Assembly and Operation of the

REMOTE VFO

MODEL SB-644

HEATH COMPANY
BENTON HARBOR, MICHIGAN 49022

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INTRODUCTION

The Heathkit SB-644 Remote VFO is an all-solid-state variable oscillator. It was designed in the new, modern Heathkit SB-series style specifically as an accessory to the Heathkit SB-104 Transceiver, and it may be used with the SB-104 Transceiver in a number of operating modes.

Simple, front panel switches select the desired mode of operation with the SB-104 Transceiver. You can transceive using the Remote VFO frequencies, receive using the Remote VFO while transmitting on the Transceiver, transmit using the Remote VFO while receiving on the Transceiver, transceive with the Transceiver only, or select either of two Remote VFO crystal frequencies with any of the preceding operations. The operating frequency is always displayed on the Transceiver readout.

While the Transceiver provides complete 80-to 10-meter band coverage, the Remote VFO allows complete coverage within any selected amateur band. The same 36:1 vernier drive as found in the SB-104 makes pinpoint spotting of any desired frequency an easy operation.

Other features include: excellent stability, freedom from excessive dial backlash, and lack of internal power circuits (all power comes from the SB-104 Transceiver).

The Remote VFO is a worthwhile addition to any ham shack and will provide many hours of enjoyment during which you can work DX stations, in split-frequency operation, that might otherwise be inaccessible. Also, its up-to-date styling permits the VFO to blend in with your other ham shack equipment.

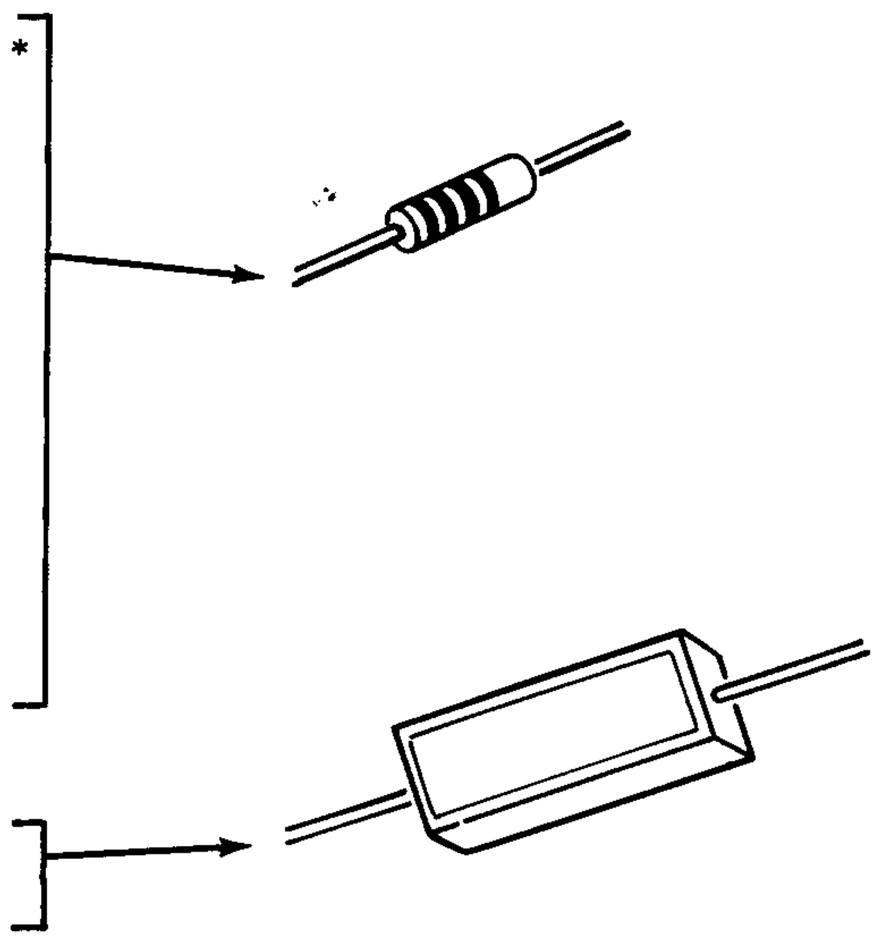
Read the "Kit Builders Guide" for complete information on unpacking, parts identification, tools, wiring, soldering, and step-by-step assembly procedures.

SWITCH CIRCUIT BOARD

PARTS LIST

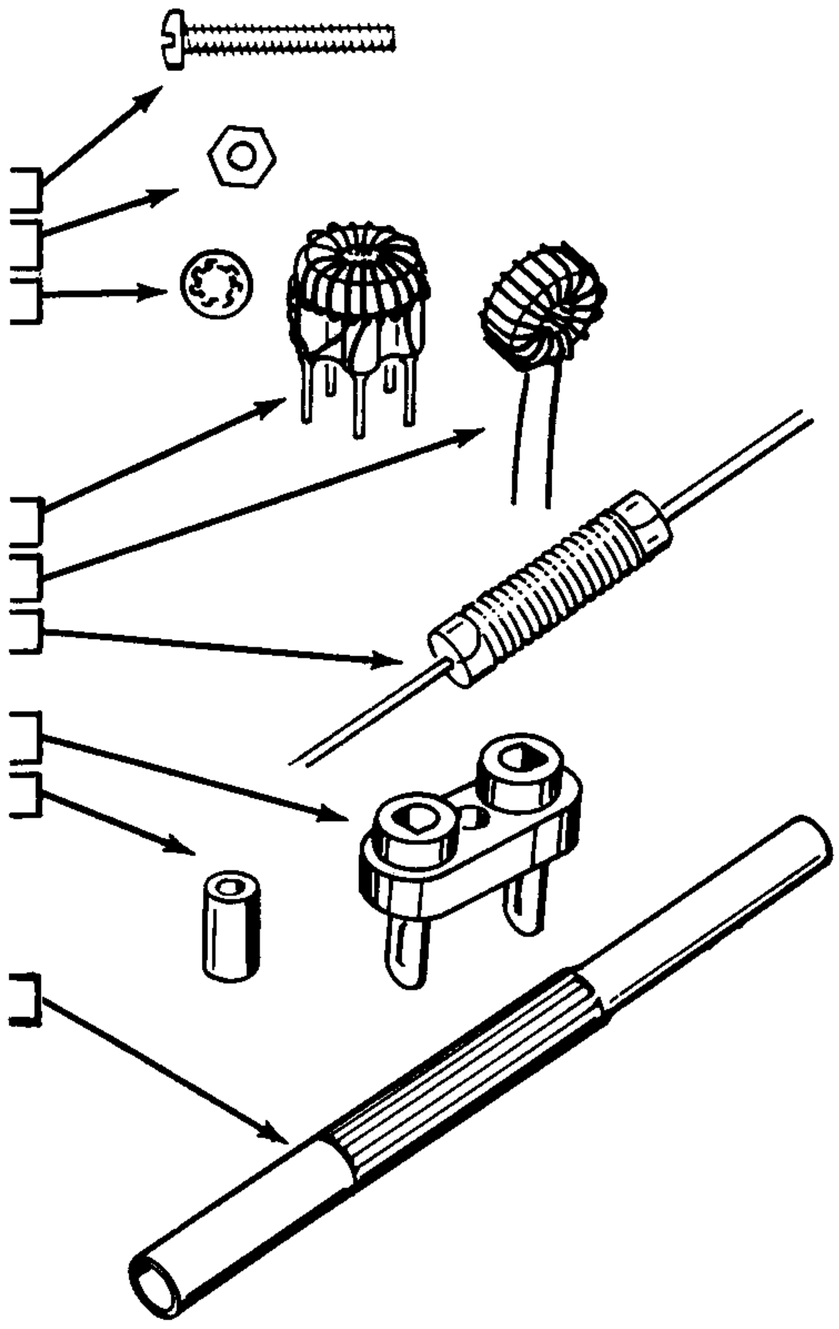
Remove the parts from Pack #1 and check each part against the following list. Make a check (✓) in the space provided as each part is identified. Any part that is packed in an individual envelope with the part number on it should be placed back in the envelope after it is identified until it is called for in a step. Do not throw away any packing materials until all parts are accounted for.

	QTY.	DESCRIPTION	PART No.	CIRCUIT Component No.	PRICE Each
RESISTORS					
NOTE: A fourth color band of silver indicates 10% tolerance; a fourth band of gold indicates 5% tolerance.					
1/2-Watt					
( )	6	100 Ω (brown-black-brown)	1-3	R1251, R1252, R1253, R1256, R1265, R1266	
( )	1	680 Ω, 5% (blue-gray-brown-gold)	1-52	R1261	
( )	2	1000 Ω (brown-black-red)	1-9	R1258, R1264	
( )	1	3300 Ω (orange-orange-red)	1-14	R1262	
( )	1	4700 Ω (yellow-violet-red)	1-16	R1254	
( )	2	22 kΩ (red-red-orange)	1-22	R1255, R1263	
Other Resistors					
( )	2	110 Ω, 5-watt, wire-wound	3-10-5	R1257, R1259	*

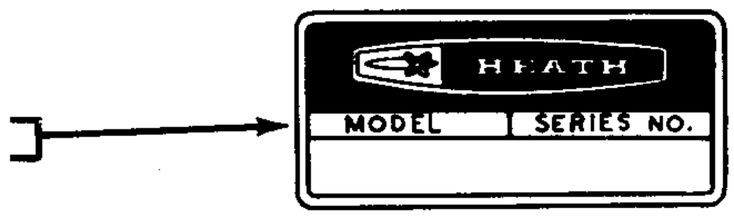


*Write to Heath Company for price information.

QTY.		DESCRIPTION	PART No.	CIRCUIT Component No.	PRICE Each
#3 Hardware					
( )	2	3-48 x 1/2" screw	250-201		
( )	2	3-48 nut	252-1		
( )	2	#3 lockwasher	254-7		
MISCELLANEOUS					
( )	1	2.3 μH toroid coil	40-1608	L1251	
( )	1	3.7 μH toroid coil	40-1684	L1252	
( )	1	RF choke	45-62	RFC1251	
( )	1	Circuit board	85-1471-2		
( )	2	Crystal socket	434-74	Y1, Y2	
( )	1	Ferrite bead	475-10	FB1251	
( )	1	Nut starter	490-5		
( )		Solder (NOTE: Additional 3' rolls of solder, #331-6, can be ordered for 25 cents each.)			
PRINTED MATERIAL					
( )	1	Blue and white label	391-34		
( )	1	Parts Order Form	597-260		
( )	1	Kit Builders Guide	597-308		
( )	1	Manual (See front cover for part number.)			



NOTE: Be sure you refer to the numbers on the blue and white label in any communications you may have about this kit with Heath Company. You may want to write the model and series numbers in this sample for a future convenience.



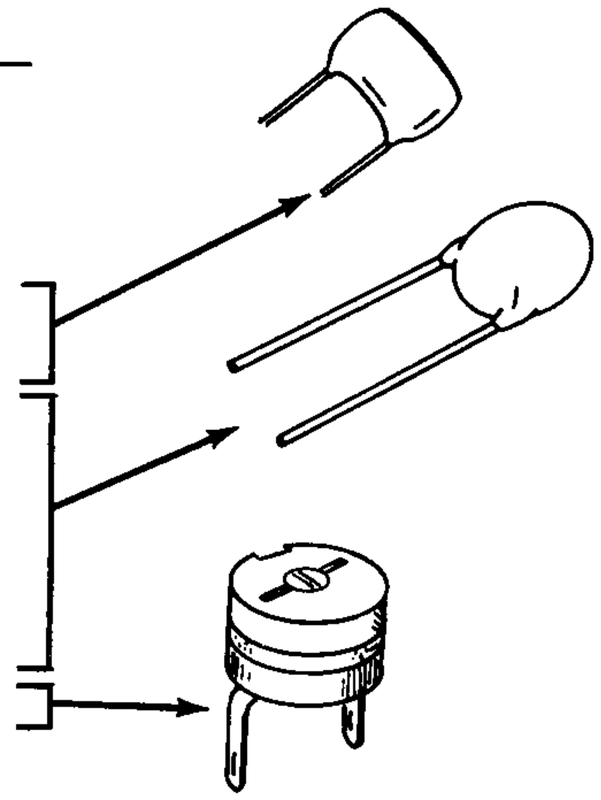
The above prices apply only on purchases from the Heath Company where shipment is to a U.S.A. destination. Add 10% (minimum 25 cents) to the price when ordering from a Heathkit Electronic Center to cover local sales tax, postage, and handling. Outside the U.S.A. parts and service are available from your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

To order a replacement part, use the Parts Order Form furnished with this kit. If a Parts Order Form is not available, refer to "Customer Service" inside the rear cover of this Manual.

QTY.	DESCRIPTION	PART No.	CIRCUIT Component No.	PRICE Each

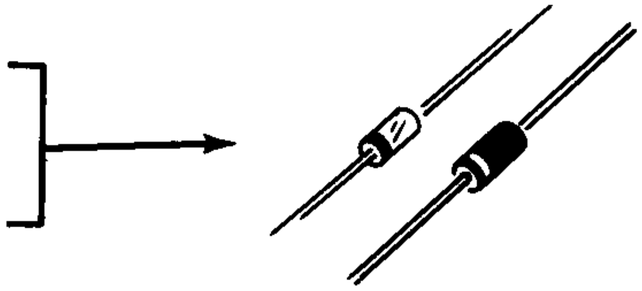
CAPACITORS

( )	1	330 pF mica	20-139	C1259
( )	1	620 pF mica	20-167	C1264
( )	1	33 pF disc	21-155	C1254
( )	2	.001 µF disc	21-140	C1261, C1262
( )	4	.005 µF disc	21-46	C1251, C1252, C1255, C1263
( )	2	.05 µF disc	21-143	C1253, C1258
( )	2	8-50 pF trimmer	31-36	C1256, C1257



DIODES-TRANSISTORS

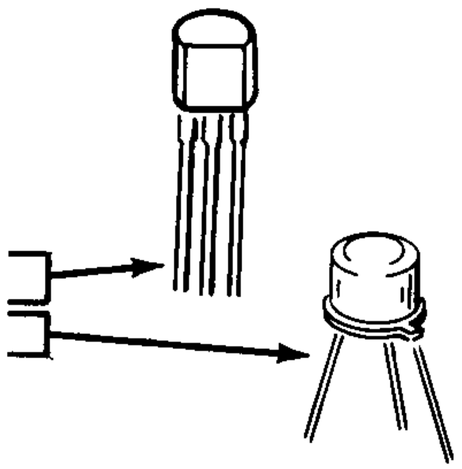
( )	10	GE-S127 diode	56-28	D1251 thru D1261
( )	1	1N4149 diode	56-56	D1262



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

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

( )	3	2N3643 transistor	417-233	Q6, Q7, Q9
( )	1	SGC5283 transistor	417-270	Q8



STEP-BY-STEP ASSEMBLY

START

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

( ) R1266: 100 Ω (brown-black-brown).

( ) R1256: 100 Ω (brown-black-brown).

( ) R1254: 4700 Ω (yellow-violet-red).

( ) R1255: 22 kΩ (red-red-orange).

( ) R1261: 680 Ω (blue-gray-brown).

( ) R1262: 3300 Ω (orange-orange-red).

( ) R1263: 22 kΩ (red-red-orange).

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

( ) R1251: 100 Ω (brown-black-brown).

( ) R1252: 100 Ω (brown-black-brown).

( ) R1253: 100 Ω (brown-black-brown).

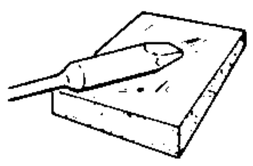
( ) R1264: 1000 Ω (brown-black-red).

( ) R1258: 1000 Ω (brown-black-red).

( ) R1265: 100 Ω (brown-black-brown).

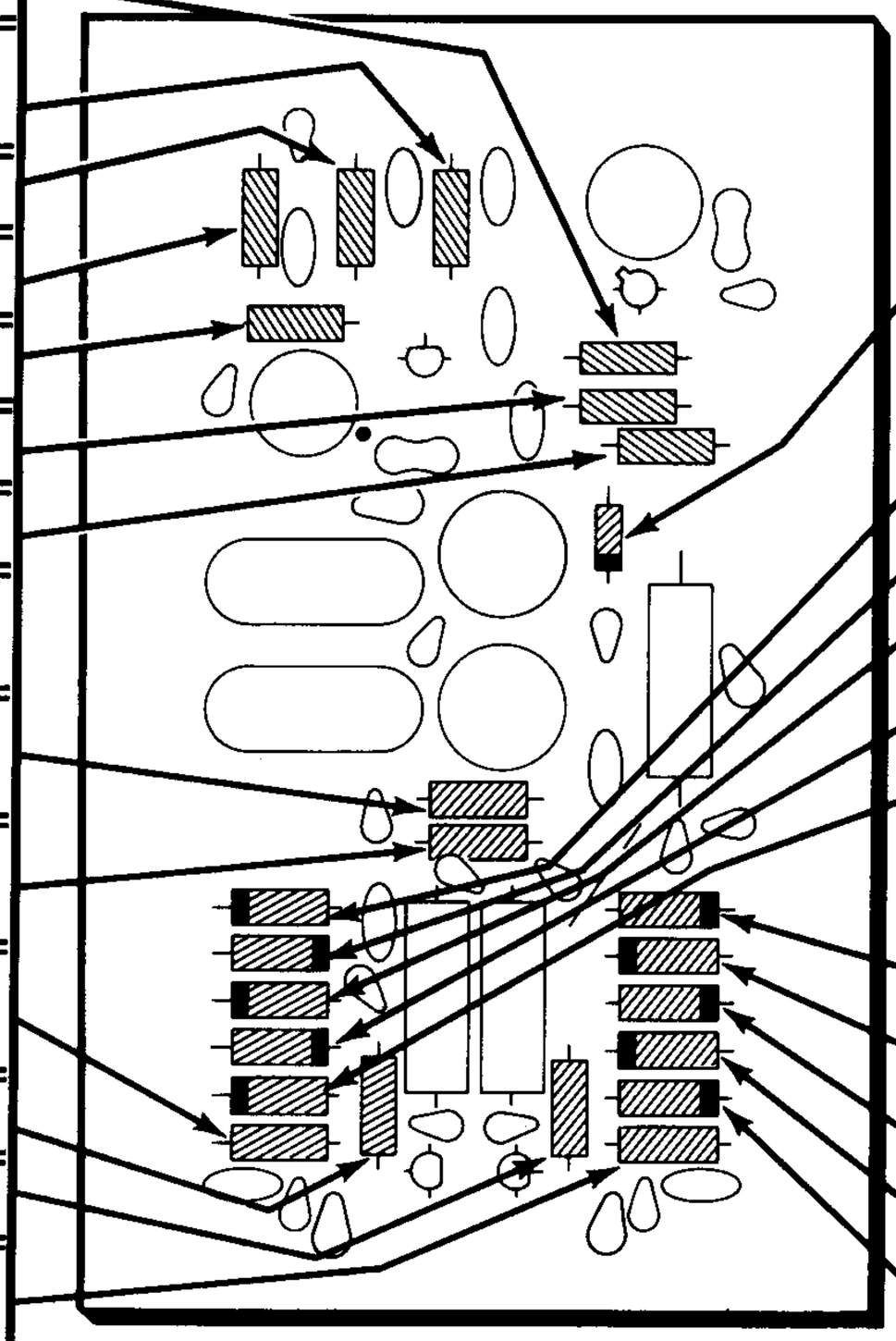
FOR GOOD SOLDERED CONNECTIONS, YOU MUST KEEP THE SOLDERING IRON TIP CLEAN...

WIPE IT OFTEN WITH A DAMP SPONGE OR CLOTH.



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

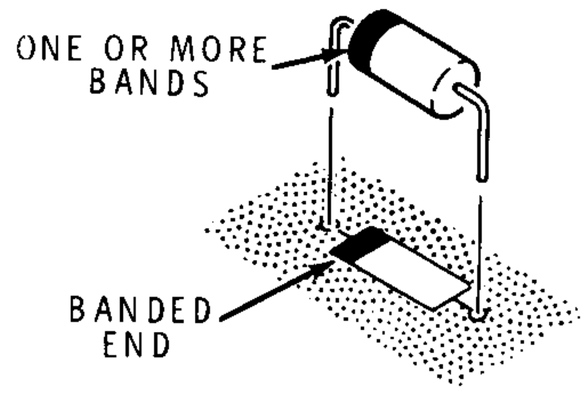
( ) Solder the leads to the foil and cut off the excess lead lengths. Save a few of the cutoff resistor leads for use later.



PICTORIAL 1-1

CONTINUE

NOTE: When you install diodes, as in the following steps, be sure you position the banded end of the diode as shown on the circuit board.



( ) D1262: 1N4149 diode (#56-56).

NOTE: Install ten GE-S127 diodes (#56-28) in the following steps.

( ) D1261.

( ) D1259.

( ) D1258.

( ) D1257.

( ) D1256.

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

( ) D1255.

( ) D1254.

( ) D1253.

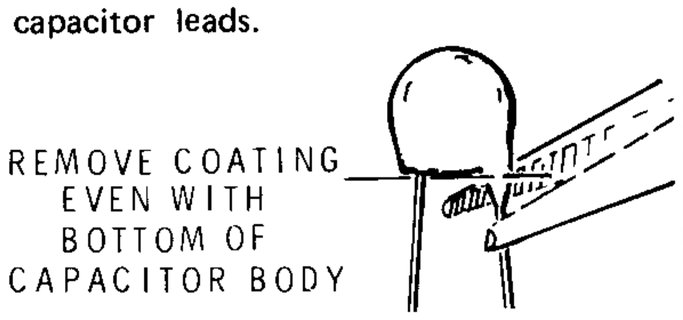
( ) D1252.

( ) D1251.

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

START

NOTE: Before you install the following disc capacitors, use long-nose pliers to remove the excess insulation from the capacitor leads.



( ) C1258: .05 μF disc.

( ) C1254: 33 pF disc.

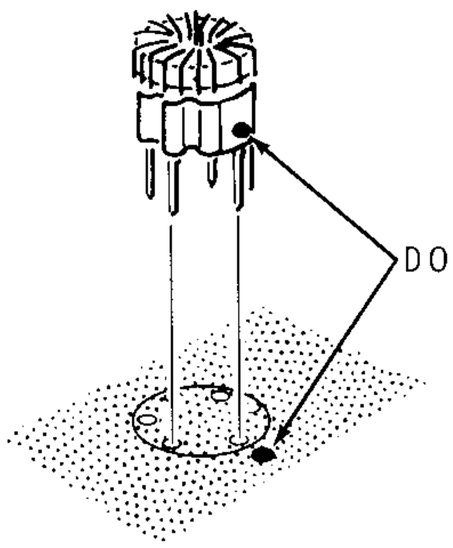
( ) C1253: .05 μF disc.

( ) C1261: .001 μF disc.

( ) C1262: .001 μF disc.

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

( ) L1251: 2.3 μH toroid coil (#40-1608). Position the dot on the coil at the dot on the circuit board. Then solder all six leads to the foil.



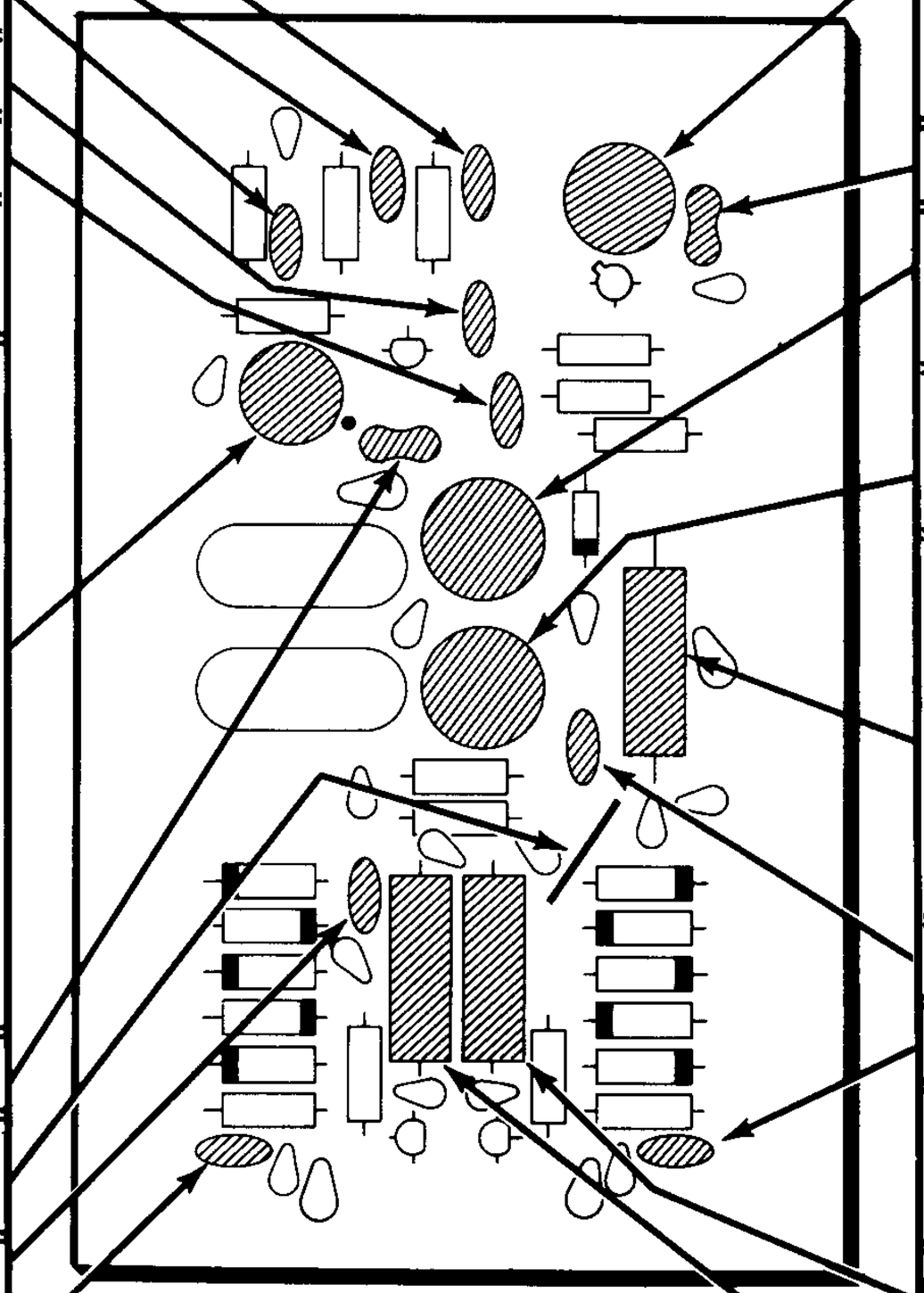
( ) C1259: 330 pF mica.

( ) 1" bare wire at "J." Use a cutoff resistor lead.

( ) C1252: .005 μF disc.

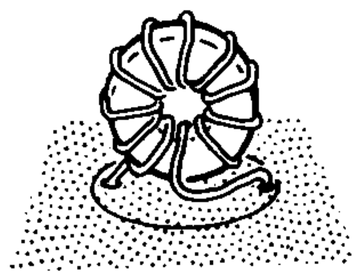
( ) C1255: .005 μF disc.

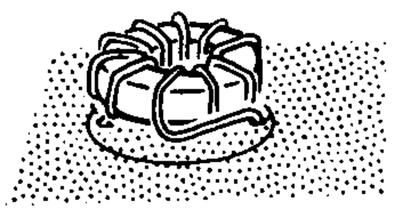
( ) Solder the leads to the foil and cut off the excess lead lengths.



CONTINUE

( ) L1252: 3.7 μH toroid coil (#40-1684). Push the coil leads through the circuit board holes as shown. Then press the coil down onto the surface of the circuit board. Solder the leads to the foil and cut off the excess lead lengths.



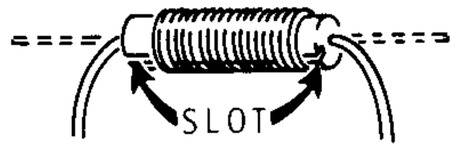


( ) C1264: 620 pF mica.

( ) C1256: 8-50 pF trimmer. Solder the lugs to the foil and cut off the excess lead lengths.

( ) C1257: 8-50 pF trimmer. Solder the lugs to the foil and cut off the excess lead lengths.

( ) RFC1251: RF choke (#45-62). To avoid damage to the choke, bend the leads toward the slots in the coil form.



( ) C1251: .005 μF disc.

( ) C1263: .005 μF disc.

NOTE: As you mount the following two resistors, position them 1/4" above the circuit board.

( ) R1259: 110 Ω, 5-watt, wire-wound resistor.

( ) R1257: 110 Ω, 5-watt, wire-wound resistor.

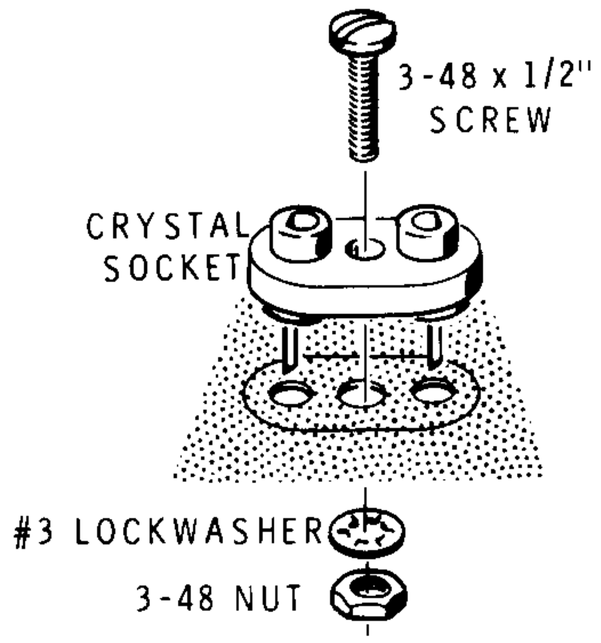
( ) Solder the leads to the foil and cut off the excess lead lengths.

PICTORIAL 1-2

START

NOTE: When hardware is called for in a step, only the screw size will be given. For instance, if 3-48 x 1/2" hardware is called for, it means that a 3-48 x 1/2" screw, one or more #3 lockwashers, and a 3-48 nut should be used. The Pictorial or a Detail will show the proper number of lockwashers used. The plastic nut starter can be used to pick up and start 3-48, 4-40 and 6-32 nuts on screws.

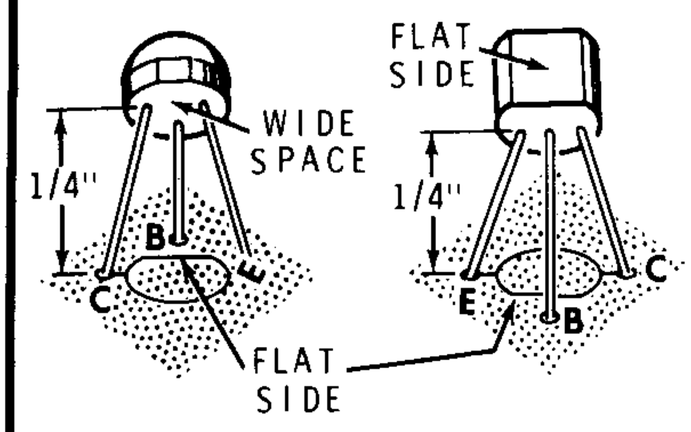
In the next two steps, mount crystal sockets at Y1 and Y2 as shown. Use 3-48 x 1/2" hardware. After each socket is mounted, solder both lugs to the foil and cut off the excess lug lengths.



( ) Crystal socket at Y1.

( ) Crystal socket at Y2.

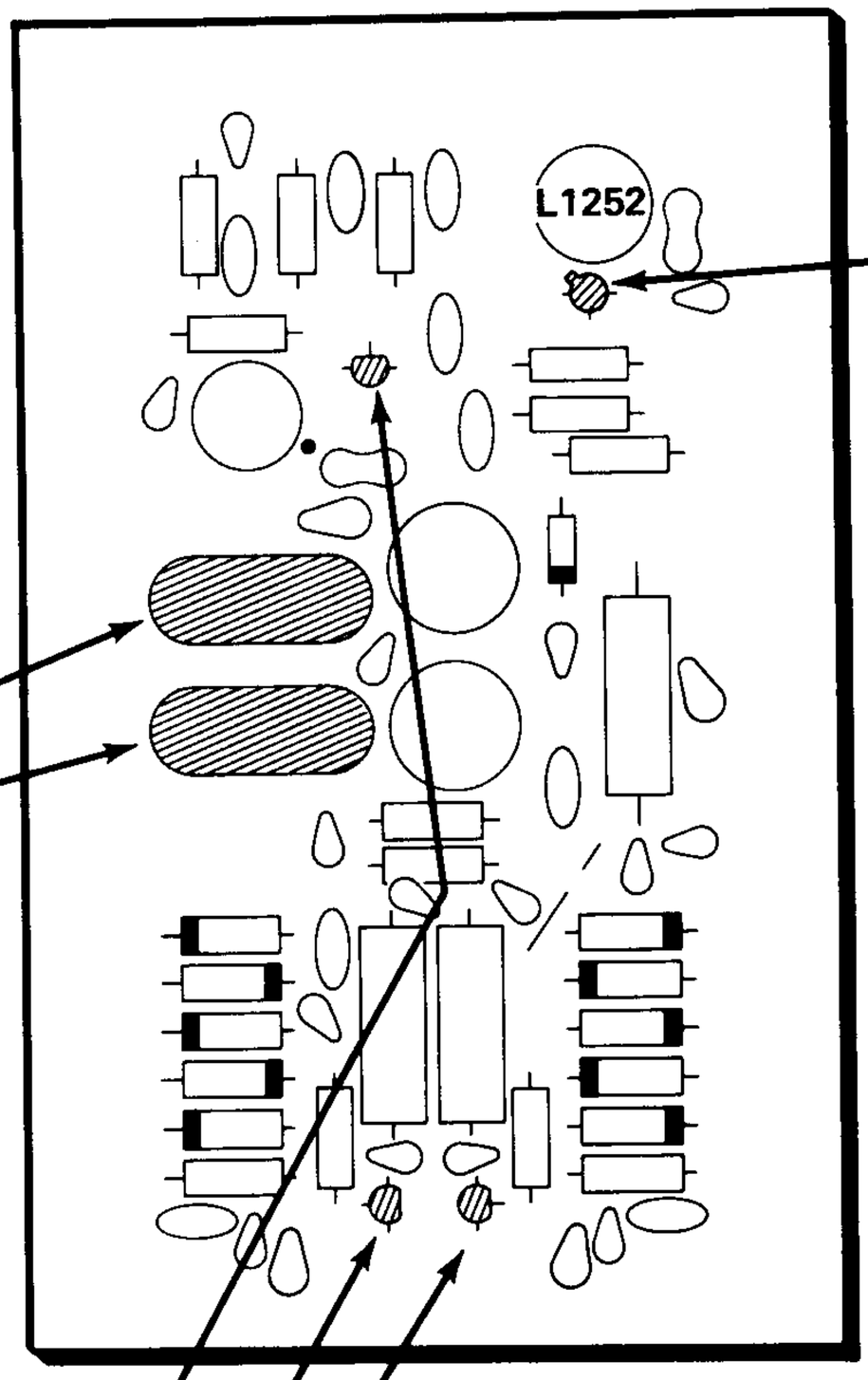
The 2N3643 transistors (#417-233) used in the following steps, may be either of the two types shown below. Identify the transistors by their part number or type number. Identify their C, B, and E leads according to their shape and insert them in the corresponding C, B, and E holes in the circuit board. As each transistor is installed, solder its leads to the foil and cut off the excess lead lengths.



( ) 2N3643 transistor (#417-233) at Q9.

( ) 2N3643 transistor (#417-233) at Q6.

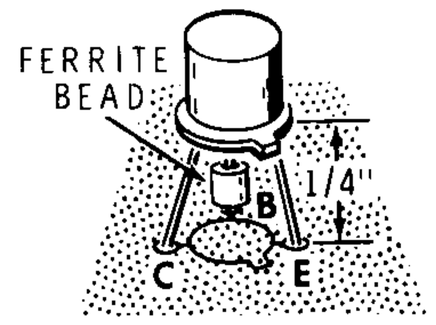
( ) 2N3643 transistor (#417-233) at Q7.



PICTORIAL 1-3

CONTINUE

NOTE: When you install the following transistor, line up the tab on the transistor with the outline of the tab on the circuit board. Place a ferrite bead on the base (B) lead of the transistor. Then insert the leads into their correct C, B, and E holes. Position the body of the transistor so it clears coil L1252 by approximately 1/16". Solder the leads to the foil and cut off the excess lead lengths.



( ) Q8: SGC5283 transistor (#417-270).

CIRCUIT BOARD CHECKOUT

Carefully inspect the circuit board for the following conditions.

( ) Unsoldered connections.

( ) "Cold" 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.

NOTE: There are several unused holes in the circuit board at this time.

Set the circuit board aside temporarily.

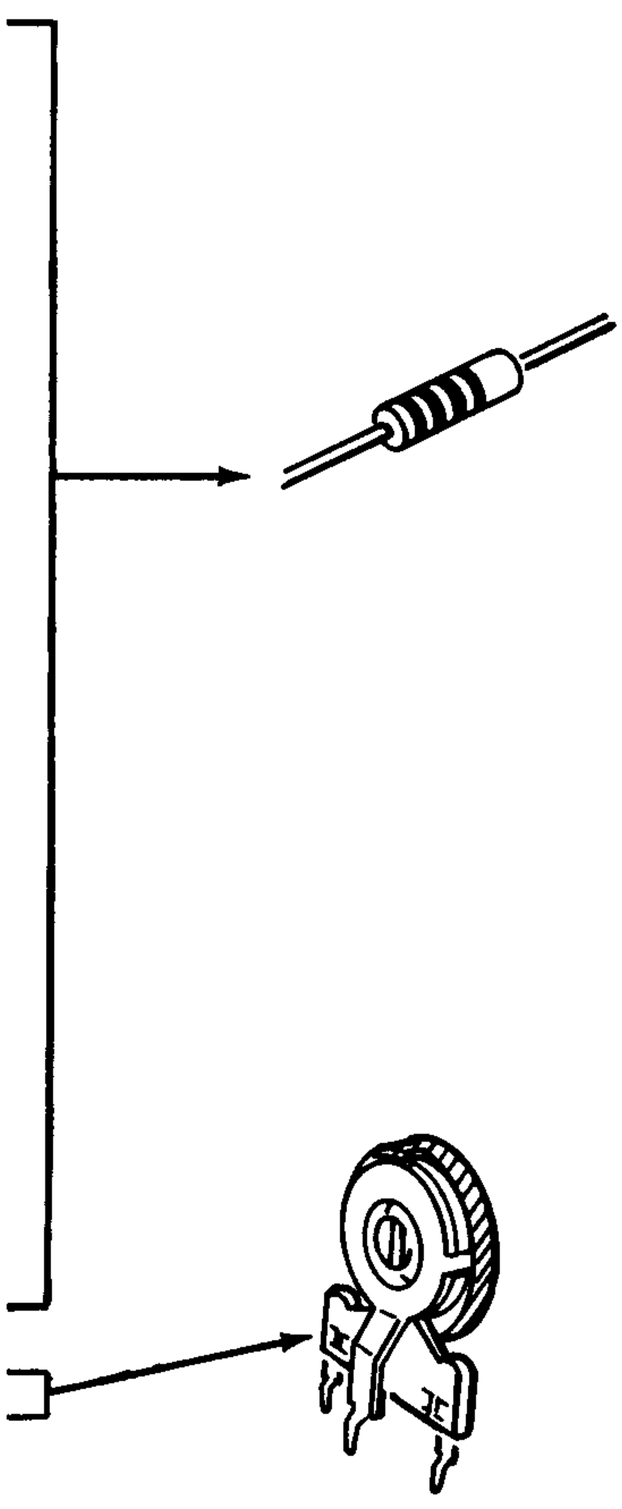
FINISH

VARIABLE FREQUENCY OSCILLATOR (VFO)

PARTS LIST

Remove the parts from Pack #2 and check each part against the following list. Make a check (✓) in the space provided as each part is identified. Any part that is packed in an individual envelope with the part number on it should be placed back in the envelope after it is identified until it is called for in a step. Do not throw away any packing materials until all parts are accounted for.

	QTY.	DESCRIPTION	PART No.	CIRCUIT Component No.	PRICE Each
RESISTORS, 1/2-Watt					
( )	1	15 Ω, 5% (brown-green-black)	1-54	R1237	
( )	2	47 Ω (yellow-violet-black)	1-1	R1205, R1206	
( )	2	100 Ω (brown-black-brown)	1-3	R1226, R1228	
( )	2	470 Ω (yellow-violet-brown)	1-6	R1233, R1236	
( )	1	1000 Ω (brown-black-red)	1-9	R1203	
( )	1	1500 Ω (brown-green-red)	1-11	R1231	
( )	1	3300 Ω (orange-orange-red)	1-14	R1234	
( )	1	3900 Ω (orange-white-red)	1-46	R1227	
( )	1	4700 Ω (yellow-violet-red)	1-16	R1201	
( )	1	10 kΩ (brown-black-orange)	1-20	R1202	
( )	2	22 kΩ (red-red-orange)	1-22	R1229, R1235	
( )	1	220 kΩ (red-red-yellow)	1-29	R1225	
( )	1	1 MΩ (brown-black-green)	1-35	R1204	
( )	1	1000 Ω (1 k) control	10-936	R1232	

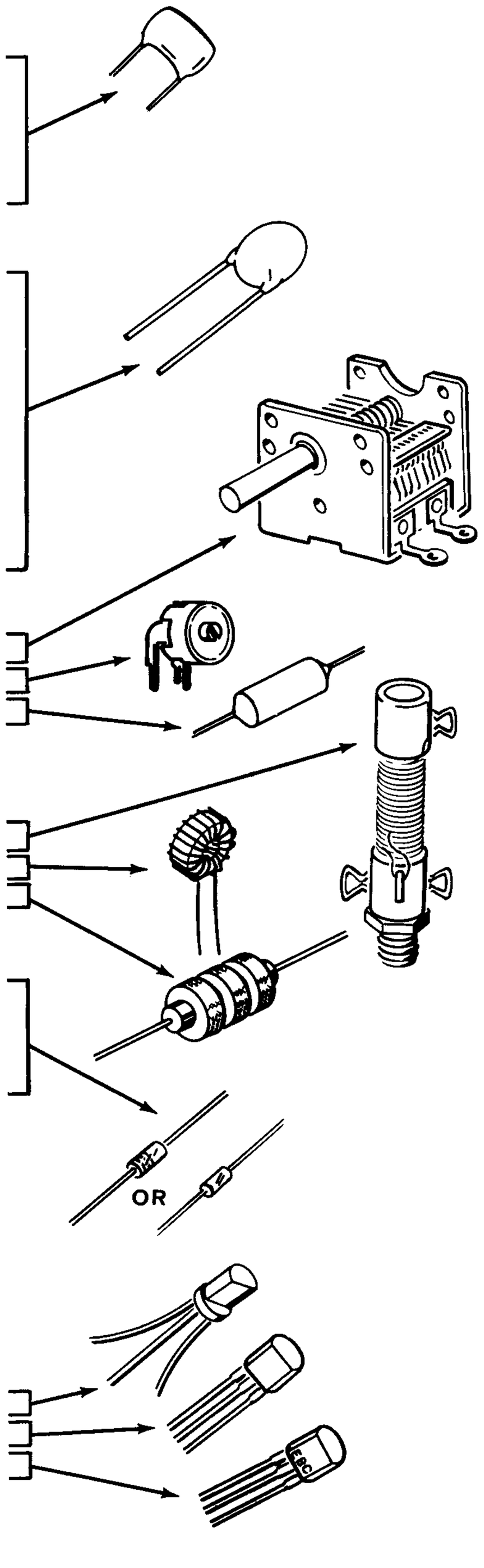


QTY.		DESCRIPTION	PART No.	CIRCUIT Component No.	PRICE Each
CAPACITORS					
Mica					
( )	1	12 pF	20-130	C1209	
( )	1	200 pF	20-108	C1231	
( )	1	330 pF	20-139	C1233	
( )	1	390 pF	20-106	C1229	
( )	1	680 pF	20-107	C1234	
Disc					
( )	1	6 pF (N470)	21-169	C1202	
( )	2	10 pF	21-3	C1214	
( )	2	56 pF	21-160	C1203, C1204	
( )	2	510 pF (N750)	21-159	C1205, C1206	
( )	1	510 pF (N1500)	21-191	C1207	
( )	1	.001 μF	21-140	C1225	
( )	1	.005 μF	21-46	C1208	
( )	6	.01 μF	21-47	C1213, C1215, C1226, C1227, C1228, C1232	
Other Capacitors					
( )	1	Tuning capacitor	26-148	C1201	
( )	1	15-60 pF trimmer	31-63	C1211	
( )	1	4.7 pF ceramic	21-29	C1212	
COILS-CHOKE					
( )	1	Variable coil	40-1720	L1201	
( )	2	Toroid coil	40-1684	L1202, L1203	
( )	1	RF choke	45-82	RFC1201	
DIODES-TRANSISTORS					
( )	1	1N191 diode (brown-white-brown)	56-26	D1201	
( )	2	1N4149 diode	56-56	D1202, D1203	
( )	1	VR-10A zener diode	56-67	ZD1201	

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

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

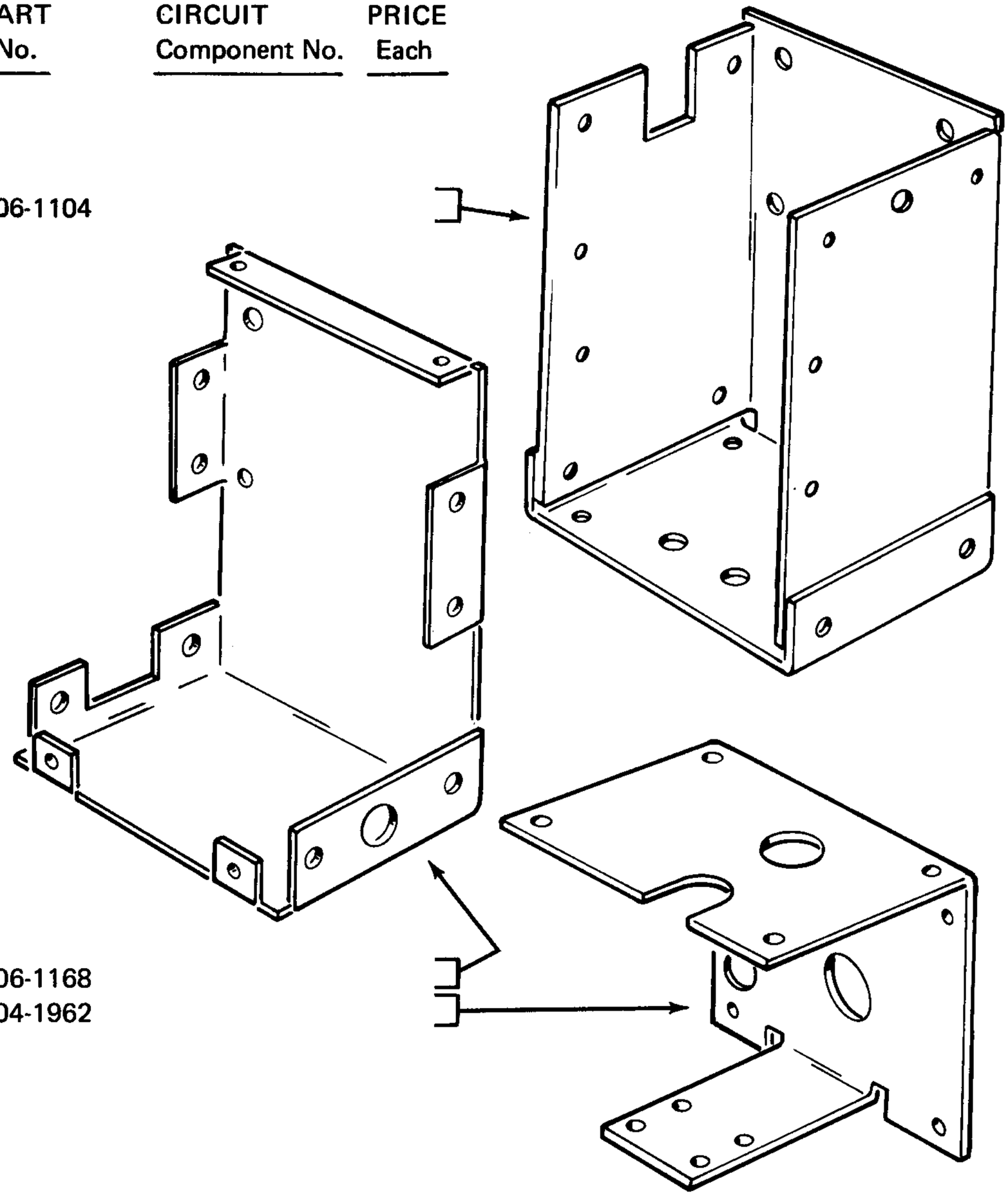
( )	1	2N3393 transistor	417-118	Q1204	
( )	2	MPF105 transistor	417-169	Q1202, Q1203	
( )	1	2N3638A transistor	417-234	Q1205	



QTY.	DESCRIPTION	PART No.	CIRCUIT Component No.	PRICE Each

METAL PARTS

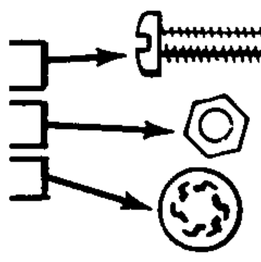
( )	1	VFO chassis	206-1104	
( )	1	VFO shield	206-1168	
( )	1	VFO bracket	204-1962	



HARDWARE

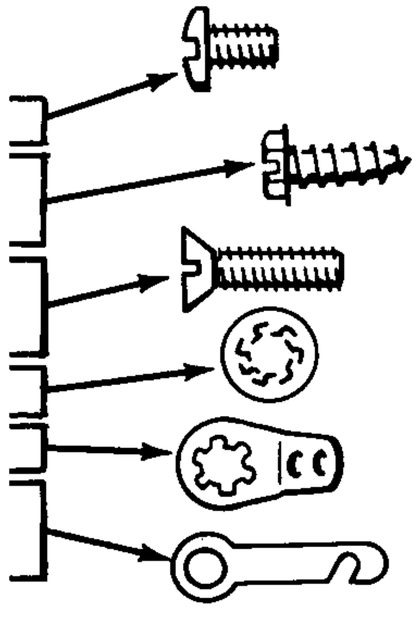
#4 Hardware

( )	4	4-40 x 5/8" screw	250-323	
( )	4	4-40 nut	252-2	
( )	4	#4 lockwasher	254-9	

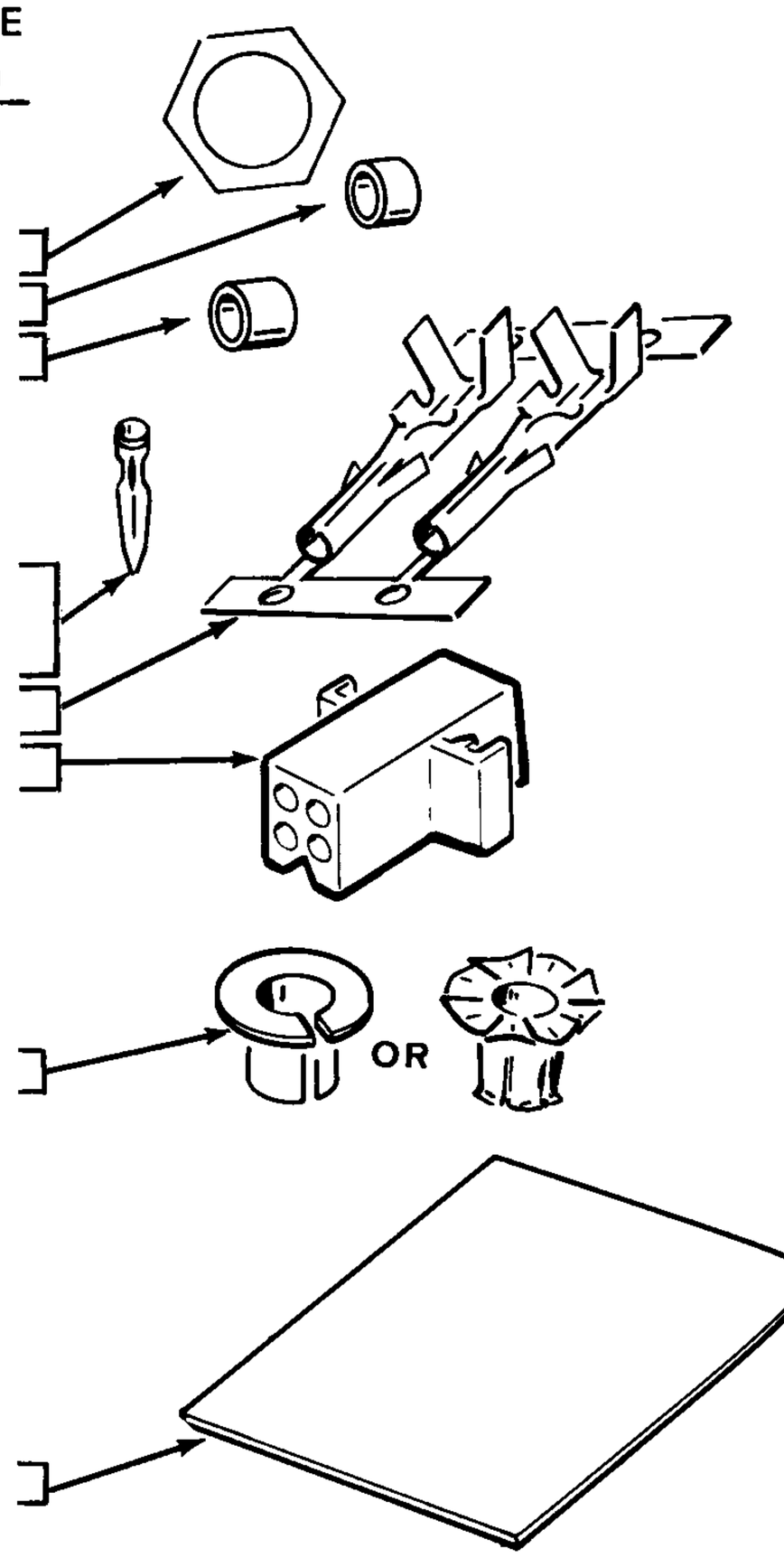


#6 Hardware

( )	4	6-32 x 3/16" screw	250-138	
( )	18	#6 x 3/8" sheet metal screw	250-475	
( )	2	6-32 x 1/2" flat head screw	250-11	
( )	4	#6 lockwasher (2 extra)	254-1	
( )	2	#6 locking solder lug	259-1	
( )	2	#6 nonlocking solder lug	259-6	

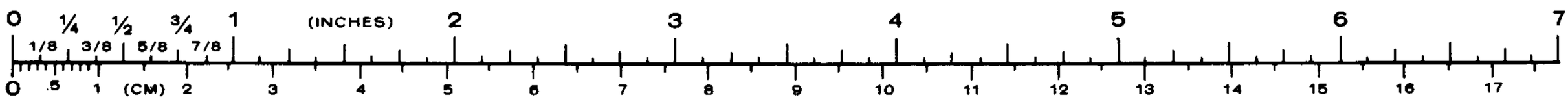


QTY.	DESCRIPTION	PART No.	CIRCUIT Component No.	PRICE Each
Other Hardware				
( ) 1	Control nut	252-7		
( ) 8	1/8" spacer	255-1		
( ) 2	3/16" spacer	255-2		
CONNECTORS				
( ) 4	Wire socket (2 extra)	432-134		
( ) 4	Female terminal	432-153		
( ) 1	4-pin plug	432-817		
MISCELLANEOUS				
( ) 1	Heat sink	215-63		
( ) 1'	Gray wire	344-58		
( ) 3'	8-wire cable	347-1		
( ) 1	Oscillator circuit board	85-1205-3		
( ) 1	Buffer circuit board	85-1206-1		
( ) 1	Cement	350-12		
( ) 2	Fiber insulator	75-90		



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

To order a replacement part, use the Parts Order Form furnished with this kit. If a Parts Order Form is not available, refer to "Customer Service" inside the rear cover of this Manual.



