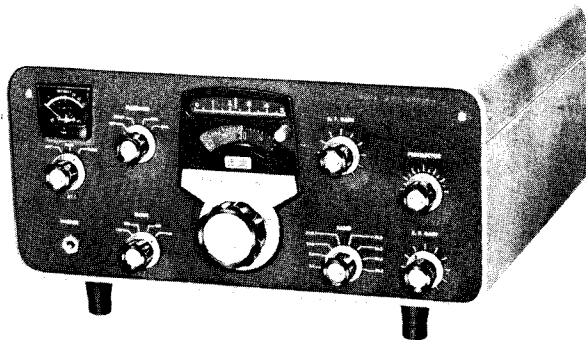


Assembly  
and  
Operation  
of the



**SSB RECEIVER**  
MODEL SB-300



HEATH COMPANY,  
BENTON HARBOR,  
MICHIGAN

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## SPECIFICATIONS

Frequency Range (megacycles) . . . . .	3.5 to 4.0, 7.0 to 7.5, 14.0 to 14.5, 21.0 to 21.5, 28.0 to 28.5, 28.5 to 29.0, 29.0 to 29.5, 29.5 to 30.
Intermediate Frequency. . . . .	3.395 megacycles.
Frequency Stability. . . . .	Less than 100 cps per hour after 20 minutes warmup under normal ambient conditions. Less than 100 cps for $\pm 10\%$ line voltage variation.
Visual Dial Accuracy. . . . .	Within 200 cps on all bands.
Electrical Dial Accuracy. . . . .	Within 400 cps on all bands after calibration at nearest 100 kc point.
Backlash. . . . .	No more than 50 cps.
Sensitivity. . . . .	Less than 1 microvolt for 15 db signal plus noise-to-noise ratio for SSB operation.
Modes Of Operation. . . . .	Switch selected: LSB, USB, CW, AM.
Selectivity. . . . .	SSB: 2.1 kc at 6 db down, 5.0 kc maximum at 60 db down (crystal filter supplied). AM: 3.75 kc at 6 db down, 10 kc maximum at 60 db down (crystal filter available as accessory). CW: 400 cps at 6 db down, 2.5 kc maximum at 60 db down (crystal filter available as accessory).
Spurious Response. . . . .	Image and IF rejection better than 50 db. Internal spurious signals below equivalent antenna input of 1 microvolt.
Audio Response. . . . .	SSB: 350 to 2450 cps nominal at 6 db. AM: 200 to 3500 cps nominal at 6 db. CW: 800 to 1200 cps nominal at 6 db.
Audio Output Impedance. . . . .	Unbalanced nominal 8 $\Omega$ speaker and high impedance headphone.
Audio Output Power. . . . .	1 watt with less than 8% distortion.
Antenna Input Impedance. . . . .	50 $\Omega$ nominal.
Muting. . . . .	Open external ground at Mute socket.
Crystal Calibrator. . . . .	100 kc crystal.
Front Panel Controls. . . . .	Main Tuning dial. Function switch. Mode switch. AGC switch. Band switch. AF Gain control. RF Gain control. Preselector. Phone jack.



Rear Apron Connections. . . . .	Spare socket. HF Antenna. VHF #1 Antenna. VHF #2 Antenna. Mute. Spare socket. ANTI-VOX 500 Ω. 8 Ω speaker. Line cord socket. Heterodyne Oscillator Output. LMO output. BFO output. VHF Converter socket.
Tube Complement. . . . .	1 - 6BZ6 RF amplifier. 1 - 6AU6 1st mixer. 1 - 6AB4 Heterodyne oscillator. 1 - 6AU6 2nd mixer. 1 - 6AU6 Linear master oscillator. 2 - 6BA6 IF amplifier. 1 - 6AU6 Crystal calibrator. 1 - 6HF8 1st audio, audio output. 1 - 6AS11 Product detector, BFO, and BFO amplifier.
Power Supply. . . . .	Transformer operated with silicon diode rectifiers.
Power Requirements. . . . .	120 volts AC, 50/60 cps, 50 watts.
Dimensions . . . . .	14-7/8" wide x 6-5/8" high x 13-3/8" deep.
Net Weight. . . . .	17 lbs.
Shipping Weight. . . . .	22 lbs.

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Test Equipment Used To Make Specification Measurements. . . . .	Hewlett-Packard Signal Generator, Model 606A. Radio Products, Inc. Panoramic Analyzer, Model SB-12 Hewlett-Packard Electronic Counter, Model 524B. Boonton Electronics Distortion Analyzer, Model 330B. Daven Company Power Output Meter, Type OP961.
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All prices are subject to change without notice. The Heath Company reserves the right to discontinue instruments and to change specifications at any time without incurring any obligation to incorporate new features in instruments previously sold.

## INTRODUCTION

The Heathkit Model SB-300 SSB Receiver is capable of receiving SSB, AM, and CW signals on all amateur bands from 3.5 to 30 megacycles. A separate crystal filter can be obtained and is switch-selected from the front panel for each of these modes of operation to assure optimum selectivity and performance. In the absence of the optional filters, AM stations are received using the exalted carrier method, and CW may be received in either SSB position.

The preassembled-prealigned linear master oscillator (LMO) and crystal-controlled hetero-

dyne oscillators assure highly accurate and stable operation. The use of circuit boards and a wiring harness provide clean chassis layout.

Other features of this Receiver are special antenna and power connections for VHF converters, a 100 kc crystal calibrator, provision for transceiver operation with a compatible transmitter, and a smooth, virtually backlash free dial tuning mechanism. The transformer-operated, silicon diode power supply is a long-life, low-heat power source.

## CIRCUIT DESCRIPTION

Refer to the Schematic (fold-out from Page 79) and Block (fold-out from Page 7) Diagrams when reading the Circuit Description. To locate parts on the Schematic, the letter-number designations for the parts are coded as follows:

1 to 99	RF Circuit Board
100 to 199	IF Circuit Board
200 to 299	Chassis Parts

NOTE: To make the various functions of the Receiver easier to understand, a selected lower sideband frequency of 3.895 megacycles will be used when tracing through the circuit in this description. All switches are shown in their

appropriate positions on the Schematic. Figure 1 lists the various frequencies that will be found throughout the Receiver. Line one indicates the frequencies referred to in the Circuit Description.

### RF AMPLIFIER

The received signal is connected from the antenna through the Converter switch to BS6R (Band switch, wafer 6, rear of wafer). The Converter switch is also used to select the output signal from a choice of two accessory VHF (very high frequency) converters and to apply power to the converter. BS6R selects the primary

BAND	HETERODYNE OSCILLATOR FREQUENCY (CRYSTAL FIXED)	RECEIVED SIGNAL FREQUENCY	PASSBAND SIGNAL FREQUENCY (BETWEEN 8.395 AND 8.895)	LMO MIXER OUTPUT CRYSTAL FILTERS AND IF (FIXED)	LMO (BETWEEN 5 AND 5.5 MC)
3.5 to 4	12.395	3.895	8.5	3.395	5.105
7 to 7.5	15.895	7.2	8.695	3.395	5.3
14 to 14.5	22.895	14.2	8.695	3.395	5.3
21 to 21.5	29.895	21.3	8.595	3.395	5.2
28 to 28.5	36.895	28.1	8.795	3.395	5.4
28.5 to 29	37.395	28.7	8.695	3.395	5.3
29 to 29.5	37.895	29.2	8.695	3.395	5.3
29.5 to 30	38.395	29.6	8.795	3.395	5.4

FREQUENCIES IN MEGACYCLES

Figure 1

of the antenna coil and BS5F (Band switch, wafer 5, front of wafer) selects the secondary of the antenna coil for the band being used. Each tuned circuit consists of a coil and capacitor combination which resonates at frequencies within the band in use. The signal, after passing through coil L2, is connected to BS5R, C200, and C201 by a tie pin that connects the selector contacts of BS5F and the entire rotor portion of BS5R. Capacitors C200 and C201 are adjusted by the Preselector control to tune the grid circuit of V1, the RF amplifier, to the desired frequency in the 3.5 megacycle band. Only capacitor C201 is used on the higher bands.

The plate circuit is also tuned to the same frequency as the grid circuit by capacitors C202 and C203, and coil L7. The plate coil for the band being used is selected by BS4F, and the appropriate tuning capacitor is selected by the use of a tie pin to BS4R. B+ is supplied to this stage by a small tie pin that connects the rotor of BS4F to BS4R. Only capacitor C203 is used for the higher bands.

#### HETERODYNE OSCILLATOR AND FIRST MIXER

The amplified signal from V1 is coupled through capacitor C7 to the grid of V2, the first Mixer. Also being fed to the grid of V2 is a highly stable crystal-controlled signal from V4, the Heterodyne Oscillator. BS1R selects the proper crystal for the band being used. In this case Y6 is switched into the grid circuit of V4 to produce an oscillator frequency of 12.395 megacycles.

The plate circuit of V4 is tuned by coils L12 through L19. The proper coil is connected to BS3R through a tie pin at BS3F to the plate of tube V4. (Each of these coils has a small pickup link which is selected by BS2R. The signal picked up by these small secondaries is fed to the Heterodyne Oscillator jack on the rear of the Receiver for use with a transmitter for transceiver operation.) The received signal of 3,895 megacycles and the oscillator signal are mixed in V2 to produce the sum and difference frequencies of 16.29 and 8.5 megacycles, respectively. Passband filter T2 is designed to pass only frequencies in a range between 8,395 and 8,895 megacycles, and to greatly attenuate all other frequencies. The 16.29 megacycle frequency, being too high, is attenuated, whereas the difference frequency of 8.5 megacycles passes through T2 without attenuation. A small tie pin connects the rotor of BS3R to BS3F supplying B+ to this stage.

#### LINEAR MASTER OSCILLATOR (LMO) AND SECOND MIXER

The 8.5 megacycle signal from T2 is coupled to the grid of V3, the second mixer. Coupled to the cathode of V3 is a signal from the tunable LMO. The LMO, consisting of tube V5 with its associated circuit, forms a very stable linear oscillator that operates over a frequency range of 5 to 5.5 megacycles. See Figure 2. Varying C4

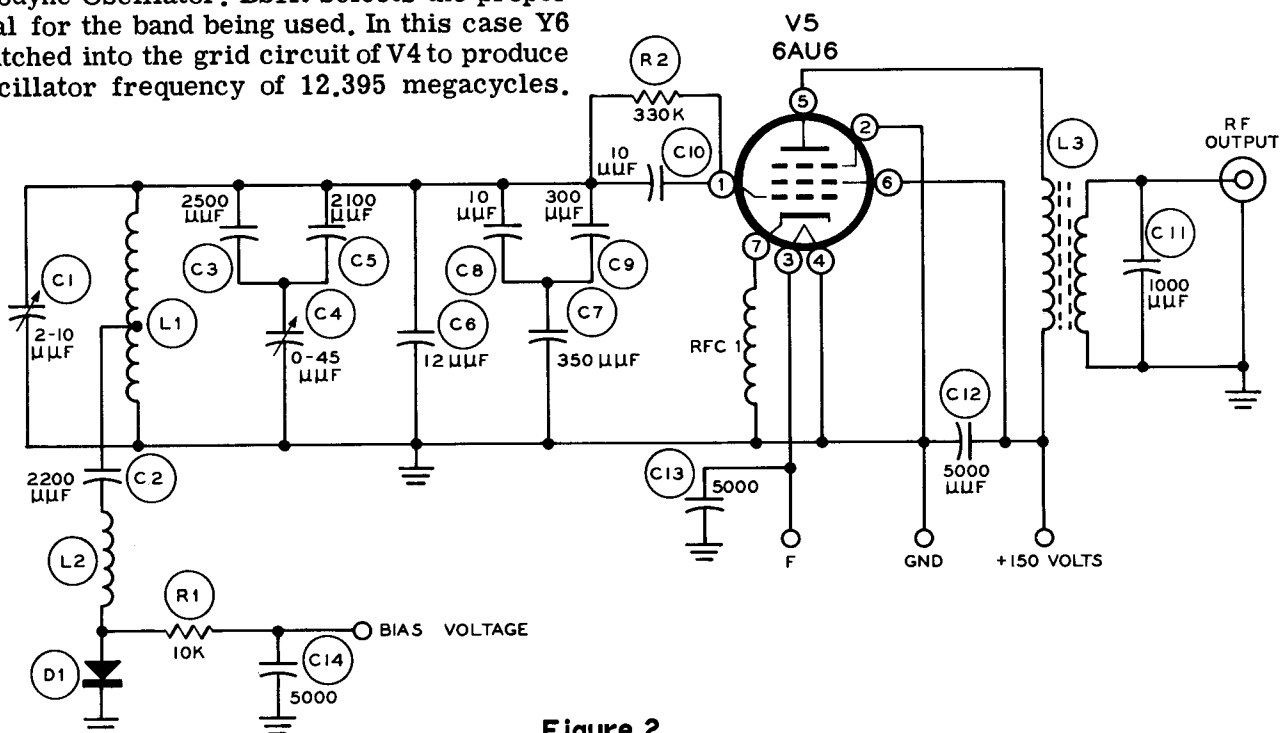


Figure 2

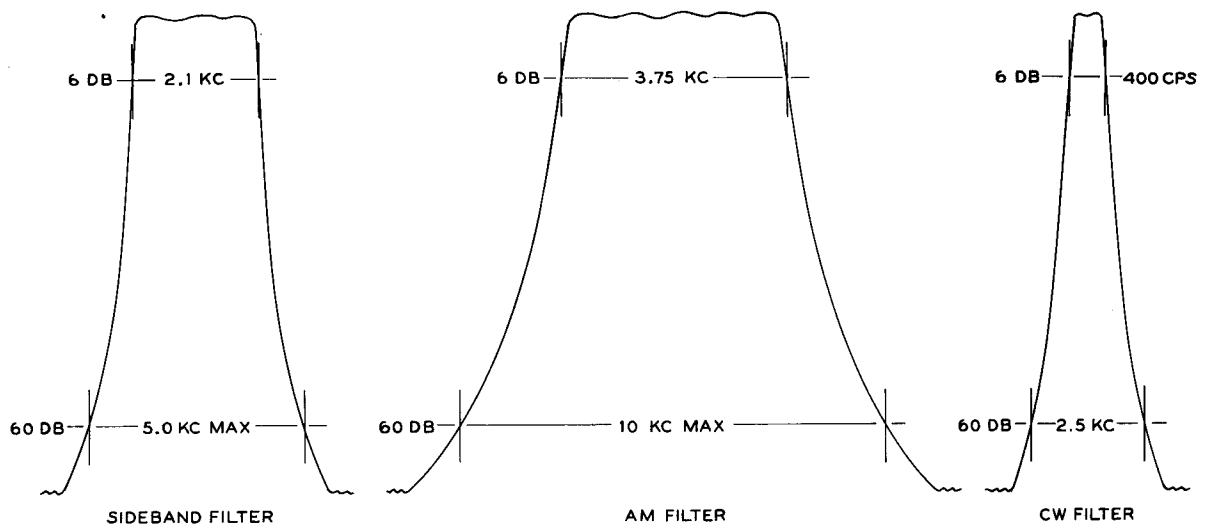


Figure 3

changes the frequency of the LMO and thus changes the operating frequency of the Receiver. The frequency at which the LMO operates is always the difference between the output frequency from the passband filter, T2, and the 3,395 megacycle IF frequency.

In this instance, a signal at 3,895 megacycles beating with the heterodyne oscillator frequency of 12,395 megacycles produces an output frequency of 8.5 megacycles. An LMO frequency of 5,105 megacycles is required to obtain the 3,395 megacycle IF frequency.

The output from the LMO is also coupled through capacitor C15 to a LMO jack on the rear of the Receiver for use with a transmitter for transmitter operation.

