
DRIVER PRESELECTOR
FINAL
MIC./CW LEVEL
METER
FUNCTION
RF GAIN
AF GAIN
MIC
HEATHKIT
SSB TRANSCEIVER

HEATHKIT® MANUAL

for the

SSB TRANSCEIVER

Model HW-101

595-1277-18

HEATH COMPANY • BENTON HARBOR, MICHIGAN

USE EXTREME CARE DURING INITIAL TESTING AND ALL SUBSEQUENT OPERATION OF THIS TRANSCEIVER. WHILE THE HW-101 IS DESIGNED FOR MAXIMUM SAFETY, NEVER LOSE RESPECT FOR THE HIGH VOLTAGE PRESENT IN THIS UNIT. PROTECT YOURSELF ALWAYS AGAINST LETHAL OR SEVERE ELECTRIC SHOCK.

HEATH COMPANY

COMPANY PHONE DIRECTORY

[redacted]

Heathkit® Manual

for the

SSB TRANSCEIVER

Model HW-101

595-1277-18

HEATH COMPANY
BENTON HARBOR, MICHIGAN 49022

TABLE OF CONTENTS

INTRODUCTION

The Heathkit Model HW-101 SSB Transceiver transmits and receives SSB (single sideband) and CW (continuous wave)

The dial mechanism has a large tuning knob which operates

PARTS PACKAGING

The Transceiver parts are packed in the large shipping carton, which contains smaller packages and other parts. Some of these smaller packages have numbers on them. The number on each of these packages corresponds to the number on one of the following seven parts lists.

After the seven numbered packages have been removed from the large carton, the remaining parts are pack #8. Pack #8 consists mainly of items too large to fit into the small packages, and those items used in the chassis assembly sections.

You will be directed to open each of these packages as they are needed. Each of the assembly sections of the Manual the beginning of each parts list you will be told which numbered package to open. You will also be directed to remove the parts from pack #8 that are required to complete that assembly section.

NOTE: To avoid intermixing parts, do not open any of the parts packs until directed to do so at the beginning of one of the parts lists. Any part that is packed in an individual envelope with a part number on it should be placed back in its envelope after it is identified until that part is called for in a step.

To order replacement parts, refer to the "Replacement Parts Price List" and use the Parts Order Form furnished with this

SWITCH-BOARDS

In this section you will assemble the following circuit boards: crystal, heterodyne oscillator, driver grid, and driver plate.

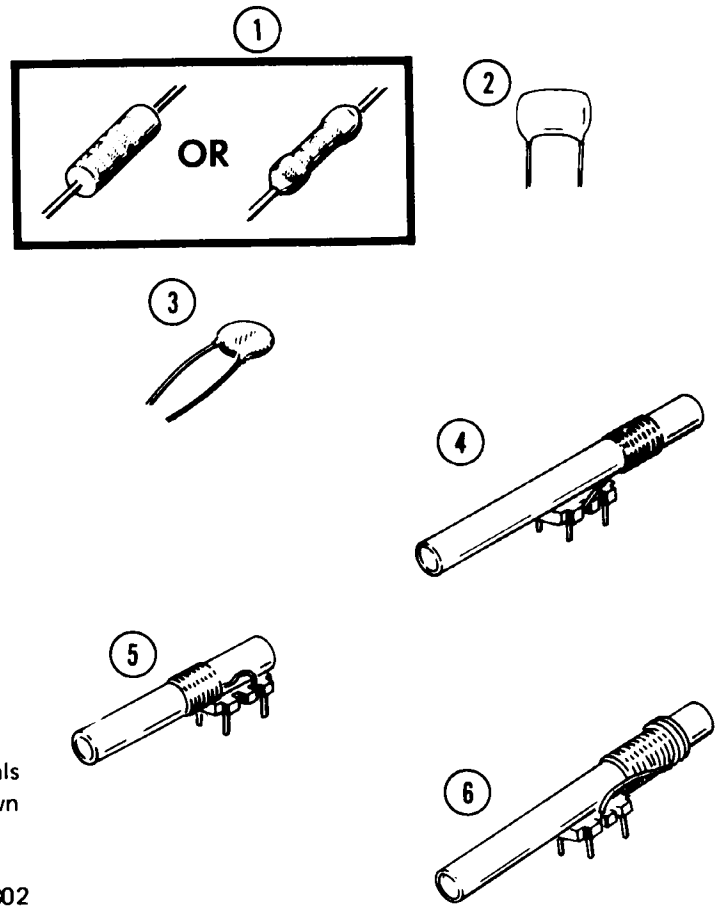
PARTS LIST #1

Open parts pack #1 and check each part against the following parts list. The key numbers correspond to the numbers in the Parts Pictorial. For pricing information, refer to the separate "Heath Parts Price List."

KEY No.	PART No.	PARTS Per Kit	DESCRIPTION
RESISTORS (1/2-Watt)			
1	6-101	1	100 Ω (brown-black-brown)
	6-102	1	1000 Ω (brown-black-red)
	6-223	1	22 kΩ (red-red-orange)
CAPACITORS			
Mica			
2	20-130	1	12 pF
	20-77	1	24 pF
	20-96	4	36 pF
	20-97	1	50 pF
	20-102	1	100 pF
	20-105	2	180 pF
	20-107	2	680 pF
Disc			
3	21-140	1	.001 μF
	21-16	2	.01 μF
COILS AND CHOKES			
4	40-686	2	7 MHz (yellow dot), L702, 802
5	40-687	4	14/21 MHz (green dot), L703, 704, 803, 804

NOTE: The appearance of the mounting base and terminals on several of the following coils may vary from those shown on the Parts Pictorial.

PARTS PICTORIAL



KEY No.	PART No.	PARTS Per Kit	DESCRIPTION

SWITCHES

9	63-396	2	Rotary wafer (red dot)
	63-397	2	Rotary wafer (yellow dot)

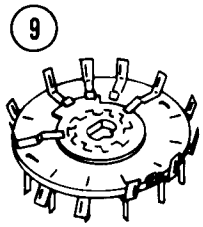
WIRE-SLEEVING

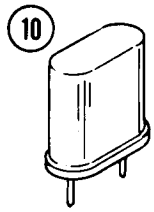
340-2	1	Small bare wire
340-3	1	Large bare wire
343-15	1	Coaxial cable
344-21	1	Large red hookup wire
344-50	1	Black hookup wire
344-51	1	Brown hookup wire
344-52	1	Red hookup wire
344-53	1	Orange hookup wire
344-59	1	White hookup wire
346-1	1	Small black sleeving
346-2	2	Clear sleeving
346-5	1	Large black sleeving

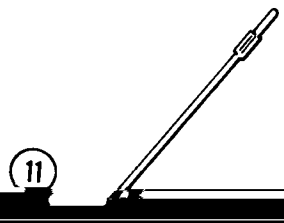
CRYSTALS

10	404-207	1	12.395 MHz
	404-208	1	15.895 MHz
	404-209	1	22.895 MHz
	404-210	1	29.895 MHz
	404-211	1	36.895 MHz

PARTS PICTORIAL







STEP-BY-STEP ASSEMBLY

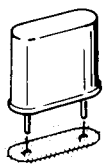
CRYSTAL SWITCH-BOARD

START

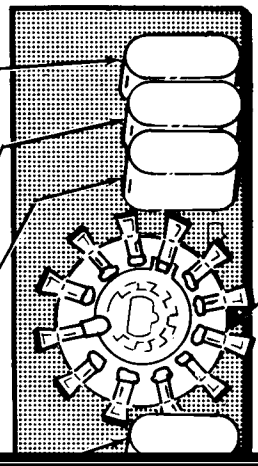
Position the crystal Switch-Board (#85-132-1) as shown.

NOTE: Solder the pins of each part to the foil as it is installed. DO NOT CUT OFF THE CRYSTAL OR SWITCH PINS AFTER SOLDERING.

( ) 12.395 MHz crystal (#404-207).

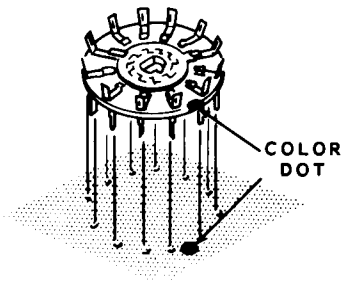


( ) 22.895 MHz crystal (#404-209).



CONTINUE

( ) Rotary switch wafer, #63-397 (yellow color dot). Position the color dot of the switch wafer over the color dot on the Switch-Board.



( ) Check to see that all connections are soldered.

HETERODYNE OSCILLATOR SWITCH-BOARD

START

Position the heterodyne oscillator Switch-Board (#85-133-1) as shown.

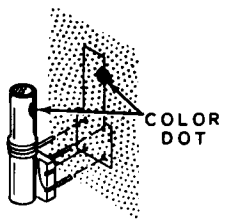
( ) 100 Ω (brown-black-brown).

( ) .001 μF disc.

( ) Solder the resistor and capacitor leads to the foil and cut off the excess lead lengths.

NOTE: When installing the coils in the following steps, align the coil form with the coil outline on the board, and position the color dot on the coil over the color dot on the Switch-Board. Then hold the coil base flat against the board and solder the coil pins. DO NOT cut off the pins after soldering.

( ) Coil #40-693 (brown color dot).



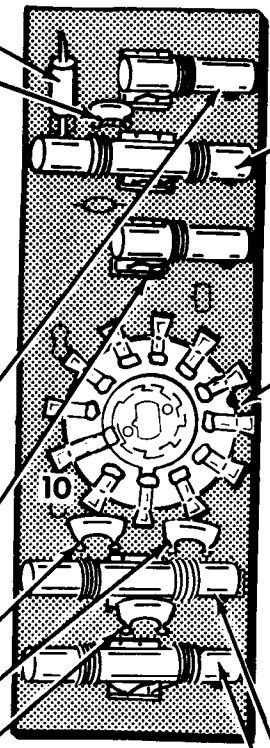
( ) Coil #40-692 (blue color dot).

( ) 100 pF mica.

( ) 50 pF mica.

( ) 24 pF mica.

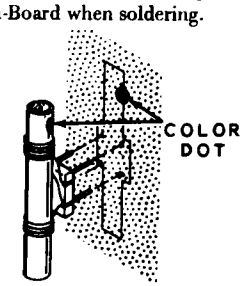
( ) Solder the capacitor leads to the foil and cut off the excess lead lengths.



PICTORIAL 1-2

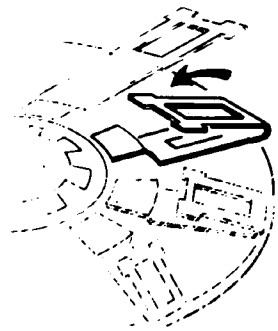
CONTINUE

( ) Coil #40-691 (violet color dot). Hold the coil base firmly against the Switch-Board when soldering.



( ) Rotary switch wafer, #63-397 (yellow color dot). Position the color dot on the switch wafer over the color dot on the Switch-Board. Solder the pins to the foil.

( ) Bend all switch lugs, except lug 10, forward out of the way. Do not damage or bend the ring contacts at the inside of the switch.



NOTE: For clarity and identification purposes, other drawings in this Manual may show the switches with the lugs extended.

( ) Coil #40-689 (red color dot).

( ) Coil #40-690 (orange color dot).

( ) Cut off the projecting switch mounting pins on the foil side of this Switch-Board only.

( ) Check to see that all connections are soldered. Disregard any unused holes in the Switch-Board.

FINISH

PROCEED TO PICTORIAL 1-3

DRIVER GRID SWITCH-BOARD

START

Position the driver grid Switch-Board (#85-133-2) as shown.

( ) 1000 Ω (brown-black-red).

( ) 680 pF mica.

( ) .01 μF disc.

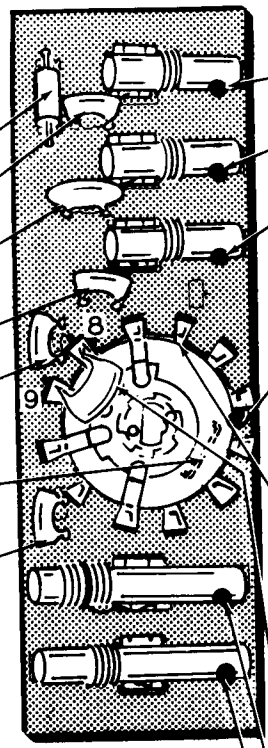
( ) 12 pF mica.

( ) 180 pF mica.

( ) 1" bare wire. Use black hookup wire with the insulation removed.

( ) 36 pF mica.

( ) Solder all leads to the foil and cut off the excess lead lengths.



CONTINUE

NOTE: Solder the pins of the coils and switch wafer as they are installed, but do not cut off their pins after soldering.

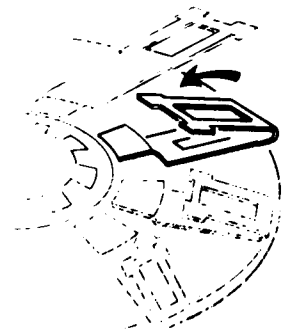
( ) Coil #40-687 (green color dot).

( ) Coil #40-687 (green color dot).

( ) Coil #40-688 (black color dot).

( ) Rotary switch wafer, #63-396 (red color dot). Position the color dot on the switch wafer over the color dot on the Switch-Board.

( ) Bend the unused switch lugs forward out of the way. Do not damage or bend the ring contacts at the inside of the switch.



NOTE: For clarity and indentification purposes, other drawings in this Manual may show the switches with the lugs extended.

( ) Cut each lead of a 36 pF mica capacitor to a length of 1/2". Connect this capacitor between lug 8 (S-1) and lug 9 (S-1) of the switch wafer.

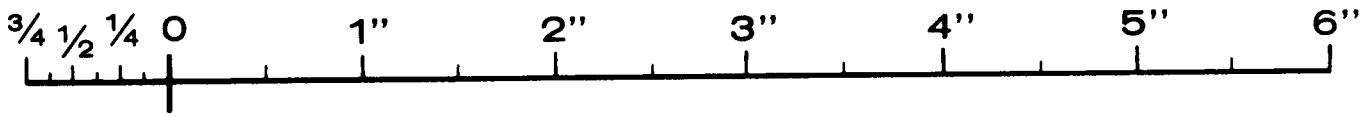
( ) Coil #40-685 (gray color dot).

( ) Coil #40-686 (yellow color dot).

( ) Check to see that all connections are soldered. Disregard any unused holes in the Switch-Board.

FINISH

PROCEED TO PICTORIAL 1-4

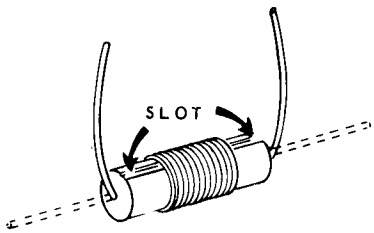


DRIVER PLATE SWITCH-BOARD

START

Position the driver plate Switch-Board (#85-133-3) as shown.

( ) 15 μH RF choke (#45-51). Bend each lead toward the slot.



( ) 680 pF mica.

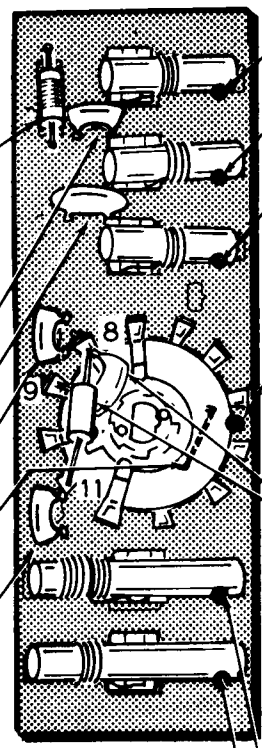
( ) .01 μF disc.

( ) 1 0 pF mica.

( ) 1" bare wire. Use black hookup wire with the insulation removed.

( ) 36 pF mica.

( ) Solder all connections and cut off the excess lead lengths.



PICTORIAL 1-4

CONTINUE

NOTE: Solder the pins of the coils and switch wafer as they are installed, but do not cut off their pins after soldering.

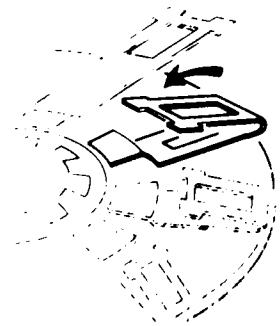
( ) Coil #40-687 (green color dot).

( ) Coil #40-687 (green color dot).

( ) Coil #40-688 (black color dot).

( ) Rotary switch wafer #63-396 (red color dot). Position the color dot of the switch wafer over the color dot on the Switch-Board.

( ) Bend the unused switch lugs forward out of the way. Do not damage or bend the ring contacts at the inside of the switch.



NOTE: For clarity and identification purposes, other drawings in this Manual may show the switches with the lugs extended.

( ) Cut each lead of a 36 pF mica capacitor to a length of 1/2". Connect this capacitor from lug 8 (NS) to lug 9 (S-1) of the switch wafer.

( ) 22 kΩ (red-red-orange) between lugs 8 (S-2) and 11 (S-1) of the switch wafer. Be sure the resistor and capacitor clear the switch rotor. Cut off the excess leads.

( ) Coil #40-685 (gray color dot).

( ) Coil #40-686 (yellow color dot).

( ) Check to see that all connections are soldered. Disregard any unused holes in the Switch-Board.

FINISH

PROCEED TO "MODULATOR CIRCUIT BOARD."

MODULATOR CIRCUIT BOARD

PARTS LIST #2

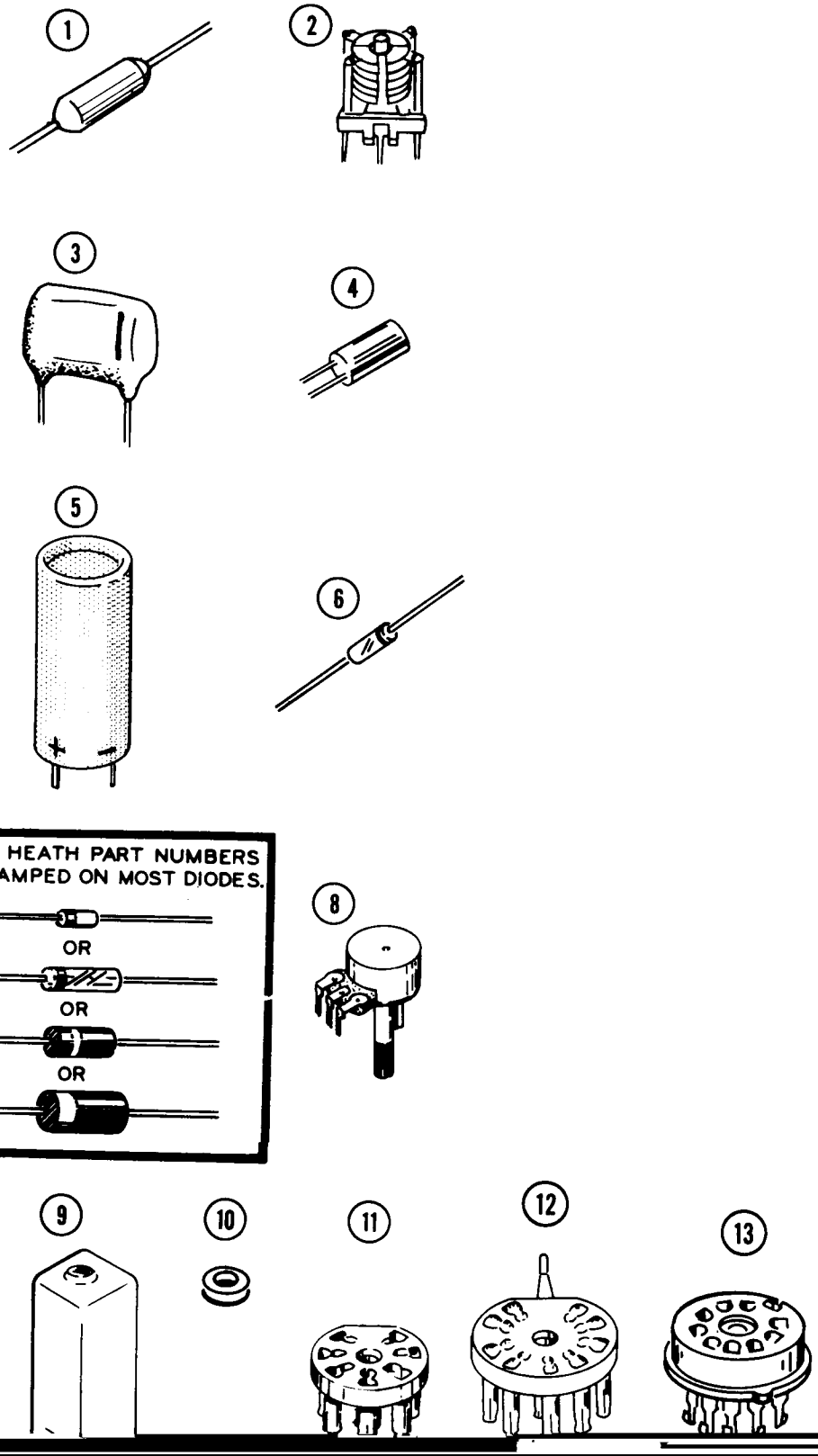
Open parts pack #2 and check each part against the following parts list. The key numbers correspond to the numbers in the Parts Pictorial. Parts that have been illustrated previously have been omitted from this Parts Pictorial. For pricing information, refer to the separate "Heath Parts Price List."

KEY No.	PART No.	PARTS Per Kit	DESCRIPTION
RESISTORS (1/2-Watt)			
	6-221	2	220 Ω (red-red-brown)
	6-471	1	470 Ω (yellow-violet-brown)
	6-102	2	1000 Ω (brown-black-red)
	6-202	2	2000 Ω (red-black-red)
	6-472	3	4700 Ω (yellow-violet-red)
	6-333	2	33 kΩ (orange-orange-orange)
	6-473	2	47 kΩ (yellow-violet-orange)
	6-104	4	100 kΩ (brown-black-yellow)
	6-154	1	150 kΩ (brown-green-yellow)
	6-105	4	1 MΩ (brown-black-green)
CAPACITORS			
Mica			
	20-130	1	12 pF
	20-77	1	24 pF
	20-96	1	36 pF
	20-97	1	50 pF
	20-102	1	100 pF
Disc			
	21-13	1	500 pF
	21-140	1	.001 μF
	21-27	2	.005 μF
	21-16	3	.01 μF
	21-31	6	.02 μF

KEY No.	PART No.	PARTS Per Kit	DESCRIPTION
Other Capacitors			
1	21-29	1	4.7 pF (MMF) ceramic tubular
2	26-94	1	13 pF differential
3	27-34	3	.2 μF Mylar*
4	25-115	1	10 μF electrolytic
5	25-135	1	20 μF electrolytic
CRYSTALS			
	404-205	1	3393.6 kHz
	404-206	1	3396.4 kHz
	404-215	1	3395.4 kHz
DIODES			
6	56-87	4	FH-1100
7	57-27	2	1N2071
MISCELLANEOUS			
8	10-147	1	200 Ω control
9	52-79	1	IF transformer
10	253-34	1	Fiber washer
11	434-112	1	7-pin socket
12	434-130	1	9-pin socket (with ground clip)
13	434-79	1	9-pin socket (without ground clip)
	85-127-2	1	Circuit board

*DuPont Registered Trademark

PARTS PICTORIAL



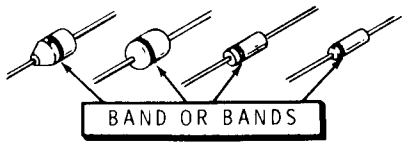
STEP-BY-STEP ASSEMBLY

START

Position the modulator circuit board (#85-127-2) as shown.

On the foil side of some circuit boards you will find lines in the foil which are parallel to an edge of the circuit board. Note that there are solder points (holes) close to each line. The lines are "solder stops" to prevent solder from running out to the edge of the board. DO NOT allow any solder to get on the dashes or on the mounting edges of the circuit boards.

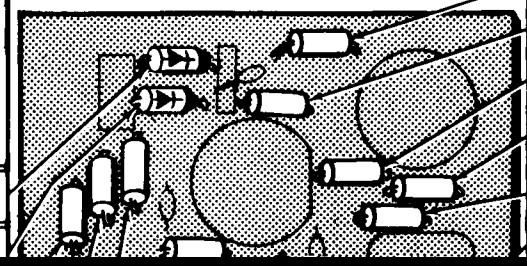
NOTE: DIODES MAY BE SUPPLIED IN ANY OF THE FOLLOWING SHAPES. THE CATHODE END OF THE DIODE IS MARKED WITH A BAND OR BANDS. ALWAYS POSITION THIS END AS SHOWN IN THE PICTORIAL.



( ) 1N2071 diode (#57-27).

( ) 1N2071 diode (#57-27).

CONTINUE



( ) 1 MΩ (brown-black-green).

( ) 150 kΩ (brown-green-yellow).

( ) 100 kΩ (brown-black-yellow).

( ) 4700 Ω (yellow-violet-red).

( ) 1 MΩ (brown-black-green).

( ) 100 kΩ (brown-black-yellow).

START

NOTE: When you install Mylar capacitors, position the banded end as shown.

( ) .2 μF Mylar. Note banded end.

CONTINUE

( ) .2 μF Mylar. Position body to clear outline of tube socket V1. Note banded end.

( ) .001 μF disc.

( ) 12 pF mica.

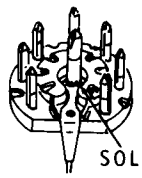
START

NOTE: Solder the pins of each part to the foil as it is installed. Do not cut off the lugs of any of these parts after soldering.

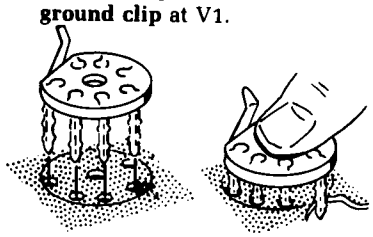
( ) 3396.4 kHz crystal (#404-206).

( ) Solder the center pin to the ground clip on the 9-pin tube socket before you mount it in the following step. Heat the center pin and allow the solder to flow onto the ground clip.

IMPORTANT: When you install tube sockets on any circuit board, DO NOT use the sockets with ground clips unless they are specifically called for, as in the following step.



( ) Install a 9-pin tube socket **with ground clip** at V1.

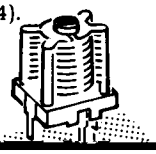


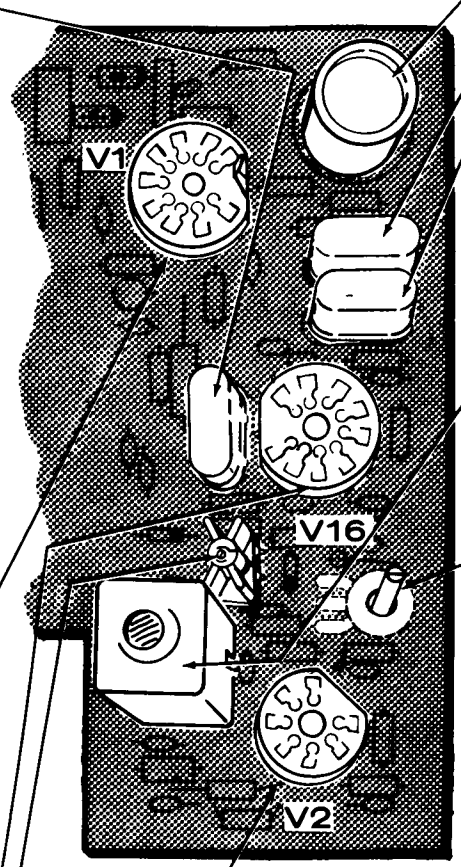
ALIGN ALL PINS TO THEIR RESPECTIVE HOLES.

PRESS THE SOCKET DOWN UNTIL IT SNAPS IN PLACE.

( ) Install a 9-pin tube socket at V16.

( ) 13 pF differential capacitor (#26-94).





PICTORIAL 2-3

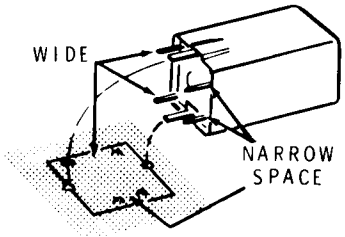
CONTINUE

( ) 20 μF electrolytic. Note (+) marking.

( ) 3393.6 kHz crystal (#404-205).

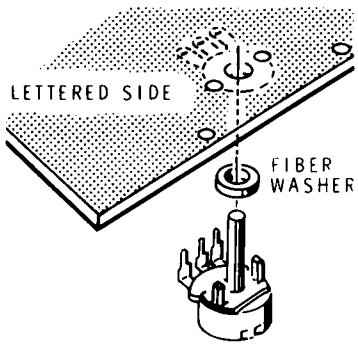
( ) 3395.4 kHz crystal (#404-215).

( ) 3.395 MHz transformer (#52-79).

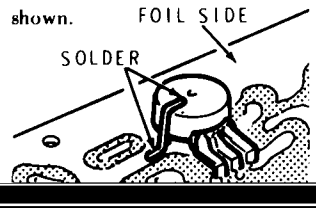


NOTE: Use a minimum of solder in the following steps to prevent rosin from getting into the control.

( ) Place a fiber washer on the shaft of a 200 Ω control (#10-147). Then install the control from the foil side of the board. Solder the five tabs to the foil.



( ) Solder a clipped-off resistor lead to the case of 200 Ω control and to the foil shown.



IF CIRCUIT BOARD

PARTS LIST #3

Open parts pack #3 and check each part against the following parts list. The key numbers correspond to the numbers in the Parts Pictorial. Parts that have been illustrated previously have been omitted from this Parts Pictorial. For pricing information, refer to the separate "Heath Parts Price List."

KEY No.	PART No.	PARTS Per Kit	DESCRIPTION
1/2-Watt			
6-470		2	47 Ω (yellow-violet-black)
6-151		1	150 Ω (brown-green-brown)
6-221		1	220 Ω (red-red-brown)
6-471		1	470 Ω (yellow-violet-brown)
6-102		3	1000 Ω (brown-black red)
COILS-TRANSFORMERS			
3	40-487	1	300 μH coil
4	40-587	1	6.8 MHz trap coil
	52-73	1	3.395 MHz IF transformer
	52-79	1	3.395 MHz IF transformer

STEP-BY-STEP ASSEMBLY

START

Position the IF circuit board (#85-128-4) as shown.

( ) 1000 Ω (brown-black-red).

( ) .005 μF disc.

( ) 22 kΩ 1-watt (red-red-orange).

( ) .02 μF disc.

( ) .02 μF disc.

( ) 100 kΩ 1-watt (brown-black-yellow).

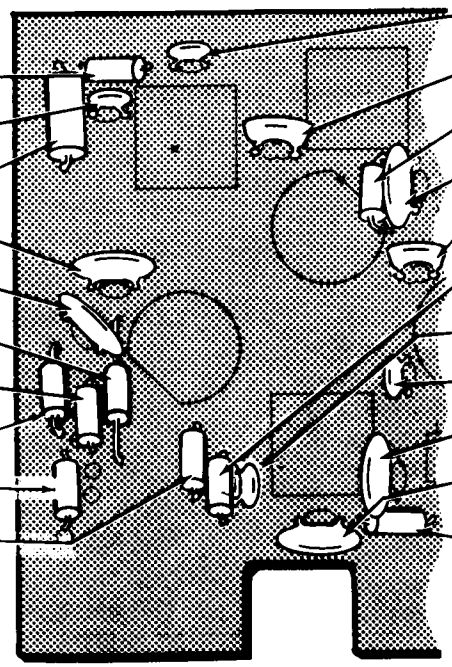
( ) 47 Ω (yellow-violet-black).

( ) 47 Ω (yellow-violet-black).

( ) 150 Ω (brown-green-brown).

( ) 100 kΩ (brown-black-yellow).

( ) Solder the leads to the foil and cut off the excess lead lengths.



CONTINUE

( ) .001 μF disc.

( ) 50 pF mica.

( ) 220 Ω (red-red-brown).

( ) .02 μF disc.

( ) 100 pF mica.

( ) 100 kΩ (brown-black-yellow).

( ) .005 μF disc.

( ) 500 pF disc.

( ) .02 μF disc.

( ) .02 μF disc.

( ) 1000 Ω (brown-black-red).

( ) Solder the leads to the foil and cut off excess lead lengths.

PROCEED TO PICTORIAL 3-2

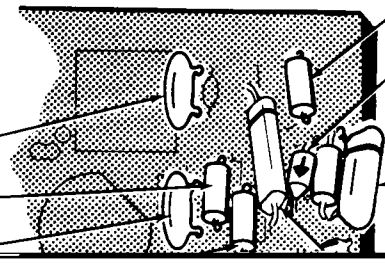
PICTORIAL 3-1

START

( ) .02 μF disc.

( ) 1000 Ω (brown-black-red).

( ) .02 μF disc.



CONTINUE

( ) 3300 Ω (orange-orange-red).

( ) 1N2071 diode (#57-27). Note cathode or banded end.

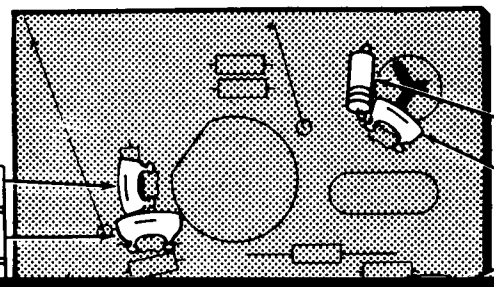
( ) 4700 Ω (yellow-violet-red) and .2 μF Mylar combination. Note banded end of capacitor.

STEP-BY-STEP ASSEMBLY

START

( ) 50 pF mica.

( ) 100 pF mica.



CONTINUE

( ) 1N191 diode (#56-26, brown-white-brown). Note banded end.

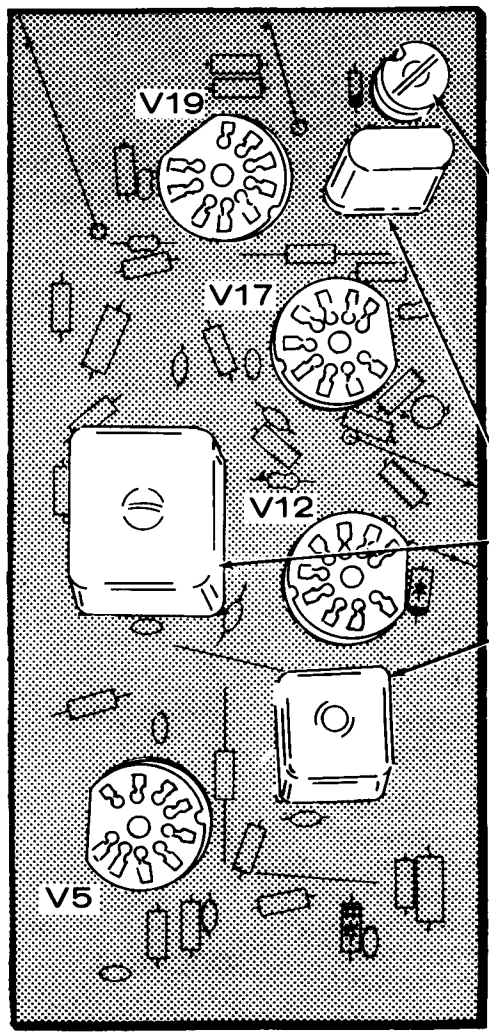
( ) 50 pF mica.

( ) 100 pF mica. Position to clear the tube socket to be installed

START

NOTE: Solder the pins of each part as it is installed. Do not cut off the lugs of these parts after soldering.

( ) Install 9-pin tube sockets at V5, V12, V17, and V19.



CONTINUE

( ) 8-50 pF trimmer capacitor (#31-36). Note position of "Y" on trimmer and circuit board. DO NOT BEND THE LEADS.

( ) 100 kHz crystal (#404-43).

( ) 8.4-8.9 MHz bandpass transformer (#52-65). NOTE: This transformer will not fit down tightly against the board.

( ) Plate tank mixer coil (#40-1023).

CAUTION: Do not solder the two pins that do not have foil around them. Be extremely careful not to let the pins touch any foil.

( ) Check to see that all connections are soldered before putting the board aside.

FINISH

PROCEED TO AUDIO CIRCUIT BOARD

PICTORIAL 4-3

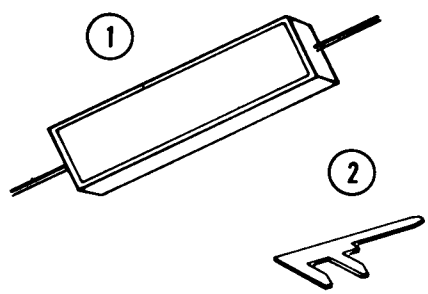
AUDIO CIRCUIT BOARD

PARTS LIST #5

Open parts pack #5 and check each part against the following parts list. The key numbers correspond to the numbers in the Parts Pictorial. Parts that have been illustrated previously have been omitted from this Parts Pictorial. For pricing information, refer to the separate "Heath Parts Price List."

KEY No.	PART No.	PARTS Per Kit	DESCRIPTION
RESISTORS			
1/4-Watt			
	6-474-12	6	470 kΩ (yellow-violet yellow)
1/2-Watt			
	6-101	2	100 Ω (brown-black-brown)
	6-331	1	330 Ω (orange-orange brown)
	6-102	1	1000 Ω (brown-black-red)
	6-472	1	4700 Ω (yellow-violet-red)
	6-223	3	22 kΩ (red-red-orange)
	6-473	7	47 kΩ (yellow-violet-orange)
	6-104	1	100 kΩ (brown-black-yellow)
	6-224	1	220 kΩ (red-red-yellow)
	6-334	2	330 kΩ (orange-orange yellow)
	6-474	4	470 kΩ (yellow-violet-yellow)
	6-684	2	680 kΩ (blue-gray-yellow)
	6-105	3	1 MΩ (brown-black-green)
	6-225	1	2.2 MΩ (red-red-green)
	6-335	1	3.3 MΩ (orange-orange-green)
1-Watt			
	1-3-1	1	3300 Ω (orange-orange-red)
7-Watt			
1	3-15-7	1	1000 Ω (1 kΩ)
	3-16-7	1	2500 Ω (2.5 kΩ)
CAPACITORS			
Mica			
	20-128	5	470 pF
Disc			
	21-13	1	500 pF
	21-140	2	.001 μF
	21-27	8	.005 μF
	21-16	2	.01 μF
	21-31	7	.02 μF
Electrolytic			
	25-135	1	20 μF
DIODES			
	57-27	1	1N2071
SOCKETS			
	434-112	1	7-pin
	434-79	2	9-pin
MISCELLANEOUS			
2	432-734	3	F connector
	85-130-4	1	Audio circuit board
	85-2138-1	1	Phase shift circuit board

PARTS PICTORIAL



STEP-BY-STEP ASSEMBLY

START

Position the audio circuit board (#85-130-2) as shown.

( ) 47 kΩ (yellow-violet-orange).

( ) 22 kΩ (red-red-orange).

( ) 1000 Ω (brown-black-red).

( ) 4700 Ω (yellow-violet-red).

( ) 330 kΩ (orange-orange-yellow).

( ) 3300 Ω 1 watt (orange-orange-red).

( ) .005 μF disc.

( ) .005 μF disc.

( ) 47 kΩ (yellow-violet-orange).

( ) 330 kΩ (orange-orange-yellow).

( ) 1 MΩ (brown-black-green).

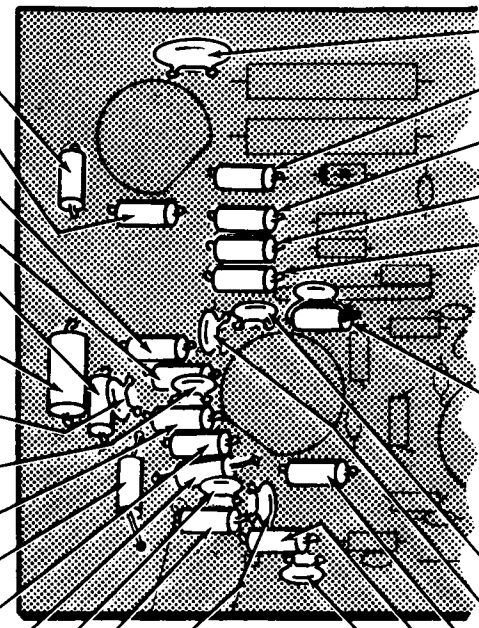
( ) 1 MΩ (brown-black-green).

( ) .001 μF disc.

( ) 470 kΩ (yellow-violet-yellow).

( ) .005 μF disc.

( ) Solder the leads to the foil and cut off the excess lead lengths.



CONTINUE

( ) .02 μF disc.

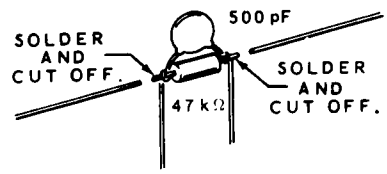
( ) 47 kΩ (yellow-violet-orange).

( ) 47 kΩ (yellow-violet-orange).

( ) 47 kΩ (yellow-violet-orange).

( ) 47 kΩ (yellow-violet-orange).

( ) 47 kΩ (yellow-violet-orange) and a 500 pF disc combination.



( ) .005 μF disc.

( ) .01 μF disc.

( ) 22 kΩ (red-red-orange).

( ) 470 kΩ (yellow-violet-yellow).

( ) .005 μF disc.

( ) Solder the leads to the foil and cut off the excess lead lengths.

PROCEED TO PICTORIAL 5-2

PICTORIAL 5-1

HEATHKIT

START

( ) 1N2071 diode. (#57-27). Note cathode end.

( ) 680 kΩ (blue-gray-yellow).

( ) 680 kΩ (blue-gray-yellow).

( ) 100 Ω (brown-black-brown).

( ) 1 MΩ (brown-black-green).

( ) .02 μF disc.

( ) .02 μF disc.

( ) 100 Ω (brown-black-brown).

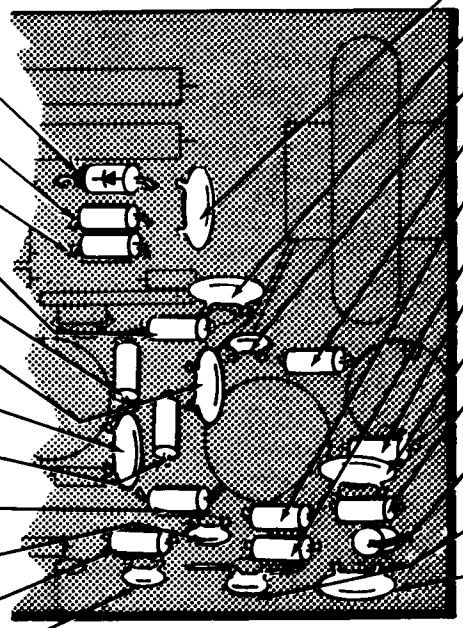
( ) 100 kΩ (brown-black-yellow).

( ) .005 μF disc.

( ) 470 kΩ (yellow-violet-yellow).

( ) .005 μF disc.

( ) Solder the leads to the foil and cut off the excess lead lengths.



PICTORIAL 5-2

CONTINUE

( ) .02 μF disc.

( ) .02 μF disc.

( ) .001 μF disc.

( ) 22 kΩ (red-red-orange).

( ) 220 kΩ (red-red-yellow).

( ) 3.3 MΩ (orange-orange-green).

( ) 330 Ω (orange-orange-brown).

( ) .02 μF disc.

( ) 470 kΩ (yellow-violet-yellow).

( ) 2.2 MΩ (red-red-green). Install in a vertical position.

( ) .005 μF disc.

( ) .02 μF disc.

( ) Solder the leads to the foil and cut off the excess lead lengths.

PROCEED TO PICTORIAL 5-3

START

Position the phase shift circuit board (#85-2138-1) as shown.

In some of the following steps you will install F connectors. First, from the component side, insert the pins into the circuit board holes and press them in until the connector body rests against the circuit board. Then solder the pins to the foil. Be sure each connector is down against the

CONTINUE

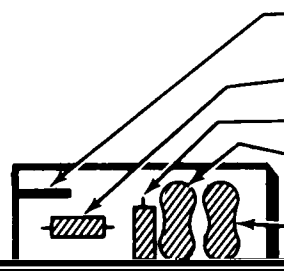
( ) F connector.

( ) 470 kΩ (yellow-violet-yellow).

( ) 470 kΩ (yellow-violet-yellow).

( ) 470 pF mica.

( ) 470 pF mica.



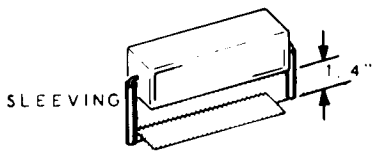
START

NOTE: Solder the connection of each part as it is installed. Cut off only the leads of the 7-watt resistors and the phase shift network after soldering.

( ) Install a 7-pin tube socket at V18.

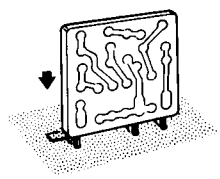
( ) Install 9-pin tube sockets at V14 and V15.

( ) 1000 Ω, 7-watt (1 kΩ). Use 1/2" of small black sleeving on each lead. Mount 1/4" above the board.



( ) 2500 Ω, 7-watt (2.5 kΩ). Use 1/2" of small black sleeving on each lead as above.

( ) Phase shift circuit board.

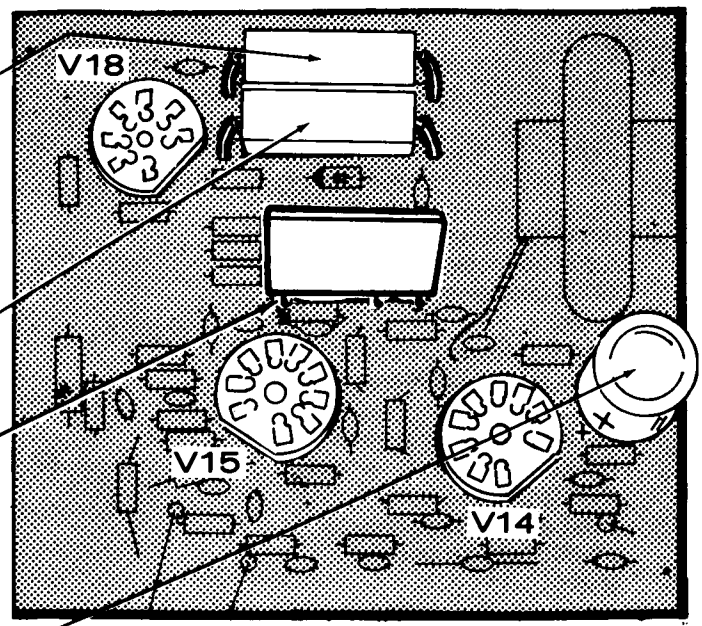


( ) 20 μF electrolytic. Note (+) marking.

( ) Check to see that all connections are soldered before putting the board aside.

FINISH

PROCEED TO "RF DRIVER CIRCUIT BOARD."



PICTORIAL 5-4

RF DRIVER CIRCUIT BOARD

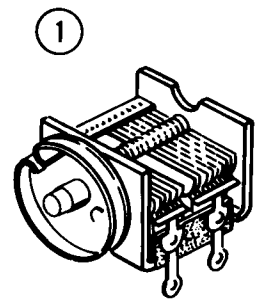
PARTS LIST #6

Open parts pack #6 and check each part against the following parts list. The key numbers correspond to the numbers in the Parts Pictorial. Parts that have been illustrated previously have been omitted from the Parts Pictorial. For pricing information, refer to the separate "Heath Parts Price List."

KEY No.	PART No.	PARTS Per Kit	DESCRIPTION
RESISTORS			
1/2-Watt			
	6-151	1	150 Ω (brown-green-brown)
	6-221	1	220 Ω (red-red-brown)
	6-331	1	330 Ω (orange-orange-brown)
	6-472	1	4700 Ω (yellow-violet-red)
	6-103	1	10 kΩ (brown-black-orange)
	6-223	1	22 kΩ (red-red-orange)
	6-104	5	100 kΩ (brown-black-yellow)
	6-154	1	150 kΩ (brown-green-yellow)
	6-474	1	470 kΩ (yellow-violet-yellow)
	6-105	2	1 MΩ (brown-black-green)
	6-335	1	3.3 MΩ (orange-orange-green)
CAPACITORS			
	20-77	2	24 pF mica
	20-105	1	180 pF mica
	21-140	1	.001 μF disc
	21-27	6	.005 μF disc
	21-31	11	.02 μF disc
1	26-122	1	2-section variable

KEY No.	PART No.	PARTS Per Kit	DESCRIPTION
SOCKETS			
	434-112	2	7-pin socket
	434-129	1	7-pin socket (with ground clip)
	434-130	1	9-pin socket (with ground clip)
MISCELLANEOUS			
	85-131-6	1	RF driver circuit board

PARTS PICTORIAL



STEP-BY-STEP ASSEMBLY

START

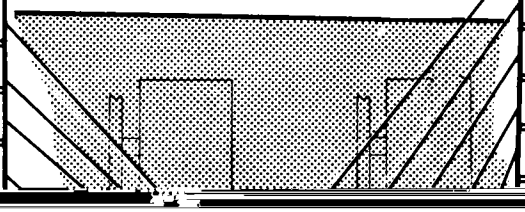
Position the driver circuit board (#85-131-6) as shown.

( ) .005 μF disc.

( ) .02 μF disc.

( ) .02 μF disc.

( ) .02 μF disc.



CONTINUE

( ) 150 Ω (brown-green-brown).

( ) .02 μF disc.

( ) .005 μF disc.

( ) .02 μF disc.

( ) 4700 Ω (yellow-violet-red).

CONTINUE

START

NOTE: This capacitor will be mount-

( ) 2-section variable capacitor.

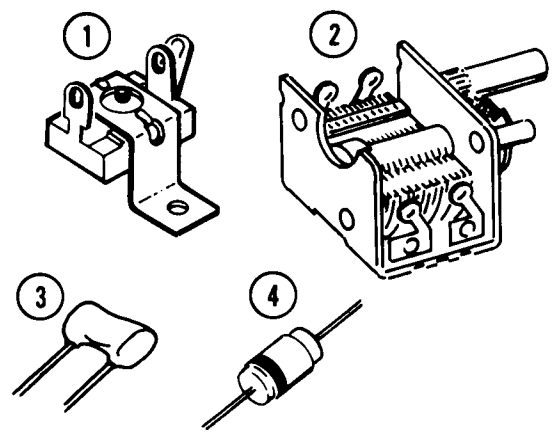
VFO

PARTS LIST #7

Open parts pack #7 and check each part against the following parts list. The key numbers correspond to the numbers in the Parts Pictorial. Parts that have been illustrated previously have been omitted from this Parts Pictorial. For pricing information, refer to the separate "Heath Parts Price List."

KEY No.	PART No.	PARTS Per Kit	DESCRIPTION
RESISTORS			
1/2-Watt			
	6-470	2	47 Ω (yellow-violet-black)
	6-101	1	100 Ω (brown-black-brown)
	6-471	2	470 Ω (yellow-violet-brown)
	6-102	1	1000 Ω (brown-black-red)
	6-472	2	4700 Ω (yellow-violet-red)
	6-103	1	10 kΩ (brown-black-orange)
	6-474	1	470 kΩ (yellow-violet-yellow)
CAPACITORS			
Disc			
	21-3	1	10 pF
	21-147	1	47 pF
	21-85	1	56 pF
	21-144	1	4700 pF (.0047)
	21-27	3	.005 μF
	21-31	2	.02 μF
Other Capacitors			
1	100-1759	1	1.7 to 24 pF mica trimmer (May be marked 31-92)
2	26-132	1	9-63 pF variable
	21-29	1	4.7 pF ceramic tubular (MMF)
3	21-41	1	14 pF ceramic tubular (brown-yellow-black-green)
4	29-4	1	1800 plastic tubular

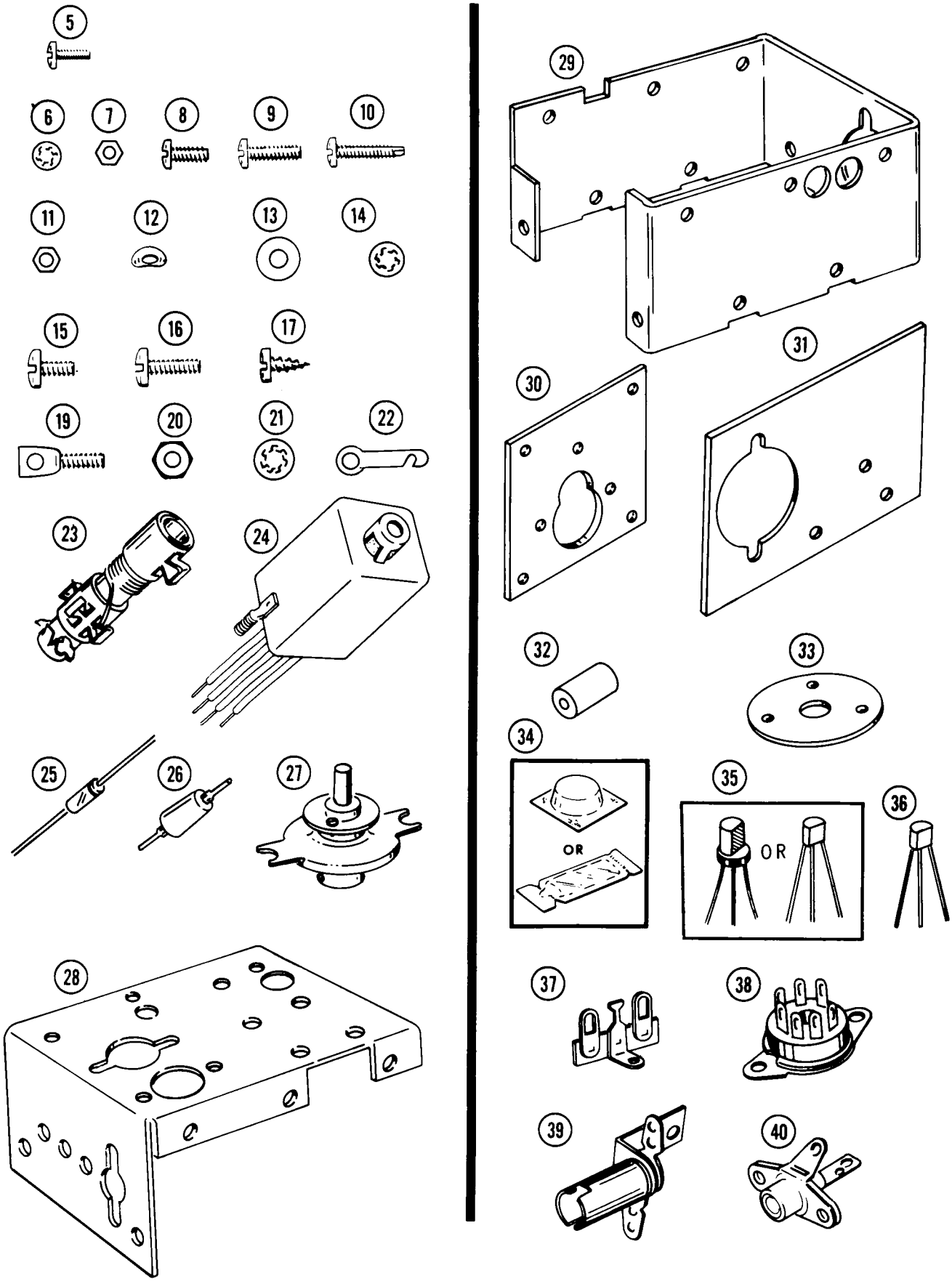
PARTS PICTORIAL



KEY No.	PART No.	PARTS Per Kit	DESCRIPTION
HARDWARE			
#3 Hardware			
5	250-49	5	3-48 x 1/4" screw
6	254-7	8	#3 lockwasher
7	252-1	5	3-48 nut
#4 Hardware			
8	250-285	3	4-40 x 1/4" screw
9	250-273	2	4-40 x 3/8" screw
10	250-248	7	4-40 x 1/2" self-tapping screw
11	252-15	4	4-40 nut

KEY No.	PART No.	PARTS Per Kit	DESCRIPTION
MISCELLANEOUS			
23	40-1076	1	VFO coil
24	52-103	1	Transformer
25	56-26	1	1N191 diode (brown white-brown)
26	75-87	3	Nylon feedthrough
27	100-1041	1	Jackson drive
28	200-590-1	1	VFO chassis
29	201-49	1	VFO chassis base
30	205-761	1	Drive mounting plate
31	205-762	1	VFO front plate
32	255-45	1	9/16" phenolic spacer

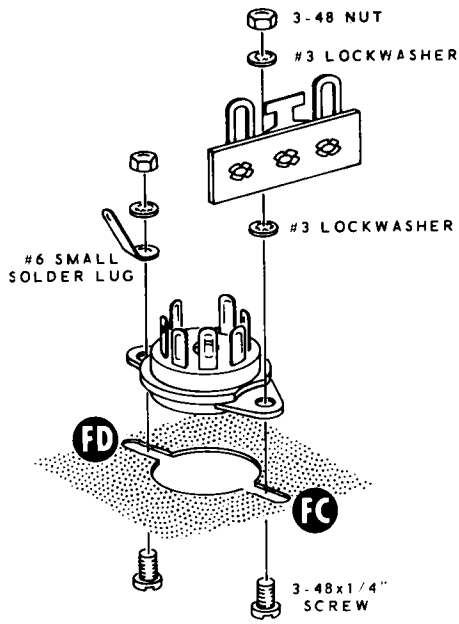
PARTS PICTORIAL



For VFO stability it is IMPORTANT that each part be positioned exactly as shown in the photograph on the fold-out from this page. Refer to this photograph when you install resistors and capacitors in the VFO.

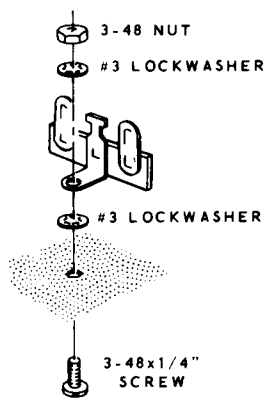
Refer to Pictorial 7-1 for the following steps.

( ) Refer to Detail 7-1A and mount a 7-pin socket at V20. Position the wide space between the lugs as shown by the arrow in the Pictorial. At FD, use a 3-48 x 1/4" screw, a #6 small solder lug shaped as shown, a #3 lockwasher and a 3-48 nut. At FC, use a 3-48 x 1/4" screw, two #3 lockwashers, a 3-lug terminal strip, and a 3-48 nut.

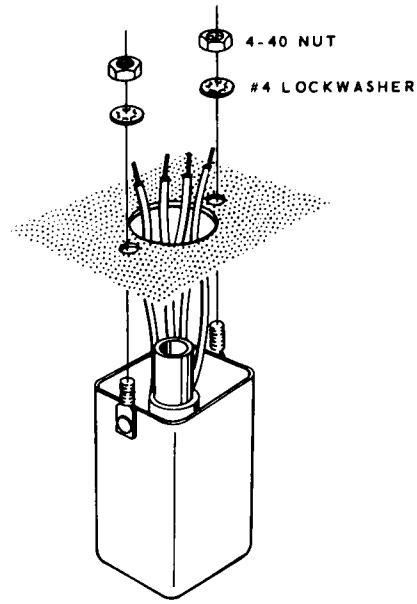


Detail 7-1A

( ) Refer to Detail 7-1B and mount a 3-lug terminal strip at FF. Use a 3-48 x 1/4" screw, two #3 lockwashers, and a 3-48 nut.



Detail 7-1B

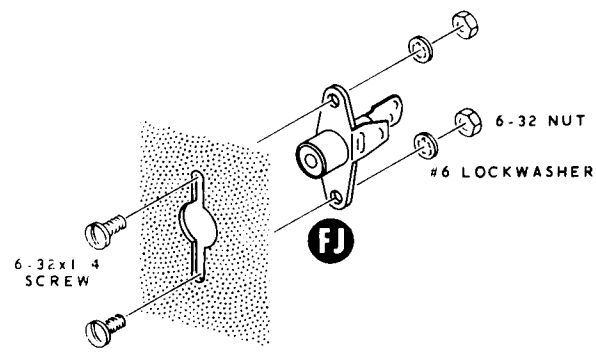


Detail 7-1C

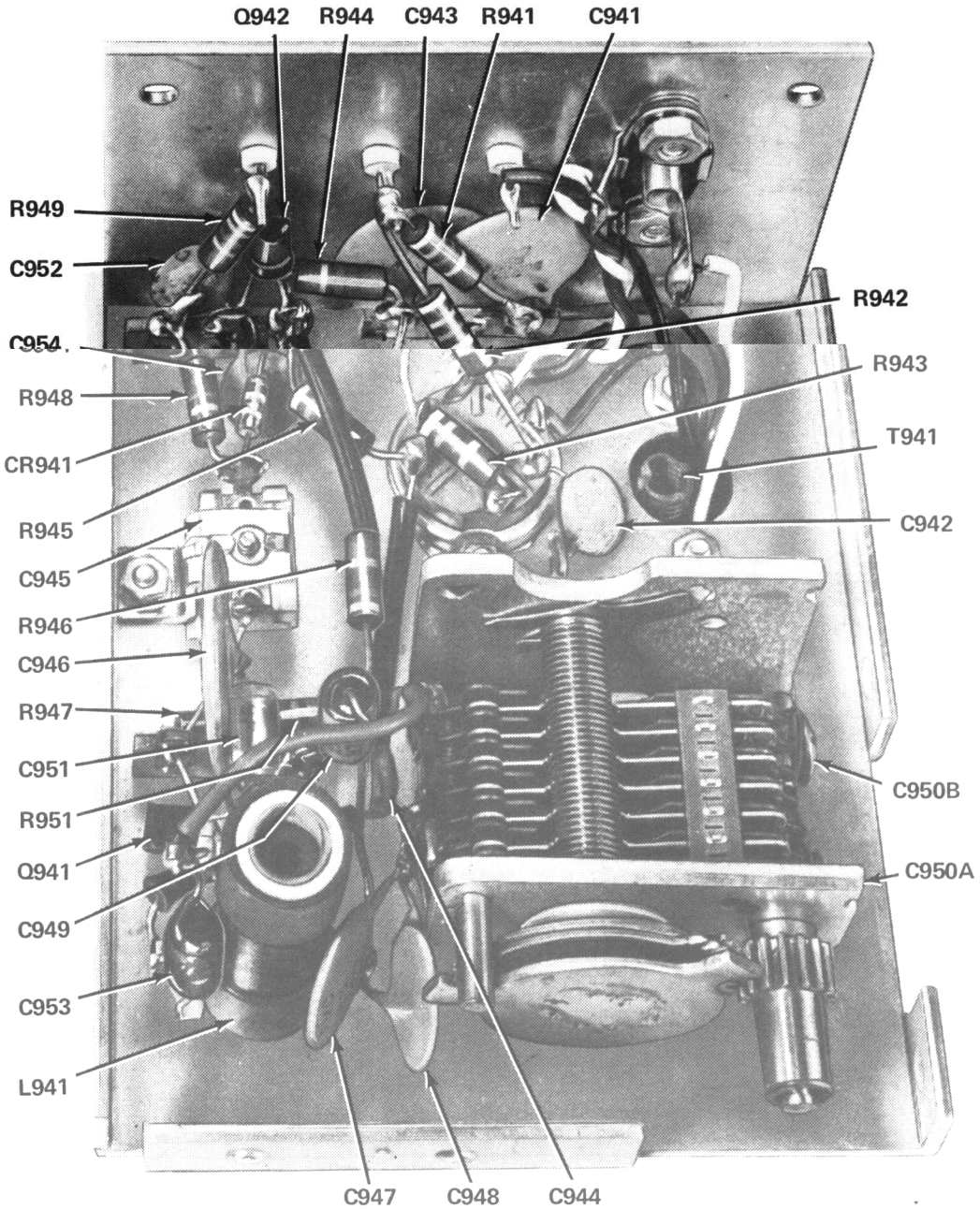
( ) Mount a 3-lug terminal strip at FH. Use a 3-48 x 1/4" screw, two #3 lockwashers, and a 3-48 nut.

