

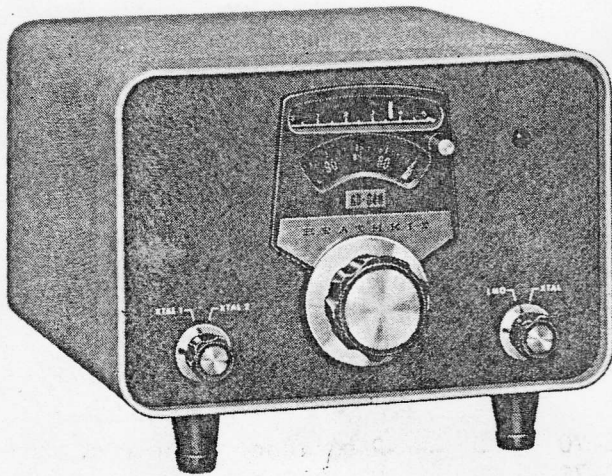
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Assembly
and
Operation
of the



EXTERNAL LMO

MODEL SB-640



COMPLETE MANUAL

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HEATH COMPANY
BENTON HARBOR, MICHIGAN

INTRODUCTION

The Heathkit External LMO (Linear Master Oscillator) is designed for use with the Heathkit Model SB-101 Transceiver. With this combination, you can transceive on this External LMO, on the internal LMO of the Transceiver, or on either of two crystal frequencies. You can also receive on the Transceiver's LMO and transmit on the external LMO. All of these functions are switch-selected from the front panels of the instruments.

To SB-101 Transceiver owners, the SB-640 provides wide versatility for working DX stations in a different sub-band, or for the customary procedure of calling 5 or 10 kHz up or down from the DX station's frequency. You can work a net by transceiving on a crystal frequency, by using both LMOs, or by transmitting crystal controlled and receiving on LMO.

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

PARTS LIST

The numbers in parentheses in the Parts List are keyed to the numbers on the Parts Pictorial (fold-out from Page 3) to aid in parts identification.

PART No.	PARTS Per Kit	DESCRIPTION	PART No.	PARTS Per Kit	DESCRIPTION
RESISTORS (1/2 Watt)					
(1) 1-83	1	56 Ω (green-blue-black)	(8) 432-70	2	9-terminal cable connector
1-3	1	100 Ω (brown-black-brown)	(9) 432-71	2	9-terminal chassis connector
1-20	1	10 KΩ (brown-black-orange)	(10) 432-72	14*	Male terminal
1-24	1	33 KΩ (orange-orange-orange)	(11) 432-73	14*	Female terminal
			(12) 434-34	1	7-pin socket
1-60	2	68 KΩ (blue-gray-orange)	(13) 434-44	2	Pilot lamp socket
CAPACITORS					
(2) 20-130	1	12 pf resin	(14) 434-74	2	Crystal socket
20-102	1	100 pf resin	(15) 434-160	1	Neon lamp socket
(3) 31-27	2	8-50 pf trimmer	(16) 438-4	1	Phono plug
(4) 21-27	6	.005 μfd disc	*2 extra of each furnished for your convenience (12 of each required to build the kit).		
(5) 27-47	2	.1 μfd resin	TUBE-LAMPS		
COIL-TRANSFORMER					
(6) 45-7	1	90 μH RF choke	411-11	1	6AU6 tube
(7) 52-103	1	5/5.5 MHz transformer	(17) 412-1	2	#47 lamp
			(18) 412-15	1	NE-2H lamp

PART No.	PARTS Per Kit	DESCRIPTION	PART No.	PARTS Per Kit	DESCRIPTION
HARDWARE					
Screws					
(19) 250-49	6	3-48 x 1/4"	90-337	1	Cabinet
(20) 250-251	2	3-48 x 3/8"	(44) 200-480-1	1	Chassis
(21) 250-156	1	4-40 x 1/8" setscrew	203-465-1	1	Panel
(22) 250-4	2	4-40 x 3/8"	(45) 204-751	1	Bracket
(23) 250-89	7	6-32 x 3/8"	(46) 206-86	2	Lamp shield
(24) 250-10	4	6-32 x 1/2"	METAL PARTS		
(25) 250-40	2	6-32 x 1-1/2"	PACKAGED DIAL DRIVE ASSEMBLY (#100-450)		
(26) 250-93	5	8-32 x 1/4" setscrew	(47) 204-553	1	Dial mounting bracket
Nuts					
(27) 252-1	8	3-48	(48) 100-443	1	Dial pointer assembly
(28) 252-15	4	4-40	(49) 464-30-1	1	Plastic dial window
(29) 252-3	13	6-32	(50) 100-447	1	Dial pointer drive arm
(30) 252-22	4	6-32 speednut	(51) 250-63	1	3-48 x 1/8" screw
(31) 252-7	2	3/8" control	(52) 266-74	1	Nylon spiral follower (small)
Washers					
(32) 234-7	8	#3 lockwasher	(53) 100-445	1	Zero set drive pulley (large)
(33) 254-9	4	#4 lockwasher	(54) 100-449	1	Circular dial
(34) 253-60	2	#6 flat	(55) 100-444	1	Dial drive pulley (large)
(35) 254-1	15	#6 lockwasher	(56) 455-42	1	Drive shaft bushing package
(36) 234-5	2	Control lockwasher	MISCELLANEOUS		
(37) 253-10	2	Control flat	(57) 63-49	2	Switch
Other Hardware					
(38) 259-1	4	#6 solder lug	(58) 446-40	1	Dial escutcheon
(39) 259-24	2	#8 long lug	110-40	1	LMO
WIRE-CABLE					
344-50	1	Black hookup wire	413-9	1	Red lens
344-52	1	Red hookup wire	431-10	3	Terminal strip
344-55	1	Green hookup wire	462-175	1	7/16" knob
344-59	1	White hookup wire	462-191	2	1-1/8" knob
343-7	1	Coaxial cable	462-193	1	2-1/2" knob
347-7	1	4-conductor cable	391-50	1	SB-640 nameplate
GROMMETS-FEET					
(40) 73-43	1	3/8" grommet	(59) 490-1	1	Alignment tool
73-46	3	5/16" grommet	(60) 490-5	1	Nut starter
(41) 261-25	2	Plastic foot	(61) 490-23	1	#4 allen wrench
(42) 255-59	2	Plastic spacer	490-85	1	#8 allen wrench
(43) 261-9	2	Rubber foot	352-13	1	Silicone grease
			331-6	1	Solder
			597-308	1	Kit Builders Guide
			597-260	1	Parts Order Form
			391-34	1	Blue and white identification label
			597-367	1	Registration card
			595-845	1	Manual

STEP-BY-STEP ASSEMBLY

Before you begin to assemble the kit, read the "Kit Builders Guide" for complete information on wiring, soldering, and step-by-step assembly procedures.

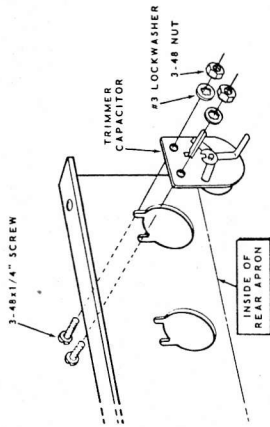
CHASSIS PARTS MOUNTING

As you mount a part on the chassis or front panel, use the hardware specified in the step and position the part as shown in the Pictorial. The step will call out only the size and type of hardware to use. For example: "Use 6-32 x 1/4 hardware" means to use a 6-32 x 1/4" screw, one or more #6 lockwashers, and a 6-32 nut. Lockwashers will be used under all nuts when you are mounting parts, unless the step directs otherwise. Note that all terminal strips have an additional lockwasher under the mounting foot.

The plastic nut starter will help you pick up a nut and start it on the screw threads. Use the smaller end for #3 or #4 nuts and the larger end for #6 nuts.

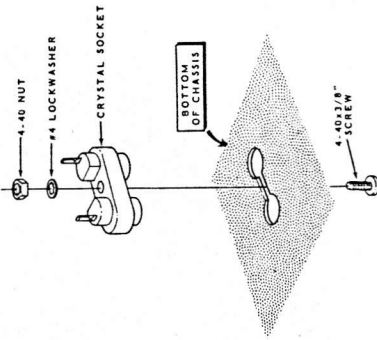
Refer to Pictorial 1 for the following steps. Place the chassis as shown and be sure to mount the parts in the positions illustrated.

() Refer to Detail 1A and mount a trimmer capacitor (#31-27) at A. Use 3-48 x 1/4" hardware. Center the round part of the capacitor in the hole.



Detail 1A

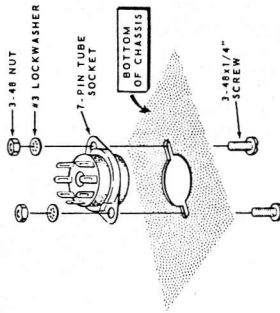
() Similarly, mount a trimmer capacitor at B.
 () Refer to Detail 1B and mount a crystal socket at C. Use 4-40 x 3/8" hardware. Do not overtighten the hardware or you may crack the socket. Disregard any numbers on the socket.



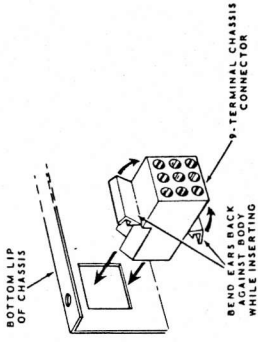
Detail 1B

() Similarly, mount a crystal socket at D.

() Refer to Detail 1C and mount a 7-pin tube socket at V1. Position the wide space between the lugs as shown by the arrow in Pictorial 1. Use 3-48 x 1/4" hardware.



Detail 1C

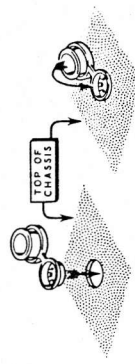


Detail 1F

() Refer to Detail 1F and mount a 9-terminal chassis connector at L. Take care to position the sawtooth "grooves" as illustrated. The plastic retaining ears should be bent back against the body of the connector, as shown, while it is being inserted.

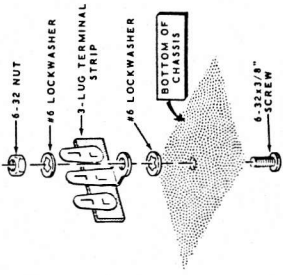
() Mount 5/16" grommets at G and N from the top of the chassis as shown in Detail 1G. Inspect under the chassis to make sure the insert part of each grommet is entirely through its bushing.

() Similarly, mount a 3/8" grommet at M.



POSITION THE SMALL PORTION OF THE GROMMET INTO THE CHASSIS HOLE. PRESS IT FIRMLY INTO PLACE.

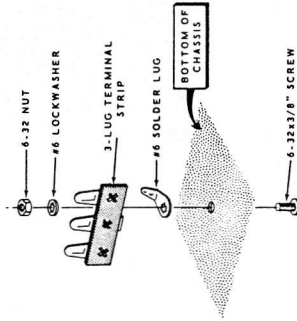
Detail 1G



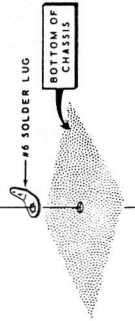
Detail 1D

() Mount a 3-lug terminal strip at E as shown in Detail 1D. Use 6-32 x 3/8" hardware with two #6 lockwashers as shown.

