New Set
RD54

PRICE $2.00

HEATH COMPANY • BENTON HARBOR, MICHIGAN

HEATHKIT®
ASSEMBLY MANUAL

2-CHANNEL SSB TRANSCEIVER
MODEL HW-18-1

595-932-02

Dear Customer:

The Heathkit electronic product you have purchased is one of the best performing electronic products in the world.

Here's how we aim to keep it that way:

Your Heathkit Warranty

During your first 90 days of ownership, any parts which we find are defective, either in materials or workmanship, will be replaced or repaired free of charge. And we'll pay shipping charges to get those parts to you — anywhere in the world.

If we determine a defective part has caused your Heathkit electronic product to need other repair, through no fault of yours, we will service it free — at the factory, at any retail Heathkit Electronic Center, or through any of our authorized overseas distributors.

This protection is exclusively yours as the original purchaser. Naturally, it doesn't cover damage by use of acid-core solder, incorrect assembly, misuse, fire, flood or acts of God. But, it does insure the performance of your Heathkit electronic product anywhere in the world — for most any other reason.

After-Warranty Service

What happens after warranty? We won't let you down. If your Heathkit electronic product needs repairs or you need a part, just write or call the factory, your nearest retail Heathkit Electronic Center, or any Heath authorized overseas distributor. We maintain an inventory of replacement parts for each Heathkit model at most locations — even for many models that no longer appear in our current product line-up. Repair service and technical consultation are available through all locations.

We hope you'll never need our repair or replacement services, but it's nice to know you're protected anyway — and that cheerful help is nearby.

Sincerely,

HEATH COMPANY
Benton Harbor, Michigan 49022

Assembly
and
Operation
of the

HEATHKIT

2-CHANNEL SSB TRANSCEIVER

MODEL HW-18-1

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HEATH COMPANY
BENTON HARBOR, MICHIGAN 49022

INTRODUCTION

The Heathkit Model HW-18-1 Two-Channel Transceiver, which includes a receiver and a fixed-frequency single sideband 200 watt transmitter, can be used for both mobile and fixed stations. It is designed for upper sideband operation on C.A.P. (Civil Air Patrol) frequencies between 4450 kHz and 4650 kHz. The receiver and transmitter circuits are locked together by a continuously-running crystal oscillator to insure that both operate at the same frequency.

The microphone push-to-talk switch actuates a unique electronic switching circuit which instantly changes the Transceiver operation from receive to transmit without the use of a relay. Other features include ALC (automatic level control) to prevent overdriving the transmitter, and AVC (automatic volume control) to maintain constant receiver output over a wide range of input signal strength. A total of twelve tubes and ten diodes are used.

The Transceiver is designed to operate into a 50 ohm antenna that is adjusted to the correct length for the operating frequency. The transmitter output circuit is fixed tuned and loaded; therefore, a final tuning control is unnecessary.

Power for the Transceiver can be obtained from the Heathkit Models HP-13 (12 VDC), HP-23 (120 VAC), or HP-23A (120 or 240 VAC) Power Supplies.

The local C.A.P. Regional Headquarters will specify the channel frequencies authorized by the Federal Communications Commission for use in your area. Determine the two channels on which you will operate. The two heterodyne oscillator crystals furnished with this Transceiver will be for the channels specified on the purchase order for the kit.

The Transceiver is very simple to operate and has only one tuning control, the Clarifier. This control fine-tunes the heterodyne oscillator, which results in the best possible voice reproduction of the received or transmitted signal. Transmit-receive switching is instant and quiet. This function is performed by solid-state electronic switching when the microphone button is pressed.

The exterior of the Transceiver is finished in an attractive two-tone green which matches the latest Heathkit Amateur Communications Equipment. You will receive many years of dependable service and great satisfaction from this fine Transceiver.

NOTE: An accurate frequency meter or counter and a 50 Ω noninductive dummy load are required for proper alignment and adjustment.

Refer to the "Kit Builders Guide" for complete information on unpacking, parts identification, tools, wiring, soldering, and step-by-step assembly procedures.

PARTS LIST

The numbers in parentheses in this Parts List are keyed to the numbers on the Parts Pictorial (fold-out from Page 5).

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

PART No	PARTS Per Kit	DESCRIPTION
RESISTORS		
1/2 Watt		
(1) 1-1	1	47 Ω (yellow-violet-black)
1-3	3	100 Ω (brown-black-brown)
1-66	1	150 Ω (brown-green-brown)
1-45	5	220 Ω (red-red-brown)
1-4	3	330 Ω (orange-orange-brown)
1-9	7	1000 Ω (brown-black-red)
1-90	2	2000 Ω 5% (red-black-red-gold)
1-14	3	3300 Ω (orange-orange-red)
1-16	4	4700 Ω (yellow-violet-red)
1-19	1	6800 Ω (blue-gray-red)
1-20	8	10 kΩ (brown-black-orange)
1-22	5	22 kΩ (red-red-orange)
1-25	12	47 kΩ (yellow-violet-orange)
1-26	9	100 kΩ (brown-black-yellow)
1-29	6	220 kΩ (red-red-yellow)
1-35	7	1 MΩ (brown-black-green)
1-37	4	2.2 MΩ (red-red-green)
OTHER RESISTORS		
(2) 1-8-1	1	68 kΩ 1 watt (blue-gray-orange)
3-2-2	1	.33 Ω 2 watt (orange-orange-silver-gold)
(This is a 2-watt wire-wound resistor but it is the same size as a 1-watt resistor.)		
(3) 1-17-2	1	6800 Ω 2 watt (blue-gray-red)
1-22-2	1	12 kΩ 2 watt (brown-red-orange)
CAPACITORS		
Disc		
(4) 21-60	9	18 pF
21-32	7	47 pF
21-49	2	68 pF 4 kV
21-21	1	200 pF
21-13	6	500 pF
21-57	19	.005 μF
21-35	2	.005 μF 1.6 kV
21-31	29	.02 μF

PART No.	PARTS Per Kit	DESCRIPTION
Phenolic-Ceramic		
(5) 28-2	2	1 pF phenolic (brown-black-white-silver)
28-4	1	1.5 pF phenolic (brown-green-white-silver)
(6) 31-21	2	1.5 to 10 pF ceramic trimmer
Resin-Mica		
(7) 20-96	5	36 pF resin
20-102	1	100 pF resin
20-127	1	1300 pF resin
(8) 20-35	1	.00091 μF (910 pF) mica
OTHER CAPACITORS		
(9) 27-47	6	.1 μF Mylar*
27-85	1	.22 μF Mylar
27-61	3	.47 μF Mylar
(10) 25-54	2	10 μF electrolytic
(11) 25-135	1	20 μF vertical mount electrolytic
(12) 26-119	1	2 to 10 pF variable
CONTROLS-SWITCHES		
(13) 10-130	1	200 Ω bushing-mount control
(14) 10-57	2	10 kΩ tab-mount control
10-127	1	1 MΩ tab-mount control
(15) 19-67	1	1 MΩ control (with switch and cover)
(16) 60-4	2	Slide switch, SPDT
(17) 60-2	2	Slide switch, DPDT
COILS-CHOKES-TRANSFORMERS		
(18) 40-821	1	Crystal filter coil (L1)
(19) 40-823	1	Final plate coil (L4)
(20) 40-824	1	Driver grid coil (L2)
(21) 40-825	1	Driver plate coil (L3)
(22) 45-58	1	13 μH bifilar choke
(23) 45-3	1	1 mH choke
45-47	1	2 mH choke
(24) 45-4	2	1.1 mH choke
(25) 52-108	3	IF transformer
(26) 51-55	1	Output transformer

*DuPont Registered Trademark

TUBES-LAMP

PART No.	PARTS Per Kit	DESCRIPTION
411-11	4	6AU6 (6AU6A) tube
411-124	3	6EA8 tube
411-161	1	6EB8 tube
411-185	2	6GE5 tube
411-24	1	12AT7 tube
411-69	1	12BY7 tube
412-17	1	#53 panel lamp

DIODES-CRYSTALS

(27) 56-26-1	5	Germanium diode
(28) 57-27	5	Silicon diode
(29) 404-206	1	3396.400 kHz crystal (Y1)
404-331	1	Package containing the following:
404-329	2	3393.800 kHz crystal
404-330	2	3395.050 kHz crystal

NOTE: You should also have two of the crystals that are listed in the Crystal Reference Chart on Page 5.

SOCKETS-PLUGS

(30) 434-42	1	Phono socket
(31) 434-44	1	Lamp socket
(32) 434-74	2	Crystal socket
(33) 434-112	4	7-pin tube socket
434-79	6	9-pin tube socket
434-140	2	12-pin tube socket
(34) 434-118	2	11-pin socket
(35) 438-29	1	11-pin plug
(36) 438-4	1	Phono plug
(37) 440-1	2	Plug cap

HARNESS-CABLE-WIRE-SLEEVING

134-171	1	Wiring harness
343-7	1	Coaxial cable
344-50	1	Black wire
344-52	1	Red wire
346-1	1	Small sleeving
346-2	2	Clear plastic sleeving

METAL PARTS-GASKET

PART No.	PARTS Per Kit	DESCRIPTION
(38) 90-265	1	Cabinet
(39) 100-697	1	Chassis
(40) 203-510	1	Panel
(41) 206-371	1	Final shield
(42) 204-182	1	Shield mounting bracket
(43) 204-576	1	Gimbal bracket
(44) 209-50-1	1	Grille screen
(45) 332-8	1	Speaker gasket

HARDWARE

#4 Hardware

(46) 250-273	26	4-40 x 3/8" screw
(47) 252-15	6	4-40 nut
(48) 252-89	20	#4 push-on nut
(49) 254-9	6	#4 lockwasher

#6 Hardware

(50) 250-56	13	6-32 x 1/4" screw (1 spare)
(51) 250-234	15	6-32 x 1/2" screw
(52) 250-134	2	6-32 x 3/4" brass screw
(53) 250-13	2	6-32 x 1" screw
(54) 250-170	9	#6 x 1/4" sheet metal screw
(55) 252-3	24	6-32 nut (2 spares)
(56) 252-19	2	6-32 Palnut*
(57) 254-1	31	#6 lockwasher (2 spares)
(58) 255-3	8	#6 x 3/8" spacer
(59) 259-1	6	#6 solder lug

#8 Hardware

(60) 250-43	2	8-32 x 1/4" setscrew
(61) 253-9	2	#8 flat washer

#10 Hardware

(62) 250-54	2	10-32 x 5/8" screw
(63) 250-83	8	#10 x 1/2" sheet metal screw
(64) 252-49	2	10-32 thumbnut
(65) 255-44	2	10-32 shoulder spacer
(66) 253-19	2	Large #10 flat washer
(67) 253-42	4	Small #10 flat washer
(68) 254-3	2	#10 lockwasher

Other Hardware

(69) 252-39	1	1/4-32 nut
(70) 253-39	1	1/4" control washer
(71) 252-7	2	3/8-32 control nut
(72) 253-10	2	Control flat washer
(73) 254-5	2	Control lockwasher

*Registered Trademark, The Palnut Co.

PART No.	PARTS Per Kit	DESCRIPTION
MISCELLANEOUS		
85-69-8	1	Circuit board
401-97	1	Speaker
407-99	1	Meter
480-58	1	Microphone
(74) 431-11	2	5-lug terminal strip
(75) 462-106	1	Black knob
(76) 462-191	2	Green knob
(77) 73-1	4	Rubber grommet
(78) 75-29	1	Strain relief
(79) 261-4	4	Rubber foot
(80) 261-9	2	Medium rubber foot
(81) 261-21	2	Large rubber foot

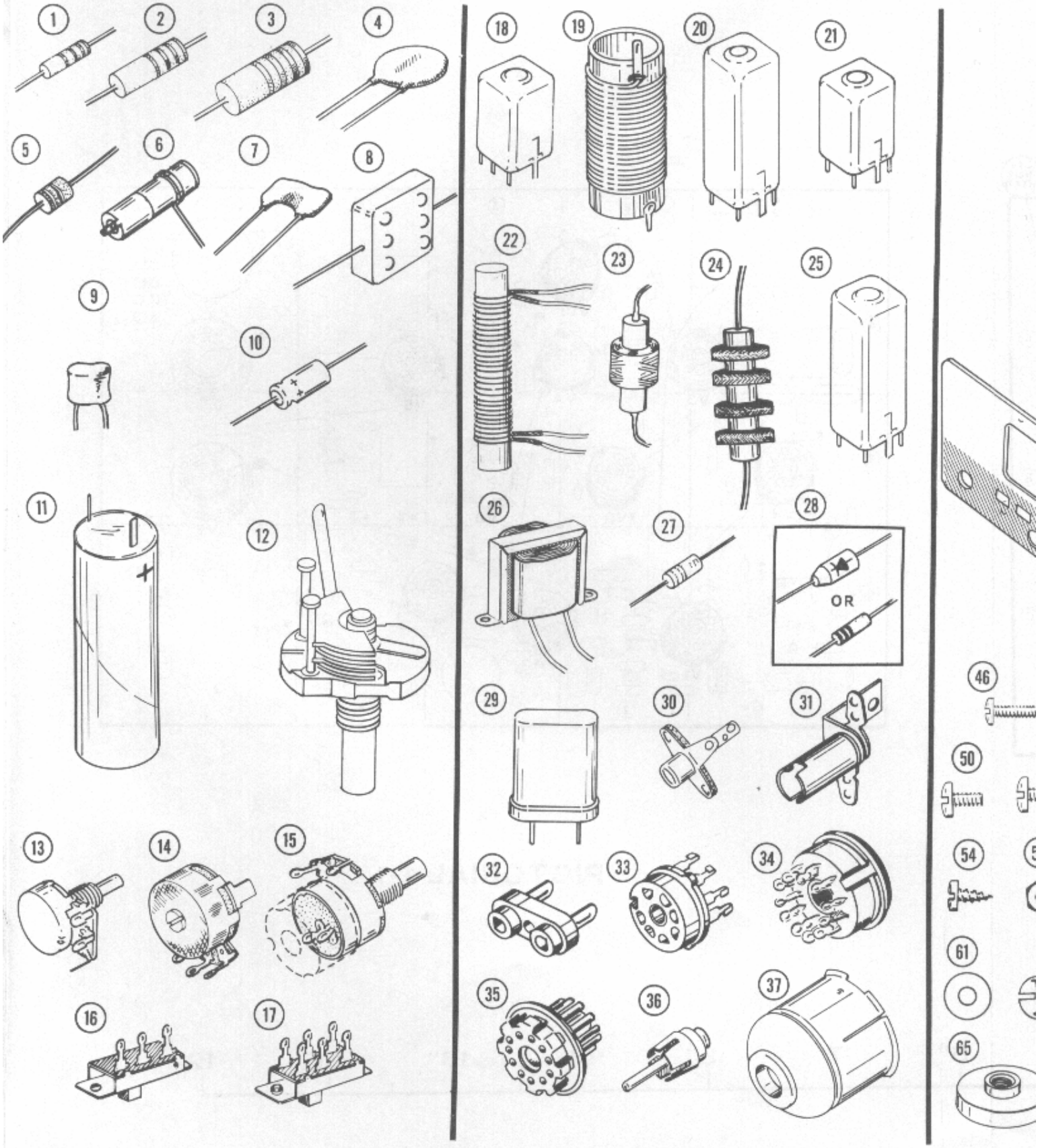
PART No.	PARTS Per Kit	DESCRIPTION
Miscellaneous (cont'd.)		
(82) 435-1	1	Plug mounting ring
(83) 259-20	40	Circuit board terminal (1 spare)
(84) 490-1	1	Alignment tool
(85) 490-5	1	Nut starter
390-186	1	Sheet of numbers and letters
391-34	1	Blue and white label
597-260	1	Parts Order Form
597-308	1	Kit Builders Guide
	1	Manual (See front cover for part number.)
		Solder

CRYSTAL REFERENCE CHART

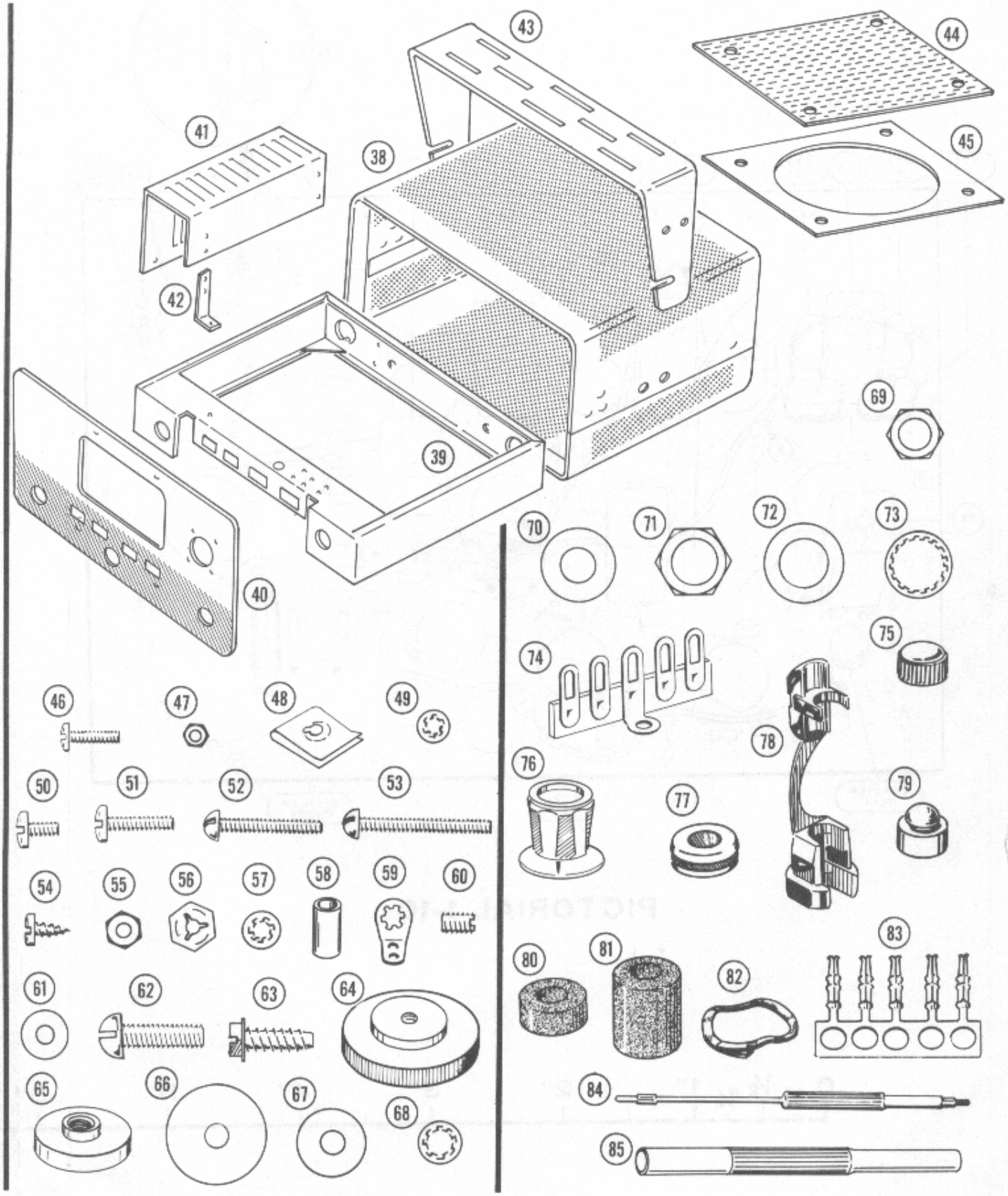
The following crystals are available from the Heath Company for use in your Transceiver. Be sure the two crystals that you use (one in each Transceiver channel) are the ones specified for your area by your C.A.P. Regional Headquarters.

CHANNEL FREQ.	PART No.	CRYSTAL FREQ.	CARRIER FREQ.
4469.0 kHz	404-345	7.8639 MHz	4467.5 kHz
4509.0 kHz	404-346	7.9039 MHz	4507.5 kHz
4586.5 kHz	404-347	7.9814 MHz	4585.0 kHz
4604.0 kHz	404-348	7.9989 MHz	4602.5 kHz
4631.5 kHz	404-349	8.0264 MHz	4630.0 kHz
4466.0 kHz	404-404	7.8609 MHz	4464.5 kHz
4506.0 kHz	404-405	7.8009 MHz	4504.5 kHz
4583.5 kHz	404-406	7.9784 MHz	4582.0 kHz
4601.0 kHz	404-407	7.9959 MHz	4599.5 kHz
4628.5 kHz	404-408	8.0234 MHz	4627.0 kHz

PARTS PICTOR



PICTORIAL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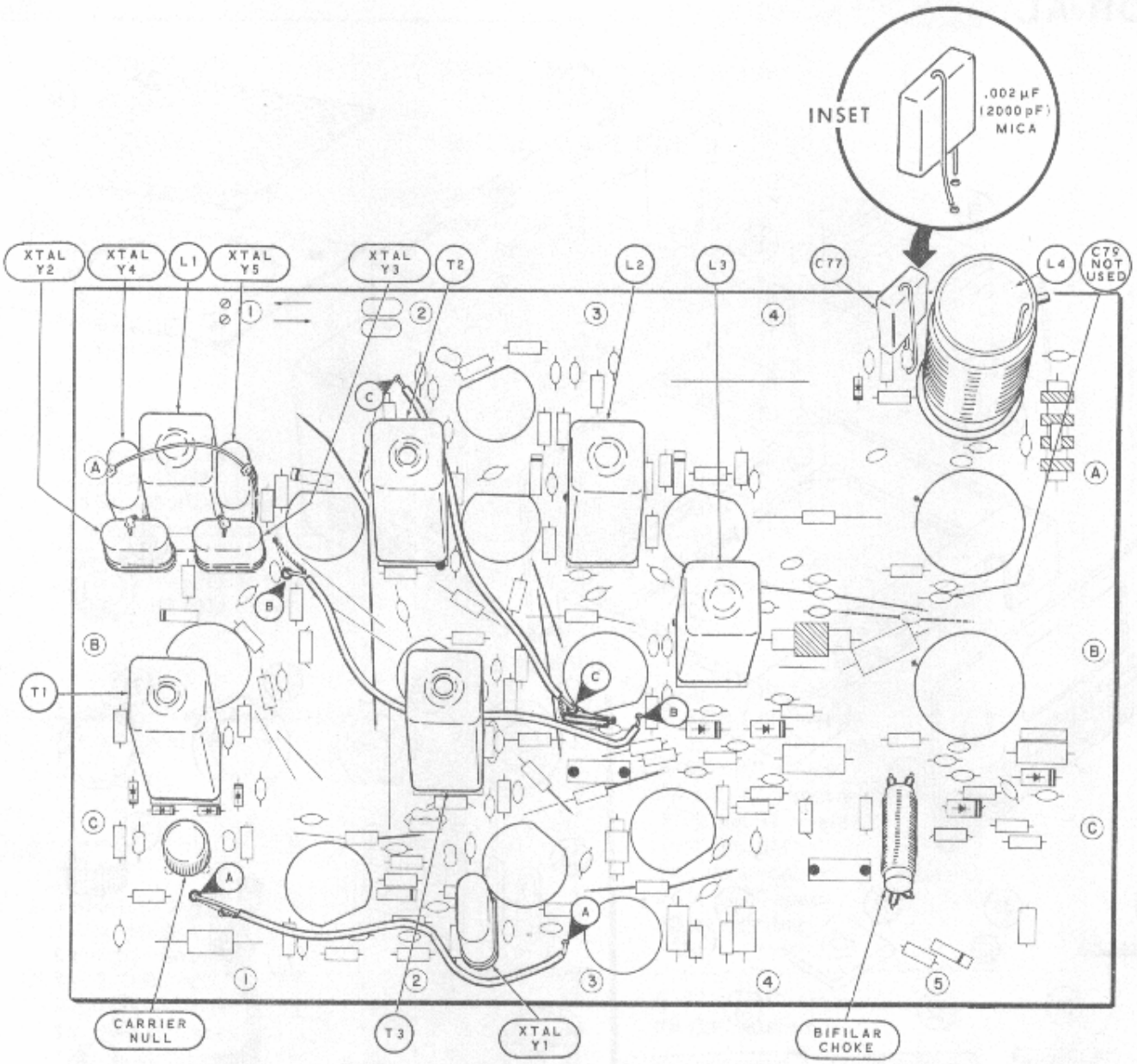
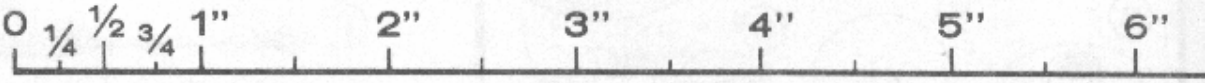


PICTORIAL 1-10



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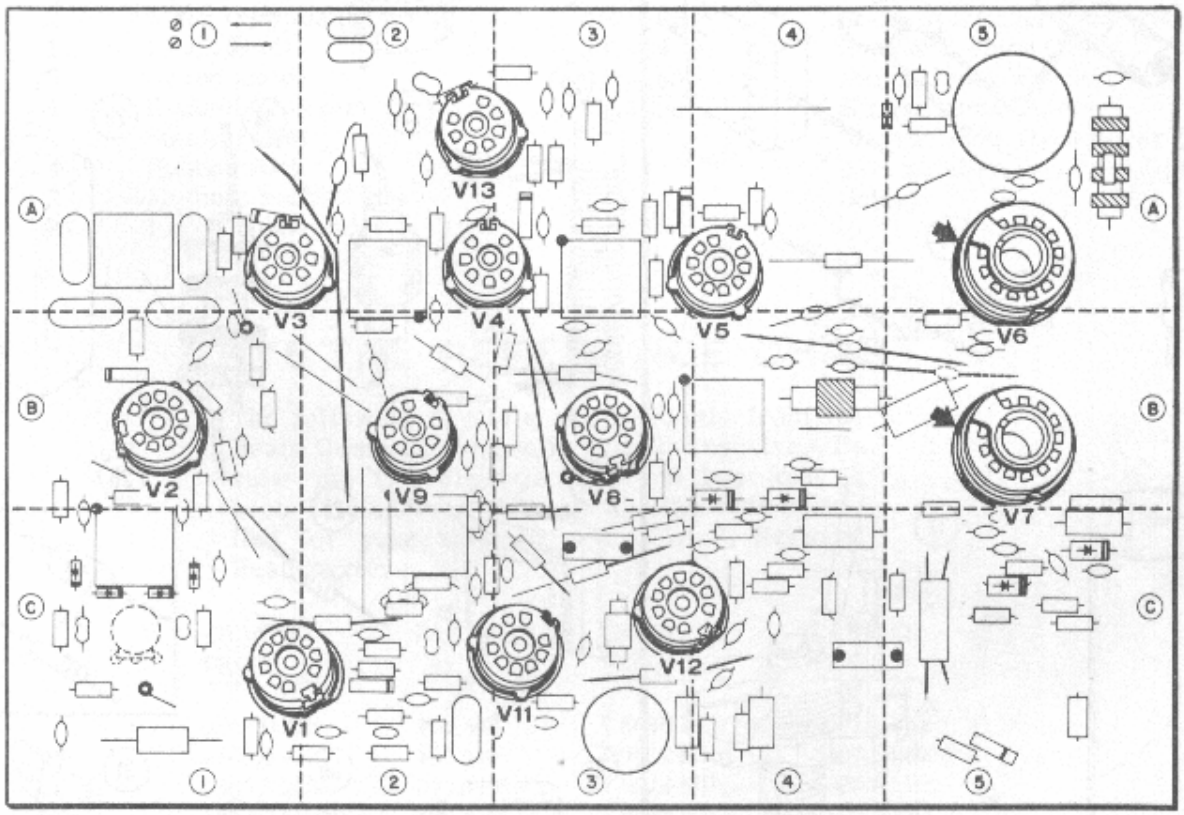


PICTORIAL 1-1

6" 7" 8" 9" 10" 11" 12"

STEP-BY-STEP ASSEMBLY

Before starting to assemble the circuit boards, be sure you have read the wiring, soldering, and step-by-step assembly information in the Kit Builders Guide.

Position all parts as shown in the Pictorials. Follow the instructions carefully, and read the entire step before performing the operation.

Use 1/2 watt resistors unless directed otherwise in a step. Resistors will be called out by the color code and the resistance value in Ω (ohms), kΩ (kilohms), or MΩ (megohms).

Capacitors will be called out by the capacitance value (in μF or pF) and type. NOTE: Some capacitors are marked with a color band at one end of the capacitor body. Disregard this color band unless directed otherwise in a step.

Be sure you insert the leads of each part in the correct holes in the circuit board. Position each part as closely as possible in the position outlined on the lettered side of the circuit board.

Perform each step in the order listed; complete each Pictorial before proceeding to the next Pictorial. When the circuit board is finished, set it aside until it is called for later.

NOTE: Rulers have been printed at the bottom of some of the pages and fold-outs to help you when you prepare the lengths of cables and wires.

CIRCUIT BOARD ASSEMBLY

Because the circuit board is quite large, it has been divided into sections to simplify its assembly. This will make it easier for you to locate the points on the circuit board that are referred to throughout the assembly instructions. The dividing lines run vertically and horizontally between the circuit board mounting holes, and divide the circuit board into fifteen sections. Pictorials 1-1 through 1-9 show these circuit board sections.

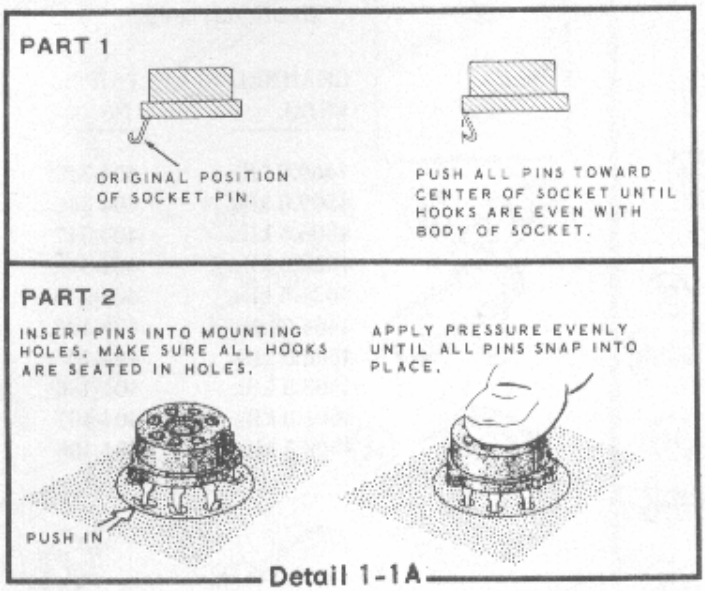
NOTE: The circuit board used in this kit is also used in other Heathkit Transceivers. Since different models require different parts, there will be holes in the circuit board that will not be used in this kit. When you assemble this kit, use only those circuit board holes that are called out in the steps and shown in the Pictorials in this Manual.

Refer to Pictorial 1-1 for the following steps.

(✓) Place the circuit board foil side down on your work surface.

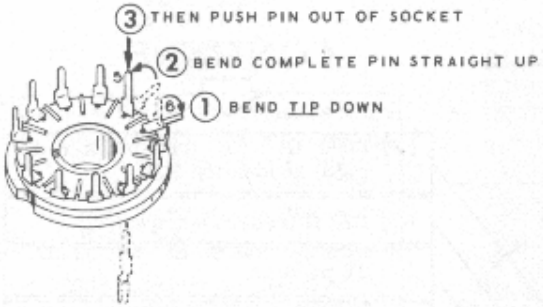
(✓) Refer to Part 1 of Detail 1-1A and bend in the pins of each 7-pin and 9-pin tube socket as shown.

(✓) Refer to Part 2 of Detail 1-1A and install 7-pin tube sockets at locations V3, V4, V9, and V13. Turn the circuit board over and be sure all pins protrude through the circuit board holes. Then solder the seven pins of each socket to the circuit board foil.



Detail 1-1A

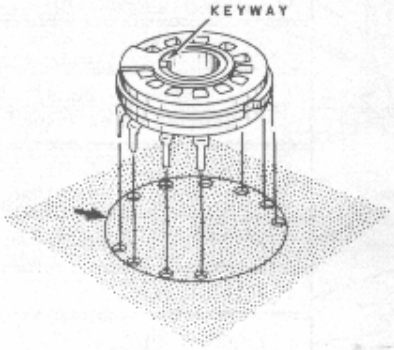
( ) In a like manner, install 9-pin tube sockets at locations V1, V2, V5, V8, V11, and V12. Then solder the nine pins of each tube socket to the foil.



Detail 1-1B

( ) Refer to Detail 1-1B and remove pins 5 and 6 from one of the 12-pin tube sockets. NOTE: The pin numbers are molded on the top and bottom of the socket.

( ) Refer to Detail 1-1C and install this socket at location V6. Align the keyway of the socket with the arrow printed on the circuit board. Solder all ten pins of the socket.



Detail 1-1C

( ) In a like manner, remove pins 8 and 9 from the other 12-pin socket.

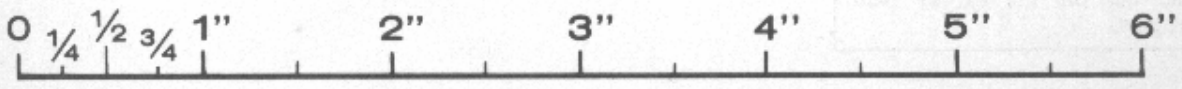
( ) Align the keyway with the arrow and install this socket at location V7. Then solder the ten socket pins to the foil.

NOTE: When resistors are called for, use 1/2 watt resistors unless the step directs otherwise. When a step calls for a jumper wire, use the black hookup wire supplied with the kit. Cut each jumper wire to the length specified in the step and remove 1/4" of insulation from each end of the wire.

In a step that calls for sleeving on a wire or component lead, use the small sleeving unless the step directs otherwise.

When installing disc capacitors, do not push the insulation on the leads through the circuit board holes.

Perform the steps listed in Pictorials 1-2 through 1-9.



HEATHKIT

CIRCUIT BOARD SECTIONS 1A, 1B, AND 1C.

START

NOTE: Do not solder the leads to the foil until directed to do so in a step.

( ) 220 Ω (red-red-brown).

( ) .1 μF Mylar.

( ) 47 kΩ (yellow-violet-orange).

( ) 100 kΩ (brown-black-yellow).

( ) 3/4" jumper wire.

( ) 4700 Ω (yellow-violet-red).

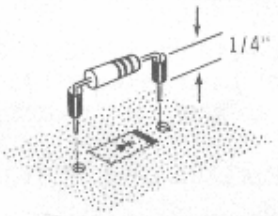
( ) .02 μF disc at location C20.

( ) 47 kΩ (yellow-violet-orange).

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

NOTE: Position the banded end of each diode as shown.

( ) Germanium diode. Use 1/4" of sleeving on each lead.



( ) Germanium diode. Use 1/4" of sleeving on each lead.

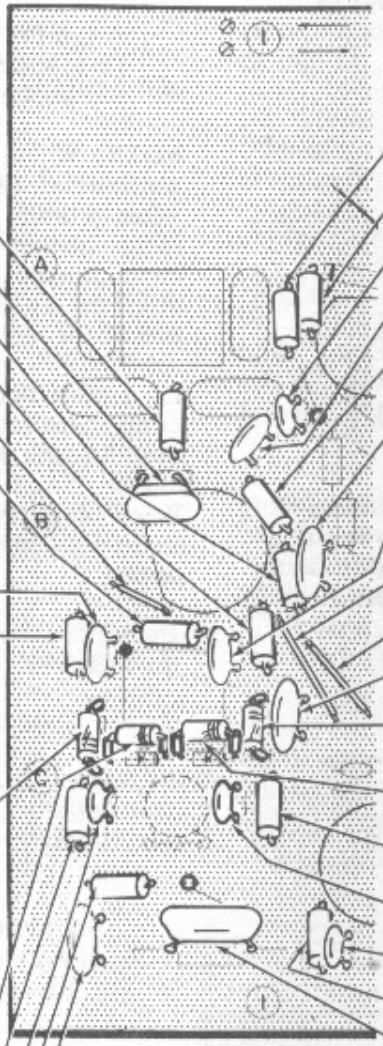
( ) 220 Ω (red-red-brown).

( ) 18 pF disc.

( ) 1000 Ω (brown-black-red).

( ) .02 μF disc.

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



PICTORIAL 1-2

CONTINUE

( ) 2000 Ω, 5% (red-black-red-gold) at location R30.

( ) 220 Ω (red-red-brown).

( ) 18 pF disc.

( ) .005 μF disc.

( ) 2000 Ω, 5% (red-black-red-gold) at location R25.

( ) .02 μF disc.

( ) .005 μF disc.

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

( ) 1-3/8" jumper wire.

( ) 1-1/4" jumper wire.

( ) .02 μF disc.

( ) Germanium diode. Use 1/4" of sleeving on each lead.

( ) Germanium diode. Use 1/4" of sleeving on each lead.

( ) 220 Ω (red-red-brown).

( ) 18 pF disc.

( ) 500 pF disc.

( ) 1000 Ω (brown-black-red).

( ) .47 μF Mylar.

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

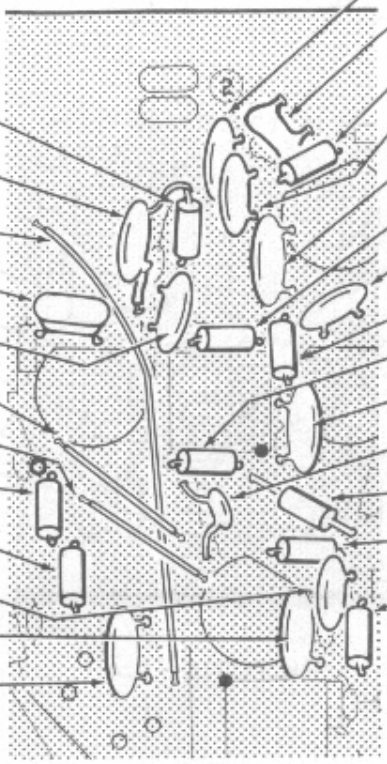
PROCEED TO PICTORIAL 1-3.

START

NOTE: Do not solder the leads to the foil until directed to do so in a step. Also, in the next two steps, one resistor lead and one capacitor lead should be inserted in the same circuit board hole.

- ( ) 3300 Ω (orange-orange-red).
- ( ) 47 pF disc. Use 1/2" of sleeving on indicated lead.
- ( ) 4-1/4" jumper wire.
- ( ) .1 μF Mylar.
- ( ) .005 μF disc.
- ( ) 1-5/8" jumper wire.
- ( ) 1-5/8" jumper wire.
- ( ) 220 kΩ (red-red-yellow).
- ( ) 47 kΩ (yellow-violet-orange).
- ( ) .005 μF disc.
- ( ) .02 μF disc.
- ( ) .02 μF disc.
- ( ) Solder the leads to the foil and cut off the excess lead lengths.

CIRCUIT BOARD SECTIONS 2A AND 2B.

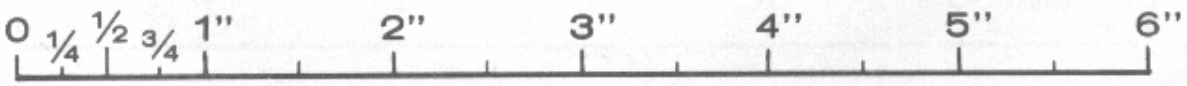


CONTINUE

- ( ) 47 pF disc at location C133.
- ( ) 36 pF resin at location C132.
- ( ) 100 kΩ (brown-black-yellow).
- ( ) 47 pF disc at location C134.
- ( ) .02 μF disc.
- ( ) 47 kΩ (yellow-violet-orange).
- ( ) .005 μF disc.
- ( ) 330 Ω (orange-orange-brown).
- ( ) 100 kΩ (brown-black-yellow).
- ( ) .02 μF disc.
- ( ) 18 pF disc.
- ( ) 4700 Ω (yellow-violet-red).
- ( ) 47 kΩ (yellow-violet-orange).
- ( ) 47 kΩ (yellow-violet-orange).
- ( ) Solder the leads to the foil and cut off the excess lead lengths.

PROCEED TO PICTORIAL 1-4.

PICTORIAL 1-3



CIRCUIT BOARD SECTION
2C.

START

NOTE: Do not solder the leads to the foil until directed to do so in a step.

