

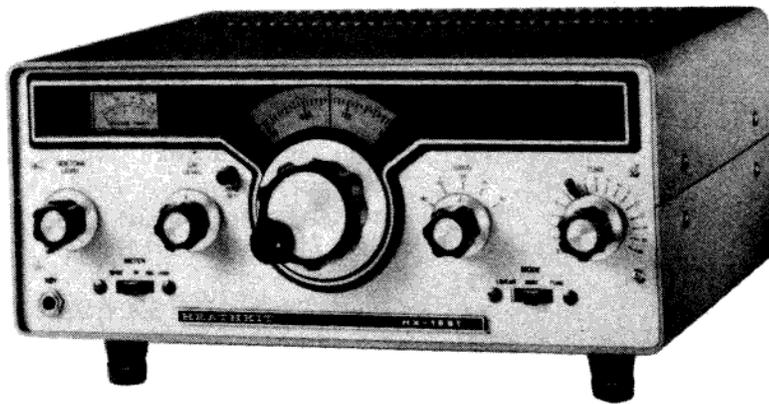
Heathkit® Manual

for the

CW TRANSMITTER

Model HX-1681

595-2240-01



HEATH COMPANY
BENTON HARBOR, MICHIGAN 49022

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INTRODUCTION

The Heathkit Model HX-1681 CW Transmitter is designed to operate on the 80, 40, 20, 15, and 10-meter amateur bands, on frequencies from 3.5 to 28.5 MHz. The Transmitter with its minimum output of 100 watts (75 watts nominal on 10 meters) may be used as an exciter for most linear amplifiers. The Heathkit Model HP-23C/PS-23 Power supply is recommended to power the Transmitter.

This CW Transmitter is designed as a companion to the popular HR-1680 Amateur Receiver. You can also use it with any other receiver, whether tube-type or solid-state. However, it will be necessary to determine the correct muting circuit for your specific receiver.

Operating features include: full break-in keying, sidetone, plate and relative power meter, and all solid-state circuitry except for the driver and power amplifier tubes. An all-steel chassis provides rugged construction. Circuit boards provide assembly shortcuts that eliminate most of the tedious point-to-point wiring, and a precut wire harness saves hours of cutting and preparing the essential wiring.

This small, sturdy Transmitter, in colors to match the already proven HR-1680 Receiver, will provide you with years of matchless performance on all the popular HF amateur bands.



UNPACKING

Your Transmitter shipping carton contains a box marked "Packs 1-3 TOP." After you remove this box, the remaining parts in the shipping carton form the Main Pack, which are items too large to fit into the other parts packs and those items which you will use in the chassis assembly section.

Set the box marked "Packs 1-3 TOP" aside until one of these packs is called for in an assembly section. DO NOT disturb any of these packs yet.

Each assembly section of this Manual contains its own "Parts List" and "Step-by-Step Assembly" in-

structions. At the beginning of each "Parts List," you will be instructed which parts pack to remove from the box and open. You may also be directed to locate certain required parts from the Main Pack.

To avoid intermixing parts, do not remove or open any of these parts packs until you are directed to do so at the beginning of one of the "Parts List." Return any part that is packed in an individual envelope, with the part number on it, back in its envelope after you identify it until that part is called for in a step. Some envelopes have one transparent side so you can identify the parts inside without opening the envelopes.



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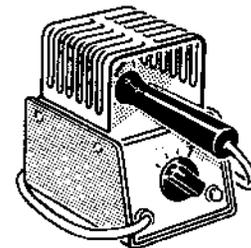
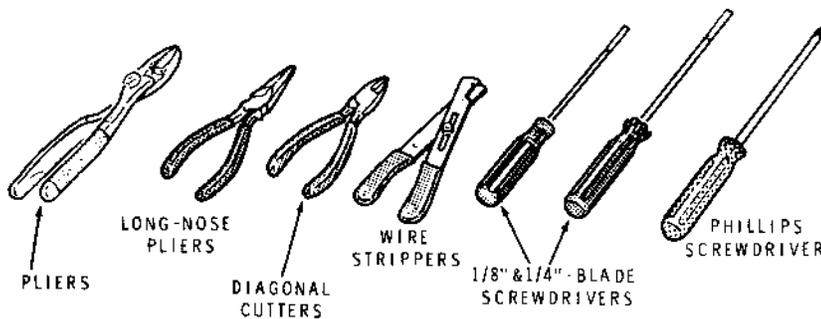
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ASSEMBLY NOTES

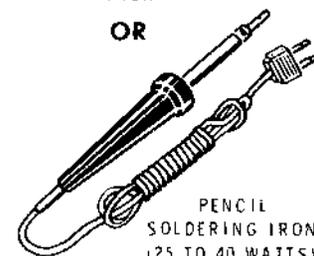
TOOLS

You will need these tools to assemble your kit.



HEATHKIT
SOLDERING
IRON

OR

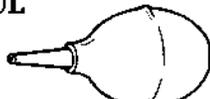


PENCIL
SOLDERING IRON
(25 TO 40 WATTS)

OTHER HELPFUL TOOLS



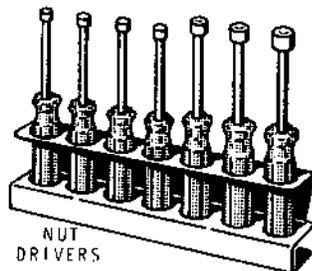
NUT STARTER
(MAY BE SUPPLIED
WITH KIT)



DESOLDERING
BULB*



DESOLDERING
BRAID*



NUT
DRIVERS

*TO REMOVE SOLDER FROM CIRCUIT CONNECTIONS.

ASSEMBLY

1. Follow the instructions carefully. Read the entire step before you perform each operation.
2. The illustrations in the Manual are called Pictorials and Details. Pictorials show the overall operation for a group of assembly steps; Details generally illustrate a single step. When you are directed to refer to a certain Pictorial "for the following steps," continue using that Pictorial until you are referred to another Pictorial for another group of steps.
3. Most kits use a separate "Illustration Booklet" that contains illustrations (Pictorials, Details, etc.) that are too large for the Assembly Manual. Keep the "Illustration Booklet" with the Assembly Manual. The illustrations in it are arranged in Pictorial number sequence.
4. Position all parts as shown in the Pictorials.
5. Solder a part or a group of parts only when you are instructed to do so.

6. Each circuit part in an electronic kit has its own component number (R2, C4, etc.). Use these numbers when you want to identify the same part in the various sections of the Manual. These numbers, which are especially useful if a part has to be replaced, appear:

- In the Parts List.
- At the beginning of each step where a component is installed.
- In some illustrations.
- In the Schematic.
- In the section at the rear of the Manual.

7. When you are instructed to cut something to a particular length, use the scales (rulers) provided at the bottom of the Manual pages.

SAFETY WARNING: Avoid eye injury when you cut off excess lead lengths. Hold the leads so they cannot fly toward your eyes.

SOLDERING

Soldering is one of the most important operations you will perform while assembling your kit. A good solder connection will form an electrical connection between two parts, such as a component lead and a circuit board foil. A bad solder connection could prevent an otherwise well-assembled kit from operating properly.

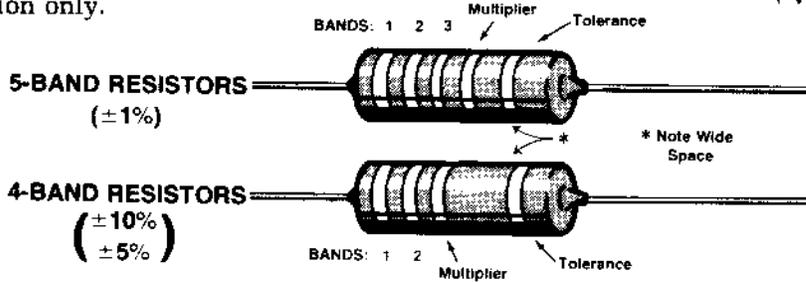
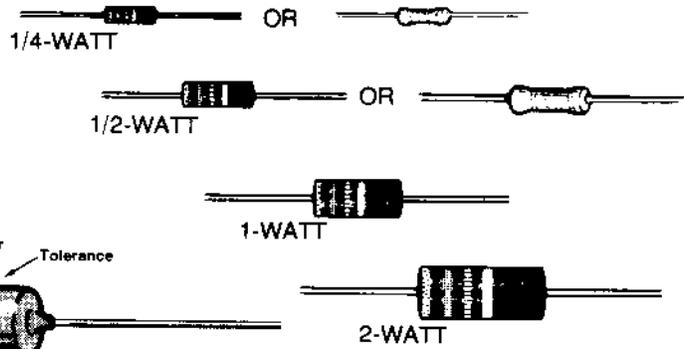
It is easy to make a good solder connection if you follow a few simple rules:

1. Use the right type of soldering iron. A 25 to 40-watt pencil soldering iron with a 1/8" or 3/16" chisel or pyramid tip works best.
2. Keep the soldering iron tip clean. Wipe it often on a wet sponge or cloth; then apply solder to the tip to give the entire tip a wet look. This process is called tinning, and it will protect the tip and enable you to make good connections. When solder tends to "ball" or does not stick to the tip, the tip needs to be cleaned and retinned.



PARTS

Resistors will be called out by their resistance value in Ω (ohms), $k\Omega$ (kilohms), or $M\Omega$ (megohms). Certain types of resistors will have the value printed on the body, while others will be identified by a color code. The colors of the bands and the value will be given in the steps, therefore the following color code is given for information only.



Band 1 1st Digit		Band 2 2nd Digit		Band 3 (if used) 3rd Digit		Multiplier		Resistance Tolerance	
Color	Digit	Color	Digit	Color	Digit	Color	Multiplier	Color	Tolerance
Black	0	Black	0	Black	0	Black	1	Silver	± 10%
Brown	1	Brown	1	Brown	1	Brown	10	Gold	± 5%
Red	2	Red	2	Red	2	Red	100	Brown	± 1%
Orange	3	Orange	3	Orange	3	Orange	1,000		
Yellow	4	Yellow	4	Yellow	4	Yellow	10,000		
Green	5	Green	5	Green	5	Green	100,000		
Blue	6	Blue	6	Blue	6	Blue	1,000,000		
Violet	7	Violet	7	Violet	7	Silver	0.01		
Gray	8	Gray	8	Gray	8	Gold	0.1		
White	9	White	9	White	9				

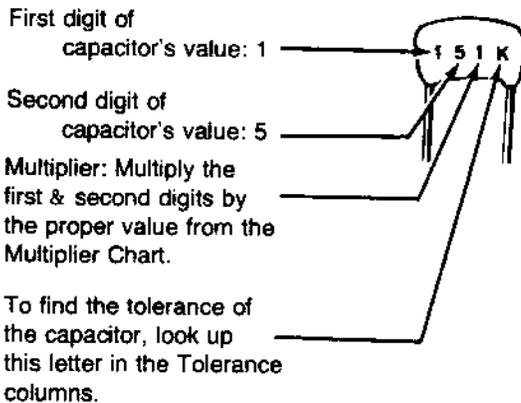
Capacitors will be called out by their capacitance value in μF (microfarads) or pF (picofarads) and type: ceramic, Mylar*, electrolytic, etc. Some capacitors may have their value printed in the following manner:

EXAMPLES:

$151K = 15 \times 10 = 150 pF$

$759 = 75 \times 0.1 = 7.5 pF$

NOTE: The letter "R" may be used at times to signify a decimal point: as in: $2R2 = 2.2 (pF \text{ or } \mu F)$.



MULTIPLIER		TOLERANCE OF CAPACITOR		
FOR THE NUMBER:	MULTIPLY BY:	10 pF OR LESS	LETTER	OVER 10 pF
0	1	±0.1 pF	B	
1	10	±0.25 pF	C	
2	100	±0.5 pF	D	
3	1000	±1.0 pF	F	±1%
4	10,000	±2.0 pF	G	±2%
5	100,000		H	±3%
			J	±5%
8	0.01		K	±10%
9	0.1		M	±20%

*DuPont Registered Trademark

CHASSIS

PARTS LIST

Locate and remove all the parts from the main pack (parts left in the shipping carton). Be sure you have removed the packs from the carton as directed in the "Unpacking" section.

Unpack these parts and check each part against the following list. The key numbers correspond to the numbers on the "Chassis Parts Pictorial" (Illustration Booklet, Page 1). Set aside any remaining parts not

called for in this Parts List. They will be called for later.

To order a replacement part, always include the PART NUMBER. Use the Parts Order Form furnished with this kit. If one is not available, see "Replacement Parts" inside the rear cover of this Manual. For prices, refer to the separate "Heath Parts Price List."

KEY No.	HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
---------	----------------	------	-------------	-------------------

RESISTORS

NOTE: The following resistors are 1/4-watt, 5% tolerance unless otherwise noted.

✓A1	6-220	1	22 Ω, 1/2-watt (red-red-blk)	R9
✓A1	6-331	1	330 Ω, 1/2-watt (org-org-brn)	R506
✓A1	6-222-12	1	2200 Ω (red-red-red)	R503
✓A1	6-682-12	1	6800 Ω (blu-gry-red)	R4
✓A1	6-103	1	10 kΩ, 1/2-watt (brn-blk-org)	R505
✓A1	6-153-12	1	15 kΩ (brn-grn-org)	R507
✓A1	6-183-12	2	18 kΩ (brn-gry-org)	Test
✓A1	6-223-1	1	22 kΩ (red-red-org)	R504
✓A1	6-473-12	1	47 kΩ (yel-viol-org)	R501
✓A1	6-223	1	22 kΩ, 1/2-watt (red-red-org)	R330
✓A1	6-105	1	1 MΩ, 1/2-watt (brn-blk-grn)	R320

NOTE: The following resistors are 2-watt, 10% tolerance unless otherwise noted.

✓A2	1-26-1	1	15 kΩ, 1-watt (brn-grn-org)	R322
✓A3	3-5-2	1	2.2 Ω (red-red-gld)	R3
✓A3	1-20-2	2	100 Ω (brn-blk-brn)	R2, R11
✓A3	1-33-2	1	120 kΩ (brn-red-yel)	R502

KEY No.	HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
---------	----------------	------	-------------	-------------------

CAPACITORS

Ceramic Capacitors

✓B1	21-172	2	100 pF	C16, C17
✓B1	21-140	2	.001 μF	C505, C506
✓B1	21-27	8	.005 μF, 500-volt	C5, C7, C8, C9, C11, C12, C13, C14
✓B1	21-16	9	.01 μF, 500-volt	C22, C23, C24, C25, C42, C501, C502, C503, C507
✓B1	21-31	3	.02 μF, 500-volt	C35, C38, C41
✓B2	21-44	2	.005 μF, 1.6 KV*	C15, C21
✓B2	21-70	2	.01 μF; bypass*	C36, C37
✓B2	21-122	1	.02 μF, 1.6 KV*	C39

*If you ever need to replace these parts, order only direct replacements, using the Heathkit part numbers shown.



KEY No.	HEATH Part No.	QTY.	DESCRIPTION
---------	----------------	------	-------------

CIRCUIT Comp. No.

Other Capacitors

✓B3	20-77	1	24 pF mica
✓B4	25-256	1	.47 μ F tantalum
✓B5	25-43	1	70 μ F electrolytic
✓B6	26-163	1	Tuning capacitor
✓B7	31-48	1	Trimmer capacitor
✓B5	25-863	1	47 μ F electrolytic

C19
C504
C43
C26
C18
C10

CONTROL-CHOKES-SWITCHES

✓B8	10-57	1	10-k Ω control
✓B9	19-95	1	10 k Ω control/switch
✓B10	45-41	1	425 μ H choke
✓B11	45-83	1	1 mH choke
✓B12	45-84	1	2 mH choke
✓B13	45-53	2	Parasitic choke
✓B14	60-22	2	3-position slide switch
✓B15	63-1343	2	Bandswitch wafer*

R6
R1/SW3
RFC3
RFC4
L501
RFC1, RFC2
SW1, SW2
SW4A, B

DIODES-TRANSISTOR-TUBES

✓C1	56-68	1	2VR68 diode	D302
✓C1	56-20	1	1N295 diode (red-wht-grn)	D503
✓C1	56-24	2	1N458 diode	D501, D502
✓C1	57-27	1	1N2071 diode	D504

NOTE: Transistors may be marked for identification in any of the following four ways:

1. Part number.
2. Type number.
3. Part number and type number.
4. Part number with a type number other than the one listed.

✓C2	417-294	1	MPSA42 transistor	Q501
✓C3	411-75	2	6146A tube	V1, V2
✓C4	411-69	1	12BY7A tube	V301

METAL PARTS

✓C5	90-1200-1	1	Cabinet top
✓C6	90-1201-1	1	Cabinet bottom
✓C7	100-1041	2	Vernier drive assembly
✓C8	200-1345	1	Chassis
✓C9	203-1957-1	1	Front panel
✓C10	203-2018-1	1	Rear panel
✓C11	204-2003	2	Meter bracket
✓C12	204-2156	1	Pressure plate
✓C13	204-2353	1	PA subchassis
✓C14	204-2398	1	VFO bracket
✓C15	205-756	1	Drive mounting plate
✓C16	205-778	1	Alignment tool blade

*IMPORTANT: If you ever need to clean these switch contacts, use only Freon 14[®] or Du Pont P.C.[®] cleaners for that purpose. Do not use "contact" cleaners.

KEY No.	HEATH Part No.	QTY.	DESCRIPTION
---------	----------------	------	-------------

Metal Parts (cont'd.)

✓C17	205-1765	1	PA cover
✓C18	205-1778	1	VFO cover
✓C19	205-1792	1	Detent plate
✓C20	206-68	1	Tube shield
✓C21	206-86	2	Lamp shield
✓C22	206-1292	1	PA shield
✓C23	206-1313	1	VFO shield
✓C24	206-1314	1	Bandswitch shield
✓C25	206-1315	1	Antenna switch shield
✓C26	466-63	1	Dial pulley

HARDWARE

NOTE: The hardware may be in more than one packet. Open all the hardware packets according to their size before you check the hardware.

Hardware is shown actual size. To identify a piece of hardware, place it over the illustration.

#4 Hardware

D1	250-156	1	4-40 \times 1/8" allen setscrew
D2	250-285	8	4-40 \times 1/4" screw
D3	250-375	3	4-40 \times 5/16" flat head screw
D4	250-273	6	4-40 \times 3/8" screw
D5	250-248	7	#4 \times 1/2" self-tapping screw
D6	250-312	4	4-40 \times 3/4" screw
D7	252-15	15	4-40 nut
D8	254-9	18	#4 lockwasher (one extra)

#6 Hardware

E1	250-33	2	6-32 \times 1/8" setscrew
E2	250-56	47	6-32 \times 1/4" screw
E3	250-327	4	6-32 \times 1/4" flat head screw
E4	250-365	34	#6 \times 1/4" hex head screw
E5	250-1157	14	1/4" circuit board spacer
E6	250-274	2	6-32 \times 5/16" flat head screw
E7	250-89	8	6-32 \times 3/8" screw
E8	250-218	4	6-32 \times 3/8" phillips head screw
E9	250-270	8	6-32 \times 3/8" black truss head screw
E10	250-381	4	6-32 \times 3/8" black pan head screw
E11	250-475	10	#6 \times 3/8" hex head screw
E12	250-162	4	6-32 \times 1/2" screw
E13	250-26	1	6-32 \times 5/8" screw
E14	250-406	1	6-32 \times 5/8" flat head screw
E15	250-1187	1	6-32 \times 1-1/4" black flat head screw



KEY HEATH QTY. DESCRIPTION
No. Part No.

#6 Hardware (cont'd.)

E18	250-79	2	6-32 × 1-1/4" screw
E19	251-1	1	6-32 spade lug
E20	252-3	59	6-32 nut
E21	252-66	1	6-32 wing nut
E22	252-127	8	6-32 spring nut
E23	253-1	1	#6 flat fiber washer
E24	253-21	2	#6 × 9/16" flat metal washer
E25	253-60	5	#6 × 3/8" flat metal washer
E26	254-1	95	#6 lockwasher
E27	259-1	7	#6 solder lug
E28	259-6	1	#6 non-locking solder lug

Other Hardware

F1	250-43	7	8-32 × 1/4" setscrew
F2	252-7	8	Control nut
F3	252-10	2	Push-on spring nut
F4	252-146	2	Round spring nut
F5	253-9	4	#8 flat washer
F6	253-59	3	Spring washer
F7	253-10	5	Control flat washer
F8	254-4	6	Control lockwasher (thick)
F9	254-5	1	Control lockwasher (thin)
F10	257-11	2	Brass eyelet
F11	259-10	1	Control solder lug
F12	259-24	5	#8 solder lug

SPACERS

F13	255-2	2	3/16" spacer
F14	255-91	2	1/4" nylon spacer
F15	255-49	4	5/16" spacer
F16	255-42	2	3/4" phenolic spacer
F17	255-77	1	7/16" spacer
F18	255-15	2	1/2" thin spacer
F19	255-94	4	17/32" tapped spacer
F20	255-59	2	1" tapered spacer

WIRE-CABLE SLEEVING

134-1068	1	Wire harness
340-1	36"	Heavy bare wire
340-3	60"	Medium bare wire
342-2	18"	RG58A/U cable
343-12	15"	RG-174 cable
344-3	18"	Heavy red wire
344-2	60"	Heavy black stranded wire
344-82	12"	Heavy white wire
344-31	12"	Heavy brown wire
344-51	15 ft	Brown hookup (solid) wire
344-72	12"	White-red wire

KEY HEATH QTY. DESCRIPTION CIRCUIT
No. Part No. Comp. No.

Wire-Cable-Sleeving (cont'd.)

346-1	12"	Small black sleeving
346-2	6"	Clear sleeving
346-4	36"	Medium black sleeving
346-21	48"	Small white sleeving
346-46	12"	Large black (heat-shrinkable) sleeving

PLASTIC PARTS

✓G1	73-52	2	1/4" grommet
✓G2	73-43	1	3/8" grommet
✓G3	73-45	1	1/2" grommet
✓G4	261-9	4	Round foot
✓G5	261-41	1	Square foot
✓G6	266-944	1	Card guide
✓G7	354-6	3	Cable tie
✓G8	446-663	1	Red window
✓G9	463-67	1	Dial pointer
✓G10	464-73	1	Tuning dial

KNOBS-BUSHINGS

✓G11	455-38	1	Brass bushing
✓G12	455-52	1	Knob bushing
✓G13	462-288	1	Pushbutton
✓G14	462-935	1	Lever knob
✓G15	462-933	4	Small round knob
✓G16	462-906	1	Large round knob

TERMINAL STRIPS-CONNECTOR-SOCKETS-JACKS-PLUGS

✓H1	431-39	1	Small 5-lug terminal strip
✓H2	431-46	2	2-lug terminal strip
✓H3	431-11	2	5-lug terminal strip
✓H4	431-43	1	3-lug terminal strip
✓H5	432-73	12	Female terminal
✓H6	432-120	6	Female PCB connector
✓H7	432-180	4	6-pin connector
✓H8	432-808	2	Extender terminal
✓H9	434-39	2	Octal tube socket
✓H10	434-42	5	Phono socket
✓H11	434-44	2	Lamp socket
✓H12	434-118	1	11-pin socket
✓H13	435-1	1	Socket retainer
✓H14	436-5	1	Coaxial jack
✓H15	436-20	1	Phone jack
✓H16	438-29	1	11-pin plug
✓H17	438-46	10	Phono plug*
✓H18	440-1	1	Plug cap

J2, J3, J4,
J5, J7
J6
J1
PL8

*NOTE: Extra phono plugs are provided for interconnect cables.





KEY No.	HEATH Part No.	QTY.	DESCRIPTION
---------	----------------	------	-------------

MISCELLANEOUS

✓	75-109	1	3-1/2" x 5-1/2" paper insulator
✓	85-2190-1	1	Antenna switch circuit board
✓ J1	407-751	1	Meter
✓ J2	412-58	2	#1813 Lamp
✓ J3	260-39	2	Anode clip
✓ J4	263-8	1	Round felt pad
✓ J5	266-159	1	Switch detent
✓	350-12	2	Cement
✓ J6	475-17	5	Ferrite bead
✓	489-1	1	Sandpaper
✓ J7	490-1	1	Alignment tool
✓ J8	490-5	1	Nut starter
✓ J9	490-23	1	Allen wrench
✓ J10	490-168	1	Open-end wrench

Solder

KEY No.	HEATH Part No.	QTY.	DESCRIPTION
---------	----------------	------	-------------

PRINTED MATERIALS

	390-147	3	"DANGER" label
	390-1045	1	Terminal label set
	391-34	1	Blue and white label
	391-617	1	"Heathkit" nameplate
	597-260	1	Parts Order Form
		1	Assembly Manual (see Page 1 for part number.)

HR-1680 MODIFICATION PARTS

NOTE: Put the envelope with the following parts aside. They will be called for later.

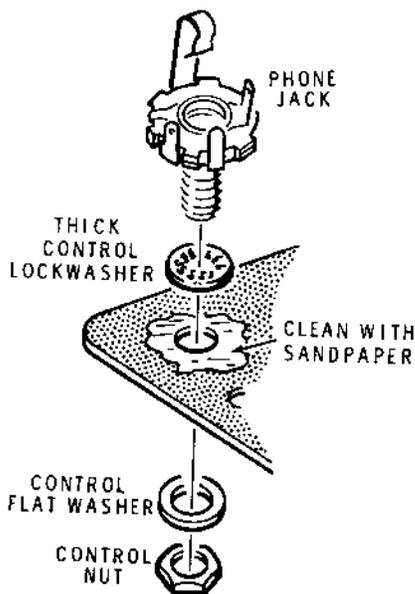
✓ A1	6-103-12	1	10 kΩ, 10% (brn-blk-org)
✓ A1	6-104-12	1	100 kΩ, 10% (brn-blk-yel)
✓	346-35	1"	Heat shrinkable sleeving

STEP-BY-STEP ASSEMBLY

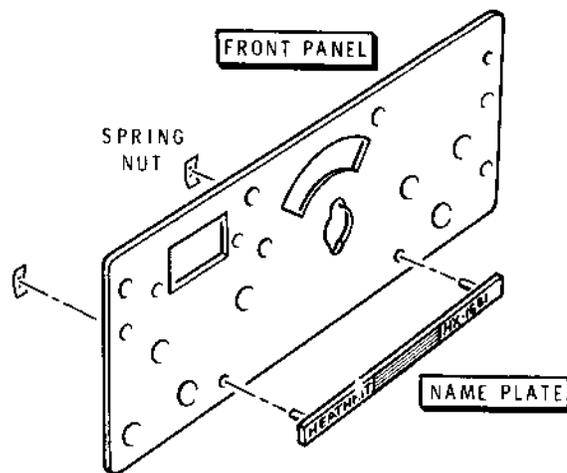
Front Panel Assembly

Refer to Pictorial 1-1 (Illustration Booklet, Page 3) for the following steps.

- (✓) Place the front panel on your work area on a soft cloth as shown in the Pictorial.
- (✓) Sandpaper any paint from inside of the front panel around hole J1 as shown in Detail 1-1A.
- (✓) In the same manner, sandpaper around the holes at SW3/R1, K, L, N, and P.
- (✓) J1: Refer to Detail 1-1A and mount the phone jack at J1 as shown. Use a thick control lockwasher, a control flat washer and a control nut. Position the jack as shown in the Pictorial.



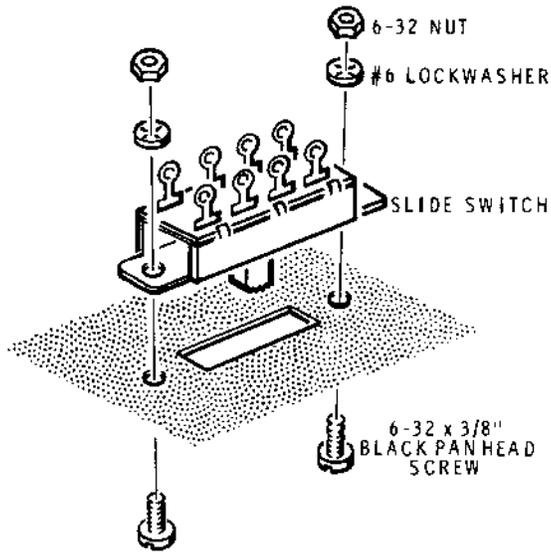
Detail 1-1A



Detail 1-1B

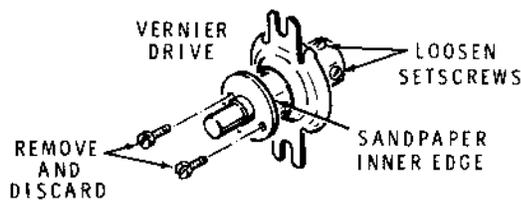
- (✓) Refer to Detail 1-1B and mount the nameplate on the front panel at A and B as shown. Use two push-on spring nuts, and make sure they are firmly seated down onto the studs.

NOTE: When hardware is called for in a step, only the screw size will be given. For instance, if 6-32 \times 3/8" hardware is called for, it means that a 6-32 \times 3/8" screw, one or more #6 lockwashers, and a 6-32 nut should be used. The Pictorial or a Detail will show the proper number of lockwashers to use. Use the plastic nut starter to pick up and start 6-32 and 4-40 nuts on screws.

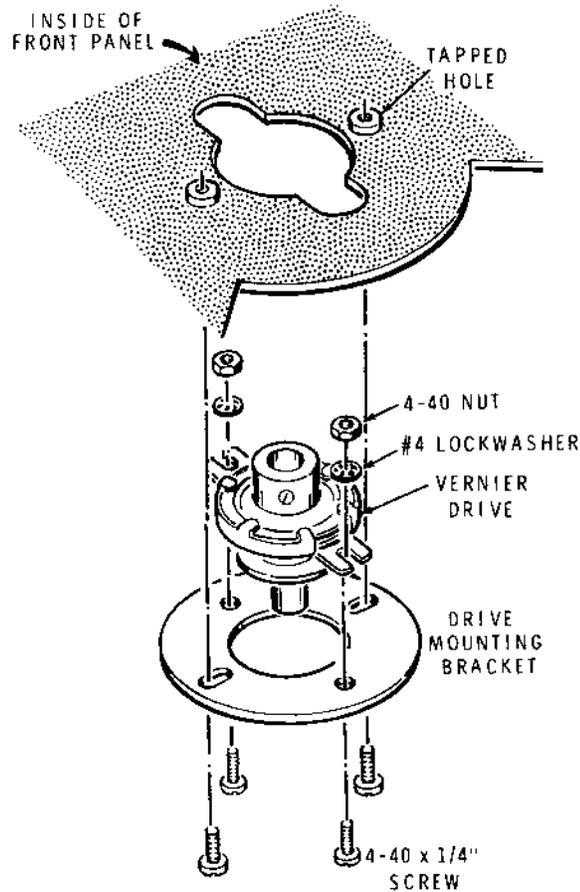


Detail 1-1C

- (✓) SW1: Refer to Detail 1-1C and mount a 3-position slide switch (#60-22) at SW1 in the manner shown. Use two sets of 6-32 × 3/8" black pan head hardware.
- (✓) SW2: In the same manner, mount the other 3-position slide switch at SW2 using 6-32 × 3/8" black pan head hardware.
- (✓) Refer to Detail 1-1D and remove and discard the two brass screws in the collar of one vernier drive. Then loosen the two setscrews in the bushing just enough to allow a 1/4" shaft to be seated in the bushing. Sandpaper the inner edge of the front drive flange as shown.

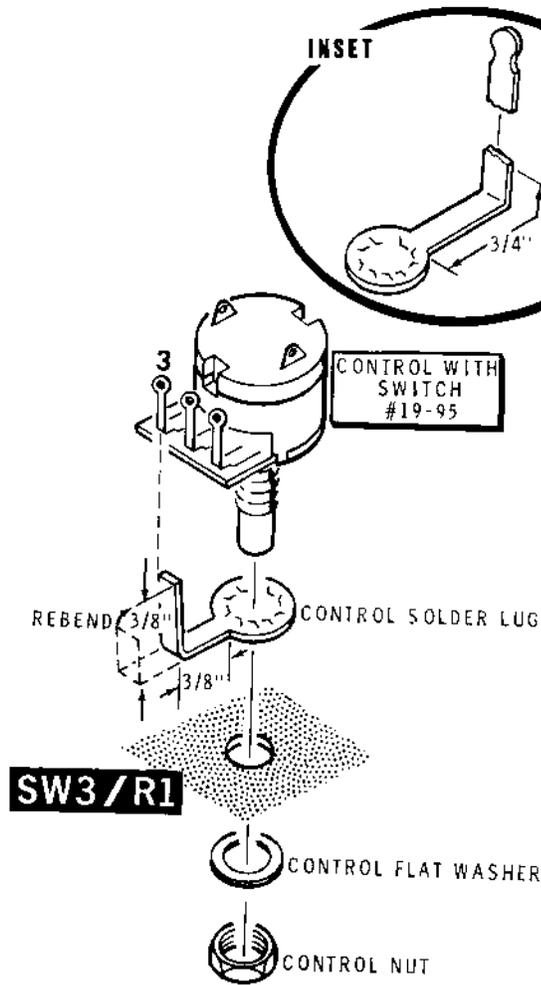


Detail 1-1D



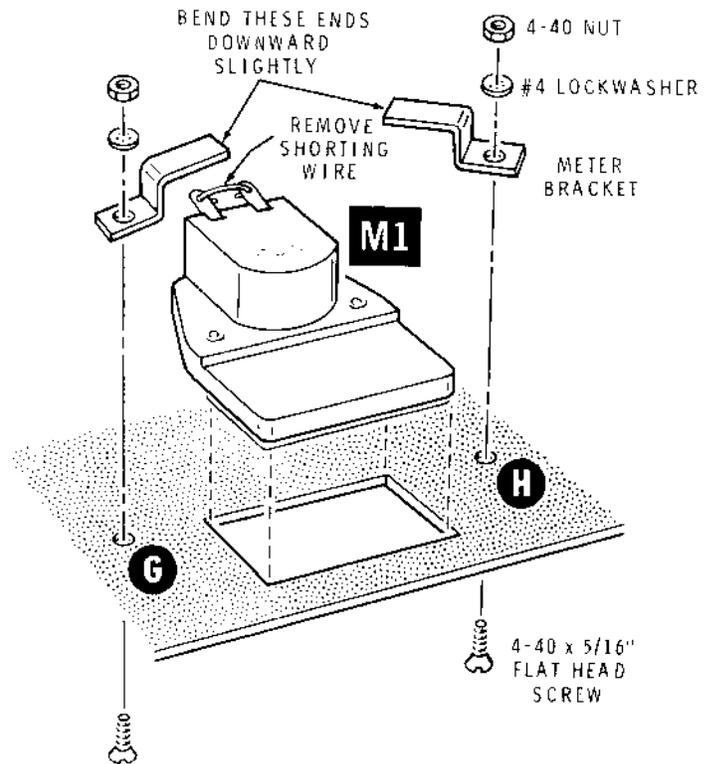
PICTORIAL 1-1E

- (✓) Refer to Detail 1-1E and mount the vernier drive onto the drive mounting bracket with 4-40 × 1/4" hardware.
- (✓) Again refer to Detail 1-1E and mount the drive bracket onto the front panel at S and T as shown. Use two 4-40 × 1/4" screws and turn the screws only finger tight.



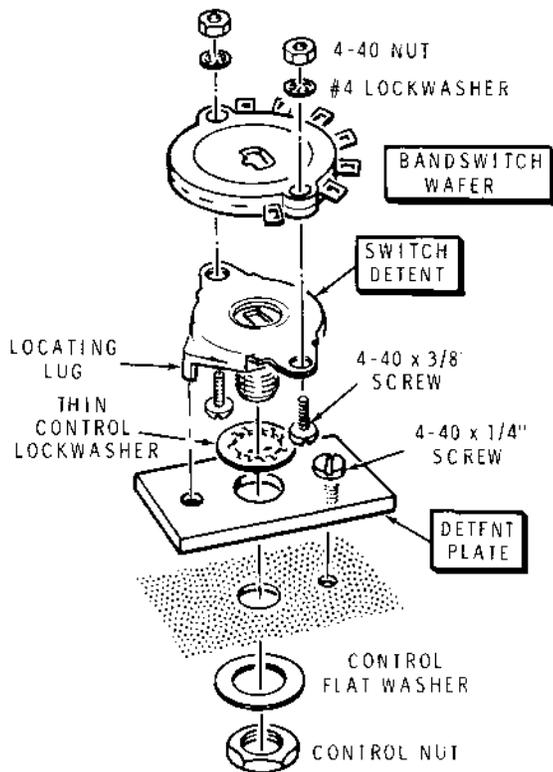
Detail 1-1F

- (✓) Refer to the inset drawing on Detail 1-1F and cut and form a control solder lug as shown. Cut the lug portion to 3/4" and bend the remaining lug to fit tightly against the control lug on R1 as indicated in the following step.
- (✓) SW3, R1: Refer to Detail 1-1F and mount the 10 kΩ control with switch (#19-95) at the hole marked SW3/R1. Position the control solder lug against control lug 3 as shown. Then secure the control/switch with a control flat washer and a control nut. Position the control/switch as shown in the Pictorial.

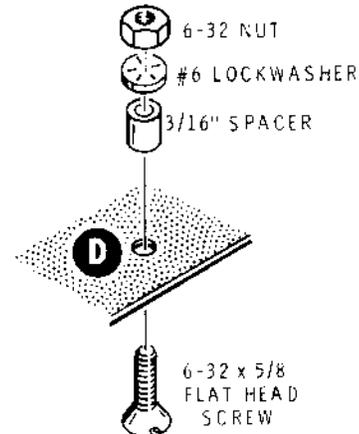


Detail 1-1G

- (✓) M1: Refer to Detail 1-1G and position the meter into the front panel cutout at M1 as shown. Secure the meter to the front panel with the two meter brackets and two sets of 4-40 x 5/16" flat head hardware at G and H. NOTE: You may have to bend the indicated ends of the brackets slightly, as shown, to assure a secure fit.
- (✓) Remove the shorting wire from the meter lugs.



Detail 1-1H

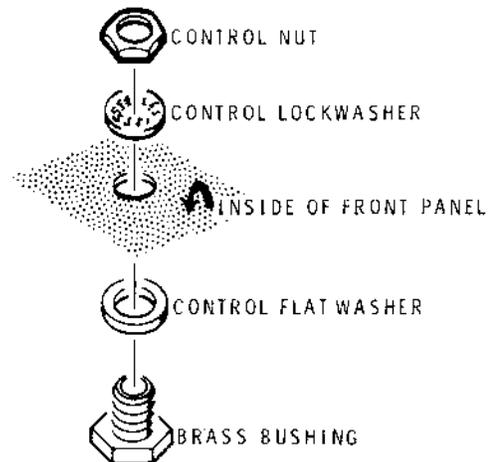


Detail 1-1J

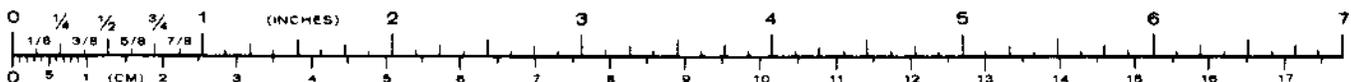
- (✓) Refer to Detail 1-1J and mount a 3/16" spacer on the inside of the front panel at D in the manner shown. Use 6-32 × 5/8" flat head hardware.
- (✓) Similarly, mount another 3/16" spacer on the inside of the front panel at E using 6-32 × 1-1/4" black flat head hardware.
- (✓) Refer to Detail 1-1K and mount a brass bushing at J with control hardware.

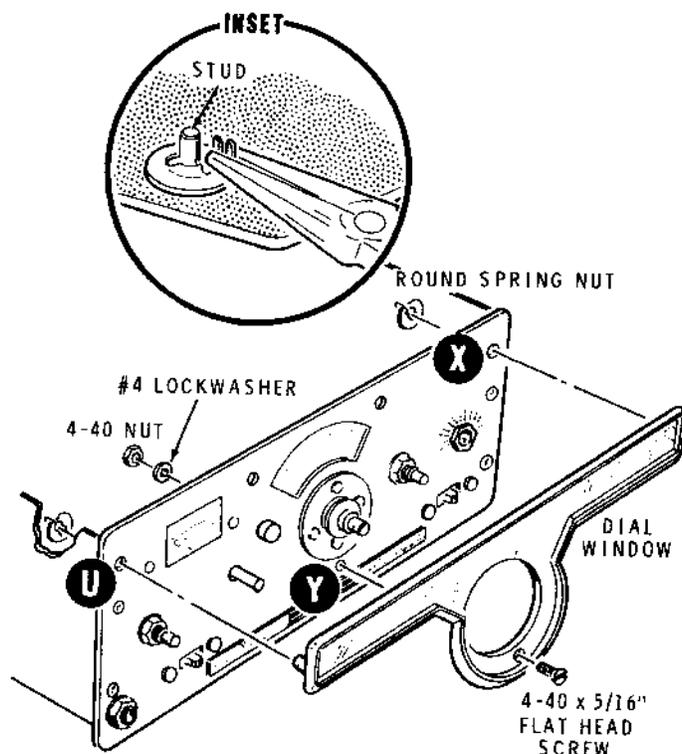
Refer to Detail 1-1H for the following steps.

- (✓) Turn a 4-40 × 1/4" screw all the way into the detent plate threaded hole as shown.
- (✓) Mount a bandswitch wafer onto the switch detent with 4-40 × 3/8" hardware. Be sure to position the detent locating lug and the switch lugs as shown.
- (✓) SW4A: Mount the bandswitch/detent assembly onto the front panel at SW4A with control hardware as shown. Position the detent locating lug into the small hole in the top of the detent plate. Position the detent plate screw into the small front panel hole. NOTE: Be sure to place the **thin** control lockwasher between the detent and the detent plate as shown.



Detail 1-1K





Detail 1-1L

(✓) Clean the dial window with a mild detergent solution and wipe it dry with a soft, lint free cloth. After the window is dry, do not touch the red part of the window. Be sure to use a soft cloth on your work area to avoid scratching the window.

(✓) Refer to Detail 1-1L and mount the dial window onto the front panel. First insert the window studs into front panel holes U and X. Then refer to the inset drawing and secure the studs at U and X with round spring nuts as shown. Secure the window at Y with 4-40 × 5/16" flat head hardware. NOTE: On the inside of the front panel, use long-nose pliers to hold the 4-40 nuts.

(✓) Position the front panel assembly front side down on your work area as shown.

NOTE: When you wire this kit, you will be instructed to prepare wires ahead of time, as in the following step. Unless you are otherwise instructed, use small brown solid (hookup) wire for all the wiring. To prepare a wire, cut it to the length indicated and remove 1/4" of insulation from each wire end. The wires are listed in the order you will use them.

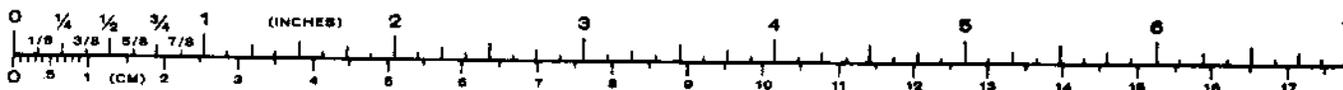
(✓) Prepare the following wires:

One 9" brown One 2-1/2" brown

Four 2" brown One 9-1/2" brown

Front Panel Wiring

Refer to Pictorial 1-2 (Illustration Booklet, Page 4) for the following steps.



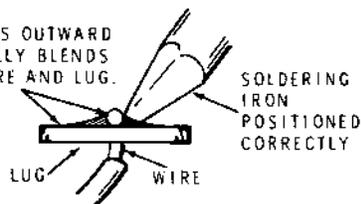


NOTES:

1. In the following steps, (NS) means not to solder because other wires will be added later. "S-" with a number, such as (S-3), means to solder the connection. The number following the "S" tells how many wires are at the connection.
2. When a wire passes through a connection and then goes to another point, as in the next step, the solder instructions will call for two wires (S-2), one entering and one leaving the connection. Be especially careful when you solder these connections that you apply enough solder and heat to properly solder these "through wires."
3. In all cases, after you solder a connection, cut off any excess wire lengths unless you are otherwise instructed.

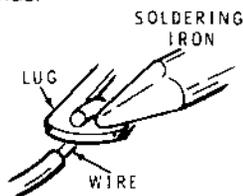
A GOOD SOLDER CONNECTION

SOLDER FLOWS OUTWARD AND GRADUALLY BLENDS WITH THE WIRE AND LUG.

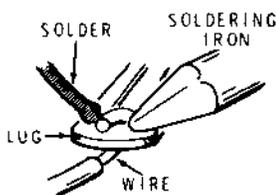


When both the wire and the lug are heated at the same time, the solder will flow onto the wire and the lug evenly. The solder will make a good electrical connection between the wire and the lug.

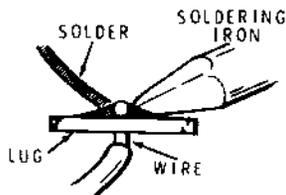
1. Push the soldering iron tip against the wire and the lug. Heat both the wire and the lug for two or three seconds.



2. Apply solder to the wire and the lug, not to the soldering iron. **IMPORTANT:** Let the heat of the wire and lug melt the solder.

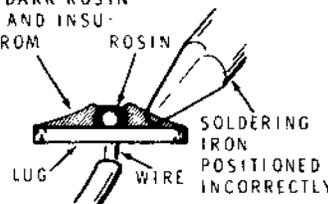


3. As the solder begins to melt, allow it to flow around the connection. Then remove the solder and the iron and let the connection cool.



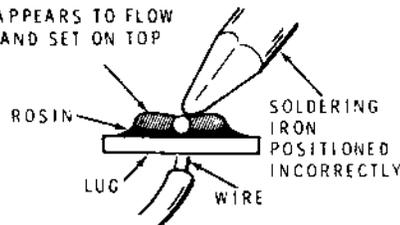
POOR SOLDER CONNECTIONS

SOLDER DOES NOT FLOW ONTO THE LUG AND WIRE. A DARK ROSIN BEAD SURROUNDS AND INSULATES THE WIRE FROM THE CONNECTION.



When the wire is not heated sufficiently, the solder will not flow onto the wire as shown above. To correct, reheat the connection and, if necessary, apply a small amount of additional solder to obtain a good connection.

SOLDER APPEARS TO FLOW INWARD AND SET ON TOP OF LUG.



When the lug is not heated sufficiently, the solder will blob on the lug as shown above. To correct, reheat the connection and, if necessary, apply a small amount of additional solder to obtain a good connection.



Connect the prepared wires as follows:

- (✓) Remove an additional 1/4" of insulation from one end of a 2" brown wire. Connect this end of the wire through control R1 lug 2 (S-2) to lug 3 (NS). Connect the other end of this wire to the negative (-) marked meter lug (S-1).
- (✓) Connect a 9" wire to the positive (+) meter lug (S-1). The free end will be connected later.
- (✓) Connect one end of a 2" wire to switch SW1 lug 4 (S-1). The free end will be connected later.
- (✓) Connect one end of a 2" wire to J1 lug 2 (NS). The free end will be connected later.
- (✓) C10: 4.7 μF electrolytic capacitor. Note the position of the identified (+ or -) lead. Then connect the positive (+) lead to J1 lug 1 (NS) and the negative (-) lead to J1 lug 2 (S-2).
- (✓) Connect one end of a 2-1/2" brown wire to switch SW2 lug 2 (S-1). The free end will be connected later.
- (✓) Connect one end of an 9-1/2" brown wire to switch SW2 lug 5 (NS). The free end will be connected later.
- (✓) Connect one end of a 2" wire to switch SW2 lug 5 (NS). The free end will be connected later.
- (✓) Cut two 1/2" pieces of small white sleeving.
- (✓) R9: Place a 1/2" piece of sleeving on each lead of a 22 Ω, 1/2-watt (red-red-black) resistor. Mount the resistor from SW4A lug 1 (S-1) to SW2 lug 5 (NS).
- (✓) Prepare two 18" heavy black stranded wires. To prepare stranded wires, cut each wire to the length indicated and remove 1/4" of insulation from each wire end. Then tightly twist each wire end and add a small amount of solder to hold the fine strands together.

NOTE: To make a "mechanically secure connection," as in the following step, refer to the inset drawing on Pictorial 1-2. Wrap the wire end(s) securely around the indicated lug or lugs before you solder the connection.

- (✓) Twist the two heavy black wires together. Then connect one black wire to switch SW3 lug 4

(S-1) and the other wire to SW3 lug 5 (S-1). Be sure to make mechanically secure connections. The free wire ends will be connected later.

WIRE HARNESS

NOTES:

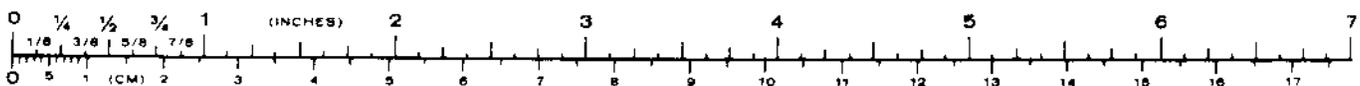
1. The locations where one or more wires leave the wiring harness are called "breakouts," abbreviated "BO." Each BO has a number, as shown in Pictorial 1-2.
2. Harness wires and cables are identified by length and color. Wires may be a solid color, or they may be white with a colored stripe (such as white-red).
3. Identify as BO#1 the end of the wire harness which has two heavy brown wires, two heavy orange wires and a small white-orange wire. The other end of the harness is BO#5.
- (✓) Refer to the Pictorial and form the wire harness on your work area in the manner shown.
- (✓) Position the wire harness near the lower edge of the front panel as shown.

Connect some of the wires at wire harness BO#5 in the following steps:

<u>Wire Color:</u>	<u>Connect To:</u>
(✓) Blue	J1 lug 1 (NS).
(✓) Yellow	J1 lug 1 (S-3).
(✓) White-orange	SW1 lug 6 (S-1).
(✓) White-brown	SW1 lug 8 (S-1).
(✓) Violet	SW1 lug 3 (S-1).

- (✓) Connect the inner lead of the short shielded cable to control R1 lug 1 (S-1). Cut a 1/2" piece of small white sleeving. Place the sleeving on the cable shield lead and connect the lead to R1 lug 3 (S-2). Be sure to solder the control lug to lug 3.

NOTE: The remaining wires coming from harness BO#5 will be connected later.





Connect the wires coming from harness BO#4 in the following steps.

<u>Wire Color:</u>	<u>Connect To:</u>
(✓) Orange	SW4A lug 6 (S-1).
(✓) White-black	SW4A lug 5 (S-1).
(✓) Red	SW4A lug 4 (S-1).
(✓) Black	SW4A lug 3 (S-1).
(✓) White-blue	SW4A lug 2 (S-1).
(✓) White-red	SW2 lug 5 (S-4).
(✓) Green	SW2 lug 6 (S-1).
(✓) Blue	SW2 lug 1 (S-1).

NOTE: Except for two pilot lamp wires that will be installed later, this completes the front panel wiring. Check to make sure all wire connections are soldered. The remaining wires coming from harness BO#4 will be connected later.

Set the front panel aside temporarily.

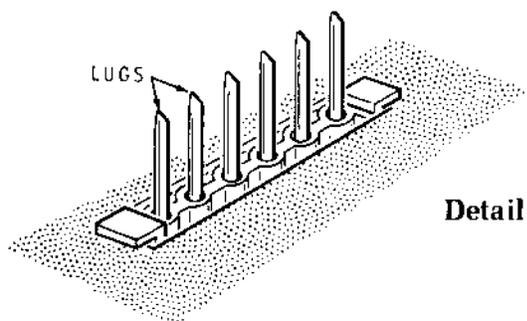
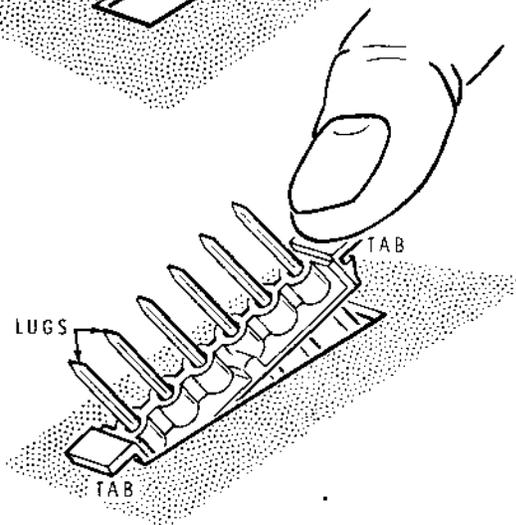
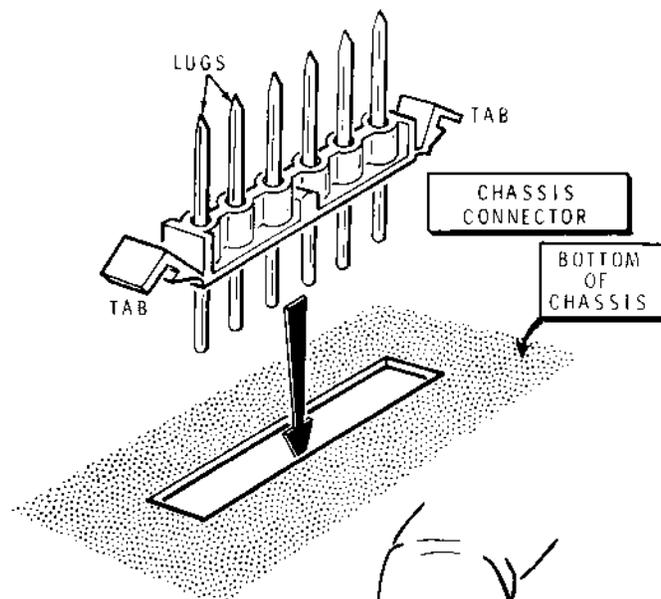
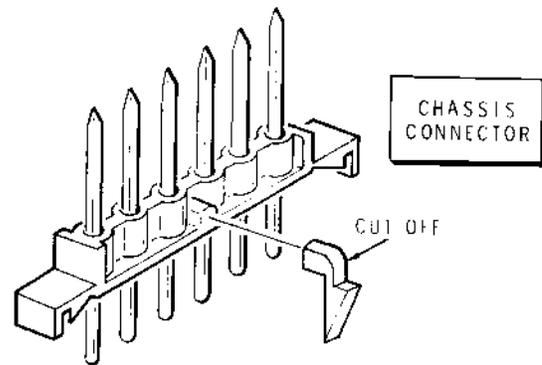
Chassis Parts Mounting

Refer to Pictorial 1-3 (Illustration Booklet, Page 5) for the following steps.

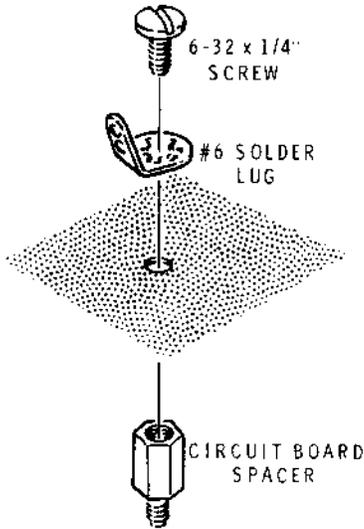
- () Position the chassis on your work area as shown in the Pictorial.

