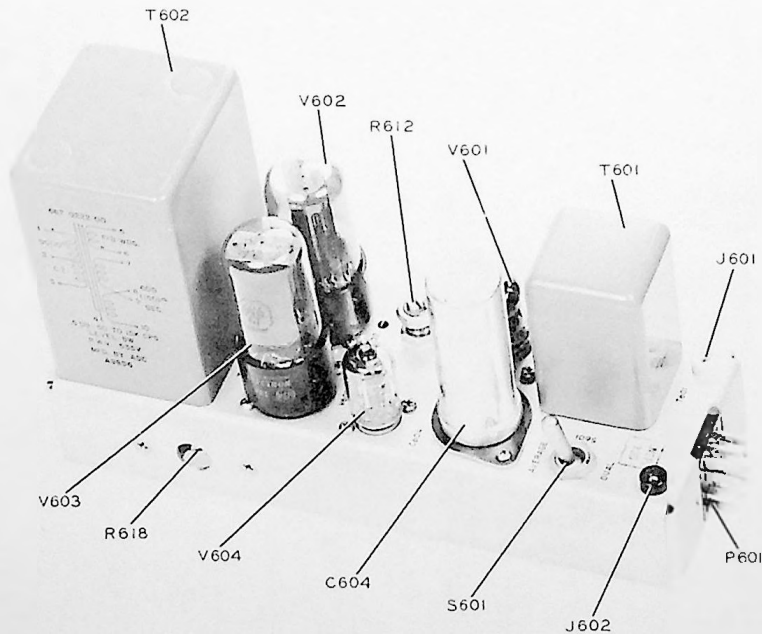
3.1 MAINTENANCE.

Normal maintenance will consist of tube replacement. When replacing V602 and V603, adjust R618 for minimum distortion at 50 cps. As these tubes age, this adjustment may again be made. If excessive distortion

occurs, replace V602 and V603. Table 3 gives voltage and resistance measurements for Limiter Amplifier 356E-1.

4.1 TABLE OF REPLACEABLE PARTS.

Table 4 gives the description, circuit function, and Collins part number for all replaceable parts in Limiter Amplifier 356E-1. When replacement of parts is necessary, only parts identical or equivalent to those listed should be used. All parts on top of the chassis are identified in figure 9. All parts mounted beneath the chassis are identified in figure 10.



C99-42-P.

Figure 9. Limiter Amplifier, 356E-1 Top View

TABLE 4. TABLE OF REPLACEABLE PARTS FOR LIMITER AMPLIFIER 356E-1

| ITEM | CIRCUIT FUNCTION | DESCRIPTION | COLLINS PART NUMBER |
|------|---|--|------------------------|
| C601 | Frequency compensation | CAPACITOR: paper, 0.001 uf $\pm 10\%$, 400 vdcw | 931 0277 00 |
| C602 | Coupling | CAPACITOR: paper, 0.1 uf $\pm 10\%$, 400 vdcw | 931 0299 00 |
| C603 | Coupling | SAME as C-602 | 931 0299 00 |
| C604 | Decoupling | CAPACITOR: electrolytic; dual section; 20 uf -10% +50%, 450 vdcw each section | 183 1262 00 |
| C605 | Coupling | SAME as C602 | 931 0299 00 |
| C606 | Coupling | SAME as C602 | 931 0299 00 |
| C607 | Part of attack-and- release time circuit | CAPACITOR: paper, 0.22 uf $\pm 10\%$, 400 vdcw | 931 0303 00 |
| C608 | Part of attack-and- release time circuit | CAPACITOR: paper, 1.00 uf $\pm 20\%$, 200 vdcw | 931 0908 00 |
| E601 | Tie point | TERMINAL, stud: melamine body, terminal, brass hot tin tipped, base brass, cadmium plated; hex | 306 0234 00 |
| E602 | Tie point | SAME as E601 | 306 0234 00 |
| J601 | Pin jack | JACK, TIP: small phone tip, insulated w/ yellow low-loss nylon; nonprecious contact w/ precious metal finish; solder wire attachment | 360 0066 00 |
| J602 | Pin jack | CONNECTOR, receptacle: 1 round female contact; straight type | 360 0063 00 |
| P601 | Connector | CONNECTOR, plug: 12 rectangular male contacts | 365 2120 00 |
| R601 | Frequency compensation | RESISTOR: comp, 0.33 megohm $\pm 5\%$, 1/2 w | 745 1456 00 |
| R602 | Cathode bias for V601A | RESISTOR: comp, 130 ohms $\pm 5\%$, 1/2 w | 745 1315 00 |
| R603 | Cathode bias for V601B | SAME as R602 | 745 1315 00 |
| R604 | Cathode bias for V601 | RESISTOR: comp, 68 ohm $\pm 5\%$, 1/2 w | 745 1302 00 |
| R605 | Plate load for V601A | RESISTOR: comp, 10,000 ohms $\pm 5\%$, 1/2 w | 745 1393 00 |
| R606 | Plate load for V601B | SAME as R605 | 745 1393 00 |
| R607 | Decoupling | RESISTOR: wire wound, 20,000 ohms $\pm 5\%$, 5 w | 747 9796 00 |
| R608 | Grid load for V602 | RESISTOR: comp, 0.51 megohm $\pm 5\%$, 1/2 w | 745 1466 00 |
| R609 | Cathode bias | RESISTOR: comp, 180 ohm $\pm 10\%$, 2 w | 745 5621 00 |
| R610 | Grid load for V603 | SAME as R608 | 745 1466 00 |
| R611 | Voltage-dropping | RESISTOR: comp, 0.20 megohm $\pm 5\%$, 1/2 w | 745 1448 00 |
| R612 | Threshold voltage adjust | RESISTOR: variable; comp, 100,000 ohms $\pm 20\%$, 2 w at 70°C | 380 5766 00 |
| R613 | Diode bias | SAME as R608 | 745 1466 00 |