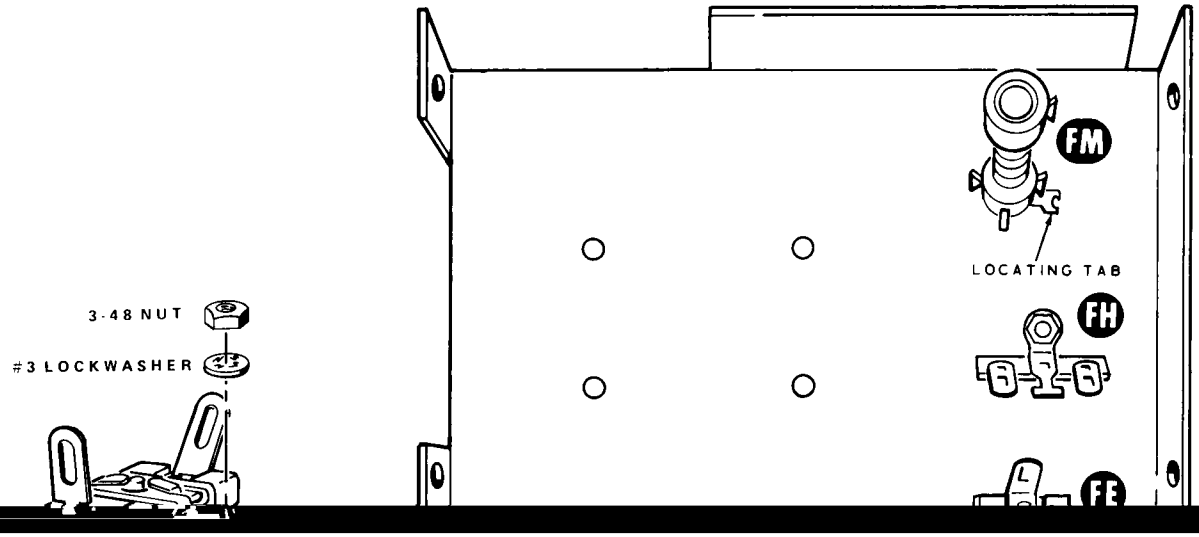
( ) Refer to Detail 7-1C and mount the transformer (#52-103) at FZ. Use a #4 lockwasher and a 4-40 nut at each mounting hole.

( ) Refer to Detail 7-1D and mount a phono socket at FJ. Use a 6-32 x 1/4" screw, a #6 lockwasher, and a 6-32 nut at each mounting hole. Position the lugs of the socket as shown in the Pictorial.



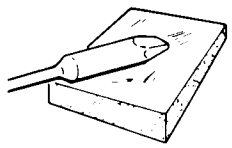
Detail 7-1D


Q942
R944
C943
R941
C941
R949
C952
C954
R942
R948
R943
CR941
T941
R945
C942
C945
R946
C946
R947
C951
C950B
R951
Q941
C950A
C949
C953
L941
C947
C948
C944


FM
LOCATING TAB
3-48 NUT
#3 LOCKWASHER
FH
FE

FOR GOOD SOLDER CONNECTIONS, YOU MUST KEEP THE SOLDERING IRON TIP CLEAN...

WIPE IT OFTEN WITH A DAMP SPONGE OR CLOTH.



Refer to Pictorial 7-2 (fold-out from Page 43) for the

( ) Connect a .005 disc capacitor between lugs 1 (NS) and 2 (NS) of terminal strip FF.

( ) Connect a .005 μF disc capacitor from lug 6 of tube socket V20 (NS) to solder lug FD (S-1).

( ) Connect one end of a 100 Ω (brown-black-brown) resistor to lug 3 of terminal strip FC (NS). Connect

( ) At the free end of the twisted pair, connect the white wire to lug 2 of phono socket FJ (S-2) and connect the brown wire to feedthrough FK (S-1).

( ) Insert a nylon feedthrough in hole FL.

( ) Connect one lead of a 470 Ω (yellow-violet-brown) resistor to lug 1 of terminal strip FC (S-2). Connect the other lead to feedthrough FL (NS).

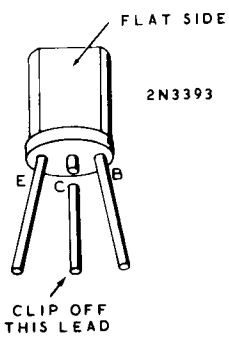
NOTE: Where a wire passes through a connection and then goes to another point, as in the next step, it will count as two wires in the solder instructions, one entering and one leaving the connection.

( ) Pass one lead of a 47 Ω (yellow-violet-black) resistor through lug 2 of tube socket V20 (S-2) to lug 3 of terminal strip FC (S-2). Connect the other end of this resistor to lug 7 of tube socket V20 (S-1).

( ) Connect one end of a 470 Ω (yellow-violet-brown) resistor to lug 6 of tube socket V20 (S-2). Connect the other end of this resistor to feedthrough FL (S-2).

( ) Connect one end of a 4700 Ω (yellow-violet-red) resistor to lug 1 of tube socket V20 (NS). Connect the other end of this resistor to lug 1 of terminal strip FF (S-3). CAUTION: DO NOT fill the opening in the lug with solder, as two additional wires will be connected later.

( ) Refer to Detail 7-2D and identify the leads of a 2N3393 transistor (#417-118). Clip off the C lead close to the body of the transistor.



Detail 7-2D

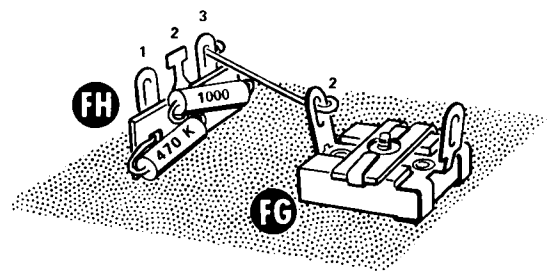
( ) Connect the E lead of the transistor to lug 1 (NS) and the B lead to lug 2 (NS) of terminal strip FF.

( ) Insert a nylon feedthrough in hole FN.

( ) Connect one end of a 4700 Ω (yellow-violet-red) resistor to lug 3 of terminal strip FF (NS). Connect the other end of this resistor to feedthrough FN (S-1).

( ) Connect one end of a 10 kΩ (brown-black-orange) resistor to lug 3 of terminal strip FF (S-3). Connect the other end of this resistor to lug 1 of trimmer capacitor FG (NS).

( ) Connect the banded end of a 1N191 diode (#56-26) to lug 2 of terminal strip FF (NS). Connect the other end of this diode to lug 1 of trimmer capacitor FG (S-2). Be sure to position the banded end as shown.



Detail 7-2E

Refer to Detail 7-2E for the next three steps. Save one of the cut-off resistor leads for use later.

( ) Connect a 1000 Ω (brown-black-red) resistor from the lower hole of lug 2 (NS) to the lower hole of lug 3 (S-1) of terminal strip FH. Be careful that the lead at lug 3 does not extend beyond the end of the terminal strip.

( ) Connect a 470 kΩ (yellow-violet-yellow) resistor from the lower hole of lug 1 (S-1) to the lower hole of lug 2 (S-2) of terminal strip FH.

( ) Connect the cut-off resistor lead from lug 2 of trimmer FG (S-1) to lug 3 of terminal strip FH (NS).

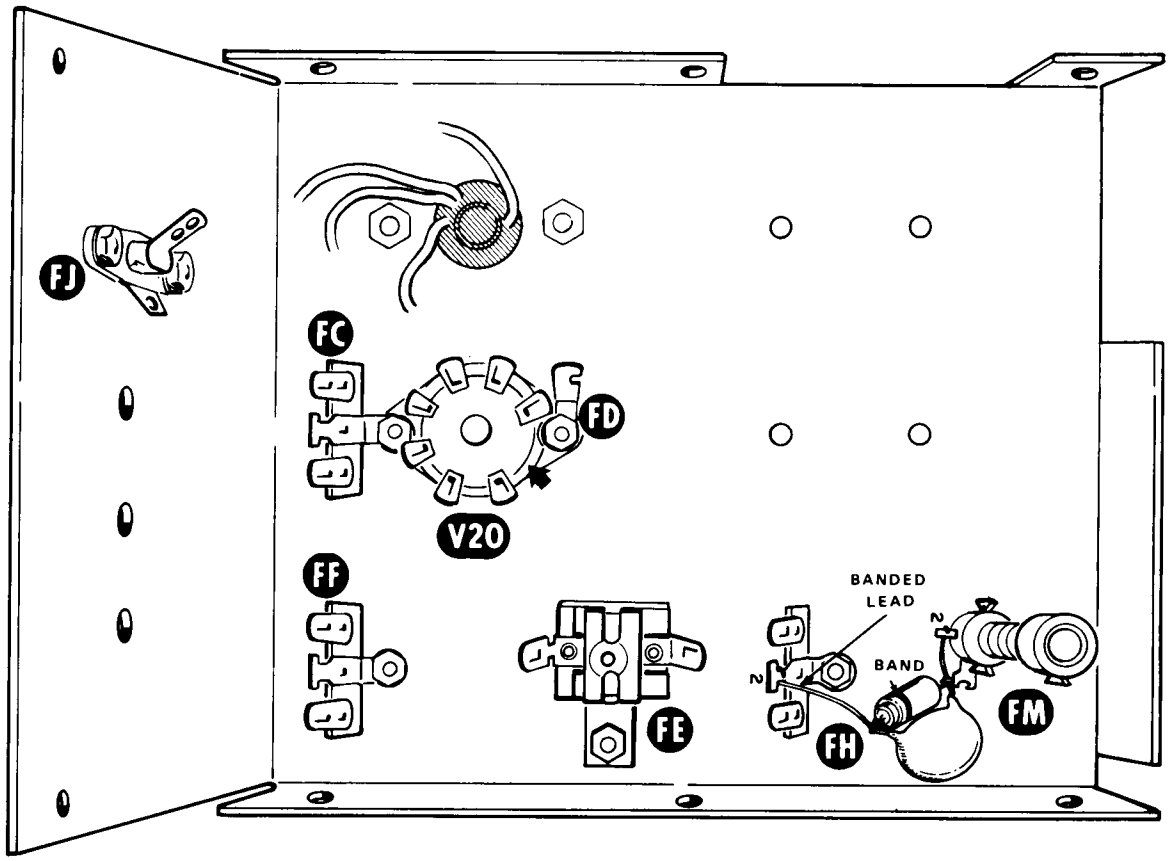
( ) Pass one lead of the 14 pF (brown-yellow-black-green) ceramic tubular capacitor through lug 2 (NS) to lug TP (NS) of coil FM. Connect the other lead to lug 3 of coil FM (NS). Position the body of the capacitor against the winding on the coil form.

( ) Prepare a 1-3/4" length of black hookup wire.

( ) Connect one end of this hookup wire to lug 3 of coil

( ) Place a 1" length of small black sleeving on each lead of a 10 pF disc capacitor. Connect one lead to lug 1 of coil FM (S-2). Connect the other lead to lug 1 of tube socket V20 (S-2).

( ) Place a 1" length of small black sleeving on one lead of a 47 Ω (yellow-violet-black) resistor, and connect this lead to lug 1 of terminal strip FF (S-2). Three wires were previously soldered to this connection. Connect



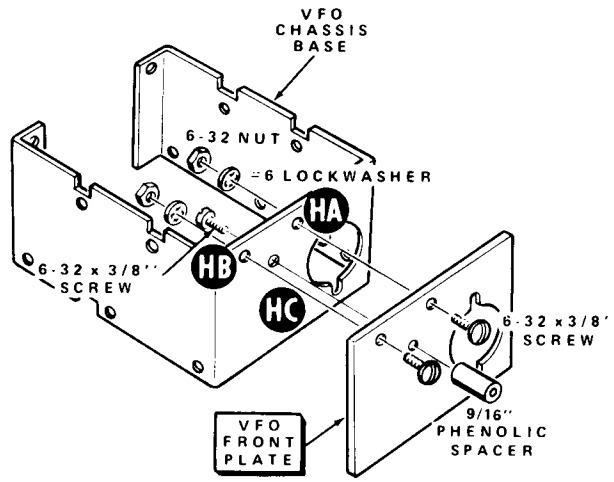
PICTORIAL 7-3

Refer to Pictorial 7-4 (fold-out from Page 43) for the following steps.

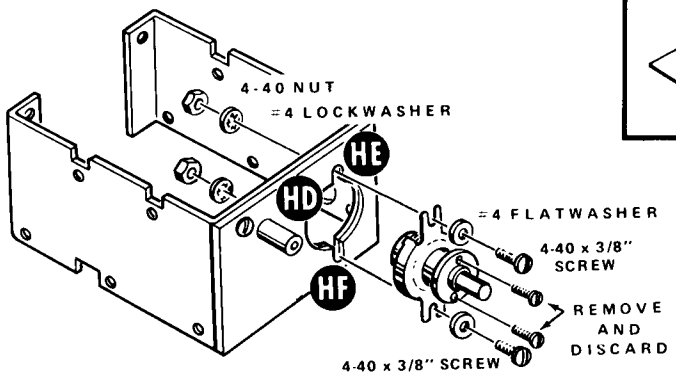
( ) Cut the leads of a 56 pF and a 47 pF disc capacitor to a length of 1/2". Connect one lead of each capacitor to the TP lug of coil FM (S-4). The other leads will be connected later.

( ) Refer to Detail 7-4A and mount the VFO front plate (#205-762) on the VFO chassis base. Use 6-32 x 3/8" hardware at HA and HB. Turn the screws only finger-tight at this time.

( ) Refer to Detail 7-4A and mount a 9/16" phenolic spacer at HC on the VFO chassis base. Use a 6-32 x 3/8" screw. Turn the screw finger-tight only. This screw will fit only one end of the spacer.



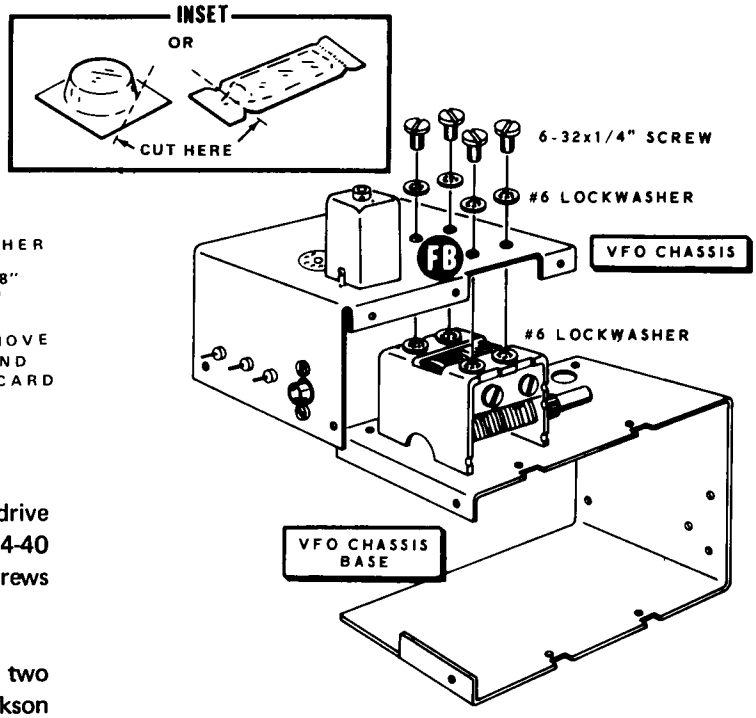
Detail 7-4A



Detail 7-4B

( ) Refer to Detail 7-4B and install a Jackson drive (#100-1041) on the VFO chassis base at HD. Use 4-40 x 3/8" hardware in slots HE and HF. Turn the screws finger-tight only.

( ) Refer to Detail 7-4B and remove and discard the two brass screws from the round collar of the Jackson drive. Use the sandpaper furnished to remove any

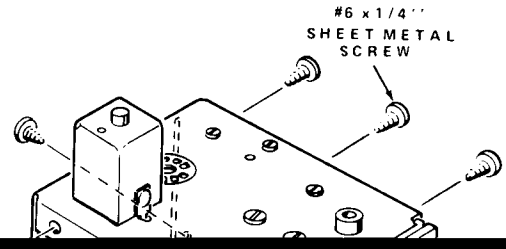


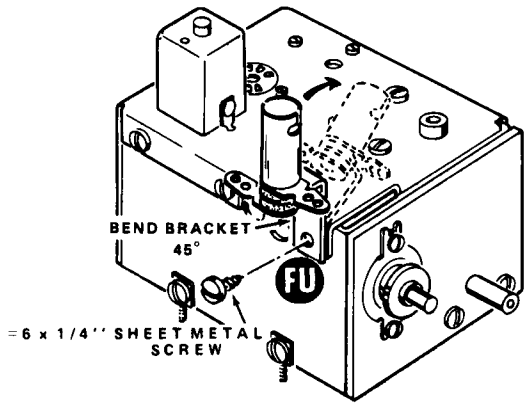
Detail 7-4C

( ) Connect the 1-3/4" black hookup wire from lug 3 of coil FM to lug 1 of the variable capacitor (NS).

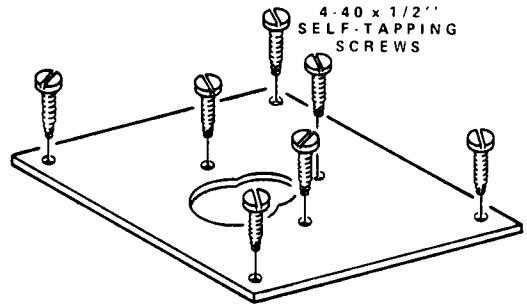
( ) Connect the free lead of the 4.7 pF ceramic tubular capacitor to lug 1 of the variable capacitor (S-2).

( ) Connect the free leads of the 56 pF and 47 pF disc capacitors to lug 2 of the variable capacitor (S-2).





Detail 7-4F



Detail 7-4G

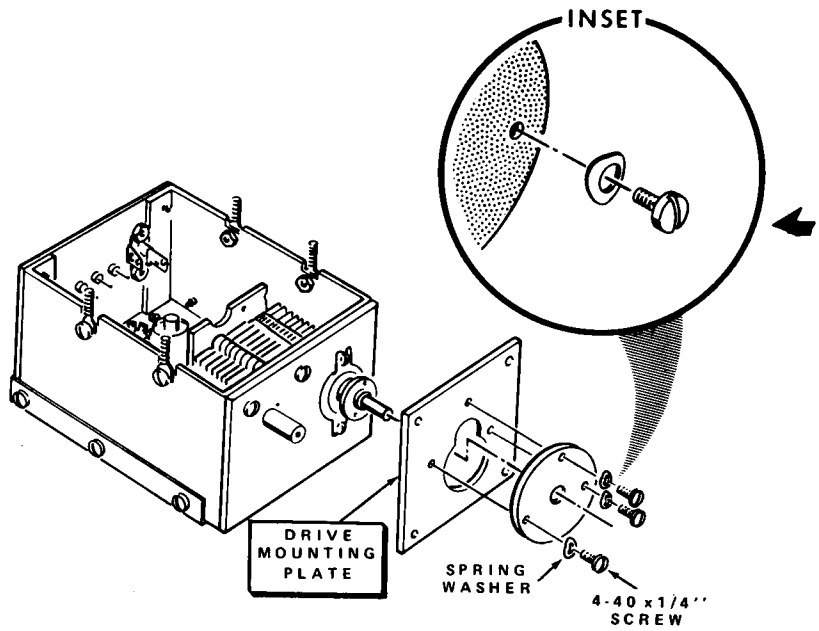
( ) Refer to Detail 7-4F and mount a pilot lamp socket at FU. Use a #6 x 1/4" sheet metal screw.

( ) Bend the socket mounting bracket to an angle of approximately 45 degrees.

( ) Check to make sure that one of the sheet metal screws does not touch lug 3 of terminal strip FF. If necessary, loosen the terminal strip mounting screw and turn the terminal strip slightly.

( ) Refer to Detail 7-4G and insert seven 4-40 x 1/2" self-tapping screws in the drive mounting plate (#205-761). Insert the screws until about one-third of their length emerges on the back side of the plate.

( ) Remove the seven screws. Four of these screws will be used later in "Chassis Assembly" section. Discard the other three screws.



Detail 7-4H

Refer to Detail 7-4H for the next two steps.

( ) Place the larger portion of the opening in the drive mounting plate over the collar of the Jackson drive and slide the plate down behind the collar.

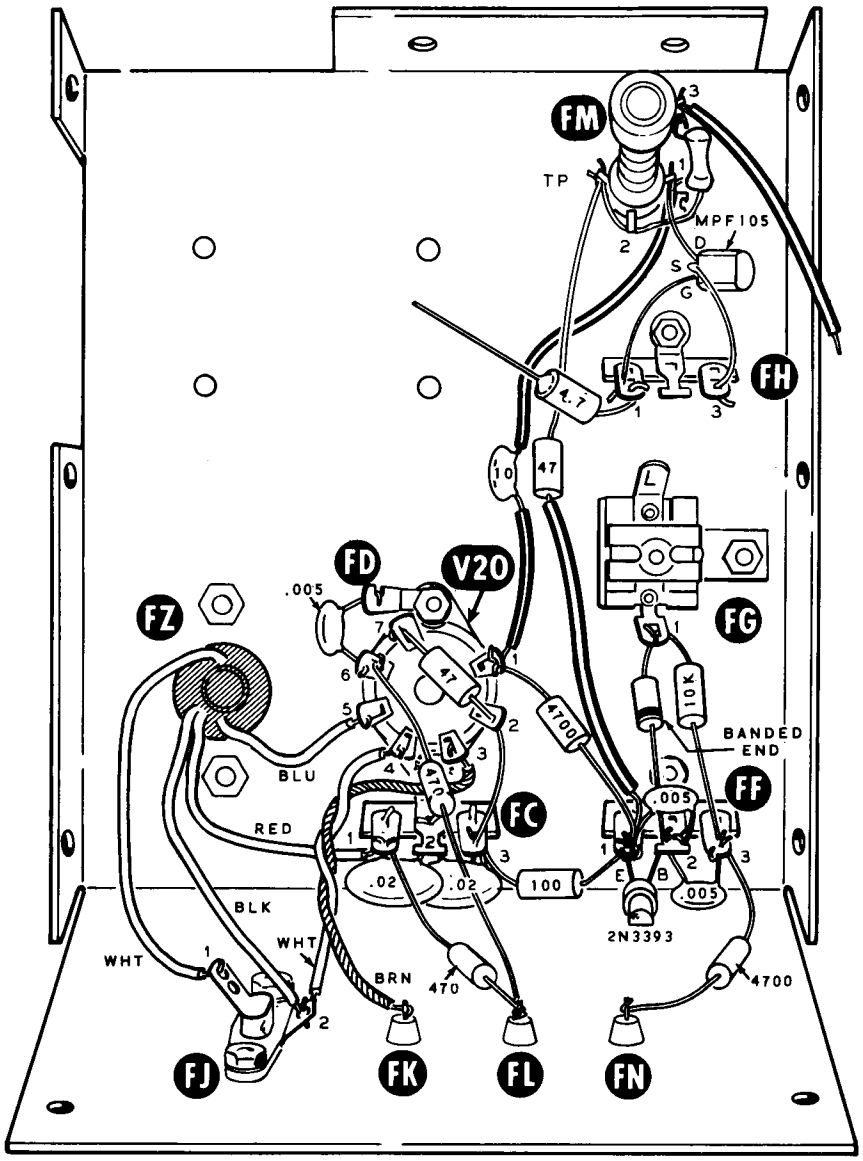
( ) Place the plastic clutch (#266-200) on the Jackson drive shaft and secure it to the drive mounting plate with three 4-40 x 1/4" screws and three #4 spring washers. Do not tighten these screws. Note the inset drawing for the position of the washers.

( ) Adjust each of the three 4-40 screws until its end is flush with the inner surface of the drive mounting plate. Then turn each screw one turn counterclockwise. The white clutch disc should then be parallel with the drive mounting plate, which, when turned by hand, should be quite stiff.

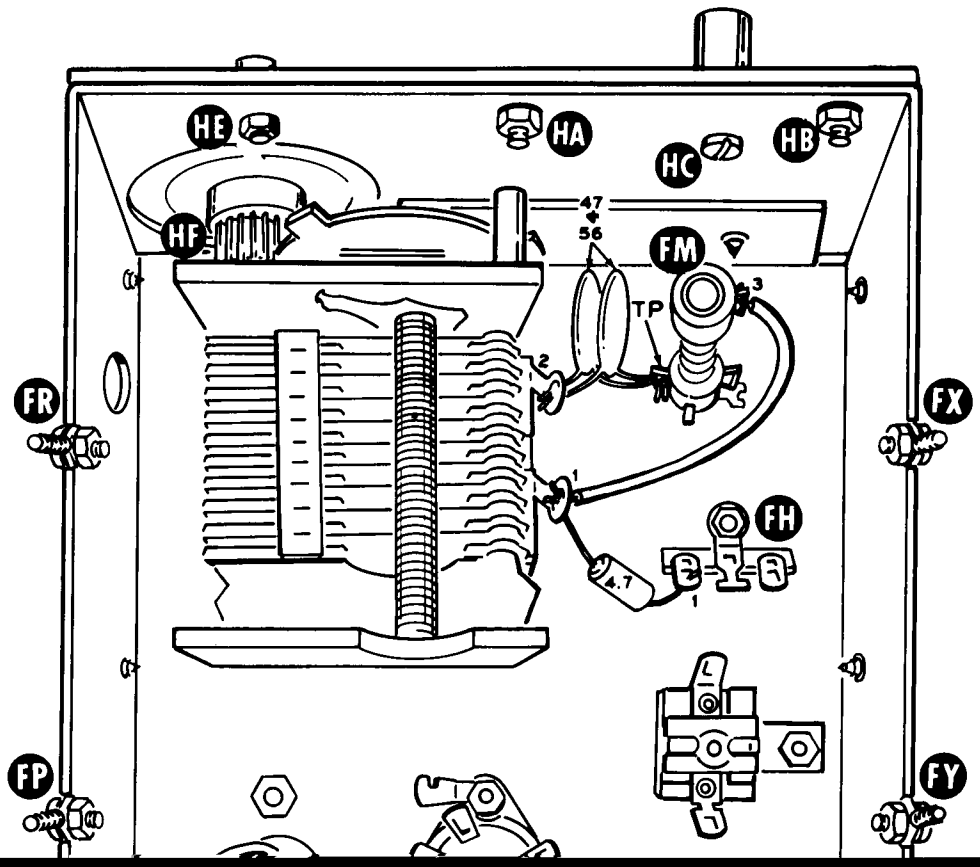
( ) Refer to the fold-out from Page 34 and tip C946 so that it touches the side of the VFO chassis. Then use the cement provided to secure the capacitor to the chassis side.

( ) Place the VFO to one side. It will be mounted later.

NOTE: Retain items such as wire, sleeving, silicone grease, etc., for use later.



PICTORIAL 7-2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FP
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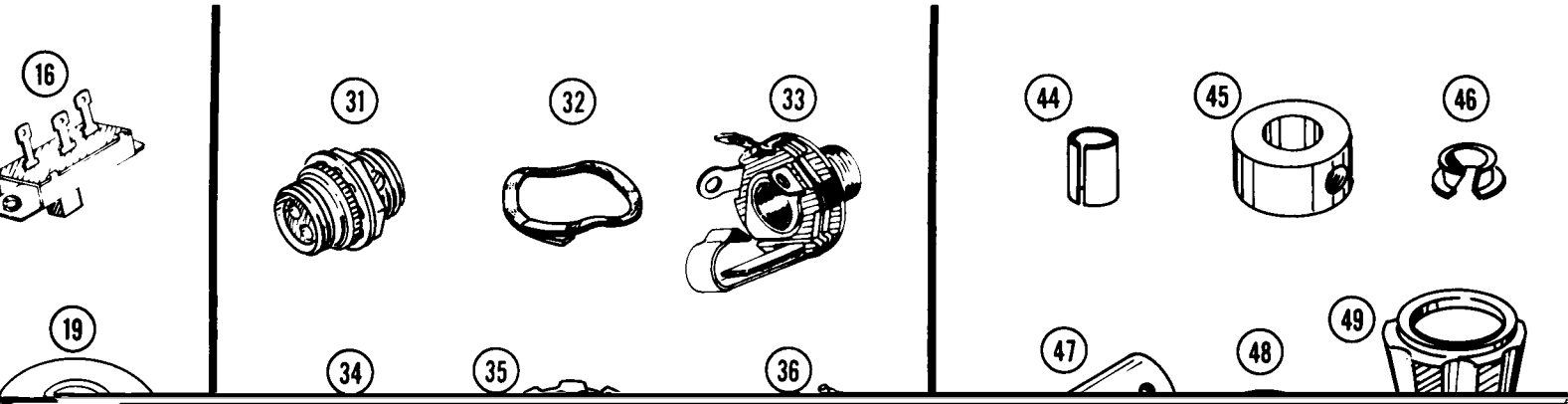
CHASSIS

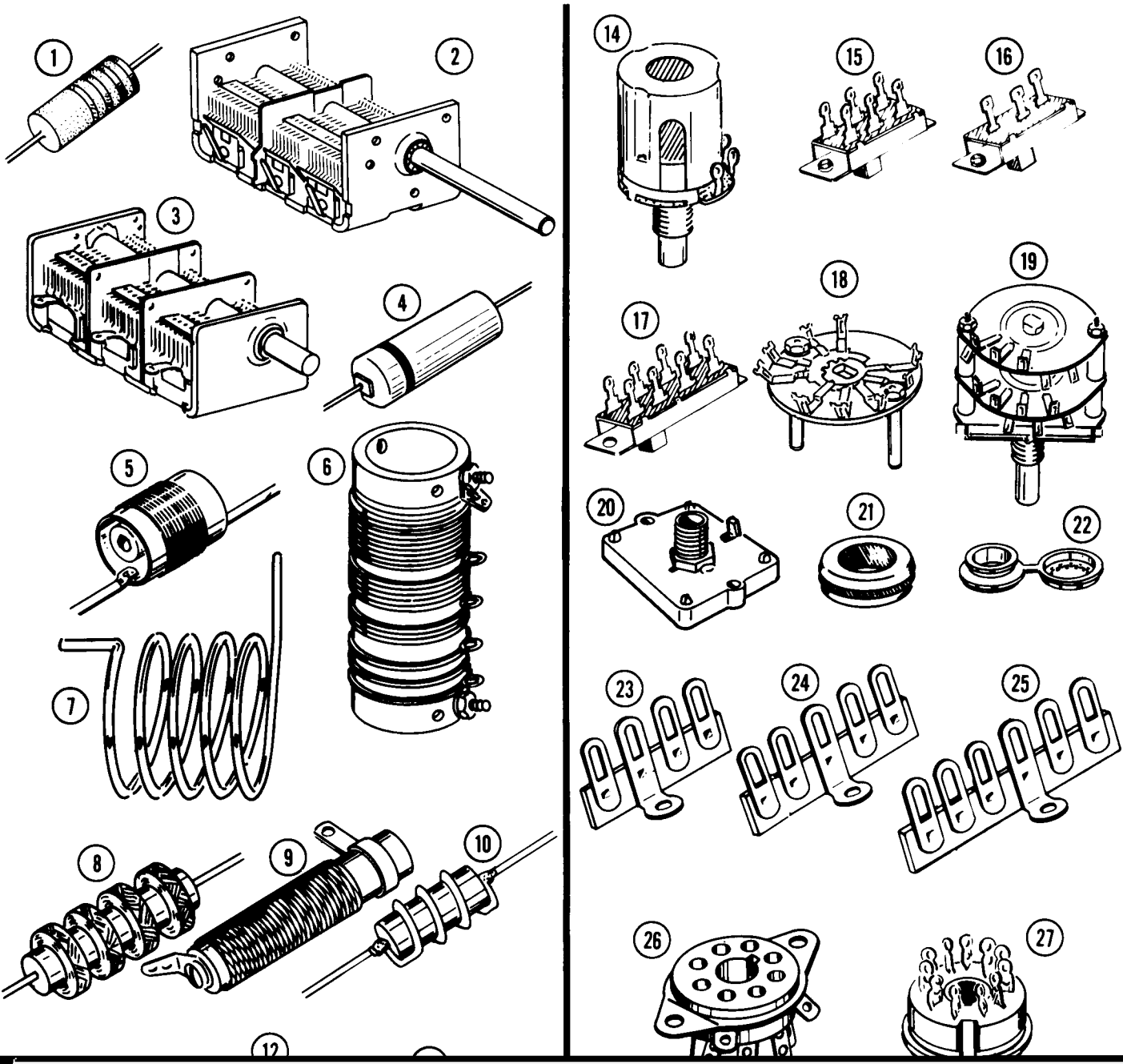
PARTS LIST #8

Check each of the remaining parts against the following parts list. The key numbers correspond to the numbers in the Parts Pictorial. Parts that have been illustrated previously have been omitted from this Parts Pictorial. Replace parts in the small envelopes with a part number on them until those parts are called for in steps. For pricing information, refer to the separate "Heath Parts Price List."

KEY No.	PART No.	PARTS Per Kit	DESCRIPTION
RESISTORS			
1/2-Watt			
	6-470	1	47 Ω (yellow-violet-black)
	6-101	4	100 Ω (brown-black-brown)
	6-331	2	330 Ω (orange-orange-brown)
	6-471	2	470 Ω (yellow-violet-brown)
	6-202	1	2000 Ω (red-black-red)
	6-472	1	4700 Ω (yellow-violet-red)
	6-103	2	10 kΩ (brown-black-orange)
	6-223	2	22 kΩ (red-red-orange)
	6-473	1	47 kΩ (yellow-violet-orange)
	6-104	1	100 kΩ (brown-black-yellow)
	6-154	1	150 kΩ (brown-green-yellow)
	6-224	1	220 kΩ (red-red-yellow)
	6-105	2	1 MΩ (brown-black-green)
	6-225	1	2.2 MΩ (red-red-green)
	6-335	1	3.3 MΩ (orange-orange-green)
2-Watt			
1	3-5-2	1	2.2 Ω (red-red-gold)
CAPACITORS			
Mica			
	20-130	2	12 pF
	20-77	2	24 pF
Mica (cont'd.)			
	20-102	1	100 pF
	20-105	3	180 pF
Disc			
	21-33	1	3.3 pF
	21-13	1	500 pF
	21-140	4	.001 μF
	21-27	15	.005 μF
	21-44	2	.005 μF, 1.6 kV
	21-16	1	.01 μF
	21-31	4	.02 μF
Variable			
2	26-92	1	3-section
	26-122	1	2-section
3	26-116	1	3-section, wide spaced
Other Capacitors			
4	23-59	1	.05 μF tubular
	25-147	1	10 μF electrolytic
	27-34	2	.2 μF Mylar
	31-48	1	3-30 pF mica trimmer

PARTS PICTORIAL

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KEY No.	PART No.	PARTS Per Kit	DESCRIPTION
COILS-CHOKES			
5	40-546	1	8.5 MHz trap coil
6	40-548	1	Final tank coil, 80-15 meters
7	40-549	1	Final tank coil, 10 meters
8	45-30	1	.5 mH RF choke
9	45-41	1	RF choke
10	45-53	2	Parasitic choke
CONTROLS			
11	10-57	2	10 kΩ, tab-mount
	10-127	2	1 MΩ, tab-mount
	10-115	1	7.5 MΩ, tab-mount
12	10-208	1	100 kΩ with switch arm
13	12-48	1	Dual-10 kΩ and 1 MΩ
14	19-67	1	1 MΩ, with switch
DIODES			
	57-27	5	1N2071
SOCKETS			
26	434-39	2	Octal
	434-42	4	Phono
	434-44	1	Pilot lamp socket
27	434-118	1	11-pin
28	440-1	1	Cap for #434-118
PLUGS-JACKS-CONNECTORS			
29	260-39	2	Anode clip
30	432-38	1	Microphone cable connector
31	432-39	1	Microphone chassis connector
32	435-1	1	Mounting ring for #438-29
33	436-4	2	3-lug jack
34	438-4	5	Phono plug
35	438-29	1	11-pin plug

SHAFTS-PULLEYS

KEY No.	PART No.	PARTS Per Kit	DESCRIPTION
38	100-19	1	1-1/4" pulley, small hole
39	100-458	1	1-1/4" pulley, large hole (red dot)
40	453-17	1	9" shaft
	453-125	1	9-3/8" shaft
41	453-146	1	8-1/4" tubular shaft
42	453-147	1	11-1/4" flatted shaft
43	466-6	2	3/4" pulley

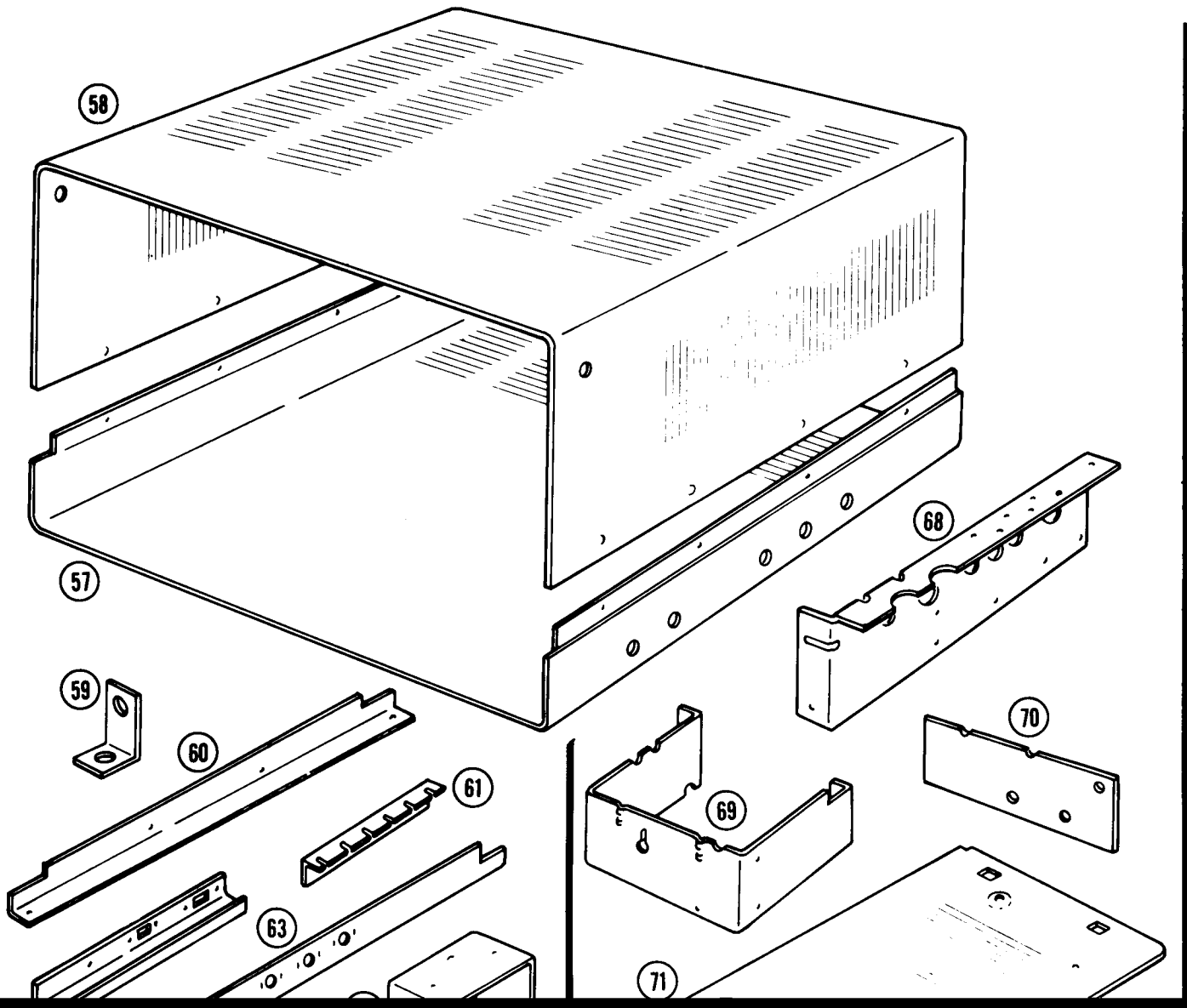
BUSHINGS-COUPLINGS

METAL PARTS

KEY No.	PART No.	PARTS Per Kit	DESCRIPTION
57	90-362-2	1	Cabinet bottom
58	90-363-2	1	Cabinet top
	203-743-1	1	Front panel
	200-593-1	1	Chassis
59	204-102	1	L bracket
60	204-560	1	Support rail
61	204-2096	2	Comb bracket
62	204-738	1	Support bracket
63	204-2256-1	1	Control bracket
64	204-793	1	Capacitor mounting bracket

KEY No.	PART No.	PARTS Per Kit	DESCRIPTION
#4 Hardware			
79	250-273	2	4-40 x 3/8" screw

KEY No.	PART No.	PARTS Per Kit	DESCRIPTION
OTHER HARDWARE			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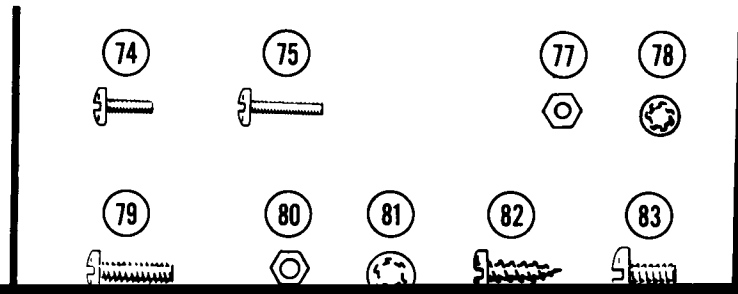
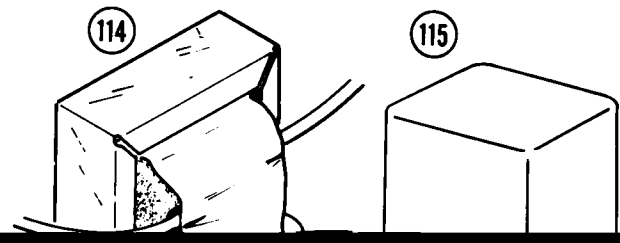
PARTS PICTORIAL (cont'd.)





STEP-BY-STEP ASSEMBLY

PARTS MOUNTING

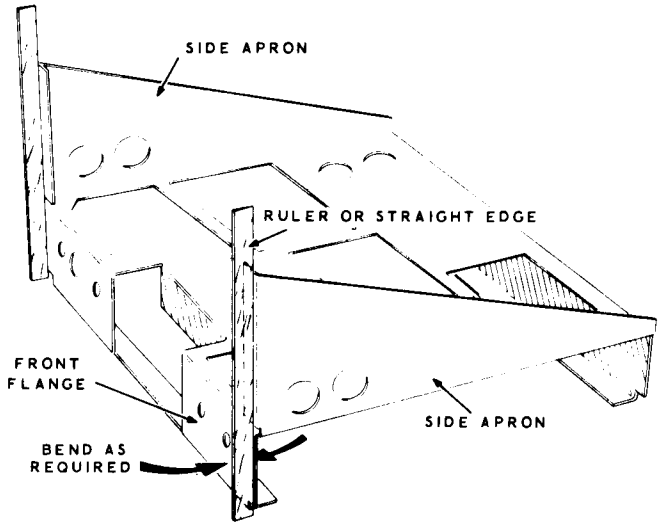
Refer to Pictorial 8-1 for the following steps.

It is important that the front edges of the chassis be in perfect alignment. This is checked at the factory. However, if the kit receives rough handling in shipment, this alignment might be changed. Check the alignment of the front edges of the chassis as directed in the following step; use care in handling the chassis throughout the assembly of the kit.

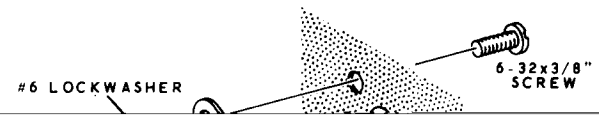
( ) Refer to Detail 8-1A and check to see that the front flange of the chassis is in alignment with the front edges of the side aprons. This can be done by placing a ruler or other straight edge along this surface as shown. Straighten the front flange of the chassis as required, by carefully bending the flange.

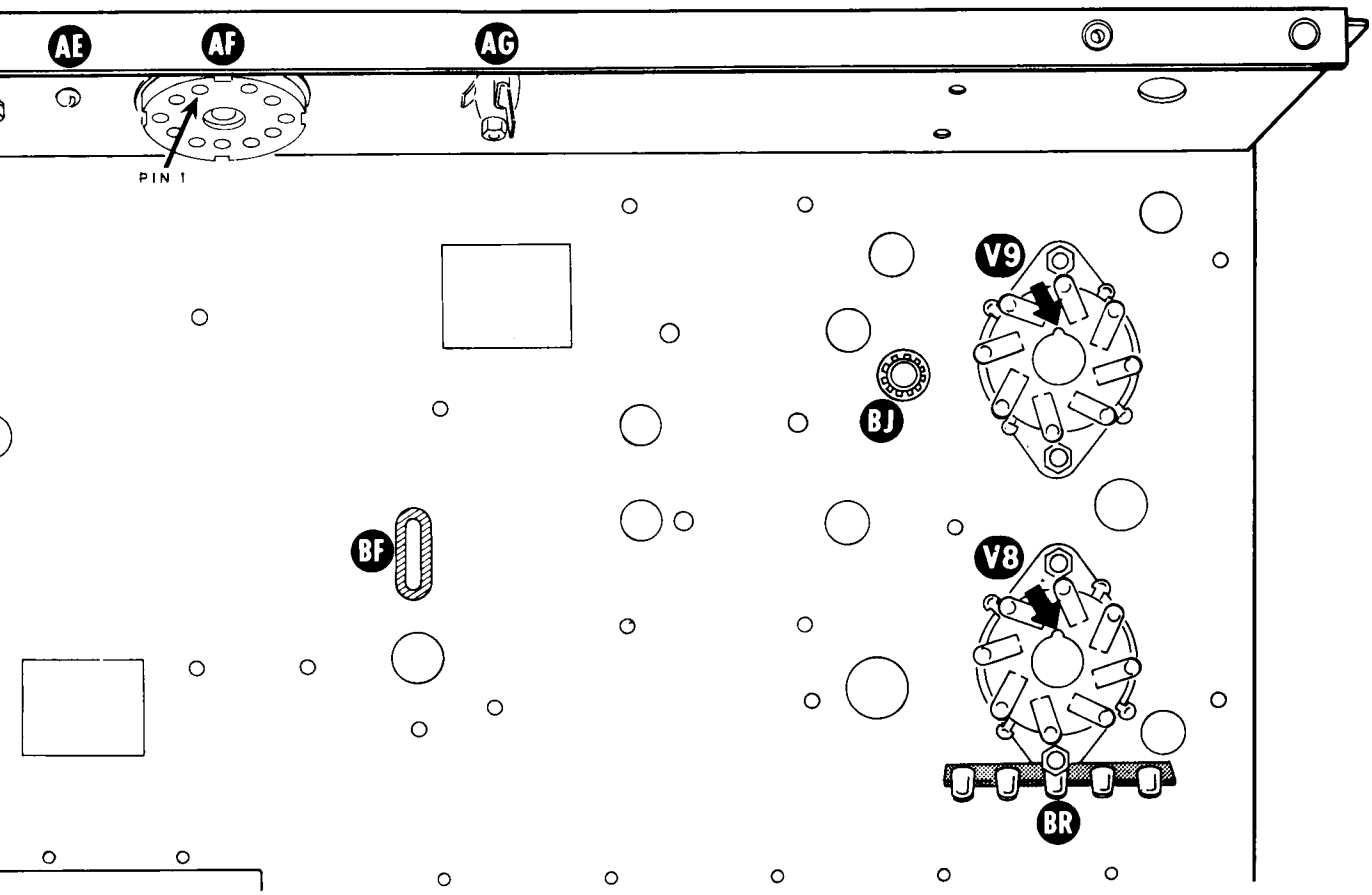
( ) Refer to Detail 8-1B and install a phono socket at AB. Use 6-32 x 3/8" hardware. Position the socket as shown.

( ) In a like manner, install phono sockets at AC, AD, and AG. Use 6-32 x 3/8" hardware. Position each socket as shown. Note the position of the lugs of AC

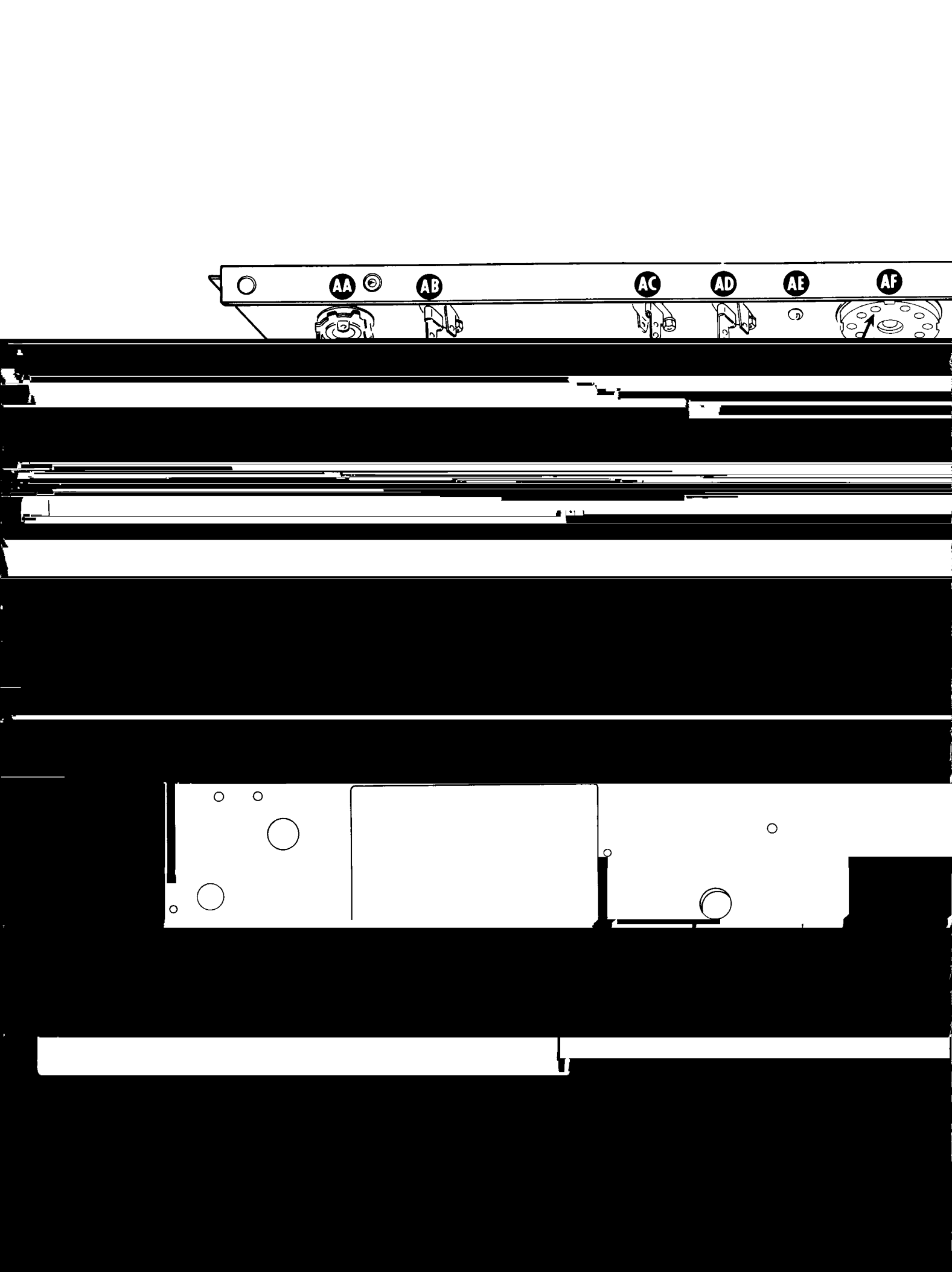


Detail 8-1A





PICTORIAL 8-1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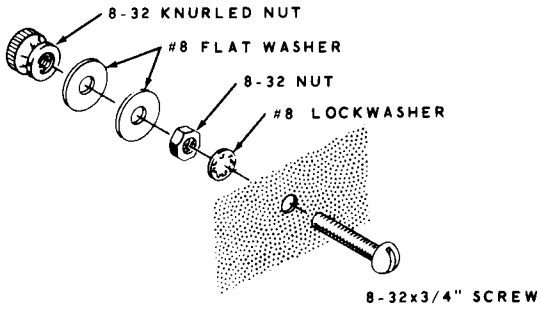
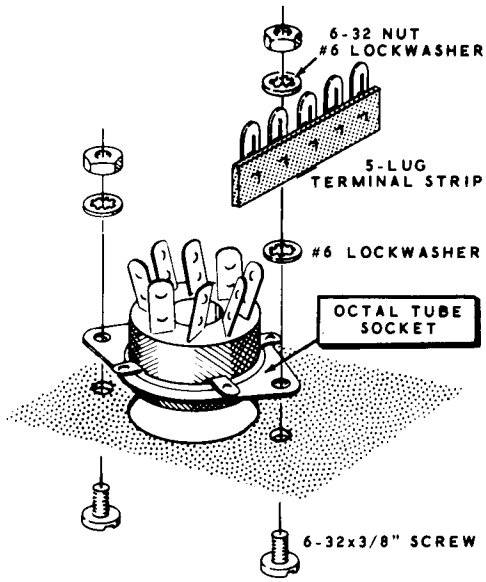
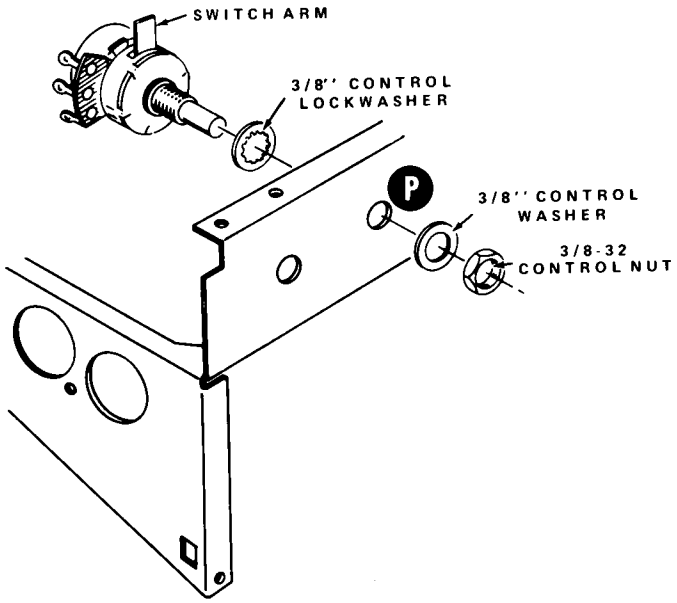


Detail 8-1E

( ) Refer to Detail 8-1E and install the 8-32 x 3/4" screw at AE. Use a #8 lockwasher, an 8-32 nut, two #8 flat washers, and an 8-32 knurled nut.





Detail 8-2A

Refer to Pictorial 8-2 (fold-out from Page 53) for the following steps.

( ) Refer to Detail 8-2A and install a 100 kΩ control with switch arm (#10-208) at P. Use a 3/8" control lockwasher, a 3/8" control flat washer, and a 3/8-32 control nut. Position the control as shown.

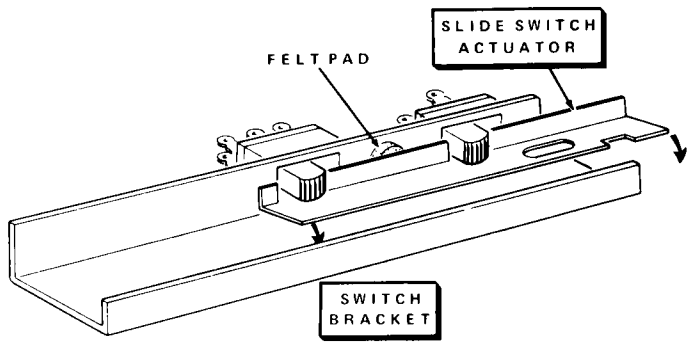
Refer to Detail 8-2B for the following three steps.

( ) Install an SPDT slide switch (#60-4) at HL on the switch bracket. Use two 6-32 x 1/4" screws.

( ) Similarly, install a DPDT slide switch (#60-2) at HN on the switch bracket. Use two 6-32 x 1/4" screws.

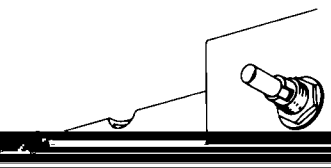
( ) Remove the clear protective backing from the felt pad. Then press the felt pad in between the screw heads and onto the switch bracket as shown.

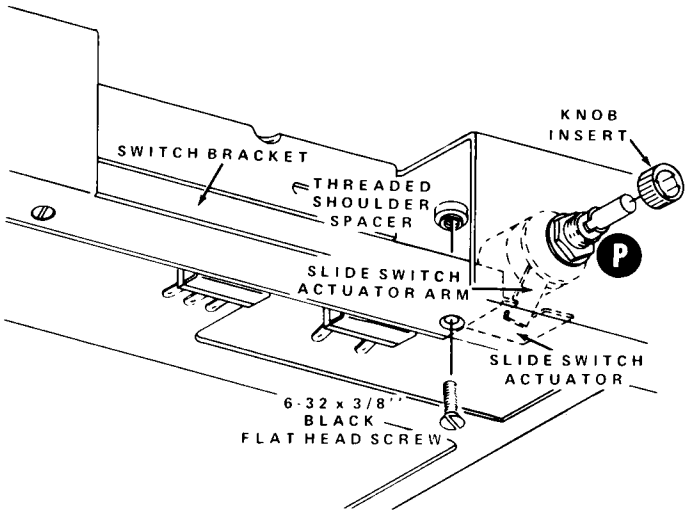
( ) Refer to Detail 8-2C and place the slide switch actuator in position on the switch bracket. The two black switch levers must fit easily into the two slots in the actuator. If they do not, loosen the switch mounting screws and readjust.



Detail 8-2C

( ) Place the switch bracket in position as shown in Detail 8-2D and secure one end to the chassis. Use a 6-32 x 3/8" black flat head screw, a #6 lockwasher, and a 6-32 nut. Do not tighten the nut at this time.





Detail 8-2E

( ) Refer to Detail 8-2E and swing the free end of the switch bracket into position. The slot in the slide switch actuator should fit over the switch actuator arm on control P. Secure the switch bracket with a 6-32 x 3/8" black flat head screw and a threaded shoulder spacer as shown. Securely tighten both 6-32 screws holding the switch bracket.

( ) Place a knob insert on the outer (slotted) shaft of control P.

( ) Rotate the knob insert back and forth two or three times to make sure the slide switches operate properly. If, at any point in its travel, the end of the switch actuator arm touches the chassis, loosen the control nut and move the control away from the lower chassis lip to clear the actuator arm. Then tighten the nut.

( ) Remove the knob insert from control P.

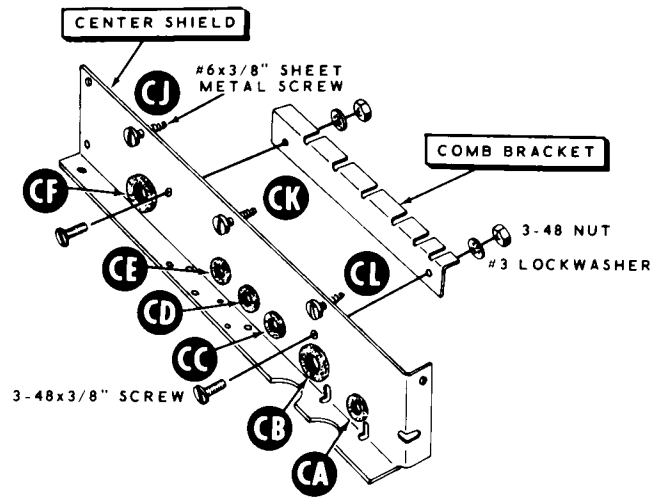
Refer to Detail 8-2F for the following steps.

( ) Install 5/16" plastic grommets at CA, CC, CD, and CE on the center shield.

( ) Install 1/2" rubber grommets at CB and CF on the center shield.

( ) Install #6 x 3/8" sheet metal screws in the center shield at CJ, CK and CL. Position the screws as shown. Leave 1/16" between underside of the screw heads and the center shield.

( ) Install a comb bracket on the center shield, with 3-48 x 3/8" hardware. Position the comb bracket as shown.