Refer to Detail 1-3A for the next two steps.

- () Cut the tab from the side of one of the 6-pin connectors as shown. Then push the connector firmly down into chassis cutout BA.
- () In the same manner, prepare and install the other 6-pin connector at cutout BB.
- () Locate the terminal label set. Remove one of the narrow strips that have a letter followed by the numerals 1 through 6. Cut the letter from the strip; then carefully press the strip on the chassis at BA so the numbers line up with the pins of connector BA as shown.
- () In the same manner, prepare a strip numbered from 7 through 12 and carefully press it in place to line up with the pins of connector BB.

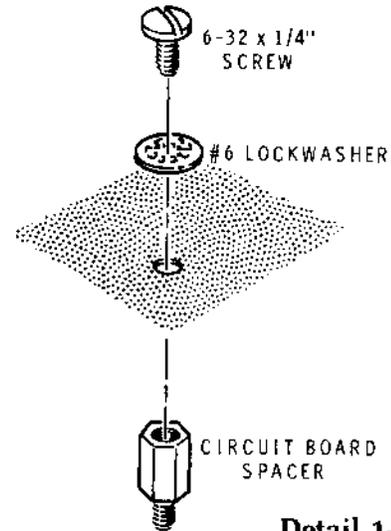


Detail 1-3A



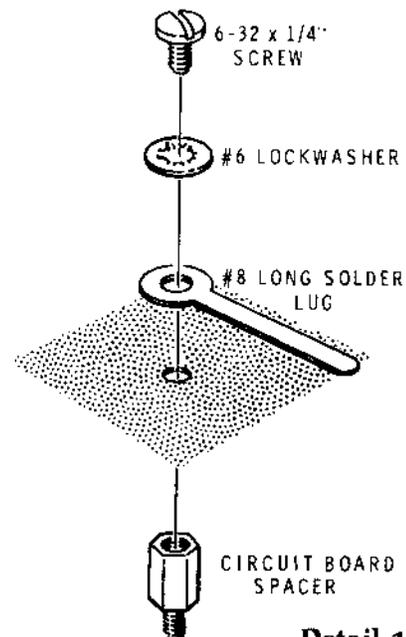
Detail 1-3B

- (✓) Remove the paper backing from one "DANGER" label and press the label in place on the underside of the chassis as shown in the Pictorial. NOTE: Be sure not to position the label over any chassis holes or cutouts.
- (✓) On the terminal label set, partially peel the G G G G label strip from the paper backing and cut a two-letter (G G) label from the strip. Press the double-G label on the underside of the chassis at the two adjacent round holes at the center front of the chassis as shown in the Pictorial.
- (✓) Refer to Detail 1-3B and install a 1/4" circuit board spacer on the top of the chassis at BP. Use a 6-32 x 1/4" screw and a #6 solder lug. Position the solder lug as shown in the Pictorial.
- (✓) Refer to Detail 1-3C and mount a 1/4" circuit board spacer at BN with a #6 lockwasher and a 6-32 x 1/4" screw.

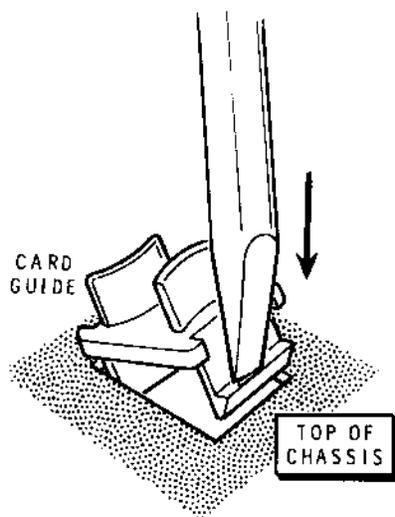


Detail 1-3C

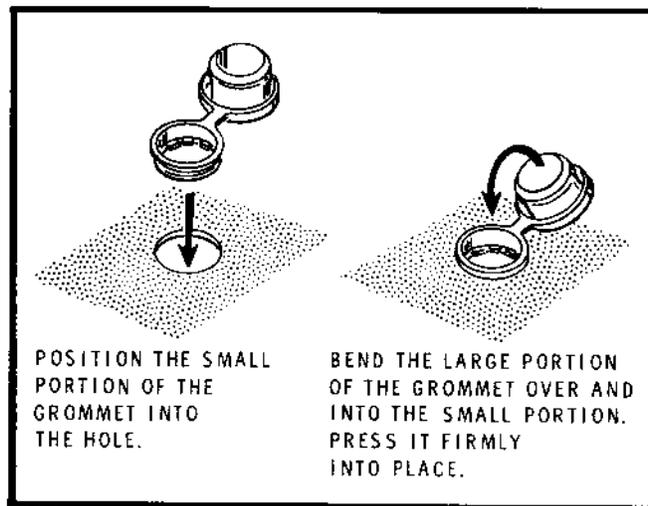
- (✓) Refer to Detail 1-3D and mount a 1/4" circuit board spacer at BL. Use a #8 long solder lug, a #6 lockwasher, and a 6-32 x 1/4" screw. Position the long solder lug as shown in the Pictorial.
- (✓) In the same manner, mount another 1/4" spacer and a #8 long solder lug at BK. Position the long lug as shown in the Pictorial.



Detail 1-3D

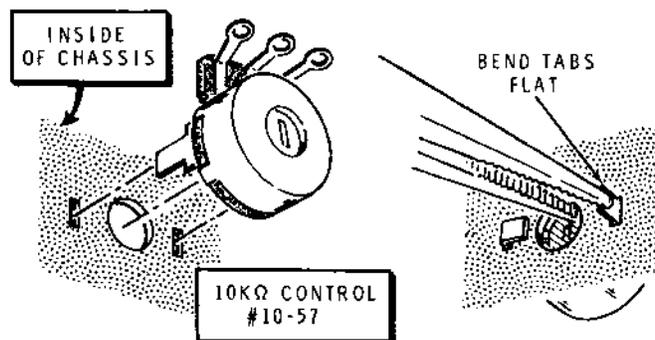


Detail 1-3E

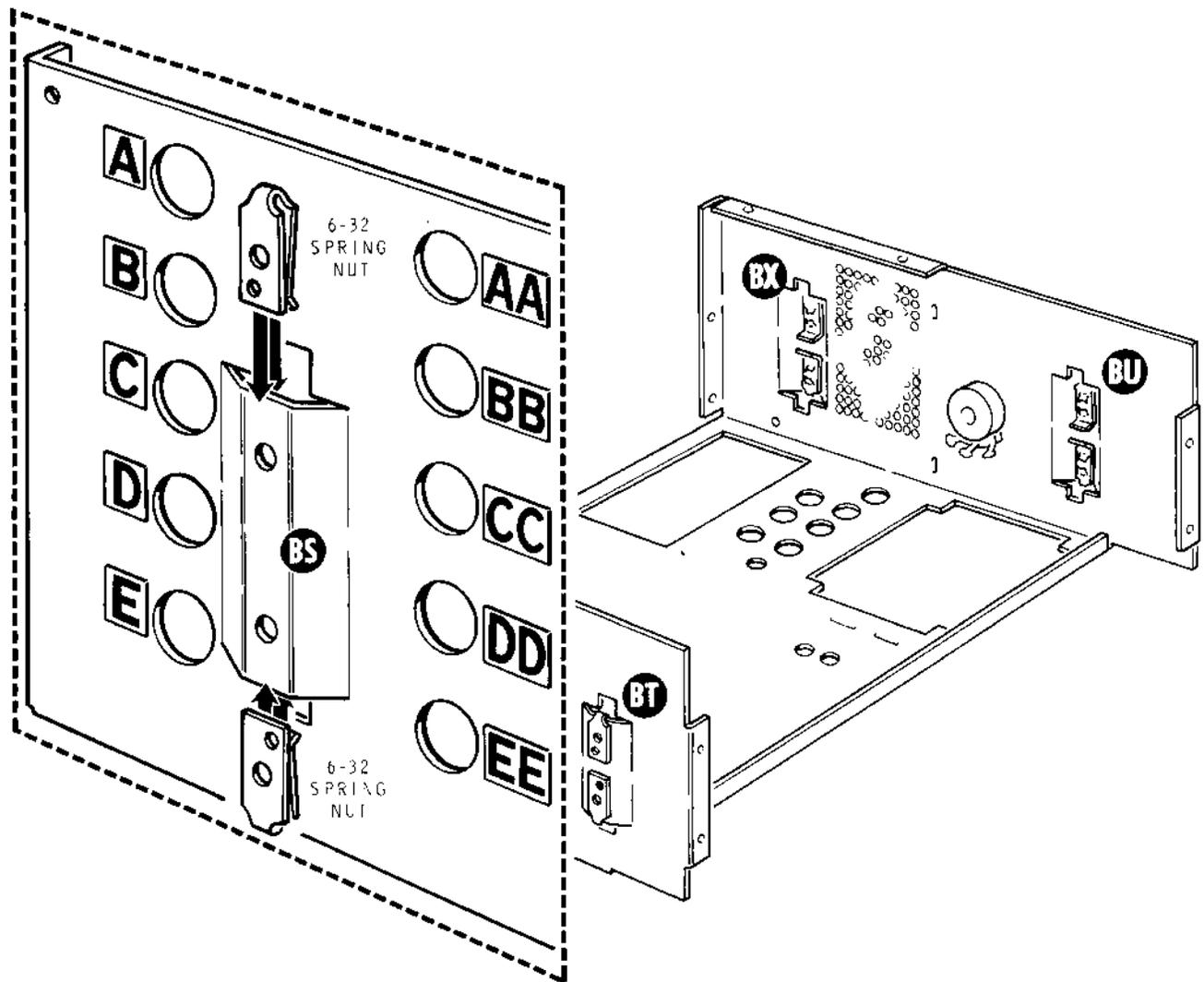


Detail 1-3F

- (✓) Refer to Detail 1-3E and push a card guide from the inside of the chassis through cutout BR as shown.
- (✓) Refer to Detail 1-3F and, from the top of the chassis, mount a 1/2" plastic grommet in hole BH.
- (✓) In the same manner, mount a 1/4" grommet in hole BJ.
- (✓) R5: Refer to Detail 1-3G and mount the 10 kΩ control (#10-57) on the side of the chassis at R6 in the manner shown. Position the lugs as shown in the Pictorial.



Detail 1-3G



PICTORIAL 1-4

Refer to Pictorial 1-4 for the following steps.

- (✓) Push a 6-32 spring nut onto each end of the chassis flange at BS in the manner shown. Be sure the curved tip of the spring nut is on the inside of the chassis.
- (✓) In the same manner, install the remaining six 6-32 spring nuts, in pairs, at BT and, on the other side of the chassis, at BU and BX.
- (✓) Peel the row of A-A-A's from the terminal label strip. Cut three "A's" from the strip and discard

the others. Cut one "A" from the three and press it onto the chassis at the top left hole on the left side of the chassis as shown. Press the remaining pair of "A's" by the side of the other top hole.

- (✓) In the same manner, cut and install first one, and then two, "B's" from the strip alongside the second two holes as shown.
- (✓) In the same manner, cut and install first one, and then two, of the "C's", and "D's", and the "E's" as shown in the Pictorial.



Refer to Pictorial 1-5 (Illustration Booklet, Page 6) for the following steps.

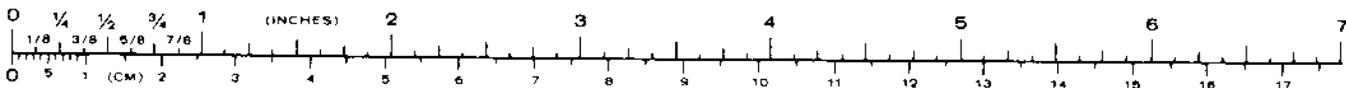
- (✓) Temporarily refer to Pictorial 1-2 and position all the harness and other wires downward from the front panel as shown.
- (✓) Position the chassis on your work area as shown in Pictorial 1-5. Then, turning the front panel top edge down, secure the front panel to the front chassis flanges at K, L, N, and P with four sets of 6-32 × 3/8" phillips head hardware as shown.
- (✓) At the right end of the front panel (as shown in this Pictorial), locate the free ends of two brown wires coming from jack J1 lug 2 and from SW1 lug 4. Connect both of these wires to the chassis ground tab at BC (S-2).
- (✓) Route the twisted heavy black wires coming from front panel switch SW3 under the wire harness and rearward across the chassis to the inside of connectors BA and BB.

Connect the remaining wires and cable leads from harness BO#5 in the following steps.

<u>Wire Color:</u>	<u>Connect To:</u>
(✓) White-blue	Connector BA pin 1 (S-1).
(✓) Black	Connector BA pin 2 (S-1).
(✓) Red	Connector BA pin 3 (S-1).
(✓) White-black	Connector BA pin 4 (S-1).
(✓) Orange	Connector BA pin 5 (S-1).
(✓) Shielded cable, shield lead	Connector BB pin 10 (NS).
(✓) Shielded cable, inner lead	Connector BB pin 11 (S-1).

- (✓) Connect a 1-1/4" medium bare wire from connector BA pin 6 (S-1) to chassis ground tab BD (S-1).
- (✓) Cut a 3" piece of brown wire. Remove all the insulation from the wire.
- (✓) Pass one end of the 3" bare wire through ground loop BE and connect it to connector BB pin 12 (S-1).
- (✓) Pass the other end of the wire back over the top of ground tab BE and then around connector BB pin 10, against pin 9, and wrap the end around pin 8. Solder the wire at BE, and BB pins 8, 9, and 10; then cut off the excess wire end.
- (✓) Refer to the inset drawing on Pictorial 1-5 and gather all the wires together at the front corner of the chassis assembly. Pass a cable tie around these wires and, after you pass the tip of the tie through the eye on the other end, pull the tie until it is tight around the wires. Cut off the excess tie end.

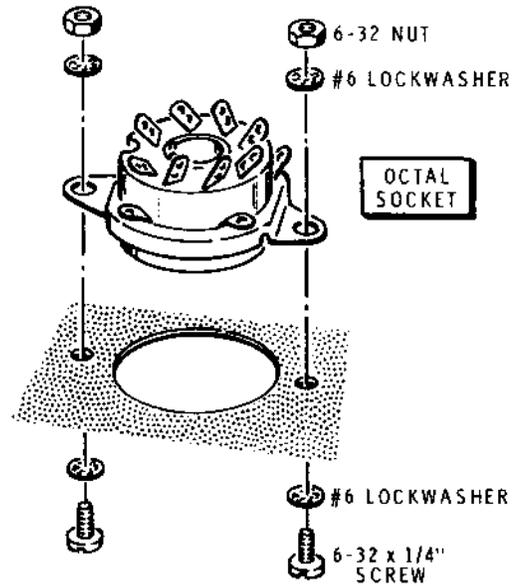
Set the chassis assembly aside temporarily.



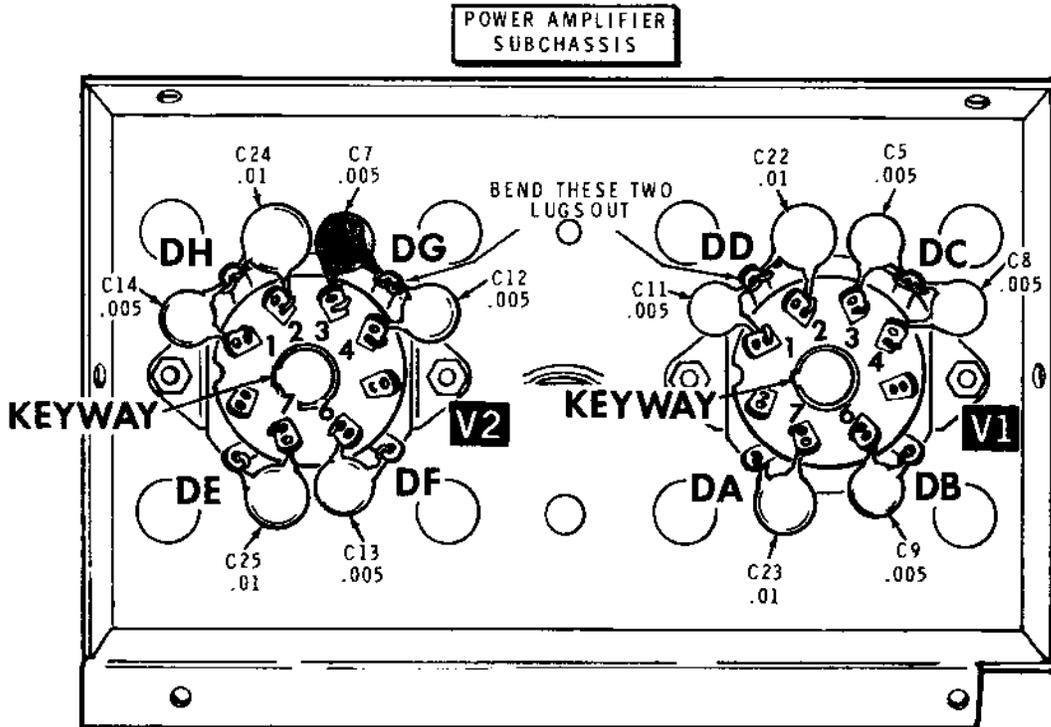
Power Amplifier Subassembly

Refer to Pictorial 2-1 for the following steps.

- (✓) Position the power amplifier (PA) subchassis on your work area as shown in the Pictorial.
- (✓) Refer to Detail 2-1A and mount an octal socket at V1 with 6-32 x 1/4" hardware as shown. Use four #6 lockwashers. Position the socket keyway as shown in the Pictorial.
- (✓) In the same manner, mount the remaining octal socket at V2.
- (✓) Bend ground lugs DD and DG straight out as shown.
- () Cut the leads of four .01 μF ceramic capacitors to 1/4".



Detail 2-1A



PICTORIAL 2-1



NOTES:

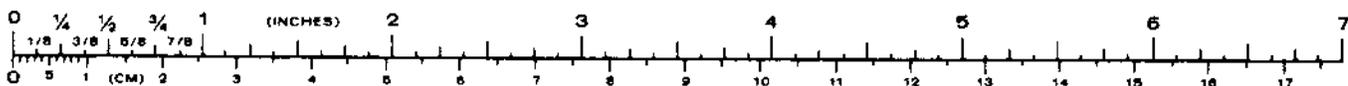
- IMPORTANT:** When you install ceramic capacitors on the octal sockets, keep the leads as short as possible, and the body of each capacitor down against the chassis and tube socket.
- Connect the leads of the capacitor to the nearest ground lug as shown in the Pictorial, and to the lower hole in the socket lug (closest to the body of the socket).

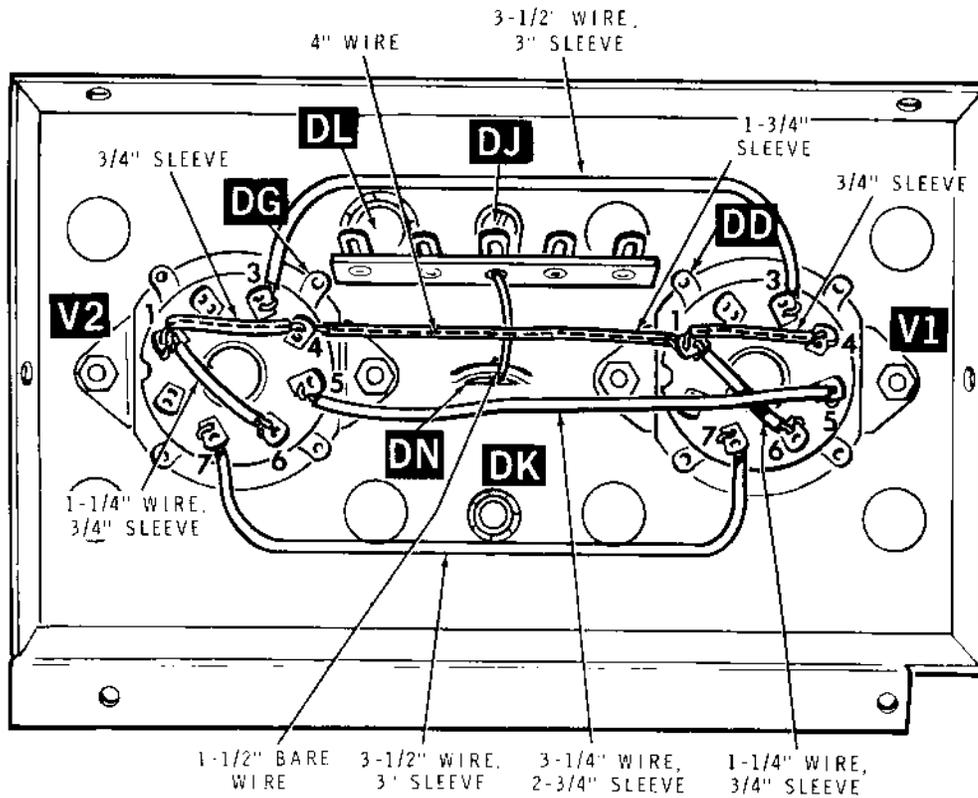
Connect the four .01 μF capacitors to tube sockets V1 and V2 as follows:

	<u>From Tube Socket Lug:</u>	<u>To Ground Lug:</u>
(✓) C23	V1 lug 7 (NS)	DA (S-1).
(✓) C22	V1 lug 2 (NS)	DD (NS).
(✓) C25	V2 lug 7 (NS)	DE (S-1).
(✓) C24	V2 lug 2 (NS)	DH (NS).
(✓)	Cut the leads of eight .005 μF ceramic capacitors to 1/4".	

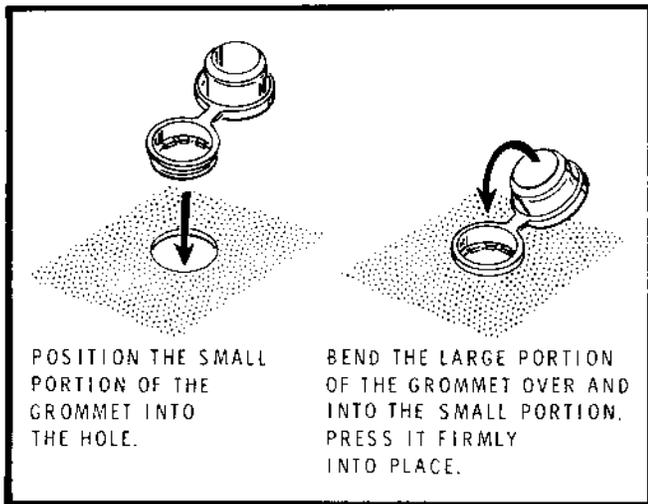
NOTE: Install the eight .005 μF capacitors on the tube sockets V1 and V2 in the same manner as with the four .01 μF capacitors in the previous steps. NOTE: Do not use the .005 μF , 1.6 KV (#21-44) capacitors.

	<u>From Tube Socket Lug:</u>	<u>To Ground Lug:</u>
(✓) C5	V1 lug 3 (NS)	DC (NS).
(✓) C8	V1 lug 4 (S-1)	DC (S-2).
(✓) C9	V1 lug 6 (NS)	DB (S-1).
(✓) C11	V1 lug 1 (NS)	DD (S-2).
(✓) C7	V2 lug 3 (NS)	DG (NS).
(✓) C12	V2 lug 4 (S-1)	DG (S-2).
(✓) C13	V2 lug 6 (NS)	DF (S-1).
(✓) C14	V2 lug 1 (NS)	DH (S-2).





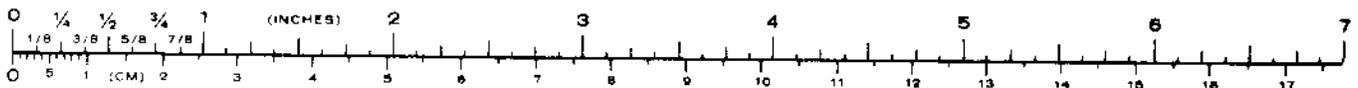
PICTORIAL 2-2

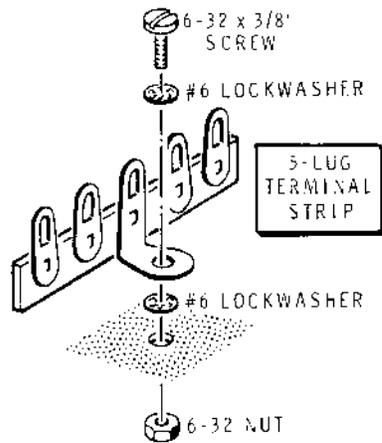


Detail 2-2A

Refer to Pictorial 2-2 for the following steps.

- (✓) Refer to Detail 2-2A and, from the top of the PA subchassis, install a 1/4" grommet in hole DK as shown.
- (✓) In the same manner, install a 3/8" grommet in subchassis hole DL.
- (✓) Refer to Detail 2-2B and mount a 5-lug terminal strip at DJ with 6-32 x 3/8" hardware as shown. Position the terminal strip as shown in the Pictorial. NOTE: If necessary, bend socket lugs DD and DG up, out of the way of the terminal strip.





Detail 2-2B

PA SUBCHASSIS WIRING

- (✓) Cut the following lengths of small white sleeving:

Two 3"	One 2-3/4"
Four 3/4"	One 1-3/4"

- (✓) Cut the following medium bare wires:

Two 3-1/2"	One 3-1/4"
Two 1-1/4"	One 4"

NOTES:

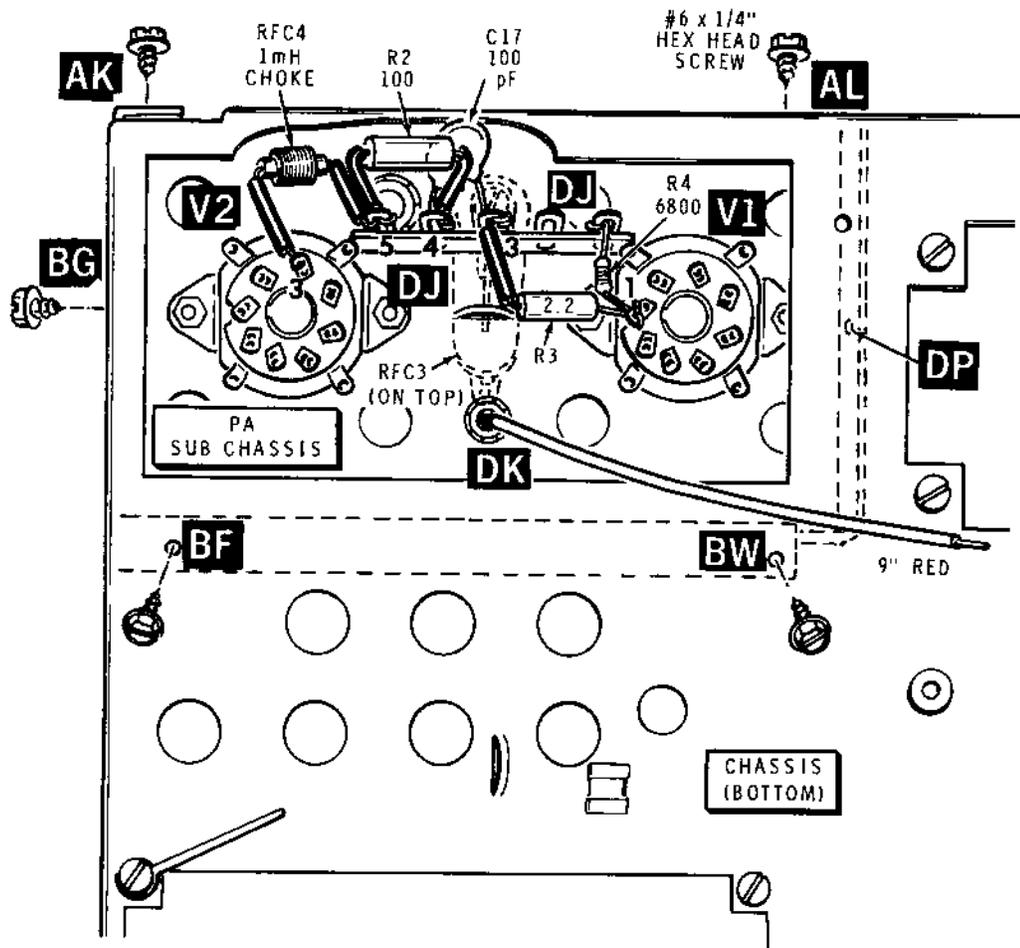
1. Connect wires to the **lower** of the two socket lug holes (closest to the socket) in the following steps, unless otherwise stated.
2. After you have soldered a connection, cut off any excess wire or lead lengths.
3. When you solder a connection at one of the lower socket lug holes, be sure to leave the upper hole clear for later connections.

IMPORTANT: When you connect wires and install components in the following steps, be sure to route the wires and position the components exactly as shown in the Pictorials and Details.

- (✓) Cut a 1-1/2" medium bare wire.
- (✓) Connect one end of the 1-1/2" wire from solder tab DN (NS) to the **eyelet** of terminal strip DJ lug 3 (S-1).
- (✓) Place a 3" sleeve on a 3-1/2" bare wire. Form the wire as shown in the Pictorial and connect the wires ends from socket V1 lug 7 **lower** hole (S-2) to V2 lug 7 **lower** hole (S-2). **NOTE:** Keep this wire down toward the underside of the sub-chassis.
- (✓) Place a 3" sleeve on another 3-1/2" bare wire. Form this wire as in the previous step and connect the ends from V1 lug 3 **lower** hole (S-2) to V2 lug 3 **lower** hole (S-2).
- (✓) Place a 3/4" sleeve on a 1-1/4" wire. Connect this wire between V1 lugs 6 (S-2) and 1 (S-2). Be sure to use the lower lug holes.
- (✓) Place a 3/4" sleeve on another 1-1/4" wire. Connect this wire between V2 lugs 6 (S-2) and 1 (S-2).

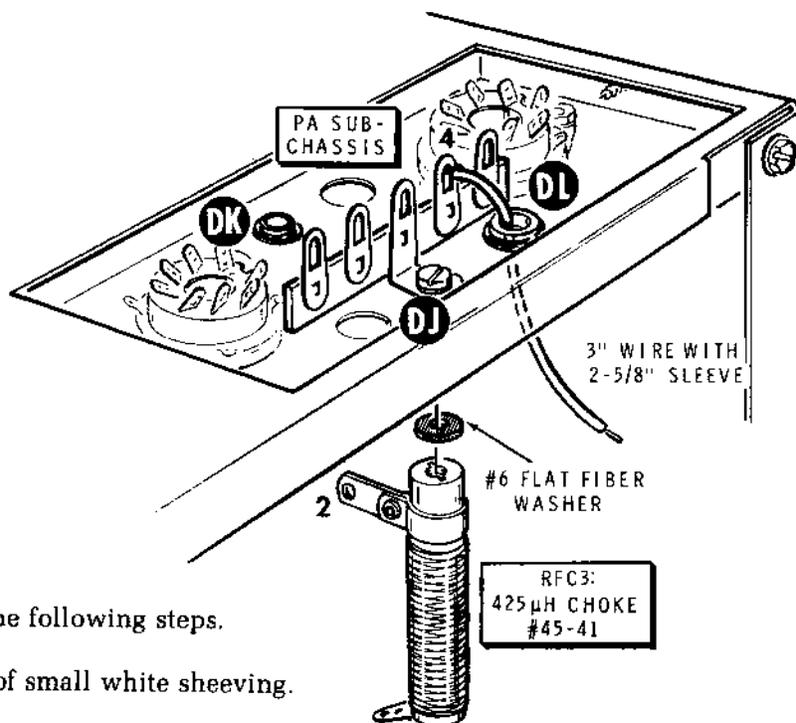
NOTE: In the following step, as you install the wire to (or through) four tube socket lugs, be sure to place a length of sleeving between each pair of lugs. Do not solder any of the lug connections until the wire is fully in place. Twist the ends of both socket lugs #4 as necessary to slide the wire through.

- (✓) Start the end of a 4" bare wire through V2 lug 1 (top hole) toward the right. Place a 3/4" length of sleeving on the wire end. Pass the end through V2 lug 4 (top), place a 1-3/4" sleeve on the wire and pass the end through V1 lug 1. Place a 3/4" sleeve on the wire and pass the wire end through V1 lug 4. Solder V2 lugs 1 (S-1) and 4 (S-2) and **only** lug 4 (S-1) of socket V1.
- (✓) Place a 2-3/4" sleeve on a 3-1/4" bare wire. Connect the wire from V1 lug (top) 5 (S-1) to V2 lug 5 (lower) (S-1).



PICTORIAL 2-3





Refer to Pictorial 2-3 for the following steps.

- (✓) Cut five 1/2" pieces of small white sheaving.
- (✓) Cut the leads of a 2.2 Ω , 2-watt (red-red-gold-silver) resistor to 3/4".
- (✓) R3: Connect one lead of the 2.2 Ω resistor to socket V1 lug 1 (NS). Place a 1/2" sleeve on the other resistor lead and connect the lead to terminal strip DJ lug 3 (NS).
- (✓) Cut the leads of a 100 pF ceramic capacitor to 3/8".
- (✓) C17: Connect the 100 pF ceramic capacitor between terminal strip DJ lugs 3 (S-2) and 4 (NS).
- (✓) Cut the leads of a 6800 Ω (blue-gray-red) resistor to 1/2".
- (✓) R4: Connect the 6800 Ω resistor from tube socket V1 lug 1 (S-4) to terminal strip DJ lug 1 (NS). Cut off the excess resistor leads at V1 lug 1.
- (✓) Cut the leads of a 1 mH choke (#45-83) to 3/4".
- (✓) RFC4: Place a 1/2" piece of sleeving on each lead of the 1 mH choke. Then connect the choke leads from socket V2 lug 3 (S-1) to terminal strip DJ lug 5 (NS).
- (✓) Cut the leads of a 100 Ω , 2-watt (brown-black-brown) resistor to 3/4".

Detail 2-3A

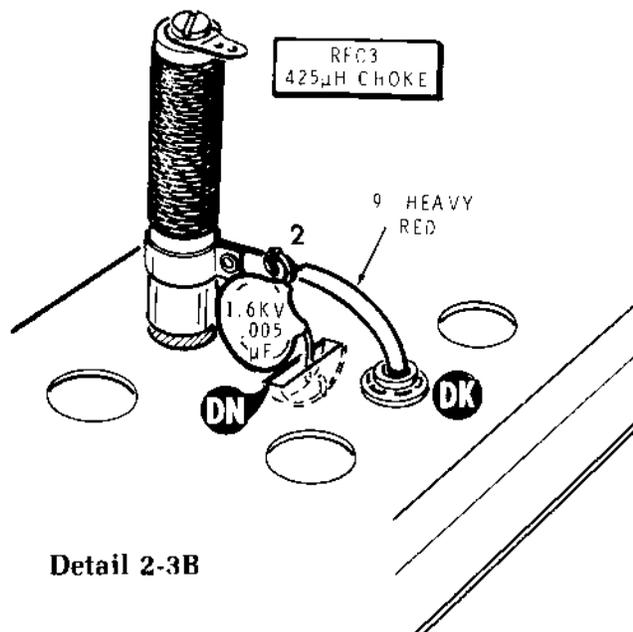
- (✓) R2: Place a 1/2" piece of sleeving on each lead of the 100 Ω resistor. Then connect the resistor between terminal strip DJ lugs 5 (S-2) and 4 (NS).
- (✓) Before you mount the PA subchassis in the following step, turn a #6 \times 1/4" hex head screw all the way into subchassis hole DP. Then remove the screw and put it back with your other hardware.
- (✓) Position the PA subchassis on the top of the chassis as shown in the Pictorial. Then secure the subchassis with five #6 \times 1/4" hex head screws at AK, AL, BW, BF, and BG as shown.

Refer to Detail 2-3A for the next four steps.

- (✓) RFC3: On the top of the PA subchassis, remove the nut that secures terminal strip DJ on the underside of the subchassis. In the place of the 6-32 nut, place a #6 flat fiber washer on screw DJ and turn the 425 μ H choke (#45-41) onto the end of the screw. On the underside of the chassis, tighten the screw on the terminal strip mounting foot until the choke is secured. Posi-

tion the choke lugs as shown in the Detail. If necessary, temporarily bend capacitor C17 away from the screw head.

- (✓) Cut a 3" medium bare wire and a 2-5/8" piece of white sleeving. Place the sleeving on the wire.
- (✓) Pass one end of the 3" sleeved wire down through grommet DL. On the underside of the PA subchassis, connect the wire end to terminal strip DJ lug 4 (NS).
- (✓) Prepare a 9" heavy red wire.
- (✓) Refer to Detail 2-3B for the next two steps.
- (✓) On the top of the PA subchassis, connect one end of the 9" red wire to RFC3 lug 2 (NS). Pass the end of this wire through grommet DK.
- (✓) C15: On the top of the PA subchassis, connect one lead of a .005 μ F, 1.6 KV ceramic capacitor (#21-44) to RFC3 lug 2 (S-2). Pass the other capacitor lead through the slot in the chassis and connect it to the solder tab at DN (S-2).

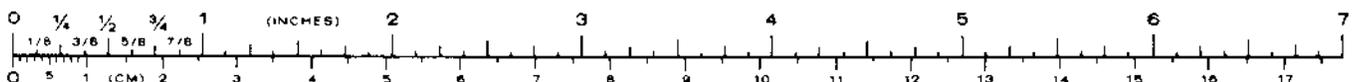


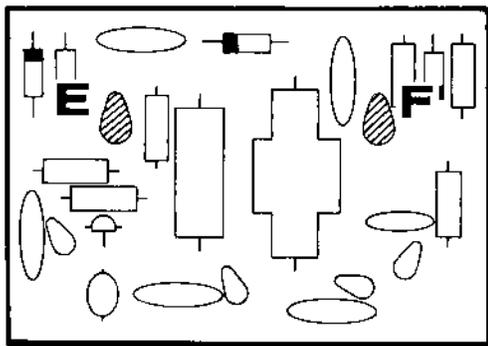
Refer to Pictorial 2-4 (Illustration Booklet, Page 6) for the following steps.

- (✓) Position the chassis assembly as shown in the Pictorial
- (✓) Route the main portion of the wire harness rearward across the center of the chassis as shown.
- (✓) At harness BO#3, push the violet and the white-brown wires down through grommet B}.
- (✓) At the rear of the chassis, route all of the wires coming from harness BO#2 toward the left (as shown in the Pictorial) and then down through grommet BH.

Connect the wires coming from BO#1 to the PA subchassis components as follows:

- (✓) Small white-orange wire to terminal strip DJ lug 1 (S-2).
- (✓) Pass the free end of the **short** heavy brown wire through two ferrite beads. Then connect the end of the wire to socket V1 lug 2 **lower** hole (S-2).
- (✓) Pass the free end of the **long** heavy brown wire through two ferrite beads and then to socket V2 lug 2 **lower** hole (S-2).
- () Set the chassis assembly aside temporarily.



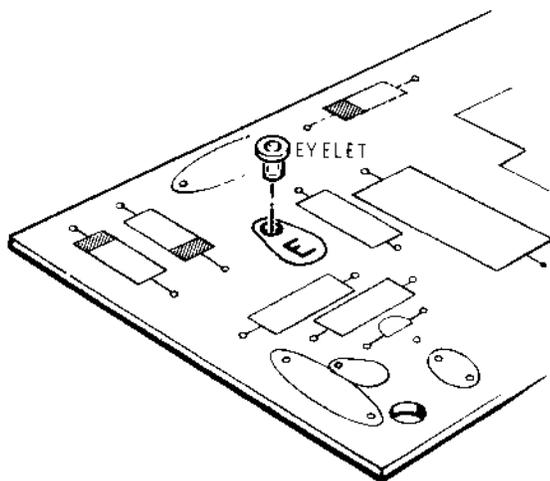


PICTORIAL 3-1

Antenna Switch Circuit Board

Refer to Pictorial 3-1 to locate circuit board holes E and F.

- (✓) Refer to Detail 3-1A and push an eyelet into the antenna switch circuit board from the printed side at holes E and F as shown. Then turn the circuit board foil side up and carefully solder around each eyelet without filling the eyelet hole.



Detail 3-1A

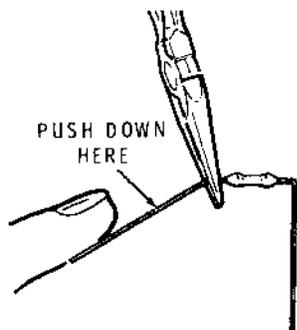
START →

In the following steps, you will be given detailed instructions on how to install and solder the first part on the circuit board. Read and perform each step carefully. Then use the same procedure whenever you install parts on a circuit board.

(✓) Position the circuit board as shown with the printed side (not the foil side) up.

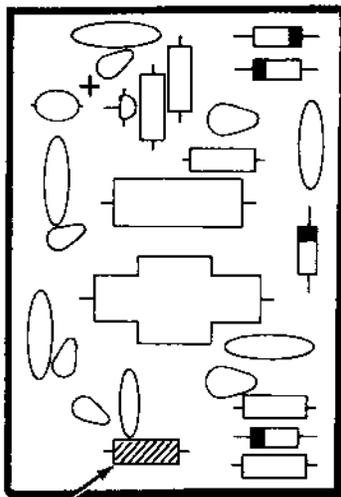
NOTE: When you install a component that has its value printed on it, position the value marking up, so it can be easily read. Diodes should be mounted with their type or part number up, if possible.

(✓) Hold a 22 kΩ (red-red-orange) resistor with long-nose pliers and bend the leads straight down to fit the hole spacing on the circuit board.



(✓) R504: Push the resistor leads through the holes at the indicated location on the circuit board. The end with color bands may be positioned either way.

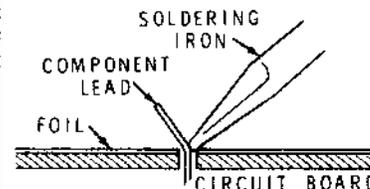
(✓) Press the resistor against the circuit board. Then bend the leads outward slightly to hold the resistor in place.



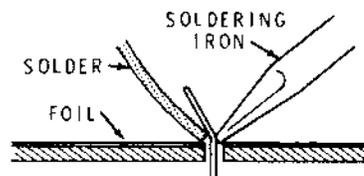
CONTINUE →

(✓) Solder the resistor leads to the circuit board as follows:

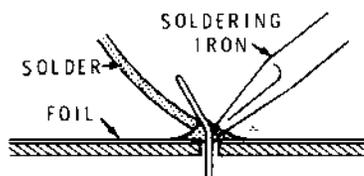
1. Push the soldering iron tip against both the lead and the circuit board foil. Heat both for two or three seconds.



2. Then apply solder to the other side of the connection. **IMPORTANT:** Let the heated lead and the circuit board foil melt the solder.



3. As the solder begins to melt, allow it to flow around the connection. Then remove the solder and the iron and let the connection cool.

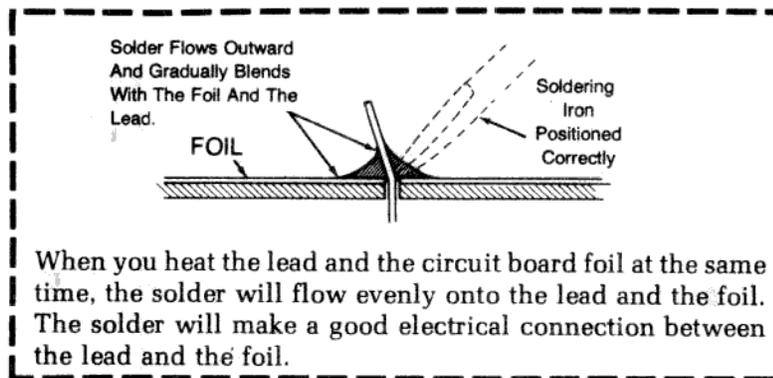


(✓) Cut off the excess lead lengths close to the connection. **WARNING:** Clip the leads so the ends will not fly toward your eyes.

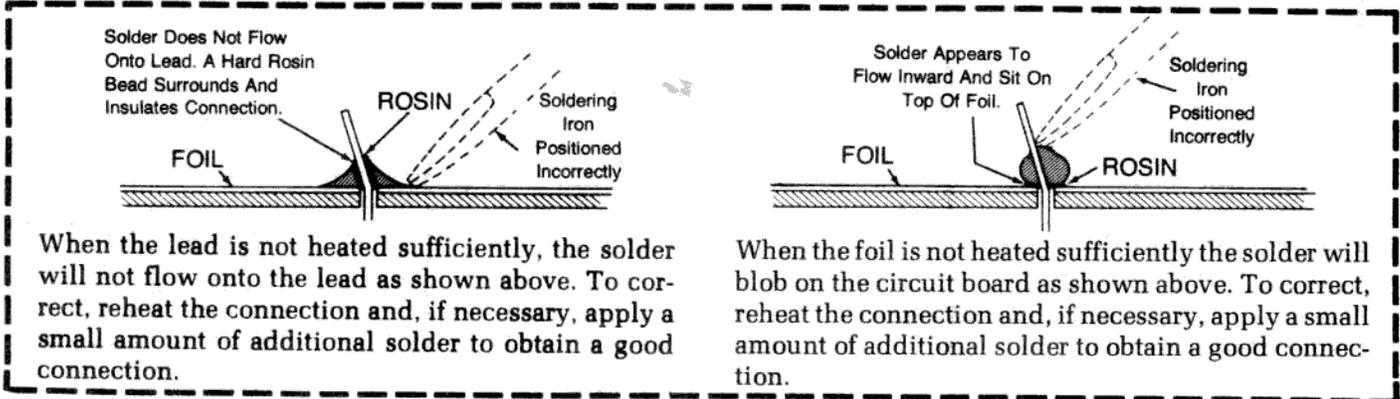
(✓) Check each connection. Compare it to the illustrations on Page 33. After you have checked the solder connections, proceed with the assembly on Page 34. Use the same soldering procedure for each connection.

PICTORIAL 3-2

A GOOD SOLDER CONNECTION



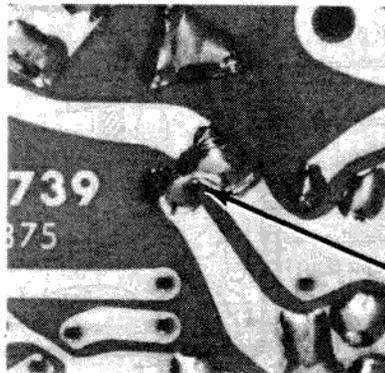
POOR SOLDER CONNECTIONS



SOLDER BRIDGES

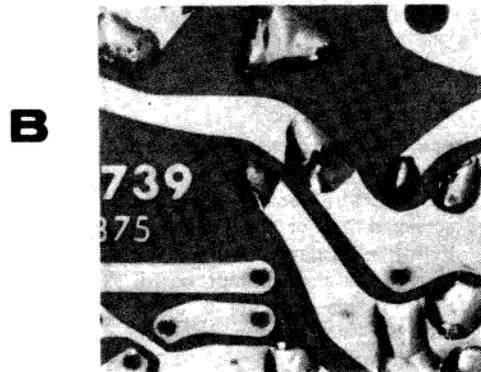
A solder bridge between two adjacent foils is shown in photograph A. Photograph B shows how the connection should appear. A solder bridge may occur if you accidentally touch an adjacent previously soldered connection, if you use too much solder, or if you "drag" the soldering iron across other foils as you remove it from the connection. A good rule to follow is: always take a good look at the foil area around each lead before you solder it. Then, when you solder the connection, make sure the solder remains in this area and does not bridge to another foil. This is especially important when the foils are small and close together. NOTE: It is alright for solder to bridge two connections on the same foil.

Use only enough solder to make a good connection, and lift the soldering iron straight up from the circuit board. If a solder bridge should develop, turn the circuit board foil-side-down and heat the solder between connections. The excess solder will run onto the tip of the soldering iron, and this will remove the solder bridge. NOTE: The foil side of most circuit boards has a coating on it called "solder resist." This is a protective insulation to help prevent solder bridges.



A

SOLDER BRIDGE

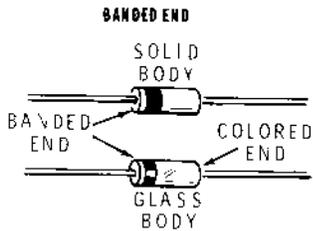
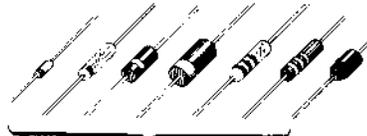


B

START →

NOTE: DIODES MAY BE SUPPLIED IN ANY OF THE FOLLOWING SHAPES. ALWAYS POSITION THE BANDED END AS SHOWN ON THE CIRCUIT BOARD.

IMPORTANT: THE BANDED END OF DIODES CAN BE MARKED IN A NUMBER OF WAYS.



If your diode has a solid body, the band is clearly defined. If your diode has a glass body, do not mistake the colored end inside the diode for the banded end. Look for a band painted on the outside of the glass.

(✓) D504: 1N2071 diode (#57-27).

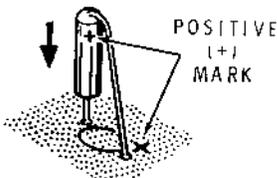
(✓) D501: 1N458 diode (#56-24).

(✓) D502: 1N458 diode (#56-24).

(✓) R507: 15 kΩ (brn-grn-org).

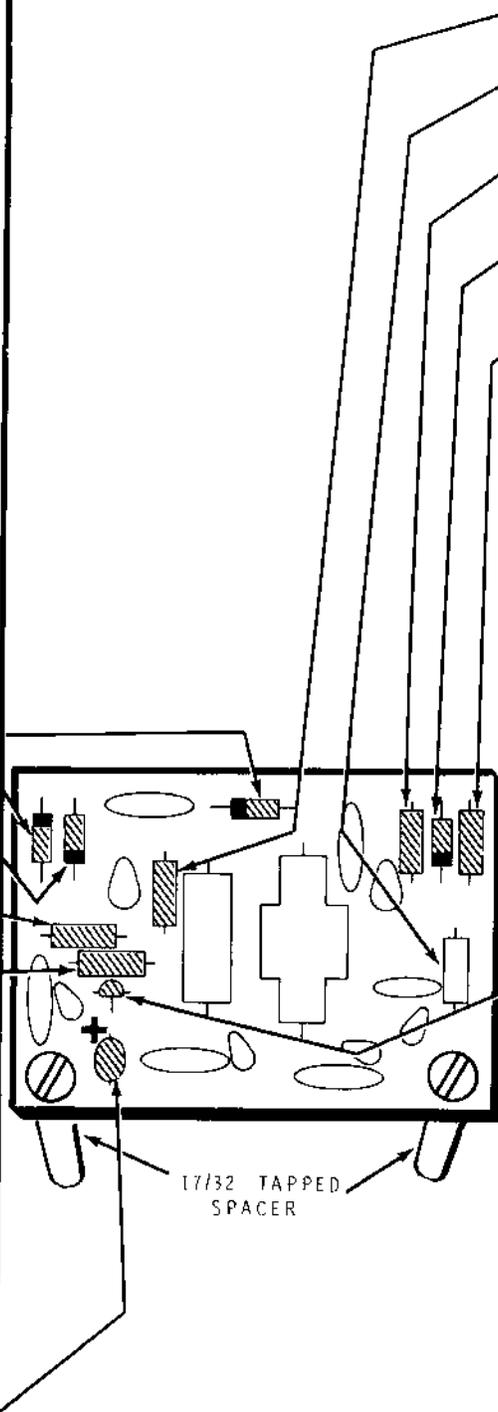
(✓) R501: 47 kΩ (yel-viol-org).

NOTE: When you install a tubular tantalum capacitor, always position the positive (+) or dot marked lead of the capacitor in the positive (+) marked hole.



(✓) C504: .47 μF tubular tantalum. NOTE: The board may be screened ".33" or ".68." The positive ("+") mark may not be marked on your circuit board. Position this capacitor to agree with the "+" marking shown in this Pictorial.

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



PICTORIAL 3-3

CONTINUE ⇐

(✓) R503: 2200 Ω (red-red-red).

(✓) Be sure you installed 22 kΩ resistor R504 in Pictorial 3-2.

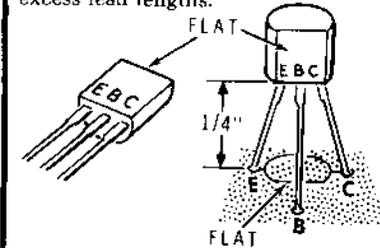
(✓) R505: 10 kΩ, 1/2-watt (brn-blk-org).

(✓) D503: 1N295 diode (red-wht-grn, #56-20). Be sure to position the banded end as shown.

(✓) R506: 330 Ω, 1/2-watt (org-org-brn).

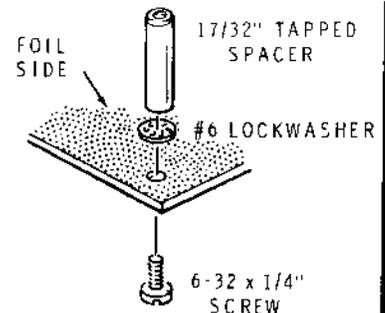
(✓) Solder the leads to the foil and cut off the excess lead lengths.

NOTE: When you install the following transistor, line up the flat on the transistor with the outline of the flat on the circuit board, then insert the leads into their correct E, B, and C holes. Solder the leads to the foil and cut off the excess lead lengths.



(✓) Q501: MPSA42 transistor (#417-294).

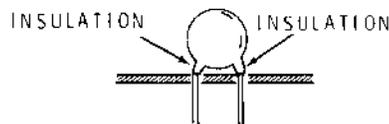
(✓) At the lower corners of the circuit board, mount two 17/32" tapped spacers with 6-32 x 1/4" hardware as shown. Be sure to place the lockwashers between the spacers and the foil.



CONTINUE ↗**START** ↘

- (✓) R502: 120 k Ω , 2-watt (brn-red-yel) resistor.

NOTE: When you install ceramic capacitors, do not push the insulated portion of the leads into the circuit board holes. This could make it difficult to solder the leads to the foil.



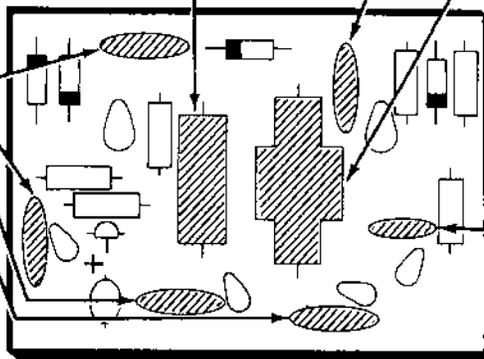
- (✓) C506: .001 μ F ceramic. NOTE: Board may be screened ".01."

- (✓) C502: .01 μ F ceramic.

- (✓) C501: .01 μ F ceramic.

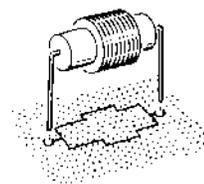
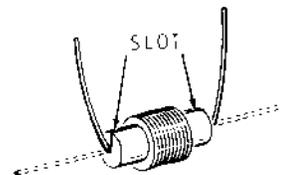
- (✓) C503: .01 μ F ceramic.

