OL-B / Williams

T O 31W2-4-322-1

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TECHNICAL MANUAL

COMBINED OPERATION AND MAINTENANCE INSTRUCTIONS AND ILLUSTRATED PARTS BREAKDOWN

SPEAKER AMPLIFIER ASSEMBLY PART NUMBER 77-440RM

TELE-SIGNAL CORPORATION
F04606-77-D-0116

THIS PUBLICATION SUPERSEDES SUPPLEMENT TO 31W2-4-322-1C DATED 22 OCTOBER 1980.

Published under authority of the Secretary of the Air Force.

1 JUNE 1978
CHANGE 1 – 19 JULY 1983

LIST OF EFFECTIVE PAGES

INSERT LATEST CHANGED PAGES. DESTROY SUPERSEDED PAGES.

NOTE: The portion of the text affected by the changes is indicated by a vertical line in the outer margins of the page. Changes to illustrations are indicated by miniature pointing hands. Changes to wiring diagrams are indicated by shaded areas.

Dates of issue for original and changed pages are:

Original . . 0 . . 1 Jun 78
Change . . 1 . . 19 Jul 83

TOTAL NUMBER OF PAGES IN THIS PUBLICATION IS 48 CONSISTING OF THE FOLLOWING:

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INTRODUCTION

This technical manual provides operation and maintenance instructions and an illustrated parts breakdown for the Speaker Amplifier Assembly Part Number 77-440RM manufactured by Tele-Signal Corporation, Hauppauge, N.Y., (figure 1-1), referred to in this manual as the speaker amplifier.

The technical content of this publication is organized in the following format. Chapter 1, General Information, contains a description and the purpose of the speaker amplifier and identifies the leading particulars, capabilities and limitations, equipment supplied, special tools and test equipment, and related technical manuals. Chapter 2, Installation, consists of two sections. Section I, Installation Logistics, contains information relating to receipt, unpacking, inspection and storage of the speaker amplifier prior to and during installation. Section II, Installation Procedures, contains installation, strapping, interconnection instructions, and installation checkout procedures, Chapter 3, Preparation For Use and Reshipment, consists of two sections. Section I, Preparation For Use, describes the procedures required to prepare the speaker amplifier for operation. Section II, Preparation For Reshipment, contains special packing instructions if the speaker amplifier is to be reshipped. Chapter 4, Operation, consists of three sections. Section I, Controls and Indicators, describes the operating controls and indicators of the speaker amplifier. Section II, Operating Instructions, contains the operating procedures for the speaker amplifier. Section III, Emergency Operation, is not applicable. Chapter 5, Theory of Operation, consists of three sections. Section I, Functional System Operation, contains principles of operation of the speaker amplifier and a block diagram discussion. Section II, Functional Operation of Electronic Circuits, contains detailed descriptions of the individual circuits that are supported by the functional block diagram and the schematic diagram. Section III, Functional Operation of Mechanical assemblies is not applicable. Chapter 6, Maintenance, consists of three sections. Section I, Organizational and Intermediate Maintenance, contains maintenance procedures such as performance checkout, troubleshooting, alignment, adjustment, removal/replacement and repair which are to be performed at the organizational and intermediate maintenance level. This section also contains a list of all associated maintenance support equipment for the speaker amplifier and performance test standard tables. Section II, Special Maintenance, contains all maintenance procedures which can be performed only at depot level. Section III, Performance Test Checks references performance checks contained in Section I. Chapter 7, Illustrated Parts Breakdown, contains a detailed breakdown of all assemblies, subassemblies and component parts of the speaker amplifier and lists all hardware and attaching parts. Illustrated views of the speaker amplifier are provided to facilitate in locating the parts. Chapter 8, Circuit Diagrams, contains schematic and wiring diagrams pertaining to the speaker amplifier.

Applicable publications governing the use of abbreviations, symbols, reference designations, and terms used in this technical manual are as follows:

MIL-STD-12C	Abbreviations for the Use on Drawings and in Technical Type Publications
MIL-STD-806C	Graphic Symbols for Logic Diagrams
USAS Y14.15-1966	Electrical and Electronic Diagrams
USAS Y32.2-1967	Graphic Symbols for Electrical and Electronic Diagrams
USAS Y32.16-1968	Reference Designations for Electrical and Electronics Parts and Equipments
MIL-STD-280	Definitions of Terms of Equipment Divisions
MIL-M-38798	Manuals, Technical: Operation Instructions, Circuit Diagrams, Alignment Procedures, and Installation Planning
MIL-M-38784	Manuals, Technical: General Requirements for Preparation of
MIL-M-38807	Manuals, Technical: Illustrated Parts Breakdown Preparation of
MIL-P-38790	Printing Production of Technical Manuals: General Requirements for

Reference publications required for the complete utilization of this manual are:

T.O. 31-1-141	Basic Electronics Technology and Testing Practices
T.O. 00-25-234	General Shop Practice Requirements for the Repair and Maintenance

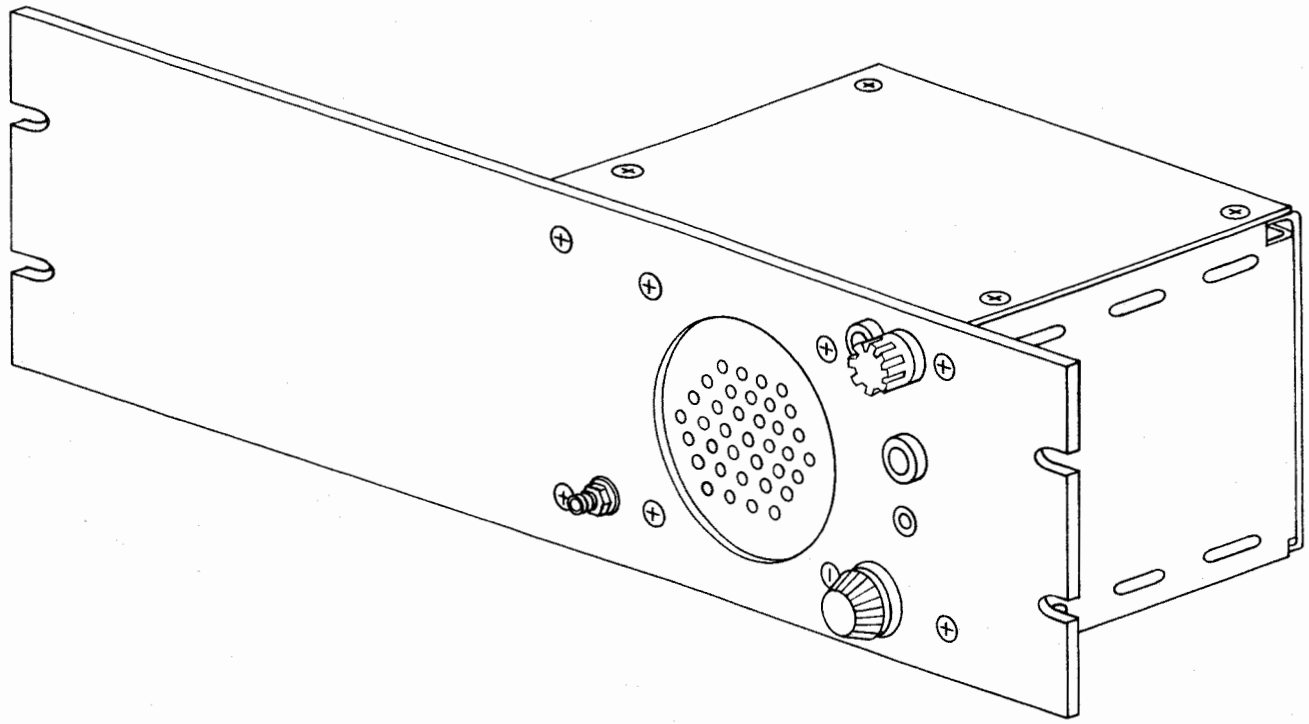

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Figure 1-1. Speaker Amplifier Assembly, Part No. 77-440RM

CHAPTER 1

GENERAL INFORMATION

1-1. GENERAL.

1-2. This chapter contains the physical description, purpose and all reference data relative to the speaker amplifier. The following paragraphs provide this information.

1-3. DESCRIPTION AND PURPOSE.

1-4. Paragraph 1-5 provides a physical description of the speaker amplifier and the purpose of the speaker amplifier is described in paragraph 1-6.

1-5. DESCRIPTION. The speaker amplifier is a self-contained rack mounted unit which is secured to a cabinet with four washer head screws. It consists of a front panel, a chassis assembly, a terminal board, and a circuit card. All operating controls and indicators are mounted on the front panel. The input power connections to the speaker amplifier are made through the terminal board mounted on the rear of the chassis assembly. Input signals can be applied to the terminal board or a front panel jack.

1-6. PURPOSE. The speaker amplifier provides loudspeaker presentation of audio signals.

1-7. REFERENCE DATA.

1-8. This paragraph contains all reference data for the speaker amplifier. Table 1-1 lists all leading particulars by item and their characteristics. Table 1-2 lists the capabilities and limitations for the speaker amplifier. Table 1-3 lists the equipment supplied with the speaker amplifier and Table 1-4 is a list of equipment required but not supplied. This table lists all test equipment required to maintain the speaker amplifier. Equivalent test equipment with same characterisitcs may be used. A list of special tools is not applicable. Table 1-5 is a list of related technical manuals by publication number, publication title and equipment nomenclature.

Table 1-1. Leading Particulars

ITEM	CHARACTERISTICS
Power Requirements	-48 ±4.8 Vdc
Environmental Conditions:	
Operating Temperature	0 to +50°C
Storage Temperature	-20 to +70°C
Relative Humidity	0 to 95%
Dimensions and Weight:	
Height	5 in.
Width	19 in.
Depth	6.5 in.
Weight	5.0 lbs.
Power Consumption:	
-48 Vdc	1.5 watts (avg)

Table 1-2. Capabilities and Limitations

CHARACTERTISTICS	SPECIFICATION
Input voltage	-48 ±4.8 Vdc
Limiting	Panel thresholds adjustment;
Muting	External
Gain	0 to 40 dB

Table 1-3. Equipment Supplied

OFFICIAL NOMENCLATURE	COMMON NAME	QUANTITY	DESCRIPTION AND PURPOSE
Speaker Amplifier Assembly, Part Number 77-440RM	Speaker Amplifier	1	Rack mounted unit to provide loudspeaker presentation of audio signals.
Circuit Card Assembly, Part Number 77-440RM-08	Circuit Card	1	Circuit Card contains circuits for amplifying the audio input and for setting the threshold of amplification.

Table 1-4. Equipment Required But Not Supplied

PART NUMBER	MFG CODE	FIGURE AND INDEX NO.	NOMENCLATURE	USE
260	55026	N/A	Volt-Ohm Multimeter	Performance test and troubleshooting
HP302	28480	N/A	Waveanalyzer	Performance test and troubleshooting
HP400EL	28480	N/A	AC Voltmeter (2)	Performance test and troubleshooting
504	80009	N/A	Oscilloscope	Performance test and troubleshooting
6274B	28480	N/A	48 Vdc Power Supply	Performance test and troubleshooting
200CD	51174	N/A	Audio Oscillator (2)	Performance test and troubleshooting
334A	51174	N/A	Distortion Analyzer	Performance test and troubleshooting
310	01401	N/A	Plug	Performance test and troubleshooting

Table 1-5. Related Technical Manuals

PUBLICATION NUMBER	PUBLICATION TITLE	EQUIPMENT NOMENCLATURE
T.O. 31W2-4-322-6WC-1	Preventive Maintenance Work Cards	Speaker Amplifier Assembly Part Number 77-440RM

CHAPTER 2

INSTALLATION

2-1. GENERAL.

2-2. This chapter consists of Section I, Installation Logistics, which contains information on unpacking and inspecting the speaker amplifier, and Section II, Installation Procuedures, which provides installation instructions, information on power and input connections, and preliminary testing instructions.

SECTION I

INSTALLATION LOGISTICS

2-3. UNLOADING AND UNPACKING.

2-4. To unpack the speaker amplifier from its shipping container, proceed as follows:

NOTE

Do not damage or discard the shipping container and protective materials. These may be used for reshipment at a later date

1. Open the container and remove all protective materials and wrappings illustrated in figure 2-1.

2. Inspect the speaker amplifier for signs of damage such as marred surface finish and loose or broken hardware.

3. Check the humidity indicator (4, figure 2-1). Indicator color must be blue; a red or pink tint indicates that the speaker amplifier may have been subjected to excessive moisture during storage or shipment.