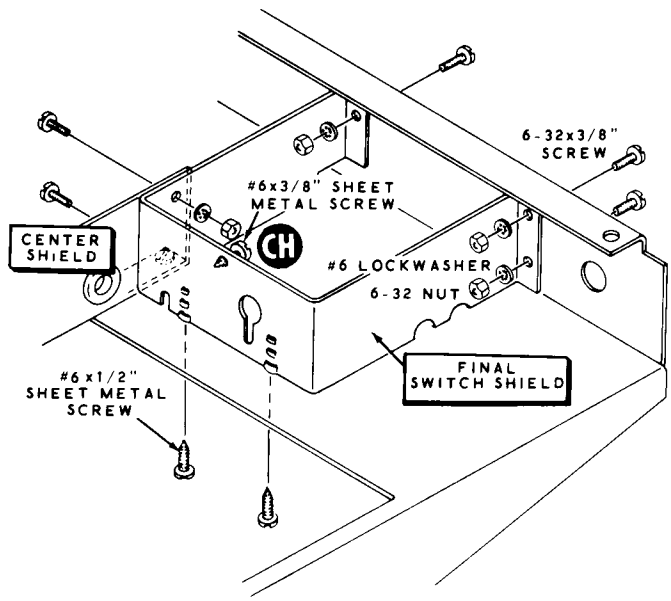


Detail 8-2F

( ) Mount the center shield in the chassis with 6-32 x 3/8" hardware at BZ, BM, and BW. Do not tighten the hardware at this time.

( ) Refer to Detail 8-2G and insert a #6 x 3/8" sheet metal screw in the final switch shield at CH. Leave 1/16" between the underside of the screw head and the shield.

( ) Refer to the same Detail and mount the final switch shield. Use 6-32 x 3/8" hardware and #6 x 1/2" sheet metal screws.



Detail 8-2G

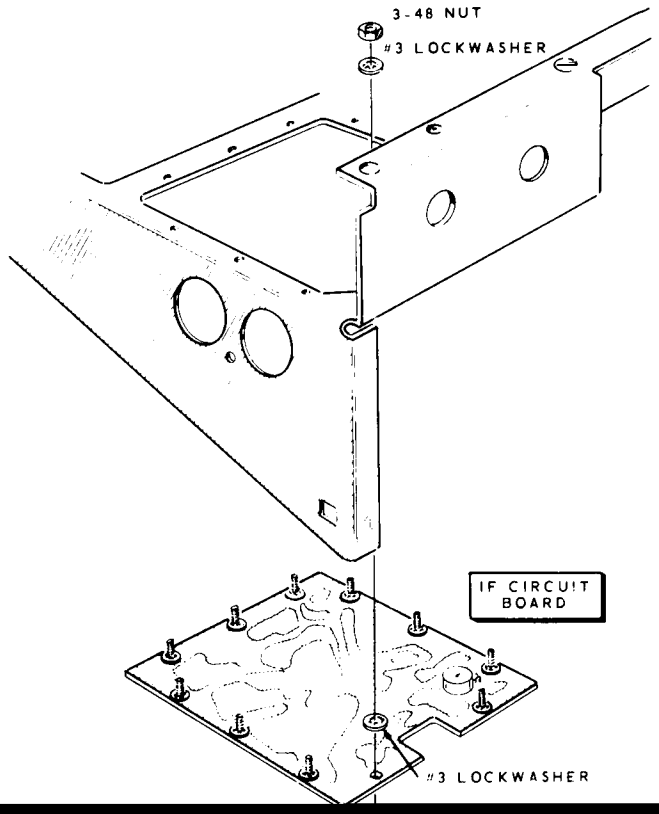
Refer to Pictorial 8-2 for the following steps.

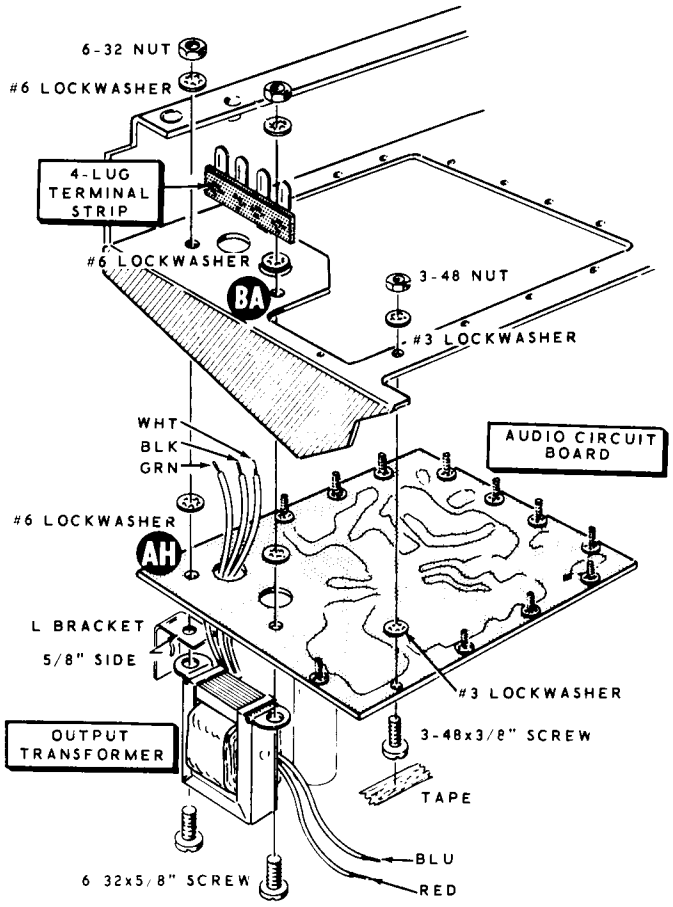
NOTE: When the circuit boards are mounted, lockwashers must be installed between the chassis and the foil sides of the circuit boards. This assures a good ground between the circuit boards and the chassis. This operation can be simplified if you place a piece of masking tape over the screw heads after the screws are installed on the lettered side of the circuit board. This will hold the screws in place until lockwashers and nuts are installed. The tape should be removed after the nuts are installed. Mount all five circuit boards on the chassis before tightening the hardware.

( ) Refer to Detail 8-2H and the inset of Pictorial 8-2, and mount the IF circuit board (#85-128-4) on the chassis. Use 3-48 x 3/8" hardware. Do not tighten the hardware at this time.

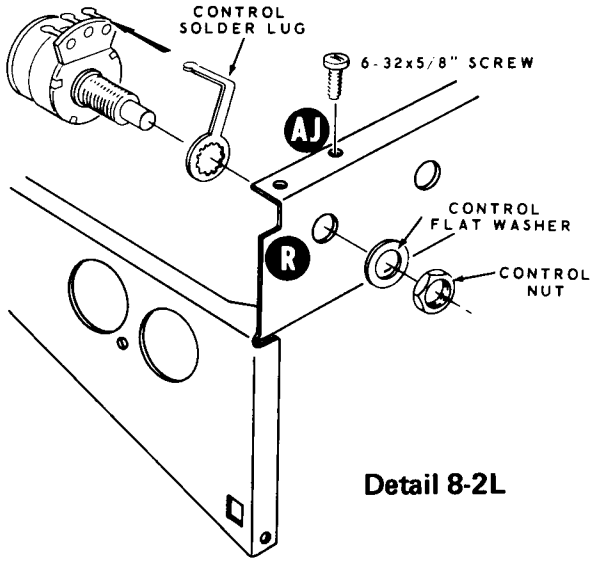
( ) In a like manner, mount the bandpass circuit board (#85-129-5). Use 3-48 x 3/8" hardware. Be sure to position the circuit board properly. Do not tighten the hardware at this time. Refer to the inset drawing on Pictorial 8-2 for the proper installation of the hardware that goes through the center shield.

( ) Mount the modulator circuit board (#85-127-2) using a 3-48 x 3/8" hardware.





Detail 8-2K



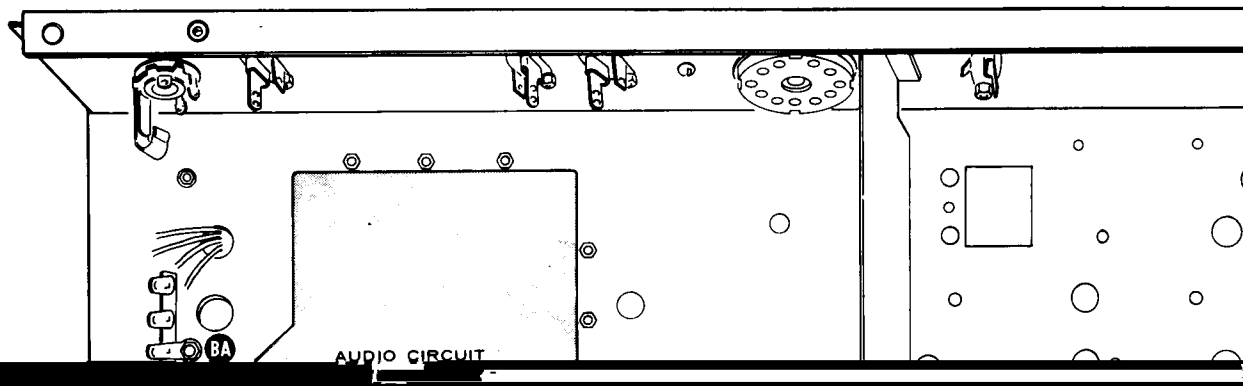
Detail 8-2L

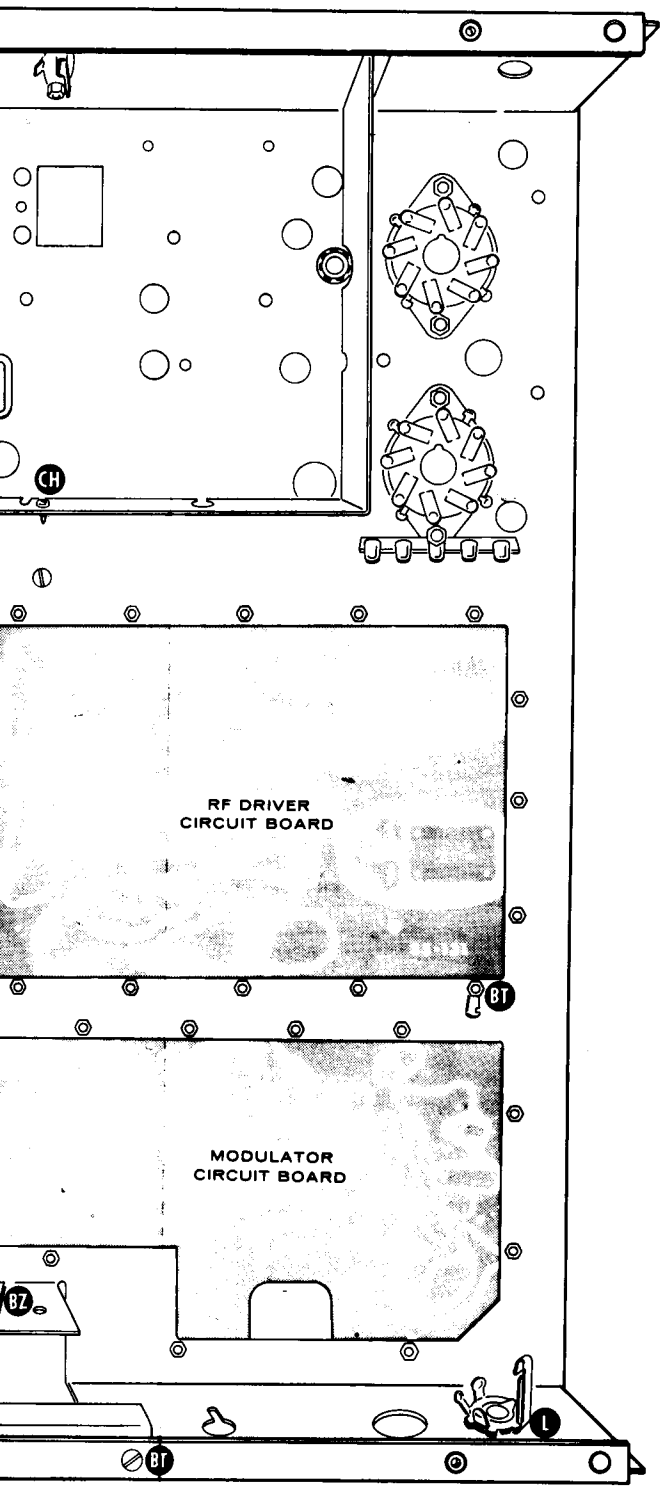
control nut. Form the control solder lug against terminal 1 of the control. Before soldering, check to see that the formed lugs will fit under the chassis lip at R. Solder lug 1 (S-1), and then remove the control flat washer and control nut.

( ) Again refer to Detail 8-2L and install this control and solder lug assembly at R. Use a control washer and a control nut. Position the lugs as shown so that lug 1 clears the screw at AJ. This insures that the control lugs will not interfere with the rubber foot to be installed later.

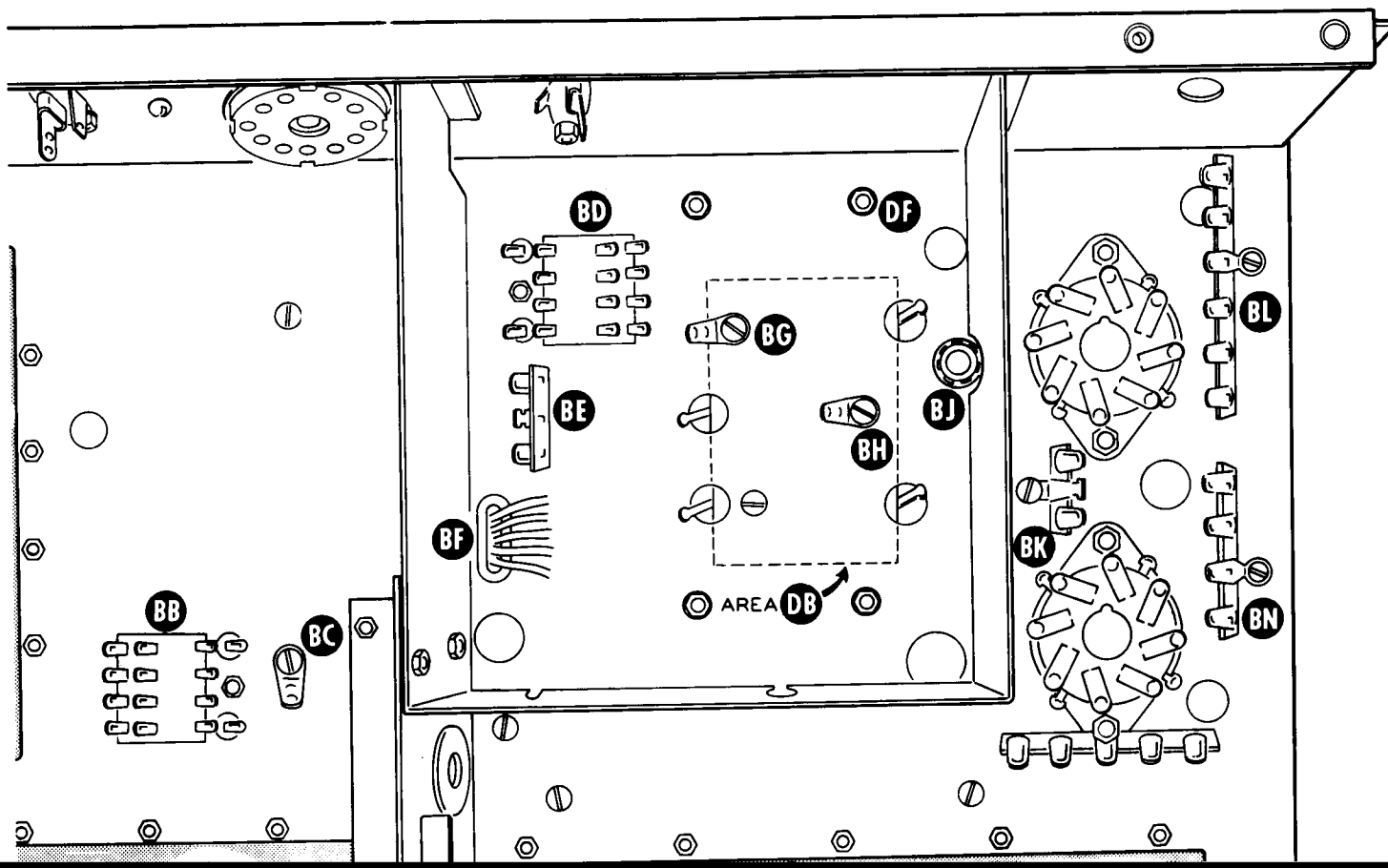
( ) On top of the chassis at AJ, mount an L bracket with

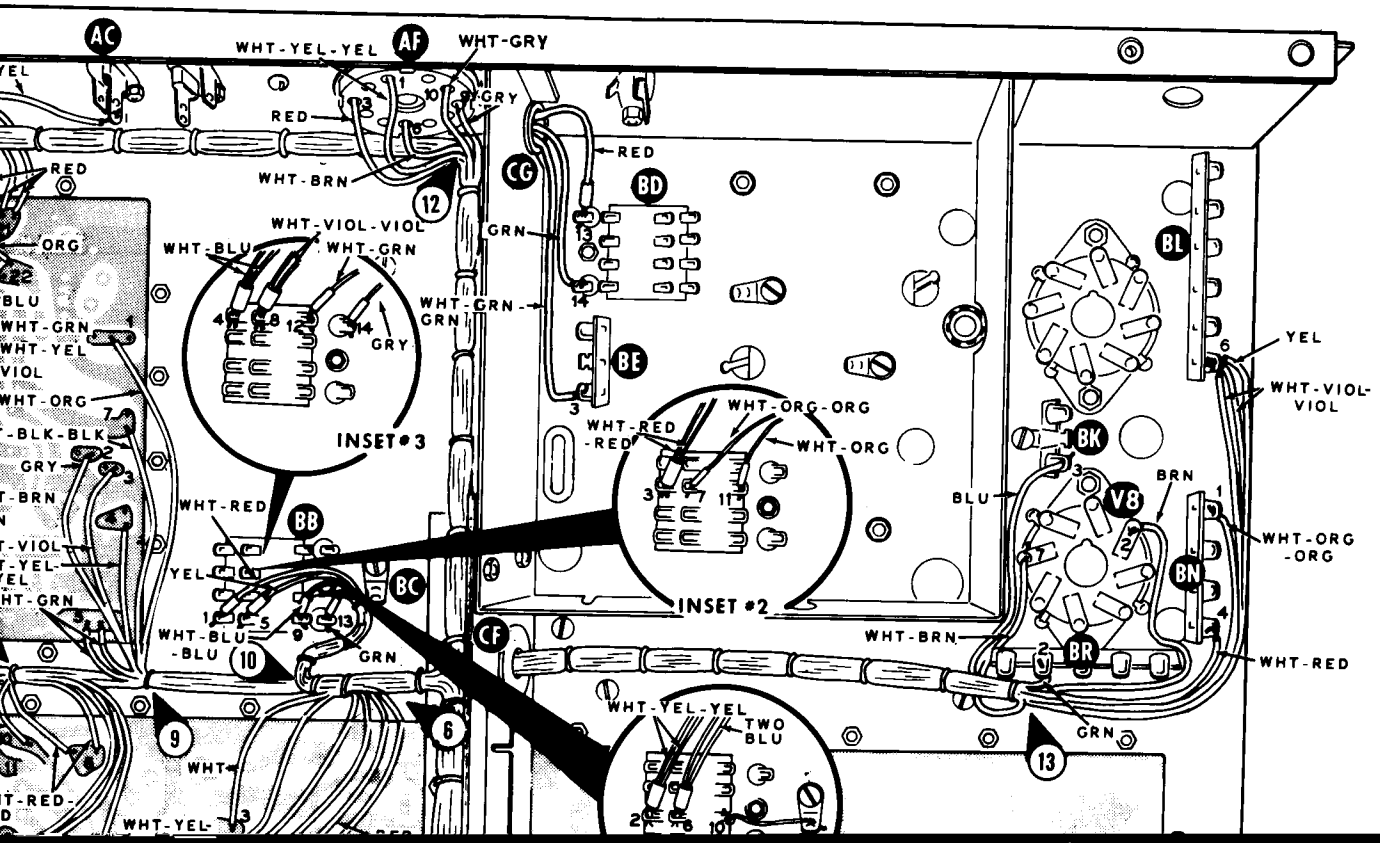
( ) Remove the screw from AJ.

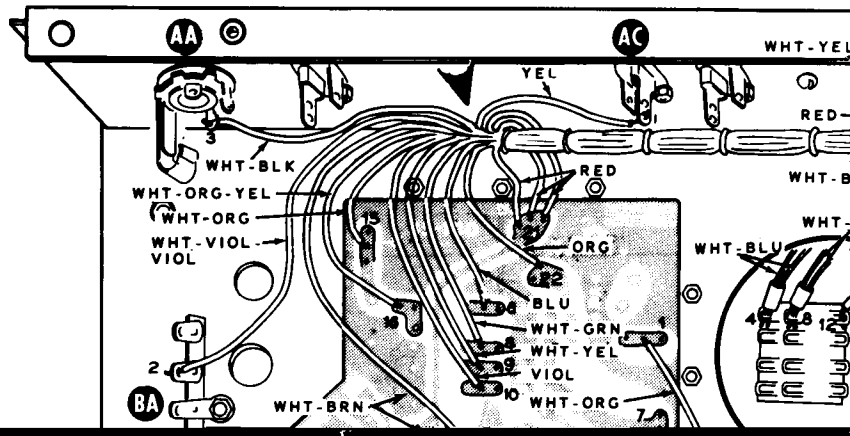

BA
AUDIO CIRCUIT

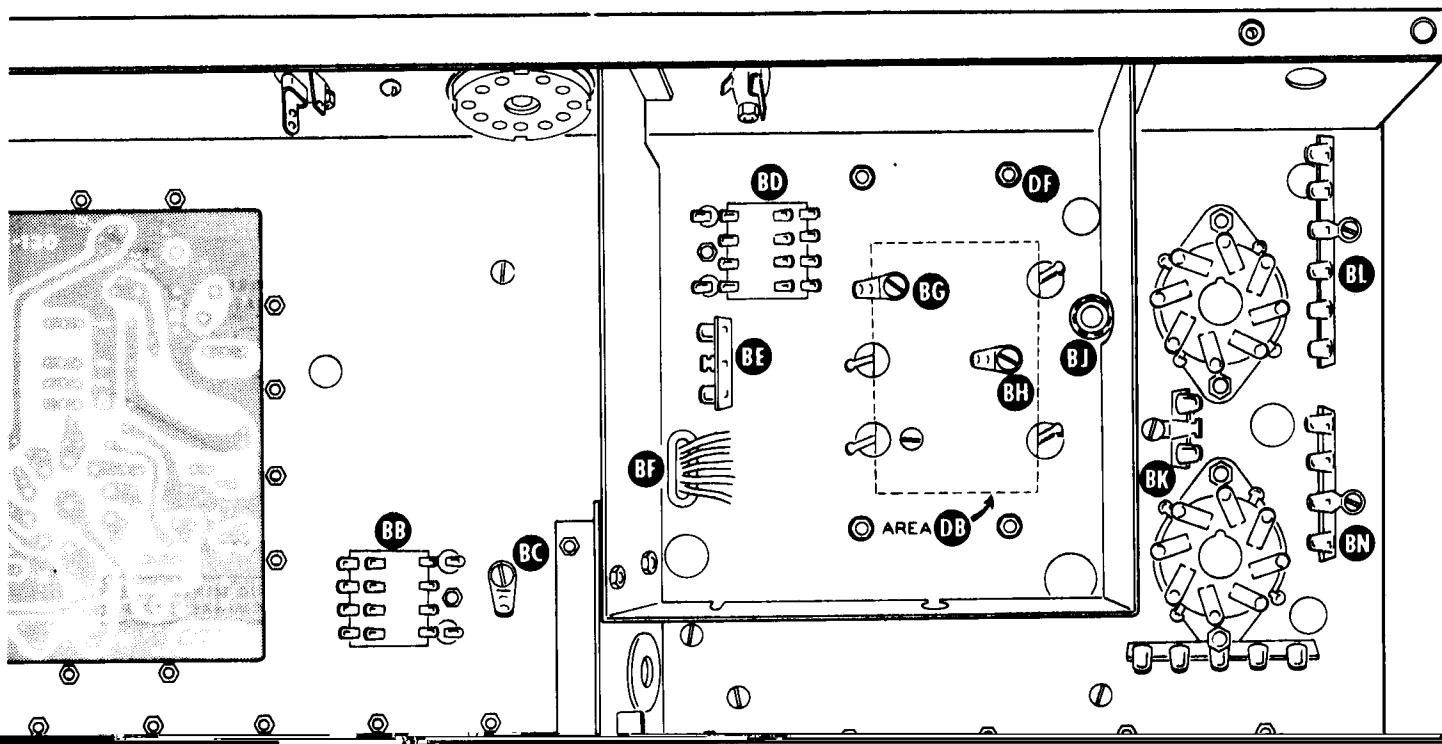


2


BD
DF
BG
BL
BE
BJ
BH
BF
BK
BN
BB
BC
AREA
DB


AC
AF
WHT-YEL-YEL
WHT-GRY
RED
WHT-BRN
CG
BD
BE
BB
BC
CF
BL
BK
V8
BN
BR
12
10
9
6
13
WHT-VIOL-VIOL
WHT-BLU
WHT-GRN
GRN
GRY
INSET #3
WHT-RED
-RED
WHT-ORG-ORG
WHT-ORG
INSET #2
YEL
BLU
BRN
WHT-ORG
-ORG
WHT-VIOL-
VIOL
WHT-BLU
-BLU
WHT-YEL-YEL
TWO
BLU
WHT
WHT-YEL-


AA
AC
WHT-YEL
YEL
RED
WHT-BLK
RED
WHT-ORG-YEL
WHT-ORG
WHT-VIOL
VIOL
ORG
WHT-BLU
BLU
WHT-GRN
WHT-YEL
VIOL
WHT-ORG
BA
WHT-BRN


BD
DF
BG
BJ
BH
BE
BF
BL
BK
BN
BB
BC
AREA DB

HARNESS WIRING

CAUTION: As you handle the chassis in the following steps, avoid damaging the 20 μF capacitor on the audio circuit board.

Refer to Pictorial 8-4 (fold-out from Page 54) for the following steps.

( ) Work a 1/2" rubber grommet into square notch CG at the rear end of the center shield.

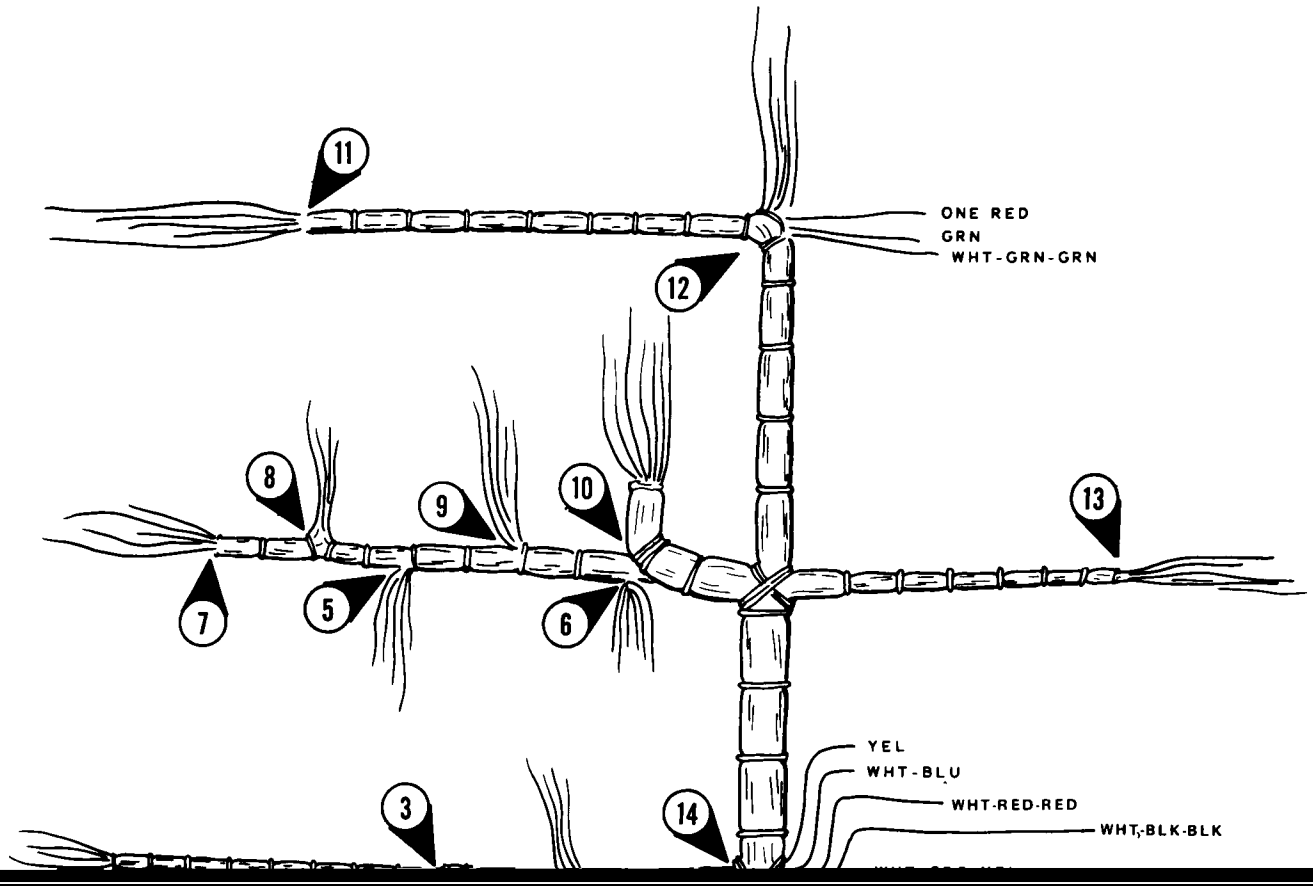
( ) Place a 1" length of masking tape over each of the two metal edges near BW and BZ at the front end of the center shield. Also tape the metal edges at breakouts 1 and 17.

Each wiring harness wire is colored in one of the following three ways:

1. A plain solid color such as green.
2. A solid color (usually white) with one stripe, such as white-orange. Body color is called out first.
3. A solid color with two stripes, such as white-red-red. Body color is called out first.

( ) Straighten out each branch of the wiring harness and the individual wires at each "breakout." For orientation, locate breakout #3, where three short red wires and one white-blue (white with blue tracer) wire leave the harness.

( ) Form the wiring harness as shown in Detail 8-4A, and position the chassis bottom side up with the front toward you.


11
12
8
9
10
13
7
5
6
3
14
ONE RED
GRN
WHT-GRN-GRN
YEL
WHT-BLU
WHT-RED-RED
WHT-BLK-BLK

( ) Hold the formed wiring harness to the left of the center of the chassis and start the longest wires through the appropriate grommet in the center shield. Then move the entire harness to the right and start the next shorter wires through their grommet. Bend the harness so that breakout #17 and #18 will pass around the front end of the center shield to the position shown in the Pictorial.Make sure the main harness is snug against the grommets.

( ) Before proceeding, check to make sure the wires have been correctly placed, as follows:

GROMMET	WIRES
CB	BO (breakout) #15 and #16
CC	WHT-ORG-YEL
CD	WHT-RED-RED, WHT-BLK-BLK
CE	YEL and WHT-BLU
CF	BO #13
CG	RED, GRN, and WHT-GRN-GRN

To get the best performance from your transceiver, it should

Connect the following wires from BO#1 as directed:

( ) Gray to lug 4 of switch R (S-1).

( ) White-gray to lug 5 of switch R (S-1).

( ) White-violet to lug 1 of control P (S-1).

( ) White-yellow-yellow to lug 3 of control P (S-1).

Connect the remaining wires from BO#1 to the IF circuit board as follows:

( ) Red to 10 (S-1).

( ) White-red to 9 (S-1).

( ) Brown to 8 (S-1).

( ) Two white-brown to 6 (S-2).

( ) Yellow to 12 (S-1).

( ) White-green to 7 (S-1).

( ) Place the switch wires in the notch of the switch cover

Connect the wires from BO#4 to the bandpass circuit board as follows:

( ) Three white-orange-yellow to 7 (S-3).

( ) Three brown to 2 (S-3).

( ) Place a 1" length of small black sleeving on the white-gray wire and insert the wire through hole BY so that at least 1-3/4" protrudes on the top of the circuit board. Make any necessary adjustments in harness positioning to insure this length. The free end of this wire will be connected later.

Connect the wires from BO#5 to the bandpass circuit board as follows:

( ) Green to 10 (S-1).

( ) Gray to 11 (S-1). Check the Pictorial for the correct hole in this foil.

( ) Two white-red-red to 8 (S-2).

( ) Two brown to 13 (one hole) (S-2).

( ) Two white-brown to 12 (S-2).

Connect the wires from BO#9 to the audio circuit board as follows:

( ) Two brown to 17 (put both wires in one hole) (S-2).

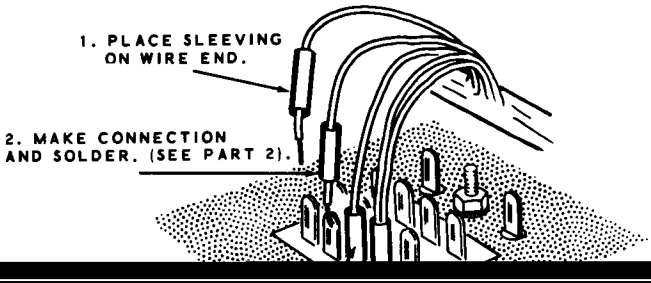
Connect the wires from BO#8 to the audio circuit board as follows:

( ) Red to 14 (S-1).

( ) Two white-yellow-yellow to 18 (S-2). NOTE: The number 18 may be partially obscured by the chassis. If so, locate the proper holes by reference to the surrounding wires and foils.

Connect three of the wires from BO#7 to the audio circuit board as follows:

( ) White-red to 19 (S-1).



Refer to Inset #3 and connect the wires from BO#10 as follows:

( ) Gray to lug 14 (S-1).

( ) White-green to lug 12 (S-1).

Connect the following wires from BO#12 (which were placed through grommet CG) as follows:

( ) Place a 1/2" length of small black sleeving over the red wire and connect it to lug 13 of relay BD (S-1). Push the sleeving down over the lug.

( ) Connect the green wire to lug 14 of relay BD (NS).

( ) Connect the white-green-green wire to lug 3 of terminal strip BE (NS).

Connect three of the wires from BO#11 as follows:

( ) Yellow to lug 1 of phono jack AC (NS).

( ) White-black to lug 3 of jack AA (NS).

( ) White-violet-violet to lug 2 of terminal strip BA (NS).

Connect the remaining wires from BO#11 to the audio circuit board as follows:

( ) Three red to 21 (S-3).

( ) White-orange to 15 (S-1).

( ) White-orange-yellow to 16 (S-1).

( ) White-brown to 12 (S-1). There is no hole provided. Solder the wire directly to the foil.

( ) Blue to 6 (S-1).

( ) White-green to 8 (S-1).

( ) White-yellow to 9 (S-1).

( ) Violet to 10 (S-1).

( ) Orange to 22 (S-1).

Connect the wires from BO#13 as follows:

( ) Blue to lug 3 of terminal strip BK (NS).

( ) White-brown to lug 7 of V8 (NS).

( ) Brown to lug 2 of V8 (NS).

( ) Green to lug 2 of terminal strip BR (NS).

( ) White-red to lug 4 of terminal strip BN (NS).

( ) White-orange-orange to lug 1 of terminal strip BN (NS).

( ) Two white-violet-violet to lug 6 of terminal strip BL (NS).

( ) Yellow to lug 6 of terminal strip BL (NS).

( ) Make sure the wires coming from BO#13 are positioned down against the chassis as shown. Also refer to the photograph on Page 183.

Connect the wires from BO#14 to the RF driver circuit board as follows:

( ) White-blue through grommet CE to 14 (S-1).

( ) Yellow through grommet CE to 13 (S-1).

( ) White-red-red through grommet CD to 11 (S-1).

( ) White-orange-yellow through grommet CC to 6 (S-1). Be sure you connect to 6, and not to 9.

The white-black-black wire from grommet CD will be connected later.

Connect the wires from BO#15 to the modulator circuit board as follows:

( ) White-violet-violet to 9 (S-1).

( ) White-red to 12 (S-1).

( ) Two orange to 13 (S-2).

( ) White-brown to 11 (S-1).

( ) Brown to 10 (S-1).

Connect the wires from BO#16 to the modulator circuit board as follows:

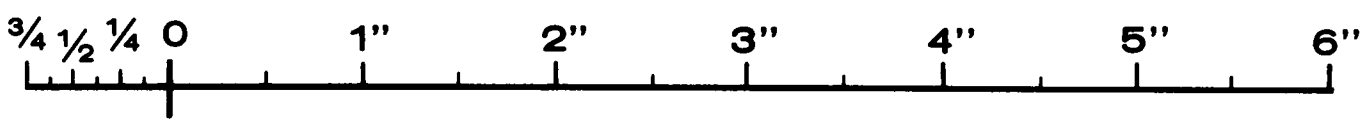
( ) Two yellow to 7 (S-2).

( ) Brown to 8 (S-1).

( ) Two white-yellow to 2 (S-2).

( ) Red to 1 (S-1).

The orange wire will be connected later.



( ) Place all the wires from BO#18 in the notch at the front of the modualtor circuit board and push them

( ) Connect one end of a 2" black hookup wire to B on the audio circuit board (S-1). The other end of this

[redacted]

ater.

( ) Connect the white-violet-violet wire from BO#17 to lug 3 of jack L (S-1).

Connect the remaining wires from BO#17 to the modulator circuit board as follows:

( ) Two white-red to 6 (S-2).

( ) Green to 5 (S-1).

( ) Brown to 4 (S-1).

( ) White-orange-orange to 3 (S-1).

The two black wires will be connected later.

CHASSIS BOTTOM-COMPONENTS AND WIRING

Refer to Pictorial 8-5 (fold-out from Page 67) for the following steps.

( ) Prepare the following lengths of black hookup wire:

2-1/2"
2-1/4"
2-1/2"
4-1/2"
2"

( ) Connect a 100 Ω (brown-black-brown) resistor from lug 2 (S-1) to lug 1 (NS) of phono socket AB.

Connect the leads from the output transformer as follows:

( ) Green to lug 1 of phono socket AB (S-2).

( ) White to lug 4 of terminal strip BA (NS).

( ) Black to lug 2 of terminal strip BA (S-2).

NOTE: When bare wire is called for in a step, use small bare wire unless the large bare wire is specifically called for.

( ) Prepare the following lengths of wire:

2-1/2" bare
3" bare
3-1/4" bare
1-1/4" bare
4-1/2" black hookup
1-1/4" large bare
8-1/2" large red (strip one end 5/8")
3" large bare

CAUTION: Before soldering bare wires in the following steps, make sure they do not touch any insulated wires.

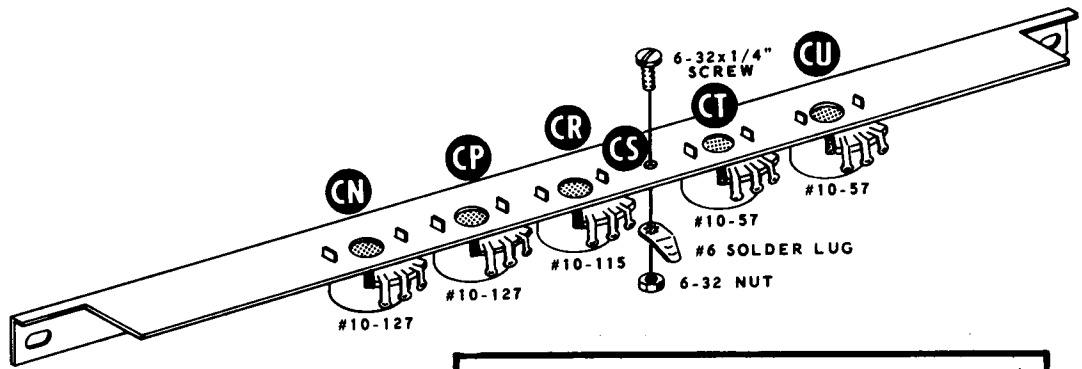
( ) Refer to Detail 8-5A and connect a 2-1/2" bare wire

( ) Connect a 24" bare wire from bus 2 of the rear switch

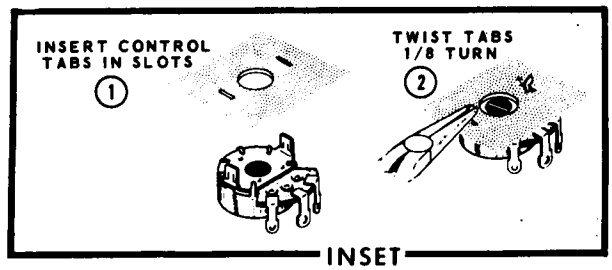
( ) Prepare the following lengths of wire.

BROWN	WHITE	BLACK	OTHER

( ) Connect a 5" red hookup wire to 1 on the modulator circuit board (S-1). The other end of this wire will be connected later.



Detail 8-5C



( ) Connect a 5" brown hookup wire to lug 3 of control CU (S-1). Place the other end of this wire up through the notch in the IF circuit board. It will be connected later.

( ) Connect a 5-1/2" white hookup wire to lug 2 of control CU (S-1). Place the other end of this wire up through the notch in the IF circuit board. It will be connected later.

( ) Connect a 4-1/2" black hookup wire from lug 1 of control CU (NS) to solder lug CS (NS).

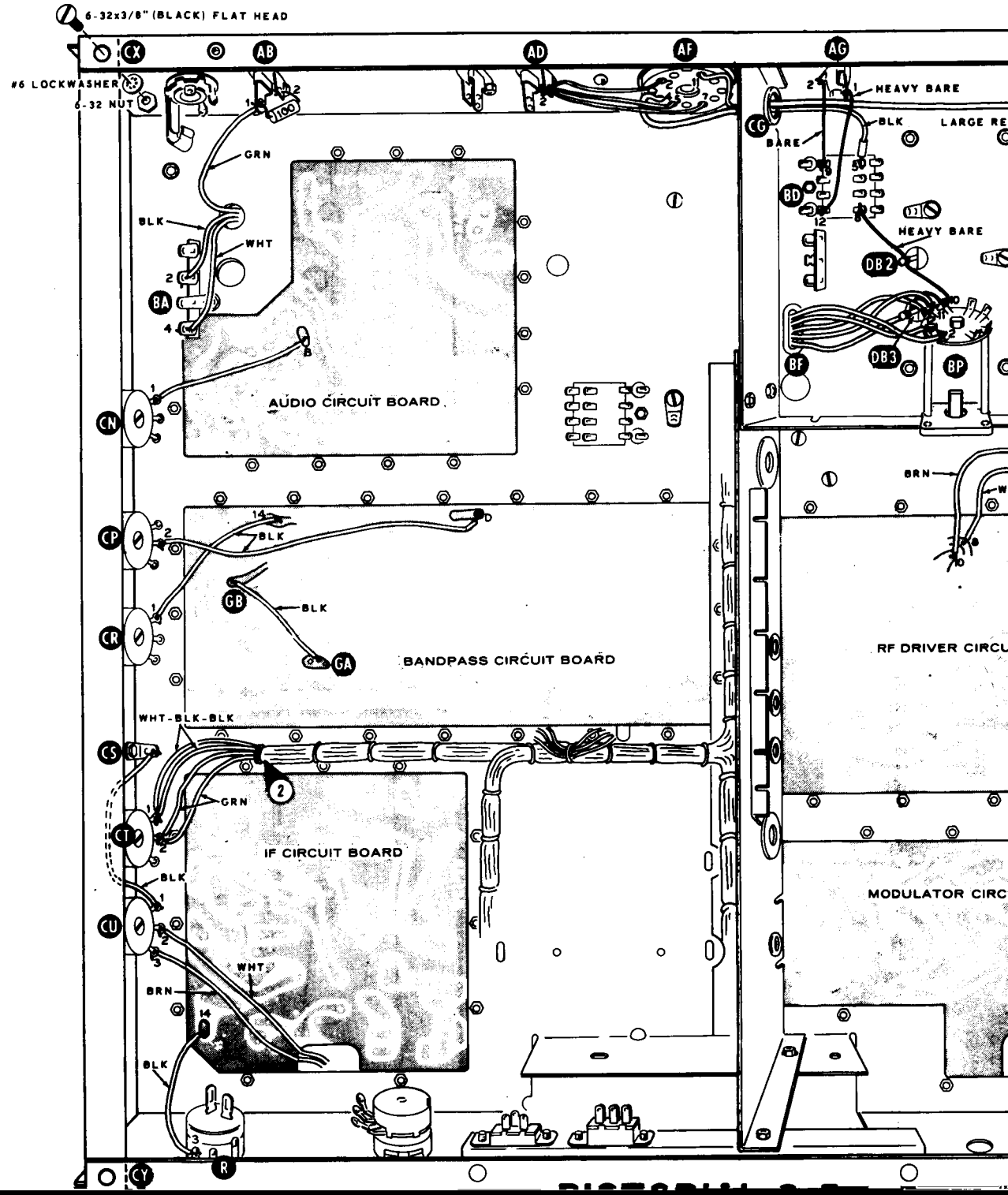
( ) Connect the two green wires from BO#2 to lug 2 of control CT (S-2).

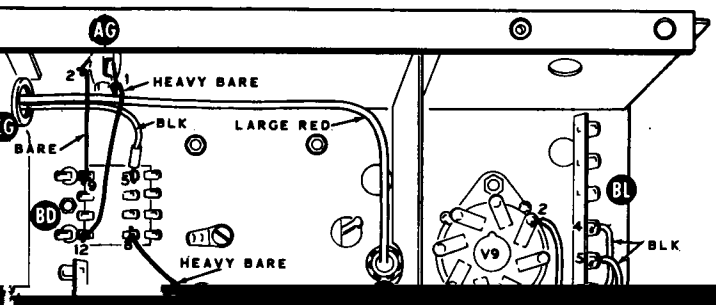
( ) Connect two white-black-black wires from BO#2 to lug 1 of control CT (S-2).

( ) Connect the black wire from point 14 on the bandpass circuit board to lug 1 of control CR (S-1).

( ) Connect the black wire from D on the bandpass circuit board to lug 2 of control CP (NS).

( ) Connect the black wire from B of the audio circuit board to lug 1 of control CN (S-1).

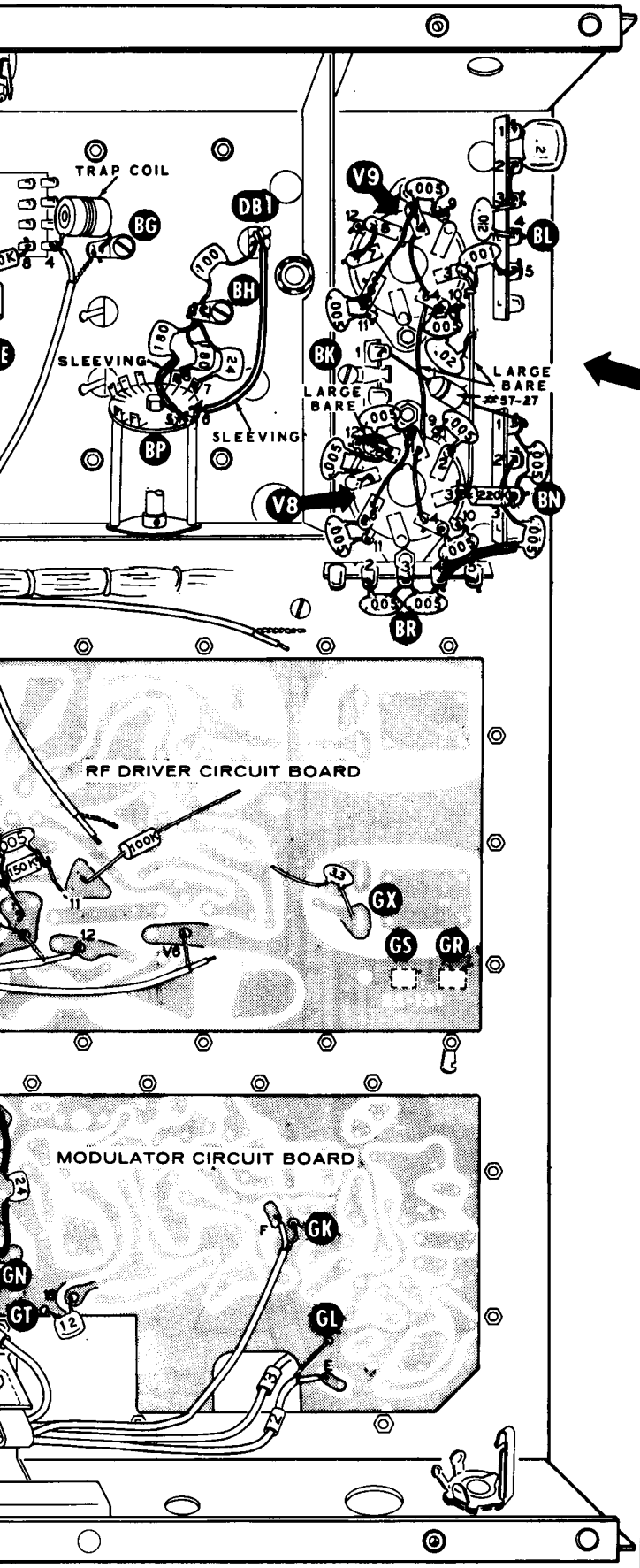

6-32x3/8" (BLACK) FLAT HEAD
#6 LOCKWASHER
6-32 NUT
CX
AB
AD
AF
AG
GRN
BLK
WHT
BA
CN
AUDIO CIRCUIT BOARD
HEAVY BARE
BLK
LARGE RE
BARE
CG
BD
HEAVY BARE
DB2
DB3
BF
BP
BRN
CP
BLK
GB
BLK
GA
CR
BANDPASS CIRCUIT BOARD
RF DRIVER CIRCU
WHT-BLK-BLK
CS
GRN
CT
IF CIRCUIT BOARD
MODULATOR CIRC
BLK
CU
WHT
BRN
BLK
CY
R

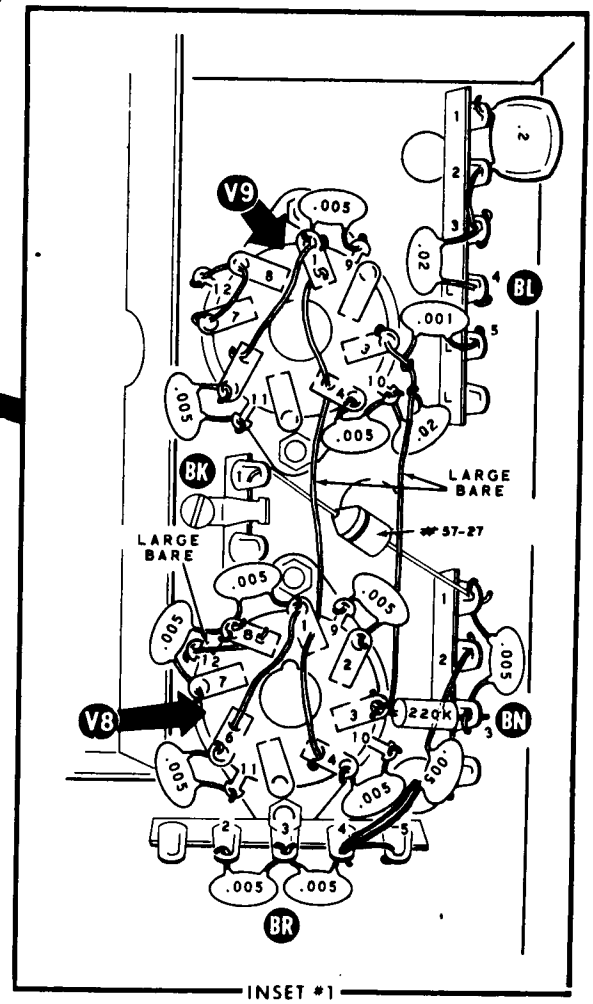

AG
2
1
HEAVY BARE
BLK
LARGE RED
BARE
BD
5
12
HEAVY BARE
V9
2
BL
4
5
BLK

COAXIAL CABLE WIRING

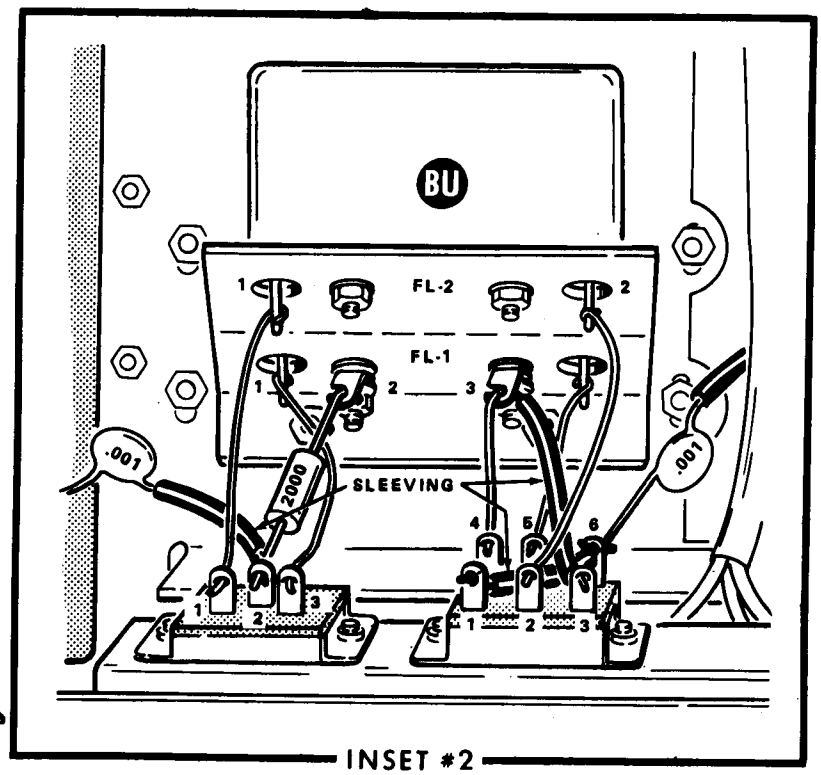
CAUTION: The insulation on the inner lead of a coaxial

( ) At the other end of this cable, connect the center conductor to F (S-1) and the shield lead to the ground foil at GK (S-1) on the modulator circuit board.

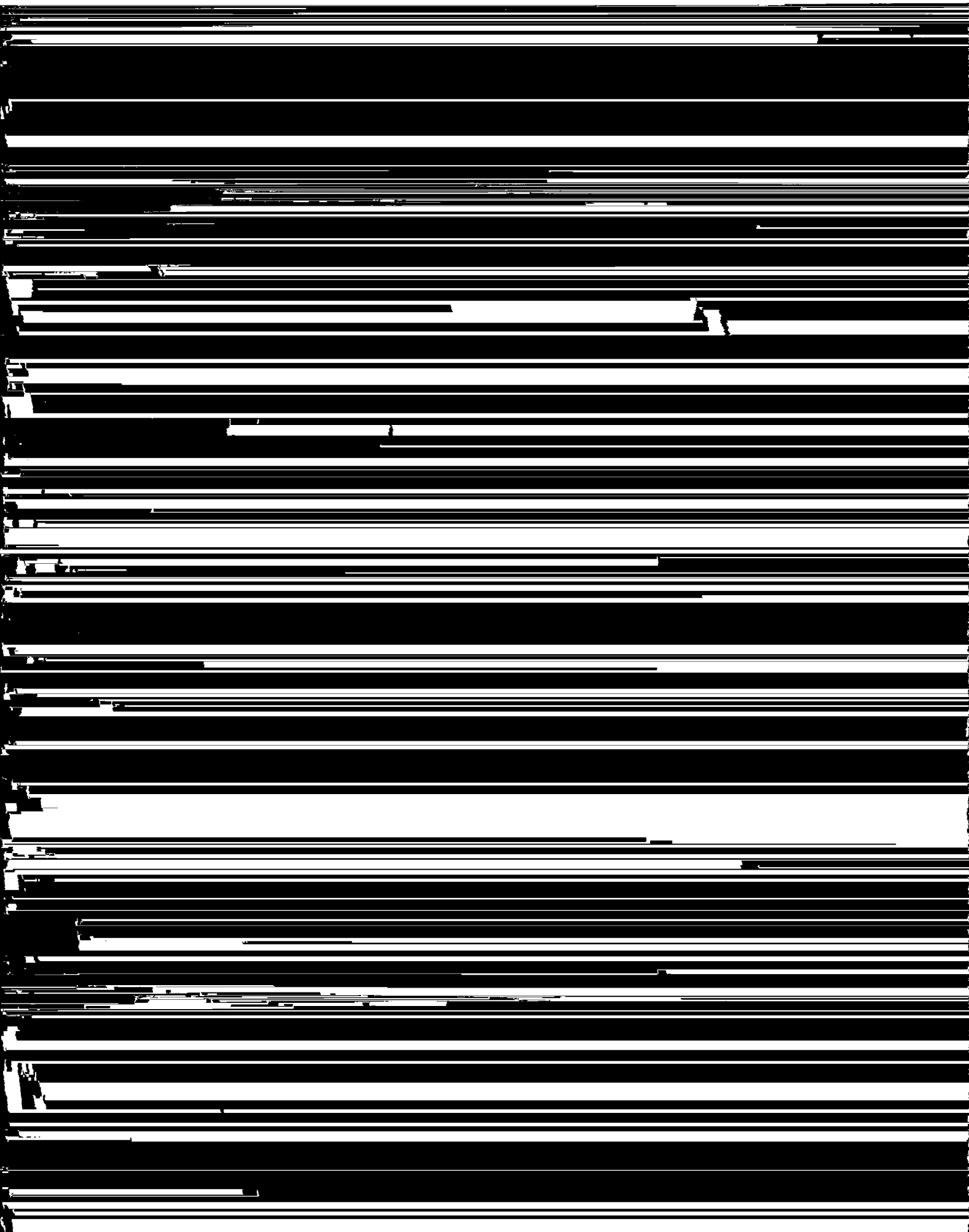




INSET #1



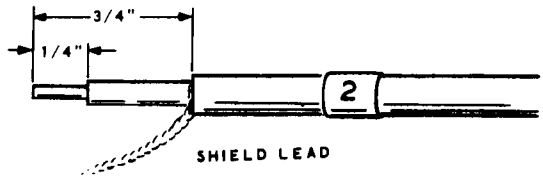
INSET #2



( ) Cut a 19", a 22-1/2", a 21-1/2", and a 24" length of coaxial cable. Do not prepare the ends.

( ) Group the four lengths of coaxial cable together in one hand, even the ends, and push them through the 11-3/8" large black sleeving. NOTE: You may wish to cut the sleeving into three equal lengths so you can more easily insert the coaxial cables. You may also use petroleum jelly to make it easier to slide the cables into the sleeving; use a cloth to clean the cables after they are in

( ) Refer to Detail 8-6D and prepare all the ends of the four coaxial cables in the large sleeving.



Detail 8-6D

Connect the ends of the coaxial cables coming from the black sleeving between BO#5 and BO#8 as follows:

( ) #1: Center conductor to C on the audio circuit board (S-1), and the shield lead to the adjacent ground foil as shown. (S-1).

( ) #2: Center conductor to lug 2 of control CN (S-1), and the shield lead to lug 3 (S-1).

( ) #3: Center conductor to lug 3 of control CP (S-1) and the shield lead to lug 1 (NS).

( ) #4: Center conductor to E on the bandpass circuit board (S-1) and the shield lead to point GD (S-1). Make sure the end of the shield lead does not protrude beyond the surface of the circuit board.

Connect the four coaxial cables coming from the other end of the large black sleeving as follows:

( ) #1: Center conductor to lug 2 of control R (S-1), and shield lead to lug 1 (S-1). Loosen and retighten the control, if necessary, to make the connection.

( ) #2: Center conductor to E on the modulator circuit board (S-1) and the shield lead to GL (S-1).

( ) #3: Pass the end of the cable up to the top of the chassis through the notch in the modulator circuit board. This end will be connected later.

( ) #4: Center conductor to G on the modulator circuit board (S-1) and the shield lead to GN (S-1).

COMPONENT MOUNTING-CHASSIS BOTTOM

Refer to Pictorial 8-6 for the following steps.

( ) Place a 1-1/2" length of black sleeving over a 2" length of large bare wire. Connect this bare wire from lug 6 of switch BP (S-1) to lug DB1 (S-2).

( ) Connect a .02 μF disc capacitor from lug 2 of terminal strip BE (NS) to lug 14 of relay BD (S-2).

( ) Connect a .01 μF disc capacitor between lugs 2 (NS) and 3 (NS) of terminal strip BE.

( ) Connect a 330 Ω (orange-orange-brown) resistor between lugs 1 (NS) and 2 (S-3) of terminal strip BE.

( ) Connect a 10 kΩ (brown-black-orange) resistor from lug 1 of terminal strip BE (NS) to lug 8 of relay BD (S-2). NOTE: In the following step, mount the diode so the body is 3/8" above the terminal strip.

( ) Connect the lead from the banded end of a 1N191 diode (#56-26) to lug 1 (S-3) and the other lead to lug 3 (S-3) of terminal strip BE.

( ) Connect either lead of an 8.5 MHz trap coil (#40-546) to lug 4 of relay BD (S-2). Connect the other lead to solder lug BG (S-2).

( ) Connect a 1" length of large bare wire from lug 12 (S-1), through lug 8 (S-2) to lug 7 (S-1) of tube socket V9.

( ) Connect a 3/4" length of large bare wire from lug 12 (S-1) to lug 8 (NS) of tube socket V8. Note that there are two holes in each lug. Position this wire in the lower hole (next to the body of the socket).

( ) Push a 3" length of bare wire through lugs 4 (NS) and 1 (NS) of tube socket V8 and through lug 4 (NS) to lug 1 (NS) of tube socket V9. Place this wire in the lower hole of the lugs.

( ) Pass one lead of a .005 μF disc capacitor through lug 1 (S-4) to lug 6 (NS) of tube socket V8. Connect the other lead to lug 8 of the same tube socket (NS).

( ) Connect a .005 μF disc capacitor from lug 6 (S-2) to lug 11 (S-1) of tube socket V8.

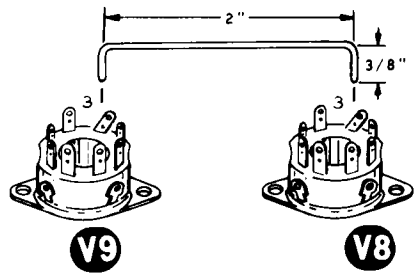
( ) Connect a .005 μF disc capacitor from lug 4 (S-2) to lug 10 (S-1) of tube socket V8.

( ) Connect a .005 μF disc capacitor between lugs 7 (S-3) and 8 (NS) of tube socket V8.

( ) Connect a .005 μF disc capacitor between lugs 2 (S-4) and 9 (S-1) of tube socket V8.

