

# **INSTRUCTION BOOK**

**32 MS - 1A**

**TRANSCEIVER EQUIPMENT**

# 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 one(1) year from date of delivery and goods are returned in accordance with Collins' instructions.
- (b) Equipment, accessories, tubes, and batteries not manufactured by Collins or from Collins' designs are subject to only such adjustments as Collins may obtain from the supplier thereof.
- (c) No equipment or accessory shall be deemed to be defective if, due to exposure or excessive moisture in the atmosphere or otherwise after delivery, it shall fail to operate in a normal or proper manner .

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

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.

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

## ADDRESS:

Collins Radio Company of Canada Limited  
11 Bermondsey Road,  
Toronto 16,  
Ontario.

## 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 of Canada Limited  
11 Bermondsey Road,  
Toronto 16,  
Ontario

## 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 of schematic
- (D) Collins' type number, name, and serial number of principal equipment

# INSTRUCTION BOOK

## TRANSCIVER EQUIPMENT

### 32MS-1A

567 5322 00

© COLLINS RADIO COMPANY OF CANADA LIMITED

13 OCTOBER 1961

PRINTED IN CANADA



## TABLE OF CONTENTS

Section		Page
I	<b>GENERAL DESCRIPTION</b> . . . . .	1
	1.1 Purpose of Instruction Book . . . . .	1
	1.2 Purpose of Equipment . . . . .	1
	1.3 Equipment Supplied . . . . .	1
	1.4 Equipment Required But not Supplied . . . . .	1
	1.5 Accessories . . . . .	3
	1.6 Components of Spare Parts Kit . . . . .	4
	1.7 Equipment Specifications . . . . .	5
	1.8 Tube, Fuse, and Semiconductor Complement . . . . .	6
	1.9 Transceiver 32MS-1A . . . . .	12
	1.10 Shockmount 390L-1A . . . . .	12
	1.11 Desk Type Remote Control Unit 48A1-SW . . . . .	12
	1.12 Mobile Type Remote Control Unit 48B2-SW . . . . .	12
	1.13 Antenna Coupler 180V-2 . . . . .	13
II	<b>INSTALLATION</b> . . . . .	15
	2.1 Unpacking and Inspecting Equipment . . . . .	15
	2.2 Installation . . . . .	15
	2.2.1 Mounting . . . . .	15
	2.2.2 Wiring Connections . . . . .	15
	2.2.3 Antenna Connections . . . . .	16
	2.2.4 Initial Alignment . . . . .	16
	2.3 Installation, Field . . . . .	16

# Table of Contents

Section		Page
	2.3.1	General . . . . . 16
	2.3.2	Fixed Station Installation . . . . . 16
	2.3.3	Wiring Connections . . . . . 16
	2.3.4	Mobile Installation . . . . . 16
	2.4	Initial Adjustment . . . . . 17
	2.5	Post Installation Check . . . . . 17
	2.5.1	SSB Operation . . . . . 17
	2.5.2	AM Operation . . . . . 17
III	<b>OPERATION</b>	19
	3.1	General . . . . . 19
	3.2	Operating Controls . . . . . 19
	3.3	Operating Procedures, SSB Mode . . . . . 19
	3.4	Operating Procedures, AM Mode . . . . . 19
IV	<b>PRINCIPLES OF OPERATION</b>	21
	4.1	General . . . . . 21
	4.2	Block Diagram . . . . . 21
	4.3	Transmitter Operation . . . . . 21
	4.3.1	Single Sideband Operation . . . . . 21
	4.3.2	Amplitude Modulated Operation . . . . . 21
	4.4	Receiver Operation . . . . . 21
	4.4.1	Single Sideband Operation . . . . . 21
	4.4.2	Amplitude Modulation Operation . . . . . 22
	4.5	Circuits Description . . . . . 22
	4.5.1	Audio Clipper . . . . . 22
	4.5.2	Speech Amplifier and Tone Oscillator . . . . . 22
	4.5.3	Cathode Follower . . . . . 22
	4.5.4	Balanced Modulator . . . . . 22
	4.5.5	Mechanical Filter . . . . . 22
	4.5.6	Balanced Mixer . . . . . 22
	4.5.7	Output Frequency Relation . . . . . 25
	4.5.8	Radio Frequency Amplifier . . . . . 25
	4.5.9	Radio Frequency Driver . . . . . 25
	4.5.10	Power Amplifier . . . . . 25
	4.5.11	Automatic Loading Control . . . . . 25
	4.5.12	Receiver Mixer . . . . . 25
	4.5.13	I-F Amplifiers . . . . . 26
	4.5.14	Product Detector . . . . . 26
	4.5.15	A-M Detector . . . . . 26
	4.5.16	Audio Amplifier . . . . . 26
	4.5.17	AGC System . . . . . 26
	4.5.18	A-C Power Supply . . . . . 26
	4.5.19	12 Volt Power Supply . . . . . 26
	4.5.20	28 Volt Power Supply . . . . . 26
	4.5.21	Automatic Receiver Gain Control . . . . . 26
	4.5.22	Remote Control Unit . . . . . 27
V	<b>MAINTENANCE</b>	29
	5.1	General . . . . . 29
	5.1.1	Test Equipment . . . . . 29
	5.2	Inspection . . . . . 29



Section		Page
5.2.1	General . . . . .	29
5.2.2	Visual Inspection . . . . .	29
5.2.3	Meter Adjustment . . . . .	29
5.3	Trouble Shooting . . . . .	29
5.3.1	Low Transmitter Output . . . . .	29
5.3.2	Receiver Inoperative . . . . .	30
5.3.3	Transmitter Inoperative . . . . .	30
5.3.4	Tube Substitution Trouble-Shooting Method . . . . .	30
5.4	Tuning Procedure . . . . .	30
5.4.1	Carrier Balance . . . . .	33
5.5	Neutralization . . . . .	33
5.5.1	R-F Amplifier . . . . .	33
5.5.2	R-F Driver . . . . .	33
5.5.3	Power Amplifier . . . . .	34
5.5.4	Feedback Neutralization . . . . .	34
5.6	Receiver I-F Alignment and Audio Output Check . . . . .	34
5.7	A-M Carrier Insertion and R-F Gain Control Adjustments . . . . .	35
5.8	Transmit Audio Gain Control Adjustment . . . . .	35
5.9	AGC Threshold Adjustment . . . . .	35
5.10	Disassembly of Control Unit 48A1-SW . . . . .	35
5.11	Reassembly of Control Unit 48A1-SW . . . . .	36
5.12	Disassembly of Control Unit 48B2-SW . . . . .	36
5.13	Reassembly of Control Unit 48B2-SW . . . . .	36
VI	<b>PARTS LIST</b> . . . . .	37
VII	<b>ILLUSTRATIONS</b> . . . . .	73

## LIST OF ILLUSTRATIONS

Figure		Page
1-1	Transceiver 32MS-1A, Overall View . . . . .	9
1-2	Control Unit 48A1-SW, Overall View . . . . .	9
1-3	Control Unit 48B2-SW, Overall View . . . . .	10
1-4	115 Volt A-C Power Supply, Overall View . . . . .	10
1-5	28 Volt D-C Power Supply, Overall View . . . . .	11
1-6	12 Volt D-C Power Supply, Overall View . . . . .	11
1-7	Shockmount 390L-1A, Overall View . . . . .	12
2-1	Transceiver 32MS-1A, Outline and Mounting Dimensions . . . . .	14
2-2	Control Unit 48A1-SW, Outline and Mounting Dimensions . . . . .	14
2-3	Control Unit 48B2-SW, Outline and Mounting Dimensions . . . . .	15
3-1	Control Unit 48A1-SW, Operating Controls . . . . .	18
4-1	Transceiver 32MS-1A, Block Diagram . . . . .	23-24
5-1	Calibration Curves for Antenna and R-F Coils . . . . .	28
5-2	PA Coil Calibration for 52 Ohm Load . . . . .	31
6-1	32MS-1A, Top View, Cover and Shield Removed, Keyed . . . . .	62
6-2	32MS-1A, Bottom View (A), Cover and Shield Removed, Keyed . . . . .	63
6-3	32MS-1A, Bottom View (B), Cover and Shield Removed, Keyed . . . . .	64
6-4	32MS-1A, Bottom View (C), Cover and Shield Removed, Keyed . . . . .	65
6-5	32MS-1A, Rear View, Keyed . . . . .	66

List of Illustrations

List of Tables

Figure		Page
6-6	Control Unit 48A1-SW or 48B2-SW Circuit Board, Keyed . . . . .	66
6-7	Control Unit 48A1-SW, Front View, Keyed . . . . .	67
6-8	Control Unit 48A1-SW, Rear View, Keyed . . . . .	67
6-9	Control Unit 48B2-SW, Top View, Keyed . . . . .	68
6-10	Control Unit 48B2-SW, Bottom View, Keyed . . . . .	68
6-11	115 Volt A-C Power Supply, Overall View, Keyed . . . . .	69
6-12	12 Volt D-C Power Supply, Overall View, Keyed . . . . .	69
6-13	12 Volt D-C Power Supply, Inside View, Keyed . . . . .	70
6-14	28 Volt D-C Power Supply, Overall View, Keyed . . . . .	70
6-15	28 Volt D-C Power Supply, Inside View, Keyed . . . . .	71
6-16	Automatic Receiver Gain Control Board, Top View, Keyed . . . . .	71
7-1	Transceiver 32MS-1A, Schematic Diagram . . . . .	75-76
7-2	Control Unit 48A1-SW, Schematic Diagram . . . . .	77
7-3	Control Unit 48B2-SW, Schematic Diagram . . . . .	78
7-4	115 Volt A-C Power Supply, Schematic Diagram . . . . .	79
7-5	12 Volt D-C Power Supply, Schematic Diagram . . . . .	80
7-6	28 Volt D-C Power Supply, Schematic Diagram . . . . .	81
7-7	Automatic Receiver Gain Control, Schematic Diagram . . . . .	82
7-8	Directional Coupler 302E-1, Schematic Diagram . . . . .	83
7-9	Antenna Coupler 180V-2 Schematic Diagram . . . . .	85-86

## LIST OF TABLES

Table		Page
1-1	Equipment Supplied . . . . .	1
1-2	Equipment Required but not Supplied . . . . .	1
1-3	Accessories . . . . .	3
1-4	Components of Spare Parts Kit . . . . .	4
1-5	Tube, Fuse, and Semiconductor Complement . . . . .	7

**SECTION I**

**GENERAL DESCRIPTION**

**1.1 PURPOSE OF INSTRUCTION BOOK**

Control Unit 48A-1SW and/or Mobile Type Remote Control Unit 48B2-SW.

This instruction book provides information for installation, operation and maintenance of Transceiver 32MS-1A equipment.

**1.2 PURPOSE OF EQUIPMENT**

**1.3 EQUIPMENT SUPPLIED**

Transceiver 32MS-1A equipment is a complete station for amplitude-modulated or single-sideband, high frequency communications in the range of 1.6 to 15 megacycles. The unit operates on either upper or lower sideband during single-sideband operation. During amplitude modulation operation, the unit operates on upper sideband with reinserted carrier. Local and semiremote operation of Transceiver 32MS-1A is provided by Desk Type Remote

The equipment is available as a fixed station utilizing a primary power source of 115 or 230 volts 50-400 cps, single phase, or as a fixed or mobile station utilizing a primary power source of 12 or 28 volts dc. The transceiver is fully controlled by either the desk type or mobile type control unit. Both control units feature a handset with a push-to-talk switch, a speaker amplifier with volume control, a pushbutton switching circuit which provides on-off control, mode selection, and channel selection at the transceiver. Overall views of the transceiver, control units power supplies and shockmount are shown in Figures 1-1 through 1-7. Table 1-1 lists equipment supplied.

UNIT	COLLINS PART NUMBER	DIMENSIONS (in.)		
		Length	Width	Height
Transceiver, 32MS-1A	522-2425-00	22-1/32	15-3/8	7-1/2
NOTE: Weight ranges are:  36-1/2 lbs. with 12 Volts d-c Supply 36-3/4 lbs. with 28 Volts d-c Supply 48-3/4 lbs. with 115/230 VAC Supply				

Table 1-1 Equipment Supplied

**1.4 EQUIPMENT REQUIRED BUT NOT SUPPLIED**

Equipment required but not supplied is listed in Table 1-2.

ITEM	QUANTITY PER TRANSCEIVER	DESCRIPTION
Antenna and antenna feed system	One required (separate antennas may be used for each channel if desired).	50 ohm characteristic impedance antenna and 50 ohm unbalanced feed system with swr not to exceed 2.5 to 1.

Table 1-2 Equipment Required but not Supplied

SECTION I  
General Description

ITEM	QUANTITY PER TRANSCEIVER	DESCRIPTION
Power Source	One	115 or 230 volts ac, 50 to 400 cps, single phase, or 12 or 28 volts dc.
Crystals	One per channel	CR-36/U as required by frequency assignment.
Coil Sets	One set of 6 each per channel	As required by frequency assignment.
Crystal Ovens	One oven for two crystals	Stability of $\pm 1$ part per million.
Power Supply	547-3991-00 or 547-3992-00 or 547-3993-00	For 115 Volts a-c operation.  For 28 Volts d-c operation  For 12 Volts d-c operation
Power Cable	547-3012-003 or	For 115/230 Volts d-c operation.
Power Cable	547-3014-003 or	For 28 Volts d-c operation
Power Cable	547-3013-003	For 12 Volts d-c operation
Desk Control Unit 48A1-SW Mobile Control Unit 48B2-SW	522-6240-00 or 522-6275-00	Desk Type Remote Control  Mobile Type Remote Control
Cable (for 48B2-SW only)	547-3114-003	48B2-SW Control Unit Cable
Shockmount 390L-1A	522-2573-005	For Transceiver 32MS-1A

Table 1-2 Equipment Required but not Supplied (Cont'd)

## 1.5 ACCESSORIES

Accessories available for use with Transceiver 32MS-1A are listed in Table 1-3.

ITEM	COLLINS PART NUMBER	DESCRIPTION
Antenna Coupler 180V-2	547-3931-00	Reversible L-type for coupling to single wire or whip antennas
Antenna Coupler Control Cable	547-3015-003	Control Cable for 180V-2
Automatic Gain Control	528-0127-00	Noise actuated gain control circuit circuit board
Antenna	013-1133-00	Centre Loaded Mobile Whip
Mounting Insulator	013-1132-00	Ball Type Mount for Mobile Use
Antenna	567-4491-004	Dipole and Balun Kit made up and cut to frequency
Antenna	097-4865-00	35 Foot Aluminum Whip
Antenna	097-4866-00	35 Foot Stainless Steel Whip
Mounting Insulator	097-4867-00	Stand-off Base Mount Type
Mounting Insulator	097-4868-00	Rooftop - Feed Through Type
Directional Coupler 302E-2	522-1462-00	For forward and reflected power measurements
Shockmount 39ON-1	522-1961-00	For 180V-2 Coupler

Table 1-3 Accessories

**1.6 COMPONENTS OF SPARE PARTS KIT**

Components of spare parts kit for 32MS-1A system are listed in Table 1-4.

QUANTITY PER KIT	DESCRIPTION	COLLINS PART NUMBER
32MS-1A TRANSCEIVER		
1	Tube V12, V13 (6660-6BZ6)	257-0185-00
1	Tube V11 ( 6BA7)	255-0209-00
1	Tube V3 ( 6DC6)	255-0226-00
2	Tube V17 ( 6AV6)	255-0307-00
1	Tube V5, 6 (6146 )	256-0101-00
1	Tube V18 (6663-6AL5)	257-0186-00
1	Tube V4 (6677-6CL6)	257-0188-00
1	Tube V1, 7, 10 (6678-6U8A)	257-0189-00
1	Tube V2, 14,15 (6679-12AT7)	257-0190-00
1	Fuse F1	264-0289-00
1	Diode CR8, 20, 21	353-0204-00
2	Diode CR2, 3, 4, 5, 6, 7 (IN 1492)	353-1661-00
1	Diode CR22	353-1546-00
1	Diode CR9, 10	353-1662-00
1	Diode CR1	353-1665-00
1	Diode CR1, 2 (Wattmeter)	353-2542-00
1	Diode CR19	353-2780-00
1	Diode matched Pair CR13, 14, 15, 16	353-0127-00
A.G.C. BOARD		
1	Transistor Q1	352-0276-00
1	Transistor Q2	352-0276-00
12 V D-C SUPPLY		
1	Fuse 4F <sub>2</sub>	264-0731-00
1	Fuse 4F <sub>1</sub>	264-0732-00
2	Transistor 4Q <sub>1</sub> , 2, 3, 4, 5, 6	352-0290-00
1	Diode 4CR <sub>5</sub>	353-1526-00
1	Diode 4CR <sub>1</sub> , 2, 3, 4	353-1662-00
28 V. D-C POWER SUPPLY		
2	Fuse 3F <sub>2</sub> , 3	264-0723-00
1	Fuse 3F <sub>1</sub>	264-0732-00
1	Transistor 3Q <sub>5</sub>	352-0065-00
1	Transistor 3Q <sub>1</sub> , 2, 3, 4	352-0290-00
1	Transistor 3Q <sub>6</sub> , 7	352-0297-00
1	Diode 3CR <sub>1</sub>	353-1537-00
1	Diode 3CR <sub>2</sub>	353-1600-00
1	Diode 3CR <sub>3</sub> , 4, 5, 6	353-1662-00

Table 1-4 Components of Spare Parts Kit

QUANTITY PER KIT	DESCRIPTION	COLLINS PART NUMBER
115 V A-C SUPPLY		
2	Fuse 2F <sub>2, 3</sub> Fuse 2F <sub>1</sub> Diode 2CR <sub>1</sub> Diode 2CR <sub>2, 3, 4, 5</sub>	264-0724-00 264-0727-00 353-1665-00 353-1766-00
48A1-SW CONTROL		
1	Transistor Q <sub>1, 2, 3, 4</sub>	352-0117-00
48B2-SW CONTROL		
1	Transistor Q <sub>1, 2, 3, 4</sub>	352-0117-00

Table 1-4 Components of Spare Parts Kit (Cont'd)

### 1.7 EQUIPMENT SPECIFICATIONS

Frequency range .....	1.6 to 15.0 mc
Modes .....	SSB or AM (one sideband plus carrier.)
Stability .....	± 1 part per million with crystal oven, Collins Part Number 292-0227-00.
Transmitter Power Output .....	SSB, 100 watts PEP with two-tone input, using the a-c power supply, or 80 watts PEP with two-tone input, using d-c power supplies.  AM, 50 watts average with single tone input, using ac power supply, or 40 watts average with single tone input, using d-c power supplies.
Transmitter Output Impedance .....	52 ohms resistive, capable of tuning SWR of 2.5:1
Spurious radiation.....	Measured with reference to 100 watts PEP output into a 52-ohm load.
Second harmonic .....	At least -45 db.
Unwanted sideband .....	At least -60 db.
Carrier .....	At least -50 db.
Two tone distortion products .....	At least -31 db.
All other spurious radiation.....	At least -50 db.

## SECTION I

### General Description

Transmitter audio frequency response . . . . .	$\pm 3$ db from 400 to 3000 cps.
Automatic Load Control . . . . .	Capable of at least 6 db of compression.
Speech clipping threshold . . . . .	-3 dbm on AM or +8 dbm on SSB with 0 dbm nominal input level.
Hum and noise level . . . . .	With open circuited microphone input, hum and noise is more than 40 db below rated power output
Keying characteristics . . . . .	All transmit-receive switching may be accomplished by a keying button on the handset or the button on front of the 32MS-1A
Audio input . . . . .	Telephone handset at the control unit, 600 ohm balanced, 0-dbm input level at 32MS-1A
Power Sources . . . . .	115/230 volts, 50 to 400 cps, single phase, 300 volt amperes max. 22 to 30 volts d-c, 300 watts max. 11 to 14 volts d-c, 300 watts max.
Receiver bandwidth . . . . .	SSB, 3 kc determined by mechanical filter; AM, 6 kc
Receiver sensitivity . . . . .	SSB less than 1.0 microvolt for 10 db signal noise-to-noise ratio. AM less than 3 microvolts 30 per cent modulated at 1000 cps for 10 db signal-to-noise ratio.
Receiver image rejection . . . . .	1.6 to 12.0 mc, 60 db 12.0 to 15.0 mc, 50 db minimum.
Automatic gain control and automatic loading control . . . . .	"Fast attack" with 0.5 second time constant release.
Receiver audio output . . . . .	Balanced 600 ohm output to the voice amplifier in the control unit. Output power 0 dbm for 2.5 microvolt input on SSB, or 2.5 microvolts input, 30 percent modulated at 400 cps on AM.
Receiver audio frequency response . . . . .	$\pm 3$ dbm, from 400 to 3000 cps.
Receiver audio distortion . . . . .	Less than 10 percent harmonic distortion.

## 1.8 TUBE, FUSE AND SEMICONDUCTOR COMPLEMENT

Table 1-5 lists tubes, fuses and semiconductors of Transceiver 32MS-1A, alternate power supplies, automatic receiver gain control and control units.



SYMBOL	TYPE	FUNCTION
V1	6678/6U8A	455 kc crystal oscillator and isolation amplifier
V2	6679/12AT7	Balanced mixer
V3	6DC6	R-f amplifier
V4	6677/6CL6	R-f driver
V5, V6	6146	Power amplifier
V7	6678/6U8A	Transmit audio amplifier and cathode follower
V10	6678/6U8A	Channel oscillator and phase inverter
V11	6BA7	Receiver Mixer
V12	6660/6BZ6	1st i-f amplifier
V13	6660/6BZ6	2nd i-f amplifier
V14	6679/12AT7	SSB product detector
V15	6679/12AT7	Receiver audio amplifier
V17	6AV6	Agc Amplifier
V18	6663/6AL5	Alc rectifier
CR1	1N1695	Bias rectifier
CR2, CR3	1N1492	High voltage rectifier - voltage doubler
CR4, CR5		
CR6, CR7		
CR8	1N457	Agc gate
CR9, CR10	1N1498	Low Voltage rectifier - voltage - doubler
CR11, CR12	1N34AS/HD2120	Transmitter audio clipper
CR13, CR14	1N67A	Balanced Modulator
CR15, CR16		
CR17	1N34AS/HD2120	Agc Rectifier
CR18	1N34AS/HD2120	AM detector
CR19	1N34AS/HD2120	Phase inverter T/R gate
CR20, CR21	1N457	Mode selector gates
CR22	1N540	Blower motor gate
AUTOMATIC RECEIVER GAIN CONTROL		
Q1	2N652A	Amplifier
Q2	2N652A	Amplifier
CR1, CR2	1N645	Audio rectifiers
CR3	PS6465A	Nonlinear time constant diode
CR4	1N753A	Agc output limiter
CR5	PS6465A	Agc delay
A - c POWER SUPPLY		
2CR1	1N1695	Relay solenoid rectifier
2CR2, 2CR3	1N1124R	28 volt rectifiers: spike clippers
2CR4, 2CR5		
2F1	6 amp	Low and high voltage common
2F2	3 amp	Low voltage
2F3	3 amp	High voltage

Table 1-5 Tube, Fuse, and Semiconductor Complement

SECTION I  
General Description

SYMBOL	TYPE	FUNCTION
3Q1, 3Q2 3Q3, 3Q4 3Q5 3Q6, 3Q7 3CR1 3CR2 3CR3, 3CR4, 3CR5, 3CR6 3F1 3F2 3F3	1556 1556 2N375 1559 HZPR-32A 1N248 1N1487  20 amp 7.5 amp 7.5 amp	High voltage oscillators Low-voltage oscillators Transient amplifier Transient control Transient reference diode Gate Spike clippers  Main Power fuse Low-voltage primary fuse High-voltage primary fuse
12-VOLT POWER SUPPLY		
4Q1, 4Q2 4Q3, 4Q4 4Q5, 4Q6 4CR1, 4CR2 4CR3, 4CR4 4CR5 4F1 4F2	2N1556  2N1556 1N1487  1N538 20 amp 15 amp	High-voltage oscillators  Low voltage oscillators 28 - volt rectifiers and spike clippers  12 - volt rectifier Low - voltage fuse High - voltage fuse
CONTROL UNIT 48A1-SW and 48B2-SW		
Q1, Q2 Q3, Q4	2N671 2N671	Phase inverter Push-pull amplifiers

Table 1-5 Tube, Fuse, and Semiconductor Complement (Cont'd)

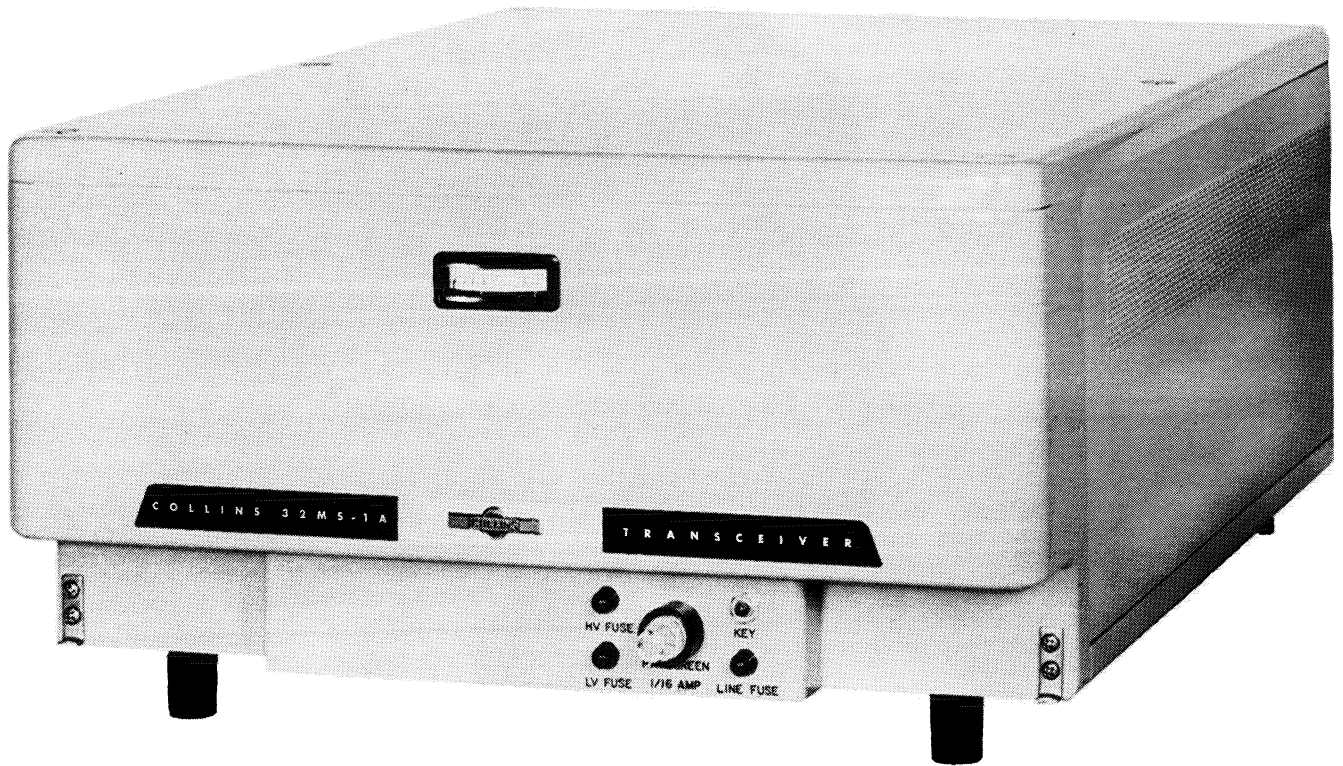


Figure 1-1 Transceiver 32MS-1A, Overall View



Figure 1-2 Control Unit 48A1-SW, Overall View

SECTION I  
General Description



Figure 1-3 Control Unit 48B2-SW, Overall View

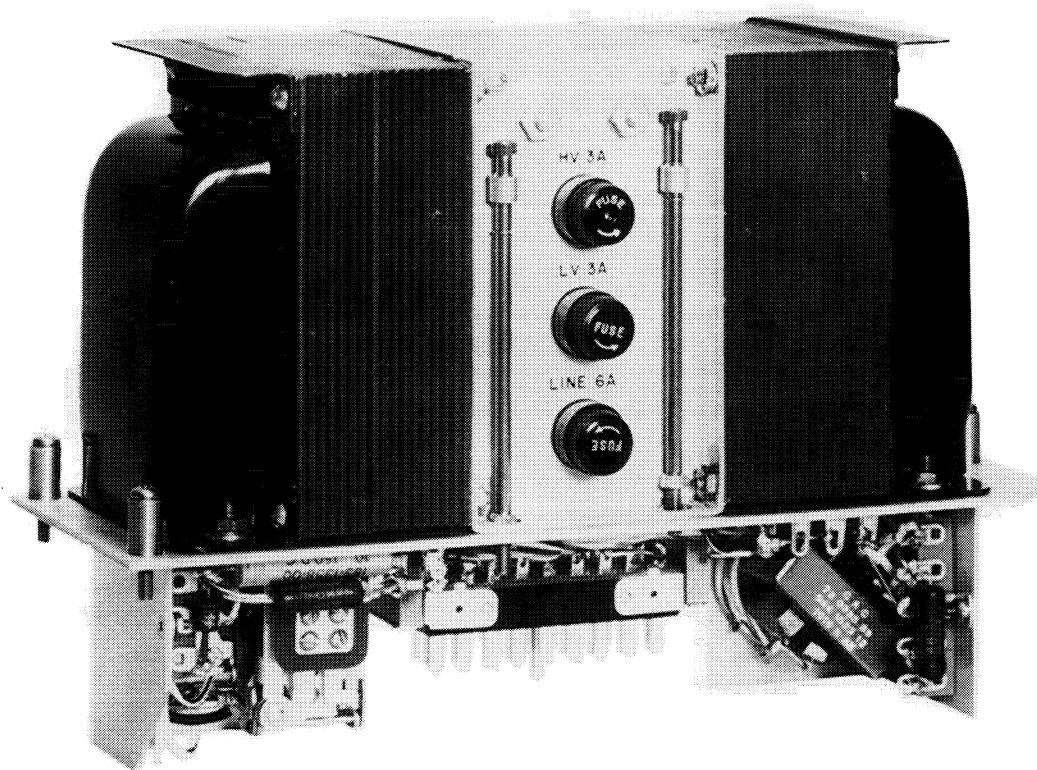


Figure 1-4 115 Volt A-C Power Supply, Overall View

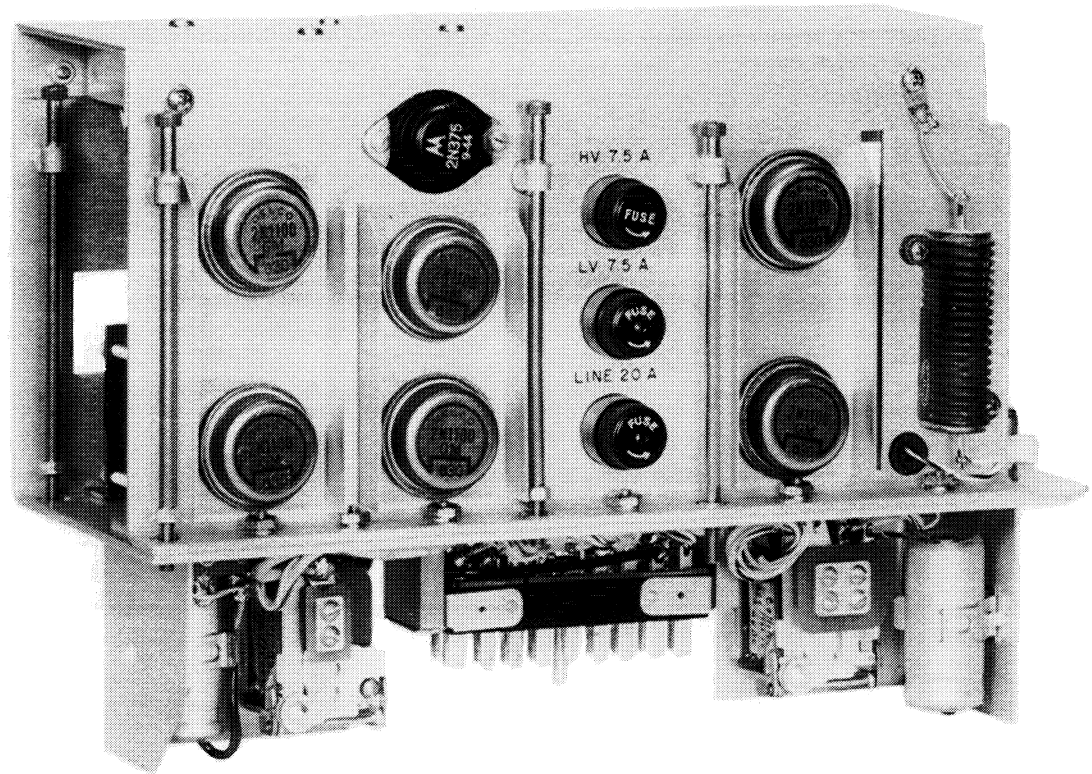


Figure 1-5 28 Volt D-C Power Supply, Overall View

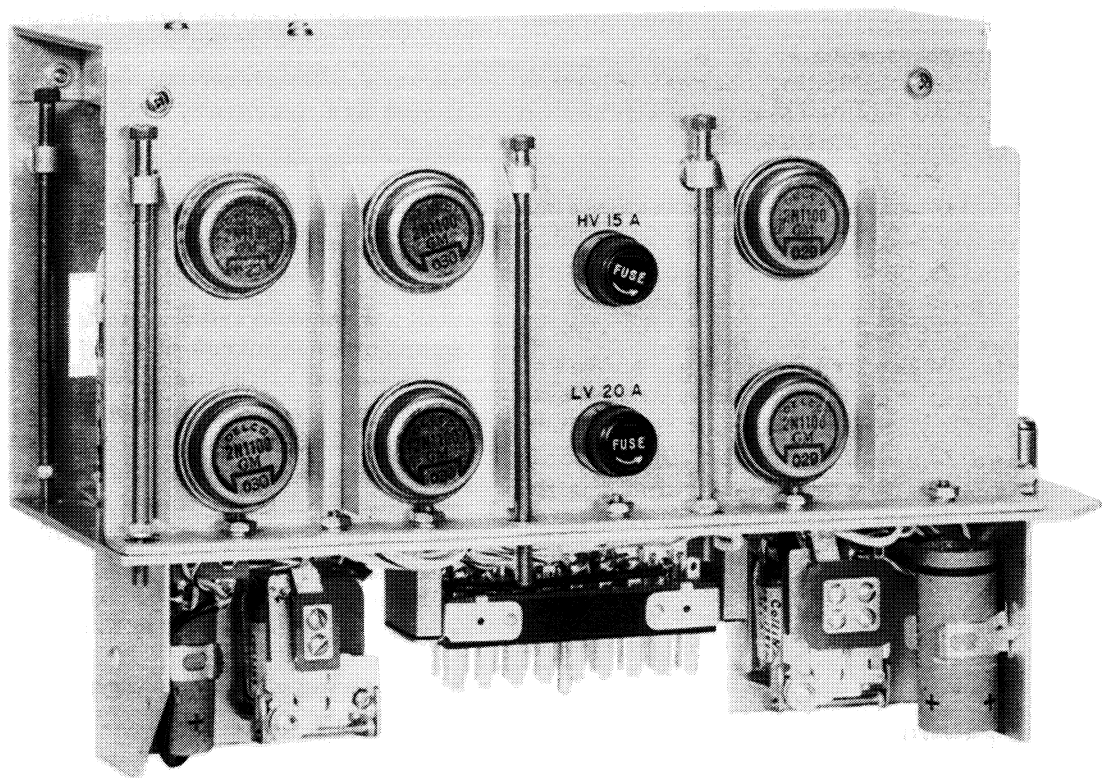


Figure 1-6 12 Volt D-C Power Supply, Overall View

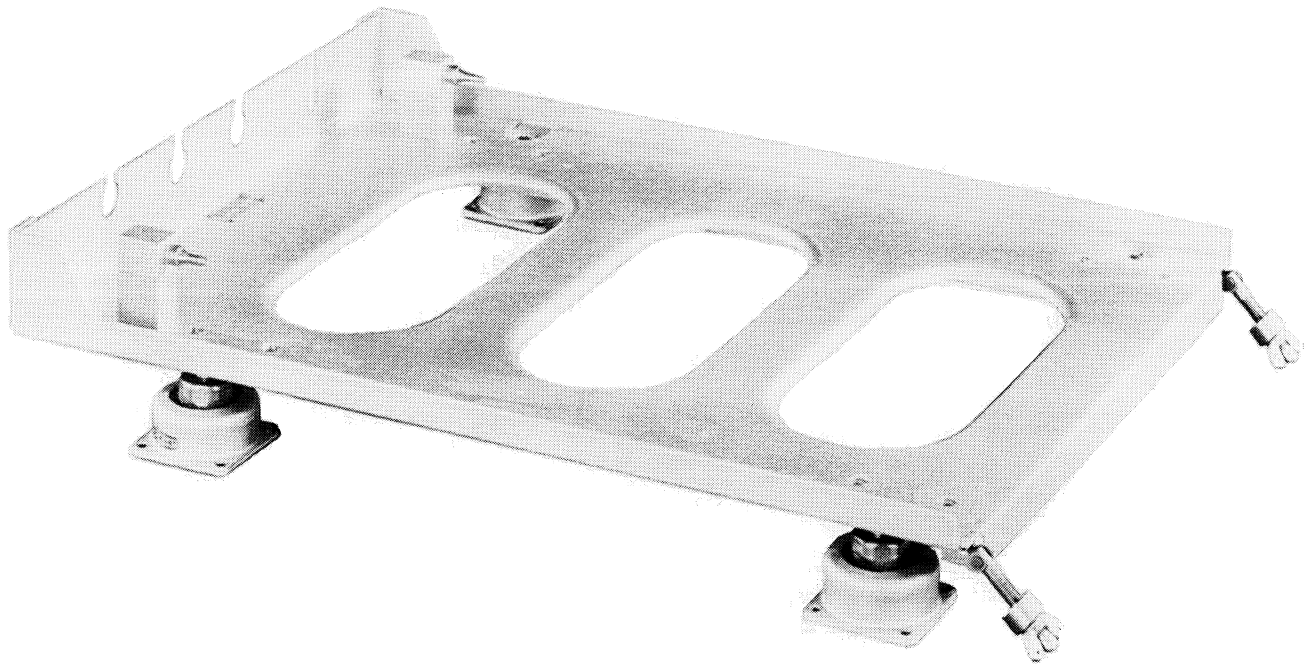


Figure 1-7 Shockmount 390L-1A, Overall View

### 1.9 TRANSCEIVER 32MS-1A

The 32MS-1A Transceiver and its associated accessory equipment permits a choice of either single sideband or compatible AM transmission and reception on any four preset frequencies in the 1.6 to 15.0 mc range. All operating functions including channel selection are controlled by pushbuttons or switches on the separate control unit.

The 32MS-1A is of panel chassis construction and is housed in a welded aluminum case. Cooling is by convection with air entering through perforations in the bottom cover and flowing out through openings in the side of the cabinet. When transmitting, a blower forces air directly on the PA tubes and effects general air circulation throughout the cabinet. All tubes and controls for initial adjustments and tuning are easily reached by removing the top and bottom covers. High stability frequency generation circuits are common to the transmitter and receiver sections to simplify overall circuitry and operation, and to ensure transmission and reception on signals on identical frequencies.