STEP-BY-STEP ASSEMBLY

( ) Cut a 16" length of 8-wire cable. Set the remaining length aside; it will be called for during chassis assembly.

( ) Carefully cut 3" of the outer insulation from one end of the 16" length of 8-wire cable.

( ) Carefully remove another 3" of insulation from the other cable end.

( ) One by one, carefully pull each wire from the remaining cable insulation. Save all the insulation for use in later steps.

NOTE: When wire is called for during the assembly of the kit, use specified lengths of these wires removed from the cable. To prepare this stranded wire, first cut it to the specified length. Then, remove 1/4" of insulation from each wire end, twist the wire end tightly, and add a small amount of solder to hold the small strands together. Also note that there is a length of gray wire which will be called for during some of the assembly steps.

START

Position the oscillator circuit board as shown. Then complete each step in the order listed.

( ) R1206: 47 Ω (yellow-violet-black).

( ) R1205: 47 Ω (yellow-violet-black).

( ) R1202: 10 kΩ (brown-black-orange).

( ) C1212: 4.7 pF ceramic. (May be marked 4.7 MMF).

( ) R1201: 4700 Ω (yellow-violet-red).

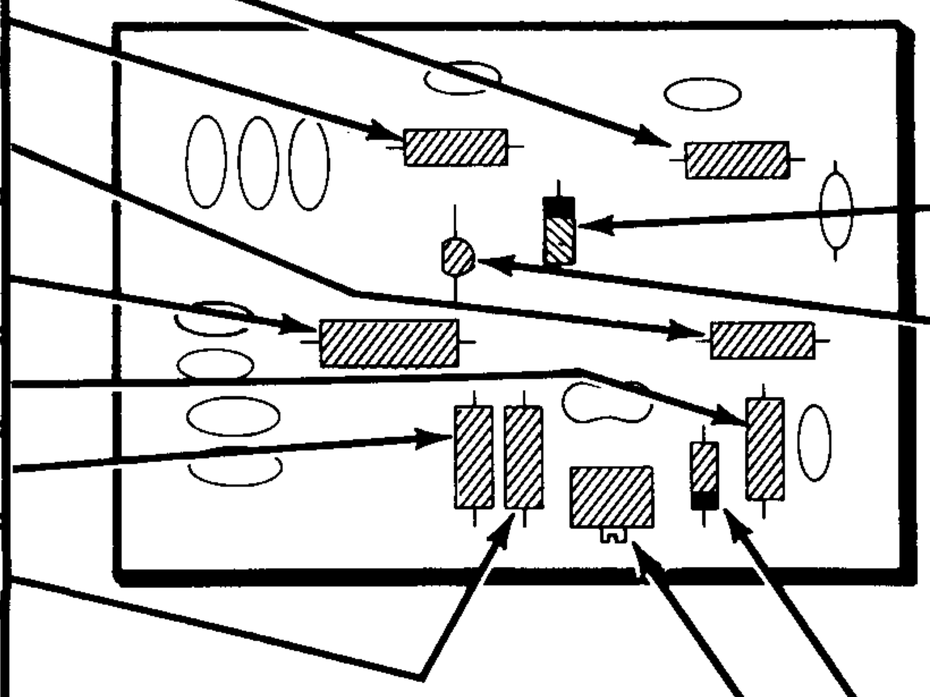
( ) R1204: 1 MΩ (brown-black-green).

( ) R1203: 1000 Ω (brown-black-red).

FOR GOOD SOLDER CONNECTIONS, YOU MUST **KEEP THE SOLDERING IRON TIP CLEAN.** WIPE IT OFTEN WITH A DAMP SPONGE OR CLOTH.

SAFETY WARNING: Avoid eye injury when you clip off excess lead lengths. We suggest you wear glasses, or at least clip the leads so the ends will not fly toward your eyes.

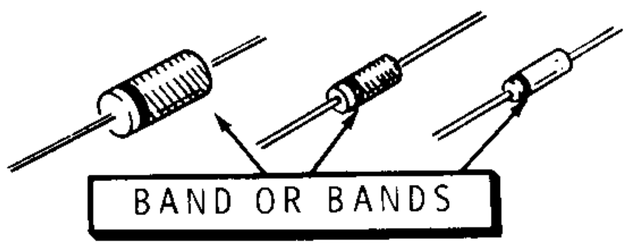
( ) Solder the leads to the foil and cut off the excess lead lengths.



PICTORIAL 2-1

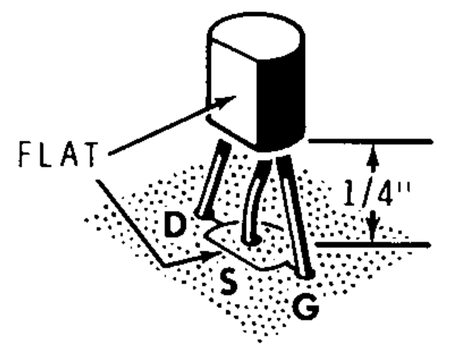
CONTINUE

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



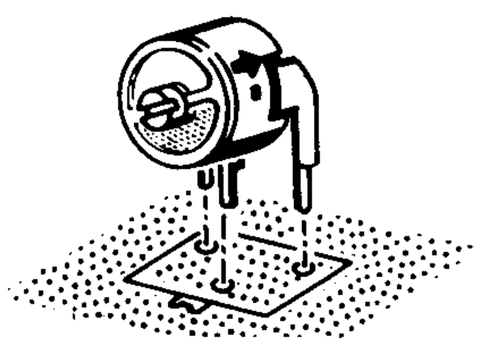
( ) ZD1201: VR-10A diode (#56-67).

( ) Q1202: MPF105 transistor (#417-169). Solder the leads to the foil and cut off the excess lead lengths.



( ) D1201: 1N191 (brown-white-brown, #56-26). Be sure to position the banded end as shown.

( ) C1211: 15-60 pF trimmer.



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

START

( ) C1205: 510 pF disc (N750).

( ) C1206: 510 pF disc (N750).

( ) C1207: 510 pF disc (N1500).

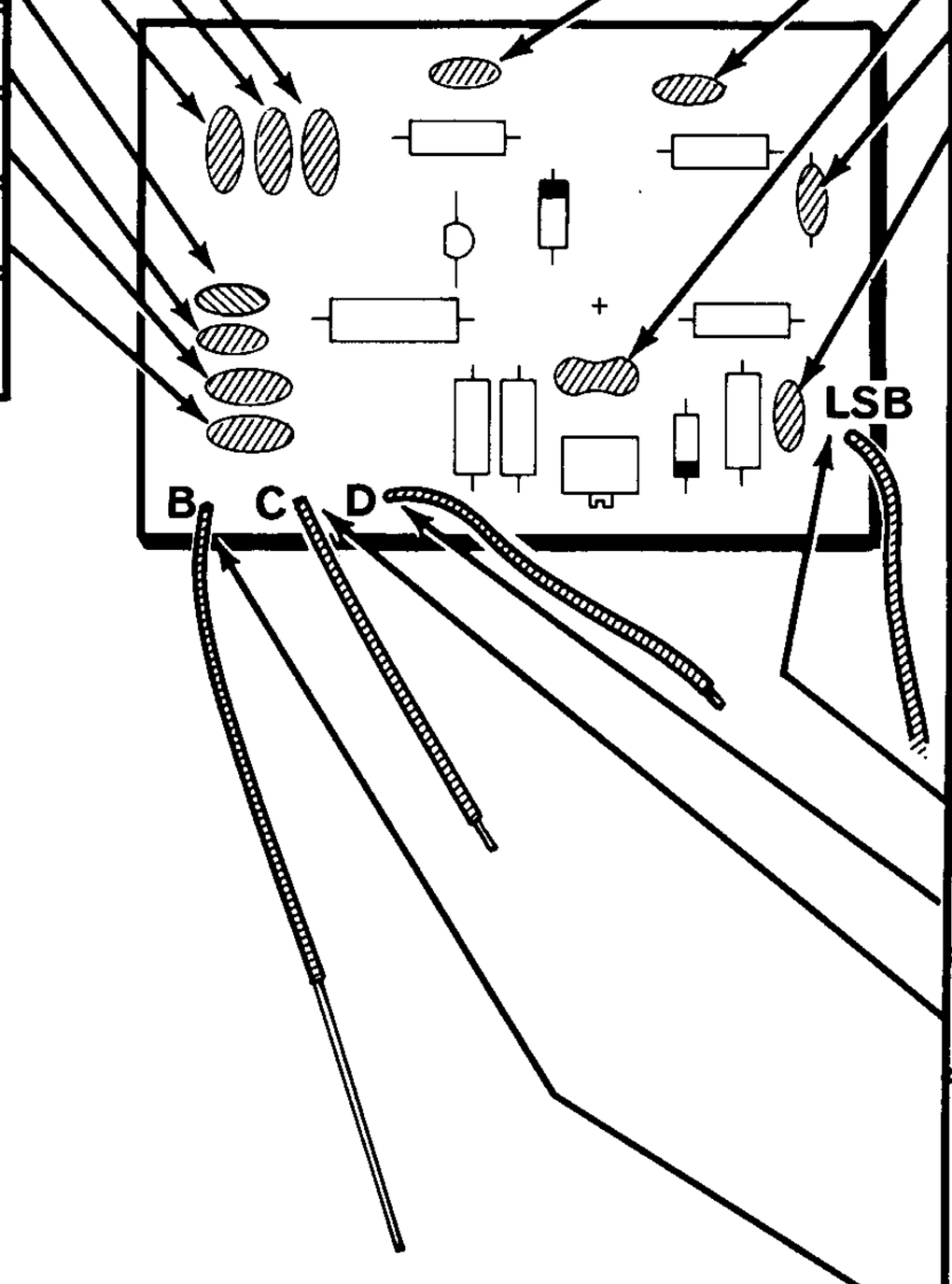
( ) C1215: 10 pF disc.

( ) C1202: 6 pF disc.

( ) C1203: 56 pF disc.

( ) C1204: 56 pF disc.

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



CONTINUE

( ) C1214: 10 pF disc.

( ) C1213: .01 µF disc.

( ) C1209: 12 pF mica.

( ) C1215: .01 µF disc.

( ) C1208: .005 µF disc.

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

NOTES:

1. Cut the following wires to the proper lengths and remove 1/4" of insulation from each end unless directed otherwise in a step. Then solder each wire as it is connected and cut off the excess lead length.

2. Only one end of each wire will be connected at this time.

( ) Connect a 6" orange wire to hole LSB.

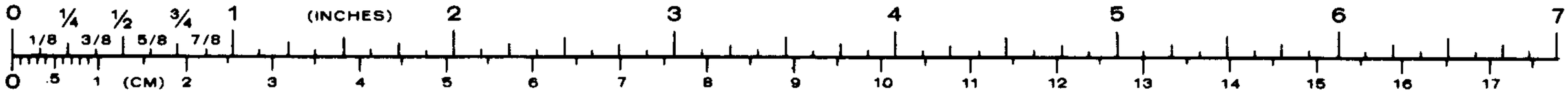
( ) Connect a 2" orange wire to hole D.

( ) Connect a 1-3/4" gray wire to hole C.

( ) Cut a 3-3/8" red wire. Then remove 1/4" of insulation from one end and 1-1/8" of insulation from the other end.

( ) Connect the 1/4" bare end of the red wire to hole B.

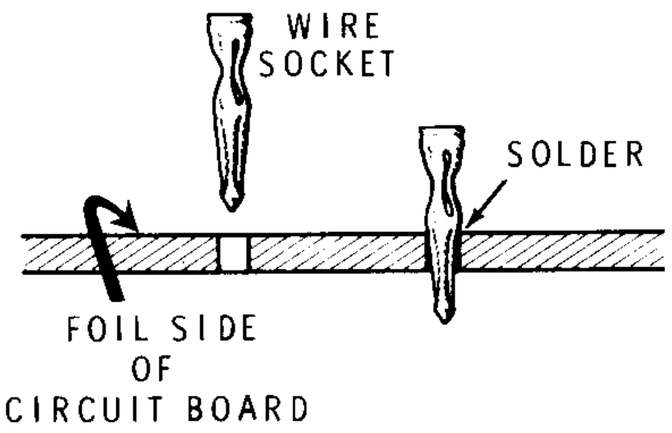
PICTORIAL 2-2

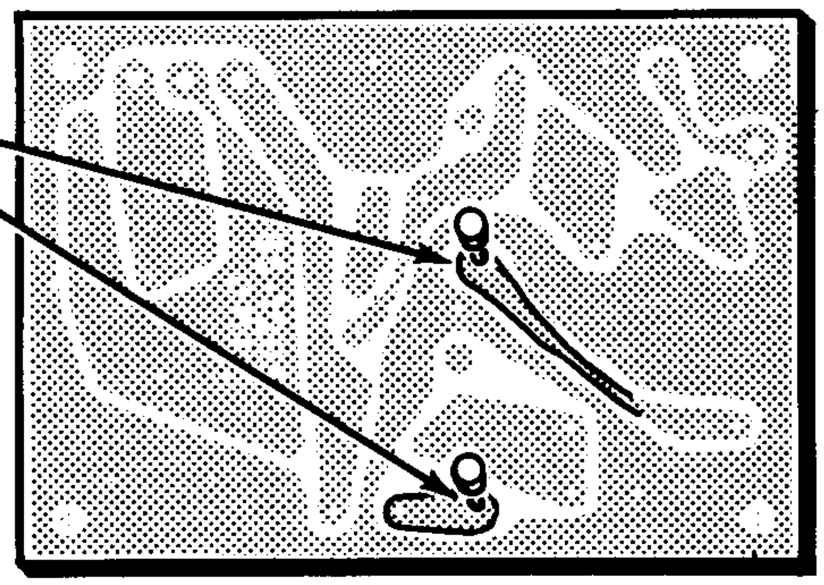


START

( ) Position the circuit board foil-side-up as shown.

( ) Install wire sockets (#432-134) at the two indicated locations as shown in the following Detail. NOTE: Use solder very sparingly to avoid filling the socket.





CIRCUIT BOARD CHECKOUT

Carefully inspect the circuit board for the following conditions.

( ) Unsoldered connections.

( ) "Cold" solder connections.

( ) Solder bridges between foil patterns.

( ) Protruding leads. No wire leads should be longer than 1/8".

( ) Transistors for the proper type and installation.

( ) Diode for the correct position of the banded end.

NOTE: There is one unused hole in the circuit board.

Set the circuit board aside temporarily.

FINISH

PICTORIAL 2-3

HEATHKIT®

START

Position the buffer circuit board (#85-1206-1) as shown.

( ) R1231: 1500 Ω (brown-green-red).

( ) R1227: 3900 Ω (orange-white-red).

( ) R1229: 22 kΩ (red-red-orange).

( ) R1226: 100 Ω (brown-black-brown).

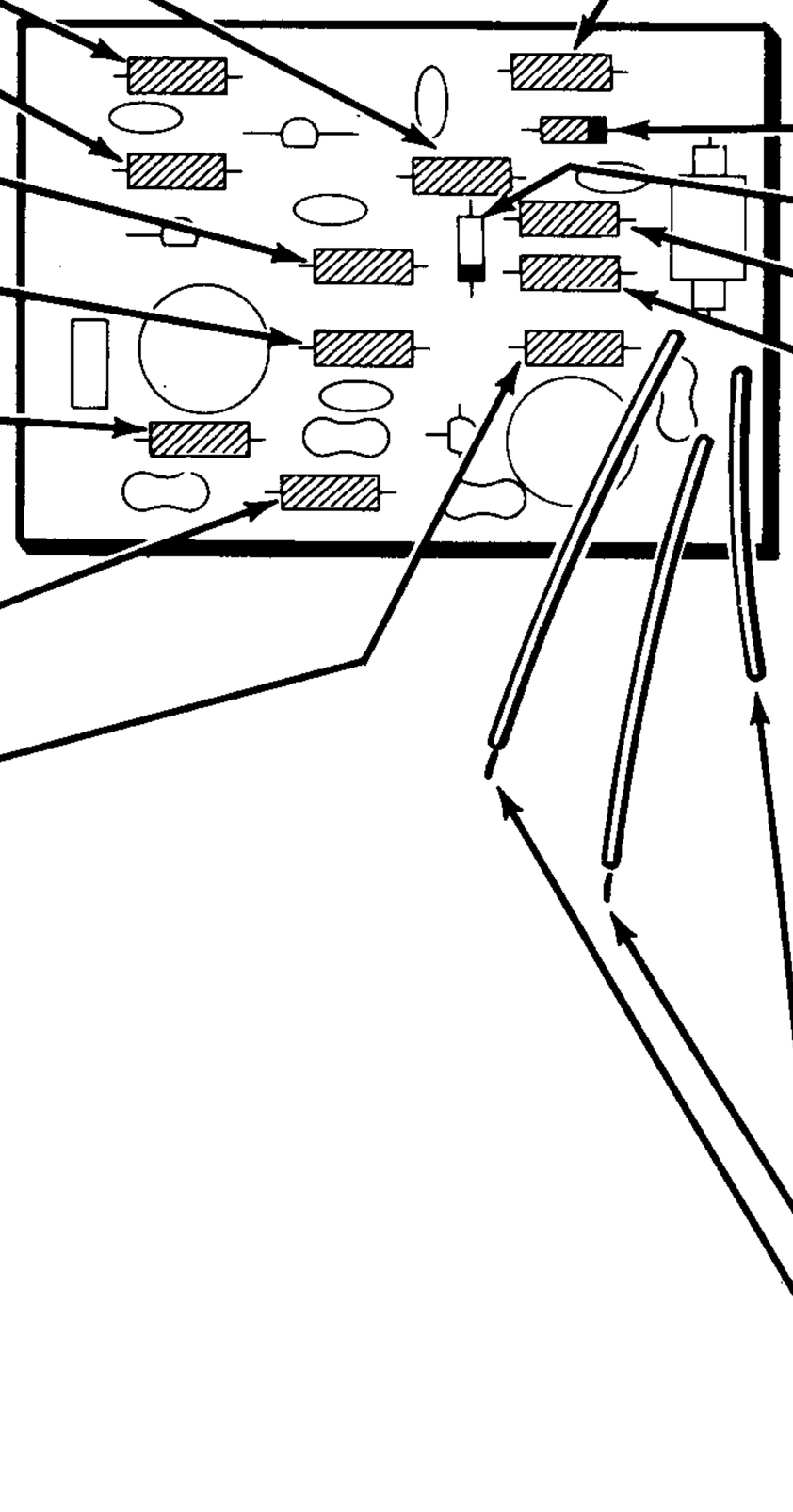
( ) R1228: 100 Ω (brown-black-brown).

( ) R1233: 470 Ω (yellow-violet-brown).

( ) R1235: 22 kΩ (red-red-orange).

( ) R1236: 470 Ω (yellow-violet-brown).

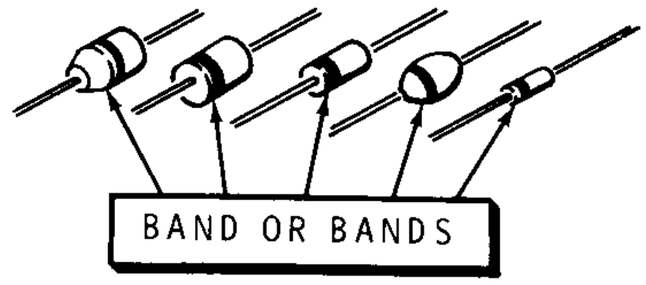
( ) Solder all leads to the foil and cut off the excess lead lengths.



CONTINUE

( ) R1225: 220 kΩ (red-red-yellow).

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



( ) D1202: 1N4149 diode (#56-56).

( ) D1203: 1N4149 diode (#56-56).

( ) R1234: 3300 Ω (orange-orange-red).

( ) R1237: 15 Ω, 5% (brown-green-black).

NOTE: In the following step, save three cutoff resistor leads for use later.

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

NOTES:

1. Cut the following wires to the proper lengths and remove 1/4" of insulation from each end. Solder each wire as it is connected and cut off the excess lead lengths.

2. Only one end of each wire will be connected at this time.

( ) 1-1/2" black wire to GND.

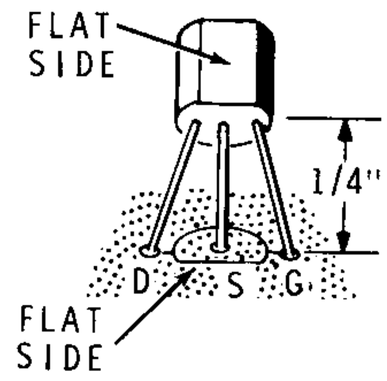
( ) 1-3/4" gray wire to OUTPUT.

( ) 1-3/4" red wire to +11.

PICTORIAL 3-1

START

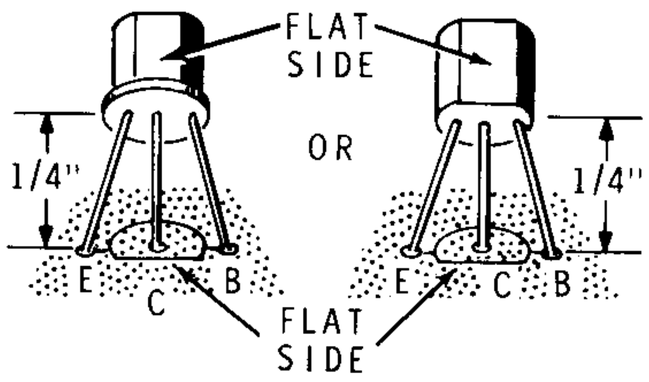
( ) Q1203: MPF105 transistor (#417-169). Line up the flat of the transistor with the outline of the flat on the circuit board. Then insert the leads into their correct D, S, and G holes. Solder the leads to the foil and cut off the excess lead lengths.



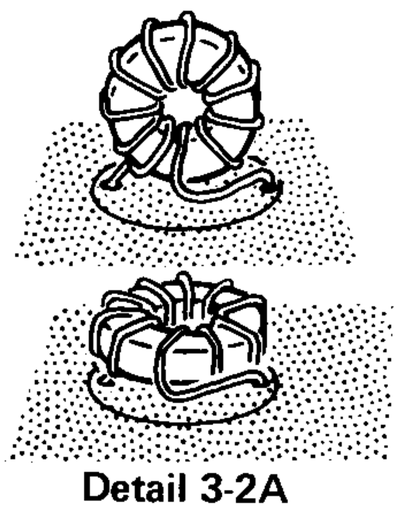
( ) C1226: .01 µF disc.

( ) C1227: .01 µF disc.

( ) Q1204: 2N3393 transistor (#417-118). The transistor may be one of the two types shown below. Insert the transistor leads into the corresponding E, C, and B holes in the circuit board as shown. Solder the leads to the foil and cut off the excess lead lengths.



( ) L1202: 3.7 µH toroid coil (#40-1684). First, mount the coil vertically. Then press the coil down onto the surface of the circuit board. Solder the leads to the foil and cut off the excess lead lengths.

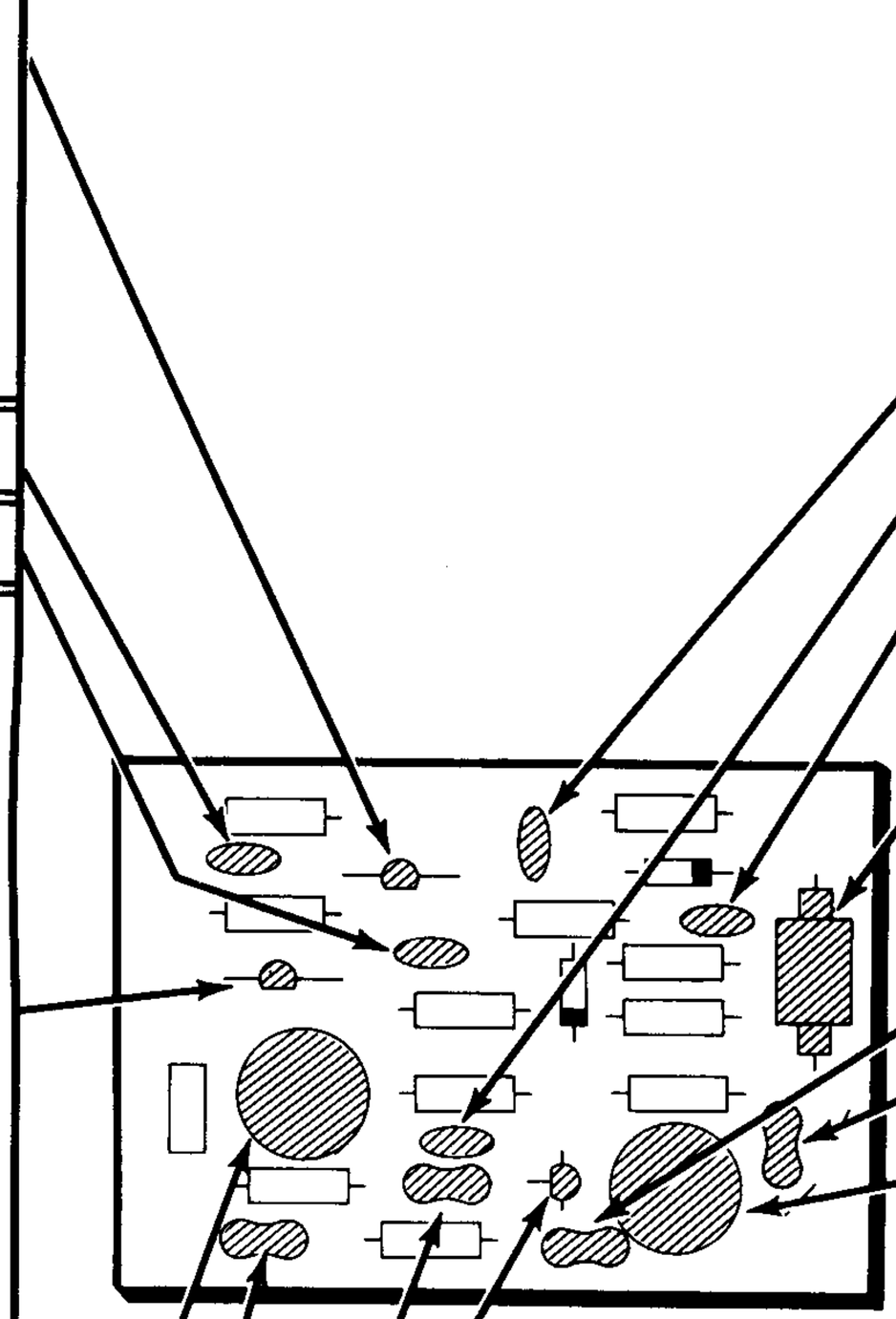


Detail 3-2A

( ) C1231: 200 pF mica.

( ) C1229: 390 pF mica.

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



PICTORIAL 3-2

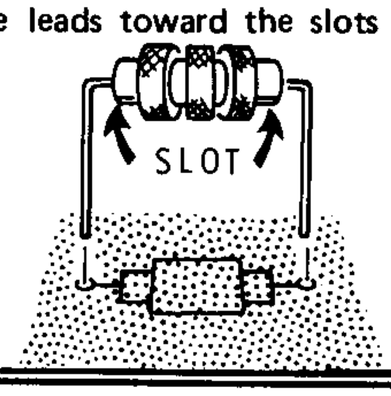
CONTINUE

( ) C1225: .001 µF disc.

( ) C1228: .01 µF disc.

( ) C1232: .01 µF disc.

( ) RFC1201: 350 µH choke (#45-82). Bend the leads toward the slots as shown.



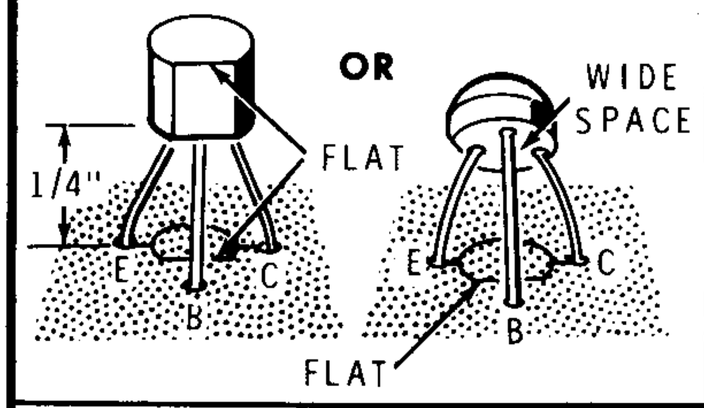
( ) C1233: 330 pF mica.

( ) C1234: 680 pF mica.

( ) L1203: 3.7 µH toroid coil (#40-1684). See Detail 3-2A in the left column.

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

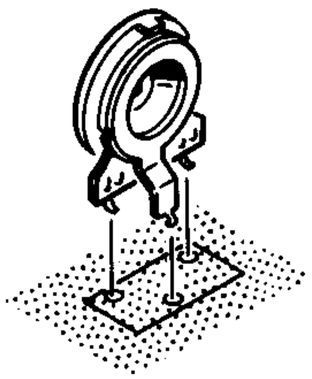
NOTE: Two types of 2N3638A transistors may be supplied. Determine which type was supplied to you; then install the transistor as shown in the following Detail.



( ) Q1205: 2N3638A transistor (#417-234). Solder the leads to the foil and cut off the excess lead lengths.

START

( ) R1232: 1000 Ω, variable. Solder the lugs to the foil.

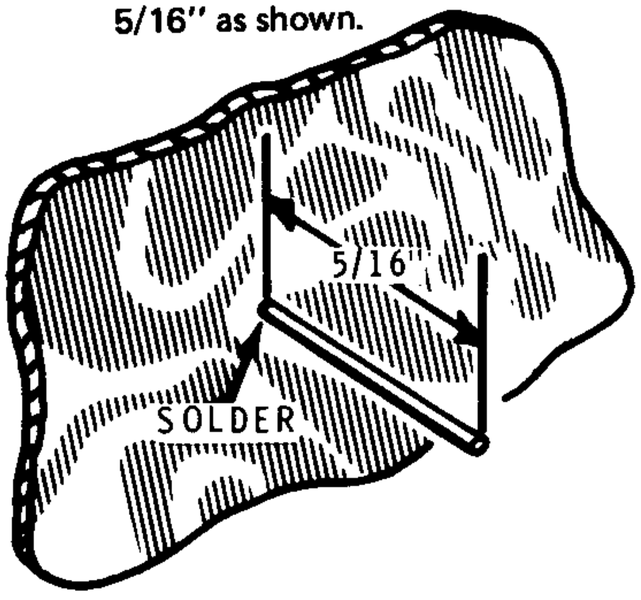


NOTE: In the following steps, after the leads have been soldered to the foil, the lead ends on the component side of the circuit board should be flush with the surface of the board.

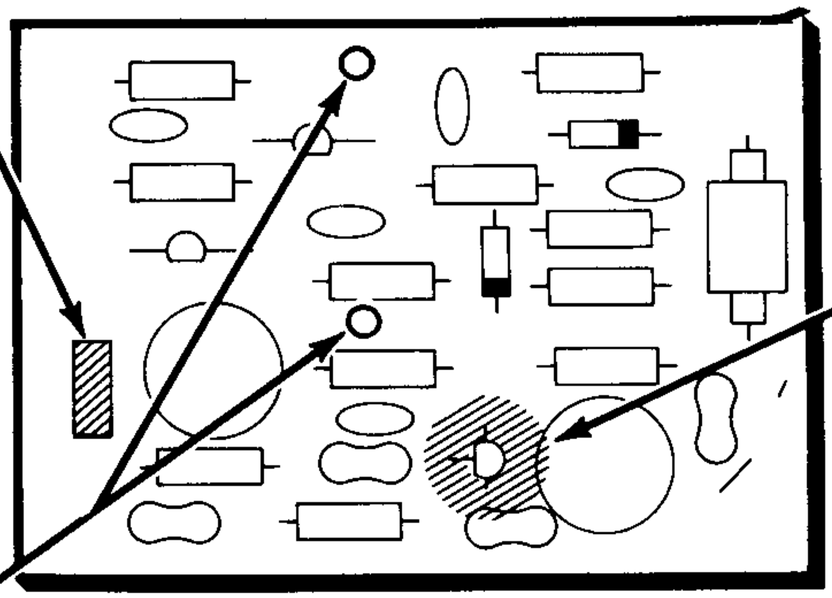
( ) 1. Install two cutoff resistor leads (saved from earlier steps) through circuit board holes E and INPUT.

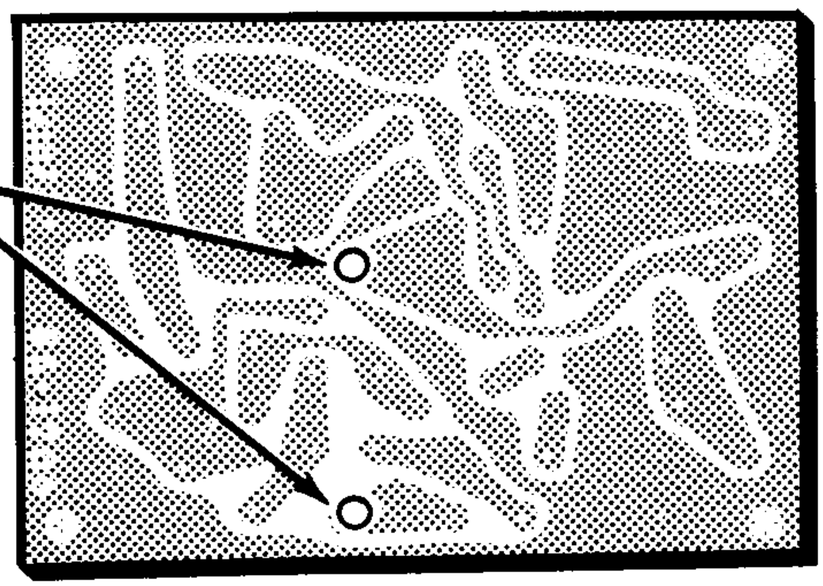
2. Solder the leads to the foil.

3. Be sure both leads extend straight out from the foil side of the board. Then cut the leads to 5/16" as shown.



COMPONENT SIDE



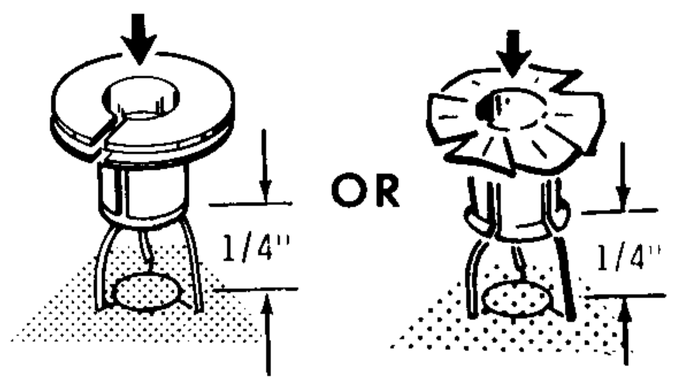


FOIL SIDE

CONTINUE

NOTE: Perform the next step carefully so you do not bend or short the transistor leads.

( ) Push a heat sink onto transistor Q1205.



CIRCUIT BOARD CHECKOUT

Carefully inspect the circuit board for the following conditions.

( ) Unsoldered connections.

( ) "Cold" solder connections.

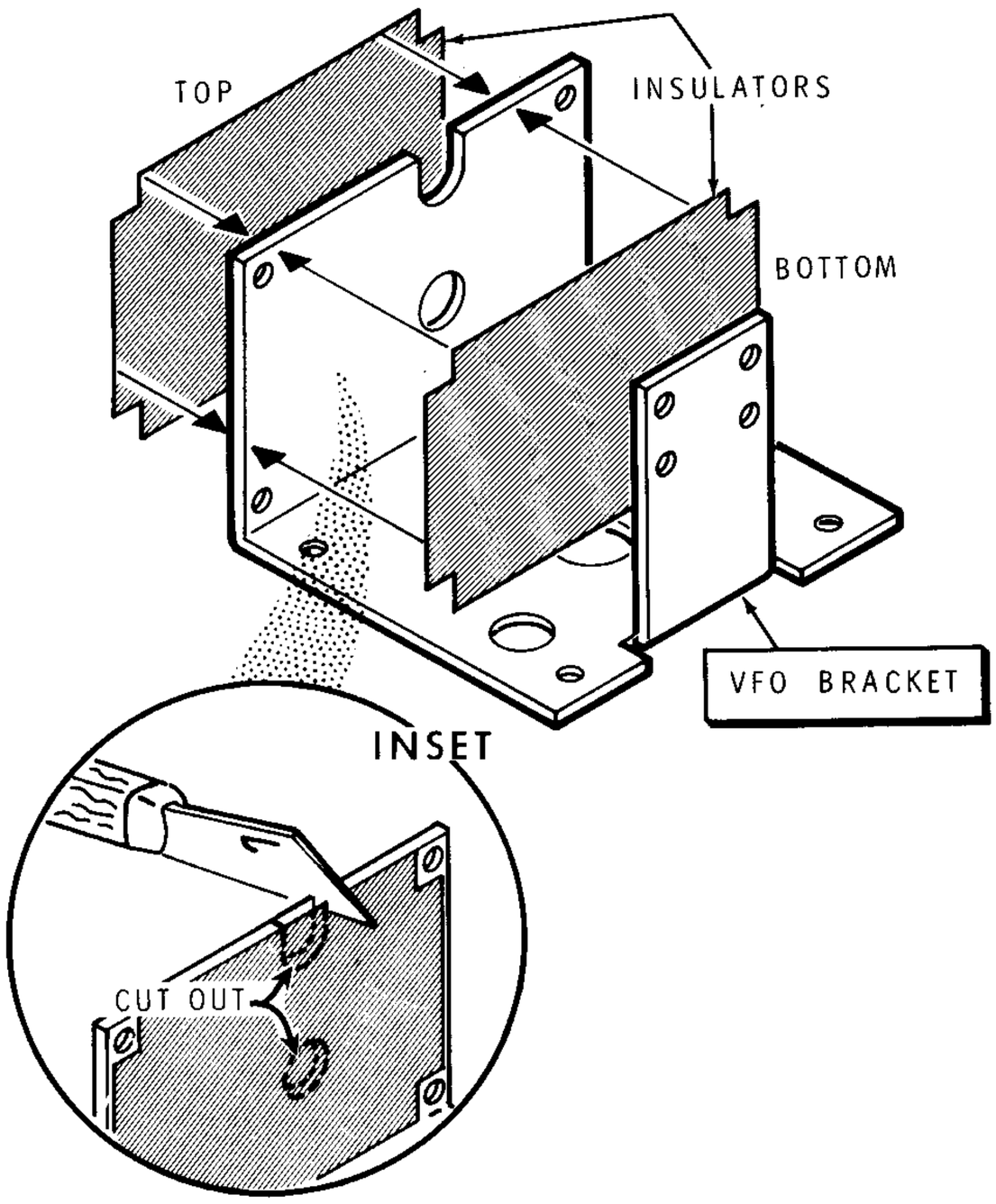
( ) Solder bridges between foil patterns.

( ) Transistors for the proper type and installation.

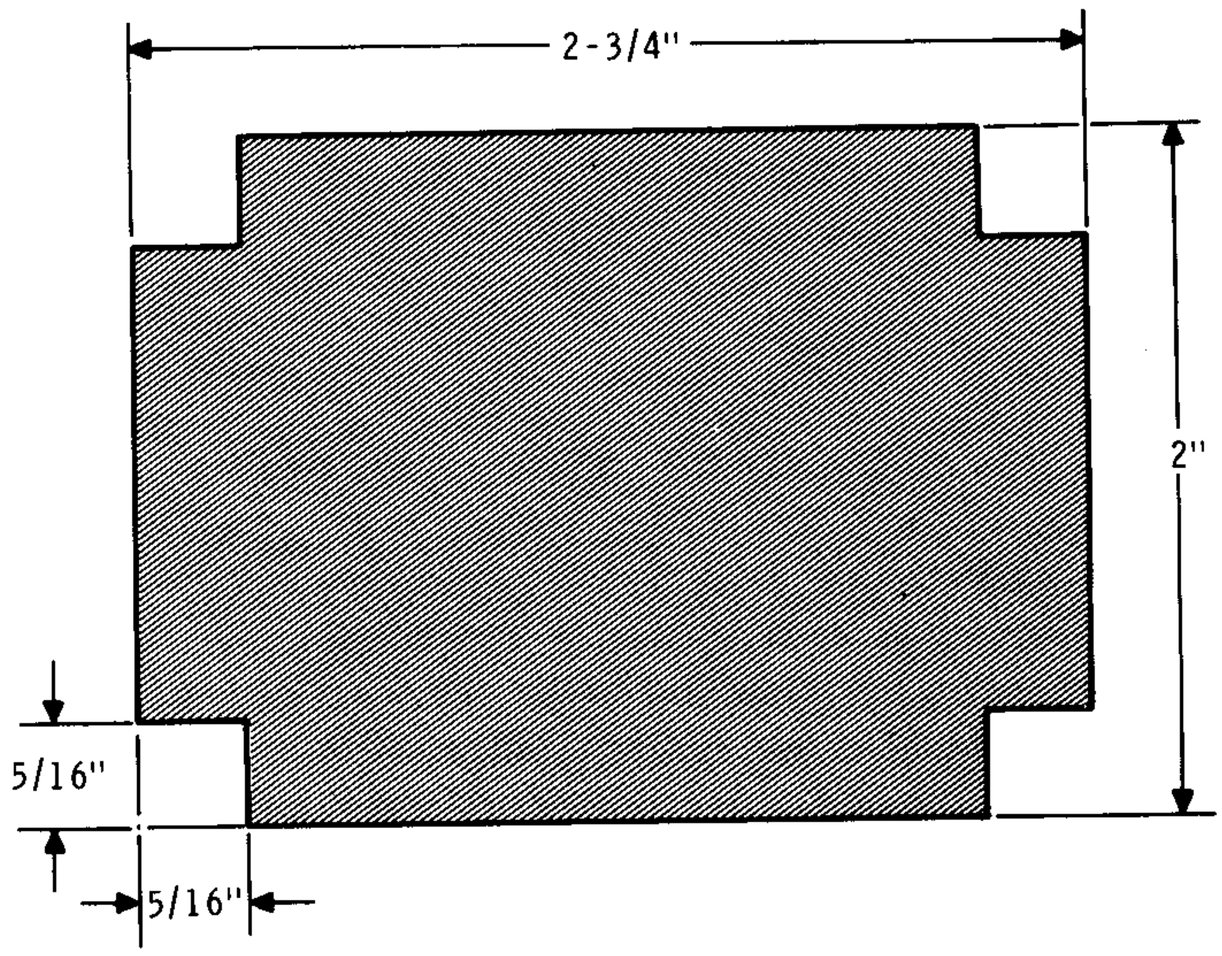
( ) Diodes for the correct position of the banded end.

FINISH

PICTORIAL 3-3



PICTORIAL 4-1



Detail 4-1A

VFO ASSEMBLY

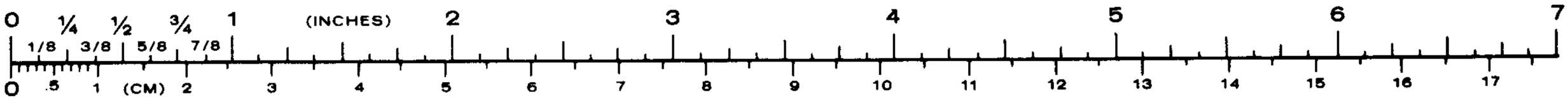
Refer to Pictorial 4-1 for the following steps.

( ) Refer to Detail 4-1A and prepare two fiber insulators as shown.

( ) Remove the paper backing from one of the prepared insulators. Refer to the Pictorial and press the insulator on the top surface of the VFO bracket.

( ) Cut the insulator out of the two openings in the bracket as shown. Use a small, sharp cutting tool.

( ) Remove the backing from the other insulator and press it onto the bottom surface of the VFO bracket. Then cut the fiber insulator out of the two bracket openings, as in the previous step.



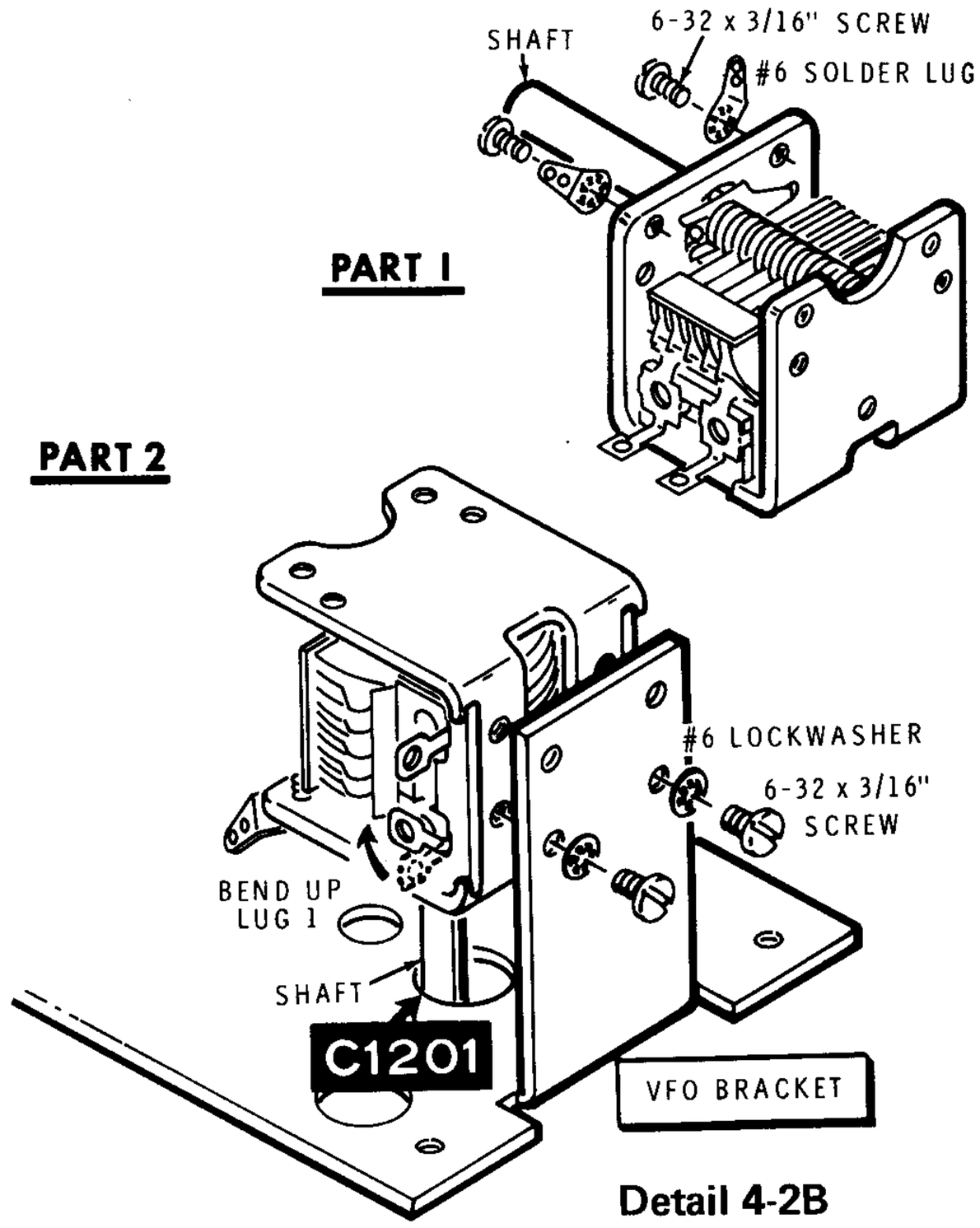
Refer to Pictorial 4-2 (fold-out from Page 27) for the following steps.

NOTE:
When the circuit boards are mounted in the following steps, position them so the two bare wires on the foil side of the buffer circuit board pass through the bracket openings and then enter the two wire sockets on the foil side of the oscillator circuit board.

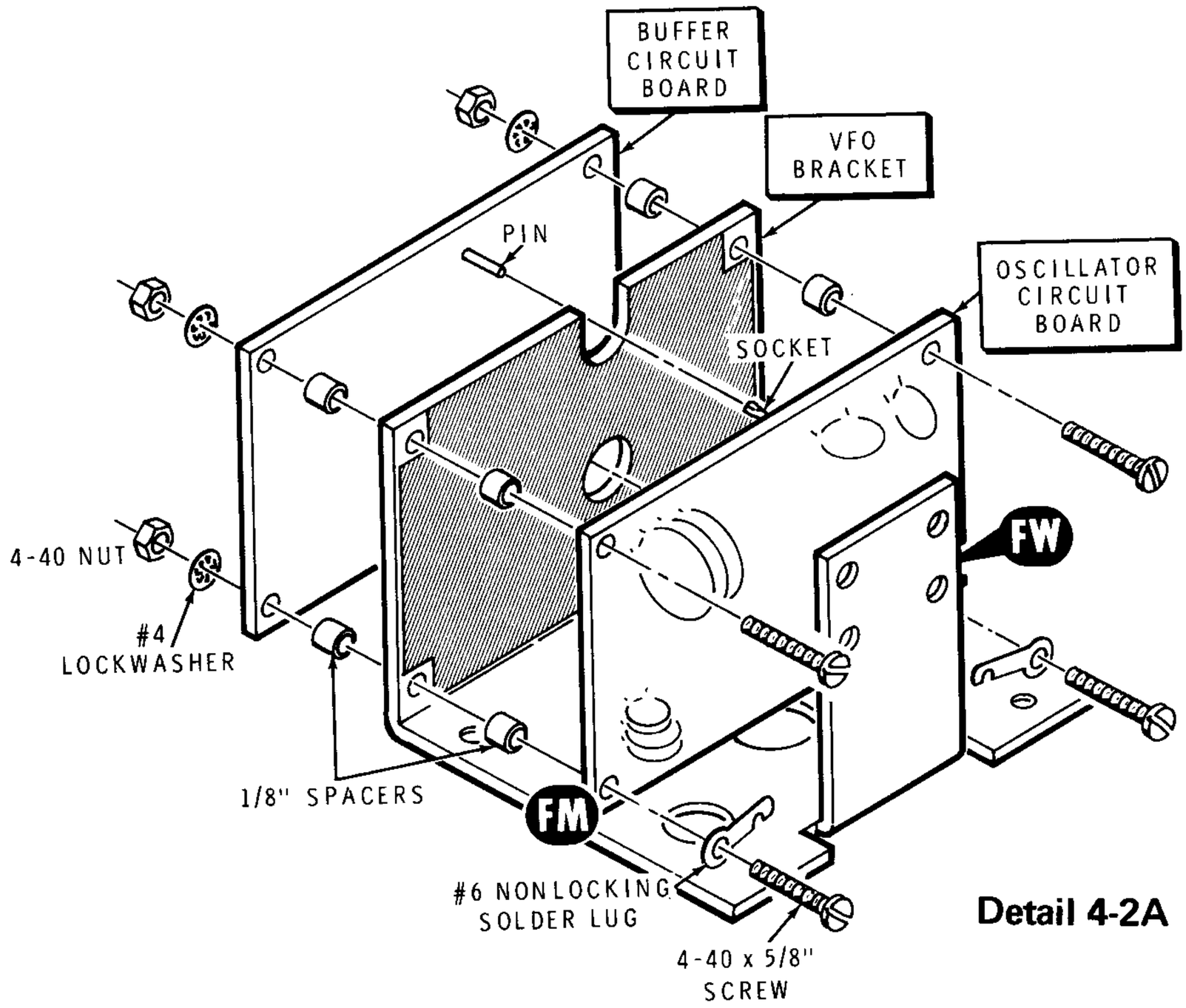
( ) Refer to Detail 4-2A and mount the oscillator circuit board and the buffer circuit board on the VFO bracket. Use 4-40 x 5/8" hardware and two 1/8" spacers at each corner of the boards. Mount a #6 nonlocking solder lug under the head of each of the two inner corner screws at FM and FW as shown; then bend the solder lugs straight up from the circuit board.

Refer to Detail 4-2B for the following steps.

NOTE: There are eight tapped holes in the tuning capacitor frame: four on the bottom, two on the corners above the shaft, and two on the rear of the frame. The two on the rear of the frame will not be used. In the next two steps, use the four screw holes nearest the tuning capacitor shaft, two on the bottom and two on the upper corners above the shaft. Keep the plates of the tuning capacitor fully meshed while you perform the following steps.



Detail 4-2B

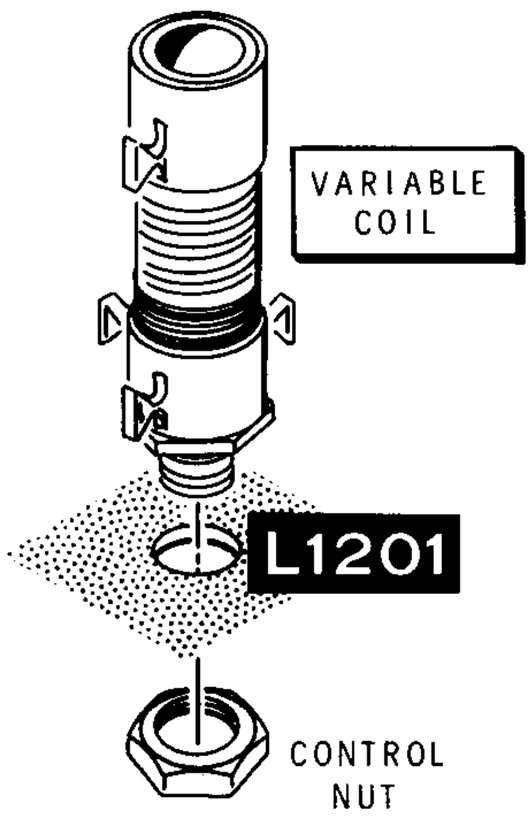


Detail 4-2A

( ) C1201. Refer to Part 1 of the Detail and mount two #6 locking solder lugs on the upper corners of the tuning capacitor. Use 6-32 x 3/16" screws. Position the solder lugs as shown.

( ) Refer to Part 2 of the Detail and insert the tuning capacitor shaft through hole C1201 in the VFO bracket. Secure the capacitor to the bracket with 6-32 x 3/16" hardware as shown. Be sure to use the front holes in the bottom of the capacitor and the two front holes in the bracket.

( ) Bend lug 1 of capacitor C1201, out of the way, as shown in the Detail.



Detail 4-2C

( ) L1201. Refer to Detail 4-2C and temporarily mount the variable coil in hole L1201 in the VFO bracket with a control nut. Position the coil as shown in the Pictorial.

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

( ) Refer to the Pictorial and connect a 1-1/2" bare wire from each solder lug on the front of the tuning capacitor to corresponding solder lugs FM and FW on the corners of the oscillator circuit board. Solder the wires at each solder lug and cut off any excess wire lengths.

Connect the wires coming from the oscillator circuit board as follows and as shown in Pictorial 4-2.

NOTES:

1. In assembly steps, the letter "S" with a number, as "(S-1)," means to solder the connection. The number following the "S" tells how many wires are at the connection. If "(NS)" is used in a step it tells you not to solder the connection because other wires will be connected later.

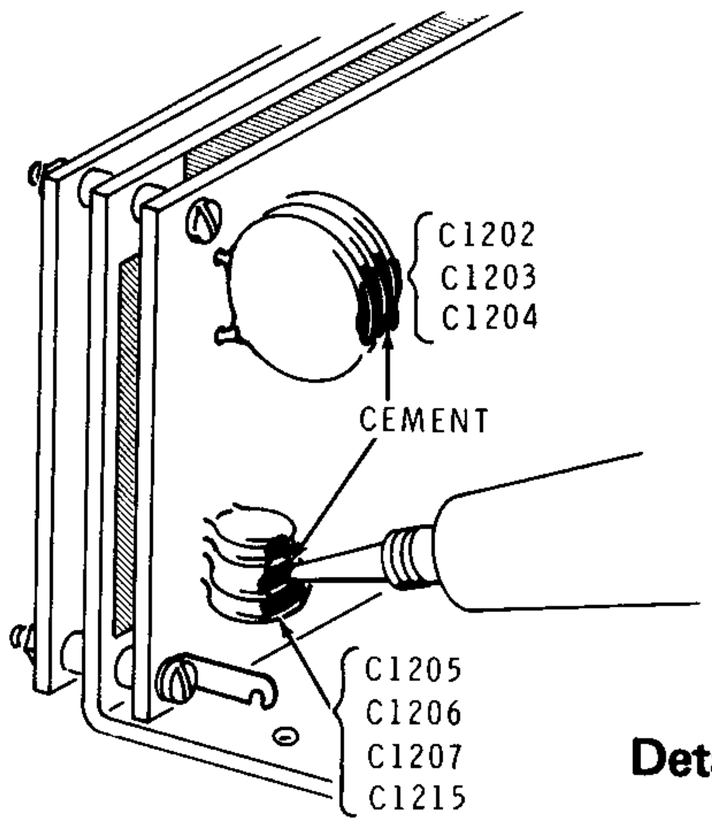
2. The coil wires you connect in the following steps should be as short as possible. Cut any excess wire lengths to make the most direct connection you can.