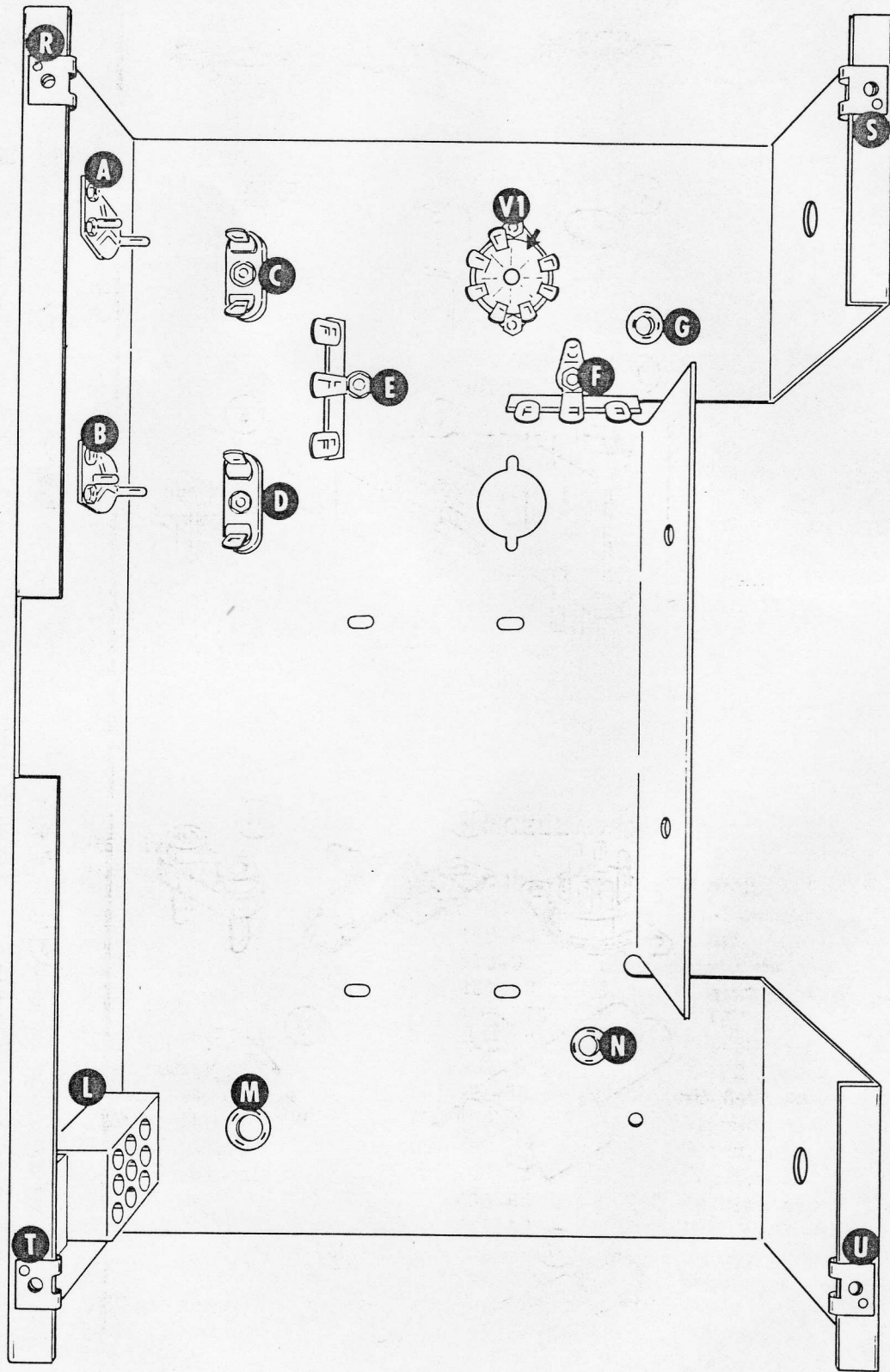
() Refer to Detail 1E and mount a 3-lug terminal strip and a #6 solder lug at F. Mount the solder lug under the foot of the terminal strip. Use 6-32 x 3/8" hardware but do not tighten it yet.



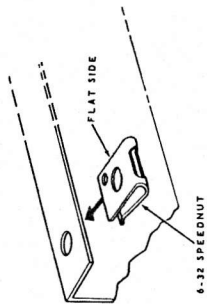
Detail 1E



BEND THE LARGE PORTION OF THE GROMMET INTO THE SMALL PORTION. PRESS IT FIRMLY INTO PLACE.



PICTORIAL 1

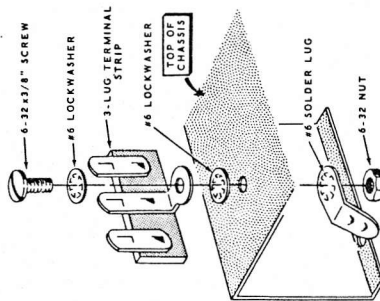


Detail 1H

() Refer to Detail 1H and install 6-32 speednuts at R, S, T, and U. Be sure to position the flat side of each speednut as shown.

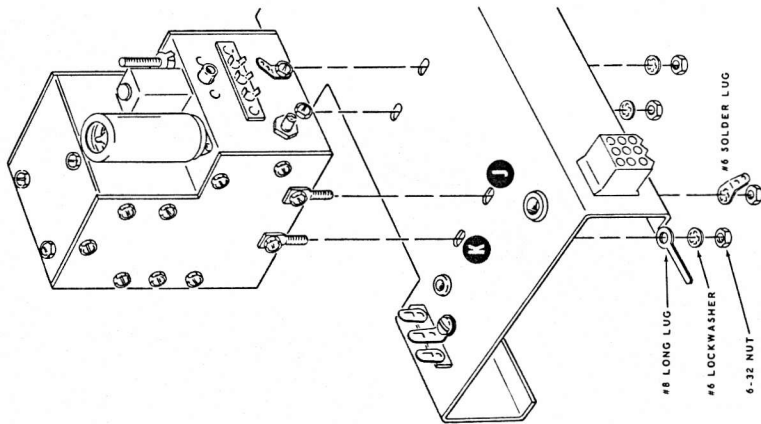
Refer to Pictorial 2 for the following steps.

() Refer to Detail 2A and mount a 3-lug terminal strip on the chassis at P. Use a 6-32 x 3/8" screw, two #6 lockwashers, a #6 solder lug, and a 6-32 nut.

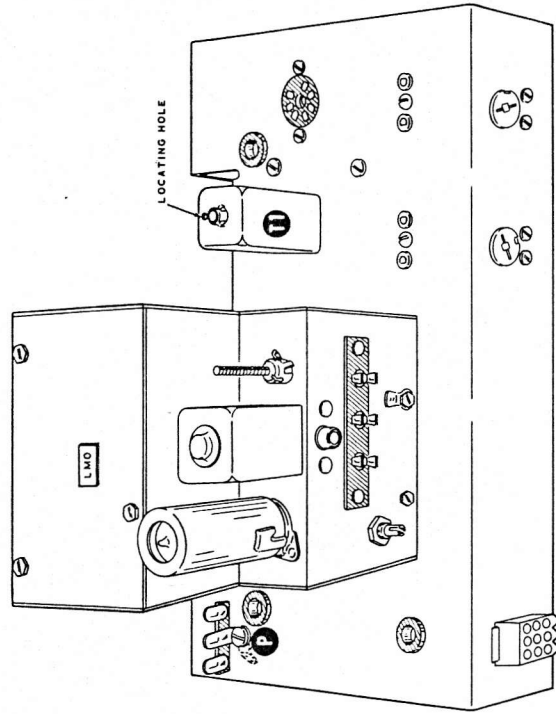


Detail 2A

() Refer to Detail 2B and mount the LMO. Use a #6 solder lug and a 6-32 nut at J. At K, use a #8 long lug, a #6 lockwasher, and a 6-32 nut. Use #6 lockwashers and nuts on the other mounting screws. Adjust the nuts only finger-tight at this time.

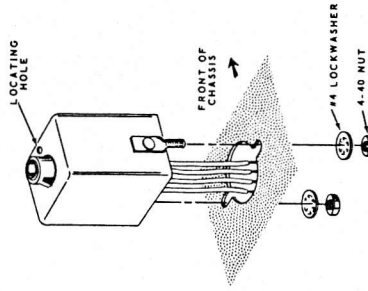


Detail 2B



PICTORIAL 2

() Refer to Detail 2C and mount a transformer (#52-103) at T1. Use #4 lockwashers and 4-40 nuts. Position the transformer locating hole toward the front of the chassis. Make sure there is no contact between a mounting nut of T1 and lug I of terminal strip F. Now tighten the hardware at F.



Detail 2C

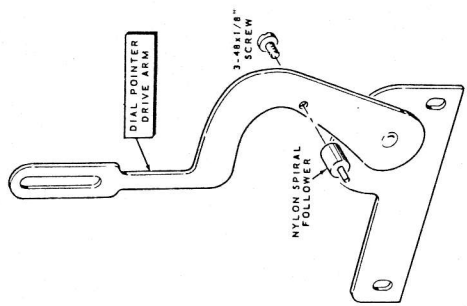


DIAL ASSEMBLY

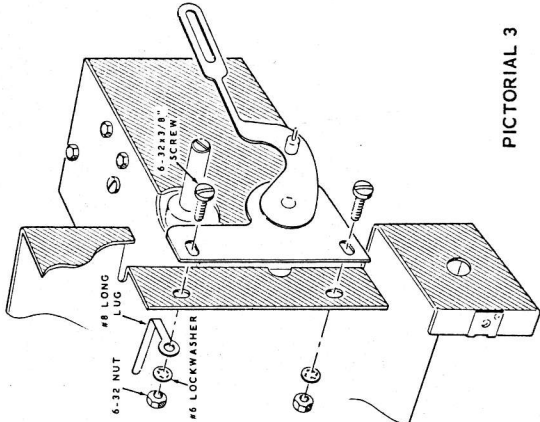
Refer to Pictorial 3 for the following steps.

NOTE: In the following steps, use the parts from the dial drive assembly package (#100-450).

() Refer to Detail 3A and install a nylon spiral follower (#266-74) on the dial pointer driver arm (#100-447), use the 3-48 x 1/8" screw supplied. Do not overtighten or you may strip the threads in the nylon.



Detail 3A

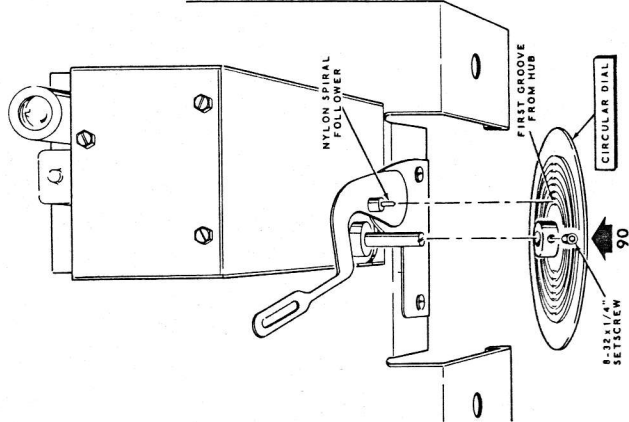


PICTORIAL 3

() Install the dial pointer drive arm on the chassis. Use 6-32 x 3/8" hardware and a #8 long lug positioned as shown. Position the hardware in the center of the chassis and tighten the nuts finger-tight. Bend the long lug so it follows the chassis corner as shown.

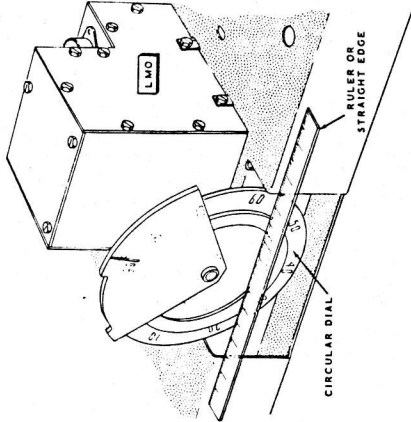
() Turn the shaft of the LMO fully counterclockwise, against the stop.

() Use the allen wrench to start an 8-32 x 1/4" setscrew in the threaded hole in the hub of the circular dial (#100-449).



Detail 3B

() Refer to Detail 3B, and position the circular dial on the LMO shaft with the "90" marking straight up and the nylon spiral follower in the first groove (nearest the hub) of the circular dial.



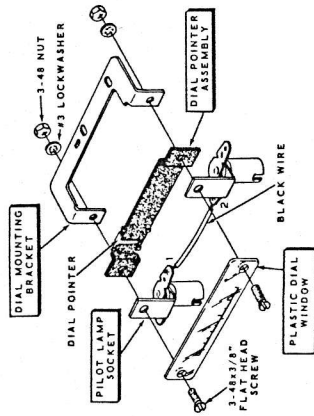
Detail 3C

() Make sure the tip of the nylon spiral follower is at the bottom of the groove in the circular dial. Then tighten the setscrew.

() Refer to Detail 3C and place a ruler or other straight edge along the front of the chassis. Adjust the LMO so the circular dial is parallel to the front edge of the chassis. Now tighten the nuts that secure the LMO to the chassis. Keep the spade bolts as near the center of the chassis slots as possible. The end of the LMO tuning shaft should be approximately flush with the edge of the chassis.

Refer to Pictorial 4 (fold-out from Page 13) for the following steps.

- () Refer to Detail 4A, and install the plastic dial window (#464-30-1), the dial pointer assembly (#100-443) and the two pilot lamp sockets (#434-44) on the dial mounting bracket (#204-553). Use 3-48 x 3/8" flat head screws. Be sure to position the plastic dial window and dial pointer assembly as shown.



Detail 4A

- () Prepare a 4-1/2" black hookup wire by removing 1/4" of insulation from each end. Connect this wire as shown in Detail 4A from one pilot lamp socket (S-1) to the other (S-1).

- () Install a pilot lamp in each socket. Check to see that there is no interference between the dial pointer mechanism and lug #2 of the pilot lamp at the "5" end of the scale.

- () Install a pilot lamp shield on each lamp. Position the open sides of the shields as shown.

- () Remove the two top-front screws from the LMO.