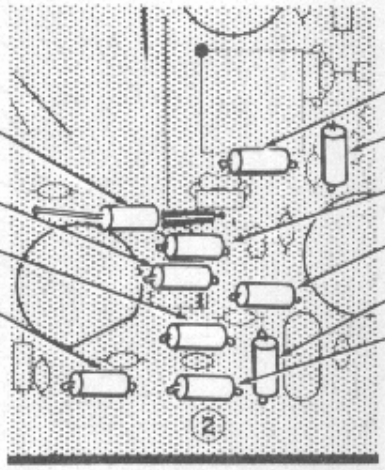
( ) 220 kΩ (red-red-yellow). Use 5/8" of sleeving on one lead as shown.

( ) 1 MΩ (brown-black-green).

( ) 1000 Ω (brown-black-red).

( ) 22 kΩ (red-red-orange).

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



CONTINUE

( ) 220 kΩ (red-red-yellow).

( ) 4700 Ω (yellow-violet-red).

( ) 1 MΩ (brown-black-green).

( ) 3300 Ω (orange-orange-red).

( ) 10 kΩ (brown-black-orange).

( ) 100 kΩ (brown-black-yellow).

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

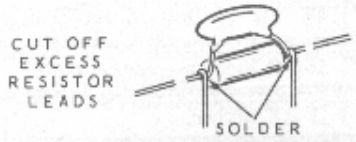
PROCEED TO PICTORIAL 1-5.

PICTORIAL 1-4

START

NOTE: Do not solder the leads to the foil until directed to do so in a step.

( ) Prepare a resistor-capacitor combination as shown below with a 2.2 MΩ (red-red-green) resistor and a .02 μF disc capacitor.



(✓) Mount the resistor-capacitor combination at the location indicated.

(✓) .005 μF disc.

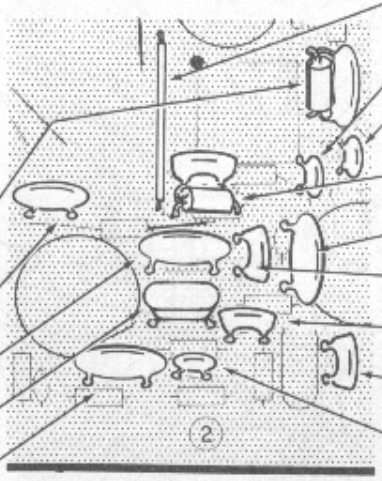
(✓) .02 μF disc.

(✓) .1 μF Mylar.

(✓) .02 μF disc.

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

CIRCUIT BOARD SECTION 2C



CONTINUE

(✓) 2" jumper wire.

(✓) 18 pF disc.

(✓) 500 pF disc.

(✓) 4700 Ω (yellow-violet-red) resistor and 100 pF resin capacitor combination.

(✓) .02 μF disc.

(✓) 36 pF resin.

(✓) 36 pF resin at location C118.

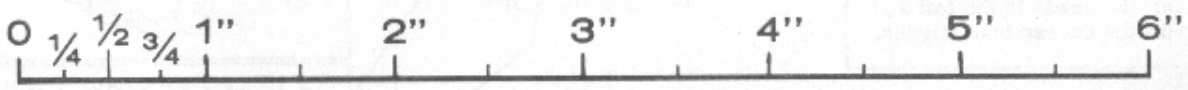
(✓) 36 pF resin at location C117.

(✓) 500 pF disc.

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

PROCEED TO PICTORIAL 1-6

PICTORIAL 1-5



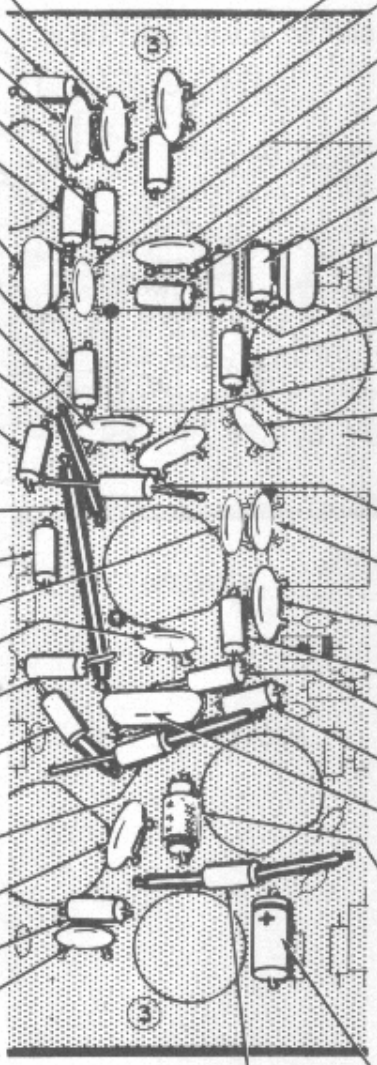
HEATHKIT

START

NOTE: Do not solder the leads to the foil until directed to do so in a step.

- (√) .02 µF disc.
- (√) 10 kΩ (brown-black-orange).
- (√) .02 µF disc.
- (√) 220 kΩ (red-red-yellow).
- (√) 22 kΩ (red-red-orange).
- (√) .1 µF Mylar.
- (√) 100 kΩ (brown-black-yellow).
- (√) .02 µF disc.
- (√) 1-1/2" jumper wire. Use 7/8" of sleeving on this wire.
- (√) 1000 Ω (brown-black-red).
- (√) Solder the leads to the foil and cut off the excess lead lengths.
- (√) 2-3/8" jumper wire. Use 1-3/4" of sleeving on this wire.
- (√) 1000 Ω (brown-black-red).
- (√) 47 pF disc.
- (√) .005 µF disc.
- (√) 2.2 MΩ (red-red-green).
- (√) 1 MΩ (brown-black-green). Use 3/8" of sleeving on one lead.
- (√) 47 kΩ (yellow-violet-orange). Use 5/8" of sleeving on one lead.
- (√) .02 µF disc.
- (√) 22 kΩ (red-red-orange).
- (√) 47 pF disc.
- (√) Solder the leads to the foil and cut off the excess lead lengths.

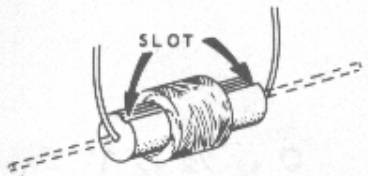
CIRCUIT BOARD SECTIONS 3A, 3B, AND 3C.



PICTORIAL 1-6

CONTINUE

- (√) .02 µF disc.
- (√) 1000 Ω (brown-black-red).
- (√) .005 µF disc.
- (√) .02 µF disc.
- (√) 47 kΩ (yellow-violet-orange).
- (√) 150 Ω (brown-green-brown).
- (√) .1 µF Mylar.
- (√) 6800 Ω (blue-gray-red).
- (√) 47 Ω (yellow-violet-black).
- (√) .02 µF disc at location C56.
- (√) 47 pF disc.
- (√) Solder the leads to the foil and cut off the excess lead lengths.
- (√) 1 MΩ (brown-black-green).
- (√) .005 µF disc.
- (√) .02 µF disc.
- (√) 47 kΩ (yellow-violet-orange).
- (√) 1 MΩ (brown-black-green).
- (√) 100 kΩ (brown-black-yellow).
- (√) .47 µF Mylar.
- (√) 2 mH (#45-47) choke. Bend each lead toward the slot.



- (√) 10 µF electrolytic. Position the positive (+) end as shown.
- (√) 2.2 MΩ (red-red-green). Use 5/8" lengths of sleeving on each lead.
- (√) Solder the leads to the foil and cut off the excess lead lengths.

PROCEED TO PICTORIAL 1-7

HEATHKIT

START

NOTE: Do not solder the leads to the foil until directed to do so in a step.

( ) 2" jumper wire.

( ) .005 µF disc.

( ) 100 kΩ (brown-black-yellow).

( ) 47 kΩ (yellow-violet-orange).

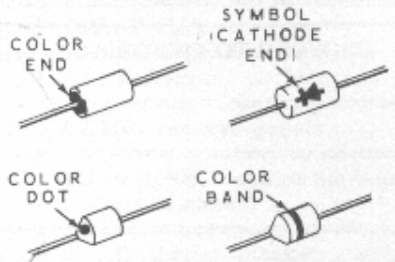
( ) 1300 pF resin.

( ) 1" jumper wire.

( ) .02 µF disc.

( ) .02 µF disc.

NOTE: When installing diodes, the cathode end must be positioned as shown on the lettered side of the circuit board. The cathode end is marked with either a color end, color dot, color band or a symbol.

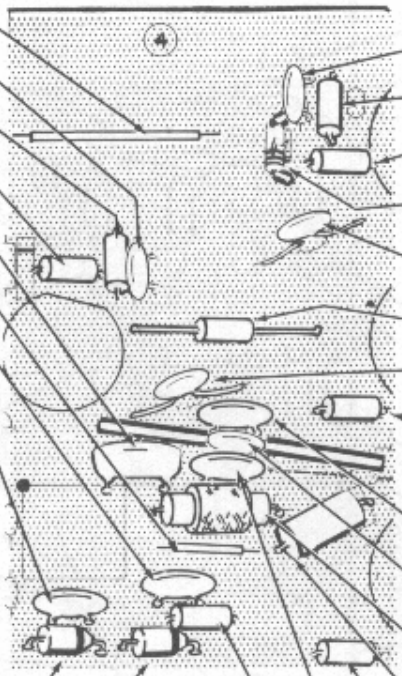


( ) Silicon diode.

( ) Silicon diode.

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

CIRCUIT BOARD SECTIONS 4A AND 4B.



CONTINUE

( ) .005 µF disc.

( ) 330 Ω (orange-orange-brown).

( ) 10 kΩ (brown-black-orange).

( ) Germanium diode. Use 1/4" of sleeving on each lead.

( ) 18 pF disc at location C64.

( ) 22 kΩ (red-red-orange).

( ) 18 pF disc at location C63.

( ) 100 Ω (brown-black-brown).

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

( ) .02 µF disc.

( ) .005 µF disc. Use 7/8" sleeving on each lead.

( ) 1 mH (#45-3) choke. Bend each lead toward the slot.

( ) 6800 Ω 2-watt (blue-gray-red).

( ) 100 Ω (brown-black-brown).

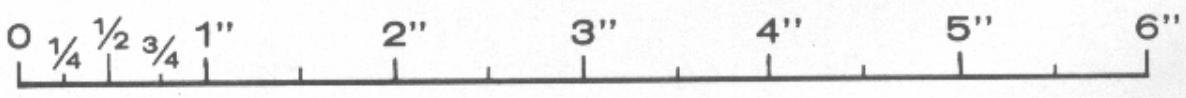
( ) .02 µF disc at location C73.

( ) 100 kΩ (brown-black-yellow).

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

PROCEED TO PICTORIAL 1-8

PICTORIAL 1-7



START

NOTE: Do not solder the leads to the foil until directed to do so in a step.

( ) 500 pF disc.

( ) .02 μF disc.

( ) 220 kΩ (red-red-yellow).

( ) .005 μF disc.

( ) 47 kΩ (yellow-violet-orange).

( ) 100 kΩ (brown-black-yellow).

( ) 200 pF disc.

( ) .005 μF disc.

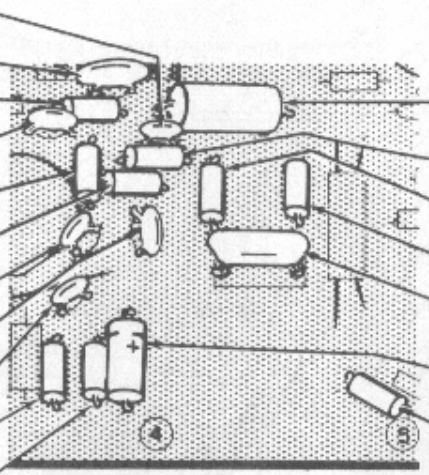
( ) 500 pF disc.

( ) 100 Ω (brown-black-brown).

( ) 3300 Ω (orange-orange-red).

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

CIRCUIT BOARD SECTION 4C.



CONTINUE

( ) 12 kΩ 2 watt (brown-red-orange).

( ) 1 MΩ (brown-black-green).

( ) 10 kΩ (brown-black-orange).

( ) 47 kΩ (yellow-violet-orange).

( ) .47 μF Mylar.

( ) 10 μF electrolytic. Position the positive (+) end as shown.

( ) 1000 Ω (brown-black-red).

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

PROCEED TO PICTORIAL 1-9

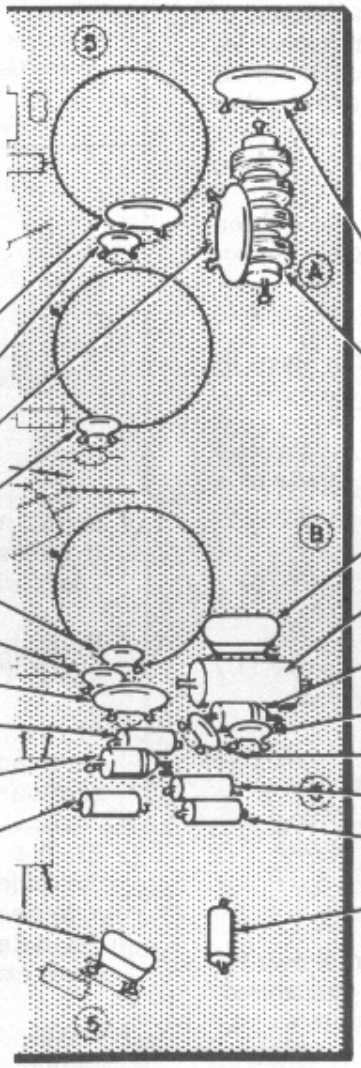
PICTORIAL 1-8

CIRCUIT BOARD SECTIONS 5A, 5B, AND 5C.

START

NOTE: Do not solder the leads to the foil until directed to do so in a step.

- ( ) .02 μF disc.
- ( ) 18 pF disc.
- ( ) .005 μF 1.6 kV disc.
- ( ) .005 μF disc.
- ( ) 18 pF disc.
- ( ) .005 μF disc.
- ( ) .02 μF disc.
- ( ) 2.2 MΩ (red-red-green).
- ( ) Silicon diode. Position the cathode end as shown.
- ( ) 10 kΩ (brown-black-orange).
- ( ) .1 μF Mylar.
- ( ) Solder the leads to the foil and cut off the excess lead lengths.



CONTINUE

- ( ) .005 μF 1.6 kV disc.
- ( ) 1.1 mH (#45-4) choke. Bend each lead toward the slot.
- ( ) .22 μF Mylar.
- ( ) .33 Ω 2-watt (orange-orange-silver-gold).
- ( ) Silicon diode. Position the cathode end as shown.
- ( ) .005 μF disc.
- ( ) .005 μF disc.
- ( ) 10 kΩ (brown-black-orange).
- ( ) 10 kΩ (brown-black-orange).
- ( ) 220 kΩ (red-red-yellow).
- ( ) Solder the leads to the foil and cut off the excess lead lengths.

PROCEED TO PICTORIAL 1-10 AND PAGE 16.

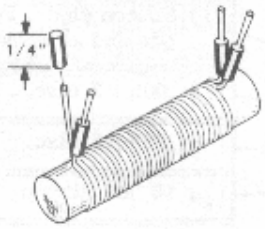
PICTORIAL 1-9

NOTE: The following Step-By-Step Assembly section of the Manual contains Pictorials and Details. Each Pictorial shows the overall result obtained after a group of assembly steps have been performed. Details are provided to help you perform assembly operations called out in one (or more) specific step. As an example, when you are directed to "Refer to Pictorial 1-10 for the following steps", continue to use that Pictorial until you are directed to refer to a different one for the next group of steps.

Solder each of the following parts and cables after they are installed on the circuit board. Then cut off the excess lead lengths.

Refer to Pictorial 1-10 (fold-out from Page 6) for the following steps.

( ) Refer to Detail 1-10A and place 1/4" lengths of sleeving on each of the four leads of a bifilar choke (#45-58).



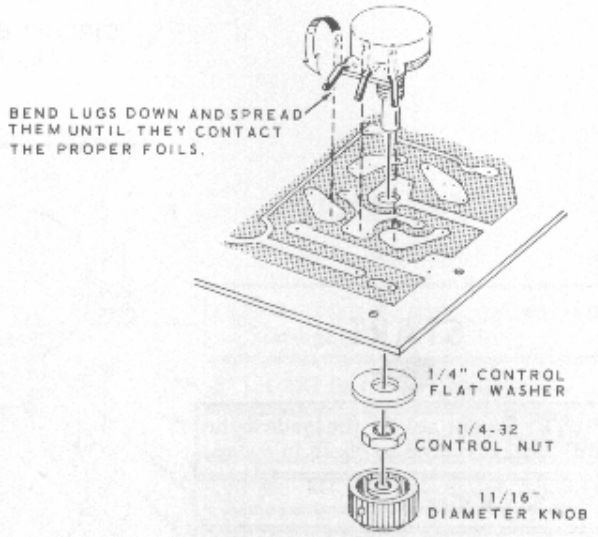
Detail 1-10A

( ) Install this choke at the location shown in section 5C. The choke should be positioned approximately 1/4" above the circuit board.

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

( ) Refer to Detail 1-10B and bend the lugs of a 200 Ω bushing-mount control (#10-130) as shown.

( ) Install this control from the foil side of the circuit board at the CARRIER NULL location in section 1C. Use a 1/4" control flat washer and 1/4-32 control nut. Be sure the control lugs are positioned on the proper foils. Then tighten the control nut and solder the control lugs to the foil.



Detail 1-10B

( ) Install the black knob on the control shaft. If necessary, carefully push the two diodes apart slightly so the knob will turn freely.

( ) Refer to Detail 1-10C and prepare the ends of a 5-1/4" coaxial cable as shown.

( ) At the end of this cable without a shield lead, connect the inner lead into hole A in section 3C (S-1).

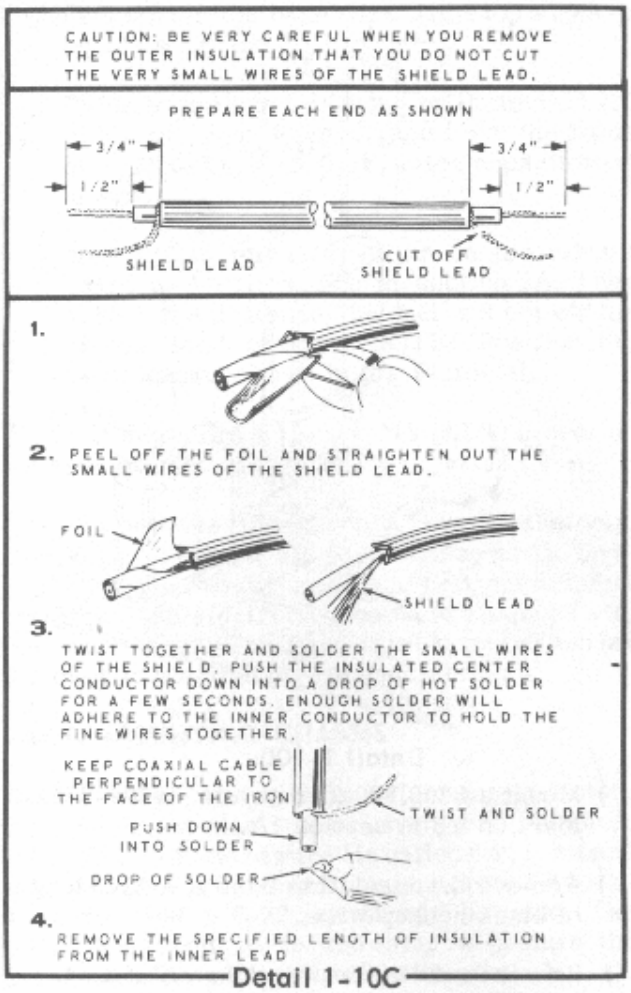
( ) At the other end of this cable, connect the inner lead into the circled hole marked A in section 1C (S-1), and the shield lead into the hole at the end of the white line coming from circled hole A (S-1).

( ) Again refer to Detail 1-10C and prepare the ends of two 6" coaxial cables.

( ) At the end of one of these 6" cables without a shield lead, connect the inner lead into the hole marked C in section 2A (S-1).

( ) At the other end of this cable, connect the inner lead into the circled hole marked C in section 3B (S-1).

( ) Place 1/2" of sleeving on the shield lead of this cable and connect the shield into the hole at the end of the white line coming from circle hole C (S-1).



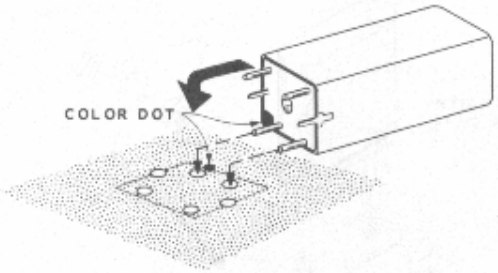
Detail 1-10C

( ) At the end of the other 6" cable without a shield lead, connect the inner lead into the hole marked B in section 3B (S-1).

( ) At the other end of this cable, connect the inner lead into the circled hole marked B in section 1B (S-1).

( ) Connect the shield lead of this cable into the hole at the end of the white line coming from circled hole B (S-1).

NOTE: Solder each part to the foil as it is mounted. CAUTION: Do not turn any of the adjusting slugs in the coils or transformers until you are directed to do so in a step. Be sure the color dot at the bottom of each coil or transformer is positioned over the color dot printed on the circuit board.



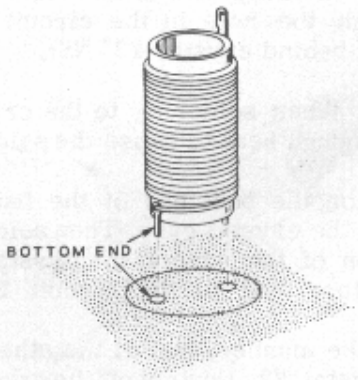
Detail 1-10D

( ) Refer to Detail 1-10D and mount the three IF transformers (#52-108) at locations T1, T2, and T3.

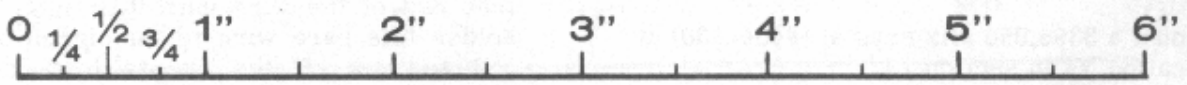
( ) Mount the driver grid coil (#40-824) at location L2.

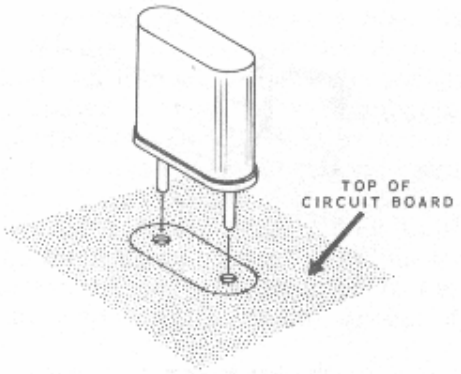
( ) Mount the driver plate coil (#40-825) at location L3.

( ) Refer to Detail 1-10E and mount the final coil (#40-823) at location L4. Be sure you position the lug connected to the bottom end of the coil winding as shown.



Detail 1-10E





Detail 1-10F

NOTE: Solder the pins to the foil as each crystal is installed. Do not cut off the excess lengths of the pins.

(√) Refer to Detail 1-10F and mount the 3396.400 kHz crystal (#404-206) at location Y1 in section 2C.

(√) Mount a 3395.050 kHz crystal (#404-330) at location Y3 in section 1A.

(√) Mount a 3393.800 kHz crystal (#404-329) at location Y2 in section 1A.

(√) Remove the insulation from two 1-1/2" lengths of black hookup wire.

(√) Refer to Detail 1-10G and bend one end of each of these bare wires as shown.

( ) Insert the long end of one of these wires through the hole in the circuit board directly behind crystal Y3 (NS).

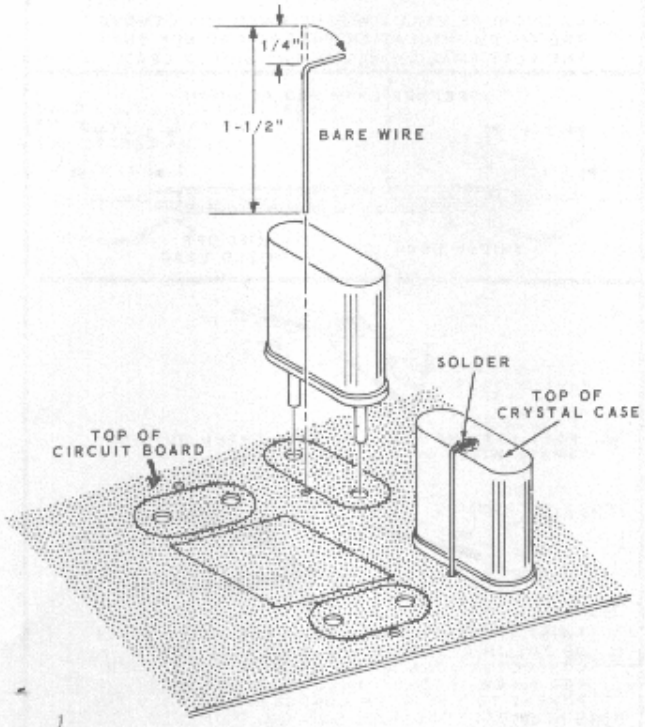
CAUTION: When soldering to the crystal case, use only enough heat to cause the solder to flow.

( ) Position the bent end of the bare wire on top of the crystal case. Then solder the bent portion of the wire to the crystal case and the other end to the circuit board foil.

( ) In a like manner, install the other bent wire on crystal Y2. Now cut off the excess lengths of wire.

(√) Mount the crystal filter coil (#40-821) at location L1 in section 1A.

(√) Mount a 3395.050 kHz crystal (#404-330) at location Y4 in section 1A.

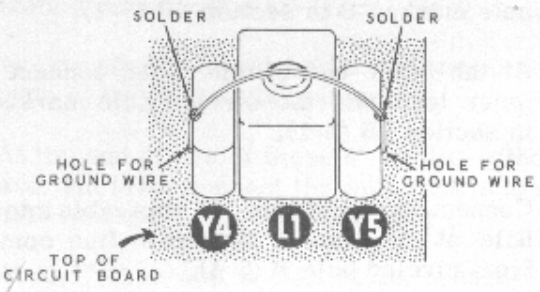


Detail 1-10G

(√) Mount a 3393.800 kHz crystal (#404-329) at location Y5 in section 1A.

(√) Remove the insulation from a 4-1/4" length of black hookup wire.

( ) Refer to Detail 1-10H and insert the ends of this 4-1/4" bare wire through the holes in the circuit board (NS). Position the wire as shown in the Detail.



Detail 1-10H

(√) Solder one end of the bare wire to the circuit board foil.

( ) Use a pair of pliers and pull gently on the free end of the wire until it is tight. Then solder this bare wire to the circuit board foil and cut off the excess lead length.

( ) Now solder the bare wire to the top edges of crystals Y4 and Y5.

( ) Refer to the inset drawing on Pictorial 1-10 (fold-out from Page 6) and form the leads of a .00091 μF (910 pF) mica capacitor as shown.

( ) Install this mica capacitor on the circuit board at location C77 in section 5A. Then solder the leads to the foil and cut off the excess lead lengths. NOTE: Position the capacitor as shown in the Pictorial.

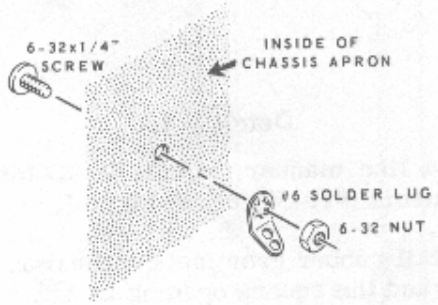
NOTE: Capacitors C79 and C73 (ALT) in section 5B are not used in this kit.

This completes the circuit board assembly. Check and be sure all parts are mounted correctly on the circuit board and that the polarity mark on each electrolytic capacitor agrees with the polarity mark on the circuit board. Then lay the circuit board aside for use later.

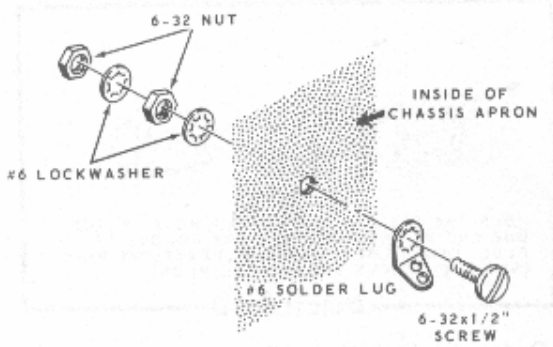
PARTS MOUNTING-CHASSIS

NOTE: When hardware is called for in a step, only the screw size will be given. For instance, if "6-32 x 1/4" hardware" is called for, it means that a 6-32 x 1/4" screw, one or more #6 lockwashers, and a 6-32 nut should be used. The Detail referred to in the step will show the proper number of lockwashers to use.

The Heath Company has provided a plastic nut starter with this kit. Use this nut starter to hold and start 6-32 and 4-40 nuts on screws. Refer to Page 3 of the Kit Builders Guide for further information.



Detail 2-1A



Detail 2-1B

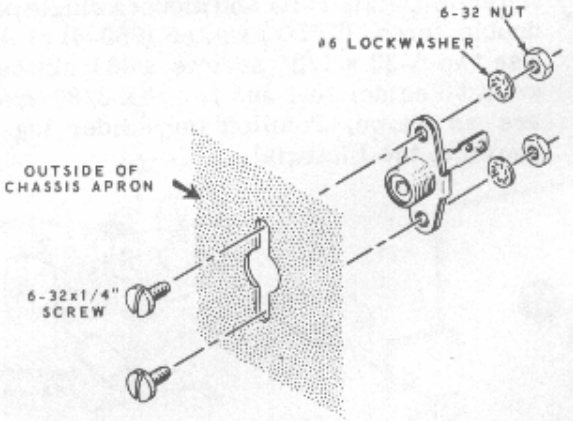
Refer to Pictorial 2-1 (fold-out from Page 21) for the following steps.

( ) Refer to Detail 2-1A and install a #6 solder lug at AB with 6-32 x 1/4" hardware. Position the solder lug as shown in the Pictorial.

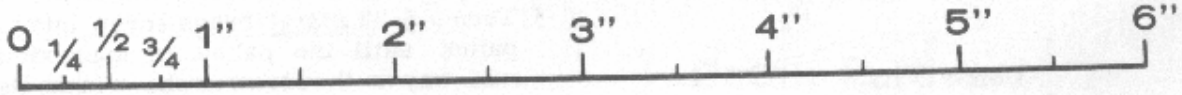
( ) Refer to Detail 2-1B and install a #6 solder lug at AC with 6-32 x 1/2" hardware. Position the solder lug as shown in the Pictorial.

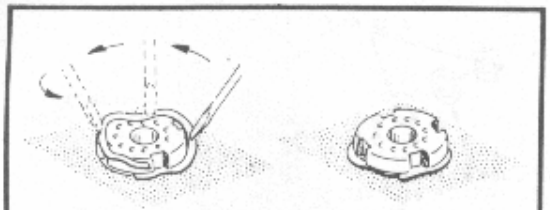
( ) Now place the second #6 lockwasher and 6-32 nut on this ground screw and tighten the nut finger tight.

( ) Refer to Detail 2-1C and install a phono socket at AD with 6-32 x 1/4" hardware. Position the socket as shown in the Pictorial.



Detail 2-1C





Detail 2-1D

( ) Refer to Detail 2-1D and mount the 11-pin plug at AE with the plug mounting ring. Position pins 1 and 11 as shown in the Pictorial.

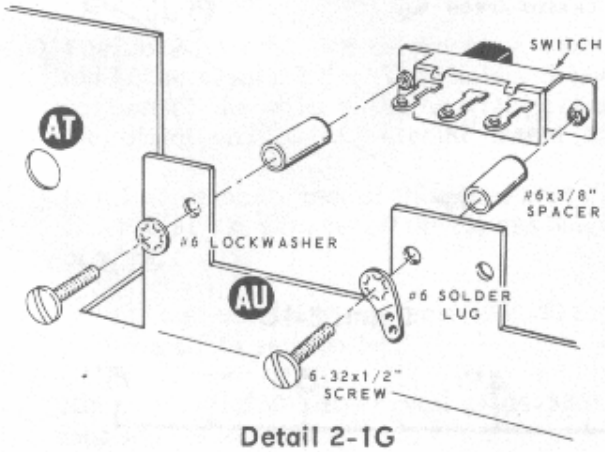
NOTE: Details 2-1E and 2-1F are on Pictorial 2-1 (fold-out from Page 21).

( ) Refer to Detail 2-1E and mount a 5-lug terminal strip at AF with 6-32 x 1/4" hardware. Position the terminal strip as shown in the Pictorial.

( ) Refer to Detail 2-1F and mount a 5-lug terminal strip at AS. Use a #6 solder lug and 6-32 x 1/4" hardware. Position the terminal strip as shown in the Pictorial. Position the solder lug toward the opening in the top of the chassis.

NOTE: Insert the blade of a screwdriver through the appropriate hole in the chassis partition when you tighten each of the slide switch mounting screws in the following steps.

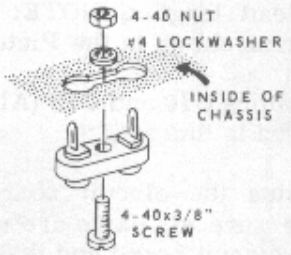
( ) Refer to Detail 2-1G and mount a single pole double throw (SPDT) switch (#60-4) at AU. Use two 6-32 x 1/2" screws, a #6 lockwasher, a #6 solder lug, and two #6 x 3/8" spacers as shown. Position the solder lug as shown in the Pictorial.



Detail 2-1G

( ) In the same manner, mount a single pole double throw switch at AY. Note the different location and position of the #6 solder lug and lockwasher at AY.

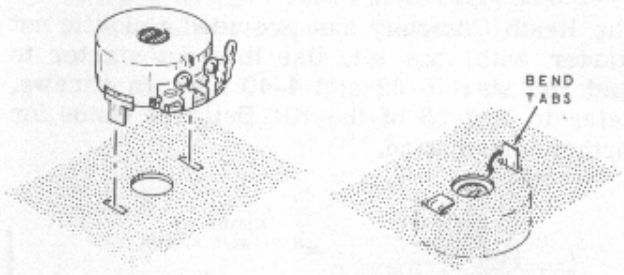
( ) In a similar manner, mount double pole double throw (DPDT) switches (#60-2) at AW and AX. NOTE: Use a #6 lockwasher on each screw. Do not use #6 solder lugs at these two locations.



Detail 2-1H

( ) Refer to Detail 2-1H and mount crystal sockets from the top of the chassis at AM and AP with 4-40 x 3/8" hardware. NOTE: Disregard any numbers that may be molded in the top or bottom of these sockets. Tighten the screws very carefully to prevent breaking the crystal sockets.

( ) Refer to Detail 2-1J and install a 1 MΩ tab-mount control (#10-127) at AA. Bend each tab toward the center of the control. Position the lugs as shown in the Pictorial.



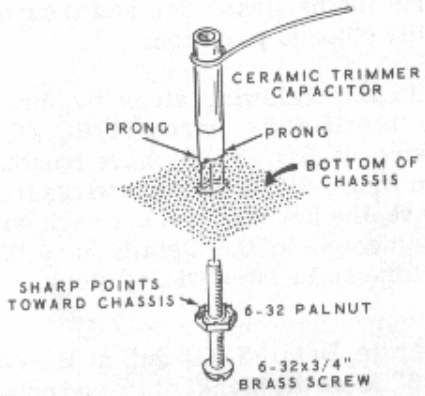
Detail 2-1J

( ) In a like manner, install 10 kΩ tab-mount controls (#10-57) at AG and AJ.

( ) Install rubber grommets in the round hole at AR and the square opening at AH.

Refer to Detail 2-1K for the following steps.

( ) Turn a 6-32 x 3/4" brass screw into a 6-32 palnut until the palnut is approximately half-way on the screw as shown in the Detail.



Detail 2-1K

NOTE: Each ceramic trimmer capacitor has two short prongs at one end. In the following steps, be sure these prongs are seated within the slotted portion of the capacitor mounting hole. Be very careful when you mount these capacitors.

( ) Place a ceramic trimmer capacitor (#31-21) over hole AL on the bottom of the chassis with the lead positioned as shown in the Pictorial.

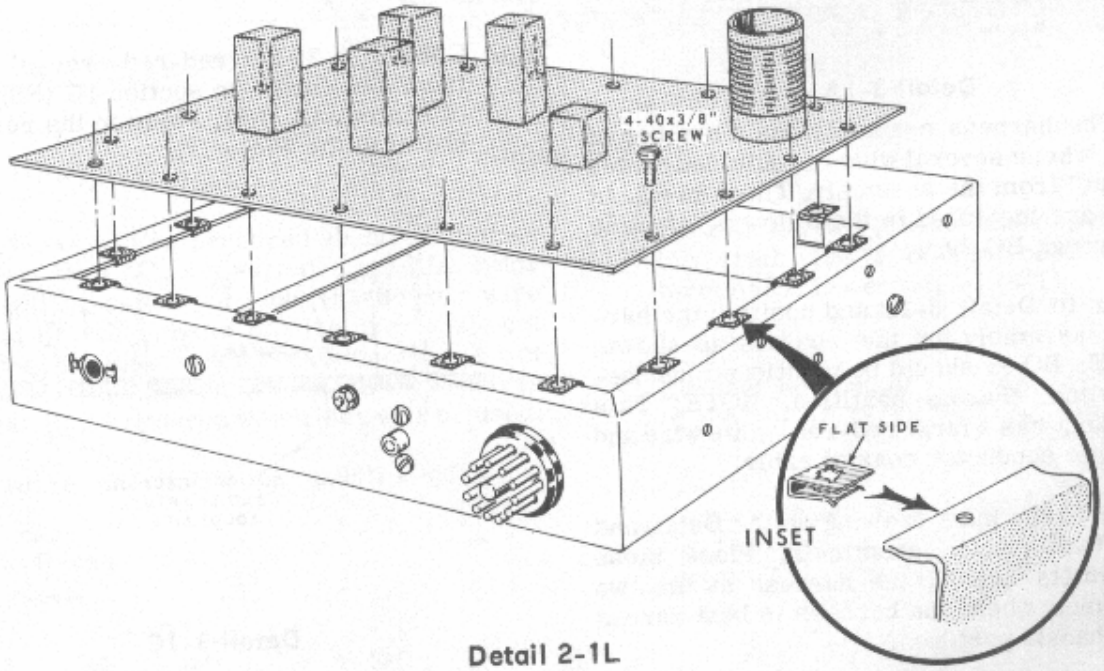
( ) Now, from the top of the chassis, turn the 6-32 x 3/4" brass screw with Palnut into the capacitor until the Palnut is against the top of the chassis. Be sure the trimmer is seated properly, then tighten the Palnut approximately 1/4 to 1/2 of a turn.

( ) In a like manner, install another ceramic trimmer capacitor at AN.

