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TECHNICAL MANUAL

for

SINGLE SIDEBAND CONVERTER

MODEL MSR-3a

(CV-657A/URR)

THE TECHNICAL MATERIEL CORPORATION

MAMARONECK, N. Y. OTTAWA, ONTARIO

Army-Navy-Air Force Nomenclature has been assigned to the Models MSR as follows:

TMC No.	Description	Nomenclature	Noun
MSR-1	Single Sideband Converter	CV-591/URR	Single Sideband Converter
MSR-3	Single Sideband Converter	CV-657/URR	Single Sideband Converter
MSR-4	Single Sideband Converter	CV-591A/URR	Single Sideband Converter

The Model MSR-3 is for use with receivers having an intermediate frequency range of 197 - 203 kc when the MSR-3 oscillator is variable or normal crystal is used. Or, 200 kc to 1.5 mc when the MSR-3 oscillator is crystal controlled only.

The Models MSR-1 and MSR-4 are for use with receivers having an intermediate frequency range of 452 - 458 kc when the MSR oscillator is variable or normal crystal is used. Or, 225 kc to 1.5 mc when the MSR oscillator is crystal controlled only.

The MSR-4 being an improved version of the MSR-1, the units are interchangeable electrically and mechanically in any installation.

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IN-213

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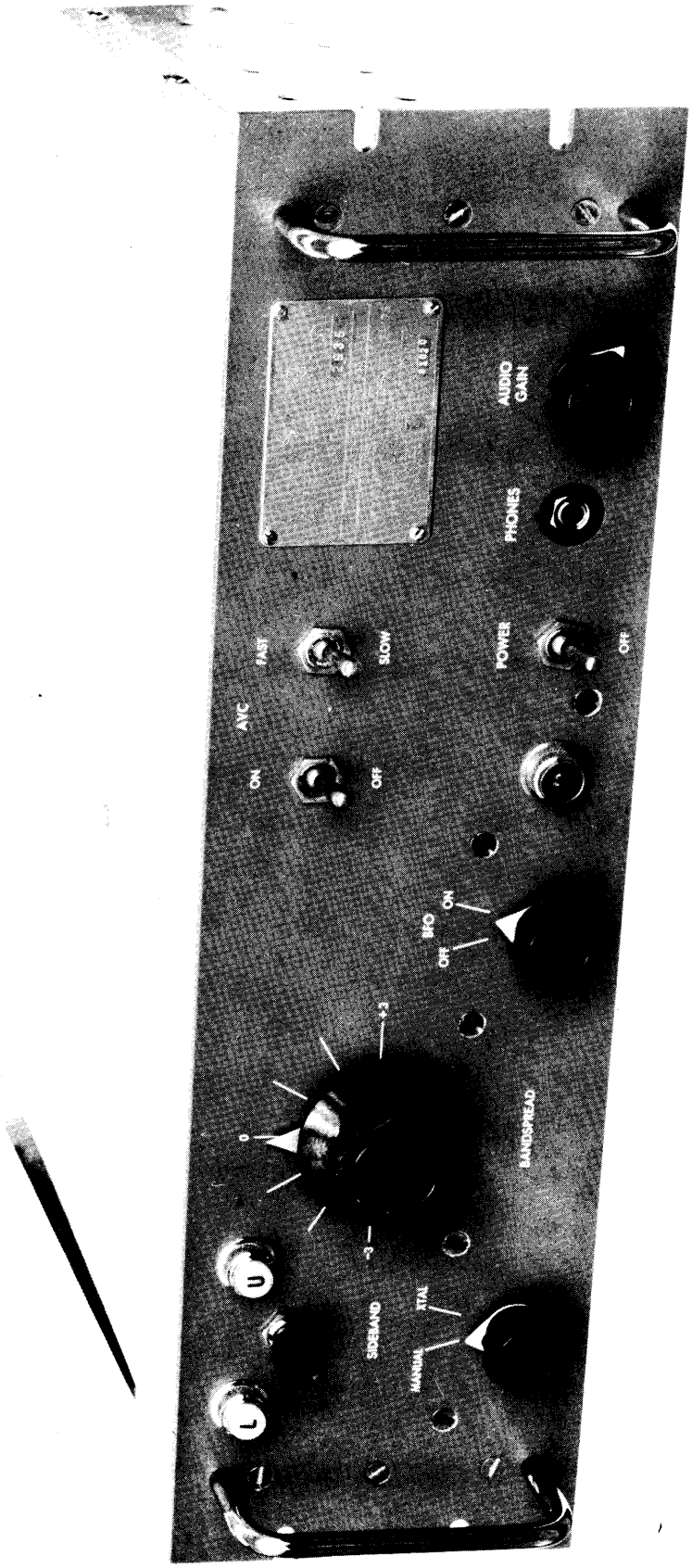

Figure 1-1 Front View, Model MSR-3a

SECTION I
GENERAL DESCRIPTION

1-1. GENERAL.

1-1-1. The TMC Model MSR-3a, Receiving Mode Selector, designed especially for the detection of single sideband signals will also provide improved reception of CW, MCW, AM, FS, and sideband signals with any degree of carrier insertion. Two MSR-3a units, both operating from the I.F. output of the same receiver, will provide complete reception of independent (seperate information) sideband.

1-1-2. A feature of the MSR-3a is improved and simplified operation of the receiver in all modes. The sharp filter characteristic of the I.F. stages provides optimum selectivity characteristics for operation in crowded bands. Also, since many receivers have tuning rates which are too fast for single side band reception, the BANDSPREAD control of the MSR-3a provides precise slow tuning across the receiver passband. A selection of AVC characteristics enables the operator to use AVC in all modes of reception. The product detector provides improved reception which is less dependent on Input and BFO injection levels.

1-1-3. For maximum stability, the first oscillator of the MSR-3a may be switched to crystal control for both upper and lower sideband positions.

1-1-4. The local or remote tuning feature of the MSR-3a permits operation with any receiver having an I.F. centered at 200 kc. However, when the oscillator is switched to crystal control and the proper crystals inserted, any I.F. up to 1.5 mc may be accomodated.

1-1-5. Audio output is available at three levels for loudspeaker or telephone lines.

1-1-6. Terminals on the rear panel provide connections for the remote control of the main features of the MSR-3a.

1-2. DESCRIPTION

1-2-1. The Model MSR-3a is shown in Figure 1-1. The front panel is 19 in. wide x 5-1/4 in. high x 3/16 in. thick and is finished in TMC grey enamel. The chassis extends 13-1/2 in. behind the panel and is self supporting.

1-2-2. All operational controls are on the front panel and are similar in function and effect to those found on any receiver. Input and output connections are made on the rear panel.

1-3. TECHNICAL SPECIFICATIONS

Types of Reception:
SSB-Selectable Sideband
CW, MCW
AM-Selectable Sideband
Exalted Carrier AM
Simultaneous AM/FS

Sideband Selection:
Upper or Lower Sideband by means of Crystal or Calibrated Bandspread Oscillator.

Remote Control Features:
Selection of Upper or Lower Sideband.
Selection of mode of operation.
AM-CW-MCW-SSB and Exalted Carrier
±3 kc Bandspread Tuning.

Input Frequency Range:
(a). 200 kc (when MSR-3a oscillator is variable or normal crystal is used).
(b). 200 kc to 1.5 mc when the MSR-3a oscillator is crystal controlled only.

Input Voltage Range:
0.1 - 10 Volts RMS.

Input Impedance:
240 K ohms

Filter Characteristics:
3.2 kc at 3 db points.
5.2 kc at 45 db points.

AVC Characteristics:
With 40 db change in input, output remains constant within 9 db.

AVC Speeds:
SLOW/FAST

Output:
High; 2 watts, 600 ohms, 8 ohms.
Low; 0 dbm, 600 ohms.
150 mw, 600 ohms, 8 ohms.

Output Impedances:
Loudspeaker 8 ohms.
Line 600 ohms.
Head Set - High or Low.

Front Panel Controls:
POWER/OFF
SIDEBAND UPPER/LOWER switch
SIDEBAND Indicator Lighting
MANUAL/XTAL switch
BANDSPREAD control
AVC ON/OFF switch
AVC FAST/SLOW switch
BFO ON/OFF switch
PHONES jack
Power Indicator Lamp

Rear Panel Facilities:
I.F. Input Jack
Threshold Control
AC Power Input
Audio Output Terminal
Remote Control Terminal
High/Low Output Level Control

Input Power Requirements:
115/230 Volts, 50/60 cycles,
65 watts.

Size:
5-1/4" high x 19" wide x 13-1/2" deep.

Mounting:
Standard Relay Rack.

Weight:
24 pounds net.

Tube Complement:

12AU7	Relay Driver
12AU7	Amplifier and Rectifier
12AT7	17 kc Oscillator and Audio Amplifier
6J6	Reactance Tube
6AG5	1st Oscillator
6BA6	I.F. Amplifier
6BE6	1st Mixer
6BE6	2nd Mixer
6AQ5	Audio Power Amplifier
5Y3	Power Rectifier
OA2	Voltage Regulator

Components and Construction:
Equipment is manufactured in accordance with JAN/MIL Specifications wherever practicable.

SECTION II
THEORY OF OPERATION

2-1. GENERAL DESCRIPTION OF CIRCUITS

2-1-1. The Model MSR-3a is composed of four major sections, (1) the frequency conversion and detection stages, (2) the audio amplification stages, (3) the remote control circuits, and (4) the power supply.

2-1-2. The incoming signal from the receiver is fed to an AVC controlled I.F. amplifier. Following this stage, the signal is converted by the 1st mixer to the 17 kc low I.F. frequency. A sharp bandpass filter rejects unwanted signal components and conversion products. The last stage of conversion produces the desired audio frequencies operating as either a product detector or plate detector depending upon the position of the BFO switch. A low pass filter suppresses the products above 5 kc.

2-1-3. The audio output from the low pass filter drives a two stage audio amplifier which has controls providing for several different audio output levels and impedances.

2-1-4. The power supply utilizes full wave rectification, heavy filtering, and gaseous voltage regulation to provide the necessary voltages for operation of the circuits.

2-2. SIMPLIFIED CIRCUIT ANALYSIS

2-2-1. The AVC System (V1 A, B)
The AVC Amplifier and Rectifier provides two kinds of control on the 1st amplifier. A fast time constant is used to control signals which have an ever present component, i.e. AM, MCW, FS. A slow time constant will hold the amplifier gain steady for a longer period for SSB and CW signals. The gain of the amplifier is wide open when the AVC is OFF.

2-2-2. The First Mixer (V3)
The incoming signal is mixed with the 1st Oscillator to place it in proper position relative to the bandpass filter. Since the filter extends from 17.3 kc to 20.5 kc and the 17 kc BFO follows, the signal carrier position must be placed at 17 kc to produce the correct tone.

2-2-3. The First Oscillator (V7)
The 1st oscillator provides the tuneable frequency source for correctly tuning the signal in the bandpass filter. It may be either variable or crystal controlled. When variable, it is tuned with the front panel BANDSPREAD control or with the reactance control.

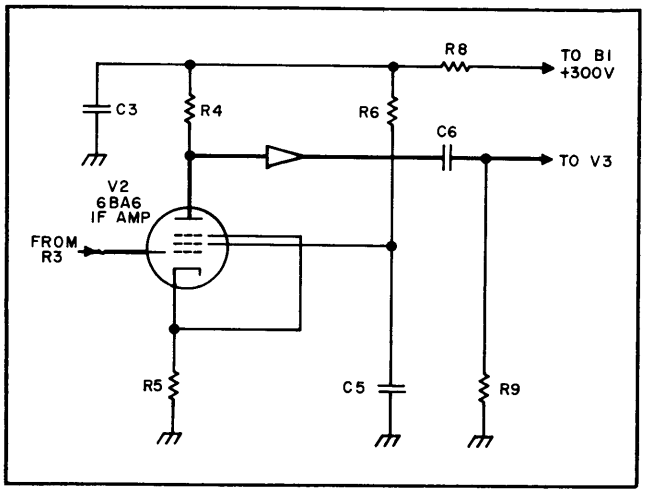

Figure 2-1 Simplified Schematic Diagram I.F. Amplifier

2-2-4. The Reactance Modulator (V8)
The reactance placed across the 1st oscillator tuned circuit is varied to change frequency. A ±4.5 vdc input to the reactance stage is sufficient to vary the oscillator ±3 kc.

2-2-5. Sideband Selector Relay (K2)
Operation of the relay driver or the front panel pushbutton advances the sideband selector relay one position. This changes the 1st oscillator frequency from upper to lower sideband selecting frequency or vice versa.

2-2-6. Bandpass Filter (Z1)
After the 1st mixer, the filter passes a band of frequencies between 17.3 and 20.5 kc. The skirts provide the sharpness required for attenuation of undesirable adjacent signals.

2-2-7. Relay Driver (V9)
When an applied negative voltage on the grid is sufficient to cut off the stage, the relay K3 is deenergized. This action in turn trips the sideband two step relay K2.

2-2-8. Sideband Tone Generator (V9B)
As the relay driver approaches cut-off, the sideband tone generator will produce an audible tone in the audio output. A tone of high pitch indicates upper sideband; low pitch indicates lower sideband.

2-2-9. The Second Mixer (V4)
Two different types of demodulation may be selected in this stage. When the BFO is turned off