2-5. HOUSING.

2-6. No special storage is required for the speaker amplifier.

2-7. RECEIVING DATA.

2-8. The crated and uncrated dimensions of the speaker amplifier are given in Table 2-1.

2-9. MATERIAL HANDLING.

2-10. No special material handling equipment is required.

Table 2-1. Packaging of Speaker Amplifier

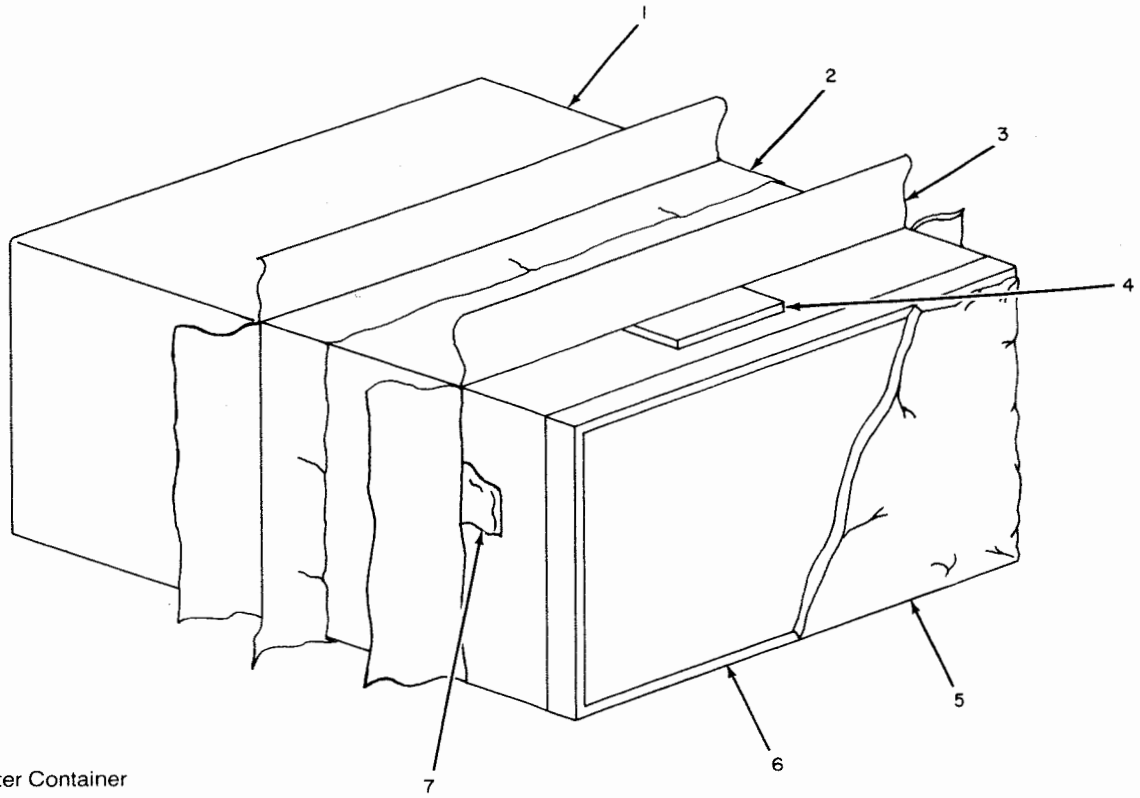
ITEM	WEIGHT	DIMENSIONS		
		HEIGHT	WIDTH	DEPTH
Speaker amplifier, crated	6 lbs	9.500 in	23 in	12.500 in
Speaker amplifier, uncrated	5 lbs	5.000 in	19 in	6.500 in

2-11. CABLES.

2-12. No special cabling requirements are applicable.

2-13. BUILDINGS AND OTHER SUPPORT STRUCTURES.

2-14. No special buildings or supporting structures are required.



1. Waterproof Outer Container
2. Foil Lined Barrier Bag
3. Inner Container (Custom Fit To Equipment)
4. Humidity Indicator
5. Foam Cushion (Front Panel Only)
6. Equipment
7. Desiccant Bag

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Figure 2-1. Speaker Amplifier Packaging Diagram

SECTION II

INSTALLATION PROCEDURES

2-15. CONSTRUCTION REQUIREMENTS.

2-16. There are no special construction requirements.

2-17. INSTALLATION MANPOWER AND MANHOUR REQUIREMENTS.

2-18. Installation of the speaker amplifier in the equipment rack requires ten minutes of work by one technician. Preliminary testing of the speaker amplifier requires 4.5 hours of work by one technician.

2-19. STRAPPING.

2-20. No special strapping is required for the speaker amplifier.

2-21. INSTALLATION SEQUENCE.

2-22. The speaker amplifier is designed for installation in a standard 19-inch electronic equipment rack. Secure speaker amplifier to rack through the four front panel screw slots, using existing rack hardware.

2-23. PRELIMINARY TESTING. Prior to connecting the speaker amplifier to an operational load, complete the performance tests described in paragraph 6-11.

2-24. ELECTRICAL CONNECTIONS. The rack in which the speaker amplifier is installed has been wired to accommodate the speaker amplifier. Secure power and, if desired, connect terminal muting wires to terminal board TB1 on the rear of the speaker amplifier. Connect audio signal plug to front panel jack or connect audio signal wires to terminal board TB1.

CHAPTER 3

PREPARATION FOR USE AND RESHIPMENT

3-1. GENERAL.

3-2. This chapter contains information for preparing the speaker amplifier for use and for preparing it for reshipment. Section I provides information necessary to ensure that the speaker amplifier is operational either after installation or after a period of non-operation. Section II contains instructions on preparing the speaker amplifier for reshipment.

SECTION I

PREPARATION FOR USE

3-3. GENERAL.

3-4. This section contains information to ensure that the speaker amplifier is operational after an extended period of non-operation and after installation.

3-5. PROCEDURES.

3-6. After installation or a period of of one year of non-operation, check the operational readiness of the speaker amplifier. Perform the tests in table 3-1 in the sequence shown. These tests are located in Chapter 6 and are to be performed as an overall performance test.

Table 3-1. Readiness Tests

SEQUENCE	TEST	TIME DURATION	DESCRIPTION
1	Frequency Response	0.5 hr	Checks frequency response of audio amplification circuits.
2	Output With Input Short Circuited	0.5 hr	Checks amount of noise generated with input to speaker amplifier shorted.
3	Input Impedance	0.5 hr	Checks operating input impedance of speaker amplifier.
4	Total Harmonic Distortion	1.0 hr	Checks that amount of harmonic distortion is within specification.
5	Intermodulation Distortion	1.0 hr	Checks that amount of intermodulation distortion is within specification.
6	Dc Power Variation	0.5 hr	Checks that output does not vary with specified charges of operating voltages.
7	Front Panel Input	0.5 hr	Checks that speaker amplifier operates with front panel input signal plug and disconnects TB1 input lines.

SECTION II

PREPARATION FOR RESHIPMENT

3-7. GENERAL.

3-8. This section contains procedures to prepare the speaker amplifier for reshipment. Perform the following procedures to prepare the speaker amplifier for reshipment:

WARNING

Dangerous voltages exist at the output terminals of the facility 115 vac power cable connected to the cabinet in which the speaker amplifier is installed. Prior to disconnecting the 115 vac power cable from the cabinet, insure that the facility 115 vac input power is removed from the cable.

NOTE

The speaker amplifier is normally shipped installed in the equipment cabinet. However, instructions are provided for removing the speaker amplifier from the cabinet.

1. Disconnect facility 115 vac power cable from the ac junction box located at the top of the cabinet.

2. To remove the speaker amplifier from the cabinet proceed as follows:

a. Disconnect wiring connected to TB1 at rear of speaker amplifier.
b. Disconnect phone plug from front panel jack.
c. Remove four washer head screws securing equipment to cabinet, and carefully remove speaker amplifier.

3. Pack speaker amplifier in the reverse order of unpacking procedures specified in paragraph 2-3. Refer to figure 2-1 for the speaker amplifier packaging diagram.

CHAPTER 4

OPERATION

4-1. GENERAL.

4-2. This chapter contains information necessary for operating the speaker amplifier. Section I contains the functions of all front panel controls and indicators. Section II contains all operating instructions including starting, operating, and stopping procedures. Section III, Emergency Operation is not applicable.

SECTION I

CONTROLS AND INDICATORS

4-3. GENERAL.

4-4. This section contains the functions of front panel controls and indicators for the speaker amplifier. The controls and indicators are identified on figure 4-1 by index number. Table 4-1 references the index number, lists the item name and reference designation, and describes the function of each control or indicator.

Table 4-1. Speaker Amplifier, Controls and Indicators

INDEX NO.	CONTROL OR INDICATOR	REF DES.	FUNCTION
1	Loudspeaker	-	Provides audible presentation of amplified signals.
2	POWER indicator	CR8	Lights to indicate primary power is applied to speaker amplifier.
3	FUSE 0.5 AMP	F1	Protects circuits from excessive current drain.
4	THRESHOLD indicator	CR3	Lights to indicate audio input is over threshold level and output is muted.
5	VOLUME control	R10	Adjusts output audio level at loudspeaker and applies and removes primary power.
6	INPUT jack	J1	Accepts a standard phone jack for applying audio signal to speaker amplifier.

SECTION II

OPERATING INSTRUCTIONS

4-5. GENERAL.

4-6. This section contains operating instructions for the speaker amplifier. Starting and stopping procedures are not applicable.

4-7. OPERATING PROCEDURES.

4-8. To operate the speaker amplifier, proceed as follows:

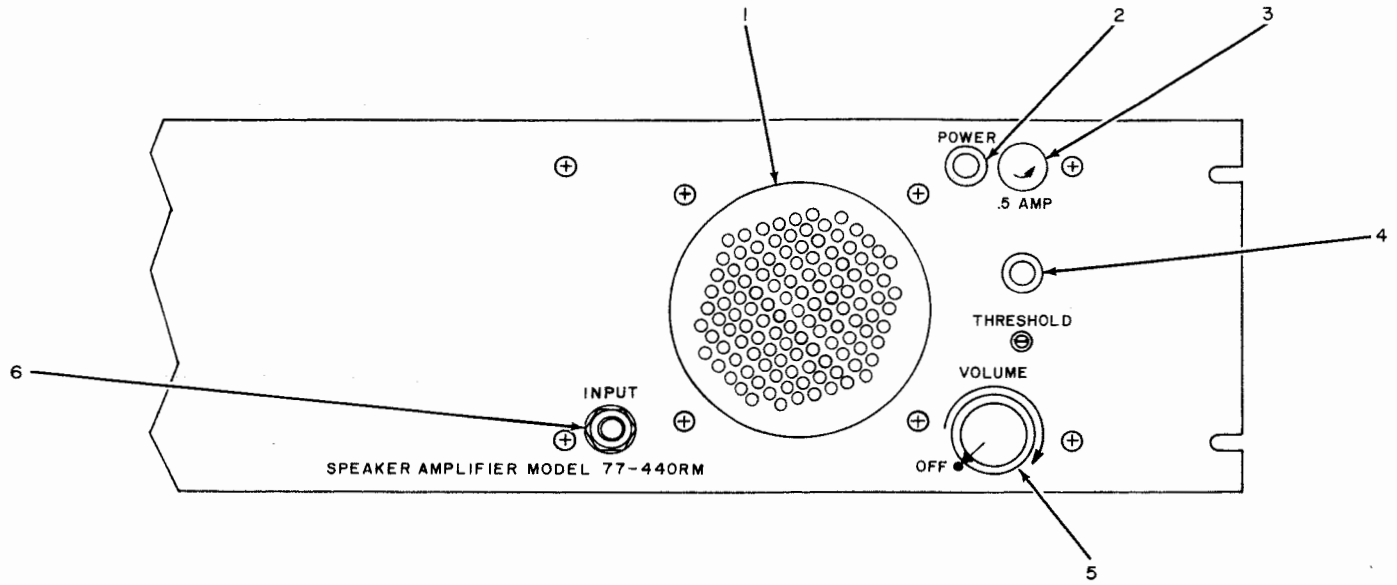
1. Connect audio input phone plug to INPUT jack.