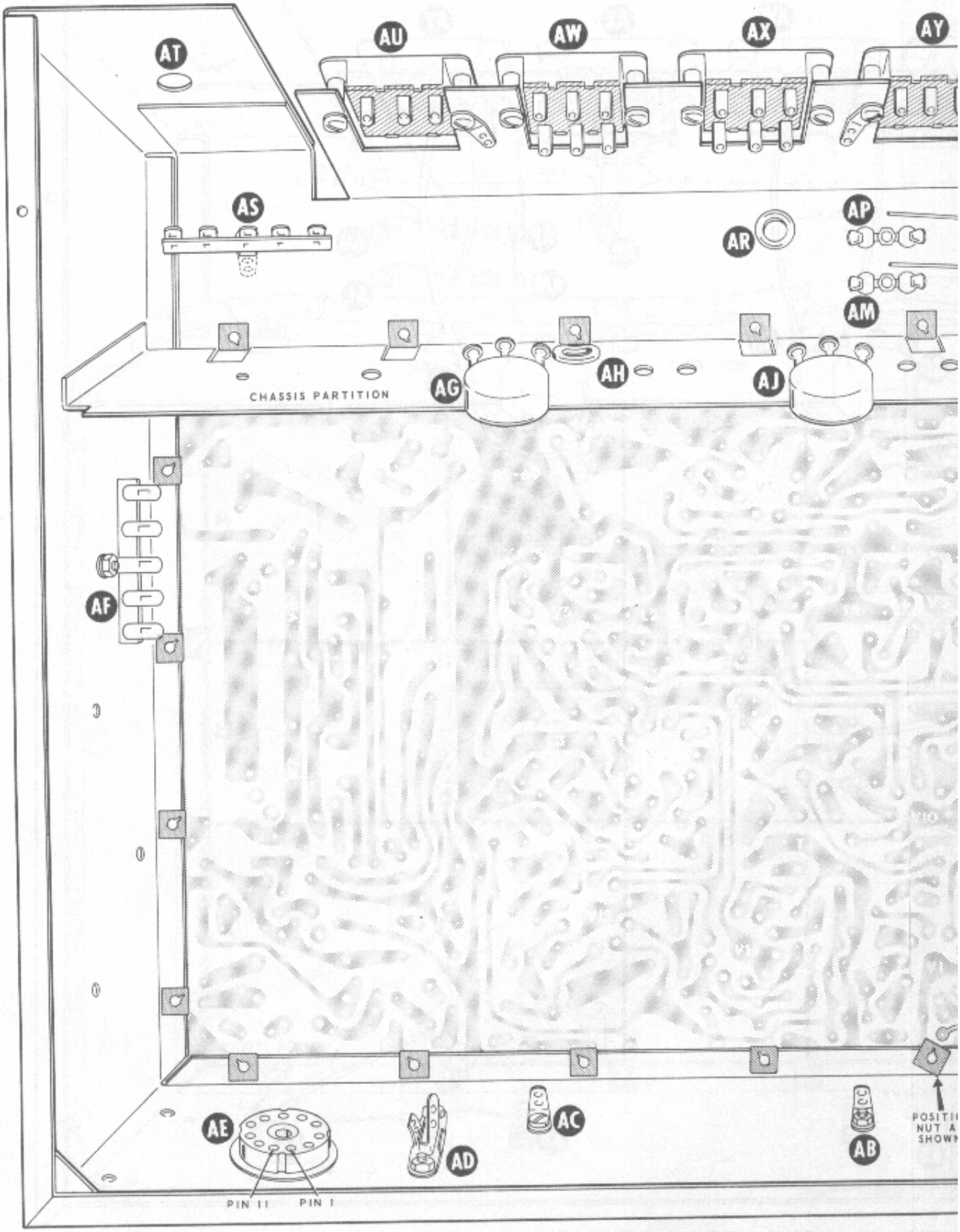
( ) Refer to the inset drawing on Detail 2-1L and install #4 push-on nuts at the twenty circuit board mounting hole locations on the chassis. Be sure you position the flat side of each nut upward as shown.

NOTE: Before you mount the circuit board on the chassis in the next step, use your soldering iron and smooth out any mounds of solder on the foil connections along the outer edges of the circuit board.

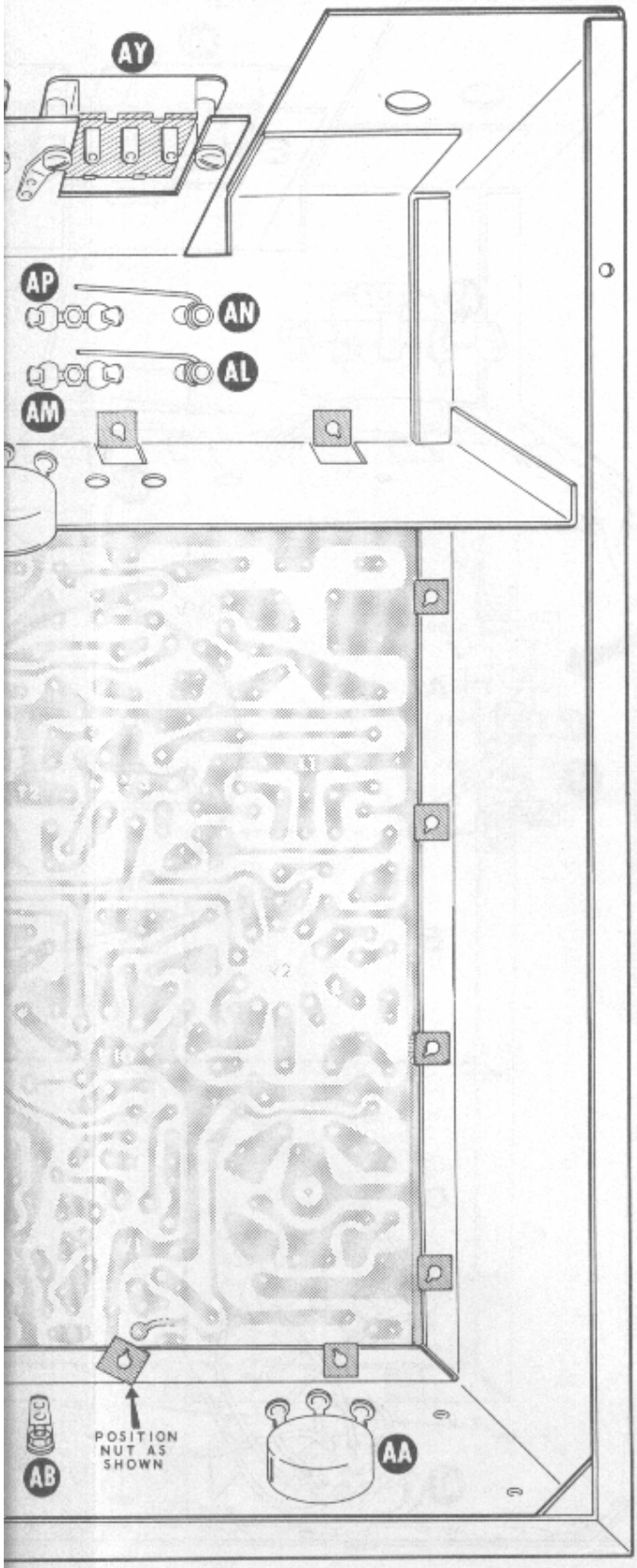
( ) Refer to Detail 2-1L and position the circuit board on the chassis. Start a 4-40 x 3/8" screw into each of the twenty mounting holes in the circuit board; then tighten each screw. Do not overtighten the screws as the thread of the nuts can be stripped. CAUTION: Be sure the push-on nut indicated by the arrow in Pictorial 2-1 is not shorted to the outlined foil.

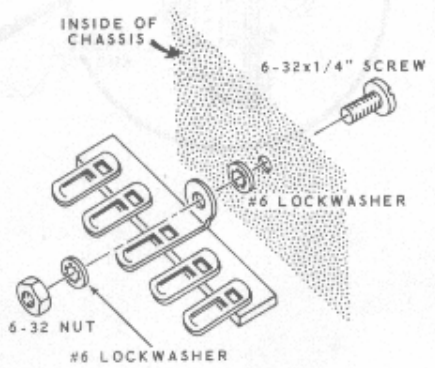


Detail 2-1L

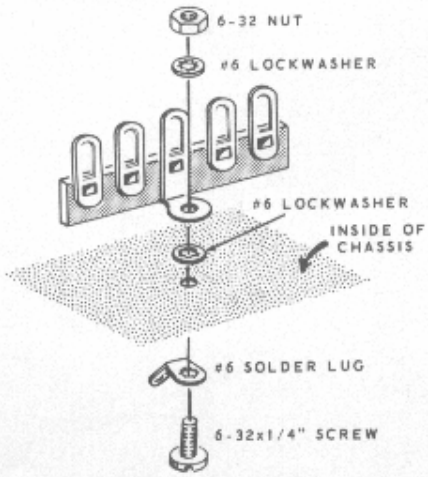


PICTORIAL 2-1

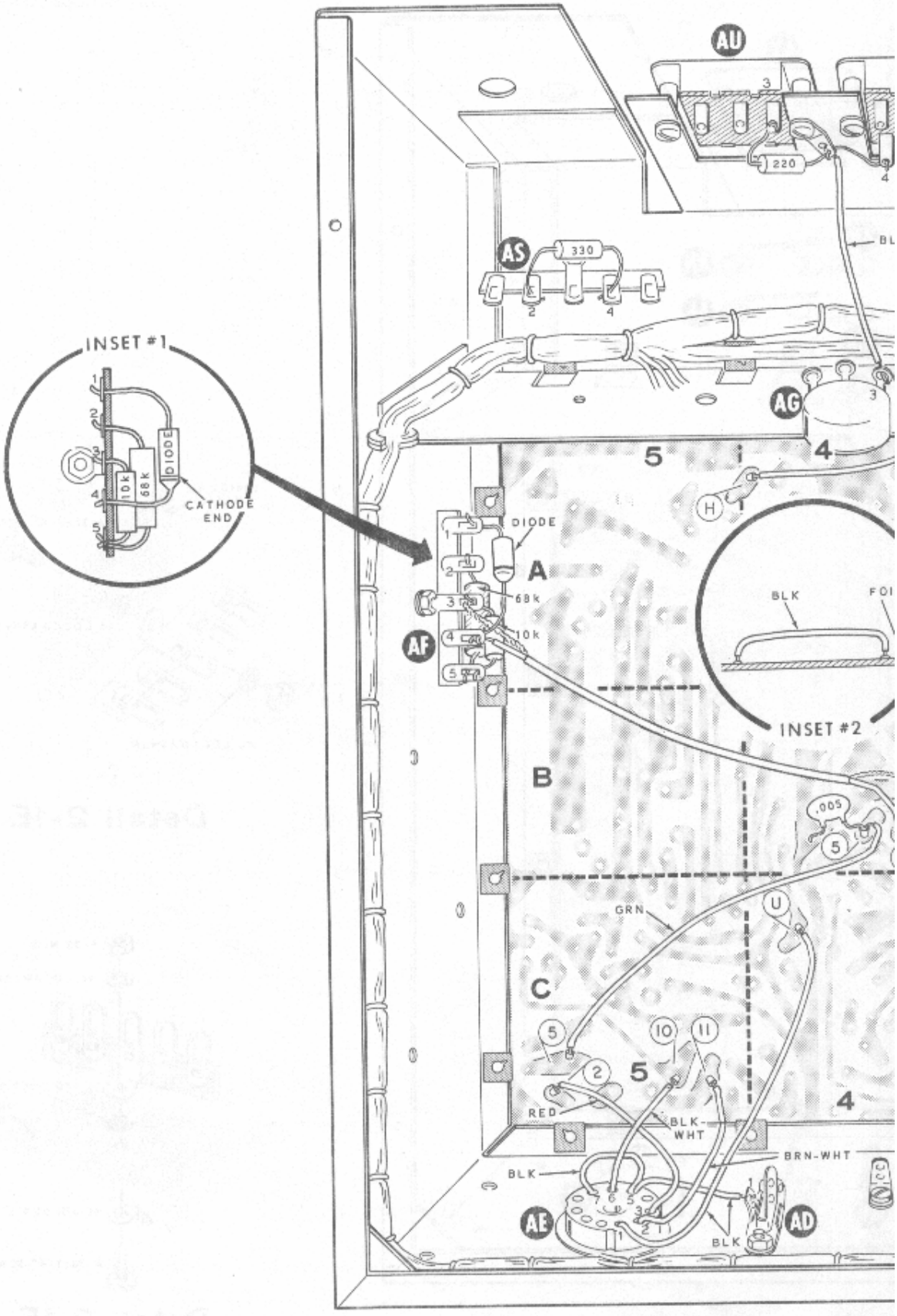




Detail 2-1E



Detail 2-1F


INSET #1
1
2
3
4
5
DIODE
10k
68k
DIODE
CATHODE END
AU
3
220
4
AS
330
2
4
BL
AG
3
5
4
H
1
DIODE
A
68k
10k
AF
1
2
3
4
5
BLK
FOI
INSET #2
B
.005
5
GRN
U
C
5
10
11
2
5
4
RED
BLK-WHT
BRN-WHT
BLK
AE
AD
BLK

PICTO

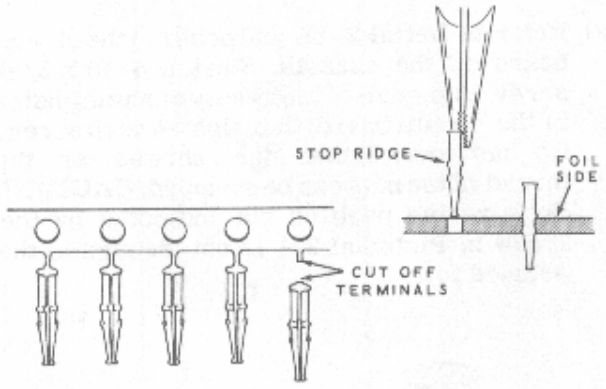
PICTORIAL 3-1

PRELIMINARY WIRING-BOTTOM OF CHASSIS

Refer to Pictorial 3-1 for the following steps.

NOTE: To obtain the best possible performance from your kit, it should be wired neatly. Position all wires and components as shown in the Pictorials. All insulated wires, whenever possible, should be positioned down against the chassis. Because the drawings are distorted to show the parts better, you should refer to the Chassis Photographs on Pages 63 through 65 from time to time during the assembly of the kit.

(✓) Refer to Detail 3-1A and 3-1B and install circuit board terminals from the foil side of the circuit board at the thirty-nine numbered or lettered open holes indicated by the black dots on the Detail. Do not solder the terminals to the foil at this time.



Detail 3-1A

NOTE: The harness assembly has a number of locations where several wires or shielded cables "break out" from the assembly. These breakout locations are identified in the following steps as BO #1 through BO #9.

( ) Refer to Detail 3-1B and position the harness assembly in the chassis as shown. NOTE: BO #5 should be positioned just behind the chassis partition. NOTE: This breakout has a large red-red-white wire and a single conductor coaxial cable.

( ) Refer to the inset drawing on the Detail and cut two rubber grommets. Place these grommets around the harness at the two locations where the harness is bent across the chassis partition.

( ) Form the harness down and around the front of the chassis partition.

NOTE: In the following steps the brown-white and the black-white wires at BO #6, and the green wire at BO #8 will have lengths of wire cut from them. Measure these wires from where they leave the harness and cut each wire to the length indicated in the Detail. Save the cut-off lengths for use in later wiring steps.

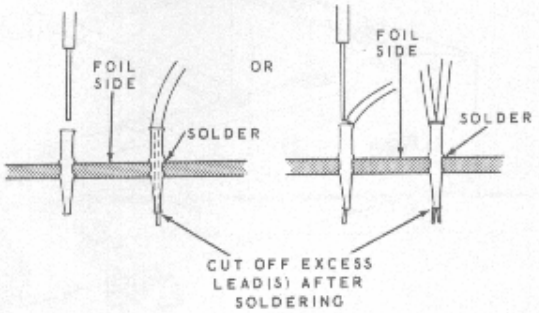
( ) Refer to Detail 3-1B and, at BO #6, cut all but 6" from the black-white and brown-white wires. Remove 1/2" of insulation from the end of each of these two harness wires.

( ) Again refer to Detail 3-1B and, at BO #8, cut all but 5" from the green wire. Remove 1/2" of insulation from the end of the green harness wire.

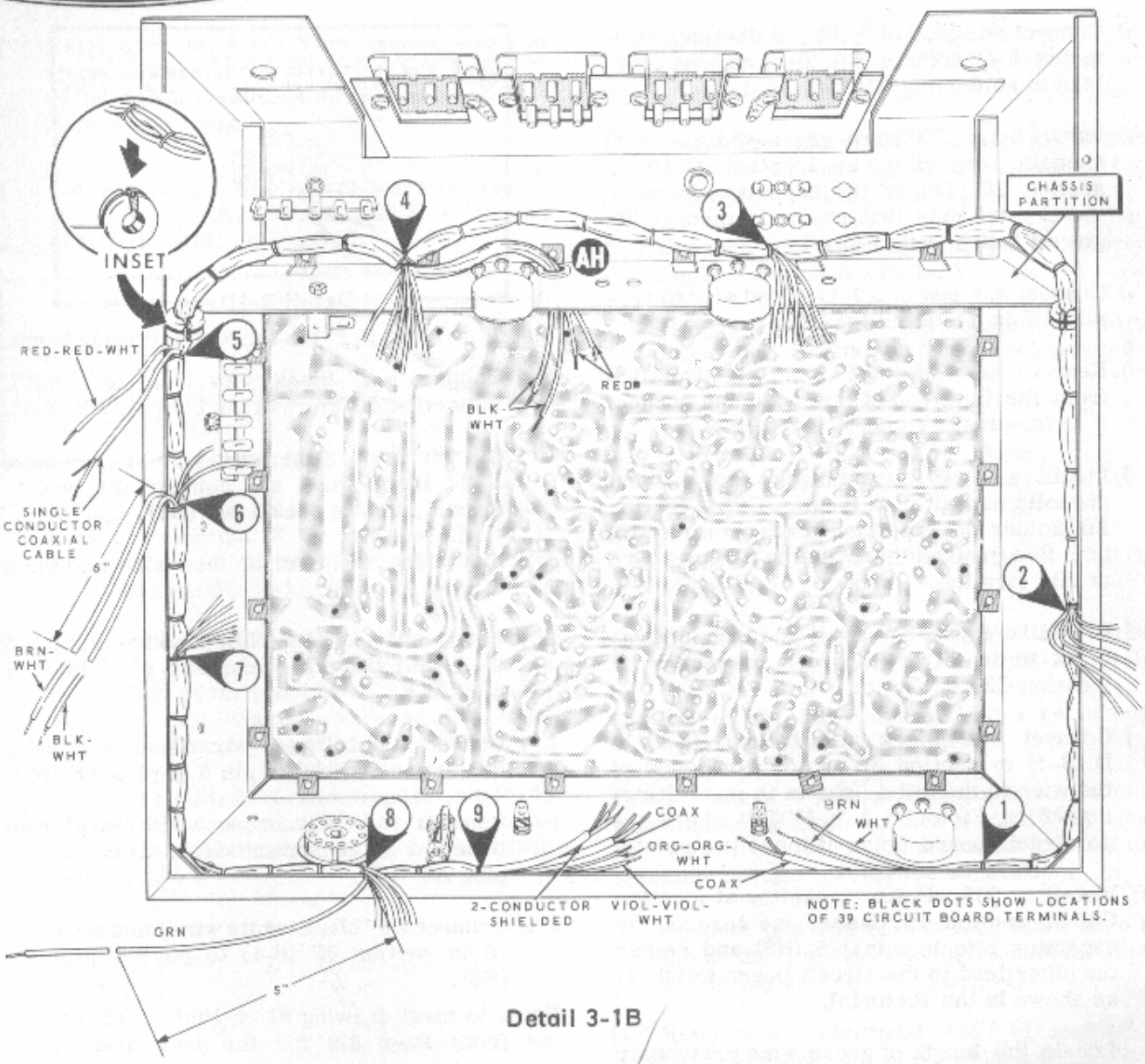
(✓) At BO #4, locate the two black-white wires and the two red wires. Insert these four wires through grommet AH for connection later.

Refer to Detail 3-1C for inserting and soldering the wires to the circuit board terminals in the following steps. Be sure each terminal is soldered to the foil. Pull on each wire (or wires) to be sure each wire is securely soldered in its terminal.

(✓) Connect a 22 kΩ (red-red-orange) resistor from terminal 1 in section 1C (NS) to lug 1 of control AA (NS). Position the resistor as shown in the Pictorial.



Detail 3-1C



Detail 3-1B

NOTE: Wires will be prepared ahead of time, as in the next step. When a wire of a specific color and length is called for, use the hookup wire specified or the lengths of wire previously cut off of the harness assembly. Remove 1/4" of insulation from both ends of each wire. Wires are listed in the order in which they will be used.

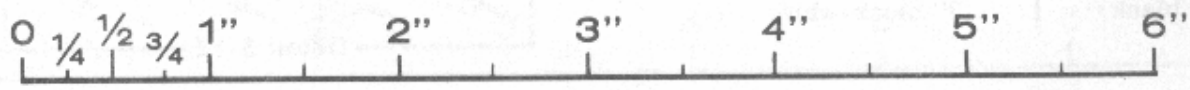
( ) Prepare the following lengths of wire:

2" black
3-1/4" red
2" black

(√) Connect a 1 MΩ (brown-black-green) resistor from lug 3 of control AA (S-1) to terminal L in section 2C (S-1).

(√) Connect one end of a 2" black wire to lug 2 of control AA (S-1).

(√) Remove an additional 1/4" of insulation from the free end of this wire and connect it to terminal M in section 1C (S-1).



( ) Connect one lead of a .02 μF disc capacitor to lug 1 of control AA (S-2) and the other lead to solder lug AB (NS).

( ) Install a 1.5 pF (brown-green-white-silver) phenolic capacitor at location C119 in section 2C. Solder the capacitor leads to the crystal pins that protrude through the circuit board at this location.

( ) Connect one end of a 3-1/4" red wire to terminal 2 in section 3B (S-1).

( ) Remove an additional 1/4" of insulation from the free end of this wire and connect it to terminal 2 in section 1B (NS).

( ) Install a 1 pF (brown-black-white-silver) phenolic capacitor at location C26 in section 1B. Solder the capacitor leads to the crystal pins that protrude through the circuit board at this location.

( ) In a like manner, install a 1 pF (brown-black-white-silver) phenolic capacitor at location C25 in section 1A.

( ) Connect a 2" black wire from D (S-1) to D (S-1) in section 3B. Solder the ends of the wire to the foil as shown in inset drawing #2 on Pictorial 3-1. NOTE: There are no circuit board holes at these two points.

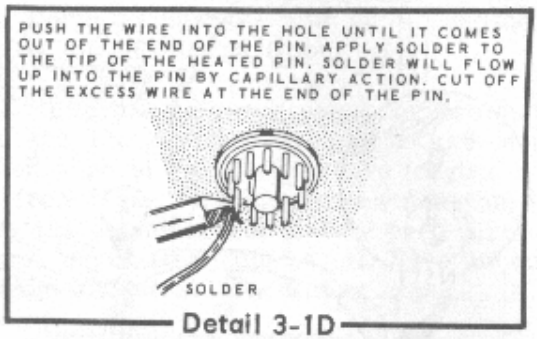
( ) Install a .005 μF disc capacitor at location C86 in section 4B. Insert one lead of the capacitor into terminal 5 (NS) and solder the other lead to the circuit board foil (S-1) as shown in the Pictorial.

( ) Locate the length of green wire previously cut from the wiring harness and remove 1/2" of insulation from the unstripped end.

( ) Connect one end of this green wire to terminal 5 on section 4B (S-2) and the other end to terminal 5 in section 5C (NS). Position the wire as shown in the Pictorial.

( ) Prepare the following lengths of wire. For these wires only, strip 1/2" of insulation from each end of each wire.

6" black	4-1/2" red
3" black	3-1/2" brown-white
3" black	3" black-white



Detail 3-1D

Refer to Detail 3-1D for the following steps.

( ) Connect a 6" black wire from terminal U in section 4C (S-1) to pin 1 of plug AE (S-1).

( ) Cut off 1/4" of the bare wire at one end of a 3" black wire, and connect this end to ground lug 1 of socket AD (NS).

( ) Insert the free end of this wire into pin 5 of plug AE (NS).

( ) Insert one end of a 3" black wire into pin 5 (S-2) and the other end into pin 7 (S-1) of plug AE.

( ) Connect a 4-1/2" red wire from terminal 2 in section 5C (NS) to pin 3 of plug AE (NS).

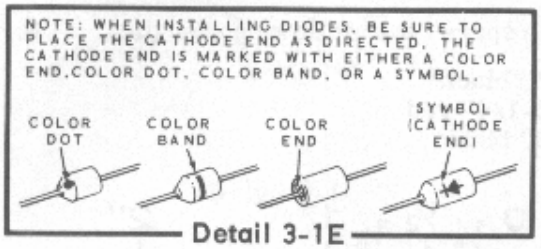
( ) Connect a 3-1/2" brown-white wire from terminal 11 in section 5C (S-1) to pin 2 of plug AE (NS).

( ) Connect a 3" black-white wire from terminal 10 in section 5C (S-1) to pin 6 of plug AE (NS).

Refer to inset drawing #1 on Pictorial 3-1 (fold-out from Page 22) for the next three steps.

( ) Connect a 68 kΩ (blue-gray-orange) 1 watt resistor from lug 2 (NS) to lug 5 (NS) of terminal strip AF.

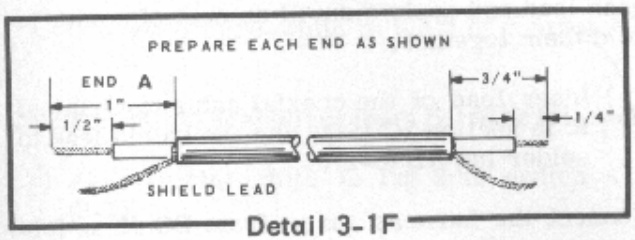
( ) Connect a 10 kΩ (brown-black-orange) resistor from lug 3 (NS) to lug 5 (NS) of terminal strip AF.



Detail 3-1E

( ) Refer to Detail 3-1E. Then connect the lead at the cathode end of a silicon diode (#57-27) to lug 4 (NS) and the other lead to lug 1 (NS) of terminal strip AF.

( ) Refer to Detail 3-1F and prepare a 6" length of coaxial cable as shown. NOTE: Refer also to Detail 1-10C on Page 17.

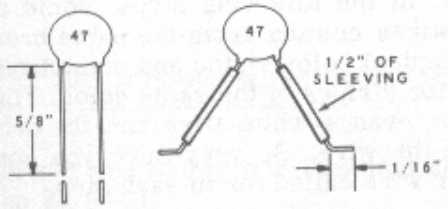


Detail 3-1F

( ) At end A of this cable, connect the inner lead to terminal E in section 4B (S-1). Connect the shield lead to the foil marked L3 in section 4B (S-1).

( ) Connect the shield lead at the other end of the cable to lug 3 (S-2) and the inner lead to lug 4 (S-2) of terminal strip AF. CAUTION: Position this coaxial cable as far away from the circuit board foils as it will go.

( ) Refer to Detail 3-1G and prepare both leads of a 47 pF disc capacitor as shown. This capacitor will be installed at location C139 in section 2A.



Detail 3-1G

NOTE: In the next two steps, be sure you solder the capacitor leads to the foil at the locations outlined in Pictorial 3-1.

( ) Solder one lead of the prepared capacitor to the outlined foil at location C139 (C) in section 2A (S-1).

( ) Solder the free lead of this capacitor to the other outlined foil at location C139 in section 2A (S-1).

( ) Connect a 330 Ω (orange-orange-brown) resistor from lug 2 (NS) to lug 4 (NS) of terminal strip AS.

( ) Insert one lead of a 220 Ω (red-red-brown) resistor through the solder lug at AU (NS) to lug 4 of switch AW (S-1).

( ) Connect the other lead of the resistor to lug 3 of switch AU (S-1).

( ) Prepare the following lengths of wire. Remove 1/4" of insulation from each end of each wire.

3-1/2" black	7" red
2-1/2" black	3-1/4" black
5-1/2" black	1-5/8" black
7" black	

( ) Place a 3" length of sleeving on a 3-1/2" black wire.

( ) Connect one end of this black wire to the foil at location F in section 2A (S-1).

( ) Insert the other end of this wire through hole X for connection later.

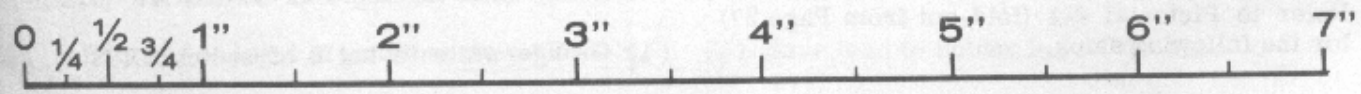
NOTE: Where a wire passes through a connection and then goes to another point, it will count as two wires in the solder instructions, one entering and one leaving the connection.

( ) Connect one end of a 2-1/2" black wire to the solder lug at AU (S-3). Connect the other end to lug 3 of control AG (S-1).

( ) Remove an additional 1/4" of insulation from one end of a 5-1/2" black wire. Then connect this end to terminal H in section 4A (S-1).

( ) Insert the free end of this wire through grommet AH and connect it to lug 2 of switch AW (S-1). Position the wire as shown in the Pictorial.

( ) Connect one end of a 7" black wire to lug 5 of switch AX (S-1). Insert the other end of the wire through grommet AR for connection later.



( ) Connect one end of a 7" red wire to lug 2 of switch AX (S-1). Insert the other end through grommet AR for connection later.

( ) Remove an additional 1-1/4" of insulation from one end of a 3-1/4" black wire.

( ) Insert the long stripped end of this wire through the solder lug at switch AY (S-2) then through lug 1 of crystal socket AP (S-2) to lug 1 of crystal socket AM (S-1).

( ) Connect the other end of this wire to lug 4 of switch AX (S-1).

( ) Carefully insert the lead of ceramic trimmer capacitor AN through lug 2 of crystal socket AP (NS) to lug 3 of switch AY (S-1). Now solder lug 2 of crystal socket AP (S-2).

( ) Connect a 1-5/8" black wire from lug 1 of switch AY (S-1) to lug 2 of crystal socket AM (NS).

( ) Connect the lead of ceramic trimmer capacitor AL to lug 2 of crystal socket AM (S-2). Cut off the excess lead length.

( ) Connect the free end of the black wire coming from hole X to lug 2 of switch AY (NS).

This completes the preliminary wiring to the bottom of the chassis. The harness wires will be connected in the following steps.

CONNECTING HARNESS WIRES-CHASSIS BOTTOM

The ends of the harness wires are stripped correctly for connecting to the circuit board terminals and to the pins of Power plug AE, but are stripped too much for connection to other points. Cut off 1/4" of the stripped end of the wire when you connect it to a control or switch lug.

NOTE: Do not shorten any of the harness wires even though they appear to be too long. Any excess wire lengths should be positioned back along the harness assembly after the wires from a specific breakout are connected.

Refer to Pictorial 4-1 (fold-out from Page 27) for the following steps.

Connect the harness wires from BO #1 as follows:

( ) Brown to terminal 1 in section 1C (S-2).

( ) White to terminal 9 in section 2C (S-1).

NOTE: Before a coaxial cable is connected, as in the next step, twist together the fine wires of each lead and apply a small amount of solder to hold them together.

( ) Inner lead of the coaxial cable to terminal K in section 2C (S-1) and the shield lead to solder lug AB (S-2).

Connect the harness wires from BO #2 as follows:

( ) Violet to terminal 7 in section 1B (S-1).

( ) Orange to terminal 3 on section 1B (S-1).

( ) Green to terminal 5 in section 1B (S-1).

( ) Gray-gray-white to terminal 28 in section 1C (S-1).

( ) Orange-white to terminal 13 in section 1B (S-1).

( ) Red to terminal 2 in section 1B (S-2).

CAUTION: In the following steps, some of the harness wires coming from the same breakout have one spiral color stripe and some have two spiral color stripes of the same color. For example, the orange-white wire and the orange-orange-white wire. Be very sure you connect the proper wire called for in each step.

Connect the harness wires from BO #3 as follows:

NOTE: Position the harness and all harness wires away from the crystal sockets and trimmer capacitors.

( ) Insert the black-white, brown-white, and blue-white wires through grommet AR for connection later.

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

( ) Both violet to lug 3 of switch AW (S-2).

( ) Orange-white to lug 6 of switch AX (S-1).

( ) Red-white to lug 3 of switch AX (S-1).

( ) Green-green-white to lug 1 of switch AX (S-1).

( ) Brown-brown-white to lug 1 of control AJ (S-1).

( ) Violet-white to lug 2 of control AJ (S-1).

( ) Orange-orange-white to lug 3 of control AJ (S-1).

Connect the harness wires from BO #4 as follows:

( ) Violet-violet-white to lug 2 of switch AU (S-1).

( ) Red-white to lug 2 of control AG (S-1).

( ) Gray-gray-white to lug 1 of control AG (S-1).

( ) Both orange to lug 1 of terminal strip AS (NS).

( ) Both brown to lug 2 of terminal strip AS (S-3).

( ) Inner lead of single conductor coaxial cable to lug 5 (NS) and the shield lead to lug 3 (NS) of terminal strip AS.

NOTE: The two gray-white wires and the 2-conductor shielded cable will be connected later.

Connect the harness wires from BO #5 as follows:

( ) Large red-red-white to terminal 22 in section 5A (S-1).

( ) Inner lead of coaxial cable to terminal J in section 5A (NS) and the shield lead to the ground foil (S-1) as shown in the Pictorial.

( ) Cut all but 3/4" from one lead of a .02 μF disc capacitor. Then insert this lead into terminal J in section 5A (S-2).

( ) Connect the other lead of the capacitor to lug 1 of terminal strip AF (NS).

Connect the harness wires from BO #6 as follows:

( ) Both red to lug 2 of terminal strip AF (S-3).

( ) Twist together the black-white and brown-white wires to form a twisted pair.

( ) Connect the brown-white wire of the twisted pair to terminal 11 in section 4B (S-1).

( ) Connect the black-white wire of the twisted pair to terminal 10 in section 3B (S-1). Position this twisted pair as far away from the HIGH VOLTAGE area of the circuit board as it will go.

( ) Connect one lead of a 1.1 mH choke (#45-4) to lug 1 (S-3) and the other lead to lug 5 (S-3) of terminal strip AF. After soldering, bend the choke away from the terminal strip mounting screw.

Connect the harness leads from BO #7 as follows:

( ) Both red to terminal 2 in section 5C (S-2).

( ) Brown to terminal 1 in section 5C (S-1).

( ) Orange to terminal 3 in section 4B (S-1).

( ) Green-green-white to terminal 25 in section 5C (S-1).

( ) Brown-brown-white to terminal 21 in section 5C (S-1).

Connect the harness wires from BO #9 as follows:

( ) Violet-violet-white to terminal 27 in section 3C (S-1).

( ) Orange-orange-white to terminal 23 in section 4C (S-1).

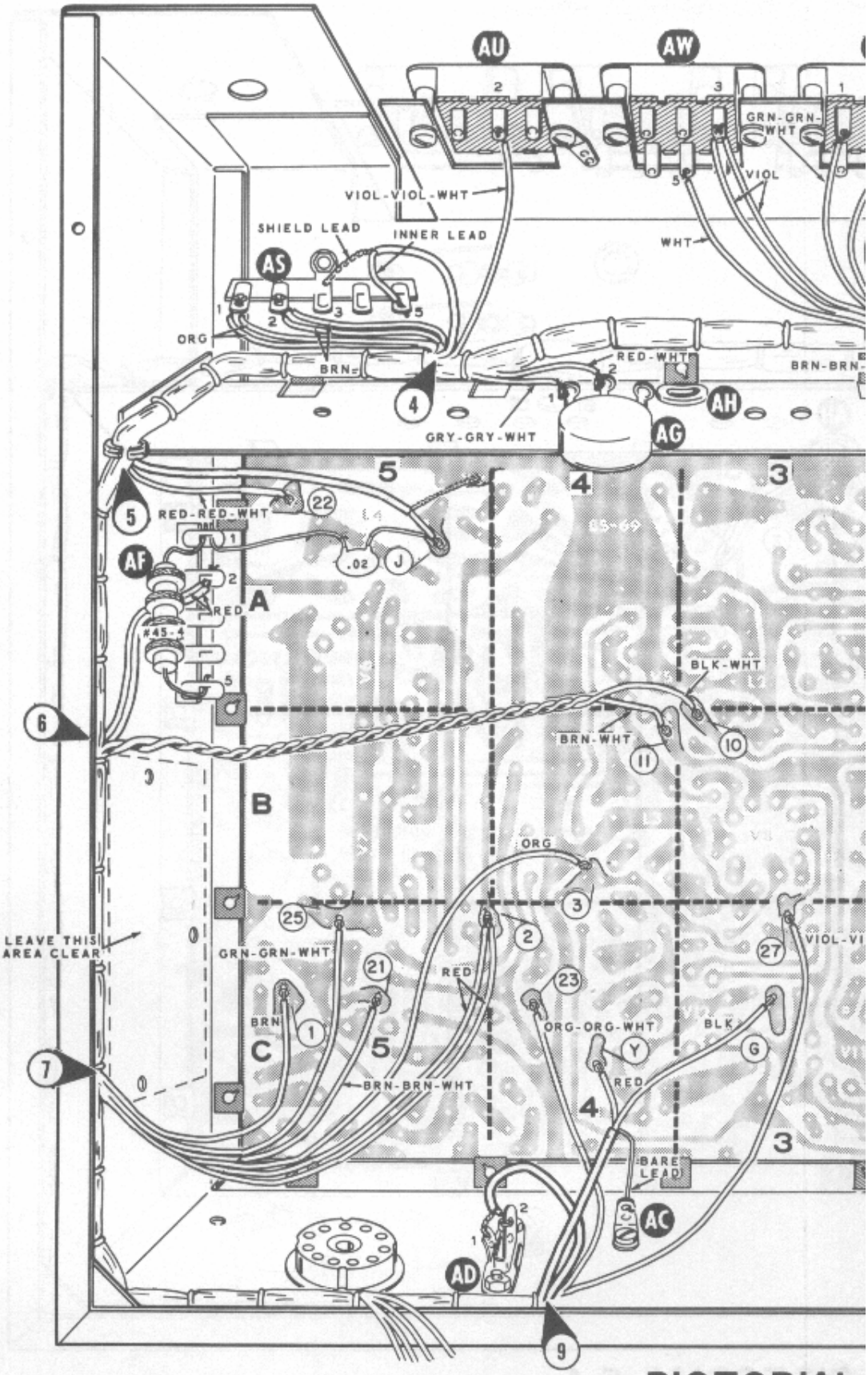
( ) Shield lead of the single conductor coaxial cable to lug 1 (S-2) and the inner lead to lug 2 (S-1) of socket AD.

Connect the 2-conductor shielded cable as follows:

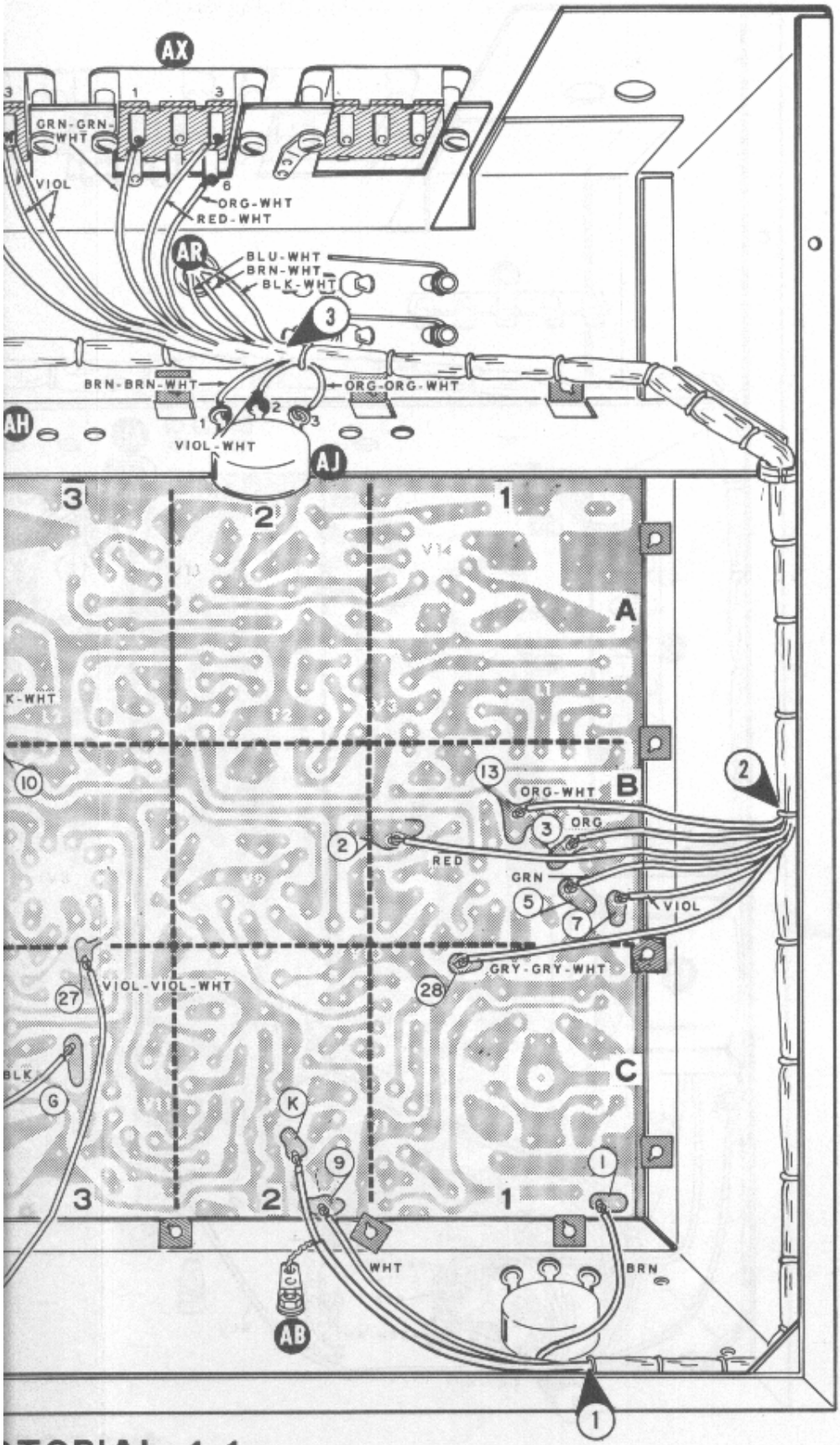
( ) Red to terminal Y in section 4C (S-1).