( ) Connect a .005 μF disc capacitor from lug 2 (NS) to lug 3 (NS) of terminal strip BR.

( ) Connect one lead of a .005 μF disc capacitor to lug 3 of terminal strip BR (S-2). Pass the other lead of this capacitor through lug 4 (NS) to lug 5 (NS) of this



Detail 8-6H

( ) Refer to Detail 8-6H and form a 2-3/4" length of large bare wire as shown. Connect this wire from lug 3 of tube socket V8 (S-2) to lug 3 of tube socket V9 (S-1). Bend the lugs out to permit the wire to enter the lugs easily. Do not attempt to bend the wires around the lugs.

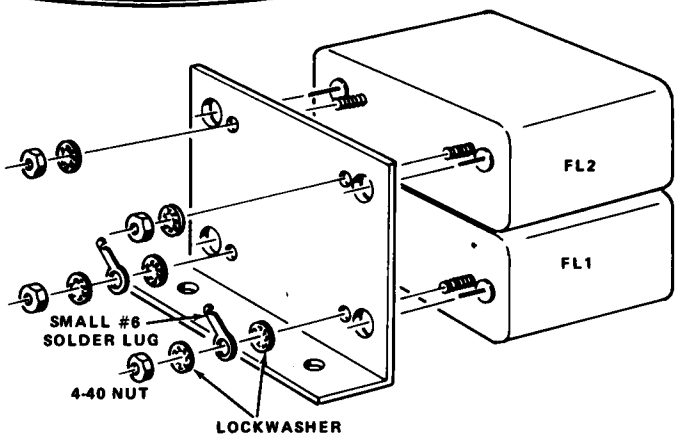
( ) Connect a .02 μF disc capacitor from lug 10 of tube

( ) Cut each lead of a 3.3 pF disc capacitor to 5/8". Bend a 1/8" foot on the end of one lead and position this foot at point GX on the RF driver circuit board (S-1). The other lead of this capacitor will be connected later.

( ) Place a 5/8" length of black sleeving on each lead of a

( ) Connect a 500 pF disc capacitor between lugs 1 (S-2) and 2 (S-2) of control CP.

( ) Pass one lead of a 2.2 MΩ (red-red-green) resistor through lug 3 (S-2) to lug 2 (S-1) of control CR.

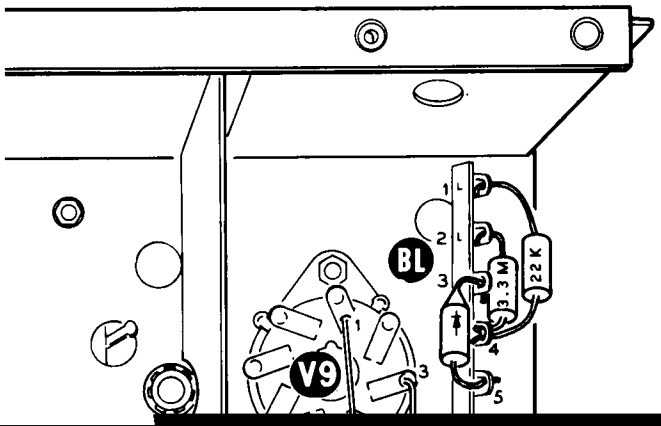


NOTE: Use 1/2 watt resistors unless the step directs otherwise.

( ) Connect a 1-3/4" bare wire from lug 1 of crystal filter FL-1 (S-1) to lug 3 of of switch EB (S-1).

( ) Connect a 2000 Ω (red-black-red) resistor from solder lug 2 of crystal filter FL-1 (S-1) to lug 2 of switch EB (NS).

( ) Place a 3/4" length of sleeving over one lead of a .001 μF disc capacitor. Connect this lead to lug 2 of switch EB (S-2) and connect the other lead to hole 15 on the IF circuit board (S-1). Check the Pictorial for the

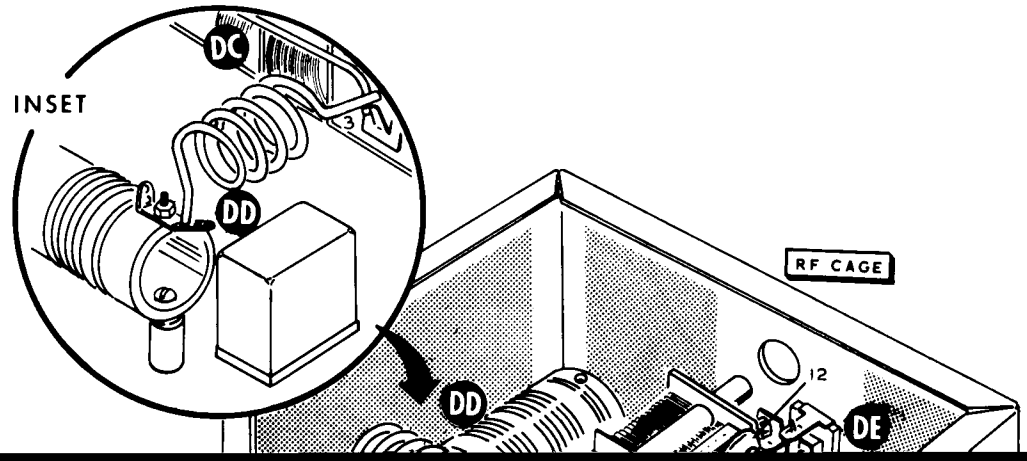


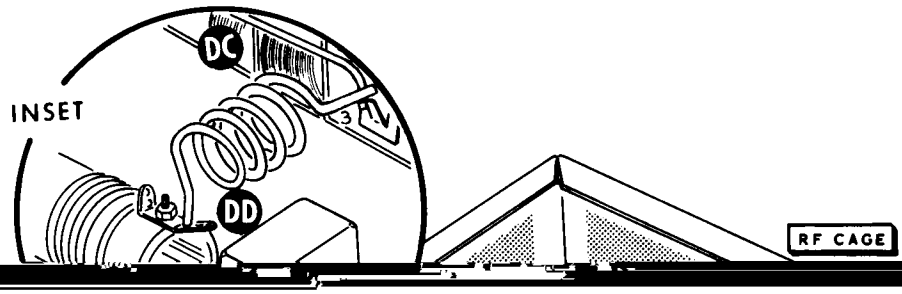
between lug 3 of tube socket V8 and lug 3 of tube socket V9 (S-1).

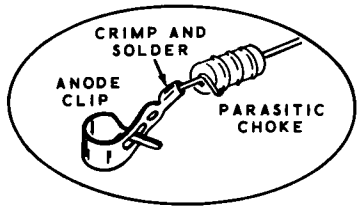
( ) Connect a 2.2 Ω (red-red-gold) 2 watt resistor from lug 6 of tube socket V9 (S-3) to lug 8 of tube socket V8 (S-4).

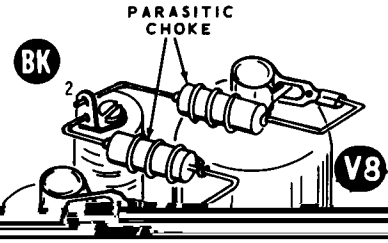
( ) Connect a 3.3 MΩ (orange-orange-green) resistor between lugs 2 (S-3) and 4 (NS) of terminal strip BL.

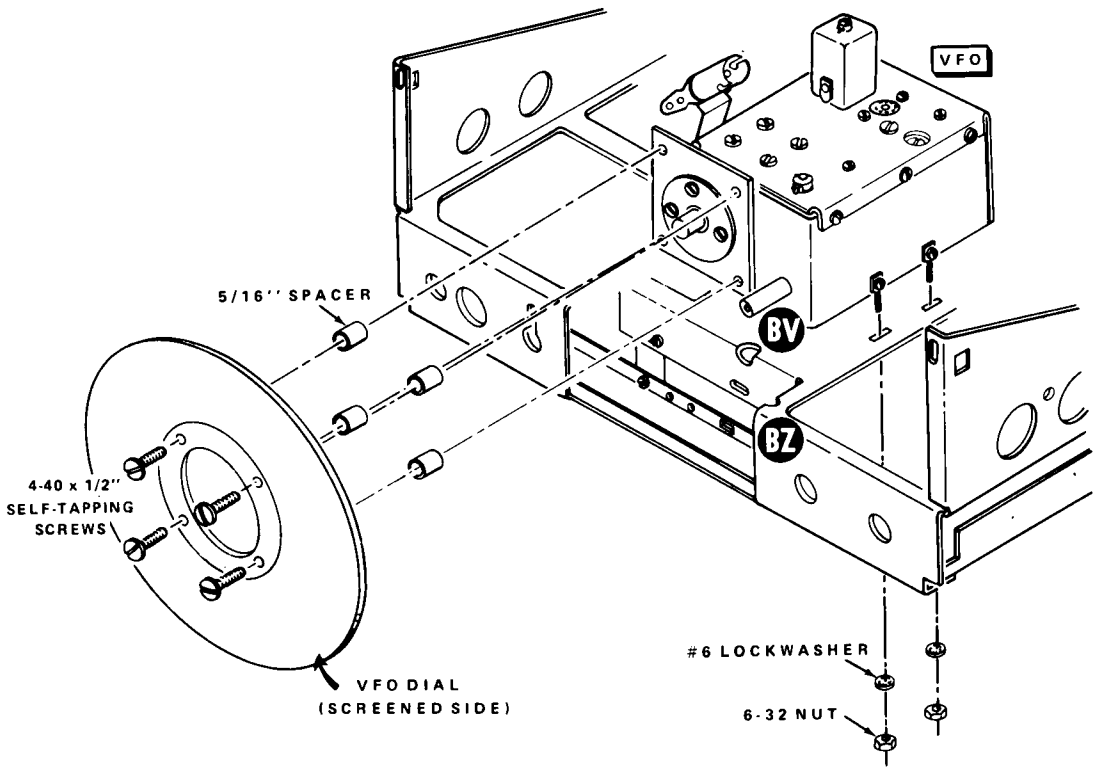
( ) Connect a 22 kΩ (red-red-orange) resistor between lugs 1 (S-2) and 4 (S-4) of terminal strip BL.


INSET
DC
3
DD
RF CAGE
12
DD
DE


INSET
DC
DD
RF CAGE

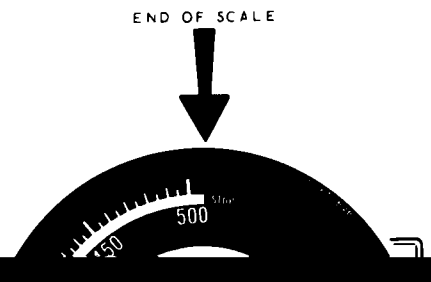

CRIMP AND SOLDER
ANODE CLIP
PARASITIC CHOKE


PARASITIC CHOKE
BK
2
V8



PICTORIAL 8-9

Refer to Pictorial 8-9 for the following steps.



( ) Squeeze out some grease from the silicone grease pod and apply a small amount to the gears of the VFO tuning capacitor at the point where they meet. Rotate the shaft several times to distribute the grease to all the gear teeth.

( ) Remove the protective backing from the circular dial.

MOUNTING PARTS-FRONT PANEL

Refer to Pictorial 8-10 for the following steps.

( ) Lay a soft cloth on the work area to prevent scratching of the front panel. Position the panel as shown.

( ) Mount the Jackson drive on the dial drive plate. Use 3-48 x 1/4" hardware. Remove and discard the two small brass screws as before.

( ) Fit the escutcheon to the front of the panel with one mounting stud in each of the four holes. Align the openings in the escutcheon and the panel.

( ) Remove the protective strip from the dial window (#446-41-2). Fit the two holes over the upper two escutcheon studs, and press the adhesive against the back of the panel.

( ) Place a speednut over each of the four escutcheon studs and press the nuts firmly against the back of the panel.

( ) Mount this dial drive assembly on the front panel at D. Use 4-40 x 3/8" screws in the two tapped holes. Leave these screws finger-tight only.

NOTE: Wherever solder lugs are used on the front panel, scrape off any excess paint around the hole on the inside of the panel, and at the points shown on the Pictorial.

( ) Mount a 10 kΩ - 1 MΩ dual control (#12-48) at F. Use a control solder lug, a control flat washer, and a control nut. Position the control and solder lug as shown in the Pictorial. Bend the solder lug against lug 1 (NS) and cut off the 1/4" excess.

( ) Mount a 4-position 2-section switch (#63-399) at G. Use a control solder lug, a control flat washer, and a control nut. Reshape the solder lug as shown so it will touch lug 7 of the rear wafer.

( ) Mount a DPTT slide switch at J. Use 6-32 x 3/8" hardware .

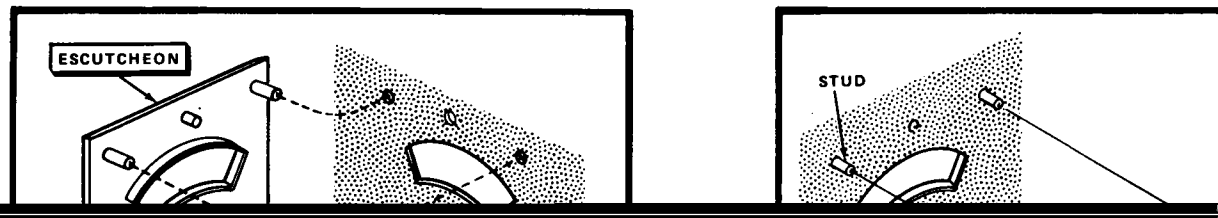
( ) Mount a DPTT slide switch at K. Use 6-32 x 3/8" hardware.

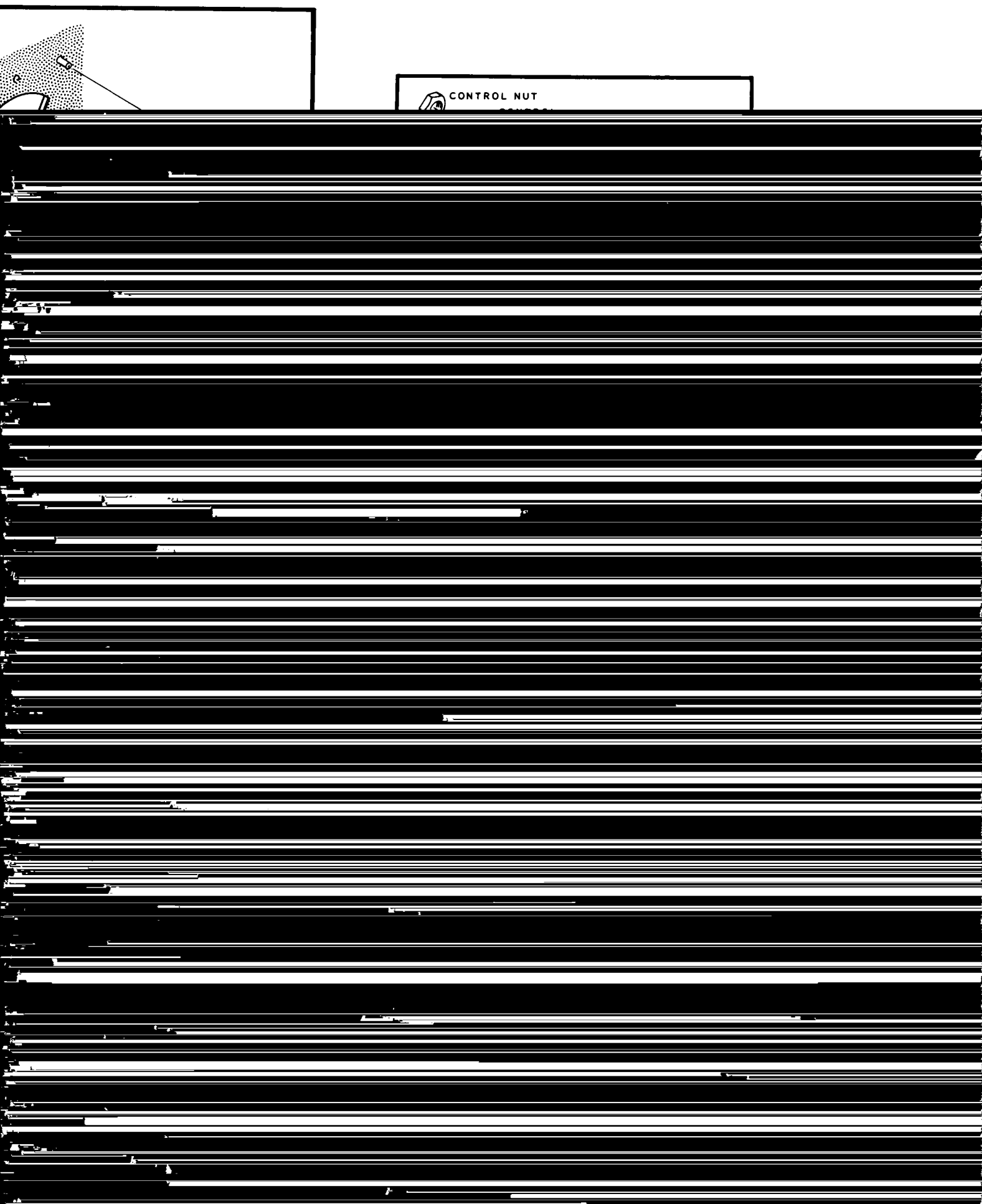
( ) Remove and discard the wire shorting clip from between the lugs of the meter.

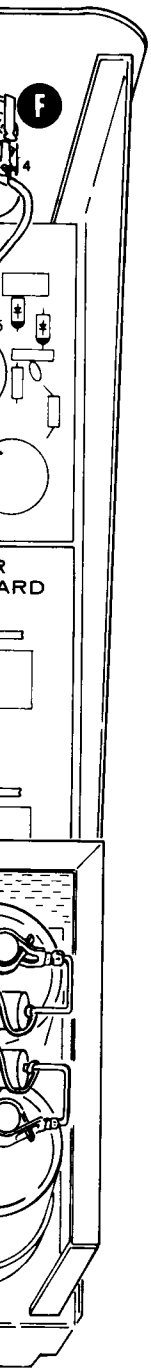
( ) Mount the meter at E, using the lockwashers and nuts furnished with the meter. Do not overtighten the nuts.

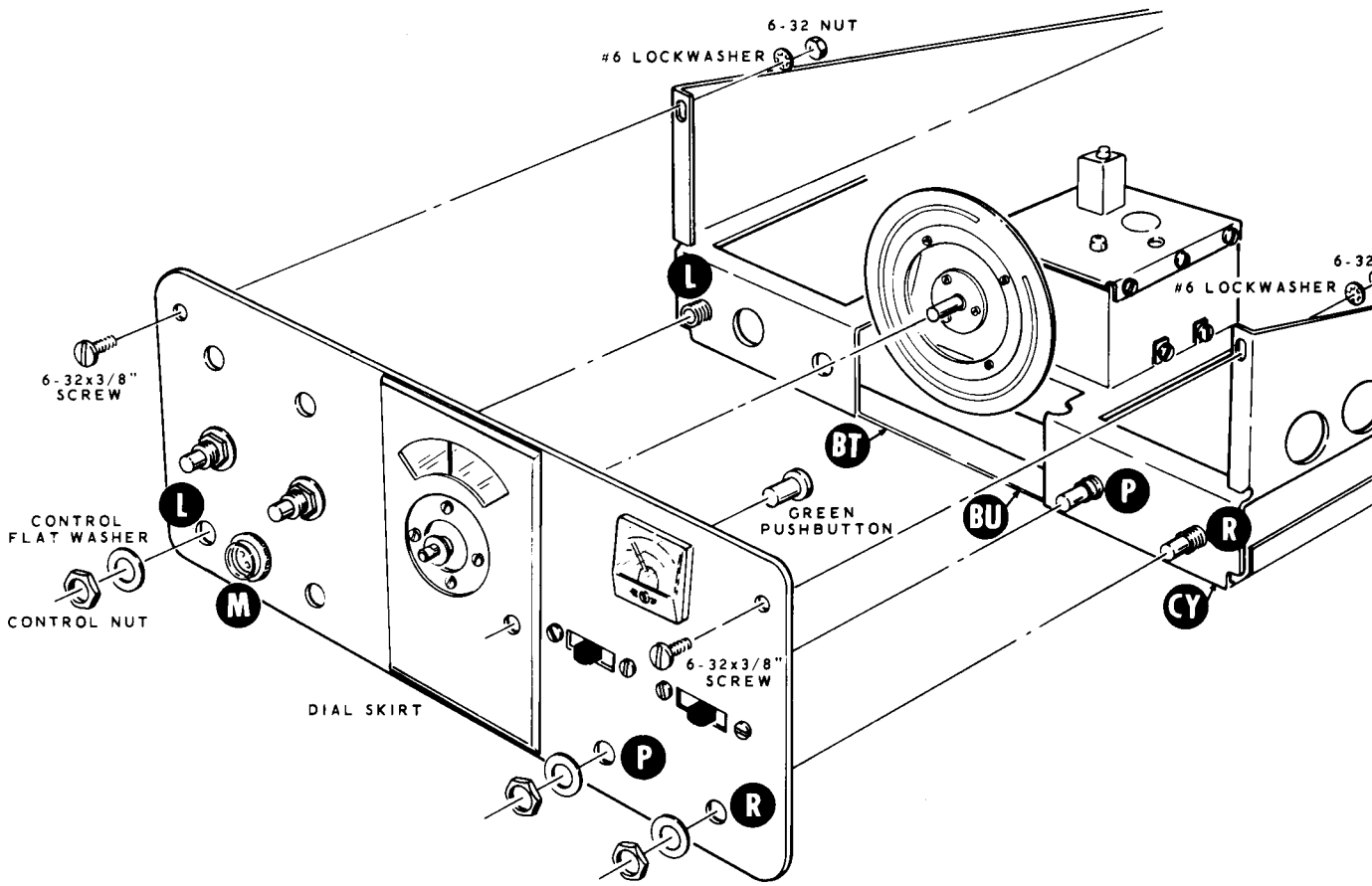
NOTE: Before mounting the microphone chassis connector in the following step, be sure the small screw that holds the connector together is snug, but not too tight. Place a drop of fingernail polish or glue over the head of this screw to keep it from working loose.

( ) Mount the microphone chassis connector on the front of the panel at M with only the nut supplied with the connector. Position lug 1 as shown. Lug numbers are molded into the connector. Tighten the nut to draw the connector into the panel. Then, without disturbing the connector, remove the nut. It will be reinstalled later, together with the lockwasher.

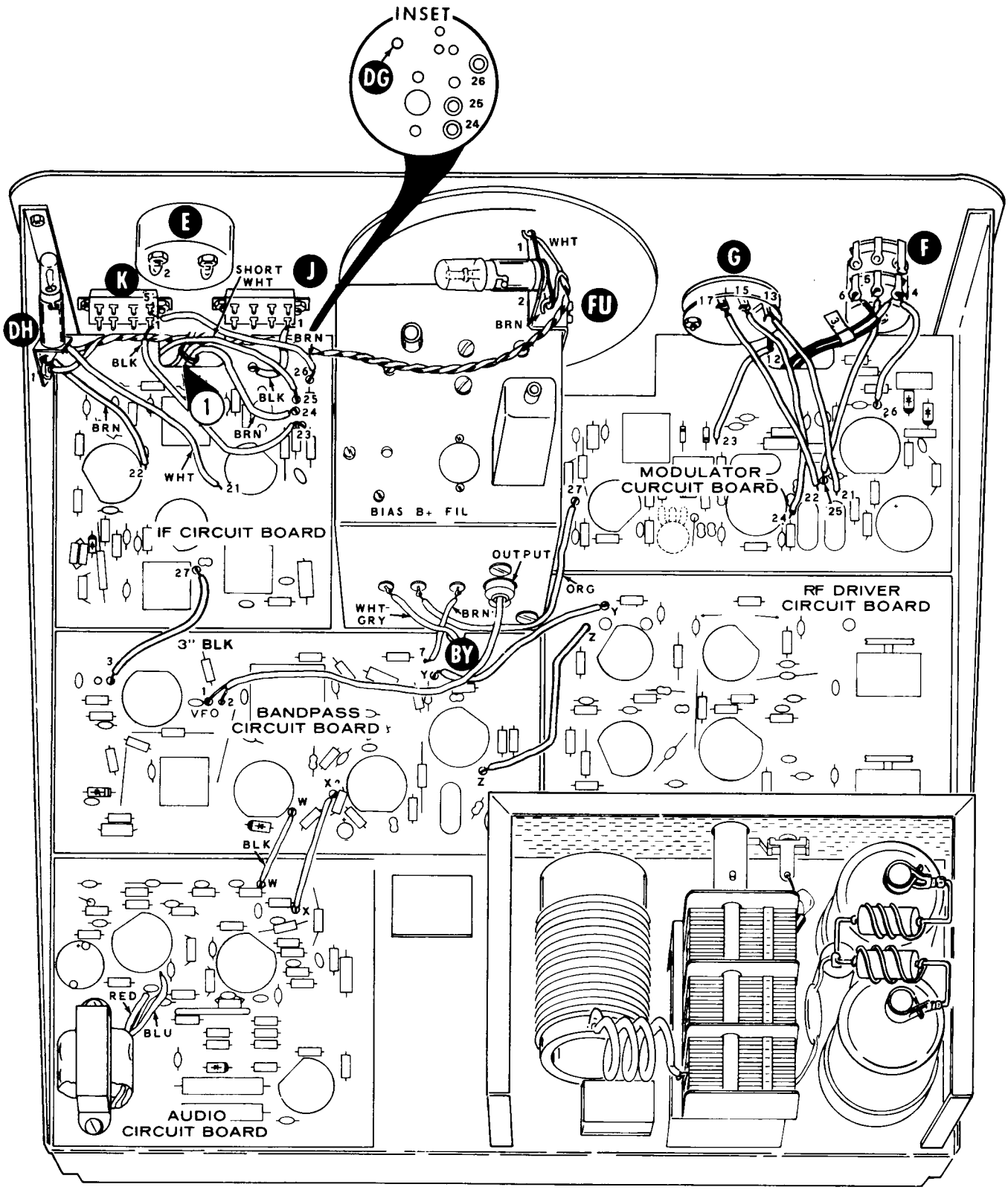

ESCUTCHEON
STUD


CONTROL NUT





PICTORIAL 8-13

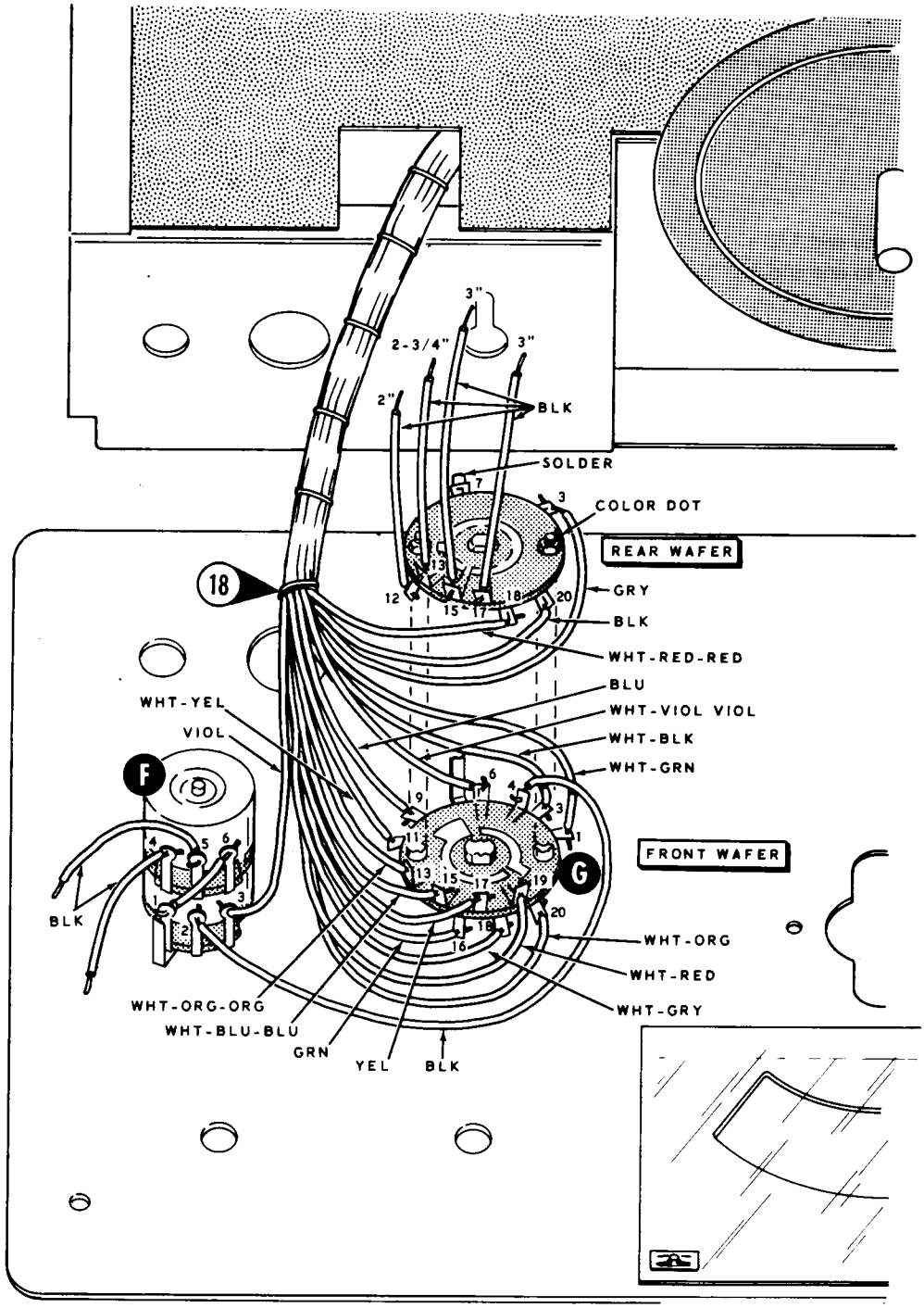


6-32x3/8 SCREW

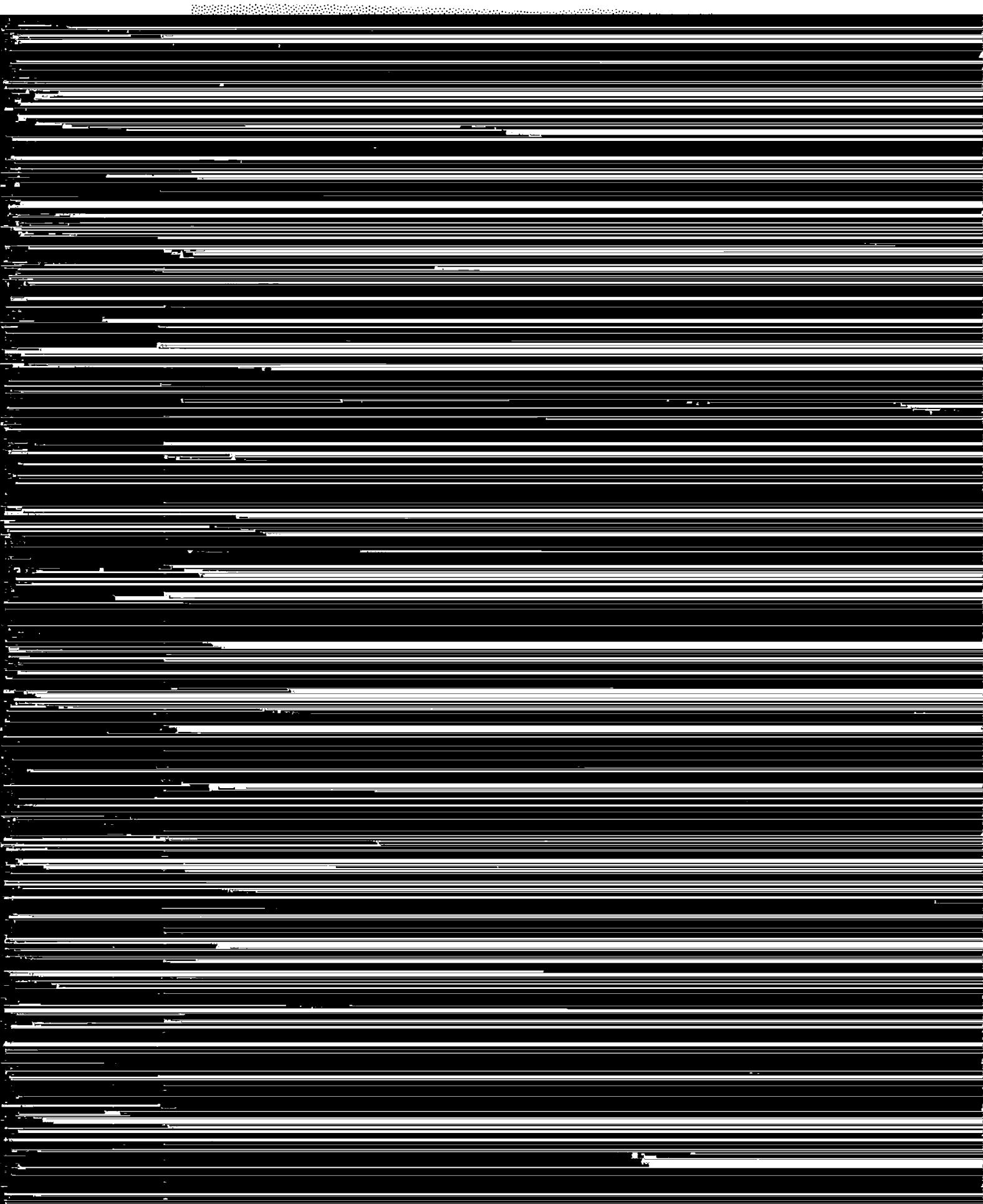
CONTROL FLAT WASH

CONTROL N

PICTORIAL 8-14



PICTORIAL 8-11



FRONT PANEL MOUNTING

Refer to Pictorial 8-13 (fold-out from Page 80) for the following steps.

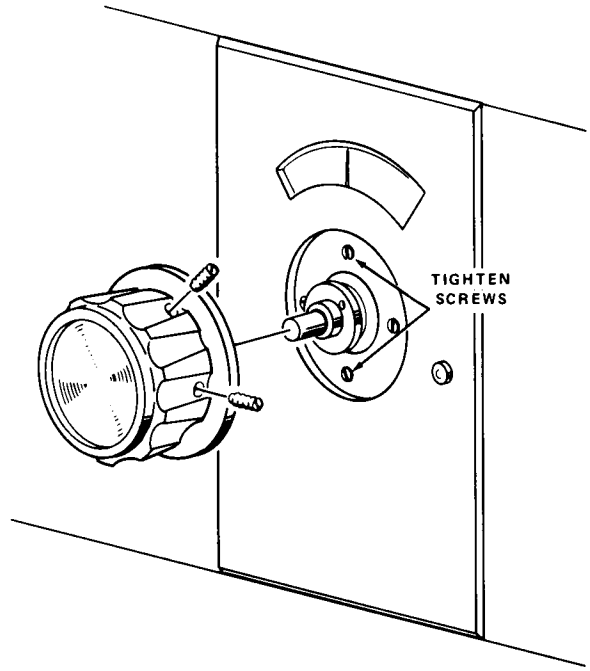
( ) Remove the control nuts and control flat washers from the controls at R and P, and from jack L.

( ) Insert the pushbutton into the Zero Set hole from the back of the panel.

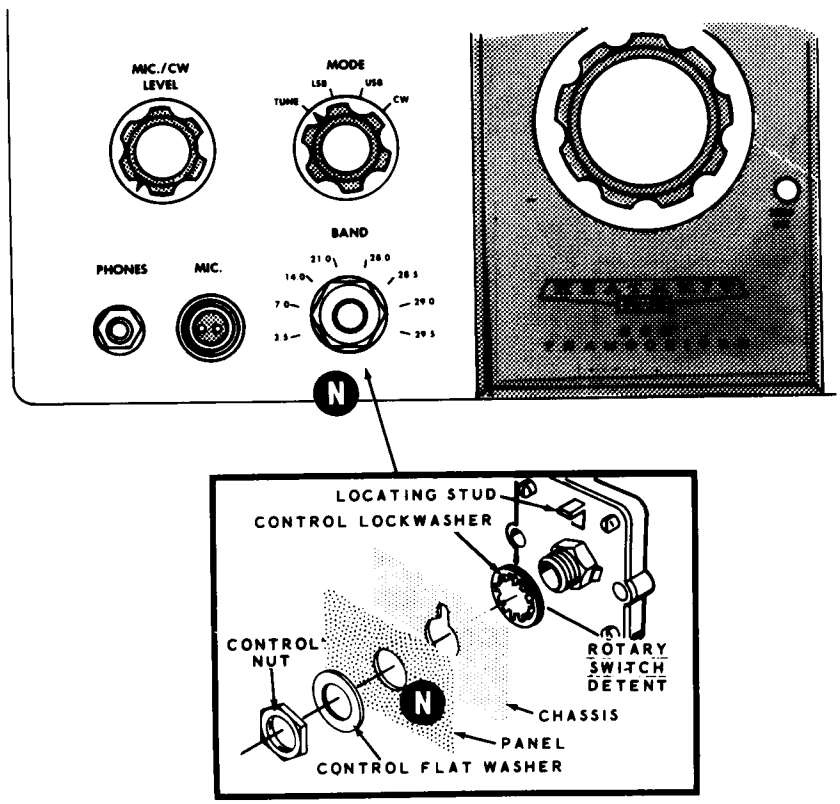
( ) Tip the front panel up into place while carefully bending the cable assemblies and wires to the switches so the front panel will fit against the front of the chassis. Do not pinch any wires between the front panel and chassis. Be careful not to break the switches. The end of the VFO shaft must enter the recess in the Jackson drive on the panel.

( ) Replace the control nuts and control flat washers at R, P, and L. Do not tighten the nuts at this time.

( ) Place the lockwasher and the nut (removed earlier) on the back of the microphone connector. Do not tighten the nut yet.



Detail 8-13A



Detail 8-13B

( ) Start 6-32 x 3/8" screw, a #6 lockwasher and a 6-32 nut at each upper corner of the panel. Do not tighten the hardware at this time.

( ) Position the front panel so its bottom edge is even with the bottom of the chassis. Tighten the nuts at L and R just enough to hold it in this position.

Refer to Detail 8-13A for the two following steps.

( ) Tighten the two Jackson drive mounting screws.

( ) Start two 8-32 x 1/4" [illegible]

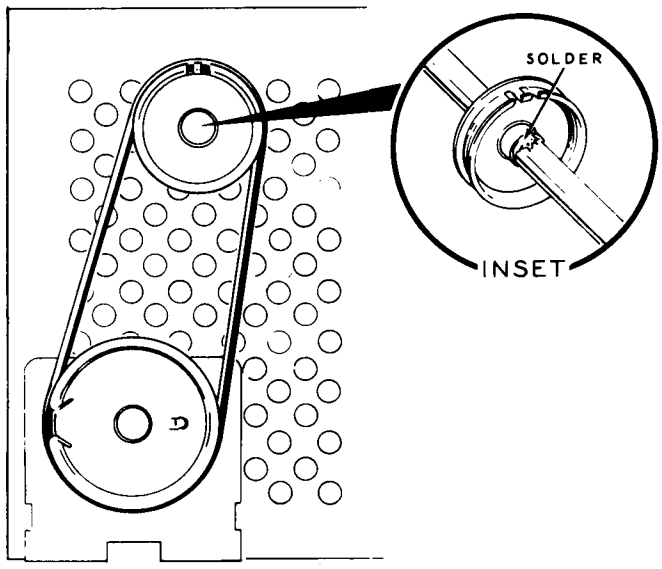
Connect each of the following wires to the designated hole in the IF circuit board:

( ) Connect the black wire from lug 1 of switch J to hole DG on the IF circuit board (S-1), as shown in the inset drawing on the Pictorial. Before soldering the wire, make sure it is connected to the ground (outside) foil of the circuit board.

( ) Brown wire from lug 5 of switch K: Hole 26 (S-1).

( ) Short white wire from the notch in IF circuit board: Hole 25 (S-1)

( ) Connect a 6" orange wire from 27 on the modulator circuit board (S-1) to the B+ terminal on the back of the VFO chassis (S-1).



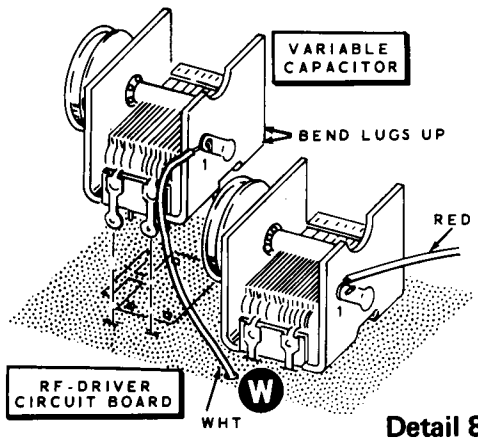
Detail 8-15B

Refer to Detail 8-15B for the following steps.

( ) Slide the rear 3/4" diameter pulley on the shaft in hole A until it is directly in line with the pulley on the variable capacitor mounted on the RF driver circuit board.

( ) Solder the pulley to the shaft as shown in the inset drawing in Detail 8-15B. Allow the pulley to cool before installing the rubber belt in the next step.

( ) Install one of the rubber belts (placed on the shaft earlier) over the lower pulley and then over the upper pulley.



Detail 8-15C

Refer to Detail 8-15C for the following steps.

( ) Remove 1/4" of insulation from only one end of a 2-1/2" white wire. Then connect this wire to lug 1 (S-1) of the remaining 2-section variable capacitor (#26-122). Bend the lug out as before.

( ) Bend the two indicated lugs of this capacitor up tight against the capacitor insulator.

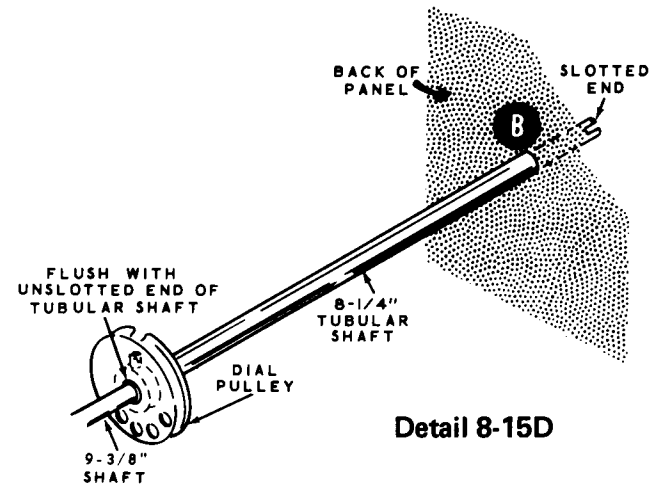
( ) Mount this capacitor at the forward position on the RF driver circuit board. Solder the four pins and two lugs of the capacitor to the circuit board foil.

( ) Insert the white wire from lug 1 of this capacitor down through hole W (about 1/8") on the circuit board. This is the neutralizing wire and its free end is left unconnected.

( ) Position the forward 3/4" diameter pulley so it is directly in line with the pulley on the forward variable capacitor on the RF driver circuit board.

( ) Rotate both the pulleys so their slots are straight up. Solder the loose pulley to the shaft. Allow the pulley to cool before installing the rubber belt in the next step.

( ) Place the remaining rubber belt over the lower pulley and then the upper pulley.

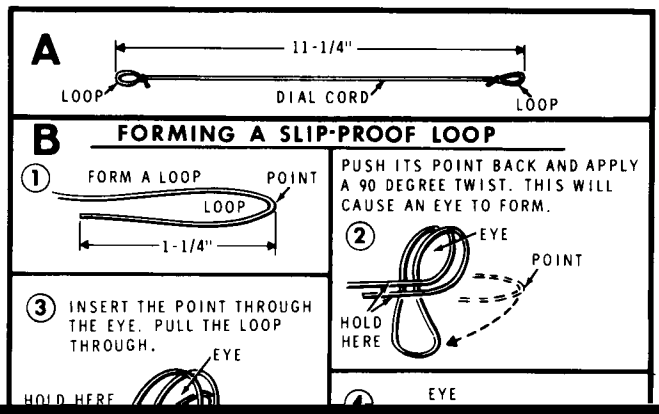


Detail 8-15D

Refer to Detail 8-15D for the following steps.

( ) Pass the unslotted end of the 8-1/4" tubular shaft over the shaft at B (put silicone grease on the solid shaft first) and into the pulley as shown.

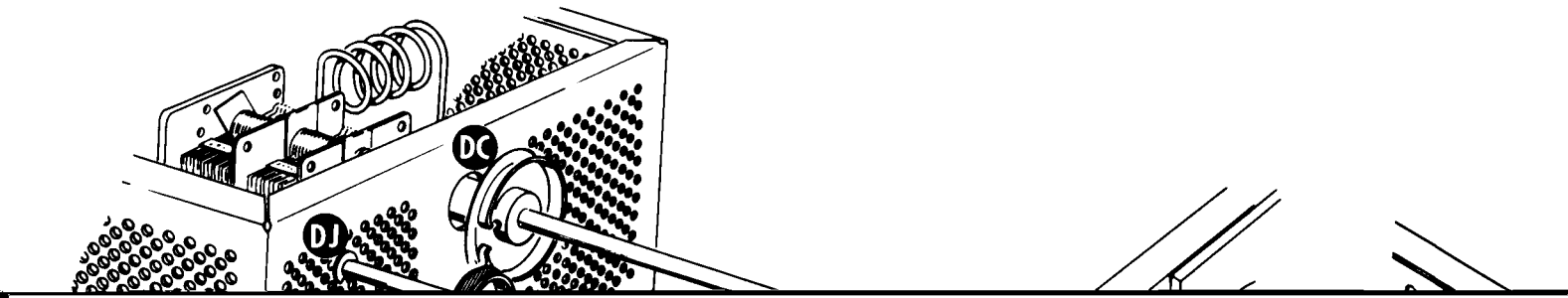
( ) Position this pulley even with the rear of the tubular shaft, and tighten the setscrew. Do not overtighten the setscrew, as this could bend the tubular shaft against the inner shaft and cause them to bind.

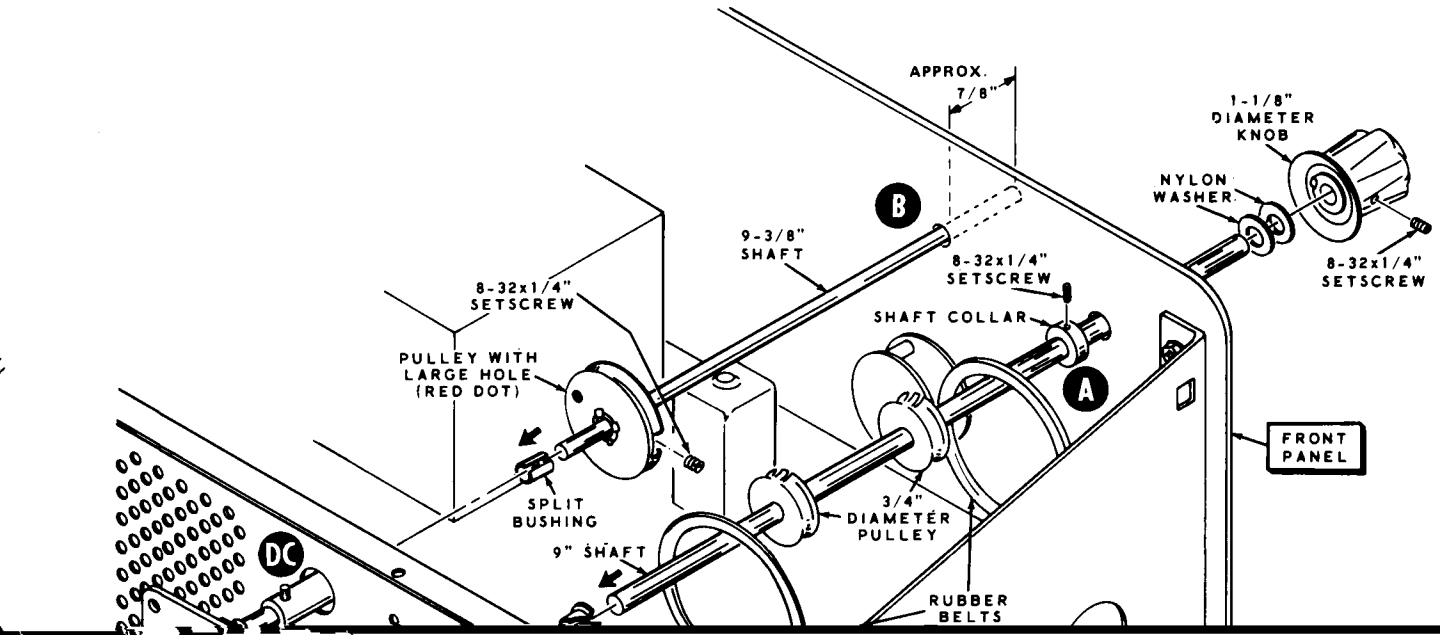


( ) Position pulleys DC and DB with their openings as shown in Detail 8-15F.

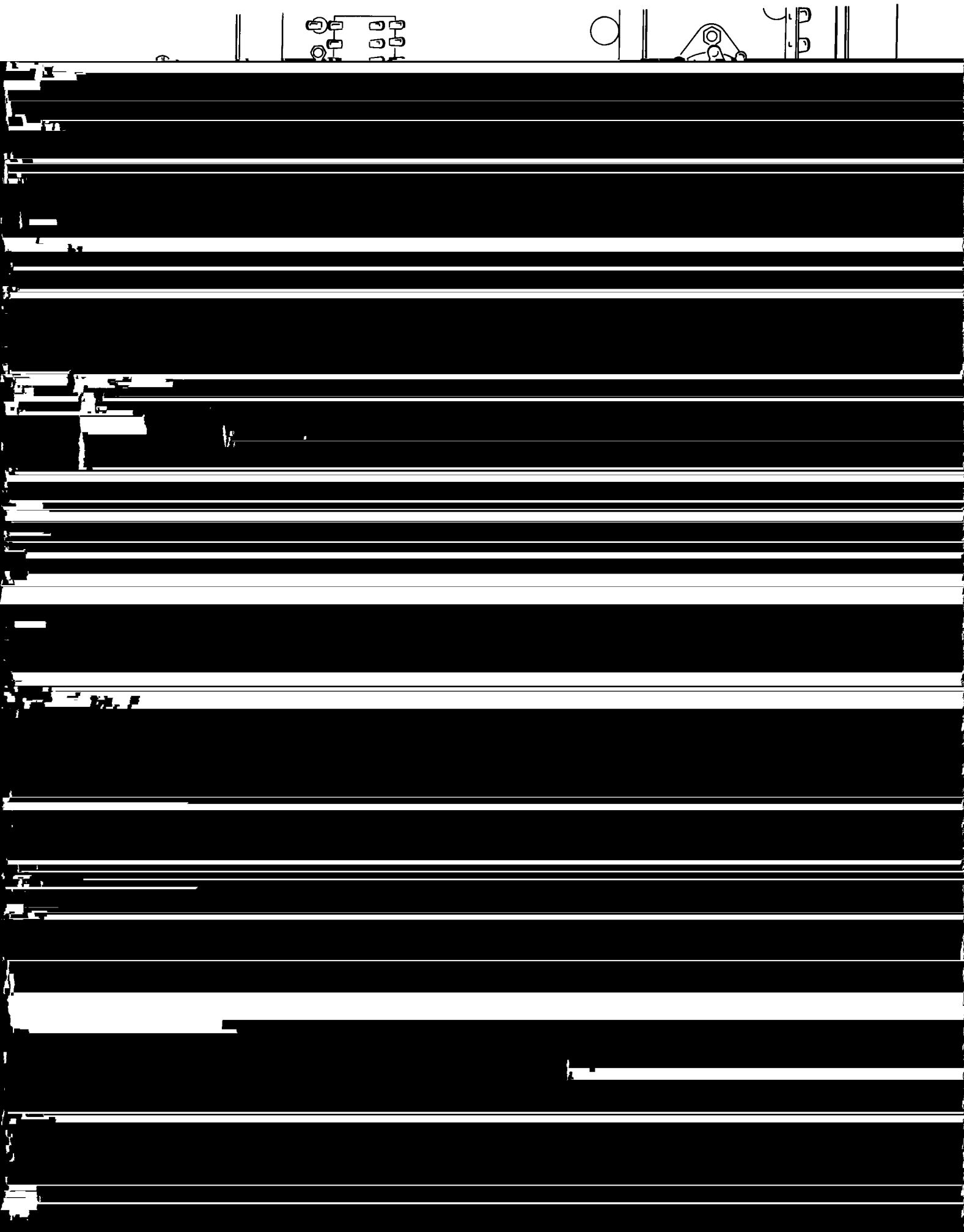
"IMPORTANT: Before you proceed with the following steps, make **sure** the tuning capacitors attached to pulleys DB and DC are **fully meshed**, and that the two pulley openings are as shown in Detail 8-15G. If necessary, loosen the pulley or shaft collar setscrews, reposition the pulleys, making sure the capacitors remain meshed, and then retighten the setscrews."

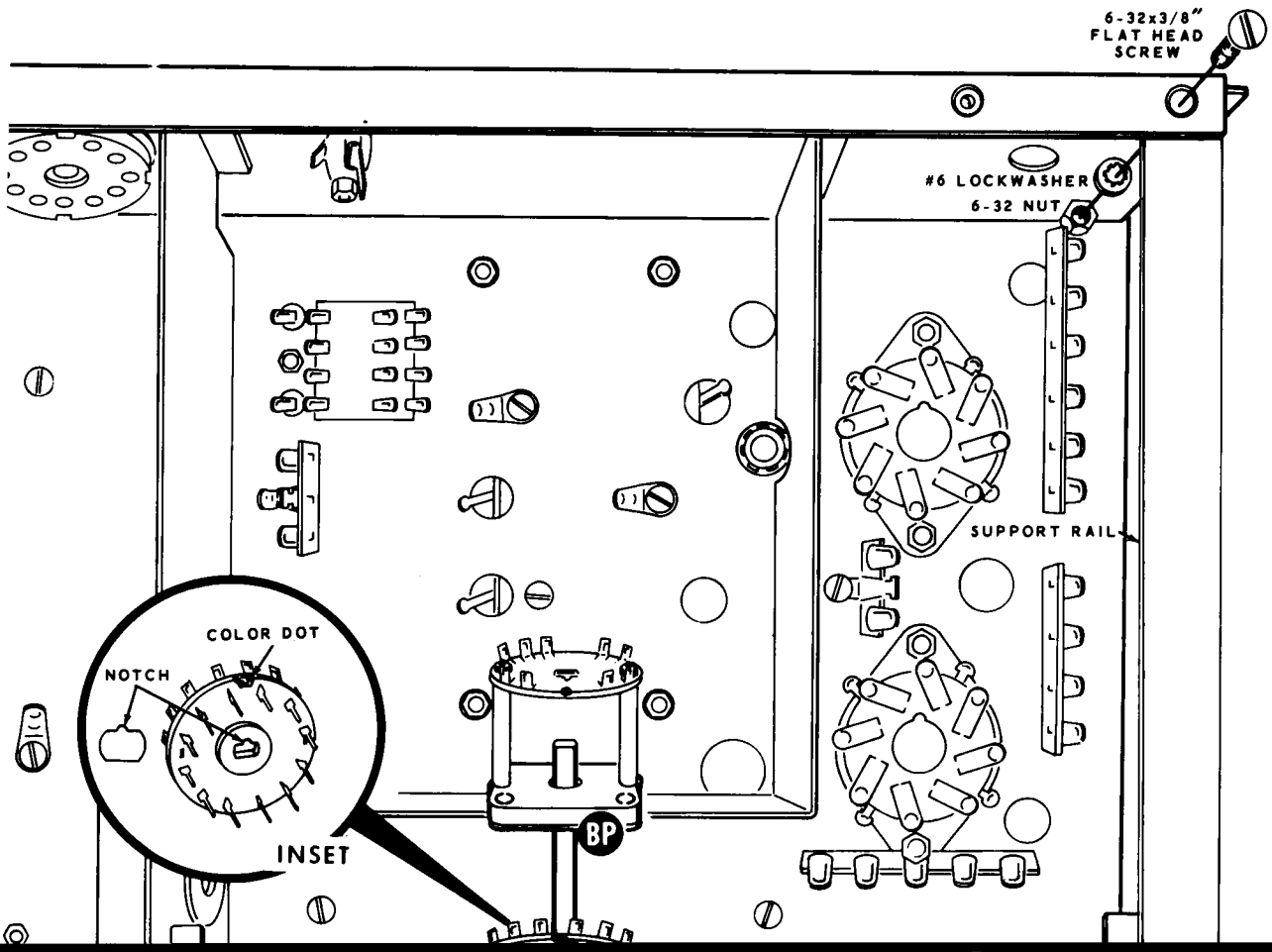
The following dial cord installation is done best as a continuous operation. Therefore, read the next three steps


DC
DJ


APPROX.
7/8"
1-1/8"
DIAMETER
KNOB
NYLON
WASHER
B
9-3/8"
SHAFT
8-32x1/4"
SETSCREW
8-32x1/4"
SETSCREW
8-32x1/4"
SETSCREW
SHAFT COLLAR
PULLEY WITH
LARGE HOLE
(RED DOT)
A
FRONT
PANEL
SPLIT
BUSHING
3/4"
DIAMETER
PULLEY
DC
9" SHAFT
RUBBER
BELTS


HEATHKIT




6-32x3/8"
FLAT HEAD
SCREW
#6 LOCKWASHER
6-32 NUT
SUPPORT RAIL
COLOR DOT
NOTCH
INSET
BP

Refer to Pictorial 8-16 for the following steps.

NOTE: Before connecting the coaxial cables in the two steps following, carefully observe two holes at A in the same foil, and two holes at B in another foil. Be careful not to confuse the holes for each letter.

Connect the coaxial cable coming from relay BG to the driver plate Switch-Board as follows:

( ) Inner lead to A (S-1) and the shield to B (S-1).

Connect the coaxial cable coming from the bandpass circuit board to the driver plate Switch-Board as follows:

( ) Inner lead to A (S-1) and the shield to B (S-1). Bend the switch lug near B out of the way.

( ) Pass one lead of a 180 pF mica capacitor through lug 1 of terminal strip BR (S-3) to lug 5 of tube socket V8 (S-2). Connect the other lead to 2 on the driver plate Switch-Board (S-1).

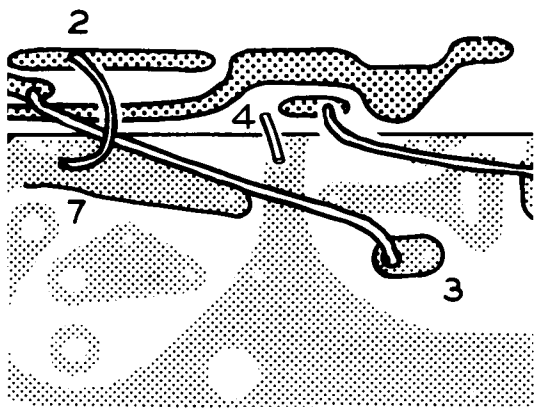
NOTE: Position the driver plate Switch-Board perpendicular to the RF driver circuit board before making the following connections.

( ) Refer to Detail 8-16C, and connect a 3/4" bare wire from the ground foil on the driver plate switch-board to the ground foil on the RF driver circuit board as shown.

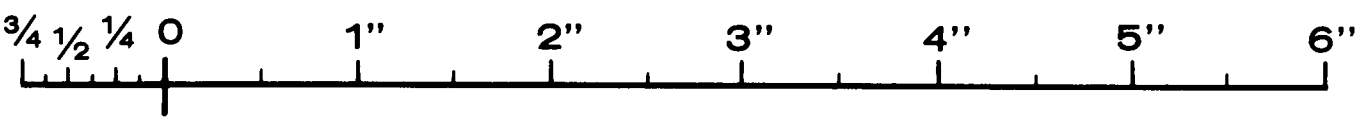
( ) Connect a 1-3/4" bare wire from 3 on the driver plate Switch-Board (S-1) to 3 on the RF driver circuit board (S-1).

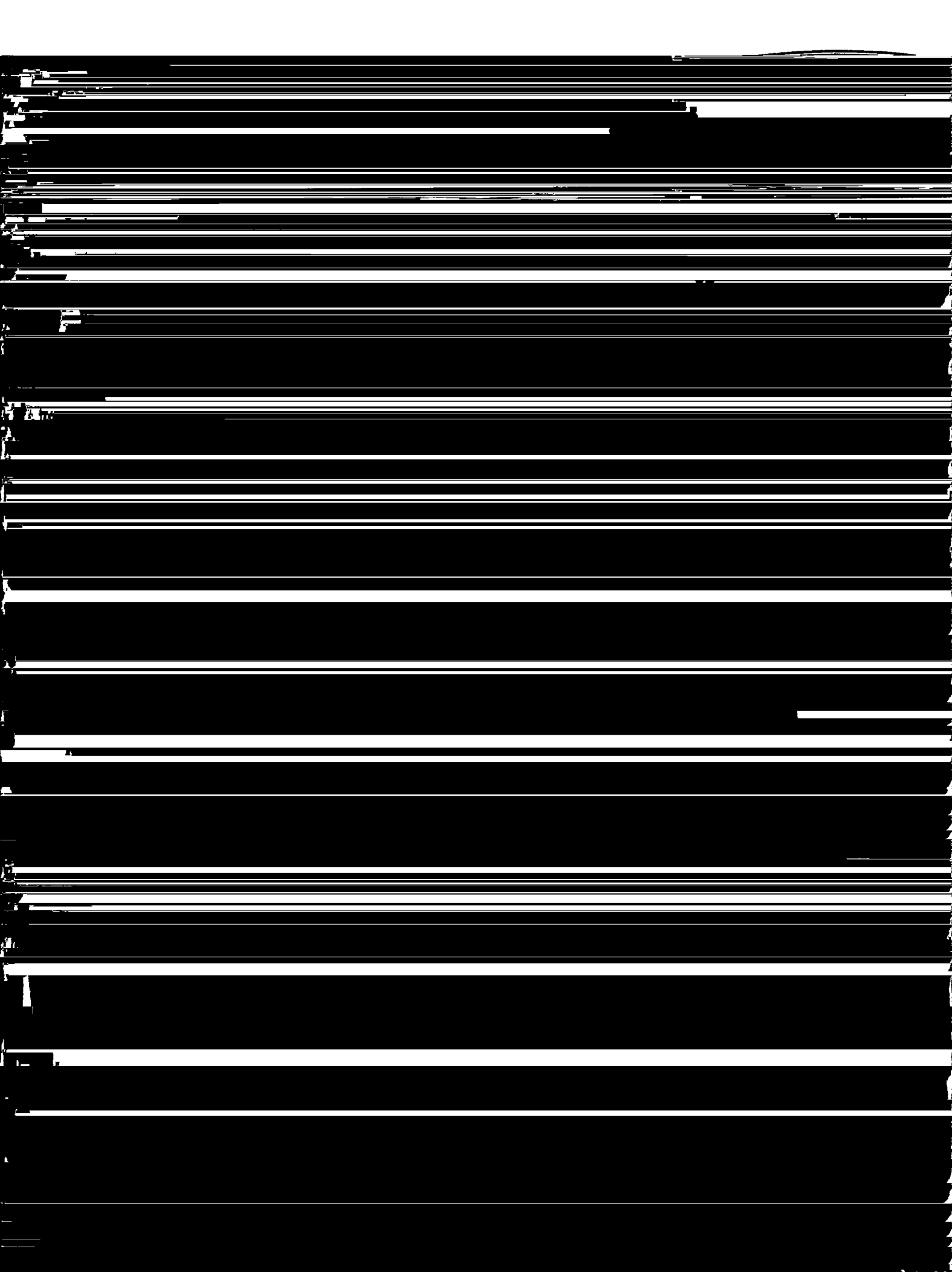
( ) Connect a 1-1/2" bare wire from 2 on the driver plate Switch-Board (S-1) to 7 on the RF driver circuit board (S-1).