- () Mount the dial mounting bracket on the LMO using the two top-front screws. Position the stud from the rear of the dial pointer in the slot of the dial pointer drive arm. Position the black wire so it does not interfere.

NOTE: If the stud from the rear of the dial pointer will not fit into the slot in the dial pointer drive arm, loosen the mounting hardware of the dial pointer drive arm and move it as required.

- () Check to see that the "90" marking on the circular dial is directly under the 2-1/2 mark on the plastic dial window when the circular dial is fully counterclockwise.

If not, loosen the circular dial setscrew and make the necessary adjustment. Retighten the setscrew. Refer to the inset drawing of Pictorial 4.

- NOTE: If the zero set dial does not rotate freely under the plastic dial window, bend the dial mounting bracket up to obtain sufficient clearance.

window. After five complete revolutions the dial pointer should be very close to the "5" marking on the plastic dial window. If not, perform one of the following two steps.

- () 1. If the dial pointer is to the left of the "5" marking, loosen the dial pointer drive arm mounting screws and move the dial pointer drive arm base up until the dial pointer is at the "5" marking. Do not move the dial pointer drive arm base left or right. Retighten the screws.
- () 2. If the dial pointer is to the right of the "5" marking, loosen the dial pointer drive arm mounting screws and move the dial pointer drive arm base down until the pointer is at the "5" marking. Do not move the dial pointer drive arm base left or right. Retighten the screws.

The preceding adjustment may affect the dial pointer setting at the zero marking. Repeat the entire procedure as many times as necessary to obtain proper dial and pointer calibration. Because the dial pointer is only a turns counter, it need not be exactly at a number when the circular dial is at one of its five possible zero settings; however, the preceding steps should permit fairly close calibration. Rotating the circular dial from the fully counterclockwise position to the fully clockwise position will cause the dial pointer to go to the left of the zero marking and to the right of the "5" marking on the plastic dial window. These adjustments in no way affect frequency calibration, which depends only on the circular dial reading.

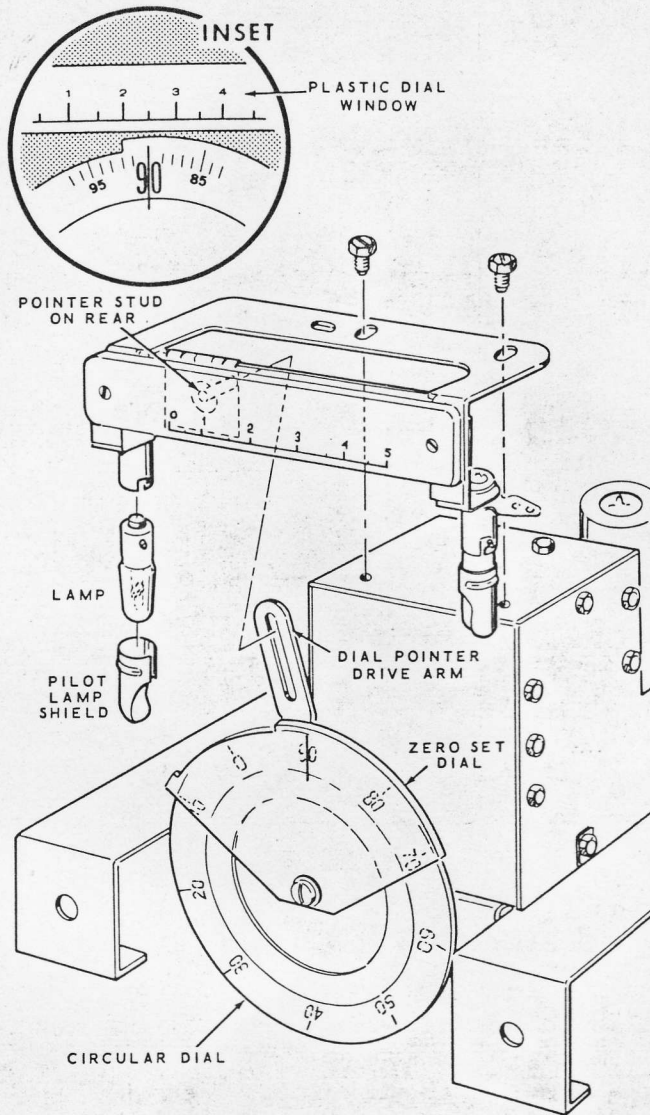
Refer to Detail 4B (fold-out from Page 13) for the following steps.

- () Rotate the circular dial clockwise from the fully counterclockwise position ("90" marking) to the first zero marking. The dial pointer should be at the zero marking on the plastic dial window. If not, perform one of the following two steps.

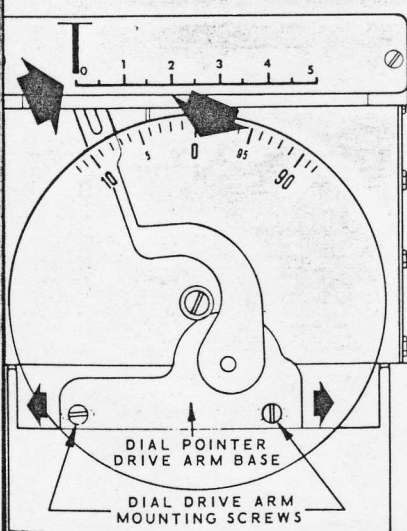
- () 1. If the dial pointer is to the right of the zero marking, loosen the dial pointer drive arm mounting screws and move the dial pointer drive arm base to the right until the dial pointer is at zero. Do not move the dial pointer drive arm base up or down. Retighten the screws.
- () 2. If the dial pointer is to the left of the zero marking, loosen the dial pointer drive arm mounting screws, and move the dial pointer drive arm base to the left until the dial pointer is at zero. Do not move the dial pointer drive arm base up or down. Retighten the screws.

Refer to Detail 4C (fold-out from Page 13) for the following steps.

- () Rotating the circular dial in a clockwise direction one revolution (zero to zero) should move the dial pointer to the "1" marking on the plastic dial window. Each time the circular dial is rotated one revolution, clockwise, the dial pointer should advance one more number on the plastic dial

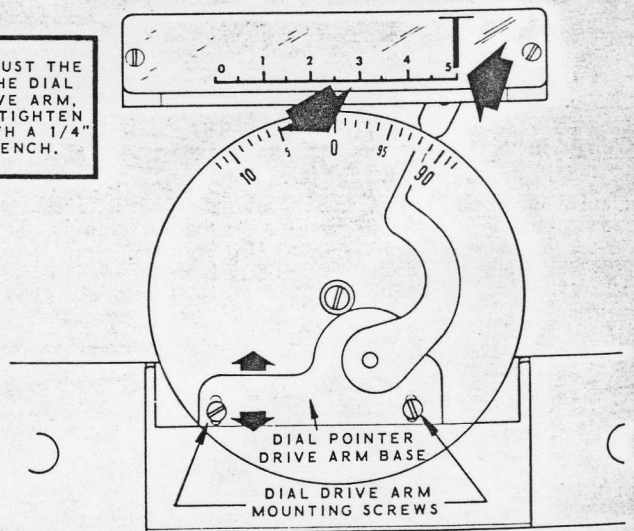


ORIAL 4



DETAIL 4B

NOTE: TO ADJUST THE SCREWS OF THE DIAL POINTER DRIVE ARM, LOOSEN AND TIGHTEN THE NUTS WITH A 1/4" OPEN END WRENCH.



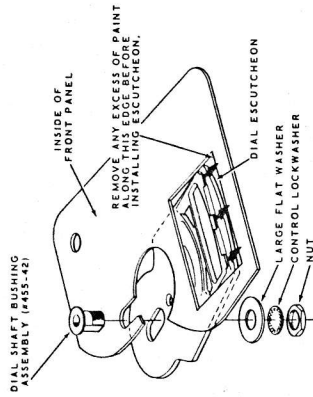
DETAIL 4C



FRONT PANEL MOUNTING

Refer to Pictorial 5 for the following steps.

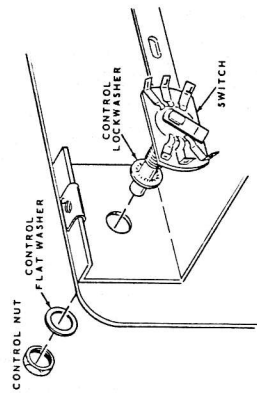
- () Place a soft cloth on the work area to prevent scratching the front panel.
- () Remove the protective paper from the back of the SB-640 nameplate and press it into place on the dial escutcheon as shown in the Pictorial.
- () Refer to Detail 5A and mount the dial escutcheon on the front panel. The tabs at the top of the escutcheon must engage the back of the panel. It may be necessary to remove paint from the back of the panel at the location of the tabs.



Detail 5A

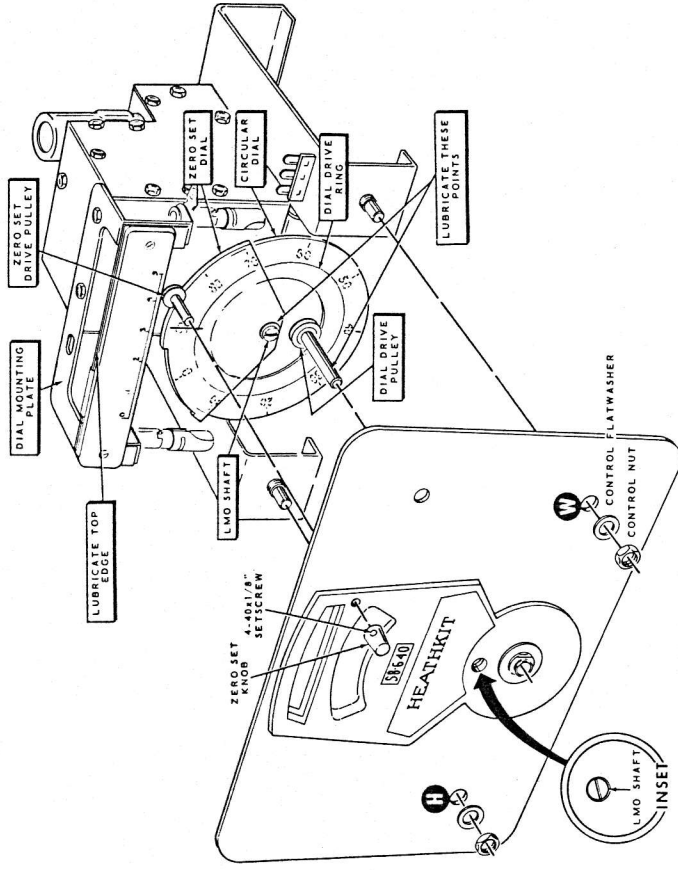
- () Install the dial shaft bushing assembly as shown. Be sure the bushing is inserted from the back of the panel. Use a large flat washer, a control lockwasher, and a control nut. Push the bushing up toward the top of the panel and tighten the nut finger-tight only.
- () Refer to Pictorial 5 and apply a small amount of silicone grease to the center hole of the zero set dial, the dial shaft, and the top edge of the black pointer slide.

- () Slide the shaft of the dial drive pulley, from the rear of the panel, into the bushing in the front panel.
- () Slide the zero set drive pulley (small shaft) onto the zero set dial. Position the pulley and dial as shown.
- () Align the shaft of the zero set drive pulley with its panel hole, and position the panel against the chassis.
- () Refer to Detail 5B and Pictorial 5 and mount switches at H and W. Use control lockwashers, control flat washers and control nuts. Align the bottom of the panel with the lower edge of the chassis and center the LMO shaft in the panel hole (as shown in the inset drawing in Pictorial 5) before tightening the nuts.



Detail 5B

- () Loosen the dial drive bushing and push it down so the pulley engages with the interior of the circular dial drive ring with just enough pressure to rotate the dial without slippage. Tighten the nut on the dial drive bushing. The amount of torque required to turn the circular dial can be adjusted by moving the dial drive bushing up or down.
- () Install the aluminum knob on the zero set drive pulley shaft. Use a 4-40 x 1/8" set-screw. Before tightening, position the knob on its shaft so the zero set dial clears the circular dial by at least 1/64."



PICTORIAL 5

UNDER CHASSIS WIRING

Be sure you have read the Kit Builders Guide before starting to wire your kit.

Refer to Pictorial 6 for the following steps.

Prepare the following lengths of hookup wire. Strip insulation from ends as shown. The wires are listed in the order in which they will be used.

COLOR	LENGTH	ONE END	OTHER END
() Black	5"	1-3/4"	1/4"
() Black	16"	1/4"	1/4"
() Green	5"	1"	1/4"*
() Green	4"	1-3/4"	1/4"
() Green	5-1/4"	1"	1/4"*

*This wire will be used later.

NOTE: Where a wire passes through a connection and then goes to another point, as in the next step, it will count as two wires in the solder instructions (S-2), one entering and one leaving the connection.