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



- (✓) C507: .01 μ F ceramic.

- (✓) L501: Bend the leads of a 2 mH choke (#45-84) as shown. Then mount the choke on the circuit board at L501.



- (✓) C505: .001 μ F ceramic.

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

CIRCUIT BOARD CHECKOUT

Carefully inspect the circuit board for the following conditions.

- (✓) Unsoldered connections.
- (✓) Poor solder connections.
- (✓) Solder bridges between foil patterns.
- (✓) Protruding leads which could touch together.
- (✓) Transistor for the proper installation.
- (✓) Tantalum capacitor for the correct position of the positive (+) lead.
- (✓) Diodes for the correct position of the banded end.

NOTE: Four holes and two eyelets will be used later. Set the circuit board aside temporarily.

PICTORIAL 3-4

DRIVER AND OUTPUT FILTER CIRCUIT BOARDS

PARTS LIST

Open the box marked "Packs 1-3 TOP." Refer to the Pack Index Sheet and locate Pack #1. Unpack these parts and check each part against the following list. The key numbers correspond to the numbers on the "Driver and Filter Circuit Board Parts Pictorial" (Illustration Booklet, Page 7).

To order a replacement part, always include the PART NUMBER. Use the Parts Order Form furnished with this kit. If one is not available, see "Replacement Parts" inside the rear cover of this Manual. For prices, refer to the separate "Heath Parts Price List."

KEY No.	HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.	KEY No.	HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
---------	----------------	------	-------------	-------------------	---------	----------------	------	-------------	-------------------

RESISTORS, 1/4-Watt

NOTES:

- Resistors may be packed in more than one envelope. Open all of the resistor envelopes in this pack before you check them against the following list.
- The following resistors have a tolerance of 5%. 5% is indicated by a gold fourth band.

A1 ✓	6-100-12	1	10 Ω (brn-blk-blk)	R311
A1 ✓	6-330-12	1	33 Ω (org-org-blk)	R308
A1 ✓	6-680-12	3	68 Ω (blu-gry-blk)	R302, R306, R317
A1 ✓	6-151-12	1	150 Ω (brn-grn-brn)	R307
A1 ✓	6-331-12	1	330 Ω (org-org-brn)	R321
A1 ✓	6-471-12	1	470 Ω (yel-viol-brn)	R318
A1 ✓	6-272-12	4	2700 Ω (red-viol-red)	R301, R304, R305, R314
A1 ✓	6-472-12	1	4700 Ω (yel-viol-red)	R313
A1 ✓	6-682-12	1	6800 Ω (blu-gry-red)	R312
A1 ✓	6-103-12	1	10 kΩ (brn-blk-org)	R316
A1 ✓	6-273-12	3	27 kΩ (red-viol-org)	R303, R309, R315
A1 ✓	6-105-12	2	1 MΩ (brn-blk-grn)	R332, R333

Other Resistors

NOTE: The following resistors are 1/2-watt, 5% tolerance unless otherwise noted.

A2 ✓	6-392	1	3900 Ω (org-wht-red)	R326
A2 ✓	6-472	1	4700 Ω (yel-viol-red)	R325
A2 ✓	6-682	1	6800 Ω (blu-gry-red)	R319
A2 ✓	6-103	2	10 kΩ (brn-blk-org)	R327, R328
A2 ✓	6-123	1	12 kΩ (brn-red-org)	R331
A2 ✓	6-223	2	22 kΩ (red-red-org)	R323, R334
A2 ✓	6-683	1	68 kΩ (blu-gry-org)	R322
A3 ✓	1-24-1	1	4700 Ω 1-watt, 10% (yel-viol-red)	R324

CAPACITORS

Mica

B1 ✓	20-52	1	7.5 pF	C603
B1 ✓	20-130	1	12 pF	C601
B1 ✓	20-77	1	24 pF	C609
B1 ✓	20-97	1	50 pF	C618
B1 ✓	20-102	1	100 pF	C608
B1 ✓	20-162	1	105 pF	C316
B1 ✓	20-124	2	115 pF	C602, C619
B1 ✓	20-104	1	130 pF	C605
B1 ✓	20-103	1	150 pF, 5% tolerance	C611
B1 ✓	20-149	1	150 pF, 1% tolerance	C321
B1 ✓	20-178	1	160 pF	C607
B1 ✓	20-105	1	180 pF	C615



KEY No.	HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
---------	----------------	------	-------------	-------------------

Capacitors, Mica (cont'd.)

B1	20-108	3	200 pF	C604, C624, C625
B1	20-111	1	230 pF	C613
B1	20-121	1	290 pF	C606
B1	20-112	1	310 pF	C614
B1	20-139	1	330 pF	C626
B1	20-116	2	400 pF	C617, C621
B1	20-133	1	430 pF	C616
B1	20-113	1	470 pF	C612
B1	20-107	1	680 pF	C622
B1	20-171	1	820 pF	C623

Ceramic

B2	21-172	1	100 pF	C318
B2	21-140	1	.001 μ F	C314
B2	21-176	5	.01 μ F, 100-volt	C304, C305, C306, C308, C309
B2	21-16	8	.01 μ F, 500-volt	C301, C302, C310, C315, C317, C319, C320, C330
B2	21-31	1	.02 μ F	C313
B2	21-143	1	.05 μ F	C307
B2	21-199	2	.1 μ F	C303, C311

Other Capacitors

B3	26-162	1	Tuning capacitor	C322
B4	27-145	1	.22 μ F Mylar	C312

COILS-CHOKES

C1	40-1940	1	1.63 μ H toroid coil	L605
C1	40-1939	1	.28 μ H toroid coil	L601
C1	40-1938	1	.44 μ H toroid coil	L606
C1	40-1964	1	.86 μ H toroid coil	L603
C1	40-1937	2	.31 μ H toroid coil	L602, L604
C1	40-1726	1	7 μ H toroid coil	L304
C1	40-1732	1	10.1 μ H toroid coil	L303
C1	40-1978	1	.85 μ H toroid coil	L306
C1	40-1979	1	.4 μ H toroid coil	L307
C1	40-1977	1	2 μ H toroid coil	L305
C2	40-1934	1	11.5 μ H coil	L609
C3	40-1975	1	.36 μ H coil	L608
C3	40-1974	1	.47 μ H coil	L607
C4	45-27	1	30 μ H RF choke	L301
C5	45-4	1	1 mH RF choke	L611

KEY No.	HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
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DIODES-TRANSISTORS

D1	57-27	2	1N2071 diode	D301, D303
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NOTE: Transistors may be marked for identification in any of the following four ways:

1. Part number.
2. Type number.
3. Part number and type number.
4. Part number with a type number other than the one listed.

D2	417-154	1	2N2369 transistor	Q301
D2	417-893	1	2N5109 transistor	Q302
D3	417-801	1	MPSA20 transistor	Q303
D3	417-836	1	MPSD51 transistor	Q304

SHAFTS-BUSHINGS

E1	453-299	1	4-3/4" center shaft
E2	453-300	1	4" hollow shaft
E3	453-301	1	7-1/4" phenolic shaft
E4	455-11	2	Split bushing
E5	455-15	1	Shaft collar
E6	455-640	1	Pulley bushing
E7	456-7	1	Shaft coupler

MISCELLANEOUS

F1	63-1344	1	2-wafer rotary switch	
F2	215-45	1	Transistor heat sink	
F3	258-103	1	Dial cord spring	
	349-3	1	Dial cord	
F4	432-120	1	Female wire connector	
F5	432-121	1	Circuit board pin	
F6	434-79	1	9-pin tube socket	
F7	434-186	1	Phono socket	
F8	475-10	1	Ferrite bead	FB

PARTS FROM MAIN PACK

	85-2160-1	1	Driver circuit board
	85-2161-1	1	Output filter circuit board

*R322 IS NOT
PUT ON DRIVER
CIRCUIT BOARD
IS NOW LISTED ON
SCHEMATIC AS 15K 1W
ON 5 1W9 TERMINAL
STRIP*

STEP-BY-STEP ASSEMBLY

Driver Circuit Board

START

Position the driver circuit board as shown. Then proceed with the following steps.

(✓) R307: 150 Ω (brn-grn-brn).

(✓) R302: 68 Ω (blu-gry-blk).

(✓) R305: 2700 Ω (red-viol-red).

(✓) R311: 10 Ω (brn-blk-blk).

(✓) R306: 68 Ω (blu-gry-blk).

(✓) R312: 6800 Ω (blu-gry-red).

(✓) R314: 2700 Ω (red-viol-red).

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

(✓) R308: 33 Ω (org-org-blk).

(✓) R317: 68 Ω (blu-gry-blk).

(✓) R303: 27 kΩ (red-viol-org).

(✓) R321: 330 Ω (org-org-brn).

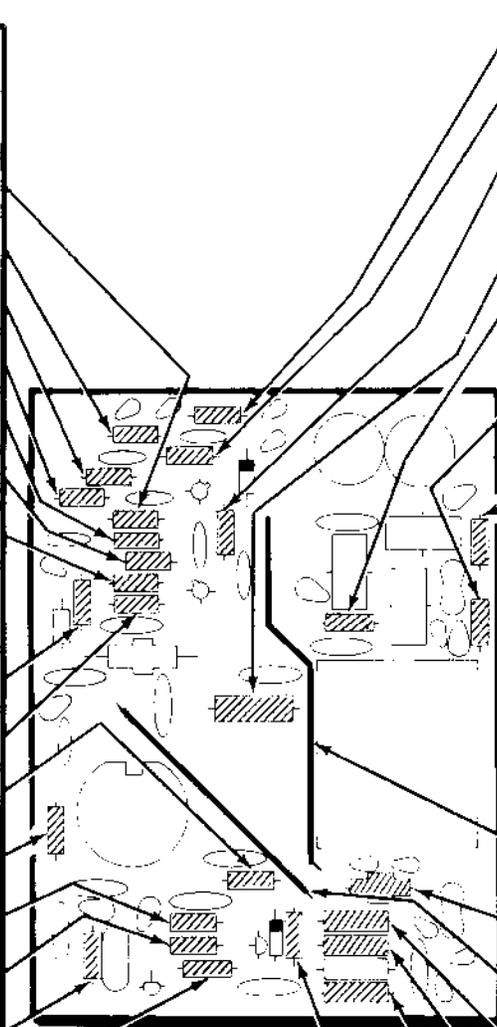
(✓) R316: 10 kΩ, 1/4-watt (brn-blk-org).

(✓) R315: 27 kΩ (red-viol-org).

(✓) R318: 470 Ω (yel-viol-brn).

(✓) R309: 27 kΩ (red-viol-org).

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



CONTINUE

(✓) R301: 2700 Ω (red-viol-red).

(✓) R304: 2700 Ω (red-viol-red).

(✓) R313: 4700 Ω, 1/4-watt (yel-viol-red).

(✓) R324: 4700 Ω, 1-watt (yel-viol-red).

(✓) R331: 12 kΩ, 1/2-watt (brn-red-org).

(✓) R325: 4700 Ω, 1/2-watt (yel-viol-red). NOTE: The board may be screened "10 K."

(✓) R326: 3900 Ω, 1/2-watt (org-wht-red). NOTE: The board may be screened "12 K."

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

(✓) Prepare a 3-1/2" and a 2-1/2" small brown wire. NOTE: When you install jumper wires, form them to the outline on the board, install the wires, then solder the wire ends to the foil and cut off the excess ends.

(✓) 3-1/2" jumper wire.

(✓) R334: 22 kΩ, 1/2-watt (red-red-org). NOTE: The board may be screened "L302."

(✓) 2-1/2" jumper wire.

(✓) R327: 10 kΩ, 1/2-watt (brn-blk-org).

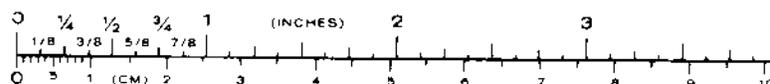
(✓) R328: 10 kΩ, 1/2-watt (brn-blk-org).

(✓) R323: 22kΩ, 1/2-watt (red-red-org).

(✓) R319: 6800 kΩ, 1/2-watt (blu-gry-red). NOTE: The board may be screened "12 K."

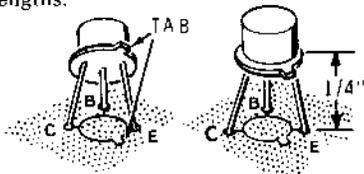
(✓) Solder the leads to the foil and cut off the excess lead lengths.

PICTORIAL 4-1



START 

NOTE: In the next two steps, when you install a transistor, line up the tab on the transistor with the outline of the tab on the circuit board. Then insert the leads in the corresponding holes in the circuit board. Position it 1/4" above the circuit board; then solder the leads to the foil and cut off the excess lead lengths.

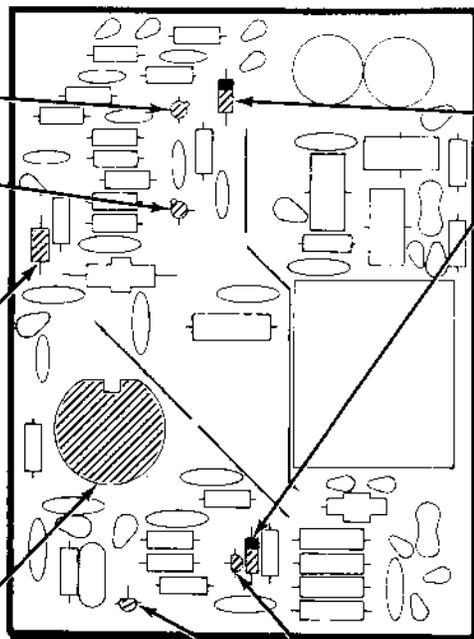
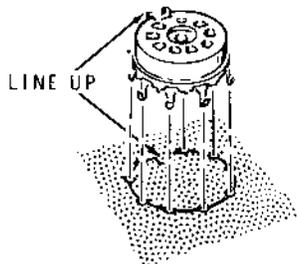


(✓) Q301: 2N2369 transistor (#417-154).

(✓) Q302: 2N5109 transistor (#417-893).

(✓) FB: Cut a 1" small brown wire and remove all the insulation. Place the ferrite bead on the wire and mount the bead on the board. Solder the wire to the foil and cut off the excess ends.

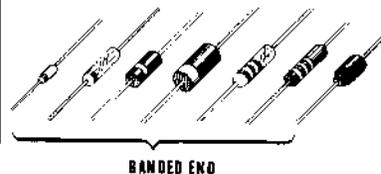
(✓) 9-pin tube socket (#434-79). Position the nine lugs into their corresponding circuit board holes as shown. Push the socket firmly down onto the board; then solder the nine socket lugs to the foil.



CONTINUE 

NOTE: When you install a diode, as in the following steps, position its banded end as shown in the Pictorial. A circuit will not operate properly if the diode is installed backward.

IMPORTANT: THE BANDED END OF DIODES CAN BE MARKED IN A NUMBER OF WAYS.

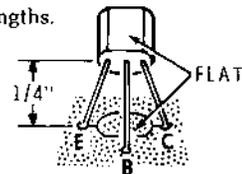


(✓) D301: 1N2071 diode (#57-27).

(✓) D303: 1N2071 diode (#57-27).

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

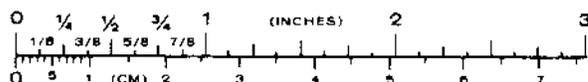
To mount a transistor as in the following steps, first bend the center lead toward the flat side of the transistor. Then line up the flat on the transistor with the outline of the flat on the circuit board and insert the leads into their corresponding holes. Solder the leads to the foil and cut off the excess lead lengths.



(✓) Q304: MPSD51 transistor (#417-836).

(✓) Q303: MPSA20 transistor (#417-801).

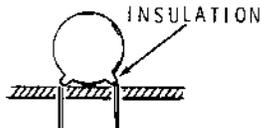
PICTORIAL 4-2



START →

NOTES:

1. In the next five steps, when you install .01 μF ceramic capacitors, be sure to use the **100-volt, smaller .01 μF** components with narrower lead spacing.
2. When you install ceramic capacitors, do not push the insulated portions of the leads into the circuit board holes. This could make it difficult to solder the leads to the foil.



(✓) C305: .01 μF , 100-volt ceramic.

(✓) C304: .01 μF , 100-volt ceramic.

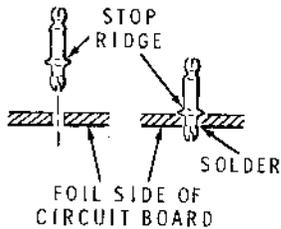
(✓) C308: .01 μF , 100-volt ceramic.

(✓) C306: .01 μF , 100-volt ceramic.

(✓) C309: .01 μF , 100-volt ceramic.

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

NOTE: When you are instructed to install a circuit board pin (#432-121), first push the pin down firmly against the top of the circuit board. Then turn the circuit board over and solder the pin to the foil.



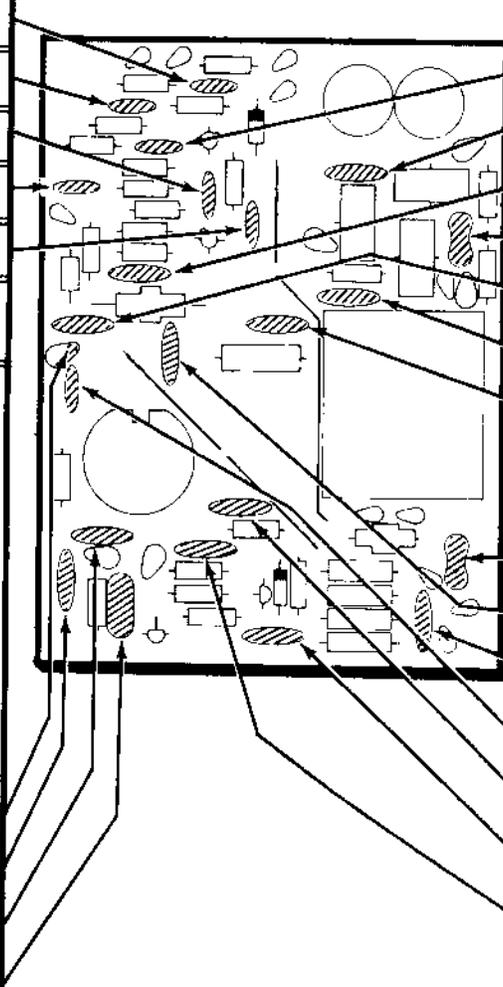
(✓) Circuit board pin at TP1.

(✓) C310: .01 μF , 500-volt ceramic.

(✓) C301: .01 μF , 500-volt ceramic.

(✓) C312: .22 μF Mylar.

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



CONTINUE →

(✓) C307: .05 μF ceramic.

(✓) C318: 100 pF ceramic.

(✓) C303: .1 μF ceramic.

(✓) C316: 105 pF mica.

(✓) C311: .1 μF ceramic.

(✓) C323: .01 μF , 500-volt ceramic.

(✓) C317: .01 μF , 500-volt ceramic.

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

(✓) C321: 150 pF, 1% mica.

(✓) C320: .01 μF , 500-volt ceramic.

(✓) C313: .02 μF ceramic. NOTE: The board may be screened ".01."

(✓) C314: .001 μF ceramic.

(✓) C319: .01 μF , 500-volt ceramic.

(✓) C315: .01 μF , 500-volt ceramic.

(✓) C302: .01 μF , 500-volt ceramic.

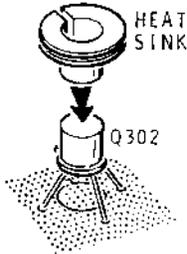
(✓) Solder the leads to the foil and cut off the excess lead lengths.

PICTORIAL 4-3

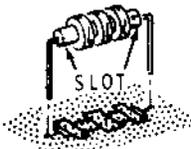
START →

NOTE: When you mount each component in this Pictorial, solder its leads to the foil and cut off the excess lead lengths.

- (✓) Place a transistor heat sink onto Q302. NOTE: Bend the adjacent ceramic capacitor (C308) away slightly if necessary.



NOTE: When you mount the following chokes, be sure you bend the leads toward the slots in the core.



- (✓) L301: 30 μ H RF choke (#45-27).

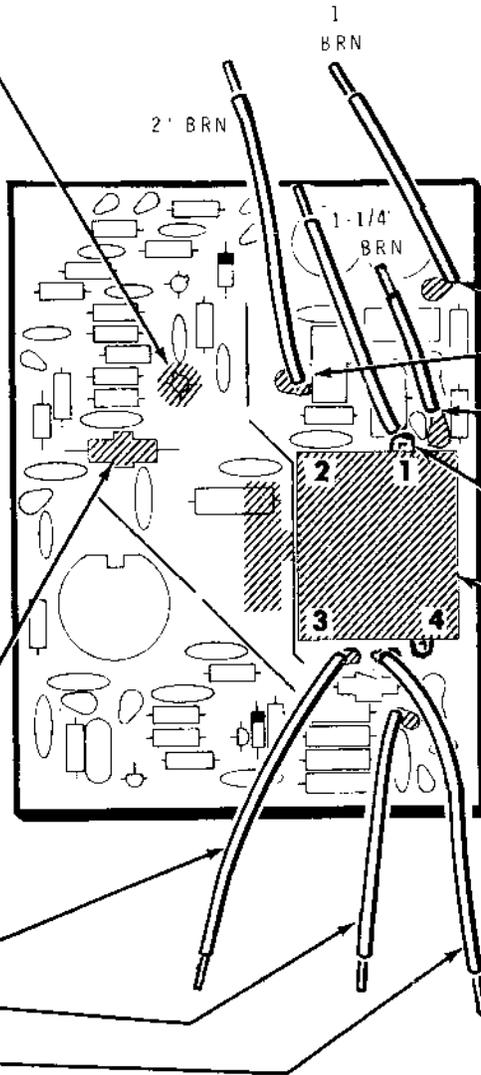
- (✓) Prepare the following small brown wires:

Two 2-1/4"	1"
1-3/4"	2"
1-1/4"	1-1/4"

- (✓) 2-1/4" wire at M.

- (✓) 2-1/4" wire at L.

- (✓) 1-3/4" wire at K.

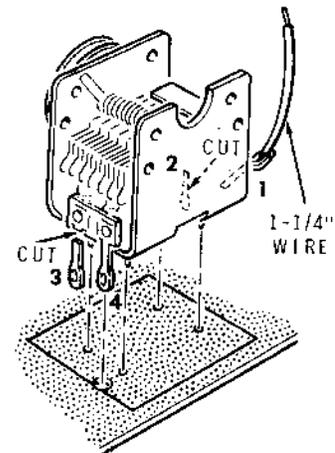


CONTINUE →

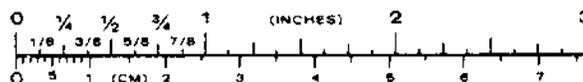
NOTE: Solder one end of the following wires to the foil; the free ends will be connected later.

- (✓) 1-1/4" wire at "40".
- (✓) 2" wire at "20".
- (✓) 1" wire at "80".
- (✓) 1-1/4" wire on tuner lug 1 as shown in the following illustration.

- (✓) C322: Cut lugs 2 and 3 from the tuning capacitor (#26-162). Bend lug 1 upward as shown. Mount the capacitor and solder its four pins and lug 4 to the foil.



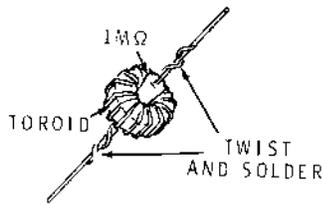
PICTORIAL 4-4



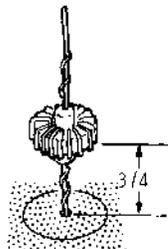
START →

NOTE: When you mount each component in this Pictorial, solder its leads to the foil and cut off the excess lead lengths.

- (✓) Locate a .7 μ H toroid coil (#40-1979). Pass a 1 M Ω (brn-blk-grn) resistor through the center of the coil as shown. Twist the toroid leads around the resistor leads. Solder both lead connections.



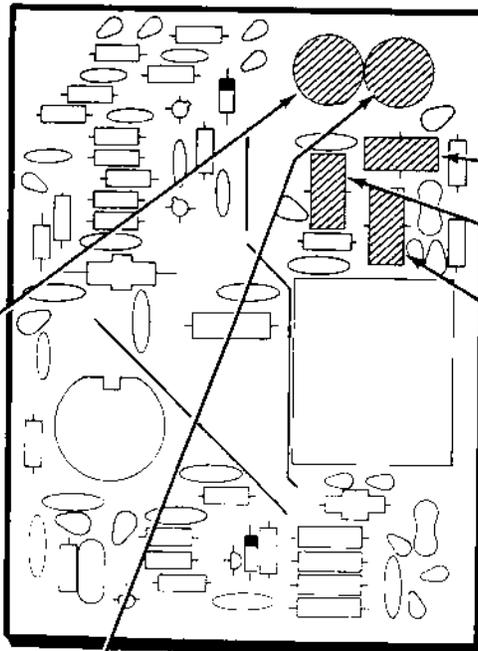
- (✓) R333, L307: Mount the prepared resistor-toroid assembly at L307 as shown. Position the toroid 3/4" above the top of the circuit board. Solder the resistor lead to the foil.



NOTE: The free resistor lead will be connected later.

- (✓) In the same manner, prepare a 1 M Ω (brn-blk-grn) resistor and an .85 μ H toroid (#40-1978) coil.

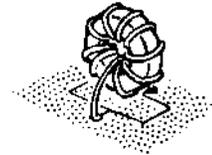
- (✓) R332, L306: Mount the resistor-toroid assembly at L306. Position the toroid 3/8" above the circuit board. Solder the resistor lead to the foil.



PICTORIAL 4-5

CONTINUE →

When you install toroid coils in the following steps, position each coil down against the circuit board as shown.



- (✓) L304: 7 μ H toroid coil (#40-1726).
- (✓) L305: 2 μ H toroid coil (#40-1977).
- (✓) L303: 10.1 μ H toroid coil (#40-1732).

CIRCUIT BOARD CHECKOUT

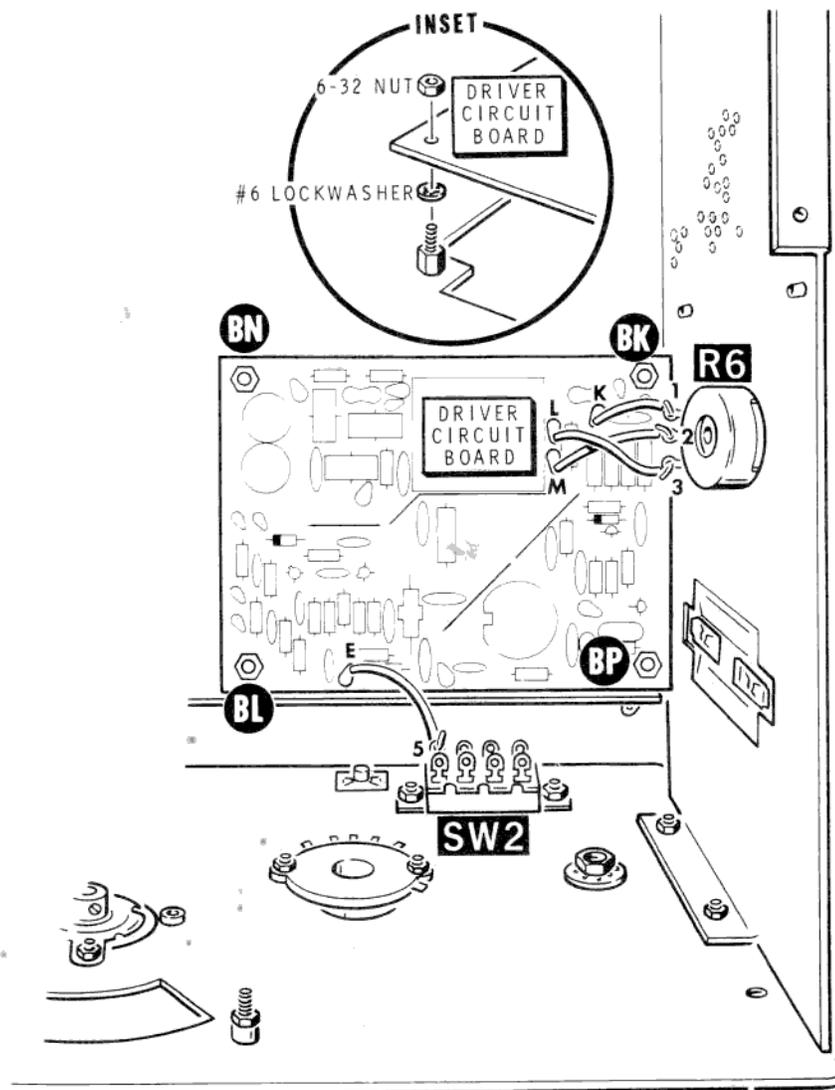
Carefully inspect the foil side of the driver circuit board for the following most commonly made errors.

- (✓) Unsoldered connections.
- (✓) Poor solder connections.
- (✓) Solder bridges between foil patterns.
- (✓) Protruding leads which could touch together.

Refer to the illustrations where the parts were installed as you make the following visual checks.

- (✓) Transistor for the proper installation.
- (✓) Diodes for the correct position of the banded end.

NOTE: There are some unused circuit board holes at this time.

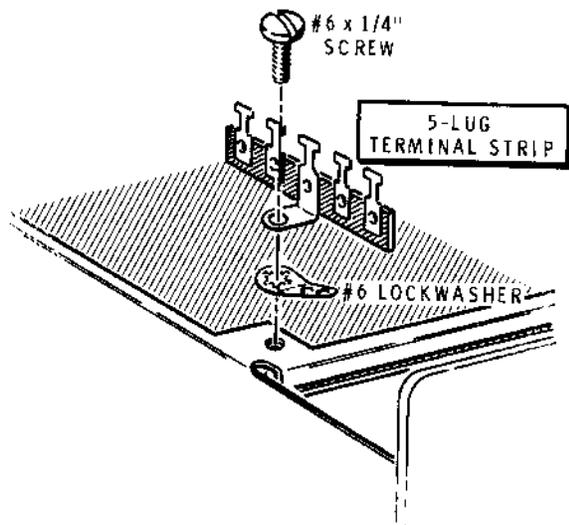


PICTORIAL 5-1

Refer to Pictorial 5-1 for the following steps.

NOTE: When you mount the driver circuit board in the following step, you may have to temporarily loosen the circuit board spacers already mounted on the chassis.

- (✓) Position the driver circuit board into the chassis and secure the board onto spacers BK, BL, BN, and BP with #6 lockwashers and 6-32 nuts. Be sure to place a lockwasher between the top of each spacer and the circuit board foil as shown in the inset drawing on Pictorial 5-1.
- (✓) Connect the end of the wire coming from circuit board hole L to control R6 lug 3 (S-1).
- (✓) Connect the end of the wire coming from circuit board hole M to control R6 lug 2 (S-1).
- (✓) Connect the end of the wire coming from circuit board hole K to control R6 lug 1 (S-1).
- (✓) Connect the free end of the 2" brown wire coming from switch SW2 lug 5 to circuit board hole E. Solder the wire to the foil and cut off the excess wire end.
- (✓) If necessary, on the underside of the chassis, tighten the screws that secure the driver circuit board spacers at BK, BL, BN, and BP.



Detail 5-2A

Refer to Pictorial 5-2 (Illustration Booklet, Page 8) for the following steps.

- (✓) Turn the chassis assembly topside down.
- (✓) Remove the $6-32 \times 1/4$ " screw and the #6 solder lug previously installed at BP. NOTE: You will use these hardware parts in the following step.
- (✓) Refer to Detail 5-2A and mount a 5-lug terminal strip at BP. Position the terminal strip and the solder lug as shown in the Detail.
- (✓) D302: Connect the lead at the banded end of a 2VR68 diode (#56-68) to terminal strip BP lug 3 (S-1). Connect the other lead of this diode to terminal strip BP lug 5 (NS). NOTE: Be sure to use the lower hole of both lugs.
- (✓) R322: Connect a 15 k Ω , 1-watt resistor (brn-grn-org) between terminal strip BP lug 2 (S-1) and lug 5 (S-2). NOTE: Be sure to use the lower hole of both lugs.
- (✓) R330: Connect a 22 k Ω , 1/2-watt resistor (red-red-org) between terminal strip BP lug 1 (NS) and lug 5 (S-1).

Used wiring resistors had to add leads to this one!

- (✓) Cut and prepare a 3-1/4" small brown wire. Connect one end of this wire to terminal strip BP lug 1 (S-1). NOTE: Be sure to use the lower hole of this lug.
- (✓) Connect the free end of the 3-1/4" small brown wire to the indicated hole in the driver circuit board (S-1).
- (✓) Connect the heavy white wire coming from wire harness BO#4 to terminal strip BP lug 2 (NS).
- (✓) Cut and prepare a 6" heavy white wire. Connect one end of this wire to terminal strip BP lug 2 (NS). NOTE: The free end of this wire will be connected later.

Connect the remaining cable and wires coming from wire harness BO#4 to the driver circuit board foil in the following steps.

NOTE: When you connect wires or leads to the foil side of the circuit board, be sure to leave about 1/8" of the bare wire end exposed above the foil to assure a good solder connection. When the connection has been soldered, cut off the excess wires and leads on the top of the circuit board.

- (✓) Cut a 3/8" piece of small white sleeving.
- (✓) Place the 3/8" sleeve on the shield lead of the short coaxial cable. Then connect the shield lead of the coaxial cable to hole H (S-1) and the inner lead to hole G (S-1).
- (✓) Connect the white-brown wire to hole F (S-1).
- (✓) Connect the white-orange wire to hole D (S-1).
- (✓) Connect the free end of the heavy white wire, coming from terminal strip BP lug 2, to hole A (S-1).
- (✓) Cut and prepare an 11" and a 15" small brown wire. Connect either wire end to driver circuit board hole B (S-1) and the other wire end to hole C (S-1). Twist these two wires together (approximately 3 turns per inch) as shown.
- (✓) Route the wires as shown in the Pictorial; to the side and then toward the rear of the chassis.



- (✓) Pass the shorter brown wire end through the two ferrite beads (around the heavy brown wire); then connect the wire to the upper hole of tube socket V2 lug 2 (NS).
- (✓) Cut and prepare a 7-1/2" and a 5-1/2" small brown wire. Pass one end of the 7-1/2" brown wire through the two ferrite beads (total of three wires) and connect it to socket V2 lug 2 (S-2). Route the wire rearward and twist it approximately three turns around the longer brown wire coming from the driver circuit board.
- (✓) Pass the end of the remaining wire coming from the driver circuit board through the two ferrite beads at V1. Connect the wire end to socket V1 lug 2 upper hole (NS).
- (✓) Pass one end of the 5-1/2" brown wire through the two ferrite beads at V1 and connect the wire end to socket V1 lug 2 (S-2). Route the wire rearward and twist it around the wire coming from socket V2 lug 2. NOTE: Both of these free wire ends will be connected later.
- (✓) Cut two 1" pieces of small black sleeving.
- (✓) Place one piece of sleeving around the long solder lug at BL. Then wrap the covered solder lug around the wire harness as shown in the Pictorial.
- (✓) In the same manner, place a 1" sleeve on long solder lug BK and wrap the lug around the two small brown wires.
- (✓) Connect the free end of the small brown wire coming from switch SW2 lug 2 to solder lug BP (S-1).
- (✓) Cut two 3/8" pieces of small white sleeving.
- (✓) Cut the leads of a 1 M Ω , 1/2-watt (brn-blk-grn) resistor to 1/2".
- (✓) Locate the two indicated foil pads on the driver circuit board. Add a generous amount of solder to each of the pads.
- (✓) R320: Position the prepared 1 M Ω resistor on the underside of the driver circuit board, as shown in the illustration, so each lead of the resistor rests on top of one of the foil pads to which you added solder in the previous step. Heat each of these connections, one at a time, to melt the solder around the resistor leads. Let one connection cool before you solder the other.

Set the chassis assembly aside temporarily.



Output Filter Circuit Board

START ↓

Position the output filter circuit board as shown. Then proceed with the following steps.

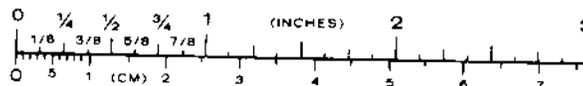
- (✓) C612: 470 pF mica.
- (✓) C609: 24 pF mica.
- (✓) C607: 160 pF mica.
- (✓) C605: 130 pF mica. NOTE: The board may be screened "125."
- (✓) C603: 7.5 pF mica.
- (✓) C604: 200 pF mica.
- (✓) C601: 12 pF mica.
- (✓) Solder the leads to the foil and cut off the excess lead lengths.
- (✓) C602: 115 pF mica.
- (✓) C626: 330 pF mica.
- (✓) C623: 820 pF mica.
- (✓) C615: 180 pF mica.
- (✓) C614: 310 pF mica.
- (✓) C613: 230 pF mica.
- (✓) C622: 680 pF mica.
- (✓) Solder the leads to the foil and cut off the excess lead lengths.

CONTINUE ↓

When bare wire is called for in a step, use the small brown hookup wire and remove all the insulation.

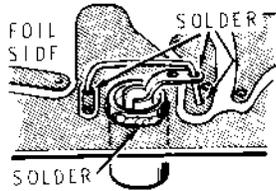
- (✓) 1" bare wire.
- (✓) C608: 100 pF mica.
- (✓) C618: 50 pF mica.
- (✓) C611: 150 pF, 5% mica.
- (✓) C621: 400 pF mica.
- (✓) C619: 115 pF mica.
- (✓) Solder the leads to the foil and cut off the excess lead lengths.
- (✓) C606: 290 pF mica.
- (✓) C616: 430 pF mica.
- (✓) C617: 400 pF mica.
- (✓) C625: 200 pF mica.
- (✓) 1" bare wire.
- (✓) Solder the leads to the foil and cut off the excess lead lengths.
- NOTE: In the next two steps, connect only one end of each wire at the indicated location. Solder just the tip of the wire to the foil as shown.
- (✓) 1" bare wire.
- (✓) 1" bare wire.

PICTORIAL 6-1



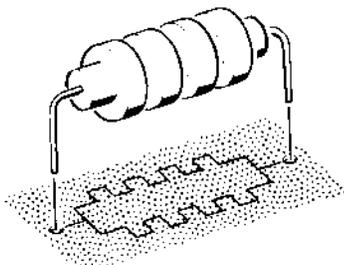
START →

(✓) J601: Phono jack. Install the jack on the component side of the board. Then turn the circuit board over and proceed as follows:

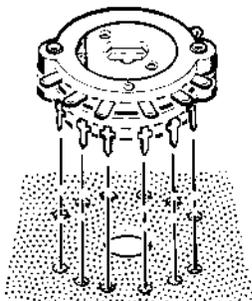


1. Position the jack as shown and solder it to the foil.
2. Prepare a 1-1/4" bare wire.
3. Pass the wire through the tip of the phono lug as shown.
4. Solder the wire ends to the indicated foil pads and the tip of the phono lug.
5. Cut the excess wire ends from the top of the board.

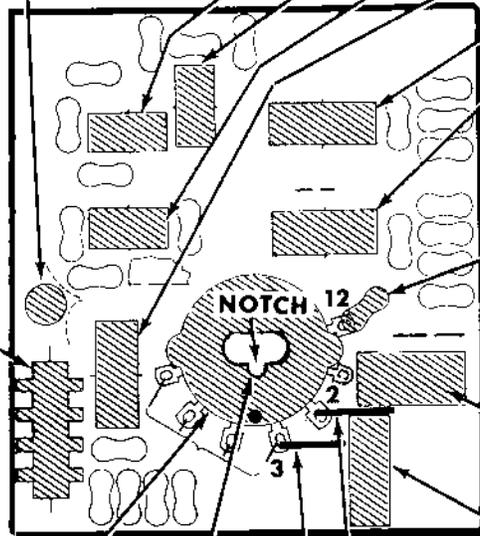
(✓) L611: 1 mH RF choke (#45-4).



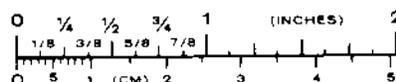
(✓) SW4C/D: Be sure the lugs of the 2-wafer rotary switch are all straight. Then mount the switch as shown. Solder its 12 lugs to the foil.



(✓) **IMPORTANT:** Turn the rotors (centers) of both switch wafers so their notches are positioned as shown.



PICTORIAL 6-2



CONTINUE →

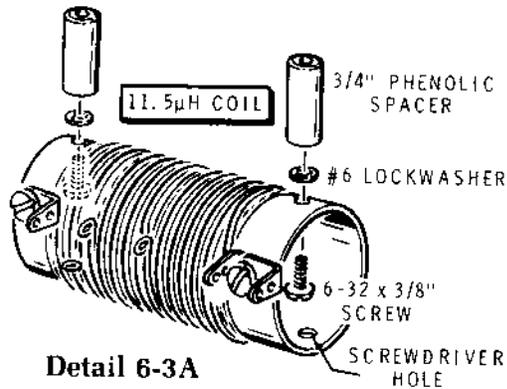
NOTE: When you install the toroid coils in this Pictorial, position them as shown by the outline on the board. Be sure each coil is all the way down onto the board; then solder its leads to the foil and cut off the excess leads.

- (✓) L602: .31 μ H toroid (#40-1937).
- (✓) L604: .31 μ H toroid (#40-1937).
- (✓) L601: .28 μ H toroid (#40-1939).
- (✓) L605: 1.63 μ H toroid (#40-1940).
- (✓) L606: .44 μ H toroid (#40-1938).
- (✓) L603: .86 μ H toroid (#40-1964).
- (✓) Cut the leads of a 200 pF mica capacitor to 1/4".
- (✓) C624: Connect the 200 pF capacitor from SW4C lug 12 (S-1) to the circuit board as shown. Solder the lead to the foil and cut off the excess.
- (✓) L607: .47 μ H coil (#40-1974) (white dot). **IMPORTANT: Mount this coil as high as possible above the surface of the board.**
- (✓) L608: .36 μ H coil (#40-1975) (red dot).
- (✓) Connect the free wire end to SW4C lug 2 (S-1).
- (✓) Connect the free wire end to SW4C lug 3 (NS).

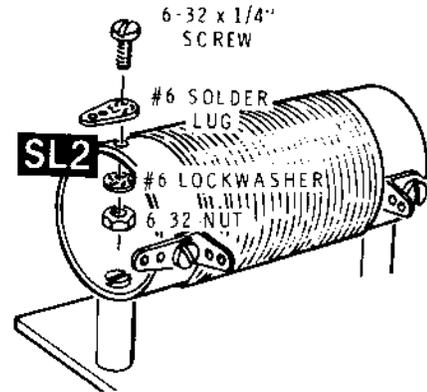
CIRCUIT BOARD CHECKOUT

Carefully inspect the foil side of the circuit board for the following most commonly made errors.

- (✓) Unsoldered connections.
- (✓) Poor solder connections.
- (✓) Solder bridges between foil patterns.
- (✓) Protruding leads which could touch together.



Detail 6-3A



Detail 6-3B

Refer to Pictorial 6-3 (Illustration Booklet, Page 8) for the following steps.

- (✓) Refer to Detail 6-3A and mount two 3/4" phenolic spacers on the 11.5 μ H coil (#40-1934) with two 6-32 \times 3/8" screws and two #6 lockwashers as shown. Be sure to place the lockwashers between the spacers and the coil.
- (✓) L609: Mount the 11.5 μ H coil onto the output filter circuit board with 6-32 \times 3/8" screws and #6 lockwashers as shown in the Pictorial. Be sure to position the coil loops in the direction of the rotary switch wafers.
- (✓) Cut the following medium bare wires:

Two 1-3/4"	One 3-1/2"
Two 1-1/2"	
- (✓) Cut four 1-1/4" pieces of white sleeving.
- (✓) Connect one end of a 1-3/4" bare wire to coil L609 lug 1 (S-1). (Connect to solder lug.) Place a 1-1/4" sleeve on the wire, then bend the wire near the middle so that it will fit straight down into switch SW4C lug 3 as shown (S-2).
- (✓) In the same manner, connect another 1-3/4" bare wire and a 1-1/4" sleeve from L609 loop 2 (S-1) to SW4C lug 4 (S-1).
- (✓) Connect a 1-1/2" bare wire and a 1-1/4" sleeve from L609 loop 3 (S-1) to switch SW4C lug 5 (S-1).
- (✓) Connect one end of a 1-1/2" bare wire to the indicated solder lug at the left end of L609 (S-1).

Place a 1-1/4" sleeve on the wire and connect it as shown in the Pictorial to SW4C lug 6 (S-1). Be sure to form this wire over the top of toroid coil L605 as shown.

- (✓) At the left end of coil L609, bend the remaining solder lug (SL1) so it stands straight out from the end of the coil.

Refer to Detail 6-3B and mount a #6 solder lug on the top of coil L609 at SL2 with 6-32 \times 1/4" hardware as shown.

- (✓) Bend the 3-1/2" medium bare wire 90 degrees, 1-3/4" from one end.
- (✓) Pass the one end of the wire up through solder lug SL1 (S-2) to SL2 (NS) as shown. Position the other wire end straight out from the coil as shown.
- (✓) Cut a 1" piece of white sleeving.
- (✓) Cut both leads of a .005 μ F, 1.6 KV (#21-44) capacitor to 1-1/4".
- (✓) C21: Place a 1" white sleeve on one capacitor lead; then connect the sleeved lead to solder lug SL2 as shown (S-2). The free capacitor lead will be connected later.
- (✓) Refer to Detail 6-3C and, using the edge of the paper insulator, slightly spread the loops of coil L607 as shown. Be sure none of the loops are touching against adjacent loops.

This completes the assembly of your output filter circuit board, set the board aside temporarily.



CHASSIS (Cont'd.)

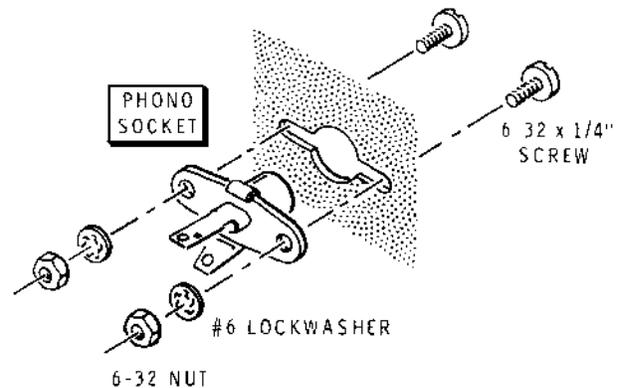
POWER AMPLIFIER ASSEMBLY

Power Amplifier Compartment

Refer to Pictorial 7-1 (Illustration Booklet, Page 9) for the following steps.

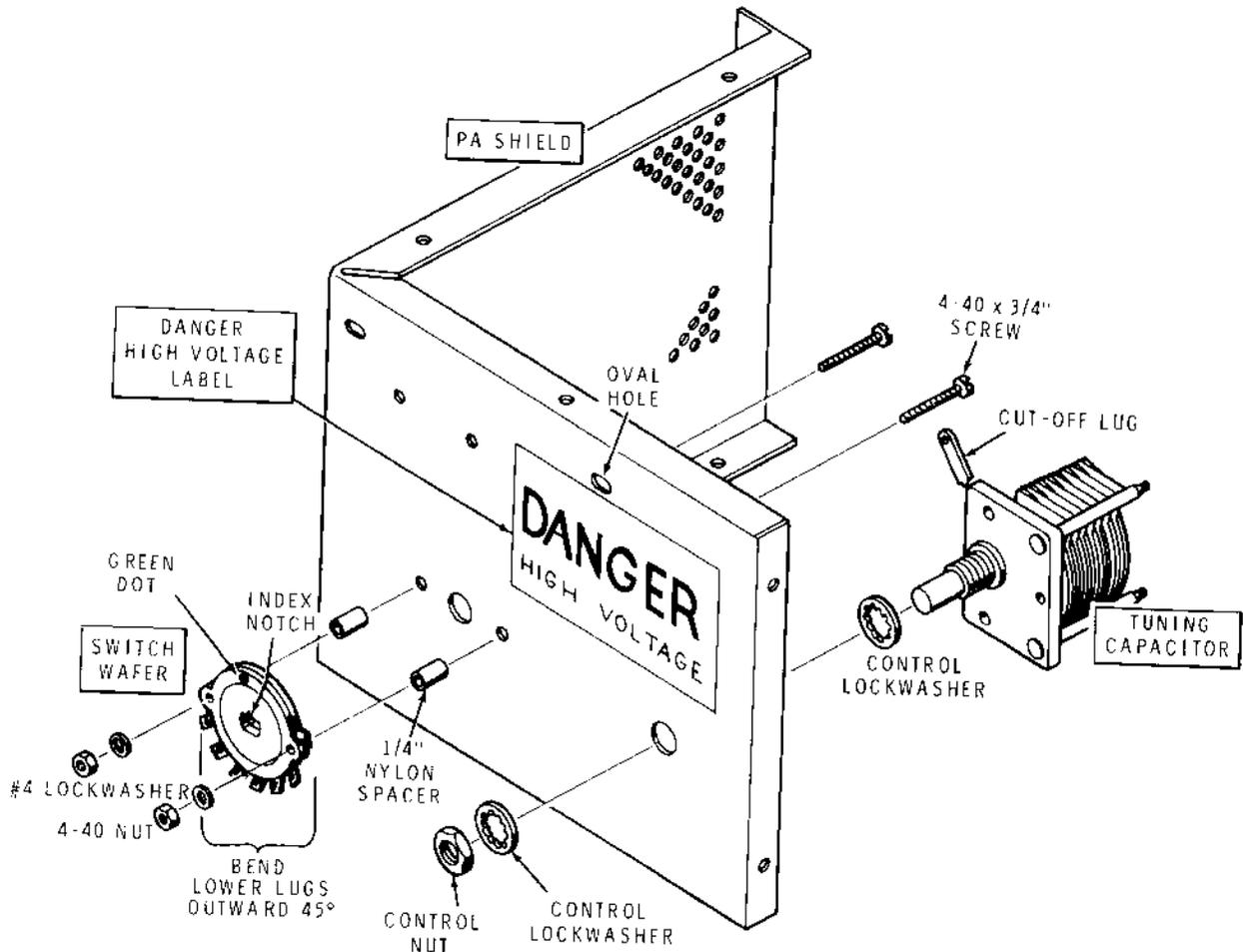
- (✓) Position the PA shield on your work area as shown.
- (✓) On the front of the PA shield, turn two #6 × 1/4" sheet metal screws into holes C and D until they are tight. Then remove the screws and place them back with the other hardware.

- (✓) Refer to Detail 7-1A and mount a phono socket at J7 on the side of the PA shield as shown. Position the lugs as shown in the Pictorial. Use 6-32 × 1/4" hardware.



Detail 7-1A



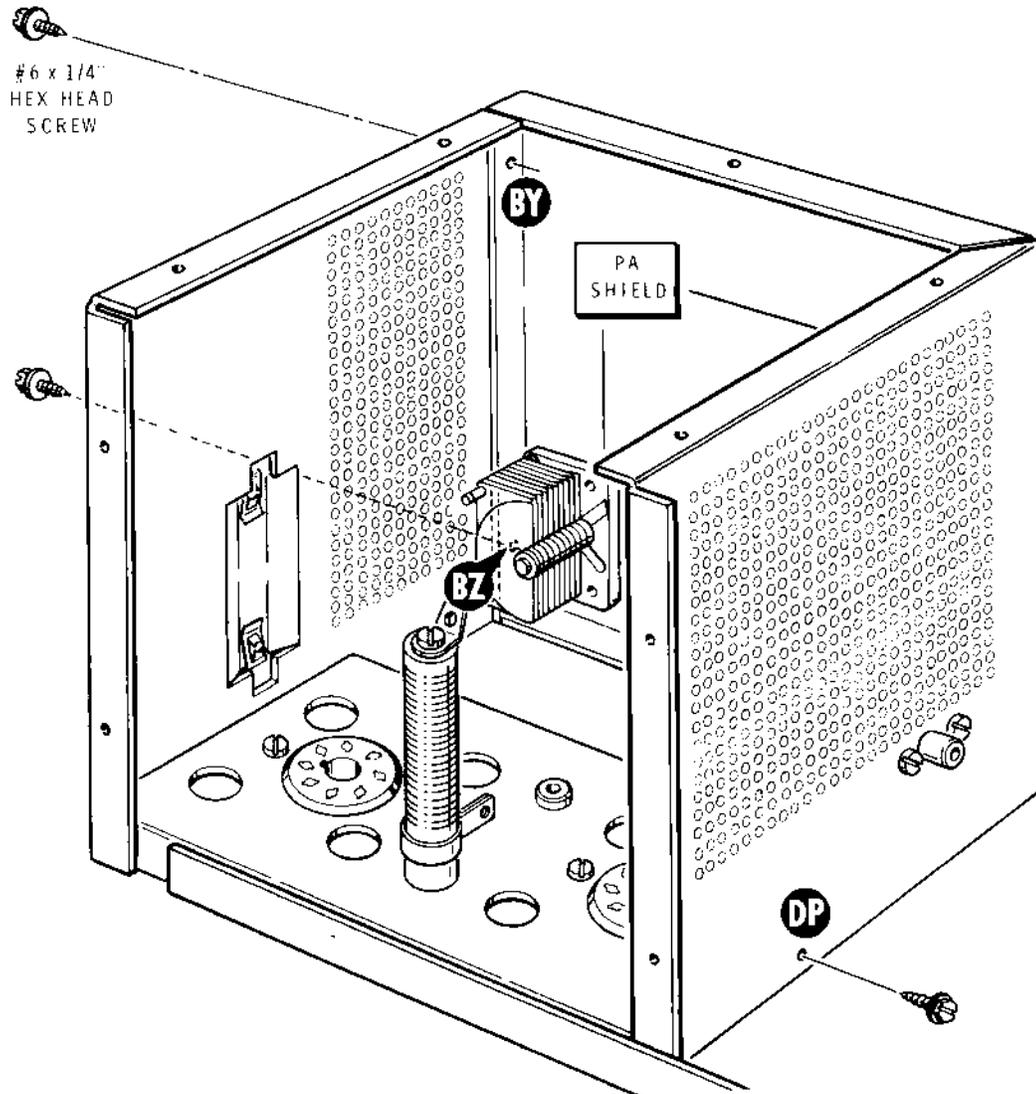


Detail 7-1B

Refer to Detail 7-1B for the next four steps.

NOTE: In the following step, if the tuning capacitor comes with a control nut mounted on it, remove and discard the nut.