2. Adjust VOLUME control for desired audio level.

SECTION III

EMERGENCY OPERATION

NOT APPLICABLE



1. Loudspeaker
2. POWER Indicator CR8
3. FUSE 0.5 AMP Fuse F1
4. THRESHOLD Indicator CR3
5. VOLUME Control R10
6. INPUT Jack J1

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Figure 4-1. Speaker Amplifier, Controls and Indicators

CHAPTER 5

THEORY OF OPERATION

5-1. GENERAL.

5-2. This chapter contains the theory of operation for the speaker amplifier. Section I provides the functional operation of the speaker amplifier. Section II provides the functional operation of electronic circuits, and Section III, functional operation of mechanical assemblies is not applicable.

SECTION I

FUNCTIONAL OPERATION

5-3. GENERAL.

5-4. This section describes the functional operation of the speaker amplifier with reference to a block diagram, figure 5-1.

5-5. BLOCK DIAGRAM DISCUSSION.

5-6. The speaker amplifier provides loudspeaker presentation of audio signals and consists of four functional circuits, namely; two amplifier circuits, a detector and a comparator circuit. (See figure 5-1.) The following paragraphs describe the functional operation of the speaker amplifier with respect to these circuits.

5-7. The audio input signal to the speaker amplifier is coupled through matching transformer T1 via jack J1 or terminal board TB1 and applied across LEVEL control R10 and THRESHOLD control R11. LEVEL control R10 adjusts the position of the audio input which is applied to the amplifier circuit and THRESHOLD control R11 adjusts the portion of the audio input which is applied to the dual amplifier circuit. The amplifier circuit amplifies the audio input and applies it to the loudspeaker for audio presentation. The dual amplifier circuit, detector, comparator circuit and THRESHOLD control R11 form a muting circuit to control the level of audio input which is allowed to be amplified.

5-8. The portion of audio signal tapped by THRESHOLD control R11 is amplified by the dual amplifier, detected and applied to the comparator. The dc voltage from the detector is proportional to the audio signal as applied to the dual amplifier. Should the dc increase beyond the reference voltage applied to the other input of the comparator, the comparator turns on the transistor switch which causes the amplifier to be inhibited. The amplifier remains inhibited as long as the audio input signal to the amplifier is beyond the threshold level set by THRESHOLD control R11. With normal levels of audio input signals and the LEVEL control R10 adjusted for desirable levels of speaker output, the THRESHOLD control R11 is set so as to prevent an abnormal level of audio input from being amplified. The speaker amplifier signals can also be inhibited by an external mute signal which switches on the transistor switch preventing amplificaiton of signals.

SECTION II

FUNCTIONAL OPERATION OF

ELECTRONIC CIRCUITS

5-9. GENERAL.

5-10. This section describes the functional operation of speaker amplifier circuits shown on the block diagram.

5-11. SPEAKER AMPLIFIER DETAILED CIRCUIT DESCRIPTION.

5-12. The speaker amplifier (see figure FO-1) has two controls. LEVEL control R10 sets the volume of audio and THRESHOLD control R11 sets the point at which the speaker amplifier output is inhibited due to excessive levels of audio input.

5-13. The audio signal to the speaker amplifier is applied from jack J1 or terminal board TB1 across the primary of transformer T1. Transformer T1 provides input impedance matching and coupling of the audio across LEVEL control R10 and THRESHOLD control R11. The audio signal is applied from the control arm of LEVEL control R10 to amplifier U1. The audio signal is amplified by U1 and coupled by capacitor C2 to amplifier U2. Amplifier U2 provides further amplification of the audio signal. The audio signal is coupled by capacitor C4 to the loudspeaker connected to terminals E6 and E8 of the circuit board. Adjusting LEVEL control R10 controls

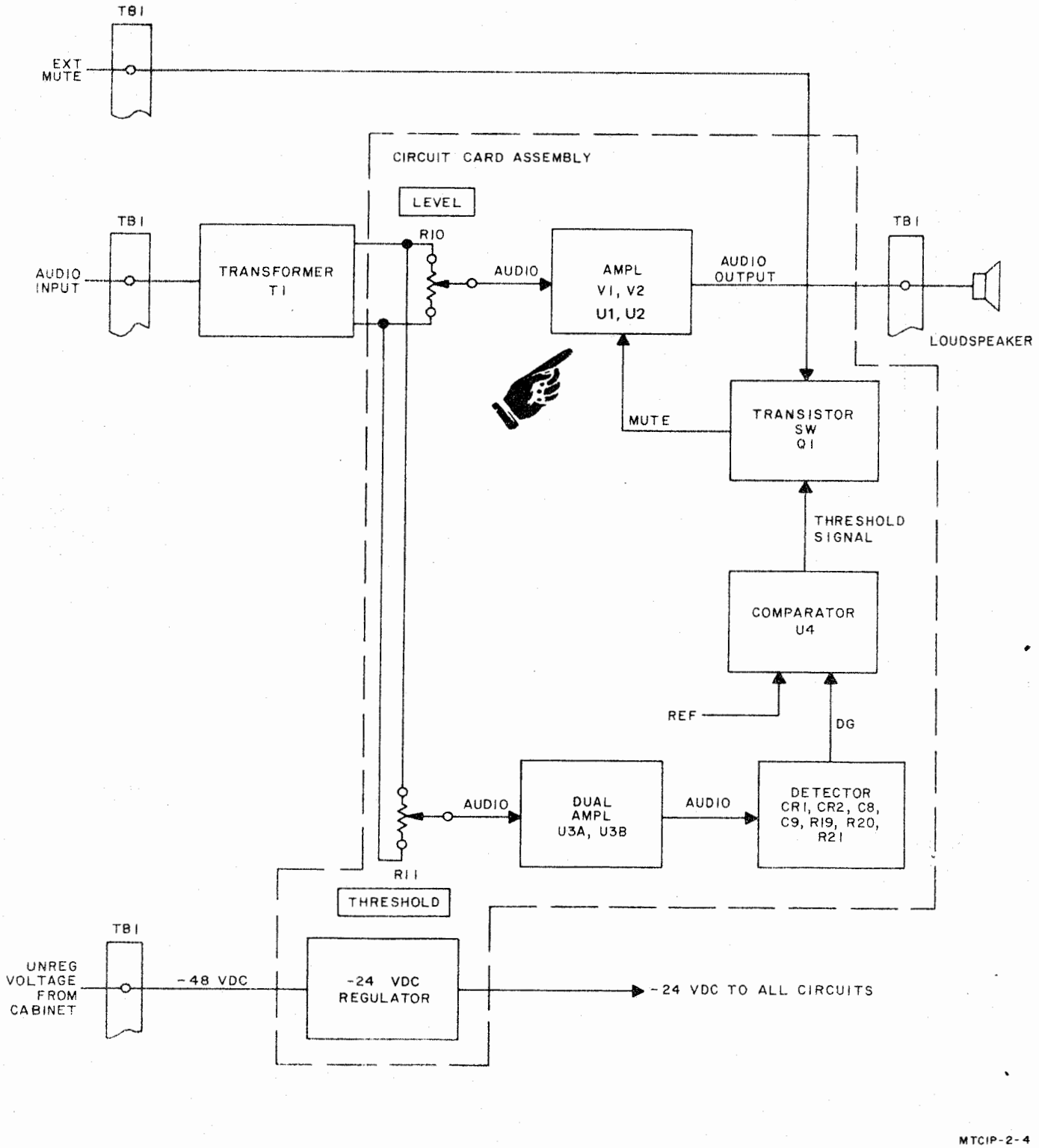


Figure 5-1. Speaker Amplifier, Block Diagram

the amount of signal amplified and subsequently the volume produced by the loudspeaker.

5-14. Dual amplifier U3A and B, comparator U4 and transistor switch Q1 comprise the muting circuits for controlling the threshold level of the speaker amplifier. The portion of audio signal topped off by THRESHOLD control R11 is applied to the first half of the dual amplifier U3A. The portion of audio is amplified by U3A and further amplified by second half of the dual amplifier, U3B. The output signal from amplifier U3B is coupled through capacitor C7 to a detector circuit consisting of diodes CR1 and CR2, capacitors C8 and C9, and resistors R19, R20 and R21. The detector circuit rectifies and filters the audio signal and produces a proportional dc voltage from the junction of resistors R20 and R21. This voltage is applied to the noninverting input of comparator U4. The inverting input of the comparator receives a reference voltage of approximately -2.2 dc developed at the junction of resistors R22 and R23. Should the level of audio as set by the THRESHOLD control R10 increase to a point whereby the dc from the detector is more positive than the reference voltage at the inverting input, the comparator output goes to approximately -24 Vdc. At this level diode CR7 is forward biased and current flows through resistors R7 and R12. Voltage drop at junction of resistors R7 and R12 turns on transistor Q1. Through the collector-emitter circuit of Q1, amplifier U2 pin 1 is placed at ground. This effectively deactivates the amplifying muting the audio output at the loudspeaker. The -24 Vdc output from comparator U4 also forward biases transistor Q2, causing THRESHOLD diode (LED) CR3 to illuminate.

5-15. When the input audio signal reduces to the point at which the dc from the detector is less positive than the -2.2 Vdc reference, comparator U4 output goes to a ground level. This causes Q1 to be reverse biased thereby removing the ground from amplifier U2 to allow signal amplification.

5-16. All operating voltages to the speaker amplifier circuits are supplied by the series regulator circuit consisting of series pass transistor Q3 and zener diodes CR5 and CR6. The regulator receives unregulated -48 Vdc. This voltage is in series with series pass transistor Q3 emitter-collector circuit. The base of transistor Q3 is clamped to a fixed voltage by zener diode CR5. Should the input -48 Vdc change within a specified range the series-pass transistor alters its conduction to compensate for this change. The output voltage is fixed at -24 Vdc by zener diode CR6. Diode (LED) CR8 illuminates to indicate the regulator is providing output power. As well as operating with -48 Vdc input power by means of straps C and D, the speaker amplifier circuits can be operated by a -24 Vdc regulated input by restrapping the circuit board with straps B and E instead of straps C and D.

5-17. By shorting the terminals at TB1 external muting can be affected. When this is done, -24 Vdc is looped back through terminal board TB1 to forward bias transistor Q1. This deactivates amplifier U2, muting the speaker amplifier output.

SECTION III

FUNCTIONAL OPERATION OF MECHANICAL ASSEMBLIES

NOT APPLICABLE

CHAPTER 6

MAINTENANCE

6-1. GENERAL.

6-2. This chapter contains information necessary to maintain the speaker amplifier. Section I contains operator maintenance to be performed at the organization and intermediate maintenance levels. This section contains performance test table, troubleshooting, and repair and replacement information. Section II consists of a reference to Section 1 for all maintenance procedures. Section III consists of a reference to Section I for the performance test table.

SECTION I

ORGANIZATIONAL AND INTERMEDIATE MAINTENANCE

6-3. TEST EQUIPMENT.

6-4. Refer to table 6-1 for a list of maintenance support equipment required for Organizational and Intermediate maintenance of the speaker amplifier.

6-5. TEST POINTS.

6-6. Table 6-2 lists the points of test designated in the performance test table. Test points are listed in numerical order and are identified by location and circuit function.

Table 6-1. Maintenance Support Equipment

EQUIPMENT IDENTIFICATION	CHARACTERISTICS	
Volt-Ohm-Milliammeter	DC voltage:	0 to 53
	DC accuracy:	±3%
	AC voltage:	0 to 127
	AC accuracy:	±4%
Audio oscillator	Range:	500 Hz to 10 KHz
	Output Level:	0 to 50 mv
AC voltmeter	Voltage range:	0 to 110 Vrms
	Accuracy:	±1.5%
Oscilloscope	Bandwidth:	15 to 25 Hz
-48 Vdc power supply	DC voltage:	43 to 53 vdc
	DC current:	1.2 amps
Distortion Analyzer	Range:	500 Hz to 10 KHz
	Accuracy:	±0.2%
Wave analyzer	Range:	500 Hz to 10 KHz
	Accuracy:	±0.5%

Table 6-2. Test Point Indicators

POINT	LOCATION	FUNCTION
1	Speaker amplifier front panel	Used to indicate power is applied to speaker amplifier.
2	Speaker amplifier front panel	Used to indicate amplification of input signals.
3	Speaker amplifier front panel	Used to indicate activation of threshold circuit.

6-7. PARTS LOCATION.