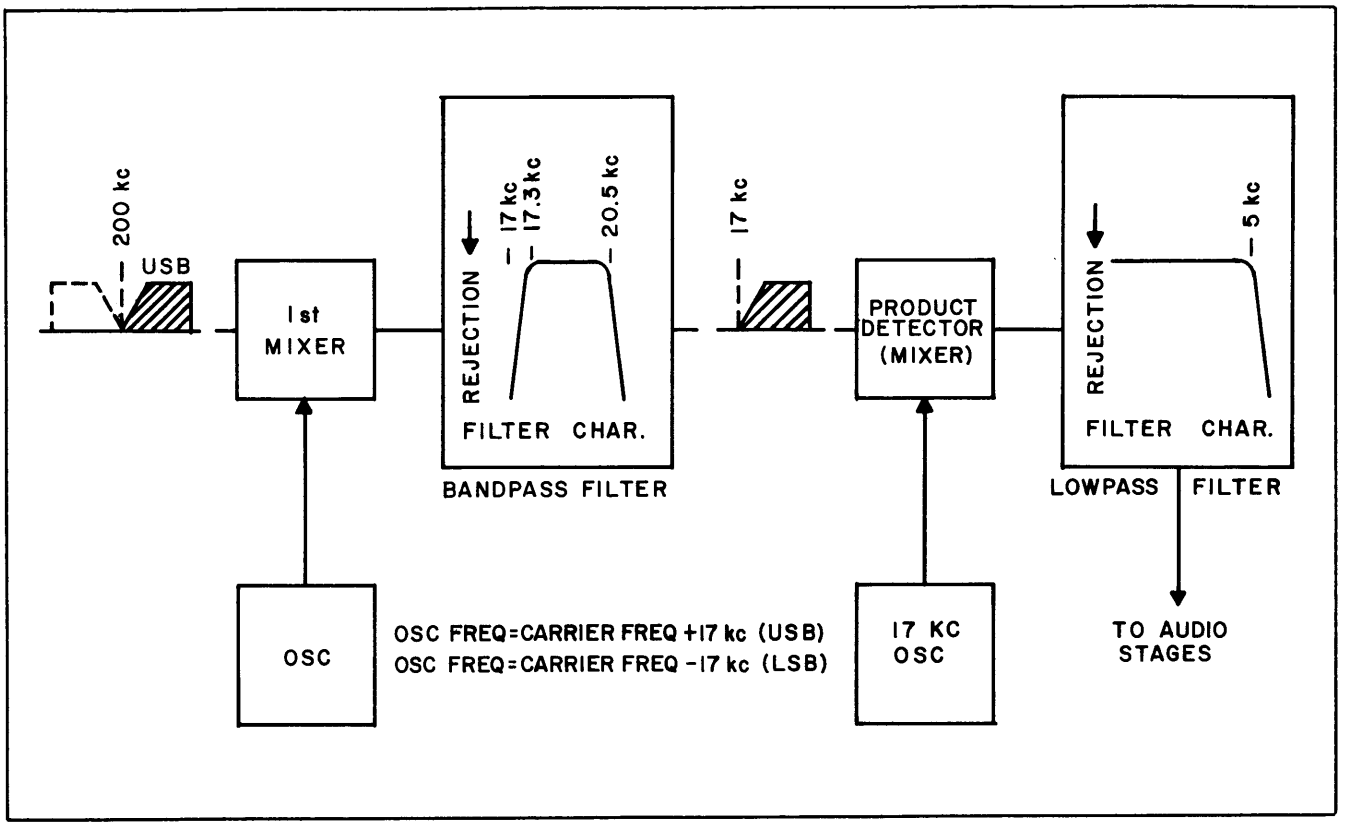

Figure 2-2 Reception of SSB, DSB, FS, CW, Exalted Carrier AM

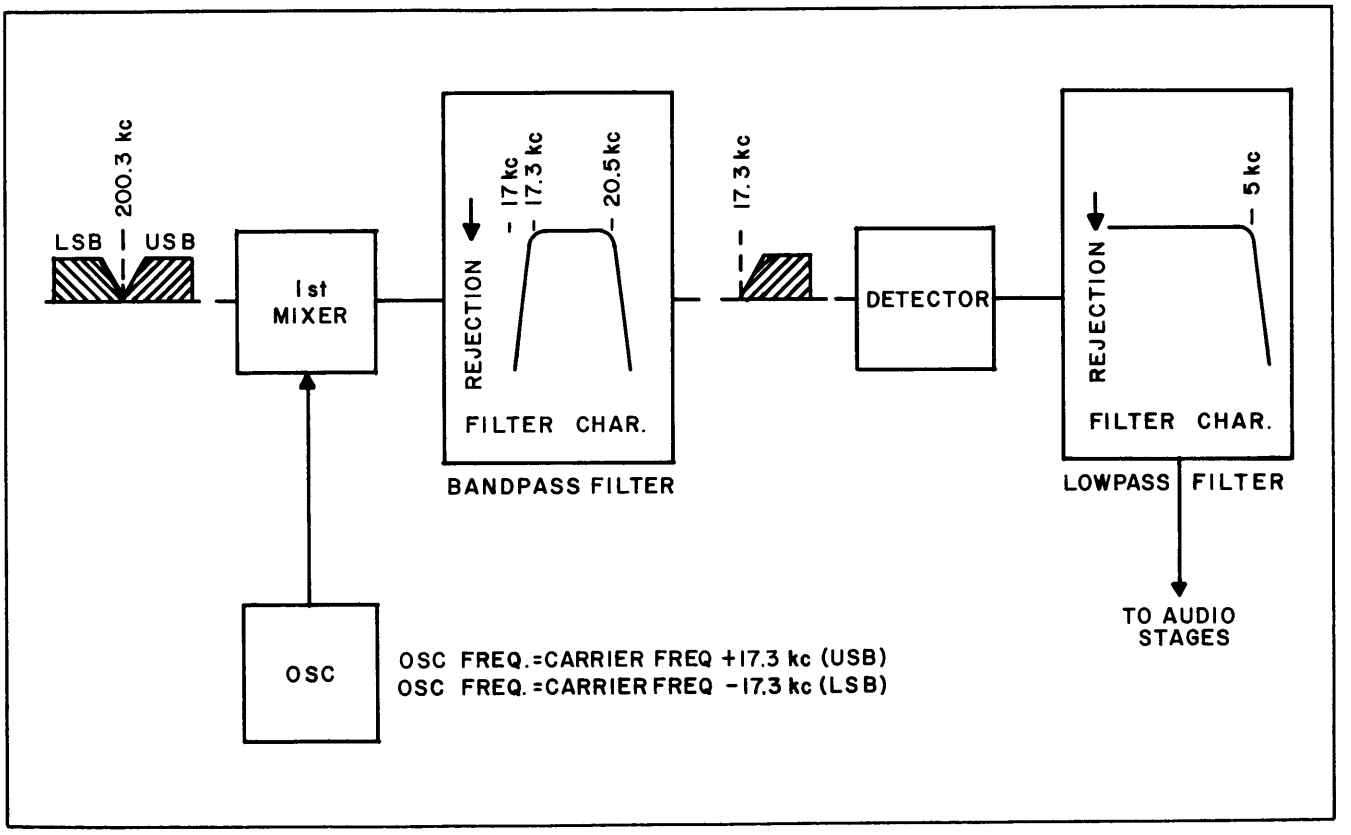

Figure 2-3 Reception of AM

the stage operates as a plate detector. When the BFO is turned on, the stage operates as a product detector.

2-2-10. The BFO (V6A)
A stable 17 kc oscillator provides the signal for operation of the product detector.

2-2-11. The BFO Relay (K1)
The BFO is turned on or off by proper actuation of the relay. The front panel BFO switch or a remote paralleled switch actuates the relay.

2-2-12. Low Pass Filter (Z2)
Following the 2nd mixer, the low pass filter

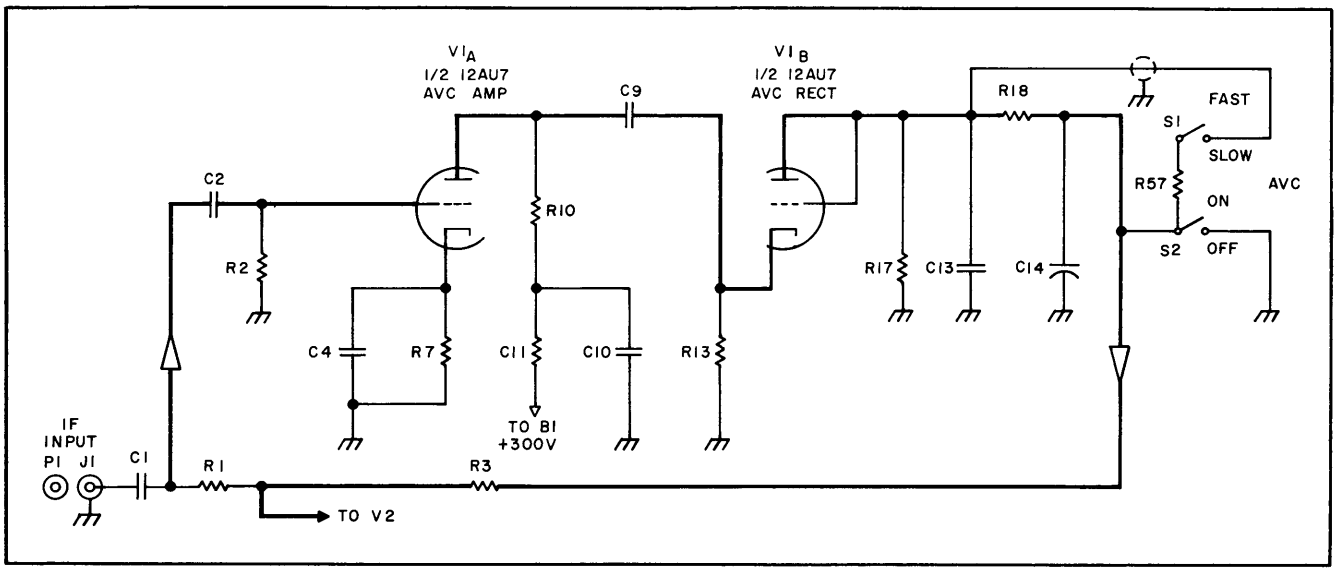

Figure 2-4 Simplified Schematic Diagram, AVC System

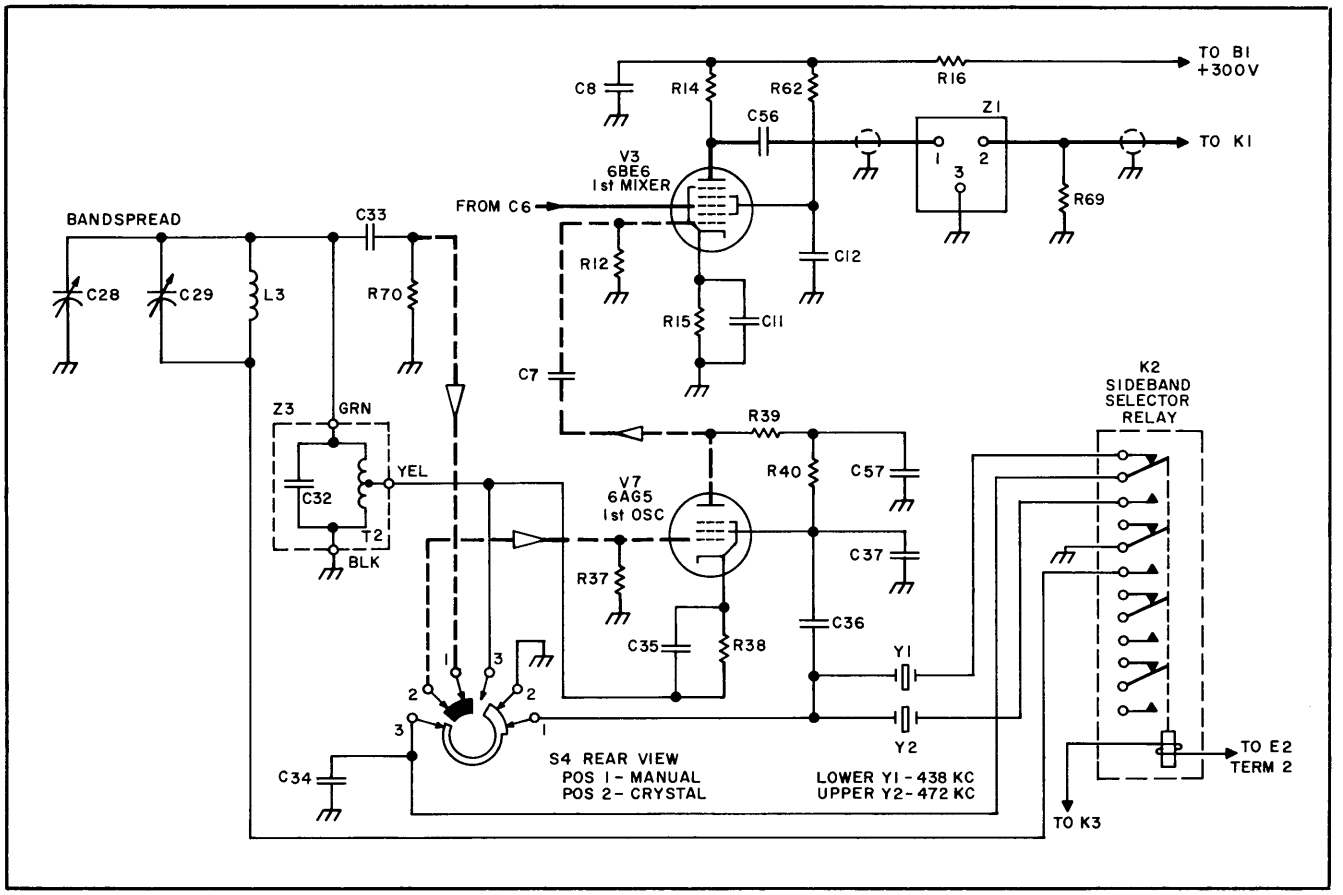

Figure 2-5 Simplified Schematic Diagram, 1st Mixer and Oscillator

attenuates any products above 5 kc. The resultant is the desired audio.

2-2-13. Audio Amplifiers (V5B, V6)
Three levels of output are provided. The output control in the HIGH position permits the full two watts of the amplifier to be available for the 600 ohm line or 8 ohm loudspeaker. In the LOW position, the gain of the amplifier is reduced so that 150 milliwatts is available for the 600 ohm line or 8 ohm loudspeaker, and 0 dbm or 1 milliwatt for the 600 ohm telephone line. A phone jack on the front panel permits monitoring of the output without disabling the other outputs.

2-2-14. Power Supply (V10)
The power supply is self contained and provides the necessary AC filament and DC B+ voltages. A regulated +150 volts stabilizes the 1st oscillator and BFO.

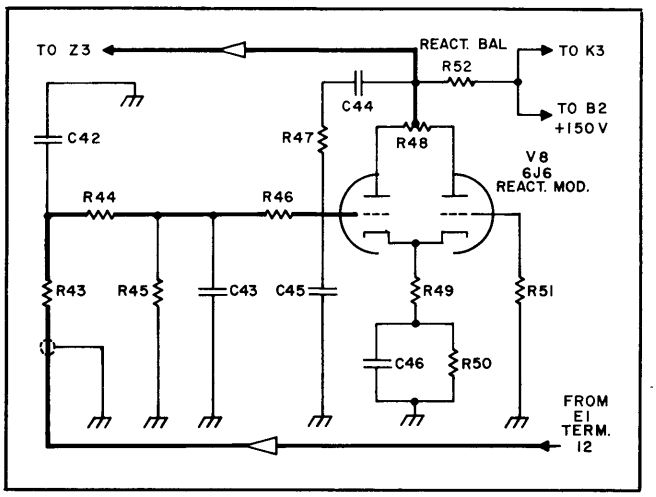

Figure 2-6. Simplified Schematic Diagram Reactance Modulator

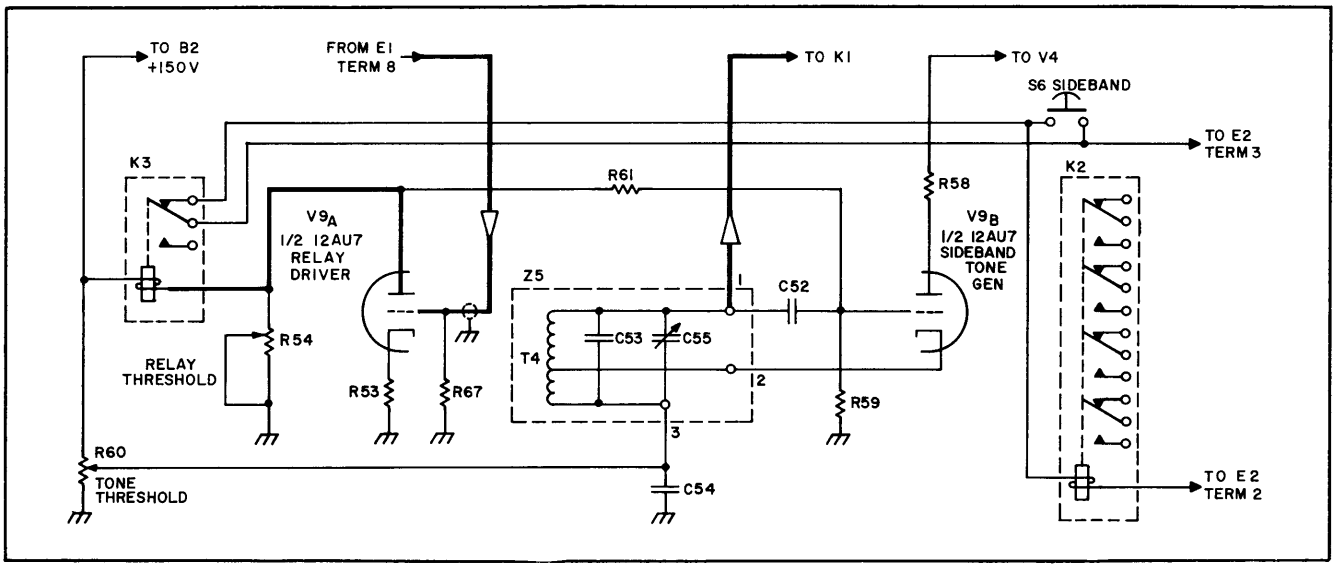

Figure 2-7. Simplified Schematic Diagram, Relay Driver and Sideband Tone Generator

