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COLLINS

instruction book

Collins Radio Company

212J-1 Broadcast Audio Console

GUARANTEE

The equipment described herein is sold under the following guarantee:

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

(a) Notice of the claimed defect is given Collins within two (2) year from date of delivery and goods are returned in accordance with Collins' instructions.

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

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

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

The guarantee of these paragraphs is void if equipment is altered or repaired by others than Collins or its authorized service center.

No other warranties, expressed or implied, shall be applicable to any equipment sold hereunder, and the foregoing shall constitute the Buyer's sole right and remedy under the agreements in this paragraph contained. In no event shall Collins have any liability for consequential damages, or for loss, damage or expense directly or indirectly arising from the use of the products, or any inability to use them either separately or in combination with other equipment or materials, or from any other cause.

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

ADDRESS:

Collins Radio Company
Service Parts Department
Dallas, Texas 75207

INFORMATION NEEDED:

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

HOW TO ORDER REPLACEMENT PARTS.

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

ADDRESS:

Collins Radio Company
Service Parts Department
Dallas, Texas 75207

INFORMATION NEEDED:

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

523-0561143-001431
15 January 1969

COLLINS

instruction book

212J-1 Broadcast Audio Console

Collins Radio Company | Dallas, Texas

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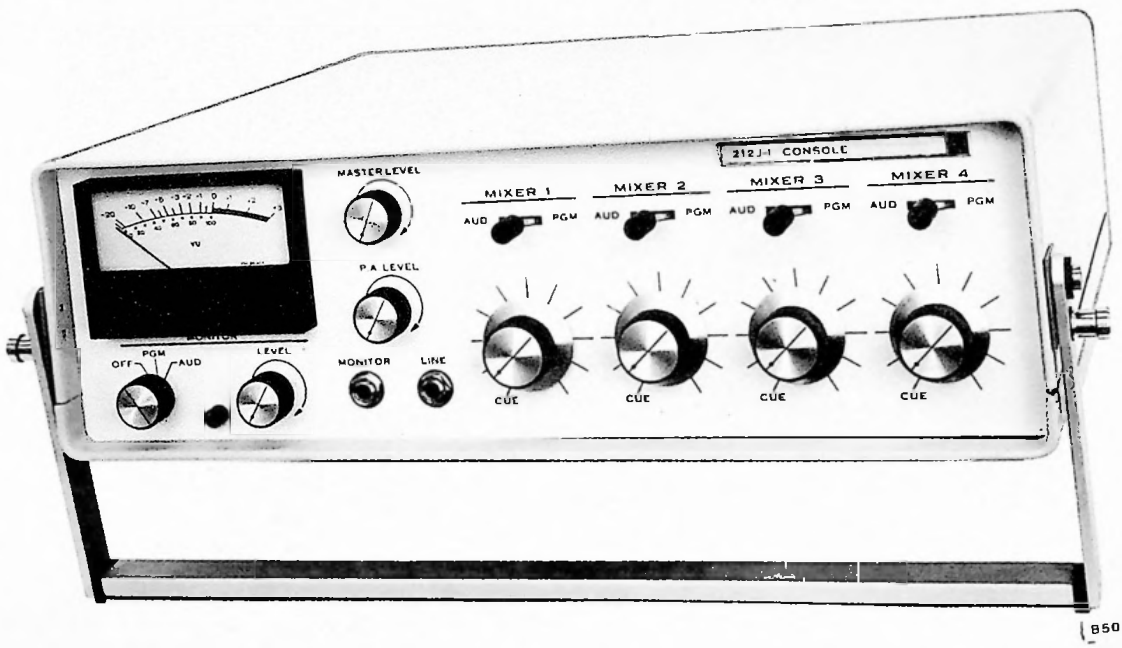

Figure 1-1. 212J-1 Broadcast Audio Console, Overall View.

section 1
general description

1.1 GENERAL

This instruction book contains all information necessary for the installation, operation, and maintenance of the 212J-1 Broadcast Audio Console. The 212J-1 is manufactured by the Collins Radio Company of Dallas, Texas.

1.2 PURPOSE OF EQUIPMENT

The 212J-1 replaces the 212H-1 and 212Z-1 Remote Amplifiers and fulfills the present day requirements for a small production console. The unit is designed for studio or remote use and handles four channels of monophonic audio broadcast information. Each channel may be switched to accept a high-level input, a microphone input, or a phonograph input. One channel may be used at a time or any number of channels may be mixed and amplified to program level. Special monitoring circuits permit monitoring of each channel independently or all channels simultaneously.

1.3 DESCRIPTION OF UNIT

The 212J-1 is a small, lightweight, console-type unit suitable for desk-top mounting (figure 1-1). The unit case is made of aluminum and finished with textured epoxy paint. A transit cover (optional) made especially for the 212J-1 protects the front panel when the unit is being transported or carried.

Printed circuit-board construction minimizes weight and size. The extensive use of simple circuitry and standard parts simplifies maintenance.

The 212J-1 may be operated with 115-volt ac, 60-Hz or 12-volt dc external power. Provisions for an internal 12-volt, nickel-cadmium battery (optional) are included for portable use.

The front panel of the 212J-1 contains a VU meter for measuring the program level, a MONITOR switch for selecting the input to the monitor amplifier, a MONITOR LEVEL control for controlling monitor amplifier gain, a MASTER LEVEL control for controlling program channel gain, a P.A. LEVEL adjustment for controlling PA output level, and four MIXER attenuators for controlling the gain of each channel. Also included are a LINE jack and a MONITOR jack. The rear panel contains input jacks, terminals, and switches for each of the four channels. Also provided are additional speaker outputs and a MULTIPLE INTERCONNECT for paralleling two consoles together. Relay contacts are available for operating both local and remote equipment, and output jacks are provided for the program and public address lines. A power switch selects AC/INT BATT or 12V EXT operation. When using the external position, an external 12 volts must be applied to the 12VDC INPUT jack.

1.4 EQUIPMENT SUPPLIED

See table 1-1 for equipment supplied.

1.5 EQUIPMENT REQUIRED BUT NOT SUPPLIED

The cables for connecting the 212J-1 to associated equipment are not supplied. The various connectors mounted on the 212J-1 are identified in figure 2-2.

1.6 BATTERY COMPLEMENT

The 212J-1 may be powered internally with a 12-volt, nickel-cadmium battery (optional).

Caution

Use only the battery type specified in table 1-2. The use of any type other than that specified voids the warranty.

1.7 TECHNICAL DATA

Ambient Temperature Range:
0 to 50°C

Ambient Humidity Range:
Up to 95%

Altitude:
Up to 10,000 feet

Table 1-1. Equipment Supplied.

ITEM	TYPE NO.	OVERALL DIMENSIONS (inches)			WEIGHT (lb)	COLLINS PART NUMBER
		H	W	D		
Broadcast audio console	212J-1	5-1/2	17	14	28	777-1428-001

Table 1-2. Optional Equipment.

ITEM	OVERALL DIMENSIONS (inches)			WEIGHT (lb)	COLLINS PART NUMBER
	H	W	D		
Transit cover	4-3/4	16-1/2	1-1/4	1	770-5589-001
Paralleling unit				1/2	770-5455-001
Battery mounting kit				1	770-5469-001
Battery				3	221-0036-020

Shock and Vibration:
Normal handling and transportation

Power Requirements:
115 volts ac ±10%, 50/60 Hz, single-phase, 170 ma, or 12 to 15 volts dc, 400 ma, maximum
Provision for internal 12-volt, nickel-cadmium battery (optional).

Input Impedance:
MIKE
150/200 or 50 ohms (supplied with 150/200)

HI LEVEL
600 ohms

PHONO
50K at 1000 Hz without compensation network

Input Level:
MIKE
-50 dbm nominal

HI LEVEL
0 dbm nominal

PHONO
6 mv at 1000 Hz

Output Impedance:
LINE
600 ohms

MONITOR
8 ohms

P.A. OUTPUT
600 ohms

PGM OUTPUT
600 ohms

Output Level:
LINE
+18 dbm

MONITOR
1/4 watt

P.A. OUTPUT
-10 dbm

PGM OUTPUT
+18 dbm

Frequency Response:
±1.5 db on MIKE or HI LEVEL, 50 to 15,000 Hz; equalized to ±1.5 db of RIAA equalization curve on PHONO, when used with Shure M44-7 cartridge.

Harmonic Distortion:
Less than 1% at rated output

Equivalent Input Noise:
-120 dbm or less

section 2
installation

2.1 UNPACKING

Remove all packing material and carefully lift the 212J-1 out of the shipping carton. Remove the eight Phillips-head screws holding the top cover and lift the cover from the unit. Inspect the interior and the front and rear panels for evidence of damage. Check the operation of the INPUT, MIXER, and MONITOR switches. Set the MONITOR switch to OFF.

Turn the 212J-1 over and place it on a piece of soft, nonscratch material. Remove the eight Phillips-head screws holding the bottom cover and lift the cover from the unit. Check the interior for evidence of damage. All claims for damages should be filed promptly with the transportation company. If a claim for damages is filed, retain the shipping carton and packing material.

2.2 INSTALLATION OF BATTERY (OPTIONAL)

A battery kit consisting of a 12-volt battery and necessary mounting hardware is required to perform the following procedures.

a. Ensure that the 12V EXT-AC/INT BATT switch is in the center (off) position.
b. Lay the 212J-1 upside down and remove the eight Phillips-head screws holding the bottom cover (figure 2-1).
c. Insert the 12-volt battery into the battery mounting clamp and install the battery as shown in figure 2-1. (The mounting clamp screws should extend through the mounting plate.)
d. Secure the mounting clamp in place with the two wingnuts supplied in the battery kit (figure 2-1).
e. Connect the red and black leads to the positive and negative terminals of the battery respectively.
f. Check the lead dress on the wires connected to the battery and replace the bottom cover.

2.3 INTERCONNECTING CABLES

Interconnecting cables for the 212J-1 are not supplied with the unit. Figure 2-2 identifies each of the connections on the 212J-1.

2.4 INITIAL SETUP PROCEDURES

a. Connect the program line to the PGM OUTPUT jack on the rear of the 212J-1 (figure 2-2).
b. Connect the inputs (microphones and/or turntables) to the appropriate jacks at the rear of the 212J-1.
c. If a public address system is used, connect the respective PA equipment to the P.A. OUTPUT jack on the rear of the 212J-1.

Note

When using a public address system, place speakers and microphones so that acoustical feedback is prevented.

d. The input circuits of the 212J-1 are wired for a microphone (mike) input impedance of 150/200 ohms. The mike input impedance of each channel may be changed to 50 ohms by making the following wiring changes between each INPUT switch and input transformer (figures 6-4 and 7-1).

INPUT 1 - Strap S1A-1 to E-108
INPUT 2 - Strap S2A-1 to E-208
INPUT 3 - Strap S3A-1 to E-308
INPUT 4 - Strap S4A-1 to E-408

e. The phono preamplifiers used in the 212J-1 are factory wired for RIAA compensation; however, +3-db treble boost or -3-db treble cut is obtainable by restrapping terminals A, B, C, and D of each amplifier as follows (figures 6-4 and 7-1).

RIAA compensation - Strap A to B
+3-db treble boost - Strap C to D
-3-db treble cut - Strap A to B and C to D

f. Apply power to the 212J-1 by plugging the unit into an available 115-volt, 60-Hz line or by applying an external 12 volts dc to the 12VDC INPUT jack on the rear of the unit. An internal battery may be used in remote locations. (Refer to paragraph 2-2.)
g. The 212J-1 may be turned on by setting the power switch on the rear of the unit to the appropriate position (AC/INT BATT or 12V EXT).

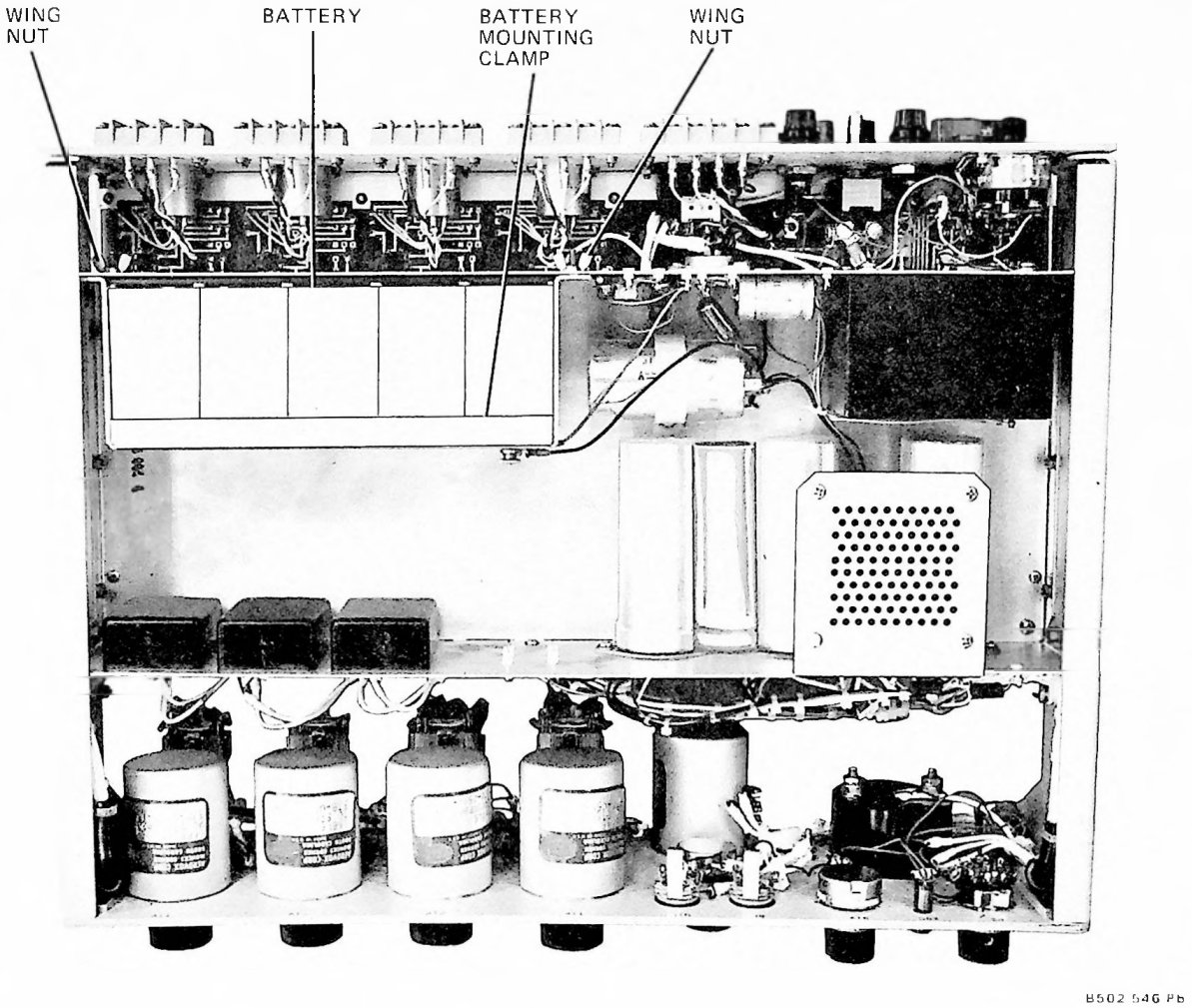

Figure 2-1. Battery Installation.

2.5 PERFORMANCE CHECK

To adequately check the performance of the 212J-1, each channel must be independently checked using external test equipment. The minimum performance standards in section 5 outline the procedures for this kind of test. No initial adjustments are required for the 212J-1 after installation.

2.6 MULTIPLE CONNECTIONS

If desired, the 212J-1 may be paralleled with a second 212J-1 console. This allows up to eight inputs to be mixed into one output and provides two separate line outputs. The two consoles are connected with a paralleling unit (optional) that plugs into the MULTIPLE INTERCONNECT jack on the rear of each console. When used as a single unit a shorting plug (supplied with console) must be inserted into the MULTIPLE INTERCONNECT jack on the rear of the unit.

2.7 OUTLINE DRAWING

The outline drawing of the 212J-1 is shown in figure 2-3.