### 1.10 SHOCKMOUNT 390L-1A

The 390L-1A provides a crash proof mount for Transceiver 32MS-1A for mobile

installations. Screw down wing nuts at the front and guide pins at the rear ensure rapid detachment of the transceiver for service. Four aircraft type vibration mounts ensure vibration isolation. The vibration mounts are readily removable and the tray may be used in conventional table or shelf mounting in fixed station service. No electrical interconnections to the mount are necessary and grounding straps are provided.

### 1.11 DESK TYPE REMOTE CONTROL UNIT 48A1-SW

The 48A1-SW Control Unit provides pushbutton control of all operating functions associated with the 32MS-1A Transceiver, including channel selection and choice of either AM or SSB mode of operation. A monitor amplifier employing transistors and a separate volume level control are located in the base of the unit. Push-to-talk control of the transmit function is provided by a switch in the handset. All connections to the transceiver are made by a single attached cable with a plug-in connector.

### 1.12 MOBILE TYPE REMOTE CONTROL UNIT 48B2-SW

The 48B2-SW Control Unit provides the same control as the 48A1-SW Control Unit of

all operating functions associated with the 32MS-1A Transceiver. An adjustable mounting bracket permits the control unit to be positioned for maximum ease of use. All connections to the transceiver are made by means of a separate control unit cable.

### **1.13 ANTENNA COUPLER 180V-2**

The 180V-2 antenna coupler is a preset, automatically switched four channel tuner for coupling the 32MS-1A Transceiver to an antenna.

It will load single wire or whip antennas longer than 50 feet over the 1.6 to 15.0 mc range, or longer than 30 feet over the 2.5 to 15.0 mc range. The circuit design is a modified reversible L-type matching network, which allows the use of either low or high impedance antennas. A directional wattmeter located in the transceiver permits rapid adjustment for a minimum of reflected power. The 180V-2 is housed in a weather-proof cabinet which may be located directly at the antennas base in fixed installations to provide maximum radiation efficiency.





SECTION II  
Installation

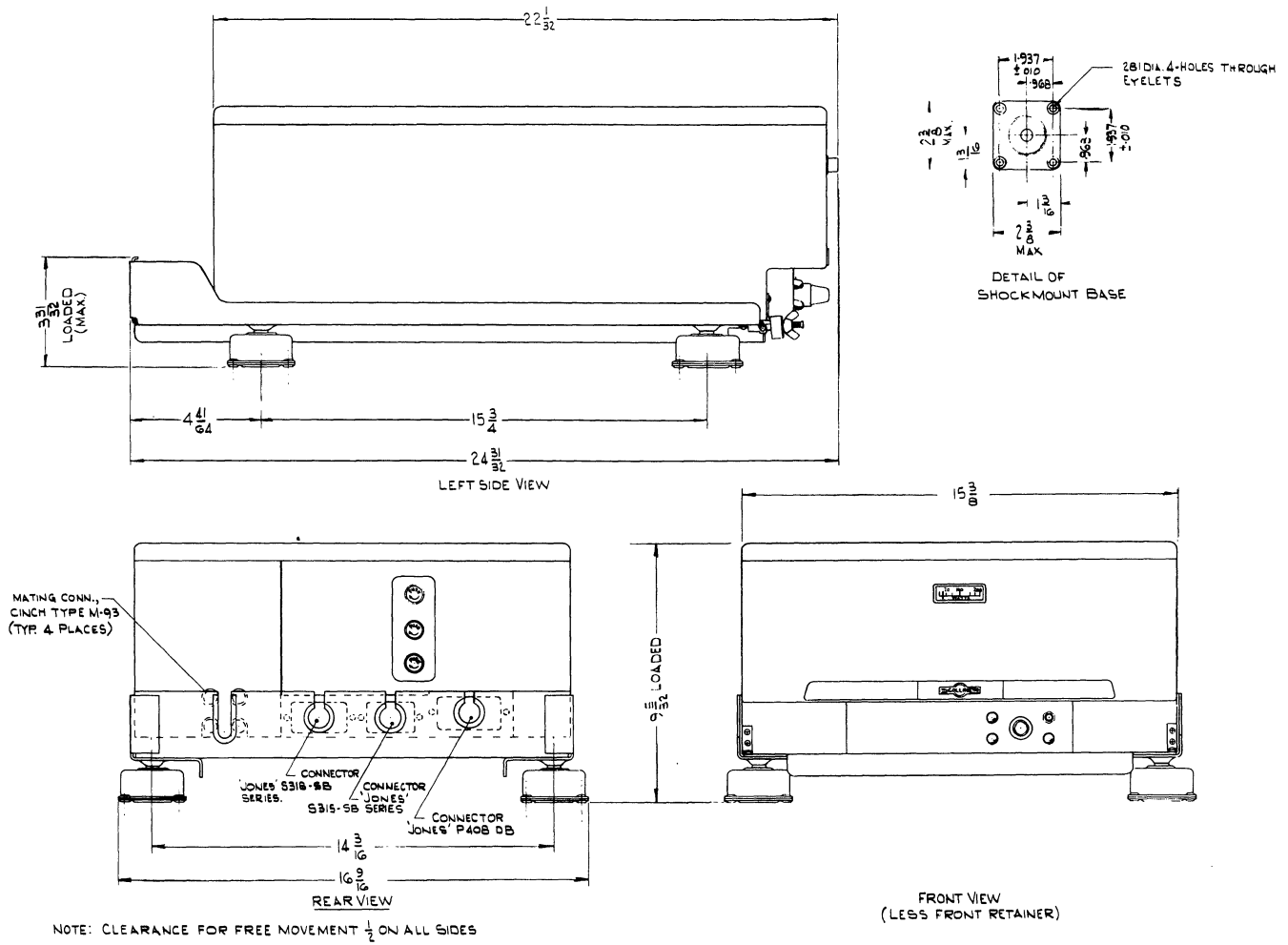


Figure 2-1 Transceiver 32MS-1A, Outline and Mounting Dimensions

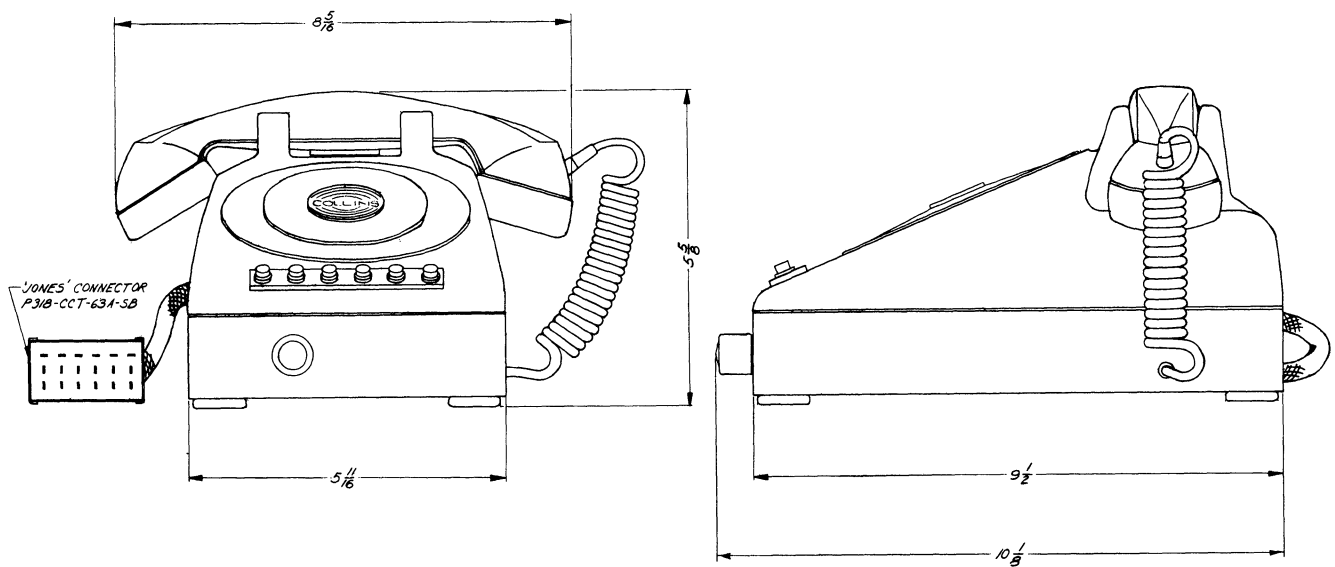


Figure 2-2 Control Unit 48A1-SW, Outline and Mounting Dimensions

SECTION II

INSTALLATION

2.1 UNPACKING AND INSPECTING EQUIPMENT

Remove all packing material, and carefully lift the units from their crates. Be careful when uncrating; use a nail puller to open the crates. Check the equipment against the packing slips and list of equipment supplied (Tables 1-1 and 1-2 of this handbook). Inspect each unit for physical damage. If damage exists, save packaging material and packing containers to substantiate claim with transportation agency.

2.2 INSTALLATION

2.2.1 Mounting

Transceiver 32MS-1A for fixed station utilization may be set on desk or bench as

desired. A suitable shockmount is available for mobile station operation. Figure 2-1 shows typical outline and mounting dimensions for the transceiver. When using the shockmount, the four legs are removed.

Figures 2-2 and 2-3 show outline and mounting dimensions for the 48A1-SW and 48B2-SW Control Units respectively.

2.2.2 Wiring Connections

Figures 7-1 through 7-9 contain inter-unit and external wiring connections. Inter-connecting cables as required for different configurations of equipment should be made up routed and connected as shown in Figures 7-1 through 7-9. When shipped, the a-c power supply unit is wired for 115 volts operation.

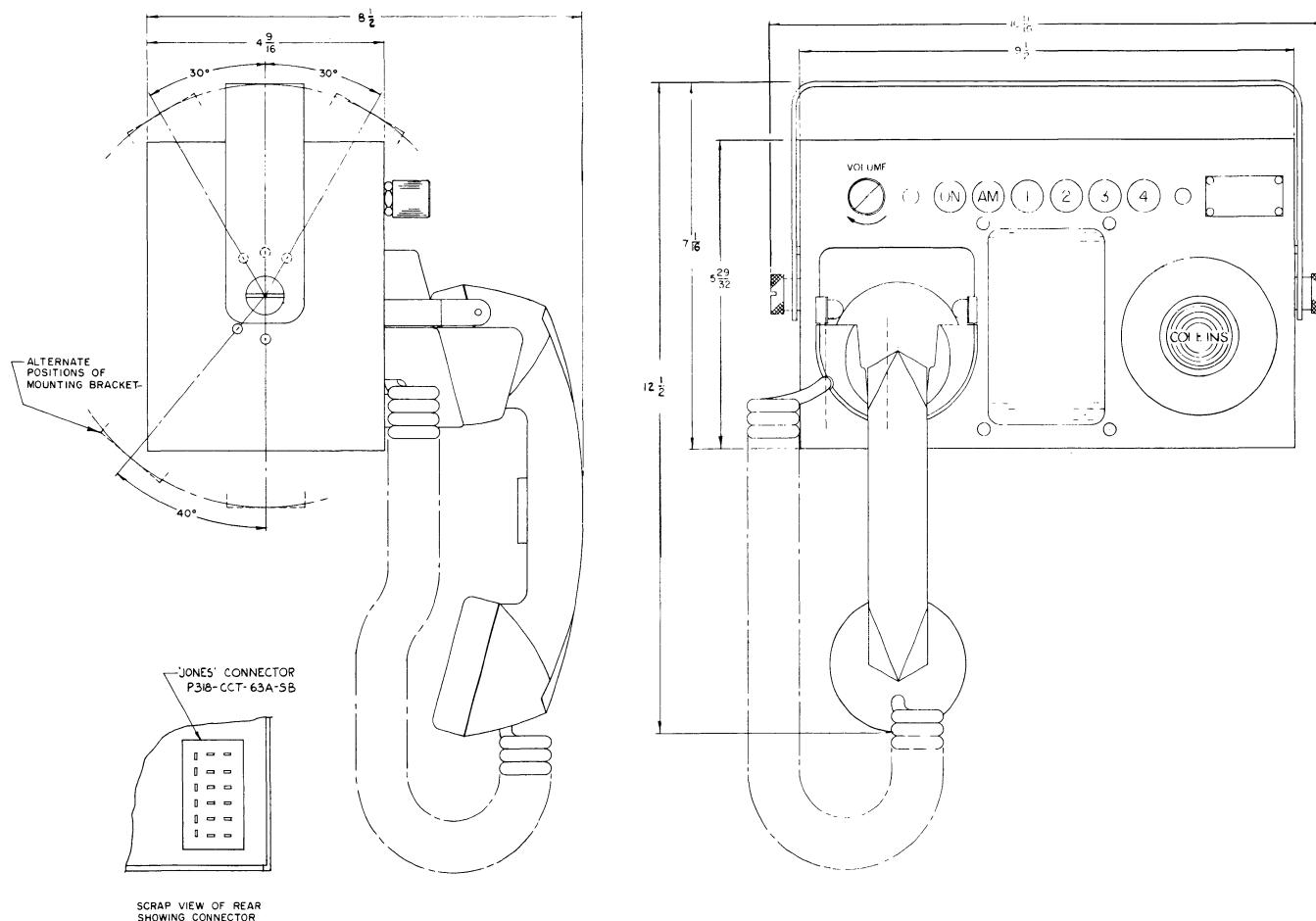


Figure 2-3 Control Unit 48B2-SW, Outline and Mounting Dimensions

## SECTION II Installation

For operation on a 230 volt primary, rewire jumpers in the power supply unit as illustrated in Figure 7-4.

### 2.2.3 Antenna Connections

An individual jack (J<sub>1</sub>, J<sub>2</sub>, J<sub>3</sub>, J<sub>4</sub>) is provided for each transceiver channel, at the rear of the 32MS-1A. Installations which provide a single feed system for all channels are accommodated by jumpering at the internal switch wafer S9.

The antenna connections at the rear are push-on phono plug switchcraft type 3501M.

### 2.2.4 Initial Alignment

The 32MS-1A is normally factory tuned and adjusted for operation with 50 ohm unbalanced antennas on the designated operating channels. When connected into such antenna systems the only adjustments required are:

- (a) Touch-up tuning and loading of the PA tanks.
- (b) Adjustment of microphone current.

In instances where a new channel is to be used, refer to paragraph 5.4 for complete tuning procedures.

#### NOTE

The PA tuning and loading adjustments are made with a non-reactive 52 ohm load. Each channel should be readjusted for the antenna used. The range of adjustment available will handle a VSWR of 2.5 to 1 or less.

## 2.3 INSTALLATION, FIELD

### 2.3.1 General

For installation, refer to Figures 2-1, 2-2, 2-3.

### 2.3.2 Fixed Station Installation

Mount the transceiver as described in para 2.2.1.

### 2.3.3 Wiring Connections

Connect associated equipment to 32MS-1A using Figures 7-1 through 7-9.



If 12V or 28V DC supplies are used make sure that proper source polarity is applied to DC supply.

### 2.3.4 Mobile Installation

- (a) Select location of 32MS-1A in available space. Allow clearance on all sides to assure adequate ventilation. Drill holes and attach the shockmount tray with self-tapping screws. In case the surface is uneven, an adaptor bracket should be prepared to fasten the 390L-1A shockmount down in the required position.
- (b) Determine necessary length of power cable from car battery to 32MS-1A and cut to required length.
- (c) Select location (under the dashboard of car) for mounting the 48B2-SW control.
- (d) Determine necessary length of control cable between 48B2-SW unit and 32MS-1A.



Be sure to observe correct polarity of power source before connecting the power cable. DO NOT connect the power cable to a battery which has a positive ground. To do so will destroy all six transistors in the power supply.

- (e) Select location on the rear fender for the centre loaded mobile whip antenna. Drill hole and fasten the antenna mount, determine and cut a proper length of coax cable RG-58/U between antenna and 32MS-1A.
- (f) For suppression of noise encountered in mobile operation, the following suggestions may be helpful. Use resistor type spark plugs, and install coaxial-bypass capacitors at ignition coil, generator and voltage regulator leads. Use bracket-mounted coaxial capacitors in the battery and generator leads to the voltage regulator and a 0.005 microfarad (or smaller) disk ceramic or mica capacitor from the field lead to ground. If capacitor bypasses are not satisfactory here, remove them, and use chokes in series with the leads from field and armature terminals of generator. Place these chokes as close to the voltage regulator as possible. For the field lead choke, wind 12 turns of No. 18 wire on a 1/4 inch powdered iron core. For the armature lead, wind 12 turns of No. 14 or larger wire on a 1/4 inch powdered iron core.

If a bypass capacitor is used from the field lead to ground, do not use a larger value than 0.005 mf unless a 4 ohm resistor is placed in series with it. Ground the rear end of the exhaust pipe to the car body, using copper braid. General information concerning the problem of ignition noise and suggested methods of noise suppression are available in current handbooks.

## 2.4 INITIAL ADJUSTMENT

Remove the top cover of Transceiver 32MS-1A and check that the power supply is compatible with the power source available. Connect the power cable to the power source.

There is one pre-operating adjustment required. Refer to the schematic diagram Figure 7-2 or 7-3. This adjustment consists of setting the microphone current in the control units to 50 ma by means of potentiometer R16. In normal operation, the +24 volt d-c source that supplies the microphone is provided by the transceiver power supply. (This is a separate 24 volt power supply from that used for the speaker amplifier transistors and the indicator lights for the push-buttons). To adjust the microphone current, carry out the following procedures:

- (a) Connect a 24 volt d-c source in series with a 0-100 ma meter.
- (b) Connect the meter and d-c source across the audio output of the microphone circuit pins 5 and 6 of the connector. Remove the handset from the cradle.
- (c) Using a flathead screwdriver, adjust R16 for a microphone current of 50 ma, as indicated by the meter. The R16 adjustment is reached through an access hole in the bottom of the 48A1-SW or by removing the dust cover of the 48B2-SW.

## 2.5 POST INSTALLATION CHECK

### 2.5.1 SSB OPERATION

Move the meter switch located inside the 32MS-1A top cover to the ALC-S position. Select SSB mode on Control Unit 48A1-SW or 48B2-SW (AM light off). Allow sufficient time for the transceiver to warm up. Listen on the handset. Check that none of the fuse-out indicators are illuminated. After the warm-up period, noise or signals should be audible on the handset. Adjust the volume control for a comfortable audio output level.

Make sure that the antenna is connected to the 32MS-1A. Switch the meter selector to the PA CATH position. Switch the OPR-TUNE switch to OPR position. Press the test button on the front of the transceiver. The meter should indicate between 10 and 15 on the watts scale.



Do not hold button down for more than 15 seconds at a time.

Switch the OPR-TUNE switch to TUNE position. With the test button depressed, move the meter selector switch to FWD POWER position. The meter should indicate approximately 90 watts forward power. Switch the meter selector to REV PWR position. With the test button depressed, the meter should indicate not more than 25 watts reflected power. Move the meter switch to the PA CATH position. The meter should indicate between 80 and 150 on the watts scale. Release the test button. Move the OPR-TUNE switch to OPR position. Press the transmit button on the handset and speak into the microphone of the handset. The meter indication should increase. Move the meter switch to FWD POWER Position and speak into the microphone. The meter indication should increase. Move the meter switch to the ALC-S position.

### 2.5.2 AM OPERATION

Move the meter-selector switch to ALC-S position. Select AM mode on the control unit. Allow sufficient time for the transceiver to warm up. Listen on the handset. Check that none of the fuse-out indicators are illuminated. After the warm up period, noise or signals should be audible on the handset. Move the meter selector switch to PA CATH position. Move the OPR-TUNE switch to OPR position. Press the test button on the front of the transceiver. The meter should indicate approximately 40 watts. Move the meter selector switch to FWD POWER position, and depress the test button. The meter should indicate approximately 25 on the watts scale. With the test button depressed and the meter selector switch in the REV PWR position, the meter should indicate not more than 6 watts reflected power. Move the meter selector switch to FWD POWER position and speak into the microphone: the meter indication should increase. Move the meter switch to ALC-S position. Replace the cover on Transceiver 32MS-1A.

SECTION III  
Operation

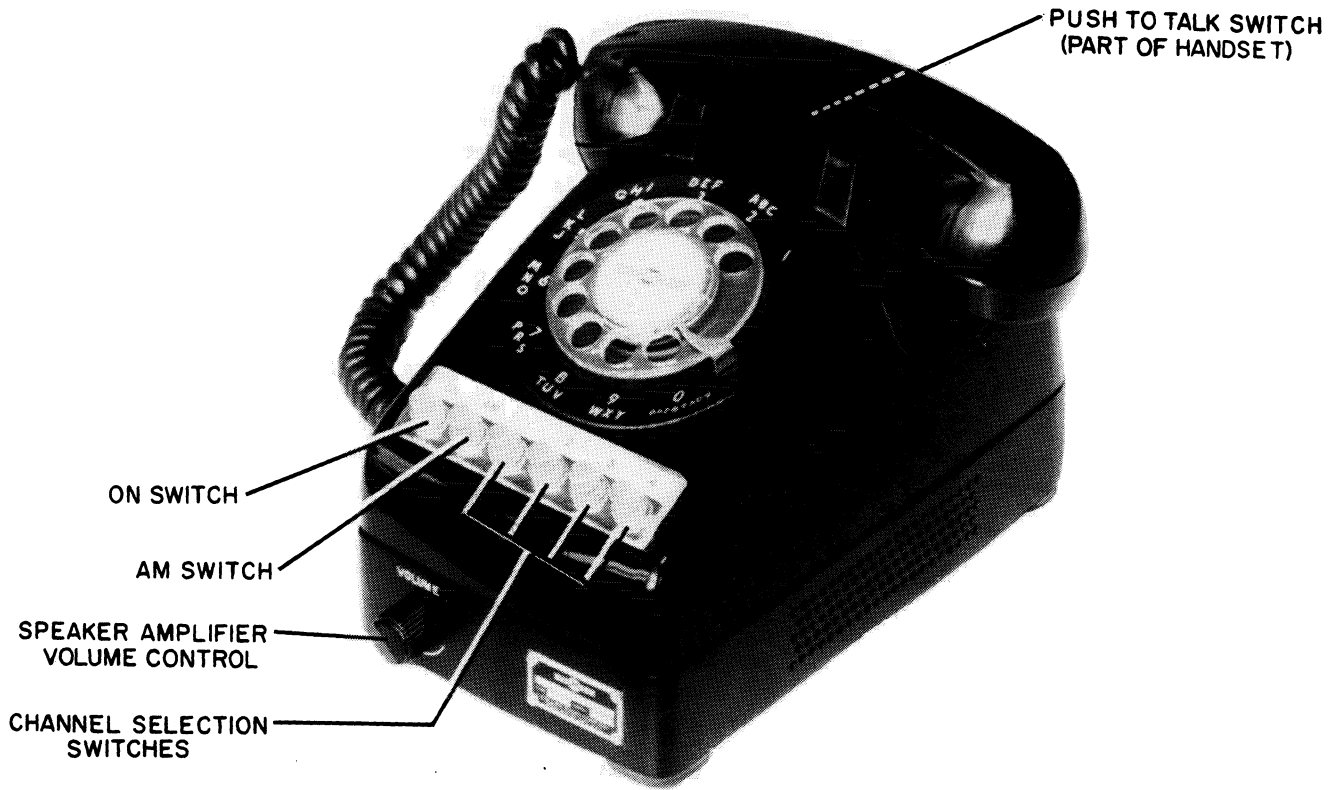


Figure 3-1 Control Unit 48A1-SW, Operating Controls

## SECTION III

# OPERATION

### 3.1 GENERAL

The following paragraphs provide operating instructions for Transceiver 32MS-1A by means of Control Unit 48A1-SW. Since the operating controls and the operation of the 48A1-SW and 48B2-SW are identical, the same general instructions can be used for either unit.

### 3.2 OPERATING CONTROLS

The operating controls of Control Unit 48A1-SW are illustrated in Figure 3-1. These controls and their functions are as follows:

- (a) A pushbutton ON switch which provides on-off control of the transceiver and the speaker amplifier in the control unit.
- (b) A pushbutton AM switch which provides mode selection.
- (c) Four pushbutton switches 1, 2, 3 and 4 which provide channel selection for the transceiver.
- (d) A VOLUME control for the speaker amplifier.
- (e) A push-to-talk switch on the handset.

### 3.3 OPERATING PROCEDURES, SSB MODE

Operating procedures for use of the 32MS-1A as a single sideband transceiver are as follows:

- (a) Push the ON button. The indicator light on the ON button should come on.
- (b) Push the assigned channel button 1, 2, 3, or 4. For standby operation, this is all that is necessary.
- (c) When the call arrives remove the handset from the cradle.
- (d) Either adjust the VOLUME control and use the speaker, or turn down the volume and use the headphone to receive the call.
- (e) For transmit, press the push-to-talk button on the handset. Hold the handset so as to speak directly into the microphone. Speak clearly and distinctly. Do not shout.

### 3.4 OPERATING PROCEDURES, AM MODE

Operating procedures for use of the 32MS-1A as a compatible amplitude modulated transceiver are as follows:

- (a) Push the ON and AM and assigned channel buttons. The indicator lights in these buttons should come on. For standby operation this is all that is necessary.
- (b) Carry out the same operating procedures as for single sideband reception and transmission described in Paragraph 3.3. steps (c) through (e).

#### NOTE

The meter selector switch in Transceiver 32MS-1A must be in the ALC-S position.

## SECTION IV

# PRINCIPLES OF OPERATION

### 4.1 GENERAL

Transceiver 32MS-1A utilizes common oscillators, r-f amplifier and tuned circuits for both transmit and receive functions. All tuned circuits are pretuned for appropriate channels. The pretuned circuits and crystals are selected from the control unit. Mode of operation, AM or SSB, is selectable from the applicable control unit. The 32MS-1A is equipped with provisions for antenna coupler autopositioning. The circuits of Control Unit 48A1-SW and Control Unit 48B2-SW are essentially identical. The schematic diagrams of the 48A1-SW and 48B2-SW are shown in Figures 7-2 and 7-3 respectively. The circuits are basically simple four-wire telephone sets.

### 4.2 BLOCK DIAGRAM

Figure 4-1 is a block diagram of AM/SSB Transceiver 32MS-1A. The heavy solid line represents the signal path during transmit operation. The heavy dotted lines indicate the signal path during receive operation and the thin solid lines indicate control voltages, alc and agc.

### 4.3 TRANSMITTER OPERATION

#### 4.3.1 SINGLE SIDEBAND OPERATION

Refer to Figures 4-1 and 7-1. Audio signals from the control unit are fed via terminals 5 and 6 of connector J5 to the audio input transformer T1. The output of the audio transformer is fed to the speech clipper CR11 and CR12, and then to V7, which is an audio amplifier and cathode follower. The output of the cathode follower is coupled to the balanced modulator, consisting of CR13, CR14, CR15 and CR16. R-f at 455 kc from crystal oscillator V1A drives isolation amplifier V1B. The output of V1B is fed to the balanced modulator. Audio and 455 kc rf are mixed within the balanced modulator. Double sideband suppressed carrier output from the balanced modulator is fed to mechanical filter FL1. Mechanical filter FL1 removes the upper sideband and allows the lower sideband to pass on to balanced mixer V2. R-f generated in

channel oscillator V10A is fed to phase inverter V10B which excites balanced mixer V2. If the channel crystal is 455 kc below the channel frequency, the output of balanced mixer V2 is lower sideband suppressed carrier. The output of V2 is fed to r-f amplifier V3. R-f amplifier V3 excites r-f driver V4 which drives the power amplifier V5 and V6. The output of the power amplifier will be upper sideband suppressed carrier if the channel crystal is 455 kc above the desired channel frequency.

#### 4.3.2 AMPLITUDE MODULATED OPERATION

Operation of Transceiver 32MS-1A on AM is similar to operation on SSB. The major difference is that the r-f carrier from the 455 kc isolation amplifier is bypassed around the balanced modulator and mechanical filter by the carrier reinsertion control. The resulting balanced mixer excitation consists of lower sideband plus carrier and channel oscillator information. Lower sideband plus carrier excitation drives the r-f amplifier. The output of Transceiver 32MS-1A during AM operation is upper sideband plus carrier, if the channel crystal is 455 kc above the desired channel frequency and lower sideband plus carrier if the channel crystal is 455 kc below the desired channel frequency.

### 4.4 RECEIVER OPERATION

#### 4.4.1 SINGLE SIDEBAND OPERATION

Refer to Figures 4-1 and 7.1. R-f signals are fed from the antenna to r-f amplifier V3. The output signal from V3 is fed to receiver mixer V11 where it is mixed with channel oscillator information from V10A. The output signals of receiver mixer V11 are fed through mechanical filter FL1 to first i-f amplifier V12. The output of the first i-f amplifier is coupled to second i-f amplifier V13. The output of the second i-f amplifier is fed to product detector V14, where it is mixed with the signal from the 455 kc oscillator V1. The audio amplifier V15 drives the 600 ohm line through transformer T2 which is connected to the control unit.

## SECTION IV

### Principles of Operation

#### 4.4.2 AMPLITUDE MODULATION OPERATION

Operation of Transceiver 32MS-1A for AM reception is similar to single-sideband reception, except for the following: The output signals of the receiver mixer are fed through an i-f transformer, instead of mechanical filter FL1, to the first i-f amplifier. The output signal from the second i-f amplifier is fed to AM detector CR18 instead of product detector V14. The output of AM detector CR18 is coupled to audio amplifier V15.

### 4.5 CIRCUITS DESCRIPTION

#### 4.5.1 AUDIO CLIPPER

Diodes CR11 and CR12 and their associated network form a series type audio clipper. The forward bias at the junction of CR11, CR12 and R24 is adjusted to cause a negative reference potential to appear at that junction. A positive going signal at the junction of T1, R21 and C24 is coupled through the low impedance of C24, CR11, CR12 and C35 to the grid of audio amplifier V7A. The positive going signal appears across resistor R24. If the positive going signal appearing across R24 should cause the reference junction of CR11, CR12 and R24 to appear positive relative to ground, CR12 will stop conducting. When CR12 stops conducting, it appears to be a very high resistance to the positive going signal. This action limits magnitude of the positive going signal that can appear at the grid of audio amplifier V1A.

A negative going signal appearing at the junction of T1, R21 and C24 is coupled through the low impedance of C24, CR11, CR12 and C35 to the grid of audio amplifier V7A. The negative going signal appears across resistor R23. If the negative going signal across R23 should cause the junction of R23, R22 and CR11 to appear negative relative to the reference potential at the junction of CR11, CR12 and R24, CR11 will stop conducting. When CR11 stops conducting, it appears to be a very high resistance to the negative going signal. This action limits the magnitude of negative going signal that can appear at the grid of V7A. Transceiver 32MS-1A uses positive and negative peak audio clipping. The clipper threshold is -3dbm input on AM and +8dbm on SSB.

#### 4.5.2 SPEECH AMPLIFIER AND TONE OSCILLATOR

When the OPR/TUNE switch S3 is in the TUNE position, tube section V7A is connected as a phase-shift audio oscillator operating at approximately 1400 cps. When S3 is in the OPR position, V7A is connected as a conventional class A pentode audio amplifier. The output of V7A is coupled to the grid of cathode follower V7B, through TRANSMIT AUDIO Gain control R61 and coupling capacitor C43.

#### 4.5.3 CATHODE FOLLOWER

V7B is a conventional cathode follower. It is used to obtain a low-impedance signal source for balanced modulator CR13, CR14, CR15 and CR16.

#### 4.5.4 BALANCED MODULATOR

The balanced modulator is composed of CR13, CR14, CR15 and CR16 and their associated network. The series type diode modulator uses single-ended audio frequency and radio frequency inputs and balanced double sideband suppressed carrier output. The balanced modulator output is coupled to mechanical filter FL1 through C165 and C48. Potentiometer R40 is the carrier balancing resistor. Capacitor C47 is used for additional balancing to reduce carrier feedthrough, Capacitor C50 tunes the input coil of mechanical filter FL1.

#### 4.5.5 MECHANICAL FILTER

The mechanical filter is a mechanically resonant device which receives electrical energy, converts it into mechanical vibration, then converts the mechanical energy back into electrical energy at the output. The centre frequency of the mechanical filter is 453.2 kc and the bandwidth of the half-power points is 2.7 kc. The output of the mechanical filter is coupled to the balanced mixer.

The mechanical filter removes the upper sideband of the double sideband suppressed carrier input signal and passes the lower sideband only.

#### 4.5.6 BALANCED MIXER

The balanced mixer V2 receives its excitation from the balanced modulator via the mechanical filter and from the channel oscillator via the phase inverter. One grid of the balanced mixer is fed by the mechanical filter.



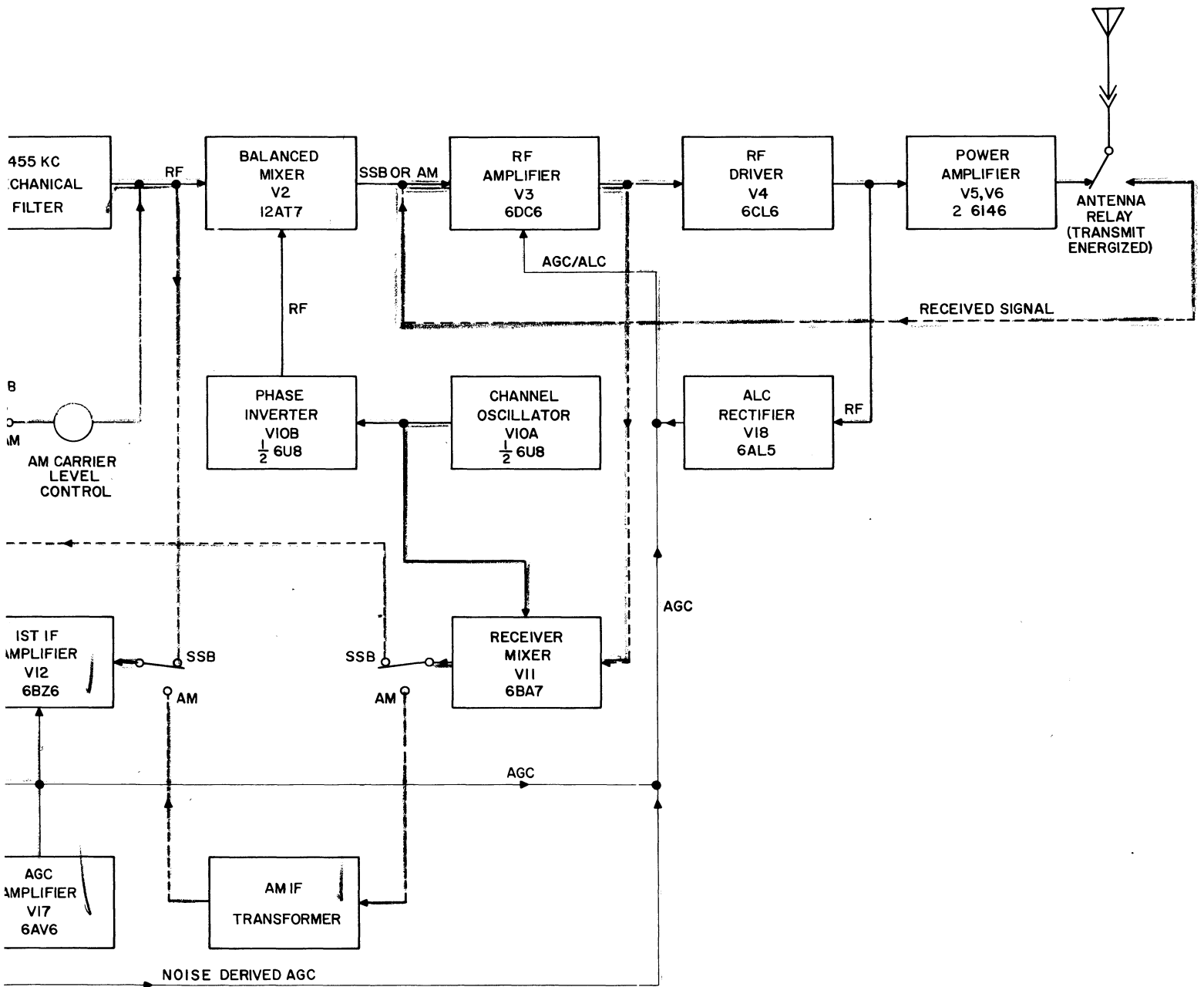
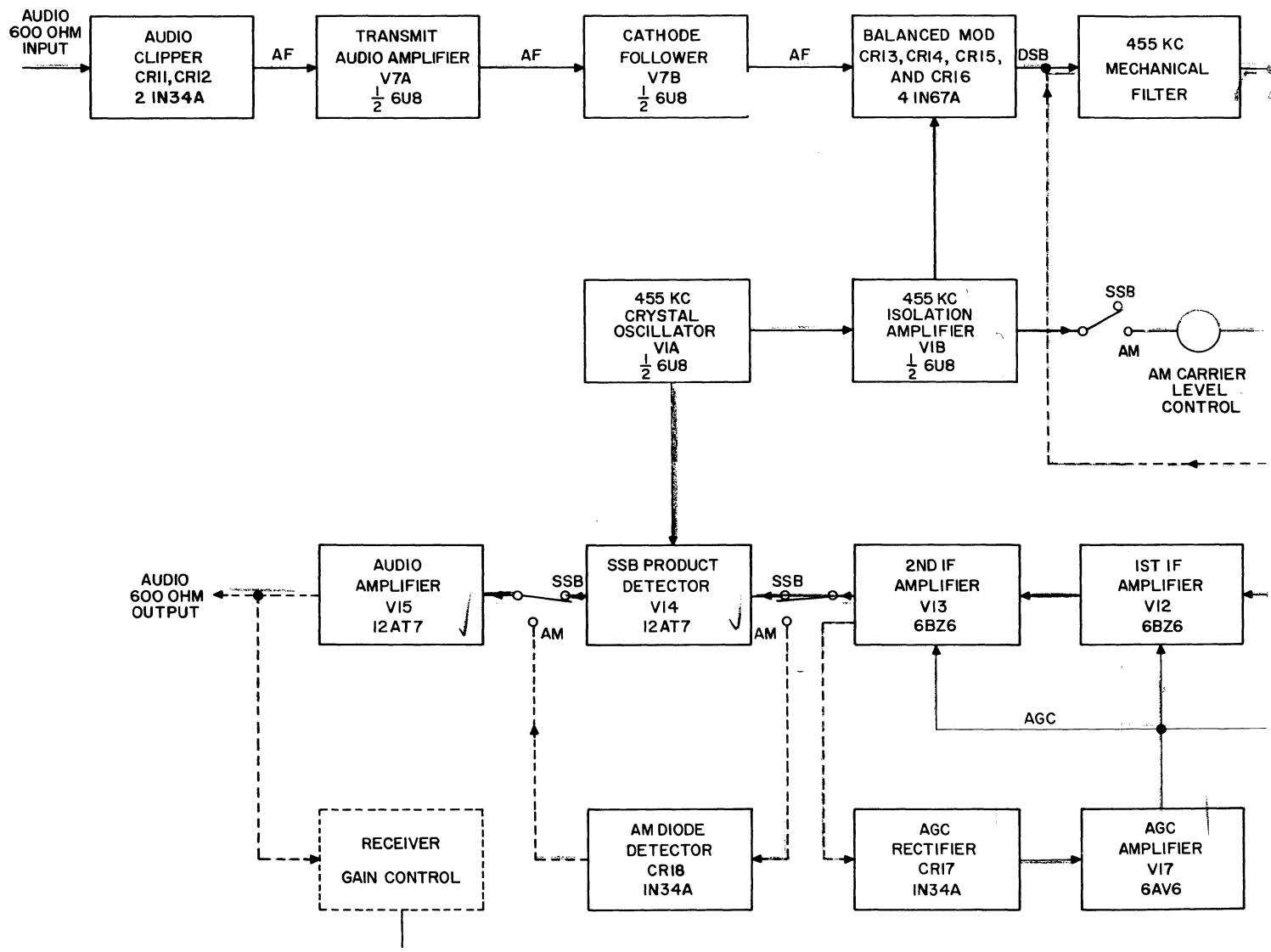


Fig. 4-1 Transceiver 32MS-1A, Block Diagram







The other grid is grounded at r-f. The cathodes of the balanced mixer are fed in push-pull by the phase inverter. The output of the balanced mixer is via the parallel connected plates of V2. R66 is a balancing potentiometer and is adjusted to reduce to a minimum the channel oscillator frequency energy which appears at the plates of balanced mixer V2.