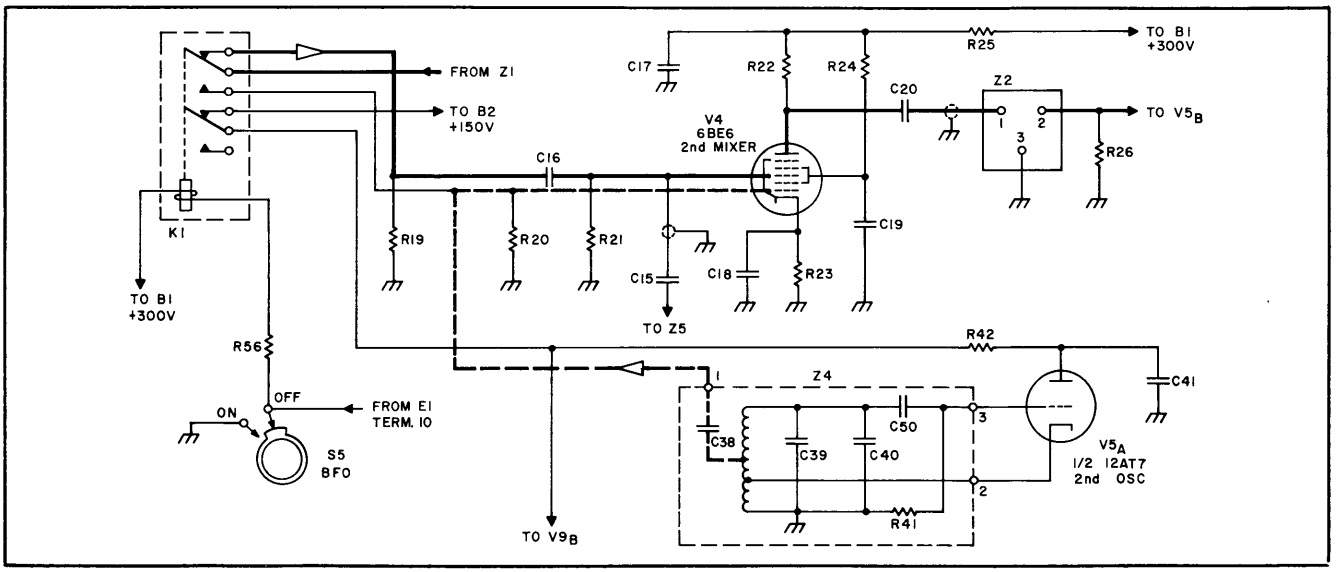

Figure 2-8. Simplified Schematic Diagram, 2nd Mixer, BFO in ON Position

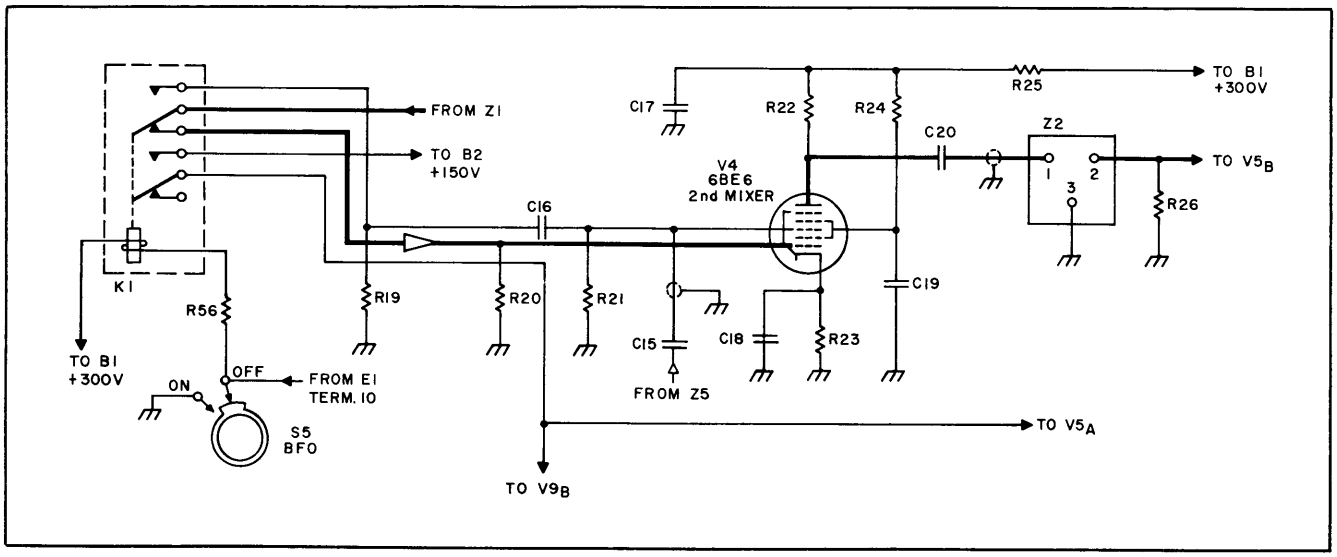

Figure 2-9. Simplified Schematic Diagram, 2nd Mixer, BFO in OFF Position

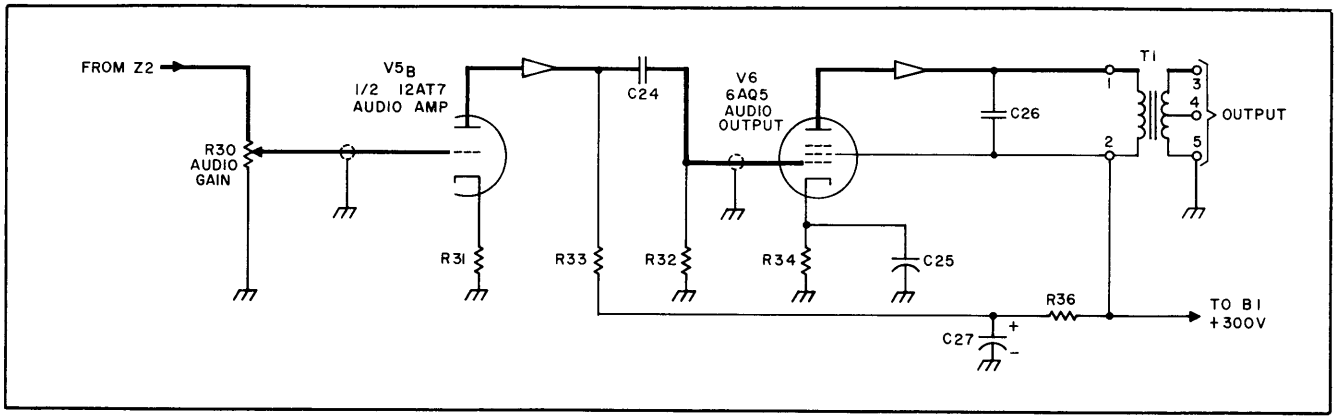

Figure 2-10. Simplified Schematic Diagram, Audio Amplifiers

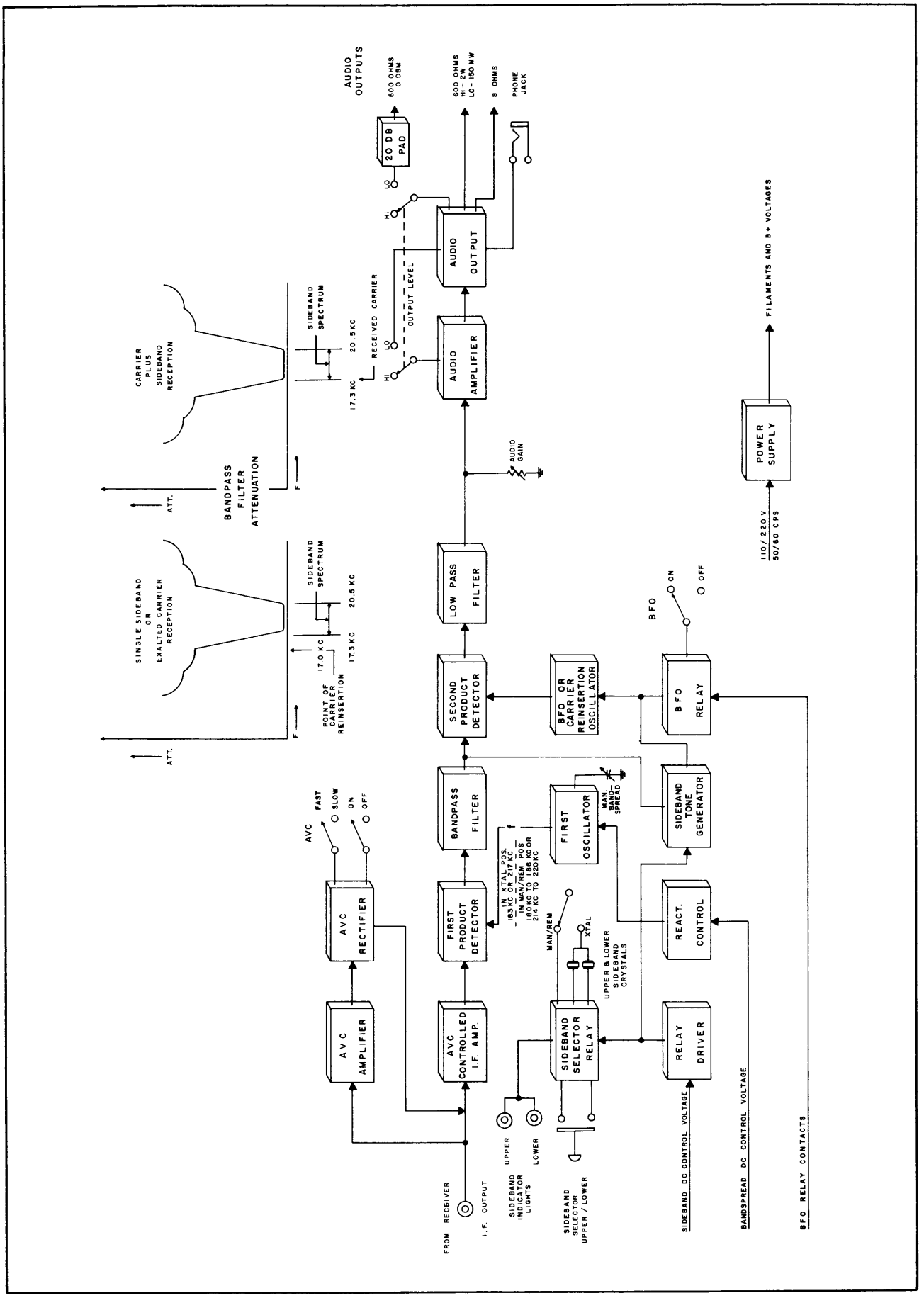

Figure 2-11. Block Diagram, Model MSR-3a

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SECTION III
INSTALLATION AND OPERATION

3-1. INSTALLATION

3-1-1. Unpacking

3-1-1-1. The TMC Model MSR-3a, Receiving Mode Selector, has been designed for ease of installation and minimum effort in operation. The unit is packed in an individual shipping container, and should be carefully unpacked. A close visual inspection should be made to determine any physical damage due to rough handling during shipment. If damage is found, notify carrier immediately.

3-1-2. Power Supply

3-1-2-1. The unit is designed for operation from 115 volts, 50-60 cycle source, unless specifically ordered for 230 volt, 50-60 cycle power. The unit is shipped wired for 115 volt AC operation. A simple wiring change in the tapped primary circuit of the power transformer is necessary to change the unit to 230 volt AC operation. (See the Schematic Diagram) This change is made directly on the power transformer lugs as follows:

3-1-2-2. Remove the switch lead from terminal 2 of T5 and connect it to terminal 3. Change rear panel fuse to 1-1/2 amps. A three wire line cord (CA-385) which connects to J2 (rear of chassis) is supplied. The free end of this cable has a 2 prong male plug with a pigtail lead for grounding purposes. If the use of this ground lead is required, loosen one of the screws on the convenience outlet face plate and insert the spade lug under the screw head. Tighten the screw to secure the ground lead. Insert plug into outlet.

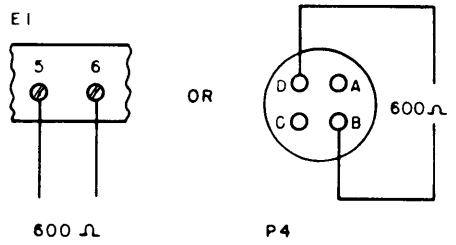
3-1-3. Electrical Connections

3-1-3-1. The proper electrical connections are made at the rear of the chassis. A low loss coaxial cable is required to connect the I.F. output of the receiver into the MSR-3a. If no I.F. output jack is available on the receiver, the proper connection may be made at the plate of the last I.F. amplifier through a 47 uufd capacitor.

3-1-3-2. The audio output connections are made on the rear apron at terminal strip E1, or the chassis connector J4 for which a mating cable connector is supplied as a loose item. Since three levels of output are available, the connections to P4 must be made as follows.

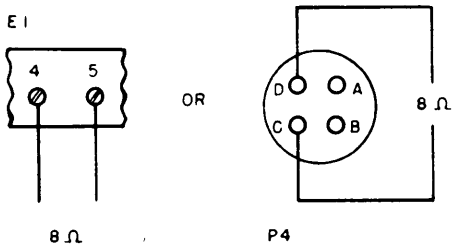
2 watt, 600 ohm output. Output Level switch in HIGH position.

E1 Terminals 5 and 6.
or
P4 Pins B and D



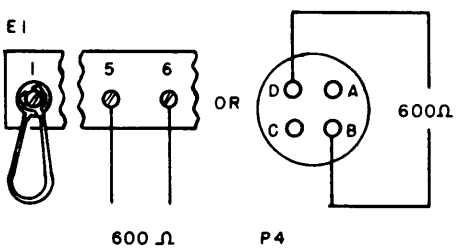
2 watt, 8 ohm output. Output Level switch in HIGH position.

E1 Terminals 4 and 5.
or
P4 Pins C and D.



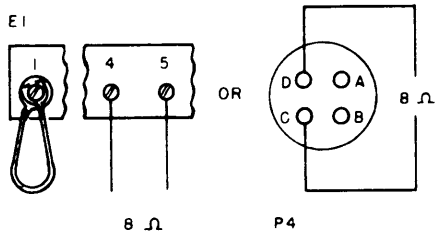
150 milliwatt, 600 ohm output. Output level switch in LOW position. Note position of jumper which is normally between terminals 1 and 3.

E1 Terminals 5 and 6.
or
P4 Pins B and D.



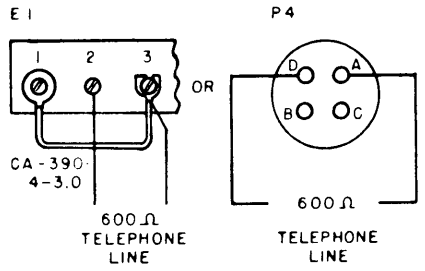
150 milliwatt, 8 ohm output. Output Level switch in LOW position. Note position of jumper which is normally between terminals 1 and 3.

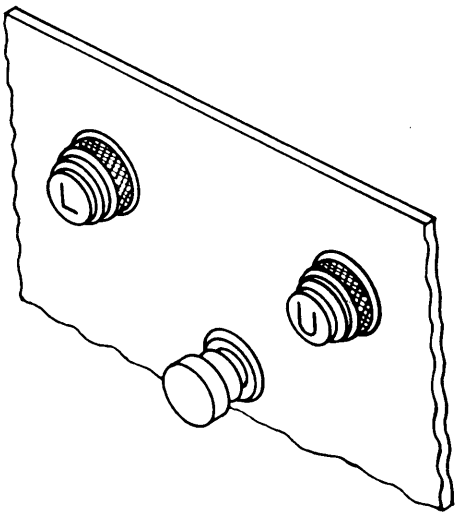
E1 Terminals 4 and 5.
or
P4 Pins C and D.



1 milliwatt, 600 ohm telephone line only. Output Level switch in LOW position. Note normal position of jumper.

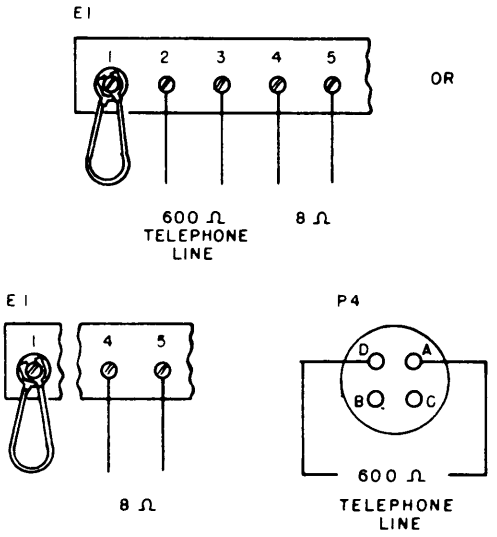
E1 Terminals 2 and 3.
or
P4 Pins A and D.





Simultaneous use of telephone line at 1 milliwatt, 600 ohms, or 8 ohm loudspeaker at 150 milliwatts. Note position of jumper.