( ) Gray wire to coil L1201, lug 2 (S-1).

( ) Short orange wire to coil L1201, lug 1 (S-1).

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. Be especially careful when you solder these connections that you apply enough solder and heat to properly solder these "through" wires.

( ) Red wire through coil L1201 lug 4 (S-2) to capacitor C1201 lug 2 (S-1).



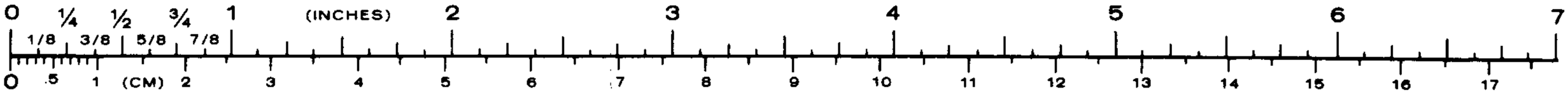
Detail 4-2D

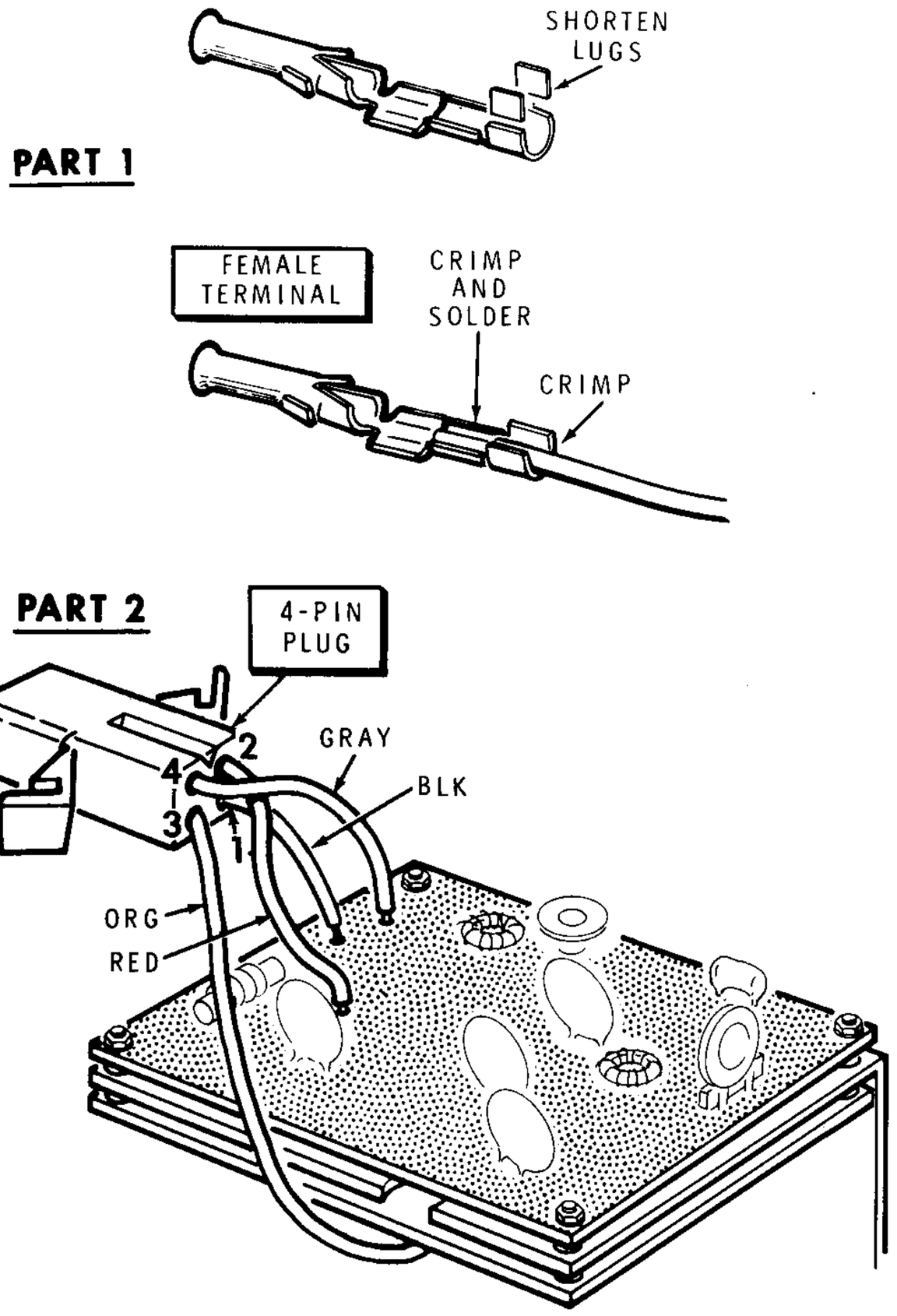
( ) Refer to Detail 4-2D and press the top edges of disc capacitors C1205, C1206, and C1207 together. In the same manner, press disc capacitors C1202, C1203, C1204, and C1215 together.

( ) Remove the cap from the tube of cement. Use a suitable small pointed tool and punch a hole in the end of the tube nozzle. CAUTION: This cement is very soft and sticky; handle it with care.

( ) Squeeze a sufficient amount of cement on the top edges of the two groups of disc capacitors to cement them together. NOTE: It will require several hours for the cement to set.

( ) Squeeze a few drops of cement into the centers of the two toroid coils on the buffer circuit board so the coils will be fixed in position on the board. NOTE: Save the remaining cement for use later.





Detail 4-3A

Refer to Pictorial 4-3 (fold-out from this page) for the following steps.

( ) Cut four female terminals from the metal strip.

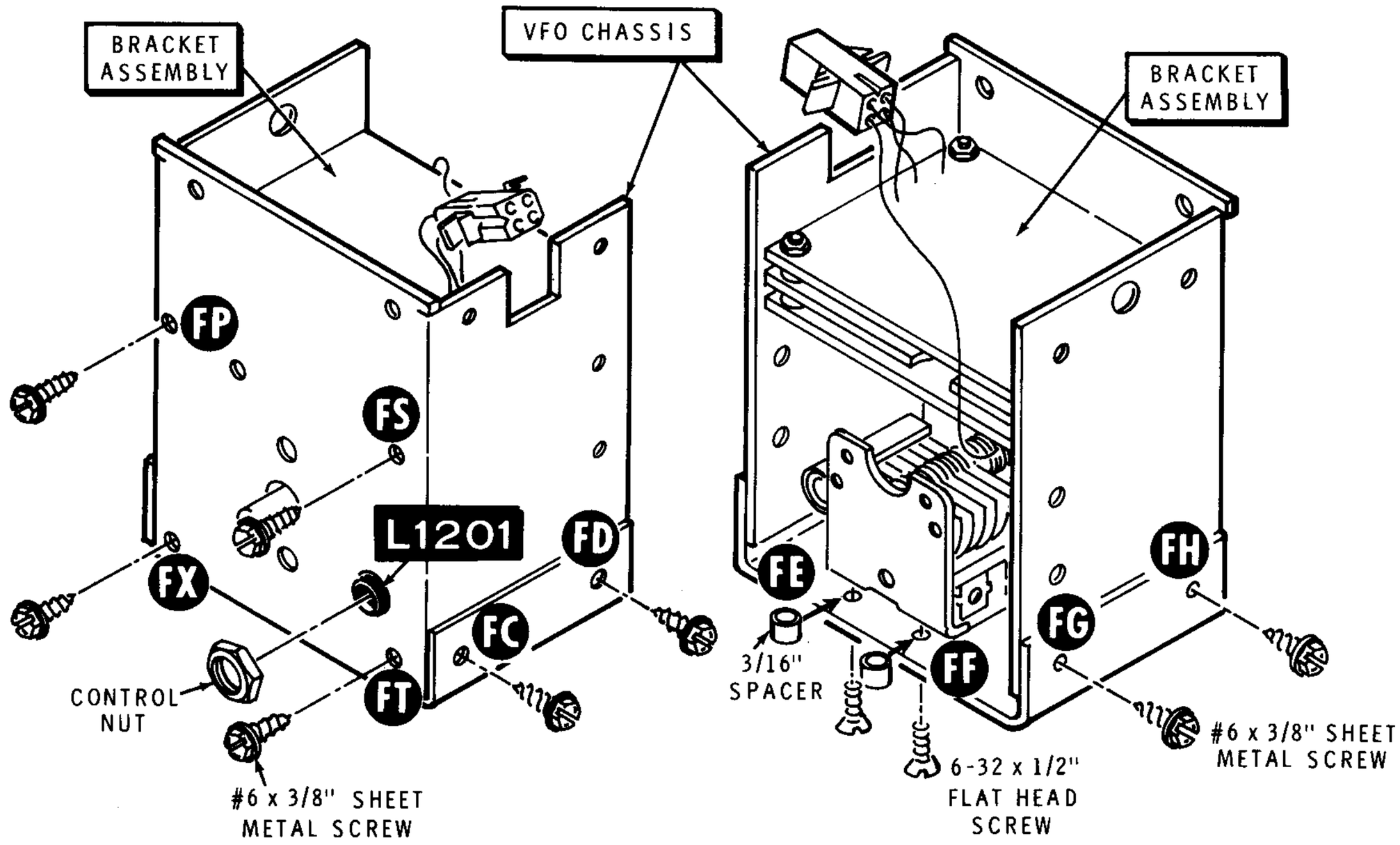
( ) Refer to Part 1 of Detail 4-3A and install female pins on the free ends of the orange, gray, black, and red wires coming from the oscillator and buffer circuit boards.

( ) Position the 4-pin plug as shown. Then refer to Part 2 of Detail 4-3A and push the female pins into the numbered plug holes: black wire to hole 1, red wire into hole 2, orange wire into hole 3, and gray wire into hole 4.

( ) Position the orange wire toward the rear of the VFO and the red, gray, and black wires straight up from the buffer circuit board.

( ) Temporarily remove the nut that secures L1201 to the VFO bracket.

( ) Carefully slide the VFO bracket assembly into the VFO chassis.



Detail 4-3B

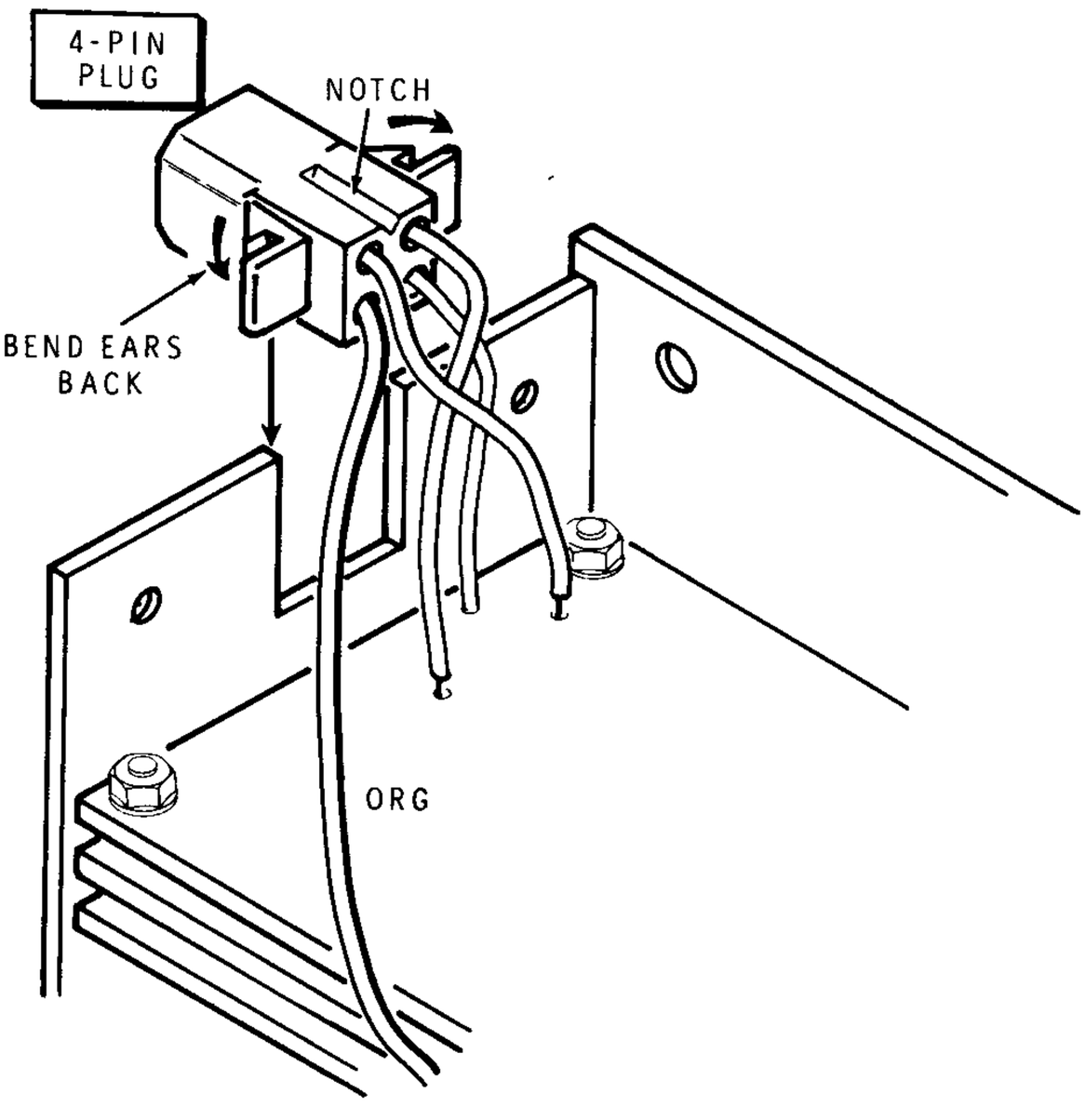
( ) Refer to Detail 4-3B and secure the VFO bracket to the VFO chassis with four #6 x 3/8" sheet metal screws at FP, FS, FT, and FX.

( ) Secure coil L201 with the control nut previously removed.

( ) Secure the lower part of the VFO bracket to the VFO chassis with 6-32 x 3/8" flat head screws and 3/16" spacers at FE and FF. Position the spacers between the bracket and the chassis as shown.

( ) Secure the bottom sides of the VFO chassis at FC, FD, FG, and FH with #6 x 3/8" sheet metal screws.

( ) Refer to Detail 4-3C and bend the ears of the 4-pin plug; then insert the plug down into the slot in the upper side of the chassis. Be sure the notch on the plug is up as shown.

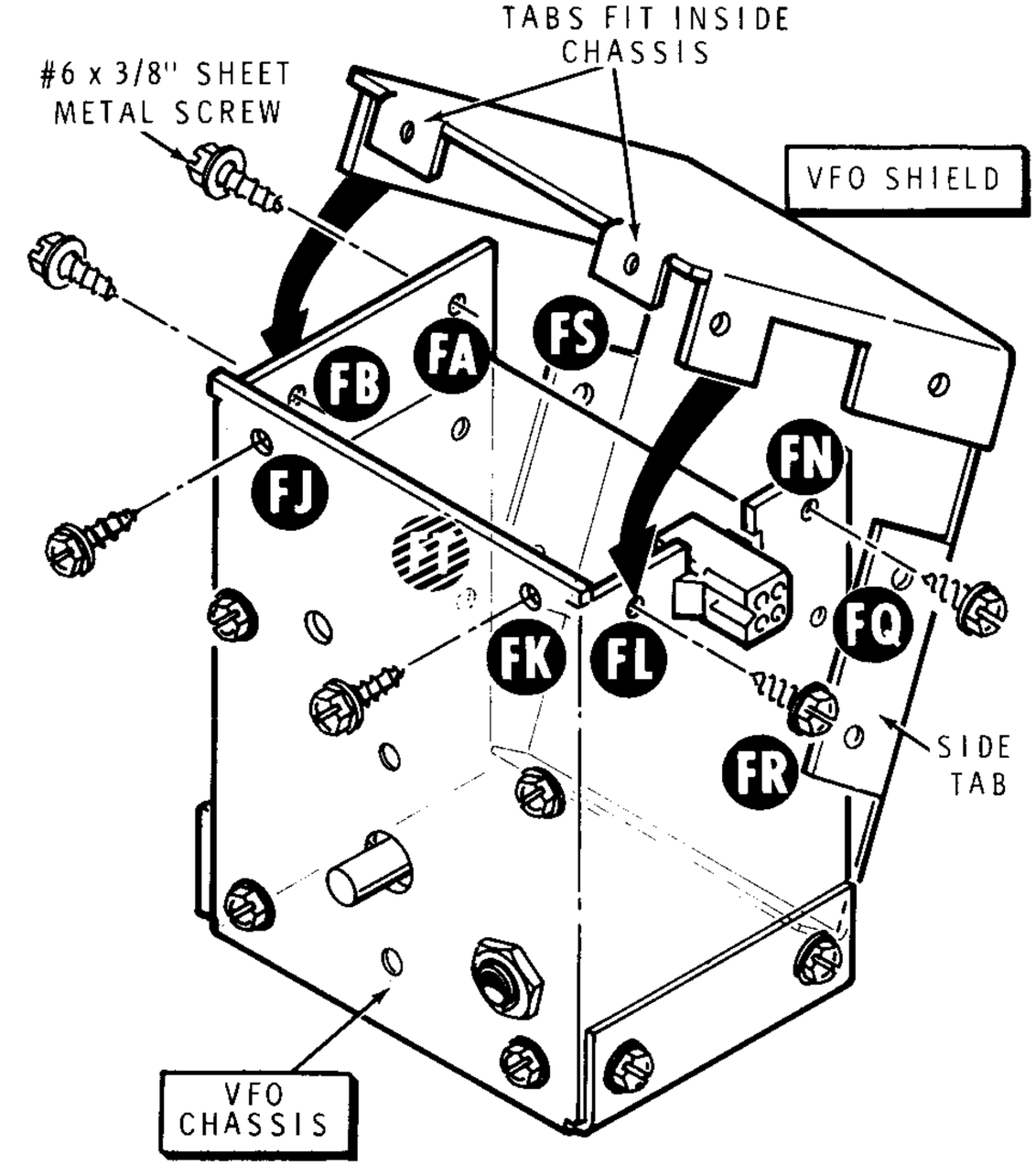


Detail 4-3C

( ) Refer to Pictorial 4-4 and secure the VFO shield to the chassis with six #6 x 3/8" sheet metal screws at FA, FB, FJ, FK, FL, and FN. Be sure the two top tabs of the shield fit inside the VFO chassis. The side shield tabs fit outside the chassis.

( ) Secure the shield side tabs to the chassis at FQ, FR, FS, and FT with #6 x 3/8" sheet metal screws.

This completes the assembly of the VFO. Set it aside temporarily. Also, set all of the unused components aside temporarily; they will be used during the chassis assembly.



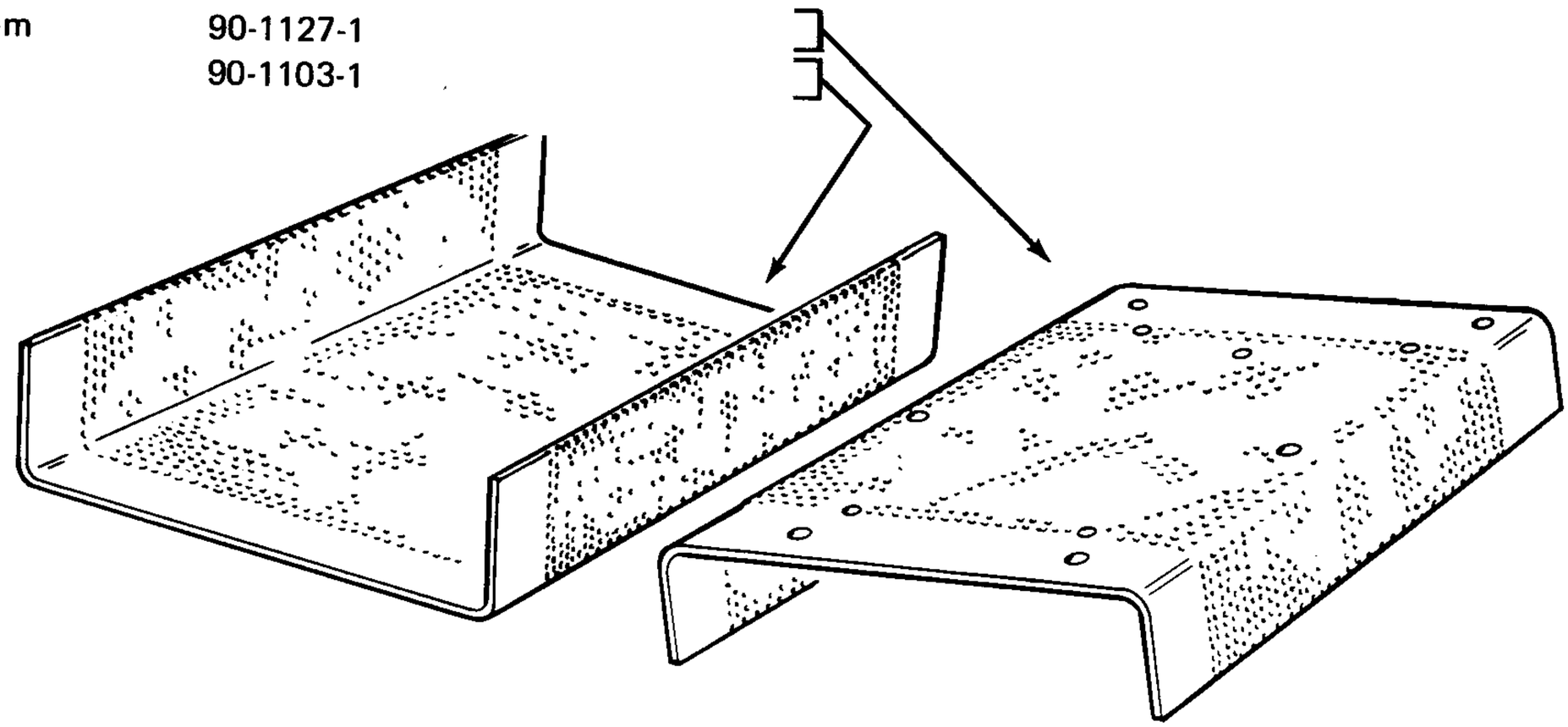
PICTORIAL 4-4

CHASSIS

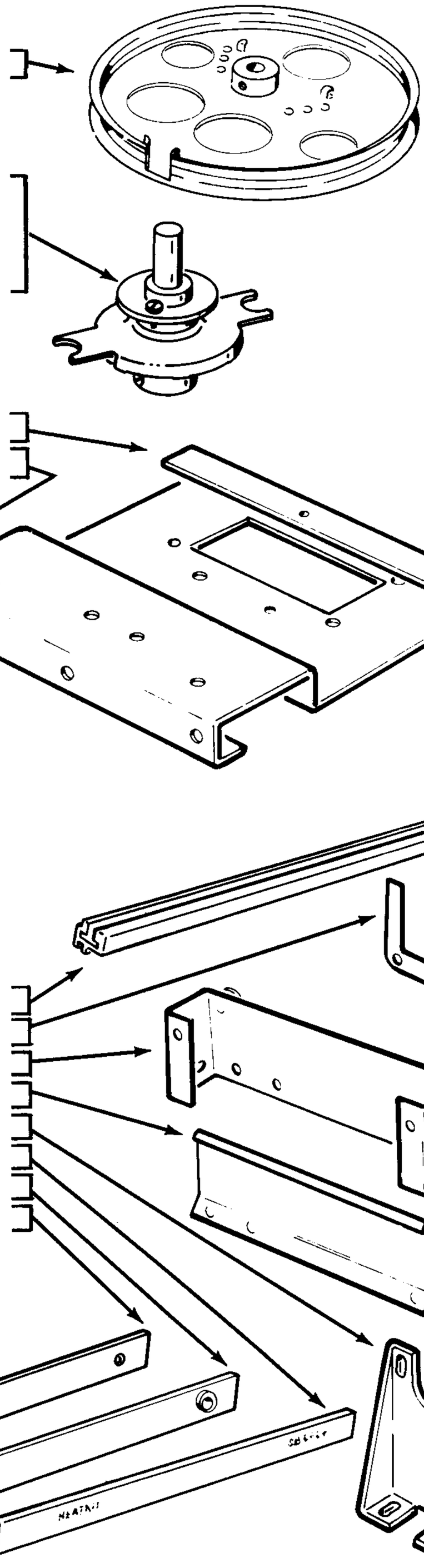
PARTS LIST

Remove the parts from Pack #3 (Final Pack) and check each part against the following list. Make a check (✓) in the space provided as each part is identified. Any part that is packed in an individual envelope with the part number on it should be placed back in the envelope after it is identified until it is called for in a step. Do not throw away any packing materials until all parts are accounted for.

	QTY.	DESCRIPTION	PART No.	CIRCUIT Component No.	PRICE Each
METAL PARTS					
( )	1	Cabinet bottom	90-1127-1		
( )	1	Cabinet top	90-1103-1		



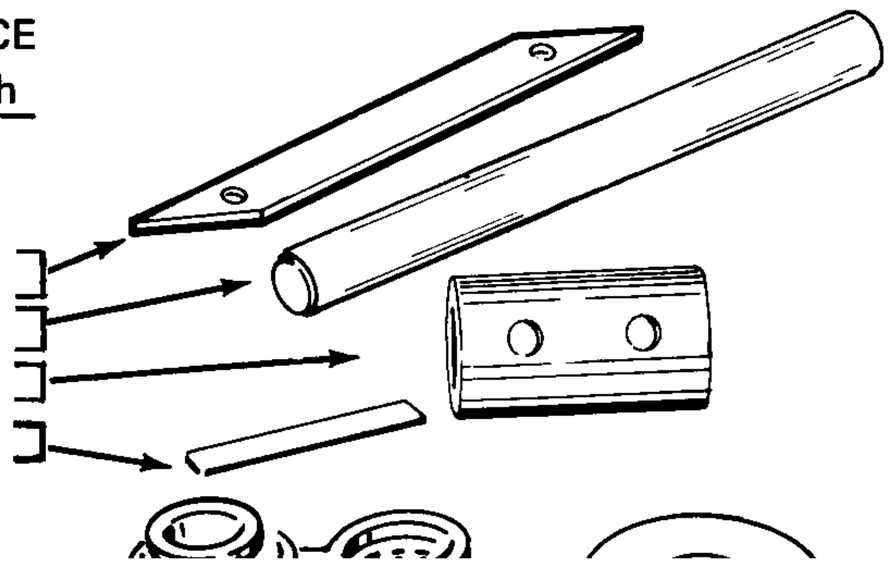
QTY.	DESCRIPTION	PART No.	CIRCUIT Component No.	PRICE Each
Metal Parts (cont'd.)				
( ) 1	Dial pulley	100-252		
( ) 1	Vernier drive (short shaft)	100-1041		
( ) 1	Vernier drive (long shaft)	100-1608		
( ) 1	Chassis	200-1239-1		
( ) 1	Front panel	203-1611-1		
( ) 2	Window bracket	204-1937		
( ) 2	U-bracket	204-1978		
( ) 1	Slide bracket	204-2006-1		
( ) 1	Reflector bracket	204-2007		
( ) 1	Dial drive bracket	204-2018		
( ) 1	Trim plate	205-1448-3		
( ) 2	Inner side strip	204-1939		
( ) 2	Outer side strip	205-1576		



QTY.	DESCRIPTION	PART No.	CIRCUIT Component No.	PRICE Each

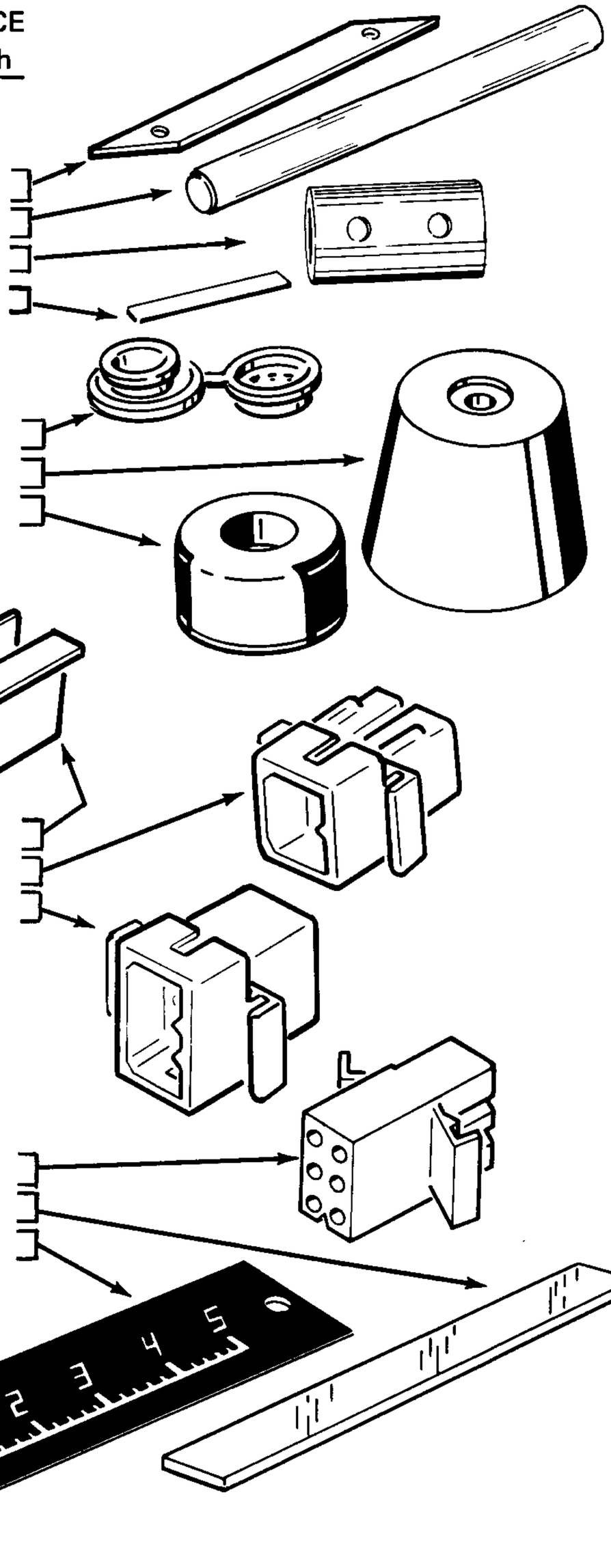
Metal Parts (cont'd.)

( )	2	Angle brace	205-1577
( )	1	Dial shaft	453-265
( )	1	Shaft coupler	456-7
( )	1	Metal blade	205-778



PLASTIC PARTS

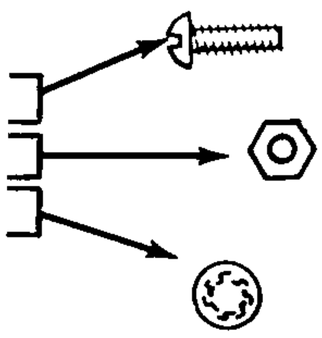
( )	1	Grommet	73-45
( )	2	Large spacer	255-59
( )	4	Foot	261-9
( )	2	Lamp holder	266-824
( )	1	4-pin socket	432-818
( )	1	6-pin socket	432-836
( )	1	6-pin plug	432-837
( )	1	Red window	446-620-1
( )	1	Dial window	446-633-1



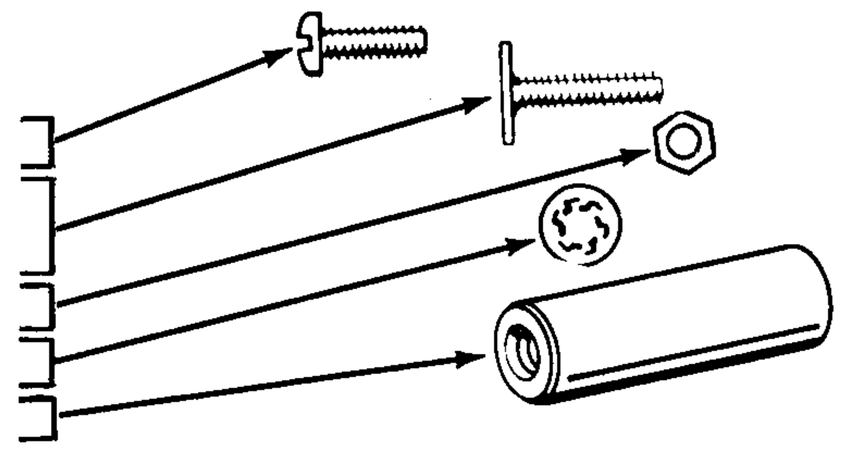
HARDWARE

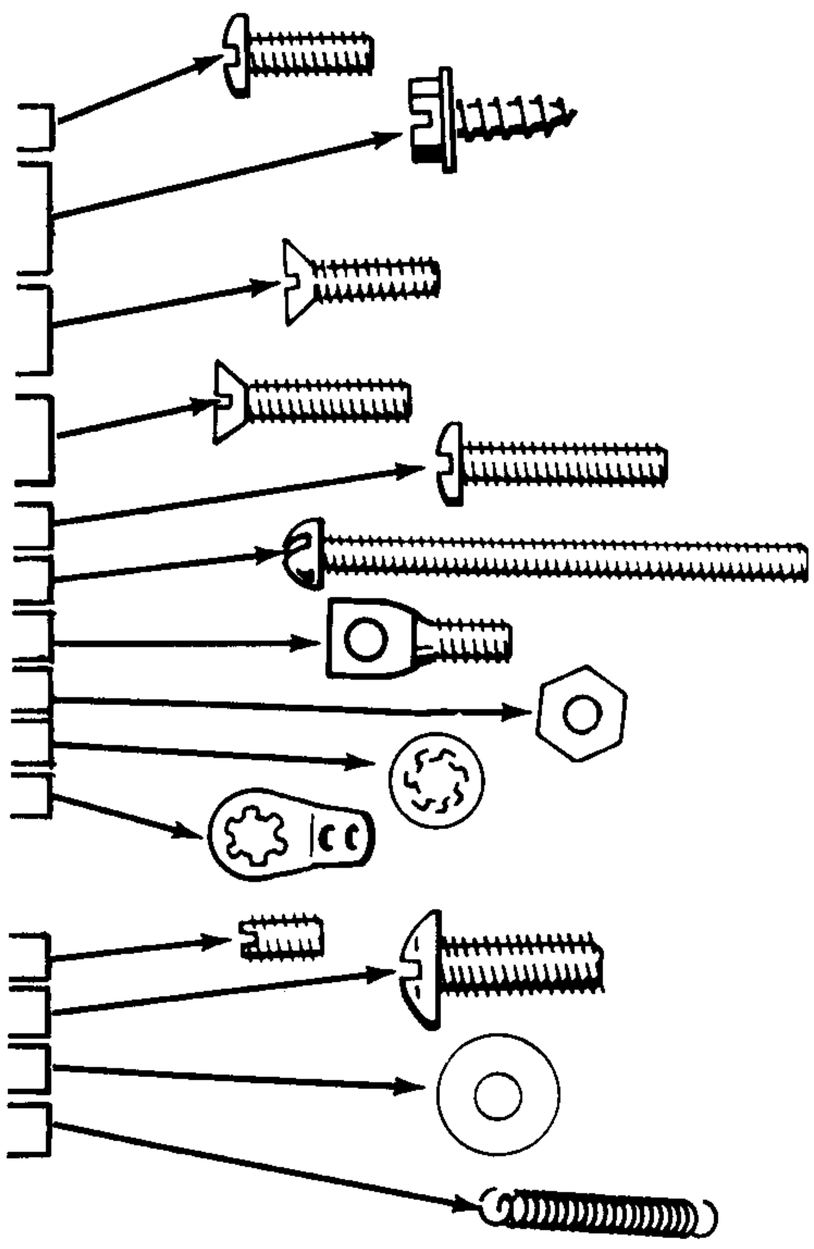
#3 Hardware

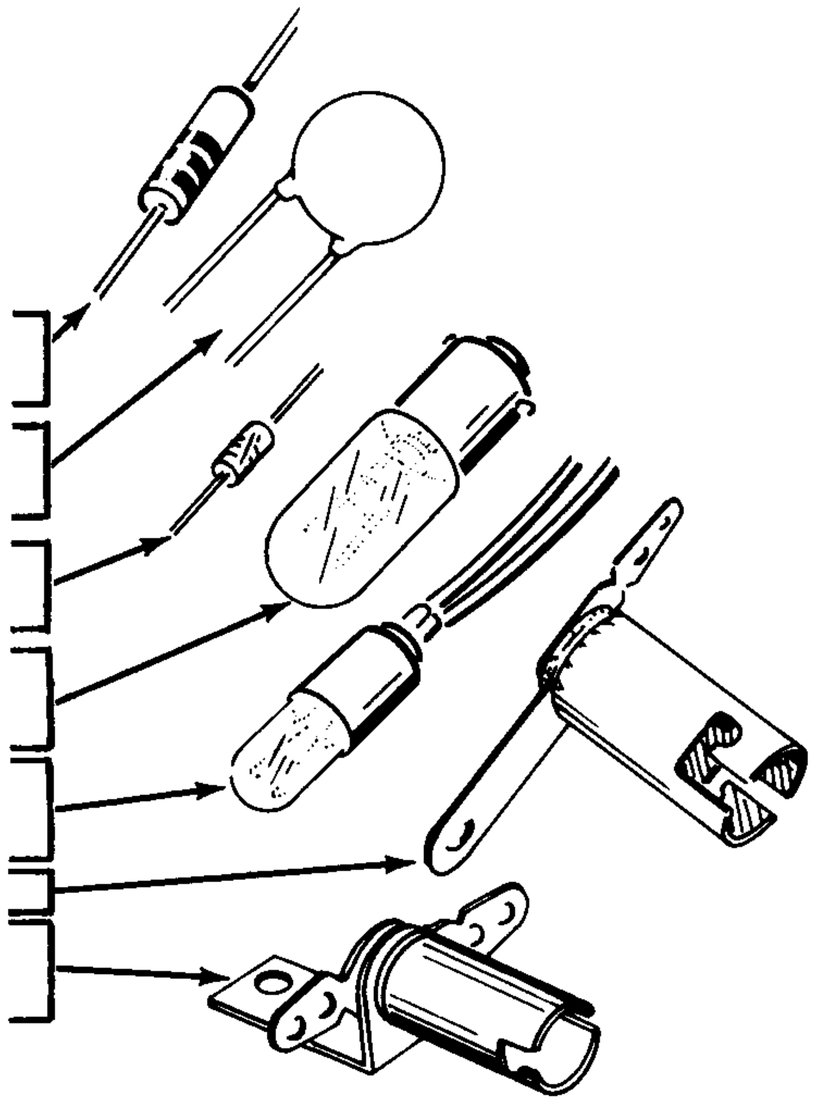
( )	4	3-48 x 5/16" screw	250-2
( )	4	3-48 nut	252-1
( )	4	#3 lockwasher	254-7



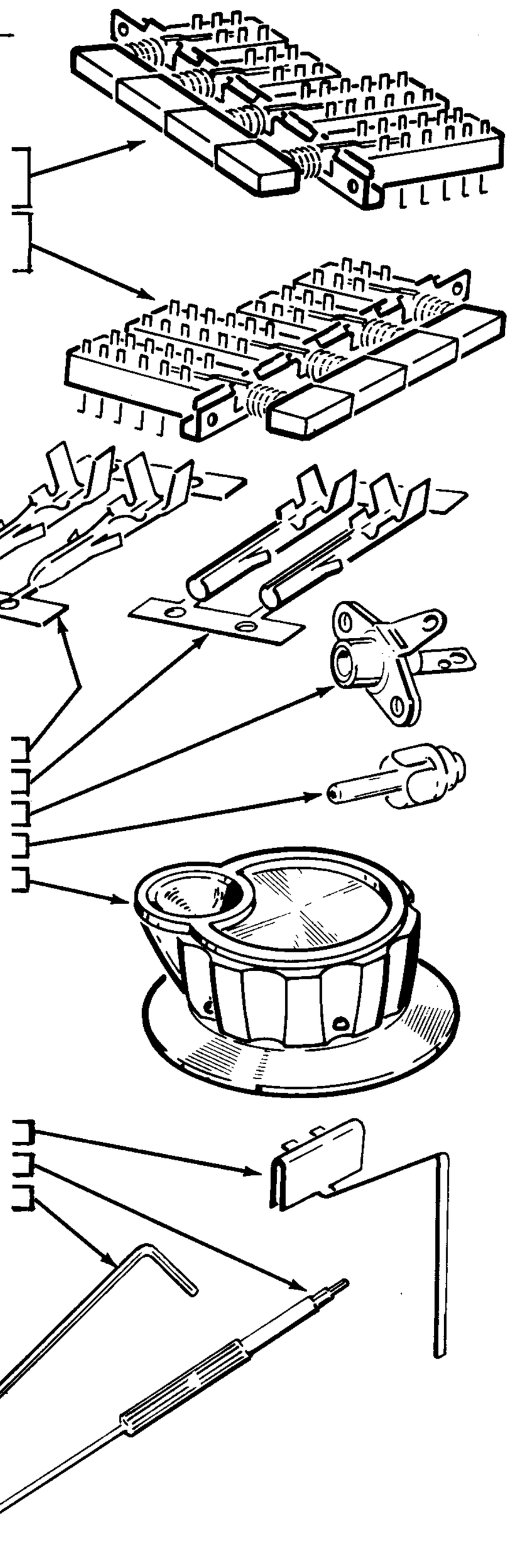
QTY.	DESCRIPTION	PART No.	CIRCUIT Component No.	PRICE Each
#4 Hardware				
( ) 8	4-40 x 5/16" screw	250-213		
( ) 7	4-40 x 1/2" square head screw	250-1194		
( ) 11	4-40 nut	252-2		
( ) 14	#4 lockwasher	254-9		
( ) 2	7/8" spacer	255-151		
#6 Hardware				
( ) 13	6-32 x 3/8" screw	250-89		
( ) 5	#6 x 3/8" sheet metal screw	250-475		
( ) 2	6-32 x 3/8" flat head screw	250-32		
( ) 2	6-32 x 1/2" flat head screw	250-11		
( ) 4	6-32 x 5/8" screw	250-26		
( ) 2	6-32 x 1-1/2" screw	250-40		
( ) 2	6-32 spade bolt	251-1		
( ) 23	6-32 nut	252-3		
( ) 19	#6 lockwasher	254-1		
( ) 4	#6 solder lug	259-1		
Other Hardware				
( ) 1	8-32 x 1/4" setscrew	250-43		
( ) 4	10-32 x 1/2" screw	250-456		
( ) 2	#8 flat washer	253-9		
( ) 1	Dial spring	258-1		
CABLE-SLEEVING				
( ) 7'	RG-174 shielded cable	343-12		
( ) 3'	5 wire cable	347-39		
GENERAL				
( ) 1	47 Ω, 1/2-watt (yellow-violet-black) resistor	1-1	R1275	
( ) 1	.05 μF disc capacitor	21-48	C1275	
( ) 1	1N191 diode (brown-white-brown)	56-26	D1275	
( ) 3	#1815 lamp	412-55	PL1201, PL1202, PL1203	
( ) 6	Indicator lamp	412-82	I1201 thru I1206	
( ) 2	Lamp socket (long foot)	434-83		
( ) 1	Lamp socket (angle foot)	434-88		







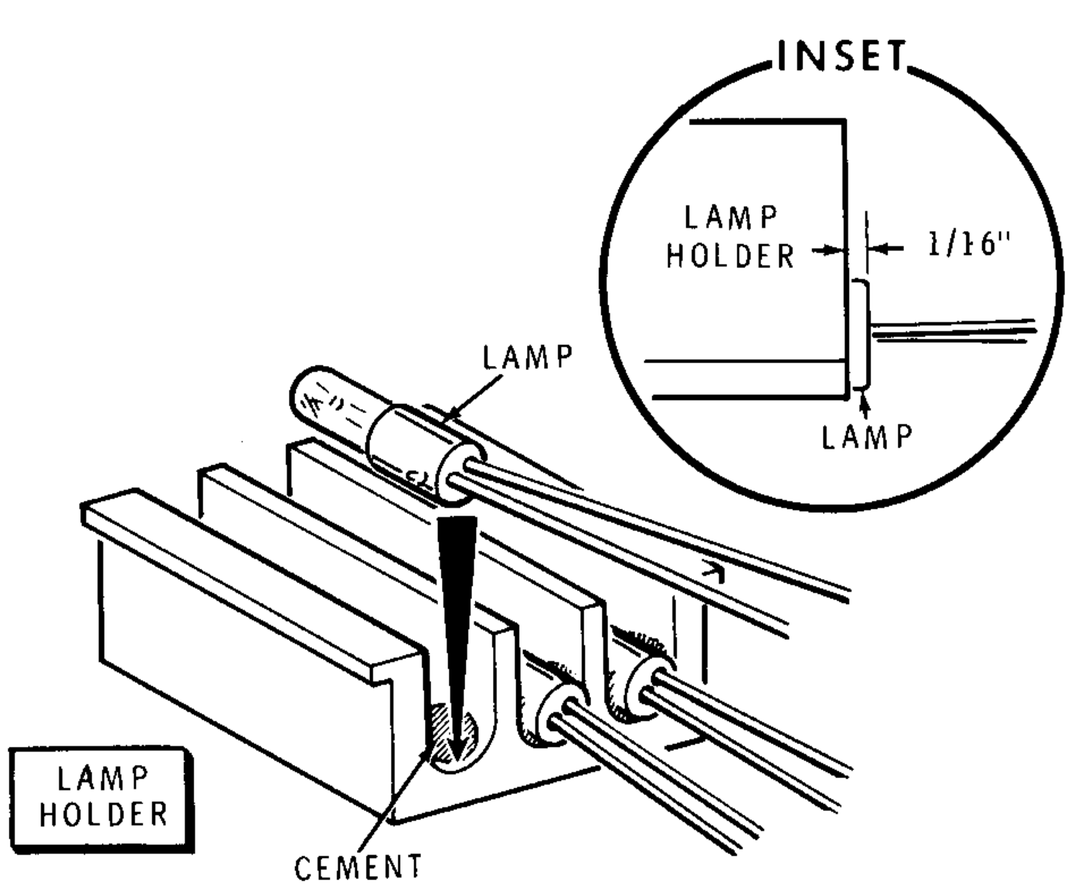
QTY.	DESCRIPTION	PART No.	CIRCUIT Component No.	PRICE Each
MISCELLANEOUS				
( ) 1	4-section switch	64-677	SW5 thru SW8	
( ) 1	4-section switch	64-678	SW1 thru SW4	
( ) 1	Dial cord assembly	100-1660		
( ) 9	Male pin	432-152		
( ) 6	Female terminal	432-153		
( ) 2	Phono socket	434-42		
( ) 4	Phono plug	438-4		
( ) 1	Knob	462-906		
( ) 1	Dial pointer	463-62		
( ) 1	Alignment tool	490-1		
( ) 1	Allen wrench	490-6		



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

To order a replacement part, use the Parts Order Form furnished with this kit. If a Parts Order Form is not available, refer to "Customer Service" inside the rear cover of this Manual.

STEP-BY-STEP ASSEMBLY



PICTORIAL 5-1

LAMP ASSEMBLIES

Refer to Pictorial 5-1 for the following steps.

NOTE: In the following steps, you will cement indicator lamps (#412-82) into their lamp holders (#266-824). These operations are performed next to give the cement time to set firmly before you install the assemblies into the front panel. As you apply cement into the lamp holder slots, keep the cement close to the outer edges to avoid getting cement onto the glass bulb portion of the lamps.

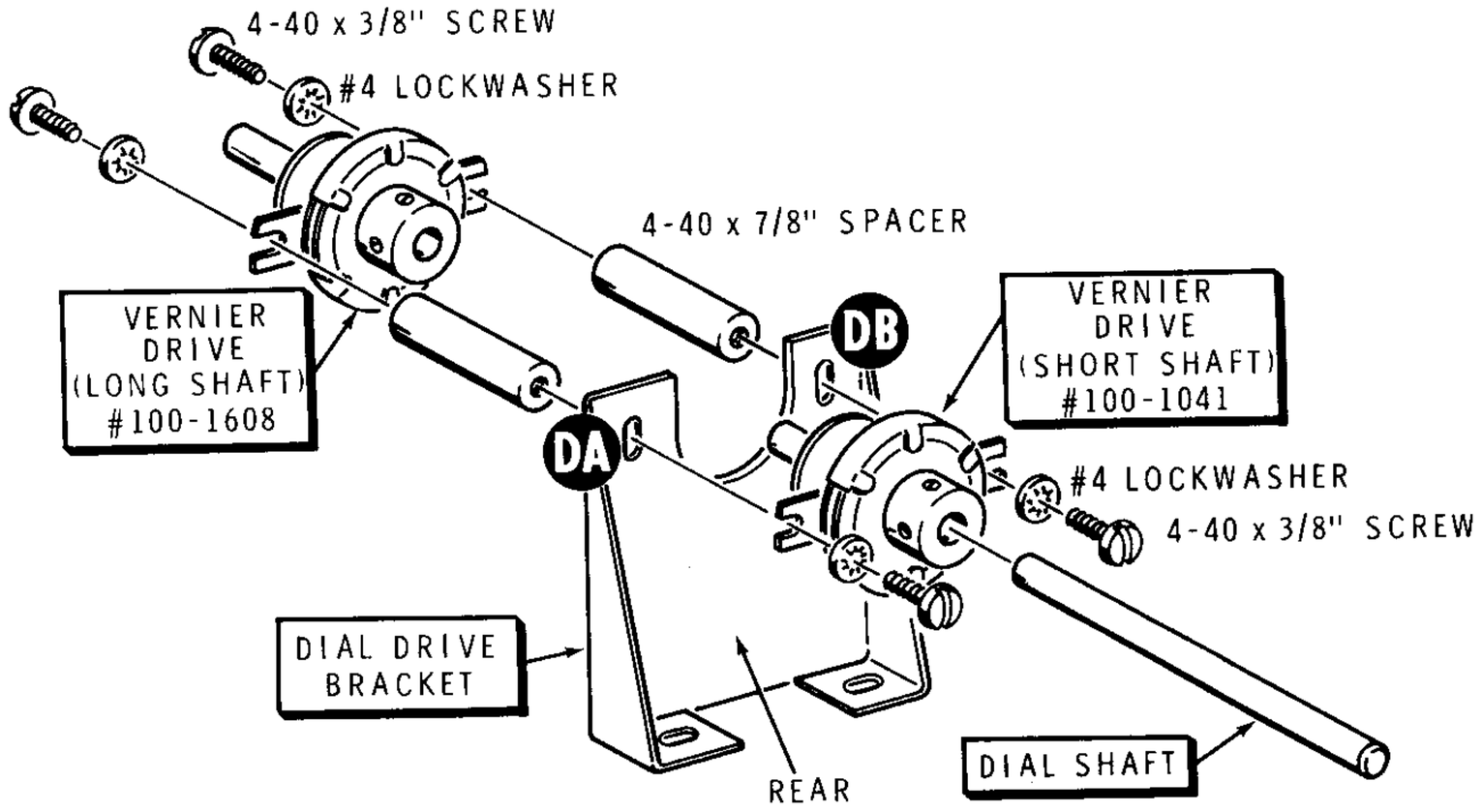
( ) Squeeze a small amount of the cement left from the VFO assembly into the sides of the three slots in either of the lamp holders.

( ) Press the brass base section of an indicator lamp into one of the three slots. Refer to the inset drawing on Pictorial 5-1 and position the outer end of the brass portion of the lamp 1/16" outside the edge of the lamp holder as shown. Press the lamp base firmly down into the cement.

( ) In the same manner, press two more indicator lamps into the remaining two slots in the lamp holder.

( ) Carefully set this lamp housing aside where it cannot be disturbed until the cement is firmly set. This assembly should be left undisturbed for at least eight hours.

( ) In the same manner, apply a small amount of cement in the slots of the other lamp holder. Press the remaining three indicator lamps into the cement. Set this assembly aside with the first one until they are called for later.

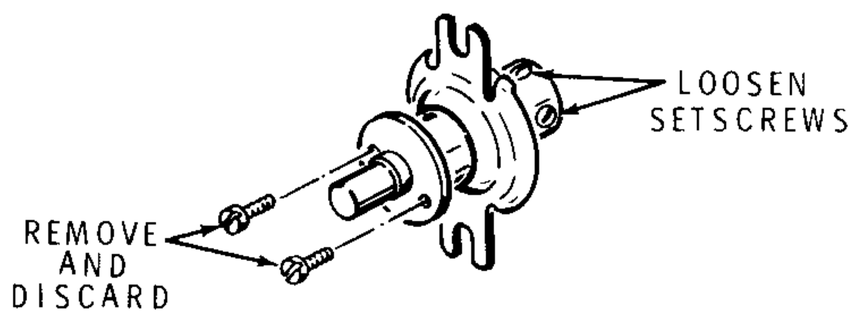


PICTORIAL 6-1

VFO DRIVE ASSEMBLY

Refer to Pictorial 6-1 for the following steps.

( ) Refer to Detail 6-1A and remove and discard the two brass screws in the collar of each of the vernier drives as shown.



Detail 6-1A

( ) Loosen the two setscrews in the bushing of each vernier drive just enough to allow a 1/4" shaft to be inserted in the bushing.

( ) Position the dial drive bracket as shown.

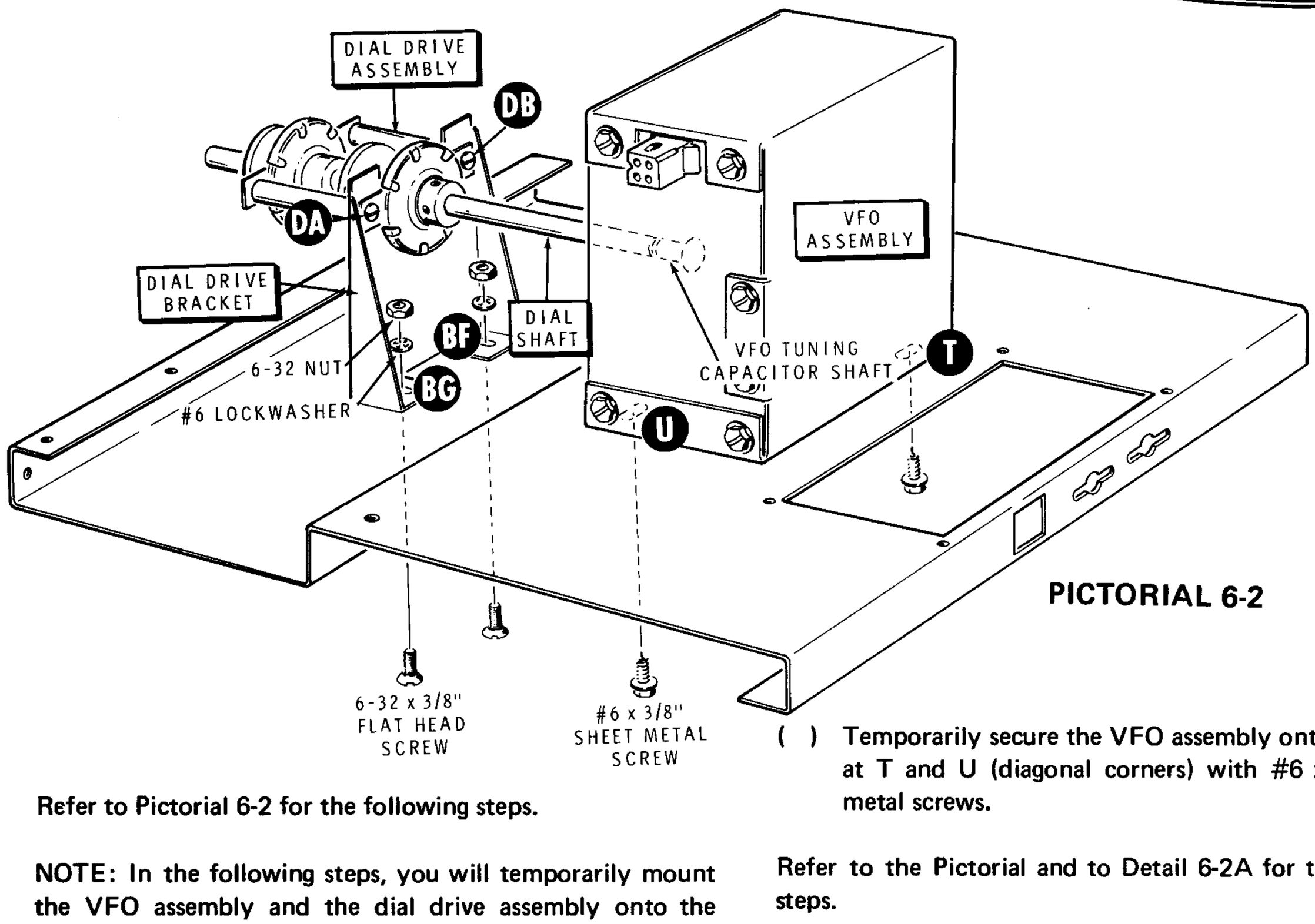
( ) Position the short-shaft vernier drive (#100-1041) onto the rear of the dial drive bracket as shown. Secure the vernier drive to the bracket at DA and DB with two 4-40 x 3/8" screws, two #4 lockwashers, and two 4-40 x 7/8" spacers.