( ) Black to terminal G in section 3C (S-1).

( ) Bare lead to solder lug AC (S-1).


AU
AW
GRN-GRN-WHT
VIOL
VIOL-VIOL-WHT
SHIELD LEAD
INNER LEAD
WHT
AS
ORG
BRN
RED-WHT
BRN-BRN-
AH
AG
GRY-GRY-WHT
4
5
RED-RED-WHT
22
.02
J
AF
RED
A
#45-4
BLK-WHT
6
BRN-WHT
11
10
B
ORG
LEAVE THIS AREA CLEAR
25
GRN-GRN-WHT
21
RED
2
3
27
VIOL-VI
23
BRN
1
C
ORG-ORG-WHT
Y
BLK
G
7
BRN-BRN-WHT
RED
BARE LEAD
AC
AD
9

PICTORIAL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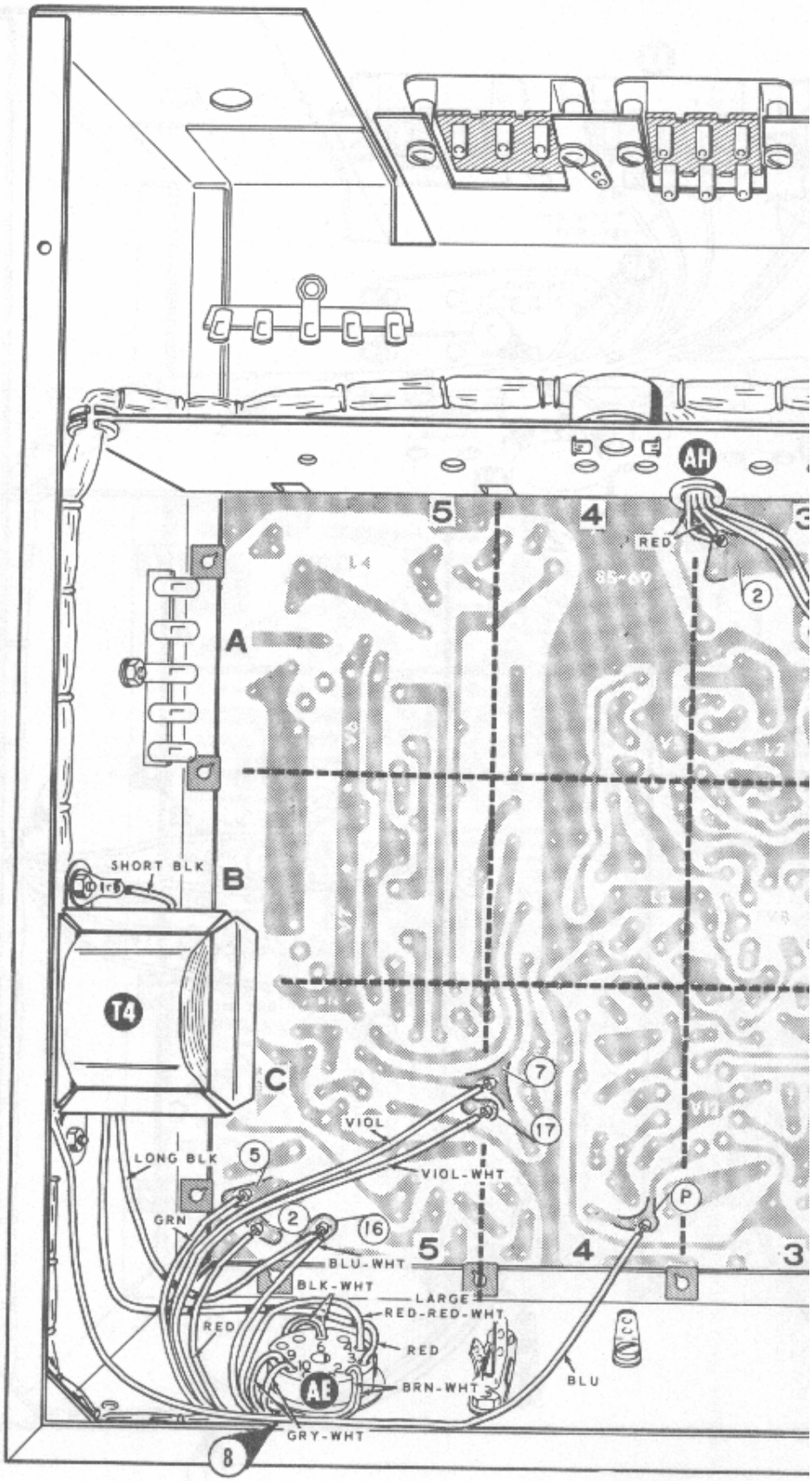
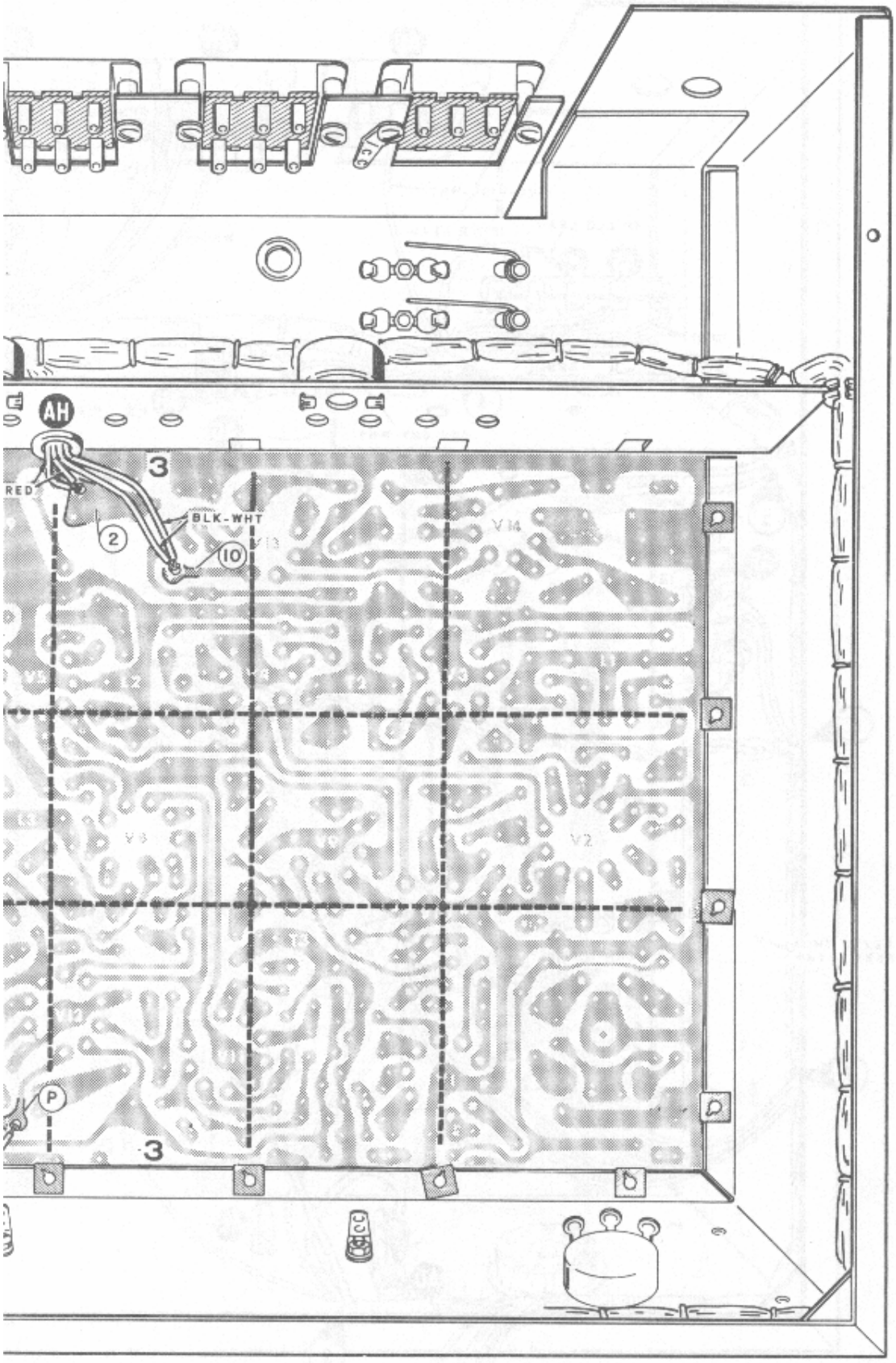
GRN-GRN-WHT
VIOL
ORG-WHT
RED-WHT
AR
BLU-WHT
BRN-WHT
BLK-WHT
3
BRN-BRN-WHT
ORG-ORG-WHT
AH
VIOL-WHT
AJ
A
B
C
13
ORG-WHT
ORG
RED
GRN
VIOL
GRY-GRY-WHT
VIOL-VIOL-WHT
WHT
BRN
AB
K-WHT
BLK

CTORIAL 4-1


AH
5
4
3
RED
2
A
B
C
SHORT BLK
T4
7
17
VIOL
VIOL-WHT
LONG BLK
5
GRN
2
16
P
BLU-WHT
BLK-WHT
LARGE
RED-RED-WHT
RED
RED
AE
BRN-WHT
BLU
GRY-WHT
8

PICTOR



PICTORIAL 5-1

Refer to Pictorial 5-1 for the following steps.

Connect the harness wires from BO #8 as follows:

( ) Green to terminal 5 in section 5C (S-2).

( ) Red to terminal 2 in section 5C (S-2).

( ) Blue-white to terminal 16 in section 5C (NS).

( ) Violet to terminal 7 in section 4C (S-1).

( ) Violet-white to terminal 17 in section 4C (S-1).

( ) Both black-white wires to pin 6 of plug AE (S-3).

( ) Either gray-white to pin 9 of plug AE (S-1).

( ) Other gray-white to pin 10 of plug AE (S-1).

( ) Remove an additional 1/16" of insulation from the free end of the large red-red-white wire.

( ) Connect this large red-red-white wire to pin 4 of plug AE (S-1).

( ) Both brown-white to pin 2 of plug AE (S-3).

Connect the wires coming from grommet AH as follows:

( ) Both red to terminal 2 in section 3A (S-2).

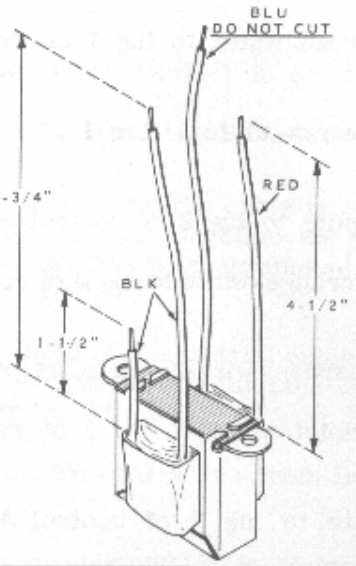
( ) Both black-white to terminal 10 in section 3A (S-2).

( ) Refer to Part 1 of Detail 5-1A and cut the leads of the output transformer (#51-55) to the lengths indicated. Measure each lead from where it comes out of the transformer. NOTE: Do not cut the blue lead.

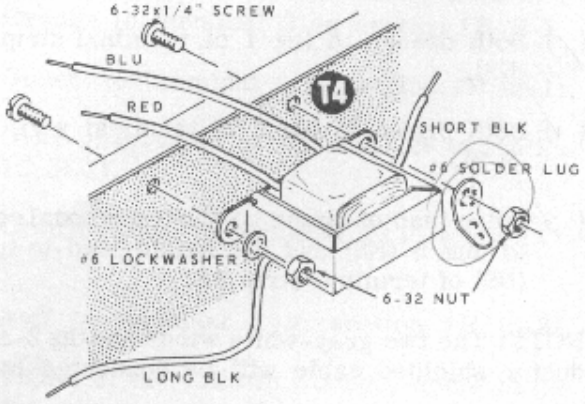
( ) Remove 1/4" of insulation from the end of the short black lead and 5/8" of insulation from the ends of the red lead and the long black lead.

( ) Remove an additional 1/4" of insulation from the end of the blue lead.

PART 1



PART 2



Detail 5-1A

( ) Refer to Part 2 of Detail 5-1A and mount the output transformer at T4. Use one #6 solder lug and 6-32 x 1/4" hardware. Be sure no wires are pinched between the transformer and the chassis.

Connect the leads of transformer T4 as follows:

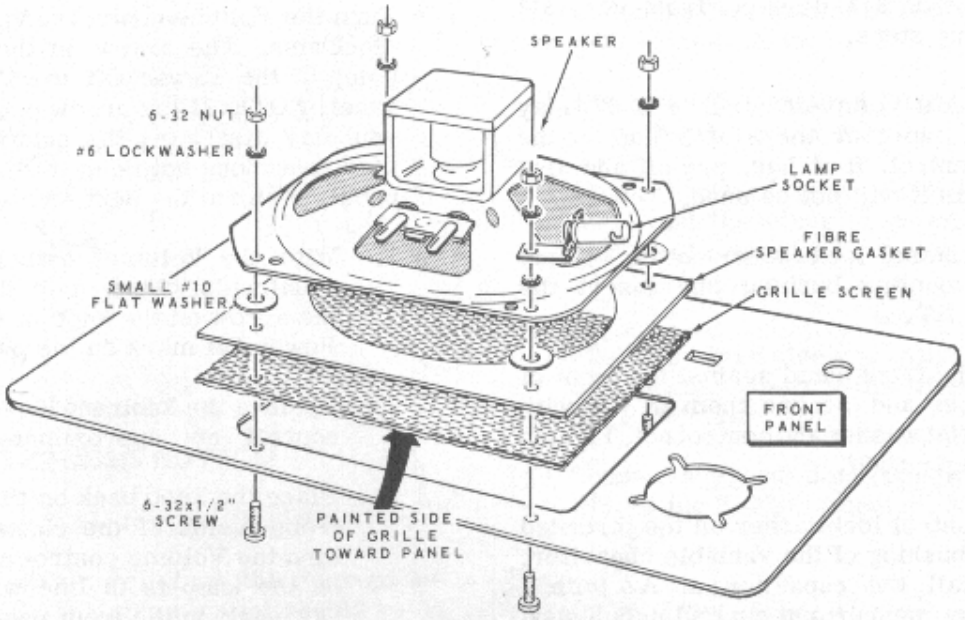
( ) Short black to the #6 solder lug (S-1).

( ) Long black to terminal 16 in section 5C (S-2).

( ) Red to pin 3 of plug AE (S-2).

( ) Blue to terminal P in section 4C (S-1).

Set the chassis aside for later use.

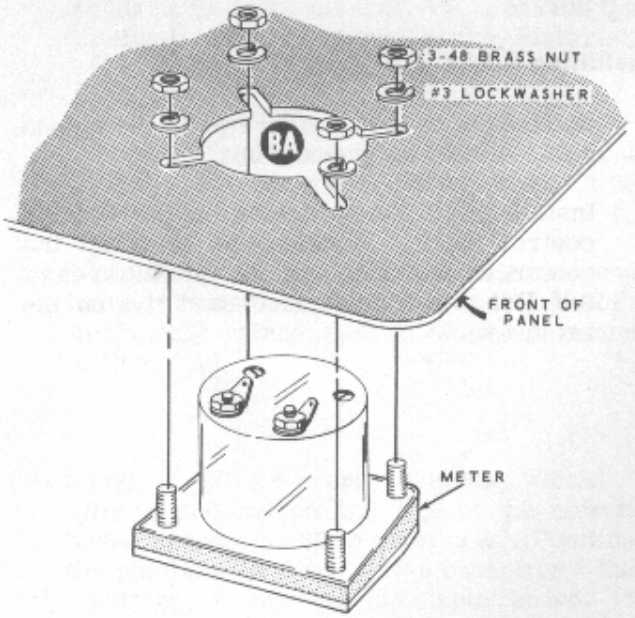


Detail 6-1A

FRONT PANEL ASSEMBLY-PANEL MOUNTING

(√) Refer to Detail 6-1A and mount the speaker on the front panel with four small #10 flat washers and 6-32 hardware. Position the lamp socket as shown. NOTE: Be sure the painted side of the grille is toward the panel.

(√) Refer to Detail 6-1B and mount the meter with the 3-48 hardware supplied with the meter. Do not overtighten the mounting nuts.



Detail 6-1B

Refer to Pictorial 6-1 (fold-out from Page 31) for the following steps.

NOTE: The 1 MΩ Volume control (#19-67) may have a metal cap over the switch lugs at the rear of the control. If it has, pry off and discard this cap as it will not be used.

( ) Place a control lockwasher on the Volume control mounting bushing and insert the control at AT.

( ) Position the front panel against the front of the chassis and secure them at AT with a control flat washer and control nut. Tighten the nut finger tight.

( ) Place a control lockwasher on the threaded mounting bushing of the variable capacitor. Then install the capacitor at AZ with a control flat washer and control nut. Install the capacitor so the ground lug is positioned as shown in the Pictorial.

( ) Now securely tighten the control nuts on the Volume control and the variable capacitor.

Installing Knobs

( ) Start 8-32 x 1/4" setscrews in the tapped holes in the two green knobs.

( ) Install one of these knobs on the Volume control shaft. Position the knob so the setscrew will seat against the flat area of the Volume control shaft and tighten the setscrew.

( ) Turn the Volume control knob fully counterclockwise. The arrow on the knob should point to the Power Off mark on the front panel. NOTE: If the arrow points correctly, you may disregard the next four steps. If the arrow does not point to this mark on the panel, perform the next four steps.

( ) 1. With the Volume control turned fully counterclockwise, note the position of the arrow on the knob in relation to the Power Off mark on the panel.

( ) 2. Remove the knob and loosen the Volume control nut approximately 1/2 turn.

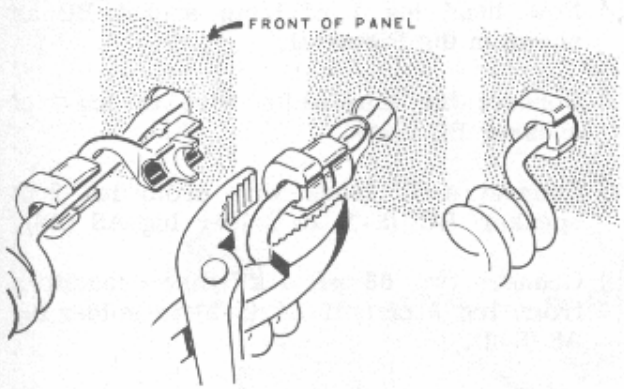
( ) 3. Place the knob back on the shaft. Then, from inside of the chassis, carefully turn the Volume control until the arrow on the knob is in line with the Power Off mark on the front panel.

( ) 4. Remove the knob and tighten the Volume control nut. Then secure the knob on the Volume control shaft.

Install the other knob on the Clarifier shaft as follows:

( ) Turn the shaft of the Clarifier (variable capacitor) until the movable plates are evenly meshed with the fixed plates.

( ) Place the knob on the Clarifier shaft so the arrow on the knob is in line with the left-hand mark (9 o'clock position) on the panel; then tighten the setscrew in the knob.



Detail 7-1A

FINAL WIRING-CHASSIS BOTTOM

Refer to Detail 7-1A for the following steps.

( ) Place the strain relief on the microphone cord. NOTE: The strain relief should be on the straight portion of the cord and close to the first coil.

( ) Place the free end of the microphone cord through hole BE in the panel and press the strain relief into the hole.

Refer to Pictorial 7-1 (fold-out from Page 31) for the following steps.

( ) Twist together the fine wire strands at the end of each microphone cord lead. Apply a small amount of solder to the tip of each lead to hold the strands together.

Connect the leads of the microphone cord to terminal strip AS as follows:

NOTE: You may wish to remove the Volume control and switch at AT to make it easier to perform the next four steps.

( ) Red to lug 1 (S-3).

( ) Black to lug 4 (S-2).

( ) White to lug 5 (S-2).

( ) Place 1" of sleeving on the shield lead and connect it to lug 3 of terminal strip AS (S-2).

Connect the free ends of the two gray-white wires, and the 2-conductor shielded cable coming from BO #4 as follows:

( ) Place a 5/8" length of large clear sleeving on each gray-white wire.

( ) Connect either gray-white wire to lug 5 (S-1) and the other gray-white wire to lug 4 (S-1) of control AT.

( ) Push the clear sleeving over the lugs on the control and position the wires as shown in the Pictorial.

( ) Connect a 500 pF disc capacitor from lug 1 (NS) to lug 2 (NS) of control AT.

( ) Place 1/2" of small sleeving on the bare wire lead of the 2-conductor shielded cable. Connect this lead to lug 1 of control AT (S-2).

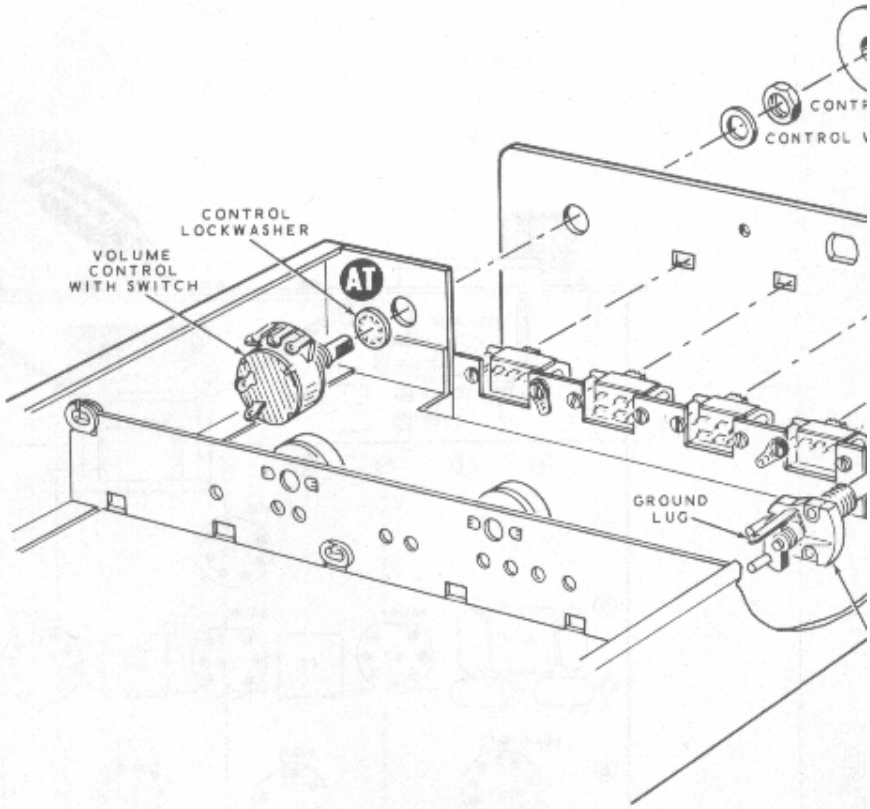
( ) Connect the black lead of the 2-conductor shielded cable to lug 2 (S-2) and the red lead to lug 3 (S-1) of control AT. Position the shielded cable as shown in the Pictorial.

( ) Place 1/2" of sleeving on one lead of a 36 pF resin capacitor. Then connect this lead to lug 2 of switch AY (S-2).

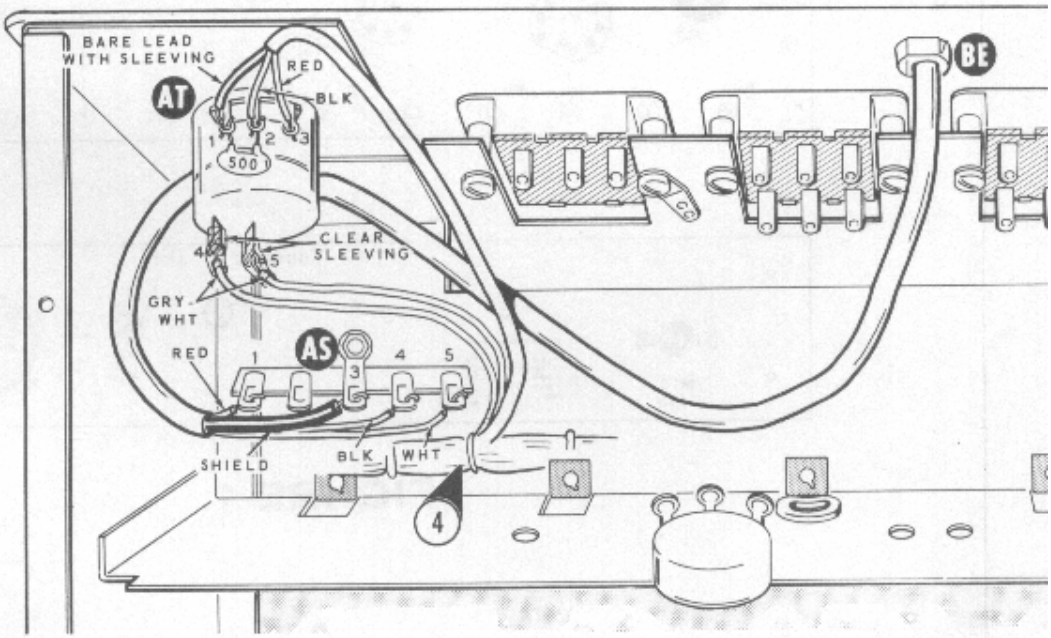
( ) Wrap the other lead of this capacitor around lug 1 of variable capacitor AZ (S-1). NOTE: Apply only enough heat to cause the solder to flow.

( ) Mount a 20 μF vertical-mount electrolytic capacitor on the top of the circuit board at location 20 in section 3C. Position the positive (+) mark on the capacitor the positive (+) mark on the circuit board. solder the pins to the foil.

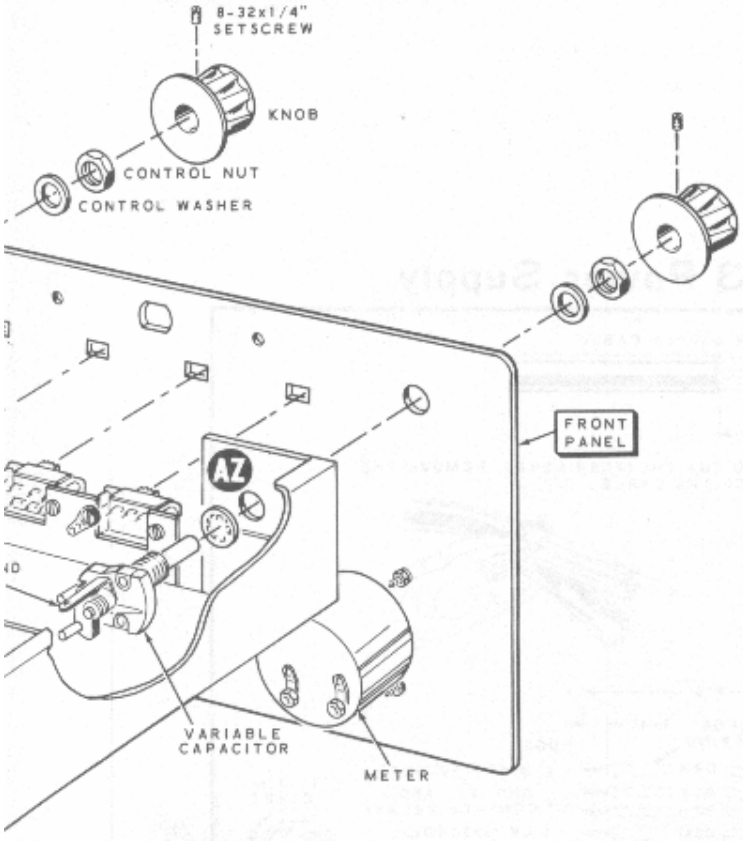
This completes the wiring on the bottom of the chassis. Proceed to Pictorial 8-1.



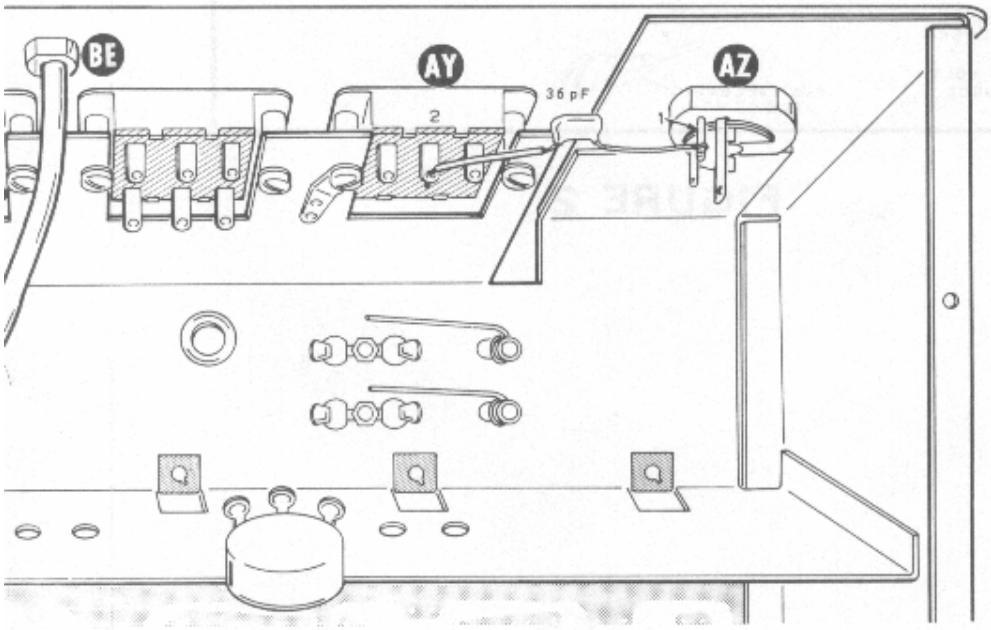
PICTOR



PICTORIA



PICTORIAL 6-1



CTORIAL 7-1

For HP-13 Power Supply

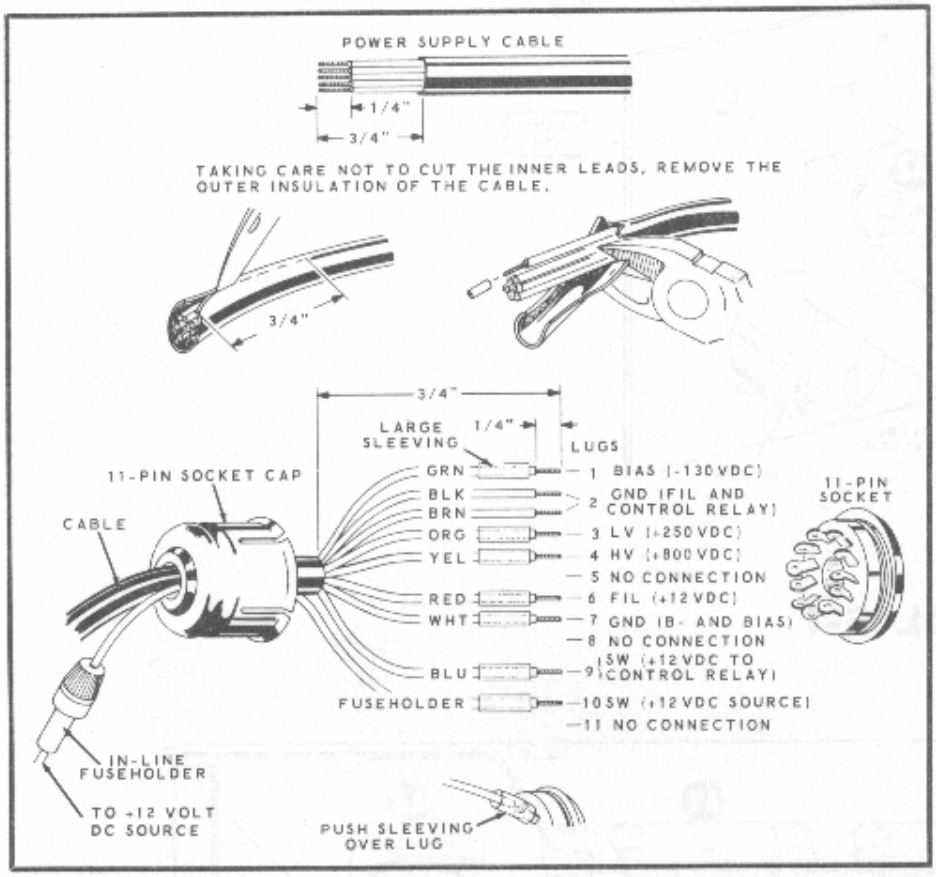


FIGURE 2

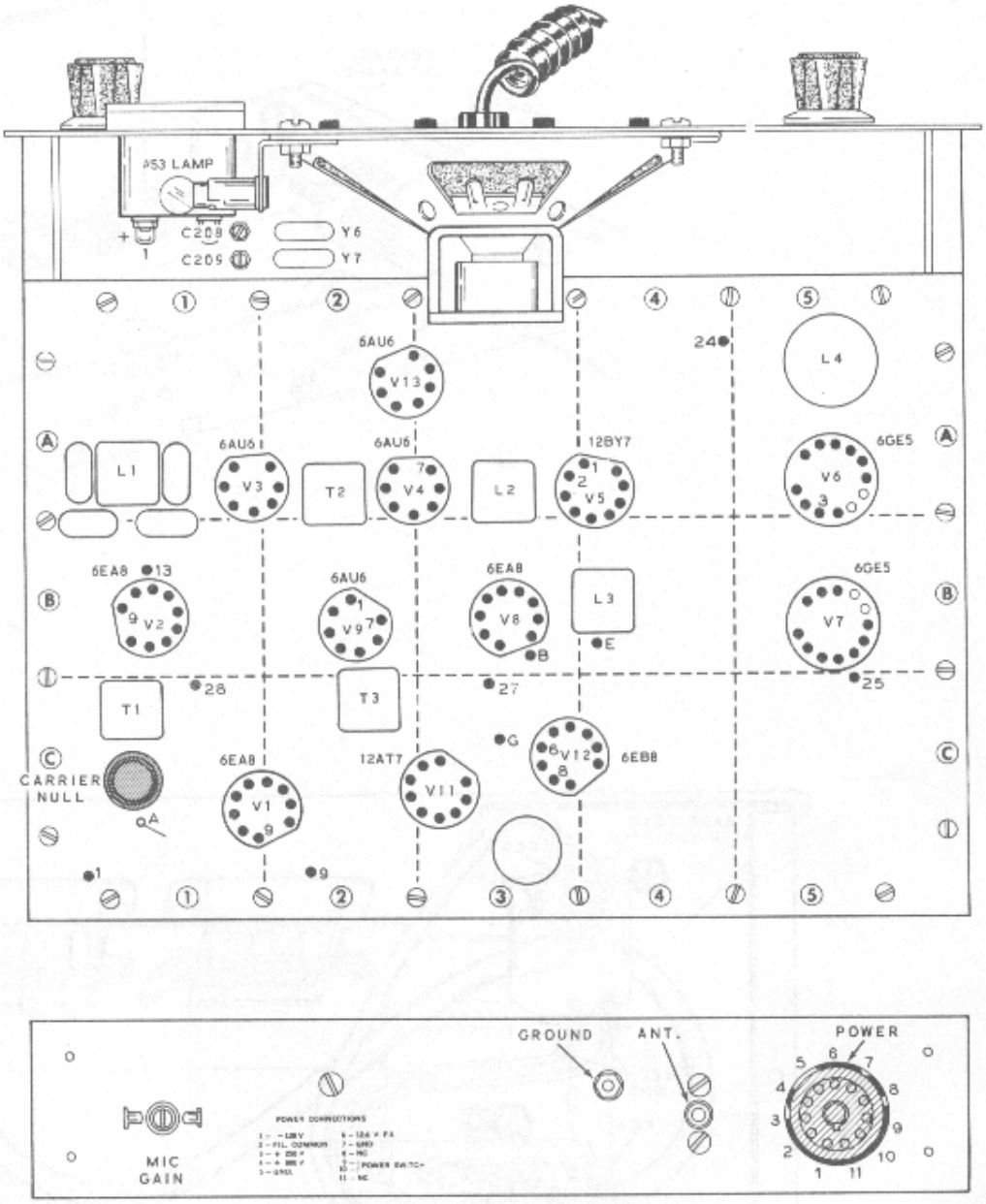

A53 LAMP
C209
C205
Y6
Y7
6AU6
V13
24
L4
L1
6AU6
V3
T2
6AU6
V4
L2
12BY7
V5
6GE5
V6
6EA8
13
V2
6AU6
V9
6EA8
V8
L3
E
B
6GE5
V7
28
T1
27
T3
25
CARRIER
NULL
A
6EA8
V1
12AT7
V11
G
V12
6EB8
1
9
GROUND
ANT.
POWER
MIC
GAIN

FIGURE 1

FINAL WIRING-CHASSIS TOP

Refer to Pictorial 8-1 for the following steps.

( ) Remove and discard the shorting clip from between the meter terminal posts.

Connect the wires coming from grommet AR as follows:

( ) Twist together the red and the black wires to form a twisted pair.

( ) Connect the red wire to lug 1 (S-1) and the black wire to lug 2 (S-1) of meter BA. Use only enough heat to cause solder to flow.

( ) Twist together the black-white and the brown-white wires. Then connect the brown-white wire to lug 1 (S-1) and the black-white wire to lug 2 (S-1) of panel lamp socket BB.

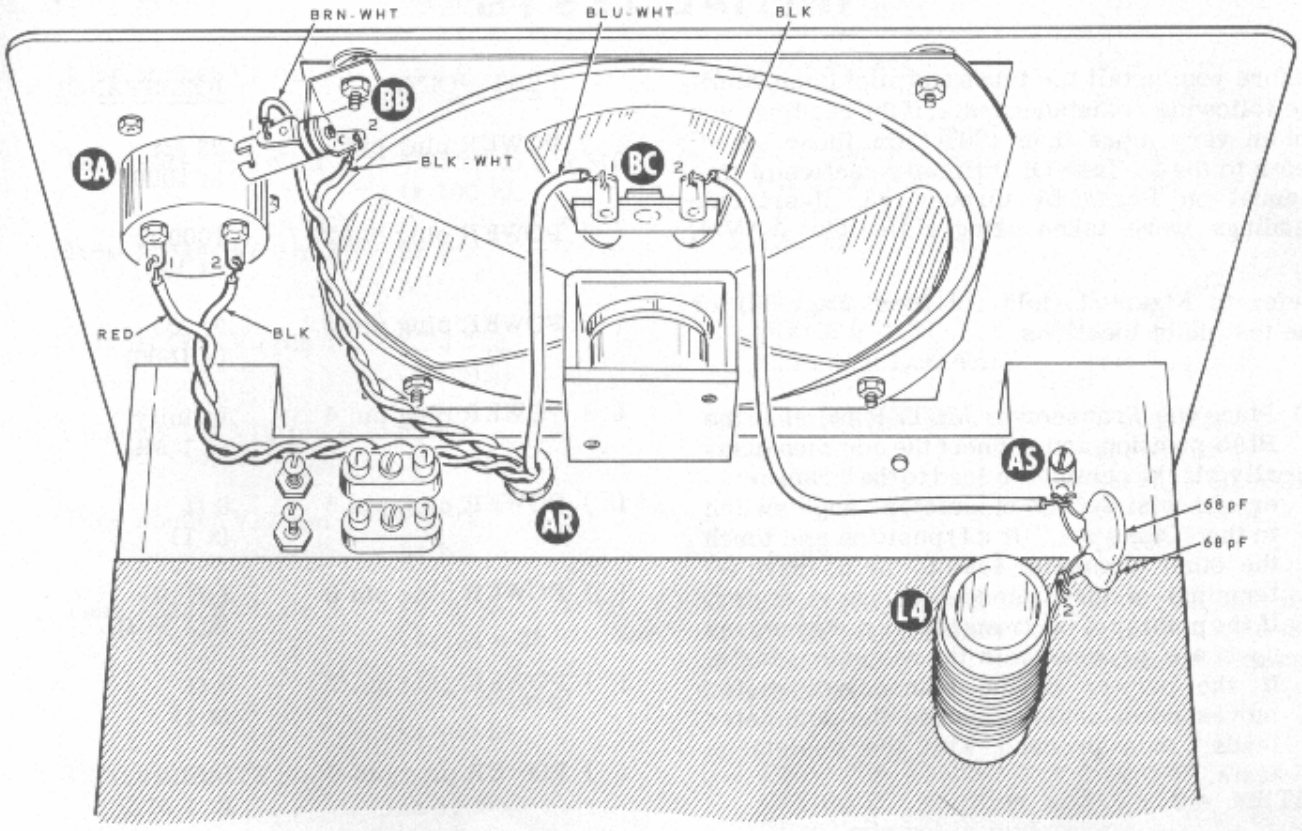
( ) Now bend lug 1 of lamp socket BB as shown in the Pictorial.