The output signal from V3 is then passed through crystal filter FL1 for bandwidth selectivity. The input and output of the SSB (single sideband), CW, or AM crystal filters are selected by MS2R (Mode switch, wafer 2, rear of wafer) and MS1F respectively.

Only the SSB filter is furnished with the Receiver. The CW and AM filters may be obtained as accessories. See Figure 3 for the bandpass characteristic of each filter.

### IF AMPLIFIERS

The signal is then fed through capacitor C100, and through stages V6 and V7, the first and second IF amplifiers. These stages are high

gain voltage amplifiers. T3 and T4 are tuned for maximum gain per stage.

The "S" meter is connected in the IF circuits to indicate received signal strength. Control R108 is adjusted for zero S-units with the antenna disconnected and RF Gain control R208 fully clockwise.

### AGC

The desired amount of amplification for the RF and IF amplifiers is determined by the negative grid bias set by control R208, the RF Gain control. Also present on this same line is the AGC (automatic gain control) voltage. This voltage is obtained by coupling a portion of the IF output signal through capacitor C110 to AGC diodes CR1 and CR2. These diodes produce a negative DC voltage proportional to the signal strength. A signal producing a negative AGC voltage higher than the preset bias voltage causes the gain of V1, V6, and V7 to be reduced below the preset level. This produces an output level from the first RF and IF amplifier stages that remains nearly constant in spite of wide changes in the amplitude of the received signal. The AGC action is instantaneous, however, the length of time it remains in control is determined by capacitors C109 and C223 along with resistor R118. These capacitors are charged by the AGC voltage when a higher than normal signal is received. C109 has a fast rate of discharge, and C223 a slow rate of discharge. The capacitors discharge through resistors R211 and R209, and control R208. Because resistor R211

is so much larger than R209 and control R208, changing the setting of control R208 has very little or no effect on the discharge time of capacitors C109 and C223. Only one of these capacitors is in the circuit at a time, as determined by the setting of the AGC switch.

### PRODUCT DETECTOR/BFO AND BFO AMPLIFIER

Tube V9 is made up of two triode and one pentode sections. The IF output signal in the LSB, USB, and CW modes is fed through capacitor C114 to the grid of V9A. V9B serves as a BFO (beat frequency oscillator). The frequency at which V9B oscillates is determined by crystals Y9 and Y10. These crystals are selected by MS4R.

Operation on LSB (lower sideband) has been described to this point. If USB (upper sideband) operation is desired, the Mode switch is placed in the USB position. MS4R switches crystal Y10 into the circuit, increasing the operating frequency of the BFO by 2.8 kilocycles. When this is done the LMO frequency must also be changed 2.8 kilocycles, but in the opposite direction. These frequency changes result in changing to the upper sideband without changing the dial setting. The change in operating frequency of the LMO is done by switching diode D1 (see Figure 2). When in the LSB mode, diode D1 is biased with a positive 50 volts, making the diode an electrical short, reducing the electrical length of coil L1. In the USB mode a negative 50 volts bias is applied to D1, making it an open circuit, thus, increasing the electrical length of coil L1.

The output signal from the BFO is coupled

through capacitor C234 to V9C, a BFO amplifier. The output signal from V9C is coupled through capacitor C237 to the BFO jack on the rear of the Receiver for use with a transmitter for transceiver operation.

### AF AMPLIFIERS

The audio output signal results from mixing the IF and BFO frequencies in the Product Detector.

The audio signal is coupled through capacitor C231 to MS4R. From MS4R the signal is fed to the grid of V10A, the first audio amplifier. This amplified signal is coupled through capacitor C116 to V10B, the second audio amplifier. The signal is then coupled through output transformer T5 to a speaker or headphones.

From the secondary of T5, an 8  $\Omega$  output is available for speaker operation, and a 500  $\Omega$  output is available for headphone operation. The 500  $\Omega$  output is also used for ANTI-VOX (voice operated transmitter or transceiver) operation.

Resistor R115 and capacitor C115 from the secondary of T5 to the cathode of V10A form a negative feedback circuit. The negative feedback circuit is used to provide a low distortion, stable audio output power of 1 watt.

### AM DETECTION

In the AM mode, the BFO is turned off and the Product Detector is disconnected from the audio amplifier by MS4R. The IF output signal is coupled through capacitor C113 to CR3, the AM detector diode. RF signals are bypassed to ground through capacitor C112. The resulting amplitude detected audio signal is coupled by MS4R to the AF Gain control R229 and to Audio Amplifier stages V10A and V10B. The setting of control R229 determines the audio output level from the Receiver.

### CRYSTAL CALIBRATOR

The 100 kc signal produced by V8, the crystal controlled calibrator stage, is coupled to the Converter switch. This signal can be used at any time to check dial calibration by placing the Function switch in the CAL position, and the Mode switch in the LSB or USB position. Zero beat cannot be heard in the CW mode due to the narrow bandpass of the CW filter, nor in the AM mode due to the absence of BFO injection.

### MUTE JACK

The Mute jack is used with a transmitter for bias receiver V10B, and a muting.

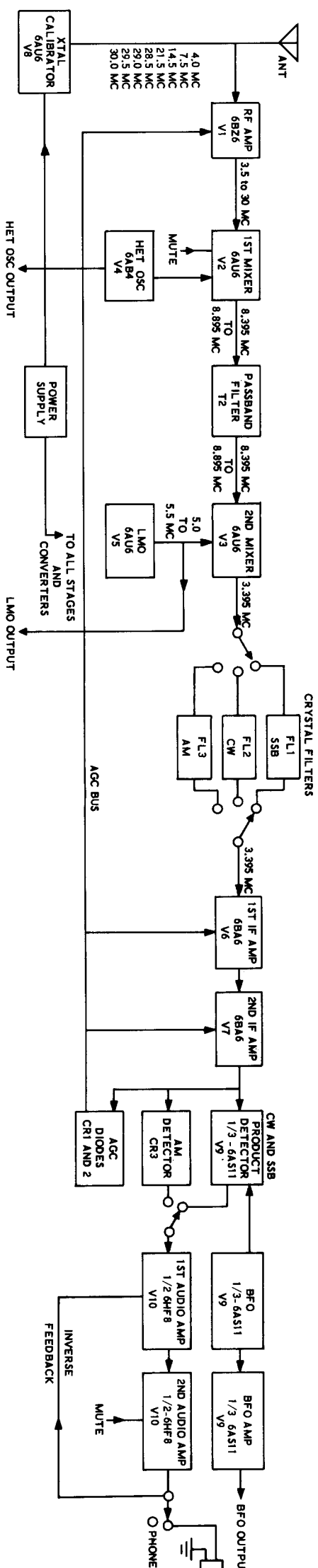
### POWER SUPPLY

The power supply uses a transformer for isolation from the AC line. Diodes CR4 and CR5 are used in a full-wave rectifier circuit. The B+ voltage is filtered by capacitors C227A, C227B, and C227C, and resistors R215 and R216. Diode CR6 is used to develop negative voltage for use as a separate section and pilot lamp.

### PLY

The power supply uses a transformer for isolation from the AC line. Diodes CR4 and CR5 are used in a full-wave rectifier circuit. The B+ voltage is filtered by capacitors C227A, C227B, and C227C, and resistors R215 and R216. Diode CR6 is used to develop negative voltage for use as a separate section and pilot lamp.

# BLOCK DIAGRAM





# INITIAL INSPECTION AND TESTS

Carefully examine the wiring for unintentional shorts. Be sure that all wire clippings and solder splashes are removed from the Receiver, and that all mechanical connections are secure.

Set the front panel controls as follows:

- RF GAIN - Full clockwise.
- BAND switch - 3.5 MC.
- MODE switch - LSB.
- AGC switch - SLOW.
- FUNCTION switch - OFF.
- AUDIO GAIN - Full counterclockwise.
- PRESELECTOR - Full counterclockwise.
- Main Tuning - Anywhere.
- Converter switch (on back of chassis) - HF.

Measure the DC resistance from the points indicated on Figure 4 to chassis ground. Be sure to check the four resistances at phono socket BM with the Function switch in the position marked on Figure 4.

This completes the Initial Inspection and Test. If any discrepancies were noted, refer to the In Case Of Difficulty section (on Page 65) of this manual.

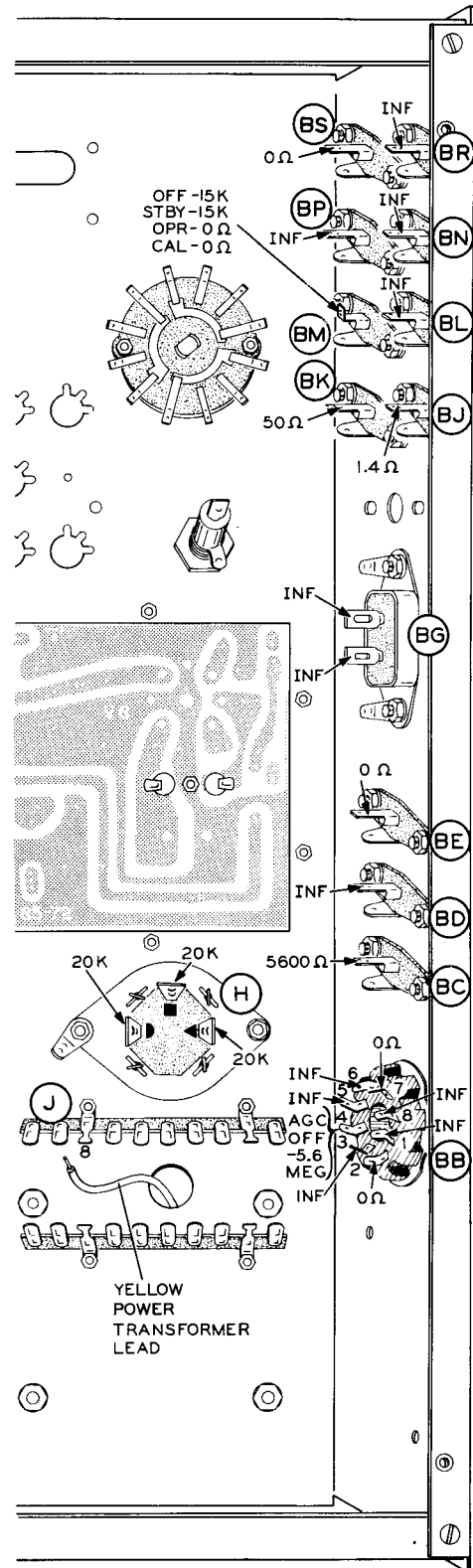
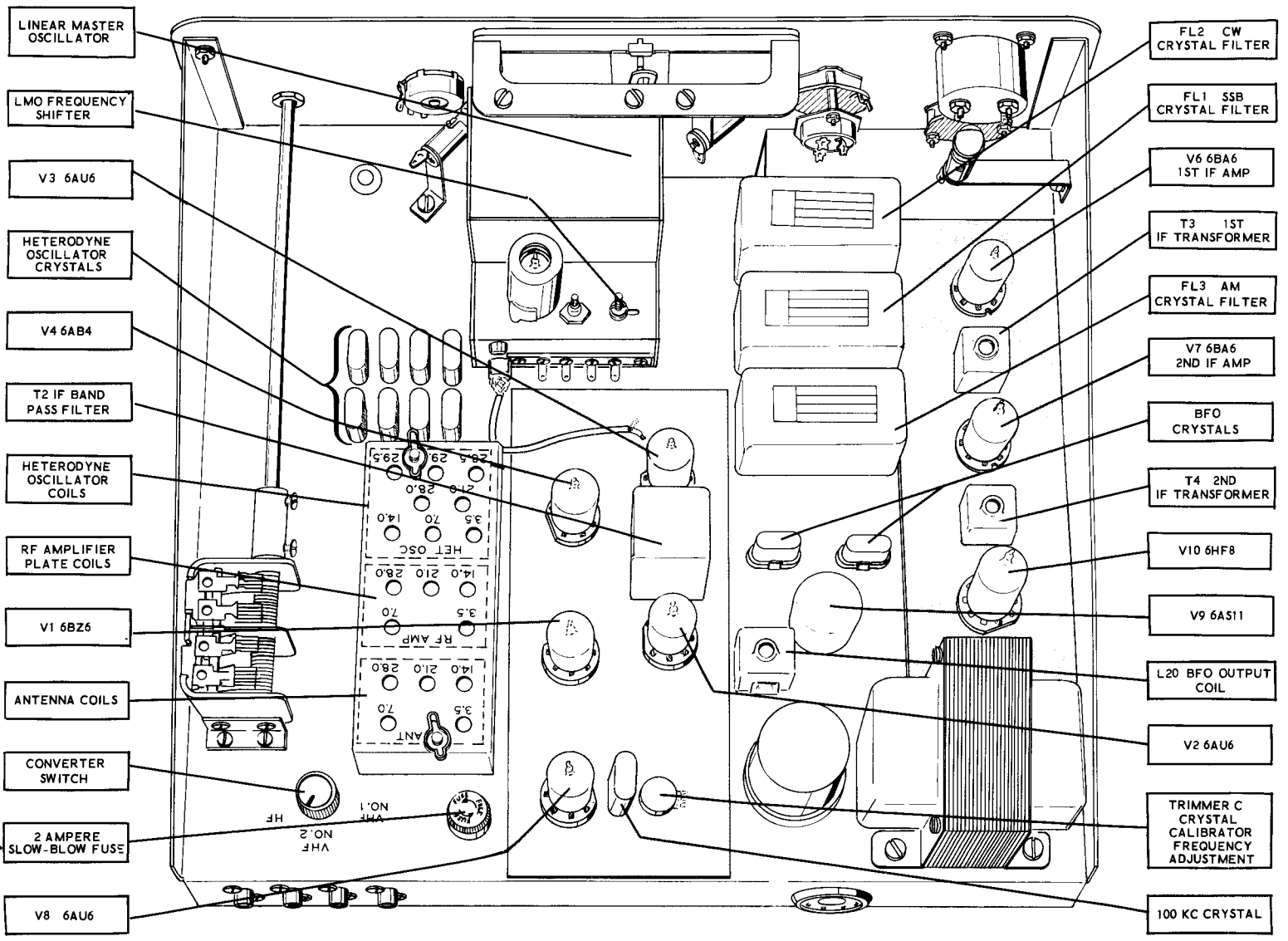
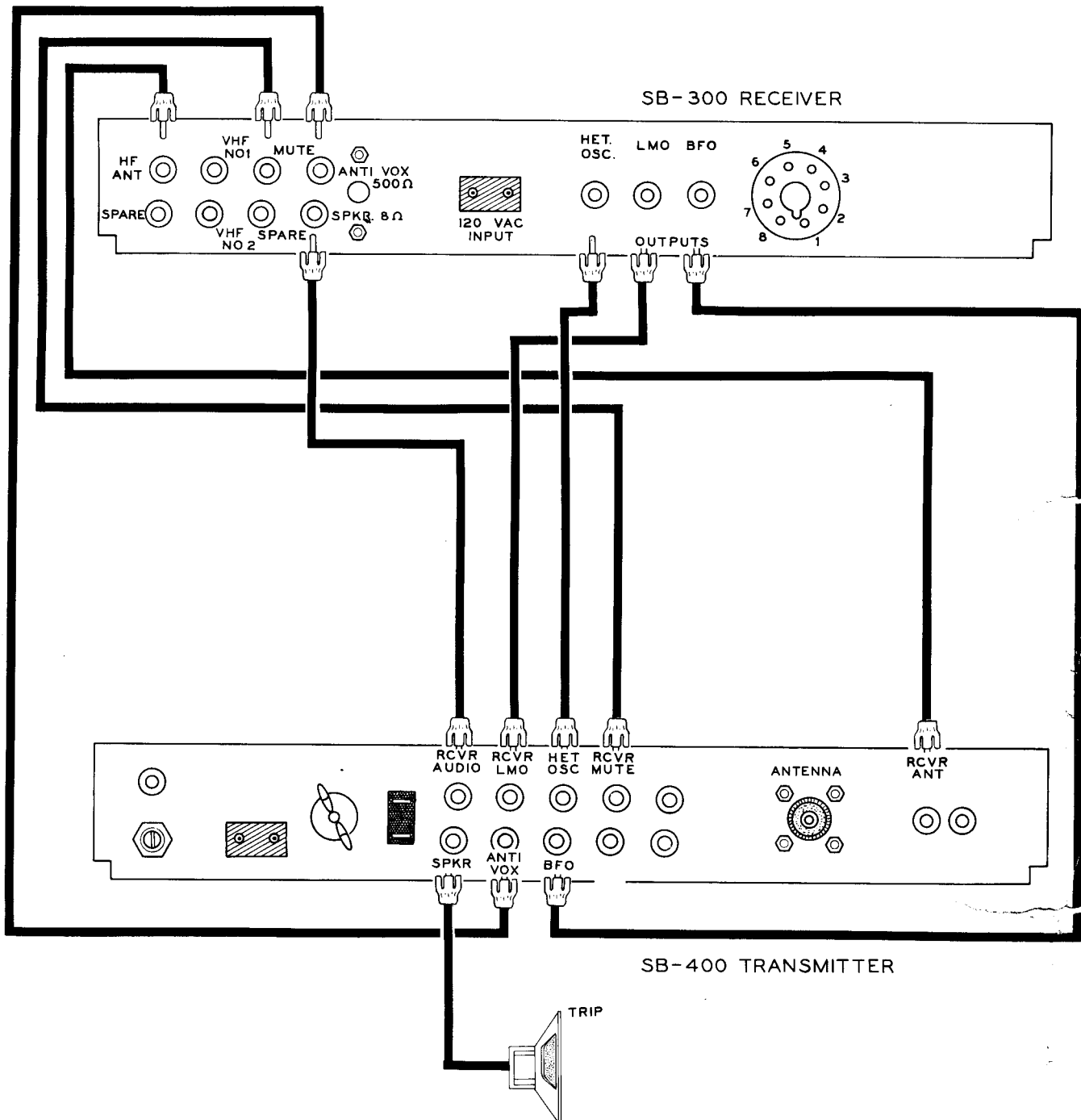