TABLE 4. TABLE OF REPLACEABLE PARTS FOR LIMITER AMPLIFIER 356E-1 (Cont)

| ITEM | CIRCUIT FUNCTION | DESCRIPTION | COLLINS PART NUMBER |
|-------|---|---|---------------------|
| R614 | Diode bias | SAME as R608 | 745 1466 00 |
| R615 | Part of attack-and-release time circuit | RESISTOR: comp, 51,000 ohms $\pm 5\%$, 1/2 w | 745 1424 00 |
| R616 | Part of attack-and-release time circuit | RESISTOR: comp, 4.3 megohm $\pm 5\%$, 1/2 w | 745 1504 00 |
| R617 | Part of attack-and-release time circuit | RESISTOR: 10 megohm $\pm 5\%$, 1/2 w | 745 1519 00 |
| R618 | V602, V603 cathode balance | RESISTOR: variable; 100 ohms $\pm 10\%$ WW A linear; 2 watts | 750 0516 00 |
| S601 | Selects Dual or AVERAGE limiting | SWITCH, toggle: spst, 30 V dc, 20 amps in locking position, phenolic body | 266 3072 00 |
| T601 | Input transformer | TRANSFORMER, AF: input type; 1000 cps, 1 milliwatt; primary 600 ohm, tap No. 1, 150 ohms, connected CT, tap No. 2, 150 ohms, 500 rms; secondary 60,000 ohms connected CT, 500 rms | 667 0211 00 |
| T602 | Output transformer | TRANSFORMER, AF: output type; primary 9000 ohms, secondary impedance 600 ohms when series connected; 150 ohm when parallel connected; transformer contains a feedback winding shielded between primary and secondary grounded | 667 0222 00 |
| TE601 | | BOARD, TERMINAL: phenolic, 3 solid lug terminals, brass terminals | 306 9033 00 |
| TB602 | | SAME as TB601 | 306 9033 00 |
| TB603 | | SAME as TB601 | 306 9033 00 |
| TE604 | | SAME as TB601 | 306 9033 00 |
| V601 | Input amplifier | TUBE, electron: vacuum tube, 6386 | 253 0015 00 |
| V602 | Output amplifier | TUBE, electron: receiving tube beam, 6V6 GT | 255 0021 00 |
| V603 | Output amplifier | SAME as V602 | 255 0021 00 |
| V604 | Diode limiter | TUBE, electron: twin diode rectifier 6AL5 | 257 0018 00 |
| XV601 | | SOCKET, tube: 9 contact miniature | 220 1262 00 |
| XV602 | | SOCKET, tube: 8 prong octal | 220 1005 00 |
| XV603 | | SAME as XV602 | 220 1005 00 |
| XV604 | | SOCKET TUBE: 7 contact miniature | 220 1235 00 |

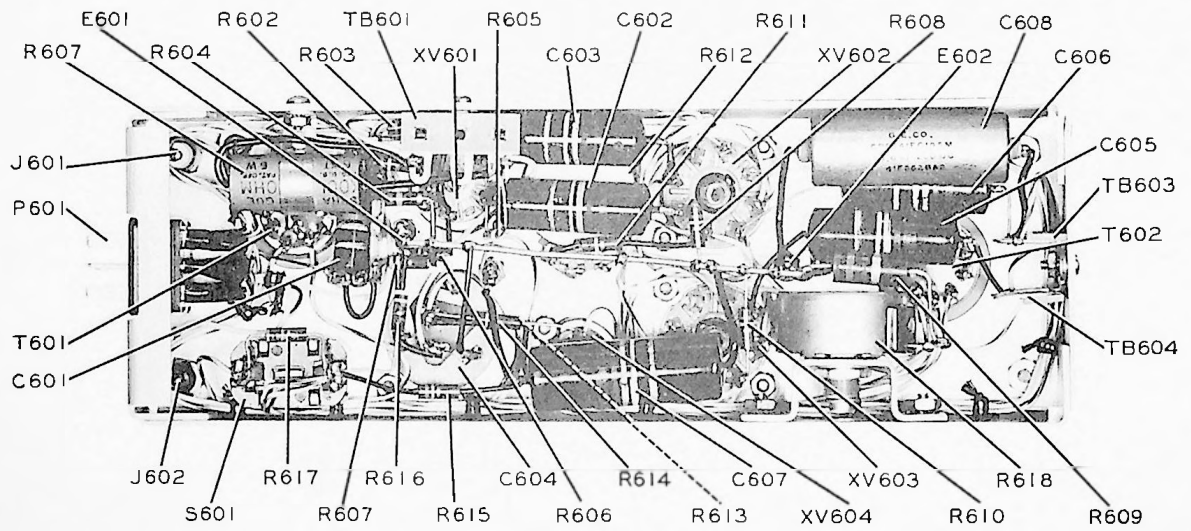
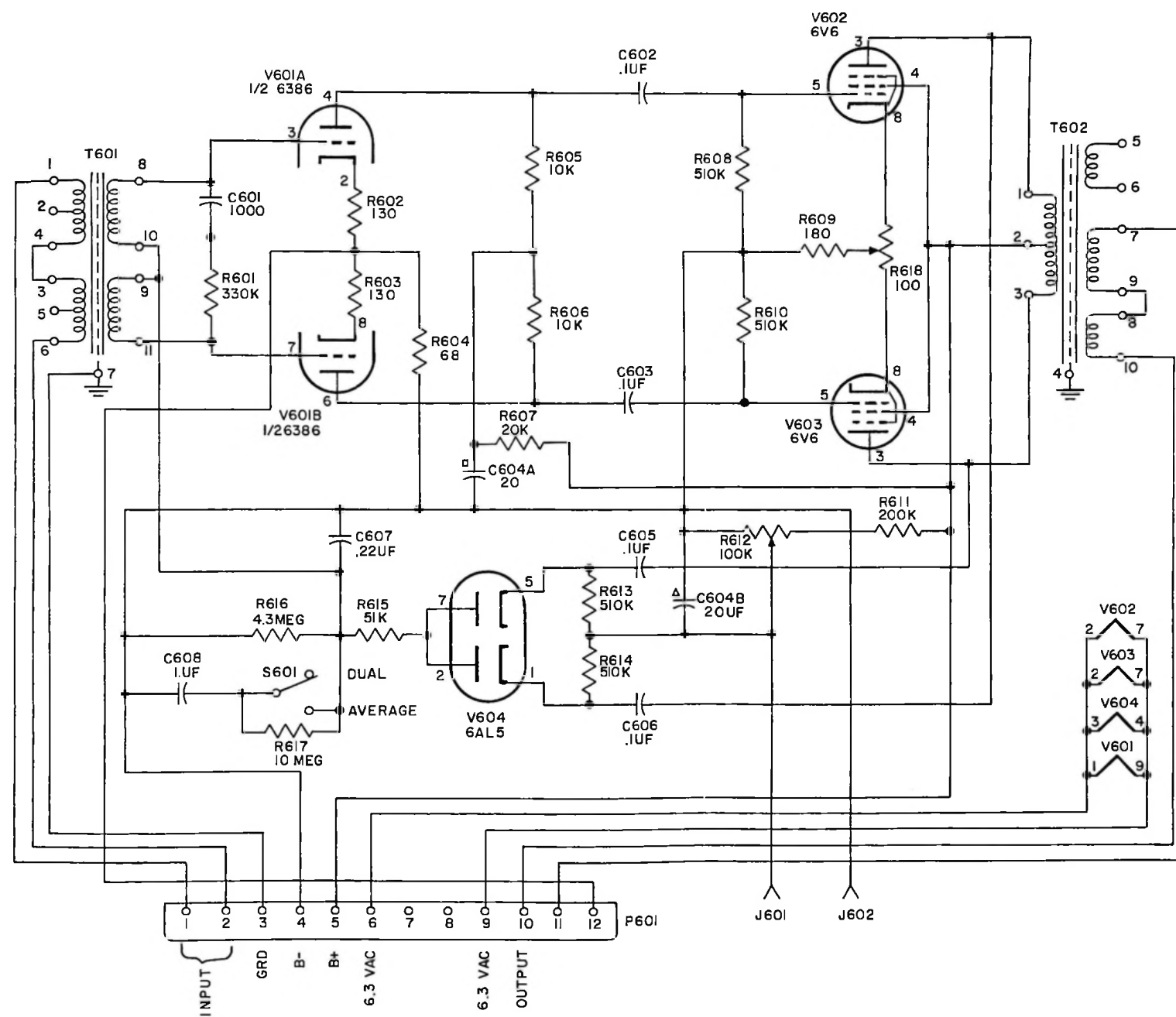


Figure 10. Limiter Amplifier, 356E-1 Bottom View

C99-43-P.