E1 600 ohm Terminals 2 and 3.
8 ohm Terminals 4 and 5.
or
P4 600 ohm Pins A and D.
E1 8 ohm Terminals 4 and 5.



3-1-3-3. Single loudspeaker operation for both the MSR-3a and the receiver is possible by paralleling the output connections of either the 600 ohm or loudspeaker tap. The output impedance is halved. Therefore, to match the impedance correctly, it should be connected to the next higher impedance on the receiver. The output is then determined by the adjustment of the audio gain control of either unit. See Figure 3-2.

3-1-3-4. When shipped, the MSR-3a front panel sideband indicators are positioned as shown at lower left.

3-1-3-4-1. This position is for receivers which have a reversal of sidebands in the I.F. due to a conversion process where the oscillator frequency is above the R.F. signal. If a succeeding conversion process has the oscillator below the I.F., no change takes place in the sideband relationship.

3-1-3-4-2. If, however, a second or third conversion oscillator frequency is above the I.F. a reversal of sideband positioning takes place. It then becomes necessary to reverse the sideband indicator jewels. Pull them out and replace as shown at the top of page 3-4.

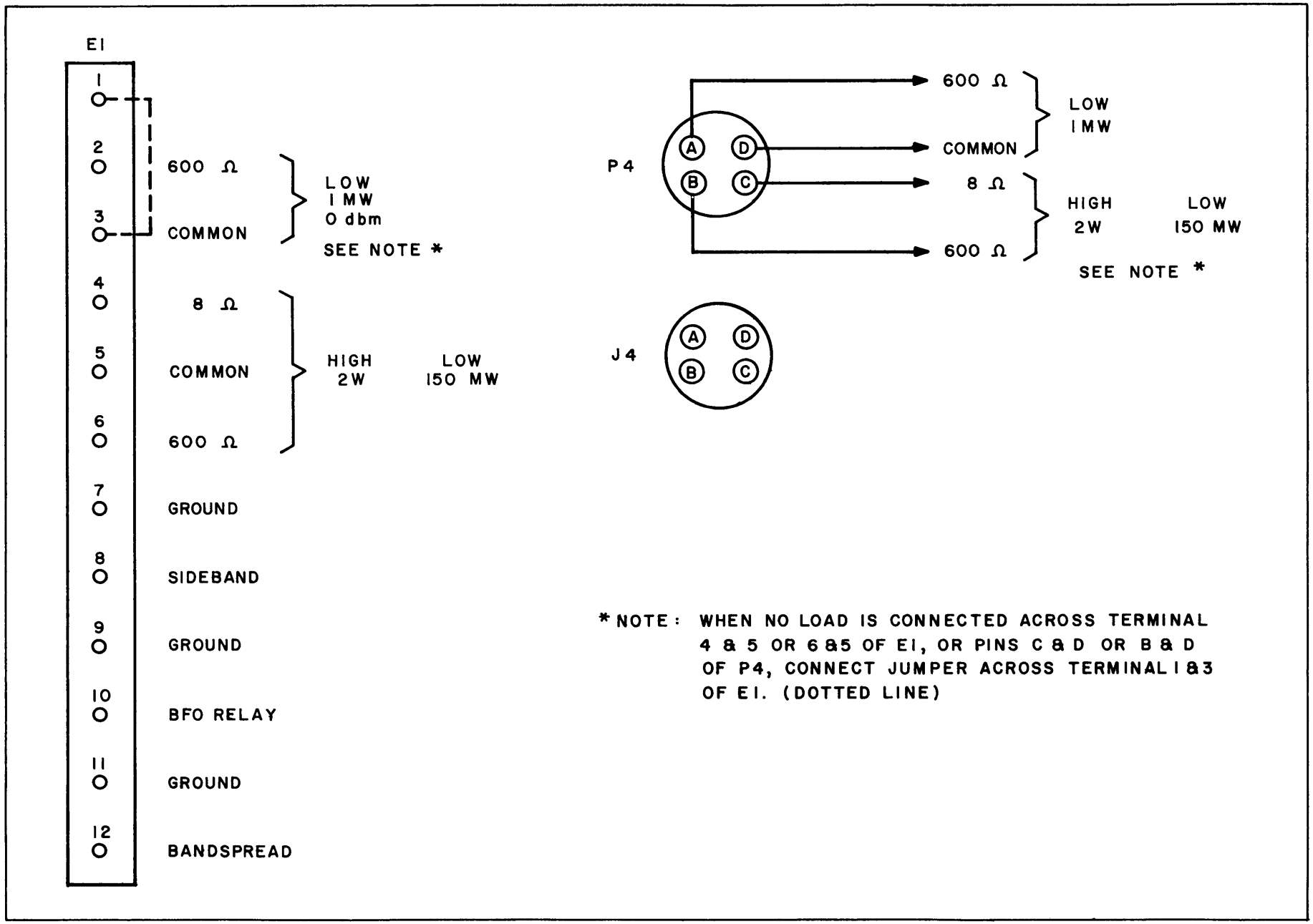
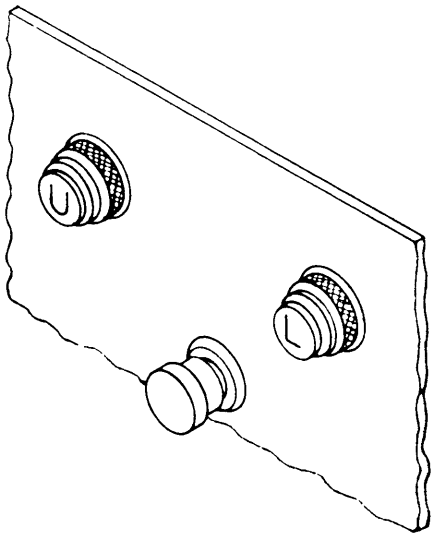


Figure 3-1 Rear Panel Connections, Model MSR-3a



3-2. OPERATION

3-2-1. Description of Controls

3-2-1-1. All operating controls are located on the front panel and perform similar functions to those found on any receiver.

A. BANDSPREAD - Tunes incoming signals across the band of the bandpass filter. Interfering signals are easily placed off the edge of the filter.

B. MANUAL/XTAL - The bandspread oscillator is variable either with the BANDSPREAD control or remotely when this switch is in the MANUAL position. In XTAL position the oscillator is fixed to the frequency of the crystal within the unit.

C. UPPER/LOWER SIDEBAND - Either sideband is selected by pushing and releasing the button. A panel light indicates which sideband will pass through the filter. See 3-1-3-4 for correct placement of indicators.

D. BFO ON/OFF - This switch controls the second oscillator which inserts the carrier for suppressed carrier operation or the tone for CW operation.

E. AVC ON/OFF - This switch permits control of signal, either with or without carrier. For SSB, CW or FS signals set this switch to SLOW. For AM or MCW signals set this switch to FAST.

F. OUTPUT LEVEL control (Rear Deck) - Controls HIGH/LOW output level. Disconnects telephone lines when in HIGH position.

G. AUDIO GAIN - This control adjusts the output of the audio amplifier.

H. PHONES - This jack permits monitoring of the audio output without disabling.

J. POWER/OFF - This switch applies power to the unit.

3-2-2. Tuning Procedure

3-2-2-1. Normal Tuning of Receiver to Signal Frequency.

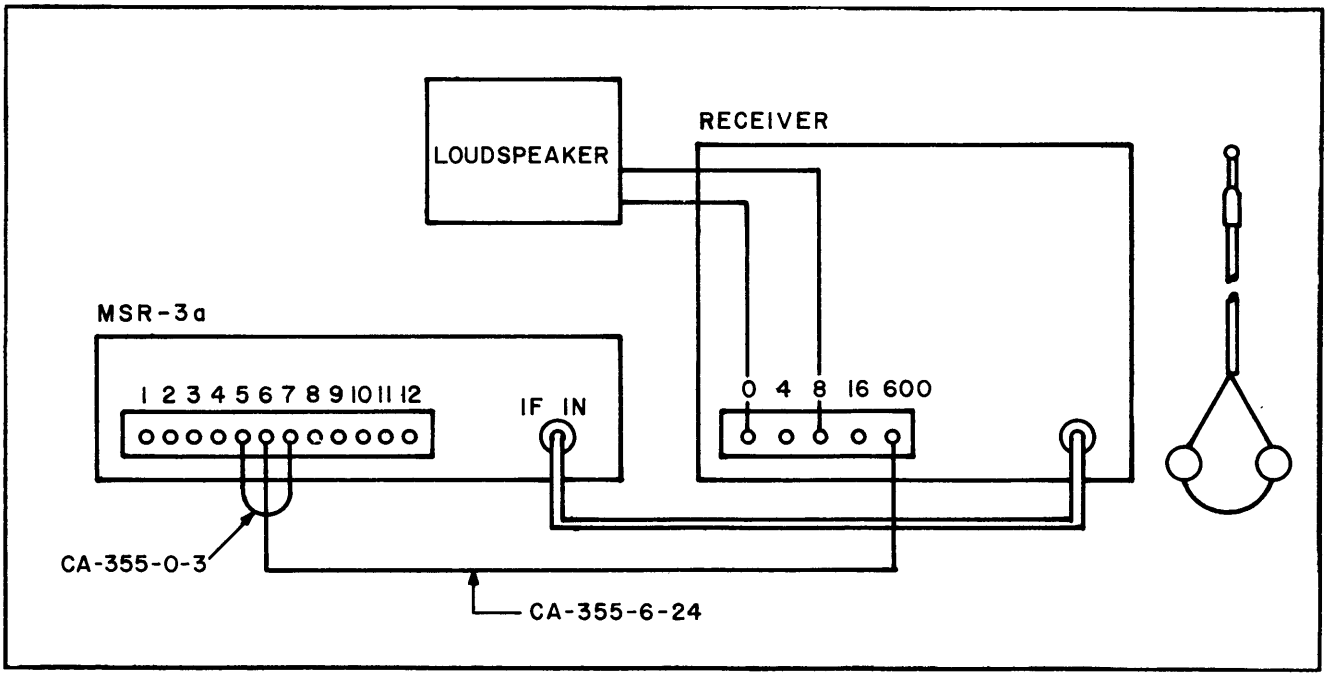


Figure 3-2 Cabling Connections for Single Loudspeaker Operation Model MSR-3a

3-2-2-1-1. This method is used when the receiver bandwidth is sufficient to pass the sideband with no decrease of sideband amplitude. To tune the receiver to the signal frequency, employ the normal oscillator frequency equations as described in the receiver instruction manual. If the receiver bandwidth is 5 kc or lower and the unimpaired passage of the desired sideband is required, then the receiver must be tuned off the signal frequency. This method is described below.

A. Reception of Single Sideband Signals

1. Tune receiver to signal frequency.
2. MSR-3a AVC ON and SLOW.
3. MSR-3a BFO switch ON.
4. MSR-3a MANUAL/XTAL switch on MANUAL.
5. Upper Sideband Reception.
   a. MSR-3a on UPPER.
   b. Tune MSR-3a BANDSPREAD control to zero center position for intelligibility.
   c. For crystal operation, set MANUAL/XTAL switch to XTAL and place a 217 kc crystal in socket Y2.
6. Lower Sideband Reception.
   a. MSR-3a on LOWER.
   b. Tune MSR-3a BANDSPREAD control to zero center position for intelligibility.
   c. For crystal operation, set MANUAL/XTAL switch to XTAL and place a 183 kc crystal in socket Y1.

B. Reception of AM Signals

1. Tune receiver to signal frequency.
2. MSR-3a AVC ON and FAST.
3. MSR-3a BFO switch OFF.
4. MSR-3a MANUAL/XTAL switch to MANUAL.
5. Reception of Both Sidebands.
   a. MSR-3a on UPPER.
   b. Tune MSR-3a BANDSPREAD control 2 kc above zero center.
   c. For crystal operation, use a 219 kc crystal in socket Y2 with MANUAL/XTAL switch in XTAL position.
6. Reception of Upper Sideband.
   a. MSR-3a on UPPER.
   b. MSR-3a MANUAL/XTAL switch on MANUAL.
   c. Tune MSR-3a BANDSPREAD control 0.4 kc above zero center.
   d. For crystal operation use a 217 kc crystal in socket Y2 with MANUAL/XTAL switch in XTAL position. Retune the receiver 0.4 kc below the signal frequency. If the receiver is crystal controlled, pull the crystal frequency approximately 400 cps with the crystal adjust control.
7. Reception of Lower Sideband.
   a. MSR-3a on LOWER.
   b. MSR-3a MANUAL/XTAL switch on MANUAL.
   c. Tune MSR-3a BANDSPREAD control 0.4 kc below zero center.
   d. For crystal operation use a 183 kc crystal in socket Y1 with MANUAL/XTAL switch in XTAL position. Retune the receiver 0.4 kc above the signal frequency. If the receiver is crystal controlled, pull the crystal frequency approximately 400 cps with the crystal adjust control.

C. Exalted Carrier Operation

1. Tune the receiver to signal frequency.
2. MSR-3a and receiver AVC ON and FAST.
3. MSR-3a BFO switch ON.
4. MSR-3a MANUAL/XTAL switch in MANUAL position.
5. Tune MSR-3a for SSB.

D. CW and FS Operation

1. Tune the receiver to signal frequency.
2. MSR-3a AVC ON and SLOW.
3. MSR-3a BFO switch ON.
4. MSR-3a MANUAL/XTAL switch in MANUAL position.
5. Tune the MSR-3a BANDSPREAD control to obtain desired pitch of signal.
6. Crystal Operation - Set MSR-3a on UPPER or LOWER and MANUAL/XTAL switch to XTAL. Tune the receiver for the desired beat note.

3-2-2-2. Off Center Tuning of Receiver to Increase Receiver Bandwidth to Sideband Reception.

3-2-2-2-1. This method of tuning will permit the maximum bandwidth of the system to pass the sideband of the desired signal in the I.F. passband by detuning the receiver 2 kc in the appropriate direction, above the signal frequency for the upper sideband and below the signal frequency for the lower sideband. The MSR-3a must also be adjusted accordingly to realign the signal.

A. Reception of Single Sideband Signals

1. MSR-3a and Receiver AVC ON and SLOW.
2. MSR-3a BFO switch ON.
3. MSR-3a MANUAL/XTAL switch in MANUAL position.

4. Upper Sideband Reception.
   a. Tune the receiver 2 kc above the signal frequency.
   b. Tune the MSR-3a BANDSPREAD control 2 kc above zero center for intelligibility.
   c. Crystal Operation - set the MSR-3a MANUAL/XTAL switch to XTAL position and place a 219 kc crystal in socket Y2. Tune the receiver for intelligibility.
5. Lower Sideband Reception.
   a. Tune the receiver 2 kc below the signal frequency.
   b. Tune the MSR-3a BANDSPREAD control 2 kc below zero center for intelligibility.
   c. Crystal Operation - set the MSR-3a MANUAL/XTAL switch to XTAL position and place a 181 kc crystal in socket Y1. Tune the receiver for intelligibility.

B. Reception of AM Signals.

1. MSR-3a and receiver AVC ON and FAST.
2. MSR-3a BFO switch OFF.
3. MSR-3a MANUAL/XTAL switch in MANUAL position.
4. Reception of Upper Sideband.
   a. Tune the receiver 1.6 kc above the signal frequency.
   b. MSR-3a set on UPPER.
   c. Tune the MSR-3a BANDSPREAD control 2 kc above zero center for intelligibility.
   d. For Crystal Operation - set the MSR-3a MANUAL/XTAL switch to XTAL position and insert a 219 kc crystal in socket Y2. Retune the receiver 1.6 kc above the signal frequency.
5. Reception of Lower Sideband.
   a. Tune the receiver 1.6 kc below the signal frequency.
   b. MSR-3a set on LOWER.
   c. Tune the MSR-3a BANDSPREAD control 2 kc below zero center for intelligibility.
   d. For Crystal Operation - set the MSR-3a MANUAL/XTAL switch to XTAL position and insert a 181 kc crystal in socket Y1. Retune the receiver 1.6 kc below the signal frequency.

C. Exalted Carrier Operation

1. MSR-3a and receiver AVC ON and SLOW.
2. MSR-3a BFO switch ON.
3. Reception of Sidebands. (See 3-2-2-2-A above).

SECTION IV
MAINTENANCE

4-1. SERVICE MAINTENANCE

4-1-1. GENERAL

4-1-1-1. The Model MSR-3a has been designed for long term trouble free duty. Little attention beyond normal maintenance is required. It is recommended that any maintenance to the equipment be performed by a competent technician.