- (✓) 1. C26: Cut off the indicated lug on the tuning capacitor (#26-163). Then mount the capacitor on the PA chassis at C26 with two control lockwashers and a control nut. Position the capacitor as shown in the Pictorial.
- (✓) 2. SW4B: Refer to Detail 7-1B and mount a switch wafer (#63-1343) on the front of the PA shield as shown. Use two 1/4" nylon spacers and 4-40 x 3/4" hardware as shown. **IMPORTANT NOTE:** Position the rotor index notch UP as shown. Also make sure the green dot is positioned outward as shown.
- (✓) 3. On switch SW4B, bend all six lugs on the bottom half of the wafer outward away from the PA shield, approximately 45 degrees.
- (✓) 4. Remove the paper backing from a "DANGER" label and press the label in place on the front of the PA shield as shown.
- (✓) Cut a 1-3/4" x 3-3/8" piece from the paper insulator. Set the remaining piece aside; it will be used later.
- (✓) Remove the paper backing from the 1-3/4" x 3-3/8" insulator and press the insulator in place on the inside of the PA shield as shown in the Pictorial. NOTE: One of the switch screw heads will be covered by the insulator. Do not cover the oval hole.

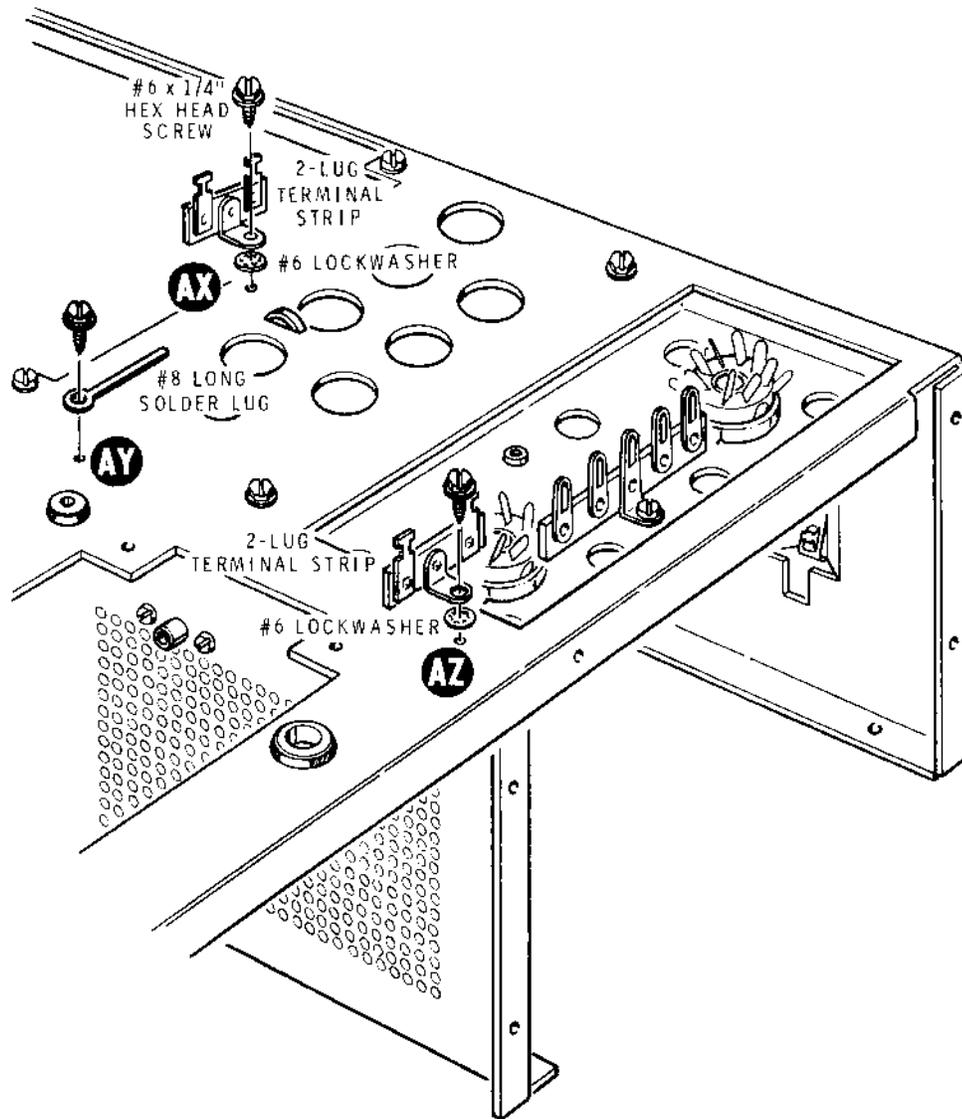


Detail 7-1C

(✓) Refer to Detail 7-1C and mount the PA shield onto the chassis as shown. Use two #6 × 1/4" hex head screws (on the side of the

chassis), and one at DP (into the end of the subchassis).





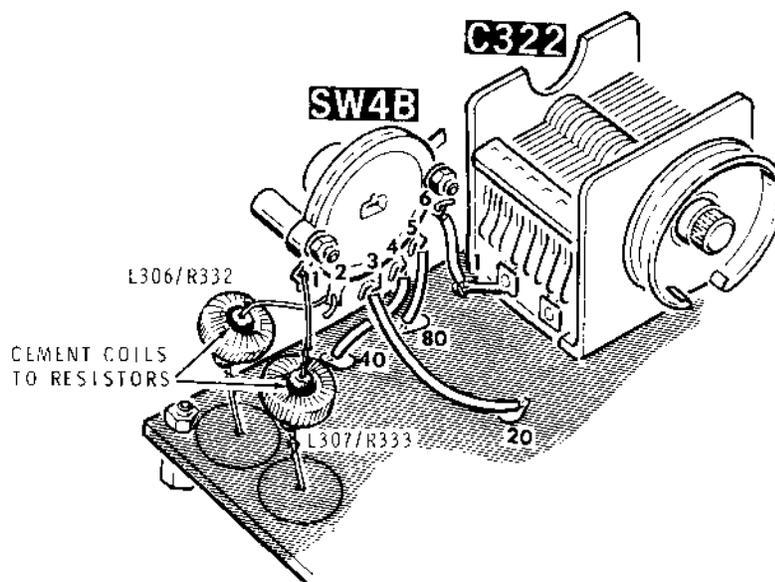
Detail 7-1E

Refer to Detail 7-1E for the next three steps.

- (✓) On the under side of the chassis, secure a 2-lug terminal strip to the chassis and the PA shield at AX with a #6 x 1/4" hex head screw and a #6 lockwasher. Position the terminal strip as shown.

- (✓) Mount a #8 long solder lug and secure the PA shield to the chassis at AY with a #6 x 1/4" hex head sheet metal screw.

- (✓) Mount another 2-lug terminal strip and secure the PA shield to the chassis at AZ with a #6 x 1/4" sheet metal screw and a #6 lockwasher as shown.



PICTORIAL 7-2

Refer to Pictorial 7-2 for the following steps.

NOTES:

1. Connect the wires coming from the driver circuit board in the following steps.

2. When you solder the connections in the following steps, use solder sparingly and be very careful that none of the solder falls onto the circuit board.

(✓) Connect the wire coming from lug 1 of tuning capacitor C322 to SW4B lug 6 (S-1).

(✓) Connect the end of the wire coming from "80" on the driver board to SW4B lug 5 (S-1).

(✓) Connect the end of the wire coming from "40" on the driver board to SW4B lug 4 (S-1).

(✓) Connect the end of the wire coming from "20" on the driver board to SW4B lug 3 (S-1).

(✓) Connect the free lead end of resistor R332 and L306 to SW4B lug 2 (S-1). Cut off the excess lead end.

(✓) Connect the free lead end of resistor R333 and coil L307 to SW4B lug 1 (S-1). Cut off the excess lead end.

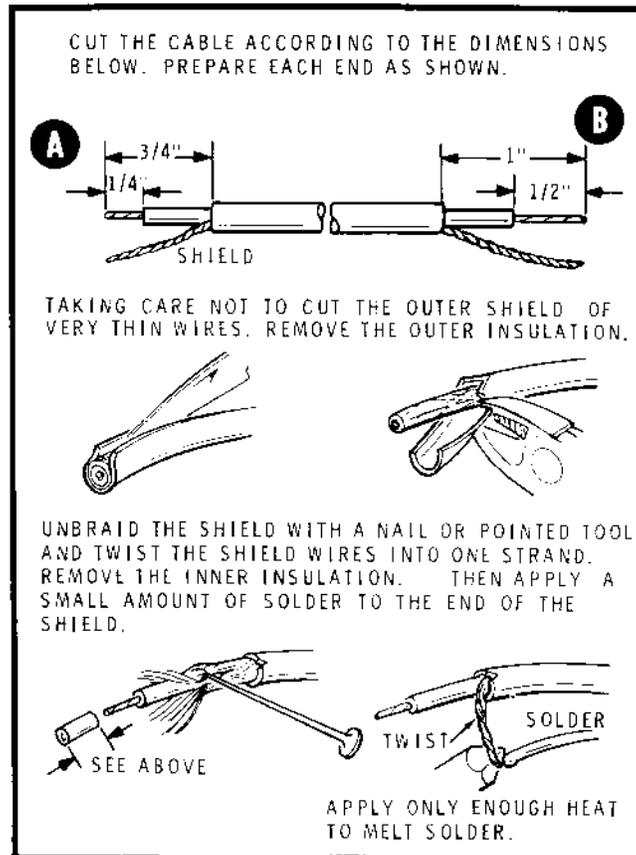
(✓) Locate the cement supplied with your kit. Apply a generous amount of cement around coils L306 and L307 and their resistors as shown.

IMPORTANT: Carefully inspect all of the wires and leads connected to switch SW4B and make sure none of the wire ends touch the PA shield, the chassis, or each other. Cut off any excess ends.

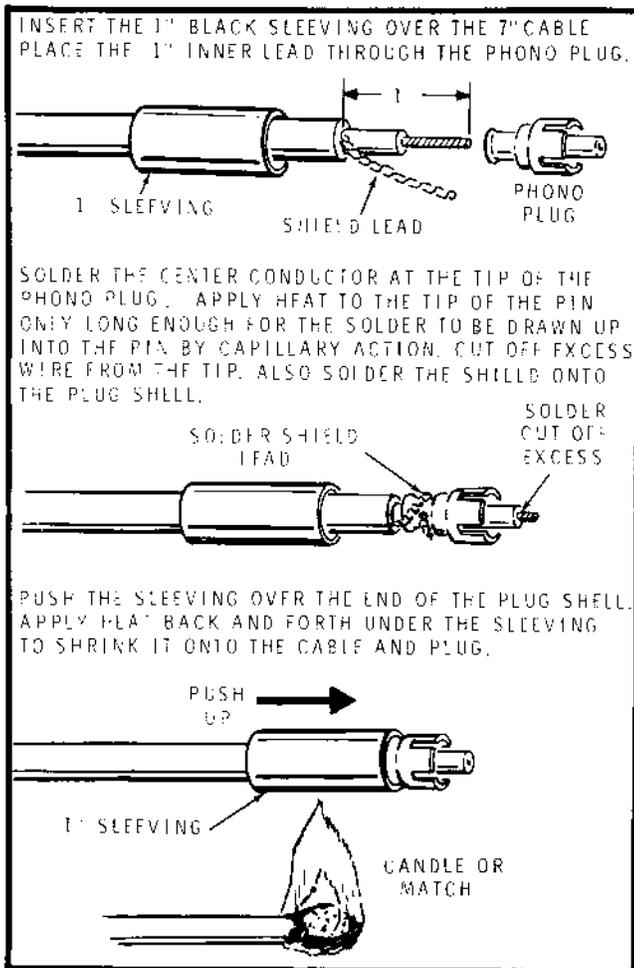
Refer to Pictorial 7-3 (Illustration Booklet, Page 9) for the following steps.

- (✓) Cut a 7" length of large (RG-58A/U) coaxial cable.
- (✓) Refer to Part A of Detail 7-3A and prepare the coaxial cable in the manner shown.

- (✓) Refer to Part B of Detail 7-3A and, on end B of the cable, install a phono plug in the manner shown. Cut any excess inner lead from the tip of the plug.

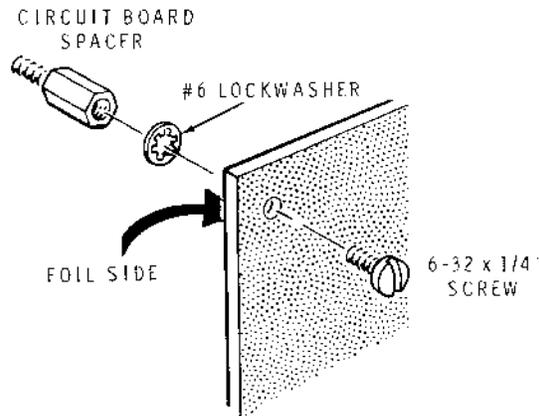


Detail 7-3A



Detail 7-3B

- (✓) Connect the inner lead at end A of the prepared cable to J7 lug 1 (S-1) and the shield lead to lug 2 (S-1).

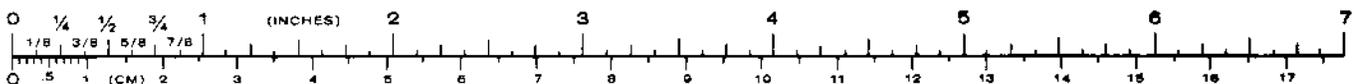


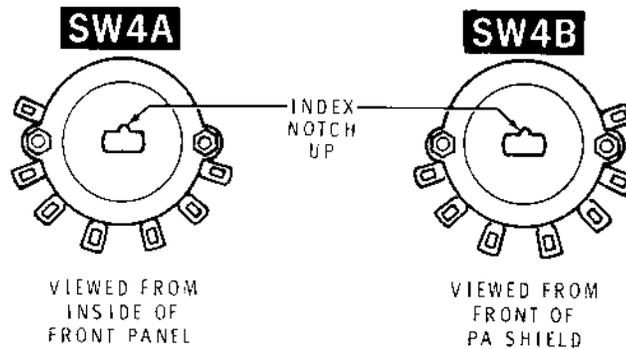
Detail 7-3C

- (✓) Refer to Detail 7-3C and mount two 6-32 × 1/4" circuit board spacers on the top corners of the output filter circuit board. Use 6-32 × 1/4" screws and #6 lockwashers. Be sure to place the lockwashers between the spacers and the foil side of the board.
- (✓) Set the output filter circuit board into the PA compartment and push the coaxial cable phono plug coming from J7 into J601 on the board. Be sure the cable shield is turned downward as much as possible, away from the coil solder lug.

NOTE: Before you mount the output filter circuit board assembly onto the PA shield, refer to Pictorial 6-2, right column, Page 46, and be sure the two switch wafer rotor index notches are turned **downward** as shown.

- (✓) Position the output filter circuit board into the PA chassis so its bottom edge fits into the card guide groove as shown.
- (✓) On the front of the PA shield, **loosely** secure the circuit board spacers to the shield with #6 lockwashers and 6-32 nuts.





Detail 7-3D

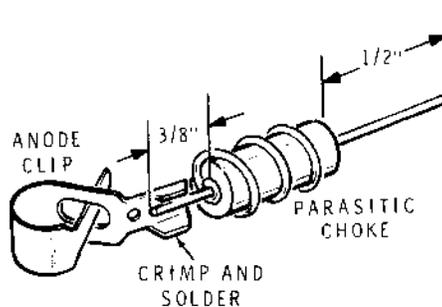
- (✓) Refer to Detail 7-3D and make sure the rotors of switch wafers SW4A and SW4B are turned so their notches are both pointing **upward** as shown. NOTE: This is exactly 180 degrees from the wafers on the output filter circuit board.
- (✓) Push the flatted end of the 7-1/4" phenolic shaft through the BAND switch bushing on the front panel, turn it slightly if necessary, and then through the rotor of SW4B on the front of the PA shield. Rock the shaft slightly if necessary.
- (✓) Then, in the same manner, push the shaft rearward through the rotors of SW4C and SW4D. If necessary, move the output filter circuit board slightly from side to side to align the shaft.
- (✓) When you are sure the phenolic shaft is correctly positioned and the output filter circuit board is adjusted to the best side-to-side position, tighten the circuit board spacer mounting hardware on the front of the PA shield.
- (✓) Carefully pull the phenolic shaft straight out from the four switch wafers without turning it. Set the shaft aside temporarily.



PA Wiring

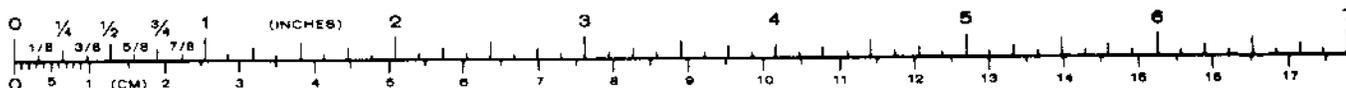
Refer to Pictorial 7-4 (Illustration Booklet, Page 10) for the following steps.

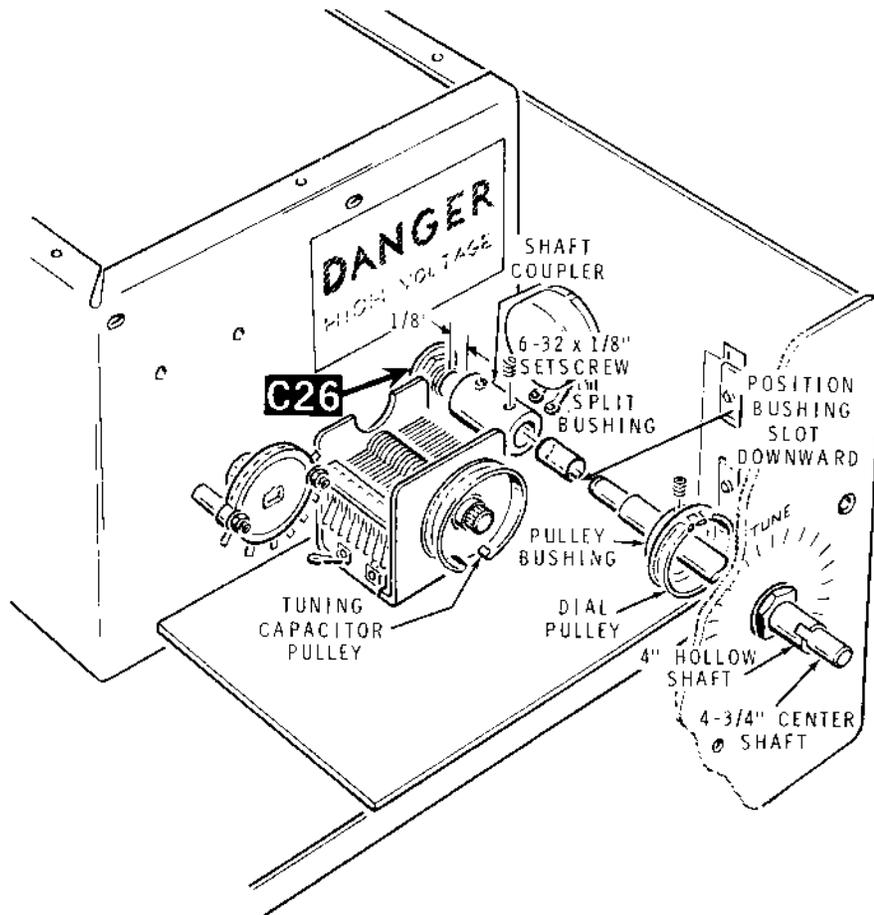
- (✓) Connect the free end of the bare wire coming from L609 SL1 to capacitor C26 upper frame post (S-1).
- (✓) Cut a 1" length of white sleeving.
- (✓) Place the 1" of white sleeving on the lead of capacitor C21 coming from coil L609. Connect this lead to RFC3 lug 1 (NS).
- (✓) Cut the leads of a 24 pF mica capacitor to 1/2".
- (✓) C19: Connect one lead of a 24 pF mica capacitor to RFC3 lug 1 (NS). Position the capacitor as shown in the Pictorial.
- (✓) V1: Carefully remove one 6146A tube from its carton. Align its socket key with the keyway in socket V1 in the chassis. Then firmly push the tube into the socket.
- (✓) V2: In the same manner, install the remaining 6146A tube at V2.
- (✓) Cut **one** lead of each of the two parasitic chokes (#45-53) to 3/8".
- (✓) Refer to Detail 7-4A and crimp and solder an anode clip onto the short lead of one of the parasitic chokes as shown.



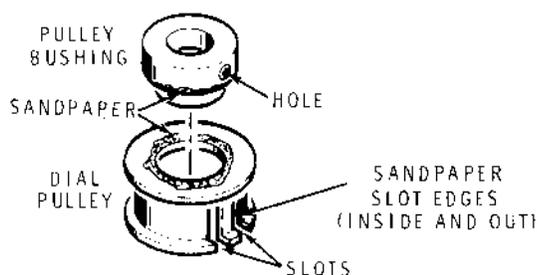
Detail 7-4A

- (✓) In the same manner, crimp and solder the other anode clip onto the short lead of the remaining parasitic choke.
 - (✓) Bend the lead of each parasitic choke approximately 90 degrees where it is soldered to the anode clip. Cut the remaining long choke lead to 1/2".
 - (✓) RFC1: Push the anode clip onto the plate cap of tube V1. Bend the free parasitic choke lead approximately 90 degrees and push the lead end into RFC3 lug 1 as shown (NS).
- NOTE: In the following step, when you solder the connection, use enough heat and solder to make a good, firm connection. When the solder has cooled, check the connection once again and reheat it if necessary.
- (✓) RFC2: As in the previous step, install the remaining anode clip and parasitic choke on tube V2. Connect the free choke lead to RFC3 lug 1 (S-4).





PICTORIAL 7-5



Detail 7-5A

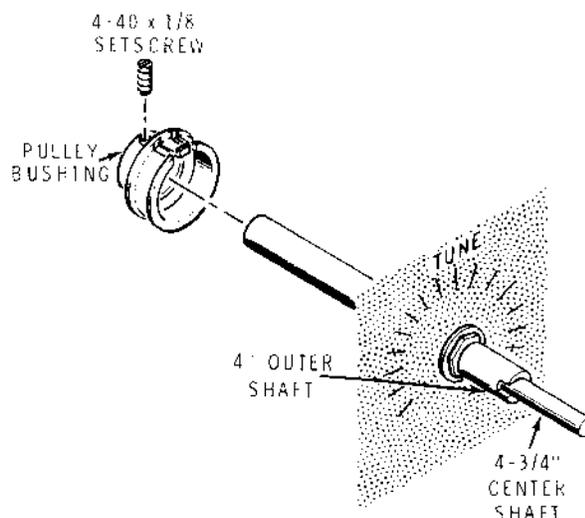
Bandswitch and Tune Capacitors

Refer to Pictorial 7-5 for the following steps.

- (✓) Start two 6-32 × 1/8" setscrews into the shaft coupler (#456-7).
- (✓) Inside the PA compartment, be sure that the leaves of tuning capacitor C26 are fully meshed. Place the shaft coupler on the shaft of C26 so the rear of the coupler is 1/8" from the capacitor shaft bushing, and so the setscrews point upward. Tighten the rear setscrew onto the capacitor shaft.
- (✓) Push a split bushing into the front of the shaft coupler. Be sure the split in the bushing is on the side opposite the setscrew.
- (✓) Sandpaper the edges of the dial pulley slots as shown to prevent cutting the dial cord. Also, sandpaper the pulley inner hole and bushing edges to prepare them for solder.

NOTE: In the following step, as you solder the two parts together, be sure not to get solder into the bushing setscrew threads.

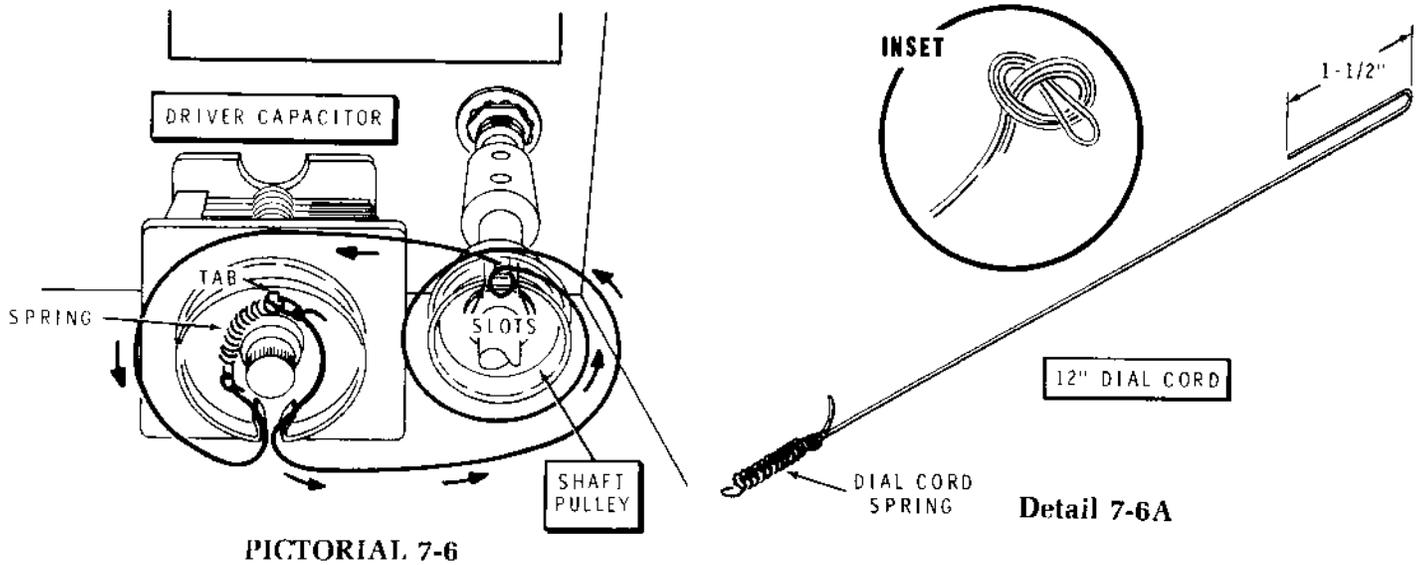
- (✓) Refer to Detail 7-5A and position the pulley bushing onto the rear of the dial pulley as shown. Be sure the setscrew hole in the bushing is positioned, in relation to the pulley slots, as shown in the Detail. Use high soldering iron heat and solder the bushing to the outside of the pulley. **WARNING:** Be sure these parts have cooled before you handle them.



Detail 7-5B

Refer to Detail 7-5B for the next two steps.

- (✓) Place the 4-3/4" center shaft inside the 4" outer shaft as shown. Push both shafts through the front panel TUNE bushing.
- (✓) Start a 4-40 × 1/8" allen setscrew into the pulley bushing.
- (✓) Place the pulley-bushing assembly onto the outer shaft as shown in the Pictorial. Push both shafts rearward as far as possible, so the center shaft is fully into the shaft coupler bushing. Tighten the front coupler setscrew to secure the inner shaft.
- (✓) On the outer shaft, position the dial pulley assembly so it is in line with the tuning capacitor pulley on the driver circuit board. Tighten the pulley setscrew.



DIAL CORD INSTALLATION

Refer to Pictorial 7-6 for the following steps.

(✓) Refer to Detail 7-6A and prepare the dial cord as follows:

- X Cut the dial cord to 12".
- X At one end of the dial cord, fold the cord back 1-1/2" from the end to form a loop. Tie an overhand knot in this loop (refer to the inset drawing).
- X At the other end of the dial cord, fold the cord back 1-1/2" from the end. Then tie the end of the dial cord spring into this loop as shown. Cut any excess cord from the spring end. The prepared length, including the spring, should be 9".

NOTE: Read through the following dial cord installation instructions as you study the Detail to become familiar with the procedure. It may be helpful if you have someone to lend a hand, or you may find masking tape useful to hold the dial cord temporarily onto either of the pulleys.

(✓) 1. Turn the driver tuning capacitor pulley, opening **upward**, so you can connect the loop without a spring to the pulley tab.

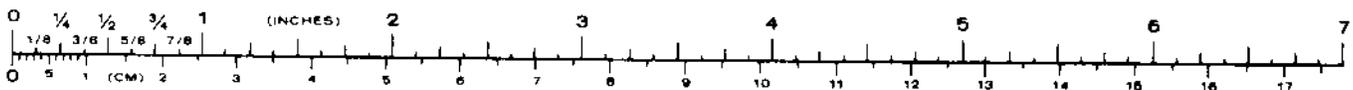
(✓) 2. Route the dial cord to the left of the pulley shaft and up through the pulley opening. As you keep the slack out of the dial cord, turn the pulley fully counterclockwise so the opening is pointing down. NOTE: Be sure the capacitor pulley remains fully counterclockwise through the remaining dial cord installation steps.

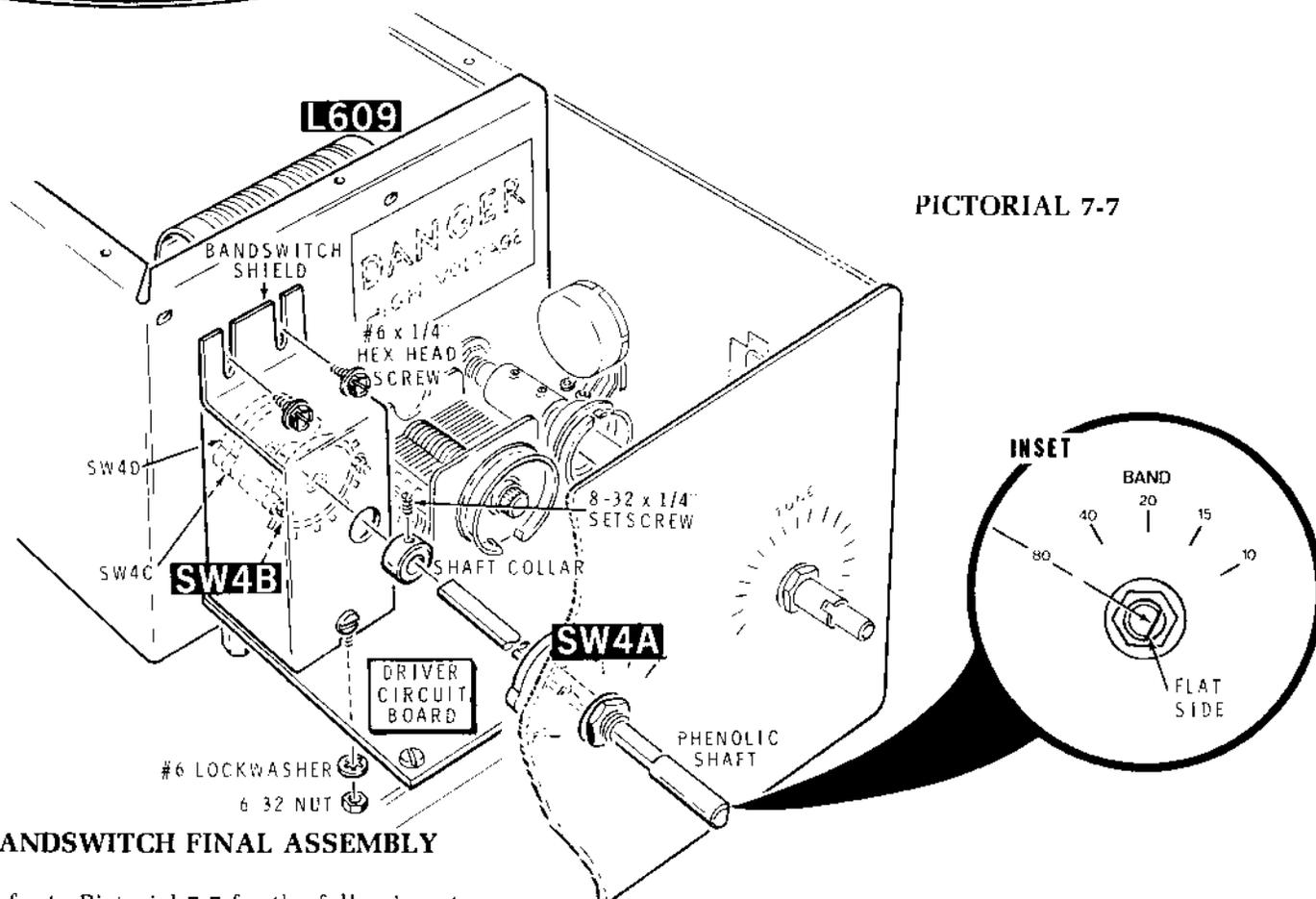
(✓) 3. Pass the dial cord to the right and all the way around the shaft pulley with its slots upward as shown. Then, as you hold this pulley in this position, route the dial cord down through one slot and up through the other, around the slot center tab. Take the slack out of the cord between the two pulleys, but be sure the pulleys do not turn.

(✓) 4. Route the spring end of the dial cord to the left and, as you turn the two pulleys slightly clockwise, route the cord back into the slot in the tuning capacitor pulley.

(✓) 5. Position the cord spring to the side of the pulley shaft opposite the previous routing and connect the eye on the spring to the pulley tab.

This completes the installation of the dial cord.





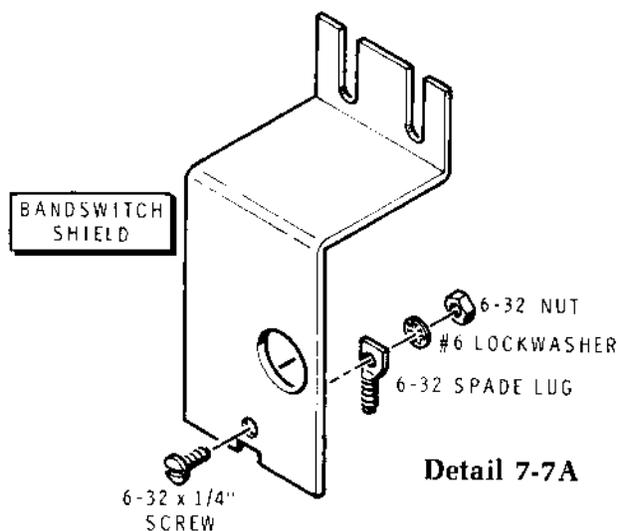
BANDSWITCH FINAL ASSEMBLY

Refer to Pictorial 7-7 for the following steps.

- (✓) Refer to Detail 7-7A and mount a 6-32 spade lug on the bottom of the bandswitch shield (#206-1314) with 6-32 × 1/4" hardware as shown. NOTE: Position the offset on the lug so the threaded part is directly under the shield edge.
- (✓) Position the bandswitch shield onto the driver circuit board and start two #6 × 1/4" hex head sheet metal screws through the top slots and into the PA shield at C and D. On the foil side of the driver circuit board, secure the shield spade lug with a #6 lockwasher and a 6-32 nut. Then tighten the two sheet metal screws on the top of the bandswitch shield.
- (✓) Start an 8-32 × 1/4" setscrew into the shaft collar.
- (✓) Refer to the inset drawing on Pictorial 7-7 and push the phenolic shaft through the BAND switch detent and through switch SW4A on the back of the front panel. Place the shaft collar on the phenolic shaft. Then push the shaft all the way rearward through the bandswitch shield, switch SW4B, the PA shield, and SW4 wafers C

and D. Be sure the shaft does not touch the coil wires coming from L609 in the PA compartment. Pull the shaft collar forward until it just touches the back of bandswitch SW4A; tighten the setscrew.

NOTE: Be sure the flat on the end of the shaft is positioned as shown.



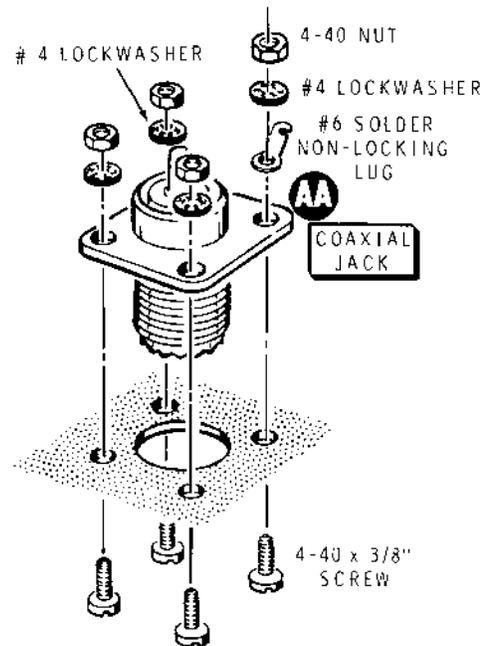
Detail 7-7A

REAR PANEL

Assembly

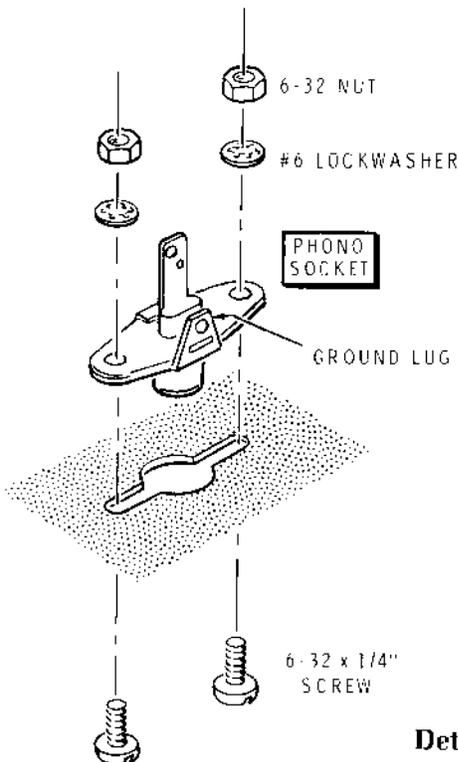
Refer to Pictorial 8-1 (Illustration Booklet, Page 11) for the following steps.

- (✓) Position the rear panel on your work area as shown in the Pictorial.
- (✓) Refer to the next drawing on Pictorial 8-1 and mount a #6 solder lug on the inside of the rear panel at SL3 with a 6-32 × 1/4" screw, a #6 lockwasher, and a 6-32 nut. Position the solder lug as shown in the Pictorial.
- (✓) Refer to Detail 8-1A and mount a phono socket at J2 with 6-32 × 1/4" hardware as shown. Position the phono socket as shown in the Pictorial.
- (✓) In the same manner, mount three additional phono sockets at J3, J4, and J5. Be sure to position the lugs as shown in the Pictorial.
- (✓) Refer to Detail 8-1B and mount the coaxial jack at J6. Use 4-40 × 3/8" hardware, except at screw AA. On screw AA, use a #6 non-locking solder lug and a #4 lockwasher.

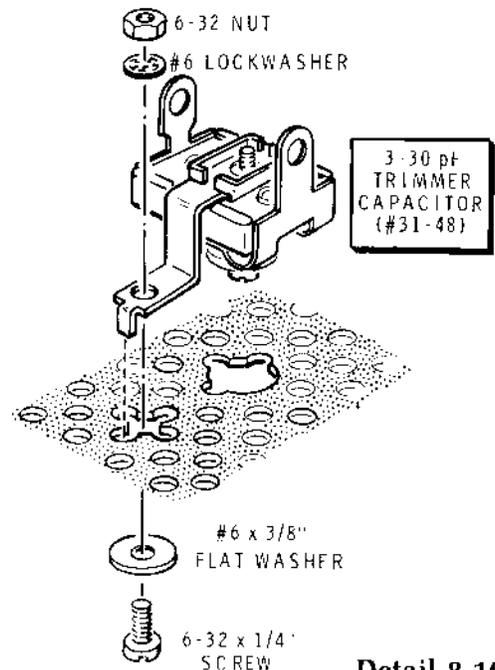


Detail 8-1B

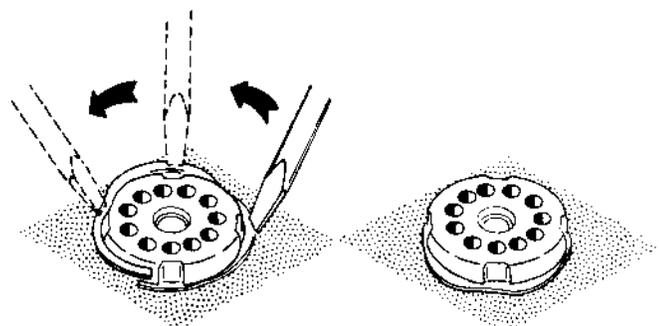
- (✓) C18: Refer to Detail 8-1C and mount a 3-30 pF trimmer capacitor at AB on the rear panel. Use 6-32 × 1/4" hardware and a #6 × 3/8" flat washer, and position the trimmer as shown in the Pictorial.



Detail 8-1A



Detail 8-1C



HOLD THE PLUG IN THE CHASSIS HOLE AND PLACE ONE END OF THE RING INTO THE GROOVE OF THE PLUG. USING A SCREWDRIVER, PRESS THE RING INTO THE GROOVE AROUND THE PLUG.

Detail 8-1D

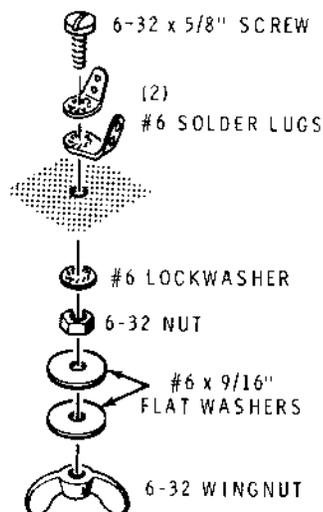
(✓) P8: Refer to Detail 8-1D and mount the 11-pin plug into the rear panel at P8 in the manner shown. Start the retaining ring at one side and work it around the plug until it is fully seated. Be sure to position the locator key on the plug as shown in the Pictorial.

(✓) Refer to Detail 8-1E and place a 6-32 × 5/8" screw through the rear panel from the inside at AD as shown in the Detail. Use two #6 solder lugs, a #6 lockwasher and a 6-32 nut. Position the solder lugs as shown in the Pictorial. When the nut is secure, place two #6 × 9/16" flat washers and a 6-32 wingnut onto the screw.

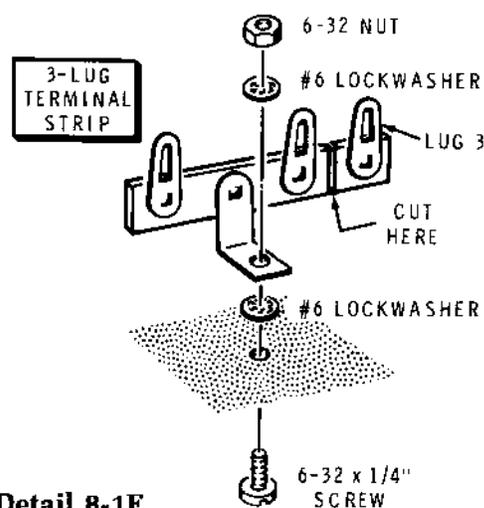
(✓) Refer to Detail 8-1F and mount a 3-lug terminal strip on the rear panel at TS2 with 6-32 × 1/4" hardware. Position the terminal strip as shown in the Pictorial.

(✓) Using diagonal cutters, cut and discard terminal strip TS2 lug 3.

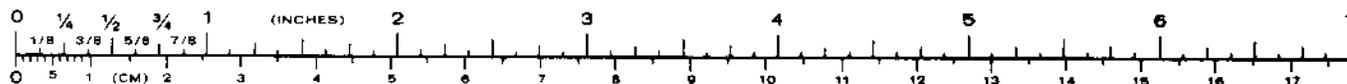
(✓) In the same manner, mount a 5-lug terminal strip on the rear panel at TS1. Position the terminal strip, as shown in Pictorial 8-1. Cut off the center lug.



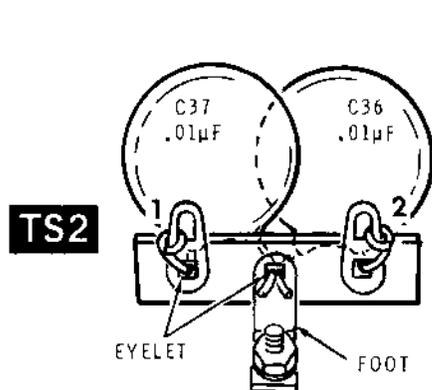
Detail 8-1E



Detail 8-1F



Rear Panel Prewiring



Detail 8-2A

Refer to Pictorial 8-2 (Illustration Booklet, Page 11) for the following steps.

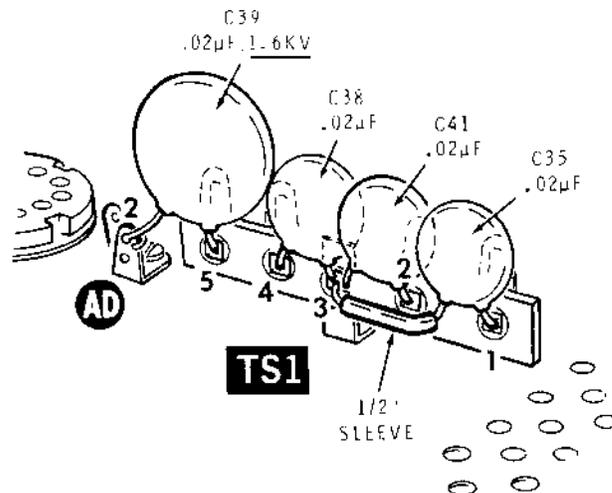
Refer to Detail 8-2A for the next three steps.

- (✓) 3. C37: Pass the leads of a $.01 \mu\text{F}$ bypass capacitor (#21-70) through the terminal strip TS2 eyelets at lug 1 and at the mounting foot. At lug 1, bring the capacitor lead upward and wrap it securely around the top of the lug as shown. Solder the eyelet at lug 1.
- (✓) 4. C36: In the same manner, mount another $.01 \mu\text{F}$ bypass capacitor (#21-70) between the eyelets at the mounting foot (S-2) and lug 2 of TS2. Wrap the lead at lug 2 around the top of the lug. Solder the eyelet at lug 2.
- (✓) 5. Bend capacitors C36 and C37 upward so they stand straight up from the rear panel as shown in the Pictorial.

Refer to Detail 8-2B for the next six steps.

NOTE: In the following steps and Details, the components may be shown from a different angle for clarity.

- (✓) 1. C39: Connect a $.02 \mu\text{F}$, 1.6 KV ceramic capacitor (#21-122) from solder lug AD2 (S-1) to the eyelet of terminal strip TS1 lug 5 (S-1).
- (✓) 2. With diagonal cutters, cut off the top of terminal strip TS1 lug 3.



Detail 8-2B

- (✓) 3. C38: Push the leads of a $.02 \mu\text{F}$, 500-volt capacitor through the eyelets at TS1 lugs 3 (NS) and 4 (S-1).
- (✓) 4. C41: Similarly, push the leads of a $.02 \mu\text{F}$, 500-volt capacitor through the eyelets at lugs 2 (S-1) and 3 (NS) of TS1.
- (✓) 5. C35: Cut a $1/2$ " piece of small white sleeving. Place the sleeving on one lead of a $.02 \mu\text{F}$, 500-volt capacitor. Install the capacitor through the eyelets at lugs 1 (S-1) and 3 (S-3) of TS1. Make sure the sleeved capacitor lead is at lug 3 as shown.
- (✓) 6. Bend the four capacitors at terminal strip TS1 straight up from the rear panel as shown in the Pictorial.

Refer to Pictorial 8-3 (Illustration Booklet, Page 12) for the following steps.

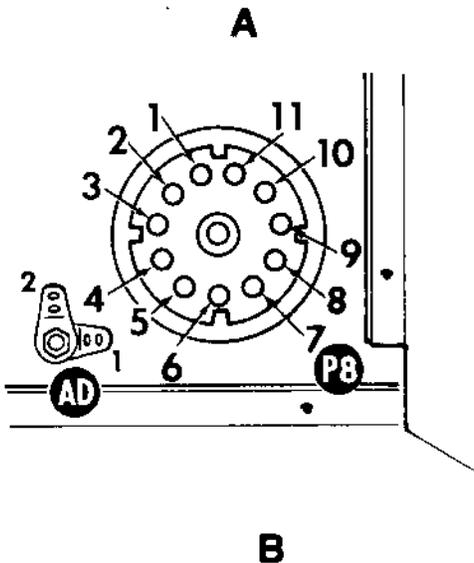
- (✓) Prepare the following heavy stranded wires. Remove $1/4$ " of insulation from one end of each wire and $1/2$ " from the other end.

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

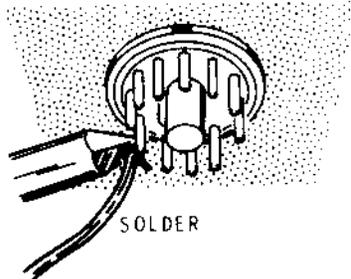


- (✓) Cut a 2" and a 2-1/2" piece of medium bare wire.

NOTE: When you connect wires to rear panel 11-pin plug P8 in the following steps, install the 1/2" prepared wire end. Then insert the wire into the plug from the rear and solder it as shown in Detail 8-3A, Part B. Part A of the Detail calls out the pin numbers of the plug pins as shown from the rear of the plug.



PUSH THE WIRE INTO THE HOLE UNTIL IT COMES OUT OF THE END OF THE PIN. APPLY SOLDER TO THE TIP OF THE HEATED PIN. SOLDER WILL FLOW UP INTO THE PIN BY CAPILLARY ACTION. CUT OFF THE EXCESS WIRE AT THE END OF THE PIN.



Detail 8-3A

- (✓) Connect one end of a 5" heavy white wire to plug P8 pin 1 (S-1).

NOTE: When you connect the wires to the lugs of terminal strips TS1 and TS2 in the following steps, wrap each wire end tightly around the indicated lug to assure a good mechanical connection.

- (✓) Connect the other end of the white wire to terminal strip TS1 lug 1 (NS).
- (✓) Connect a 4-1/4" brown wire from P8 pin 2 (S-1) to terminal strip TS1 lug 2 (NS).
- (✓) Connect a 3" red wire from P8 pin 4 (S-1) to terminal strip TS1 lug 5 (NS).
- (✓) Connect a 2" medium bare wire from P8 lug 5 (S-1) to solder lug AD1 (NS).
- (✓) Connect a 3-1/2" heavy brown wire from P8 pin 6 (S-1) to terminal strip TS1 lug 4 (NS).
- (✓) Connect a 2-1/2" medium bare wire from P8 pin 7 (S-1) to solder lug AD (S-2).
- (✓) Connect a 3-1/2" heavy black wire from P8 pin 9 (S-1) to terminal strip TS2 lug 2 (NS).
- (✓) Connect a 4-1/4" heavy black wire from P8 pin 10 (S-1) to terminal strip TS2 lug 1 (NS).
- (✓) With pliers, pull on each of the wires connected to plug P8 to be sure they are all firmly connected. If necessary, reheat a pin and add more solder to make a secure connection.



Installation and Wiring

Refer to Pictorial 8-4 (Illustration Booklet, Page 12) for the following steps.

- (✓) Temporarily remove the two #6 × 1/4" sheet metal screws that secure the PA subchassis to the rear edge of the chassis.
- (✓) Loosely mount the rear panel to the chassis as follows:
 - ✗ At AG, AH, and AJ, use 6-32 × 1/4" hardware.
 - ✗ At AK and AL, use #6 × 3/8" sheet metal screws.
 - ✗ At AN, AP, AR, and AS, use #6 × 1/4" sheet metal screws.
 - ✗ Then tighten the mounting hardware in steps 1, 2, and 3.

Refer to Pictorial 8-5 (Illustration Booklet, Page 13) for the following steps.

- (✓) Lift the anode clip from tube V2. Then carefully remove the tube from the chassis.
- (✓) Connect the end of the sleeved wire coming from grommet DL to trimmer C18 lug 2 (S-1).
- (✓) Connect the free end of the 24 pF mica capacitor coming from RFC3 lug 1 to rear panel trimmer C18 lug 1 (S-1).
- (✓) Reinstall 6146A tube V2 and push the anode clip back onto the tube anode.
- (✓) Locate the two heavy brown wires coming from the wire harness and up through grommet BH. Connect either of these wires to terminal strip TS1 lug 2 (S-2), and connect the other wire to lug 4 (S-2).

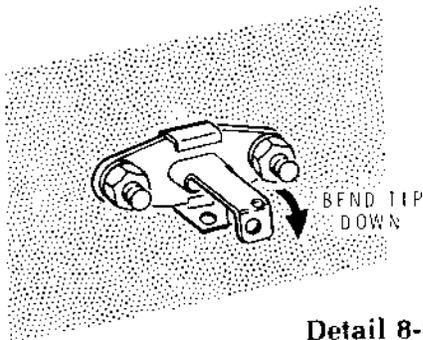
- (✓) On the underside of the chassis, locate the heavy red wire coming from PA subchassis grommet DK. Route this wire up through grommet BH. Connect the wire end to terminal strip TS1 lug 5 (S-2).
- (✓) Locate the shorter orange wire coming from grommet BH. Remove an additional 1/4" of insulation from the wire end (total 1/2"). Then connect this wire to plug P8 pin 3 (S-1).
- (✓) Connect the end of the heavy white wire to terminal strip TS1 lug 1 (NS).
- (✓) On the underside of the chassis, locate the two heavy black wires coming from the front panel. Route these two wires up through chassis grommet BH.
- (✓) Connect either of these heavy black wires to terminal strip TS2 lug 1 (S-3), and connect the other wire to lug 2 (S-3).
- (✓) Carefully check all the connections at terminal strips TS1 and TS2 to make sure all wires and leads are solidly attached. If necessary, reheat a connection and add a little more solder.

Refer to Pictorial 8-6 (Illustration Booklet, Page 14) for the following steps.

- (✓) Cut two 3/4" medium bare wires.

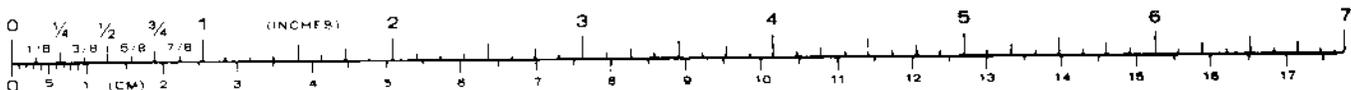
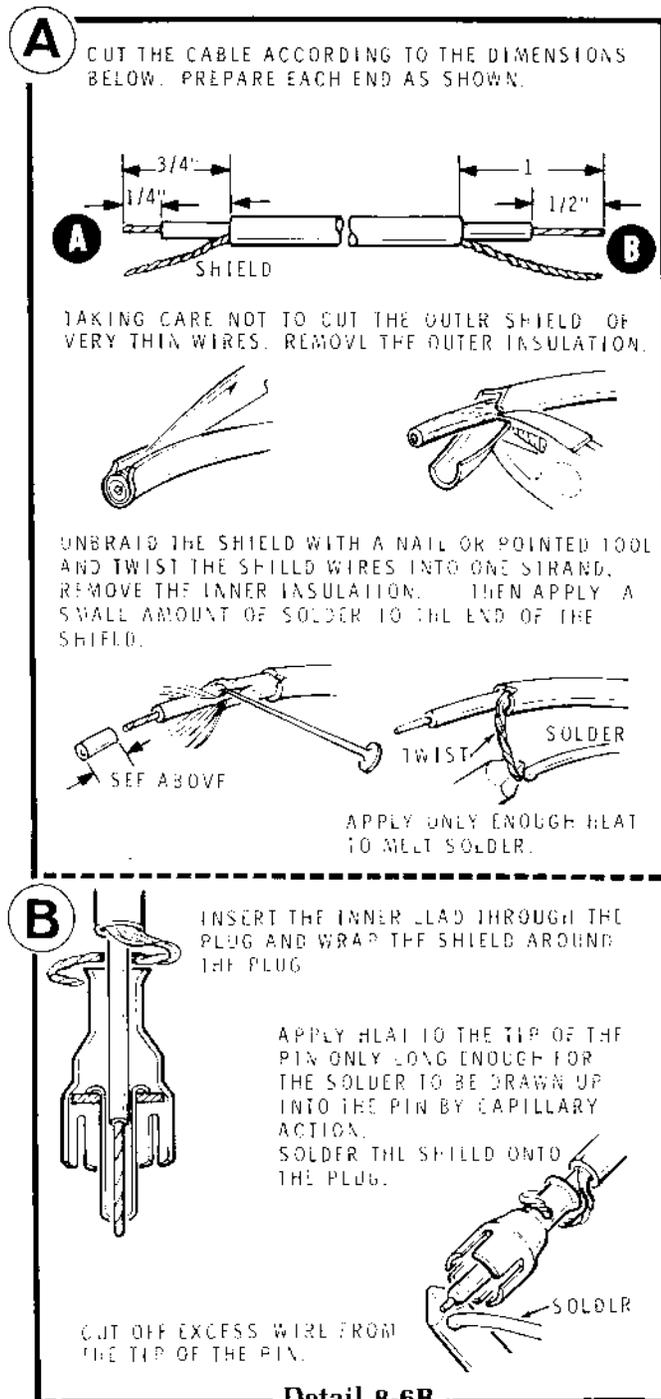
NOTE: In the following steps, hold the wires with pliers as you install them. Add solder to the connection first, then pick up the wire and, as you heat the connection, solder the wire in. Remove the soldering iron and let the solder harden before you remove the pliers.