NOTES
 1. UNLESS OTHERWISE SPECIFIED, RESISTOR VALUES ARE IN OHMS,
 CAPACITOR VALUES ARE IN MICROMICROFARADS.
 2. S601 SHOWN IN DUAL POSITION.

Figure 11. Limiter Amplifier 356E-1,
 Schematic Diagram

UNIT INSTRUCTIONS

TD-326
3rd EDITION, 15 SEPTEMBER 1961
523-0034-00

CUE AMPLIFIER 356Q-1

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1960, 1961

CEDAR RAPIDS, IOWA, U.S.A.

PRINTED IN THE UNITED STATES OF AMERICA

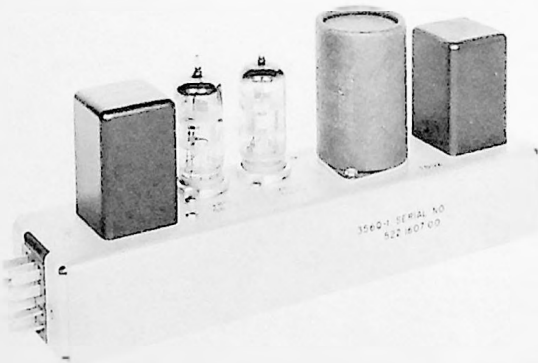


Figure 1. Cue Amplifier 356Q-1

CS83-14-P

1.1 PURPOSE OF EQUIPMENT.

Cue Amplifier 356Q-1 is intended for use as an audio amplifier with broadcast equipment, such as Collins Broadcast Console 212G-1. It may be used in AM, FM, and TV broadcast service or program control in audio systems for cueing tapes and records.

1.2 PHYSICAL DESCRIPTION.

The 356Q-1 (figure 1) is a plug-in module containing the necessary circuitry for two stages of audio amplification. The 356Q-1 is 4-5/8 inches high, 2-1/8 inches wide, and 9-1/2 inches long and weighs approximately 2-1/4 pounds.

1.3 TUBE COMPLEMENT.

| FUNCTION | SYMBOL | TUBE TYPE |
|------------------|--------|-----------|
| Input amplifier | V801 | 5879 |
| Output amplifier | V802 | 5879 |

1.4 ELECTRICAL CHARACTERISTICS.

a. CONNECTORS. One 12-pin connector, P801, is located at the front end of the chassis. All connections to the 356Q-1 are made at this connector.

b. POWER REQUIREMENTS. Power requirements for Cue Amplifier 356Q-1 are as follows: 250-300 volts d-c filtered at 6.5-7.5 ma and 6.3 volts a-c or d-c at 0.3 ampere.

c. FREQUENCY RANGE. The frequency range of the 356Q-1 is 300 to 10,000 cycles per second.

d. INPUT IMPEDANCE. Cue Amplifier 356Q-1 is factory wired for 600 ohms unloaded transformer input impedance.

e. GAIN. A -30-dbm nominal input signal produces an output of +20 dbm nominal. Gain through the amplifier is 55 db.

f. OUTPUT IMPEDANCE. Cue Amplifier 356Q-1 is factory wired for 4 ohms output impedance.

g. FREQUENCY RESPONSE. The frequency response of the 356Q-1 is within 3 db from 300 to 10,000 cps.

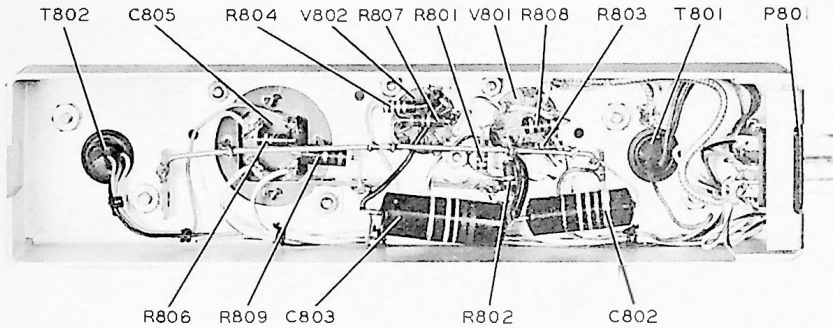


Figure 2, Cue Amplifier 356Q-1,
Bottom View

C593-22-P

h. NOISE LEVEL. The equivalent input noise level of Cue Amplifier 356Q-1 is -100 dbm. When the 356Q-1 is used with Collins Power Supply 409X-2, the filaments are maintained at approximately +30 volts d-c above ground. This positive bias minimizes a-c noise in the amplifier.

2.1 CIRCUIT DESCRIPTION.

Figure 3 is a schematic diagram of Cue Amplifier 356Q-1. Input to the 356Q-1 is coupled by transformer T801 and the CUE gain control, R58, in the 212G-1, to the grid of V801.

NOTE

If Cue Amplifier 356Q-1 is used in equipment that does not provide a cue gain control, a 50,000-ohm potentiometer must be connected between terminals 8, 12, and 3 of P801. The potentiometer tap must be connected to terminal 8. Terminal 3 is ground.

The input amplifier, V801, is a pentode-connected type 5879. Its output is resistance-capacitance coupled to the grid of a triode connected type 5879, V802. Output from V802 is taken from the secondary winding of transformer T802. All connections to the 356Q-1 are made at P801.

3.1 MAINTENANCE.

Normal maintenance consists of tube replacement. Voltage and resistance measurements may be made by referring to figure 3.