6-8. Parts location diagrams are provided to locate all assemblies and circuit elements which are part of the speaker amplifier. Parts location diagrams are included for the speaker amplifier, figure 6-1, and circuit card assembly, figure 6-2. These diagrams also identify the test points used in the performance test table and trouble-shooting procedures. Primary test points are identified by numbers enclosed in stars. Secondary test points are identified by uppercase letters enclosed in circles.

6-9. PRELIMINARY INSPECTION PROCEDURE.

WARNING

Prior to performing inspection, remove power from the speaker amplifier.

6-10. Refer to table 6-3 for a guide to inspecting the components of the speaker amplifier.

Table 6-3. Preliminary Inspection Procedure

ITEM	INSPECT FOR	CORRECTIVE ACTION
Capacitors	Overheated or bulging capacitors.	Replace defective capacitors.
Cover	Damaged cover.	Repair or replace damaged cover.
Diode	Burnt diode.	Replace defective diode.
Indicators	Dirt, cracked lenses, and defective lamps or lamp holder.	Clean or replace damaged or defective part(s).
Knobs	Loosened or cracked knobs.	Tighten if loose, Replace if cracked.
Panels	Scratches, chipped paint, and obliterated panel markings.	Clean and retouch panel.
Resistors	Overheated or cracked resistors.	Replace defective resistor(s)
Switch	Positive detent action for rotary switch.	Replace defective switch.
Terminal Board	Dirt, overheating, arcing, and cracks.	Clean or replace damaged terminal board(s).
Wiring	Cold or unsoldered joints, frayed wires, and broken insulation. Loose or broken cable clamp.	Resolder and/or replace as required.

Table 6-3. Preliminary Inspection Procedure (Cont)

ITEM	INSPECT FOR	CORRECTIVE ACTION
Chassis Assembly	Dents, chips, scratches rust and corrosion.	Clean and retouch cabinet.

6-11. PERFORMANCE TEST TABLE.

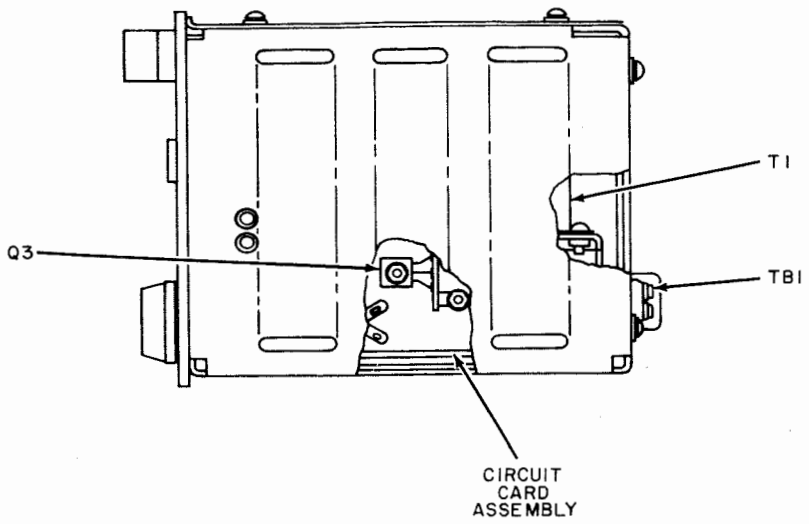
6-12. The performance tests are contained in Table 6-4 and consist of step-by-step instructions in tablualr form to be performed whenever it is suspected that the speaker amplifier does not meet an operational performance standard or when it is desired to check equipment performance after repair has been performed. Each performance standard in the performance test table has a corresponding step in the troubleshooting table of this section. If the speaker amplifier fails to meet any performance standard in the performance standard column of the performance test table, refer to the corresponding step in the troubleshooting table to locate the probable cause of failure of the speaker amplifier before proceeding to the next step of the performance test table. Test points referenced in the performance test table are shown on the schematic diagrams located in Chapter 8 of this manual. The parts location diagrams should be referred to as necessary to facilitate test point locations.

6-13. TROUBLESHOOTING.

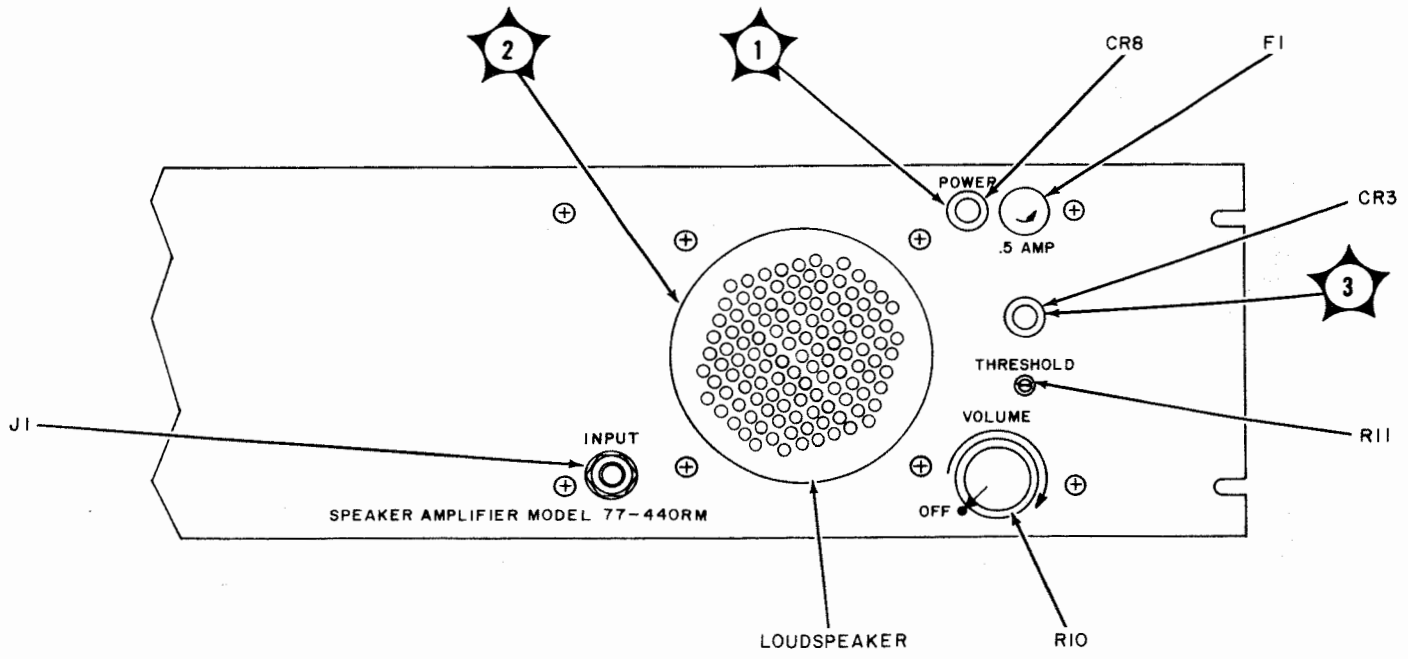
6-14. Troubleshooting of the speaker amplifier is presented in Table 6-5 which provides step-by-step instructions for isolating a malfunction to an adjustment or replaceable component. The troubleshooting table is used when the speaker amplifier fails to meet a performance standard specified in Table 6-4, the performance test table, and contains procedures for isolating a malfunction to a component. Test points referenced in the troubleshooting are shown on the schematic diagram contained in Chapter 8. Parts location diagrams should be referred to, as necessary, to facilitate test point locations.

Table 6-4. Speaker Amplifier, Performance Test Standards

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARDS
NOTE Disconnect loudspeaker from terminal E6 and E8 for the performance test standards.				
FREQUENCY RESPONSE				
1	Connect test equipment as shown in Figure 6-3.		Turn VOLUME control to OFF position and THRESHOLD control fully counterclockwise.	
2		test point 1	Turn VOLUME control to ON position and observe POWER indicator.	Indicator lights.
3	Adjust audio oscillator No. 1 for a frequency of 1 KHz at a level of 35 mv rms as indicated by AC voltmeter No. 1.			
4	Observe oscilloscope waveform.		Adjust VOLUME control for a 3.8 Vrms indication on AC voltmeter No. 2.	10.75 ±2.5 V p-p free of clipping or limiting.



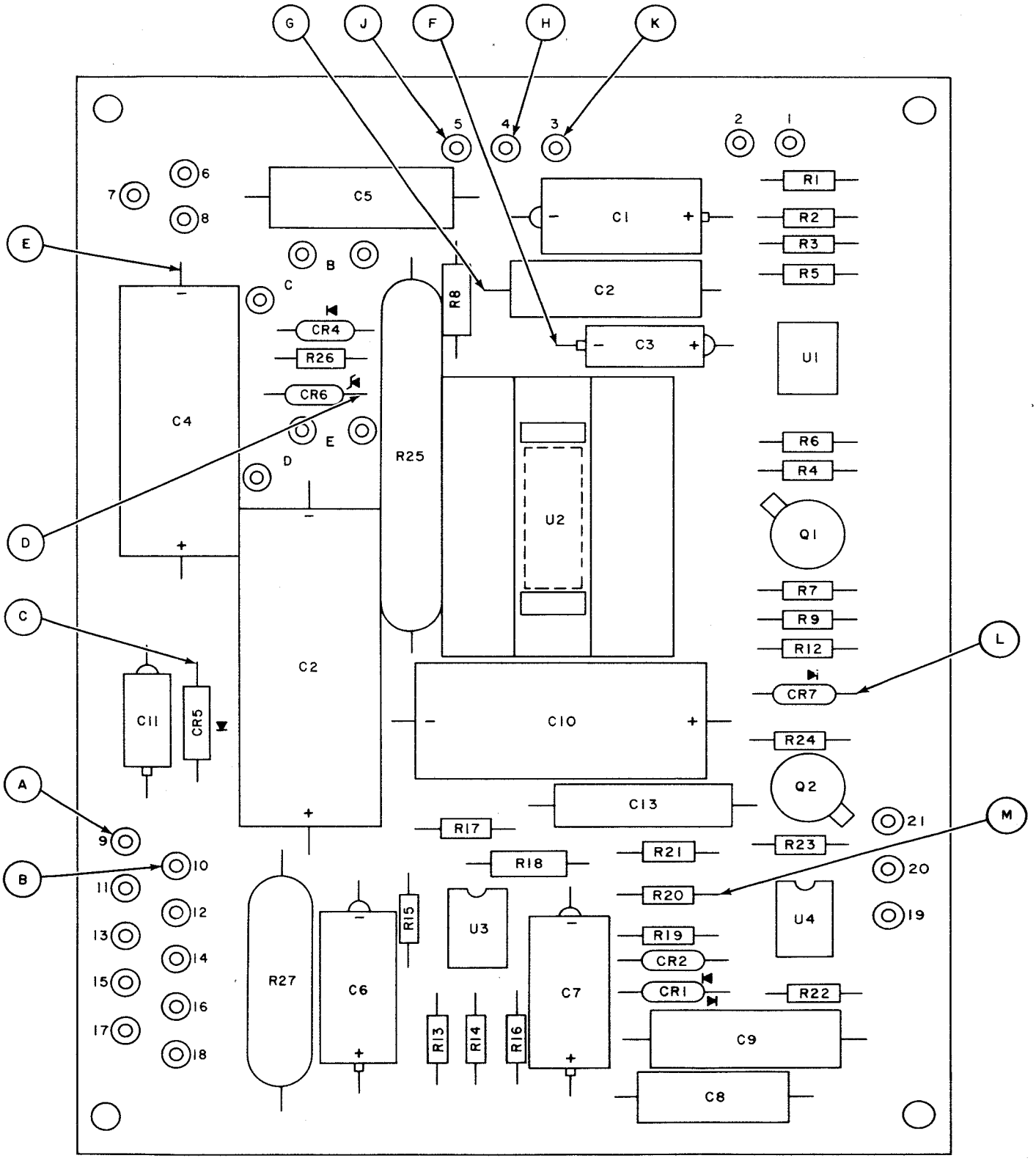
SIDE VIEW



FRONT VIEW

MTCIP-2-12

Figure 6-1. Speaker Amplifier, Parts Location Diagram



MTCIP-2-13

Figure 6-2. Circuit Card Assembly, Parts Location Diagram

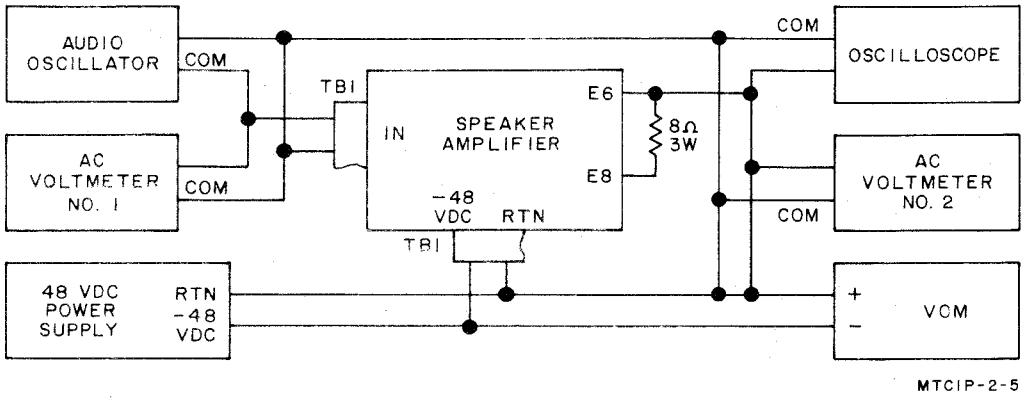


Figure 6-3. Frequency Response, Test Setup Diagram

Table 6-4. Speaker Amplifier, Performance Test Standards (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARDS
5	Repeat steps 2 and 3 for frequencies of 500 Hz, 5 KHz, and 10 KHz.			Same as step 3.
6	Connect test equipment as shown in figure 6-4.			
	OUTPUT WITH INPUT SHORT CIRCUITED			
7	Record AC voltmeter indication as Vrms.			Less than 28.2 mv.
	TOTAL HARMONIC DISTORTION			
8	Connect test equipment as shown in figure 6-5.			