4-1-1-2. Should normal operation procedure produce unsatisfactory results, a quick check of the power supply will very often determine the cause of the trouble. A pilot light indicates when power is being applied to the unit. Should the pilot lamp fail to light then the UPPER/LOWER SIDEBAND switch should be operated as an alternate means of checking since the sideband switching relay operates directly off of the 115 volt line. If no power is evident then check the fuse on the rear apron. A blown fuse should be replaced with one of equal value. If the fuse blows again the unit should be checked for shorts. The most common cause of operational failure is usually tube failure. Checking the tubes will often save many hours of unnecessary trouble-shooting.

4-1-2. PREVENTIVE

4-1-2-1. All components in this unit have been carefully selected to assure maximum efficiency in operation. If the sensitivity should drop and tube failure is suspected, test each tube in a reliable tube tester. The measured characteristics of the tube should be within the manufacturers tolerances (usually ±20% from tube manual tolerances). No special selection is necessary in the event of tube replacement, but the operator should remember that tubes of the same type will vary slightly in their individual characteristics.

4-1-2-2. Failure may occur due to breakdown of capacitors or resistors. Test all AC and DC voltages as indicated on Tube Voltage and Resistance charts, and investigate any serious discrepancies.

4-1-2-3. A faulty capacitor may cause overload of associated resistors, which should be checked for any change in resistance value. A shorted resistor may be detected by scorching or discoloration marks on the surface of the resistor. An open capacitor may cause unwanted oscillations and may be checked by connecting a good capacitor across it.

4-1-2-4. In order to prevent failure of the equipment due to corrosion, dust, and other destructive ambient conditions, it is recommended that the inside of the chassis be thoroughly inspected for signs of dirt, dampness, molding, charring or corrosion every 6 months. Correct any defect with cleaning agent of proven quality. When placing the unit in the rack, the operator should make certain that all terminal screw connections are tight.

4-2. CIRCUIT ALIGNMENT

4-2-1. The oscillators have been aligned to their correct frequencies at the factory. Readjustment will only be required if the performance of the unit is impaired as when the bandspread oscillator is off scale with a signal centered on 200 kc. The oscillators may be aligned either with an accurate signal generator or with a receiver as the signal source.

A. ALIGNMENT WITH SIGNAL GENERATOR.

Equipment Required
RF signal Generator
Audio Generator
Vacuum Tube Volt Meter
Oscilloscope
DC Source 0 to ±10 volts.

1. Alignment of Bandspread Oscillator-Upper Sideband.
   a. Feed a 217.00 kc signal from the RF signal generator to the IF input jack J1.
   b. Connect the oscilloscope to pin 5 of V3 the 1st Mixer.
   c. Switch sideband to UPPER.
   d. To assure a zero potential at terminal 12 of E1, short terminals 11 and 12.
   e. Set BANDSPREAD control to zero.
   f. Adjust the core of Z3 for a zero beat on scope (steady horizontal trace).

2. Alignment of Bandspread Oscillator-Lower Sideband.
   a. Switch sideband to LOWER.
   b. Set RF signal generator to 183.00 kc.
   c. Adjust C29 for a zero beat on scope (steady horizontal trace).
   d. Remove short from terminals 11 and 12 of E1.

TUBE	TYPE	FUNCTION	SOCKET PIN NUMBERS								
			1	2	3	4	5	6	7	8	9
V1	12AU7	AVC AMP.-RECT.	-0.6	-0.6	0.4	6.3*	6.3*	104	0	2.3	6.3*
V2	6BA6	I.F. AMP.	0	2.8	6.3*	6.3*	140	110	2.8		
V3	6BE6	1st MIXER	-11.2	2.2	6.3*	6.3*	255	66	0		
V4	6BE6	2nd MIXER	-4	0.7	6.3*	6.3*	170	42	0		
V5	12AT7	2nd OSC.-AUD.AMP.	134	-30	0	6.3*	6.3*	60	0	0.7	6.3*
V6	6AQ5	AUDIO OUT.	NC	19	6.3*	6.3*	300	300	0		
V7	6AG5	1st OSC.	-3.	0.44	6.3*	6.3*	60	83	NC		
V8	6J6	REACT. MOD.	60	60	6.3*	6.3*	0	0	1.8		
V9	12AU7	RELAY DRIVER-SIDE TONE GEN.	60	0	1.4	6.3*	6.3*	148	30	58	6.3*
V10	5Y3	RECTIFIER	NC	365	NC	365*	NC	365*	NC	365	
V11	0A2	VOLT. REG.	150	NC	NC	NC	150	NC	0		

CONDITIONS:
ALL MEASUREMENTS TAKEN WITH V.T.V.M.
BFO - ON
SIDEBAND—MANUAL

AUDIO GAIN—CLOCKWISE
AVC - OFF
AVC - FAST
NO SIGNAL

NC = NO CONNECTION
* = AC VOLTAGE

AC LINE VOLTAGE - 115 V.
ALL VOLTAGES TO GROUND EXCEPT AC
FILAMENT VOLTAGES - ACROSS FILAMENTS

CH180

Figure 4-1. Voltage Chart Model MSR-3a.

3. Bandspread Oscillator Remote Control.
   a. Connect the variable DC supply to terminal 12 of E1.
   b. Varying the DC voltage ±4.5 volts should produce a balanced shift of approximately ±4 kc in either upper or lower sideband position. If not reasonably balanced, adjust Reactance Balance Control, R48 for proper balance.

4. Alignment of 17 kc Oscillator.
   a. Feed a 17.00 kc audio signal to pin 7 of V4 the 2nd Mixer.
   b. Connect the scope to pin 5 of V4.
   c. Set the BFO switch to ON.
   d. Adjust the C40 (mounted on top of Z4) for a zero beat on the scope.

5. Sideband Selector Remote Operation.
   a. Connect the variable DC source to terminals 7 and 8 of E1 with negative lead on 8.
   b. Vary the DC voltage from zero to -9.0 volts. Switching should occur between -7.5 and -8.0 volts. If not adjust R54 accordingly.

6. Alignment of Side Tone Generator.
   a. Set BFO switch to ON.
   b. Connect the VTVM to pin 7 of V4.
   c. Vary the DC supply connected to pins 7 and 8 of E1 from zero to -9.0 volts. As the DC voltage approaches -5.0 volts the side tone oscillator should just start. Decreasing the voltage to -9.0 volts should increase the output of the oscillation to approximately 2.5 volts.

   NOTE: Oscillator will start at two positions of threshold. Correct position produces increased output as control voltage goes more negative.

TUBE	TYPE	FUNCTION	SOCKET PIN NUMBERS								
			1	2	3	4	5	6	7	8	9
V1	12AU7	AVC AMP-RECT.	1.2M	1.2M	150K	0	0	80K	430K	470	0
V2	6BA6	I.F. AMP.	470K	330	0	0	66K	100K	330		
V3	6BE6	1st MIXER	22K	220	0	0	50K	63K	470K		
V4	6BE6	2nd MIXER	9	120	0	0	150K	90K	20K		
V5	12AT7	2nd OSC.-AUD. AMP	inf.	100K	1.2	0	0	140K	1.0M	390	0
V6	6AQ5	AUDIO OUT.	NC	560	0	0	38K	38K	470K		
V7	6AG5	1st OSC.	22K	120	0	0	72K	72K	NC		
V8	6J6	REACT. MOD.	90K	90K	0	0	270K	33K	1.5K		
V9	12AU7	RELAY DRIVER-SIDE TONE GEN.	52K	1m	390	0	0	inf.	220K	30K	0
V10	5Y3	RECTIFIER	NC	38K	NC	100	NC	100	NC	38K	
V11	0A2	VOLT. REG.	38K	NC	NC	NC	38K	NC	0		

CONDITIONS:

OHMMETER – SIMPSON 260 OR EQUIVALENT
RESISTANCES TO GROUND
AUDIO GAIN – CLOCKWISE

MANUAL/XTAL - MANUAL
POWER - OFF
AVC - OFF / FAST
BFO - ON

NC = NO CONNECTION
K = THOUSAND
M = MILLION

CH179

Figure 4-2. Resistance Chart Model MSR-3a.

d. Set sideband to LOWER.
e. Adjust C55 on Z5 for 500 cps note.
f. Set sideband to UPPER.
g. Output frequency will be approximately 2.5 kcs.

7. When the sidebands are reversed as explained in Par. 3-1-3-4. the above procedure is reversed as shown below.
   d. Set sideband to UPPER.
   e. Adjust C55 on Z5 for 500 cps note.
   f. Set sideband to LOWER.
   g. Output frequency will be approximately 2.5 kcs.

B. ALIGNMENT WITH RECEIVER

Tune in a stable signal so that its carrier passes through the center of the IF. If the receiver has a selective IF filter, it should be used in its narrowest position to determine correct placement of the carrier on 200 kc. Place the sideband oscillator of the MSR in the XTAL position at either 217 kc or 183 kc.

(1) Set BFO to ON.
(2) Tune 17 kc oscillator (C40) to obtain a zero beat.
(3) Set BANDSPREAD control to zero.
(4) Set sideband to UPPER.
(5) Switch from XTAL to MANUAL.
(6) Adjust T2 of Z3 to obtain a zero beat.
(7) Set sideband to LOWER.
(8) Adjust C29 to obtain zero beat.

The side tone generator is checked as in A (6) above since no input signal is required.

SECTION V
PARTS LIST

MODE SELECTOR, RECEIVING MODEL MSR-3a

SYM.	DESCRIPTION	FUNCTION	TMC DWG. OR PART NO.
C1	CAPACITOR, fixed: ceramic; .01 mfd, +80 -20%; 500 wvdc.	IF Input Coup.	CC-100-16
C2	CAPACITOR, fixed: ceramic; .01 mfd, +80 -20%; 500 wvdc. Same as C1.	AVC Blocking Cap., V1A	CC-100-16
C3	CAPACITOR, fixed: ceramic; .01 mfd, +80 -20%; 500 wvdc. Same as C1.	Plate Bypass Cap., V2	CC-100-16
C4	CAPACITOR, fixed: ceramic; .01 mfd, +80 -20%; 500 wvdc. Same as C1.	Cath. Bypass V1A	CC-100-16
C5	CAPACITOR, fixed: ceramic; .01 mfd, +80 -20%, 500 wvdc. Same as C1.	Screen Bypass V2	CC-100-16
C6	CAPACITOR, fixed: ceramic; 120 mmfd, ±24 uuf; 500 wvdc.	Coupling Cap. V2-V3	CC-101-4
C7	CAPACITOR, fixed: ceramic; 47 mmfd, ±10%; 500 wvdc.	Coupling Cap. V3-V8	CC21SL470K
C8	CAPACITOR, fixed: ceramic; .01 mfd, +80 -20%; 500 wvdc. Same as C1.	Plate Bypass Cap. V3	CC-100-16
C9	CAPACITOR, fixed: plastic; .01 mfd, +40 -10%; 400 wvdc.	Coupling Cap. V1A-V1B	CN-100-1
C10	CAPACITOR, fixed: ceramic; .01 mfd, +80 -20%; 500 wvdc. Same as C1.	Plate Decoup. Cap., V1A	CC-100-16
C11	CAPACITOR, fixed: ceramic; .01 mfd, +80 -20%; 500 wvdc. Same as C1.	Cath. Bypass Cap., V3	CC-100-16
C12	CAPACITOR, fixed: ceramic; .01 mfd, +80 -20%; 500 wvdc. Same as C1.	Screen Bypass Cap., V3	CC-100-16
C13	CAPACITOR, fixed: ceramic; .001 mfd, ±200 uufd; 500 wvdc.	Plate Bypass Cap., V1B	CC-100-9
C14	CAPACITOR, fixed: plastic; .1 mfd, ±5%; 200 wvdc.	AVC Filter Cap. V1B	CN108C1003J
C15	CAPACITOR, fixed: ceramic; 47 mmfd, ±10%; 500 wvdc. Same as C7.	Coupling Cap. V4-V10	CC21SL470K
C16	CAPACITOR, fixed: ceramic; 82 mmfd, ±5%; 500 wvdc.	Coupling Cap. V4	CC26SL820J
C17	CAPACITOR, fixed: ceramic; .01 mfd, +80 -20%; 500 wvdc. Same as C1.	Plate Bypass Cap., V4	CC-100-16
C18	CAPACITOR, fixed: ceramic; .01 mfd, +80 -20%; 500 wvdc. Same as C1.	Cath. Bypass Cap., V4	CC-100-16

SYM.	DESCRIPTION	FUNCTION	TMC DWG. OR PART NO.
C19	CAPACITOR, fixed: ceramic; .01 mfd, +80 -20%, 500 wvdc. Same as C1.	Screen Bypass Cap., V4	CC-100-16
C20	CAPACITOR, fixed: plastic; .01 mfd, +40 -10%; 400 wvdc. Same as C9.	Coupling Cap. V4-V5	CN-100-1
C21	NOT USED		
C22	NOT USED		
C23	CAPACITOR, fixed: ceramic; 0.1 ufd, +40 -10%; 400 wvdc.	Feedback Cap. V5B	CN-100-4
C24	CAPACITOR, fixed: plastic; .01 mfd, +40 -10%; 400 wvdc. Same as C9.	Coupling Cap. V6B-7	CN-100-1
C25	CAPACITOR, fixed: plastic; 2 mfd, ±10%; 200 wvdc.	Cath. Bypass Cap., V7	CN108C2004K
C26	CAPACITOR, fixed: ceramic; .01 mfd, +80 -20%; 500 wvdc. Same as C1.	Audio Bypass Cap., V7	CC-100-16
C27	CAPACITOR, fixed: electrolytic; 10 mfd, 300 wvdc.	P.S. Filter Cap. V7	CE64C100N
C28	CAPACITOR, variable: air; 2.8-16 mmfd, 1200 v RMS.	Bandspread	CB-135-4
C29	CAPACITOR, variable: ceramic; 7-45 mfd, 500 wvdc.	Bandspread Adj. Cap.	CV11C450
C30	CAPACITOR, fixed: ceramic; 100 mmfd, ±5%; 500 wvdc.	Coupling Cap. V9	CC32CH101J
C31	NOT USED		
C32	CAPACITOR, fixed: mica; 82 mfd, ±2%; 500 wvdc.	p/o Bandpass Filter, Z3	CM20D820G
C33	CAPACITOR, fixed: ceramic; 47 mmfd, ±5%; 500 wvdc.	Coupling Cap., S4	CC32CH470J
C34	CAPACITOR, fixed: ceramic; 30 mmfd, ±5%; 500 wvdc.	Grid Bypass Cap., S4	CC21SL300J
C35	CAPACITOR, fixed: ceramic; 0.1 ufd, +80 -20%, 500 wvdc.	Cath. Bypass Cap., V8	CC-100-28
C36	CAPACITOR, fixed: ceramic; .01 mfd, +80 -20%; 500 wvdc. Same as C1.	Screen Bypass Cap., V8	CC-100-16
C37	CAPACITOR, fixed: ceramic; 150 mmfd, ±10%; 500 wvdc.	Screen Bypass Cap., V8	CC-101-2
C38	CAPACITOR, fixed: mica; .001 mfd, ±2%; 500 wvdc.	p/o 17 Kc Osc. Tank, Z4	CM20D102G
C39	CAPACITOR, fixed: mica; 1500 mmfd, ±2%; 500 wvdc.	p/o 17 Kc Osc. Tank, Z4	CM20D152G