( ) Position the long-shaft vernier drive (#100-1608) on the short shaft of the other vernier drive. Secure the long-shaft vernier drive to the 7/8" spacers with two 4-40 x 3/8" screws and two #4 lockwashers.

( ) Tighten the two setscrews in the bushing of the long-shaft vernier drive.

( ) Place the dial shaft into the bushing of the short-shaft vernier drive. Tighten the bushing setscrews onto the dial shaft.

( ) Slightly loosen bracket mounting screws DA and DB to allow for height adjustment in following steps.

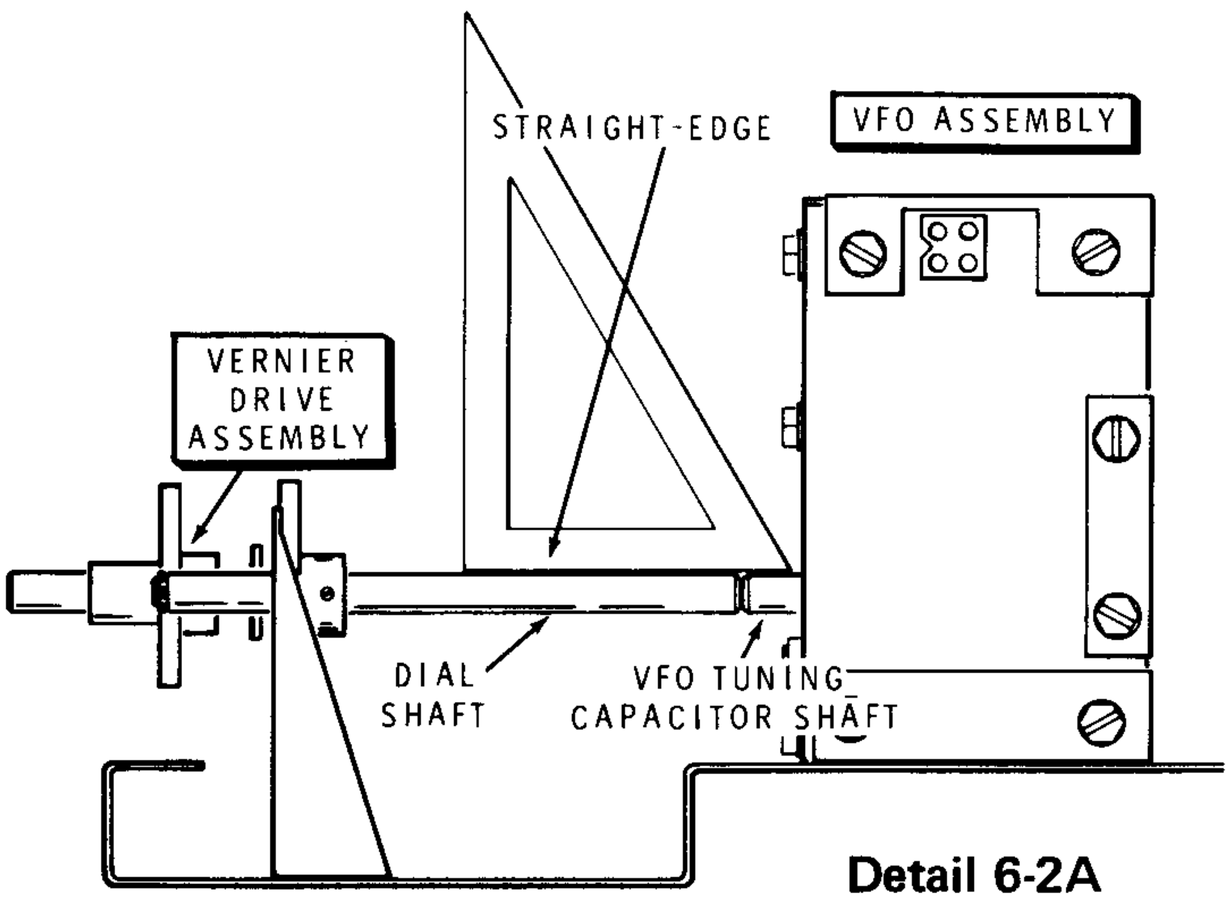


PICTORIAL 6-2

Refer to Pictorial 6-2 for the following steps.

NOTE: In the following steps, you will temporarily mount the VFO assembly and the dial drive assembly onto the chassis. This will allow you to adjust the dial shaft for its proper height. Other adjustments will be performed later.

( ) Temporarily secure the dial drive bracket to the chassis at BG and BF with 6-32 x 3/8" flat head hardware. Position the dial drive assembly as far forward (away from the VFO assembly) in the bracket slots as possible.



Detail 6-2A

( ) Temporarily secure the VFO assembly onto the chassis at T and U (diagonal corners) with #6 x 3/8" sheet metal screws.

Refer to the Pictorial and to Detail 6-2A for the following steps.

( ) Position the chassis with its side toward you as shown in the Detail. This will permit you to observe the relative heights of the dial shaft and the VFO tuning capacitor shaft. NOTE: A short straightedge placed along the top of either shaft may help you to accurately align the two shafts.

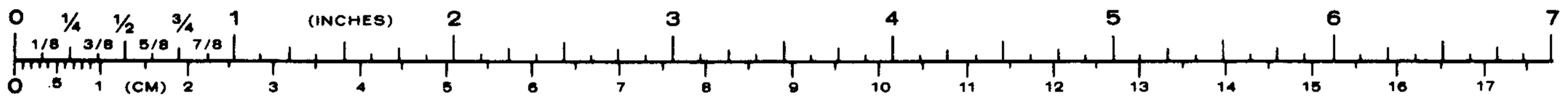
( ) Slightly adjust the vernier drive upward or downward in dial drive bracket slots DA and DB until the height of the VFO shaft and the dial drive shaft are equal. Refer to the Pictorial and tighten bracket screws DA and DB.

( ) Loosen and remove VFO mounting screws T and U. Set these and the VFO assembly aside temporarily.

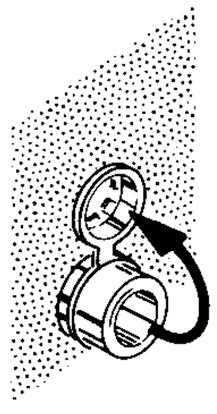
( ) Loosen and remove dial drive bracket mounting screws BF and BG. Set these screws and the dial drive assembly aside temporarily.

Refer to Pictorial 7-1 (fold-out from Page 39) for the following steps.

( ) Refer to Detail 7-1A and mount a phono socket at F with 6-32 x 3/8" hardware. Position the short (ground) lug toward the inner chassis fold as shown.



POSITION THE SMALL PORTION OF THE GROMMET INTO THE CHASSIS HOLE.



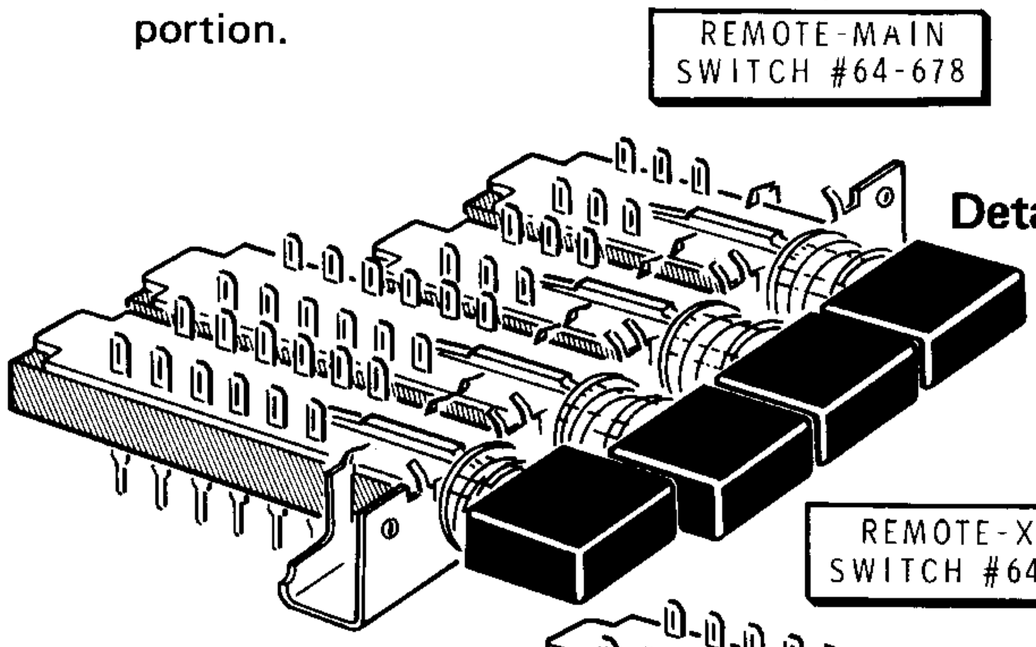
BEND THE LARGE PORTION OF THE GROMMET OVER AND INTO THE SMALL PORTION. PRESS IT FIRMLY INTO PLACE.

Detail 7-1B

( ) In the same manner, mount a phono socket at G.

( ) Mount the switch circuit board on the chassis as shown. Use 4-40 x 5/16" hardware to secure the board at C, D, and E. Use a 4-40 x 5/16" screw, a #6 solder lug, and a 4-40 nut at B. Position the solder lug as shown.

( ) Refer to Detail 7-1B and push the small portion of the plastic grommet into hole A. Secure the grommet by pushing the large portion firmly into the small portion.



Detail 7-1C

Detail 7-1D

NOTE: Refer to Detail 7-1C and Detail 7-1D. It is very important that the two 4-section switch assemblies (#64-678) be properly identified. In the following steps they will be referred to by their functional names, according to the lettering on the front panel. Position both switch assemblies side-by-side with the looped lugs upward as shown. When they are mounted onto the chassis, the assembly shown in Detail 7-1C (#64-678) is the Remote-Main switch. The assembly shown in Detail 7-1D (#64-677) is the Remote-Xtal switch. In the following steps, you will install wires on the switch assemblies. For this purpose, use the wires separated from the 8-wire cable during the VFO assembly.

REMOTE-MAIN SWITCH WIRING (#64-678)

Refer to Pictorial 8-1 (fold-out from this page) for the following steps.

( ) Turn the Remote-Main switch assembly upside down on your work area so the plain lugs are up with the pushbuttons toward you. Carefully note the switch lug numbering.

( ) Prepare the following lengths of small stranded wire:

1-1/2" red	2" brown
2" green	1-1/4" brown
1-1/4" brown	1-3/4" green

Connect the following wires to the indicated switch lugs:

	Wire Color	From Switch-Lug	To Switch-Lug
( )	1-1/2" red	SW4, lug 5 (S-1)	SW3, lug 2 (S-1)
( )	2" green	SW4, lug 3 (S-1)	SW2, lug 6 (NS)
( )	1-1/4" brown	SW3, lug 6 (S-1)	SW2, lug 12 (NS)
( )	2" brown	SW2, lug 11 (S-1)	SW1, lug 5 (S-1)
( )	1-1/4" brown	SW2, lug 12 (S-2)	SW1, lug 12 (S-1)
( )	1-3/4" green	SW2, lug 6 (S-2)	SW1, lug 6 (S-1)

( ) Turn the Remote-Main switch assembly right side up and position it so the pushbuttons are still toward you.

( ) Remove all the insulation from the remaining length of gray wire. You will use this bare wire in the following steps.

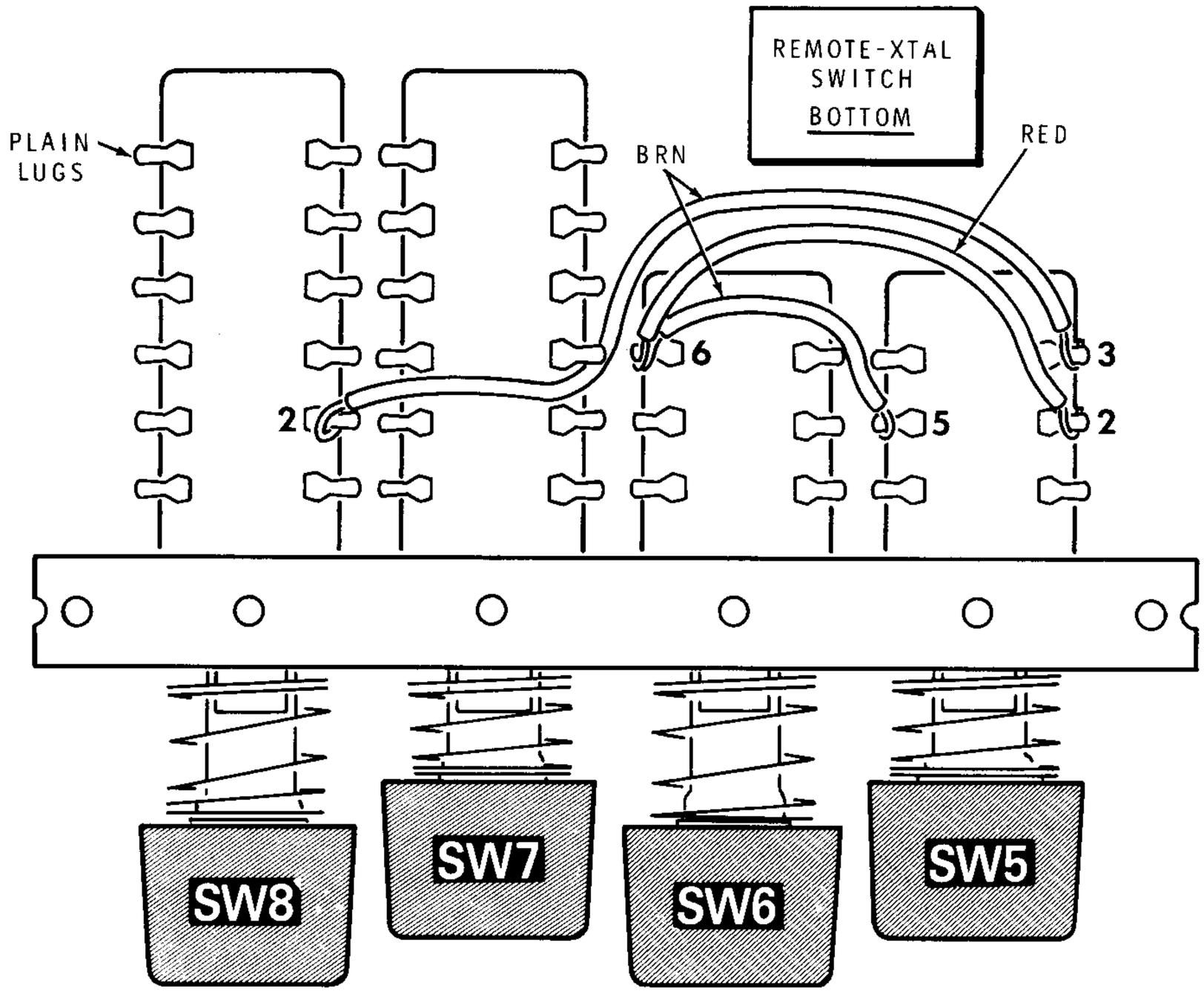
( ) Connect a 3/8" bare wire from SW1 lug 11 (S-1) to SW2 lug 5 (NS).

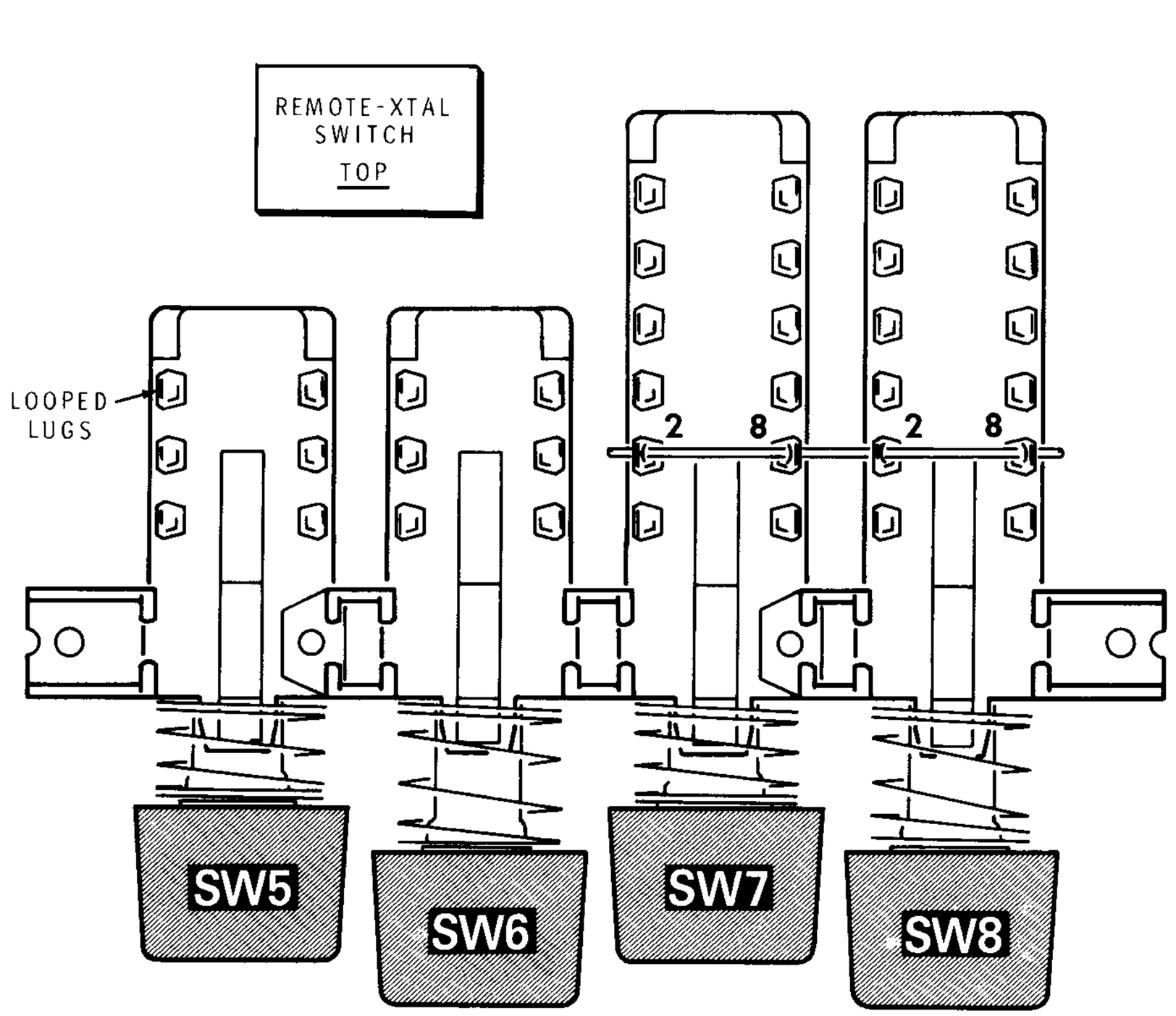
( ) Connect a 3/8" bare wire from SW3 lug 5 (S-1) to SW4 lug 2 (NS).

NOTE: When the following bare wire has been correctly installed on the switch assembly, solder each lug.

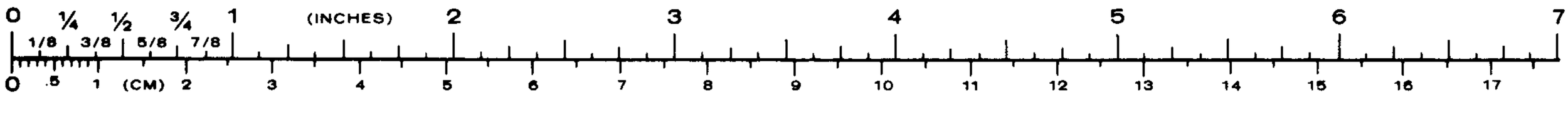
( ) Pass a 1-1/8" bare wire through SW1 lugs 2 (NS) and 8 (S-2), through SW2 lugs 2 (S-2) and 8 (S-2), and connect the end of the wire to SW3 lug 2 (S-1).

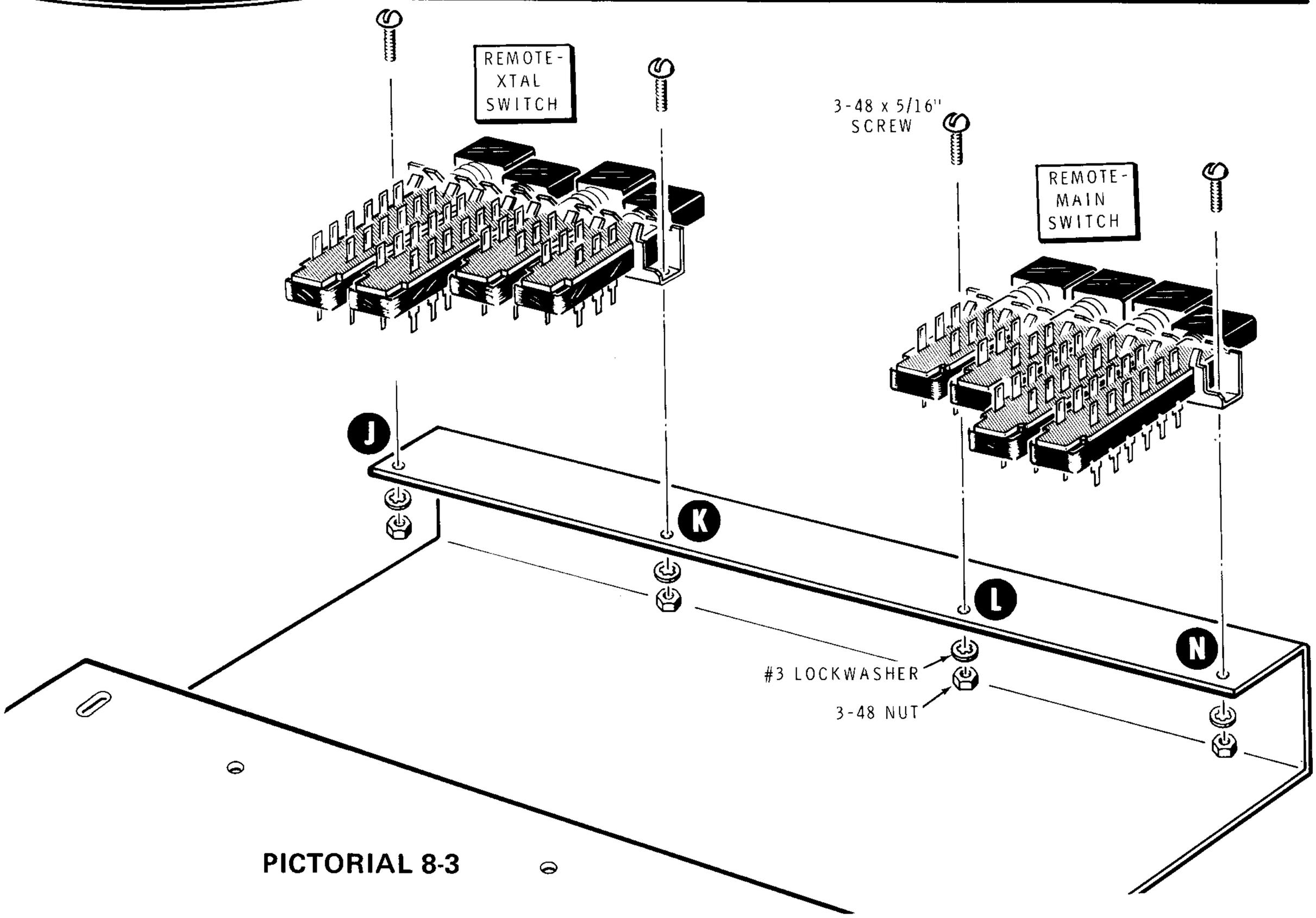
Set the Remote-Main switch aside temporarily. Save the remaining bare wire.





PICTORIAL 8-2





PICTORIAL 8-3

REMOTE-XTAL SWITCH WIRING (#64-677)

Refer to Pictorial 8-2 for the following steps.

( ) Turn the Remote-Xtal switch assembly bottom-side up on your work area so the pushbuttons are toward you. Carefully note the switch lug numbering.

( ) Prepare the following lengths of small stranded and bare wire:

2-1/2" brown
1-1/2" red
1-1/2" brown
7/8" bare

NOTE: Solder the wires as directed in the following steps. Make the connections carefully so as not to short them to nearby connections.

( ) Connect a 2-1/2" brown wire from SW5 lug 3 (S-1) to SW8 lug 2 (S-1).

( ) Connect a 1-1/2" red wire from SW5 lug 2 (S-1) to SW6 lug 6 (NS).

( ) Connect a 1-1/2" brown wire from SW5 lug 5 (S-1) to SW6 lug 6 (S-2).

( ) Turn the Remote-Xtal switch top-side up so the pushbuttons are still toward you.

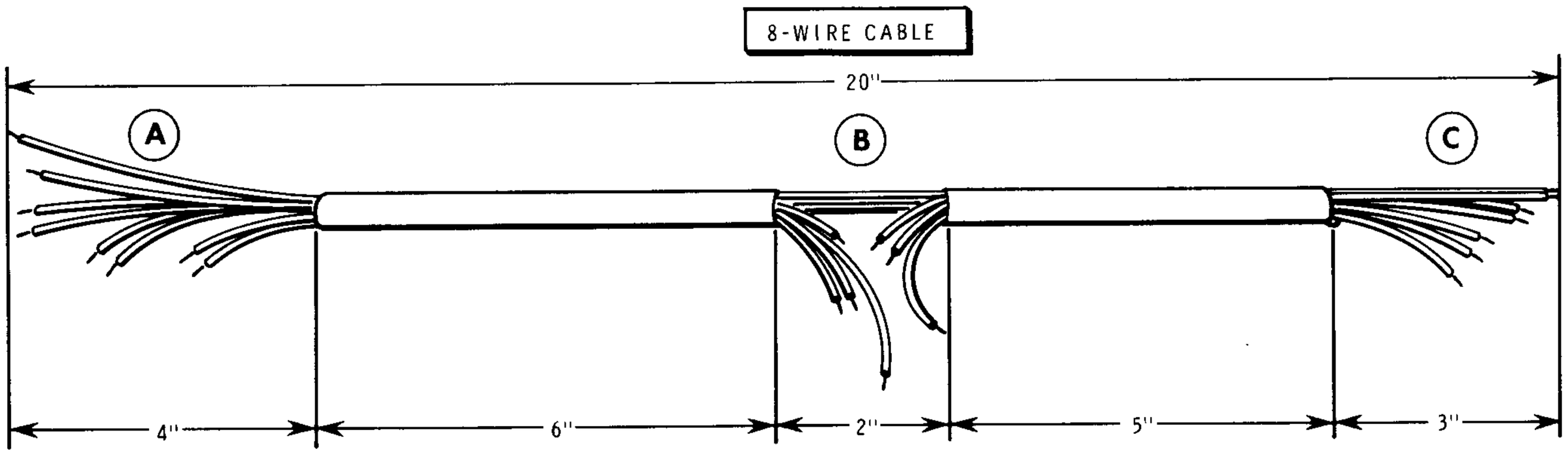
( ) Connect a 7/8" bare wire from SW7 lug 2 (S-1), through SW7 lug 8 (S-2), through SW8 lug 2 (S-2), to SW8 lug 8 (S-1).

Refer to Pictorial 8-3 for the following steps.

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

( ) Mount the Remote-Main switch assembly (#64-678) at L and N on the front of the chassis with 3-48 x 5/16" hardware. Be sure not to pinch any wires between the switch assembly frame and the chassis. NOTE: It may be necessary to turn the screws through the switch mounting holes.

( ) In the same manner, mount the Remote-Xtal switch assembly on the chassis at J and K with 3-48 x 5/16" hardware.



PICTORIAL 8-4

8-WIRE CABLE PREPARATION AND INSTALLATION

Refer to Pictorial 8-4 for the following steps.

NOTE: In the following step, be sure not to use the 5-wire cable.

( ) Cut the 8-wire cable to 20".

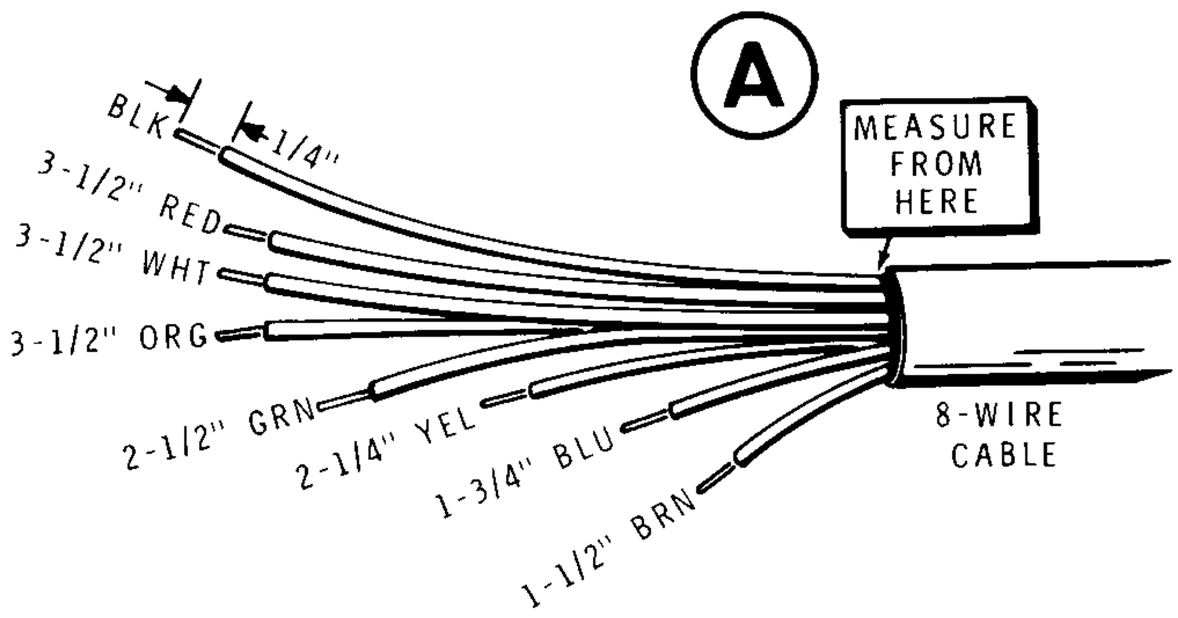
NOTE: In the following steps, you will remove the outer insulation from designated segments of the 8-wire cable. Cut this outer insulation carefully so as not to cut through the insulation of the wires inside.

( ) At one end of the cable remove 4" of the outer insulation. This will be referred to as "end A."

( ) Remove 3" of the outer insulation from the other end of the cable. This will be referred to as "end C."

( ) Measure 10" along the cable from the wire ends at A; mark that point on the cable. Measure another 2" along the cable (total 12" from end A) and mark that point. Carefully cut and remove this 2" segment of outer insulation from the cable. This portion of exposed wires will be referred to as segment "B."

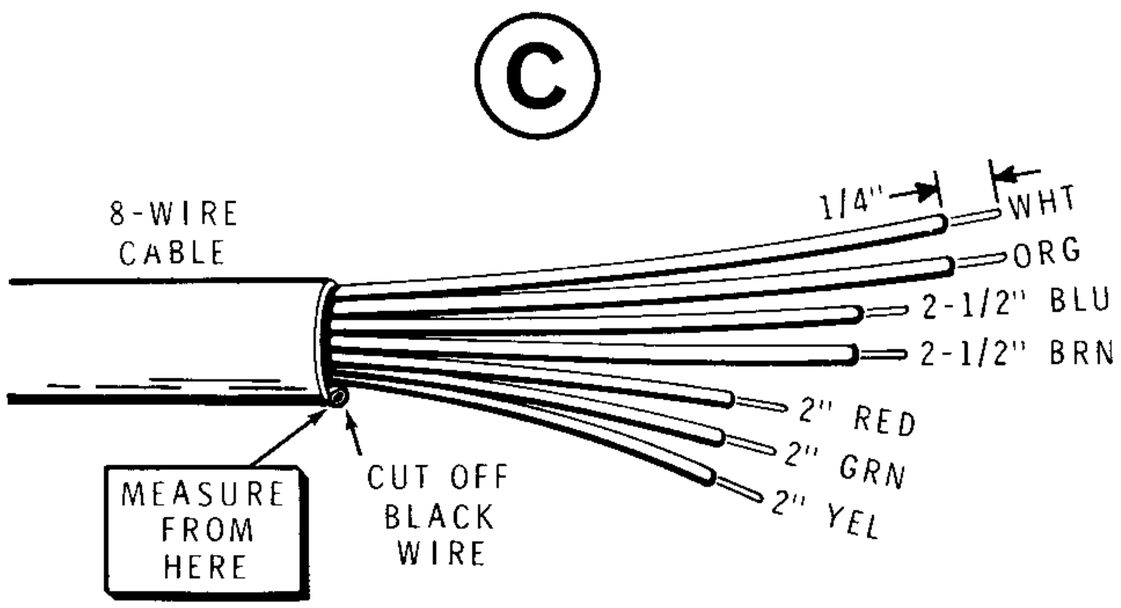
NOTE: In the following steps, cut the wires to the indicated lengths. Then, to avoid pulling the wires from the insulation, grasp each wire with pliers and remove 1/4" of insulation from the wire end. Then, tightly twist each wire end and apply a small amount of solder to hold the small strands together.



Detail 8-4A

( ) Refer to Detail 8-4A and cut each of the eight wires at end A of the 8-wire cable as follows:

Black – (do not cut)	Green – 2-1/2"
Red – 3-1/2"	Yellow – 2-1/4"
White – 3-1/2"	Blue – 1-3/4"
Orange – 3-1/2"	Brown – 1-1/2"

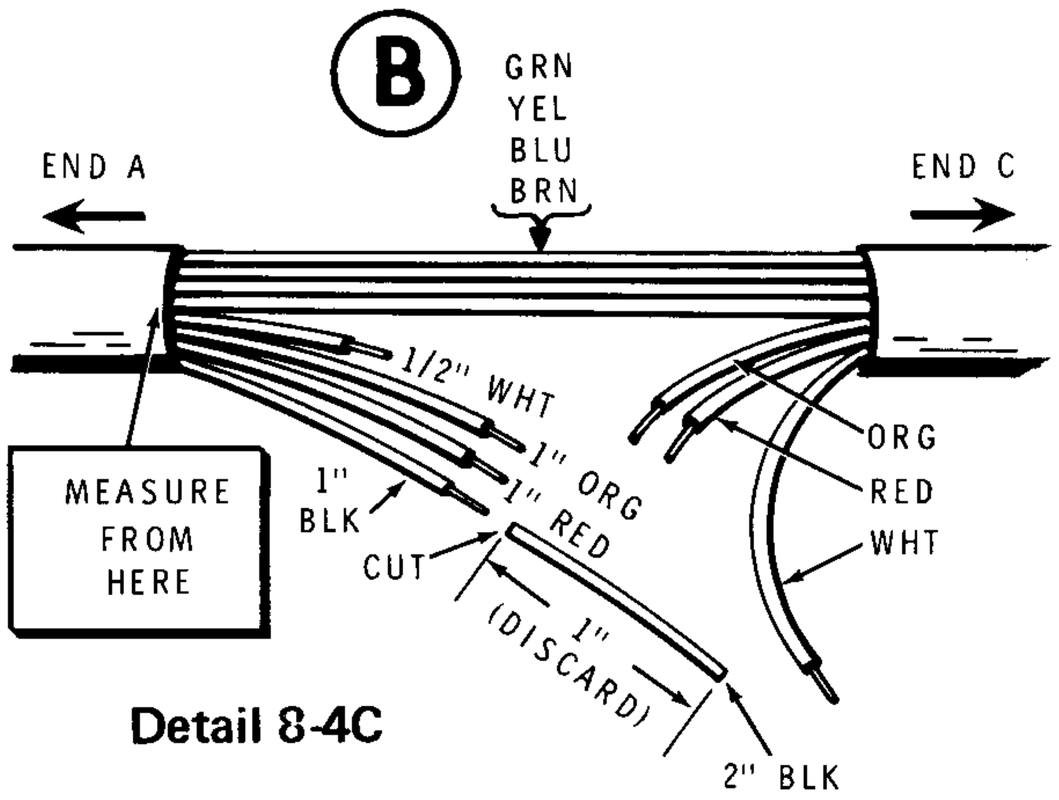


Detail 8-4B

( ) Refer to Detail 8-4B and cut each of the eight wires at end C of the 8-wire cable as follows:

White – (do not cut)	Green – 2"
Orange – (do not cut)	Yellow – 2"
Blue – 2-1/2"	Red – 2"
Brown – 2-1/2"	Black – cut off at insulation (not used)

NOTE: To prepare the wires in segment B of the 8-wire cable, cut only the designated wires; some wires are "through" wires and will not be interrupted by cutting at segment B. Cut the wires at points measured from the end of the insulation nearest end A.



Detail 8-4C

( ) Refer to Detail 8-4C and cut each of the following wires as shown. Prepare both ends of the cut wires, except for the black wire; it will have only one end connected at this point.

Black – 2" (then cut 1" from the 2" exposed end)
Red – 1" Orange 1"
White – 1/2"

Refer to Pictorial 8-5 (fold-out from Page 40) for the following steps.

( ) Pass end A of the 8-wire cable through chassis grommet A, from the front toward the rear. Turn the chassis upside down and pull the cable through the grommet until the outer insulation is at the front edge of the switch circuit board.

NOTE: In the following steps, several wires from end A of the cable will be connected to the foil side of the switch circuit board. To do this, push the wire through the indicated hole in the foil; leave 1/16" of the bare wire exposed at the foil. Then, solder the wire to the foil. Do not cut the excess wires from the top side of the board as they will be used as test points later.

( ) Brown wire to hole C (S-1).

( ) Blue wire to hole D (S-1).

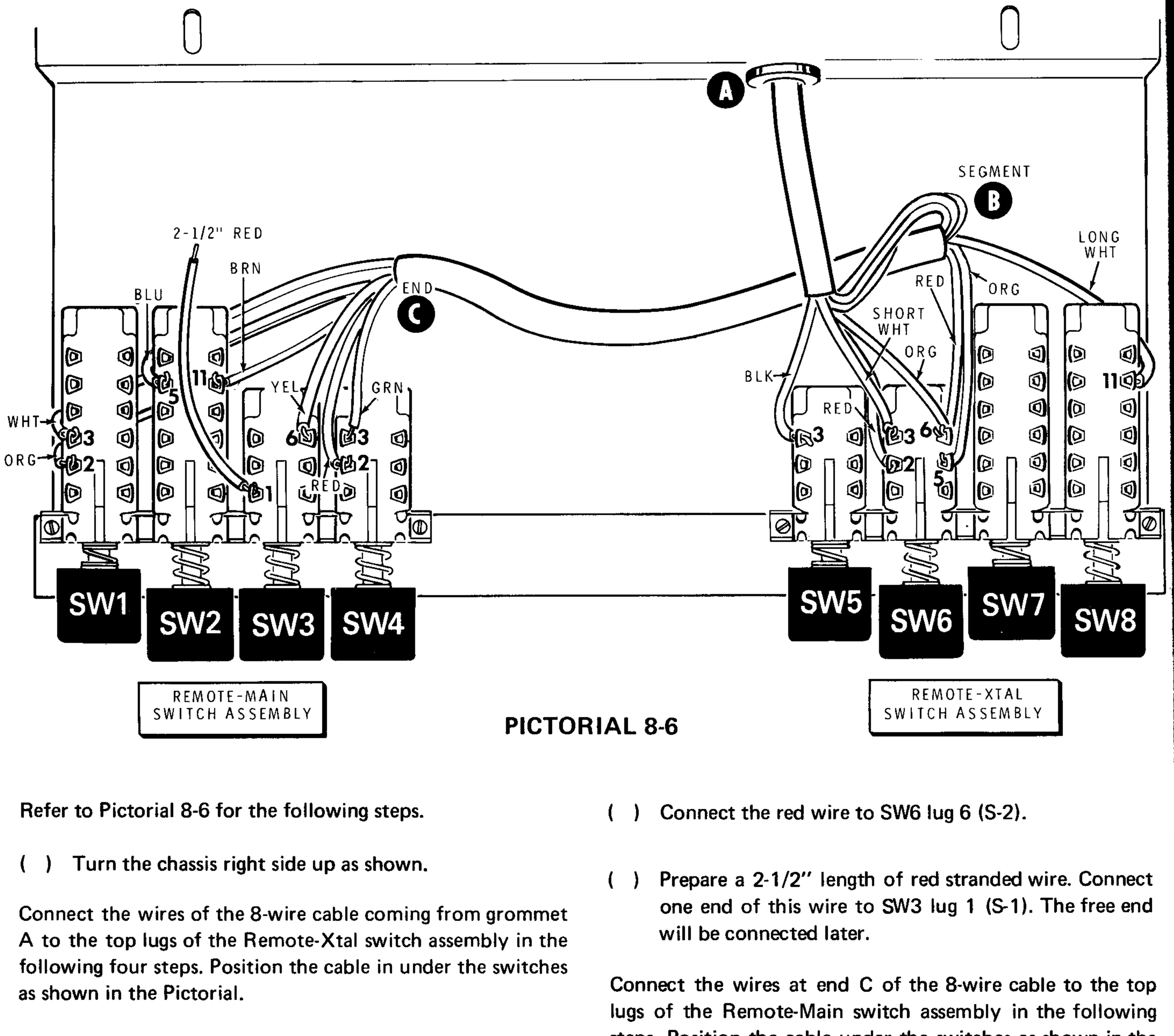
( ) Green wire to hole K (S-1).

( ) Orange wire to hole B (S-1).

( ) Black wire to hole S (S-1).

( ) Yellow wire to hole F (S-1).

The red and white wires will be connected later.



PICTORIAL 8-6

Refer to Pictorial 8-6 for the following steps.

( ) Turn the chassis right side up as shown.

Connect the wires of the 8-wire cable coming from grommet A to the top lugs of the Remote-Xtal switch assembly in the following four steps. Position the cable in under the switches as shown in the Pictorial.

( ) Connect the black wire to SW5 lug 3 (S-1).

( ) Connect the short white wire to SW6 lug 3 (S-1).

( ) Connect the red wire to SW6 lug 2 (S-1).

( ) Connect the orange wire to SW6 lug 6 (NS).

Connect the wires of the 8-wire cable at "Segment B" to the top lugs of the Remote-Xtal switch assembly in the following three steps.

( ) Connect the long white wire to SW8 lug 11 (NS).

( ) Connect the orange wire to SW6 lug 5 (S-1).

( ) Connect the red wire to SW6 lug 6 (S-2).

( ) Prepare a 2-1/2" length of red stranded wire. Connect one end of this wire to SW3 lug 1 (S-1). The free end will be connected later.

Connect the wires at end C of the 8-wire cable to the top lugs of the Remote-Main switch assembly in the following steps. Position the cable under the switches as shown in the Pictorial.

( ) Green wire to SW 4 lug 3 (S-1).

( ) Red wire to SW4 lug 2 (S-2).

( ) Yellow wire to SW3 lug 6 (S-1).

( ) Brown wire to SW2 lug 11 (S-1).

( ) Blue wire to SW2 lug 5 (S-2).

( ) Orange wire to SW1 lug 2 (S-2).

( ) White wire to SW1 lug 3 (S-1).

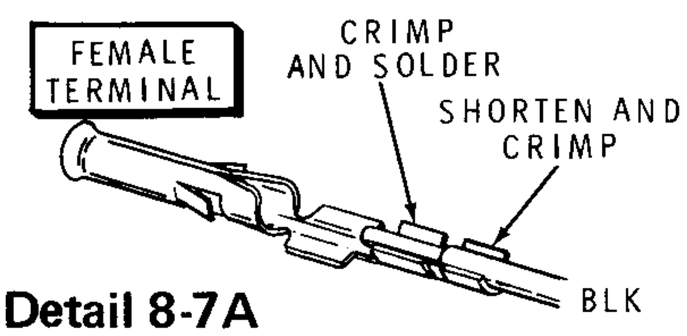
CHASSIS WIRING

Refer to Pictorial 8-7 (fold-out from this page) for the following steps.

( ) Prepare a 1" length of bare wire. Pass this wire through lug 1 (the center conductor) of phono socket G and into hole R in the switch circuit board as shown. Solder both connections.

( ) Prepare the following lengths of small stranded wire:

4-1/2" black	13-1/2" blue
3" yellow	13-1/2" white
2" red	

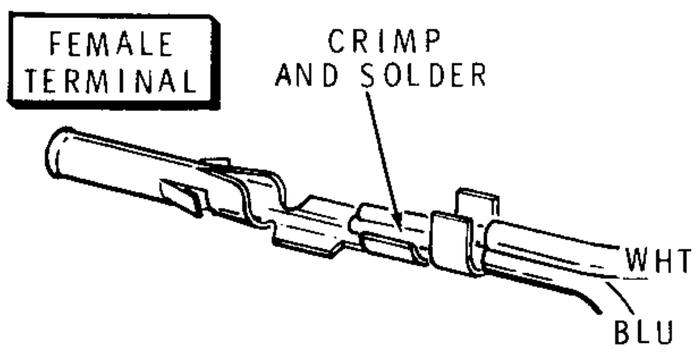


Detail 8-7A

( ) Refer to Detail 8-7A and crimp and solder a female terminal (#432-153) to one end of the 4-1/2" black wire.

( ) In the same manner, crimp and solder female terminals onto one end of the 3" yellow, the 2" red, and the 13-1/2" white wires.

( ) Locate the red wire coming from the 8-wire cable. Crimp and solder a female terminal onto the end of this red wire.



Detail 8-7B

( ) Refer to Detail 8-7B. Locate the white wire coming from the 8-wire cable. Crimp the end of this wire and one end of the 13-1/2" blue wire into a female terminal. Carefully solder the wires to the pin.

Carefully study the 6-pin plug and locate the numbered holes as shown on the inset drawing in Pictorial 8-7. Then push the female terminals into the plug from the rear in the following steps. Push each terminal in until you detect a faint latching click. Check for full seating into the plug by lightly tugging each wire after it is installed.

( ) Black wire terminal into hole 6.

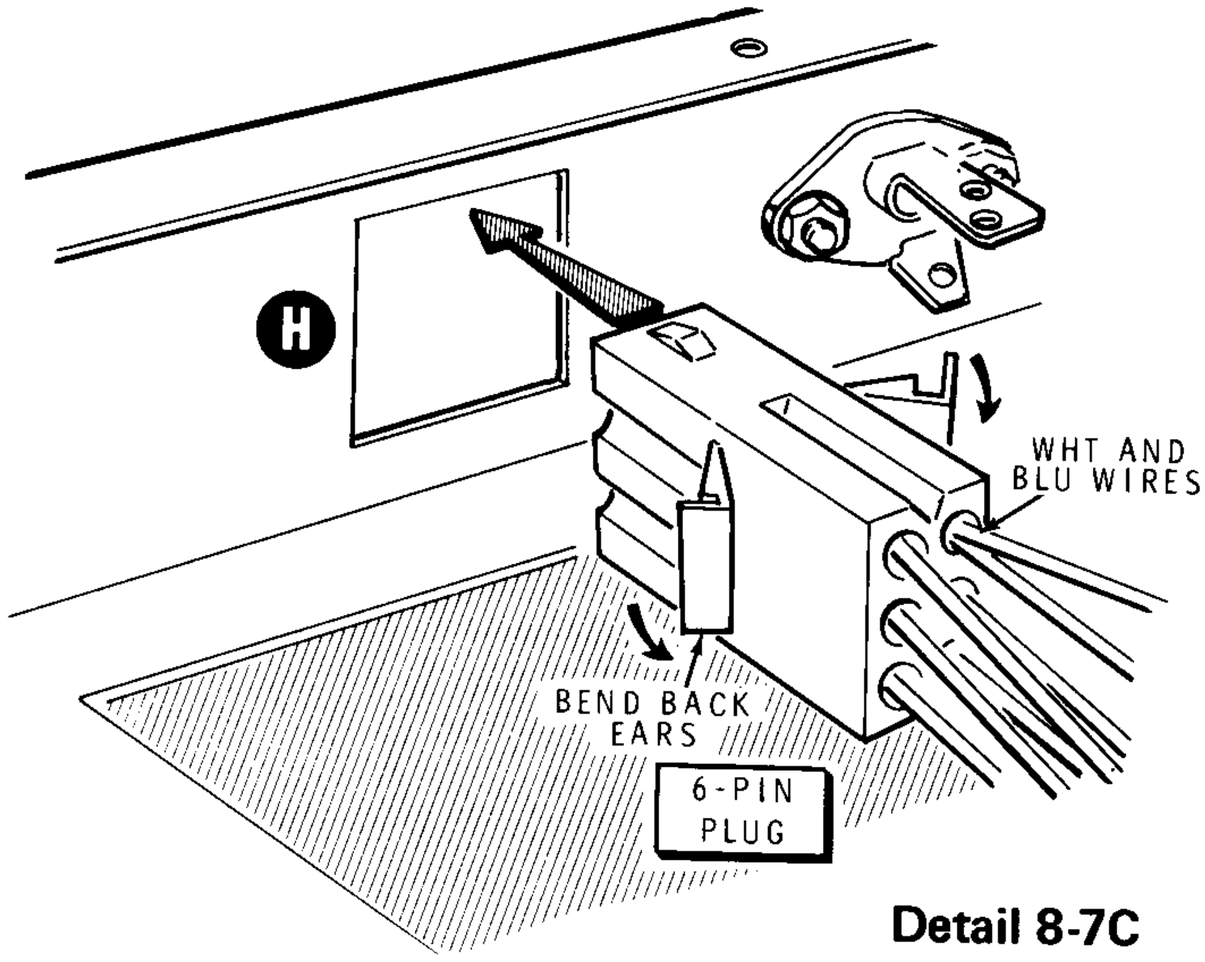
( ) Yellow wire terminal into hole 5.

( ) Short red wire terminal into hole 2.

( ) Long white wire terminal into hole 1.

( ) Red wire terminal from the 8-wire cable into hole 3.

( ) Terminal on the white and blue wires into hole 4.



Detail 8-7C

( ) Refer to Detail 8-7C and position the 6-pin plug as shown. Bend the ears of the plug rearward; then push the plug firmly into opening H in the chassis until the plug ears are secured at the sides of the opening.

( ) Pass the free ends of the long white and the long blue wires coming from socket H through grommet A as shown in the Pictorial. The free ends will be connected later.

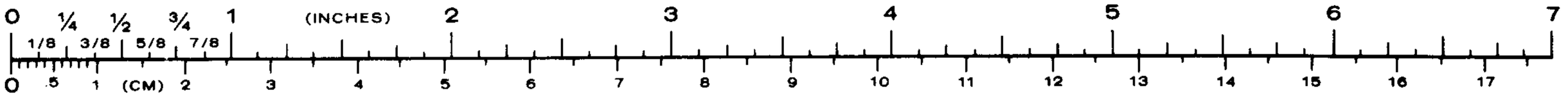
( ) Prepare a 10" stranded green wire. Connect one end of this wire to hole L in the switch circuit board (S-1). Route this wire across the board as shown and pass the free end through grommet A. The free end will be connected later.

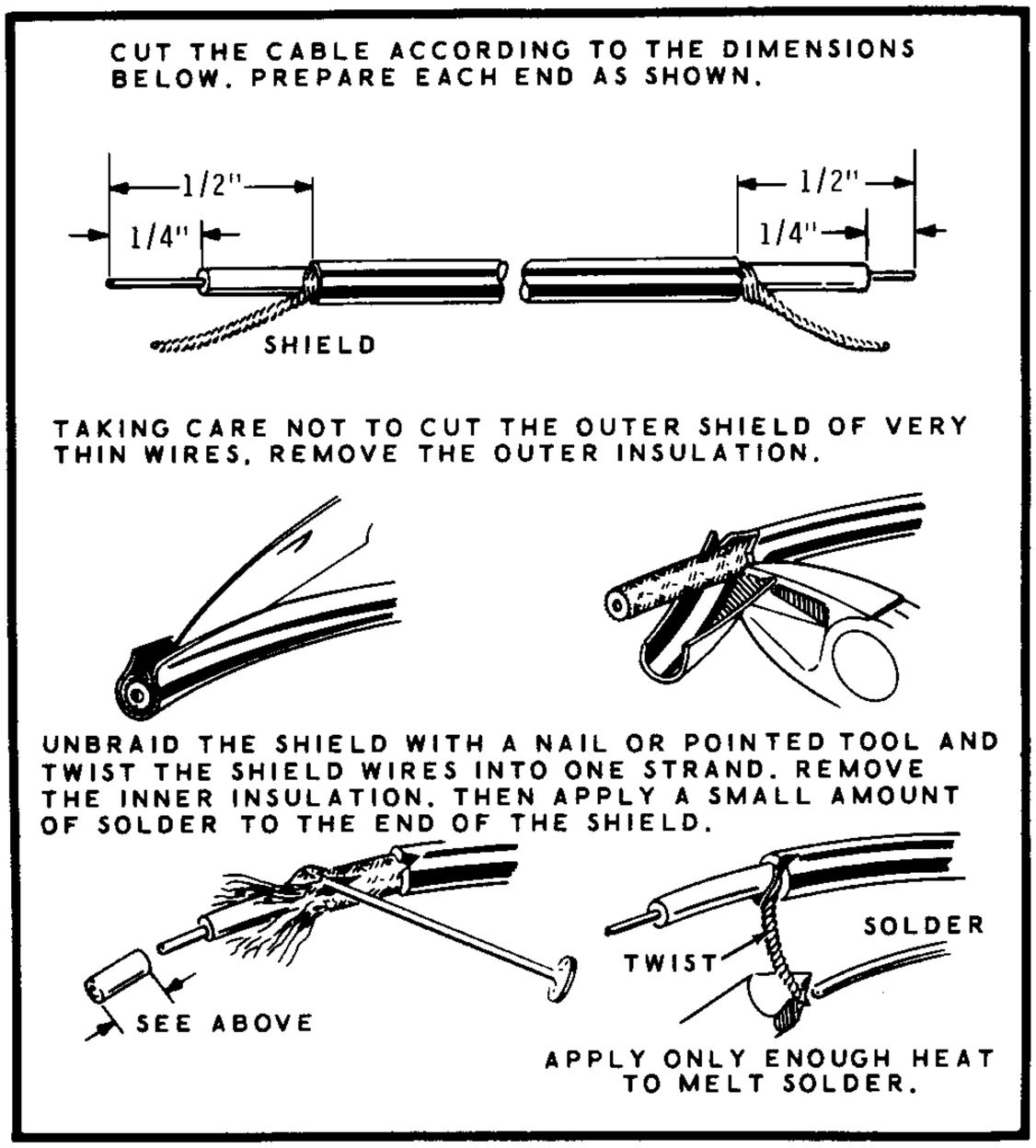
Connect the wires from the 6-pin socket to the switch circuit board in the following steps.