The output of the balanced mixer is fed to the r-f amplifier.

When the output frequency of the balanced mixer is the difference between the channel oscillator frequency and the modulated 455 kc lower sideband suppressed carrier signal, the output of the balanced mixer will be upper sideband suppressed carrier.

#### 4.5.7 OUTPUT FREQUENCY RELATION

If the 455 kc signal is modulated with a 2 kc tone, the output of the balanced modulator will be 453 kc and 457 kc (the 455 kc signal is balanced out in the balanced modulator). The mechanical filter will not pass the 457 kc signal. The 453 kc signal (lower sideband) is passed by the mechanical filter to the balanced mixer. The modulating tone is mixed with the channel oscillator frequency. Assume the channel oscillator frequency is 8000 kc, the output of the balanced mixer will be  $8000 \text{ kc} - 453 \text{ kc} = 7547 \text{ kc}$ . The signal represents the modulation sideband. If the 455 kc signal appeared in the output of the balanced mixer, its frequency would have translated to  $8000 \text{ kc} - 455 \text{ kc} = 7545 \text{ kc}$ . It is apparent that the sideband signal is 2 kc higher than the "carrier" frequency, and due to subtractive mixing has been inverted from a lower to an upper sideband.

#### 4.5.8 RADIO FREQUENCY AMPLIFIER

The r-f amplifier V3 is a class A amplifier using a remote cutoff pentode. This stage is bridge neutralized. The input and output coils are selected by the channel selector switch. The r-f amplifier gain is controlled by alc during transmit operation and agc during receiving operation. The output is coupled to the r-f driver.

#### 4.5.9 RADIO FREQUENCY DRIVER

The r-f driver V4 is a class AB<sub>1</sub> linear amplifier and is bridge neutralized. The input and output coils are selected by the channel selector switch. The output of the r-f driver is coupled to the power amplifier.

#### 4.5.10 POWER AMPLIFIER

Power amplifier V5 and V6 is a linear amplifier using two beam power tubes in parallel and operated under class AB<sub>1</sub> conditions. Grid current impulses are minimized by the alc circuit. Feedback from the power amplifier plate to the cathode of the r-f driver is used to improve the linearity in the power amplifier stage. The output of the power amplifier is fed through the directional wattmeter to the channel selector switch, which selects the proper antenna connector. The output of the power amplifier is tuned by  $\pi$ -L networks selected by the channel selector switch.

#### 4.5.11 AUTOMATIC LOADING CONTROL

Alc rectifier V18 is a duo-diode. Grid current impulses from the power amplifier are fed through capacitor C159 to the cathode of one diode and the plate of the other diode. The second diode is shunted across the impulse signal line and the first diode is in series with the impulse signal line. This connection results in a voltage-doubler-rectifier configuration. The rectified grid impulses are filtered and applied to the grid of the r-f amplifier as control voltage. The negative voltage on the grid of the r-f amplifier as a result of the alc voltage, reduces the gain of the r-f amplifier. Reducing the gain of the r-f amplifier reduces the excitation of the r-f drive, which in turn reduces the excitation to the power amplifier. Reducing the drive to the power amplifier decreases the magnitude of the grid current impulses and thus decreases the distortion caused by grid current.

#### 4.5.12 RECEIVER MIXER

The receiver mixer, V11 is a conventional pentagrid mixer. The received signal from the r-f amplifier is coupled into grid 3, pin 7 of the 6BA7. The channel oscillator signal is injected on grid 1, pin 2 of the 6BA7. The oscillator injection signal from V10, pin 6 is fed through diode gate CR19. During transmit operation, CR19 is reverse biased by being connected to +250 volts via pins 7 and 8 of relay K3 and decoupling network. The reverse bias condition of CR19 prevents the oscillator signal from appearing on grid 1, pin 2 of the receiver mixer. The cathode d-c path is opened during transmit by opening contacts 8 and 9 of K2 during transmit operation.

## SECTION IV Principles of Operation

The output signal of the receiver mixer is coupled through mechanical filter FL1, while the 32MS-1A is in SSB mode, or i-f transformer T5 while in AM mode, to i-f amplifier V12. Selection of mechanical filter or i-f transformer is accomplished by selective biasing of diode gates CR20 and CR21 and keying relay K4.

### 4.5.13 I-F AMPLIFIERS

The i-f amplifiers are conventional class A amplifiers using high gain pentodes. The outputs of the two i-f amplifiers are transformer coupled to the following stage. The transformer coupling is supplemented by a small amount of capacitive coupling to increase bandwidth. The output signal from the second i-f amplifier, V13, is fed to product detector V14, AM detector CR18, and agc rectifier CR17.

### 4.5.14 PRODUCT DETECTOR

The product detector, V14, is a twin triode. The i-f signal is coupled into one of the grids, pin 2: this section of the tube is connected as a cathode follower. The above section is directly coupled to the cathode of the second triode section. The bfo signal from the 455-kc oscillator is coupled into the grid, pin 7, of the second triode section. The i-f signal and the bfo signal are mixed in this section of the twin triode.

The output of the second triode section is bypassed to ground for i-f, bfo, and the higher product signals and only the difference frequency appears across the plate load resistor R38. The audio output signal from the product detector is coupled to the audio amplifier via relays K5 pins 11 and 12.

### 4.5.15 AM DETECTOR

The AM detector CR18, is a conventional diode detector. The output of the AM detector is fed to the audio amplifier via relay K5 pins 10 and 11.

### 4.5.16 AUDIO AMPLIFIER

The audio amplifier is a twin triode, V15. Audio from the detectors is coupled through relay K5 pin 11 to pin 2 of the 12AT7 audio amplifier. The output of the audio amplifier is coupled through transformer T2 to connector J5. During transmit operation the grid, pin 7 of the audio amplifier is grounded through the contacts pins 2 and 1, of relay K1.

### 4.5.17 AGC SYSTEM

The agc rectifier CR17, agc amplifier V17, and the associated network form an agc system with d-c amplification. Agc voltage is applied to the r-f and i-f amplifiers.

### 4.5.18 A-C POWER SUPPLY

The a-c power supply may be used on either 115 or 230 volts 50-400 cps. The schematic diagram, figure 7-4 shows the unit connected for 115-volt operation. For 230-volt operation, the primaries of each transformer are series connected.

### 4.5.19 12-VOLT POWER SUPPLY

The 12 volt power supply is to be used with a 12-volt, d-c power source. Refer to figure 7-5 schematic diagram of the unit. Transistors 4Q1 through 4Q4 are operated as a push-pull parallel oscillator. The low and high voltage oscillators are frequency locked by coupling the emitter of 4Q6 with the bases 4Q1 and 4Q2, and the emitter of 4Q5 with the bases of 4Q3 and 4Q4. The banks of resistors in the base leads of 4Q1 through 4Q4 are a current balancing network.

### 4.5.20 28-VOLT POWER SUPPLY

The 28-volt power supply is to be used with a 28-volt d-c power source. Refer to figure 7-6 schematic diagram of the unit. Transistors 3Q1 and 3Q2 operate as a push-pull oscillator. Diodes 3CR3 through 3CR6 inclusive are spike clippers. Transistors 3Q5 through 3Q7 inclusive, diode 3CR2, Zener diode 3CR1, and the associated circuits form a transient blanking network to suppress transients which may appear on the 28 volt source line. Transistors 3Q3 and 3Q4 operate as a push-pull oscillator. The low and high voltage oscillators are frequency locked by coupling the emitters of 3Q3 and 3Q4 to the bases of 3Q1 and 3Q2.

### 4.5.21 AUTOMATIC RECEIVER GAIN CONTROL

The automatic receiver gain control, Collins part number 528-0127-00, is a noise operated device used for controlling receiver gain. Receiver noise at 2650 cps is amplified, rectified and fed to the 32MS-1A agc line as control voltage. Since most voice audio power occurs near 800 cps, the voice audio being received by the 32MS-1A has very little or no effect on the long-term d-c output of this unit.

The 32MS-1A receiver gain is thus controlled by noise rather than voice-modulated input. Figure 6-16 is a top view and figure 7-7 is a schematic diagram of the automatic receiver gain control board. Q1 and Q2 are noise amplifiers. CR1 and CR2 perform full wave rectifier functions. CR4 is an agc output limiter and CR5 is the agc delay diode. CR3 with R11 and C12 is a nonlinear time constant device which is not used in the 32MS-1A. Removing the ground from pin F of the connector will result in an additional 10 db control available from this unit. When the unit is installed, pin F is grounded to the 32MS-1A chassis.

#### 4.5.22 REMOTE CONTROL UNIT

Refer to figures 7-2 and 7-3 schematic diagrams of Control Units 48A1-SW and 48B2-SW respectively.

The headphone circuit consists of the headphone transformer T1, capacitors C2 and C3, potentiometer R2, and the +24 volt d-c input. The audio signal is coupled into the headphone circuit through T1. Capacitor C2 blocks d-c voltage from the headphones. Capacitor C3 provides additional filtering for the power source. Potentiometer R2 limits current flow through the headphones and, in addition, provides a volume control for the speaker amplifier.

The speaker amplifier consists of two transistorized class B push-pull amplifier stages. The input signal is obtained from potentiometer R2, which functions as a volume control.

In normal operation, the speaker amplifier is in standby, drawing approximately 10 ma of current, when the ON button has been pressed. An incoming signal is coupled through C4 and R4 to the base of Q1. The collector output of Q1 is developed in one half of T2. The signal across resistor R6 in the emitter circuit of Q1 provides the input signal to Q2. The collector output of Q2 is developed in the other half of T2 in push-pull with the previously mentioned collector output of Q1.

Bias for transistor Q1 is obtained from a voltage divider consisting of resistors R5 and R8. The Q2 bias is obtained from a voltage divider consisting of R7 and R11. Resistors R9 and R10, respectively, limit current through Q1 and Q2 to a safe value.

The output of the Q1-Q2 stage is coupled by transformer T2 to the input of the second push-pull amplifier Q3 and Q4. The operation of the second stage is identical to that of the first stage, except that the inputs of Q3 and Q4 are obtained from a center-tapped transformer winding, rather than by the method used for the Q1-Q2 transistors. The push-pull output of the second stage is coupled to the speaker by transformer T3.

The microphone circuits of the remote control units consist of the microphone, transformer T4, potentiometer R16, capacitors C7 and C8, and hookswitch S7C. In the off hook position of S7C, as illustrated in Figure 7-2, the audio output circuit is closed to provide an output signal and to give off-hook supervision to the central office ringing circuit. This switch opens when the handset is placed on the hook. Transformer T4 couples the microphone output from the microphone circuit to the output of the control unit. Resistor R16 provides an adjustment for microphone current, and capacitors C7 and C8 are used for coupling and bypass.

The push-to-talk switch, which is physically located on the grip of the handset, provides a ground to the transceiver. This ground performs the necessary push-to-talk switching at the transceiver.

Selector switches S1 through S6 are six individual pushbutton switches. Each switch functions to provide a ground at the transceiver to perform the specified switching. The four channel selector switches S3 through S6, are mechanically interlocked so that when one is depressed, the other three are released. In the 48A1-SW, the on-off switch S1 is also interlocked with the four channel selector switches, so that when the on-off switch is depressed, all channel switches return to their off positions. There is no interlock between the on-off switch and the channel selector switches in the 48B2-SW.





SECTION V  
Maintenance

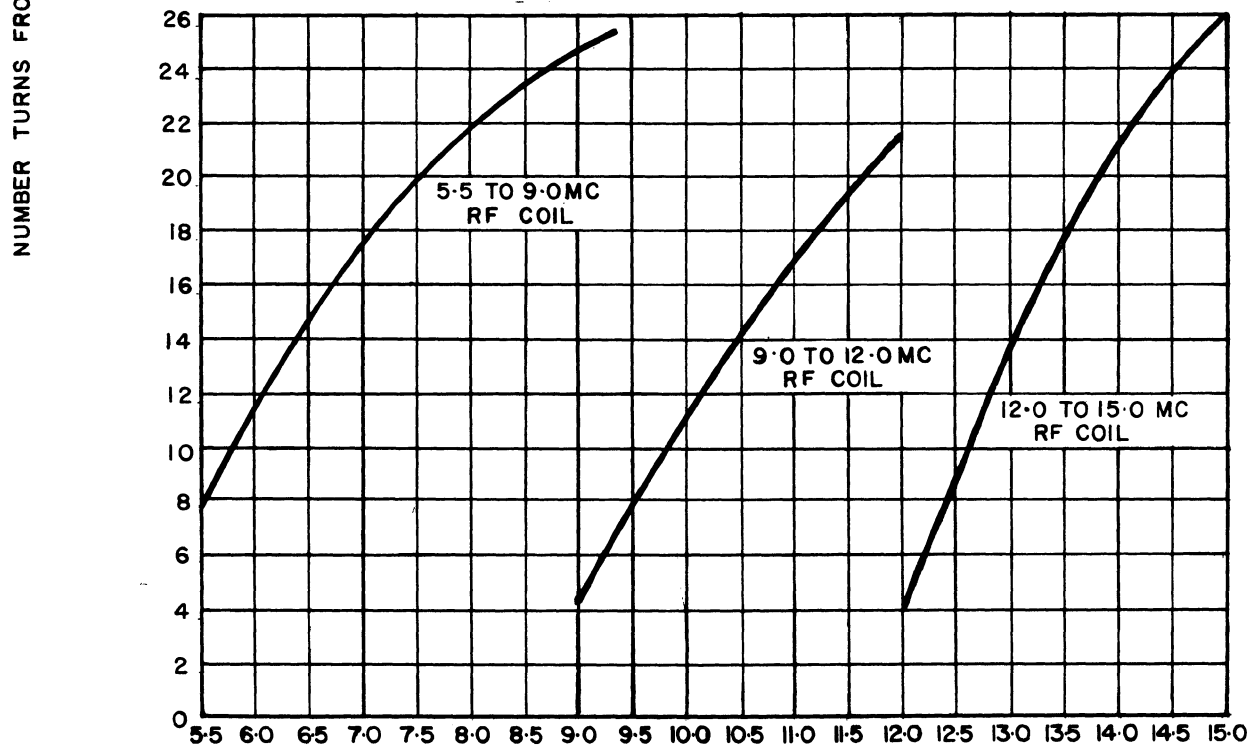
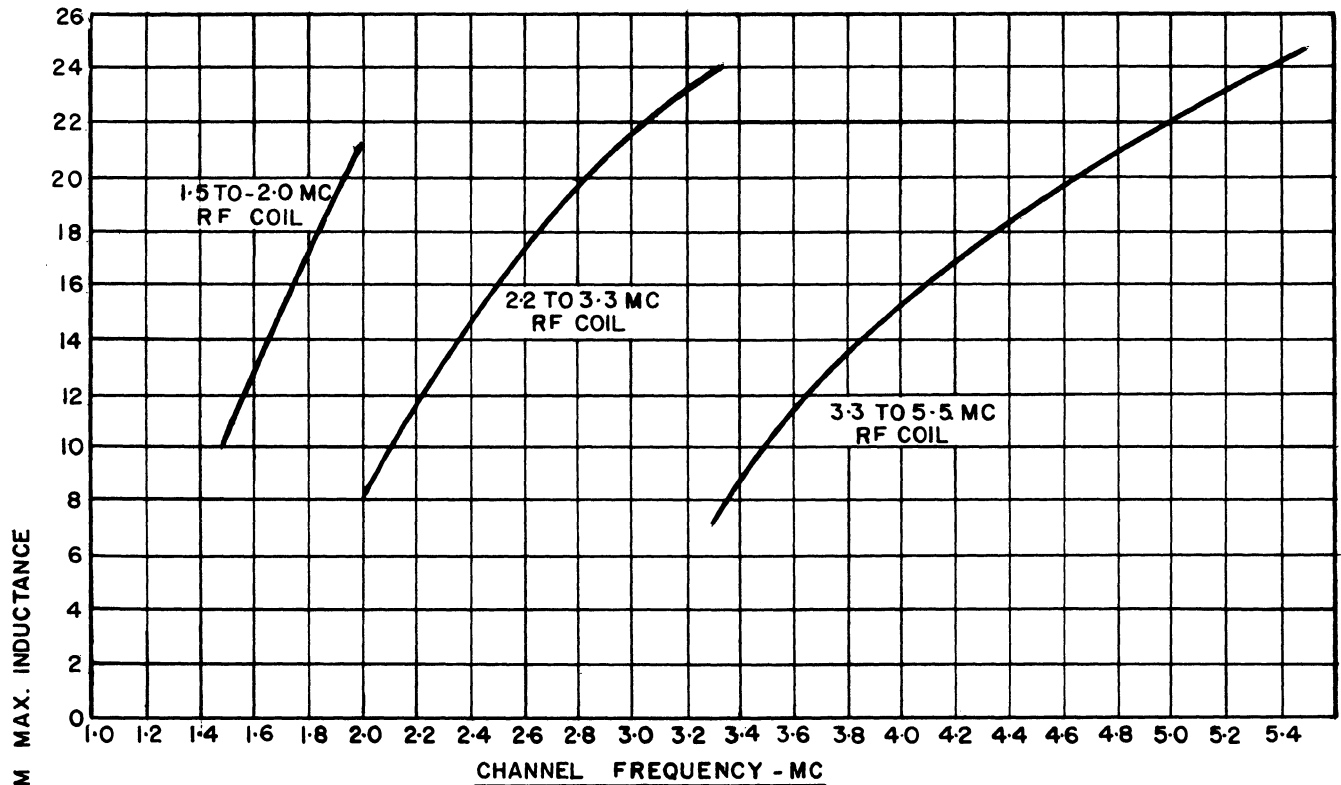


Figure 5-1 Calibration Curves for Antenna and R-F Coils

## SECTION V

# MAINTENANCE

### 5.1 GENERAL

This section contains trouble-shooting procedures, alignment instructions and performance tests for Transceiver 32MS-1A and disassembly and assembly procedures for Control Unit 48A1-SW and Control Unit 48B2-SW.

#### 5.1.1 TEST EQUIPMENT

The following test equipment items (or equivalents) are suggested for testing Transceiver 32MS-1A.

- (a) 48A1-SW or 48B2-SW control Unit.
- (b) R-f signal generator, capable of 1.0 volt input (Measurements Corporation Model 65B).
- (c) Vacuum-tube voltmeter, Ballantine Model 310A.
- (d) Volt-ohm-milliammeter, Simpson 260.
- (e) Audio generator, Heathkit AG-9.
- (f) 52-ohm load, Bird Model 820.
- (g) Communications receiver, general coverage - with S-meter, Collins 51J or equivalent type.

### 5.2 INSPECTION

#### 5.2.1 GENERAL

It is suggested that, at the beginning of station operation the operator make a log of meter readings (including output power readings) and that the operator continues keeping this log up to date. A comparative check of meter readings over a period of time will give an indication of over-all transceiver operations. Also, trading log information with other stations within the radio net helps in determining over-all equipment operation.

#### 5.2.2 VISUAL INSPECTION

Remove the covers from the 32MS-1A, and make a visual inspection of circuit components and relay and switch contacts. Remove any dust or dirt that may have accumulated.

#### 5.2.3 METER ADJUSTMENT

Before attempting to troubleshoot or tune the 32MS-1A, the meter adjustment should be checked. The transceiver should be in receive operation during this adjustment. Turn the power on and allow the 32MS-1A to warm up. Move the meter selector switch to ALC-S position. Adjust the meter ZERO-adjust potentiometer, R81, to obtain a zero indication on the meter.

### 5.3 TROUBLE SHOOTING

The following procedure is to be used in trouble shooting Transceiver 32MS-1A under emergency conditions. Malfunctioning units should normally be returned to overhaul facilities for repair and alignment. Below are checks that can be made.

#### 5.3.1 LOW TRANSMITTER OUTPUT

If transmitter output is low, make the following checks with the transceiver in SSB mode, the OPR-TUNE switch in TUNE position, and the test button on the front of the transceiver depressed.



Do not hold the test button depressed for more than a few seconds at any time.

- (a) Check the forward-to-reflected power ratio with a directional wattmeter or other instrument. The forward power should be approximately  $90 \pm 20$  watts with a-c supply and  $70 \pm 20$  watts with d-c supply. The reflected power should not exceed 20 percent of the forward power indication. If reflected power is greater than 20 percent of the forward power indication, check cables, coaxial transmission line and antenna.

SECTION V:  
Maintenance

(b) Check the power amplifier cathode current. Switch the meter selector to the PA CATH position for this check. The meter should indicate between 80 and 150 on the watts scale. If the indication is high, perform the power amplifier tuning procedure as outlined in paragraph 5.4.

(c) Check the grid drive. Grid drive is checked with the meter selector in the ALC-S position. The meter should indicate  $20 \pm 5$  on the watts scale. If the indication is low increase the transmit audio gain control: use the substitute tube method outlined in paragraph 5.3.4 substituting V1, V2, V3, V4, V7, V10. If grid drive is low on one channel only, substitute crystal associated with low-output channel. If alc indication is normal and PA cathode indication is low, switch the OPR-TUNE switch to OPR position and check the power amplifier static cathode current. The indication on the meter with no tone or modulation and the test button depressed should be between 10 and 15 as indicated on the watts scale. If not, adjust the PA GRID BIAS potentiometer to obtain the proper indication on the watts scale. If alc indication is normal and the PA CATH indication is low, try PA tuning-loading procedure per paragraph 5.4. If still low, substitute V5 and V6.

### 5.3.2 RECEIVER INOPERATIVE

If the receiver is inoperative, use the substitute tube method per paragraph 5.3.4. Substitute for tubes V12, V13, V11, V3, V14, V15, V10 and V1. Substitute channel crystals if the unit is inoperative on one channel only.

### 5.3.3 TRANSMITTER INOPERATIVE

If the transmitter is inoperative, use the substitute tube method per paragraph 5.3.4. Substitute V1, V2, V10, V3, V4, V7, and V5 and V6. Substitute channel crystals if the unit is inoperative on one channel only.

### 5.3.4 TUBE SUBSTITUTION TROUBLE-SHOOTING METHOD

Check the V-number of the tube to be replaced. Check the tube type and location. Choose the proper tube type from the spare parts kit. Remove the tube which is to be replaced.

### NOTE

Remove only one tube at a time.

Place the substitute tube of the same type from the spare parts kit in the transceiver. Be careful not to bend the tube pins during removal or installation. Try the radio with the substitute tube installed. If the transceiver is still inoperative, remove the substitute tube and replace the original tube. Check the next V-number and tube type. Repeat the above procedure until the unit functions properly. Be sure to allow sufficient time for the transceiver to warm up if the unit is turned off during tube change periods. Allow time for the substitute tube to warm up if the unit has not been turned off during the tube change period.

### **WARNING**

Turn Transceiver 32MS-1A off before touching the power amplifier tubes V5 and V6. Voltages present within the power amplifier shield cage are dangerous to life.

## 5.4 TUNING PROCEDURE

Ensure that the coils inserted in Transceiver 32MS-1A cover the range in which the channel frequency falls (the frequency range of the coils is stenciled on the coils). Ensure that the transceiver is set to the channel to be aligned. Do not adjust the coils of the other channels while the transceiver is set on a specific channel.

Insert desired channel crystals into channel crystal ovens, HR2, and HR3. Channel crystals are located according to oven pins as follows:

CHANNEL	CRYSTAL LOCATION
1	Pins 7 and 8 of HR3
2	Pins 3 and 4 of HR3
3	Pins 3 and 4 of HR2
4	Pins 7 and 8 of HR2

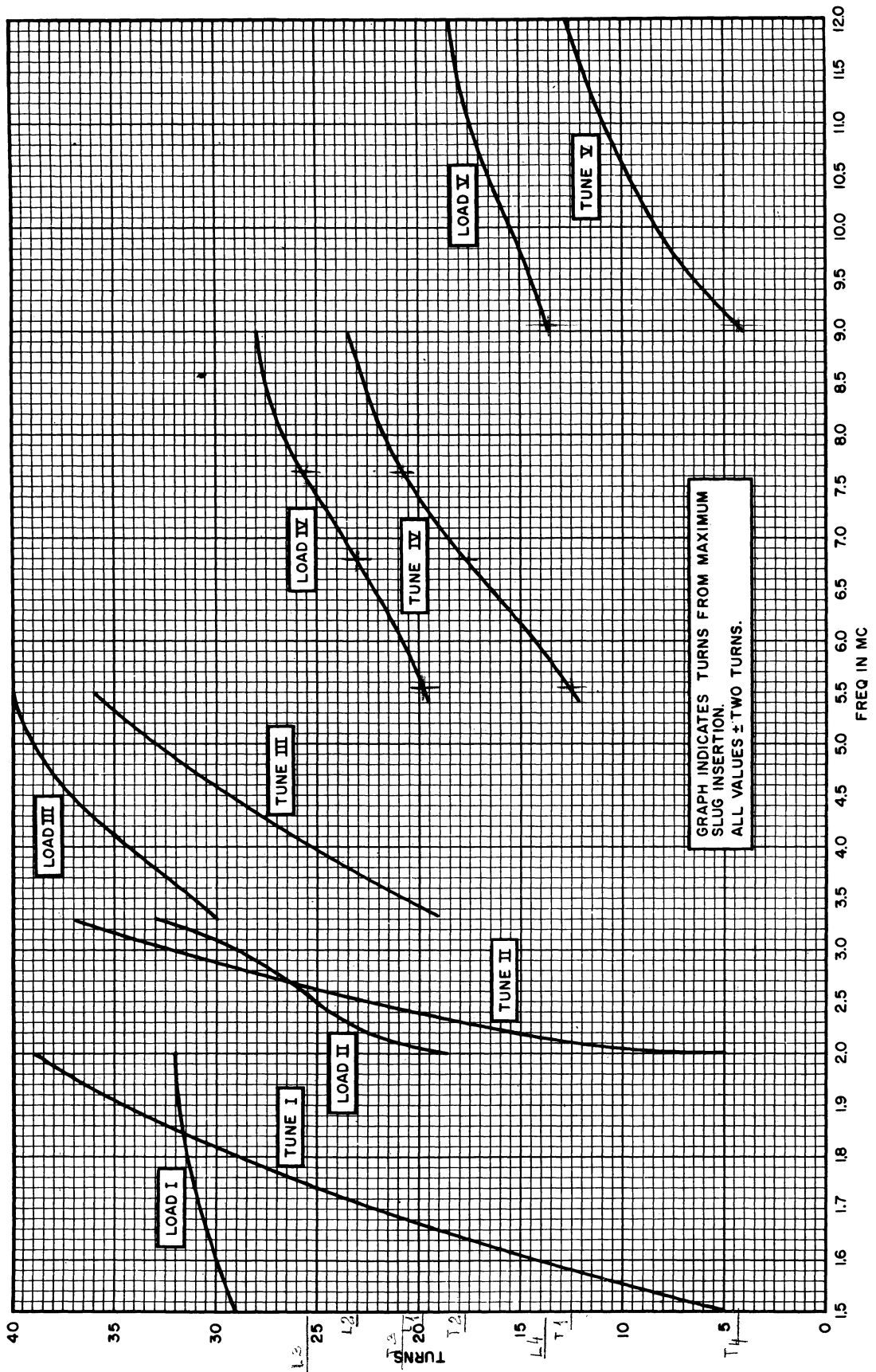


Figure 5-2 PA Coil Calibration for 52 Ohm Load

SECTION V  
Maintenance

- (a) Turn the slugs of the coils to be aligned all the way in.
- (b) Refer to figure 5-1 and turn the slugs out the proper number of turns corresponding to the channel frequency.
- (c) Refer to figure 5-2 and run the rollers of the power amplifier tuning and loading coils to the position corresponding to the channel frequency.
- (d) Move the meter switch to PA CATH position.
- (e) With the OPR-TUNE switch in OPR position, depress the test button on the front of the transceiver. Adjust the power amplifier bias control to obtain a meter indication of 10 to 15 on the watts scale.

NOTE

Setting the power amplifier static current to less than an indication of 10 will result in distorted output. Setting the power amplifier to an indication of more than 15 will result in shortened tube life.

- (f) Attach a 52-ohms, nonreactive dummy load to the antenna connector on the rear of the 32MS-1A.
- (g) With the meter selector in PA CATH position, switch the OPR-TUNE switch to TUNE position.
- (h) Turn the transmit audio gain control full counterclockwise.
- (i) Depress the test button on the front of the 32MS-1A and turn the transmit audio gain control clockwise far enough to obtain an indication on the meter slightly higher than 10 on the watts scale.
- (j) Adjust the slugs of the r-f coils to obtain maximum indication of power amplifier cathode current. Decrease the audio gain control each time that tuning the slugs causes a significant increase in power amplifier cathode current.

NOTE

At higher frequencies the coils may be adjusted to the wrong mixing product frequency (i. e. 455 kc on the other side of the channel injection frequency) or to

the channel injection frequency. There will be an output indication, even with OPR-TUNE switch (S3) in OPR position.

If moving S3 to OPR position does not eliminate the wrong mixing frequency output, remove the crystal oven with the proper channel crystals to eliminate the channel injection frequency output. If, after removing the channel crystal, the channel injection frequency output is not present, reinsert the crystal and rebalance the balanced mixer as described in para. 5.4.1(g).

If the PA cathode current is still high, this indicates oscillation in one or more r-f stages. In this case the r-f stage, transmit driver and PA stage should be neutralized as described in para 5.5.



Do not allow the cathode current to exceed 40 on the watts scale for more than a few seconds at a time. Release the test button and allow the tubes to cool when the 40 reading has been exceeded.

- (k) For the following adjustments, it is suggested that the unit be keyed by the telephone handset so that the PA may be allowed to cool while not being adjusted. Advance the TRANSMIT AUDIO gain control until PA cathode current is slightly increased.
- (l) Refer to Figure 5-2 for approximate PA coil settings for a 52-ohm resistive antenna. Adjust the TUNE coil in the appropriate PA Tank coil assembly in either direction until PA cathode current dips. Adjust for current minimum.
- (m) Increase the transmit audio gain control setting until PA cathode current stops increasing.
- (n) If the PA CATH current reads 150 the TX is properly loaded. If PA CATH current is below 150 the TX is underloaded. Increase loading by turning the loading coil in a clockwise direction and retuning the tune coil for a dip each time loading is increased appreciably.

Repeat these steps until a reading of 150 is obtained. If PA CATH current is above 150 the TX is overloaded and the reversal of the above steps must be done.

#### NOTE

For this adjustment, the transmitter should be on for not more than 10 seconds at a time with 10 seconds off to ensure good PA tube life.

(o) Repeat steps (k) through (n) for each channel. Be sure the CHANNEL SELECTOR is set to the channel being aligned.

(p) Since tolerance is permitted in grinding channel crystals to frequency, it may be necessary to trim these crystals to channel frequency. If no frequency standard is available, the appropriate channel trimmer can be adjusted until the received signal from a station on the desired channel is received satisfactorily.

(r) Adjust the TRANSMIT AUDIO gain to read 15 on the meter with meter switch in ALC-S position.

#### 5.4.1 CARRIER BALANCE

(a) Loosely couple a general coverage receiver to the 52-ohm nonreactive load. Connect the load to the antenna connector of Transceiver 32MS-1A.

(b) Turn the TRANSMIT AUDIO gain control to minimum and select SSB mode on the control unit.

(c) Move the OPR-TUNE switch to OPR position.

(d) Tune the general coverage receiver to the channel frequency.

(e) Depress the test button on the front of the 32MS-1A and adjust the carrier balance potentiometer R40 and capacitor C47, CARRIER BAL, for minimum indication on the general coverage receiver. Adjust these two controls alternately several times: there is some interaction between the controls and several adjustments are necessary to obtain an absolute minimum.

(f) Release the test button.

(g) Select the highest frequency channel and the SSB mode. Tune the general coverage receiver to the channel injection frequency. Balance R66 and C108 for a minimum indication on the receiver S-meter.

### 5.5 NEUTRALIZATION

Neutralization should not be attempted unless the unit shows instability on transmit at high frequency, and all other trouble sources have been eliminated. Perform the tuning procedure of paragraph 5.4 above. Connect a 52-ohm nonreactive load to the output of Transceiver 32MS-1A. Select the highest frequency channel. Turn the transmit audio gain control to minimum (fully counterclockwise). Switch to SSB mode of operation. Move the OPR-TUNE switch to TUNE position.

#### 5.5.1 R-F AMPLIFIER

(a) Remove the screen and plate voltages from V3. Leave low and high voltages on other circuits.

(b) Connect a general coverage receiver antenna terminals to the 32MS-1A output jack. Tune the general coverage communications receiver to the channel frequency.

(c) Adjust the transmit audio gain control to obtain a midscale indication on the S-meter of the general coverage receiver.

(d) Using an insulated alignment tool, adjust C113 for minimum output indication on the S-meter of the receiver.

(e) Tune the r-f amplifier plate coil for maximum indication on the S-meter.

(f) Adjust C113 for minimum output indication on the S-meter. Disconnect the receiver.

(g) Restore the plate and screen voltages.

#### 5.5.2 R-F DRIVER

(a) Remove plate and screen voltages from V4. Leave low and high voltages on all other circuits.

(b) With the general coverage receiver connected as in 5.5.1, tune the receiver to the channel frequency and adjust the transmit audio gain control of the 32MS-1A to obtain a mid scale indication on the S-meter of the general coverage receiver.

SECTION V  
Maintenance

(c) Using an insulated alignment tool, adjust C137 for minimum indication on the S-meter.

(d) Adjust the r-f driver plate coil for maximum indication on the S-meter.

(e) Adjust C137 for minimum output as indicated by the receiver S-meter.

(f) Restore the screen and plate voltages to V4.

5.5.3 POWER AMPLIFIER

(a) Remove the screen voltage from V5 and V6 and remove the HV Fuse. Leave low and high voltages on all other circuits.

(b) With the general coverage receiver connected as in paragraph 5.5.1, tune to the channel frequency and adjust the 32MS-1A transmit audio gain control to obtain midscale indication on the S-meter of the general coverage receiver.

(c) Using an insulated alignment tool, adjust C156 for minimum indication on the S-meter of the receiver.

(d) Adjust the PA TUNING for maximum indication on the receiver S-meter, and readjust C156 for minimum indication on the S-meter. Disconnect the receiver.

(e) Restore the screen voltage to V5 and V6. Replace HV fuse.

5.5.4 FEEDBACK NEUTRALIZATION

(a) Couple the antenna terminals of the general coverage receiver through a 22-pf capacitor to the plate of V3.

(b) Connect a signal generator through a 10-pf capacitor to the above chassis end of C140, a feedthrough capacitor. Ensure that the interconnecting coaxial leads, signal generator to transceiver and transceiver to general coverage receiver, are short and the shields of the coaxial leads are grounded securely.

(c) Remove the crystal oven containing the crystal associated with the channel to which the transceiver is set.

(d) Remove the screen fuse and turn the power on.

(e) Move the OPR-TUNE switch to OPR position.

(f) Tune the signal generator and general coverage receiver to the highest channel frequency.

(g) Press the test button on the front of the 32MS-1A. Adjust the output level of the signal generator to obtain a midscale indication on the general coverage receiver S-meter if possible.

(h) Using an insulated alignment tool, adjust C141 for minimum S-meter indication. Remove the signal generator and receiver connections from the transceiver. Replace the screen fuse.

**5.6 RECEIVER I-F ALIGNMENT AND AUDIO OUTPUT CHECK**

(a) Select AM mode of operation.

(b) Connect a signal generator to the grid of V11. Set the signal generator to 455 kc, 30 percent modulated. Adjust the output level control of the signal generator to obtain a slight indication on the S-meter of the 32MS-1A. (S-meter in ALC-S position).

(c) Connect a swamping tool consisting of a 0.01 uf capacitor in series with a 4700-ohm resistor across terminals A and C of T3.

(d) Tune the top slug of transformer T3 for maximum deflection of the S-meter of the 32MS-1A.

(e) Remove the swamping tool from terminals A and C. Place the swamping tool across terminals D and F of T3.

(f) Tune the bottom slug of T3 for maximum deflection on the S-meter of the 32MS-1A.

(g) Repeat the above procedure for i-f transformers T4 and T5. Swamp terminals A and C before tuning the top slugs and terminals D and F before tuning the bottom slugs. The top slugs of the i-f transformers adjust the tuning of the primary windings. The bottom slugs adjust the tuning of the secondary windings. Terminals D and F are connected to the primary windings and terminals A and C are connected to the secondary windings.

NOTE

Keep the output level of the signal generator adjusted to yield the minimum usable indication on the meter of the 32MS-1A during adjustment of i-f transformers T3, T4 and T5.

NOTE

R110 is channel 4 gain control

R111 is channel 3 gain control

R112 is channel 2 gain control

R113 is channel 1 gain control

(h) Select SSB mode of operation. Tune the signal generator to 453.5 kc. Turn off the modulation of the signal generator. Adjust the output of the signal generator to obtain a slight indication on the meter of the 32MS-1A. If the signal generator level is between 100 and 500 microvolts, the receiver i-f stages are operating properly.

(i) Adjust the mechanical filter tuning capacitors C50 and C87, to obtain an indication of maximum on the meter of the 32MS-1A.

(j) With the signal generator input set at AVC threshold, (as in step (h)) increase the setting of the receiver audio gain control R31. A beat note between the 455 kc crystal oscillator and the 453.5 kc signal should be heard in the handset of the control unit.

(k) Connect a vacuum tube voltmeter between pin 8 of connector J5 and ground. Retune the signal generator to 453.5 kc or to maximum indication on the vacuum tube voltmeter. Adjust the receiver audio gain control R31 to produce a reading of 0.4 volts on the vacuum tube voltmeter. If the audio gain is low, check V12, V13, V14, V15 and their associated circuits.

### 5.7 A-M CARRIER INSERTION AND R-F GAIN CONTROL ADJUSTMENTS

(a) Turn all r-f gain controls R110, R111, R112 and R113 to maximum clockwise position.

(b) Select AM mode of operation.

(c) Check and record the power output of the 32MS-1A on each channel.

(d) Select the channel showing the lowest power output and adjust the CARRIER INSERT control, R133 to obtain an indication of 25 watts output.

(e) Select the other channels one at a time and adjust their respective r-f gain controls to obtain an indication of 25 watts output on each channel.

### 5.8 TRANSMIT AUDIO GAIN CONTROL ADJUSTMENT

(a) Connect a 1 kc audio signal generator across the input of the audio input transformer T1. Connect a VTVM across the output of audio transformer T1.

(b) Select SSB mode of operation.

(c) Adjust the audio signal generator to obtain an indication of zero dbm.

(d) Adjust the TRANSMIT AUDIO gain control, R61 to obtain an indication of 25 watts output.

(e) Remove the signal generator and VTVM.

### 5.9 AGC THRESHOLD ADJUSTMENT

(a) Select a channel which yields nominal gain in receiver operation.