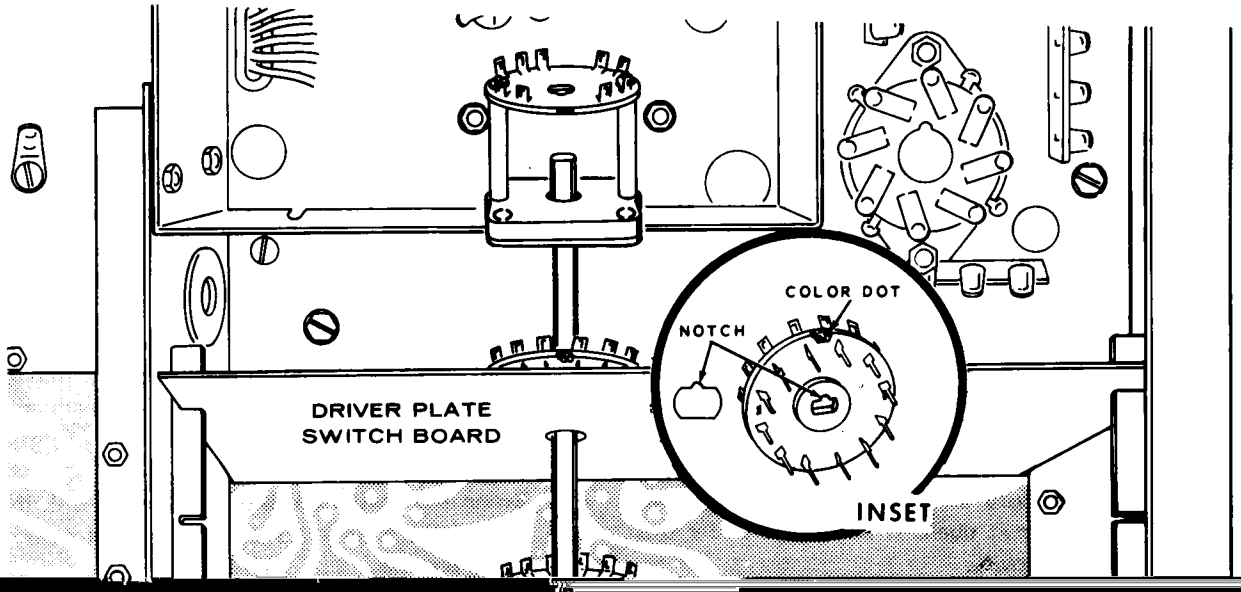
( ) Connect a 1-1/2" bare wire from 4 on the driver plate Switch-Board (S-1) to 1 on the RF driver circuit board (S-1). Do not allow this wire to extend more than 1/8" through the lettered side of the RF driver circuit board, as this would short circuit the variable capacitor mounted on top of the circuit board.



Detail 8-16C






COLOR DOT
NOTCH
DRIVER PLATE
SWITCH BOARD
INSET

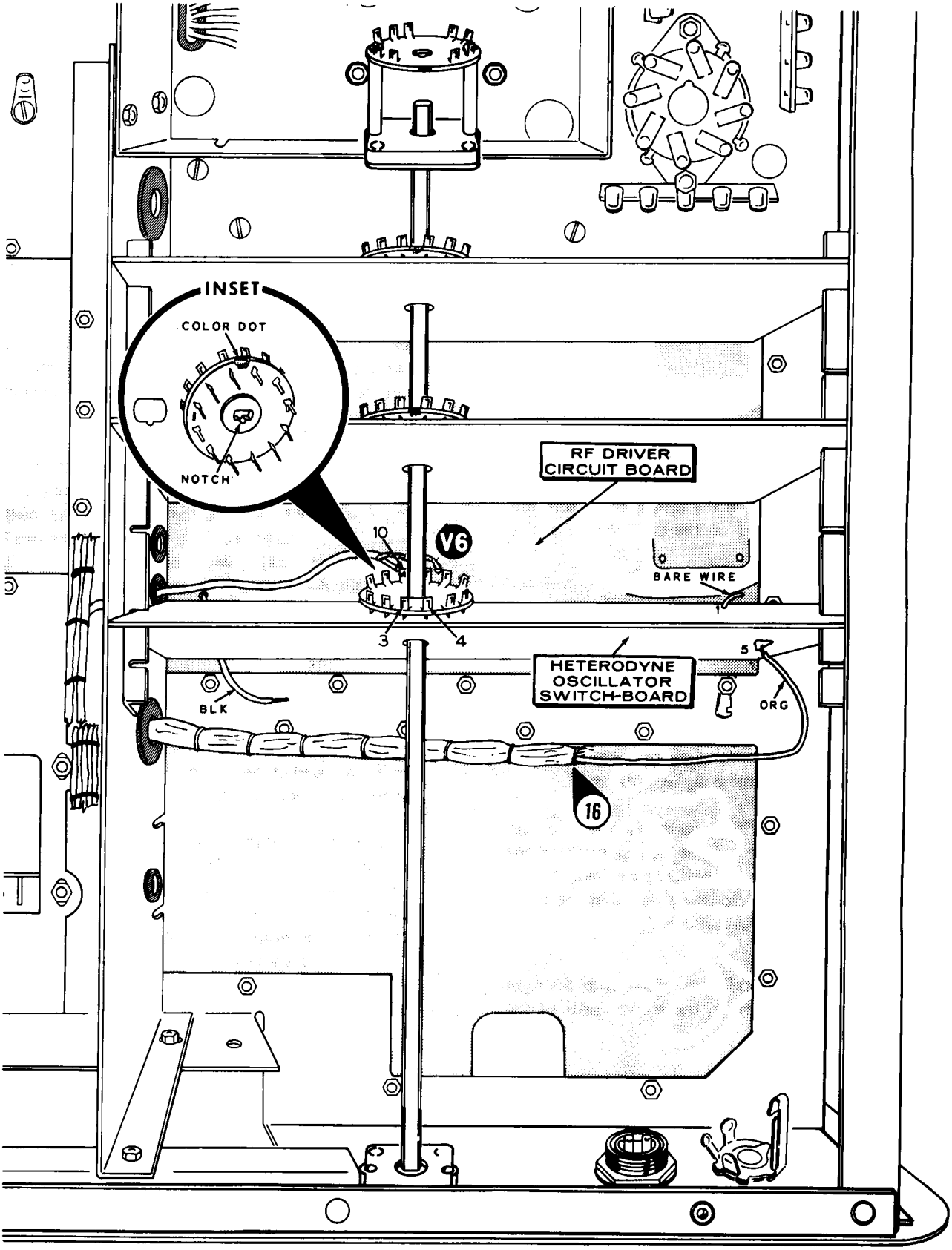
Refer to Pictorial 8-18 for the following steps.

( ) Remove the shaft and swing the support rail outward.

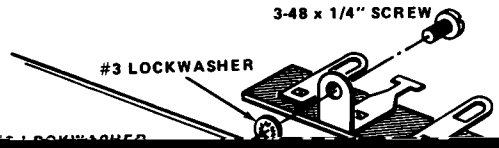
( ) Position the notch in the rotor of the switch wafer on the heterodyne oscillator Switch-Board so it is

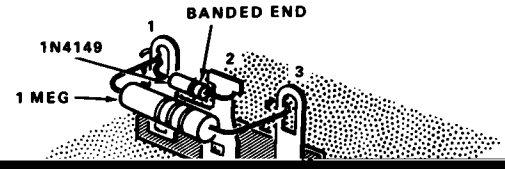
( ) Make sure the notch on the rotor and the color dot of the switch wafer of the crystal Switch-Board are aligned with each other.

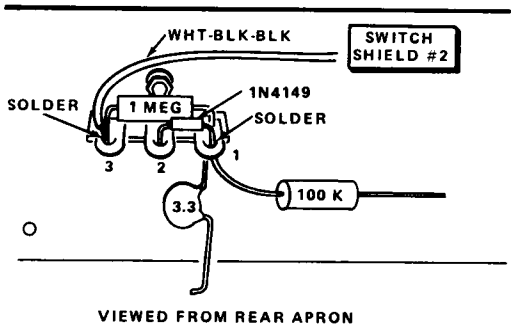
( ) Position the crystal Switch-Board over the chassis.



PICTORIAL 8-18


3-48 x 1/4" SCREW
#3 LOCKWASHER


BANDED END
1
1N4149
2
3
1 MEG



Detail 8-19D

Refer to Detail 8-19D for the next three steps.

( ) Connect the free end of the 100 kΩ resistor from the RF driver circuit board to lug 1 of the 3-lug terminal strip on switch shield #2 (NS).

( ) Connect the free lead of the 3.3 pF disc capacitor to lug 1 of the 3-lug terminal strip (S-4).

( ) Connect the end of the white-black-black wire from grommet CD to lug 3 of the terminal strip (S-2). Pass this wire over the band switch shaft as shown in Detail 8-19A.

( ) Connect a 3/4" bare wire from the hole in the lower right corner of switch shield #2 (S-1) to the ground (outside) foil of the RF driver circuit board (S-1). Solder this end of the wire directly to the foil. There is no hole at this location. Be sure the ground foil is used.

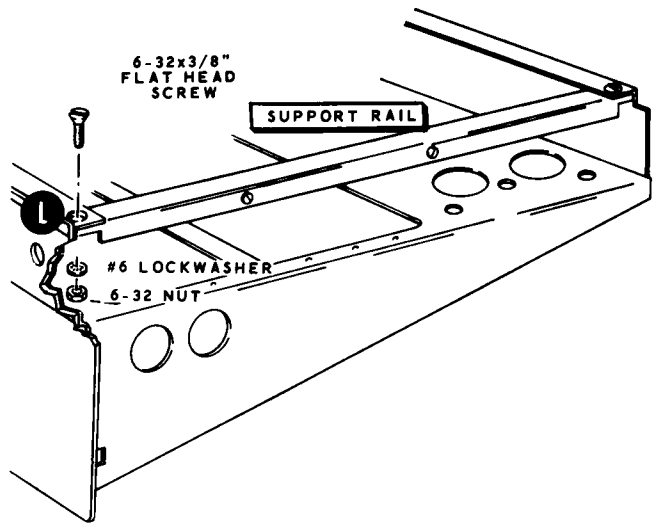
( ) Cut two 1/2" pieces of small black sleeving.

( ) Cut each lead of a 100 Ω (brown-black-brown) resistor to 3/4" and place a 1/2" piece of sleeving on each resistor lead. Then form the leads as shown so the resistor can be mounted around the end of switch shield #2.

( ) Solder one lead of this resistor directly to the foil marked 2 on the RF Driver circuit board. Solder the other lead directly to the ground foil on the panel side of switch shield #2 (there is no hole at either soldering location).

( ) Cut each lead of a 100 Ω (brown-black-brown) resistor to 1". Connect the resistor from 5 on the driver plate Switch-Board (S-1) to 5 on the driver grid Switch-Board (S-1). Position this resistor around the end of switch shield #1.

( ) Refer to Detail 8-19E and secure the front of the support rail to the front flange of the chassis. Use 6-32 x 3/8" flat head hardware. Tighten the hardware at the rear of this support rail. Be sure the front screw clears the lugs of the phone jack at L.

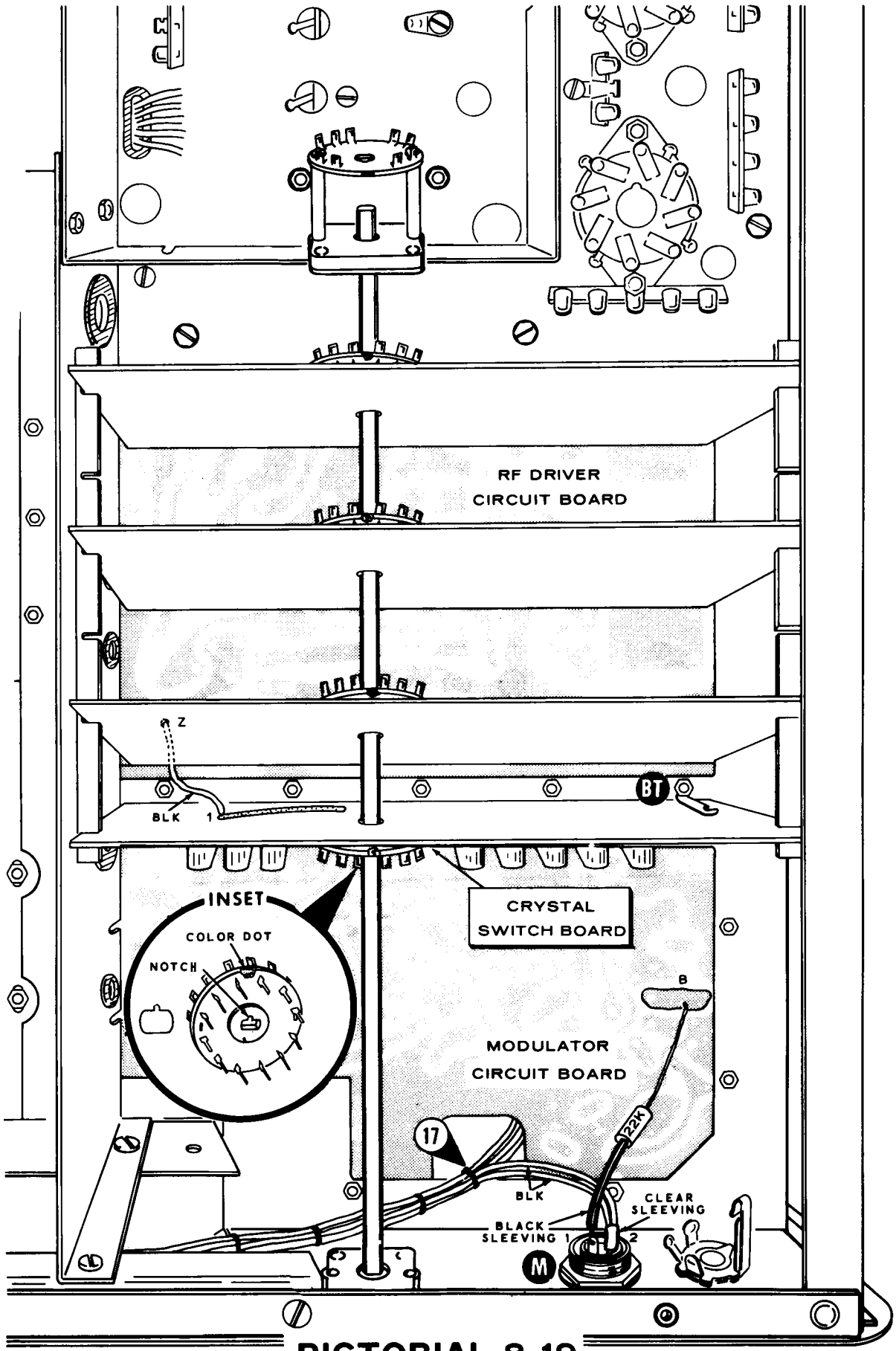


Detail 8-19E

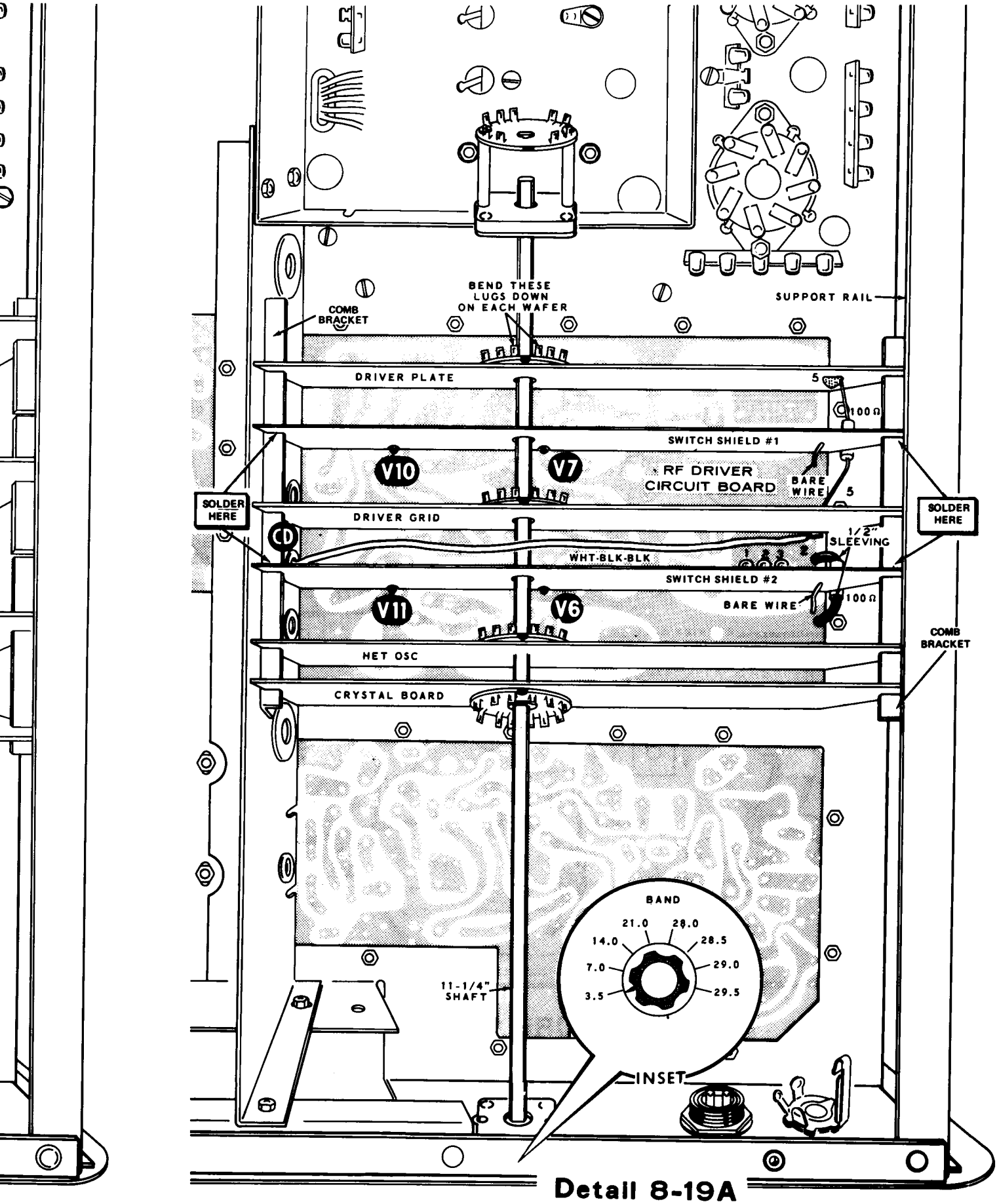
Refer to Detail 8-19F for COLOR

KNOB INSTALLATION

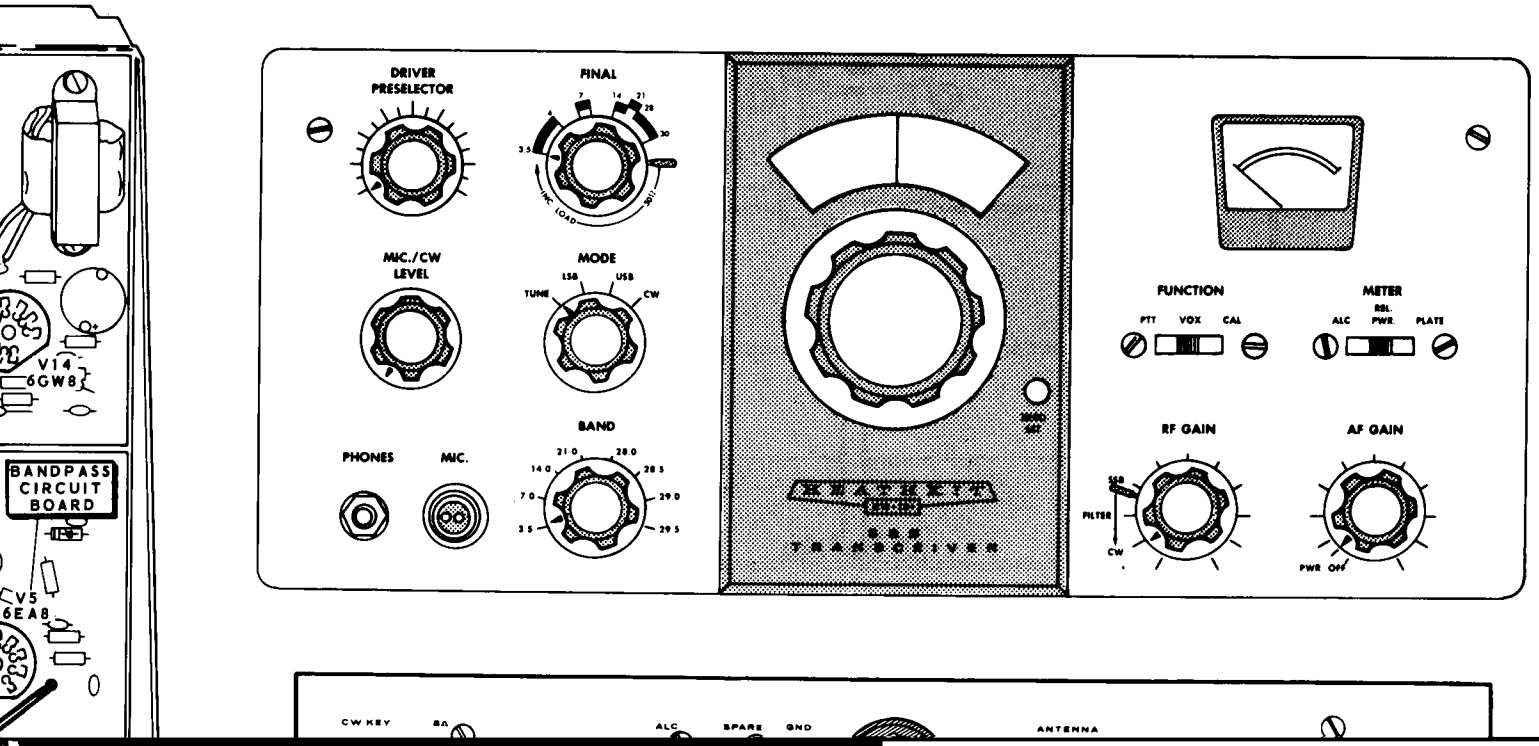
Refer to Pictorial 8-20 for the following steps.



PICTORIAL 8-19


BEND THESE LUGS DOWN ON EACH WAFER
COMB BRACKET
SUPPORT RAIL
DRIVER PLATE
5
100Ω
SWITCH SHIELD #1
V10
V7
RF DRIVER CIRCUIT BOARD
BARE WIRE
5
SOLDER HERE
DRIVER GRID
CD
1/2" SLEEVING
WHT-BLK-BLK
SWITCH SHIELD #2
V11
V6
BARE WIRE
100Ω
SOLDER HERE
COMB BRACKET
HET OSC
CRYSTAL BOARD
BAND
21.0
28.0
14.0
28.5
7.0
29.0
3.5
29.5
11-1/4" SHAFT
INSET

Detail 8-19A


DRIVER PRESELECTOR
FINAL
MIC./CW LEVEL
MODE
TUNE
LSB
USB
CW
PHONES
MIC.
BAND
FUNCTION
PTT
VOX
CAL
METER
ALC
PWR
PLATE
RF GAIN
AF GAIN
FILTER
PWR OFF
V14 6GW8
BANDPASS CIRCUIT BOARD
V5 6EA8

CW KEY
ALC
SPARE
GND
ANTENNA

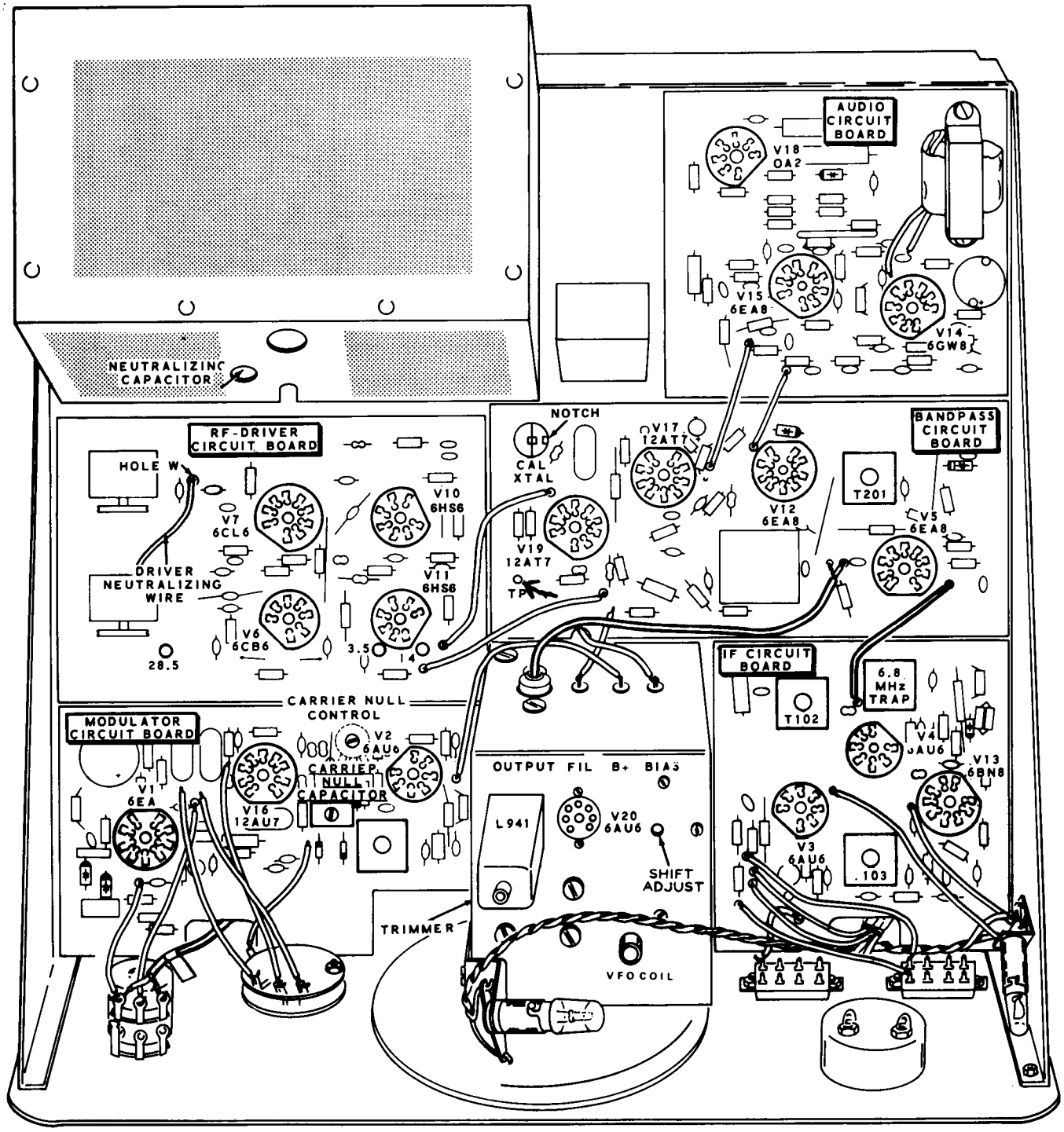

AUDIO CIRCUIT BOARD
V18 0A2
V15 6EA8
V14 6GW8
NEUTRALIZING CAPACITOR
RF-DRIVER CIRCUIT BOARD
HOLE W
V7 6CL6
V10 6HS6
V11 6HS6
DRIVER NEUTRALIZING WIRE
V6 6CB6
28.5
3.5
14
NOTCH
CAL XTAL
V17 12AT7
V19 12AT7
TP
V12 6EA8
BANDPASS CIRCUIT BOARD
T201
V5 6EA8
IF CIRCUIT BOARD
T102
6.8 MHz TRAP
V4 6AU6
V13 6BN8
V3 6AU6
.103
CARRIER NULL CONTROL
MODULATOR CIRCUIT BOARD
V2 6AU6
CARRIER NULL CAPACITOR
V1 6EA
V16 12AU7
OUTPUT FIL B+ BIAS
L941
V20 6AU6
SHIFT ADJUST
TRIMMER
VFO COIL

FIGURE 1-2

CONTROL AND CONNECTOR FUNCTIONS

The functions of the front panel and chassis controls are outlined in this section. Read the following paragraphs carefully, so you will be familiar with the operation of each control before starting to check, align, or operate this Transceiver. The location of the controls is shown in Figure 1-1 and Figure 1-2 (fold-out from Page 100).

FRONT PANEL FUNCTIONS

DRIVER PRESELECTOR

This control is used to peak the receiver RF amplifier and transmitter driver tuned circuits. The adjustment can be made in either the receive or transmit mode of operation, and must be adjusted at each position of the BAND switch. This adjustment should also be made when the operating frequency is changed appreciably.

MIC/CW LEVEL

When the MODE switch is in the LSB or USB position, this control is used to adjust the audio drive. The control has range enough to adjust for most high impedance crystal or dynamic microphones.

With the MODE switch in the Tune or CW position, the carrier output level of the transmitter is adjusted with this

MIC (Microphone)

A high-impedance microphone should be connected to this socket. Provisions are made in the socket for connecting a microphone with a push-to-talk switch.

FINAL TUNE AND LOAD

The round knob is the FINAL TUNE control. After the MAIN TUNING control has been set to the desired operating frequency, and the MODE switch set to the TUNE position, this control is adjusted for maximum (Relative Power) meter indication to tune the transmitter for maximum output.

The lever arm is the FINAL LOAD control. It is also tuned

MODE

This switch selects the LSB, USB, or CW mode of operation for the receive and transmit sections. In the TUNE position, the transmitter is turned on so the driver and final RF stage can be tuned.

BAND

In the first four positions, this switch selects the following ranges: 3.5 to 4 MHz (80 meters); 7 MHz to 7.3 MHz (40 meters); 14 to 14.5 MHz (20 meters); and 21 to 21.5 MHz (15 meters).

The following 500 kHz portions of the 10-meter band are selected in the other four positions of this switch: 28.0 MHz to 28.5 MHz, 28.5 MHz to 29.0 MHz, 29.0 MHz to 29.5 MHz, and 29.5 MHz to 30.0 MHz.

MAIN TUNING

The MAIN TUNING dial controls the frequency of the VFO over its range of 500 kHz. The dial is scaled 0 to 500. To read frequency directly, calibrate the dial at the closest harmonic of the calibration oscillator. Then turn the dial to

Transceiver, and turns the CAL (calibration oscillator) on and off. This switch should be in the PTT or VOX position when the MODE switch is in the TUNE position.

In the PTT switch position, the Transceiver is changed from receive to transmit operation by closing a push-to-talk microphone switch, or by closing the key when set up for CW.

In the VOX position, the Transceiver is changed from receive to transmit operation when the operator talks into the microphone, or when the key is closed in the CW mode.

In the CAL position, the 100 kHz crystal oscillator is turned on to calibrate the MAIN TUNING dial at 100 kHz intervals. The harmonics of this oscillator are easily discernible throughout the range of the Transceiver.

FILTER

This lever switch selects the SSB crystal filter or the CW crystal filter (when installed).

RF GAIN

RIGHT SIDE CONTROL FUNCTIONS

VOX SENS

The VOX SENS (Sensitivity) control adjusts the VOX relay circuit to operate at the voice level desired by the operator. When the operator talks into the microphone, the VOX relay is energized and turns the transmitter on.

VOX DELAY

When the FUNCTION switch is set at VOX, this control adjusts the "hold-in" time (length of time the trasmitter stays on) after a spoken word or a keyed character. Proper setting of the VOX DELAY control eliminates excessive keying of the transmitter between words or characters.

ANTI-TRIP

The ANTI-TRIP control adjusts the VOX circuit so the signal from the speaker will not turn on the transmitter by feeding back into the microphone.

ZERO ADJUST

The meter ZERO ADJ control is adjusted for a zero reading on the meter, in the receive mode of operation, with the antenna disconnected and with the RF GAIN control turned fully clockwise.

BIAS

This control adjusts the bias voltage on the final RF amplifier tubes for linear operation.

TOP CHASSIS CONTROL FUNCTIONS

CARRIER NULL CONTROL (Modulator Circuit Board)

This control balances the modulator to suppress the carrier.

CARRIER NULL CAPACITOR (Modulator Circuit Board)

The adjustment of this capacitor completes the modulator balance.

CAL XTAL (Bandpass Circuit Board)

This trimmer adjusts the 100 kHz oscillator to exact frequency.

REAR APRON CONNECTIONS

CW KEY: This jack is used to connect a key or keyer to the Transceiver. Use a phone plug having a 1/4" sleeve. Connect the hot lead of your key to the tip of the plug and the ground lead to the sleeve.

8Ω: This phono socket is used to connect a speaker to the Transceiver. It accepts a standard phono plug. The output transformer is designed for a speaker having an impedance of 8 ohms, although other speakers from 4 to 16 ohms impedance may be used.

ALC: Automatic level control voltage from an external amplifier may be applied to the Transceiver through this phono socket.

SPARE: For accessories.

GND: For safety, a low-resistance, heavy-duty ground connection should be connected to this terminal.

PWR. and ACC.: The cable socket from your power supply engages this plug.

ANTENNA: This socket is used to connect the antenna to the Transceiver. If the Transceiver is to be used with an amplifier or monitor scope, refer to the "Installation" section of this Manual.

NOTE: The unoccupied hole at one edge of the rear apron is used with the Heathkit Mobile Mount.

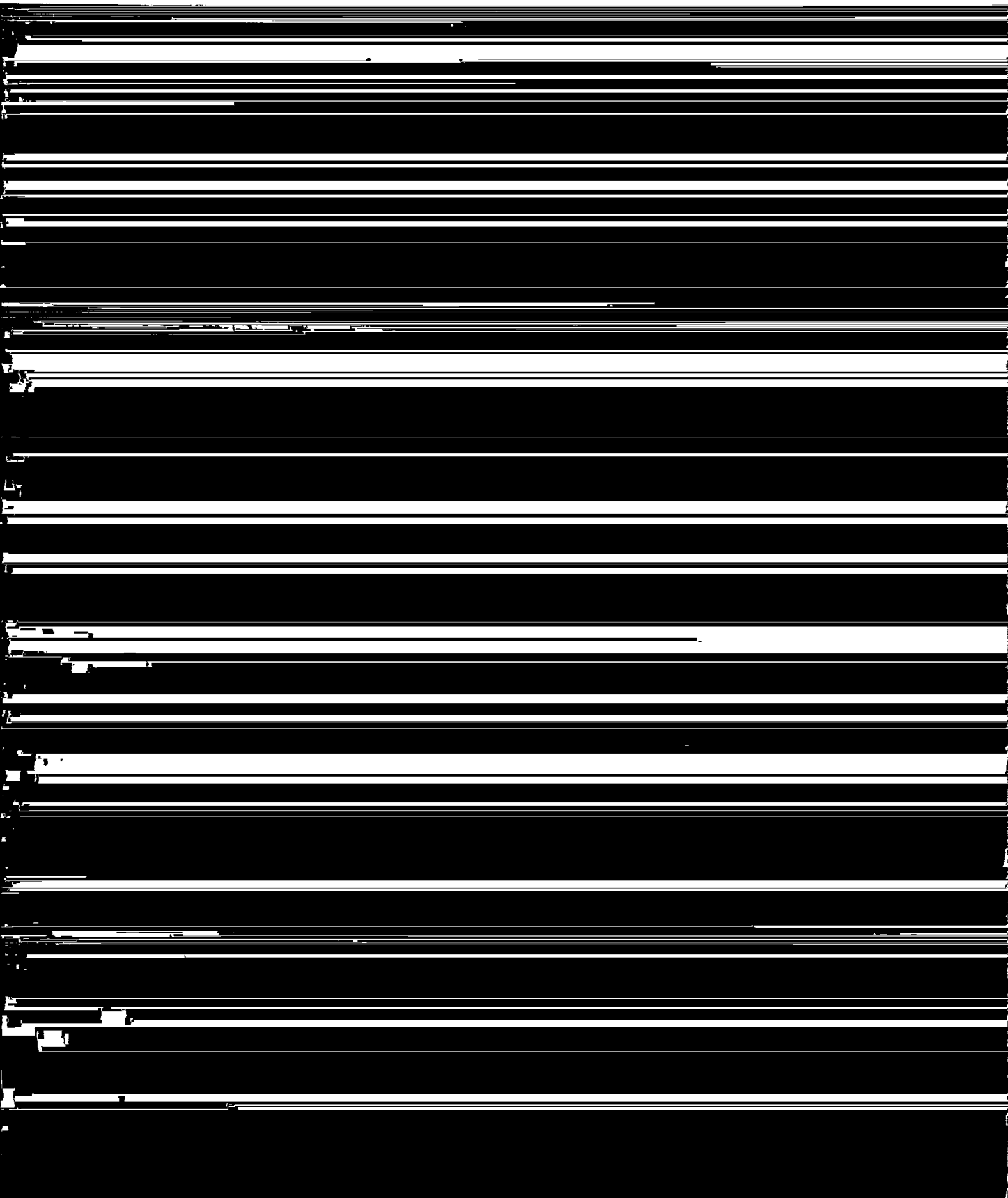
( ) Check the polarity of the ohmmeter leads as follows: Connect one ohmmeter lead to the Transceiver chassis and the other lead to pin 1 of tube socket V9. If an "up-scale" deflection of the Transceiver panel meter is not obtained, reverse the ohmmeter leads. When an "up scale" meter indication is obtained, the meter lead connected to pin 1 of tube socket V9 should be marked (+) positive. This lead should be used as the positive (+) lead for the remaining checks.

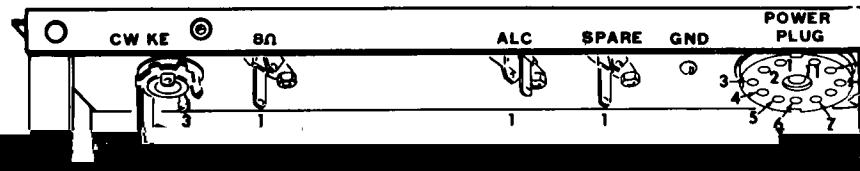
NOTE: Perform the two steps in the following box. The panel meter should read up-scale, which shows that it is connected correctly. If the panel meter does NOT read up-scale, the meter or meter switch circuits are incorrectly wired (or faulty) and must be corrected before additional tests are made.

METER SWITCH	OHMMETER RANGE	COMMON LEAD	POSITIVE (+) LEAD
( ) ALC	RX1	Pin 7 of tube socket V3 (on IF circuit board)	Chassis
( ) REL PWR	RX1	lug 1 of terminal strip BE	Chassis

RESISTANCE CHECKS

[redacted]




CW KE
8Ω
ALC
SPARE
GND
POWER PLUG
3
1
1
1
3
2
4
5
6
7

OHMMETER TEST POINTS		MODE SWITCH	RESISTANCE IN OHMS	NOTES
COMMON LEAD	POSITIVE (+) LEAD			
( ) Chassis	CW KEY jack, lug 3	CW	50 k	
( ) CW KEY jack, lug 3	Chassis	"	35 k	(Diode)
( ) "	"	TUNE, LSB, and USB	70 k	(Diode)
( ) Chassis	8 Ω jack, lug 1	TUNE	.6	
( ) "	Spare jack, lug 1	"	INF	
( ) "	ALC jack, lug 1	"	70	(Diode)
( ) ALC jack, lug 1	Chassis	TUNE and CW	10 k - low Ω (use RX100 scale)	(Diode) Varies with setting of MIC/ CW LEVEL control.
( ) "	"	LSB and USB	3.4 M	(Diode)
( ) Power plug, Pin 1	"	TUNE	13 k	
( ) Chassis	Power plug, Pin 2	"	0	
( ) "	" Pin 3	TUNE, USB, CW	25 k	
( ) "	" Pin 3	LSB	20 k	
( ) "	Power plug, Pin 4	TUNE	INF	
( ) "	" Pin 5	"	0	
( ) "	" Pin 6	"	1.6	
( ) "	" Pin 7	"	0	
( ) "	" Pin 8	"	INF	
( ) "	" Pin 9	"	INF	
( ) "	" Pin 10	"	INF	
( ) "	" Pin 11	"	INF	

CHART #1

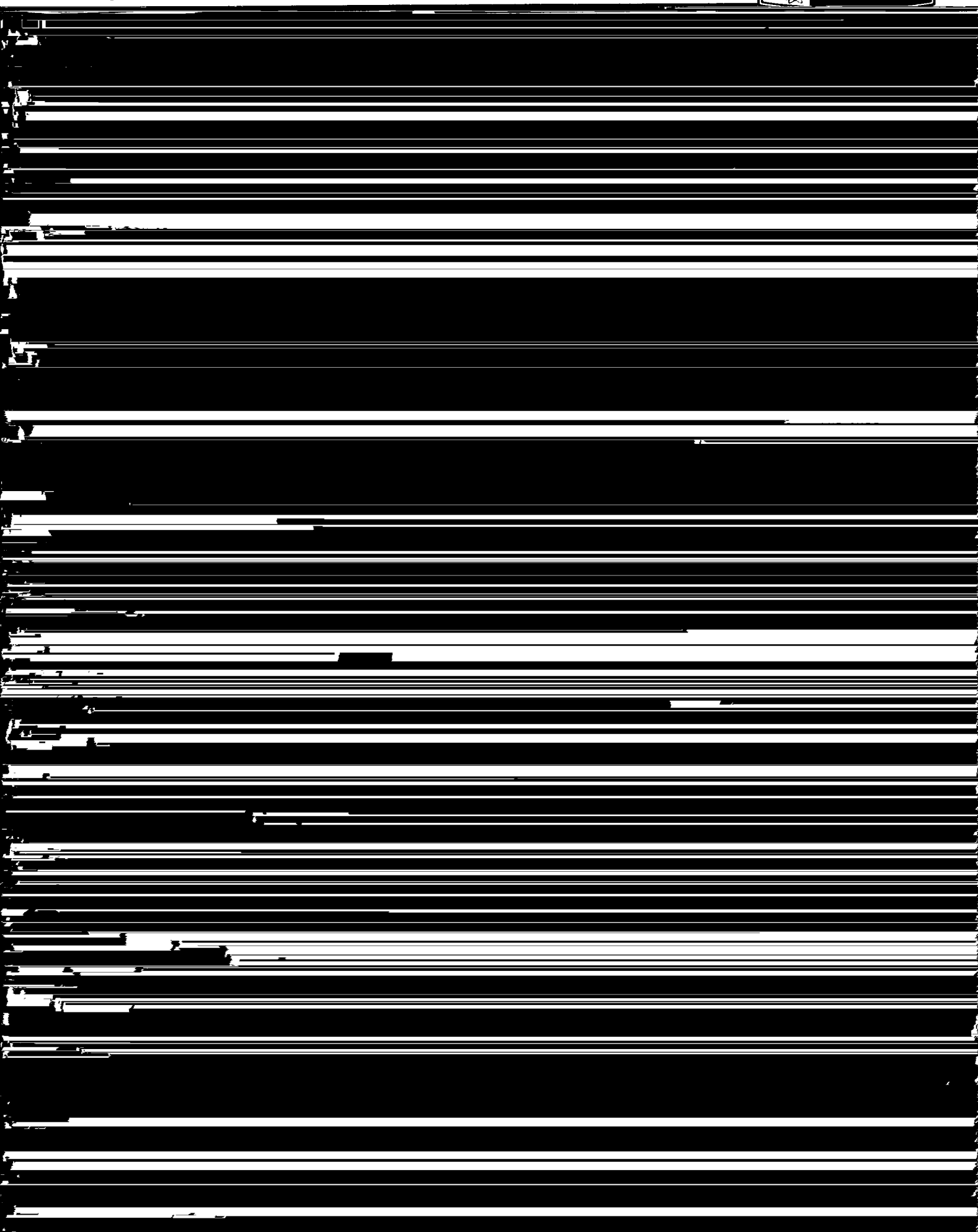
OHMMETER TEST POINTS				
COMMON LEAD	POSITIVE (+) LEAD	MODE SWITCH	RESISTANCE IN OHMS	NOTES
( ) Power plug, Pin 9	Power plug, Pin 10	TUNE	INF	
( ) " "	" "	"	0	Turn the AF GAIN control clockwise until a click is heard. Make the measurement. Then return the AF GAIN to the full counterclockwise (OFF) position.
( ) Chassis	ANTENNA jack, lug 1	"	0	
( ) "	PHONES jack, contact 4	"	Closed 0 Open 100 Ω	Press on contact 4 to open contact for lug 2.
( ) "	MIC socket, lug 1	"	1 M	
( ) "	" lug 2	"	0	
( ) "	" " "	LSB, USB, and CW	500 k	
( ) "	RF GAIN control, lug 2	TUNE	70 k to 10	Varies with setting of RF GAIN control.
( ) "	AF GAIN control, lug 2	"	25 to 1 M	Varies with setting of AF GAIN control.
( ) 13 on the IF circuit board	Chassis	All	5 M	

CHART #2

OHMMETER TEST POINTS		BAND SWITCH	RESISTANCE IN OHMS
COMMON LEAD	POSITIVE (+) LEAD		
( ) Chassis	Capacitor lug DB-1	3.5 and 7.0	10 k
( ) "	" " "	14.0 through 29.5	INF
( ) Power Plug, Pin 3	CIRCUIT BOARD LOCATION RF DRIVER Foil 7	3.5	100
( ) "	" 3	"	100
( ) "	" 3	7.0 through 29.5	22 k
( ) "	" 9	3.5	1000
( ) "	" 4	"	1000
( ) "	" 4	7.0 through 29.5	INF
( ) Chassis	Lug 1 (Wafer BS1 of BAND switch)	3.5	5200
( ) "	"	7.0 through 29.5	INF
( ) "	Audio Circuit Board 22	3.5	30 k
( ) Audio Circuit Board 22	Bandpass Circuit Board B	All positions	100

This completes the "Preliminary Checks."

CHART #3



COIL COVER AND TUBE INSTALLATION

Refer to Pictorial 8-21 for the following steps.

( ) Refer to Detail 8-21A and install four pairs of spring clips on the under side of the coil cover. Use 3-48 × 3/8" hardware. Bend the clip ends down slightly as shown in the insert drawing. Make sure the clips still touch each other after bending.

CAUTION: Be sure that none of the lugs of the switch wafers mounted on the circuit boards extend beyond the edges of the circuit boards so they cannot short-circuit when the coil cover is in place.

( ) As shown in the Pictorial, push the plain edge of the coil cover under the support rail in such a manner that

( ) Check the resistance between pin 4 of the power plug and the chassis. It should be infinity (∞).

( ) Remove the common lead of the ohmmeter from the chassis and connect it to pin 1 of the power plug. The minimum resistance to the chassis should be 13 kΩ.

If resistances are below those shown, refer to the "In Case of Difficulty" section, or otherwise correct the trouble.

Place the tube shields on loose tubes as follows:

NOTE: You will install the three tube shields in the following steps. If a tube shield is too loose, remove it from the tube,

POWER SUPPLY CONNECTIONS

The Transceiver was designed to operate with the Heathkit Models HP-13 (12 Vdc power source) and HP/PS-23 (117 Vac power source) Power Supplies. The following information will help you wire the 11-pin socket (supplied with the Transceiver) for the power cable of the Power Supply you intend to use. The same cable and power supplies can be used with many other Heathkit models. Be sure to use the correct low B+ voltage for each model.

HP-13 SERIES POWER SUPPLY CONNECTIONS

CAUTION: Be sure the alternate connection in the low voltage dc circuit of the HP-13 Power Supply is connected for +300 volts output as outlined in the HP-13 Manual. Be sure the automobile voltage regulator is set to less than 14.5 volts. NOTE: If you use a different power supply, be certain that it is correctly fused for use with this Transceiver.

NOTE: If the Heathkit Mobile Mount is used, complete the power supply connections as directed in that manual.

Refer to Figure 1-5 for the following steps.

( ) Install the 11-pin socket cap over the free end of the 8-wire cable from the Power Supply, as shown.

( ) Remove 3/4" of the outer insulation from the end of the 8-wire cable. Then remove 1/4" of insulation from the end of each wire.

( ) Melt a small amount of solder on each of the exposed wire ends to hold the small strands of wire together.

( ) Insert the lead from the cap end of the fuse-holder (an in-line fuseholder with lead is supplied with the power supply) through the socket cap as shown.

( ) Cut seven 5/8" lengths of clear sleeving and slip them over the indicated wires.

( ) Connect the wires of the 8-wire cable and the fuseholder lead to the 11-pin socket lugs as shown. Solder each connection.

( ) Push the lengths of sleeving over the lugs of the socket.

( ) Snap the socket cap onto the 11-pin socket. IMPORTANT: When using the HP-13 Power Supply with the Transceiver, be sure the Bias control of the power supply is in its fully clockwise position. This setting will supply a maximum bias voltage at pin 9 of the power socket.

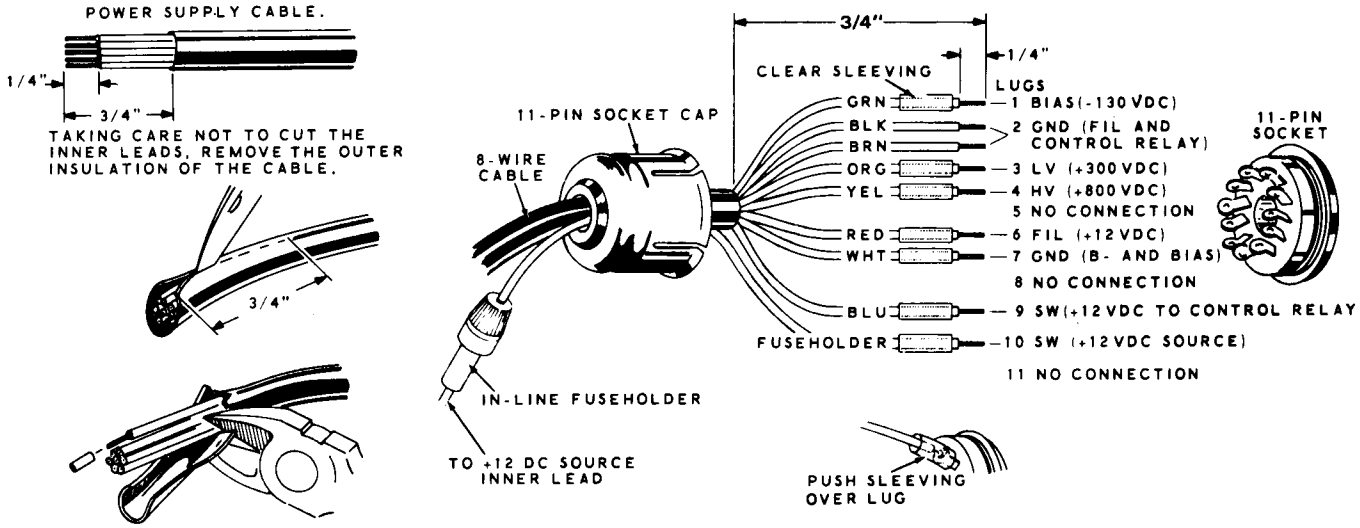


Figure 1-5

HP/PS-23 SERIES POWER SUPPLY CONNECTIONS

CAUTION: Be sure the low voltage dc circuit of the HP-23A Power Supplies are switched for 300 Vdc output. In the HP-23B, HP-23C, and PS-23 Power Supply, make the internal connections for 300 Vdc output.

Refer to Figure 1-6 for the following steps.

( ) Install the 11-pin socket cap over the free end of the 8-wire cable from the Power Supply.

( ) Remove 3/4" of the outer insulation from the end of the 8-wire cable. Then remove 1/4" of insulation from the end of each wire.

( ) Melt a small amount of solder on each of the exposed wire ends to hold the small strands of wire together.

For the SB-201 and other linear amplifiers, use a piece of coaxial cable through the cap to bring out the relay connections.

( ) Cut seven 5/8" lengths of clear sleeving and slip them over the indicated wires.

( ) Connect the wires of the 8-wire cable and the coaxial cable (if a linear amplifier is used) to the 11-pin socket lugs as shown. Solder each connection.

( ) Push the lengths of sleeving over the lugs of the socket.

( ) Snap the socket cap onto the 11-pin socket. Be careful not to pinch any wires.

NOTE: With the above connections, the BIAS control in the HP-23 Power Supply is inoperative. Proper bias settings are accomplished with the BIAS control in the Transceiver.

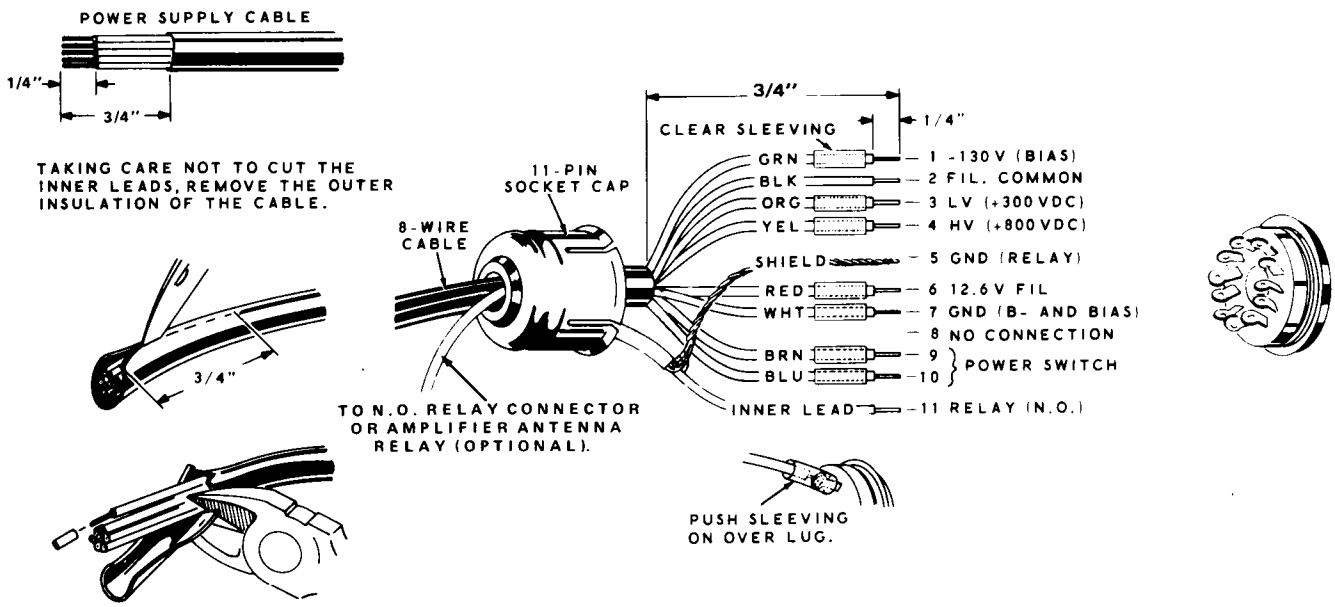
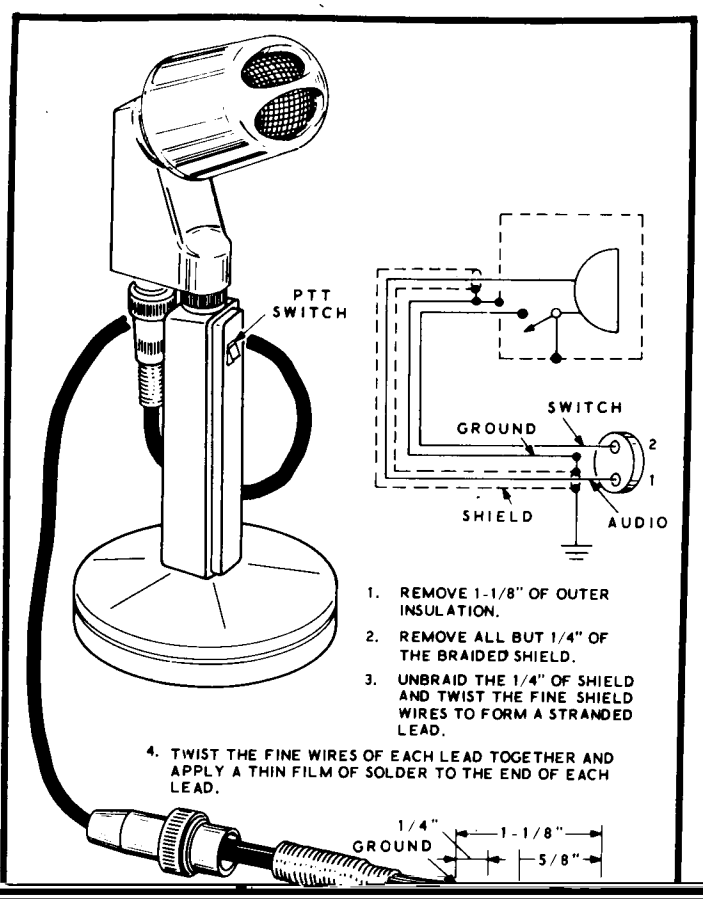


Figure 1-6

MICROPHONE CONNECTIONS

A high-impedance microphone equipped with a push-to-talk switch should be used with the Transceiver so either the PTT or VOX methods may be used to turn on the Transmitter. A two-pin microphone connector (Amphenol 80MC2M) is furnished for this purpose. It should be connected to the microphone cable as directed in the following steps.



Heath Microphones

( ) Determine the desired length of your microphone cable, and cut off any excess.

( ) Perform the numbered steps in Figure 1-7.

Other Microphones

If you use a microphone different than the one shown.

INITIAL TEST

CAUTION: BEFORE APPLYING POWER TO THE TRANSCEIVER, NOTE THAT LETHAL VOLTAGES ARE PRESENT BOTH ABOVE AND BELOW THE CHASSIS. DO NOT TOUCH ANY HIGH VOLTAGE POINTS WITH YOUR HANDS. USE WELL INSULATED TOOLS FOR ANY ADJUSTMENTS ON THE CHASSIS.

TO LESSEN THE SHOCK HAZARD, CONNECT A LEAD FROM A GOOD EARTH GROUND TO THE GROUND TERMINAL LOCATED ON THE REAR OF THE CHASSIS

( ) Connect the power supply to the proper power source and set its switch at ON.

( ) Connect an 8 Ω speaker to the 8 Ω socket at the rear of the Transceiver. CAUTION: Never operate the Transceiver unless a speaker or headphones are connected. For safety reasons, it is recommended that headphones NOT be used during the testing of the Transceiver.

ALIGNMENT

The coils and transformers in your Transceiver have been preset at the factory. Only minor readjustments should be necessary during the following alignment procedure.

The following equipment is necessary for alignment of the Transceiver.

1. A test meter, such as an 11 megohm input voltmeter. (Vacuum tube and solid-state models are found in the Heath catalog.) A 20,000 ohm-per-volt VOM may be used, but will load the circuits to a greater extent.

2. A 50 Ω nonreactive dummy load that is capable of 100 watts dissipation, such as the Heathkit Cantenna. Do not use light bulbs for a dummy load as they present an impedance which varies with power and frequency.

3. A receiver capable of receiving WWV at 2.5, 5, 10, or 15 MHz. If this type of receiver is not available, a receiver tunable to a standard broadcast station which is operating at an even multiple of 100 kHz (such as 600 kHz, 1000 kHz, etc.) can be used.

4. An accurate 100 kHz standard oscillator may be used for the alignment of tuned circuits. DO NOT use such an oscillator to adjust the Transceiver crystal calibrator. For this purpose refer to the "Crystal Calibrator Alignment" section of this Manual.

For the alignment of the transmitter section it is recommended that you use an oscilloscope, such as the Heathkit Signal Monitor Scope to observe the output RF envelope.

WARNING: Do not place the Transceiver in the transmit mode of operation until directed to do so or the Transceiver may be seriously damaged.

( ) Connect a 50 Ω dummy load, capable of 100 watts dissipation, to the ANTENNA jack on the rear of the chassis. CAUTION: Do not use light bulbs as a dummy load.

( ) Be sure an 8 Ω speaker is connected to the 8 Ω jack on the rear of the chassis.

( ) Preset the CAL XTAL trimmer so its notch is towards the 100 kHz crystal as shown in Figure 1-2 (fold-out from Page 100).

( ) Preset the front panel controls as follows:

DRIVER PRESELECTOR – 12 o'clock position.

MIC/CW LEVEL – fully counterclockwise.

MODE – LSB.

BAND – 3.5.

MAIN TUNING Dial (VFO) – 200.

FUNCTION – PTT.

RF GAIN – fully clockwise.

METER – ALC.

AF GAIN – 9 o'clock position.

S METER ADJUSTMENT

( ) Adjust the ZERO ADJ control (on the right side of the chassis) for a zero indication on the meter with the antenna disconnected and the RF GAIN control at the full clockwise position.

RECEIVER ALIGNMENT

( ) Set the test meter switches so the meter will indicate a negative (-) dc voltage.

( ) Connect the common lead of the test meter (11 megohm input voltmeter) to the chassis and the other lead to the circuit board foil at TP (Figure 1-2) on the screened side of the bandpass circuit board near tube V19. If your meter reads 0 at TP, contact instead the adjacent lead of the 100 kΩ (brown-black-yellow) resistor. A reading of -.82 V or higher is normal.