4.1 REPLACEABLE PARTS.

The parts list gives the description and Collins part number for all replaceable parts in Cue Amplifier 356Q-1. When replacement of parts is necessary, only parts identical or equivalent to those listed should be used. All parts are identified in figure 2.

| ITEM | DESCRIPTION | COLLINS PART NUMBER |
|----------------------|---|---------------------|
| CUE AMPLIFIER 356Q-1 | | 522-1607-00 |
| C801 | NOT USED | |
| C802 | CAPACITOR, FIXED, PAPER: 400 v dc; 47,000 uuf, $\pm 10\%$ | 931-0295-00 |
| C803 | CAPACITOR, FIXED, PAPER: 0.1 uf $\pm 10\%$, 400 v dc w | 931-0299-00 |
| C804 | NOT USED | |
| C805 | CAPACITOR, FIXED, ELECTROLYTIC: 4 sections; 1 & 2, 450 v dc working, 20 uuf; sections 3 & 4, 50 v dc working, 50 uf | 183-1260-00 |
| P801 | CONNECTOR, RECEPTACLE, ELECTRICAL: 12 male contacts, 10 amps, 730 v ac | 365-2120-00 |
| R801 | RESISTOR, FIXED, COMPOSITION: 0.16 megohms $\pm 5\%$, 1/2 w | 745-1445-00 |
| R802 | RESISTOR, FIXED, COMPOSITION: 0.10 megohms $\pm 10\%$, 1/2 w | 745-1436-00 |
| R803 | RESISTOR, FIXED, COMPOSITION: 51,000 ohms $\pm 5\%$, 1/2 w | 745-1424-00 |
| R804 | RESISTOR, FIXED, COMPOSITION: 0.47 megohms, $\pm 10\%$, 1/2 w | 745-1464-00 |
| R805 | NOT USED | |
| R806 | RESISTOR, FIXED, COMPOSITION: 30,000 ohms $\pm 5\%$, 1/2 w | 745-1413-00 |

| ITEM | DESCRIPTION | COLLINS PART NUMBER |
|-------|--|---------------------|
| R807 | RESISTOR, FIXED, COMPOSITION: 820 ohms $\pm 5\%$, 1/2 w | 745-1348-00 |
| R808 | RESISTOR, FIXED, COMPOSITION: 8200 ohms, $\pm 10\%$, 1/2 w | 745-1391-00 |
| R809 | RESISTOR, FIXED, COMPOSITION: 9100 ohms, $\pm 5\%$, 1 w | 745-3392-00 |
| R801 | TRANSFORMER, AUDIO, FREQUENCY: input type, primary 600 ohms, secondary 50,000 ohms; primary current rating-zero; secondary current rating-zero; metal encased. 1-5/16 x 1-5/16 x 2-1/16 in. h two threaded stud type terminals | 667-0442-00 |
| T802 | TRANSFORMER, AUDIO, FREQUENCY: output type; primary 16,000 ohms; secondary 4 ohms; primary current rating-7 ma; secondary current rating-zero; metal encased 1-9/32 x 1-9/32 x 1-61/64 in. h; wire lead terminals | 667-0441-00 |
| V801 | ELECTRON TUBE: type 5879 | 257-0104-00 |
| V802 | ELECTRON TUBE: same as V801 | 257-0104-00 |
| XV801 | SOCKET, ELECTRON TUBE: 9 contact miniature top mtg tube socket w/o shield base; plastic | 220-1274-00 |
| XV802 | SOCKET, ELECTRON TUBE: same as XV801 | 220-1274-00 |

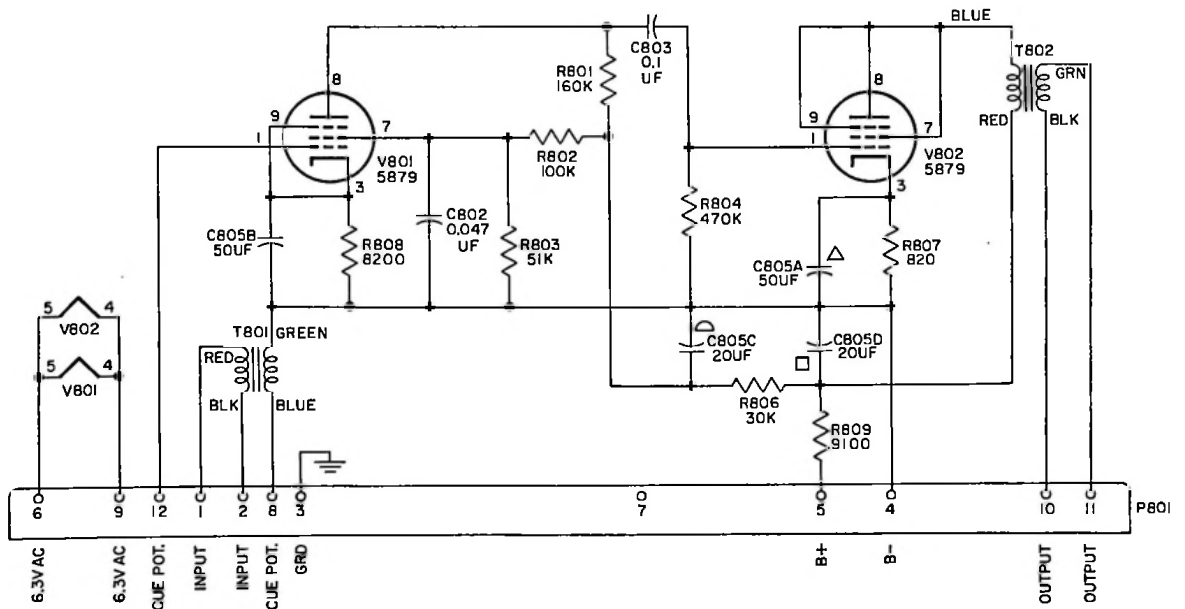


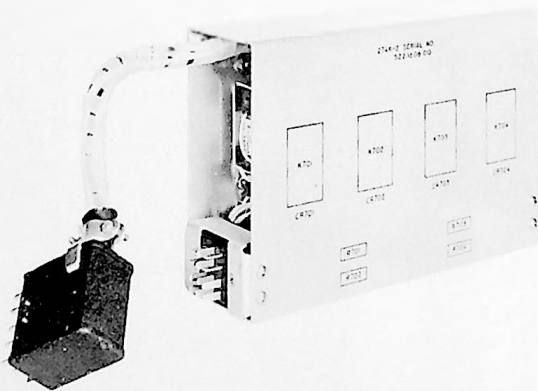
Figure 3. Cue Amplifier 356Q-1, Schematic Diagram

RELAY UNIT 274K-2

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1960

CEDAR RAPIDS, IOWA, U.S.A.

PRINTED IN THE UNITED STATES OF AMERICA



C583-13-P

Figure 1. Relay Unit 274K-2

1.1 PURPOSE OF EQUIPMENT.

Relay Unit 274K-2 controls application of audio power to station speakers and a-c power to studio warning lights when used with broadcast studio equipment, such as Collins Broadcast Console 212G-1. It may be used in AM, FM, and TV broadcast service or program control in audio systems.