Figure 4



PICTORIAL 22



**FIGURE 7**

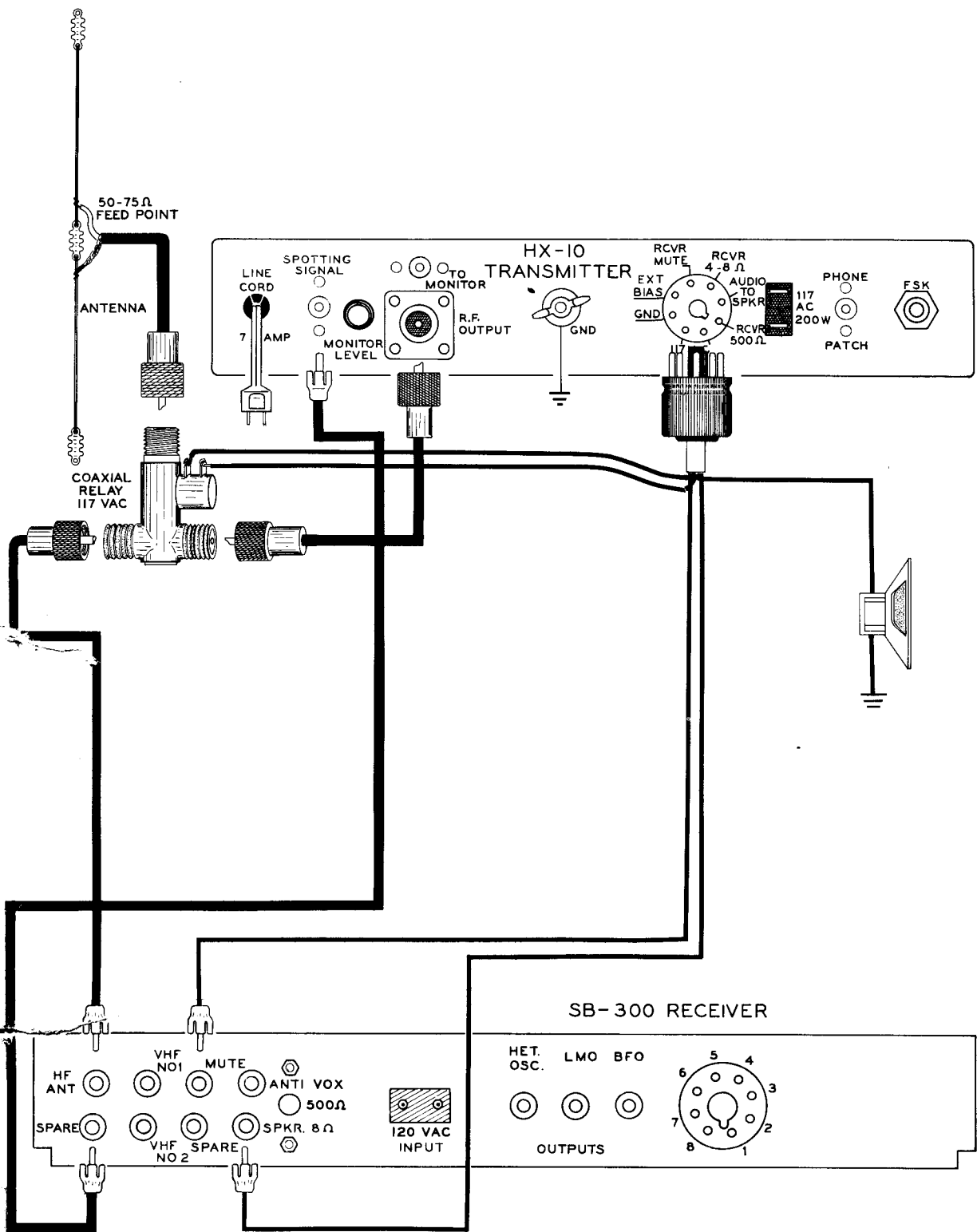


FIGURE 8

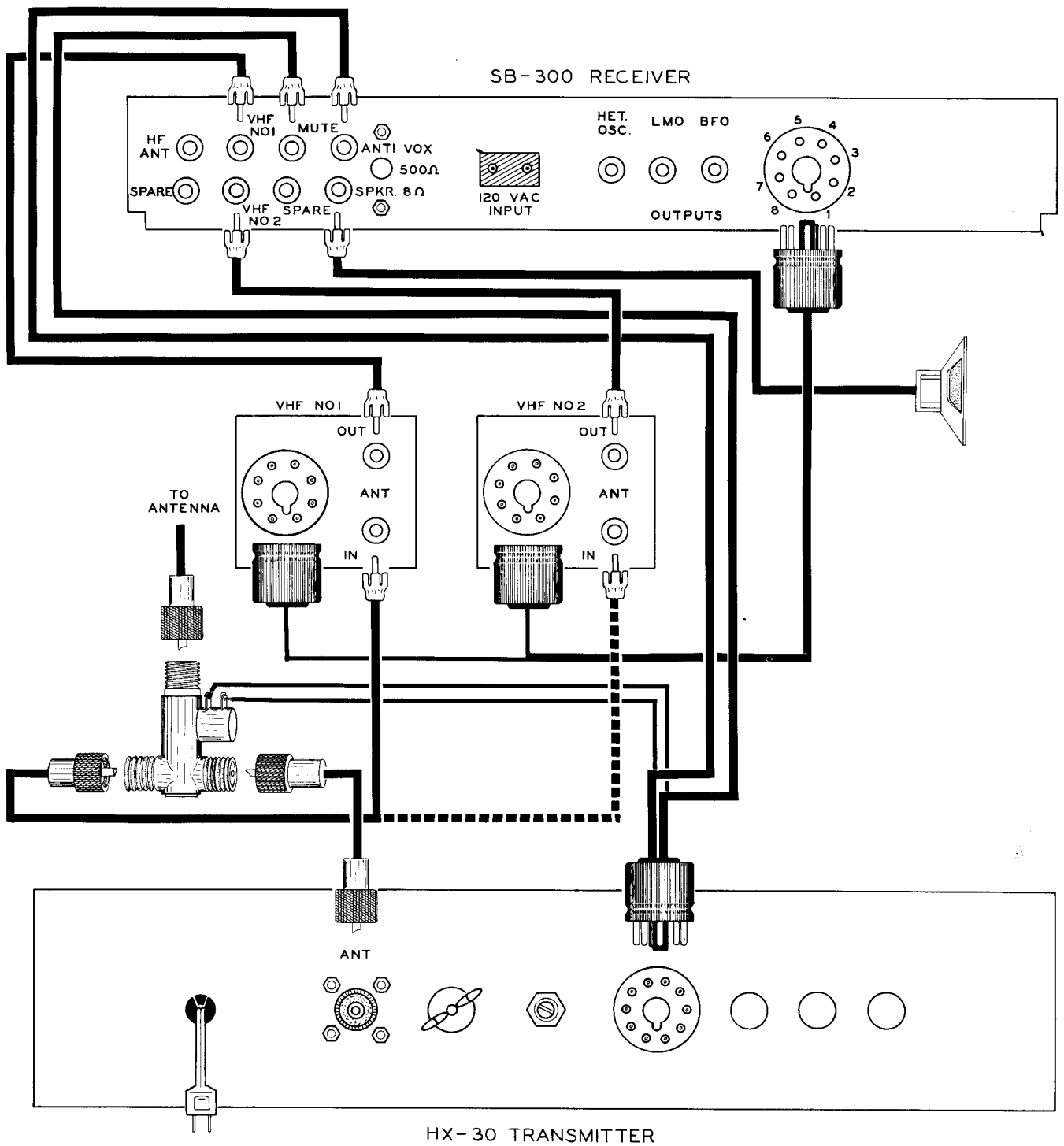


FIGURE 9

## ALIGNMENT

### READING RECEIVER FREQUENCY

To read frequency, add to the BAND switch setting, in megacycles, the slide rule pointer setting in hundreds of kilocycles and the circular dial setting in kilocycles.

For example: if the BAND switch is set to 3.5 and the slide rule pointer is between 2 and 3 and the circular dial is set to 53, the frequency is 3,753 mc. If the BAND switch is set to 14.0, the slide rule pointer between 0 and 1 and the circular dial is set to 12, the frequency is 14,012 mc.

NOTE: A speaker should be connected to the Receiver whenever it is turned on.

There are two methods of alignment that can be used with this Receiver. One requires the use of an accurate signal generator covering frequencies from 3,395 mc to 30 mc. In the other method, a receiver capable of receiving WWV is used to calibrate the 100 kc crystal calibrator. The crystal calibrator will then be used for a signal source. A broadcast receiver can also be used to calibrate the 100 kc crystal calibrator, but the accuracy will be slightly less than with WWV. Refer to Pictorial 22 for all alignment points. At no time should the slug in coil L20 be adjusted as it is prealigned at the factory.

### ALIGNMENT USING A SIGNAL GENERATOR

#### IF TRANSFORMER ALIGNMENT

✓ Set the front panel controls as follows:

PRESELECTOR - Any place.  
 RF GAIN - full clockwise  
 BAND switch - 3.5 MC  
 AF GAIN - 3 o'clock  
 AGC - FAST  
 FUNCTION switch - OFF  
 Mode switch - LSB  
 Main Tuning - 4.0 mc  
 Converter switch (at rear of chassis) - HF

✓ Plug the line cord into the Receiver and then into a 120 volt, 50/60 cps AC outlet.

✓ Turn the FUNCTION switch to the OPR position.

✓ Adjust the METER ADJ control for a zero S-Meter reading. Turn the FUNCTION switch to OFF.

✓ Connect the RF output of the signal generator through a .01 or .001  $\mu$ fd disc capacitor to lug 1 of tube socket V6. Use a 1 millivolt signal level. Set the generator for a 3,395 mc unmodulated signal.

✓ Adjust IF transformers T3 and T4 for maximum S-Meter reading. Alternate from T3 to T4 until no further increase can be noticed in the S-Meter reading.

✓ Turn the Receiver off and disconnect the signal generator.

#### HETERODYNE OSCILLATOR ADJUSTMENT

✓ Turn the FUNCTION switch to OPR.

✓ Connect a vacuum tube voltmeter with an 11 megohm input impedance between the chassis and test point A on the RF circuit board. Use the voltmeter 5 volt scale to read -DC.

✓ Refer to the following chart and complete each step by adjusting the indicated coil for the indicated voltage; On one side of the voltage peak, the voltage will rise and drop in a slow linear fashion. Use this side of the slope. On the wrong side of the peak, the voltage will drop rapidly. The frequency of each coil is marked on the coil cover in the area designated HET. OSC.

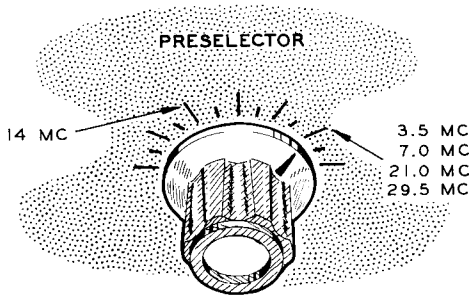
BAND SWITCH POSITION	ADJUST COIL	DC VOLTS AT TEST POINT A
3.5 MC	3.5	-1.8 volt
7.0 MC	7.0	-1.3 volt
14.0 MC	14.0	-1.5 volt
21.0 MC	21.0	-1.7 volt
28.0 MC	28.0	-2 volts
28.5 MC	28.5	-2 volts
29.0 MC	29.0	-1.7 volt
29.5 MC	29.5	-1.5 volt

Recheck the adjustment of each coil for proper voltage.

NOTE: After the Antenna and RF Amplifier Alignment has been completed, readjust the Heterodyne Oscillator coils for a maximum S-Meter reading. Be sure to keep the coil on the side of the peak with the slow rise and fall of voltage.

**ANTENNA AND RF AMPLIFIER ALIGNMENT**

Figure 5



NOTE: It is very important that the PRESELECTOR be adjusted properly during the rest of the Alignment procedure. The proper PRESELECTOR knob settings for the various bands are shown in Figure 5.

- ( ) All front panel controls should be set as described for the previous adjustments. Be sure to turn the PRESELECTOR to the position indicated in Figure 5 for the band being aligned.
- ( ) Connect the RF output of the RF signal generator to the HF ANTENNA jack on the rear of the Receiver.
- ( ) Complete each step as indicated in the following chart. Be sure to keep the signal generator level as low as possible while still obtaining a usable reading on the S-Meter.

NOTE: The crystal filter has a very narrow passband and care must be taken to tune the Main Tuning knob to maintain the signal in the center of the filter passband indicated by maximum S-Meter reading.

BAND SWITCH	RECEIVER AND GENERATOR FREQUENCY	ADJUST FOR MAXIMUM	SECTION BEING ADJUSTED
3.5 MC	4.0 MC	3.5	Antenna Coil
*3.5 MC	4.0 MC	3.5	RF Amp Plate Coil
7.0 MC	7.5 MC	7.0	Antenna Coil
7.0 MC	7.5 MC	7.0	RF Amp Plate Coil
14.0 MC	14.5 MC	14.0	Antenna Coil
14.0 MC	14.5 MC	14.0	RF Amp Plate Coil
21.0 MC	21.5 MC	21.0	Antenna Coil
21.0 MC	21.5 MC	21.0	RF Amp Plate Coil
29.5 MC	30.0 MC	28.0	Antenna Coil
29.5 MC	30.0 MC	28.0	RF Amp Plate Coil

No adjustments are made for the 28.0, 28.5, and 29.0 BAND switch positions.