( ) Short red wire to hole U (S-1).

( ) Yellow wire to hole A (S-1).

( ) Black wire to solder lug B (S-1).





Detail 8-8A

Refer to Pictorial 8-8 (fold-out from this page) for the following steps.

( ) Refer to Detail 8-8A and prepare the following lengths of shielded cable:

4"	9-1/2"
11"	9-1/2"

( ) Refer to Pictorial 8-8. At one end of the 4" shielded cable, connect the inner lead to lug 1 (S-1) and the shield lead to lug 2 (S-1) of phono socket F. At the other end of the cable, connect the inner lead to hole E (S-1) and the shield lead to hole EE (S-1) in the switch circuit board.

( ) Connect the inner lead of an 11" shielded cable to hole H (S-1) and the shield lead to hole HH (S-1) in the switch circuit board. Pass the free end of this cable through grommet A as shown; it will be connected later.

( ) Connect the inner lead of a 9-1/2" shielded cable to hole N (S-1) and the shield lead to hole NN (S-1) in the switch circuit board. Cut the shield lead from the free end of the cable. Then pass the free end through grommet A; it will be connected later.

( ) Connect the inner lead of the other 9-1/2" shielded cable to hole P (S-1) and the shield lead to hole PP (S-1) in the switch circuit board. Cut the shield lead from the free end of the cable. Then pass the free end through grommet A; it will be connected later.

This completes the wiring and connections on the under side of the chassis. Circuit board hole T will remain unused. Carefully inspect all the connections to see that they are properly soldered, that there are no shorted connections, and that each of the wires is properly routed.

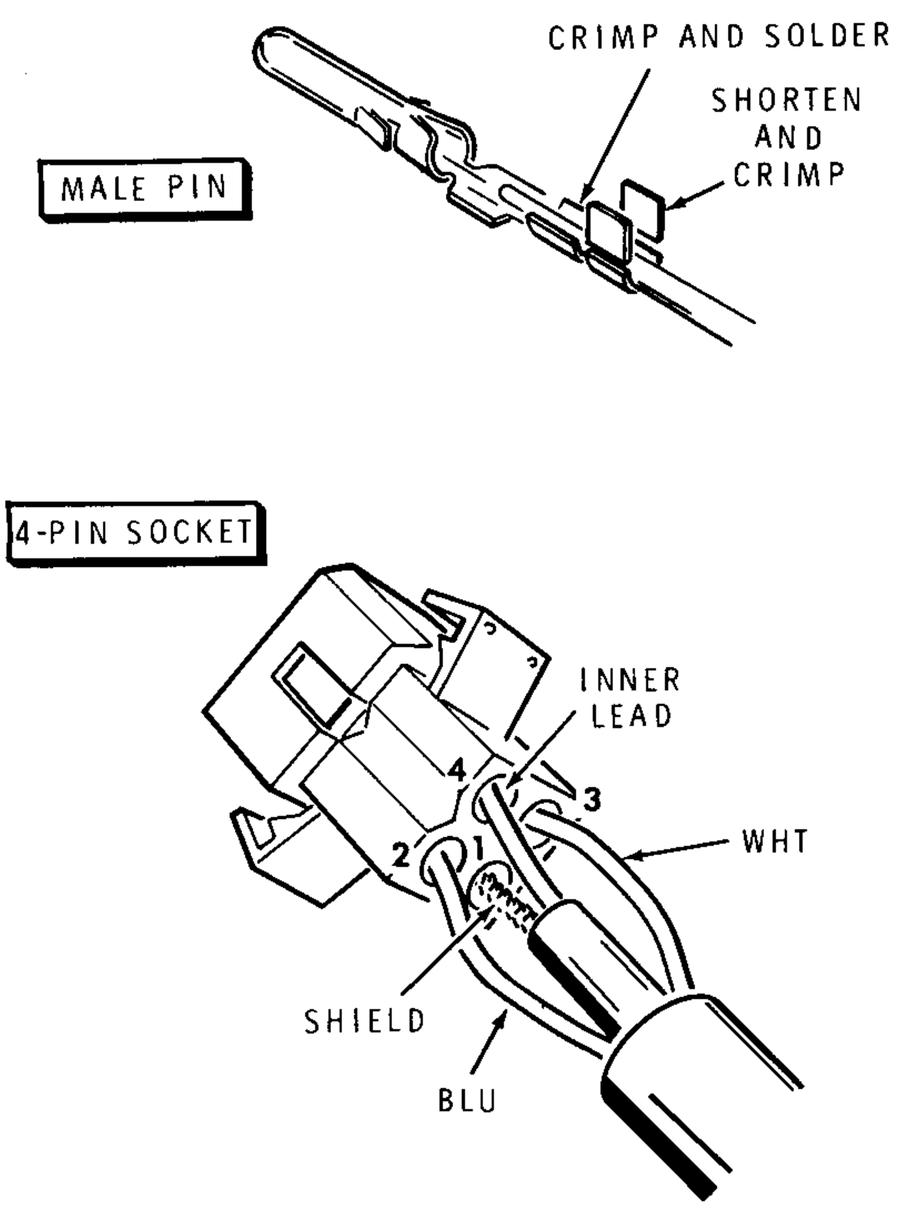
Refer to Pictorial 8-9 for the following steps.

( ) Turn the chassis assembly right side up as shown.

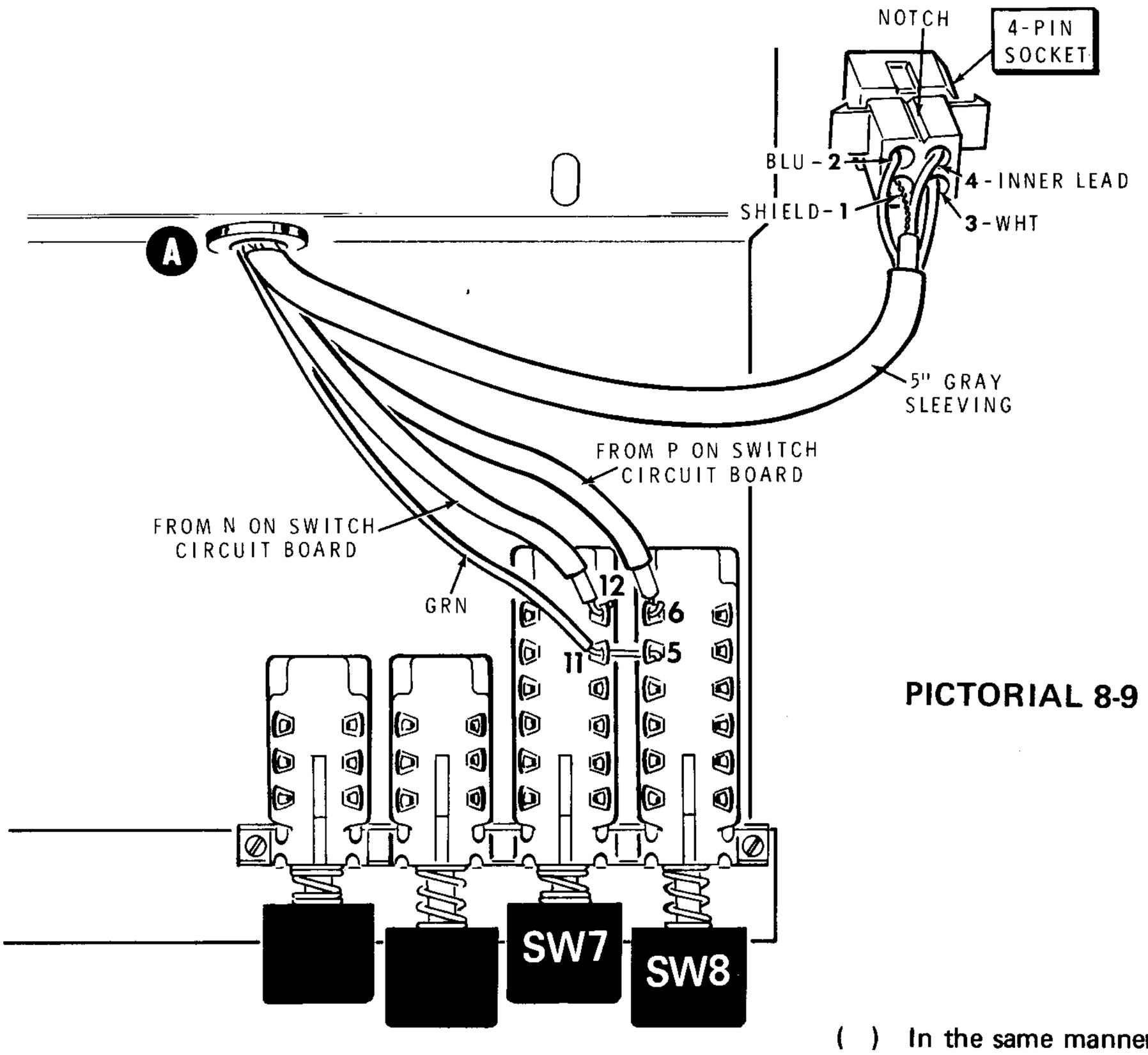
( ) Locate the shielded cable coming from N in the switch circuit board. Connect the inner lead to SW7 lug 12 (S-1).

( ) Connect the inner lead of the shielded cable coming from P in the switch circuit board to SW8 lug 6 (S-1).

( ) Remove an additional 1/8" of insulation from the end of the green wire coming from grommet A. Then pass this end through SW7 lug 11 (S-2) to SW8 lug 5 (S-1).



Detail 8-9A



PICTORIAL 8-9

VFO Cable Preparation

The VFO cable consists of the blue and white wires and the remaining shielded cable coming from grommet A. In the following steps, the 4-pin VFO socket will be prepared using these wires and the cable.

( ) Cut a 5" length of gray sleeving, left over from the circuit board assembly.

( ) Slide the 5" gray sleeving over the free ends of the remaining shielded cable, and the white and blue wires coming from grommet A as shown in the Pictorial. Slide the sleeving down to the grommet.

Refer to Detail 8-9A for the following steps.

( ) Crimp and solder a male pin (#432-152) onto the end of the blue VFO cable wire.

( ) In the same manner, crimp and solder a male pin onto the end of the white wire, the inner lead of the shielded cable, and the shield lead of the shielded cable.

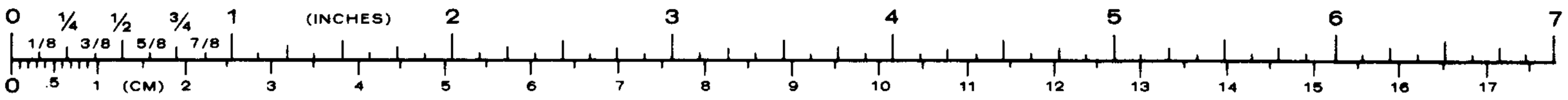
( ) Carefully position the 4-pin socket as shown in the Pictorial.

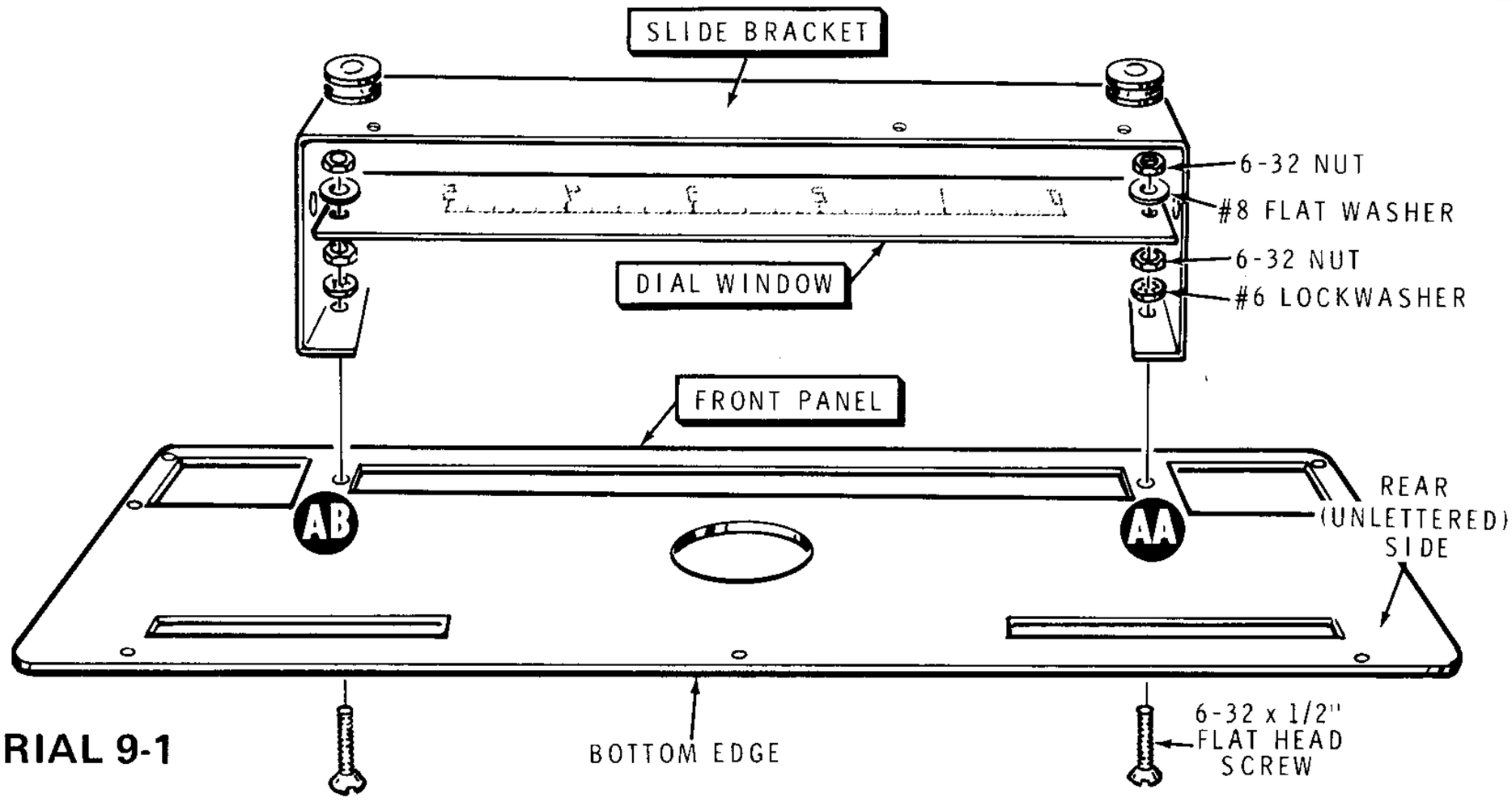
( ) Push the pin on the blue wire into hole 2 in the socket. Push the pin in until a faint latching click is heard.

( ) In the same manner, push the pin on the white wire into hole 3 in the socket.

NOTE: The ends of the shielded cable will be installed in the 4-pin socket in the following step. Start the pins of both leads at the same time as the leads are not long enough to permit them to be installed separately.

( ) Push the pin on the inner lead of the shielded cable into hole 4 and the shield lead into hole 1 of the 4-pin socket. Then, push each pin firmly into the socket until it is properly seated.





PICTORIAL 9-1

FRONT PANEL ASSEMBLY

Refer to Pictorial 9-1 for the following steps.

( ) Secure the slide bracket (#204-2006) to rear side of the front panel at AA and AB with 6-32 x 1/2" flat head hardware. Be sure the pulleys on the rear of the slide bracket are positioned as shown.

NOTE: In the following step, carefully observe the dial window printing. Be sure the bottom of the window is toward the bottom of the front panel, and that the numbers read correctly from left to right as seen from the front side of the panel.

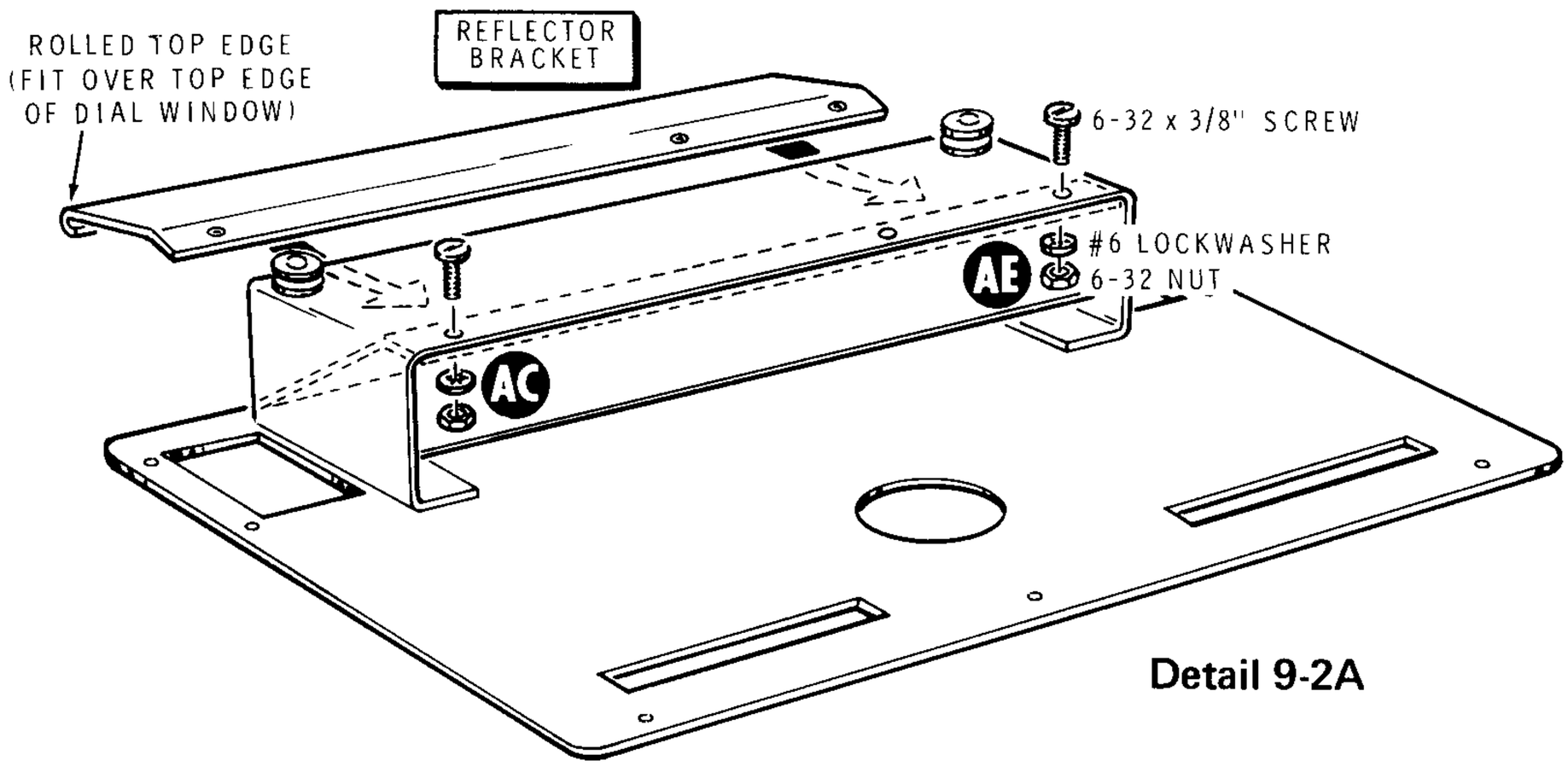
( ) Place the dial window onto the threaded ends of the flat head screws mounted in the previous step. Loosely secure the dial window (finger tight plus 1/8 turn) with a #8 flat washer and a 6-32 nut on each screw end. If the dial window is bowed; slightly loosen the nuts securing each end. Be sure the dial base line is parallel to the opening in the front panel.

Refer to Pictorial 9-2 (fold-out from Page 46) for the following steps.

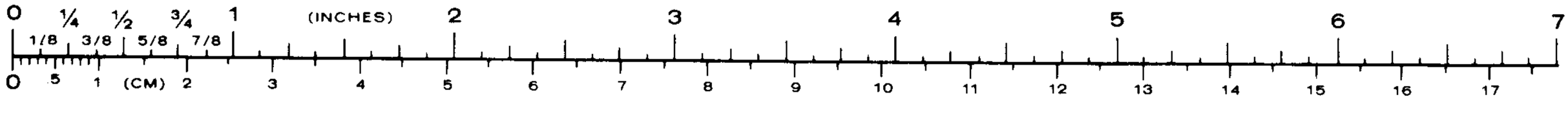
( ) Refer to Detail 9-2A and secure the reflector bracket to the lower edge of the slide bracket with 6-32 x 3/8" hardware as shown. Be sure to position the rolled top edge over the top edge of the dial window to hold it in place.

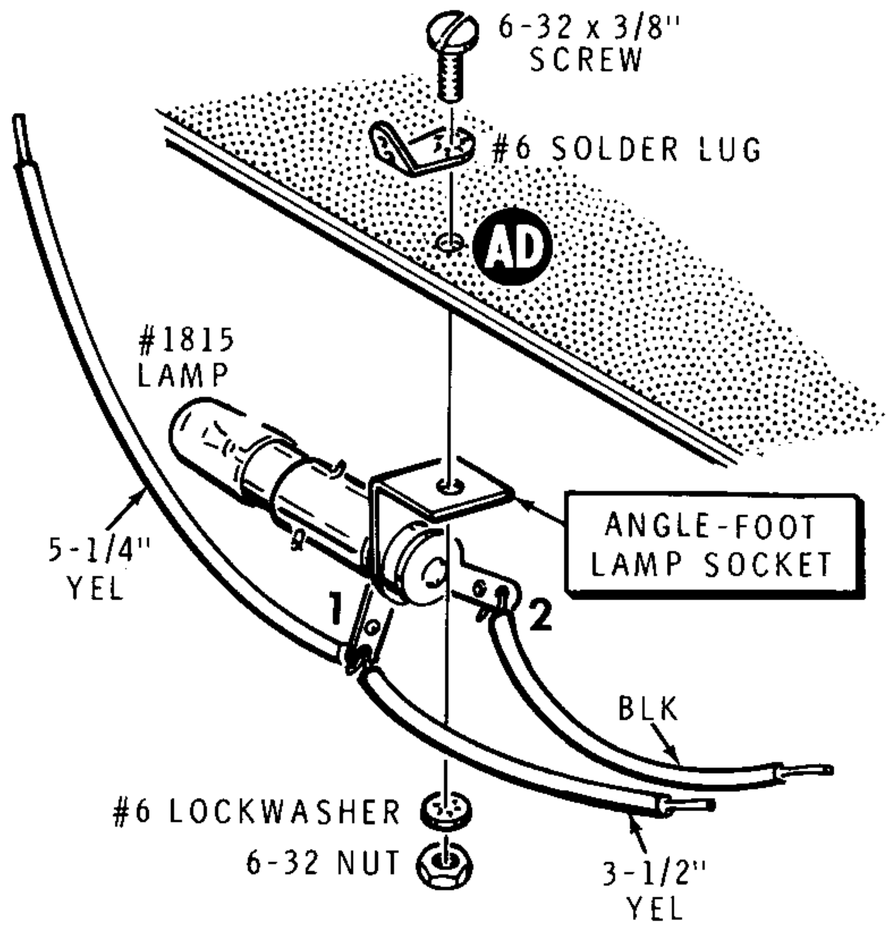
( ) Prepare the following lengths of stranded wire:

2" black
3-1/2" yellow
5-1/4" yellow



Detail 9-2A





Detail 9-2B

Refer to Detail 9-2B for the following steps.

( ) Connect the 2" black wire to lug 2 of the angle foot lamp socket (#434-88) as shown (S-1).

( ) Connect one end of a 3-1/2" yellow wire and one end of a 5-1/4" yellow wire to lug 1 of the same lamp socket (S-2). NOTE: The free ends of the black wire and the two yellow wires will be connected later.

( ) Install a #1815 pilot lamp in lamp socket AD.

( ) Secure the lamp assembly to the slide bracket and the reflector bracket at AD with a #6 solder lug and 6-32 x 3/8" hardware as shown in the Detail. Position the lamp socket housing parallel to the bottom edge of the slide bracket.

Refer to Detail 9-2C for the following steps.

( ) Mount a long-foot lamp socket (#434-83), a #6 solder lug, and an angle bracket at AF on the slide bracket. Use 6-32 x 3/8" hardware. Position the solder lug, the angle bracket (approximately 45 degrees to the front panel), and the lamp socket as shown in the Pictorial. NOTE: These components will be repositioned later.

( ) In the same manner, mount the remaining long-foot lamp socket, a #6 solder lug, and the other angle bracket at AG on the slide bracket as shown. Use 6-32 x 3/8" hardware. Position the components as shown in Pictorial 9-2.

( ) Refer to the inset drawing on Detail 9-2C and mount a spade bolt on the lower angled edge of each of the angle brackets as shown. Use 6-32 x 3/8" hardware.

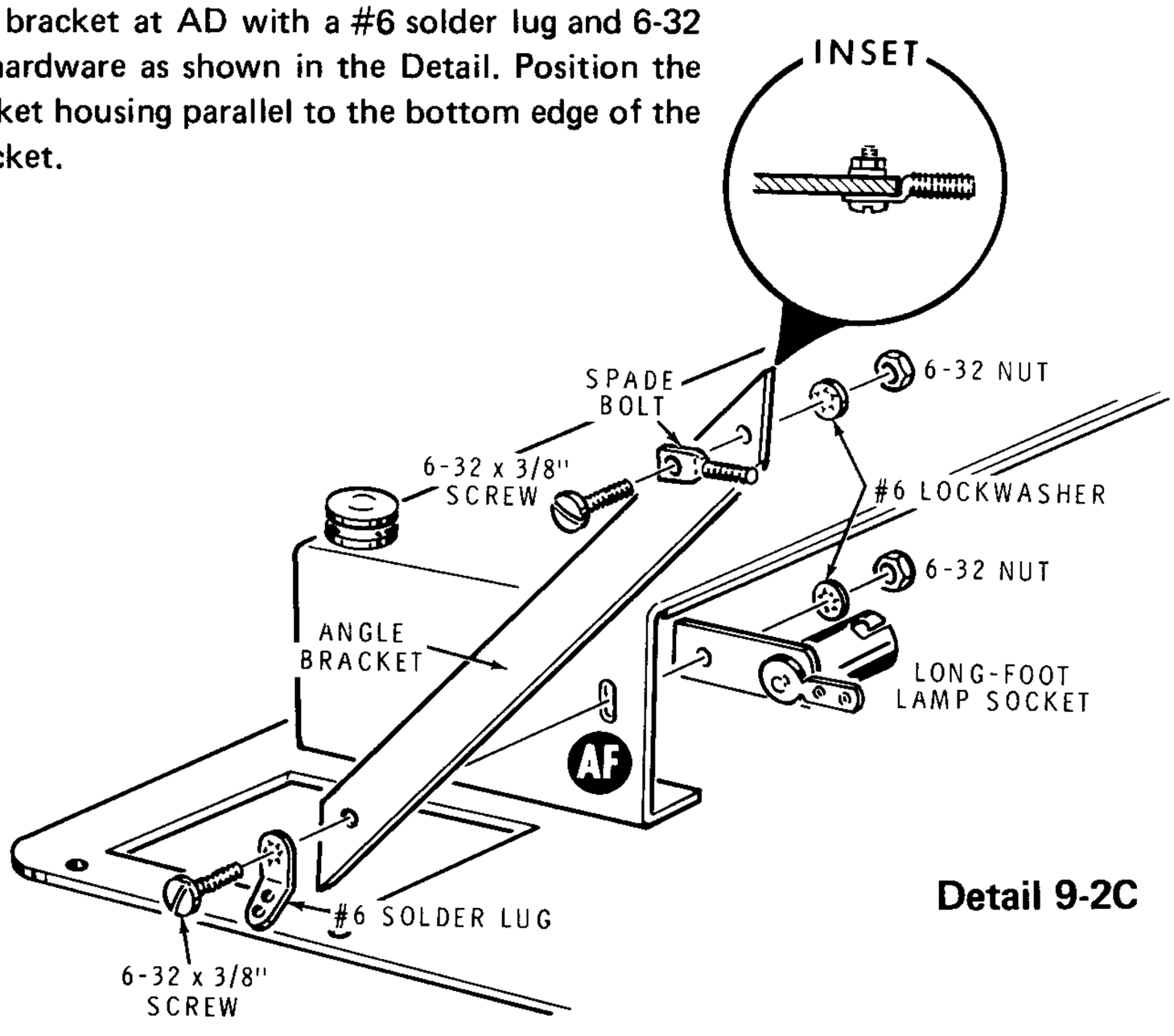
Refer to Pictorial 9-2 (fold-out from Page 46).

( ) Connect the short black wire coming from lug 2 of lamp socket AD to solder lug AD (S-1).

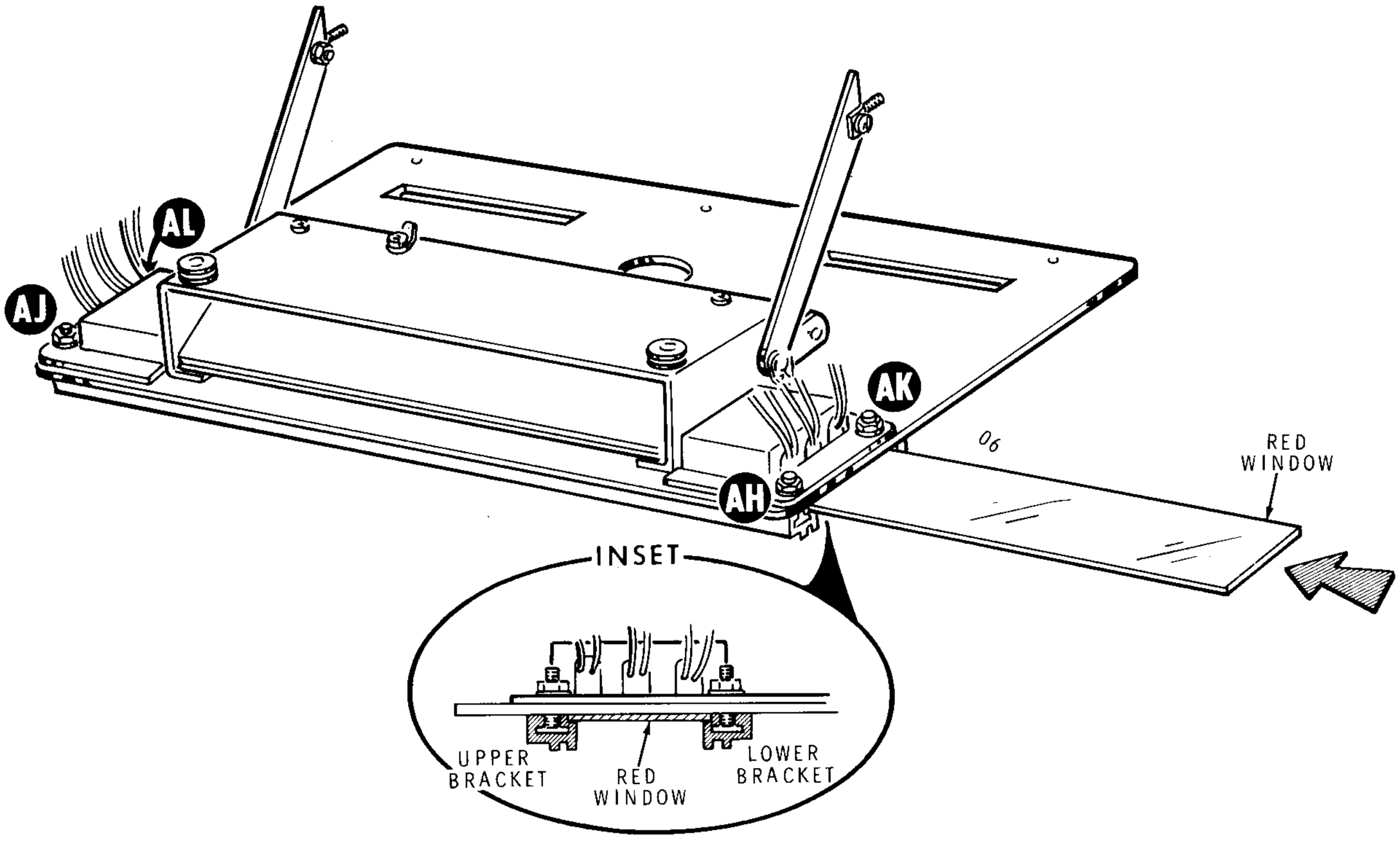
( ) Connect the shorter yellow wire coming from lug 1 of socket AD to lug 1 of lamp socket AG (NS).

( ) Connect the longer yellow wire coming from lug 1 of socket AD to lug 1 of lamp socket AF (S-1).

( ) Install #1815 pilot lamps in lamp sockets AF and AG.



Detail 9-2C



PICTORIAL 9-3

Refer to Pictorial 9-3 for the following steps.

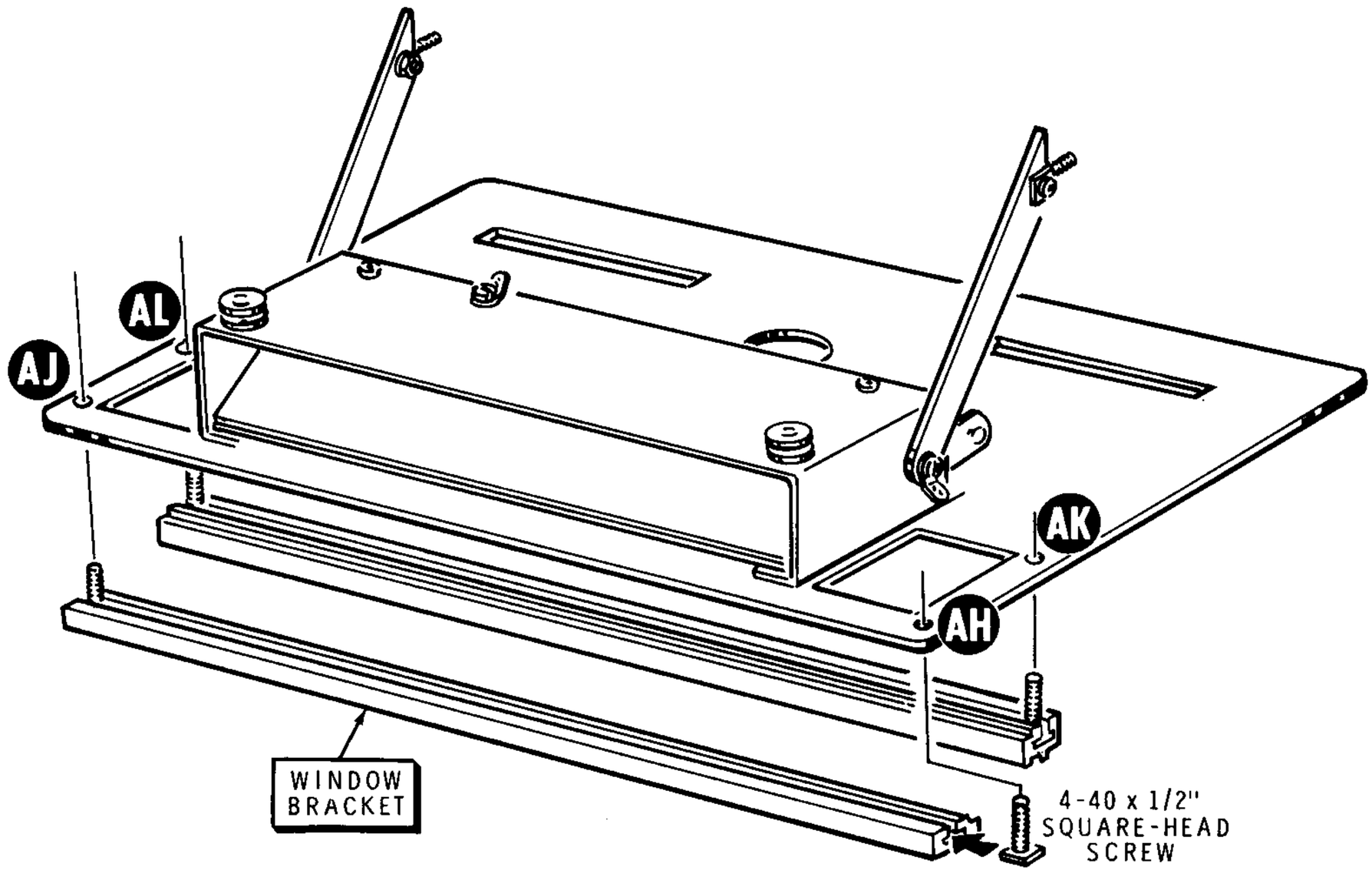
NOTE: Carefully study the inset drawing on Pictorial 9-3 and note how the upper and lower window brackets are positioned as they are installed. It is important that they are positioned exactly as shown to hold the red window securely to the front panel.

Refer to Detail 9-3A for the following steps.

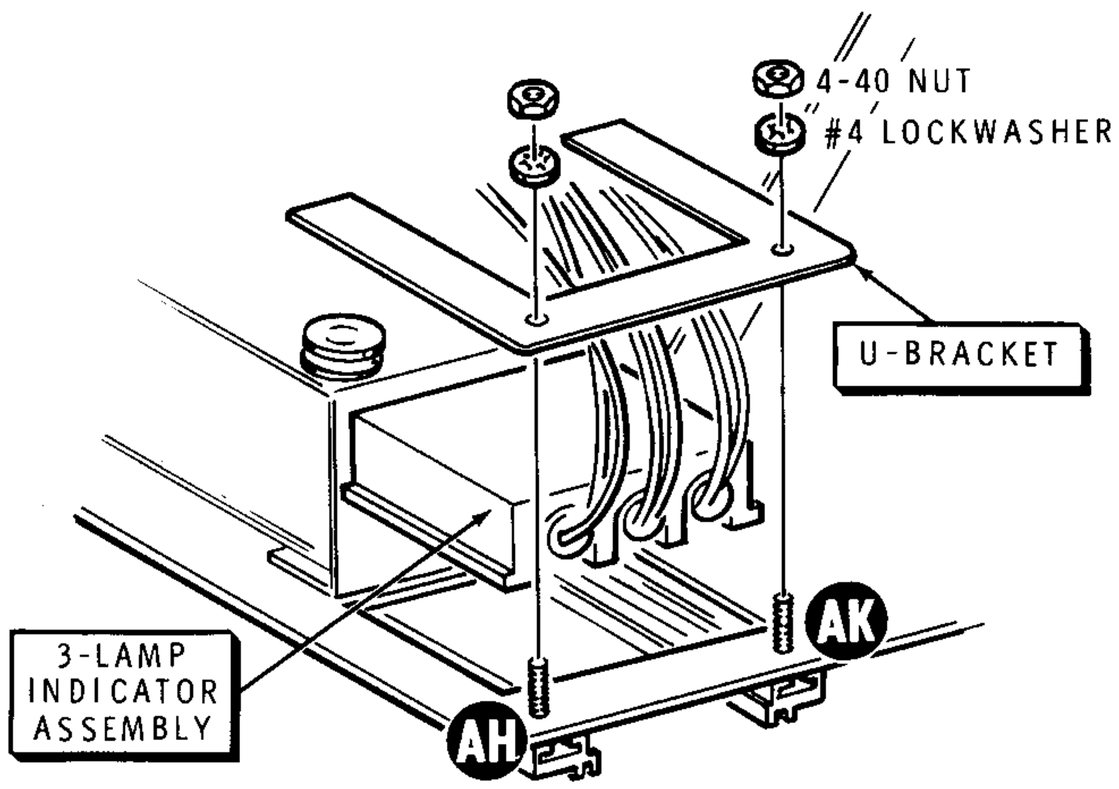
( ) Slide two 4- 40x 1/2" square head screws into the slot in one of the window brackets as shown. Position one bolt at each end of the strip.

( ) Turn the bracket so it will be positioned on the front panel as the upper strip. Then lower the front panel onto the screws so they enter holes AH and AJ in the front panel. Do not secure these screws at this time.

( ) In the same manner, slide and position two more 4-40 x 1/2" square head screws into the other window bracket. Position the bracket as shown in the inset drawing as the lower bracket. Pick up the front panel while holding the top bracket in place and lower the panel onto the lower bracket so the screw studs pass through front panel holes AK and AL.



Detail 9-3A



Detail 9-3B

Refer to Detail 9-3B for the following steps.

( ) Place the two 3-lamp indicator assemblies into the front panel openings at both ends of the slide bracket assembly. Position each so the lamp leads are toward the outer edges of the front panel as shown.

( ) Slide a U-bracket under the lamp leads and over the upper and lower flanges of each of the lamp housings. Then position the bracket onto the screw studs at AH and AK, and at AJ and AL.

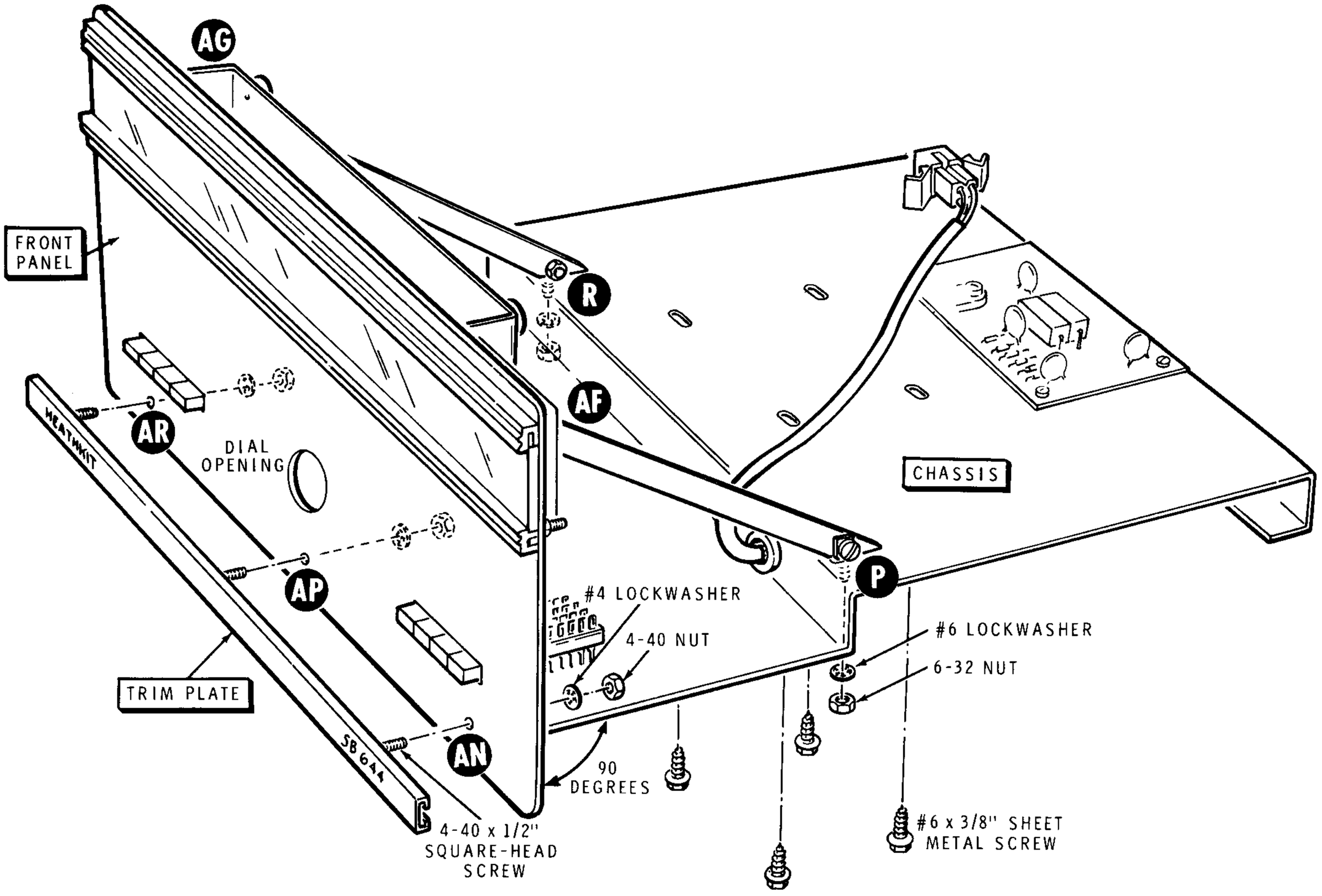
( ) Loosely secure the trim strips, lamp housings, and U-brackets to the front panel with #4 lockwashers and 4-40 nuts at AH, AK, AJ, and AL.

( ) There may be paper backing or a thin protective film on the red window. If so, remove the paper or film from the window.

NOTE: Hold the red window to the light and observe the position in which it will be correctly installed. If necessary, carefully wash the window in warm, mild detergent water, rinse it, and then dry it with a soft cloth. Perform the following step slowly and carefully to avoid scratching the window screening.

( ) Hold the red window upright and slide it into the notches in the upper and lower window brackets on the front panel. NOTE: It may be necessary to loosen the window bracket nuts slightly to perform this step.

( ) When you are certain the window is installed correctly, tighten the window bracket nuts at AH, AK, AJ, and AL.



PICTORIAL 9-4

Refer to Pictorial 9-4 for the following steps.

( ) Slide three 4-40 x 1/2" square head screws into the trim plate as shown. Slide one screw to the center of the strip and the other two at opposite ends of the strip.

( ) Hold the trim plate right side up and pass the screw threads through holes AN, AP, and AR in the front panel.

( ) Position the chassis against the front panel and push the screws through holes AN, AP, and AR. Secure the screws, the trim plate, and the front panel to the chassis with 4-40 nuts and #4 lockwashers. Be sure to center the trim plate on the front panel. NOTE: Be especially careful not to pinch any wires between the chassis and the front panel.

( ) Slightly loosen the screws at the top end of the angle brackets (at AF and AG).

( ) Position the spade bolts on the end of the angle bracket into holes P and R in the chassis. Loosely secure the spade bolts with 6-32 nuts and #6 lockwashers.

( ) Check to be sure the front panel is 90 degrees to the bottom panel of the chassis. Then tighten bracket nuts P and R.

( ) Tighten bracket screws AF and AG.

Indicator Lamp Wiring

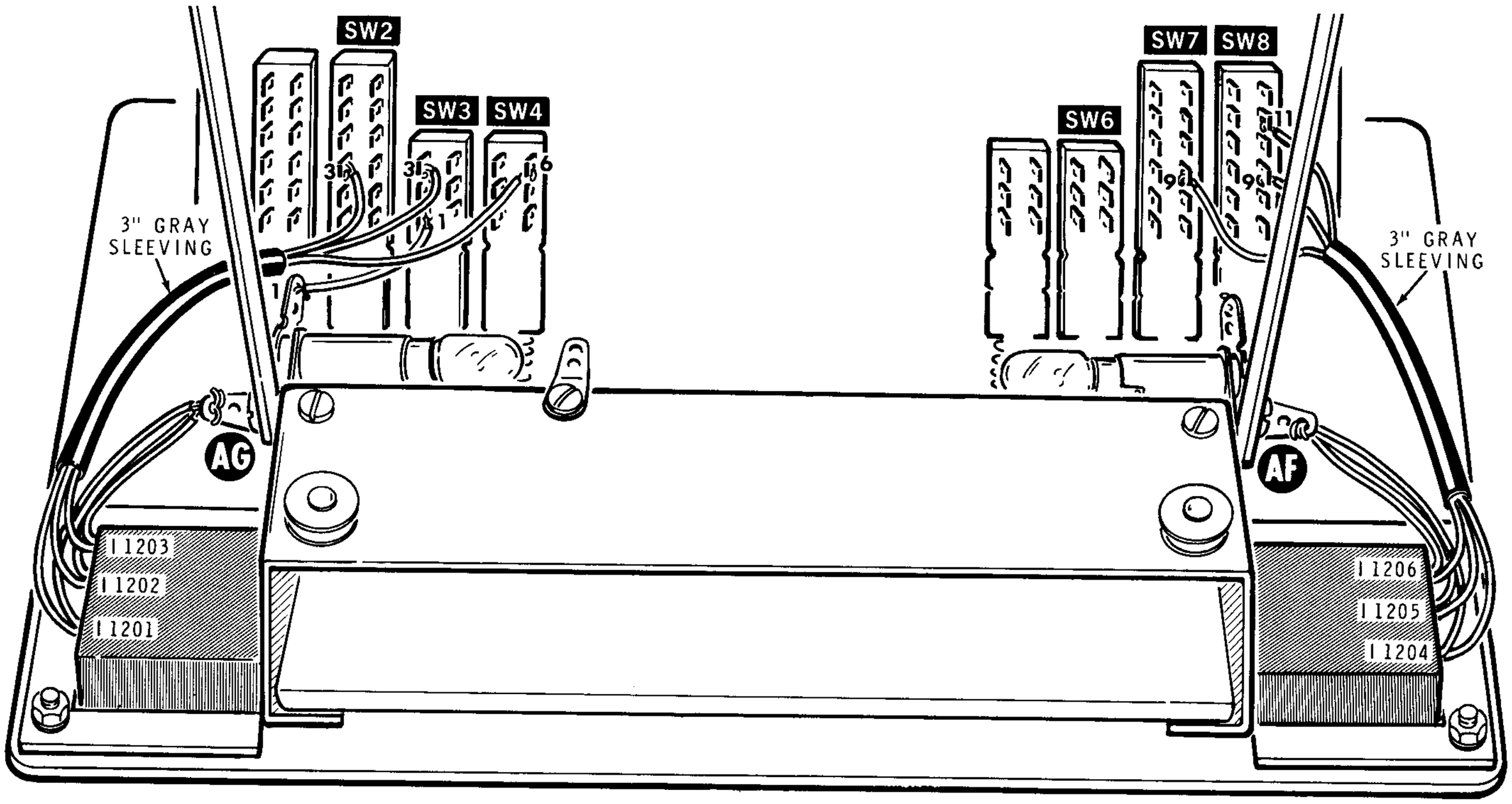
Refer to Pictorial 9-5 for the following steps.

( ) Cut <u>one</u> lead on each indicator lamp to the following lengths:

I1201 – 4-1/2"	I1204 – 4-1/2"
I1202 – 4-1/4"	I1205 – 4-1/4"
I1203 – 4"	I1206 – 4"

NOTE: In the next two steps, the three wire ends twisted together will be counted as <u>one wire</u> at the solder connection.

( ) Remove 1/4" of insulation from the ends of the leads cut a I1201, I1202, and I1203. Tightly twist the three lead ends together and add a small amount of solder to hold them. Connect this twisted end to solder lug AG (S-1).



PICTORIAL 9-5

( ) In the same manner, prepare and twist the lead ends together coming from I1204, I1205, and I1206. Add solder to the lead ends. Connect the twisted end to solder lug AF (S-1).

( ) Connect the end of the red wire coming from SW3 lug 1 to lug 1 of lamp socket AG (S-2).

NOTE: In the following steps, cut each remaining indicator lamp lead to the indicated length. Then, remove 1/4" of insulation from the end of the lead and add a small amount of solder to hold the small strands together.

	LAMP LEAD FROM:	CUT TO:
( )	I1201	5"
( )	I1202	6"
( )	I1203	4-1/2"
( )	I1204	5"
( )	I1205	5-1/2"
( )	I1206	4-1/2"

NOTE: The two 3" lengths of gray insulation saved from the circuit board assembly will be used as sleeving in the following steps.

( ) Place a 3" piece of gray sleeving on the leads coming from I1201, I1202, and I1203.

NOTE: In the following steps, be sure you connect the correct wire to each designated switch lug.

( ) Connect the lead coming from I1201 to SW3 lug 3 (S-1).

( ) Connect the lead coming from I1202 to SW4 lug 6 (S-1).

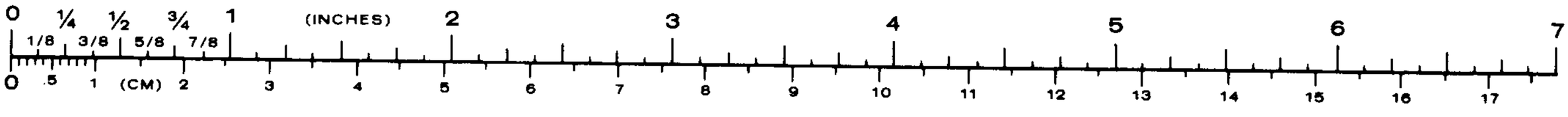
( ) Connect the lead coming from I1203 to SW2 lug 3 (S-1).

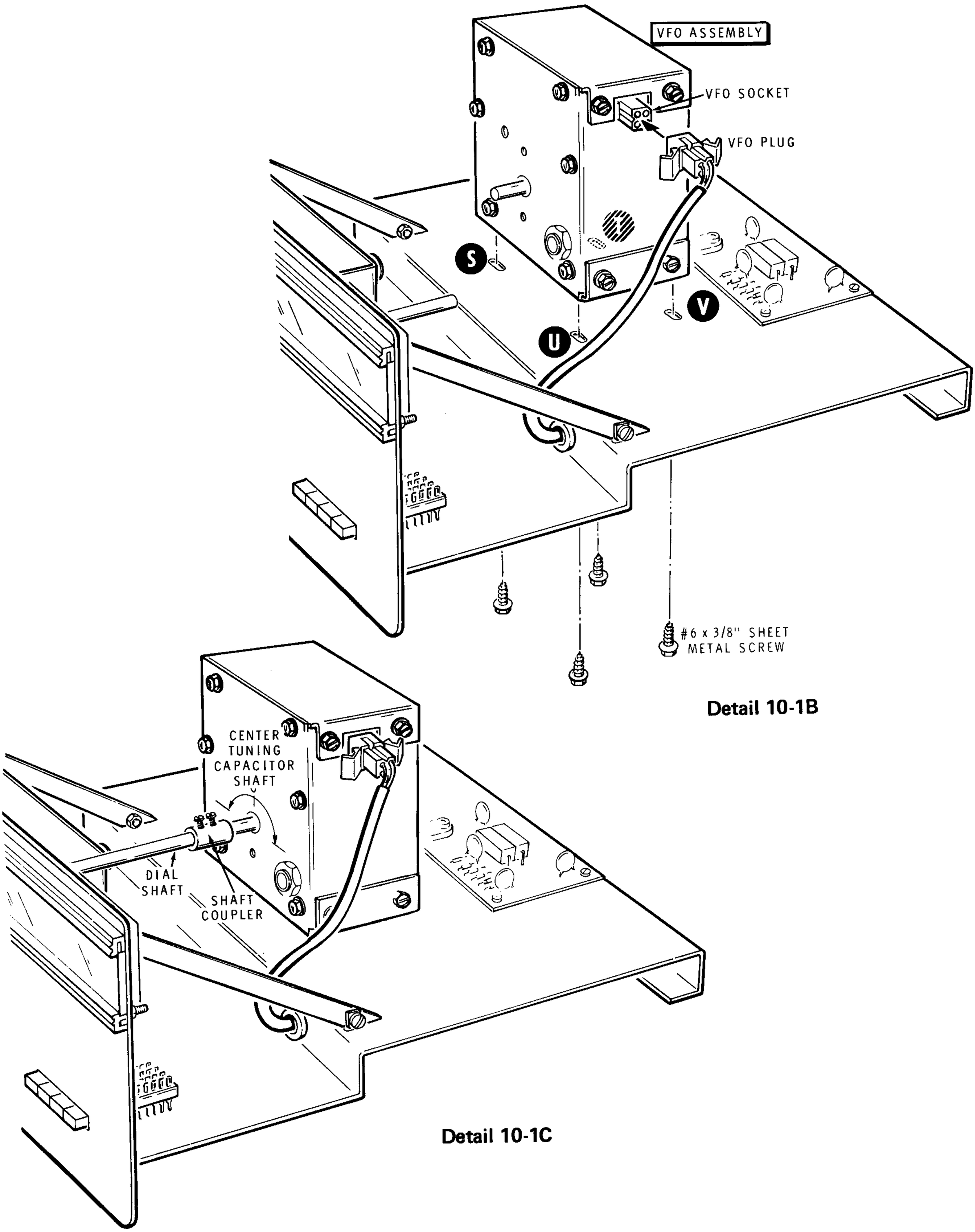
( ) Place a 3" piece of gray sleeving on the leads coming from I1204, I1205, and I1206.