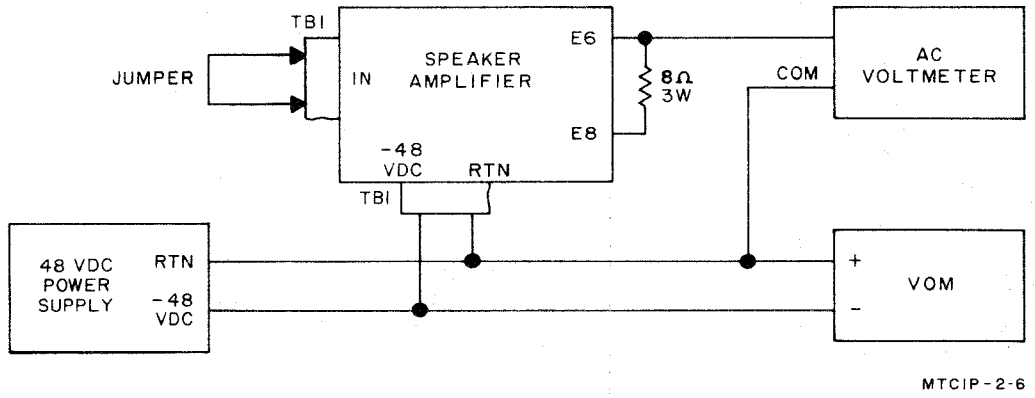


Figure 6-4. Output with Input Short-Circuited, Test Setup Diagram

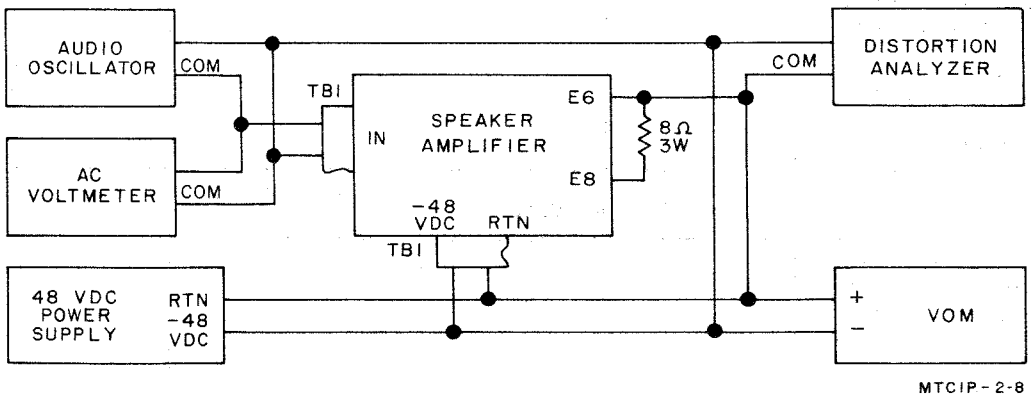


Figure 6-5. Total Harmonic Distortion, Test Setup Diagram

Table 6-4. Speaker Amplifier, Performance Test Standards (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARDS
	TOTAL HARMONIC DISTORTION (Cont)			
9	Set distortion analyzer controls as follows: Control/ Switch — Setting INPUT — NORMAL FUNCTION — VOLT-METER MODE — MANUAL METER RANGE — 10V HIGH PASS FILTER — As Required			
10	Adjust audio oscillator for a frequency of 500 Hz at a level of 35 mv rms as indicated by AC voltmeter No. 1.		Adjust VOLUME control for a 3.8 Vrms indication on distortion analyzer.	
11	Set FUNCTION switch to SET LEVEL and METER RANGE switch to 100 PERCENTAGE.			
12	Adjust SENSITIVITY and VERNIER controls for a full scale deflection of meter.			
13	Set FUNCTION switch to DISTORTION.			
14	Set FREQUENCY RANGE, FREQUENCY DIAL, and BALANCE controls and METER RANGE switch as required to obtain a minimum indication on distortion analyzer meter.			Less than 5 percent.
15	Repeat steps 9 through 14 for frequencies of 1 KHz, 5 KHz, and 10 KHz.			Same as step 14.
	INTERMODULATION DISTORTION			
16	Except for audio oscillators, connect test equipment as shown in figure 6-6.			
17	Set wave analyzer controls and switches as follows:			

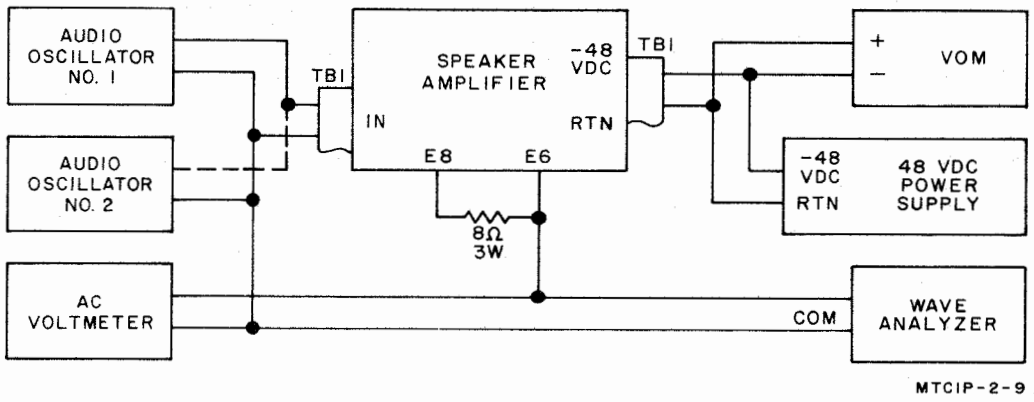


Figure 6-6. Intermodulation Distortion, Test Setup Diagram

Table 6-4. Speaker Amplifier, Performance Test Standards (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARDS
	INTERMODULATION DISTORTION (Cont)			
	Control/ Switch — Setting SCALE VALUE — ABSOLUTE MAX, INPUT VOLTAGE — 3V RANGE — 3V MODE — NORMAL SELECTOR FREQUENCY — 1 KHz			
18	Connect audio oscillator No. 1 to speaker amplifier.			
19	Adjust audio oscillator No. 1 for a frequency of 1 KHz at a level of 35 mv as indicated by AC voltmeter No. 1.			

Table 6-4. Speaker Amplifier Performance Test Standards (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARDS
		INTERMODULATION DISTORTION (Cont)		
20	Adjust wave analyzer FREQUENCY, COARSE and FINE controls for maximum indication.			
21			Adjust VOLUME control for 1.9 Vrms indication on wave analyzer.	
22	Connect audio oscillator No. 2 to speaker amplifier.			
23	Adjust aduio oscillator No. 2 for a frequency of 1.2 KHz.			
24	Adjust wave analyzer FREQUENCY, COURSE and FINE controls for maximum meter indication.			
25	Adjust audio oscillator No. 2 level for a 1.9 Vrms indication on wave analyzer.			
26	Set wave analyzer SCALE VALUE switch to % or dB and RANGE switch to IV.			
27	Adjust wave analyzer REFERENCE ADJUST control for full scale meter indication.			
28	Adjust wave analyzer FREQUENCY control for 800 Hz.			
29	Using frequency controls and RANGE switch obtain maximum meter indication. Relate indications to percent of intermodulation distortion as follows: 1 V = 100 percent 300 mv = 30 percent 100 mv = 10 percent 30 mv = 3 percent			Less than 5 percent.
30	Repeat steps 28 and 29 for 1.4 KHz.			Same as step 29.
		SIGNAL TO NOISE RATIO		
31	Connect test equipment as shown in figure 6-7.			

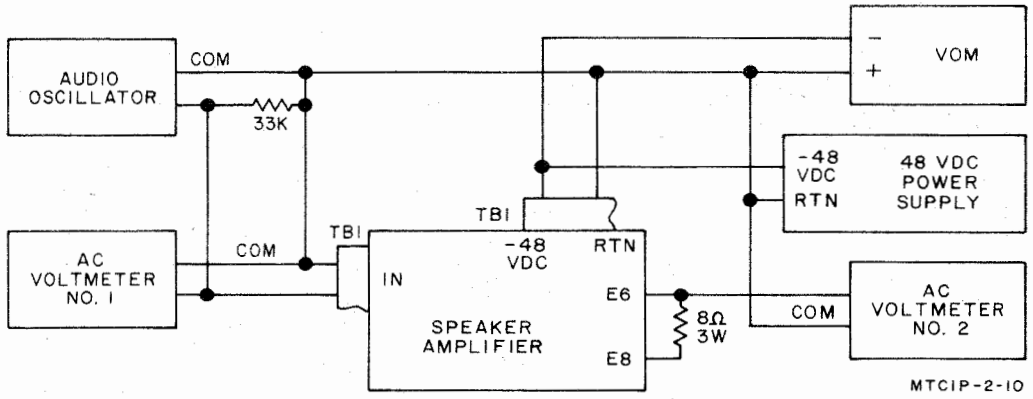


Figure 6-7. Signal to Noise Ratio, Test Setup Diagram

Table 6-4. Speaker Amplifier Performance Test Standards (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARDS
		SIGNAL TO NOISE RATIO (Cont)		
32	Adjust audio oscillator for 35 mVrms as indicated by AC voltmeter No. 1.		Adjust VOLUME control for 3.8 Vrms indication on AC voltmeter No. 1 and note dB equivalent.	
33	Remove audio oscillator and connect 33 kohm resistor to input. Note AC voltmeter dB indication. Algebraically calculate dB difference between this indication and as noted in step 32 in order to obtain signal to noise ratio.			Greater than 40 dB.
		DC POWER VARIATION		
34	Connect test equipment as shown in figure 6-8.			

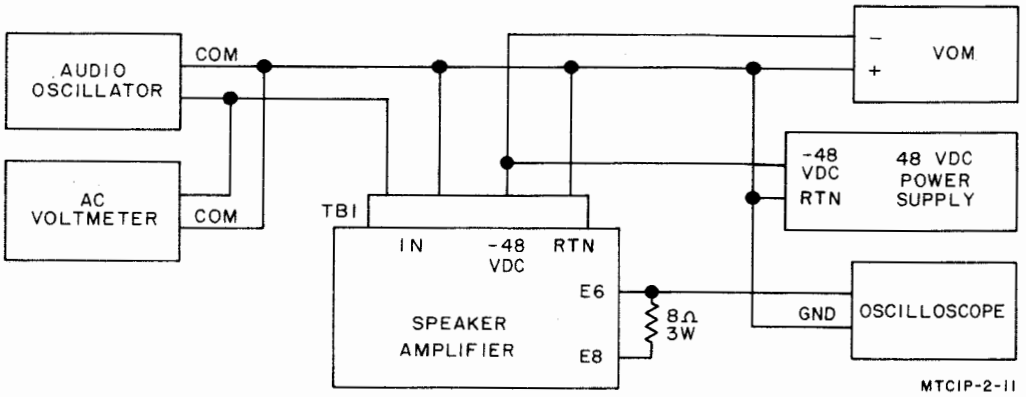


Figure 6-8. DC Power Variation, Test Setup Diagram

Table 6-4. Speaker Amplifier Performance Test Standards (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARDS
		DC POWER VARIATION (Cont)		
35	Adjust audio oscillator to 1 KHz at 35 mVrms as indicated on AC voltmeter.		Adjust VOLUME control for 10.75 V p-p waveform as displayed by oscilloscope.	
36	Adjust power supply for -43.2 Vdc as indicated by VOM and observe oscilloscope waveform.			10.75 V p-p.
37	Repeat step 40 for an input voltage of -52.8 Vdc.			Same as step 36.
38	Adjust power supply for -48 Vdc as indicated by VOM.			
		FRONT PANEL INPUT		
39	Connect test equipment as shown in figure 6-9.		Adjust VOLUME control to OFF position.	