- () Pass the 1-3/4" stripped end of a 5" black wire through lug 4 (S-2) to lug 3 (NS) of switch H. Connect the other end of the wire to solder lug F (NS).
- () Connect a 16" black wire to lug 4 of tube socket V1 (NS). Place the other end of this wire through grommet M. This end will be connected later. Route the wire as shown.
- () Pass the 1-3/4" bared end of a 4" green wire through lug 6 (S-2) to lug 1 (NS) of switch H. Connect the other end of the wire to lug 1 of tube socket V1 (NS). Be sure the bared wire does not touch the rotor of the switch.

Connect the leads from transformer T1 as follows:

- () Red to lug 1 of terminal strip F (NS).
- () Black to lug 2 of terminal strip F (NS).
- () White to lug 3 of terminal strip F (NS).
- () Blue to lug 5 of tube socket V1 (S-1).

NOTE: When preparing hookup wires, strip 1/4" of insulation from each end of each wire unless the step directs otherwise.

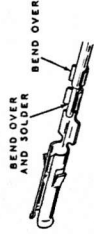
Prepare the following lengths of hookup wire:

COLOR	LENGTH
() Red	9"
() Red	3-1/4"
() Red	10"
() White	5"

- () Connect a 9" red wire from lug 3 of terminal strip E (NS) to lug 6 of switch W (S-1).
- () Connect a 3-1/4" red wire to lug 5 of switch W (NS). Place the other end through grommet N. This end will be connected later.
- () Connect a 10" red wire to lug 4 of switch W (S-1). Place the other end through grommet M. This end will be connected later.
- () Connect a 5" white wire to lug 3 of tube socket V1 (NS). Place the other end of this wire through grommet G. This end will be connected later.

- () Remove all the insulation from a 2-1/2" length of white wire. Pass one end of this bare wire through lug 2 of crystal socket C (S-2) to lug 2 of capacitor A (S-1). Pass the other end of the wire through lug 1 of crystal socket D (NS) to lug 2 of capacitor B (S-1).
- () Pass the 1" bared end of a 5" green wire through lug 1 of the crystal socket C (S-2) to lug 1 of capacitor A (S-1). Connect the other end of this wire to lug 5 of switch H (S-1).

- () Pass the 1" bared end of a 5-1/4" green wire through lug 2 of crystal socket D (S-2) to lug 1 of capacitor B (S-1). Connect the other end of the wire to lug 2 of switch H (S-1).



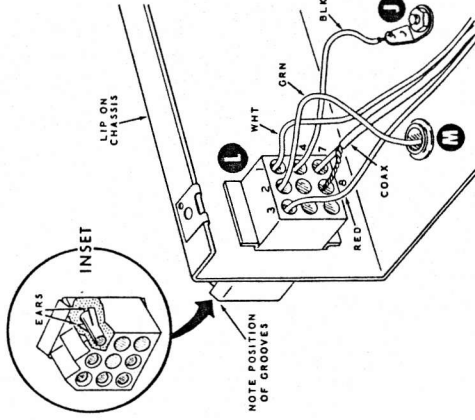
Detail 6A

Refer to Detail 6A, prepare the following lengths of hookup wire, and connect a female terminal (#432-73) to one end of each. Solder each connection.

- () 14" white
- () 8" green
- () 8" red
- () 3" black

Refer to Detail 6B for the proper method of inserting the female terminals into connector L in the following steps. The inset drawing shows how the metal ears expand to lock each terminal in place. CAUTION: Be sure to use the right hole for each wire.

- () Insert the white wire terminal into hole #1. Connect the other end of this wire to lug 3 of tube socket V1 (NS).



Detail 6B

- () Insert the green wire terminal into hole #2. Pass the other end of this wire through grommet M to be connected later.
- () Insert the red wire terminal into hole #3. Connect the other end of this wire to lug 5 of switch W (S-2).
- () Insert the black wire terminal into hole #4. Connect the other end of this wire to solder lug J (S-1).

NOTE: Fold any excess wire neatly under connector L.

CAUTION: When preparing coaxial cable, be extremely careful that you do not nick or cut the wires just underneath the foil.

pulley, from
pushing in the

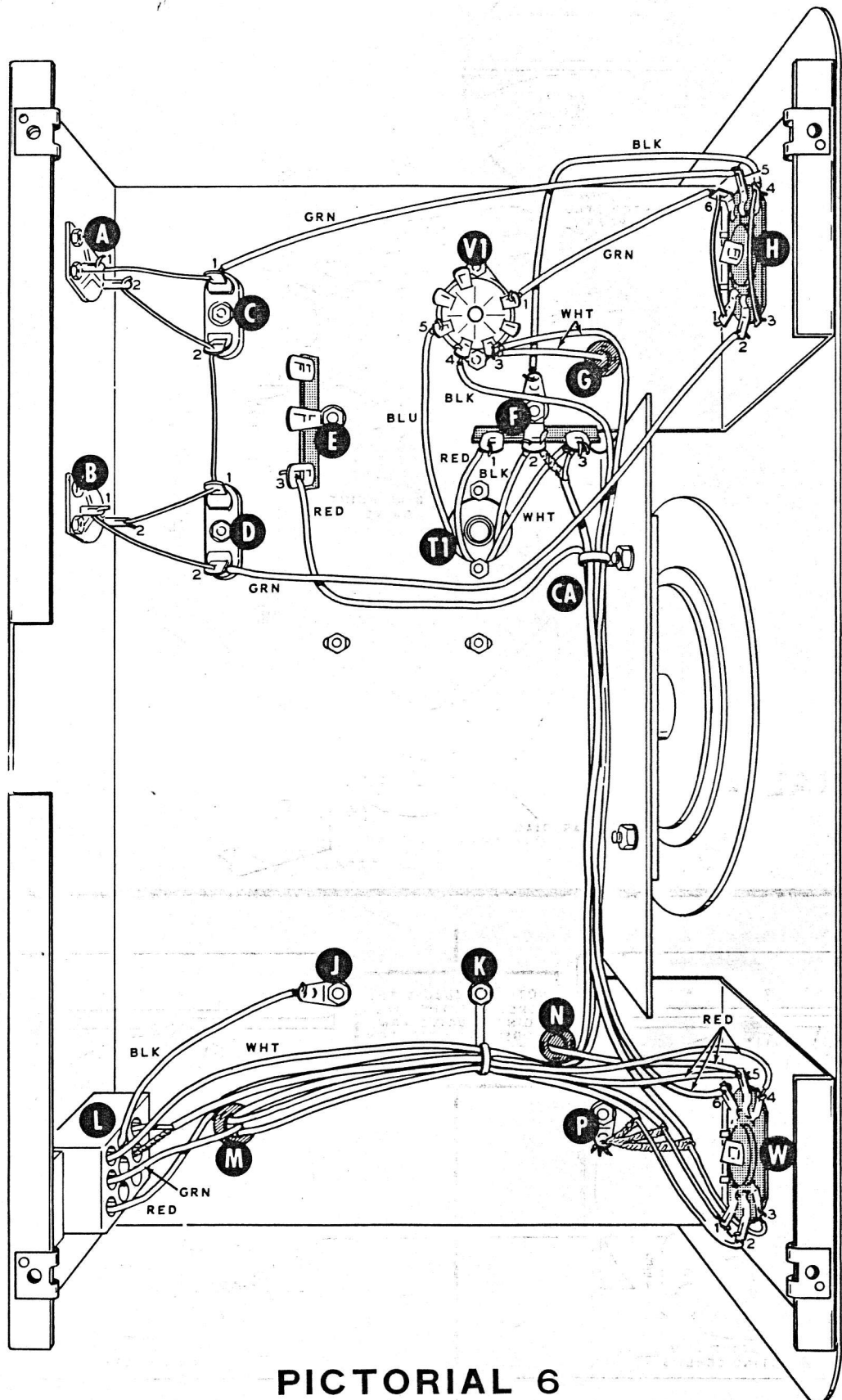
(small shaft)
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drive pulley
on the panel

5 and mount
control lock-
and control
panel with the
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tightening the

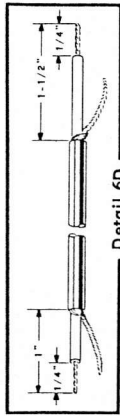
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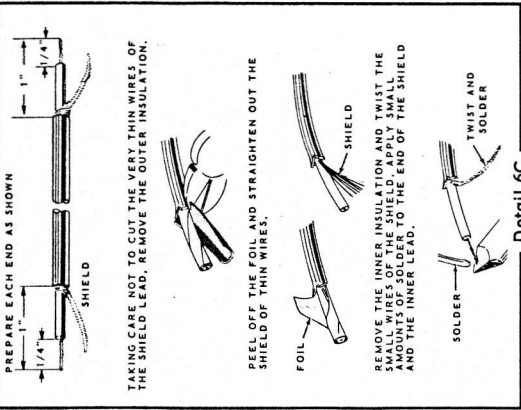
PICTORIAL 6

- () Refer to Detail 6C and prepare a 7" coaxial cable.
- () At one end of this 7" coaxial cable, connect one female terminal to the center conductor (S-1) and another female terminal to the shield (S-1).
- () Refer back to Detail 6B and insert the female terminal on the center conductor into hole #7 of connector L. Insert the female terminal on the shield into hole #8.
- () At the other end of this coaxial cable, connect the center conductor to lug 2 of switch W (S-1) and connect the shield to solder lug P (NS).

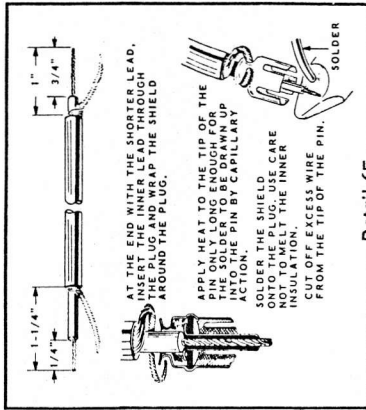


Detail 6D

- () Refer to Detail 6D and prepare an 8" coaxial cable.
- () At the end of the cable with 1-1/2" of insulation removed, connect the center conductor to lug 3 of switch W (S-1) and connect the shield to solder lug P (NS).
- () At the other end of the cable, connect the center conductor to lug 3 (S-2) and the shield to lug 2 (NS) of terminal strip F.
- () Prepare a 10-1/4" coaxial cable as shown in Detail 6E. Then install a phono plug as shown at the end of the cable with the shorter leads.
- () Push the other end of this cable through grommet M from the top of the chassis.
- () At the bottom side of the chassis, connect the center conductor of this cable to lug 1 of switch W (S-1) and connect the shield to solder lug P (S-3).
- () Refer to Pictorial 6 and bend the #8 long lug at K up and over to encircle and hold in place the wires passing over it.
- () Similarly, form the #8 long lug at CA.



Detail 6C

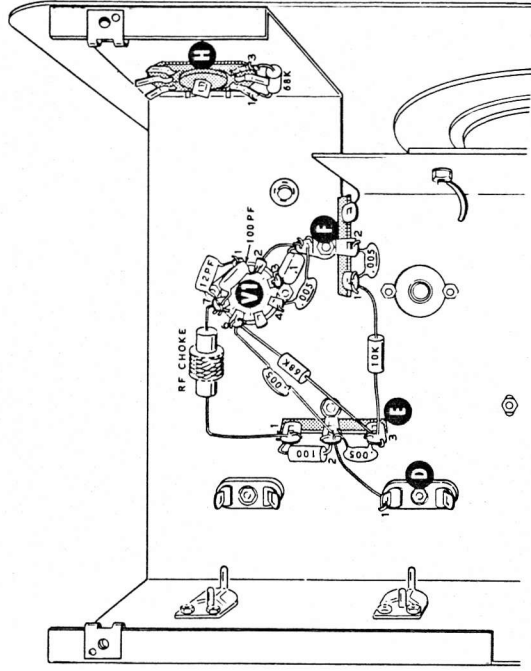


Detail 6E

- Refer to Pictorial 7 for the following steps.
- () Pass one lead of a 100 pf resin capacitor through lug 2 of tube socket V1 (S-2) to solder lug F (NS). Connect the other lead to lug 7 of V1 (NS).
- () Connect a 12 pf resin capacitor between lug 1 (S-2) and lug 7 (NS) of tube socket V1.
- () Connect one lead of an RF choke (#45-7) to lug 7 of tube socket V1 (S-3). Connect the other lead to lug 1 of terminal strip E (NS).
- () Connect a 100 Ω (brown-black-brown) resistor between lug 1 (S-2) and lug 2 (NS) of terminal strip E.
- () Connect a 68 KΩ (blue-gray-orange) resistor from lug 6 of tube socket V1 (NS) to lug 3 of terminal strip E (NS).
- () Connect a 10 KΩ (brown-black-orange) resistor from lug 3 of terminal strip E (NS) to lug 1 of terminal strip F (NS).