( ) Connect the blue-white wire to lug 1 of speaker BC (S-1).

( ) Connect a 7" black wire from lug 2 of speaker BC (S-1) to solder lug AS (NS).

( ) Connect <u>two</u> 68 pF 4 kV disc capacitors from lug 2 of coil L4 (S-2) to solder lug AS (S-3).

This completes the wiring of the Transceiver. Check it over carefully to see that all connections are soldered and there are no solder bridges between foils on the circuit board. Shake out any wire clippings or solder splashes. Be sure the shield leads of the coaxial cables do not touch any adjacent lugs or connections. Cut off any excess lengths of wire protruding from the ends of the circuit board terminals on the component side of the circuit board.



PICTORIAL 8-1

INITIAL TESTS

Before you install the tubes and pilot lamp, make the following resistance tests. If the readings you obtain vary more than ±20% from those listed, refer to the In Case Of Difficulty section of this Manual on Pages 51 through 53. Resistance readings were taken using a Heathkit VTVM.

Refer to Figure 1 (fold-out from Page 32) for the test point locations.

( ) Place the Transceiver METER switch in the BIAS position and connect the common (usually black) ohmmeter lead to the Transceiver chassis. Set the ohmmeter range switch to the "Ohms x 1" (R x 1) position and touch the other ohmmeter lead to the positive (+) terminal of the Transceiver panel meter. If the pointer of the transceiver meter moves up-scale, proceed with the resistance tests. If the pointer of the transceiver meter moves down-scale, reverse the ohmmeter leads; then proceed with the resistance tests.

( ) Set the Transceiver controls and switches as follows:

Control or switch	Set to:
VOLUME	Fully counterclockwise
RECEPTION	DISTANT
MODE	SSB
METER	BIAS
CHANNEL	Either position
CLARIFIER	12 o'clock position
All other controls	Fully counterclockwise

NOTE: The values shown in parentheses ( ) in the RESISTANCE column of the following chart indicates the setting of your ohmmeter's resistance range switch. For example: In the first step, the ohmmeter range switch should be set to the R x 1000 (ohms times one thousand) position. If your ohmmeter ranges are different from those indicated, place its resistance switch in the closest corresponding position.

TEST POINT	RESISTANCE
( ) POWER plug pin 1	33 kΩ (x 1000)
( ) POWER plug pin 2	1000 Ω (x 100)
( ) POWER plug pin 3	31 kΩ (x 1000)
( ) POWER plug pin 4	Infinity (x 1 MΩ)
( ) POWER plug pin 5	0 Ω (x 1)
( ) POWER plug pin 6	Infinity (x 1 MΩ)
( ) POWER plug pin 7	0 Ω (x 1)
( ) POWER plug pin 8	Infinity (x 1 MΩ)
( ) POWER plug pin 9	Infinity (x 1 MΩ)
( ) POWER plug pin 10	Infinity (x 1 MΩ)
( ) POWER plug pin 11	Infinity (x 1 MΩ)
( ) 28 in section 1C	9 kΩ (x 1000)
( ) A in section 1C	200 to 500 Ω (x 100)
( ) B in section 3B	250 kΩ (x 100 k)
( ) 13 in section 1B	220 Ω (x 100)
( ) Tube socket V4 pin 7	330 Ω (x 100)

TEST POINT	RESISTANCE
( ) Tube socket V5 pin 1	150 Ω (x 100)
( ) Tube socket V5 pin 2	100 kΩ to 2.3 MΩ (x 100 k)
( ) Tube socket V6 pin 3	85 kΩ (x 10 k)
( ) Tube socket V9 pin 1	1.25 MΩ (x 1 MΩ)
( ) Tube socket V12 pin 8	35 kΩ (x 1000)
( ) Tube socket V12 pin 6	120 Ω (x 10)
( ) Tube socket V1 pin 9	40 k to 1 MΩ- varies with setting of MIC GAIN control (x 100 k)
( ) Tube socket V2 pin 9	1 Ω (x 1)
( ) Tube socket V2 pin 9, with microphone button depressed.	130 kΩ (x 10 k)
( ) E in 4B	10 k to 250 kΩ (x 100 k)
( ) E in 4B (reverse leads)	150 kΩ (x 100 k)
( ) 1 in section 1C	20 kΩ (x 1000)
( ) 1 in section 1C (press microphone button)	330 Ω (x 100)
( ) 9 in section 2C (MODE switch in SSB)	0 (x 1000)
( ) 9 in section 2C (MODE switch in CARRIER)	22 k (x 1000)
( ) ANT socket	10 k (x 1000)
( ) 27 in section 3C (RECEPTION switch in DISTANT)	220 Ω (x 100)
( ) 27 in section 3C (RECEPTION switch on LOCAL)	Infinity (x 1 MΩ)
( ) G in section 3C	0 to 1 MΩ- varies with setting of VOLUME control (x 100 k)

NOTE: When you use the S-Meter in the next few steps, just touch the test point and note that the S-Meter deflects; do not attempt to measure the resistance.

( ) Place the Transceiver Meter switch in the OPERATE position and set the METER ZERO control to mid-range.

NOTE: Use the ohmmeter R x 100 range for the next two steps.

( ) 28 in section 1C	S-Meter deflects up-scale.
( ) V9 pin 7	S-Meter deflects down-scale.

( ) Set the Transceiver Meter switch to BIAS. Use the ohms x 1 range for the next step.

( ) 25 in section 5C	S-Meter deflects up-scale.

This completes the Initial Tests.

( ) Refer to Figure 1 (fold-out from Page 32) and install the tubes in their sockets. The tube numbers are lettered on the circuit board. Support the circuit board from underneath while installing the tubes to prevent damage to the circuit board.

( ) Install the pilot lamp in its socket. Be sure the lamp does not touch the case of the meter.

( ) Locate the two channel crystals you specified when you ordered this kit. Install the lower frequency crystal in socket Y7 and the other crystal in socket Y6. NOTE: When the crystals are installed in this manner, the lower channel frequency will be obtained with the CHANNEL switch in the left-hand position.

( ) Locate the sheet of numbers and letters. Then carefully cut out and remove the appropriate numbers or letters for the two channels of the Transceiver.

( ) Remove the backing paper from each number or letter and press them onto the appropriate white area on the front panel adjacent to the CHANNEL switch.

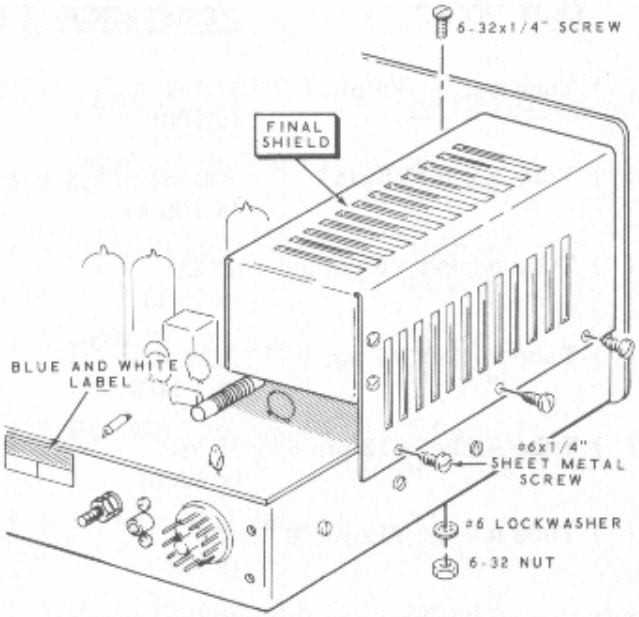
Refer to Pictorial 9-1 and Detail 9-1A for the following steps.

( ) Install 4-40 hardware in the four end holes of the final shield.

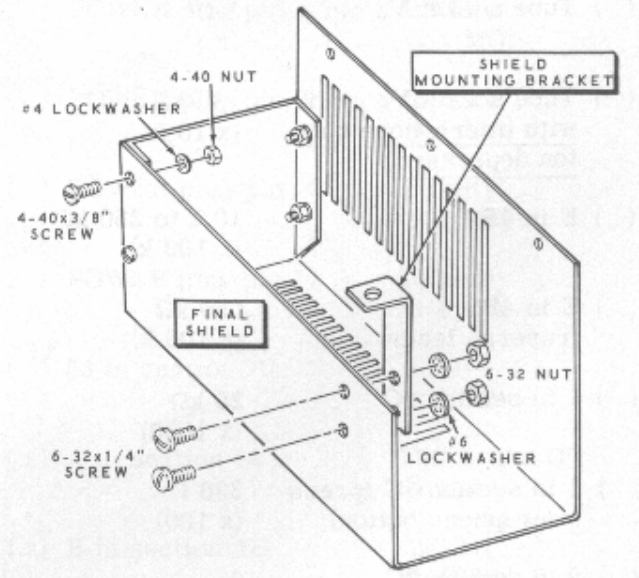
( ) Mount the shield mounting bracket on the shield with 6-32 x 1/4" hardware.

( ) Mount the final shield on the chassis with three #6 x 1/4" sheet metal screws in the side of the chassis, and 6-32 x 1/4" hardware in the top of the chassis.

( ) Carefully peel away the backing paper from the blue and white identification label. Then press the label onto the rear of the chassis as shown. Be sure to refer to the numbers on this label in any communications you have with the Heath Company about this kit.



PICTORIAL 9-1



Detail 9-1A

POWER SUPPLY CONNECTIONS

This Transceiver was designed to operate with the HP-13 (12 VDC input), and HP-23 (120 VAC input) or HP-23A (120 or 240 VAC input) Power Supplies. The following information will help you prepare the power supply cables for the power supplies you intend to use. Two 11-pin sockets and socket caps are supplied with the Transceiver.

NOTE: Power supplies and cables used with Heathkit Models HW-12A, HW-22A, HW-32A, HW-100, SB-100, SB-101, and SB-110 Transceivers may be used as a power source for this Transceiver, provided that the Low B+ voltage output is set for 250 volts DC.

HP-13 POWER SUPPLY CONNECTIONS

CAUTION: Be sure the alternate connection in the low voltage DC circuit of the HP-13 Power Supply is connected for +250 volts output as outlined in the HP-13 Manual. Be sure the charging limit of the automobile voltage regulator does not exceed 14.5 volts.

NOTE: The power cable to be used is supplied with the HP-13 DC Power Supply. The following steps show you how to connect the free end of this cable to the 11-pin socket supplied with this Transceiver.

Refer to Figure 2 (fold-out from Page 32) for the following steps.

( ) Install the socket cap over the free end of the 8-wire cable from the HP-13 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 the tip of each of the exposed wire ends to hold the small strands of wire together.

( ) Insert the lead from the cap end of the fuseholder (an in-line fuseholder with lead is supplied with the HP-13 Power Supply) through the socket cap as shown.

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

( ) Connect the wires of the 8-wire cable and the fuseholder lead to the lugs of the 11-pin socket 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 this Transceiver, be sure the Bias control of the Power Supply is in its fully clockwise position. This setting will supply full bias voltage to pin 1 of the power plug on the Transceiver.

HP-23 AND HP-23A POWER SUPPLY CONNECTIONS

CAUTION: Be sure the alternate connection in the low voltage DC circuit of the HP-23 Power Supply is connected for +250 volts DC output as outlined in the HP-23 Manual. If you use the HP-23A Power Supply, be sure the AC-OFF switch on the front panel of the Power Supply is in the LV250 DC position.

NOTE: The power cable to be used is supplied with the HP-23 or HP-23A AC Power Supply. The following steps show you how to connect the free end of this cable to the 11-pin socket supplied with this Transceiver.

Refer to Figure 3 for the following steps.

( ) Install the 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 the tip of each of the exposed wire ends to hold the small strands of wire together.

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

( ) Connect the wires of the 8-wire cable to the lugs of the 11-pin socket 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.

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

For HP-23 And HP-23A Power Supplies

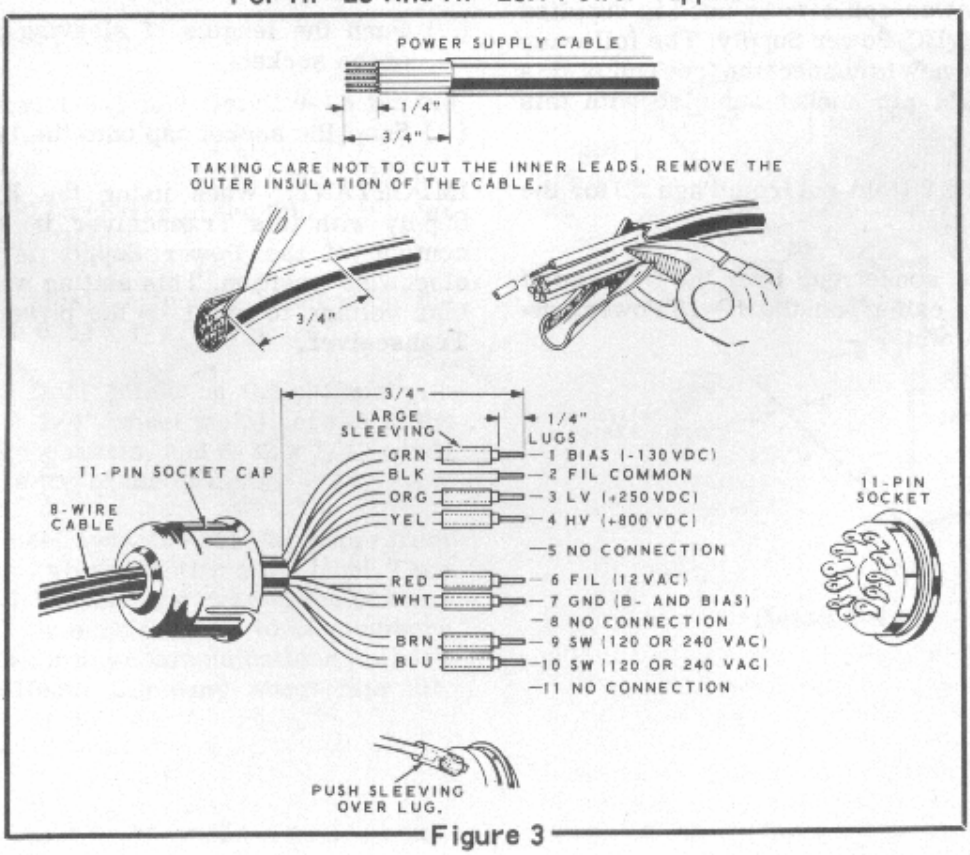


Figure 3

ALIGNMENT AND ADJUSTMENTS

NOTE: The following equipment should be used during the alignment and frequency adjustments.

50 Ω noninductive dummy load.
Accurate frequency meter or counter.
11 megohm input voltmeter.
RF probe.

( ) Set the controls and switches as follows:

Control or switch	Set to:
RECEPTION	DISTANT
METER ZERO	Fully counterclockwise
MODE	SSB
METER	BIAS
BIAS ADJUST	Fully counterclockwise
CHANNEL	Either switch position
CLARIFIER	12 o'clock position
MIC GAIN (rear of chassis)	Fully counterclockwise

NOTE: If you do not obtain the proper response in any of the following steps, refer to the In Case Of Difficulty section of the Manual (Page 51) and correct the difficulty before proceeding.

Refer to Figure 1 (fold-out from Page 32) for the following tests.

Use an ohmmeter to make the following resistance checks at the POWER plug. Resistance readings should not vary more than ±20%. The common ohmmeter lead should be connected to the chassis.

TEST POINT	RESISTANCE	RANGE SWITCH IN OHMS
Pin 1	33 kΩ	x 1000
Pin 3	31 kΩ	x 1000
Pin 4	Infinity	x 1000

RECEIVER ALIGNMENT

NOTE: A phono plug is provided for connecting to the ANT (antenna) socket on the rear of the Transceiver chassis. Refer to Figure 4 for connecting a phono plug to a coaxial cable.

( ) Use a small screwdriver to adjust the slotted screw in the front of the meter case until the meter pointer is over the zero line on the meter scale.

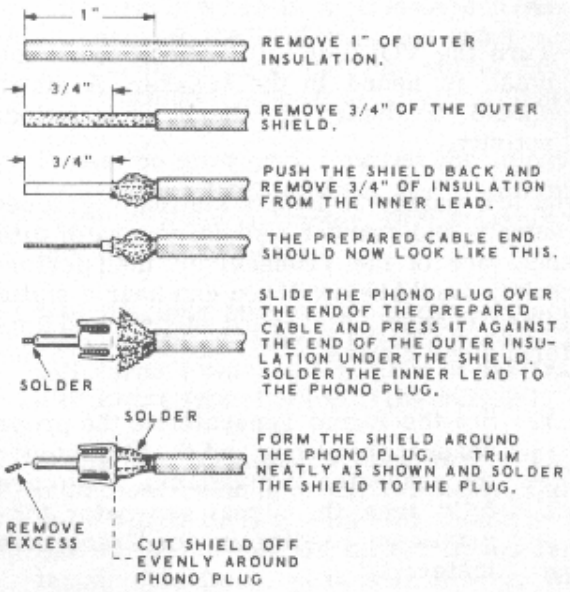


Figure 4

( ) Connect the socket on the power supply cable to the Transceiver POWER plug. NOTE: Be sure the low voltage DC circuit of the power supply is set for +250 volts output.

( ) Connect a 50 Ω dummy load to the ANT socket. NOTE: Do not use a light bulb as a dummy load. The impedance of a light bulb type of dummy load can be high enough to damage the T-R circuitry of the Transceiver.

( ) Turn the VOLUME control clockwise until the switch clicks on. The pilot lamp and the tube filaments should light. CAUTION: Watch the meter pointer. If it should start to deflect, turn off the Transceiver immediately, as the bias circuit of tube stages V6 and V7 is probably shorted and must be corrected before any other adjustments are made.

( ) If the meter pointer remained at zero in the preceding step, place the METER switch in the OPERATE position. Then adjust the METER ZERO control (through hole in front panel) until the meter pointer again indicates zero.

( ) Disconnect the dummy load from the ANT socket. Plug an antenna having a 50 Ω impedance into the ANT socket.

( ) Turn the VOLUME control clockwise until noise is heard in the speaker. A station should be heard if there is any local activity.

If you are unable to hear a station, disconnect the antenna and connect a signal generator to the antenna jack of the Transceiver; then perform steps 1, 2, 3 and 4 below. If you can hear a station on either channel, disregard steps 1 and 2 and perform steps 3 and 4.

( ) 1. Set the signal generator to the proper channel frequency and the RF output of the generator to maximum. Then carefully tune the signal generator for a maximum reading on the Transceiver meter.

( ) 2. Now reduce the RF output of the signal generator until the Transceiver meter reads approximately S3.

NOTE: When you adjust the slugs in the transformers, use the short end of the alignment tool to adjust the top slug and the long end to adjust the bottom slug. When you insert the long end of the alignment tool through the top slug to reach the bottom slug, be careful you do not change the adjustment of the top slug.

( ) 3. Adjust the top and bottom slugs in transformer T3 (receiver IF) for the highest S-Meter reading. Repeat these adjustments until the highest meter reading is obtained.

( ) 4. Adjust the top slug in transformer T2 for the highest meter reading.

( ) 5. Turn off the Transceiver and disconnect the antenna. NOTE: Do not change the setting of the controls while you perform the following alignment procedure until directed to do so in a step.

TRANSMITTER ALIGNMENT

NOTE: TRANSMITTER ALIGNMENT AND FREQUENCY ADJUSTMENTS MUST BE PERFORMED BY A SECOND CLASS (OR HIGHER) COMMERCIAL RADIOTELEPHONE LICENSEE BEFORE THIS TRANSCEIVER IS PUT ON THE AIR. MAKE THE REQUIRED ENTRIES IN THE STATION LOG.

Bias Setting

( ) Preset the brass screw in each of the two crystal trimmer capacitors; the top of each screw head should be 3/8" above the top of the chassis, as shown in Figure 5.

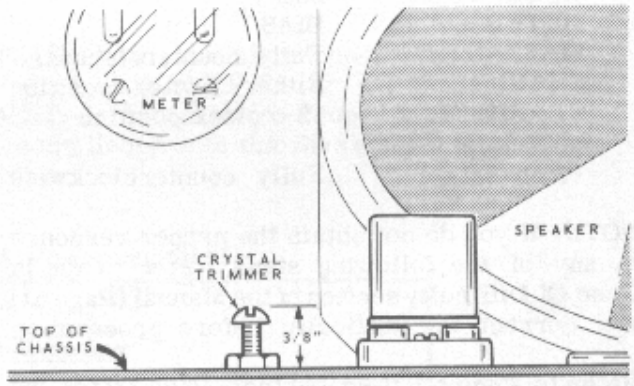


Figure 5

( ) Set the CHANNEL switch to the desired channel and the METER switch to BIAS.

( ) Remove the 12BY7 tube from tube socket V5.

( ) Connect the dummy load to the ANT socket.

( ) Adjust the Clarifier knob so its pointer is at the 12 o'clock position.

( ) Turn on the Transceiver and allow it to operate for at least thirty minutes before you perform the following steps.

( ) Press the push-to-talk button on the microphone.

( ) Insert a small screwdriver through the BIAS ADJUST hole in the front panel and adjust this control for a reading of S3 on the panel meter. There is a small triangle above the "3" on the meter scale to indicate the proper bias.

( ) Turn off the Transceiver and reinstall 12BY7 tube V5.

IF Amplifier Adjustment

( ) Place the MODE switch in the CARRIER position and the METER switch in the BIAS position. Then turn on the Transceiver and again allow it to reach operating temperature.

( ) Depress the microphone switch and observe the panel meter reading.

( ) If the reading is above S9, adjust the CARRIER NULL control until the meter reads between S3 and S5.

( ) Now adjust the top and bottom slugs in transformer T2 for maximum reading on the panel meter. Then release the microphone switch.

Balanced Modulator Adjustment

( ) Place the MODE switch in the SSB position.

NOTE: Perform only one of the next three steps. Be sure the Transceiver is at its normal operating temperature before making any adjustments.

( ) 1. If you use a voltmeter and RF probe with your dummy load, place the RF probe near the dummy load. Do not connect directly to the load as there is sufficient output from the Transceiver to burn out the diodes in some RF probes.

( ) 2. If you do not use the RF probe, connect the voltmeter to the dummy load (if the load has a DC voltmeter connection).

( ) 3. If the dummy load does not have a DC voltmeter connecting point, connect the voltmeter between terminal 24 (on top of circuit board in section 4A) and chassis ground. CAUTION: Do not short circuit terminal 24 to the final shield. Set the voltmeter range for -1.5 volts full scale.

( ) Press the microphone switch and adjust the CARRIER NULL control for a minimum reading on the voltmeter. NOTE: Do not talk into the microphone.

( ) Use the long end of the alignment tool to turn the bottom slug in transformer T1 two full turns toward the bottom of its travel (clockwise from the top of the chassis).

( ) Adjust the top slug in transformer T1 for maximum reading on the voltmeter. Only a very slight turn of this slug should be required. If the slug is turned in too far, a larger, but false, peak will appear. When properly adjusted, the coil slug should be approximately 1/4" below the top of the transformer can.

( ) Again adjust the CARRIER NULL control for a minimum reading on the voltmeter.

NOTE: The signal level should now be quite low, and if a voltmeter and RF probe are being used, the RF probe should be connected to the center lug (lug 2) of the ANT socket.

( ) Adjust the bottom slug in transformer T1 back up into the transformer. Adjust this slug until a minimum reading (dip) is obtained on the voltmeter.

( ) Readjust the CARRIER NULL control and the bottom slug in transformer T1 until the lowest possible reading is obtained on the voltmeter. NOTE: These adjustments will now be quite critical: therefore, adjust them very carefully. Repeat these adjustments until the best null is obtained. The minimum reading should be 1/4 volt or less.

( ) Release the microphone switch and disconnect the voltmeter from the Transceiver.

NOTE: Driver tuning coils L2 and L3 are preset at the factory and need no further adjustment.

Frequency Adjustments

NOTE: THE FOLLOWING ADJUSTMENTS MUST BE PERFORMED AND CERTIFIED BY A SECOND CLASS (or higher) COMMERCIAL RADIOTELEPHONE LICENSEE BEFORE YOU CAN USE THE TRANSMITTER.

( ) Place the MODE switch in the CARRIER position and the CHANNEL switch in the left-hand position. Be sure the pointer on the CLARIFIER knob is at the 12 o'clock position.

( ) Couple the frequency meter or counter to the dummy load. Follow the equipment instructions carefully.

( ) Set up the frequency meter or counter so it will read the correct frequency for this channel. Then press the microphone switch.

( ) Now adjust the brass screw in crystal trimmer capacitor C209 until the Transceiver frequency is correct as indicated by the frequency meter or counter.

( ) Turn the CLARIFIER knob to its 9 o'clock position and check the frequency. With the knob pointer lined up with this panel mark, the Transceiver frequency should be approximately 100 Hz lower than it was with the pointer in the 12 o'clock position.

( ) Turn the CLARIFIER knob to its 3 o'clock position and check the frequency. With the knob pointer lined up with this panel mark, the Transceiver frequency should be approximately 100 Hz higher than it was with the pointer in the 12 o'clock position.

( ) Place the CHANNEL switch in the right-hand position. Then set up the frequency meter or counter so it will read the correct frequency for this second channel.

( ) Turn the knob on the CLARIFIER control until the pointer is at the 12 o'clock position. Then press the microphone switch.

( ) Now adjust the brass screw in crystal trimmer capacitor C208 until the Transceiver frequency is correct for this second channel as indicated by the frequency meter or counter.

( ) Turn the CLARIFIER knob to its 9 o'clock position and check the frequency. The Transceiver frequency should now be approximately 100 Hz lower than it was with the knob pointer in the 12 o'clock position.

( ) Turn the CLARIFIER knob to its 3 o'clock position and check the frequency. The Transceiver frequency should now be approximately 100 Hz higher than it was with the knob pointer in the 12 o'clock position.

WARNING: The frequency must be checked if channel crystals or carrier oscillator crystals are changed.

Setting Microphone Gain

( ) Place the MODE switch in the SSB position and the METER switch in the OPERATE position.

( ) Press the microphone switch and talk steadily into the microphone.

( ) At the same time, slowly adjust the MIC GAIN control, (on the rear of the chassis) clockwise and watch the panel meter.

( ) Continue to adjust the MIC GAIN control until, with speech, a point is reached where the meter pointer moves up-scale 2 or 3 S-units above the resting point. NOTE: Additional rotation of the control will not produce more output and may cause distortion.

FINAL ASSEMBLY

Refer to Pictorial 10-1 for the following steps.

NOTE: The clip supplied with the microphone may be installed at either end of the cabinet in a vertical or horizontal position.

(✓) Secure the microphone clip at the desired location with 6-32 x 1/4" hardware.

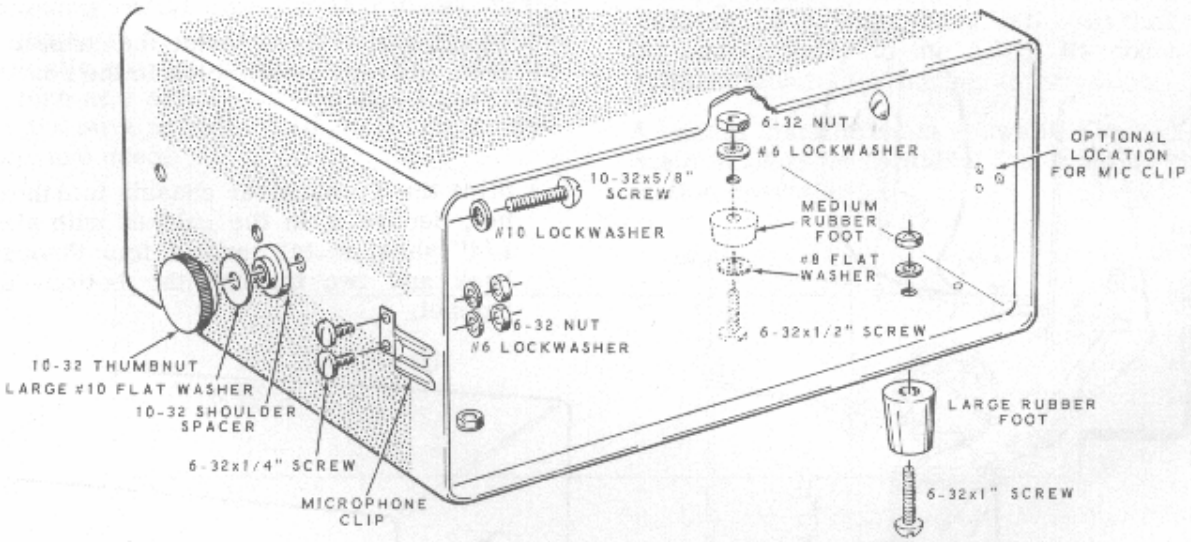
FIXED STATION-MOBILE CONSIDERATIONS

Before installing the Transceiver in the cabinet, determine whether it will be used for fixed station or mobile operation, or both. For fixed station use only, perform the steps under "For Fixed Stations;" for mobile use only, perform the steps under "For Mobile Stations." If you plan to use the Transceiver alternately in fixed station and mobile installations, perform the steps in both sections.

For Fixed Stations

( ) Install medium rubber feet at the two rear holes in the bottom of the cabinet with 6-32 x 1/2" hardware and #8 flat washers.

( ) Install large rubber feet at the two front holes (nearest the perforated area) in the bottom of the cabinet with 6-32 x 1" hardware.



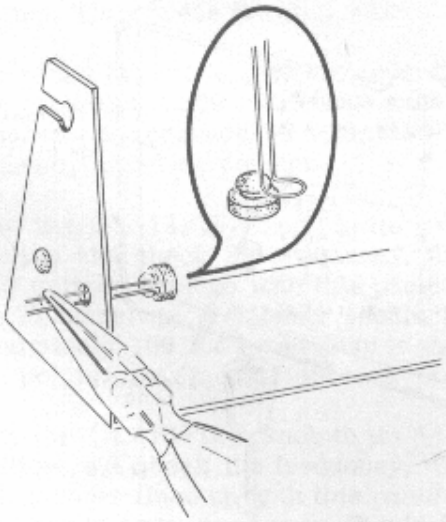
PICTORIAL 10-1

For Mobile Stations

Determine whether the Transceiver is to be mounted under the dash or on the floor of the automobile. See Figure 6. If under-the-dash mounting is preferred, there are two holes near the center on each side of the cabinet which can be used for mounting. For floor mounting, use the holes at the rear on each side of the cabinet. Choose the holes that will provide the best balance for your installation.

( ) Mount the gimbal bracket hardware in the cabinet holes decided upon. Use 10-32 x 5/8" screws, #10 lockwashers, 10-32 shoulder spacers, large #10 flat washers, and 10-32 thumbnuts. See Pictorial 10-1.

( ) Refer to Detail 10-1A, and install four small rubber feet into the gimbal bracket. This can be done by looping a length of bare wire around the groove of the rubber foot and passing the wire through the hole in the gimbal bracket. Pull on the wire until the rubber foot is properly seated in the hole.



Detail 10-1A

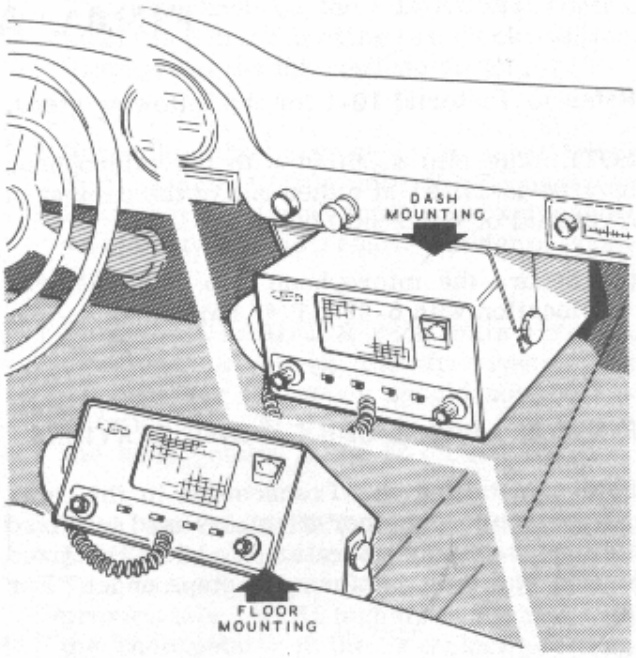
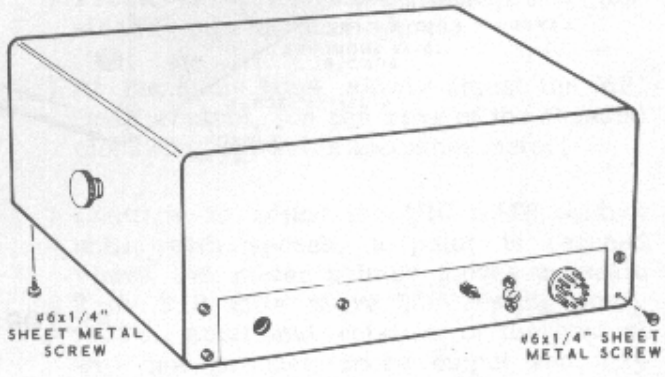


Figure 6

( ) Position the wires inside the chassis away from the four small holes in the rear apron of the chassis.

( ) Slide the Transceiver chassis into the cabinet. Secure it in the cabinet with six #6 x 1/4" sheet metal screws, four through the back and two through the bottom of the cabinet.



PICTORIAL 11-1

INSTALLING CHASSIS IN CABINET

Refer to Pictorial 11-1 for the following steps.

( ) Disconnect the antenna (or dummy load) and the Power Supply cable from the Transceiver.

INSTALLATION

FIXED STATION

The Transceiver must be placed in a location with adequate ventilation because of the amount of heat given off by the tubes. Inadequate ventilation could cause considerable damage to the circuit components.

The power supply can be mounted in any convenient out-of-the-way location, since it is controlled by the POWER switch in the Transceiver.

The Transceiver requires about 300 watts of power when transmitting, therefore, it should not be operated from an already heavily-loaded AC outlet.

Connect a heavy wire from the GROUND terminal on the rear panel of the transceiver to a good earth ground, or to a cold water pipe. Before using a water pipe, however, check to see that a continuous metal pipe exists running to the water main. In some areas plastic pipe is used (or a plastic connector), and this eliminates the water pipe as a satisfactory ground connection. Also make sure no nonmetallic water meter connections are used.

ANTENNA

The formula for determining the length of a half-wave dipole is the number 468 divided by the frequency in MHz. For example:

$$468 \div 4.469 \text{ MHz} = 104' \ 8\text{-}1/2".*$$

*This length does not include the additional foot of wire necessary for connection (3" at each insulator eye).

A doublet antenna fed by RG-58 coaxial cable or an inverted "Vee" type antenna will operate very well with the Transceiver. Other types of antennas that use high impedance end-feeding, off-center feeding, open wire lines, or 300 Ω twin lead, can only be used if an antenna coupler is used between the antenna and Transceiver. The antenna used must provide a low SWR (standing wave ratio) to the Transceiver for successful operation. A properly-matched antenna will result in an SWR of 1.2 or less. SWR measurements will be discussed under the heading "Measuring Standing Wave Ratio" on the following pages. Refer to the ARRL Handbook or an Antenna Manual for further information.

A typical installation is shown in Figure 7. This basic hookup is suitable for fixed or mobile station operation.

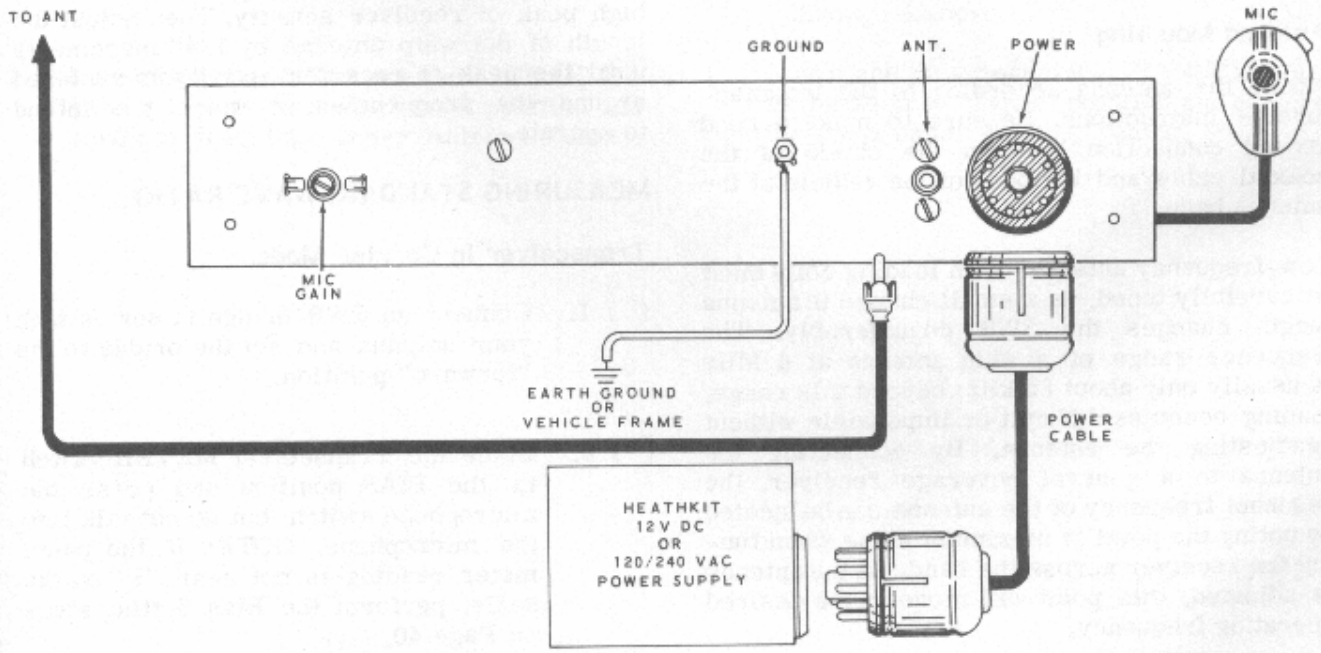


Figure 7

MOBILE STATION

Transceiver Mounting

The Transceiver may be mounted under the instrument panel or on the floor. See Figure 6 on Page 44. The gimbal bracket should be mounted in the desired location in the vehicle, using the #10 x 1/2" sheet metal screws. The starting holes for these screws should be made with a 9/64" drill. Be careful not to drill into existing wiring or instruments. Keep all Transceiver cables clear of the vehicle pedals and control cables.

Any cables that have to go through the fire wall will usually fit through existing grommets. If it is necessary to make holes through a sheet metal partition, a long tapered punch usually works better than a drill. A drilled hole leaves sharp edges which can cut the wires. When a punch is driven through the metal, the sharp edge is rolled back and a smooth hole will result. Be sure to leave enough extra cable so the Transceiver can be operated when it is removed from the gimbal bracket. Cables that must be connected inside of the engine compartment should be as far away from the ignition wires as possible to avoid noise pickup.

Check the setting of the vehicle voltage regulator. The charging voltage should not exceed 14.5 volts.

Antenna Mounting

Mount the antenna according to the manufacturer's instructions. Be sure to make a good ground connection between the shield of the coaxial cable and the body of the vehicle at the antenna base.