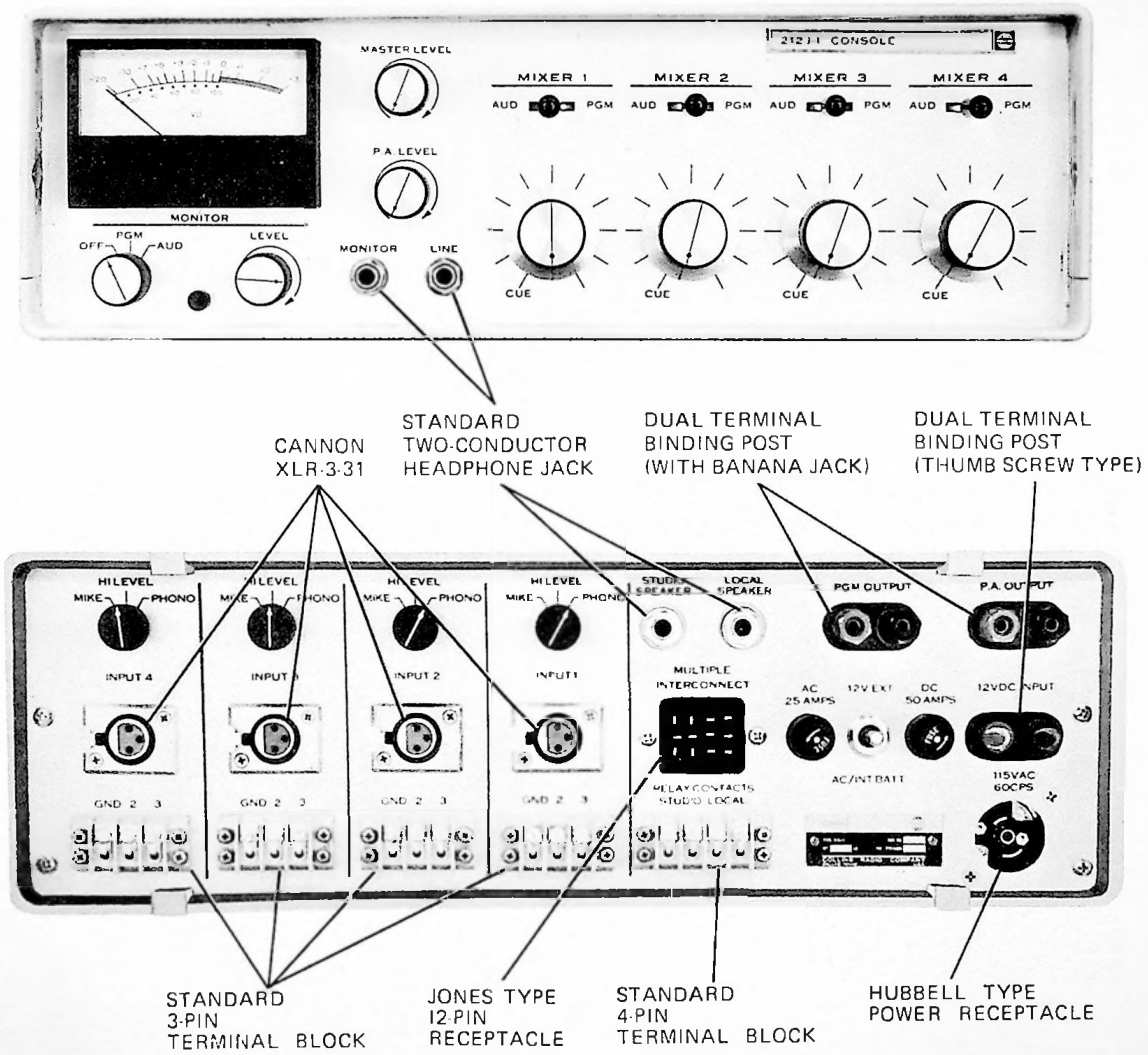

Figure 2-2. 212J-1 Broadcast Audio Console, Connector Identification.

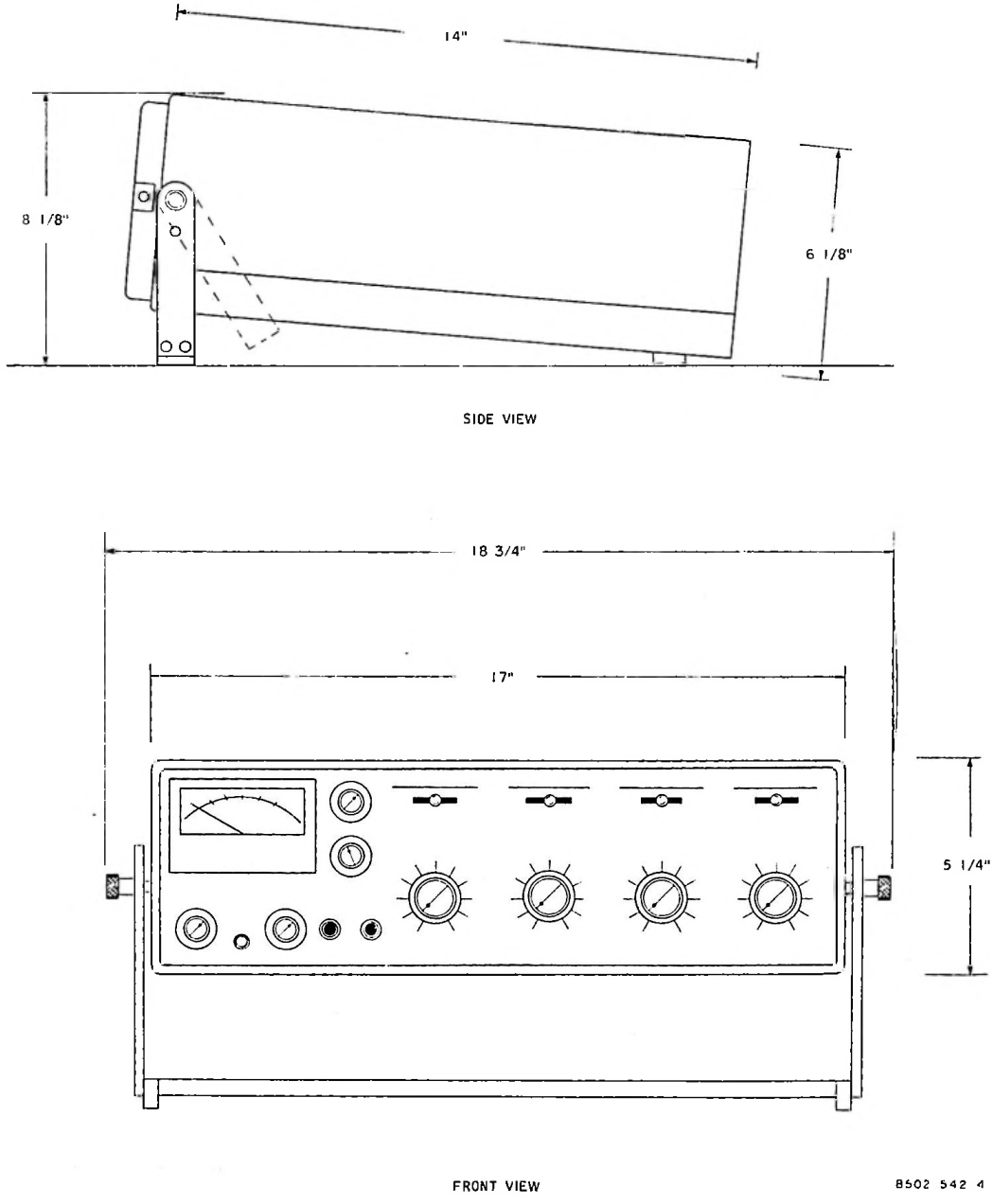

Figure 2-3. 212J-1 Broadcast Audio Console, Outline Drawing.

section 3
operation

3.1 GENERAL

This section contains operating instructions for the 212J-1 Broadcast Audio Console.

3.2 OPERATING CONTROLS AND INDICATORS

Table 3-1 contains a description of each of the operating controls and indicators on the 212J-1. The locations of these controls and indicators are shown in figure 3-1.

3.3 GENERAL OPERATING INFORMATION

Due to varying operational requirements, specific operating instructions are not included in this section. The following paragraphs summarize the important operational features of the 212J-1 Broadcast Audio Console.

3.3.1 Level Adjustments

Each channel is applied to the program line by setting the respective MIXER switch to PGM. The gain (level) of each channel is controlled by adjusting one of the four MIXER attenuators on the front panel. The MASTER LEVEL control (front panel) adjusts the composite program signal level at the PGM OUTPUT terminals. When the VU meter indicates 0 vu, the composite output signal (one to four channels) at the PGM OUTPUT terminals will be +8 dbm. The P.A. OUTPUT jack provides an output for a tape recorder or public address system. This output may be independently adjusted with the P.A. OUTPUT control.

3.3.2 Cuing

Cuing of any channel is accomplished by rotating the respective MIXER attenuator to the CUE position. When the CUE position is entered, the channel is applied directly to the monitor circuits and is available at the MONITOR, LOCAL SPEAKER, and STUDIO SPEAKER jacks and may also be heard in the internal speaker. Each channel may be cued at any time regardless of which position (PGM or AUD) the respective MIXER switch may be in.

3.3.3 Monitoring

Monitoring of any channel is accomplished by setting the appropriate MIXER switch and the MONITOR switch to AUD. The program signal may be monitored by setting the MONITOR switch to PGM. The MONITOR, LOCAL SPEAKER, and STUDIO SPEAKER jacks and the internal speaker are all connected directly to the monitor circuits. The MONITOR LEVEL control is used to adjust for a proper output level at these jacks. The MONITOR jack provides a connection for external monitoring equipment (such as a headset). When the MONITOR jack is used, the internal and local speakers are disabled. The program signal (at the PGM OUTPUT jack) may be monitored directly by connecting the external monitoring equipment to the LINE jack.

Table 3-1. Operating Controls and Indicators.

NAME	FUNCTION
MIXER switches 1, 2, 3, and 4	Connect respective channel to program (PGM) or audition (AUD) bus lines. (Also manually control muting relays K1 and K2 when properly wired.)
VU meter	Monitors program output signal level.
MONITOR switch	Selects input to monitor amplifier. Permits monitoring of output program level when set to PGM or monitoring of any channel (channel MIXER switch must be set to AUD) when set to AUD.

Table 3-1. Operating Controls and Indicators (Cont).

NAME	FUNCTION
MONITOR LEVEL control	Controls monitor amplifier gain.
MASTER LEVEL control	Adjusts signal level at PGM OUTPUT.
P.A. LEVEL control	Adjusts signal level at P.A. OUTPUT.
Attenuator-CUE controls	Adjust the signal level of channels 1 through 4 and provide cuing of a particular channel when the control is turned fully ccw to the CUE position. In the CUE position the mixer output of the particular channel is applied directly to the monitor amplifier.
MONITOR jack	Provides a monitor output connection for external equipment. The internal and local speakers are disabled when this jack is used.
LINE jack	Permits external monitoring of program output. Connects to PGM OUTPUT jack.
INPUT 1, 2, 3, and 4 switches	Select appropriate input circuits for acceptance of MIKE, HI LEVEL, or PHONO inputs.
INPUT jacks 1, 2, 3, and 4	Provide access to inputs 1 through 4. Each jack serves as an input connection for a microphone, a phonographic cartridge, or a high-level input.
INPUT terminals 1, 2, 3, and 4	Provide access to inputs 1 through 4, same as INPUT jacks.
STUDIO SPEAKER jack	Provides output for studio monitor speakers.
LOCAL SPEAKER jack	Provides output for connection of local speaker. Internal speaker is disabled when this jack is used.
MULTIPLE INTERCONNECT	Allows two consoles to be connected in parallel when used with paralleling unit. Shorting plug must be in place when units are used separately.
RELAY CONTACTS STUDIO LOCAL	Provides contact closure for operating local or remote warning lights or other equipment. Contacts rated 115 volts ac. 1 ampere resistive, 0.3 ampere inductive, or 28 volts dc, 1 ampere resistive. (See section 4 for complete details.)
PGM OUTPUT jack	Connects normal program output to lines.
P.A. OUTPUT jack	Provides an independently adjustable program output (within limits of MASTER LEVEL setting) for use with tape recorder or public address system. Output level is controlled by P.A. LEVEL control.
AC/INT BATT-12V EXT switch	Selects power source to be used. When set to AC/INT BATT position, the unit operates from 115-volt ac line or from internal battery (optional) if used. When set to 12V EXT position, the unit requires an external 12 volts for operation (applied at the 12V DC INPUT jack.)
12VDC INPUT jack	Provides for connection of external 12-volt power source. (Used when ac is not available.)
115VAC 60CPS receptacle	Connects 115-volt, 60-Hz power source to equipment.

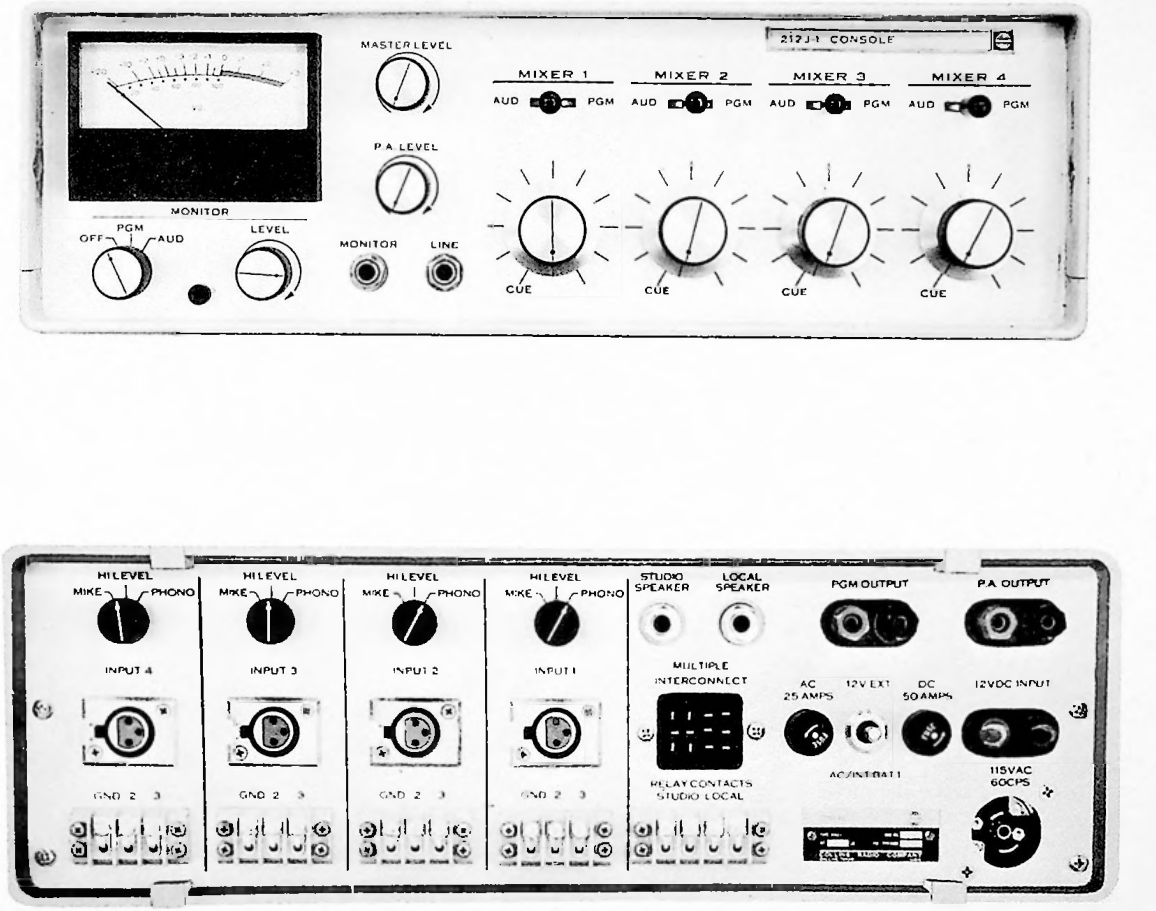

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Figure 3-1. 212J-1 Broadcast Audio Console, Operating Controls and Indicators.

section 4
principles of operation

4.1 GENERAL

This section explains the principles of operation of the 212J-1 Broadcast Audio Console.

4.2 BLOCK DIAGRAM

Refer to the 212J-1 block diagram, figure 4-1, while studying the following paragraphs.

Up to four input signals may be applied to the 212J-1 audio console. Input selector switches S1, S2, S3, and S4 must be set to the appropriate position for either microphone, high-level, or phonographic inputs. The microphone or high-level signals are fed through input transformers T4, T3, T2, and T1 to preamplifiers Z1, Z3, Z5, and Z7 respectively. The phonographic signals are applied directly to RIAA compensated phono preamplifiers (Z2, Z4, Z6, and Z8). The output signal from each channel preamplifier is applied to attenuator (AT1, AT2, AT3, or AT4), which controls the signal level of channel 1, 2, 3, or 4 respectively. The output from each attenuator is routed to a common line through S5, S6, S7, and S8. When these selector switches are set to AUD, all four attenuator outputs are routed to the audition bus, which carries the composite signal through the MULTIPLE INTERCONNECT junction to MONITOR switch S9. When S9 is set to AUD, the audition bus is connected directly to preamplifier Z11 and monitor amplifier Z12. The output of the monitor amplifier is applied to the MONITOR jack where the operator may monitor any of the four channels with headphones. LOCAL and STUDIO SPEAKER jacks are also provided as well as an internal speaker. Mute relays K1 and K2 are used to silence the speakers and are described in detail in paragraph 4.3 of this section.

Attenuators AT1, AT2, AT3, and AT4 also permit cueing of channels 1, 2, 3, or 4 respectively. When each attenuator is rotated completely ccw to the CUE position, the output signal from each respective channel preamplifier is connected directly to the monitor circuits, regardless of which position S5, S6, S7, or S8 may be in. The cue level control (internal adjustment) controls the amplitude of the cue signals entering the monitor amplifier.