The heterodyne oscillator output will be checked at each position of the BAND switch in the following steps. If necessary, the heterodyne oscillator coils will be adjusted to obtain a preliminary output voltage reading. Final adjustment will be made later. Carefully insert the slim end of the alignment tool fully into each slug before turning, to avoid core breakage.

NOTE: The heterodyne oscillator crystals that are supplied with the Transceiver provide coverage from 3.5 to 4.0 MHz, 7.0 to 7.3 MHz, 14.0 to 14.5 MHz, 21.0 to 21.5 MHz, and 28.0 to 30.0 MHz. As the driver grid and driver plate coils must be sequence-tuned (because of their series-parallel arrangement) other heterodyne crystals for out-of-band operation could introduce a wide variety of possible tuning conditions. Therefore, we recommend that you do not use crystals of frequencies other than those supplied.

It is not abnormal to receive "birdies" in the vicinity of 3740 kHz and 21,200 kHz.

( ) With the BAND switch at 3.5, the test meter should indicate about -0.5 to -2 volts dc. If necessary, adjust coil 3.5 (near tube V11 on the top side of the RF driver circuit board) to bring the voltage into this range. NOTE: When adjusting this coil in one direction, the oscillator output voltage will change rapidly; when adjusting the coil in the opposite direction from the peak, the output voltage will change slowly. Adjust the coil in the direction that gives the slower change in output voltage.

( ) Similarly, check the heterodyne oscillator output voltage at all positions of the BAND switch. If necessary, adjust the correct heterodyne oscillator coil for any BAND switch position that does not give an indication of about -0.5 to -2 volts dc on the test meter. The heterodyne oscillator coils for bands 3.5, 14, and 28.5 are marked, and adjusted at the top side of the RF driver circuit board; the coils for the other bands are marked on the shield cover, and are adjusted from the bottom of the chassis.

( ) Turn both VFO trimmer capacitor screws (through two holes on the left side of the VFO chassis) clockwise until just snug. Then turn each capacitor screw counterclockwise one-quarter turn.

( ) Set the FUNCTION switch to CAL and the BAND switch to 3.5; then turn the MAIN TUNING dial back and forth around 400 to get a calibrator signal. Check for the calibrate signal by turning the FUNCTION switch to VOX and back to CAL; the signal should stop and then start again and should peak with the DRIVER PRESELECTOR.

( ) Reset the DRIVER PRESELECTOR to the 12 o'clock position.

( ) Disconnect the test meter leads from the Transceiver.

The S Meter will be used as an output indicator during the remaining alignment of the Transceiver and the 100 kHz calibrator will be used as a signal source.

When adjusting the transformers in the following steps, use the large end of the tuning tool for the top core. Use the long, thin end (which is inserted through the top core) for the bottom core.

CAUTION: The 6.8 MHz trap coil is sealed, and should not be turned.

NOTE: It should not be necessary to turn the cores of transformers T201 and T103 more than two turns.

( ) Adjust transformer T201 for maximum volume.

( ) Adjust the top and bottom slugs of transformer T102 for a maximum volume or S Meter indication.

( ) Turn the slug of transformer T103 up (CCW) 14 turns. Then adjust it for a maximum S Meter reading (no more than about one turn).

( ) Readjust transformers T201, T102, and T103 slightly for maximum S Meter reading.

VFO ALIGNMENT

( ) Make sure the Transceiver has been warmed up for at least 30 minutes before making the following adjustments.

NOTE: Refer to Reading the Dial on Page 139.

( ) As the two preceding adjustments interact to some extent, repeat them until the 3500 kHz and 4000 kHz CAL signals coincide respectively with the 0 and 500 marks on the dial.

NOTE: The VFO signal may be tuned in on a general coverage receiver at 5000 kHz for the "500" dial setting, and at 5500 kHz for the "0" dial setting.

DRIVER GRID AND PLATE COILS

The driver grid and driver plate coils will be adjusted in the following steps. The coil locations are marked on the shield cover on the bottom of the chassis. These coils must be adjusted in the proper sequence as follows:

( ) Set the MAIN TUNING dial to 200 and the DRIVER

( ) Change the setting of the front panel controls as follows:

DRIVER PRESELECTOR – 21.2 position. See the inset drawing on Figure 1-3.

BAND – 21.0

MAIN TUNING dial – 200 kHz

NOTE: In the following step, the CAL signal and the VFO harmonic will be found very close together, showing that the VFO is correctly calibrated. The CAL signal is much stronger and can be identified by switching the FUNCTION switch between CAL and VOX.

( ) Turn the MAIN TUNING dial back and forth around 21.2 MHz for the loudest signal.

( ) Adjust driver grid coil 21 and driver plate coil 21 for a maximum S Meter indication.

( ) Turn the BAND switch to 14.0, the MAIN TUNING dial to 200 kHz, and the DRIVER PRESELECTOR to the 14.2 position.

( ) Tune the MAIN TUNING dial for the loudest signal and check for the calibrate signal.

( ) Adjust driver grid coil 14 and driver plate coil 14 for a maximum S Meter indication.

( ) Set the BAND switch at 7.0 and the MAIN TUNING dial at 200 kHz.

( ) Tune the MAIN TUNING dial for the loudest signal.

( ) Adjust driver grid coil 7 and driver plate coil 7 for a maximum S Meter indication.

( ) Set the FUNCTION switch to PTT.

Proper receiver operation will be indicated by minimum calibrator signals of S9 +20 dB at 3700 kHz and decreasing to S3 at 29.2 MHz.

TRANSMITTER ALIGNMENT

See the "Reading the Meter" section on Page 139 before making any more adjustments.

CAUTION: The coil cover MUST be in place for proper transmitter operation.

( ) Connect a push-to-talk microphone to the MIC connector on the front panel.

( ) If a Monitor Scope is available, connect it between the

FINAL (round knob) – to 10 o'clock.

FINAL (lever knob) – to 4 o'clock.

MODE – LSB.

BAND – 3.5.

MAIN TUNING dial – 200 kHz.

( ) Set the MODE switch at the TUNE position and slowly turn the MIC/CW LEVEL control in a clockwise direction until there is an indication of RF output on the meter or oscilloscope.

( ) Adjust the DRIVER PRESELECTOR control for maximum RF output.

( ) Adjust the FINAL tune (round knob) control for

( ) Turn the MIC/CW LEVEL control fully counterclockwise.

( ) Turn the MODE switch to LSB, push the microphone button, and adjust the CARRIER NULL control for minimum RF output. Note that the smaller end of the nut starter fits the shaft of this control.

( ) Adjust the CARRIER NULL capacitor for minimum

( ) Set the BAND switch at 21.0 and turn the MAIN TUNING dial to read 21.2 MHz.

( ) Adjust the DRIVER PRESELECTOR control and the FINAL TUNE and LOAD controls for maximum RF output; then turn the DRIVER PRESELECTOR control back and forth to see if this produces a smooth peaking in RF output.

( ) If turning the DRIVER PRESELECTOR control causes ragged changes in the RF output, readjust the position of, or bend, the free end of the driver neutralizing wire to produce a smooth peaking in RF output (this is the white, insulated wire inserted in hole W of the RF Driver circuit board, as shown in Figure 1-2, fold-out from Page 100).

( ) Set the BAND switch to 14.0 MHz and the MAIN TUNING dial to 14.2 MHz. As you did before on the 3.5 MHz band, peak the DRIVER PRESELECTOR and FINAL controls for maximum output. Compare the control settings at which maximum relative power output and minimum plate current occur. Again adjust the neutralizing capacitor until these points coincide. This completes the neutralization.

( ) Rezero the ALC position of the S Meter while receiving, with the BAND switch at 29.5. Then check to be sure the meter reads zero in each BAND switch position. If the S Meter does not read zero on any band, readjust the heterodyne oscillator coil for that band, as directed in previous steps.

NOTE: The S Meter may rest below zero while you are transmitting. This condition is normal.

CRYSTAL CALIBRATOR ALIGNMENT

In the following steps, the 100 kHz crystal calibrator signal is adjusted by "zero beating" it against the accurate signal from WWV on another receiver, or against the signal from a standard broadcast station that is on a multiple of 100 kHz.

Zero beat will occur when a harmonic of the 100 kHz crystal calibrator signal corresponds to the frequency of the station tuned in on the external receiver. As zero beat is approached, a tone will be heard that decreases in frequency until it stops completely at the zero beat point; then the tone begins to increase again as the dial is turned.

If the external receiver has an S Meter, accurate alignment can be achiever by observing the S Meter as zero beat is approached. When you tune close to zero beat, the S Meter will start to pulsate. The closer you approach zero beat, the slower the pulsations will become. At zero beat the pulsations will stop. Use a "fast" AVC position, if one is available.

IMPORTANT: For greatest accuracy, be sure to adjust the crystal calibrator as close to zero beat as possible. A 20 Hz error at the 100 kHz calibrator frequency, for example, would cause a 740 Hz error at 3.7 MHz (where the 37th harmonic of 100 kHz would be used for dial calibration purposes; 100 kHz x 37 = 3.7 MHz; 20 Hz x 37 = 740 Hz). In view of this, it is recommended that the crystal calibrator be adjusted to the 15 MHz signal of station WWV.

( ) Connect a random length of wire from the antenna connection of the external receiver to the ANTENNA connection of the Transceiver. If necessary, use one of the phono plugs furnished. It can be removed later.

( ) Set the Transceiver controls as follows:

FUNCTION switch – CAL.

AF GAIN control – full counterclockwise.

MODE switch – CW, LSB, or USB.

( ) Tune the external receiver to WWV, or a standard broadcast station transmitting at a frequency which is a multiple of 100 kHz.

( ) Carefully adjust the CAL XTAL trimmer capacitor (on the bandpass circuit board) for a "zero beat" in the external receiver. When WWV is tuned in, the period when no tone modulation is present allows the zero beat to be more easily heard.

( ) Switch the Transceiver FUNCTION switch to VOX and return it to CAL to be sure the external receiver S Meter stays steady, thus insuring a true zero beat.

( ) Remove the external receiver antenna wire from the ANTENNA jack on the Transceiver.

NOTE: To make sure it is heard on each band, a high content of harmonic energy is needed in the 100 kHz calibrate signal. Because of this, some spurious signals may also appear when tuning across some segments of the bands. The desired 100 kHz calibrate signals are easily identified by their greater signal strength. Also, the proper harmonics may be peaked by the DRIVER PRESELECTOR.

VFO SHIFTER ADJUSTMENT

( ) Adjust the MAIN TUNING dial to 200 kHz and the BAND switch to 3.5.

( ) Set the FUNCTION switch to CAL.

( ) Turn the MODE switch to USB.

( ) Carefully zero beat the calibrator signal. Use the MAIN TUNING dial and peak the DRIVER PRESELECTOR control.

( ) Set the MODE switch to LSB. Be careful not to touch the MAIN TUNING dial. Note that the calibrator signal may or may not be exactly at zero beat in the LSB position.

( ) Turn the SHIFT ADJUST on the VFO for an exact zero beat in the LSB mode. See Figure 1-2 (fold-out from Page 100).

( ) Recheck the zero beat in the USB mode to be certain of the adjustment. Repeat the procedure, if necessary.

DIAL CALIBRATION

NOTE: The instructions in this section use the 0 mark on the MAIN TUNING dial as the dial calibration point. The same instructions also apply at any 100 kHz marking.

( ) Set the BAND switch at 3.5 and the MAIN TUNING dial at 0 kHz. Zero beat the crystal calibrator signal at 3.5 MHz. If the 0 mark on the dial is not behind the index line in the dial window, proceed with the following steps.

( ) Note which way you turn the dial, and move the 0 on the dial behind the index mark in the dial window.

( ) Push the ZERO SET button to lock the dial in place, and turn the dial knob in the opposite direction to bring the calibrate signal into zero beat at the 0 mark on the dial. Release the ZERO SET button.

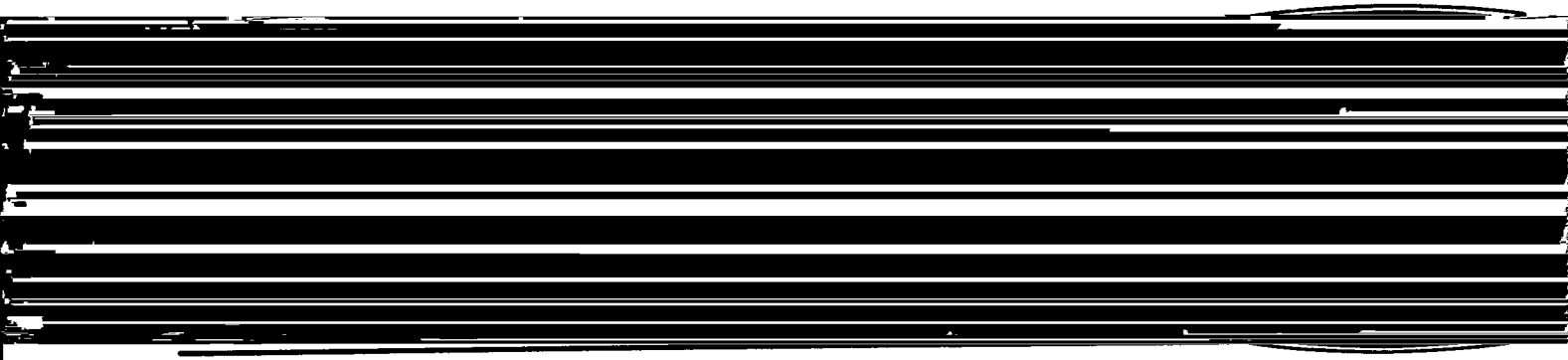
( ) Check the accuracy of the adjustment and repeat the above steps, if necessary.

This completes the alignment of your Transceiver.

NOTE: To verify that the VFO is operating on the proper frequency, tune in a signal of known frequency, such as time station CHU on 7335 kHz. This station is operated by the Dominion Observatory, Canada.

IMPORTANT

To avoid serious damage to the final amplifier tubes, DO NOT operate the transmitter until you have read and completely understand the tune-up procedure as outlined on Pages 140 through 143.



CABINET INSTALLATION

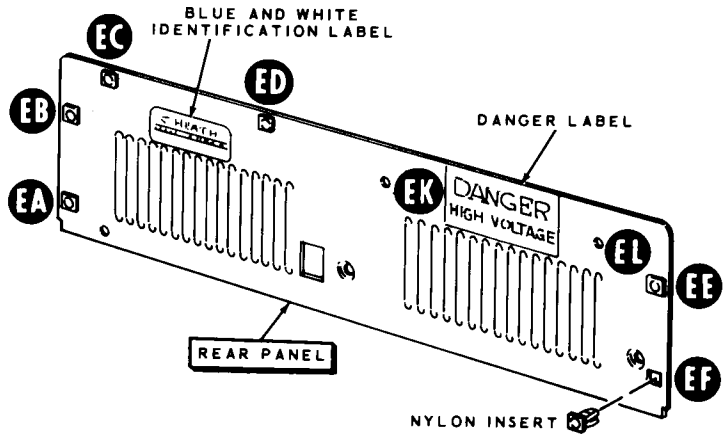


Figure 1-8

Refer to Figure 1-8 for the following steps.

( ) Position the rear panel on your table or bench as shown, being sure to have square openings EC and ED to your left.

( ) Remove the backing from the red Danger Label and press the label firmly into position between holes EK and EL.

( ) In a like manner, mount the blue and white identification label on the rear panel as shown. NOTE: Refer to the numbers on the blue and white label in any communications with the Heath Company about this kit; this will assure you the most complete and up-to-date information in return.

( ) Push nylon inserts into square openings EA, EB, EC, ED, EE, and EF.

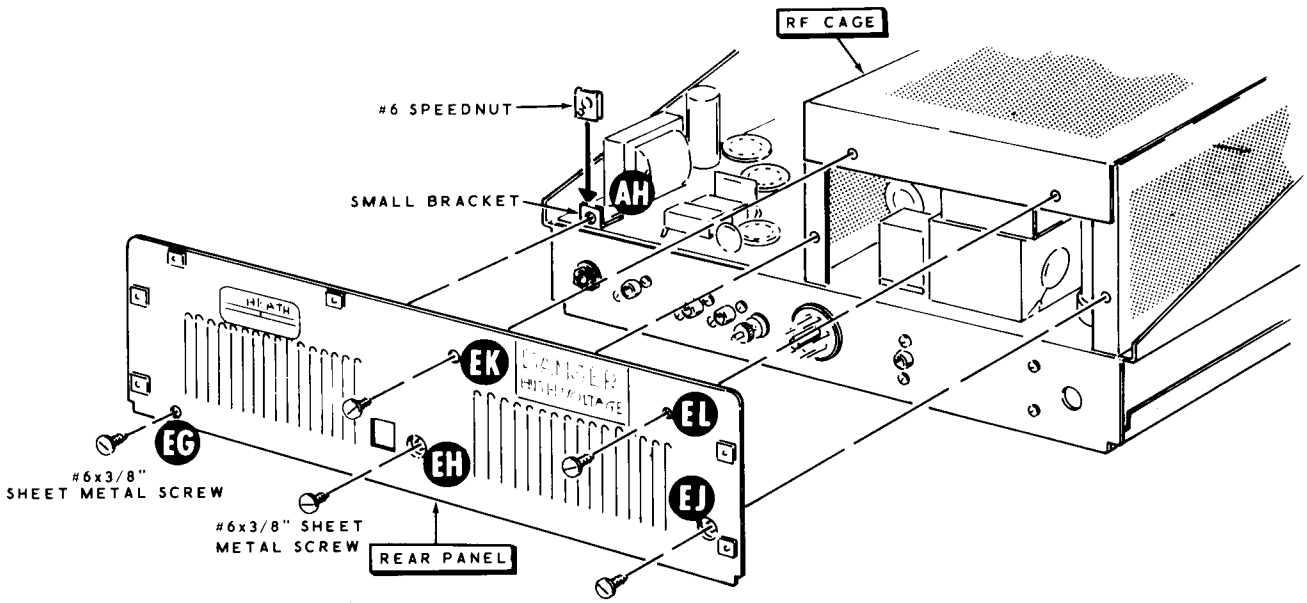


Figure 1-9

Refer to Figure 1-9 for the following steps.

( ) Mount a #6 speednut on the angle bracket at AH. Position the curved lip of the speednut toward the audio transformer.

( ) Mount the rear panel on the chassis. Use #6 x 3/8" sheet metal screws at EG, EH, EJ, EK, and EL.

Refer to Figure 1-10 for the following steps.

( ) If a mobile mount is to be used, mount 5/16" grommets in holes ET and EU in the cabinet top.

( ) Install #6 speednuts on the cabinet bottom at EN, EP, ER, ES, and at the four corresponding holes on the opposite lip of the cabinet bottom. Be sure the curved lip of each speednut is on the inside of the lip.

( ) Place the chassis into the cabinet bottom so that the front panel is against the lips upon which the speednuts are mounted. Be sure the five control access holes are on the right side.

( ) Fit the cabinet top over the chassis. The lips on the rear will be just outside the nylon inserts on the rear panel.

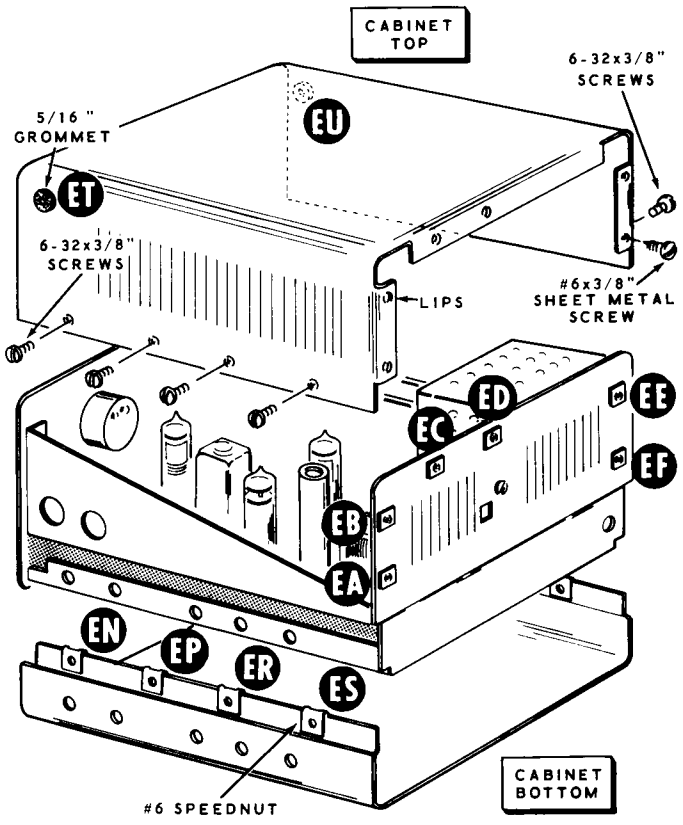


Figure 1-10

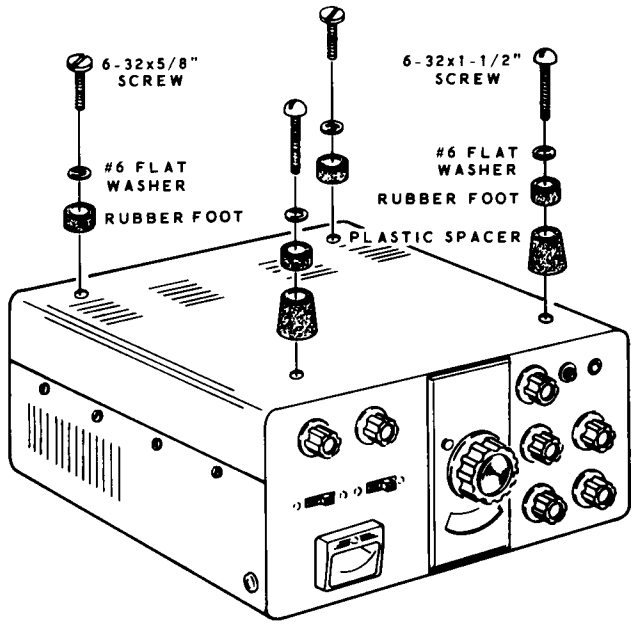


Figure 1-11

Refer to Figure 1-11 for the following steps.

( ) Install plastic spacers and rubber feet at the front corners on the bottom of the cabinet. Use a plastic spacer, a rubber foot, a #6 flat washer, and a 6-32 ×

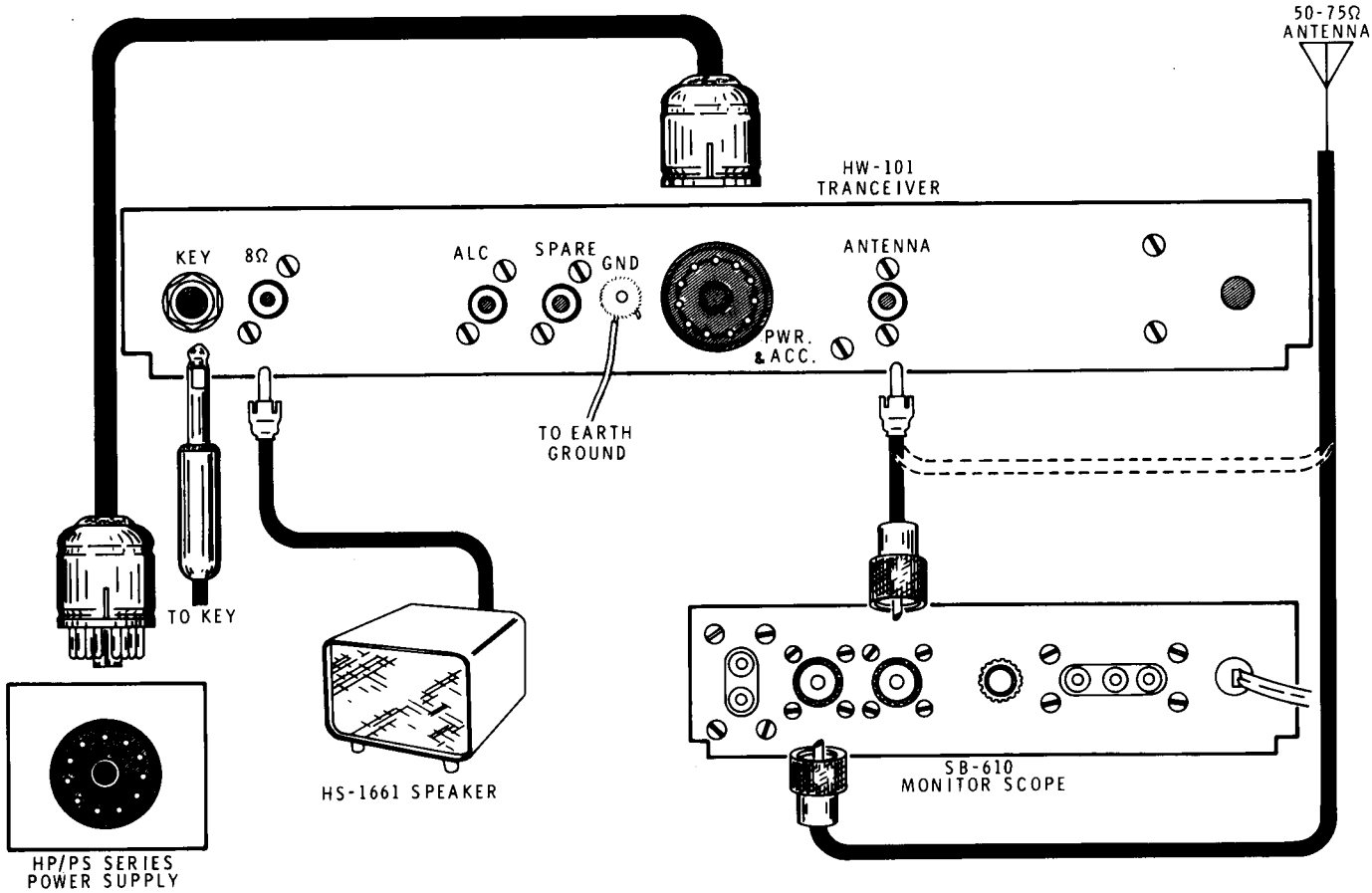

50-75Ω
ANTENNA
HW-101
TRANCEIVER
KEY
8Ω
ALC
SPARE
GND
ANTENNA
PWR.
& ACC.
TO EARTH
GROUND
TO KEY
HS-1661 SPEAKER
SB-610
MONITOR SCOPE
HP/PS SERIES
POWER SUPPLY

Figure 1-12

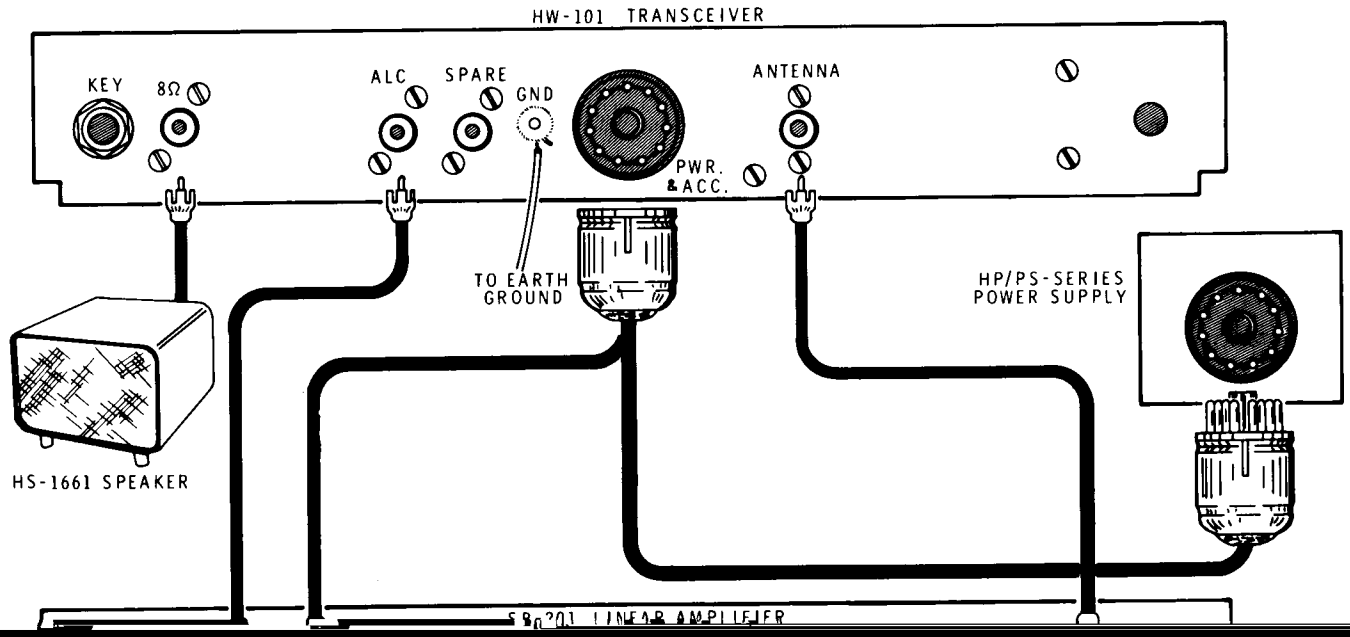
INSTALLATION

Be sure to allow for adequate heat dissipation from the Transceiver. Do not obstruct air passage through the unit by placing other equipment, papers, or objects under or on top of the Transceiver.

FIXED STATION INSTALLATION

Figure 1-12 shows a typical fixed station hookup. A Monitor Scope is shown that may be used with the Transceiver. The

PREPARE EACH END AS SHOWN


HW-101 TRANSCEIVER
KEY
8Ω
ALC
SPARE
GND
PWR. & ACC.
ANTENNA
TO EARTH GROUND
HP/PS-SERIES POWER SUPPLY
HS-1661 SPEAKER

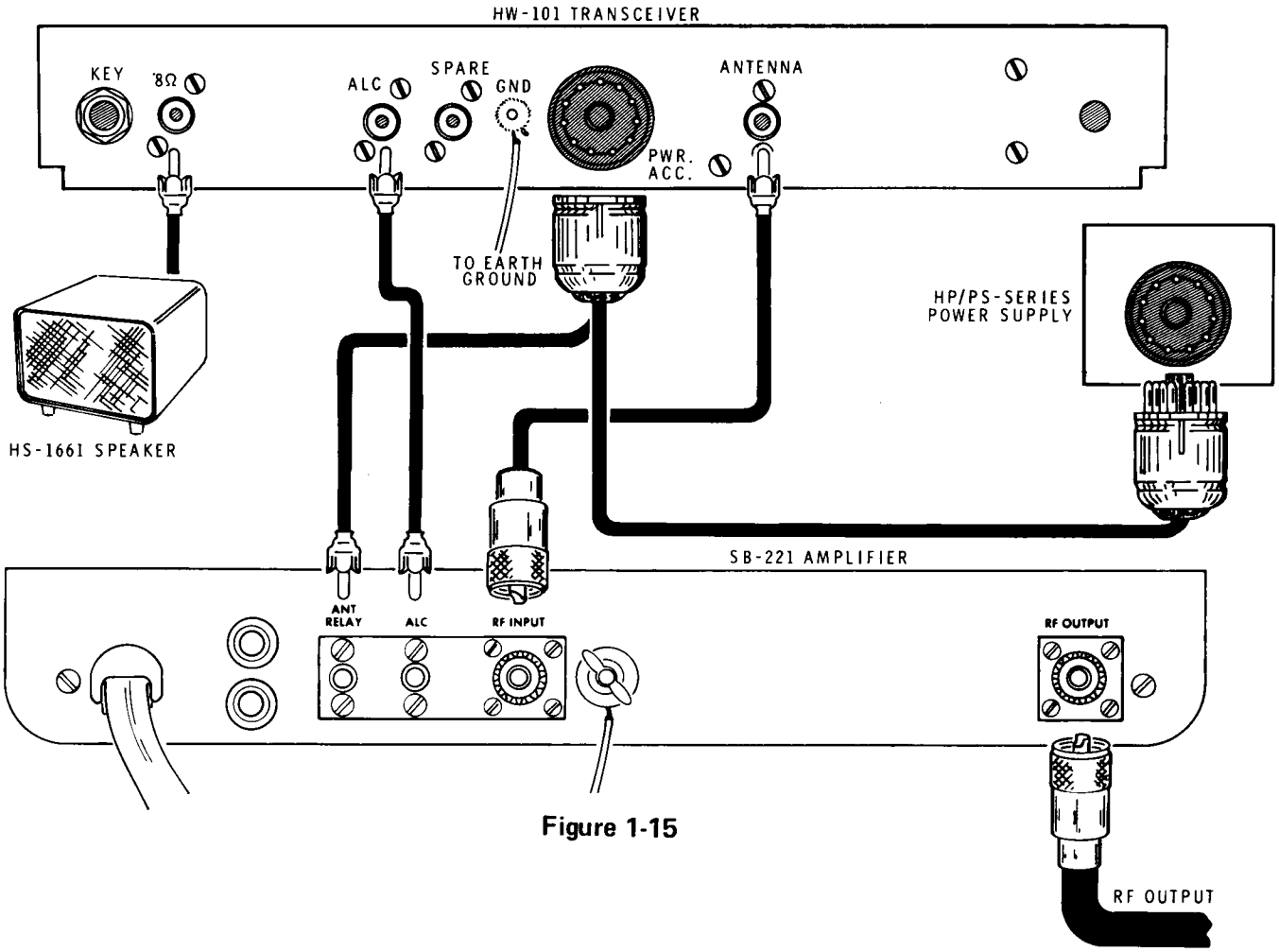
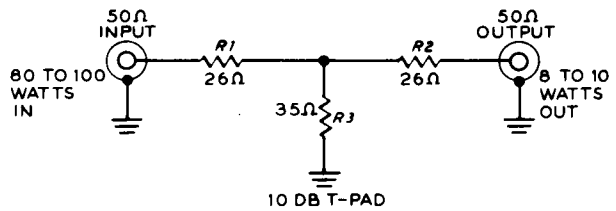


Figure 1-15

Resistors R1, R2, and R3 in Figure 1-16 can be made from combinations of common 2-watt, carbon resistors wired into a metal box with phono-type jacks or connectors. NOTE: Do not use wire-wound resistors; the resistors in the T-pad must be a noninductive type.



Combinations of 2-watt, 10%, carbon resistors for a pad suitable for SSB service at reduced power levels, are listed below. WARNING: Steady full level carrier excitation

MOBILE INSTALLATION

CAUTION: Be sure the voltage regulator of the automobile is set in accordance with the manual for your dc power supply. Have the regulator adjusted at a competent garage.

MOBILE ANTENNAS

Mount the antenna according to the manufacturer's instructions. Make a good ground connection between the shield of the coaxial cable and the car body at the antenna base. Eliminate any coating between two adjacent metal surfaces which can add resistance to the ground connections. Be sure the antenna is grounded to large metal areas of the car body and NOT to small panels which may be isolated by paint or rubber from the metal mass of the body.

Mobile antennas present loading situations which must be carefully handled for each band. Because whip antennas must be kept short for mobile use, they represent only a fraction of a wavelength on the lower frequency bands. Their radiation resistance is extremely low and their reactance is capacitive. Therefore, loading coils must be used and the losses kept low to insure a minimum loss of radiated power in the form of heat in the loss resistances.

A good quality antenna will have low resistance losses, and with a high "Q" loading coil, its bandwidth on 75 meters could be less than the IF bandwidth of many receivers used for AM reception. A typical loading coil with a "Q" of 300 would have a bandwidth of 13 kHz to the half-power points at 3.9 MHz.

Because of this sharp tuning, deviation from the center frequency of the antenna will quickly introduce enough reactance to present an impossible loading situation to the transmitter. The antenna should be carefully adjusted for a low SWR (standing wave ratio) before placing the transmitter in operation.

The following is a list of antenna considerations for each band of the Transceiver.

3.5 MHz

This band presents the greatest problem. The normal tuning range of a good antenna on this band is about 10 kHz on each side of the antenna's resonant frequency.

Actual measured resistance at the base of an antenna at these frequencies is 15 to 20 ohms; this represents an SWR of nearly 3 to 1. In order to get proper matching to the 50 ohm line, some antennas may require a 1000 pF mica capacitor connected between the inner conductor and shield of the coaxial line at the base of the antenna. Other antennas may require a different value, somewhere between 300 and 1500 pF. This capacitor is part of an L network that is used to get a 50 ohm match. The inductive portion of this network is formed by a portion of the loading coil. The correct combination is the one which produces the lowest SWR at the desired operating frequency.

7 MHz

This band ordinarily does not need a correcting network, and has a useful bandwidth of about 50 kHz.

14 MHz

No network needed. Bandwidth is approximately 100 kHz.

21 MHz

No network needed. Bandwidth is about 150 kHz.

28 MHz

The antenna for this band is normally cut for 1/4 wavelength, with no loading coil required. The bandwidth is about 200 kHz.

TYPICAL TUNING PROCEDURE

The following is a typical tuning procedure.

A whip antenna that is properly tuned on 75 meters will have a high peak of receiver activity for about 25 kHz around the antenna's resonant frequency. Turn on the

receiver and tune through the band to discover where this

( ) 6. Switch the SWR meter to the "reverse" position. Note the SWR reading.

Noise Suppression Troubleshooting Chart

TYPE OF NOISE	POSSIBLE CAUSE	RECOMMENDED REMEDY
Loud popping increasing with engine speed.	Ignition system.	1. Replace plugs with resistor type. (Highly recommended.) 2. Loose crimped connections should be cleaned and soldered. 3. Place resistors in distributor system.
Whine - varies with engine speed.	Generator or alternator.	1. Coaxial type capacitor in series with the armature or stator lead. 2. Clean commutator. 3. Replace brushes. 4. Ground generator shaft. 5. Parallel trap (#10 wire-coil and suitable capacitor) in series with armature lead, tuned to operating frequency.
Distinct but irregular clicking noise.	Voltage regulator.	1. Coaxial type capacitor in series with the battery (B) and armature (A) leads. 2. A series combination of a .002 μF mica capacitor and a 4 Ω carbon resistor to ground from the field (F) terminal. All components should be mounted as shown in diagram, close to voltage regulator.
Same as above.	Energy transfer to primary system.	1. Bypass at the following points: coaxial bypass in lead to coil from ignition switch; battery lead to ammeter; to gas gauge; to oil signal switch; head and tail light leads;

Loud popping noise that changes from one type road to another. Most pronounced on concrete.	Wheel static.	1. Installation of front wheel static collectors (available from most automotive distributors). These should be checked every 5000 miles for excessive wear.
Same as above.	Tire static.	1. Injection of anti static powder into tire.

NOISE SUPPRESSION

To obtain good noise suppression, you must suppress electrical interference at its source, so it does not reach the input of the receiver. Once it has been radiated, noise cannot be suppressed by bypassing, etc.

It is difficult to determine the source of various types of noise, particularly when several items are contributing to the noise. Follow the procedure outlined below to isolate and identify the various noise sources.

In most case, one source of interference will mask others. Consequently, it will be necessary to suppress the strongest item first, and then continue with the other steps. Figure 1-17 (fold-out from Page 143) shows a typical ignition system and the suggested placement of noise suppression components.

1. Position the vehicle in an area that is free from other man-made electrical interference such as power lines, manufacturing processes and particularly other automobiles.

2. With the Transceiver on, run the automobile at medium speed. Then let up on the gas, and turn the ignition switch to the "accessory" position or "off." Allow the vehicle to coast in neutral. If the interference stops, the major source of interference is the ignition system.

3. If the noise has a "whine" characteristic and changes in pitch with varying engine speed, then the generator is the major source of interference.

4. A distinct but irregular clicking noise, or "hash" as it is sometimes called, that disappears with the engine idling, indicates the voltage regulator is at fault.

5. A steady popping noise that continues with the ignition off indicates wheel or tire static interference. This is more pronounced on smooth roads.

6. The same type of interference as in step 5, but more irregular when on bumpty roads, particularly at slow speeds, indicates body static.

Refer to the Troubleshooting Chart on Page 146 and Figure 1-17 (fold-out from Page 143), to help determine how to suppress most noise interference. Naturally, not all vehicles will require suppression to the extent shown in Figure 1-17, but some stubborn cases may require all the suppression components shown, plus shielding of the ignition system.

Bonding of various parts of the automobile, starting from the hood and continuing to the trunk, even including bonding of the transmission line every few feet from the antenna, may be necessary. Refer to the ARRL, and other amateur handbooks, on this subject.

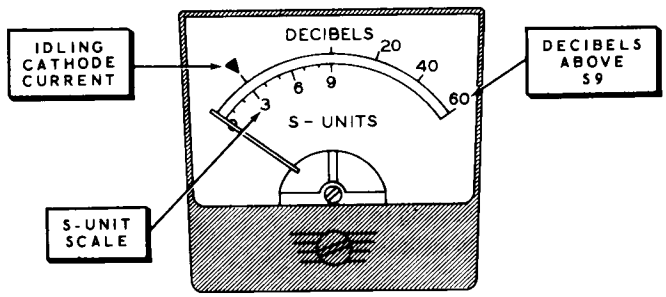

IDLING CATHODE CURRENT
DECIBELS
20
40
60
6
9
3
S - UNITS
DECIBELS ABOVE S9
S-UNIT SCALE

Figure 1-18

OPERATION

NOTE: YOU MUST HAVE AN AMATEUR RADIO OPERATOR AND A STATION LICENSE BEFORE PLACING THE TRANSMITTER SECTION OF THE TRANSCEIVER ON THE AIR. INFORMATION ABOUT LICENSING AND AMATEUR FREQUENCY ALLOCATIONS IN THE UNITED STATES IS AVAILABLE FROM PUBLICATIONS OF THE FEDERAL COMMUNICATIONS COMMISSION OR THE AMERICAN RADIO RELAY LEAGUE, 225 West Main Street, Newington, Connecticut 06111.

Operation of the Transceiver has been simplified as much as the initial settings have been made, it should not be necessary to readjust most of the controls. Read the following information carefully. Good operating techniques will provide good clean signals and long trouble-free life of the Transceiver.

CAUTION: Be sure a 50 to 75 Ω nonreactive load is connected to the ANTENNA jack before operating the Transceiver. This load can be an antenna, a dummy load, or a properly adjusted linear amplifier. (See the "Installation"

RECEIVER SECTION

1. Set the MODE switch to either LSB or USB.

2. Turn the RF GAIN control to its fully clockwise postion.

3. Turn the AF GAIN knob and allow the Transceiver to warm up.

4. Adjust the AF GAIN control clockwise until some receiver noise is heard.

5. Set the FILTER switch to SSB or CW, as appropriate.

If an extremely strong station overloads the receiver front end, leave the AF GAIN control set for comfortable listening; then adjust the receiver level with the RF GAIN control. This will keep the front end from overloading and masking weaker signals.

The S Meter will move with adjustment of the RF GAIN control, but will still read correctly with the RF GAIN set at less than maximum (if the received signal level is high enough to register on the S Meter). For example, if the RF GAIN control is set for no-signal meter reading of S5, and the meter registers S9 with a signal, then the received signal is S9.

6. The Transceiver is now ready to receive. Turn the BAND switch to select the desired 500 kHz band segment. The frequency of the tuned signal is determined by adding together the settings of the BAND switch, and the circular dial.

7. Peak the DRIVER PRESELECTOR for maximum signal.

8. Set the FUNCTION switch to CAL. Rotate the MAIN TUNING dial (VFO) to the nearest 100 kHz point on the circular dial.

9. Adjust the MAIN TUNING dial until the calibrate signal is at zero beat. (To be sure that the correct calibrate signal is being used, check the DRIVER PRESELECTOR tuning. If the signal strength varies, you are tuned to the correct calibrator signal.)

TRANSMITTER SECTION

WARNING: Portions of each band are for CW operation only. DO NOT operate the Transceiver with voice modulation in any portion of a CW subband. To do so (in the U.S.A.) will invite disciplinary action by the Federal Communications Commission.

Make SURE your dial calibration is correct, since it is possible for the circular dial to be 100 kHz off frequency. For example, your dial could read 14.3 MHz but your actual transmitting frequency could be 14.4 MHz, which is out of the amateur band. Checking with the built-in calibrator can insure that the circular dial is exactly on a 100 kHz point, but you cannot be sure which one it is on. Therefore, before

INITIAL TUNE UP

The 10 steps of this procedure must be performed for all modes of operation.

1. Set the BAND switch and Main Tuning dial for the desired frequency.

2. Place the METER switch in the PLATE position.

3. Turn the MIC/CW LEVEL control fully counterclockwise.

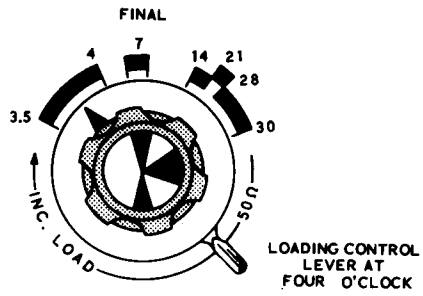


Figure 1-19

Refer to Figure 1-19 for settings of the FINAL TUNE knob and lever.

5. Set the METER switch to REL PWR and adjust the LOAD lever to the four o'clock position.

6. Set the FINAL TUNE knob to the position corresponding to the band in use.

7. Turn the MIC/CW LEVEL control clockwise to obtain a small up-scale indication on the meter. Then alternately adjust the PRESELECTOR, the FINAL TUNE knob, and the LOAD lever for a maximum indication on the meter.

8. Turn the MIC/CW LEVEL control clockwise until the meter reading no longer increases with knob rotation, and again peak the FINAL TUNE and FINAL LOAD controls for maximum output.

9. Set the METER switch to PLATE. The meter needle should read approximately 40 on the scale, indicating a plate current of 250 mA. (See "Reading the Meter," Page 139).

Important: Before you put the transmitter into operation for the first time, and any time you change the final amplifier tubes, make the following check: Tune the transmitter as outlined in Steps 1 through 9 above. Then operate the METER switch between REL PWR and PLATE. The maximum power output (REL PWR) should occur at approximately the same point on the FINAL TUNE knob as the maximum **dip** in PLATE current. If it does not occur at the same point, DO NOT operate the transmitter until you have re-neutralized the unit as outlined (starting in the left column) on Page 123.

10. Return the MIC/CW LEVEL control to its full counterclockwise position.

CAUTION: The Transceiver should be retuned if the frequency is changed by any great amount. Be sure to readjust the FINAL TUNE controls. It may also be necessary to repeak the DRIVER PRESELECTOR control.

This completes the Initial Tune Up. Before placing the Transceiver in operation, complete either the following CW or Single Sideband adjustments.

CW OPERATION

For CW operation, the FUNCTION switch can be set to either the PTT or VOX positions. Even though CW operation is possible in the Calibrate position, it is not recommended because of possible spurious outputs from calibrator signals being present at the grid of the driver stage.

For 400 Hz CW selectivity, the Heath SBA-301-2 CW crystal filter may be installed in addition to the SSB crystal filter supplied with the Transceiver. The filter switch will then select the SSB or the CW filter.

Be sure steps 1 through 10 have been satisfactorily completed before proceeding with the following adjustments.

( ) Place the MODE switch in the CW position.

( ) Plug a key into the CW KEY jack.

The VOX DELAY control is located on the right side of the Transceiver.

( ) While sending a series of "V's", adjust the VOX DELAY control so the relays stay energized between groups of characters. Clockwise rotation of this control will increase the holding time of the relays.

The final setting of the VOX DELAY control will be determined by the sending speed of the operator. The slower the sending speed, the higher the setting of this control. NOTE: Be sure the VOX DELAY control is adjusted so the relays do not open after each character is sent.

( ) Set the MIC/CW LEVEL control to the minimum position that produces full output (increasing the control setting above this level DOES NOT increase the output or the REL PWR reading).

CROSS-MODE OPERATION

After the dial is set to zero beat the calibrator signal, the frequency of the CW output signal is 1000 Hz higher than the dial reading. The received signal is actually in the USB position even though the MODE switch is set at CW. Consequently, cross-mode operation is possible between USB and CW without any resetting of the MAIN TUNING dial. For example, if two stations begin operation in the USB mode of operation and one operator changes to CW, the other station will hear a 1000 Hz note without retuning his receiver. Also, the station operating in the CW mode will receiver the USB signal from the other station without

changing back to the USB position of the MODE switch. When two stations are operating in the LSB mode and the operator of one changes to USB or CW, contact will be lost until the other station changes to either USB or CW.

SINGLE SIDEBAND OPERATION

Be sure steps 1 through 10 have been satisfactorily completed before proceeding with the following adjustments.

( ) While speaking into the microphone, turn the VOX SENS control to just beyond a setting that will energize the relays. Be sure this control is not set so high that it will allow background noise to trip the relays.

( ) Tune the receiver to a fairly strong signal and adjust the AF GAIN control for a comfortable listening level.

( ) Place the microphone where it will normally be used. Advance the ANTI-TRIP gain control to just beyond a

MOBILE OPERATION

If the Heathkit dc Mobile Power Supply is to be used with the Transceiver in a mobile installation, and the BIAS control in the Transceiver has already been preset for fixed station operation, make the following adjustments.

( ) Turn the MIC/CW LEVEL control fully counterclockwise.

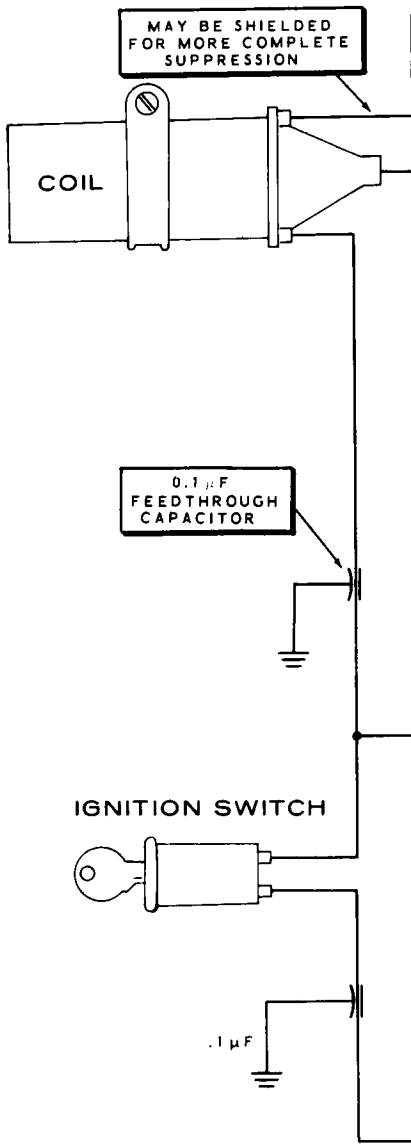
( ) Place the MODE switch in either the USB or LSB position.

( ) Set the FUNCTION switch to PTT.

Activate the transmitter with the push-to-talk button on the microphone, and adjust the bias control in the mobile power supply for a cathode current reading of ▼ (50 mA). This will make it unnecessary to readjust the BIAS control of the Transceiver each time it is changed from mobile to fixed station use.

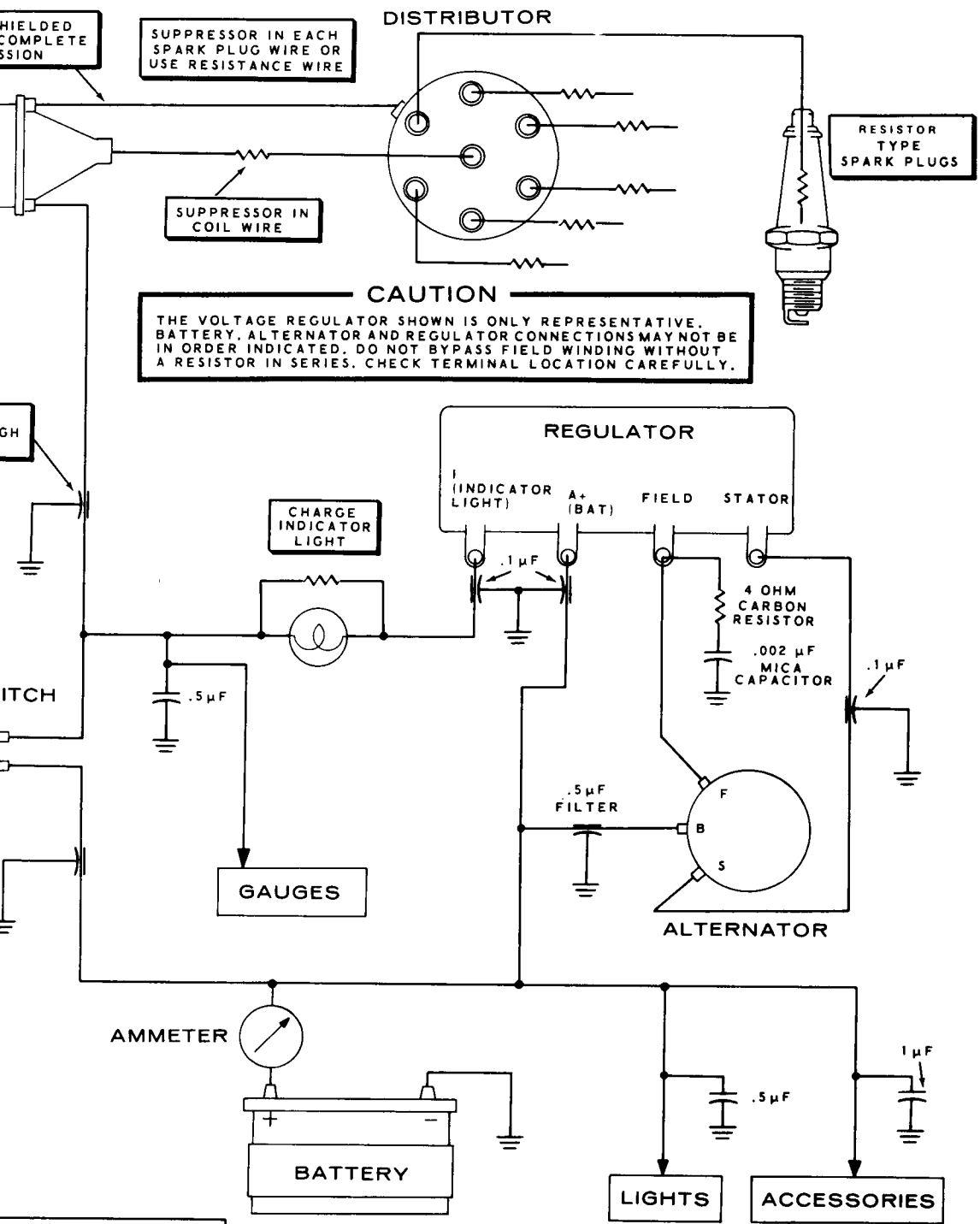
The VOX SENS, VOX DELAY, and ANTI-TRIP circuits will operate in mobile use, but because of the different power supplies, it may be necessary to readjust these controls.

Transmitter loading may be somewhat more critical on



A

VALUE OF SUPPRESSOR	MANUFACTURER REPRESENTATIVE	
10K OHM	ERIE TYPE	L7V
5K OHM	ERIE TYPE	L7V
.5 μF FEEDTHROUGH	SPRAGUE	48P18 BRACKE
.1 μF FEEDTHROUGH	SPRAGUE	80P3 (2 BULKHEA
	SPRAGUE	48P9 (2 BRACKE
.5 μF	MALLORY	AG-
1 μF	MALLORY	AG-



ANUFACTURER AND RESENTATIVE TYPE	
TYPE	L7VR-10ME
TYPE	L7VR-5ME
UE	48P18 (40 AMP), BRACKET MOUNT
UE	80P3 (20 AMP), BULKHEAD MOUNT
UE	48P9 (20 AMP), BRACKET MOUNT
ORY	AG-451
ORY	AG-452

NOTE: ALL GROUND CONNECTIONS SHOULD BE MADE TO THE COMPONENT BEING BYPASSED, PREFERABLY BY MOUNTING THE SUPPRESSOR DIRECTLY ON THE COMPONENT.

FIGURE 1-17

IN CASE OF DIFFICULTY

A review of the "Operation" and "Installation" sections of the Manual may indicate any conditions overlooked.

Refer to the Schematic Diagram (fold-out from Page 199) and to the "Chassis Photos" and "X-Ray Views" sections (Pages 182 to 189) for the locations of parts.

Check the receiver and transmitter voltage readings against those shown in Figures 1-20 and 1-21 (fold-out from Page 144). Check the resistance readings against the readings shown in Figure 1-22 (fold-out from Page 155). All voltage readings were taken with an 11 MΩ input electronic voltmeter. Voltages may vary as much as 10%.

Refer to the Receiver Signal Voltage Chart (Figure 1-20) if a signal generator is used to troubleshoot the Transceiver.

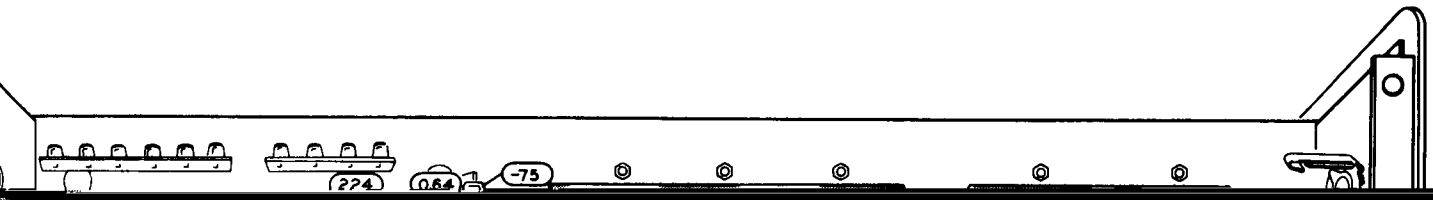
NOTE: Breaks in the foil of the circuit boards can be detected by placing a bright light under the foil side of the board and looking through the board from the lettered side. A break will appear as a hair-line crack in the foil.

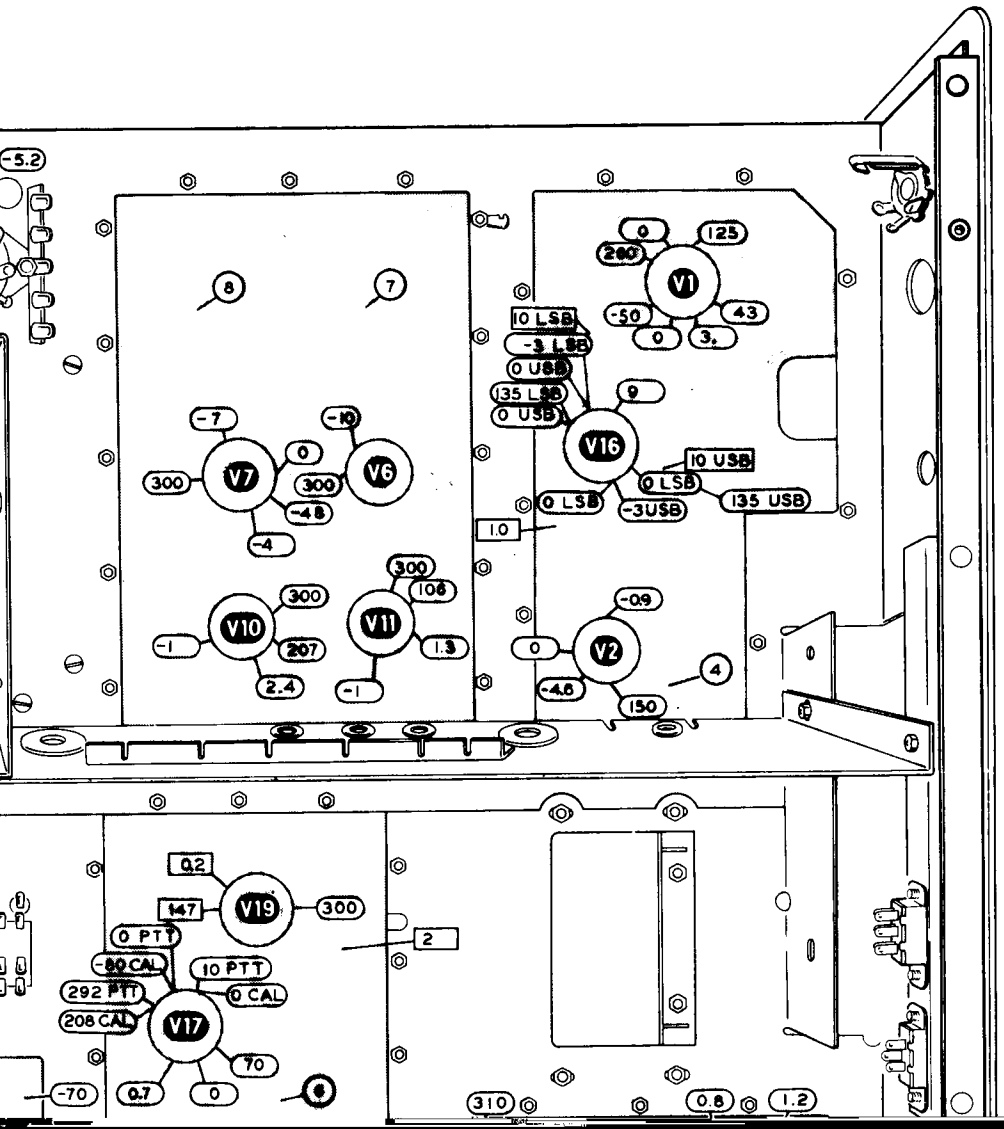
Wiring errors and poor soldering are the most common causes of difficulty. Therefore, the first step in troubleshooting is to recheck all wiring against the Pictorials and Schematic Diagrams. Often, having a friend check the wiring will locate an error consistently overlooked by the builder.

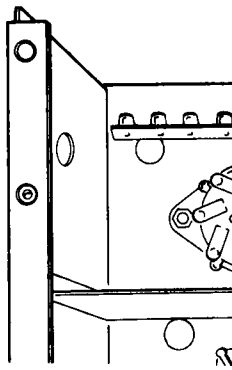
Quite often, soldered connections that appear good will have an insulating coating or rosin between the wire, the terminal, and the solder. This results from insufficient heat being applied when you are soldering. You can eliminate many troubles by reheating each connection to make sure that it is properly soldered as illustrated in the "Kit Builders Guide." The power supply should be turned off and the power cable should be removed from the power supply for such tests. As additional insurance against shock, a screwdriver blade should be used to short from the chassis to the red B+ wires.

If fuses blow instantly when power is applied to the unit, check the power supply, B+ circuit, and filament circuits. Check all tubes for possible shorts. Also, refer back to the "Initial Test" section on Page 117. Check to be sure that all tubes are in their proper locations.

Be sure to read the "Circuit Description" so that "Cause-and-Effect" reasoning may be employed as the search for the trouble progresses. If some difficulty still persists after the steps outlined in the Troubleshooting Chart have been completed, try to localize the trouble to a particular stage in the circuit by using the voltage and resistance charts. Then refer to the Block Diagram and Schematic to visualize circuit relationships.