\*Upon completion of this step, repeak transformer T3 and T4 to compensate any error in the preceding IF Alignment.

SB-300 to the CAL position. Turn the SB-300 AUDIO GAIN control fully counterclockwise.

- ( ) Tune the other receiver to WWV or a standard broadcast station as described above. Adjust ceramic trimmer capacitor C on the RF circuit board with an insulated screwdriver for "zero beat" heard in the other receiver. When WWV is used, the period when no tone modulation is present allows easier identification of zero beat. Zero beat will be recognized as the point at which a harmonic of 100 kc corresponds to the frequency of the station that is tuned in on the receiver. As zero beat is approached, a tone, decreasing in frequency until it finally stops, will be heard from the receiver. Set the FUNCTION switch to OPR and then back to CAL to be sure you have a true zero beat.

**CRYSTAL CALIBRATOR ALIGNMENT**

- ( ) Couple the antenna connector of the SB-300 Receiver to the antenna connector of another receiver capable of receiving WWV at 2.5 mc, 5 mc, 10 mc, or 15 mc. If this is not possible, a receiver tuned to a standard broadcast station, operating at an even multiple of 100 kc can be used.
- ( ) Turn ON the SB-300 and the other receiver. Set the FUNCTION switch of the

## ALIGNMENT WITH 100 KC CRYSTAL CALIBRATOR

The output of the crystal calibrator will be used as the signal source in this alignment procedure. In order to obtain this signal, place the FUNCTION switch in CAL position and tune the Main Tuning knob to one side of the zero beat, placing the signal in the center of the crystal filter passband as indicated by a maximum S-Meter reading.

( ) Set the Front Panel controls as follows:

PRESELECTOR - To the proper setting for the band being aligned. See Figure 5.  
 RF GAIN - full clockwise  
 BAND switch - 3.5 MC  
 AF GAIN - 3 o'clock  
 AGC - FAST  
 FUNCTION switch - OFF  
 MODE switch - LSB  
 Main Tuning - 4.0 MC  
 Converter switch (at rear of chassis) - HF

- ( ) Plug the Receiver into a 120 volt, 50/60 cps AC outlet and turn the FUNCTION switch to the OPR position and adjust the Meter Adjust control for a zero reading on the S-Meter.
- ( ) Perform the Heterodyne Oscillator Adjustment as described on Page 60.
- ( ) Perform the Crystal Calibrator Alignment as described on Page 61.
- ( ) With the SB-300 still set on one side of zero beat, adjust IF transformers T3 and T4 for a maximum audio output or S-Meter reading.
- ( ) Place the PRESELECTOR knob in the position indicated in Figure 5 for the band being aligned.
- ( ) Alignment of the antenna and RF amplifier plate coils can now be performed. Use the chart on Page 61. Turn the Receiver's FUNCTION switch to CAL and tune the Main Tuning to the side of zero beat that gives a maximum S-Meter indication at the frequencies noted in the SB-300 Receiver And Generator Frequency column of the Chart. Then adjust the coil as described.

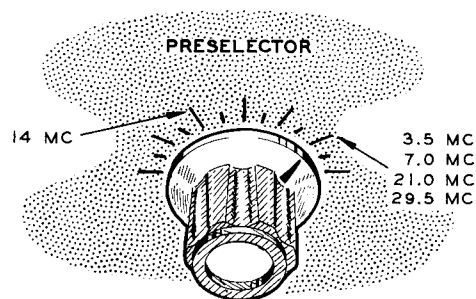


Figure 5

### LMO SHIFTER ADJUSTMENT

- ( ) Set the Main Tuning for 3.8 mc.
- ( ) Turn the FUNCTION switch to CAL. Carefully zero beat the calibrator signal (using the Main Tuning knob) with the MODE switch in the USB position and peak the PRESELECTOR.
- ( ) Turn the MODE switch to the LSB position. Be careful not to touch the Main Tuning dial. Now note that the calibrate signal may or may not be exactly at zero beat in the LSB position. Turn the Frequency Shift adjustment on the LMO for an exact zero beat in the LSB mode. Recheck the zero beat in the USB mode to be certain of the adjustment. Repeat the procedure if necessary.

### DIAL CALIBRATION

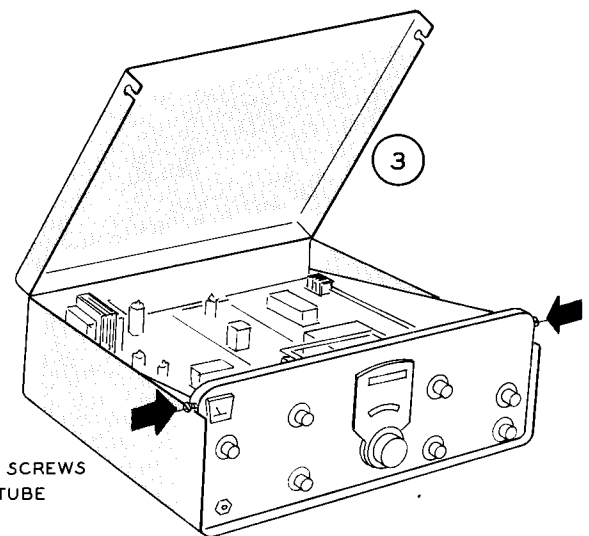
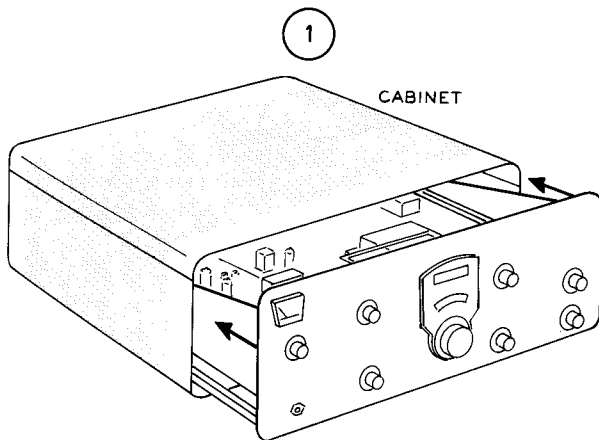
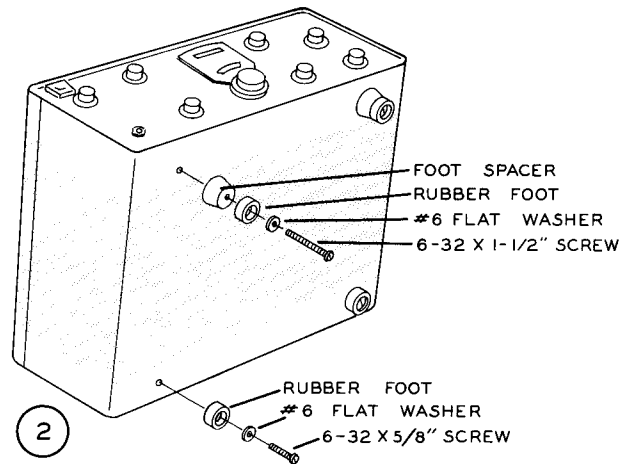
- ( ) Zero beat the crystal calibrator at 3.8 mc.
- ( ) Set the zero set marking in the center of the circular dial window.
- ( ) Remove the knob from the Main Tuning shaft without disturbing the zero beat.
- ( ) Place a screwdriver through the hole in the dial escutcheon directly above the Main Tuning shaft and into the LMO dial drive shaft.
- ( ) Hold the LMO drive shaft on zero beat and loosen the setscrew in the circular dial bushing. Turn the circular dial until the 0 is directly under the marking on the zero set dial. Now tighten the setscrew.



( ) Make sure that the circular dial turns freely and that the spiral drive pawl is properly engaged in the spiral before proceeding.

( ) Replace the knob on the Main Tuning shaft.

This completes the alignment of your Heathkit SSB Receiver.



**Figure 6** LOOSEN THESE TWO SCREWS TO LIFT COVER FOR TUBE REPLACEMENT.

## CABINET INSTALLATION

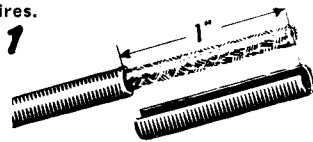
Refer to Figure 6 for the following steps.

- ( ) Slide the Receiver into the cabinet from the front. Be sure the cabinet is right-side up.
- ( ) Turn the Receiver and cabinet over and mount a rubber foot on each rear corner. Use 6-32 x 5/8" screws, with #6 flat washers. Fasten the screws into the tapped holes on the bottom of the chassis. If you do not wish to have the Receiver set at an angle, mount two rubber feet on the front of the Receiver in the same manner. For angle positioning of the Receiver, see the next two steps.
- ( ) Place a #6 flat washer in one of the remaining rubber feet. Place a 6-32 x 1-1/2" screw through the foot. Now slip a foot spacer over the screw with the wide end up. Screw the 6-32 screw into the bottom of the cabinet at either front corner.
- ( ) Similarly, mount the other rubber foot and foot spacer on the front of the cabinet.
- ( ) Install the 8-32 x 1/4" undercut oval head screws in the cabinet as shown to secure the cabinet top cover, close the top and tighten the screws.

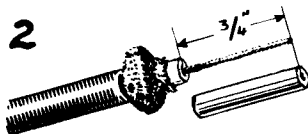
## INSTALLATION

Refer to Figures 7 (fold-out from Page 59), 8, and 9 (fold-out from Page 60) for examples of station hookup using the Receiver. Although the Receiver operates at a normal ambient temperature, it should be placed where adequate circulation is present. Refer to Figure 7A for installing a phono plug on the RG-62/U coaxial cable supplied with the kit. These cables are for the LMO, BFO, and Heterodyne Oscillator output jacks for transceiver operation. They must be cut to exactly 24". They should be made up at this time and stored for future use.

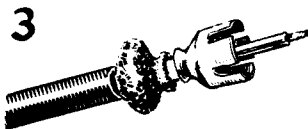
Remove 1" of outer insulation. It may be necessary to slit the insulation lengthwise to remove. Take care not to cut shield wires.



Push the shield back as far as it will go and strip off 3/4" of insulation from the inner conductor and tin inner conductor.



Place phono connector on cable firmly against inner insulation. Solder inner conductor.



Dress shield up on base of connector and solder. Then trim inner conductor from tip.



Figure 7A

### REAR APRON CONNECTIONS

**HF ANTENNA** - The antenna input circuit is designed to accept a 50  $\Omega$  unbalanced antenna. The receiving antenna for signals in the 3.5 to 30 MC amateur bands should be connected to the socket.

**VHF NO 1 AND NO 2 ANTENNA** - The 28 mc output of the VHF converters used is connected to either of these input sockets. Either socket is switch selected by the Converter switch at the rear of the chassis.

**MUTE** - The muting function is connected to the VOX control relay in the transmitter. Normal operation is obtained with the FUNCTION switch in STBY and the muting cable is shorted through the VOX relay. Muting occurs under transmission when the VOX relay is open.

**ANTI-VOX-500  $\Omega$**  - The anti-vox is connected into the anti-vox jack on the transmitter to prevent the Receiver audio from tripping the transmitter VOX.

**SPEAKER** - The speaker socket is for the connection of an 8  $\Omega$  speaker.

**LMO OUTPUT** - The LMO operating frequency is present at this socket for connection to a compatible transmitter for transceiver operation. Use the RG-62/U coaxial cable supplied.

**HETERODYNE OSCILLATOR** - The heterodyne oscillator operating frequency is available at this socket for connection to a compatible transmitter for transceiver operation. Use the RG-62/U coaxial cable supplied.

**BFO** - The BFO output signal is present at this socket for connection to a compatible transmitter for transceiver operation. Use the RG-62/U coaxial cable supplied.

**CONVERTER SOCKET** - B+ and filament voltages are present at this socket for VHF NO 1 and VHF NO 2 converter operation. These voltages are applied to the appropriate converter when the converter switch on the rear of the chassis is switched to the converter position. An AGC voltage is available for connection to converters for gain control.



## OPERATION

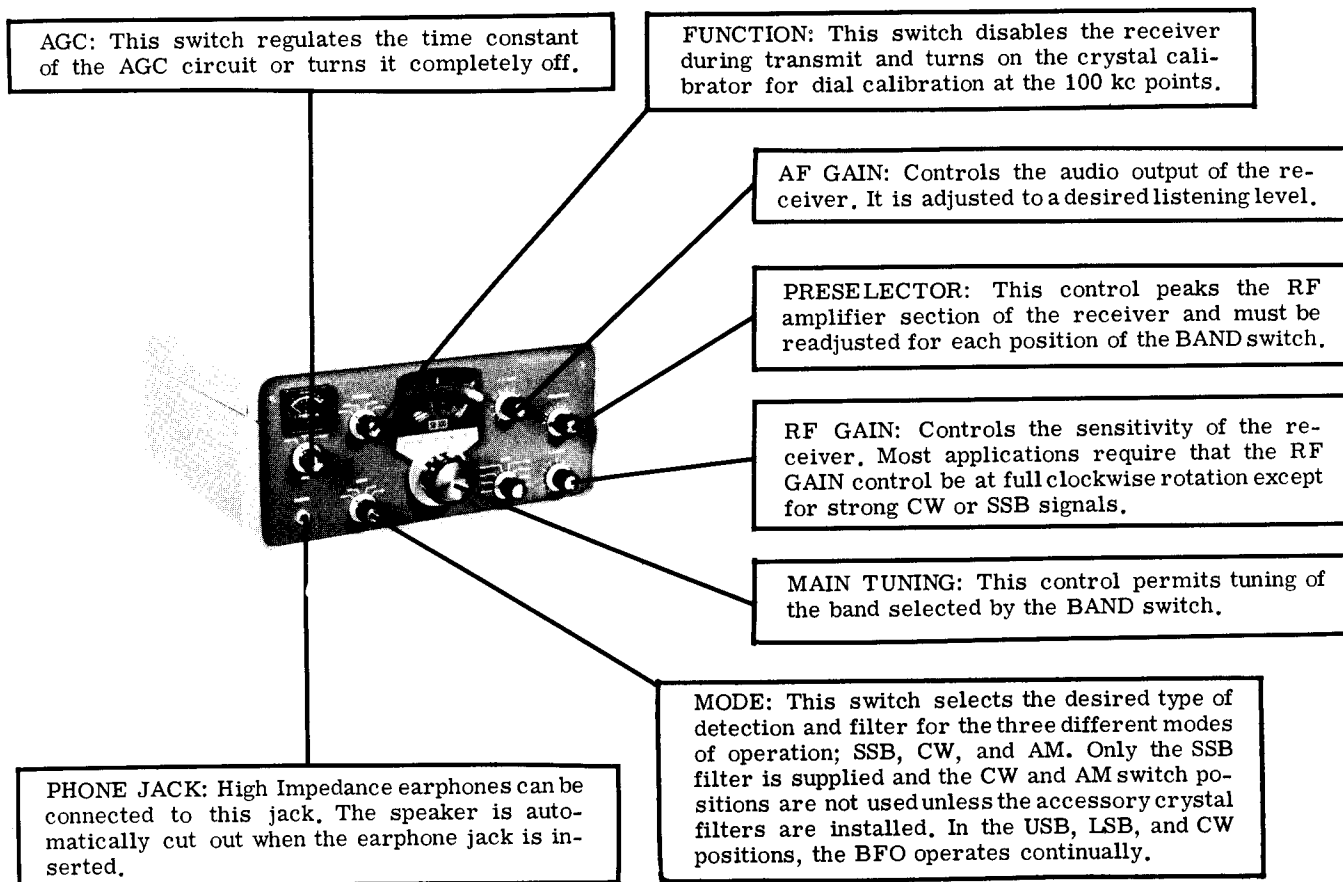


Figure 10

Refer to Figure 10 for a complete explanation of each front panel control. The Operation section will be broken into three separate sections: Single Sideband Tuning, AM Tuning, and CW Tuning.