When switches S5, S6, S7, and S8 are set to PGM, all signals are routed to the program bus, which carries the composite signal through the MULTIPLE INTERCONNECT junction to preamplifier Z9 and program amplifier Z10. The program signal is available at the PGM OUTPUT terminals and a VU meter monitors the program signal level. A LINE jack, which is connected in parallel with the PGM OUTPUT, provides a means of directly monitoring the program signal. The program signal level is controlled by the MASTER LEVEL control. A separate public address output is provided for operating a public address system. This output may be controlled by the P.A. LEVEL control.

When S9 is set to PGM, the monitor amplifier circuits are connected directly to the output of the program amplifier. This connection permits monitoring of any or all program signals. All input signals to the monitor amplifier are controlled by the MONITOR LEVEL control.

The 212J-1 may be operated locally from a 115-volt ac source or a 12-volt dc source. When the unit must be used in a remote location, an optional internal battery that will power the unit for approximately 10 hours must be installed. When the 212J-1 is to be operated from a 115-volt ac source or with the optional battery, switch S10 must be set to AC/INT BATT. In this mode the power supply will operate from 115 volts ac (when plugged in) and charge the battery (if used) at the same time. When the 115-volt power is removed, the unit will operate from the battery.

When the 212J-1 is to be operated from an external 12 volts, switch S10 must be set to 12V EXT and the external voltage must be applied to the 12VDC INPUT terminals. When used in this mode, the power supply and battery (if used) are completely disconnected.

4.3 DETAILED CIRCUIT DESCRIPTION

Most of the circuits used in the 212J-1 (figure 7-1) are of conventional design and need no detailed explanation. Therefore only the special design features and peculiarities of the 212J-1 are covered in the following paragraphs.

Preamplifiers Z1, Z3, Z5, and Z7 and their associated input impedance matching networks are identical. Although impedance matching transformers T1, T2, T3, and T4 are wired for the specified input impedances, the wiring may be changed as explained in paragraph 2.4 of this manual. Phono preamplifiers Z2, Z4, Z6, and Z8 are also identical. The frequency response characteristics of these amplifiers depend on the manner in which each feedback network (consisting of R6, R7, R8, C3, C4, and C10) is connected. Strapping procedures for these amplifiers are included in paragraph 2.4.

The attenuator-CUE controls (AT1, AT2, AT3, and AT4) control the signal level of each channel and also provide cuing for each channel. Rotating each attenuator cw or ccw increases or decreases the output from each attenuator respectively. When the attenuator is rotated completely ccw to CUE, the input (terminal 1) is connected directly to the cue output (terminal 2) and the signal at the output (terminal 4) is reduced to zero. The cue output of each attenuator is routed over a common line to the monitor amplifier circuits through transformer T4 and cue level control R38.

Preamplifiers Z9 and Z11 are identical and, except for minor component changes, are basically the same as input preamplifiers Z1, Z3, Z5, and Z7. Program amplifier Z10 is identical to monitor amplifier Z12, each being a conventional complementary symmetry-type output amplifier. The P.A. OUTPUT and PGM OUTPUT terminals as well as VU meter M1 are all connected to the program amplifier through an output network consisting of T5, T6, and resistors R23 through R32. This network provides line isolation and impedance matching for the outputs and calibration for meter M1.

Mute relays K1 and K2 prevent acoustical feedback by silencing the local, studio, and internal speakers when microphones are being used. Because operating requirements may vary, internal strapping facilities are provided so that relays K1 and K2 may be wired in any combination to MIXER switches S5, S6, S7, and S8. When switches S5, S6, S7, and S8 are set to PGM or AUD, terminals E8, E9, E10, and E11 are grounded respectively. When terminals E12 and E13 are grounded, relays K1 and K2 energize and deactivate the studio and local speakers. By connecting terminals E12 or E13 to terminals E8, E9, E10, or E11, MIXER switches S5, S6, S7, and S8 may be used to control these relays as desired. Mute relays K1 and K2 also provide contacts for operating local or studio warning lights or alarms. These contacts are normally open but will close when the relays are energized.

When more than four channels are required, two consoles may be connected in parallel to provide a maximum of eight channels. The MULTIPLE INTERCONNECT jack on the rear of each unit permits two consoles to be joined with an optional paralleling unit. The MULTIPLE INTERCONNECT jack for a single console is shown in detail in figure 7-1 and a simplified drawing of two consoles connected in parallel is shown in figure 4-2. The two audio consoles shown in figure 4-2 are identical units and have been labeled audio console no. 1 and audio console no. 2 for purposes of explanation.

When switches S5, S6, S7, and S8 on each console are set to PGM, all eight channels are routed through a common program bus to the program amplifier of console no. 2. In this mode of operation, all eight channels are available at the PGM OUTPUT terminals of console no. 2. The program amplifier output is also routed to switch S9 of each console and may be monitored at either console by setting switch S9, in each case, to PGM.

When switches S5, S6, S7, and S8 on each console are set to AUD, all eight channels are routed through a common audition bus to the program amplifier of console no. 1. In this mode of operation, all eight channels are available at the PGM OUTPUT terminals of console no. 1 and the composite program signal may be monitored at either console by setting switch S9, in either case, to AUD.

Plugs P5A and P5B of the paralleling unit may be connected as shown or may be reversed. When P5A and P5B are reversed, the program and audition bus lines are connected to opposite program amplifiers and the PGM OUTPUT signal is shifted in a reverse manner when operating switches S5, S6, S7, and S8 on each console. The operation of the monitor circuits remains the same regardless of the manner in which P5A and P5B are connected.

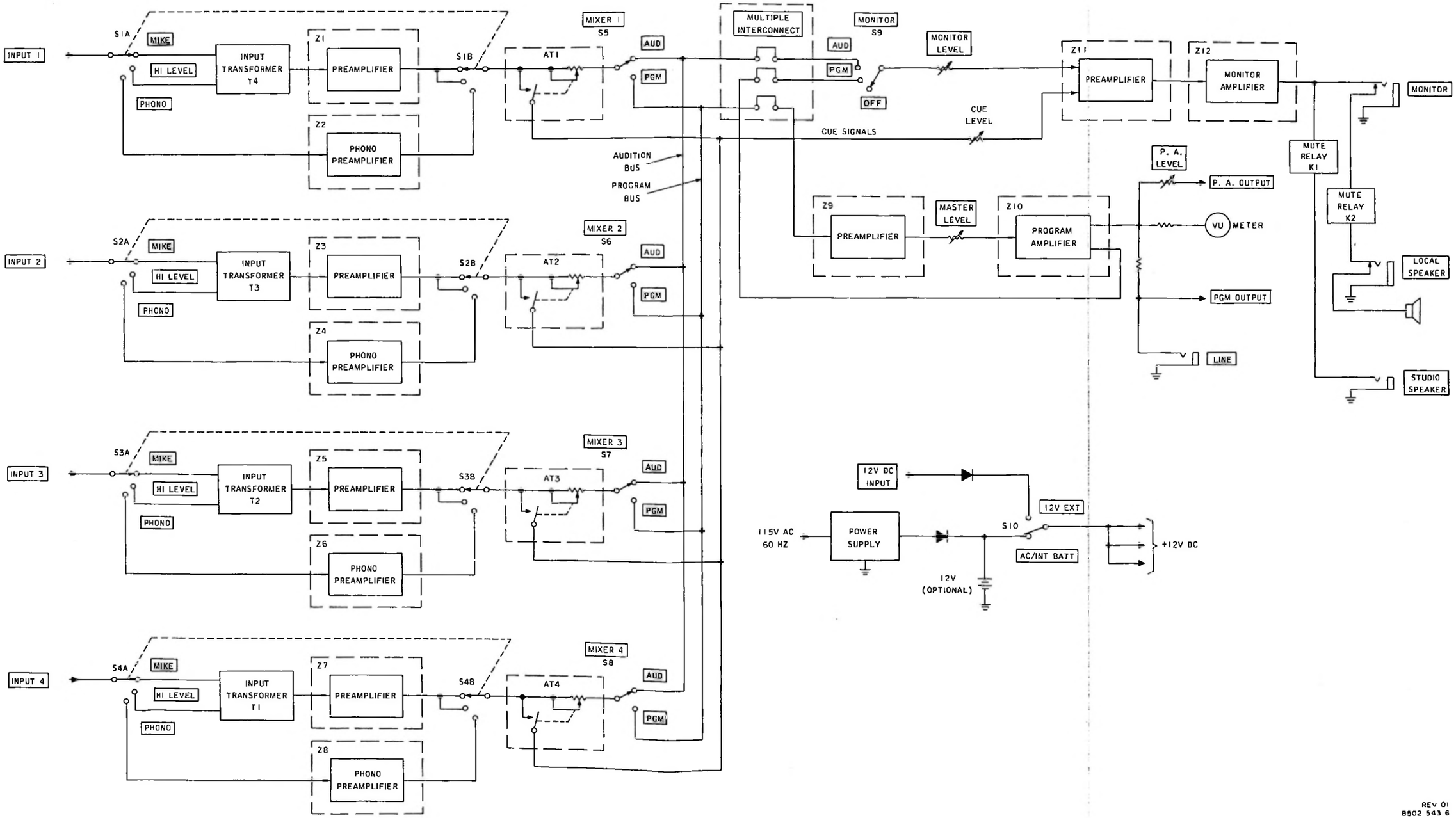

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Figure 4-1. 212J-1 Broadcast Audio Console, Block Diagram.

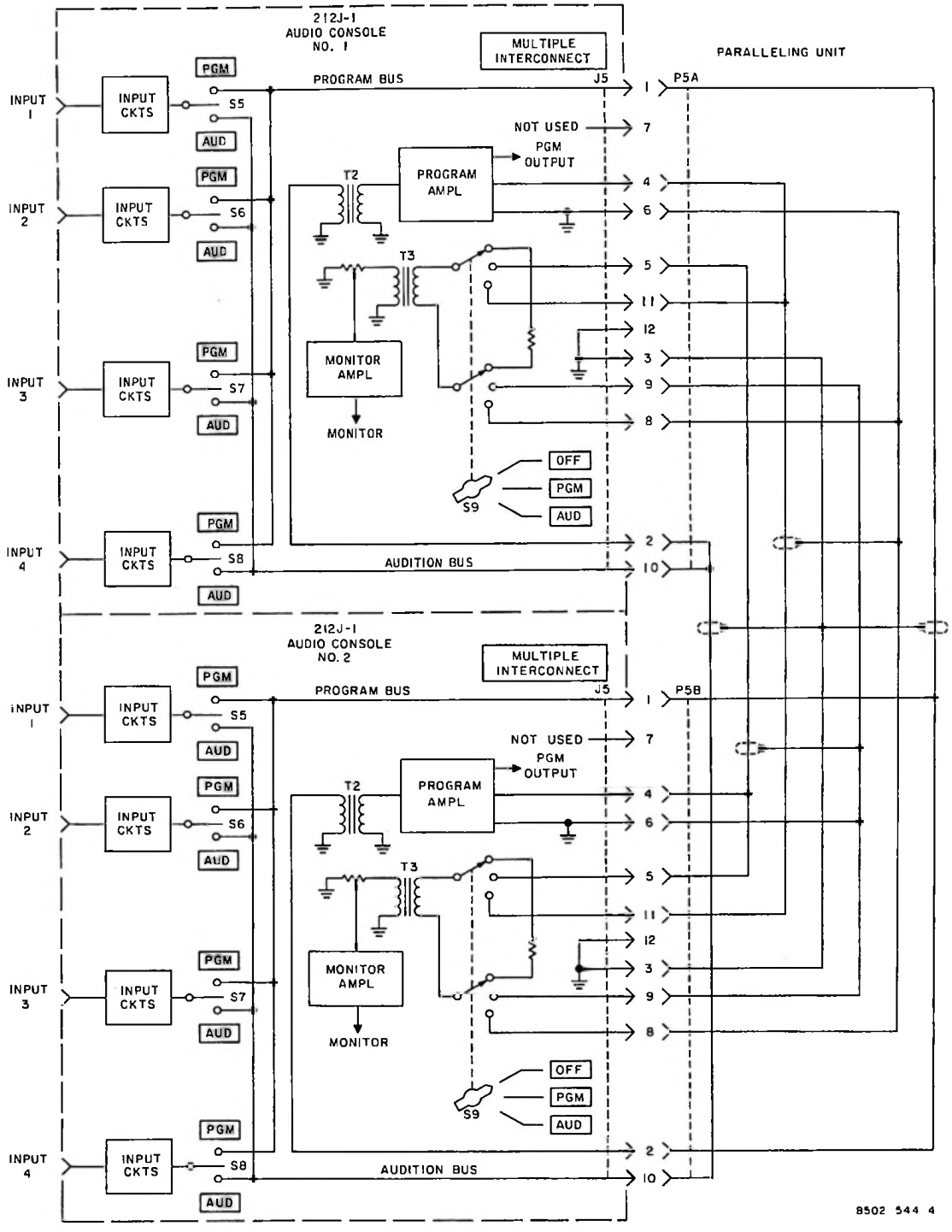

Figure 4-2. Equipment Connections for Parallel Operation.

section 5
maintenance

5.1 GENERAL

This section contains alignment instructions, adjustment procedures, and minimum performance standards for the 212J-1 Broadcast Audio Console.

5.2 TEST EQUIPMENT REQUIRED

Table 5-1 lists the test equipment required to perform the procedures specified in this section. The equipment listed or equivalent may be used.

Table 5-1. Test Equipment Required.

FUNCTION	TYPE
Ac vtvm	Hewlett-Packard 400D
Dc vtvm	Hewlett-Packard 412A
Audio oscillator	Hewlett-Packard 206A
Distortion analyzer	Hewlett-Packard 331A
Oscilloscope	Tektronix 545-A
Connector	Cannon XL
Load resistor	619-ohm, 1/2-watt, (2 required)
Load resistor	8-ohm, 1-watt
Load resistor	10-ohm, 20-watt
Speaker	8-ohm

5.3 ALIGNMENT AND ADJUSTMENT

5.3.1 Preliminary Tests

Perform the following procedure prior to performing any of the alignment procedures. Refer to section 6 for location of all components.

a. Remove the top and bottom covers of the unit and visually inspect the unit for damaged components and loose wiring.
b. Ensure that the shorting plug is inserted into the MULTIPLE INTERCONNECT jack on the rear of the unit.
c. Set all MIXER switches to center position and rotate all MIXER attenuators completely ccw, (but not to the CUE position).
d. Terminate P.A. OUTPUT and PGM OUTPUT jacks with 619-ohm load resistors.
e. Set the 12V EXT-AC/INT BATT switch (S10) to the center position.
f. Install the power cable on the rear of the unit, but do not plug it in.

5.3.2 Power Supply Adjustment

a. Adjust R7 on the power supply fully ccw.
b. Connect the dc vtvm (30-volt dc scale) across C6.
c. Plug the unit in and set S10 to AC/INT BATT.
d. Adjust R7 for 13 ±0.25 volts dc on the vtvm.
e. Overload the power supply temporarily with a 10-ohm resistor, remove resistor, and remeasure the output voltage, which should return to the level specified in step d.

5.3.3 Channel 1 Test

Allow the equipment to warm up for several minutes (with S10 set to AC/INT BATT) before making any adjustments. Perform the following tests in the order given.

5.3.3.1 Speaker Operation

a. Set INPUT 1 switch (S1) to MIKE and adjust the audio oscillator for a -50-dbm, 150-ohm, balanced, 400-Hz output. (Use an ac vtvm to set the output level.) Connect the oscillator to INPUT 1 and readjust for -50 dbm.
b. Set MIXER 1 attenuator (AT1) to CUE and adjust R38 (cue level) until the volume of the internal speaker is slightly above a comfortable listening level.

5.3.3.2 VU Meter Operation

a. Set MIXER 1 switch (S5) to PGM.
b. With the audio oscillator connected as in step a. of paragraph 5.3.3.1, adjust MIXER 1 attenuator (AT1) for a program bus level of

-40 dbm (7.75 mv) ±1 db. Take this measurement from S5B-6 to S5A-3. (Refer to figure 7-1.)
c. Connect the ac vtvm across the PGM OUTPUT load.
d. Adjust the MASTER LEVEL control for a reading of +8 dbm ±1 db on the vtvm. (Do not disturb this setting unless instructed to do so.)
e. Adjust the oscillator output level for exactly +8 dbm on the vtvm and observe the front panel VU meter indication.
f. The VU meter should read 0 ±0.5 vu.

5.3.3.3 Frequency Response

a. With the oscillator connected as in step a. of paragraph 5.3.3.1, adjust the output frequency for 1000 Hz.
b. Connect the ac vtvm across the PGM OUTPUT load.
c. Adjust the oscillator output level for a reading of exactly +8 dbm on the vtvm.
d. Alternately set the oscillator frequency for 50 and 15,000 Hz. (Ensure that the input level remains constant.)
e. The vtvm should indicate no less than +7 dbm and no more than +9 dbm at each frequency.