- () Connect a 68 KΩ (blue-gray-orange) resistor between lug 1 (S-2) and lug 3 (S-2) of switch H.
- () Connect a .005 μfd disc capacitor from lug 6 of tube socket V1 (S-2) to lug 2 of terminal strip E (NS).
- () Pass one lead of a .005 μfd disc capacitor through lug 2 of terminal strip E (S-4) to lug 1 of socket D (S-3). Connect the other lead to lug 3 of terminal strip E (S-4).
- () Connect one lead of a .1 μfd resin capacitor to lug 4 of tube socket V1 (S-3). Connect the other lead to solder lug F (NS).
- () Connect one lead of a .005 μfd disc capacitor to lug 4 of tube socket V1 (S-2). Connect the other lead to solder lug F (S-4).
- () Connect a .005 μfd disc capacitor between lug 1 (S-3) and lug 2 (S-3) of terminal strip F.

This completes the under chassis wiring of your kit.

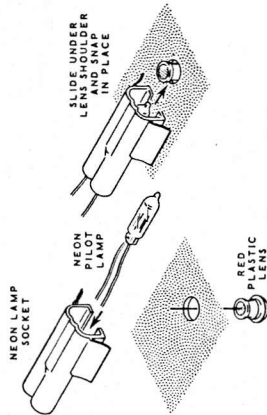


PICTORIAL 7

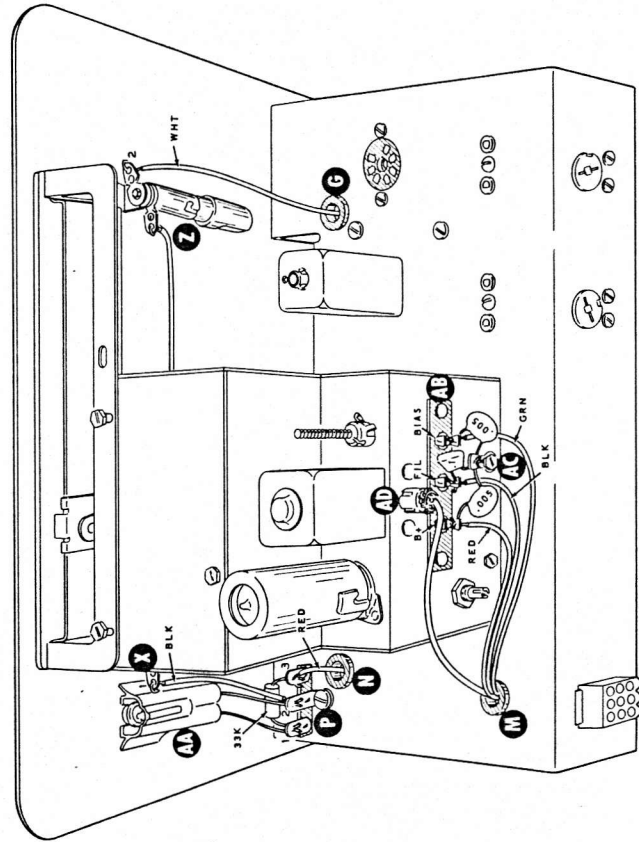
ABOVE CHASSIS WIRING

Refer to Pictorial 8 for the following steps.

- () Connect the white wire from grommet G to lug 2 of the pilot lamp socket at Z (S-1).
- () Connect a 33 KΩ (orange-orange) resistor between lugs 1 (NS) and 3 (NS) of terminal strip P.
- () Connect the red wire from grommet N to lug 3 of terminal strip P (S-2).
- () Connect a 2-3/4" black wire from lug 1 of the pilot lamp socket at X (S-1) to lug 2 of terminal strip P (NS).
- () Refer to Detail 8A and install the neon pilot lamp socket, the red plastic lens and the neon lamp at AA.



Detail 8A



PICTORIAL 8

- () Connect one lead of the neon lamp to lug 2 (S-2) and the other lead to lug 1 (S-2) of terminal strip P.

Connect the three hookup wires from grommet M to terminal strip AB as follows:

WIRE COLOR CONNECT TO

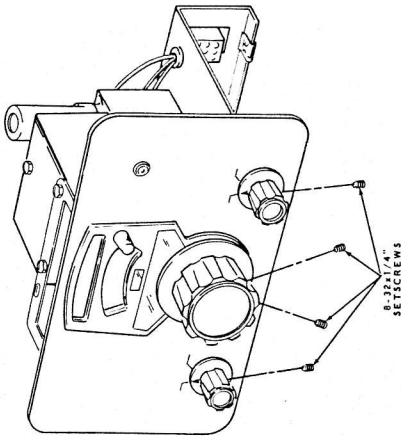
- () Red B+ (NS).
- () Black FIL (NS).
- () Green Bias (NS).
- () Connect a .005 μfd disc capacitor from the B+ lug of terminal strip AB (S-2) to solder lug AC (NS).
- () Connect a .005 μfd disc capacitor from the Bias lug of terminal strip AB (S-2) to solder lug AC (NS).
- () Connect a .1 μfd resin capacitor from the Fil lug of terminal strip AB (S-2) to solder lug AC (S-3).
- () Insert the phono plug on the coaxial cable coming from grommet M into phono jack AD.

This completes the above chassis wiring.

KNOB INSTALLATION

Refer to Pictorial 9 for the following steps.

- () Use the #8 allen wrench to insert two 8-32 x 1/4" setscrews into the tapped holes in the large knob and one 8-32 x 1/4" setscrew into each small knob. Do not let the screws protrude into the dial shaft opening.
- () Push the large knob onto the dial shaft, leaving about 1/16" clearance between the knob skirt and the Heathkit nameplate. Tighten both setscrews with the allen wrench.
- () Turn the shafts of both switches to the counterclockwise position.
- () Push a small knob onto each switch shaft and position the arrows on the knob skirts so they point to XTAL 1 and LMO respectively. Tighten the setscrew in each knob.
- () Carefully peel away the backing paper from the blue and white identification label. Then press the label onto the rear of the chassis. Be sure to refer to the numbers on this label in any communications you have with the Heath Company about this kit.



PICTORIAL 9

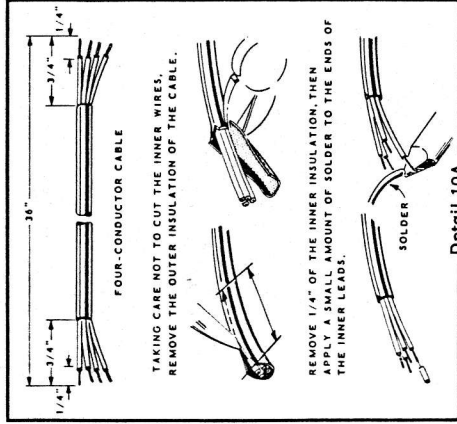
This completes the assembly of your Heathkit External LMO. Carefully inspect all connections for loose wires or unsoldered joints. Remove any wire clippings or solder splashes that may be lodged in the wiring. Then proceed to the Installation section.

INSTALLATION

CONNECTING CABLE PREPARATION

Refer to Pictorial 10 for the following steps.

- () Refer to Detail 10A and prepare the 4-conductor cable as shown.



Detail 10A

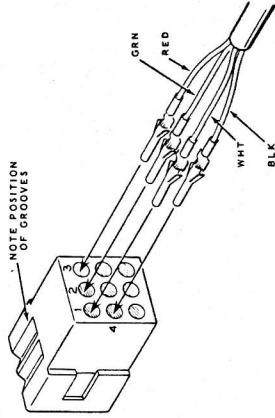
- () Refer to Detail 10B and connect one male terminal (#432-72) to each of the four wires at both ends of the 4-conductor cable (total of eight terminals).



Detail 10B

Each of the next four steps will be performed twice, once at each end of the 4-conductor cable. First, use one set of check-off spaces to install a 9-terminal cable connector at one end of the cable. Then use the other set of check-off spaces to install a 9-terminal cable connector at the other end of the cable.

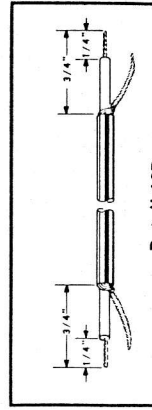
3- 347-1
1.2 432-72
2 432-70
3- 343-7



Detail 10C

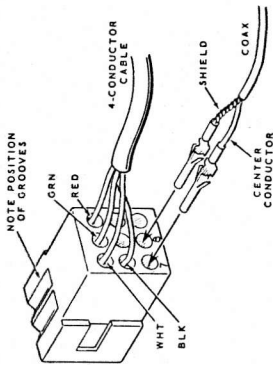
Refer to Detail 10C for the following steps and push each of the four male terminals into the proper connector hole. CAUTION: Be sure you insert each terminal into the proper hole (once a terminal is installed, it cannot be removed).

- () () Black wire to hole 4.
- () () Red wire to hole 3.
- () () Green wire to hole 2.
- () () White wire to hole 1.
- () Refer to Detail 10D and prepare a 36" coaxial cable as shown.



Detail 10D

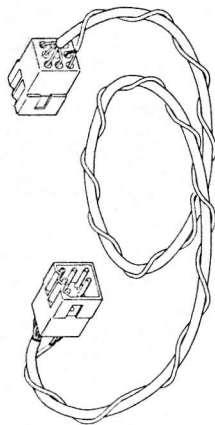
- () Connect male terminals to the center conductor and the shield wires at each end of the cable (total of 4 terminals). Solder each connection.



Detail 10E

- () Refer to Detail 10E and insert the center conductor terminal at one end of the coaxial cable into hole #7 of a cable connector. Insert the terminal on the shield into hole #8 of the same cable connector. Be sure to use the correct holes and to fully seat the terminals.
- () Wrap this coaxial cable around the 4-conductor cable to form a twisted pair. Adjust the number of turns so there will be little or no difference in the length of the two cables. An additional length adjustment may be made by pushing the ends of the 4-conductor cable up close to the connector at each end.
- () Again refer to Detail 10E, and insert the remaining terminals as shown. Fully seat the terminals.

This completes preparation of the connecting cable.

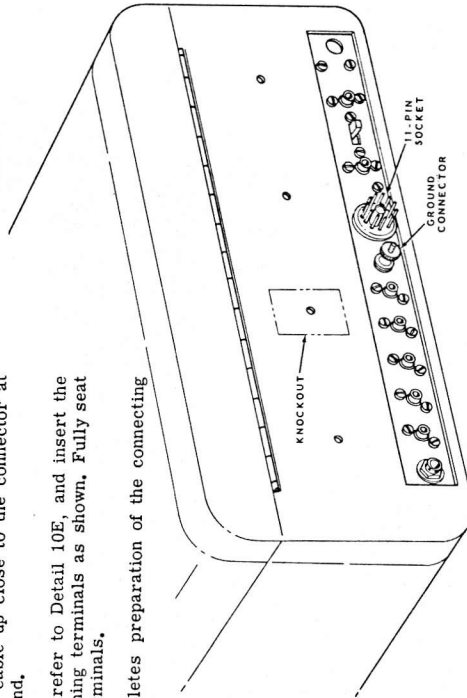


PICTORIAL 10

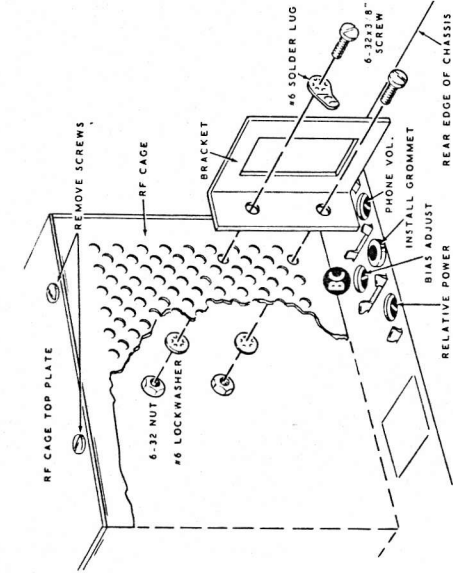
SB-101 TRANSCIEVER MODIFICATIONS

Refer to Pictorial 11 for the following steps.

- () Remove the Transceiver from its cabinet.
- () Locate the knockout rectangle that is located above the GND connection on the rear of the SB-101 Transceiver cabinet.
- () Use a screwdriver or chisel to loosen the knockout. Then grasp one edge of the knockout with pliers, twist it loose, and discard it.