Low-frequency antennas with loading coils must be carefully tuned, as a small change in antenna length changes the SWR considerably. The frequency range of a whip antenna at 4 MHz is usually only about 25 kHz; beyond this range, loading becomes difficult or impossible without readjusting the antenna. By connecting the antenna to a general coverage receiver, the resonant frequency of the antenna can be located by noting the point of maximum noise when tuning the receiver across the band. As the antenna is adjusted, this point will move to the desired operating frequency.

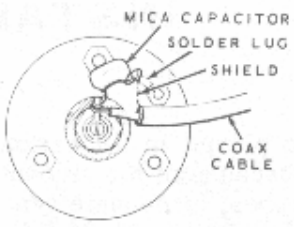


Figure 8A

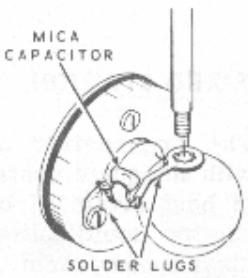


Figure 8B

IMPORTANT NOTE: To make a loaded whip antenna present a 50 Ω load to match the coaxial cable on 4 MHz, a capacitor usually must be connected between the base of the antenna and ground. This can be done inside the vehicle body as shown in Figure 8A, or between the antenna and one of the mounting screws, using two solder lugs, as shown in Figure 8B. A 1000 pF mica capacitor, can be used for this purpose with most antennas; but a capacitor of a different value, between 300 pF and 1500 pF, may be required for proper operation of your antenna. The antenna will require retuning when a capacitor is installed or changed.

A whip antenna that is properly tuned for 4 MHz operation will have a high peak of receiver activity for about 30 kHz around the antenna's resonant frequency. If a communications receiver is available, connect it to the antenna and tune through the 4 MHz range to locate this high peak of receiver activity. Then adjust the length of the whip antenna by 1/4" increments until the peak of receiver activity is centered around the frequencies at which you intend to operate.

MEASURING STANDING WAVE RATIO

Transceiver In Carrier Mode.

( ) 1. Connect an SWR bridge in series with your antenna and set the bridge to the "forward" position.

( ) 2. Place the Transceiver METER switch in the BIAS position and press the microphone switch, but do not talk into the microphone. NOTE: If the panel meter reading is not near "3" on the scale, perform the Bias Setting steps on Page 40.

( ) 3. Now place the transceiver MODE switch in the CARRIER position and the METER switch in the OPERATE position.

NOTE: In the following steps, limit the transmit time to 30 seconds to avoid overheating while in the carrier mode.

( ) 4. With the SWR bridge in the "forward" position, press the microphone button and, at the same time, adjust the SWR bridge sensitivity control for a full-scale reading on the SWR meter. Note this reading if a full scale reading cannot be obtained.

( ) 5. While pressing the microphone button, switch the SWR bridge to the "reverse" position and note the SWR meter reading.

( ) 6. The "reverse" reading should not be more than one-fifth of the forward reading for an acceptable SWR.

( ) Place the Transceiver CHANNEL switch in the other channel position and again perform steps 1 through 6 above.

( ) Now place the Transceiver CHANNEL switch in the desired channel position and perform the steps under Antenna Tuning.

Transceiver In SSB Mode

NOTE: Perform the following steps if you could not obtain a full-scale reading on the SWR meter in step 4 under Transceiver In Carrier Mode.

( ) 1. Place the Transceiver MODE switch in the SSB position and the SWR bridge in the "forward" position.

NOTE: In the next two steps, it is important that the level at which you whistle or hum remain constant.

( ) 2. Press the microphone button and whistle or hum into the microphone. At the same time adjust the sensitivity control on the SWR bridge for a full-scale reading on the SWR meter.

( ) 3. While maintaining the same level of sound into the microphone, switch the SWR bridge to the "reverse" position and again note the SWR meter reading.

( ) 4. The SWR meter "reverse" reading should not be more than one fifth of the "forward" reading for an acceptable SWR.

( ) Place the Transceiver CHANNEL switch in the other channel position and repeat steps 1 through 4 above.

( ) Now place the transceiver CHANNEL switch in the desired channel position and perform the steps under Antenna Tuning.

ANTENNA TUNING

NOTE: If the Transceiver channels are separated by more than 30 kHz, it may not be possible to obtain the same low SWR on both channels. Therefore, tune the whip antenna to the channel you will use the most.

( ) Place the Transceiver channel switch in the desired channel position. Then adjust the length of the antenna as follows:

A. If the lowest SWR reading was obtained on the lower frequency channel, shorten the antenna as described in "C" below.

B. If the lowest SWR reading was obtained on the higher frequency channel, lengthen the antennas as described in "C" below.

NOTE: Each time you change the length of the antenna, repeat steps 4, 5, and 6 under Transceiver In Carrier Mode, or steps 1, 2, 3, and 4 under Transceiver In SSB Mode.

C. Increase or decrease the length of the whip antenna in 1/4" increments until the minimum SWR is obtained. The SWR should be 1.2 or less at the desired operating frequency. NOTE: It may be necessary to change the value of the mica capacitor at the base of the antenna as previously described, in order to reduce the SWR to 1.2 or less.

( ) Mount the Transceiver in the gimbal bracket. Then position the Transceiver as desired and tighten the thumbnuts.

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 items that may be producing the major noise interference.

In most cases, 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 9 (fold-out from Page 53) shows a typical ignition system and the suggested placement of noise suppression components.

1. Noise suppression checks should be made in an area that is free from other man-made electrical interference, such as power lines, manufacturing processes, and other vehicles.

2. With the Transceiver turned on, drive the automobile at medium speed. Then let up on the gas, and turn the ignition switch to the "accessory" position or to "off". Allow the vehicle to coast in gear. If the noise stops, the major source of interference is from the ignition system. To prevent muffler damage, stop the vehicle before you restart the engine.

3. If the noise heard in step 2 continues, but at a reduced level, the charging system, and the oil, temperature, and fuel tank "sending" units can be at fault.

4. If the noise has a "whine" characteristic, or changes in pitch with varying engine speed, and is still present with the ignition off, then the charging system is the major source of interference.

5. A distinct but irregular clicking noise, or "hash," that appears with the engine idling, indicates the voltage regulator is cutting in and out.

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

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

Refer to the Noise Suppression Troubleshooting Chart and Figure 9 to help determine how to suppress most noise interference. Naturally, not all vehicles will require suppression to the extent shown in Figure 9 but some stubborn cases may require all the suppression components shown, plus shielding of the ignition system.

Bonding various parts of the vehicle together may also be necessary, starting from the hood and continuing to the trunk. You may also have to bond the shield of the coaxial antenna lead to the body every few feet, all the way from the antenna to the Transceiver.

NOTE: If a great amount of noise suppression is required, the engine should be retimed and tuned up according to the manufacturer's specifications.

Noise Suppression Troubleshooting Chart

TYPE OF NOISE	POSSIBLE CAUSE	RECOMMENDED REMEDY
Loud popping increasing to buzz with increased 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.	Alternator or generator.	1. Coaxial type capacitor in series with the armature or stator lead. 2. Clean commutator. 3. Replace brushes. 4. 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 the 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; accessory wiring from engine compartment.
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 through valve stem.
Irregular popping noise when on bumpy roads, particularly at slow speeds.	Body static.	1. Tighten all loose screws. 2. Use heavy flexible braid and bond the engine to the frame and fire wall. Bond the control rods, speedometer cable, exhaust pipes, etc., to the frame.

OPERATION

NOTE: IT IS NECESSARY TO HAVE THE PROPER STATION AND OPERATOR LICENSE BEFORE THIS TRANSCEIVER IS PLACED ON THE AIR. Information regarding licensing and frequency allocations may be obtained from the Federal Communications Commission.

FUNCTION OF OPERATING CONTROLS

Figure 10 (fold-out from Page 53) contains a brief description of the function of each control. Study this Figure very carefully; then proceed with the following operating information.

RECEIVING

The Transceiver is quite simple to operate, since there is little tuning to do after it has been aligned. Turn the Transceiver on by turning the VOLUME control knob clockwise. After a short warm-up period, background noise should be heard, as well as any stations transmitting on the channels you are using. Adjust the VOLUME control for the desired sound level.

With the METER switch in the OPERATE position and the RECEPTION switch in the DISTANT position, the panel meter will indicate the strength of the received signal in "S" units, and in decibels (dB) over S9. If the received signal is extremely strong, the receiver circuits may overload or block. This condition could occur if one mobile station is very close to another mobile or fixed station. Placing the RECEPTION switch in the LOCAL position will attenuate the signal by at least 30 dB. The reading of the panel meter will be reduced since the input signal voltage to the meter will also be attenuated.

The CLARIFIER control should be adjusted to provide the most natural-sounding voice reproduction of the received signal.

TRANSMITTING

Normal operation will be obtained with the MODE switch in the SSB position. The CARRIER position should only be used when the station receiving your transmission is capable of receiving only AM signals. WARNING: Do not transmit for more than 30 seconds at a time with the MODE switch in the CARRIER position, since considerable heat is generated in this transmitting mode.

To transmit, set the CHANNEL switch to the desired channel; then press the microphone button and talk into the microphone. Since this Transceiver is designed for 2-channel fixed frequency operation, no external transmitter controls are provided.

The panel meter will indicate ALC (automatic level control) voltage while you are transmitting, when the METER switch is in the OPERATE position. As the operator talks, the meter should deflect several S units, indicating maximum output peaks. When transmitting, the meter pointer may rest above or below the zero mark without harm. (The Heath Monitorscope can also be used with the Transceiver in fixed-station operation to provide a visual display of transmitter output.)

If the Meter switch is placed in the BIAS position while you transmit, the meter will indicate cathode current variations of the final RF amplifiers. Normal talking should produce peaks at about S6 on the meter, with load steady tones resulting in full-scale peaks. If normal talking produces a meter deflection above S9, the MIC GAIN control is set too high. It should be adjusted to produce an average meter reading of S6. The meter should read S3 without modulation.

To keep the Transceiver in top operating condition, it should be adjusted periodically as directed in the Alignment and Adjustments section of the Manual. The BIAS ADJUST control setting should also be checked and adjusted whenever power supplies are changed. After alignment has been completed and the carrier properly nulled, the bias level can be checked and adjusted anytime by observing the meter in the BIAS position when the microphone button is pressed, with no modulation.

ANTENNA

The antenna must have a low SWR (standing wave ratio), since the Transceiver loading and tuning are fixed. The antenna resonance should be checked with a reflected power meter or SWR bridge to make sure the SWR is 1.5 to 1, or less. If the SWR is too high, the antenna must be adjusted until the SWR has been reduced to 1.5 to 1 or less. Operation with a high SWR will result in overloading and damage to the output tubes.

When using the SWR bridge, place the mode switch in the CARRIER position and press the microphone button, but do not talk into the microphone.

Fifty ohm coaxial cable should be used as the transmission line and the antenna should be matched to the transmission line. If the impedance presented to the Transceiver by the antenna system is other than 50 Ω, an antenna coupler or tuner must be used to provide the proper load to the Transceiver.

Special care must be taken with mobile installations, since shortened and center-loaded antennas are very critical to tune. An operating frequency change of 10 or 20 kHz will often change the antenna tuning considerably. Better antennas, with loading coils, have higher "Q" and sharper tuning. Follow the antenna manufacturer's instructions carefully to obtain proper adjustment.

IN CASE OF DIFFICULTY

1. Recheck the wiring. Trace each lead in colored pencil on the Pictorial as it is checked. It is frequently helpful to have a friend check your work. Someone who is not familiar with the unit may notice something consistently overlooked by the builder.

2. About 90% of the kits that are returned for repair do not function properly due to poor connections and soldering. Therefore, many troubles can be eliminated by reheating all connections to make sure that they are soldered as described in the Proper Soldering Techniques section of the Kit Builders Guide.

3. Check to be sure that all tubes and cable connections are in their proper locations. Make sure that all tubes light up properly.

4. Check the tubes with a tube tester or by substitution of tubes of the same types that are known to be good.

5. Check the power supply and antenna.

6. Check the values of the parts. Be sure that the proper part has been wired into the circuit, as shown in the Pictorial diagrams and as called out in the wiring instructions.

7. Check for bits of solder, wire ends, or other foreign matter, which may be lodged in the wiring.

8. If, after careful checks, the trouble is still not located and an ohmmeter and voltmeter are available, check the resistance and voltage readings against those shown in Figures 11, 12 (fold-out from Page 56) and 13 (fold-out from Page 61). NOTE: All voltage readings were taken with an 11 megohm input voltmeter. Voltages may vary as much as ±20%.

NOTE: To aid in servicing or troubleshooting the Transceiver, refer to the Circuit Board X-Ray View (fold-out from Page 62) and Chassis Photographs shown on Pages 63 through 65.

A break in the circuit board foil 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.

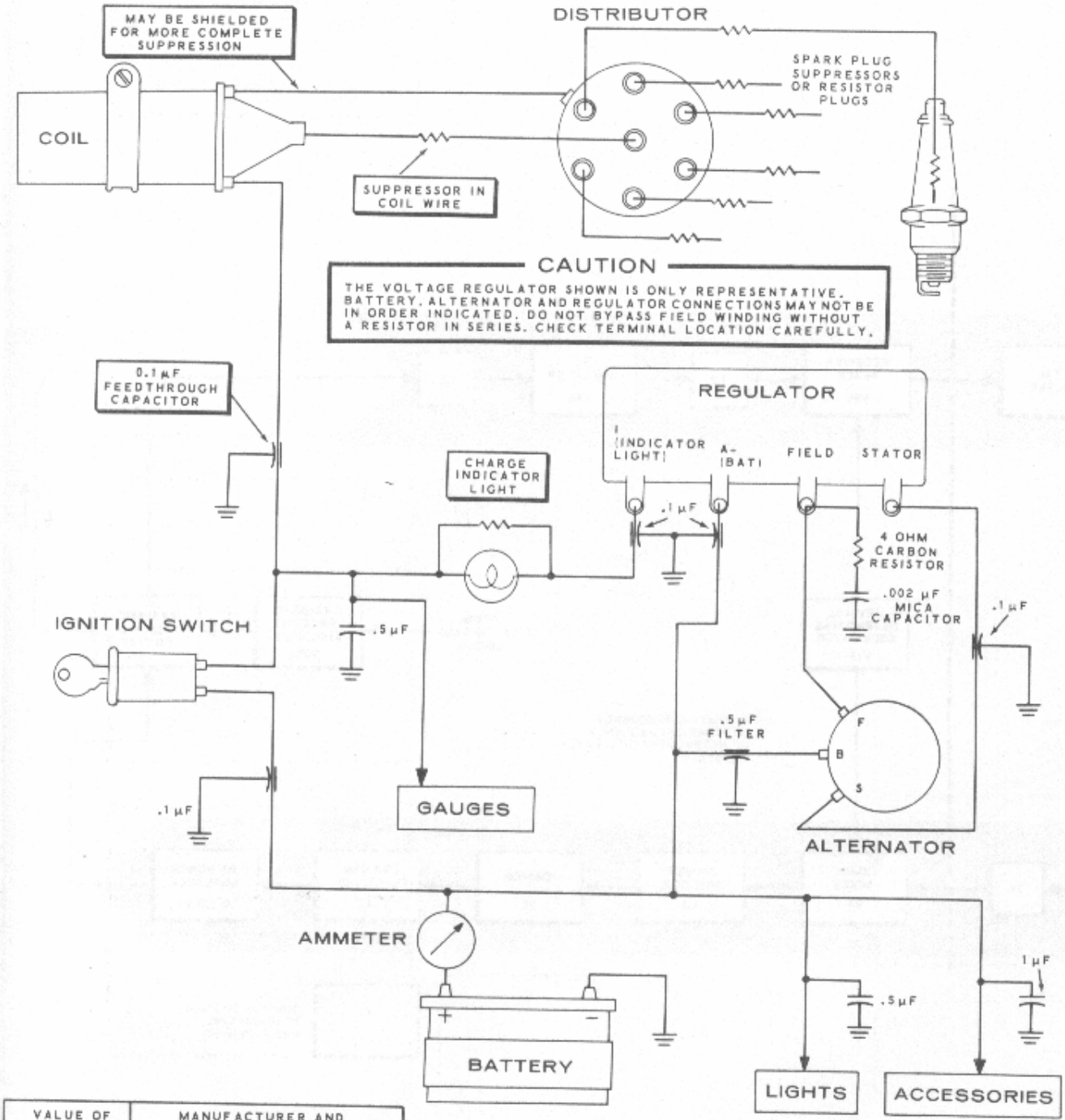
NOTE: In an extreme case where you are unable to resolve a difficulty, refer to the Service and Warranty section of the "Kit Builders Guide", and to the "Factory Repair Service" information on Page 56 of this Manual.

Troubleshooting Chart

TRANSMITTER DIFFICULTIES	POSSIBLE CAUSE
Carrier Null control changes carrier level, but not to a low enough level.	1. Mode switch in Carrier position, inserting carrier. 2. Crystal diodes CR1 through CR4 installed backwards or are faulty. 3. Transformer T1 incorrectly aligned. 4. Microphone picking up noise.
Poor modulation in Carrier position.	1. Resistor R61 burned out, due to transmitting without antenna. 2. Antenna shorted. 3. Faulty diode CR60.
Chopped or broken modulation, especially on peaks.	1. MIC Gain control set too high. 2. Faulty microphone cable or connections. 3. Receiver cutoff bias line partially shorted. Check voltages and resistances.
Radical change in Bias reading.	1. Mode switch in Carrier position. 2. Changed power supplies without rechecking transmitter adjustment. 3. Faulty Bias Adj control.
Transceiver locked in transmit mode.	1. Push-to-talk button stuck in depressed position. 2. Power supply low voltage DC incorrect. Should be 250 volts.
Plates of RF final amplifier tubes get red hot.	1. No bias on tubes. Check voltages and resistance. 2. Antenna disconnected, open, or grounded. 3. Power supply voltage too high.
Very low input to grids of RF final amplifier tubes from driver V5.	1. Coils L2 and L3 improperly installed. Check color dot markings. 2. T2 not aligned properly.
Meter switch in Operate position: Pointer does not rest near zero when microphone button is depressed.	1. Interchange V2 with V1 or V8. 2. Interchange V9 with V3 or V4. 3. Recheck setting of meter zero control. NOTE: This condition can occur if heterodyne oscillator crystals Y6 or Y7 have extremely high outputs. To overcome this condition, refer to the X-Ray View (fold-out from Page 62) and change resistor R43 in section 3A of the circuit board from 100 kΩ to 47 kΩ.

RECEIVER DIFFICULTIES	POSSIBLE CAUSE
Receiver squeals and oscillates with no antenna connected.	1. Transmitter cutoff bias line partially shorted, turning on portions of the transmitter. Check voltages and resistances. 2. Faulty capacitor C121. 3. Check bias and low B+ supply voltage.
Clarifier will not clear up speech of received SSB signal.	1. Off frequency. Check for proper heterodyne crystal. 2. Check with other known and accurate station of the same frequency. 3. Capacitor C211 incorrectly connected.
Poor sensitivity.	1. Reception switch in Local position. 2. Jumper wire between D and D improperly connected. 3. Check for shorted leads at ends of coaxial cables on circuit board.
No sound from speaker.	1. Volume control incorrectly wired. 2. Speaker faulty, or broken wire to speaker. 3. Unit is transmitting. 4. Microphone switch is not grounding receiver cut-off line (black wire). 5. Tube V11 or V12 faulty.
Low audio output.	1. Capacitor C200 (on Volume control) incorrect value.

GENERAL DIFFICULTIES	POSSIBLE CAUSE
Receive RF burns when removing antenna connector.	1. Transmitter turned on.
Filaments stay lit when Transceiver is turned Off.	1. Improper connections to DC Power Supply.
Meter reads backwards.	1. Meter improperly wired. 2. Meter switch improperly wired. 3. Meter Adjust control not set properly.
No output from heterodyne oscillator tube V13.	1. Wrong or faulty tube in socket V13. 2. C210 (Clarifier) plates shorted together. 3. Channel switch improperly wired.



VALUE OF SUPPRESSOR	MANUFACTURER AND REPRESENTATIVE TYPE	
10K OHM	ERIE TYPE	L7VR-10ME
5K OHM	ERIE TYPE	L7VR-5ME
.5 µF FEEDTHROUGH	SPRAGUE	48P18 (40 AMP), BRACKET MOUNT
.1 µF FEEDTHROUGH	SPRAGUE	80P3 (20 AMP), BULKHEAD MOUNT
	SPRAGUE	48P9 (20 AMP), BRACKET MOUNT
.5 µF	MALLORY	AG-451
1 µF	MALLORY	AG-452

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

FIGURE 9

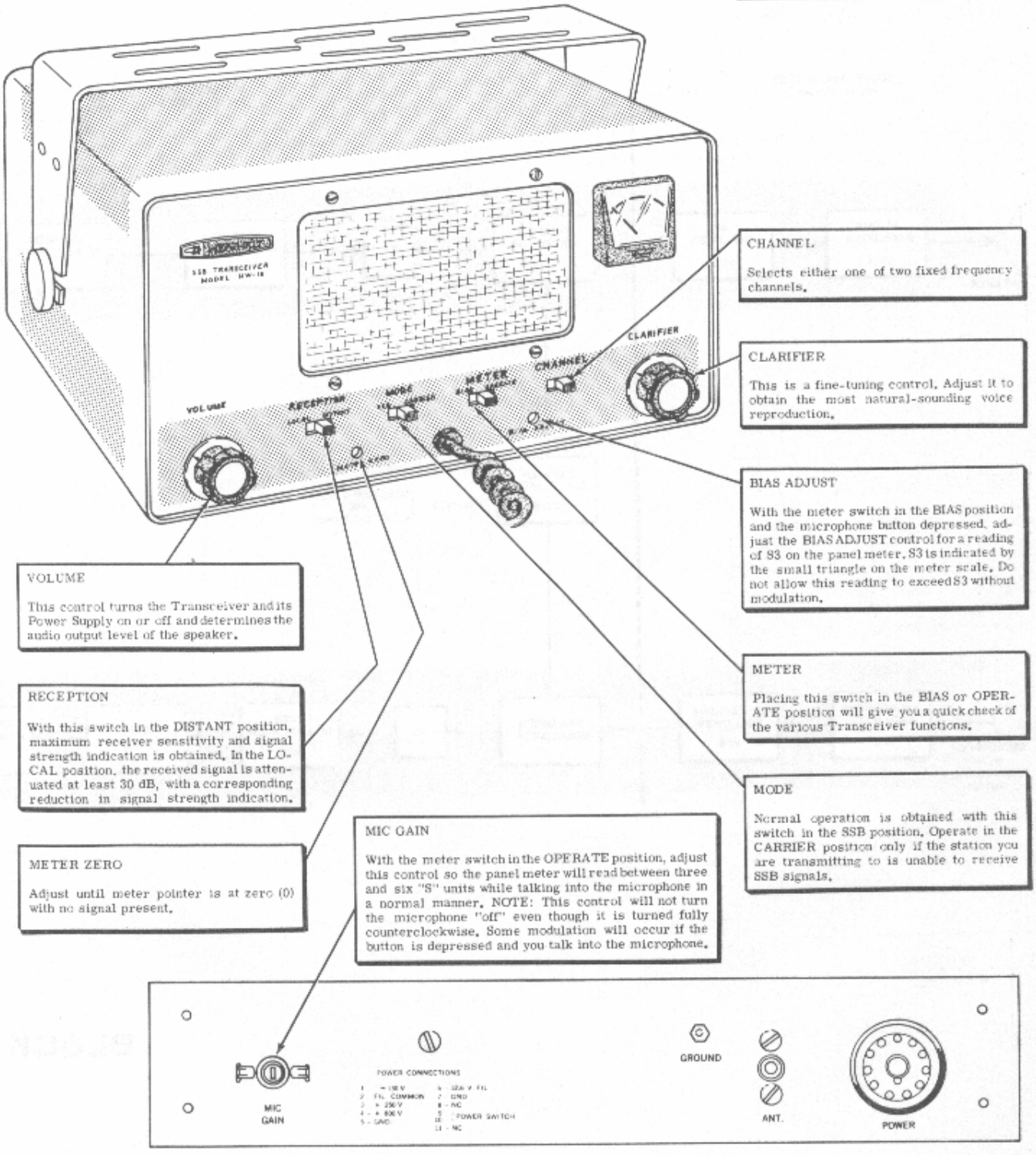
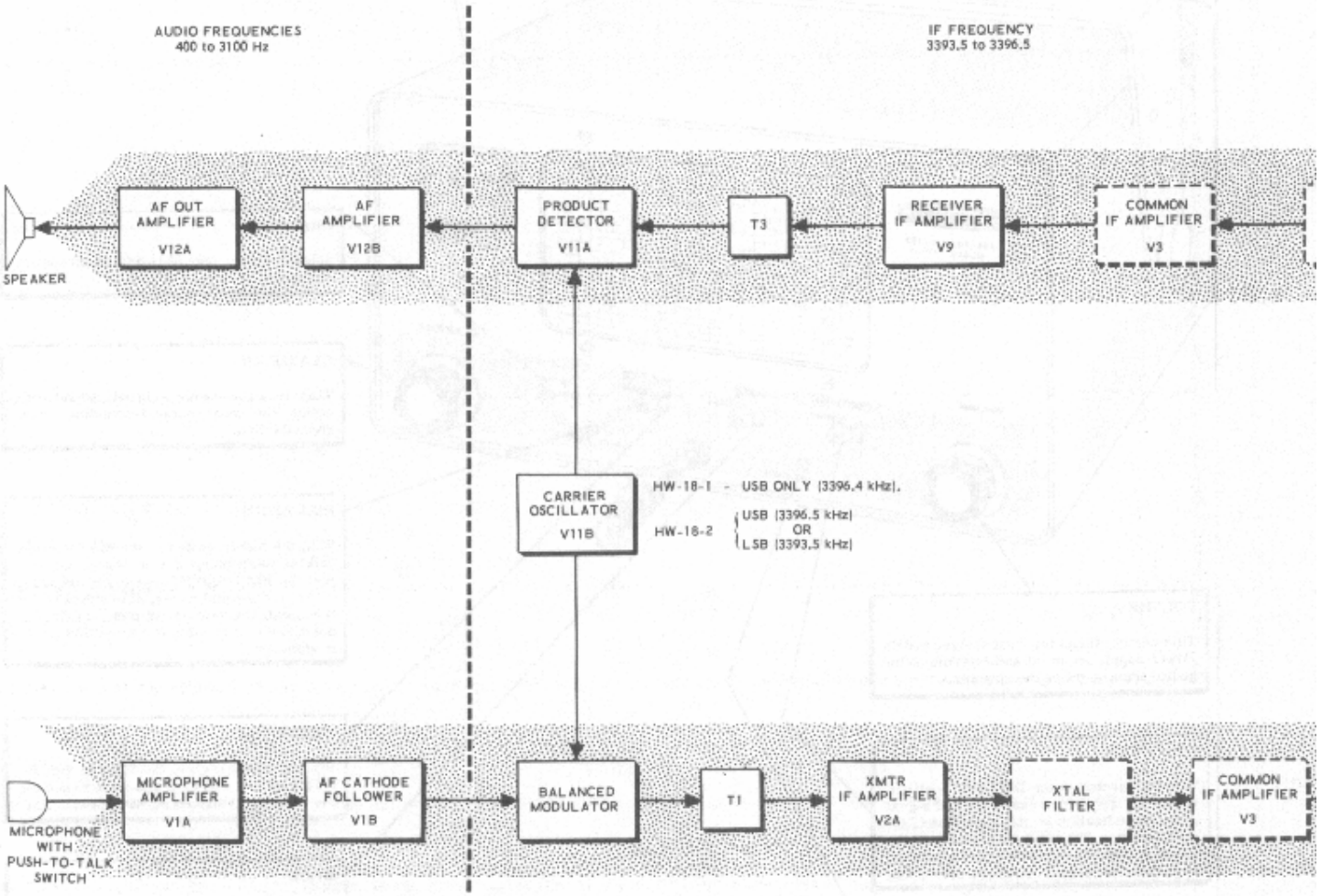
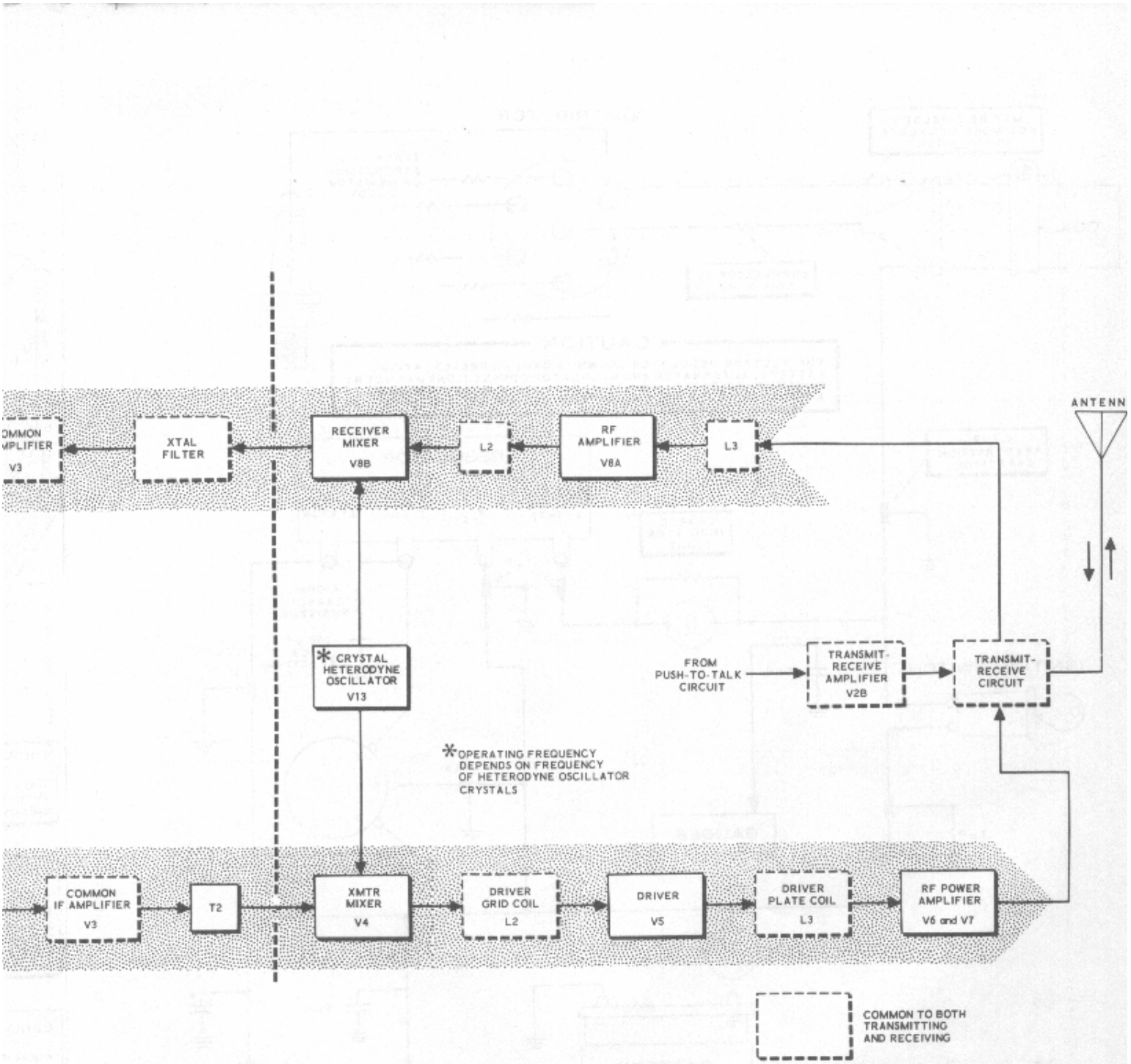

CARRIER NULL (Inside Cabinet on Circuit Board)
This control adjusts the balanced modulator so the carrier is eliminated from the transmitted output signal.
CHANNEL
Selects either one of two fixed frequency channels.
CLARIFIER
This is a fine-tuning control. Adjust it to obtain the most natural-sounding voice reproduction.
BIAS ADJUST
With the meter switch in the BIAS position and the microphone button depressed, adjust the BIAS ADJUST control for a reading of S3 on the panel meter. S3 is indicated by the small triangle on the meter scale. Do not allow this reading to exceed S3 without modulation.
METER
Placing this switch in the BIAS or OPERATE position will give you a quick check of the various Transceiver functions.
MODE
Normal operation is obtained with this switch in the SSB position. Operate in the CARRIER position only if the station you are transmitting to is unable to receive SSB signals.
VOLUME
This control turns the Transceiver and its Power Supply on or off and determines the audio output level of the speaker.
RECEPTION
With this switch in the DISTANT position, maximum receiver sensitivity and signal strength indication is obtained. In the LOCAL position, the received signal is attenuated at least 30 dB, with a corresponding reduction in signal strength indication.
METER ZERO
Adjust until meter pointer is at zero (0) with no signal present.
MIC GAIN
With the meter switch in the OPERATE position, adjust this control so the panel meter will read between three and six "S" units while talking into the microphone in a normal manner. NOTE: This control will not turn the microphone "off" even though it is turned fully counterclockwise. Some modulation will occur if the button is depressed and you talk into the microphone.
SSB TRANSCEIVER MODEL HW-18
VOLUME
RECEPTION
MODE
METER
CHANNEL
CLARIFIER
MIC GAIN
POWER CONNECTIONS
GROUND
ANT.
POWER

FIGURE 10


AUDIO FREQUENCIES
400 to 3100 Hz
IF FREQUENCY
3393.5 to 3396.5
SPEAKER
AF OUT AMPLIFIER V12A
AF AMPLIFIER V12B
PRODUCT DETECTOR V11A
T3
RECEIVER IF AMPLIFIER V9
COMMON IF AMPLIFIER V3
CARRIER OSCILLATOR V11B
HW-18-1 - USB ONLY (3396.4 kHz).
HW-18-2 USB (3396.5 kHz) OR LSB (3393.5 kHz)
MICROPHONE WITH PUSH-TO-TALK SWITCH
MICROPHONE AMPLIFIER V1A
AF CATHODE FOLLOWER V1B
BALANCED MODULATOR
T1
XMTR IF AMPLIFIER V2A
XTAL FILTER
COMMON IF AMPLIFIER V3

BLOCK DIA


OMMON
MPLIFIER
V3
XTAL
FILTER
RECEIVER
MIXER
V8B
L2
RF
AMPLIFIER
V8A
L3
ANTENN
* CRYSTAL
HETERODYNE
OSCILLATOR
V13
FROM
PUSH-TO-TALK
CIRCUIT
TRANSMIT-
RECEIVE
AMPLIFIER
V2B
TRANSMIT-
RECEIVE
CIRCUIT
*OPERATING FREQUENCY
DEPENDS ON FREQUENCY
OF HETERODYNE OSCILLATOR
CRYSTALS
COMMON
IF AMPLIFIER
V3
T2
XMTR
MIXER
V4
DRIVER
GRID COIL
L2
DRIVER
V5
DRIVER
PLATE COIL
L3
RF POWER
AMPLIFIER
V6 and V7
COMMON TO BOTH
TRANSMITTING
AND RECEIVING

OCK DIAGRAM

SPECIFICATIONS

RECEIVER SECTION

Frequency Coverage	4450 to 4650 kHz.
Channels	2 (upper sideband).
Clarifier Range	±100 Hz.
Sensitivity	.5 microvolt of input signal will provide at least a 10 dB signal-plus-noise to noise ratio.
Selectivity	2.1 kHz at 6 dB down. 6 kHz at 50 dB down.
Intermediate Frequency (IF)	3395 kHz.
Image Rejection	80 dB.
IF Rejection	50 dB.
Antenna Input Impedance	50 Ω, unbalanced.
Receiver Audio Response	400 to 3000 Hz.
Receiver Audio Power Output	1 watt.
Internal Speaker	8 Ω rectangular 4" x 6".

TRANSMITTER SECTION

Frequency Coverage	4450 to 4650 kHz.
Channels	2.
Transmitting Modes	Upper sideband carrier-suppressed, and low level carrier with sideband.
Low-level Carrier Output	Approximately 20 watts.
Frequency Accuracy	.005% overall (after adjusting to channel frequency).
Clarifier Range	±100 Hz.
RF Power Input	
SSB Mode	200 watts P.E.P.
Carrier Mode	40 watts minimum.
Output Impedance	50 Ω, unbalanced.
Transmitter Audio Response	400 to 3100 Hz.
Microphone	High impedance, ceramic.

Unwanted Sideband Suppression.	45 dB minimum below peak output with 1000 Hz modulation.
Carrier Suppression.	45 dB minimum below peak output.
Ambient Temperature Range.	+10 degrees to +110 degrees F.

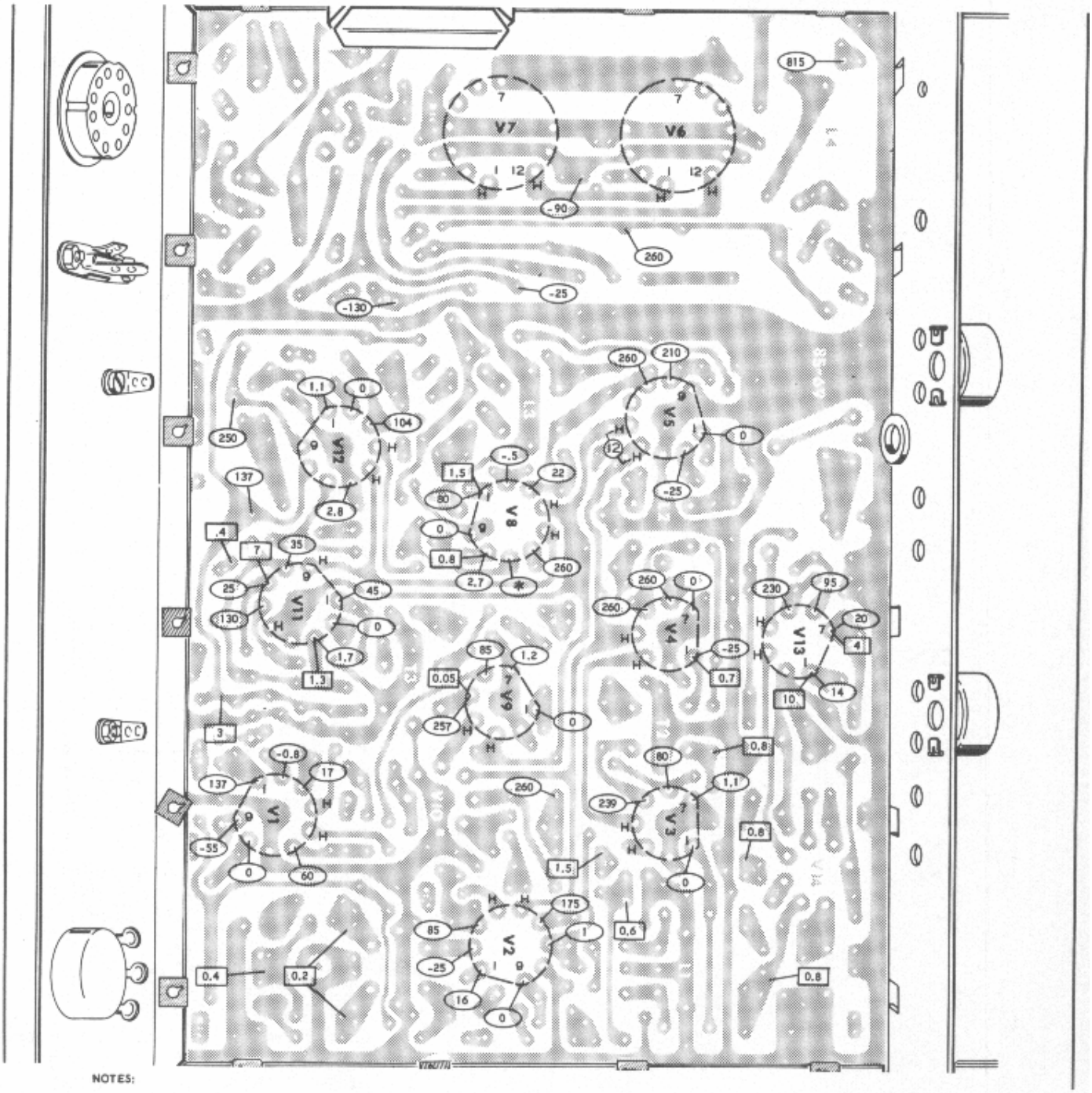
CONTROLS-SWITCHES

Front Panel.	VOLUME (with On/Off switch) RECEPTION (Local-Distant). MODE (SSB-Carrier). METER (Bias-Operate). CHANNEL (Two position). CLARIFIER (Fine Tuning). METER ZERO. BIAS ADJUST.
Circuit Board.	CARRIER NULL.
Chassis Rear.	MIC GAIN.