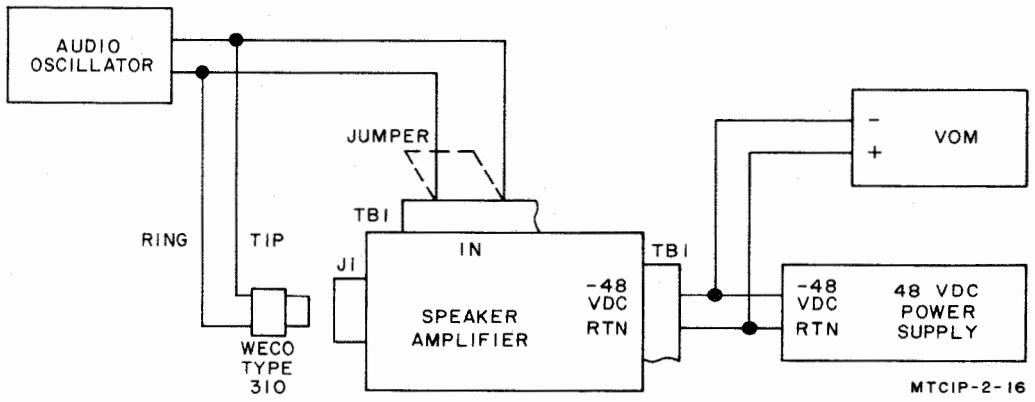


Figure 6-9. Front Panel Input, Test Setup Diagram

Table 6-4. Speaker Amplifier Performance Test Standards (Cont)

STEP	OPERATION OF TEST EQUIPMENT	POINT OF TEST	CONTROL SETTINGS AND OPERATION OF EQUIPMENT	PERFORMANCE STANDARDS
NOTE Jumper shown on figure 6-9 (TB1 input) shall not be connected.				
FRONT PANEL INPUT (Cont)				
40			Reconnect loudspeaker to terminals E6 and E8 and adjust VOLUME control for a comfortable listening level.	
41	Disconnect audio oscillator from terminal board TB1 and install a jumper across TB1 input pins and observe audible tone.	Test point 2		Tone is not audible at loudspeaker.
42			Plug in WECO 310 plug or equivalent into INPUT jack.	Tone is audible at loudspeaker.
43	Disconnect all test equipment.			

Table 6-5. Speaker Amplifier, Troubleshooting Procedure

STEP	SYMPTOM	ISOLATION PROCEDURE	IF INDICATION IS NORMAL	IF INDICATION IS ABNORMAL
2	POWER indicator does not light.	Connect VOM between test point A(-) and B(+) and check for -48 Vdc.	Proceed to step 4c.	Check fuse F1 and replace if blown.
		c. Connect VOM between test point C(-) and B(+) and check for zener voltage.	Proceed to step 4d.	Check diode CR4 and CR5 and resistor R25.
		d. Connect VOM between test point D(-) and B(+) and check for -24 Vdc ±10%.	Proceed to step 4e.	Check series-pass transistor Q3, diode CR6, resistor R26, and capacitor C12. Replace defective component.
4	Output waveform is out of tolerance.	a. Connect oscilloscope between test point E (vert) and B (ground) and observe waveform free of clipping and/or limiting.	Check capacitor C4 and C5 and resistor R8.	Proceed to step 4b.
		b. Connect VOM between test point B(+) and E(-) and check for approximately -12 Vdc.	Proceed to step 4c.	Proceed to step 4f.
		c. Connect oscilloscope between test point B (ground) and G (vert) and check for waveform free of clipping and/or limiting.	Check U2 and associated components. Replace U2 or defective component.	Proceed to step 4d.
		d. Connect oscilloscope between B (ground) and H (vert) and check for waveform.	Check U1 and associated components. Replace U1 or defective component.	Proceed to step 4e.
		e. Connect oscilloscope between test point J (ground) and K (vert) and check for waveform.	Replace LEVEL potentiometer R10.	Replace transformer T1.
		f. Connect VOM between test point B(+) and L(-) and check for approximately zero volts.	Check transistor Q1 and resistor R7. Replace defective component.	Proceed to step 4g.
		g. Connect VOM between test point B(+) and M(-) and check for voltage less than -2.2 Vdc.	Check CR1 and CR2, resistors R18, R19, R20 and R21, and capacitors C7, C8, and C9. Replace defective component.	Replace potentiometer R11.

Table 6-5. Speaker Amplifier Troubleshooting Procedure (Cont)

STEP	SYMPTOM	ISOLATION PROCEDURE	IF INDICATION IS NORMAL	IF INDICATION IS ABNORMAL
5	Output waveform is out of tolerance.	Connect oscilloscope between test point G (vert) and B (ground) and observe waveform.	Replace U2.	Replace U1.
7	Output level is not within tolerance with input shorted.			Replace U2.
14	Total harmonic distortion is not in tolerance.	Connect distortion analyzer between test points G(-) and B(+) and check for minimum distortion.	Replace U2.	Replace U1.
15	Total harmonic distortion is not in tolerance.	Same as step 14.	Replace U2.	Replace U1.
29	Intermodulation distortion is not in tolerance.	Connect distortion analyzer between test point G(-) and B(+) and check for acceptable intermodulation distortion.	Replace U2.	Replace U1.
30	Same as step 29.			
33	Signal-to-noise ratio is not in tolerance.			Replace U2.
36	Waveform is out of tolerance.			Check diodes CR4, CR5 and CR6 and transistor Q3. Replace defective transistor.
37	Waveform is out of tolerance.			Same as step 36.
41	Tone is audible from loudspeaker.			Replace INPUT jack J1.
42	Tone is not audible from loudspeaker.			Same as step 41.

6-15. REPAIR AND REPLACEMENT.

6-16. Repair and replacement information is contained in the following paragraphs.

6-17. REPAIR. Repair of the speaker amaplifier is accomplished using standard shop practices. Locate the defective component and/or part with the aid of the parts location diagrams contained in this section.

6-18. REMOVAL AND REPLACEMENT. Remove defective assemblies by reversing the order of the installation procedures contained in paragraph 2-18. Replace the defective assemblies by performing the procedures given in paragraph 2-18. Remove and replace defective components and/or parts of the assemblies in accordance with the following paragraphs.

6-19. Chassis and Panel Mounted Components. No special procedures are required for removal of chassis and panel mounted components. Their removal is obvious. Refer to illustrated parts breakdown, Chapter 7, to aid in location and removal of components. When removing components perform the following:

1. Remove all power from equipment before attempting disassembly.

2. When disconnecting leads from components, tag leads to ensure proper replacement and reconnection of leads.

WARNING

Avoid breathing fumes generated by soldering. Eye protection is required.

3. When unsoldering component, always use a heat sink applied to component lead.

6-20. Printed Circuit Card Components.

1. Always use a heatsink applied to the component lead being soldered. Sink the lead as near the soldering connection as possible, between the point of application of heat and the component.

2. Use the minimum soldering iron tip heat consistent with area being soldered.

CAUTION

Do not use ac powered soldering iron without line isolation.

3. When soldering operation is completed, clean flux residue from area of repair.

6-21. REASSEMBLY AND TESTING.

6-22. The following paragraphs contain the necessary information reassembling and testing the speaker amplifier.

6-23. REASSEMBLY. Reassemble the speaker amplifier components and/or parts in the reverse order of removal and use the applicable illustration in Chapter 7, Illustrated Parts Breakdown.

6-24. TESTING. After the speaker amplifier has been repaired and reassembled, test in accordance with the performance test standards provided in Table 6-4.

6-25. CLEANING.

6-26. All exterior and interior surfaces of the speaker amplifier should be free of dirt, grease, and fungus. Perform the following general procedures to clean the speaker amplifier.

1. Using a clean, dry lint-free cloth or brush, remove dust and loose dirt.

2. Remove grease, fungus, and ground-in dirt in accordance with TT-C-490 Type I, method III. Dry with a clean, dry, lint-free cloth.

3. Clean the front panel and controls using a soft clean cloth. If dirt is difficult to remove, dampen the cloth with water.

4. Clean the interior surfaces with a dry, lint-free cloth or vacuum cleaner. If available, a stream of low pressure compressed air may be used.

WARNING

Enamel, Gloss Alkyd, TT-E-489 is flammable and moderately toxic to eyes, skin and respiratory tract. Eye and skin protection required. Good general ventilation is normally adequate.

5. To preserve the appearance of the equipment and prevent rust and corrosion, retouch painted surfaces where paint has been gouged or scraped off. Before repainting a defective area, repeat step 2 to remove dirt, dust, grease and other foreign matter. Use No. 00 or No. 000 sandpaper (FSN 5350-271-7939) to clean the surface down to the bare metal. Use a clean soft cloth to remove loose dust and metal particles. Apply one coat of wash primer per MIL-C-15328 followed by one coat of light gray lusterless baking enamel per MIL-E-15090, color No. 36307 of federal standard 595.

6-27. LUBRICATION.

NOT APPLICABLE.

6-28. ALIGNMENT AND ADJUSTMENT.

6-29. The only alignment or adjustment required for the speaker amplifier, is the adjustment of the threshold control located on the front panel. Adjustment of the THRESHOLD control varies with the installation and desired listening levels. The following procedures provide a method for achieving an approximate setting. The operator at his discretion may desire to vary from this setting:

1. Adjust THRESHOLD control (screwdriver adjustment on front panel) fully counterclockwise.

2. With audio input at normal levels adjust VOLUME control for desired level of listening.

3. Adjust THRESHOLD control until audio for loudspeaker is not heard.

4. Adjust THRESHOLD control slowly counterclockwise until audio is again heard. Continue turning control counterclockwise approximately 1/8 turn past the point at which audio signals were heard.

SECTION II

SPECIAL MAINTENANCE

6-30. GENERAL.

6-31. All special maintenance procedures are the same as those for organizational and intermediate maintenance. Refer to Section I for these procedures.

SECTION III

PERFORMANCE TEST CHECKS

6-32. GENERAL.

6-33. Perform the overall performance test checks for the speaker amplifier provided in Table 6-4 to ensure that the equipment meets minimum performance standards. These tests cover significant overall functions of the equipment to enable maintenance personnel to determine if the speaker amplifier is operating correctly.

CHAPTER 7

ILLUSTRATED PARTS BREAKDOWN

7-1. INTRODUCTION.

7-2. This Illustrated Parts Breakdown lists and describes the parts necessary for the support of the Speaker Amplifier Assembly Part Number 770-440RM, manufactured by Tele-Signal Corporation, Hauppauge, N.Y. It is used for requisitioning, storing, issuing and identifying parts, and for illustrating assembly and disassembly relationships.

7-3. In general, the assemblies and parts installed at the time the end item(s) was manufactured are listed and identified in the manual. When an assembly or part (including vendor items), which is different from the original, was installed during the manufacture of later items, series, or blocks, all assemblies and parts are listed (and "Usable On" coded). However, when the original assembly or part does not have continued application (no spares of the original were procured or such spares are no longer authorized for replacement), only the preferred assembly or part is listed. Also, when an assembly or part was installed during modification, and the original does not have continued application, only the preferred item is listed. Repair Parts Kits and Quick Change Kits are listed when they are available for replacement.

7-4. MAINTENANCE PARTS LIST.

7-5. This parts list is separated into figures by main groups or assemblies and keyed to associated illustrations by figure and index numbers. The groups are systematically broken down into installations, assemblies, and detail parts, which fall into the following categories: Those which have been procured as spares, and those which are subject to frequent removal and replacement.