PICTORIAL 11



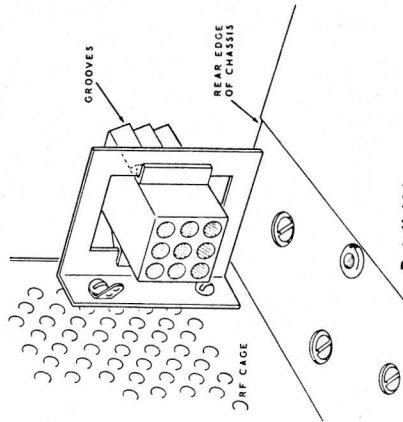
PICTORIAL 12

Refer to Pictorial 12 for the following steps.

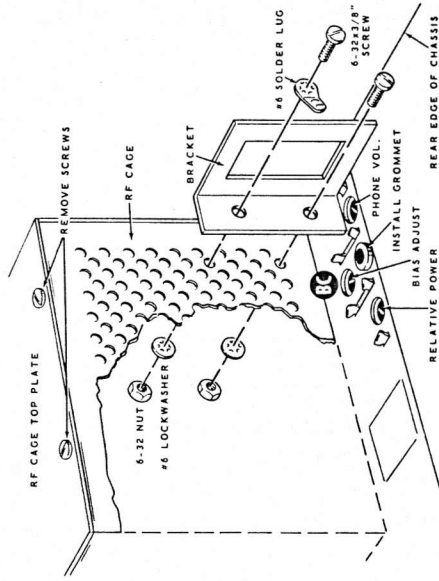
- () Locate the unused hole next to BC, the Bias Adjust control. Install a 5/16" grommet in this hole.
- () Remove the RF cage top and rear plates. Lay them and the retaining screws aside temporarily.
- () Install a bracket (#204-751) on the side of the RF cage. Use a 6-32 x 3/8" screw, a #6 solder lug, a #6 lockwasher, and a 6-32 nut at the upper hole. Use a 6-32 x 3/8" screw, #6 lockwasher, and a 6-32 nut at the lower hole.

NOTE: Be sure to position the bracket mounting lip and the solder lug as shown, and to use the mounting holes indicated in the RF cage. To permit easier access to screw heads, temporarily remove V18 while you mount the bracket. If the rear mounting lug of the Phone Volume control interferes, bend the lug enough to clear the bracket.

- () Replace the two RF cage plates, the retaining screws, and V18.



Detail 12A



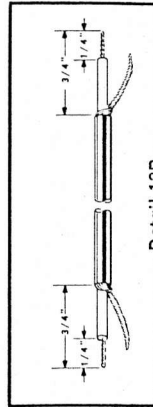
PICTORIAL 12
(Repeat)

Prepare the following lengths of hookup wire:

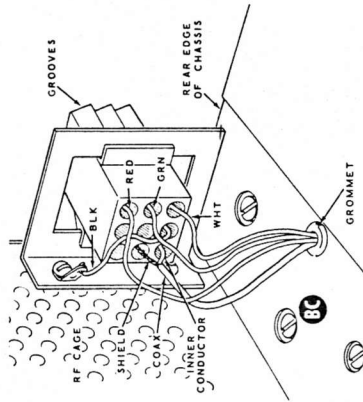
COLOR	LENGTH
() Black	2-1/2"
() White	6"
() Red	14"
() Green	16-1/2"

() Install a female terminal (#432-73) on one end of each of the prepared wires. Solder each connection.

() Refer to Detail 12B and prepare an 11-1/2" coaxial cable.



Detail 12B



Detail 12C



() Pass the coaxial cable and the red, green, and white wires through the grommet near BC. Leave about 1" of slack above the chassis. These wires will be connected later.

() Connect the black wire to the solder lug (S-1) under the upper bracket mounting screw.

Refer to Pictorial 13 for the following steps.

Refer to Detail 13A and locate, unsolder, and remove the following three parts from the bandpass circuit board. These parts can then be discarded.

- () 100 pf mica capacitor C322.
- () 36 μ H coil L202.
- () 1000 Ω (brown-black-red) resistor R220.
- () Connect a 56 Ω (green-blue-black) resistor on top of the circuit board between points G and ZZ (marked by arrows in the Pictorial and on the circuit board). Refer to the top view on Detail 13A and the bottom view on the Pictorial. **SOLDER AT POINT ZZ ONLY.**

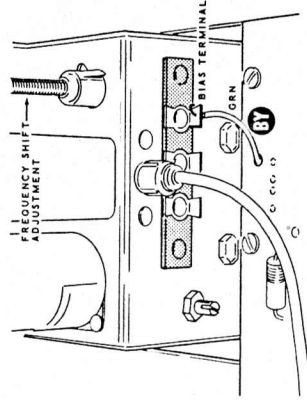
Refer to Pictorial 14 for the following steps.

- () Route the white wire from the grommet to point 12 (S-1) on the audio circuit board.
- () Route the red wire from the grommet to point 19 (S-1) on the bandpass circuit board.
- () Route the green wire from the grommet to point BY on the bandpass circuit board, and pass it up through the hole. It will be connected later.
- () Route the coaxial cable center conductor to point G on the bandpass circuit board. Form a small hook around the lead of the 56 Ω resistor that protrudes from the circuit board at this point. Then solder both the resistor lead and coaxial cable center conductor to the circuit board. Cut off the excess resistor lead.

() Twist the shield wires of the coaxial cable together tightly. Then solder the shield to the circuit board at YY. Make sure the shield cannot touch other foils or wires.

NOTE: One or two turns of electrical tape may be added as shown in the Pictorial to hold the red wire and the coaxial cable to the wiring harness.

- () Turn the Transceiver right-side up.
- () Refer to Detail 14A and connect the green wire from hole BY to the Bias terminal of the LMO (S-1). NOTE: This makes a total of three wires soldered to this terminal.

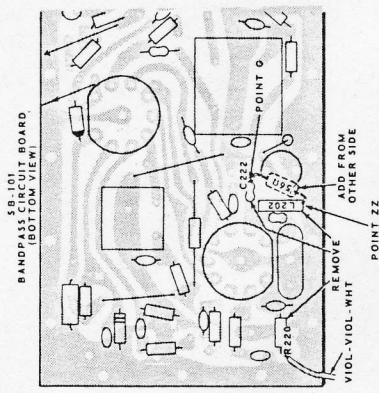


Detail 14A

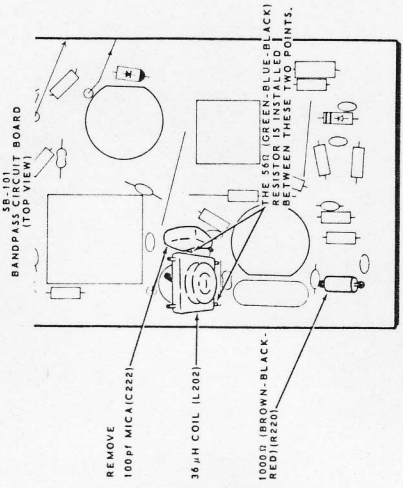
NOTE: A partial schematic, showing circuitry of the SB-101 after modification, is shown in Figure 1 (fold-out from Page 26).

This completes the modification of the Model SB-101 Transceiver. Carefully inspect all the connections that were just made for loose wires or unsoldered connections.

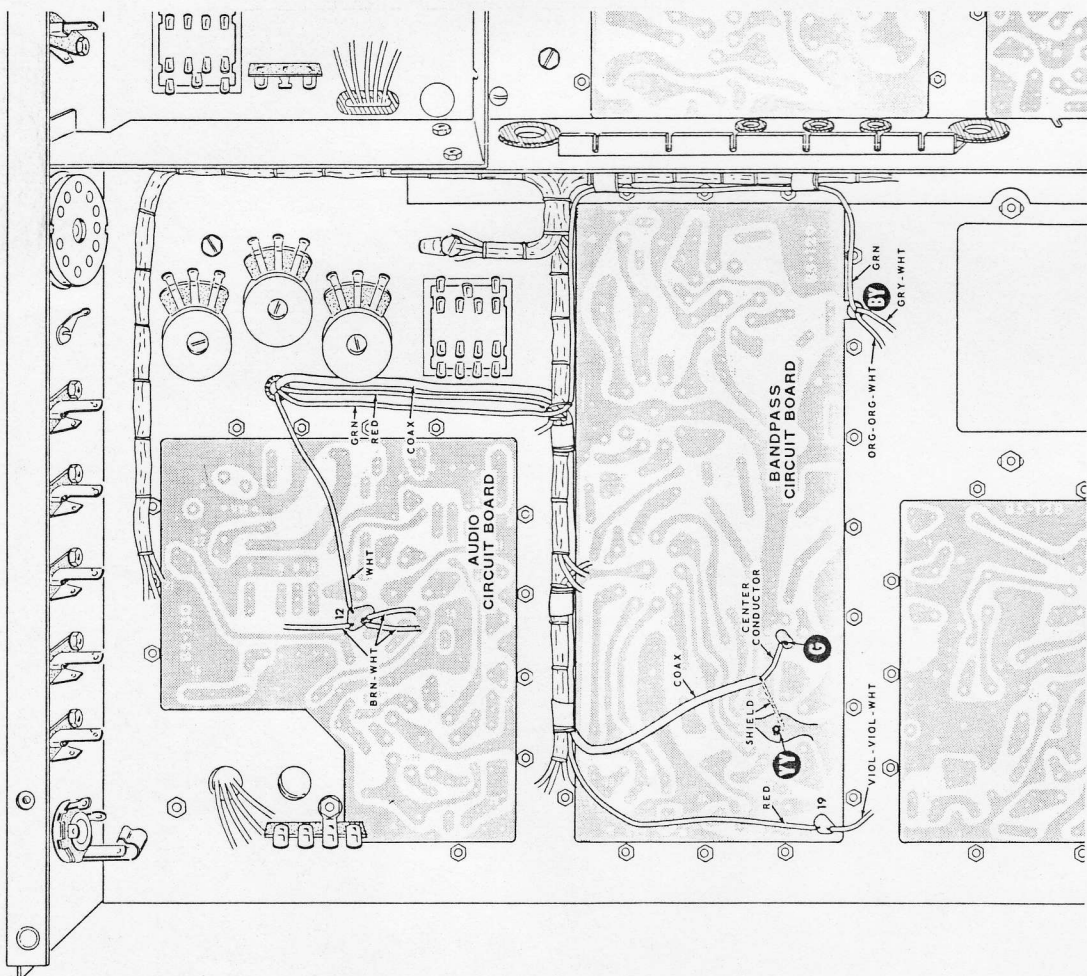
- () Replace the Transceiver in its cabinet. Proceed to the Test section.



PICTORIAL 13



DETAIL 13A



PICTORIAL 14

TEST

INITIAL CHECKS

Turn the External LMO bottom-side up and make the following resistance checks. The readings shown were made with a vacuum tube voltmeter having an input resistance of 11 megohms, Voltage readings may be lower if a volt-ohm-milliammeter is used.

Plug the connecting cable into the External LMO only, and make the following resistance checks between the chassis and the test point indicated. If your resistance readings vary more than $\pm 20\%$ from those given below, refer to the In Case of Difficulty section of the Manual on Page 31.

TEST POINT	RESISTANCE
() V1, pin 1	68 K Ω
() V1, pin 2	0 Ω
() V1, pin 3	Infinity*
() V1, pin 5	Infinity

*With one pilot lamp removed.

ADJUSTMENT

DIAL CALIBRATION

- () Turn the FREQ CONTROL switch on the SB-101 front panel to LOCKED NORMAL.
- () Tune your transceiver to the calibrator signal at 3.7 MHz, and peak the DRIVER PRESELECTOR for maximum S-meter reading.
- () Turn the MODE switch to USB.
- () Turn the FREQ CONTROL switch to LOCKED AUX. The red panel light should glow.

RESISTANCE

TEST POINT	RESISTANCE
() V1, pin 6	Infinity
() V1, pin 7	100 Ω
() Connector, coaxial cable center conductor pin	.3 Ω
() Connector, coaxial cable shield pin	0 Ω
() Connector, black wire pin	0 Ω
() Connector, green wire pin	13 K Ω or more (diode)

- () Turn the External LMO right-side up.
- () Insert the 6AU6 tube in its socket.
- () Plug the free end of the connecting cable into the socket you installed on the SB-101 Transceiver.
- () Turn on the Transceiver and let it warm up. Make a visual check that the tube filaments and the two dial lamps are lighted. Then proceed to the Adjustment section.

- () Tune the External LMO to 3,700 MHz. Check for the calibrate signal and set the Zero Set dial. If the hairline is not close to the window center, proceed with the following steps.
- () Remove the knob from the Main Tuning shaft of the External LMO without disturbing the zero beat setting.
- () Place a screwdriver through the hole in the dial escutcheon (directly above the main tuning shaft) and into the LMO dial drive shaft.



- () Hold the LMO dial drive shaft on zero beat and loosen the setscrew in the circular dial. Turn the circular dial until the 0 is directly behind the line on the zero set dial. Now retighten the setscrew in the circular dial.
- () Make sure the circular dial turns freely and the nylon spiral follower is properly engaged in the spiral groove before proceeding.
- () Replace the knob on the Main Tuning shaft.