GENERAL

	12.6 V, AC or DC	800 V DC B+	250 V DC B+	-130 V DC Bias
Power Requirements - Transmit.	3.75 A	250 mA peak	100 mA	5 mA
Receive.	3.75 A	-0-	65 mA	5 mA

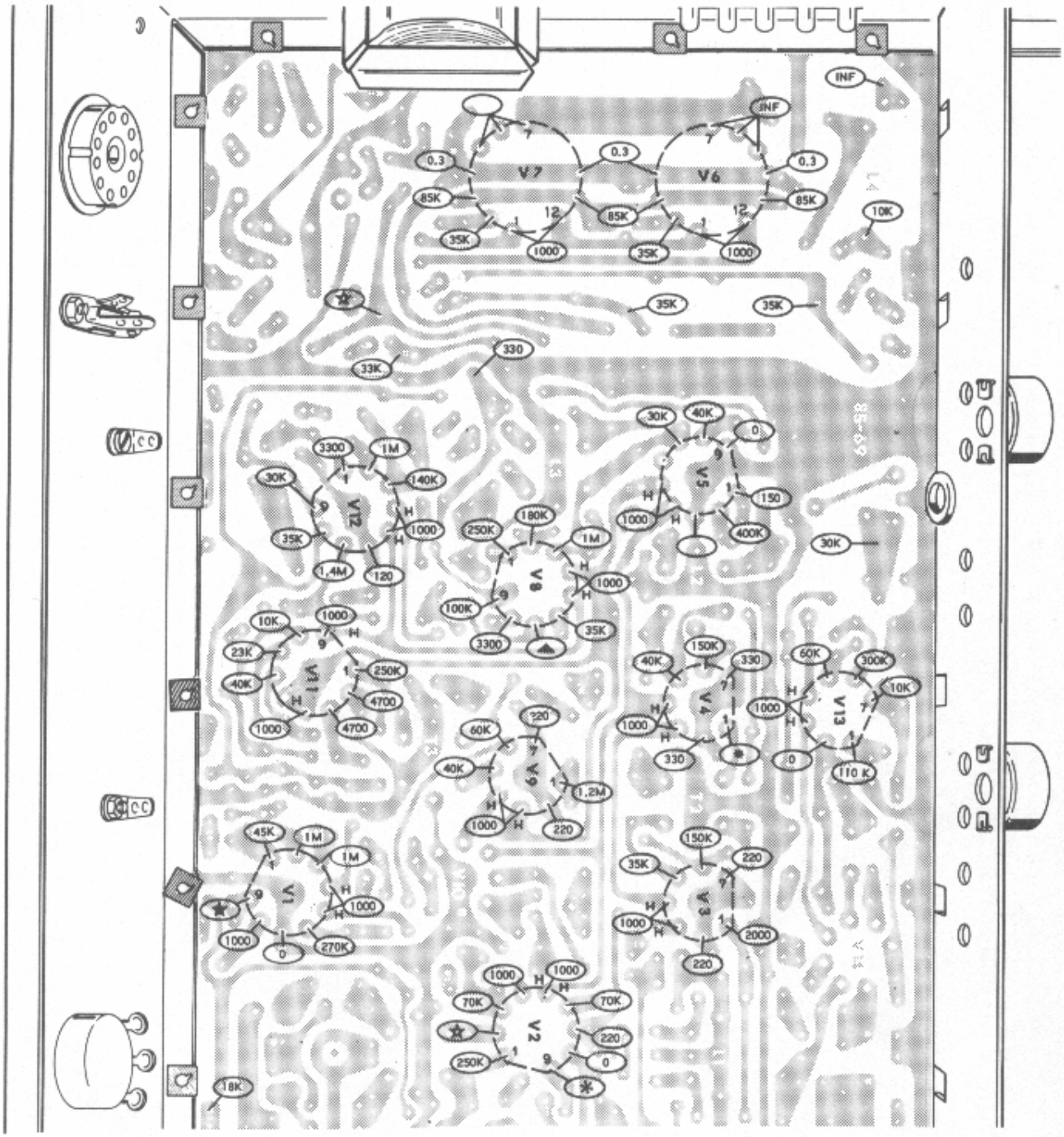
Tube Complement.	3 - 6EA8: Microphone amplifier and AF cathode follower - Transmitter IF amplifier and TR amplifier - RF amplifier and receiver mixer. 4 - 6AU6: Heterodyne oscillator - IF amplifiers (2) - Transmitter mixer. 1 - 12BY7: Transmitter driver. 1 - 12AT7: Product detector and carrier oscillator. 1 - 6EB8: AF amplifier and AF output. 2 - 6GE5: Transmitter RF output.
Cabinet Dimensions.	6-1/4" high x 12-1/4" wide x 10" deep. Add 1" to height, width, and depth for gimbal bracket, knobs, and connecting plugs.
Net Weight.	12 lbs.



NOTES:

1. NO SIGNAL INPUT.
2. VOLUME CONTROL - 9 O'CLOCK.
3. MODE SWITCH IN SSB POSITION.
4. METER SWITCH IN OPERATE POSITION.
5. WITH HP-23 OR HP-23A POWER SUPPLY.
6. ⬭ INDICATES VOLTAGE MEASURED WITH 11 MΩ INPUT VTVM FROM POINT INDICATED TO CHASSIS GROUND.
7. ▭ INDICATES RF VOLTAGE MEASURED WITH RF PROBE AND 11 MΩ INPUT VTVM FROM POINT INDICATED TO CHASSIS GROUND.
8. (*) .3 V WITH RECEPTION SWITCH IN DISTANT POSITION. 15 V WITH RECEPTION SWITCH IN LOCAL POSITION.
9. HEATER (FILAMENT) VOLTAGE MEASURED BETWEEN POINTS H AND H AT EACH TUBE LOCATION. VOLTAGE WILL BE EITHER AC OR DC DEPENDING ON POWER SUPPLY BEING USED. ALL HEATER VOLTAGES ARE 6 V UNLESS MARKED OTHERWISE.
10. VOLTAGE READINGS MAY VARY ±20%.

RECEIVER VOLTAGE CHART
FIGURE 12



NOTES:

1. READINGS TAKEN BETWEEN POINTS INDICATED AND CHASSIS GROUND.
2. UNIT COLD - ALL TUBES AND PILOT LAMP INSTALLED.
3. ANTENNA, GROUND, AND POWER SUPPLY CABLES DISCONNECTED.
4. METER SWITCH IN OPERATE POSITION.
5. RECEPTION SWITCH IN DISTANT POSITION EXCEPT AS NOTED.
6. DIODES IN CIRCUITS MAY AFFECT READINGS, DEPENDING ON RESISTANCE RANGE USED.

- RECEPTION SWITCH IN DISTANT POSITION - 220 Ω.
  RECEPTION SWITCH IN LOCAL POSITION - INFINITE RESISTANCE.
- MICROPHONE BUTTON PRESSED - 150 kΩ.
  MICROPHONE BUTTON RELEASED - 0 Ω.
- 30 kΩ TO 2.2 MΩ (DIODE AFFECTS RESISTANCE READING).
- 100 kΩ TO 2.2 MΩ (DIODE AFFECTS RESISTANCE READING).
- VARIES FROM 42 kΩ TO 1 MΩ WITH ROTATION OF MIC GAIN CONTROL.

RESISTANCE CHART
FIGURE 11

Equipment Used To Prepare Specifications.	Heathkit IM-11 VTVM with 309-C RF Probe. Heathkit SB-610 Monitorscope. Heathkit IG-72 Audio Generator. Heathkit IM-12 Distortion Meter. Heathkit HN-31 Cantenna. Panoramic Radio Products, Inc. "Panalyzer," Model SB-12A. Hewlett Packard, Signal Generator, Model 606A. Tektronix Oscilloscope, Model 581A. Boonton RF Voltmeter, Model 91-CA. Dynascan Digital Voltmeter, Model III.
Equipment Needed To Check And Calibrate. . . .	VTVM and RF Probe preferable (VOM may be used). Dummy load. Reflected power meter. Accurate frequency meter or counter. Signal generator covering operating frequencies.

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.

FACTORY REPAIR SERVICE

You can return your completed kit to the Heath Company Service Department to have it repaired for a minimum service fee. (Kits that have been modified will not be accepted for repair.) If you wish, you can deliver your kit to a nearby Heath Authorized Service Center. These centers are listed in your Heathkit catalog.

To be eligible for replacement parts under the terms of the warranty, equipment returned for factory repair service, or delivered to a Heath Authorized Service Center, must be accompanied by the invoice or the sales slip, or a copy of either. If you send the original invoice or sales slip, it will be returned to you.

If it is not convenient to deliver your kit to a Heath Authorized Service Center, please ship it to the factory at Benton Harbor, Michigan and follow the following shipping instructions:

Prepare a letter in duplicate, containing the following information:

- Your name and return address.
- Date of purchase.
- A brief description of the difficulty.
- The invoice or sales slip, or a copy of either.
- Your authorization to ship the repaired unit back to you C.O.D. for the service and shipping charges, plus the cost of parts not covered by the warranty.

Attach the envelope containing one copy of this letter directly to the unit before packaging, so that we do not overlook this important information. Send the second copy of the letter by separate mail to Heath Company, Attention: Service Department, Benton Harbor, Michigan.

Check the equipment to see that all parts and screws are in place. (Do not include wooden cabinets when shipping receivers, tuners, amplifiers, or TV sets, as these are easily damaged in shipment.) Then, wrap the equipment in heavy paper. Place the equipment in a strong carton, and put at least THREE INCHES of resilient packing material (shredded paper, excelsior, etc.) on all sides, between the equipment and the carton. Seal the carton with gummed paper tape, and tie it with a strong cord. Ship it by prepaid express, United Parcel Service, or insured parcel post to:

Heath Company
Service Department
Benton Harbor, Michigan 49022

CIRCUIT DESCRIPTION

Refer to the Schematic Diagram (fold-out from Page 69) and Block Diagram (fold-out from Page 54) while reading this Circuit description.

SCHEMATIC DIAGRAM

The letter-number designations on the Schematic Diagram are used to identify resistors, capacitors, chokes, etc. Each of these designations is related by its first (and second) number to the tube stage in which it is used. For instance, the resistors in tube stage V1 are designated R10, R11, etc. In tube stage V12 they are designated R120, R121, etc. This system of component designation is used throughout the Schematic.

Numbers or letters in a diamond on the Schematic refer to the terminals on the circuit board and the color of the harness wires. Numbers 1 through 9 indicate solid colors; numbers 10 through 18 refer to wires with a white background and a single color stripe; and numbers 20 through 28 refer to wires with a white background and two identical color stripes. The numbers can be related to wire colors by using the same color code as used for resistors: brown = 1, red = 2, orange = 3, etc. For example: ◇7◇ = a violet wire, ◇22◇ = a red-red-white wire.

TRANSMITTER SECTION

Transmit-Receive Amplifier V2B

Depressing the push-to-talk switch on the microphone removes the ground from terminal R of the switch, which causes the receiver stages and T-R (transmit-receive) amplifier V2B to be biased to cutoff. At the same time, switch terminal T is grounded, reducing the high negative bias voltage on the transmitter cutoff line and placing the transmitter into operation. Since V2B is now at cutoff, its plate voltage will be almost equal to the B+ supply voltage. This condition isolates the antenna from coil L3 by reverse biasing T-R diode D72 so no signal will pass through it. Coil L3 now functions as the Driver plate coil.

With the microphone switch in the normal (listen) position, the receiver cutoff line and the grid of V2B are grounded. This saturates V2B, resulting in a low voltage at its plate.

The anode side of T-R diode D72 is positive biased by a voltage divider that consists of R87 and R88 from the B+ 250 V line to ground. The cathode end of T-R diode D72 is connected to the plate of T-R amplifier V2B. Since the voltage at the plate of V2B is lower than the voltage at the anode of D72, diode forward current will flow. This will effectively switch the incoming signals from the antenna to the primary of coil L3, which now functions as the receiver antenna coil.

Microphone Amplifier V1A

Voice signals from the microphone are coupled through capacitor C12 to the grid of microphone amplifier tube V1A. The amplified signal at the plate of V1A is coupled through C14 to the Mic Gain control. The setting of the Mic Gain control determines the amount of modulation.

Audio Frequency Cathode Follower

The audio signal from the Mic Gain control is applied to AF cathode follower stage V1B. This stage matches the impedance of the balanced modulator. Bypass capacitor C19 keeps the modulator RF voltages from reaching V1B. During receiving, bias voltage cuts off V1B and the other transmitter stages.

Balanced Modulator

The audio signal from V1B and the RF signal from carrier oscillator V11B are applied to the 4-diode balanced modulator. This ring-type modulator uses germanium diodes CR1 through CR4.

The carrier signal is applied across the modulator diode ring in a balanced circuit, consisting of one winding of transformer T1, capacitors C1 and C2, resistors R3 and R4, and the Carrier Null control. The Carrier Null control is used to balance out the carrier signal in the modulator, leaving only the upper and lower sideband signals at the modulator output.

The output from the balanced modulator is the result of combining the audio and carrier signals. Neither the audio or carrier signals appear in the output, but the effect of the audio signals unbalancing the nulled circuit at an audio rate produces the sum-and-difference frequencies called sidebands. With no audio, there is virtually no output from the balanced modulator.

With the Mode switch in the Carrier position, a DC voltage is applied to the balanced modulator through resistors R1 and R2. This DC voltage is used to unbalance the modulator and produce a low-level compatible AM output signal.

Transmitter IF Amplifier

The sideband signals from the balanced modulator are coupled through transformer T1 and amplified by transmitter IF amplifier V2A. These signals are then applied to a crystal filter, consisting of crystals Y2 through Y5, and coil L1. The crystal filter eliminates one sideband, and permits the other sideband to pass through to common IF amplifier V3 for additional amplification.

Stage V2A is turned off while receiving by applying additional negative voltage to its grid through the secondary of transformer T1. This control voltage is impressed on the ALC (automatic level control) line, and controls the gain of stages V4 and V5 to prevent overloading. The relative amount of ALC voltage is indicated by the meter. Normally the meter pointer rests at or slightly below zero. If the operator talks too loudly or if the Mic Gain control is set too high, the ALC voltage change will increase the bias and reduce the transmitter gain.

Common IF Amplifier V3

When transmitting, V3 amplifies the single sideband signal from the crystal filter, and then applies this signal to IF transformer T2. When receiving, the receiver IF signal is amplified by V3 and is then applied to receiver IF amplifier V9.

Transmitter Mixer V4

Transmitter mixer V4 receives two signals simultaneously; one is the SSB signal from T2, and the other is the heterodyne oscillator signal from V13, which is coupled through the secondary of transformer T2. Tube V4 produces the frequency difference of these signals, which is at the operating frequency. This signal is applied to the primary of coil L2. (Tube V4 is cut off by bias voltage from the ALC line when receiving.)

Coil L2, which has two windings, is broad-tuned to cover the Transceiver channel frequencies. When transmitting, it is the driver grid coil; when receiving, it is the coupling between receiver RF, amplifier V8A and receiver mixer V8B.

Heterodyne Oscillator V13

Heterodyne oscillator V13 is a Colpitts type oscillator which operates above the transceiver IF and operating frequencies and is crystal controlled for maximum stability. Capacitors C132, C133, and C134 form a divider for oscillator feedback and output. The oscillator output is taken from the junction of C133 and C134 and is common to both the transmitter and receiver sections. This output is applied to the cathode of receiver mixer V8B, and coupled through C135, C139, and transformer T2 to transmitter mixer V4.

The Channel switch selects either one of two crystals Y6 or Y7. C208 and C209 are crystal trimmer capacitors for setting each channel to exact frequency. Clarifier capacitor C210 provides a fine tuning range of approximately 100 Hz above or below the channel frequency.

Driver V5

Driver V5 receives the signal voltage from coil L2 through parasitic suppressor resistor R50. The ALC line is also connected to V5 to control

transmitter gain, and to cut off the driver when receiving. Single-tuned coil L3 and double-tuned coil L2 form a bandpass device that covers the frequencies involved without the necessity of tuning the driver stage. Voltage for bridge neutralization of final amplifier tubes V6 and V7 is fed through capacitors C63 and C64 to the bottom of coil L3, and across C55. The small winding of coil L3 is used for the input signal from the antenna when receiving.

RF Final Amplifiers

RF final amplifiers V6 and V7 are connected in parallel. High voltage plate connections are under the chassis. The grids are connected by a long foil strip on the circuit board. This strip is bypassed at its ends by capacitor C61 and C71 to suppress VHF oscillations. Cathode resistor R71 is a meter shunt for measuring cathode current when the Meter switch is in the Bias position.

Tubes V6 and V7 are operated as linear amplifiers, with high power sensitivity. Grid load resistor R72 is connected to the Bias Adjust control through R73, to allow adjustment of the grid voltage for proper operation. The Bias Adjust control is grounded through resistors R75 and R203 when transmitting. When receiving, this control is grounded through resistors R76 and R77. This increases the grid bias and cuts off the final tubes.

Automatic Level Control (ALC)

No grid current is drawn by tubes V6 and V7 in normal linear operation; however, when higher than normal grid drive is applied, grid current will flow and change the bias voltage. This higher-than-normal grid drive, caused by too much signal, makes the bias voltage change at an audio rate. This varying bias voltage is coupled through capacitor C75 to diodes D70 and D71. These diodes rectify the signal to develop the negative ALC voltage, which is applied to V2A, V4, and V5 to control their gain. Capacitor C74 and resistor R79 filter this voltage and provide the proper time delay for ALC action. The entire ALC circuit is biased "below ground" by resistors R76 and R77 to cut off the transmitter section when receiving.

Transmitter Output Circuit

The plates of the RF amplifier tubes are connected to the supply voltage by choke RFC61. Their signal is coupled to the pi-section output circuit through capacitor C67. Output coil L4 is fixed-tuned by capacitors C206 and C207. Antenna loading is fixed by capacitor C77 for a 50 Ω load. With the Mode switch in the Carrier position, a sampling of the output voltage at the junction of resistors R61, R62, and diode CR60 results in a bias voltage on the ALC line which will limit the carrier-plus-sideband output to a level of approximately 20 watts.

RECEIVER SECTION

Radio Frequency Amplifier V8A And Receiver Mixer V8B

The incoming signal is connected to RF amplifier V8A through coil L3. The amplified signal from V8A is then coupled through coil L2 to receiver mixer V8B. During receiving, cutoff bias is removed from the receiver section to permit tubes V8A, V8B, V9, and V12A to operate. V8A is controlled by bias from the AVC (automatic volume control) circuit. AVC in the receiver is similar to ALC in the transmitter, in that it maintains a constant receiver output (gain) even though the incoming signal level may vary considerably.

The Reception switch, in the Local position, opens the cathode of RF amplifier V8A to prevent overloading on very strong signals. This reduction in RF gain will also be reflected in lower meter indications. Operating at a reduced RF gain, however, does not disturb the AGC circuitry, nor will it cut off the receiver completely. It simply reduces strong signals to a level that can be handled by the receiver to provide minimum cross modulation or desensitization.

Crystal Filter

The signal from mixer V8B is coupled to the crystal filter through capacitor C80, which is small in value to avoid upsetting the input impedance of the filter. The crystal filter exhibits

the same characteristics in receiving as in transmitting; it shapes the IF passband to have steep sides, a flat top, and a narrow bandwidth. This permits good selectivity for SSB reception in crowded bands.

Common IF Amplifier V3 And Receiver IF Amplifier V9

Signals from the crystal filter are amplified by common IF amplifier V3 and then fed to receiver IF amplifier V9. The cathode (and suppressor grid) of V9 is connected to the cathode of transmitter IF amplifier tube V2A. The meter, which is connected in this circuit, indicates received signal strength in S units, as the AVC voltage changes the current in V9. The meter functions as an ALC indicator when transmitting, without any switching. The gain of V9 is controlled by the AVC voltage applied by resistors R91 and R92.

Product Detector V11A And Audio Frequency Amplifier V12B

The amplified signal from V9 is coupled through IF transformer T3 to the grid, and a signal from carrier oscillator V11B is fed to the cathode, of product detector V11A. A heterodyne mixing action takes place in V11A that results in an audio output signal which is equal to the difference frequency between these two signals. Capacitors C111 and C113 bypass any RF signal coming from V11A, but permit the audio signal to pass through to AF amplifier V12B. The output from V12B is fed to the AF output amplifier V12A through the Volume control, and to the AVC circuit.

Automatic Volume Control

Audio voltage is coupled to diodes D120 and D121 through resistor R128 and capacitor C128. The diodes and capacitor C129 form a voltage doubler, producing a negative DC voltage proportional to the signal strength. Full AVC voltage is applied to the grid of receiver RF amplifier V8A to prevent overloading by strong received signals.

Capacitor C129 in the AVC circuit charges quickly to furnish a fast AVC response time, while the charging of larger capacitor C88 gives a slow AVC release time. Resistors R80, R93, R124, R122, and R123, with capacitors C88, C93, and C129 divide the AVC voltage applied to V9 and V12A and provide decoupling. To provide delayed AVC, resistor R123 is returned to the cathode of V12B rather than to ground. This balances the AVC voltage (which is caused by noise when no signal is being received) with a small positive voltage to improve receiver sensitivity at low signal levels.

CARRIER OSCILLATOR

Carrier oscillator V11B supplies an RF signal to the balanced modulator, and a heterodyning signal to product detector V11A. Tube V11B is a Colpitts type oscillator. Crystal Y1 determines the operating frequency to accurately maintain the proper frequency relationship with the crystal filter bandpass frequencies. Capacitors C117 and C118 provide feedback to maintain oscillation. The output of V11B is coupled through capacitors C115 and C116 to the receiver and transmitter circuits respectively.

AUDIO FREQUENCY OUTPUT AMPLIFIER V12A

Amplified audio signals from V12A are fed to the speaker through output transformer T4. To provide maximum intelligibility, the frequency response of the output stage is limited to the voice frequency range by a sharp-cutoff, high frequency, degenerative feedback loop. High frequencies across RFC120 causes its impedance to rise. The high frequencies are returned out-of-phase to the grid of V12B by C126. This signal cancels out the incoming high frequency audio and noise signals at the grid of V12B. Capacitor C120 is a low frequency cathode bypass to ground, and capacitor C127 serves as a parasitic oscillation suppressor.

FILAMENTS

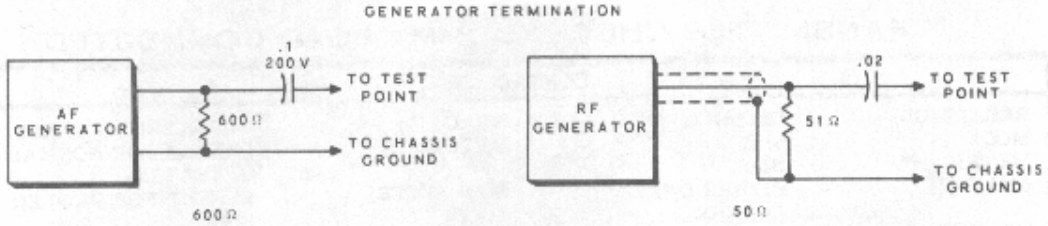
The filament wiring of the Transceiver is a series-parallel arrangement that balances the filament voltage without wasting power in dropping resistors. This filament arrangement allows the use of both 6 volt and 12 volt filament tubes in the Transceiver design. The filaments of RF power amplifiers V6 and V7 are isolated by choke RFC60 to prevent RF energy from getting to the other tube filaments.

POWER SUPPLY

Operating voltages for the Transceiver are provided by an external power supply. The power supply is turned on or off by the switch on the Transceiver Volume control, which is wired through the Transceiver Power plug to the external power supply.

RECEIVER
SIGNAL VOLTAGE CHART

NOTE: Refer to Figure 14 for Signal Voltage Test Points.

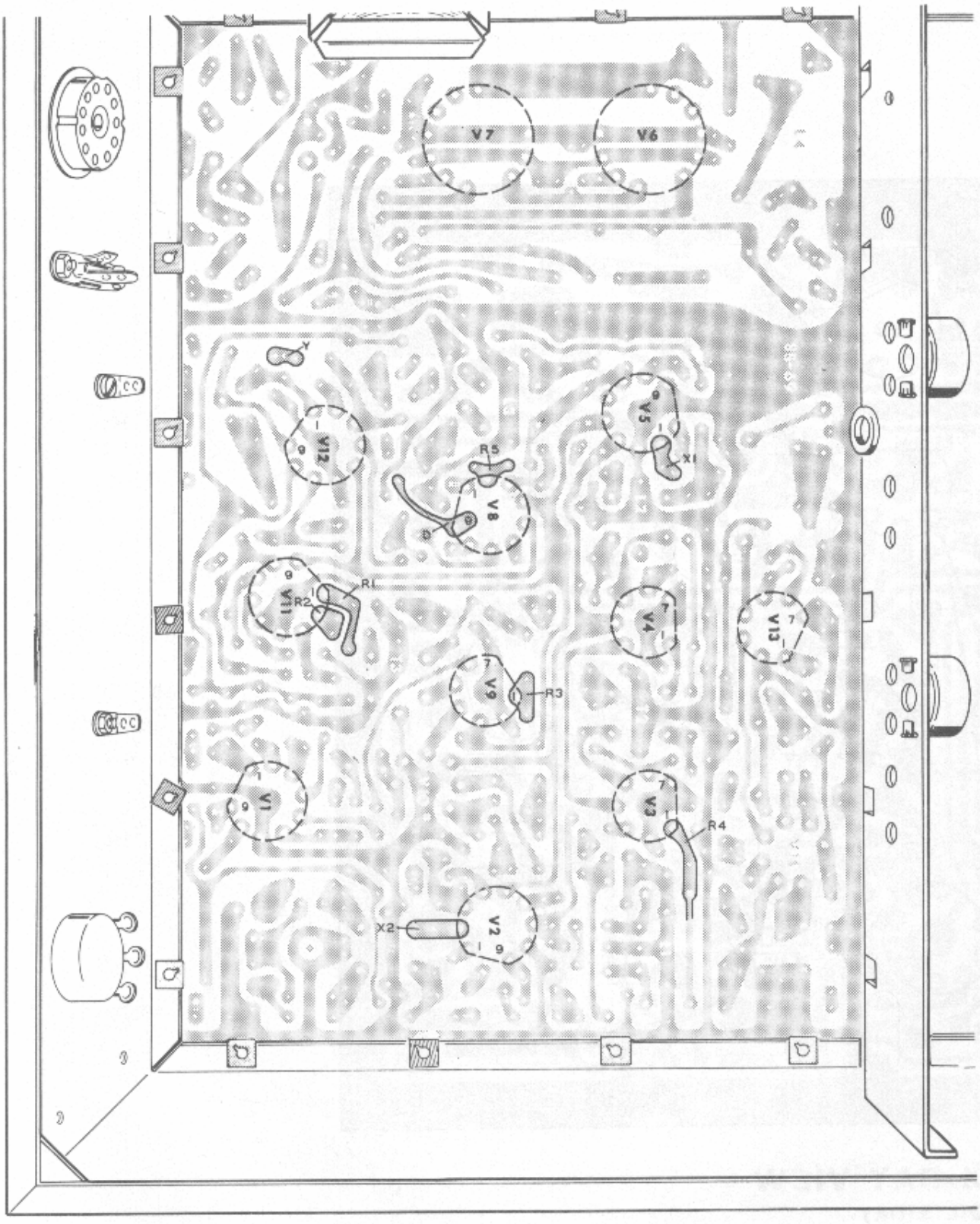


RECEIVER CHECK (ANTENNA DISCONNECTED)

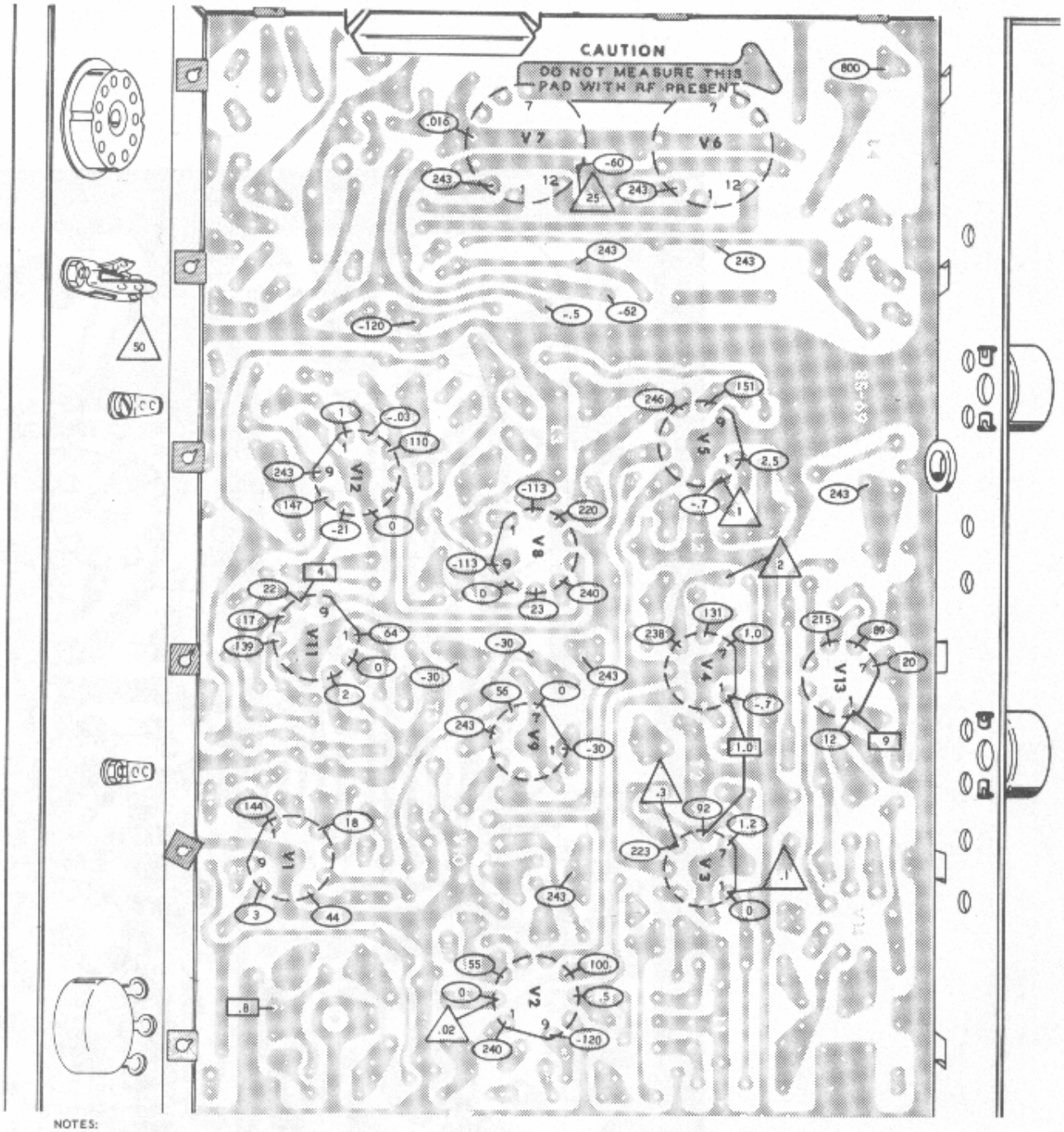
CONTROL SETTINGS

RECEPTION	-	DISTANT.	MIC GAIN	-	COUNTERCLOCKWISE.
MODE	-	SSB.	METER ZERO	-	PRESET FOR NORMAL OPERATION.
METER	-	OPERATE.			
CHANNEL	-	EITHER OPERATING CHANNEL.	BIAS ADJUST	-	PRESET FOR PROPER BIAS.
VOLUME	-	POWER ON - VOLUME AT MINIMUM.	CARRIER NULL	-	PRESET FOR NULLED CARRIER.
CLARIFIER	-	12 O'CLOCK.			

INPUT POINT	GENERATOR TERMINATION	GENERATOR FREQUENCY	INPUT LEVEL	OUTPUT POINT	VOLTMETER OR S-METER READING	NOTES
Y	AF GENERATOR 600 Ω	1000 Hz	1.0 V	ACROSS SPKR TERMINALS	1.7 VAC	Turn volume control fully clockwise.
R1			0.1 V		S9	Adjustment of volume control affects reading.
R2	RF GENERATOR 50 Ω	3395 kHz	15,000 μV		S9	Volume control at 9 o'clock position.
R3			1500 μV		S9	
R4			50 μV		S9	
D	RF GENERATOR 50 Ω	EITHER CHANNEL FREQUENCY	300 μV		S9	
R 5			300 μV		S9	
ANT	RF GENERATOR DIRECT		100 μV		S9	



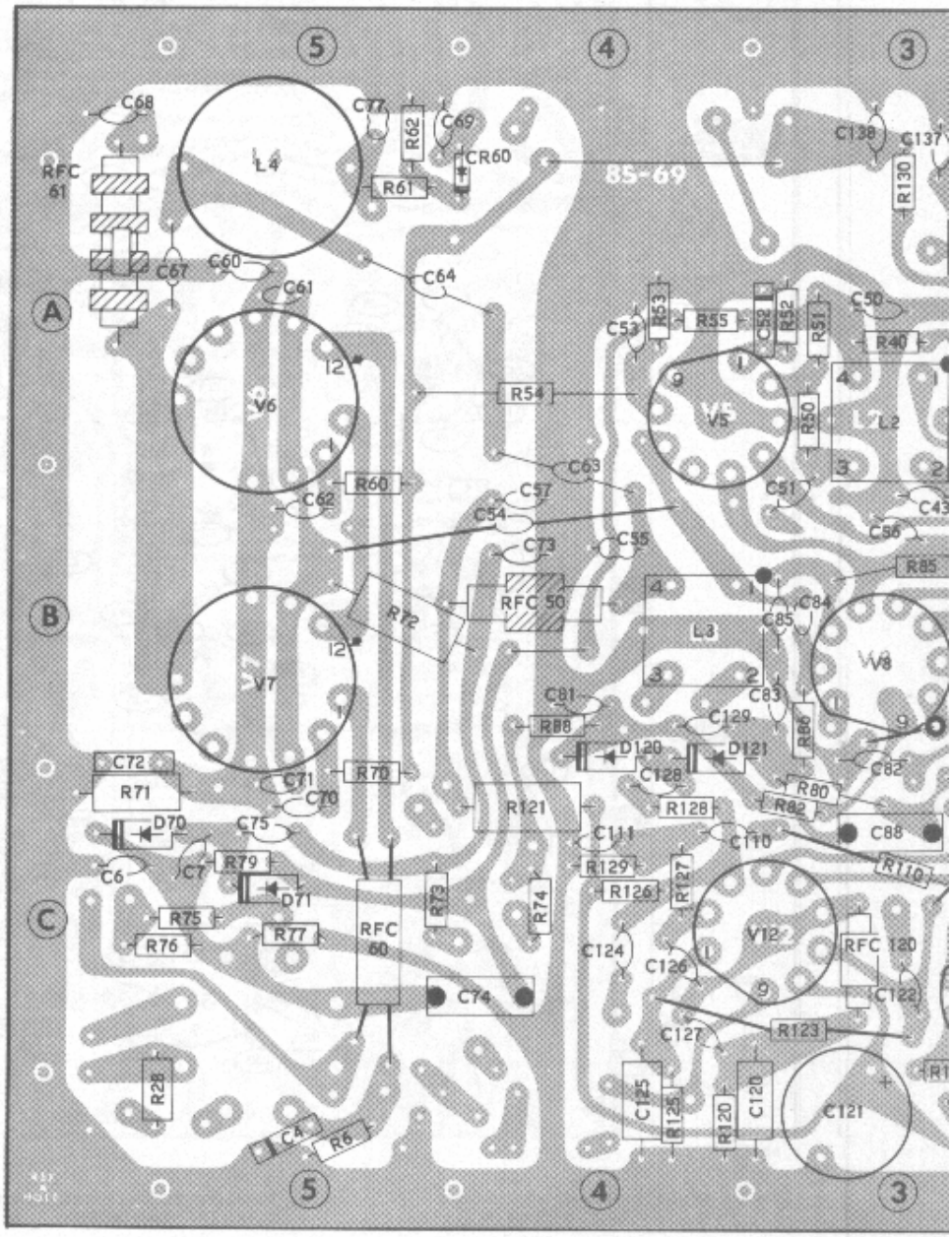
SIGNAL VOLTAGE TEST POINTS
FIGURE 14



NOTES:

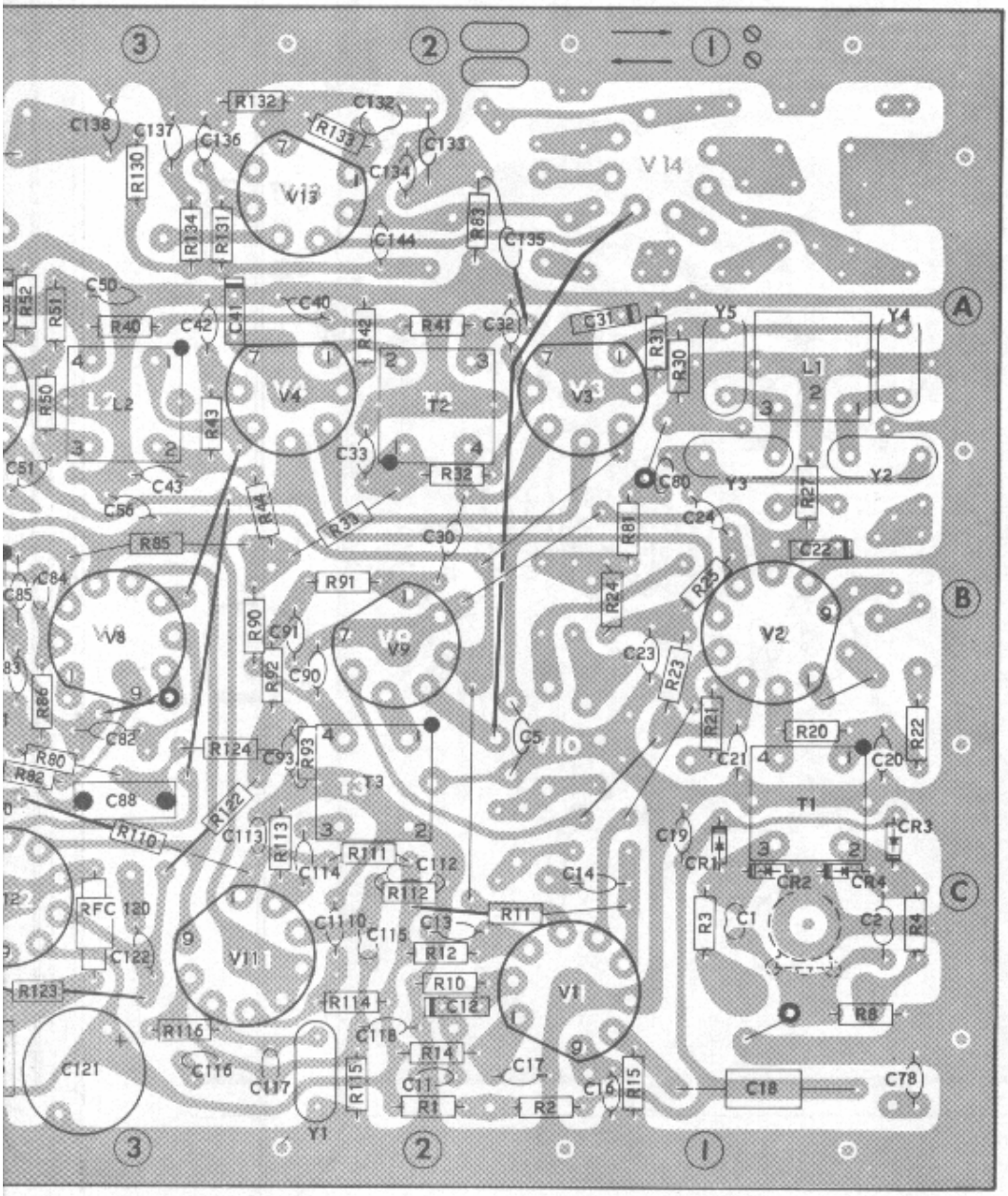
1. ALL READINGS TAKEN WITH 50 Ω DUMMY LOAD CONNECTED TO ANTENNA JACK.
2. MODE SWITCH IN SSB POSITION.
3. METER SWITCH IN BIAS POSITION.
4. CARRIER NULLED.
5. BIAS - SET TO MARK ▼ ON METER SCALE.
6. MIC GAIN - COUNTERCLOCKWISE.
7. ⬭ INDICATES DC VOLTAGE MEASURED WITH 11 MΩ INPUT VTVM FROM POINT INDICATED TO CHASSIS GROUND.
8. △ INDICATES RF VOLTAGE MEASURED WITH RF PROBE AND 11 MΩ INPUT VTVM. PRESS MICROPHONE BUTTON - THEN HUM INTO MICROPHONE AND ADJUST MIC GAIN CONTROL TO PRODUCE A READING OF S9 ON TRANSCEIVER METER.
9. ▭ INDICATES RF VOLTAGE - NO MODULATION.
10. ALL READINGS TAKEN WITH MICROPHONE BUTTON DEPRESSED.
11. VOLTAGES MAY VARY ±20%.