SYM.	DESCRIPTION	FUNCTION	TMC DWG. OR PART NO.
C40	CAPACITOR, variable: mica; 100-550 mmfd, 250 wvdc.	17 Kc Osc. Adj., Z4	CV-100-304
C41	CAPACITOR, fixed: ceramic; .01 mfd, +80 -20%; 500 wvdc. Same as C1.	Plate Bypass Cap., V6A	CC-100-16
C42	CAPACITOR, fixed: plastic; .1 mfd, ±5%; 200 wvdc. Same as C14.	Filter Cap. V9	CN108C1003J
C43	CAPACITOR, fixed: plastic; .1 mfd, ±5%; 200 wvdc. Same as C14.	Filter Cap. V9	CN108C1003J
C44	CAPACITOR, fixed: ceramic; .001 mfd, ±200 uufd; 500 wvdc. Same as C13.	Plate Coupling Cap., V9	CC-100-9
C45	CAPACITOR, fixed: ceramic; 22 mmfd, ±5%; 500 wvdc.	Screen Bypass Cap., V9	CC21SL220J
C46	CAPACITOR, fixed: ceramic; .005 mfd, G.M.V.: 500 wvdc.	Cath. Bypass Cap., V9	CC-100-15
C47 A,B	CAPACITOR, fixed: ceramic; two section; .01 mfd, 500 wvdc.	AC Line Filter Cap.	CC-100-23
C48	CAPACITOR, fixed: paper; 4 mfd, +20 -10%, 600 wvdc.	PS Filter Cap. V11	CP41B1FF405V
C49 A,B	CAPACITOR, electrolytic: 35 - 35 mfd.	PS Filter Cap. V11	CE52F350R
C50	CAPACITOR, fixed: mica; .001 mfd, ±2%; 500 wvdc. Same as C38.	p/o 17 Kc Osc. Tank, Z4	CM20D102G
C51	CAPACITOR, fixed: mica; 820 mmfd, ±2%; 500 wvdc.	Grid Bypass Cap., V4	CM20D821G
C52	CAPACITOR, fixed: mica; .001 mfd, ±2%; 500 wvdc. Same as C38.	Grid Coupling Cap., V10B	CM20D102G
C53	CAPACITOR, fixed: mica; 820 mmfd, ±2%; 500 wvdc. Same as C51.	p/o Side Tone Gen. Tank, Z5	CM20D821G
C54	CAPACITOR, fixed: ceramic; .01 mfd, +80 -20%; 500 wvdc. Same as C1.	Bypass Cap., Z5	CC-100-16
C55	CAPACITOR, variable: mica; 275-970 mmfd, 250 wvdc.	Side Tone Gen. Adj., Z5	CV-100-306
C56	CAPACITOR, fixed: plastic; .01 mfd, +40 -10%; 400 wvdc. Same as C9.	Coupling Cap., V3	CN-100-1
C57	CAPACITOR, fixed: ceramic; .01 mfd, +80 -20%; 500 wvdc. Same as C1.	PS Filter Cap., V11	CC-100-16
E1	TERMINAL BOARD, barrier type: plastic; 12 terminals, screw w/feed thru solder lug type.	Input Term. Board	TM-100-12

SYM.	DESCRIPTION	FUNCTION	TMC DWG. OR PART NO.
E2	TERMINAL BOARD, barrier type: plastic; 8 terminals, screw w/feed thru solder lug type.	Inter. Term. Board	TM-100-8
E3	NOT USED		
E4	TERMINAL BOARD, phenolic: 12 terminals, right angle spade lug type. (Supplied as loose item).	Fanning Strip	TM-105-12-AL
F1	FUSE, cartridge: 3 amp; 250 v; instantaneous.	Line Fuse	FU-100-3
I1	LAMP, incandescent: 6-8 V; 150 ma; T-3-1/4 clear bulb; bayonet base.	Sideband Indicator	BI-101-47
I2	LAMP, incandescent: 6-8 V; 150 ma; T-3-1/4 clear bulb; bayonet base. Same as I1.	Sideband Indicator	BI-101-47
I3	LAMP, incandescent: 6-8 V; 150 ma; T-3-1/4 clear bulb; bayonet base. Same as I1.	Power Indicator	BI-101-47
J1	CONNECTOR, receptacle: electrical; 1 female contact; 52 ohms; BNC type.	IF Input Jack	UG-625/U
J2	CONNECTOR, receptacle: electrical; 3 contacts, male.	AC Line Input	MS3102A-16S-5P
J3	JACK, telephone: tip and sleeve; bushing mounted; fits plug PJ-055.	Phones Jack	JJ-034
J4	CONNECTOR, electrical: 4 contacts, male.	Audio Output	MS3102A-14S-2P
K1	RELAY, armature: DPDT; 80 vdc, 32 w; 20,000 ohms.	BFO Relay	RL-105
K2	RELAY, armature: impulse type; 4 PDT; 115 vac; 60 cps.	Sideband Selector Relay	RL-118-17A115-60-A
K3	RELAY, armature: DPDT; 80 vdc, 32 w; 20,000 ohms. Same as K1.	Side Tone Selector Relay	RL-105
L1	REACTOR, fixed: 15 henries; 85 ma dc; 285 ohms dc; 2500 v. RMS Test.	PS Filter Choke V11	TF-5000
L2	REACTOR, fixed: 15 henries; 85 ma dc; 285 ohms dc; 2500 v RMS Test. Same as L1.	PS Filter Choke V11	TF-5000
L3	REACTOR, fixed: 6.4 mh.	p/o 1st Osc. Tank	A-1507
P2	CONNECTOR, plug: electrical; 4 contacts, female. (Supplied as loose item).	Output	MS3106A-16S-5S
P4	CONNECTOR, plug: electrical; 4 contacts, female. (Supplied as loose item).	AC Line Input Plug	MS3106A-14S-2S

SYM.	DESCRIPTION	FUNCTION	TMC DWG. OR PART NO.
R1	RESISTOR, fixed: composition; 100,000 ohms, ±10%; 1/2 watt.	Grid Limiting Res., V2	RC20GF104K
R2	RESISTOR, fixed: composition; 470,000 ohms, ±10%; 1/2 w.	Grid Res., V1A	RC20GF474K
R3	RESISTOR, fixed: composition; 100,000 ohms, ±10%; 1/2 w. Same as R1 .	Grid Res., V2	RC20GF104K
R4	RESISTOR, fixed: composition; 22,000 ohms, ±10%; 1 watt.	Plate Load Res., V2	RC30GF223K
R5	RESISTOR, fixed: composition; 330 ohms, ±10%; 1/2 watt.	Cath. Bias Res. V2	RC20GF331K
R6	RESISTOR, fixed: composition; 68,000 ohms, ±10%; 1 watt.	Screen Grid Res., V2	RC30GF683K
R7	RESISTOR, fixed: composition; 470 ohms, ±10%; 1/2 watt.	Cath. Bias Res., V1A	RC20GF471K
R8	RESISTOR, fixed: composition; 2200 ohms, ±10%; 1/2 watt.	Plate Decoupl. Res., V2	RC20GF222K
R9	RESISTOR, fixed: composition; 470,000 ohms, ±10%; 1/2 watt. Same as R2.	Grid Res., V3	RC20GF474K
R10	RESISTOR, fixed: composition; 22,000 ohms, ±10%; 1 watt. Same as R4.	Plate Load Res., V1A	RC30GF223K
R11	RESISTOR, fixed: composition; 22,000 ohms, ±10%; 1 watt. Same as R4.	Plate Decoup. Res., V1A	RC30GF223K
R12	RESISTOR, fixed: composition; 22,000 ohms, ±10%; 1/2 w.	Grid Res., V1B	RC20GF223K
R13	RESISTOR, fixed: composition; 150,000 ohms, ±10%; 1/2 w.	Cath. Bias Res., V1B	RC20GF154K
R14	RESISTOR, fixed: composition; 10,000 ohms, ±10%; 1/2 w.	Plate Load Res., V3	RC20GF103K
R15	RESISTOR, fixed: composition; 220 ohms, ±10%; 1/2 watt.	Cath. Bias Res., V3	RC20GF221K
R16	RESISTOR, fixed: composition; 2200 ohms, ±10%; 1/2 watt. Same as R8.	Plate Decoupl. Res., V3	RC20GF222K
R17	RESISTOR, fixed: composition; 1.5 megohm, ±10%; 1/2 watt.	AVC Load Res., V1B	RC20GF155K
R18	RESISTOR, fixed: composition; 10 megohms, ±10%; 1/2 watt.	AVC Time Constant Cap.	RC20GF106K
R19	RESISTOR, fixed: composition; 20,000 ohms, ±5%; 1/2 watt.	Grid Res., V4	RC20GF203J
R20	RESISTOR, fixed: composition; 100,000 ohms, ±10%; 1/2 watt. Same as R1.	Grid Res., V4	RC20GF104K

SYM.	DESCRIPTION	FUNCTION	TMC DWG. OR PART NO.
R21	RESISTOR, fixed: composition; 20,000 ohms, ±5%; 1/2 watt. Same as R19.	Grid Res., V4	RC20GF203J
R22	RESISTOR, fixed: composition; 100,000 ohms, ±10%; 1/2 watt. Same as R1.	Plate Load Res., V4	RC20GF104K
R23	RESISTOR, fixed: composition; 120 ohms, ±10%; 1/2 watt.	Cath. Bias Res., V4	RC20GF121K
R24	RESISTOR, fixed: composition; 47,000 ohms, ±10%; 2 watts.	Screen Decoupl. Res., V4	RC42GF473K
R25	RESISTOR, fixed: composition; 10,000 ohms, ±10%; 1 watt.	Plate Decoupl. Res., V4	RC30GF103K
R26	RESISTOR, fixed: composition; 12,000 ohms, ±10%; 1/2 watt.	Grid Res., V5	RC20GF123K
R27	NOT USED		
R28	NOT USED		
R29	NOT USED		
R30	RESISTOR, variable: composition; 1 megohm, ±20%, 2 watts, log taper.	Grid Res., V6B	RV4ATRD105D
R31	RESISTOR, fixed: composition; 390 ohms, ±10%; 1/2 watt.	Cath. Bias Res., V6B	RC20GF391K
R32	RESISTOR, fixed: composition; 470,000 ohms, ±10%; 1/2 watt. Same as R2.	Audio Gain Control, V7	RC20GF474K
R33	RESISTOR, fixed: composition; 100,000 ohms, ±10%; 1/2 watt. Same as R1.	Plate Load Res., V7	RC20GF104K
R34	RESISTOR, fixed: composition; 560 ohms, ±10%, 2 watts.	Cath. Bias Res., V7	RC42GF561K
R35	RESISTOR, fixed: composition; 3900 ohms, ±10%, 1/2 watt.	Imp. Match Res., J3	RC20GF392K
R36	RESISTOR, fixed: composition; 33,000 ohms, ±10%, 1 watt.	Decoupling Res., T1	RC30GF333K
R37	RESISTOR, fixed: composition; 330,000 ohms, ±10%, 1/2 watt.	Grid Res., V7	RC20GF334K
R38	RESISTOR, fixed: composition; 120 ohms, ±10%; 1/2 watt. Same as R23.	Cath. Bias Res., V8	RC20GF121K
R39	RESISTOR, fixed: composition; 39,000 ohms, ±10%; 1/2 watt.	Plate Load Res., V8	RC20GF393K
R40	RESISTOR, fixed: composition; 39,000 ohms, ±10%, 1/2 watt. Same as R39.	Screen Grid Res., V8	RC20GF393K
R41	RESISTOR, fixed: composition; 100,000 ohms, ±10%; 1/2 w. Same as R1.	p/o 17 Kc Osc. Tank, Z4	RC20GF104K

SYM.	DESCRIPTION	FUNCTION	TMC DWG. OR PART NO.
R42	RESISTOR, fixed: composition; 22,000 ohms, ±10%; 1/2 watt. Same as R12.	Plate Load Res., V6A	RC20GF223K
R43	RESISTOR, fixed: composition; 470,000 ohms, ±10%; 1/2 w. Same as R2.	Grid Filter Res., V9	RC20GF474K
R44	RESISTOR, fixed: composition; 680,000 ohms, ±10%, 1/2 watt.	Grid Filter Res., V9	RC20GF684K
R45	RESISTOR, fixed: composition; 150,000 ohms, ±10%; 1/2 w. Same as R13.	Grid Filter Res., V9	RC20GF154K
R46	RESISTOR, fixed: composition; 120,000 ohms, ±10%, 1/2 w.	Grid Res., V9	RC20GF124K
R47	RESISTOR, fixed: composition; 82,000 ohms, ±10%, 1/2 watt.	p/o Phase Circuit, V9	RC20GF823K
R48	RESISTOR, variable: composition; 2500 ohms, ±10%, 2 watts, linear taper.	React. Bal. Control, V9	RV4ATSA252A
R49	RESISTOR, fixed: composition; 180 ohms, ±10%, 1/2 watt.	Cath. Degen. Res., V9	RC20GF181K
R50	RESISTOR, fixed: composition; 1000 ohms, ±10%, 1/2 watt.	Cath. Bias, V9	RC20GF102K
R51	RESISTOR, fixed: composition; 33,000 ohms, ±10%, 1/2 watt.	Grid Res., V9	RC20GF333K
R52	RESISTOR, fixed: composition; 56,000 ohms, ±10%, 1/2 watt.	Plate Load Res., V9	RC20GF563K
R53	RESISTOR, fixed: composition; 390 ohms, ±10%; 1/2 watt. Same as R31.	Cath. Bias V10A	RC20GF391K
R54	RESISTOR, variable: composition; 1 megohm, ±20%, 2 watts; linear taper.	Relay Thresh. Control	RV4ATXA105B
R55	RESISTOR, fixed: wire wound; 4500 ohms, ±5%, 10 watts.	B+ Dropping Res.	RW-109-47
R56	RESISTOR, fixed: composition; 56,000 ohms, ±10%, 2 watts.	B+ Dropping Res., K1	RC42GF563K
R57	RESISTOR, fixed: composition; 1 megohm, ±10%, 1/2 watt.	AVC T.C. Res. S1-S2	RC20GF105K
R58	RESISTOR, fixed: composition; 47,000 ohms, ±10%, 1/2 watt.	Plate Load Res., V10B	RC20GF473K
R59	RESISTOR, fixed: composition; 470,000 ohms, ±10%; 1/2 watt. Same as R2.	Grid Res., V10B	RC20GF474K
R60	RESISTOR, variable: composition; 100,000 ohms, ±10%, 2 watts, linear taper.	Tone Thresh. Control	RV4ATSA104B
R61	RESISTOR, fixed: composition; 470,000 ohms, ±10%; 1/2 watt. Same as R2.	Grid Voltage Div. Res. V10B	RC20GF474K

SYM.	DESCRIPTION	FUNCTION	TMC DWG. OR PART NO.
R62	RESISTOR, fixed: composition; 22,000 ohms, ±10%, 2 watts.	Screen Grid Res., V3	RC42GF223K
R63	RESISTOR, fixed: composition; 47,000 ohms, ±10%, 1/2 watt. Same as R58.	Audio Feedback V5B	RC20GF473K
R64	RESISTOR, fixed: composition; 680 ohms, ±10%, 1/2 watt.	Audio Trans. Load	RC20GF681K
R65	RESISTOR, fixed: composition; 2700 ohms, ±10%, 1/2 watt.	30 db pad Res., T1	RC20GF272K
R66	RESISTOR, fixed: composition; 680 ohms, ±10%, 1/2 watt. Same as R64.	30 db pad Res., T1	RC20GF681K
R67	RESISTOR, fixed: composition; 1 megohm, ±10%, 1/2 watt. Same as R57.	Grid Resistor	RC20GF105K
R68	RESISTOR, fixed: composition; 20,000 ohms, ±5%; 1/2 watt. Same as R19.	Filter Load	RC20GF203J
R69	RESISTOR, fixed: composition; 20,000 ohms, ±5%; 1/2 watt. Same as R19.	Filter Load	RC20GF203J
R70	RESISTOR, fixed: composition; 22,000 ohms, ±10%; 1/2 w. Same as R12.	Grid Res.	RC20GF223K
S1	SWITCH, toggle: SPST; 3 amp. at 250 v, bat type toggle.	AVC FAST/SLOW Switch	ST-12A
S2	SWITCH, toggle: SPST; 3 amp at 250 v, bat type toggle. Same as S1.	AVC ON/OFF Switch	ST-12A
S3	NOT USED		
S4	SWITCH, rotary: 1 section; 2 position; 2 moving contacts; 6 fixed contacts.	XTAL/MANUAL Switch	SW-226
S5	SWITCH, rotary: 1 section; 2 position; 1 moving contact; 2 fixed contacts.	BFO ON/OFF Switch	SW-194
S6	SWITCH, push: SPST; 1 amp at 250 v, normally open.	SIDEBAND switch	SW-168SPST-2-NOBB
S7	SWITCH, toggle: DPST; 2 amp at 250 v, bat type toggle.	POWER/OFF Switch	ST-22K
S8	SWITCH, toggle; DPST; 2 amp at 250 v, bat type toggle. Same as S7.	OUTPUT LEVEL	ST-22K
T1	TRANSFORMER, audio frequency: plate coupling type; primary: 5000 ohms, 35 ma; secondary: 600 ohms, tapped at 8 ohms; 5 w maximum operating level.	Audio Output Transformer	TF-100
T2	TRANSFORMER, radio frequency: 225 microhenries, Q=75; tapped at 115 microhenries, Q=50; tuning core included.	p/o Bandpass Filter, Z3	p/o A-1507