224
0.64
-75





TRANSMITTER VOLTAGES (±20%)

CAUTION: POWER SUPPLY FUSE OR CIRCUIT B
IF TRANSMITTER IS OPERATED WITH FULL TU
FOR MORE THAN 30 SECONDS.

NOTES:

1. BANDSWITCH IN 3.5 POSITION.
2. DIAL SET AT 3700 kHz. TUNED FOR MAX. C
3. MODE SWITCH IN TUNE POSITION UNLESS
4. METER SWITCH IN REL PWR POSITION.
5. FUNCTION SWITCH IN PTT POSITION.
6. MIC/CW LEVEL FULLY COUNTERCLOCKW
SIGNAL VOLTAGE MEASUREMENT (SEE BE

⬭ DC VOLTAGE WITH MODE SWITCH IN TUNE

◯ DC VOLTAGE WITH TRANSMITTER TURNE
PTT SWITCH.

▭ RF OSCILLATOR VOLTAGE (USE RF PROBE

□ RF SIGNAL VOLTAGE WITH MIC/CW LEVE
S9 + 20 DB IN REL PWR POSITION.

RECEIVER VOLTAGE CHART NOTES

DC VOLTAGES (±20%)

1. POWER SUPPLY AND 8 Ω SPEAKER CONNECTED.
2. ANTENNA NOT CONNECTED.
3. BAND SWITCH IN 3.5 POSITION.
4. MODE SWITCH IN LSB POSITION.
5. FUNCTION SWITCH IN PTT POSITION.
6. RF GAIN MAXIMUM CLOCKWISE.
7. AF GAIN AT 9 O'CLOCK POSITION.
8. FILAMENT VOLTAGES NOT SHOWN: -
   BROWN - 6.3 V AC/DC
   WHITE/BROWN - 12.6 V AC/DC
9. BIAS AT 50 MA PLATE CURRENT.

(oval) MEASURED WITH 11 MEGOHM INPUT ELECTRONIC VM.

(rectangle) RF VOLTAGES - NO SIGNAL (USE RF PROBE WITH ELECTRONIC VM).

SIGNAL VOLTAGES

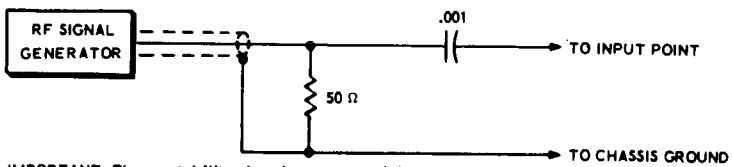
(Refer to Receiver DC Voltage Chart for Test Points)

CONTROL AND SWITCH SETTINGS AS IN DC VOLTAGE CHART EXCEPT AS FOLLOWS:

1. DIAL FREQUENCY - 3.900 MHz
2. MODE SWITCH - LSB OR USB.
3. AF GAIN - SET TO HEAR SIGNAL WITH APPROXIMATELY 1000 Hz TONE.
4. METER SWITCH IN ALC POSITION.

(◯) SIGNAL INPUT POINTS.

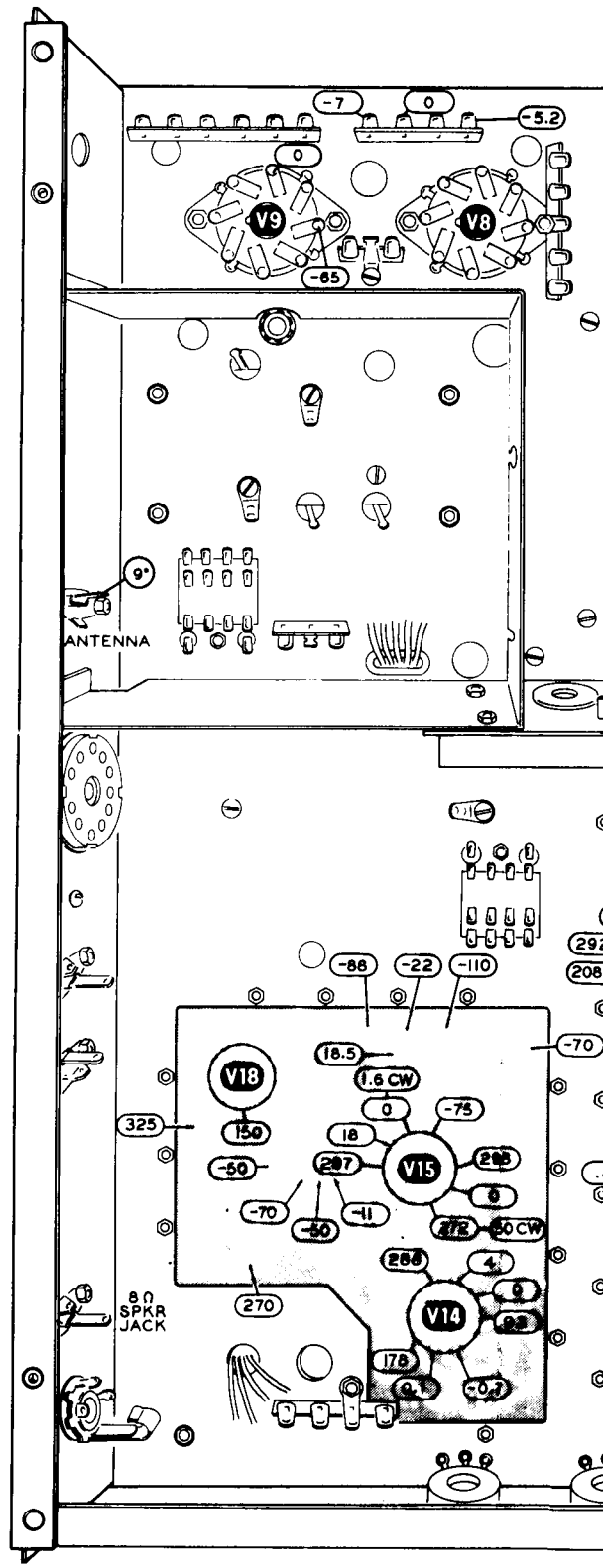
SIGNAL GENERATOR TERMINATION



IMPORTANT: The crystal filter is quite narrow and the signal generator must be very carefully adjusted for the strongest signal indication at the Input Frequency listed in the chart below.

INPUT POINT	INPUT FREQUENCY	INPUT LEVEL	ELECTRONIC VM OR S-METER READING
1	3.395 MHz	20 mV	(AF GAIN MAX. CLOCKWISE) 4 V RMS AT 8 Ω JACK
2	"	10 mV	S-4
3	"	10 mV	S-9 + 60 DB.
4	"	10 mV	S-9 + 60 DB.
5	"	10 mV	S-9 + 10 DB.
6	8.5 MHz	10 mV	S-9 + 40 DB.
7	3.900 MHz	10 mV	S-9 + 20 DB.
8	3.900 MHz.	10 mV	S-9 + 40 DB PEAK DRIVER PRESELECTOR
XTAL CAL ON	3.900 MHz		S-9 + 20 DB PEAK DRIVER PRESELECTOR
9 *	3.900 MHz	30 μV	S-9 APPROXIMATELY

* GENERATOR CONNECTED DIRECTLY- NO TERMINATION.



RECEIVE

Most of the RF voltages can be measured with an RF probe connected to your VTVM. Read the comment under "RF Voltage Servicing."

A grid dip meter, or wavemeter, and a general coverage receiver are ideal instruments for checking operation of the RF circuits.

NOTE: If there is instability in the unit, check all circuit board mounting screws. These screws should be tight to the chassis and to the circuit board. Be sure lockwashers are against the foil side of the boards for good grounding.

The enclosed relays used in this unit should be troublefree for years of normal use.

DO NOT REMOVE ANY OF THE TUBES OR PILOT LAMPS WITH POWER APPLIED TO THE UNITS. Because of the series-parallel filament circuit arrangement, removing a tube with power applied may destroy other tubes due to an increase in filament current through them.

RF Voltage Servicing

On the Schematic at the end of this Manual, the symbol ◯ encloses a number indicating the RF voltage at that point. Most of these symbols are found near the top of the Schematic, although others will be observed near V16, the VFO output, V19B, and the antenna output.

RF voltages are shown at the grid and plate of most tubes carrying RF so you can determine whether the problem lies in the grid or the plate circuit.

A Heathkit 11 MΩ input voltmeter with a Heathkit RF probe rated at 90-volts rms was used to measure the RF voltages. If your probe has a lower voltage rating, use the following procedure:

Turn the MIC/CW LEVEL control fully counterclockwise, touch the probe to the measurement point, and then turn the MIC/CW LEVEL clockwise until a meter reading of 30 volts is obtained. If this occurs, consider that the reading at this point is satisfactory. It should be expected that voltages will vary from Transceiver to Transceiver. Crystal oscillator voltages will vary considerably.

This procedure traces the RF signal voltage from stage to stage. By this method, it is easy to isolate a problem stage so that steps can be taken to correct the trouble. You should start at the carrier oscillator and work through to the final, as each stage is dependent on the previous stage.

Trace the RF up to the point it is lost; then back up one stage. Should one or two bands be operating properly and the rest have difficulty, make reference RF voltage measurements on one of the operating bands and make comparison measurements on the inoperative bands. In this way, the stage causing difficulty is quickly isolated.

Once the stage is isolated, steps can be taken to correct the problem. Check for wiring errors, intermittent solder connections, loose hardware and bent switch contacts first; then look for weak tubes, and last, for defective components.

VFO Troubleshooting

VFO troubleshooting instructions are included on Page 154.

NOTE: In an extreme case where you are unable to resolve a difficulty, refer to the "Customer Service" information inside the rear cover of the Manual. Your Warranty is located inside the front cover of the Manual.

SYMPTOM	POSSIBLE CAUSE
8. No screen voltage at tubes V4.	A. Lugs 3, 7, or 11 of relay RL2 wired wrong.
9. High-pitched audio oscillation unaffected by AF Gain control.	A. Red and blue audio output transformer leads reversed. B. AVC line shorted - no cutoff bias to V10 or V11.

SYMPTOM	POSSIBLE CAUSE
14. No signal output, but noise output can be heard.	A. Transformer T201 misaligned or defective. B. No VFO injection signal at the cathode of V12A. (Check item 34B). C. Coaxial cable connected between the bandpass and driver plate circuit boards, open or shorted. D. First IF amplifier tube V3 defective. E. Second receiver mixer tube V12A defective. F. No heterodyne oscillator injection signal at the cathode of V11. (Check items 36A through 36I). G. First receiver mixer V11 or RF amplifier V10 defective. Also check items 3B and 4B. H. Coaxial cable connected between relay RL1 and the driver plate circuit board, open or shorted. I. Relay RL1 wired incorrectly. J. Bandpass filter T202 defective. K. Crystal filter FL1 defective. L. Filter switch in wrong position. NOTE: One filter terminal may normally have a 3 Ω to 5 Ω resistance to ground.
15. Audio output with signal, but weak.	A. Low B+ supply voltage. B. Coils on driver plate, driver grid, and heterodyne oscillator circuit boards misaligned. C. Check items 3B, 5A, 5B, 6B, 13A through 13I and 14A through 14K. D. RF Gain control is partially counterclockwise or wired incorrectly.
16. Receiver tends to be unstable, oscillates. (Receiver noise may be extremely high, or many "birdies" appear across tuning range.	A. RF driver and IF circuit board mounting hardware not tight, or lockwashers left out between the chassis and circuit boards. B. Antenna transmission line open or shorted, or has high SWR. C. Supply voltage too high. (Check items 5B and 6B). D. Transmitter cutoff bias too low (V6 and V7).
17. Sideband reception reversed or highly distorted.	A. Carrier generator crystals Y1 and Y2 interchanged. B. CW carrier generator crystal Y3 inter-

SYMPTOM	POSSIBLE CAUSE
18. S Meter inoperative, indicates backwards, is inoperative in	A. Leads connected to the meter are reversed. B. Improper wiring of Meter switch.

SYMPTOM	POSSIBLE CAUSE
23. Low relative power reading.	A. MIC/CW Level control set too low. B. Transceiver not properly tuned. C. Antenna shorted, or too low impedance. D. Improper voltages to V8 or V9.
24. High relative power reading.	A. Antenna too high impedance. B. Open-circuited antenna.
25. No RF output from second transmitter mixer, regardless of the Mode switch setting. (First transmitter mixer appears to be OK.)	A. Check items 5A through 5C, 19A, 19B, 22D, and 22E. B. No heterodyne oscillator injection signal at cathode of V6. (Check items 36A through 36L.) C. Coaxial cable connected between the bandpass and driver plate circuit board open or shorted. D. Second transmitter mixer tube V6 defective.
26. No RF output from first transmitter mixer regardless of the Mode switch position. (First IF amplifier appears to be OK.)	A. Check items 19A, 19B, 20B, 20C, 22D, and 22E. B. No VFO output signal to cathode of V5 (pin 7). C. First transmitter mixer tube V5A defective. D. Bandpass filter T202 defective.
27. No RF output from first IF amplifier, regardless of the Mode switch position. (Isolation amplifier output appears to be OK.)	A. Check items 14A, 14C, 14D, 14K, 19A, and 19B.
28. No RF output from isolation amplifier, regardless of the Mode switch position.	A. Check items 20B and 20C. B. Resistors R18, R19, R23, R24, R937, and/or R938 wrong value. C. Transformer T1 misaligned or faulty. D. Isolation amplifier tube V2 defective. E. Carrier oscillator not operating. (Check items 31B through 31E.)

SYMPTOM	POSSIBLE CAUSE
29. No RF output with the Mode switch in USB or LSB, but output in Tune or CW positions OK.	A. Check items 19A and 25A. B. No carrier injection signal to balanced modulator. (Check items 30B, 30C, and 32A through 32F. C. Balanced modulator diodes CR1 through CR4, installed improperly, wrong type, or defective. D. Coaxial cable #3 connected to the MIC/CW Level control open or shorted. E. Wafer 1F or 1R of the Mode switch wired incorrectly. F. MIC connector wired wrong. G. Speech amplifier tube V1 defective. H. Microphone defective. I. MIC/CW Level control defective.
30. No RF output with the Mode switch in Tune or CW, but output in LSB or USB OK.	A. Check items 19A, 19B, 20C, and 29B. B. MIC/CW Level control defective. C. Rear wafer of Mode switch wired wrong.
31. No carrier oscillator injection signal with the Mode switch in Tune or CW positions, but LSB and USB output OK.	A. Check items 19A and 19B. B. CW crystal Y3 improper frequency or defective. C. Lugs 1, 5, and/or 9 of the Mode switch wired incorrectly. D. Incorrect wiring of Mode switch wafers 1F or 2R. E. Tube V16 defective.
32. No carrier oscillator injection signal with the Mode switch in either LSB or USB positions. Tune and CW output OK.	A. Check items 19A and 19B. B. Coaxial cable from IF circuit board to modulator circuit board shorted. C. USB crystal Y1, or LSB crystal Y2, improper frequency or defective. D. Capacitors C4 through C8, C16 and C17, wrong value. E. Resistors R6 through R9, or R11, wrong value. F. Tube V16 defective.

SYMPTOM	POSSIBLE CAUSE
33. Very low output in USB or LSB modes.	A. T1 not aligned. B. Microphone output level too low. C. Tube V1 defective. D. Check item 23A.
34. No VFO injection signal at cathodes of V5 or V12.	A. Check items 5A, 5B, and 5C. B. Tube V20 defective.
35. VFO frequency does not shift properly with Mode switch in various positions.	A. Check items 5A, 5B, 5C, 32D, and 32E. B. Mode switch wafer 1F wired incorrectly. C. Resistor R306 or R307 wrong value.
36. No heterodyne oscillator injection signal at cathodes of V6 and V11.	A. Check items 5A, 5B, and 5C. B. One of the crystals Y501 through Y508 defective, depending on the band being used. C. Coaxial cable from heterodyne oscillator circuit board to bandpass circuit board, open or shorted. D. Capacitors C208 or C223 wrong value. E. Tube V19 defective or wrong type. F. Coils L601 through L608 misaligned or faulty. G. Capacitor C604 wrong value. H. No 150 V B+ voltage to the heterodyne oscillator circuit board. I. Rotors reversed 180 degrees in the switch wafer on the crystal or heterodyne oscillator circuit boards.
37. Relays RL1 and RL2 do not energize with the Mode switch in the Tune position.	A. Tube V12B defective. B. Relays RL1 or RL2 defective. C. Wafer 2F of Mode switch wired incorrectly.
38. Relays RL1 and RL2 will not energize with Mode switch in LSB or USB, and Function switch in VOX position.	A. Check items 5A through 5C. B. VOX SENS control improperly adjusted. C. Tube V17A defective of wrong type. D. Diode D201 wrong type or installed backwards. E. Zener diode D202 installed backwards or defective. F. Function switch wired incorrectly. Check the white-red-red wire to lug 3. G. Anti-Trip control set too high.

SYMPTOM	POSSIBLE CAUSE
39. Relays energize and stay energized regardless of VOX Sens control setting.	A. PTT switch on microphone stuck closed or shorted. B. Key closed. C. C213 defective. D. V12 defective. E. Low B+, at 250 Vdc instead of 300 Vdc.
40. Transmitter tends to be unstable.	A. Final and/or driver neutralization not proper. B. Mounting hardware for Modulator and RF driver circuit board not tight. Lockwashers between circuit boards and chassis left out. C. Check items 16C and 16D. D. Coils L802 through L805 and/or L801 misaligned. E. Antenna impedance wrong. F. Coil shield cover loose or missing. G. Ground clips for tube shields bent out. H. Hardware loose on sockets V8 and V9. I. Excessive lead lengths of components around V8 and V9.
41. Receiver has slow recovery from transmit condition.	A. Diode D101 defective.
42. Transmit output falls off.	A. Excessive heat due to restricted air circulation. B. Incorrect bias setting. C. Improper load to RF output. D. Gassy 6146 tubes. E. Tube V7 weak.
43. Zero setting of main tuning dial changes considerably from band to band.	A. 100 kHz calibrator is not set exactly at 100 kHz. B. Heterodyne oscillators not properly tuned. C. Repeat the VFO alignment procedure on Page

VFO TROUBLESHOOTING

A tube adapter may be used to check "in circuit" voltages present at tube V20 in the VFO. Other than this, it will normally be necessary to remove the VFO chassis from the main chassis. Instructions follow for removing and replacing the VFO and dial assembly as a unit.

VFO ASSEMBLY REMOVAL

( ) Remove tube V19 from its socket.

( ) Remove the screw holding the pilot lamp socket to the VFO.

( ) Unplug the coaxial cable from the VFO output socket.

( ) Unsolder the bias, B+, and filament wires from the Bias, B+, and Fil terminals on the back of the VFO chassis.

( ) Remove the 6-32 nuts and lockwashers from the spade bolts which hold the VFO chassis to the main chassis.

( ) Work the VFO chassis upward until the spade bolts are out of their slots, and to the rear until the VFO shaft is free from the Jackson drive hub.

( ) Tack solder extensions to the power wires that were removed from the back of the VFO chassis; tape the joints to avoid short circuits. Connect and solder the extensions to the appropriate terminals on the removed VFO chassis.

( ) Use a clip lead or wire to ground the VFO chassis to the main chassis.

( ) Turn the power on and test the unit in operation.

VFO ASSEMBLY REPLACEMENT

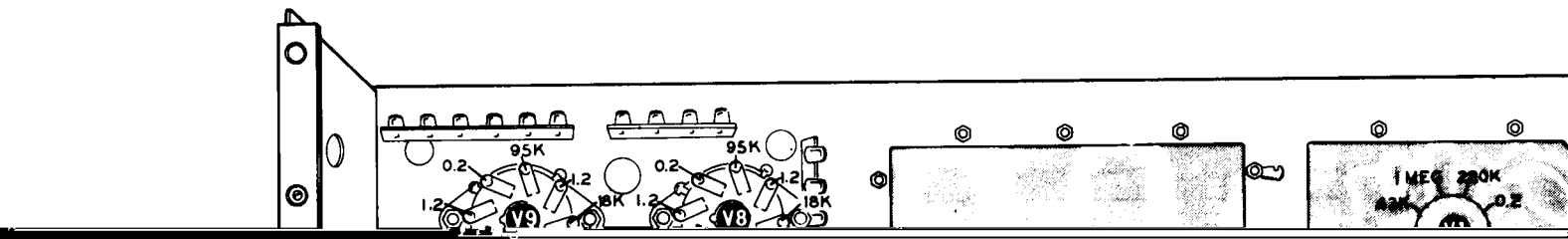
VFO Troubleshooting Chart

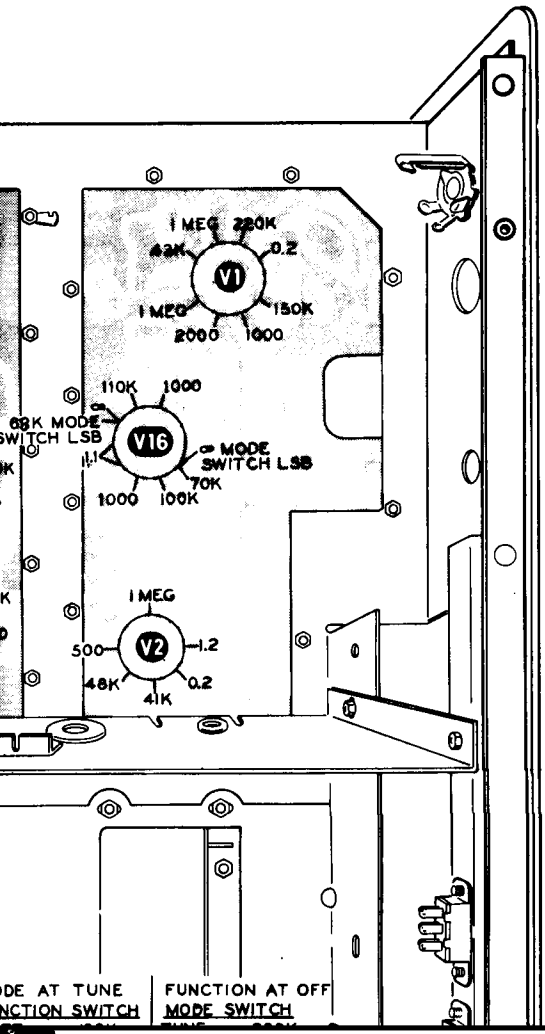
SYMPTOM	POSSIBLE CAUSE
1. Output low (after calibration).	A. Tube V20 weak. B. Turn the Main Tuning dial to 300 and tune the top core of coil FM for maximum VFO output.
2. Output high.	A. Resistor R221 not soldered to point F on the bandpass circuit board. B. Core of VFO coil turned to wrong end. It should be approximately 1-1/4" below the end of the coil.
3. No output.	A. Q942 connected backwards. B. Q941 connected wrong. C. Lugs of C950 touching the chassis. D. Output cable shorted. E. Lead of C951 not connected through lug 2 to TP terminal of L941.
4. VFO shifter does not work.	A. CR941 reversed.
5. Microphonics generated by tapping VFO chassis.	A. Bend the leads of, or reposition, the two 56 pF disc capacitors so their surfaces are separated more than 1/8". B. Component leads too long, permitting vibrations or motion.

VFO RF TROUBLESHOOTING

Figure 1-23 shows the ac, dc, and RF voltages to be expected in the VFO. These measurements were made with an 11 MΩ input voltmeter and, in the case of RF voltages only, a Heathkit RF probe. RF voltage measurements were made at 3700 kHz, LSB, receiving, with VFO output open circuited. RF voltages may vary 25%.

Follow the same step-by-step procedure as outlined for the other parts of the Transceiver. Look for poorly soldered joints, stray bits of wire or solder, and component leads improperly touching each other or the chassis.


95K
0.2
1.2
18K
V9
95K
0.2
1.2
18K
V8
1 MEG
220K
0.2



NOTES

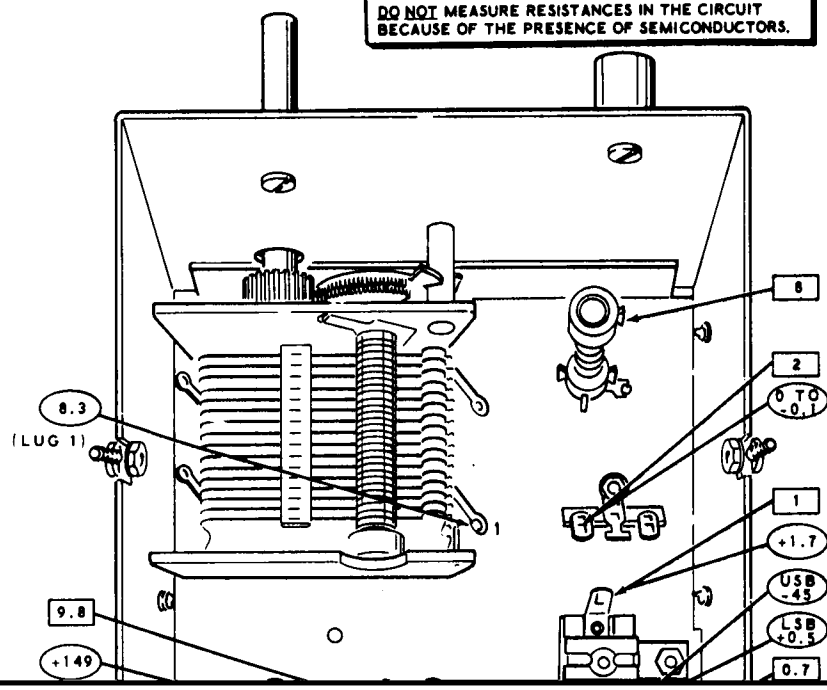
VFO OUTPUT: OPEN CIRCUIT

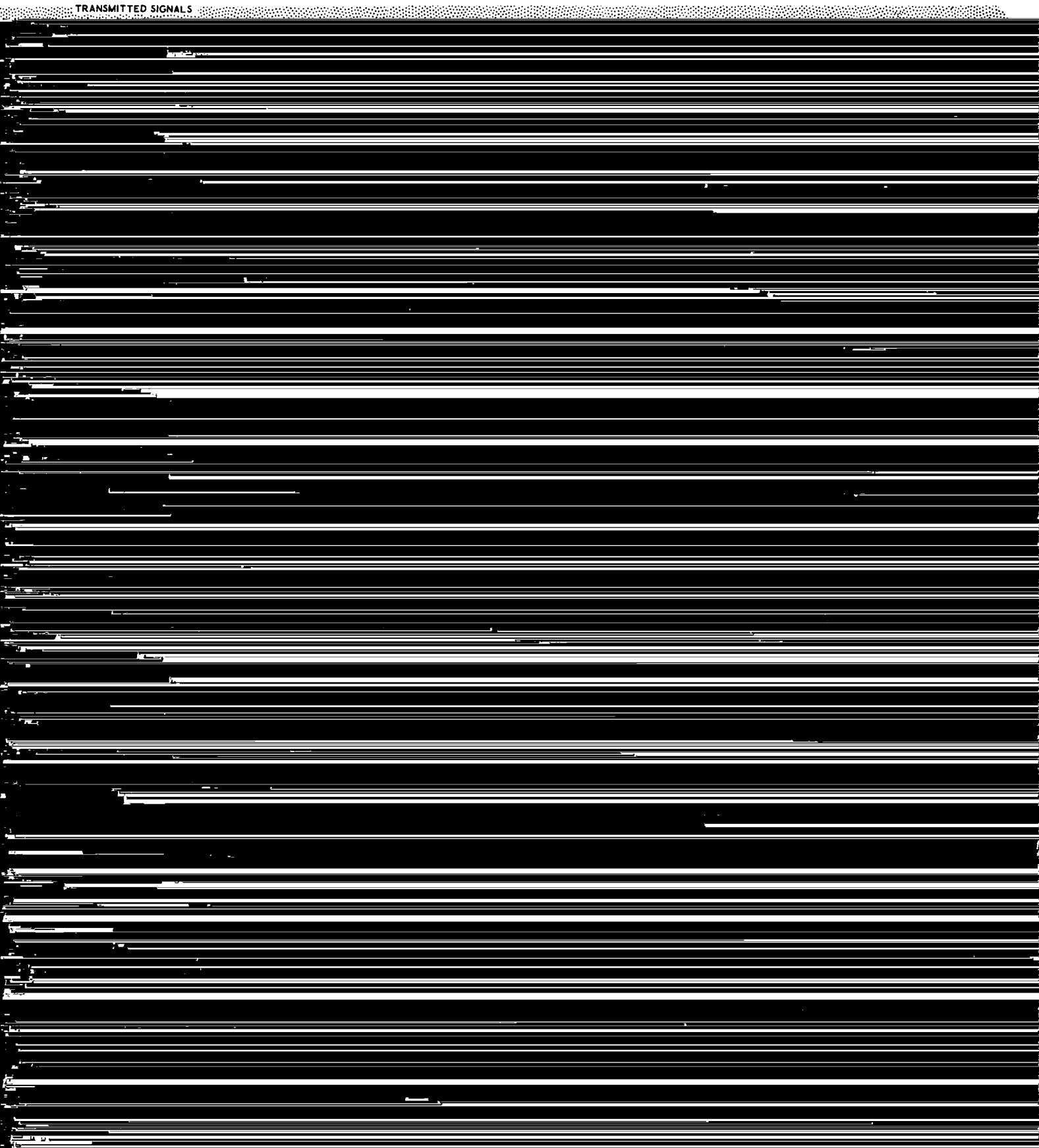
AC VOLTAGE

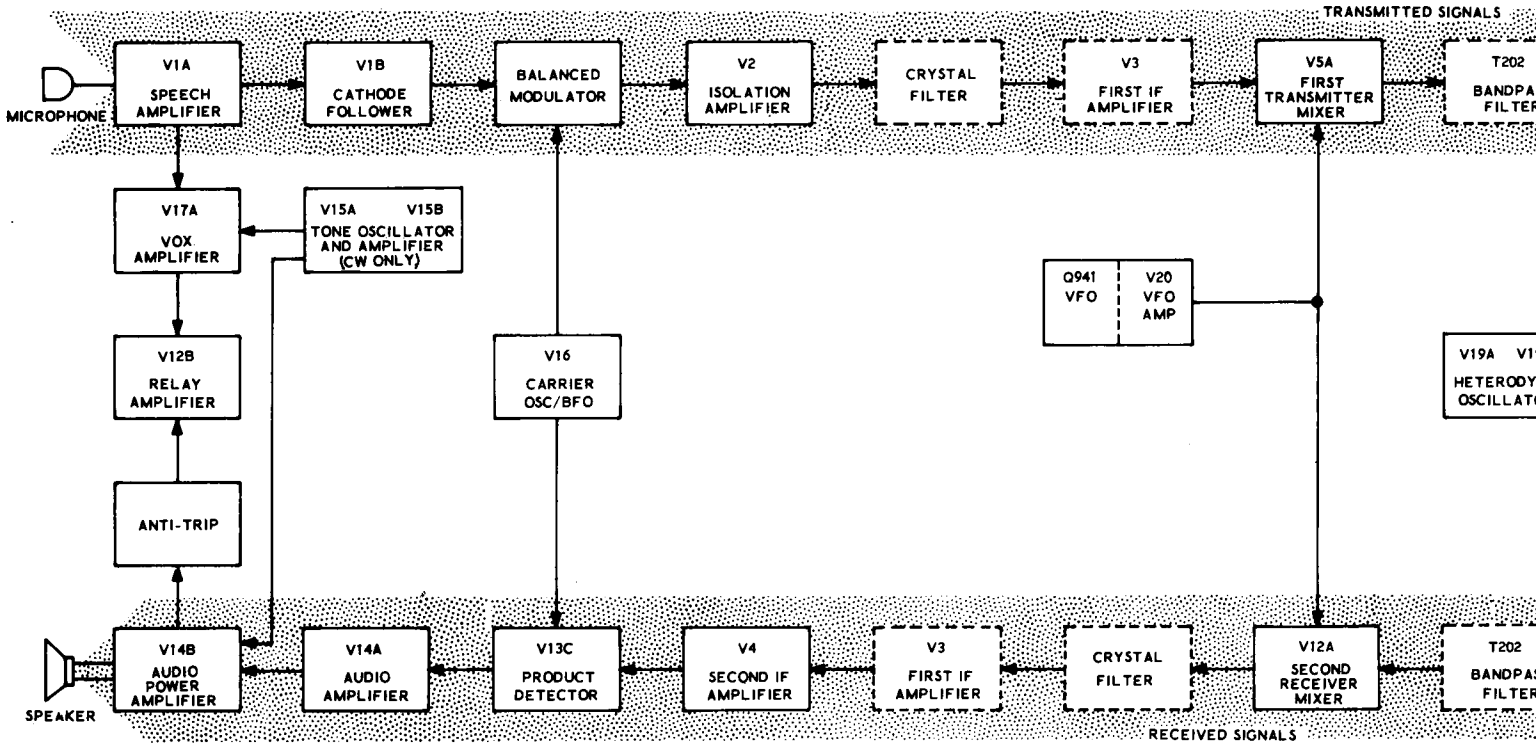
DC VOLTAGE

RF VOLTAGE

DO NOT MEASURE RESISTANCES IN THE CIRCUIT BECAUSE OF THE PRESENCE OF SEMICONDUCTORS.




TRANSMITTED SIGNALS



BLOCK DIAGRAM

SPECIFICATIONS

RECEIVER

Sensitivity	Less than .3 microvolt for 10 dB signal-plus-noise to noise ratio for SSB operation.
SSB Selectivity	2.1 kHz minimum at 6 dB down, 7 kHz minimum at 60 dB down (3.395 MHz filter).
CW Selectivity (With Optional SBA-301-2 CW Filter Installed)	400 Hz minimum at 6 dB down, 2.0 kHz maximum at 60 dB down.
Power Output	2 watts with less than 10% distortion.
Spurious Response	Image and IF rejection better than 50 dB.

TRANSMITTER

DC Power Input	SSB: (A3J emission) 180 watt P.E.P. (normal voice, continuous duty cycle). CW: (A1 emission) 170 watts (50% duty cycle).
RF Power Output	100 watts on 80 through 15 meters; 80 watts on 10 meters (50 Ω nonreactive load).
Output Impedance	50 Ω to 75 Ω with less than 2:1 SWR.
Oscillator Feedthrough or Mixer Products	55 dB below rated output.
Harmonic Radiation	40 dB below rated output.
Transmit-Receive Operation	SSB: PTT or VOX. CW: Provided by operating VOX from a keyed tone, using grid-block keying.

CW Side-Tone	Internally switched to speaker to headphones, in CW mode. Approximately 1000 Hz tone.
Microphone Requirement	High impedance with a rating of -45 to -55 dB.
Carrier Suppression	45 dB down from single-tone output.

Side Controls	Meter Zero control. Bias Adjust. VOX Sensitivity. VOX Delay. Anti-Trip.
Internal Controls	Carrier Null (control and capacitor). Neutralizing. Crystal calibrator. VFO trimmer. VFO shifter. VFO coil.
Tube Complement	OA2 Regulator (150 V). 6HS6 RF amplifier. 6HS6 1st receiver mixer. 6AU6 Isolation amplifier. 6AU6 1st IF amplifier. 6AU6 2nd IF amplifier. 6BN8 Product detector and AVC. 6AU6 VFO Amplifier. 6CB6 2nd transmitter mixer. 6CL6 Driver. 6EA8 Speech Amplifier and cathode follower. 6EA8 1st transmitter mixer. 6EA8 2nd receiver mixer and relay amplifier. 6EA8 CW side-tone oscillator and amplifier. 6GW8 Audio amplifier and audio output. 12AT7 Heterodyne oscillator and cathode follower. 12AT7 VOX amplifier and calibrator oscillator. 12AU7 Sideband oscillator. 6146 Final amplifiers (2).
Diode Complement	6 Germanium Diodes: Balanced modulator, RF sampling, and crystal calibrator harmonic generator. 9 Silicon Diodes: ALC rectifiers, anti-trip rectifiers, and DC blocking. 1 Zener Diode: cathode bias.
Transistors	MPF-105 FET-VFO. 2N3393 Voltage regulator.
Rear Apron Connectors	CW Key. 8 Ω output. ALC input. Power and accessory plug. Antenna. Spare.
Power Requirements	700 to 850 volts at 250 mA with 1% maximum ripple. 300 volts at 150 mA with .05% maximum ripple. -115 volts at 10 mA with .5% maximum ripple. 12 volts ac/dc at 4.76 amps.

Cabinet Dimensions	14-13/16" wide x 6-5/16" high x 13-3/8" deep.
Net Weight	17-1/2 lbs.
Equipment Used to Prepare Specifications	Heath HN-31 "Cantenna." Heath SB-610 Monitor Scope. Heath IM-11 VTVM. Heath MM-1 VOM. Heath IG-72 Audio Generator. Heath HDP-21A Microphone. Hewlett-Packard Electronic Counter, Model 5246L. Tektronix Oscilloscope, Model 581A. Hewlett-Packard Signal Generator, Model 606A. Panoramic Radio Products Inc., "Panalyzor," Model SB-12A. Boonton RF Voltmeter, Model 91-CA. Dynascan Digital Voltmeter, Model 111.

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.

CIRCUIT DESCRIPTION

Refer to the Block Diagram (fold-out from Page 156) and to the Schematic (fold-out from Page 199) while reading this Circuit Description. Small sections of the Schematic are also included in this description to make the circuits easier to follow.

Note that the receiver circuits are across the bottom, and the transmitter circuits are across the top of the Schematic and Block Diagrams. Also, several of the circuits that are used for transmitting are also used for receiving (such as the crystal filter and the first IF amplifier). These circuits, which are shown in both the transmitter and receiver portions of the Block Diagram, are identified in the Block Diagram by dotted lines.

Each rotary switch is identified by the front panel name of the switch, and by a letter-number designation that shows the position of that wafer in the switch. See Figure 2-1.

Letter-number designations for the resistors, capacitors, coils, etc., are placed in the following groups:

0-99 Modulator circuit board.
100-199 IF circuit board.
200-299 Bandpass circuit board.
300-399 Audio circuit board.
400-499 RF driver circuit board.
500-599 Crystal Switch-Board.
600-699 Heterodyne oscillator Switch-Board.
700-799 Driver grid Switch-Board.
800-899 Driver plate Switch-Board.
900-999 Chassis and VFO.

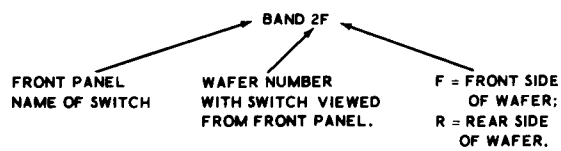


Figure 2-1

TRANSMITTER CIRCUITS

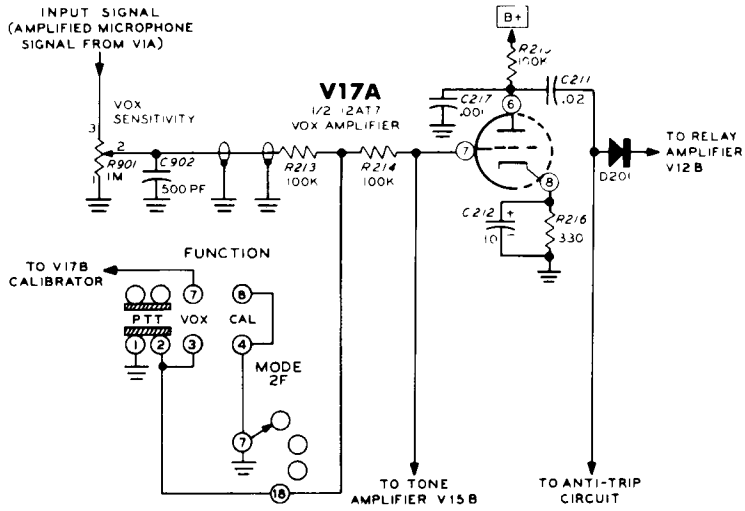


Figure 2-3

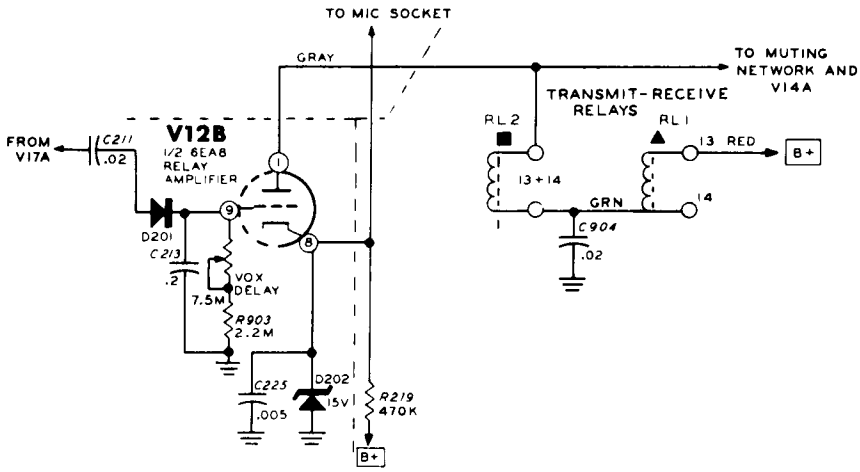


Figure 2-4

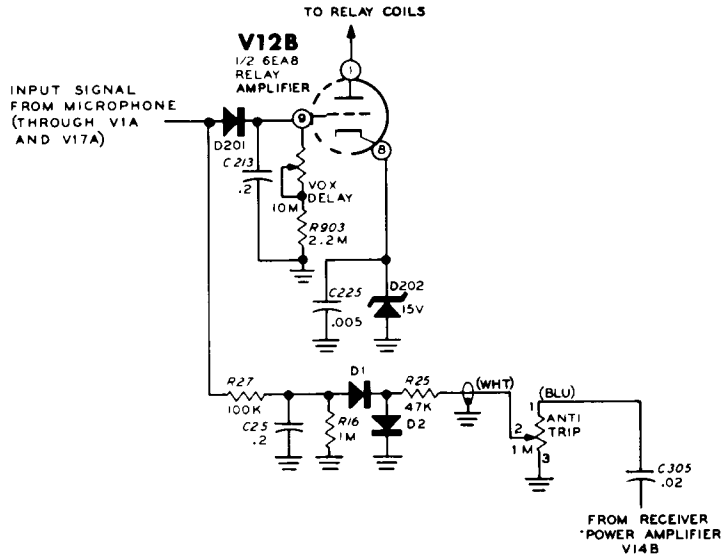


Figure 2-5

ANTI-TRIP CIRCUIT (Figure 2-5)

The anti-trip circuit is used in the receive mode of operation to keep the speaker signals from activating relay amplifier V12B.

An audio signal is coupled through capacitor C305 from audio power amplifier V14B to the Anti-Trip control. This audio signal is then coupled through isolation resistor R25 and rectified by diodes D1 and D2, resulting in a negative dc voltage across capacitor C25 and resistor R16. This negative voltage is then coupled through resistor R27 to diode D201 as back bias, where it cancels out the voltage from the VOX amplifier. Thus, with no positive voltage at its grid, relay amplifier V12B remains cut off, and the relays remain in the receive position.

SPEECH AMPLIFIER AND CATHODE FOLLOWER (Figure 2-6)

The audio signal from the microphone is coupled directly from lug 1 of the Microphone socket through resistor R931 to the grid of speech amplifier V1A. Capacitor C1, at the grid of V1A, limits the high frequency response of this stage and bypasses to ground any RF signals present at this point. The amplified signal from the plate of V1A is coupled through capacitor C9 to the Microphone Level section of the Mic/CW Level control and also to the VOX amplifier.

The setting of the Microphone Level control determines the amount of modulation since it adjusts the amount of speech signal that is coupled through cathode follower V1B to the

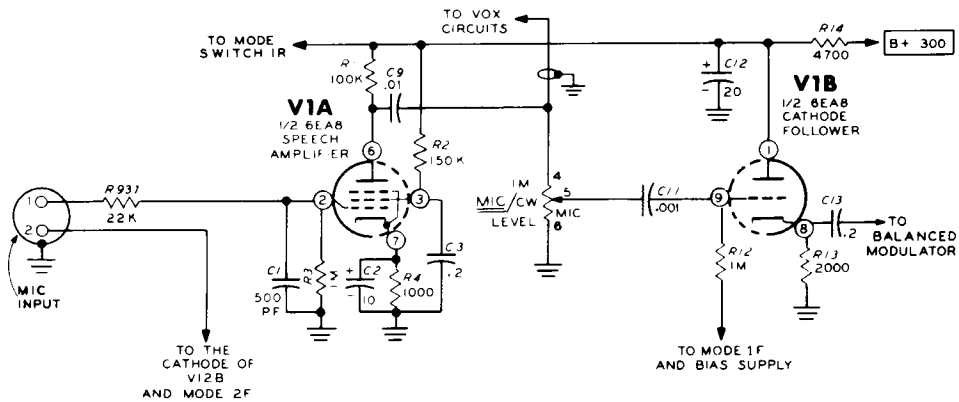


Figure 2-6

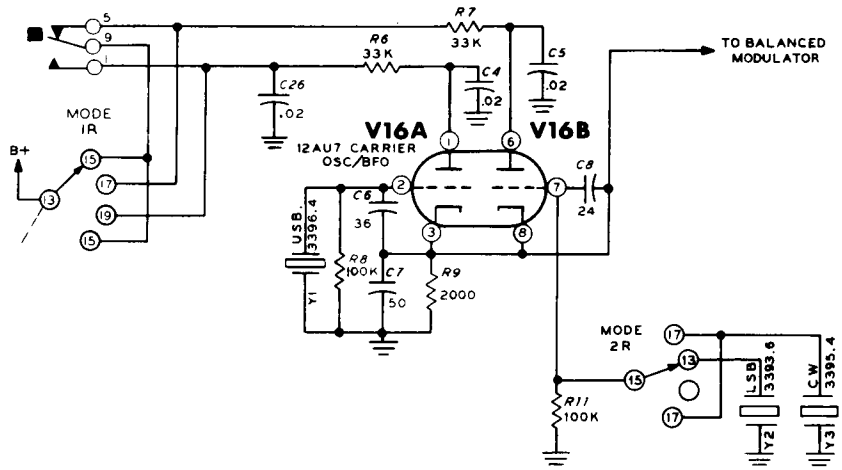


Figure 2-7

balanced modulator circuit. For LSB and USB operation, V1B grid resistor R12 is returned to ground through wafer 1F of the Mode switch and contacts 6 and 10 of relay RL2. When the Mode switch is in the Tune or CW position, cathode follower V1B is cut off by a bias voltage that is supplied to it from the junction of bias voltage divider resistors R308 and R309.

CARRIER OSCILLATOR (Figure 2-7)

The carrier oscillator consists of two Colpitts crystal oscillators. These oscillators supply an RF signal to the balanced modulator for transmit operation, and a heterodyne signal to product detector stage V13C for receive operation. Tube V16A and crystal Y1 (3396.4 kHz) serve as the USB (upper sideband) carrier oscillator, and tube V16B with crystals Y2 (3393.6 kHz) and Y3 (3395.4 kHz) acts as the LSB (lower sideband) and CW carrier oscillator.

The desired carrier oscillator, V16B, for the transmitted frequency being used in this Description (3393.6 kHz), is placed in operation by wafer 1R of the Mode switch which connects its plate circuit to B+. Wafer 2R of the Mode switch connects the proper crystal to the grid of V16B: Y2 for LSB operation and Y3 for tune or CW transmit operation.

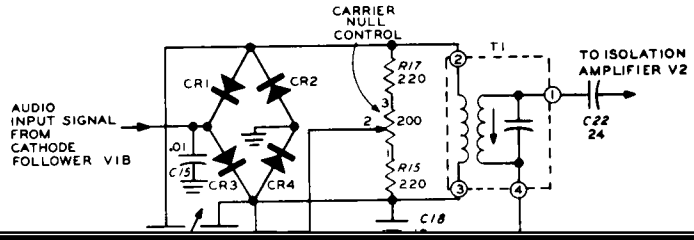
When the Mode switch is in the CW position, B+ is connected through part of relay RL2 to either V16A (for receive) or V16B (for transmit).

For receiving CW signals, lugs 9 and 1 of relay RL2 place tube V16A and crystal Y1 in operation. For transmitting CW, lugs 9 and 5 of relay RL2 place tube V16B and crystal Y3 in operation.

When receiving a 1000 Hz CW signal, the receiver is tuned 1 kHz below the incoming signal (this signal is zero beat against your transmitting frequency) by V16A and crystal Y1, which are used as a VFO (beat frequency oscillator). This generates a 1000 Hz audible signal. When transmitting, tube V16B and crystal Y3 cause the output signal of the Transceiver to be at the same frequency as the incoming signal from the other station.

BALANCED MODULATOR (Figure 2-8)

Diodes CR1, CR2, CR3, and CR4, are connected in a ring type balanced modulator circuit. When the audio signal from cathode follower V1B and the RF signal from carrier oscillator V16 are applied to this balanced modulator, two additional frequencies are produced: one is equal to the sum



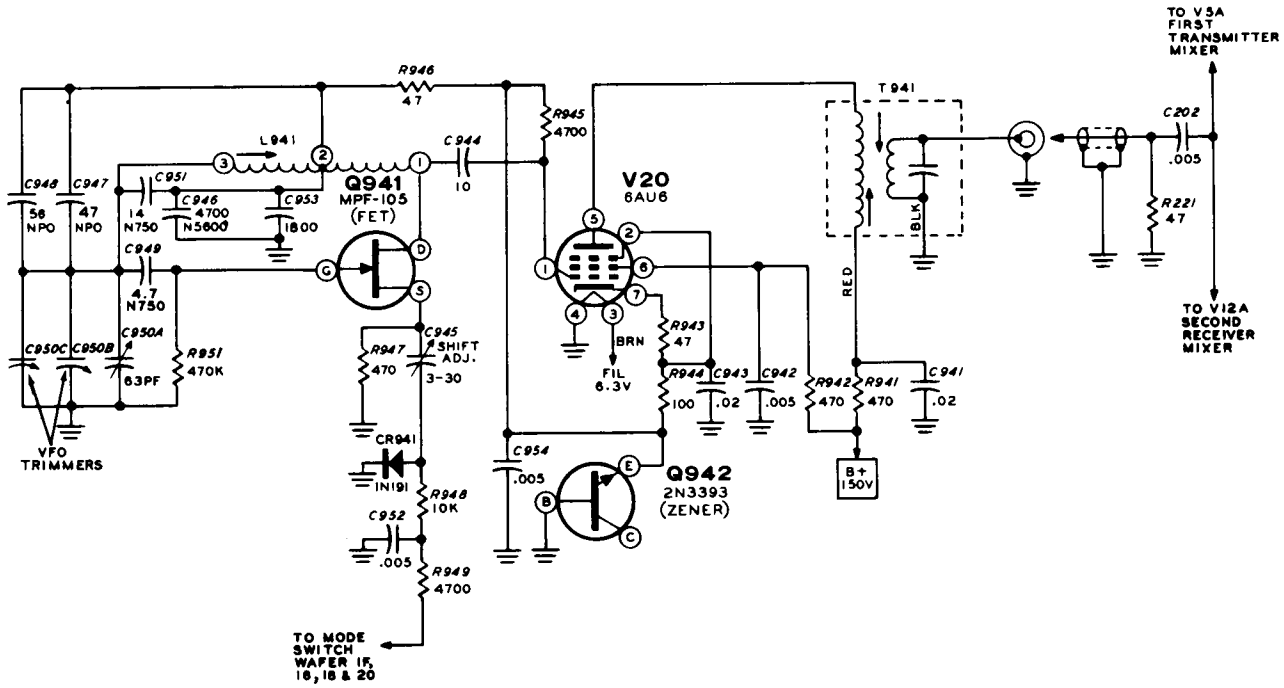


Figure 2-12

VFO (Figure 2-12)

A field effect transistor is used in a type of Hartley oscillator circuit in the VFO. Part of coil L941, variable capacitor

Capacitor C944 couples the signal to the grid of tube V20, which amplifies the VFO signal and couples it through T941 to the cathode of mixer tube V5A.

The Bandpass filter T202 is tuned to pass only those signal frequencies between 8.395 and 8.895 MHz; all other frequencies are attenuated. Only the 8.5 MHz sum of the IF and VFO signals falls within this frequency range, so it only is passed on to the second mixer.

First transmitter mixer V5A, second transmitter mixer V6, and driver V7 are cut off during the receive mode of operation by a negative voltage that is applied to their grids through diode D301 and resistor R301. This negative voltage is removed for the transmit mode by contacts 6 and 10 of relay RL2, which cause the cathode side of diode D301 to be grounded.

HETERODYNE OSCILLATOR AND CATHODE FOLLOWER (Figure 2-14)

Heterodyne oscillator V19A operates as a tuned-plate crystal oscillator. The proper plate coil for each band, L601 through L608, is selected by wafer 2F on the Band switch. The output signal from the plate of the oscillator is coupled through cathode follower V19B to the cathode of second transmitter mixer V6 and to the cathode of first receiver mixer V11. The correct oscillator crystal for each band is selected by wafer 1R of the Bandswitch. The crystals below 20 MHz are fundamental types, and the higher frequency crystals operate on their third overtones.

The grid voltage of V19A can be metered at TP to check oscillator activity.

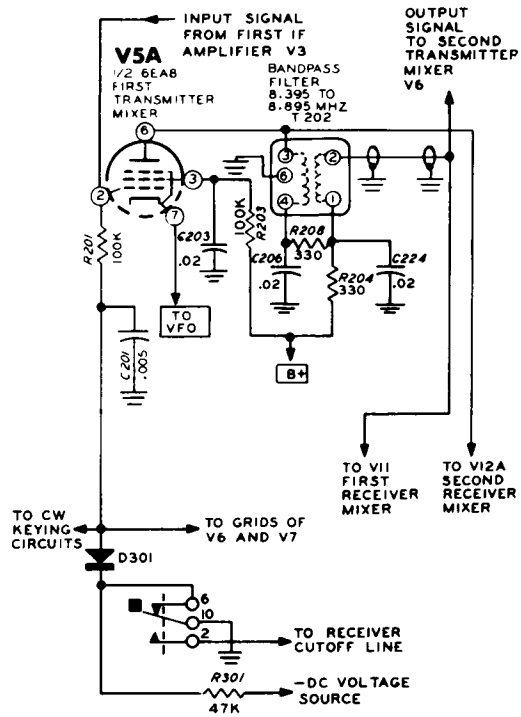


Figure 2-13

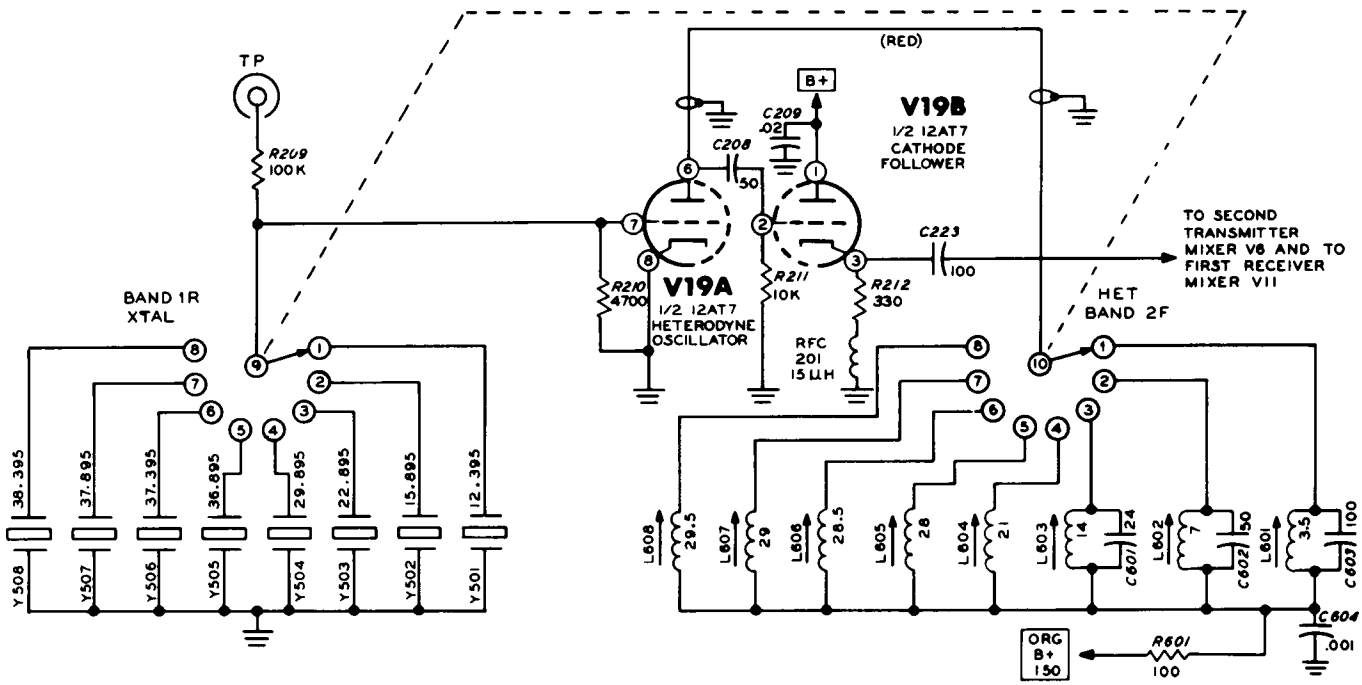


Figure 2-14

[redacted]

2. The variations that occur in the final amplifier screen supply voltage on speech peaks produce a varying voltage which is coupled through capacitor C908 to rectifiers D902 and D903. This second voltage source produces additional ALC voltage.

3. Additional ALC voltage can be obtained from an external linear power amplifier. This voltage is applied to the ALC Input and goes directly to an RC network, which is explained below.

The rectified voltage from diode D903 (and the voltage from an external amplifier, if used) is applied to an RC network consisting of resistors R914 and R915 and capacitors C921

Tone oscillator V15A is turned on when its cathode is connected to ground through wafer 2F of the Mode switch. The output frequency of V15A is determined by the phase-shift network in its grid circuit. From the plate of V15A, the 1000 Hz tone is coupled through capacitor C315 and resistor R329 to the grid of tone amplifier V15B.

Tone amplifier V15B is normally cut off by a negative bias that is applied to its grid from the junction of resistors R311 and R312. When the CW key is closed, this cut-off bias is removed (resistor R311 is shorted out through Mode switch wafer 1F and the key), and V15B conducts.

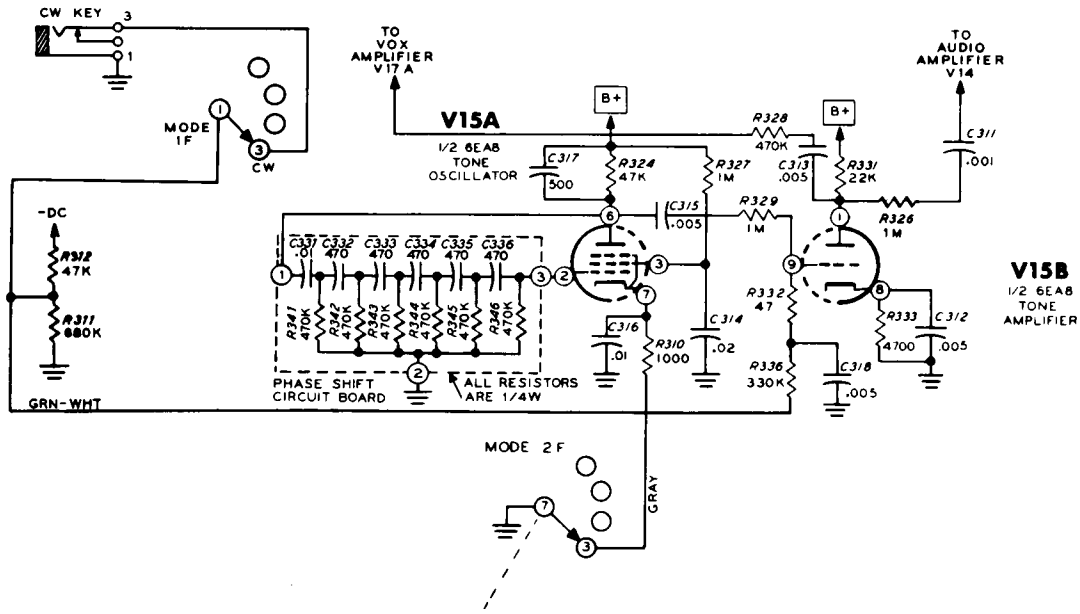


Figure 2-18

4. The transmitter CW signal passes through the SSB Filter.

5. The drive to the final amplifiers is controlled by the CW section of the MIC/CW Level control, which adjusts the bias of isolation amplifier V2 and IF amplifier V3.

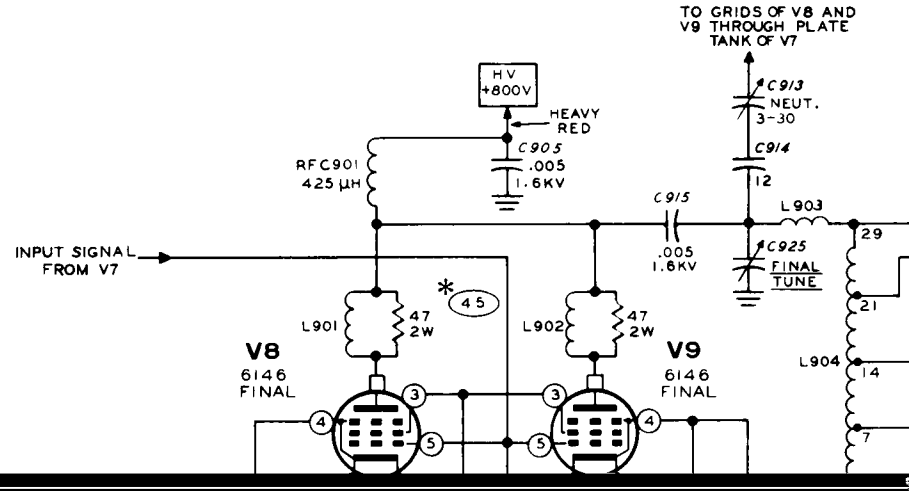
6. Cutoff bias is applied to the grids of transmitter mixers V5A and V6, and to the grid of driver amplifier V7, through Mode switch wafer 1F and diode D904.

7. Tone oscillator V15A is turned on.

When the key is closed, the 1000 Hz tone signal is coupled to the VOX circuit, where it causes the relays to be switched to the transmit position. The relays stay in this position for a length of time that is determined by the setting of the VOX Delay control.