5.3.3.4 Harmonic Distortion

a. With the oscillator connected as in step a. of paragraph 5.3.3.1, adjust the output frequency for 1000 Hz.
b. Connect the ac vtvm across the PGM OUTPUT load.
c. Adjust MIXER 1 attenuator (AT1) for a reading of +18 dbm on the vtvm.
d. Connect a distortion analyzer to the PGM OUTPUT load.
e. Measure the thd (total harmonic distortion) at 1000 Hz.
f. Adjust the audio oscillator for 50 and 15,000 Hz and measure the thd at each of these frequencies.
g. The thd should not exceed 0.75 percent at each frequency.

5.3.3.5 Input Clipping

a. Ensure that the oscillator is connected as in step a. of paragraph 5.3.3.1.
b. Connect an oscilloscope to the PGM OUTPUT load.
c. Adjust MIXER 1 attenuator (AT1) for a PGM OUTPUT level of +18 dbm. (Measure this level with an ac vtvm.)
d. Increase the oscillator signal (while maintaining a constant PGM OUTPUT level with MIXER 1) until the PGM OUTPUT signal shows signs of clipping.
e. Measure the oscillator input signal with an ac vtvm. The input level should be -42 dbm or higher.

5.3.3.6 Noise

a. Ensure that the oscillator is connected as in step a. of paragraph 5.3.3.1.
b. Adjust MIXER 1 attenuator (AT1) for a program bus level of -30 dbm and the MASTER LEVEL control for a PGM OUTPUT level of +18 dbm. (Measure these levels with the ac vtvm.)
c. Remove the audio oscillator from the input.
d. Connect the ac vtvm to the PGM OUTPUT. The vtvm should indicate a maximum noise level of -52 dbm.

5.3.3.7 High Level

a. With the oscillator connected as in step a. of paragraph 5.3.3.1, adjust MIXER 1 attenuator (AT1) for a program bus level of -40 dbm and the MASTER LEVEL control for a PGM OUTPUT level of +8 dbm.
b. Set the audio oscillator to 600 ohms balanced and reconnect it.
c. Set INPUT 1 switch (S1) to HI LEVEL and connect the ac vtvm to the PGM OUTPUT load.
d. Increase the oscillator signal until the vtvm reads +8 dbm.
e. Connect the vtvm to the input and measure the oscillator signal. The vtvm should indicate between 0 and -10 dbm.

5.3.3.8 Phonograph Equalization

a. With the oscillator connected as in step a. of paragraph 5.3.3.1, adjust MIXER 1 attenuator (AT1) for a program bus level of -40 dbm and the MASTER LEVEL control for a PGM OUTPUT level of +8 dbm.
b. Set INPUT 1 switch (S1) to PHONO.
c. Set the audio oscillator for a 600-ohm, balanced, 6-mv, 1000-Hz output and reconnect it. (Set the voltage with an ac vtvm.)
d. Connect the ac vtvm to the PGM OUTPUT load and measure the output voltage. (Record this voltage.)

e. Set the oscillator to 50 Hz and adjust the oscillator output level until the ac vtvm (connected across the PGM OUTPUT load) indicates the same voltage as was measured in step d.
f. Connect the ac vtvm across the oscillator output terminals and measure the oscillator voltage. The voltage measured should be -17 ±1.5 db below the 6-mv reference level in step c.
g. Set the oscillator to 15,000 Hz and adjust the oscillator output level until the ac vtvm (connected across the PGM OUTPUT load) indicates the same voltage as was measured in step d.
h. Connect the ac vtvm across the oscillator output terminals and measure the oscillator voltage. The voltage measured should be +17 ±1.5 db above the 6-mv reference level in step c.

5.3.3.9 Phonograph Harmonic Distortion

a. Ensure that the oscillator is connected as in step c. of paragraph 5.3.3.8.
b. Connect the ac vtvm to the PGM OUTPUT load and adjust MIXER 1 attenuator (AT1) for a reading of +8 dbm ±1 db on the ac vtvm.
c. Connect a distortion analyzer to the PGM OUTPUT load and measure the thd.
d. The thd measured should not exceed 0.75 percent.

5.3.4 Monitor Operation

a. Perform step a. of paragraph 5.3.3.1, but set the oscillator to 1000 Hz.
b. Set MONITOR switch (S9) to PGM.
c. Connect an ac vtvm across the PGM OUTPUT load. Ensure that the ac vtvm indicates +8 dbm. (Readjust MIXER 1 if necessary.)
d. Attach an 8-ohm load to the MONITOR jack on the front panel. (Use standard 2-conductor headphone plug with resistor attached.)
e. Connect the ac vtvm across the 8-ohm load.
f. Adjust the MONITOR LEVEL control for a reading of 1.4 vrms on the ac vtvm.
g. Set the audio oscillator for 50 Hz and 15,000 Hz, while observing the ac vtvm. The vtvm should indicate between 1.1 and 1.8 volts at each frequency. Return oscillator to 1000 Hz.
h. Set the MONITOR switch to AUD and observe the ac vtvm. The vtvm should indicate 3 mv or less.
i. Set MIXER 1 switch (S5) to AUD and observe the ac vtvm. The vtvm should indicate between 1.0 and 2.0 vrms.
j. Connect a distortion analyzer across the 8-ohm load and measure the thd with the audio oscillator set for 50 Hz. (Ensure that the ac vtvm indicates 1.4 vrms when this measurement is taken.)
k. The thd measured should not exceed 0.75 percent.
l. Connect the 8-ohm load to the LOCAL SPEAKER jack.
m. Connect the ac vtvm across the 8-ohm load.
n. Observe the indication on the vtvm. This reading should be between 1.26 and 1.58 volts.
o. Set MIXER 2 switch (S6) to PGM. The vtvm should now indicate 3 mv or less.
p. Return MIXER 2 switch (S6) to the center position.

5.3.5 Public Address

a. Perform steps a. and c. of paragraph 5.3.4.
b. Set MIXER 1 switch (S5) to PGM.
c. Connect the ac vtvm across the P.A. OUTPUT load.
d. Adjust the P.A. LEVEL control for an indication of -10.0 ±0.5 dbm on the ac vtvm.

5.3.6 Channel 2 Test

Repeat the alignment in paragraph 5.3.3 for input 2 using INPUT 2 switch (S2) and MIXER 2 attenuator (AT2) in place of S1 and AT1. Step b. of paragraph 5.3.3.1 should require a check only.

5.3.7 Channel 3 Test

Repeat the alignment in paragraph 5.3.3 for input 3 using INPUT 3 switch (S3) and MIXER 3 attenuator (AT3) in place of S1 and AT1. Step b. of paragraph 5.3.3.1 should require a check only.

5.3.8 Channel 4 Test

Repeat the alignment in paragraph 5.3.3 for input 4 using INPUT 4 switch (S4) and MIXER 4 attenuator (AT4) in place of S1 and AT1. Step b. of paragraph 5.3.3.1 should require a check only.

5.3.9 Overall Tests

The following tests should be performed only after the VU meter check (paragraph 5.3.3.2) has been performed.

5.3.9.1 External Speaker Check

The following check must be made through a channel that does not control muting relay K1. Channel 4 is used in this test because the equipment is

supplied with MIXER switches S5 and S6 strapped to relays K1 and K2.

a. Connect the audio oscillator to INPUT 4 and adjust the oscillator for a 600-ohm, balanced, 1000-Hz, 6-mv output. (Set the output level with an ac vtvm.)
b. Set INPUT 4 switch (S4) to PHONO and MIXER 4 switch (S8) to PGM.
c. Connect the ac vtvm across the PGM OUTPUT load.
d. Adjust MIXER 4 attenuator (AT4) for an indication of +8 dbm on the vtvm.
e. Connect an 8-ohm speaker to the STUDIO SPEAKER jack (J7).
f. Set MIXER 4 switch (S8) to PGM (all other MIXER switches to center) and MONITOR switch (S9) to PGM. A tone should be heard in the external speaker.
g. Set MIXER 4 switch to AUD and MONITOR switch (S9) to AUD. A tone should be heard in the external speaker.
h. Set MIXER 1 attenuator to CUE (completely ccw). A tone should be heard in the external speaker.
i. Remove the speaker from the STUDIO SPEAKER jack (J7) and set MIXER 1 attenuator (AT1) to center position.

5.3.9.2 Audition Test

a. Perform steps a. through d. of paragraph 5.3.9.1.
b. Set MONITOR switch (S9) to AUD and MIXER 4 switch (S8) to AUD.
c. Listen for tone from internal speaker.

5.3.9.3 Program Monitor Test

a. Perform steps a. through d. of paragraph 5.3.9.1
b. Set MONITOR switch (S9) to PGM and MIXER 4 switch (S8) to PGM.
c. Listen for tone from internal speaker.

5.3.9.4 Line Jack Operation

a. Perform steps a. through d. of paragraph 5.3.9.1.
b. Remove the 619-ohm PGM OUTPUT load and connect it to the LINE jack. (Use a standard 2-conductor headphone plug with the resistor attached.)
c. Set MIXER 4 switch (S8) to PGM and connect an ac vtvm across the 619-ohm load.
d. The vtvm should indicate +8.0 ±1.5 dbm.
e. Return the 619-ohm load to the PGM OUTPUT terminals.

section 6
parts list

6.1 GENERAL

This section contains a list of all replaceable electrical, electronic, and critical mechanical parts for the 212J-1 Broadcast Audio Console.

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

2.6 LIST OF EQUIPMENT

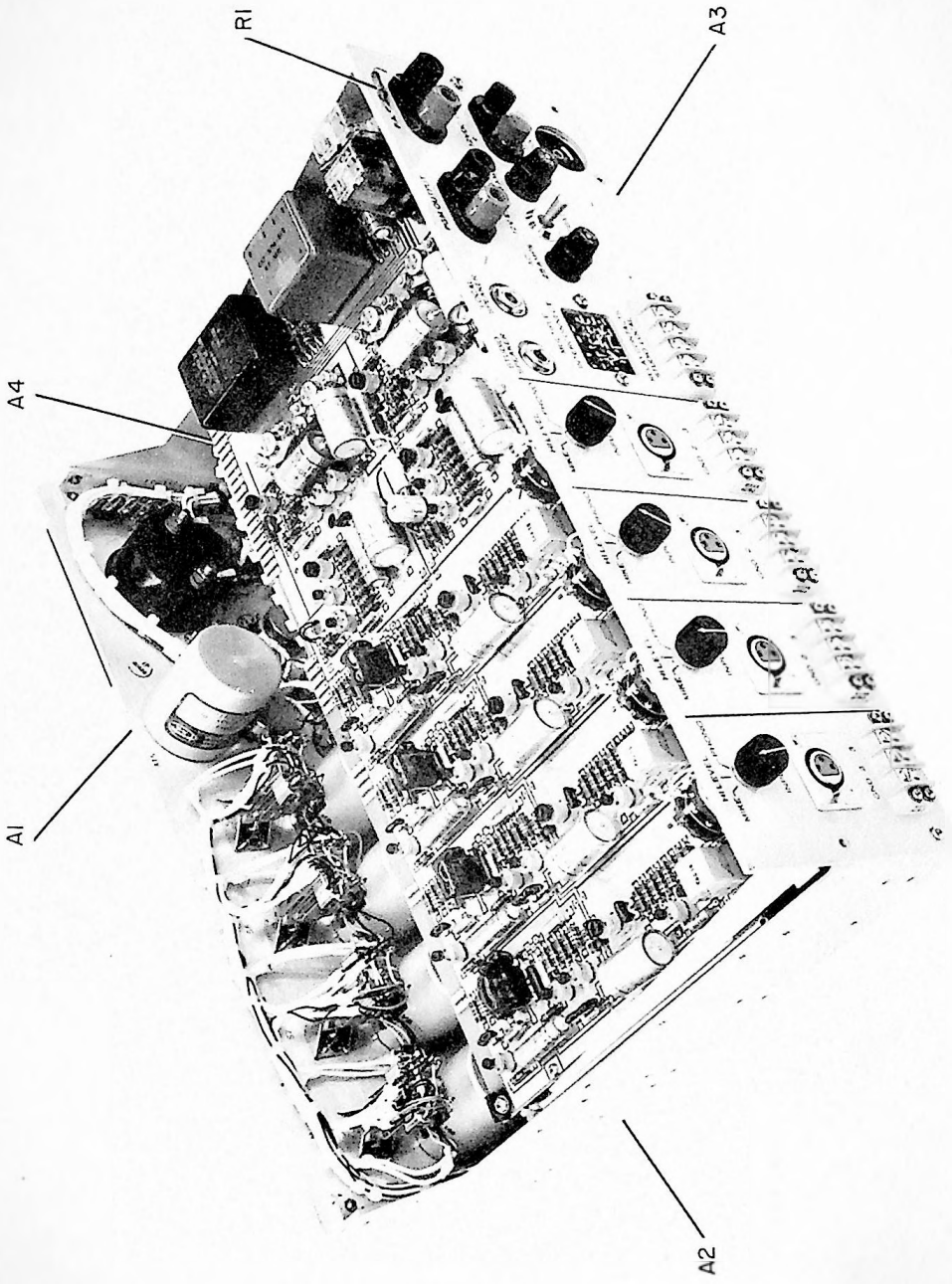

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Figure 6-1. 212J-1 Broadcast Audio Console.

SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR CODE	COLLINS PART NUMBER
	212J-1 BROADCAST AUDIO CONSOLE			777-1428-001
A1	CABLE ASSEMBLY			770-5373-001
	CONSIST OF			
	PLUG			368-0304-000
	-QTY 2-			
A2	CHASSIS CONSOLE			770-5580-001
	SEE BREAKDOWN ON PAGE 6-4			
A3	REAR MODULE			770-5578-001
	SEE BREAKDOWN ON PAGE 6-9			
A4	REMOTE AMPLIFIER BOARD			774-7547-001
	SEE BREAKDOWN ON PAGE 6-11/6-12			
R1	RESISTOR, FXD, COMPOSITION 470 OHMS, 5% TOL, 1/2 WATT	RC20GF471J	81349	745-1337-000

Figure 6-2. Chassis Console (Sheet 1 of 3).

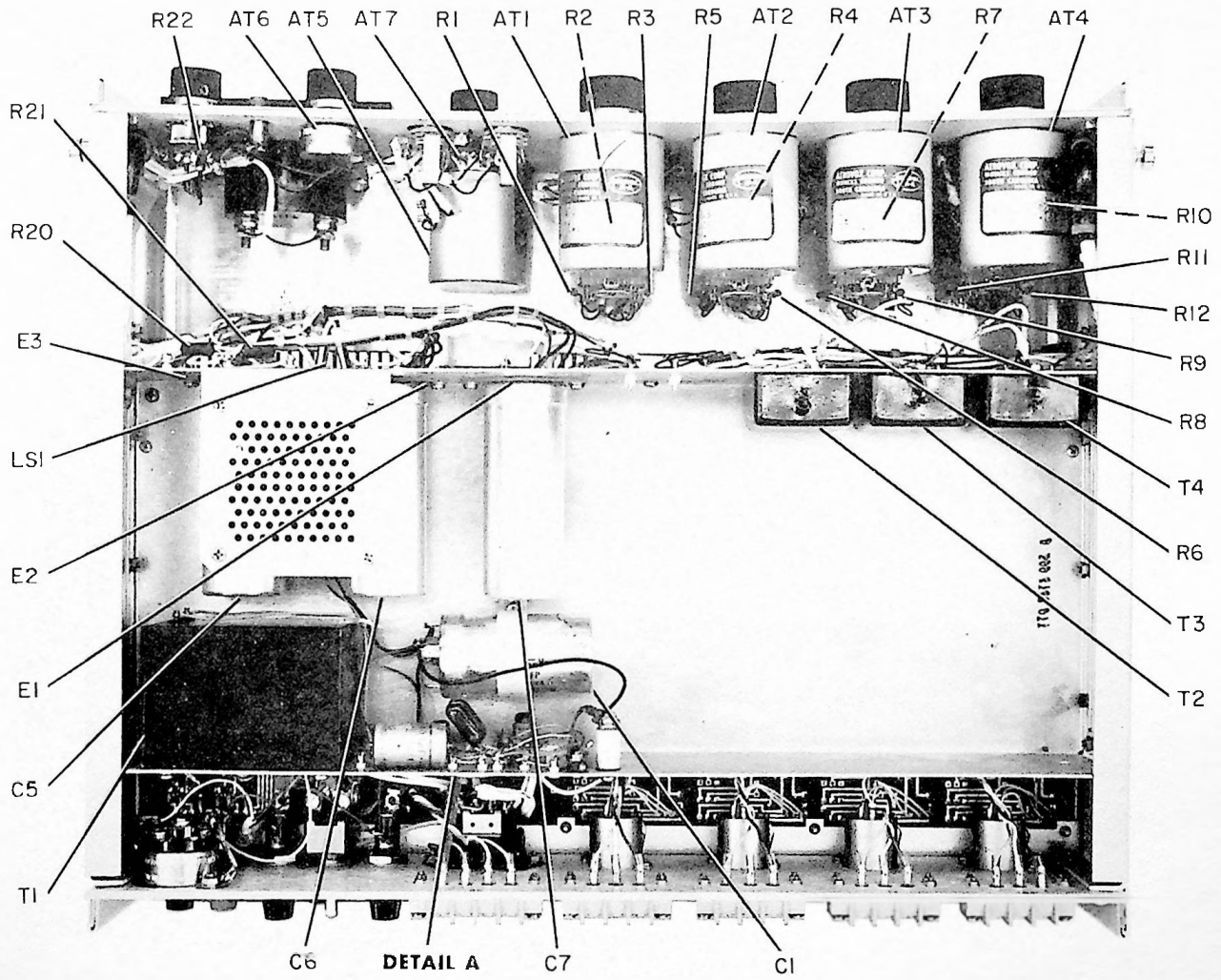

Figure 6-2. Chassis Console (Sheet 2 of 3).