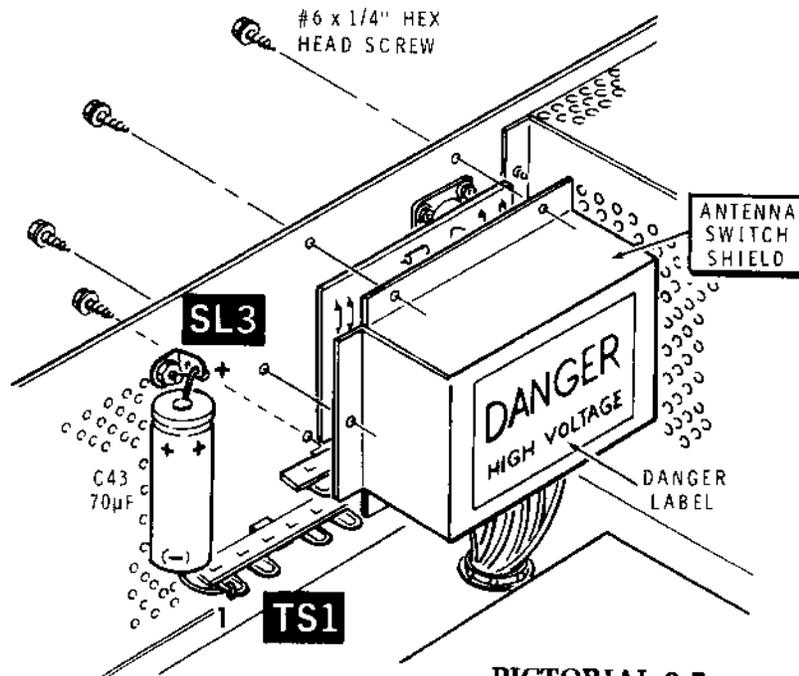
- (✓) Add solder to the center connection of coaxial jack J6. Heat the connection and install a 3/4" bare wire. Be sure the wire stands straight out from the jack.



Detail 8-6A

- (✓) Refer to Detail 8-6A and bend the tip of phono socket J2 lug 1 down at a point between the two holes as shown.
- (✓) Bend the tip of a 3/4" bare wire 90 degrees. The bent end should be approximately 1/16" long. Place this tip into the small hole in phono socket J2. Hold the wire with pliers as you solder the connection. Be sure the wire stands straight out from the socket as shown.
- (✓) Refer to Part A of Detail 8-6B and prepare a 7-1/2" length of RG-58A/U coaxial cable as shown.
- (✓) Refer to Part B of Detail 8-6B and, on end B of the cable, install and solder a short-tip phono plug as shown.
- (✓) Cut a 1" piece of large black sleeving.
- (✓) As in a previous step, push the sleeving onto the coaxial cable, all the way over the base of the phono plug; then shrink the sleeving onto the cable and plug.
- (✓) At end A of the coaxial cable, form a hook in the end of the inner lead and connect it to the center conductor close to the body of coaxial jack J6 (S-1). Connect the shield lead to solder lug AA (S-1). Push the shield lead and solder lug as close as you can to the inside of the rear panel.
- (✓) Plug the phono plug at the other end of the shielded cable into PA phono socket J7.





PICTORIAL 8-7

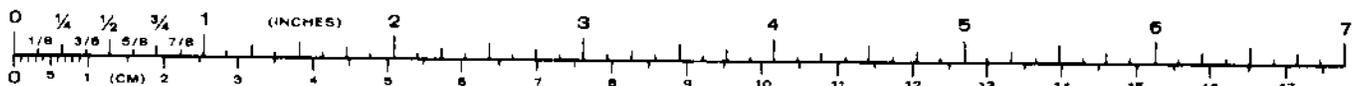
NOTE: In the following steps, as you connect the wires coming from grommet BH to the antenna switch board, solder each wire to the foil and cut off the excess wire end.

- (✓) Heavy orange wire to hole A (S-1).
- (✓) White-brown wire to hole D (S-1).
- (✓) Gray wire to hole B (S-1).
- (✓) Prepare a 5-1/2" small brown wire.
- (✓) Connect one end of the brown wire to antenna switch circuit board hole C. Pass the free end of the wire down through chassis grommet BH; it will be connected later.
- (✓) Position the antenna switch board onto the rear panel so the bare wire ends coming from J2 and J6 come through circuit board eyelets E and F from the foil side of the circuit board. Secure the circuit board spacers to the rear panel at AM and AW with two 6-32 \times 1/4" screws and two #6 lockwashers as shown.
- (✓) On the component side of the circuit board, solder the wires from J2 and J6 to the circuit board eyelets and cut off the excess wire ends.

- (✓) Make sure the shield lead to coaxial jack J6 does not short to the circuit board foil.

Refer to Pictorial 8-7 for the following steps.

- (✓) Remove the paper backing from a "Danger" label and press the label in place on the antenna switch shield as shown.
- (✓) Mount the antenna switch shield on the rear panel with four #6 \times 1/4" sheet metal screws as shown. NOTE: Reposition the wires to the antenna switch circuit board so they are routed through the cutout in the bottom of the shield as shown. Also, make sure the ceramic capacitors below the shield do not touch the shield.
- (✓) Cut the leads of a 70 μ F electrolytic capacitor to 3/4".
- (✓) C43: Connect the **positive** lead of the 70 μ F capacitor to solder lug SL3 (S-1) and the **negative** lead to terminal strip TS1 lug 1 (S-3). Position the capacitor as shown in the Pictorial.





POWER SUPPLY AND VFO ASSEMBLY

PARTS LIST

Refer to the Pack Index Sheet and locate Pack #2. Unpack these parts and check each part against the following list. The key numbers correspond to the numbers on the "Power Supply and VFO Circuit Board Parts Pictorial" (Illustration Booklet, Page 15).

To order a replacement part, always include the PART NUMBER. Use the Parts Order Form furnished with this kit. If one is not available, see "Replacement Parts" inside the rear cover of this Manual. For prices, refer to the separate "Heath Parts Price List."

KEY No.	HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
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RESISTORS, 1/4-Watt

NOTES:

- Resistors may be packed in more than one envelope. Open all of the resistor envelopes in this pack before you check them against the following list.
- The following resistors have a tolerance of 5%. 5% is indicated by a gold fourth band.

A1	✓ 6-391-12	5	390 Ω (org-wht-brn)	R203, R208, R210, R212, R214
A1	✓ 6-471-12	2	470 Ω (yel-viol-brn)	R402, R414
A1	✓ 6-681-12	1	680 Ω (blu-gry-brn)	R428
A1	✓ 6-102-12	6	1000 Ω (brn-blk-red)	R207, R215, R217, R219, R404, R412
A1	✓ 6-152-12	3	1500 Ω (brn-grn-red)	R408, R417, R418
A1	✓ 6-182-12	4	1800 Ω (brn-gry-red)	R204, R205, R206, R216
A1	✓ 6-562-12	3	5600 Ω (grn-blu-red)	R409, R419, R424

KEY No.	HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
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Resistors, 1/4-Watt (cont'd.)

A1	✓ 6-682-12	2	6800 Ω (blu-gry-red)	R403, R407
A1	✓ 6-103-12	6	10 kΩ (brn-blk-org)	R401, R405, R411, R413, R415, R422
A1	✓ 6-273-12	3	27 kΩ (red-viol-org)	R209, R211, R416
A1	✓ 6-473-12	3	47 kΩ (yel-viol-org)	R423, R426
A1	✓ 6-154-12	1	150 kΩ (brn-grn-yel)	R427
A1	✓ 6-224-12	2	220 kΩ (red-red-yel)	R421
A1	✓ 6-822-12	1	8200 Ω (gry-red-red)	R201, R202, R400

CAPACITORS

Mica

A2	✓ 20-78	1	56 pF	C217
A2	✓ 20-103	1	150 pF	C219
A2	✓ 20-113	1	470 pF	C221
A2	✓ 20-167	1	620 pF	C216
A2	✓ 20-122	1	.001 μF (1000)	C218



KEY No.	HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
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Capacitors (cont'd.)**Ceramic**

A3 ✓	21-168	2	4.7 pF	C204, C205
A3 ✓	21-6	1	27 pF (marked "NPO")	C34
A3 ✓	21-716	1	27 pF (marked "N330")	C203
A3 ✓	21-155	2	33 pF	C201, C202
A3 ✓	21-46	2	.005 μ F	C406, C407
A3 ✓	21-176	11	.01 μ F	C207, C208, C209, C211, C212, C213, C214, C215, C403, C405, C408
A3 ✓	21-95	2	.1 μ F	C206, C210
A4 ✓	21-145	4	.001 μ F feedthrough (1 extra)	C31, C32, C33

Other Capacitors

A5 ✓	25-276	1	4.7 μ F tantalum	C404
A6 ✓	25-885	1	100 μ F electrolytic	C402
A6 ✓	25-269	1	2000 μ F electrolytic	C401
A7 ✓	26-153	1	VFO capacitor	C29

INDUCTORS

B1 ✓	40-1859	1	5.5 μ H variable inductor	L201
B2 ✓	40-1869	1	Toroid coil (green dot)	L203
B2 ✓	40-1870	1	Toroid coil (red dot)	L202

DIODES-TRANSISTORS

C1 ✓	56-16	1	1N751 diode	D401 , D413
C1 ✓	56-28	3	GE-S127 diode	D201, D202, D203
C1 ✓	56-56	2	1N4149 diode	D407, D408
C1 ✓	56-617	2	850 mA zener diode	D411, D414
C1 ✓	57-27	9	1N2071 diode	D402, D403, D404, D405, D406, D409, D410, D412, D415

KEY No.	HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
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Diodes-Transistors (cont'd.)

NOTE: Transistors may be marked for identification in any of the following four ways:

1. Part number.
2. Type number.
3. Part number and type number.
4. Part number with a type number other than the one listed.

C2 ✓	417-201	1	X29A829 transistor	Q205
C3 ✓	417-293	2	2N5770 transistor	Q203, Q204
C3 ✓	417-169	2	MPF105 transistor	Q201, Q202
C3 ✓	417-294	1	MPSA42 transistor	Q411
C3 ✓	417-801	9	MPSA20 transistor	Q401, Q402, Q403, Q404, Q405, Q406, Q407, Q409, Q410
C3 ✓	417-836	1	MPSD51 transistor	Q408
C3 ✓	417-927	1	MPSA93 transistor	Q412

MISCELLANEOUS

D1 ✓	10-1158	1	5000 Ω (5K) control	R8
D2 ✓	10-391	1	1000 Ω (1K) control	R213
D2 ✓	10-389	1	100 k Ω control	R406
D2 ✓	10-384	1	500 k Ω control	R425
D3 ✓	204-2154	1	VFO front bracket	
D4 ✓	205-761	1	Drive plate	
D5 ✓	206-502	1	Coil shield	
D6 ✓	215-89	1	Heat sink	
D7 ✓	266-200	1	Clutch	
D8 ✓	432-120	2	Female wire connector	
D9 ✓	432-121	3	Circuit board pin	
D10 ✓	434-42	1	Phono socket	J8
D11 ✓	442-681	1	μ A78L08 integrated circuit (IC)	U201
D12 ✓	442-674	1	μ A7812 integrated circuit (IC)	U401

PARTS FROM MAIN PACK

85-2189-1 ✓	1	VFO circuit board
85-2198-1 ✓	1	Power supply circuit board

STEP-BY-STEP ASSEMBLY

Power Supply Circuit Board

START

Position the power supply circuit board as shown. Then proceed with the following steps.

(✓) R401: 10 kΩ (brn-blk-org).

(✓) R414: 470 Ω (yel-viol-brn).

(✓) R412: 1000 Ω (brn-blk-red).

(✓) R416: 27 kΩ (red-viol-org).

(✓) R417: 1500 Ω (brn-grn-red).

(✓) R418: 1500 Ω (brn-grn-red).

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

(✓) R413: 10 kΩ (brn-blk-org).

(✓) R428: 680 Ω (blu-gry-brn).

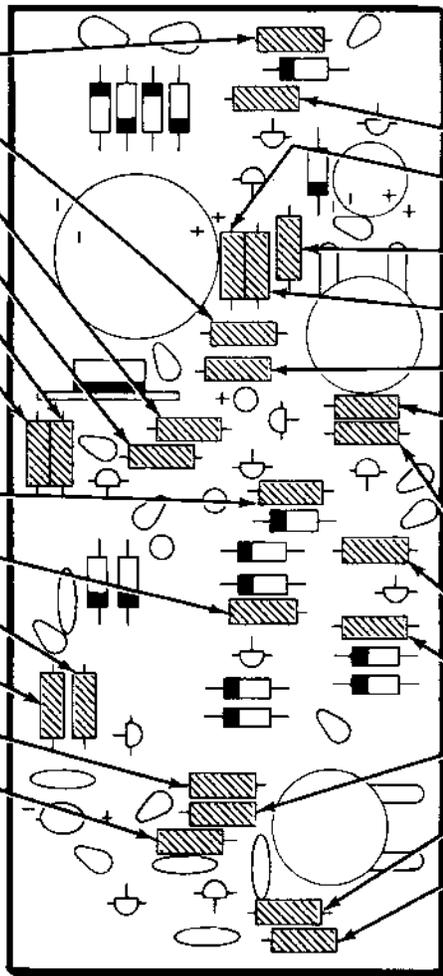
(✓) R415: 10 kΩ (brn-blk-org).

(✓) R419: 5600 Ω (grn-blu-red).

(✓) R422: 10 kΩ (brn-blk-org).

(✓) R426: 47 kΩ (yel-viol-org).

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



CONTINUE

(✓) R402: 470 Ω (yel-viol-brn).

(✓) R404: 1000 Ω (brn-blk-red).

(✓) R407: 6800 Ω (blu-gry-red).

(✓) R403: 6800 Ω (blu-gry-red).

(✓) R411: 10 kΩ (brn-blk-org).

(✓) R405: 10 kΩ (brn-blk-org).

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

(✓) R409: 5600 Ω (grn-blu-red).

(✓) R408: 1500 Ω (brn-grn-red).

(✓) R427: 47 kΩ (yel-viol-org).

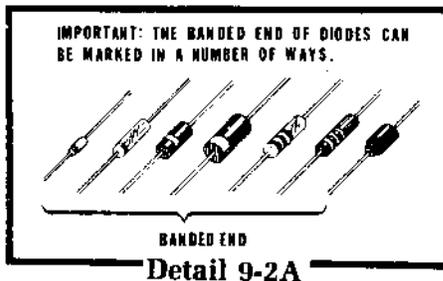
(✓) R421: 150 kΩ (brn-grn-yel).

(✓) R423: 47 kΩ (yel-viol-org).

(✓) R424: 5600 Ω (grn-blu-red).

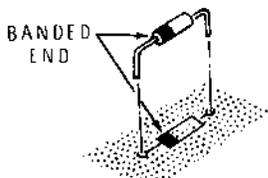
(✓) Solder the leads to the foil and cut off the excess lead lengths.

PICTORIAL 9-1



START

NOTE: When you install a diode, always match the band on the diode with the band mark on the circuit board. A DIODE WILL NOT WORK IF INSTALLED BACKWARDS. See Detail 9-2A.

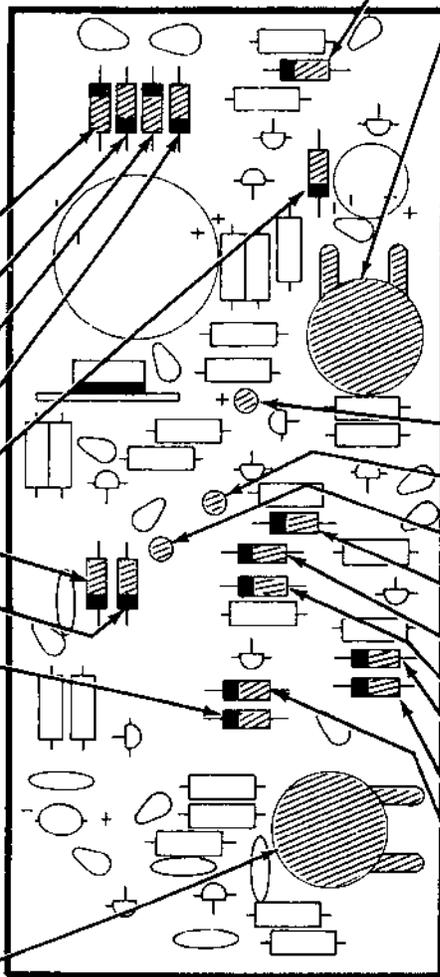


Install eight 1N2071 diodes (#57-27) in the following steps.

- (✓) D402
- (✓) D403
- (✓) D404
- (✓) D405
- (✓) D406
- (✓) D409
- (✓) D410
- (✓) D415

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

(✓) R425: 500 kΩ control (#10-384). Push the control firmly down onto the board; then solder all its lugs to the foil.



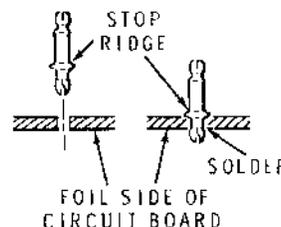
PICTORIAL 9-2

CONTINUE

(✓) R400: 8200 Ω (gray-red-red) resistor. (Disregard the diode outline on the circuit board.)

(✓) R406: 100 kΩ control (#10-389). See the Detail at the bottom of the left column.

NOTE: When you are instructed to install a circuit board pin (#432-121), first push the pin down firmly against the top of the circuit board. Then turn the circuit board over and solder the pin to the foil.



(✓) Circuit board pin at "+RX."

(✓) Circuit board pin at "+TX."

(✓) Circuit board pin.

(✓) D407: 1N4149 diode (#56-56).

(✓) D408: 1N4149 diode (#56-56).

(✓) D413: 1N751 diode (#56-16).

(✓) D411: 850 mA zener diode (#56-617).

(✓) D412: 1N2071 diode (#57-27).

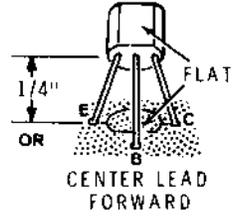
(✓) D414: 850 mA zener diode (#56-617).

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

NOTE: Carefully recheck all of the diodes to be sure the banded ends are correctly positioned.

START →

NOTE: When you install each of the transistors in this Pictorial, line up the flat or tab on the component with the outline of the flat or tab on the circuit board. Then insert the leads in the corresponding holes in the circuit board. Position it 1/4" above the circuit board; then solder the leads to the foil and cut off the excess lead lengths.



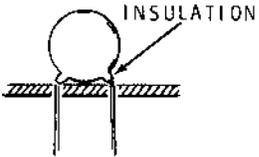
(✓) Q402: MPSA20 transistor (#417-801).

(✓) Q403: MPSA20 transistor (#417-801).

(✓) Q404: MPSA20 transistor (#417-801).

(✓) Q408: MPD51 transistor (#417-836).

NOTE: When you install ceramic capacitors, do not push the insulated portions of the leads into the circuit board holes. This could make it difficult to solder the leads to the foil.



(✓) C405: .01 μ F ceramic.

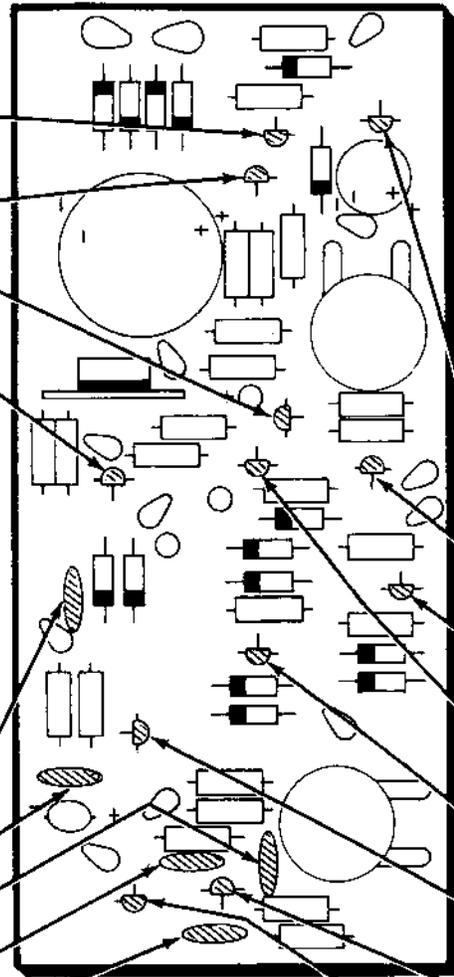
(✓) C403: .01 μ F ceramic.

(✓) C408: .01 μ F ceramic.

(✓) C407: .005 μ F ceramic.

(✓) C406: .005 μ F ceramic.

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



CONTINUE →

(✓) Q401: MPSA20 transistor (#417-801).

(✓) Q406: MPSA20 transistor (#417-801).

(✓) Q412: MPSA93 transistor (#417-927).

(✓) Q405: MPSA20 transistor (#417-801).

(✓) Q411: MPSA42 transistor (#417-294).

(✓) Q407: MPSA20 transistor (#417-801).

(✓) Q410: MPSA20 transistor (#417-801).

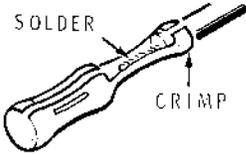
(✓) Q409: MPSA20 transistor (#417-801).

PICTORIAL 9-3

START

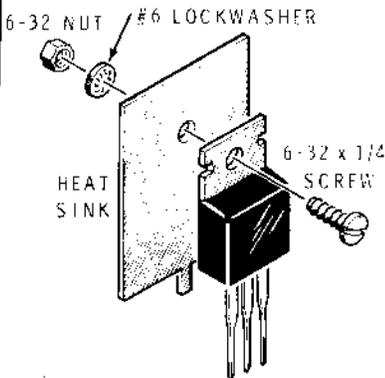
(1) Prepare a 2" small brown wire.

(2) Crimp and solder a female wire connector onto each end of the wire as shown. Be careful not to get solder into the outer end.

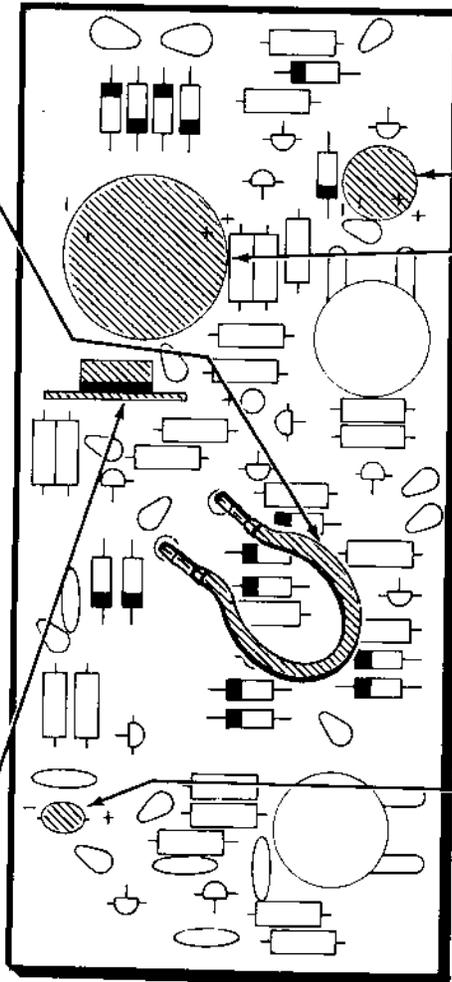
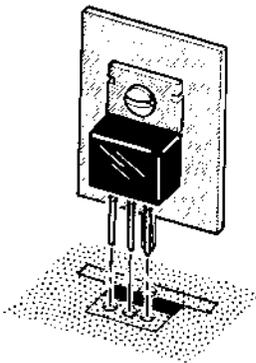


(3) Push the brown wire with connectors onto the unmarked circuit board pin and the "+TX" circuit board pin.

(4) Mount a μ A7812 IC (#342-674) onto a heat sink (#215-89) with 6-32 x 1/4" hardware as shown.

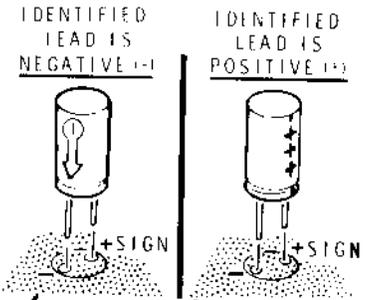


(5) U401: Mount the IC heat sink assembly at U401 in the manner shown. Be sure to solder the three IC leads and the heat sink tab to the foil. Cut off any excess leads.



CONTINUE

When you install an electrolytic capacitor, note the position of the identified (+ or -) lead. Be sure you connect the positive (+) lead to the positive (+) marked point on the circuit board.

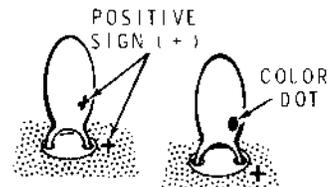


(6) C402: 100 μ F electrolytic.

(7) C401: 2000 μ F electrolytic. Push the capacitor firmly down onto the board.

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

NOTE: When you install a tantalum capacitor, always position the positive (+) or dot marked lead of the capacitor in the positive (+) marked hole.



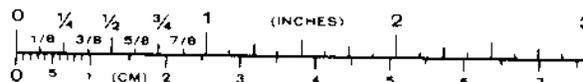
(9) C404: 4.7 μ F tantalum. Solder its leads to the foil and cut off the excess leads.

(10) Squeeze a generous amount of cement around the base and under the 2000 μ F capacitor.

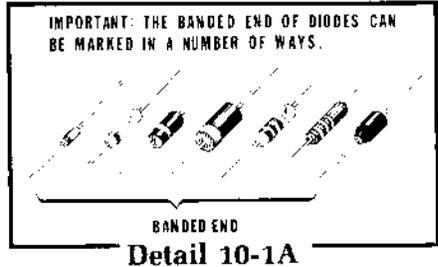
(11) In the same manner, apply cement around the base and under 100 μ F capacitor C402. Save the unused cement for use later.

Set the circuit board aside temporarily.

PICTORIAL 9-4



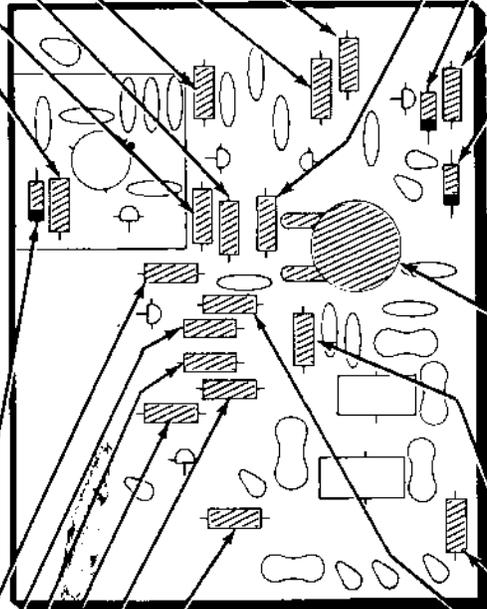
VFO Circuit Board



START

Position the VFO circuit board as shown. Then proceed with the following steps.

- (✓) R216: 1800 Ω (brn-gry-red).
 - (✓) R215: 1000 Ω (brn-blk-red).
 - (✓) R203: 390 Ω (org-wht-brn).
 - (✓) R204: 1800 Ω (brn-gry-red).
 - (✓) R201: 220 kΩ (red-red-yel).
 - (✓) R202: 220 kΩ (red-red-yel).
- NOTE: When you install a diode, always match the band on the diode with the band mark on the circuit board. A DIODE WILL NOT WORK IF INSTALLED BACKWARDS. See Detail 10-1A.
-
- BANDED END
- (✓) D201: GE-S127 diode (#56-28).
 - (✓) Solder the leads to the foil and cut off the excess lead lengths.
 - (✓) R205: 1800 Ω (brn-gry-red).
 - (✓) R212: 390 Ω (org-wht-brn).
 - (✓) R210: 390 Ω (org-wht-brn).
 - (✓) R207: 1000 Ω (brn-blk-red).
 - (✓) R208: 390 Ω (org-wht-brn).
 - (✓) R206: 1800 Ω (brn-gry-red).
 - (✓) Solder the leads to the foil and cut off the excess lead lengths.



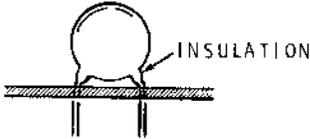
CONTINUE

- (✓) R209: 27 kΩ (red-viol-org).
 - (✓) D203: GE-S127 diode (#56-28). Position the banded end as shown.
 - (✓) R217: 1000 Ω (brn-blk-red).
 - (✓) D202: GE-S127 diode (#56-28). Position the banded end as shown.
-
- (✓) R213: 1000 Ω (1K) control (#10-391).
 - (✓) R214: 390 Ω (org-wht-brn).
 - (✓) R219: 1000 Ω (brn-blk-red).
 - (✓) R211: 27 kΩ (red-viol-org).
 - (✓) Solder the leads to the foil and cut off the excess lead lengths.

PICTORIAL 10-1

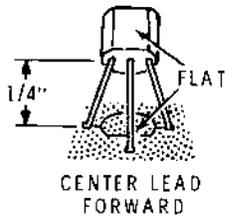
START

NOTE: When you install ceramic capacitors, do not push the insulated portion of the leads into the circuit board holes. This could make it difficult to solder the leads to the foil.

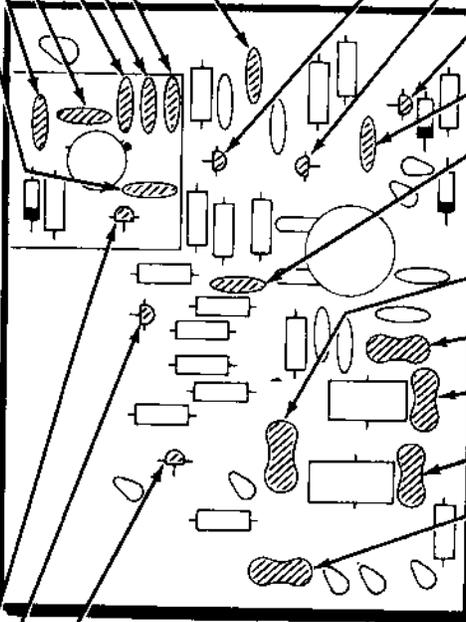


- (✓) C210: .1 μ F ceramic.
- (✓) C206: .1 μ F ceramic.
- (✓) C202: 33 pF ceramic.
- (✓) C203: 27 pF ceramic. Be sure to use the capacitor marked "N330".
- (✓) C201: 33 pF ceramic.
- (✓) C204: 4.7 pF ceramic.
- (✓) C205: 4.7 pF ceramic.
- (✓) Solder the leads to the foil and cut off the excess lead lengths.

NOTE: When you install each of the following components, line up the flat or tab on the component with the outline of the flat or tab on the circuit board. Then insert the leads in the corresponding holes in the circuit board. Position it 1/4" above the circuit board; then solder the leads to the foil and cut off the excess lead lengths.



- (✓) Q201: MPF105 transistor (#417-169).
- (✓) U201: μ A78L08 IC (#442-661).
- (✓) Q205: X29A829 transistor (#417-201).



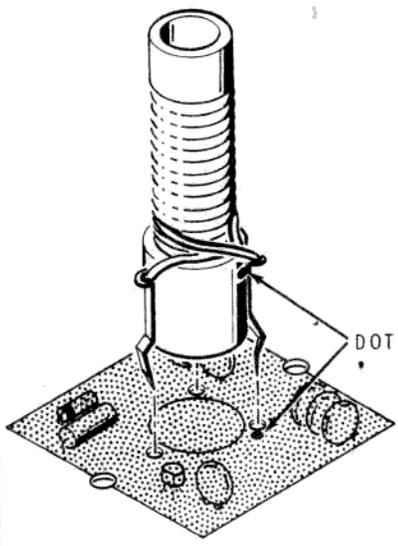
CONTINUE

- (✓) Q202: MPF105 transistor (#417-169).
- (✓) Q203: 2N5770 transistor (#417-293).
- (✓) Q204: 2N5770 transistor (#417-293).
- (✓) C211: .01 μ F ceramic.
- (✓) C208: .01 μ F ceramic.
- (✓) Solder the leads to the foil and cut off the excess lead lengths.
- (✓) C218: 1000 pF mica.
- (✓) C216: 620 pF mica.
- (✓) C217: 56 pF mica.
- (✓) C219: 150 pF mica.
- (✓) C221: 470 pF mica.
- (✓) Solder the leads to the foil and cut off the excess lead lengths.

PICTORIAL 10-2

START

(✓) L201: Match the color dot on the 5.5 μ H variable inductor (#40-1859) with the dot on the circuit board as shown. Push the coil firmly down onto the board and solder its lugs to the foil.



(✓) Squeeze a drop of cement onto the inside of the 33 pF ceramic capacitor and push it against the side of coil L201. Then squeeze a drop of cement onto the 4.7 pF ceramic capacitor and push it firmly against the side of the 33 pF capacitor.

(✓) In the same manner, add a generous amount of cement to the tops of the 27 pF, the 33 pF and the .1 μ F capacitors. Squeeze the tops of these capacitors together.

CONTINUE

- (✓) C207: .01 μ F ceramic.
- (✓) C209: .01 μ F ceramic.
- (✓) C213: .01 μ F ceramic.
- (✓) C212: .01 μ F ceramic.

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

(✓) Prepare the following small brown wires:
Three 3"
Two 2-1/2"

NOTE: When you install these wires in the following steps, solder the wires to the foil and cut off the excess ends.

(✓) 3" brown wire at F.

(✓) 3" brown wire at G.

(✓) C214: .01 μ F ceramic.

(✓) C215: .01 μ F ceramic.

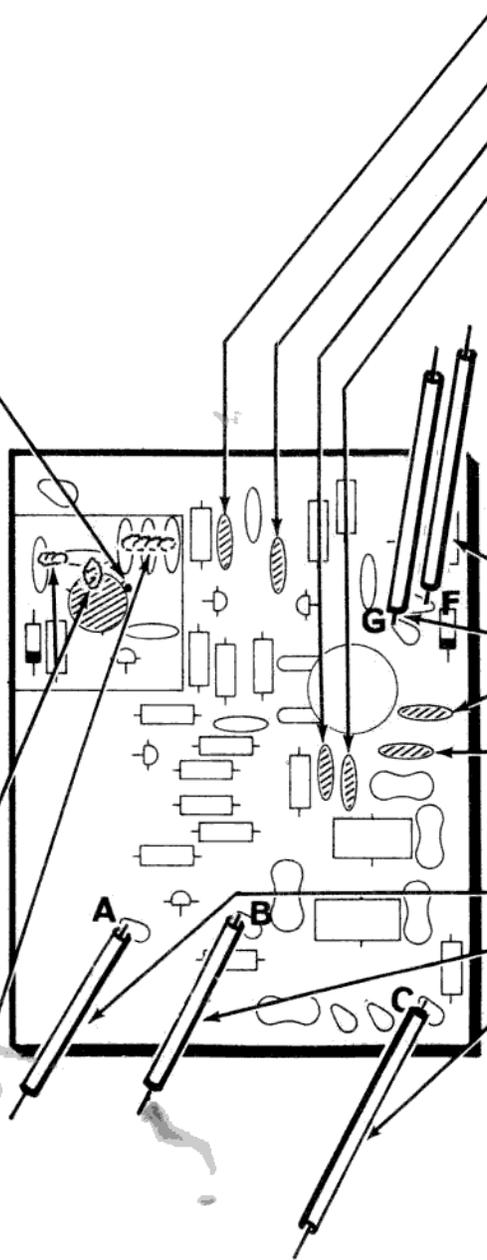
(✓) Solder the leads to the foil and cut off the excess lead lengths.

(✓) 2-1/2" brown wire at A.

(✓) 2-1/2" brown wire at B.

(✓) 3" brown wire at C.

NOTE: The free ends of the wires installed in this Pictorial will be connected later.

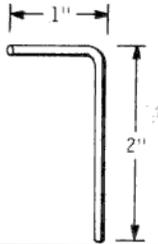


PICTORIAL 10-3



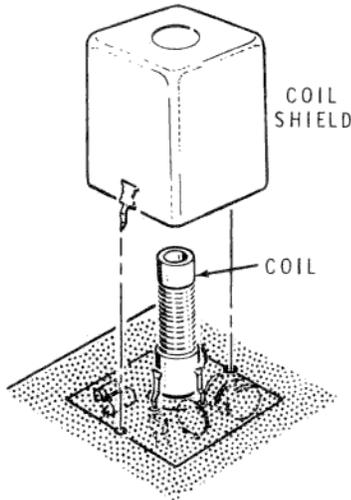
START

- (✓) Cut a 3" heavy bare wire. Form this wire as shown.

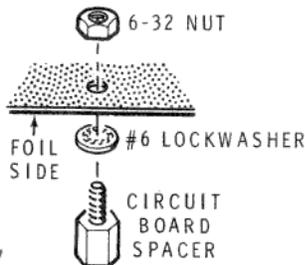


- (✓) Install the bare wire at H. Position the wire as shown.

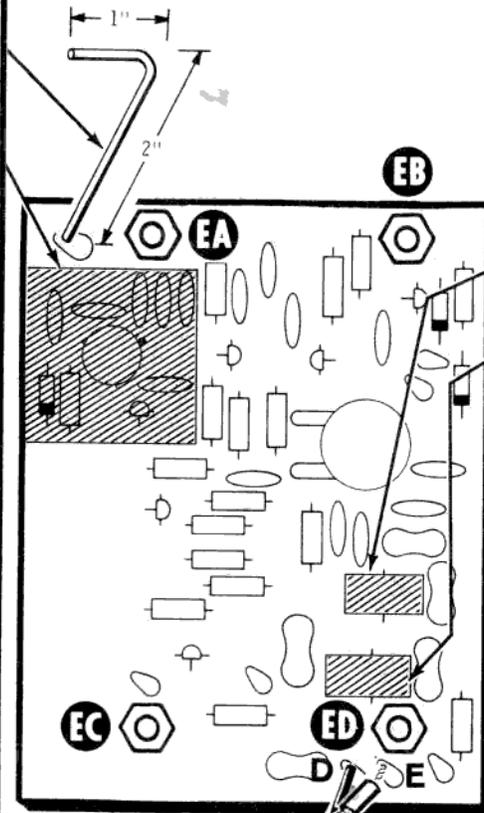
- (✓) Position the coil shield as shown. Be sure the shield is all the way down onto the circuit board. Then solder the shield lugs to the foil.



Mount circuit board spacers onto the circuit board as shown. Be sure to place lockwashers between the top of the spacers and the circuit board foil.

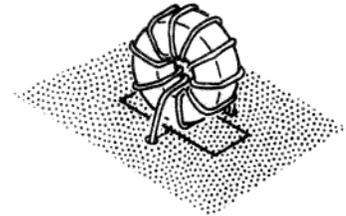


- (✓) Mount circuit board spacers at EA, EB, EC, and ED.



CONTINUE

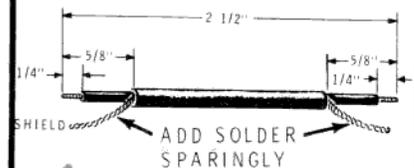
In the following steps, when you install toroid coils, position the coil as shown. Be sure the coil is flush with the board. Then solder the leads to the foil and cut off the excess lead lengths.



- (✓) L202: Red dot toroid coil (#40-1870).

- (✓) L203: Green dot toroid coil (#40-1869).

- () Cut a 2-1/2" length of small shielded cable. Prepare the cable as shown.



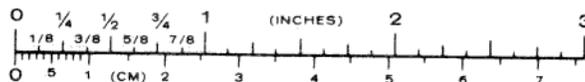
- (✓) Cut a 3/8" piece of small white sleeving.

- (✓) Connect the shielded cable inner lead to hole D (S-1). Place the 3/8" sleeve on the shield lead and connect the lead to hole E (S-1). Cut off the excess leads.

NOTE: The free end of the cable will be connected later.

Set the VFO circuit board aside temporarily.

PICTORIAL 10-4





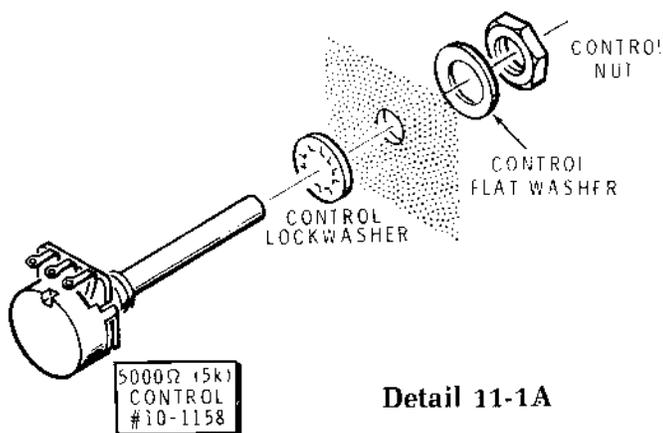
CIRCUIT BOARD CHECKOUT

Carefully inspect the foil side of the power supply and the VFO circuit boards (where applicable) for the following most commonly made errors.

- (✓) Unsoldered connections.
- (✓) Poor solder connections.
- (✓) Solder bridges between foil patterns.
- (✓) Protruding leads which could touch together.

Refer to the illustrations where the parts were installed as you make the following visual checks.

- (✓) Transistors for proper installation.
- (✓) Electrolytic capacitor for the correct position of the identified (+ or -) lead.

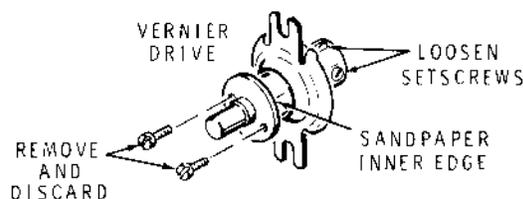


Detail 11-1A

VFO Assembly and Wiring

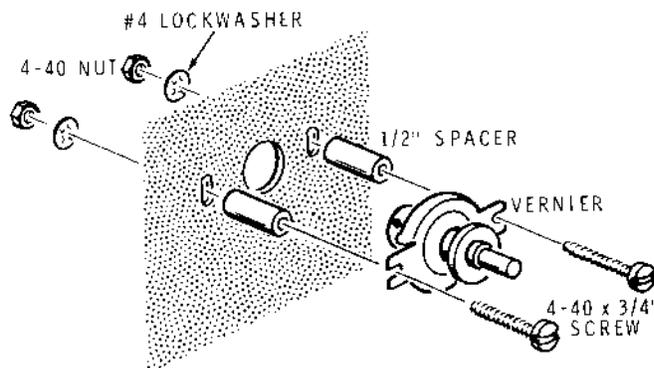
Refer to Pictorial 11-1 (Illustration Booklet, Page 15) for the following steps.

- (3) R8: Refer to Detail 11-1A and mount a 5000 Ω (5K) control (#10-1158) on the VFO bracket as shown. Use a control lockwasher, a control flat washer, and a control nut. Position the control as shown in the Pictorial.



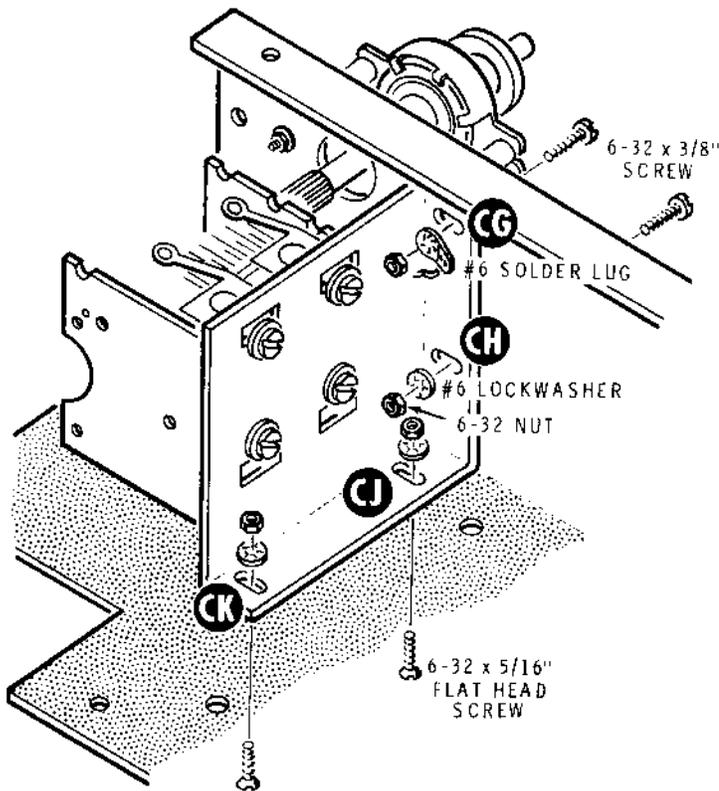
Detail 11-1B

- (✓) Refer to Detail 11-1B and remove and discard the two brass screws in the collar of the remaining vernier drive. Then loosen the two setscrews in the bushing just enough to allow a 1/4" shaft to be inserted into the bushing.
- (✓) Carefully sandpaper the inner edge of the vernier drive front flange to remove the sharp edge and any burrs.



Detail 11-1C

- (✓) Refer to Detail 11-1C and loosely mount the vernier onto the VFO bracket at CA and CB with 1/2" spacers and 4-40 \times 3/4" hardware.
- (✓) Locate the VFO capacitor (#26-153). Then turn the shaft fully clockwise until the capacitor leaves are fully meshed (closed).
- (✓) C29: Refer to Detail 11-1D (Illustration Booklet, Page 15) and loosely mount the VFO capacitor to the capacitor mounting bracket at CC, CD, CE, and CF with 6-32 \times 1/4" hardware as shown. Be sure to place the flat washers against the mounting bracket as shown in the Detail.



Detail 11-1E

(✓) Refer to Detail 11-1E and **loosely** mount the capacitor bracket onto the VFO bracket at CG and CH with 6-32 × 3/8" hardware, and at CJ and CK with 6-32 × 5/16" **flat head** hardware as shown. Be sure the capacitor shaft enters the bushing in the vernier drive. Use a #6 solder lug at CG and position it as shown in the Detail.

(✓) Tighten the vernier bushing setscrews onto the capacitor shaft.

Refer to Detail 11-1F for the next five steps.

(✓) Set the VFO bracket into the chassis and align the VFO vernier drive shaft with the vernier drive bushing in the front panel.

(✓) Loosely secure the VFO bracket to the chassis at CL and CN with 6-32 × 1/4" hardware. Push the VFO bracket toward the front panel as far as it will go. Tighten the hardware at CL and CN.

(✓) Tighten the setscrews in the front vernier bushing onto the shaft of the VFO vernier drive.

NOTE: Make sure the vernier drives are vertically aligned and that none of the screws on the VFO capacitor or VFO drive are binding.

(✓) Tighten VFO capacitor mounting screws CC, CD, CE, and CF.

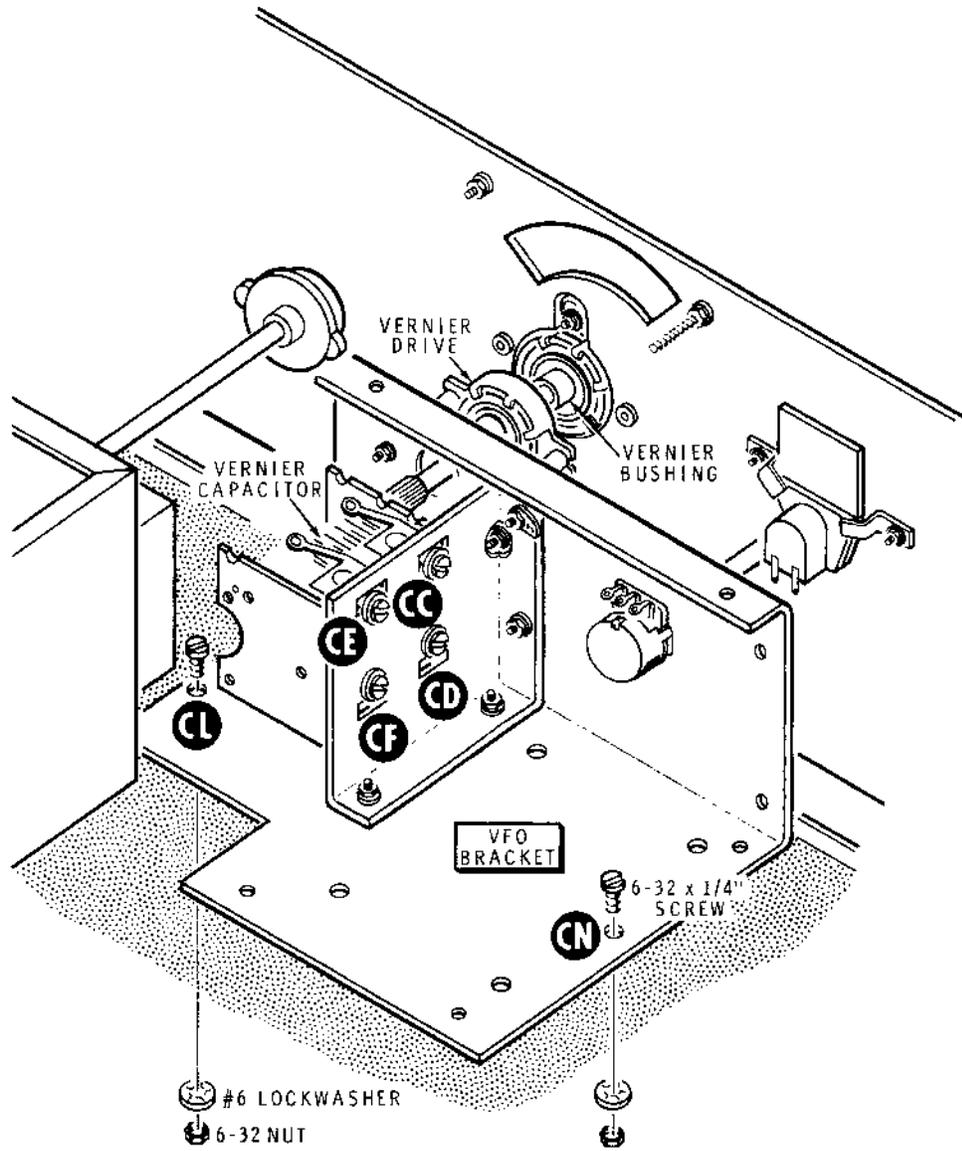
(✓) Remove chassis mounting screws CL and CN. Loosen the **front panel** vernier bushing setscrews. Then lift the VFO bracket assembly from the chassis. Set the chassis aside.

(✓) On the VFO assembly, tighten vernier mounting screws CA and CB.

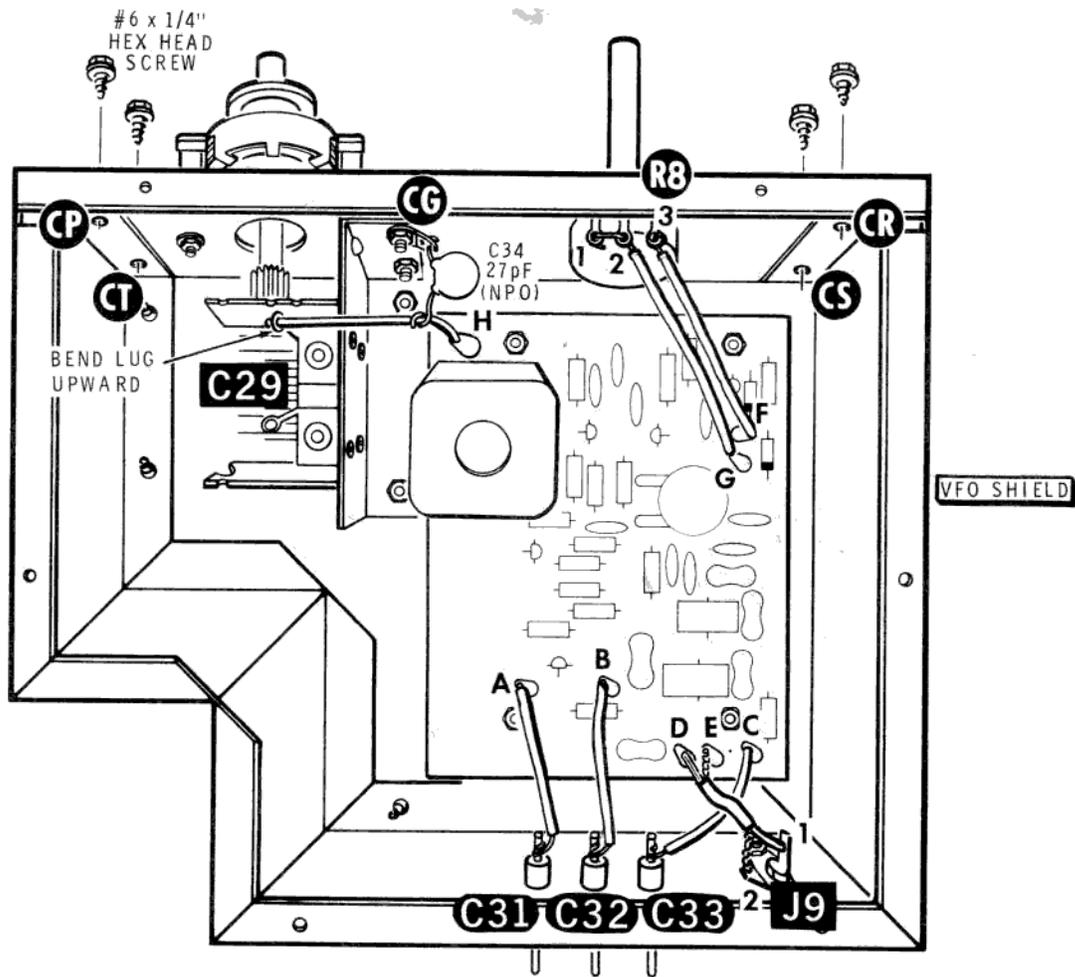
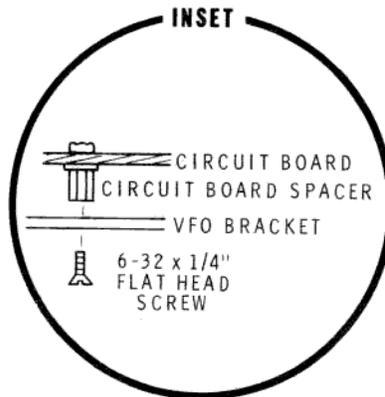
(✓) Tighten capacitor bracket screws CG and CH, and then CJ and CK.