1.2 PHYSICAL DESCRIPTION.

Relay Unit 274K-2 (figure 1) is a plug-in module containing four 12-volt d-c relays and their associated circuitry. The 274K-2 is provided with a cover to protect relay contacts from dust and damage while handling. The 274K-2 is 5-1/2 inches high, 2-1/2 inches wide, and 9-1/2 inches long and weighs approximately 2.5 pounds.

1.3 ELECTRICAL CHARACTERISTICS.

a. CONNECTORS. One 12-pin connector, P702, (Howard Jones Type P-312-AB) mounted on the front end of the chassis and one 15-pin connector, P701, (Howard Jones Type P-315-CCE) on a 5-1/2-inch pendant cable.

b. POWER REQUIREMENTS. Power requirements for Relay Unit 275K-2 are 12 volts d-c at 560 milliamperes.

c. NOISE. The four relays of the 274K-2 are mounted on rubber to minimize noise.

2.1 CIRCUIT DESCRIPTION.

Figure 3 is a schematic diagram of Relay Unit 274K-2. The relays are normally de-energized. When 12 volts d-c is applied, the relays are energized. All connections to the relay coils and contacts are made at P701 and P702. CR701 through CR704 are connected as transient suppressors across the relay coils to minimize radio interference and contact wear. Power necessary for operation of the relays must be supplied from an external source, such as Collins Power Supply 409X-2.

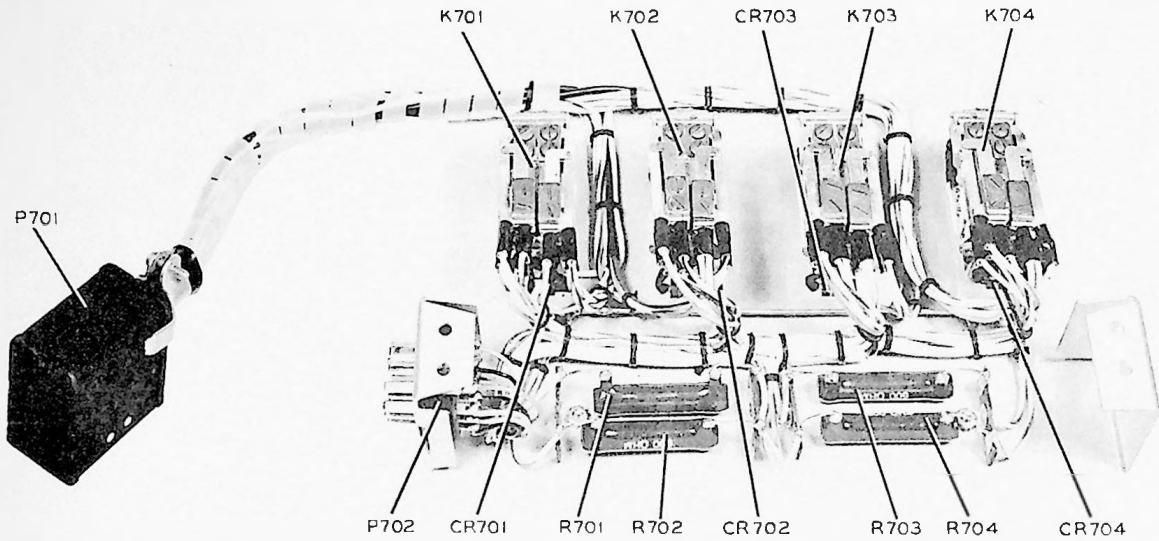


Figure 2. Relay Unit 274K-2, Cover Removed

C583-18-P

3.1 MAINTENANCE.

Relay Unit 274K-2 requires very little maintenance other than periodic inspections. Keep the relay contacts clean and bright. Refer to figure 3, if necessary, to perform continuity checks.

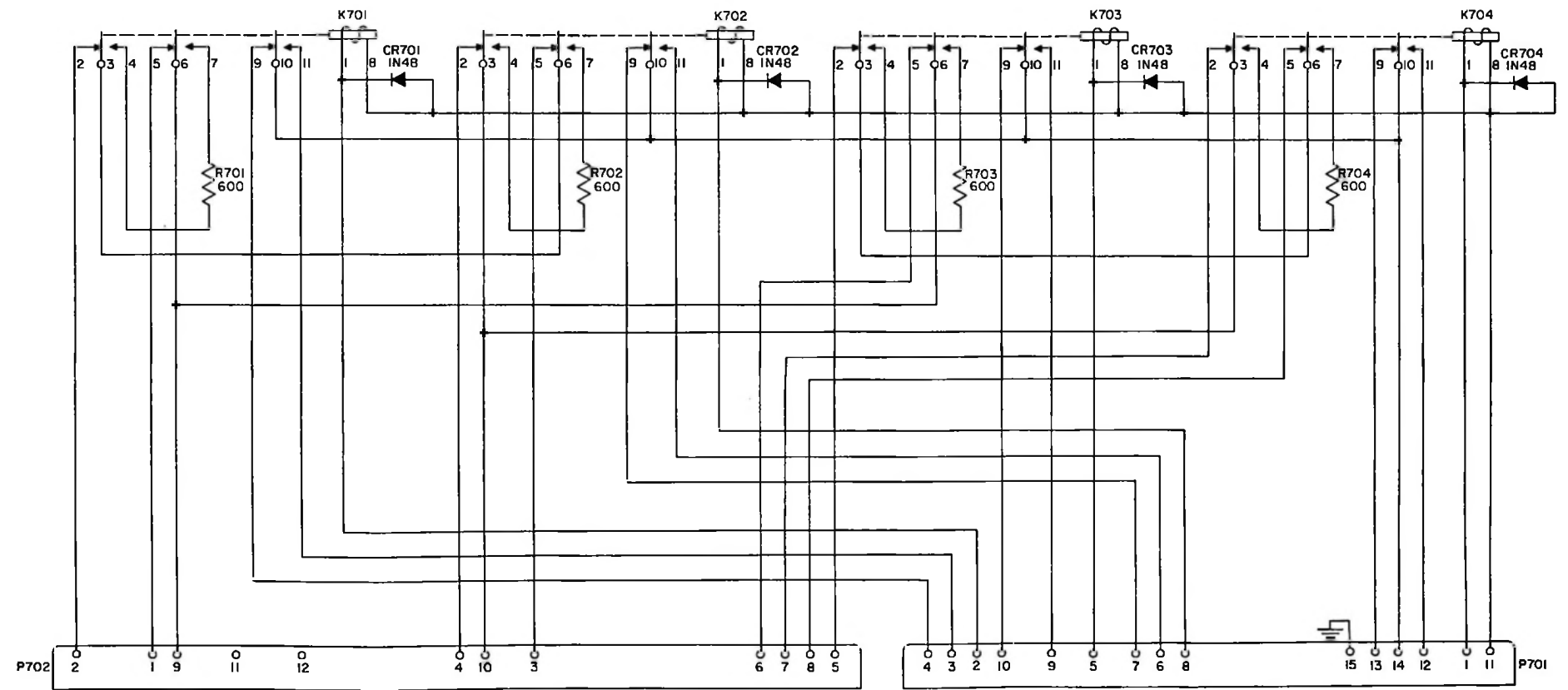
4.1 REPLACEABLE PARTS.