( ) Connect the lead coming from I1204 to SW8 lug 11 (S-2).

( ) Connect the lead coming from I1205 to SW7 lug 9 (S-1).

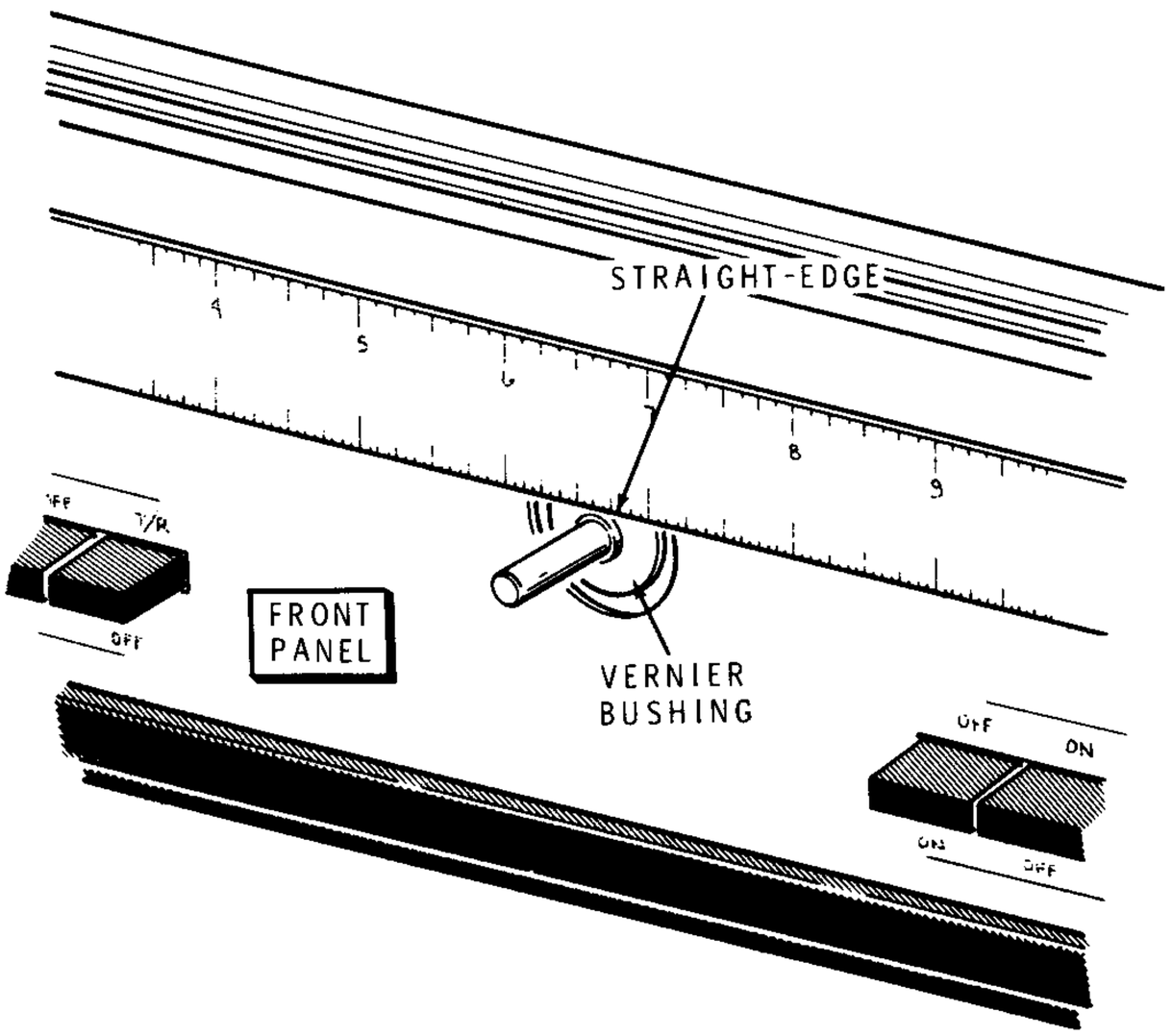
( ) Connect the lead coming from I1206 to SW8 lug 9 (S-1).





Detail 10-1B

Detail 10-1C



Detail 10-1A

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

( ) Start an 8-32 x 1/4" setscrew into the bushing of the dial pulley.

( ) Place the dial pulley onto the dial shaft as shown in the Pictorial. Be sure the "flush" side of the pulley is toward the front panel. Do not tighten the setscrew at this time.

( ) Position the dial drive assembly into the chassis as shown. Loosely secure the drive assembly to the chassis at BF and BG with 6-32 x 3/8" flat head hardware.

( ) Refer to Detail 10-1A. Place a straightedge across the top of the dial opening in the front panel as shown. Carefully position the dial drive assembly forward or rearward so the large portion of the vernier bushing is flush with the straightedge.

( ) Secure dial drive bracket screws BF and BG.

( ) Start two 6-32 x 3/8" screws into the shaft coupler as shown. Place the coupler onto the dial shaft. Do not tighten the coupler screws.

( ) Refer to Detail 10-1B and loosely mount the VFO assembly on the chassis with four #6 x 3/8" sheet metal screws at S, T, U, and V. Position the VFO as shown in the Pictorial.

NOTE: In the following steps, you will position the VFO assembly to line up with the dial shaft from side to side. Do this as you observe the two shafts from directly above.

Carefully move the VFO assembly toward one side of the chassis or the other until the VFO capacitor shaft is directly in line with the dial shaft. NOTE: A short straightedge may be helpful.

( ) Secure VFO mounting screws S, T, U, and V. Recheck the alignment of the shafts. If necessary, loosen the screws S, T, U, and V and carefully reposition the VFO assembly. Again, tighten the mounting screws.

( ) Plug the VFO socket onto the VFO plug as shown.

Refer to Detail 10-1C for the following steps.

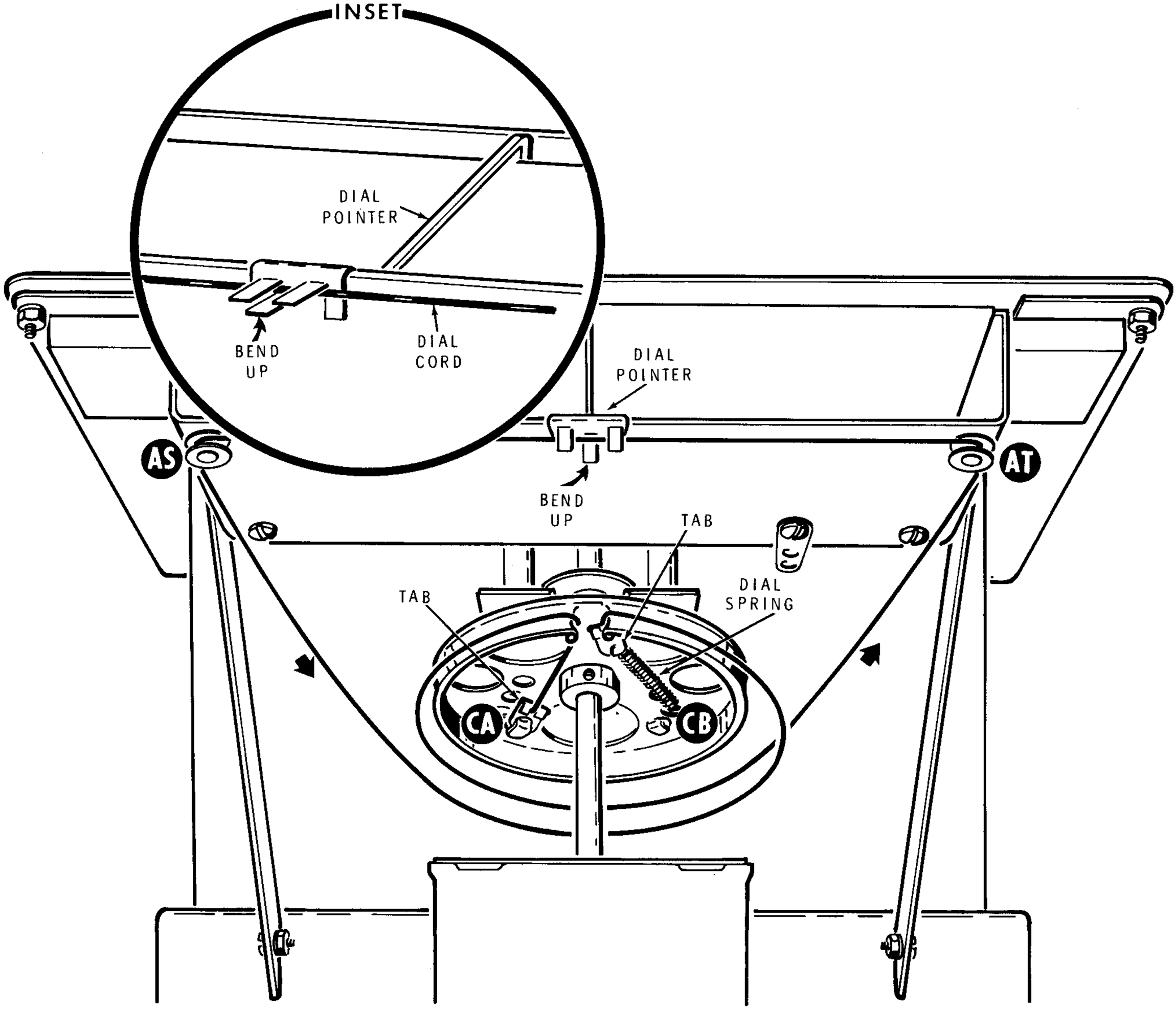
( ) Slide the shaft coupler rearward onto the VFO tuning capacitor shaft. Position the coupler so it is half onto the capacitor shaft and half on the dial shaft. Secure the 6-32 x 3/8 screw on the tuning capacitor shaft.

( ) Rotate the tuning capacitor shaft in both directions; then position it at a point midway between the two extremes.

( ) Loosen the coupler setscrew and retighten it so it is straight up as shown in the Pictorial.

( ) Tighten the other 6-32 x 3/8" coupler screw onto the dial shaft.

( ) Position the dial pulley against the vernier drive bushing so the opening in the edge of the pulley is straight up as shown in the Pictorial. Tighten the setscrew.



PICTORIAL 10-2

Refer to Pictorial 10-2 for the following steps.

( ) Be sure the opening in the dial pulley is straight up as shown. Proceed to string the dial cord as follows:

1. Form an open hook in both ends of the dial spring.

2. Connect one dial cord tab around lug CA in the pulley.

3. Pass the dial cord upward, and then down and under the dial pulley in a counterclockwise direction as viewed from the rear.

4. Over the top of pulley AT on the slide bracket.

5. Over the top of pulley AS on the slide bracket.

6. Down under the dial pulley, counterclockwise, to the top slot in the pulley.

7. Connect one open hook of the dial spring to the hole in the other dial cord tab.

8. Connect the free end of the dial cord spring to hole CB in the dial pulley.

( ) Place the dial pointer onto the top rear edge of the slide bracket as shown in the Pictorial. Check to see that the pointer slides freely back and forth without rubbing between the front panel and the dial window.

If necessary, adjust the pointer slightly so it will slide freely and smoothly on its bracket.

( ) Position the pointer midway between the two pulleys AS and AT. Refer to the inset drawing on Pictorial 10-2 and position the dial cord into the tabs on the rear of the dial pointer. Carefully bend the center tab upward until the pointer is just snugged at that position on the cord. CAUTION: Do not crimp the tabs too tightly. This could cut the dial cord.

( ) Place the knob onto the vernier shaft protruding through the front panel. Secure the knob by tightening the two allen setscrews with the wrench supplied. Leave approximately 1/32" of space between the knob skirt and the front panel. Rotate the knob and be sure it does not rub on the front panel. If it does, loosen the setscrews, position the knob outward slightly, and then retighten the setscrews.

CABLE PREPARATION

Refer to Pictorial 11-1 (fold-out from Page 56) for the following steps.

( ) Remove the acessory plug and cap from the Acessory socket on the SB-104 Transceiver.

( ) Remove the cap from the plug.

( ) Carefully remove 1/4" of insulation from the center of the orange jumper wire connecting pins 2 and 5 of the 11-pin plug.

( ) Remove 1-1/4" of the outer insulation from each end of the 5-wire cable.

( ) At one end of the cable, remove 1/2" of the brown wire.

( ) Remove 1/4" of insulation from the wires at both ends of the cable. Tightly twist each wire end and apply a small amount of solder to hold the strands together.

( ) At the end of the cable with shortened brown wire, connect this brown wire to the orange jumper between pins 2 and 5 of the 11-pin plug (S-1).

NOTE: As you install the wires in the 11-pin plug in the following steps, push each wire into its designated pin; then, heat the pin and allow a small amount of solder to flow into the pin. When the solder has cooled, make sure the wire is secure by tugging on it.

( ) Push the green wire into 11-pin socket pin 11 (S-1).

( ) Push the white wire into pin 1 (S-1).

( ) Push the black wire into pin 6 (S-1).

( ) Push the red wire into pin 7 (S-1).

( ) Slide the open end of the cap onto the free end of the 5-wire cable as shown in the Pictorial. Then snap the cap onto the socket.

( ) At the free end of the 5-wire cable, solder a male pin (#432-152) onto the end of the black wire as shown in the inset drawing on Pictorial 11-1.

( ) In the same manner, solder male pins onto the ends of the red, brown, white, and green wires.

( ) Push the pin on the black wire into 6-pin socket (#432-837) hole 6. Push the pin in until it locks in place.

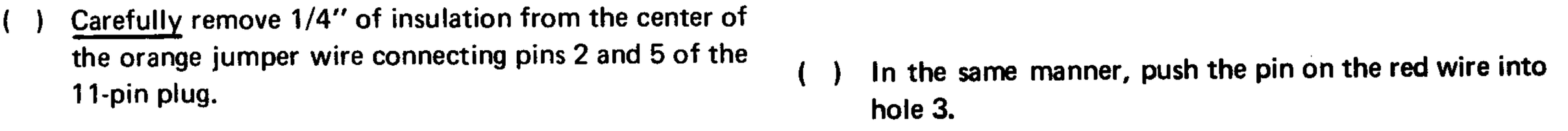
( ) In the same manner, push the pin on the red wire into hole 3.

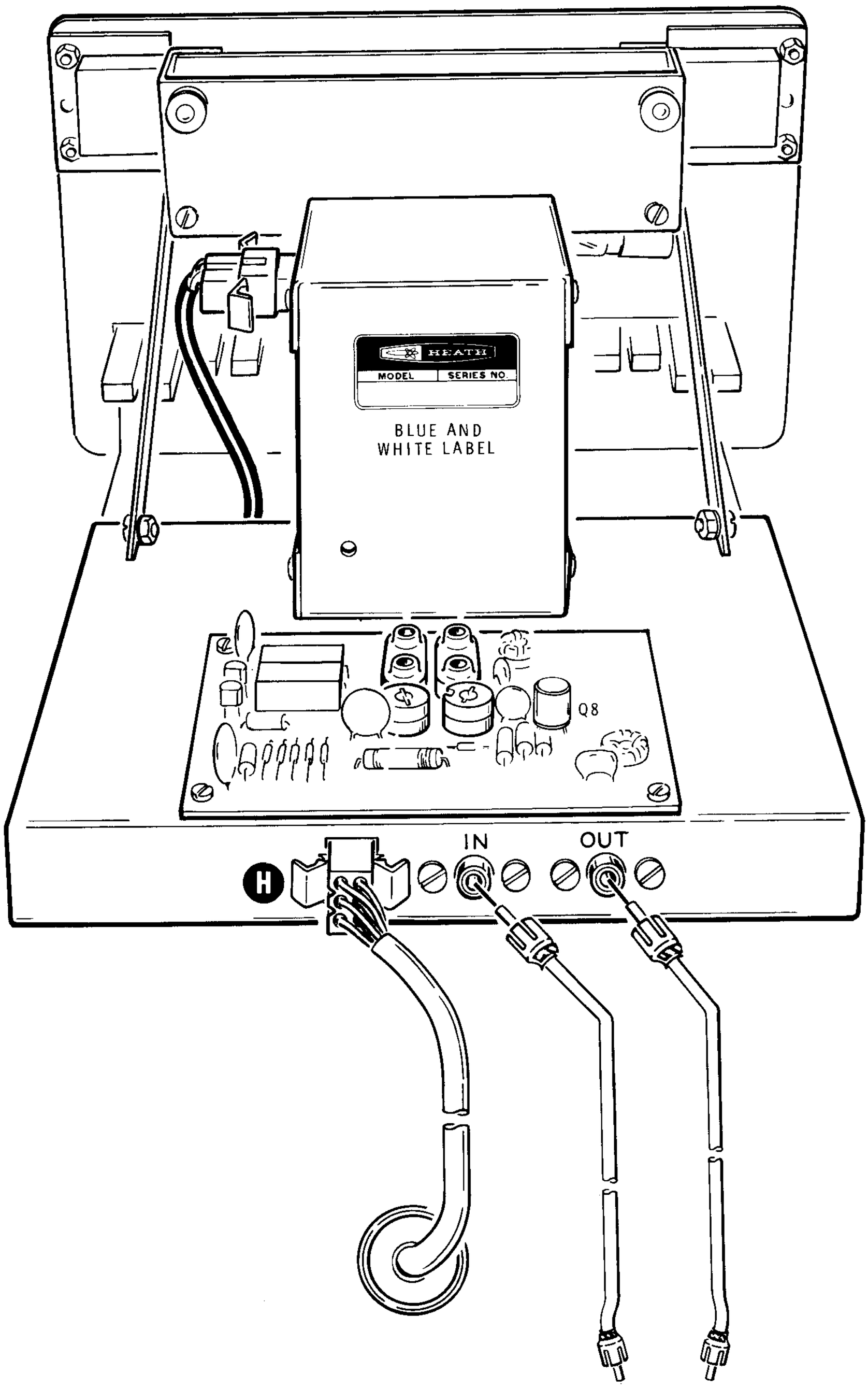
( ) Push the pin on the brown wire into hole 5.

( ) Push the pin on the green wire into hole 2.

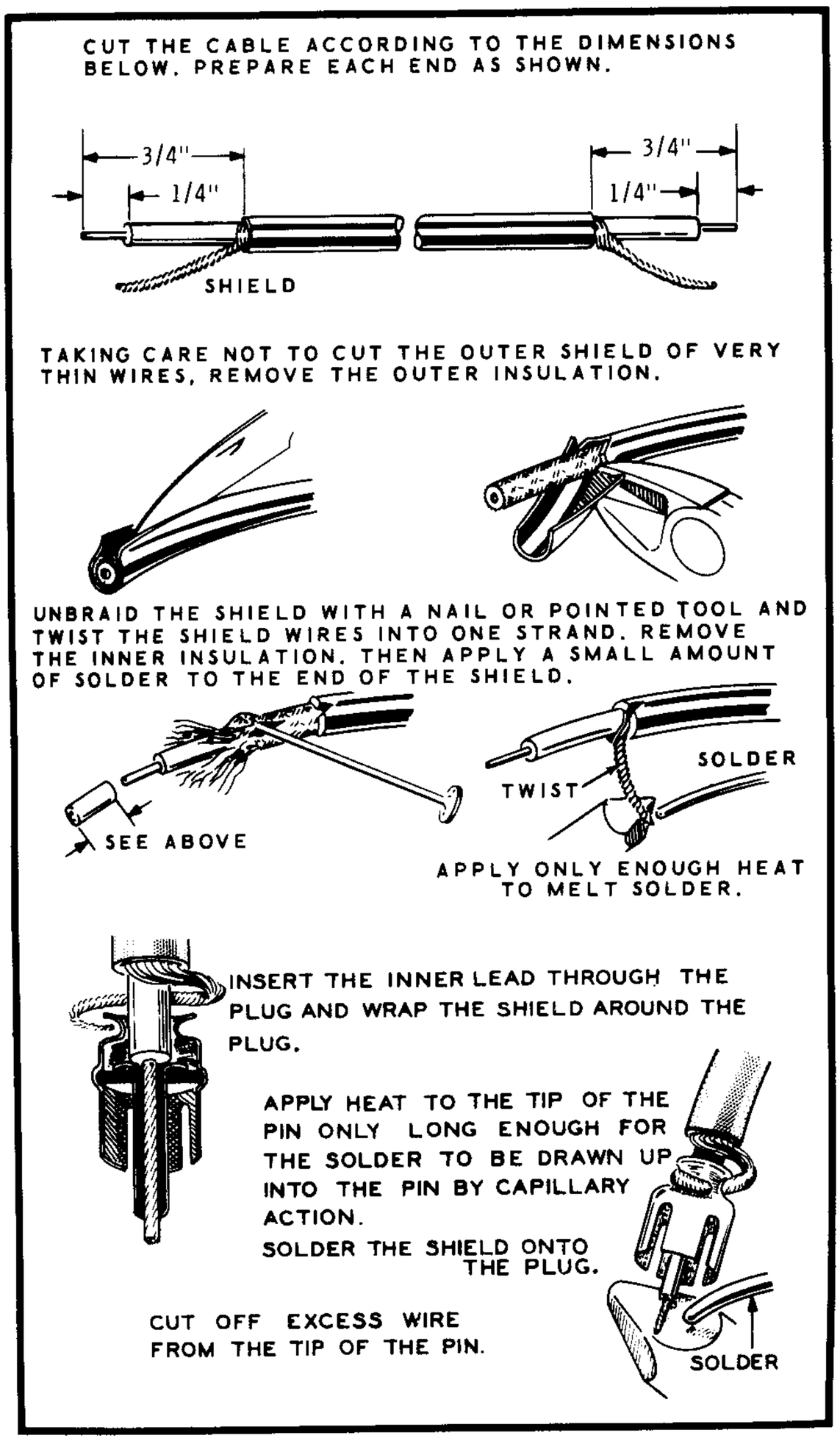
( ) Push the pin on the white wire into hole 1.

NOTE: There is no wire going to hole 4 of the 6-pin socket.





PICTORIAL 11-2



Detail 11-2A

Refer to Pictorial 11-2 for the following steps.

( ) Push the 6-pin socket onto the plug H on the chassis.

Refer to Detail 11-2A for the following steps.

( ) Cut the remaining length of RG-174 shielded cable into two equal lengths.

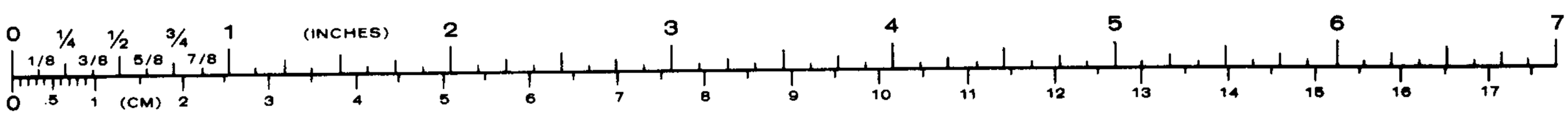
( ) Refer to the Detail and prepare both cables as shown. Connect and solder phono plugs to both ends of both cables.

( ) Plug one end of one cable into the phono socket labeled IN, and the end of the other cable into the phono socket labeled OUT on the rear of the chassis. The free ends of the cables will be connected later.

( ) Remove the paper backing from the blue and white label. Press the label in place on the rear of the VFO assembly as shown in the Pictorial.

NOTE: The blue and white label shows the model number and the production series number of your kit. Refer to these numbers in any communications you have with the Heath Company about this kit.

This completes the "Step-by-Step Assembly" of your Remote VFO, except for "Final Assembly" which will follow the "Test and Adjustment" section of the Manual. You have a 47 ohm resistor, a .05 disc capacitor, and a 1N191 diode remaining. Save these parts for use in the "In Case of Difficulty" steps.



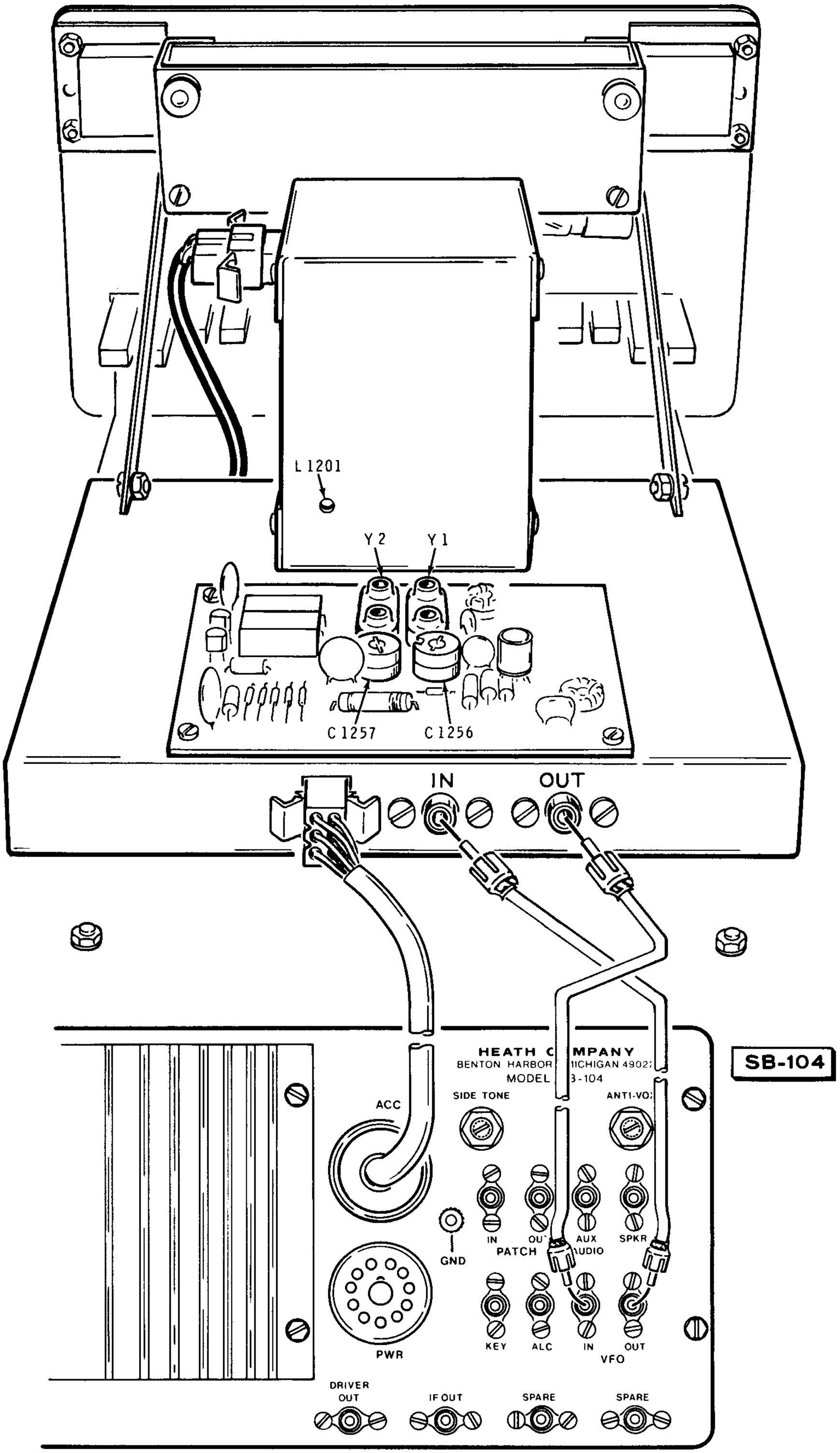

L 1201
Y 2
Y 1
C 1257
C 1256
IN
OUT
ACC
GND
PWR
HEATH C MPANY
BENTON HARBOR ICHIGAN 4902
MODEL 3-104
SB-104
SIDE TONE
ANTI-VOX
IN
OUT
AUX
SPKR
PATCH
KEY
ALC
IN
OUT
VFO
DRIVER OUT
IF OUT
SPARE
SPARE

Figure 2

TEST AND ADJUSTMENT

NOTE: If you do not get the proper results in any of the following steps, turn the Transceiver power off and refer to the "In Case of Difficulty" section of the Manual on Page 69.

Refer to Figure 1 (fold-out from Page 73) for front panel switch locations and functions.

( ) Turn the SB-104 Transceiver off.

( ) Locate the REMOTE-OFF switch (third from the left) on the front panel of the Remote VFO. Depress this switch.

( ) Depress the XTAL-OFF switch (third from the right).

Refer to Figure 2 for locations on the rear of the Remote VFO. Then make the following connections.

( ) Connect the 11-pin plug coming from the Remote VFO to the Accessory socket on the rear of the Transceiver.

( ) Remove the jumper cable from the SB-104 Transceiver VFO IN and OUT sockets.

( ) Connect the shielded cable coming from the Remote VFO OUT socket to the VFO IN socket on the Transceiver.

( ) Connect the shielded cable coming from the Remote VFO IN socket to the VFO OUT socket on the Transceiver.

( ) Turn the Transceiver on and adjust the dial readout to approximately 14.200 MHz. Then push the Remote VFO RX switch (first switch on the left) to the ON position. NOTE: Do not key the Transceiver except into a properly terminated load.

NOTE: At this time, the three pilot dial lights should be on, and the upper right indicator light, "R/REM T/MAIN," should be on.

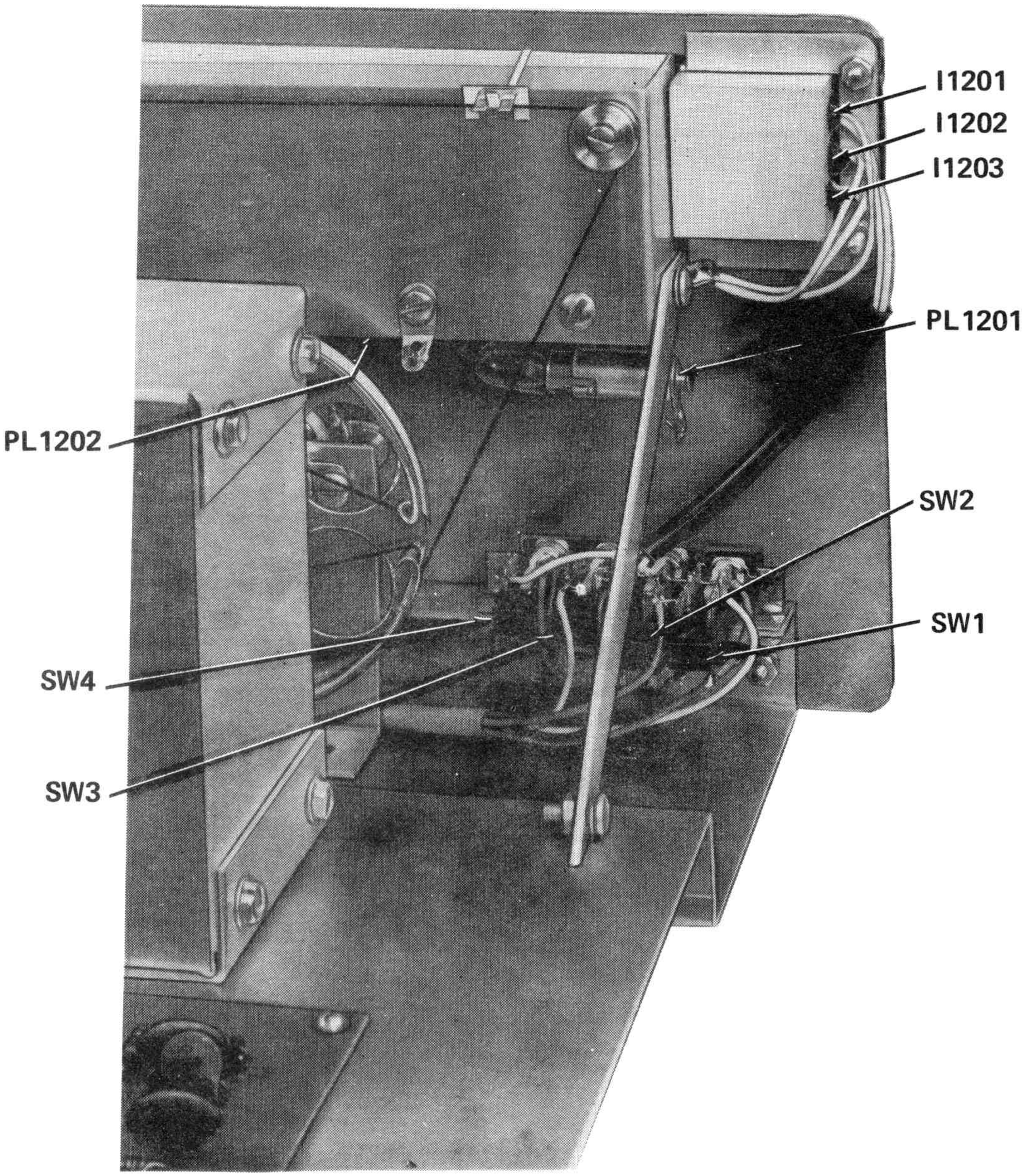
( ) Push the following switches and observe that all indicator lights are properly illuminated:

SWITCH	SCALE LIGHT	INDICATOR LIGHT
SW1	ON	R/REM – T/MAIN
SW2	ON	R/MAIN – T/REM
SW3	OFF	MAIN
SW4	ON	REMOTE
SW5	OFF	
SW6	ON if SW1, SW2, or SW4 selected	
SW7 and SW5	OFF	XTAL 1 (ON)
SW8 and SW5	OFF	XTAL 2 (ON)

NOTE: Carefully observe the illumination of the dial. If it appears to be unevenly lit, the pilot lamps at each end of the slide bracket may be adjusted forward or rearward slightly. Do this in the following steps.

( ) Slightly loosen the 6-32 screws at AF and AG. (See Pictorial 9-5 on Page 53). Position each of these pilot lamps until the dial is evenly illuminated all the way across. Then retighten both screws securely.

CHASSIS PHOTOGRAPHS



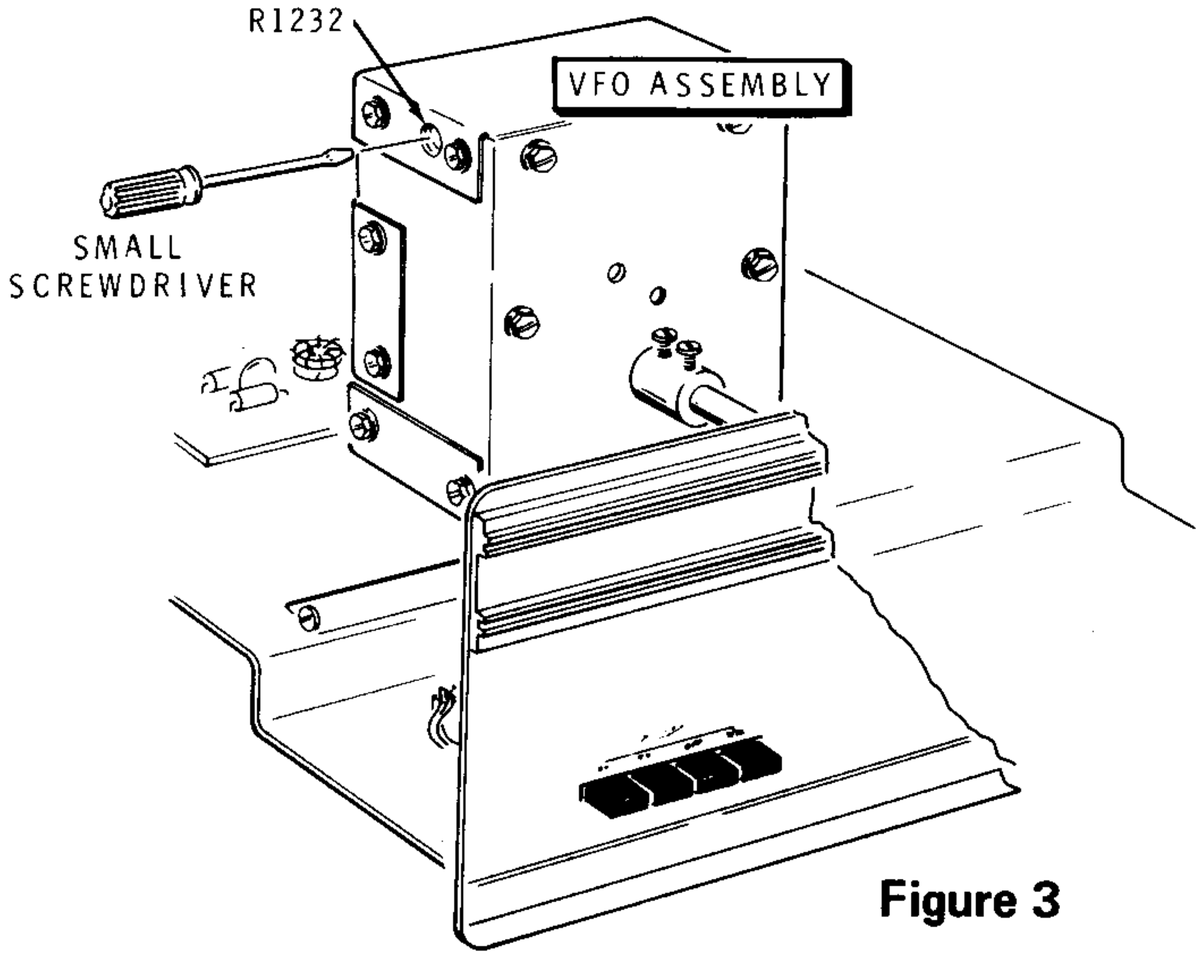


Figure 3

OUTPUT LEVEL ADJUST (R1232)

Refer to Figure 3 for the following steps.

( ) Set the Transceiver controls as follows:

Bandswitch: 29.5

Power: On.

( ) Set the Remote VFO controls as follows:

Remote T/R (SW4): On.

Remote On (SW6): On.

Dial Pointer: 4.

( ) Turn control R1232 in the Remote VFO assembly fully clockwise. Note that the Transceiver readout may be flickering and unstable at this time. NOTE: If the display does not become unstable, leave control R1232 turned fully clockwise. Then, turn the Transceiver Band-switch until you see an unstable display.

( ) Slowly turn control R1232 counterclockwise until the Transceiver readout just becomes stable. Then, turn the control a very small amount (less than 1/8 turn) further counterclockwise.

( ) Check for a stable display at all positions of the Transceiver Bandswitch. Turn control R1232 counterclockwise as necessary to get a stable readout on all bands. NOTE: The right digit may still be slightly unstable at some positions of the main tuning knob.

NOTES:

1. If you are unable to obtain the desired results, turn to the "In Case of Difficulty" section of the Manual on Page 69.

2. Because of a very small amount of loss in interconnecting cables, the Transceiver readout may be slightly unstable. You will be able to correct this by similarly adjusting control R1232 on the Transceiver VFO assembly.

( ) Depress the REMOTE OFF switch (SW3) to turn the Remote VFO off.

( ) Turn the Transceiver power off.

This completes the "Output Level Adjust (R1232)."

VFO FREQUENCY ADJUST (L1201)

( ) Depress the REMOTE ON switch (third from right) and the REMOTE T/R switch (fourth from left).

( ) Make sure the dial pointer is adjusted to travel to points at each end of the dial equally distant from the end of the scale. Then, turn the dial to 2.00 on the scale.

( ) Refer to Figure 2 on Page 60 and use the plastic alignment tool furnished with the kit to adjust coil L1201 in the VFO. Place the alignment tool into the coil slug and adjust the coil in either direction for a reading of 14.200 on the Transceiver. NOTE: The correct slug position will be when you see the reading 14.200 and the slug is furthest forward from the panel opening. Or, the slug will be in the most clockwise position to obtain the reading.

( ) Turn the VFO to "0." The Transceiver should read out "14.000." If it does not, adjust coil L1201 to obtain that reading.

( ) Turn the Remote VFO dial to "5." The Transceiver should read out "14.500." If not, carefully adjust coil L1201 for 1/2 the difference between 14.500 and the readout on the Transceiver.

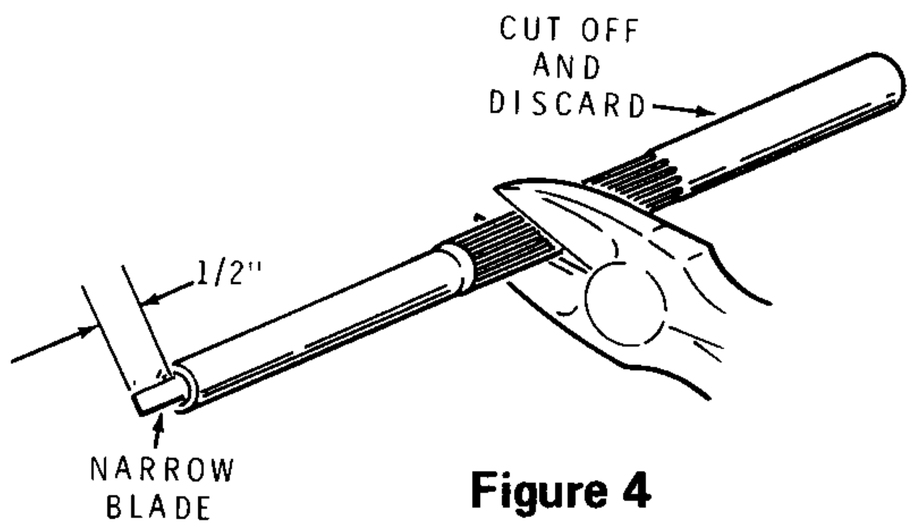


Figure 4

LSB OFFSET ADJUSTMENT (C1211)

Refer to Figure 4 for the following steps.

( ) Push the narrow metal blade into the small end of the nut starter as shown. Leave 1/2" of the blade exposed from the nut starter.

( ) Cut the nut starter in half with a sharp tool.

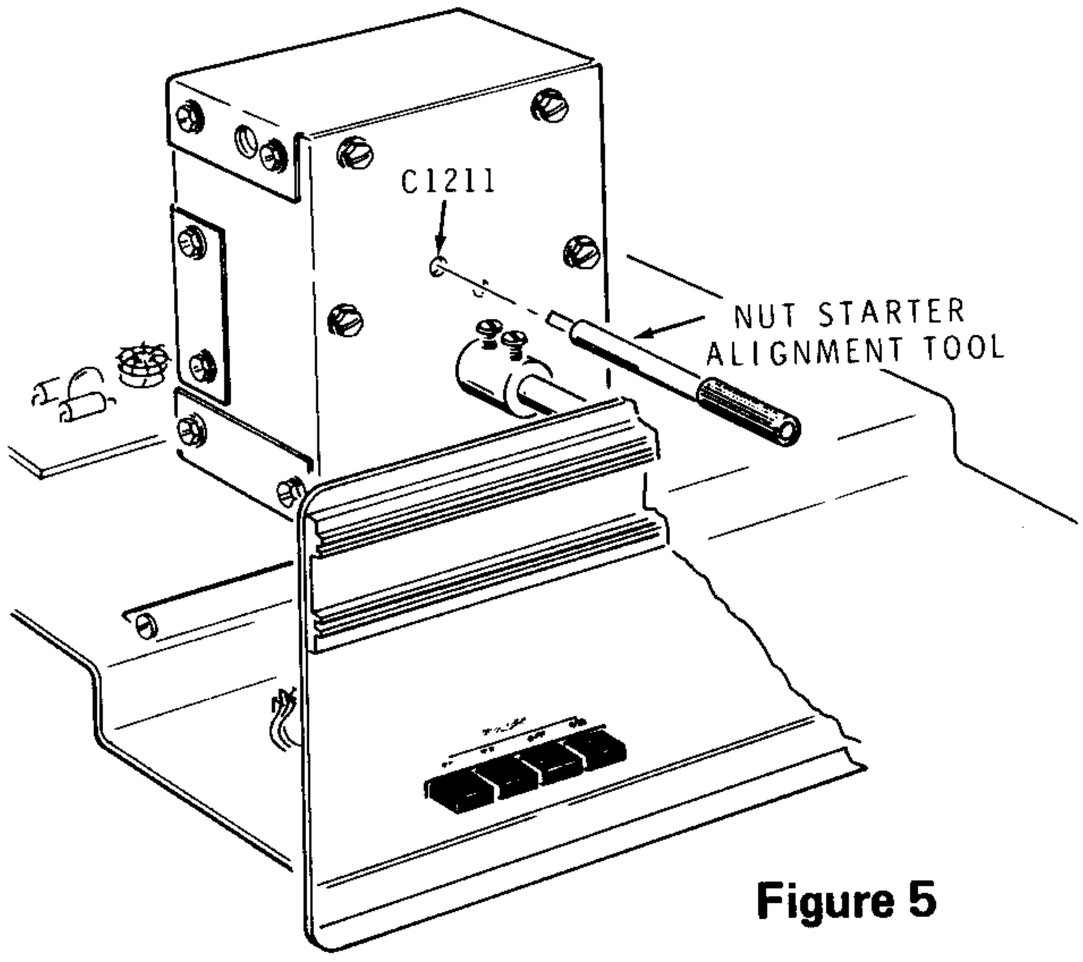


Figure 5

Refer to Figure 5 for the following steps.

NOTE: Use the nut starter alignment tool to make the following adjustments.

1. Turn the Transceiver and the Remote VFO on. Set the Transceiver control to USB. Depress the Remote VFO T/R switch (SW4). Allow 30 minutes for both units to stabilize.
2. Position the Remote VFO dial pointer to 3.
3. Record the digital display readout on the Transceiver.
4. Depress the LSB control on the Transceiver.
5. Adjust trimmer C1211 until the same readout is displayed on the Transceiver as you recorded in Step 3.
6. Depress the Transceiver USB control and check for the reading recorded in Step 3.
7. Repeat Steps 3 through 6 until identical readings are obtained on the upper and lower sidebands.

This completes the LSB Offset Adjustment.

SPECIAL CRYSTAL CONSIDERATIONS

CRYSTAL SELECTION FOR NET OPERATION

When the controls of the Transceiver and the Remote VFO are in the crystal (Xtal) mode of operation, the transmitted and received signals will be at a fixed frequency determined by a crystal in the Remote unit. Provisions are made on the switch circuit board for the use of two crystals, Y1 and Y2. These crystals are independent of one another and are selected by separate switches on the front panel of the Remote VFO.

BAND	f_h
3.5	12.3950
7.0	15.8950
14.0	22.8950
21.0	29.8950
28.0	36.8950
28.5	37.3950
29.0	37.8950
29.5	38.3950

IMPORTANT: Because of the steep-sided characteristics of the bandpass filter, operation of the Transceiver using a crystal at Y1 and Y2 will be limited to approximately 25 kHz outside of each band.

Definition of terms:

f_x = Crystal frequency in MHz for crystals Y1 or Y2.

f_h = heterodyne crystal frequency, different for each band:

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 receiver of the receiving station would have to be retuned 1 kHz lower to receive SSB, and this would be impossible if it were crystal controlled.

Select the crystal frequency for Y1 or Y2 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:

$$f_x\ (CW) = f_h - f_n - 3.3957$$

When using crystal control, switching modes will cause the transmitting frequency to change, except for compatible USB-CW operation. Therefore, be careful. Avoid out-of-band operation by inadvertently switching to the wrong mode.

Example: MARS SSB on USB at 7.305 MHz.

f_h (7.0) = 15.8950
f_m (USB) = 7.3050
8.5900
-3.3964
f_x (USB) = 5.1936 MHz

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

When purchasing crystals for Y1 or Y2, 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_1)	32 pF.
Internal Capacity (C_o)	7 pF maximum.
Series Resistance (R_s)	25 Ω maximum.
Drive Level	10 milliwatts.

Trimmer capacitors across each of the crystals can be adjusted for an exact MARS or Net frequency.

Heterodyne oscillator crystals that are supplied with the Transceiver provide coverage from 3.5 to 4.0 MHz, 7.0 to 7.3 MHz, 14.0 to 14.5 MHz, 21.0 to 21.5 MHz, and 28.0 to 30.0 MHz.

If you have previously purchased crystals for your Remote VFO, install them in their sockets at this time.

TRIMMER ADJUSTMENT

( ) Turn the Transceiver on and adjust the tuning for the approximate frequency of the crystal.

( ) Depress the REMOTE T/R switch, the XTAL ON switch, and the Y1 switch.

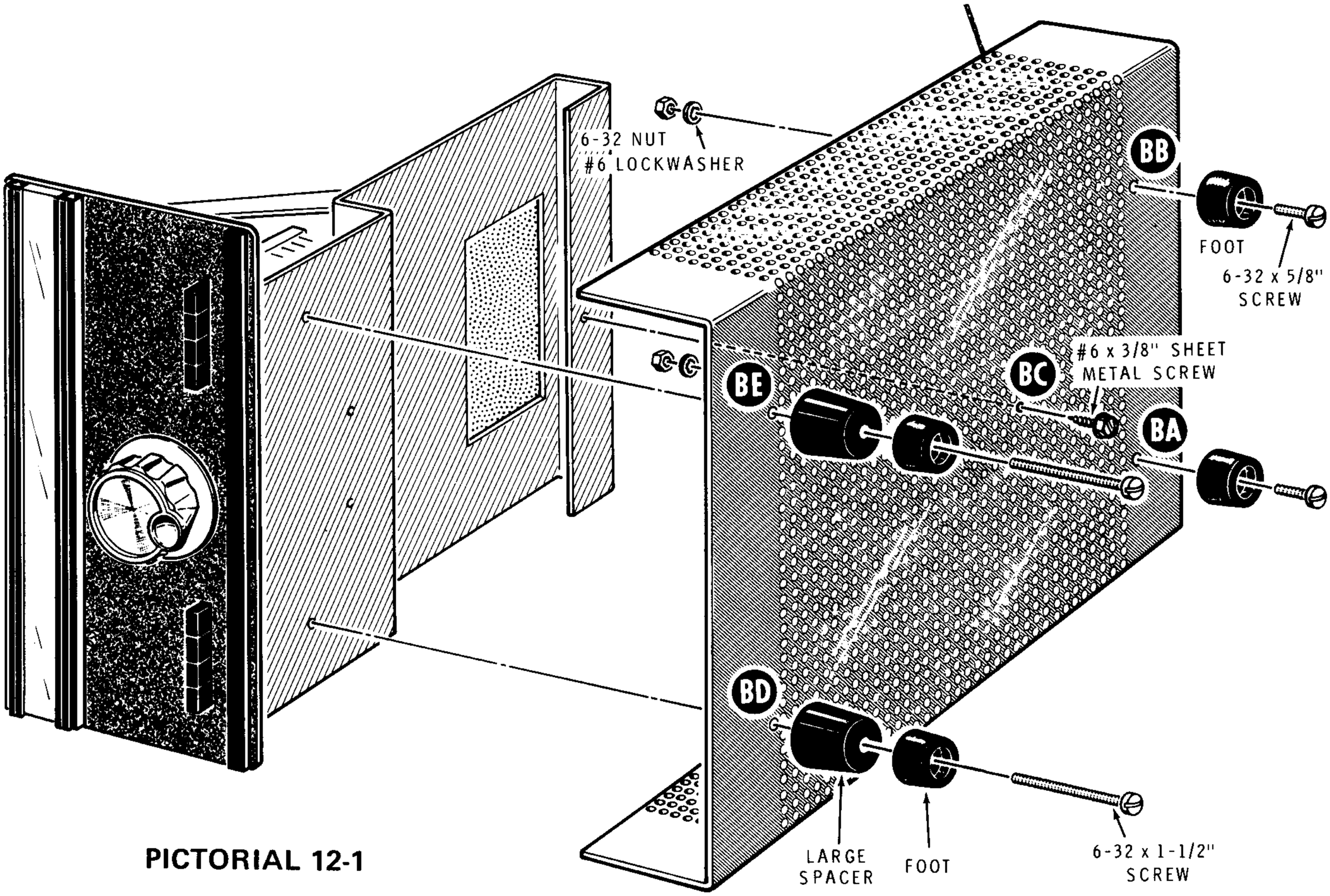
( ) Note the frequency indicated on the readout on the Transceiver as the transmitter is keyed. If the exact frequency of the desired net is not indicated, proceed with the following steps.

( ) While you key the transmitter, slowly adjust trimmer C1256 on the driver circuit board until the desired frequency is obtained.

( ) In the same manner, depress the Y2 XTAL switch to its ON position. Key the transmitter and then slowly adjust trimmer C1257 on the switch circuit board until the desired frequency is shown on the Transceiver dial readout.

This completes the "Test and Adjustment" of your Remote VFO. Turn off the Remote VFO and the Transceiver and remove the cables connected to the rear of the Remote unit. Proceed to the "Final Assembly" section of the Manual on the following pages.

FINAL ASSEMBLY



PICTORIAL 12-1

Refer to Pictorial 12-1 for the following steps.

( ) Place the chassis assembly into the cabinet bottom as shown. Secure the chassis to the bottom at BC with a #6 x 3/8" sheet metal screw.

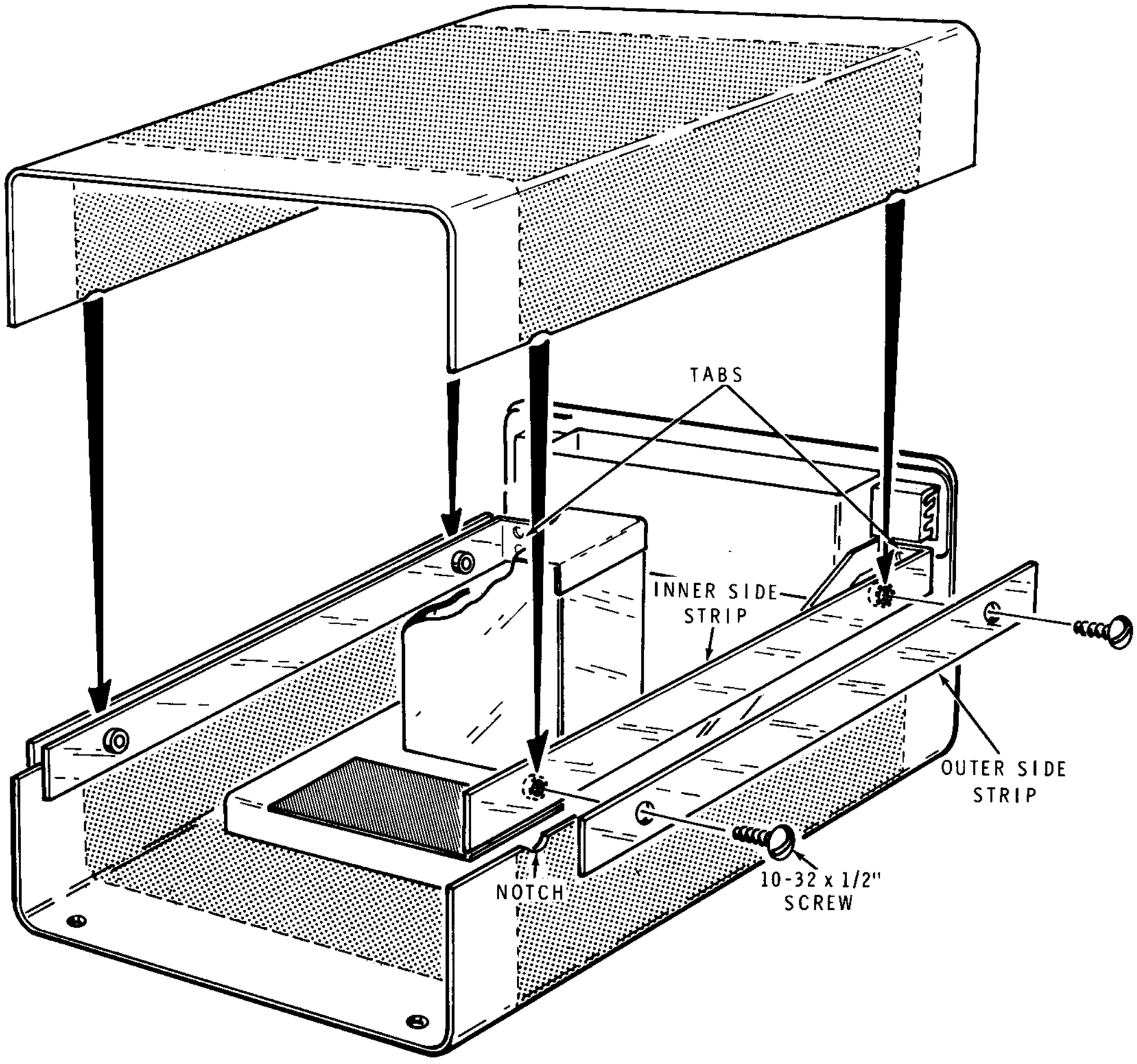
NOTE: In the following steps, you have the option of mounting feet and spacers to tilt the Remote VFO up at the front: or you may leave off the large spacers and install the VFO level. If you choose the level option, use the two extra 6-32 x 5/8" screws in the next two steps instead of the 1-1/2" screws, and leave out the large spacers.