(✓) Completely loosen the VFO vernier bushing setscrews. Turn the front vernier shaft. It is important that the vernier bushing not bind on the capacitor shaft. As you turn the vernier drive shaft in either direction, the tuning capacitor shaft should not turn at all.

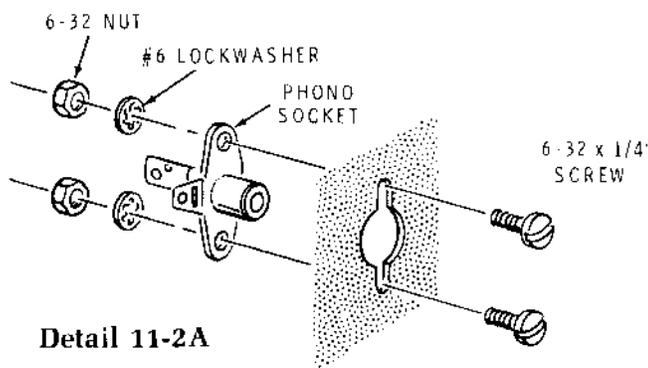
IMPORTANT: If, in the preceding step, the vernier bushing and the capacitor shaft bind against one another to cause the capacitor to rotate, first retighten the vernier bushing screws tightly; then loosen screws CA and CB slightly. Make sure the spacers on CA and CB are straight before you tighten the screws. Once again, loosen the bushing setscrews and make sure the vernier will rotate freely without turning the capacitor shaft. **DO NOT** proceed until you are able to do this. If necessary, you may have to slightly loosen and then retighten capacitor mounting screws CC, CD, CE, and CF, or bracket screws CG, CH, CJ, and CK. If this is done, be sure to tighten the bushing setscrews **before** you loosen any other hardware. Make sure the other hardware is tight before you loosen the setscrews to check for binding.



Detail 11-1F



PICTORIAL 11-2

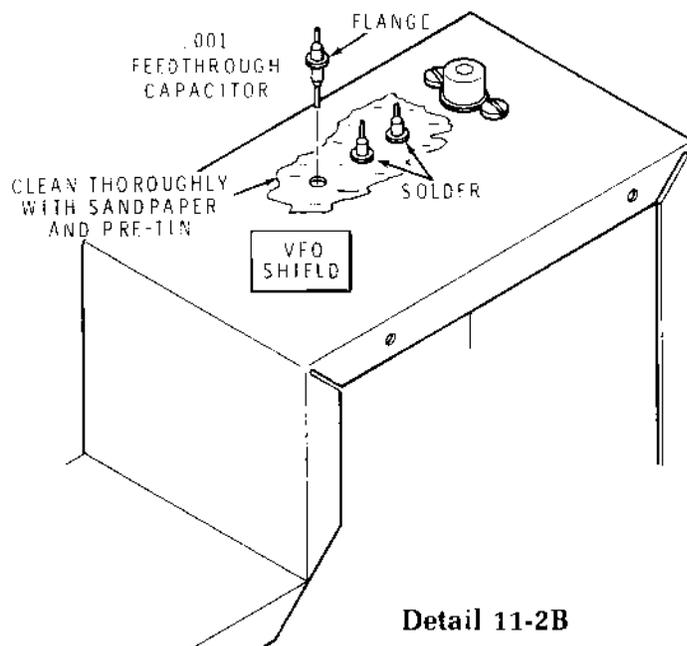


Detail 11-2A

Refer to Pictorial 11-2 for the following steps.

- (✓) Position the VFO circuit board onto the VFO bracket as shown in the Pictorial. Refer to the inset drawing on Pictorial 11-2 and secure the circuit board spacers to the bracket with four 6-32 × 1/4" flat head screws. If necessary, temporarily slightly loosen the spacer mounting hardware on the top of the board.
- (✓) Bend the indicated lug of tuning capacitor C29 toward the circuit board and push the free end of the heavy bare wire coming from circuit board hole H into the capacitor lug loop (S-1).
- (✓) C34: Connect a 27 pF capacitor (marked "NPO") from solder lug CG (S-1) to the top bend of the wire coming from circuit board hole H (S-1).
- (✓) Connect the free end of the wire coming from circuit board hole F to control R8 lug 3 (S-1).
- (✓) Remove an additional 1/4" of insulation from the wire coming from hole G. Pass the end of the wire through R8 lug 2 (S-2) to lug 1 (S-1).
- (✓) Locate the VFO shield (#206-1313) and position it on your work area as shown.
- (✓) Using sandpaper, or some other abrasive substance, thoroughly clean the area around the three small holes in the rear of the VFO shield. This will assure a good solder connection in a later step.
- (✓) J9: Refer to Detail 11-2A and mount a phono socket at J8 on the VFO shield as shown. Use 6-32 × 1/4" hardware. Position the socket lugs as shown in the Pictorial.

NOTE: After you have installed the feedthrough capacitors in the following step, be careful not to bump them or to lay the shield down on them, as they are rather easily broken.

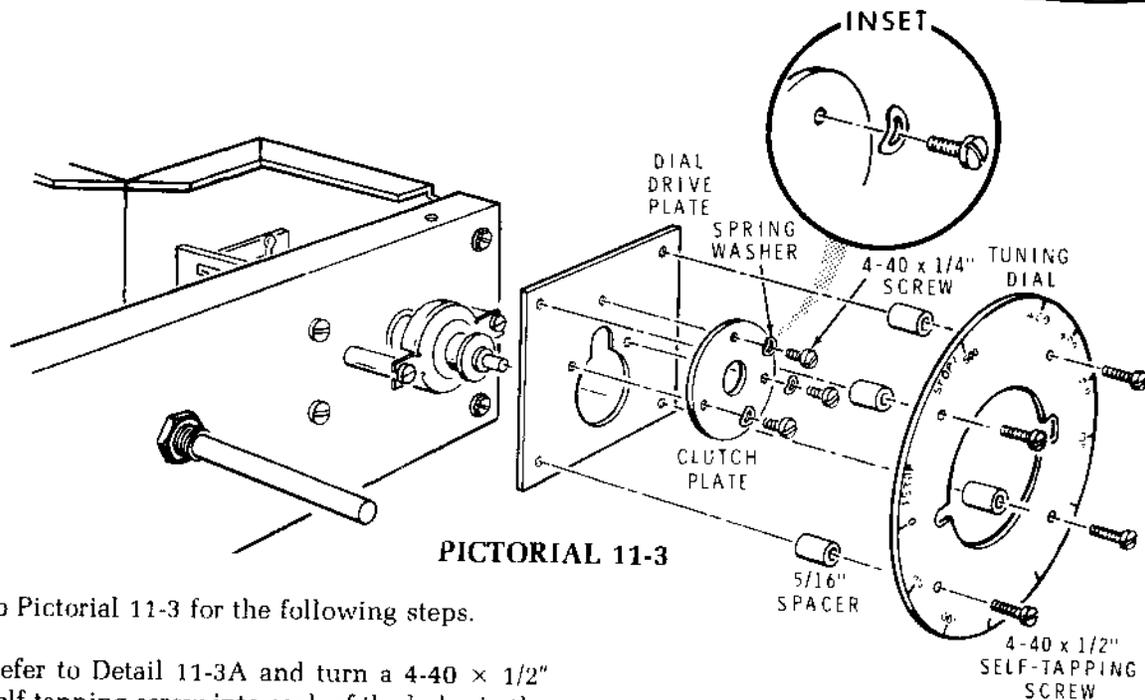


Detail 11-2B

- (✓) C31, C32, C33: Refer to Detail 11-2B and position the VFO shield on your work area with the front two flanges on the work surface. Place three .001 μF feedthrough capacitors (#21-145) into the three small holes in the shield. Use a high-heat soldering iron with a heavy tip and solder the flanges on the three capacitors to the shield. NOTE: One extra feedthrough capacitor has been supplied in case one of the original three should break.
- (✓) Refer to Pictorial 11-2 and position the VFO bracket onto the VFO shield as shown. Secure the front flanges of the shield to the bracket at CP, CR, CS, and CT with four #6 × 1/4" hex head screws.

NOTE: In the next four steps, connect the wires coming from the VFO circuit board to the VFO shield components.

- (✓) Connect the brown wire coming from A to feedthrough capacitor C31 (S-1).
- (✓) Connect the wire coming from B to feedthrough capacitor C32 (S-1).
- (✓) Connect the wire coming from C to feedthrough capacitor C33 (S-1).
- (✓) Connect the **inner** lead of the shielded cable coming from D and E to phono socket J9 lug 1 (S-1) and the **shielded** lead to lug 2 (S-1).



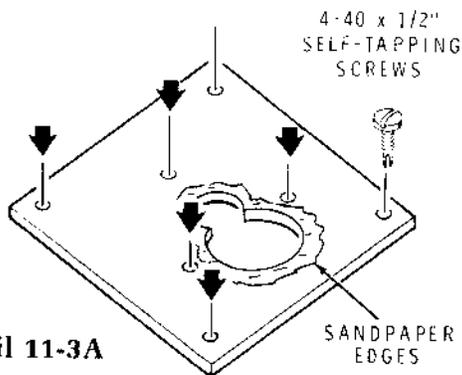
PICTORIAL 11-3

Refer to Pictorial 11-3 for the following steps.

- (✓) Refer to Detail 11-3A and turn a 4-40 × 1/2" self-tapping screw into each of the holes in the dial drive plate as shown. Turn the screw in until approximately 1/3 of its length extends from the rear of the plate. Then remove the screw. There is a screw provided to tap each hole.

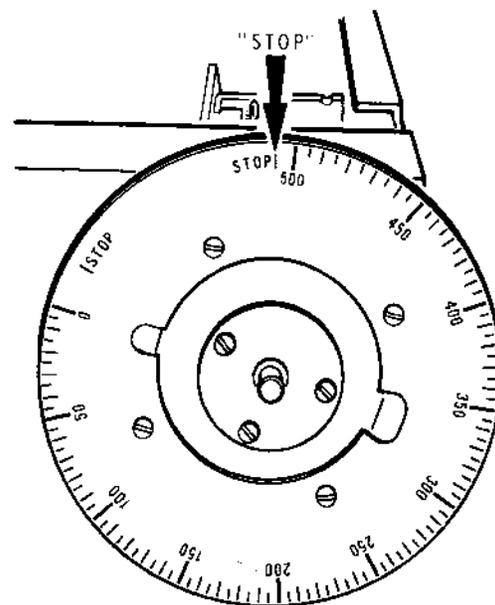
- (✓) Remove the paper backing from the tuning dial. Then mount the dial onto the dial drive plate with four 4-40 × 1/2" self-tapping screws and four 5/16" spacers.

- (✓) Turn the shaft of the vernier drive to its fully clockwise position; the VFO capacitor plates should be fully meshed. Then slip the tuning dial in a clockwise direction until the "Stop" at the "500" end of the scale is at the 12 o'clock position as shown in Detail 11-3B.

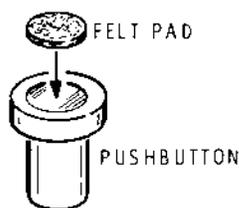


Detail 11-3A

- (✓) Sandpaper the edges of the dial drive plate as shown in Detail 11-3A to remove sharpness and burrs.
- (✓) Place the larger portion of the opening in the dial drive plate over the collar of the VFO vernier drive and slide the plate down behind the collar.
- (✓) Place the clutch onto the vernier drive and secure it to the dial drive plate with three 4-40 × 1/4" screws and three spring washers. Tighten these screws until the end of each screw is flush with the back side of the dial drive plate. Then turn each screw one turn counterclockwise.



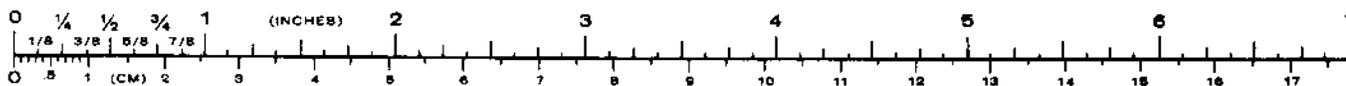
Detail 11-3B

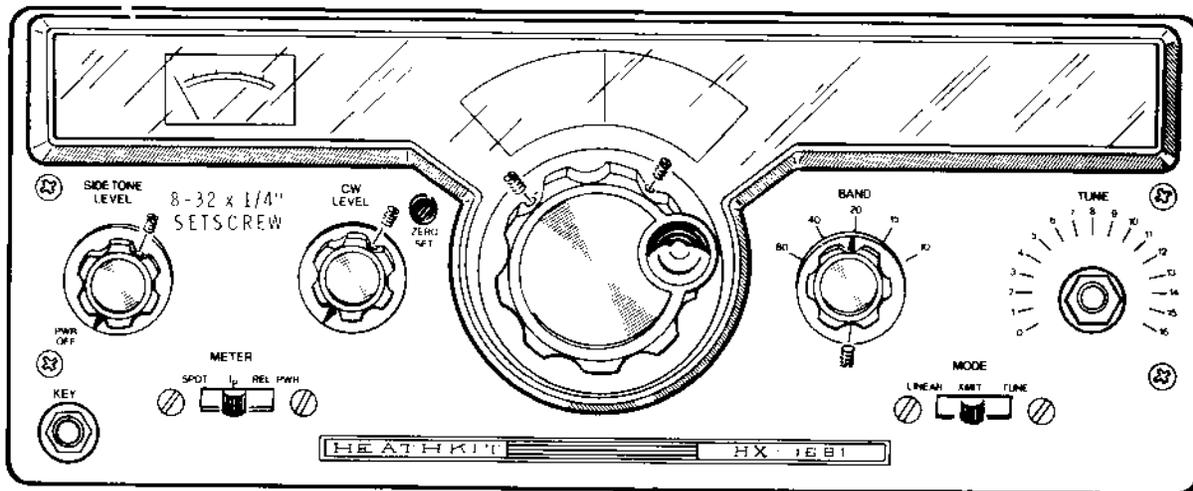


Detail 11-4A

Refer to Pictorial 11-4 (Illustration Booklet, Page 16) for the following steps.

- (✓) Locate the pushbutton. Remove the backing from the small round felt pad and press it onto the back of the larger portion of the pushbutton as shown in Detail 11-4A.
- (✓) Install the pushbutton into the front panel, from the inside, as shown.
- (✓) Position the VFO assembly into the chassis so the VFO vernier shaft slides into the front panel vernier rear bushing.
- (✓) On the underside of the chassis, start six #6 × 3/8" hex head screws into holes EA, EB, EC, ED, EF, and EG. Do **not** tighten the screws securely. Install a #8 long solder lug on screw EA.
- (✓) On the top of the chassis, push the VFO assembly all the way forward. The VFO assembly should be approximately 1/8" from the front edge of the chassis. Secure the front vernier setscrews onto the shaft of the VFO vernier.
- (✓) On the underside of the chassis, tighten the six screws at EA through EG. Position the long solder lug at EA as shown.
- (✓) Cut a 1" piece of small black sleeving. Place the sleeving onto long lug EA; then wrap the lug firmly around the two heavy black wires at that point.
- (✓) Refer to inset drawing #1 on Pictorial 11-4 and, on the outside of the front panel, tighten the two 4-40 screws on the vernier drive bracket at S and T.
- (✓) Prepare a 9" white-red wire and a 6-1/2" small brown wire.
- (✓) Pass the two prepared wires up through chassis grommet BJ. Connect the end of the brown wire to feedthrough capacitor C33 (NS). The free end of this wire will be connected later.
- (✓) Refer to inset drawing #2 on Pictorial 11-4 and pass the end of the white-red wire through a ferrite bead as shown. Take one full turn around the bead, approximately 1" from the wire end. Connect the end of the wire to feedthrough capacitor C31 (S-1). The free end of the wire will be connected later.
- (✓) Connect the free end of the violet wire coming from grommet BJ to capacitor C33 (S-2).
- (✓) Connect the free end of the white-brown wire coming from grommet BJ to capacitor C32 (S-1).





Detail 11-5A

Refer to Pictorial 11-5 (Illustration Booklet, Page 16) for the following steps.

Refer to Detail 11-5A for the next six steps.

- (✓) 1. Start an 8-32 × 1/4" setscrew into the holes in the sides of the four small round knobs.
- () 2. Similarly, start two 8-32 × 1/4" setscrews into the two holes in the large round knob.
- (✓) 3. Position the large round knob onto the front panel vernier shaft. Tighten the setscrews onto the shaft. Turn the knob in both directions several turns to make sure the knob and tuning capacitor operate freely. NOTE: If the tuning dial mounting screws touch the red window mounting screw, loosen the VFO assembly mounting screws and slide the VFO rearward **slightly**. Retighten the screws.

- (✓) 4. Turn the shaft of the SIDETONE LEVEL control fully counterclockwise until the control clicks "off." Place a small round knob onto the shaft and position the knob pointer until it points directly to PWR OFF. Then tighten the setscrew.
- (✓) 5. Turn the CW LEVEL control shaft fully counterclockwise. Place another small round knob onto the shaft and position its pointer at the 7 o'clock position. Tighten the setscrew onto the shaft.
- (✓) 6. Turn the Band switch fully clockwise, then **two** clicks counterclockwise. Place a small round knob onto the Band switch shaft and position the knob pointer so it is straight upward toward the index line at "20." Tighten the setscrew onto the shaft.



Refer to Detail 11-5B for the next four steps.

NOTE: In the next four steps, be sure the two tuning capacitor plates stay fully meshed (until you complete Step 4).

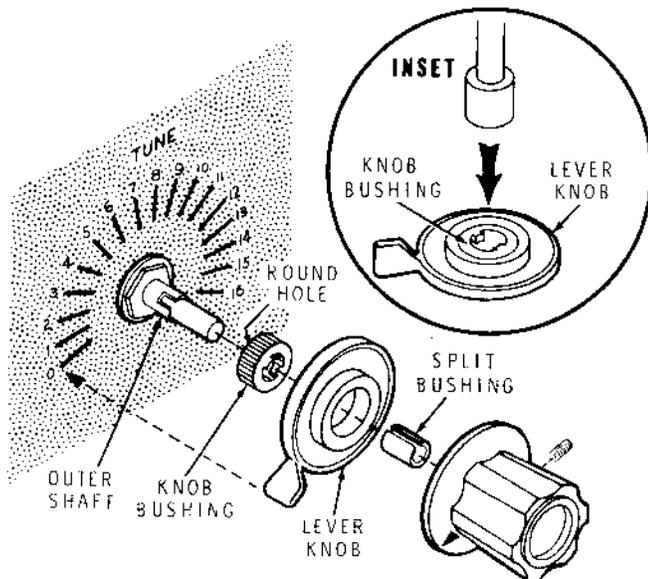
- (✓) 1. Locate the (round) lever knob and the knob bushing. Refer to the inset drawing on Detail 11-5B and push the bushing into the center of the knob. Be sure the notches in the bushing face outward as shown and that the top of the bushing is flush with the top center portion of the knob.
- (✓) 2. Place the lever knob onto the outer Tune capacitor shaft and line up the notches in the bushing with those on the shaft. NOTE: If the shaft does not come all the way to the front of the bushing, loosen the rear setscrew on the PA tuning capacitor shaft coupler and slide the coupler forward slightly. Then retighten the setscrew in the coupler.
- (✓) 3. Turn the outer Tune shaft fully counterclockwise until the tuning capacitor plates are fully meshed. Loosen the allen setscrew in

the dial cord pulley on the outer shaft; then turn the lever knob in either direction, until the lever is positioned over the "0" on the front panel. Making sure the two dial pulleys are exactly aligned, tighten the shaft pulley setscrew.

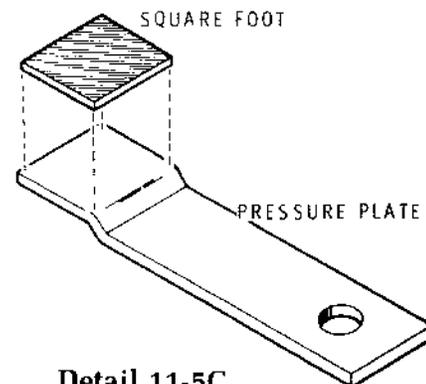
- (✓) 4. Place a split bushing into the remaining small round knob. Temporarily tighten the setscrew and knob onto the inner Tune capacitor shaft. As you watch the capacitor inside the PA compartment (C26) rotate the round Tune knob until the capacitor plates are fully meshed. Then loosen the knob setscrew and turn the knob until the pointer is at the "0" position. Tighten the setscrew.

NOTE: Check the action of the two (inner and outer) TUNE controls. If they bind or interact, you may correct this if you: (1) Loosen the front panel bushing and retighten it; or (2) Adjust the shaft coupler (and bushing) **slightly** toward the rear of the Transmitter.

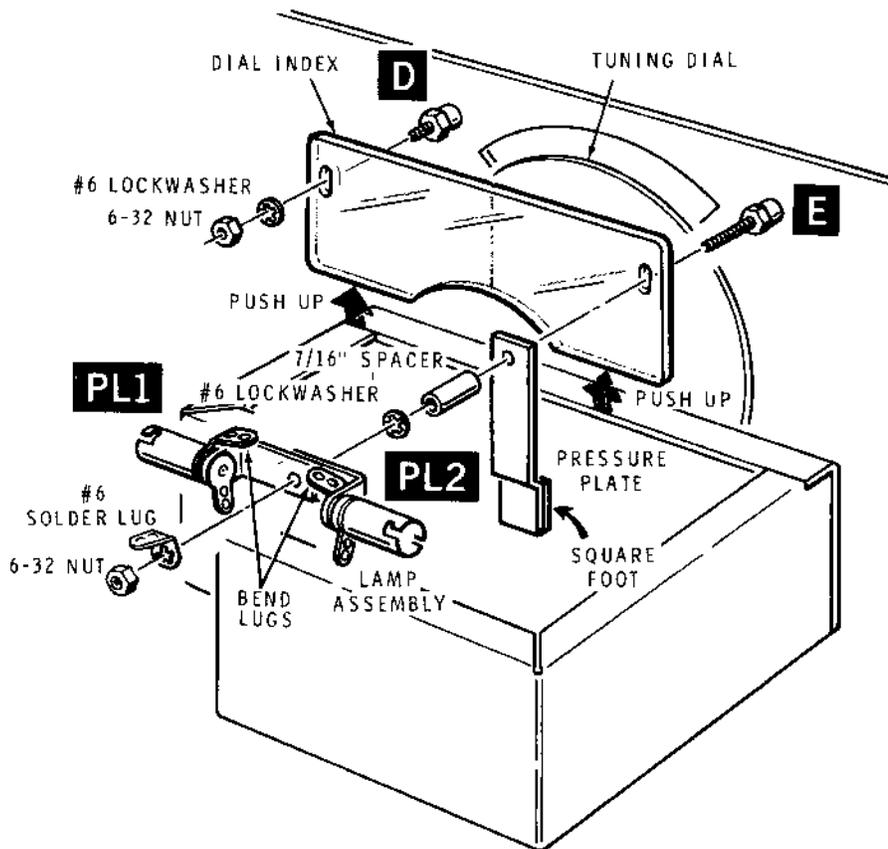
- (✓) Refer to Detail 11-5C and remove the paper backing from the square foot and press the foot in place on the pressure plate as shown.



Detail 11-5B



Detail 11-5C



Detail 11-5E

Refer to Detail 11-5E for the next four steps.

- (✓) Place the dial index onto the front panel screws at D and E with the index line facing the rear of the tuning dial. Position the index toward the top of the front panel as far as possible, then secure the index at D with a #6 lockwasher and a 6-32 nut.
- (✓) Place the pressure plate and a 7/16" spacer onto screw E as shown in the Detail.

- (✓) Secure two lamp sockets onto the end of screw E. Position the sockets as shown and secure them with a #6 lockwasher, a #6 solder lug, and a 6-32 nut. Be sure the dial index is parallel with the top edge of the front panel.
- (✓) Bend the top lugs of the sockets at PL1 and PL2 and the #6 solder lug sharply over as shown in the Detail. Be sure the sides of the lugs do not come in contact with any other part of either socket.



CHASSIS FINAL WIRING

FRONT PANEL

Refer to Pictorial 11-6 (Illustration Booklet, Page 16) for the following steps.

(✓) Prepare a 2" brown wire. Connect this wire from lamp socket PL2 lug 2 (S-1) to PL1 lug 2 (NS).

(✓) Locate the 9-1/2" brown wire coming from front panel switch SW2 lug 5. Connect this wire end to PL1 lug 2 (S-2).

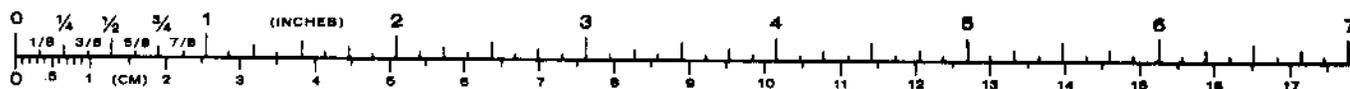
(✓) Cut a 2" brown wire and remove all the insulation from it. Connect the wire from PL1 lug 1 (S-1), through solder lug Z (S-2), to PL2 lug 1 (S-1).

(✓) Position the long wire coming from SW2 to PL1 so it will not come between the lamp and the dial index.

NOTE: Carefully check the wires and connections at PL1 and PL2. Make sure that the connections are well soldered, and that there are no excess wire ends which could short together or to other components, the front panel, or the lamp sockets.

(⊖) Install two #1813 lamps in sockets PL1 and PL2.

(✓) Place a lamp shield on each of the lamps and turn the open sides directly toward the front panel as shown.



CHASSIS WIRING

Refer to Pictorial 11-7 (Illustration Booklet, Page 17) for the following steps.

- (✓) Refer to Detail 11-7A (Illustration Booklet, Page 17) and loosely mount a 6-32 × 1/4" spacer on one corner of the power supply circuit board.
- (✓) In the same manner, mount three additional circuit board spacers on the other corners of the power supply board.
- (✓) Position the power supply circuit board onto the chassis and secure the board at DR, DS, DT, and DU with 6-32 × 1/4" screws and #6 lockwashers as shown in the Pictorial. Also mount a #8 long solder lug at DU.
- (✓) Tighten all the power supply spacer mounting hardware.
- (✓) Cut a 1" piece of small black sleeving. Place the sleeving on long lug DU; then wrap the lug around the heavy black wires at the rear corner of the power supply circuit board.

Connect the wires coming from wire harness BO#3 to the power supply circuit board in the following steps.

- (✓) Yellow wire to B (S-1).
- (✓) Gray wire to D (S-1).
- (✓) Green wire to L (S-1).
- (✓) White-orange wire to C (S-1).
- (✓) White-red wire to one hole at A (S-1). NOTE: Be careful not to fill the other two holes with solder.
- (✓) Cut a 1/4" piece of white sleeving.

(✓) Shielded cable inner lead to one hole at G (S-1). Place a 1/4" sleeve on the shield lead and connect the lead to the adjacent unmarked foil pad as shown (S-1).

(✓) Connect the brown wire coming from grommet BJ to circuit board hole J (S-1).

(✓) Connect the white-red wire coming from grommet BJ to circuit board hole A (S-1). Be sure not to cover the remaining hole at A.

(✓) Connect the brown wire coming from grommet BH to circuit board hole N (S-1).

(✓) Connect either of the twisted brown wires coming from tube socket V1 to circuit board hole E (S-1) and the other brown wire to hole F (S-1).

(✓) Prepare the following brown wires:

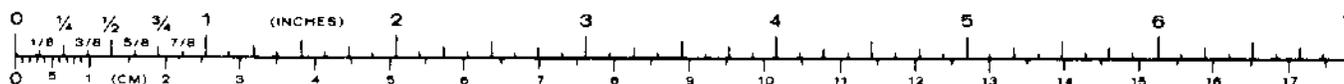
5"	2-1/2"
2"	4-1/2"

(✓) Connect a 5" brown wire from circuit board hole A (S-1) to terminal connector BB pin 7 (S-1). Route the wire as shown in the Pictorial.

NOTE: If you intend to use your Transmitter with a solid-state receiver, complete step A below. If you plan to use a tube-type receiver, complete step B.

A. (✓) Connect a 2" brown wire from circuit board hole H (S-1) to phono socket J3 lug 1 (S-1). Form the wire as shown (solid lines).

B. () Connect a 3-1/4" brown wire from circuit board hole I (S-1) to phono socket J3 lug 1 (S-1). Form the wire as shown (dotted lines).





- (✓) Connect a 2-1/2" brown wire from circuit board foil pad at G (S-1) to phono socket J4 lug 1 (S-1). Form the wire as shown.
- (✓) Connect a 4-1/2" brown wire from circuit board hole M (S-1) to phono socket J5 lug 1 (S-1). Form the wire as shown.
- (✓) Where possible, gather the wires at the left rear corner of the power supply circuit board and push them into the loop of long lug DU. Wrap the lug securely around the wires.

This completes the wiring of the power supply circuit board. Check the circuit board as follows.

CIRCUIT BOARD CHECKOUT

Carefully inspect the power supply circuit board for the following conditions.

- () Unsoldered connections.
- (✓) Poor solder connections.
- (✓) Solder bridges between foil patterns.
- (✓) Protruding leads which could touch together.

NOTE: There are three unused circuit board holes.

- (✓) C27: Cut the leads of a .01 μ F ceramic capacitor to 1/2". Connect this capacitor between terminal strip AZ lug 1 (NS) and the mounting foot eyelet (S-1).
- (✓) R11: Cut the leads of a 100 Ω , 2-watt (brn-blk-brn) resistor to 3/4". Connect this resistor from tube socket V1 lug 3 (S-1) to terminal strip AZ lug 1 (NS). Position the resistor down as close to the chassis as possible.
- (✓) Locate the two heavy orange wires coming from harness BO#1. Connect the ends of both wires to terminal strip AZ lug 1 (S-4).
- (✓) Cut a 1" piece of small black sleeving. Place the sleeving on long lug AY. Wrap the lug firmly around the adjacent harness wires as shown in the Pictorial.
- (✓) Cut a 5-3/4" length of medium bare wire.

- (✓) Cut a 4-1/4" and a 3/4" piece of small white sleeving.

- (✓) Pass one end of the medium bare wire through the eyelet of terminal strip AX lug 2 (S-2). Place the 4-1/4" white sleeve on the wire. Connect this end of the wire to terminal strip DJ lug 4 (S-4). NOTE: Be sure to use enough solder and heat to make a solid connection on all four wires and leads.

- (✓) Place a 3/4" piece of sleeving on the other end of the wire. Then form the wire across and down into driver circuit board hole I (S-1).

- (✓) Cut a 6" medium bare wire and a 5-1/2" piece of small white sleeving. Place the sleeving on the wire.

- (✓) Refer to Detail 11-7B (Illustration Booklet, Page 17) and form the 6" wire as shown. Connect the 1/4" end of the longer wire length to tube socket V2 lug 5 (upper hole) (S-1). Connect the other end of this wire to driver circuit board hole J (S-1).

- (✓) Cut one lead of a 100 pF ceramic capacitor to 1/4".

- (✓) C16: Pass the long capacitor lead through the eyelet on terminal strip AX mounting foot and then over the top of the strip. Connect the lead to ground loop GL (S-1). Solder the mounting foot eyelet.

- (✓) Connect the short capacitor lead to terminal strip AX lug 2 (S-1).

- (✓) Refer to the inset drawing on Pictorial 11-7 and install cable ties around all the wires at DX and DY. Pull the ties tight, then cut off the excess tie ends.

This completes the chassis wiring of your Transmitter. Once again, carefully check all the connections to make sure there are no loose wires or leads (except the long wire connected to the meter + lug), that all the wires are well soldered, and that there are no wire ends that can touch together or to other components and parts of the chassis. IMPORTANT: On the top of the chassis, check the wiring to the rear panel to be sure none of the wires are near the components on the power supply circuit board.



HFO/MIXER CIRCUIT BOARD

PARTS LIST

Refer to the Pack Index Sheet and locate Pack #3. Unpack these parts and check each part against the following list. The key numbers correspond to the numbers on the "HFO/Mixer Circuit Board Parts Pictorial" (Illustration Booklet, Page 18).

To order a replacement part, always include the PART NUMBER. Use the Parts Order Form furnished with this kit. If one is not available, see "Replacement Parts" inside the rear cover of this Manual. For prices, refer to the separate "Heath Parts Price List."

KEY No.	HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
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RESISTORS, 1/4-Watt

NOTES:

- Resistors may be packed in more than one envelope. Open all of the resistor envelopes in this pack before you check them against the following list.
- The following resistors have a tolerance of 5%. 5% is indicated by a gold fourth band.

A1✓	6-220-12	2	22 Ω (red-red-blk)	R126, R142
A1✓	6-101-12	4	100 Ω (brn-blk-brn)	R112, R119, R121, R123
A1✓	6-151-12	1	150 Ω (brn-grn-brn)	R117
A1✓	6-271-12	2	270 Ω (red-viol-brn)	R124, R127
A1✓	6-331-12	2	330 Ω (org-org-brn)	R104, R116

KEY No.	HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
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Resistors (cont'd.)

A1✓	6-102-12	12	1000 Ω (brn-blk-red)	R125, R128, R129, R131, R132, R133, R134, R135, R136, R137, R138, R139
A1✓	6-562-12	4	5600 Ω (grn-blu-red)	R102, R103, R108, R141
A1✓	6-682-12	1	6800 Ω (blu-gray-red)	R122
A1✓	6-103-12	4	10 kΩ (brn-blk-org)	R101, R107, R114, R118,
A1✓	6-153-12	3	15 kΩ (brn-grn-org)	R106, R111, R113

KEY No.	HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
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CAPACITORS
Mica

A2 ✓	20-130	3	12 pF	C108, C148, C153
A2 ✓	20-99	2	22 pF	C102, C104
A2 ✓	20-77	2	24 pF	C117, C123
A2 ✓	20-100	3	30 pF	C109, C136, C141
A2 ✓	20-101	1	47 pF	C115
A2 ✓	20-110	2	75 pF	C121, C122
A2 ✓	20-183	2	120 pF	C128, C133
A2 ✓	20-103	5	150 pF	C106, C156, C157, C161, C162
A2 ✓	20-108	2	200 pF	C151, C152
A2 ✓	20-116	2	400 pF	C138, C139
A2 ✓	20-113	1	470 pF	C105
A2 ✓	20-171	2	820 pF	C131, C132

Other Capacitors

A3 ✓	21-140	4	.001 μ F ceramic	C111, C112, C124, C125
A3 ✓	21-176	14	.01 μ F ceramic	C103, C107, C113, C114, C116, C118, C119, C127, C135, C143, C144, C145, C146, C147
A3 ✓	21-95	2	.1 μ F ceramic	C101, C126
A4 ✓	31-68	8	1-8 pF trimmer	C137, C142, C149, C154, C155, C158, C159, C163
A5 ✓	31-85	2	5-25 pF trimmer	C129, C134

COILS-INDUCTORS

B1 ✓	40-1863	1	.37 μ H toroid coil (red-yellow dot)	L106
B1 ✓	40-1875	2	4.5 μ H toroid coil (red dot)	L115, L116
B1 ✓	40-1882	4	15.5 μ H toroid coil (white dot)	L107, L108, L109, C110
B2 ✓	40-1726	4	7 μ H toroid coil	L111, L112, L113, L114
B3 ✓	40-1973	1	.4 μ H variable inductor	L105
B3 ✓	40-1972	1	.5 μ H variable inductor	L104
B3 ✓	40-1971	1	.8 μ H variable inductor	L103

KEY No.	HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
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DIODES-TRANSISTORS

C1 ✓	56-20	1	1N295 diode (red-white-green)	D124
C1 ✓	56-28	8	GE-S127 diode	D101, D104, D105, D109, D110, D111, D112, D113
C1 ✓	56-56	13	1N4149 diode	D102, D103, D106, D107, D108, D114 through D121, D122, D123
C1 ✓	56-646	2	BA-244 diode (red-yel-yel)	

NOTE: Transistors may be marked for identification in any of the following four ways:

1. Part number.
2. Type number.
3. Part number and type number.
4. Part number with a type number other than the one listed.

C2 ✓	417-293	4	2N5770 transistor	Q101, Q102, Q103, Q104
C3 ✓	417-893	1	2N5109 transistor	Q105

CRYSTALS

C4 ✓	404-569	1	9.0 MHz	Y101
C4 ✓	404-568	1	12.5 MHz	Y102
C4 ✓	404-567	1	19.5 MHz	Y103
C4 ✓	404-566	1	26.5 MHz	Y104
C4 ✓	404-565	1	33.5 MHz	Y105

MISCELLANEOUS

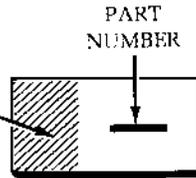
D1 ✓	10-917	1	200 Ω control	R109
D1 ✓	10-918	1	500 Ω control	R105
D2 ✓	150-72	1	Balanced mixer	U101
D3 ✓	215-45	1	Heat sink	
D4 ✓	432-121	3	Circuit board pin	
D5 ✓	432-124	12	Edge connector	
D6 ✓	432-134	12	Wire socket	
D7 ✓	434-186	1	Phono socket	J101

PART FROM MAIN PACK

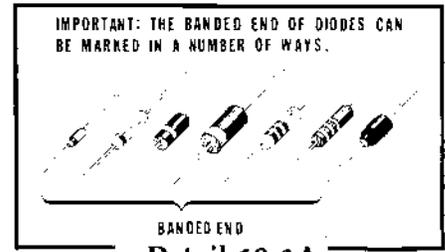
✓	85-2188-1	1	HFO/Mixer circuit board	
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STEP-BY-STEP ASSEMBLY

The steps performed in this Pictorial are in this area of the circuit board.



IDENTIFICATION DRAWING



IMPORTANT: THE BANDIED END OF DIODES CAN BE MARKED IN A NUMBER OF WAYS.

Detail 12-1A

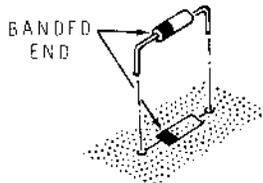
START

Position the IIFC Mixer circuit board as shown in the identification drawing. Then proceed with the following steps.

(✓) R102: 5600 Ω (grn-blk-red).

(✓) R101: 10 kΩ (brn-blk-org).

NOTE: When you install a diode, always match the band on the diode with the band mark on the circuit board. A DIODE WILL NOT WORK IF INSTALLED BACKWARDS. See Detail 12-1A.



(✓) D104: GE-S127 diode (#56-28).

(✓) D101: GE-S127 diode (#56-28).

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

(✓) R103: 5600 Ω (grn-blu-red).

(✓) R104: 330 Ω (org-org-brn).

(✓) R106: 15 kΩ (brn-grn-org).

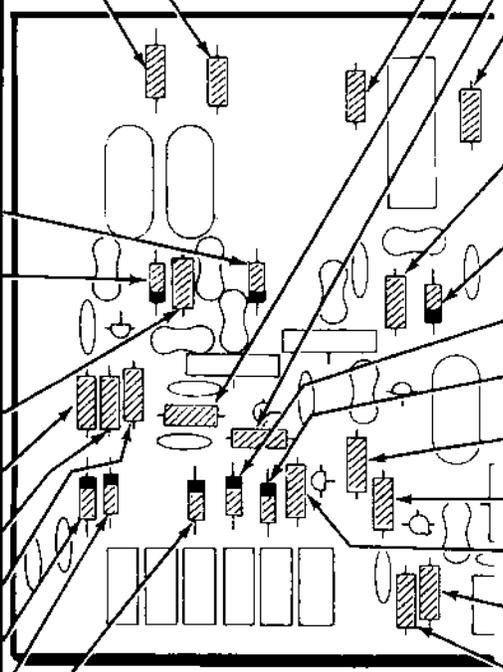
(✓) R107: 10 kΩ (brn-blk-org).

(✓) D102: 1N4149 diode (#56-56).

(✓) D103: 1N4149 diode (#56-56).

(✓) D106: 1N4149 diode (#56-56).

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



CONTINUE

(✓) R112: 100 Ω (brn-blk-brn).

(✓) R117: 150 Ω (brn-grn-brn).

(✓) R113: 15 kΩ (brn-grn-org).

(✓) R119: 100 Ω (brn-blk-brn).

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

(✓) R111: 15 kΩ (brn-grn-org).

(✓) D109: GE-S127 diode (#56-28). Position the banded end as shown.

(✓) D107: 1N4149 diode (#56-56).

(✓) D108: 1N4149 diode (#56-56).

(✓) R108: 5600 Ω (grn-blu-red).

(✓) R116: 330 Ω (org-org-brn).

(✓) R114: 10 kΩ (brn-blk-org).

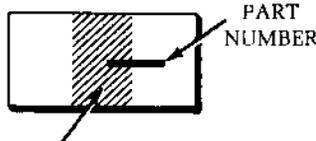
(✓) R121: 100 Ω (brn-blk-brn).

(✓) R142: 22 Ω (red-red-blk).

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

PICTORIAL 12-1

IDENTIFICATION
DRAWING

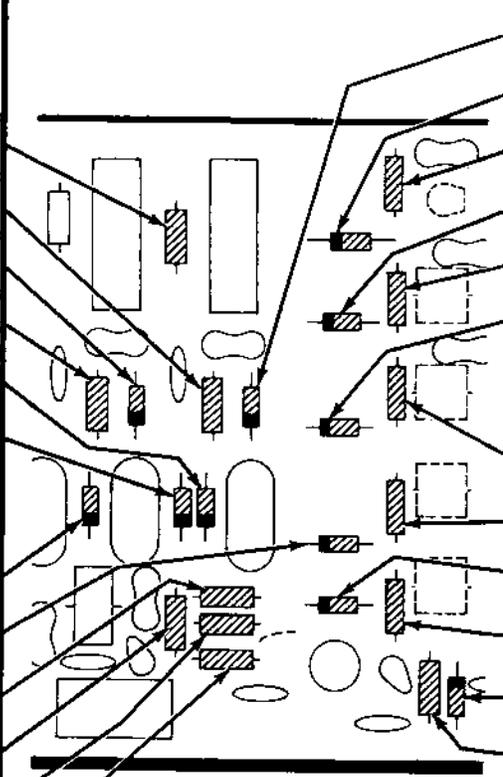


The steps performed in this Pictorial are in this area of the circuit board.

START ↘

IMPORTANT: On this Pictorial, when you install diodes, be sure to position the banded ends as shown. If you do not, your Transmitter will not work.

- (✓) R123: 100 Ω (brn-blk-brn).
- (✓) R122: 6800 Ω (blu-gry-red).
- (✓) D111: GE-S127 diode (#56-28).
- (✓) R118: 10 kΩ (brn-blk-org).
- (✓) D112: GE-S127 diode (#56-28).
- (✓) D110: GE-S127 diode (#56-28).
- (✓) Solder the leads to the foil and cut off the excess lead lengths.
- (✓) D105: GE-S127 diode (#56-28).
- (✓) D120: 1N4149 diode (#56-56).
- (✓) R125: 1000 Ω (brn-blk-red).
- (✓) R124: 270 Ω (red-viol-brn).
- (✓) R127: 270 Ω (red-viol-brn).
- (✓) R126: 22 Ω (red-red-blk).
- (✓) Solder the leads to the foil and cut off the excess lead lengths.

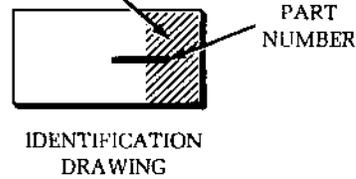


CONTINUE ↘

- (✓) D113: GE-S127 diode (#56-28).
- (✓) D114: 1N4149 diode (#56-56).
- (✓) R128: 1000 Ω (brn-blk-red).
- (✓) D116: 1N4149 diode (#56-56).
- (✓) R132: 1000 Ω (brn-blk-red).
- (✓) D118: 1N4149 diode (#56-56).
- (✓) Solder the leads to the foil and cut off the excess lead lengths.
- (✓) R134: 1000 Ω (brn-blk-red).
- (✓) R136: 1000 Ω (brn-blk-red).
- (✓) D122: BA-244 diode (red-yel-yel, #56-646).
- (✓) R138: 1000 Ω (brn-blk-red).
- (✓) D124: 1N295 diode (#56-20).
- (✓) R141: 5600 Ω (grn-blu-red).
NOTE: The board may be screened "27 k."
- (✓) Solder the leads to the foil and cut off the excess lead lengths.

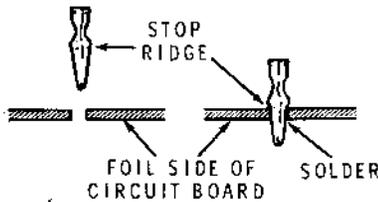
PICTORIAL 12-2

The steps performed in this Pictorial are in this area of the circuit board.

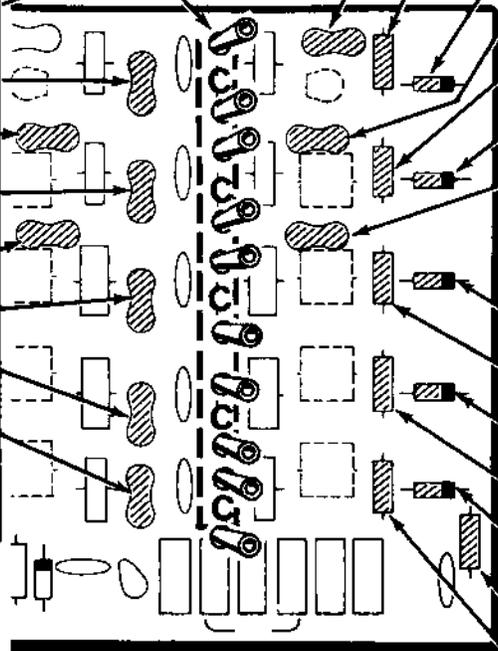


START ↘

NOTE: When you install a wire socket, push the socket tight into its hole in the circuit board and then solder the socket to the foil. DO NOT get solder in the wire socket. Extra wire sockets have been provided.



- (✓) Install 10 wire sockets, two at each "C-" location.
- (✓) C131: 820 pF mica.
- (✓) C136: 30 pF mica.
- (✓) C138: 400 pF mica.
- (✓) C148: 12 pF mica.
- (✓) C151: 200 pF mica.
- (✓) C156: 150 pF mica.
- (✓) C161: 150 pF mica.
- (✓) Solder the leads to the foil and cut off the excess lead lengths.



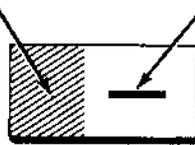
CONTINUE ↙

- (✓) C133: 120 pF mica.
- (✓) R129: 1000 Ω (brn-blk-red).
- IMPORTANT: When you install diodes, be sure to position the banded ends as shown. If you do not, your Transmitter will not work.
- (✓) D115: 1N4149 diode (#56-56).
- (✓) C141: 30 pF mica.
- (✓) R133: 1000 Ω (brn-blk-red).
- (✓) D117: 1N4149 diode (#56-56).
- (✓) C153: 12 pF mica.
- (✓) Solder the leads to the foil and cut off the excess lead lengths.
- (✓) D119: 1N4149 diode (#56-56).
- (✓) R135: 1000 Ω (brn-blk-red).
- (✓) D121: 1N4149 diode (#56-56).
- (✓) R137: 1000 Ω (brn-blk-red).
- (✓) D123: BA-244 diode (red-yel-yel. #56-646).
- (✓) R131: 1000 Ω (brn-blk-red).
- (✓) R139: 1000 Ω (brn-blk-red).
- (✓) Solder the leads to the foil and cut off the excess lead lengths.

PICTORIAL 12-3

The steps performed in this Pictorial are in this area of the circuit board.

PART NUMBER



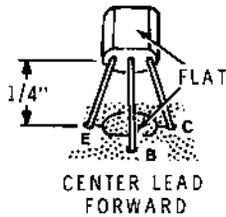
IDENTIFICATION DRAWING

CONTINUE

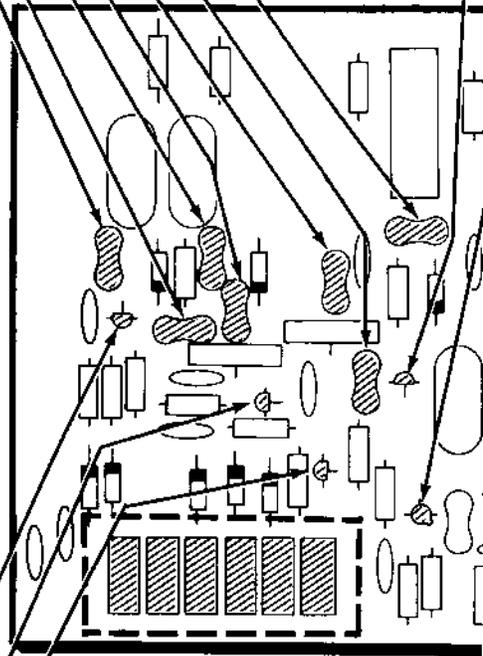
START

- (✓) C115: 47 pF mica.
- (✓) C108: 12 pF mica.
- (✓) C109: 30 pF mica.
- (✓) C106: 150 pF mica.
- (✓) C104: 22 pF mica.
- (✓) C105: 470 pF mica.
- (✓) C102: 22 pF mica.
- (✓) Solder the leads to the foil and cut off the excess lead lengths.

NOTE: When you install each of the following transistors line up the flat or tab on the transistor with the outline of the flat or tab on the circuit board. Then insert the leads in the corresponding holes in the circuit board. Position it 1/4" above the circuit board; then solder the leads to the foil and cut off the excess lead lengths.

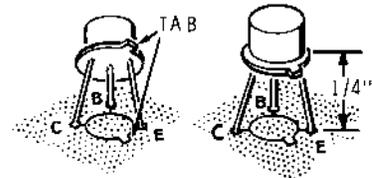


- (✓) Q101: 2N5770 transistor (#417-293).
- (✓) Q102: 2N5770 transistor (#417-293).
- (✓) Q104: 2N5770 transistor (#417-293).



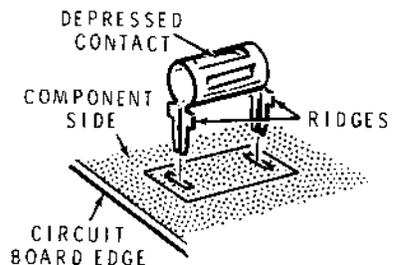
- (✓) Q103: 2N5770 transistor (#417-293).

NOTE: When you install the following transistor, line up the tab on the transistor with the outline of the tab on the circuit board. Then insert the leads in the corresponding holes in the circuit board. Position the transistor 1/4" above the circuit board; then solder the leads to the foil and cut off the excess lead lengths.



- (✓) Q105: 2N5109 transistor (#417-893).

Install six edge connectors in the following manner. Note that inside each connector the spring contact is depressed on one end. This depressed end of the connector should face away from the edge of the circuit board. Insert the mounting tabs through the circuit board until the ridges of the connector are firmly against the circuit board. Look at the row of connectors to make sure the depressed end of the contact of each connector is toward the center of the circuit board. Solder the tabs to the foil.

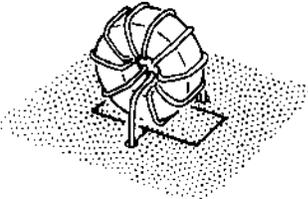


PICTORIAL 12-4

START

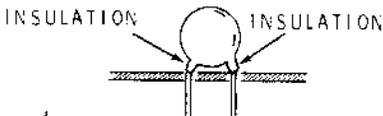
NOTE: As you install each component on this Pictorial, solder its leads to the foil and cut off the excess lead lengths.

NOTE: When you install toroid coils, do not remove a coil from its envelope until you are ready to mount it. Then start the leads through their holes in the top of the board. Grasp the lead ends on the foil side of the board and pull the coil down onto the board.



(✓) L108: 15.5 μ H toroid (white dot) (#40-1882).

NOTE: When you install ceramic capacitors, do not push the insulated portion of the leads into the circuit board holes. This could make it difficult to solder the leads to the foil.



(✓) C143: .01 μ F ceramic.

(✓) C144: .01 μ F ceramic.

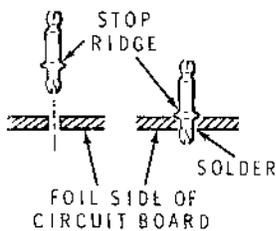
(✓) L110: 15.5 μ H toroid (white dot) (#40-1882).

(✓) C145: .01 μ F ceramic.

(✓) L112: 7 μ H toroid (#40-1726).

(✓) C125: .001 μ F ceramic.

(✓) Install a small PCB pin (#432-121) at B. First push the pin down firmly against the top of the circuit board. Then turn the circuit board over and solder the pin to the foil.

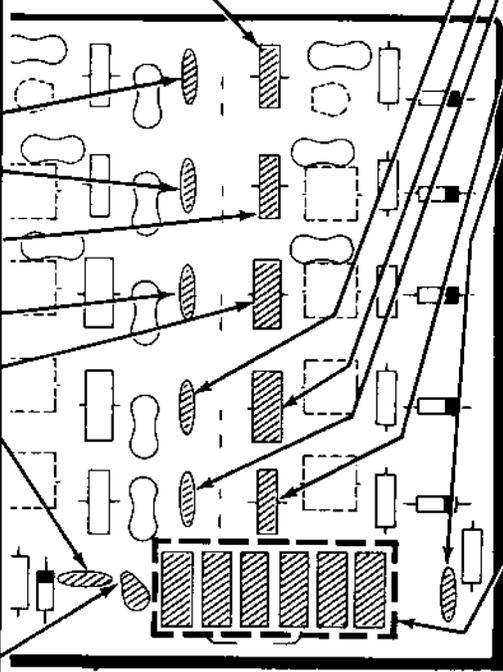


PART NUMBER



IDENTIFICATION DRAWING

The steps performed in this Pictorial are in this area of the circuit board.



CONTINUE

(✓) C146: .01 μ F ceramic.

(✓) L114: 7 μ H toroid (#40-1726).