SYM.	DESCRIPTION	FUNCTION	TMC DWG. OR PART NO.
T3	TRANSFORMER, audio frequency: input type; 43.5 millihenries; Q=20; 10.5 ohms; 2 taps.	p/o Second Osc. Tank, Z4	A-1382
T4	TRANSFORMER, audio frequency: input type; 43.5 millihenries; Q=20; 10.5 ohms; tapped.	p/o Side Tone Gen. Tank Z5	A-1383
T5	TRANSFORMER, power: primary - 105 v, 115 v, 125 v, 210 v, 230 v, 50/60 cps, single phase: secondary #1 - 6.3 v at 5 amps CT; secondary #2 - 6.3 v at 2 amps CT; secondary #3 - 340-0-340 v rms, 100 ma dc operating into 4 ufd input filter; secondary #4 - 5 v at 2 amps: all windings insulated for 1000 volts. Hermetically sealed in rectangular steel case.	Power Transformer	TF-196
V1	TUBE, electron: medium-mu duo triode; 9 pin miniature.	AVC Ampl. Rect.	12AU7
V2	TUBE, electron: remote cutoff RF pentode; 7 pin miniature.	IF Amplifier	6BA6
V3	TUBE, electron: heptode converter; 7 pin miniature.	First Mixer	6BE6
V4	TUBE, electron: heptode converter; 7 pin miniature. Same as V3.	Second Mixer	6BE6
V5	TUBE, electron: duo triode; 9 pin miniature.	2nd Osc-Aud Amp.	12AT7
V6	TUBE, electron: beam power amplifier; 7 pin miniature.	Audio Output	6AQ5
V7	TUBE, electron: sharp cutoff RF pentode; 7 pin miniature.	First Osc.	6AG5
V8	TUBE, electron: duo-triode; 7 pin miniature.	React. Mod.	6J6
V9	TUBE, electron: medium-mu duo triode; 9 pin miniature. Same as V1.	Relay Driver-Side Tone Gen.	12AU7
V10	TUBE, electron: full-wave rectifier; octal base.	Power Rect.	5Y3GT
V11	TUBE, electron: voltage regulator; 7 pin miniature.	Voltage Reg.	OA2
W1	CABLE ASSEMBLY, power, electrical: 3 conductor, 6 ft. long, w/integral male plug with pigtail ground lead one end, and MS3106A-16S-5S with MS3057-8 clamp on other end.	AC Line Cord	CA-385

SYM.	DESCRIPTION	FUNCTION	TMC DWG. OR PART NO.
XF1	FUSEHOLDER, extractor post type: 250 v, 15 amp.	Socket for F1	FH-100-2
XI1	LIGHT, indicator: w/green faceted lens; for miniature bayonet base T-3-1/4 bulb.	Socket for I1	TS-133
XI2	LIGHT, indicator: w/green faceted lens; for miniature bayonet base T-3-1/4 bulb.	Socket for I2	TS-133
XI3	LIGHT, indicator: w/red frosted lens; for miniature bayonet base T-3-1/4 bulb.	Socket for I3	TS-106-1
XV1	SOCKET, electron tube: 9 pin miniature.	Socket for V1	TS103P01
XV2	SOCKET, electron tube: 7 pin miniature.	Socket for V2	TS102P01
XV3	SOCKET, electron tube: 7 pin miniature. Same as XV2.	Socket for V3	TS102P01
XV4	SOCKET, electron tube: 7 pin miniature. Same as XV2.	Socket for V4	TS102P01
XV5	SOCKET, electron tube: 9 pin miniature. Same as XV1	Socket for V5	TS103P01
XV6	SOCKET, electron tube: 7 pin miniature. Same as XV2.	Socket for V6	TS102P01
XV7	SOCKET, electron tube: 7 pin miniature. Same as XV2.	Socket for V7	TS102P01
XV8	SOCKET, electron tube: 7 pin miniature. Same as XV2.	Socket for V8	TS102P01
XV9	SOCKET, electron tube: 9 pin miniature. Same as XV1.	Socket for V9	TS103P01
XV10	SOCKET, electron tube: octal.	Socket for V10	TS101P01
XV11	SOCKET, electron tube: 7 pin miniature. Same as XV2.	Socket for V11	TS102P01
XY1	SOCKET, crystal: 2 contacts; 0.486 in. spacing for .050 in. pin diam; steatite body.	Socket for Y1	TS-104-1
XY2	SOCKET, crystal: 2 contacts; 0.486 in. spacing for .050 in. pin diam; steatite body. Same as XY1.	Socket for Y2	TS-104-1
Y1	CRYSTAL UNIT, quartz: 183 kc, ±0.01%; includes holder HC-6/U.	183 Kc Crystal	CR-105-1-.1830
Y2	CRYSTAL UNIT, quartz: 217 kc, ±0.01%; includes holder.	217 Kc Crystal	CR-105-1-.2170P
Z1	FILTER, bandpass: 19.1 kc; 3.4 kc bandwidth; 10,000 ohms impedance.	Bandpass Filter	FX-153

SYM.	DESCRIPTION	FUNCTION	TMC DWG. OR PART NO.
Z2	FILTER, low-pass: 3500 cps cutoff frequency.	Low-Pass Filter	FX-152
Z3	TRANSFORMER, radio frequency: 790 kc; (consists of C32 & T2).	First Osc. Tank	A-1507
Z4	OSCILLATOR NETWORK, audio frequency: 17 kc; (consists of C38, 39, 40, 50, R41 & T3).	Second Osc. Tank	A-1381
Z5	OSCILLATOR NETWORK, audio frequency: 43.5 millihenries (consists of C53, 55, T4).	Side Tone Gen. Tank	A-1384

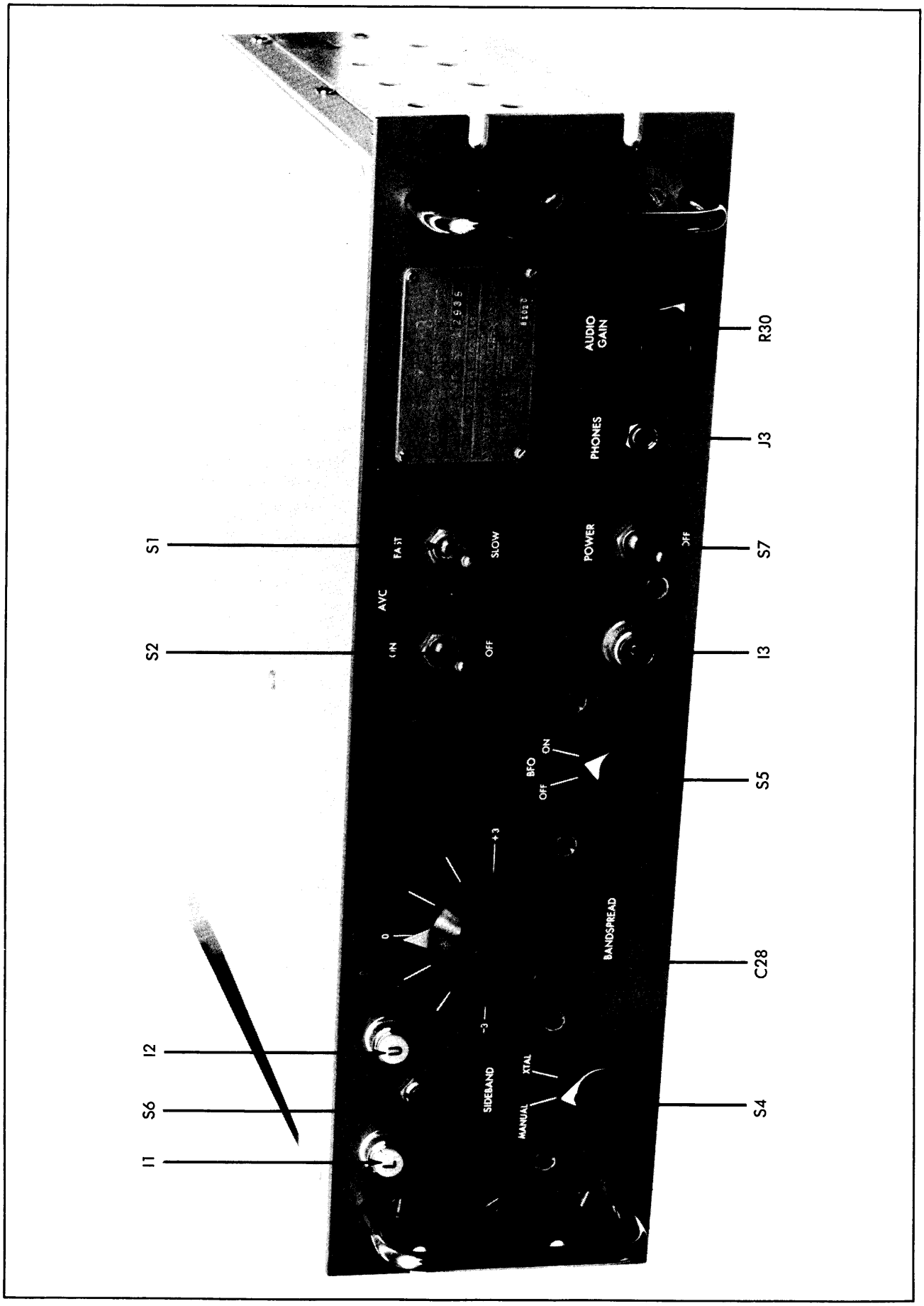
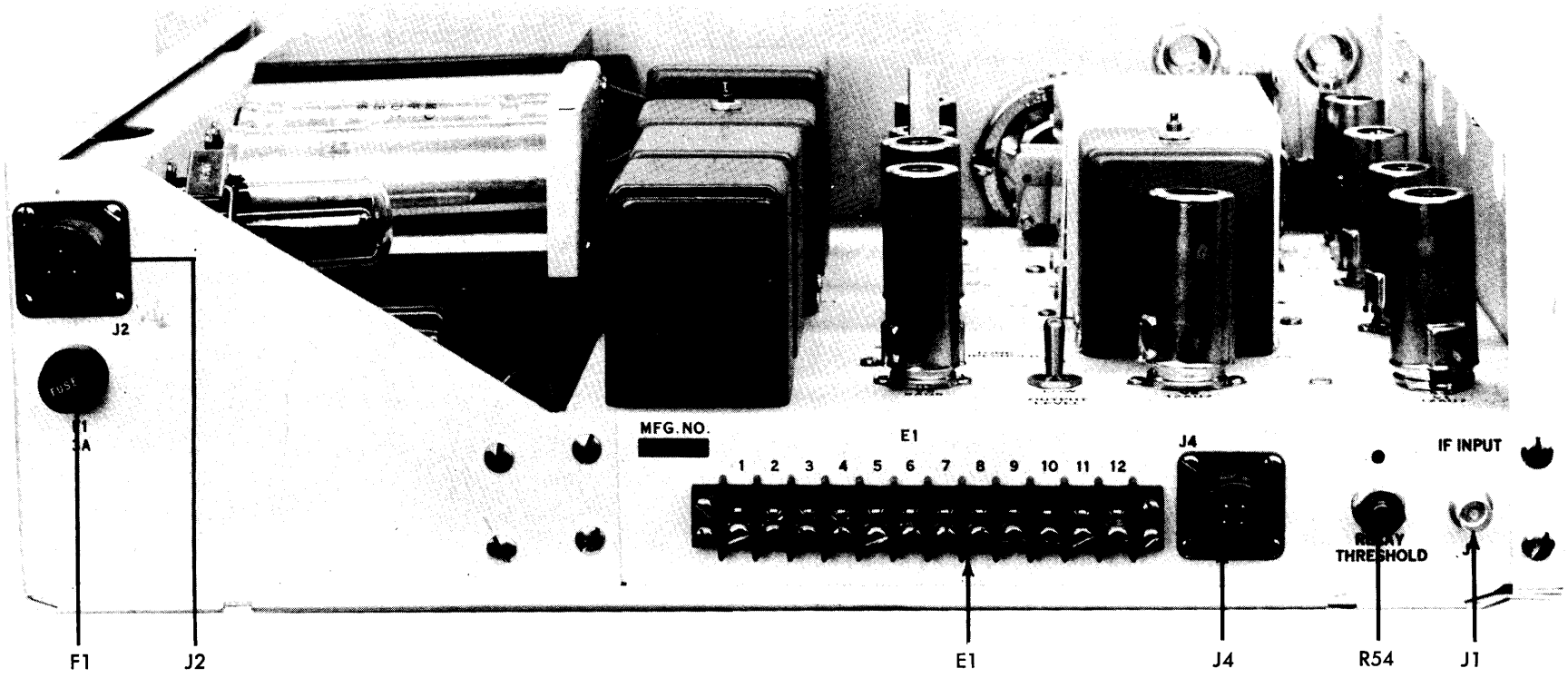


Figure 5-1 Front View, Model MSR-3a.



PH-974

Figure 5-2 Rear View, Model MSR-3a.

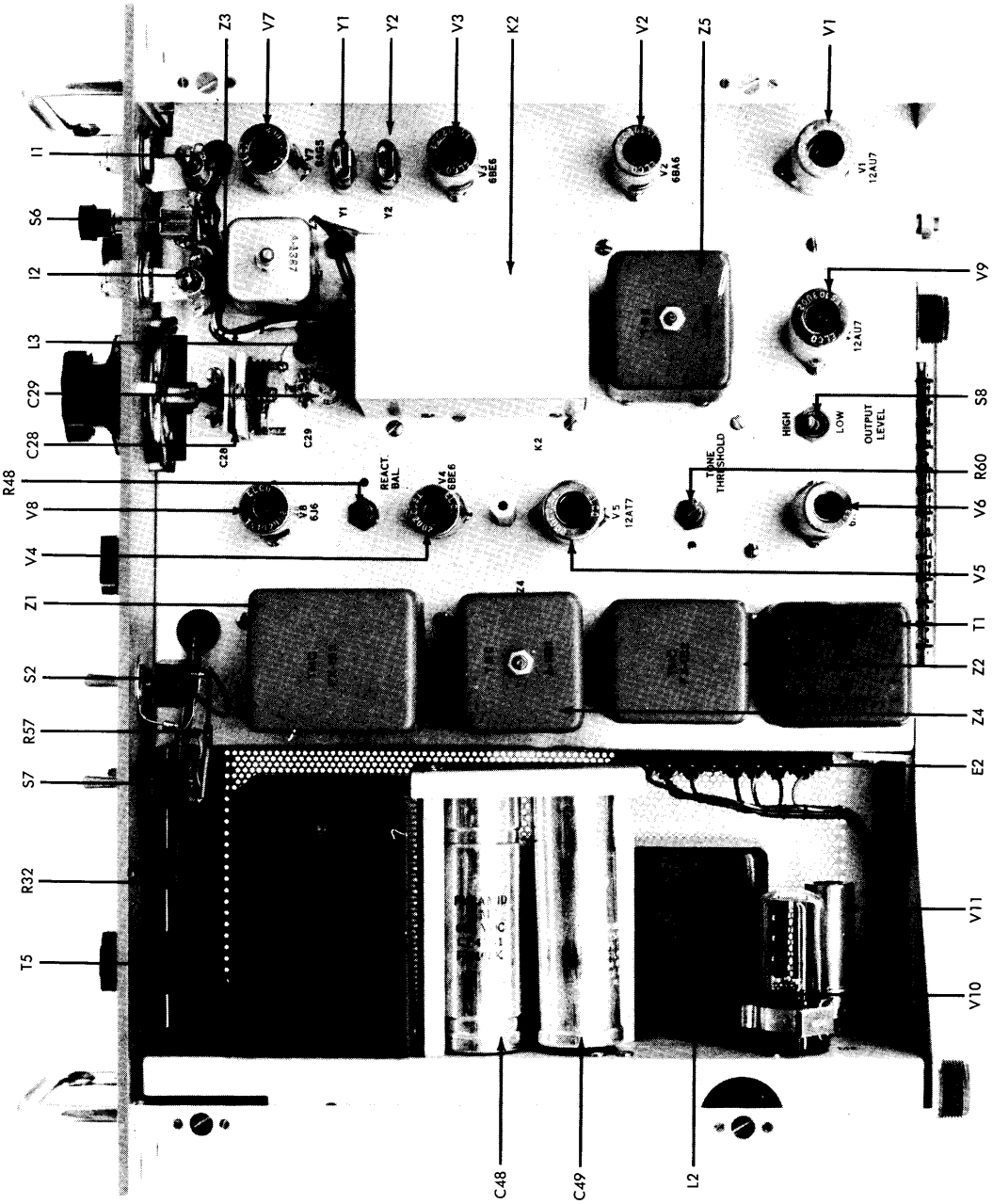


Figure 5-3 Top View, Model MSR-3a.