( ) Pass a 6-32 x 1-1/2" screw through a foot and then through a large spacer as shown in the Pictorial. Secure the foot and the spacer to the chassis at BD.

( ) In the same manner, mount a foot and a spacer onto the chassis at BE.

( ) Mount a foot on the rear of the cabinet bottom at BA. Use a 6-32 x 5/8" screw, a #6 lockwasher, and a 6-32 nut.

( ) In the same manner, mount the remaining foot on the rear of the cabinet bottom at BB. Use 6-32 x 5/8" hardware as shown.



PICTORIAL 12-2

Refer to Pictorial 12-2 for the following steps.

( ) Connect one outer side strip to an inner side strip with two 10-32 x 1/2" screws. Position the tab on the inner side away from the outer strip as shown in the Pictorial.

( ) In the same manner, connect the remaining inner and outer side strips.

( ) Place the two side-strip assemblies onto the upper edges of the cabinet bottom as shown in the Pictorial. Position the tabs on the inner strips toward the front panel. Position each side strip assembly so the retaining screws fit down into the cabinet edge notches.

( ) Mount the cabinet top so the side edges fit down into the slots formed by the side strips on each side of the cabinet bottom. Tighten the four 10-32 x 1/2" side strip screws.

This completes the "Final Assembly" of your Remote VFO.

OPERATION

The Remote VFO is designed for use with the Model SB-104 Transceiver. Refer to Figure 2 on Page 58 and make the remote VFO connections to the Transceiver as follows: Shielded cable from Remote OUT to Transceiver VFO IN, shielded cable from Remote IN to Transceiver VFO OUT, and the 5-wire cable 11-pin plug to the Transceiver ACC (Accessory) socket. NOTE: Whenever power is applied to the Transceiver, power will also be supplied to the Remote VFO.

Refer to Figure 1 (fold-out from Page 73) for the location and functions of front panel controls and switches.

Frequency coverages of 0.5 MHz (total) increments are indicated by the dial. When the Transceiver is switched to the indicated bands, the VFO dial coverages are as follows:

BAND	FREQUENCY	
	Low	High
3.5	3.500 MHz	4.000 MHz
7.0	7.000 MHz	7.500 MHz
14.0	14.000 MHz	14.500 MHz
21.0	21.000 MHz	21.500 MHz
28.0 – 29.5	28.000 MHz	30.000 MHz*

When the Transceiver is in operation, its digital readout will always indicate the transmitting or receiving frequency of operation at that moment.

*Continuous, 4-segment band coverage as determined by Transceiver controls.

VARIABLE FREQUENCY OPERATION

Push the REMOTE ON-XTAL OFF (SW6) switch in. This enables the variable oscillator and disables the crystal circuits. NOTE: Approximate frequencies are shown on the Remote VFO dial. Exact frequencies are always shown on the Transceiver digital display.

When the REMOTE RX-MAIN TX switch (SW1) is depressed, receive frequencies are indicated by the position of the Remote VFO dial pointer. For example, if the SB-104 Transceiver Band switch is in the 14.0 position, the Remote VFO will select any desired 20-meter receive frequency. This frequency will be displayed on the digital readout on the Transceiver. When the Transceiver is keyed to transmit a signal, even if on a different frequency than that to which the Remote VFO is tuned, the transmitting frequency will then be displayed.

When the REMOTE TX-MAIN RX switch (SW2) is depressed, the opposite of the preceding operation takes place. Receive or transmit frequencies are always displayed on the Transceiver's digital readout. However, in this case, the frequency of the transmitted signal is selected by the Remote unit and displayed on the Transceiver, while the receive signal frequency is determined by the setting of the Transceiver controls. Once again whether transmitting or receiving, the frequency of operation is always displayed by the Transceiver.

When the REMOTE OFF-MAIN T/R switch (SW3) is depressed, the entire process of frequency selection is determined by the setting of the Transceiver's VFO and is displayed on the digital readout. The Remote VFO is bypassed.

When the REMOTE T/R-MAIN OFF switch (SW4) is depressed, the transceive frequency is shown by the position of the VFO dial pointer. The exact frequency of the signals is indicated on the Transceiver display. The Transceiver VFO is bypassed in this configuration.

CRYSTAL FREQUENCY OPERATION

When you operate in the crystal mode, the REMOTE T/R-MAIN OFF switch (SW4) must be depressed. The transceive frequency will be determined by the frequency of the crystals in the Remote VFO unit.

To enable the crystal circuit, depress the REMOTE OFF-XTAL ON switch (SW5); then select the desired crystal frequency by depressing either the XTAL 1 or the XTAL 2 switch (SW7 or SW8). Receive and transmit frequencies will now always be the same, as determined by the crystal selected. As with the variable mode of operation, the digital readout on the Transceiver will indicate the frequency of operation.

When a variable mode of operation is again desired, depress the REMOTE ON-XTAL OFF switch (SW6). The crystal circuit in the Remote VFO will be disabled, and the previously described modes of variable frequency operation will be enabled.

IN CASE OF DIFFICULTY

Begin your search for any trouble that occurs after assembly by carefully following the steps listed below in the "Visual Tests." After the "Visual Tests" are completed, refer to the Troubleshooting Chart.

NOTE: Refer to the "Circuit Board X-Ray Views" on Page 79 for the physical location of parts on the circuit boards.

VISUAL TESTS

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

2. About 90% of the kits that are returned to the Heath Company 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 they are soldered as described in the "Soldering" section of the "Kit Builders Guide." Be sure there are no solder bridges between circuit board foils.

3. Check to be sure that all transistors and diodes are in their proper locations. Make sure each lead is connected to the proper point. Make sure that each diode band is positioned above the band printed on the circuit board.

4. Check the values of the parts. Be sure in each step that the proper part has been wired into the circuit, as shown in the Pictorial Diagrams. It would be easy, for example, to install a 22 kΩ (red-red-orange) resistor where a 3300 Ω (orange-orange-red) resistor should have been installed.

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

6. Look under each circuit board to be sure all leads have been cut off. Be sure that none of the wire ends touch each other or the chassis.

7. A review of the "Circuit Description" may also help you determine where the trouble is.

If the trouble is still not located after the "Visual Tests" are completed, and a voltmeter is available, check voltage readings against those shown on the "Voltage Charts" on Page 81. Read the "Precautions for Troubleshooting" before you make any measurements. NOTE: All voltage readings were taken with a high impedance voltmeter. Voltages may vary ±20%.

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

PRECAUTIONS FOR TROUBLESHOOTING

1. Be cautious when testing diode and transistor circuits. Although they have almost unlimited life when used properly, they are much more sensitive to excessive voltage or current than tubes.
2. Be sure you do not short any terminals to ground when making voltage measurements. If the probe should slip, for example, and short across components or voltage sources, it is very likely to cause damage to one or more transistors or diodes.

TROUBLESHOOTING CHART

The following chart lists the "Condition" and the "Possible Cause" of a number of malfunctions. If a particular part or parts are mentioned (transistor Q1, diode D1204, etc.) as a possible cause, check these parts to see if they are incorrectly 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.

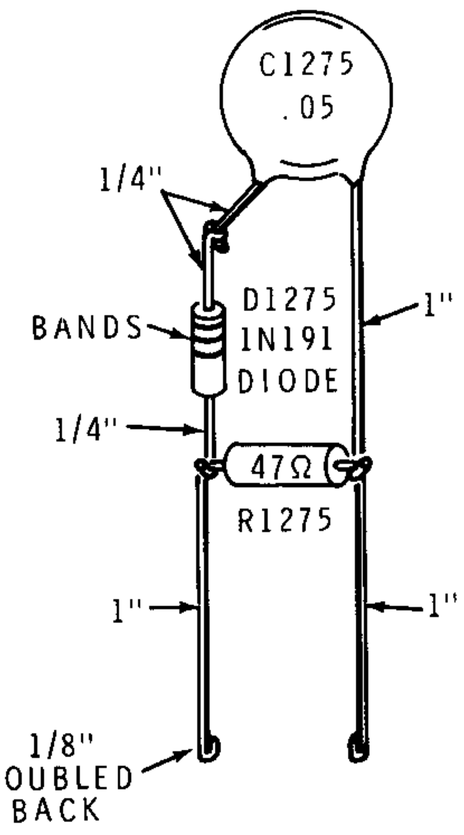
NOTE: Some Test Points will be suggested in the "Possible Cause" column below. These will be shown in parentheses. For example: (B-Q8) or the base of transistor Q8, (TP-H) or connection H on the switch circuit board. Check points within the VFO will not be listed. See the "Circuit Board X-Ray Views" on Page 79, the "Voltage Charts" on Page 81, or the "Schematic Diagram" (fold-out from Page 85).

CONDITION	POSSIBLE CAUSE
No DC (rectified RF) output from VFO assembly. (See "Test Circuit Assembly and Use" on Page 71.)	1. No 11-volt DC from Transceiver source. 2. No ground return from Transceiver source. 3. Internal problems. Refer to the "VFO Flow Chart" on fold-out from Page 68. 4. Cable connections.
No output from the Remote VFO as seen on the Transceiver display.	1. Transceiver input (B-Q8). 2. Switched input (TP-H).
No output from the Transceiver.	1. Transceiver input (B-Q8). 2. Switched input (TP-E).
No output, either of two crystals.	1. Transceiver input (B-Q8). 2. Trimmers C1256 or C1257.
Works properly in Remote T/R. No output in Remote TX, or Remote RX.	1. Incorrect voltages (TP-F and TP-K). 2. Transistors Q1 or Q2. 3. Transistors Q6 or Q7 (TP-C and TP-D). 4. Input to transistors Q6 and Q7 should be zero volts while receiving, 13.6 volts while transmitting.

CONDITION	POSSIBLE CAUSE
Frequency instability.	1. Recheck all mechanical connections. 2. Check cemented capacitors and coils on oscillator circuit board. 3. Shorten wires to variable coil L1201 and resolder them securely. 4. Resolder ground wires from tuning capacitor C1201 to circuit board solder lugs.

TEST CIRCUIT ASSEMBLY AND USE

To assist you in isolating problems in the Remote VFO, you may easily determine whether your problem is in the VFO assembly, or in the cabling, switching, or other output circuits if you assemble and apply the simple test circuit as described in the following steps. NOTE: If you have an RF voltmeter, do not perform the following test circuit assembly steps; refer directly to the steps outlined under "Isolation Test – RF Voltmeter" below.



Detail 13-1A

Refer to Pictorial 13-1 (fold-out from Page 68) and Detail 13-1A for the following steps.

Cut and form the VFO test circuit component leads in the following steps.

( ) C1275: .05 μF disc capacitor. Cut one lead to 1/4" and the other lead to 1." Bend a small hook in each lead.

( ) R1275: Cut both leads of a 47 Ω, 1/2-watt (yellow-violet-black) resistor to 1." Bend 1/8" of the tip of each lead tightly back against the main part of the lead. Then bend both resistor leads 90 degrees to the resistor body as shown in the Detail.

( ) D1275: Cut both leads of a 1N191 (brown-white-brown) diode (#56-26) to 1/4". Form a small hook in the end of each lead as shown.

( ) Connect the short lead of disc capacitor C1275 to the banded end of diode D1275 as shown. Crimp the hooks together; then solder the connection.

( ) Connect the long lead of capacitor C1275 to one lead of resistor R1275. Hook the capacitor lead close to the body of the resistor as shown; then solder the connection.

( ) Hook the remaining lead of diode D1275 to the other end of resistor R1275 as shown. Solder the connection.

( ) Prepare a 1-1/2" length of gray wire by removing 1/4" of insulation from each wire end. Double one end tightly back against the running length of the wire.

Refer to Pictorial 13-1 for the following steps.

( ) Remove the VFO socket from the VFO plug.

( ) Push the doubled end of the 1-1/2" gray wire into hole 2 of the VFO plug.

( ) Push the resistor-diode lead of the test circuit into hole 4 of the VFO plug. Then push the resistor-capacitor lead of the test circuit into hole 1.

NOTE: To perform the following test, you will need two lengths of wire to connect from the accessory socket on the Transceiver to the VFO assembly on the Remote unit. You will also need a high-impedance input voltmeter.

( ) Remove the plug from the Transceiver accessory socket.

( ) Connect a length of wire from Transceiver accessory socket pin 6 to the VFO plug connection at pin 1. This is the common (ground) connection.

( ) Connect a length of wire from Transceiver accessory socket pin 7 to the end of the gray wire at VFO plug pin 2. This is the +11-volt source to the VFO assembly.

( ) Connect the negative or common lead of the voltmeter to the connection at VFO plug pin 1.

( ) Connect the positive (+) lead of the voltmeter to the junction of diode D1275 and capacitor C1275 as shown.

( ) Turn the VFO dial pointer to midscale (2.5).

Allow the VFO to stabilize for 10 minutes with Transceiver power applied.

( ) Turn the voltmeter to a low range and set the function switch to measure +DC volts.

( ) Check for a small output reading on the voltmeter. NOTE: the level is immaterial at this time. However, you may wish to check that control R1232 in the VFO assembly is functioning properly. To do this, turn the control with a small screwdriver and check for a reading on the voltmeter, varying from (approximately) 0.2 volt to 2 volts.

NOTE: If you observed an output reading on the voltmeter, the VFO assembly is operating properly for the purposes of this check; problems in the Remote VFO are outside the VFO assembly.

ISOLATION TEST – RF VOLTMETER

Refer to Pictorial 13-2 (fold-out from Page 73) for the following steps.

In addition to your voltmeter, you will need two lengths of wire that will connect from the Transceiver accessory socket to the VFO assembly on the Remote unit.

( ) Remove the plug from the Transceiver accessory socket.

( ) Remove the socket from the Remote VFO assembly.

( ) Connect a length of wire from Transceiver accessory socket pin 6 to Remote VFO assembly plug pin 1.

( ) Connect another length of wire from Transceiver accessory socket pin 7 to Remote VFO assembly plug pin 2.

( ) Connect the common lead of the RF voltmeter to either chassis (ground).

( ) Connect the positive (+) RF voltmeter probe to VFO assembly plug pin 4.

( ) Read some small RF voltage. Turn Level control R1232 in the top of the VFO assembly and check for a varying output as seen on the voltmeter. This variation should be approximately 0.2 volt to 2 volts.

NOTE: If you observed an output reading on the RF voltmeter, the VFO assembly is operating properly for the purposes of this check; problems in the Remote VFO are outside the VFO assembly.

This completes the checkout procedure for proper RF output from the VFO assembly.

VOLTAGE AND RESISTANCE CHARTS

NOTE: Resistance readings must be made with the Remote VFO cables disconnected from the Transceiver. Readings should be taken with an ohmmeter from the point indicated to chassis ground. All readings indicated are accurate to within ±20%.

NOTE: The voltage readings indicated are shown with the Remote switches in the indicated positions. Readings are taken with a high impedance input voltmeter and are accurate to within ±20%. All cables are properly connected to the Transceiver and power is applied.

TEST POINT (on Switch Circuit Board)	DEPRESS REMOTE VFO SWITCH (See Figure 1, fold-out from Page 73.)	+DC VOLTS (TP to gnd)
A	TX (SW2)	13.6
B	any	13.6 (source)
C	RX (SW1)	13.6
C	TX (SW2)	0.1
D	RX (SW1)	0.1
D	TX (SW2)	13.6
E	any	0.34
F	OFF (SW3)	13.6
F	T/R (SW4)	0
H	T/R (SW4)	0.34
K	OFF (SW3)	0
K	T/R (SW4)	13.6
R	T/R (XTAL-ON) (SW4-SW5)	0.34
S	T/R (XTAL-ON) SW4-SW5)	13.6
T	any	13.6
U	any	13.6

Switch Board Transistors

LEAD	Q6	Q7	Q8	Q9
Emitter (E)	0 Ω	0 Ω	12 Ω	100 Ω
Base (B)	1000 Ω	800 Ω	20 kΩ	1200 Ω
Collector (C)	100 Ω	100 Ω	0 Ω	30 kΩ

VFO FLOW CHART (fold-out from Page 68)

NOTE: In order to make the following voltage checks in the VFO chassis and circuit board assembly, you will need either an oscilloscope or an RF voltmeter. It will be necessary for you to first remove the circuit board and bracket assembly from the VFO chassis. Then, hook up the test circuit and install it in the VFO 4-pin plug as outlined on Page 71 and as shown in Pictorial 13-1 (fold-out from Page 68).

VFO Voltage and Resistance Chart

TRANSISTOR		RESISTANCE*	VOLTS DC**	VOLTS RF**
Q1205	Collector	0 Ω	0	1.25
	Base	21 kΩ	8.9	0.1
	Emitter	1200 Ω	9.6	
Q1204	Collector	1200 Ω	11.0	0.35
	Base	1200 Ω	3.5	0.8
	Emitter	500 Ω	2.9	0.8
Q1203	Gate	3000 Ω	0	1.7
	Source	1300 Ω	3.0	0.82
	Drain	1200 Ω	11.0	
Q1202	Gate	2300 Ω	0	
	Source	900 Ω	1.9	1.7
	Drain	1000 Ω	9.8	2.9

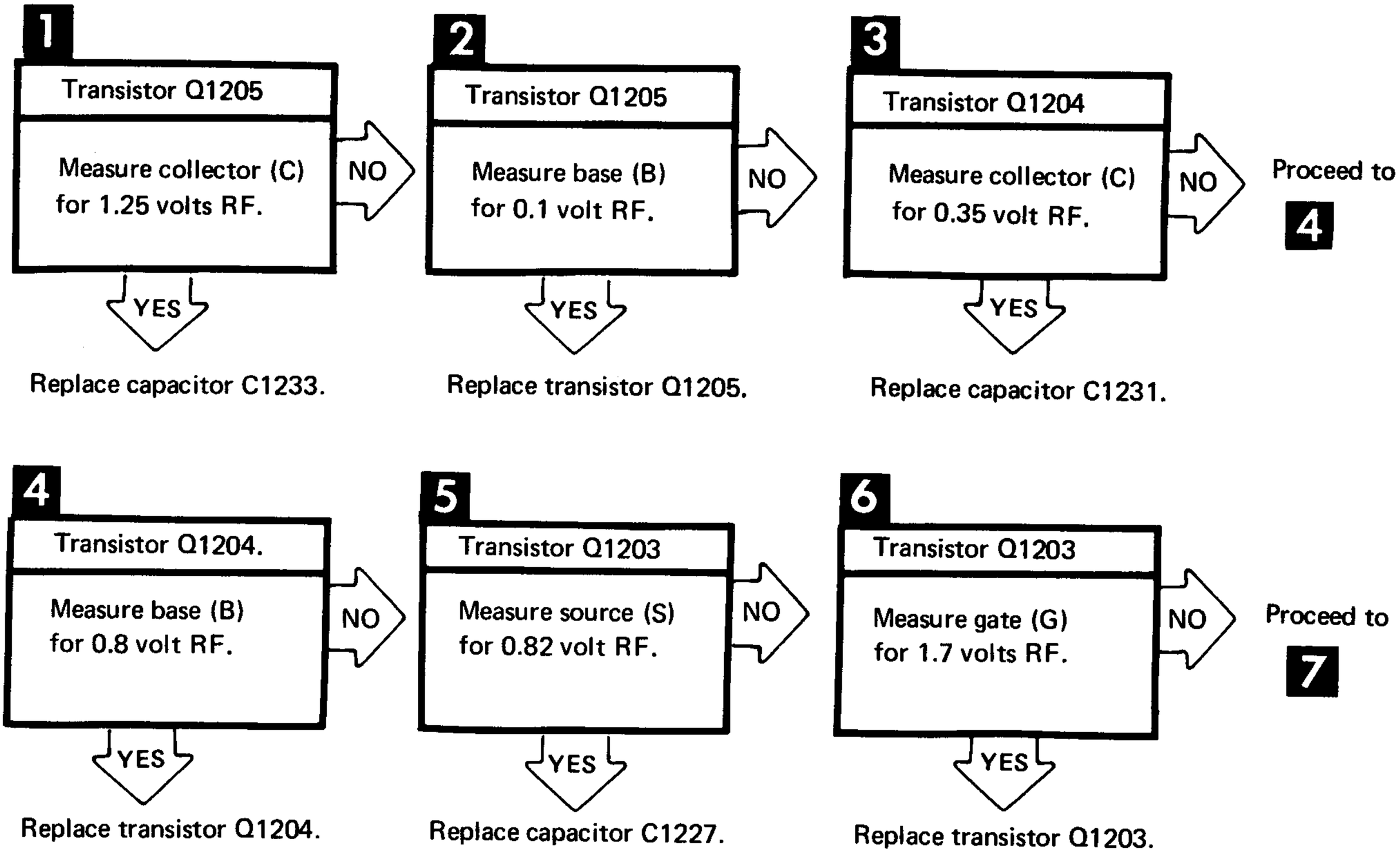
*Resistance readings may vary ±10%.
**Voltage readings may vary ±20%.

SPECIFICATIONS

VFO Frequency Range	5.0 to 5.5 MHz.
Modes of Operation	Remote VFO only. Main VFO only. Remote Transmit/Main Receive. Main Transmit/Remote Receive. Crystal, 2 frequencies.
Stability	Less than 100 Hz drift per hour after 30 minute warmup.
Dial Backlash	Less than 100 Hz.
Power Requirement (Source SB-104 Transceiver)	11.0 volts DC at 50 mA and 13.6 volts DC at 460 mA.
Dimensions (overall)	13-7/8" long x 9-7/8" wide x 7-1/8" high. (35.2 cm. x 25.1 cm. x 18.1 cm.)
Net Weight	6-1/2 lbs. (2.95 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.

VFO FLOW CHART



CIRCUIT DESCRIPTION

Refer to the Schematic Diagram (fold-out from Page 85) 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, chassis, and circuit boards:

1201-1225 Parts mounted on the chassis and on the oscillator circuit board.

1226-1250 Parts mounted on the buffer circuit board.

1251-1274 Parts mounted on the switch circuit board.

VARIABLE FREQUENCY OSCILLATOR (VFO)

The VFO circuit consists of two circuit boards and two externally mounted components, a tuning capacitor and a variable inductor.

Oscillator Circuit Board

Transistor Q1202 is the oscillator stage whose operating frequency is controlled by the action of tuning capacitor C1201. This capacitor is coupled directly to the dial pointer and through a 36:1 dual vernier drive system to the tuning knob. Variable coil L1201 adjusts the frequency range of the Remote VFO so its frequency dial reading will correspond with the Transceiver digital display to balance the tuning of the stage. Capacitors C1202 through C1207, on the gate of Q1202, are selected to compensate for any temperature variations and thus assure stability for the circuit under a wide range of conditions.

A 13.6 volt shift signal will be present at the LSB connection on the circuit board whenever the Transceiver is switched to the LSB mode. This positive voltage causes diode D1201 to conduct, which furnishes an RF ground to the source of VFO oscillator transistor Q1202 through capacitor C1209 and trimmer C1211. The frequency of oscillation is thus shifted for LSB operation.

Zener diode ZD1201 is a 10-volt source regulator for the oscillator circuits.

The output of the oscillator circuit is coupled from the drain (D) of transistor Q1202, through capacitor C1214, to the input of the buffer stage.

Buffer Circuit Board

The sine wave input from the oscillator is coupled through C1225 to the base of isolation amplifier transistor Q1203. The purpose of this transistor stage is to isolate the oscillator from the following stages.

The signal is coupled to the base of voltage amplifier transistor Q1204 through capacitor C1227. The voltage level at the collector of Q1204 is determined by the action of temperature compensating diode D1202 and the base-to-emitter current through the transistor as set by variable control R1232.

The collector circuit of power amplifier transistor Q1205 is resonant to the frequency range of the VFO output. Diode D1203 in the base circuit of Q1205 insures a linear class of operation.

RF choke RFC1201 and capacitor C1232 filter any RF from the supply voltage that originates in transistor Q1205.

The output of the buffer stage is coupled to a network of switches and switching circuits that route the signal back to the Transceiver.

SWITCH CIRCUIT BOARD AND SWITCHES

When the Remote VFO is correctly connected by its three cables to the SB-104 Transceiver, power will be applied to the remote unit whenever the Transceiver power is on. Therefore, the pilot lights may be illuminated, and one of the indicator lights (according to which switch circuit is activated) will be lit when the Remote-On switch is depressed.

Diode Switching

The conduction of the two diode switches (D1 and D2), which consists of D1251 through D1255 (D1) and D1256 through D1261 (D2), is controlled by switch transistors Q6 and Q7. These transistors are, in turn controlled by the keying of the transmit function in the Transceiver. A voltage is present on the base of transistor Q6 when the transmitter is keyed. The base of Q6 goes high and causes Q6 to saturate. This in turn causes the voltage on the base of transistor Q7 to go low, which turns off Q7. The collector of Q6 will be approximately .6 volt and the collector of Q7 will be approximately 13 volts. Depending on the positions of switches SW1 through SW5, the diode switches are alternately enabled and disabled to permit passage of the Remote VFO, Remote Crystal, or Main VFO signals back to the Transceiver.

Switch Functions

When switch SW1 is depressed, the Remote VFO will control the receive frequency when the receiver is enabled. The unkeyed transmitted signal disables transistor Q6 and enables transistor Q7, which in turn enables diode switch D2. The VFO signal generated within the remote unit is passed through switch D2, passed through output amplifier transistor Q8, and then into the Transceiver. When the transmitter is keyed, diode switch D2 is disabled, diode switch D1 is enabled, and the Transceiver VFO signal is coupled through SW1, on through amplifier transistor Q8, and back to the Transceiver.

When switch SW2 is depressed, the action described in the preceding paragraph is reversed. The VFO signal from the remote unit is connected through the amplifier transistor to the Transceiver during the transmit cycle. The VFO signal used during the receive cycle is first generated in the Transceiver, routed through the Remote unit, and then applied directly back into the Transceiver.

When switch SW3 is enabled, the VFO functions in both the receive and transmit cycles originate in the Transceiver and are passed through the Remote unit and back to the Transceiver. The internal signals of the Remote VFO are disabled.

When switch SW4 is depressed, the VFO signal from the Transceiver is disabled at all times. The VFO signal generated within the Remote unit is passed through amplifier transistor Q8 for use in the Transceiver during both the receive and transmit cycles of that unit.

Switch SW5 disables the variable oscillator within the Remote unit. This switch is used in conjunction with Remote T/R switch SW4 and either Xtal 1 or Xtal 2 switches SW7 or SW8. Source voltage to the variable oscillator is disconnected by switch SW6, and is present at circuit board connection S where it enables crystal oscillator transistor Q9. Either crystal Y1 or crystal Y2 is selected by its individual switch. The crystal frequency is passed through the oscillator stage to the base of transistor Q8. Trimmers C1256 (across Y1) and C1257 (across Y2) compensate for inherent crystal variations.

Transistor Q8 amplifies the outgoing signals, whether generated in the variable oscillator or in the crystal circuits, or if they are the "passed through" signals generated in the Transceiver. The purpose of the amplifier stage is to compensate for an approximate 1 to 3 dB loss within the Remote unit.

A shift signal of approximately 13 volts is present at pin 1 of socket SO1202 at all times when the Transceiver is switched to the LSB mode of operation.

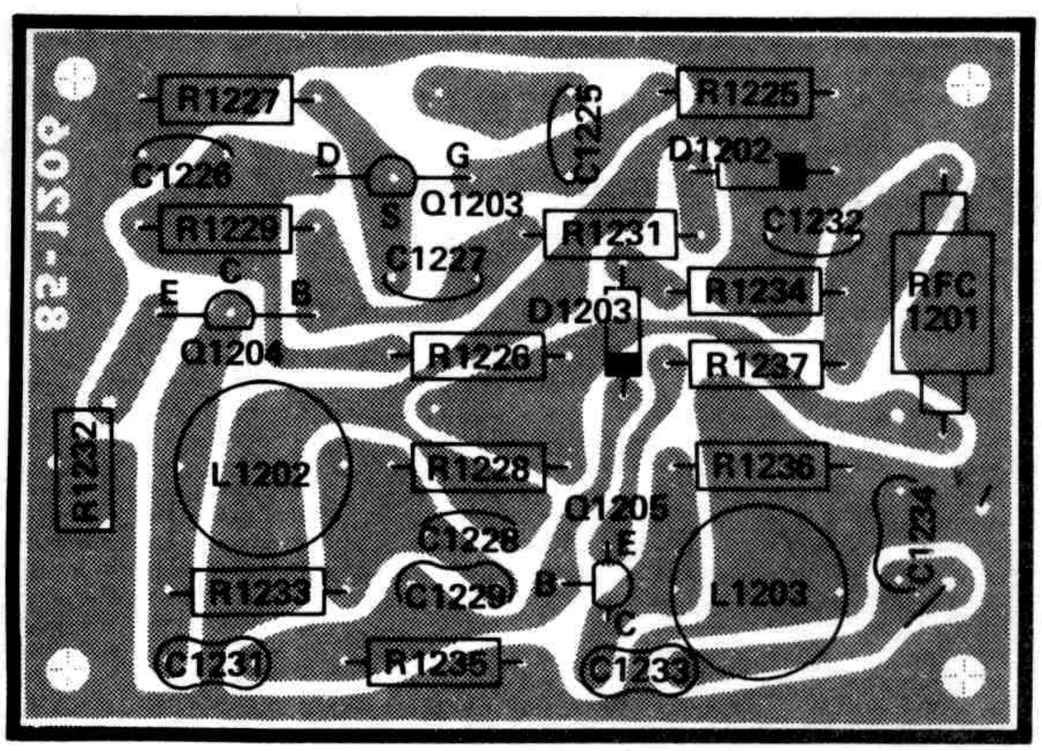
CIRCUIT BOARD X-RAY VIEWS

NOTE: To find the PART NUMBER of a component for the purpose of ordering a replacement part:

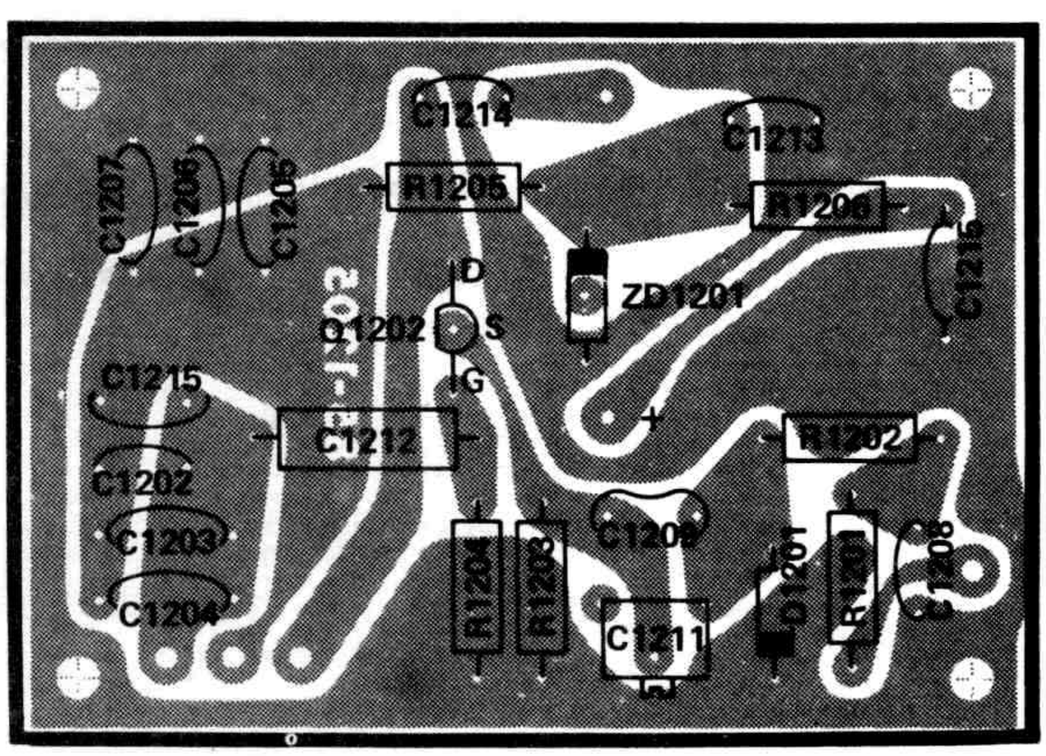
A. Find the circuit component number (R5, C3, etc.) on the "X-Ray View" or "Chassis Photograph."

B. Locate this same number in the "Circuit Component Number" column of the "Parts List" in the front of this Manual.

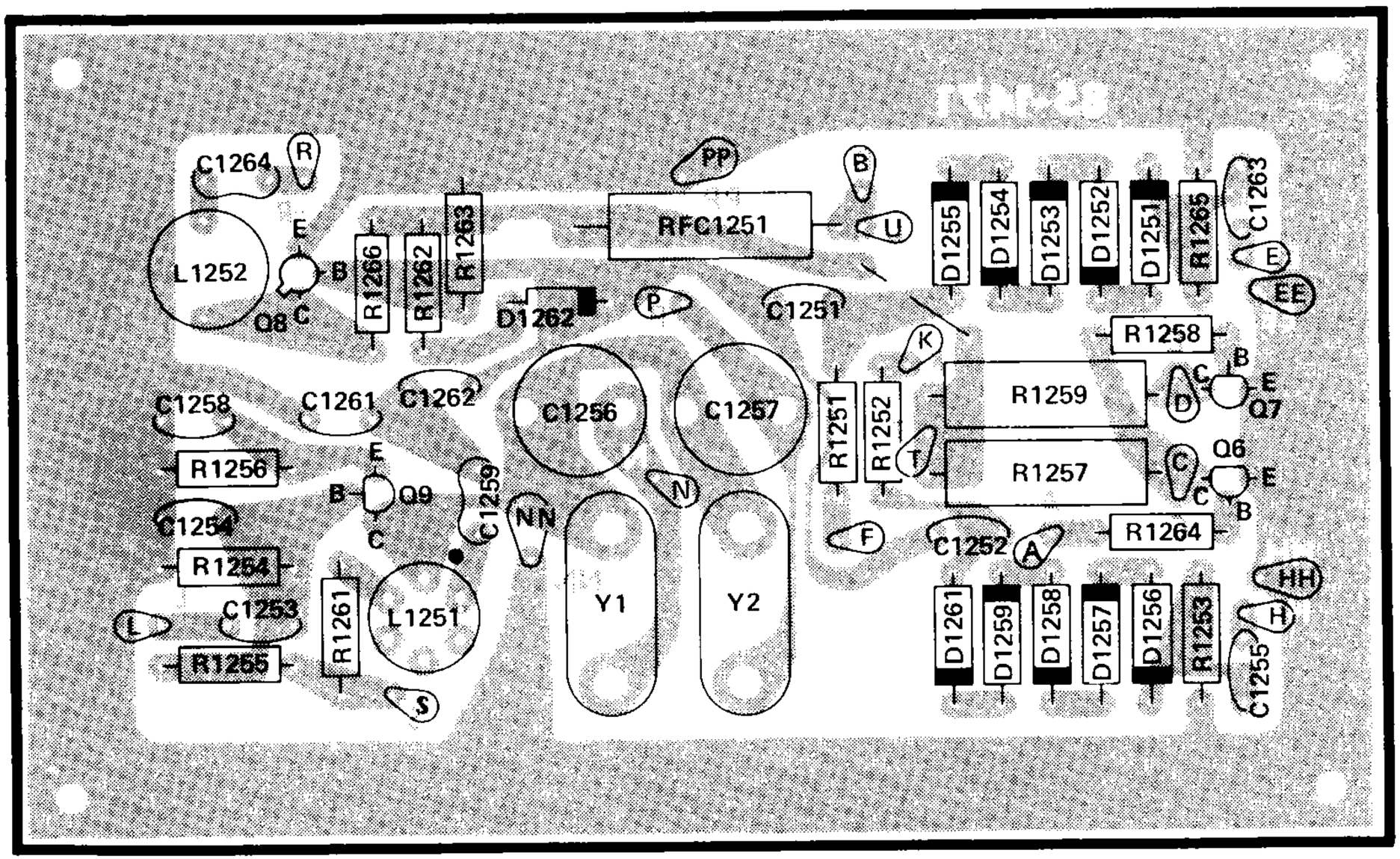
C. Adjacent to the circuit component number, you will find the PART NUMBER and DESCRIPTION which must be supplied when you order a replacement part.



BUFFER CIRCUIT BOARD
(Shown from component side)



OSCILLATOR CIRCUIT BOARD
(Shown from component side)



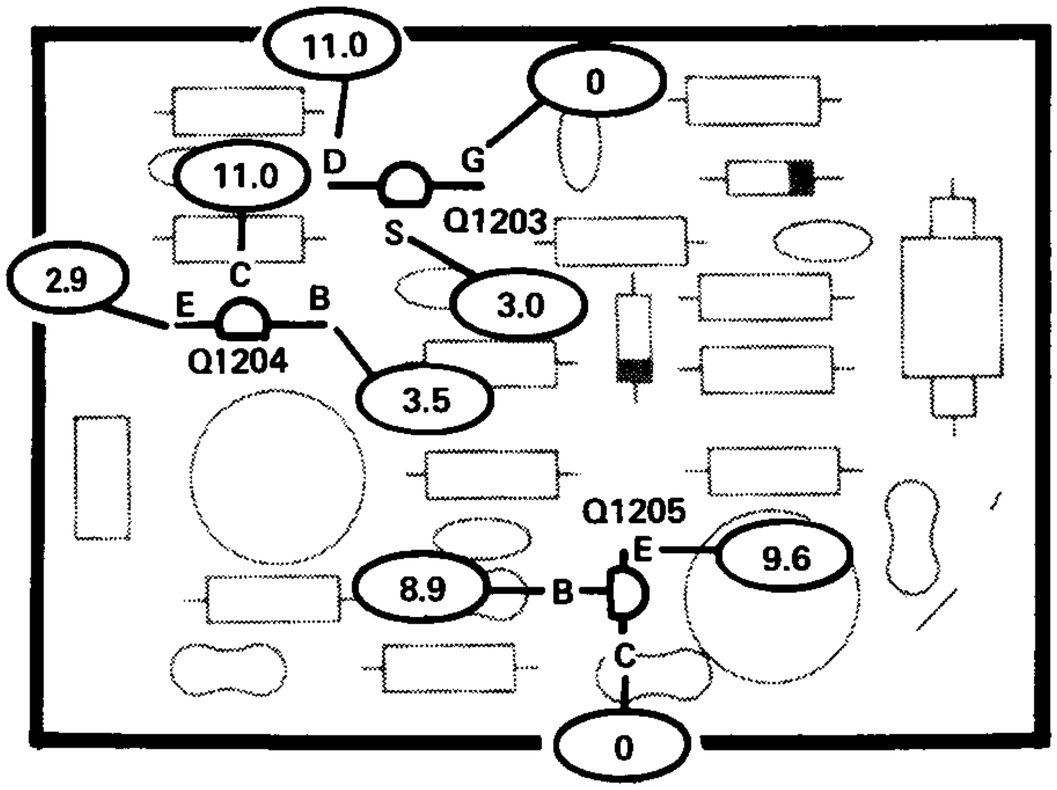
SWITCH CIRCUIT BOARD
(Shown from component side)

VOLTAGE CHARTS

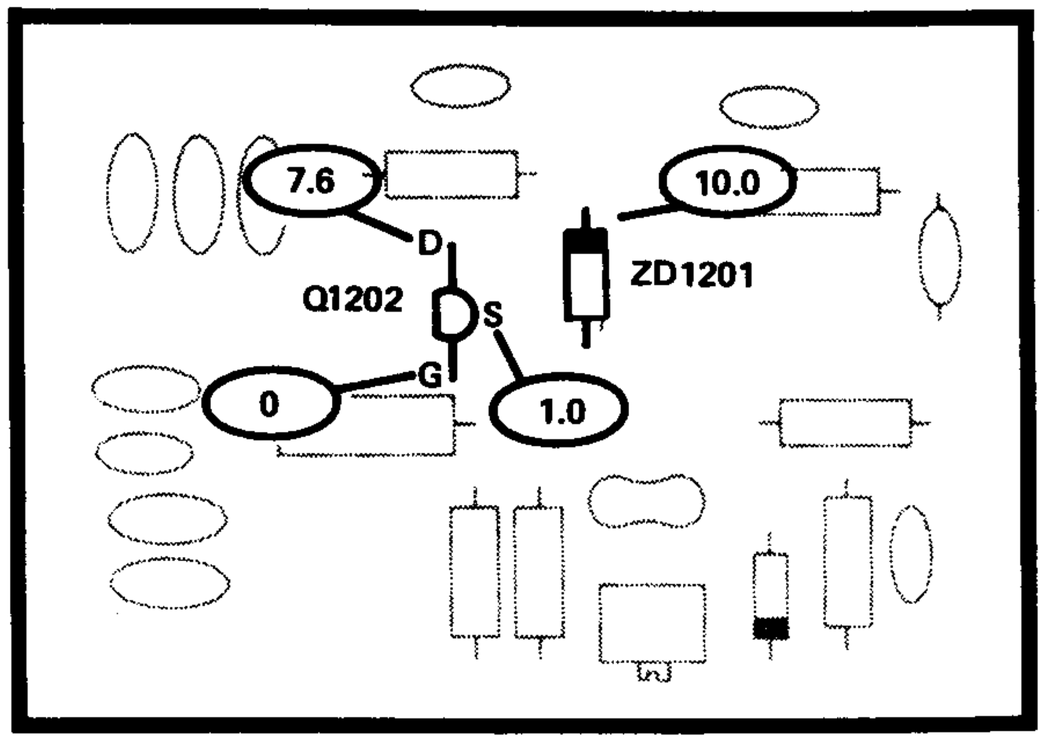
NOTES:

1. Voltage readings may vary ±20%.

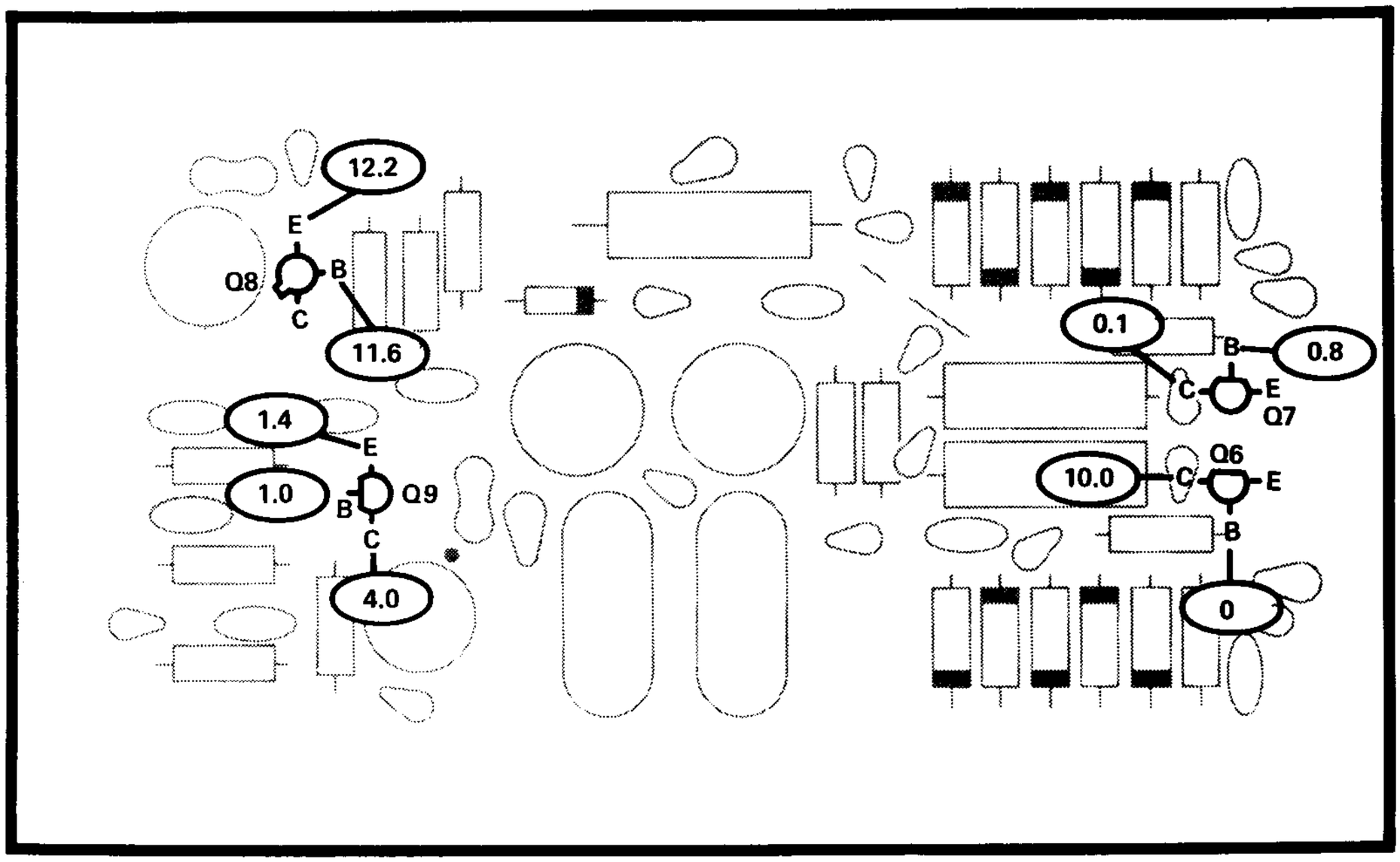
2. Remote T/R switch (SW4) depressed (on).



BUFFER CIRCUIT BOARD
(Shown from component side)

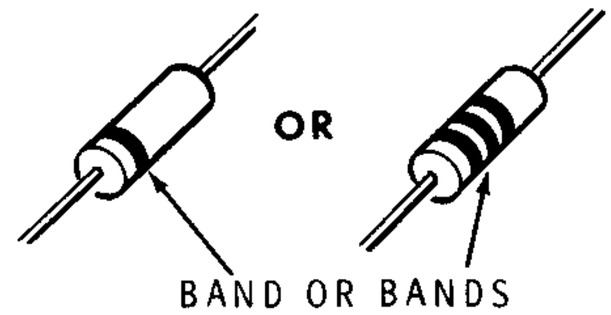
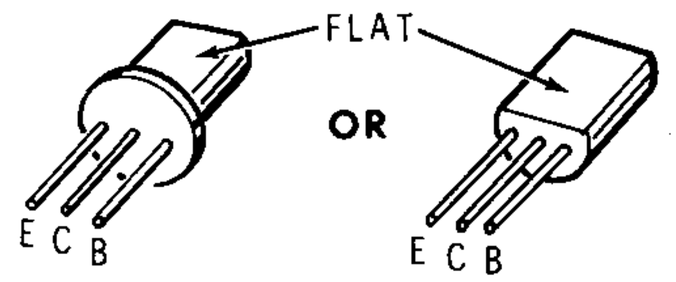
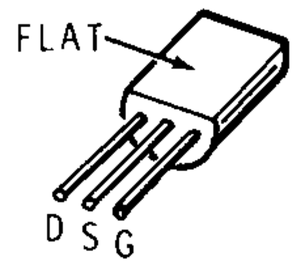
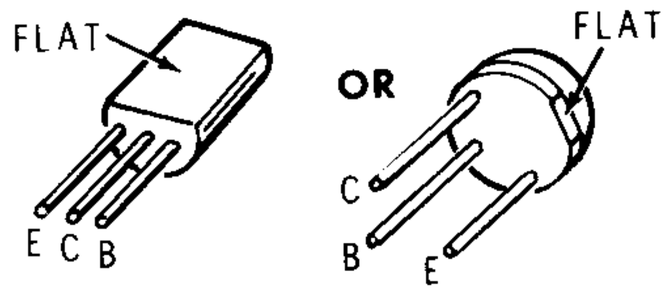
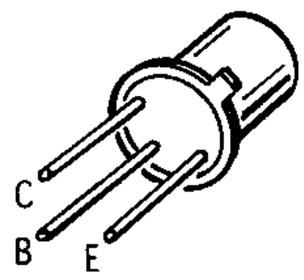


OSCILLATOR CIRCUIT BOARD
(Shown from component side)



SWITCH CIRCUIT BOARD
(Shown from component side)

IDENTIFICATION CHART

COMPONENT	HEATH PART NO.	MAY BE REPLACED WITH	IDENTIFICATION
ZD1201	56-67	VR-10A ZENER	
D1201, D1275	56-26	IN191	
D1251 THROUGH D1261	56-28	GE-S127	
D1202, D1203, D1262	56-56	IN4149	
Q1201, Q1204	417-118	2N3393	
Q1202, Q1203	417-169	MPF105	
Q1205	417-234	2N3638A	
Q6, Q7, Q9	417-233	2N3643	
Q8	417-270	SGC5283	

I1203: R/MAIN T/REM – This indicator lamp will be on when the REMOTE TX-MAIN RX switch is enabled.

I1206: XTAL 2 – This lamp will be on when the REMOTE OFF – XTAL ON and the XTAL 2 switches are enabled.

I1202: REMOTE – This indicator lamp will be on when the REMOTE T/R-MAIN OFF switch is enabled.

I1205: XTAL 1 – This lamp will be on when the Remote OFF – XTAL ON and the XTAL 1 switches are enabled.

I1201: MAIN – This indicator lamp will be on when the REMOTE OFF-MAIN T/R switch is enabled.

DIAL LAMPS: ON when SW1, SW2 and SW4 are enabled. May also be on with SW6.

I1204: R/REM-T/MAIN – This indicator lamp will be on when the REMOTE RX-MAIN TX switch is enabled.

MAIN

REMOTE

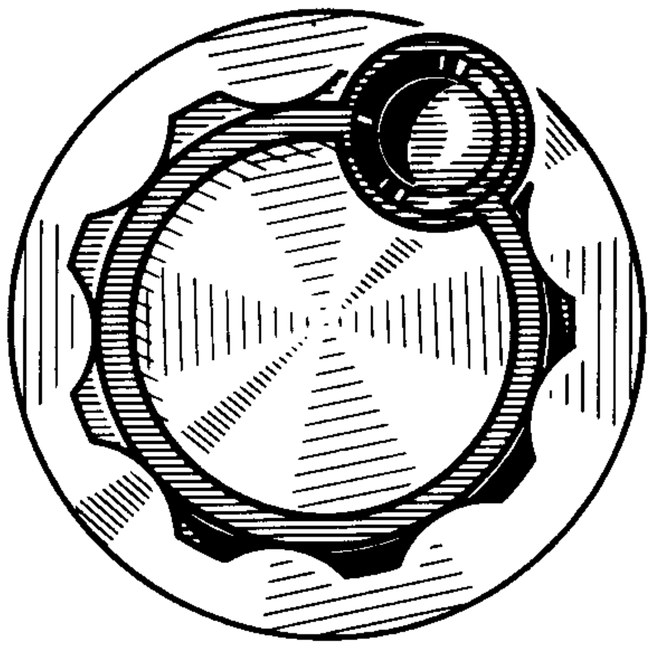
R/MAIN T/REM

R/REM T/MAIN

XTAL 1

XTAL 2

0 1 2 3 4 5



REMOTE

RX TX OFF T/R

TX RX T/R OFF

MAIN

REMOTE

OFF ON

ON OFF 1 2

XTAL

HEATHKIT

SB-644

SW1: REMOTE RX – MAIN TX switch. Enables the Remote VFO during receive and enables the Transceiver VFO during transmit.

SW2: REMOTE TX – MAIN RX switch. Enables the Remote VFO during transmit and enables the Transceiver VFO during receive.

SW3: REMOTE OFF – MAIN T/R switch. Disables the Remote VFO; the Transceiver VFO is enabled at all times.

SW4: REMOTE T/R – MAIN OFF switch. The Remote VFO is enabled at all times; the Transceiver VFO is disabled. This switch must be depressed for crystal (Xtal) operation.

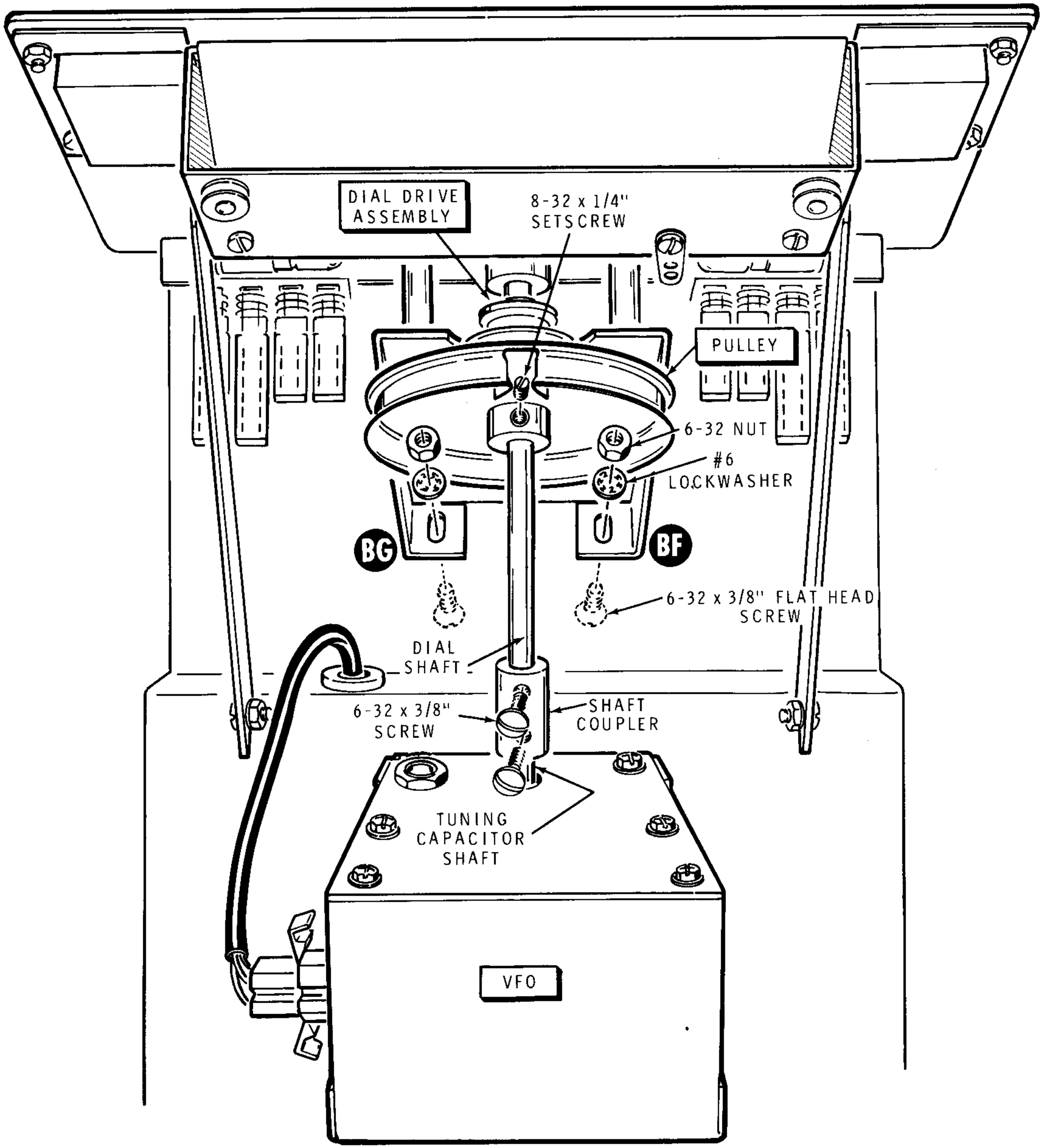
SW5: REMOTE OFF – XTAL ON switch. Disables the variable oscillator and enables the crystal circuits in the oscillator. This switch is used with SW4, and with either SW1 or SW8.