### SINGLE SIDEBAND TUNING

1. Place the front panel controls as follows:

RF GAIN control - Full clockwise  
 BAND switch - Desired Band  
 AF GAIN control - 10 o'clock  
 MODE switch - USB or LSB as desired  
 AGC switch - SLOW  
 FUNCTION switch - CALibrate  
 Main Tuning - Desired frequency

2. Zero beat the calibrator signal at the calibration point nearest the desired signal frequency. Turn the Zero Set knob until the zero set line is directly over the zero on the circular dial. Turn the FUNCTION switch to OPR.
3. Peak the PRESELECTOR for maximum audio or S-Meter reading.
4. Tune in a single sideband signal and adjust the AF GAIN control for the desired audio output level.

## AM TUNING

Set the front panel controls the same as for "Single Sideband Tuning" except place the AGC switch in the FAST position, and if an AM crystal filter was installed in your receiver, place the MODE switch to AM. Otherwise, leave the MODE switch in the USB or LSB position.

1. Adjust the AF GAIN control for the desired audio output level.
2. Peak the PRESELECTOR for maximum audio or S-Meter reading.
3. Tune in an AM signal and adjust the AF GAIN control for the desired audio output level. NOTE: If you are using the single sideband filter for the reception of AM signal, you will hear a heterodyne beat note on the AM signal. It is necessary to zero beat this note to obtain satisfactory AM signal reception.

## CW TUNING

1. Set the front panel controls as described

under "Single Sideband Tuning" except place the MODE switch in the CW position, if the CW crystal filter was installed in your receiver. If not, leave the MODE switch in the USB or LSB position.

If the CW filter is used, the bandpass of the Receiver is so narrow that the zero beat cannot be heard. When the CW signal is centered in the filter passband, an audio signal of 1000 cps will be heard. It is suggested the CW signal be located in the USB mode and tuned for an audio note of 1000 cps. Now switch to the CW mode for elimination of interference and single signal reception.

For extremely weak signals, other than slow AGC may be desired. The Receiver has provision for SLOW, FAST, or OFF AGC. Operation with the AF GAIN control at maximum and adjusting volume with the RF GAIN control will degrade the signal-to-noise performance of the Receiver.

This Receiver can be used with the Heathkit SB-400 Transmitter for transceiver operation. Transceiver operation is discussed in the SB-400 Manual.

## IN CASE OF DIFFICULTY

NOTE: At no time should the LMO be opened or the warranty will be voided. The LMO was aligned using the tube supplied. Changing this tube may cause some slight difference in calibration. Replace the tube with one of the same brand if replacement is necessary.

Refer to the photographs and X-ray views at the rear of the manual for the location of the components on the circuit boards and chassis.

1. Recheck the wiring. Trace each lead in colored pencil on the Pictorial as it is checked. It is frequently helpful to have a friend check your work. Someone who is not familiar with the unit may notice something consistently overlooked by the constructor.
2. It is interesting to note that about 90% of the kits that are returned for repair, do not function properly due to poor connections and soldering. Therefore, many troubles can be eliminated by reheating all connections to make sure that they are soldered as described in the Proper Soldering Techniques section of this manual.
3. Check to be sure that all tubes are in their proper locations. Make sure that all tubes light up properly.
4. Check the tubes with a tube tester or by substitution of tubes of the same types and known to be good.
5. Check the values of the parts. Be sure that the proper part has been wired into the circuit, as shown in the pictorial diagrams and as called out in the wiring instructions.
6. Check for bits of solder, wire ends or other foreign matter which may be lodged in the wiring.
7. If, after careful checks, the trouble is still not located and a voltmeter is available, check voltage readings against those shown on the Schematic Diagram. NOTE: All voltage readings were taken with an 11 megohm input vacuum tube voltmeter. Voltages may vary as much as 10%.
8. A review of the Circuit Description will prove helpful in indicating where to look for trouble.

## TROUBLESHOOTING CHART

NOTE: Refer to the Schematic Diagram (fold-out from Page 79) for voltages and to the Circuit Board X-Ray Views and Chassis Photos (Page 72) for the locations of resistor and capacitors on the Circuit Boards and chassis, by R and C numbers.

SYMPTOM	POSSIBLE CAUSE
Pilot lamps and/or tube filaments do not light.	<ol style="list-style-type: none"> <li>1. Open fuse in AC line.</li> <li>2. Function switch incorrectly wired.</li> <li>3. Terminal strip K (lugs 2, 3, and 4) incorrectly wired to wiring harness or power transformer.</li> <li>4. Brown leads to circuit boards, V5, and V9 not connected to lug 3 of terminal strip J.</li> </ol>
No audio output at speaker.	<ol style="list-style-type: none"> <li>1. Speaker not connected to 8 <math>\Omega</math> speaker socket.</li> <li>2. Black-orange coaxial cable not internally wired to 8 <math>\Omega</math> speaker socket.</li> <li>3. Black-orange coaxial cable grounded between 8 <math>\Omega</math> Speaker socket and lug 4 of phone jack FA.</li> <li>4. Audio transformer incorrectly wired to terminal strip K, or to B+ and lug 9 of V10.</li> <li>5. Bad tube at V10.</li> <li>6. Cathode resistors R114 or R117 open or omitted.</li> <li>7. AF Gain control R229 incorrectly wired.</li> <li>8. Black-yellow coaxial cable from lug 2 of V10 to lug 3 of control R229 shorted.</li> <li>9. Coupling capacitor C116 omitted.</li> <li>10. Mode switch MS4R incorrectly wired.</li> <li>11. BFO (V9B) inoperative.</li> <li>12. No B+ at lug 4 of V9.</li> <li>13. Y9 or Y10 defective.</li> <li>14. Product detector (V9A) inoperative.</li> <li>15. No B+ at lug 8 of V9.</li> <li>16. Capacitor C114 omitted.</li> </ol>
No IF output.	<ol style="list-style-type: none"> <li>1. Bad tube at V6 or V7.</li> <li>2. No voltage at lugs 5 and 6 of V6 or V7.</li> <li>3. Open cathode resistors at V6 or V7.</li> <li>4. T3 and T4 not peaked at 3395 kc.</li> <li>5. C114 omitted (for product detection only).</li> <li>6. C113 omitted (for AM detection only).</li> </ol>

SYMPTOM	POSSIBLE CAUSE
AGC inoperative.	<ol style="list-style-type: none"> <li>1. C110 omitted.</li> <li>2. Defective diodes at CR1 and CR2.</li> <li>3. Diode CR1 or CR2 installed backwards.</li> <li>3. C109 and/or R118 defective or incorrectly wired to AGC switch.</li> <li>4. IF amplifiers V6 and V7 incorrectly wired to AGC switch.</li> <li>5. Bad tubes at V6 and V7.</li> <li>6. AGC switch in OFF position.</li> </ol>
S-Meter does not zero.	<ol style="list-style-type: none"> <li>1. Meter incorrectly wired in circuit.</li> <li>2. S-Meter Adjust control R108 incorrectly wired.</li> <li>3. Bad tube at V6 or V7.</li> <li>4. No B+ voltage at lugs 5 and 6 of V6.</li> <li>5. Open cathode resistor at V7.</li> </ol>
Improper filter selected for mode in use.	<ol style="list-style-type: none"> <li>1. MS1F and MS2R wired incorrectly.</li> <li>2. Reversed rotor or wafer at MS1 and MS2.</li> </ol>
Improper selection of product or AM detectors.	<ol style="list-style-type: none"> <li>1. Wrong BFO frequency caused by incorrect wiring at Y9 and Y10.</li> <li>2. Y9 and Y10 mounted in wrong sockets. NOTE: Selection of detectors is made at MS4R. Selection of BFO frequency for product detection is made at MS4R.</li> </ol>
No 2nd mixer (V3) output.	<ol style="list-style-type: none"> <li>1. Bad tube at V3.</li> <li>2. No B+ at plate and screen of V3.</li> <li>3. Open cathode resistor R12.</li> <li>4. Shorted LMO coaxial cable.</li> <li>5. No LMO output (5.0 to 5.5 mc).</li> <li>6. Bad tube at V5.</li> <li>7. Lack of filament or plate voltage to LMO.</li> <li>8. Lack of output from V2 and/or T2.</li> <li>9. No B+ at lugs 5 and 6 of V2.</li> <li>10. Open cathode resistor R8.</li> <li>11. No heterodyne oscillator (V4) output.</li> <li>12. No RF amplifier (V1) output.</li> <li>13. Reversed rotor or wafer at BS1R and BS3R.</li> <li>14. Reversed rotor or wafer at BS5F and BS5R.</li> <li>15. Reversed rotor or wafer at BS6R.</li> </ol>
No 1st mixer (V2) output.	<ol style="list-style-type: none"> <li>1. Bad tube at V2.</li> <li>2. No B+ at lugs 5 and 6 of V2.</li> <li>3. Open cathode resistor R8.</li> <li>4. No heterodyne oscillator (V4) output.</li> <li>5. No B+ at lug 1 of V4.</li> <li>6. Heterodyne oscillator plate coil untuned or defective.</li> <li>7. Crystal defective or not in socket.</li> <li>8. Crystal improperly wired to BS1R.</li> <li>9. Plate coils improperly wired to BS3R.</li> </ol>

SYMPTOM	POSSIBLE CAUSE
No 1st mixer (V2) output (cont'd.).	10. C8 at BS3F improperly wired or omitted. 11. Coaxial cable from BS3F3 to lug 1 of V2 shorted. 12. No RF amplifier (V1) output. 13. Reversed rotors on wafers at BS1R, BS3R, BS5 and BS6.
No RF Amplifier (V1) output or low sensitivity.	1. Bad tube at V1. 2. No B+ at lugs 5 and 6 of V1. 3. Open cathode resistor R2. 4. Antenna and RF amplifier coils not aligned properly. 5. Low heterodyne oscillator (V4) output. 6. Low B+ to V1 and V4. 7. Antenna and RF amplifier coils incorrectly wired. 8. Coaxial cable from BS5R to lug 1 of V1 shorted. 9. Reversed rotors or wafers at BS6R, BS5, and BS4.
Crystal calibrator (V8) inoperative.	1. Bad tube at V8. 2. No B+ at lugs 5 and 6 of V8. 3. Open cathode resistor R17. 4. C21 omitted or incorrectly wired. 5. Cathode lead to Function switch omitted. 6. Function switch not in <u>CAL</u> position. 7. Crystal not in socket. 8. Trimmer C20 or R16 omitted or miswired.
Power supply difficulties.	1. Check B+ voltages at capacitor H(C227). 2. Check filament voltage at lug 3 of terminal strip J. 3. Check bias voltage at lugs 1 and 10 of terminal strip J and lugs 1 and 7 of terminal strip K. NOTE: These voltages should be as shown on the Schematic.
Converter switching difficulties.	1. Check for filament voltage at lug 11 of Converter switch. 2. Check for B+ voltage at lug 3 of Converter switch. 3. Check wiring from Converter switch to Converter sockets.

## SERVICE INFORMATION

### SERVICE

If, after applying the information in this manual and your best efforts, you are still unable to obtain proper performance, it is suggested that you take advantage of the technical facilities which the Heath Company makes available to its customers.

The Technical Consultation Department is maintained for your benefit. This service is available to you at no charge. Its primary purpose is to provide assistance for those who encounter difficulty in the construction, operation or maintenance of HEATHKIT equipment. It is not intended, and is not equipped to function as a general source of technical information involving kit modifications nor anything other than the normal and specified performance of HEATHKIT equipment.

Although the Technical Consultants are familiar with all details of this kit, the effectiveness of their advice will depend entirely upon the amount and the accuracy of the information furnished by you. In a sense, YOU MUST QUALIFY for GOOD technical advice by helping the consultants to help you. Please use this outline:

1. Before writing, fully investigate each of the hints and suggestions listed in this manual under In Case Of Difficulty. Possibly it will not be necessary to write.
2. When writing, clearly describe the nature of the trouble and mention all associated equipment. Specifically report operating procedures, switch positions, connections to other units, and anything else that might help to isolate the cause of trouble.
3. Report fully on the results obtained when testing the unit initially and when following the suggestions under In Case Of Difficulty. Be as specific as possible and include voltage readings if test equipment is available.
4. Identify the kit model number and date of purchase, if available. Also mention the date of the kit assembly manual. (Date at bottom of Page 1.)
5. Print or type your name and address, preferably in two places on the letter.

With the preceding information, the consultant will know exactly what kit you have, what you would like it to do for you and the difficulty you wish to correct. The date of purchase tells him whether or not engineering changes have been made since it was shipped to you. He will know what you have done in an effort to locate the cause of trouble and, thereby, avoid repetitious suggestions. In short, he will devote full time to the problem at hand, and through his familiarity with the kit, plus your accurate report, he will be able to give you a complete and helpful answer. If replacement parts are required, they will be shipped to you, subject to the terms of the Warranty.

The Factory Service facilities are also available to you, in case you are not familiar enough with electronics to provide our consultants with sufficient information on which to base a diagnosis of your difficulty, or in the event that you prefer to have the difficulty corrected in this manner. You may return the completed equipment to the Heath Company for inspection and necessary repairs and adjustments. You will be charged a minimal service fee, plus the price of any additional parts or material required. However, if the completed kit is returned within the Warranty period, parts charges will be governed by the terms of the Warranty. State the date of purchase, if possible.

Local Service by Authorized HEATHKIT Service Centers is also available in some areas and often will be your fastest, most efficient method of obtaining service for your HEATHKIT equipment. Although charges for local service are generally somewhat higher than for factory service, the amount of increase is usually offset by the transportation charge you would pay if you elected to return your kit to the Heath Company.

HEATHKIT Service Centers will honor the regular 90 day HEATHKIT Parts Warranty on all kits, whether purchased through a dealer or directly from Heath Company; however, it will be necessary that you verify the purchase date of your kit.



Under the conditions specified in the Warranty, replacement parts are supplied without charge; however, if the Service Center assists you in locating a defective part (or parts) in your kit, or installs a replacement part for you, you may be charged for this service.

HEATHKIT equipment purchased locally and returned to Heath Company for service must be accompanied by your copy of the dated sales receipt from your authorized HEATHKIT dealer in order to be eligible for parts replacement under the terms of the Warranty.

THIS SERVICE POLICY APPLIES ONLY TO COMPLETED EQUIPMENT CONSTRUCTED IN ACCORDANCE WITH THE INSTRUCTIONS AS STATED IN THE MANUAL. Equipment that has been modified in design will not be accepted for repair. If there is evidence of acid core solder or paste fluxes, the equipment will be returned NOT repaired.

For information regarding modification of HEATHKIT equipment for special applications, it is suggested that you refer to any one or more of the many publications that are available on all phases of electronics. They can be obtained at or through your local library, as well as at most electronic equipment stores. Although the Heath Company sincerely welcomes all comments and suggestions, it would be impossible to design, test, evaluate and assume responsibility for proposed circuit changes for special purposes. Therefore, such modifications must be made at the discretion of the kit builder, using information available from sources other than the Heath Company.

## REPLACEMENTS

Material supplied with HEATHKIT products has been carefully selected to meet design requirements and ordinarily will fulfill its function without difficulty. Occasionally, improper operation can be traced to a faulty component. Should inspection reveal the necessity for replacement, write to the Heath Company and supply all of the following information.