The parts list gives the description and Collins part number for all replaceable parts in Relay Unit 274K-2. When replacement of parts is necessary, only parts identical or equivalent to those listed should be used. All parts are identified in figure 2.

PARTS LIST

| ITEM | DESCRIPTION | COLLINS PART NUMBER |
|-------------------|--|---------------------|
| RELAY UNIT 274K-2 | | 522 1606 00 |
| CR701 | SEMICONDUCTOR DEVICE, DIODE: germanium type 1N48; C.B.S. Hytron | 353 0027 00 |
| CR702 thru CR704 | SEMICONDUCTOR DEVICE, DIODE: same as CR701 | 353 0027 00 |
| K701 | RELAY, ARMATURE: contact arrangement, right 1C, left 2C; 12 v, 3 amps, 150 w | 970 1139 00 |
| K702 thru K704 | RELAY, ARMATURE: same as K701 | 970 1139 00 |

| ITEM | DESCRIPTION | COLLINS PART NUMBER |
|----------------|--|---------------------|
| P701 | CONNECTOR, PLUG, ELECTRICAL: 15 male contacts; type 300 | 365 9150 00 |
| P702 | CONNECTOR, RECEPTACLE, ELECTRICAL: 12 male contacts, 10 amps, 730 v ac | 365 2120 00 |
| R701 | RESISTOR, FIXED, WIRE WOUND: 600 ohms, ±10%, 7 w at 25°C derated linearly to 3.5 w at +105°C | 710 9017 00 |
| R702 thru R704 | RESISTOR, FIXED, WIRE WOUND: same as R701 | 710 9017 00 |



C583-03-4

Figure 3. Relay Unit 274K-2, Schematic Diagram

UNIT INSTRUCTIONS

TD-328
15 JANUARY 1960
523 0035 00

POWER SUPPLY 409X-2

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1960

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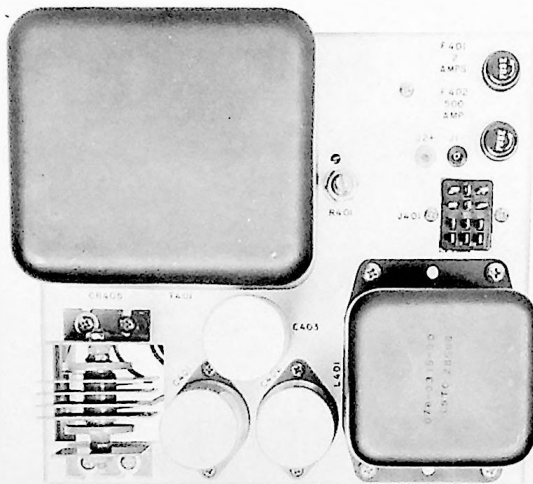


Figure 1. Power Supply 409X-2

C583-17-P

1.1 PURPOSE OF EQUIPMENT.

Power Supply 409X-2 furnishes power for filaments, plate circuits, and relays in Collins Broadcast Consoles 212E-1, 212F-1, and 212G-1.

1.2 PHYSICAL DESCRIPTION.

Power Supply 409X-2 (figure 1) is a plug-in power supply. It is 9 inches long, 8 inches wide, and 6 inches high and weighs 25 pounds.

1.3 ELECTRICAL CHARACTERISTICS.

a. CONNECTORS. One 12-pin connector, J401, is located on top of the chassis. All connections to Power Supply 409X-2 are made at this connector.

b. POWER SOURCE. The 409X-2 requires a 115- or 230-volt a-c $\pm 10\%$, 50/60-cps, single-phase power source capable of supplying 225 watts maximum power.

c. OUTPUT VOLTAGES. The output of the 409X-2 is as follows: 250 to 300 volts d-c (adjustable) at 250 ma maximum, 6.3 volts a-c at 6.0 amperes, biased at approximately +30 volts d-c, 12 volts d-c at 1 ampere.

2.1 CIRCUIT DESCRIPTION.

Figure 3 is a schematic diagram of Power Supply 409X-2. The 409X-2 is factory wired for a 115-volt a-c operation, but may be connected to a 230-volt source if transformer T401 primary terminals are connected as follows: disconnect the wires from terminal 1 to terminal 2 and from terminal 3 to terminal 4 on TB401. Connect terminal 2 to terminal 3. Replace F401 with a 1.0-amp fuse. The power supply is protected by fuse F401 in the transformer primary circuit and by fuse F402 in the B- output lead. The 409X-2 has an unregulated output.

Four type 1N1492 silicon rectifiers, CR401 through CR404, are utilized to provide the high-voltage output. This output is filtered by C401, C402, and L401. The high-voltage output may be adjusted from 250 to 300 volts d-c by R401. A selenium rectifier, CR405, provides 12 volts d-c for operation of relays. The 12-volt supply is filtered by C403. The a-c power is supplied to the rectifying circuits from windings on T401. The winding associated with the 12-volt supply has a high-voltage tap to be used when necessary to compensate for aging of CR405. Another winding on T401 provides the 6.3-volt a-c for the filament string. This winding is biased with approximately +30 volts d-c to minimize a-c noise in the preamplifiers.

3.1 MAINTENANCE.

Normal maintenance consists of fuse replacement. Refer to figure 4, if necessary, to perform continuity or voltage checks. Test points J1- and J2+ are located on top of the chassis for ease of B+ adjustment.

4.1 REPLACEMENT PARTS.

The parts list gives the description and Collins part number for all replaceable parts in Power Supply 409X-2. When replacement of parts is necessary, only parts identical or equivalent to those listed should be used. All parts are identified in figure 2.