PH-972

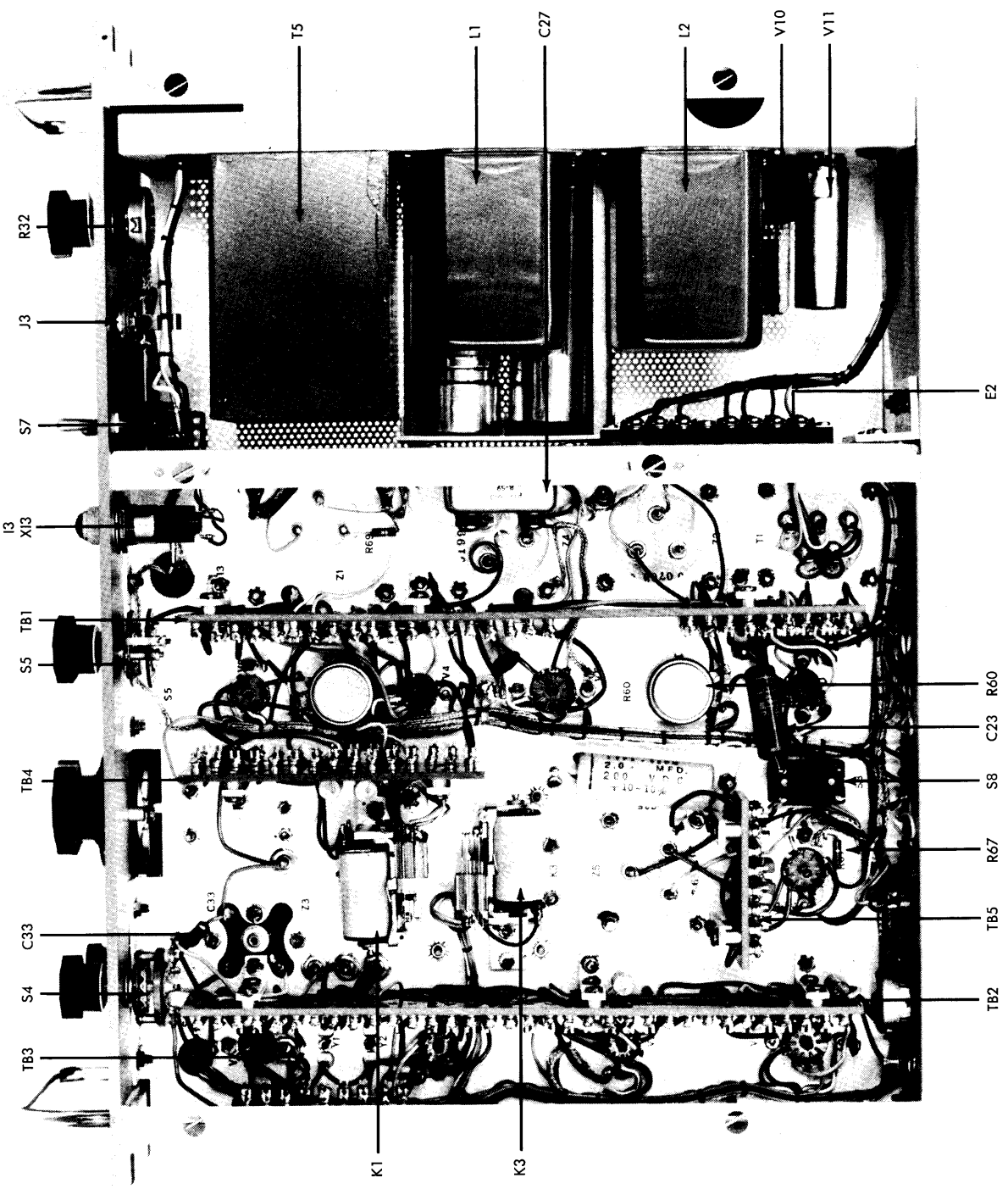


Figure 5-4 Bottom View, Model MSR-3a.

PH-967

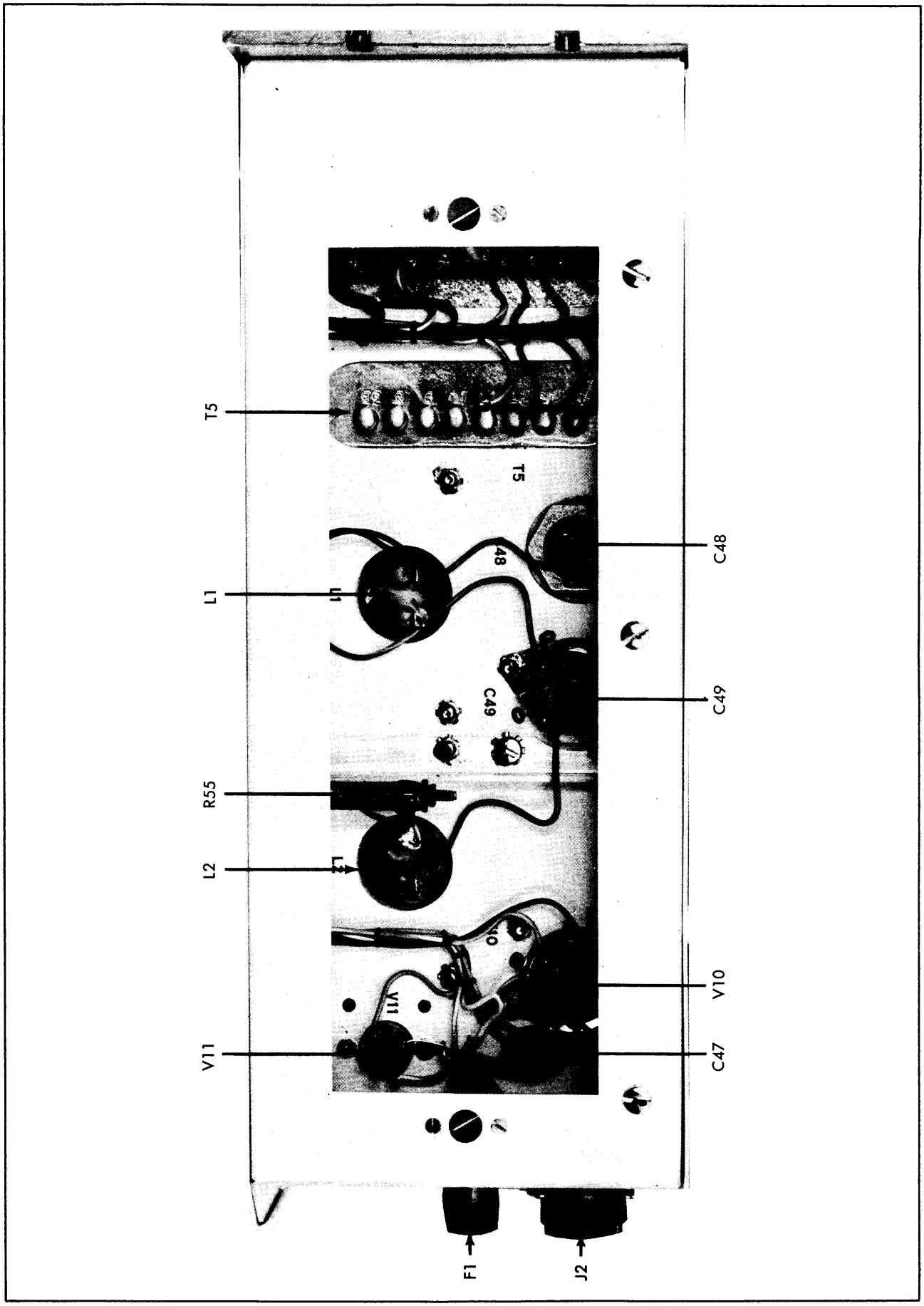


Figure 5-5 Bottom View, Power Supply Section

PH-968

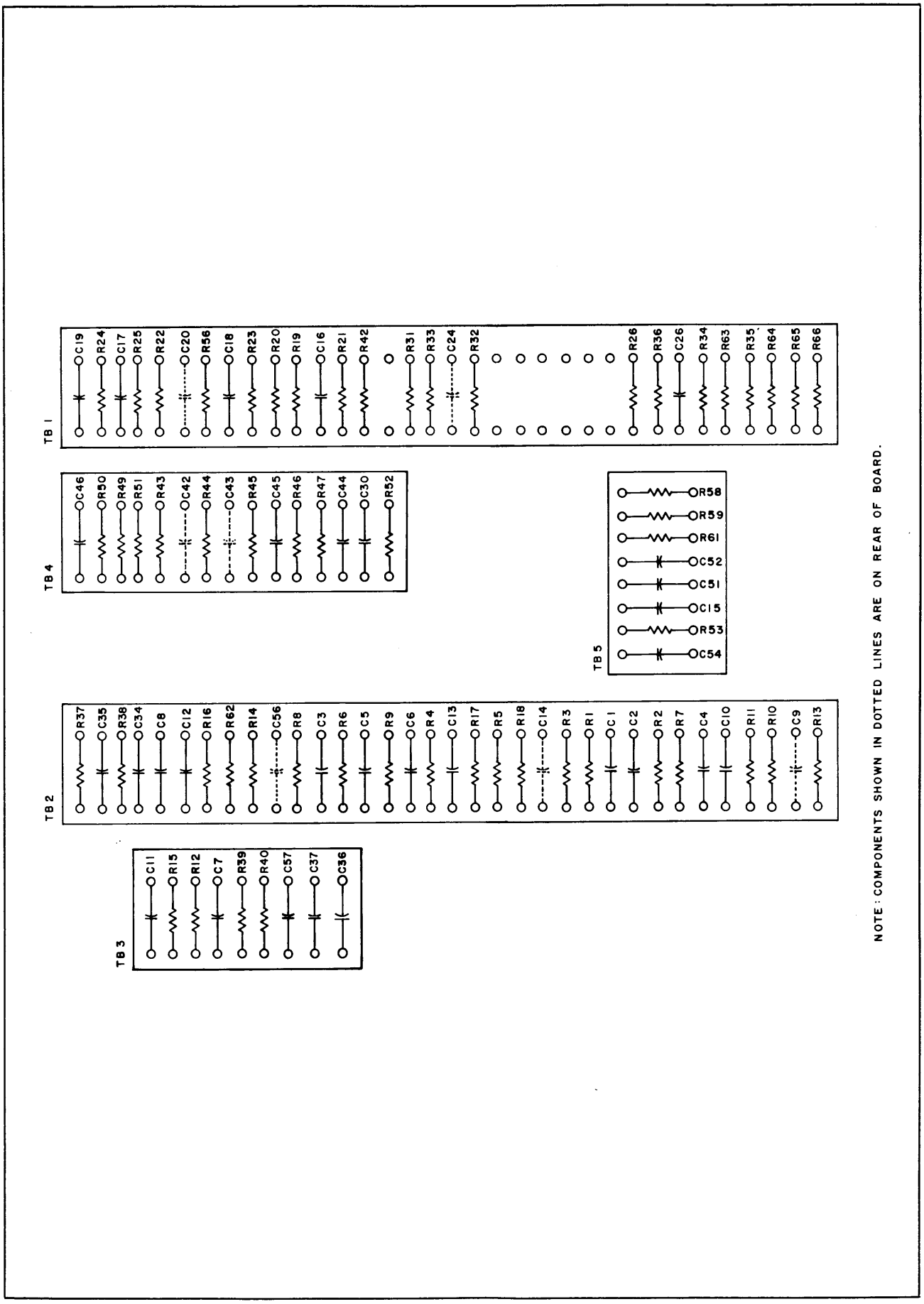
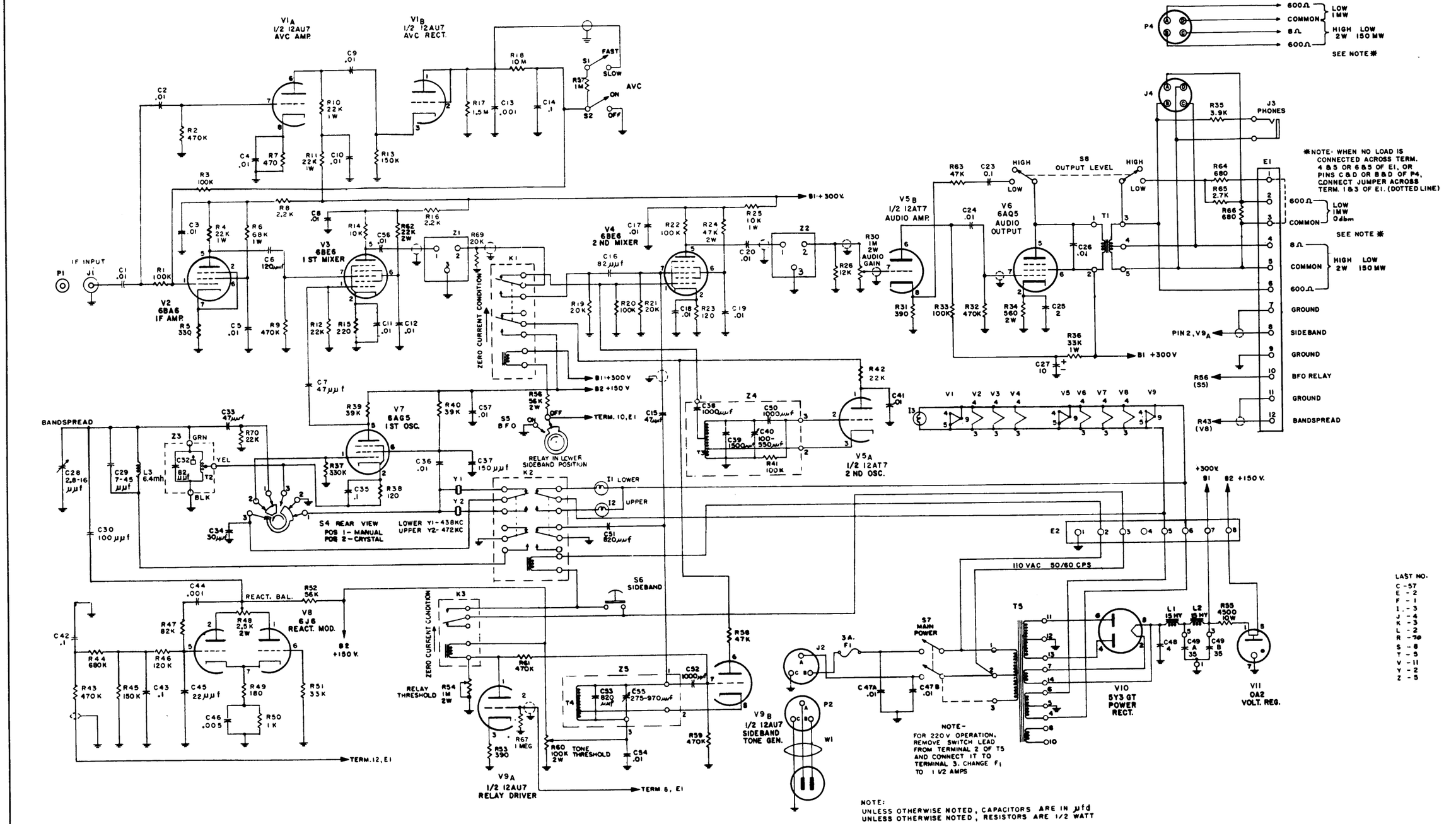


Figure 5-6 Terminal Board Layout, Model MSR-3a



CK-416

Figure 5-7 Schematic Diagram, Model MSR-3a