(b) Connect a signal generator to the antenna terminal of the 32MS-1A. Tune the signal generator to the channel frequency and adjust the output level of the signal generator to 2.5 microvolts.

(c) Connect a d-c vtm to the agc line of the 32MS-1A.

(d) Adjust the AGC ADJUST R4 to obtain -1.0 volt indicated on the vtm.

(e) Remove the vtm and signal generator.

(f) Readjust the Meter as described in para. 5.2.3.

### 5.10 DISASSEMBLY OF CONTROL UNIT 48A1-SW

To disassemble the 48A1-SW Control Unit proceed as follows:



SECTION V  
Maintenance

- (a) Remove the volume control knob by loosening the two Allen-Head set screws and pulling the knob from the shaft.
- (b) Remove the two holding screws that hold the top in place. Access to these screws is obtained through holes in the bottom of the unit. One screw is located in the front of the unit, and one at the back.
- (c) Lift the top from the unit.
- (d) Take out the four holding screws (one at each corner) which hold the base plate to the bottom cover.
- (e) Lift the assembly from the bottom cover and invert.
- (f) Remove the two holding screws from the heat sink of the printed circuit board.
- (g) Disengage the printed circuit board connector and remove the board from the assembly.

**5.11 REASSEMBLY OF CONTROL UNIT  
48A1-SW**

Reassemble the 48A1-SW Control Unit by reversing the procedures of Para. 5.10.

**5.12 DISASSEMBLY OF CONTROL UNIT  
48B2-SW**

To disassemble the 48B2-SW Control Unit, proceed as follows:

- (a) Remove the dust cover from the back of the control unit after loosening two holding screws. One screw is located at the top of the unit, and one at the bottom.
- (b) After the back dust cover is removed, remove two holding screws from the heat sink of the exposed printed circuit board.
- (c) Disengage the printed circuit board connector and remove the printed circuit board from the assembly.

**5.13 REASSEMBLY OF CONTROL UNIT  
48B2-SW**

Reassemble the 48B2-SW Control Unit by reversing the procedures of Para. 5.12.



SECTION VI  
**PARTS LIST**

SECTION VI  
Parts List

ITEM	DESCRIPTION	COLLINS PART NUMBER
TRANSCEIVER 32MS-1A		522-2425-00
B1	MOTOR: 12 v dc, 10 rpm; 2 in. lbs continuous duty capacity, 5 in. lb intermittent with gear train	230-0403-00
B2	MOTOR: 28 v dc	230-0273-00
C1	CAPACITOR, FIXED, ELECTROLYTIC: 150 uf, -10% +100%, 50 v dc	183-1564-00
C2	CAPACITOR, FIXED, ELECTROLYTIC: 1500 uf, -10% +40%, 50 v dc	183-1405-00
C3	CAPACITOR, FIXED, CERAMIC: 0.001 uf, ±20% 1000 v dc	913-3742-00
C4	CAPACITOR, FIXED, CERAMIC: same as C3	913-3742-00
thru C8		
C9	CAPACITOR, FIXED, ELECTROLYTIC: 10 uf, -15% +50%, 250 v dc	183-1046-00
C10	CAPACITOR, FIXED, ELECTROLYTIC: 10 uf, -10% +100%, 150 v dc	183-1040-00
C11	CAPACITOR, FIXED, ELECTROLYTIC: 60 uf, +100% -10%, 350 v dc	183-1772-00
C12	CAPACITOR, DUAL: 60-30 uf, 350 v dc, electrolytic	183-1489-00
C13	CAPACITOR, FIXED, CERAMIC: 0.05 uF, +80%, -20%, 500 v dc	913-3153-00
C14	CAPACITOR, FIXED, ELECTROLYTIC: 3 sections, 15 uf, 15 uf, 10 uf, -10% +50%, 450 v dc	183-1091-00
C15	CAPACITOR, FIXED, CERAMIC: 1000 uuf, +100% -20%, 500 v dc	913-3009-00
C16	CAPACITOR, FIXED, ELECTROLYTIC: same as C11	183-1772-00
thru C23		
C24	CAPACITOR, FIXED, PAPER: 0.1 uf, ±10%, 400 v dc	931-0299-00
C25	CAPACITOR, FIXED, ELECTROLYTIC: 25 uf, -10% +100%, 50 v dc	183-1037-00
C26	CAPACITOR, FIXED, ELECTROLYTIC: same as C14	183-1091-00
C27	CAPACITOR, FIXED, CERAMIC: same as C15	913-3009-00
C28	CAPACITOR, FIXED, CERAMIC: 10,000 uuf, +100%, -20% 500 v dc	913-3013-00
C29	CAPACITOR, FIXED, MICA: 39 uuf, ±2%, 500 v dc	912-0463-00
*C29	CAPACITOR, FIXED, MICA: 68 uuf, ±10%, 500 v dc	912-0483-00
*C29	CAPACITOR, FIXED, MICA: 100 uuf, ±10%, 500 v dc	912-0495-00
*C29:	CAPACITOR, FIXED, MICA: 130 uuf, ±10%, 500 v dc	912-0504-00
*C29	CAPACITOR, FIXED, MICA: 160 uuf, ±10%, 500 v dc	912-0510-00
*C29	CAPACITOR, FIXED, MICA: 200 uuf, ±10%, 500 v dc	912-0516-00
C30	CAPACITOR, FIXED, CERAMIC: same as C28	913-3013-00
C31	CAPACITOR, FIXED, MICA: same as *C29	912-0495-00
C32	CAPACITOR, FIXED, MICA: 330 uuf, ±10%, 500 v dc	912-0531-00
C33	CAPACITOR, FIXED, MICA: 22 uuf, ±10%, 500 v dc	912-0447-00
C34	CAPACITOR, FIXED, MICA: 510 uuf, ±10%, 300 v dc	912-0546-00
C35	CAPACITOR, FIXED, CERAMIC: 0.02 uf, +100% -20%, 500 v dc	913-4364-00
*	Chosen for operational requirement.	

ITEM	DESCRIPTION	COLLINS PART NUMBER
C36 thru C38	CAPACITOR, FIXED, CERAMIC: same as C15	913-3009-00
C39	CAPACITOR, FIXED, CERAMIC: same as C28	913-3013-00
C40	CAPACITOR, FIXED, CERAMIC: same as C35	913-4364-00
C41	CAPACITOR, FIXED, CERAMIC: 0.02 uf, +100% -20%, 500 v dc	913-2142-00
C42	CAPACITOR, FIXED, CERAMIC: same as C28	913-3013-00
C43	CAPACITOR, FIXED, CERAMIC: same as C28	913-3013-00
C44	CAPACITOR, FIXED, ELECTROLYTIC: 25 uf -10% +100%, 25 v dc	183-1034-00
C45	CAPACITOR, FIXED, CERAMIC: same as C28	913-3013-00
C46	CAPACITOR, FIXED, CERAMIC: same as C41	913-2142-00
C47	CAPACITOR, VARIABLE, CERAMIC: 8 to 75 uuf, 350 v dc	917-1075-00
C48	CAPACITOR, FIXED, MICA: 150 uuf, ±2%, 500 v dc	912-0505-00
C49	CAPACITOR, FIXED, MICA: 30 uuf, ±2%, 500 v dc	912-0454-00
C50	CAPACITOR, VARIABLE, CERAMIC: same as C47	917-1075-00
C51	CAPACITOR, FIXED, CERAMIC: same as C15	913-3009-00
C52	CAPACITOR, FIXED, CERAMIC: same as C35	913-4364-00
C53	CAPACITOR, FIXED, CERAMIC: same as C28	913-3013-00
C54	CAPACITOR, FIXED, CERAMIC: same as C41	913-2142-00
C55	CAPACITOR, FIXED, CERAMIC: same as C15	913-3009-00
C56	CAPACITOR, FIXED, CERAMIC: 6.0 uuf, ±1/4 uuf, 500 v dc	916-0121-00
C57	CAPACITOR, FIXED MICA: same as C34	912-0546-00
C58	CAPACITOR, FIXED, CERAMIC: same as C35	913-4364-00
C59	CAPACITOR, FIXED, CERAMIC: same as C28	913-3013-00
C60	CAPACITOR, FIXED, CERAMIC: same as C28	913-3013-00
C61	CAPACITOR, FIXED, CERAMIC: same as C35	913-4364-00
C62	CAPACITOR, FIXED, CERAMIC: same as C35	913-4364-00
C63	CAPACITOR, FIXED, MICA: same as C34	912-0546-00
C64	CAPACITOR, FIXED, CERAMIC: same as C28	913-3013-00
C65	CAPACITOR, FIXED, CERAMIC: same as C15	913-3009-00
C66	CAPACITOR, FIXED, CERAMIC: 2.0 uuf, ±1/4 uuf, 500 v dc	916-0075-00
C67	CAPACITOR, FIXED, MICA: 10 uuf, ±10%, 500 v dc	912-0432-00
C68	CAPACITOR, FIXED, CERAMIC: same as C41	913-2142-00
C69	CAPACITOR, FIXED, CERAMIC: same as C35	913-4364-00
C70	CAPACITOR, FIXED, CERAMIC: same as C35	913-4364-00
C71	CAPACITOR, FIXED, CERAMIC: same as C28	913-3013-00
C72	CAPACITOR, FIXED, MICA: same as C67	912-0432-00
C73	CAPACITOR, FIXED, CERAMIC: same as C28	913-3013-00
C74	CAPACITOR, FIXED, CERAMIC: same as C41	913-2142-00
C75	CAPACITOR, FIXED, CERAMIC: 4700 uuf, +100% -20%, 500 v dc	913-1187-00
C76	CAPACITOR, FIXED, MICA: 68 uuf, ±10%, 500 v dc	912-0483-00
*C76	CAPACITOR, FIXED, MICA: 47 uuf, ±10%, 500 v dc	912-0471-00
*C76	CAPACITOR, FIXED, MICA: 82 uuf, ±10%, 500 v dc	912-0489-00
C77	CAPACITOR, FIXED, MICA: same as C31	912-0495-00
C78	CAPACITOR, FIXED, CERAMIC: same as C15	913-3009-00

SECTION VI  
Parts List

ITEM	DESCRIPTION	COLLINS PART NUMBER
C79	CAPACITOR, FIXED, CERAMIC: same as C28	913-3013-00
C80	CAPACITOR, FIXED, CERAMIC: same as C28	913-3013-00
C81	CAPACITOR, FIXED, MICA: same as C67	912-0432-00
C82	CAPACITOR, FIXED, CERAMIC: 4700 uuf, +100%	913-3012-00
thru	-20%, 500 v dc	
C85		
C86	CAPACITOR, FIXED, CERAMIC: same as C28	913-3013-00
C87	CAPACITOR, VARIABLE, CERAMIC: same as C47	917-1075-00
C88	CAPACITOR, FIXED, CERAMIC: same as C82	913-3012-00
C89	CAPACITOR, FIXED, MICA: same as C67	912-0432-00
C90	CAPACITOR, FIXED, CERAMIC: same as C28	913-3013-00
C91	CAPACITOR, VARIABLE, AIR, DIELECTRIC: 3.6 uuf min, 30.0 uuf max. 28 plates; 860 v ac, 60 cps	922-0038-00
C92	CAPACITOR, VARIABLE, AIR: same as C91	922-0038-00
C93	CAPACITOR, FIXED, CERAMIC: same as C28	913-3013-00
C94	CAPACITOR, FIXED, CERAMIC: same as C28	913-3013-00
C95	CAPACITOR, FIXED, CERAMIC: same as C15	913-3009-00
C96	CAPACITOR, VARIABLE, AIR: same as C91	922-0038-00
C97	CAPACITOR, VARIABLE, AIR: same as C91	922-0038-00
C98	CAPACITOR, FIXED, CERAMIC: same as C28	913-3013-00
C99	CAPACITOR, FIXED, CERAMIC: same as C28	913-3013-00
C100	CAPACITOR, FIXED, CERAMIC: same as C28	913-3013-00
C101	CAPACITOR, FIXED, CERAMIC: same as C35	913-4364-00
C102	CAPACITOR, FIXED, CERAMIC: same as C15	913-3009-00
C103	CAPACITOR, FIXED, CERAMIC: same as C15	913-3009-00
C104	CAPACITOR, FIXED, CERAMIC: same as C35	913-4364-00
C105	CAPACITOR, FIXED, CERAMIC: same as C28	913-3013-00
C106	CAPACITOR, FIXED, CERAMIC: same as C15	913-3009-00
C107	CAPACITOR, FIXED, CERAMIC: same as C15	913-3009-00
C108	CAPACITOR, VARIABLE, CERAMIC: 5 uuf min 37.5 uuf max 350 v dc	917-1073-00
C109	CAPACITOR, FIXED, CERAMIC: same as C28	913-3013-00
C110	CAPACITOR, FIXED, MICA: 100 uuf, ±10%, 500 v dc	912-0495-00
C111	CAPACITOR, FIXED, CERAMIC: same as C35	913-4364-00
C112	CAPACITOR, FIXED, CERAMIC: same as C15	913-3009-00
C113	CAPACITOR, VARIABLE, CERAMIC: 3 uuf min. 18 uuf max, 350 v dc	917-1072-00
C114	CAPACITOR, FIXED, MICA: 5 uuf, ±10%, 500 v dc	912-0429-00
C115	CAPACITOR, FIXED, MICA: 51 uuf, ±2%, 500 v dc	912-0472-00
C116	CAPACITOR, FIXED, CERAMIC: same as C28	913-3013-00
thru		
C118		
C119	CAPACITOR, FIXED, CERAMIC: same as C15	913-3009-00
C120	CAPACITOR, FIXED, MICA: same as C34	912-0546-00
C121	CAPACITOR, FIXED, CERAMIC: same as C35	913-4364-00
C122	CAPACITOR, FIXED, CERAMIC: same as C28	913-3013-00
C123	CAPACITOR, FIXED, CERAMIC: same as C15	913-3009-00
C124	CAPACITOR, FIXED, CERAMIC: same as C35	913-4364-00
C125	CAPACITOR, FIXED, PAPER: 0.05 uf, +30% -10%, 600 v dc	931-0199-00
C126	CAPACITOR, FIXED, CERAMIC: same as C15	913-3009-00

ITEM	DESCRIPTION	COLLINS PART NUMBER
C127	CAPACITOR, FIXED, CERAMIC: same as C28	913-3013-00
C128	CAPACITOR, FIXED, CERAMIC: same as C28	913-3013-00
C129	CAPACITOR, FIXED, MICA: 47 uuf, $\pm 2\%$ , 500 v dc	912-0469-00
C130	CAPACITOR, FIXED, PAPER: 0.5 uf, +20% -10% 200 v dc	931-0169-00
C131	CAPACITOR, FIXED, PAPER: same as C130	931-0169-00
C132	CAPACITOR, FIXED, CERAMIC: same as C15	913-3009-00
C133	CAPACITOR, FIXED, CERAMIC: same as C35	913-4364-00
C134	CAPACITOR, FIXED, MICA: same as C34	912-0546-00
C135	CAPACITOR, FIXED, MICA: same as C31	912-0495-00
C136	CAPACITOR, FIXED, MICA: same as C115	912-0472-00
C137	CAPACITOR, VARIABLE, CERAMIC: same as C108	917-1073-00
C138	CAPACITOR, FIXED, CERAMIC: 100 uuf, $\pm 20\%$ 50 v dc	913-3550-00
C139	CAPACITOR, FIXED, MICA: same as C67	912-0432-00
C140	CAPACITOR, FIXED, CERAMIC: 5000 uuf, +80% -20%, 50 v dc	913-3549-00
C141	CAPACITOR, VARIABLE, CERAMIC: same as C47	917-1075-00
C142	CAPACITOR, FIXED, MICA: same as C129	912-0469-00
C143	CAPACITOR, FIXED, CERAMIC: same as C28	913-3013-00
C144	CAPACITOR, FIXED, CERAMIC: same as C82	913-3012-00
C145	CAPACITOR, FIXED, CERAMIC: same as C82	913-3012-00
C146	CAPACITOR, FIXED, CERAMIC: same as C28	913-3013-00
C147	CAPACITOR, FIXED, CERAMIC: same as C15	913-3009-00
C148	CAPACITOR, FIXED, MICA: same as C114	912-0429-00
C149	CAPACITOR, FIXED, CERAMIC: same as C28	913-3013-00
C150	CAPACITOR, FIXED, MICA: same as C34	912-0546-00
C151	CAPACITOR, FIXED, CERAMIC: same as C28	913-3013-00
C152	CAPACITOR, FIXED, CERAMIC: same as C28	913-3013-00
C153	CAPACITOR, FIXED, CERAMIC: 10 uuf, $\pm 10\%$ 500 v dc	913-0972-00
C154	CAPACITOR, FIXED, CERAMIC: 2000 uuf, $\pm 20\%$ 2000 v dc	913-3571-00
C155	CAPACITOR, FIXED, CERAMIC: same as C154	913-3571-00
C156	CAPACITOR, VARIABLE, CERAMIC: same as C108	917-1073-00
C157	CAPACITOR, FIXED, CERAMIC: same as C153	913-0972-00
C158	CAPACITOR, FIXED, CERAMIC: same as C154	913-3571-00
C159	CAPACITOR, FIXED, PAPER: 0.22 uf, $\pm 10\%$ , 400 v dc	931-0303-00
C160	CAPACITOR, FIXED, CERAMIC: same as C28	913-3013-00
C161	CAPACITOR, FIXED, CERAMIC: same as C28	913-3013-00
C162	CAPACITOR, FIXED, CERAMIC: same as C15	913-3009-00
C163	CAPACITOR, FIXED, MICA: 1000 uuf, $\pm 5\%$ , 500 v dc	912-3001-00
C164	CAPACITOR, FIXED, MICA: same as C67	912-0432-00
C165	CAPACITOR, FIXED, MICA: same as C48	912-0505-00
C166	CAPACITOR, FIXED, CERAMIC: same as C138	913-3550-00
C167	CAPACITOR, FIXED, CERAMIC: same as C35	913-4364-00
C168	CAPACITOR, FIXED, MICA: 33 uuf, $\pm 10\%$ , 500 v dc	912-0459-00
C169	CAPACITOR, FIXED, CERAMIC: same as C28	913-3013-00
C170	CAPACITOR, FIXED, CERAMIC: same as C15	913-3009-00
C171	CAPACITOR, FIXED, MICA: 1800 uuf, $\pm 5\%$ , 500 v dc	912-3019-00
C172	CAPACITOR, FIXED, CERAMIC: same as C35	913-4364-00

SECTION VI  
Parts List

ITEM	DESCRIPTION	COLLINS PART NUMBER
C173	CAPACITOR, FIXED, CERAMIC: same as C13	913-3153-00
C174	CAPACITOR, FIXED, ELECTROLYTIC: 25 uf	044-4345-00
C175	CAPACITOR, FIXED, CERAMIC: same as C35	913-4364-00
thru C184		
C185	CAPACITOR, FIXED, CERAMIC: same as C28	913-3013-00
C186	CAPACITOR, FIXED, CERAMIC: 3000 uuf +22% -56% 1000 v dc	913-3189-00
C187	CAPACITOR, FIXED, CERAMIC: same as C186	913-3189-00
CR1	SEMICONDUCTOR DEVICE, DIODE: silicon; General Electric Co. part no. 1N1695	353-1665-00
CR2	SEMICONDUCTOR DEVICE, DIODE: silicon; General Electric Co. part no. 1N1492	353-1661-00
CR3 thru CR7	SEMICONDUCTOR DEVICE, DIODE: same as CR2	
CR8	SEMICONDUCTOR DEVICE, DIODE: silicon; 1N457	353-0204-00
CR9	SEMICONDUCTOR DEVICE, DIODE: silicon; Motorola part no. 1N1487	353-1662-00
CR10	SEMICONDUCTOR DEVICE, DIODE: same as CR9	353-1662-00
CR11	SEMICONDUCTOR DEVICE, DIODE: 1N34KS	353-2780-00
CR12	SEMICONDUCTOR DEVICE, DIODE: same as CR11	353-2780-00
CR13	SEMICONDUCTOR DEVICE, DIODE: germanium; Hughes Aircraft Co. part no. 1N67A	353-0147-00
CR14	SEMICONDUCTOR DEVICE, DIODE: same as CR13	353-0147-00
CR15	SEMICONDUCTOR DEVICE, DIODE: same as CR13	353-0147-00
CR16	SEMICONDUCTOR DEVICE, DIODE: same as CR13	353-0147-00
CR17	SEMICONDUCTOR DEVICE, DIODE: same as CR11	353-2780-00
thru CR19		
CR20	SEMICONDUCTOR DEVICE, DIODE: same as CR8	353-0204-00
CR21	SEMICONDUCTOR DEVICE, DIODE: same as CR8	353-0204-00
→ CR22	DIODE: 1N540	353-1546-00
DS1	LAMP: molded in red plastic holder, 24 to 28v; Eldema p/n B2C-6801-6	262-1711-00
DS2	LAMP: same as DS1	262-1711-00
DS3	LAMP: same as DS1	262-1711-00
E1	TERMINAL, STANDOFF: brass, 1/4 in hex by 5/8 in. lg; tapped 4-40 5/32 in. deep one end	306-0976-00
E2 thru E4	TERMINAL STANDOFF: same as E1	306-0976-00
E5	NOT USED	
E6	NOT USED	
E7	SUPPRESSOR ASSEMBLY, PARASITIC: 5 turns no. 18 AWG wire around 47 ohm, 2 w resistor	543-7374-00
E8	NOT USED	
E9	TERMINAL STANDOFF: same as E1	306-0976-00
E10	TERMINAL STANDOFF: same as E1	306-0976-00



SECTION VI  
Parts List

ITEM	DESCRIPTION	COLLINS PART NUMBER
F1	FUSE, CATRIDGE: glass enclosed, time lag, 1/16 amp rating, 250 max volt; 1-1/4 in. lg by 0.250 in. dia	264-0289-00
FL1	FILTER, BANDPASS: 453.2 kc operating frequency 451.85 to 454.55 kc bandwidth, 27,000 ohms input and output; 7/16 in. dial by 2-1/2 in lg. F455Z-5	526-9365-00
HR1	CRYSTAL OVEN: will hold 2 crystals, stability $\pm 1$ PPM	292-0227-00
HR2	CRYSTAL OVEN: same as HR1	292-0227-00
HR3	CRYSTAL OVEN: same as HR1	292-0227-00
J1	JACK, TELEPHONE: steel, panel mtg. 5/8 in od by 27/32 in. lg	360-0195-00
J2	JACK TELEPHONE: same as J1	360-0195-00
thru		
J4		
J5	CONNECTOR, RECEPTACLE, ELECTRICAL: 18 pin; Howard B. Jones part no. S-318-EB	365-0027-00
J6	CONNECTOR, RECEPTACLE, ELECTRICAL: 15 pin; Howard B. Jones part no. S-315-EB	365-0026-00
J7	CONNECTOR, PLUG, ELECTRICAL: phenolic, 8 pin contacts, panel mtg. 15 amps	365-0025-00
J8	CONNECTOR, RECEPTACLE, ELECTRICAL: 27 pin; Howard B. Jones part no. S-327-EB	365-0021-00
J9	CONNECTOR, RECEPTACLE, ELECTRICAL: 15 flat female contacts, 5 amps; straight shape	372-1583-00
K1	JACK TIP: accommodates standard banana contact	360-2020-00
K1	RELAY, ARMATURE: 2A, 2C, 250 v dc at 50 ma or 115 v ac at 300 ma; coil 84 v dc, 6 ma, 14,000 ohms	972-1353-00
K2	RELAY, ARMATURE: 4C contact arrangement, 3 amps at 30 v dc or 115 v ac, noninductive, 115 v ac nom coil voltage; 10,000 ohms $\pm 20\%$ coil resistance	972-1346-00
K3	RELAY, ARMATURE: 4C contact arrangement, 3 amps at 30 v dc or 115 v ac, noninductive, 115 v ac nom coil voltage, 10,000 ohms $\pm 20\%$ coil resistance	972-1346-00
K4	RELAY, ARMATURE: 3 amps at 30 v dc or 115 v ac resistive; max coil voltage 18 v dc, resistance 60 ohms, $\pm 20\%$	970-2129-00
K5	RELAY, ARMATURE: same as K4	970-2129-00
K6	RELAY, ARMATURE: 3 amps at 30 v dc or 115 v ac resistive; max coil voltage 18 v dc; resistance 60 ohms, $\pm 20\%$	970-2128-00
L1	REACTOR: fixed inductive type; 0.75 henrys, 210 ma dc, 25 ohms max dc resistance, exposed core and coil; 2 in. w by 3-1/4 in. lg	668-0270-00
L2	REACTOR: same as L1	668-0270-00
L3	COIL, RADIO FREQUENCY: 3 universal wound pi sections 75 turns ea; #36 AWG copper wire; powdered iron coil form; 220 uh inductance, 0.1 amp	240-0037-00

SECTION VI  
Parts List

ITEM	DESCRIPTION	COLLINS PART NUMBER
L4	COIL, RADIO FREQUENCY: same as L3	240-0037-00
L5	COIL, RADIO FREQUENCY: same as L3	240-0037-00
L6	COIL, RADIO FREQUENCY: multiple-pi dualateral wound on ceramic form, 5 sections, 6 mh, 21 ohms dc resistance	240-5900-00
L7	COIL, RADIO FREQUENCY: same as L3	240-0037-00
L8	COIL, RADIO FREQUENCY: same as L3	240-0037-00
L9	COIL, RADIO FREQUENCY: same as L3	240-0037-00
C10	COIL, RADIO FREQUENCY: same as L3	240-0037-00
L11	COIL, RADIO FREQUENCY: same as L3	240-0037-00
L12	COIL, RADIO FREQUENCY: same as L3	240-0037-00
L13	COIL, RADIO FREQUENCY: same as L3	240-0037-00
L14	COIL, RADIO FREQUENCY: same as L3	240-0037-00
M1	AMMETER: panel type, dc, microamperes 0-200 range, scale reading 0-200 w, linear, scale divisions increments of 10, 1.600 by 0.965 by 2.260 solder lug terminals	458-0407-00
MP1	BEARING, SLEEVE: bronze; 0.2505 in. max id, 0.377 in. max od, 0.380 in. max lg	309-0029-00
MP2	BEARING, SLEEVE: bronze; flanged; 0.1885 in. max id, 0.3595 in. max od, 0.130 in. max lg	309-0124-00
MP3	BEARING, BALL: 1/4 id; Heim Co. part no. RF4-11-B	309-1063-00
MP4	BEARING, SLEEVE: bronze; flanged; 0.359 in. dia by 0.1094 in. w	309-1484-00
MP5	PULLEY, FLAT IDLER, PRESSED: aluminum; grooved; 1 in. od by 0.375 in. w; incl 1 bearing	547-3953-00
MP6	SHAFT, SHOULDERED SPROCKET: CRES; 0.248 in. dia by 1 in. lg; one end slotted, one end chamfered	547-3932-00
MP7	SHAFT, STRAIGHT SWITCH: glass base, melamine, grooved; 0.250 in. dia by 15-1/8 in lg	547-3972-00
P1	CONNECTOR: BNC	357-9292-00
P2	CONNECTOR: BNC-Right angle	357-9169-00
R1	RESISTOR, FIXED, WIREWOUND: 4000 ohms, - ±5%, 5 w	747-5504-00
R2	RESISTOR, FIXED COMPOSITION: 3900 ohms, - ±10%, 2 w	745-5670-00
R3	RESISTOR, VARIABLE, WIREWOUND: 2500 ohms, - 2 w	377-0309-00
R4	RESISTOR, VARIABLE, WIREWOUND: 1000 ohms, - 2 w	377-0308-00
R5	RESISTOR, FIXED, COMPOSITION: 4700 ohms, - ±10%, 2 w	745-5680-00
R6	RESISTOR, FIXED, COMPOSITION: 40 ohms, ±5% - 5 w	747-5432-00
R7	RESISTOR, FIXED, COMPOSITION: 10 ohms, - ±10%, 2 w	745-5568-00
R8	RESISTOR, FIXED, WIREWOUND: 27,000 ohms, ±10%, 25 w	710-0376-00
R9-	RESISTOR, FIXED, WIREWOUND: 31 ohms, ±5% - 2-1/2 w at 275°C operating temp	747-5430-00

SECTION VI  
Parts List

ITEM	DESCRIPTION	COLLINS PART NUMBER
R10	RESISTOR, FIXED, COMPOSITION: 220,000 ohms, $\pm 10\%$ , 1 w	745-3450-00
R11 thru R17	RESISTOR, FIXED, COMPOSITION: same as R10	745-3450-00
R18	NOT USED	
R19	RESISTOR, FIXED, COMPOSITION: 33 ohms, $\pm 10\%$ , 2 w	745-5589-00
R20	RESISTOR, FIXED, COMPOSITION: 100 ohms, $\pm 10\%$ , 2 w	745-5610-00
R21	RESISTOR, FIXED, COMPOSITION: 680 ohms, $\pm 10\%$ , 1/2 w	745-1345-00
R22	RESISTOR, FIXED, COMPOSITION: 4700 ohms, $\pm 10\%$ , 1/2 w	745-1380-00
R23	RESISTOR, FIXED, COMPOSITION: 3300 ohms, $\pm 10\%$ , 1/2 w	745-1373-00
R24	RESISTOR, FIXED, COMPOSITION: 0.10 megohms, $\pm 10\%$ , 1/2 w	745-1436-00
R25	RESISTOR, FIXED, COMPOSITION: same as R23	745-1373-00
R26	RESISTOR, FIXED, COMPOSITION: 68 ohms, $\pm 10\%$ , 1/2 w	745-1303-00
R27	RESISTOR, FIXED, COMPOSITION: same as R26	745-1303-00
R28	RESISTOR, FIXED, COMPOSITION: 47,000 ohms, $\pm 10\%$ , 1 w	745-3422-00
R29	RESISTOR, FIXED, WIREWOUND, 10 ohms 2-1/2 w	747-5320-00
R30	RESISTOR, FIXED, COMPOSITION: same as R24	745-1436-00
R31	RESISTOR, VARIABLE, COMPOSITION: 100,000 ohms, $\pm 20\%$ , 0.2 w	376-4622-00
R32	RESISTOR, FIXED, COMPOSITION: 47,000 ohms, $\pm 10\%$ , 1/2 w	745-1422-00
R33	RESISTOR, FIXED, COMPOSITION: 68,000 ohms, $\pm 10\%$ , 1 w	745-3429-00
R34	RESISTOR, FIXED, COMPOSITION: 820 ohms, $\pm 10\%$ , 1/2-w	745-1349-00
R35	RESISTOR, FIXED, COMPOSITION: 2200 ohms, $\pm 10\%$ , 1/2 w	745-1366-00
R36	RESISTOR, FIXED, COMPOSITION: 0.56 megohms, $\pm 10\%$ , 1/2 w	745-1468-00
R37	RESISTOR, FIXED COMPOSITION: same as R24	745-1436-00
R38	RESISTOR, FIXED COMPOSITION: same as R24	745-1436-00
R39	RESISTOR, FIXED COMPOSITION: same as R26	745-1303-00
R40	RESISTOR, VARIABLE, COMPOSITION: 250 ohms, $\pm 30\%$ , 0.2 w	376-4600-00
R41	RESISTOR, FIXED, COMPOSITION: same as R26	745-1303-00
R42	RESISTOR, FIXED, COMPOSITION: same as R24	745-1436-00
R43	RESISTOR, FIXED, COMPOSITION: 0.22 megohms, $\pm 10\%$ , 1/2 w	745-1450-00 <sup>6</sup>
R44 thru R47	RESISTOR, FIXED, COMPOSITION: same as R24	745-1436-00
R48	RESISTOR, FIXED, COMPOSITION: same as R21	745-1345-00

SECTION VI  
Parts List

ITEM	DESCRIPTION	COLLINS PART NUMBER
R49	RESISTOR, FIXED, COMPOSITION: 2.2 megohms ±10%, 1/2 w	745-1492-00
R50	RESISTOR, FIXED, COMPOSITION: same as R28	745-3422-00
R51	RESISTOR, FIXED, COMPOSITION: same as R24	745-1436-00
R52	RESISTOR, FIXED, COMPOSITION: 27,000 ohms, ±10%, 1/2 w	745-1412-00
R53	RESISTOR, FIXED, COMPOSITION: 1000 ohms, ±10%, 1/2 w	745-1352-00
R54	RESISTOR, FIXED, COMPOSITION: same as R21	745-1345-00
R55	RESISTOR, FIXED, COMPOSITION: 10,000 ohms, ±10%, 1/2 w	745-1394-00
R56	RESISTOR, FIXED, COMPOSITION: 5600 ohms, ±10%, 2 w	745-5684-00
R57	RESISTOR, FIXED, COMPOSITION: 22,000 ohms, ±10%, 1 w	745-3408-00
R58	RESISTOR, FIXED, COMPOSITION: same as R21	745-1345-00
R59	RESISTOR, FIXED, COMPOSITION: same as R36	745-1468-00
R60	RESISTOR, FIXED, COMPOSITION: same as R36	745-1468-00
R61	RESISTOR, VARIABLE, COMPOSITION: 1 megohm, 1/2 w, 5 C Log Taper	376-4627-00
R62	RESISTOR, FIXED, COMPOSITION: same as R32	745-1422-00
R63	RESISTOR, FIXED, COMPOSITION: 22K 2 w	745-5708-00
R64	RESISTOR, FIXED, COMPOSITION: 120 ohms, ±10%, 1/2 w	745-1314-00
R65	RESISTOR, FIXED, COMPOSITION: 470 ohms, ±10%, 1/2 w	745-1338-00
R66	RESISTOR, VARIABLE, COMPOSITION: 1000 ohms, ±30%, 0.2 w	376-4601-00
R67	RESISTOR, FIXED, COMPOSITION: same as R65	745-1338-00
R68	RESISTOR, FIXED, COMPOSITION: same as R53	745-1352-00
R69	RESISTOR, FIXED, COMPOSITION: same as R24	745-1436-00
R70	RESISTOR, FIXED, COMPOSITION: same as R36	745-1468-00
R71	RESISTOR, FIXED, COMPOSITION: 0.15 megohms, ±10%, 1/2 w	745-1443-00
R72	RESISTOR, FIXED, COMPOSITION: same as R57	745-3408-00
R73	RESISTOR, FIXED, COMPOSITION: same as R53	745-1352-00
R74	RESISTOR, FIXED, COMPOSITION: same as R53	745-1352-00
R75	RESISTOR, FIXED, COMPOSITION: same as R26	745-1303-00
R76	RESISTOR, FIXED, COMPOSITION: same as R36	745-1468-00
R77	RESISTOR, FIXED, COMPOSITION: same as R28	745-3422-00
R78	RESISTOR, FIXED, COMPOSITION: same as R24	745-1436-00
R79	RESISTOR, FIXED, COMPOSITION: 180 ohms, ±10%, 1/2 w	745-1321-00
R80	RESISTOR, FIXED, COMPOSITION: 82 ohms, ±10%, 1/2 w	745-1307-00
R81	RESISTOR, FIXED, COMPOSITION: same as R40	376-4600-00
R82	RESISTOR, FIXED, COMPOSITION: same as R56	745-5684-00
R83	RESISTOR, FIXED, COMPOSITION: same as R28	745-3422-00
R84	RESISTOR, FIXED, COMPOSITION: same as R26	745-1303-00
R85	RESISTOR, FIXED, COMPOSITION: same as R36	745-1468-00
R86	RESISTOR, FIXED, COMPOSITION: 470 ohms, ±10%, 2 w	745-5638-00

SECTION VI  
Parts List

ITEM	DESCRIPTION	COLLINS PART NUMBER
R87	RESISTOR, FIXED, COMPOSITION: 0.18 megohms, ±10%, 1/2 w	745-1447-00
R88	RESISTOR, FIXED, COMPOSITION: same as R55	745-1394-00
R89	RESISTOR, FIXED, COMPOSITION: same as R28	745-3422-00
R90	RESISTOR, FIXED, COMPOSITION: same as R53	745-1352-00
R91	RESISTOR, FIXED, COMPOSITION: same as R34	745-1349-00
R92	RESISTOR, FIXED, COMPOSITION: same as R35	745-1366-00
R93	RESISTOR, FIXED, COMPOSITION: 22,000 ohms, ±10%, 1/2 w	745-1408-00
R94	RESISTOR, FIXED, COMPOSITION: same as R26	745-1303-00
R95	RESISTOR, FIXED, COMPOSITION: same as R34	745-1349-00
R96	RESISTOR, FIXED, COMPOSITION: same as R32	745-1422-00
R97	RESISTOR, FIXED, COMPOSITION: 39,000 ohms, ±10%, 2 w	745-5719-00
R98	RESISTOR, FIXED, COMPOSITION: 56,000 ohms, ±10%, 1 w	745-3426-00
R99	RESISTOR, FIXED, COMPOSITION: same as R97	745-5712-00
R100	RESISTOR, FIXED, COMPOSITION: same as R55	745-1394-00
R101	RESISTOR, FIXED, COMPOSITION: same as R26	745-1303-00
R102	RESISTOR, FIXED, COMPOSITION: same as R93	745-1408-00
R103	RESISTOR, FIXED, COMPOSITION: same as R35	745-1366-00
R104	RESISTOR, FIXED, COMPOSITION: 0.10 megohms, ±10%, 2 w	745-5736-00
R105	RESISTOR, FIXED, COMPOSITION: same as R24	745-1436-00
R106	RESISTOR, FIXED, COMPOSITION: 0.47 megohms, ±10%, 1/2 w	745-1464-00
R107	RESISTOR, FIXED, COMPOSITION: same as R24	745-1436-00
R108	RESISTOR, FIXED, COMPOSITION: 15,000 ohms, ±10%, 2 w	745-5701-00
R109	RESISTOR, FIXED, COMPOSITION: same as R108	745-5701-00
R110	RESISTOR, VARIABLE, COMPOSITION: 2500 ohms, ±30%, 0.2 w	376-4628-00
R111	RESISTOR, VARIABLE: same as R110	376-4628-00
thru R113		
R114	RESISTOR, FIXED, COMPOSITION: same as R49	745-1492-00
R115	RESISTOR, FIXED, COMPOSITION: 220 ohms, ±10%, 1/2 w	745-1324-00
R116	RESISTOR, FIXED, COMPOSITION: same as R24	745-1436-00
R117	RESISTOR, FIXED, COMPOSITION: same as R28	745-3422-00
R118	RESISTOR, FIXED, COMPOSITION: same as R57	745-3408-00
R119	RESISTOR, FIXED, COMPOSITION: same as R35	745-1366-00
R120	RESISTOR, FIXED, COMPOSITION: 4700 ohms, ±10%, 1 w	745-3380-00
R121	RESISTOR, FIXED, COMPOSITION: same as R24	745-1436-00
R122	RESISTOR, FIXED, COMPOSITION: 2700 ohms, ±10%, 1/2 w	745-1370-00
R123	RESISTOR, FIXED, COMPOSITION: 5600 ohms, ±10%, 1/2 w	745-1384-00
R124	RESISTOR, FIXED, COMPOSITION: same as R24	745-1436-00