SW6: REMOTE ON – XTAL OFF switch. Disables the crystal circuits and enables any of the variable oscillator modes as selected by SW1 through SW4.

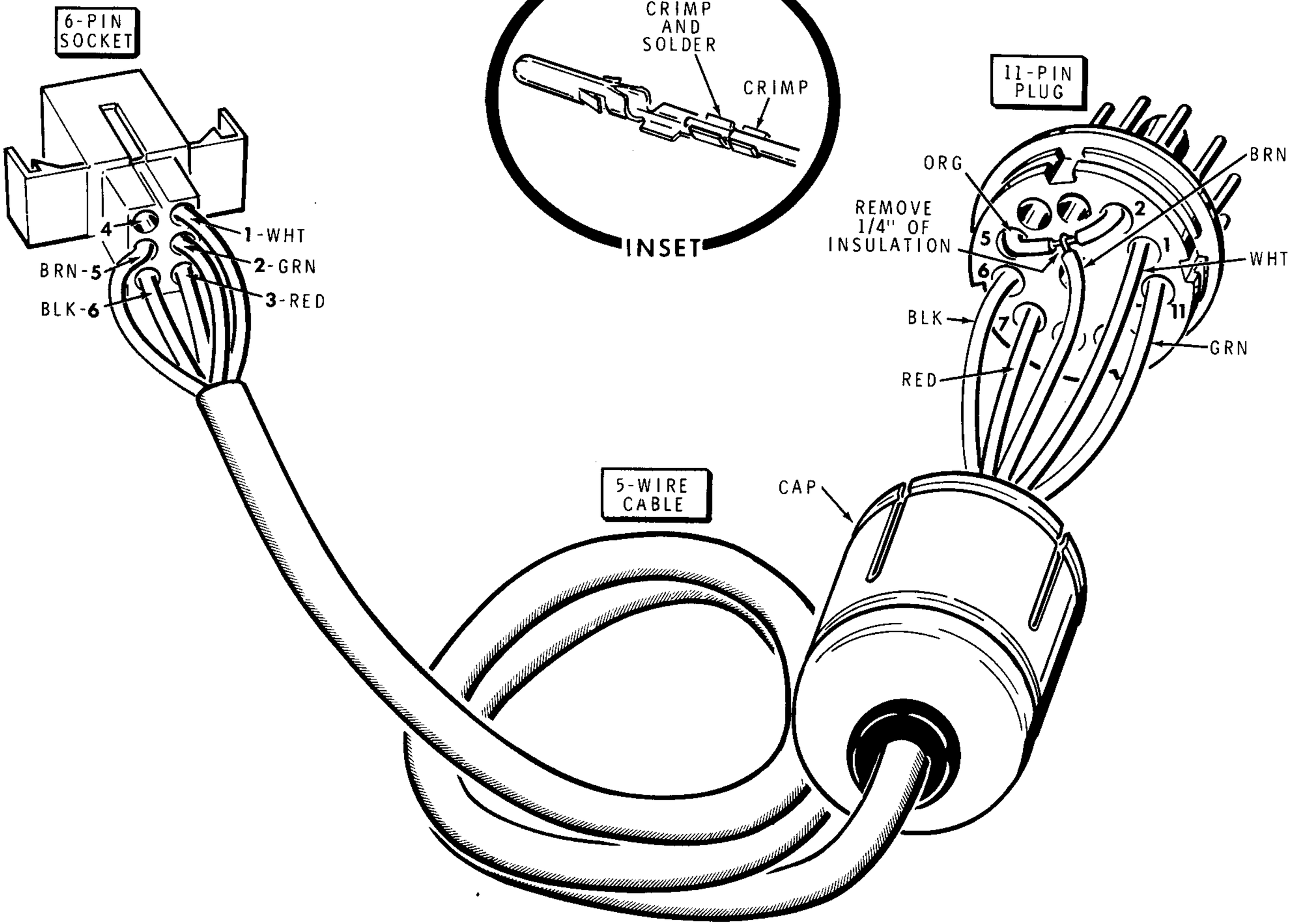
SW7: XTAL 1 switch. Enables crystal Y1 circuits. Controls transceive frequency. It is used with switches SW4 and SW5.

SW8: XTAL 2 switch. Enables crystal Y2 circuits. Controls transceive frequency. It is used with switches SW4 and SW5.

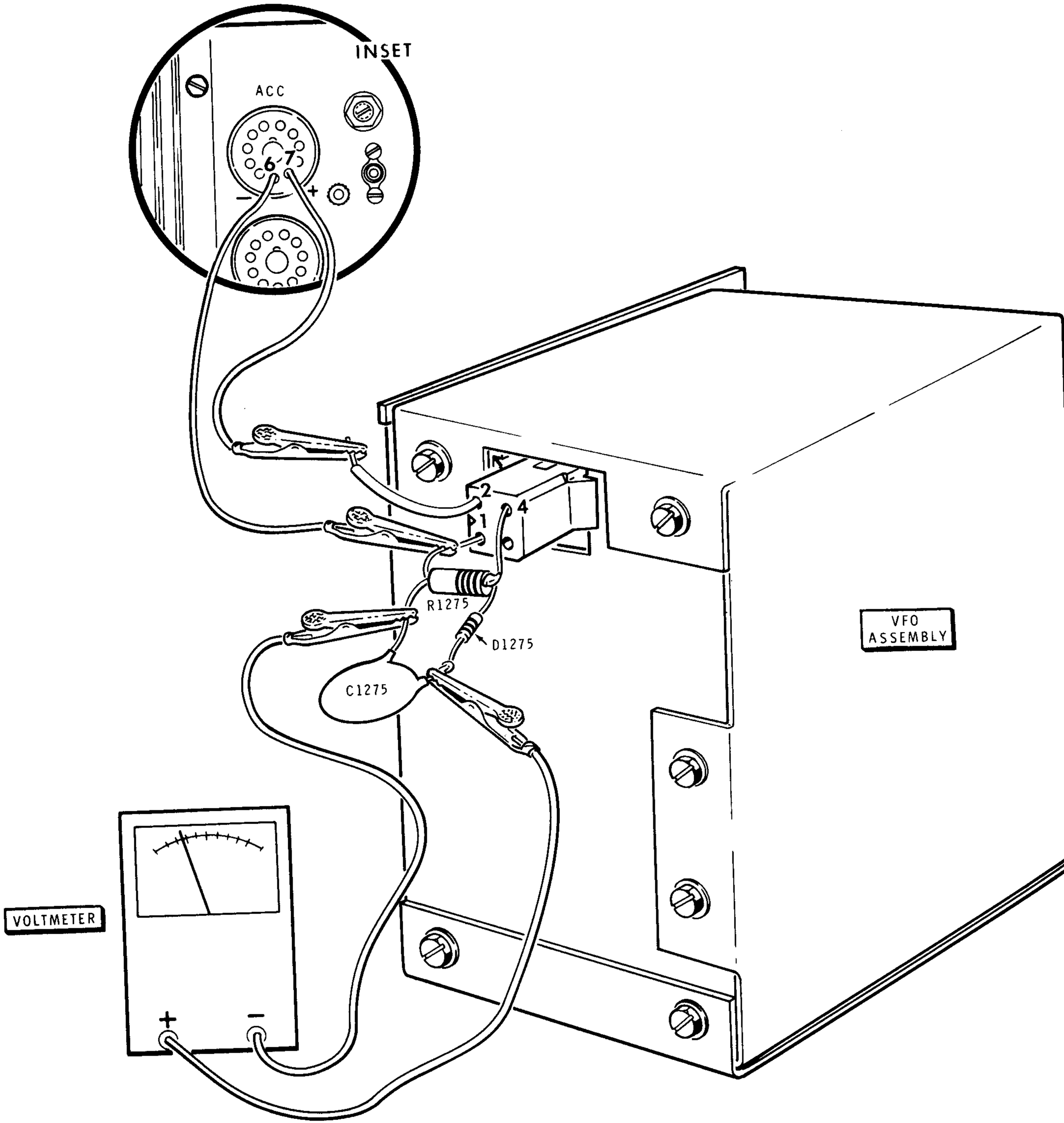
Figure 1



PICTORIAL 10-1



PICTORIAL 11-1



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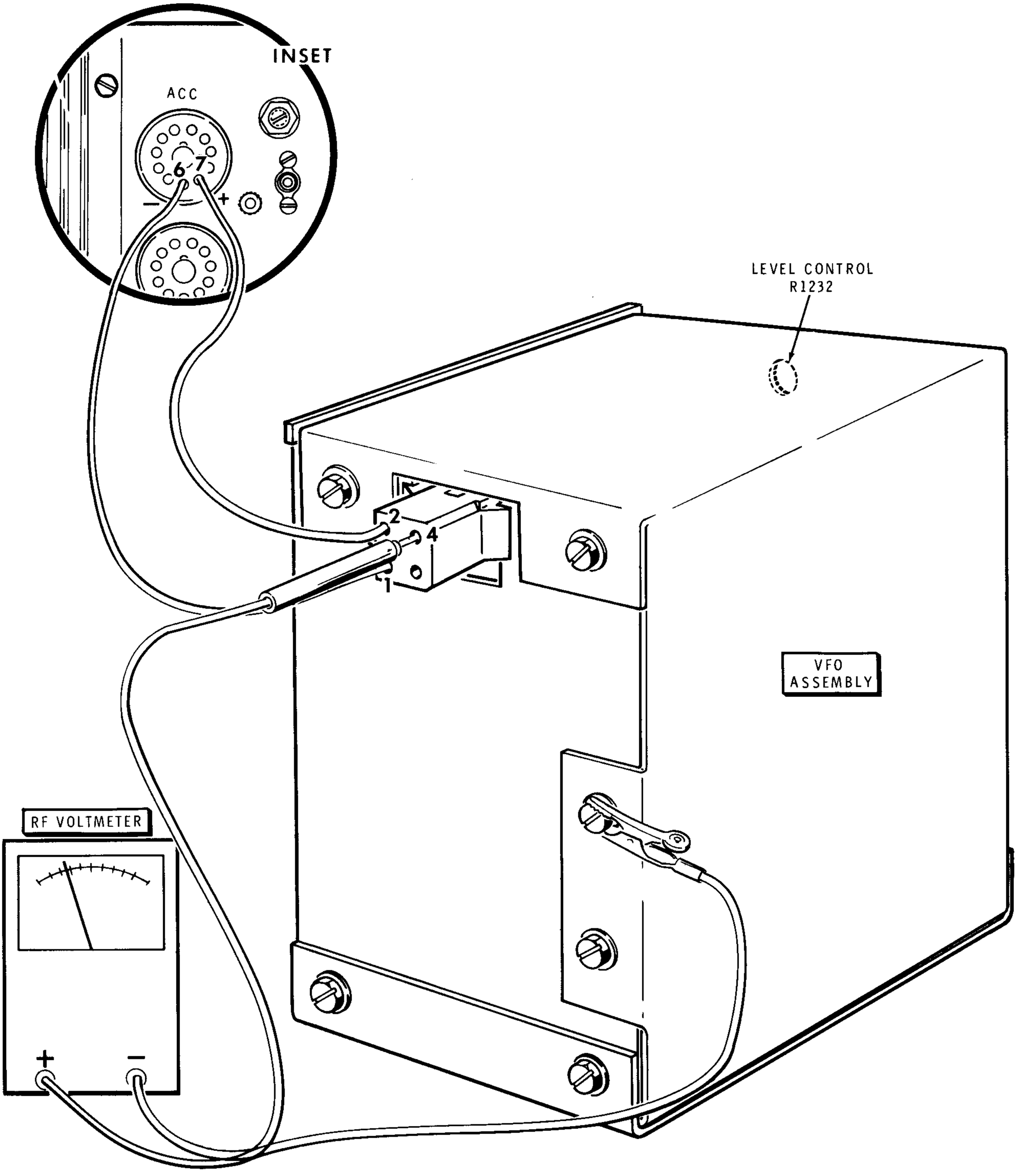
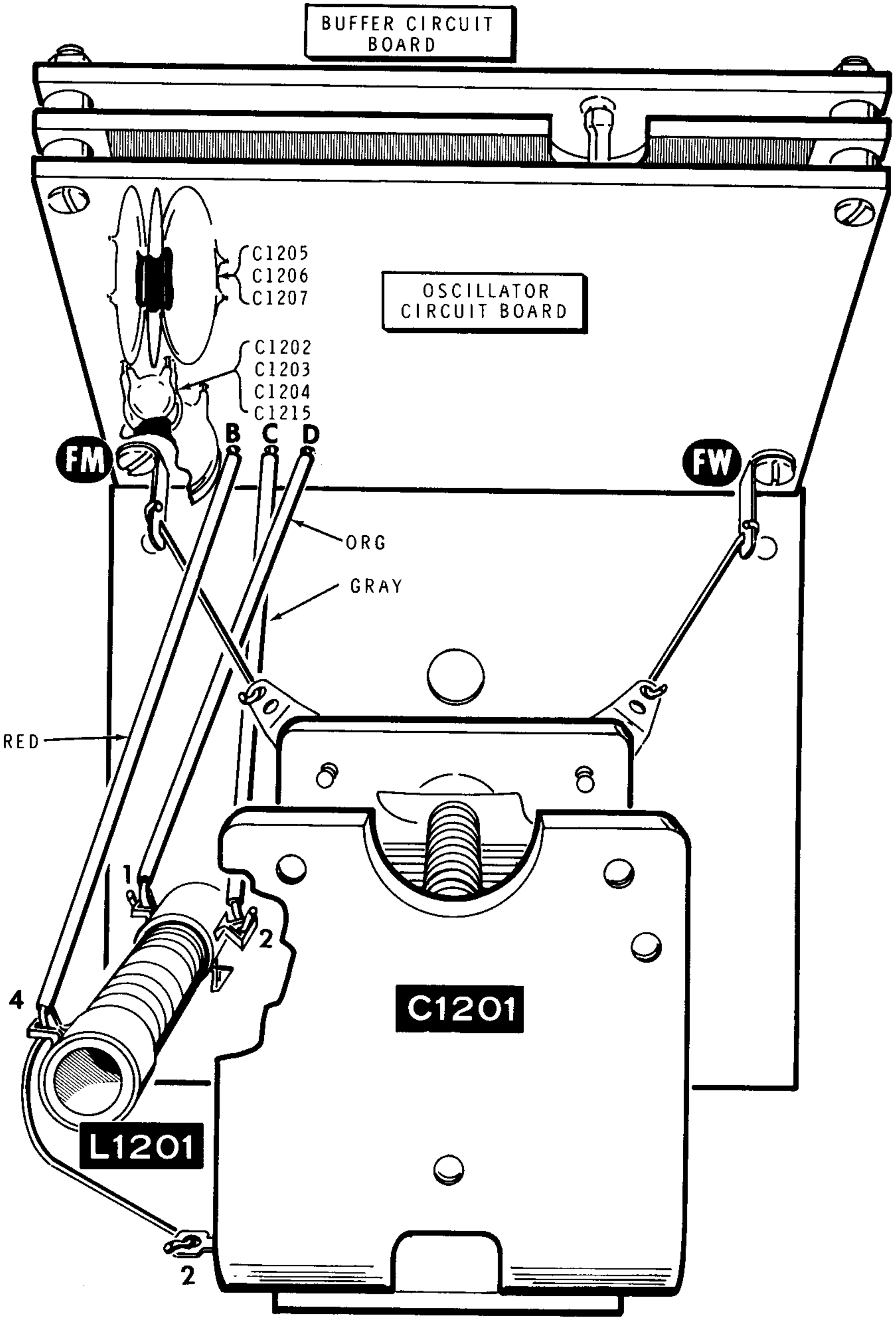
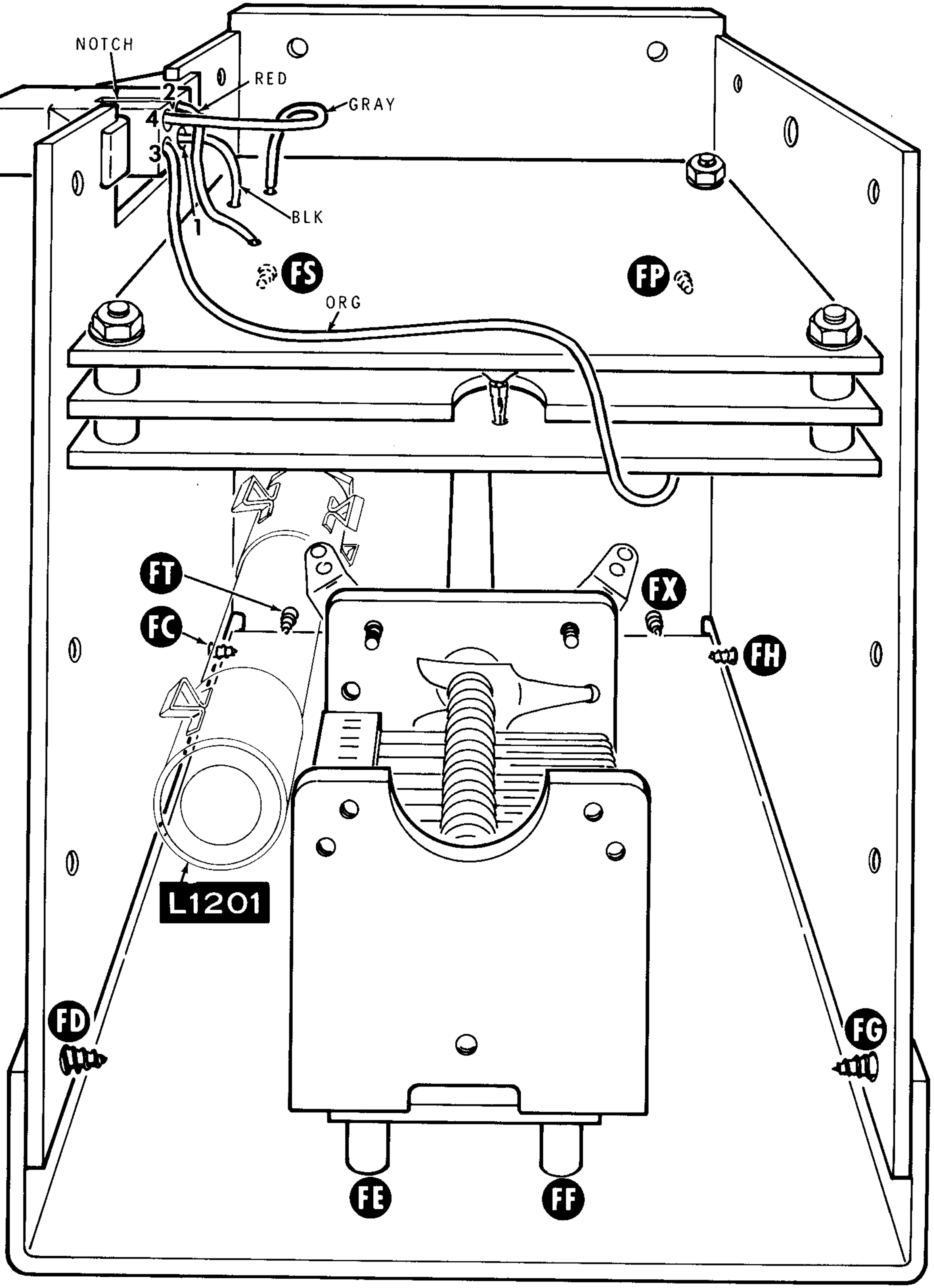
PICTORIAL 13-1



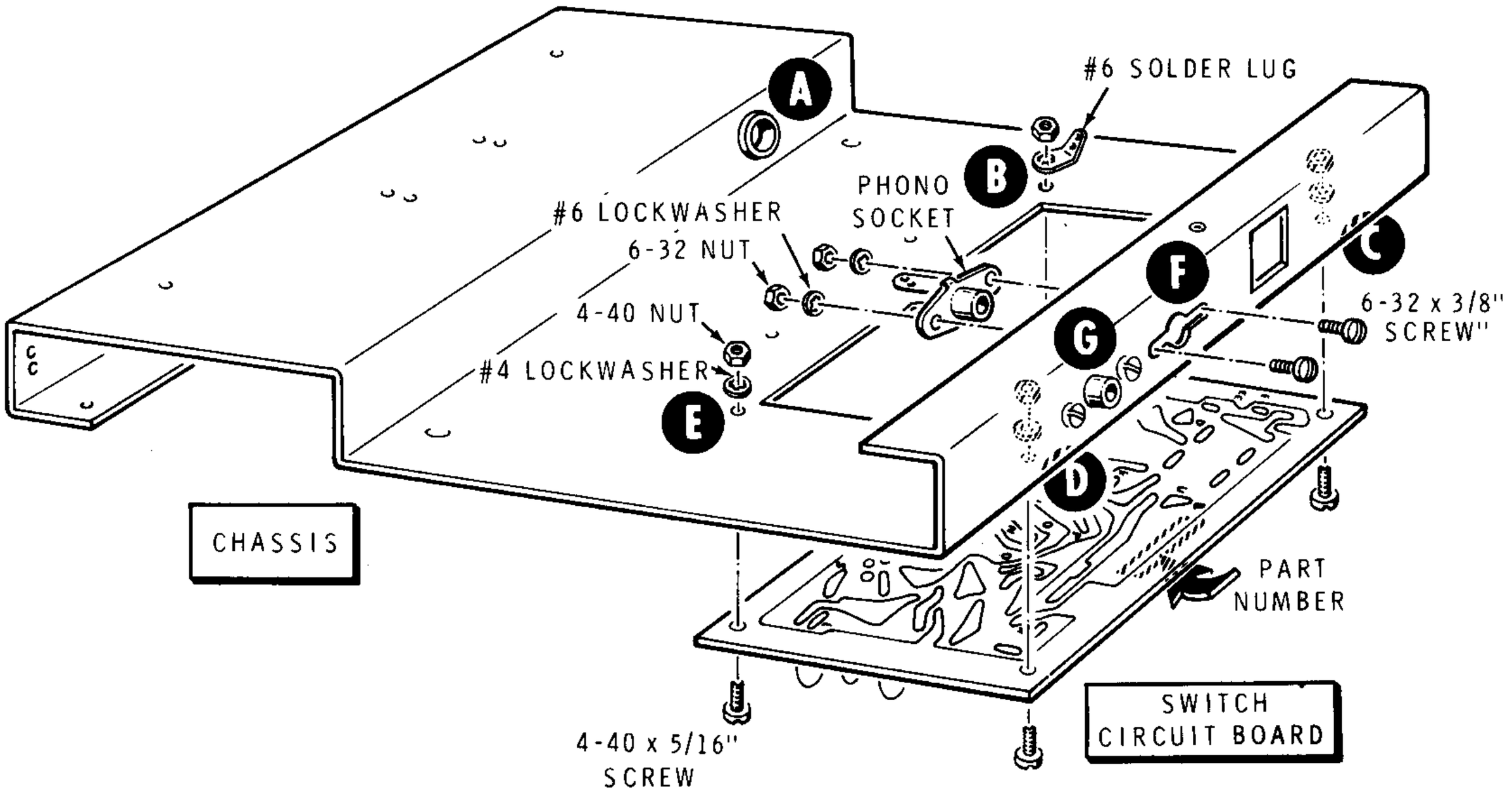
PICTORIAL 13-2



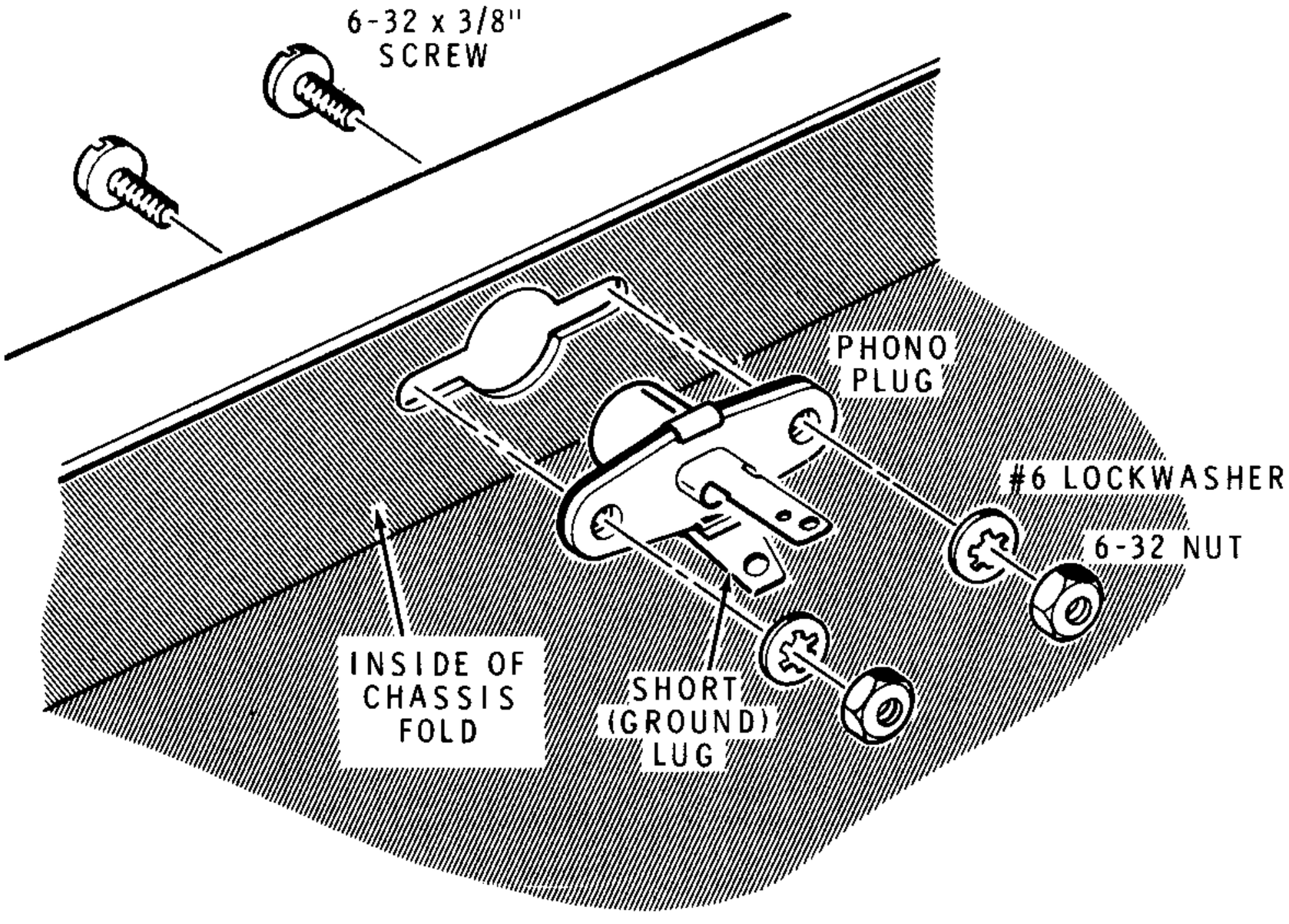
PICTORIAL 4-2



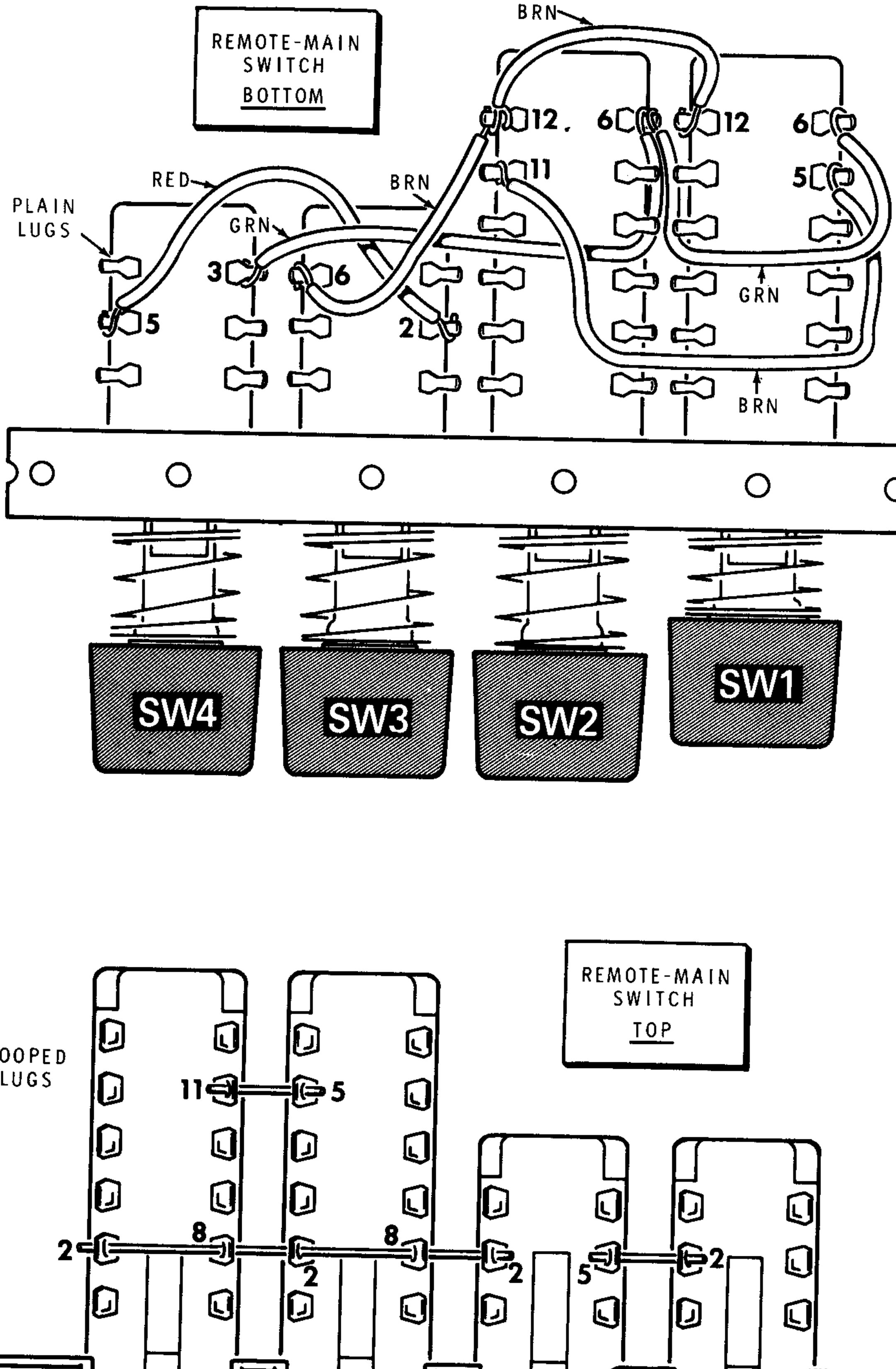
PICTORIAL 4-3



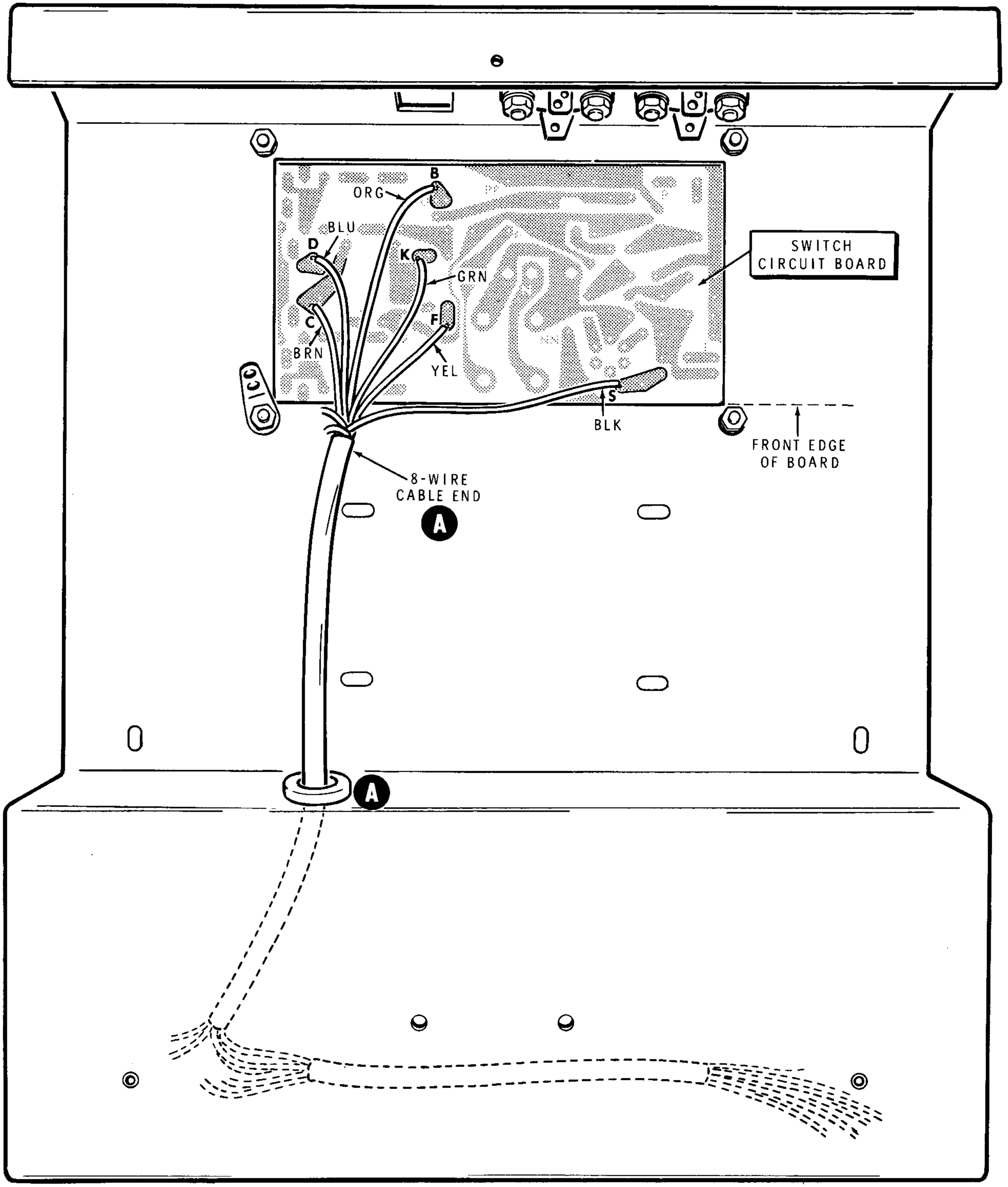
PICTORIAL 7-1



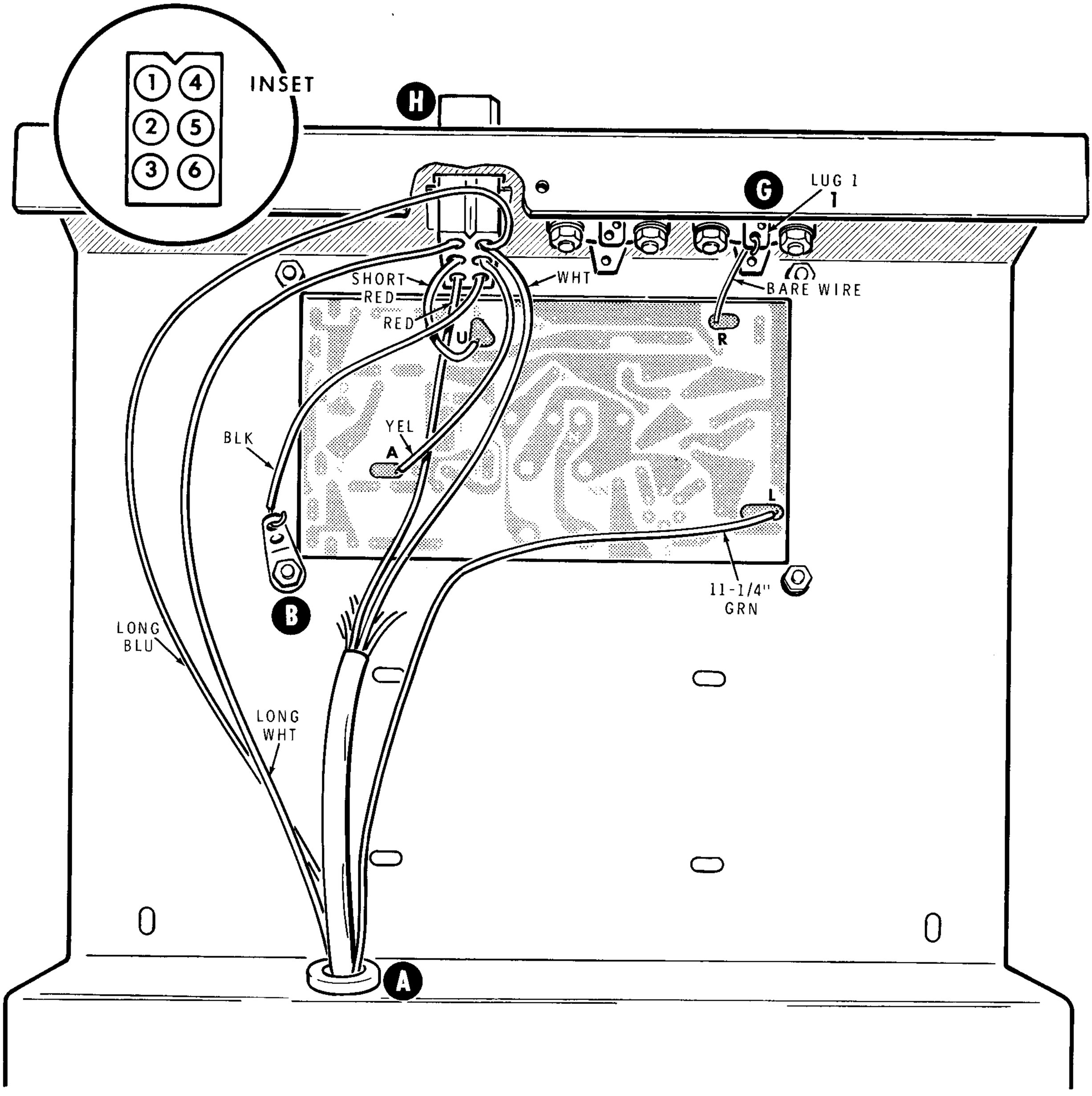
Detail 7-1A



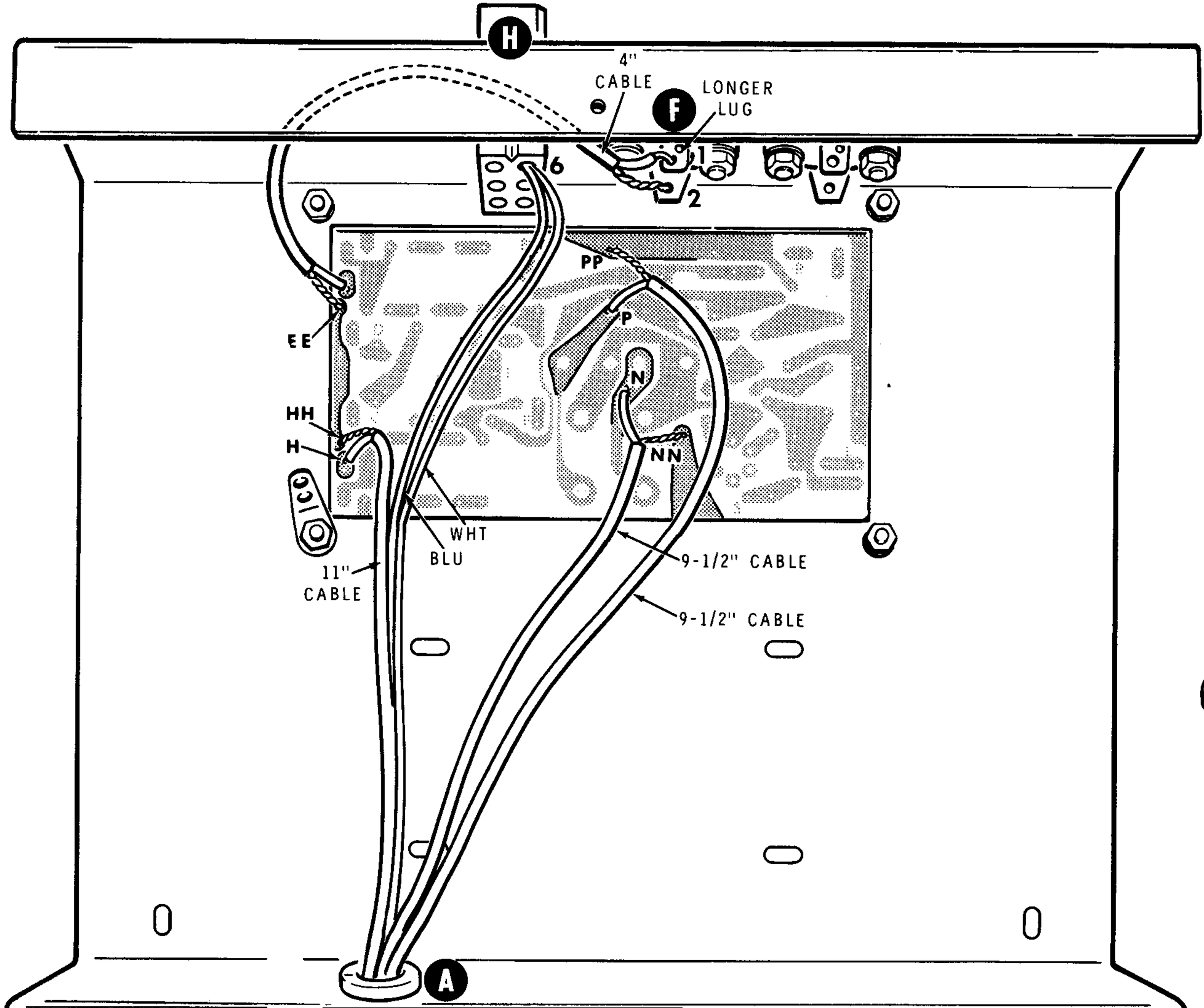
PICTORIAL 8-1



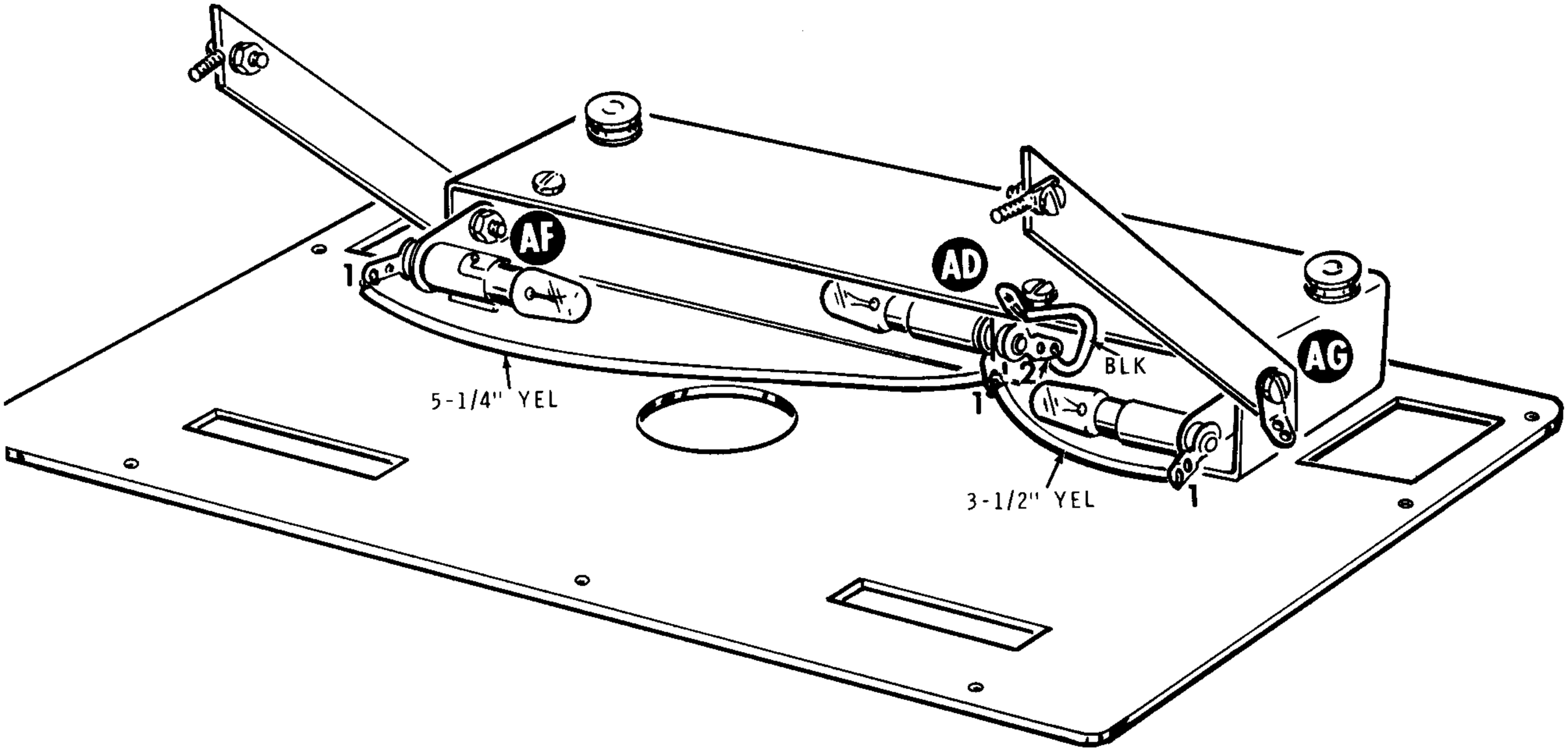
PICTORIAL 8-5



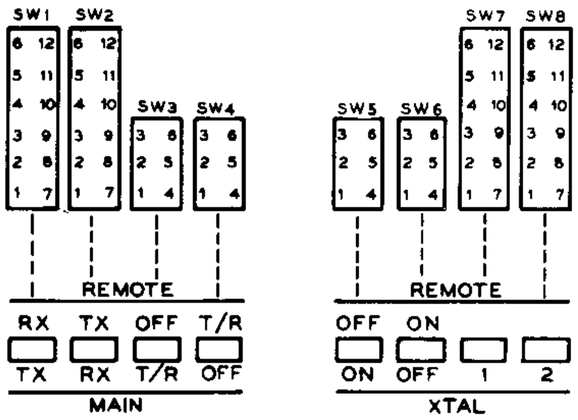
PICTORIAL 8-7



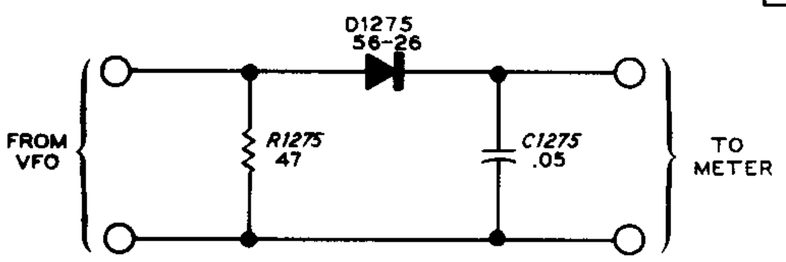
PICTORIAL 8-8



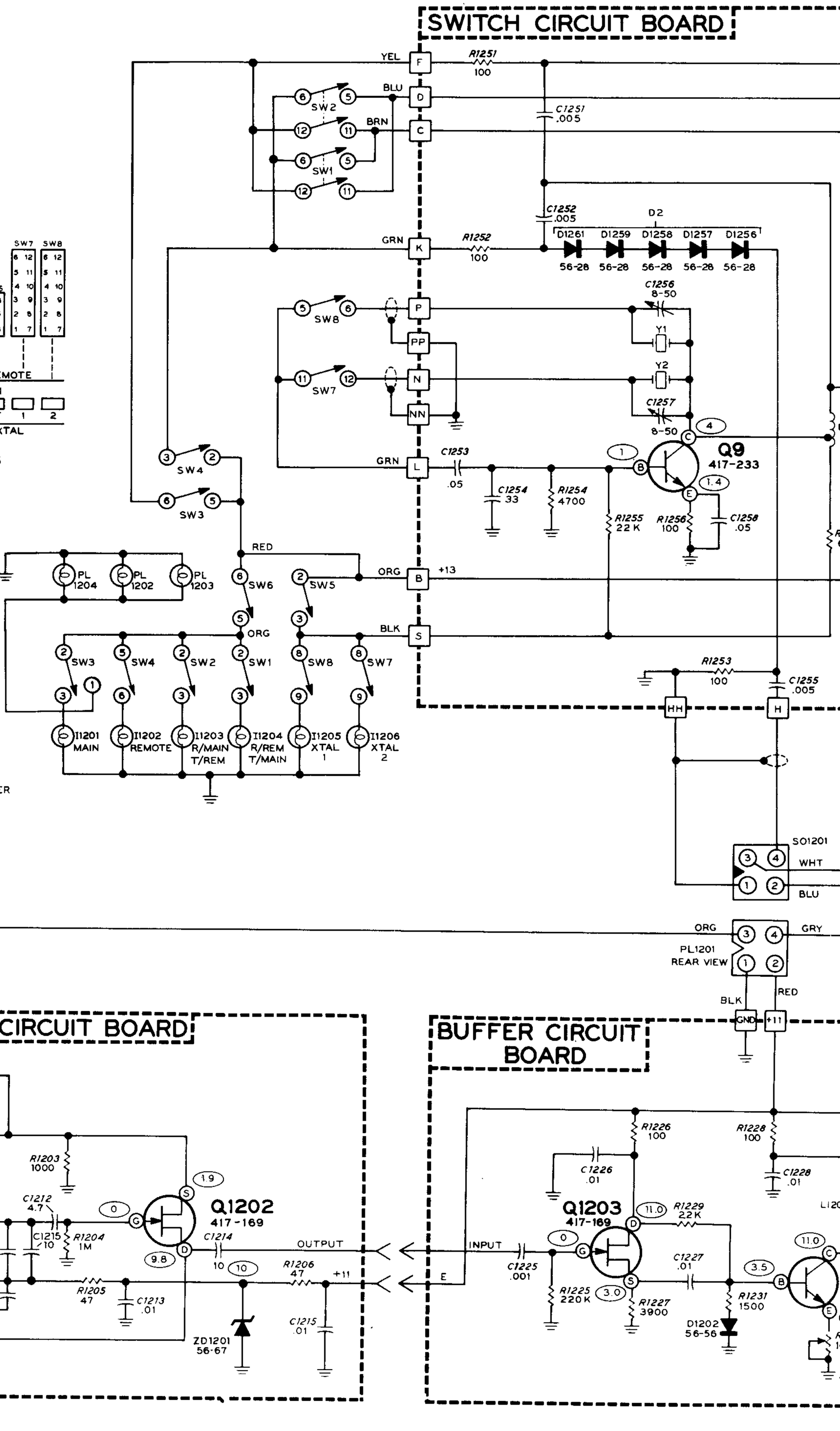
PICTORIAL 9-2

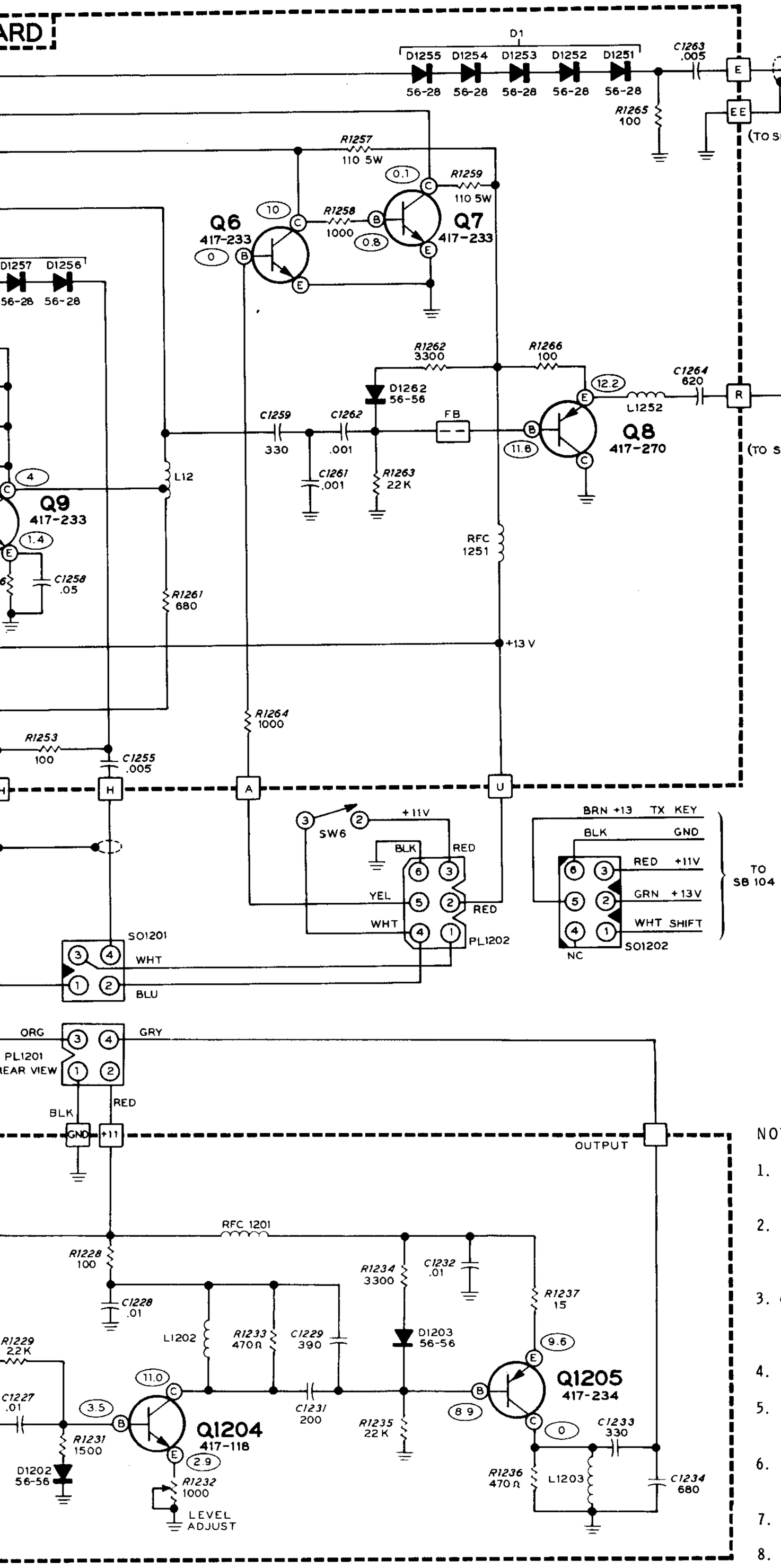


FRONT PANEL SWITCHES
(TOP VIEW)



TEST CIRCUIT





SCHEMATIC OF THE HEATHKIT® REMOTE VFO MODEL SB-644

NOTES:

1. ALL RESISTORS ARE 1/2-WATT, 10% TOLERANCE UNLESS OTHERWISE MARKED.
2. CAPACITORS LESS THAN 1 ARE IN µF (MICROFARADS). ALL OTHER CAPACITORS ARE IN pF (PICOFARADS) UNLESS OTHERWISE MARKED.
3. ⬭ THIS SYMBOL INDICATES A DC VOLTAGE MEASURED WITH A HIGH IMPEDANCE INPUT VOLTMETER FROM THE POINT INDICATED TO CHASSIS GROUND.
4. ⏚ THIS SYMBOL INDICATES CHASSIS GROUND.
5. □ THIS SYMBOL INDICATES A SOLDERED CONNECTION TO A CIRCUIT BOARD.
6. REFER TO THE "CHASSIS PHOTOGRAPHS" AND "CIRCUIT BOARD X-RAY VIEWS FOR THE PHYSICAL LOCATION OF PARTS.
7. TP = TEST POINT.
8. FB = FERRITE BEAD.