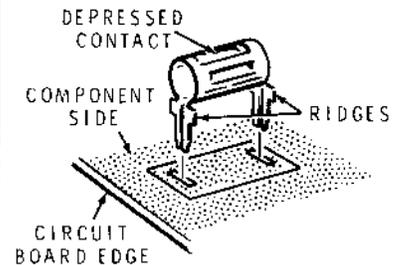
(✓) C147: .01 μ F ceramic.

(✓) L116: 4.5 μ H coil (red dot) (#40-1875).

(✓) C135: .01 μ F ceramic.

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

(✓) As in a previous step, install six circuit board connectors in the following manner. The depressed end of the connector should face away from the edge of the circuit board. Insert the mounting tabs through the circuit board until the ridges of the connector are firmly against the circuit board. Look at the row of connectors to make sure the depressed end of the contact of each connector is toward the center of the circuit board. Solder the tabs to the foil.

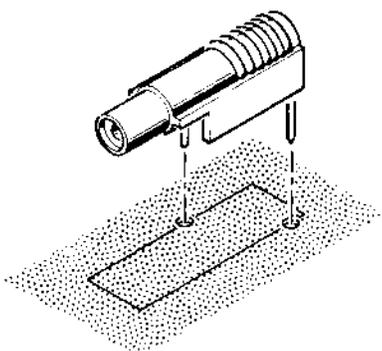


PICTORIAL 12-5

The steps performed in this Pictorial are in this area of the circuit board.

START →

NOTE: When you mount the variable inductors, be sure they are fully seated on the board before you solder their leads and cut off the excess ends.



(✓) L105: .4 μ H variable inductor (#40-1973) (blue housing).

(✓) L104: .5 μ H variable inductor (#40-1972) (gray housing).

(✓) C123: 24 pF mica.

(✓) C117: 24 pF mica.

(✓) C118: .01 μ F ceramic.

(✓) C116: .01 μ F ceramic.

(✓) C122: 75 pF mica.

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

(✓) C121: 75 pF mica.

NOTE: In the following step, when you mount the toroid coil, be sure to pull its leads all the way through the board so the coil will be down onto the top of the board.

(✓) L106: .37 μ H toroid (red and yellow dots) (#40-1863).

(✓) C124: .001 μ F ceramic.

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

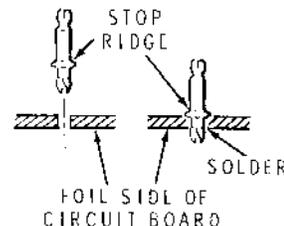
PART NUMBER



IDENTIFICATION DRAWING

CONTINUE →

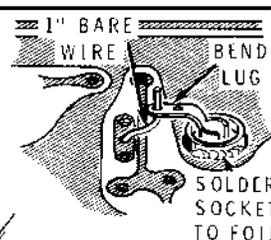
(✓) Install circuit board pins (#432-121) at A and C as shown in this Pictorial. Be sure each pin is straight and pressed in until the stop ridge is against the circuit board.



(✓) C128: 120 pF mica.

(✓) C127: .01 μ F ceramic.

NOTE: To mount a circuit board socket, seat the socket in its hole on the top of the circuit board. Turn the circuit board over and support the socket with the corner of a book to hold the socket up against the board. Position the lug toward the foil pad as shown. Then solder the socket to the foil by moving a soldering iron around the socket and foil while you apply solder. The lug will be soldered later.

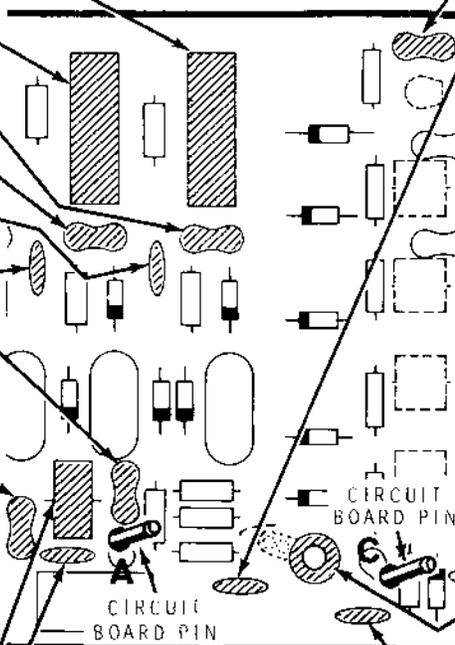


(✓) Phono socket at J101.

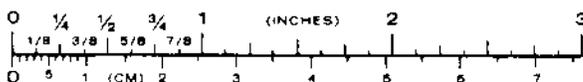
(✓) Bend lug 1 of the phono socket toward the hole labeled "to J101." Connect a 1" bare wire from the hole (S-1) to socket lug 1 (S-1).

(✓) C126: .1 μ F ceramic.

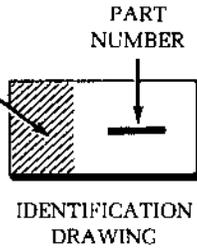
(✓) Solder the leads to the foil and cut off the excess lead lengths.



PICTORIAL 12-6

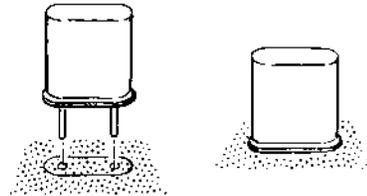


The steps performed in this Pictorial are in this area of the circuit board.



START

NOTE: Mount crystals on the circuit board in the following steps. Be sure you mount each crystal in its correct location, fully seated onto the top of the board. Then use a minimum amount of heat to solder the leads to the foil. DO NOT CUT OFF THE CRYSTAL PINS.



(✓) Y102: 12.5 MHz crystal (#404-568).

(✓) Y101: 9.0 MHz crystal (#404-569).

(✓) C107: .01 μ F ceramic.

(✓) C111: .001 μ F ceramic.

(✓) C112: .001 μ F ceramic.

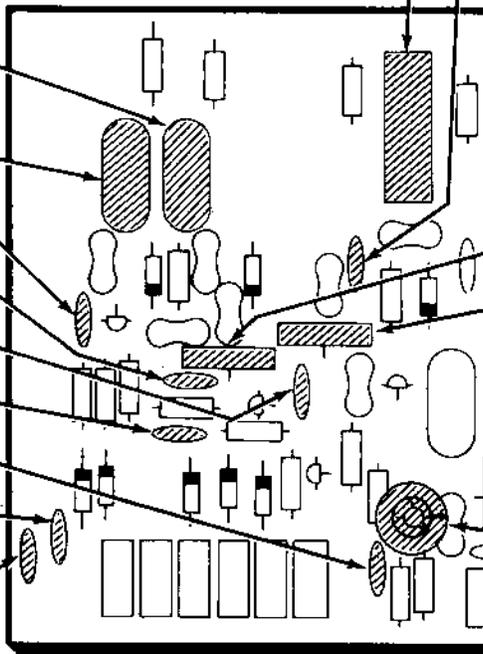
(✓) C114: .01 μ F ceramic.

(✓) C119: .01 μ F ceramic.

(✓) C103: .01 μ F ceramic.

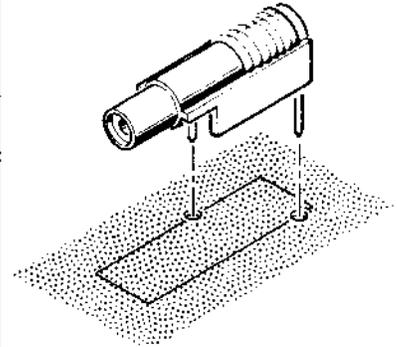
(✓) C101: .1 μ F ceramic. NOTE: Board may be screened ".01."

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



CONTINUE

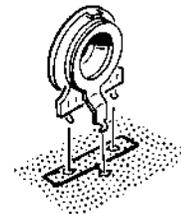
(✓) L103: Mount a .8 μ H (brown) variable inductor (#40-1971) as shown. Solder its leads to the foil and cut off the excess lead lengths.



(✓) C113: .01 μ F ceramic.

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

In the following steps, solder the leads of each control when you install it. Be sure the control is pushed down tight against the circuit board and that the leads on the control extend through the circuit board holes before you solder the leads to the foil.



(✓) R105: 500 Ω control (#10-918).

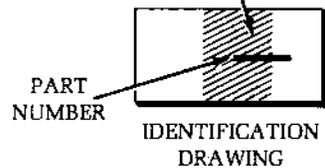
(✓) R109: 200 Ω control (#10-917).

(✓) Push a heat sink onto the top of transistor Q105. The bottom of the heat sink must not project below the transistor body or its leads might be shorted.



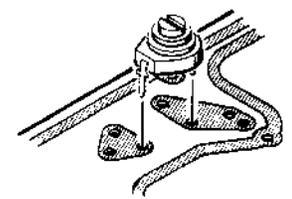
PICTORIAL 12-7

The steps performed in this Pictorial are in this area of the circuit board.



CONTINUE

NOTE: In the following step, mount the trimmer capacitor on the foil side of the circuit board. Be sure to match the flat on the trimmer with the outline of the flat on the top of the board.



(✓) C129: 5-25 pF trimmer (#31-85).

NOTE: In the following steps, similarly mount 1-8 pF trimmers on the foil side of the board. These trimmers may be installed in either direction.

(✓) C137: 1-8 pF trimmer (#31-68).

(✓) C149: 1-8 pF trimmer (#31-68).

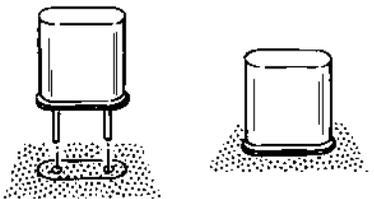
(✓) C155: 1-8 pF trimmer (#31-68).

(✓) C159: 1-8 pF trimmer (#31-68).

START

NOTE: As you mount each component in this Pictorial, solder its leads to the foil and cut off the excess lead lengths.

Mount the crystals on the circuit board in the following steps. Be sure you mount each crystal in its correct location, fully seated onto the top of the board. Then use a minimum amount of heat to solder the leads to the foil.

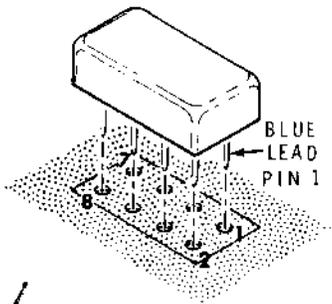


(✓) Y104: 26.5 MHz crystal (#404-566).

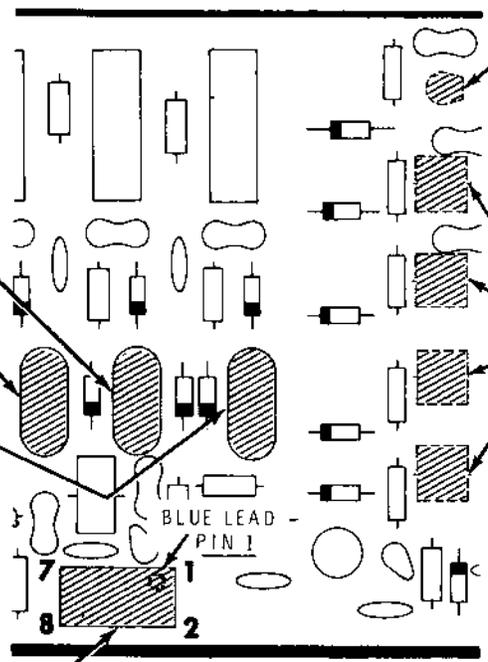
(✓) Y103: 19.5 MHz crystal (#404-567).

(✓) Y105: 33.5 MHz crystal (#404-565).

Turn the balanced mixer pin-side up and identify pin 1 (blue lead). When you install the mixer, be sure to position pin 1 as shown in the Pictorial.

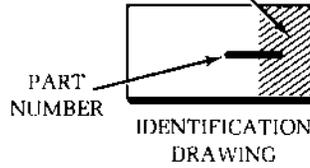


(✓) U101: Balanced mixer (#150-72).



PICTORIAL 12-8

The steps performed in this Pictorial are in this area of the circuit board.

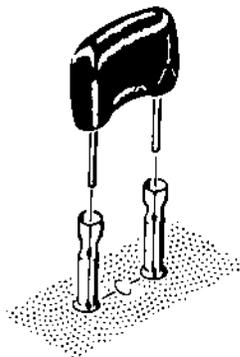


START ▾

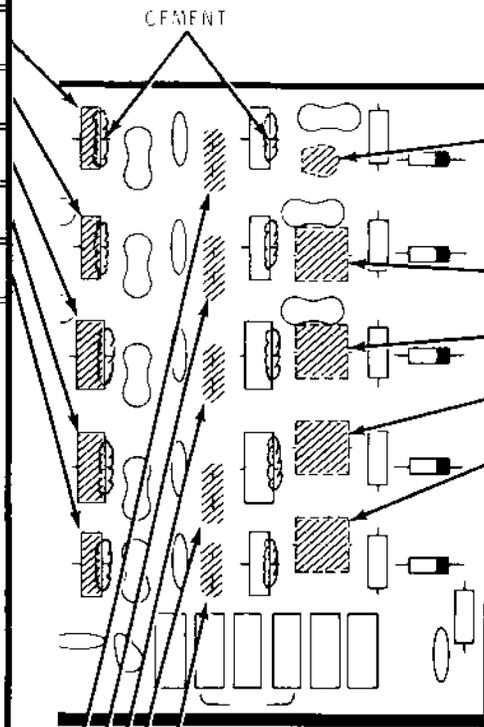
Mount toroid coils, as in a previous Pictorial, in the next five steps. As each coil is mounted, solder its leads to the foil and cut off the excess leads.

- (✓) L107: 15.5 μ H toroid (#40-1882).
- (✓) L109: 15.5 μ H toroid (#40-1882).
- (✓) L111: 7 μ H toroid (#40-1726).
- (✓) L113: 7 μ H toroid (#40-1726).
- (✓) L115: 4.5 μ H toroid (#40-1875).

In the next five steps, cut the leads of the indicated capacitors to 3/8". Then push the capacitor leads into the indicated wire connectors as shown. Do not solder the capacitor leads.



- (✓) C132: 820 pF mica.
- (✓) C139: 400 pF mica.
- (✓) C152: 200 pF mica.
- (✓) C157: 150 pF mica.
- (✓) C162: 150 pF mica.



CONTINUE ▾

NOTE: In the next five steps, mount and solder the trimmer capacitors to the foil side of the circuit board.

- (✓) C134: 5-25 pF trimmer (#31-85). Be sure to match the flat on the trimmer with the outline of the flat on the top of the board.
- (✓) C142: 1-8 pF trimmer (#31-68).
- (✓) C154: 1-8 pF trimmer (#31-68).
- (✓) C158: 1-8 pF trimmer (#31-68).
- (✓) C163: 1-8 pF trimmer (#31-68).

CIRCUIT BOARD CHECKOUT

Carefully inspect the circuit board for the following conditions.

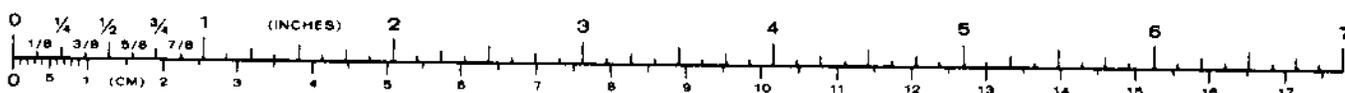
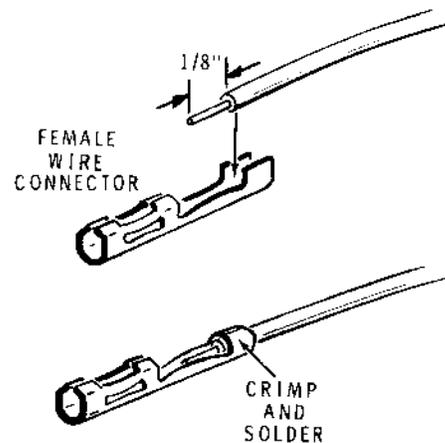
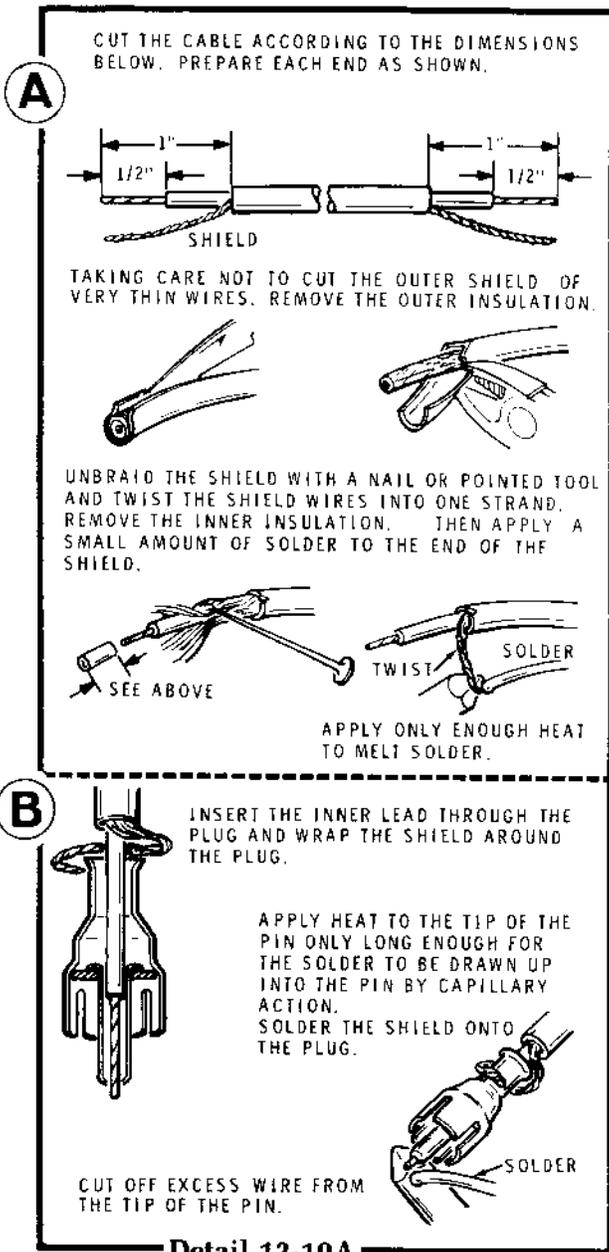
- (✓) Unsoldered connections.
- (✓) Poor solder connections.
- (✓) Solder bridges between foil patterns.
- (✓) Protruding leads which could touch together.
- (✓) Transistors for the proper type and installation.
- (✓) Diodes for the correct position of the banded end.
- (✓) Apply a generous amount of cement at the bottom of all ten toroid coils, L107 through L116. You may discard the remaining cement.

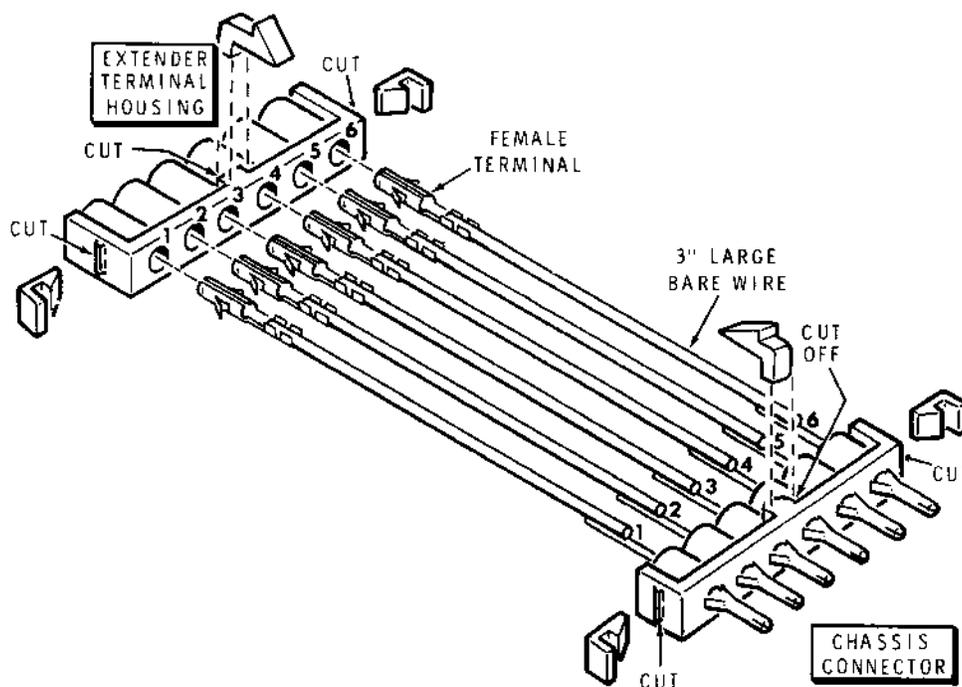
PICTORIAL 12-9

Refer to Pictorial 12-10 (Illustration Booklet, Page 18) for the following steps.

- (✓) Install a 1/2" spacer on the two upper corners of the HFO/mixer circuit board as shown in the Pictorial. Use #6 lockwashers and 6-32 x 1/4" screws. Be sure to install the lockwashers between the spacers and the foil side of the board.
- (✓) Refer to Part A of Detail 12-10A and prepare a 6" length of RG-174 (small) shielded cable as shown.

- (✓) Refer to Part B of Detail 12-10A and install a phono plug on **one end** of the 6" shielded cable.
- (✓) Cut **two 1"** pieces of large black sleeving.
- (✓) Push one piece of sleeving onto the prepared cable and over the base of the phono plug. Heat shrink the sleeve onto the cable and plug.
- (✓) When the cable and first sleeve has cooled, slide the other 1" sleeve onto the cable as far as possible.
- (✓) As in an earlier step, install a phono plug onto the other end of the 6" cable. After the solder has cooled, slide the loose sleeving over the plug base and shrink it tightly.
- (✓) Plug one end of the 6" shielded cable into HFO/mixer socket J101. Then lower the HFO board into the chassis as shown in the Pictorial. Be sure the board is pushed all the way down onto the two 6-pin connectors. **NOTE:** Do not secure the circuit board spacers at this time.
- (✓) Plug the other end of the shielded cable into VFO assembly phono socket J9.
- (✓) Locate the long wire coming from the meter positive (+) lug. Cut the bare wire end to 1/8". Then refer to Detail 12-10B and crimp and solder a female wire connector (#432-120) onto the end of the wire as shown.





PICTORIAL 12-11

Refer to Pictorial 12-11 for the following steps.

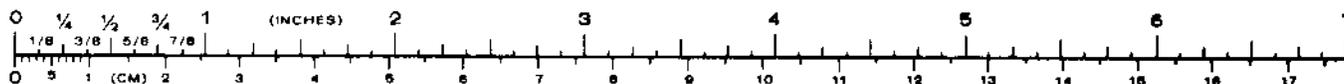
NOTE: Perform the next four steps two times, once for each extender assembly.

NOTE: The Pictorial shows only one extender assembly. You will actually be building two of these assemblies when you perform the following steps.

- () Unfold and straighten the large bare wire as much as possible.
- () Cut twelve 3" large bare wires.
- () Cut twelve 2-3/4" lengths of medium black sleeving.
- () Solder a female connector on one end of each of the large bare wires.
- () Place a piece of sleeving on each wire.
- () Cut the ears from the two extender terminal housings and the two remaining 6-pin connectors.

- () () Push one of the female terminals on the end of a large bare wire into each of the six holes in an extender terminal housing. Push each terminal until it locks in place.
- () () Cut the free ends of the six bare wires, if necessary, until their ends are even.
- () () Solder the free ends of the bare wires to the six terminals on a chassis connector.
- () () Check the extender assembly. All connections should be soldered. Also, make sure the bare wires do not touch each other.
- () Set the two extender assemblies aside temporarily, they will be used during "Calibrator Adjustment."

Except for the installation of the VFO and power amplifier covers, and the "Final Assembly," this completes the step-by-step assembly of your transmitter.





INITIAL TESTS

NOTE: To perform the tests as outlined in this section, you will need a volt-ohmmeter (VTVM or DMM).

(✓) Refer to Pictorial 13-1 (Illustration Booklet, Page 19) and set the front panel controls as follows:

SIDETONE LEVEL control:

Fully counterclockwise until it clicks "off."

CW LEVEL control: Fully Counterclockwise

BAND switch: 80.

TUNE capacitor knobs: Set both to "0."

METER switch: Set to "Ip."

MODE switch: Set to "XMIT."

NOTE: At this time, the main tuning knob may be at any point on the dial.

RESISTANCE CHECKS

Refer to Pictorials 13-2 through 13-6 (Illustration Booklet, Page 19) to locate the controls, switches, test points, and other components as you perform the following checks.

- (✓) Connect the ohmmeter common lead to any convenient bare metal point on the chassis.

NOTE: Use the the ohmmeter positive lead to make the following checks. Set the ohmmeter range to X10. Check for a "no-short" reading at each test point. If you find a short (zero reading on the ohmmeter) except where specifically called for, do not proceed until you have corrected the problem. Refer to the "In Case of Difficulty" section, starting on Page 128.

Refer to Pictorial 13-2 for the following steps.

- (✓) Check all the pins on rear panel plug P8. NOTE: P8 pins 5 and 7 **will** indicate a short or grounded condition; that is the power supply "common" or ground connection.

On the rear panel, check the RECEIVE ANT phono socket J2 for no short. Reverse the ohmmeter leads and once again measure J2 for no short.

- (✓) Reconnect the ohmmeter common lead to chassis ground.

- (✓) Remove the paper backing from the blue and white label and press the label onto the rear panel as shown in the Pictorial. NOTE: Be sure to refer to the Model and Series numbers on the blue and white label in any correspondence you have with the Heath Company about your kit.

- (✓) Refer to Pictorial 13-3 and on the under side of the driver circuit board, check foils I and J as indicated for no shorts.

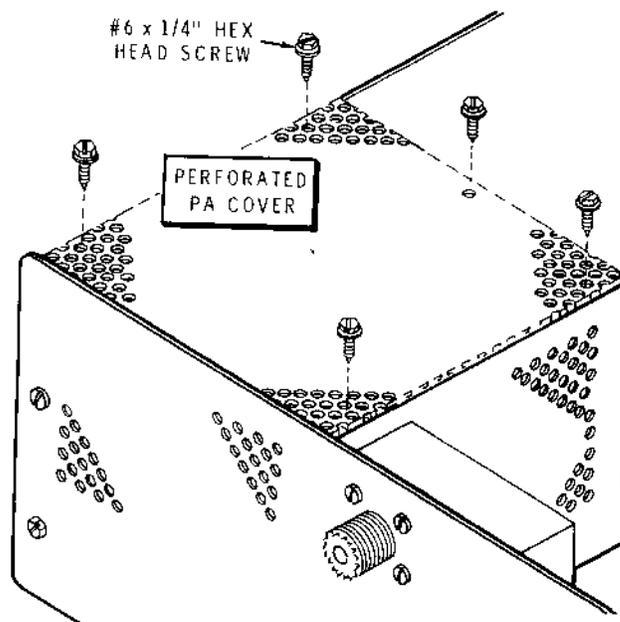
- (✓) Temporarily remove lamps PL1 and PL2 from their sockets.

- (✓) Refer to Pictorial 13-4 and check chassis connector BB pin 7 for **no short**.

- (✓) Refer to Pictorial 13-5 and check terminal strip BA lugs 1 through 5 as you rotate the BAND switch through its five positions. Note that, although a resistance may drop, all readings **must** indicate **no short**.

- (✓) Refer to Pictorial 13-6 and check the three feed-through capacitors on the back of the VFO shield for **no short**. NOTE: Capacitor C33 will indicate a short if the METER switch is in the SPOT position.

- (✓) Replace lamps PL1 and PL2 into their sockets.



PICTORIAL 13-7

- (✓) Refer to Pictorial 13-7 and secure the perforated PA cover to the top of the PA compartment with five #6 × 1/4" sheet metal screws as shown.

5-20-64
 φ 1000-101



HP/PS-23 SERIES POWER SUPPLY CONNECTIONS

The transmitter is designed to operate with the Heathkit Model HP-23C/PS-23 117 VAC Power Supply. The following information will help you wire the 11-pin socket for the power cable of the HP-23C/PS-23 Power Supply. The same cable and power supply can be used with many other Heathkit models. Be sure to use the correct low B+ voltage for each model.

CAUTION: Be sure the low voltage DC circuit of the HP-23A or the HP-23B Power Supply is switched for 250-VDC output. In the HP-23C/PS-23 Power Supply, make the internal connections for 250 VDC output.

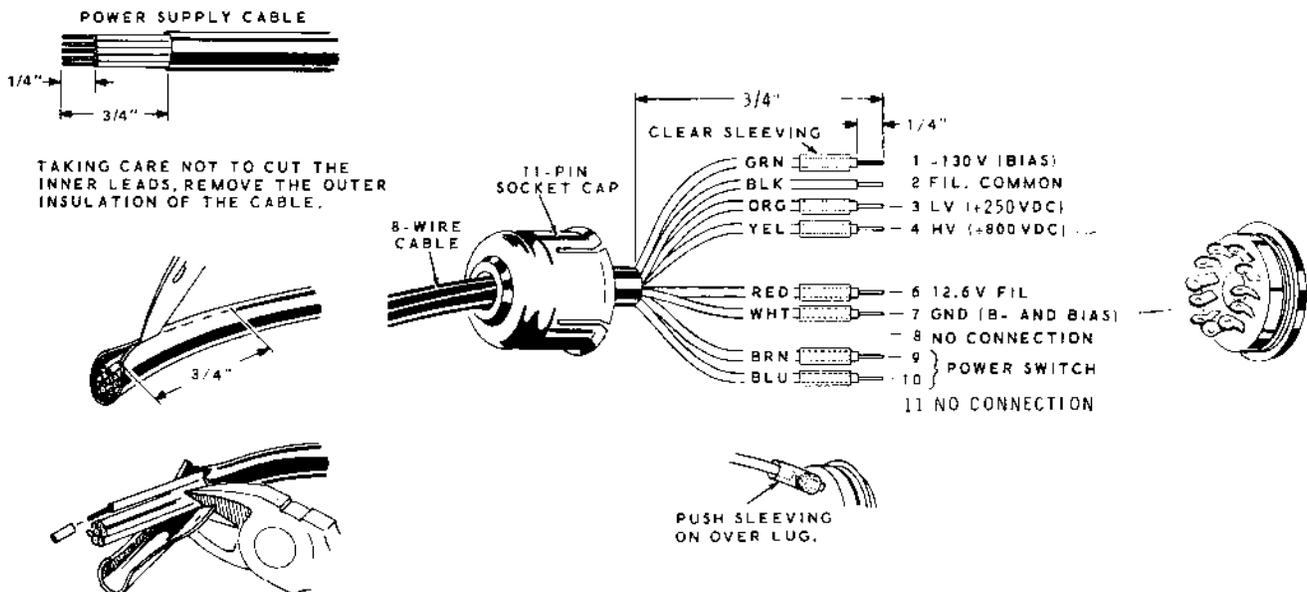
Refer to Pictorial 13-8 for the following steps.

- () Install the 11-pin socket cap over the free end of the 8-wire cable from the Power Supply.
- () Remove 3/4" of the outer insulation from the end of the 8-wire cable. Then remove 1/4" of insulation from the end of each wire.
- () Melt a small amount of solder on each of the exposed wire ends to hold the small strands of wire together.

- () Cut seven 5/8" lengths of clear sleeving and slip them over the indicated wires.
- () Connect the wires of the 8-wire cable to the 11-pin socket lugs as shown. Solder each connection.
- () Push the lengths of sleeving over the lugs of the socket.
- () Snap the socket cap onto the 11-pin socket. Be careful not to pinch any wires.

NOTES:

1. With the above connections, the BIAS control in the HP-23A or HP-23B Power Supply is inoperative. Proper bias settings are accomplished with the BIAS control in the Transmitter.
2. The referenced "+250 volts" or "+250 VDC" from the power supply indicates the lowered voltage during "key-down" transmissions. Key-up (not transmitting) voltages at these points will be nominally +275 volts.



HR-1680 MODIFICATION

If you intend to use this Transmitter with the Heathkit Model HR-1680 Receiver, you must modify your Receiver, as explained below, to avoid excessive sidetone overloading and distortion.

- () Remove the hardware securing the Receiver cabinet top to the chassis. Set the cabinet top and the hardware aside temporarily.
- (/) Remove and save the hardware securing the AUD/REG circuit board to its compartment. Then remove the circuit board from the Receiver. NOTE: This is the circuit board closest to the rear of the Receiver.
- () Locate the envelope marked "HR-1680 MOD. KIT." Remove the two resistors and the sleeving from the envelope. You will be using these parts in the following steps.

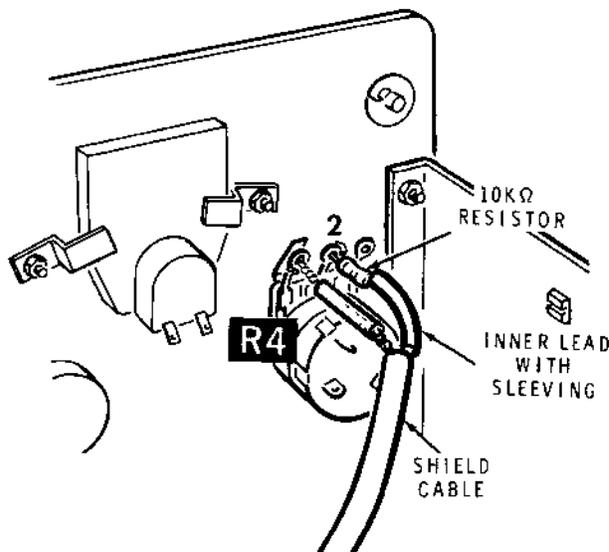
Refer to Pictorial 4-2 (Page 34) in the HR-1680 Assembly Manual for the following steps.

- (/) Locate resistor R204 on the AUD/REG circuit board (right column, tenth step). Use your soldering iron to heat the foil pads for this resistor so you can remove it. Discard the resistor.
- () R204: Install a 100 k Ω (brown-black-yellow) resistor at R204. Solder the leads to the foil and cut off the excess lead lengths.
- (/) Reinstall the AUD/REG circuit board in its compartment. Secure the circuit board with the hardware you removed earlier.

Refer to Pictorial 5-3 (Illustration Booklet) in your HR-1680 Assembly Manual for the following steps.

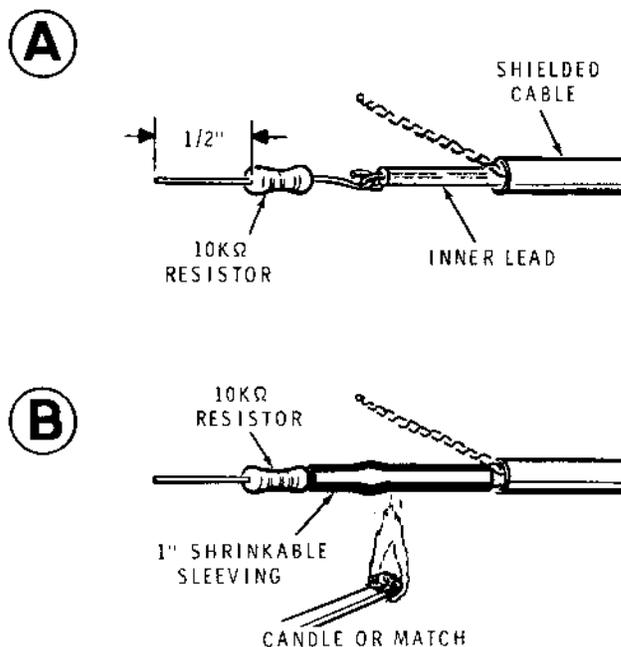
- () Place the Receiver chassis upright and with the front panel towards you.
- (/) Locate the AF control with switch (SW1/R4) on the left side of the front panel. Disconnect the inner conductor of the shielded cable going to control R4 lug 2.

Refer to Pictorial 13-9 of this Manual for the following steps.



PICTORIAL 13-9

- () Cut both leads of the 10 k Ω (brown-black-orange) resistor to 1/2".



Detail 13-9A

- () Refer to Detail 13-9A Part A and form a small loop at the end of one resistor lead. Then insert the inner conductor of the shielded cable into the loop as shown. Solder the connection and cut off the excess lead length of the inner conductor.
- () Use the heat of a flame from a match, lighter, or a candle to shrink the sleeving around the junction. See Detail 13-9B.
- () Connect the free end of the 10 k Ω resistor to control R4 lug 2. Solder the connection.
- () Refer to Detail 13-9A Part B and slide a 1" length of heat shrinkable sleeving over the junction of the resistor and the inner conductor of the shielded cable until the end of the sleeving is flush with the resistor.
- () Reinstall the cabinet top on the Receiver chassis. Use the hardware you removed earlier.

This completes the "HR-1680 Modification."

USE EXTREME CARE DURING INITIAL TESTING AND ALL SUBSEQUENT OPERATION OF THIS TRANSMITTER. WHILE THE HX-1681 IS DESIGNED FOR MAXIMUM SAFETY, NEVER LOSE RESPECT FOR THE HIGH VOLTAGE PRESENT IN THIS UNIT. PROTECT YOURSELF ALWAYS AGAINST LETHAL OR SEVERE ELECTRIC SHOCK.

HEATH COMPANY



VOLTAGE TESTS

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

TO LESSEN THE SHOCK HAZARD, CONNECT A LEAD FROM A GOOD EARTH GROUND TO THE GROUND TERMINAL LOCATED ON THE REAR OF THE CHASSIS AND TO ALL TEST EQUIPMENT.

- () Refer to Pictorial 13-1 (Illustration Booklet, Page 19) and set the front panel controls as follows:

SIDETONE LEVEL control:

Fully counterclockwise to click "off."

CW LEVEL control: Fully counterclockwise.

BAND switch: Set to "80."

TUNE controls (inner and outer):

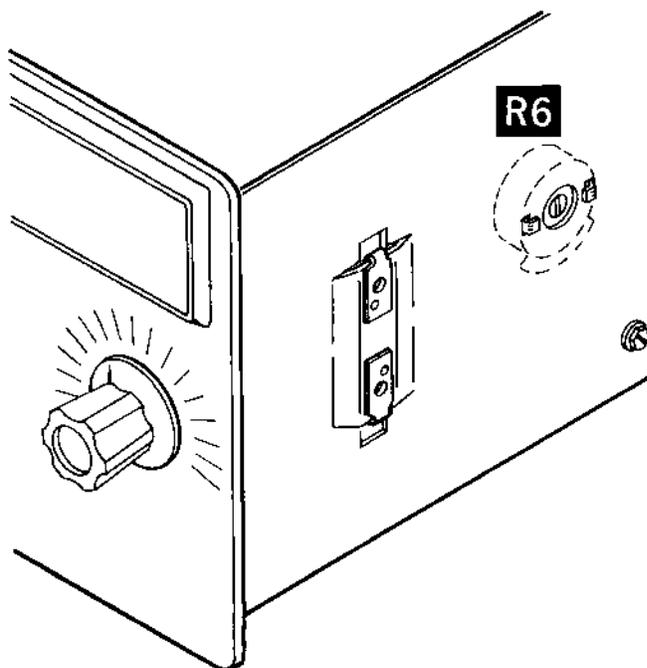
Set both to "8."

METER switch: Set to "REL PWR."

MODE switch: Set to "XMIT."

Set the main tuning dial to approximately "250."

- () Refer to Pictorial 13-10 and set BIAS control R6 to the center of its rotation.
- () Make sure the power supply is off, then plug the power cable into the Transmitter rear panel.



PICTORIAL 13-10

NOTES:

1. If at any time during the following checks you observe anything unusual, or if you fail to obtain any of the desired test results, immediately turn the SIDETONE LEVEL control all the way to "OFF," disconnect the power from the Transmitter, then refer to the "In Case of Difficulty" section, starting on Page 130. Do not resume these checks until you have found the cause of the problem and have corrected it.

2. All voltage indications may be $\pm 10\%$.

() Turn the SIDETONE LEVEL control clockwise until the power switch clicks on.

() Check to make sure both pilot lamps are on, then check the two power amplifier tubes (in the PA compartment) for a faint glow of the tube filaments.

() Visually check all parts of the Transmitter for signs of overheating.

Refer to Pictorial 13-6 and check for the indicated voltages on the three VFO feedthrough capacitors in the next three steps.

() C31: +12 VDC.

() C32: 0 volts.

() C33: Approximately +12.0 volts.

() Turn off the Transmitter power (SIDETONE LEVEL) control fully counterclockwise.

() Turn the Transmitter top side down; then once again apply power to the unit.

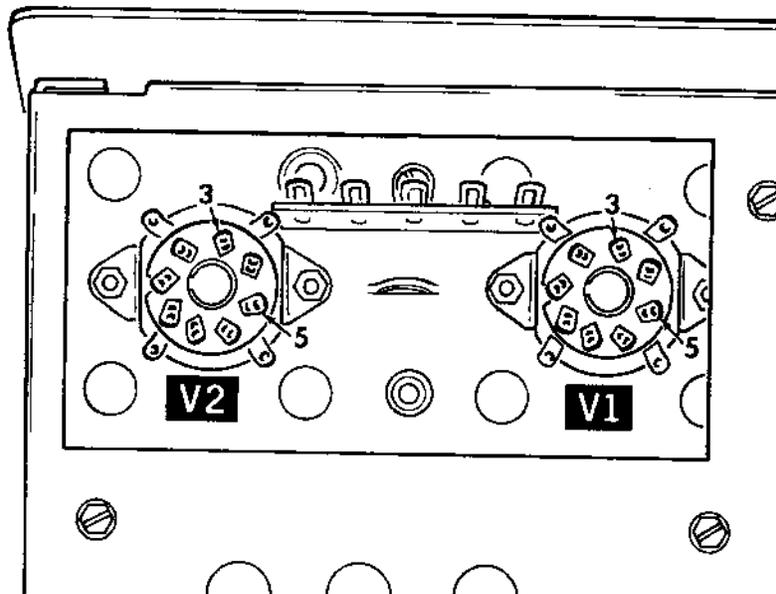
Refer to Pictorial 13-3 and check for the indicated voltages on the driver circuit board in the next five steps.

<u>Test Point</u>	<u>DC Volts</u>
() A	-130 V.
() J	-130 V.
() E	+12 V.
() F	0 V.
() I	+275 V.

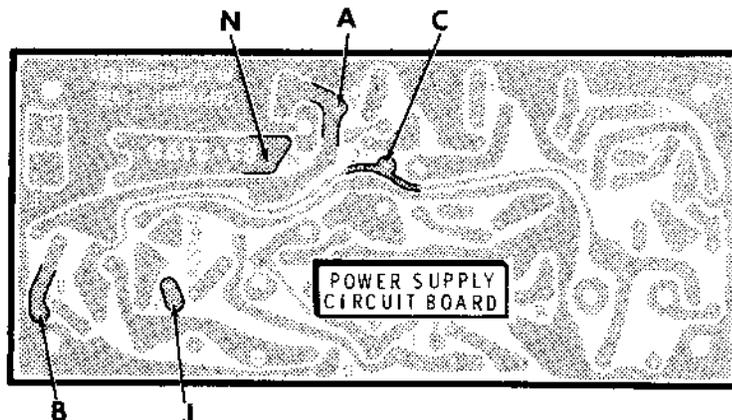
Refer to Pictorial 13-11 and check for the indicated DC voltages on the power amplifier tube socket V1 lugs in the next two steps.

() Socket V1 lug 3: +275 V (key-up voltage).

() Socket V1 lug 5: -130 V.



PICTORIAL 13-11



PICTORIAL 13-12

Refer to Pictorial 13-12 and check for the indicated voltages on the power supply circuit board in the next five steps.

Refer to Pictorial 13-5 and check the indicated connector BA pins in the next five steps for +12 VDC.

<u>Test Point</u>	<u>DC Volts</u>	<u>Set BAND Switch To:</u>	<u>Check Connector BA Pin:</u>
() A	+12 V.	() 80	BA1
() B	+5.5 V. ✓	() 40	BA2
() C	+0.2 V. ✓	() 20	BA3
() J	+12 V. ✓	() 15	BA4
() N	+19.5 V. ✓	() 10	BA5

() Refer to Pictorial 13-4 and check HFO connector BB pin 7 for +12 VDC.

This completes the "Initial Tests" of your Transmitter. Turn off the Transmitter power and disconnect the power supply cable. Proceed to "Alignment."

ALIGNMENT

You will need the following equipment when you align your Transmitter.

- A 50 Ω non-reactive dummy load that is capable of at least 100 watts dissipation. Do **not** use light bulbs for a dummy load, as they present an impedance that varies with power and frequency.
- A receiver covering the 10-80 meters amateur bands.

NOTE: You may be able to improve the frequency accuracy of the transmitted signal by using a frequency counter. However, it is not necessary.

If you do not obtain the proper results during the alignment, proceed to the "In Case of Difficulty" section on Page 130.

ALIGNMENT PREPARATION

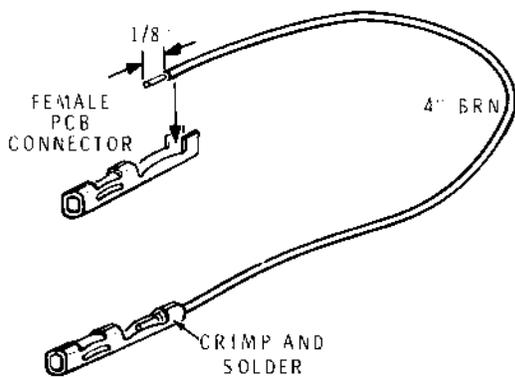
Refer to Pictorial 14-1 for the following steps.

- () Prepare a 4" brown wire.
- () Solder a female PCB connector on each end of the 4" wire.

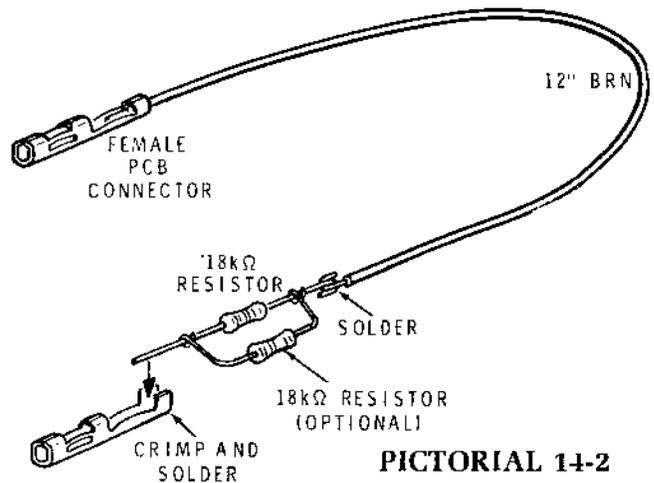
Set this jumper wire aside. It will be used during "HFO Coil Adjustments."

- () Prepare a 12" brown wire. Then solder an 18 k Ω (brn-gry-org) resistor to one end of this wire. Refer to Pictorial 14-2 and solder a female PCB connector to each end of the wire/resistor assembly. NOTE: Use the **optional** 18 k Ω resistor only when the meter deflection is near "0" during the alignment.

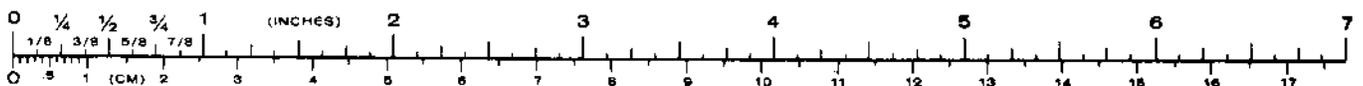
Set the wire/resistor assembly aside. It will be used during "Bandpass Filter Adjustments."

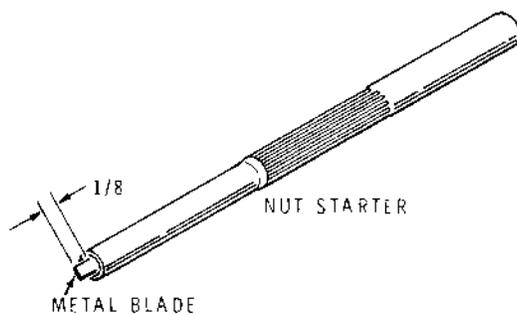


PICTORIAL 14-1



PICTORIAL 14-2





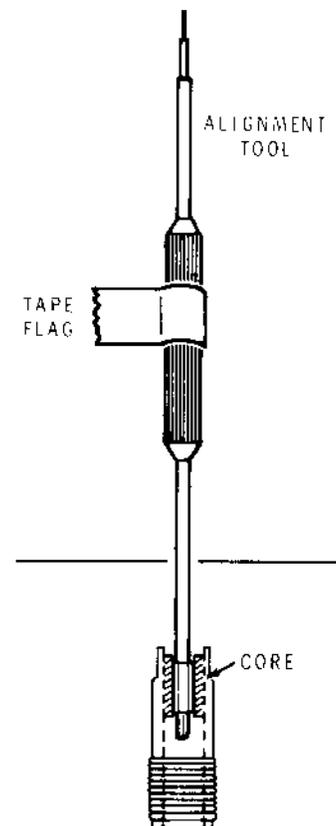
PICTORIAL 14-3

- () Refer to Pictorial 14-3 and use a pair of pliers to push the 1" steel blade into the smaller end of the nut starter until 1/8" of the blade remains exposed. Use this tool when you are instructed to adjust trimmer capacitors.
- () Set the front panel controls and switches as follows:
 - SIDETONE LEVEL Fully counterclockwise.
 - METER SPOT.
 - CW LEVEL Fully counterclockwise.
 - BAND 80.
 - MODE XMIT.
 - TUNE (round knob) 8.
 - TUNE (lever knob) 8.

Refer to Pictorial 14-4 (Illustration Booklet, Page 20) for the following steps.

- () Set VFO LEVEL ADJ control R213, on the VFO circuit board, to the center of its rotation.
- () Set HFO LEVEL ADJ (80M, 40M) and (20M, 15M, 10M) controls R105 and R109, on the HFO/mixer circuit board, to the centers of their rotation.

NOTE: Refer to Pictorial 14-5 for the methods of inserting the alignment tool into the coil and making a "flag" out of tape for the alignment tool so you can count the turns of the tool.



PICTORIAL 14-5

- () Use the coil alignment tool to turn the core of HFO/mixer circuit board coil L103 until the top of the core is flush with the top of its coil form. Then turn the core 15 complete turns clockwise.
- () Repeat the last step for HFO/mixer circuit board coils L104 and L105.

HFO COIL ADJUSTMENTS

- () Disconnect the coaxial cable from HFO/mixer circuit board jack J101. Then temporarily remove this circuit board from the Transmitter.
- () Push the connector at either end of the 4" brown wire that you prepared earlier, onto HFO/mixer circuit board pin A. Connect the other end of this wire to pin B.
- () Push the connector on the free end of the brown wire coming from the "+" terminal of meter M1 onto HFO/mixer circuit board pin C.

- () Reconnect the free end of the coaxial cable coming from VFO output jack J9 to HFO/mixer circuit board jack J101.
- () Refer to Pictorial 14-6 (Illustration Booklet, Page 21) and mount the HFO/mixer circuit board to the left side of the chassis. Secure the circuit board with two 6-32 \times 1/4" screws and two #6 lockwashers.
- () Make sure the power supply is off, then plug the power cable into the Transmitter rear panel.
- () Turn the Transmitter on.
- () Adjust HFO LEVEL ADJ (80M and 40M) control R105 for a reading of 3 on the **relative power** (lower) scale of front panel meter M1.
- () Turn the BAND switch to 40. You should get a meter reading between 1 and 4.
- () Turn the BAND switch to 20.

NOTE: In the next five steps do not turn the slugs of coils L103, L104, and L105 more than two turns in either direction.

- () Adjust coil L103 for maximum meter indication.
- () Turn the BAND switch to 15.
- () Adjust coil L104 for maximum meter indication.
- () Turn the BAND switch to 10.
- () Adjust coil L105 for maximum meter indication.
- () Adjust HFO LEVEL ADJ control R109 (20m, 15m, 10m) for a reading of 3 on the relative power scale.
- () Turn the Transmitter off.
- () With long-nose pliers, carefully disconnect the 4" jumper wire from HFO/mixer circuit board pins A and B.

PRELIMINARY VFO ALIGNMENT

- () Set the front panel controls and switches as follows:

SIDETONE LEVEL .. Fully counterclockwise.

METER SPOT.

CW LEVEL Fully counterclockwise.

BAND 80.

MODE XMIT.

TUNE (round knob) 8.

TUNE (lever knob) 8.

- () Turn VFO LEVEL ADJ control R213, fully counterclockwise, and then 1/4-turn clockwise.
- () Refer to the inset drawing on Pictorial 14-4 (Illustration Booklet, Page 20) and, on the underside of the chassis, turn the screw in each VFO trimmer at GG clockwise until they are snug. Turn each trimmer **1/4 turn** counterclockwise. Do **not** force.
- () Turn the MAIN TUNING knob clockwise until the dial stops rotating.
- () Turn the square dial drive plate, located between the VFO assembly and the front panel, clockwise until the STOP mark near **500** aligns with the pointer.
- () Turn the MAIN TUNING knob counterclockwise until the dial reads **100**.
- () Connect a 50 Ω coaxial cable with phono plugs at both ends between the RCVR ANT jack on the rear panel of the Transmitter and the antenna jack of your receiver. NOTE: Refer to Pictorial 16-1 (on Page 124) in the "Installation" section of this Manual for the information on how to install phono plugs on the ends of the cables you will use with your Transmitter.
- () Similarly, connect a shielded cable between the MUTE socket of the Transmitter and the mute socket of your receiver.



- () Turn the receiver band switch to 80m (3.5 MHz).
- () Turn the receiver main tuning knob until the receiver is tuned to 3.6 MHz.
- () Turn your Transmitter and receiver on.
- () Turn the receiver AF gain control knob clockwise until you hear noise from the speaker.
- () If your receiver has a preselector knob, rotate it for maximum noise from the speaker.
- () Insert the alignment tool into the slug in VFO circuit board coil L201.

NOTE: When you adjust the coil in the following step, you should be able to hear the tone in your receiver within 2 turns either way from its present setting.

- () Turn the alignment tool very slowly until you hear a tone. It is not necessary to zero beat this tone.
- () Turn the Transmitter and the receiver off.

NOTE: You will perform the "FINAL VFO ALIGNMENT" later.

BANDPASS FILTER ADJUSTMENTS

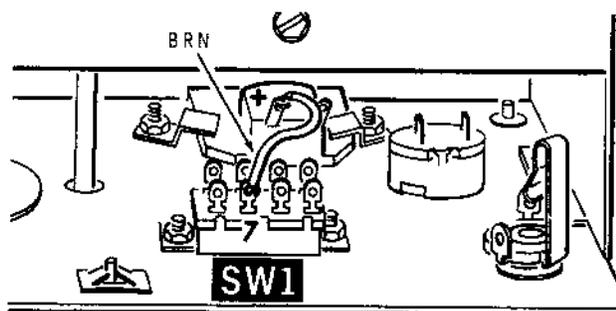
Refer to Pictorial 14-4 (Illustration Booklet, Page 20) and Pictorial 14-6 (Illustration Booklet, Page 21) for the following steps.