- A. Thoroughly identify the part in question by using the part number and description found in the manual Parts List.

- B. Identify the type and model number of kit in which it is used.
- C. Mention date of purchase.
- D. Describe the nature of defect or reason for requesting replacement.

The Heath Company will promptly supply the necessary replacement. PLEASE DO NOT RETURN THE ORIGINAL COMPONENT UNTIL SPECIFICALLY REQUESTED TO DO SO. Do not dismantle the component in question as this will void the guarantee. This replacement policy does not cover the free replacement of parts that may have been broken or damaged through carelessness on the part of the kit builder.

## SHIPPING INSTRUCTIONS

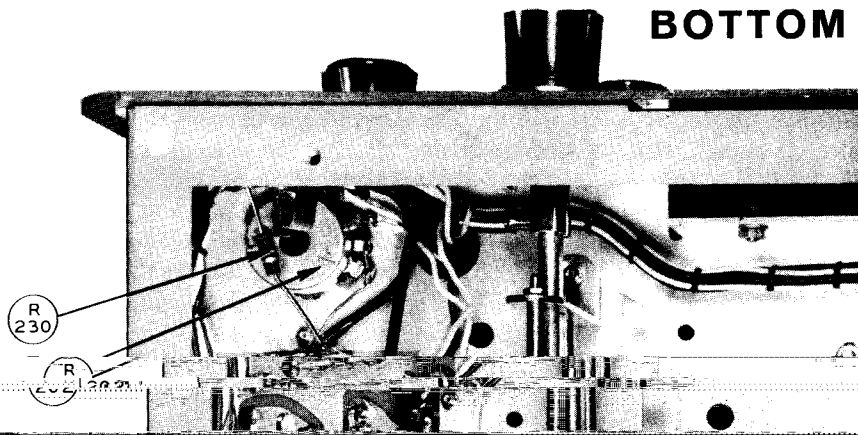
In the event that your instrument must be returned for service, these instructions should be carefully followed.

Wrap the equipment in heavy paper, exercising care to prevent damage. Place the wrapped equipment in a stout carton of such size that at least three inches of shredded paper, excelsior, or other resilient packing material can be placed between all sides of the wrapped equipment and the carton. Close and seal the carton with gummed paper tape, or alternately, tie securely with stout cord. Clearly print the address on the carton as follows:

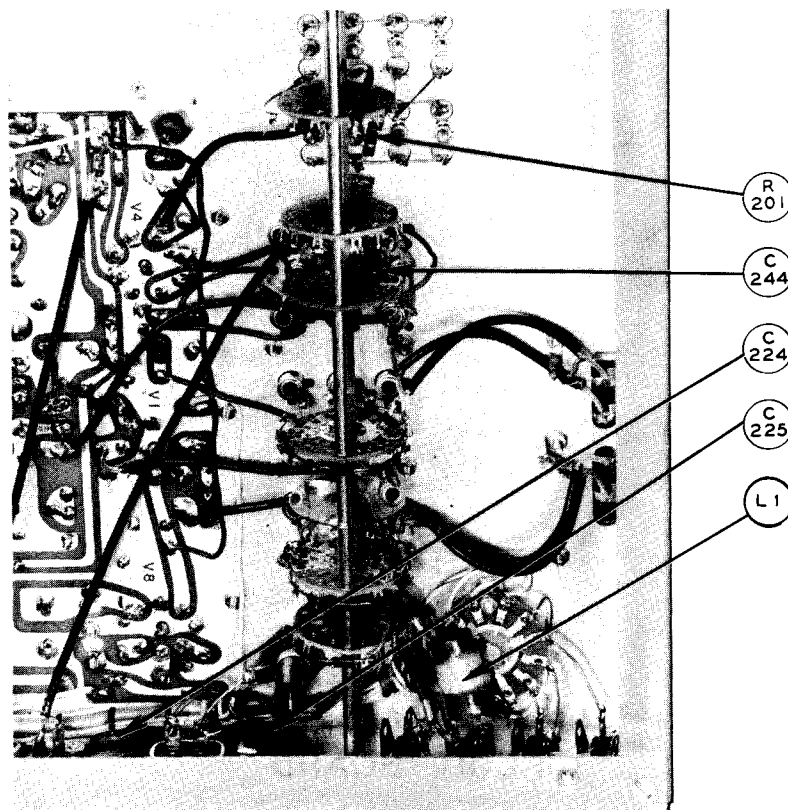
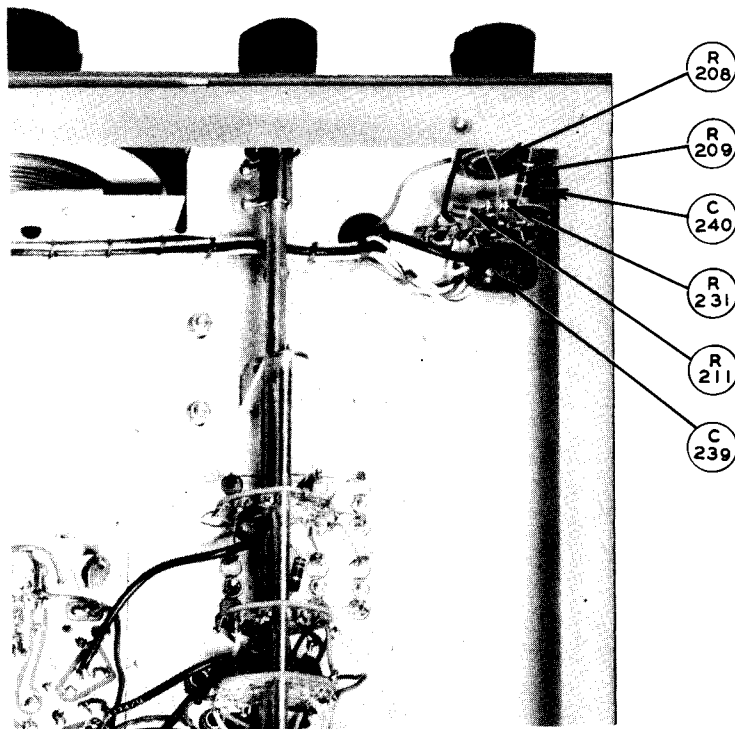
To: HEATH COMPANY  
Benton Harbor, Michigan

ATTACH A LETTER TO THE OUTSIDE OF THE CARTON BEARING YOUR NAME, COMPLETE ADDRESS, DATE OF PURCHASE, AND A BRIEF DESCRIPTION OF THE DIFFICULTY ENCOUNTERED. Also, include your name and return address on the outside of the carton. Preferably affix one or more "Fragile" or "Handle With Care" labels to the carton, or otherwise so mark with a crayon of bright color. Ship by insured parcel post or prepaid express; note that a carrier cannot be held responsible for damage in transit if, in HIS OPINION, the article is inadequately packed for shipment.

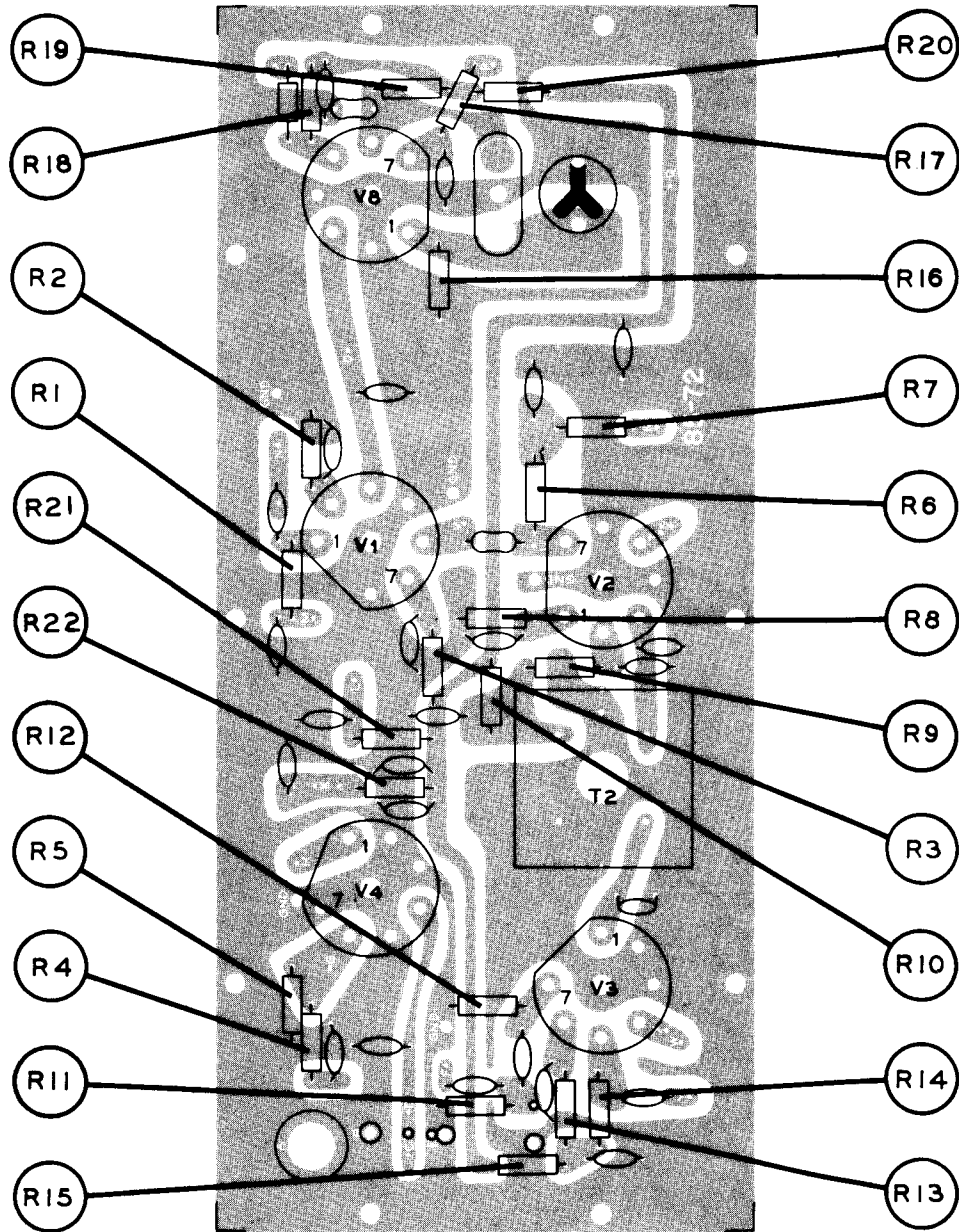
# BOTTOM VIEW OF CHASSIS



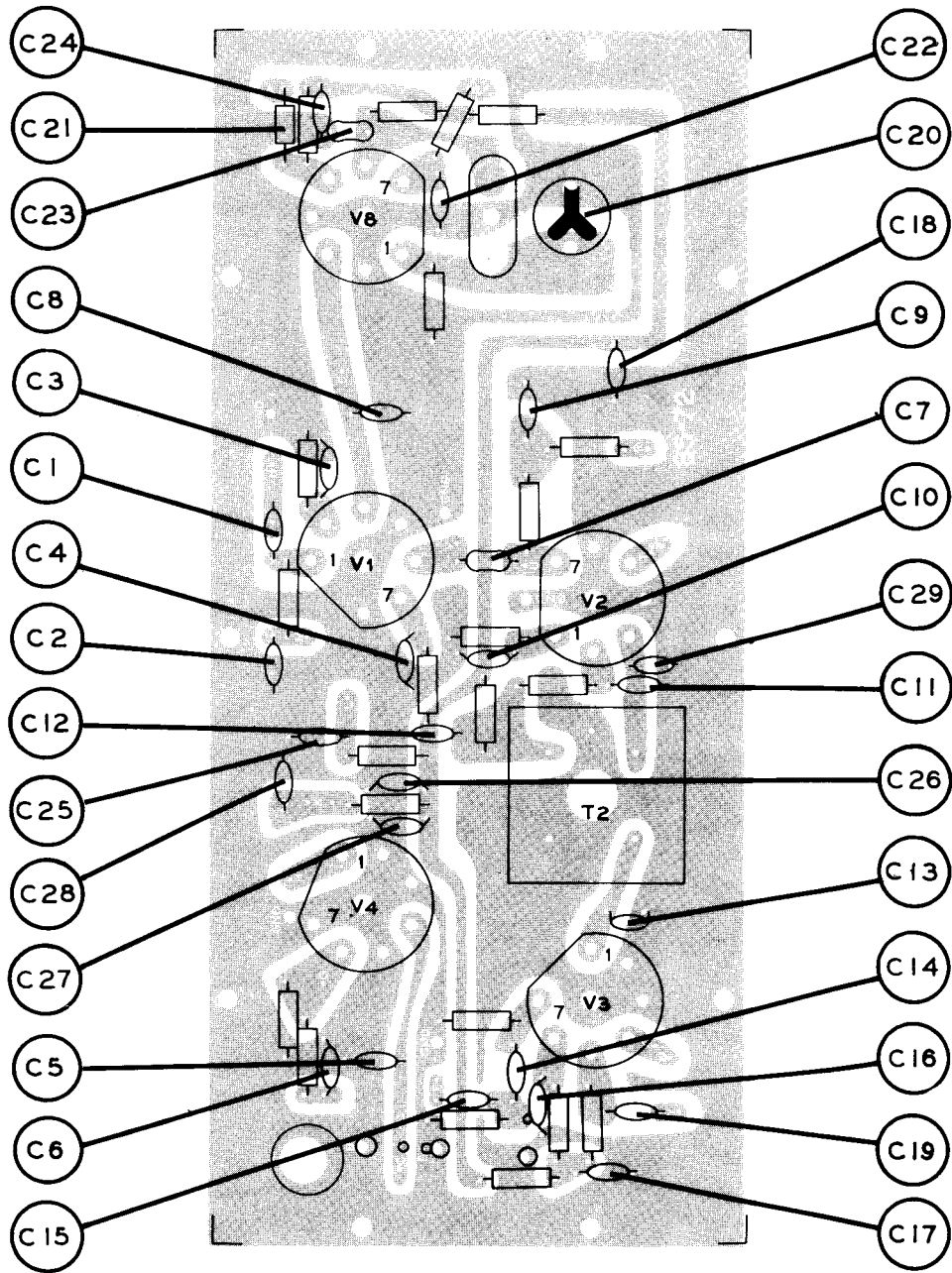
# IN FOUR SECTIONS



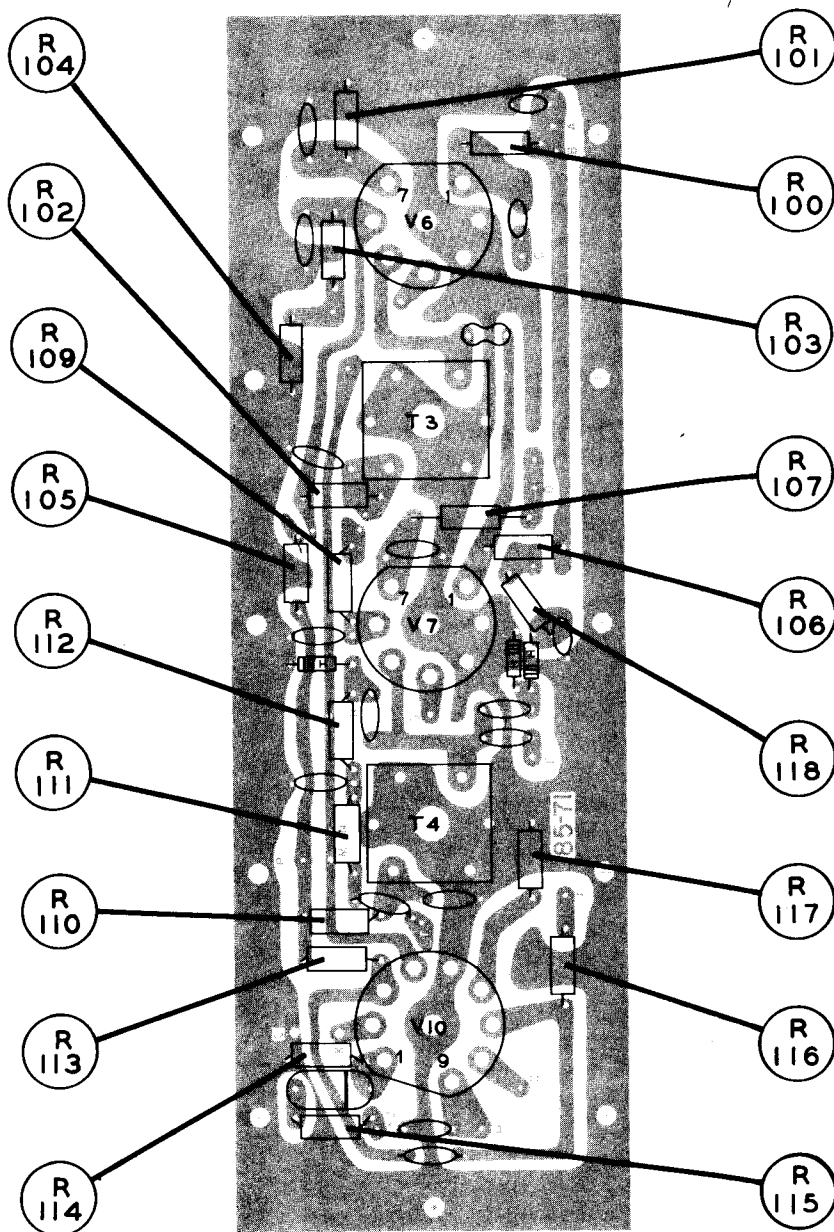
# CIRCUIT BOARD X-RAY VIEWS (VIEWED FROM FOIL SIDE)