LMO SHIFTER ADJUSTMENT

- () Tune your transceiver to 3.7 MHz and peak the DRIVER PRESELECTOR for maximum S-meter reading.
- () Turn the FREQ CONTROL switch to the LOCKED AUX position.
- () Set the FUNCTION switch to CAL.

- () Turn the MODE switch to USB, and tune the External LMO MAIN TUNING dial to 3,700 MHz, zero beating the calibrator signal.
- () Turn up the AF Gain to hear slow beats.

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

- () Turn the Frequency Shifter adjustment screw on the External LMO (see Detail 14A) for an exact zero beat in the LSB mode.
- () Recheck the zero beat in the USB mode to be certain of the adjustment. Repeat the procedure if necessary.

CRYSTAL ADJUSTMENT

Crystal frequencies may be adjusted within narrow limits by using the trimmer capacitors provided on the rear apron. This adjustment is required only if you plan to crystal control your Transceiver as you might do, for example, when operating on a net frequency.

Crystals are not supplied with the External LMO, nor are they available from the Heath Company. Before using or buying a crystal for this use, read the Special Crystal Information on Page 30.

- () Place the LMO-XTAL switch of the External LMO at XTAL.
- () Plug in a crystal and turn the Crystal switch to the correct position.

- () Position the Transceiver switches as follows:

FREQ CONTROL switch: at either AUX position.
LEVEL control: fully counterclockwise.
MODE switch: at TUNE.

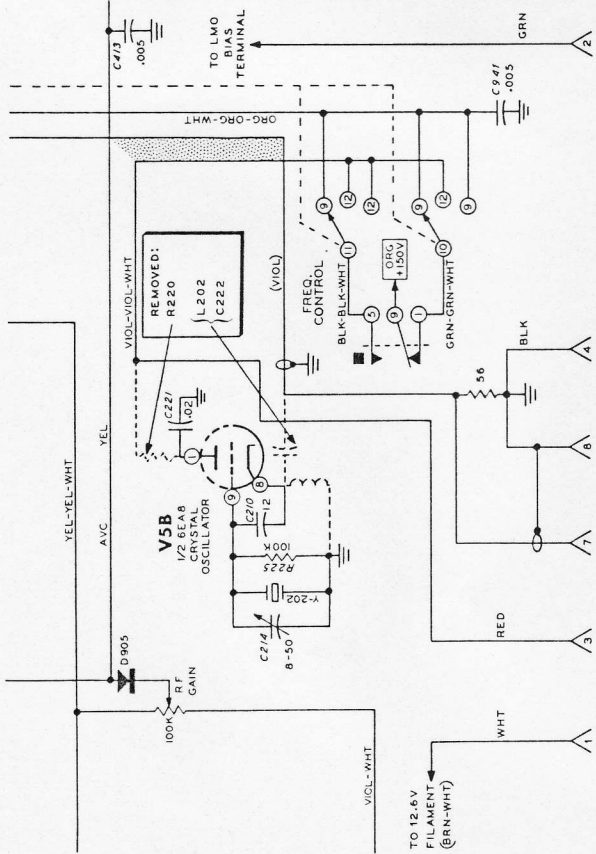
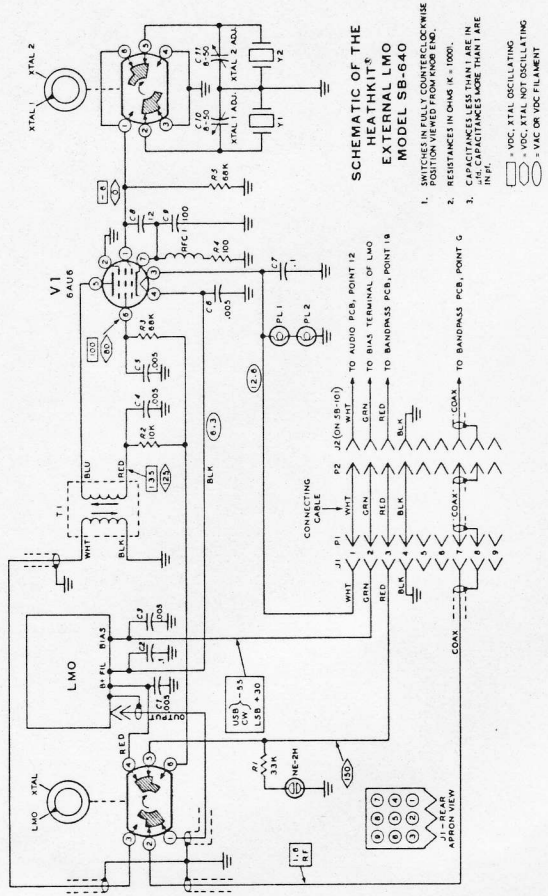
- () Use a dummy load and tune the Transceiver for maximum output. Reduce the LEVEL control to the point where there is just enough output to obtain a useable indication on the REL PWR meter.

- () Insert the alignment tool that was furnished with the kit into the top of transformer T1 in the External LMO. Turn the tool slowly back and forth until it engages the core of the transformer.

- () Slowly rotate the core for maximum indication on the REL PWR meter. Then withdraw the alignment tool.

NOTE: If you plan to use more than one crystal, repeat the adjustment for REL PWR indication for each crystal. If the crystals are separated far enough in frequency to make a significant difference in the power output indication, adjust the core of transformer T1 for the highest average output. Crystals separated in frequency by more than 500 kHz should not be used due to the bandpass width of the Transceiver.

This completes the Tests.



REVISED SB-101 CIRCUITRY AFTER MODIFICATION FOR USE WITH SB-640

FIGURE 1

FINAL ASSEMBLY

- Refer to Figure 2 for the following steps.
- () Install 6-32 x 1/2" screws through holes CB and CC into the rear lip of the chassis.
 - () Install plastic feet at the two rear corners of the cabinet. For each foot, use a 6-32 x 1/2" screw, a #6 lockwasher, and a 6-32 nut.
 - () Slide the chassis into the cabinet from the front.
 - () Carefully turn the cabinet and chassis over, while holding the chassis in place.
- This completes the assembly of your External LMO.

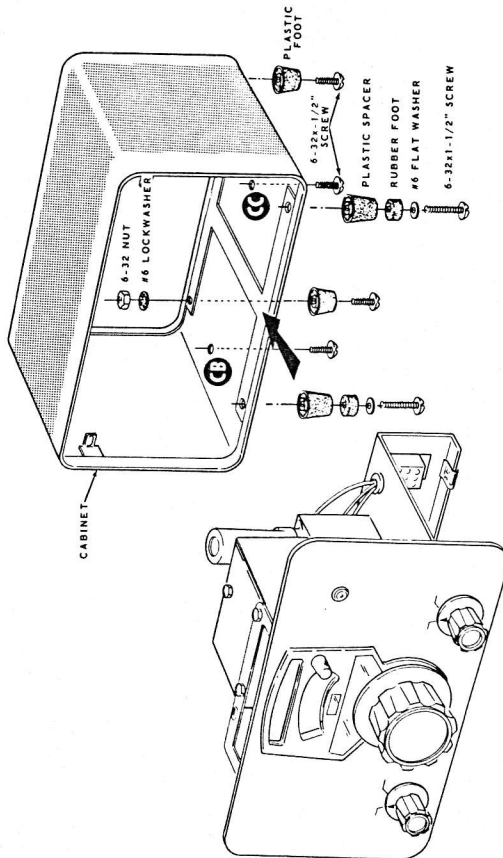


Figure 2

OPERATION

The External LMO will provide either a variable (LMO) or a crystal oscillator signal to the SB-101 Transceiver. The crystal oscillator has provision for two different crystals.

FREQUENCY CONTROL

The Frequency Control switch on the Transceiver selects the frequency controlling source. In the Locked Normal position, the LMO in the Transceiver controls the transceiver frequency as it did before the modification. In the Locked AUX position, the External LMO controls the transceiver frequency. Then either an LMO signal or either of two crystal frequencies may be switch-selected.

In the Unlocked AUX position, the Transceiver's LMO governs the receiving frequency. The transmitting frequency is then either LMO or

crystal-controlled by the External LMO, whose red panel light is illuminated whenever it is controlling the frequency.

The internal crystal in the Transceiver cannot be used after the External LMO is installed. If a crystal has been used previously, it should now be transferred to one of the crystal sockets in the External LMO. Then refer to the Crystal Adjustment section of this Manual (Page 27). Before purchasing or installing a crystal, refer to Special Crystal Information on Page 30.

The frequency control of the mated SB-101 Transceiver and the SB-640 External LMO is accomplished as follows. A dash in a column means that the setting of this switch, in this case, will have no effect on Transceiver operation.

SB-101 FREQ CONTROL SWITCH	SB-640 LMO-XTAL SWITCH	OPERATION
1. LOCKED NORMAL	-	Transceives on SB-101 LMO.
2. LOCKED AUX	LMO	Transceives on SB-640 LMO.
3. LOCKED AUX	XTAL	Transceives on SB-640 crystals.
4. UNLOCKED AUX	LMO	Transmits on SB-640 LMO and receives on SB-101 LMO.
5. UNLOCKED AUX	XTAL	Transmits on SB-640 crystal and receives on SB-101 LMO.

Whenever the External LMO is controlling the frequency in use, its red panel light will be On. Thus, in conditions 4 and 5 above, the red light will be On while transmitting and Off when receiving. Under conditions 2 and 3 above, the red light will remain On.

FREQUENCY CONSIDERATIONS

The DRIVER PRESELECTOR tunes the same circuits for both transmit and receive. Therefore, when you operate with the Transceiver FREQ CONTROL switch in the UNLOCKED AUX position, it is recommended that the Transceiver be tuned for "peak" output using the External LMO to determine the transmitting frequency. Then the Transceiver LMO will select the receiving frequency.

The following table shows how many kHz above or below the "peaked" transmitting frequency you can receive in the UNLOCKED AUX position before you have a loss of 3 db in the received signal. Maximum permissible deviation is governed by the strength of the received signal; if the signal is strong enough, it will overcome the losses.

BAND (MHz)	kHz BELOW PEAK	kHz ABOVE PEAK
3.5	15	50
7	20	100
14	50	200
21	100	300
28-29.5	200	400

SPECIAL CRYSTAL INFORMATION

Because of the steep-sided characteristics of SB-101 Bandpass filter T202, crystal operation of the Transceiver is limited to approximately 25 kHz outside of each band. Crystal frequencies must be between 4975 and 5525 kHz. NOTE: Crystals at the transmitter output frequency, or sub-multiples thereof, cannot be used because of the heterodyne circuitry in the SB-101.

Refer to Frequency Considerations in the Operations section for the maximum permissible deviation between transmitting and receiving frequencies.

Use the following formulas to help select the crystal frequency for the sideband to be used, or for CW operation. The examples below are for one of the MARS channels located at 7,305 MHz.

For USB and compatible USB-CW operation:

$$f_{x(USB)} = f_h - f_m - 3.3964$$

For LSB operation:

$$f_{x(LSB)} = f_h - f_m - 3.3936$$

For CW Net operation:

$$f_{x(CW)} = f_h - f_m - 3.3954$$

Definition of terms:

f_x = Crystal frequency in MHz.

f_h = heterodyne crystal frequency, different for each band.

BAND	f_h
3.5	12,3950
7.0	15,8950
14.0	22,8950
21.0	28,8950
28.0	36,8950
28.5	37,3950
29.0	37,8950
29.5	38,3950

f_m = carrier frequency of desired SSB operation, further specified by LSB or USB designations. This is the operating frequency for SSB.

f_n = exact transmitter frequency for CW Nets. Use this where CW only is used on a specific frequency. This operation is not compatible with USB operation, as the receiving station would have to retune his receiver 1 kHz lower to receive SSB, and this would be impossible if he were crystal controlled.

Example: Mars SSB on USB at 7,305 MHz.

$$f_{h(7.0)} = 15.8950$$

$$f_{m(USB)} = 7.3050$$

$$8.5900$$

$$f_{x(USB)} = 3.3964$$

$$5.1936$$

CAUTION: Always be sure to use the correct heterodyne crystal frequency.

When purchasing crystals, specify the frequency and the following characteristics:

Operation Mode - Fundamental.

Tolerance - .01%.

Holder - HC-6/U

Pin Diameter - .050".

Pin Spacing - .486.

Load Capacity (C.) - 32 pf.

Internal Capacity (C_o) - 7 pf maximum.

Series Resistance (R₁) - 25 Ω maximum.

Drive Level - 10 milliwatts.

The trimmer capacitors next to Y1 and Y2 (FREQUENCY ADJUST) can be adjusted for an exact MARS or Net frequency.