SECTION VI  
Parts List

ITEM	DESCRIPTION	COLLINS PART NUMBER
R125	RESISTOR, FIXED, COMPOSITION: 1.5 megohms, ±10%, 1/2 w	745-1485-00
R126	RESISTOR, FIXED, COMPOSITION: same as R49	745-1492-00
R127	RESISTOR, FIXED, COMPOSITION: 27,000 ohms, ±10%, 1 w	745-3412-00
R128	RESISTOR, FIXED, COMPOSITION: same as R32	745-1422-00
R129	RESISTOR, FIXED, FILM: 8.2 megohms, 1/2 watts ±5%	745-1516-00
R130	RESISTOR, FIXED, COMPOSITION: 33,000 ohms, ±10%, 1/2 w	745-1415-00
R131	RESISTOR, FIXED, COMPOSITION: 3900 ohms, ±10%, 1/2 w	745-1377-00
R132	RESISTOR, FIXED, COMPOSITION: 68,000 ohms, ±10%, 1/2 w	745-1429-00
R133	RESISTOR, VARIABLE, COMPOSITION: 25,000 ohms, ±20%, 0.02 w	376-4610-00
R134	RESISTOR, FIXED, COMPOSITION: same as R106	745-1464-00
R135	RESISTOR, FIXED, COMPOSITION: same as R106	745-1464-00
R136	RESISTOR, FIXED, COMPOSITION: same as R106	745-1464-00
R137	RESISTOR, FIXED, COMPOSITION: same as R106	745-1464-00
R138	RESISTOR, FIXED, FILM: 3830 ohms, ±1%, 1/4 w	705-7124-00
R139	RESISTOR, FIXED, WIREWOUND: 3.21 ohms, ±1%, 2 w	747-9621-00
R140	RESISTOR, FIXED, COMPOSITION: same as R24	745-1436-00
R141	RESISTOR, FIXED, COMPOSITION: same as R49	745-1492-00
R142	RESISTOR, FIXED, COMPOSITION: same as R52	745-1412-00
R143	RESISTOR, FIXED, COMPOSITION: 56,000 ohms, ±10%, 2 w	745-5726-00
R144	RESISTOR, FIXED, COMPOSITION: 220 ohms, ±10, 1/2 w	745-1324-00
R145	RESISTOR, FIXED, COMPOSITION: 56,000 ohms, ±10%, 1/2 w	745-1426-00
R146	RESISTOR, FIXED, COMPOSITION: same as R106	745-1464-00
R147	RESISTOR, FIXED, COMPOSITION: same as R6	747-5432-00
R148	RESISTOR, FIXED, COMPOSITION: same as R52	745-1412-00
R149	RESISTOR, FIXED, COMPOSITION: 0.10 megohms, ±10%, 1/2 w	745-1436-00
R150	RESISTOR, FIXED, COMPOSITION: 120 ohms, ±10%, 1/2 w	745-1314-00
R151	RESISTOR, FIXED, COMPOSITION: 4700 ohms, ±10%, 1 w	745-3282-00
S1	SWITCH, PUSH: 0.1 amp at 115 v ac resistive; phenolic case; solder type terminals; normally open	260-2709-00
S2	SWITCH SECTION, ROTARY: 2 circuit, 12 positions, 10 fixed contacts, 1 moving contact, phenolic insulation	269-2283-00
S3	SWITCH, SLIDE: dpdt; 1 amp at 125 v ac, dc; 1-3/8 in. lg by 21/32 in w; incl terminals	260-2597-00
S4	SWITCH SECTION, ROTARY: 2 circuit, 12 positions, 10 fixed, 2 moving contacts; phenolic insulation	269-1990-00

SECTION VI  
Parts List

ITEM	DESCRIPTION	COLLINS PART NUMBER
S5 thru S7	SWITCH, PUSH: same as S4	269-1990-00
S8	SWITCH, ROTARY: 12 fixed contacts, 2 moving contacts, 2 pole, 4 throws; 230 v ac, dc, 0.25 amps	259-0893-00
S9	SWITCH SECTION, ROTARY: 2 circuit, 12 positions, 20 fixed contacts, 4 moving contacts, phenolic insulation	269-1991-00
S10	SWITCH, PUSH: same as S4	269-1990-00
S11	SWITCH SECTION, ROTARY: same as S9	269-1991-00
T1	TRANSFORMER, AUDIO FREQUENCY: pri 600 ohms sec 600 ohms; metal encased, 300 cps to 3500 cps, solder-type terminals	667-0015-00
T2	TRANSFORMER, AUDIO FREQUENCY: pri 10,000 ohms, 10 ma; sec no. 1, 150 ohms, sec. no. 2, 150 ohms, sec. no. 3, 0.26 v rms; 100 to 3000 cps; solder type terminals	667-0522-00
T3	TRANSFORMER, INTERMEDIATE, FREQUENCY: 455 kc center frequency; 1-3/8 in. by 1-3/8 in. by 2-3/4 in.; excluding terminals	278-0197-00
T4	TRANSFORMER, INTERMEDIATE, FREQUENCY: same as T3	278-0197-00
T5	TRANSFORMER, INTERMEDIATE, FREQUENCY: same as T3	278-0197-00
TB1	TERMINAL BOARD: mtg strip w/ 3 brass solder lug terminals	306-9033-00
TB2	TERMINAL BOARD: same as TB1	306-9033-00
TB3	TERMINAL BOARD: phenolic; 1/16 in. by 3/8 in. by 1-1/2 in.; incl 4 solder lug terminals	306-9032-00
TB4	TERMINAL BOARD: same as TB1	306-9033-00
TB5	TERMINAL BOARD: same as TB3	306-9032-00
TB6	TERMINAL BOARD: phenolic; incl 4 solder lug terminals; 1/16 in. by 3/8 in. by 1-1/2 in.	306-0838-00
TB7	TERMINAL BOARD: same as TB3	306-9032-00
TB8	TERMINAL BOARD: same as TB1	306-9033-00
TB9	TERMINAL BOARD: same as TB3	306-9032-00
TB10	TERMINAL BOARD: same as TB1	306-9033-00
TB11	TERMINAL BOARD: same as TB1	306-9033-00
TB12	TERMINAL BOARD: phenolic; w/ 3 terminals; 1/16 in. by 3/8 in. by 1-1/8 in.	306-0001-00
TB13	TERMINAL BOARD: phenolic, incl 5 solder lug terminals; 1/16 in. by 3/8 in. by approx 1-15/16 in.	306-0550-00
TB14	TERMINAL BOARD: same as TB1	306-0001-00
TB15	TERMINAL BOARD: same as TB12	
TB16	TERMINAL BOARD: two terminals, mounted; one terminal grounded; 1/16 in. by 7/8 in. by 3/4 in lg	306-2220-00
TB17	TERMINAL BOARD: same as TB3	306-9032-00
TB18	TERMINAL BOARD: same as TB1	306-9033-00
TB19	TERMINAL BOARD: same as TB3	306-9032-00
TB20	TERMINAL BOARD: same as TB1	306-9033-00
TB21	TERMINAL BOARD: same as TB19	306-9032-00

SECTION VI  
Parts List

ITEM	DESCRIPTION	COLLINS PART NUMBER
TB22	TERMINAL BOARD: same as TB1	306-9033-00
TB23	TERMINAL BOARD: same as TB1	306-9033-00
TB24	TERMINAL BOARD: same as TB16	306-2220-00
TB25	TERMINAL BOARD: same as TB16	306-2220-00
TB26	TERMINAL BOARD: same as TB19	306-9032-00
TB27	TERMINAL BOARD: same as TB1	306-9033-00
TB28	TERMINAL BOARD: same as TB19	306-9032-00
TB29	TERMINAL BOARD: same as TB6	306-0838-00
TB30	TERMINAL BOARD: same as TB19	306-9032-00
TB31	TERMINAL BOARD: same as TB19	306-9032-00
TB32	TERMINAL BOARD: same as TB1	306-9033-00
TB33	TERMINAL BOARD: same as TB19	306-9032-00
TB34	TERMINAL BOARD: same as TB1	306-9033-00
TB35	TERMINAL BOARD: same as TB13	306-0550-00
TB36	TERMINAL BOARD: phenolic; two rings each w/ 6 terminals; 1-1/2 in. lg	306-0909-00
TB37	TERMINAL BOARD: same as TB3	306-9032-00
TB38	TERMINAL BOARD: same as TB19	306-9032-00
TB39	TERMINAL BOARD: same as TB12	306-0001-00
TB40	TERMINAL BOARD: same as TB13	306-0550-00
TB41	TERMINAL BOARD: same as TB13	306-0550-00
TB42	TERMINAL BOARD: same as TB19	306-9032-00
TB43	TERMINAL BOARD: same as TB1	306-9033-00
TB44	TERMINAL BOARD: same as TB13	306-0550-00
TB45	TERMINAL BOARD: same as TB1	306-9033-00
TB46	TERMINAL BOARD: phenolic; 18 solder lug terminals; 1/16 in. thk by 1-1/2 in. by 3-13/16 in.	543-7372-003
TB47	TERMINAL BOARD: plastic; 12 post type terminals; 2-5/8 in. w by 2-3/4 in. lg	547-3944-003
TB48	TERMINAL BOARD: plastic; 20 post type terminals; 2-5/8 in. w by 4-1/4 in. lg	547-3947-003
TB49	TERMINAL BOARD: phenolic; 3 solder lug terminals; 3/8 in w by 1-1/8 in lg by 1/16 in. thk	306-0587-00
TB50	TERMINAL BOARD: same as TB16	306-2220-00
TB51	TERMINAL BOARD: same as TB16	306-2220-00
V1	ELECTRON TUBE: glass envelope; triode-pentode; type 6678 (6U8A)	257-0189-00 <del>257-0328</del>
V2	ELECTRON TUBE: glass envelope; twin triode, type 6679 (12AT7)	257-0190-00 <del>257-0205-</del>
V3	ELECTRON TUBE: glass envelope; pentode; type 6DC6	255-0226-00 <del>255-0216</del>
V4	ELECTRON TUBE: power pentode; type 6677 (6CL6)	257-0188-00
V5	ELECTRON TUBE: glass envelope; beam power pentode; type 6146	256-0101-00
V6	ELECTRON TUBE: same as V5	256-0101-00
V7	ELECTRON TUBE: same as V1	257-0189-00
V8	NOT USED	
V9	NOT USED	
V10	ELECTRON TUBE: same as V1	257-0189-00
V11	ELECTRON TUBE: pentagrid converter type: Type 6BA7	255-0209-00



SECTION VI  
Parts List

ITEM	DESCRIPTION	COLLINS PART NUMBER
V12	ELECTRON TUBE: glass envelope; pentode, type 6660 (6BZ6)	<del>255-0240</del> 257-0185-00
V13	ELECTRON TUBE: same as V12	257-0185-00
V14	ELECTRON TUBE: same as V2	257-0190-00
V15	ELECTRON TUBE: same as V2	257-0190-00
V16	NOT USED	
V17	ELECTRON TUBE: glass envelope; double diode-triode; type 6AV6	255-0307-00
V18	ELECTRON TUBE: glass envelope; twin diode rectifier, type 6663 (6AL5)	<del>257-0186-00</del> 257-0618
XF1	FUSEHOLDER: extractor post type; transparent, with 3 AG fuses	265-1072-00
XHR1	SOCKET, ELECTRON TUBE: 8 prong octal tube socket, molded construction plastic	220-1005-00
XHR2	SOCKET, ELECTRON TUBE: same as XHR1	220-1005-00
XHR3	SOCKET, ELECTRON TUBE: same as XHR1	220-1005-00
XV1	SOCKET, ELECTRON TUBE: 9 contact miniature; top mtg. tube socket w/o shield base; plastic	220-1274-00
XV2	SOCKET, ELECTRON TUBE: 9 contact miniature; 0.043 min. wire hole size	220-1293-00
XV3	SOCKET, ELECTRON TUBE: 7 pin miniature, brass and copper w/phenolic insulation	220-1291-00
XV4	SOCKET, ELECTRON TUBE: same as XV2	220-1293-00
XV5	SOCKET, ELECTRON TUBE: 8 prong octal tube socket, molded construction plastic	220-1005-00
XV6	SOCKET ELECTRON TUBE: same as XV5	220-1005-00
XV7	SOCKET ELECTRON TUBE: same as XV1	220-1274-00
XV8	NOT USED	
XV9	NOT USED	
XV10	SOCKET, ELECTRON TUBE: same as XV2	220-1293-00
XV11	SOCKET, ELECTRON TUBE: same as XV2	220-1293-00
XV12	SOCKET, ELECTRON TUBE: same as XV3	220-1291-00
XV13	SOCKET, ELECTRON TUBE: same as XV3	220-1291-00
XV14	SOCKET, ELECTRON TUBE: same as XV1	220-1274-00
XV15	SOCKET, ELECTRON TUBE: same as XV1	220-1274-00
XV16	NOT USED	
XV17	SOCKET, ELECTRON TUBE: 7 contact miniature top mtg tube socket w/o shield base	220-1152-00
XV18	SOCKET, ELECTRON TUBE: same as XV17	220-1152-00
Y1	CRYSTAL UNIT, QUARTZ: channel freq } CRYSTAL UNIT, QUARTZ: channel freq } CRYSTAL UNIT, QUARTZ: channel freq } CRYSTAL UNIT, QUARTZ: channel freq }	In accordance with customer frequency assignment.
Y2		
Y3		
Y4		
Y5	CRYSTAL UNIT, QUARTZ: 455 kc freq range	289-1618-00
Z1	SUPPRESSOR, PARASITIC: c/o one composition resistor, 47 ohms, ±10%, 2 w; w/5 turns of no. 18 wire equally spaced length of resistor	543-7468-00
Z2		

SECTION VI  
Parts List

ITEM	DESCRIPTION	COLLINS PART NUMBER
AUTOMATIC GAIN CONTROL		528-0127-004
C1	CAPACITOR, FIXED, MICA: 6200 uuf $\pm 2\%$ , 500 vdcw	912-2719-00
C2	CAPACITOR, FIXED, ELECTROLYTIC: 1.0 uf -15% +30%, 100 vdcw	184-7177-00
C3	CAPACITOR, FIXED, ELECTROLYTIC: 0.22 uf $\pm 20\%$ , 35 vdcw	184-7407-00
C4	CAPACITOR, FIXED, MICA: same as C1	912-2719-00
C5	CAPACITOR, FIXED, ELECTROLYTIC: 33 uf $\pm 20\%$ , 10 vdcw	184-7382-00
C6	CAPACITOR, FIXED, ELECTROLYTIC: 6.8 uf $\pm 20\%$ , 35 vdcw	184-7693-00
C7	CAPACITOR, FIXED, ELECTROLYTIC: 4.7 uf $\pm 20\%$ , 10 vdcw	184-7379-00
C8	CAPACITOR, FIXED, MICA: 8200 uuf $\pm 2\%$ , 500 vdcw	912-2728-00
C9	CAPACITOR, FIXED, MICA: 6800 uuf $\pm 2\%$ , 500 vdcw	912-2722-00
C10	CAPACITOR, FIXED, ELECTROLYTIC: 22 uf $\pm 20\%$ , 35 vdcw	184-7695-00
C11	CAPACITOR, FIXED, MICA: 10,000 uuf $\pm 2\%$ , 500 vdcw	912-2734-00
C12	CAPACITOR, FIXED, ELECTROLYTIC: 15 uf $\pm 20\%$ , 20 vdcw	184-7371-00
C13	CAPACITOR, FIXED, ELECTROLYTIC: 330 uf $\pm 20\%$ , 6 vdcw	184-7647-00
C14	CAPACITOR, FIXED, ELECTROLYTIC: same as C10	184-7695-00
CR1	SEMICONDUCTOR DEVICE, DIODE: silicon; Texas Instruments type 1N645	353-2607-00
CR2	SEMICONDUCTOR DEVICE, DIODE: silicon; Pacific Semiconductors part no. 1N724A	353-2747-00
CR3	SEMICONDUCTOR DEVICE, DIODE: hermitically sealed glass case, zener voltage 2.47 v min to 2.73 max. 75 ua at +25°C, 100 ua at +100°C; Pacific Semiconductors part no. PS6465A	353-2892-00
CR4	SEMICONDUCTOR DEVICE, DIODE: silicon; Texas Instruments part no. 1N754A	353-2716-00
CR5	SEMICONDUCTOR DEVICE DIODE: same as CR3	353-2892-00
E1	PRINTED CIRCUIT BOARD, FLARED: plastic-glass cloth epoxy 0.062 in. thk, copper cladding both sides w/3 rivets and 98 tubelets; 4.437 in w by 4.533 in lg approx.	547-3007-004
L1	COIL, RADIO FREQUENCY: toroidal wound, 600 mh inductance; 1.2 ohms dc resistance, 16.2 ma current rating	240-0284-00
L2	COIL, RADIO FREQUENCY: same as L1	240-0284-00
L3	COIL, RADIO FREQUENCY: toroidal wound, 240 mh 1000 cps, 25.3 ma current rating	240-0279-00

ITEM	DESCRIPTION AUTOMATIC GAIN CONTROL (CONT'D)	COLLINS PART NUMBER
L4	COIL, RADIO FREQUENCY: toroidal wound, 360 mh inductance, 200 ohms dc resistance	240-1246-00
Q1	TRANSISTOR: PNP type germanium, hermitically sealed; Motorola, Inc. part no. 2N652A	352-0276-00
Q2	TRANSISTOR: same as Q1	352-0276-00
R1	RESISTOR, VARIABLE, WIREWOUND: 200 ohms ±5%, 1 w	381-1263-00
R2	RESISTOR, FIXED, COMPOSITION: 220 ohms ±10%, 1/2 w	745-1324-00
R3	RESISTOR, FIXED, COMPOSITION: 22,000 ohms ±10%, 1/2 w	745-1408-00
R4	RESISTOR, FIXED, COMPOSITION: 1000 ohms ±10%, 1/2 w	745-1352-00
R5	RESISTOR, FIXED, COMPOSITION: same as R3	745-1408-00
R6	RESISTOR, FIXED, COMPOSITION: 3900 ohms ±10%, 1/2 w	745-1377-00
R7	RESISTOR, FIXED, COMPOSITION: 3300 ohms ±10%, 1/2 w	745-1373-00
R8	RESISTOR, FIXED, COMPOSITION: 1800 ohms ±10%, 1/2 w	745-1366-00
R9	RESISTOR, FIXED, COMPOSITION: same as R7	745-1373-00
R10	RESISTOR, FIXED, FILM: 4220 ohms ±1%, 1/4 w	705-7126-00
R11	RESISTOR, FIXED, COMPOSITION: 33,000 ohms ±10%, 1/2 w	745-1415-00
R12	RESISTOR, FIXED, COMPOSITION: 39,000 ohms ±10%, 1/2 w	745-1419-00
R13	RESISTOR, FIXED, COMPOSITION: 470,000 ohms ±10%, 1/2 w	745-1464-00
R14	RESISTOR, FIXED, COMPOSITION: 680 ohms ±10%, 1/2 w	745-1345-00
MISCELLANEOUS		
	KIT COIL: 1.6 - 2.0 mc; incls Antenna Coil 1st R-F coil RF Coil (Qty 3 required) P. A. Coil KIT COIL: 2.0 - 3.3 mc incls Antenna Coil 1st R-F RF Coil (Qty. 3 required) P. A. Coil KIT COIL: 3.3 - 5.5 mc incls Antenna Coil 1st R.F. Coil R. F. Coil (Qty. 3 required) P. A. Coil	567-4662-00 544-6102-00 546-6035-00 544-6103-00 543-7360-00 543-7496-00 543-7735-00 546-6036-00 543-4346-00 567-4663-00 567-4664-00 543-7736-00 546-6037-00 543-4347-00 543-7360-00

SECTION VI  
Parts List

ITEM	DESCRIPTION MISCELLANEOUS (CONT'D)	COLLINS PART NUMBER
	KIT COIL: 5.5 - 9.0	567-4665-00
	Antenna Coil	543-7737-00
	1st R.F. Coil	546-6038-00
	R.F. Coil (Qty. 3 required)	543-4348-00
	P.A. Coil	543-7361-00
	KIT COIL: 9.0 - 12.0 mc incls	567-4666-00
	Antenna Coil	543-7738-00
	1st R.F. Coil	546-6039-00
	R.F. Coil (Qty. 3 required)	543-4349-00
	P.A. Coil	543-7362-00
	KIT COIL: 12.0 - 15.0 mc incls	567-4667-00
	Antenna Coil	545-3237-00
	1st R.F. Coil	545-7589-00
	R.F. Coil (Qty. 3 required)	545-3238-00
	P.A. Coil	543-7362-00
P1	CONNECTOR, RECEPTACLE, ELECTRICAL: female; 8 contacts w/1/2 in. dia hole in top and a cable clamp	364-8082-00
	CABLE ASSEMBLY, POWER ELECTRICAL, BRANCHED: 12 v dc input; c/o 2 battery clips, 2 flat washers, 2 lock washers, 2 terminal lugs, 2 cable markers, sleeving insulation and 12 ft 1 in. electrical wire and	547-3013-00
P1	CONNECTOR, RECEPTACLE, ELECTRICAL: female; 8 contacts w/1/2 in. dia. hole in top and a cable clamp	364-8082-00
	CABLE ASSEMBLY, POWER ELECTRICAL, BRANCHED: 28 v dc; c/o 2 cable markers, 2 flat washers, 2 lock washers, 2 battery clips, sleeving insulation 12 ft 1-1/4 in electrical wire and	547-3014-00
P1	CONNECTOR, RECEPTACLE, ELECTRICAL: female; 8 contacts w/1/2 in. dia hole in top and a cable clamp	364-8082-00
E1 and E2	TERMINAL, LUG: copper, plastic insulated; solderless; 1-5/32 in lg, 1/2 in. w	304-0276-00
	CABLE ASSEMBLY, SPECIAL PURPOSE, ELECTRICAL: Tuner Control; c/o 6 rubber bushings, 2 cable markers plus 50 ft 1 in. electrical wire and	547-3015-00
P1	CONNECTOR, RECEPTACLE, ELECTRICAL: male; 15 prong plug connector w/ cap having 1/2 in dia hole in top and cable clamp; 1-1/8 in. by 1-11/16 in. by 3-3/32 in.	365-0030-00
P2	CONNECTOR, PLUGS, ELECTRICAL: female; 7 contact AN type straight plug connector; 20 amp. #16 AWG	357-4906-00
	CABLE ASSEMBLY, RADIO FREQUENCY, OUTPUT: c/o jacket modified RG-58C/U coaxial cable, 600 in. lg w/ straight phono plug termination one end and other w/ UG-88 D/U BNC type plug connector	547-3085-002

ITEM	DESCRIPTION MISCELLANEOUS (CONT'D)	COLLINS PART NUMBER
	CRYSTAL OVEN: will hold 2 crystals; stability $\pm 1$ PPM (Qty. 3)	292-0227-00
115-VOLT POWER SUPPLY		547-3991-00
2C1	CAPACITOR, FIXED, ELECTROLYTIC: 10 uf -0% +100%, 150 v dc	183-1358-00
2CR1	SEMICONDUCTOR DEVICE, DIODE: silicon; General Electric part no. 1N1695	353-1665-00
2CR2	CRYSTAL UNIT, RECTIFYING: silicone crystal; 0.812 in. lg. by 7/16 in. hex 1N1124R	353-1766-00
2CR3	CRYSTAL UNIT, RECTIFYING: same as 2CR2	353-1766-00
2CR4	CRYSTAL UNIT, RECTIFYING: same as 2CR2	353-1766-00
2CR5	CRYSTAL UNIT, RECTIFYING: same as 2CR2	353-1766-00
2F1	FUSE: 6 amp AGC	264-0727-00
2F2	FUSE: 3 amps MDX	264-0724-000
2F3	FUSE: same as 2F2	264-0724-000
2K1	RELAY ARMATURE: 2 contact arrangement; 3 amp at 30 v dc or 115 v ac, 48 v dc nom. coil voltage, 2000 ohms $\pm 20\%$ coil resistance	972-1343-00
2K2	RELAY ARMATURE: contact arrangement 1A, 15 amp at 20 v dc or 115 v ac resistive, 50 ma at 250 v dc inductive; 24 v dc nom coil voltage, 220 ohms $\pm 10\%$ coil resistance	970-2130-00
2P1	CONNECTOR, RECEPTACLE, ELECTRICAL: 27 male contacts panel mtg; phenolic insulation; modified	547-3030-00
2R1	RESISTOR, FIXED, WIREWOUND: 4000 ohms $\pm 5\%$ , 5 w	747-5504-00
2R2	RESISTOR, FIXED, WIREWOUND: same as 2R1	747-5504-00
2R3	RESISTOR, FIXED, WIREWOUND: 5000 ohms $\pm 5\%$ , 5 w	747-5506-00
2T1	TRANSFORMER, HIGH VOLTAGE: multiple winding, step-up	662-0018-00
2T2	TRANSFORMER, LOW VOLTAGE: multiple winding, step-up, step-down	662-0016-00

SECTION VI  
Parts List

ITEM	DESCRIPTION 115 VOLT POWER SUPPLY (CONT'D)	COLLINS PART NUMBER
3T3	TRANSFORMER, POWER, STEP-DOWN: 115 v ac, 115 v ac, primary winding, 50, 60, 400 cps, 95 v ac, ±3% .025 amp secondary winding, single phase	662-0019-00
2TB1	TERMINAL BOARD: phenolic, 5 solder lug terminals; 1/16 in. by 3/8 in. by 1-7/8 in.	306-0550-00
2TB2	TERMINAL BOARD: phenolic, 4 solder lug terminals 1/16 in. by 3/8 in. by 1-1/2 in.	306-9032-00
2TB3	TERMINAL BOARD: same as 2TB2	306-9032-00
2TB4	TERMINAL BOARD: phenolic 3 solder lug terminals; 1/16 in by 3/8 in by 1-1/8	306-9033-00
2XF1	FUSEHOLDER: extractor post type; 125 v, 15 amps; 11/16 in dia. by 2-9/64 in. lg. over-all	265-1019-00
2XF2	FUSEHOLDER: same as 2XF1	265-1019-00
2XF3	FUSEHOLDER: same as 2XF1	265-1019-00
28-VOLT POWER SUPPLY		547-3992-00
3C1	CAPACITOR, FIXED, ELECTROLYTIC: 150 uf -10% +100%, 50 v dc	183-1564-00
3C2	CAPACITOR, FIXED, ELECTROLYTIC: same as 3C1	183-1564-00
3C3	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 20,000 uuf, -20% +100%, 500 v dc	913-2142-00
3C4	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 0.1 uf GMV, 100 v dc	913-3681-00
3C5	CAPACITOR, FIXED, ELECTROLYTIC: 15 uf -10% +100%, 100 v dc	183-1385-00
3CR1	SEMICONDUCTOR DEVICE, DIODE: silicon; Hoffman Electronic Corp. part no. HZPR-32A	353-1537-00
3CR2	SEMICONDUCTOR DEVICE, DIODE: silicon; JETEC type 1N248	353-1600-00
3CR3	SEMICONDUCTOR DEVICE, DIODE: silicon; General Electric part no. 1N1487	353-1662-00
3CR4	SEMICONDUCTOR DEVICE, DIODE: same as 3CR3	353-1662-00
3CR5	SEMICONDUCTOR DEVICE, DIODE: same as 3CR3	353-1662-00
3CR6	SEMICONDUCTOR DEVICE, DIODE: same as 3CR3	353-1662-00
3F1	FUSE: 20 amp, SFE	264-0732-00
3F2	FUSE: 7-1/2 amp, AGC	264-0728-00
3F3	FUSE: same as 3F2	264-0728-00
3E1	INSULATOR, STANDOFF: single-ended metal base insulated terminal, brass cadmium plated, 4-40 mounting stud, 1/4 in. across hex by 3/4 in. lg.	306-0977-00
3K1	RELAY, ARMATURE: contact arrangement 1A, 15 amp at 28 v dc or 115 v ac, 24 v dc nom coil voltage, 220 ohms ±10% coil resistance	970-1875-00
3K2	RELAY, ARMATURE: contact arrangement 1A, 15 amp at 28 v dc or 115 v ac resistive, 50 ma at 250 v dc inductive; 24 v dc nom. coil voltage, 220 ohms ±10%, coil resistance	970-2130-00

SECTION VI  
Parts List

ITEM	DESCRIPTION 280 VOLT POWER SUPPLY (CONT'D)	COLLINS PART NUMBER
3L1	COIL, RADIO FREQUENCY: 5.5 uh, $\pm 20\%$ , 15-3/4 turns 2-3/4 in. lg overall, 8-32NC-2 thd one end	240-0021-00
3L2	COIL, RADIO FREQUENCY: choke; single layer wound; 26 turns no. 14 AWG wire; 2.218 in lg. by 31/32 in. w by 3/4 in. dia overall	240-0002-00
3P1	CONNECTOR, RECEPTACLE, ELECTRICAL: 27 male contacts panel mtg; phenolic insulation; modified	547-3030-002
3Q1	TRANSISTOR: germanium; Motorola type 2N1556	352-0290-00
3Q2	TRANSISTOR: same as 3Q1	352-0290-00
3Q3	TRANSISTOR: same as 3Q1	352-0290-00
3Q4	TRANSISTOR: same as 3Q1	352-0290-00
3Q5	TRANSISTOR: germanium; Motorola type 2N375	352-0065-00
3Q6	TRANSISTOR: germanium; type 2N1559	352-0297-00
3Q7	TRANSISTOR: same as 3Q6	352-0297-00
3R1	RESISTOR, FIXED, COMPOSITION: 100 ohms $\pm 5\%$ , 3 w	747-5103-00
3R2	RESISTOR, FIXED, COMPOSITION: 10 ohms $\pm 10\%$ , 1 w	745-3268-00
3R3	RESISTOR, FIXED, COMPOSITION: same as 3R2	745-3268-00
3R4	RESISTOR, FIXED, COMPOSITION: 2200 ohms $\pm 10\%$ , 2 w	745-5666-00
3R5	RESISTOR, FIXED, COMPOSITION: same as 3R4	745-5666-00
3R6	RESISTOR, FIXED, COMPOSITION: same as 3R2	745-3268-00
3R7	RESISTOR, FIXED, COMPOSITION: same as 3R2	745-3268-00
3R8	RESISTOR, FIXED, COMPOSITION: 47 ohms $\pm 10\%$ , 1 w	745-3296-00
3R9	RESISTOR, FIXED, COMPOSITION: same as 3R8	745-3296-00
3R10	RESISTOR, FIXED, COMPOSITION: 33 ohms $\pm 10\%$ , 1 w	745-3289-00
3R11	RESISTOR, FIXED, COMPOSITION: same as 3R8	745-3296-00
3R12	RESISTOR, FIXED, COMPOSITION: same as 3R8	745-3296-00
3R13	RESISTOR, FIXED, COMPOSITION: same as 3R4	745-5666-00
3R14	RESISTOR, FIXED, COMPOSITION: same as 3R4	745-5666-00
3R15	RESISTOR, FIXED, COMPOSITION: 3300 ohms $\pm 10\%$ , 1 w	745-3373-00
3R16	RESISTOR, FIXED, COMPOSITION: 100 ohms $\pm 10\%$ , 1/2 w	745-1310-00
3R17	RESISTOR, FIXED, COMPOSITION: same as 3R16	745-1310-00
3R18	RESISTOR, FIXED, WIREWOUND: 120 ohms $\pm 5\%$ 25 w	747-8635-00
3R19	RESISTOR, FIXED, WIREWOUND: 18 ohms $\pm 5\%$ 11 w	747-0216-00
3R20	RESISTOR, FIXED, COMPOSITION: 2200 ohms, 5 w	747-5467-00
3T1	TRANSFORMER, POWER, STEP-UP: open frame; 54 v peak, 400 cps, single phase primary; 410 v peak, 410 v peak secondary; 0.937 in by 0.937 in. by 1.437 in. o/a dim	664-1006-00

SECTION VI  
Parts List

ITEM	DESCRIPTION 28 VOLT POWER SUPPLY (CONT'D)	COLLINS PART NUMBER
3T2	TRANSFORMER, POWER STEP-UP: open frame, 27 v dc primary, center tapped, 400 cps, 1 phase 850 v dc, 185 ma secondary; 3-1/4 in. by 3-5/16 in. by 3-11/16 in.	664-0284-00
3T3	TRANSFORMER, POWER, STEP-UP: open frame; 27 v dc, 400 cps, 1 phase primary, 300 v dc, zero ma, 260 v dc, 220 ma secondary; 1-7/8 in. by 2 in. by 3-1/6 in.	664-1009-00
3TB1	TERMINAL BOARD: phenolic, 1/16 in. by 3/8 in. by 1-1/2 in. 4 brass solder lug terminals	306-9032-00
3TB2	TERMINAL BOARD: same as 3TB1	306-9032-00
3TB3	TERMINAL BOARD: same as 3TB1	306-9032-00
3TB4	TERMINAL BOARD: Bakelite, two terminals mounted, 1 terminal grounded; 3/4 in. by 3/8 in. excluding terminals	306-2220-00
3TB5	TERMINAL BOARD: same as 3TB4	306-2220-00
3XF1	FUSEHOLDER: extractor post type; 125 v 15 amp 11/16 in. dia. by 2-9/64 in. lg. overall	265-1019-00
3XF2	FUSEHOLDER: same as 3XF1	265-1019-00
3XF3	FUSEHOLDER: same as 3XF1	265-1019-00
12-VOLT POWER SUPPLY		547-3993-00
4C1	CAPACITOR, FIXED, ELECTROLYTIC: 250 uf, -20°C to +85°C operating temp. range, 25 v dc	183-1305-00
4C2	CAPACITOR, FIXED, ELECTROLYTIC: same as 4C1	183-1305-00
4C3	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 100,000 uuf, GMV, 100 v dc	913-3681-00
4C4	CAPACITOR, FIXED, CERAMIC DIELECTRIC: same as 4C3	913-3681-00
4CR1	SEMICONDUCTOR DEVICE, DIODE: silicon, General Electric part no. 1N1487	353-1662-00
4CR2	SEMICONDUCTOR DEVICE, DIODE: same as 4CR1	353-1662-00
4CR3	SEMICONDUCTOR DEVICE, DIODE: same as 4CR1	353-1662-00
4CR4	SEMICONDUCTOR DEVICE, DIODE: same as 4CR1	353-1662-00
4CR5	SEMICONDUCTOR DEVICE, DIODE: silicon, General Electric part no. 1N538	353-1526-00
4F1	FUSE: 20 amp, SFE	264-0732-00
4F2	FUSE: 15 amp, AGC	264-0731-00
4K1	RELAY, ARMATURE: contact arrangement 1A, 15 amp at 28 v dc or 115 v ac resistive, 12 v dc nom working voltage, 60 ohms ±10% coil resistance	970-1858-00
4K2	RELAY: 12 v dc, 60 ohms DPST	970-2131-00
4L1	COIL, RADIO FREQUENCY: 5.5 uh, ±20%, 15-3/4 turns; 2-3/4 in. lg overall, 8-32NC-2 thd one end	240-0021-00
4L2	COIL, RADIO FREQUENCY: choke; single layer wound; 26 turns no. 14 AWG wire; 2.218 in. lg by 31/32 in. w by 3/4 in. dia. overall	240-0002-00



ITEM	DESCRIPTION 12 VOLT POWER SUPPLY (CONT'D)	COLLINS PART NUMBER
4P1	CONNECTOR, RECEPTACLE ELECTRICAL: 27 male contacts, panel mtg; phenolic insulation modified	547-3030-00
4Q1	TRANSISTOR: germanium, Motorola type 2N1556	352-0290-00
4Q2	TRANSISTOR: same as 4Q1	352-0290-00
4Q3	TRANSISTOR: same as 4Q1	352-0290-00
4Q4	TRANSISTOR: same as 4Q1	352-0290-00
4Q5	TRANSISTOR: same as 4Q1	352-0290-00
4Q6	TRANSISTOR: same as 4Q1	352-0290-00
4R1	RESISTOR, FIXED, WIREWOUND: 300 ohms, ±5%, 2 w	747-9321-00
4R2	RESISTOR, FIXED, WIREWOUND: same as 4R1	747-9321-00
4R3	RESISTOR, FIXED, COMPOSITION: 10 ohms, ±10%, 1/2 w	745-1268-00
4R4	RESISTOR, FIXED, COMPOSITION: same as 4R3	745-1268-00
4R5	RESISTOR, FIXED, COMPOSITION: same as 4R3	745-1268-00
4R6	RESISTOR, FIXED, COMPOSITION: same as 4R3	745-1268-00
4R7	RESISTOR, FIXED, COMPOSITION: same as 4R3	745-1268-00
4R8	RESISTOR, FIXED, COMPOSITION: same as 4R3	745-1268-00
4R9	RESISTOR, FIXED, COMPOSITION: same as 4R3	745-1268-00
4R10	RESISTOR, FIXED, COMPOSITION: same as 4R3	745-1268-00
4R11	RESISTOR, FIXED, COMPOSITION: same as 4R3	745-1268-00
4R12	RESISTOR, FIXED, COMPOSITION: same as 4R3	745-1268-00
4R13	RESISTOR, FIXED, COMPOSITION: same as 4R3	745-1268-00
4R14	RESISTOR, FIXED, COMPOSITION: same as 4R3	745-1268-00
4R15	RESISTOR, FIXED, COMPOSITION: 12 ohms, ±5%, 2 w	745-5572-00
4R16	RESISTOR, FIXED, COMPOSITION: 470 ohms, ±10%, 2 w	745-5638-00
4T1	TRANSFORMER, POWER, STEP-UP: open frame, 27 v peak, 400 cps, single phase primary; 217 v peak, 217 v peak secondary; 0.937 in. by 0.937 in. by 1.375 in o/a dim.	664-1004-00
4T2	TRANSFORMER, POWER, STEP-UP: open frame, 16 v peak, 400 cps, single phase ct primary; 250 ma max. 850 v max secondary; 3.250 in. by 3.312 in. by 3.687 in o/a dim.	664-0276-00
4T3	TRANSFORMER, POWER, STEP-UP: open frame, 16 v peak, 400 cps, single phase ct primary; 20.8 v peak, 20.8 v peak; 174.4 v peak tapped at 100.8 v peak secondary; 1.875 in. by 2 in. by 3.062 in. o/a dim.	664-1005-00
4TB1	TERMINAL BOARD: phenolic 12 solder lug terminals	306-0909-00
4TB2	TERMINAL BOARD: same as 4TB1	306-0909-00
4TB3	TERMINAL BOARD: Bakelite, two terminals; 3/8 in. by 3/4 in.	306-2220-00
4TB4	TERMINAL BOARD: same as 4TB3	306-2220-00
4XF1	FUSEHOLDER: extractor post type; 125 v, 15 amp; 11/16 in. dia. by 2-9/64 in lg. o/a	265-1019-00
4XF2	FUSEHOLDER: same as 4XF1	265-1019-00