At the same time, the key shorts out the cutoff bias that is applied to the transmitter mixer stages and to the driver amplifier stage, allowing them to conduct and place the transmitter on the air.

The RF output signal from CW carrier oscillator V16B is coupled to the balanced modulator stage. The unbalanced condition of this stage causes the RF signal to be coupled through transformer T1 to isolation amplifier V2. From V2, the signal proceeds through the transmitter in the same manner as the LSB and USB signals.


TO GRIDS OF V8 AND V9 THROUGH PLATE TANK OF V7
HV +800V
HEAVY RED
C905 .005 1.6KV
RFC901 425 µH
C913 NEUT. 3-30
C914 12
C915
.005 1.6KV
L903
C925 FINAL TUNE
29
21
L904
14
7
INPUT SIGNAL FROM V7
*45
L901 47 2W
L902 47 2W
V8 6146 FINAL
V9 6146 FINAL
3
4
5

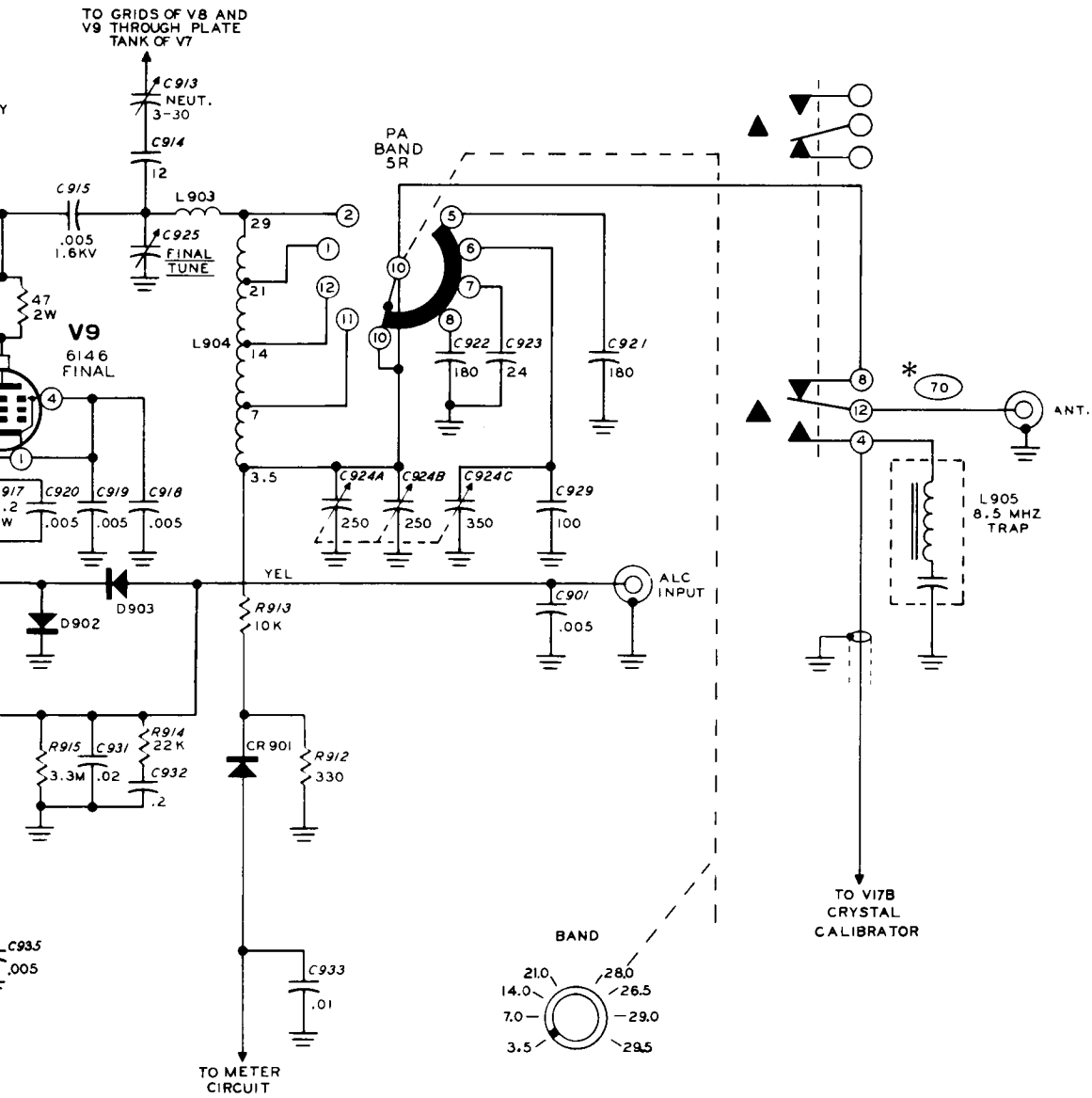
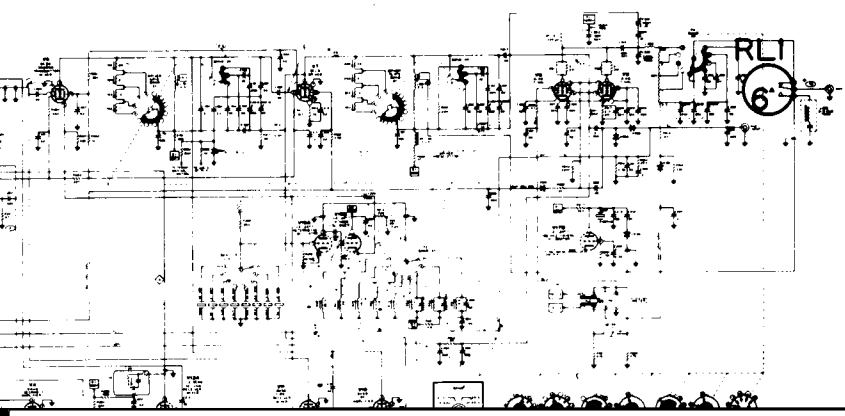

TO GRIDS OF V8 AND V9 THROUGH PLATE TANK OF V7
C913 NEUT. 3-30
C914 12
C915 .005 1.6KV
L903
C925 FINAL TUNE
29
21
14
7
3.5
L904
47 2W
V9 6146 FINAL
PA BAND 5R
C922 180
C923 24
C921 180
C924A 250
C924B 250
C924C 350
C929 100
C917 .2 W
C920 .005
C919 .005
C918 .005
D903
D902
YEL
R913 10K
C901 .005
ALC INPUT
R915 3.3M
C931 .02
R914 22K
C932 .2
CR 901
R912 330
C933 .01
TO METER CIRCUIT
BAND
21.0
14.0
7.0
3.5
28.0
26.5
29.0
29.5
70
ANT.
L905 8.5 MHZ TRAP
TO V17B CRYSTAL CALIBRATOR

FIGURE 2-17

T-R SWITCHING

of negative bias are also applied to second receiver mixer


RL1
6

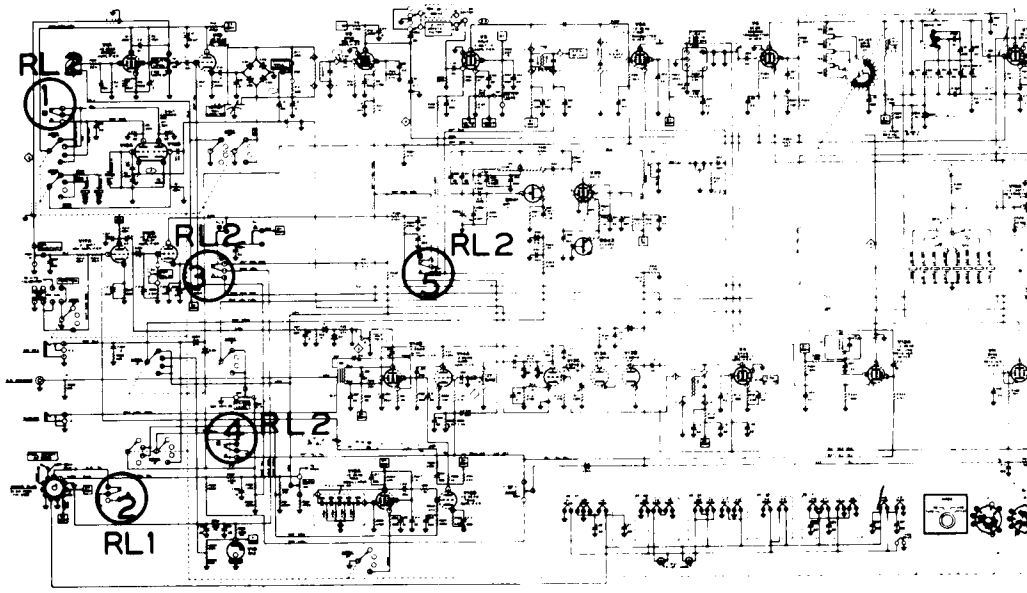
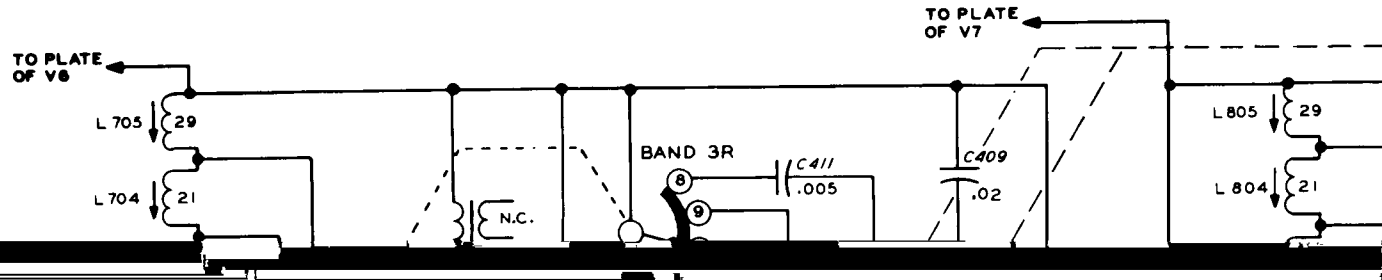

RL2
RL2
RL2
RL2
RL1

FIGURE 2-19


TO PLATE OF V8
L 705
29
L 704
21
N.C.
BAND 3R
8
9
C411
.005
TO PLATE OF V7
C409
.02
L 805
29
L 804
21

RECEIVER CIRCUITS

NOTE: Figure 2-20 shows the various frequencies that will be found throughout the Transceiver on the different bands. A received signal (lower sideband) frequency of 3.895 MHz, shown on the first line of the chart, will be used when tracing through the receiver circuits. The other associated frequencies used in this Description are also shown on the first line.

BAND	RECEIVED SIGNAL FREQUENCY	HETERODYNE OSCILLATOR FREQUENCY (CRYSTAL)	SIGNAL FREQUENCY AT BANDPASS FILTER (BETWEEN 8.395 AND 8.895)	2ND RECEIVER MIXER CRYSTAL FILTER AND IF FREQUENCIES	VFO FREQUENCY (BETWEEN 5 AND 5.5)
3.5 to 4	3.895	12.395	8.5	3.395	5.105
7 to 7.3	7.2	15.895	8.695	3.395	5.3
14 to 14.5	14.2	22.895	8.695	3.395	5.3
21 to 21.5	21.3	29.895	8.595	3.395	5.2
28 to 28.5	28.1	36.895	8.795	3.395	5.4
28.5 to 29	28.7	37.395	8.695	3.395	5.3
29 to 29.5	29.2	37.895	8.695	3.395	5.3
29.5 to 30	29.6	38.395	8.795	3.395	5.4

All frequencies in MHz.

Figure 2-20

RF AMPLIFIER (Figure 2-21, fold-out from Page 174)

The 3.895 MHz input signal from the antenna is coupled through lugs 4 and 12 of the antenna relay (RL1) to the link winding of coil L801. The secondary of L801, part of the driver preselector capacitor, and the other components in the driver plate tank circuit, are also used as the input tuned circuit for RF amplifier V10. From L801, the signal is coupled through capacitor C408 to the grid of V10.

The received signal is amplified in V10, and then coupled through capacitor C419 to first receiver mixer V11. The plate tuned circuit of V10 consists of coil L701, part of the driver preselector capacitor, and the other components of the second transmitter mixer plate tank circuit. The automatic switching of C955 into the plate circuit of V10 is described under "T-R Switching."

The gain of RF amplifier V10 and first receiver mixer V11 is controlled by the AVC voltage, and an adjustable negative bias that is coupled to their grids from the RF Gain control.

The 8.5 MHz trap at the antenna switching relay helps to prevent entry of very strong signals (at this frequency) which might interfere with the IF circuits.

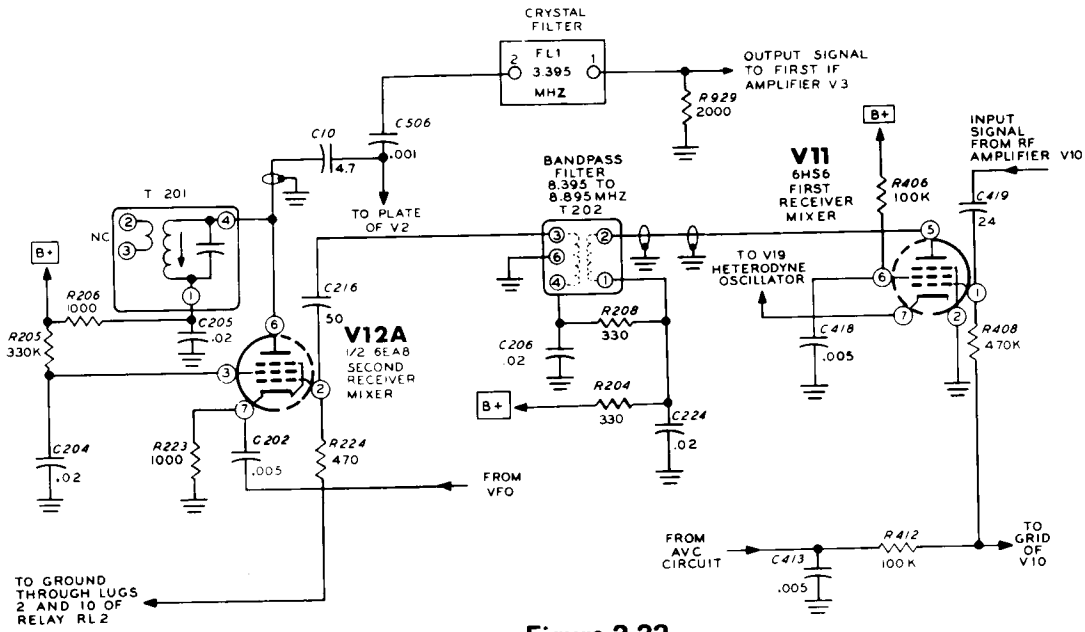


Figure 2-22

FIRST AND SECOND RECEIVER MIXERS (Figure 2-22)

The amplified 3.895 MHz signal from RF amplifier V10 is coupled through capacitor C419 to the grid of V11, the first receiver mixer.At the same time, a crystal controlled 12.395 MHz signal is coupled to the cathode of V11 from V19B, the heterodyne oscillator cathode follower. These two signals are then mixed together in V11 and the sum and difference frequencies are coupled to the bandpass filter.

The bandpass filter, which passes only the frequencies between 8.395 and 8.895 MHz, allows the 8.5 MHz difference frequency to pass on from V11 to the grid of second mixer tube V12A.

A 5.105 MHz signal is coupled from VFO to the cathode of V12A. The 8.5 MHz signal at the grid and the 5.105 MHz signal at the cathode are then mixed together in tube V12A and the 3.395 MHz difference frequency is coupled through crystal filter FL1 to the IF amplifiers.

IF AMPLIFIERS (Figure 2-23)

The signal from crystal filter FL1 is coupled through capacitor C101 to first IF amplifier V3. The amplified signal from V3 is coupled to two places: to grid of V5A, which is cut off in receive operation; and to second IF amplifier V4 through IF transformer T102.

The amplified signal from V4 is coupled through IF transformer T103 to the product detector, V13C. The same signal is also coupled through capacitor C112 to the plate of AVC rectifier V13B. Supply voltage for the screen of IF amplifier V4 is switched through lugs 3 and 11 of relay RL2.

AVC voltage is supplied to the grid of V4 by the AVC line. AVC voltage is switched to the grid of V3 through lugs 4 and 12 of relay RL2.

AVC CIRCUIT (Figure 2-24)

The negative bias at the control grids determines the amount of amplification that will be obtained from RF amplifier

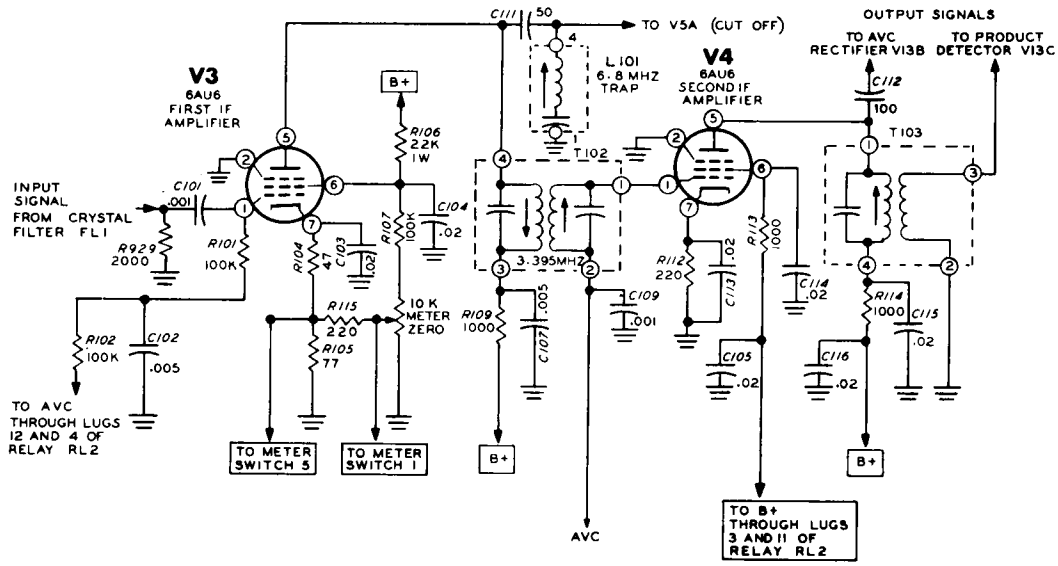


Figure 2-23

V10, first receiver mixer V11, and IF amplifiers V3 and V4. The dc bias for these stages comes from the following two sources: from the -dc voltage at the arm of the RF Gain control; and from the AVC voltage. These two voltage sources are connected to diodes D101 and D905, which act as a diode gate. This diode gate permits either voltage to control the gain (of V10, V11, etc.) without interacting with each other.

From the two diodes, the bias voltage is coupled through resistor R412 to the grids of V10 and V11, and through resistor R415 to the grids of V3 and V4. Voltage divider resistors R415 and R416 cause only one half of the total bias voltage to be coupled to the grids of IF amplifiers V3 and V4.

AVC voltage is obtained by coupling part of the IF signal through capacitor C112 to AVC diodes V13A and V13B. These diodes produce a negative dc voltage at pin 1 of V13A that is proportional to the signal strength. This negative voltage is developed across resistors R124 and R117, and capacitors C110 and C124. Capacitor C124 charges quickly to the peak voltage so the AVC will respond quickly to keep large signals from being distorted in V3, V4, V10, and V11. Capacitor C110 charges more slowly, and causes the AVC voltage to be proportional to the average signal level of the received signal. This produces a fast-attack, slow-release AVC characteristic.

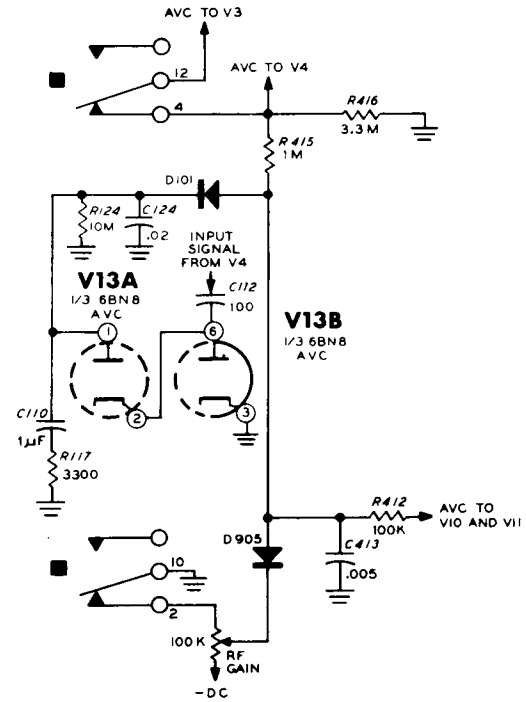
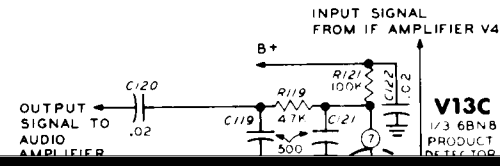


Figure 2-24

An incoming signal that produces a negative AVC voltage that is significantly higher than the bias voltage from the RF Gain control causes the gain of V10, V11, V3, and V4 to be reduced. This keeps the output of the RF and IF amplifier stages at a nearly constant level despite wide amplitude changes in the received signal.

PRODUCT DETECTOR (Figure 2-25)



The 3.395 MHz signal from IF amplifier V4 is coupled to the grid of product detector tube V13C. At the same time,

CRYSTAL CALIBRATOR (Figure 2-27)

Crystal calibrator stage V17B is connected as a Pierce crystal oscillator. When the Function switch is placed in the Calibrate position, the cathode of V17B is grounded, and an accurate 100 kHz signal is connected through capacitor C218 and diode CR201 to the antenna input of the receiver. The harmonics of this signal are then used for dial calibration checks.

Capacitor C220 may be adjusted to set the crystal calibrator to exactly 100 kHz using some standard such as WWV.

The Calibrate position of the Function switch also connects the grid of VOX amplifier V17A to ground to avoid accidental energizing of the transmitter when using the crystal calibrator.

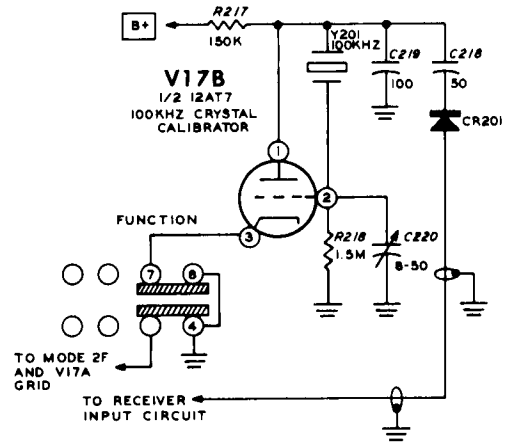


Figure 2-27

METERING CIRCUITS

Refer to Figure 2-28.

For the transmitting mode of operation, there are three different settings of the Meter switch: Plate (Final Power Amplifier cathode current), ALC voltage, and Relative Power output. In the ALC position, in the receive mode, the meter operates as an S Meter.

To measure power amplifier cathode current, the meter is connected between the cathodes of the finals and ground, in parallel with the cathode resistor. To read cathode current on the meter, consider that each of the figures on the meter scale (3, 6, 9, 20, 40, and 60) represents 50 mA of current. For example, if the meter needle is at the figure 9, it shows 150 mA of cathode current (three 50 mA units) or the full

cathode are indicated on the meter. Since the ALC voltage at the grid controls the gain of V3, the cathode current of V3 gives a relative indication of the ALC voltage level.

For Relative Power measurements, a small portion of the transmitter output signal is developed across resistor R912, rectified by diode CR901, and filtered by capacitor C933. The resulting dc voltage is then indicated by the meter.

When the Transceiver is in the receive condition, and the Meter switch is at ALC, the meter indicates the relative strength of the received signal in S units. The circuit operates just as it does when it measures ALC voltage, except that the current in V3 is now controlled by the AVC voltage at the grid of V3.

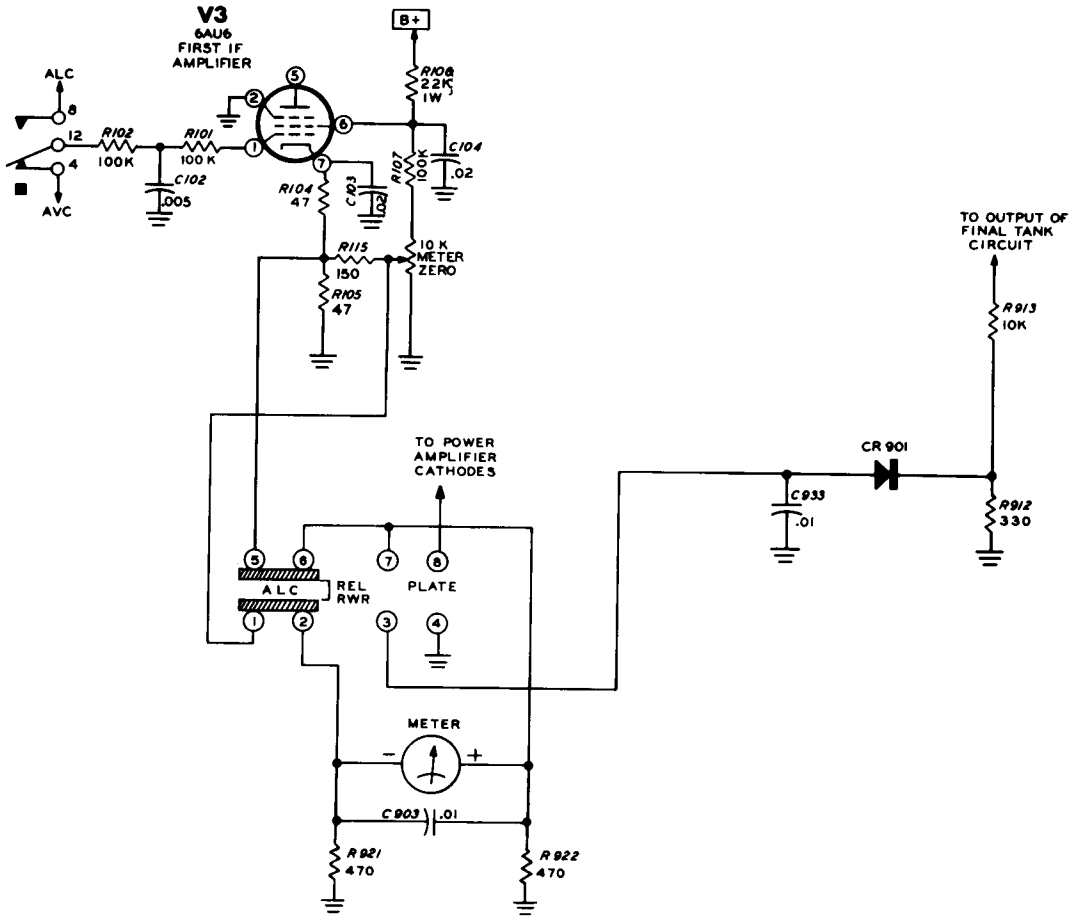
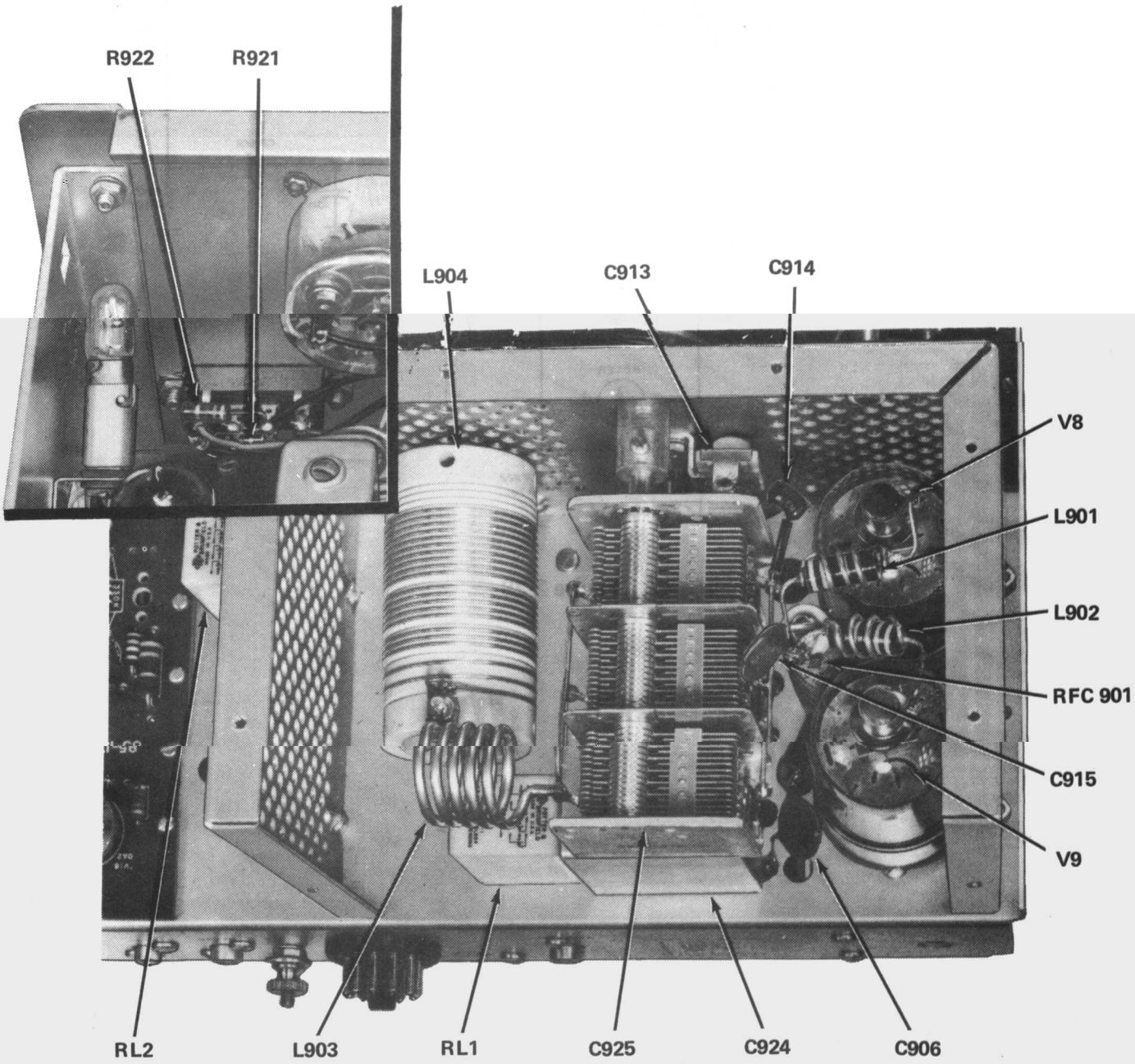
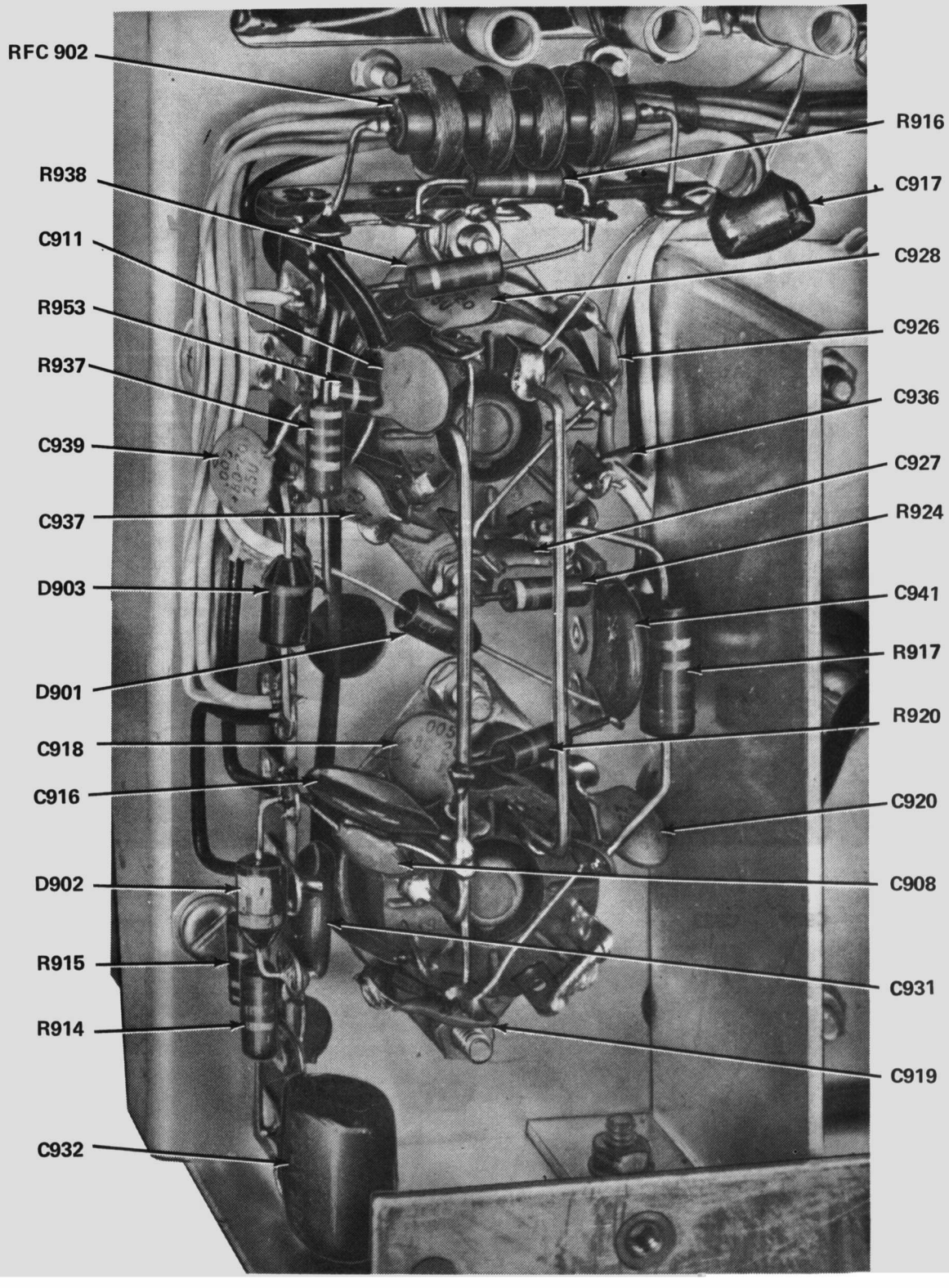
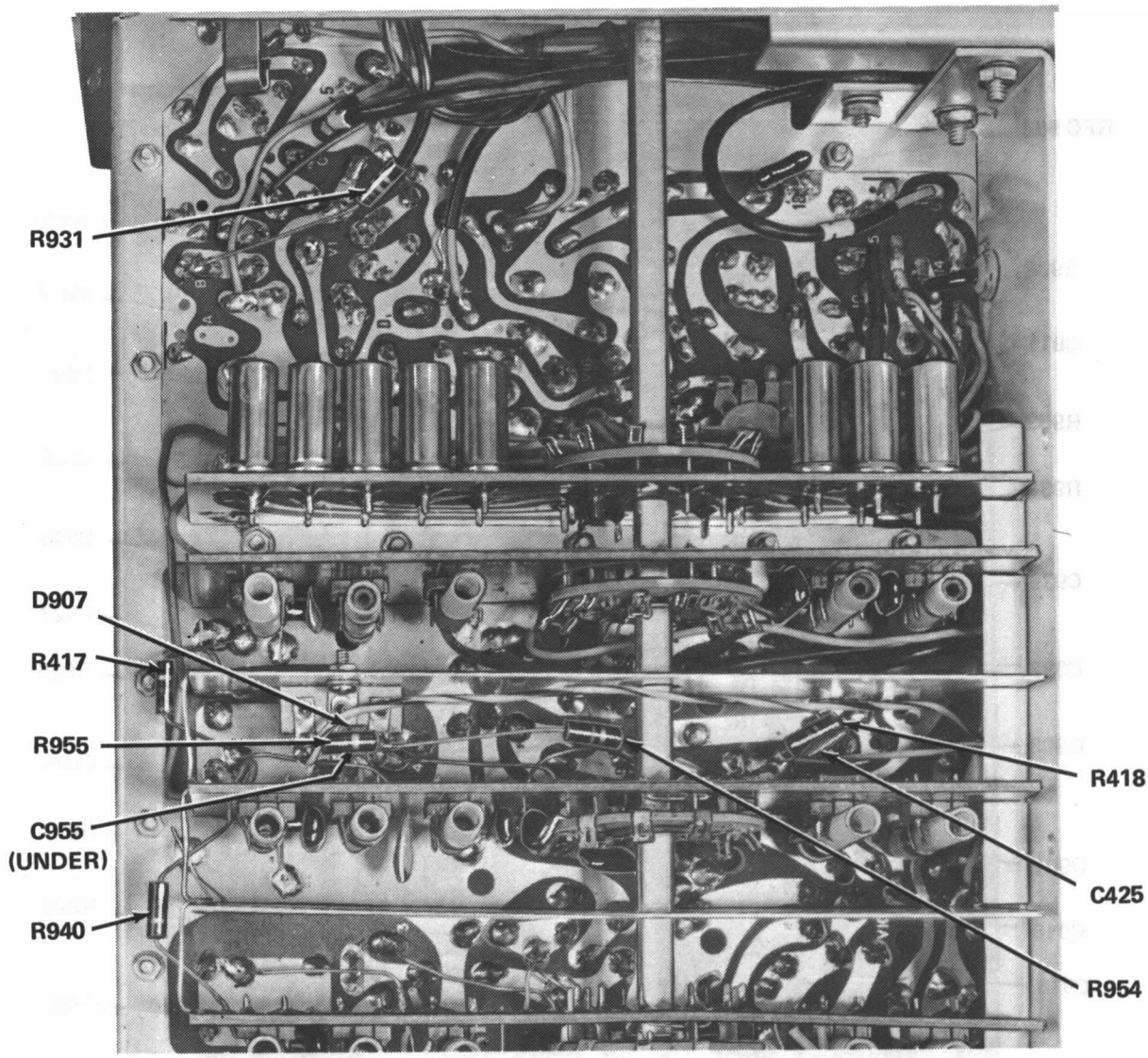

V3
6AU6
FIRST IF
AMPLIFIER
B+
ALC
AVC
R102
100K
R101
100K
C102
.005
R104
47
R108
2.2K
1W
R107
5K
C104
.02
R115
150
10K
METER
ZERO
R105
47
TO OUTPUT OF
FINAL TANK
CIRCUIT
R913
10K
CR901
C933
.01
R912
330
TO POWER
AMPLIFIER
CATHODES
ALC
REL
RWR
PLATE
METER
C903
.01
R921
470
R922
470

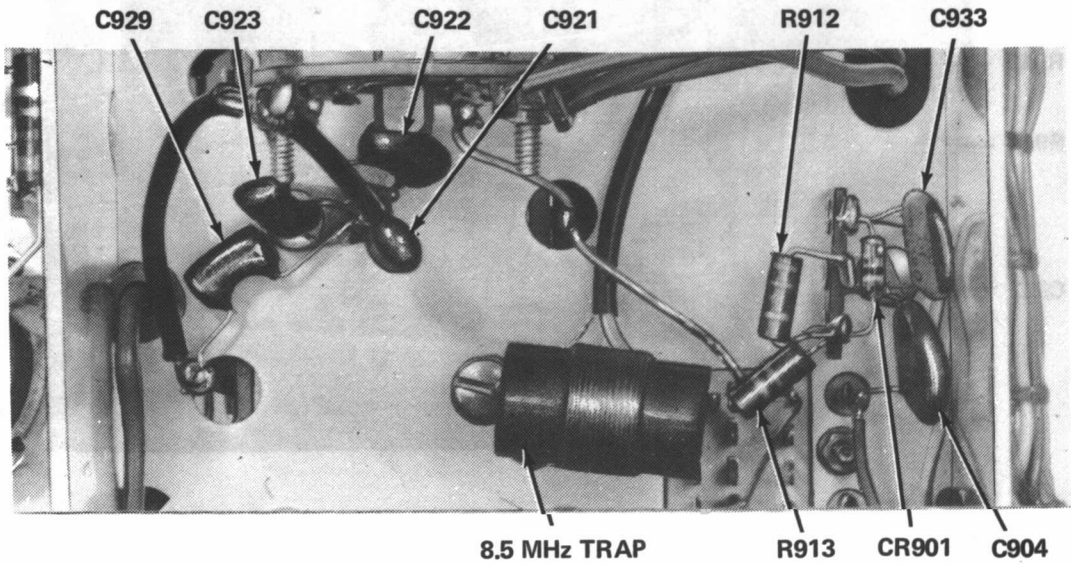
Figure 2-28

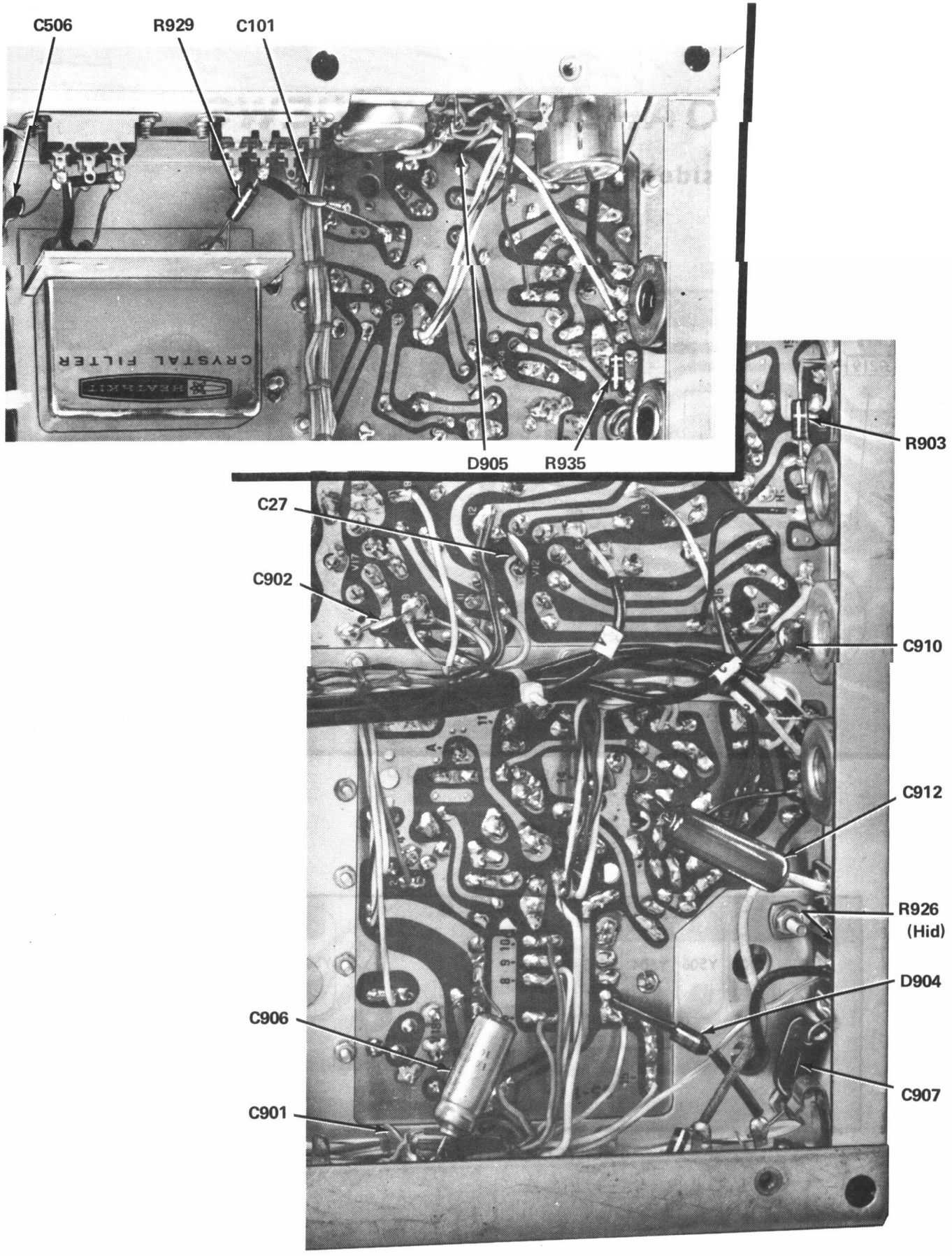
CHASSIS PHOTOGRAPHS




RFC 902
R938
C911
R953
R937
C939
C937
D903
D901
C918
C916
D902
R915
R914
C932
R916
C917
C928
C926
C936
C927
R924
C941
R917
R920
C920
C908
C931
C919

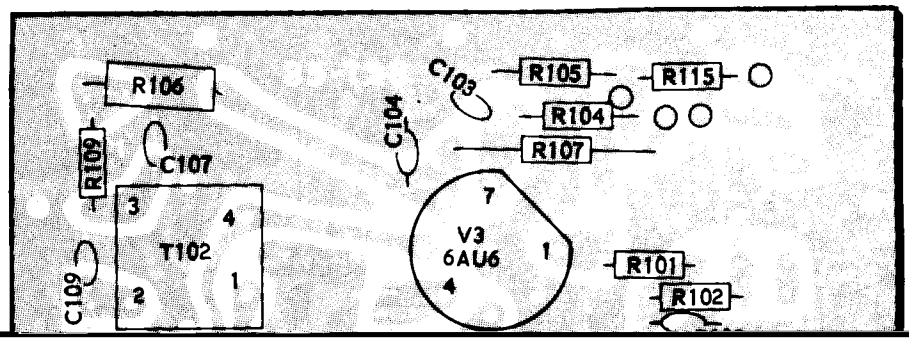

R931
D907
R417
R955
C955
(UNDER)
R940
R418
C425
R954

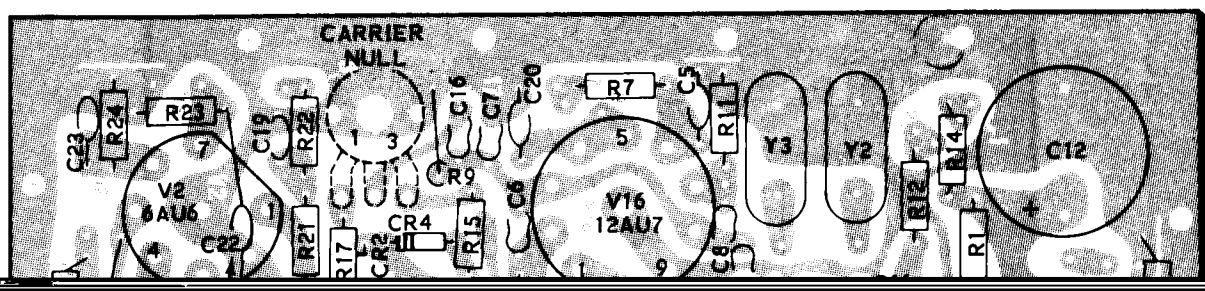

C929
C923
C922
C921
R912
C933
8.5 MHz TRAP
R913
CR901
C904

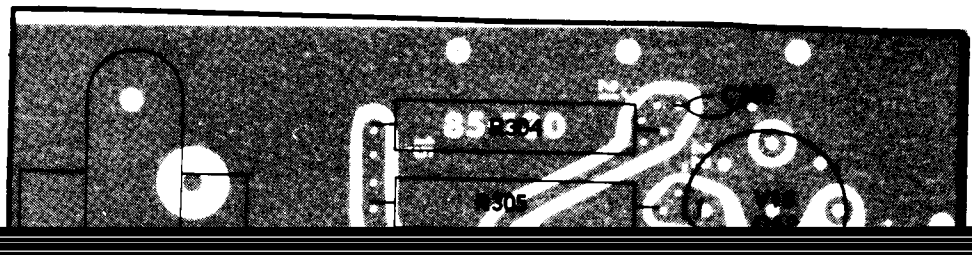

C506
R929
C101
CRYSTAL FILTER
D905
R935
R903
C27
C902
C910
C912
R926
(Hid)
D904
C906
C907
C901

CIRCUIT BOARD X-RAY VIEWS

(viewed from foil side)


R106
R108
C107
C109
3
4
T102
2
1
C103
C104
R105
R115
R104
R107
7
V3
6AU6
1
4
R101
R102


CARRIER
NULL
R24
R23
C23
V2
6AU6
C22
R21
R17
CR2
CR4
R15
C16
C17
C18
R7
C5
R11
V16
12AU7
C9
Y3
Y2
R12
R14
C12
R1

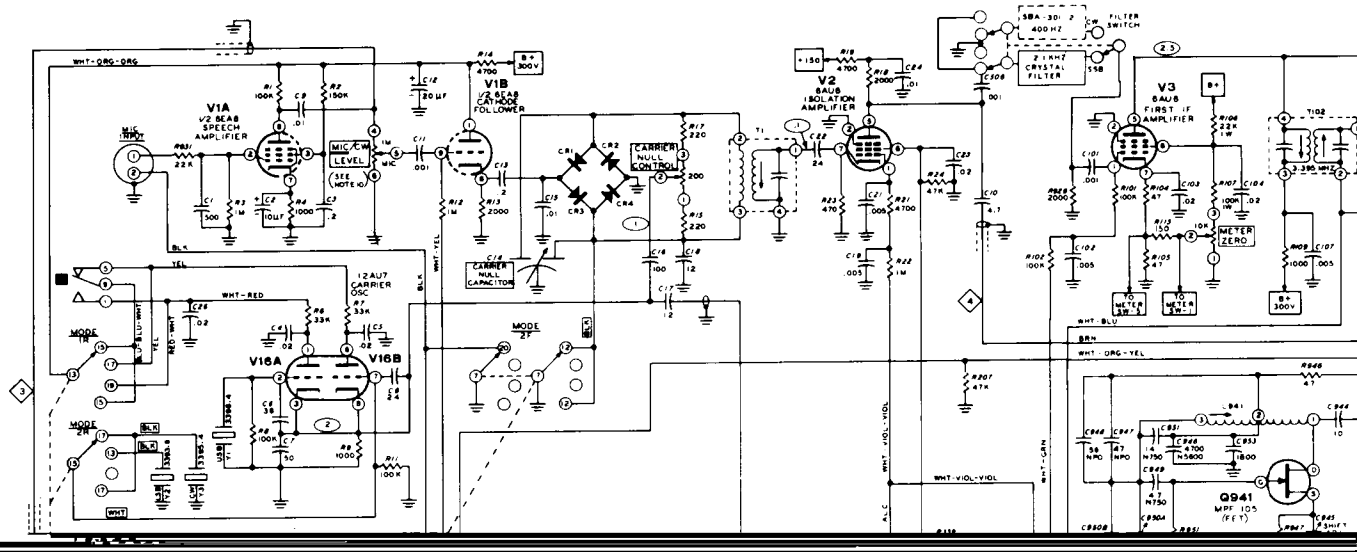


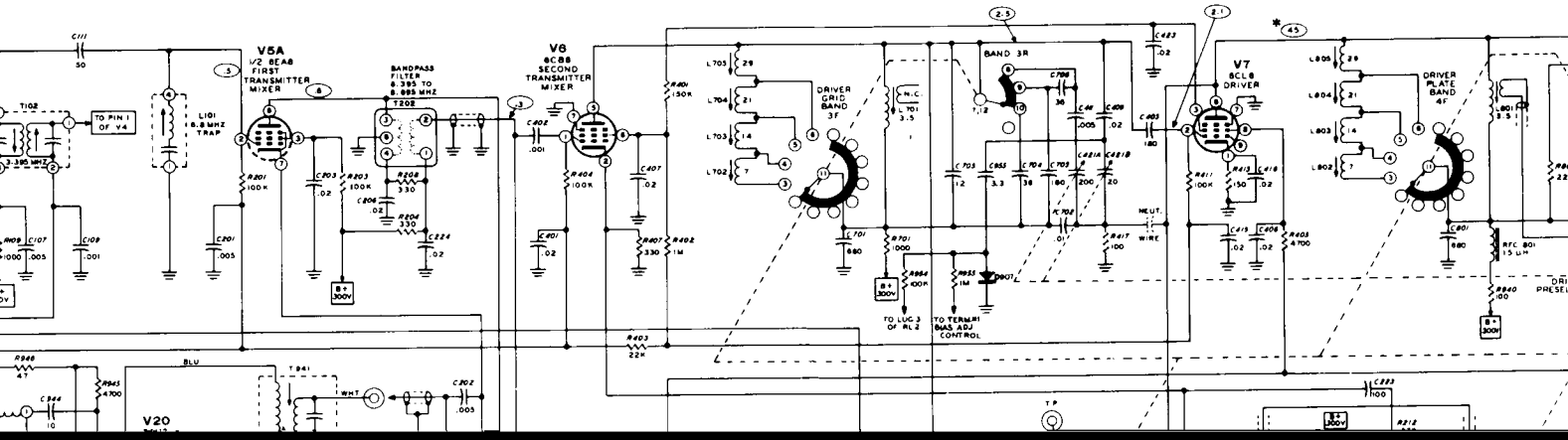
PARTS IDENTIFICATION

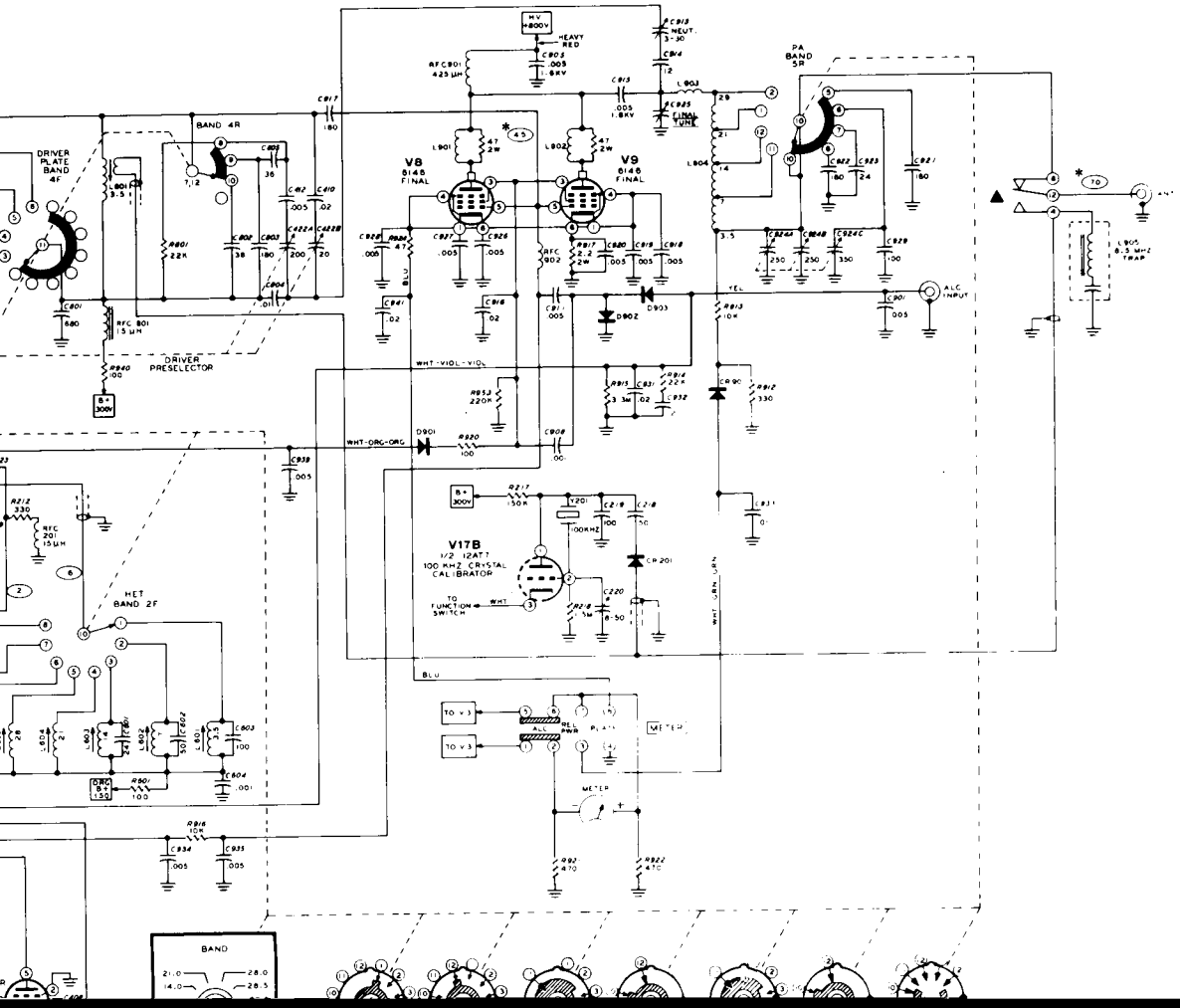
Most small parts which are not marked, or whose markings are illegible, may be identified from their locations on the circuit board X-Ray views, or from the chassis photographs. Reference to the Schematic will then give the value of the part in many instances. Cross reference charts to Heath part numbers follow (or are included on the Schematic) for transistors, diodes, coils, and transformers. Once the part number has been determined, refer to the "Replacement Parts Price List."

INDUCTOR CROSS REFERENCE TABLE

COMPONENT DESIGNATION	HEATH PART NO.	COMPONENT DESIGNATION	HEATH PART NO.
L101	40-587	L904	40-548
L601, 602	40-689	L905	40-546
L603, 604	40-690	L941	40-1076
L605	40-693	P.E.C.	84-22
L606, 607	40-691	RFC 101	40-487
L608	40-692	RFC 201	45-51
L701	40-685	RFC 801	45-51
L702	40-686	RFC 901	45-41
L703, 704	40-687	RFC 902	45-30
L705	40-688	T1	52-79
L801	40-685	T102	52-73
L802	40-686	T103	52-79
L803, 804	40-687	T201	40-1023
L805	40-688	T202	52-65
L901, 902	45-53	T301	51-123
L903	40-549	T941	52-103


V1A
V2 6EA8
SPEECH AMPLIFIER
V1B
V2 6EA8
CATHODE FOLLOWER
V2
6AU8
ISOLATION AMPLIFIER
V3
6AU8
FIRST IF AMPLIFIER
V16A
V16B
12AU7
CARRIER OSC
MIC/CW LEVEL
CARRIER NULL CONTROL
CARRIER NULL CAPACITOR
METER ZERO
Q941
MPF 105
(FET)
B+ 300V
2.1 KHZ CRYSTAL FILTER
FILTER SWITCH
400 HZ
MODE 1B
MODE 2B
MODE 2T
WHT-ORG-ORG
WHT-RED
WHT-VIOL-VIOL
WHT-BLU
BRN
WHT-ORG-YEL


V5A
V2 6EA8
FIRST
TRANSMITTER
MIXER
V8
6C88
SECOND
TRANSMITTER
MIXER
V7
6CL6
DRIVER
BAND 3R
DRIVER
GRID
BAND
3F
DRIVER
PLATE
BAND
4F
BANDPASS
FILTER
8.395 TO
8.895 MHZ
T202
L101
8.8 MHZ
TRAP
TO PIN 1
OF V4
B+
300V
V20
BLU
WHT
NEUT.
WIRE
TP


DRIVER PLATE BAND 4F
BAND 4R
DRIVER PRESELECTOR
V8 6146 FINAL
V9 6146 FINAL
PA BAND 5R
HEAVY RED
WHT-VIOL-VIOL
WHT-ORG-ORG
V17B 1/2 12AT7 100 KHZ CRYSTAL CALIBRATOR
TO FUNCTION SWITCH
ALC INPUT
BAND
21.0
14.0
28.0
28.5

SCHEMATIC OF THE HEATHKIT® SSB TRANSCEIVER MODEL HW-101

DIODES

COMPONENT DESIGNATION	TYPE	HEATH PART NO.
D 1, 2, 101, 201, 301, 902, 903, 904, 905, 906	1N2071 (1 A, 600 PRV)	57-27
D901	1N4149	56-56
CR 1, 2, 3, 4, 201, 401, 441	1N191	56-26-1
D 202	15 V Zener	56-25

TRANSISTORS

COMPONENT DESIGNATION	HEATH PART NO.	MANUFACTURER'S NUMBER	(BOTTOM VIEW) BASING
Q941	417-169	MPF 105 FET	
Q942	417-118	2N3393	

FOR PARTS REQUESTS ONLY

- Be sure to follow instructions carefully.
- Use a separate letter for all correspondence.
- Please allow 10 - 14 days for mail delivery time.

DO NOT WRITE IN THIS SPACE

FOR PARTS REQUESTS ONLY

- Be sure to follow instructions carefully.
- Use a separate letter for all correspondence.
- Please allow 10 - 14 days for mail delivery time.

DO NOT WRITE IN THIS SPACE

CUSTOMER SERVICE

REPLACEMENT PARTS

Please provide complete information when you request replacements from either the factory or Heath Electronic Centers. Be certain to include the **HEATH** part number exactly as it appears in the parts list.

ORDERING FROM THE FACTORY

Print all of the information requested on the parts order form furnished with this product and mail it to Heath. For telephone orders (parts only) dial 616 982-3571. If you are unable to locate an order form, write us a letter or card including:

- Heath part number.
- Model number.
- Date of purchase.
- Location purchased or invoice number.
- Nature of the defect.
- Your payment or authorization for COD shipment of parts not covered by warranty.

Mail letters to: Heath Company
Benton Harbor
MI 49022
Attn: Parts Replacement

Retain original parts until you receive replacements. Parts that should be returned to the factory will be listed on your packing slip.

OBTAINING REPLACEMENTS FROM HEATH ELECTRONIC CENTERS

For your convenience, "over the counter" replacement parts

Also include switch positions, connections to other units, operating procedures, voltage readings, and any other information you think might be helpful.

Please do not send parts for testing, unless this is specifically requested by our Consultants.

Hints: Telephone traffic is lightest at midweek — please be sure your Manual and notes are on hand when you call.

Heathkit Electronic Center facilities are also available for telephone or "walk-in" personal assistance.

REPAIR SERVICE

Service facilities are available, if they are needed, to repair your completed kit. (Kits that have been modified, soldered with paste flux or acid core solder, cannot be accepted for repair.)

If it is convenient, personally deliver your kit to a Heathkit Electronic Center. For warranty parts replacement, supply a copy of the invoice or sales slip.

If you prefer to ship your kit to the factory, attach a letter containing the following information directly to the unit:

- Your name and address.
- Date of purchase and invoice number.
- Copies of all correspondence relevant to the service of the kit.
- A brief description of the difficulty.
- Authorization to return your kit COD for the service and