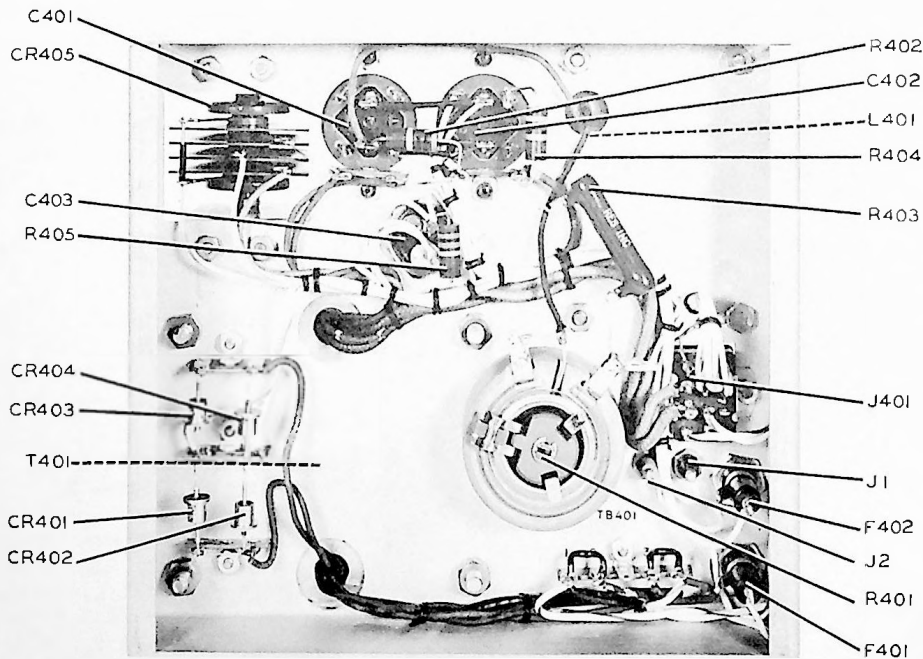


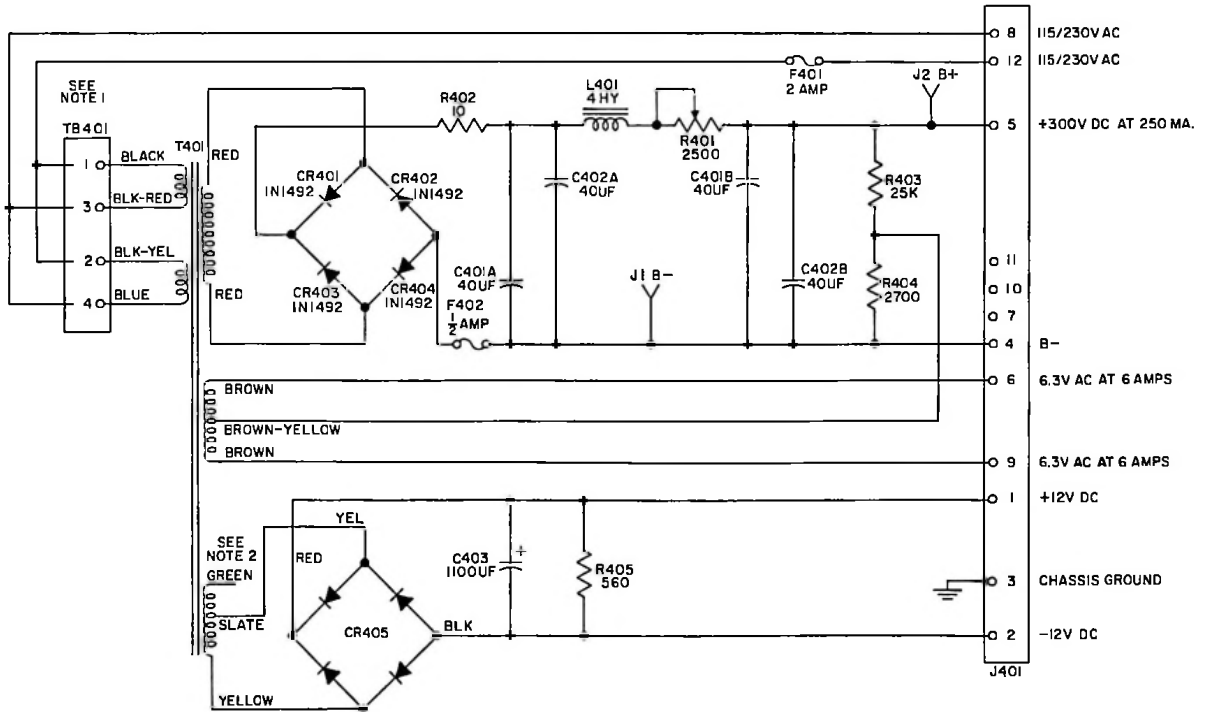
Figure 2. Power Supply 409X-2, Bottom View

C583-19-P

PARTS LIST

| ITEM | DESCRIPTION | COLLINS PART NUMBER |
|---------------------|--|---------------------|
| POWER SUPPLY 409X-2 | | 522 1691 000 |
| C401 | CAPACITOR, FIXED, ELECTROLYTIC: dual section, 40 uf ea, +5% -10%, 450 v dc | 183 1259 00 |
| C402 | CAPACITOR, FIXED, ELECTROLYTIC: same as C401 | 183 1259 00 |
| C403 | CAPACITOR, FIXED, ELECTROLYTIC: 1100 uf, 25 v dc | 184 2000 00 |
| CR401 | RECTIFIER: silicon, General Electric IN1492 | 353 1661 00 |
| CR402 | RECTIFIER: same as CR401 | 353 1661 00 |
| CR404 | RECTIFIER, METALLIC: selenium; Sarkes-Tarzian type 5N26-1B-1BBS | 353 0254 00 |
| CR405 | | |
| F401 | FUSE, CARTRIDGE: 2 amp, 125 v dc; time delay, ferrule type terminal | 284 0008 00 |
| F402 | FUSE, CARTRIDGE: 1/2 amp, 250 v; time delay, ferrule terminals; 1/4 in. dia. by 1-1/4 in. lg o/a | 264 0293 00 |
| J401 | CONNECTOR, RECEPTACLE, ELECTRICAL: 12 male contacts, 10 amps, 730 v ac; straight shape | 356 2120 00 |
| J1 | JACK, TIP: accommodates standard phone tip, black plastic insulation, precious metal plated contact, terminal lug for wire accommodation | 360 0063 00 |
| J2 | JACK, TIP: accommodates std phone tip, red plastic insulation, precious metal plated contact, terminal lug for wire accommodation | 360 0062 00 |

| ITEM | DESCRIPTION | COLLINS PART NUMBER |
|-------|--|---------------------|
| L401 | REACTOR: 4.0 by inductance 275 ma dc, 100 ohms dc resistance, metal encased, 3-1/4 in. by 4-1/32 in. by 3-7/8 in. h | 668 0446 00 |
| R401 | RESISTOR, VARIABLE, WIRE WOUND: 2500.0 ohms, ±10%, 50 w | 738 0231 00 |
| R402 | RESISTOR, FIXED, COMPOSITION: 10 ohms, ±10%, 2 w | 745 5568 00 |
| R403 | RESISTOR, FIXED, WIRE WOUND: 25,000 ohms, ±10%, 10 w | 710 8068 00 |
| R404 | RESISTOR, FIXED, COMPOSITION: 2700 ohms, ±10%, 2 w | 745 5670 00 |
| R405 | RESISTOR, FIXED, COMPOSITION: 560 ohms, ±10%, 2 w | 745 5642 00 |
| T401 | TRANSFORMER POWER STEP-UP, STEP-DOWN: encased, metal case, primary winding no. 1 and no. 2, 115 v each 230 connected, 50/60 cps secondary windings 265 v, 12.0 v, 13.5 v, 6.3 v ct | 662 0445 00 |
| TB401 | TERMINAL BOARD: phenolic; incl 5 solder lug terminals; 1/16 in. by 3/8 in. by approx 1-15/16 in. | 306 0550 00 |
| XF401 | FUSEHOLDER: extractor post type; 250 v, 15 amp | 265 1003 00 |
| XF402 | FUSEHOLDER: same as XF401 | 265 1003 00 |



NOTES:
 1. T401 WIRED FOR 115V OPERATION. FOR 230V OPERATION MAKE FOLLOWING CHANGES ON TB401: REMOVE JUMPERS 1 TO 2 AND 3 TO 4, ADD JUMPER 2 TO 3. REPLACE F401 WITH 1 AMP FUSE.
 2. GREEN LEAD OF T401 IS AN AGING TAP.