TRANSMITTER VOLTAGE CHART
FIGURE 13



CIRCUIT BOARD

(VIEWED FROM F



BOARD X-RAY VIEW

VED FROM FOIL SIDE)

TRANSMITTER
SIGNAL VOLTAGE CHART

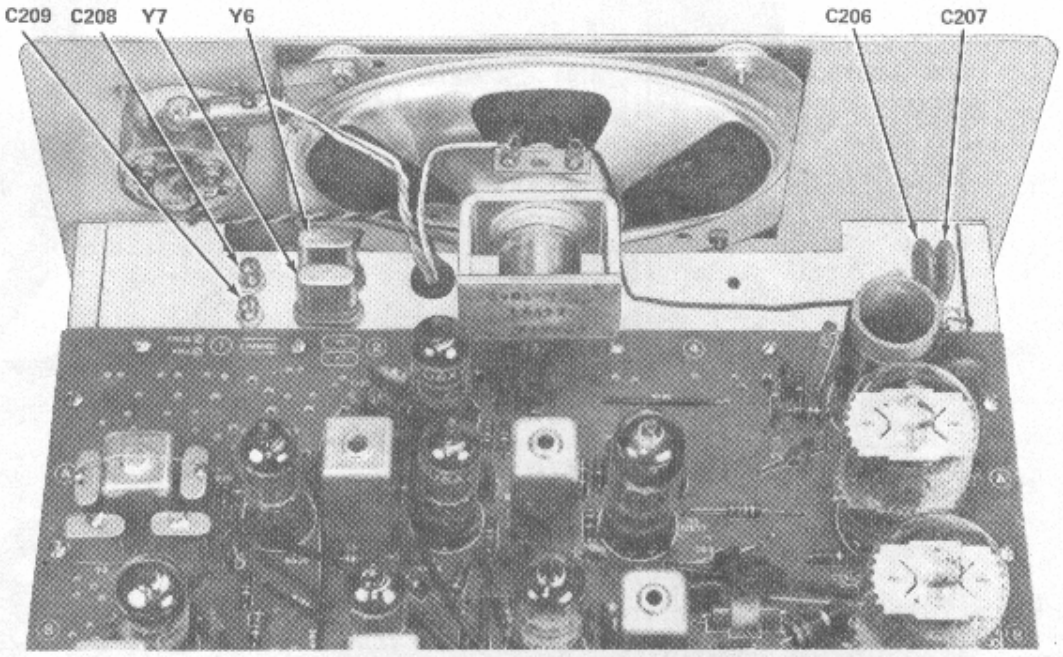
NOTE: Refer to Figure 14 for Input Point locations.

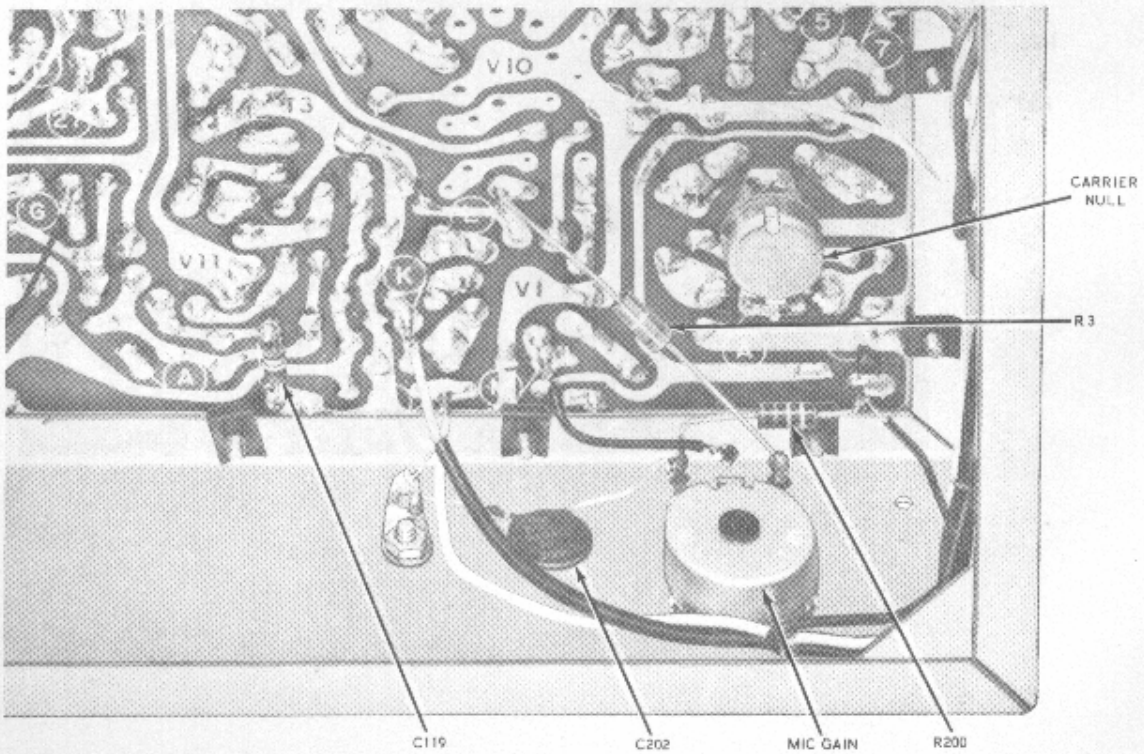
TRANSMITTER CHECK (DUMMY LOAD CONNECTED)

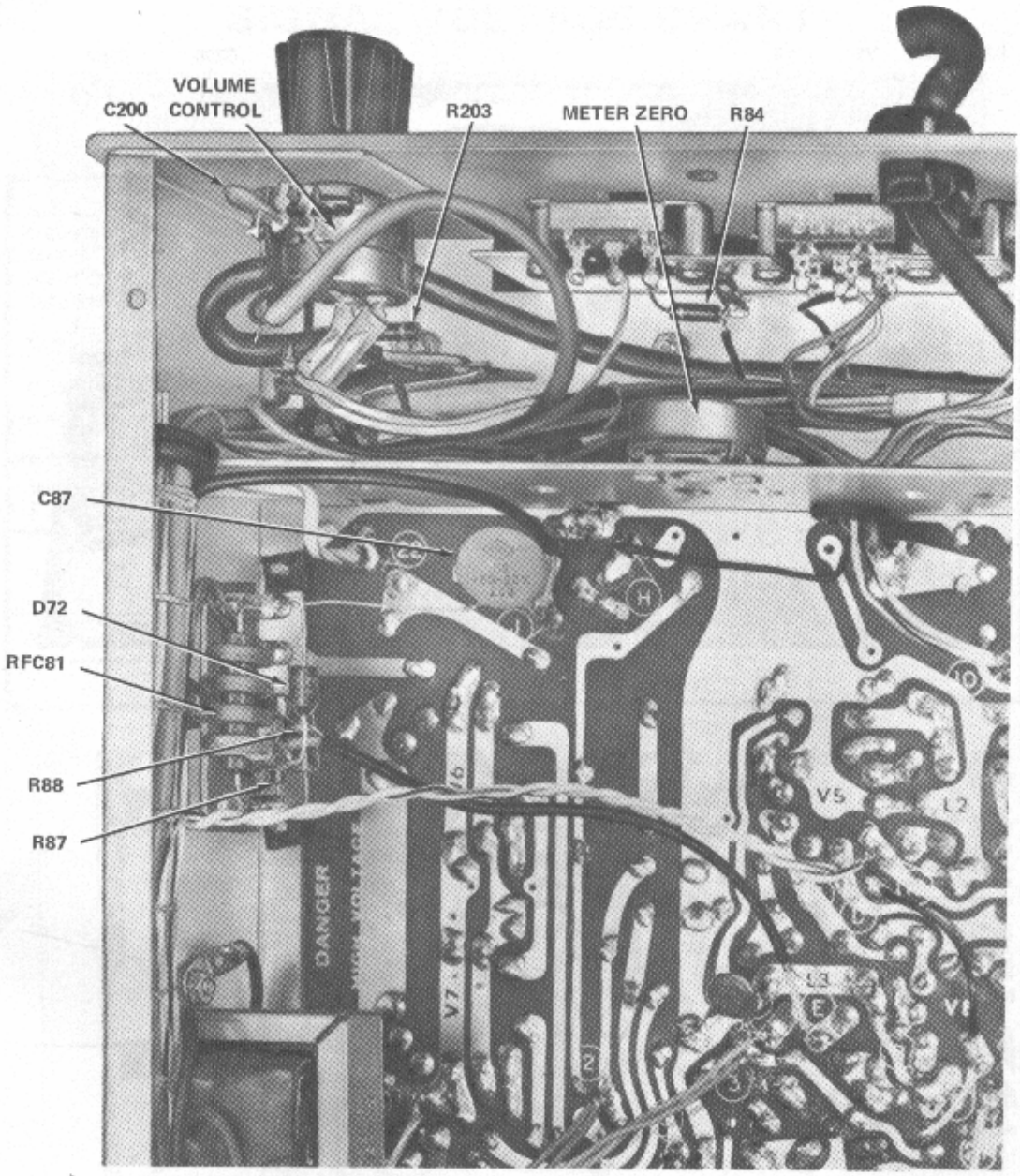
CONTROL SETTINGS			
RECEPTION - DISTANT.		MIC GAIN -	COUNTERCLOCKWISE.
MODE - SSB.		METER ZERO -	PRESET FOR NORMAL OPERATION.
METER - BIAS.			
CHANNEL -	EITHER OPERATING CHANNEL.	BIAS ADJUST -	PRESET FOR PROPER BIAS.
VOLUME -	POWER ON - VOLUME AT MINIMUM.	CARRIER NULL -	PRESET FOR NULLED CARRIER.
CLARIFIER -	12 O'CLOCK.		

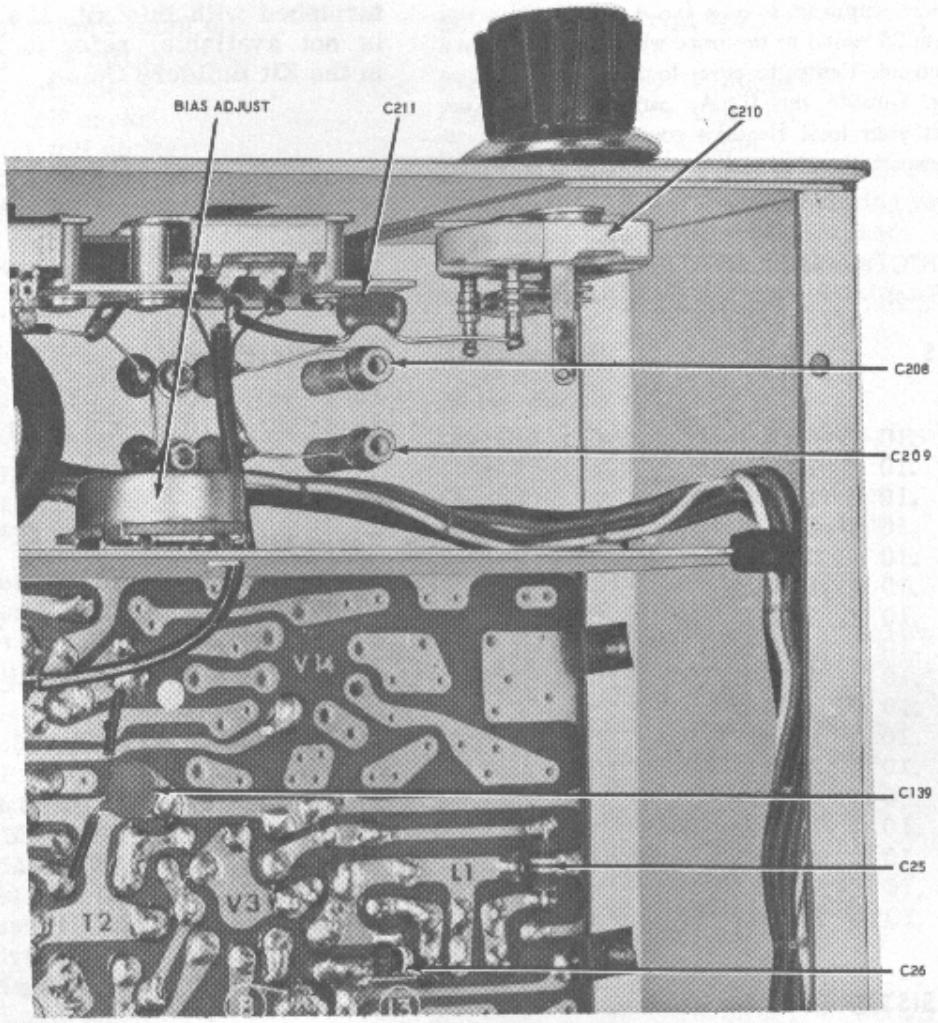
INPUT				OUTPUT	NOTES
INPUT POINT	RF GENERATOR TERMINATION	RF GENERATOR FREQUENCY	INPUT LEVEL	S-METER READING	
X1	50 Ω	OPERATING CHANNEL FREQUENCY	.6 V	S9	All readings obtained with microphone button depressed.
R4	50 Ω	3395 kHz	10,000 μV	S9	
X2	50 Ω	3395 kHz	2000 μV	S9	

CHASSIS PHOTOGRAPHS






C200
VOLUME CONTROL
R203
METER ZERO
R84
C87
D72
RFC81
R88
R87
DANGER HIGH VOLTAGE
V7
V5
L2
L3
V1


BIAS ADJUST
C211
C210
C208
C209
V14
C139
C25
L1
V3
T2
C26

REPLACEMENT PARTS PRICE LIST

The following prices apply only on purchases from the Heath Company where shipment is to a U.S.A. destination. Add 10% (minimum 25 cents) to the price when ordering from a Heathkit Electronic Center to cover local sales tax, postage and handling. Outside the U.S.A. parts and service are available from your local Heathkit source and will reflect additional transportation, taxes, duties and rates of exchange.

To order parts, use the Parts Order Form furnished with this kit. If a Parts Order Form is not available, refer to Replacement Parts in the Kit Builders Guide.

PART No.	PRICE Each	DESCRIPTION
RESISTORS		
1/2 Watt		
1-1	.10	47 Ω
1-3	.10	100 Ω
1-66	.10	150 Ω
1-45	.10	220 Ω
1-4	.10	330 Ω
1-9	.10	1000 Ω
1-90	.10	2000 Ω 5%
1-14	.10	3300 Ω
1-16	.10	4700 Ω
1-19	.10	6800 Ω
1-20	.10	10 kΩ
1-22	.10	22 kΩ
1-25	.10	47 kΩ
1-26	.10	100 kΩ
1-29	.10	220 kΩ
1-35	.10	1 MΩ
1-37	.10	2.2 MΩ
OTHER RESISTORS		
1-8-1	.10	68 kΩ 1 watt
3-2-2	.25	.33 Ω 2 watt
1-17-2	.15	6800 Ω 2 watt
1-22-2	.15	12 kΩ 2 watt
CAPACITORS		
Disc		
21-60	.10	18 pF
21-32	.10	47 pF
21-49	.20	68 pF 4 kV
21-21	.10	200 pF
21-13	.10	500 pF
21-57	.10	.005 μF
21-35	.15	.005 μF 1.6 kV
21-31	.10	.02 μF
Phenolic-Ceramic		
28-2	.10	1 pF phenolic
28-4	.10	1.5 pF phenolic
31-21	.15	1.5 to 10 pF ceramic trimmer
Resin-Mica		
20-96	.15	36 pF resin
20-102	.15	100 pF resin
20-127	.40	1300 pF resin
20-35	.25	.00091 μF (910 pF) mica
OTHER CAPACITORS		
27-47	.20	.1 μF Mylar
27-85	.25	.22 μF Mylar
27-61	.40	.47 μF Mylar
25-54	.25	10 μF electrolytic
25-135	.70	20 μF vertical mount electrolytic
26-119	1.85	2 to 10 pF variable
CONTROLS-SWITCHES		
10-130	.80	200 Ω bushing-mount control
10-57	.35	10 kΩ tab-mount control
10-127	.35	1 MΩ tab-mount control
19-67	1.80	1 MΩ control (with switch and cover)
60-4	.20	Slide switch, SPDT
60-2	.30	Slide switch, DPDT
COILS-CHOKES-TRANSFORMERS		
40-821	.80	Crystal filter coil
40-823	1.45	Final plate coil
40-824	1.75	Driver grid coil
40-825	1.05	Driver plate coil

PART No.	PRICE Each	DESCRIPTION
Coils-Chokes-Transformers (cont'd.)		
45-58	.55	13 μH bifilar choke
45-3	.30	1 mH choke
45-47	.35	2 mH choke
45-4	.45	1.1 mH choke
52-108	1.10	3.395 MHz IF transformer
51-55	1.65	Output transformer
TUBES-LAMP		
411-11	1.00	6AU6 tube (6AU6A)
411-124	1.50	6EA8 tube
411-161	2.20	6EB8 tube
411-185	1.95	6GE5 tube
411-24	1.45	12AT7 tube
411-69	1.55	12BY7 tube
412-17	.10	#53 panel lamp
DIODES-CRYSTALS		
56-26-1	.30	Germanium diode
57-27	.50	Silicon diode
404-206	5.00	3396.400 kHz crystal
404-331	14.20	Package containing the following:
404-329		3393.800 kHz crystal
440-330		3395.050 kHz crystal
SOCKETS-PLUGS		
434-42	.10	Phono socket
434-44	.15	Lamp socket
434-74	.10	Crystal socket
434-112	.10	7-pin tube socket
434-79	.15	9-pin tube socket
434-140	.20	12-pin tube socket
434-118	.40	11-pin socket
438-29	.48	11-pin plug
438-4	.10	Phono plug
440-1	.20	Plug cap
HARNESS-CABLE-WIRE-SLEEVING		
134-171	5.00	Wiring harness
343-7	.05/ft	Coaxial cable
344-50	.05/ft	Black wire
344-52	.05/ft	Red wire
346-1	.05/ft	Small sleeving
346-2	.05/ft	Clear plastic sleeving

PART No.	PRICE Each	DESCRIPTION
METAL PARTS-GASKET		
90-265	6.50	Cabinet
100-697	2.90	Chassis
203-510	1.20	Panel
206-371	1.25	Final shield
204-182	.10	Shield mounting bracket
204-576	1.45	Gimbal bracket
209-50-1	1.20	Grille screen
332-8	.25	Speaker gasket
HARDWARE		
#4 Hardware		
250-273	.05	4-40 x 3/8" screw
252-15	.05	4-40 nut
252-89	.05	#4 push-on nut
254-9	.05	#4 lockwasher
#6 Hardware		
250-56	.05	6-32 x 1/4" screw
250-234	.05	6-32 x 1/2" screw
250-134	.05	6-32 x 3/4" brass screw
250-13	.05	6-32 x 1" screw
250-170	.05	#6 x 1/4" sheet metal screw
252-3	.05	6-32 nut
252-19	.05	6-32 Palnut*
254-1	.05	#6 lockwasher
255-3	.05	#6 x 3/8" spacer
259-1	.05	#6 solder lug
#8 Hardware		
250-43	.05	8-32 x 1/4" setscrew
253-9	.05	#8 flat washer
#10 Hardware		
250-54	.05	10-32 x 5/8" screw
250-83	.05	#10 x 1/2" sheet metal screw
252-49	.30	10-32 thumbnut
255-44	.10	10-32 shoulder spacer
253-19	.05	Large #10 flat washer
253-42	.05	Small #10 flat washer
254-3	.05	#10 lockwasher
Other Hardware		
252-39	.05	1/4-32 nut
253-39	.05	1/4" control washer
252-7	.05	3/8-32 control nut
253-10	.05	Control flat washer
254-5	.05	Control lockwasher

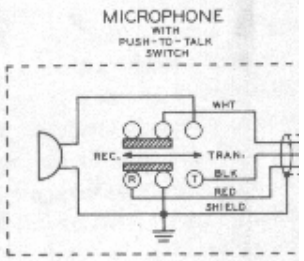
*Registered Trademark, The Palnut Co.

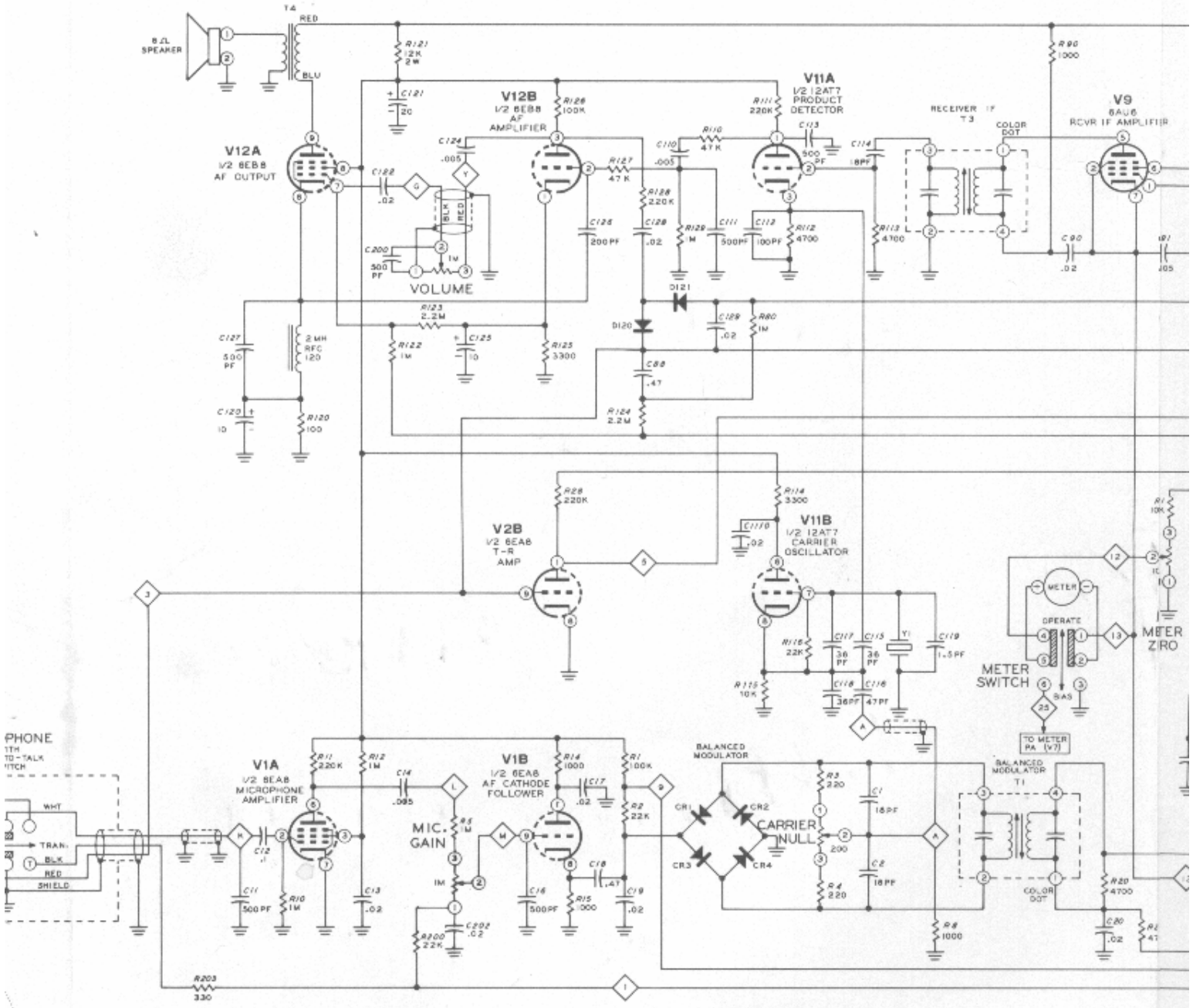
MISCELLANEOUS

PART No.	PRICE Each	DESCRIPTION
85-69-8	5.00	Circuit board
401-97	5.00	Speaker
407-99	9.85	Meter
480-58	7.70	Microphone
431-11	.10	5-lug terminal strip
462-106	.15	Black knob
462-191	.70	Green knob
73-1	.10	Rubber grommet
75-29	.10	Strain relief
261-4	.05	Rubber foot
261-9	.05	Medium rubber foot
261-21	.15	Large rubber foot
435-1	.10	Plug mounting ring
259-20	.05	Circuit board terminal
490-1	.10	Alignment tool
490-5	.10	Nut starter
331-6	.15	Solder
390-186	.30	Sheet of numbers and letters
	2.00	Manual (See front cover for part number.)

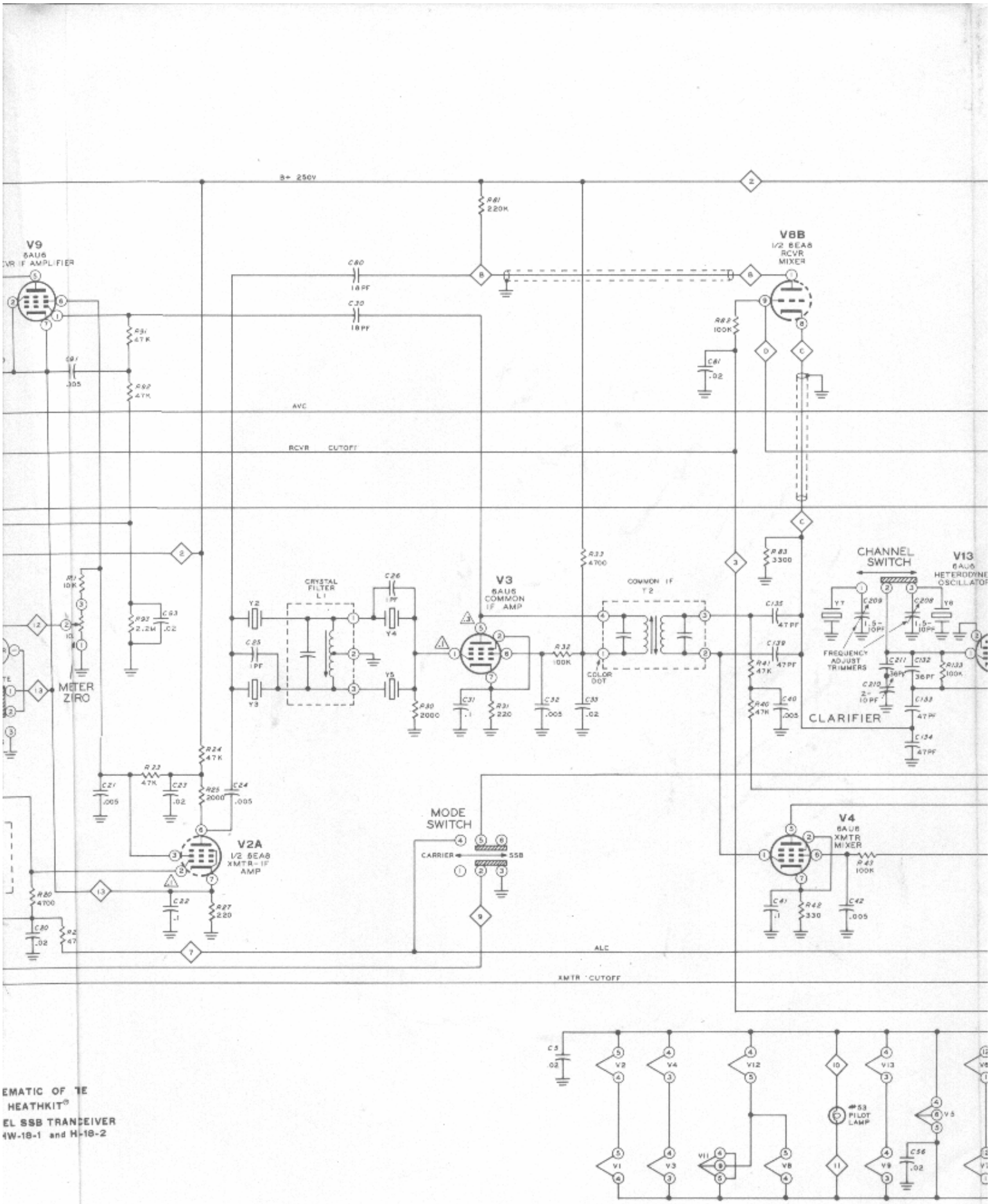
CRYSTAL PRICE LIST

PART No.	PRICE Each	CRYSTAL FREQUENCY
404-345	4.95	7863.9000 kHz
404-346	4.95	7903.9000 kHz
404-347	4.95	7981.4000 kHz
404-348	4.95	7998.9000 kHz
404-349	4.95	8026.4000 kHz
404-404	4.95	7860.9000 kHz
404-405	4.95	7800.9000 kHz
404-406	4.95	7978.4000 kHz
404-407	4.95	7995.9000 kHz
404-408	4.95	8023.4000 kHz

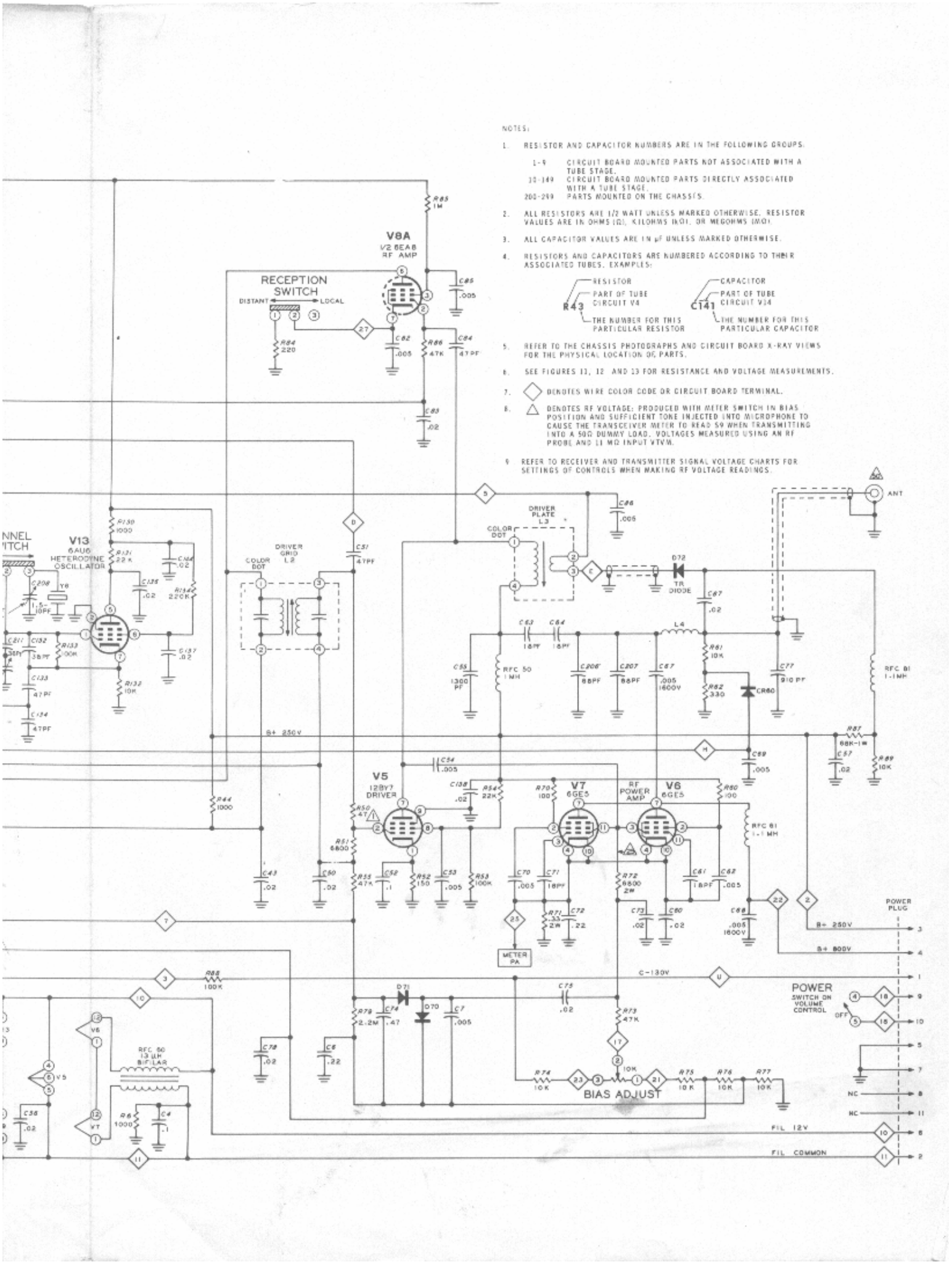

MICROPHONE
WITH
PUSH-TO-TALK
SWITCH
WHT
REC.
TRANS.
R
T
BLK
RED
SHIELD



SCHEMATIC OF TE
HEATHKIT®
2-CHANNEL SSB TRANCEIVE
MODELS HW-16-1 and H-16-2



EMATIC OF TE
HEATHKIT®
EL SSB TRANSCEIVER
W-18-1 and H-18-2


NOTES:
1. RESISTOR AND CAPACITOR NUMBERS ARE IN THE FOLLOWING GROUPS.
1-9 CIRCUIT BOARD MOUNTED PARTS NOT ASSOCIATED WITH A TUBE STAGE.
10-149 CIRCUIT BOARD MOUNTED PARTS DIRECTLY ASSOCIATED WITH A TUBE STAGE.
200-249 PARTS MOUNTED ON THE CHASSIS.
2. ALL RESISTORS ARE 1/2 WATT UNLESS MARKED OTHERWISE. RESISTOR VALUES ARE IN OHMS (Ω), KILOHMS (kΩ), OR MEGOHMS (MΩ).
3. ALL CAPACITOR VALUES ARE IN μF UNLESS MARKED OTHERWISE.
4. RESISTORS AND CAPACITORS ARE NUMBERED ACCORDING TO THEIR ASSOCIATED TUBES. EXAMPLES:
R43 — RESISTOR, PART OF TUBE CIRCUIT V4, THE NUMBER FOR THIS PARTICULAR RESISTOR
C141 — CAPACITOR, PART OF TUBE CIRCUIT V14, THE NUMBER FOR THIS PARTICULAR CAPACITOR
5. REFER TO THE CHASSIS PHOTOGRAPHS AND CIRCUIT BOARD X-RAY VIEWS FOR THE PHYSICAL LOCATION OF PARTS.
6. SEE FIGURES 11, 12 AND 13 FOR RESISTANCE AND VOLTAGE MEASUREMENTS.
7. ◇ DENOTES WIRE COLOR CODE OR CIRCUIT BOARD TERMINAL.
8. △ DENOTES RF VOLTAGE: PRODUCED WITH METER SWITCH IN BIAS POSITION AND SUFFICIENT TONE INJECTED INTO MICROPHONE TO CAUSE THE TRANSCEIVER METER TO READ S9 WHEN TRANSMITTING INTO A 50Ω DUMMY LOAD. VOLTAGES MEASURED USING AN RF PROBE AND 11 MΩ INPUT VTVM.
9. REFER TO RECEIVER AND TRANSMITTER SIGNAL VOLTAGE CHARTS FOR SETTINGS OF CONTROLS WHEN MAKING RF VOLTAGE READINGS.
V8A 12 6EA8 RF AMP
RECEPTION SWITCH
DISTANT
LOCAL
R85 1M
C85 .005
R84 220
C82 .005
R86 47K
C84 47PF
C83 .02
V13 6AU6 HETERODYNE OSCILLATOR
R130 1000
R131 22K
C136 .02
C135 .02
R134 220K
C137 .02
R133 100K
R132 10K
C133 47PF
C134 47PF
C132 36PF
C211 36PF
C208 1.5-10PF
Y8
DRIVER GRID L2
COLOR DOT
C51 47PF
DRIVER PLATE L3
C86 .005
D72 TR DIODE
C87 .02
C63 18PF
C64 18PF
L4
C55 1300 PF
RFC 50 1 MH
C208 68PF
C207 68PF
C67 .005 1600V
R61 10K
R62 330
CR60
C77 910 PF
RFC 81 1-1MH
ANT
B+ 250V
R87 68K-1W
C57 .02
R89 10K
C69 .005
V5 12BY7 DRIVER
C54 .005
C138 .02
R54 22K
R50 47
R51 6800
R55 47K
C52 .1
R52 150
C53 .005
R53 100K
R44 1000
C43 .02
C50 .02
V7 6GE5
V6 6GE5
RF POWER AMP
R70 100
R60 100
RFC 81 1-1 MH
C70 .005
C71 18PF
R72 6800 2W
C61 18PF
C62 .005
R71 33 2W
C72 .22
C73 .02
C60 .02
C68 .005 1600V
METER PA
B+ 250V
B+ 800V
C-130V
R88 100K
D71
D70
C74 .47
R78 2.2M
C7 .005
C75 .02
R73 47K
C78 .02
C6 .22
R74 10K
R75 10K
R76 10K
R77 10K
BIAS ADJUST
POWER SWITCH ON VOLUME CONTROL
OFF
POWER PLUG
NC
NC
FIL 12V
FIL COMMON
RFC 50 13 UH BIFILAR
R6 1000
C4 .1
C56 .02
V5
V6
VT

CUSTOMER SERVICE

REPLACEMENT PARTS

If you need a replacement part, please fill in the Parts Order Form that is furnished and mail it to the Heath Company. Or, if you write a letter, include the:

- **Part number** and **description** as shown in the **Parts List.**
- Model number and Series number from the blue and white label.
- Date of purchase.
- Nature of the defect.

Please do not return parts to the factory unless they are requested. Parts that are damaged through carelessness or misuse by the kit builder will not be replaced without cost, and will not be considered in warranty.

Parts are also available at the Heathkit Electronic Centers listed in your catalog. Be sure to provide the Heath part number. Bring in the original part when you request a warranty replacement from a Heathkit Electronic Center.

NOTE: Replacement parts are maintained specifically to repair Heathkit products. Parts sales for other reasons will be declined.

TECHNICAL CONSULTATION

Need help with your kit? . . . . Self-Service? . . . . Construction? . . . . Operation? . . . . Call or write for assistance. You'll find our Technical Consultants eager to help with just about any technical problem except "customizing" for unique applications.

The effectiveness of our consultation service depends on the information you furnish. Be sure to tell us:

- The Model number and Series number from the blue and white label.
- The date of purchase.
- An exact description of the difficulty.
- Everything you have done in attempting to correct the problem.

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.
- Copies of all correspondence relevant to the service of the kit.
- A brief description of the difficulty.
- Authorization to return your kit C.O.D. for the service and shipping charges. (This will reduce the possibility of delay.)

Check the equipment to see that all screws and parts are secured. (Do not include any wooden cabinets or color television picture tubes, as these are easily damaged in shipment.) Place the equipment in a strong carton with at least THREE INCHES of *resilient* packing material (shredded paper, excelsior, etc.) on all sides. Use additional packing material where there are protrusions (control sticks, large knobs, etc.). If the unit weighs over 15 lbs., place this carton in another one with 3/4" of packing material between the two.

Seal the carton with reinforced gummed tape, tie it with a strong cord, and mark it "Fragile" on at least two sides. Remember, the carrier will not accept liability for shipping damage if the unit is insufficiently packed. Ship by prepaid express, United Parcel Service, or insured Parcel Post to:

Heath Company
Service Department
Benton Harbor, Michigan 49022

HEATH COMPANY

BENTON HARBOR, MICHIGAN

THE WORLD'S FINEST ELECTRONIC EQUIPMENT IN KIT FORM

LITHO IN U.S.A.