NOTE: Because of the manufacturing tolerances of the heterodyne crystals, the heterodyne crystal frequencies may be in error by as much as 1500 Hz. For critical applications, therefore, it will be advisable to measure the heterodyne crystal frequencies exactly to obtain correct values of f_h for the above formulae.

To measure the heterodyne oscillator frequency, connect a frequency counter or frequency meter through a small capacitor to pin 7 of V11. Leave the Transceiver in the receive mode, with the FREQ CONTROL switch in the LOCKED AUX position, the RF GAIN control set to maximum counterclockwise, the FUNCTION switch at PTT and the MODE switch at LSB.

Compatible USB-CW operation is used in some MARS Nets. In this service, a channel is specified which is wide enough for only one sideband. The carrier frequency is specified at the lower edge of the channel, and CW transmission is 1 kHz higher than the carrier frequency. This 1 kHz offset then produces a 1 kHz beat note in the receivers set to USB or CW without any tuning. Either USB or CW can then be transmitted or received.

When using auxiliary crystal control, switching modes will cause the transmitting frequency to change, except for compatible USB-CW operation. Therefore, care must be taken to avoid out-of-band operation by inadvertently switching to the wrong mode or crystal.



IN CASE OF DIFFICULTY

1. Recheck the wiring. Trace each lead in colored pencil on the Pictorial as it is checked. Have a friend check your work. Someone who is not familiar with the unit may notice something that is overlooked by the builder.
2. About 90% of the kits that are returned for repair do not function properly due to poor connections and soldering. Therefore, many troubles can be eliminated by reheating all connections to make sure that they are soldered as described in the Soldering section of the Kit Builders Guide.
3. Check the tubes with a tube tester, or by substitution of tubes of the same types that are known to be good. Be sure the tube filaments light up properly.
4. Check the values of the parts. Be sure that the proper part has been wired into the circuit, as shown in the pictorial diagrams and as called out in the wiring instructions.
5. Check for bits of solder, wire ends or other foreign matter which may be lodged in the wiring.
6. If, after careful checks, the trouble is still not located and a voltmeter is available, check voltage readings against those shown on the Schematic Diagram. NOTE: All voltage readings were taken with an 11 megohm input vacuum tube voltmeter. Voltages may vary as much as $\pm 10\%$.
7. An ohmmeter can be used to check continuity of circuits through switches, plugs, jacks, and soldered connections. Connect the ohmmeter between the points of interest and set it on a scale which will give a reading at about the center of the scale for circuits containing resistance; for circuits containing little or no resistance, set the ohmmeter on the lowest scale. By operating switches and wiggling wires, connections, and connectors, any deviations from normal can be observed and investigated.
8. A review of the Circuit Description will help indicate where to look for the trouble.
9. Refer to the Kit Builders Guide for service and warranty information.



SPECIFICATIONS

Frequency Output, LMO.....	5 to 5.5 MHz.
Frequency Output, Crystal.....	4.975 to 5.525 MHz.
Frequency Stability*.....	Less than 100 Hz per hour after 20 minutes warmup from normal ambient conditions, Less than 100 Hz for $\pm 10\%$ line voltage variations.
Visual Dial Accuracy*.....	Within 200 Hz on all bands.
Electrical Dial Accuracy*.....	Within 400 Hz after calibration at nearest 100 kHz point.
Dial Mechanism Backlash*.....	Less than 50 Hz.
Front Panel Controls.....	Main (LMO) Tuning dial, LMO/XTAL switch, Crystal Selector switch-XTAL 1/XTAL 2.
Panel Light.....	ON when transmitting or transceiving frequency is controlled by External LMO.
Rear Apron Facilities.....	Connector to SB-101, Frequency Adjust trimmers XTAL 1 and XTAL 2.
Power Requirements (from SB-101 Transceiver).....	150 VDC at 5 ma, 12.6 VAC at 450 ma.
Cabinet Dimensions.....	6-5/8" high (plus feet) x 10" wide x 11-3/8" deep (including knobs).
Net Weight.....	5-1/4 lbs.

*Identical to the same specification in the SB-101 Transceiver.

The Heath Company reserves the right to discontinue instruments and to change specifications at any time without incurring any obligation to incorporate new features in instruments previously sold.

CIRCUIT DESCRIPTION

Refer to the Schematic Diagram (fold-out from Page 26) while reading the following Circuit Description.

The External LMO is composed of a variable oscillator (LMO) and a crystal oscillator. All operating voltages for these circuits are obtained from the SB-101 Transceiver through the connecting cable. The output of the External LMO is coupled to the Transceiver through a coaxial cable.

The LMO-XTAL switch on the External LMO connects the B+ and the output coaxial cable to either the linear master oscillator or the crystal oscillator circuit. The output signal is then fed as the injection frequency to the first transmitter mixer and the second receiver mixer of the SB-101 Transceiver. Whenever the B+ line from the Transceiver is activated, voltage is fed to the NE-2H neon lamp. Therefore, this lamp glows whenever the External LMO is controlling the frequency.

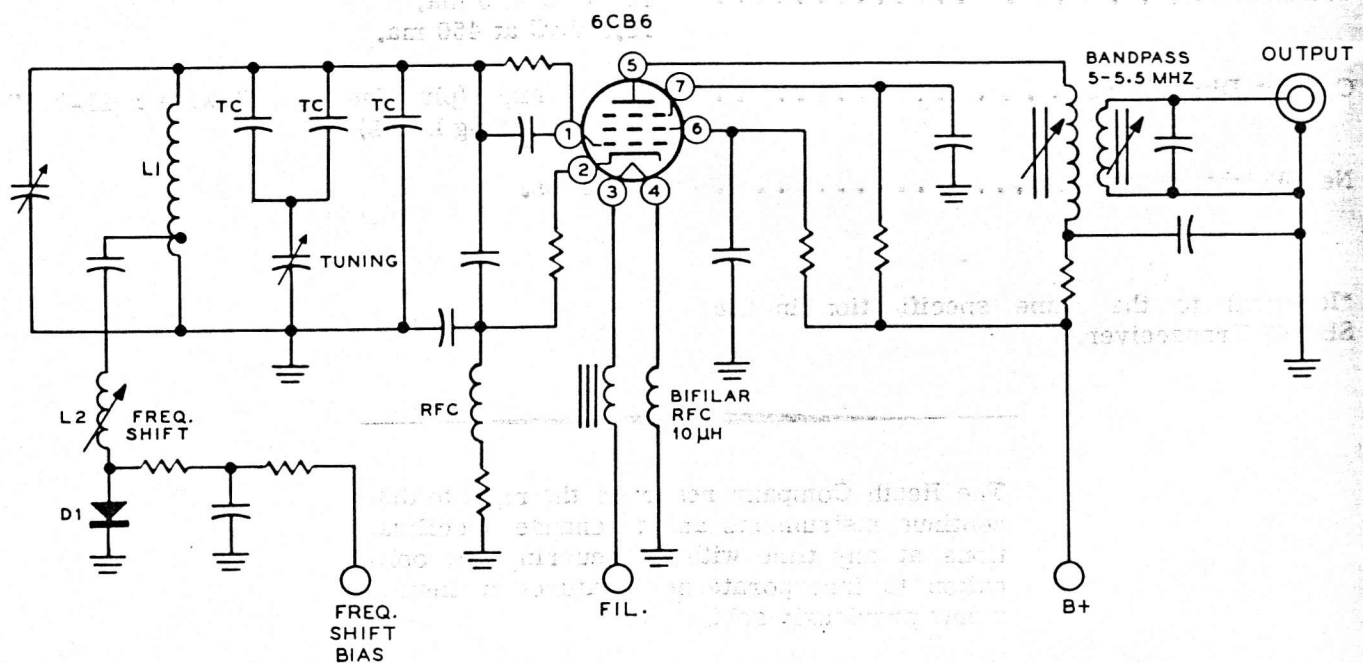
Crystal oscillator tube V1 is connected as a Colpitts oscillator, and either of two crystals (not furnished) may be switched into its grid

circuit. Each crystal is provided with a trimmer capacitor for minor frequency adjustment. Transformer T1 couples the output of V1 (through pins 3 and 2 of the LMO-XTAL switch) to the cathodes of first transmitter mixer V5A and second receiver mixer V12A in the SB-101 Transceiver. The output of the LMO is routed through pins 1 and 2 of the LMO-XTAL switch in a like manner to the Transceiver.

The LMO used in the External LMO is the same as the one used in the SB-101 Transceiver. It uses a parallel-tuned Colpitts circuit with temperature compensating capacitors (marked "TC"). Figure 3 shows the essential parts of the LMO.

A bandpass filter is included in the LMO to suppress undesired frequencies. The bifilar-wound RF choke in the filament circuit of the oscillator adds isolation stability.

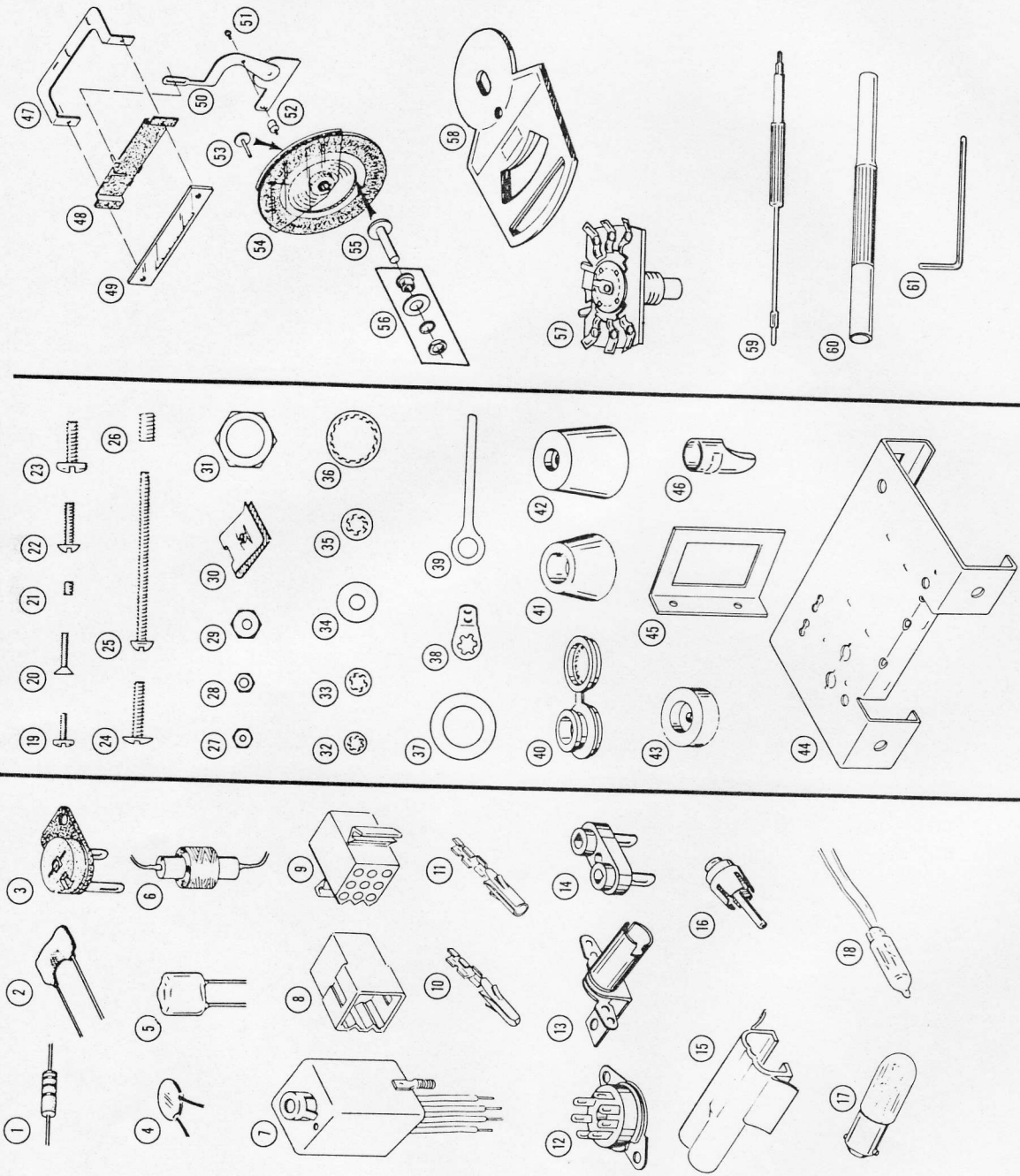
Coil L2 is placed in parallel with a portion of L1 to secure the necessary frequency shift between upper and lower sidebands. Application of the proper bias to diode D1 causes it to act as a switch and to open or close the circuit from L2 to ground.



LMO SCHEMATIC

Figure 3

PARTS PICTORIAL



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