Figure 3. Power Supply 409X-2, Schematic Diagram

Electrical Wire Code

EXAMPLES:

| | | | | | |
|---------------|---|--------------------------|------------------------------------|-------------------------------|---------------------------------|
| DA 92 | UNSHIELDED WIRE, POLYVINYL, NO. 22 AWG, WHITE WITH A RED TRACER | | | | |
| | <u>D</u> Type of Wire | <u>A</u> Size of Wire | <u>9</u> Color of Body | <u>2</u> Color of Tracers | |
| DAS 9123 | SHIELDED WIRE (SINGLE) POLYVINYL, NO. 22 AWG, WHITE BODY WITH BROWN, RED AND ORANGE TRACERS | | | | |
| | <u>D</u> Type of Wire | <u>A</u> Size of Wire | <u>S</u> Shielded | <u>9</u> Color of Body | <u>123</u> Color of Tracers |
| DASJ (9) (92) | SHIELDED AND JACKETED WIRE (MULTIPLE), POLYVINYL, NO. 22 AWG, WHITE AND WHITE WITH RED TRACER | | | | |
| | <u>D</u> Type of Wire | <u>A</u> Size of Wire | <u>SJ</u> Shielded and Jacketed | <u>(9)</u> First Conductor | <u>(92)</u> Second Conductor |
| AZA 91 | UNSHIELDED WIRE, IRRADIATED POLYOLEFIN, NO. 22 AWG, WHITE WITH BLACK TRACER | | | | |
| | <u>A2</u> Type of Wire | <u>A</u> Size of Wire | <u>9</u> Color of Body | <u>1</u> Color of Tracer | |

| TYPE OF WIRE CODE | | SIZE OF WIRE | | COVERING OF WIRE | COLOR CODE | |
|-------------------|--|--------------|------------|------------------|------------|--------------|
| CODE | DESCRIPTION | CODE | SIZE | | CODE | TYPE |
| A | Cotton Braid Over Plastic | A | No. 22 AWG | | 0 | Black |
| A2 | Irradiated Modified Polyolefin, (300 Volts) | B | No. 20 | | 1 | Brown |
| A3 | Irradiated Modified Polyolefin, (600 Volts) | C | No. 18 | | 2 | Red |
| A4 | Irradiated Modified Polyolefin, (1000 Volts) | D | No. 16 | | 3 | Orange |
| A5 | Irradiated Modified Polyolefin, (3000 Volts) | E | No. 14 | | 4 | Yellow |
| B | Busswire, Round Tinned | F | No. 12 | | 5 | Green |
| C | Polyvinyl Chloride, MIL-W-16878, Type B (600 Volts) (No. 20-18-16) | G | No. 10 | | 6 | Blue |
| D | Polyvinyl Chloride, MIL-W-16878, Type B (600 Volts) (No. 22-26-28) | H | No. 8 | | 7 | Violet |
| E | Vinyl, MIL-W-5086, Type I (600 Volts) | J | No. 6 | | 8 | Gray (Slate) |
| E2 | Vinyl, MIL-W-5086, Type II (600 Volts) (No. 22-12) Note 1 | K | No. 4 | | 9 | White |
| E3 | Vinyl, MIL-W-5086, Type II (600 Volts) (No. 0000-10) Note 2 | L | No. 2 | | a | Clear |
| E4 | Vinyl, MIL-W-5086, Type III (600 Volts) (No. 12-22) Note 3 | M | No. 1 | | b | Tan |
| E5 | Vinyl, MIL-W-5086, Type III (600 Volts) (No. 0000-10) Note 4 | N | No. 0 | | c | Pink |
| G | | P | No. 00 | | d | Maroon |
| H | Kel-F (Monochlorotrifluoroethylene) | Q | No. 000 | | e | Light Green |
| I | Not Available | R | No. 0000 | S | f | Light Blue |
| J | | T | No. 28 | | | |
| K | Neon Sign Cable (15,000 Volts) | V | No. 26 | SJ | | |
| L | Silicone, MIL-W-16878, Type FF (600 Volts) | W | No. 24 | | | |
| L2 | Silicone, MIL-W-16878, Type FFW (1000 Volts) | X | No. 19 | | | |
| L3 | Silicone, Non-MIL (5000 Volts) | Y | No. 30 | | | |
| L4 | Silicone, Non-MIL (10,000 Volts) | Z | | | | |
| L5 | Silicone, Non-MIL (15,000 Volts) | | | | | |
| M | | | | | | |
| N | Single Conductor Stranded (Non-Rubber) | | | | | |
| O | Not Available | | | | | |
| P | Single Conductor Stranded (Rubber Covered) | | | | | |
| Q | | | | | | |
| R | Polyvinyl Chloride, MIL-W-16878, Type C (1000 Volts) | | | | | |
| S | Not Available | | | | | |
| T | Teflon (TFE), MIL-W-16878, Type E (600 Volts) Stranded | | | | | |
| U | Not Available | | | | | |
| V | Polyvinyl Chloride, MIL-W-16878, Type D (3000 Volts) | | | | | |
| W | Teflon (TFE), MIL-W-16878, Type EE (1000 Volts) | | | | | |
| X | Teflon (TFE), MIL-W-16878, Type ET (250 Volts) | | | | | |
| X2 | Teflon (FEP), MIL-W-16878, Type K (600 Volts) | | | | | |
| X3 | Teflon (FEP), MIL-W-16878, Type KT (250 Volts) | | | | | |
| X4 | Teflon (TFE), Non-MIL (3000 Volts) | | | | | |
| Y | Telephone Type, Polyvinyl | | | | | |
| Y1 | Teflon (TFE), Non-MIL; Solid Conductor | | | | | |
| Z | Telephone Type, Braided Yarn | | | | | |

Note 1 - Extruded nylon over fiber glass braid.

Note 2 - Braided, lacquered nylon over fiber glass braid.

Note 3 - Extruded nylon over secondary vinyl over fiber glass over primary vinyl.

Note 4 - Lacquered extruded nylon over secondary vinyl over fiber glass over primary vinyl.