SECTION VI  
Parts List

ITEM	DESCRIPTION	COLLINS PART NUMBER
	CONTROL UNIT 48A1-SW CONTROL UNIT 48B2-SW	522-6240-00 522-6275-00
C1	NOT USED	
C2	CAPACITOR, FIXED, PAPER: 0.22 uf, ±20%; 100 vdcw; Sprague Electric part no. 186P22401S3	931-5652-00
C3	CAPACITOR, FIXED, ELECTROLYTIC: 7 uf, -10% +100%, 50 vdcw	183-1171-00
C4	CAPACITOR, FIXED, PAPER: 0.22 uf ±20%;	931-5663-00
C5	CAPACITOR, FIXED, CERAMIC: 47,000 uuf ±20%; 400 vdcw	913-3735-00
C6	CAPACITOR, FIXED, CERAMIC: 100,000 uuf ±20%; 400 vdcw	913-3737-00
C7	CAPACITOR, FIXED, PAPER: 2 uf, 50 vdcw Fernando Electric part no. MS53205	951-0969-00
C8	CAPACITOR, FIXED, PAPER: same as C7	951-0969-00
C9	CAPACITOR, FIXED, ELECTROLYTIC: 150 uf, -10% +100% 50 vdcw	183-1564-00
CR1	NOT USED	
CR2	NOT USED	
DS1	LAMP: Flange Base, 28 volt, 0.04 amp Filament C-2F	262-1207-00 262-0179-00 (used on 48B2-SW)
DS2 thru DS6	LAMP: same as DS1 Filament C-2F	262-1207-00 262-0179-00 (used on 48B2-SW)
HS1	HANDSET:	564-8645-002 (48A1-SW) 564-8639-003 (48B2-SW)
J1	CONNECTOR: 15 contact for printed circuit cards	372-1583-00
J2	CONNECTOR PLUG: 18 contacts, Chassis mtg. (used on 48B2-SW)	365-2180-00
LS1	LOUDSPEAKER: 4 in. round, permanent magnet, Quam type 4-AIR, voice coil imp. 3.2 ohms.	271-0230-00 (48A1-SW) 271-0229-00 (48B2-SW)
P2	CONNECTOR PLUG: 18 contacts	365-8180-00 (used on 48A1-SW)
Q1	TRANSISTOR, GERMANIUM: PNP, alloy junction medium power; Philco part no. 2N671	352-0117-00
Q2 thru Q4	TRANSISTOR, GERMANIUM: same as Q1	352-0017-00
R1	NOT USED	
R2	RESISTOR, VARIABLE, COMPOSITION: 25,000 ohms, ±20%, 1 w, linear taper	380-1342-00
R3	RESISTOR, FIXED, COMPOSITION: 10,000 ohms, ±10%, 1/2 w	745-1394-00
R4	RESISTOR, FIXED, COMPOSITION: 4700 ohms, ±10%, 1/2 w	745-1380-00
R5	RESISTOR, FIXED, COMPOSITION: 16,000 ohms, ±5%, 1/2 w	745-1403-00
R6	RESISTOR, FIXED, COMPOSITION: 510 ohms, ±5%, 1/2 w	745-1340-00

SECTION VI  
Parts List

ITEM	DESCRIPTION CONTROL UNIT 48A1-SW AND CONTROL UNIT 48B2-SW (CONT'D)	COLLINS PART NUMBER
R7	RESISTOR, FIXED, COMPOSITION: same as R5	745-1403-00
R8	RESISTOR, FIXED, COMPOSITION: 75,000 ohms, ±5%, 1/2 w	745-1431-00
R9	RESISTOR, FIXED, COMPOSITION: 100 ohms, ±10%, 1/2 w	745-1310-00
R10	RESISTOR, FIXED, COMPOSITION: same as R9	745-1310-00
R11	RESISTOR, FIXED, COMPOSITION: same as R8	745-1431-00
R12	RESISTOR, FIXED, COMPOSITION: 27,000 ohms, ±10%, 1/2 w	745-1412-00
R13	RESISTOR, FIXED, COMPOSITION: 10 ohms, ±10%, 1/2 w	745-1268-00
R14	RESISTOR, FIXED, COMPOSITION: same as R13	745-1268-00
R15	RESISTOR, FIXED, COMPOSITION: same as R12	745-1412-00
R16	RESISTOR, VARIABLE, COMPOSITION: 500 ohms, ±20%, 2 w, linear taper	380-0636-00 380-5773-00 (used on 48B2-SW)
R17	RESISTOR, FIXED, COMPOSITION: 33,000 ohms ±10%, 2 w	745-5589-00
S8	SWITCH: Single pole, double throw (dial)	266-7002-00 (used on 48A1-SW)
S9	SWITCH: Part of Telephone Dial	564-8591-002 (used on 48A1-SW)
T1	TRANSFORMER: Driver	667-0021-00
T2	TRANSFORMER: Audio Interstage	667-0022-00
T3	TRANSFORMER: Audio	667-0024-00
T4	TRANSFORMER: Audio	667-0023-00
TB1	TERMINAL BOARD:	564-8598-00 367-0138-00 (used on 48B2-SW)
TB2	TERMINAL BOARD: same as TB1	367-0138-00 (used on 48B2-SW)
TB3	TERMINAL BOARD:	367-0136-00 (used on 48B2-SW)