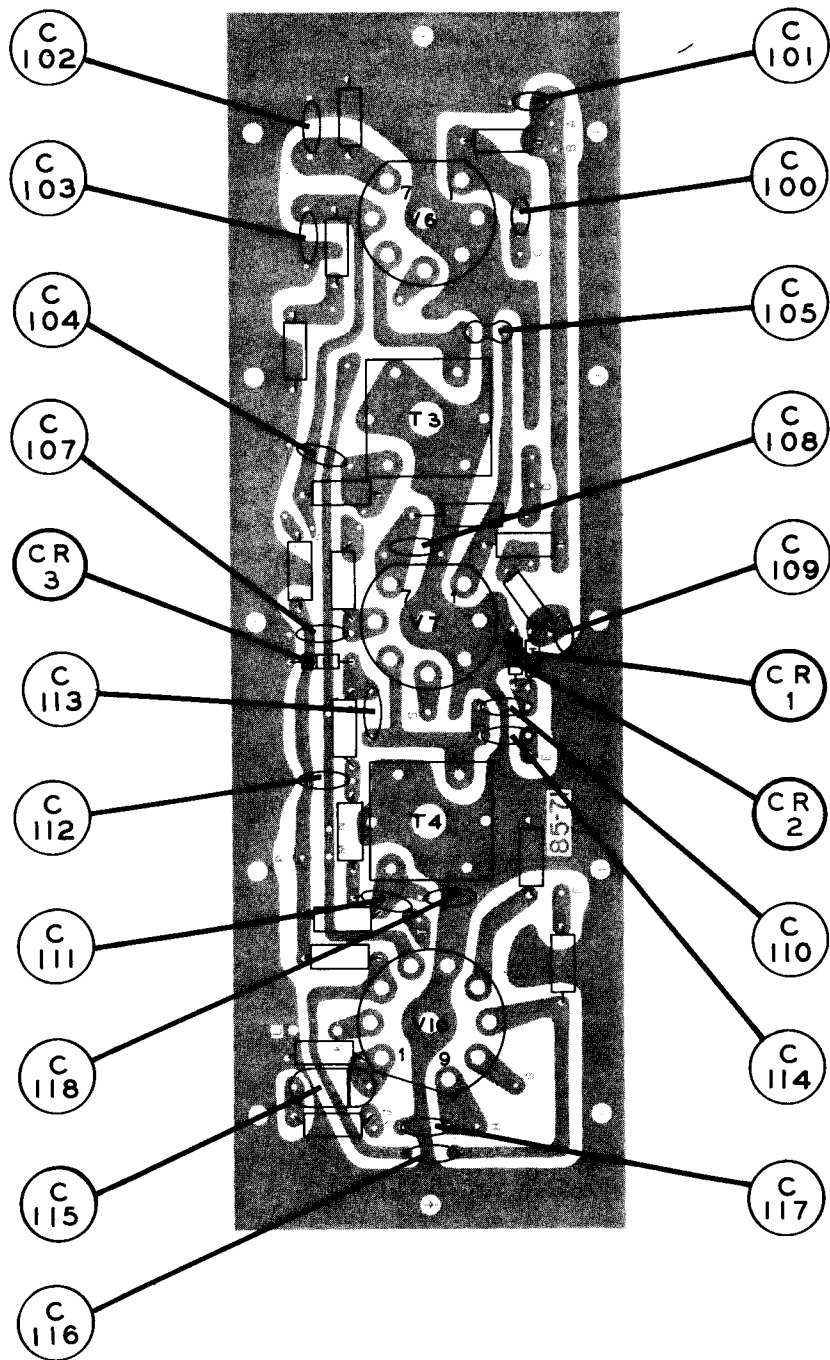
- RESISTORS -  
RF AMPLIFIER  
CIRCUIT BOARD



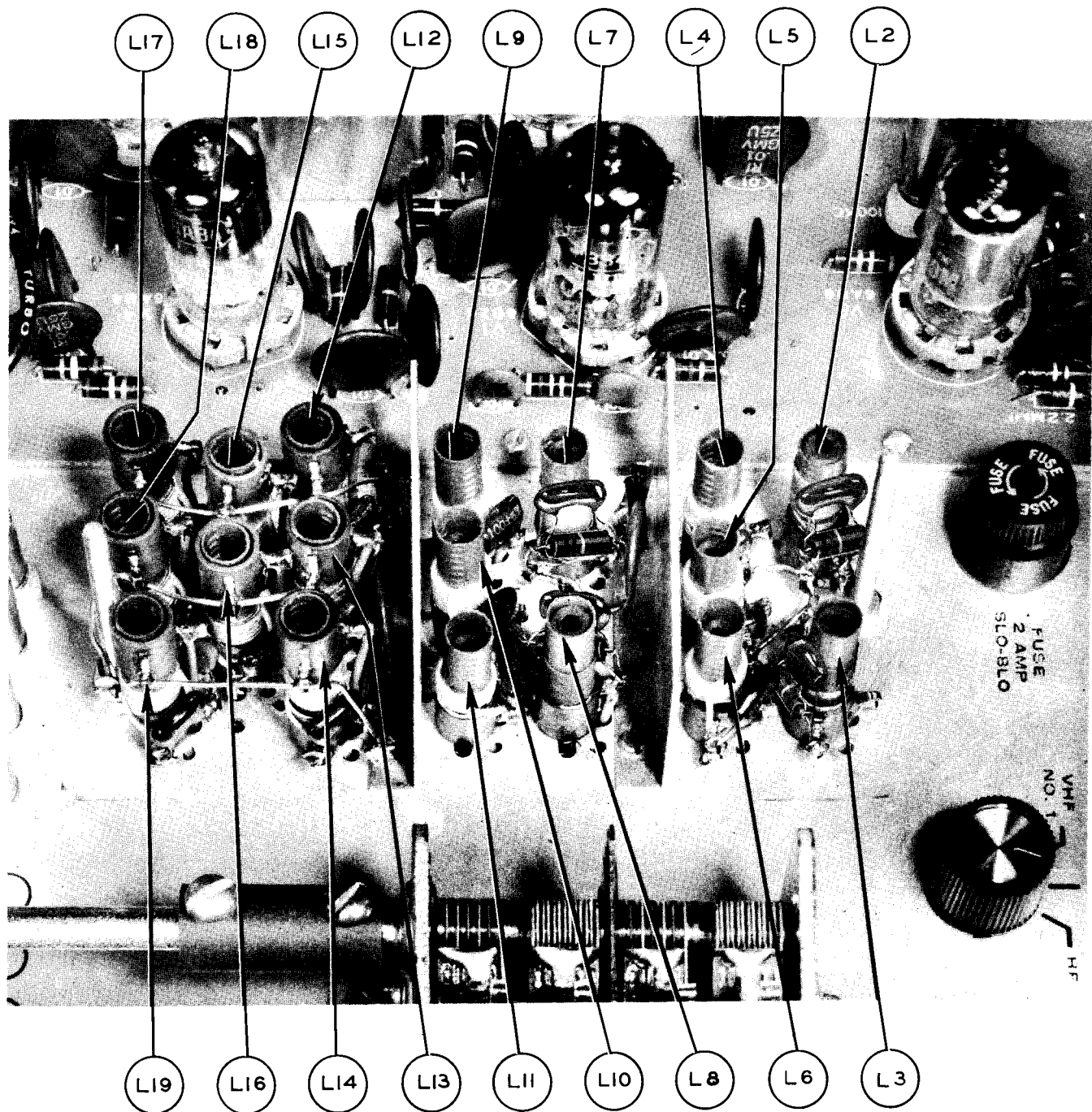
-CAPACITORS-  
RF AMPLIFIER  
CIRCUIT BOARD



-RESISTORS-  
IF AMPLIFIER  
CIRCUIT BOARD



-CAPACITORS-  
IF AMPLIFIER  
CIRCUIT BOARD





## WARRANTY

Heath Company warrants that all Heathkit parts shall be free of all defects in materials and workmanship under normal use and service, and in fulfillment of such warranty Heath Company will, for a period of three months from the date of shipment, replace any part upon verification that it is defective.

The foregoing warranty shall apply only to the original buyer, and is and shall be in lieu of all other warranties, whether express or implied and of all other obligations or liabilities on the part of Heath Company and in no event shall Heath Company be liable for any anticipated profits, consequential damages, loss of time or other losses incurred by the buyer in connection with the purchase, assembly or operation of Heathkits or components thereof. No replacement shall be made of parts damaged by the buyer in the course of handling or assembling Heathkit equipment.

The foregoing warranty is completely void if corrosive solder or fluxes have been used in wiring the equipment, Heath Company will not replace or repair any equipment in which corrosive solder or fluxes have been used.

This warranty applies only to Heath equipment sold and shipped within the continental United States including APO and FPO shipments. Warranty replacements for Heathkit equipment outside the United States is on a f.o.b. factory basis. Contact the Heathkit authorized distributor in your country or write: Heath Company, International Division, Benton Harbor, Michigan, U.S.A.

HEATH COMPANY

**NOTES:**

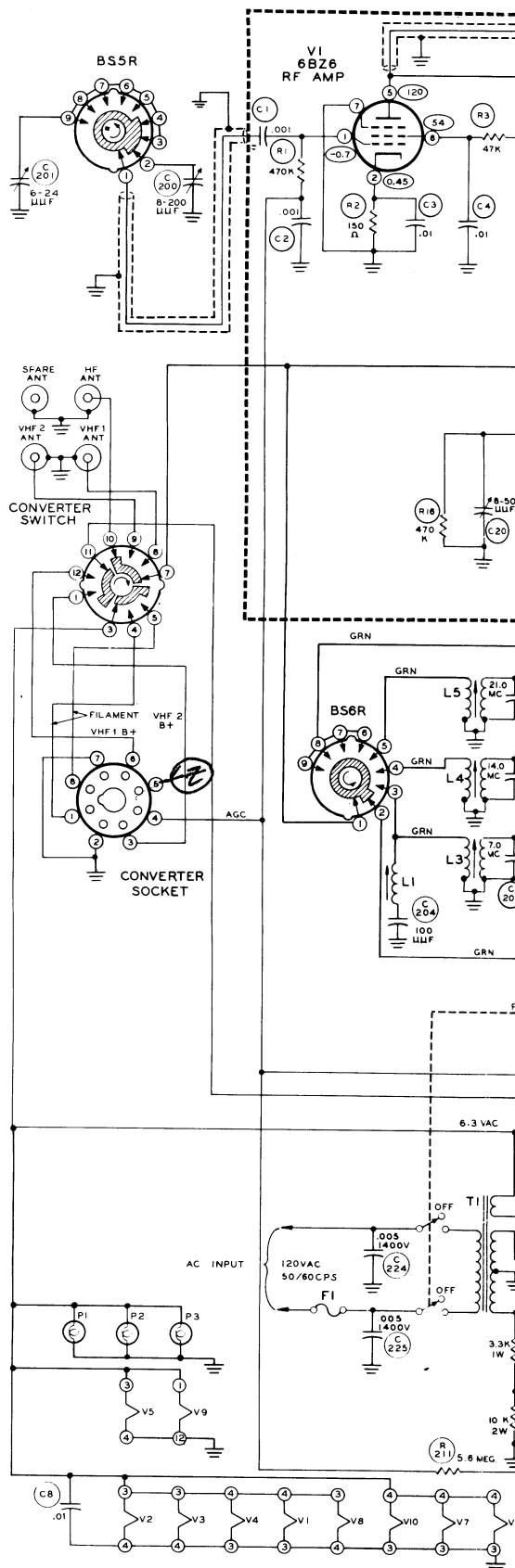
- ALL RESISTORS ARE 1/2 WATT UNLESS MARKED OTHERWISE.
- ALL RESISTOR VALUES ARE IN OHMS (K=1000, MEG=1,000,000).
- ALL CAPACITOR VALUES ARE IN  $\mu$ F UNLESS MARKED OTHERWISE.
- INDICATES VOLTAGE READING.
- ALL VOLTAGES MEASURED WITH NO SIGNAL INPUT.
- ALL VOLTAGES ARE DC POSITIVE UNLESS MARKED OTHERWISE.
- ALL VOLTAGES ARE MEASURED FROM POINT INDICATED TO CHASSIS GROUND, EXCEPT AC VOLTAGES ON POWER TRANSFORMER WINDINGS.
- VOLTAGE READINGS TAKEN WITH AN 11 MEGOHM INPUT VTVM.
- VOLTAGES MAY VARY  $\pm 10\%$ .
- ALL SWITCHES VIEWED FROM THE REAR, (UNLESS MARKED OTHERWISE), AT FULL COUNTERCLOCKWISE ROTATION.
- ARROW (→) INDICATES CLOCKWISE ROTATION OF KNOB.