7-6. INDENTION. Parts listed in the maintenance list are indented to indicate item relationship or NHA. The nomenclature of each assembly is followed in the list (except for attaching parts) by the nomenclature of its components indented one column to the right. This indention indicates the relationships of the components to the assembly. To determine the next higher assembly of a part or assembly, note the column in which the first word of the nomenclature appears. The first item directly above which appears one column to the left (except for attaching parts), is the NHA.

7-7. ABBREVIATIONS. All symbols and abbreviations used in this maintenance parts list are in accordance with Military Standard MIL-STD-12.

7-8. ATTACHING PARTS. Attaching parts are identified by the abbreviation (AP) following the description of the part.

7-9. UNITS PER ASSEMBLY. The quantity shown in this column represent the units required for one next higher assembly, sub-assembly, or sub-subassembly. The abbreviation "AR" (as required) is used when the quantity required must be determined when the parts are installed. The abbreviation "REF" (reference) indicates that this item has been previously listed under its next higher assembly. The "SEE FIGURE" notation in the description of the item will indicate the figure and index number at which the units per assembly can be determined.

7-10. MANUFACTURER'S CODE. Part Numbers other than those of the prime contractor are designated by manufacturer's code symbols in parentheses following the description of the part. These codes are in accordance with the Federal Supply Code for Manufacturer's Cataloging Handbook H4-1, H4-2, or H4-3 and amendments thereto. The absence of a code, or manufacturer's name, in the Maintenance Parts List means that the part is identified by the part number of the end item manufacturer or the part is a Government Standard.

7-11. USABLE ON CODE. The absence of a usable on code symbol in the Usable on Code column of the Maintenance Parts List indicates that the part is used on all articles covered by this manual. There are no Usable on Codes applicable to this manual.

7-12. SOURCE, MAINTENANCE, AND RECOVERABILITY (SMR) CODE DEFINITIONS. Definitions of applicable source, maintenance, and recoverability (SMR) codes are set forth in T.O. 00-25-195. Codes were not available for insertion in the SMR column herein as of the publication date of this manual.

7-13. The manufacturer's codes arranged numerically are as follows:

Manufacturer's Code	Manufacturer's Name and Address
00348	Microtran Co. Inc. 145 East Mineola Ave. Valley Stream, N.Y. 11582
01349	Alliance Mfg. Co. 22790 Lake Park Blvd. Alliance, Oh 44601

Manufacturer's Code	Manufacturer's Name and Address
04232	Staver Co. Inc., The 41-51 N. Saxon Ave. Bay Shore, N.Y. 11706
04713	Motorola Inc., Semiconductor Products Div. 5005 E. McDowell Rd. Phoenix, AZ 85008
09023	Cornell-Dublier Electronics Division of Federal Pacific Electric Co. 2652 Dalrymple St. Sanford, NC 27330
12040	National Semiconductor Corp. P. O. Box 443 Commerce Dr. Danbury, Ct 06810
26234	Greenfield Tap and Die A United-Greenfield Div of TRW Inc. Sanderson St. Greenfield, MA 01301
46384	Penn Engineering and Mfg Corp. Old Easton Highway Doylestown, PA 18901
71279	Cambridge Thermonic Corp. 445 Concord St. Cambridge, MA 02139
72619	Dialight Corp. Sub. of Digitronics Corp. 60 Stewart Ave. Brooklyn, NY 11237
75382	Kulka Electric Corp. 633-643 S. Fulton Ave. Mt. Vernon, N.Y. 10550
75915	Littlefuse Inc. 800 E. Northwest Hwy. Des Plaines, IL 60016
82389	Switchcraft Inc. 5555 N. Elston Ave. Chicago, IL 60630
83330	Smith Herman H. Inc. 812 Snediker Ave. Brooklyn, NY 11207

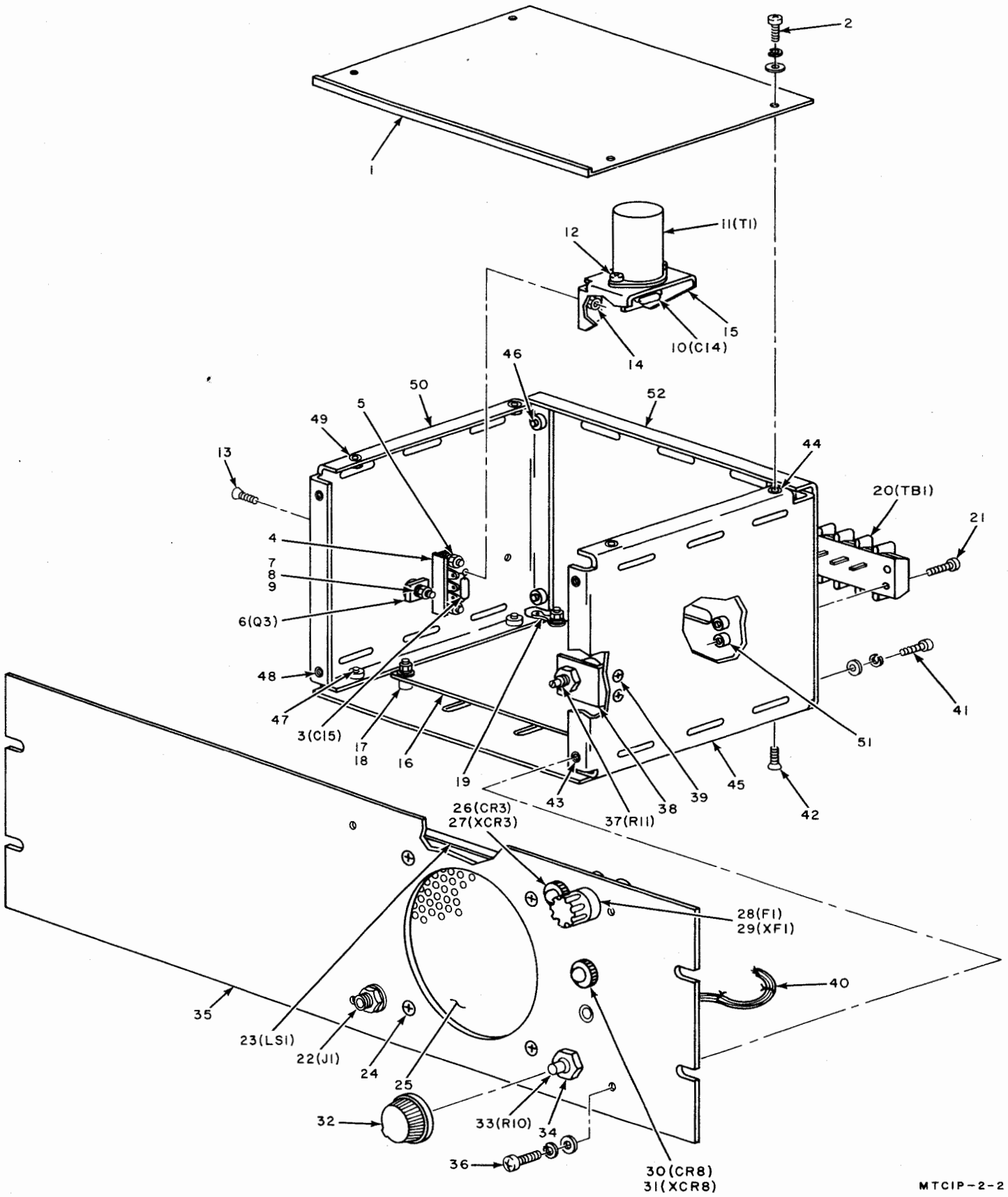


Figure 7-1. Speaker Amplifier Assembly

Figure & Index Number	Part Number	1 2 3 4 5 6 7 8 Description	Units Per Assy	Usable On Code	SMR
7-1-	77-440RM	SPEAKER AMPLIFIER ASSEMBLY	1		AFFFD
-1	77-440RM-26	. COVER	1		XBFZZ
-2	MS51957-14	. SCREW (AP)	4		PAFZZN
	MS35338-134	. WASHER (AP)	4		PAFZZN
	MS15795-804	. WASHER (AP)	4		PAFZZN
-3	CK06BX104M	. CAPACITOR	1		PAFZZN
-4	1073	. TERMINAL, Strip (83330)	1		XBFZZ
-5	MS51959-3	. SCREW (AP)	2		PAFZZN
	MS15795-802	. WASHER (AP)	2		PAFZZN
	MS35338-134	. WASHER (AP)	2		PAFZZN
	MS35650-224	. NUT (AP)	2		PAFZZN
-6	JAN2N4919	. TRANSISTOR	1		PAFZZN
-7	MS51959-5	. SCREW (AP)	1		PAFZZN
	MS15795-802	. WASHER (AP)	1		PAFZZN
	MS35338-134	. WASHER (AP)	1		PAFZZN
	MS35650-224	. NUT (AP)	1		PAFZZN
-8	BS2600F-006	. WASHER, Compression (04713)	1		PAFZZN
-9	B5220F-003	. WASHER, Mica (04713)	1		PAFZZN
-10	CM06FD132G03	. CAPACITOR	1		PAFZZN
-11	M4H	. TRANSFORMER (00348)	1		PAFZZN
-12	MS51959-3	. SCREW (AP)	2		PAFZZN
	MS15795-802	. WASHER (AP)	2		PAFZZN
	MS35338-134	. WASHER (AP)	2		PAFZZN
	MS353650-224	. NUT (AP)	2		PAFZZN
	77-440RM-25	. BRACKET, Transformer	1		XBFZZ
-13	MS51959-14	. SCREW (AP)	1		PAFZZN
-14	LKS440-2	. . NUT, Self-locking, clinch (46384) (Tele-Signal specification control drawing A318T005-104)	2		PAFZZN
-15	77-440RM-25-101	. . BRACKET	1		XBFZZ
-16	77-440RM-08	. CIRCUIT CARD ASSEMBLY Speaker amplifier (See figure 7-2 for detail breakdown)	1	see -D	PAFDDT
-17	MS51959-17	. SCREW (AP)	4		PAFZZN
	MS15795-804	. WASHER (AP)	4		PAFZZN
	MS35338-135	. WASHER (AP)	4		PAFZZN
	MS35650-244	. NUT (AP)	4		PAFZZN
-18	8703	. SPACER, Sleeve (83330) (Tele-Signal specification control drawing A308T019-012)	4		XBFZZ
-19	1410-4	. TERMINAL LUG (83330) (Tele-Signal specification control drawing A540T017-102)	1		PAFZZN
-20	600Y8	. TERMINAL BOARD (7 [illegible]82)	1		XBFZZ
-21	MS51957-30	. SCREW (AP)	4		PAFZZN
-22	JJ082	. JACK, Phone (82389)	1		PAFZZN
-23	4-½SR10B	. SPEAKER (26234)	1		PAFZZN
-24	MS51959-32	. SCREW (AP)	4		PAFZZN
	MS15795-806	. WASHER (AP)	4		PAFZZN
	MS35338-136	. WASHER (AP)	4		PAFZZN
	MS35650-264	. NUT (AP)	4		PAFZZN
-25	77-440RM-28	. SPEAKER SCREEN	1		MFFZZ
-26	507-4761-3331-500	. LED, Red Cartridge (72619)	1		PAFZZN
-27	250-8738-14-504	. LED, Holder (72619)	1		PAFZZN
-28	F02A250V1-2A	. FUSE, (01349)	1		PAFZZN
-29	342004	. FUSE HOLDER (75915)	1		PAFZZN
-30	507-4861-3332-500	. LED, Green Cartridge (72619)	1		PAFZZN
-31	250-8738-14-504	. LED, Holder (72619)	1		PAFZZN
-32	MS91528-1F2B-1F2B	. KNOB, Volume Control	1		PAFZZN
-33	RV4NBYSD253C	. POTENTIOMETER	1		PAFZZN
-34	MS25082-20	. NUT (AP)	1		PAFZZN
-35	77-440RM-21	. PANEL, Front	1		XBFZZ
-36	MS51957-27	. SCREW (AP)	4		PAFZZN
	MS35338-136	. WASHER (AP)	4		PAFZZN
	MS15795-806	. WASHER (AP)	4		PAFZZN
-37	GA2G028S253C	. POTENTIOMETER	1		PAFZZN