SECTION VI  
Parts List

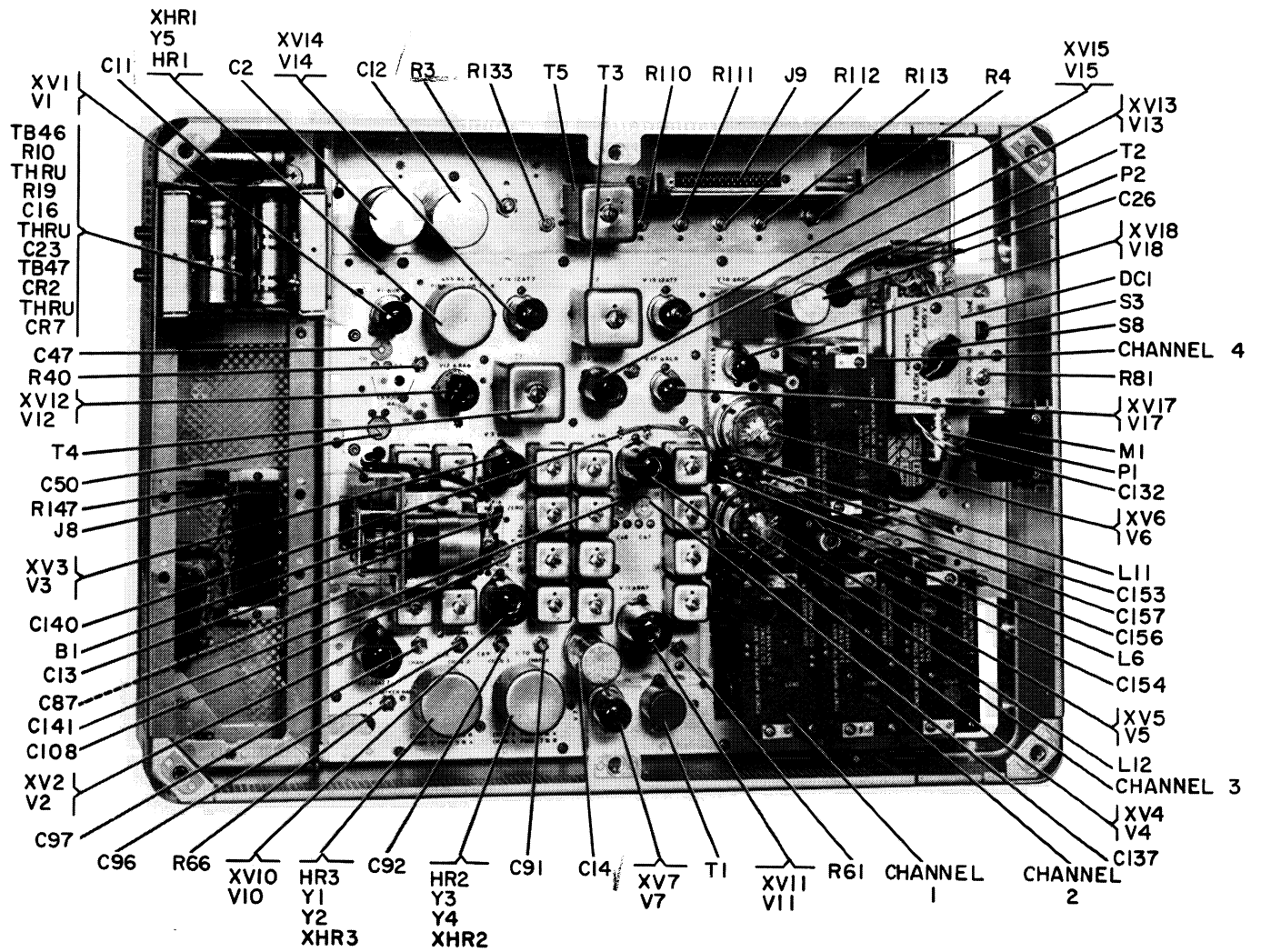


Figure 6-1 32MS-1A, Top View, Cover and Shield Removed, Keyed

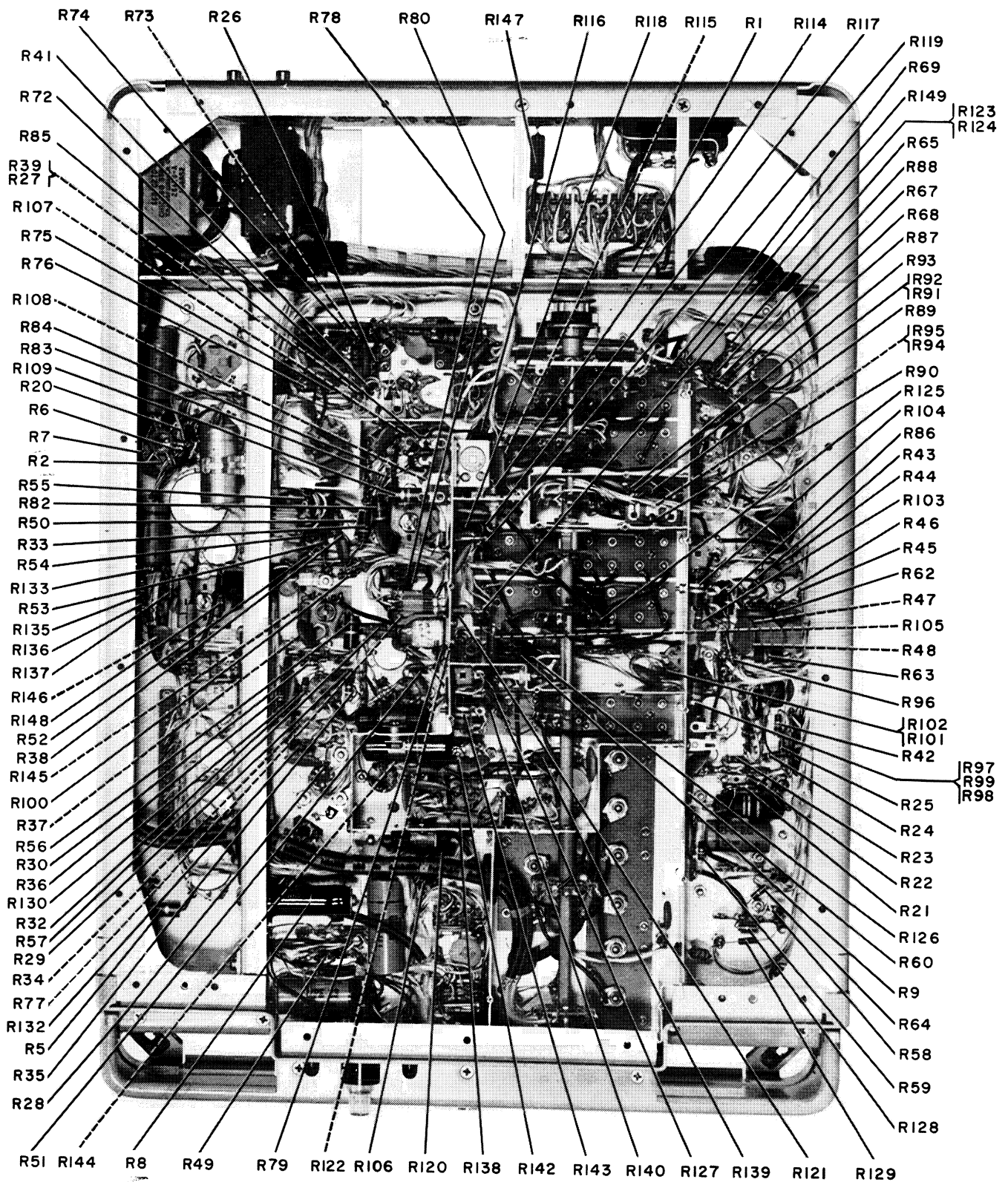


Figure 6-2 32MS-1A, Bottom View (A), Cover and Shield Removed, Keyed

SECTION VI  
Parts List

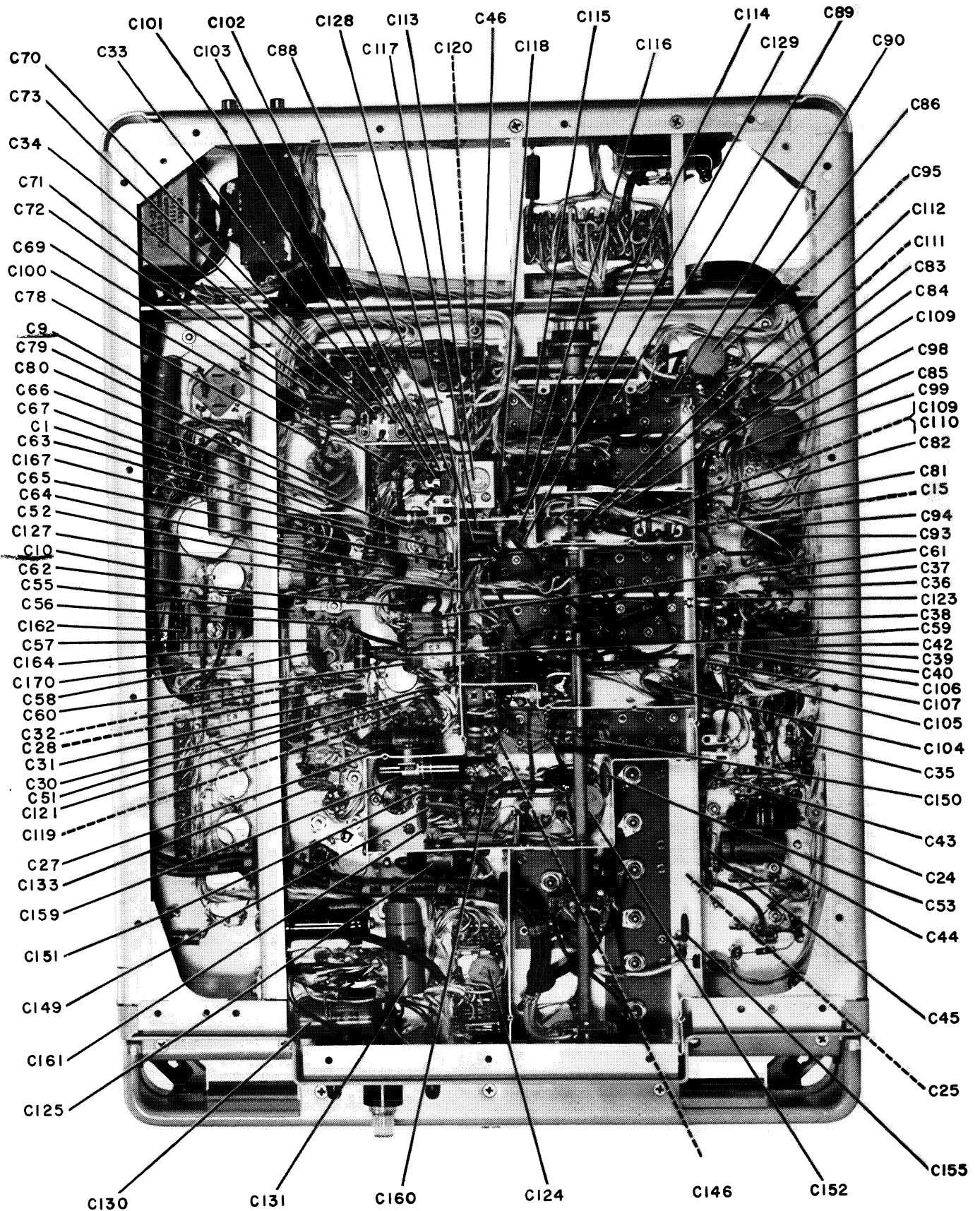


Figure 6-3 32MS-1A, Bottom View (B), Cover and Shield Removed, Keyed



SECTION VI  
Parts List

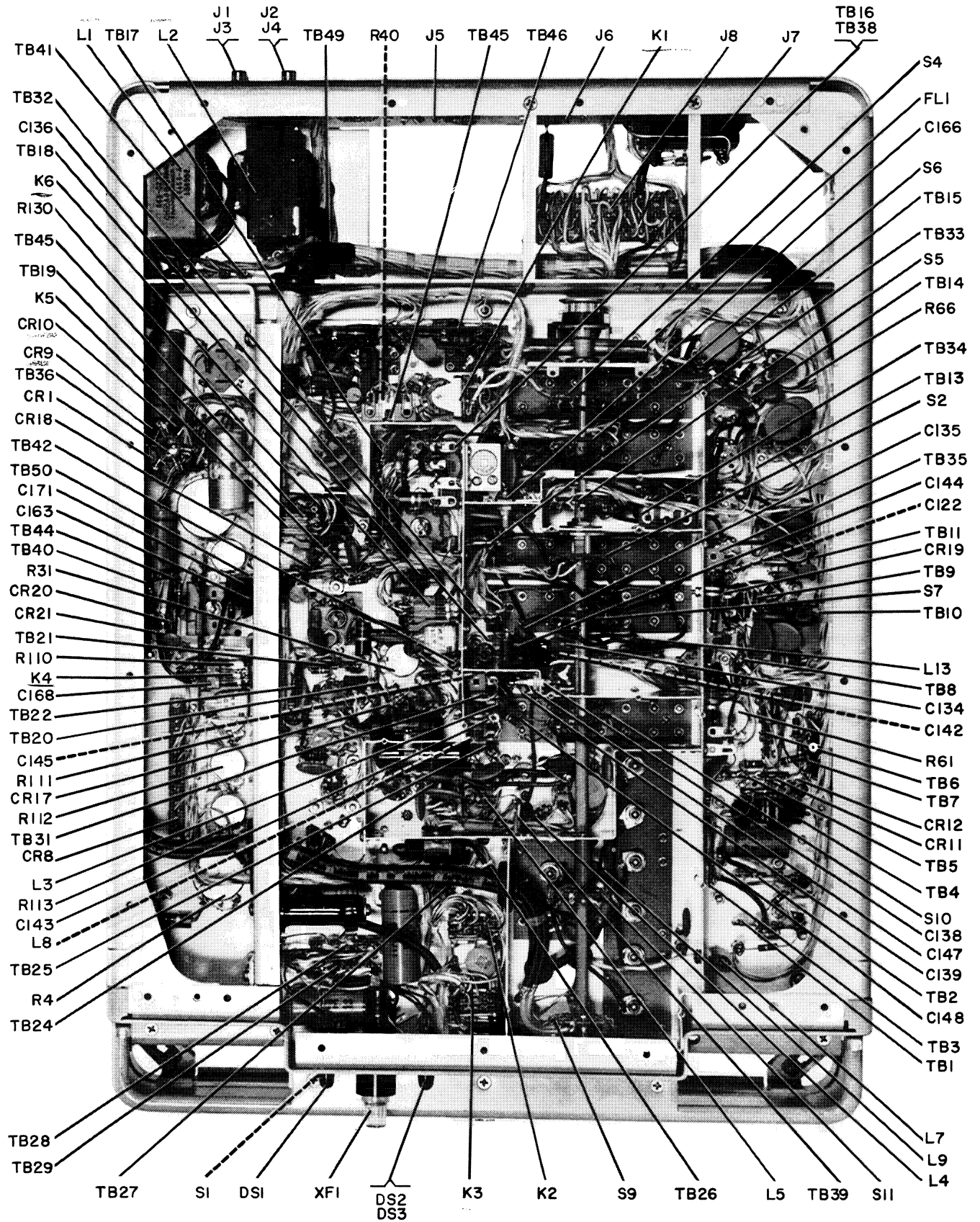


Figure 6-4 32MS-1A, Bottom View (C), Cover and Shield Removed, Keyed

SECTION VI  
Parts List

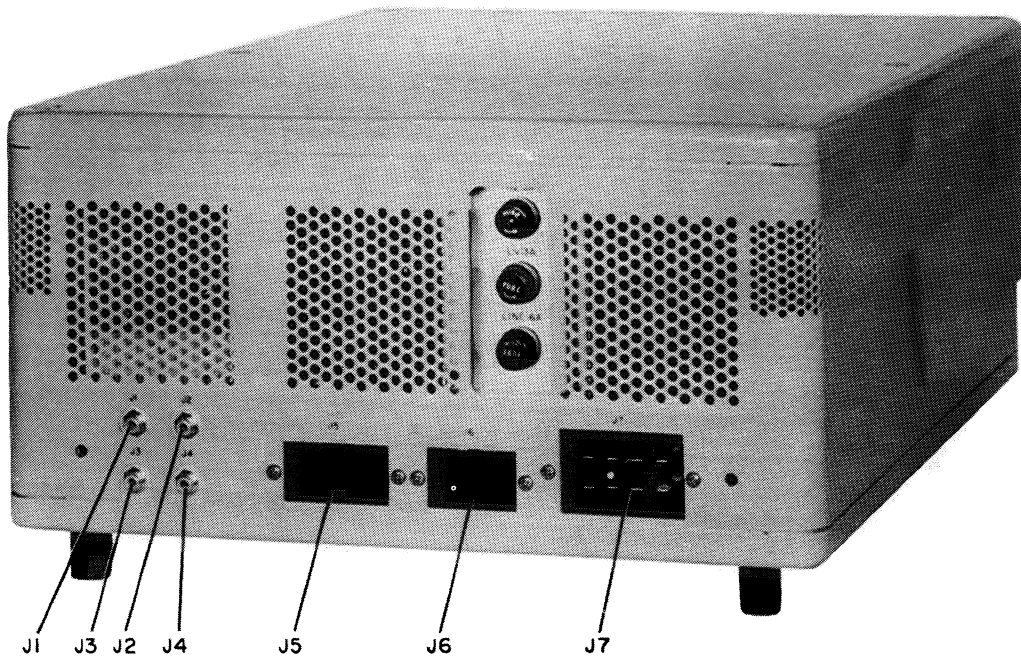


Figure 6-5 32MS-1A, Rear View, Keyed

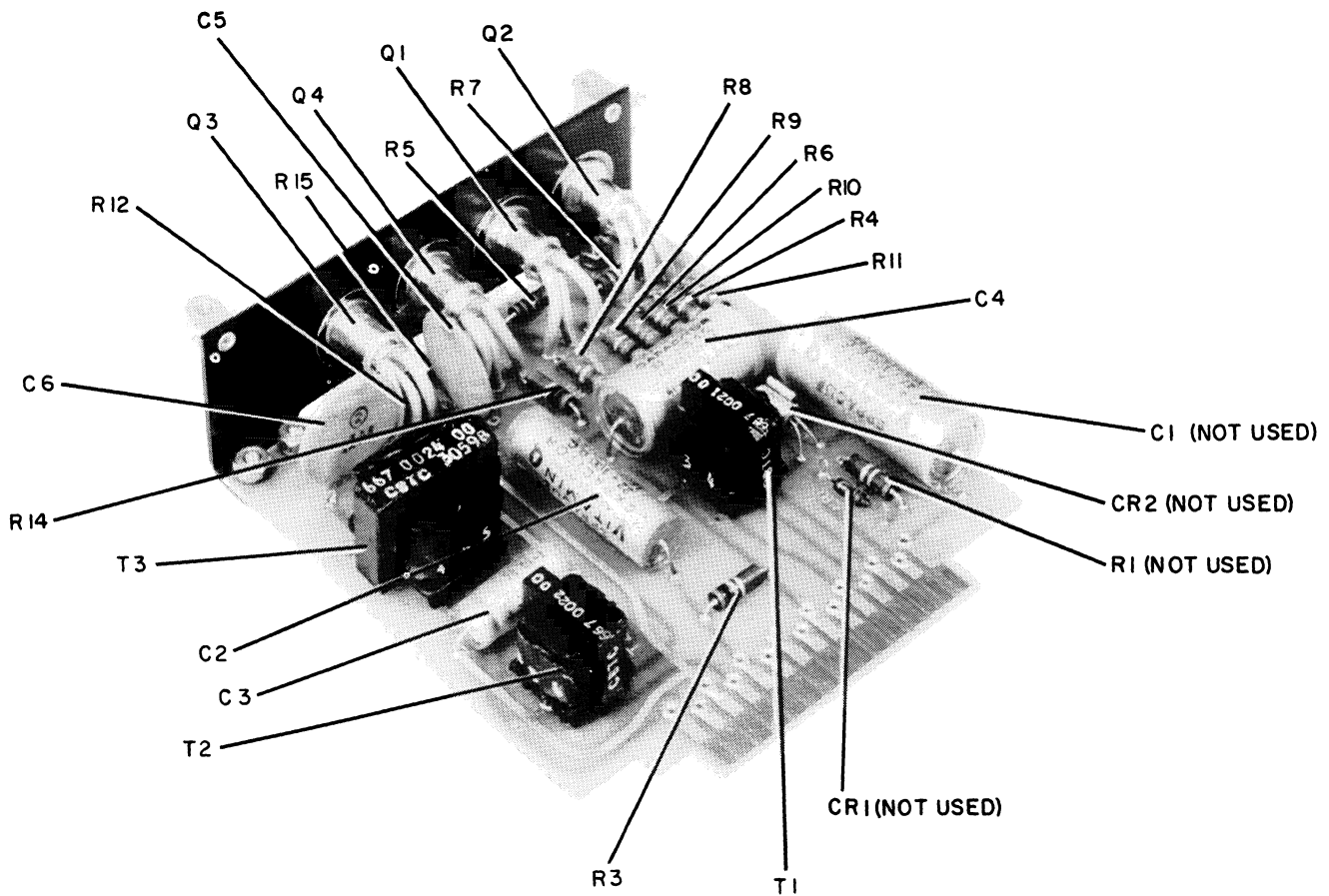


Figure 6-6 Control Unit 48A1-SW or 48B2-SW Circuit Board, Keyed



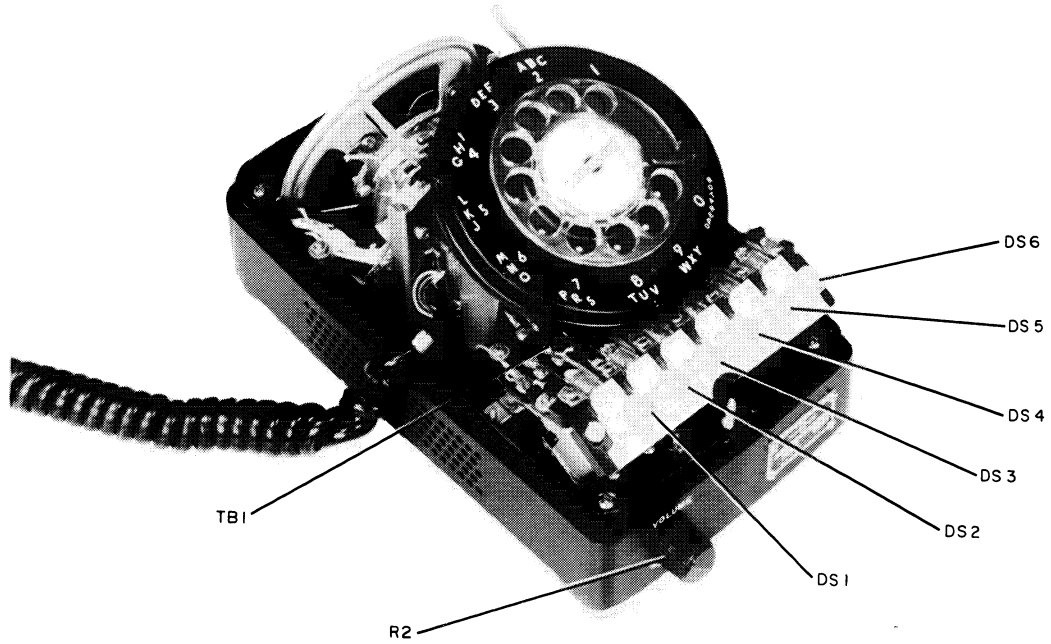


Figure 6-7 Control Unit 48A1-SW, Front View, Keyed

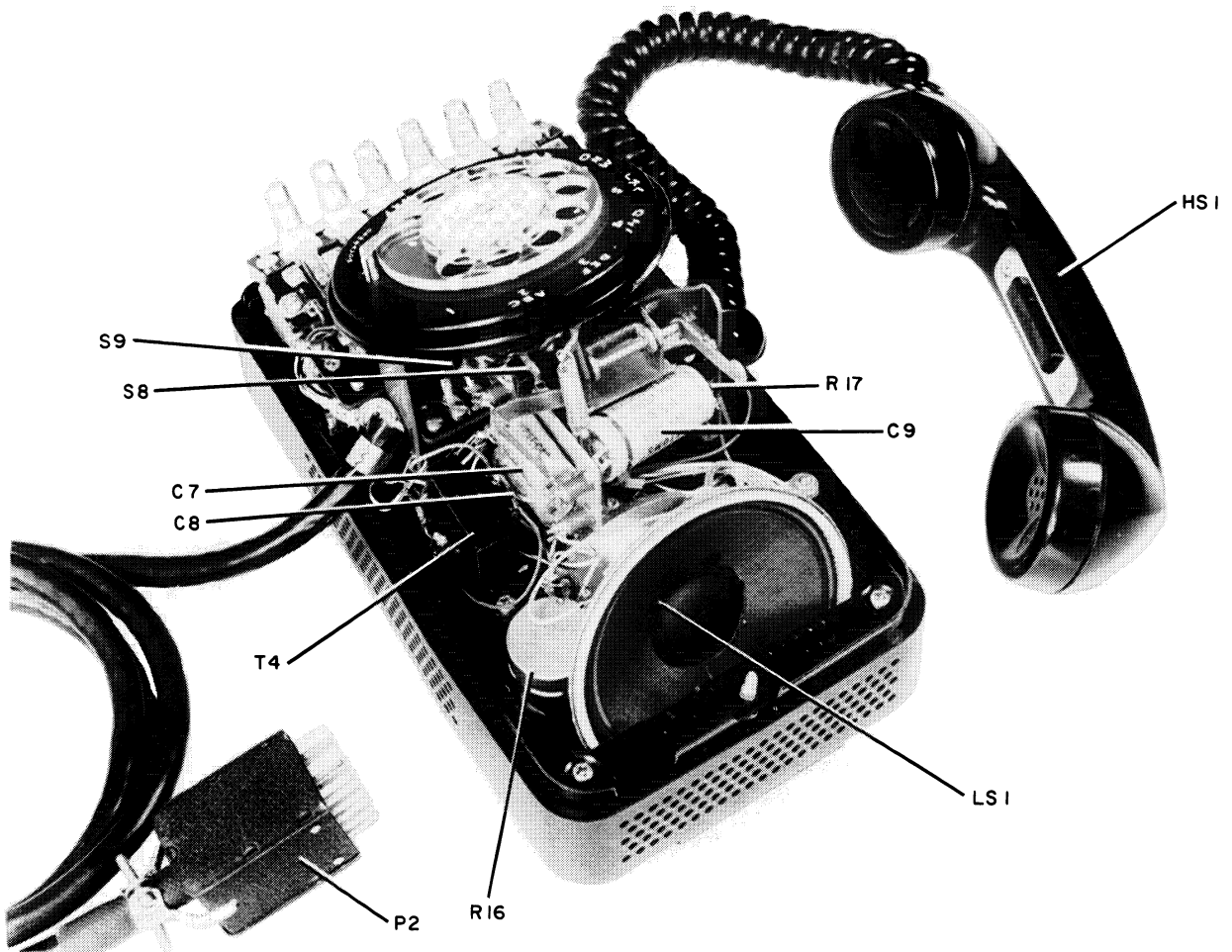


Figure 6-8 Control Unit 48A1-SW, Rear View, Keyed

SECTION VI  
Parts List

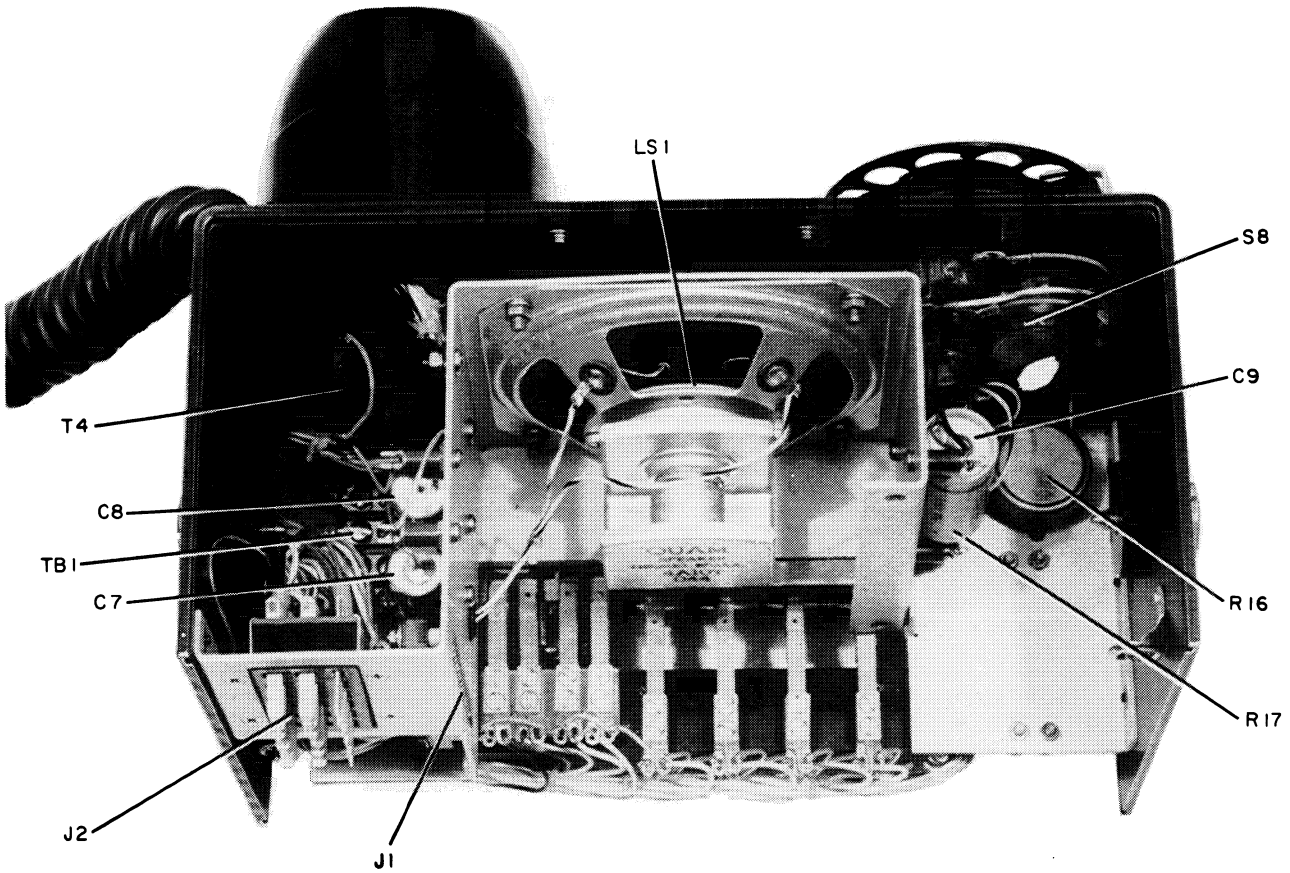


Figure 6-9 Control Unit 48B2-SW, Top View, Keyed

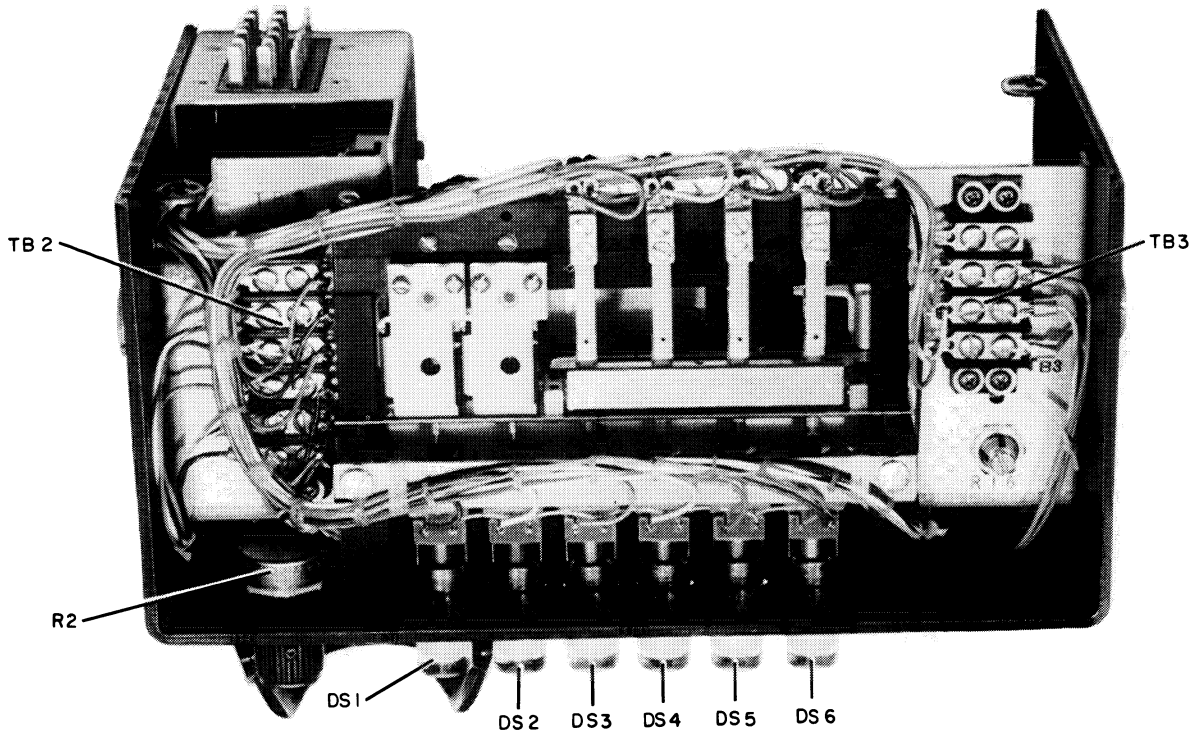


Figure 6-10 Control Unit 48B2-SW, Bottom View, Keyed

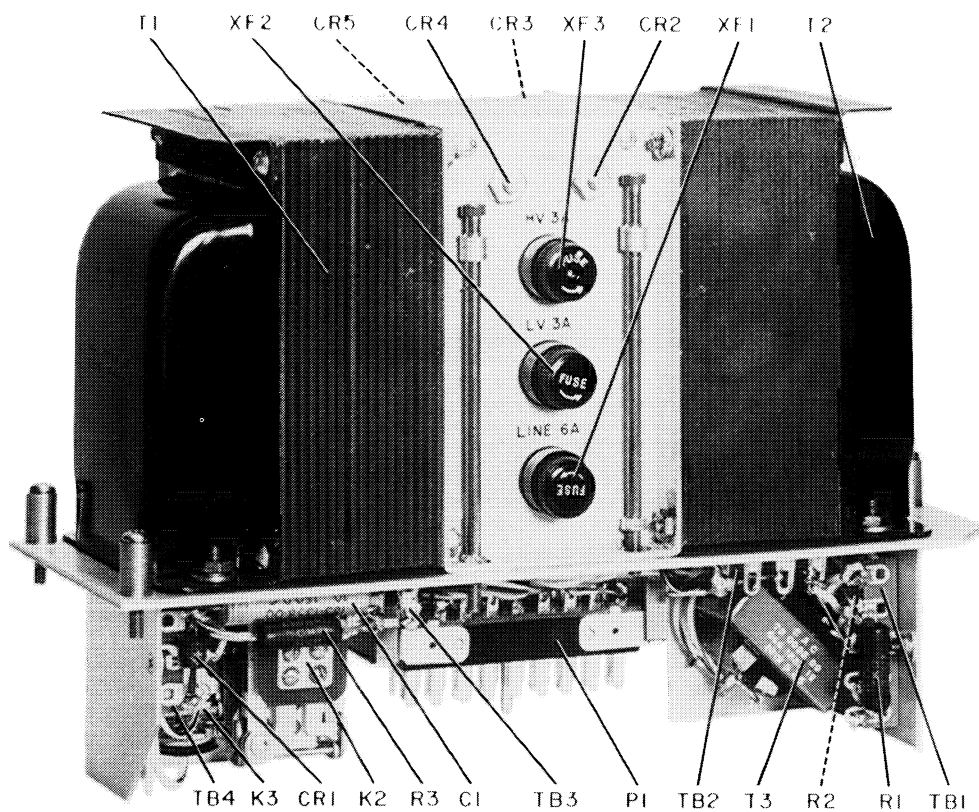


Figure 6-11 115 Volt A-C Power Supply, Overall View, Keyed

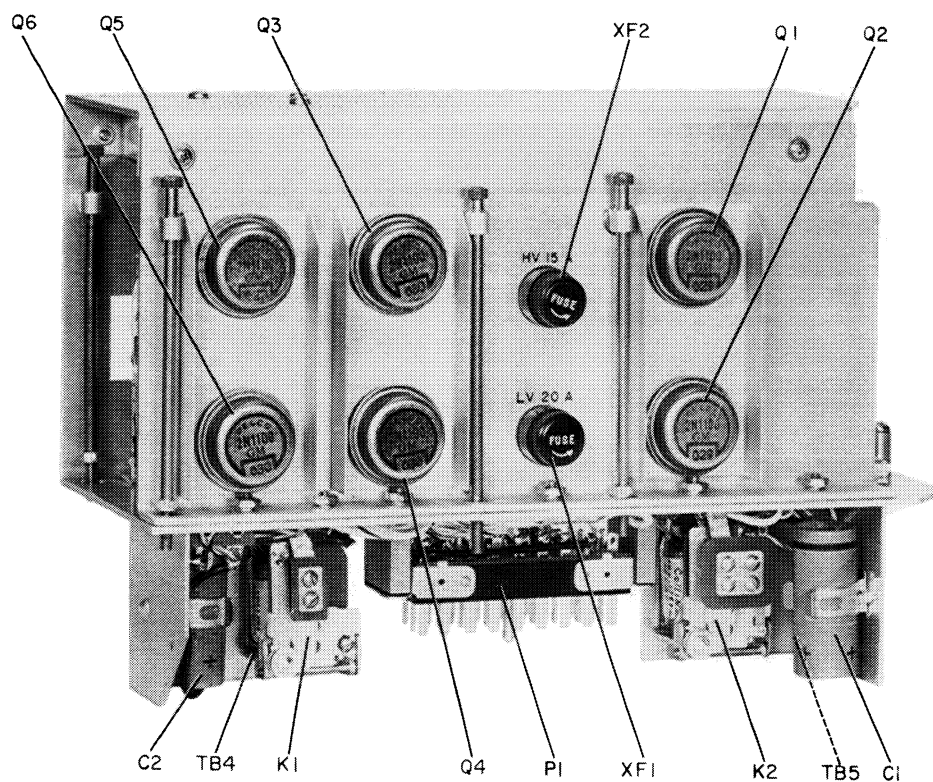


Figure 6-12 12 Volt D-C Power Supply, Overall View, Keyed

SECTION VI  
Parts List

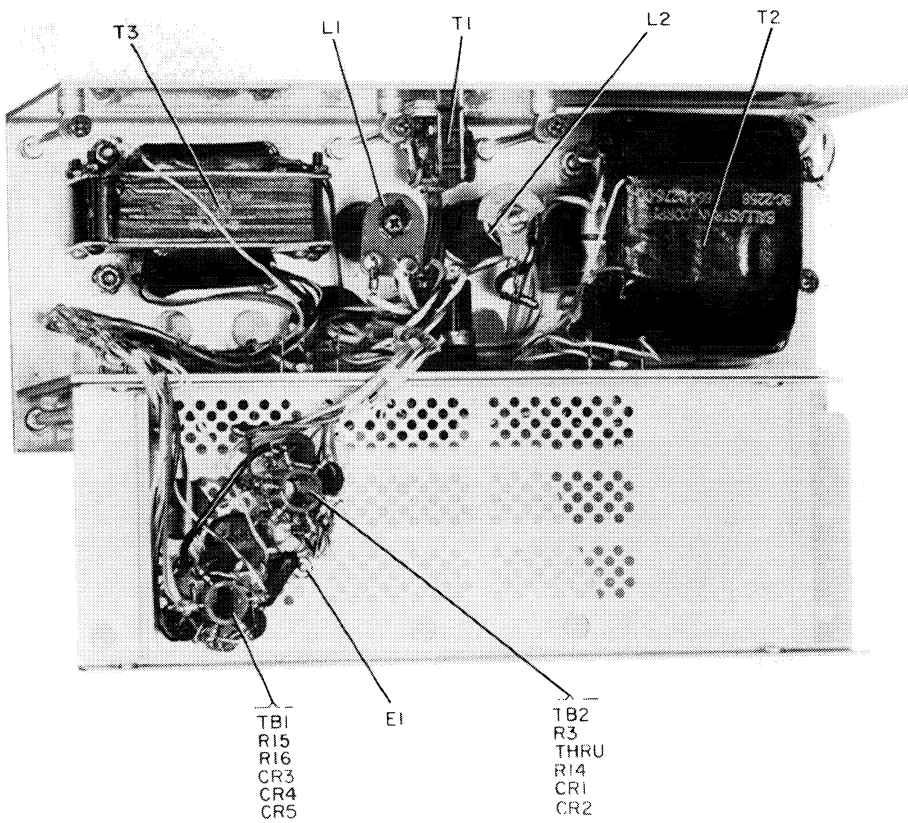


Figure 6-13 12 Volt D-C Pow - Supply, Inside View, Keyed

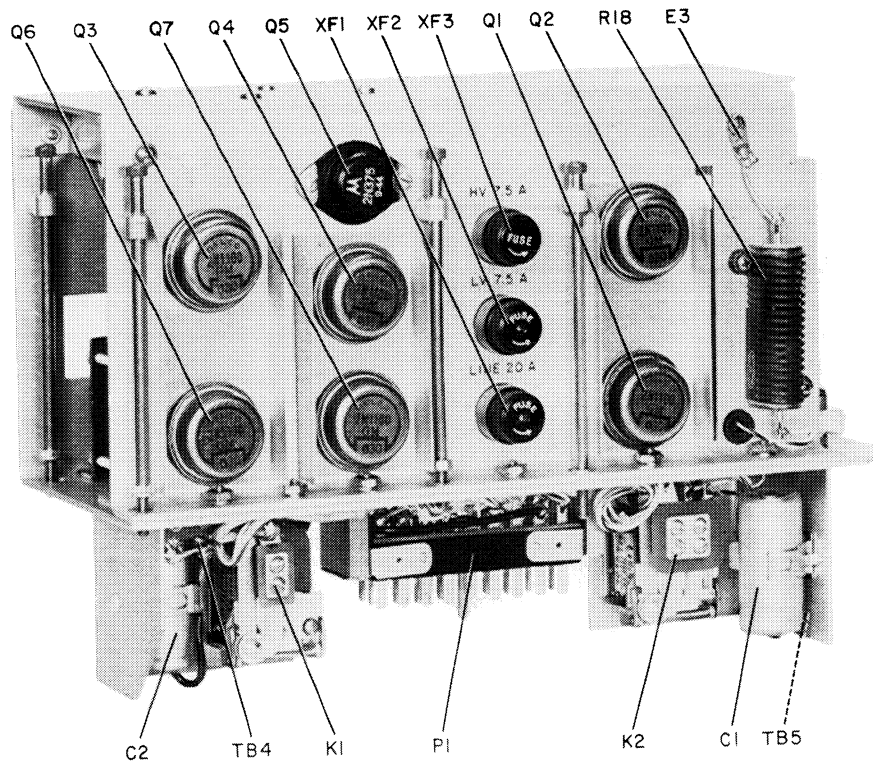


Figure 6-14 28 Volt D-C Power Supply, Overall View, Keyed

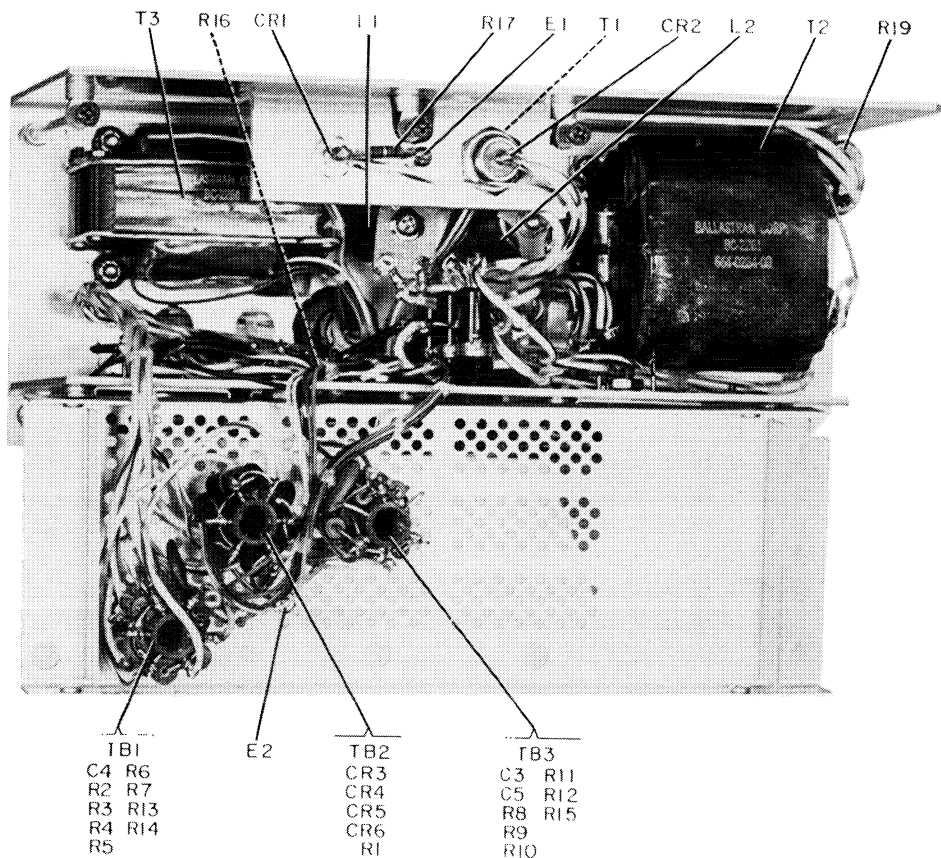


Figure 6-15 28 Volt D-C Power Supply, Inside View, Keyed

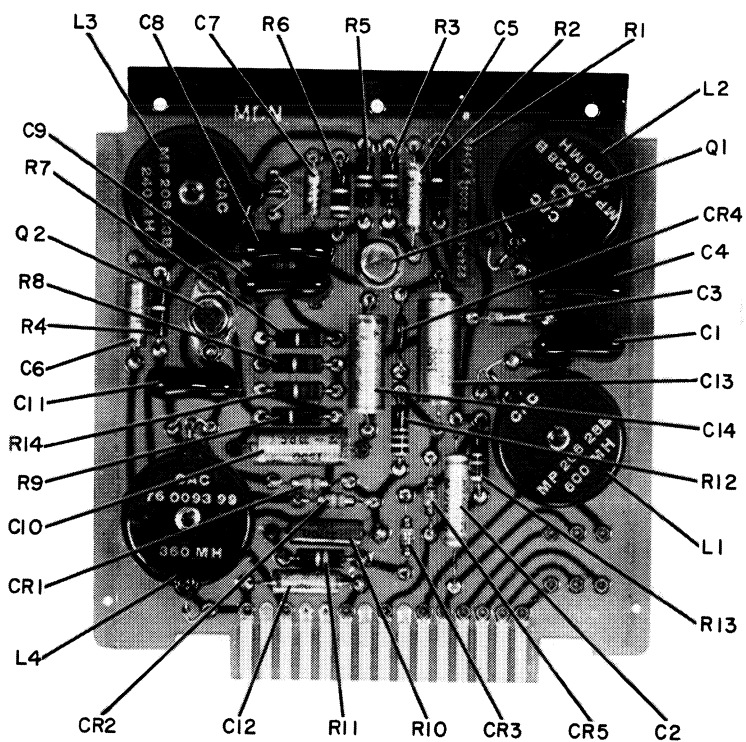
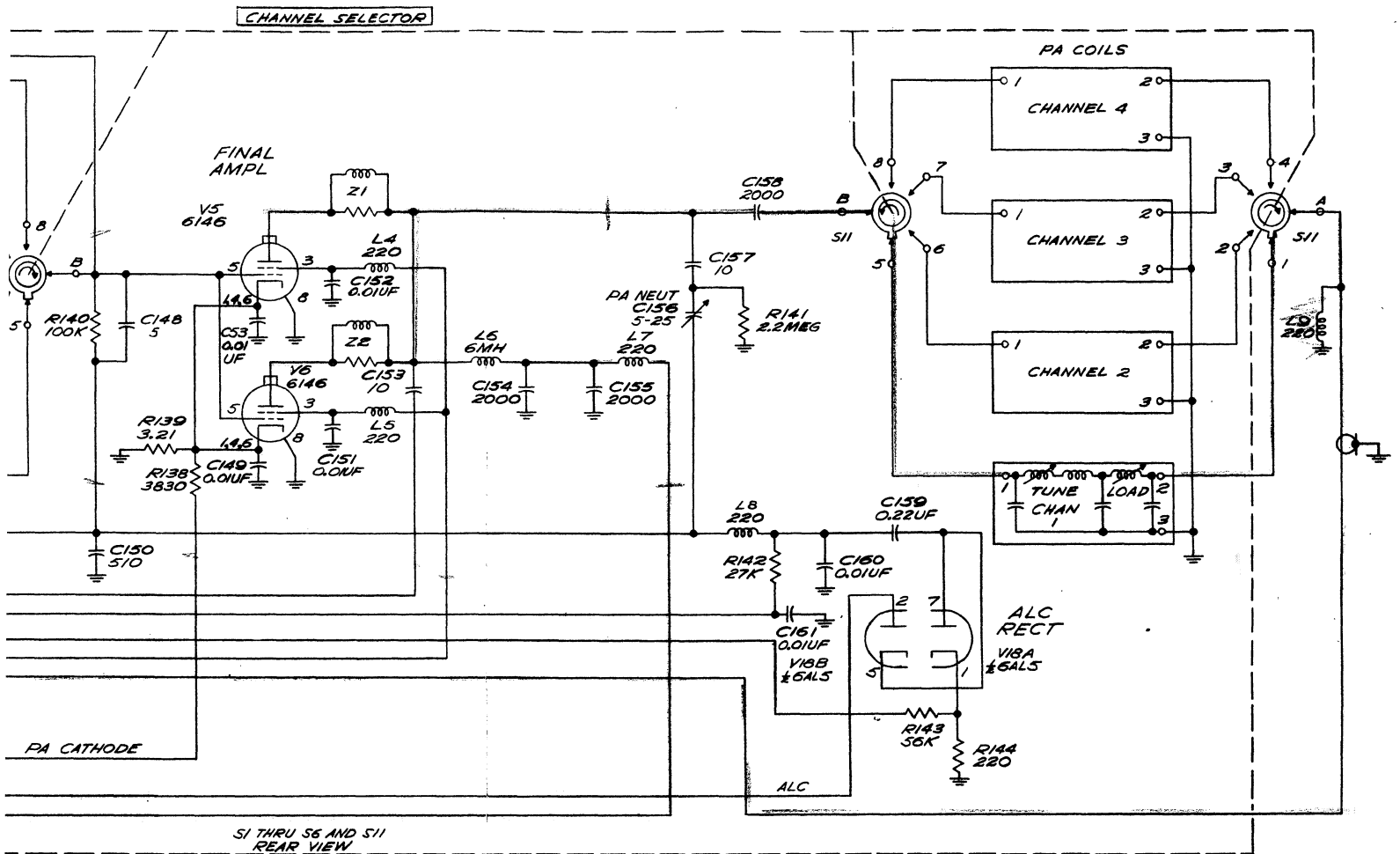
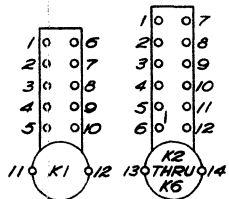
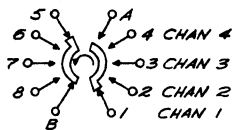


Figure 6-16 Automatic Receiver Gain Control Board, Top View, Keyed





S1 THRU S6 AND S11  
REAR VIEW

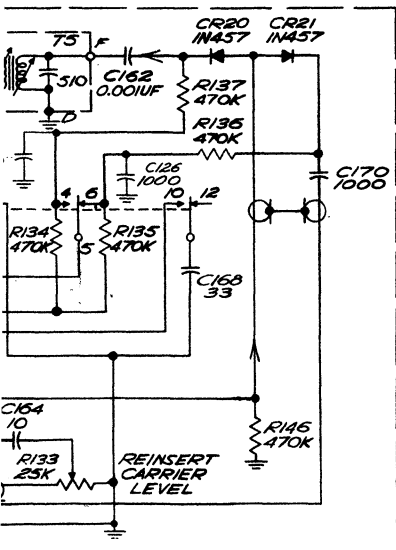


K1, K2 AND K3 SHOWN  
IN RECEIVE POSITION.  
K4 AND K5 SHOWN IN  
SSB POSITION. K5 IS  
SHOWN IN NON-OPERATE  
POSITION.



NOTES:

- UNLESS OTHERWISE INDICATED: ALL RESISTANCE VALUES ARE IN OHMS, ALL CAPACITANCE VALUES ARE IN MICROMICROFARADS, AND ALL INDUCTANCE VALUES ARE IN MICROHENRYS.
- RECEIVER MIXER PLATE AND SCREEN VOLTAGES VARY WITH CHANNEL CRYSTAL ACTIVITY.
- C29 IS SELECTED IN TEST. NORMAL RANGE OF VALUES: 22UF THROUGH 68UF. C75 IS SELECTED IN TEST. NORMAL RANGE OF VALUES: 82UF THROUGH 220UF.
- IF ONLY ONE ANTENNA USED ON ALL CHANNELS, JUMPER 1,2,3,4 OF S3A DISCONNECT UNUSED COAX CABLES AT S9

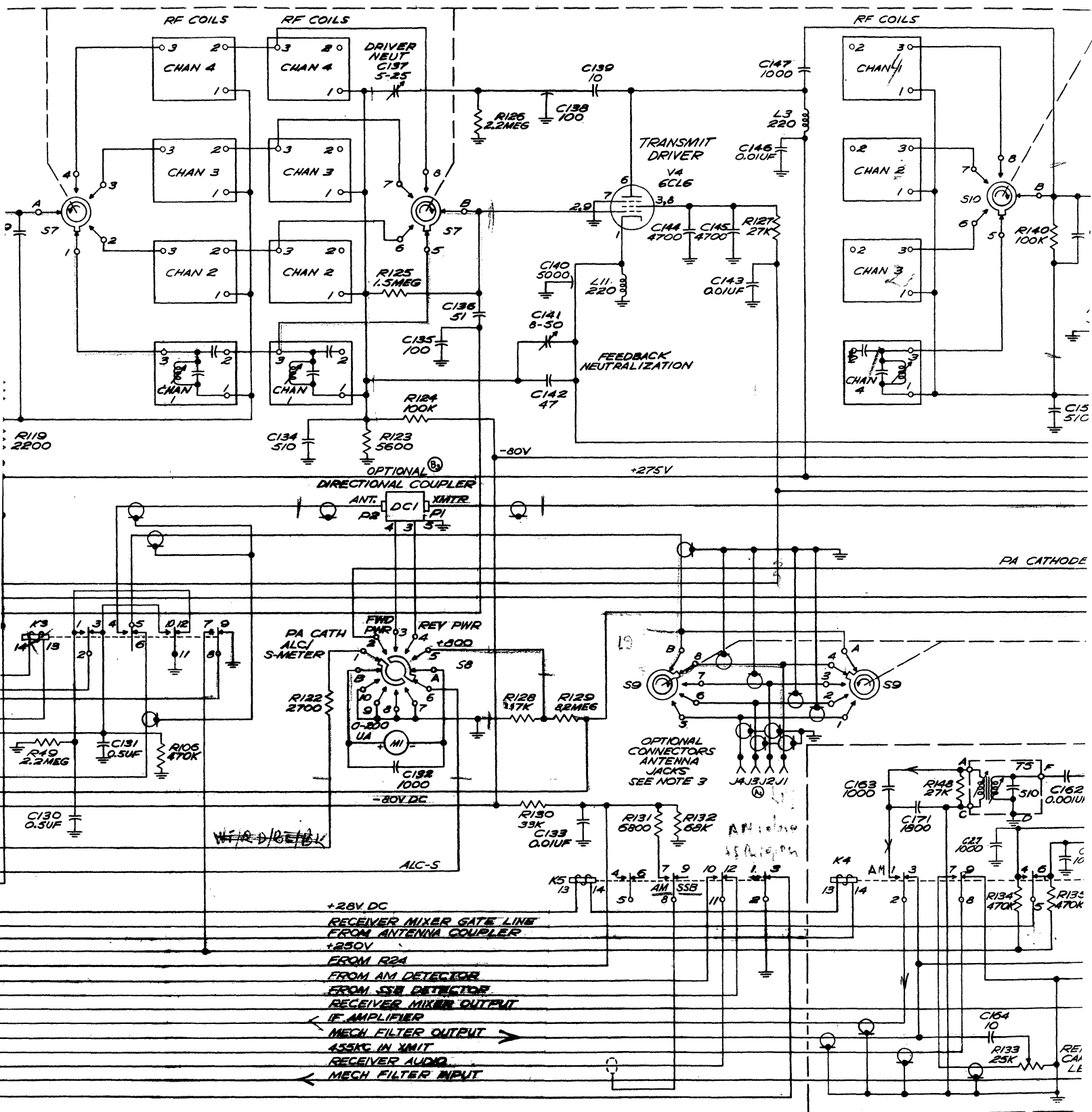


LAST CAPACITOR NO IS C187  
LAST RESISTOR NO IS R151

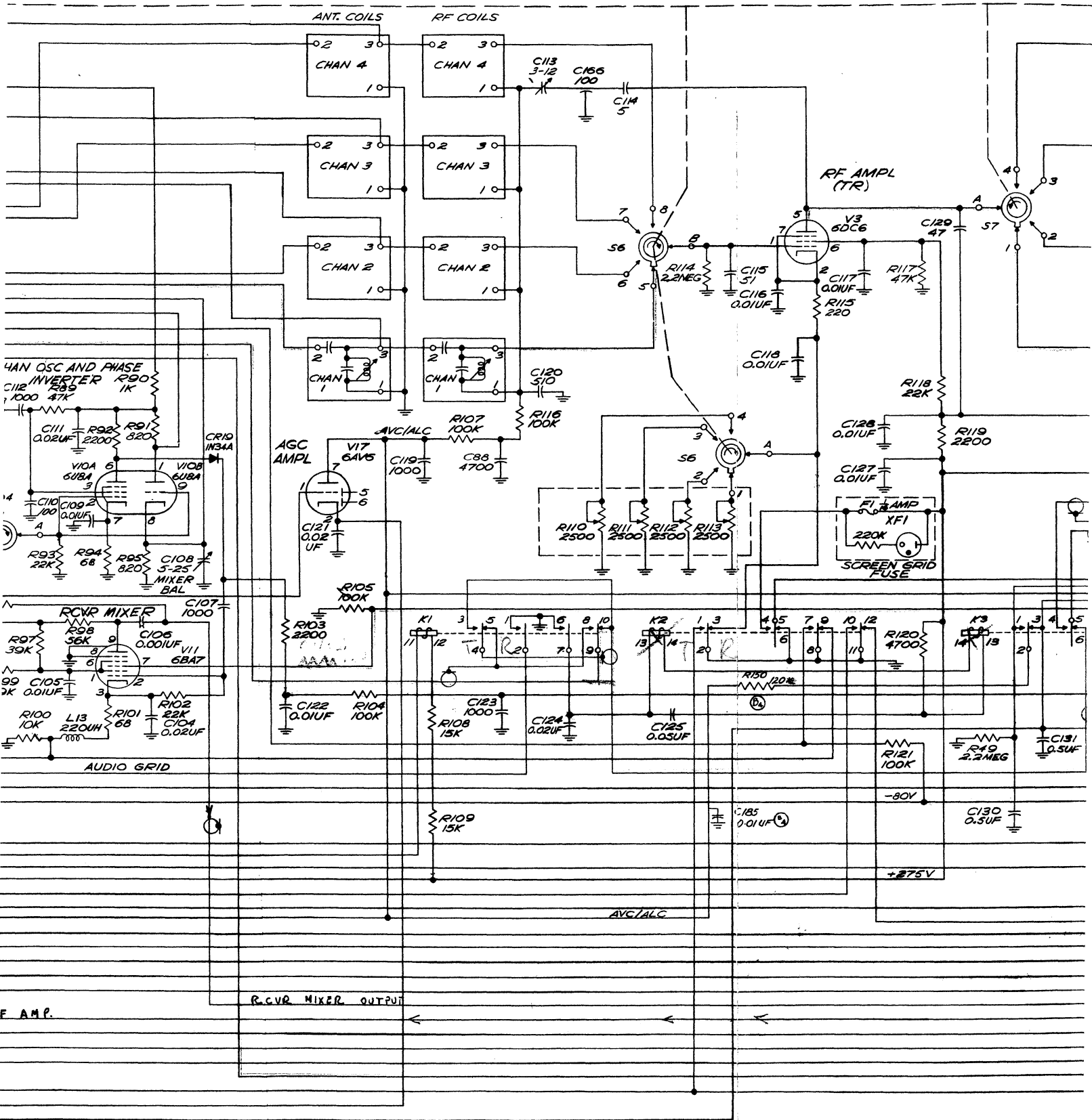
Figure 7-1 Transceiver 32MS-1A, Schematic Diagram



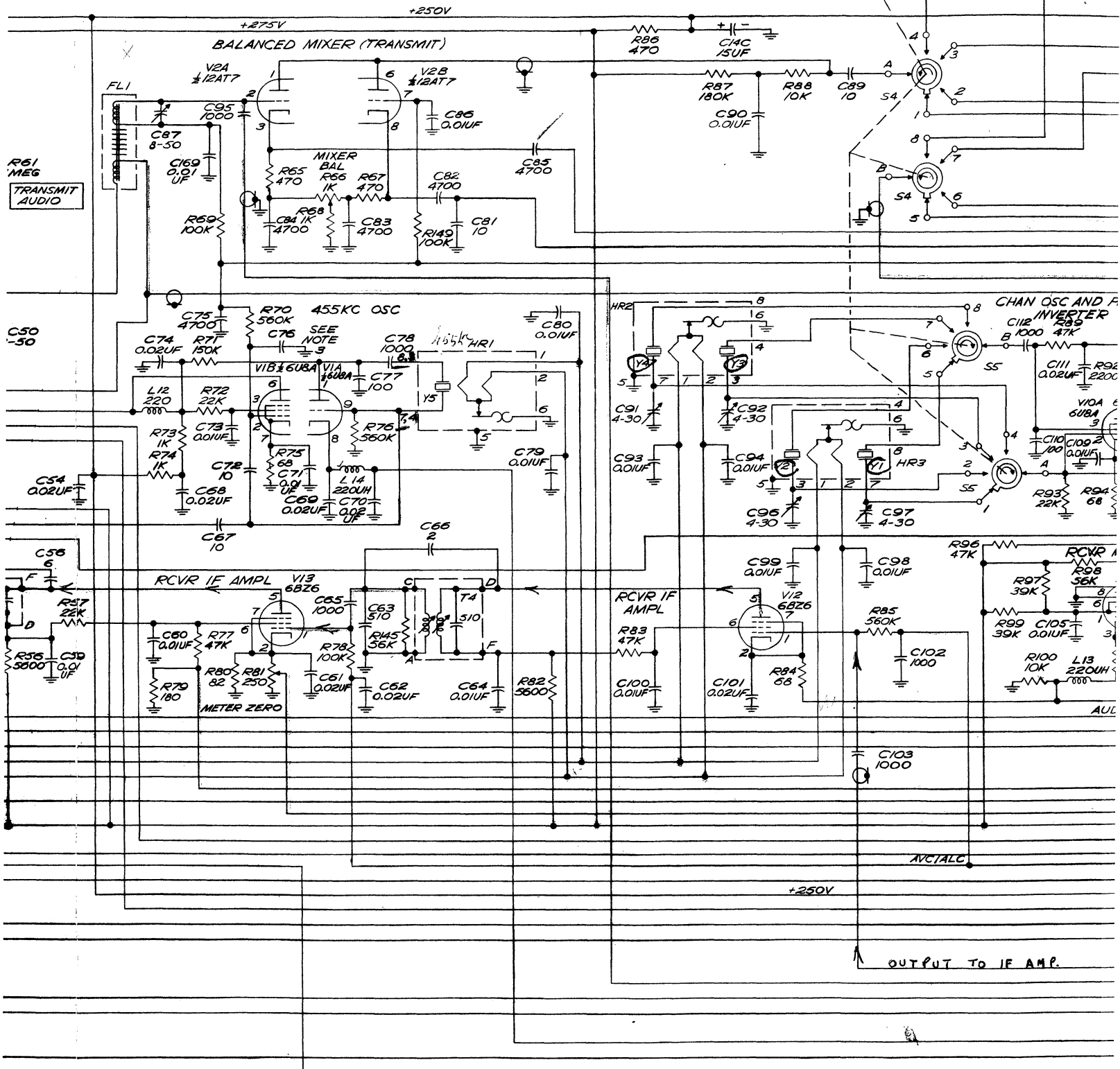






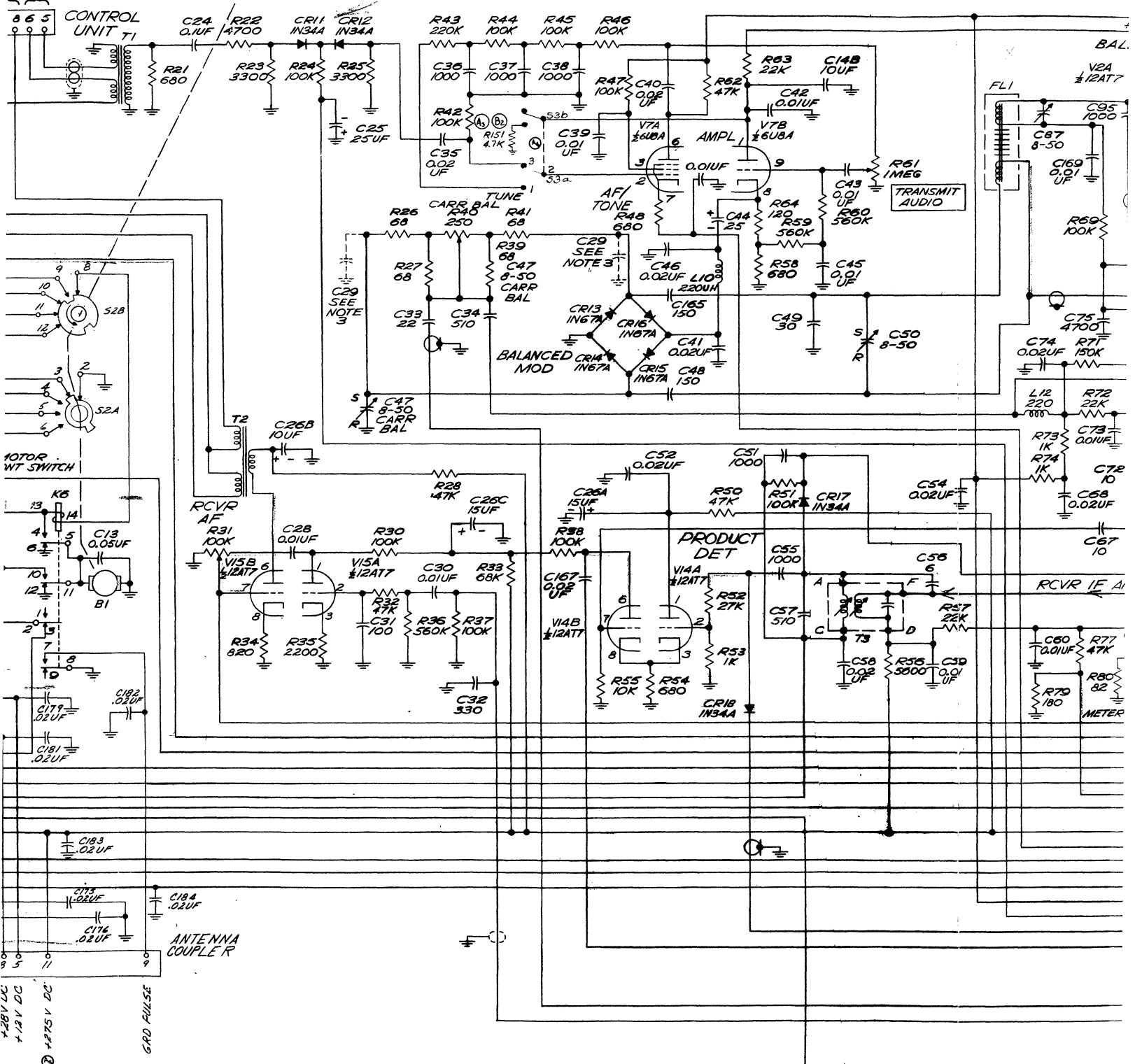








600 OHMS 0 DBM  
AUDIO INPUT  
600 OHMS 0 DBM



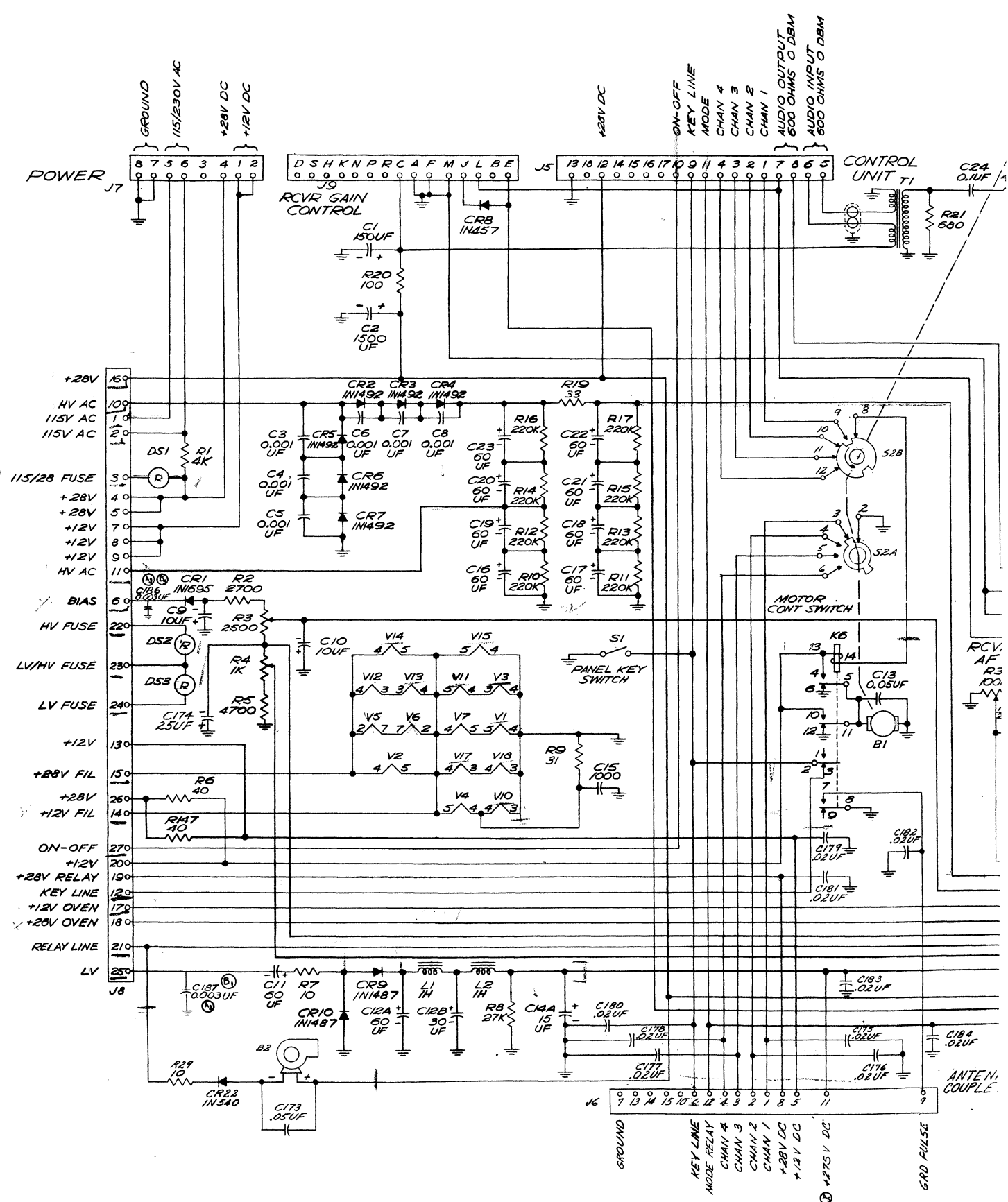
+28V DC  
+12V DC  
+275V DC

ANTENNA COUPLER

GRD PULSE







- POWER J7
- GROUND
- 115/230V AC
- +28V DC
- +12V DC
- +28V
- HV AC
- 115V AC
- 115V AC
- 115/28 FUSE
- +28V
- +28V
- +12V
- +12V
- +12V
- HV AC
- BIAS
- HV FUSE
- LV/HV FUSE
- LV FUSE
- +12V
- +28V FIL
- +28V
- +12V FIL
- ON-OFF
- +28V RELAY
- KEY LINE
- +12V OVEN
- +28V OVEN
- RELAY LINE
- LV

- RCVR GAIN CONTROL J5
- D
- S
- H
- K
- N
- P
- R
- C
- A
- F
- M
- J
- L
- B
- E
- +28V DC
- ON-OFF
- KEY LINE
- MODE RELAY
- CHAN 4
- CHAN 3
- CHAN 2
- CHAN 1
- AUDIO OUTPUT 600 OHMS 0 DBM
- AUDIO INPUT 600 OHMS 0 DBM
- CONTROL UNIT T1
- C24 0.1UF
- R21 680
- MOTOR CONT SWITCH
- S2A
- S2B
- PANEL KEY SWITCH S1
- K6
- B1
- C13 0.05UF
- C18 0.02UF
- C19 0.02UF
- C20 0.02UF
- C21 0.02UF
- C22 0.02UF
- C15 1000
- R9 31
- C10 10UF
- R3 2500
- R4 1K
- R5 4700
- R6 40
- R7 10
- R8 27K
- C4A 15 UF
- C11 50 UF
- C12 30 UF
- C13 0.05UF
- C14 25UF
- C16 60 UF
- C17 60 UF
- C18 60 UF
- C19 60 UF
- C20 60 UF
- C21 60 UF
- C22 60 UF
- C23 60 UF
- C24 0.1UF
- C71 0.003UF
- C72 0.02UF
- C73 0.02UF
- C74 0.02UF
- C75 0.02UF
- C76 0.02UF
- C77 0.02UF
- C78 0.02UF
- C79 0.02UF
- C80 0.02UF
- C81 0.02UF
- C82 0.02UF
- C83 0.02UF
- C84 0.02UF
- ANTENNA COUPLE J6
- GROUND
- KEY LINE
- MODE RELAY
- CHAN 4
- CHAN 3
- CHAN 2
- CHAN 1
- +28V DC
- +12V DC
- +12V V DC
- GRD PULSE