- () Make sure a dummy load is connected to the TRANSMIT ANT jack on the rear panel of your Transmitter.
- () Turn the MAIN TUNING dial to 100.
- () Push the connector at the resistor end of the wire/resistor assembly prepared earlier onto driver circuit board pin TP1. Connect the other end of this wire assembly to HFO/mixer circuit board pin B.

NOTE: Use the optional 18 k Ω resistor, as shown in Pictorial 14-2 on Page 114, only when the meter is near "0" during the alignment, or when no meter reading can be seen.

- () Turn the Transmitter on.

- () Adjust the trimmers at A and AA, accessible through the holes in the side of the chassis, for maximum meter indication.
- () Turn the BAND switch to 40.
- () Turn the MAIN TUNING dial to 50.
- () Adjust the trimmers at B and BB for maximum meter deflection.
- () Turn the BAND switch to 20.
- () Adjust the trimmers at C and CC for maximum meter deflection.
- () Turn the BAND switch to 15.
- () Adjust the trimmers at D and DD for maximum meter deflection.
- () Turn the BAND switch to 10.
- () Adjust the trimmers at E and EE for maximum meter deflection.
- () Turn the Transmitter off and disconnect the power supply cable.
- () Remove the wire/resistor assembly that is connected from drive circuit board pin TP1 to HFO/mixer circuit board pin B.
- () Unplug the brown wire from HFO/mixer circuit board pin C. Then cut this wire off 6" from its free end. Prepare the wire end.
- () Connect the free end of the brown wire coming from the "+" terminal of meter M1 to switch SW1 lug 7 (S-1). Refer to Pictorial 14-7.



PICTORIAL 14-7



- () Remove each of the five mica capacitors that were installed in the wire sockets, labeled "C" on the HFO/mixer circuit board. NOTE: These capacitors were installed in Pictorial 12-3 on Page 96.
- () Refer to Pictorial 14-8 (Illustration Booklet, Page 21) and install the VFO cover on the top of the VFO shield. Use six #6 × 1/4" hex head screws.
- () Cut out a letter "F" from the terminal label set.
- () Carefully remove the protective backing from the letter and press it on the VFO cover at the location shown.

FINAL VFO ALIGNMENT

You may use either of two methods to align the VFO of your Transmitter. If you desire to have the VFO aligned more accurately, and you have access to a frequency counter, perform the steps under Method #1. If a frequency counter is not available, perform the steps under Method #2. NOTE: The VFO output level is approximately 100 mV.

Method #1

- () Set the front panel controls and switches as follows:
 - SIDETONE LEVEL .. Fully counterclockwise.
 - METER SPOT.
 - CW LEVEL Fully counterclockwise.
 - BAND 80.
 - MODE XMIT.
 - TUNE (round knob) 8.
 - TUNE (lever knob) 8.

Refer to Pictorial 14-9 (Illustration Booklet, Page 21) for the following steps.

- () Temporarily disconnect the coaxial cable from VFO jack J9.
- () Connect a 50 Ω coaxial cable between an accurate frequency counter and VFO output jack J9.
- () Turn the MAIN TUNING knob until the dial reads 500.
- () Make sure the power supply is off. Then plug the power cable into the Transmitter rear panel.
- () Turn the power supply and the Transmitter on.
- () Insert the alignment tool into the slug in VFO coil L201.
- () Turn the alignment tool very slowly until the counter reads 5.000 MHz.
- () Turn the MAIN TUNING knob counterclockwise until the dial reads 0.
- () Carefully adjust either VFO trimmer at "GG" (through the access holes in the bottom of the chassis) until the counter reads 5.500 MHz.
- () Turn the MAIN TUNING knob until the dial reads 500.
- () Adjust VFO coil L201 slightly until the counter reads 5.000 MHz.
- () Return the Transmitter dial to 0.
- () Adjust either VFO trimmer at "GG" until the counter reads 5.500 MHz.
- () Repeat the preceding four steps as many times as necessary until the frequency counter reads 5.500 MHz within ± .002 MHz when the dial is set to 0 and 5.000 MHz within ± .002 MHz when the dial is set to 500.
- () Turn the Transmitter off and disconnect the frequency counter.



Method #2

- () Set the front panel controls and switches as follows:

SIDETONE LEVEL .. Fully counterclockwise.

METER SPOT.

CW LEVEL Fully counterclockwise.

BAND 80.

MODE XMIT.

TUNE (round knob) 8.

TUNE (lever knob) 8.

Refer to Pictorial 14-9 (Illustration Booklet, Page 21) for the following steps.

- () Set the band switch on your receiver to the 80M (3.5 MHz) band.
- () Turn the receiver main tuning knob until the receiver is tuned to 4.0 MHz.
- () Turn your receiver on.
- () Turn the receiver AF gain control knob clockwise until you hear noise from the speaker.
- () If your receiver has a preselector knob, rotate it for maximum noise from the speaker.
- () Turn the Transmitter MAIN TUNING knob counterclockwise until the dial reads 500.
- () Turn the Transmitter on.
- () Insert the alignment tool into the slug in VFO coil L201.
- () Turn the alignment tool very slowly until you hear a tone. It is not necessary to zero beat this tone.

- () Turn the Transmitter MAIN TUNING knob counterclockwise until the dial reads 0.

- () Turn the receiver main tuning knob until the dial reads 0.

- () If necessary, turn the Transmitter MAIN TUNING one or two dial divisions to either side of zero until you hear the signal from the speaker. Note whether the signal occurred higher or lower in frequency than the zero mark on the dial.

- () Return the dial to 0.

NOTES:

- Several of the alignment steps call for adjusting your Transmitter to obtain a zero beat. To do this, slowly make the required adjustment in one direction and listen for a decrease in pitch and volume of the tone. If the pitch and volume seem to increase, make the adjustment in the opposite direction. The tone will go lower and lower in frequency and either disappear or become only an intermittent growl. This is zero beat.
 - Perform **one** of the next two steps. If one trimmer does not provide enough range, adjust both trimmers in the same direction. Refer to the inset drawing for the location of the access holes on the bottom of the chassis.

() If the signal was **lower** in frequency, carefully adjust either VFO trimmer (through access hole "GG" in the chassis bottom) **counterclockwise** until you hear the signal. Adjust the trimmer (with an insulated tool) for zero beat.

() If the signal was **higher** in frequency, carefully adjust either VFO trimmer (through access hole "GG" in the chassis bottom) **clockwise** until you hear the signal. Adjust the trimmer (with an insulated tool) for zero beat.
- () Turn the Transmitter MAIN TUNING knob until the dial reads 500.
- () Turn the receiver main tuning knob until the dial reads 500.



- () Adjust coil VFO L201 slightly for zero beat.
- () Return the Transmitter dial to 0.
- () Turn the receiver main tuning knob until the dial reads 0.
- () Adjust either VFO trimmer at "GG" for zero beat.
- () Repeat the preceding five steps as many times as necessary until zero beat occurs at 0 and 500 on the dial. Be sure the **last** adjustment you make is to a VFO trimmer. NOTE: You may have to repeat these adjustments several times.
- () Turn the Transmitter and the receiver off.

BIAS ADJUSTMENT

- () Turn BIAS control R6 fully clockwise. Then turn the control counterclockwise 1/4 turn.
- () Temporarily disconnect the coaxial cable that goes between VFO jack J9 and HFO/mixer circuit board jack J101.
- () Connect a 50 Ω dummy load to the TRANSMIT ANT jack on the rear panel, if this has not already been done.
- () Connect a CW key to the KEY jack on the front panel. CAUTION: Do **not** depress the key until you are specifically instructed to do so.
- () V301: Install driver tube 12BY7 into driver circuit board socket V301.
- () Install the tube shield over tube V301.

IMPORTANT

To avoid possible damage to the final amplifier tubes during neutralization, it is necessary to follow the preset instructions for capacitor C18 very carefully.

- () On the rear panel, turn the screw of neutralizing trimmer capacitor C18 clockwise until it is snug. DO NOT force it. Then turn the screw counterclockwise **two full turns**.

NOTE: For convenience during neutralization, use a wattmeter or relative-strength meter to provide an indication of the maximum relative power output. Then you will not need to frequently turn the METER switch between "REL PWR" and "I_p."

- () Turn the Transmitter on. Allow two minutes warm-up time.
- () Set the METER switch to IP.
- () Connect a voltmeter, set to read – volts, from chassis ground to final amplifier tube socket V2 pin 5 as shown in Pictorial 14-10 (Illustration Booklet, Page 21).
- () Depress the key. Then slowly turn BIAS ADJUST control R6, on the right side of the chassis until the voltmeter reads –70 volts. This sets the idling cathode current. **Do not depress the key more than a few seconds at a time until this current has been properly adjusted.**
- () Release the key.
- () Turn the Transmitter off.
- () Reconnect the coaxial cable between VFO jack J8 and HFO/mixer circuit board jack J101.

NEUTRALIZATION

IMPORTANT

To avoid serious damage to the final amplifier tubes, do NOT operate the Transmitter until you have read and completely understand the tuneup procedure as outlined on Pages 127 and 128 of this Manual.

- () Set the front panel controls and switches as follows:

SIDETONE LEVEL	Fully counterclockwise
METER	REL PWR.
CW LEVEL	Fully counterclockwise



BAND 20.
 MODE XMIT
 TUNE (round knob) 8.
 TUNE (lever knob) 14.
 TUNING DIAL 200.

- () Turn the SIDETONE control until the power switch clicks on. Allow the Transmitter to warm up for two minutes.
- A. () Set the MODE switch to TUNE. Then slowly turn the CW LEVEL control clockwise until you obtain an up-scale reading on the front panel meter.
- B. () Adjust the TUNE (lever knob) control for maximum meter indication.
- C. () Adjust the TUNE (round knob) control for maximum meter indication.
- D. () Set the METER switch to Ip. Turn the CW LEVEL control for a meter reading that does not exceed 200 on the upper scale.
- E. () Set the MODE switch to XMIT.

NOTE: In the following steps, you will make the neutralizing adjustments. Read the steps through all the way before you make any adjustments. This will help you visualize what is supposed to take place.

1. Set the METER switch to Ip.
2. Depress the key and adjust the TUNE (round knob) control for minimum meter indication. Then note the position of the control.
3. Set the METER switch to REL PWR.
4. Adjust the TUNE (round knob) control for maximum meter indication. Then note the position of the control.
5. If maximum relative power (REL PWR) and minimum plate current (Ip) do not occur at the same setting of the TUNE control, turn neutralizing capacitor C18 a small amount in either direction.

6. Adjust capacitor C18 a small amount at a time until minimum plate current and maximum relative power occur at the same setting of the TUNE control.
7. Turn the BAND switch to 10.
8. Turn the MAIN TUNING dial to 300.
9. Repeat steps A through E and 1 through 6 above for the second time. After the second time, proceed directly from Step 6 to "VFO LEVEL ADJUSTMENT (below).

This completes the neutralization of your Transmitter.

VFO LEVEL ADJUSTMENT

- () Make sure the front panel controls and switches are set as follows:

SIDETONE LEVEL . Fully counterclockwise.

METER REL PWR.

CW LEVEL Fully counterclockwise.

BAND 10.

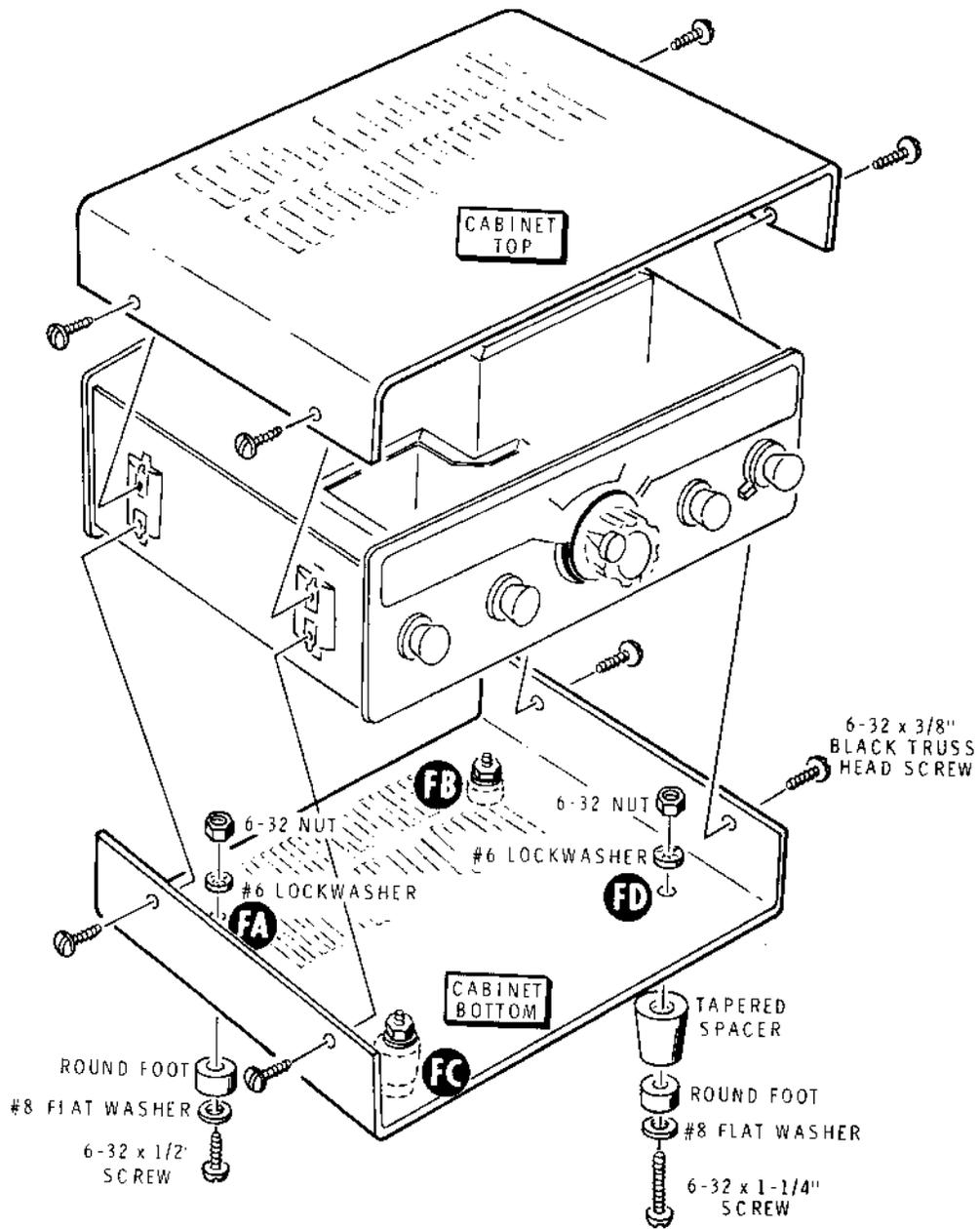
MODE XMIT

TUNING DIAL 300.

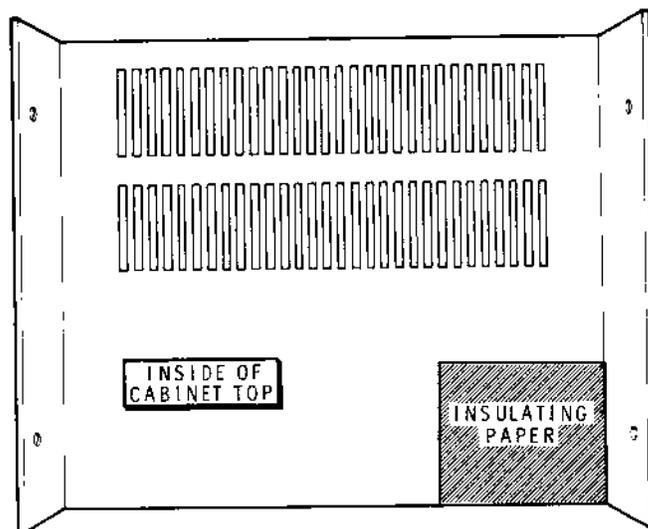
- () Depress the key while you turn the CW LEVEL control clockwise for an up-scale meter indication. Then adjust both TUNE controls for maximum meter indication.
- () Turn the CW LEVEL control fully clockwise.
- () Set the METER switch to Ip.
- () Adjust VFO LEVEL ADJ control R213, accessible through hole F in the VFO cover, for an approximate reading of 250 on the upper meter scale.
- () Release the key.
- () Turn the Transmitter off.

This completes the "Alignment." Proceed to "Final Assembly."

FINAL ASSEMBLY



PICTORIAL 15-1



Detail 15-1A

Refer to Pictorial 15-1 for the following steps.

- () Mount round feet on the cabinet bottom at FA and FB with 6-32 \times 1/2" screws, #8 flat washers, #6 lockwashers and 6-32 nuts as shown.

NOTE: Perform only one of the next two steps.

- () If you want your Transmitter to set level, mount only the round feet on the cabinet bottom at FC and FD using 6-32 \times 1/2" hardware with #8 flat washers as in the previous step.
- () If you want to elevate the front of the cabinet, at FC and FD on the cabinet bottom use round feet, two tapered spacers, and the 6-32 \times 1-1/4" screws, #8 flat washers, #6 lockwashers, and 6-32 nuts as shown in the Pictorial.

- () Refer to Detail 15-1A, remove the paper backing from the remaining paper insulator, and press the insulator on the inside of the cabinet bottom as shown.
- () Set the cabinet bottom on your work area, feet down. Then set the chassis assembly into the cabinet bottom and secure the two together with four 6-32 \times 3/8" black truss head screws.
- () Position the cabinet top down over the chassis assembly and secure it to the chassis with four 6-32 \times 3/8" black truss head screws.

This completes the "Final Assembly" of your Transmitter.

INSTALLATION

This section of the Manual gives you examples of how to connect the Transmitter to the Heathkit HR-1680 Receiver or how to use it with a different receiver for station operation.

BASIC CONNECTIONS

Pictorial 16-1 shows how to install phono plugs on the ends of your cables (not furnished). Cut the cables to the lengths required for your installation. Pictorial 16-2 (Illustration Booklet, Page 22) shows how to install a coaxial plug and a coaxial plug insert (not furnished) on the free end of the RG-58A/U coaxial cable coming from your antenna. NOTE: If you are using RG-8A/U or similar coaxial cable as transmission line, refer to the "ARRL Handbook" for the proper installation instructions.

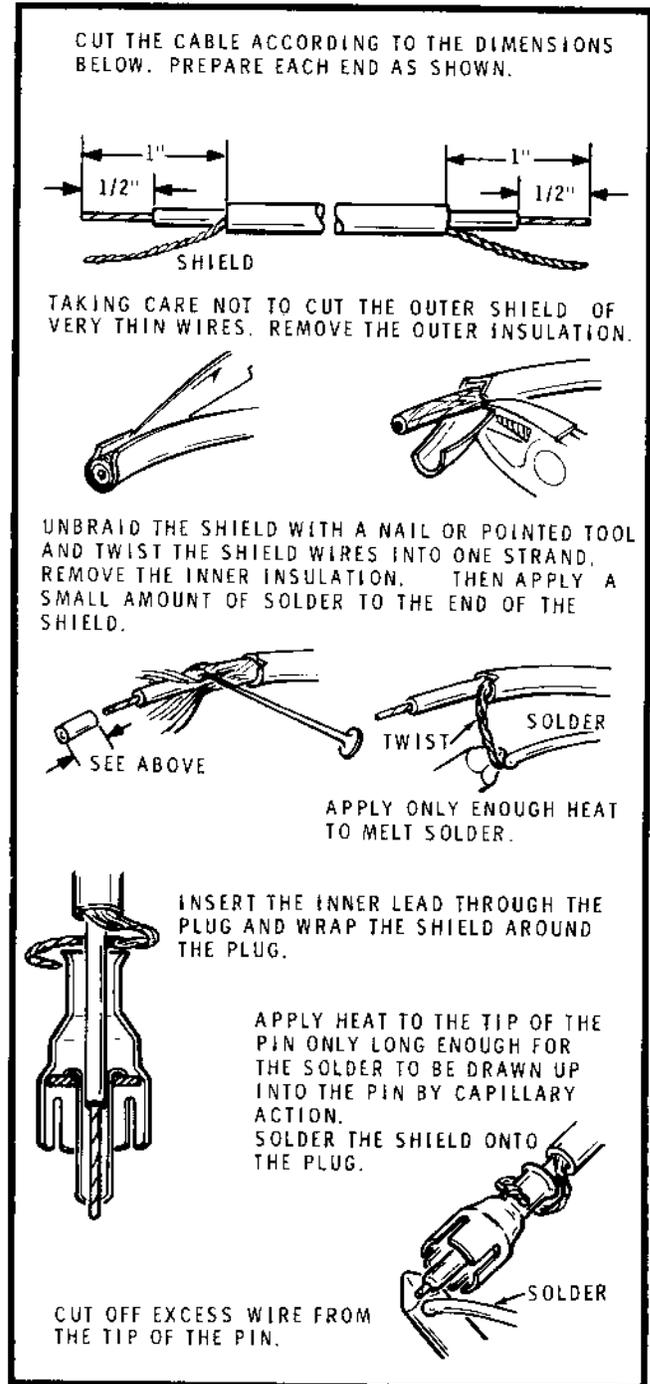
STATION CONNECTIONS

NOTE: Pictorials 16-3 and 16-4 are in the Illustration Booklet, pages 22 and 23.

Pictorial 16-3 shows the Transmitter connected to the Heathkit HR-1680 Receiver. Pictorial 16-4 shows an example of the connections to a different receiver. The sidetone jack (J4) provides an adjustable audio signal that can be fed into the receiver audio amplifier so you can monitor the transmitted signal. The mute output jack (J3) acts as a switch. It will switch between open for one mode and ground for the other mode.

KEY CONNECTIONS

A positive voltage is present at the KEY jack on the front panel. If you use a key designed for grid block keying, you should reverse the usual keyer leads. If your keyer uses a relay, the lead connections are usually immaterial. However, you should study the schematic diagram of the keyer to insure proper connections.



PICTORIAL 16-1



OPERATION

NOTE: You must have an amateur radio operator license and a station license before you place this Transmitter on the air. Information about licensing and amateur frequency allocations is available from publications of the Federal Communications Commission (FCC) or the American Radio Relay League (ARRL).

Operation of the Transmitter has been simplified as much as possible to permit rapid adjustments by the

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

IMPORTANT: Make sure you connect a 50Ω nonreactive load to the TRANSMIT ANT jack before you operate your transmitter. This load can be an antenna, a dummy load, or a properly adjusted amplifier.

CONTROL FUNCTIONS

Refer to Pictorial 17-1 (Illustration Booklet, Page 24) for a front panel view of the Transmitter and a concise explanation of the control functions. Pictorial 17-2 (Illustration Booklet, Page 25) shows rear panel connections. The following paragraphs describe the control functions more completely.

TUNING DIAL

The tuning dial is calibrated in divisions from 0 to 500. Each division represents 5 kHz. The dial reading (in kHz) is added to the BAND switch setting (in MHz) to determine the frequency to which the Transmitter is tuned. For example:

BAND switch	40 (7MHz)
Dial reading	35
Frequency	7.035 MHz

ZERO SET

This button, when pressed, holds the tuning dial so you can turn the MAIN TUNING knob and change the VFO frequency to calibrate the dial at intervals determined by the calibrator in the accompanying receiver. **NOTE:** The METER switch must be set to SPOT to do this.

SIDETONE LEVEL

Turns the power on. Clockwise rotation increases the level of the sidetone coupled into the sidetone jack of the accompanying receiver.

CW LEVEL

Clockwise rotation increases the RF drive.

BAND

Selects the desired HF amateur band in meters. The BAND switch markings on the front panel correspond to the following frequencies in MHz when the tuning dial is set to zero (0):

80	3.500
40	7.000
20	14.000
15	21.000
10	28.000

TUNE

The outer TUNE control (lever knob) adjusts the driver plate tank circuit for resonance at the operating frequency.

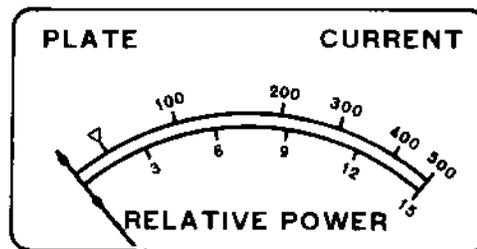
The inner TUNE control (round knob) is the input capacitor of the Pi network of the power amplifier (PA) stage. This capacitor tunes the Pi network for resonance at the operating frequency.

KEY

Connect a "straight key" or an electronic keyer through a phone plug.

METER

The meter gives the following indications with the meter switch in the remaining designated positions. The meter face is shown in Pictorial 17-3.



PICTORIAL 17-3

I_p: Indicates the cathode current in the PA stage on the upper scale. The ▽ mark designates the correct 50 mA idling cathode current of this stage.

REL PWR: Indicates relative power output on the lower scale.

MODE

Place this switch in the XMIT position when you operate without a linear amplifier. Full break-in operation is only possible in the XMIT position.

In the LINEAR position, a ground return is provided for the relay in the accompanying amplifier. Only partial break-in operation is possible in this position.

With the switch in the TUNE position, the Transmitter may be tuned up without depressing the CW key.



TUNE-UP

INITIAL ACTIONS

Before you attempt to use the Transmitter, check to make sure all of the following connections have been completed.

1. Connect 50-ohm antenna with a 2:1 or less VSWR for the band in use to the rear panel TRANSMIT ANT jack. If you use a power amplifier, use RG-58A/U coaxial cable to connect the TRANSMIT ANT jack to the amplifier input.
2. You should connect an RG-58A/U coaxial cable from the RECEIVE ANT phono socket on the Transmitter rear panel to the antenna connector of the accompanying receiver.
3. If you use the companion HR-1680 receiver, connect a shielded cable from the MUTE and SIDETONE sockets on the Transmitter rear panel to the respective sockets on the HR-1680 Receiver. This will provide full break-in operation.
4. Connect power supply cable to the power connector on the rear panel.
5. Connect the Transmitter to a good ground.
6. If you use a power amplifier, providing that the amplifier's transmit-receive relay is the type which is activated by grounding the relay coil, connect the amplifier's relay coil connection to the LINEAR socket on the rear panel. NOTE: The voltage at the amplifier's relay connector may be either negative or positive.
2. Set the METER switch to Ip.
3. Turn the CW LEVEL control fully counterclockwise.
4. With the RF load connected to the TRANSMIT ANT jack, set the MODE switch to TUNE. The meter needle should read 50 (at the ∇ mark).

NOTE: If the meter indicates other than 50 mA, perform the "Bias Adjustment" described on Page 120 of this Manual.

CAUTION: In the following steps, do not turn on full output power continuously for more than 30 seconds at one time, or the final amplifier tubes or power supply may be damaged. Each time full output power is turned off, allow the tubes to cool off for at least a minute.

5. Set the METER switch to REL PWR.
6. Set the inner TUNE control (round knob) to 8 and the outer TUNE control (lever knob) to 7.
7. Turn the CW LEVEL control clockwise to obtain a small up-scale indication on the front panel meter.
8. Adjust the outer TUNE control for maximum relative power. Turn the CW LEVEL control, as necessary, to keep the meter needle below 6 on the lower scale.
9. Adjust the inner TUNE control for maximum relative power. Turn the CW LEVEL control, as necessary, to keep the meter needle below 300 on the upper scale.
10. Repeat step 8 above.
11. Set the MODE switch to XMIT.
12. Set the METER switch to Ip.
13. Set the MODE switch to TUNE.

INITIAL TUNE-UP

CAUTION: Each time you operate, you should perform all of the following "Initial Tune-Up" steps. You should also follow this procedure any time you change the transmitter frequency by more than ± 20 kHz.

1. Set the BAND switch and the TUNING DIAL for the desired frequency.



14. Turn the CW LEVEL control clockwise until the meter indicates 250 (mA) on the upper scale. NOTE: At this plate current, the output power is about 100 watts on 15 through 80 meters. On 10 meters this current corresponds to about 75 watts output power.
15. Set the MODE switch to XMIT.
16. Return the CW LEVEL control to its full counterclockwise position.

The Transmitter is now properly tuned up for maximum performance at the chosen operating frequency.

IMPORTANT: Notice that while you turn the CW LEVEL control clockwise, the plate current (Ip) and the relative power (REL PWR) readings may reach a saturation point. Rotation of the control past this point will not increase the power output or the meter readings, but could result in distorted signals.

RECEIVING

The antenna is automatically switched to the receiver when the key is not depressed and with the Transmitter turned on. Full break-in operation between letters is possible. Muting and sidetone outputs have been designed for break-in operation with different receivers in addition to the HR-1680 Receiver.

RECEIVER MUTING

Your Transmitter can be used with a variety of receivers, both solid-state and tube-type. In some solid-state receivers, like the Heathkit Model HR-1680, the mute line is open in the receive (Rx) mode while it is closed in the transmit (Tx) mode. In other solid-state receivers, however, the mute line is closed in the receive mode and open in the transmit mode. If necessary, refer to your receiver manual to determine what kind of mute circuit your receiver is using. Then perform the appropriate step listed below.

1. If the mute line in your solid-state receiver is closed in the transmit mode, plug the brown jumper wire on the power supply circuit board onto the "+Tx" pin.

2. If the mute line in your solid-state receiver is open in the transmit mode, plug the brown jumper wire on the power supply circuit board onto the "+Rx" pin.
3. For some tube-type receivers, the brown jumper wire on the power supply circuit board may be left connected to either the "Tx" or the "+Rx" pin. Move the wire from MUTE jack J3 to "I" on the power supply circuit board.

TRANSMITTING

ANTENNA COUPLER

1. If you use an antenna coupler that has an SWR meter, connect it between the TRANSMIT ANT jack on the rear panel and your transmission line with a length of RG-58A/U coaxial cable.
2. Connect the Transmitter as in "Installation" (on Page 124).



3. Depress the key and advance the CW LEVEL control until you get a meaningful SWR meter indication of forward power. Adjust the SWR meter sensitivity control for a full-scale deflection.
4. Switch to the reflected power position and adjust the coupler controls for a minimum VSWR.

NOTE: Advance the CW LEVEL control only enough to get useful VSWR readings.

5. Record the antenna coupler dial readings for the amateur bands of interest to facilitate future adjustments.

NOTE: If you are adjusting an antenna coupler with a receiver only, adjust the coupler for the greatest S-meter deflection.

CW TRANSMISSION

1. Connect the Transmitter as in "Initial Actions" (Page 127).
2. Set the METER switch to Ip.
3. Depress the key and advance the CW LEVEL control clockwise until the front panel meter indicates **no more than 250 (on the upper scale)** when you operate on the 80, 40, 20, and 15 meter bands. When you operate on the 10 meter band, however, you may advance the CW LEVEL control fully clockwise.
4. Adjust the SIDETONE control for the desired sound level from the speaker of the accompanying receiver.

5. Adjust SIDETONE FREQ ADJ control R425, on the power supply circuit board, for the desired audio/frequency (tone) from the speaker of the accompanying receiver.

This completes the CW tune-up procedure; you may proceed to transmit.

LINEAR AMPLIFIER OPERATION

Operation with a linear amplifier is similar to operating with an antenna at the output of the Transmitter, except that the linear amplifier input may have a different impedance. This will make it necessary to adjust the tune controls for maximum rated output (input to the linear amplifier).

1. Connect the linear amplifier as shown in the amplifier manual.
2. Set the MODE switch to LINEAR. NOTE: The Transmitter now operates in a semi break-in mode.
3. While sending a series of "V's", adjust TIME DELAY ADJ control R406 (on the power supply circuit board) so the linear amplifier relay stays energized between groups of characters. Counterclockwise rotation of this control will increase the holding time of the relay. NOTE: In most cases, full break-in keying is lost because of the amplifier internal relay.

IMPORTANT: When you use this Transmitter with an amplifier, make sure plate current Ip does **NOT** exceed 250 mA. Also, do **NOT** advance the Transmitter gain beyond the point where amplifier output power ceases to increase with rotation of the CW LEVEL control.



PRECAUTIONS FOR TROUBLESHOOTING

WARNING: Be very careful when you measure voltages so you do not damage circuit board components.

1. Be sure you do not short any adjacent foils when you make voltage measurements. If the probe should slip, for example, and short together two adjacent connections, it is very likely to damage the diodes or transistors.
2. Be especially careful when you test any circuit that contains a transistor. Although these components have an almost unlimited life when used properly, they are much more vulnerable to damage from excessive voltage or current than many other parts.

TROUBLESHOOTING CHARTS

The following charts list the "Problem" and the "Possible Cause" of a large number of possible malfunctions. If a particular part or parts are mentioned (transistor Q301, for example, or Band switch SW4A) as a

possible cause, check these parts to see if they are wired or installed incorrectly. Also check to see if an improper part was installed at that location. It is also possible, on rare occasions, for a part to be faulty.

GENERAL

PROBLEM	POSSIBLE CAUSE
1. No power, pilot lamps and tube filaments do not light. no B+ or bias voltage.	A. Power supply switch in the off position. B. Power plug wired incorrectly. C. Power cable from power supply wired incorrectly or has loose connections. D. Defective AC snap switch on Sidetone Level control. E. Fuses or circuit breakers in power supply are open. F. Defective power supply.
2. Tube filaments light, but no B+ voltage present.	A. Check items 1B, 1C, and 1F. B. Rectifiers defective in external power supply.

POWER SUPPLY CIRCUIT BOARD

PROBLEM	POSSIBLE CAUSE
3. Regulated "+12V" supply too high or too low.	A. Integrated circuit U401 installed incorrectly or defective.
4. Voltage at "B" too high or too low with key open.	A. Diode D401 installed incorrectly or defective. B. Transistor Q401 installed incorrectly or defective.
5. Voltage at "B" too high with key closed.	A. Key defective. B. Wiring of key jack J1.
6. Voltage at "C" too high with key open.	A. Check items 4A or 4B.
7. Voltage at "C" too low with key closed.	A. Check items 5A or 5B.
8. Voltage at "D" too low with key open.	A. Transistors Q401, Q402, Q404, Q405, or Q406 installed incorrectly or defective.



POWER SUPPLY CIRCUIT BOARD (Cont'd.)

PROBLEM	POSSIBLE CAUSE
9. Voltage at "D" too high with key closed.	A. Check items 4A or 4B. B. Check item 8A.
10. Accompanying receiver is not muted when key is closed.	A. Check to make sure you have chosen the correct muting circuit for your receiver. B. Diodes D407 through D410 incorrectly installed or defective. C. Transistors Q407 or Q408 incorrectly installed or defective.
11. No sidetone signal in the accompanying receiver.	A. Wiring of sidetone level control R1. B. Check to make sure the sidetone input on your receiver is working properly. C. Transistors Q409 or Q410 incorrectly installed or defective.
12. Transmitter does not key linear amplifier.	A. Mode switch is not in the LINEAR position. B. Diodes D412 or D415 installed backward or defective. C. Transistors Q411 or Q412 incorrectly installed or defective. D. Zener diodes D411, D413, or D414 installed backward or defective.
13. No time delay with MODE switch in the LINEAR position.	A. Capacitor C402 installed backwards or defective. B. Transistor Q403 incorrectly installed or defective.

VFO CIRCUIT BOARD

PROBLEM	POSSIBLE CAUSE
14. No VFO signal.	A. Front panel CW Level control R8 turned fully counterclockwise. B. VFO Level Adj control R213 turned fully clockwise. C. Transistors Q201 through Q205 incorrectly installed or defective. D. 8-volt regulator IC U201 incorrectly installed or defective.

HFO/MIXER CIRCUIT BOARD

PROBLEM	POSSIBLE CAUSE
15. No HFO signal on one band only.	A. Heterodyne oscillator (HFO) coil for the affected band. Readjust (see steps on Page 115). B. Switching diode for the affected band installed backwards or defective. C. Defective crystal installed for the affected band.
16. No HFO signal on any band.	A. Transistors Q102, Q104, or Q105 incorrectly installed or defective. B. Diodes D101 through D123 installed backwards or defective. C. Incorrect parts installed at L103 through L105. D. Incorrect parts installed at C115, C117, or C123. E. Incorrect parts installed at Y101 through Y105 or crystal defective. F. Balanced mixer U101 defective. G. Wiring of Band switch SW4.



DRIVER CIRCUIT BOARD

PROBLEM	POSSIBLE CAUSE
17. No RF signal present at TP1 on any band.	A. Transistors Q301 or Q302 incorrectly installed or defective.
18. No RF signal present at "J" on one or more bands.	A. Incorrect parts installed at L303 through L307.

POWER AMPLIFIER

PROBLEM	POSSIBLE CAUSE
19. Transmitter tends to be unstable.	A. Neutralizing capacitor C18 improperly set. B. Improper load impedance. C. Hardware loose on tube sockets of final amplifier tubes V1 and V2. D. Excessive lead lengths on components connected to tube sockets of V1 and V2.
20. Power output drops off during transmission.	A. Excessive heat due to restricted air circulation. B. Incorrect bias setting. C. Improper load impedance. D. Gassy 6146A tubes at V1 and V2. E. Weak 12BY7A driver tube at V301.
21. No meter deflection with Meter switch in the Ip position.	A. Wiring of Meter switch SW1. B. Wiring of pins 1 and 4 of final amplifier tubes V1 and V2.

ANTENNA SWITCH CIRCUIT BOARD

PROBLEM	POSSIBLE CAUSE
22. Final amplifier has output, however, there is no output to the antenna.	A. Check for solder bridges on the circuit board. B. Transistor Q501 incorrectly installed or defective. C. Diodes D501, D502, and D504 installed backwards or defective.
23. No meter deflection with the Meter switch in the REL PWR position.	A. Wiring of Meter switch SW1. B. Diode D503 installed backwards or defective.

CHECKING TRANSISTORS AND DIODES

SILICON BIPOLAR TRANSISTORS

To check a transistor accurately, you should use a transistor tester. However, if a tester is not available, you can use an ohmmeter to determine the general condition of any one of the bipolar transistors in this kit. The ohmmeter you use must have at least 1 volt DC at the probe tip to exceed the threshold of the diode junctions in the transistor you are testing. Most vacuum tube voltmeters meet this requirement.

To check a transistor with an ohmmeter, proceed as follows:

1. Unsolder and remove the transistor from the circuit.
2. Set the ohmmeter to the $R \times 1000$ range.
3. Connect one of the ohmmeter test leads to the base (B) of the transistor. Touch the other meter lead to the emitter (E) and then to the collector (C). Both readings should be the same, but may be either high or low. If one reading is high and the other low, the transistor should be replaced. (Use the "Semiconductor Identification Charts" on Page 143 to identify the transistor leads.)
4. Interchange the test leads and repeat step 3.

NOTE: In the unusual case when the readings are all low or all high no matter which ohmmeter lead is connected to the base, the transistor should be replaced.

JFET CHECKING

JFET's are used at Q201 and Q202 on the VFO circuit board. Usually, any defect in these devices is an internal short circuit between the source (S) and the gate (G). You can check them in the circuit with a high impedance voltmeter (10 megohms) or higher. An abnormally low source voltage may indicate an internal short.

DIODES

To check a diode, unsolder one end from the circuit board and pull the lead up and out of the circuit board hole. Then proceed as follows:

1. Set the ohmmeter to $R \times 1000$ range.
2. Connect one of the ohmmeter test leads to the lead at the cathode (banded) end of the diode. Connect the other test lead to the other diode lead. Note the meter reading. Then interchange the meter leads and take another reading. One reading should be high and the other low (at least a 10:1 ratio). If both readings are either high or low, the diode should be replaced.



SPECIFICATIONS

RF Power Output	100 watts (nominal) on 80 through 15 meters 75 watts (nominal) on 10 meters.
Output Impedance	50 ohms, less than 2:1 SWR.
Frequency Coverage (in MHz)	3.5 to 4.0, 7.0 to 7.5, 14.0 to 14.5, 21.0 to 21.5, 28.0 to 28.5.
Frequency Stability	Less than 100 Hz/30 minutes drift after 60 minutes warmup; less than 100 Hz drift for $\pm 10\%$ change in primary voltage.
Dial Accuracy	Within 2 kHz after calibration at the nearest 100 kHz marker.
Tuning Backlash	50 Hz or less.
Tuning Rate	Approximately 15 kHz per turn.
Harmonic Radiation	At least 50 dB down at rated RF power output.
Spurious Radiation	At least 60 dB down at rated RF power output.
Mode of Operation	CW.
Keying Characteristics	Break-in with automatic antenna switching and mut- ing of the companion HR-1680 Receiver. Provision for operation with linear amplifier.
Muting	Completes external ground at Mute socket.
CW Sidetone	Internally generated. Connected to companion HR- 1680 Receiver. Adjustable level and adjustable-fre- quency audio tone.



Active Devices	All solid-state except driver and final tubes.
Front Panel Controls and Connections	Main (VFO) tuning Sidetone Level/Power on-off switch. CW Level. Band switch. Final tuning. Driver tuning. Meter switch. Mode switch. Key jack.
Power Requirements	700 to 850 volts to 250 mA with maximum 1% ripple. 250 volts at 50 mA with maximum .05% ripple. -130 volts at 10 mA with .5% maximum ripple. 12.6 volts AC/DC at 2.5 amperes.
Overall Dimensions (with knobs and feet installed)	12-3/4" wide × 6-3/4" high × 12" deep (32.4 × 17.2 × 30.5 cm)
Net weight	12-1/8 lbs. (5.5 kg).

The Heath Company reserves the right to discontinue products and to change specifications at any time without incurring any obligation to incorporate new features in products previously sold.



CIRCUIT DESCRIPTION

Refer to the Block Diagram (Illustration Booklet, Page 26) and to the fold-in Schematic while you read this "Circuit Description." The part numbers on the Schematic are arranged in the following groups to help you locate specific parts on the Schematic, circuit boards, and chassis:

- 1-99 Parts mounted on the chassis.
- 100-199 Parts mounted on the HFO/mixer circuit board.
- 200-299 Parts mounted on the VFO circuit board.
- 300-399 Parts mounted on the driver circuit board.
- 400-499 Parts mounted on the power supply circuit board.
- 500-599 Parts mounted on the antenna switch circuit board.
- 600-699 Parts mounted on the output filter circuit board.

A VFO (variable frequency oscillator) signal is first mixed with an HFO (heterodyne frequency oscillator) signal in the balanced mixer to produce an on-frequency signal in the desired band. This signal is coupled from the output of the appropriate bandpass filter on the HFO/mixer circuit board and is amplified by predriver transistors Q301 and Q302. The amplified signal is then further amplified in driver tube V301 and finally amplified in power amplifier tubes V1 and V2.

The following paragraphs describe the operation of each circuit in more detail.

VFO CIRCUIT BOARD

VFO CIRCUIT

FET (field effect transistor) Q202 is used in a Hartley oscillator circuit for the VFO. Part of coil L201, main tuning capacitor C29, and fixed temperature-compensating capacitors C201 through C205 are used in the frequency determining circuit. The remaining part of coil L201 is used for feedback to sustain oscillation. Voltage regulator U201 regulates the voltage at the drain of transistor Q201.

VFO BUFFER

The output of oscillator Q201 is coupled through a series of buffer stages, which consist of transistors Q202 through Q204. The output of Q204 passes through a low-pass filter (L202, L203, C216 through C219, and C221) to help reduce the harmonic output of the VFO signal. The frequency range of the VFO is 5.0 to 5.5 MHz.



Diode D203 ensures that transistor Q204 is completely turned off in the receive mode. This guarantees that no on-frequency signal is generated in the Transmitter when signals are being received.

SPOT FUNCTION

Transistor Q205 is used as a switch that actuates the spot function. When switch SW1 is placed in the Spot position, point C is grounded. Diode D202 is now forward-biased, providing the VFO signal with a low-resistance path around CW Level control R8. This results in the amplitude of the VFO output signal being larger than this signal is in the transmit mode. In the transmit mode, diode D202 is reverse-biased. This allows control R8 to vary the amplitude of the VFO signal.

HFO/MIXER CIRCUIT BOARD

HFO OSCILLATORS

Transistor Q101 forms a basic Colpitts oscillator for the 80 and 40-meter HFO's. Switching diodes D101 through D104 and Band switch SW1 determine that the proper crystal, Y101 or Y102, is connected to Q101 for these two bands. These crystals operate in the fundamental mode.

Transistor Q103 is used in a similar circuit for the 20, 15, and 10-meter HFO's. Switching diodes D105 through D109, D111 through D113, and Band switch SW1 determine which crystal (Y103, Y104, or Y105), with its associated tuned collector circuit, is connected to Q103. Crystals Y103 through Y105 operate on the third overtone.

The output from the selected HFO is coupled to the base of the appropriate amplifier stage, transistor Q102 or Q104. The signal is then coupled into emitter-follower transistor Q105, which is a buffer and impedance matching device. The HFO signal is next filtered through a low-pass filter made up of C121, L106, and C122. Then the signal is coupled into double-balanced mixer U101 where the HFO and VFO signals are mixed. The difference frequency obtained from mixing these two signals passes through a bandpass filter. The bandpass filters for each of the five bands are diode switched from the front panel. These filters are designed to pass only the difference of the HFO and the VFO signals while all other mixing products are filtered out. The output of these bandpass filters is coupled to the input of the pre-driver stages.

DRIVER CIRCUIT BOARD

PREDRIVER

Transistors Q301 and Q302 with their associated components form the predriver circuit. This circuit is a broad banded amplifier that amplifies the relatively low output from the bandpass filters (located on the HFO/mixer circuit board) to a level that is suitable to drive the driver stage.

DRIVER

Driver tube V301 has a tuned output tank circuit for each of the five bands. These circuits are switched by wafer SW4B and tuned by variable capacitor C322.



KEYING CIRCUITRY

When the key is open, a -30 volts is applied to the control grid of V301 to cut off the plate current of this tube. For this condition, the voltage on the collector (C) of Q304 is -130 volts. Diode D303 is reverse-biased; this prevents the -130 volts potential from being applied to the control grid of V301. At the same time, a -130 volt bias voltage is applied to power amplifier V1 and V2. This voltage limits the zero-signal current to less than 20 mA for these tubes. This

high bias voltage also reduces the amplitude of the thermal noise generated in the final amplifier stage. This noise would otherwise desensitize the accompanying receiver.

With the key closed, transistors Q303 and Q304 turn on the driver and the final amplifier stages. The voltage on the collector of Q304 will now be $+12$ volts. Diode D303 is forward biased, and the current through it produces 18 volts across R319. This results in a -6 volts key-down bias for V301.

FINAL AMPLIFIER

Final amplifier tubes V1 and V2 are connected in parallel and function as class AB₁ amplifiers. With the key closed, bias control R6 is set to provide about -70 volts to the control grid of each final amplifier tube. RF driving voltage is developed across RF choke L302. The plate voltage is shunt fed through RF choke RFC3.

The output signal from V1 and V2 is coupled through RF parasitic chokes RFC1 and RFC2, then through capacitor C21 to tune capacitor C26 and final tank coils L607, L608, and L609. The parasitic chokes suppress VHF oscillations.

Band switch wafer SW4D connects the proper portion

of the total plate tank coil for each band by shorting out the unused section. Switch wafer SW4D also selects the proper combination of final tank tuning and loading capacitors for each band. The loading capacitors serve a dual purpose as they make up the various low-pass filters at the Transmitter output. These filters help to reduce higher harmonic signals produced in the Transmitter.

Neutralization of the final amplifiers is accomplished by feeding a portion of the plate signal to the control grid of tubes V1 and V2. The signal is fed through neutralizing capacitors C19 and C18; then across three 100 pF capacitors in parallel (C6, C16, and C318) in a bridge circuit.

ANTENNA SWITCH CIRCUIT BOARD

This circuitry provides solid-state antenna switching which enables the Transmitter to operate with full break-in.

In the receive mode, $+11$ volts is applied to the junction of C502 and R501. This turns transistor Q501 on. The potential at the cathode of diode D504 is lower than the potential at its anode. The incoming signal then follows a path through C507, the conducting

diode D504, C506 to the input of the accompanying receiver.

In the transmit mode, Q501 is cut off, diode D504 is reverse-biased, and the RF signal from the output of the final amplifiers has no path that leads to the input of the receiver. Diodes D501 and D502 clamp any signal that could damage the receiver input to a safe value.

POWER SUPPLY CIRCUIT BOARD

12 V SUPPLY

Diodes D402 through D405 rectify the 12.6-volt AC voltage supplied by the external power supply. Capacitor C401 filters this rectified voltage and it is then applied to the input of voltage regulator ICU401. This regulator supplies +12 volts required to operate all the solid-state circuitry in the Transmitter.

KEYING CIRCUITRY

When the key is closed, the collector of Q401 goes high (+9 volts). This voltage causes transistors Q303 and Q304 (on the driver circuit board) to turn on the driver and the final amplifier stages. This forward-biases diode D303 and +9 volts is applied to emitter-follower Q204 (on the VFO circuit board) which allows the VFO signal to be coupled to VFO output jack J8. At the same time +9 volts is applied to predriver Q301. This permits the on-frequency signal, at "G" on the driver circuit board, to be amplified to the desired level at the Transmitter antenna jack.

When the Mode switch is placed in the LINEAR position, +12 volts is applied to the Q403 circuitry. The collector of Q403 goes low (about 0 volt). Capacitor C402 charges up whenever the key is closed. The capacitor discharges through two paths. One path is through resistors R405 and R409 to ground. The other path is through control R406, resistor R407, transistor Q403 to ground. The setting of delay time adjust control R406 determines how long transistor Q404 is

turned on. This in turn determines how long the linear amplifier antenna relay remains in the transmit position. When a positive voltage is used for the antenna relay, transistor Q411 grounds this relay. Transistor Q412 grounds the antenna relay when a negative voltage is used.

MUTING CIRCUITRY

The purpose of this circuit is to shut down the accompanying receiver during transmit so no interfering or strong signals are present.

This circuitry provides muting for various receivers, both solid-state and tube-type versions. Transistor Q407 and its associated components make up the muting circuitry used with most solid-state receivers (like the Heathkit HR-1680 Receiver). Depending on where the jumper wire on the power supply circuit board is connected (to +Rx or +Tx), point "H" is either grounded or open during transmit. Transistor Q408 and associated components make up the muting circuitry used with tube-type receivers.

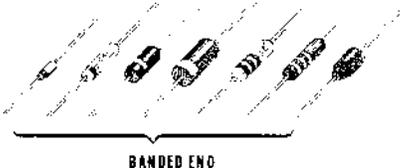
SIDETONE OSCILLATOR

Transistors Q409 and Q410 provide a sidetone signal for the companion receiver. The frequency of the signal may be varied by adjusting control R425. The output is connected across front panel Sidetone control R1. A portion of this signal is fed from the wiper arm of control R1 to the Sidetone jack.

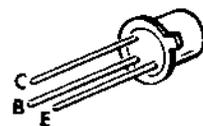
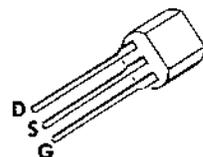
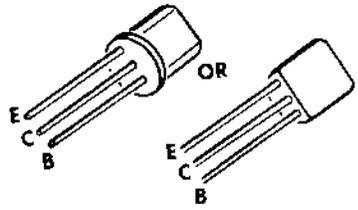
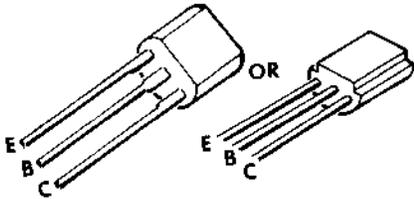
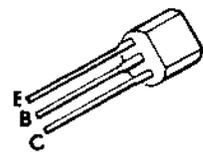
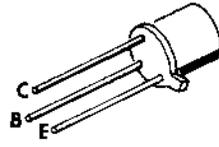


SEMICONDUCTOR IDENTIFICATION CHARTS

DIODES

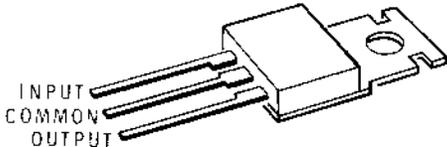
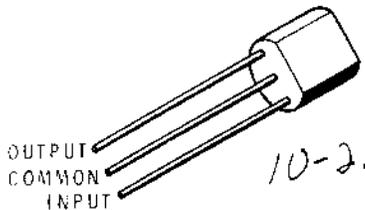
COMPONENT	HEATH PART NO.	MAY BE REPLACED WITH	IDENTIFICATION
D401, D413	56-16	1N751	<p>IMPORTANT: THE BANDED END OF DIODES CAN BE MARKED IN A NUMBER OF WAYS.</p> 
D124, D503	56-20	1N295	
D501, D502	56-24	1N458	
D101, D104, D105 D109, D110, D111 D112, D113, D201 D202, D203	56-28	GE-S127	
D102, D103, D106 D107, D108, D114 D115, D116, D117 D118, D119, D120 D121, D407, D408	56-56	1N4149	
D411, D414	56-617	1N5277	
D122, D123	56-646	BA-244	
D301, D402, D403 D404, D405, D406 D409, D410, D412 D415, D504	57-27	1N2071	

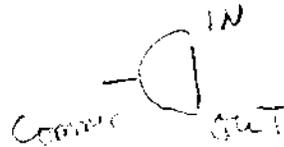
TRANSISTORS

COMPONENT	HEATH PART NO.	MAY BE REPLACED WITH	IDENTIFICATION
Q301	417-154	2N2369	
Q201, Q202	417-169	MPF105	
Q205	417-201	X29A829	
Q101, Q102, Q103 Q104, Q203, Q204	417-293	2N5770	
Q411, Q501	417-294	MPSA42	
Q303, Q401, Q402 Q403, Q404, Q405 Q406, Q407, Q409 Q410	417-801	MPSA20	
Q304, Q408	417-836	MPSD51	
Q412	417-927	MPSA93	
Q105, Q302	417-893	2N5109	



INTEGRATED CIRCUITS

COMPONENT	HEATH PART NO.	MAY BE REPLACED WITH	IDENTIFICATION
U401	442-674	μ A7812	
U201	442-681	μ A78L08	 <p>10-23</p> <p>EU output</p>



FOR PARTS REQUESTS ONLY

- Be sure to follow instructions carefully.
- Use a separate letter for all correspondence.
- Please allow 10 - 14 days for mail delivery time.

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Total enclosed \$ _____

- If you prefer COD shipment, check the COD box and mail this form. COD

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 Date Purchased _____ Location Purchased _____

LIST HEATH PART NUMBER	QTY	PRICE EACH	TOTAL PRICE

TOTAL FOR PARTS

HANDLING AND SHIPPING

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TOTAL AMOUNT OF ORDER

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 BENTON HARBOR
 MICHIGAN 49022
ATTN: PARTS REPLACEMENT

Phone (Replacement parts only): 616 982-3571

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- Please allow 10 - 14 days for mail delivery time.

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TOTAL FOR PARTS

HANDLING AND SHIPPING

MICHIGAN RESIDENTS ADD 4% TAX

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