Figure & Index Number	Part Number	1 2 3 4 5 6 7 8 Description	Units Per Assy	Usable On Code	SMR
7-1-38	77-440RM-27	. BRACKET, Potentiometer	1		XBFZZ
-39	MS51957-3	. SCREW (AP)	2		PAFZZN
	MS15795-802	. WASHER (AP)	2		PAFZZN
	MS35338-134	. WASHER (AP)	2		PAFZZN
	MS35650-224	. NUT (AP)	2		PAFZZN
-40	77-440RM-90	. WIRING HARNESS	1		MFFZZ
	77-440RM-22	. PLATE, Right Side	1		AFFFZ
-41	MS51957-14	. SCREW (AP)	2		PAFZZN
	MS35338-134	. WASHER (AP)	2		PAFZZN
	MS15795-804	. WASHER (AP)	2		PAFZZN
-42	MS51959-14	. SCREW (AP)	2		PAFZZN
-43	CLS632-2	. . NUT, Plain, clinch (46384) (Tele-Signal specification control drawing A318T006-111)	2		PAFZZN
-44	LKS440-2	. . NUT, Self-locking, clinch (46384) (Tele-Signal specification control drawing A318T005-104)	6		PAFZZN
-45	77-440RM-22-101	. . PLATE	1		XBFZZ
	77-440RM-23	. PLATE, Left Side	1		AFFFZ
-46	MS51957-14	. SCREW (AP)	2		PAFZZN
	MS35338-134	. WASHER (AP)	2		PAFZZN
	MS15795-804	. WASHER (AP)	2		PAFZZN
-47	MS51959-14	. SCREW (AP)	2		PAFZZN
-48	CLS632-2	. . NUT, Plain, clinch (46384) (Tele-Signal specification control drawing A318T006-111)	2		PAFZZN
-49	LKS440-2	. . NUT, Self-locking, clinch (46384) (Tele-Signal specification control drawing (A318T005-104)	2		PAFZZN
-50	77-440RM-23-101	. . PLATE	1		XBFZZ
-51	CLS632-2	. . NUT, Plain, clinch (46384) (Tele-Signal specification control drawing A318T006-111)	4		PAFZZN
-52	77-440RM-24-101	. . PLATE	1		XBFZZ

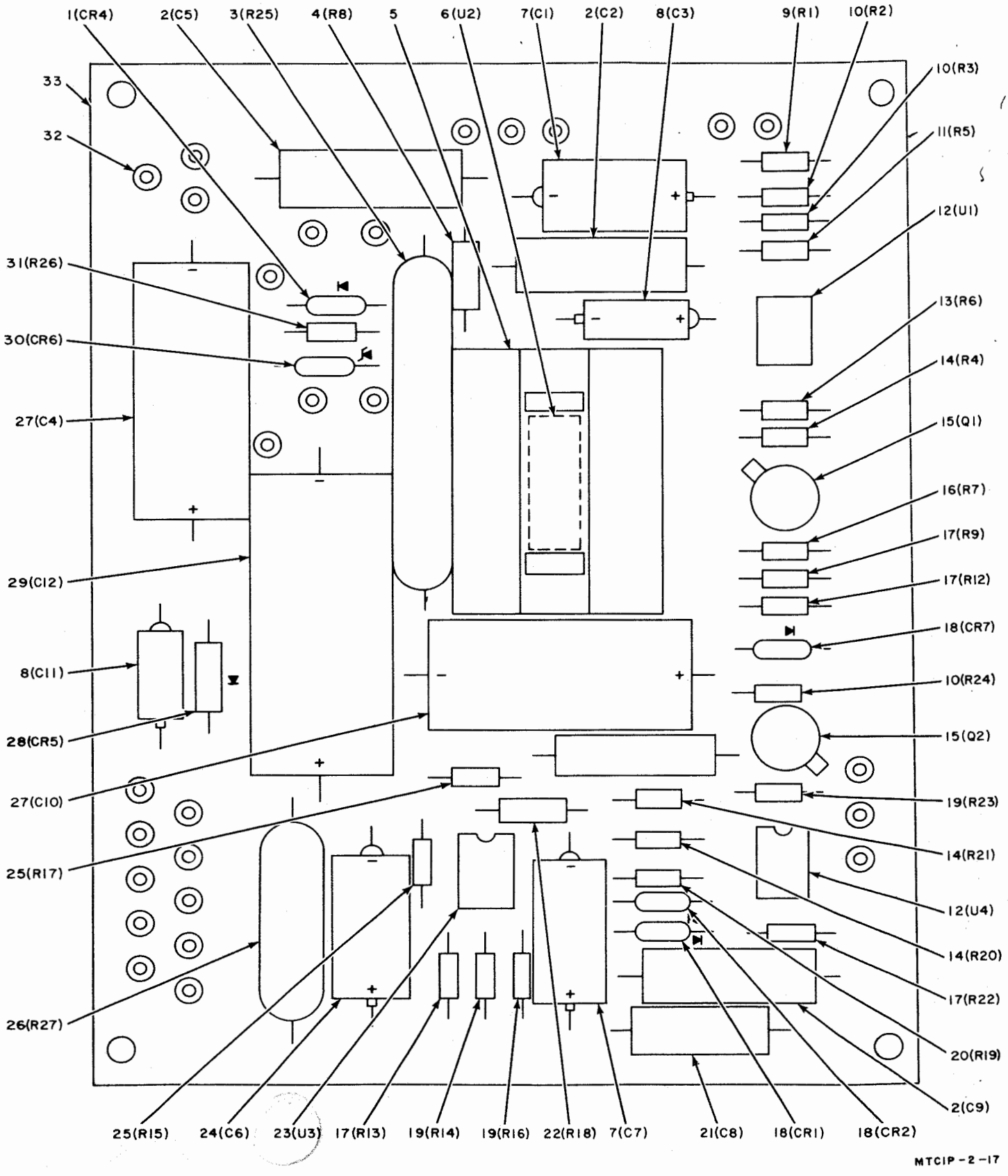


Figure 7-2. Speaker Amplifier Circuit Card Assembly

Figure & Index Number	Part Number	1 2 3 4 5 6 7 8 Description	Units Per Assy	Usable On Code	SMR
7-2-	77-440RM-08	CIRCUIT CARD ASSEMBLY, Speaker Amplifier (see figure 7-1-16 for NHA)	Ref	D	PAFDDT
-1	JAN1N4002	. SEMICONDUCTOR DEVICE	1		PAFZZN
-2	WMF1P1	. CAPACITOR, Precision Mylar (69023) (Tele-Signal specification control drawing TCM0104KL1)	3		PAFZZN
-3	RW68V500	. RESISTOR	1		PAFZZN
-4	RCR20G2R0JM	. RESISTOR	1		PAFZZN
-5	V7-2	. HEATSINK (04232)	1		XBFZZ
-6	LM384	. AMPLIFIER, Linear power	1		PAFZZN
-7	CS13BG226K	. CAPACITOR	2		PAFZZN
-8	CS13BG475K	. CAPACITOR	2		PAFZZN
-9	RCR07G393JM	. RESISTOR	1		PAFZZN
-10	RCR07G822JM	. RESISTOR	3		PAFZZN
-11	RN55D3572F	. RESISTOR	1		PAFZZN
-12	IC54A	. AMPLIFIER, Linear	2		PAFZZN
-13	RN55D2003F	. RESISTOR	1		PAFZZN
-14	RCR07G203JM	. RESISTOR	3		PAFZZN
-15	JAN2N3638A	. TRANSISTOR	2		PAFZZN
-16	RCR07G222JM	. RESISTOR	1		PAFZZN
-17	RCR07G103JM	. RESISTOR	4		PAFZZN
-18	JAN1N456A	. SEMICONDUCTOR DEVICE	3		PAFZZN
-19	RCR07G102JM	. RESISTOR	3		PAFZZN
-20	RCR07G243JM	. RESISTOR	1		PAFZZN
-21	WMF1S68	. CAPACITOR (09023)	1		PAFZZN
-22	RCR20G510JM	. RESISTOR	1		PAFZZN
-23	IC55A or MC1458N	. AMPLIFIER, Linear dual — 5962-01-123-9587	1		PAFZZN
-24	CS13BF476K	. CAPACITOR	1		PAFZZN
-25	RCR07G473JM	. RESISTOR	2		PAFZZN
-26	RW69V200	. RESISTOR	1		PAFZZN
-27	WBR250-50	. CAPACITOR (09023)	2		PAFZZN
-28	JAN1N5359B	. SEMICONDUCTOR DEVICE	1		PAFZZN
-29	WBR500-35	. CAPACITOR (09023)	1		PAFZZN
-30	JAN1N5361B	. SEMICONDUCTOR DEVICE	1		PAFZZN
-31	RCR07G392JM	. RESISTOR	1		PAFZZN
-32	1558-2	. LUG, Turret (71279)	22		PAFZZN
-33	77-440RM-06-101	. PRINTED WIRING BOARD	1		XAFZZ

CHAPTER 8

CIRCUIT DIAGRAMS

8-1. GENERAL.

8-2. This chapter contains the schematic and wiring diagrams for the Speaker Amplifier.

8-3. INDEX OF DIAGRAMS.

8-4. The schematic and wiring diagrams and their corresponding figure numbers are listed as follows:

Figure Number	Title
FO-1	Speaker Amplifier, Schematic Diagram
FO-2	Speaker Amplifier, Wiring Diagram

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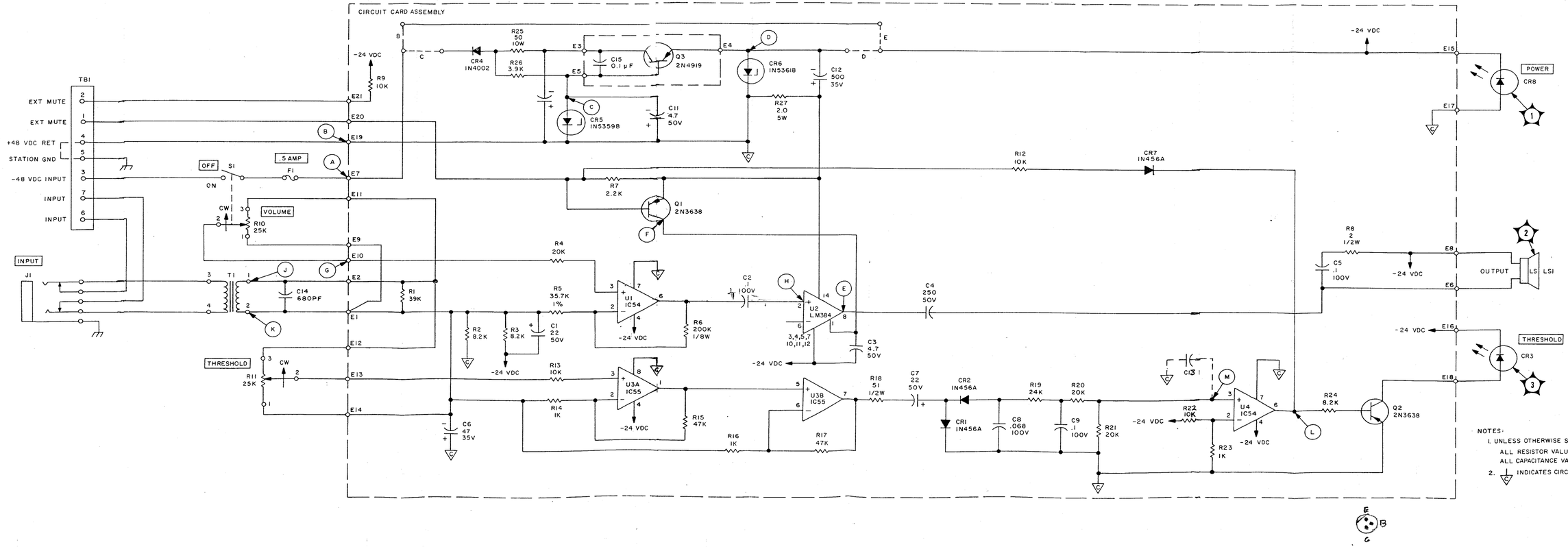

NOTES:

1. UNLESS OTHERWISE SPECIFIED:
   ALL RESISTOR VALUES ARE IN OHMS, 1/4 W.
   ALL CAPACITANCE VALUES ARE IN MICROFARADS.
2. ⏚ INDICATES CIRCUIT COMMON.

MTCIP-2-14

Figure FO-1. Speaker Amplifier, Schematic Diagram