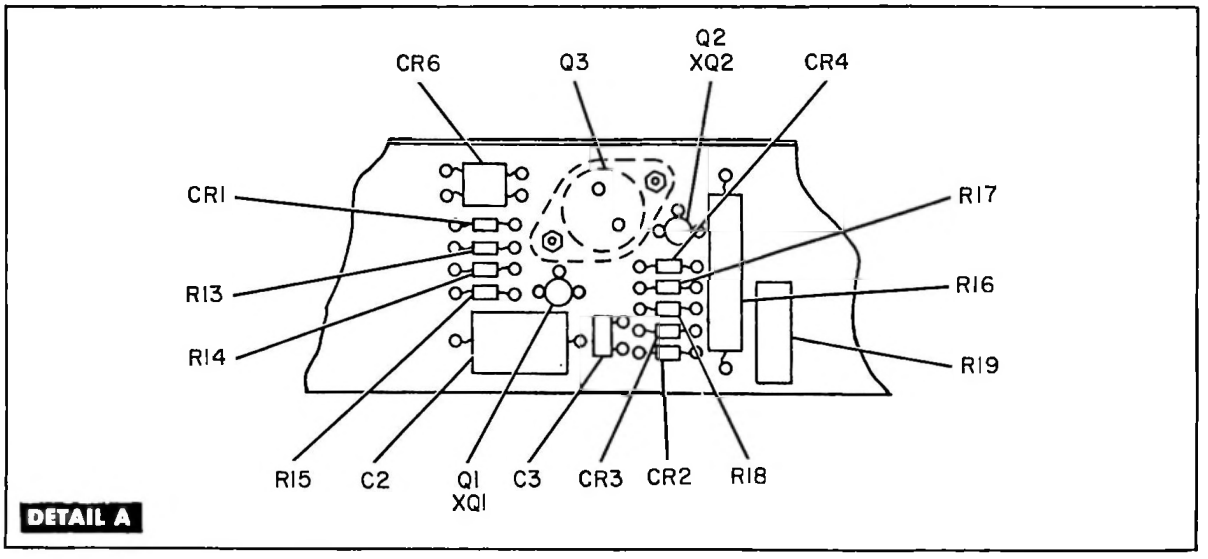

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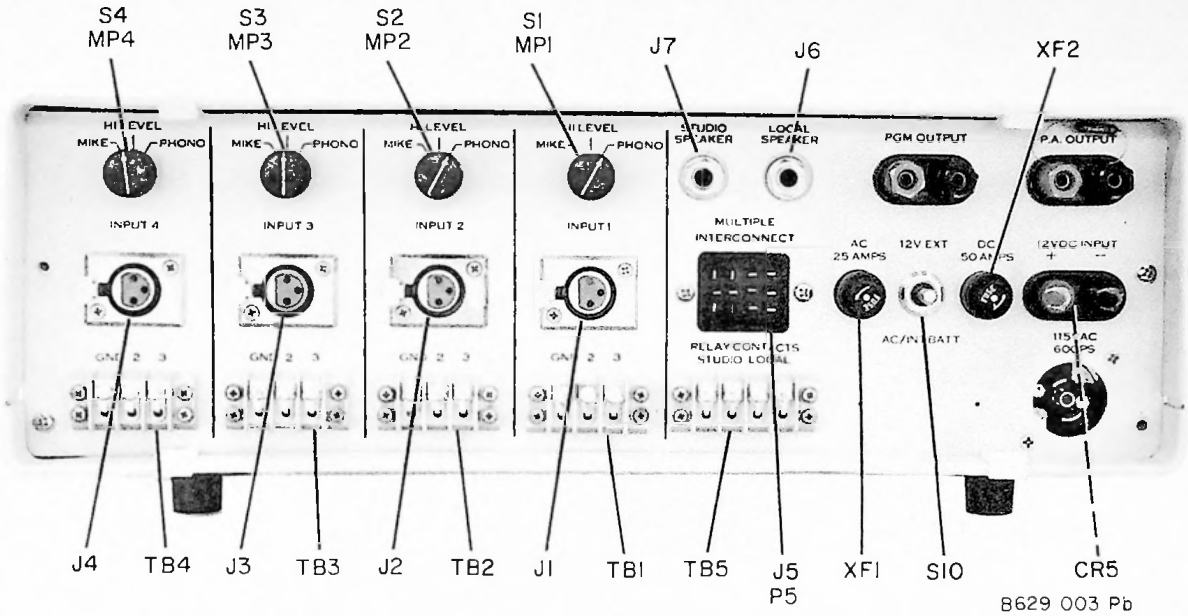
Figure 6-2. Chassis Console (Sheet 3 of 3).

SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR CODE	COLLINS PART NUMBER
	CHASSIS CONSOLE			770-5580-001
AT1	ATTENUATOR, VARIABLE 6 DB, 600 OHMS IMPEDANCE,	SP66845	71471	378-0592-110
AT2	SAME AS AT1			
AT3	SAME AS AT1			
AT4	SAME AS AT1			
AT5	ATTENUATOR, VARIABLE 6 DB, 600 OHMS IMPEDANCE,	SP66846	71471	378-0592-120
AT6	ATTENUATOR, VAR, COMPOSITION 25,000 OHMS, 20% TOL, 3 WATTS	304482	11236	376-0258-010
AT7	ATTENUATOR, VAR, COMPOSITION 5000 OHMS, 20% TOL, 3 WATTS	304663	11236	376-0258-020
C1	CAPACITOR, FXD, ELECTROLYTIC 3000 UF, PLUS 150% MINUS 10%, 35 VDCW	20-23360	37942	183-1292-050
C2	CAPACITOR, FXD, ELECTROLYTIC 400 UF, PLUS 50% MINUS 10%, 40 VDCW	C437ARG400	73445	183-2355-160
C3	CAPACITOR, FXD, MICA 0.015 UF, 5% TOL, 500 VDCW	CM07FD153J03	81349	912-2741-000
C4	NOT USED			
C5	CAPACITOR, FXD, ELECTROLYTIC 10,000 UF, PLUS 150% MINUS 10%, 20 VDCW	20-23511	37942	183-1292-070
C6	SAME AS C5			
C7	SAME AS C5			
CR1	SEMICONDUCTOR DEVICE, DIODE	1N4003	07688	353-6442-030
CR2	SAME AS CR1			
CR3	SEMICONDUCTOR DEVICE, DIODE	1N749A	07688	353-2706-000
CR4	SEMICONDUCTOR DEVICE, DIODE	1N752A	07688	353-2712-000
CR5	NOT USED			
CR6	SEMICONDUCTOR DEVICE, RECTIFIER	MDA942-2	04713	353-0422-020
DS1	LIGHT INDICATOR RED	XX	XX	262-0422-510
DS2	SAME AS DS1			
DS3	SAME AS DS1			
E1	WASHER, FLAT 0.147 IN. ID	19888	14655	310-0046-000
E2	SAME AS E1			
E3	SAME AS E1			
J1 THROUGH J8	NOT USED			
J9	JACK, TELEPHONE	JJ089	81349	358-0014-000
J10	SAME AS J9			
LS1	LOUDSPEAKER, PERMANENT MAGNET 3 WATTS POWER RATING	3K7	32001	371-0217-000
M1	VOLTMETER, AC -20 TO +3 VU, TOP SCALE 0 TO 100 VU, BOTTOM SCALE	V569	81030	458-0252-020 757-0233-003
MP1	KNOB			
MP2	SAME AS MP1			
MP3	SAME AS MP1			
MP4	SAME AS MP1			
MP5	KNOB			757-0232-002
MP6	SAME AS MP5			
MP7	SAME AS MP5			
MP8	SAME AS MP5			
Q1	TRANSISTOR	2N3567	07688	352-0629-010
Q2	SAME AS Q1			
Q3	TRANSISTOR	2N3715	07688	352-0677-030
R1	RESISTOR, FXD, COMPOSITION 390 OHMS, 5% TOL, 1/2 WATT	RC20GF391J	81349	745-1334-000
R2	RESISTOR, FXD, COMPOSITION 1K OHMS, 5% TOL, 1/2 WATT	RC20GF102J	81349	745-1351-000
R3	SAME AS R2			
R4	SAME AS R1			
R5	SAME AS R2			

SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR CODE	COLLINS PART NUMBER
R6	SAME AS R2			
R7	SAME AS R1			
R8	SAME AS R2			
R9	SAME AS R2			
R10	SAME AS R1			
R11	SAME AS R2			
R12	SAME AS R2			
R13	RESISTOR, FXD, COMPOSITION 3900 OHMS, 5% TOL, 1/2 WATT	RC20GF392J	81349	745-1376-000
R14	RESISTOR, FXD, COMPOSITION 470 OHMS, 5% TOL, 1/2 WATT	RC20GF471J	81349	745-1337-000
R15	SAME AS R14			
R16	NOT USED			
R17	SAME AS R14			
R18	RESISTOR, FXD, COMPOSITION 100 OHMS, 5% TOL, 1/2 WATT	RC20GF101J	81349	745-1309-000
R19	RESISTOR, VAR, WIRE WOUND 1K OHMS, 5% TOL, 1/2 WATT	224L1-102	80294	381-1285-000
R20	RESISTOR, FXD, WIRE WOUND 1 OHM, 5% TOL, 3 WATTS	RW69V1R0	81349	747-5300-000
R21	SAME AS R20			
R22	SAME AS R14			
R23 THROUGH R28	NOT USED			
R29	RESISTOR, FXD, WIRE WOUND 10 OHMS, 10% TOL, 10 WATTS	XX	XX	710-9050-000
S1 THROUGH S4	NOT USED			
S5	SWITCH, LEVER 1A, 1D CONTACT ARRANGEMENT	1G-10004-89	01548	375-1020-070
S6	SAME AS S1			
S7	SAME AS S1			
S8	SAME AS S1			
S9	SWITCH, ROTARY 1 SECTION, 3 POLES 3 POSITIONS	266728A1	76854	259-2649-030
T1	TRANSFORMER, POWER STEP DOWN OPEN FRAME	1721K1	21394	662-0344-050
T2	TRANSFORMER, AF CONTINUOUS	124A29	11700	667-0187-010
T3	SAME AS T2			
T4	SAME AS T2			
XQ1	SOCKET, TRANSISTOR 1 AMP CURRENT RATING	05-3307-51	91662	352-9903-000
XQ2	SAME AS XQ1			



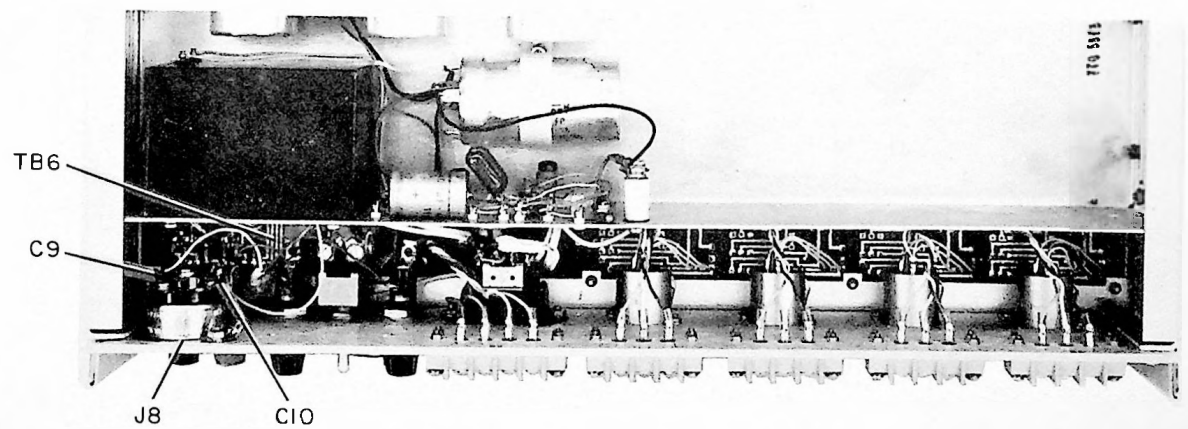


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Figure 6-3. Rear Module.

SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR CODE	COLLINS PART NUMBER
	REAR MODULE			770-5578-001
C1 THROUGH C8	NOT USED			
C9	CAPACITOR, FXD, CERAMIC 0.02 UF, PLUS 80% MINUS 20%, 100 VDCW	845-014X5V0503Z	72982	913-3678-000
C10	SAME AS C9			
CR1 THROUGH CR4	NOT USED			
CR5	SEMICONDUCTOR DEVICE, DIODE	1N4003	81349	353-0442-030
J1	CONNECTOR, ELECTRICAL 3 CONTACTS	XLR3-31	91146	369-0011-000
J2	SAME AS J1			
J3	SAME AS J1			
J4	SAME AS J1			
J5	CONNECTOR, ELECTRICAL 12 CONTACTS	P312DB	71785	365-0017-000
J6	JACK, TELEPHONE	DS00-1912PX090	17419	358-0014-000
J7	SAME AS J6			
J8	CONNECTOR, ELECTRICAL 1 CONTACT	7595	74545	368-0309-010
MP1	KNOB			757-0228-001
MP2	SAME AS MP1			
MP3	SAME AS MP1			
MP4	SAME AS MP1			
P1 THROUGH P4	NOT USED			
P5	CONNECTOR, ELECTRICAL			770-5633-001
S1	SWITCH, ROTARY 2 SECTIONS, 6 POLES, 3 POSITIONS	266727-A3	76854	259-2649-020
S2	SAME AS S1			
S3	SAME AS S1			
S4	SAME AS S1			
S5 THROUGH S9	NOT USED			
S10	SWITCH, TOGGLE 2C CONTACT ARRANGEMENT	MS35059-21	96906	266-3091-000
TB1	BOARD, TERMINAL 3 TERMINALS	40TB3	81349	367-1570-000
TB2	SAME AS TB1			
TB3	SAME AS TB1			
TB4	SAME AS TB1			
TB5	BOARD, TERMINAL 4 TERMINALS	40TB4	81349	367-1571-000
TB6	BOARD, TERMINAL	1513-A	71785	306-2220-000
XF1	FUSEHOLDER 15 AMPS	340138	75915	265-1097-000
XF2	SAME AS XF1			

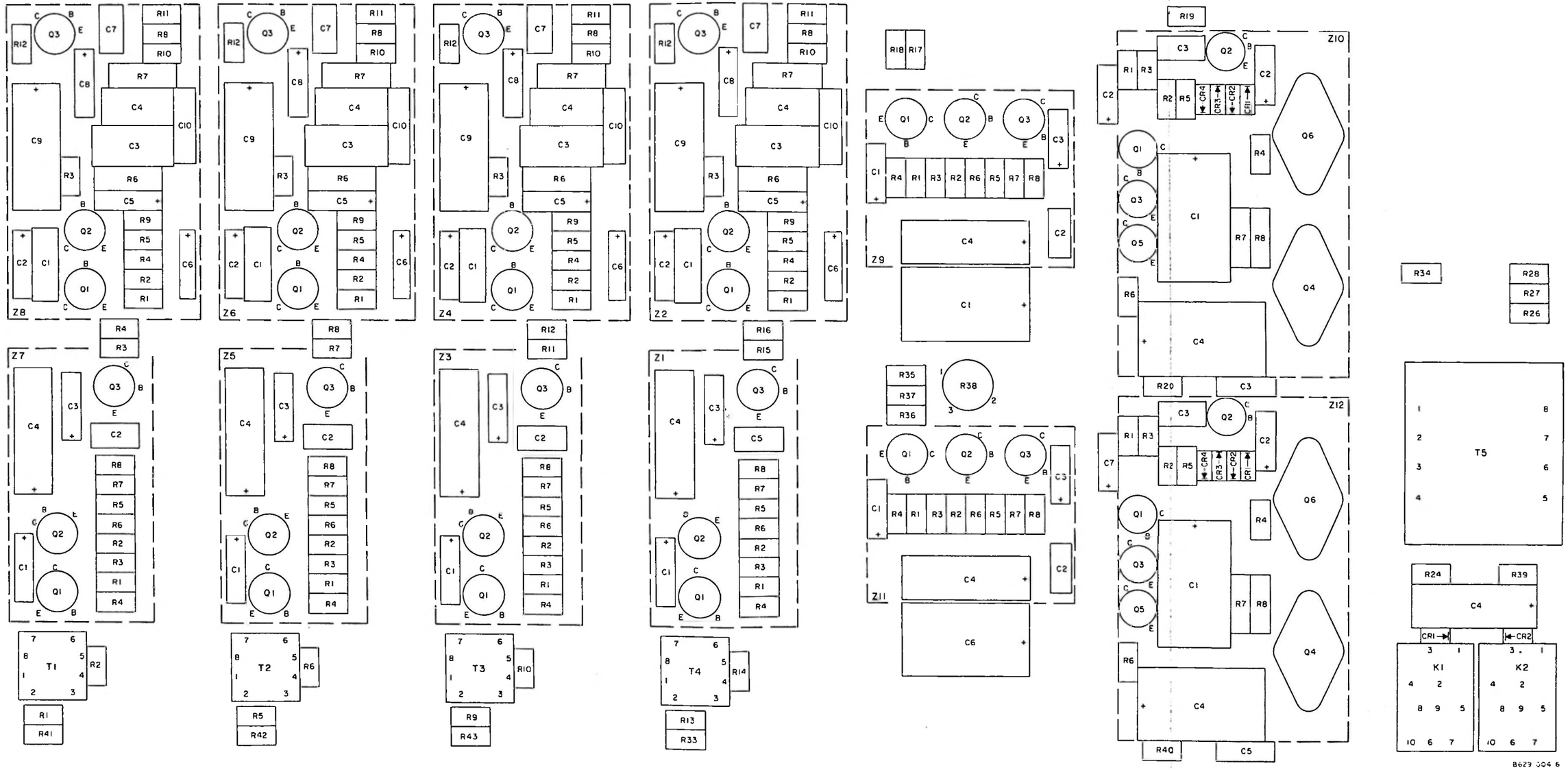

Figure 6-4. Remote Amplifier Board.

SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR CODE	COLLINS PART NUMBER
	REMOTE AMPLIFIER BOARD			774-7547-001
C1	CAPACITOR, FXD, ELECTROLYTIC 640 UF, PLUS 50% MINUS 10%, 25 VDCW	C437ARF640	73445	183-2355-120
C2	CAPACITOR, FXD, ELECTROLYTIC 40 UF, 20% TOL, 10 VDCW	150D406X0010B2	56289	184-7380-000
C3	CAPACITOR, FXD, CERAMIC 0.1 UF, PLUS 80% MINUS 20%, 25 VDCW	3C19A	56289	913-5516-000
C4	CAPACITOR, FXD, ELECTROLYTIC 160 UF, PLUS 50% MINUS 10%, 25 VDCW	C437ARF160	73445	183-2355-100
C5	SAME AS C3			
C6	SAME AS C1			
C7	SAME AS C2			
CR1	SEMICONDUCTOR DEVICE, DIODE	1N4003	07688	353-6442-030
CR2	SAME AS CR1			
K1	RELAY, ARMATURE 2C CONTACT ARRANGEMENT	TS154CC8-5MA	70309	970-2456-010
K2	SAME AS K1			
R1	RESISTOR, FXD, COMPOSITION 56K OHMS, 5% TOL, 1/2 WATT	RC20GF563J	81349	745-1425-000
R2	SAME AS R1			
R3	RESISTOR, FXD, COMPOSITION 100K OHMS, 5% TOL, 1/2 WATT	RC20GF104J	81349	745-1435-000
R4	SAME AS R3			
R5	SAME AS R1			
R6	SAME AS R1			
R7	SAME AS R2			
R8	SAME AS R2			
R9	SAME AS R1			
R10	SAME AS R1			
R11	SAME AS R2			
R12	SAME AS R2			
R13	SAME AS R1			
R14	SAME AS R1			
R15	SAME AS R2			
R16	SAME AS R2			
R17	RESISTOR, FXD, COMPOSITION 390 OHMS, 5% TOL, 1/2 WATT	RC20GF391J	81349	745-1337-000
R18	RESISTOR, FXD, COMPOSITION 1K OHMS, 5% TOL, 1/2 WATT	RC20GF102J	81349	745-1351-000
R19	RESISTOR, FXD, COMPOSITION 620 OHMS, 5% TOL, 1/2 WATT	RC20GF621J	81349	745-1343-000
R20	RESISTOR, FXD, COMPOSITION 22 OHMS, 5% TOL, 1/2 WATT	RC20GF220J	81349	745-1281-000
R21	NOT USED			
R22	NOT USED			
R23	NOT USED			
R24	RESISTOR, FXD, COMPOSITION 10K OHMS, 5% TOL, 1/2 WATT	RC20GF103J	81349	745-1393-000
R25	NOT USED			
R26	RESISTOR, FXD, FILM 5620 OHMS, 1% TOL, 1/4 WATT	RN60D5621F	81349	705-6632-000
R27	RESISTOR, FXD, FILM 2610 OHMS, 1% TOL, 1/4 WATT	RN60D2611F	81349	705-6616-000
R28	RESISTOR, FXD, FILM 1960 OHMS, 1% TOL, 1/4 WATT	RN60D1961F	81349	705-6610-000
R29 THROUGH R32	NOT USED			
R33	RESISTOR, FXD, COMPOSITION 560 OHMS, 5% TOL, 1/2 WATT	RC20GF561J	81349	745-1341-000
R34	RESISTOR, FXD, COMPOSITION 10 OHMS, 5% TOL, 1/2 WATT	RC20GF100J	81349	745-1267-000
R35	RESISTOR, FXD, COMPOSITION 2200 OHMS, 5% TOL, 1/2 WATT	RC20GF222J	81349	745-1365-000
R36	SAME AS R35			

SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR CODE	COLLINS PART NUMBER
R37	SAME AS R18			
R38	RESISTOR, VAR, COMPOSITION 10K OHMS, 20% TOL, 1/2 WATT	FR103M	01121	380-3761-070
R39	RESISTOR, FXD, COMPOSITION 47 OHMS, 5% TOL, 1/2 WATT	RC20GF470J	81349	745-1295-000
R40	SAME AS R20			
R41	SAME AS R33			
R42	SAME AS R33			
R43	SAME AS R33			
T1	TRANSFORMER, AF	JB204	80223	667-0174-010
T2	SAME AS T1			
T3	SAME AS T1			
T4	SAME AS T1			
T5	TRANSFORMER, AF	A17115	70674	667-0196-010
XK1	SOCKET, RELAY 5 AMPS CURRENT RATING	30055-3	70309	220-1518-000
XK2	SAME AS XK1			
Z1	PREAMPLIFIER, FE SEE BREAKDOWN ON PAGE 6-14			774-7536-001
Z2	PHONOGRAPH PREAMPLIFIER, FE SEE BREAKDOWN ON PAGE 6-15			774-7538-001
Z3	SAME AS Z1			
Z4	SAME AS Z2			
Z5	SAME AS Z1			
Z6	SAME AS Z2			
Z7	SAME AS Z1			
Z8	SAME AS Z2			
Z9	BUFFER AMPLIFIER, FE SEE BREAKDOWN ON PAGE 6-15			786-1553-001
Z10	AMPLIFIER, FE SEE BREAKDOWN ON PAGE 6-16			774-7603-001
Z11	SAME AS Z9			
Z12	SAME AS Z10			
	PREAMPLIFIER, FE			774-7536-001
Z1C1	CAPACITOR, FXD, ELECTROLYTIC 40 UF, 20% TOL, 10 VDCW	150D406X0010B2	56289	184-7380-000
Z1C2	NOT USED			
Z1C3	SAME AS C1			
Z1C4	CAPACITOR, FXD, ELECTROLYTIC 1000 UF, PLUS 50% MINUS 10%, 16 VDCW	C437ARE1000	73445	183-2355-090
Z1C5	CAPACITOR 180			183-7784-000
Z1Q1	TRANSISTOR	2N3565	07688	352-0638-010
Z1Q2	SAME AS Q1			
Z1Q3	TRANSISTOR	2N3569	07688	352-0629-030
Z1R1	RESISTOR, FXD, COMPOSITION 47K OHMS, 5% TOL, 1/2 WATT	RC20GF473J	81349	745-1421-000
Z1R2	SAME AS R1			
Z1R3	RESISTOR, FXD, COMPOSITION 62K OHMS, 5% TOL, 1/2 WATT	RC20GF623J	81349	745-1427-000
Z1R4	RESISTOR, FXD, COMPOSITION 1200 OHMS, 5% TOL, 1/2 WATT	RC20GF122J	81349	745-1355-000
Z1R5	RESISTOR, FXD, COMPOSITION 6800 OHMS, 5% TOL, 1/2 WATT	RC20GF682J	81349	745-1386-000
Z1R6	RESISTOR, FXD, COMPOSITION 1K OHMS, 5% TOL, 1/2 WATT	RC20GF102J	81349	745-1351-001
Z1R7	RESISTOR, FXD, COMPOSITION 560 OHMS, 5% TOL, 1/2 WATT	RC20GF561J	81349	745-1341-000
Z1R8	RESISTOR, FXD, COMPOSITION 150 OHMS, 5% TOL, 1/2 WATT	RC20GF151J	81349	745-1316-000
Z1R9	RESISTOR, FXD, COMPOSITION 2200 OHMS, 5% TOL, 1/2 WATT	RC20GF222J	81349	745-1365-000

SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR CODE	COLLINS PART NUMBER
Z1XQ1	SOCKET, TRANSISTOR 1 AMP CURRENT RATING	05-3307-51	91662	352-9903-000
Z1XQ2	SAME AS XQ1			
Z1XQ3	SAME AS XQ1			
	PHONOGRAPH PREAMPLIFIER, FE			774-7538-001
Z2C1	CAPACITOR, FXD, MICA 620 UUF, 5% TOL, 500 VDCW	CM06FD621J03	81349	912-2986-000
Z2C2	CAPACITOR, FXD, ELECTROLYTIC 1 UF, 20% TOL, 35 VDCW	150D105X0035A2	56289	184-7398-000
Z2C3	CAPACITOR, FXD, MICA 0.015 UF, 5% TOL, 500 VDCW	CM07FD153J03	81349	912-2741-000
Z2C4	CAPACITOR, FXD, MICA 4700 UUF, 5% TOL, 500 VDCW	CM06FD472J03	81349	912-3052-000
Z2C5	CAPACITOR, FXD, ELECTROLYTIC 40 UF, 20% TOL, 10 VDCW	150D406X0010B2	56289	184-7380-000
Z2C6	SAME AS C5			
Z2C7	CAPACITOR, FXD, MICA 27 UUF, 5% TOL	CM05ED270J03	81349	912-2774-000
Z2C8	SAME AS C5			
Z2C9	CAPACITOR 160 UF, PLUS 50% MINUS 20%, 25 VDCW	C4737ARF160	73445	183-2355-100
Z2C10	CAPACITOR, FXD, MICA 3300 UUF, 5% TOL, 500 VDCW	CM06FD332J03	81349	912-3040-000
Z2Q1	TRANSISTOR	2N3565	07688	352-0638-010
Z2Q2	SAME AS Q1			
Z2Q3	SAME AS Q1			
Z2R1	RESISTOR, FXD, COMPOSITION 56K OHMS, 5% TOL, 1/2 WATT	RC20GF563J	81349	745-1425-000
Z2R2	RESISTOR, FXD, COMPOSITION 1.5 MEGOHMS, 5% TOL, 1/2 WATT	RC20GF155J	81349	745-1484-000
Z2R3	RESISTOR, FXD, COMPOSITION 130K OHMS, 5% TOL, 1/2 WATT	RC20GF134J	81349	745-1441-000
Z2R4	RESISTOR, FXD, COMPOSITION 1600 OHMS, 5% TOL, 1/2 WATT	RC20GF162J	81349	745-1361-000
Z2R5	RESISTOR, FXD, COMPOSITION 820K OHMS, 5% TOL, 1/2 WATT	RC20GF824J	81349	745-1474-000
Z2R6	RESISTOR, FXD, FILM 316K OHMS, 1% TOL, 1/2 WATT	RN65D3163J	81349	705-7216-000
Z2R7	RESISTOR, FXD, FILM 18.7K OHMS, 1% TOL, 1/2 WATT	RN65D1872F	81349	705-7156-000
Z2R8	RESISTOR, FXD, COMPOSITION 39K OHMS, 5% TOL, 1/2 WATT	RC20GF393J	81349	745-1418-000
Z2R9	RESISTOR, FXD, COMPOSITION 4700 OHMS, 5% TOL, 1/2 WATT	RC20GF472J	81349	745-1379-000
Z2R10	RESISTOR, FXD, COMPOSITION 2700 OHMS, 5% TOL, 1/2 WATT	RC20GF272J	81349	745-1369-000
Z2R11	RESISTOR, FXD, COMPOSITION 560 OHMS, 5% TOL, 1/2 WATT	RC20GF561J	81349	745-1341-000
Z2R12	RESISTOR, FXD, COMPOSITION 47 OHMS, 5% TOL, 1/2 WATT	RC20GF470J	81349	745-1295-000
Z2XQ1	SOCKET, TRANSISTOR 1 AMP CURRENT RATING	05-3307-51	91662	352-9903-000
Z2XQ2	SAME AS XQ1			
Z2XQ3	SAME AS XQ1			
	BUFFER AMPLIFIER, FE			786-1553-001
Z9C1	CAPACITOR, FXD, ELECTROLYTIC 40 UF, 20% TOL, 10 VDCW	150D406X0010B2	56289	184-7380-000
Z9C2	CAPACITOR, FXD, MICA 390 UUF, 5% TOL, 500 VDCW	CM05FD391J03	81349	912-2858-000
Z9C3	SAME AS Z9C1			

SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR CODE	COLLINS PART NUMBER
Z9C4	CAPACITOR 160 UF, PLUS 50% MINUS 10%, 25 VDCW	C437ARF160	73445	183-2355-100
Z9C5	CAPACITOR, FXD, ELECTROLYTIC 180 UF, 20% TOL, 10 VDCW	109D187X0010F2	56289	183-7784-000
Z9Q1	TRANSISTOR	2N3565	07688	352-0638-010
Z9Q2	SAME AS Z9Q1			
Z9Q3	TRANSISTOR	2N3569	07688	352-0629-030
Z9R1	RESISTOR, FXD, COMPOSITION 47K OHMS, 5% TOL, 1/2 WATT	RC20GF473J	81349	745-1421-000
Z9R2	SAME AS Z9R1			
Z9R3	RESISTOR, FXD, COMPOSITION 62K OHMS, 5% TOL, 1/2 WATT	RC20GF623J	81349	745-1421-000
Z9R4	RESISTOR, FXD, COMPOSITION 1200 OHMS, 5% TOL, 1/2 WATT	RC20GF122J	81349	745-1355-000
Z9R5	RESISTOR, FXD, COMPOSITION 6800 OHMS, 5% TOL, 1/2 WATT	RC20GF682J	81349	745-1386-000
Z9R6	RESISTOR, FXD, COMPOSITION 1K OHMS, 5% TOL, 1/2 WATT	RC20GF102J	81349	745-1351-000
Z9R7	RESISTOR, FXD, COMPOSITION 560 OHMS, 5% TOL, 1/2 WATT	RC20GF561J	81349	745-1341-000
Z9R8	RESISTOR, FXD, COMPOSITION 150 OHMS, 5% TOL, 1/2 WATT	RC20GF151J	81349	745-1316-000
Z9R9	RESISTOR, FXD, COMPOSITION 2200 OHMS, 5% TOL, 1/2 WATT	RC20GF222J	81349	745-1365-000
Z9XQ1	SOCKET, TRANSISTOR 1 AMP CURRENT RATING	05-3307-51	91662	352-9903-000
Z9XQ2	SAME AS Z9XQ1			
Z9XQ3	SAME AS Z9XQ1			
	AMPLIFIER, FE			774-7603-001
Z10C1	CAPACITOR, FXD, 1000 UF, PLUS 50% MINUS 10%, 16 VDCW	C473ARE1000	73445	183-2355-090
Z10C2	CAPACITOR, FXD, ELECTROLYTIC 40 UF, 20% TOL, 10 VDCW	150D406X0010B2	56289	184-7380-000
Z10C3	CAPACITOR, FXD, MICA 27 UF, 5% TOL, 500 VDCW	CM05ED270J03	81349	912-2774-000
Z10C4	SAME AS Z10C1			
Z10CR1	SEMICONDUCTOR DEVICE, DIODE	1N914	07688	352-2906-000
Z10CR2	SAME AS Z10CR1			
Z10CR3	SAME AS Z10CR1			
Z10CR4	SAME AS Z10CR1			
Z10Q1	TRANSISTOR	2N3567	07688	352-0629-010
Z10Q2	TRANSISTOR	2N3565	07688	352-0638-010
Z10Q3	TRANSISTOR	2N3645	07688	352-0732-020
Z10Q4	TRANSISTOR	2N3766	07688	352-0689-010
Z10Q5	TRANSISTOR	2N4250	07688	352-0773-030
Z10Q6	TRANSISTOR	2N3740	07688	352-0695-010
Z10R1	RESISTOR, FXD, COMPOSITION 27K OHMS, 5% TOL, 1/2 WATT	RC20GF273J	81349	745-1411-000
Z10R2	RESISTOR, FXD, COMPOSITION 82K OHMS, 5% TOL, 1/2 WATT	RC20GF823J	81349	745-1432-000
Z10R3	RESISTOR, FXD, COMPOSITION 12K OHMS, 5% TOL, 1/2 WATT	RC20GF123J	81349	745-1397-000
Z10R4	RESISTOR, FXD, COMPOSITION 2200 OHMS, 5% TOL, 1/2 WATT	RC20GF222J	81349	745-1365-000
Z10R5	RESISTOR, FXD, COMPOSITION 4700 OHMS, 5% TOL, 1/2 WATT	RC20GF472J	81349	745-1379-000
Z10R6	SAME AS Z10R1			
Z10R7	RESISTOR, FXD, WIRE WOUND 2.2 OHMS, 5% TOL, 3 WATTS	RW69V2R2	81349	747-5307-000
Z10R8	SAME AS Z10R7			
Z10XQ1	SOCKET, TRANSISTOR 1 AMP CURRENT RATING	05-3307-51	91662	352-9903-000
Z10XQ2	SAME AS Z10XQ1			
Z10XQ3	SAME AS Z10XQ1			

SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR CODE	COLLINS PART NUMBER
Z10XQ4	NOT USED			
Z10XQ5	SAME AS Z10XQ1			

MANUFACTURERS CODES

CODE	MANUFACTURER
01121	ALLEN BRADLEY CO MILWAUKIE, WIS 53204
01548	CAPITOL MACHINE AND SWITCH CO DANBURY, CONN 06810
04713	MOTOROLA SEMICONDUCTOR PRODUCTS INC PHOENIX, ARIZ 85008
07688	MILITARY SPECIFICATIONS
11236	CTS OF BERNE INC BERNE, IND
11700	JB ELECTRONIC TRANSFORMERS INC CHICAGO, ILL.
14655	CORNELL DUBILIER ELECTRIC CORP NEWARK, N.J.
17419	DEUTSCH CO LOS ANGELES, CALIF 90009
21394	FLORIDA HINDLE TRANSFORMER DELAND, FLA 32721
32001	JENSEN MFG CO CHICAGO, ILL. 60638
37942	MALLORY PR AND CO INC INDIANAPOLIS, IND 46206
56289	SPRAGUE ELECTRIC CO NORTH ADAMS, MASS.
70309	ALLIED CONTROL CO INC NEW YORK, N.Y.
70674	ADC PRODUCTS INC MINNEAPOLIS, MINN. 55426
71471	CINEMA PLANT HI-Q DIVISION AEROVOX CORP BURBANK CALIF 91503
71785	CINCH MFG CO AND HOWARD B JONES DIV CHICAGO, ILL. 60624
72982	ERIE TECHNOLOGICAL PRODUCTS INC ERIE, PA. 16512
73445	AMPEREX ELECTRONIC CO DIV OF NORTH AMERICAN PHILIPS CO INC HICKSVILLE, N.Y.
74545	HUBBELL HARVEY INC BRIDGEPORT, CONN 06603
75915	LITTLEFUSE INC DES PLAINES, ILL. 60016
76854	OAK MFG CO CRYSTAL LAKE, ILL.
80223	UNITED TRANSFORMER CO NEW YORK, N.Y.
80294	BOURNS INC RIVERSIDE, CALIF 92506
81030	INTERNATIONAL INSTRUMENTS INC ORANGE, CONN 06477
81349	MILITARY SPECIFICATIONS
91146	ITT CANNON ELECTRIC INC SALEM DIVISION SALEM, MASS.
91662	ELCO CORP WILLOW GROVE, PA.
96906	MILITARY SPECIFICATIONS

section 7
illustrations

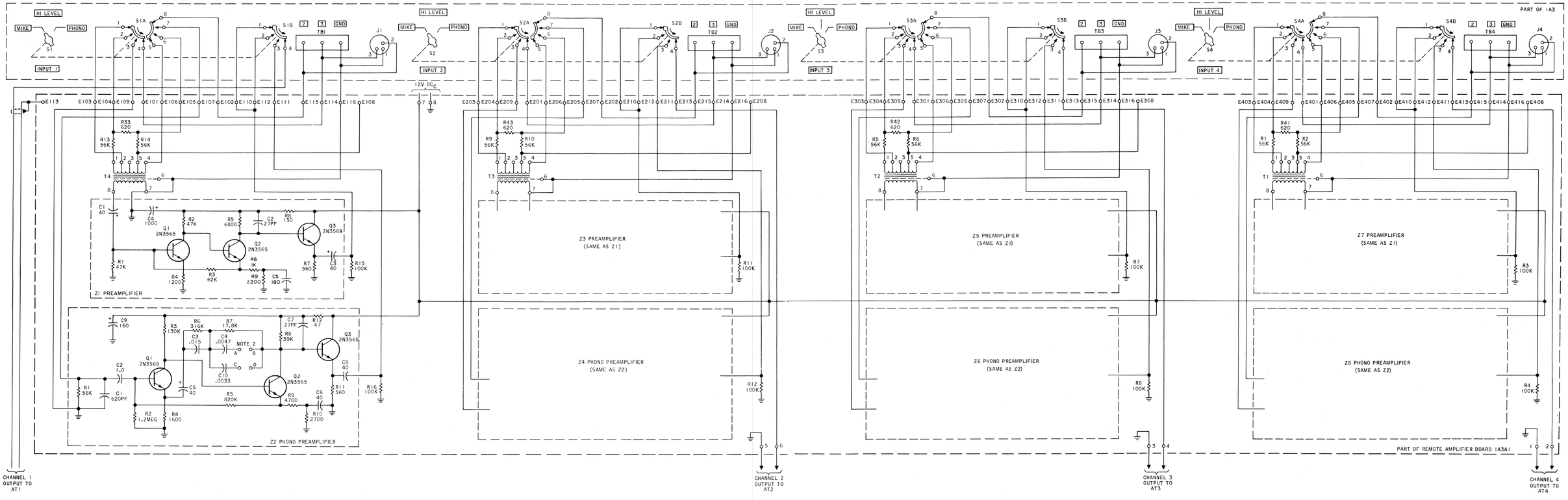

Figure 7-1. 212J-1 Broadcast Audio Console, Schematic Diagram (Sheet 2 of 3).

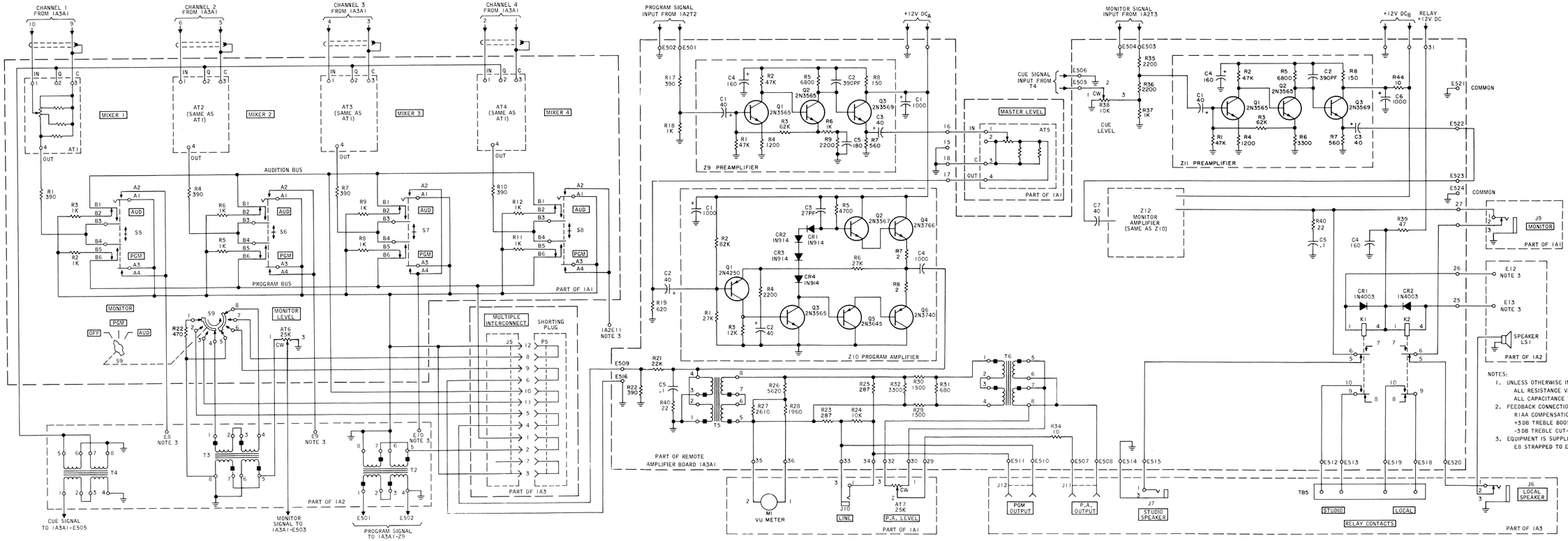

Figure 7-1. 212J-1 Broadcast Audio Console, Schematic Diagram (Sheet 3 of 3).

WIRE CODE

TYPE

CODE	DESCRIPTION
A	HOOKUP WIRE, STRANDED
B	BUS WIRE, SOLID
C	**HOOKUP WIRE, COPPERWELD, 30% COND.
D	**HOOKUP WIRE, COPPERWELD, 40% COND.
E	ELECTRICAL (CONSTRUCTION)
F	
G	
H	
J	
K	
L	LITZ
M	MAGNET
N	NEON
P	
R	
S	
T	TELEPHONE
V	
W	TEST LEADS
X	
Y	HOOKUP WIRE, COPPERCLAD STEEL, SOLID
Z	HOOKUP WIRE, SOLID

** STRANDED

SIZE

CODE	DESCRIPTION
01	1 AWG (817 X #30 IF STRANDED)
02	2 AWG (665 X #30 IF STRANDED)
03	3 AWG
04	4 AWG (133 X #25 IF STRANDED)
05	5 AWG
06	6 AWG (133 X #27 IF STRANDED)
07	7 AWG
08	8 AWG (133 X #29 IF STRANDED)
09	9 AWG
10	10 AWG (37 X #26 IF STRANDED)
11	11 AWG
12	12 AWG (19 X #25 IF STRANDED)
13	13 AWG
14	14 AWG (19 X #27 IF STRANDED)
15	15 AWG
16	16 AWG (19 X #29 IF STRANDED)
17	17 AWG
18	18 AWG (7 X #26 IF STRANDED)
19	19 AWG
20	20 AWG (7 X #28 IF STRANDED)
21	21 AWG
22	22 AWG (7 X #30 IF STRANDED)
23	23 AWG
24	24 AWG (7 X #32 IF STRANDED)
25	25 AWG
26	26 AWG (7 X #34 IF STRANDED)
27	27 AWG (7 X #35 IF STRANDED)
28	28 AWG (7 X #36 IF STRANDED)
29	29 AWG
30	30 AWG (7 X #38 IF STRANDED)
31	31 AWG
32	32 AWG (4 X #36 IF STRANDED)
33	33 AWG
34	34 AWG SOLID
35	35 AWG SOLID
36	36 AWG SOLID
37	37 AWG SOLID
38	38 AWG SOLID
39	39 AWG SOLID
40	40 AWG SOLID
41	41 AWG SOLID
42	42 AWG SOLID
43	43 AWG SOLID
44	44 AWG SOLID
45	45 AWG SOLID
46	46 AWG SOLID
47	47 AWG SOLID
48	48 AWG SOLID
49	49 AWG SOLID
50	50 AWG SOLID
51	1 AWG STRANDED (259 X #25)
52	6 AWG STRANDED (266 X #30)
53	8 AWG STRANDED (168 X #30)
54	10 AWG STRANDED (49 X #27)
55	14 AWG STRANDED (37 X #29)
56	16 AWG STRANDED (96 X #36)
57	18 AWG STRANDED (65 X #36)
58	18 AWG STRANDED (41 X #34)
59	18 AWG STRANDED (19 X #30)
60	20 AWG STRANDED (19 X #32)
61	20 AWG STRANDED (10 X #34)
62	22 AWG STRANDED (19 X #34)
63	22 AWG STRANDED (27 X #36)
64	26 AWG STRANDED (10 X #36)
65	26 AWG STRANDED (19 X #38)
66	26 AWG STRANDED (8 X #36)
67	18 AWG STRANDED (16 X #30)
68	24 AWG STRANDED (19 X #36)
69	
70	18 AWG STRANDED (19 X #28)
71	12 AWG STRANDED (7 X .0305)
72	16 AWG STRANDED (37 X #26)
73	20 AWG STRANDED (41 X #36)
74	14 AWG STRANDED (168 X #37) (7 X 24) ***
75	16 AWG STRANDED (26 X #30)
76	20 AWG STRANDED (10 X #30)
77	8 AWG STRANDED (7 X .0486)
78	6 AWG STRANDED (7 X .0612)
79	18 AWG STRANDED (16 X #30)
80	36 AWG STRANDED (10 X #36)
81	14 AWG STRANDED (41 X #30)
82	2 AWG STRANDED (7 X .0974)
83	4 AWG STRANDED (7 X .0772)
84	10 AWG STRANDED (105 X #30)
85	12 AWG STRANDED (65 X #30)
86	12 AWG STRANDED (64 X #31)
87	26 AWG STRANDED (65 X #44)
88	10 AWG STRANDED (7 X .0345)
89	14 AWG STRANDED (7 X .0242)
90	
91	0 AWG (1045 X #30 IF STRANDED)
92	00 AWG (1330 X #30 IF STRANDED)
93	000 AWG (1665 X #30 IF STRANDED)
94	0000 AWG (2109 X #30 IF STRANDED)
95	
96	
97	
98	
99	

NOTE: NUMBERS 1 THRU 32 CAN BE STRANDED OR SOLID WIRE. NUMBERS 51 THRU 90 ARE STRANDED WIRE, USUALLY NON-STANDARD STRANDING COMBINATIONS.