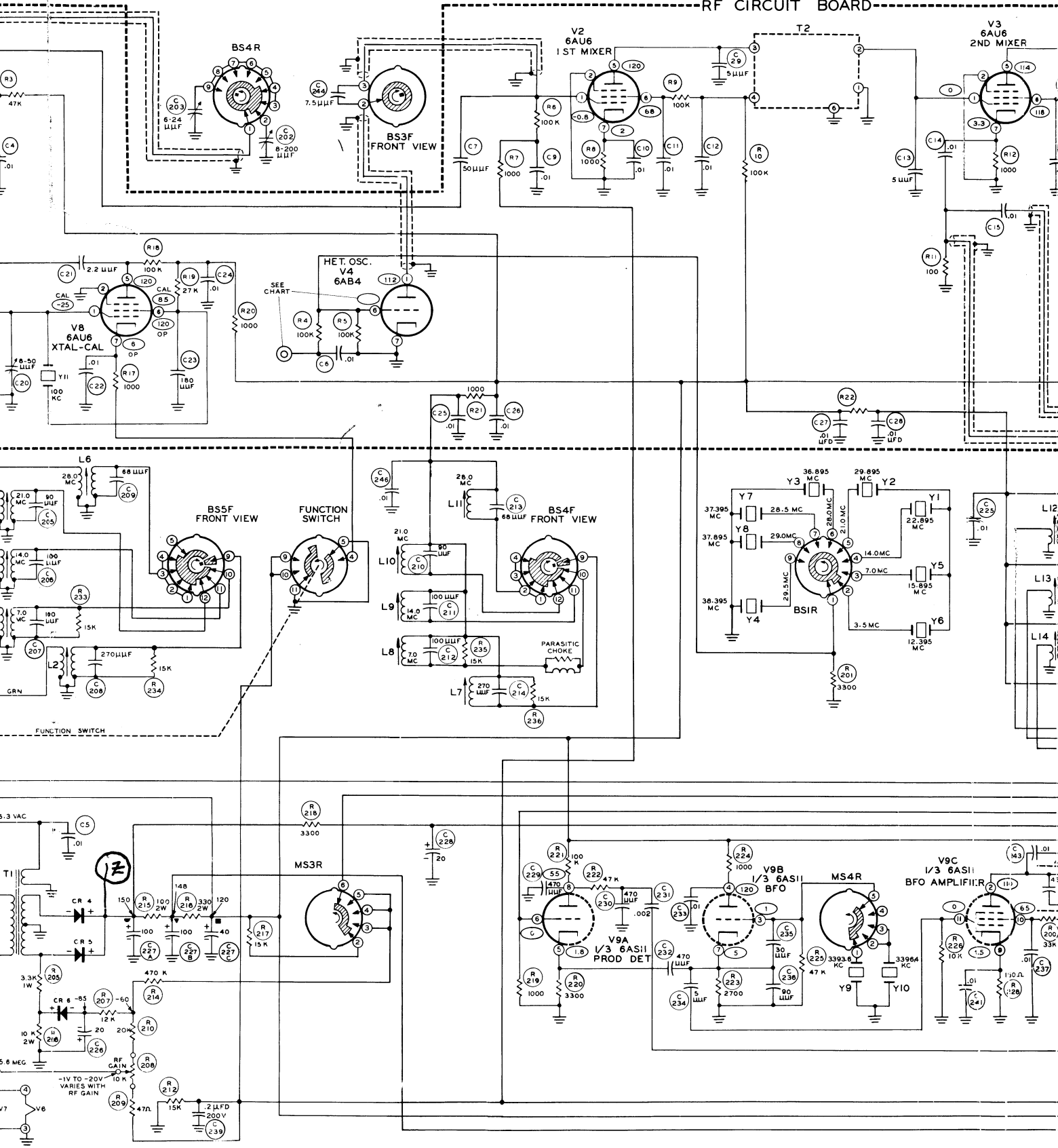
THE SMALL SQUARE DOT IN THE CENTER OF SOME SWITCH WAFERS ON THE FUNCTION, MODE, AND BAND SWITCHES INDICATE A CONNECTION BETWEEN THE FRONT AND REAR ROTORS OF THAT WAFER.

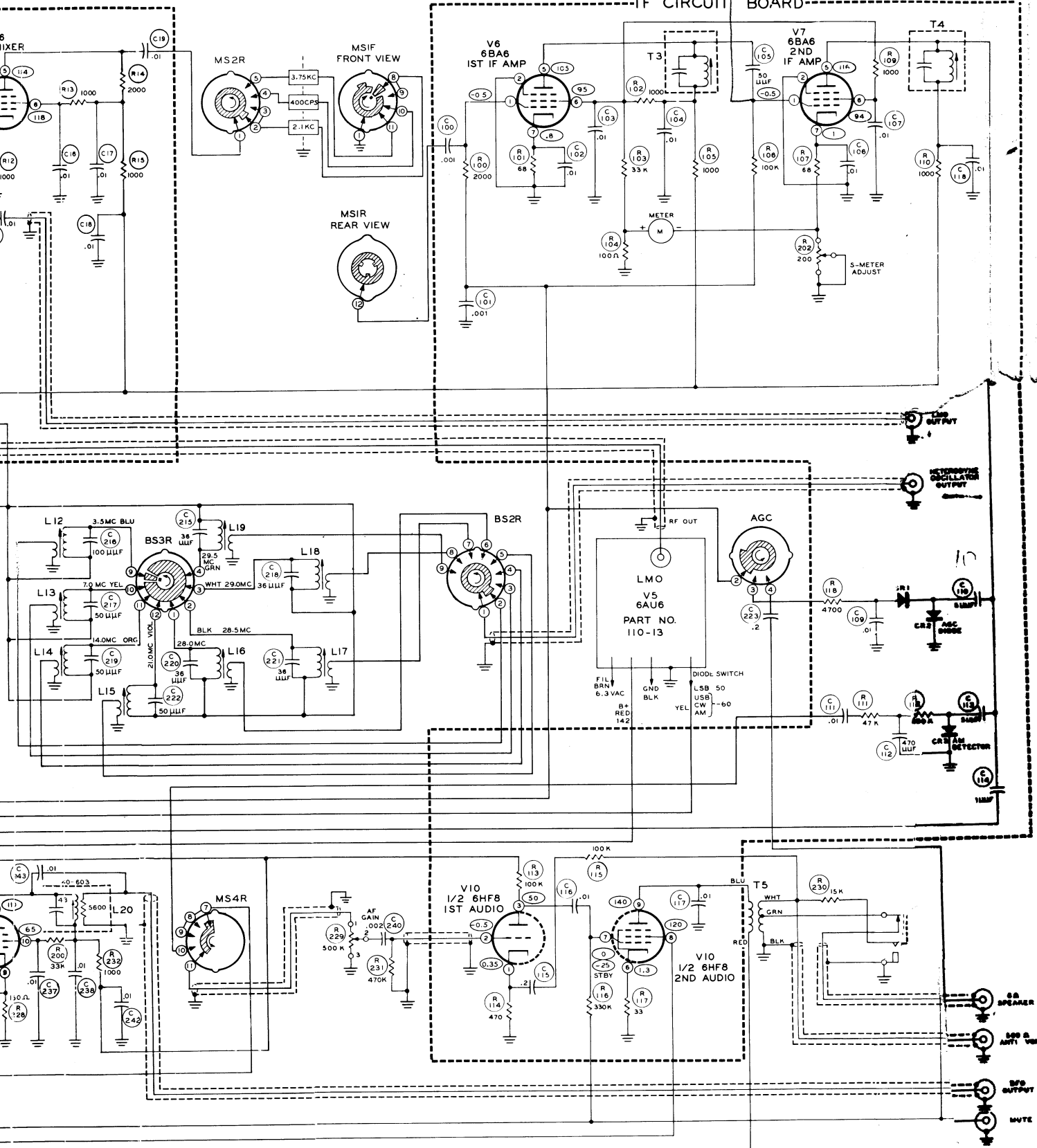
REFER TO THE X-RAY VIEWS FOR THE PHYSICAL LOCATION OF PARTS ON THE CIRCUIT BOARD.

**SCHEMATIC OF THE  
HEATHKIT  
SSB AMATEUR RECEIVER  
MODEL SB-300**



RF CIRCUIT BOARD



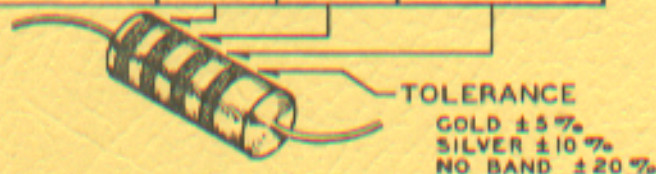


# RESISTOR AND CAPACITOR COLOR CODES

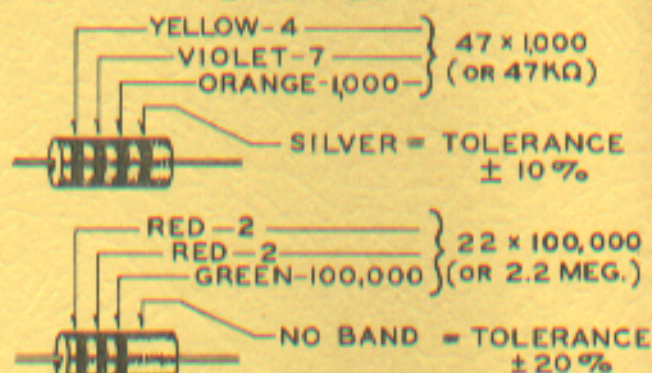
## RESISTORS

The colored bands around the body of a color coded resistor represent its value in ohms. These colored bands are grouped toward one end of the resistor body. Starting with this end of the resistor, the first band represents the first digit of the resistance value; the second band represents the second digit; the third band represents the number by which the first two digits are multiplied. A fourth band of gold or silver represents a tolerance of  $\pm 5\%$  or  $\pm 10\%$  respectively. The absence of a fourth band indicates a tolerance of  $\pm 20\%$ .

CODE			
COLOR	1ST DIGIT	2ND DIGIT	MULTIPLIER
BLACK	0	0	1
BROWN	1	1	10
RED	2	2	100
ORANGE	3	3	1,000
YELLOW	4	4	10,000
GREEN	5	5	100,000
BLUE	6	6	1,000,000
VIOLET	7	7	10,000,000
GRAY	8	8	100,000,000
WHITE	9	9	1,000,000,000
GOLD	-	-	.1
SILVER	-	-	.01



## EXAMPLES



## CAPACITORS

Generally, only mica and tubular ceramic capacitors, used in modern equipment, are color coded. The color codes differ somewhat among capacitor manufacturers, however the codes

shown below apply to practically all of the mica and tubular ceramic capacitors that are in common use. These codes comply with EIA (Electronics Industries Association) Standards.

### MICA

CODE				TOLER. %
COLOR	1 <sup>st</sup> DIGIT	2 <sup>nd</sup> DIGIT	MULTIPLIER	
BLACK	0	0	1	$\pm 20$
BROWN	1	1	10	$\pm 10$
RED	2	2	100	$\pm 5$
ORANGE	3	3	1,000	$\pm 5$
YELLOW	4	4	10,000	$\pm 5$
GREEN	5	5	—	$\pm 5$
BLUE	6	6	—	$\pm 5$
VIOLET	7	7	—	$\pm 5$
GRAY	8	8	—	$\pm 5$
WHITE	9	9	—	$\pm 5$
GOLD	-	-	—	$\pm 10$
SILVER	-	-	—	$\pm 10$

### EXAMPLE



CHARACTERISTIC  $\pm 5\%$

2700μF  $\pm 5\%$   
OR .0027 μF

OBSERVE DIRECTION OF ARROW

WHT OR BLK DOT INDICATES MICA

CHARACTERISTIC—SEE NOTE 1 BELOW

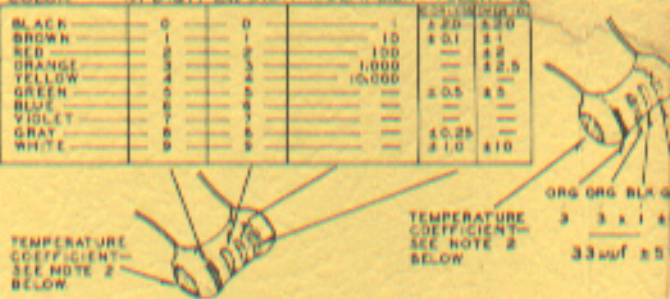
(VALUE IN μF—SEE NOTE 3 BELOW)

### TUBULAR CERAMIC

Place the group of rings or dots to the left and read from left to right.

CODE				TOLER. %
COLOR	1 <sup>st</sup> DIGIT	2 <sup>nd</sup> DIGIT	MULTIPLIER	
BLACK	0	0	1	$\pm 20$
BROWN	1	1	10	$\pm 10$
RED	2	2	100	$\pm 5$
ORANGE	3	3	1,000	$\pm 5$
YELLOW	4	4	10,000	$\pm 5$
GREEN	5	5	—	$\pm 0.5$
BLUE	6	6	—	$\pm 0.5$
VIOLET	7	7	—	$\pm 0.25$
GRAY	8	8	—	$\pm 1.0$
WHITE	9	9	—	$\pm 10$

### EXAMPLE



TEMPERATURE COEFFICIENT—SEE NOTE 2 BELOW

TEMPERATURE COEFFICIENT—SEE NOTE 2 BELOW

ORG ORG BLK GRN

3 3 1 5%

33 μF  $\pm 5\%$

(VALUE IN μF—SEE NOTE 3 BELOW)

## NOTES:

1. The characteristic of a mica capacitor is the temperature coefficient, drift capacitance and insulation resistance. This information is not usually needed to identify a capacitor but, if desired, it can be obtained by referring to EIA Standard, RS-153 (a Standard of Electronic Industries Association.)

2. The temperature coefficient of a capacitor is the predictable change in capacitance with temperature change and is

expressed in parts per million per degree centigrade. Refer to EIA Standard, RS-198 (a Standard of Electronic Industries Association.)

3. The farad is the basic unit of capacitance, however capacitor values are generally expressed in terms of μF (micro-farad, .000001 farad) and μμF (micro-micro-farad, .000001 μF); therefore, 1,000 μμF = .001 μF, 1,000,000 μμF = 1 μF.

## USING A PLASTIC NUT STARTER

A plastic nut starter offers a convenient method of starting the most used sizes: 3/16" and 1/4" (3-48 and 6-32). When the correct end is pushed down over a nut, the pliable tool conforms to the shape of the nut and the nut is gently held while it is being picked up and started on the screw. The tool should only be used to start the nut.

6-32



3-48



## TYPICAL COMPONENT TYPES

This chart is a guide to commonly used types of electronic components. The symbols and related illustrations

should prove helpful in identifying most parts and reading the schematic diagrams.

<p><b>RESISTOR</b></p>	<p><b>CAPACITOR</b></p>	<p><b>TUBE</b></p>
<p><b>POTENTIOMETER (CONTROL)</b></p>	<p><b>ELECTROLYTIC CAPACITOR</b></p>	<p><b>TRANSISTOR</b></p>
<p><b>TRANSFORMER (IRON CORE)</b></p>	<p><b>VARIABLE CAPACITOR</b></p>	<p><b>RECTIFIER (DIODE)</b></p>
<p><b>TRANSFORMER (ADJUSTABLE POWDERED IRON CORE)</b> ARROW INDICATES DIRECTION OF CORE MOVEMENT TO INCREASE INDUCTANCE</p>	<p><b>BATTERY</b></p>	<p><b>NEON BULB</b></p>
<p><b>TRANSFORMER (ADJUSTABLE CORE)</b></p>	<p><b>PHONO JACK</b></p>	<p><b>ILLUMINATING BULB</b></p>
<p><b>POWER TRANSFORMER</b></p>	<p><b>PHONE JACK</b></p>	<p><b>METER</b></p>
<p><b>INDUCTOR (COIL)</b></p>	<p><b>RECEPTACLE</b></p>	<p><b>SWITCH (TOGGLE)</b></p>
<p><b>PIEZOELECTRIC CRYSTAL</b></p>	<p><b>SPEAKER</b></p>	<p><b>SWITCH (ROTARY)</b></p>
<p><b>BINDING POST</b></p>	<p><b>MICROPHONE</b></p>	<p><b>FUSE</b></p>
<p><b>ANTENNA</b></p> <p>GENERAL      LOOP</p>	<p><b>EARTH GROUND</b></p> <p><b>CHASSIS GROUND</b></p>	<p><b>CONDUCTORS</b></p> <p>NOT CONNECTED      CONNECTED      SHIELDED</p>