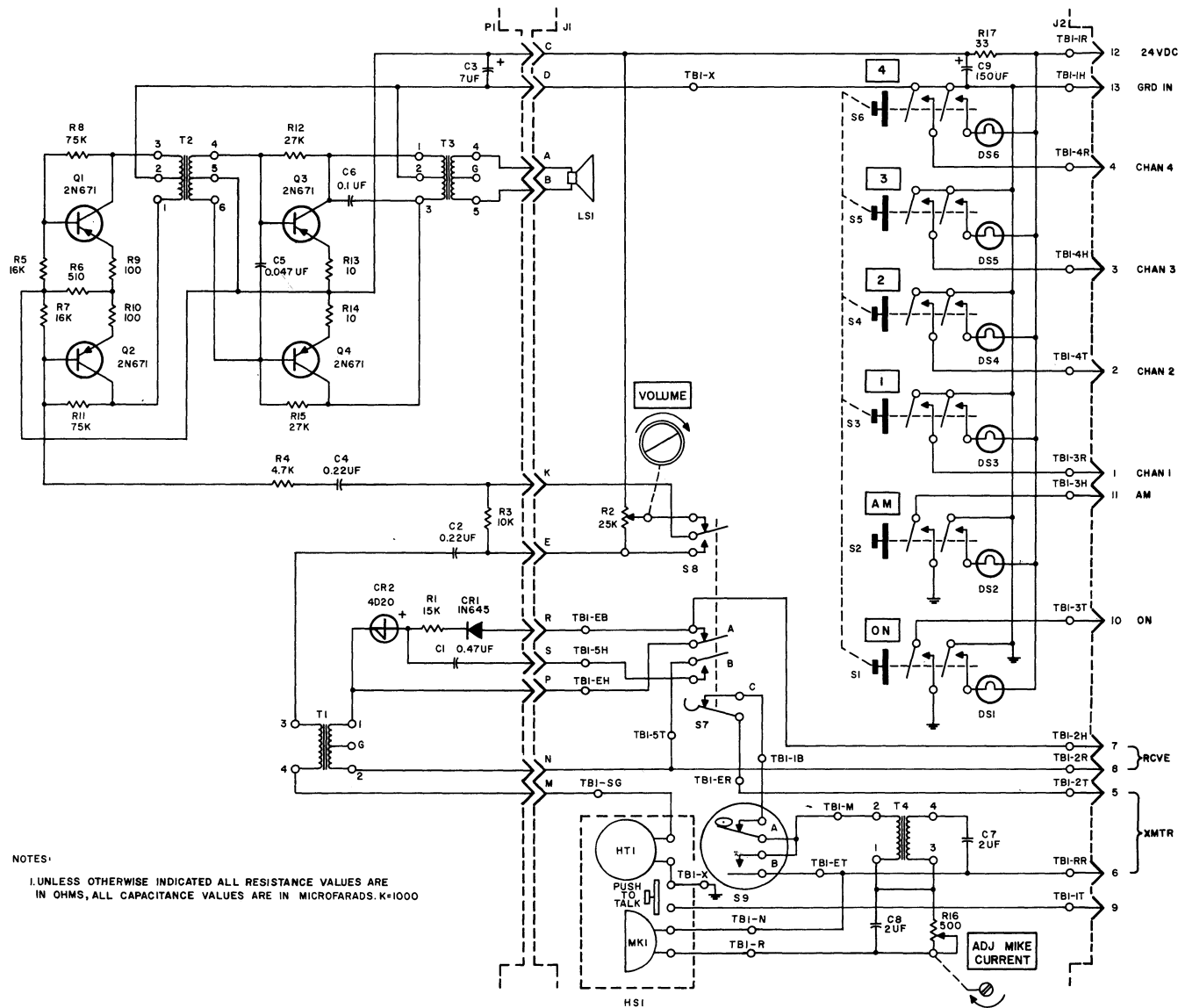
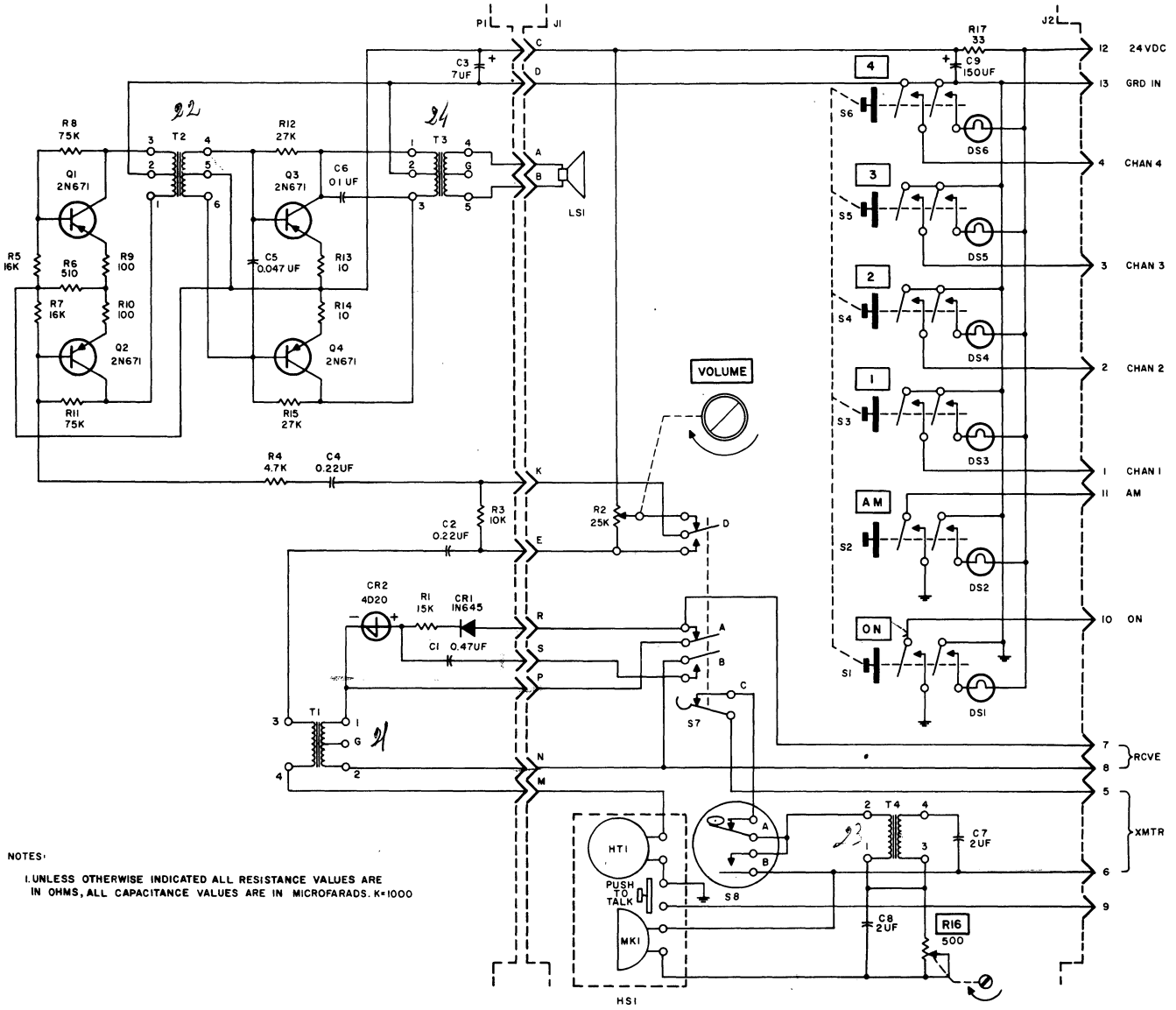


Figure 7-2 Control Unit 48A1-SW, Schematic Diagram

SECTION VII  
Illustrations



NOTES:  
1. UNLESS OTHERWISE INDICATED ALL RESISTANCE VALUES ARE IN OHMS, ALL CAPACITANCE VALUES ARE IN MICROFARADS. K=1000

Figure 7-3 Control Unit 48B2-SW, Schematic Diagram

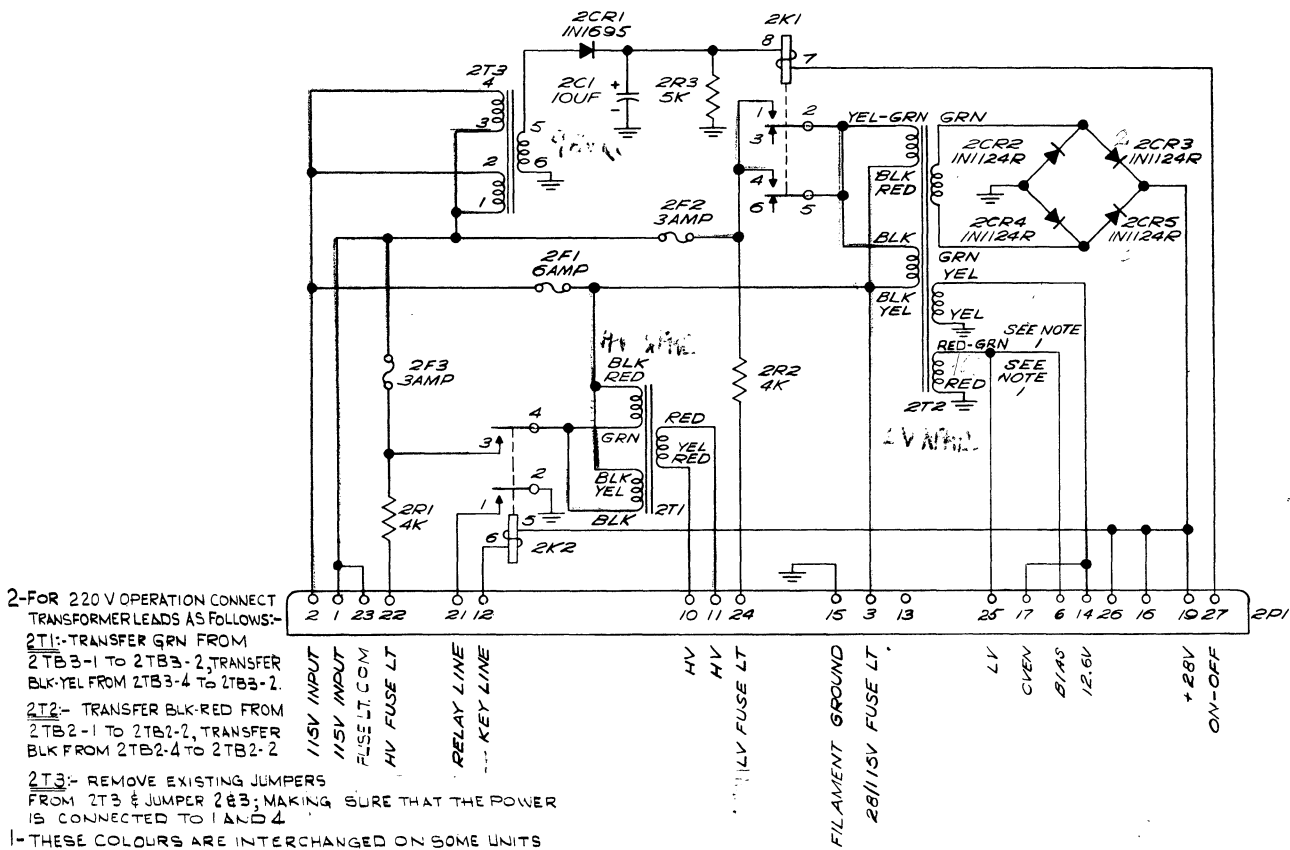
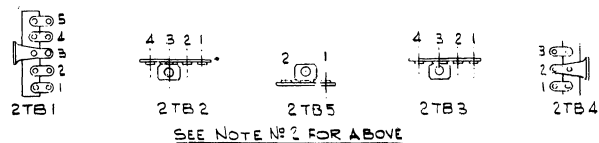


Figure 7-4 115 Volt A-C Power Supply, Schematic Diagram



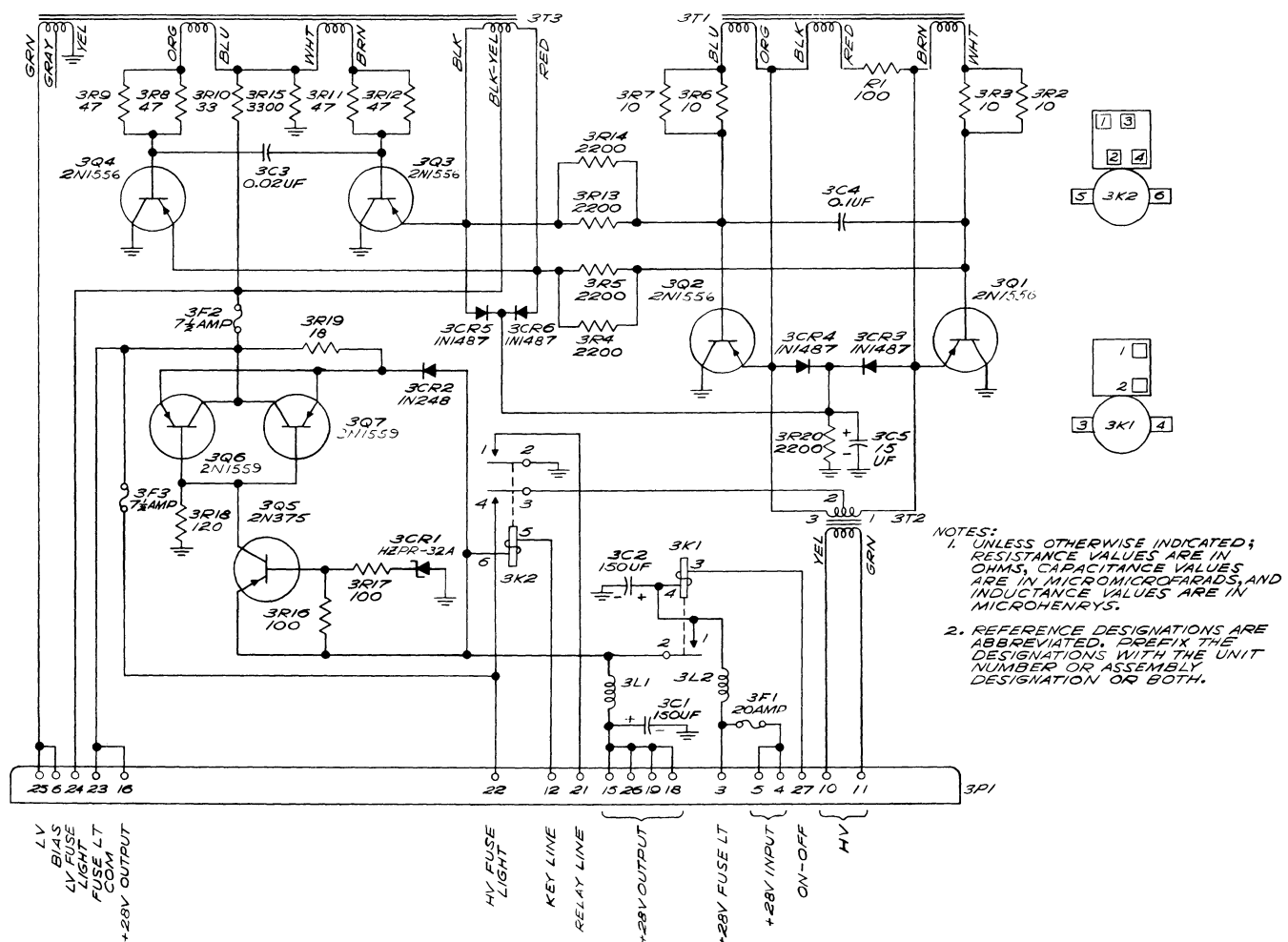


Figure 7-6 28 Volt D-C Power Supply, Schematic Diagram

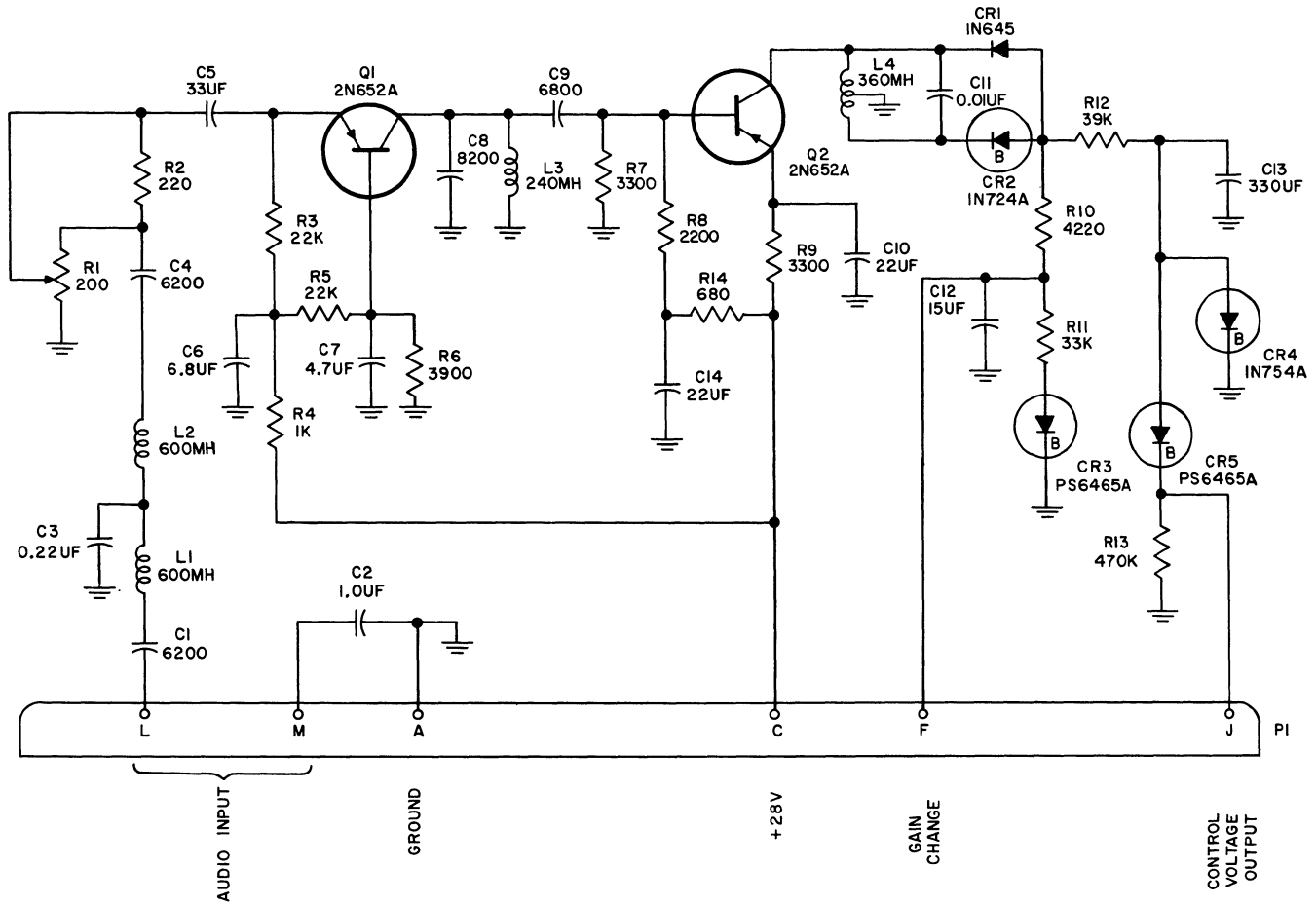
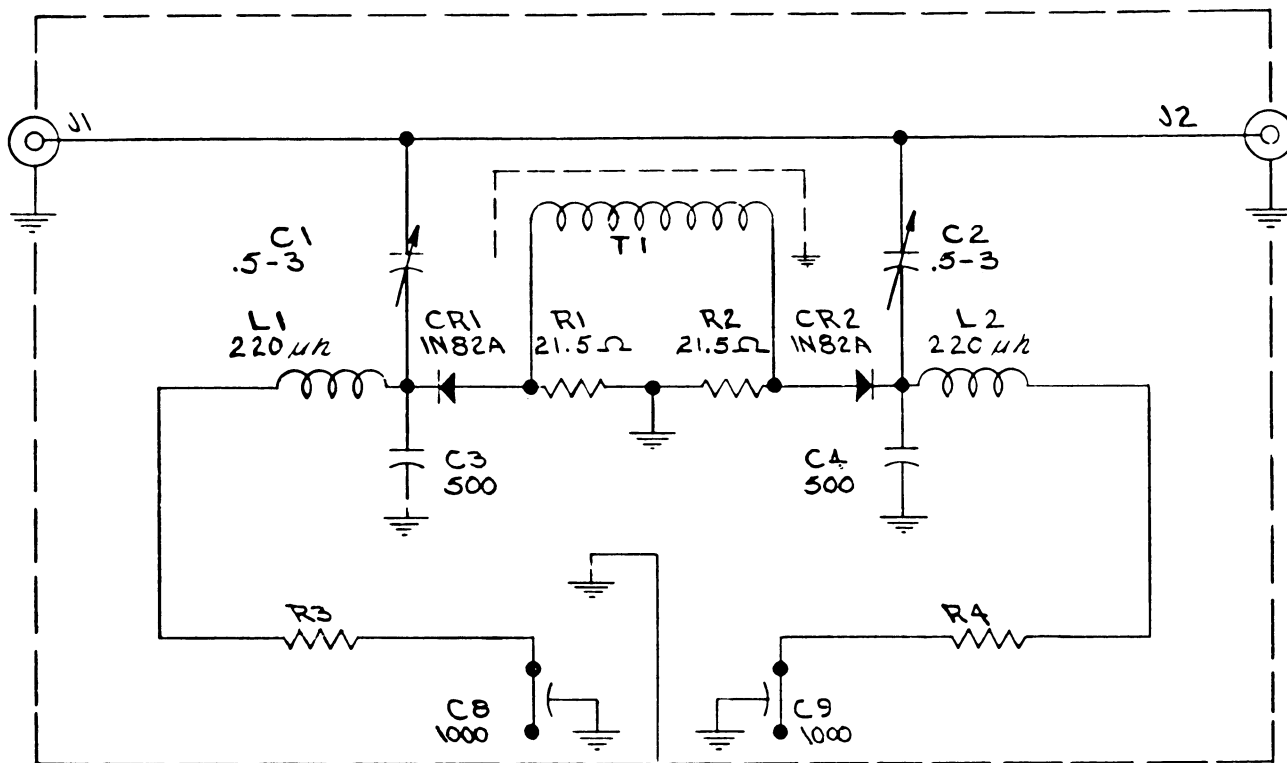


Figure 7-7 Automatic Receiver Gain Control, Schematic Diagram





R3 & R4 VALUE SELECTED TO CALIBRATE 200 WATT RANGE

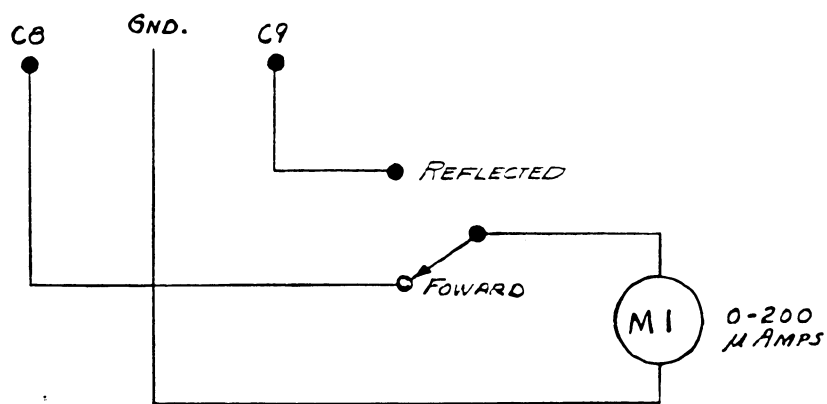


Figure 7-8 Directional Coupler 302E-1, Schematic Diagram



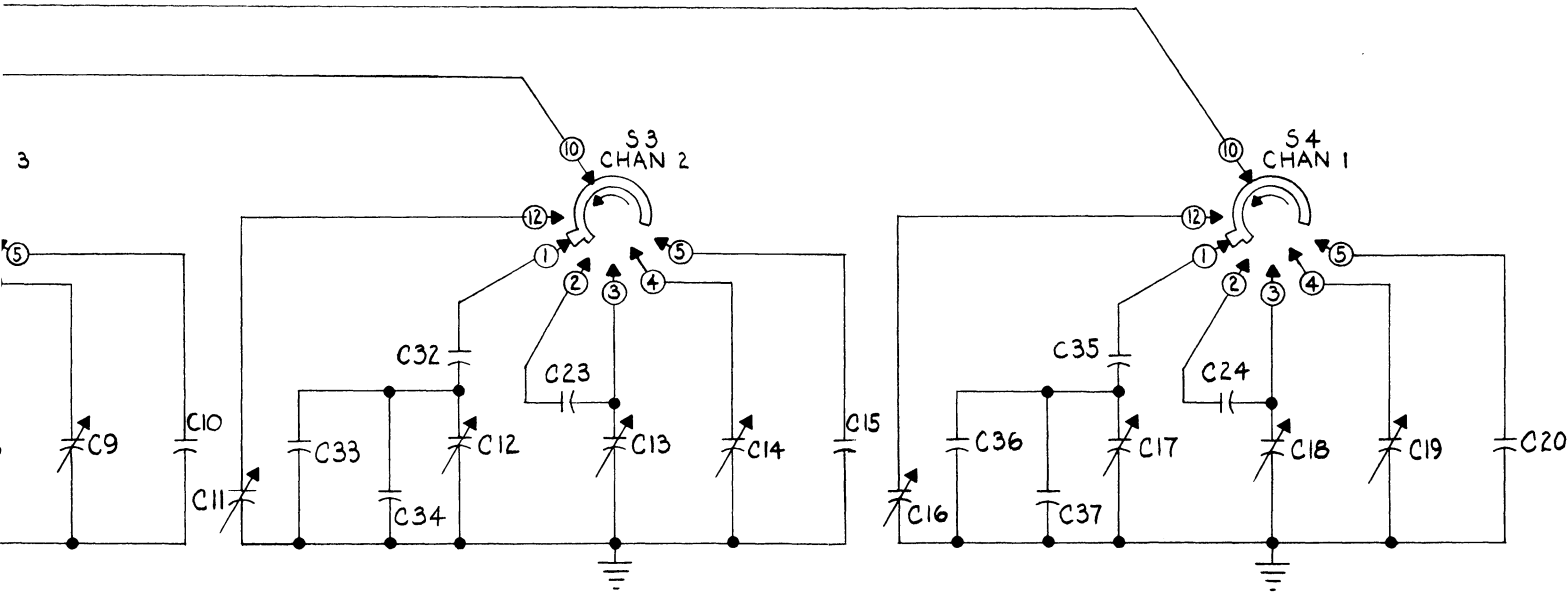
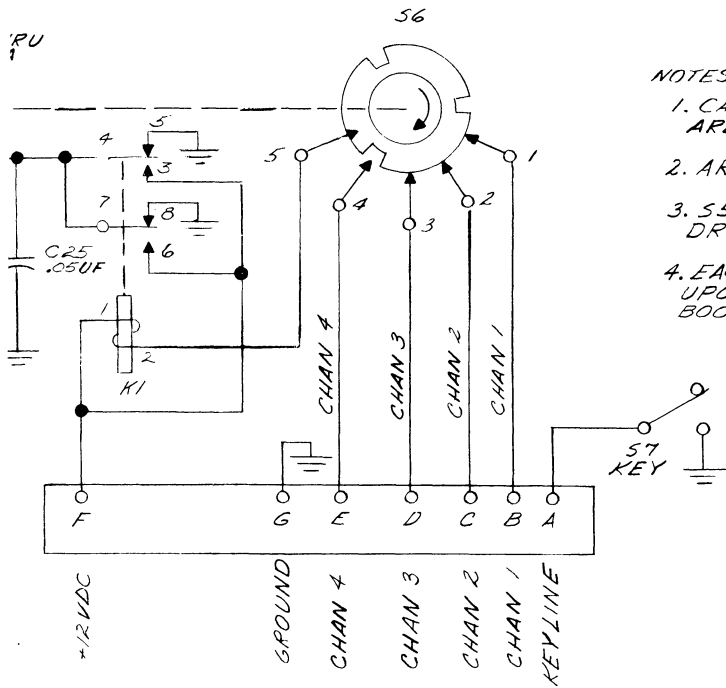
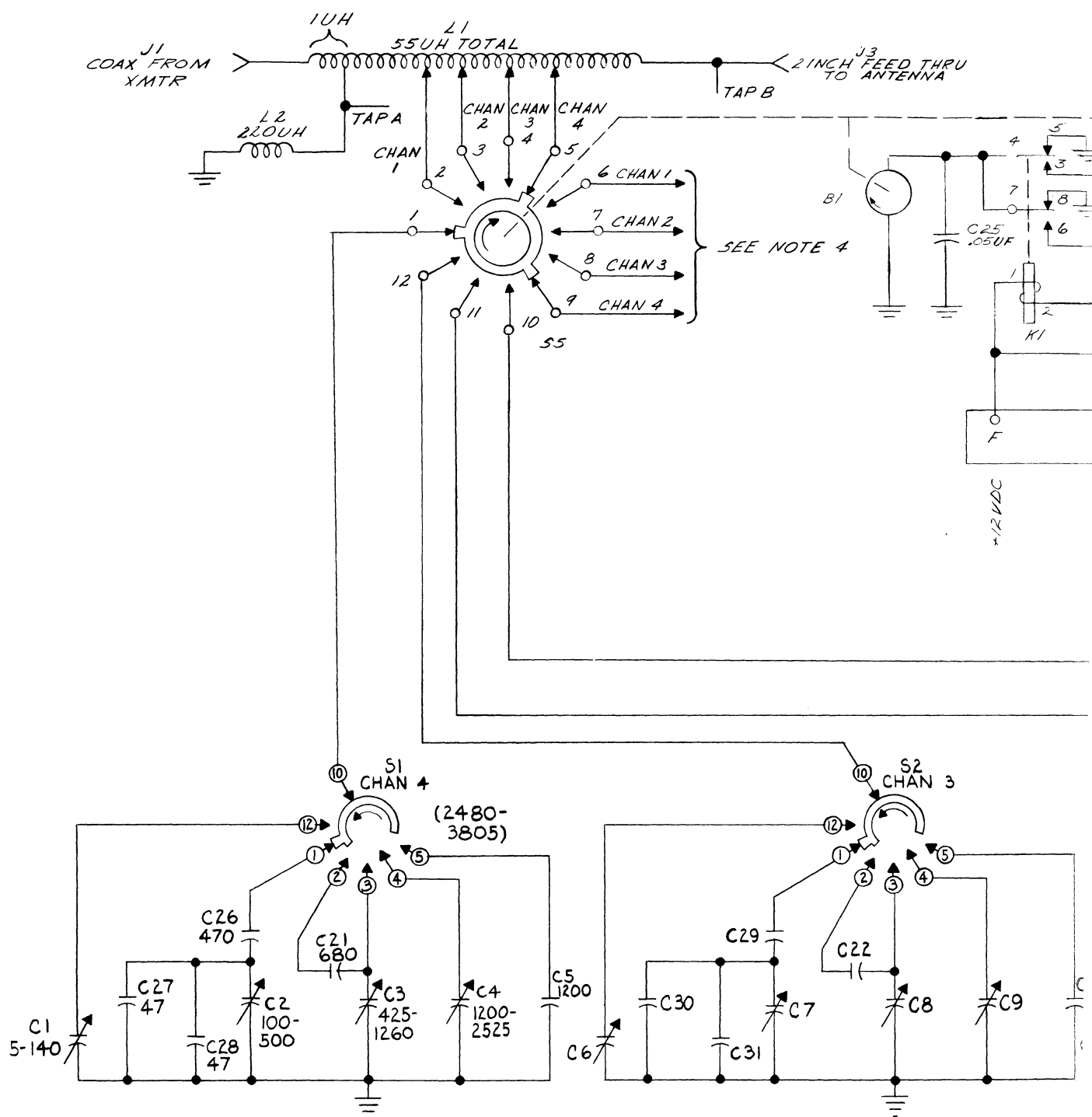


Figure 7-9 Antenna Coupler 180V-2 Schematic Diagram







ADDENDUM TO 32MS-1A INSTRUCTION BOOK (June 1962)

Make the following changes to the instruction book:

1. Figure 7-1

- a. Move L9 from between S11-A and ground, to between S9-B and ground.
- b. Remove Coax Cables from S9A(1, 2, 3) to J4, J3 and J2 respectively, and jumper S9A(1, 2, 3, 4).
- c. Reference below S9B, should read: "See Note 4".
- d. Change Note 4 to read: S9 may be used to connect separate antennas for each channel to Jacks 1, 2, 3 and 4. When individual antennas are used, remove jumpers from S9A(1, 2, 3, 4) and run separate lengths of RG-58/U cable (30" ea) from S9A (3), S9A (2) and S9A (1) to J2, J3 and J4 respectively.
- e. R150-120K located in AVC/ALC lead near the centre of schematic should read R150-120.
- f. Add choke L1001 - 680 uh between CR9 and C12A.
- g. Add capacitor C1001 - 0.02 uf from junction CR10 and CR9 to ground.
- h. Add capacitor C1002 - 2.5 uf from J8 pin 16 to ground.
- i. Add resistor R152 - 120 (ohms) between R105 and Pin 7 of V11.
- j. RF coils at S10 should be numbered bottom to top: CH1, CH2, CH3, CH4.
- k. Add Note 5: C67 on some units is connected to HR1-8, 3 instead of HR1-7, 4.
- l. Add Note 6: R55 is selected in Test. Normal range of values 3.3K through 10K.
- m. Add Note 7: Leads from C85 and from C82 to V2 cathodes on some units are interchanged.
- n. Change note at the right hand side of schematic to read: Last Resistor No. is R152.

2. Figure 7-2

- a. Delete CR2, CR1, C1 and R1 and leads.

- b. Jumper S7-A contacts.
- c. Delete S9
- d. Connect TB1-1B to TB1-M.
- e. Transfer connection from bottom contact of S8 to slider of R2.

3. Figure 7-3

- a. Delete CR2, CR1, C1 and R1 and leads.
- b. Jumper S7-A contacts.
- c. Delete S8.
- d. Connect S7C to T4-2.
- e. Transfer connection from bottom contact of S7-D to slider of R2.
- f. Lift from ground, then parallel ground lamp contacts of S3, 4, 5, 6 and add R18 - 330 (ohms) between this line and ground.
- g. Add R19 - 330 (ohms) between DS2 and 24VDC Line.
- h. Add R20 - 330 (ohms) between DS1 and 24VDC Line.

4. Figure 7-4

Add 2R4 - 820 (ohms) from 2T2 to 2P1 pin 6 (bias-line).

5. Figure 7-6

- a. Disconnect Junction of 3Q5 (Emitter) and 3R16 from Junction of 3K2-6 and 3L1.
- b. Connect the junction of 3Q5 and 3R16 to the cathode of 3CR2.

6. Figure 7-7

- a. Delete C12, R10, R11, R13, CR3.
- b. Jumper Cathode to anode of CR5.
- c. Change Value of R9 from 3.3K to 15K.
- d. Change Value of R12 from 39K to 10K.
- e. Change Value of C13 from 330 uf to 47 uf.



f. Add R10-120K between P1-J and P1-C.

7. Figure 7-9

a. Change Channel numbers accompanying S1, S2, S3 and S4 to read:  
S1 - Channel 1, S2 - Channel 2, S3 - Channel 3, S4 - Channel 4.

b. Connections between S1, 2, 3, 4 and S5 should be as follows:

S1 - 10 to S5-10

S2 - 10 to S5-11

S3 - 10 to S5-12

S4 - 10 to S5-1

8. Page 3

Antenna Coupler 180V-2 Collins Part No. should be 522-2423-00.

9. Page 6

Receiver Sensitivity....."signal noise-to-noise ratio", should be "signal-plus-noise-to-noise ratio".

10. Page 8

Add title at the top of the page: 28-VOLT POWER SUPPLY

11. Page 12

Paragraph 1.9 last sentence....."on signals on identical frequencies", should be ..... "of signals on identical frequencies".

12. Page 27

a. Delete the end of para. 4.5.21 starting "and CR5".

b. Add following: R1 is a multi turn gain pre-set control. It is normally adjusted clockwise to produce a slight indication of AVC on the S Meter on receive with antenna disconnected from the 32MS-1A. The minimum gain (AVC) position for R1 is fully anticlockwise, recognized by a clicking sound in the potentiometer. The automatic receiver gain control or noise operated gain adjusting device (NOGAD) differs from normal AGC circuitry, in that it automatically reduces sensitivity (and consequently noise output) during monitor periods, whereas normal AGC action is based rather on the average carrier level.

13. Page 33

Change paragraph 5.4 to read: "With the OPR-TUNE switch in TUNE position, adjust the Transmit Audio gain to read between 10 and 15 on

the S Meter with meter switch in ALC-S position.

14. Page 44

C10, COIL RADIO FREQUENCY etc., should read L10 COIL, RADIO FREQUENCY etc.

15. Page 48

Add R152 - RESISTOR FIXED COMPOSITION: Same as R64  
Collins Part No. 745-1314-00.

16. Page 51

Add the following items at bottom of page.

a. L1001 - COIL, RADIO FREQUENCY: 680 uh inductance,  
0.155 amp, Collins Part No. 240-2536-00.

b. C1001 - CAPACITOR FIXED CERAMIC: Same as C35,  
Collins Part No. 913-4364-00.

c. C1002 - CAPACITOR ELECTROLYTIC TANTALUM: 2.5  
uf - 15% +50%, 60 v dc, Collins Part No. 184-8324-00.

17. Page 53

1.6 to 2 mc: P.A. Coil should read: "P.A. Tank Assembly, Collins  
Part No. 567-4652-00.

2.0 - 3.3 mc Kit coil should have Collins Part No. 567-4663-00.

2.0 - 3.3 mc P.A. coil should read: P.A. Tank Assy. Collins  
Part No. 567-4653-00.

3.3 - 5.0 mc P.A. coil should read: P.A. Tank Assy. Collins  
Part No. 567-4654-00

18. Page 54

5.5 - 9.0 mc P.A. coil should read: P.A. Tank Assy. Collins  
Part No. 567-4655-00.

9.0 - 12.0 mc P.A. coil should read: P.A. Tank Assy. Collins  
Part No. 567-4656-00.

12.0 - 15.0 mc P.A. coil should read: P.A. Tank Assy. Collins  
Part No. 567-4656-00.



© **COLLINS RADIO COMPANY**

CEDAR RAPIDS, IOWA •

261 Madison Avenue, NEW YORK 16, NEW YORK •

1930 Hi-Line Drive, DALLAS 2, TEXAS •

2700 W. Olive Avenue, BURBANK, CALIFORNIA •

COLLINS RADIO COMPANY OF CANADA LTD.

11 Bermondsey Road, Toronto 16, Ontario •