*** ROPE LAY

STYLE

CODE	DESCRIPTION
AA*	ASBESTOS, TYPE AA (BRAIDED) (300 VOLTS)
AD*	ASBESTOS, PLIOFILM, GLASS YARN BRAID, LACQUERED, (1000 VOLTS)
AC*	ASBESTOS, PLIOFILM, GLASS YARN BRAID, LACQUERED, (600 VOLTS)
AD*	ASBESTOS, PLIOFILM, GLASS YARN BRAID, LACQUERED, (5000 VOLTS)
AE*	ASBESTOS, DENSE SEAMLESS, IMPREGNATED WALL OF FELTED ASBESTOS, COVERED BY ASBESTOS BRAID. (300 VOLTS) (RHEOSTAT AND STOVE WIRE)
BA	BUS, QQ-W-343, TYPE S, SOFT OR DRAWN AND ANNEALED TIN COATED
BB	BUS, QQ-W-343, BARE ANNEALED, COPPER SOFT DRAWN
BC	BUS, QQ-W-345, TYPE I, TINNED COPPER-CLAD STEEL
BE*	BUS, QQ-W-343, TYPE S, SOFT DRAWN COPPER WITH 99% MIN. PURE SILVER COATING, .001 INCH MIN. THICK
BF*	BUS, 1/2 H TEMP, COPPER .001 MIN. 10KT. GOLD PLATING
BG*	BUS, HARD DRAWN
BH	BUS, QQ-W-343, STRANDED ANNEALED, COPPER SOFT DRAWN
BJ*	STRANDED, NICKEL PLATED ALLOY WIRE
BK*	STRANDED, SOFT OR DRAWN AND ANNEALED
BL	STRANDED, MIL-W-3861, TYPE RB, CLASS K
BM	BUS, MIL-N-46026, SOLID NICKEL, ANNEALED
BN*	BUS, SOLID NICKEL PER MIL-N-46026
BR	BUS, MIL-S-19424, CLASS 2, CONDITION 4, SOLID SILVER
BS	BUS, MIL-N-46026, ANNEALED NICKEL ALLOY, GOLD PLATED
BT*	BUS, QQ-W-343, TYPE S, (210-0475-00)
CA*	CAMPRIC VARNISHED, GLYPTAL TREATED BRAID
EA	THERMOPLASTIC, TYPE THW (MOISTURE AND FLAME RETARDANT). NEC TYPE
EB	THERMOPLASTIC* TYPE TW (FLAME AND MOISTURE RETARDANT). NEC TYPE
EC*	THERMOPLASTIC, SD COPPER COND., .010 WALL, MIN. HOOKUP
FA	POLYURETHANE, MIL-W-583, TYPE T, RD
FB	POLYURETHANE, MIL-W-583, TYPE T2, RD
FC	POLYURETHANE, MIL-W-583, TYPE T3, RD
FD	POLYURETHANE, MIL-W-583, TYPE T4, RD
FE	VINYL ACETAL, MIL-W-563, TYPE T, RD
FF	VINYL ACETAL, MIL-W-583, TYPE T2, RD
FG	VINYL ACETAL, MIL-W-583, TYPE T3, RD
FH	VINYL ACETAL, MIL-W-563, TYPE T4, RD
FJ	POLYIMIDE, MIL-W-583, TYPE K (ML), RD
FK	POLYIMIDE, MIL-W-583, TYPE K2 (ML), RD
FL	POLYESTER, MIL-W-583, TYPE L, RD
FM	POLYESTER, MIL-W-583, TYPE L2, RD
FN	POLYESTER, MIL-W-583, TYPE B, RD
FP	POLYESTER, MIL-W-583, TYPE B2, RD
GA	POLYURETHANE, MIL-W-583, TYPE T2, RD (3 STRANDS)
GB	POLYURETHANE, MIL-W-583, TYPE T2, RD (4 STRANDS)
GC	POLYURETHANE, MIL-W-583, TYPE T2, RD (5 STRANDS)
GD	POLYURETHANE, MIL-W-583, TYPE T2, RD (6 STRANDS)
GE	POLYURETHANE, MIL-W-583, TYPE T2, RD (7 STRANDS)
GF	POLYURETHANE, MIL-W-583, TYPE T2, RD (8 STRANDS)
GG	POLYURETHANE, MIL-W-583, TYPE T2, RD (9 STRANDS)
GH	POLYURETHANE, MIL-W-583, TYPE T2, RD (10 STRANDS)
GJ	POLYURETHANE, MIL-W-583, TYPE T2, RD (11 STRANDS)
GK	POLYURETHANE, MIL-W-583, TYPE T2, RD (13 STRANDS)
GL	POLYURETHANE, MIL-W-583, TYPE T2, RD (16 STRANDS)
GM	POLYURETHANE, MIL-W-583, TYPE T2, RD (20 STRANDS)
GN	POLYURETHANE, MIL-W-583, TYPE T2, RD (26 STRANDS)
GP	POLYURETHANE, MIL-W-583, TYPE T2, RD (32 STRANDS)
GR	POLYURETHANE, MIL-W-583, TYPE T2, RD (41 STRANDS)
GS	POLYURETHANE, MIL-W-583, TYPE T2, RD (50 STRANDS)
GT	POLYURETHANE, MIL-W-583, TYPE T2, RD (62 STRANDS)
KA*	KEL-F, MIL-W-12349, (600 VOLTS), SILVER COATED COND. 125°C.
KB*	KEL-F, MIL-W-12349, (1000 VOLTS), SILVER COATED COND. 125°C.
KC*	KEL-F, MIL-W-12349, EXCEPT 4000 VOLTS, SILVER COATED COND. 125°C.
MA*	TWO SERVINGS CELANESE, ONE SERVING COTTON WRAP, COATED WITH PLASTICIZED BUTYRATE LACQUER (300 VOLTS) (TELEPHONE TYPE)
MB*	TWO SERVINGS CELLULOSE ACETATE RAYON YARN, ONE SERVING COTTON WRAP WITH PLASTICIZED CELLULOSE BUTYRATE LACQUER
PA	POLYVINYL CHLORIDE, MIL-W-16878, TYPE B (600 VOLTS) SILVER COATED COND.
PB	POLYVINYL CHLORIDE, MIL-W-16878, TYPE B (600 VOLTS) TIN COATED COND.
PC	POLYVINYL CHLORIDE, MIL-W-16878, TYPE C (1,000 VOLTS) TIN COATED COND.
PD	POLYVINYL CHLORIDE, MIL-W-16878, TYPE D (3,000 VOLTS) TIN COATED COND.
PE*	POLYVINYL CHLORIDE, NON-MIL, TELEPHONE TYPE
PF*	POLYVINYL CHLORIDE, JAN-C-76, TYPE WL (600 VOLTS)
PG*	POLYVINYL CHLORIDE, JAN-C-76, TYPE SHR (1000 VOLTS)
PH*	POLYVINYL CHLORIDE, JAN-C-76, TYPE SHH (2500 VOLTS)
PI*	POLYVINYL CHLORIDE, JAN-C-76, TYPE SHH (600 VOLTS)
PJ*	POLYVINYL CHLORIDE, JAN-C-76, TYPE SHR (1000 VOLTS), WITH GLASS YARN BRAID, VARNISHED AND LACQUERED
PK	POLYVINYL CHLORIDE, MIL-W-16878, TYPE B (600 VOLTS), TIN COATED COND., FUSED STRANDS
PL	POLYVINYL CHLORIDE, MIL-W-16878, TYPE C (1,000 VOLTS), TIN COATED COND., FUSED STRANDS
PM*	POLYVINYL CHLORIDE, JAN-C-76, TYPE WL (600 VOLTS) WITH GLASS YARN BRAID, VARNISHED AND LACQUERED
PN*	POLYVINYL CHLORIDE, (600 VOLTS), TIN COATED CONDUCTOR
PO*	POLYVINYL CHLORIDE, TYPE SHFS, 15CI, (750 VDC)
PP*	POLYETHYLENE, RF, (2500 VOLTS)
PR*	POLYAMIDE (NYLON) (600 VOLTS)
PS*	POLYETHYLENE, NEON SIGN TYPE, 20,000 VDC -55°C TO +105°C
PT*	POLYETHYLENE, COTTON BRAIDED, FLAME - MOISTURE RESISTANT, TYPE W-146, MIL SPEC 7J-3189
PV*	POLYVINYL CHLORIDE, MIL-W-16878, MIN. OD. (.053)
PW*	POLYVINYL, HIGH FLEXIBILITY
PX	POLYVINYL, U.L. STYLE 1061, 300 V -10°C TO +80°C
RA	RUBBER, TYPE RH-RW (HEAT AND MOISTURE RESISTANT) NEC TYPE
RB	RUBBER, MIL-C-13486, TYPE 1, CLASS A (30 VOLT DC) NEOPRENE JACKET, FIBER GLASS BRAID
RC	RUBBER, NEC TYPE RHH (POLYCHLOROPRENE) -40°C TO +90°C
RD*	RUBBER, LACQUERED COTTON BRAID (NEON CABLE) 15,000 VOLTS
RE	RUBBER, BUNA-S (TEST LEADS) MIL-W-13169
RF*	RUBBER, TEST LEADS, COMM., 5000 VOLTS

STYLE (Cont)

CODE	DESCRIPTION
SA	SILICONE, MIL-W-16878, TYPE F (600 VOLTS) TIN COATED CONDUCTOR
SB	SILICONE, MIL-W-16878, TYPE FF (1,000 VOLTS) TIN COATED CONDUCTOR
SC	SILICONE, MIL-W-16878, TYPE FFW (1,000 VOLTS) TIN COATED CONDUCTOR
SD*	SILICONE, 5,000 VOLTS
SE*	SILICONE, 10,000 VOLTS
SF*	SILICONE, 15,000 VOLTS
SG*	SILICONE, 20,000 VOLTS
SH*	SILICONE, 25,000 VOLTS, -150°C.
SJ*	SILICONE, 30,000 VOLTS
SK*	SILICONE, 600 VOLTS LACQUERED NYLON BRAID COVER, -105°C.
SL*	SILICONE, RUBBER, 500 VOLTS, 200°C, .008 WALL
TA	TEFLON, MIL-W-16878, TYPE E (600 VOLTS) SILVER COATED CONDUCTOR
TB*	TEFLON, MIL-W-16878, TYPE E (600 VOLTS) NICKEL COATED COPPER ALLOY CONDUCTOR (210-0229-00) (210-0230-00)
TC	TEFLON, MIL-W-16878, TYPE EE (1,000 VOLTS) SILVER COATED CONDUCTOR
TD*	TEFLON, MIL-W-16878, TYPE EE (1,000 VOLTS) NICKEL COATED COPPER ALLOY CONDUCTOR (210-0231-00) (210-0232-00)
TE	TEFLON, MIL-W-16878, TYPE ET (250 VOLTS) SILVER COATED CONDUCTOR
TF	TEFLON, MIL-W-16878, TYPE ET (250 VOLTS) NICKEL COATED CONDUCTOR
TG	TEFLON, MIL-W-16878, TYPE K (600 VOLTS) SILVER COATED CONDUCTOR
TH	TEFLON, MIL-W-16878, TYPE K (600 VOLTS) NICKEL COATED CONDUCTOR
TJ	TEFLON, MIL-W-16878, TYPE KT (250 VOLTS) SILVER COATED CONDUCTOR
TK	TEFLON, MIL-W-16878, TYPE KT (250 VOLTS) NICKEL COATED CONDUCTOR
TL*	TEFLON, (3,000 VOLTS) SILVER COATED CONDUCTOR. NOT COVERED BY MIL-W-16878 BUT SIMILAR TO TYPE EE
TM	MIL-W-16878, TYPE E, (600 VOLTS) EXCEPT SOLID CONDUCTOR, SILVER PLATED
TN	TEFLON, MIL-W-16878, TYPE KT, EXCEPT 300 V SILVER PLATED ANNEALED COPPER CONDUCTOR
TP	TEFLON, MIL-W-16878, TYPE E (600 VOLTS) SILVER COATED COND. INSULATION BONDED
TR*	TEFLON, MIL-W-16878, TYPE E (600 VOLTS) SILVER COATED COPPER ALLOY CONDUCTOR (210-0527-00) (210-2528-00) (210-0533-00) (210-0534-00) (210-0535-00)
TS*	TEFLON, MIL-W-16878, TYPE KT (250 VOLTS) SILVER COATED COPPER ALLOY EXCEPT WITH A 0.001 MIN. COATING OF "ML" POLYMER OVER TEFLON (210-0424-00)
TT*	TEFLON, MIL-W-16878, TYPE KT (250 VOLTS) NICKEL COATED COPPER ALLOY EXCEPT WITH A 0.001 MIN. COATING OF "ML" POLYMER OVER TEFLON (210-0276-00)
TV*	TEFLON, MIL-W-16878, TYPE E (600 VOLTS) SILVER COATED COPPER ALLOY CONDUCTOR (210-0425-00) (210-0469-00) (210-0118-00) (210-0419-00) (210-0455-00) (210-0454-00)
TW	TEFLON, MIL-W-16878, TYPE E (600 VOLTS) SILVER COATED COPPER ALLOY CONDUCTOR
TX*	TEFLON, MIL-W-16878, TYPE E (600 VOLTS) EXCEPT NICKEL, 99.5% CONDUCTOR 1/8H, WELDABLE PER MIL-N-46026 (210-0401-00)
TY*	TEFLON, MIL-W-16878, TYPE ET (250 VOLTS) SILVER COATED COPPER ALLOY CONDUCTOR (210-0522-00) (210-0537-00)
TZ*	TEFLON, MIL-W-16878, TYPE EE (1,000 VOLTS) SILVER COATED COPPER ALLOY CONDUCTOR (210-0420-00) (210-0421-00) (210-0529-00) (210-0530-00)
VA	VINYL, MIL-W-5086, TYPE II, (600 VOLTS) SIZE 22-12
VB	VINYL, MIL-W-5086, TYPE II, (600 VOLTS) SIZE 0000-10
VC	VINYL, MIL-W-5086, TYPE III, (600 VOLTS) SIZE 22-12
VD	VINYL, MIL-W-5086, TYPE IV, (600 VOLTS) SIZE 0000-10
VE	VINYL, MIL-W-5086, TYPE I, (600 VOLTS) SIZE 22-12
ZA*	POLYOLEFIN, IRRADIATED, MODIFIED, (300 VOLTS)
ZB*	POLYOLEFIN, IRRADIATED, MODIFIED, (600 VOLTS)
ZC	CROSSLINKED POLYALKENE INSULATED, SILVER-PLATED COPPER, ABRASION RESISTANT, MIL-W-81044/1
ZD	CROSSLINKED POLYALKENE INSULATED, TIN-COATED COPPER, ABRASION RESISTANT, MIL-W-81044/2
ZE	CROSSLINKED POLYALKENE INSULATED, SILVER-PLATED COPPER, LIGHTWEIGHT, MIL-W-81044/3
ZF	CROSSLINKED POLYALKENE INSULATED, TIN-COATED COPPER, LIGHTWEIGHT, MIL-W-81044/4

*NON-PREFERRED FOR NEW DESIGN. DUE TO INCOMPLETE DESCRIPTION, CODES MARKED (*) ARE NOT TO BE USED ON MILITARY DRAWINGS. FOR REFERENCE ONLY.

STANDARD DRAWING

ANY REVISION TO THIS DRAWING MUST BE APPROVED BY THE CEDAR RAPIDS DIVISION STANDARD COORDINATOR (SPEC & STDS. GROUP). CONFORMS TO COLLINS DRAWING NUMBER 554-9999-004, REVISION J, 10 OCTOBER 1966.

IF ASTERISK (NON-PREFERRED) CODE IS REQUIRED FOR USE ON MILITARY DRAWINGS, CONTACT THE CEDAR RAPIDS DIVISION STANDARDS COORDINATOR (SPECS. & STDS. GROUPS)

WIRE CODE EXAMPLES

A	20	TA	.50	T	9123
TYPE	SIZE	STYLE	SHIELD	JACKET	COLOR

HOOKUP WIRE, STRANDED, SIZE 20 AWG, TEFLON INSULATION PER MIL-W-16878, TYPE E, (600 VOLTS), SILVER COATED CONDUCTORS, SHIELDED 90% MINIMUM COVERAGE, WITH TEFLON (FEP) OVERALL JACKET: WHITE WIRE WITH BROWN, RED AND ORANGE TRACKER

SOME POSSIBLE COMBINATIONS

A20TA00X9XXX

A20TA21T91XX

A22TD145912X

A18PC92P9123

R26RA00XXXXX

NOTE: ALL DRAWINGS MUST SHOW A (X) IN THE VACANT FIELD OF THE CODE TO PREVENT MISINTERPRETATION.

SHIELD

CODE	DESCRIPTION
00	NONE
01	BRAIDED, 3 ENDS, 36 AWG, 20 PICKS, 16 CARRIERS*
02	BRAIDED, 3 ENDS, 36 AWG, 22 PICKS, 16 CARRIERS*
03	BRAIDED, 4 ENDS, 36 AWG, 14 PICKS, 16 CARRIERS*
04	BRAIDED, 4 ENDS, 36 AWG, 16 PICKS, 16 CARRIERS*
05	BRAIDED, 4 ENDS, 36 AWG, 23 PICKS, 16 CARRIERS*
06	BRAIDED, 5 ENDS, 36 AWG, 12 PICKS, 16 CARRIERS*
07	BRAIDED, 5 ENDS, 36 AWG, 12 PICKS, 24 CARRIERS*
08	BRAIDED, 6 ENDS, 36 AWG, 10 PICKS, 16 CARRIERS*
09	BRAIDED, 6 ENDS, 36 AWG, 12 PICKS, 16 CARRIERS*
10	BRAIDED, 6 ENDS, 36 AWG, 10 PICKS, 24 CARRIERS*
11	BRAIDED, 6 ENDS, 36 AWG, 12 PICKS, 24 CARRIERS*
12	BRAIDED, 7 ENDS, 36 AWG, 10 PICKS, 16 CARRIERS*
13	BRAIDED, 7 ENDS, 36 AWG, 12 PICKS, 16 CARRIERS*
14	BRAIDED, 7 ENDS, 36 AWG, 10 PICKS, 24 CARRIERS*
15	BRAIDED, 8 ENDS, 33 AWG, 8 PICKS, 24 CARRIERS*
16	BRAIDED, 8 ENDS, 33 AWG, 9 PICKS, 24 CARRIERS*
17	BRAIDED, 8 ENDS, 34 AWG, 8 PICKS, 24 CARRIERS*
18	BRAIDED, 9 ENDS, 36 AWG, 9 PICKS, 24 CARRIERS*
19	BRAIDED, 9 ENDS, 36 AWG, 8.5 PICKS, 24 CARRIERS*
20	BRAIDED, 9 ENDS, 36 AWG, 9 PICKS, 24 CARRIERS*
21	BRAIDED, 4 ENDS, 36 AWG, 10 PICKS, 16 CARRIERS*
22	
23	
24	
25	
26	
27	
28	
29	
30	
51	SPIRAL WRAPPED 5 ENDS OF #36 AWG, 8 CARRIERS
52	SPIRAL WRAPPED 100% COVERAGE
53	
54	
55	
56	
57	
58	
59	
90	90% MINIMUM COVERAGE
91	91% MINIMUM COVERAGE
92	92% MINIMUM COVERAGE
93	93% MINIMUM COVERAGE
94	94% MINIMUM COVERAGE
95	95% MINIMUM COVERAGE
96	96% MINIMUM COVERAGE
97	97% MINIMUM COVERAGE
98	98% MINIMUM COVERAGE
99	99% MINIMUM COVERAGE

*90% MIN.

OVERALL JACKET

CODE	DESCRIPTION
A	
B	
C	
D	
E	
F	FIBER GLASS
G	
H	
J	
K	
L	SYNTHETIC RESIN
M	
N	NEOPRENE
P	POLYAMIDE (NYLON)
R	RUBBER
S	TEFLON, (TFE)
T	TEFLON, (FEP)
V	VINYL, (POLYVINYL CHLORIDE)
W	IRRIDIATED
	MODIFIED POLYOLEFIN
X	NONE
Z	

OVERALL JACKET OVER COLLINS STANDARD SHIELDED WIRE IS WHITE. ANY DEVIATION MUST BE CALLED OUT ON THE DRAWING.

PRIMARY INSULATION COLOR OR STRIPING COLOR (SEE EXAMPLE)

CODE	DESCRIPTION
X	NONE
0	BLACK
1	BROWN
2	RED
3	ORANGE
4	YELLOW
5	GREEN
6	BLUE
7	VIOLET
8	GREY
9	WHITE

NOTE: COLORS ARE IN ACCORDANCE WITH EIA STANDARD GEN-101 A.